Condensate Return System

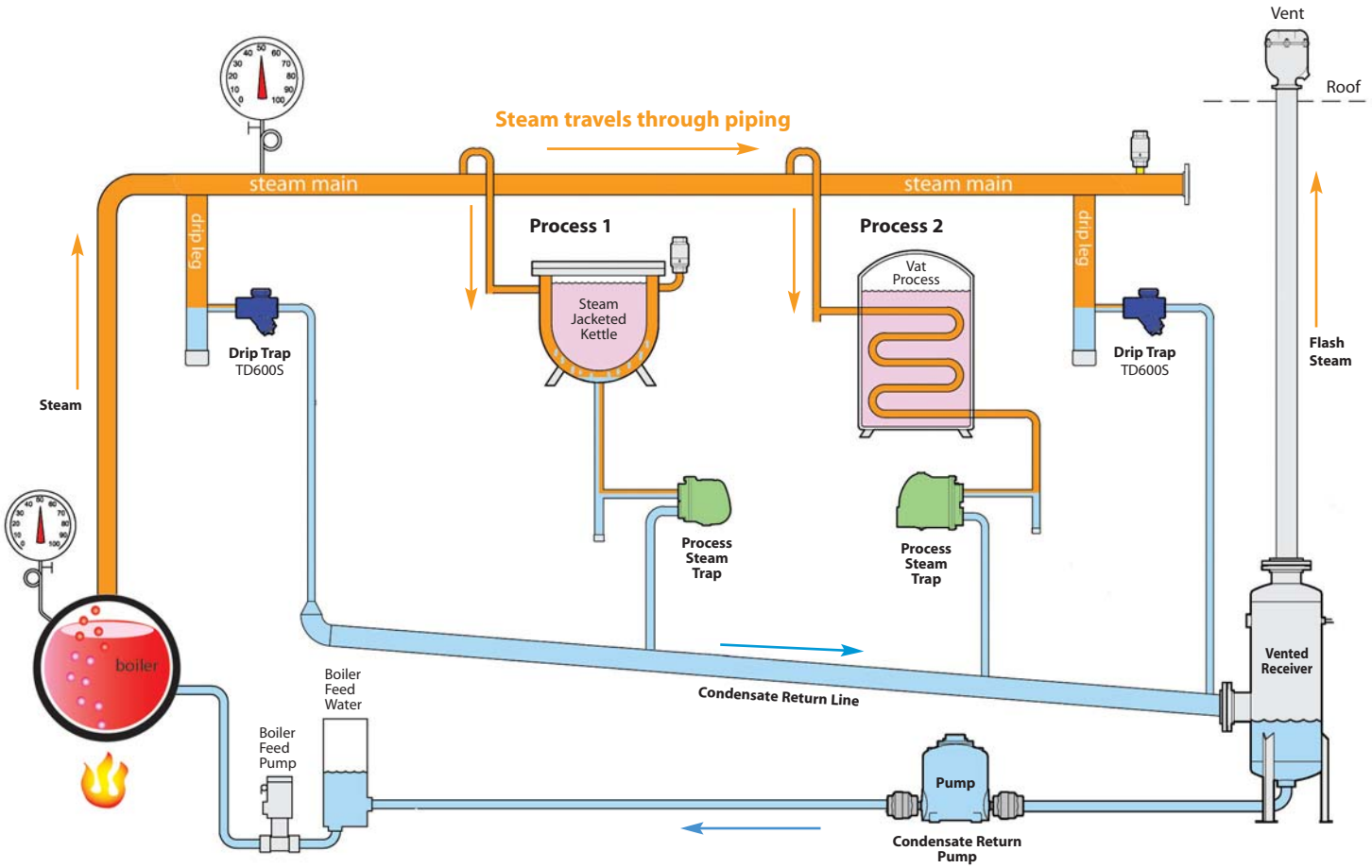
Shown below is a simplified view of a steam system from steam generation to condensate return. Steam generated by the boiler travels through the steam distribution lines supplying steam to various pieces of process equipment. The steam flowing to this equipment is separated from the condensate return lines by steam traps.

Relatively small steam traps, referred to as “Drip traps,” are used for optimization and protection of steam systems by draining condensate from steam distribution lines into the condensate return line.

Process Applications refer to draining condensate from the actual process using the steam into the condensate return line. The steam traps used in these applications have relatively high condensate capacity and are referred to as “Process traps”.

A large plant may have many separate pieces of process equipment and thousands of drip traps discharging condensate into the condensate return lines. On efficiently run steam systems, this condensate is returned back to the boiler for reuse.

Steam Distribution & Condensate Return System



What are Condensate Return Pumps & when are they required?

In certain cases, the steam pressure of the system may be sufficient to push the condensate through the steam traps and condensate return lines, back to the condensate holding tank in the boiler room. In most practical situations, however, one or more condensate return pumps are required to assist in overcoming gravity, pressure drops from long piping runs, and back pressures in return lines. Condensate Return Pumps are either electrically-driven centrifugal pumps or non-electric mechanical pumps that use steam pressure as the motive force to pump the condensate. Non-electric pumps are referred to as Pressure Motive Pumps (PMPs).

What is a Boiler Feed Pump? A facility will often have a separate area that contains various components required for the generation of steam, such as a boiler, condensate holding or deaerator (DA) tank, boiler feed pump, water treatment, etc. Regulated by the boiler control system, the boiler feed pump sends condensate from the holding tank back to the boiler.

What are Pressure Motive Pumps (PMPs)?

Pressure Motive Pumps (PMPs) are non-electric pumps which return condensate back to the boiler room; using steam pressure as the motive force. PMPs can be supplied as stand-alone units – which include a pump tank, the internal operating mechanism, and a set of inlet and outlet check valves, or: as a packaged system – which also includes the vented receiver tank (to collect the condensate) mounted on a common base.

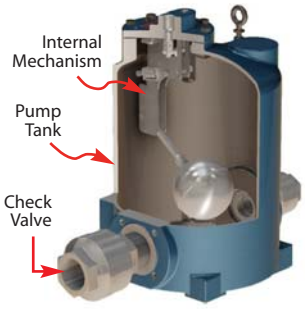
What is the purpose of a Vented Receiver?

Condensate from several different sources, at different pressures, are often discharging into the same return line. The discharge from one of the higher pressure sources could easily increase the pressure in the return line, which would stop the discharge from a critical process application operating at lower pressures.

By connecting the condensate return line to a vented receiver, the pressure in the return line will be effectively equalized to atmospheric pressure, allowing condensate to freely drain from all condensate sources. This is an extremely important and often overlooked aspect of any properly operating steam and condensate return system. The receiver and vent must be adequately sized to allow for the discharge of flash steam without building up excessive pressure. Higher condensate pressures or loads would require larger receiver and vent sizes. Condensate then flows by gravity from the vented receiver to the condensate return pump and is then returned back to the boiler room.

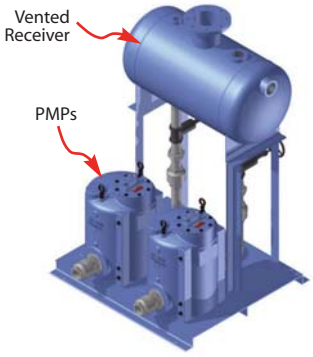
Mechanical & Electric Condensate Return Pumps

PMP
(stand-alone pump)



Mechanical stand-alone Pressure Motive Pumps (PMPs)

A stand-alone Pressure Motive Pump (PMP) consists of a pump tank with internal operating mechanism, and a set of inlet and outlet check valves. Pump tanks can be made from ductile iron (PMPC), fabricated steel (PMPF) or stainless steel (PMPSS). A PMP requires some form of a separate vented receiver tank that collects the condensate prior to entering the pump. This vented receiver is required to neutralize the pressure in the condensate return line by venting the flash steam to the atmosphere.



Pumps with Receiver Tanks (Standard Skid Systems)

Simplex, Duplex, and Triplex packaged systems include stand alone pumps and check valves with a vented receiver tank, mounted on a steel base and frame. Multiple pumping units can be used for increased capacity or for system redundancy. The stand-alone pumps are available in ductile iron, carbon steel and stainless steel; options include sight glasses, insulation jackets, cycle counters, motive and vent piping, pressure regulators, steam traps, strainers and ASME code stamp. All components of the system are properly sized and pre-piped together; requiring only four connections to be made in the field.

Electric Pumps

Electric Condensate Return Pumps are designed to work intermittently, discharging condensate only when the receiver tank is nearly full. This is accomplished with a float switch. A float connected to the switch assembly rises when condensate enters the tank. Once it rises above a set point, the switch energizes the motor on the pump, which runs until the water level drops below the bottom position of the float switch. The switch then de-energizes the motor to shut off the pump. Watson McDaniel electric pumps are offered in Simplex and Duplex models.

Why choose a PMP instead of an electric (centrifugal) condensate return pump?

Reliability is the primary purpose for selecting Mechanical type PMP's instead of Electric condensate pumps.

Electric pumps require a mechanical seal to prevent the leakage of liquid around the rotating shaft that drives the impeller. The liquid being pumped acts as a lubricant so the seal faces of the mechanical seal may rotate freely against each other. When the liquid remains relatively cool, the mechanical seal could last for many years. However, hot condensate can flash to steam between the seal faces leading to seal failure.

A centrifugal pump creates a low pressure zone at the eye of the impeller which draws the fluid into the pump. Hot condensate can flash into steam in the low pressure zone causing Cavitation. Cavitation happens when bubbles form in the liquid on the inlet side of the pump that will re-compress on the outlet side, causing erosion of the impeller and pump housing. When a pump cavitates, it often sounds like marbles or sand is being pumped. This flashing also blocks the flow of incoming condensate; causing the pump to run dry which decreases performance and also leads to seal failure.

1) PMP's do not have any seals to fail.
2) No cavitation can occur because the body of the pump is filled by the natural flow due to gravity from a vented receiver, and then discharged by steam pressure.

Therefore, Pressure Motive pumps are much more forgiving than centrifugal pumps when pumping hot condensate.

Installation of mechanical type PMP's vs. Electric pumps:

Standard **Electric Pumps** are supplied with a receiver tank and are intended for lower pressure steam systems. In these instances, the vent size on the receiver tank should be adequate to vent minimal flash steam, allowing condensate to freely enter the receiver and to adequately cool prior to being pumped. In higher pressure steam systems, the condensate temperature is hotter, resulting in more flash steam as the condensate is discharged through steam traps and into the return line. Additional options may be required for the electric pumps if condensate does not cool to suitable temperatures.

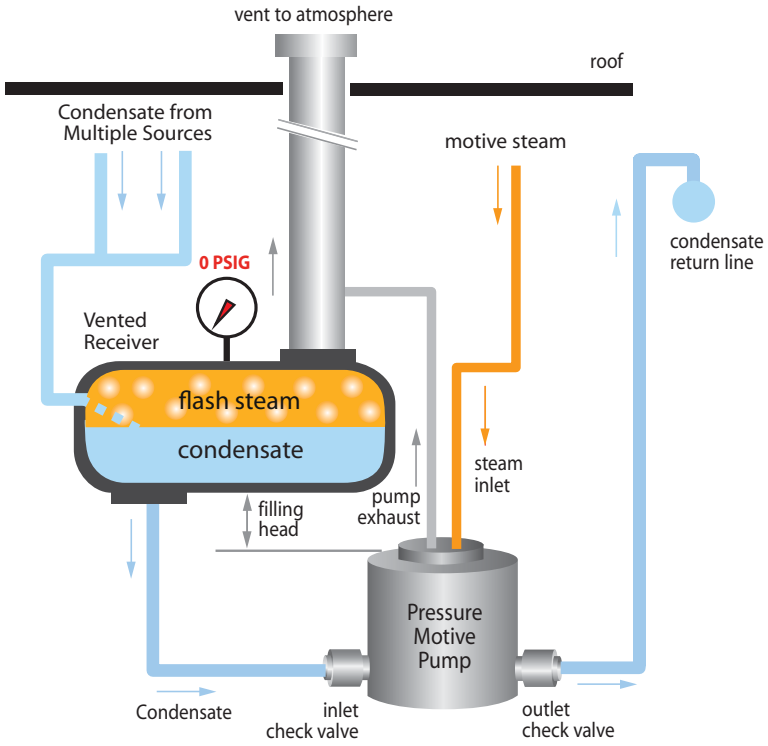
PMPs discharge high temperature condensate that drains from vented receivers. A **stand-alone PMP** pump tank cannot be used as the vented receiver since it is intermittently pressurized with steam or air to pump the condensate. PMPs require a separate vented receiver to collect the condensate and to vent the flash steam to atmosphere. The Simplex, Duplex or Triplex packaged systems include the separate vented receiver tank mounted on a common base along with the PMP(s).

Vented Receivers should generally be sized to maintain 0 psig in both the receiver and condensate return line upstream of the receiver. This helps ensure free drainage of condensate from sources that may be operating at both high and low pressure. Sizing criteria is based on condensate pressure and the amount of the flash steam created. Undersizing the receiver or the vent will increase the pressure in the receiver and condensate return line, possibly causing issues with condensate drainage from process equipment upstream. Undersizing of the vent will increase the velocity of flash steam in the pipe which could possibly draw condensate from the receiver and discharge it out of the vent.

Pump (PMP) with a Vented Receiver

A Vented Receiver (or Flash Tank) is used to collect the condensate generated from one or several different sources (drip & process applications) in the facility.

Pressure from the Flash steam generated by the hot condensate is vented to the atmosphere to maintain atmospheric pressure (0 PSIG) in the receiver tank. This assures that condensate will freely flow by gravity to the receiver tank and then to the pump tank, avoiding potential condensate back-up.

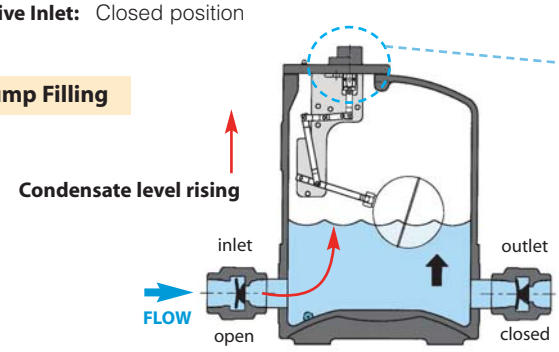


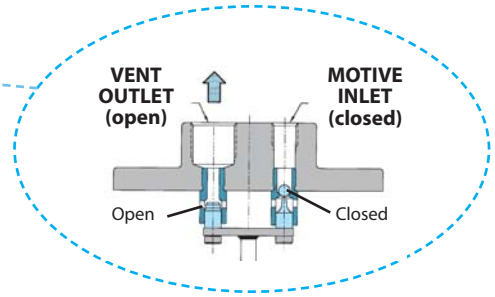
Operation of PMP Pressure Motive Pump

Vent Outlet: Open position, allowing any pressure in the pump tank to vent out and water to freely enter pump by gravity.

Motive Inlet: Closed position

Pump Filling





1 Condensate flows from the receiver tank through the inlet check valve and fills the pump tank. During the filling cycle the float inside the tank rises.

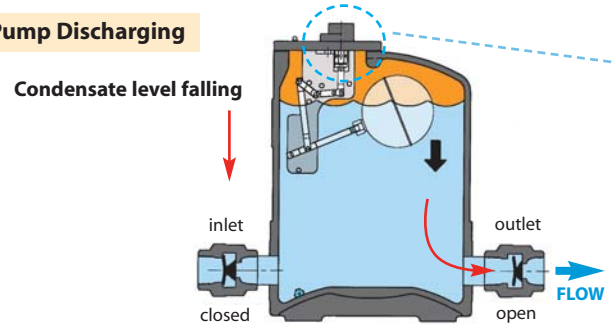
The positions of the **Vent** and **Motive** valves control the filling and discharge of the pump. The Vent valve must be open during the filling cycle to allow air or steam in the pump tank to be displaced as water enters the pump. Since water flows into the pump tank by force of gravity, the pump tank pressure must be neutralized for the pump tank to fill.

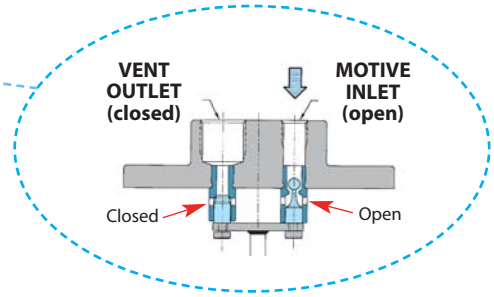
When the pump tank reaches its fill point the vent valve closes and the motive valve opens. The incoming steam pressure rapidly forces the water out of the pump tank through the outlet check valve. When the pump tank empties, the vent valve opens and motive inlet valve closes.

Vent Outlet: Closed

Motive Inlet: Open; steam pressure enters tank and discharges condensate

Pump Discharging



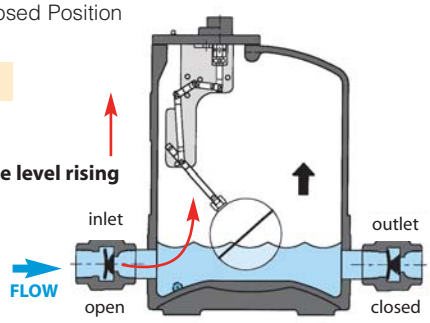


2 When the pump tank has filled to the trip point, the mechanism triggers, opening the motive gas inlet valve and simultaneously closing the vent valve. This allows motive pressure to enter the pump body, which drives the condensate thru the outlet check valve into the condensate return line. During the discharge cycle, the liquid level and the float inside the pump tank drop.

Vent Outlet: Open position, allowing any pressure in the pump tank to vent out and water to freely enter pump by gravity.

Motive Inlet: Closed Position

Pump Filling



3 At the lower trip point, the mechanism triggers and the motive gas inlet valve to the pump tank closes and simultaneously the vent valve opens. The fill and discharge cycle then repeats.

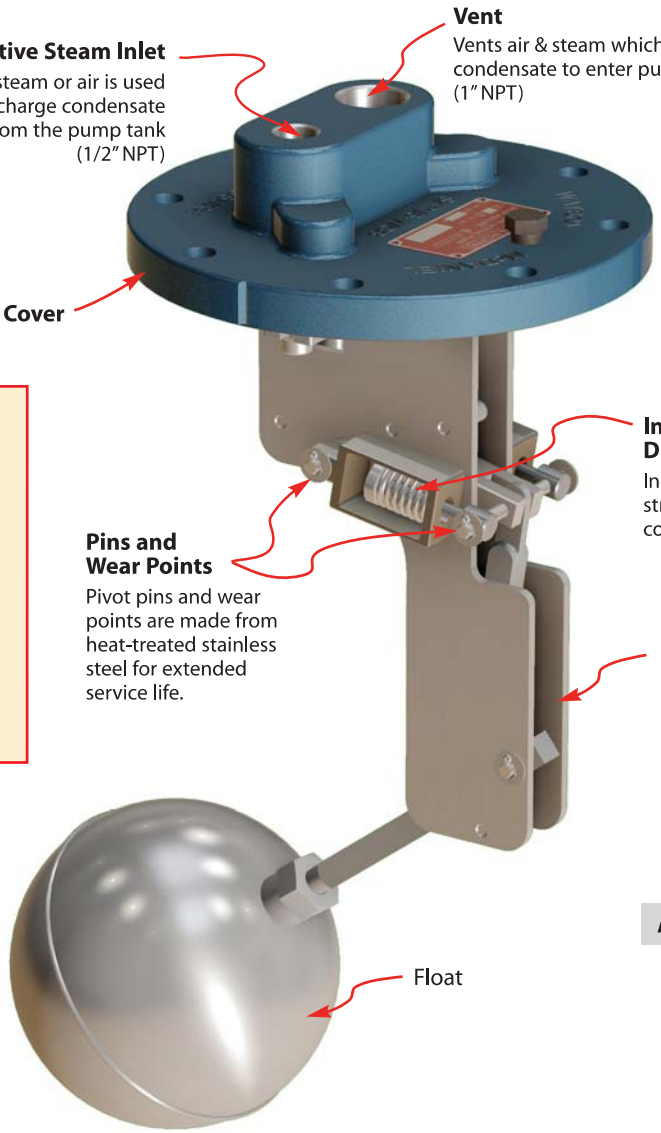
Check Valves

The inlet check valve on the PMP system must have a very low cracking pressure (opening pressure) so that the liquid will freely enter the pump tank. The proper check valve is very critical to the proper operation of the PMP system. Watson McDaniel recommends using spring-loaded stainless steel check valves with ¼ PSI cracking pressure.

The Internal Working Mechanism

The heart of the PMP is the internal working mechanism, which features the **Patented SNAP-ASSURE™** Design. This feature, exclusive to Watson McDaniel's PMPs, **Guarantees to extend pump life** even in the most demanding applications.

The environment inside a pump tank can be extremely harsh and volatile. Hot condensate can be very aggressive and may even corrode stainless steel springs when they are under tension or compression (high stress). This is known as stress corrosion-cracking. Additionally, condensate systems normally contain fine particles of rust and other contaminants, such as pipe scale, further aggravating mechanical components. The Watson McDaniel Pump Mechanism has been refined and developed over many years and has proven itself in its performance and reliability.



The Patented Snap-Assure Feature stops dirt and abrasive iron oxide particles from jamming the mechanism. The Snap-Assure Feature forces the internal toggle action to trigger ("**snap**") between vent and motive, "**assuring**" that fill and discharge cycles occur properly. Without Snap-Assure, the added friction of abrasive particles or worn components can inhibit a pump from operating.

All STAINLESS STEEL Internals

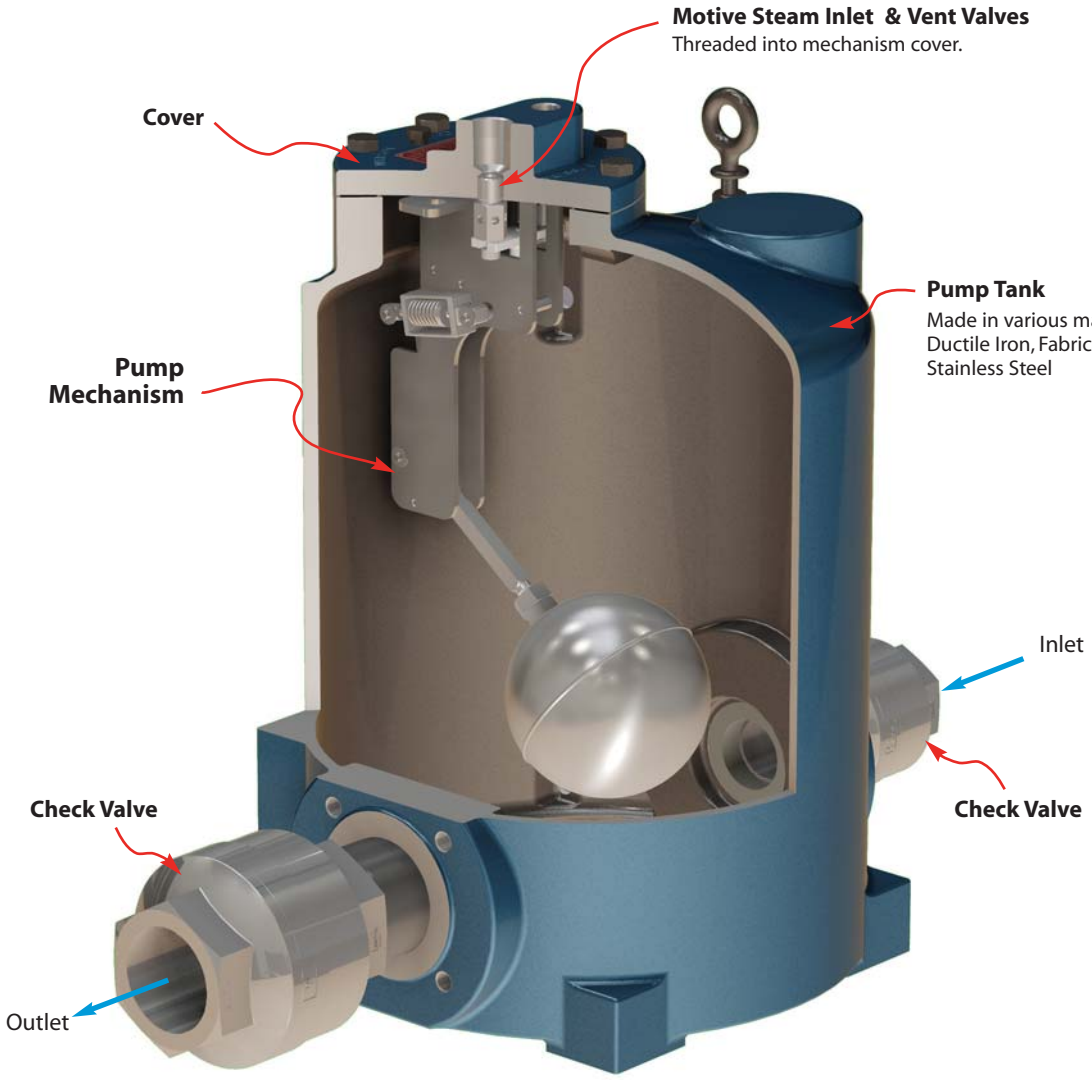
Snap-Assure
U.S. Patent No. 6572340

Internal Mechanism Features

- Equipped with Watson McDaniel's patented "Snap-Assure" feature, which extends the useful life of the pump by assuring that the internal toggle action triggers at every fill and discharge cycle
- All Stainless Steel components minimize corrosion (spring material is Inconel-X-750)
- Hard chrome-plated pivot pins and wear points substantially reduce the rate of wear on critical components
- 17-4 heat-treated stainless steel inlet and vent valve (Hardened seats have proven themselves to last years)
- Dual-compression springs, made from Inconel-X-750, eliminate the effects of stress corrosion-cracking and are designed to last indefinitely
- Precision manufactured mechanisms never require field adjustments
- Watson McDaniel "Snap-Assure" mechanisms can be purchased separately and will fit other manufacturers' pump tanks

Snap-Assure Pump Mechanism

1) Cover & mechanism bolt to top of pump tank.
2) Mechanism is field-repairable by replacing any of the functioning components such as springs and valve seats.
3) Mechanism can fit other manufacturers' pump tanks.



Check Valves

The inlet check valve on the PMP system must have a very low cracking pressure (opening pressure) so that the liquid will freely enter the pump tank. The proper check valve is very critical to the proper operation of the PMP system. Watson McDaniel recommends using spring-loaded stainless steel check valves with ¼ PSI cracking pressure.

Mechanical Condensate Return Pumps are available as:

1) PMP (Pressure Motive Pump - Stand-Alone Unit) or
2) Pump System (Pumps with Vented Receiver Tanks):

Mechanical PMP Stand-Alone Pumps

Watson McDaniel's **Pressure Motive Pump** (**PMP** stand-alone unit) consists of the pump tank, which is made from ductile iron, fabricated steel, or stainless steel, and Watson McDaniel's patented "Snap-Assure" internal operating mechanism, along with a set of inlet and outlet check valves. An additional vented receiver or flash tank is required to collect the condensate before it enters the pump.

Watson McDaniel offers a full line of PMP accessories, including custom tanks, insulation jackets, gauge glasses, cycle counters, pre-piped accessories, pump mechanisms, check valves and anything else you may need to maintain your system.

Several choices of pump body materials, types and configurations are available to meet specific customer applications:

Ductile Iron Pump Tanks
Ductile Iron is far superior to cast iron in handling higher pressures and temperatures. Ductile iron is also extremely corrosion resistant to condensate and water and can last in excess of 50 years before tank replacement is required. Our ductile iron tanks can be ASME coded on request.

Fabricated Carbon Steel Pump Tanks
Carbon steel tanks are required in certain industrial facilities such as chemical and petrochemical refineries. However, fabricated cast steel is much less corrosion-resistant to condensate than ductile iron. Our carbon steel tanks are standard ASME coded.

Fabricated Stainless Steel Pump Tanks
Stainless steel (304L) tanks are extremely corrosion-resistant, giving increased longevity and can serve as a substitute for fabricated carbon steel tanks.

Low Profile Pump Tanks
Low-profile tanks are required when vertical space for adequate filling head of the pump is limited.

Stand-Alone Units - Pressure Motive Pumps

PMPC
Cast Ductile Iron

Significantly more corrosion-resistant to condensate when compared to carbon steel.

PMPF
Fabricated Carbon Steel

Carbon Steel may be required by code in Chemical and Petro-Chemical industries (required in certain industries).

PMPSS
304L Stainless Steel (Corrosion Resistant)

Can serve as a substitute for fabricated carbon steel tanks for extended life or when Stainless Steel is required.

PMPLS
Fabricated Carbon Steel (Reduced-Profile)

Lower in height than PMPF. Required when vertical space for adequate filling head of the pump is limited.

PMPBP
Carbon Steel (High-Capacity)

For applications requiring large transfer rates of condensate or other liquids.

PMPNT
Ductile Iron or Stainless Steel (Low-Profile)

For lower capacity applications.

PMPSP Sump Drainer (non-electric sump pump)

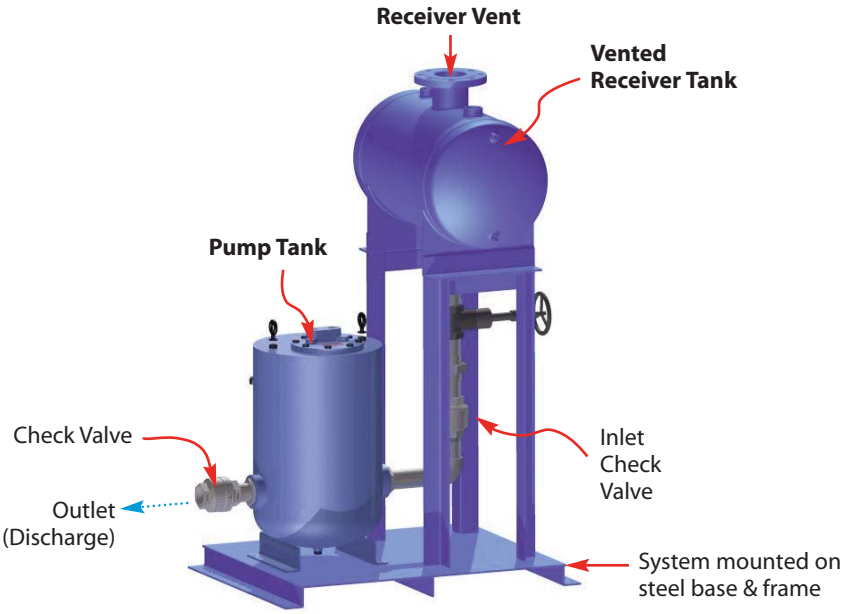
Sump drainers are used to pump water from pits or sumps using steam or air pressure. They are similar to the standard PMP models except that they discharge vertically upwards. This piping configuration allows them to be lowered into a sump or pit.

Pump Systems (Pumps with Receiver Tanks)

The **PMPC**, **PMPF** & **PMPLS** pump units are also available with a Vented Receiver mounted on a common base. The vented receiver is needed to collect the condensate which then drains by gravity into the pump tank. These standard **Simplex, Duplex** and **Triplex** packaged systems include stand-alone pump(s) and check valves with a vented receiver tank mounted on a steel base and frame. Multiple pumping units can be used for increased capacity or for system redundancy. The pump units are available in ductile iron (**PMPC**) or carbon steel (**PMPF**). Additional options include sight glasses, insulation jackets, cycle counters, motive and vent piping, pressure regulators, steam traps, strainers, ASME code stamps, etc.

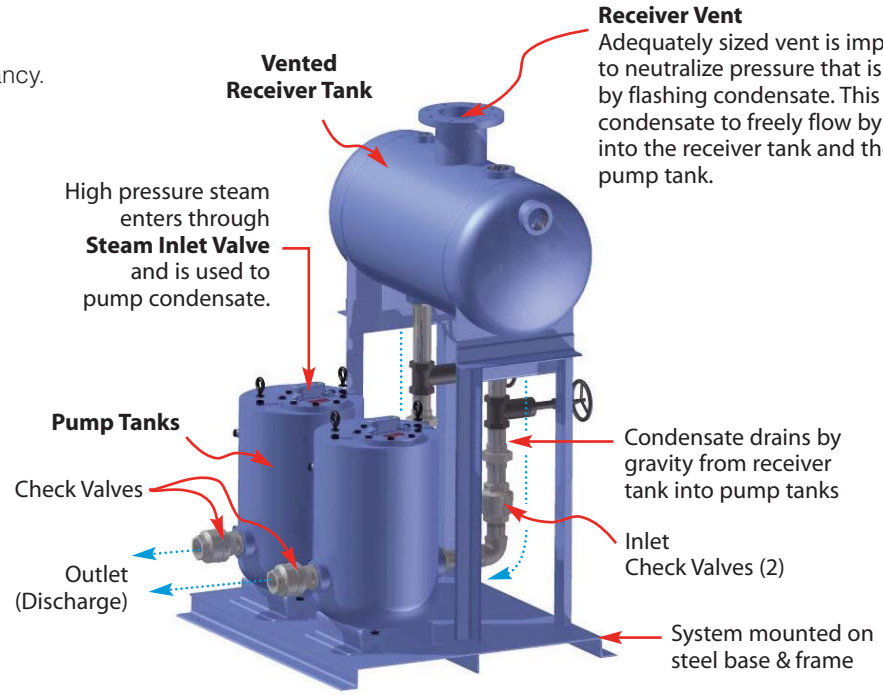
Simplex Pumping System (shown)

Single pump with receiver tank mounted on a common base.

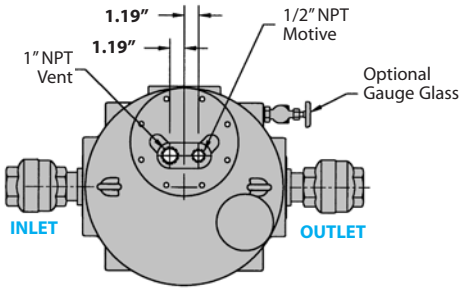


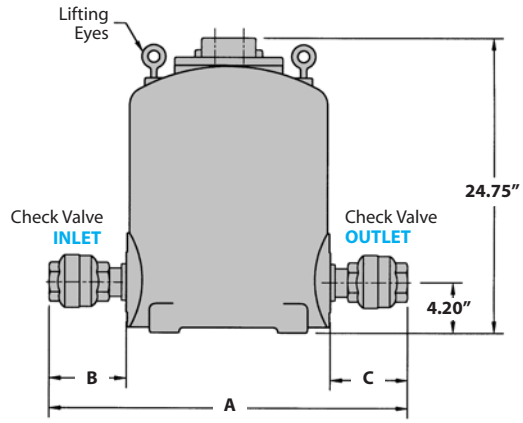
Duplex Pumping System (shown)

More than one pump can be used for increased capacity or system redundancy.



PMPC
Pressure Motive Pump





Model	**PMPC**
Body	**Ductile Iron**
Cover	**Ductile Iron**
Check Valves	**Stainless Steel**
PMO Max. Operating Pressure	**200 PSIG**
TMO Max. Operating Temperature	**388°F**
PMA Max. Allowable Pressure	**200 PSIG @ 650°F**
TMA Max. Allowable Temperature	**650°F @ 200 PSIG**

Typical Applications

The **PMPC** model **Ductile Iron** non-electric pressure motive pump is typically used when liquids must be moved to higher elevation, higher pressure or extended distances. This stand-alone pump is capable of operating with a maximum motive pressure of 200 PSIG provided by steam, air or other gas supply. **ASME "UM" code stamp is available.**

Features

- Equipped with our **Patented "Snap-Assure"** Mechanism which **extends the useful life of the pump**
- Mechanism incorporates **heat-treated stainless steel wear items**
- All stainless steel internals for ultimate corrosion resistance
- Dual compression springs made from Inconel-X-750 for high-temperature corrosive service
- Operates using steam, air, nitrogen or other pressurized gases as the motive force
- **Non-Electric** – can be used in remote locations or NEMA 4, 7, 9 and hazardous areas

Sample Specification

The non-electric pressure powered pump shall be capable of operating with a maximum motive pressure of 200 PSIG provided by steam, air or other gas supply. The pump body shall be cast ASTM A-395 Ductile Iron capable of an ASME "UM" code stamp if requested. The pump mechanism shall be float operated with a patented "Snap-Assure" feature constructed of all stainless steel materials with all load bearing points hardened for extended service life. The mechanism shall feature two Inconel springs used in compression with motive & vent valves hardened to 40c Rockwell.

DIMENSIONS – *inches*

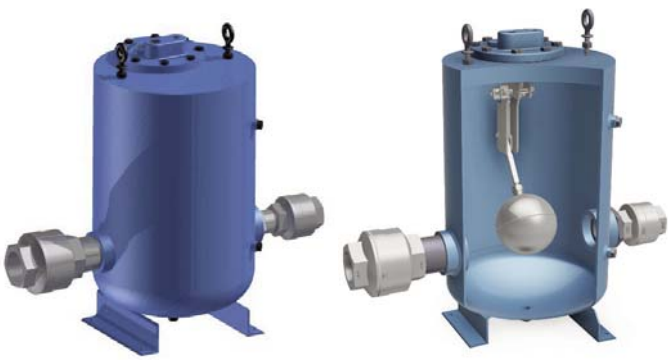
Size (Inlet x Outlet)	Model Code	A	B	C	Weight (lbs)
1" x 1"	PMPC-1X1-N-SS	29 1/2	6	6	360
1 1/2" x 1"	PMPC-1.5X1-N-SS	30 3/4	7 1/2	6	365
1 1/2" x 1 1/2"	PMPC-1.5X1.5-N-SS	31 1/4	7 1/2	7 1/2	367
2" x 1"	PMPC-2X1-N-SS	31	8	6	370
2" x 1 1/2"	PMPC-2X1.5-N-SS	32 1/2	8	7 1/2	380
2" x 2"	PMPC-3X2-N-SS	32 3/4	8	8	385
3" x 2"	PMPC-3X2-N-SS	35 1/4	9 1/4	8	390

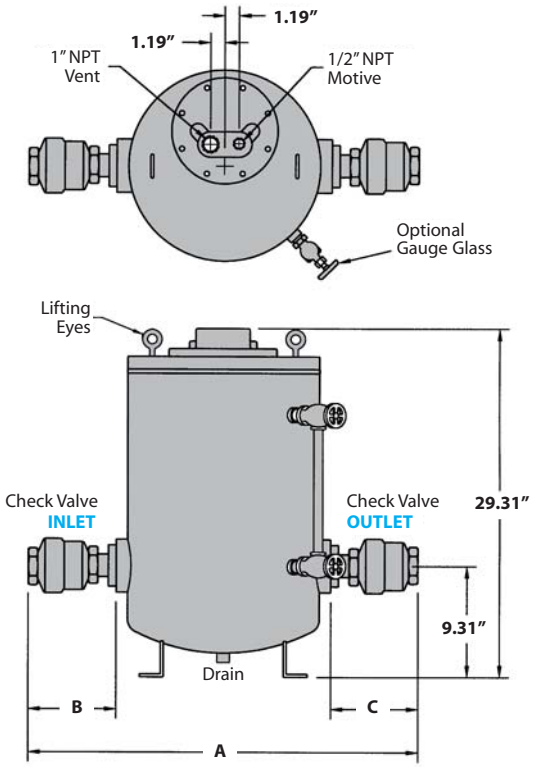
The PMPC Stand Alone Pump consists of pump tank, internal mechanism, and inlet and outlet stainless steel check valves.

MATERIALS

Body & Cover	**Ductile Iron**
Cover Gasket	Grafoil
Cover Bolts	Steel
Inlet Valve	Hardened Stainless Steel 40 Rc
Vent Valve	Hardened Stainless Steel 40 Rc
Mechanism Yoke	304 Stainless Steel
Ball Float	304 Stainless Steel
Check Valves	Stainless Steel
Springs	Inconel-X-750
Other Internal Components	Stainless Steel

Snap-Assure U.S. Patent No. 6572340





Model	**PMPF**
Body	**Carbon Steel**
Cover	**Carbon Steel**
Check Valves	**Stainless Steel**
PMO Max. Operating Pressure	**200 PSIG**
TMO Max. Operating Temperature	**388°F**
PMA Max. Allowable Pressure	**250 PSIG @ 650°F**

Typical Applications

The **PMPF** model **Carbon Steel** non-electric pressure motive pump is typically used when liquids must be moved to higher elevation, higher pressure or extended distances. This stand-alone pump is capable of operating with a maximum motive pressure of 200 PSIG provided by steam, air or other gas supply. These tanks are fabricated with 1/8" corrosion allowance and receive the ASME "UM" code stamp.

Features

- Equipped with our **Patented "Snap-Assure"** Mechanism which **extends the useful life of the pump**
- Mechanism incorporates **heat-treated stainless steel wear items**
- All stainless steel internals for ultimate corrosion resistance
- Dual compression springs made from Inconel-X-750 for high-temperature corrosive service
- Operates using steam, air, nitrogen or other pressurized gases as the motive force
- **Non-Electric** – can be used in remote locations or NEMA 4, 7, 9 and hazardous areas

Sample Specification

The non-electric pressure powered pump shall be capable of operating with a maximum motive pressure of 200 PSIG provided by steam, air or other gas supply. The pump body shall be fabricated carbon steel and certified with the ASME "UM" code stamp. The pump mechanism shall be float operated with a patented "Snap-Assure" feature constructed of all stainless steel materials with all load bearing points hardened for extended service life. The mechanism shall feature two Inconel springs used in compression with motive & vent valves hardened to 40c Rockwell.

DIMENSIONS – *inches*

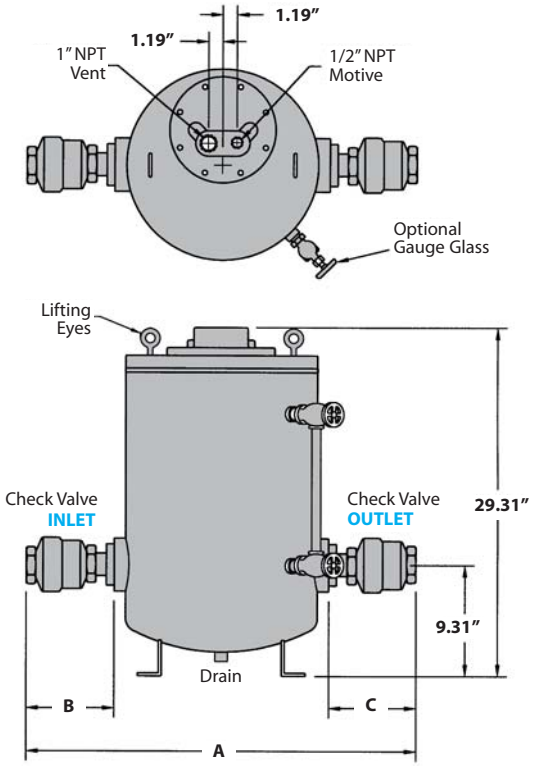
Size (Inlet x Outlet)	Model Code	A	B	C	Weight (lbs)
1" x 1"	PMPF-1X1-N-SS	30 1/2	6	6	215
1 1/2" x 1"	PMPF-1.5X1-N-SS	31 3/4	7 1/2	7 1/2	220
1 1/2" x 1 1/2"	PMPF-1.5X1.5-N-SS	32 1/4	7 1/2	6	223
2" x 1"	PMPF-2X1-N-SS	32	8	6	225
2" x 1 1/2"	PMPF-2X1.5-N-SS	33 1/2	8	7 1/2	230
2" x 2"	PMPF-2X2-N-SS	33 3/4	8	8	235
3" x 2"	PMPF-3X2-N-SS	35 1/4	9 1/4	8	240

The PMPF Stand Alone Pump consists of pump tank, internal mechanism, and inlet and outlet stainless steel check valves.

MATERIALS

Body & Cover	**Carbon Steel**
Cover Gasket	Grafoil
Cover Bolts	Steel
Inlet Valve	Hardened Stainless Steel 40 Rc
Vent Valve	Hardened Stainless Steel 40 Rc
Mechanism Yoke	304 Stainless Steel
Ball Float	304 Stainless Steel
Check Valves	Stainless Steel
Springs	Inconel-X-750
Other Internal Components	Stainless Steel

Snap-Assure U.S. Patent No. 6572340



Model	PMPSS
Body	304L Stainless Steel *
Cover	304L Stainless Steel *
Check Valves	Stainless Steel
PMO Max. Operating Pressure	150 PSIG
TMO Max. Operating Temperature	366 °F
PMA Max. Allowable Pressure	150 PSIG @ 650°F

* For special 316L SS, consult factory.

Typical Applications

The **PMPSS** model **Stainless Steel** non-electric pressure motive pump can be used in harsh and corrosive environments or as a substitute for fabricated carbon steel tanks for increased longevity. This stand-alone pump is capable of operating with a maximum motive pressure of 150 PSIG provided by steam, air or other gas supply. These pumps receive the ASME "UM" code stamp.

Features

- Equipped with our **Patented "Snap-Assure"** Mechanism which **extends the useful life of the pump**
- Mechanism incorporates **heat-treated stainless steel wear items**
- All stainless steel internals for ultimate corrosion resistance
- Dual compression springs made from Inconel-X-750 for high-temperature corrosive service
- Operates using steam, air, nitrogen or other pressurized gases as the motive force
- **Non-Electric** – can be used in remote locations or NEMA 4, 7, 9 and hazardous areas

Sample Specification

The non-electric pressure powered pump shall be capable of operating with a maximum motive pressure of 150 PSIG provided by steam, air or other gas supply. The pump body shall be 304L Stainless Steel and certified with the ASME "UM" code stamp. The pump mechanism shall be float operated with a patented "Snap-Assure" feature constructed of all stainless steel materials with all load bearing points hardened for extended service life. The mechanism shall feature two Inconel springs used in compression with motive and vent valves hardened to 40c Rockwell.

DIMENSIONS – *inches*

Size (Inlet x Outlet)	Model Code	A	B	C	Weight (lbs)
1" x 1"	PMPSS-1X1-N-SS	30 1/2	6	6	215
1 1/2" x 1"	PMPSS-1.5X1-N-SS	31 3/4	7 1/2	7 1/2	220
1 1/2" x 1 1/2"	PMPSS-1.5X1.5-N-SS	32 1/4	7 1/2	6	223
2" x 1"	PMPSS-2X1-N-SS	32	8	6	225
2" x 1 1/2"	PMPSS-2X1.5-N-SS	33 1/2	8	7 1/2	230
2" x 2"	PMPSS-2X2-N-SS	33 3/4	8	8	235
3" x 2"	PMPSS-3X2-N-SS	35 1/4	9 1/4	8	240

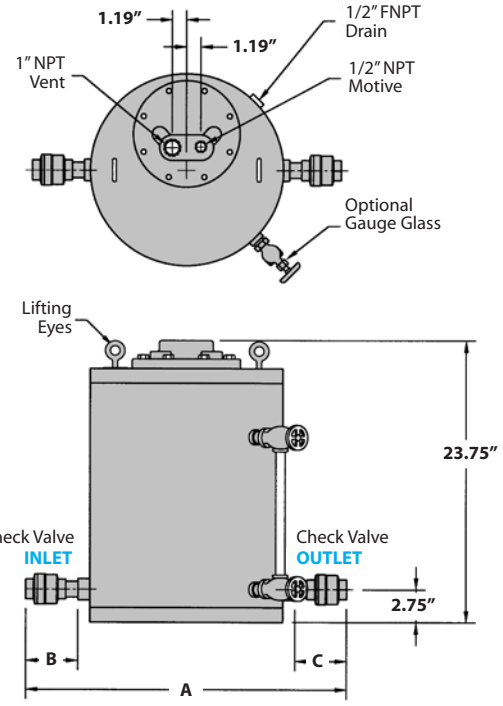
The PMPSS Stand Alone Pump consists of pump tank, internal mechanism, and inlet and outlet stainless steel check valves.

MATERIALS

Body & Cover	**304L Stainless Steel**
Cover Gasket	Grafoil
Cover Bolts	Steel
Inlet Valve	Hardened Stainless Steel 40 Rc
Vent Valve	Hardened Stainless Steel 40 Rc
Mechanism Yoke	304 Stainless Steel
Ball Float	304 Stainless Steel
Check Valves	Stainless Steel
Springs	Inconel-X-750
Other Internal Components	Stainless Steel

Snap-Assure U.S. Patent No. 6572340

PMPLS
Pressure Motive Pump



Model	**PMPLS**
Body	**Carbon Steel**
Cover	**Carbon Steel**
Check Valves	**Stainless Steel**
PMO Max. Operating Pressure	**150 PSIG**
TMO Max. Operating Temperature	**366°F**
PMA Max. Allowable Pressure	**150 PSIG @ 650°F**

Note: Optional 200 PSIG PMA/PMO. Consult Factory.

Typical Applications

The **PMPLS** model **Carbon Steel** non-electric pressure motive pump is a lower profile than the standard PMPF model. It is sometimes required when draining condensate from process equipment that is positioned close to the ground, which limits the filling head of the pump. This stand-alone pump is capable of operating with a maximum motive pressure of 150 PSIG provided by steam, air or other gas supply. These pumps receive the ASME "UM" code stamp.

Features

- Equipped with our **Patented "Snap-Assure"** Mechanism which **extends the useful life of the pump**
- Mechanism incorporates **heat-treated stainless steel wear items**
- All stainless steel internals for ultimate corrosion resistance
- Dual compression springs made from Inconel-X-750 for high-temperature corrosive service
- Operates using steam, air, nitrogen or other pressurized gases as the motive force
- **Non-Electric** – can be used in remote locations or NEMA 4, 7, 9 and hazardous areas

Sample Specification

The non-electric pressure powered pump shall be capable of operating with a maximum motive pressure of 150 PSIG provided by steam, air or other gas supply. The pump body shall be fabricated carbon steel and certified with the ASME "UM" code stamp. The pump mechanism shall be float operated with a patented "Snap-Assure" feature constructed of all stainless steel materials with all load bearing points hardened for extended service life. The mechanism shall feature two Inconel springs used in compression with motive and vent valves hardened to 40c Rockwell.

DIMENSIONS – *inches*

Size (Inlet x Outlet)	Model Code	A	B	C	Weight (lbs)
1" x 1"	**PMPLS-1X1-N-SS**	29 1/2	5 5/8	5 5/8	200
1 1/2" x 1"	**PMPLS-1.5X1-N-SS**	30 3/4	7	5 5/8	205
1 1/2" x 1 1/2"	**PMPLS-1.5X1.5-N-SS**	32 1/8	7	7	210

The PMPLS Stand Alone Pump consists of pump tank, internal mechanism, and inlet and outlet stainless steel check valves.

MATERIALS

Body & Cover	**Carbon Steel**
Cover Gasket	Grafoil
Cover Bolts	Steel
Inlet Valve	Hardened Stainless Steel 40 Rc
Vent Valve	Hardened Stainless Steel 40 Rc
Mechanism Yoke	304 Stainless Steel
Ball Float	304 Stainless Steel
Check Valves	Stainless Steel
Springs	Inconel-X-750
Other Internal Components	Stainless Steel

Snap-Assure U.S. Patent No. 6572340

PMPNT
Pressure Motive Pump

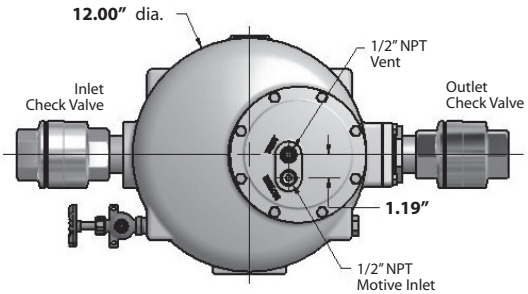
Model	PMPNT	PMPNTS
Body	Ductile Iron	Stainless Steel
Cover	Stainless Steel	Stainless Steel
Sizes	1", 1 1/2" NPT	1 1/2" FLG or NPT
Check Valves	Stainless Steel	Stainless Steel
PMO Max. Operating Pressure	125 PSIG	125 PSIG
TMO Max. Operating Temperature	366°F	366°F
PMA Max. Allowable Pressure	150 PSIG @ 450°F	150 PSIG @ 450°F

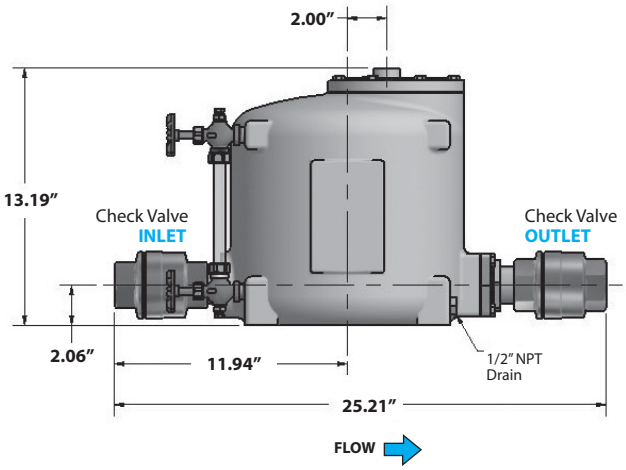
Typical Applications

The **PMPNT(S)** non-electric pressure motive pumps are light in weight and have an extremely low-profile. This stand-alone pump is capable of operating with a maximum motive pressure of 125 PSIG provided by steam, air or other gas supply. ASME Code Stamp available upon request.

Features

- Equipped with our proven, **Patented "Snap-Assure"** mechanism which **extends the useful life of the pump**
- Internal mechanism can be removed from the top of the pump while pump remains piped in line
- Mechanism incorporates **heat-treated stainless steel wear items** for ultimate corrosion resistance
- Dual compression springs made from Inconel-X-750 for high-temperature, corrosive service
- **Non-Electric** – can be used in remote locations or NEMA 4, 7, 9 and hazardous areas
- Operates using steam, air, nitrogen or other pressurized gas as the motive force





MATERIALS	
Body PMPNT	**Ductile Iron SA-395**
Body PMPNTS	**Stainless Steel CF3M**
Cover	Stainless Steel CF8
Cover Gasket	Garlock
Cover Bolts	Steel
Inlet Valve	Hardened Stainless Steel 40 Rc
Vent Valve	Hardened Stainless Steel 40 Rc
Ball Float	300 Stainless Steel
Check Valves	Stainless Steel 316SS CF3
Springs	Inconel-X-750
Other Internal Components	Stainless Steel

Size	Model Code	PMO PSI	Weight lbs
Ductile Iron Pump Body (NPT)			
1" x 1"	**PMPNT-1X1-N-SS**	125	85
1 1/2" x 1 1/2"	**PMPNT-1.5X1.5-N-SS**	125	95
Stainless Steel Pump Body (NPT or 150# FLG)			
1 1/2" x 1 1/2"	**PMPNTS-1.5X1.5-N-SS**	125	95
1 1/2" x 1 1/2"	**PMPNTS-1.5X1.5-F150-SS**	125	98

The PMPNT Stand Alone Pump consists of pump tank, internal mechanism, and inlet and outlet stainless steel check valves.

CAPACITIES – *Condensate (lbs/hr)*

Motive Pressure (PSIG)	Back Pressure (PSIG)	6" Filling Head	
		Steam Motive 1" x 1"	Steam Motive 1 1/2" x 1 1/2"
5	2	1225	2131
10	5	1204	2093
10	2	1391	2419
25	15	1171	2037
25	5	1458	2535
50	40	987	1716
50	10	1491	2593
75	60	992	1726
75	40	1262	2195
75	15	1505	2617
100	80	995	1731
100	60	1209	2102
100	15	1545	2687
125	100	997	1734
125	80	1174	2042
125	60	1316	2288
125	15	1570	2731

Note: Multiply Capacity by 1.16 for **12"** Fill Head.
Multiply Capacity by 1.28 for **18"** Fill Head.

PMPBP
Pressure Motive Pump

Model	**PMPBP**
Body	**Carbon Steel**
Cover	**Carbon Steel**
Check Valves	**Stainless Steel & Steel**
PMO Max. Operating Pressure	**150 PSIG**
TMO Max. Operating Temperature	**366°F**
PMA Max. Allowable Pressure	**150 PSIG @ 470°F**

Typical Applications

The **PMPBP** model non-electric **Carbon Steel** pressure motive pump is extremely high-capacity for applications requiring large transfer of condensate or other liquids. This stand-alone pump is capable of operating with a maximum motive pressure of 150 PSIG provided by steam, air, nitrogen or other pressurized gases as the motive force. ASME "U" Code Stamp available upon request.

Features

- All stainless steel internals for ultimate corrosion resistance
- Operates using steam, air, nitrogen or other pressurized gas as the motive force
- **Non-Electric** – can be used in remote locations or NEMA 4, 7, 9 and hazardous areas

Options

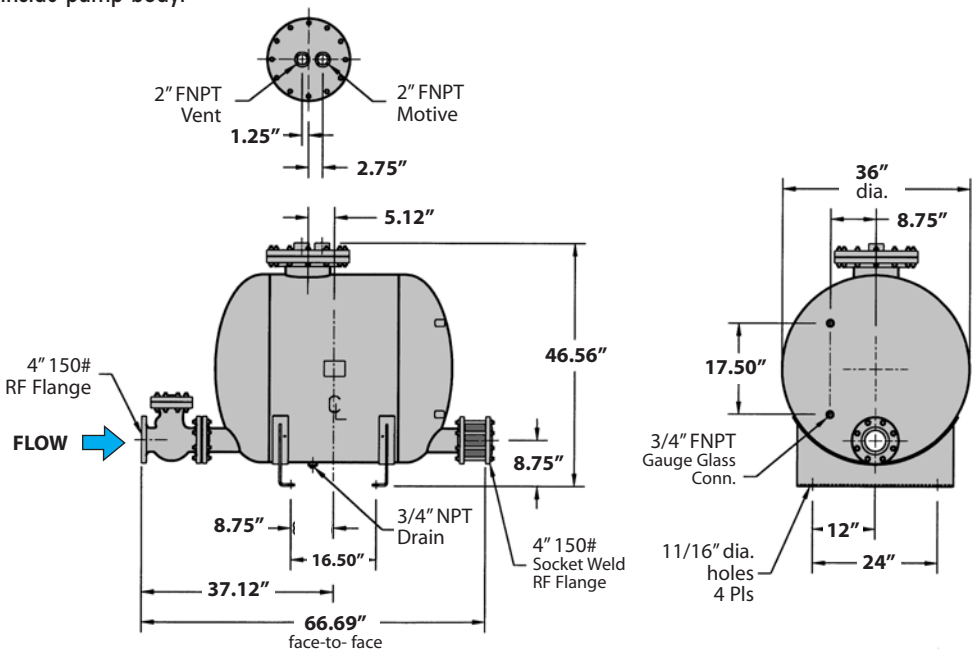
- Cycle counter for measuring the amount of condensate flow through the pump.
- Insulation jackets are available to stop heat losses through the pump body.
- Sight glass for monitoring liquid level inside pump body.

MATERIALS

Body & Cover	**Carbon Steel**
Cover Gasket	Non-Asbestos
Cover Bolts	Steel
Inlet Valve	Stainless Steel
Vent Valve	Stainless Steel
Mechanism Yoke	304 Stainless Steel
Ball Float	304 Stainless Steel
Check Valves	Stainless Steel & Steel
Springs	Stainless Steel
Other Internal Components	Stainless Steel

Size (Inlet x Outlet)	Connection	Model Code	PMO PSI	Weight (lbs)
4" x 4"	150#FLG	PMPBP-4X4-F150-SS	150	1050

The PMPBP Stand Alone Pump consists of pump tank, internal mechanism, and inlet and outlet check valves.



PMPSP

PMPSPL

Model	**PMPSP/PMPSPL**
Body	**Carbon Steel**
Cover	**Ductile Iron**
Check Valves	**Stainless Steel**
PMO Max. Operating Pressure	**150 PSIG**
TMO Max. Operating Temperature	**366°F**
PMA Max. Allowable Pressure	**150 PSIG @ 650°F**

Typical Applications

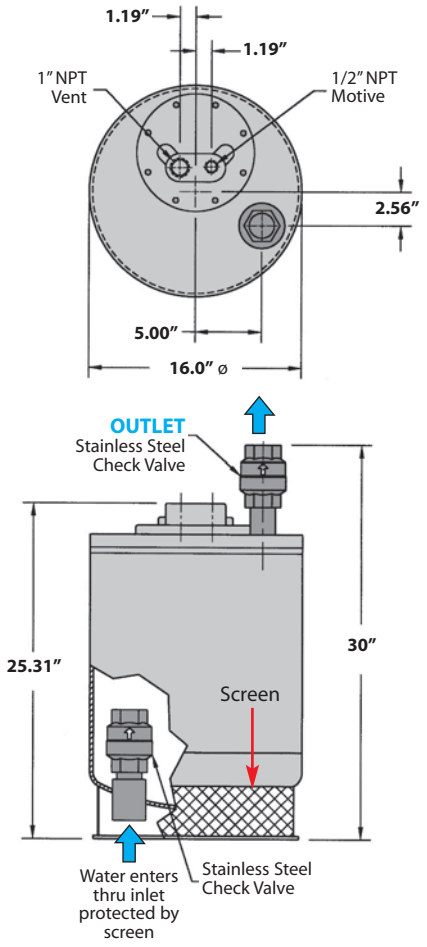
The **PMPSP** Sump Drainer uses the same internal mechanism as the standard PMP models. The piping configuration is such that the liquid is discharged vertically out the top as opposed to horizontally out the side. This allows the unit to be easily positioned inside of a sump area. Condensate or water from the sump enters the tank through a stainless steel low resistance check valve. This unit is capable of operating with a maximum motive pressure of 150 PSIG using steam, air, nitrogen or other pressurized gas as the motive force.

Features

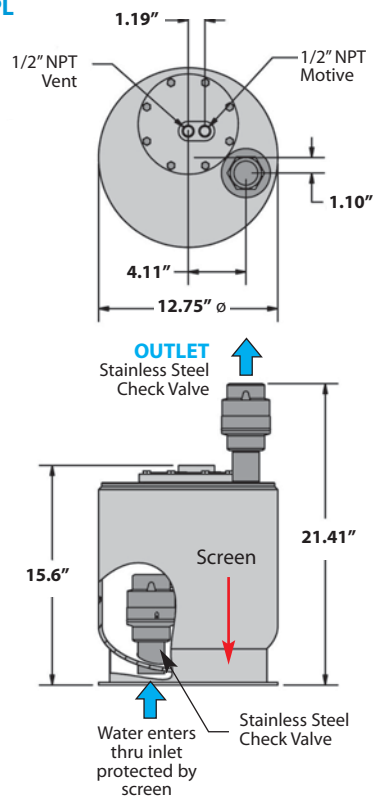
- Equipped with our **Patented "Snap-Assure"** Mechanism which **extends the useful life of the pump**
- Mechanism incorporates **heat-treated stainless steel wear items** for ultimate corrosion resistance
- Dual compression springs made from Inconel-X-750 for high-temperature corrosive service
- Operates using steam, air, nitrogen or other pressurized gas as the motive force
- **Non-Electric** – can be used in remote locations or NEMA 4, 7, 9 and hazardous areas
- Built-in Strainer screen

Snap-Assure U.S. Patent No. 6572340

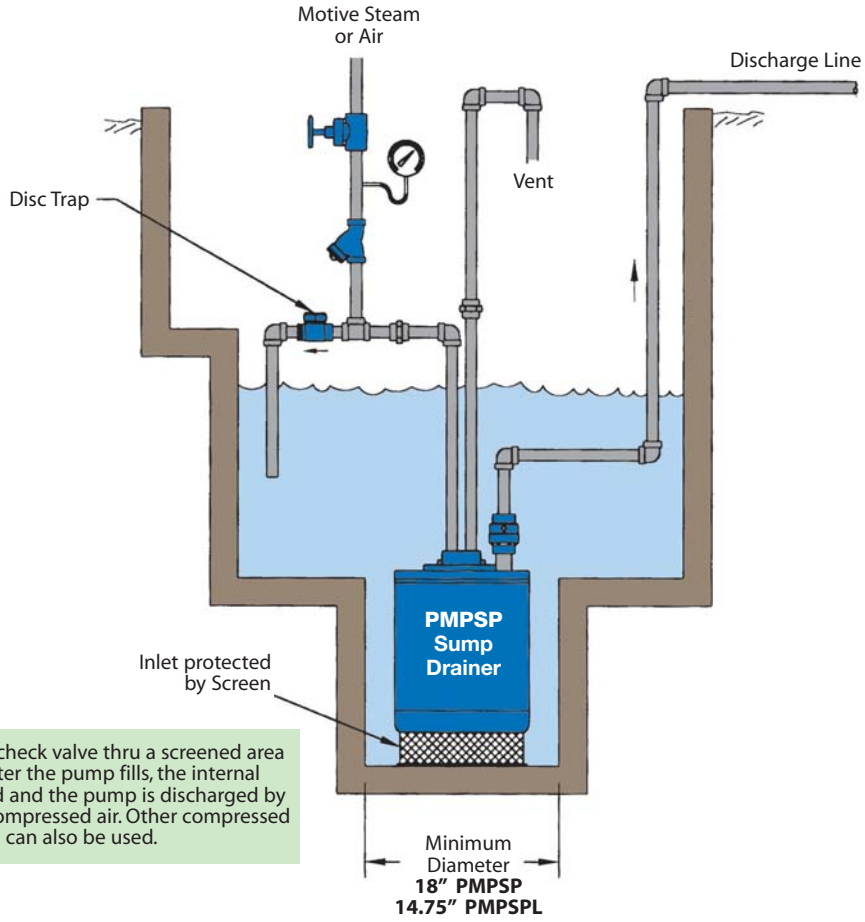
PMPSP



PMPSPL



Typical PMPSP Piping Configuration



Water enters the inlet check valve thru a screened area at bottom of pump. After the pump fills, the internal mechanism is actuated and the pump is discharged by the motive steam or compressed air. Other compressed gases such as nitrogen can also be used.

Size/Connection (Outlet) NPT	Model Code	PMO PSI	Weight lbs
1 1/2"	PMPSPL	150	110
1 1/2"	PMPSP-1	150	230
2"	PMPSP-2	150	270
2"	PMPSP-3	150	290

PMPSP & PMPSPL

PUMP CAPACITIES – *Water (GPM)*

Motive Pressure (PSIG)	Total Back Pressure (PSIG)	PMPSPL 1 1/2"	PMPSP-1 1 1/2"	PMPSP-2 2"	PMPSP-3 2"
10	0	2.8	11.7	22.2	35
20	10	3.1	9.2	17.5	22
20	0	3.3	12.5	23.7	30
40	20	3.2	8.7	16.5	21
40	10	3.4	10.4	19.8	25
40	0	3.5	13.1	25	31.4
70	40	3.2	7.1	12.1	17
70	20	3.4	9.4	15	22.5
70	0	3.6	12.9	20.6	31
100	70	3.2	5.4	8.6	10.8
100	40	3.4	7.5	12	15
100	20	3.4	9.4	15	18.8
100	0	3.5	12.3	19.7	24.6
150	100	-	4.5	7.2	9
150	70	-	5.7	9.1	11.4
150	40	-	7.2	11.5	14.4
150	20	-	8.8	14	17.6
150	10	-	9.5	15.2	19
150	0	-	10.7	17.1	21.4

PMPC & PMPF
Pressure Motive Pumps

Standard Skid Mounted Systems

Package Model	Simplex, Duplex, Triplex	Simplex, Duplex, Triplex
Pump Model (PMP)	**PMPF**	**PMPC**
Pump Body Material	**Carbon Steel**	**Ductile Iron**
Receiver Material	**Carbon Steel**	**Carbon Steel**
Check Valves	**316 Stainless Steel**	**316 Stainless Steel**
PMO Max. Operating Pressure	**200 PSIG**	**200 PSIG**
TMO Max. Operating Temperature	**388°F**	**388°F**
PMA Max. Allowable Pressure	**250 PSIG @ 650°F**	**200 PSIG @ 650°F**
Receiver Pressure Rating	**150 PSIG @ 566°F**	**150 PSIG @ 566°F**

Typical Applications

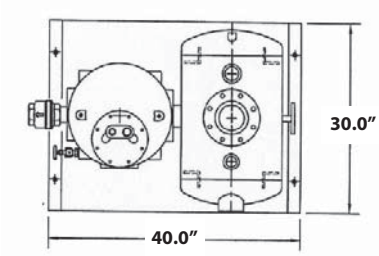
Condensate Return Pressure Motive Pump (PMPs) with a Vented Receiver. Standardized Simplex, Duplex, Triplex, and Quadraplex packaged systems include stand-alone pump(s), check valves and vented receiver, mounted on a steel base and frame. Multiple pumping units can be used for increased capacity or for system redundancy. The PMP units are available in ductile iron, carbon steel and stainless steel. Additional options include sight glasses, insulation jackets, cycle counters, motive and vent piping, pressure regulators, steam traps, strainers, ASME code stamps, etc.

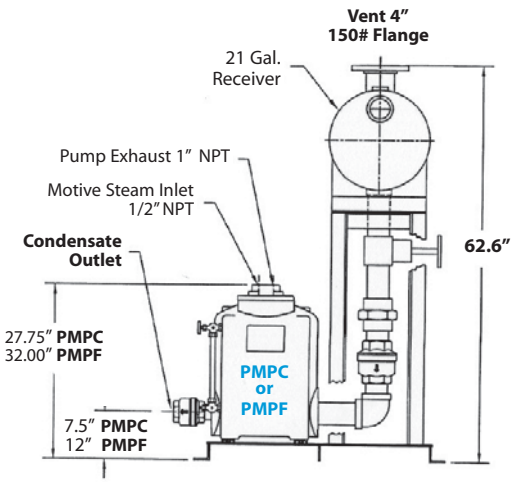
Sample Specifications

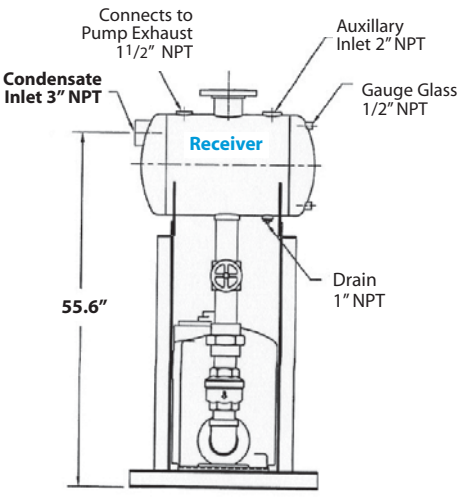
Unit shall be a Watson McDaniel, pre-packaged system to include pressure motive pump(s) with stainless steel check valves, an ASME vented receiver with "UM" code stamp, and interconnecting piping including inlet isolation valve. The carbon steel PMPF shall receive an ASME "UM" code stamp and the ductile iron PMPC shall offer it as an option. The pump mechanism shall be float operated with a patented "Snap-Assure" feature constructed of all stainless steel materials with all load bearing points hardened for extended service life, with no external seals or packing.

Connection NPT Inlet x Outlet	PMPC • Ductile Iron Mode Code	PMPF • Carbon Steel Mode Code	Receiver Size Gallons
Simplex Systems - One Pump with Receiver			
1" x 1"	**S-PMPC-1X1-SS-21**	**S-PMPF-1X1-SS-21**	21
1 1/2" x 1"	**S-PMPC-1.5X1-SS-21**	**S-PMPF-1.5X1-SS-21**	21
2" x 1"	**S-PMPC-2X1-SS-21**	**S-PMPF-2X1-SS-21**	21
2" x 1 1/2"	**S-PMPC-2X1.5-SS-21**	**S-PMPF-2X1.5-SS-21**	21
2" x 2"	**S-PMPC-2X2-SS-21**	**S-PMPF-2X2-SS-21**	21
3" x 2"	**S-PMPC-3X2-SS-21**	**S-PMPF-3X2-SS-21**	21
Duplex Systems - Two Pumps with Receiver			
3" x 2"	**D-PMPC-3X2-SS-48**	**D-PMPF-3X2-SS-48**	48
3" x 2"	**D-PMPC-3X2-SS-75**	**D-PMPF-3X2-SS-75**	75
3" x 2"	**D-PMPC-3X2-SS-116**	**D-PMPF-3X2-SS-116**	116
Triplex Systems - Three Pumps with Receiver			
3" x 2"	**T-PMPC-3X2-SS-75**	**T-PMPF-3X2-SS-75**	75
3" x 2"	**T-PMPC-3X2-SS-116**	**T-PMPF-3X2-SS-116**	116

SIMPLEX Systems







PMPC & PMPF
Pressure Motive Pumps

Standard Skid Mounted Systems

ASME Certified

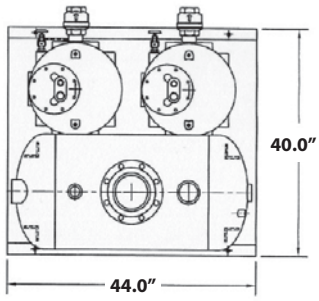
Features

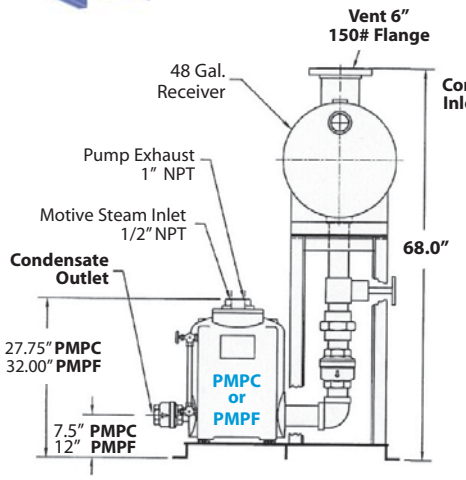
- PMP pump systems reduce installation costs. Only 4 pipe connections are required in the field
- Watson McDaniel ensures that vented receivers and other components are properly sized for optimum system performance
- Watson McDaniel's fully-qualified fabrication facility is ASME code certified. Our engineers can design and build complete custom systems to meet all your requirements

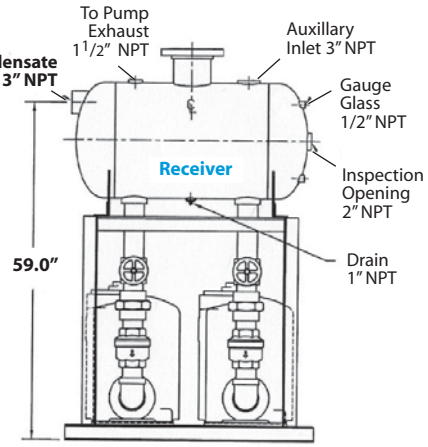
Options

- Gauge glass assembly
- Cycle counter
- Insulation covers
- Motive steam drip trap
- Overflow pipe connection
- Pressure regulator for motive supply line

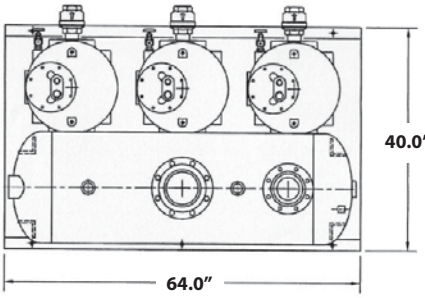
DUPLEX Systems

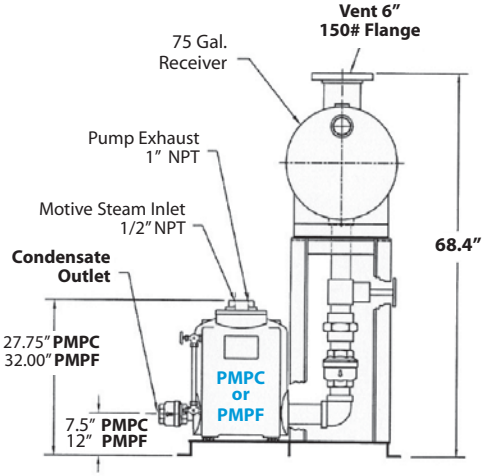


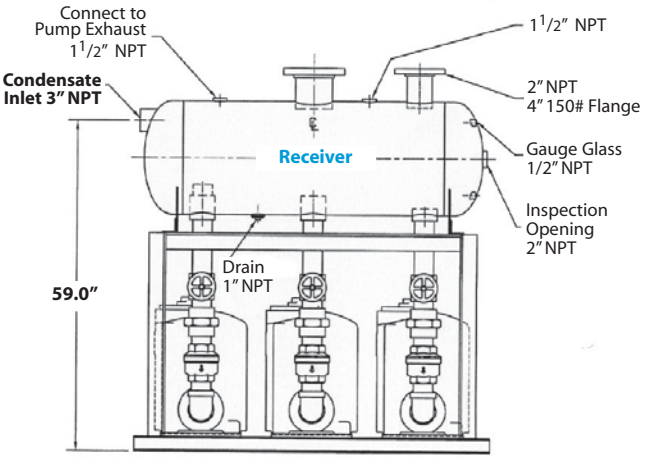




TRIPLEX Systems







Sizing and Selecting a PMP

The Capacity Charts cover both Stand Alone Pumps (PMPC, PMPF, PMPLS, etc.) as well as Pumps with Receiver Tanks (Simplex, Duplex, Triplex). If a stand alone pump is chosen, consideration should be given to the size of the vented receiver that collects the condensate before the PMP (see flash tank vent sizing). If the pump is replacing an existing installation, a vented receiver that is acceptable in size and configuration may already be installed. If required to meet capacity, pre-packaged systems with more than one pump, such as the Duplex or Triplex are available. These units come pre-mounted with the pump(s), a receiver tank as well as other options to optimize the system. A multiple pump unit may also be chosen for reserve capacity or pump redundancy in critical applications.

To select the proper size pressure motive pump requires you to know a few key pieces of information:

1. **Condensate load you need to pump:** Condensate Load is normally expressed in lbs/hr. To convert to GPM flow rate, note that 500 lbs/hr is equivalent to 1 GPM.

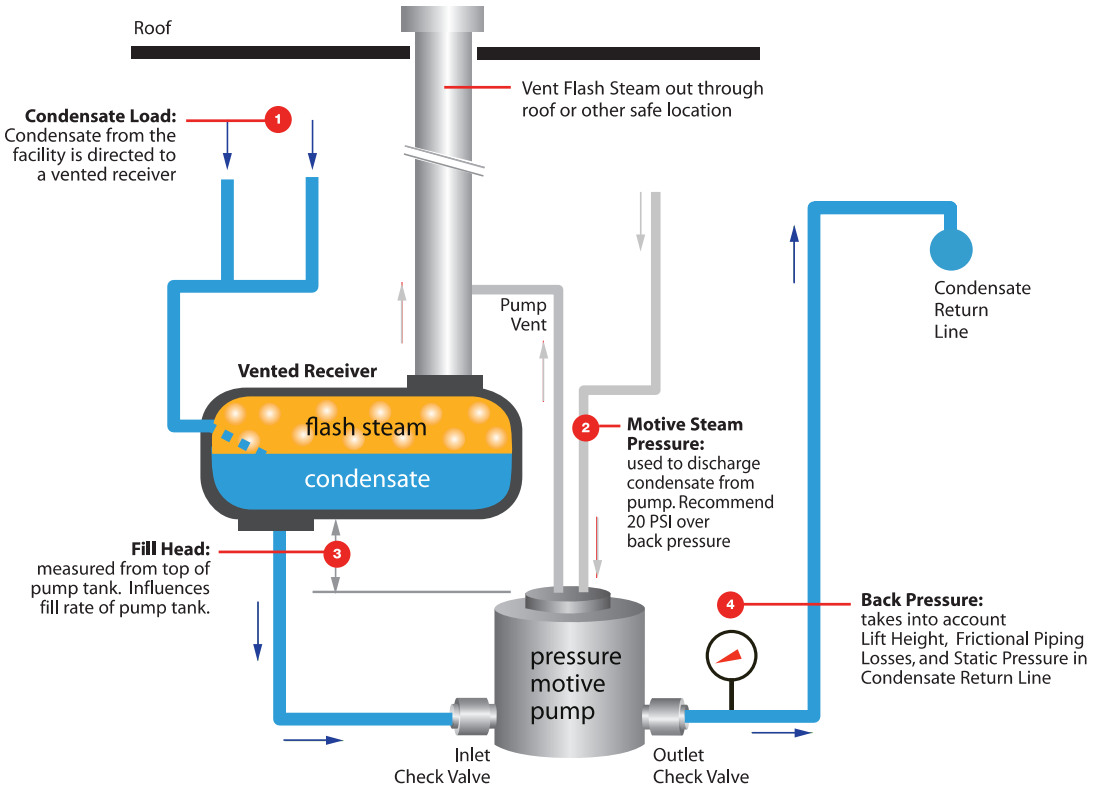
2. **Motive Pressure:** The motive pressure of the steam (or other gas) impacts pump capacity. The sizing chart indicates different flow rates based upon motive steam inlet pressure. It is recommended to regulate the steam inlet pressure to 20 psi above the total back pressure.

3. **Fill head:** Is the height (in inches) of the condensate receiver tank (or flash tank) above the pump tank. This head pressure determines how quickly the pump tank will refill with condensate after its discharge cycle. Therefore, reducing the fill time will increase the overall capacity of the pump. The capacity chart is based on 12" of fill head (PMPLS based on 6" fill head). Increasing fill head height can increase capacity by as much as 20 - 50%. (See Capacity Correction Chart.)

4. **Back Pressure:** Back Pressure is the sum total of condensate return line pressure and the physical height that the condensate needs to be elevated. (See sizing section for guidance on how to calculate back pressure.)

Inlet x Outlet Size:

In addition to body material, pumps are designated by inlet and outlet size. For example, PMPC 3 x 2 has 3" inlet and 2" outlet check valves with a ductile iron tank. Since the pump fills by gravity from the receiver tank located above it, the size of the inlet check valve significantly impacts pump capacity. The larger the check valve, the quicker the condensate will fill the pump tank, allowing it to cycle again. For example, a 3" check valve may have twice the inlet flow rate of a 2" check valve. The size of the outlet (or discharge) check valve also affects capacity but to a lesser extent.



Capacity Charts

Stand Alone Pumps & Systems

Capacity based on 12" Fill Head except as noted

CAPACITIES – *Condensate (lbs/hr)* **Using steam as a motive pressure**

Motive Pressure (PSIG)	Total Back Pressure (PSIG)	PMPLS 6" Fill Head 1" X 1"	PMPC, PMPF, PMPSS* (12" Fill Head)									PMPBP 4" x 4" 24" Head
			1½" X 1"	1½" X 1½"	2" X 1"	2" X 1½"	2" X 2"	3" x 2"	Duplex 3" x 2"	Triplex 3" x 2"	Quadraplex 3" x 2"	
5	2	1,760	1,860	1,920	2,860	3,180	3,540	5,000	10,000	15,000	20,000	16,600
10	5	1,870	2,200	2,450	4,350	4,840	5,380	7,210	14,420	21,630	28,840	19,000
10	2	2,200	3,030	3,370	6,880	7,650	8,500	11,110	22,220	33,330	44,440	22,600
25	15	1,650	3,130	3,480	4,990	5,550	6,170	8,230	16,460	24,690	32,920	33,200
25	10	1,980	3,600	3,990	6,560	7,290	8,100	10,780	21,560	32,340	43,120	40,300
25	5	2,300	4,700	5,200	7,970	8,860	9,850	13,350	26,700	40,050	53,400	46,200
50	40	1,650	2,280	2,530	3,370	3,750	4,170	5,670	11,340	17,010	22,680	33,300
50	25	1,980	4,050	4,500	6,800	7,560	8,440	11,550	23,100	34,650	46,200	40,100
50	10	2,300	4,700	5,240	7,970	8,860	9,850	13,440	26,880	40,320	53,760	47,000
75	60	1,540	2,400	2,660	3,600	4,000	4,440	6,340	12,680	19,020	25,360	32,900
75	40	1,980	3,780	4,190	5,920	6,580	7,320	9,870	19,740	29,610	39,480	39,400
75	15	2,420	5,130	5,700	8,580	9,540	10,600	14,330	28,660	42,990	57,320	47,200
100	80	1,650	2,750	3,060	4,160	4,630	5,150	6,860	13,720	20,580	27,440	27,200
100	60	1,870	3,600	4,000	5,560	6,180	6,870	9,100	18,200	27,300	36,400	35,100
100	40	2,090	4,700	5,210	6,880	7,650	8,500	11,270	22,540	33,810	45,080	42,100
100	15	2,420	5,400	6,010	8,740	9,720	10,800	14,330	28,660	42,990	57,320	48,000
125	115	1,430	2,380	2,640	3,270	3,640	4,050	4,960	9,920	14,880	19,840	19,500
125	100	1,540	2,980	3,330	4,140	4,600	5,130	6,390	12,780	19,170	25,560	25,300
125	80	1,760	3,430	4,100	5,400	6,000	6,670	8,540	17,080	25,620	34,160	32,200
125	60	1,980	4,170	4,850	6,600	7,340	8,160	10,530	21,060	31,590	42,120	38,500
125	40	2,200	5,100	5,950	7,760	8,630	9,590	12,500	25,000	37,500	50,000	44,000
125	15	2,420	5,850	6,660	9,240	10,270	11,420	15,100	30,200	45,300	60,400	49,200
150	120	1,590	2,650	2,940	3,400	3,780	4,200	5,690	11,380	17,070	22,760	21,600
150	100	1,640	3,150	3,490	4,320	4,800	5,350	7,000	14,000	21,000	28,000	29,000
150	80	1,860	3,800	4,230	5,490	6,100	6,770	9,100	18,200	27,300	36,400	34,500
150	60	2,080	4,500	5,000	6,660	7,400	8,240	11,120	22,240	33,360	44,480	40,300
150	40	2,300	5,290	5,870	7,920	8,800	9,780	13,220	26,440	39,660	52,880	44,700
150	15	2,520	6,100	6,820	9,450	10,500	11,680	15,500	31,000	46,500	62,000	49,500
175	140	-	2,600	2,900	3,800	4,200	4,650	6,200	12,400	18,600	24,800	-
175	120	-	3,100	3,400	4,400	4,850	5,400	7,200	14,400	21,600	28,800	-
175	100	-	3,600	4,000	5,100	5,700	6,300	8,400	16,800	25,200	33,600	-
175	60	-	4,850	5,400	6,900	7,700	8,550	11,400	22.800	34.200	45,600	-
175	40	-	6,200	6,900	8,900	9,850	10,950	14,600	29,200	43,800	58,400	-
175	15	-	7,500	8,350	10,600	11,900	13,200	17,600	35,200	52,800	70,400	-
200	160	-	2,400	2,700	3,500	3,800	4,300	5,700	11,400	17,100	22,800	-
200	140	-	3,100	3,400	4,400	4,900	5,400	7,200	14,400	21,600	28,800	-
200	100	-	4,200	4,650	5,950	6,600	7,350	9,800	19,600	29,400	39,200	-
200	80	-	4,700	5,250	6,750	7,500	8,300	11,100	22,200	33,300	44,400	-
200	40	-	6,800	7,550	9,700	10,800	11,950	15,950	31,900	47,850	63,800	-
200	15	-	8,400	9,350	12,000	13,300	14,800	19,700	39,400	59,100	78,800	-

** PMPSS is rated to only 150 PSIG.*

Note: For PMPNT capacity, refer to PMPNT specification page.

Capacity Correction Factors for Alternate Filling Heads

Pump Inlet Size	Filling Head 6"	12"	18"	24"	36"	48"	60"
1"	1.00	1.10	1.20	1.30	1.50		
1½"	0.70	1.00	1.10	1.20	1.35		
2"	0.70	1.00	1.10	1.20	1.35		
3"	0.84	1.00	1.04	1.08	1.20		
4"			0.80	1.00	1.10	1.15	1.20

NOTE: *When the filling head differs from the standard filling height, the capacity of the pressure power pumps are either increased or decreased. For example, a pump with a 3" inlet that has a filling head of 36" as opposed to a standard filling head of 12", will have a capacity increase of 20%. Multiply the value found in the Capacity Table above by 1.2.*

Capacity Correction Factors for Gas as Motive Pressure

Pump Inlet Size	% Back Pressure relative to Motive Pressure 10%	20%	30%	40%	50%	60%	70%	80%	90%
1"	1.00	1.13	1.16	1.20	1.25	1.30	1.35	1.40	1.45
1½"	1.04	1.06	1.08	1.10	1.12	1.15	1.18	1.23	1.28
2"	1.04	1.06	1.08	1.10	1.12	1.15	1.18	1.23	1.28
3"	1.04	1.06	1.08	1.10	1.12	1.15	1.18	1.23	1.28
4"	No Capacity Change								

Note: For low specific gravity applications, consult factory.

Sizing & Selection

Vented Receiver (Open-Loop System)

Pump Size

The models of a Pressure Motive Pump are designated by the size of the inlet and outlet check valves (for example, a 3" x 2" PMPC or PMPF has a 3" Inlet check valve and a 2" outlet check valve). The larger the check valves, the larger the pump capacity.

STAND-ALONE PUMPS include pump tank, internal pumping mechanism, and check valves.

PUMP(S) WITH RECEIVER TANKS includes stand-alone pump(s), and vented receiver tank mounted together on a frame. These are available in Simplex, Duplex, Triplex and Quadraplex systems.

When sizing and selecting a Pressure Motive Pump, Four system conditions are required:

(See Diagram on following page)

1. **Condensate Load:** If condensate from several sources of equipment is required to be pumped, sum up the maximum flow rate of condensate each could produce separately.
2. **Motive Pressure:** Normally steam is used; however, other gases can be used to pump the condensate, including Air or Nitrogen.
3. **Filling Head:** The Filling Head is measured between the bottom of the receiver tank and the top of the pump tank. It has a significant effect on pump capacity.
4. **System Back Pressure:** Pressure in condensate return line that pump will be operating against, as determined by condensate return line pressure and vertical height condensate must be lifted.

Sample System Conditions:

1	**Condensate Load**	**8,000 lbs/hr**
2	**Motive Steam Pressure**	**100 PSIG**
3	**Filling Head**	**12"**
4	**System Back Pressure:**	**40 PSIG**

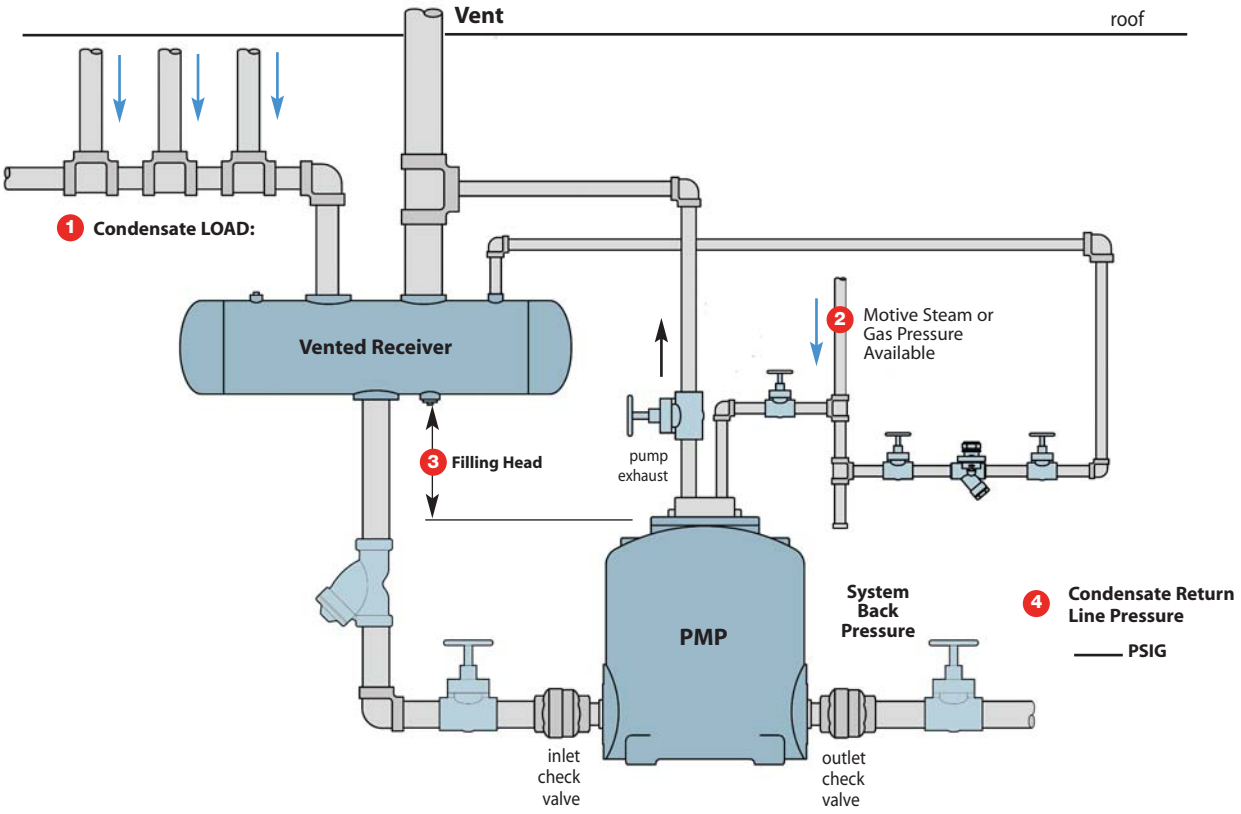
(To find the pressure required to lift condensate in PSIG, multiply Vertical lift in feet by 0.433)

For PMP Selection: Consult PMP Sizing Capacity Chart using 100 PSIG inlet pressure and 40 PSIG back pressure. A 2" x 2" pump has a capacity of 8,500 lbs/hr and is an appropriate selection. Pump choices are models PMPC, PMPF and PMPSS.

How to specify when ordering:	Example:
1) Model	**PMPC**
2) Size of Pump(s)	**2" x 2"**
3) Stand-alone Pump or Pump with Receiver Tank *(Note: Size of Receiver Tank must be specified when ordering Pump with Receiver Tank)*	**Simplex or Duplex**
4) Options	**Gauge glass**
5) When ordering a Customized Skid System, please confirm and specify Receiver size.	

Sizing & Selection

Vented Receiver (Open-Loop System)



Receiver & Vent Sizing

The purpose of the vented receiver is to neutralize the pressure inside the condensate return line so condensate will properly drain from the processes and into the pump tank. An undersized vent will increase the velocity of flash steam in the vent pipe, potentially pulling condensate from the receiver tank out the vent. It may also increase pressure in the receiver and condensate return line upstream of the receiver, possibly causing issues with condensate drainage from the steam traps. The table below lists vent and corresponding receiver sizes based on the amount of flash steam. The amount of flash steam generated is determined by the condensate flow rate and condensate pressure entering the vented receiver.

Determine the amount of condensate in lbs/hr flowing into the vented receiver. The percentage of condensate that will flash into steam is based on the initial condensate pressure and the pressure inside the vented receiver. Since we are trying to achieve 0 psig, reference the 0 psig flash tank pressure to determine % flash steam. Multiply the % flash by the total condensate load.

Example: 10,000 lbs/hr of condensate is generated at an estimated steam pressure of 20 psig. The percent (%) flash steam is **4.9%**. **Quantity of flash steam = .049 x 10,000 = 490 lbs/hr**.

From the table, select a Vent and Receiver size which can handle **600 lbs/hr** of flash steam. (**4”** vent with a **10”** receiver diameter and **36”** length.)

PERCENT (%) FLASH STEAM

Produced when condensate is discharged to atmosphere or into a flash tank controlled at various pressures

Condensate Pressure (PSIG)	Flash Tank Pressure (PSIG)								
	0	5	10	20	30	40	60	80	100
5	**1.6**	0.0							
10	**2.9**	1.3	0.0						
15	**3.9**	2.4	1.1						
20	**4.9**	3.3	2.1	0.0					
30	**6.5**	5.0	3.7	1.7	0.0				
40	**7.8**	6.3	5.1	3.0	1.4	0.0			
60	**10.0**	8.5	7.3	5.3	3.7	2.3	0.0		
80	**11.8**	10.3	9.1	7.1	5.5	4.2	1.9	0.0	
100	**13.3**	11.8	10.6	8.7	7.1	5.8	3.5	1.6	0.0
125	**14.9**	13.5	12.3	10.4	8.8	7.5	5.3	3.4	1.8
150	**16.3**	14.9	13.7	11.8	10.3	9.0	6.8	4.9	3.3

VENTED RECEIVER SIZING *(inches)*

Quantity of Flash Steam (lbs/hr)	Vent Line Diameter	Receiver Diameter	Receiver Length
75	1″	4″	36″
150	2″	6″	36″
300	3″	8″	36″
600	4″	10″	36″
900	6″	12″	36″
1200	6″	16″	36″
2000	8″	20″	60″
3000	8″	24″	60″
4000	10″	26″	60″
5000	10″	28″	60″
6000	12″	30″	72″
7000	12″	32″	72″
8000	14″	36″	72″

Pump & Trap Combinations

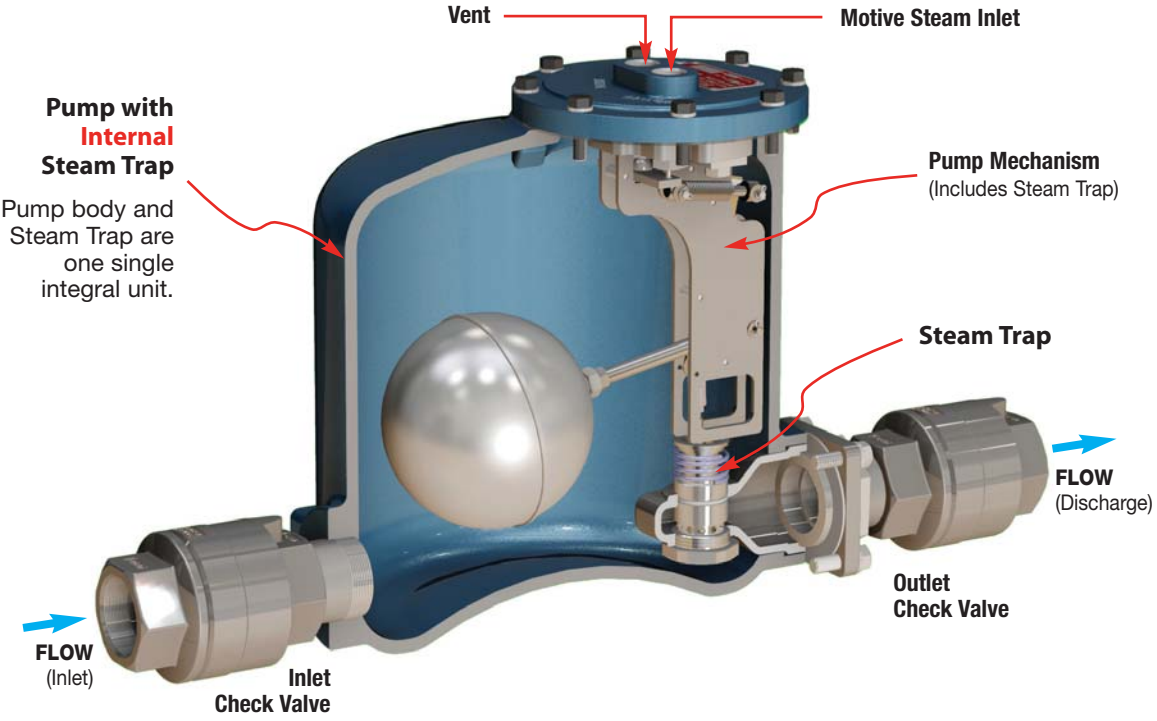
PMPT & WPT

What is a Pump-Trap?

A Pump-Trap is a float-operated steam trap that works in conjunction with a steam powered condensate return pump (Pressure Motive Pump). It is used when system conditions prevent a steam trap from effectively discharging condensate due to excessive back-pressure, or when it is desirable to operate a heat exchanger in vacuum.

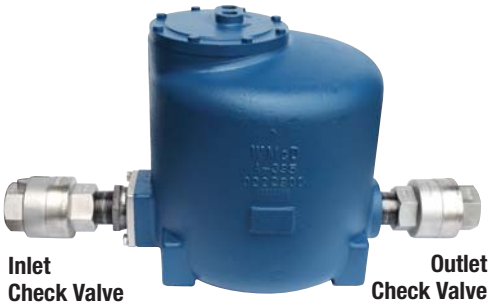
What is a Pump-Trap used for?

A **Pump-Trap** is used in place of a Steam Trap to drain condensate from a process application when the steam pressure in the process is not sufficient to push the condensate thru the steam trap and into the condensate return line. When steam pressure in a Heat Exchanger is less than the back pressure on the discharge side of the steam trap, the condensate backs up, causing inconsistent heat transfer and potential waterhammer. This frequently occurs on applications where a temperature control valve is used to supply steam to a Heat Exchanger based on product temperature and flow rate. The temperature control valve increases and decreases steam flow to the Heat Exchanger to satisfy the temperature set point. When system demand is high, the steam pressure in the Heat exchanger is most likely adequate to overcome system back pressure; however, when system demand decreases, steam pressure to the Heat Exchanger must also decrease and can fall below the back pressure. This condition is referred to as Stall, since it causes condensate to back up into the Heat Exchanger. To prevent condensate backup under stall conditions, a pump-trap must be used in place of a steam trap.



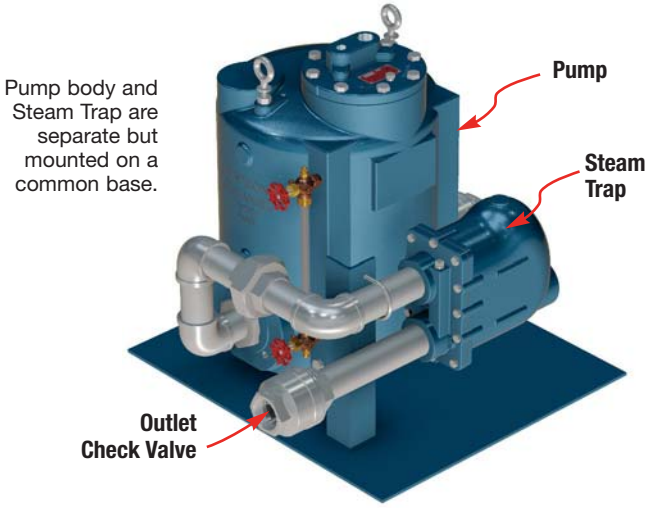
Pump with Internal Steam Trap (PMPT)

The **PMPT** pressure motive pump has an internal steam trap. The compact design makes it a suitable choice for most applications.



Pump with External Steam Trap (WPT)

The **WPT** is a stand-alone pump unit with a separate steam trap mounted on a common base. It is used when capacity requirements exceed that of the PMPT model.



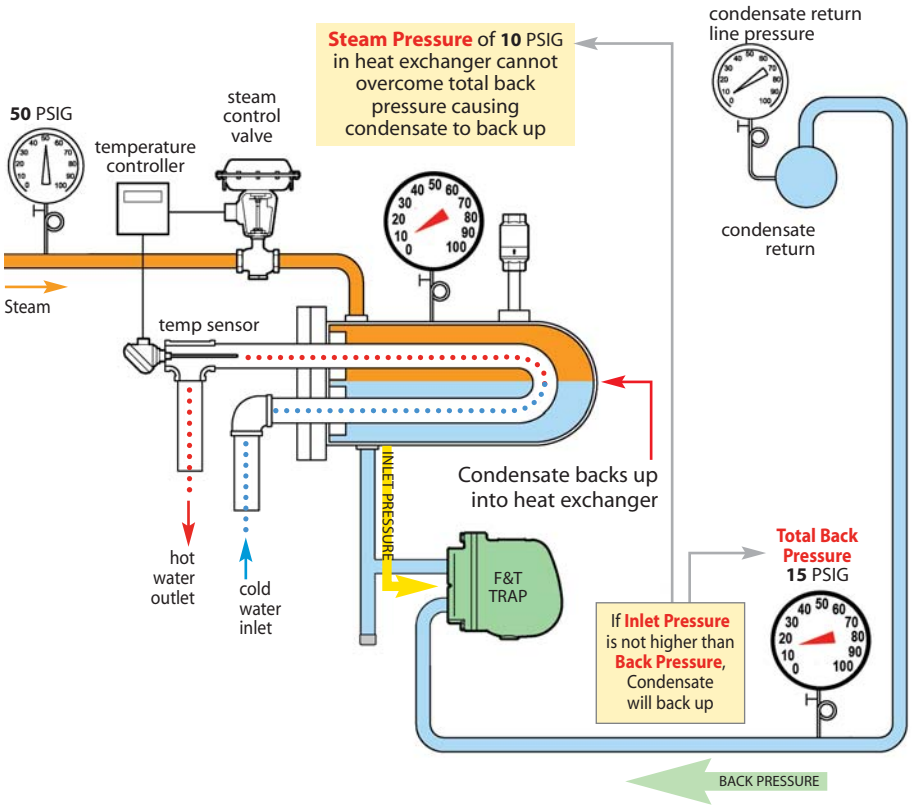
Why use a Pump-Trap?

Problem:

Condensate Backs Up Into Heat Exchanger

The diagram shows a temperature control valve delivering steam to a Heat Exchanger that is using steam to heat water. Condensate formed in the heat exchanger is being discharged through the steam trap into the condensate return line. This particular application demonstrates what happens when the return line is elevated and/or pressurized. The plant steam pressure on the inlet side of the control valve would be adequate to purge (push) the condensate through the trap and into the return line. However, the steam pressure in the heat exchanger is controlled by the valve and is dependent on the demand of the system. When the demand for HOT water is low, the steam pressure in the Heat Exchanger falls below the back pressure and the system backs up with condensate, creating unstable temperature control and waterhammer. This undesirable condition, referred to as Stall, occurs when the steam pressure in the heat exchanger falls to or below the system back pressure due to a decrease in the demand (flow rate) of hot water.

Heat Exchanger System with Steam Trap

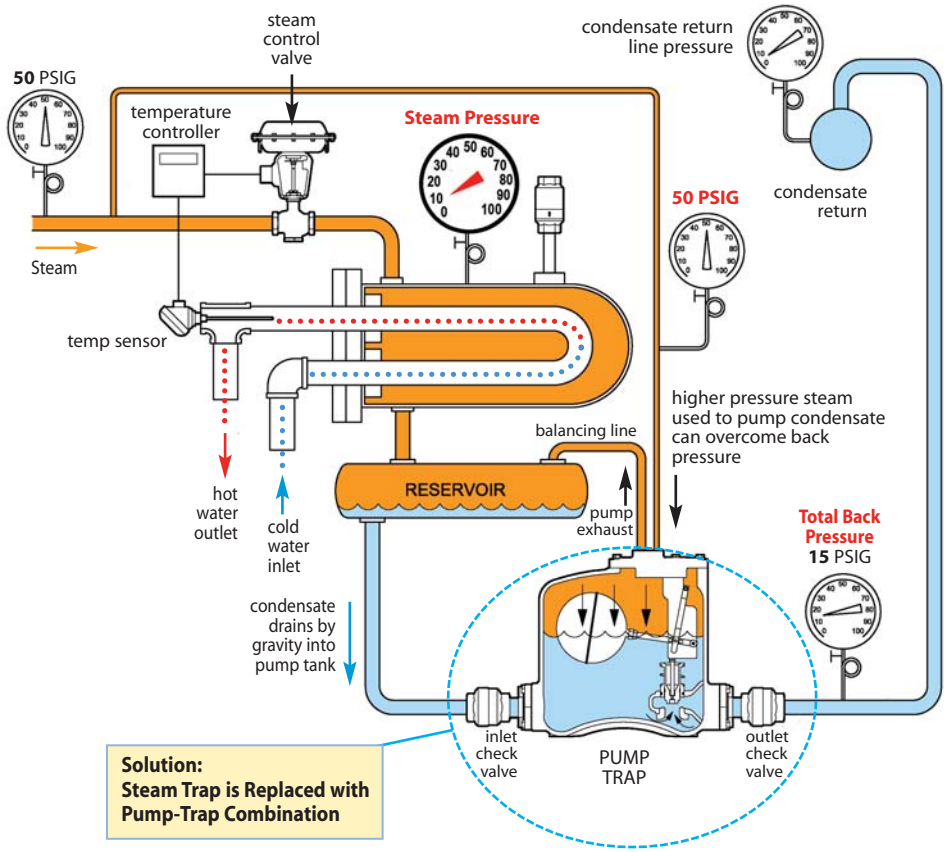


Solution:

Use a Pump-Trap to Avoid Condensate Back-up & Improve Temperature Control

To eliminate condensate backing up (STALL), the standard float trap is replaced with a PUMP-TRAP. When steam pressure in the Heat Exchanger is greater than the back pressure, the steam pressure will push the condensate through the Pump-Trap and it functions like a standard float-operated trap. When the steam pressure to the Heat Exchanger drops below the back pressure, the condensate backs up inside the PUMP-TRAP, raising the float. When the trip point of the mechanism is reached, the high-pressure steam valve will open to drive the condensate out.

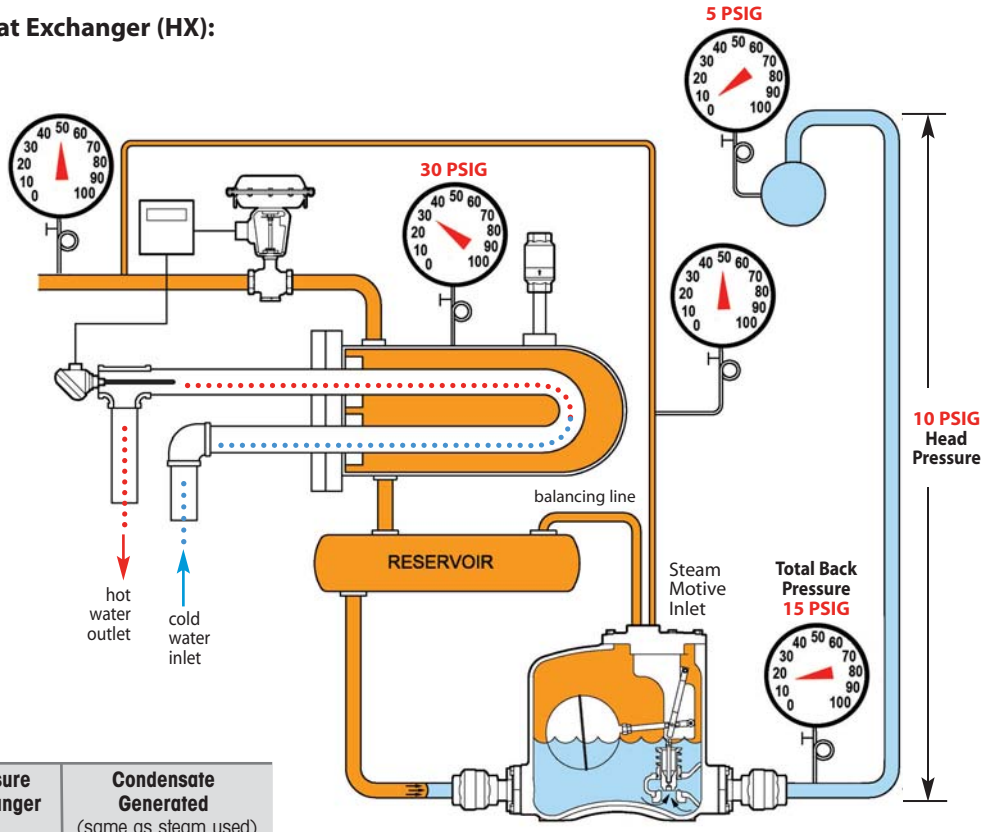
Heat Exchanger System with Pumping Trap



How a Pump-Trap Works

Operation of a PUMP-TRAP with a Heat Exchanger (HX):

The steam pressure to the HX will vary depending on the flow rate of hot water required by the system. Let's assume the HX was sized for a maximum flow rate of 40 GPM of HOT water at 140˚F using 30 PSIG steam. When maximum flow rate of water is required, the 30 PSIG steam pressure is more than adequate to push the condensate generated thru the steam trap against the 15 PSIG back pressure. Now, if the hot water requirement reduces from 40 to 20 GPM, the steam flow (lbs/hr) to the Heat Exchanger must drop by about half. Since it is the same size HX, the steam temperature (steam pressure) must also reduce (see table below).

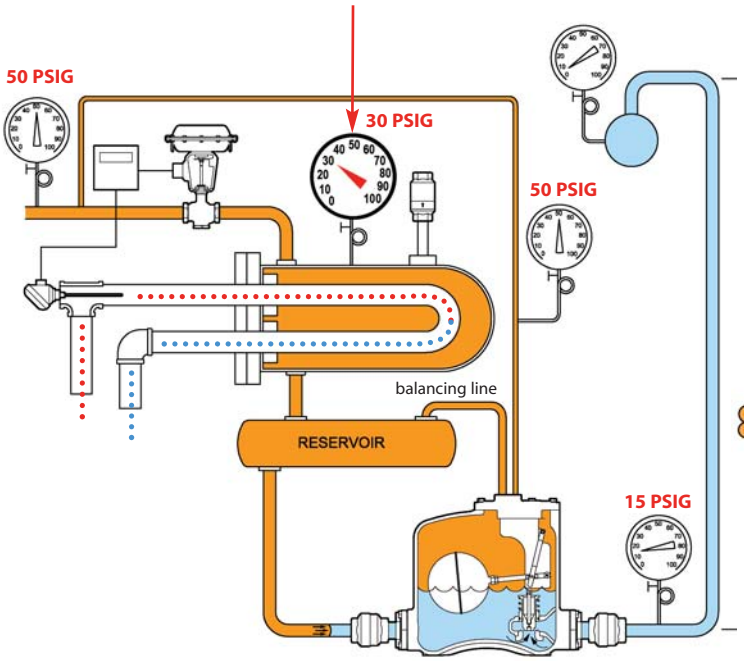


Steam Pressure vs. Hot Water Required

Flow Rate Water (gallons per minute)	Steam Usage (lbs/hr)	Steam Pressure in Heat Exchanger (PSIG)	Condensate Generated (same as steam used)	
40	1,900	30	1,900	Trap Mode
35	1,650	15	1,650	*Stall Point*
32	1,530	10	1,530	Pump Mode
20	950	-6.6 (Vacuum)	950	

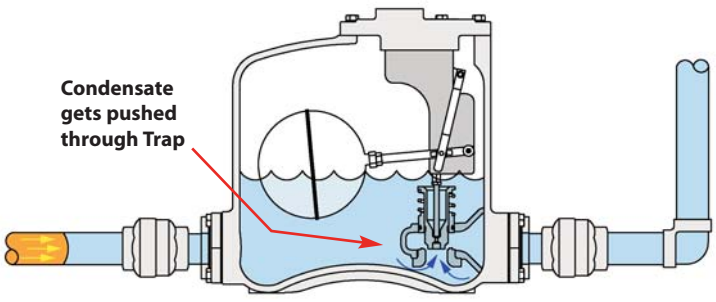
TRAP Mode

The system is operating with **30 PSIG** inlet pressure to the heat exchanger. The Pump-Trap unit functions like a standard float-operated trap. Condensate is pushed thru the pump-trap into the return line by the steam pressure in the HX.



Vent Outlet: Open position, allowing pressure in the pump tank to equal pressure in the heat exchanger, allowing condensate to freely enter Pump-Trap by gravity, even under vacuum.

Motive Inlet: Closed position

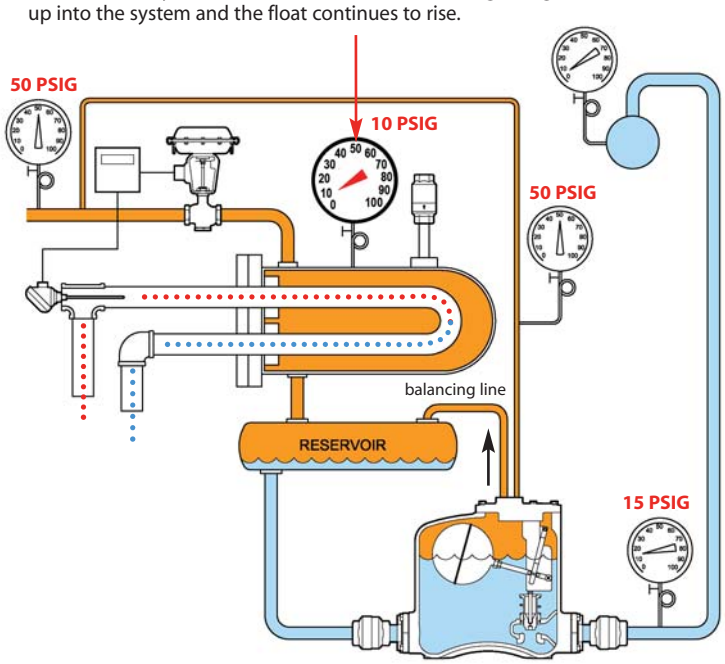


1 TRAPPING Mode: Inlet steam pressure is higher than back pressure. Steam pushes condensate through Pump-Trap.

How a Pump-Trap Works

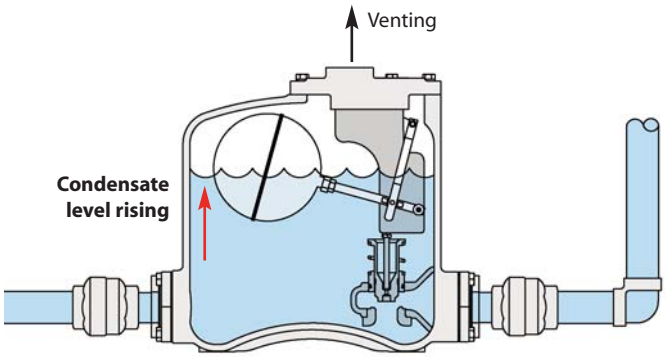
PUMP Mode

The pressure in the HX has now dropped to **10 PSIG**. This was in response to a fall off in demand of hot water. Based on this particular size HX, 10 PSIG steam will heat 32 GPM of water. Since back pressure is 15 PSIG, the system is stalled and condensate is beginning to back up into the system and the float continues to rise.



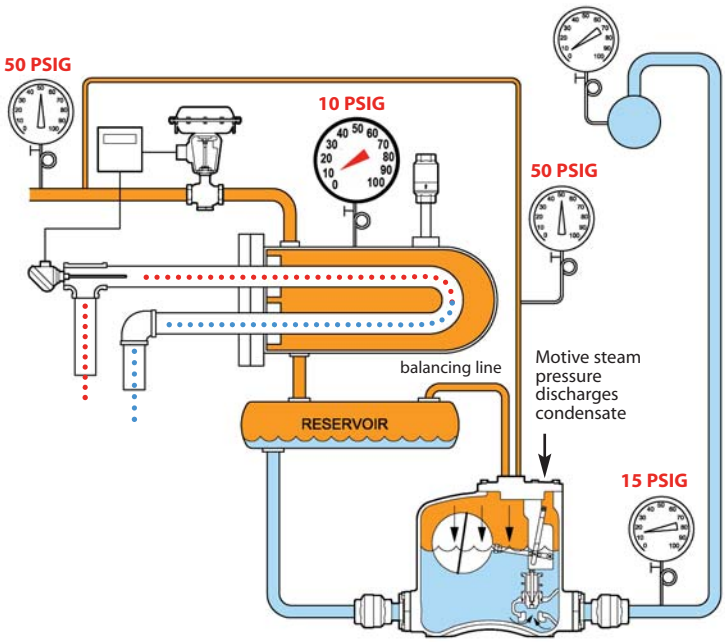
Vent Outlet: Open position, allowing pressure in the pump tank to equal pressure in the heat exchanger, allowing condensate to freely enter Pump-Trap by gravity.

Motive Inlet: Closed position



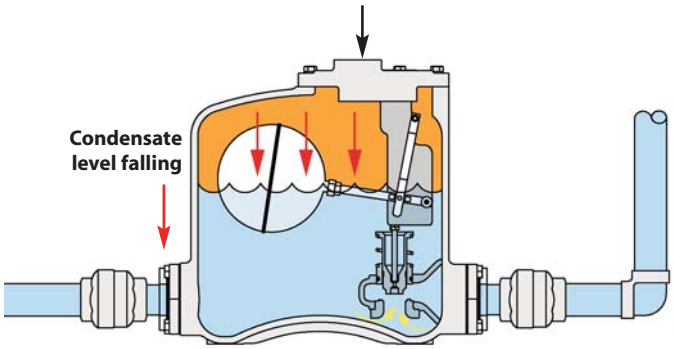
2 PUMP TANK FILLS: Inlet steam pressure falls below back pressure. Steam can no longer push the condensate through the Steam Trap.

Condensate rises to a level that the float triggers the inlet steam valve and closes the vent valve. Full line pressure steam (50 PSIG) enters thru the inlet valve on top of the pump body to discharge the condensate. Because of check valves, condensate will not flow back to HX and is discharged to the condensate return line. Unit will continue to operate and cycle in pump mode as long as pressure in the HX is below back pressure. Pump-Trap will also operate in vacuum conditions.



Vent Outlet: Closed

Motive Inlet: Open; steam pressure (50 PSI) enters tank and discharges condensate.



3 PUMP Mode: Pump is activated. When the pump tank has filled to the trip point, the mechanism triggers, opening the motive gas inlet valve and simultaneously closing the vent valve. This allows motive pressure to enter the pump body, which drives the condensate thru the outlet check valve and into the condensate return line. During the discharge cycle, the liquid level and the float inside the pump tank drop. When the lower trip point is reached, the mechanism closes the motive inlet valve and opens the vent valve so the pump-trap can fill on the next cycle.

Pump & Trap Combination
Internal Steam Trap

PMPT

Model	PMPT	PMPTS
Body	Ductile Iron	Stainless Steel
Cover	Stainless Steel	Stainless Steel
Sizes	1", 1½" NPT	1½" FLG
Check Valves	Stainless Steel	Stainless Steel
PMO Max. Operating Pressure	125 PSIG	125 PSIG
TMO Max. Operating Temperature	366ºF	366ºF
PMA Max. Allowable Pressure	150 PSIG @ 450˚F	150 PSIG @ 450˚F

Steam Trap internal to pump body will function like a normal float trap discharging condensate as its formed. If condensate backs up, the pumping mechanism will use motive steam pressure to discharge the condensate.

Typical Applications

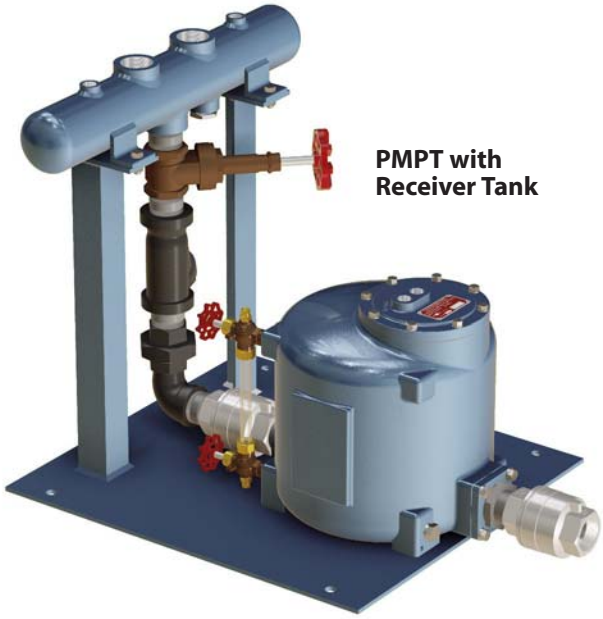
The **PMPT** low-profile pressure motive pump & trap combination has an internal steam trap for draining heat exchangers and other equipment whose steam pressure is modulated by a temperature regulator or a temperature control valve. In these applications the steam pressure in the heat exchanger may not be sufficient to overcome the back pressure in the condensate return line. When this condition occurs, the pressure powered pump takes over and uses high pressure steam supplied to the pump to discharge the condensate. When sufficient pressure does exist, the PMPT functions like a standard steam trap. Its small compact design is perfect for applications with limited space.

Pump-Traps facilitate condensate discharge under all operating conditions, including vacuum.

Features

- Low-profile design allows for condensate drainage of equipment positioned close to the floor
- Equipped with our proven, **Patented "Snap-Assure"** mechanism which extends the useful life of the pump
- Internal mechanism can be removed from the top of the pump while pump remains piped in line
- Mechanism incorporates heat-treated stainless steel wear items
- Dual compression springs made from Inconel-X-750 for high-temperature, corrosive service

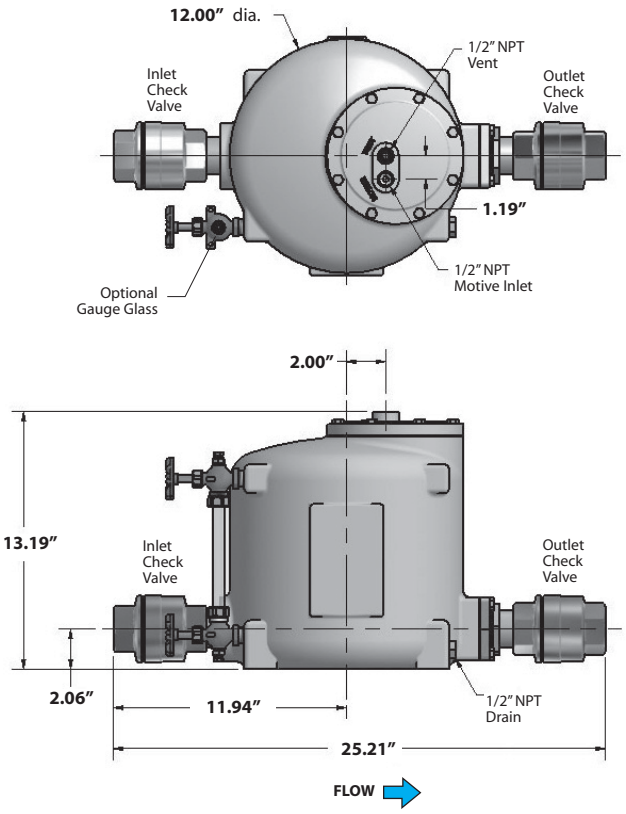
NOTE: Reservoir - Pump-Trap Combination may require a reservoir above the pump to collect condensate generated in the heat exchanger during the discharge cycle of the pump. Consult Reservoir Sizing Guidelines or contact factory for additional information.



PMPT with Receiver Tank

Options

- Horizontal pipe reservoir (recommended)
- Motive and vent piping
- Motive piping components such as steam trap, strainer and regulator
- Packaged systems available with reservoir, base and skid
- Gauge Glass
- Insulation Jacket
- ASME Code Stamp

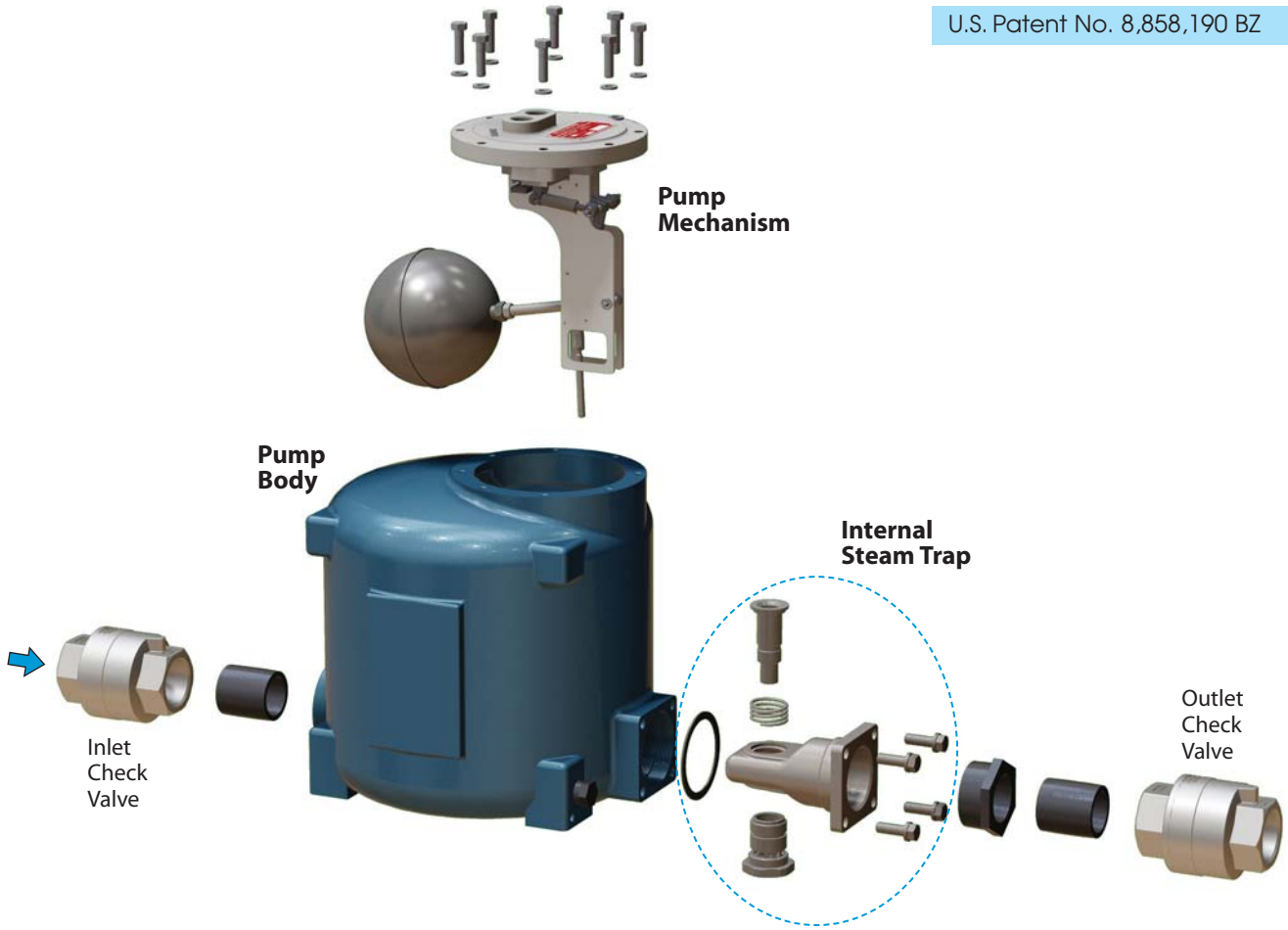


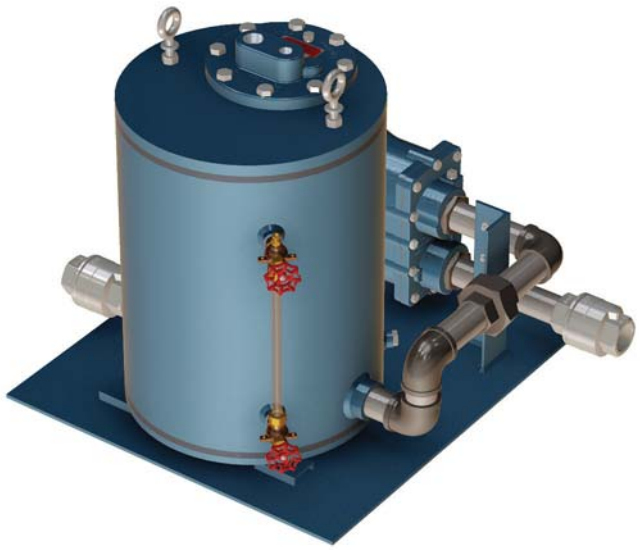
MATERIALS	
Body PMPT	**Ductile Iron SA-395**
Body PMPTS	**Stainless Steel CF3M**
Cover	Stainless Steel CF8
Cover Gasket	Garlock
Cover Bolts	Steel
Inlet Valve	Hardened Stainless Steel 40 Rc
Vent Valve	Hardened Stainless Steel 40 Rc
Ball Float	300 Stainless Steel
Check Valves	Stainless Steel 316SS CF3
Springs	Inconel-X-750
Other Internal Components	Stainless Steel

Size	Model **Code**	PMO **PSI**	Weight **lbs**
Ductile Iron Pump Body (NPT)			
1" x 1"	**PMPT-1X1-N-SS**	125	85
1 1/2" x 1 1/2"	**PMPT-1.5X1.5-N-SS**	125	95
Stainless Steel Pump Body (NPT or 150# FLG)			
1 1/2" x 1 1/2"	**PMPTS-1.5X1.5-N-SS**	125	95
1 1/2" x 1 1/2"	**PMPTS-1.5X1.5-F150-SS**	125	98

The PMPT Pump-Trap consists of pump tank, internal mechanism & trap, and inlet & outlet stainless steel check valves.

U.S. Patent No. 8,858,190 BZ





WPT-Series Pump-Trap Combinations simplify Selection & Installation of Pressure Motive Pumps

- **3 size ranges available**
- **Up to 13,000 lbs/hr of condensate load**

Typical Applications

WPT Pump-Trap Combinations are excellent for draining condensate from heat exchangers and other equipment whose steam pressure is modulated by a temperature regulator or a temperature control valve. In these applications the steam pressure in the heat exchanger may not be sufficient to overcome the back pressure in the condensate return line. When this condition occurs, the pressure powered pump takes over and uses high pressure steam supplied to the pump to discharge the condensate. When sufficient pressure does exist, the WPT functions like a standard steam trap.

Pump-Traps facilitate condensate discharge under all operating conditions, including vacuum.

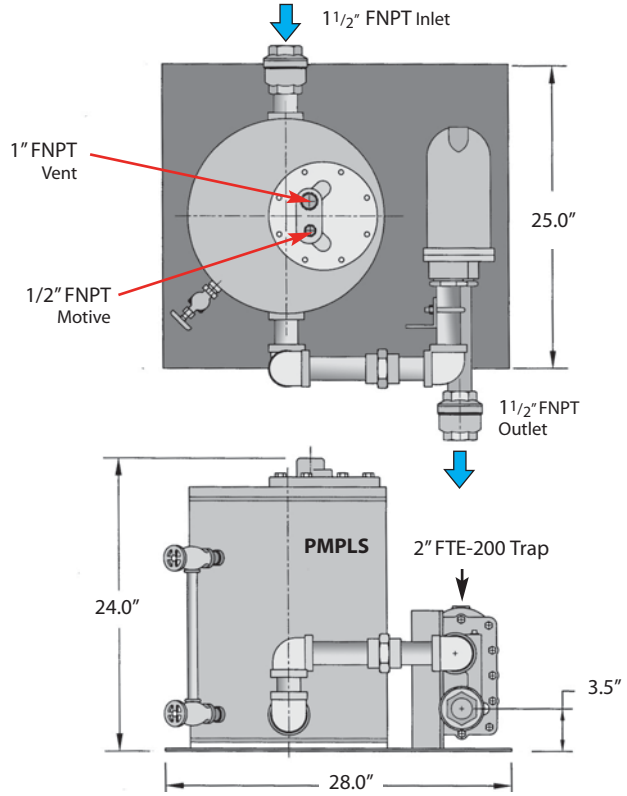
Pump-Trap Features

- Pump and Steam Trap are pre-mounted together on a single base for easy installation
- Higher capacities than Pump-Trap combinations with internal steam traps (PMPT)
- Engineering and selection is simplified using a pre-mounted system

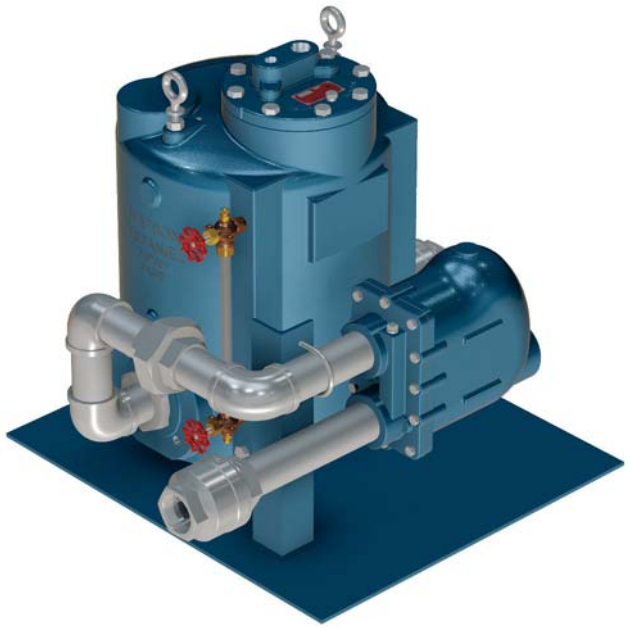
NOTE: Reservoir - Pump-Trap Combination may require a reservoir above the pump to collect condensate generated in the heat exchanger during the discharge cycle of the pump. Consult Reservoir Sizing Guidelines or contact factory for additional information.

WPT3 • 1 1/2 x 1 1/2

(**PMPLS** with 2" FTE-200 Steam Trap)

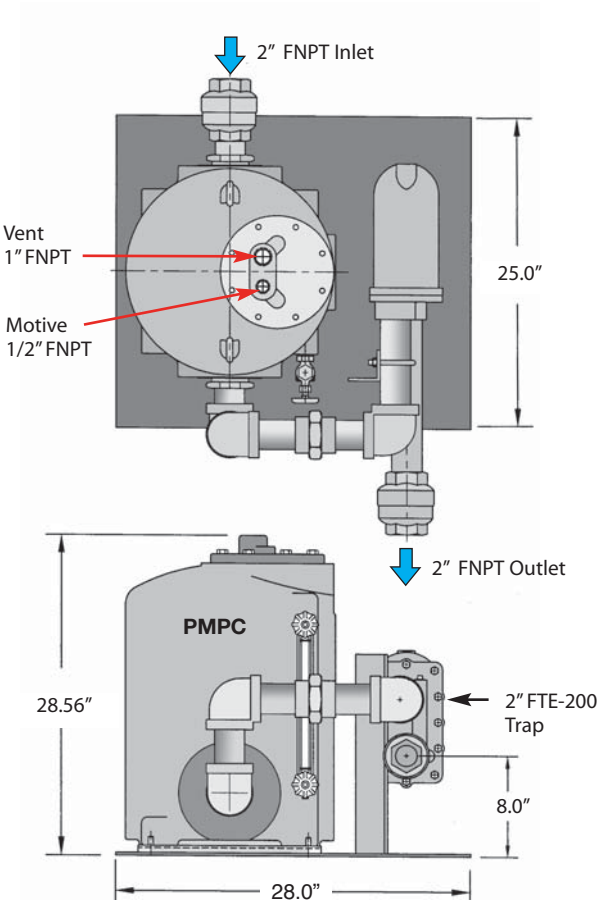


MATERIALS	WPT3		WPT4		WPT5	
	Pump	Trap	Pump	Trap	Pump	Trap
Body	**Carbon Steel**	**Ductile Iron SA-395**	**Ductile Iron SA-395**	**Ductile Iron SA-395**	**Ductile Iron SA-395**	**Ductile Iron SA-395**
Cover	Carbon Steel	Ductile Iron SA-395	Ductile Iron SA-395	Ductile Iron SA-395	Ductile Iron SA-395	Ductile Iron SA-395
Cover Gasket	Garlock	Garlock	Garlock	Garlock	Garlock	Garlock
Cover Bolts	Steel	Steel	Steel	Steel	Steel	Steel
Inlet Valve	17-4 Ph SS 40 Rc	n/a	17-4 Ph SS 40 Rc	n/a	17-4 Ph SS 40 Rc	n/a
Vent Valve	17-4 Ph SS 40 Rc	n/a	17-4 Ph SS 40 Rc	n/a	17-4 Ph SS 40 Rc	n/a
Ball Float	304 SS	304 SS	304 SS	304 SS	304 SS	304 SS
Check Valves	316 SS	n/a	316 SS	n/a	316 SS	n/a
Springs	Inconel-X-750	n/a	Inconel-X-750	n/a	Inconel-X-750	n/a
Other Internal Components	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel



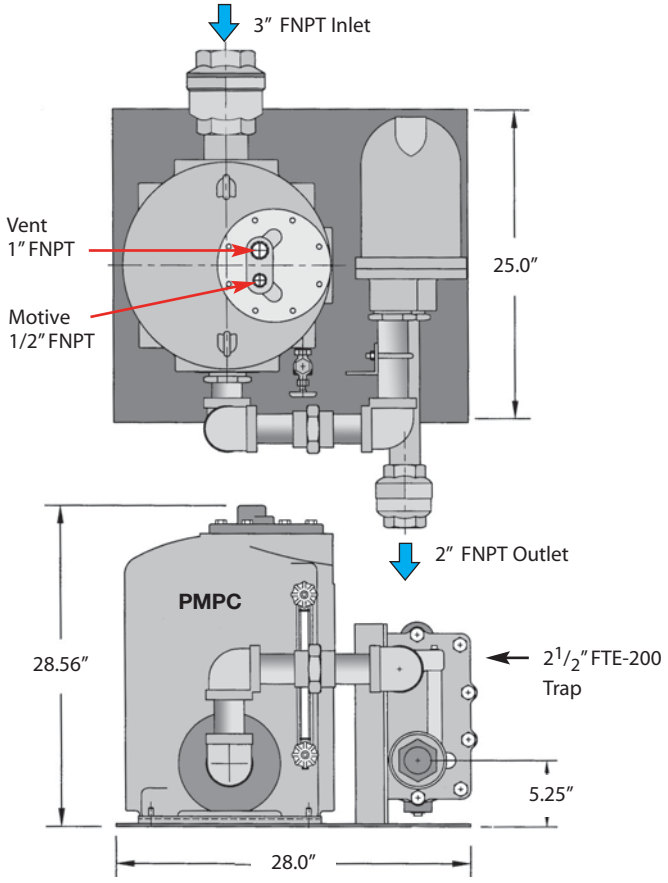
WPT4 • 2″ x 2″

(**PMPC** with 2″ FTE-200 Steam Trap)



WPT5 • 3″ x 2″

(**PMPC** with 2 1/2″ FTE-200 Steam Trap)



PMPT & WPT Pump-Trap Combinations (Operating in **Pump** Mode)

PUMP CAPACITIES – *Condensate (lbs/hr); using steam as a motive pressure*

Motive Pressure (PSIG)	Total Back Pressure (PSIG)	PMPT 1" x 1" 6" Fill Head	PMPT 1 1/2" x 1 1/2" 6" Fill Head	WPT3 1 1/2" x 1 1/2" 12" Fill Head	WPT4 2" x 2" 12" Fill Head	WPT5 3" x 2" 12" Fill Head
5	2	1,064	1,850	1,310	2,320	4,270
10	5	1,049	1,824	1,760	3,740	6,230
10	2	1,200	2,087	2,350	5,640	9,450
25	15	1,026	1,784	2,700	4,690	7,230
25	10	1,151	2,002	3,020	5,970	9,370
25	5	1,257	2,186	3,780	6,850	11,400
50	40	877	1,525	2,090	3,410	5,040
50	25	1,115	1,939	3,620	6,650	10,200
50	10	1,286	2,237	4,080	7,140	11,500
75	60	882	1,533	2,250	3,730	5,660
75	40	1,102	1,916	3,470	6,010	8,770
75	15	1,298	2,257	4,390	7,920	12,400
100	80	884	1,538	2,620	4,390	6,140
100	60	1,058	1,841	3,390	5,780	8,120
100	40	1,192	2,074	4,310	6,940	10,000
100	15	1,331	2,314	4,620	8,000	12,300
125	115	737	1,281	2,280	3,490	4,440
125	100	886	1,541	2,880	4,420	5,720
125	80	1,030	1,792	3,520	5,700	7,630
125	60	1,146	1,992	4,110	6,880	9,390
125	40	1,243	2,161	4,910	7,800	11,100
125	15	1,351	2,350	5,120	8,420	12,900
150	120	-	-	2,560	3,640	5,100
150	100	-	-	3,020	4,610	6,270
150	80	-	-	3,630	5,780	8,140
150	60	-	-	4,230	6,910	9,920
150	40	-	-	4,830	7,930	11,700
150	15	-	-	5,230	8,590	13,300

PMPT & WPT Pump-Trap Combinations (Operating in **Trap** Mode)

TRAP CAPACITIES – *Condensate (lbs/hr)*

Differential Pressure (PSI)	PMPT	WPT3 & WPT4	WPT5
1/4	1,511	2,770	7,200
1/2	2,137	4,100	12,300
1	3,020	5,700	17,400
2	4,030	7,400	25,400
5	4,354	9,900	27,600
10	4,841	11,800	32,600
15	5,150	13,400	36,000
20	5,686	14,400	39,300
30	6,425	16,400	43,100
40	7,711	18,000	46,600
50	8,000	19,000	49,200
75	9,100	21,000	54,700
100	10,334	23,000	58,800
125	11,451	24,500	61,900
200	NA	29,200	74,000

Recommended Reservoir sizes for Pump-Trap Applications

RESERVOIR PIPE LENGTH in feet (ft)

Condensate Load (lbs//hr)	Reservoir Pipe Size (Diameter) 3"	4"	6"	8"	10"
0-500	2'				
1,000	2'				
1,500	3'	2'			
2,000	3.5'	2'	1'		
3,000		3'	2'		
4,000		4'	2'	1'	
5,000		6'	3'	2'	
6,000			3'	2'	
7,000			3'	2'	
8,000			4'	2'	
9,000			4.5'	3'	2'

Pump-Trap Sizing:

When the steam pressure in the heat exchanger is higher than the return line back pressure, the PUMP-TRAP functions like a standard float-operated TRAP, allowing the steam pressure in the heat exchanger to discharge the condensate. Under these conditions, the unit is in TRAP mode. When the steam pressure in the heat exchanger falls below the back pressure, the condensate backs up into the body of the pump-trap, raising the float and opening the motive steam inlet valve, which then pumps the condensate into the return line. Under these conditions, the unit is in PUMP mode. We therefore have two separate and distinct capacities; the **PUMP CAPACITY** (when operating in Pump Mode) and the **TRAP CAPACITY** (when operating in Trap Mode).

In the example below, the system will be analyzed to determine when the Pump-Trap is in Trap Mode and when it is in Pump Mode, and the specific capacity requirement of the pump. If the total back-pressure of the condensate return line is known, the Pump-Trap should be selected with sufficient pump capacity to handle the condensate load at the system stall point. (i.e.; when the steam pressure is equal to the total back-pressure). Alternatively, if the total back-pressure is not known, it is best to select a pump-trap with enough pump capacity to handle the maximum condensate load of the application. (i.e., at maximum steam pressure and flow). Refer to Sizing Charts.

Reservoir Sizing: (Refer to chart on previous page)

When using a Pump-Trap, a condensate holding reservoir should be installed above the pump-trap and below the heat exchanger (shown below). This will enable the condensate to collect while the pump is in the discharge cycle, thus preventing condensate backup. When back pressure against the pump outlet is less than 50% of the steam pressure to the heat exchanger, the pipe lengths given in the chart can be reduced by half.

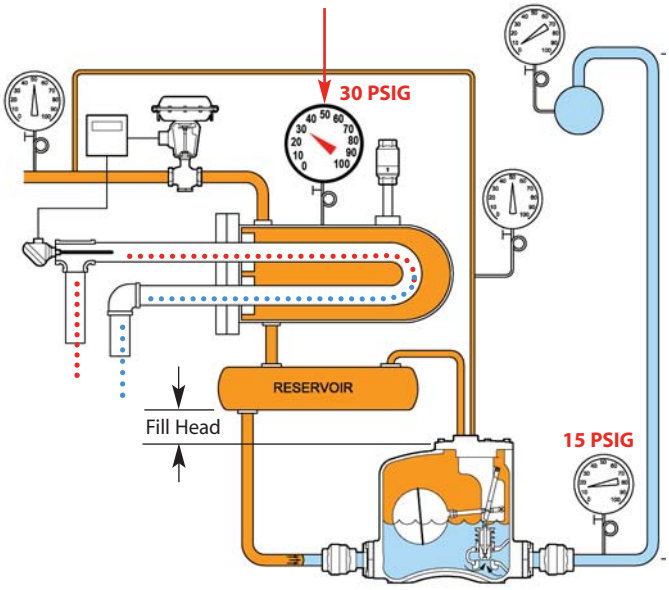
Heat Exchanger (HX) using Steam to heat Hot Water

The following example describes a Heat Exchanger (HX) using Steam to heat domestic hot water for a medium size apartment complex. Note that the hot water usage varies significantly depending on the time of day. The physical size of the heat exchanger needed (sq. ft. of surface area) is based on the following criteria: **(1)** MAXIMUM water usage (GPM), **(2)** the temperature rise of the water, and **(3)** what pressure steam will be used to heat the water during maximum demand.
Note: The selection of the steam pressure (which determines the steam temperature), to heat the water at maximum demand (flow rate), is the primary factor in heat exchanger sizing.

The application is requiring water to be heated from **45˚F** to **140˚F** in a HX using Steam. The maximum flow rate has been determined to be **60 GPM**. The Steam Trap will be discharging into a condensate return line that may have a Total Back Pressure of **15 PSIG** and the flow rate of heated water could be as low as **20 GPM**. The facility engineer has chosen to base the HX size on using **50 PSIG** of steam pressure. Therefore, the size of the heat exchanger was selected based on heating **60 GPM** of water using **50 PSIG** of steam.

TRAP Mode

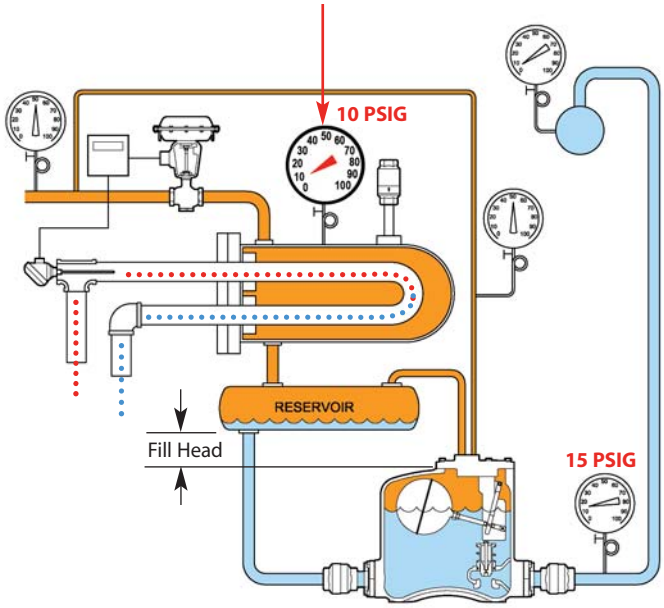
The system is operating with **30 PSIG** inlet pressure to the heat exchanger. The Pump-Trap unit functions like a standard float operated trap. Condensate is pushed thru into the return line by the steam pressure in the HX. Based on this particular size HX, 30 PSIG steam will heat 53 GPM of water.



ΔP Trap = 30 psig - 15 psig
= 15 psi

PUMP Mode

In response to a reduction in demand of hot water, the pressure in the HX has now dropped to **10 PSIG**. Based on this particular size HX, 10 PSIG steam will heat 43 GPM of water. Since back pressure is **15 PSIG**, the system is stalled and condensate backs up into the system; the float will continue to rise to activate the pump and discharge the condensate.



Summary of conditions for a Heat Exchanger (HX) using Steam to heat Water

Set of conditions used to size the Heat Exchanger:

1)	Maximum Flow of Hot Water		=	**60 GPM**
2)	Water temperature required	T_o	=	**140˚F**
3)	Steam Pressure in Heat Exchanger		=	**50 PSIG**
4)	Temperature of 50 PSIG Steam	T_s	=	**298˚F**
5)	Inlet Water Temperature	T_i	=	**45˚F**
6)	Temperature Rise of Water (140˚ F - 45˚F = 95˚ F)		=	**95˚F**

What is the Heat Transfer Rate (E) to heat 60 GPM of water from 45˚to 140˚F?

$$E \left[\frac{Btu}{hr}\right] = \textbf{Water Flow Rate} \text{ (GPM) x } \textbf{500} \text{ x } \textbf{Temp Rise } (^{\circ}F)$$

$$= 60 \times 500 \times [140^{\circ} - 45^{\circ}F]$$

$$= \textbf{2,850,000} \text{ Btu/hr}$$

How much Steam Flow is required?

$$Q_s \text{ (steam)} = \frac{E}{LH} \quad \text{(For 50 psi steam, the LH is 912 Btu/lb)}$$

$$= \frac{2{,}850{,}000 \text{ Btu/hr}}{912 \text{ Btu/lb}}$$

$$= \textbf{3,125} \text{ lbs/hr}$$

$$E = U \times A \times \Delta T$$

Fundamental formula for heat transfer and the basic formula for HX sizing

The formula shows that the heat transfer rate (**E**) between the hot steam and cold water is directly proportional to the Surface contact area (**A**) inside the HX and the difference in temperature between the steam and water (ΔT). The more surface area (larger HX) the more heat will get transferred or the hotter the steam temperature (higher pressure) the more heat will get transferred.

E = **Heat Transfer Rate** in Btu/hr of the energy in the steam to the water. The flow of steam (Q_s) required in lbs/hr is determined by dividing **E** by the Latent Heat of Steam (LH) in Btu/lb.

U = is referred to as the **Overall Heat Transfer Coefficient**. This depends on the HX type and the materials involved. Typical **U** values are 120 for Stainless Steel and 200 for Copper. We will use 120 for Stainless Steel HX.

A = The internal **Surface Area** (size) of the HX in Sq. Ft. The size of a HX is determined by the surface contact area between the Steam and Water.

ΔT = **Average Temperature Difference** between Steam & Water. Since the water temperature changes as it flows thru the HX, we need to use the average temperature difference between the steam temperature and the water temperature. See formula below:

Average Temperature Difference

$$\Delta T = \frac{(T_s - T_i) + (T_s - T_o)}{2}$$

$$= \frac{(298 - 45) + (298 - 140)}{2}$$

$$\Delta T = \textbf{205˚F} = \text{Avg Temp. Difference}$$

Heat Exchanger Size

$$E = U \times A \times \Delta T$$

Above formula is rearranged to solve for **A**:

$$A = \frac{E}{U \times \Delta T}$$

$$= \frac{2{,}850{,}000}{120 \times 205}$$

$$A = \textbf{116} \text{ (sq ft.)}$$

The actual size of a Heat Exchanger depends on many factors; however, based on the criteria given, **116** sq. ft of surface area is required to heat 60 GPM of water from 45˚F to 140˚F, based on a steam pressure of 50 PSIG.

Stall Condition:
When the steam pressure in the HX is equal to the back pressure of **15 PSIG**, the condensate will no longer drain out of the HX. The Pump-Trap will now need to operate in Pump Mode to remove the condensate from the HX. We need to calculate how much condensate will be produced when there is **15 PSIG** in the HX.

$$\Delta T = \frac{(T_s - T_i) + (T_s - T_o)}{2}$$

[From the steam table, 15 PSIG steam has a temp of 250°F]

$$= \frac{(250 - 45) + (250 - 140)}{2}$$

ΔT = 157.5° F = Avg Temp. Difference

To find out how much energy will be transferred to the water, we use the **ΔT** calculated above in our heat transfer equation.

E = U x A x ΔT
= 120 x 116 x 157.5
= **2,192,400** Btu/hr

To determine how much steam is required to heat the water, we use the following formula. (LH = Latent Heat.)

$$Q_s \text{ lbs/hr} = \frac{E}{LH} = \frac{2{,}192{,}400}{946}$$

(For 15 psig steam, the LH is 946 Btu/lb)

Steam Flow = **2,318** lbs/hr

When the HX stalls, we will be using 2,318 lbs/hr of steam and will need to pump 2,318 lbs/hr of condensate. The pump-trap must be sized to handle this condensate load since it is the maximum load under stall conditions (see table below).

Table based on a HX size of 116 ft² and back pressure of 15 PSIG

The following table summarizes the above results and shows how the steam flow, pressure, temperature and latent heat vary as a function of the water flow rate. It can be seen that the system is operating in **Trap Mode** between water flow rates of 60 to ~46 GPM, and in **Pump Mode** between ~46 to 20 GPM (based on 15 PSIG back pressure). Also, at flow rates below 35 GPM, the steam pressure inside the HX is below atmospheric pressure (0 PSIG).

Flow Rate Water (GPM)	Steam Usage (lbs/hr)	Steam Pressure in HX (PSIG)	Steam Temp in HX (°F)	Latent Heat of Steam (Btu/lb)	Condensate Generated (lbs/hr)	Trap Differential Pressure (PSI)	System Condition	
60	**3,125**	**50**	**298**	**912**	**3,125**	**35**		**(Maximum Heat Load)**
57.0	2,943	40	287	920	2,943	25	**Trap Mode**	
53.2	2,720	30	274	929	2,720	15		
48.8	2,466	20	259	940	2,466	5		
46.2	**2,318**	**15**	**250**	**946**	**2,318**	**0**	**(Stall Point)**	**Steam Pressure = Back Pressure**
42.9	2,140	10	239	953	2,140	---	**Pump Mode**	
35.0	1,715	0	212	970	1,715	---		
29.2	1,409	-5	192	983	1,409	---	(Vacuum)	
20	**948**	**-10**	**161**	**1,002**	**948**	---		**(Minimum Heat Load)**

Watson McDaniel offers a full line of accessories for our Condensate Return Pumps and Pump Systems. If there is something you don't see, please call our factory and we will do our best to help you.

ASME CODE STAMP for Receiver Pump Tanks

Four standard condensate receiver sizes are available for Pressure Motive Pump Systems: 21, 48, 75 and 116 gallons. Custom receiver fabrication is available with Watson McDaniel's ASME-certified fabrication facility. ASME Code is Standard on 21, 48, 75 and 116 gallon receiver tanks and PMPF, PMPLS, PMPSS pump tanks.

ASME Code Stamp:	Model Code
for PMPC, PMPC & PMPNT Pump Tanks	Contact Factory

Cycle Counter

The Digital Cycle Counter option allows monitoring of pump cycles for the purpose of scheduling maintenance and repairs, as well as calculation of condensate flow through the pump (i.e. returned condensate). There are several options available depending on the PMP selected as well as the operating conditions. Therefore, proper selection is required to ensure proper function and operation. See below for selection, or consult factory for additional assistance.

- Pump Only (Open Loop), with pump back pressure 15 psig or above – Standard
- Pump Only (Open Loop), with pump back pressure below 15 psig – Low Pressure Option
- Pump-Trap (Closed Loop) – Special option required – consult factory.

Pump-traps (closed loop) can not use the pressure switch because the vent pressure will vary, so pressure differential can not be guaranteed.

Cycle Counter (fits all PMPs) Open Loop Systems Only	Model Code
Digital Cycle Counter	**1529100**
Digital Cycle Counter with auxiliary contacts	**1529102**
Low Pressure Cycle Counter with auxiliary contacts	**1529103**
Low Pressure Cycle Counter w/o auxiliary contacts	**1529104**
Closed Loop Cycle Counter	**2450300**

Gauge Glass

Pumps tanks are available with gauge glass to show condensate level inside the tank (bronze or stainless steel retainer).

Gauge Glass for:	Model Code
Standard Bronze Gauge Glass	
PMPC, PMPF, PMPLS (stand alone pumps)	**GAUGE GLASS-1**
PMPT (stand alone pump)	**GAUGE GLASS-PMPT**
PMPM (stand alone pump)	**GAUGE GLASS-PMPM**
21 Gallon Receiver Tank	**GAUGE GLASS-1**
48 Gallon Receiver Tank	**GAUGE GLASS-1**
75 Gallon Receiver Tank	**GAUGE GLASS-1**
116 Gallon Receiver Tank	Contact Factory
Stainless Steel Gauge Glass	
PMPSS (stand alone pump)	**GAUGE GLASS SS**
PMPT & PMPNT	Contact Factory
Options for Gauge Glass	
Auto Drain (self-drain) Stainless Steel Armored	**GAUGE GLASS-1A**
Reflex Gauge for PMPC, PMPF, PMPLS, 21 Gallon Receiver	**GAUGE GLASS-1HP**

Insulation Jacket

Insulation Jackets improve safety by protecting personnel from hot surfaces and conserve energy by reducing heat loss. Jackets have velcro closures for easy installation or removal and fit tightly around pump tanks and receivers.

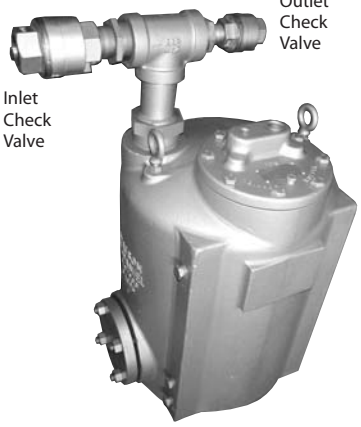
Insulation Cover

Insulation Cover for:		Model Code
PMPC	(Ductile Iron Pump)	**INSUL-CRV-PMPC**
PMPF	(Fabricated Steel Pump)	**INSUL-CRV-PMPF**
PMPLS	(Low-Profile Pump)	**INSUL-CRV-PMPLS**
PMPBP	(High Capacity Pump)	**INSUL-CRV-PMPBP**
PMPT & PMPNT	(Pump-Trap Combination or Pump)	**INSUL-CRV-PMPT**
PMPM	(Mini Pump)	**INSUL-CRV-PMPM**
21 Gallon Receiver		**INSUL-CRV-21**
48 Gallon Receiver		**INSUL-CRV-48**
75 Gallon Receiver		**INSUL-CRV-75**
116 Gallon Receiver		**INSUL-CRV-116**

"T-Bone" Connection

Outlet Check Valve

Inlet Check Valve



Vertical Discharge Pump

Vertical Discharge Pump with "T-Bone" connection allows inlet and outlet condensate hook-ups to be made above the pump. This is an advantage when space is limited around the base of the pump due to equipment or piping obstructions.

Vertical Discharge Pump	Model Code
T-Bone Connections available for Stand Alone Pump	**PMP-TBONE**

Check Valves - Stainless Steel

The **Inlet Check Valve** on PMP systems require a very low opening pressure (cracking pressure) so that the liquid will freely enter the pump tank. The proper check valve is critical to the operation of the PMP system. Watson McDaniel uses only Stainless Steel Check Valves with a maximum of ¼ PSI cracking pressure. (See Check Valves in Pipeline Accessories.)

Check Valves - NPT	Model Code
1/2"	**WSSCV-12-N-0**
3/4"	**WSSCV-13-N-0**
1"	**WSSCV-14-N-0**
1 1/4"	**WSSCV-15-N-0**
1 1/2"	**WSSCV-16-N-0**
1 1/2" (no closing spring)	**WSSCVQF-16-N-0**
2"	**WSSCV-17-N-0**
3"	**WSSCV-19-N-0**

Mechanism for Pump Tanks (with Patented "Snap-Assure" Feature)

The Patented "Snap-Assure" feature extends the useful life of the pump by assuring the internal mechanism toggles at every fill and discharge cycle. These mechanisms are simple and easy to replace, and are a cost-effective way to make your pump as good as new. They will also fit other manufacturers' pump tanks.

Mechanisms for:	Model Code
Complete Mechanism Assembly with Cover for:	
PMPF & PMPSP	**W-KIT-900-03**
PMPC & PMPLS	**W-KIT-910-03**
PMPBP	**W-KIT-900-01**
PMPM	**W-KIT-911-03**
PMPT	**W-KIT-912-03**
PMPNT	**W-KIT-914-03**
Rebuilt Mechanism* for:	
PMPF	**W-KIT-900-03R**
PMPC & PMPLS	**W-KIT-910-03R**
PMPT & PMPNT	**W-KIT-912-03R**

*** Note for Rebuilt Mechanisms:**
The exchange program is for mechanisms with two years of service or less. The old mechanism must be returned along with the order for the rebuilt mechanism. Orders without old mechanisms will be invoiced at the new mechanism price.

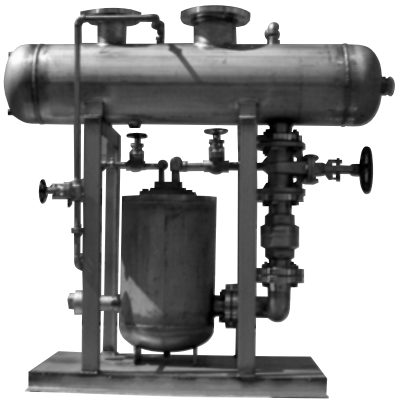
Pre-Piped PRV & Drip Leg

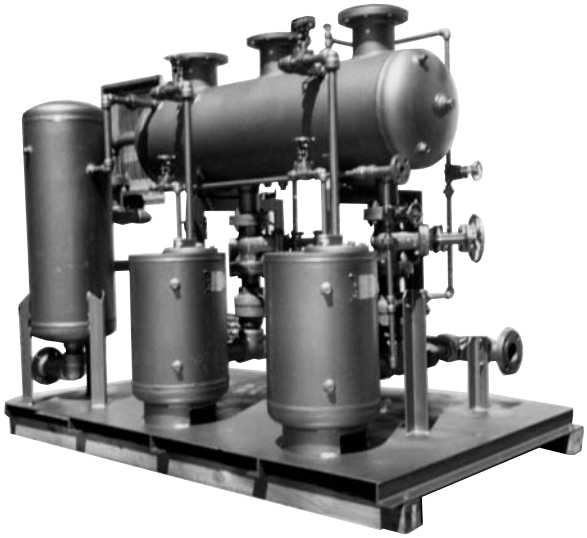
A fully-assembled Pre-piped PRV, Drip Leg, or PRV and Drip Leg Assembly guarantees proper installation of your PMP System. It assures that your skid package performs to optimum levels.

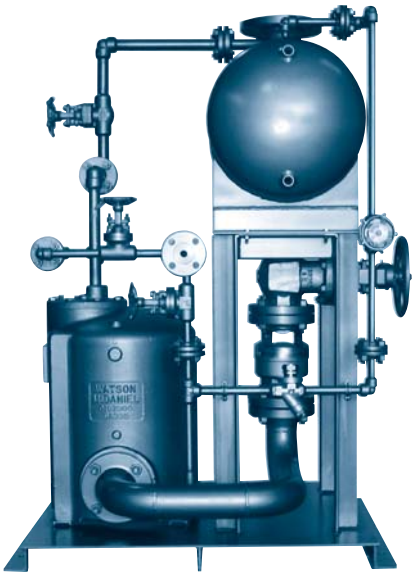
Pre-Piped Accessories	Model Code
Pre-piped Motive Line with Pressure Regulating Valve (PRV) for control of motive steam or air (drip trap not included – to be by others)	**PRV1**
Pre-piped Motive Line with Drip Leg Station and Steam Trap	**PRV2**
Pre-piped Motive Line with PRV, Drip Leg, and Steam Trap (PRV1 + PRV2)	**PRV3**
Pre-piped Exhaust Line	**PRV4**
Overflow J-pipe	Contact Factory
Pressure Gauge	Contact Factory
Drain Valve	Contact Factory

ASME Certified

Watson McDaniel's fully equipped ASME qualified fabrication facility stands ready to assist you with all of your fabrication needs. Our engineering staff specializes in the design of Pressure Motive Condensate Pumping Systems for both industrial and institutional applications. You can order either standard packages, available from stock, or specialized systems to meet your specific needs.







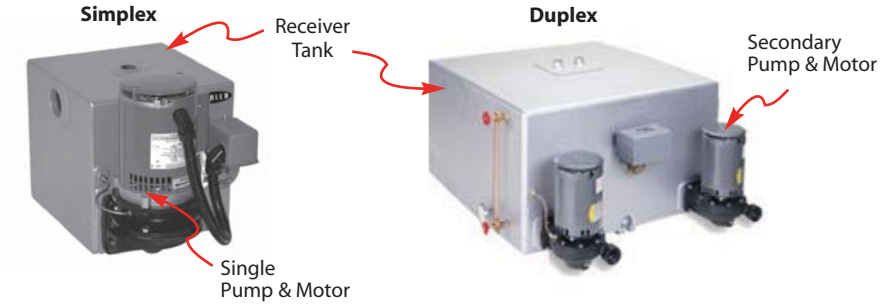
ELECTRIC PUMPS

W4100, W4200 & W4300 Condensate Pumps

Watson McDaniel's **Condensate Return** and **Boiler Feed** Pumps are equipped with Cast Iron bodies and Bronze Impellers. The pump receiver tanks are available in either **Carbon Steel** (W4100), **Cast Iron** (W4200), or **Stainless Steel** (W4300) in Simplex or Duplex configurations.

Typical Condensate Pump Features

- Fabricated Steel Receivers (W4100), Cast Iron Receivers (W4200), Stainless Steel Receivers (W4300)
- Simplex and Duplex Packages
- Bronze Fitted Centrifugal Pumps
- Energy Efficient 3450 RPM motors
- Ceramic Pump Seal
- Heavy-duty Float Switch



Characteristics of Condensate Return Pumps Vs. Boiler Feed Pumps

Condensate Return Pumps

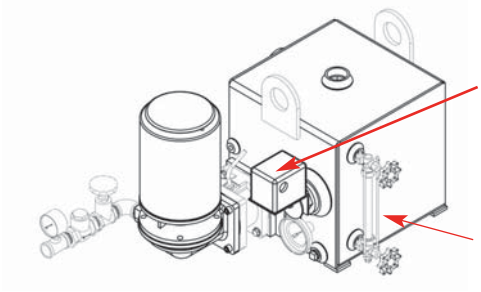
Used for returning condensate from the facility back to the boiler room. In Condensate Return applications, the operation of the pump is controlled by a **Float Switch** located on the receiver tank. The pump turns on when the receiver tank is full and shuts off when emptied. Duplex units contain a **Mechanical Alternator** float switch to alternate operation between the two pumps.

Boiler Feed Pumps

For Boiler Feed applications, the operation of the pump is controlled by the **water level control system** on the boiler. When the boiler requires water, the pump switches on pumping water from the receiver into the boiler. The receiver tank also contains an internal **make-up water valve** actuated by a stainless steel float. If the amount of condensate being returned to the receiver tank is inadequate, additional boiler feed water is automatically added to the receiver tank.

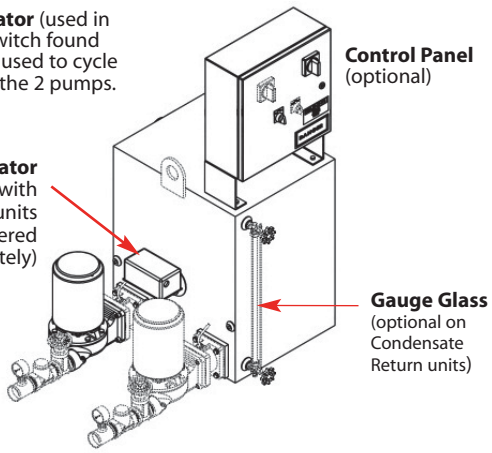
SIMPLEX

Float Switch is used to activate the pump.



DUPLEX

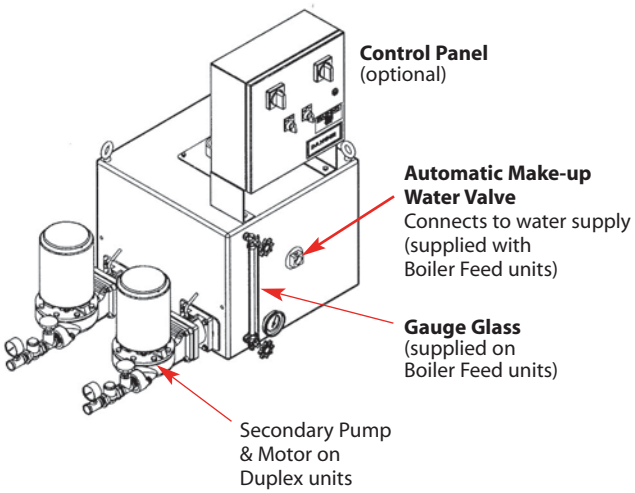
Mechanical Alternator (used in place of the Float Switch found on Simplex units) is used to cycle operation between the 2 pumps.



SIMPLEX & DUPLEX

Water Level Control System on boiler is used to activate the pump.

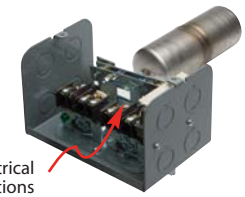
Automatic Make-up Water Valve is activated by a level float that adds additional boiler feed water to the receiver tank if required.



Simplex vs. Duplex Pump Operation:

A Simplex System contains a single pump and receiver tank. Duplex Systems contain two pumps on a common receiver tank allowing the second pump to serve as a back up in case of failure.

Mechanical Alternator/Float Switch
(must be ordered separately with Duplex units)

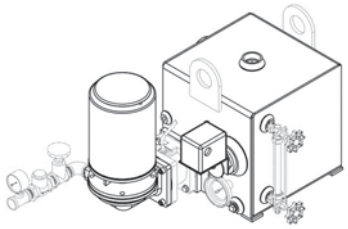


For **Duplex Condensate Return Pumps** the Float Switch is replaced with a Mechanical Alternator. The Mechanical Alternator is attached to a float and activates only one pump at a time in an alternating manner. The Mechanical Alternator switches power between the two motors so that the runtime of each pump is shared, allowing the system to continue operation in the event of a single pump failure.

Motors & Controls

Single-Phase motors

Single-phase motors supplied with these pumps have overload protection and therefore do not require ancillary motors starters. Single-phase motors can be wired directly to the Float Switch (for Simplex units) or the Mechanical Alternator (on Duplex units) and no control panel is required for installation.



3-Phase motors

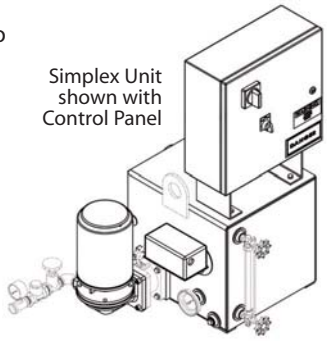
3-Phase motors do not have overload protection and therefore require a separate **Motor Starter** to operate. A Motor Starter contains a set of Electrical Contactors with overload protection (OL) to protect the motor. The standard Float Switch or Mechanical Alternator/Float Switch is wired to the Motor Starter and closes the Contactors to start the pump. The OL device incorporated into the Motor Starter protects the motor from damage. A separate circuit breaker or fuse box is still required to protect the circuitry.

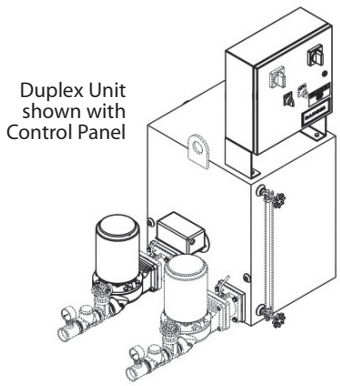
NEMA-12 Control Panel

For **Simplex** units, the control panel would include a single motor starter with a single **HOA** (Hand-Off-Automatic) selector switch to turn the pump on manually to verify functionality; or, to set in automatic mode along with a single Motor Circuit Protector switch to shut power off to the pump in case of overload. The purpose of the Motor Circuit Protector is to protect the wiring to the pump eliminating the need for a separate circuit breaker or fuse box.

For **Duplex** systems, the control panel would include two motor starters, two HOA Switches and two Motor Circuit Protector switches.

NEMA-12
Control Panel





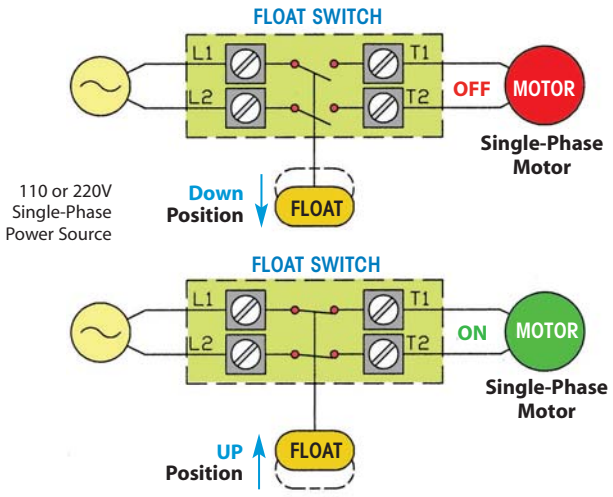
ELECTRIC PUMPS

Float Switch for Simplex Condensate Return Units: Wiring Diagrams

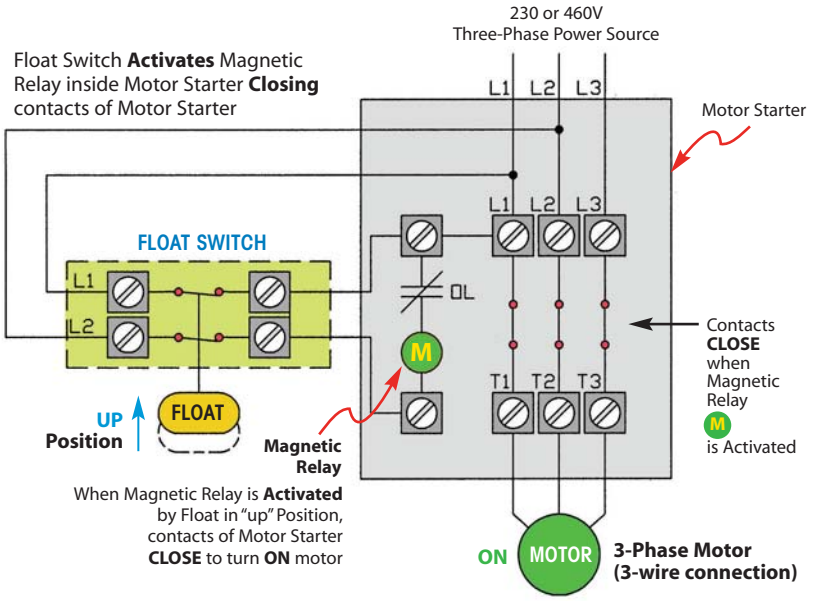
The diagrams below show typical Single-phase & 3-phase wiring diagrams for the float switch used on Simplex Condensate Return Units. The Float Switch can be used to turn on a Single-phase motor directly or to activate a **Motor Starter**. A Motor Starter is required to operate 3-phase motors.

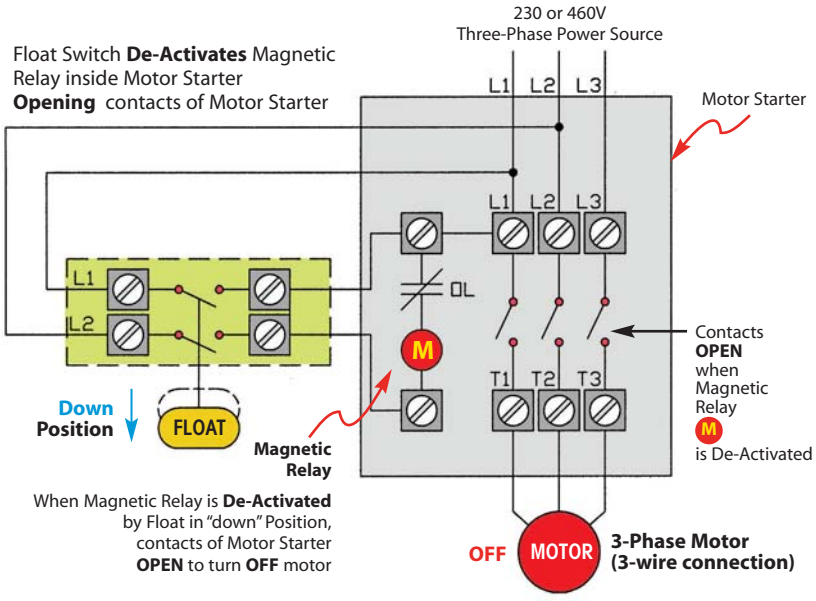
Float Switch for Simplex Pumps

Float Switch Wired Directly to a Single-Phase Motor



Float Switch Turning on a 3-Phase Motor Using a Motor Starter



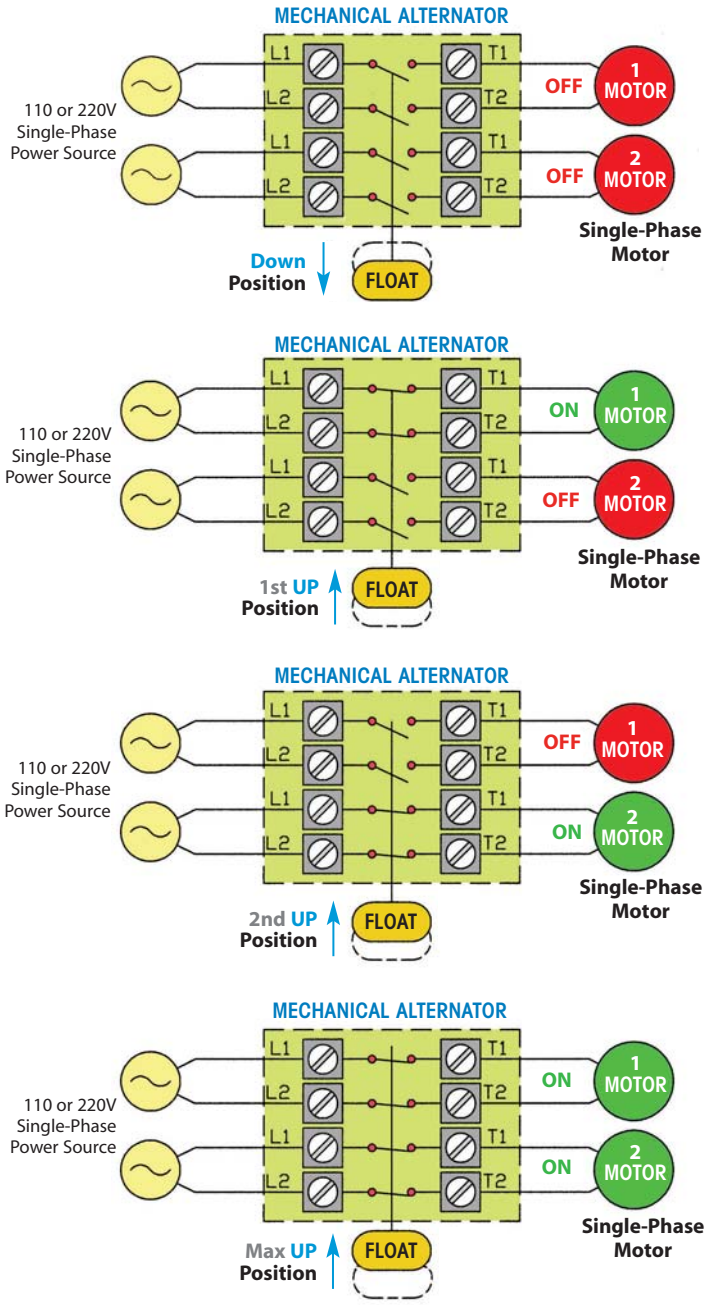


NEMA 1 Control Panel Motor Starter for Simplex Pumps

Mechanical Alternator for Duplex units: Wiring Diagrams

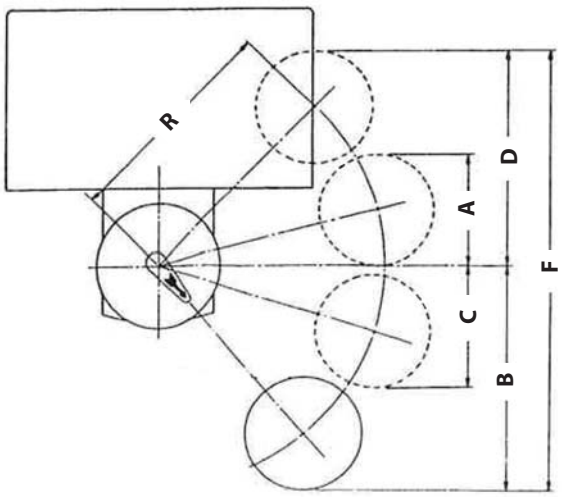
The diagrams below show a Mechanical Alternator operating two separate Single-Phase Motors required to operate a Duplex Pump System. The Mechanical Alternator can also be used to operate two separate Motor Starters which in turn would be used to operate two separate 3-phase motors.

Mechanical Alternator Operating Two Single-Phase Motors



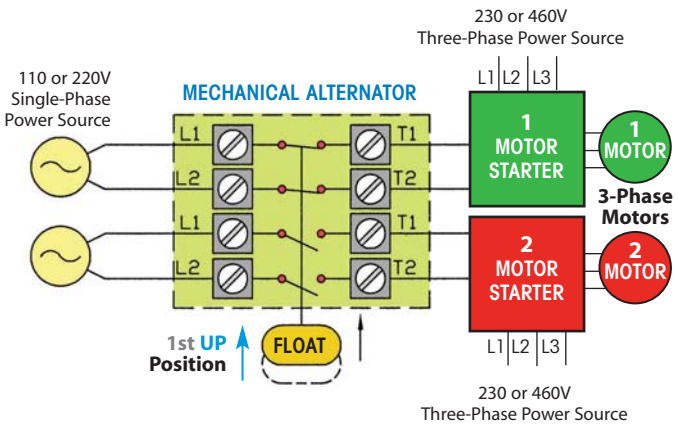
Explanation of Float Travel Position On Mechanical Alternator

Normal Operation: Switches will cut in and cut out at the high point of distance A + B given in the Figure below. Under normal conditions, as long as one pump alone is able to handle the incoming water, the pumps will alternate at this distance. With the water level continuing to rise, the second switch will cut in and start the second pump, when the float reaches the top of distance D. Both pumps will continue to run until the float returns to the lower point of distance D + C, where one pump will cut out. The other pump will continue until the float reaches the low point of distance B.



Mechanical Alternator Operating Two 3-Phase Motors

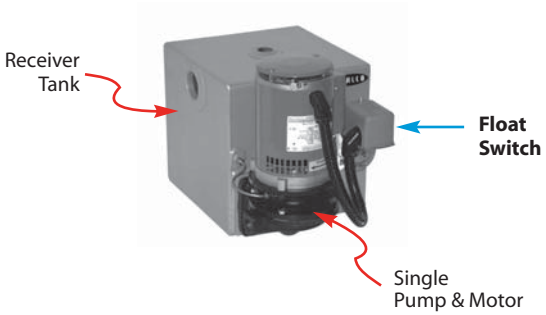
The Mechanical Alternator can also be used to operate two separate Motor Starters which in turn would be used to operate two separate 3-phase motors. Schematic shows **Motor Starter 1** activated which will turn on the 1st motor.



Operation of CONDENSATE RETURN Pumps

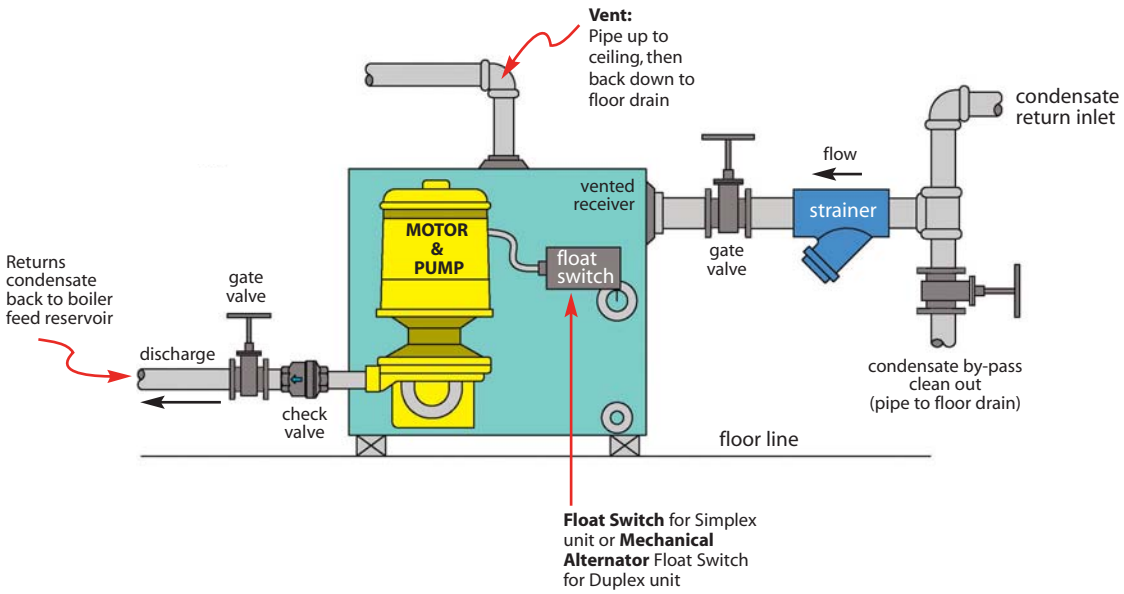
Condensate Return Pumps are designed to operate intermittently, discharging condensate only when the receiver tank is full. This is accomplished with a float switch that energizes the pump when the float rises above a set point. Once started, the pump will continue to operate until the water level drops below the bottom set position of the float switch. On Duplex condensate return pumps, a Mechanical Alternator float switch is mounted to the receiver so that both pumps are used in an alternating manner.

Simplex Unit



Duplex Unit

Condensate Return Pump Piping Diagram

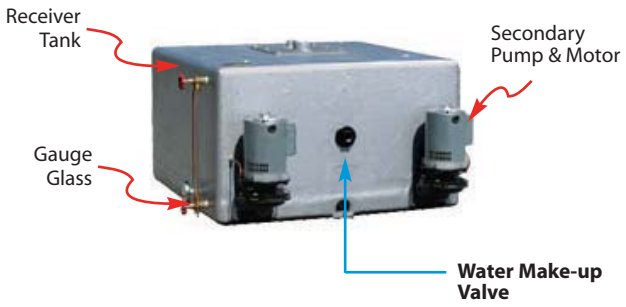


Operation of BOILER FEED Pumps

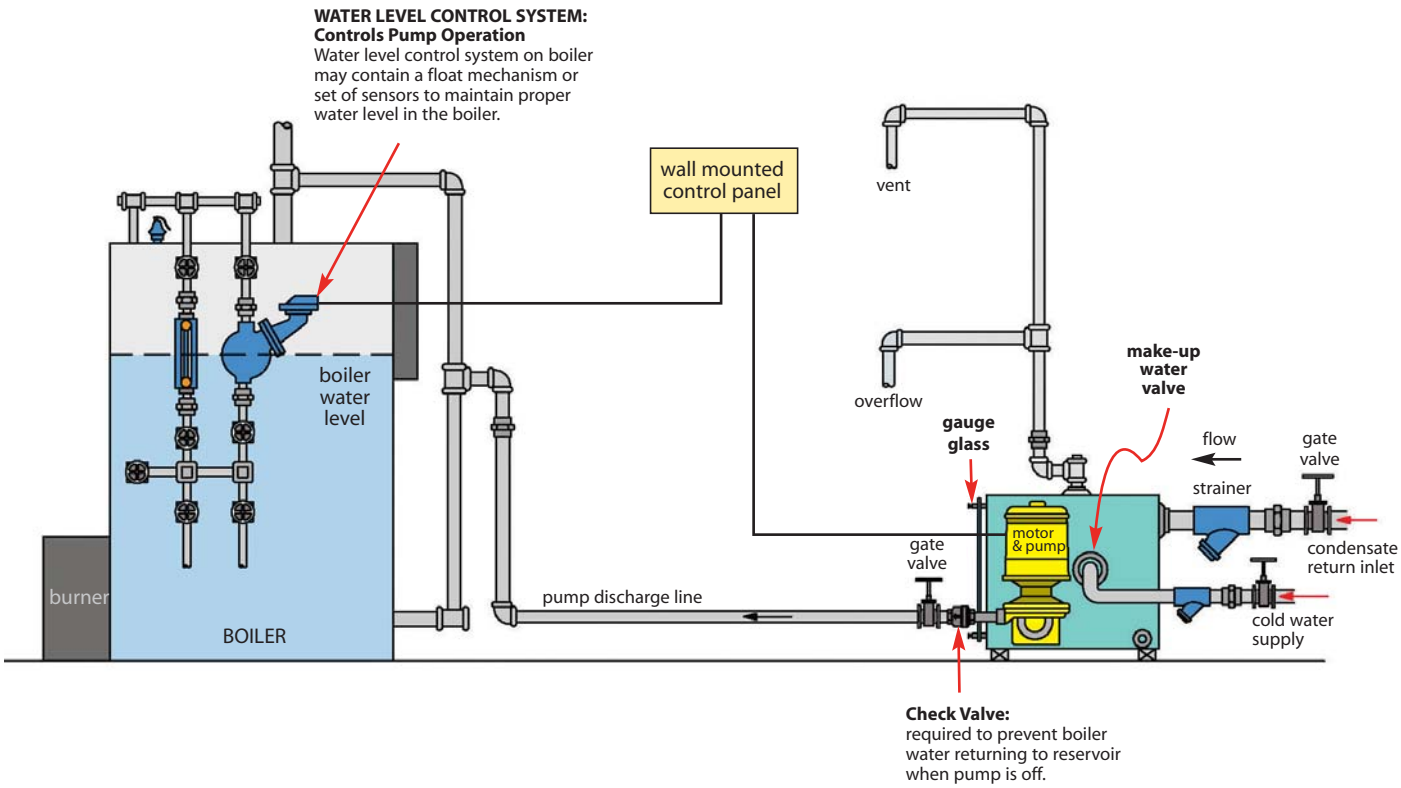
For Boiler Feed applications, the operation of the pump is controlled by the **water level control system** on the boiler. When the boiler requires water, the pump switches on pumping water from the receiver into the boiler. The receiver tank also contains an internal **make-up water valve** actuated by a stainless steel float. If the amount of condensate being returned to the receiver tank is inadequate to supply the boiler, additional make-up water is added to the receiver tank. This condition may occur when more steam is being produced than condensate being returned; common at system start-up.

An overflow pipe is used to dump excess condensate to drain during times when less boiler feed water is required than the amount of condensate being returned. Larger boiler feed tanks may be advantageous to keep systems in balance.

Duplex Boiler Feed Unit



Boiler Feed Pump Piping Diagram



What is required to choose and install an Electric Pump?

Selecting a Condensate Return Pump:

- A **Condensate Return Pump** contains an automatic float switch in the receiver tank to activate the pump when the tank is filled and deactivate when empty.
- On Duplex units, the standard float switch is replaced with a Mechanical Alternator float switch to alternate operation between the two pumps. Must be ordered separately. An Electric Alternator is also an option.
- The capacity of the condensate return pump in Gallons Per Minute (GPM) is based on the amount of Effective Direct Radiation (EDR) in sq ft. of heating surface in the facility that the pump is expected to handle.

  For Example: an EDR of 2000 sq. ft. can condense up to 500 lbs/hr of steam which translates to 1.0 GPM of condensate flow. Using a 3:1 safety factor would require a 3.0 GPM Condensate Return pump. The properly sized receiver tank that is adequate for that pump capacity is shown in the model selection chart for **Condensate Return** units. Larger receiver sizes are always desireable in order to cool condensate.
- Select a discharge pressure for the pump to overcome all system back pressures including frictional piping losses. Pump discharge pressures of 20-50 PSI are available. Selecting a pump with a significantly higher discharge pressure than required can cause pump to cavitate.

Selecting a Boiler Feed Pump:

- For a **Boiler Feed Pump**, the operation of the pump is controlled by the **water level control system** on the boiler. When the boiler requires water, the pump switches on pumping water from the receiver into the boiler. The receiver tank also contains an internal **make-up water valve** actuated by a stainless steel float. This is used if the amount of condensate being returned to the receiver tank is inadequate.
- On Duplex boiler feed pumps, an Electric Alternator is required to cycle operation between the two pumps.
- The capacity of the boiler feed pump in Gallons Per Minute (GPM) is based on the Boiler horsepower (hp).

  For Example: A 15 horsepower boiler will produce up to 500 lbs/hr of steam when running at maximum load which translates to requiring 1.0 GPM of water make-up to the boiler. Using a 3:1 safety factor would require a 3.0 GPM Boiler Feed pump. The recommended receiver sizes based on boiler horsepower are shown in selection chart.
- Select a discharge pressure for the pump to overcome boiler pressure and all system back pressure including frictional piping losses. Pump discharge pressures of 20-50 PSI are available.

General Information:
Applies to both Condensate Return & Boiler Feed Pumps

1) **Select the model** with the appropriate sized receiver and pump discharge pressure. 4100-Series Carbon Steel tank, 4200-Series – Cast Iron tank or 4300-Series – Stainless Steel tank.

   Safety factors and proper operating conditions: Pumps have a 3:1 safety factor. The 3:1 safety factor for Condensate Return pumps is based on the maximum condensate that can be produced by the EDR (Effective Direct Radiation) in square feet. For Boiler Feed pumps, the 3:1 safety factor is based on the maximum amount of water that would be required by the boiler (based on Boiler hp). Therefore, when the system is operating at maximum capacity, the pump will operate only one third of the time. Please note: these pumps as configured are not recommended for pumping condensate above 190˚ F.

2) **Motor hp** required for any given pump model is listed in the selection chart. For motor sizes below 1 hp, it is most common to choose single phase motors; (1Ph either 110 or 220 Volts). Single-phase motors (available up to 2 hp) have inherent overload protection (OL) and can therefore be wired directly to the float switch or Mechanical Alternator. This is the simplest method of control and does not require any additional electrical hardware. Since 3-Phase motors do not have inherent OL protection, they require a separate Motor Starter. Motor starters can be purchased separately from an electrical supply house or ordered separately with pump unit. Reference our NEMA 1 or NEMA 12 Control Panels with Motor Starter.

3) **Duplex pump units** require the addition of a mechanical or electrical **Alternator** which activates one pump at a time in alternating fashion. Condensate Return pumps most commonly use a Mechanical Alternator in place of the standard float switch and must be ordered separately. Refer to Model **MECH-ALT-N1**. For duplex Boiler Feed pumps, the **Electric Alternator** option on the NEMA-12 Control Panel (suffix code E) must be chosen. An Electric Alternator can also be used with Condensate Return pumps; however, an additional 2-level float switch is required (2-level float switch is Not required on boiler feed units).

W4100, W4200 & W4300

Electric Pump

Model	W4100	W4200	W4300
Connections	NPT	NPT	NPT
Tank Material	Carbon Steel	Cast Iron	Stainless Steel
Max Disch. Press.	50 PSIG	50 PSIG	50 PSIG
TMO/TMA	190˚F	190˚F	190˚F
Options	Mechanical & electrical alternators; gauge glass; thermometer; discharge pressure gauges; isolation valves; magnetic starters; 1750 RPM motors; control panels; oversized or stainless steel receivers; high temperature components		

Typical Applications

Used for general condensate return or for boiler feed applications. Available in Simplex or Duplex configurations with several different receiver sizes available.

How It Works

For Condensate Return Applications:

The float, which is connected to the switch assembly, rises when condensate enters the receiver tank. When the float rises above its set point, it energizes the motor on the pump. Once started, the pump will continue to run until the water level drops below the bottom position of the float switch.There it will de-energize the motor to shut off the pump. This cycle repeats as condensate begins to fill the receiver tank. On duplex systems the float switch is replaced with a Mechanical Alternator-Switch connected to a float. The Mechanical Alternator cycles use between the two pumps, allowing only one pump to run at a time under normal conditions. If the condensate reaches a high water level, both pumps will be activated.

For Boiler Feed Applications:

For Boiler Feed units, the operation of the pump is controlled by the water level control device which is part of the boiler control package. When the boiler requires water, the pump switches on pumping water from the receiver into the boiler. On Duplex boiler feed units, an Electrical Alternator is used to activate one pump at a time in alternating fashion. The receiver tank also contains an internal make-up water valve actuated by a stainless steel float. This is used if the amount of condensate being returned to the receiver tank is inadequate.

Sample Specifications

Pump(s) shall be of the centrifugal type with 2-piece closed bronze impeller, cast iron housing and stainless steel motor shaft. A flat perforated brass strainer shall be provided in the inlet of the pump.

Installation

Place on an elevated, level and substantial foundation in a clean, dry and accessible area. Locate receiver tank inlet below lowest point of the condensate return lines.

Features

- Fabricated steel receivers (W4100), Cast Iron (W4200), Stainless Steel (W4300)
- Simplex and duplex packages
- Bronze-fitted centrifugal pumps
- Energy-efficient 3450 RPM motors
- Automatic venting of mechanical seal
- Ceramic pump seal with carbon face
- Heavy-duty float switch
- All steel and iron receivers over 24 gallons include a threaded NPT overflow port

Options

- Mechanical and Electrical Alternators
- Gauge Glass
- Thermometers
- Discharge Pressure Gauges
- Isolation valves
- Magnetic Starters with HOA Selector Switch
- 1750 RPM Motors
- Larger pumping capacities & higher discharge pressures
- Wide variety of control panels
- Oversized Receivers (45, 60 & 95 gallons)
- Stainless Steel Receivers
- High Temperature (250˚F) Components

ELECTRIC PUMPS

How to Order an Electric Condensate Return or Boiler Feed Pump

Ordering Guidelines:

1) Decide on appropriate Receiver tank material for the application; W4100-Series with Steel Receiver tanks, W4200-Series with Cast Iron Receiver tanks or W4300 with Stainless Steel Receiver tanks.

2) Based on the particular application the **model selection charts** are separated on adjoining pages into either Boiler Feed or Condensate Return units. The proper pump model/size in GPM (gallons per minute) to suit the application and recommended receiver size for a Boiler Feed application is based on boiler size measured in Boiler Horsepower. The proper pump model size in GPM and recommended receiver size for a Condensate Return application is based on the Effective Direct Radiation (EDR) in square feet of the heating surfaces throughout the facility that the pump is expected to handle.

3) Select a pump discharge pressure that will exceed system back pressure, friction loss in piping and pressure in the boiler (in the case of a boiler feed pump). Selecting a pump with a significantly higher discharge pressure than required can cause pump to cavitate.

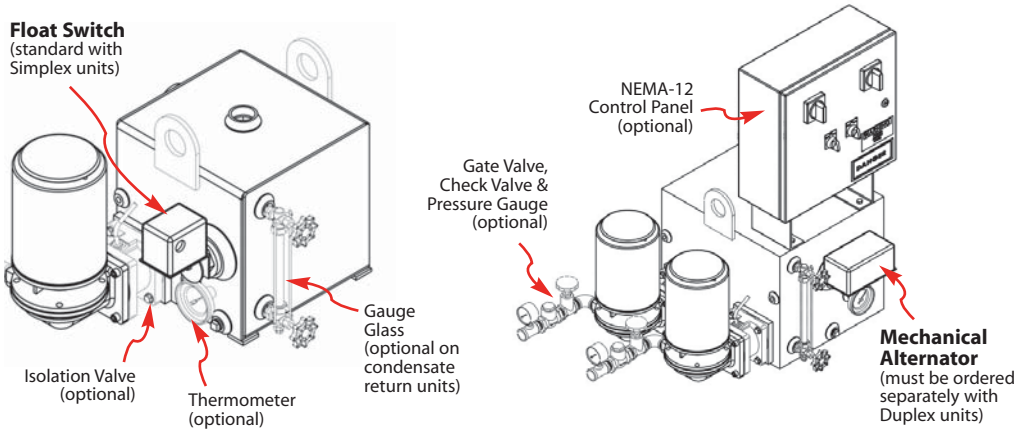
4) Decide if a Simplex (Single pump) unit is adequate or a Duplex (two pump) unit would be more appropriate in terms of system reliability and redundancy in the event of a pump failure.

5) Select Motor Phase and Voltage (reference chart). For smaller units under 1 1/2 hp Single phase motors may be desirable because of ease of installation. For units in excess of 1 1/2 hp, the more efficient and robust 3-phase motors are recommended.

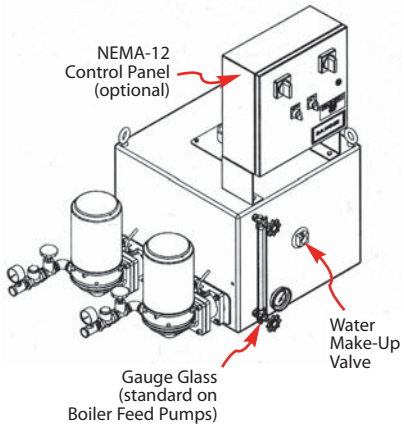
Example Model Code: **W4142JD-3P230** (Pump Unit) — Duplex Condensate Return Pump, 3 GPM flow rate & 40 PSI discharge pressure & 15 gallon receiver, 1hp, 230 VAC, 60Hz, 3-Phase motor.

Example Model Code: **MECH-ALT-N1** (Mechanical Alternator) — Note: Since a Duplex pump was chosen, a Mechanical Alternator must be purchased separately to replace the standard Float Switch.

Condensate Return



Boiler Feed



Phase & Voltage Codes for Standard 60/50 Hz Motors

Motor Phase & Voltage		60 Hz Motor Code	50 Hz Motor Code
Single Phase	115 VAC	**1P115**	**1P115E**
	208 VAC	**1P208**	**1P208E**
	230 VAC	**1P230**	**1P230E**
Three Phase	208 VAC	**3P208**	**3P208E**
	230 VAC	**3P230**	**3P230E**
	460 VAC	**3P460**	**3P460E**
	575 VAC	**3P575**	**3P575E**

Codes for Specialty Motors (add as a Suffix)

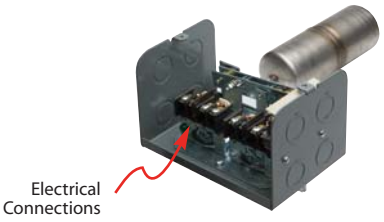
Option	Suffix Code
Totally Enclosed Fan Cooled (1/2 to 3 hp)	**TEFC**
Explosion Proof – 1/2, 3/4, 1 hp	**EP1**
Explosion Proof – 1 1/2 & 2 hp	**EP2**
Explosion Proof – 3 hp	**EP3**

How to Order an Electric Condensate Return or Boiler Feed Pump

Condensate Return			Boiler Feed
			
Simplex Cast Iron Tank	**Duplex** Cast Iron Tank	**Duplex** Stainless Steel Tank	**Duplex** Cast Iron Tank

Mechanical Alternator For Duplex Condensate Return Pump Only

Replaces the standard float switch on Duplex Condensate Return Units. Must be ordered separately.



On Duplex units, the standard float switch is replaced with a Mechanical Alternator float switch to alternate operation between the two pumps. Must be ordered separately. An Electric Alternator is also an option.

For Duplex Pumps must choose either:
A Mechanical Alternator or 2-Level Float Switch with the Electric Alternator Option on NEMA-12 Control Panel

Mechanical Alternator & Float Switches	Model Code
Mechanical Alternator - NEMA 1 (replaces Float Switch on Duplex pumps)	**MECH-ALT-N1**
Mechanical Alternator - NEMA 4 (replaces Float Switch on Duplex)	**MECH-ALT-N4**
Mechanical Alternator - Explosion Proof (replaces Float Switch on Duplex)	**MECH-ALT-EP**
2-Level Float Switch – (required when using an Electrical Alternator - Reference NEMA-12 Control Panel)*	**FLOAT-SWITCH-2L**
(Option) High-Level Auxiliary Contacts for Mechanical Alternator	**CONTACTS-HLA**

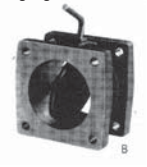
* 2-level float switch not required with Duplex Boiler Feed Units

Accessory Items

Condensate Return Pumps (ordered separately)	
For **SIMPLEX** and **DUPLEX** pumps	Model Code
Gauge Glass for Steel Tank	**GAUGE-GLASS-ST**
Gauge Glass for Cast Iron Tank	**GAUGE-GLASS-CI**
Isolation Valve	**ISO-VALVE**
Dial Thermometer	**DIAL-THERM**
Discharge Pressure Gauge	**PRESS-GAUGE-D**
Discharge Check Valve	**CHECK VALVE-D**
Float Switch - NEMA 4 (for Simplex Unit)	**FLOAT-SWITCH-N4**
Float Switch - Explosion Proof (for Simplex Unit)	**FLOAT-SWITCH-EP**

Boiler Feel Pumps (ordered separately)	
For **SIMPLEX** and **DUPLEX** pumps	Model Code
Isolation Valve	**ISO-VALVE**
Dial Thermometer	**DIAL-THERM**
Discharge Pressure Gauge	**PRESS-GAUGE-D**
Discharge Check Valve	**CHECK VALVE-D**

Gauge glass is standard on boiler feed pumps.



Isolation Valve
Allows pump and motor to be removed without draining condensate.

Motor Control Panel

NEMA 12 - Control Panel (for **Duplex** & **Simplex** Pumps)

Purchasing the optional motor control panel is a convenient and simple method of hooking up your pump.

For **Simplex** units, the control panel would include a single motor starter with a single HOA (HAND-OFF-AUTOMATIC) selector switch to turn the pump on manually to verify functionality; or, to set in automatic mode along with a single Motor Circuit Protector switch to shut power off to the pump.

For **Duplex** systems, the control panel would include two motor starters with two HOA (HAND-OFF-AUTOMATIC) selector switches to turn either of the two pumps on manually to verify functionality, or to set in automatic mode along with two separate Motor Circuit Protector switches to shut power off to either of the two pumps.

An Electric Alternator option can be used to replace the standard Mechanical Alternator; this option uses electronic logic as opposed to a mechanical device to cycle operation between the two pumps. If an Electrical Alternator is chosen, the Mechanical Alternator is replaced with a 2-level float switch (suffix code **E**).

Other Options, such as Pilot Light indicating when the pump is running or High Level Alarm Horn & Light indicating a flood system condition, can be added.

Control Panel Model Codes

Standard CONTROL PANEL	Simplex Model Code	Duplex Model Code
1/3 thru 5 Horsepower	**CPN12-P1-S**	**CPN12-P1-D**
Over 5 Horsepower	**CPN12-P2-S**	**CPN12-P2-D**

Standard Control Panel Includes:

- Motor Circuit Protector(s)
- HOA Selector Switch(s)
- External Reset(s)

Control Panel Options

Options	Suffix Code
UL Certification	**UL**
Pilot Light (Power On) (1 required per pump)	**P**
Test Push Button (1 required per pump)	**T**
Electric Alternator (for Duplex)* (2-Level Float Switch is required with Electric Alternator)	**E**
High-Level Alarm Horn & Light with Silencing Switch	**HA**
All of the Above Options	**AO**

Note: Standard Voltages are: 1-phase/60 Hz/115, 208, 230 VAC and 3-phase/60Hz/208, 230, 460, 575 VAC.

For non-standard voltages; consult factory.

* 2-Level Float Switch is required with Electric Alternator for Condensate Pumps Only; Not required for Boiler Feed Units.

Pilot Light
Indicates when a pump is running;
Simplex - One light; Duplex - Two Lights.

Test Push Button
Used to test if pilot light is functional. Press to test.

Electric Alternator
Uses electronic logic to alternate operation between two pumps. This option is required for Duplex Boiler Feed systems.

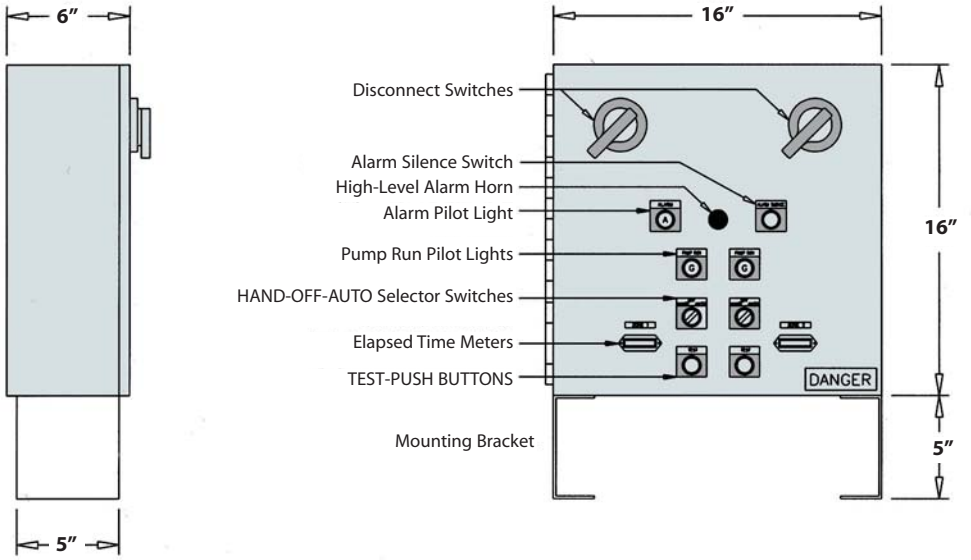
For Condensate Return Systems: if an Electric Alternator is chosen instead of the Mechanical Alternator, a 2-Level Float Switch is required. (See Accessories - Electric Alternator Option. Model: **FLOAT-SWITCH-2L**)

High-Level Alarm
Alarm to indicate if maximum water level is exceeded.

Example Model Codes: 1) **CPN12-P1-S** (Control Panel, NEMA 12, 1/3 thru 5 hp, Simplex, no options)
2) **CPN12-P1-S-UL** (Control Panel, NEMA 12, 1/3 thru 5 hp, Simplex with UL Certification)
3) **CPN12-P2-D-E** (Control Panel, NEMA 12, over 5 Hp, Duplex, with Electric Alternator)

Motor Control Panel

NEMA 12 - Control Panel (for **Duplex** & **Simplex** Pumps)



NEMA 1 - Control Panel (for **Simplex** Pumps Only)

For Simplex units, the NEMA 1 Control Panel will include a single motor starter with a **HOA** (HAND-OFF-AUTOMATIC) selector switch to turn the pump on manually, or to set in automatic mode. A single Motor Circuit Protector switch shuts the power off to the pump when an overload (OL) condition is detected.

- Magnetic across-the-line motor starter *
- Thermal overload and Hand-Off-Automatic (HOA) selector switch
- Optional Pilot Light

* Allows for remote start-up with full line voltage across the motor terminals.

Phase	Power	Voltage	Model Code
Single Phase	Up to 1 HP	115 VAC	**MSN1-1P-1-115**
	Up to 2 HP	230 VAC	**MSN1-1P-2-230**
	Up to 2 HP	115 VAC	**MSN1-1P-2-115**
	Up to 3 HP	230 VAC	**MSN1-1P-3-230**
Three Phase	Up to 3 HP	230 VAC	**MSN1-3P-3-230**
	Up to 2 HP	460 VAC	**MSN1-3P-2-460**
	Up to 7.5 HP	230 VAC	**MSN1-3P-7-230**
	Up to 5 HP	460 VAC	**MSN1-3P-5-460**
Option	Pilot Light		(Suffix Code) **P**

Example Model Codes:

1) **MSN1-1P-1-115** (Motor Starter, NEMA 1, single-phase, 1 HP, 115 VAC)

2) **MSN1-3P-3-230-P** (Motor Starter, NEMA 1, three-phase, 3 HP, 230 VAC with Pilot light)

ELECTRIC PUMPS

Boiler Feed Pumps **Steel** Receivers (G & J Series Pumps)

G (**20 PSI** Max Discharge Pressure) / **J** (up to **50 PSI** Max Discharge Pressure)

CAPACITIES

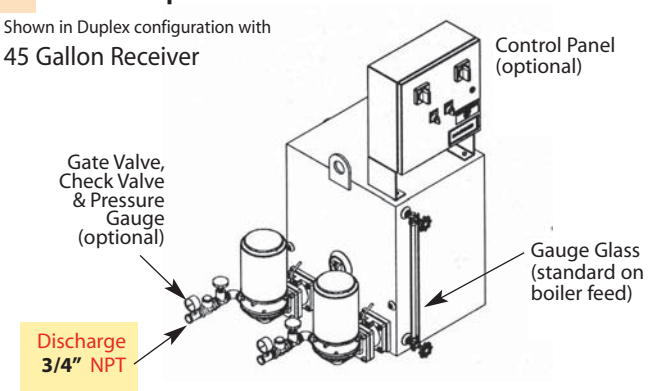
Boiler Horsepower	Discharge Pressure (PSIG)	Flow Rate (GPM)	Motor Horsepower	Receiver Capacity (gallons)	Simplex Model #	Pump Series	Weight (lbs)	Duplex Model #	Weight (lbs)
15	20	3	1/3	30	W4122GF	G	200	W4122GDF	240
	30		1/2		W4132JF	J	260	W4132JDF	300
	40		1		W4142JF	J	265	W4142DF	310
	50		2		W4152JF	J	275	W4152JDF	330
30	20	6	1/3	30	W4124GF	G	200	W4124GDF	240
	30		1/2		W4134JF	J	260	W4134JDF	300
	40		1		W4144JF	J	265	W4144DF	310
	50		2		W4154JF	J	275	W4154JDF	330
45	20	9	1/3	45	W4126GF	G	240	W4126GDF	280
	30		1/2		W4136JF	J	300	W4136JDF	340
	40		1		W4146JF	J	305	W4146DF	350
	50		2		W4156JF	J	315	W4156JDF	370
60	20	12	1/3	60	W4128GF	G	275	W4128GDF	335
	30		1/2		W4138JF	J	335	W4138JDF	395
	40		1		W4148JF	J	340	W4148DF	405
	50		2		W4158JF	J	350	W4158JDF	425

Typical 4100-Series BOILER FEED Pumps (available in Simplex & Duplex with 30, 45 & 60 Gallon Receivers)

SIMPLEX & DUPLEX

G Series Pump

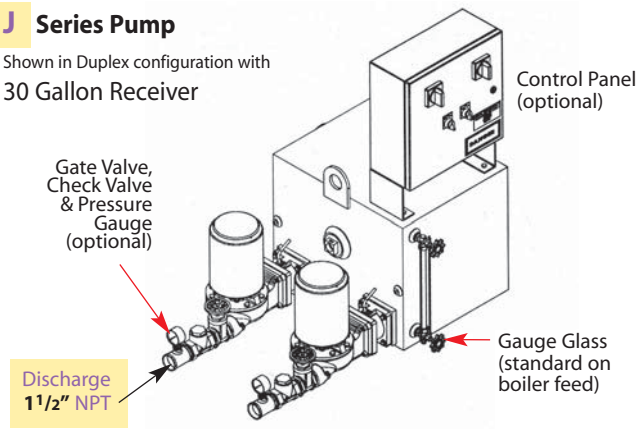
Shown in Duplex configuration with 45 Gallon Receiver



SIMPLEX & DUPLEX

J Series Pump

Shown in Duplex configuration with 30 Gallon Receiver

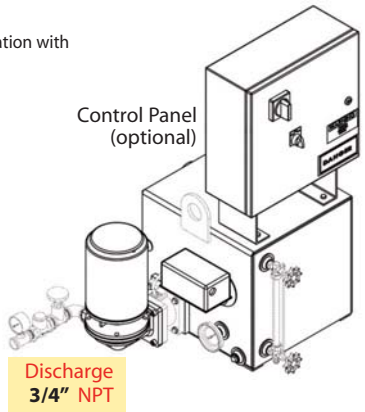


Typical 4100-Series CONDENSATE RETURN Pumps

SIMPLEX & DUPLEX

G Series Pump

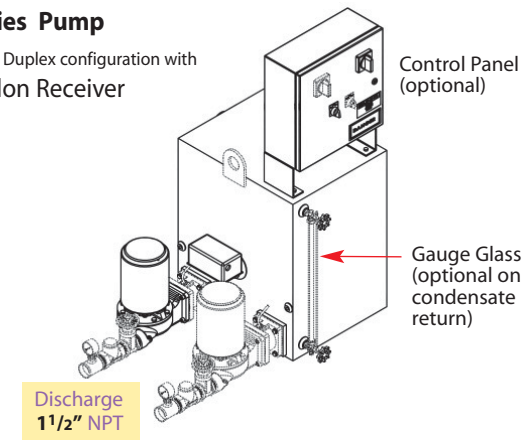
Shown in Simplex configuration with 15 Gallon Receiver



SIMPLEX & DUPLEX

J Series Pump

Shown in Duplex configuration with 45 Gallon Receiver



Condensate Return Pumps **Steel** Receivers (G & J Series Pumps)

G (**20 PSI** Max Discharge Pressure) / **J** (up to **50 PSI** Max Discharge Pressure)

CAPACITIES

EDR	Discharge Pressure (PSIG)	Flow Rate (GPM)	Motor HP	Receiver Capacity (gallons)	Simplex Model #	Weight (lbs)	Duplex Model #	Weight (lbs)
2000	20	3	1/3	15	W4122G	125	W4122GD	185
4000	20	6	1/3	15	W4124G	125	W4124GD	185
6000	20	9	1/3	15	W4126G	125	W4126GD	185
8000	20	12	1/3	15	W4128G	125	W4128GD	185
10000	20	15	1/2	30	W41210G	190	W41210GD	240
15000	20	22.5	1/2	30	W41215G	190	W41215GD	240
20000	20	30	3/4	30	W41220G	200	W41220GD	250
25000	20	37.5	3/4	45	W41225J	285	W41225JD	350
30000	20	45	1	45	W41230J	285	W41230JD	350
40000	20	60	1 1/2	60	W41240J	335	W41240JD	405
50000	20	75	2	95	W41250J	385	W41250JD	460
2000	30	3	1/2	15	W4132J	180	W4132JD	250
4000	30	6	1/2	15	W4134J	180	W4134JD	250
6000	30	9	1/2	15	W4136J	180	W4136JD	250
8000	30	12	1/2	15	W4138J	180	W4138JD	250
10000	30	15	3/4	15	W41310J	185	W41310JD	250
15000	30	22.5	1	30	W41315J	230	W41315JD	300
20000	30	30	1	30	W41320J	230	W41320JD	300
25000	30	37.5	1	45	W41325J	285	W41325JD	350
30000	30	45	1 1/2	45	W41330J	290	W41330JD	355
40000	30	60	2	60	W41340J	340	W41340JD	410
50000	30	75	3	95	W41350J	395	W41350JD	470
2000	40	3	1	15	W4142J	190	W4142JD	270
4000	40	6	1	15	W4144J	190	W4144JD	270
6000	40	9	1	15	W4146J	190	W4146JD	270
8000	40	12	1	15	W4148J	190	W4148JD	270
10000	40	15	1	15	W41410J	190	W41410JD	270
15000	40	22.5	1 1/2	30	W41415J	240	W41415JD	310
20000	40	30	1 1/2	30	W41420J	240	W41420JD	310
25000	40	37.5	1 1/2	45	W41425J	290	W41425JD	355
30000	40	45	2	45	W41430J	295	W41430JD	360
40000	40	60	2	60	W41440J	240	W41440JD	410
50000	40	75	3	95	W41450J	395	W41450JD	470
2000	50	3	2	15	W4152J	195	W4152JD	275
4000	50	6	2	15	W4154J	195	W4154JD	275
6000	50	9	2	15	W4156J	195	W4156JD	275
8000	50	12	2	15	W4158J	195	W4158JD	275
10000	50	15	2	15	W41510J	195	W41510JD	275
15000	50	22.5	2	30	W41515J	245	W41515JD	320
20000	50	30	3	30	W41520J	255	W41520JD	330
25000	50	37.5	3	45	W41525J	305	W41525JD	385
30000	50	45	3	45	W41530J	305	W41530JD	385
40000	50	60	5	60	W41540J	370	W41540JD	500
50000	50	75	5	95	W41550J	430	W41550JD	500

Notes: 1) EDR = Square Feet of Equivalent Direct Radiation
2) Capacity of Steam (lbs/hr) = EDR x 0.25
3) 2,000 EDR will produce 500 lbs/hr of condensate
3) 500 lbs/hr = 1 GPM

ELECTRIC PUMPS

Boiler Feed Pumps **Cast Iron** Receivers (G & J Series Pumps)

G (**20 PSI** Max Discharge Pressure) / **J** (up to **50 PSI** Max Discharge Pressure)

CAPACITIES

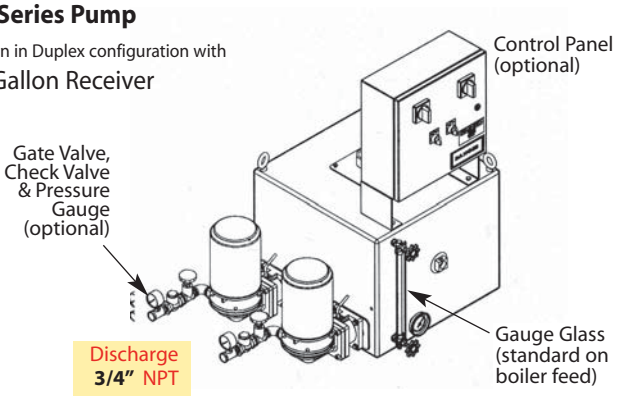
Boiler Horsepower	Discharge Pressure (PSIG)	Flow Rate (GPM)	Motor Horsepower	Receiver Capacity (gallons)	Simplex Model #	Weight (lbs)	Duplex Model #	Weight (lbs)
15	20	3	1/3	36	W4222GF	465	W4222GDF	500
	30		1/2		W4232JF	505	W4232JDF	580
	40		1		W4242JF	510	W4242DF	590
	50		2		W4252JF	520	W4252JDF	600
30	20	6	1/3	36	W4224GF	465	W4224GDF	500
	30		1/2		W4234JF	505	W4234JDF	580
	40		1		W4244JF	510	W4244DF	590
	50		2		W4254JF	520	W4254JDF	600
45	20	9	1/3	50	W4226GF	575	W4226GDF	610
	30		1/2		W4236JF	615	W4236JDF	690
	40		1		W4246JF	620	W4246DF	700
	50		2		W4256JF	625	W4256JDF	710
60	20	12	1/3	50	W4228GF	575	W4228GDF	610
	30		1/2		W4238JF	615	W4238JDF	690
	40		1		W4248JF	620	W4248DF	700
	50		2		W4258JF	625	W4258JDF	710

Typical 4200-Series BOILER FEED Pumps

SIMPLEX & DUPLEX

G Series Pump

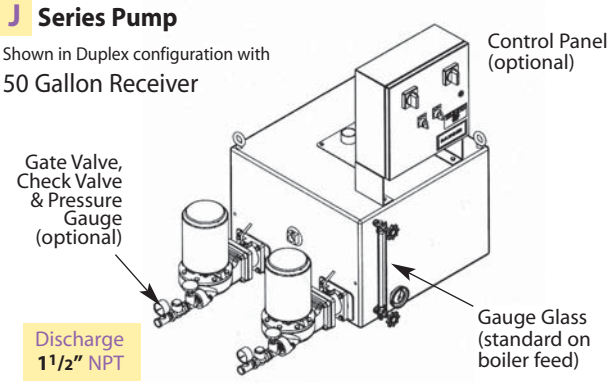
Shown in Duplex configuration with
36 Gallon Receiver



SIMPLEX & DUPLEX

J Series Pump

Shown in Duplex configuration with
50 Gallon Receiver

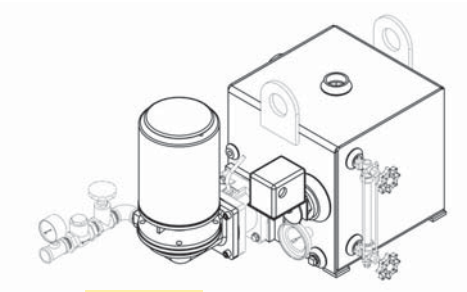


Typical 4200-Series CONDENSATE RETURN Pumps

SIMPLEX

G Series Pump

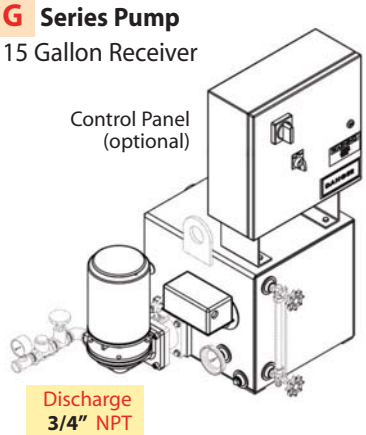
6 Gallon Receiver



SIMPLEX & DUPLEX

G Series Pump

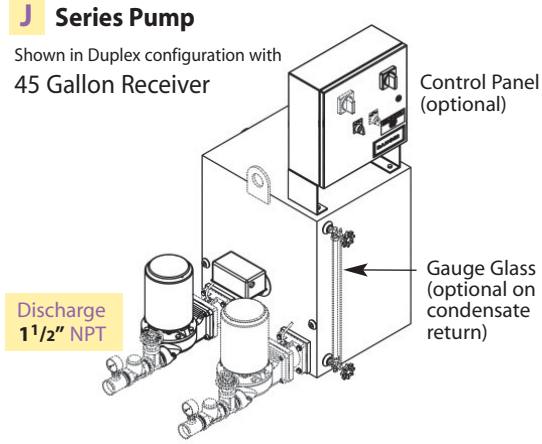
15 Gallon Receiver



SIMPLEX & DUPLEX

J Series Pump

Shown in Duplex configuration with
45 Gallon Receiver



Condensate Return Pumps **Cast Iron** Receivers (G & J Series Pumps)

G (**20 PSI** Max Discharge Pressure) / **J** (up to **50 PSI** Max Discharge Pressure)

CAPACITIES

EDR	Discharge Pressure (PSIG)	Flow Rate (GPM)	Motor HP	Receiver Capacity (gallons)	Simplex Model #	Weight (lbs)	Duplex Model #	Weight (lbs)
2000	20	3	1/3	6	W4222G	150	N/A	N/A
4000	20	6	1/3	6	W4224G	150	N/A	N/A
6000	20	9	1/3	15	W4226G	260	W4226GD	295
8000	20	12	1/3	15	W4228G	260	W4228GD	295
10000	20	15	1/2	15	W42210G	260	W42210GD	295
15000	20	22.5	1/2	24	W42215G	300	W42215GD	335
20000	20	30	3/4	36	W42220G	410	W42220GD	445
25000	20	37.5	3/4	36	W42225J	350	W42225JD	420
30000	20	45	1	36	W42230J	355	W42230JD	430
40000	20	60	1 1/2	50	W42240J	420	W42240JD	500
50000	20	75	2	50	W42250J	425	W42250JD	510
2000	30	3	1/2	6	W4232J	165	N/A	N/A
4000	30	6	1/2	6	W4234J	165	N/A	N/A
6000	30	9	1/2	15	W4236J	295	W4236JD	360
8000	30	12	1/2	15	W4238J	295	W4238JD	360
10000	30	15	3/4	15	W42310J	300	W42310JD	365
15000	30	22.5	1	24	W42315J	305	W42315JD	380
20000	30	30	1	36	W42320J	355	W42320JD	430
25000	30	37.5	1	36	W42325J	355	W42325JD	430
30000	30	45	1 1/2	36	W42330J	360	W42330JD	440
40000	30	60	2	50	W42340J	425	W42340JD	510
50000	30	75	3	50	W42350J	435	W42350JD	525
2000	40	3	1	6	W4242J	170	N/A	N/A
4000	40	6	1	6	W4244J	170	N/A	N/A
6000	40	9	1	15	W4246J	295	W4246JD	360
8000	40	12	1	15	W4248J	295	W4248JD	360
10000	40	15	1	15	W42410J	295	W42410JD	360
15000	40	22.5	1 1/2	24	W42415J	310	W42415JD	390
20000	40	30	1 1/2	36	W42420J	360	W42420JD	440
25000	40	37.5	1 1/2	36	W42425J	360	W42425JD	440
30000	40	45	2	36	W42430J	365	W42430JD	450
40000	40	60	2	50	W42440J	425	W42440JD	510
50000	40	75	3	50	W42450J	435	W42450JD	525
2000	50	3	2	6	W4252J	175	N/A	N/A
4000	50	6	2	6	W4254J	175	N/A	N/A
6000	50	9	2	15	W4256J	315	W4256JD	395
8000	50	12	2	15	W4258J	315	W4258JD	395
10000	50	15	2	15	W42510J	315	W42510JD	395
15000	50	22.5	2	24	W42515J	330	W42515JD	415
20000	50	30	3	36	W42520J	370	W42520JD	460
25000	50	37.5	3	36	W42525J	370	W42525JD	460
30000	50	45	3	36	W42530J	370	W42530JD	460
40000	50	60	5	50	W42540J	445	W42540JD	535
50000	50	75	5	50	W42550J	445	W42550JD	535

Notes: 1) EDR = Square Feet of Equivalent Direct Radiation
2) Capacity of Steam (lbs/hr) = EDR x 0.25
3) 2,000 EDR will produce 500 lbs/hr of condensate
3) 500 lbs/hr = 1 GPM

ELECTRIC PUMPS

Boiler Feed Pumps **Stainless Steel** Receivers (G & J Series Pumps)

G (**20 PSI** Max Discharge Pressure) / **J** (up to **50 PSI** Max Discharge Pressure)

CAPACITIES

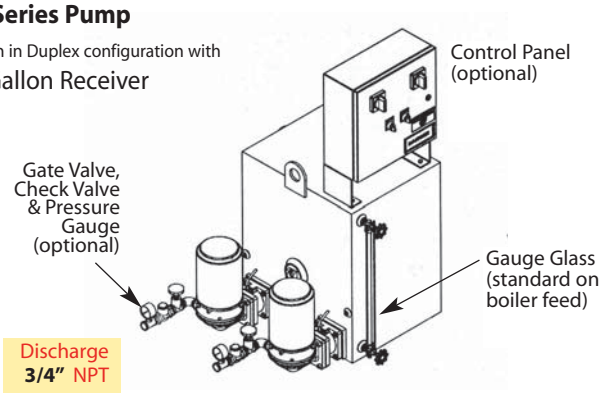
Boiler Horsepower	Discharge Pressure (PSIG)	Flow Rate (GPM)	Motor Horsepower	Receiver Capacity (gallons)	Simplex Model #	Weight (lbs)	Duplex Model #	Weight (lbs)
15	20	3	1/3	30	W4322GF	200	W4322GDF	240
	30		1/2		W4332JF	260	W4332JDF	300
	40		1		W4342JF	265	W4342DF	310
	50		2		W4352JF	275	W4352JDF	330
30	20	6	1/3	30	W4324GF	200	W4324GDF	240
	30		1/2		W4334JF	260	W4334JDF	300
	40		1		W4344JF	265	W4344DF	310
	50		2		W4354JF	275	W4354JDF	330
45	20	9	1/3	45	W4326GF	240	W4326GDF	280
	30		1/2		W4336JF	300	W4336JDF	340
	40		1		W4346JF	305	W4346DF	350
	50		2		W4356JF	315	W4356JDF	370
60	20	12	1/3	60	W4328GF	275	W4328GDF	335
	30		1/2		W4338JF	335	W4338JDF	395
	40		1		W4348JF	340	W4348DF	405
	50		2		W4358JF	350	W4358JDF	425

Typical 4300-Series BOILER FEED Pumps

SIMPLEX & DUPLEX

G Series Pump

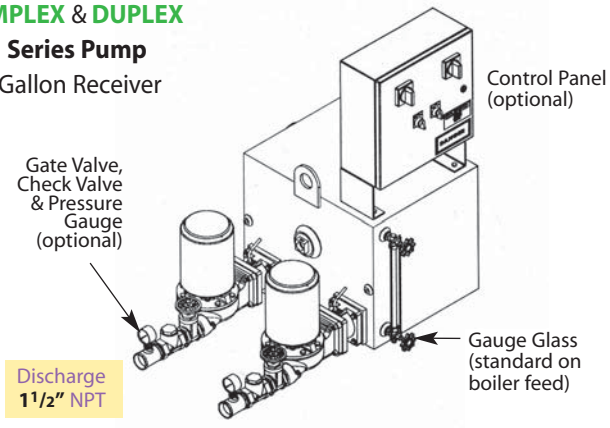
Shown in Duplex configuration with 45 Gallon Receiver



SIMPLEX & DUPLEX

J Series Pump

30 Gallon Receiver

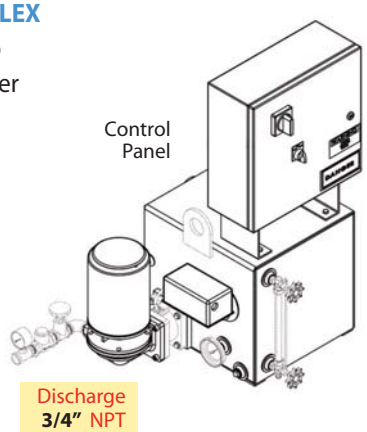


Typical 4300-Series CONDENSATE RETURN Pumps

SIMPLEX & DUPLEX

G Series Pump

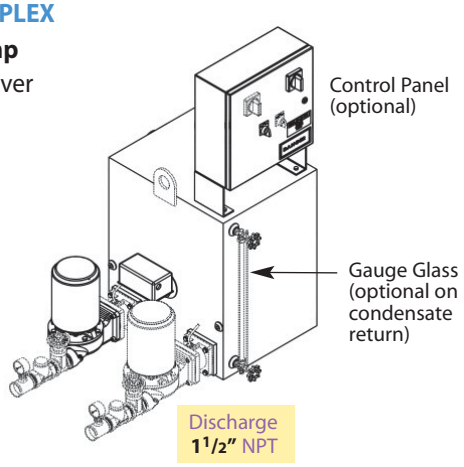
15 Gallon Receiver



SIMPLEX & DUPLEX

J Series Pump

45 Gallon Receiver



Condensate Return Pumps Stainless Steel Receivers (G & J Series Pumps)

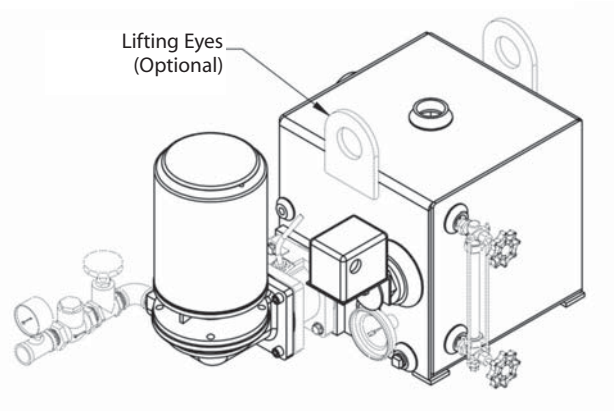
G (**20 PSI** Max Discharge Pressure) / **J** (up to **50 PSI** Max Discharge Pressure)

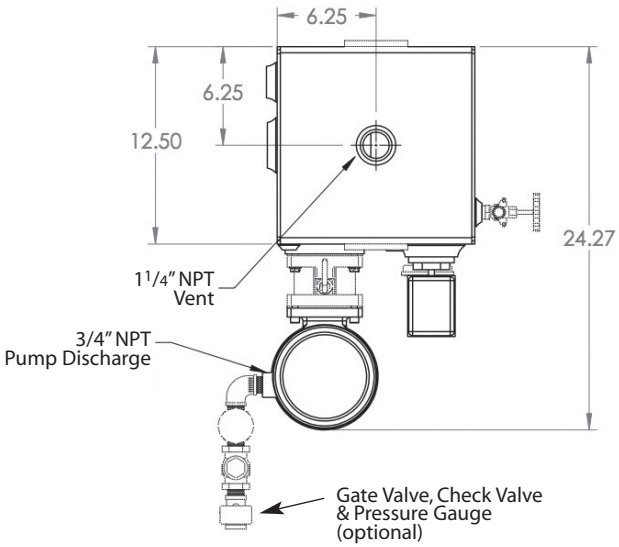
CAPACITIES

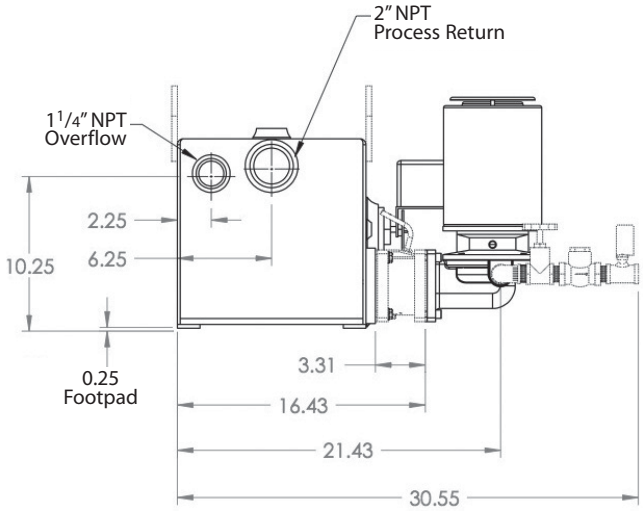
EDR	Discharge Pressure (PSIG)	Flow Rate (GPM)	Motor HP	Receiver Capacity (gallons)	Simplex Model #	Weight (lbs)	Duplex Model #	Weight (lbs)
2000	20	3	1/3	15	W4322G	125	W4322GD	185
4000	20	6	1/3	15	W4324G	125	W4324GD	185
6000	20	9	1/3	15	W4326G	125	W4326GD	185
8000	20	12	1/3	15	W4328G	125	W4328GD	185
10000	20	15	1/2	30	W43210G	190	W43210GD	240
15000	20	22.5	1/2	30	W43215G	190	W43215GD	240
20000	20	30	3/4	30	W43220G	200	W43220GD	250
25000	20	37.5	3/4	45	W43225J	285	W43225JD	350
30000	20	45	1	45	W43230J	285	W43230JD	350
40000	20	60	1 1/2	60	W43240J	335	W43240JD	405
50000	20	75	2	95	W43250J	385	W43250JD	460
2000	30	3	1/2	15	W4332J	180	W4332JD	250
4000	30	6	1/2	15	W4334J	180	W4334JD	250
6000	30	9	1/2	15	W4336J	180	W4336JD	250
8000	30	12	1/2	15	W4338J	180	W4338JD	250
10000	30	15	3/4	15	W43310J	185	W4310JD	250
15000	30	22.5	1	30	W43315J	230	W43315JD	300
20000	30	30	1	30	W43320J	230	W43320JD	300
25000	30	37.5	1	45	W43325J	285	W43325JD	350
30000	30	45	1 1/2	45	W43330J	290	W43330JD	355
40000	30	60	2	60	W43340J	340	W43340JD	410
50000	30	75	3	95	W43350J	395	W43350JD	470
2000	40	3	1	15	W4342J	190	W4342JD	270
4000	40	6	1	15	W4344J	190	W4344JD	270
6000	40	9	1	15	W4346J	190	W4346JD	270
8000	40	12	1	15	W4348J	190	W4348JD	270
10000	40	15	1	15	W43410J	190	W43410JD	270
15000	40	22.5	1 1/2	30	W43415J	240	W43415JD	310
20000	40	30	1 1/2	30	W43420J	240	W43420JD	310
25000	40	37.5	1 1/2	45	W43425J	290	W43425JD	355
30000	40	45	2	45	W43430J	295	W43430JD	360
40000	40	60	2	60	W43440J	240	W43440JD	410
50000	40	75	3	95	W43450J	395	W43450JD	470
2000	50	3	2	15	W4352J	195	W4352JD	275
4000	50	6	2	15	W4354J	195	W4354JD	275
6000	50	9	2	15	W4356J	195	W4356JD	275
8000	50	12	2	15	W4358J	195	W4358JD	275
10000	50	15	2	15	W43510J	195	W43510JD	275
15000	50	22.5	2	30	W43515J	245	W43515JD	320
20000	50	30	3	30	W43520J	255	W43520JD	330
25000	50	37.5	3	45	W43525J	305	W43525JD	385
30000	50	45	3	45	W43530J	305	W43530JD	385
40000	50	60	5	60	W43540J	370	W43540JD	500
50000	50	75	5	95	W43550J	430	W43550JD	500

Notes: 1) EDR = Square Feet of Equivalent Direct Radiation
2) Capacity of Steam (lbs/hr) = EDR x 0.25
3) 2,000 EDR will produce 500 lbs/hr of condensate
3) 500 lbs/hr = 1 GPM

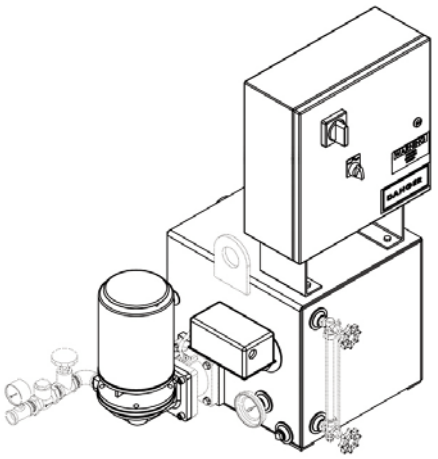
G SIMPLEX • 8 Gallon Receiver
4100 • Steel Receiver
4300 • Stainless Steel Receiver

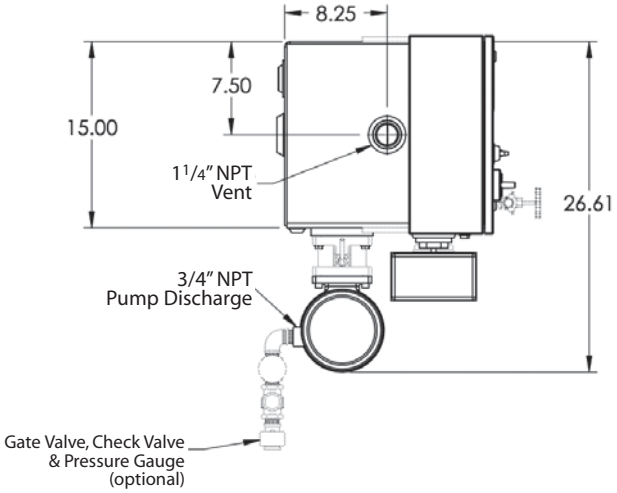


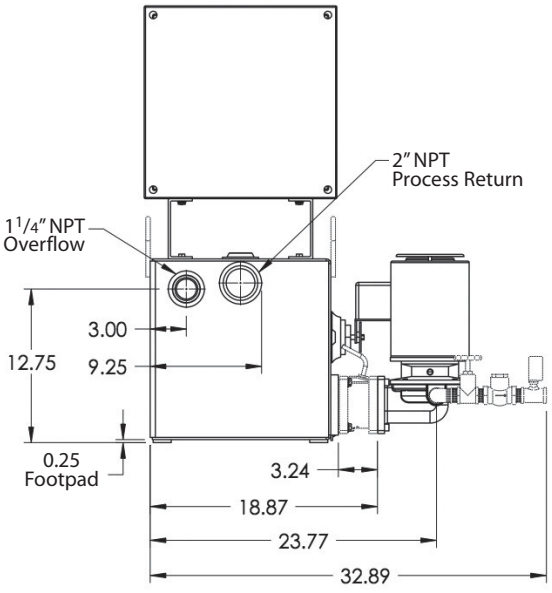




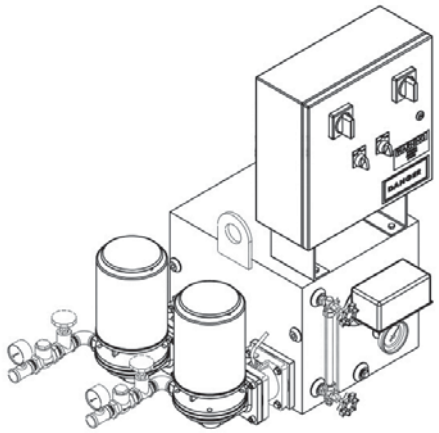
G SIMPLEX • 15 Gallon Receiver
4100 • Steel Receiver
4300 • Stainless Steel Receiver

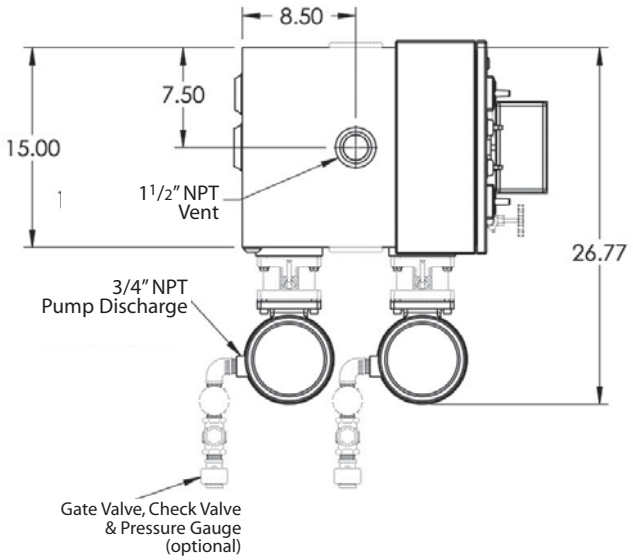


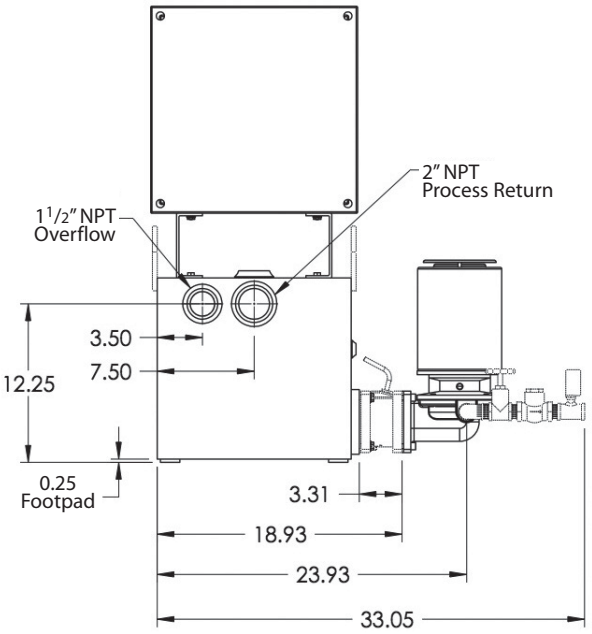




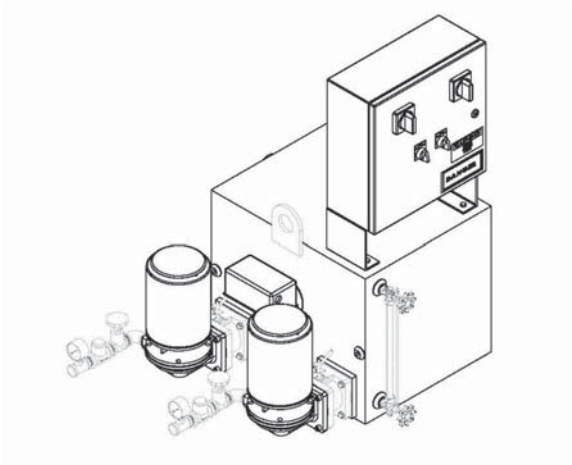
G DUPLEX • 15 Gallon Receiver
4100 • Steel Receiver
4300 • Stainless Steel Receiver

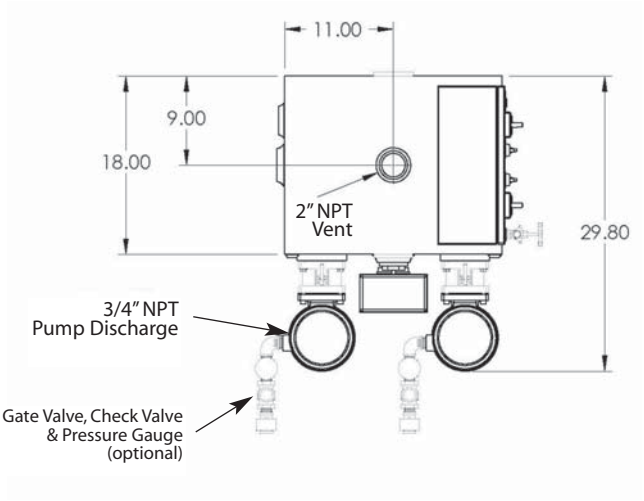


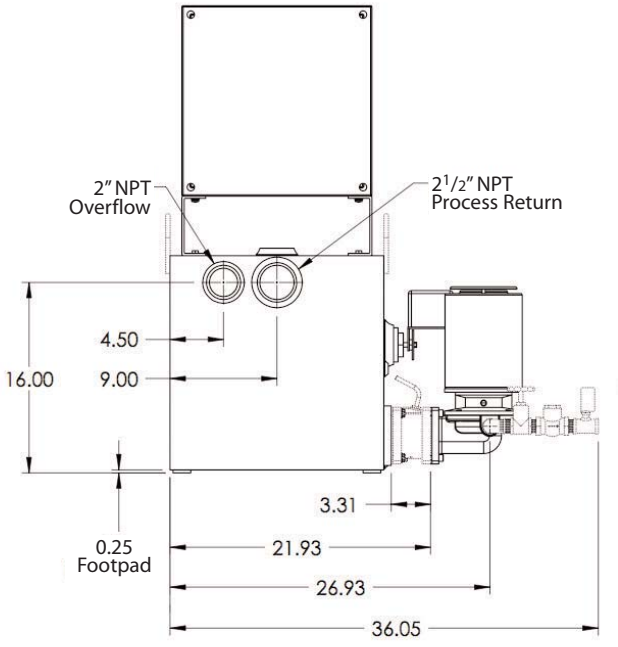




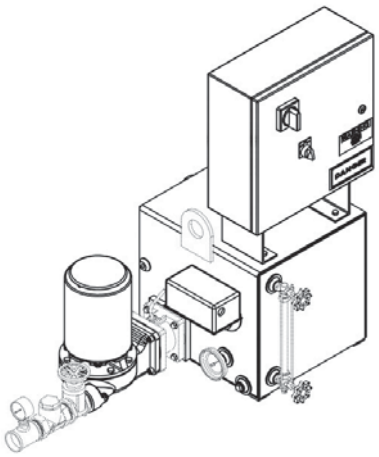
G DUPLEX • 30 Gallon Receiver
4100 • Steel Receiver
4300 • Stainless Steel Receiver

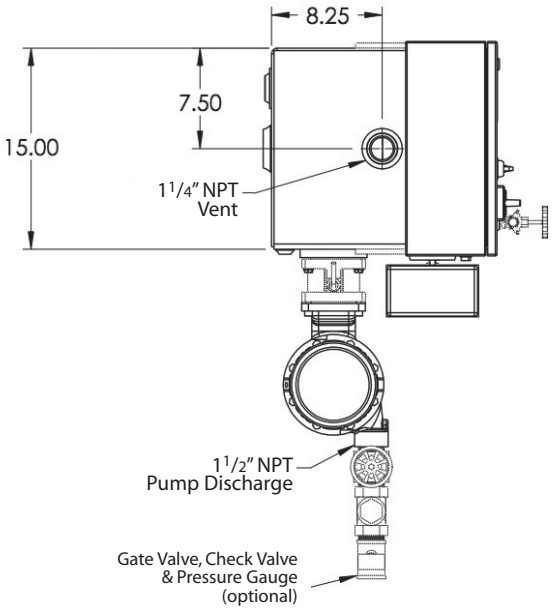


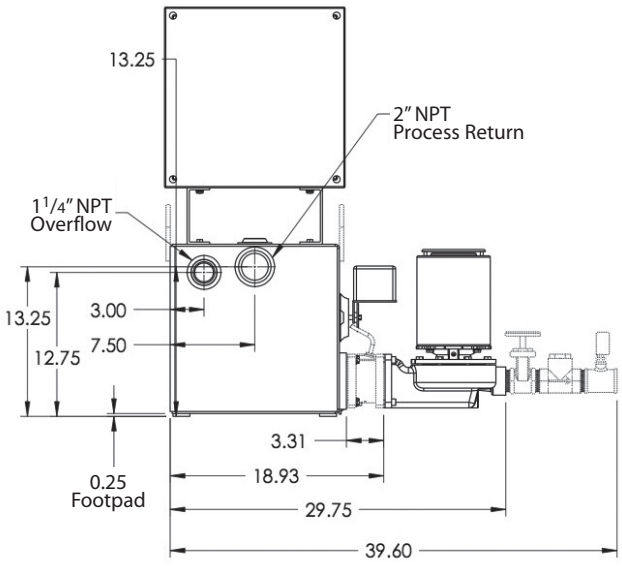




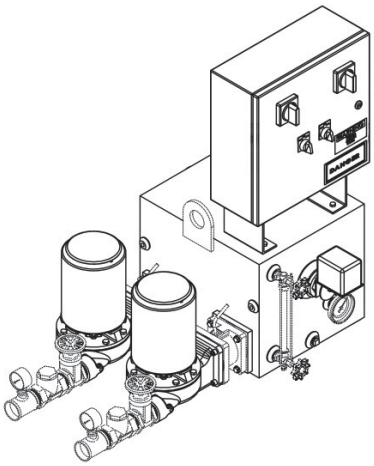
J SIMPLEX • 15 Gallon Receiver
4100 • Steel Receiver
4300 • Stainless Steel Receiver

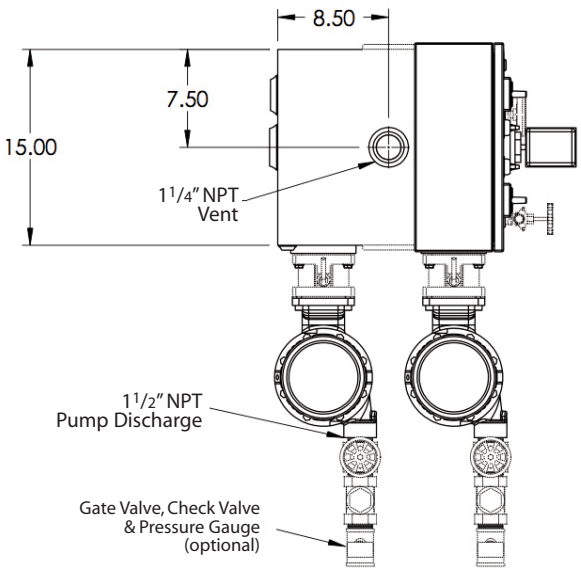


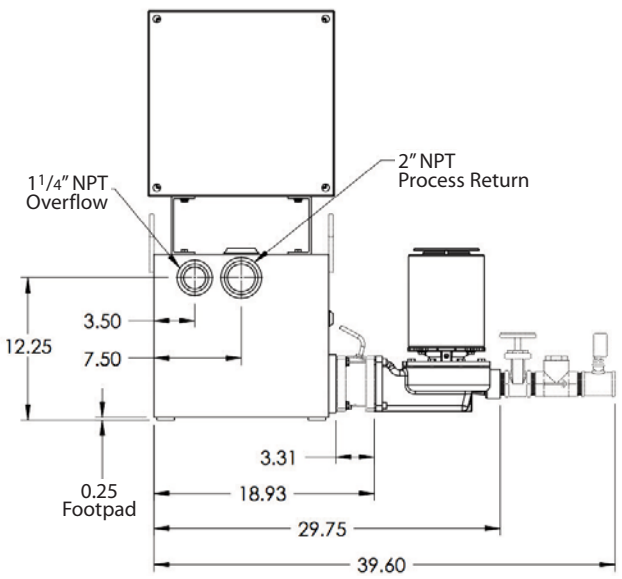




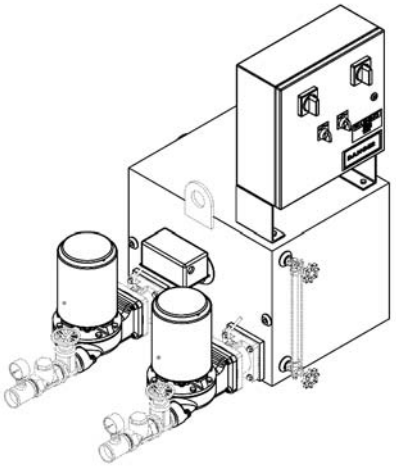
J DUPLEX • 15 Gallon Receiver
4100 • Steel Receiver
4300 • Stainless Steel Receiver

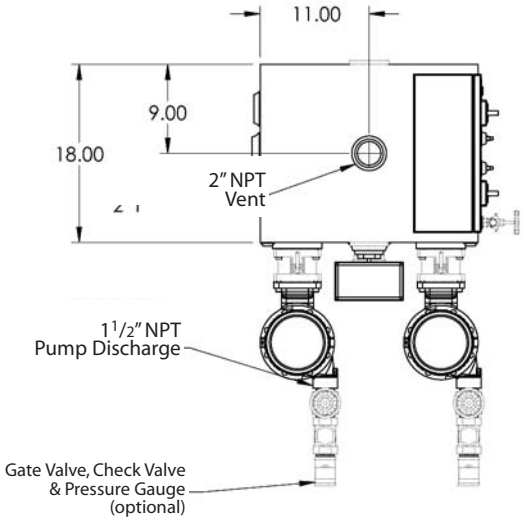


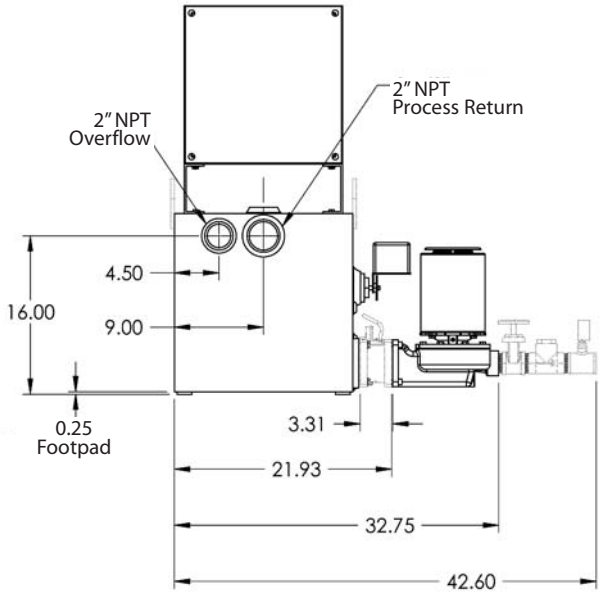




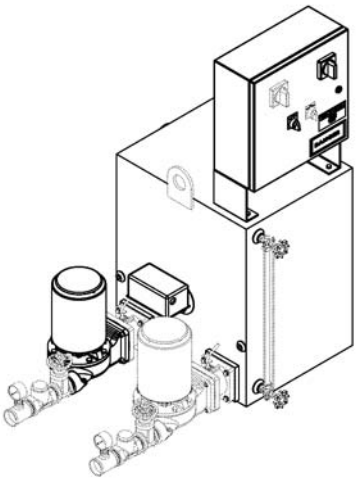
J SIMPLEX & DUPLEX • 30 Gallon Receiver
4100 • Steel Receiver
4300 • Stainless Steel Receiver

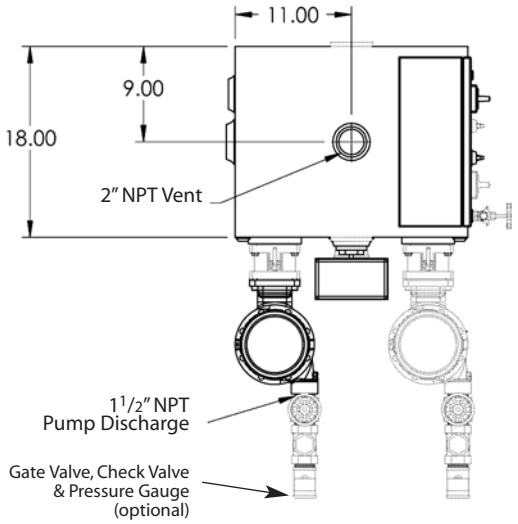


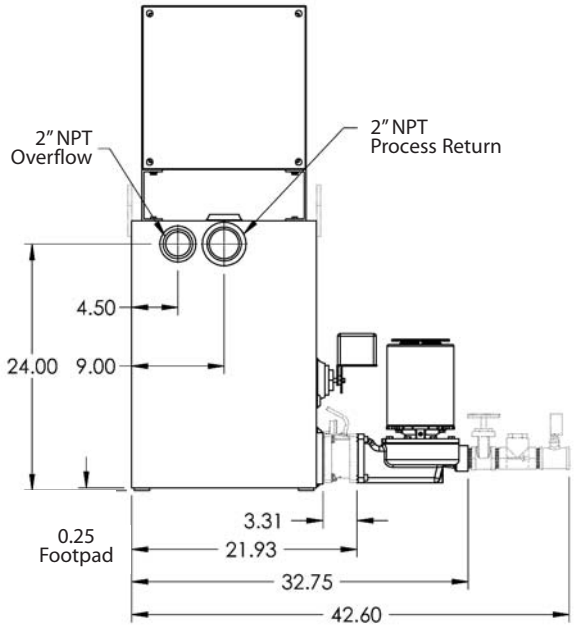




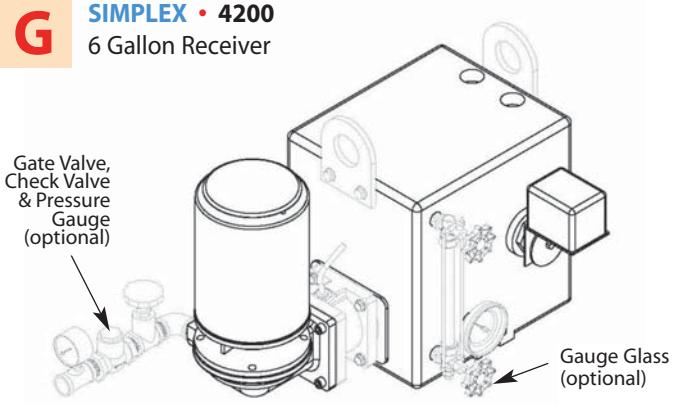
J SIMPLEX & DUPLEX • 45 Gallon Receiver
4100 • Steel Receiver
4300 • Stainless Steel Receiver

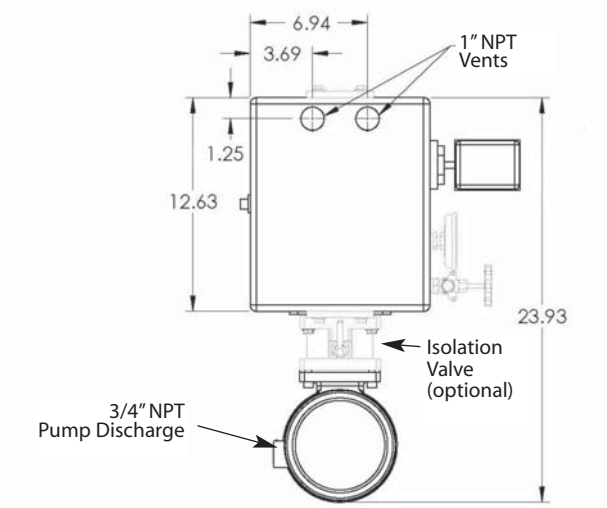


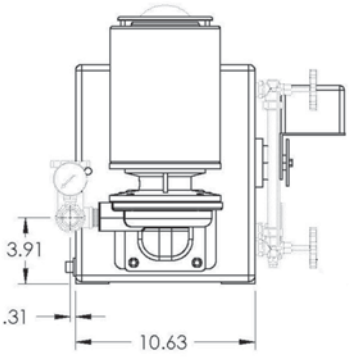


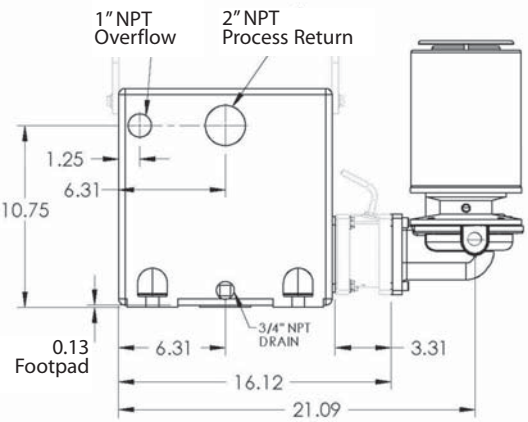


G SIMPLEX • 4200
6 Gallon Receiver

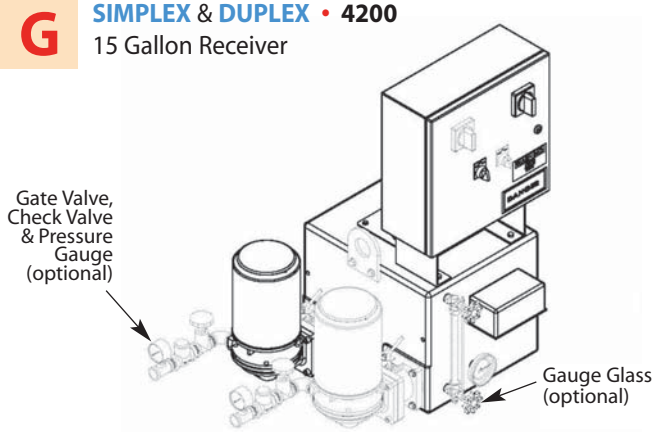


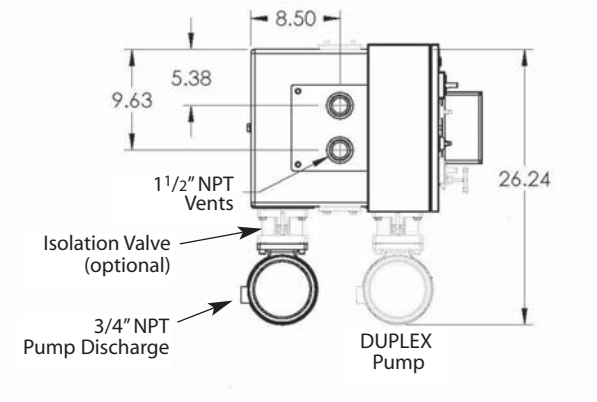


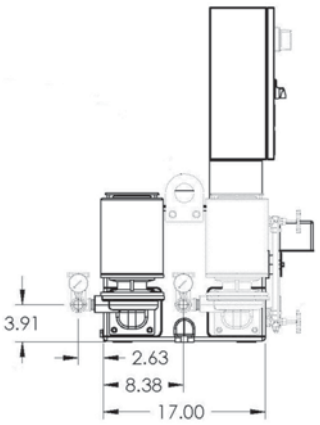


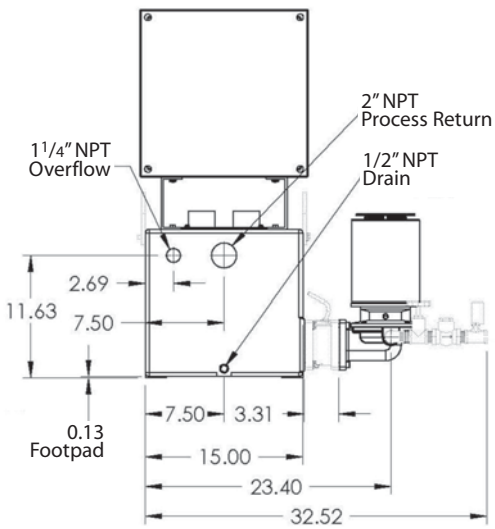


G SIMPLEX & DUPLEX • 4200
15 Gallon Receiver

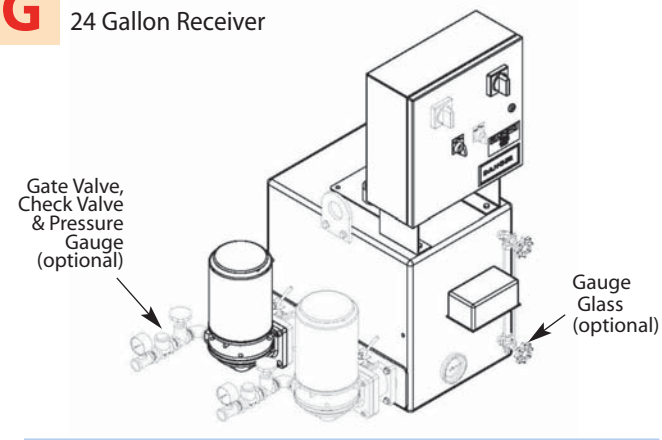


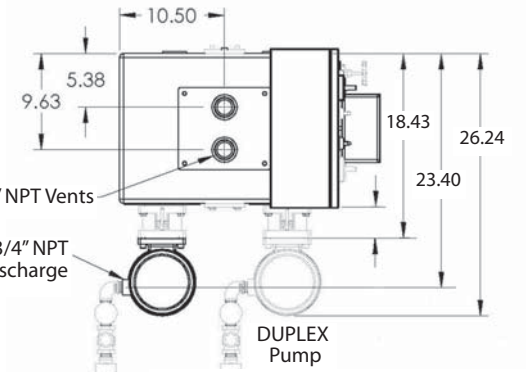


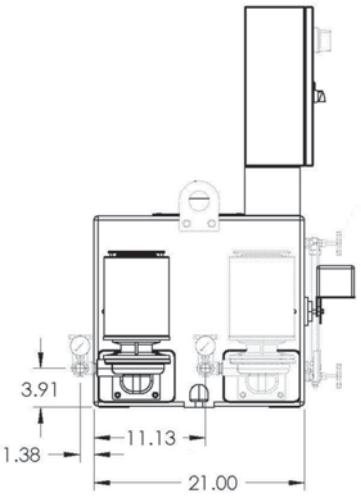


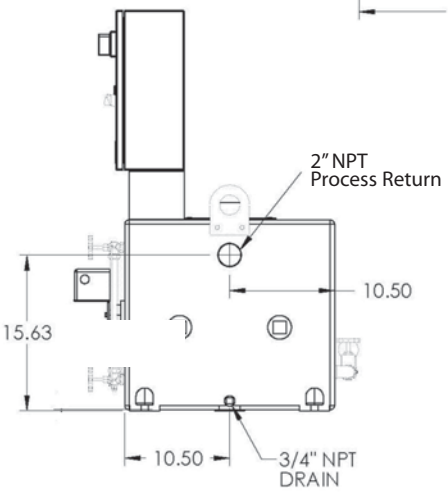


G SIMPLEX & DUPLEX • 4200
24 Gallon Receiver

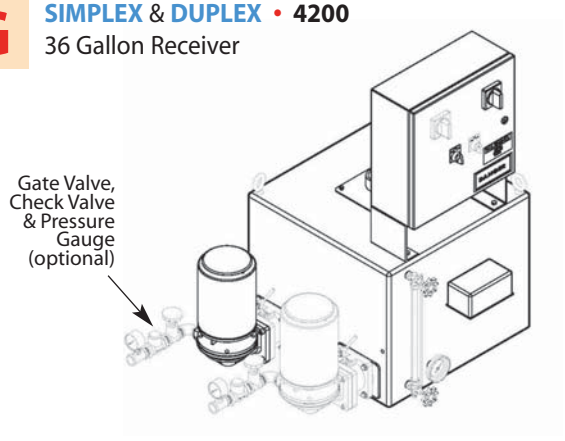


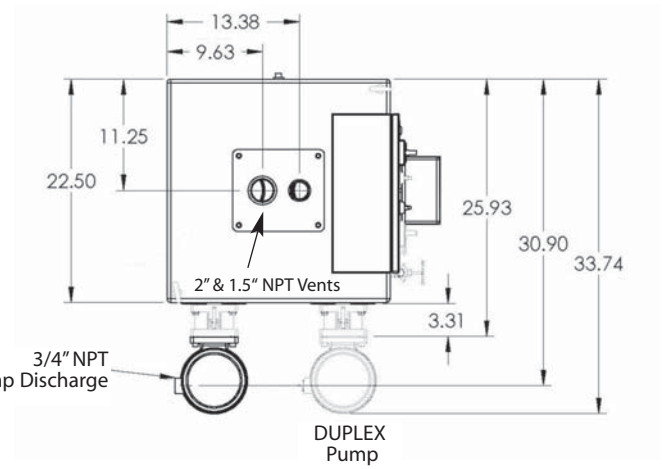


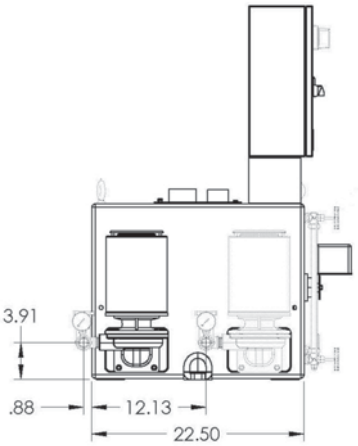


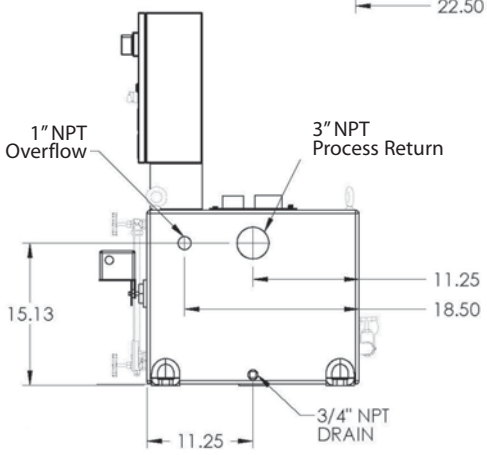


G SIMPLEX & DUPLEX • 4200
36 Gallon Receiver



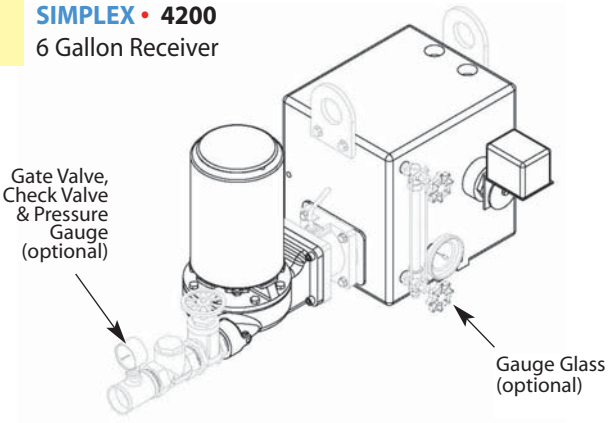


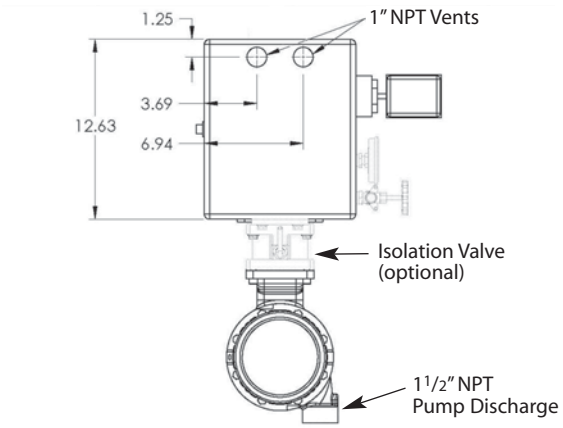


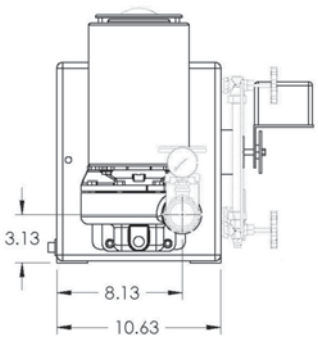


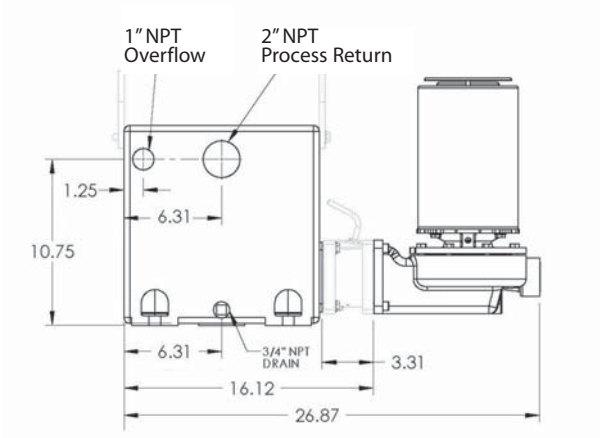
ELECTRIC PUMPS

J SIMPLEX • 4200
6 Gallon Receiver

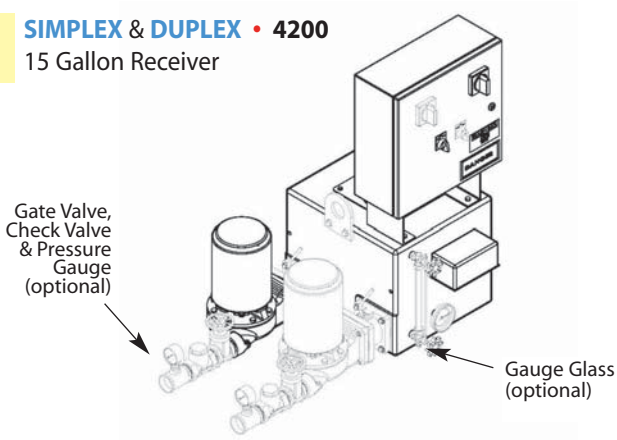


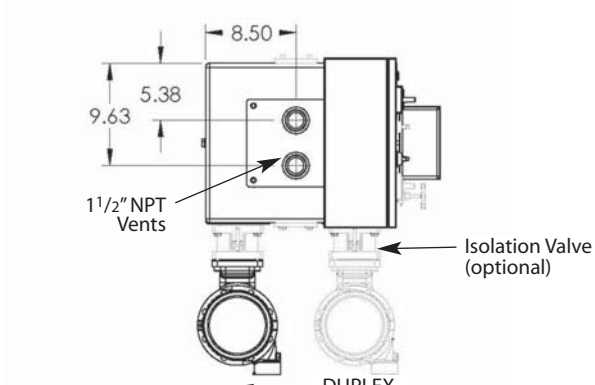


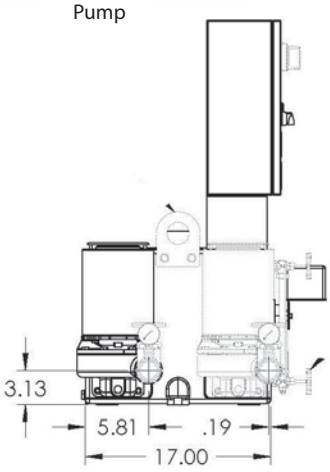


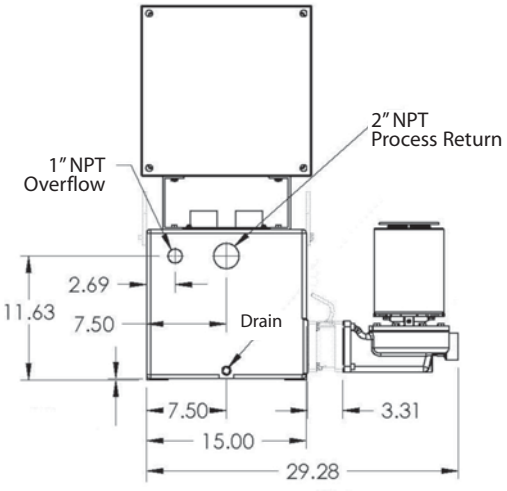


J SIMPLEX & DUPLEX • 4200
15 Gallon Receiver

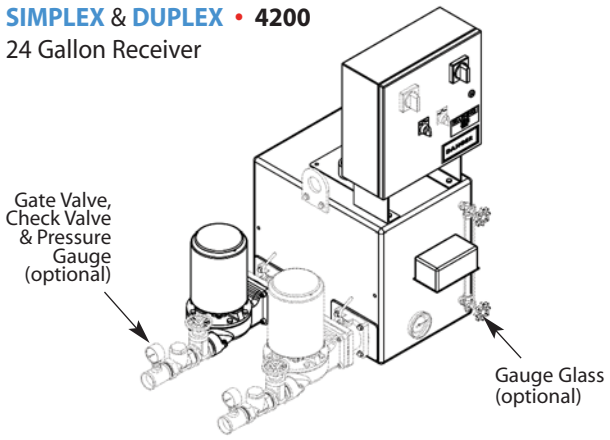


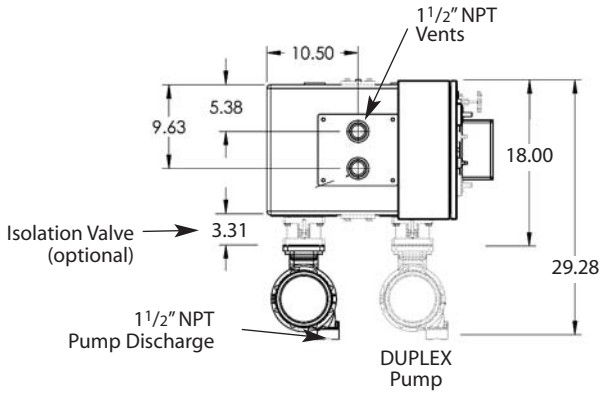


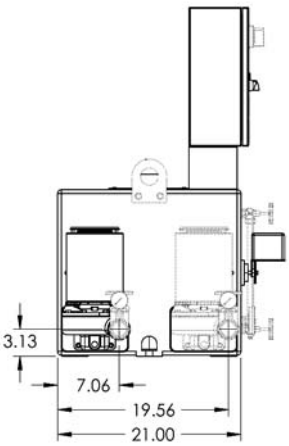


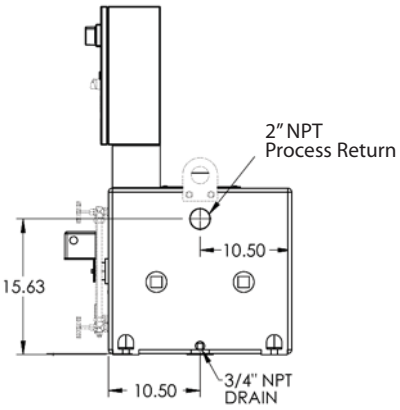


J SIMPLEX & DUPLEX • 4200
24 Gallon Receiver









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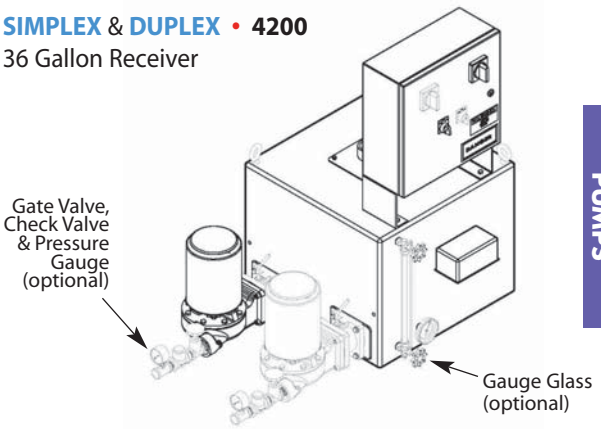
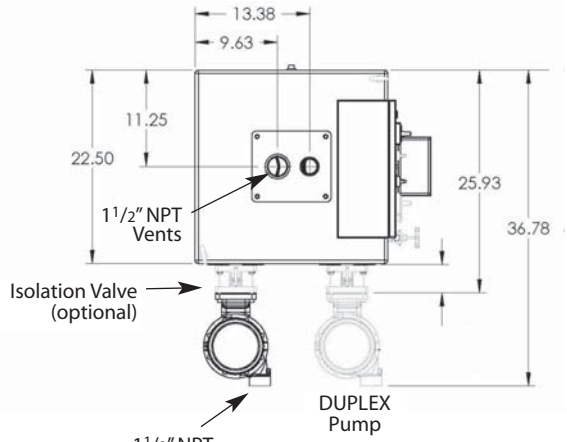
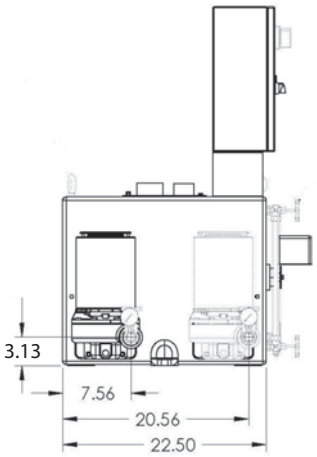
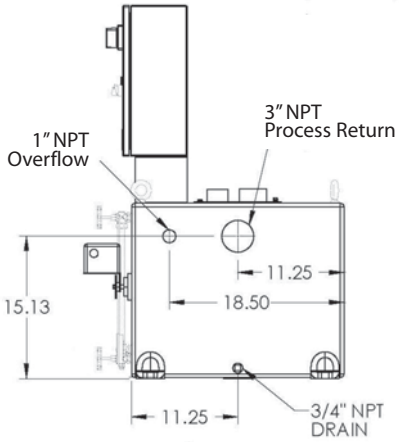
36 Gallon Receiver



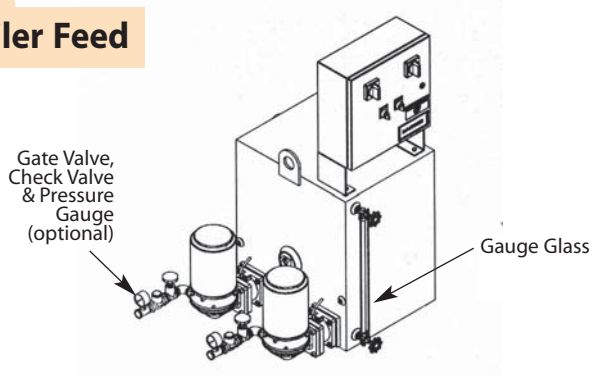


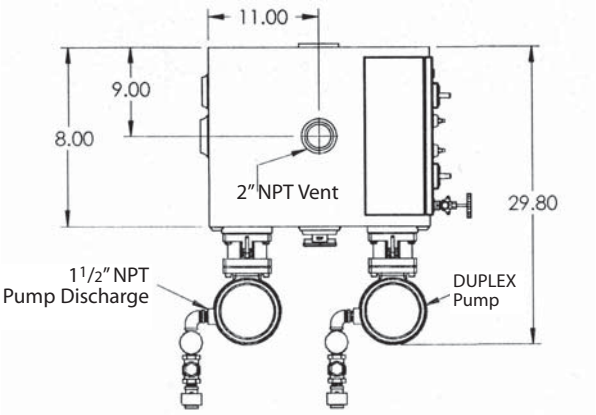


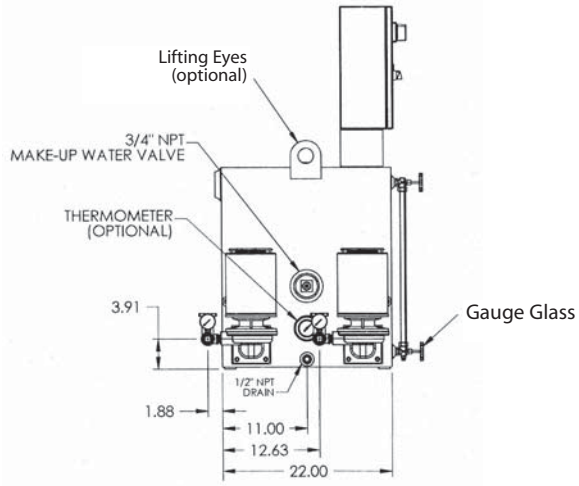


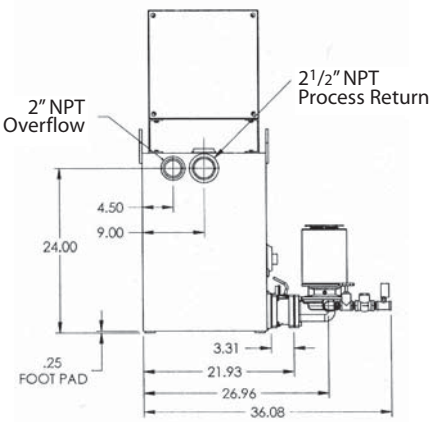
G SIMPLEX & DUPLEX • 4100/4300
45 Gallon Receiver

Boiler Feed



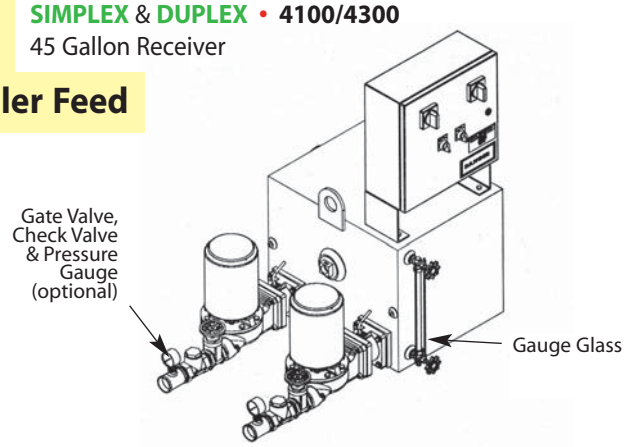


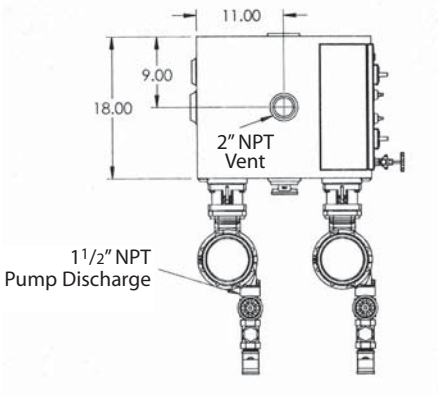


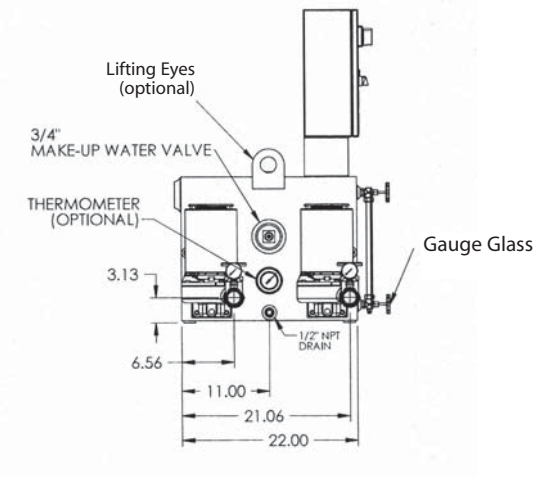


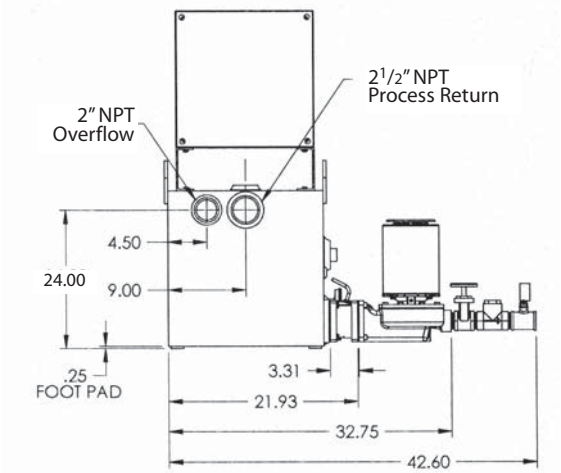
J SIMPLEX & DUPLEX • 4100/4300
45 Gallon Receiver

Boiler Feed



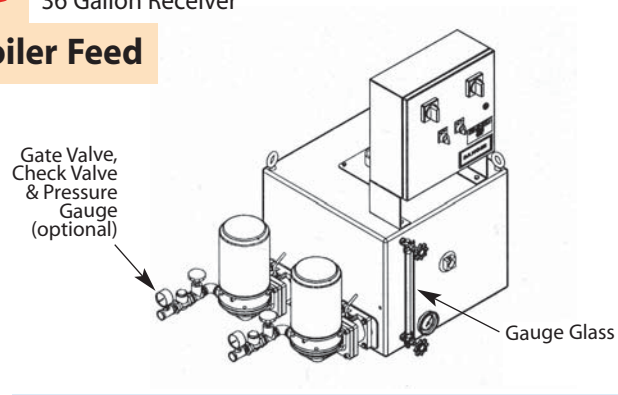


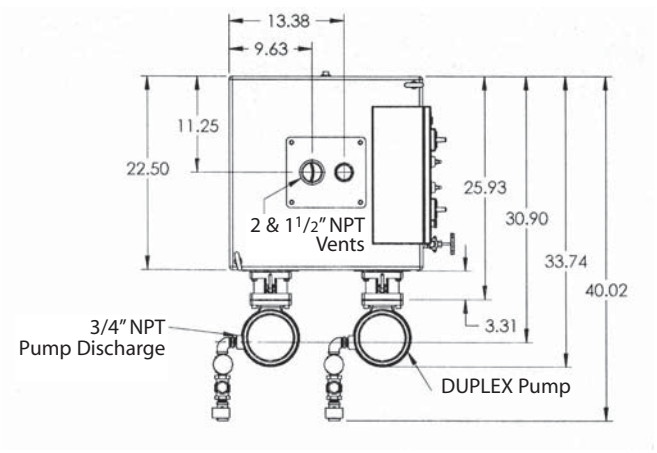


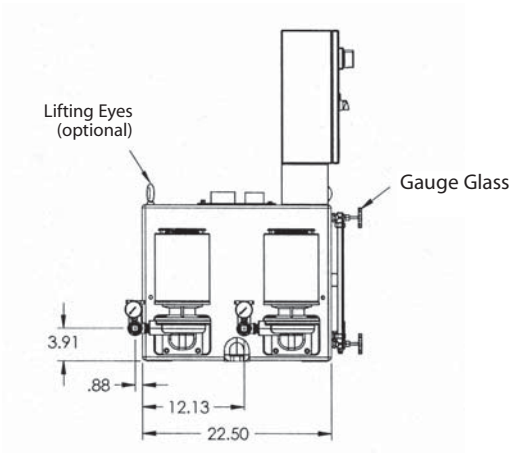


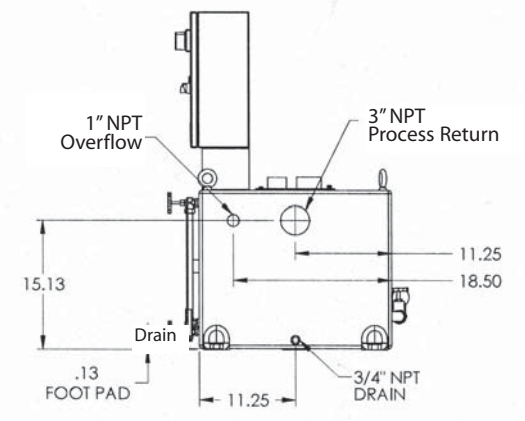
G SIMPLEX & DUPLEX • 4100/4300
36 Gallon Receiver

Boiler Feed









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50 Gallon Receiver

Boiler Feed