SECTION 15460
HYDROPNEUMATIC SURGE TANKS

PART 1  GENERAL

1.01  SUMMARY

A. Scope:
   1. This section specifies a hydropneumatic surge tank complete with control devices,
      compressed air system, surge system control panel and appurtenances, for surge
      control in a recycled water force main.

B. Type:
   1. Tanks provided under this section shall be air-over-water type, welded steel,
      horizontally mounted, and cylindrical. Tanks shall be supplied complete including
      level control system and air compressors.

C. Equipment List:

<table>
<thead>
<tr>
<th>Item</th>
<th>Equipment Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydropneumatic Tank</td>
<td>T-1030</td>
</tr>
<tr>
<td>Air Compressor</td>
<td>CMP-1031-1</td>
</tr>
<tr>
<td>Receiver Tank</td>
<td>T-1031</td>
</tr>
<tr>
<td>Surge System Control Panel</td>
<td>VCP-1031</td>
</tr>
</tbody>
</table>

1.02  RELATED SECTIONS

A. Concrete
B. Anchor system
C. Painting
D. Instrumentation and controls
E. Pipeline testing and cleaning
F. Piping, Valves and appurtenances

1.03  REFERENCES

A. This section contains references to the following documents. They are a part of this
   section as specified and modified. In case of conflict between the requirements of this
   section and those of the listed documents, the requirements of this section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect
   at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the
   Agreement if there were no Bids). If referenced documents have been discontinued by
   the issuing organization, references to those documents shall mean the replacement
documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued or replaced.

1. American Society of Mechanical Engineers (ASME) Code for Unfired Pressure Vessels, Section VIII, Division 1, Latest Revision
2. Local Plumbing Codes
3. International Building Code (IBC)
4. The National Electrical Code (NEC)
5. ASME B16.5 Pipe flanges and Flanged Fittings
6. ASME CSD-1 Controls and Safety Devices for Automatically Fired Boilers
7. ASME B31.1 Power Piping
8. ASTM A36/A36M Carbon Structural Steel
9. ASTM A53/A53M Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
10. ASTM A181/A181M Carbon Steel Forgings, for General-Purpose Piping
11. NSF/ANSI 61 Drinking Water System Components

1.04 SUBMITTALS

A. The following shall be submitted in accordance with Section 01330 Submittals for review and approval:

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. A check mark shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

2. Complete design calculations for all tanks. Calculations shall be signed by a mechanical or structural engineer registered in the State of California verifying that the tanks have been designed to meet all design criteria given in these specifications.

3. Detailed fabrication drawings, system assembly and installation drawings, catalog data and dimensional drawings showing accessories, supports, and connections.

4. Complete electrical and instrumentation diagrams.

5. Weights of all components and anchor bolt designs.


7. Instruments and gauges.
8. Surge Tank & Level Control Panel layout, schematic diagram and device connection diagram.
9. Air Compressor & Control Panel layout, data sheets, schematic diagram and device connection diagram.
10. Description of the manufacturer's design and equipment fabrication ability and a list of completed installations that are similar to this project in size and service for Engineer’s review.

1.05 QUALITY ASSURANCE

A. General:
   1. Tanks shall be fabricated and assembled in strict compliance with the specifications. The tanks shall not be shipped prior to approval by the Engineer.
   2. The hydropneumatic tanks shall be furnished by a manufacturer who is fully experienced, reputable and qualified in the design and manufacture of the equipment and has completed a minimum of six operating surge control systems of similar size or larger within the last 5 years.

B. Unit Responsibility
   1. The Contractor shall assign unit responsibility to the manufacturer of the Hydropneumatic Surge Tank and controls system provided under this section.
   2. This manufacturer is the unit responsibility manufacturer and has unit responsibility for both the equipment and assembly specified in this section.
   3. This manufacturer is responsible for the coordination of all interconnecting components.

1.06 DESIGN REQUIREMENTS:

1. Operating Conditions:
   a. Hydropneumatic tanks provided under this section shall be suitable for the following operating conditions:

<table>
<thead>
<tr>
<th>Equipment Number</th>
<th>Fluid</th>
<th>T-1030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluid</td>
<td>Recycled water</td>
<td></td>
</tr>
<tr>
<td>Minimum Total Volume, gal</td>
<td>20,000</td>
<td></td>
</tr>
<tr>
<td>Tank diameter (approximate), feet</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Over-all tank length (maximum), feet</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Outlet Flange Size, inch</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>Normal Operating Pressure (NOP), psi</td>
<td>110</td>
<td></td>
</tr>
<tr>
<td>Maximum Allowable Working Pressure (MWAP), psi</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>Pressurized Air : Water ratio at NOP, ratio</td>
<td>40:60</td>
<td></td>
</tr>
<tr>
<td>Maximum Fluid Temperature, degrees F</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Minimum Fluid Temperature, degrees F</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Environment</td>
<td>Tank and Control System: Outdoor installation in un-shaded, hot environment with high UV exposure. Compressor: Indoor installation</td>
<td></td>
</tr>
</tbody>
</table>
Maximum ambient air temperature, degrees F | 110
Minimum ambient air temperature, degrees F | 32

2. The design shall satisfy all Building Code, Mechanical Code, and Seismic Requirements.

3. The design shall allow for the most severe combination of conditions, which may include any or all of the following:
   a. Internal or external pressure.
   b. Specifically:
      1) Shell overturning due to seismic:
         a) Critical buckling.
         b) Design factor on tension side.
      2) Anchoring, due to overturning or internal pressure:
         a) Lug design.
         b) Analysis of attachment to shell.
         c) Effect on shell knuckle.
         d) Maximum pullout forces and moments reported for the foundation design.
      3) Internal pressure or vacuum:
         a) Main shells, hoop and axial.
         b) Cutout reinforcements at nozzles.
         c) Effect on any discontinuities or special components.
      4) Thermal:
         a) Differential expansion at temperature extremes.
         b) Thermal gradient through tank wall.

4. Factory Testing:
   a. Results of all tests shall be provided as Product Data.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Candidate manufacturers are listed below:
   1. Pulsco Corporation
   2. Charlotte America Tanks
   3. Young Engineering
   4. ZZ Technology

   Or equal [Per Addenda No. 1]

B. The manufacturer’s standard product may require modification to conform to specified requirements.

C. Manufacturer of the hydropneumatic tank shall be ISO-9001 certified for designing, manufacturing and testing complete surge tank system and components.
2.02 CONSTRUCTION

A. Materials:
   1. Tank materials shall comply with the ASME Boiler and Pressure Vessel Code, latest edition as the time of bidding. Tank shell shall be constructed of deep drawn carbon steel, double sub-arc welded domes, and side shells with double welded seems. Provide removable manway to allow inspection and maintenance. Provide ASME code stamp, National Board registration number, and pressure rating on tank.
   2. Instrumentation, valves, stilling well, sight glass, and all connected equipment shall be rated for the pressure requirements and environmental conditions per section 1.06.

B. Support:
   1. Tank shall be supported by support legs welded to the tank for anchoring to a concrete pad.

C. Level Control System:
   1. Provide Automatic Level Control System that includes Unit Control Panel, Level Transmitter, Level Probe(s), Solenoid Valves and Air Compressor to control the air volume in the tank by maintaining the water level within a specified operating range. Air shall be added to the tank from the air compressor and through the add air solenoid valve when water level is above the normal operating range. Air shall be vented from the tank through the vent air solenoid valve when water is below the normal operating range. Dry contacts shall be provided in the panel for surge tank fail, high, and low alarm signals when the water level is out of range. Use time delays to prevent false alarms and minor fluctuations.
   2. Unit Control Panel. House all electrical components including Vent-auto-Add switch, reset switch, disconnect, level switches, control relays, time delay relays, alarm contacts and Hi, mid, low indicating lights. The panel enclosure shall be wall mounted, 120V, 20A, NEMA 4X (304 Stainless Steel) UL Listed. Panel shall be factory wired and components shall be labeled. The control panel shall contain Warrick relays (or equal) for the level probes mounted in the stillwell on the tank. The level relays control the solenoid valves for air into and out of the surge tank. The level relays provide the high-high and low-low alarms. Provided output contacts or ethernet port for connection to remote level monitoring and alarms.
   3. Level Transmitter: differential pressure, 316L SST materials, silicone, BUANA, 3-way manifold, condensation valve, and copper tubing from tank.
   4. Level switches: Flange-mounted conductance type level probes (4), stainless steel body, electrode housing, and stilling well.
   5. Solenoid Valves. One solenoid valve for adding air and one solenoid valve for venting air. Solenoid valves shall be 120 volt, 60 Hz, of the size, type, CS4SM class or as recommended by the manufacturer.
   6. Surge control panel and instrumentation shall be in accordance with DIV 16 and DIV 17.
   7. Air Compressor. The air compressor package shall be a Duplex (two air-cooled, two-stage, oil lubricated reciprocating type air compressors mounted on one air receiver). Air Compressors shall include all necessary piping (tubing) for connection to the air receiver and all components wired to the air compressor control panel. The air compressor package shall be the standard product of a manufacturer who is
regularly engaged in the design and construction of fully automatic air compressor systems. The air compressor system shall include the following items.

a. A Totally Enclosed Fan Cooled (TEFC) motor shall drive the compressor and shall be adequate to drive the compressor continuously at full-rated output. Motor shall be 10 hp. Power supply shall be 460 volts, 3 phase and 60 hertz.
b. Compressor unit shall include a totally enclosed crankcase of cast iron, separate detachable deep finned cylinders, matched balanced pistons, separately removable valve housing, automatic drain valve, pressure switches, low oil switch and a direct reading pressure gauge. The low oil switch shall shut down the compressor if the oil level is too low. The switch shall not reset without adding oil and pressing the reset switch.
c. The air compressor control panel shall be provided with a run time meter, alternating relay, power on light, Hand-Off-Automatic (HOA) switch, reset switch, run light, motor thermal overload alarm light and low oil level alarm light. The Hand-Off-Auto selector switches for each motor shall be lockable in the off position. The panel shall be powered from a common 480V power supply and contain 2 combination magnetic motor starters and feeder circuit disconnect with the handle accessible from the panel door. Control panel shall be in accordance with Section 16950.
d. The air compressors shall start and stop in lead-lag based on pressure in the air receiver. Dry contacts shall be provided in the panel for remote indication of running, low oil, and common fail conditions for the compressor. The compressor shall be shut down by motor thermal overload, or low oil level. An alarm condition shall energize a local alarm light. One compressor shall be able to continue operating if the other fails or disconnected for service.
e. The compressor shall start automatically and run continuously if its HOA switch is in the HAND position and shall shut down if its HOA switch is in the OFF position.
f. The Hydropneumatic Surge Control System supplier shall select the compressor volumetric capacity and discharge pressure. The capacity and discharge pressure selected shall be sufficient for the application.
g. The compressor will be located approximately 300 feet from the surge tank. A 2-inch diameter service air pipe, provided by the contractor, will supply air from the compressor to the surge tank. Size the compressor to account for pressure loss induced by the service air pipe.
h. The air receiver shall be a minimum of 120-gallon capacity.
i. The air compressor package shall be coated with the standard factory coating.
j. Separator: The moisture separator shall be of the centrifugal impingement type, selected for the air flows specified. Moisture separator shall be Wright-Austin, Adams, Basco, or equal. The trap size shall be recommended by the separator manufacturer and shall be the automatic, float-actuated type.
k. Intake Filter-Silencer: Each compressor shall be provided with a cleanable, oil bath type inlet air filter and inlet silencer. Interior surfaces shall receive a rust-inhibitive coating. Minimum noise reduction by octave frequency band shall be as follows:
### Octave band, Hz | Attenuation, decibels
---|---
63 | 14
125 | 19
250 | 25
500 | 22
1000 | 21
2000 | 18
4000 | 17
8000 | 17

h. Air compressors shall be Ingersoll Rand or equal.

D. Miscellaneous Components:
1. Safety Relief Valve. The Surge Tank shall have a safety valve sized in accordance with the ASME code to prevent over pressurizing the Surge Tank above its design pressure. Safety Relief Valve set point shall be set to the maximum allowable working pressure of the Surge Tank.
2. Check Valve for Air Line.
3. Ball Valves for isolation and bypass of Solenoid Valves, isolation and drain of the probe well and drain and isolation of the air piping.
4. Probe Well. The probe well shall be mounted to the tank for use with level monitoring instrumentation. The connecting piping shall include isolation valves and a drain.
5. Sight Glass Assembly. The sight glass shall be mounted on the probe well for visually checking Surge Tank water level. The sight glass connection shall have isolation valves with ball check. Glass shall extend from approximately 6” below and 6” above the designed operating range. Guard rods shall be included.
6. Air Muffler for reducing the noise generated from the venting of air from the Surge Tank.
7. Pressure Gauge for indicating pressure in Tank
8. Probe Well, stainless steel with couplings for connection to Surge Tank and installation of level transmitter/level probes, sight glass and drain valve.
9. Contractor shall supply 80-feet of 4-inch diameter flexible hose, such as a fire hose, with female camlock couplings, to be used for tank draining operations.

E. Safety Warnings and Signage
1. Label all valves connected to surge tank with safety warning signage as follows:
   a. **WARNING: COMPRESSED AIR HAZARD. DO NOT OPEN BEFORE DEPRESSURIZING THE TANK. REFER TO STANDARD OPERATING PROCEDURES.**
2. Label surge tank manway with safety warning signage as follows:
   a. CONFINED SPACE. PERMIT REQUIRED FOR ENTRY.
3. Label air compressor with safety warning signage as follows:
   a. WARNING: AUTOMATIC STARTS.
4. Label all piping to show flow direction and color-code piping per EMWD standard.

2.03 COATINGS

A. Prior to coating, all surfaces shall be thoroughly dried and cleaned of all rust, dirt, grease, millscale and other foreign material. Abrasive blast interior and exterior surfaces in accordance with SSPC – SPID “Near-white Metal Blast Cleaning, or NACE equivalent.”

B. All painting and coating shall be completed at the factory. Tank exterior shall be coated with a high build epoxy primer and UV-resistant polyurethane top coat. Tank interior shall be coated with a high build epoxy primer and polyurethane top coat that is suitable for recycled water. Apply primer in a uniform layer to a minimum thickness of 12 mils applied in two coats. Apply top coat in a uniform layer to a minimum thickness of 12 mils applied in two coats.

C. All colors will be determined by the owner.

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspection of all tanks shall be performed by the tank manufacturer.

3.02 PREPARATION

A. The tanks shall be installed as shown and in accordance with the Fabricator's written instructions. The tank shall rest on a level, even, concrete base that supports the entire bottom of the mounting plates.

3.03 INSTALLATION

A. The unit shall be fully constructed by the manufacturer prior to shipping. Install the hydropneumatic tank in accordance with the manufacturer's written procedures. All ancillary supports, piping, valves, and related appurtenances required to install the manufacturer's Hydropneumatic Surge Tank system shall be provided by the Contractor.

3.04 FIELD QUALITY CONTROL

A. Manufacturer shall provide the services of a factory trained representative for one full day during tank installation to assist the Contractor.

B. Manufacturer shall provide the services of a factory trained representative for one full additional day after installation for training.
3.05 SYSTEM STARTUP

A. After approval of the installation by the Engineer and the manufacturer's representative in writing, the hydropneumatic surge tank system shall be tested under actual operating conditions in the presence of the Engineer and manufacturer's representative. The test conditions shall be selected to determine the ability of the hydropneumatic surge tank to perform as specified and will include functional test of the level control system and at least one transient pressure test condition, such as a simulated pump power failure. If the tank performance does not meet the specified requirements, corrective measures shall be taken under the direction of the manufacturer. The hydropneumatic surge tank system shall comply fully with this Section prior to acceptance.

3.06 CLOSEOUT ACTIVITIES

A. The tanks shall be hydraulically field tested by filling the entire tank with water and monitoring the tanks as well as all fitting connections for at least 24 hours. Leaks shall be corrected by the Fabricator prior to acceptance. Following successful field tank testing, the tanks shall be completely emptied.

END OF SECTION