PENINSULAR®
CYLINDER CO.

Common Pneumatic Formulas

Air Valves help to regulate pressure in the cylinder and are sized for flow capacity **(Cv). Cv** is based on the specific cylinder stroke & travel time requirements, as well as piston size. **Cv** is a coefficient that measures the quantity of air a device can pass.

Cv= $\frac{\text{Area (in}^2\text{) x Length (ins.) x Compression Factor}}{\text{Pressure Drop Factor x Time (secs) x 29}}$

Area= Effective cylinder piston area *(square inches)*
A= πr^2 (3.14 x radius^2)

PLEASE NOTE: The same formulas apply for the rod end of the cylinder. However, to make precise calculations, one must take the cylinder area (in^2) minus the rod end area (in^2) when utilizing this valve sizing formula to determine return stroke Cv rating.

Length= The total cylinder stroke length in inches (in.)

Compression Factor= Taken from the table (based on supply pressure rating).

Pressure drop factor= 10 or 15 psi drop is a good guideline for using this formula (refer to Table 20 for further details)

Time= Required cylinder stroke time (in seconds)

Pressure Drop Factor PD for Various Pressure Drops						
Supply Pressure	Compression Factor	2	5	10	15	20
PSI	CF	PSID				
40	3.7	9.9	15.3	20.5	23.6	N/A
50	4.4	10.8	16.7	22.6	26.4	29
60	5.1	11.7	18.1	24.6	29	32
70	5.8	12.5	19.3	26.5	31.3	34.8
80	6.4	13.2	20.5	28.2	33.5	37.4
90	7.1	13.9	21.6	29.8	35.5	39.9
100	7.8	14.5	22.7	31.3	37.4	42.1
110	8.5	15.2	23.7	32.8	39.3	44.3
120	9.2	15.8	24.7	34.2	41	46.4
130	9.8	16.4	25.6	35.5	42.7	48.4
140	10.5	16.9	26.5	36.8	44.3	50.3
150	11.2	17.5	27.4	38.1	45.9	52.1

Table 20

Compression Factor= Taken from Table 20 (based on supply pressure rating).

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Common Pneumatic Formulas (cont'd)

Sizing Example

- 6 inches bore cylinder with 2-inch rod thickness and 15-inch total stroke
- Travel time=2 seconds
- 100 psi supply pressure
- 15 psi pressure drop factor to be used

Calculate the 6" diameter piston bore area (in square inches) for extend calculations

A= 6 ins. x 6 ins. x .7854 = 28.27 (in^2)
PLEASE NOTE: This is for the cylinder extend area. To calculate the cylinder return area, the rod area must be calculated (in^2) and then this value must be subtracted from the piston bore area (in^2).

Calculate the 2" diameter rod end area in square inches
A= 2 ins. x 2 ins. x .7854 = 3.1416 (in^2)
Thus, Cylinder Return Area is 28.27 in^2 - 3.1416 in^2 = 25.12 in^2

Apply these application variables to the Cv sizing formula:

$$\textbf{Cv} = \frac{28.27\ in^2 \times 15\ ins. \times 7.8}{37.4 \times 2\ secs. \times 29} = \frac{3{,}307}{2169} = 1.52\ Cv\ (to\ extend)$$

$$\textbf{Cv} = \frac{25.12\ in^2 \times 15\ in \times 7.8}{37.4 \times 2\ secs \times 29} = \frac{2939}{2169} = 1.52\ Cv\ (to\ extend)$$

Select a valve that meets this 1.52 Cv rating

Air Flow Rates

SCFM - Standard Cubic Feet per Minute – One cubic foot of gas (air) per minute at conditions of:
14.69 Pounds per Square Inch (psi)
68 degrees F
Relative humidity of 36%

Cubic Feet Per Minute (CFM): A particular unit of measurement for airflow volume. It's determined by how many cubic feet of air passes by a stationary point per minute.

Free Air Flow: How much flow is actually generated (in standard condition).