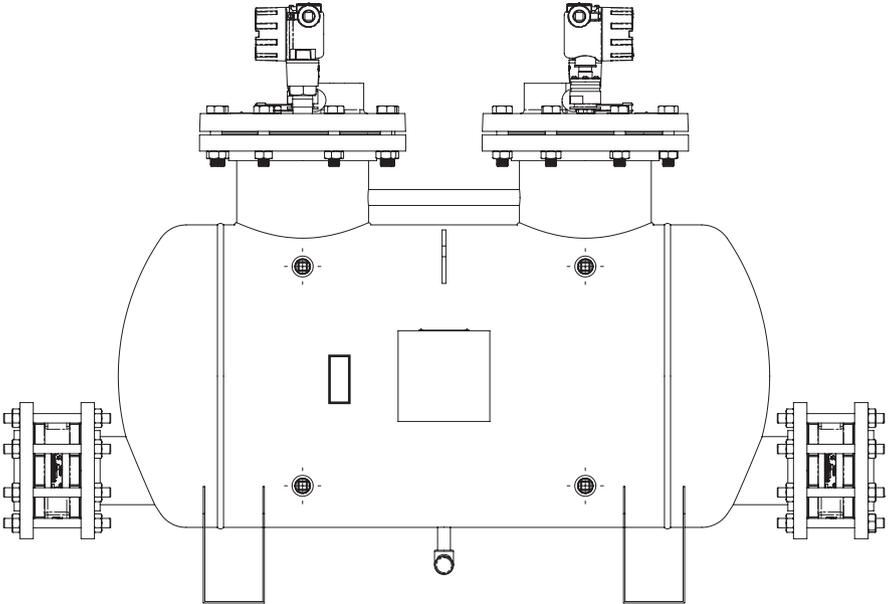




The Pivotrol® Pump (Patented)
PTF4 - Dual Mechanism - Pressure Powered Pump
Featuring Reliable PowerPivot® Technology
Installation and Maintenance Instructions

Operating Pressure Range 30 to 200 psi g (2 to 13.8 bar g)



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1. Safety information

Safe operation of these products can be guaranteed only if they are properly installed, commissioned, used and maintained by qualified personnel (see point 11 on this document) in compliance with the operating instructions. General installation and safety instructions for pipeline and plant construction, as well as the proper use of tools and safety equipment, must also be complied with.

1.1. Intended use

- I) Referring to the Installation and Maintenance Instructions, Nameplate and Technical Information Sheet, check that the product is suitable for the intended use/ application.
- II) Check material suitability, pressure and temperature and their maximum and minimum values. If the maximum operating limits of the product are lower than those of the system in which it is being fitted, or if malfunction of the product could result in a dangerous overpressure or over-temperature occurrence, ensure a safety device is included in the system to prevent such over-limit situations.
- III) Determine the correct installation situation and direction of fluid flow.
- IV) Spirax Sarco products are not intended to withstand external stresses, including pipe stresses, which may be induced by any system to which they are fitted. It is the responsibility of the installer to consider these stresses and take adequate precautions to minimise them.
- V) Remove protective covers from all connections before installation.

1.2. Access

Ensure safe access and if necessary a safe working platform (suitably guarded) before attempting to work on the product. Arrange suitable lifting gear if required

1.3. Lighting

Ensure adequate lighting, particularly where detailed or intricate work is required.

1.4. Hazardous liquids or gases in the pipeline

Consider what is in the pipeline or what may have been in the pipe-line at some previous time. Consider; flammable materials, sub-stances hazardous to health, extremes of temperature.

1.5. Hazardous environment around the product

Consider; explosion risk areas, lack of oxygen (e.g. tanks, pits), dangerous gases, extremes of temperature, hot surfaces, fire hazard (e.g. during welding), excessive noise, moving machinery.

1.6. The system

Consider the effect on the complete system of the work proposed. Will any proposed action (e.g. closing isolation valves, electrical isolation) put any other part of the system or any personnel at risk? Dangers might include isolation of vents or protective devices or the rendering ineffective of controls or alarms. Ensure isolation valves are turned on and off in a gradual way to avoid system shocks.

1.7. Pressure systems

Ensure that any pressure is isolated and safely vented to atmospheric pressure. Consider double isolation (double block and bleed) and the locking or labelling of closed valves. Do not assume that the system has depressurised even when the pressure gauge indicates zero.

1.8. Temperature

Allow time for temperature to normalise after isolation to avoid danger of burns.

1.9. Tools and consumables

Before starting work ensure that you have suitable tools and/or consumables available. Use only genuine Spirax Sarco replacement parts.

1.10. Protective clothing

Consider whether you and/or others in the vicinity require any protective clothing to protect against the hazards of, for example, chemicals, high/low temperature, radiation, noise, falling objects, and dangers to eyes and face.

1.11. Permits to work

All work must be carried out or be supervised by a suitably competent person. Installation and operating personnel should be trained in the correct use of the product according to the Installation and Maintenance Instructions.

Where a formal 'permit to work' system is in force it must be complied with. Where there is no such system, it is recommended that a responsible person should know what work is going on and, where necessary, arrange to have an assistant whose primary responsibility is safety.

Post 'warning notices' if necessary.

1.12. Handling

Manual handling of large and/or heavy products may present a risk of injury. Lifting, pushing, pulling, carrying or supporting a load by bodily force can cause injury particularly to the back. You are advised to assess the risks taking into account the task, the individual, the load and the working environment and use the appropriate handling method depending on the circumstances of the work being done.

1.13. Residual hazards

In normal use the external surface of the product may be very hot. If used at the maximum permitted operating conditions the surface temperature of some products may reach temperatures in excess of 450°F. Many products are not self-draining. Take due care when dismantling or removing the product from an installation (refer to "Maintenance Instructions").

1.14. Freezing

Provision must be made to protect products which are not self draining against frost damage in environments where they may be exposed to temperatures below the freezing point.

1.15. Disposal

Unless otherwise stated in the Installation and Maintenance Instructions, this product is recyclable and no ecological hazard is anticipated with its disposal providing due care is taken.

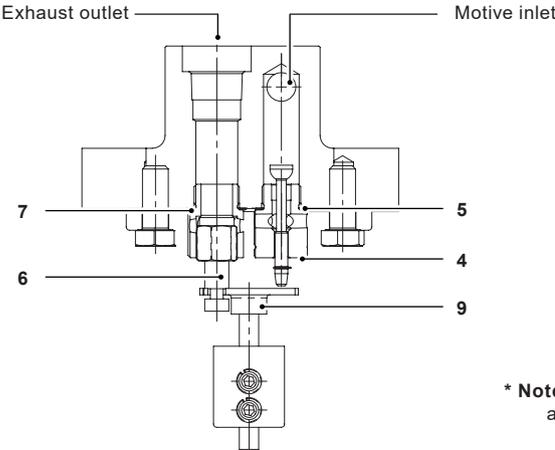
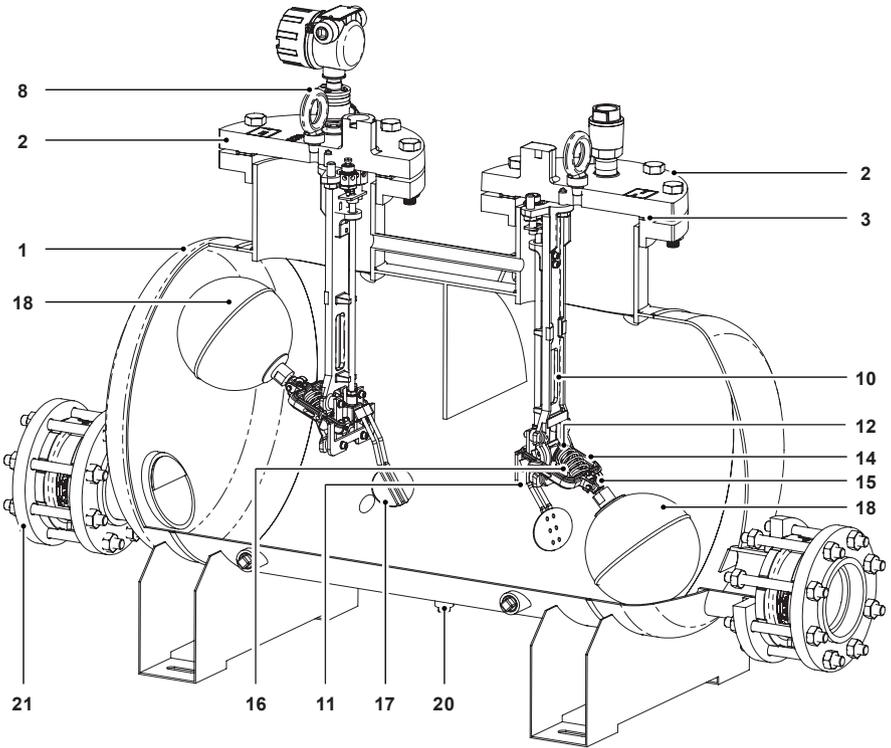
1.16. Returning Products

Customers and stockists are advised that under EC Health, Safety and Environment Law, when returning products to Spirax Sarco they must provide information on any hazards and the precautions to be taken due to contamination residues or mechanical damage which may present a health, safety or environmental risk. This information must be provided in writing including Health and Safety data sheets relating to any substances identified as hazardous or potentially hazardous.

2. How The Pivotrol Pump® Operates

1. In the normal position before start up the float (18) is at its lowest position with the steam inlet valve (4) is closed, the exhaust valve (6) is open.
2. When liquid flows, by gravity, through the inlet check valve (21) in to the pump body, the float (18) will become buoyant and rise.
3. As the float (18) continues to rise the float arm assembly (14) is engaged which increases the compression in the spring (13). When the float (18) has risen to its upper tripping position the energy in the spring is released instantaneously causing the float arm assembly (14) to snap upwards over center moving the push rod (9) upwards to simultaneously open the steam inlet valve (4) and close the exhaust valve (6).
4. Steam will now flow through the steam inlet valve (4) and develop a pressure within the body forcing the liquid out through the discharge check valve (21). The inlet check valve (21) will be closed during the discharge cycle.
5. As the liquid level in the pump body lowers so does the float's (18) position. Before the float (18) reaches its lowest position the float arm assembly (14) is engaged increasing the compression in the spring (13). When the float (18) is at its lower tripping position in the body the energy in the spring (13) is released instantaneously causing the float arm assembly (14) to snap over center downward moving the push rod (9) down causing the steam inlet valve (4) to close and exhaust valve (6) to open simultaneously.
6. Liquid will again flow through the inlet check valve (21) to fill the pump body and the cycle will be repeated.

Operating Pressure Range 30 to 200 psi g (2 to 13.8 bar g)



* **Note:** Pressure gauges may be fitted into any of the top gauge glass connectors

3. Installation - vented systems

Recommended installation of Pivotrol® Pump when fitted with a reservoir or vented receiver. In an "open" system flash steam must be vented or condensed ahead of pump inlet.

Application details will dictate which of the following options will be necessary to accomplish this.

Caution

Installation, maintenance and troubleshooting should be performed by qualified service personnel only.

Before installation or maintenance is performed on the pump and associated piping system; ensure all condensate, steam, air or gas lines are isolated, relieved of internal pressure, and hot parts have cooled to prevent risk of burns and any other possible personal injury.

Before breaking any connections on the pump or piping system every effort should be made to ensure all internal pressure has been relieved and the motive supply line is shut off to prevent inadvertent discharge of the pump.

When breaking any connection, piping/bolts should be removed slowly so that if the line is under any internal pressure, this fact will be apparent before completely removing the pipe or component.

Always relieve pressure before breaking any joint.

It is highly recommended by Spirax Sarco that an adequately sized overflow is fitted to all condensate receivers.

This should be considered best practice and overflows should only be excluded from installations in exceptional circumstances.

Discharge from both overflows and vent pipes MUST be piped to a safe location, such that there is no risk to personnel.

In the event of pump or system malfunction or over-load, very hot condensate may be discharged from the overflow, or the vent pipe, or both.

Where the vent pipe is not piped to a pit, or similar safe location, the use of a vent head to reduce the chance of entrained hot condensate spraying out of the vent is recommended.

Overview Connection

Overflow piping must be used on a vented system.

Over-flow connections are required to ensure that in the event of pump or system malfunction, condensate will run in a controlled manner, from the condensate receiver to a safe location, such as a drain (subject to temperature and local regulations) or to an alternative safe location.

The overflow piping must be a 'U' bend water seal which has a 12" minimum depth.

Once primed on start-up the water seal is self-filling and should be piped to a suitable drain.

The addition of the overflow provides a safety mechanism ensuring the pressure within the receiver does not increase. The overflow is also a tool to diagnose system problems.

In the event of the overflow spilling fluid the operator is immediately made aware of a system problem.

This could include failed traps feeding the package failed pump and changes in system loads and overloaded receiver.

Pump or system malfunction which could cause the receiver to over-flow, can occur for many reasons.

These including, loss of motive steam due to blockage or incorrect operation, mechanical failure of the pump mechanism or associated check valves, blockage of the condensate inlet strainer or closure of the pumped return line and system shutdowns.

Over-flows will normally be a minimum of 1½" (DN40) in diameter, but may need to be larger for high capacity units such as packaged PTF4, or where the length of over flow pipe run, between receiver and discharge point, is more than 2 meters (6 ft.).

A general "rule of thumb" (based on a 2 m (6 ft.) pipe run and a head of 0.6 m (2 ft.).

Condensate loads from zero to 5000 l/hr. (zero to 11000 lb. /hr.) use 1½" Condensate loads from 5000 l/hr.to 10000 l/hr. (11000 to 22000 lb. /hr.) use 2" Condensate loads from 10000 to 18000 l/hr. (22000 to 39600 lb. /hr.) use 3"

Normally over-flow connections will be fitted with a "loop seal" arrangement or a suitably sized float trap, to prevent steam escaping via the over-flow connection.

Vent to atmosphere. Vent to be piped to a safe location such that there is no risk to personnel. Vent head recommended if vent not piped to a pit or similar location.

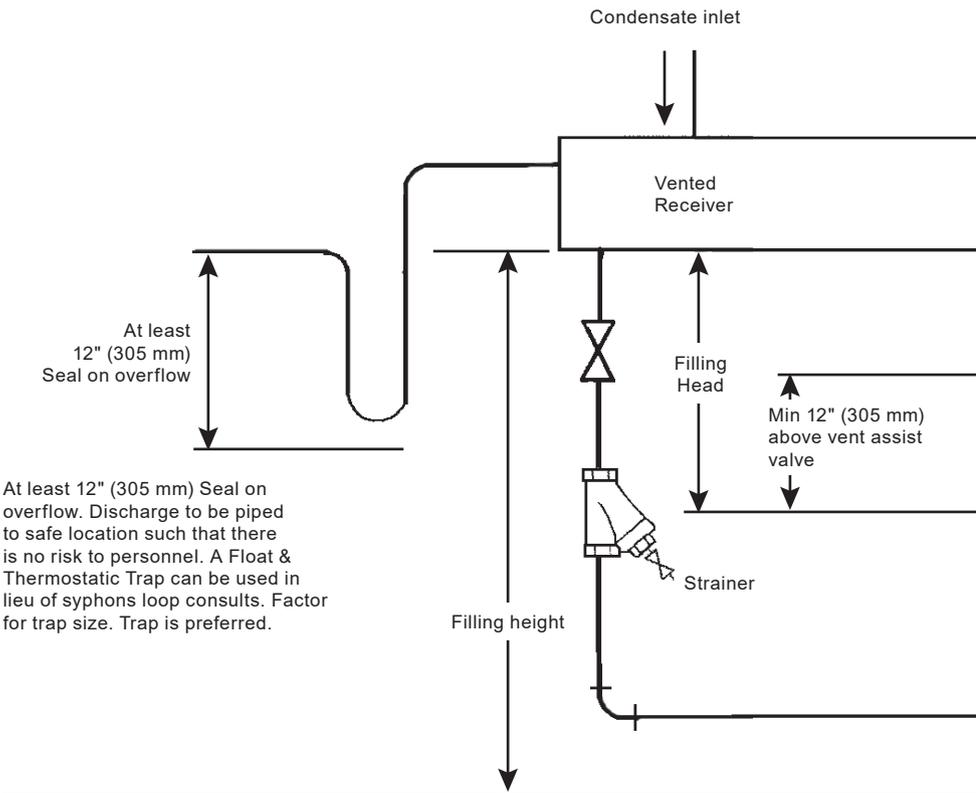
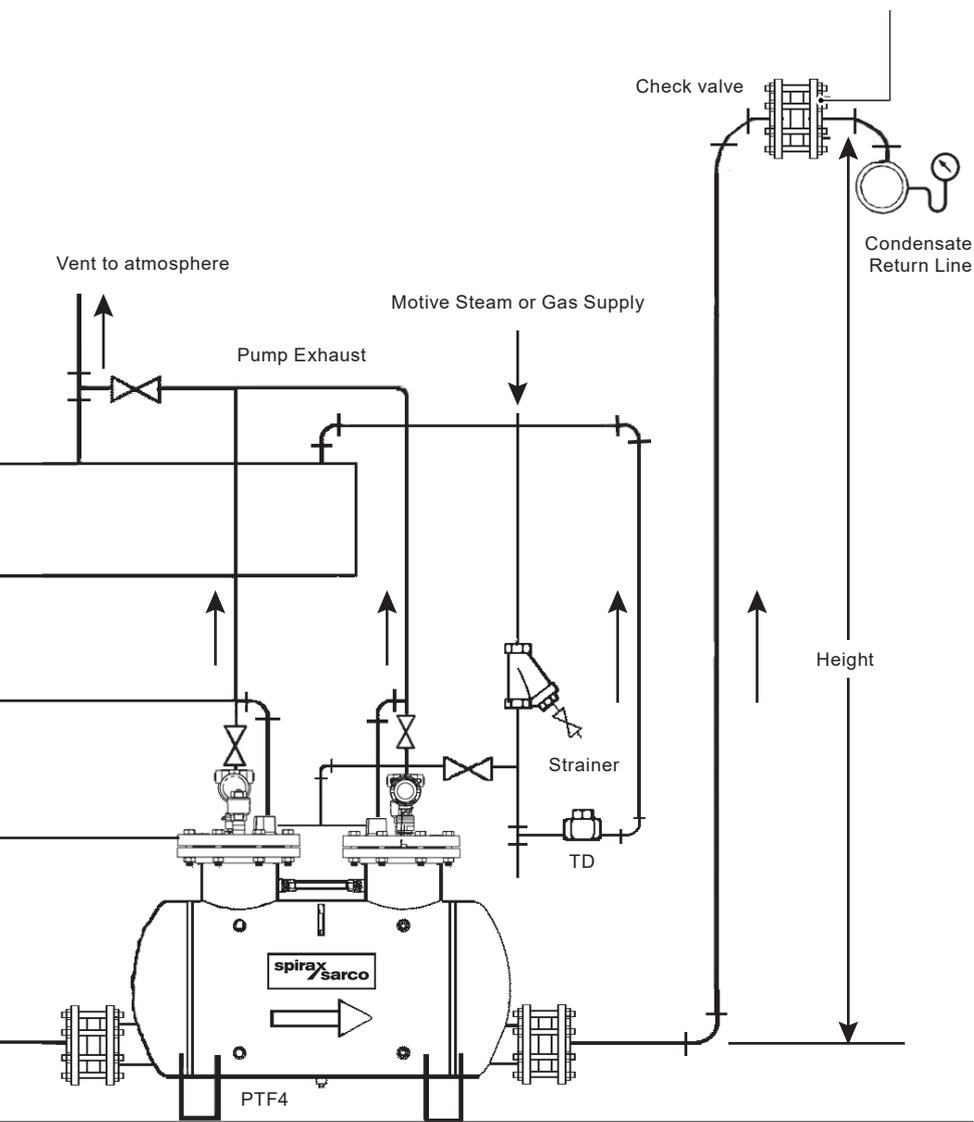


Fig. 2 Vented Pump System

Check valve to help reduce likelihood of backflow and waterhammer.



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4. Vented Receivers

To drain condensate from single or multiple sources in an "open" system, a vented receiver should be installed in a horizontal plane ahead of the pump. Sufficient volume is needed above the filling head level to accept the condensate reaching the receiver during the pump discharge stroke. More importantly, the receiver must be sized to allow sufficient area for complete flash steam separation from the condensate. The chart below shows proper vented receiver sizing (per criteria set forth in the A.S.H.R.A.E. Handbook) based on the amount of flash steam present. By sizing the receiver as shown below, there will be sufficient volume for condensate storage and sufficient area for flash steam separation. The receiver can be a length of large diameter pipe or a tank.

A receiver overflow piping should be installed as shown in Fig. 2 and piped to a suitable drain. The piping must form a loop type water seal at least 12" deep immediately after the receiver.

1. Install the pump physically below the receiver to be drained with the exhaust connection vertically upwards. Pump should be installed with the recommended filling head (the vertical distance between the top of the pump and the bottom of the receiver) as shown in Fig. 2. For other filling head variations, see the capacity table on TI-P207-12-US.
2. To prevent equipment flooding during the pump discharge stroke, a vented receiver should be installed in a horizontal plane ahead of the pump as shown in Figure 2. For proper receiver sizing, refer to table 1. All inlet line fittings must be fully ported.

Table 1

Pump Size - PTF4			
Flash Steam Up to	Receiver		Vent Line Diameter
	Diameter	Length	
1000 lb/hr	16"	60"	6"
2000 lb/hr	20"	60"	8"
3000 lb/hr	24"	60"	8"
4000 lb/hr	26"	60"	10"
5000 lb/hr	28"	60"	10"
6000 lb/hr	30"	72"	12"
7000 lb/hr	32"	72"	12"
8000 lb/hr	36"	72"	14"

3. Connect the vented receiver to the inlet check valve on the pump. Connect the discharge to the return main or other installation point. For best performance, horizontal runs immediately ahead of the inlet check valve should be kept to a minimum. Connect the discharge to the return main or other installation point. **Where the return line rises to a high level directly after leaving the pump a second check valve should be fitted at the highest point, either in the horizontal or vertical run, to prevent water from falling back on the outlet check valve of the pump and reducing its service life. This prevents waterhammer in the condensate return line.**

Note

To achieve rated capacity and maintain the pumps warranty, each pump must be installed with the check valves as supplied by Spirax Sarco Inc, except at the inlet on a sump pit application as shown in Figure 9.

4. Connect the operating medium (steam, air or gas) supply inlet in the cover. Supply main should have a strainer and steam trap (steam service) or drain trap (air or gas service) installed upstream of the supply inlet. The steam trap/drain discharge should be piped into the receiver ahead of the pump for steam systems. **For increased service life operate the pump with motive pressures of 15 to 20 psi g above the pump back pressure, while ensuring the maximum required pump capacity is still achieved.**

Note

When available motive pressure exceeds 200 psi g, a Spirax Sarco pressure reducing valve is required to reduce pressure to the pump. The PRV should be located as far from the pump as possible. For best operation, motive pressure should be reduced to the minimum required to overcome pump back pressure and achieve the desired capacity. A safety relief valve should be installed at the connection provided in the pump cover or in the motive supply piping.

5. Any horizontal runs in the exhaust line should be pitched so that the line is self-draining. The exhaust line should be piped, unrestricted, to atmosphere as shown in Figure 2.

5. Open System considerations

The pump will not satisfactorily operate below motive pressure of 30 psi g.

The steam inlet pipework must allow for an equal quantity of steam to be fed into each of the two mechanisms. For this to happen the steam inlet pipework must be of equal pipe size and length when split into two lines from the main steam inlet pipework. For the customer's convenience and to ensure correct steam inlet hook-up the option has been made available to purchase an inlet piping assembly. At a minimum, when using steam, the inlet piping should be at least 2" NB pipe from the steam header dropping to the pump. Only when the steam (motive) inlet pipework is close to 2 ft to the pump should the motive line piping be reduced and split equally into two separate lines. These should be of equal diameter and length to be fed into each mechanism's motive inlet. This will ensure steam (air or motive gas) is supplied uni-formly to each of the PTF4 pump mechanisms and will provide synchronous operation of both mechanisms.

When the PTF4 is placed in an Open/Vented System the Vent Assist Valve must be piped to atmospheric pressure without restriction to ensure correct operation. Any back pressure acting on the Vent Assist Valve will reduce its ability to open and function correctly.

When the PTF4 is placed in an Open/Vented System the vent line from the exhaust valve must be piped into the vent line from the Vent Assist Valve. To ensure no back pressure is placed on the Vent Assist Valve the vent line from the exhaust valve must be tied in at least 12 inches above the Vent Assist Valve.

6. Installation - closed loop systems

A closed-loop installation is one in which the exhaust line of the pump is piped back (pressure equalized) to the reservoir being drained.

Caution

Installation, maintenance and troubleshooting should be performed by qualified service personnel only.

Before installation or maintenance is performed on the pump and associated piping system; ensure all condensate, steam, air or gas lines are isolated, relieved of internal pressure, and hot parts have cooled to prevent risk of burns and any other possible personal injury.

Before breaking any connections on the pump or piping system every effort should be made to ensure all internal pressure has been relieved and the motive supply line is shut off to prevent inadvertent discharge of the pump.

When breaking any connection, piping/bolts should be removed slowly so that if the line is under any internal pressure, this fact will be apparent before completely removing the pipe or component. Always relieve pressure before breaking any joint.

1. Install the pump physically below the equipment being drained with the exhaust connection vertically upwards. Pump should be installed with the recommended filling head (the vertical distance between the top of the pump and the bottom of the reservoir) as shown in Fig. 3. For other filling head variations, see Capacity Table on TI-P208-03-US.
2. To prevent equipment flooding during the pump discharge stroke, a reservoir pipe should be installed in a horizontal plane ahead of the pump as shown in Fig. 3. For proper reservoir sizing, refer to "Inlet Reservoir Piping" table 2 . All inlet line fittings must be fully ported. If desired, overflow piping can be installed using a properly sized float and thermostatic trap. The trap inlet should be located at the maximum allowable water level, at or near the top of the reservoir, and it should discharge to a suitable drain.
3. For best performance, horizontal piping runs immediately ahead of the inlet check valve should be kept to a minimum. Connect the discharge to the return main or other installation point. Where the return line rises to a high level directly after leaving the pump a second check valve should be fitted at the highest point, either in the horizontal or vertical run, to prevent water from falling back on the outlet check valve of the pump and reducing its service life. This prevents waterhammer in the condensate return line.

Note

To achieve rated capacity, and maintain the pumps warranty, pump must be installed with check valves as supplied by Spirax Sarco, Inc.

4. Connect the operating medium supply to the motive supply inlet in the cover. Supply main should have a strainer and steam trap installed upstream of the supply inlet. The steam trap discharge should be piped to the downstream piping (Non-flooded).

Note

When available motive pressure exceeds 200 psi g, a Spirax Sarco pressure reducing valve is required to reduce pressure to the pump. The PRV should be located as far from the pump as possible. For best operation, motive pressure should be reduced to the minimum required to overcome backpressure and achieve desired capacity. A safety relief valve should be installed at the connection provided in the pump cover or in the motive steam supply piping.

5. Exhaust line must be piped, unrestricted, to the top of the reservoir in order to equalize all pressures and ensure condensate drains by gravity. On vacuum systems the exhaust line may be connected to the steam space being drained. A thermostatic air vent should be installed at the highest point of the exhaust line to vent all non-condensibles during start-up. Any horizontal runs in the exhaust line should be pitched so that the line is self-draining.
6. If at any time the backpressure against the pump is less than the pressure in the equipment being drained, a properly sized float and thermostatic trap must be installed between the pump and discharge check valve as shown in Figure 3.

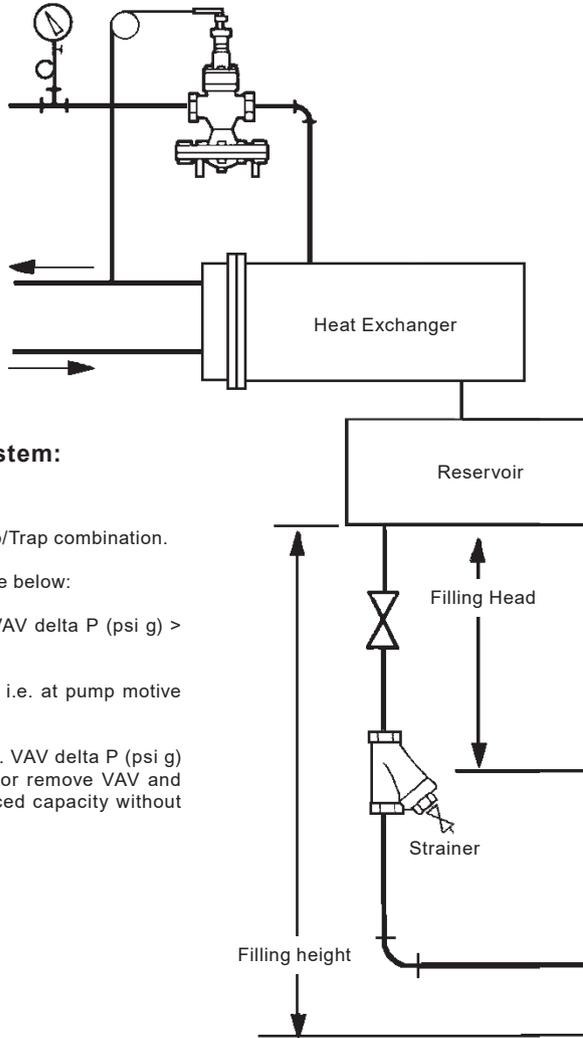
7. Closed system considerations

The pump will not satisfactorily operate below motive pressure of 30 psi g.

The steam inlet pipework must allow for an equal quantity of steam to be fed into each of the two mechanisms. For this to happen the steam inlet pipework must be of equal pipe size and length when split into two lines from the main steam inlet pipework. For the customer's convenience and to ensure correct steam inlet hook-up the option has been made available to purchase an inlet piping assembly. At a minimum, when using steam, the inlet piping should be at least 2" NB pipe from the steam header dropping to the pump. Only when the steam (motive) inlet pipework is close to 2 ft to the pump should the motive line piping be reduced and split equally into two separate lines. These should be of equal diameter and length to be fed into each mechanism's motive inlet. This will ensure steam (air or motive gas) is supplied uni-formly to each of the PTF4 pump mechanisms and will provide synchronous operation of both mechanisms.

When the PTF4 is placed in a Closed System the exhaust line from the exhaust valve must be piped into the exhaust line from the Vent Assist Valve. To ensure no back pressure is placed on the Vent Assist Valve the exhaust line from the exhaust valve must be tied in at least 12 inches above the Vent Assist Valve.

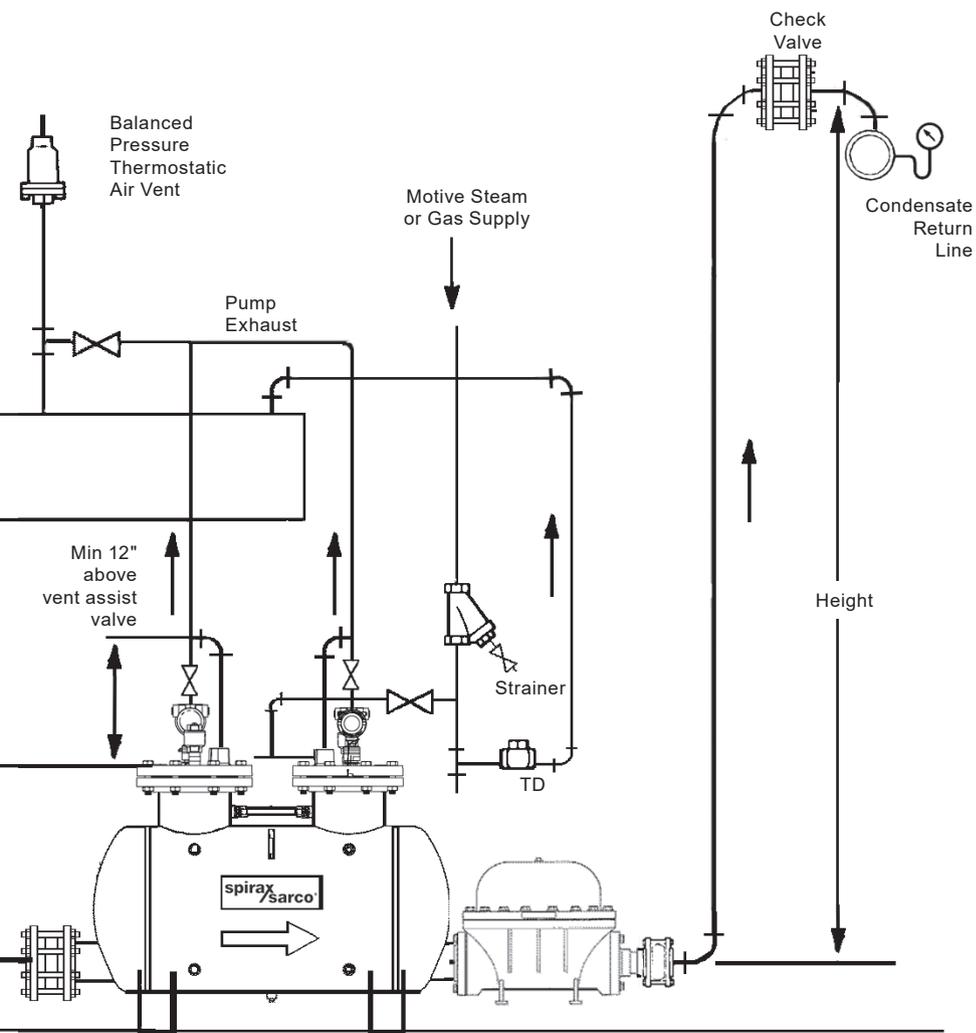
- In an open system, the back pressure acting on the exhaust side of the Vent Assist Valve (VAV) will be atmospheric pressure. When the pump is fitted in a closed system, the back pressure acting on the exhaust side of the Vent Assist Valve (VAV) is the closed system pressure.
- The maximum possible closed system pressure acting on the exhaust side of the Vent Assist Valve will be the static back pressure acting on the Pump/Trap combination. If the closed system pressure were higher than the static back pressure on the Pump/Trap combination the condensate would flow through both the pump and trap. The pump would not operate.



To size the PTF4 in a closed system:

- Establish available motive pressure.
- Establish static back pressure on Pump/Trap combination.
- Place established pressures in formulae below:
- Pump Motive Pressure (psi g) – min. VAV delta P (psi g) > Back Pressure (psi g)
- Capacity charts to be read as normal, i.e. at pump motive and back pressure.
- If, Pump Motive Pressure (psi g) – min. VAV delta P (psi g) < Back Pressure (psi g), then isolate or remove VAV and multiply capacity by 0.77 to find reduced capacity without VAV.

Fig. 3 Closed Loop System With Trap



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8. Installation - Multiple Pressure Powered Pumps

To ensure even wear and extended service life of each of the pumps in a multiple pump set the pumps should not be staged so that a primary pump operates continuously and the secondary pump seldom operates. Each pump should be piped to ensure even operation of each pump. When piping multiple pumps into a single return line an additional check valve should be fitted in the single return line to reduce the likelihood of waterhammer in the return line due to high flowrates and velocities induced during multiple pump discharge cycles.

9. Startup Procedure (All Hookups)

1. Slowly open supply (steam, air or gas) to provide pressure at the PP Pump inlet valve. Check that trap/drain on motive line is operational.
2. Open gate valves in the PP Pump inlet and discharge lines.
3. Open valve(s) ahead of unit allowing condensate to enter the receiver/reservoir and fill the PP Pump body. Pump will discharge when full.
4. Observe operation for any abnormalities. PP Pump(s) will cycle periodically with an audible exhaust at the end of the pumping cycle. If any irregularities are observed, recheck installation instructions for proper hookup. Consult factory if necessary.
5. If overflow piping has been provided, check that a water seal has been established to prevent any steam from being vented during normal operation. Prime overflow piping if necessary.

10. PTF4 Steam Inlet/exhaust Pipe - Hook Up

The PTF4 motive supply line should be sized correctly to ensure sufficient motive capacity during the pumping stroke. A correctly sized inlet pipe will prevent pressure spikes and dips during the pumping stroke and ensure smooth operation and published capacities are met.

At a minimum, when using steam, the inlet piping should be at least 2" NB pipe from the steam header dropping to the pump. Only when the steam (motive) inlet pipework is close to 2 ft to the pump should the motive line piping be reduced and split equal into two separate lines. These should be of equal diameter and length to be fed into each mechanism's motive inlet. This will ensure steam (air or motive gas) is supplied uni-formly to each of the PTF4 pump mechanism and will provide synchronous operation of both mechanisms. (see Figure 4 opposite)

Hook up of the exhaust lines running from the pump must be clear and free to atmosphere when piped in an open system, and clear and free when piped into the reservoir in a closed system. The Vent Assist Valves must be piped directly into either the pump's receiver or, the pump's vent line. In this latter case the Vent Assist Valve exhaust line must be piped into the vent line at least 12 inches away from the pump exhaust connection. Traps discharge pipelines must not be piped into any of the pumps vent lines. (see Figure 6)

11. Recommended Steam Inlet Piping Hook Up

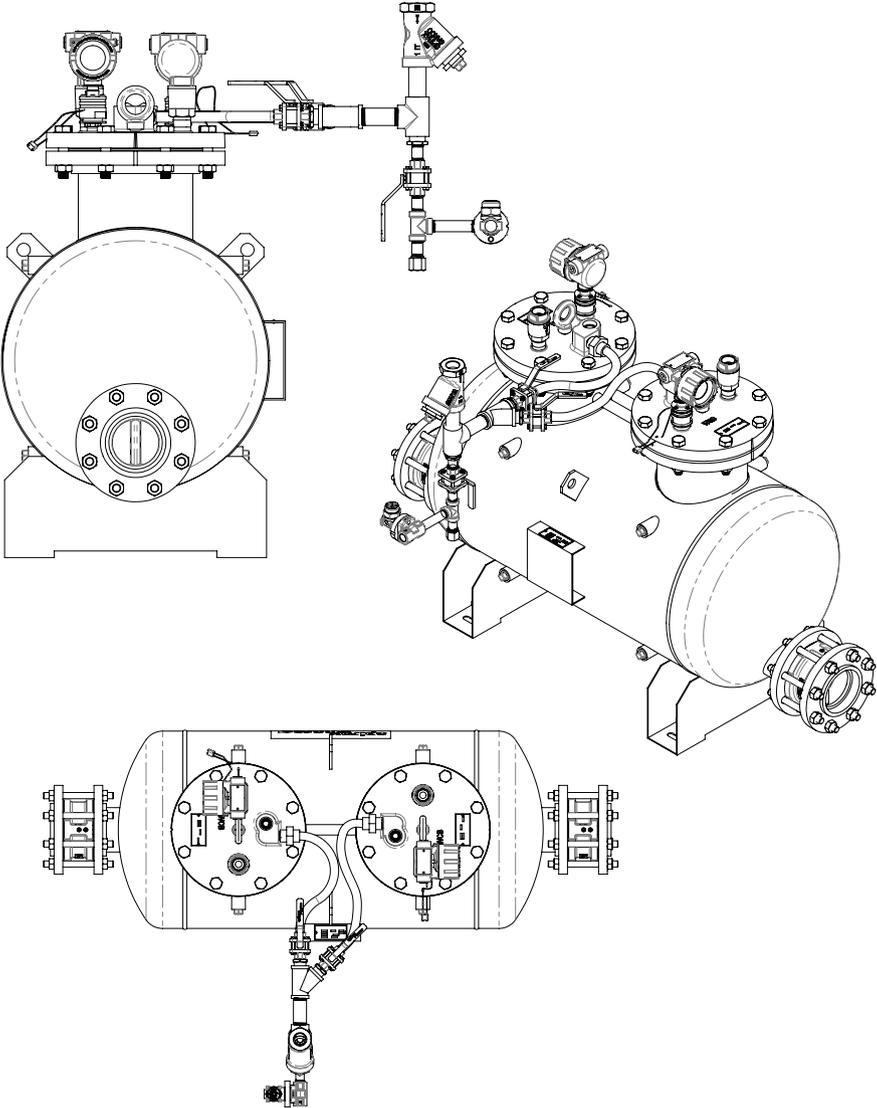


Fig. 4

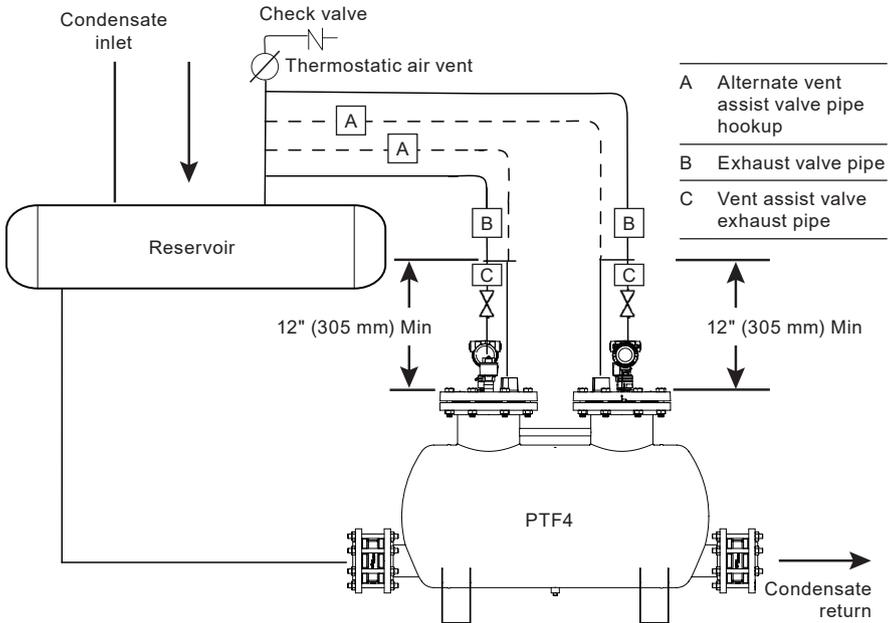


Fig. 5a
Typical PTF4 exhaust and vent assist valve pipe hookup for closed system.

Vent to atmosphere. Vent to be piped to a safe location such that there is no risk to personnel. Vent head recommended if vent not piped to a pit or similar location.

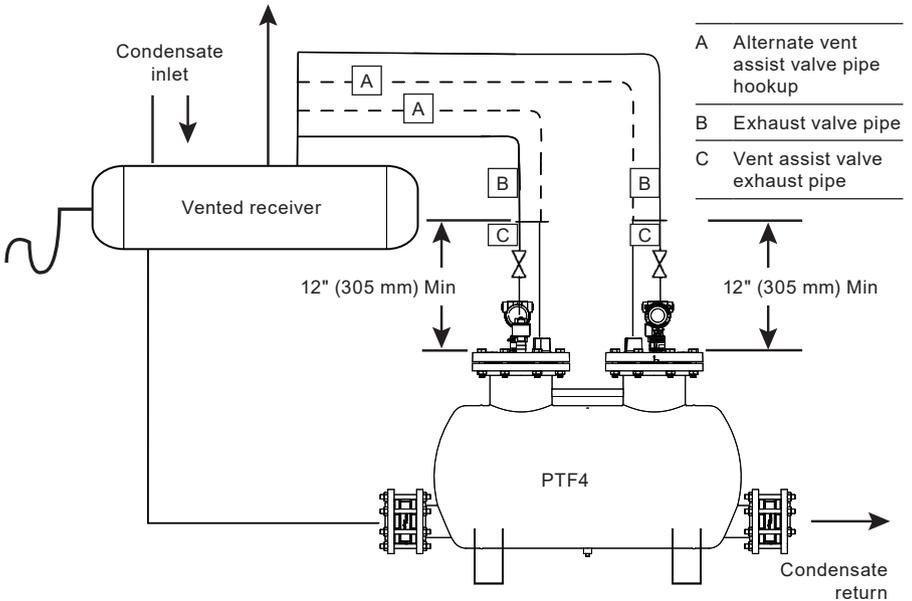


Fig. 5b
Typical PTF4 exhaust and vent assist valve pipe hookup for open (vented) system.

12. Limiting operating conditions

Filling Head Requirements	Filling Head Above Pump cover	Filling Height From base of Pump
Standard recommended	12" (305 mm)	44.3" (1125 mm)
Max filling head	60" (1524 mm)	92" (2337 mm)
Min filling head	-3" (-76 mm)	29.3" (744 mm)

Max back pressure: 75% motive pressure
 Max Number of Cycles per minute = 6
 Specific gravity of pumped liquid options = 0.88 to 1.0

Product is safe for use under full vacuum

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13. Maintenance - Inspection & Replacement

CAUTION:

Installation, maintenance and troubleshooting should be performed by qualified service personnel only. Before installation or maintenance is performed on the pump and associated piping system; ensure all condensate, steam, air or gas lines are isolated, relieved of internal pressure, and hot parts have cooled to prevent risk of burns and any other possible personal injury.

Before breaking any connections on the pump or piping system every effort should be made to ensure all internal pressure has been relieved and the motive supply line is shut off to prevent inadvertent discharge of the pump.

When breaking any connection, piping/bolts should be removed slowly so that if the line is under any internal pressure, this fact will be apparent before completely removing the pipe or component. Always relieve pressure before breaking any joint.

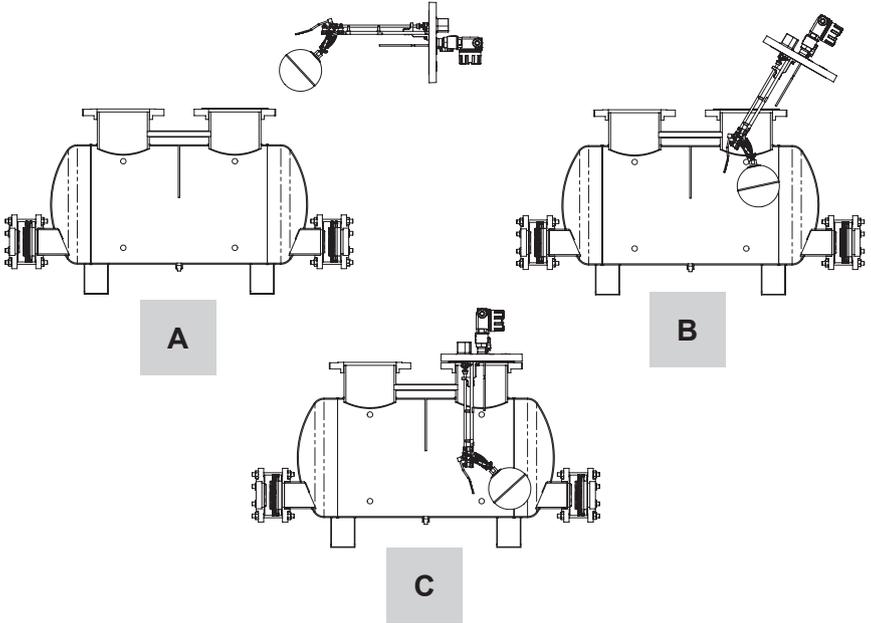
Use caution when removing cover and gasket. Gasket contains thin stainless steel reinforcement that may cause cuts to the skin. Care should be taken to prevent personal injury from the strong snapping action.

1. Break and disconnect all connections to the cover. Remove cover bolts and lift the cover and mechanism assembly from the body, noting the cover orientation.
2. Visually inspect the mechanism to verify that it is free of dirt and scale and that the float and mechanism moves freely.

Note

Each mechanism assembly is factory set and tested. No adjustment to the mechanism should be made. If the mechanism assembly does not function correctly the entire mechanism should be returned to the factory for replacement under the warranty terms.

3. To re-assemble, reverse the above procedure noting the following points.
 - a. When installing the cover and mechanism in tight spaces the mechanism should be held horizontally as shown in diagram A.
 - b. The float should be inserted into the pump body first, carefully ensuring the cycle counter probe and paddle do not clash with the body, per diagram B. Special attention must be made when fitting the cover and mechanism assembly. Do not knock the mechanism against the body or similarly hard object as this may dislodge the pivots and can permanently affect the pumps performance.
 - c. As the mechanism is inserted into the pump body the mechanism should be held vertically and gently lowered to its final resting position. The cover must be orientated so the "V" cast in to the pump cover lines up with the body vertical line on the outside diameter of the mating flange located on Diagram D.
4. Assemble cover bolts and torque to 155 to 175 ft/lbs in a cross pattern as shown in diagram D.



CAUTION
 DO NOT KNOCK THE MECHANISM AGAINST THE BODY OR SIMILAR HARD OBJECTS AS THIS MAY DISLodge THE PIVOTS AND CAN PERMANENTLY AFFECT THE PUMPS PERFORMANCE.

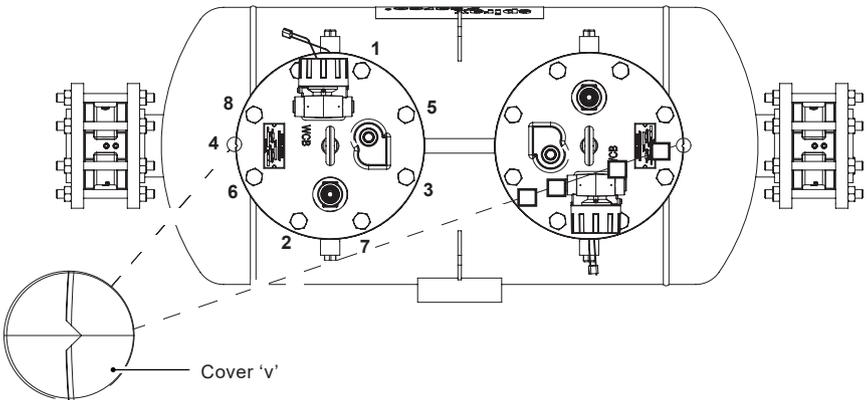


Fig. 6

14. Troubleshooting

If a correctly sized Pressure Powered Pump does not operate properly, an incorrect hookup is suspect in new installations. For existing installations where the pump operates occasionally or not at all, the cause is often a change in the system supply or back pressure conditions beyond the original design parameters. With the system conditions and problem symptoms determined, check the following in turn and correct as necessary.

Caution:

Installation, maintenance and troubleshooting should be performed by qualified service personnel only. Before installation or maintenance is performed on the pump and associated piping system; ensure all condensate, steam, air or gas lines are isolated, relieved of internal pressure, and hot parts have cooled to prevent risk of burns and any other possible personal injury.

Before breaking any connections on the pump or piping system every effort should be made to ensure all internal pressure has been relieved and the motive supply line is shut off to prevent inadvertent discharge of the pump.

When breaking any connection, piping/bolts should be removed slowly so that if the line is under any internal pressure, this fact will be apparent before completely removing the pipe or component. Always relieve pressure before breaking any joint.

Symptom	Cause	Check and cure
1. Pump fails to operate on startup.	1. a) Motive supply closed.	1. a) Open valve(s) to supply motive pressure to pump.
	b) Condensate inlet line closed.	b) Open all valves to allow condensate to reach pump.
	c) Condensate discharge line closed.	c) Open all valves to allow free discharge from pump to destination.
	d) Motive pressure insufficient to overcome backpressure.	d) Check motive pressure and static backpressure. Adjust motive pressure to 15 - 20 psi g higher than static backpressure.
	e) Check valves(s) installed in wrong direction.	e) Verify proper flow direction and correct, if required.
	f) Pump air-locked.	f) On vented system, assure that vent line is unrestricted to atmosphere and self-draining to the pump or receiver. On a closed system, isolate the pump from the pressurized space being drained. (Exhaust tie-back line closed.) Break exhaust connection at pump cover. Keep personnel clear of exhaust connection. If pump begins to cycle, air locking has occurred. Recheck that exhaust tie-back is in accordance with the installation instructions. Install a thermostatic air vent at a high point in the exhaust line. Assure that the equalizer line is self-draining.
	g) Vent Assist Valve not closing on start-up.	Close isolation valve fitted in exhaust line above the VentAssist Valve, closing the Vent Assist Valve discharge but still allowing the exhaust valve to discharge fully. Allow hot condensate to reach pump and then re-open the isolation valve above the Vent Assist Valve.

Symptom	Cause	Check and cure
2. Supply line/equipment flooded, but pump appears to cycle normally (periodic audible exhaust observed). Remove check valve & visually inspect, body and plate faces, hinge and spring.	2. a) Pump undersized.	2. a) Verify rate capacity per TI-P207-12-US capacity table. Increase check valve size or install additional pump as required.
	b) Insufficient filling head.	b) Verify required filling head per TI-P207-12-US. Lower pump to achieve required filling head.
	c) Insufficient motive pressure to achieve rated capacity.	c) Check motive pressure setting and maximum back-pressure during operation. Compare to capacity table of TI-P207-12-US. Increase motive pressure as required to meet load conditions.
	d) Restriction in condensate inlet line.	d) Verify that fully ported fittings are used. Blowdown the strainer, if fitted. Check that all valves are fully open.
	e) Inlet check valve stuck open (debris).	e) Isolate inlet check valve and relieve line pressure. Clean seating surfaces and reinstall or replace, if necessary.
3. Supply line/equipment flooded, and pump has stopped cycling (audible periodic exhaust not observed).	3. a) Discharge line closed or blocked.	3. a) Check motive pressure and static back-pressure (at pump discharge). If equal, a closed or blocked discharge line is suspected. Check all valves downstream of pump to assure an unobstructed discharge.
	b) Discharge check valve stuck closed.	b) After checking per 3(a), isolate discharge check valve and safely relieve line pressure. Remove check valve & visually inspect body and plate faces, hinge and spring. Clean seating surfaces and reinstall or replace, if necessary.
	c) Insufficient motive pressure.	c) If motive pressure is below static backpressure, increase motive pressure setting to 15-20 psi g above static backpressure. Do not exceed rated pressure limits of equipment.

Symptom	Cause	Check and cure
<p>Important Safety note: For steps (d) through (g) it is necessary to break the exhaust/tie-back line at the pump exhaust connection. On closed loop systems, care should be exercised to assure that the pump is isolated (motive supply, condensate inlet and discharge, and exhaust/tie-back line all closed) and that case pressure is relieved prior to breaking this connection to avoid injury to personnel. Also, under fault conditions, it is possible that hot condensate may run out of the exhaust connection when broken for both closed loop and vented systems. This possibility should be taken into consideration when performing these steps to avoid scalding of personnel or water damage to nearby equipment.</p>	<p>d) Motive inlet valve leaking and/or worn.</p>	<p>d) Slowly open motive supply line, leaving the condensate inlet and discharge lines closed. Observe the exhaust connection for steam or air leakage. If leakage is observed, an inlet valve problem is indicated. Isolate pump, and safely relieve pressure, remove cover and mechanism assembly and visually inspect. Replace inlet valve and seat assembly.</p>
	<p>e) Mechanism Faults i) Broken spring ii) Ruptured float</p>	<p>e) With motive line open, slowly open condensate inlet line to the pump, allowing pump to fill and observe exhaust connection. Keep personnel clear of exhaust! If condensate runs out exhaust connection, a mechanism fault is clearly indicated. Isolate pump by shutting off motive supply and condensate inlet, and safely relieve pressure, remove cover and mechanism assembly, and visually inspect. Examine springs and float for obvious defects. Stroke mechanism and check for any source of binding or increased friction. Repair and/or replace all defects observed.</p>
	<p>f) Exhaust/tie-back causing vapor lock (vented or closed loop).</p>	<p>f) If mechanism is heard to trip and no fluid is observed running out the exhaust connection, slowly open the discharge line from the pump and observe operation. Keep personnel clear of exhaust connection! If pump cycles normally, a fault in the exhaust/tie-back line is suspected. Recheck the exhaust/tie-back piping layout for compliance with the installation instructions. Exhaust/tie-back line must be self-draining to prevent vapor locking the pump.</p>
	<p>g) Inlet check valve stuck closed.</p>	<p>g) If mechanism is not heard to trip and fluid is not observed running from the exhaust connection, it is suspected that the fault lies in the condensate inlet piping. Assure that all valves leading to the pump have been opened. If so, this indicates that the inlet valve is stuck closed. Isolate the pump and check valve and relieve line pressure. Visually inspect the head, seat and stem. Clean seating surfaces and reinstall or replace, if necessary. Reinstall exhaust/tie-back connection and open line.</p>

Symptom	Cause	Check and cure
4. Chattering or banging in return main after pump discharges.	4. a) Vacuum created at pump outlet after discharge because of acceleration/ deceleration of large water slug in return main (usually results from long horizontal run with multiple rises and drops).	4. a) Install a vacuum breaker at the top of the lift (at high point in return line). For pressurized return systems and air eliminator may be required downstream of the vacuum breaker. (See Fig. 8).
	b) Pump "blow-by".	b) Check condensate inlet pressure and static backpressure at the pump discharge. If the inlet pressure equals or exceeds the static backpressure, a "blow through" problem is suspected. On vented systems, check for leaking traps discharging into the condensate inlet line which would increase inlet line pressure. Replace any faulty traps. On closed loop systems, if condensate inlet pressure can exceed static backpressure under normal operation (i.e. boost in equipment operating pressure via a modulating control valve or significant decrease in static return main pressure), a pump trap combination is required. The pump trap combination will prevent passage of steam into the return main and allow the pump to cycle normally when condensate is present (See Fig. 4)

Symptom	Cause	Check and cure
<p>5. Vent line discharging excessive flash steam (vented applications only).</p>	<p>5. a) Faulty steam traps discharging live steam into condensate inlet line (See also 4(b), Pump "Blow-By").</p>	<p>5. a) Check for leaking traps discharging into condensate return. Repair or replace faulty traps. (See also 4(b), Pump "Blow-By").</p>
	<p>b) Excessive (over 50 lb/hr) flash steam being vented through pump.</p>	<p>b) Vent receiver ahead of pump.</p>
	<p>c) Exhaust valve stuck or worn.</p>	<p>c) Isolate pump and safely relieve pressure, and remove cover and mechanism assembly. Remove exhaust head and seat assembly. Visually inspect seating surface. Clean and reinstall or replace, if worn.</p>
	<p>d) Vent assist Valve not closing.</p>	<p>d) Close isolation valve fitted in exhaust line above the Vent Assist Valve, closing the Vent Assist Valve discharge but still allowing the exhaust valve to discharge fully. If discharge stops and pumping capacity still acceptable leave as is. If by closing the Vent Assist Valve is no longer acceptable replace Vent Assist Valve.</p>

15. Other typical hook-up sketches

The hook-up sketches shown do not necessarily represent recommended arrangements for specific service conditions; but rather serve only to illustrate the variety of applications where the pressure-powered pump can be utilized.

Design requirements for each application should be evaluated for the best condensate recovery arrangement tailored to your specific needs.

For use of the pressure powered pump in hook-ups other than those described previously, and for any additional information you may require, contact Spirax Sarco Applications Engineering Department, toll free:

1-800-883-4411

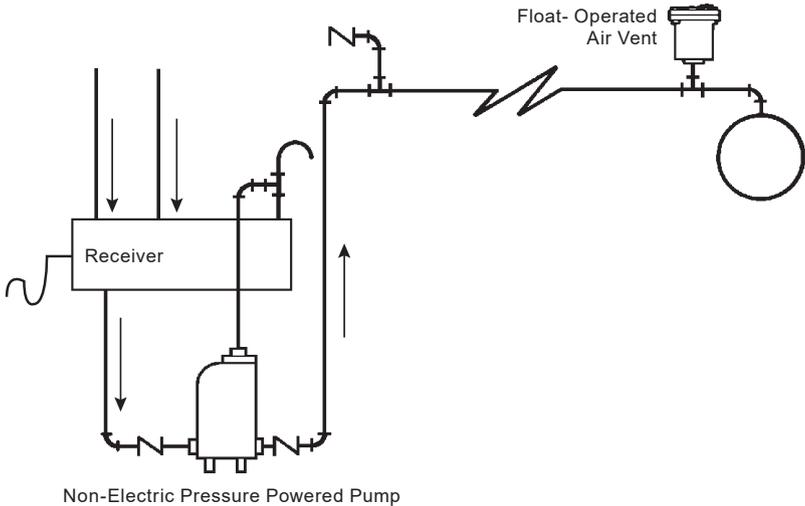


Fig. 12 Pressure Powered Pump Discharging to Long Delivery Line

(Air Eliminator needed with seal in piping)

*See piping in Figure 15. Trap should discharge into vented receiver.

†H - Total lift or back pressure is the height (H) in feet (meters) x 0.433 plus psi g (.1 plus bar g) in return line, plus downstream piping friction pressure drop in PSI (bar g) calculated at a flow rate of the lesser of the 6 times the actual condensate flowrate.

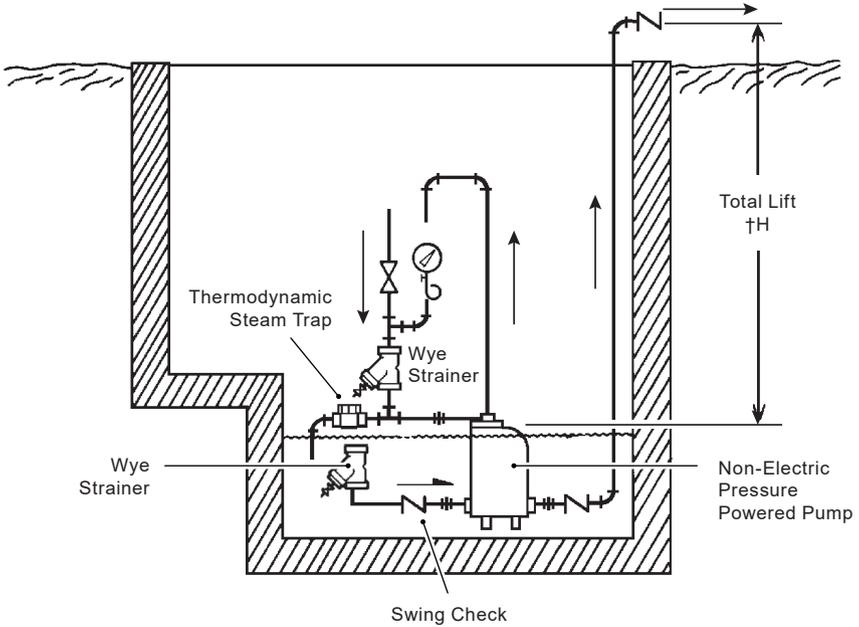


Fig. 13 Pressure Powered Pump Draining Water from Sump Pit

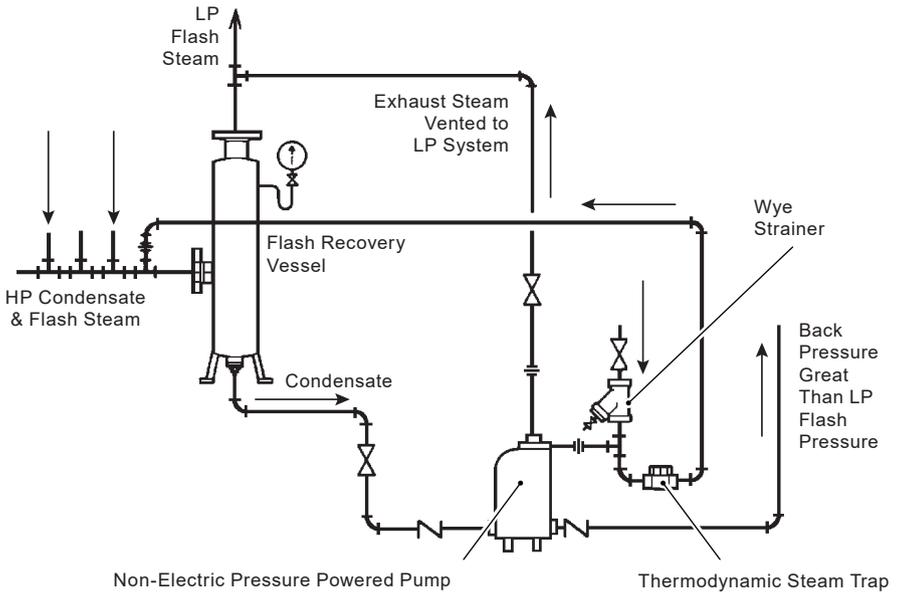


Fig. 14 Flash Steam Recovery at Pressure Above or Below Atmospheric

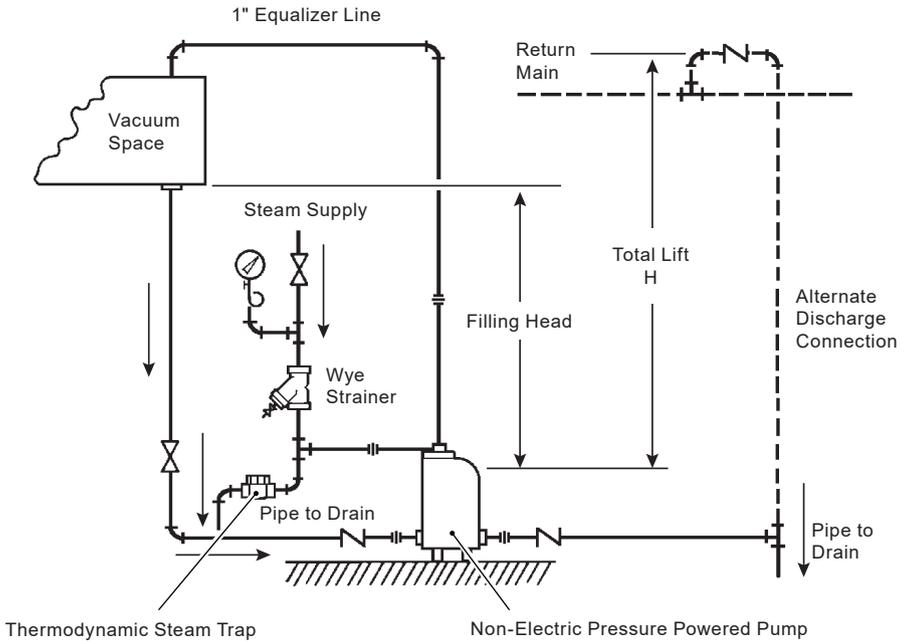


Fig. 15 - Draining Condensate from Vacuum Space to Return Main

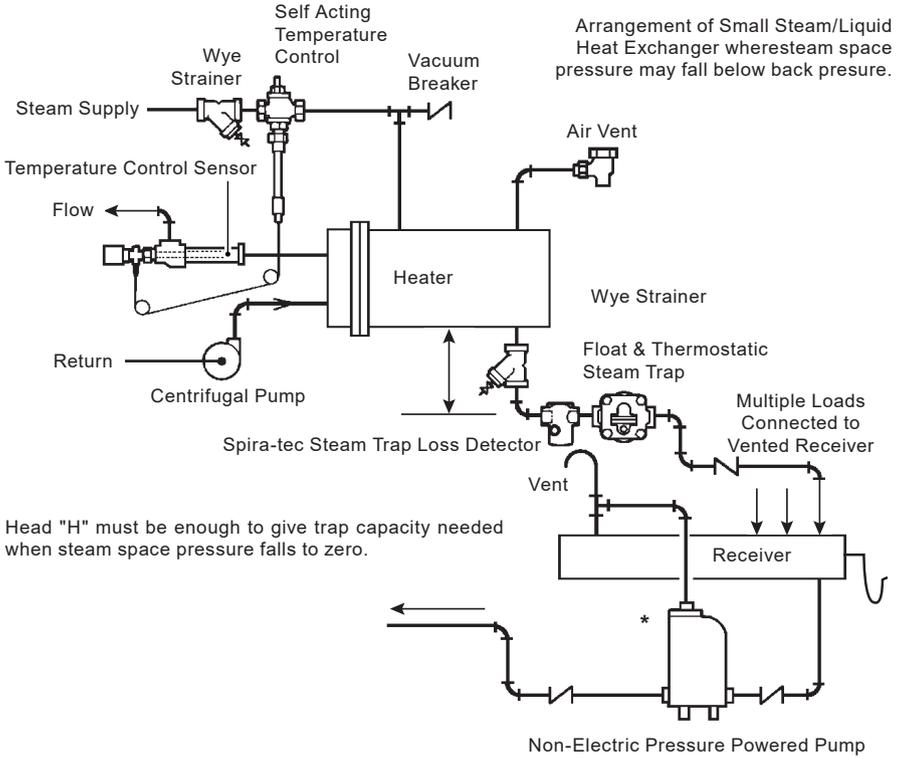


Fig. 16 Draining Small Heat Exchanger and Other Loads to Pressure Powered Pump

* See piping Figure 15 Trap should discharge into vented receiver.

Spirax Sarco Applications Engineering Department
Toll Free at: 1-800-883-4411

SPIRAX SARCO, INC.
1150 NORTHPOINT BLVD.
BLYTHEWOOD, SC 29016
PHONE 803-714-2000
FAX 803-714-2222
www.spiraxsarco.com/global/us