PT 104
Flow coefficient, Cv
March 3, 2026

Overview

The flow coefficient, Cv, is widely used for sizing flow devices. A Cv is defined as the flow of a non-compressible fluid, water, through a device in one minute with no more than a 1 psi difference in pressure, differential, from inlet to outlet. The Cv value is the flow of water in gallons per minute (GPM). There are formulas for calculating Cv values with gases with the most common method in the semiconductor industry per SEMI F32, which is based upon ISA S75.02. If calculated with a gas, the Cv value still relates to water flow in GPM.

Cv is a great sizing tool devices which are either static like a filter or on/off like a valve. Pressure regulators, which when functioning properly are not fully open, a Cv is more problematic, as follows.

Pressure regulator

The Cv of a pressure regulator defines the point of choked flow, which is when increasing the pressure drop ceases to correspondingly increase the flow. This is also referred to as the knee because the shape of the curve looks like a leg with a bent knee. Knowing the point of choked flow is useful, however it does not provide an indication of the flow performance prior to reaching the knee. A pressure drop of more than 10 to 20 psig, depending upon the regulator size and application, which typically before the point of the Cv's choked flow, is generally not desirable as it leads to unacceptable pressure fluctuation with flow. Stated differently, *the Cv does not indicate flow performance within a regulator's usable flow range, so it should never be used for flow sizing. Cv values can vary significantly between regulators with similar flow curves before choked flow. The pressure drop with flow can only be accurately determined with a flow curve and not with Cv.* However, a Cv can be useful in grossly selecting regulators to enable a comparison of flow curves for final selection for an application.

Flow curves with equivalent parameters of gas, inlet and outlet pressures are the best way to compare and select a pressure regulator for an application. It must also be noted that formulas for calculating flow performance do not take into account all of a specific gas's characteristics, such as thermal and enthalpy cooling. Regulator selection guides based upon empirical data are the better

approach to size a regulator for an application.

Cv xT

SEMI F32 defines the pressure drop ratio, x, as the ratio of the pressure drop across a device to the inlet pressure in absolute pressure, such as psia, and not gauge pressure. The choked flow ratio, pressure drop ratio factor, (xt) is the value of x at the point any further decrease in outlet pressure results is no increase in flow. Xt is utilized in formulas for calculating Cv in SEMI F32. It is generally utilized defining Cv of valves and not regulators, as Cv is not recommended for sizing regulators so Xt has little value.

Cv defines choked flow as the point where a change in outlet pressure makes little change in flow and Xt further defines to the point where no increase in flow occurs with the pressure change and it is a ratio rather than value in GPM like Cv.