How to Trap Flash Tanks

When hot condensate or boiler water, under pressure, is released to a lower pressure, part of it is re-evaporated, becoming what is known as flash steam. The heat content of flash is identical to that of live steam at the same pressure, although this valuable heat is wasted when allowed to escape through the vent in the receiver. With proper sizing and installation of a flash recovery system, the latent heat content of flash steam may be used for space heating; heating or preheating water, oil and other liquids; and low pressure process heating.

If exhaust steam is available it may be combined with the flash. In other cases, the flash will have to be supplemented by live make-up steam at reduced pressure. The actual amount of flash steam formed varies according to pressure conditions. The greater the difference between initial pressure and pressure on the discharge side, the greater the amount of flash that will be generated.

To determine the exact amount, as a percentage, of flash steam formed under certain conditions, refer to page CG-4 for complete information.

**Trap Selection**

The condensate load can be calculated using the following formula:

$$Q = \frac{L \times P}{100}$$

Where:
- $Q$ = Condensate load in lbs/hr
- $L$ = Condensate flow into flash tank in lbs/hr
- $P$ = Percentage of flash

**EXAMPLE:** Determine the condensate load of a flash tank with 5,000 lbs/hr of 100 psig condensate entering the flash tank held at 10 psig. From page CG-4, the flash percentage is $P = 10.5\%$. Using the formula:

$$Q = \frac{5,000 \times 10.5}{100} = 4,475 \text{lbs/hr}$$

Due to the importance of energy conservation and operation against back pressure, the trap best suited for flash steam service is the inverted bucket type with large bucket vent. In addition, the IB operates intermittently while venting air and CO2 at steam temperature.

In some cases, the float and thermostatic type trap is an acceptable alternative. One particular advantage of the F&T is its ability to handle heavy start-up air loads.

Refer to Chart CG-3 (page CG-4) for percentage of flash steam formed when discharging condensate to reduced pressure.

A third type of device that may be the preferred selection in many cases is the automatic differential condensate controller. It combines the best features of both the IB and F&T and is recommended for large condensate loads that exceed the separating capability of the flash tank.

**Safety Factor**

The increased amount of condensate at start-up and the varying loads during operation accompanied by low pressure differential dictates a safety factor of 3:1 for trapping flash tanks.

**Figure CG-57. Typical Flash Tank Piping Sketch**

Flash steam tank with live steam make-up, showing recommended fittings and connections. The check valves in the incoming lines prevent waste of flash when a line is not in use. The by-pass is used when flash steam cannot be used. Relief valves prevent pressure from building up and interfering with the operation of the high pressure steam traps. The reducing valve reduces the high pressure steam to the same pressure as the flash, so they can be combined for process work or heating.

**Chart CG-21. Recommendations Chart**

<table>
<thead>
<tr>
<th>Equipment Being Trapped</th>
<th>1st Choice and Feature Code</th>
<th>Alternate Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flash Tanks</td>
<td>IBLV B.E.M.L.I.A.F</td>
<td>F&amp;T or *DC</td>
</tr>
</tbody>
</table>

*Recommended where condensate loads exceed the separating capability of the flash tank.*
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Installation
Condensate return lines contain both flash steam and condensate. To recover the flash steam, the return header runs to a flash tank, where the condensate is drained, and steam is then piped from the flash tank to points of use, Fig. CG-57. Since a flash tank causes back pressure on the steam traps discharging into the tank, these traps should be selected to ensure their capability to work against back pressure and have sufficient capacity at the available differential pressures.

Condensate lines should be pitched toward the flash tank, and where more than one line feeds into a flash tank, each line should be fitted with a swing check valve. Then, any line not in use will be isolated from the others and will not be fed in reverse with resultant wasted flash steam. If the trap is operating at low pressure, gravity drainage to the condensate receiver should be provided.

Generally, the location chosen for the flash tank should meet the requirement for maximum quantity of flash steam and minimum length of pipe.

Condensate lines, the flash tank, and the low pressure steam lines should be insulated to prevent waste of flash through radiation. The fitting of a spray nozzle on the inlet pipe inside the tank is not recommended. It may become choked, stop the flow of condensate, and produce a back pressure to the traps.

Low pressure equipment using flash steam should be individually trapped and discharged to a low pressure return. Large volumes of air need to be vented from the flash tank; therefore, a thermostatic air vent should be used to remove the air and keep it from passing through the low pressure system.

Flash Tank Dimensions
The flash tank can usually be conveniently constructed from a piece of large diameter piping with the bottom ends welded or bolted in position. The tank should be mounted vertically. A steam outlet is required at the top and a condensate outlet at the bottom. The condensate inlet connection should be 6'-8' above the condensate outlet.

The important dimension is the inside diameter. This should be such that the upward velocity of flash to the outlet is low enough to ensure that the amount of water carried over with the flash is small. If the upward velocity is kept low, the height of the tank is not important, but good practice is to use a height of 2'-3'.

It has been found that a steam velocity of about 10' per second inside the flash tank will give good separation of steam and water. On this basis, proper inside diameters for various quantities of flash steam have been calculated; the results are plotted in Chart CG-22. This curve gives the smallest recommended internal diameters. If it is more convenient, a larger tank may be used.

Chart CG-22 does not take into consideration pressure—only weight. Although volume of steam and upward velocity are less at a higher pressure, because steam is denser, there is an increased tendency for priming. Thus it is recommended that, regardless of pressure, Chart CG-22 be used to find the internal diameter.

Chart CG-22. Determination of Internal Diameter of Flash Tank to Handle a Given Quantity of Flash Steam
Find amount of available flash steam (in pounds per hour) on bottom scale, read up to curve and across to vertical scale, to get diameter in inches.