Valve Sizing Data: Sizing Equations

Tables are provided in the applicable Product Specifications for selecting the proper sized AERCO Valves and Regulators based on pressure drop and C_V for saturated steam flow at sea level conditions.

Occasionally it is necessary to select valves for conditions other than those provided in the tables. The required C_V for other conditions may be calculated from the formulae below. All flow equations are based on those adopted by the Fluid control Institute, May 16, 1962 and published in FCI 62-1.

The proper valve size will be that valve having a C_V equal to, or slightly smaller than the value calculated. Control valves and regulators provide poor requlation and control if oversized too much. The optimum size for good control is frequently smaller than line size, and can only be properly determined by calculating the C_V required for a given flow capacity.

When calculating the C_V of a valve for steam control on an AERCO Semi-Instantaneous water heater, the selected Pressure Drop across the valve, P2 - P1, should be such that P2 equals approximately .5 or .6 of P1. For example, having 100 PSIG steam supply available, steam pressure <u>out</u> of the valve (and hence <u>to</u> the coils of the AERCO heater) should be approximately 50 or 60 PSIG. This provides for best hot water outlet temperature control.

<u>CRITICAL PRESSURE DROP - Steam Flow:</u>
When the pressure drop through a valve or regulator exceeds 0.5 times P1, further reduction of the downstream pressure produces no further increase in steam flow. Therefore, if the value of P2 is less than 0.5 P1, substitute 0.5 P1 for both P2 and ΔP when using the formulae (2) and (3) below.

<u>ABSOLUTE PRESSURE:</u>
P1 and P2, the inlet and outlet pressure used in formulae (2) and (3) are expressed as PSIA (pounds per square inch <u>absolute</u>). Values customarily provided are in terms of PSIG (pounds per square inch gauge). To arrive at values of PSIA, add 14.7 to the gauge reading at sea level. For high altitudes, .5 PSI per 1000 feet elevation above sea level should be subtracted.

<u>DEGREES OF SUPERHEAT:</u>
To determine the "degrees of superheat" subtact the saturation temperature from the total temperature of the steam.

1. Formula for Water

$$C_V = Q\sqrt{\frac{1}{\Delta P}}$$

2. Formula for Saturated Steam

$$Cv = \frac{W}{2.1}\sqrt{\frac{1}{\Delta P(P1 + P2)}}$$

3. Formula for Superheated Steam

$$Cv = 1 + \frac{0.0007S}{2.1}\,W\sqrt{\frac{1}{\Delta P(P1 + P2)}}$$

Where:

C_V = Flow coefficient

P1 = Inlet Pressure (PSIA)

P2 = Outlet Pressure (PSIA).

ΔP = Pressure Drop (ΔP = P2 - P1)

Q = Flow in GPM

W = Flow in lbs./hr.

S = Degrees of Superheat (^{o}F)