SECTION 11900

hydropneumaTIC bladder control system

# GENERAL

## DESCRIPTION

This specification describes the requirements for a Hydropneumatic Bladder Control System. The purpose of the system is to control pump on-off operation and to minimize transient pressures from shock waves due to pump start-up, shutdown or valve shut-off.

The work included in this section consists of the furnishing of all labor, materials, equipment and appurtenances for a bladder tank on the discharge side of the pump station to control pumps and to prevent column separation and/or to limit surge upon pump shutdown including a power failure situation.

The bladder type tank shall consist of a cylindrical pressure tank, including: bladder, shell assembly, gas plate assembly, rupture disc, pressure gauges, other miscellaneous appurtenances and constructed in accordance with A.S.M.E. Section VIII Pressure Vessel Code Division I. Design pressure shall be *[125] [200] [250]* PSIG. The surge arrestor shall be constructed on a reinforced concrete foundation with steel supports as detailed on the Drawings.

## related work specified elsewhere

### Section 17000 – General Requirements for I&C System

## GENERAL REQUIREMENTS

### The unit shall be supplied by; Pulsco, Wessels, Bell & Gossett, or approved equal.

### The supplier must have a minimum of five years experience and must submit a surge analysis for the engineer’s approval (or verify analysis performed by others) showing: input data for the piping system, initial flow rate, initial and maximum expanded air volume and envelope of maximum and minimum line pressure throughout the pipe system. In addition, a predicted pressure-time history at the pump station and at other critical points in the pipe system will also be required.

### The hydropneumatic control system shall include a surge tank, bladder, air valve, pressure monitor and transmitter, level transmitter, and other miscellaneous appurtenances.

### The bladder tank must be designed to match the dynamics of the pumping system.

### The bladder tank supplier shall indicate the gas-to-fluid ratio in the tank based on the normal operating requirements.

### An operation and maintenance manual must be provided and personnel representing the bladder tank manufacturer are required to check the installation and instruct the owner’s personnel in the operating of the bladder tank control system. A field test of the equipment will be performed in conjunction with this site visit.

## REFERENCE SPECIFICATIONS, CODES AND STANDARDS

### Pressure vessels shall be in accordance with the latest revision of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section VIII, Division 1, “U” shaped with a National Board (NB) number, and U-1A Form Certification.

### All local Plumbing Codes shall be met.

### The system and anchorage of the tank shall conform to the International Building Code (IBC), latest edition.

## SUBMITTALS

### All equipment submittals shall be in accordance with the Contractor Submittals section of these specifications.

### **Shop Drawings:** Detailed tank fabrication drawings, system assembly and installation drawings.

### **Product Data:** Specifications for system components, accessories and protective coatings.

### **Design Data:** ASME code calculations.

### **Electrical:** Complete electrical diagrams.

### **Operation and Maintenance Manuals:** Provide with delivery of the system.

### **Shop Testing:** Tank ASME Form U-1A. Provide with O & M manuals.

### Guaranteed tank and bladder design with bladder performance sheets.

### Seismic and anchoring calculations prepared by a California-registered engineer.

### Spare part list for no additional cost to the District.

### Field installation training.

## WARRANTY

The tank, bladder and instrumentation shall carry a warranty of one year from initial operation or twenty-four months from delivery whichever comes first.

## DESIGN AND PERFORMANCE REQUIREMENTS

### One hydropneumatic surge control system shall be supplied. Major components shall include:

#### Hydropneumatic Bladder Tank

#### RF Welded Fabricated Bladder

#### Inlet dissipating device, differential pressure drop nozzle, and anti-vortexing device.

#### Miscellaneous instruments and valves

#### Non-intrusive electronic volume indicator with continuous 4-20 mA analog outputs.

### The pressure transients in the pipeline system following pump shutdown/start-up from design operating conditions must not cause cavitations nor water column separation at any point in the pipeline system and must not exceed the pressure rating of the piping at any point in the pipeline system.

## MANUFACTURER’S SERVICES

Provide equipment manufacturer’s services at the jobsite for a minimum one man-day to perform the following:

### Installation assistance and inspection of the surge control system.

### Field-testing and adjustment of the surge control system operations.

### Instruct the District’s personnel in the operation and maintenance of the surge control system electrical control system and level control system.

## PERFORMANCE GUARANTEE

Provide a written guarantee of performance, materials and workmanship guaranteeing that the bladder tank control system will conform to the design criteria specified. Such performance shall be verified by the field-testing specified. In the event that the test results show that the surge control equipment fails to comply with the design criteria, upgrade or reconstruct the surge control system so that it meets the design criteria.

## SYSTEM DATA

For pump control and surge protection purposes, the following criteria and data shall be used for designing and sizing the bladder tank.

### Pump Size and Pumping Conditions

### Approximate System-Head Curve Data for Design Flow Rates (Interim and Ultimate)

### Pipeline and Elevation Data

### Detailed distribution system information can be obtained from the owner or owner’s engineer.

### Hydraulic Design Criteria

|  |  |
| --- | --- |
| **Friction Factor** | **130 Hazen-Williams** |
| Flow rate - Maximum Normal | *x gpm* |
| Flow rate – maximum Emergency | *x gpm* |
| Maximum Allowable Pressure due to Surge @ Discharge | *x psi* |
| Minimum Allowable Pressure due to Surge @ Discharge | *x psi* |
| Minimum Allowable Pressure due to Surge @ Any Point in Pipeline | *x psi* (no column separation) |

The surge vessel is to be connected to the discharge pipeline as shown on the Plans. Pump control are utilized on the discharge of each pumping unit.

Include the following surge/flow conditions in the design of the surge vessel.

Pump failure at the design flow rate(s) indicated.

Size surge vessel with allowances for:

### The minimum net tank volume shall be *xxx* gallons.

### The surge tank shall contain approximately 60-percent water under steady state flow conditions and be connected to the discharge pipeline with a minimum *x-inch* diameter pipe.

## PHYSICAL SIZING

The bladder tank shall be sized so as to fit the pump station site area limitations as shown on the Drawings. Any variation of the size indicated on the Drawings shall be subject to approval by the Engineer, and District.

# MATERIALS

## HYDROPNEUMATIC BLADDER TANK

### The surge tank shall be constructed of carbon steel for a maximum allowable working pressure of *xxx psig* in accordance with the ASME Pressure Vessel Code, Section VIII. The surge arrestor shall be provided with a 14-inch flanged line connection, adequate supports, lifting lugs and couplings for a drain, pressure gauge, bladder, gas inlet nozzle, energy dissipater plate and manway.

### The surge tank shall be *xxx* gallons minimum in volume.

### The horizontal surge tank shall be approximately *xx* feet in diameter *xx* feet long and have a *xx*-inch inch bottom mounted ANSI B16 flanged inlet.

### The shell shall be constructed of carbon steel SA516 Gr 70 and have a *xx*-inch man way for internal inspection and access to rubber bladder. The tank shall be internally sand blasted and coated with epoxy 10-12 MDFT.

### The bladder shall have a gas valve to add and a valve to release gas to a given precharge with nitrogen gas. The unit shall also have a 4” diameter pressure gauge permanently mounted. A safety relief valve device shall be installed to prevent over pressurization of the tank.

### The fluid nozzle shall be *xx-*inches in diameter with a 150 lb. Flange. The inlet shall include an energy dissipater nozzle and vortex breaker. The nozzle loss factor shall be an outflow k=2.0 and an inflow k=3.2 to the full equivalent flow area of the *xx-*inch nozzle. The tank shall be fitted with a 316 stainless steel perforated plate to prevent the bladder from escaping through the fluid port.

### The unit shall have support legs designed per UBC requirements to withstand earthquake loading for location where the tank is located and installed.

### The bladder surge tank shall be equipped with a non-intrusive volume indicator device to monitor gas precharge levels without disrupting tank operations. This device shall be portable and be able to be used on bladder surge tank to determine the condition of the bladder gas precharge.

### The bladder tank shall be equipped with a non-intrusive electronic gas volume monitoring and indicating device with no connections to the pressure boundaries of the shell:

#### Non-intrusive volume indicator to continuously monitor gas pre-charge pressure without disrupting tank operations.

#### The device shall be local and be able to be used on bladder type tanks to determine the condition of the gas pre-charge in the bladder in real time conditions.

#### The indicator panel shall consist of a “precharge pressure in range” light and a “precharge pressure out of range” light along with 4-20 mA analog output signals to indicate precharge pressure, liquid level, and operating pressure.

#### Provide alarm indicator and alarm output signal (dry contact 5A rated).

#### The control panel shall be a NEMA 4X enclosure (316 stainless steel).

#### The device shall continuously monitor the bladder tank gas pressure in real time, and serve as a transmitter to connect to the SCADA system.

#### The unit shall be powered by 120 Vac, single phase, 60 hertz power.

#### Pressure transmitter shall be Rosemount 3051C series or equal.

#### Level transmitter shall be Rosemount 3051C DP series or equal.

#### Pressure gauge shall be Ascroft 1279 series or equal.

# EXECUTION

## SOURCE QUALITY CONTROL

### Hydrostatic test the hydropneumatic bladder surge tank in accordance with ASME Code for Unfired Pressure Vessels.

### Submissions shall include Form U-1A “Manufacturers’ Data Report for Unfired Pressure Vessels” prepared by the tank manufacturer to certify that the tank was built in accordance with ASME Code Rules for the Contraction of Unfired Pressure Vessels and inspected by a certified inspector. Copies of the form shall be included in the Operation and Maintenance Manual.

## INSTALLATION AND TESTING

### The supplier shall provide all components and assembly instructions to the Contractor for installation.

### Testing shall be performed by the Contractor in the presence of the Engineer and a representative of the supplier. Testing shall consist of functional test of the simulated power failure when pumps are running at maximum operating flow conditions.

### System supplier shall provide start-up support (one trip, one day) to test and instruct District’s personnel.

## UNIT RESPONSIBILITY

The entire surge control system shall be designed and supplied by a single manufacturer. However, this shall not relieve the General Contractor’s responsibility for coordinating, installing and performing his complete portion of the work.

**END OF SECTION**