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Quality

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BULLETIN 182
4/2020

FLASH TANKS

TYPE VFT
Vertical Flash Tank

TYPE HFT
Horizontal Flash Tank

The Formation of Flash Steam

When hot condensate under pressure is released to a lower pressure, its temperature must very quickly drop to the boiling point for the lower pressure as shown in the steam tables. The surplus heat is utilized by the condensate as latent heat causing some of it to re-evaporate into steam. Commonly referred to as "flash steam", it is in fact perfectly good useable steam even at low pressure.

Percentage of Flash Steam From Condensate											
Steam Pressure (psig)	Atmosphere	Flash Tank Pressure									
		5	**10**	**15**	**20**	**30**	**50**	**60**	**80**	**100**	**150**
5	1.7	0.0									
10	2.9	1.4	0.0								
15	4.0	2.4	1.1	0.0							
20	4.9	3.4	2.1	1.1	0.0						
30	6.5	5.0	3.8	2.6	1.7	0.0					
40	7.8	6.4	5.1	4.0	3.1	1.3	0.0				
60	10.0	8.6	7.3	6.3	5.4	3.6	1.0	0.0			
80	11.7	10.3	9.0	8.1	7.1	5.5	2.9	1.9	0.0		
100	13.3	11.8	10.6	9.7	8.8	7.0	4.6	3.5	1.7	0.0	
125	14.8	13.4	12.2	11.3	10.3	8.6	6.3	5.2	3.4	1.8	0.0
150	16.4	14.9	13.8	12.7	11.8	10.3	7.9	6.8	4.9	3.3	0.0
160	16.8	15.4	14.1	13.2	12.4	10.6	8.4	7.4	5.6	4.0	0.6
200	18.6	17.3	16.1	15.2	14.3	12.8	10.4	9.3	7.5	5.9	2.9
250	20.6	19.3	18.1	17.2	16.3	14.7	12.6	11.2	9.8	8.2	5.2
300	22.7	21.1	19.9	19.0	18.2	16.7	14.5	13.4	11.8	10.1	7.2

Figure 1: Percentage of Flash Steam from Condensate

How to Size Condensate Return Line, Flash Tank and Vent Line

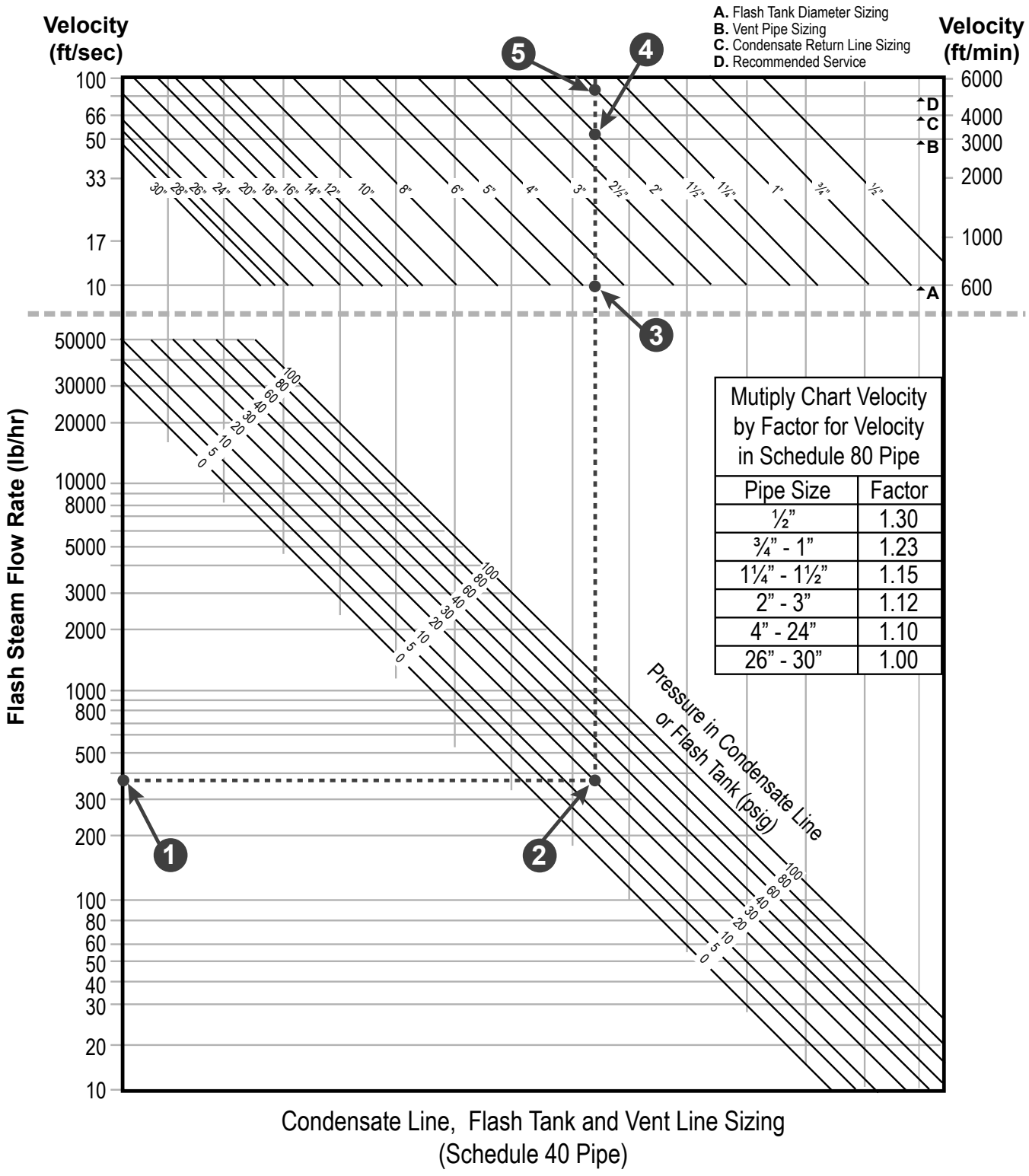
Velocity in condensate return lines should be between 4000-6000 ft/min. In order to size the pipe the following must be known:

- Condensate Load (lbs/hr)
- Inlet Pressure to Steam Traps (psig)
- Return Line System Pressure

Example: For a 160 psig Steam Trap discharging to a 20 psig Flash Tank the condensate load is 3000 lbs/hr.

Using the table "**Percentage of Flash Steam from Condensate"** (Figure 1) it can be determined that 12.4% of the condensate will flash into steam. Therefore 0.124 × 3000 = 372 lbs/hr of flash steam will be produced. From the diagram "**Condensate Line, Flash Tank, and Vent Line Sizing"** (Figure 2) perform the following:

1. Look up the Flash Steam Flow Rate of 372 lbs/hr starting from **Point 1.**
2. Move horizontally to the Flash Tank pressure of 20 psig at **Point 2**.
3. Move vertically upwards to **Point 3** to determine that a 5-inch Flash Tank diameter is needed to keep velocities less than 600 ft/min.
4. Continuing to move vertically to **Point 4** determines the Vent Line on the Flash Tank should be a 2-inch diameter in order to keep velocities less than 4000 ft/min.
5. Finally, moving vertically to **Point 5** determines the condensate line diameter should be 1½-inch to maintain line velocities between 4000-6000 ft/min.



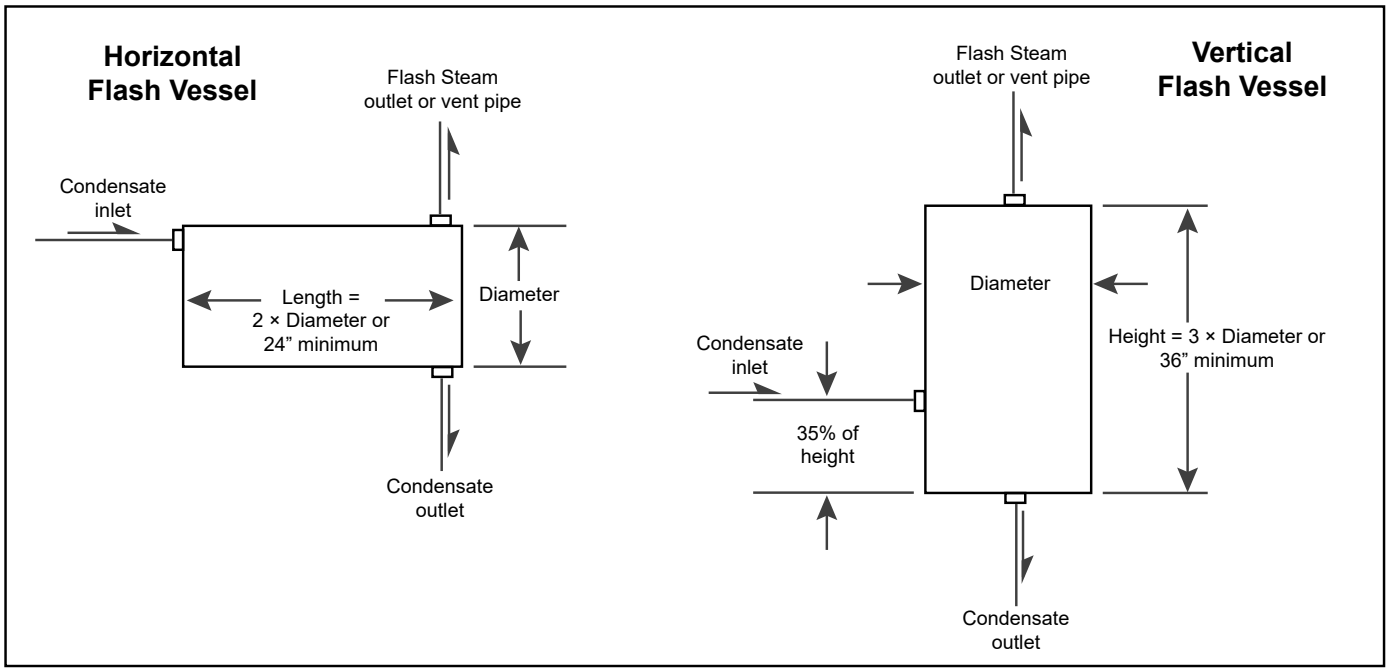
[Figure 2: Condensate Line, Flash Tank, and Vent Line Sizing]

How to Size Flash Tanks and Vent Lines

Whether a flash tank is atmospheric or pressurized for flash recovery, the procedure for determining its size is the same. The most important dimension is the diameter. It must be large enough to provide adequate separation of the flash and condensate to minimize condensate carryover.

Flash Vessel Configurations

Flash vessels can be either horizontal or vertical. For flash steam recovery (pressurized receiver) the vertical style is preferred because of its ability to provide better separation of steam and water.



[Figure 3: Flash Vessel Configurations]

Your Goal is to Maximize Condensate Recovery

There are a number of reasons why condensate should not be allowed to discharge to drain. The most important consideration is the valuable heat and energy savings which it contains even after flash steam has been recovered. It is possible to use condensate as hot process water but the best arrangement is to return it to the boiler room where it can be re-used as boiler feed water without further treatment, saving preheating fuel, raw water and the chemicals needed for boiler feed treatment. These savings will be even greater in cases where effluent charges have to be paid for the discharge of valuable hot condensate down the drain.

Condensate recovery with low NPSH pumps can result in large cost savings for a plant's steam generation. One justifiable reason for not returning condensate is the risk of contamination. Perforated coils in process vessels and heat exchangers do exist and the cross contamination of condensate and process fluids is always a danger. If contaminated, a condensate after cooler must be used to cool condensate below 130°F as similarly done with a blowdown separator.

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