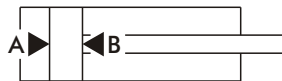


Cylinders' theoretic force



unit: N

Bore (mm)		12	16	20	25	32	40	50	63	80	100	125	150	200	
Rod (mm)		6	6	8	10	12	16	20	20	25	25	35	40	50	
Area (mm ²)	A	113	201	314	491	804	1257	1963	3117	5027	7854	12271	17671	31416	
	B	85	173	264	412	691	1056	1649	2803	4536	7363	11309	16415	29452	
Operating pressure (MPa)	0.1	A	11	20	31	49	80	126	196	312	502	785	1227	1767	3140
		B	8.5	17	26	41	69	106	165	280	453	736	1131	1642	2944
	0.2	A	23	40	63	98	161	251	393	623	1005	1571	2454	3534	6280
		B	17	35	53	82	138	211	330	561	907	1473	2262	3283	5888
	0.3	A	34	60	94	147	241	377	589	935	1508	2356	3681	5301	9420
		B	25	52	79	124	207	317	495	841	1361	2209	3393	4925	8832
	0.4	A	45	80	126	196	322	503	785	1247	2011	3142	4908	7068	12560
		B	34	69	106	165	276	422	660	1121	1814	2945	4524	6566	11776
	0.5	A	57	101	157	245	402	629	982	1559	2514	3927	6135	8836	15700
		B	42	87	132	206	346	528	825	1402	2268	3682	5655	8208	14720
	0.6	A	68	121	189	294	482	754	1178	1870	3016	4712	7363	10603	18840
		B	51	104	158	247	415	634	989	1682	2722	4418	6785	9849	17664
	0.7	A	79	141	220	343	563	880	1374	2182	3519	5498	8589	12370	21980
		B	59	121	185	289	484	739	1154	1962	3175	5154	7916	11491	20608
	0.8	A	90	161	251	393	643	1006	1570	2494	4022	6283	9816	14137	25120
		B	68	138	211	330	553	845	1319	2242	3629	5890	9047	13132	23552
	0.9	A	102	181	283	442	724	1131	1767	2805	4524	7069	11043	15904	28260
		B	76	155	238	371	622	950	1484	2523	4082	6627	10178	14774	26496
	1.0	A	113	201	314	491	804	1257	1963	3117	5027	7854	12271	17671	31400
		B	85	173	264	412	691	1056	1649	2803	4536	7363	11309	16415	29440

The method of calculation (Cylinders' force)

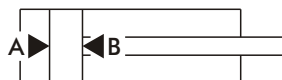
$$F = P \times A - f$$

F:	Cylinders' force	(N)
P:	Air pressure	(MPa)
A:	Piston area	(mm ²)
f:	Friction drag	(N)

Pressure conversion chart

Pa	kPa	MPa	bar	mbar	kgf/cm ²	cmH ₂ O	mmH ₂ O	mmHg	p.s.i.
1	10 ⁻³	10 ⁻⁶	10 ⁻⁵	10 ⁻²	10.2 × 10 ⁻⁶	10.2 × 10 ⁻³	101.97 × 10 ⁻³	7.5 × 10 ⁻³	0.15 × 10 ⁻³
10 ³	1	10 ⁻³	10 ⁻²	10	10.2 × 10 ⁻³	10.2	101.97	7.5	0.15
10 ⁶	10 ³	1	10	10 ⁴	10.2	10.2 × 10 ³	101.97 × 10 ³	7.5 × 10 ³	0.15 × 10 ³
10 ⁵	10 ²	10 ⁻¹	1	10 ³	1.02	1.02 × 10 ³	10.2 × 10 ³	750.06	14.5
10 ²	10 ⁻¹	10 ⁻⁴	10 ⁻³	1	1.02 × 10 ⁻³	1.02	10.2	0.75	14.5 × 10 ⁻³
98066.5	98.07	98.07 × 10 ⁻³	0.98	980.67	1	1000	10000	735.56	14.22
98.0665	98.07 × 10 ⁻³	98.07 × 10 ⁻⁶	0.98 × 10 ⁻³	0.98	10 ⁻³	1	10	0.74	14.22 × 10 ⁻³
9.80665	9.807 × 10 ⁻³	9.807 × 10 ⁻⁶	9.807 × 10 ⁻⁶	9.807 × 10 ⁻³	10 ⁻⁴	0.1	1	73.56 × 10 ⁻³	1.42 × 10 ⁻³
133.32	133.32 × 10 ⁻³	133.32 × 10 ⁻⁶	1.33 × 10 ⁻³	1.33	1.36 × 10 ⁻³	1.36	13.6	1	19.34 × 10 ⁻³
6894.76	6.89	6.89 × 10 ⁻³	68.95 × 10 ⁻³	68.95	70.31 × 10 ⁻³	70.31	703.07	51.71	1

Compressed air consumption



unit : ℓ/min

Bore (mm)		12	16	20	25	32	40	50	63	80	100	125	150	200
Rod (mm)		6	6	8	10	12	16	20	20	25	25	35	40	50
Area (mm ²)	A	113	201	314	491	804	1257	1963	3117	5027	7854	12271	17671	31416
	B	85	173	264	412	691	1056	1649	2803	4536	7363	11309	16415	29452
Operating pressure (MPa)	0.1	0.040	0.075	0.116	0.181	0.299	0.462	0.722	1.183	1.912	3.042	4.714	6.814	12.168
	0.2	0.059	0.112	0.173	0.271	0.448	0.693	1.083	1.775	2.867	4.563	7.071	10.221	18.252
	0.3	0.079	0.150	0.231	0.361	0.598	0.924	1.444	2.367	3.823	6.084	9.428	13.628	24.336
	0.4	0.099	0.187	0.289	0.451	0.747	1.156	1.805	2.959	4.779	7.605	11.785	17.035	30.420
	0.5	0.119	0.224	0.347	0.542	0.897	1.387	2.167	3.550	5.734	9.126	14.142	20.441	36.502
	0.6	0.138	0.262	0.405	0.632	1.046	1.618	2.528	4.142	6.690	10.647	16.499	23.848	42.586
	0.7	0.158	0.299	0.463	0.722	1.196	1.849	2.889	4.734	7.646	12.168	18.856	27.255	48.670
	0.8	0.178	0.336	0.520	0.812	1.345	2.080	3.250	5.325	8.602	13.689	21.213	30.662	54.754
	0.9	0.198	0.374	0.578	0.903	1.495	2.311	3.611	5.917	9.557	15.209	23.570	34.069	60.838
	1.0	0.218	0.411	0.636	0.993	1.644	2.542	3.972	6.509	10.513	16.927	25.927	37.476	66.922

● The table is for a complete cycle with 100mm stroke in one minute.

The method of calculation (Compressed air consumption)

$$Q_n = (A_a + A_b) \times L \times \frac{P + 0.101}{0.101} \times n \times 10^{-6}$$

Q _n :	Compressed air consumption	(ℓ/min)
A _a :	Piston area of A	(mm ²)
A _b :	Piston area of B	(mm ²)
L:	Stroke of cylinder	(mm)
P:	Air pressure	(MPa)
n:	Cycle of operation	(cycle/min)

Flow rate conversion chart

m ³ /s	l/s	cm ³ /s	m ³ /h	m ³ /min	l/h	l/min	ft ³ /min (scfm)	gallon min UK	gallon min USA
1	10 ³	10 ⁶	3.6 × 10 ⁶	60	3.6 × 10 ⁶	60 × 10 ³	2.12 × 10 ³	13.2 × 10 ³	15.85 × 10 ³
10 ⁻³	1	10 ³	3.6	60 × 10 ⁻³	3.6 × 10 ³	60	2.12	13.2	15.85
10 ⁻⁶	10 ⁻³	1	3.6 × 10 ⁻³	60 × 10 ⁻⁶	3.6	60 × 10 ⁻³	2.12 × 10 ⁻³	13.2 × 10 ⁻³	15.85 × 10 ⁻³
0.28 × 10 ⁻³	0.28	0.28 × 10 ³	1	16.67 × 10 ⁻³	10 ³	16.67	0.59	3.67	4.4
16.67 × 10 ⁻³	16.67	16.67 × 10 ³	60	1	60 × 10 ³	10 ³	35.31	219.97	264.17
0.28 × 10 ⁻⁶	0.28 × 10 ⁻³	0.28	10 ⁻³	16.67 × 10 ⁻⁶	1	16.67 × 10 ⁻³	0.59 × 10 ⁻³	3.67 × 10 ⁻³	4.4 × 10 ⁻³
16.67 × 10 ⁻⁶	16.67 × 10 ⁻³	16.67	60 × 10 ⁻³	10 ⁻³	60	1	35.31 × 10 ⁻³	219.97 × 10 ⁻³	264 × 10 ⁻³
0.47 × 10 ⁻³	0.47	0.47 × 10 ³	1.699	28.32 × 10 ⁻³	1.699 × 10 ³	28.32	1	6.23	7.48
75.79 × 10 ⁻⁶	75.77 × 10 ⁻³	75.77	0.273	4.55 × 10 ⁻³	0.273 × 10 ³	4.55	0.16	1	1.2
63.09 × 10 ⁻⁶	63.09 × 10 ⁻³	63.09	0.227	3.79 × 10 ⁻³	0.227 × 10 ³	3.79	0.13	0.83	1