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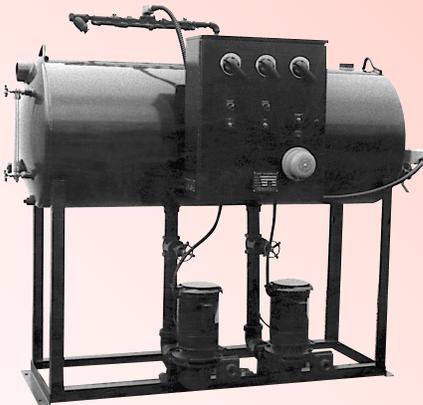
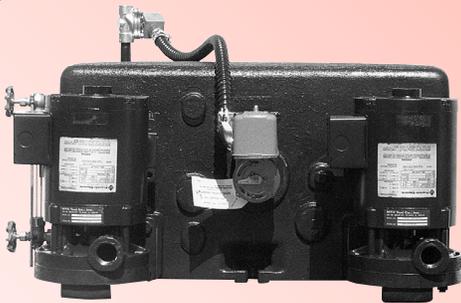
Pride

Quality

Craftsmanship

BULLETIN 167
Revised 12/22

SHIPCO®
Surge Tanks



Centrifugal Bronze Fitted Pump
For many years of dependable service
with low maintenance
3500 RPM or 1750 RPM Motors
Black or Stainless Steel
or Lined or Cast Iron Receivers
Pumps have no internal bearings
Pumps designed to run continuously

SHIPCO®
PUMPS equipped with Mechanical Seals rated up to a standard 250°F.
Higher temperature seals and special faces available upon request.

Surge Tank Pump Selection & Sizing

When Is a Surge Tank Used?

The general rules of thumb are as follows:

On systems with 80% or more make-up a surge tank is not required.

On systems with more than 20% returns a surge tank is required to achieve good deaeration.

What Is a Surge Tank?

A surge tank is another name for a boiler feed tank. It acts exactly like a boiler feed tank except that it feeds a deaerator in lieu of a boiler. With a surge tank the make-up water is added into this tank and blended with the return water to avoid shocking the deaerator with extreme temperature and capacity variations. In addition, the pumps on the surge tank must run continuously, pumping the water directly into the modulating transfer or the make-up valve on the deaerator. The second transfer pump on a SHIPCO® surge tank is a standby pump that may be activated by a low-level switch on the deaerator (-2T or -2C Type Units) or stacked. This standby pump runs automatically in case the lead pump fails or can't keep up.

A surge tank is not a condensate pump since a condensate pump turns on and off based on the water level in its receiver. When a condensate style unit is used as a surge tank, it defeats the entire purpose of a surge tank by allowing large variations in capacity and temperature into the system. The main purpose of the surge tank is to level out the transients or control the fluctuations in capacity and temperature so the deaerator runs as smoothly and effectively as possible.

If controlling these variations in temperature were not important, no need would exist to use expensive controls that modulate on the deaerator.

What Does a Surge Tank Look Like?

Since a surge tank is another name for a boiler feed tank, as mentioned earlier, the tank can take many shapes and forms. The tank can be made of stainless steel, close grained cast iron (with a 20-year warranty against corrosion failure) to prevent against corrosion failure, Plasite #7156 lined, or simply black steel.

The surge tank can be an integral part of the deaerator, like a two-compartment style (look under its specific tab) or be free standing by itself (called a two-tank or -2T system) or even mounted under the Deaerator (DA) as a stacked unit.

Where surge tanks are in a free-standing by itself situation (-2T systems), the free-standing surge tank can be elevated or mounted on the floor like many of the types throughout the entire catalog (see Reference Chart A below). Yes, the surge tank may be placed on the floor. This is possible because at 150, 180 or even 200°F. the water temperature is low enough that NPSH is not a major concern. For example, with 194°F water you have 10.46 feet of NPSH available at sea level. If you look at the pump curves in the catalog under Model D or P, the pumps, if properly selected, are 2 ft., 4 ft. or 6 ft. NPSH at the best efficient point on the curve; hence, the NPSH available is greater than the pump NPSH requirement based on 194°F water in tank.

All floor-mounted units should be sold and specified with SHIPCO® bronze isolated valves that are factory tested for servicing the pump.

CHART A

<i>Vertical Floor Mounted</i>	<i>EMV Tab</i>
<i>Floor or Elevated Cast Iron</i>	<i>DMC/PMC/PMEC Tab</i>
<i>Rectangular Steel Tanks</i>	<i>DMS/ PMS/PMES Tab</i>
<i>Cylindrical Steel Floor Mounted – Pump on end</i>	<i>CS-B Tab</i>
<i>Cylindrical Steel Floor or Elevated – pump on side</i>	<i>CS & CES Tab</i>
<i>Dished Head Steel Floor or Elevated</i>	<i>SHM & SHEM Tab</i>
<i>ASME Code Stamped Units</i>	<i>HT Tab</i>

How to Determine Transfer Pump (Gallons per Minute) GPM

All deaerator units are rated in lbs/hr of steam. The transfer pumps on the surge tank units are sized based on this rating. Lbs/hr divided by 500 equals the evaporation rate in GPM for these pumps. The pumps are sized as follows:

If transfer pumps are feeding a deaerator on a free-standing by itself surge tank (-2T) system, the pump rate in GPM equals the evaporation rate or the total load rating on the deaerator. For example, if deaerator system is rated 10,000 lbs/hr, then each transfer pump should be rated for 20 GPM.

If transfer pumps feeding a deaerator with the surge tank are part of the complete unit like our two-compartment model (-2C), the transfer pumps are sized differently based on being an atmospheric or pressurized deaerator.

If a pressurized two-compartment deaerator unit is used (-2C), the pump rate equals the evaporation rate or the total load rating on the deaerator (as mentioned earlier).

If an atmospheric two-compartment deaerator is used (.005 DA-2C or .03 DA-2C), the pump rate in GPM equals the evaporation rate of the deaerator multiplied by 1.5. For example, if deaerator is rated 10,000 lbs/hr, then each transfer pump should be rated for 30 GPM (20 GPM x 1.5). This is to allow recirculation of water through the vent condensers. In addition, this is the only type of surge tank where NPSH is a concern and pumps should have an NPSH requirement lower than the height of the stand to be safe.

Recirculation for these continuously running transfer pumps may be required. The SHIPCO® Model P and D pumps have as standard a bleed line that does not require any additional recirculation when pumping liquids lower in temperature than the saturation or boiling point.

How to Determine the Pump Discharge Pressure PSIG

The surge tank pumps are sized as follows:

- A) To overcome the operating pressure of the deaerator
- B) Spray nozzles
- C) Friction loss in pipe
- D) Vertical lift between deaerator and surge tank
- E) Safety margin generally 5 PSIG
- F) Pressure drop associated with transfer valve

The amount of these values, or these values added together, is normally expressed in feet of head. To convert to pounds per square inch, or PSIG, 2.31 ft. = 1 PSIG.

Generally the surge tank is located beside the deaerator or when it is part of the deaerator itself; therefore, a transfer pump discharge of 25 PSIG, if feeding an atmospheric deaerator, or 35 PSIG, if feeding a pressurized deaerator, is used as our standard since our standard transfer modulating valves are sized for 100% of the deaerator load with a 10 PSIG drop across valve.

How to Size and What Style of Make-Up to Use

Since the purpose of a surge tank is to gather all the returns from the system and mix the make-up water with the returns to blend the temperature, the make-up valve should be a standard close closing solenoid valve activated by a float switch in the tank. By using a modulating make-up valve you are wasting money on an expensive valve and controller that serve no purpose unless your system is larger than 75,000 lbs/hr.

The make-up valve capacity should be sized for 100% of the total load of the system so you have emergency backup. In addition, make sure that your city water supply pressure is adequate for the pressure drop through this valve.

What Special Equipment Should I Have?

If you are purchasing a high quality deaerator with high and low water alarms and pump low water cut-off, your surge tank should be equipped with the same alarms and cut-offs. In addition, since surge tanks are vented to atmosphere, they will corrode. Surge tanks should be cast iron, Plasite lined with #7156 or made of 300 series stainless steel for about the same price.

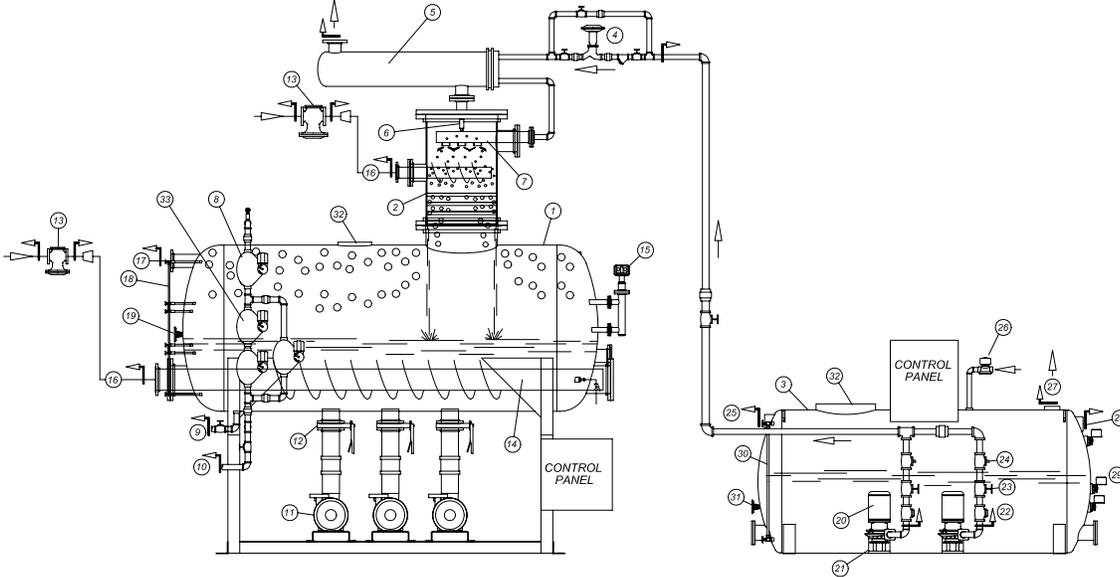
Determining Receiver Size

The receiver on a surge tank is sized based on the total load of all boilers in the system or the deaerator rating, the same sizing as that of a standard boiler feed unit. The receiver size is generally based on 10 minutes of net storage as a general rule of thumb just like the deaerators.

The suggested specifications, Installation, Operation and Maintenance Manuals, Dimension Prints, Piping Details and Bulletins are located for your convenience behind the appropriate catalog tab.

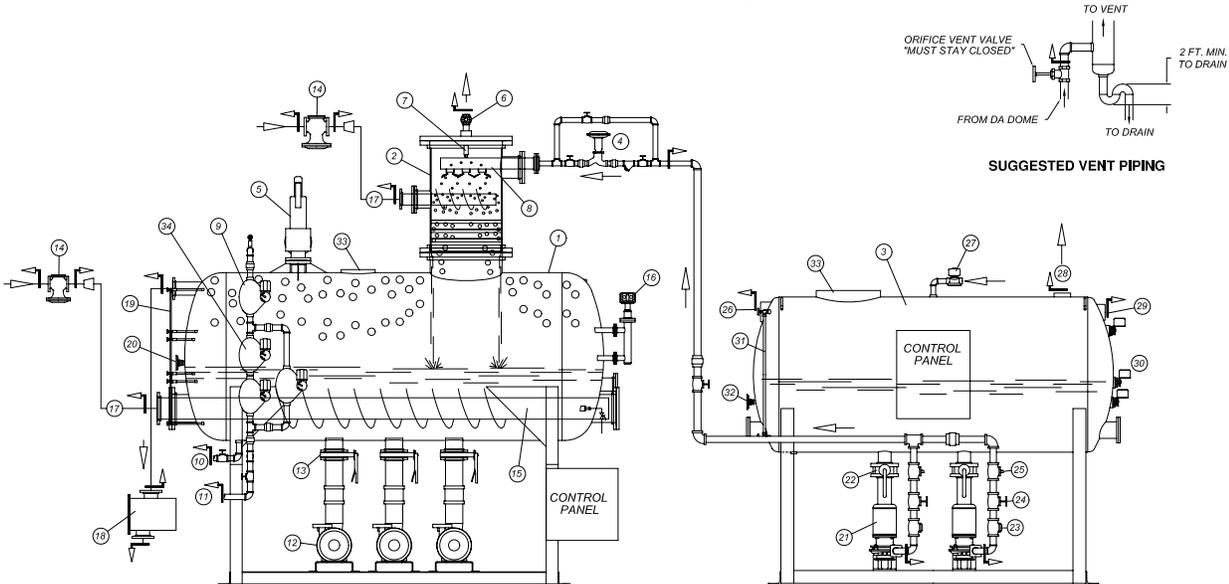
TYPICAL PIPING DIAGRAMS

- | | | |
|-------------------------------------|---|--|
| 1. DEAERATOR STORAGE RECEIVER | 12. BOILER FEED SUCTION VALVE - ONE PER PUMP | 23. DISCHARGE SHUT-OFF VALVE - ONE PER B.F. & TRANSFER PUMP |
| 2. DEAERATION DOME | 13. STEAM REGULATOR - SHIPPED LOOSE | 24. DISCHARGE BALANCING VALVE - ONE PER B.F. & TRANSFER PUMP |
| 3. SURGE STORAGE RECEIVER | 14. SUBMERGED HEATER TUBE | 25. CONDENSATE RETURN INLET |
| 4. DEAERATOR MODULATING INLET WATER | 15. MODULATING LEVEL CONTROLLER | 26. SURGE MAKE-UP WATER VALVE |
| 5. SHELL & TUBE VENT CONDENSER | 16. PREHEAT TUBE/STEAM SUPPLY INLET | 27. SURGE RECEIVER VENT |
| 6. DIAL THERMOMETER (DA DOME) | 17. OVERFLOW TO DRAIN | 28. SURGE RECEIVER OVERFLOW |
| 7. SPRAY NOZZLE MANIFOLD | 18. SIGHT GLASS | 29. FLOAT SWITCH CONTROLS |
| 8. EXTERNAL FLOAT CONTROLS | 19. DIAL THERMOMETER (DA RECEIVER) | 30. SIGHT GLASS |
| 9. DEAERATOR RECEIVER DRAIN | 20. SURGE TRANSFER PUMPS | 31. DIAL THERMOMETER (SURGE RECEIVER) |
| 10. EXTERNAL FLOAT CONTROL DRAIN | 21. TRANSFER PUMP SUCTION VALVE - ONE PER PUMP | 32. MANWAY |
| 11. BOILER FEED PUMPS | 22. NON SLAM CHECK VALVE - ONE PER B.F. & TRANSFER PUMP | 33. STAND-BY TRANSFER PUMP CONTROL |



┌ INDICATES WHERE SHIPCO PIPING ENDS ┐

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|-------------------------------------|--|--|
| 1. DEAERATOR STORAGE RECEIVER | 12. BOILER FEED PUMPS | 23. NON SLAM CHECK VALVE - ONE PER B.F. & TRANSFER PUMP |
| 2. DEAERATION DOME | 13. BOILER FEED SUCTION VALVE - ONE PER PUMP | 24. DISCHARGE SHUT-OFF VALVE - ONE PER B.F. & TRANSFER PUMP |
| 3. SURGE STORAGE RECEIVER | 14. STEAM REGULATOR - SHIPPED LOOSE | 25. DISCHARGE BALANCING VALVE - ONE PER B.F. & TRANSFER PUMP |
| 4. DEAERATOR MODULATING INLET WATER | 15. SUBMERGED HEATER TUBE | 26. CONDENSATE RETURN INLET |
| 5. PRESSURE RELIEF VALVE | 16. MODULATING LEVEL CONTROLLER | 27. SURGE MAKE-UP WATER VALVE |
| 6. DEAERATOR ORIFICE VENT VALVE | 17. PREHEAT TUBE/STEAM SUPPLY INLET | 28. SURGE RECEIVER VENT |
| 7. DIAL THERMOMETER (DOME) | 18. OVERFLOW DRAINER - SHIPPED LOOSE | 29. SURGE RECEIVER OVERFLOW |
| 8. SPRAY NOZZLE MANIFOLD | 19. SIGHT GLASS | 30. FLOAT SWITCH CONTROLS |
| 9. EXTERNAL FLOAT CONTROLS | 20. DIAL THERMOMETER (DA RECEIVER) | 31. SIGHT GLASS |
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| | | 34. STAND-BY TRANSFER PUMP CONTROL |



┌ INDICATES WHERE SHIPCO PIPING ENDS ┐