SIZING CONDENSATE RETURN LINES

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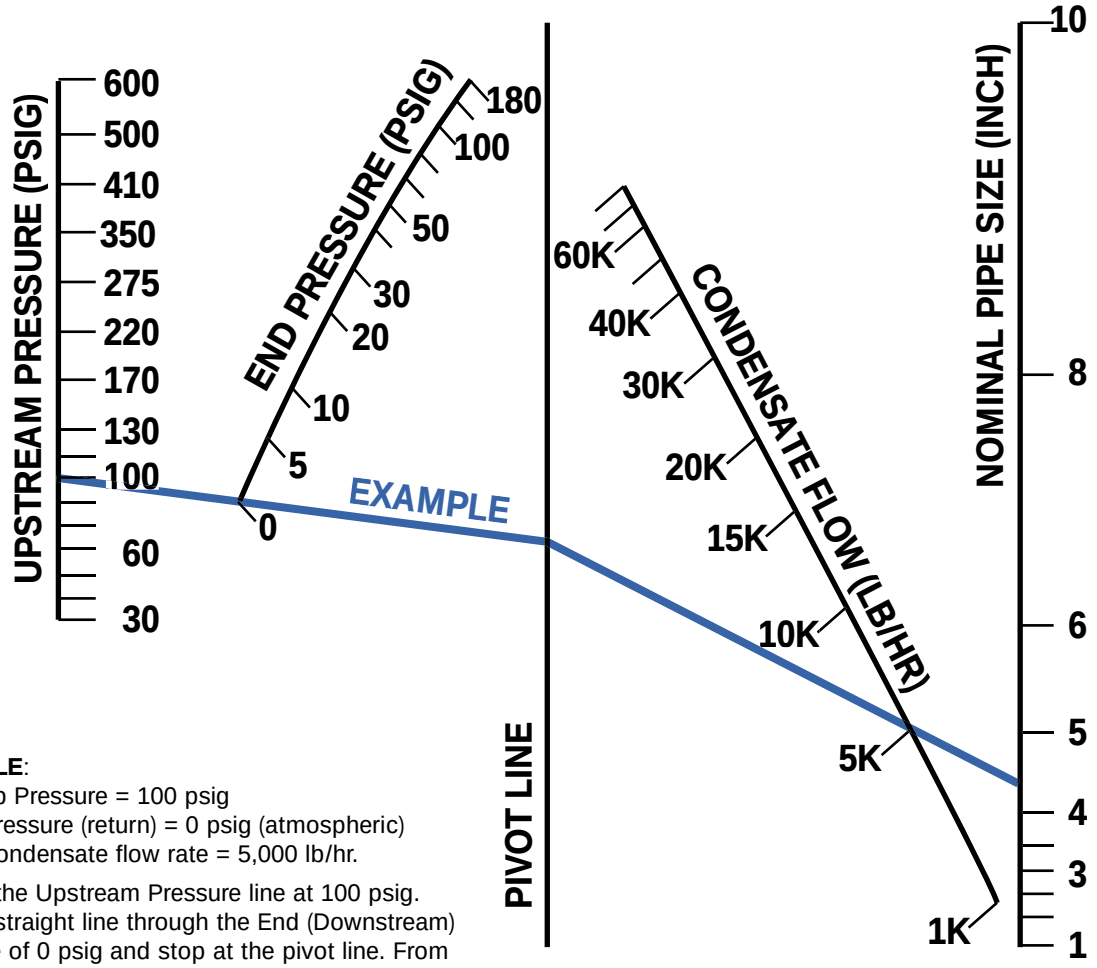
When condensate passes through a steam trap orifice, it drops from the upstream pressure in the heat exchanger to the downstream pressure in the condensate return line. The energy in the upstream condensate is greater than the energy in the downstream condensate. As the condensate passes through the steam trap, the additional energy from the upstream condensate forms a percentage of flash steam that changes based upon the upstream and downstream pressures (this percentage can be seen in Table 5 in the Condensate Commander section).

When sizing condensate return lines after the steam trap, it is important to take into account the amount of flash steam created when hot, saturated condensate undergoes a pressure drop. The flash steam has very large volume and can cause very high velocities if the return line is not sized properly. These high velocities can create high backpressure in the return line that often leads to poor steam trap performance.

We will size the condensate return line based upon flash steam velocities, The percentage of flash steam versus condensate (water) is usually on the order of 20 to 1, so the effect of the water in the system sizing is usually small. Choosing a velocity of flash steam is often subjective and different manufacturers will suggest different values. The nomograph below sizes return lines based upon 50 feet/second.



EXAMPLE:
Inlet Trap Pressure = 100 psig
Outlet Pressure (return) = 0 psig (atmospheric)
Actual condensate flow rate = 5,000 lb/hr.

Start at the Upstream Pressure line at 100 psig. Make a straight line through the End (Downstream) Pressure of 0 psig and stop at the pivot line. From that point, make a straight line through the Condensate Flow Rate of 5,000 and stop at the Nominal Pipe size line. It intersects slightly higher than 4". You may select the 4" line size without concern for undersizing the line because a low velocity of 50 ft/sec was used.

Note: If design requirements dictate using a velocity other than the 50 ft/sec value in the Nomograph, a ratio can be made of the pipe size because the velocity is proportional to the Pipe Diameter squared. For example, if you require a Pipe Diameter for 80 ft/sec, use the following equation:

$$\text{Nomograph Diameter} \times \sqrt{\frac{50\ \text{FT/SEC}}{\text{New Velocity (FT/SEC)}}}$$

Example: The Nomograph Diameter determined in the previous example is 4.2". Using the above formula, the Pipe Diameter for 80 ft/sec is 3.3".