BEST PRACTICE NO. 60
FLASH TANK SIZING STEAM AP

1.1. Steps to Designing a Flash Tank

1. ***Calculate the amount of condensate entering the flash tank.***
   The amount of condensate entering the tank will be the sum of the steam-consuming capacity of all equipment discharging into the condensate return line that is going to the flash tank. This could be only one component or multiple components.

   Example: 25,000 lbs./hr. (11.3 tons/hr.)

2. ***Determine the process pressure and flash tank pressure.***

   Example: Process pressure: 150 psig (10.3 bar)

   Flash tank pressure: 10 psig (0.7 bar)

3. ***Calculate the condensate that flashes to steam.***

   Formula:
   % Flash = High 150 psig (10.3 bar) sensible heat (–) Low 10 psig (0.7 bar) sensible heat
   Low 10 psig (0.7 bar) latent heat

   $$\% \text{ Flash} = \frac{338.4 \text{ Btu @ 150 psig (10.3 bar)} - 207.9 \text{ Btu @ 10 psig (0.7 bar)}}{952.6 \text{ Btu @ 10 psig (0.7 bar)}}$$

   Example: $13.7\% = \frac{338.4 - 207.9 \text{ Btu}}{952.6 \text{ Btu}}$

   25,000 lbs. per hr. (11.3 tons/hr.) X 13.7% = 3,425 lbs./hr. (1.7 tons/hr.) flash steam

4. ***Size the steam space.***

   If the condensate line is adequately sized, a high percentage of the steam flashing will occur in the condensate line. The steam section of the tank need only be sized to take care of the instantaneous flash. Unfortunately, a high percentage of the condensate lines in industrial plants are undersized for a number of reasons.

   Therefore, the following example should be followed in sizing the steam section of the flash tank.

   $$\frac{3{,}425 \text{ lbs./hr.} \times 16.5 \text{ (sp. vol. of steam @ 10 psig) cu. ft./lb.}}{3{,}600 \text{ sec./hr.}} = 15.7 \text{ cu. ft./sec. flashing}$$

To accommodate steam system malfunctions that introduce additional steam to the system, SEA recommends adding a sizing factor of 1.5.

1.5 x 15.7 cu. ft./sec. = 23.55 cu. ft.

A 42 in. tank is capable of 9.65 cu. ft./12 in. Therefore, 23.55 ÷ 9.65 * 12 in. = 29.3 in.

Answer: 29.3 in. length on a 42 in. diameter tank for the steam section

5. ***Size the condensate section.***

   25,000 lbs. per hour (total volume) – 3,425 lbs./hr. (flash steam volume) = 21,575 lbs./hr. liquid or condensate

   21,575 lbs./hr. ÷ 8.33 lb./gal. = 2,590 gal./hr.

   2,590 gal./hr. ÷ 60 min. = 43.2 gpm (gallons per minute)

   To provide stability of flow from the flash tank, at least five minutes of water should be provided.

   43.2 gpm x 5 min. = 216 gal.

   42 in. tank gallon capacity per 12 in. = 72 gal.

   216 gal. ÷ 72 gal. * 12 in. = 36 in.

   Answer: 36 in. length on a 42 in. diameter tank for the condensate section.

6. ***Size the tank.***

   29.3 in. length on a 42 in. diameter tank for the steam section

   36 in. length on a 42 in. diameter tank for the condensate section

   65.3 in. length on 42 in. diameter tank

   5.44 ft. length on 42 in. diameter tank

7. ***Size the flash vent line off the tank.***
   Tank outlet flash steam velocities should not exceed 3,000 feet per minute.

   $$\mathbf{V\ (fpm) = \frac{2.4 \times flow\ (lb./hr.) \times v\ (cu.\ ft./lb.)}{A\ (sq.\ in.)}}$$

   $$\mathbf{V\ (fpm) = \frac{2.4 \times 3{,}425\ (flash\ steam) \times v\ 16.5}{50\ (8\ in.\ vent\ line)} = 2{,}712.6\ fpm}$$