PMP & PUMP-TRAP APPLICATIONS

CONDENSATE DRAINAGE • using Pump-Trap

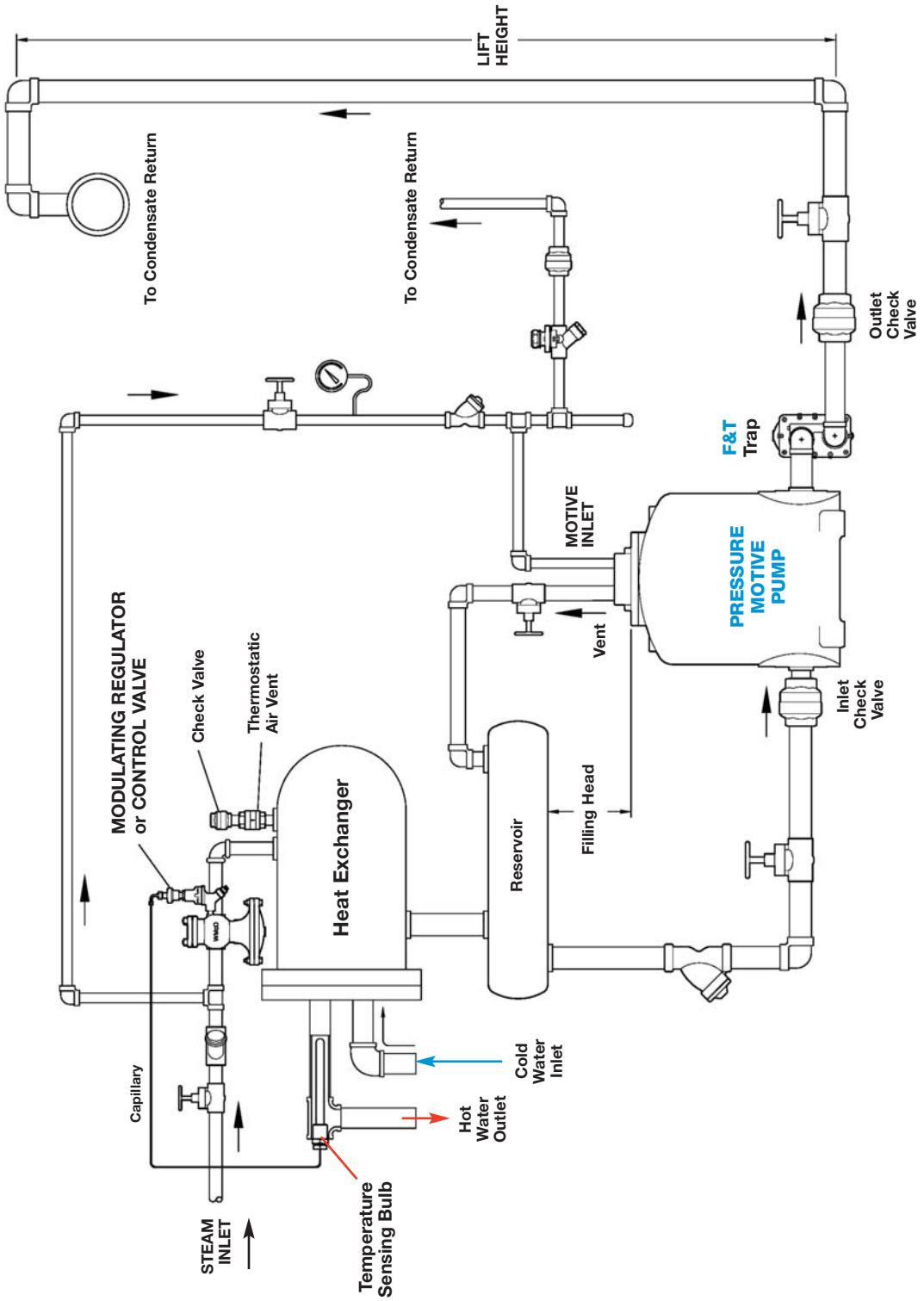
PURPOSE: For removing condensate from below steam heat transfer equipment when a modulating valve is used for control, and condensate discharge is elevated and/or pressurized, resulting in Stall condition.

OPERATION: The Pressure Motive Pump (PMP) is used to overcome the stall condition that exists when steam feeding a single piece of heat transfer equipment is controlled by a modulating steam valve and steam pressure falls below system back pressure as the valve closes. A steam trap is required after the PMP to prevent the loss of live steam when the system is under positive pressure. Operating as a closed loop provides an energy-efficient system by eliminating the need to vent flash steam.

INSTALLATION GUIDELINES: (see Figure13)

- Proper installation and piping of the pump vent line is critical to ensure the system operates correctly. Follow guidelines or consult factory for additional information.
- Maintain proper fill head above the top of the pump to ensure proper function of the pump and system. A suitably sized reservoir or oversized piping should be installed ahead of the pump for accumulation of condensate during the pump's discharge cycle (i.e. when not filling).
- The steam trap after the pump must be sized in conjunction with the pump to ensure proper function as a system. Improper sizing may result in reduced capacity leading to condensate back-up, poor heat transfer and potentially dangerous waterhammer. Consult appropriate sections of this catalog or the factory for guidelines regarding proper sizing of the pump-trap combination.
- While a separator is appropriate for protection of the Regulator, it is not always required, as a properly sized drip leg with steam trap may be sufficient. It is recommended for systems where steam is known to be "wet" and the entrained moisture could affect valve performance and/or result in component damage.
- Low-cracking pressure (1/4 PSI opening pressure) check valves should be installed after steam traps when discharging into condensate return lines. Check valves eliminate the possibility of condensate backing up through the steam trap into the system.
- The thermostatic air vent installed on the heat exchanger promotes optimum heat transfer. The air vent improves heat-up times and overall heat transfer by expelling accumulated air on start-up. When properly sized and installed, the pump-trap combination can operate in sub-atmospheric (i.e. vacuum) conditions; therefore, a vacuum breaker should not be used.

Figure 13:



Drainage of a Single Source of Condensate for a Closed Loop System
(Pump-Trap Applications)

ENGINEERING

PMP & PUMP-TRAP APPLICATIONS

CONDENSATE DRAINAGE from Below Grade • using Pump-Trap

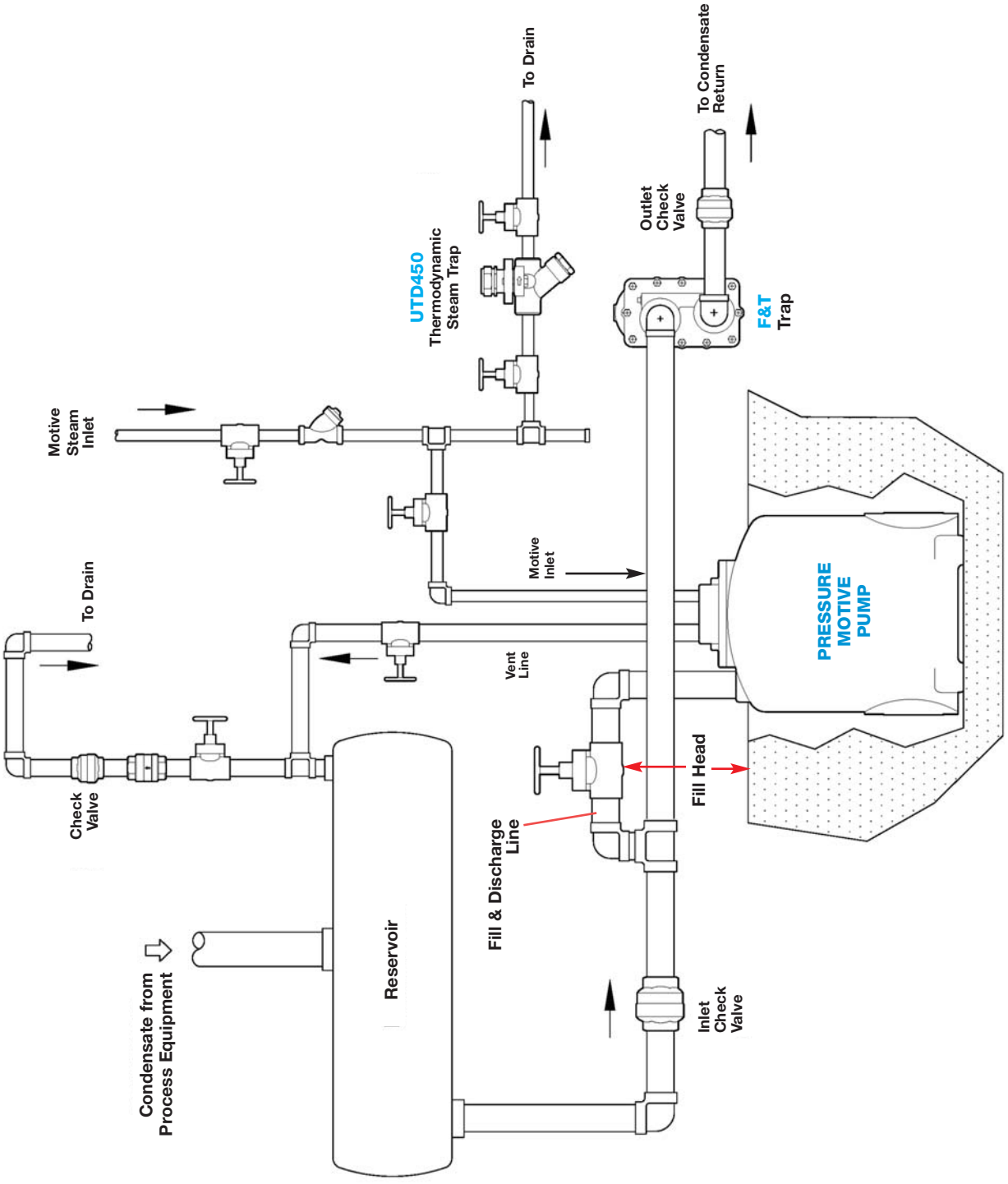
PURPOSE: For drainage of condensate from below process equipment where fill head is limited due to height restrictions and the pump must be installed below grade.

OPERATION: When fill head is restricted and it is more suitable to create a pit below grade than reposition process equipment, the Pressure Motive Pump (PMP) may be modified so both condensate inlet and outlet connections are on top to limit the necessary pit size. When stall exists, condensate will accumulate between the inlet and outlet check valves and eventually drain into and fill the PMP tank. Once the PMP fills and its mechanism trips, high pressure motive steam will enter the pump tank and force condensate back out the same connection. The check valves will direct the flow of pumped condensate into the return piping.

INSTALLATION GUIDELINES: (see Figure 14)

- The positioning of the check valves and PMP fill/discharge line are the key elements which allow the system to function properly. The check valves dictate the proper direction of condensate flow for both fill and discharge cycles of the PMP. The PMP fill/discharge line should be taken off the top, as shown, so condensate only accumulates and fills the pump during stall.
- Proper installation and piping of the pump vent line is critical to ensure the system operates correctly. Follow guidelines or consult factory for additional information.
- Maintain proper fill head above the top of the pump to ensure proper function of the pump and system. A suitably sized reservoir or oversized piping should be installed ahead of the pump for accumulation of condensate during the pump's discharge cycle (i.e. when not filling).
- The steam trap after the pump must be sized in conjunction with the pump to ensure proper function as a system. Improper sizing may result in reduced capacity leading to condensate back-up, poor heat transfer and potentially dangerous waterhammer. Consult appropriate sections of this catalog or the factory for guidelines regarding proper sizing of the pump-trap combination.
- Low-cracking pressure (1/4 PSI opening pressure) check valves should be installed after steam traps when discharging into condensate return lines. Check valves eliminate the possibility of condensate backing up through the steam trap into the system.

Figure 14:



Drainage of Condensate from BELOW GRADE for a Closed Loop System in Situations with Minimal Fill Head
(Pump-Trap Applications)

CONDENSATE DRAINAGE using Vertical Reservoir and Pump-Trap

PURPOSE: For drainage of condensate from below process equipment where fill head is limited due to height restrictions and a horizontal reservoir cannot be installed.

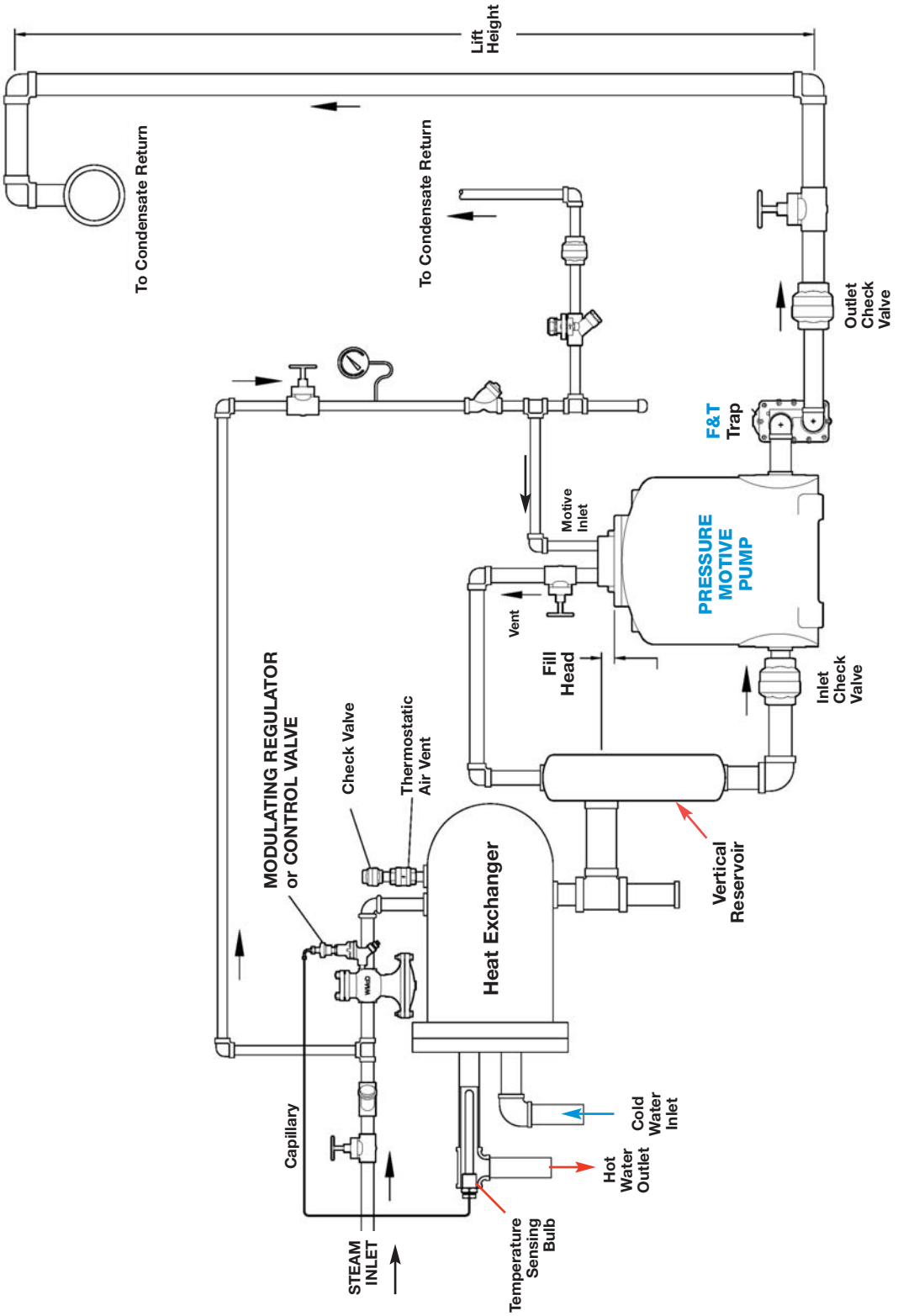
OPERATION: This system functions similarly to the system shown on page 455. However, when fill head is restricted due to heat exchanger height above ground, consider a vertical reservoir in lieu of a horizontal reservoir. This would accommodate condensate back-up as well as provide sufficient vapor space for the adequate venting of the pump while providing sufficient fill head to ensure proper operation of the pump.

INSTALLATION GUIDELINES: (see Figure 15)

- The vertical reservoir must be properly designed and installed to allow adequate condensate back-up during the pump's discharge cycle (i.e. when not filling), unobstructed venting of the pump, as well as sufficient fill head to ensure proper pump and system operation. Consult factory for additional assistance.
- Proper installation and piping of the pump vent line is critical to ensure the system operates correctly. Follow guidelines or consult factory for additional information.
- The steam trap after the pump must be sized in conjunction with the pump to ensure proper function as a system. Improper sizing may result in reduced capacity leading to condensate back-up, poor heat transfer and potentially dangerous waterhammer. Consult appropriate sections of this catalog or the factory for guidelines regarding proper sizing of the pump-trap combination.
- Low-cracking pressure (1/4 PSI opening pressure) check valves should be installed after steam traps when discharging into condensate return lines. Check valves eliminate the possibility of condensate backing up through the steam trap into the system. .
- The thermostatic air vent located on the heat exchanger promotes optimum heat transfer. The air vent improves heat-up times and overall heat transfer by expelling accumulated air on start-up. When properly sized and installed, the pump-trap combination can operate in sub-atmospheric (i.e. vacuum) conditions; therefore, a vacuum breaker should not be used.

CONDENSATE DRAINAGE using Vertical Reservoir and Pump-Trap

Figure 15:



Drainage of Condensate from HEAT EXCHANGER positioned Close to the Ground
(Pump-Trap Applications)

FLASH STEAM RECOVERY

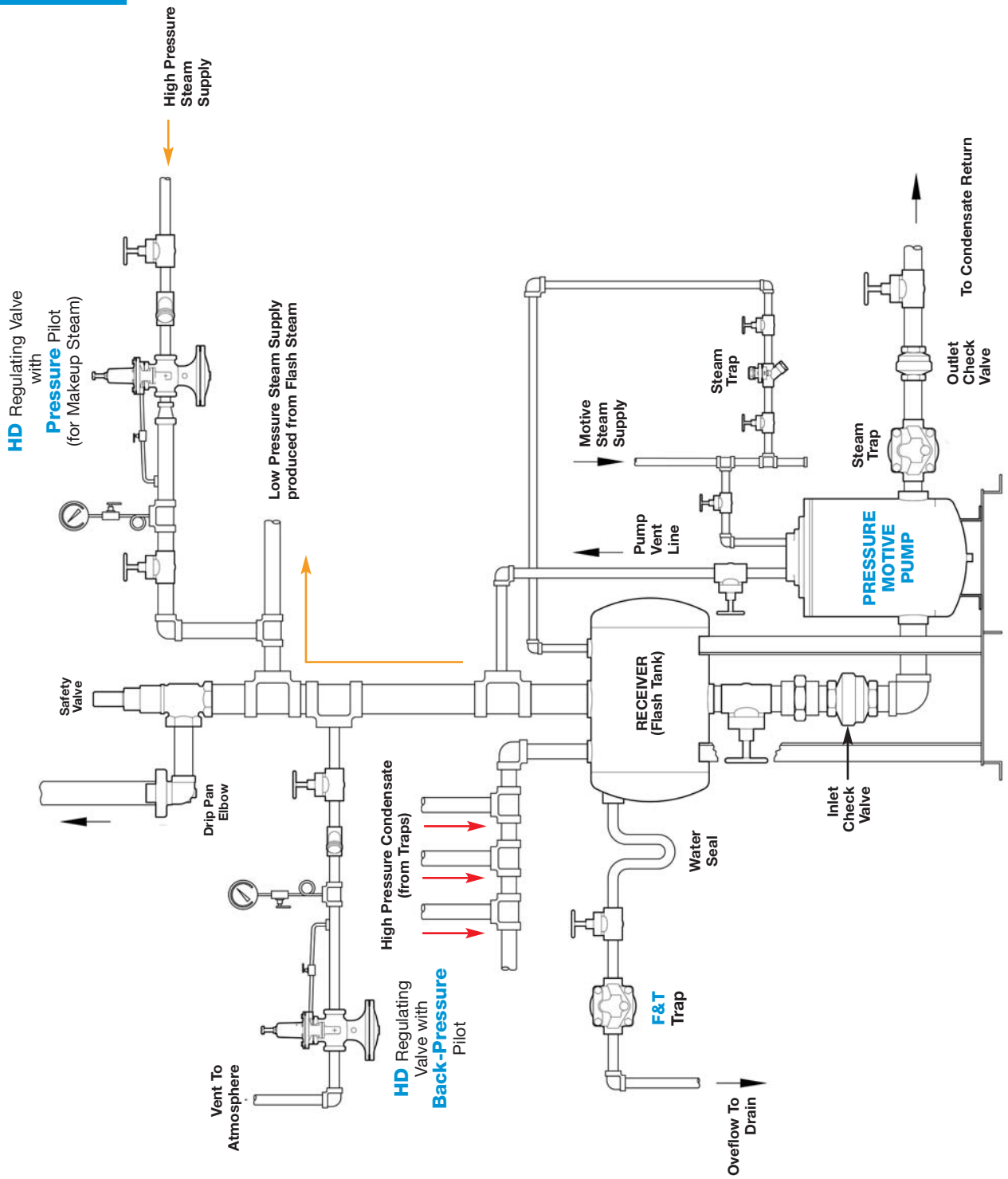
PURPOSE: For recovering flash steam from multiple condensate sources and drainage of the condensate when the total system back pressure is greater than the total of the individual source pressures.

OPERATION: Condensate at various pressures collects in a receiver (flash tank), equalizing the pressures to that of the flash tank. This allows drainage by gravity into the Pressure Motive Pump (PMP), filling the PMP until the internal mechanism reaches its upper trip point and activates the motive steam used for pumping. The flash steam generated from the high pressure condensate may be used to supplement other applications for optimum energy efficiency. The pressure in the receiver tank is maintained by a back pressure regulator and protected by a safety relief valve.

INSTALLATION GUIDELINES: (see Figure 16)

- The key element for proper system operation is the sizing of the receiver tank and receiver vent connection, which must accommodate the flash steam. Consult appropriate sections of this catalog or the factory for guidelines regarding proper sizing of the receiver tank and receiver vent connection.
- Proper installation and piping of the pump vent line is critical to ensure the system operates correctly. Follow guidelines or consult factory for additional information.
- Careful consideration should be given to sizing of the auxiliary components such as the back pressure regulator and safety relief valve.
- Maintain proper fill head above the top of the pump to ensure proper function of the pump and system. A suitably sized receiver or oversized piping should be installed ahead of the pump for accumulation of condensate during the pump's discharge cycle (i.e. when not filling).
- The steam trap after the pump must be sized in conjunction with the pump to ensure proper function as a system. Improper sizing may result in reduced capacity leading to condensate back-up, poor heat transfer and potentially dangerous waterhammer. Consult appropriate sections of this catalog or the factory for guidelines regarding proper sizing of the pump-trap combination.
- While the separator shown upstream is appropriate for protection of the PRV, it is not always required, as a properly sized drip leg with steam trap may be sufficient. It is recommended for systems where steam is known to be "wet" and the entrained moisture could affect valve performance and/or result in component damage.
- Low-cracking pressure (1/4 PSI opening pressure) check valves should be installed after steam traps when discharging into condensate return lines. Check valves eliminate the possibility of condensate backing up through the steam trap into the system.
- A safety relief valve (SRV) is appropriate where applicable codes dictate their requirement, or anywhere protection of downstream piping and equipment from over-pressurization is desired. Consult the factory for appropriate SRV sizing guidelines.

Figure 16:



FLASH STEAM RECOVERY (Pump-Trap Applications)

ENGINEERING

REMOVAL OF WATER OR CONDENSATE FROM A PIT

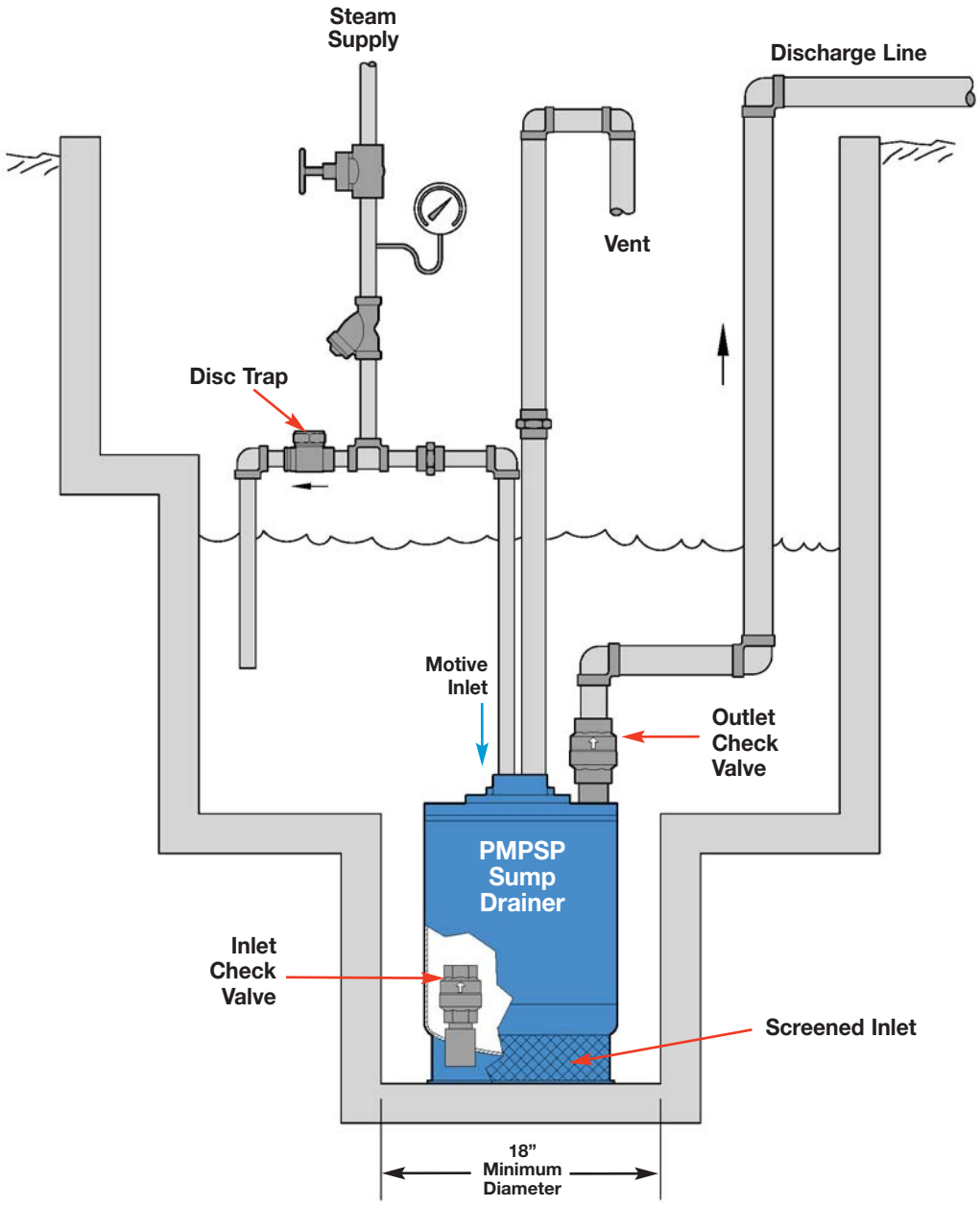
PURPOSE: For drainage of water and condensate from collection pits – especially with minimal horizontal space.

OPERATION: Water enters the inlet check valve through a screened area at the bottom of the PMPSP Sump Drainer. After the pump fills, the internal mechanism is actuated and the water is discharged from the pump by motive steam or compressed air or other gas.

INSTALLATION GUIDELINES: (see Figure 17)

- Make certain vent line is unobstructed and allowed to discharge directly to atmosphere.
- Other compressed gases, such as nitrogen, may be used as a motive source.
- Pit diameter should be at least 18” to ensure proper installation and operation.
- Proper installation and piping of the pump vent line is critical to ensure the system operates correctly. Follow guidelines or consult factory for additional information.
- Note that liquid level in the pit must rise above the pump to allow proper function.

Figure 17: Sump Drainer: "The Pit Boss"



PMPSP Sump Drainer ("The Pit Boss")