SHIPCO® PUMPS

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CRAFTSMANSHIP

BULLETIN 108
Revised 6/08

CUSTOM DESIGN
TYPE CS-B

Cylindrical **S**teel **B**oiler Feed Pumps

NOTE: If unit used as a surge tank, pumps should run continuously.

Features:

- Heavy wall steel receiver provides years of service.
- Overflow for unusual or seasonal surges.
- Narrow configuration—for narrow access doors. (209 gallon receiver is only 32" wide)
- Durable centrifugal bronze fitted pumps.
- Units available in most popular voltages.
- Control panels (optional) are available and can be factory mounted and wired to NEMA and J.I.C. specifications.

(Note: magnetic starters should be provided for all three phase motors.)

SHIPCO® PUMPS are equipped with Mechanical Seals rated for temperatures up to 250˚F as standard.
Higher temperature seals and special faces available upon request.

When should a Boiler Feed Unit be used?

In general, a boiler feed unit should be used on all installations using today's high efficiency boilers.

1. High efficiency boilers have less water capacity than older, less efficient boilers. The excess system condensate must be collected and stored in the boiler feed unit instead of being returned to the boiler directly.
2. High efficiency boilers require the water level to be maintained in a smaller relative range. The boiler level controls operate the boiler feed pumps, keeping the water level in an efficient operating range.
3. Make-up water for the system can be added to the boiler feed receiver. The cold city water (usually at 50°F or less) is mixed with the return condensate to produce a blend temperature and reduce thermal shock to the boiler.
4. Properly sizing the boiler feed receiver for the system lag time and mixed high demand cycles in spring and fall allows adequate storage for high condensate. Reusing high quality condensate in lieu of raw make-up water reduces corrosion in the boiler and piping.

Model CS-B (Floor-mounted) Boiler Feed Unit:

CS-B boiler feed units are fitted with horizontal, black steel receiver as standard. The unit is floor mounted. The tanks are heavy gauge black steel receivers for years of service. Numerous sizes of receivers are available to permit flexibility and economical selections. Pumps are bronze-fitted with industry standard motors. Various pump models are available. A brief summary of different pump models is provided below.

Units are typically furnished with a float actuated electric solenoid valve. Make-up water is added to the system at this point to blend the cold make-up water with the hotter return condensate which reduces the thermal shock to the boiler. The furnished valves are piston pilot operated with a cushioned closing feature and epoxy-resin molded waterproof coil. This type of valve has been very reliable, providing years of service.

The floor-mounted CS-B model is designed for applications with low gravity returns. Another major advantage of a floor-mounted style is *avoiding expense of seismic bracing* by fitting the receiver with low NPSH pumps for high temperatures applications. There is a tendency for people to elevate all boiler feed units due to a lack of understanding of pump Net Positive Suction Head (NPSH). *However, boiler feed units are not required to be elevated—it depends on the job specific requirements.*

Various options and accessories are available including:

- Receivers can be 300 series stainless steel or lined to increase corrosion protection.
- Tank dimensions can be *custom designed* to fit special footprint requirements or fit through doorways and/or elevators.
- Tank thickness can be *custom designed* for nonstandard requirements.
- Motors can be either 1750 RPM or 3500 RPM and single-phase or three-phase. If needed, special duty motors such as washdown or explosion proof are available.
- Pumps can be sized for 50 Hz applications outside the U.S.
- Various styles of make-up valves.
- Manual three-valve bypass around solenoid make-up valves (see Figure B).
- Air gap assembly for make-up to meet state and/or local requirements.
- Inlet basket strainers to screen out debris.
- Water level gauge to monitor water level in tank.
- Various styles of thermometers including dial, angle, digital, stainless steel, explosion proof, etc.
- Suction isolation valves (see Figure C) allow pump maintenance to be done without need to drain the receiver.
- Manways and/or handholes to access inside of tank.
- Alarm bell with silencing relay and dry contacts for connect to building alarm systems.
- Low water cutoff to turn off boiler feed pumps if water level in tank gets too low.
- Low water and high water alarm to alert plant operators.
- Vinyl or metal jacketed insulation.
- Control panels that meet various NEMA ratings such as NEMA 1, NEMA 2, NEMA 4, NEMA 7, NEMA 12, etc. Panels may include either combination integral starter/circuit breakers or NEMA-rated starters with fused-disconnect or circuit breakers.
- Single point connection for control panels.
- Control circuit disconnects.
- Magnesium anode.
- Inlet cascade baffle.

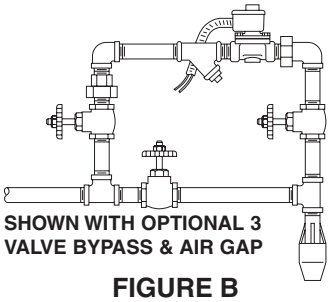

FIGURE B
Three-valve Make-up Bypass

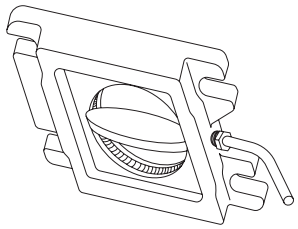

FIGURE C
Suction Isolation Valve

Sizing Boiler Feed Units

A properly sized and correctly installed Boiler Feed Unit can help reduce your overall operating costs by:

- Maintaining the proper water level for the most efficient operation.
- Retaining the high quality condensate to be reused and blended with the required make-up, thus reducing thermal shock and corrosion.

Sizing Pump Flow Rate

Pump selection is based on flow rate (GPM) and pump discharge pressure (PSIG). Boilers are usually rated in boiler horsepower (BHP). The evaporation rate (also referred to as condensing rate) of one boiler horsepower (BHP) is .069 gallons per minute (GPM). Therefore, to calculate the evaporation rate, multiply the BHP by .069. For example, the evaporation for 200 BHP would be 13.9 GPM (200 x .069).

However, sometimes the load of boilers may be stated in other metrics such as Square Feet EDR or lbs/hr. The table below shows equivalences to convert to BHP. For example, to convert EDR to BHP, divide load by 139.4.

	Condensing Rate (GPM)	BTUs/Hr.	Lbs/Hour	Sq. Ft. EDR
1 Boiler HP (BHP)	.069	33,475	34.5	139.4
1,000 Sq. Ft. EDR	.50	240,000	247.3	1,000

FIGURE D

Boiler Feed Applications

Pump flow rates are sized differently depending on the application:

a. Pumps Run On/Off

b. Pumps Run Continuously

For *On/Off applications*, the boiler feed pumps are typically sized at 2.0 times the evaporation rate.

For *Continuous Run* applications, the boiler feed pumps are typically sized at 1.5 times the evaporation rate.

This method of sizing boiler feed pumps helps to balance the boiler conditions and reduce thermal shock to the boiler. Thermal shock can be caused if the feed pumps are oversized. Oversizing also tends to cause short cycling. (Note: Some boiler manufacturers have special requirements that differ from the above guidelines.)

Surge Tank Applications

Surge tank pumps must be continuous run and are sized at the evaporation rate or full load of system.

For both boiler feed and surge tank applications, SHIPCO® pumps are fitted with bleed lines that eliminate the need for bypass orifices in most applications since the bleed line provides sufficient flow to protect the mechanical seal if the pump should dead head.

Sizing Pump Discharge Pressure

The rules-of-thumb for sizing the pump discharge pressure depend of whether pumps are used on a boiler feed unit or a surge tank and the type of application as explained below.

Boiler Feed Applications

Discharge pressure should be equal to the maximum boiler operating pressure, plus the increase in elevation, plus the friction loss of pipe, fittings, and valves, plus a safety margin of typically 5 to 10 PSIG. Good engineering practices also call for a balancing valve to be installed in the discharge piping. Balancing the pump will limit the motor horsepower load and help prevent cavitation.

Boiler feed units are usually located near the boilers they feed. To be safe you should determine the amount of vertical rise + friction loss in pipe + valve loss + feed valve loss (if any) + back pressure in line (boiler operating pressure) + a safety margin of approximately 5 PSIG. The amount of these values, or these values added together, are normally expressed in feet of head. To convert between PSIG and feet of head use the following equation: **2.31 feet of head = 1 PSIG**.

The discharge pressure on boiler feed pumps is sized differently depending on the type of application:

a. Boiler Feed Pump Runs On/Off

b. Boiler Feed Pump Runs Continuously (without a Stack Economizer)

c. Boiler Feed Pump Runs Continuously (with a Stack Economizer)

Boiler Feed On/Off applications generally have low-pressure steam boilers running in the range of .5 to 15 PSIG with returns. Returns could be gravity and pumped. Therefore, a discharge pressure of 20 PSIG should be adequate.

Boiler Feed Continuous Run without Stack Economizer application, an additional 10 PSIG is required to overcome the pressure drop through the modulating feed valve on the boiler. However, the Cv rating of the valve should be verified to ensure 10 PSIG is sufficient. Generally these applications have a high-pressure steam boiler.

Boiler Feed Continuous Run with Stack Economizer application, an additional 30 PSIG is required to overcome the pressure drop through both the modulating feed valve and the stack economizer. However, the Cv rating of the modulating valve and the pressure drop through the stack economizer should be verified to ensure the 30 PSIG is sufficient. Generally these applications have a high-pressure steam boiler.

Notes:

1) The discharge pressure for a boiler feed pump vessel must be able to overcome the boiler safety relief valve setting plus three percent of valve setting and meet most state and local codes.

2) The pressure drops mentioned above are based on the valves used in typical SHIPCO® designs. The pressure drops may vary based on the modulating valve used.

Surge Tank Applications

Transfer pumps run continuously. The discharge pressure of the transfer pumps on a surge tank are sized differently depending on the type of application:

a. Feeding an atmospheric deaerator

b. Feeding a pressurized deaerator

For *Atmospheric Deaerator* applications, the discharge pressure is 25 PSIG assuming a pressure drop of 10 PSIG through the modulating transfer valve.

For *Pressurized Deaerator* applications, the discharge pressure is 35 PSIG assuming a pressure drop of 10 PSIG through the modulating transfer valve and the safety relief valve set at 15 PSIG on the deaerator.

Notes:

1) The pressure drops mentioned above are based on the valves used in typical SHIPCO® designs. The pressure drops may vary based on the modulating valve used.

For more information on surge tanks, see SHIPCO® Bulletin 166.

Sizing Receiver

The rules-of-thumb for sizing the receiver depend on the application as explained below.

Boiler Feed Application

System boiler horsepower is defined as the total possible load of all boilers being fed by the boiler feed unit. For example: A quantity of two 100 HP boilers would have a system load of 200 HP if both boilers ran at the same time for even only a few minutes. Therefore, the boiler feed receiver must be based on the worst case condition.

For low-pressure boiler applications with a large percent of system returns (typically of low-pressure steam system), the receiver is typically sized to provide storage capacity of 15-20 Gross Gallons (which equates to 10-15 minutes Net Gallons).

For high-pressure applications with a large percent of make-up (i.e., minimal or no returns), a smaller storage capacity can be chosen—typically 15 Gross Gallons (which equates to 10 minutes Net Gallons).

SHIPCO® expresses the capacity of its boiler feed tank in gross Gallons because that is standard terminology for industry literature. Our literature always mentions Gross Gallons.

Other characteristics of the steam system may also influence the receiver size:

- For example, if the piping system served by the boiler is in a heating system extending over a considerable area, the amount of time required for the condensate return will be slow. Under such conditions, it is advisable to select a receiver of larger capacity.
- If the piping is concentrated in a high office building on a small ground area, experience dictates that the condensate returns quickly, and a small receiver size may be chosen.

Surge Tank Application

On surge tank applications, the receiver is typically sized to provide 15 minutes Gross Gallons of storage, which equates to approximately 10 minutes of Net Gallons.

MODEL D

The Model D Pump is the center of all SHIPCO® Units. These pumps are bronze fitted and are designed with NPSH requirements in mind. Vertical mounting saves floor space and avoids dirt and water. Industry standard, vertical style motors available in single or three phase, 1750 RPM or 3500 RPM. All units are equipped with mechanical seals rated for 250°F as standard. (Higher temperature seals and special faces available upon request.)

MODEL P

The Model P Pump pumps high temperature condensate. This 2 ft. NPSH pump has mechanical seals rated for 250°F as standard. (Higher temperature seals and special faces available upon request.) Industry standard, vertical motors available in single or three phase, 3500 RPM. This bronze fitted pump has an axial flow propeller to provide the necessary NPSH that high temperature water can not, thus assuring cavitation free operation. The P Pump also contains straightening vanes to ensure that the water enters the suction cavity as smooth and straight as possible.

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