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Calculating the C' (C Prime) Factor

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The C' (C Prime) factor is used to compute the flow rate at different differential pressures and/or static pressures. Once a flow element has been sized with a flow element sizing package, such as ORIFICE for Windows, the C' factor can be computed. Then using the C' factor and a calculator, the user can compute the flow rate as differential or static pressure changes.

Following is a brief description of how to calculate the C prime factor for a flow element. The following information is necessary to compute the C' factor.

- Q_m Maximum flow rate in any units of measure
- P_a Absolute inlet pressure to flow element in pounds per square inch absolute.
- ΔP Differential pressure in inches of water column for which the flow rate is desired
- ΔP_m Maximum differential pressure in inches of water column.

Use these values to compute the C' factor with the following equation.

$$C_{\text{prime}} := \frac{Q_m}{\sqrt{\Delta P_m \cdot P_a}}$$

Once you have calculated the C' factor based upon the maximum rates, use the desired conditions to compute the predicted flow rate. The flow version of this equation is:

$$Q := C_{\text{prime}} \cdot \sqrt{\Delta P \cdot P_a}$$

Where:

- Q Predicted flow rates in the same units that the C' factor was calculated at.
- C_{prime} C' factor calculated above.
- ΔP Differential pressure at measurement conditions, inches of water.
- P_a Inlet pressure in pounds per square inch absolute.

Example

Compute the C' factor with the input data given below. Then using the computed C' factor, compute the estimated flow at 45 inches of water column.

$Q_m := 6000$	Maximum flow in Std. Cubic Feet/Hour
$\Delta P_m := 100$	Maximum Differential, Inches of Water Column
$P_a := 815$	Flowing pressure, Pounds/Sq. Inch Absolute

First compute the C' factor with the input data at maximum conditions.

$$C_{\text{prime}} := \frac{Q_m}{\sqrt{\Delta P_m \cdot P_a}} \quad C_{\text{prime}} = 21.0171 \quad \text{Calculated C prime factor}$$

Once the C' factor has been computed, 21017.0833, solve the flow equation for 45 inches of water column.

$$\Delta P := 45$$

$$Q := C_{\text{prime}} \cdot \sqrt{\Delta P \cdot P_a}$$

$$Q = 4024.9224$$