Flash High-Pressure Condensate to Regenerate Low-Pressure Steam

Low-pressure process steam requirements are usually met by throttling high-pressure steam, but a portion of the process requirements can be achieved at low cost by flashing high-pressure condensate. Flashing is particularly attractive when it is not economically feasible to return the high-pressure condensate to the boiler. In the table below, the quantity of steam obtained per pound of condensate flashed is given as a function of both condensate and steam pressures.

High-Pressure Condensate Flashing

High-Pressure Condensate (psig)	Percent of Condensate Flashed, lb steam/lb condensate			
	Low-Pressure Steam (psig)			
	50	30	15	5
200	10.4	12.8	15.2	17.3
150	7.8	10.3	12.7	14.9
100	4.6	7.1	9.6	11.8
75	2.5	5.1	7.6	9.9

Example

In a plant where the cost of steam is $4.50 per million Btu (MMBtu), saturated steam at 150 pounds per square inch gauge (psig) is generated, and a portion of it throttled to supply 30-psig steam. Assuming continuous operation, determine the annual energy savings of producing low-pressure steam by flashing 5,000 pounds per hour of 150-psig condensate. The average temperature of the boiler make-up water is 70°F.

From the table above, when 150-psig condensate is flashed at 30 psig, 10.3 percent of the condensate vaporizes.

Low-Pressure Steam Produced = 5,000 lbs/hr x 0.103 = **515 lbs/hr**

From the ASME Steam Tables, the enthalpy values are:

For 30-psig saturated steam = 1171.9 Btu/lb
For 70°F makeup water = 38.0 Btu/lb

Annual savings are obtained as follows:

Annual Savings = 515 lb/hr x (1171.9–38.0) Btu/lb x 8,760 hours/year x $4.50/MMBtu
= $23,019

Proximity Is a Plus

The source of high-pressure condensate should be relatively close to the low-pressure steam header to minimize piping and insulation costs.

Match Availability and Use

The economics of heat recovery projects are most favorable when the waste steam heat content is high and the flow is continuous. Seasonal space heating is not the most desirable end use.

Steam Tip Sheet information adapted from material provided by the Industrial Energy Extension Service of Georgia Tech and reviewed by the DOE BestPractices Steam Technical Subcommittee. For additional information on steam system efficiency measures, contact the OIT Clearinghouse at (800) 862-2086.

Suggested Actions

Determine the potential for high-pressure condensate flashing by completing a plant survey that:

- Identifies all sources of high-pressure condensate.
- Determines condensate flow and duration, as well as the heat recovery potential due to flashed steam production.
- Identifies compatible uses for low-pressure steam.
- Estimates the cost effectiveness of installing appropriate heat-recovery devices and interconnecting piping.

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