



# Pumping Trap Installation and Maintenance

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*This bulletin should be used by experienced personnel as a guide to the installation and maintenance of the pumping trap or pumping trap package. Selection or installation of equipment should always be accompanied by competent technical assistance. We encourage you to contact Armstrong or your local representative if further information is required.*

The maximum operating pressure for all Armstrong model pumping traps is 125 psig (9 bar). The maximum design pressure for PT-300/400 models is 150 psig at 650°F (10 bar @ 343°C). The PT-200 Series pumping traps weigh 210 lb (96 kg), PT-300 Series weigh 150 lb (68 kg), PT-400 Series weigh 166 lb (75 kg) and the PT-3500 Series weigh 270 lb (123 kg).

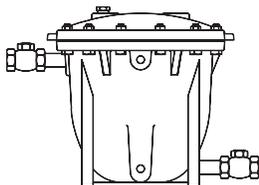


Figure 1  
PT-200 Series  
Cast Iron Body

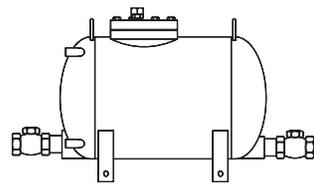


Figure 2  
PT-300 Series  
Horizontal Steel  
Body, ASME Coded

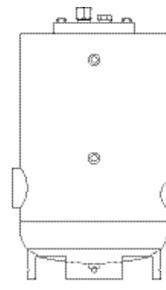


Figure 3  
PT-400 Series  
Vertical Steel  
Body, ASME Coded

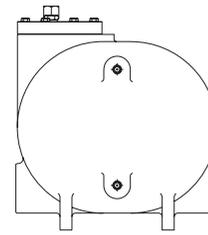


Figure 4  
PT-3500 Series  
Cast Iron Body

**Note:** Although the maximum operating pressure is 125 psi (8.5 bar), it is highly recommended that the motive be set only 15 - 20 psi (1.0 - 1.4 bar) above the discharge pressure. This will provide optimum performance and reduce venting time between cycles.

## Pumping Trap Operation

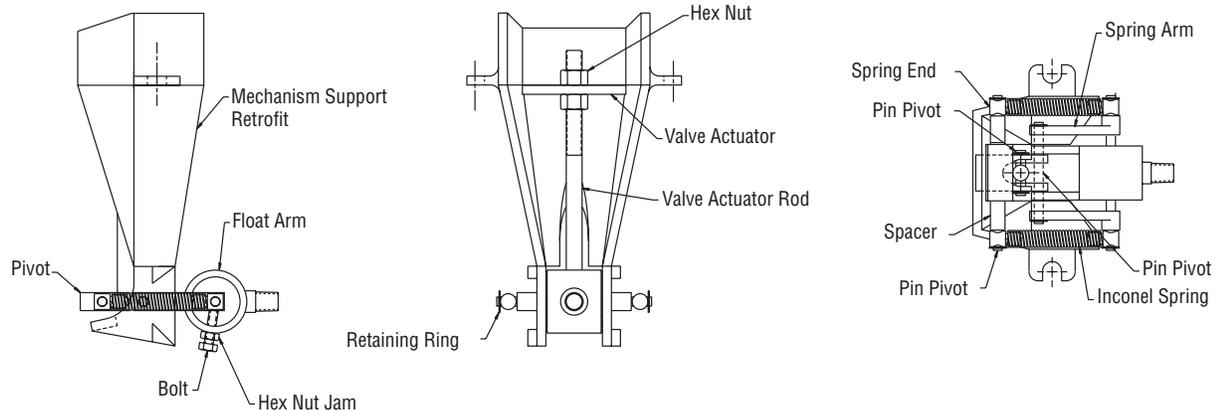
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1. At start-up, the float lies at its lowest position in the bottom of the tank. The motive inlet valve is closed and the vent valve is open.
2. Liquid enters the pump body by gravity through the inlet swing check valve. Back pressure (typically) holds the discharge check valve closed. The float becomes buoyant and begins rising.
3. Continued rising of the float, through linkage, increases spring tension until the float reaches its upper tripping point. Energy is then released instantly from the springs, causing the linkage to snap upwards over center. This upward motion opens the motive inlet valve and closes the vent valve simultaneously. See figure 4 on page 2.
4. Steam, air, or inert gas enters the inlet valve and builds pressure inside the pumping trap. This pressure will close the inlet check valve and force liquid out through the discharge check valve as it opens.
5. The discharge cycle will lower the float level and, through linkage, increase spring tension until the float reaches its lower tripping point. Energy is then released instantly from the springs, causing the linkage to snap over center downward. This downward motion closes the motive inlet valve and opens the vent valve.

## Pumping Trap

6. Venting of pressure from the body opens the inlet check valve and closes the discharge check valve. Liquid now flows by gravity through the inlet check valve into the pumping trap body as a new cycle begins.

Figure 4



## Suggested Installation of Accessories

**The gauge glass assembly will have male NPT connections.**

If mounting on a PT-200 Series pumping trap, one (1) 1/2" x close nipple and one (1) 1/2" coupling will be required. The PT-300 series and PT-400 Series pumping traps will not require any additional parts.

### Cycle Counter:

If a cycle counter is required the installation will be the same for all model pumping traps. There is a 1/2" connection on the cap of the pumping traps where the cycle counter may be mounted. It is very important that a steel siphon or "pig tail" be used prior to the cycle counter to avoid any damage to the cycle counter. See figure 5.

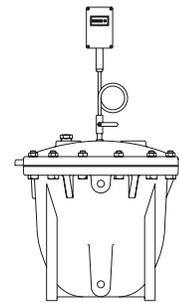


Figure 5

## Installation

**Note: On pre-piped packaged units, inspect and tighten all threaded fittings (such as unions, etc.) which may have loosened during shipment.**

### Filling Head:

Install the pumping trap below the equipment being drained. A minimum filling head of 6" (152 mm) is recommended for Models PT-204 and PT-206 and 12" (304 mm) for all models in the PT-300, PT-400 and PT-3500 series. Filling head is the distance between the bottom of a receiver or reservoir pipe and the top of the pumping trap cap. See typical hook-up on page 7 for an example. All inlet fittings must be fully ported and match the pump's liquid inlet connection size. Greater fill heads increase the capacity of the pump trap. Reference capacity chart for multiplying factors for other filling heads in Catalog 326.

### Liquid Reservoir:

Liquid flowing from the equipment being drained must be stored during the pump's discharge cycle. A liquid reservoir (pipe reservoir) or vented receiver should be installed in a horizontal plane to prevent flooding of equipment. Please contact your local Armstrong representative for

## Pumping Trap

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questions regarding reservoir pipe sizing or reference reservoir sizing data in catalog 326, page 199.

### Check Valves:

NOTE: The pumping trap will not function without inlet and discharge check valves. Connect the Armstrong supplied check valves to the pump. The swing check is the inlet check valve, a stainless steel in-line spring type check valve is used at the pump discharge. **The use of Armstrong supplied check valves is necessary to ensure the pump will attain published capacities.**

Stainless steel in-line spring type check valves are recommended for applications where the differential pressure between the motive pressure and back pressure is greater than 25 psi. The stainless steel check valves are also a good choice for critical applications where the extended life of the stainless steel check valve would be of great value.

The following guidelines apply if the Pumping Trap is installed without Armstrong supplied check valves.

- Inlet check valves should be bronze swing type with teflon disc, Class 150 (minimum).  
Pipe size of the check valve must match the size of the pump's liquid inlet connection.
- Discharge check valve should be in-line spring assist type, Class 150 (minimum) and match the size of the pump's liquid discharge connection.

### Motive Inlet Piping:

Connect the motive force piping (steam, air or inert gas) to the inlet connection on the pump cap. Proper piping and trapping of the motive supply line must include a strainer, check valve, properly sized drip leg with mud pocket, and drip trap. The drip trap discharge line should be connected to the reservoir piping or vented receiver when practical. See figure 5 and 6 on page 7. It is recommended to install a union near the motive inlet (valve seat) to provide quick access to the externally removable seat.

**Note:** To visually determine the location of the **motive** connection, for Series PT-200, PT-300, and PT-3500, look into the pumping trap's **condensate** inlet and the **motive** connection will be on the **right** side of the cap and is 1/2" NPT.

**Note:** For Series PT-400, the **motive** connection will be the 1/2" NPT connection in the cap that is not steel plugged.

**Maximum operating pressures for the pump trap 125 psi (9 bar).** A pressure reducing valve must be used when the motive pressure exceeds 125 psi (9 bar). It is also recommended that motive pressure be set between 15-20 psi (1.0 - 1.4 bar) above the total discharge pressure (total discharge pressure = vertical lift in psi plus return line pressure). This pressure setting keeps venting time to a minimum and, when using steam, reduces the temperature differential. The PRV should be installed as far from the pump trap as possible. A good rule is to use a minimum of 10 ft. of 1" pipe after PRV.

Installation of a safety relief valve and pressure gauge is recommended in the motive force supply line. The relief valve should be set for 150 psig (10 bar).

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### **Vent Connection ("Open System" - vented to atmosphere):**

Piping from the pump's cap connection labeled "Vent" should be installed vertically upward when possible and unrestricted. If piping travels greater than three feet, the piping should be expanded to one inch or greater. If a horizontal run is required, this line should be pitched toward the pump trap in order to be self draining. It is recommended to install a union near the vent connection (valve seat) to provide quick access to the externally removable seat.

**Note:** To visually determine the location of the **vent** connection for Series PT-200, PT-300 and PT-3500, look into the pumping trap's **condensate** inlet and the **vent** connection will be on the **left** side of the cap and is 1" for PT-300/3500.

**Note:** The location of the **vent** connection for Series PT-400 is the 1" NPT connection in the cap.

### **Vent Connection (Closed loop system):**

From the pump cap connection labeled "Vent", the equalizing line should be routed to the top of the equipment being drained or it's outlet piping immediately after the heat exchange equipment. An Armstrong thermostatic air vent is recommended (for steam) at the high point of the exhaust line. (See Figure 7 on page 8.) Piping of the equalizing line should be a minimum 1" (25 mm) diameter and must be pitched in order to be self draining.

If pressure from the equipment being drained could ever exceed back pressure against the pump, a properly sized inverted bucket steam trap with a large vent or a float and thermostatic trap must be installed between the pump and discharge check valve. See Figure 9 on page 8.

**Packaged Receiver Vent Connections:** The receiver vent must be unrestricted and atmospherically vented unless an ASME coded tank is specified.

**Packaged Pump Trap Vent Connections:** Piping from the pump's cap connection labeled "vent" should be installed upward to connect with the receiver vent line, and be a minimum of one (1) inch (25 mm) diameter.

### **Package Connections:**

NOTE: All receiver tanks should be operated at atmospheric pressure (vented) unless the package was ordered with an ASME coded tank.

A pumping trap receiver package designates the number of pumps with a "S" for single (one pump), "D" for duplex (two pump), "T" for triple (three pump), and "Q" for quad (four pumps). For example: SPT-308RP or TPT-412RP. The "LBRP" at the end of the model number means low boy receiver package.

All Armstrong model pumping traps have 1/2" (10 mm) NPT gauge glass connections.

**NOTE: Replace any temporary plastic plugs in these connections with permanent steel plugs or appropriate fittings before start-up.**

## Pumping Trap

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### Start-Up

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1. Slowly open motive force (steam, air or inert gas) supply to Pumping Trap providing pressure to the inlet valve. Check for proper operation of drip trap on the motive line if using steam.
2. Open isolation valves leading to pump liquid inlet and discharge lines.
3. Open any additional valves upstream allowing liquid to enter Pumping Trap from the equipment being drained. Pump will begin discharging when body is nearly full.
4. Proper operation includes an audible exhaust after each pump cycle. If operation doesn't seem proper, recheck the installation and start-up procedure. Contact Armstrong or your local Armstrong Representative if necessary.
5. Armstrong strongly recommends the use of overflow piping on receiver tanks in open condensate return systems. Properly installed overflow piping increases the efficiency of the system, while addressing potential safety issues involved with the unintentional escape of hot condensate. One suggestion would be the use of a "P"-trap to form a sufficient water seal. Be sure to check that a water seal has formed to prevent venting of steam through the overflow connection during operation.

### Maintenance

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1. Close the valves in the motive supply, vent, condensate supply and discharge lines. Also close the shut-off valve to the receiver for packaged units. **Make sure that the pumping trap is completely relieved of pressure before breaking any connections.**

**NOTE: If a problem is suspected with motive or vent valve and seat combinations, the pump cap may not need to be removed. The seats are externally replaceable. This provides for visual inspection and cleaning of the seats without removal of the cap.**

2. Break motive inlet and vent (all cap) connections. Remove bolts and lift the cap. A 15 inch (381 mm) withdrawal distance is required in order to remove the mechanism assembly with float for all Armstrong Pumping Traps.

**NOTE: Mechanism assembly is factory set. No adjustment to mechanism assembly should be made.**

3. Inspect the mechanism for freedom of movement. Remove any dirt or scale inhibiting the motion of the mechanism. See Figure 4 on page 2.
4. Check condition of the springs. If defective, remove retaining rings and slide springs (with spring ends) from pins. Replace springs (with spring ends) and install new retaining rings. Once the retaining rings have been removed they should **not** be reused.
5. Check the float for pinhole leaks, dents, or corrosion. Immerse in hot water and look for air bubbles to detect pinhole leaks.

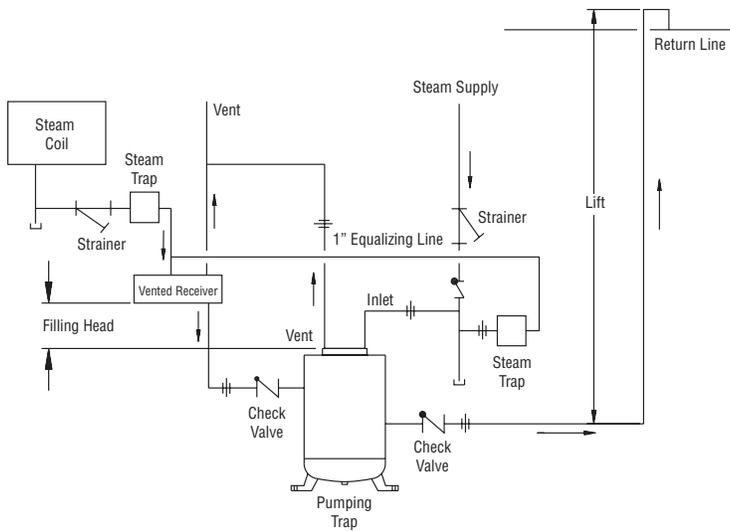
# Pumping Trap

6. Inspect seating surfaces of motive inlet and vent valves for evidence of wear. Clean the surfaces. Each valve slides out from its position in the valve actuator. Reinstall or replace parts as necessary. Removal of the inlet or vent seat may require replacement of the appropriate metal gasket before either seat is reinstalled or replaced. The same number of gaskets should be put back as were removed.
7. Inspect inlet check valve and discharge check valve for free movement. It is important that both check valves are able to fully seat. Foreign material or debris may damage seating surfaces.

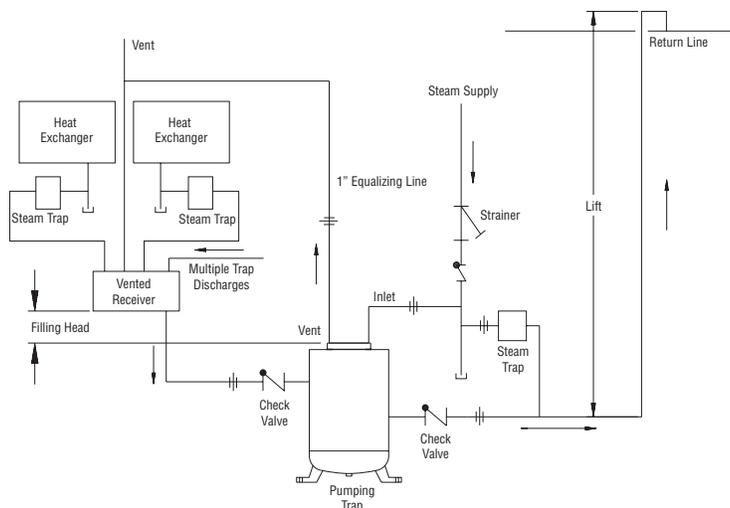
# Typical Hook-Ups

**NOTE:** Hook-up sketches depict the Pumping Trap for clarity. However, the cap inlet and vent connections are actually located closer to each other than shown.

## Vented Systems



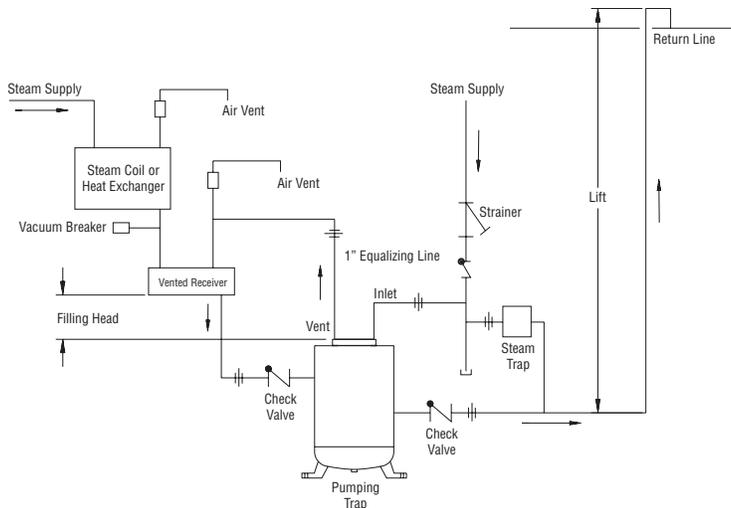
**FIGURE 5:** Condensate drainage to vented receiver with overhead condensate return. Use of the Pumping Trap, combined with proper sizing of the steam trap and receiver assures successful coil drainage under low pressure conditions.



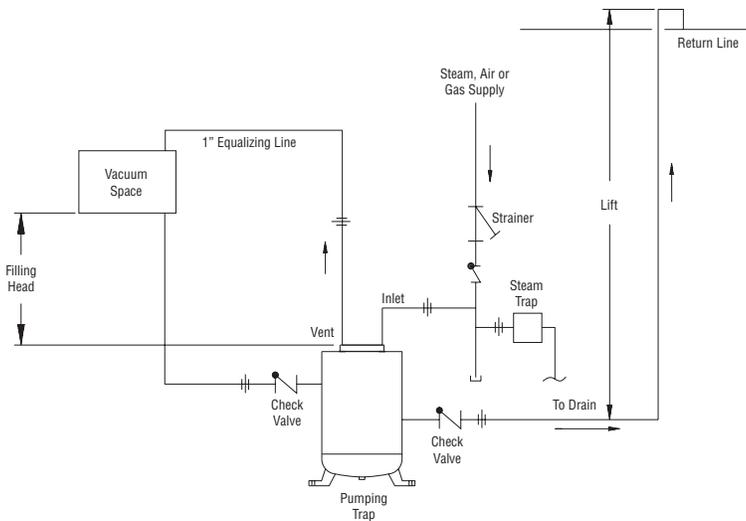
**FIGURE 6:** Pumping of condensate from vented receiver handling multiple steam trap discharges. Motive force of steam is depicted.

# Closed Loop Systems

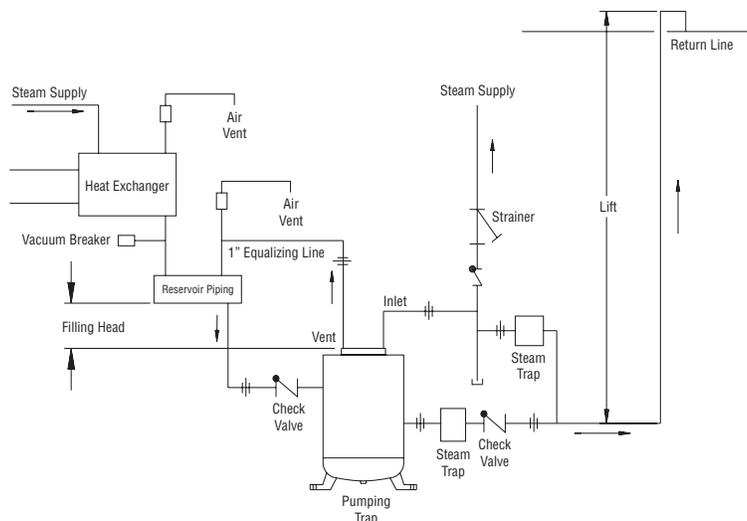
A closed loop system must be installed with caution and if any questions arise, contact Armstrong Fluid Handling's Application Engineering Department.



**FIGURE 7:** Draining steam coil or heat exchanger when pressure in heat exchanger is lower than return line pressure combined with overhead lift. Please note the equipment is not trapped. In this application the pumping trap is used as both a steam trap and a pump.



**installation.**  
**FIGURE 8:** Draining liquid from equipment under vacuum. The Pumping Trap provides drainage assistance whether liquid discharge is to gravity or overhead.

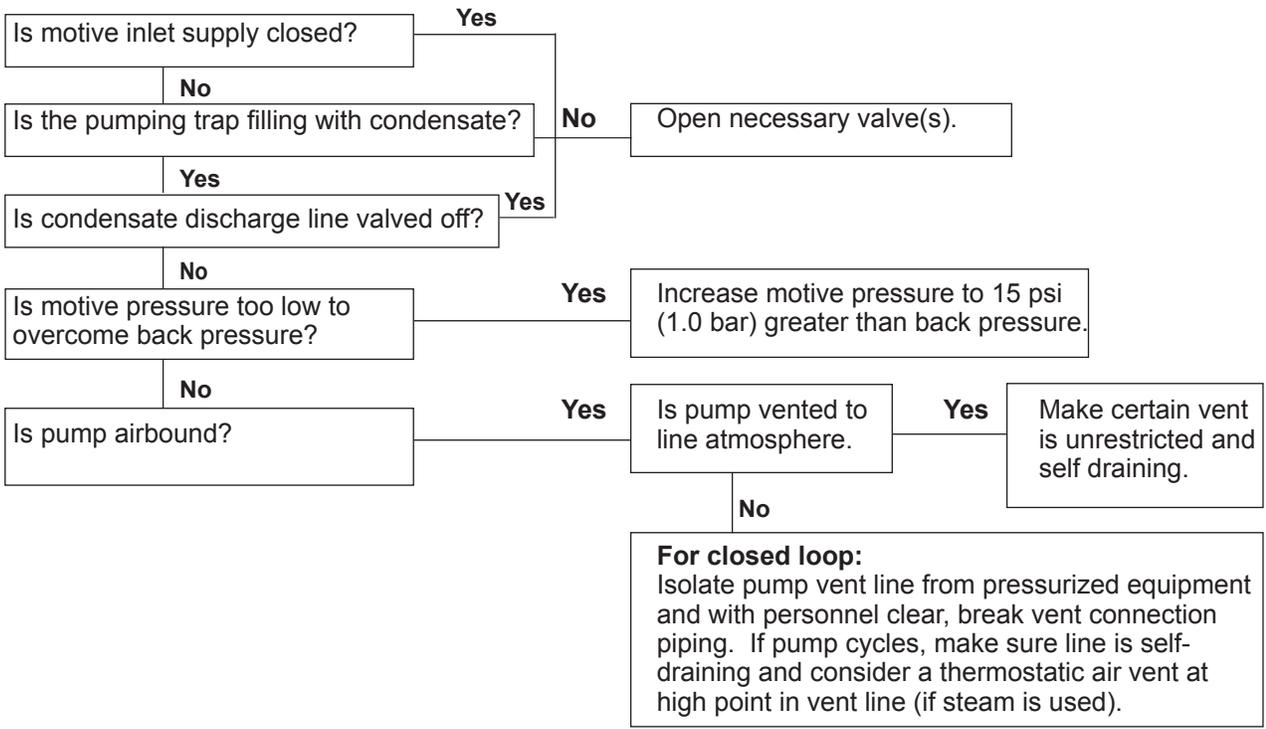


**FIGURE 9:** Drainage from a heat exchanger in a closed-loop system where the supply pressure may be higher or lower than the back pressure. If the heat exchanger pressure exceeds the back pressure the pumping trap will be idle and the steam trap will prevent the steam from "blowing through" into the return line. Motive force of steam is depicted.  
**NOTE: It is suggested that Armstrong Fluid Handling's Application Engineering Department be contacted prior to**

# Troubleshooting Flow Charts

**For Safety of Personnel** - Vent line piping should be isolated from equipment and pump pressure should be relieved prior to breaking connections. **WARNING: WATER MAY RUN OUT OF THE VENT CONNECTION WHEN PIPING IS BROKEN. CARE SHOULD BE TAKEN TO AVOID DANGER TO PERSONNEL OR DAMAGE TO NEARBY EQUIPMENT.**

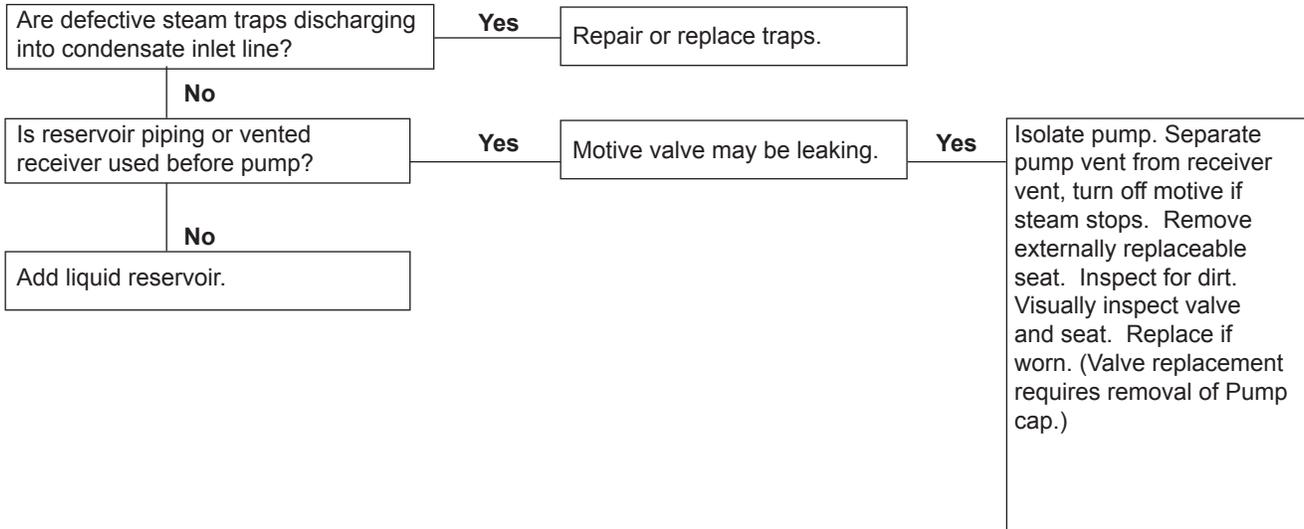
## 1. Pump Does Not Cycle During Start-Up



## Troubleshooting Flow Charts -- Continued...

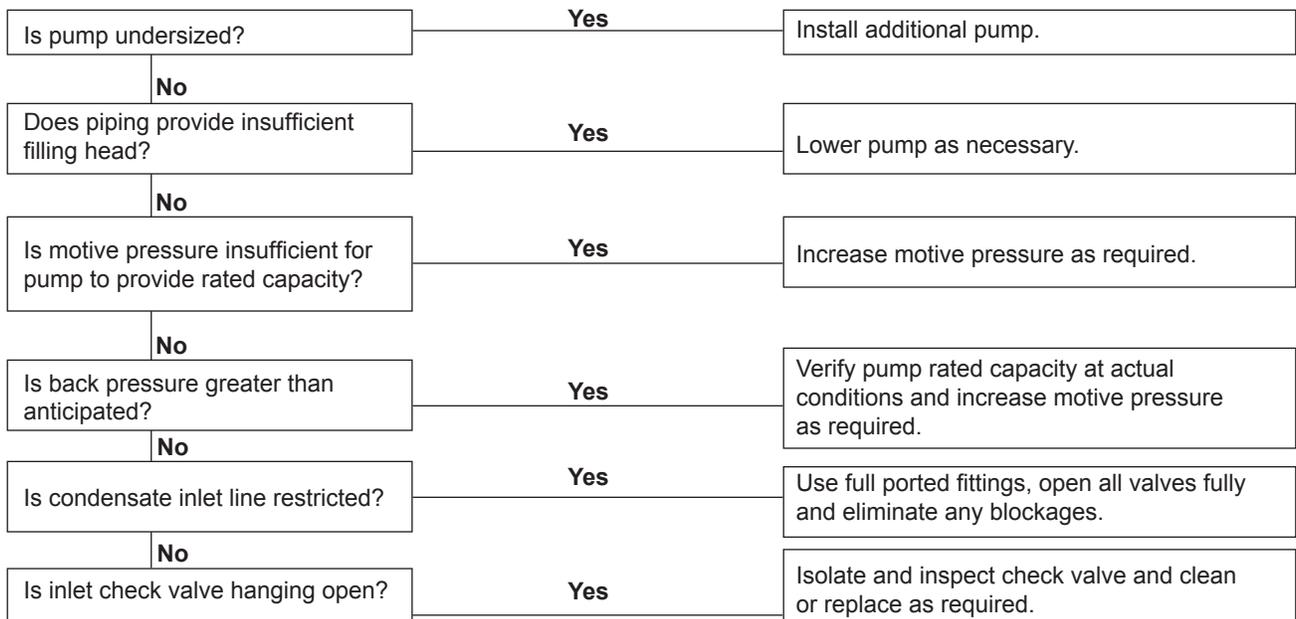
**For Safety of Personnel** - Vent line piping should be isolated from equipment and pump pressure should be relieved prior to breaking connections. **WARNING: WATER MAY RUN OUT OF THE VENT CONNECTION WHEN PIPING IS BROKEN. CARE SHOULD BE TAKEN TO AVOID DANGER TO PERSONNEL OR DAMAGE TO NEARBY EQUIPMENT.**

### 2. Excessive flash steam passed through vent



### 3. Pump cycles but equipment or piping is flooded

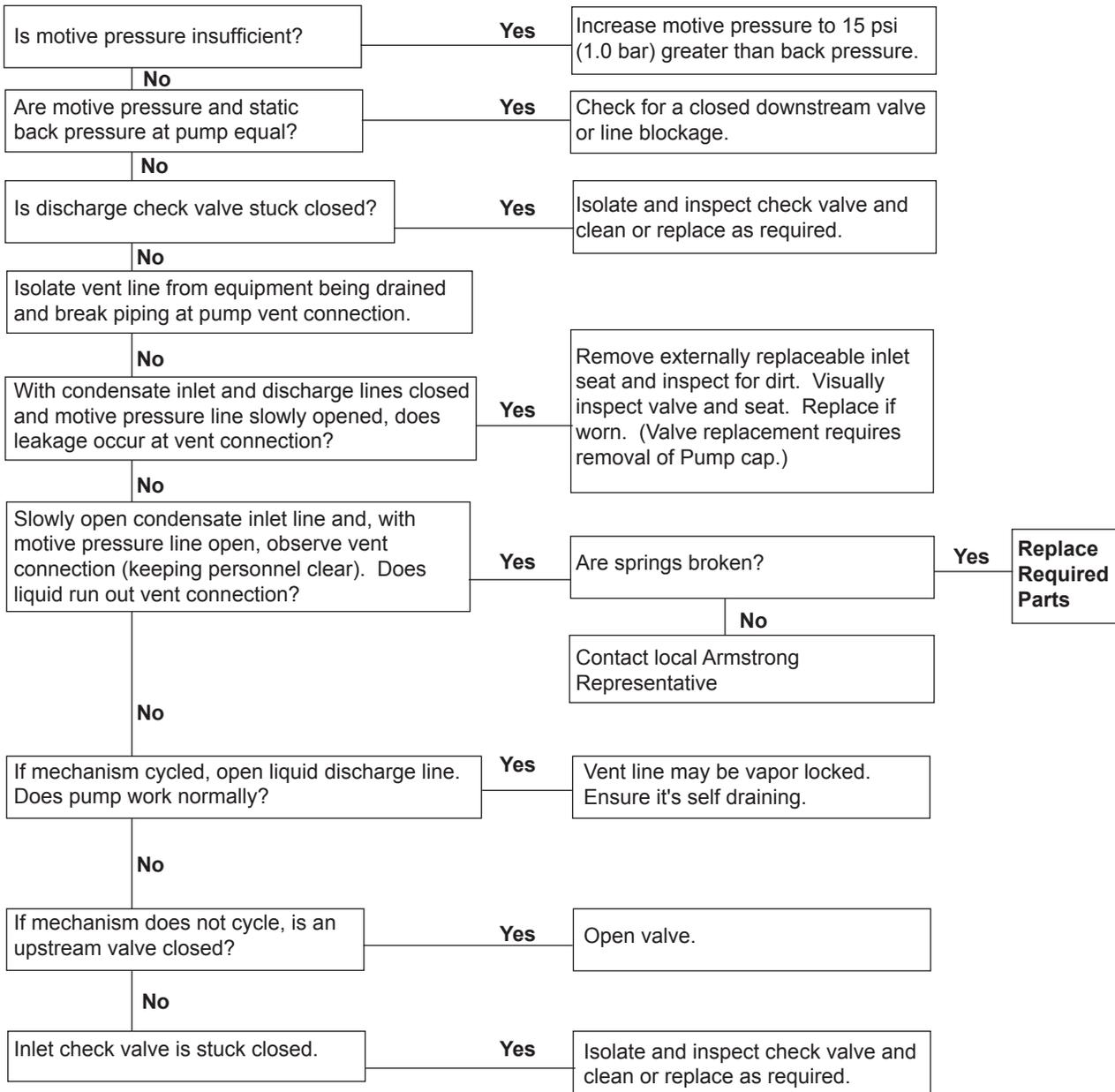
NOTE: See Catalog 326 for sizing.



## Troubleshooting Flow Charts -- Continued...

**For Safety of Personnel** - Vent line piping should be isolated from equipment and pump pressure should be relieved prior to breaking connections. **WARNING: WATER MAY RUN OUT OF THE VENT CONNECTION WHEN PIPING IS BROKEN. CARE SHOULD BE TAKEN TO AVOID DANGER TO PERSONNEL OR DAMAGE TO NEARBY EQUIPMENT.**

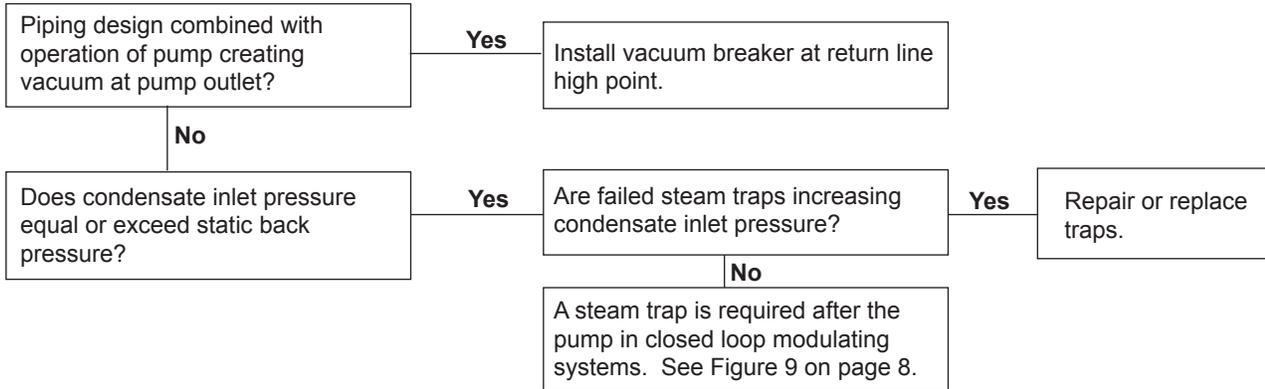
### 4. Pump stops cycling and equipment is flooded



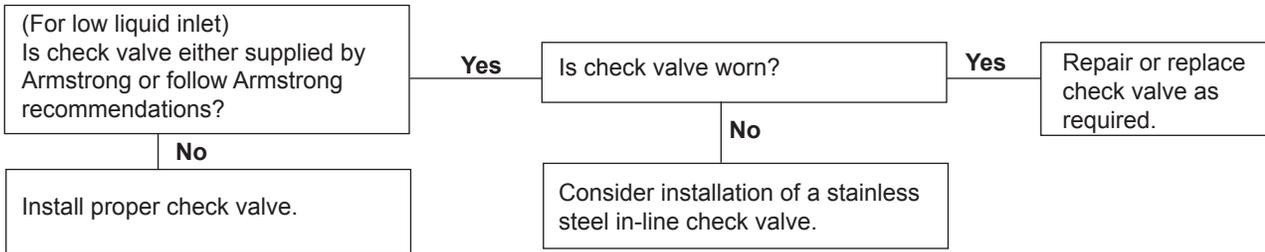
## Troubleshooting Flow Charts -- Continued...

**For Safety of Personnel** - Vent line piping should be isolated from equipment and pump pressure should be relieved prior to breaking connections. **WARNING: WATER MAY RUN OUT OF THE VENT CONNECTION WHEN PIPING IS BROKEN. CARE SHOULD BE TAKEN TO AVOID DANGER TO PERSONNEL OR DAMAGE TO NEARBY EQUIPMENT.**

### 5. Chattering or knocking in return line after discharge



### 6. Excessive chatter from inlet check valve



For additional information on Pumping Traps, contact your Armstrong Representative and request Catalog No. 326.







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