



# young engineering manufacturing, inc.

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## BLADDER SURGE CONTROL SYSTEM

### PART I – GENERAL

#### 1.01 Description

This specification describes the requirements for a Bladder Surge Control System. The purpose of the system is 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 surge protection at the discharge side of each well pump to prevent column separation and/or to limit surge upon pump shutdown including a power failure situation.

The bladder type surge arrestor shall consist of a cylindrical pressure tank for surge control, 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 \_\_\_\_\_ psig. The surge arrestor shall be constructed on a reinforced concrete foundation with steel supports as detailed on the Drawings.

#### 1.02 General Requirements

- A. A The unit shall be supplied by Young Engineering and Manufacturing Inc., San Dimas, California. Unit shall be model \_\_\_\_\_ bladder surge tank rated at \_\_\_\_ psi design working pressure.
- B. 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.
- C. The bladder surge control system shall include a surge tank, bladder, gas valve and other miscellaneous appurtenances.
- D. The surge tank must be designed to match the dynamics of the pumping system.
- E. The surge tank supplier shall indicate the percent of fluid in the tank, with a nominal value of 60% fluid to 40% nitrogen gas.
- F. An operation and maintenance manual must be provided and personnel representing the bladder type surge arrestor manufacturer are required to check the installation and instruct the owner's personnel in the operating of the surge control system. A field test of the equipment will be performed in conjunction with this site visit.

#### 1.03 Reference Specifications, Codes and Standards

- A. Pressure vessels shall be in accordance with the latest revision of the American Society of Mechanical Engineers (ASME) Code for Unfired Pressure Vessels, Section VIII, Division 1.
- B. All local Plumbing Codes shall be met.
- C. The system and anchorage of the tank shall conform to the Uniform Building Code (UBC).



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## 1.04 Submittals

- A. All equipment submittals shall be in accordance with the Contractor Submittals section of the Request for Quote (RFQ).
- B. Shop Drawings: Detailed tank fabrication drawings, system assembly and installation drawings.
- C. Product Data: Specifications for system components, accessories and protective coatings.
- D. Design Data: ASME code calculations.
- E. Operation and Maintenance Manuals: Provide with delivery of the system.
- F. Shop Testing: Tank ASME Form U-1A. Provide with O & M manuals.
- G. Confirmation of the tank sizing as performed by others.
- H. Seismic and anchoring calculations.

## 1.05 Warranty

The tank, bladder and instrumentation shall carry a warranty of one year from delivery.

## 1.06 Design and Performance Requirements

- A. One surge control system shall be supplied. Major components shall include:
  - 1. Bladder Surge Tank
  - 2. Bladder
  - 3. Inlet energy dissipating device
  - 4. Miscellaneous instruments and valves
- B. The pressure transients in the pipeline system following pump shutdown/startup 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.

## 1.07 Surge Analysis

- A. The manufacturer shall review the plans and specifications and the surge analysis as performed by others in regards to the system hydraulics and the surge vessels.
- B. Results of the analysis shall indicate that the design and size of the surge arrester provided will adequately protect the system from excessive pressure surges and shall show the hydropneumatic bladder type surge control system will meet the Performance Guarantees in Section 1.10.

## 1.08 Manufacturer's Services

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

- A. Installation assistance and inspection of the surge control system.
- B. Field-testing and adjustment of the surge control system operations.



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- C. Instruct the Owner’s personnel in the operation and maintenance of the surge control system level control system.

## 1.09 Manufacturers

The manufacturer shall be experienced for at least 5 years in the design and operation of surge control systems and shall provide a list of similar installations for review by the Engineer.

## 1.10 Performance Guarantee

The tank system shall be designed to take no benefit from the operation of air and vacuum valves, pressure relief valves or air release valves which may be located along the pipeline. Surge protection tanks shall be designed to satisfy the system pressure as follows:

Provide a written guarantee of performance, materials and workmanship guaranteeing that the surge 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.

## 1.11 System Data

For surge protection purposes, the following criteria and data shall be used for designing and sizing the surge arrestor.

- A. Pump Size and Pumping Conditions
- B. Approximate System-Head Curve Data for Design Flow Rates (Interim and Ultimate)  
The individual well information regarding the pump column length, diameter, bowl setting, pump (dynamic) well water level and other critical hydraulic parameters can be obtained in the plans, specifications and well drilling report.
- C. Pipeline and Elevation Data

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

### D. Hydraulic Design Criteria

Friction Factor	Hazen-Williams
Flow rate through Interim	_____ gpm
Flow rate through Ultimate	_____ gpm
Maximum Allowable Pressure due to Surge @ Discharge	_____ psi
Minimum Allowable Pressure due to Surge @ Discharge	15 psi
Minimum Allowable Pressure due to Surge @ Any Point in Pipeline	5 psi (no column separation)

The surge vessel is to be connected to the discharge pipeline as shown on the Plans. Non-slam check valves 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.



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Size surge vessel with allowances for:

- A. The minimum net tank volume shall be \_\_\_\_ gallons.
- B. The surge tank shall contain approximately 60-percent fluid under steady state flow conditions and be connected to the discharge pipeline with a minimum 8-inch diameter pipe.

## 1.12 Physical Sizing

The surge arrestor shall be sized so as to fit the pump station site area limitations as shown on the Drawings. The bladder surge tank and any appurtenances shall not exceed a height of \_\_\_\_\_ from the finished surface. Any variation of the size indicated on the Drawings shall be subject to approval by the Engineer and Owner.

## PART II – MATERIALS

### 2.01 Bladder Surge Tank

- A. The surge tank shall be constructed of carbon steel for a maximum allowable working pressure of \_\_\_\_ psig in accordance with the ASME Pressure Vessel Code, Section VIII. The surge arrestor shall be provided with a \_\_\_\_ flanged line connection, adequate supports, lifting lugs and couplings for a drain, pressure gauge, bladder, gas inlet nozzle, energy dissipater plate and manway.
- B. The surge tank shall be \_\_\_\_\_ gallons minimum in volume.
- C. The horizontal or vertical surge tank shall be approximately \_\_\_\_\_ in diameter \_\_\_\_ length and have a \_\_\_\_ inch bottom mounted ANSI B16 flanged inlet.
- D. The shell shall be constructed of carbon steel SA516 Gr 70 and have a see below\* -inch manway for internal inspection and access to rubber bladder. The tank shall be internally sand blasted and coated with epoxy 10-12 MDFT.

\*(Note: Our standard recommended manway for 36" diameter tank and smaller is 8". Above 36" diameter, 18" manway is recommended.)

- E. The bladder shall have a gas valve to add or 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.
- F. The fluid nozzle shall be \_\_\_\_ inches in diameter with a 150 or 300 lb. Flange (based on specifications). 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 \_\_\_\_ inch nozzle. The tank shall be fitted with a 304 stainless steel perforated plate to prevent the bladder from escaping through the fluid port.
- G. The unit shall have support legs or saddles designed per UBC Seismic Zone 4 requirements to withstand earthquake loading.
- H. 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.



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## 2.02 Miscellaneous Components

- A. Pressure Gauge
- B. Gas Charging Nozzle
- C. ½" Rupture Disc
- D. Electronic Volume Indicator (Portable)

## PART III – EXECUTION

### 3.01 Source Quality Control

- A. Hydrostatic test the hydropneumatic bladder surge tank in accordance with ASME Code for Unfired Pressure Vessels.
- B. 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 Construction of Unfired Pressure Vessels and inspected by a certified inspector. Copies of the form shall be included in the Operation and Maintenance Manual.

### 3.02 Performance Guarantee

- A. The manufacturer shall provide a guarantee of performance and workmanship certifying that the system will meet all provisions of these specifications.
- B. Such performance shall be certified by operational field tests.

### 3.03 Installation and Testing

- A. The supplier shall provide all components and assembly instructions to the Contractor for installation.
- B. 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.
- C. System supplier shall provide start-up support (one trip, one day) to test and instruct project personnel.

### 3.04 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.

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(BST Control System 8-4-06)