Purchasing Division
Finance Department

Room 120
411 West First Street
Duluth, Minnesota 55802

218-730-5340
purchasing@duluthmn.gov

Addendum 1
Solicitation 24-99440
Woodland Booster Station Upgrade

This addendum serves to notify all bidders of the following changes to the solicitation documents:

- Please see the attached documents

  Please acknowledge receipt of this Addendum by checking the acknowledgement box within the www.bidexpress.com solicitation.

Posted: **April 16, 2024**

ADDENDUM #1
24-99440
WOODLAND BOOSTER STATION UPGRADE
CITY OF DULUTH
PROJECT 00616177
APRIL 16, 2024

CERTIFICATION

I hereby certify that this document was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Print Name: Scott Chilson

Signature: Scott R. Chilson

Date: 4/11/24 License #: 44287

NOTICE

This Addendum is issued to modify, explain or correct the original drawings, specifications and/or previous addendums and is hereby made a part of the Contract Documents. Please attach this Addendum to the specifications in your possession and note receipt of this Addendum on page 00 41 00-2 of the bid. The bid date remains unchanged.

PROJECT MANUAL

DIVISION 08 – OPENINGS
Section 08 71 00 – Door Hardware

Page 08 71 00-3, 3.05 Schedule (H.S. = Hardware Set)

H.S. 1 (Door 101A and 101C), 2 cylinders:

ADD: "The two cylinders shall be full size interchangeable cores."

H.S. 2 (Door 102A):

ADD: "2 cylinders Schlage full size interchangeable cores"

DIVISION 40 – PROCESS INTEGRATION
Section 40 23 23 – Process Piping, Valves and Specialties

Page 40 23 23-3, Section 2.04, Paragraph B

REPLACE Paragraph B with the following:

"All valves 4-inch and large shall be designed with self-adjusting packing. Valves shall have a minimum of 4 rings of Vee-Type packing. Valves shall conform to the sizes shown on the contract drawings and shall be of the type and quality as follows, unless otherwise designed on the contract drawings."

Page 40 23 23-4, Section 2.04, Paragraph J

ADD the following:

"All hardware on above grade exposed valves shall be 316 stainless steel."

Page 40 23 23-4 Section 2.04, Paragraph L

REPLACE #7 with the following:

"Valve interiors and exteriors shall be coated with an NSF/ANSI 61 certified fusion bonded epoxy in accordance with AWWA C550."

REMOVE #8(f) in its entirety

Page 40 23 23-5, Section 2.04, Paragraph M

REPLACE #9(g) with the following:

"Fusion-bond epoxy, NSF Standard 61 approved"

REPLACE #10(b) with the following:

"Provide adjustable closing speed controls, pressure gauges, test valves and connections, isolation cock valves, and stainless wye strainer. Contractor shall provide copper/brass tubing and fittings to direct drainage water into floor drain"

Page 40 23 23-6 through 40 23 2307, Paragraph O

REPLACE #2(b) with the following:

"F2: Flanged connections"

REPLACE #2(f) with the following:

"Disk: ductile iron with 316SS edge"

REPLACE #2(g) with the following:

"Shaft: 17-4PH stainless steel"

REPLACE #5 with the following:

"Manually operated valves shall provide totally enclosed gasket sealed gear-actuated operator with handwheel with arrow cast in metal to indicate direction of opening. Actuators shall be sized to close against pumping head during pump operation. Exposed valves shall have integral position indicator (ie pointer) on the gearbox."

Page 40 23 23-16

ADD Section 3.25 as follows:

"3.25 - Start-up Service and Operator Training

A. The valve representative shall provide 4 hours of start-up service and training to the owner for each type of valve provided. "

<u>DIVISION 44 – POLLUTION CONTROL EQUIPMENT</u>
<u>Section 44 42 00.14 – Water System Surge Vessels</u>

REPLACE Section 44 42 00.14 in its entirety with the attached.

END OF ADDENDUM

SECTION 44 42 00.14
WATER SYSTEM SURGE VESSELS
(ADDENDUM #1)

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. American National Standards Institute (ANSI), Specifications and Standards, Current Edition.
   2. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Current Edition.
   3. American Water Works Association (AWWA), Specifications and Standards, Current Edition.
   4. National Electrical Manufacturers Associations (NEMA), Specifications and Standards, Current Edition.
   5. Underwriters Laboratories, Inc. (UL), Specifications and Standards, Current Edition.

1.03 DESCRIPTION OF WORK

A. The work under this section shall cover the furnishing of all materials, equipment, supervision and labor necessary to install all process piping, valves and specialties. This section shall not apply to electrical conduit or piping for heating and ventilating or plumbing.

B. Materials and installation shall comply with City of Duluth Standards Guidelines.

C. Surge and transients present in the water system have been modeled in the selection of equipment. Interchangeability and system compatibility of equipment will be the CONTRACTORS responsibility if substitutions are requested.

D. The work described by this section of specifications consists of furnishing all equipment, materials, and labor to provide, install and test one (1) vertical bladder-type surge tank for potable water surge control as shown on the Contract Drawings and specified in the Contract Documents.

E. Submittals shall meet the requirements of Instruction to Bidders - Submittals. The following items shall also be included in the submittals:
   1. Layout drawings shall be submitted and include the dimensions of all equipment, accessories, supports, connections, outlets, and all related piping.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Submittals - Division 01

C. High Performance Coatings - Division 09

D. Plumbing - Division 22

E. Electrical - Division 26

F. Process Plant Water Piping, Valves and Specialties - Division 40

G. Process Equipment – Division 44

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1.05 SUBMITTALS

A. The Contractor shall submit such Submittals and/or catalog cuts required for the construction and installation of the equipment. These drawings shall be accurate in every detail and shall contain all information necessary to relate the equipment to the specifications.

B. The Contractor shall provide a list of all instrumentation and control equipment components to be provided.

C. Submittals shall indicate the intended equipment arrangement, major support requirements, plot area, and process flow.

D. The tank manufacturer shall submit a liquid level report to the Engineer for review based on the sizing information provided in this specification.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

A. The manuals shall include operating and maintenance literature for all components provided. The submitted literature shall be in sufficient detail to allow for the installation, operation, adjustment, calibration, maintenance and removal of each component provided.

B. Preparation of this document shall be in conformance with the requirements stated in Submittals - Division 01 of these specifications. The Contractor shall submit to the Engineer for review, an outline of any variations of information for the operation and maintenance manuals and other documentation he proposes to prepare.

1.07 QUALITY ASSURANCE

A. Provide quality assurance in accordance with Section 01 45 00 - Quality Control.

B. All materials, equipment, and parts shall be new and unused of current manufacture.

C. Provide all necessary accessories required for a complete and operable system.

1.08 WARRANTY

A. Materials and workmanship shall be warranted for a period of not less than 1 year from the date of commissioning against defects in material and workmanship.

B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

C. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

D. The supplier shall provide an application performance guarantee for the water system.

1.09 EQUIPMENT SPACE

A. The equipment capsule size as shown on the drawings for this project is appropriate for National Standard mandated clearances and for proper clearances above, below and around equipment to provide for safe servicing, removal and reinstallation of that equipment.

B. Likewise, the entrance manway and/or equipment hatches shall be sized to provide for the eventual removal and replacement of any component within the station without altering the station to accomplish that task.

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C. The drawing for this equipment illustrates centerline and clearance/maintenance dimensions about major equipment items. These dimensions are minimum. Dimensions less than those shown "will not" be accepted.

PART 2 PRODUCTS AND MATERIALS

2.01 GENERAL

A. All materials and equipment furnished shall be current production of manufacturers regularly engaged in the manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new (less than 1 year old when turned over to the Owner).

B. Work under this contract shall provide (1) 1,000-gallon water in bladder vertical surge vessel rated for operating and surge pressures for this application. The tank shall be provided in compliance with the space and dimensions detailed on the drawings.

2.02 ACCEPTABLE MANUFACTURERS

A. Basis of Design is a vertical bladder-type vessel as manufactured by Blacoh Surge Control as represented by Dorner Company.

B. Equivalent and/or Substitute equipment shall be the responsibility of the BIDDER. The ENGINEER will not review substitute equipment pre-bid. Substitute equipment shall have the following qualifications:
   1. Incomplete substitute equipment submittal will be rejected, resubmittals will not be accepted. Any clarification of submittal shall be at the discretion of the ENGINEER.
   2. Equipment shall have qualified local representative with qualified full-service department.
   3. Equipment shall have similar fitment and submittal shall provide confirmation.
   4. Equipment manufacture shall have a minimum of a 100 installation of the proposed model with references contacts.
   5. Line by line comparison of the proposed vessel to the basis of design vessel including construction and performance.
   6. Confirmation delivery will meet project requirements.

C. All products specified within this section shall be manufactured in North America whenever possible.

D. This specification has been constructed around a vertical bladder-type vessel. Any related construction and/or design modifications necessitated due to the use of an alternate tank design shall be the responsibility of the Contractor.
   1. The manufacturer shall be ISO-9001-2015 certified which includes engineering, design, manufacturing and testing of complete components.
   2. The manufacturer shall provide x-rays of welds per RT-3. All seams are spot x-rayed; submittals will define the area to be X-rayed. The U1A form required for approval by Engineer before blast and painting can start Hydrostatic test. The Engineer reserves the right to inspect the vessel manufacturing facility to confirm the requirement above.

2.03 PRODUCT

A. Provide in surge vessel system in compliance with the drawings and specifications.

B. Surge Tank
   1. The tank shall be a vertical, bladder-type vessel suitable for use with potable water.
   2. The sizing of the surge bladder tank is based on the hydraulic surge analysis conducted by the Engineer:
      a. Minimum volume of 1,000 gallons
      b. 72-inch diameter and 30 inch seam to seam length

C. Structural Design and Supports shall include the tank, supports, and anchor bolts shall be designed based upon local building codes in addition to the following criteria:

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1. Design for a hydrostatic operating pressure of 300 psi
2. Test pressure of 390 psi with no reactive load permitted through the inlet/outlet piping.
3. Vacuum Pressure rated for -15 psi
4. Maximum operating temperature 120-degrees F
5. MDMT -20-degrees F
6. Minimum corrosion allowance is 0.0625-inches
7. Support tank by structural legs (for minimum) for attaching to a concrete floor or slab. Material of construction shall comply with ASTM A 36 or ASTM A 285, Grade C. Weld the support legs to the tank.
8. Seismic Design Parameters to conform to the current IBC (if necessary and required by design engineer).

2.04 SURGE TANK DESIGN AND MATERIALS

A. Materials for the tank shall be Carbon Steel grade SA516 grade 70 with the steel shell and end caps from USA foundry with MTR's required, design, and shop fabrication and inspection shall comply with Section VIII, Division 1, of the ASME Boiler and Pressure Vessel Code with only the plate steels in Table UCS-23 of said code being used. Provide ASME code stamp, National Board Registration number and pressure rating on tank. Tank materials will be in full compliance with the American Iron and Steel (AIS) Provision.

B. Minimum design pressure shall be as stated in this section of the Specifications. Perform hydrostatic testing in shop. Test pressure shall be 130% minimum of the design pressure of the tank.

C. The surge tank bladder and internal painting system shall be in compliance with NSF-61 approval requirements for potable water.

D. Complete anchor bolt assembly (studs, nuts, washers, etc.) to be provided by contractor.

E. Bladders shall only be manufactured in the USA. The delivery time shall be at a maximum of three weeks with packaging only in a plastic shipping crate without wood and/or nails.

F. Provide 1-inch 250 lb ANSI flanged connection at the top of the tank to contain a gas charging valve and pressure gauge. The gas charging piping system shall be 316 stainless steel and plumbed to 5 feet from the ground level. Tank shell will be constructed of deep drawn carbon steel double sub-arc welded domes and side shells with double welded seams. Tank shall be equipped with a NSF61 approved bladder. The pre-charge pressure will be located between the shell of the tank and the bladder. The bladder shall be sized to conform to the inner shape of the vessel. Tank shall be of the vertical configuration

G. Bladder tank shall be National Board approved with Liquid Relief Valve set at 10% above the operating pressure. Leser model 437 or approved equal. No rupture discs will be accepted.

2.05 SERVICE CONDITIONS

A. Tank hydraulic performance conditions and design data shall be as shown below. The tank manufacturer shall submit a liquid level report to the Engineer for review based on the information provided below. In the event that the manufacturer's liquid level report of the system yields varying design requirements, the Engineer should be contacted.

Tank Configuration:	Vertical
Minimum Capacity:	1000 Gallons
Tank size:	72-inch diameter, 30 inch seam to seam length, 94-inch overall length
Type:	Bladder
Bladder Material:	NSF 61 PVC.

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Minimum Operating Pressure:	300 psi
Minimum Test Pressure:	390 psi
Precharge Pressure Setting:	90 psi (Air)
Inlet/Outlet Flange Size:	8 inch
Flange Rating:	ANSI Class 250 per ANSI B16.1
Minimum Manhole Size:	24 inch

2.06 VALVES

A. The tank shall be designed to function properly with the specific valves, including but not limited to butterfly valves and check valves, submitted by the Contractor. Acceptance of these valves shall be clearly stated in the surge tank submittal.

B. Refer to section 40 23 23.

2.07 PRESSURIZING SYSTEM

A. Refer to section 40 23 23

B. Pressure Gauges
1. Proved back panel attached to the tank for mounting of the instruments and pressurizing appurtenances.
2. Phosphorus bronze bourdon tube type, brass socket; 4-1/2-inch dial, adjustable pointer, 0-400 psi range, 2-psi graduations; ¼-inch NPTM bottom connection.
3. Provide brass isolation cocks for each gauge.

C. Tank Accessories
1. Tank accessories shall include compressed air inlet, gauge, water inlet and outlet.

2.08 FACTORY PAINTING AND COATING

A. All coating is to be applied per coating manufacturer's procedures.

B. All painting and coating shall be completed at the factory. Field painting and coating will not be accepted. No paint runs or sags will be permitted.

C. The internal and external coating systems shall be detailed in the submittal and approved by the Engineer.

D. Interior coating system shall be NSF-61 approved paint (Sherwin Williams, Carboline or prior approved equal). Two coats Sherwin Williams – Marcopoxy 5500LT, 6 mil DFT per coat; documentation of holiday testing required. Painting system will be rejected if paint has runs or sags.

E. Exterior coating system (Sherwin Williams, Carboline or prior approved equal):
1. 3 part system. Total DFT shall be minimum 10 mil:
   a. 1st coat, zinc primer, minimum 3 mil DFT;
   b. 2nd coat, epoxy, 5 mil DFT;
   c. 3rd coat, polyurethane, 2 mil DFT. Final exterior color to be advised at time of submittal.

2.09 SURGE VESSEL LIQUID LEVEL MONITORING

A. System and appurtenances shall be organized on a tank mounted back panel.

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B. Surge Vessel liquid level Controller provides comprehensive control functionality for any 4–20 mA or HART compatible transmitters.
   1. The backlit display gives a clear visual indication of the measured values and status of all inputs and outputs.
   2. The controller can take input from two transmitters and perform sum or differential calculations to provide a single current output.
   3. The controller shall provide power to the transmitters.
   4. The 4 to 20 mA output shall represent the liquid level inside the surge vessel.
   5. The controller shall be installed inside a stainless-steel enclosure equal to a Hoffman CSD242010SS with C-WHPTO padlocking handle.
   6. The Back plate shall be a CAMO242010CSD.
   7. The enclosure shall have a Phoenix contact modular terminal stripe:
      a. 120V Power
      b. (2) 4 to 20 mA Inputs
         1) High Pressure Transmitter
         2) Low Pressure Transmitter
      c. (3) 4 to 20 mA Output
         1) High Pressure
         2) Low Pressure
         3) Liquid Level
      d. (5) relays outputs
         1) Surge Event
         2) Low Liquid Level
         3) High Liquid Level
         4) Power Fail
         5) Common Alarm
   8. The terminal stripe shall have a disconnect switch and protected by a 10 AMP fuse.

C. High-Pressure (Bladder/Liquid) transmitter
   1. Shall be connected to the flanged connection on the outlet of the surge vessel.
   2. The transmitter shall have a 300 lb. ANSI flanged ball valve in 316 Stainless Steel.
   3. The transmitter shall have a gauge seal welded to the transmitter.
   4. The transmitter shall have 10 year installed stability and 0.04% of span accuracy.
   5. The transmitter shall have an LCD display showing force main pressure. The transmitter shall be a Rosemount 3051T or equal.

D. Low-Pressure (Tank/Gas) transmitter
   1. shall be connected to the top of the surge vessel, recording the gas charge pressure inside the bladder.
   2. The transmitter shall have an LCD display showing the bladder pre charge pressure during commissioning (as part of the computer surge model submitted by the surge vessel manufacture) and the low pressure side of the differential pressure level pressure during operation.
   3. The transmitter shall be mounted to the surge vessel with a ½" NPT connection with a ½" full port stainless steel ball valve.
   4. The transmitter shall be a Rosemount 3051T or equal.

PART 3 CONSTRUCTION METHODS

3.01 EXAMINATION

A. Verify equipment is in compliance with approved submittal drawings.

3.02 FIELD MEASUREMENTS

A. Field-verify all measurements. Do not base on contract drawings.

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B. Identify conflicts with the work of other trades prior to installation of work.

C. Adjust system to satisfy field requirements.

3.03 DELIVERY, STORAGE AND HANDLING

A. Receive, sign for and store all equipment in this section.

B. Maintain original quality and condition of equipment while it is in storage.

C. If the vessel is not commissioned within 6 months of delivery, the bladder should be installed on site after delivery and immediately prior to commissioning the vessel to avoid damage to the bladder and/or the vessel.

3.04 INSTALLATION

A. Install the water pressurizing system components as indicated on the contract drawings and in accordance with the manufacturer's instructions.

B. Provide and connect piping, valves, accessories and controls as indicated as required to insure a complete, operable system.

C. The tank shall be installed in accordance with the manufacturer's suggested procedures. All supports, piping, valves, and related appurtenances shall be provided and installed by the Contractor at no additional cost to the Owner.

D. Contractor shall provide 120 VAC to panel and field wire (shielded pair installed inside conduit) the two transmitters located on surge vessel and land wired inside surge vessel level control panel.

3.05 EQUIPMENT START-UP

A. The equipment shall be started by a factory-trained representative who shall certify to the Engineer that all equipment is properly installed and the plant operator has been instructed concerning proper operation and maintenance.

B. A written report covering the representative's activities and installation approval shall be submitted to the Engineer. This report shall cover all inspections and outline in detail any deficiencies in the installation.

3.06 INSTALLATION, OPERATION AND TESTING

A. Surge Control System manufacturer shall provide manufacturer's services at the jobsite at no additional cost to the Owner. Two full days of service from the manufacturer's representative shall be provided to approve the surge control system installation and advise the Contractor during startup, testing, and final adjustment of each tank.

B. The pre-qualified Surge Control System representative will be performing startup and testing. The individual's resume shall include at least 5 references for similar applications to include computer surge models, testing results recording system pressure at a minimum of 100 times per second and photos of application. The resume shall include details on computer surge modeling and have a computer surge model of the system being tested.

C. One full 8-hour day of testing shall be scheduled by the contractor a minimum of two weeks in advance with the Engineer and owner. Testing shall include transient pressure monitoring and liquid level inside the surge vessel during a pump trip, both recorded at a minimum of 100 times per second. The field testing shall graph the system pressure and liquid level in steady state and during a pressure surge event (Pump Trip). Data files on liquid level and pressure shall be uploaded two months after initial startup and commissioning for site meeting with operations to discuss surge vessel volume change, age of water and

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testing of chlorine residuals inside the surge vessel. Water samples shall be taken from the outlets at either end of the surge vessel.
Field calibration of liquid level inside surge vessel:
4mA_____inch of H2O 20mA_____inch of H2O
Field calibration of transient pressure transducer(s)
0 volts_____psi 5 volts_____psi
Field calibration of flow meter:
4mA_____gpm (fps) 20mA_____gpm (fps)

Field recorded data	Computer modeling data
Pumps running:_____	_____
Pump speed:_____	_____
Pump suction pressure or reservoir level _____	_____
Flow rate_____gpm	_____gpm
Steady State Pressure_____psi	_____psi
Minimum pressure during pump trip_____	_____psi
Maximum pressure during pump trip_____	_____psi

Liquid level inside surge vessel during steady state: _____ inch of H2O	_____inch of H2O
Minimum level during pump trip_____	_____inch of H2O
Maximum level during pump trip_____	_____inch of H2O

Testing shall document check valve closing time and closing surge pressure. If the pressure exceeds the maximum operating pressure of the system, field adjustments to the closing speed of the check valve shall be made and the test shall be repeated. Relief of high pressure through the check valve shall be minimized to protect the pump from spinning backward. If pump control check valves are in service, document opening and closing time in automatic operation. Check starting amps on motor, control valve opening time to reach minimum flow by pump manufacture.

Check valve closing time_____seconds _____seconds
Maximum pressure when check valve closed:
_____psi _____psi
Normal pump start and stop: max pressure on upstream and downstream of check valve:
Upstream _____psi Downstream_____psi
Opening time:_____sec Closing time:_____sec

The pressure relief control valve or surge anticipating control valve, if required and installed at the pump station, then the surge control systems representative shall test the valves operation in the system in accordance with the computer surge model data. If the system requires the valve to operate during a transient event, open, closing time and pressures shall be recorded and graph data at a minimum of 100 times per second.
Relief Valve opening pressure:_____psi Computer model:_____psi
Opening time on up surge from steady state pressure:_____seconds
Relief Valve closing pressure:_____psi Computer model:_____ psi time on down surge from maximum pressure:_____seconds
Should a pump by-pass control valve bein operation, time to reach set point: ____ seconds

Should the pipeline be modeled to drop below atmospheric pressure, field testing shall be conducted at specific air/vacuum valves. Testing of specific air/vacuum valves shall graph open time of the air valve on down surge and minimum pressure. Testing data shall graph the maximum pressure when the air valve closes upon reflection of high pressure wave.

Air Valve delay in opening during a down surge starting at atmospheric pressure: _____seconds

Computer modeling input data on air valve delay:_____seconds

Maximum up surge pressure when air valve closes on returning high pressure wave:_____psi

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Surge Check switch set point_____ Computer model switch value:_

Active valves within the piping system:
Opening time_____ Closing time_____

Set points for variable speed electric motor operator on control valve_____

If constant speed electric motor operator, what is the travel time:_____
Field test data:_____psi Computer model data:_____

The graphed data and this form with recorded data shall be emailed to the contractor the same day of test. The pressure test shall have date, time and location of test imbedded into data via GPS. The contractor shall document to the Engineer and owner a proof of design submittal showing the transient monitoring testing is within the minimum and maximum pressures shown in the computer surge model.

3.07 SURGE VESSEL LIQUID LEVEL MONITORING FIELD TESTING AND PERFORMANCE MONITORING

A. Contractor and surge tank manufacturer shall provide, calibrate, install, program and maintain all test equipment and devices required to perform the specified testing and performance monitoring. Contractor/Supplier shall be responsible for providing all taps, valves, electrical power, and/or other components necessary to conduct the testing and monitoring as required. Contractor/Supplier and/or surge tank manufacturer shall collect and analyze all data collected and shall provide detailed report(s) as necessary to thoroughly document the system's performance and to identify and resolve any and all discrepancies. Contractor/Supplier shall provide Engineer with all data collected during testing within 72 hours following each test. Contractor/Supplier shall provide a final written report of the testing and performance monitoring, which shall be approved by the Engineer before Substantial Completion will be granted. All raw data collected throughout the monitoring period shall be provided in original digital format in the O&M.

B. Performance monitoring shall be conducted commencing at startup of the surge tank and continuing until all required field testing has been completed and the Contractor/Supplier has successfully demonstrated acceptable performance of the surge tanks and associated components, including check valve closing time, to the satisfaction of the Engineer.

C. Following startup of all new pumping equipment and after all permanent piping has been installed, Contractor/Supplier shall provide onsite field testing and monitoring of the completed installation to verify performance complies with minimum/maximum operating pressures and liquid levels inside the surge vessel. Testing shall consist of functional tests of simulated power failure or valve closure as per the computer surge model.

D. The surge vessel manufacturer shall set the transmitters with a HART handheld computer with 4 mA representing the bottom of the vessel and 20 mA representing the top of the vessel. During startup and commissioning, the surge vessel manufacture shall verify the pre charge pressure inside the bladder. The liquid level inside the surge vessel shall be verified with the computer surge model during steady state and surge conditions. During commissioning, the surge vessel manufacture shall record the liquid level inside the surge vessel and the force main pressure at 100 times per second. This data shall be compared with the computer surge model, submitted during approval, and submitted to the Engineer for commissioning approval.

3.08 SYSTEM TEST AND ADJUSTMENT

A. In the event a component fails to perform as specified or is proven defective during operation, correct all deficiencies and retest. Testing shall be conducted in the presence of and to the satisfaction of the Engineer.

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B. Manufacture shall provide pressure recording instruments to record system operation and tank performance during start-up testing. Recorded data and recommendations shall be included in the final start-up report and manufacture certification the tank may be put into service.

C. During startup and commissioning, the surge vessel manufacture shall verify the pre charge pressure inside the bladder. The liquid level inside the surge vessel shall be verified with the computer surge model during steady state and surge conditions. During commissioning, the surge vessel manufacture shall record the liquid level inside the surge vessel and the force main pressure at 100 times per second. This data shall be compared with the computer surge model, submitted during approval, and submitted to the Engineer for commissioning approval.

3.09 OWNER TRAINING

A. Provide minimum of 8-hour training on equipment operation.

B. The vertical bladder-type surge tank shall be provided with the manufacturer's services at the jobsite at no additional cost to the Owner. One full 8-hour day of service from the manufacturer's representative shall be provided per tank to approve the tank installation and advise the Contractor during startup, testing, and final adjustment of each tank. In addition to this day, one additional full 8-hour day shall be provided in a separate trip to instruct the Owner's personnel in the operation and maintenance of the tank system.

3.10 SPARE EQUIPMENT

A. None.

END OF SECTION

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