Condensate Pumps

Watson McDaniel

Condensate Return System

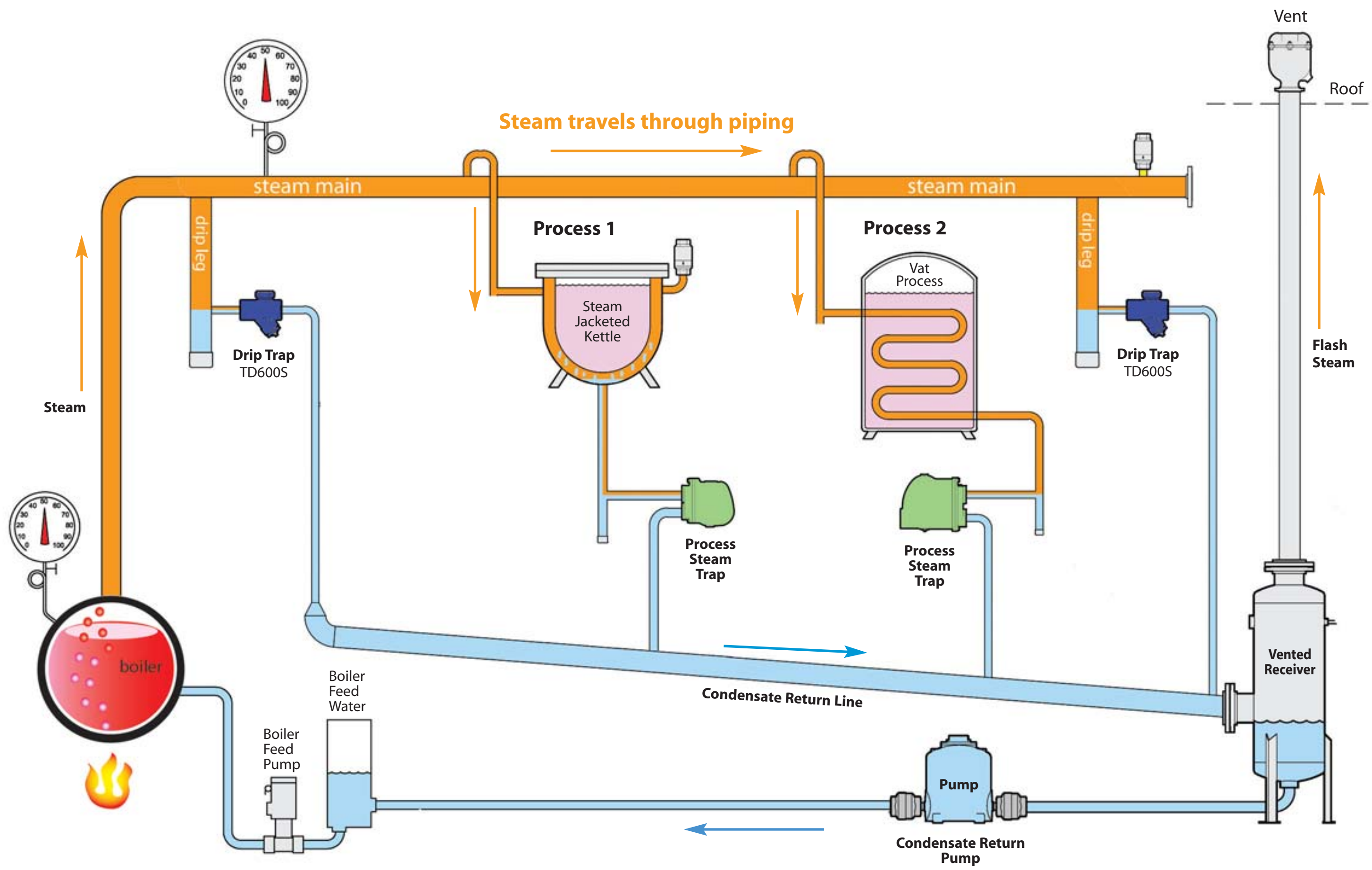
Shown below is a simplified view of a steam system from steam generation to condensate return. Steam generated by the boiler travels through the steam distribution lines supplying steam to various pieces of process equipment. The steam flowing to this equipment is separated from the condensate return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

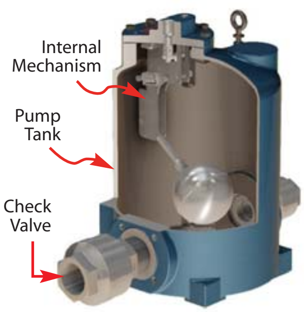
What is the purpose of a Vented Receiver?

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.

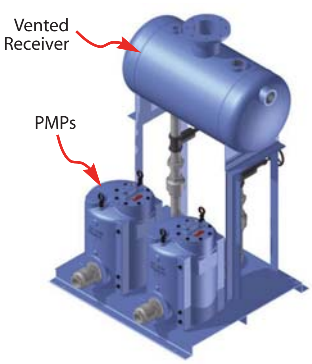
Mechanical & Electric Condensate Return Pumps

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.

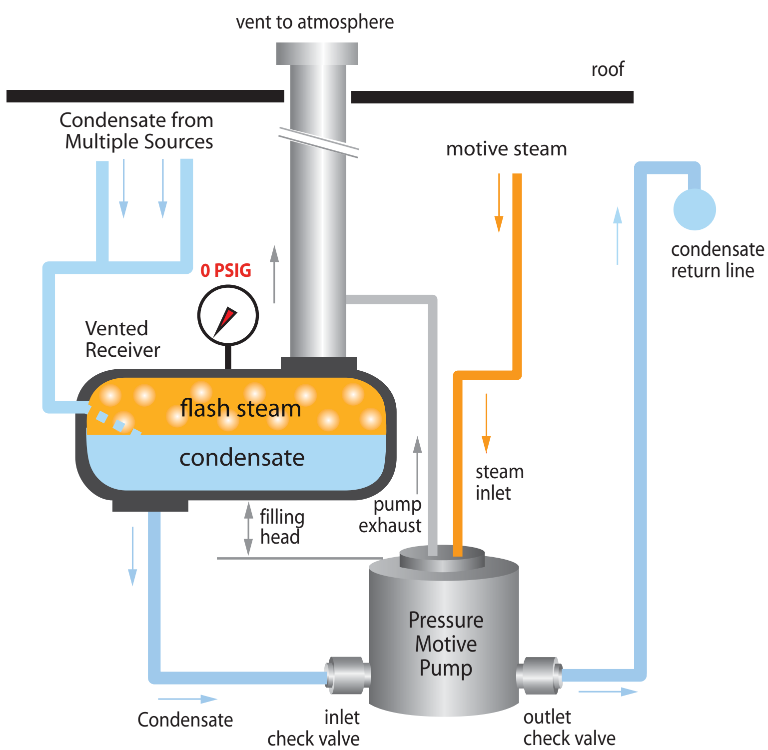
PMPs discharge high temperature condensate that drains from vented receivers. A **stand-alone PMP** pump tank cannot be used as the vented receiver since it is intermittently pressurized with steam or air to pump the condensate. PMPs require a separate vented receiver to collect the condensate and to 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.



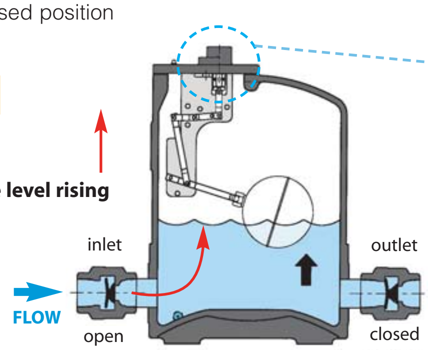
Operation of PMP Pressure Motive Pump

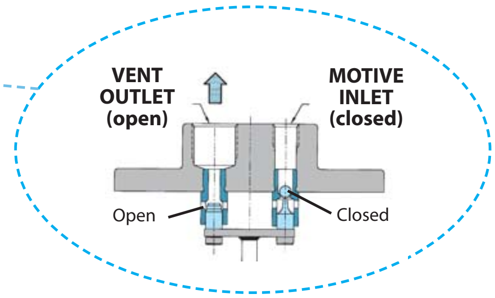
Vent Outlet: Open position, allowing any pressure in the pump tank to vent out and water to freely enter pump by gravity.

Motive Inlet: Closed position

Pump Filling

Condensate level rising





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.

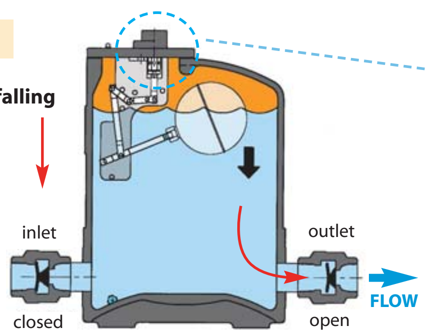
When the pump tank reaches its fill point the vent valve closes and the motive valve opens. The incoming steam pressure rapidly forces the water out of the pump tank through the outlet check valve. When the pump tank empties, the vent valve opens and motive inlet valve closes.

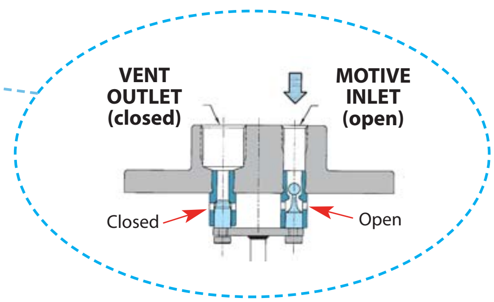
Vent Outlet: Closed

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

Pump Discharging

Condensate level falling





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.

Check Valves

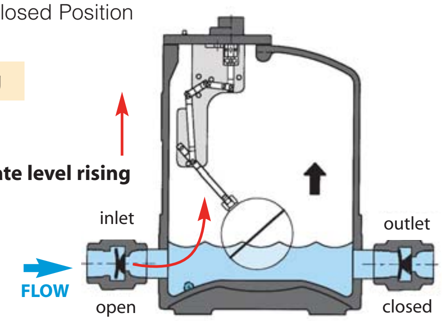
The inlet check valve on the PMP system must have a very low cracking pressure (opening pressure) so that the liquid will freely enter the pump tank. The proper check valve is very critical to the proper operation of the PMP system. Watson McDaniel recommends using spring-loaded stainless steel check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

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

Condensate level rising

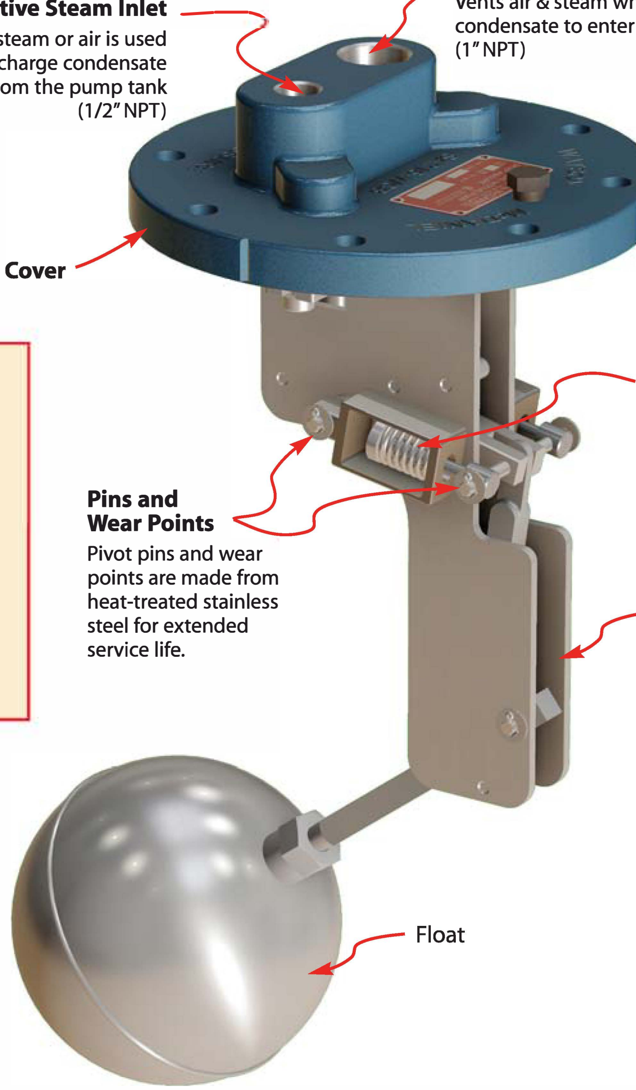


3 At the lower trip point, the mechanism triggers and the motive gas inlet valve to the pump tank closes and simultaneously the vent valve opens. The fill and discharge cycle then repeats.

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

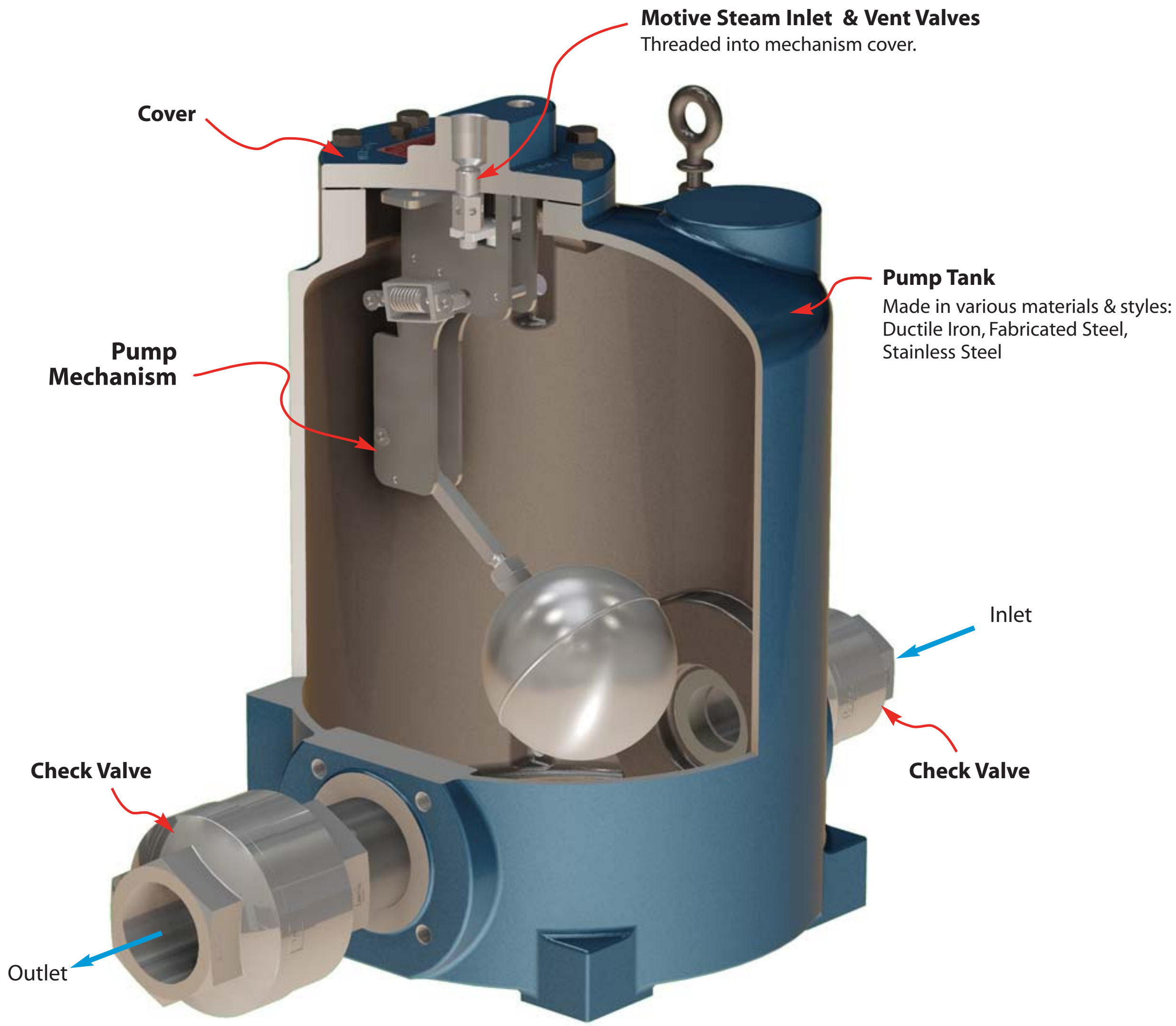
Snap-Assure
U.S. Patent No. 6572340

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.


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

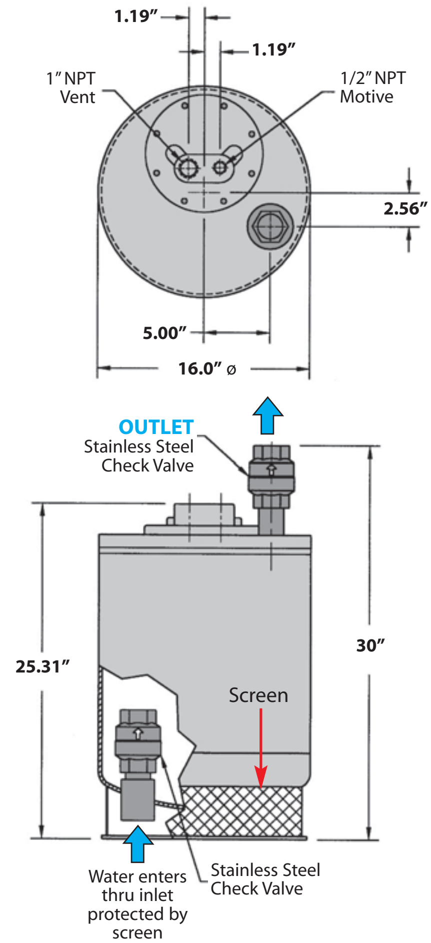
The **PMPSP** Sump Drainer uses the same internal mechanism as the standard PMP models. The piping configuration is such that the liquid is discharged vertically out the top as opposed to horizontally out the side. This allows the unit to be easily positioned inside of a sump area. Condensate or water 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

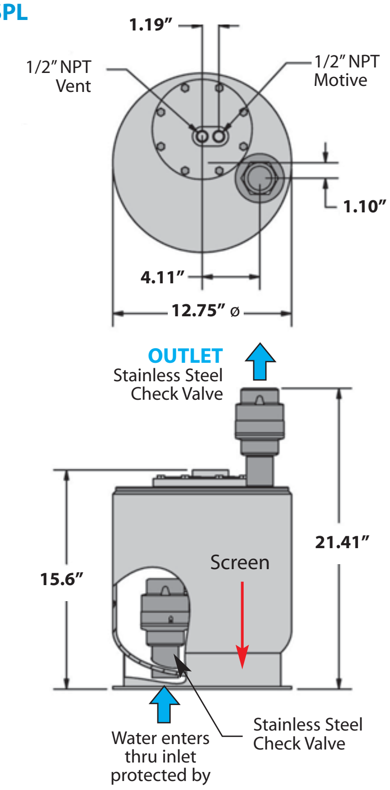
- Equipped with our **Patented "Snap-Assure"** Mechanism which **extends the useful life of the pump**
- Mechanism incorporates **heat-treated stainless steel wear items** for ultimate corrosion resistance
- Dual compression springs made from Inconel-X-750 for high-temperature corrosive service
- Operates 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



Pump & Trap Combinations

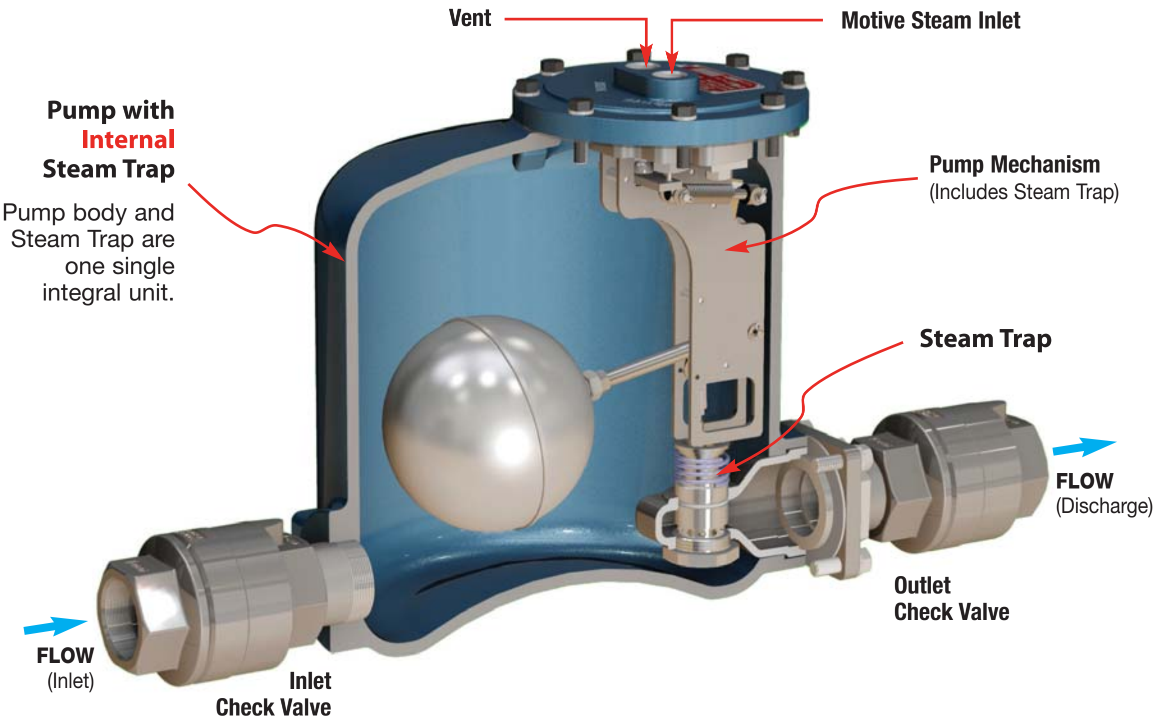
PMPT & WPT

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.

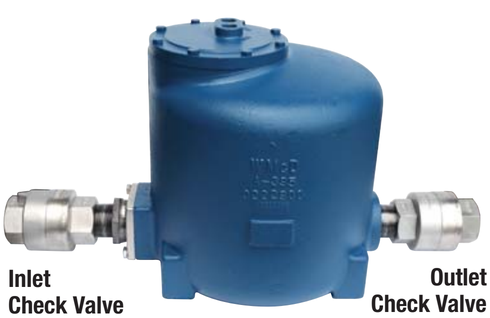
What is a Pump-Trap used for?

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.



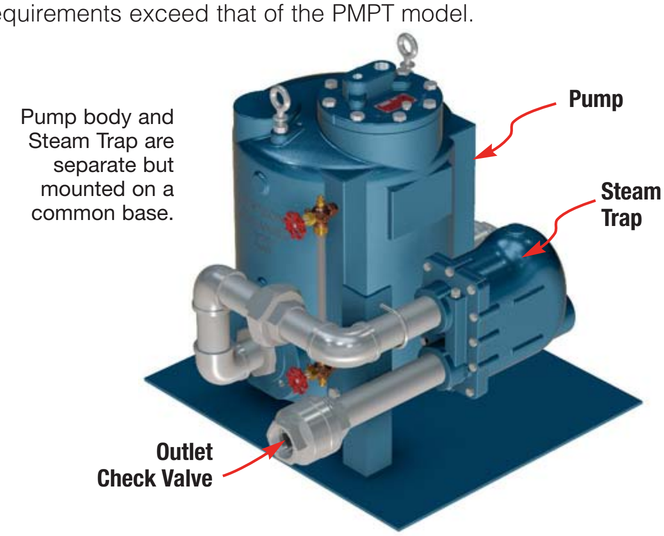
Pump with Internal Steam Trap (PMPT)

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.



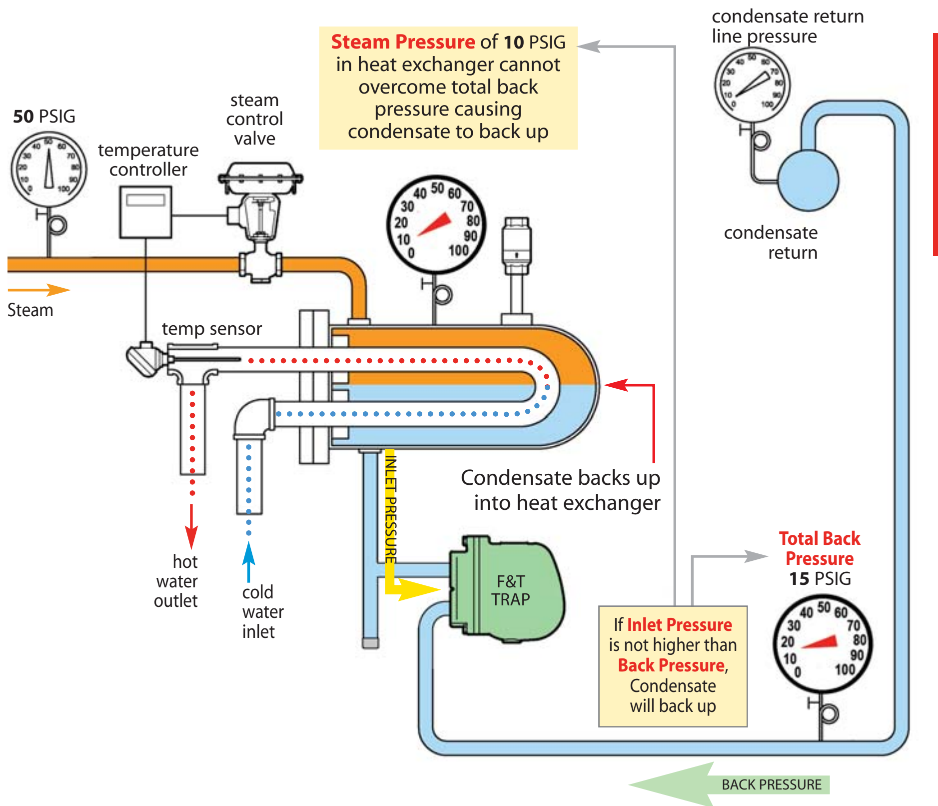
Why use a Pump-Trap?

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

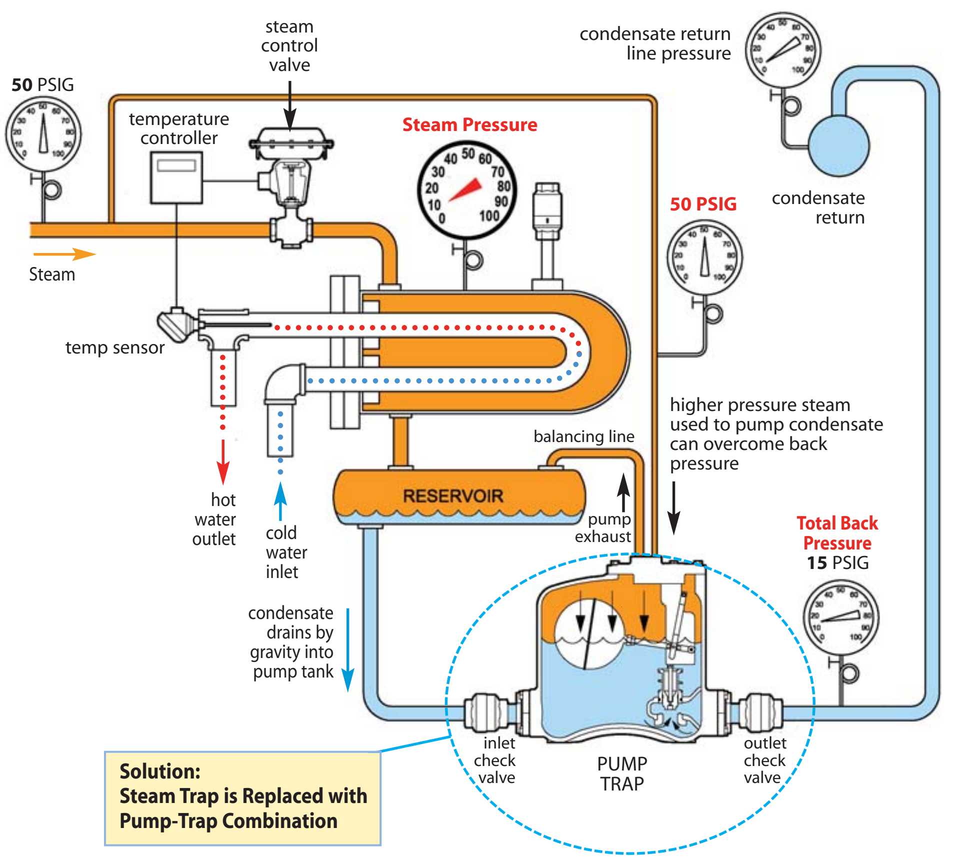


Solution:

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.

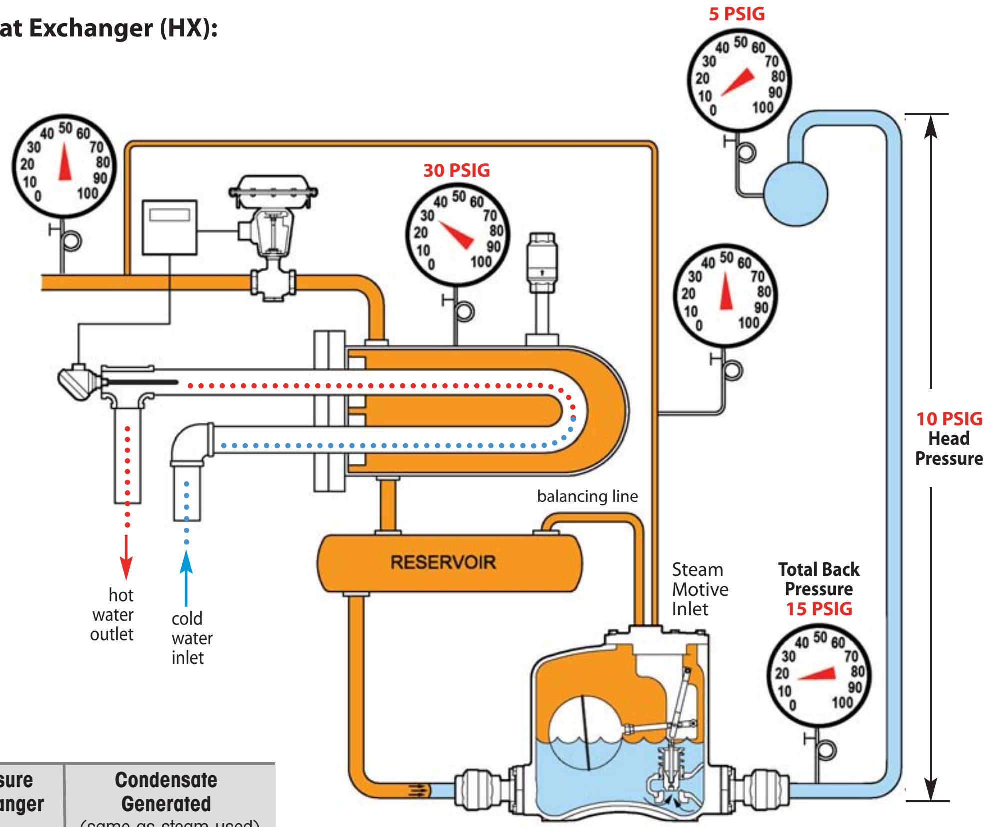
Heat Exchanger System with Pumping Trap



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).

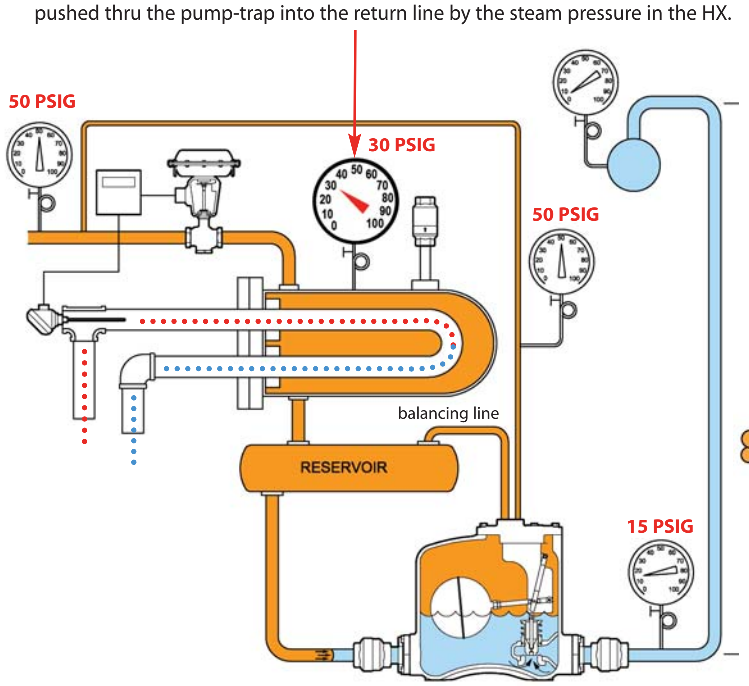


Steam Pressure vs. Hot Water Required

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	

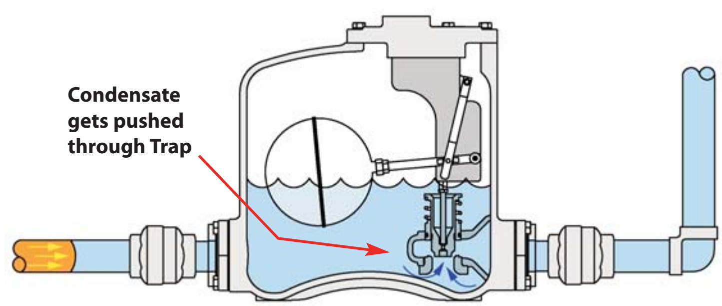
TRAP Mode

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

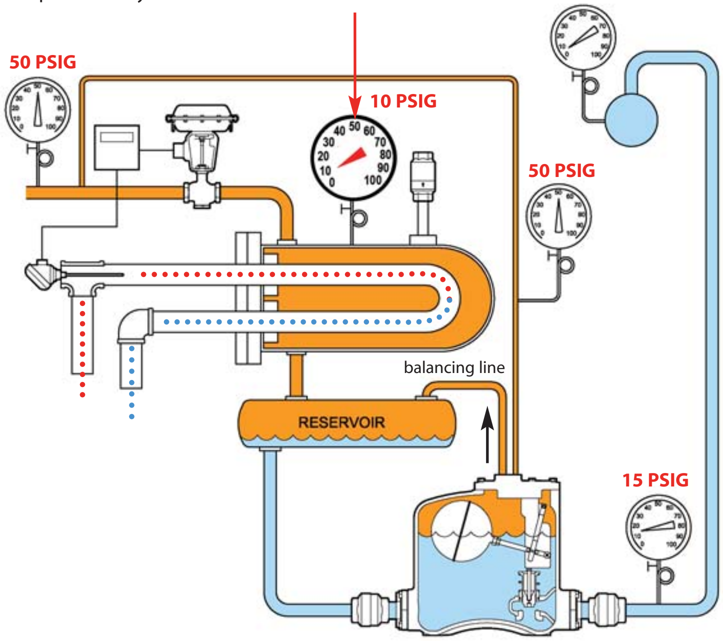


1 TRAPPING Mode: Inlet steam pressure is higher than back pressure. Steam pushes condensate through Pump-Trap.

How a Pump-Trap Works

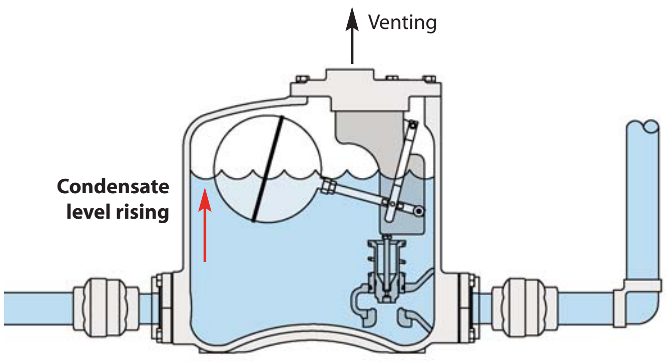
PUMP Mode

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.



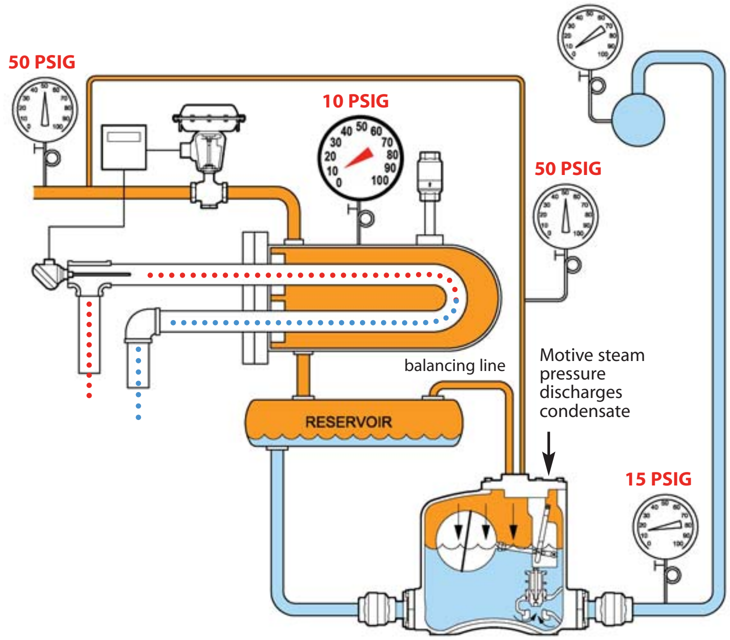
Vent Outlet: Open position, allowing pressure in the pump tank to equal pressure in the heat exchanger, allowing condensate to freely enter Pump-Trap by gravity.

Motive Inlet: Closed position



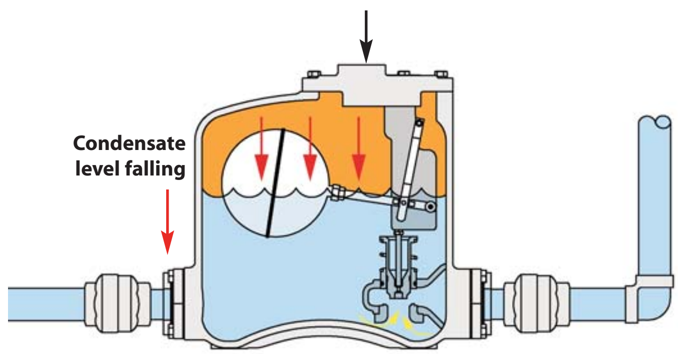
2 PUMP TANK FILLS: Inlet steam pressure falls below back pressure. Steam can no longer push the condensate through the Steam Trap.

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	366°F	366°F
PMA Max. Allowable Pressure	150 PSIG @ 450˚F	150 PSIG @ 450˚F

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.

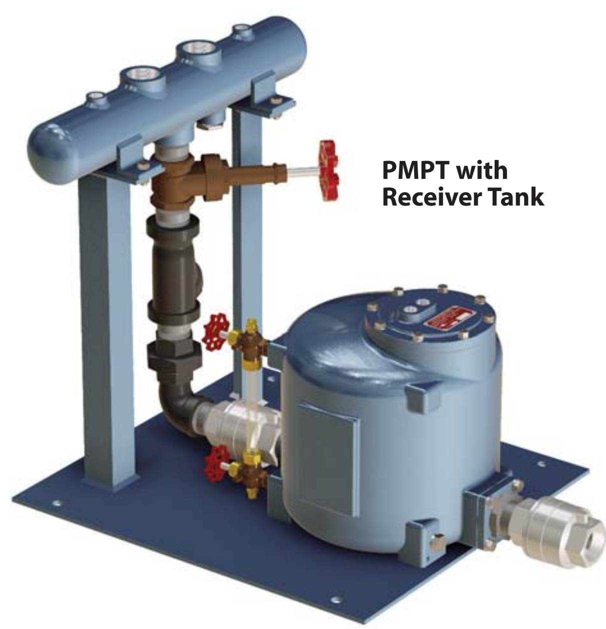
Pump-Traps facilitate condensate discharge under all operating conditions, including vacuum.

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.

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

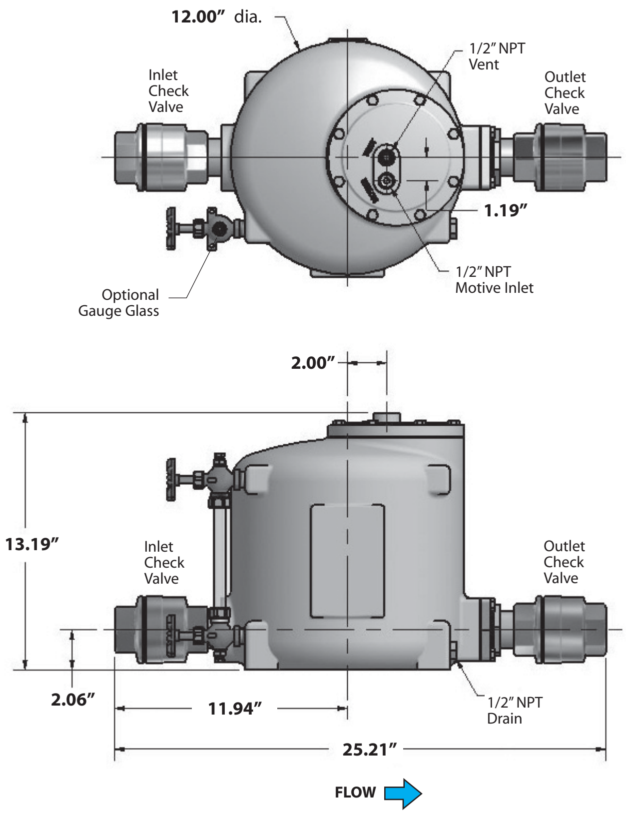
NOTE: Reservoir - Pump-Trap Combination may require a reservoir above the pump to collect condensate generated in the heat exchanger during the discharge cycle of the pump. Consult Reservoir Sizing Guidelines or contact factory for additional information.



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

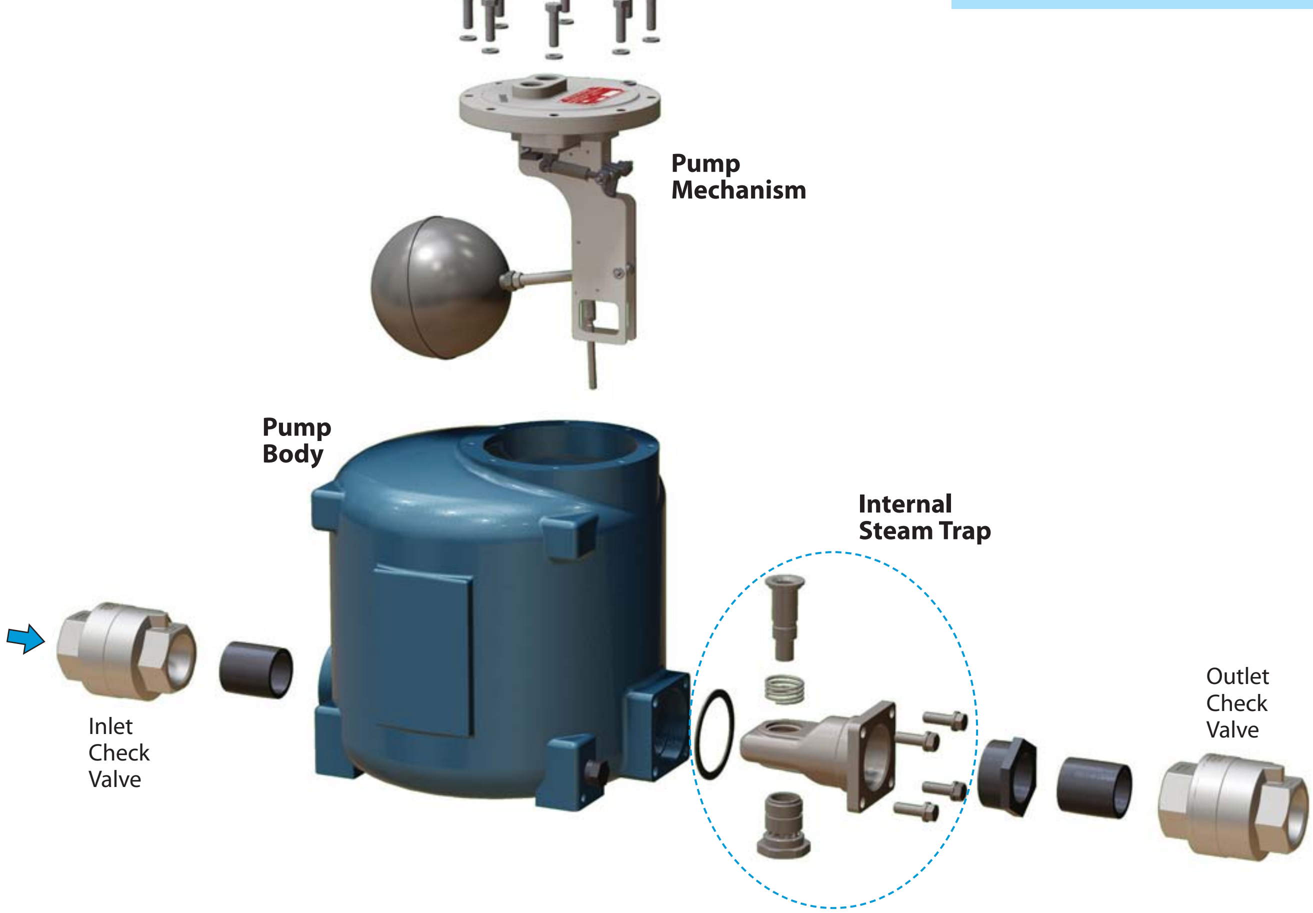


MATERIALS	
Body PMPT	**Ductile Iron SA-395**
Body PMPTS	**Stainless Steel CF3M**
Cover	Stainless Steel CF8
Cover Gasket	Garlock
Cover Bolts	Steel
Inlet Valve	Hardened Stainless Steel 40 Rc
Vent Valve	Hardened Stainless Steel 40 Rc
Ball Float	300 Stainless Steel
Check Valves	Stainless Steel 316SS CF3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



Sizing & Selection

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.

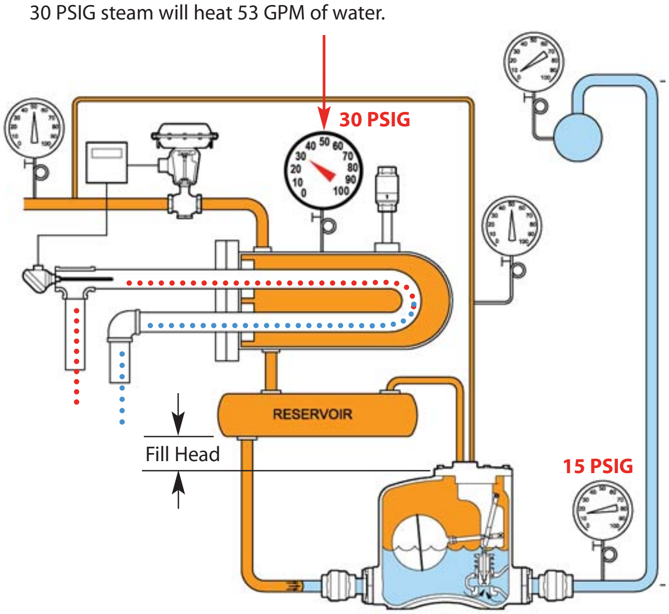
Heat Exchanger (HX) using Steam to heat Hot Water

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

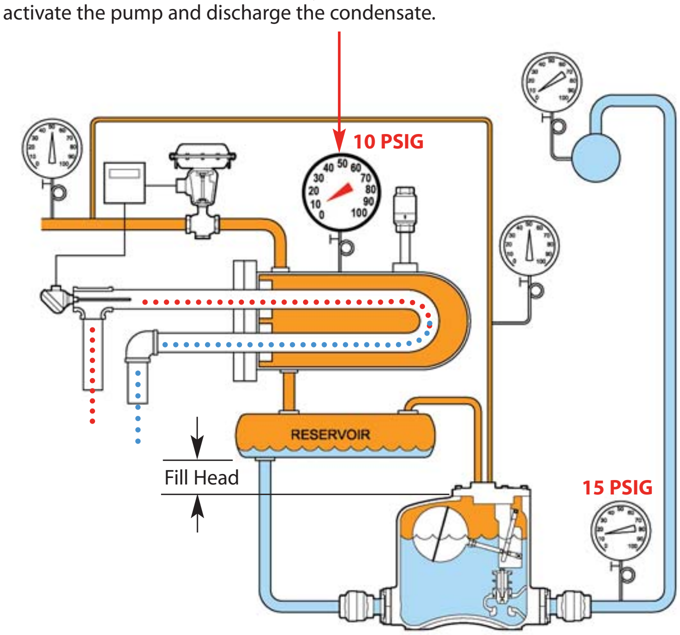
The system is operating with **30 PSIG** inlet pressure to the heat exchanger. The Pump-Trap unit functions like a standard float operated trap. Condensate is pushed thru into the return line by the steam pressure in the HX. Based on this particular size HX, 30 PSIG steam will heat 53 GPM of water.



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.



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**