FLOW RATING (C_V)

Sizing your Valves

Ensuring you have the correct valve for the job, will save you time & money.
Below are some simple formulas for sizing your valves properly, enter in your values to determine your Capacity Co-efficient or C_V.

$$C_V = \frac{\text{Cylinder Area (Sq. In.) (See Table 1)} \times \text{Cylinder Stroke (In.)} \times \text{Compression Factor (Table 2)} \times \text{“A” (Table 2)}}{\text{Stroke Time (sec.)} \times 28.8}$$

If you are wanting to extend a 3¼" bore cylinder which has a 12" stroke, in one second & you have a supply pressure of 80 PSI to do the job. Below are the known parameters:

Cylinder area for a 3¼" bore, from Table 1 .... 8.30 sq. In.
Cylinder Stroke... 12 in.
Stroke time required in seconds.. 1 sec.
Compression factor at 80 PSI, from Table 2.................................. 6.4
"A" constant for 80 PSI, from Table 2... 0.048

Enter the above into the formula:

$$C_V = \frac{8.30 \times 12 \times 6.4 \times .048}{1 \times 28.8} = 1.06$$

Any valve, therefore which has a C_V of at least 1.063, will extend the cylinder the specified distance in the required time.

Choosing the Valve 'Series'

To choose a basic valve design for the job, see Table 3.
Having selected the basic valve design, consult the Capacity Co-Efficient (C_V) tables which describe the individual valve capacities.

Selecting the Valve Model, Options & Accessories

Having determined C_V, series, port size, flow path configuration (pre-determined by circuit design) and actuation method, the exact valve model number can be chosen.
You can order parts online (www.jmcpneumatics.com) or contact JMC Pneumatics by phone. If you have any queries or need to discuss any of the above including circuit design, please contact JMC Pneumatics via the contact page on their website or call a representative on the number below.

See Tables 1, 2 & 3 below...

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Table 1
Effective Square-Inch Areas for Standard-Bore-Size Cylinders

Bore Size	Cylinder Area (Sq. In.)	Bore Size	Cylinder Area (Sq. In.)
3/4"	.44	4"	12.57
1"	.79	4 1/2"	15.90
1 1/8"	.99	5"	19.64
1 1/4"	1.23	6"	28.27
1 1/2"	1.77	7"	38.48
1 3/4"	2.41	8"	50.27
2"	3.14	10"	78.54
2 1/2"	4.91	12"	113.10
3 1/4"	8.30	14"	153.94
3 5/8"	10.32		

Table 2
Compression Factors and "A" Constants

Inlet Pressure (PSIG)	Compression Factor	"A" Constants for Various Pressure Drop*		
		2 PSI ΔP	5 PSI ΔP	10 PSI ΔP
10	1.6	.155	.102	
20	2.3	.129	.083	.066
30	3.0	.113	.072	.055
40	3.7	.097	.064	.048
50	4.4	.091	.059	.043
60	5.1	.084	.054	.040
70	5.7	.079	.050	.037
80	6.4	.075	.048	.035
90	7.1	.071	.045	.033
100	7.8	.068	.043	.031
110	8.5	.065	.041	.030
120	9.2	.062	.039	.029
130	9.9	.060	.038	.028
140	10.6	.058	.037	.027
150	11.2	.056	.036	.026
160	11.9	.055	.035	.026
170	12.6	.054	.034	.025
180	13.3	.052	.033	.024
190	14.0	.051	.032	.024
200	14.7	.050	.031	.023

Note: Use "A" constant at 5 PSI Δ P for most applications. On very critical applications, use "A" at 2 PSI Δ P. You will find in many cases, a 10 PSI Δ P is not detrimental, and can save money and mounting space.

* Tabulated values are the solution of $\frac{1}{22.48}\sqrt{\frac{GT}{(P_1 - P_2)\,P_2}}$ where T is for 68°F and G =1 for Air.

Table 3
Characteristics of the Major Valve Designs

A. Poppet 3-Way and 4-Way	1. High flow capacities 2. Minimum lubrication requirements 3. Fast response 4. Self-cleaning poppet seats 5. Pressures of 15 to 150 PSIG (modifications for vacuum to 250 PSIG)
B. Spool Valves (WCS) 3-Way and 4-Way	1. Low friction 2. Lower operating pressures 3. Fast response 4. Less wear 5. Long Cycle Life - Under pressure, radial expansion of the seal occurs to maintain sealing contact with the valve bore 6. Non-Lube Service - No lubrication required for continuous valve shifting 7. Bi-Directional Spool Seals - Common spool used for any pressure, including vacuum
C. Packed Bore 4-Way	1. Wide range of flow capacities 2. Wide range of flow-path configurations 3. Pilot-operated models available 4. Pressures of vacuum to 150 PSIG
D. Rotary Or Reciprocating Disc 4-Way, manually operated	1. Inexpensive 2. Versatility in manual actuation

C_V–Capacity Co-efficients–(sometimes called Flow Factors). Each flow path through the valve has its own C_V value. All C_V ratings for each valve cataloged on this page are listed on the front side of this sheet.

$$C_V = \frac{Q}{22.48}\sqrt{\frac{GT}{(P_1 - P_2)\,P_2}}$$

$$C_V = Q \times \text{"A" (Table 2)}$$

Q = Flow in Standard Cubic Feet per minute (14.7 PSIA at 60°F)
P_1 = Inlet Absolute Pressure (gauge pressure + 14.7)
P_2 = Outlet Absolute Pressure (gauge pressure + 14.7)
Note: P_2 must be greater than .53 x P_1
G = Specific Gravity of flowing medium (Air, G =1)
T = Absolute Temperature of Air (460 + °F.)