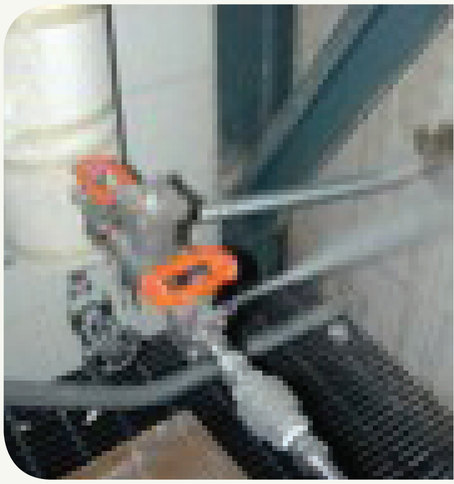
Flash Steam: Are You Venting (Flash) Steam to Atmosphere?



With Today's Fuel Cost, Plants Can't Afford to Release Steam into the Atmosphere

Why does flash occur?

For any given saturated steam or condensate pressure, there can be only the specific values listed in the steam tables for temperature, sensible heat, latent heat, and specific volume. Condensate at a given pressure, discharged into an area of lower pressure, automatically adjusts the condensate temperature to the saturated conditions and other values at the lower pressure.

A specific amount of heat energy is released for each lower pressure condition and the heat energy that is release causes an effect that is called "flash steam", which is a percentage of condensate being re-evaporated into flash steam at the lower pressure.

This phenomenon is called "flashing" and the resultant steam is called "flash steam".

Review: When high pressure condensate (higher energy content) discharges (through a steam trap, control valve, or other device) to a lower pressure area (condensate return line, flash tank, or other system) the condensate liquid temperature must be at the saturated conditions of the lower pressure. To reduce the temperature of the condensate at the lower pressure, a percentage of the condensate is flashed into the steam.

What is the Quantity of Flash?

The steam tables indicate each pound of condensate at 100 psi contains 309 BTU's (sensible energy) and at 0 psi or atmospheric pressure condensate contains 180 BTU's (sensible energy).

The high-pressure condensate, therefore, contains 309 Btu's (100 psi) sensible energy - 180 Btu's (0 psi) or 129 Btu's more Btu's than it can embrace at atmospheric conditions.

To put this in terms of energy conservation, 129 Btu's of heat energy are released into the atmosphere and wasted from each pound of condensate returned to the boiler operation; if not recovered in the condensate system.

Since the latent heat of steam at atmospheric pressure (0 psi) is 970 Btu' per pound of steam at atmospheric conditions; the following equation would indicate how many pounds of steam would be produced:

$$\frac{129}{970} = 0.133 \text{ lb.}$$

That 0.133 lb of steam will be liberated or "flashed" off each pound of condensate returned at atmospheric conditions.

The flash loss can be calculated for any condition by solving the following formula:

$$\text{Flash Steam} = \frac{(SH\text{-}SL)}{LHL}$$

SH = Sensible heat in condensate at higher pressure
SL = Sensible heat in condensate at lower pressure
LHL = Latent heat in the steam at the lower pressure to which the condensate has been discharged

Flash steam affects:

1. Condensate return lines sizing
2. Condensate receiver tank vent sizing
3. Steam system testing
4. Steam trap discharge piping
5. Energy loss
6. Increased chemical cost
7. Increased make-up water usage
8. Can cause waterhammer; if not properly piped

Example of Energy Loss

Example:

Process steam consumption:	12,000 lbs per hour
Process steam pressure:	120 psi
Process steam load:	Modulating
Condensate return pressure:	zero (0)

SH @ 120 psi	321
SL @ zero	180
LHL @ zero	970

Percentage of flash	.145
Amount of flash steam	1,740 lbs per hour
Cost of steam	$14.80 per thousand lbs

Loss per year	$225,587.52 (24/7 @ 365 days a year)

This would be the loss; if not recovered.

Energy loss:

This vent is flashing 2800 lbs per hour (24 hrs a day) 360 days. What is the energy loss?

Best Practices

1. Review plant site for venting
2. Non-modulating steam process loads; use high pressure return systems or flash tank systems
3. Modulating steam process loads; use vent condensers

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