



SPLASH ALERT!

Hydropneumatic Tank Inspection and Maintenance

Water and wastewater systems are being alerted the hazards concerning aging hydropneumatic and surge tanks. The ACWA/JPIA recommends agencies take tank inspections seriously. Regular preventative maintenance, annual, and five-year inspections should be scheduled. Pressure vessels are dynamic devices. When they fail, they can fail catastrophically. They can cause major damage, injury, and even death.

Several tanks have failed in California; one resulted in the death of a wastewater system operator in June 2011.

<http://www.paintsquare.com/news/?fuseaction=view&id=5797>

<http://www.redding.com/news/2011/jun/16/city-osh-investigate-explosion/>.

Most recently, a tank exploded at an ACWA/JPIA Member's facility, causing tens of thousands of dollars in damages. In this case, the explosion was so powerful that the tank was forced off its foundation, and the perimeter block wall was destroyed. Fortunately, no one was injured or killed.



All metal vessels used as hydropneumatic or surge tanks must be constructed to American Society of Mechanical Engineers (ASME) standards or be Code-certified. This can often be verified by reviewing the manufacturer's plate installed at the time of construction. Tanks without an ASME plate should be structurally evaluated by a registered engineer if the tank will continue to be pressurized.

The metal skin of pressure vessels is under continual tension. When corrosion, crack, or break occurs, it can rip through the metal skin at speeds in the range of hundreds of miles per hour. In other words, you won't see it happening. You will hear it, and if you are standing next to it, you will not be able to move fast enough to get away from it.

As of October 1, 2012, Cal/OSHA has no regulatory guidance for the inspection and maintenance of hydropneumatic tanks. The Division of Occupational Safety and Health (DOSH) is expected to issue a "Guidance Letter" on the topic within a few months. In the interim, the JPIA recommends its members take the following actions based on industry "best practices" and the regulatory guidance established by the State of Florida.

ACWA/JPIA is recommending its member districts check all conventional (*non-bladder*) hydropneumatic and surge tanks and ensure:

1. All tanks have a manufacturer's plate indicating they were constructed to ASME standards and lists the maximum operating pressure and minimum wall thickness (see the enclosed sample photos)
 - The manufacturer's U-1 report is needed if the ASME plate does not indicate the minimum wall thickness. The U-1 report is used to determine the original head and shell thickness. The measured thickness is compared to the U-1 indications.
 - Tanks that do not have an ASME plate, should be removed from service and replaced as soon as possible.
 - If a tank without an ASME plate is to remain in service temporarily, a registered professional engineer familiar with ASME standards must determine the maximum operation pressure of the tank based on an inspection and measuring the wall thickness of the tank.
2. A functioning pressure gauge is installed to monitor tank pressure.
3. Tanks have been cleaned and inspected within the **past five years. *IF NOT:***
 - An interior and exterior inspection is required to assess structural and coating integrity, pit, depth, and wall thickness.
 - Individuals conducting these inspections should be experienced in American Society of Mechanical Engineers (ASME) standards, and be qualified as a National Board of Boiler and Pressure Vessel (NB) or American Petroleum Institute (API) inspector for determining

- regarding the structural and coating integrity of a finished-water storage tank.
- Water systems are advised to keep written records documenting these inspections.
 - Tanks excluded from this recommendation would be HPDE and bladder tanks.
4. All pressure gauges, sight levels, and hoses are in working order, and free of damage or defects.
 - A site level or other method for verifying the water level in a tank is required.
 5. A pressure relief valve (PRV) is installed to prevent tank over-pressurization.
 - The PRV installed must not exceed the maximum operating pressure of the tank.
 - This valve should be tested and exercised periodically.
 - PRVs should not be painted, tampered with, or damaged.
 - PRVs should be **replaced every five-years**.
 6. No visual signs of exterior damage or corrosion should exist.
 - Tanks should be maintained and painted to prevent rust and corrosion.
 - It is important to inspect the lower side and welding seams on tanks.
 7. Tanks must be properly secured to a foundation to prevent accidental movement.
 8. Any maintenance, repairs, grinding, sandblasting, or welding on hydropneumatic tanks should be performed by individuals properly trained, and certified to work on ASME pressure vessels.
 - Welds on tanks can only be made by a NB “R” stamp holder, and these repairs must be inspected by a NB inspector before the tank is pressurized and placed back into service.
 - Alterations to hydropneumatic tanks can reduce structural integrity and compromise the tanks pressure rating.
 9. If a cut-in valve is installed between the tank and PRV, the valve must be isolated (locked open) to prevent it from being closed while the tank is operating under pressure until the cut-in valve can be removed.

- The use or installation of a “cut-in valve” in front of the PRV is not recommended, or may not be allowed by Code.
- The cut-in valve should only be closed by using lock out/tag out procedures, when the tank has been removed from operations.

10. As part of regular and annual preventive maintenance for conventional hydropneumatic and surge tanks, agencies are reminded to ensure:

- The manufacturer’s plate indicating a tank was constructed to ASME standards is legible, and that it lists the maximum operating pressure.
- Tanks are secured to a foundation to prevent accidental movement.
- A functioning pressure gauge is installed to monitor the pressure.
- All pressure gauges, sight levels, and hoses are in working order and free of damage or defects.
- A pressure relief valve (PRV) is installed to prevent tank over-pressurization.
- The PRV installed must not exceed the maximum operating pressure of the tank.
- The PRVs are tested and exercised periodically.
- PRVs are not painted, tampered with, or damaged.
- PRVs are **replaced every five-years**.
- If a cut-in valve is installed between the tank and PRV, the valve must be isolated (locked open) to prevent it from being closed while the tank is operating under pressure, until the cut-in valve can be removed.
- No visual signs of exterior damage or corrosion exist.
- Tanks are maintained and painted to prevent rust and corrosion. It is important to inspect the lower side and welding seams on tanks.
- An interior inspection is accomplished at least every five-years.
- If interior corrosion is found, an NB inspection is performed to determine the thickness of the vessel wall.
- If repairs are required, welds must only be completed by certified welders (NB “R” stamp holder).
- All repairs must be inspected by a NB inspector.

If an Agency is unsure of the condition of its hydropneumatic and surge tanks, or has not had their tanks inspected within the last five-years, the above inspections should be performed as soon as possible. A sample **SCOPE OF WORK** is provided.



All metal vessels used as hydropneumatic or surge tanks must be constructed to American Society of Mechanical Engineers (ASME) standards or be Code-certified. This can often be verified by reviewing the manufacturer's plate installed at the time of construction.

Data found on the manufacturer's plate is critical to evaluating the structural condition and operational levels for any hydro pneumatic or surge tank.

ASME or Code Stamp
 Serial Number
 Shell and Head Thickness



Manufacturer
 Maximum Allowable Working Pressure
 Year Constructed
 Construction Materials

All metal vessels used as hydropneumatic or surge tanks must be constructed to American Society of Mechanical Engineers (ASME) standards or be Code-certified. This can often be verified by reviewing the manufacturer's plate installed at the time of construction. Tanks without an ASME plate should be structurally evaluated by a registered engineer if the tank will continue to be pressurized.

**Sample Scope of Work for Preventive Maintenance on
Hydropneumatic Tanks. *(Adopted from the State of Florida)***

TANK INSPECTION AND CLEANING SERVICES

Contractor should propose to furnish all materials, equipment, labor to provide cleaning, and inspection services on the following hydropneumatic or surge tank:

Tank	Location	Size	ASME / Serial #
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All inspections and reports completed by must be made by a qualified National Board of Boiler and Pressure Vessel (NB) or American Petroleum Institute (API) inspector.

Services to include; (all exclusions must be in writing)

Item #1--Scheduling

- Inspection date and time will be coordinated with the Agency and the Engineer/Contractor prior to actual inspection scheduling to ensure that all of the water users are properly notified prior to the agreed upon inspection date and time.

Item #2--Tank Draining

- Remove the hydropneumatic tank from service.
- Shut off, including lockout/tagout (LOTO), of wells, high service pumps, air compressor, etc.
- Provide hoses etc, to drain the tank and discharge the water to drainage facility or appropriate site without causing erosion or runoff.

Item #3--Tank Cleaning

- Remove the man way cover and clean the mating and sealing surfaces.
- Remove the sludge, mineral deposits, and bio-growths from interior of tank with an industrial vacuum system.
- Clean and wash the tank interior with a pressure washer and chlorine solution.

Item #4--Inspection Services

- Comply with all Cal/OSHA safety practices during the tank inspection process. (Contractor shall be qualified in confined space entry procedures)
- Visual observation of the interior and exterior surfaces of the tank will be performed by personnel under the responsible charge of a National Board of Boiler and Pressure Vessel (NB) or American Petroleum Institute (API) inspector. Inspection will include either entering into, or reaching into, the tank(s), depending upon the configuration of the access ports and tanks, to perform the interior inspection. Photograph the interior of

the tank including both ends, the entire shell circumference and all ports or penetrations.

- Report the condition of the interior coating.
 - Measurements of steel shell and head along with the coating thickness will be acquired by utilizing a Krautkramer DMS-2/TC Ultrasonic Thickness Gauge, or equal.
 - Measurements will be systematically taken at pre-determined points on the overall tank and additional measurements will be taken at points of obvious visual degradation.
 - Measurements should represent actual thicknesses at the location of the test points. Every effort should be made to locate the most severe conditions of deterioration (loss of material thickness due to corrosion found)
 - Visually inspect all welds.
 - Photograph the entire tank exterior and report the condition.
 - Final written documents shall require a U-1 report for determining head & shell thickness to compare with measured thickness.

Item #5--Returning the Tank to Normal Operation

- Contractor and Agency shall review procedures on how to restart the vessel after shutdown for inspection.
- Procedures may include, but not be limited to:
 - Disinfect the tank per CA-DPH standards when the interior inspection is completed.
 - Install a new rubber gasket in the man way.
 - Pre-charge the tank with 50% air.
 - Fill the tank with water and check chlorine levels.
 - Remove the bypass equipment and drain hoses.
 - Test and operate PRV to ensure working operation.
 - Notify Agency and return the equipment pump(s) to normal operation.
 - Remove all LOTO devices.

Item #6--Reports

- Provide (2), original, bound color copies, or acceptable digital media, of the U-1 report and other Inspection finding signed and sealed by a qualified National Board of Boiler and Pressure Vessel (NB) or American Petroleum Institute (API) inspector .
- The report shall include an itemized description of the condition of the tank (interior and exterior), color photographs, and general recommendations as applicable.
- Additional report copies are available at \$_____ each.

Item #7--Maintain Water Service to the System and Bypass the Tank (If listed in the attached Proposal)

- Contractor and Agency shall review procedures on how to restart the vessel after shutdown. Visit the site, inspect, and test the operation of the inlet, outlet, and bypass valves at tank.
- Install pressure relief valves on the distribution system, (such as fire hydrants or Blow Offs) and discharge hoses (to discharge water into drainage or retention ponds etc.) to allow the manual operation of the pump(s) and bypass of the tank.

Item #8--Bacteriological Sample Collection and Testing (Proposal option; may be performed by Agency)

- Collect and submit four bacteriological water samples of the hydropneumatic Tank per CA-DPH standards.

Item #9--Appurtenances

- The following items can be repaired or replace during the inspection if found during course of inspection, damaged or not in working order during course of inspection, per an approved written change order; Pressure Gauge, Pressure Switch, Site Glass, Water Level Sensor, Tank Mounted Air Compressor, Pressure Relief Valve, Tank Drain Valve, and Chlorine Injection Point. Provide itemization costs for parts and labor to replace as part of proposal.