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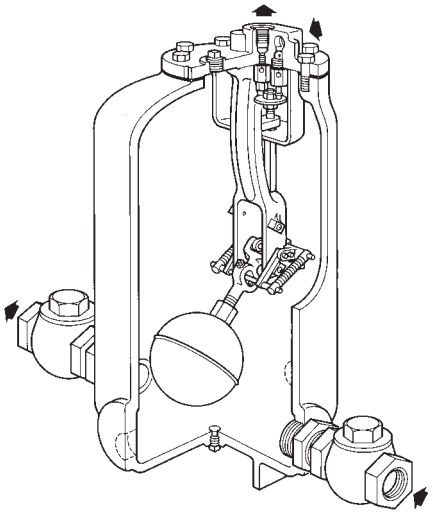
PPC, PPF and PPEC Pressure Powered Pump
Installation and Maintenance Instructions



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1. Operation

1. In the normal position before start-up the float (5) is at its lowest position with the steam valve (6) closed and exhaust valve (7) open.

2. When liquid flows by gravity through inlet check valve (8) into pump body, the float (5) will become buoyant and rise.

3. As the float (5) continues to rise the mechanism link (3) is engaged which increases the tension in the springs (15). When the float (5) has risen to its upper tripping position, the linkage mechanism snaps upward over centre. The energy in the springs is released as the push rod is moved upward, to simultaneously open the motive steam inlet valve and close the exhaust valve.

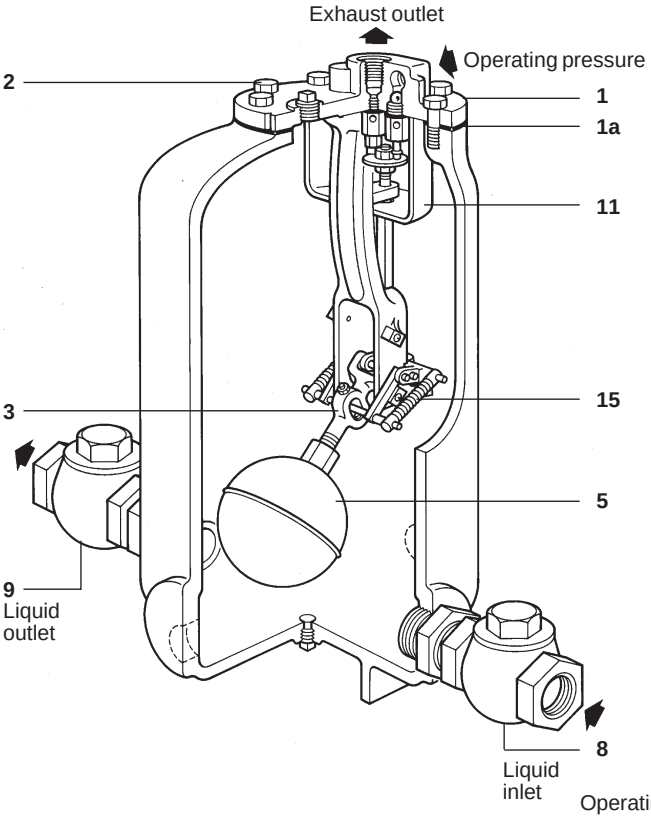

Fig.1 PPC and PPF pressure power pump

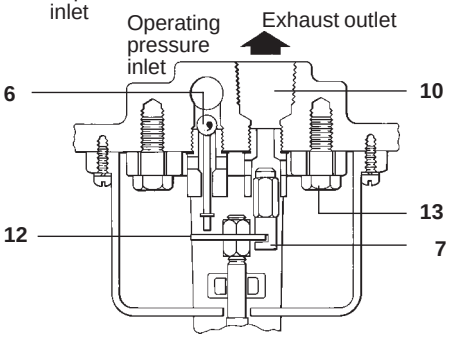

Fig. 1a

4. Steam flow through the inlet valve (6) increases the pressure within the body. This closes the inlet check valve (8) and forces out the liquid through the discharge check valve (9).

5. As the liquid level in the pump body falls the float is lowered and the mechanism link (3) is engaged, which again increases the tension in the spring (15). When the float reaches the lower tripping position, the linkage mechanism snaps downward over centre. The energy in the spring is released as the pushrod then moves downward to simultaneously open the exhaust valve and close the steam inlet valve.

6. When the pressure in the pump body has fallen to the same level as the pressure in the inlet pipe, the inlet check valve opens. Liquid will again flow through the check valve to fill the body and begin the next cycle.

Note: Fig. 1 shows the PPC and PPF pump assembly. The principle of operation for all pressure powered pumps, including PPEC is essentially the same. Fig. 2 shows the PPEC pump.

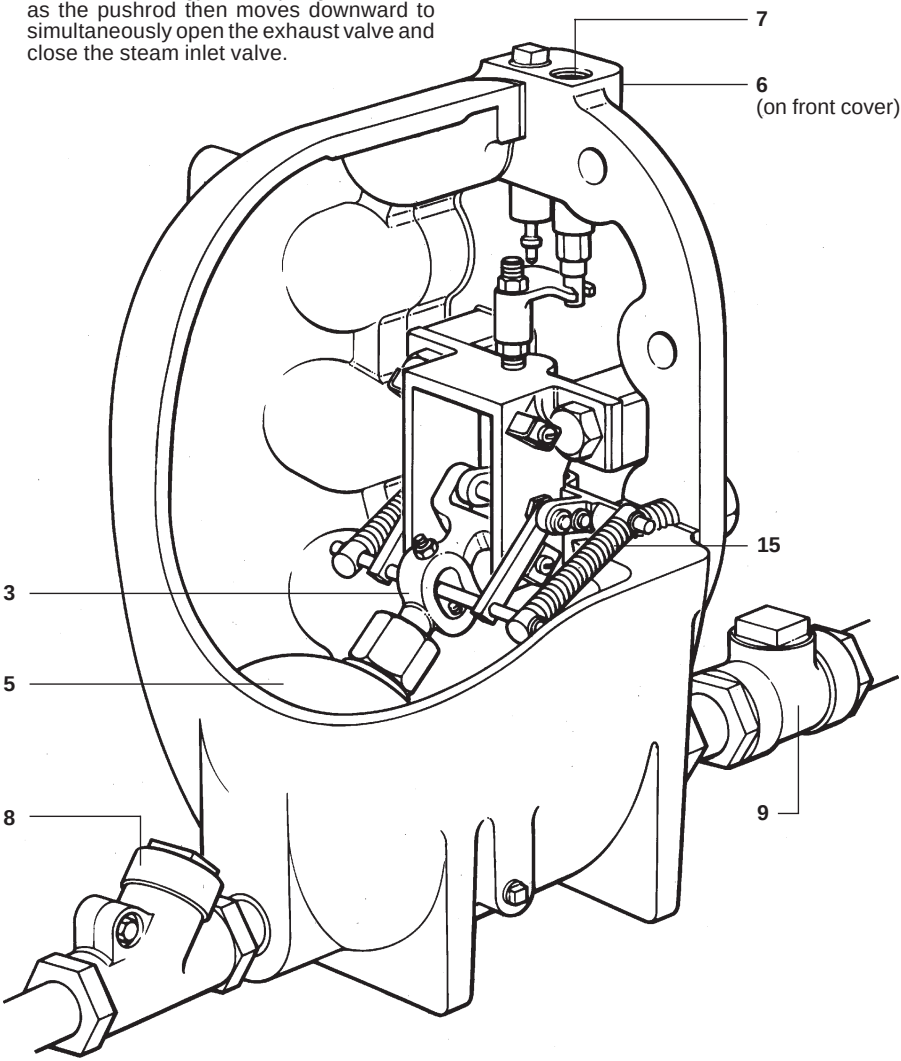

Fig. 2 PPEC low profile pressure powered pump

Installation - vented systems

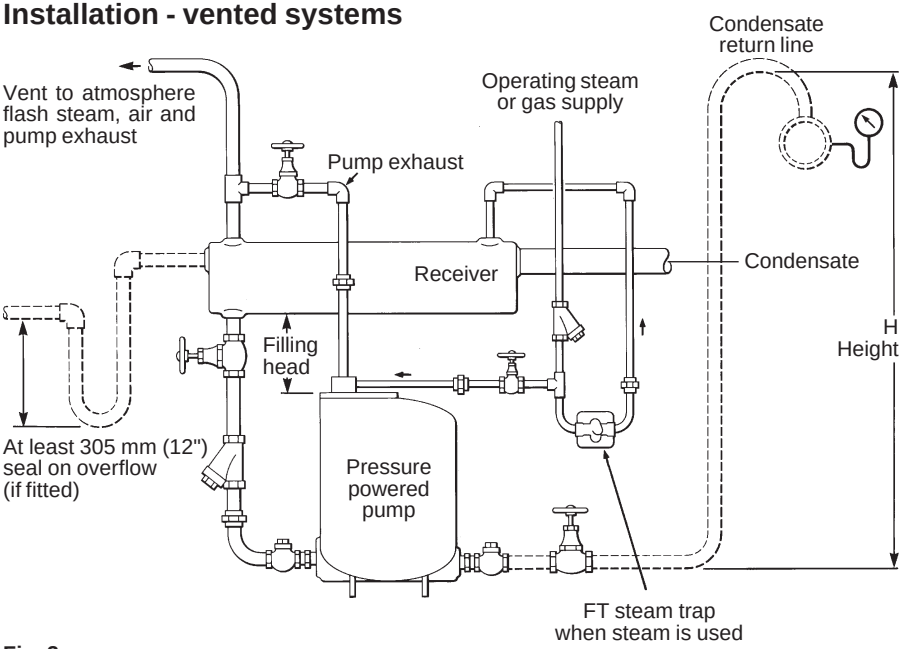

Fig. 3

Caution:
Before installation or any maintenance is performed, ensure that all steam, air or gas lines are closed to prevent personnel injury.

1. Install the pump below the equipment to be drained with the exhaust connection (10) 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/receiver) as shown below. For other filling head variations, see the capacity table on TI-P135-05.

2. To prevent equipment flooding during the pump discharge stroke, a vented receiver or reservoir pipe should be installed in a horizontal plane ahead of the pump as shown in Fig. 3. For proper receiver / reservoir sizing, refer to 'Inlet receiver capacities' table shown below. All inlet line fittings must be fully parted.

3. Connect the check valves (8) and (9) to the pump making sure that the flow through the valves is in the proper direction. For best performance, horizontal piping runs immediately ahead of the inlet check valve and after the discharge check valve should be kept to a minimum. Connect the discharge to the return main or other installation point.

4. Connect the operating medium (steam, air or gas) supply to the motive supply inlet in the cover. Supply main should have a strainer and a steam trap (steam service) installed upstream of the supply inlet. The steam trap discharge should be piped to the receiver or reservoir piping ahead of the pump.

5. Exhaust line should be piped, unrestricted, to atmosphere. Line should be vertical, if possible. If horizontal runs must be used, line should be pitched so that it is self draining to the pump or receiver.

Inlet receiver capacities

Sufficient reservoir volume is needed above the filling head level to accept the condensate reaching pump during the discharge stroke. The receiver can be a length of pipe of large diameter or a tank. If desired, receiver overflow piping can be installed as shown in Fig. 3 and piped to a suitable drain. The piping must form a U-type water seal at least 305 mm (12") deep immediately after the receiver.

Pump size	1" PPEC	1"	1½" PPC / PPF	2"	5 x 2"
Receiver size	0.6 m 24" x 6"	0.6 m 24" x 6"	0.65 m 26" x 8"	0.65 m 26" x 10"	1.1 m 44" x 10"

Inlet reservoir piping

When draining a single piece of equipment and a receiver is not supplied ahead of the pump, install with sufficient piping as given in the table below, and use recommended filling head. This will prevent any flooding of the equipment while the pump is discharging.

Feet of reservoir piping above top of pump when pressure powered pump is installed without a receiver.

Pump sizes 1, 1½, 2 and 3 x 2.

Liquid	Load	Inlet check valve and pipe size							
		1		1½		2		3	
kg/h	lb/h	m	ft	m	ft	m	ft	m	ft
277 or less	500 or less	1.2	4						
454	1000	2	6.5	1.2	4				
681	1500	3	10	1.5	5	1.2	4		
908	2000	4	13	1.8	6	1.5	5		
1362	3000			3	10	2.1	7		
1816	4000			3.6	12	3	10		
2270	5000					3.6	12	1.2	4
2724	6000							1.5	5
3178	7000							1.8	6
3632	8000							2.1	7
4086	9000							2.4	8
4540	10000							2.7	9
9994	11000							3	10

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 steam space being drained.

Caution: Before installation or any maintenance is performed ensure that all steam, air or gas lines are closed to prevent personnel injury.

1. Install the pump below the equipment being drained with the exhaust connection (10) 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 / receiver) as shown below. For other filling head variations, see the capacity table on TI-P135-03.
2. To prevent equipment flooding during the pump discharge stroke, a receiver or reservoir pipe should be installed in a horizontal plane ahead of the pump as shown in Fig. 4. For proper receiver / reservoir sizing refer to 'Inlet piping' table shown on page 4. 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 receiver / reservoir, and it should discharge to a suitable drain.

Recommended filling head

1 PPEC	152 mm (6")
1, 1½, 2, 3 x 2 PPC / PPF	305 mm (12")

Note: To achieve rated capacity, pump must be installed with check valves as supplied by Spirax Sarco.

Note: When available motive steam pressure exceeds 8.6 bar (125 psi), a Spirax Sarco pressure reducing valve is required to reduce pressure to the pump. This PRV should be located as far as possible from the pump for best operation, motive pressure should be reduced to the minimum required to overcome back pressure 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.

3. Connect the check valves (8) and (9) to the pump, making sure that the flow through the valves is in the proper direction. For best performance, horizontal piping runs immediately ahead of the inlet check valve and after the discharge check valve should be kept to a minimum. Connect the discharge to the return main or other installation point.
4. Connect the operating medium (steam only) supply to the motive supply inlet in the cover. Supply main should have a strainer and a steam trap installed upstream of the supply inlet. The steam trap discharge should be piped to the receiver or reservoir piping ahead of the pump.
5. Exhaust line should be piped, unrestricted, to the steam space being drained. The exhaust line can be connected to the inlet pipe between the control valve and the equipment or directly into the top (inlet side) of the equipment. 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 exhaust line should be pitched so that the line is self-draining.
6. If, at any time, the back pressure 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 Fig. 5.

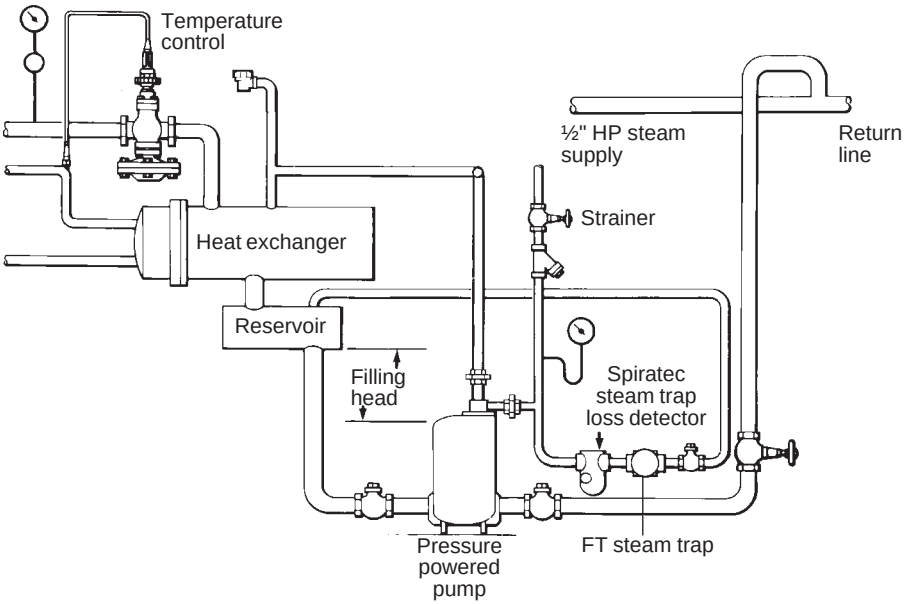

Fig. 4 Draining L.P. heat exchanger to overhead return. Pressure at PP pump outlet P2 exceeds pressure of supply to heat exchanger P1

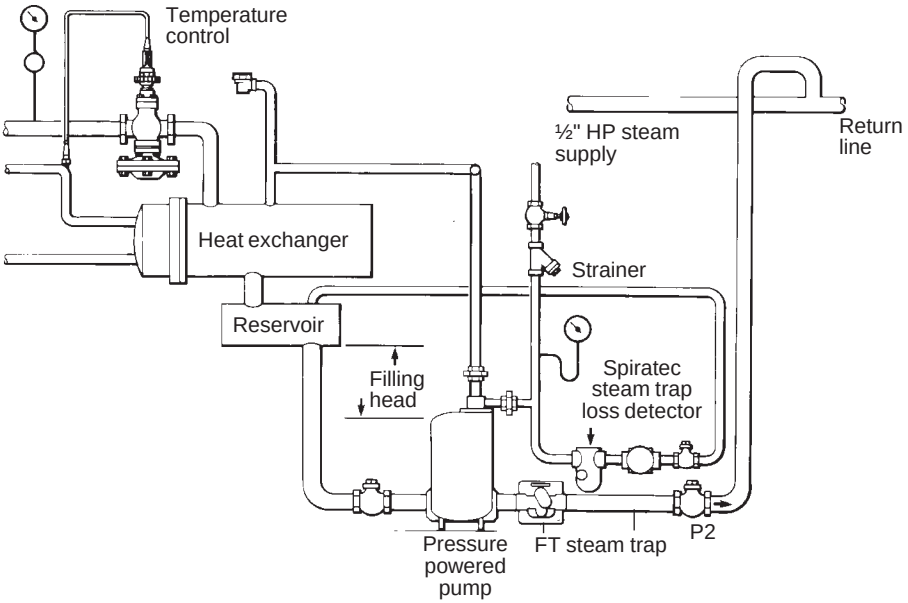

Fig. 5 Draining heat exchanger to overhead return. Pressure at PP pump outlet P2 does not always exceed pressure of supply to heat exchanger P1

3. Start-up procedure

1. Slowly open supply (steam, air or gas) to provide pressure at the PP pump inlet valve. Check that trap is operational.

2. Open gate valves in the condensate inlet and discharge line.

3. Open valve(s) ahead of the unit allowing condensate to enter the receiver and fill the PP pump body. Pump will discharge when full.

4. Observe operation for any abnormalities. PP pump(s) should cycle periodically with an audible exhaust at the end of the pumping cycle. If any irregularities are observed, recheck installation instructions for proper hook-up. Consult Spirax Sarco if necessary.

5. If overflow piping has been provided, check that a water seal has been established to prevent any steam from being vented in normal operation. Prime piping if necessary.

4. Maintenance

Mechanisminspection andrepair

Caution:

Before removing the cover and mechanism assembly, be sure that the pump is completely isolated and relieved of any internal pressure. Motive supply, exhaust, condensate inlet, and discharge lines should all be closed prior to performing any work on the pump.

1. Break 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 moves freely.

3. Visually check springs (15). If defective, remove retaining clips and slide spring from pins. Replace with new springs (if necessary) and install retaining clips.

4. To check inlet and exhaust valves:

4. a) On PPC/PPF sizes 1 to 3 x 2, take off the baffle (11) by removing the three retaining screws. PPEC has no baffle.

b) Remove the mechanism casting securing bolts (13). Carefully lift mechanism assembly free from cover.

Note: Mechanism assembly is factory set and tested. No adjustments to the mechanism assembly should be made. If required, entire cover and mechanism assembly should be returned to the factory for repair and recalibration.

c) Visually inspect seating surfaces of inlet and exhaust valves for signs of wear (inlet valve must be removed to check seat). Clean seating areas and reinstall or replace if necessary.

d) To reassemble, reverse the above procedure. Replace any damaged gaskets.

5. When reinstalling cover and mechanism assembly, cover should be oriented as noted (1) above. Follow the start-up procedure to bring the pump back in operation.

5. Troubleshooting check list

If a correctly sized pressure-powered pump does not operate properly, an incorrect hook-up 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 and troubleshooting should be performed by qualified service personnel. Before breaking any connections of the pump or piping system every effort should be made to assure that internal pressure has been relieved and that 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 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 start-up.	1. (a) Motive supply closed.	1. (a) Open valves to supply motive pressure to pump.
	(b) Condensate inlet line	(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 back-pressure.	(d) Check motive pressure and static back-pressure. Adjust motive pressure to 0.6 to 1 bar or more higher than static back-pressure.
	(e) Check valve(s) installed in wrong direction.	(e) Verify proper flow direction and correct if required.
	(f) Pump air-locked.	(f) On vented system, ensure 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 feedback line closed). Break exhaust connection at pump cover. Keep personnel clear of exhaust connection. If pumps begin to cycle, air locking has occurred. Recheck that exhaust feed-back is in accordance with the installation instructions. Install a thermostatic air vent at a high point in the exhaust line. Assure that

Symptom	Cause	Check and Cure
2. Supply line/equipment flooded, but pump appears to cycle normally (periodic audible exhaust observed).	2. (a) Pump undersized.	2. (a) Verify rated capacity per TI-P135-03 capacity table. Increase check valve size or install additional pump as required
	(b) Insufficient filling head.	(b) Verify required filling head per TI-P135-03. 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. Compared to capacity table of TI-P135-03. 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 or outlet check valve stuck open (debris).	(e) Isolate check valve and relieve line pressure. Remove cap and visually inspect head, seat, and stem. 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 down stream of pump to ensure an unobstructed discharge.
	(b) Discharge check valve stuck closed.	(b) After checking per 3(a), isolate discharge check valve and relieve line pressure. Remove cap and visually inspect head, seat and stem. Clean seating surfaces and reinstall or replace, if necessary.
	(c) Insufficient motive pressure.	(c) If motive pressure is below static back-pressure, increase motive pressure setting to 0.6 to 1 bar g or more above static back pressure. Do not exceed rated pressure limits or equipment. For steps 3(d) to 3(g) overleaf - with exhaust feed back line isolated from the equipment being drained (close-loop systems), break the exhaust/ feed-back connection at the pump cover and -

Symptom	Cause	Check and Cure
Important safety note: For steps (d) through to (g). It is necessary to break the exhaust / feed-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/feed-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.	(d) Motive inlet valve leaking and / or worn.	(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, remove cover and mechanism assembly and visually inspect. Replace inlet valve and seat assembly.
	(e) Mechanism faults i) Broken springs ii) Ruptured float iii) Mechanism binding	(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, 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.
	(f) Exhaust / feed-back causing vapour lock (vented or closed loop)	(f) If mechanism is heard to trip and no fluid is observed running out from the exhaust connection, slowly open the discharge line from the pump and observe operation. Keep personnel clear of exhaust connection. If pump cycles normally, fault in the exhaust feed-back line is suspected. Recheck the exhaust / feed back piping layout for compliance with the installation instructions. Exhaust / feed-back line must be self-draining to prevent vapour locking the pump Fit thermostatic air vent to balance line on closed loop applications.

Symptom	Cause	Check and Cure
	(g) Inlet check valve stuck closed.	(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. Ensure that all valves leading to the pump have been opened. If so, this indicates that the inlet check valve is stuck closed. Isolate the pump and check valve and relieve line pressure. Remove the cap and visually inspect the head seat and stem. Clean seating surfaces and reinstall or replace, if necessary. Reinstall exhaust / feed-back connection and open line.
	(h) Inlet strainer blocked.	(h) Close gate valve ahead of strainer. Remove strainer cap and screen. Clean screen in pail of water or replace if damaged. Insert screen in cap and refit to strainer. Open gate valve.
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 an air eliminator may be required downstream of the vacuum breaker. (See Fig. 8).
	(b) Pump “blow-by”.	(b) Check condensate inlet pressure and static back-pressure at the pump discharge. If the inlet pressure equals or exceeds the static back-pressure, 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 back-pressure 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. 5.)

Symptom	Cause	Check and Cure
5. Vent line discharging excessive flash steam (vented applications only).	5. (a) Faulty steam traps discharging live steam into condensate inlet line. (See also 4(b), Pump 'Blow-By').	5. (a) Check for leaking traps discharging into condensate return. Repair or replace faulty traps. (See also 4(b). Pump 'Blow-By').
	(b) Excessive (over 20 kg/h) flash steam being vented through pump.	(b) Vent receiver or reservoir piping ahead of pump.
	(c) Exhaust valve stuck or worn.	(c) Isolate pump and remove cover and mechanism assembly. Remove exhaust head and seat assembly. Visually inspect seating surface. Clean and reinstall or replace, if worn.

PPC and PPF

AVAILABLE SPARE	
Cover gasket	B
Float	F
Inlet / outlet check valve (each)	M
Cover and internal mechanism assembly (complete)	A

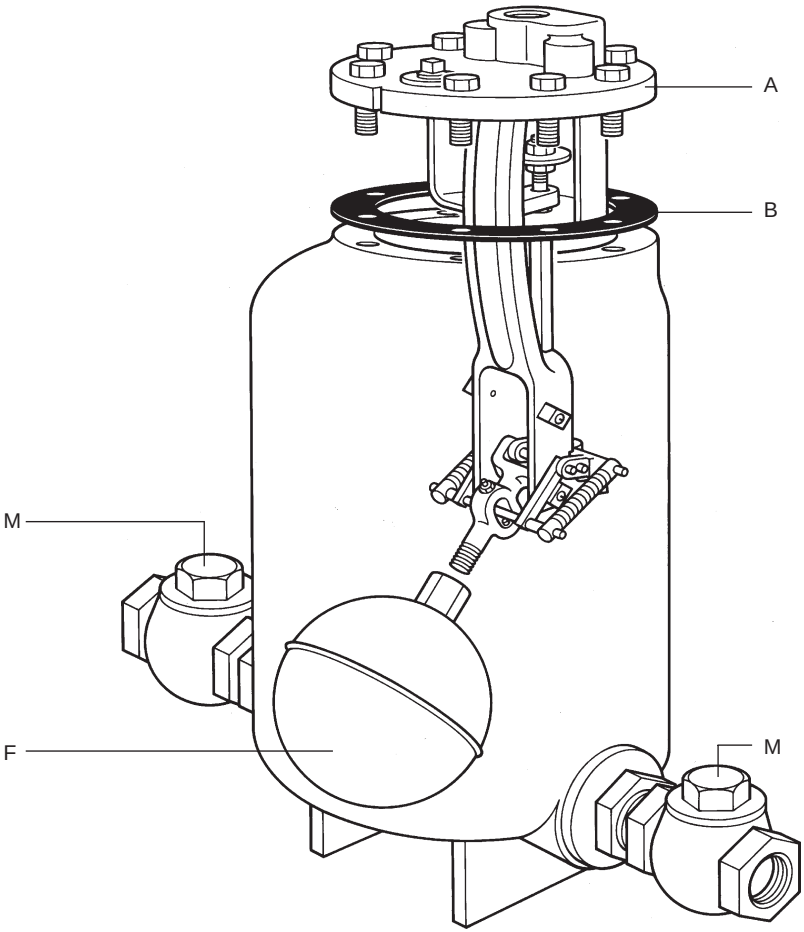

Fig. 6 PPC and PPF pump spare parts

PPEC

AVAILABLE SPARE	
Cover gasket	B
Float	F
Inlet check valve (each)	M_1
Outlet check valve	M_2
Cover and internal mechanism assembly (complete)	A

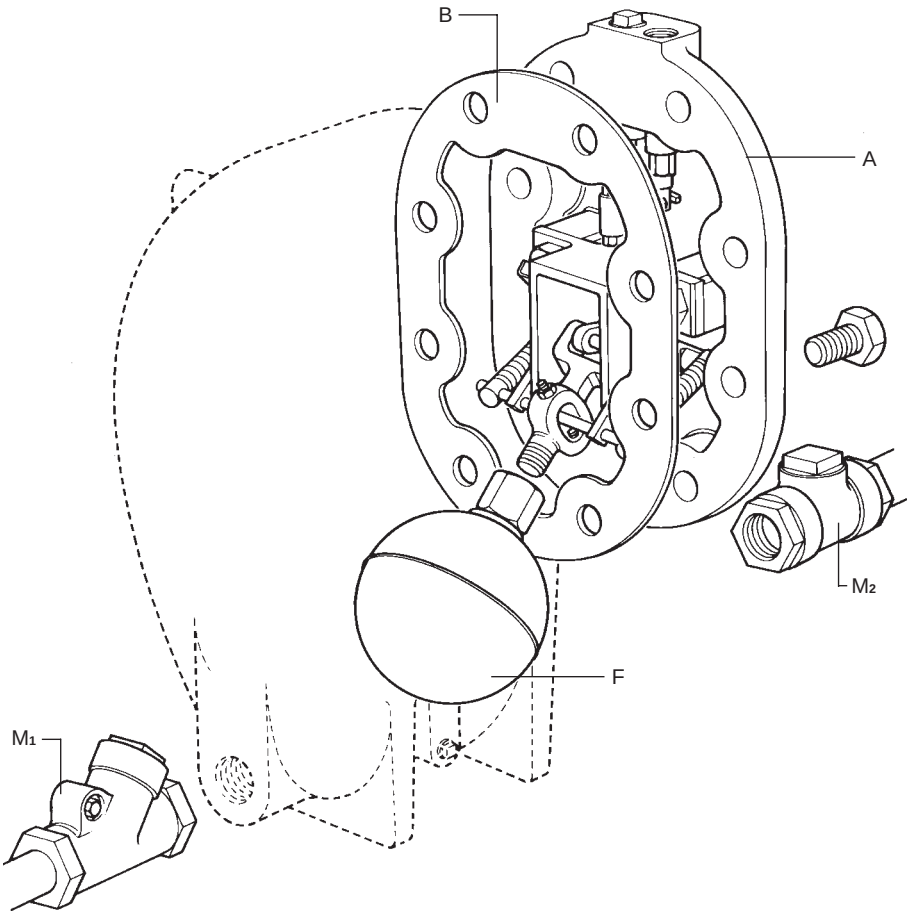

Fig. 7 PPEC pump spare parts

7. Typical applications

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.

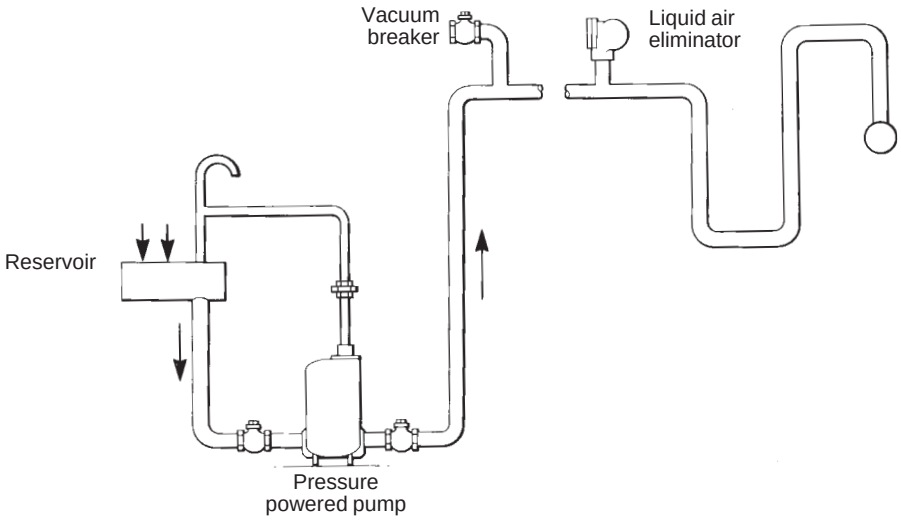

Fig. 8 Pressure powered pump discharging to long delivery line

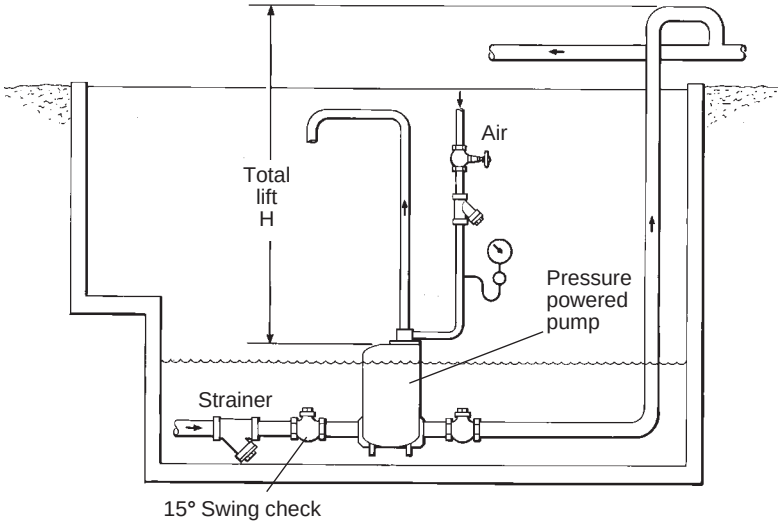

Fig. 9 Pressure power pump draining water from sump pit

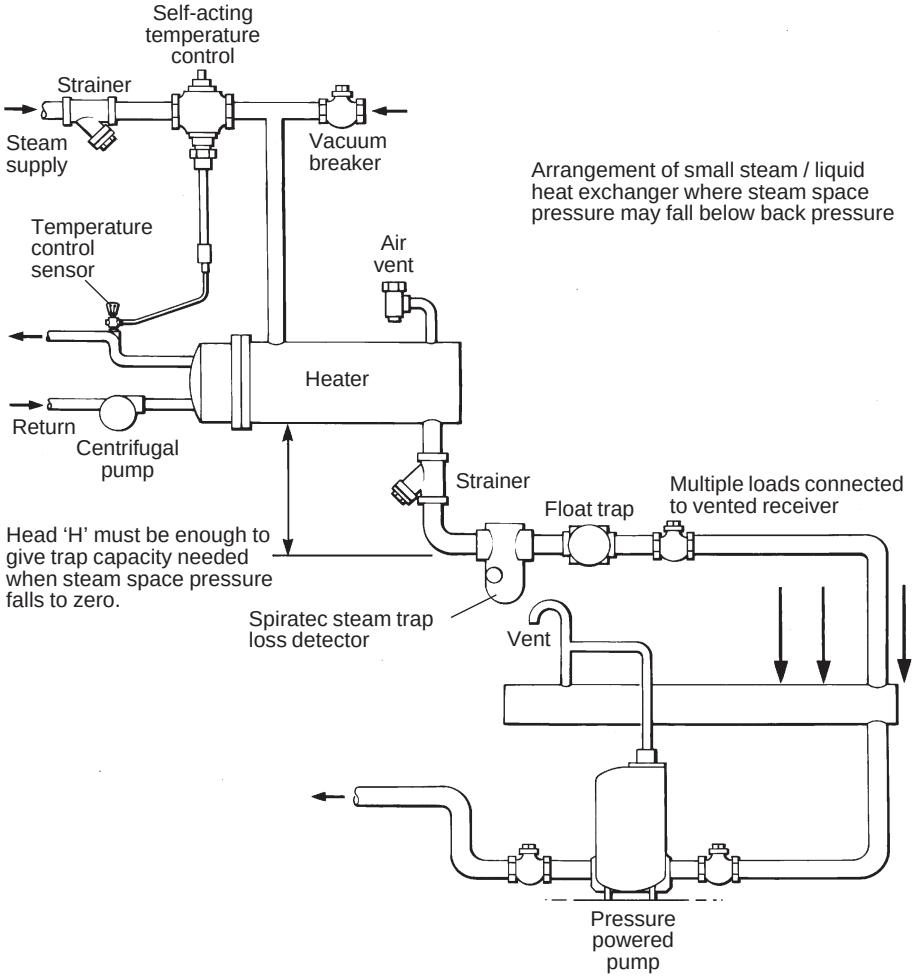

Fig. 10 Draining small heat exchanger and other loads to pressure powered pump