Flow Coefficient Cv

Extensive experimentation has shown that, in general, for a given flow passage and completely turbulent flow the relationship between fluid flow rate and pressure drop follows a power law.

Variable: ΔP = Pressure drop across flow passage (PSI)
Q = Volume flow rate of fluid through passage (GPM)
Cv = Flow coefficient [$GPM/PSI^{1/2}$]

The flow coefficient Cv is the necessary proportionality constant, and it is typically determined experimentally. Usually, flow coefficient is expressed as the flow rate in GPM for a pressure drop of 1 PSI across a flow passage. By definition:

$$Cv = \sqrt{\frac{1}{\Delta P}}$$

A standardized test procedure for finding Cv factors is presented in ISA S75.02. A form of the equation is:

$$\Delta P = \left[\frac{Q}{Cv}\right]^2$$

Example 1:
A Hayward 1/2" True Union Ball Valve has an experimentally-determined Cv rating of 8 for water. It is required to flow 20 GPM of water through this valve. The anticipated pressure drop across this valve may be calculated as follows:

$$\Delta P = \left[\frac{20}{8}\right]^2 = 6.3 \text{ PSI}$$

Example 2:
If a 0.5 PSI pressure drop has been allotted for a Hayward 4˝ True Union Ball Valve, the associated flow rate may be calculated by:

$$Q = Cv\sqrt{\Delta P}$$

A Hayward 4" True Union Ball Valve has an experimentally-determined Cv rating of 600 for water. The approximate flow rate at a 0.5 PSI pressure drop is calculated by:

$$Q = 600\sqrt{0.5} = 420 \text{ GPM}$$