NOMENCLATURE

- \( C_v \) = Valve flow coefficient
- \( g \) = Specific gravity of liquid at flowing conditions
- \( G \) = Specific gravity of gas at flowing conditions
- \( P_1 \) = Upstream pressure, psia
- \( P_2 \) = Downstream pressure, psia
- \( \Delta P \) = Actual pressure drop (\( P_1 - P_2 \)), psi
- \( q \) = Liquid volumetric flow rate, U.S. GPM
- \( Q \) = Gas volumetric flow rate, SCFH
- \( W \) = Steam weight (mass) flow rate, LB/HR
- \( T \) = Flowing Temperature, °R (460 + °F)

Once the required \( C_v \) is determined, selection of the proper size control valve can be obtained by comparing the required \( C_v \) to the \( C_v \) values for the valve. As a general rule, the maximum capacity of a control valve should be 15 to 50% above the maximum process flow, and the minimum required \( C_v \) must be within the available rangeability of the valve for proper control. If only the maximum process flow rate was used to calculate \( C_v \), then the percent travel of the valve should be checked and should fall in the range of 65 to 80% of total travel.

**SUB-CRITICAL FLOW**

- Liquid \( C_v = q \left( \frac{W}{\Delta P (P_1 + P_2)} \right)^{1/2} \)

- Gas \( C_v = \frac{Q}{963 \left( \frac{G \times T}{\Delta P (P_1 + P_2)} \right)^{1/2}} \)

- Steam \( C_v = \frac{W}{2.1 \left[ \Delta P (P_1 + P_2) \right]^{1/3}} \)

**CRITICAL FLOW**

- Gas or steam where \( \Delta P > \frac{P_1}{2} \)

- \( C_v = \frac{Q (G \times T)^{1/2}}{750 \times P_1} \)

- \( C_v = \frac{W}{1.65 \times P_1} \)

**TERMINOLOGY**

- **Pressure Drop** – The difference in upstream and downstream pressures of the fluid flowing through the valve.

- **Critical Flow** – The flow has reached the point of being choked. At the choked condition, the flow rate has hit a maximum limit and does not increase with further increase in pressure drop across the valve.

- **Cv or Valve Flow Coefficient** – The number of U.S. gallons per minute of water at 60°F that will pass through the valve with a pressure drop of 1 psi. For example, a Hi-Flow™ valve with a maximum \( C_v \) of 10.75 has an effective port area in the full open position such that it passes 10.75 GPM of water with a pressure drop of 1 psi.

- **Full Port** – The port diameter of the valve is the same diameter as the piping connections.

- **Rangeability** – The ratio of maximum controllable flow to minimum controllable flow of a valve. For example, a valve with a 50 to 1 rangeability and a total flow capacity of 100 GPM at full open controls flow accurately to as low as 2 GPM.

- **Valve Flow Characteristic** – The relationship between the stem travel or rotation of a valve, expressed in percent travel, and the fluid flow through the valve, expressed in percent of full flow.