vented condensate tank operations

>> Steam Best Practices

Sheet 3

Condensate is a natural consequence of steam system operations. Efficient systems collect condensate and either return it to a deaerator, a boiler feed tank, or use it in another process. The majority of steam systems are modulating, meaning the steam pressures vary throughout the process. Modulating process steam systems enable condensate to flow downstream from heat transfer equipment to a vented condensate tank system that ensures pressure does not build up on the condensate return lines. The vented condensate tank then delivers the condensate back to the boiler—without this system, the differential pressure is insufficient for delivering the condensate to the boiler plant. The system works in a similar fashion for pumping condensate from the boiler to the pressurized deaerator system.

In selecting a vented condensate tank, it is important to choose a design that will not create any backpressure during operation of the tank. The condensate tank should vent to the condenser or the atmosphere in order to dissipate flash steam and alleviate pressure within the tank (Flash steam vent lines will allow velocities of 3,000 feet per minute maximum).

TYPES OF CONDENSATE PUMPING SYSTEMS

- **Electric (On-Off)**
  The condensate tank contains a float switch, and when the condensate reaches a certain level, the contact in the float switch closes, causing the condensate pump to start. The pump operates until the condensate level decreases enough that the contact in the float switch opens, and the pump stops. This operation repeats as the water level rises and falls.
- **Electric (Continuous Flow)**
  The condensate tank contains a modulating valve on the discharge valve (or the variable speed drive motor) that modulates to keep a constant condensate level in the tank. As the level of condensate increases, the valve opens (or the motor speeds up) to pump condensate flow into the condensate return system. As the level drops, the valve closes (or the motor is slowed) and reduces the amount of condensate being discharged.
- **Steam Motive Pump (Self-Actuating)**
  Steam is the operating force that drives a steam motive pump. A vented receiver or collection head is essential to this type of system in order to separate any flash steam from the condensate before the condensate flows into the pump chamber.

System Type	Selection Process	Advantages	Disadvantages
Electric (On-Off)	• Capacity up to 12,000 pph • Single pump or dual pump • Gravity systems, low- or medium-pressure returns	• Low cost • Simple operation	• Low capacity • Possible surging in condensate lines
Electric (Continuous Flow)	• Capacity up to 12,000 pph • Single pump (common)	• High capacity • Handles condensate load variations • Continuous condensate flow in the return system • No surging in the condensate lines	• A more complicated operation • Higher cost upfront
Self Motive Pump (Self-Actuating)	• Capacity up to 12,000 pph	• No electricity is required • Used in explosion-proof areas	• Low capacity and high operating costs • Requires fill head • Mechanical failures of the mechanism • Limited chamber venting of flash steam

STEAM MOTIVE VERSUS ELECTRIC PUMP SYSTEMS

Electric pumps offer a number of advantages over steam motive pumps with the most obvious being low operational cost and high reliability. Overall, steam motive pumps will cost up to eight times more per year than electric motor-driven pumps, and steam pumps will likely require maintenance in the first 6 years. Electric motor-driven pumps—when designed correctly—can exceed 6 years of operations without repairs at a fraction of the cost.

Electric Pump Operation

Operational cost per year: $2,254.37

- Horsepower: 4 horsepower
- Electrical cost: $0.08 kWh
- RPM: 1,800

Steam Motive Operation

Operational cost per year: $6,232.00

- Number of pump actions per hour: 6
- Quantity of steam per actions: 42 lbs.
- Number of hours: 8,760
- Steam motive pressure: 60 psig
- Condensate main line pressure: 25 psig

Table 2: Comparison of electric pump and steam motive operation

Operational cost calculations take into account tank size, steam motive pressure, tank configuration, etc.; the calculations listed are based on assumed parameters that are considered conservative. Additional considerations include:

- *Condensate system: Gravity flow to condensate pumping system*
- *Condensate flow: 8,200 pph*
- *Condensate return line pressure: 25 psig*
- *Length of operation: 8,740 hours*

REQUIRED SYSTEM INFORMATION

To ensure installation and operation of your condensate pumping system are successful, the following parameters should be benchmarked:

- *Condensate flow rate: Maximum, Minimum, Normal*
- *Flash steam flow rate: Maximum, Minimum, Normal*
- *Condensate line: Pressure back to boiler plant*
- *Electrical requirements: Voltage available*
- *Pump: Operation at 1,800 rpm*

ABOUT US

Inveno personnel are experts in the field of steam and condensate systems engineering with vast real-world experience and highly recognized professionals in the industrial arena. Our services include design, engineering, requests for quotations, standard operating procedures, root cause analysis, system optimization, steam balancing and project management. Inveno can review your entire steam and condensate system from steam generation to distribution to end user processes and condensate recovery.