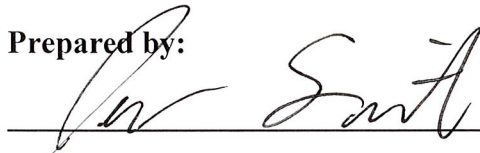


Hydropneumatic Tanks

BSB 0600-01

Prepared by:



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Date: 01/30/2023

Procedure approved by:



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Date: 01/30/2023

BOILER SAFETY BUREAU

STANDARD OPERATING PROCEDURE MANUAL

1.0 PURPOSE AND SCOPE

To provide uniform, comprehensive inspection requirements for hydropneumatic tanks to ensure that they are safe for continued operation.

Applies to inspections of all hydropneumatic tanks that are required to be inspected by Boiler Safety Bureau (BSB or Bureau) Deputy and Special Inspectors.

2.0 PERSONNEL RESPONSIBILITIES

- 2.1 The Bureau Chief – BSB has the overall responsibility for implementation of this instruction.
- 2.2 The Assistant Bureau Chief has the oversight responsibility for this procedure as it applies to the inspection staff.
- 2.3 The Inspector Supervisors are responsible for ensuring the inspectors use this instruction, as a minimum, in their inspections.
- 2.4 BSB Inspectors are responsible for cognizance, understanding and use of this instruction.

3.0 HEALTH AND SAFETY ISSUES

The purpose of this procedure is to guide inspectors through the process of inspecting these particular objects. This will aid the inspector in performing thorough and effective inspections which will promote the safe operation of the object(s).

4.0 PROCEDURE

- 4.1 The duties of the Inspector shall include, but are not limited to the following:
 - 4.1.1 Verify that the hydropneumatic tank is due for inspection.

NOTE: Hydropneumatic tanks shall be inspected at least every four (4) years. The inspector may require a shorter period if the condition of the vessel warrants more frequent inspection. The inspector shall document concerns about the vessel and reasons for a shorter inspection frequency on his report.

- 4.1.2 Note the maximum allowable working pressure (MAWP) and the safety relief and/or relief valve (if used) set pressure, from the last inspection. See Figure 0600-01-01 for valve placement.
- 4.2 When possible, find out from the owner/user when the vessel will be drained, cleaned, and manhole covers removed. If it is feasible to coincide inspection with the cleaning, access to the internal services will

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facilitate a thorough inspection and knowledge about generalized corrosion. This knowledge of thinning areas will allow for a determination of potential de-rating.

4.3 Internal Inspections:

- 4.3.1 When making internal inspections, adherence to the following procedures is required: BSB 0200-07, CONFINED SPACE ENTRY and BSB 0200-08, TAGOUT/LOCKOUT.
- 4.3.2 If an internal inspection is made, ensure that a person is stationed outside of the vessel when entering.
- 4.3.3 Have accumulations of sludge and debris, which could mask problems, removed prior to inspection.
- 4.3.4 Inspect interior surfaces of the shell for general corrosion, pitting and scale build-up. Pitting or craters should be checked for depth to determine the remaining thickness of shell material.
- 4.3.5 Inspect weld seams for corrosion and/or signs of cracking. See Figure 600-01-02 for possible weld configuration.
- 4.3.6 If possible, view the safety relief and/or relief valve through the nozzle to verify that the flow path is clear of obstructions.

4.4 External Inspections:

- 4.4.1 Inspect safety relief and/or relief valves for correct size, set pressure, capacity, condition, i.e., evidence of leaking, scale or spring, and that the seals are in place. Have the owner/user manually operate the lifting lever to ensure it is free, and that the valve operates smoothly.
 - a) The safety valve or relief valve for the air side of the vessel must be installed on top of the vessel in order to relieve the air space. **NOTE: A stop valve may be installed between the safety valve and the vessel as long as it is pad locked in the open position.**
 - b) Inspect the discharge piping from the safety valve outlet. If the piping is routed to a closed piping system, inquire from the owner if there will be any back pressure acting on the downstream side of the safety valve's disk. If so, how much back pressure? If so, determine if the valve is designed and set to handle back pressure acting on the downstream side of the valve's disk.
 - c) Inspect the nameplate to verify that an ASME Code stamp and National Board capacity certification mark exists. If an air compressor is connected to the vessel to provide the air

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cushion, verify that the safety valve capacity is appropriate for the compressor output.

- d) Inspect for an additional waterside relief valve. If the vessel should fill completely with water with no air the valve could be necessary. The liquid relief valve should be in units of gallons per minute. Compare the valve's nameplate capacity against the pump's capacity rating and verify that the valve's minimum relieving capacity equals or exceeds that of the pump. **NOTE: This valve is optional and is not required.**

4.4.2 Inspect all exposed exterior surfaces of the vessel paying particular attention to weldments. Do not ignore saddle-to-vessel welds. If signs of corrosion and/or leakage exist, such as moisture, rust stains, etc., inspect further to attempt to determine the source of suspected leaking. Many hydropneumatic tanks rest on saddles without welding and may have a rubber seal that deteriorates over time. Rainwater can and does run down the tank and lies between the saddle and the vessel causing rapid corrosion due to the physical contact stresses between the saddle and the vessel.

4.4.3 When possible, vessel thickness should be checked with an ultrasonic thickness measuring instrument (UT device). If significant changes in thickness are measured, the vessel should be opened and internally inspected. If thickness is reduced, the maximum allowable working pressure will probably need to be reduced.

4.4.4 The pressure rating determination shall be based on the thickness of the thinnest area using the following formula:

$$P = \frac{TStE}{rFS}, \quad \text{where:}$$

P = Pressure allowed (psig)

TS = Tensile strength (45000 if material is unknown)

t = Vessel wall thickness (inches)

E = Longitudinal joint efficiency (See Figure 0600-01-02)

FS = Factor of safety (2 if non-ASME)

r = Inside radius (inches)

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- 4.4.5 On completion of the inspection, determine if the maximum allowable working pressure for the vessel is appropriate. If there is general corrosion and thinning and the pressure should be lowered, contact the Inspector Supervisor, and notify him of the deficiency. The Inspector Supervisor shall confer with the Bureau Chief. If the Bureau Chief concurs with the decision to lower the pressure, the nameplate stamping shall be obliterated, and the new pressure stamped on the plate along with the Inspector's initials and the date.
- 4.4.6 If the Inspector deems it necessary, a hydrostatic test of the vessel shall be undertaken. If the Inspector requests the hydrostatic test, he or she shall be on hand to witness the test. The test pressure shall not exceed 1.1 times the MAWP. **NOTE: Safety valves may have to be removed.**
- 4.4.7 The Uniform Boiler & Pressure Vessel Act of North Carolina and Administrative Rules, along with the ASME Code and the NBIC are the criteria by which the Inspector recommends the issuance or non-issuance of a Certificate of Inspection.

5.0 CUSTOMER SERVICE REQUIREMENTS

The purpose of following this procedure is to provide the customer, be it the public, employees of the Bureau, or other state agencies, with the most efficient service, information, training, and assistance possible.

6.0 DATA AND RECORD MANAGEMENT

The Inspector shall complete an inspection report (form BB-101) after the inspection. If directives are to be given, they shall be detailed on the report. Where additional space is needed, pages shall be attached as necessary. ***Records shall be maintained in accordance with the Functional Schedule for North Carolina State Agencies as adopted by State Archives, a Division of the North Carolina Department of Natural and Cultural Resources.***

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FIGURE 0600-01-01

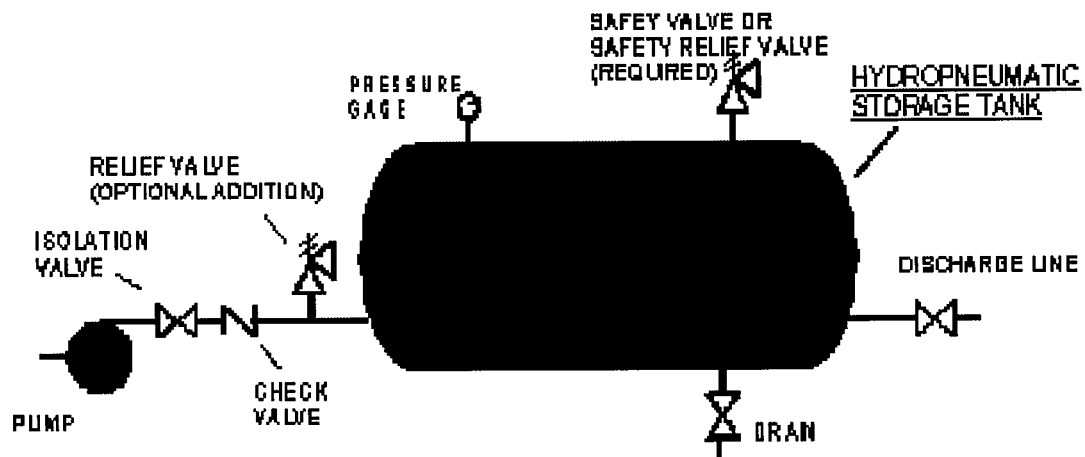
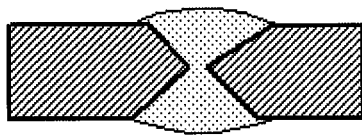
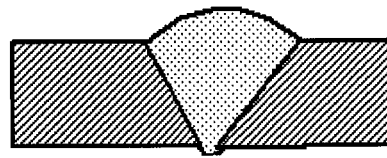


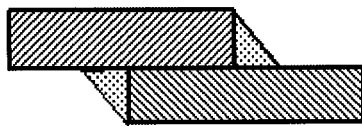
FIGURE 0600-01-02



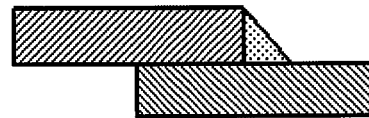
DOUBLE V GROOVE
E=0.75



SINGLE V GROOVE
E=0.60



DOUBLE WELDED LAP JOINT
E=0.50



SINGLE WELDED LAP JOINT
E=0.40