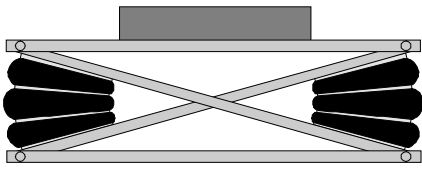
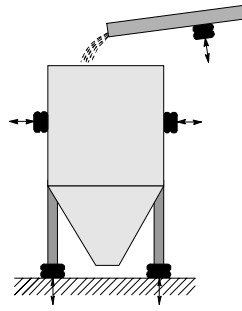


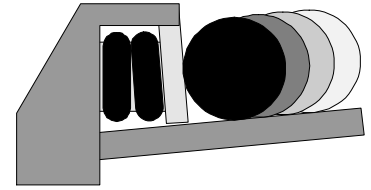
Applications



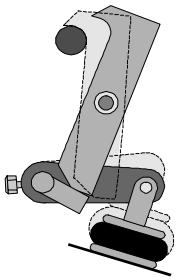
Scissor lift



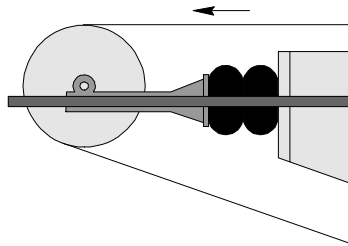
Hopper vibration and damping



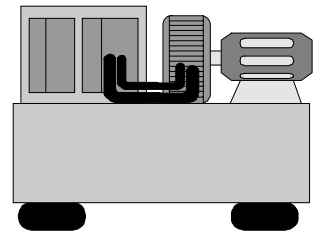
Mechanical handling stop



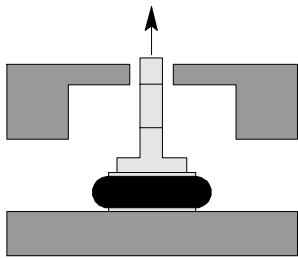
Quick lock device



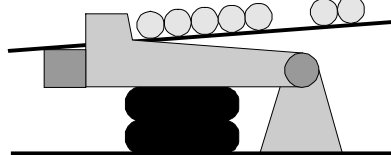
Reel tensioning



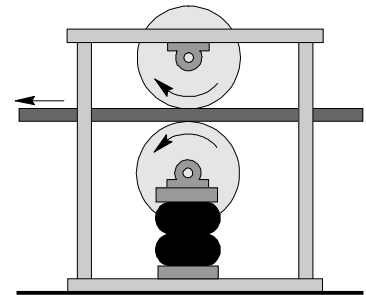
Machine isolation



Direct force



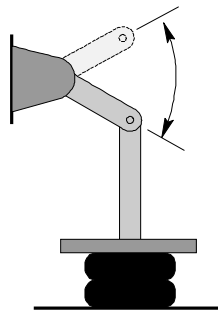
Impact absorption



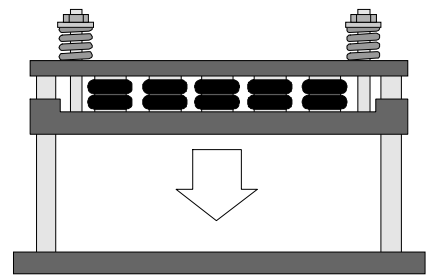
Roller tensioning



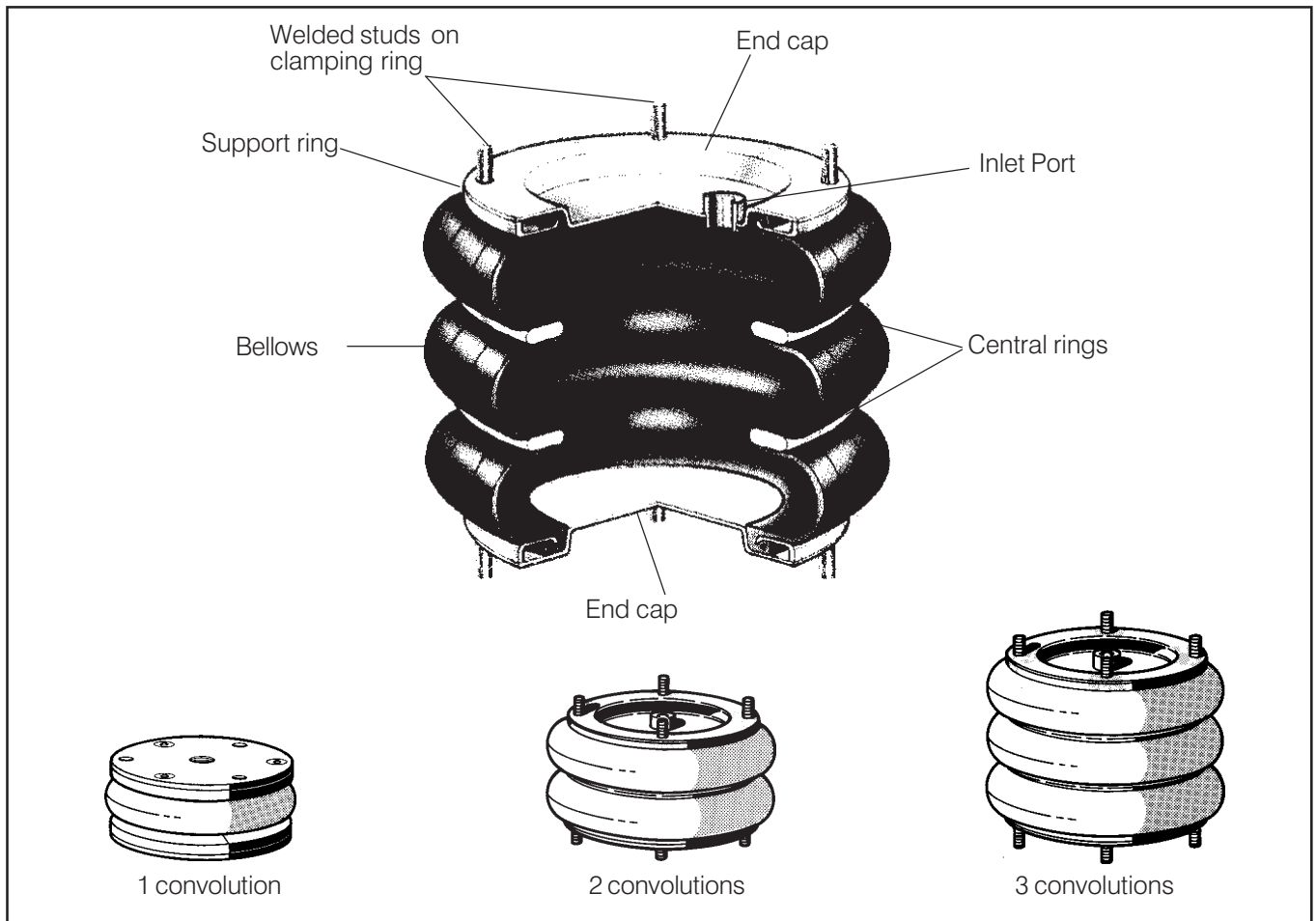
Platform lift



Short stroke mechanical linkage



Hot foil stamping press



Air Bellows

Air bellows are the ideal choice for applications requiring short stroke, high thrust single acting actuators.

Manufactured from fabric reinforced synthetic rubber in one, two or three convolutions according to stroke and model. They incorporate no reciprocating metal parts and so provide virtually frictionless thrust compared with conventional pneumatic cylinders.

All models are single acting only. The return stroke is provided in part by the natural spring action of the bellows but more usually by the load itself. The simplicity of construction provides an extremely long, virtually maintenance-free service life even under arduous conditions.

Versions

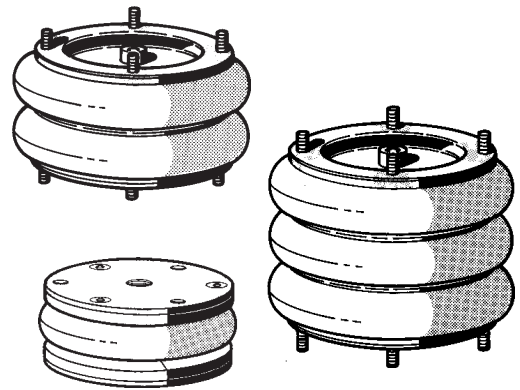
Available in ten bore sizes, they are supplied completely assembled. Bore 70 up to 150 mm Air Bellows have aluminium end caps and support rings.

Operation

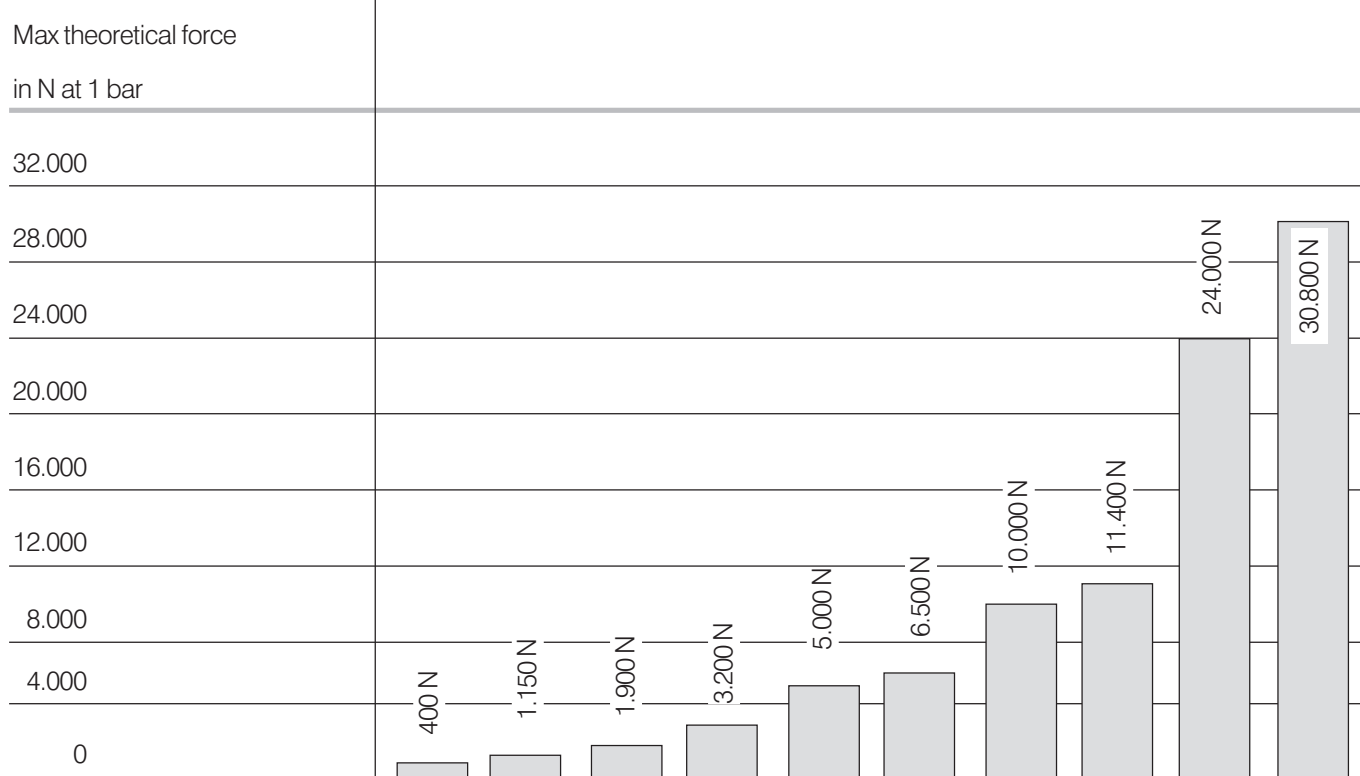
Due to their flexible construction the mounting of Air Bellows is less critical than with conventional pneumatic cylinders, which normally require rigid fixing and guidance and provide only one axis of movement. Air Bellows will operate in any axis within a limit of 15° between faces. Additionally the axial location of the end plates may be off set by up to 10mm. When pressurised Air Bellows will follow the line of least resistance. Accordingly care must be taken with the mounting geometry in angled applications.

When depressurised Air Bellows will fit in to surprisingly small spaces, especially useful for clamping or moving awkwardly shaped or very heavy loads.

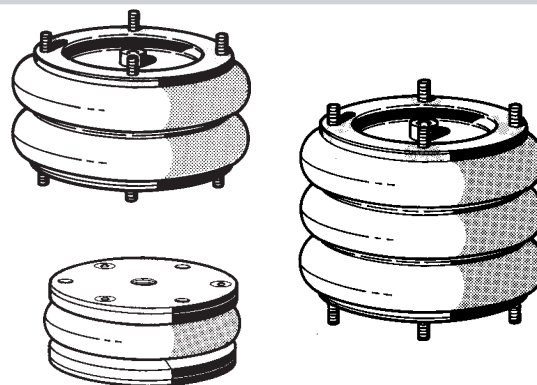
In operation it is recommended that the unit is not allowed to 'bottom out' or achieve its maximum height. Various mechanical devices may be employed to achieve this.



Cylinder bore	mm	70	110	150	200	250	300	370	410	550	660
	inch	2¾	4½	6	8	10	12	14½	16	21½	26
Port size		G1/4	G3/8	G1/2	G1/2	G1/2	G1/2	G1/2	G1/2	G3/4	G3/4
Max stroke mm		65	100	173	225	300	330	350	375	300	310
Max diameter mm		80	125	175	230	280	330	395	440	580	700
Max operating pressure bar		8	8	8	8	8	8	8	8	8	8
Single acting		●	●	●	●	●	●	●	●	●	●
High-temp		●	●	●	●	●	●	●	●	●	●
Low-temp		●	●	●	●	●	●	●	●	●	●
Dry		●	●	●	●	●	●	●	●	●	●



- 10 sizes, diameters 70-660 mm
- Strokes from 65 to 430 mm
- Single, double or triple convolutions
- High thrust and frictionless movement
- Maintenance free



Specification

Material

Standard versions

End plates

Ø70, 110, 150, 550 Aluminium
 Ø200, 250, 300, 370, 410, 660 Steel

Clamping ring, central ring;

Ø70, 110, 150, 550, 660 Aluminium
 Ø200, 250, 300, 370, 410 Steel

Bellows NBR

Operating information

Working pressure Max 8 bar
 Working temperature -30 ° to +70 °C
 Operation Dry air

Mounting :

Ø 70, 110, 150, 550, 660 Threaded holes
 Ø 200, 250, 300, 370, 410 Studs

Clamping torques for screws and mounting nuts :

Ø 70 x 2 and 70 x 3 5Nm
 Ø 110 x 1 to 110 x 3 7 to 11 Nm
 Ø 150 x 1 to 150 x 3 12Nm
 Ø 200 x 1 to 660 x2 20 à 28 Nm

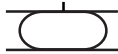
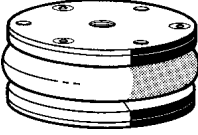
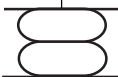
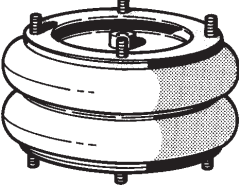
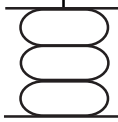
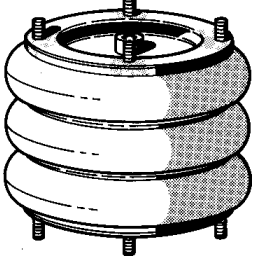
Options and additional information

High-temperature version :

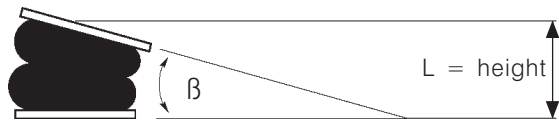
Bellows material : Chlorobutyl
 -30° C to +115°C dynamic
 -40°C to +130° static

Air bellows are suitable for vibration applications i.e. device feeders at high frequency. Please refer to technical leaflet for more information

It is recommended that external mechanical stops are used to limit the stroke. The units should not achieve maximum stroke or be allowed to 'bottom out'.
 Air Bellows may not be stacked, use singly only.

Symbol	Ø	Port size	Maxi stroke	Weight	Order code	
	mm				mm	(kg)
Single convolution  	110 (4 ^{1/2} X 1)	G3/8	45	0,8	9109400	9109600
	150 (6 X 1)	G1/2	55	2,4	9109004A	9109204A
	200 (8 x 1)	G1/2	75	3,05	9109014	9109214
	250 (10 x 1)	G1/2	100	3,9	9109024	9109224
	300 (12 x1)	G1/2	100	6,2	9109044	9109244
	370 (14 ^{1/2} x 1)	G1/2	115	6,9	9109064	9109264
Double convolutions  	70 (2 ^{3/4} X 2)	G1/4	50	0,5	9109009	9109509
	110 (4 ^{1/2} X 2)	G3/8	80	1	9109401	9109502
	150 (6 X 2)	G1/2	112	2,7	9109001A	9109201A
	200 (8 x 2)	G1/2	180	3,7	9109011	9109211
	250 (10 x 2)	G1/2	200	5	9109021	9109221
	300 (12 x2)	G1/2	195	6,7	9109041	9109241
	370 (14 ^{1/2} x 2)	G1/2	225	9,1	9109061	9109261
	410 (16x2)	G1/2	250	9,7	9109171	9109271
	550 (21 ^{1/2} x 2)	G3/4	300	20,6	9109150	9109250
660 (26 x2)	G3/4	310	23	9109156	N/A	
Triple convolutions  	70 (2 ^{3/4} X 3)	G1/4	65	0,6	9109010	9109510
	110 (4 ^{1/2} X 3)	G3/8	100	1,2	9109402	9109503
	150 (6 X 3)	G1/2	173	3	9109007A	9109207
	200 (8 x 3)	G1/2	225	4,4	9109017	9109219
	250 (10 x 3)	G1/2	300	5,6	9109031	9109231
	300 (12 x 3)	G1/2	330	8,1	9109051	9109251
	370 (14 ^{1/2} x 3)	G1/2	350	10,7	9109069	9109269
410 (16 x 3)	G1/2	375	12,9	9109177	9109275	

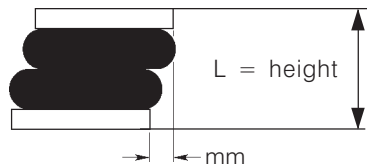
Angular misalignment



It is not possible to combine angular misalignment with axial misalignment

Ø mm	Convolution	Types	Angle β = 5°	Angle β = 10°	Angle β = 15°	Angle β = 20°	Angle β = 25°
			For heights (mm) between	For heights (mm) between	For heights (mm) between	For heights (mm) between	For heights (mm) between
70	2	2 ^{3/4} X 2	75-100	80-95	XXXXX	XXXXX	XXXXX
	3	2 ^{3/4} X 3	90-120	95-110	XXXXX	XXXXX	XXXXX
110	1	4 ^{1/2} X 1	60-75	XXXXX	XXXXX	XXXXX	XXXXX
	2	4 ^{1/2} X 2	75-130	80-125	90-120	100-115	XXXXX
150	3	4 ^{1/2} X 3	125-180	130-170	XXXXX	XXXXX	XXXXX
	1	6 X 1	95-85	65-80	XXXXX	XXXXX	XXXXX
200	2	6 X 2	90-155	95-150	105-145	110-135	XXXXX
	3	6 X 3	195-255	200-250	XXXXX	XXXXX	XXXXX
250	1	8 x 1	60-105	70-100	XXXXX	XXXXX	XXXXX
	2	8 x 2	XXXXX	90-210	100-205	110-220	115-190
300	3	8 x 3	250-305	255-300	XXXXX	XXXXX	XXXXX
	1	10 x 1	60-125	70-115	80-105	XXXXX	XXXXX
370	2	10 x 2	XXXXX	95-260	115-250	135-245	155-235
	3	10 x 3	185-330	245-370	280-350	XXXXX	XXXXX
410	1	12 x 1	60-125	75-115	90-105	XXXXX	XXXXX
	2	12 x 2	XXXXX	100-255	110-245	115-235	160-225
410	3	12 x 3	200-375	230-340	250-310	XXXXX	XXXXX
	1	14 ^{1/2} x 1	65-145	85-135	XXXXX	XXXXX	XXXXX
410	2	14 ^{1/2} x 2	XXXXX	105-300	115-290	135-275	170-260
	3	14 ^{1/2} x 3	280-430	300-390	270-310	XXXXX	XXXXX
410	2	16 x 2	XXXXX	125-350	150-340	185-325	225-310
	3	16 x 3	200-510	350-480	370-450	XXXXX	XXXXX

Axial misalignment



The following values are for short time movement

Ø mm	Convolution	Types	5 mm	10 mm	20 mm	30 mm	40 mm	50 mm
			For heights (mm) between	For heights (mm) between	For heights (mm) between	For heights (mm) between	For heights (mm) between	For heights (mm) between
70	2	2 ^{3/4} X 2	80-100	85-95	XXXXX	XXXXX	XXXXX	XXXXX
	3	2 ^{3/4} X 3	90-125	100-115	XXXXX	XXXXX	XXXXX	XXXXX
110	1	4 ^{1/2} X 1	60-80	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
	2	4 ^{1/2} X 2	XXXXX	85-135	95-130	110-130	XXXXX	XXXXX
150	3	4 ^{1/2} X 3	120-200	110-180	XXXXX	XXXXX	XXXXX	XXXXX
	1	6 X 1	XXXXX	70-80	XXXXX	XXXXX	XXXXX	XXXXX
200	2	6 X 2	XXXXX	100-165	125-155	XXXXX	XXXXX	XXXXX
	3	6 X 3	115-250	105-230	XXXXX	XXXXX	XXXXX	XXXXX
250	1	8 x 1	XXXXX	95-115	70-95	XXXXX	XXXXX	XXXXX
	2	8 x 2	XXXXX	95-230	95-220	115-210	130-195	XXXXX
300	3	8 x 3	110-280	100-260	XXXXX	XXXXX	XXXXX	XXXXX
	1	10 x 1	XXXXX	70-135	80-130	90-115	XXXXX	XXXXX
370	2	10 x 2	XXXXX	105-280	125-275	145-265	170-250	XXXXX
	3	10 x 3	XXXXX	165-390	200-380	220-365	230-350	240-345
410	1	12 x 1	XXXXX	70-135	80-130	90-115	XXXXX	XXXXX
	2	12 x 2	XXXXX	105-270	130-260	150-245	175-230	XXXXX
410	3	12 x 3	XXXXX	150-400	175-385	195-375	215-360	235-345
	1	14 ^{1/2} x 1	XXXXX	85-160	95-145	105-125	XXXXX	XXXXX
410	2	14 ^{1/2} x 2	XXXXX	120-330	140-320	165-315	185-305	XXXXX
	3	14 ^{1/2} x 3	XXXXX	180-450	205-440	225-425	245-410	260-385
410	2	16 x 2	XXXXX	180-380	205-375	225-365	245-355	XXXXX
	3	16 x 3	XXXXX	230-520	255-510	275-500	290-485	305-475

Types bore mm inches	Force in N at 1 bar Note: Max force and stroke may exceed values - see next two columns													Max force in N for max stroke at 1 bar	Max stroke mm	Height mm		Load to obtain min height N
																min	max	
70	400	250	70											70	50	65	115	140
2 3/4	370	270	150											70	65	80	145	160
110	1150	700	200											200	45	45	90	120
4 1/2	900	750	550	300										280	80	65	145	130
	900	750	600	450	280									280	100	100	200	140
150	1900	1200	500											350	55	50	105	140
6	1800	1650	1400	1100	800	450								400	112	78	190	170
	1800	1600	1400	1200	1000	800	600	400						400	173	102	275	190
200	3200	2400	1700	850										850	75	50	125	120
8	3000	2900	2600	2250	1900	1600	1200	800						800	180	70	250	130
	3000	2750	2500	2250	2000	1750	1500	1250	1050	950				800	225	100	325	150
250	5000	4000	3300	2100	1000									1000	100	50	150	100
10	4800	4500	4250	3700	3200	2800	2400	1800	1250					1250	200	70	270	100
	4800	4600	4400	4160	3900	3600	3300	2900	2500	2100	1700	1300	800	800	300	100	400	110
300	6500	5900	4900	3500	2000									2000	100	50	150	90
12	6800	6400	6000	5200	4800	4200	3150	2950	2250					2250	195	75	270	90
	6800	6500	6200	5850	5500	5200	4800	4400	4000	3600	3000	2500	1800	1800	330	100	430	100
370	9600	8800	7700	6300	4500									3500	115	50	165	80
14 1/2	10000	9500	9000	8500	7800	7250	6600	6000	5250	4500				4500	225	70	295	80
	10200	10000	9700	9550	9250	8750	8500	8000	7500	7100	6500	6000	5500	3500	350	100	450	290
410	11400	11100	10600	10100	9600	9000	8400	7750	7200	6500	5300			5300	250	75	325	80
16	10500	10250	10000	9600	9250	8900	8600	8200	7700	7250	6750	6250	5750	4200	375	125	500	650
550	24000	23000	22000	20080	19500	18200	17000	15300	13800	12000	10000	8000	6000	6000	300	90	390	70
21 1/2																		
660	30800	30500	30000	29200	28100	26900	25600	24300	23000	21800	20700	19500	18200	18200	310	90	400	70
26																		
Stroke	0	25	50	75	100	125	150	175	200	225	250	275	300					

Selection of Air Bellows

1. Establish the force required in N at working air pressure
2. Divide the force required by the working air pressure in bar
3. Select the standard stroke: Always choose the next highest stroke to that required
4. Read upwards in the column to find the figure equal to or greater than the figure which resulted from step 2
5. Read across to the left for recommended unit size

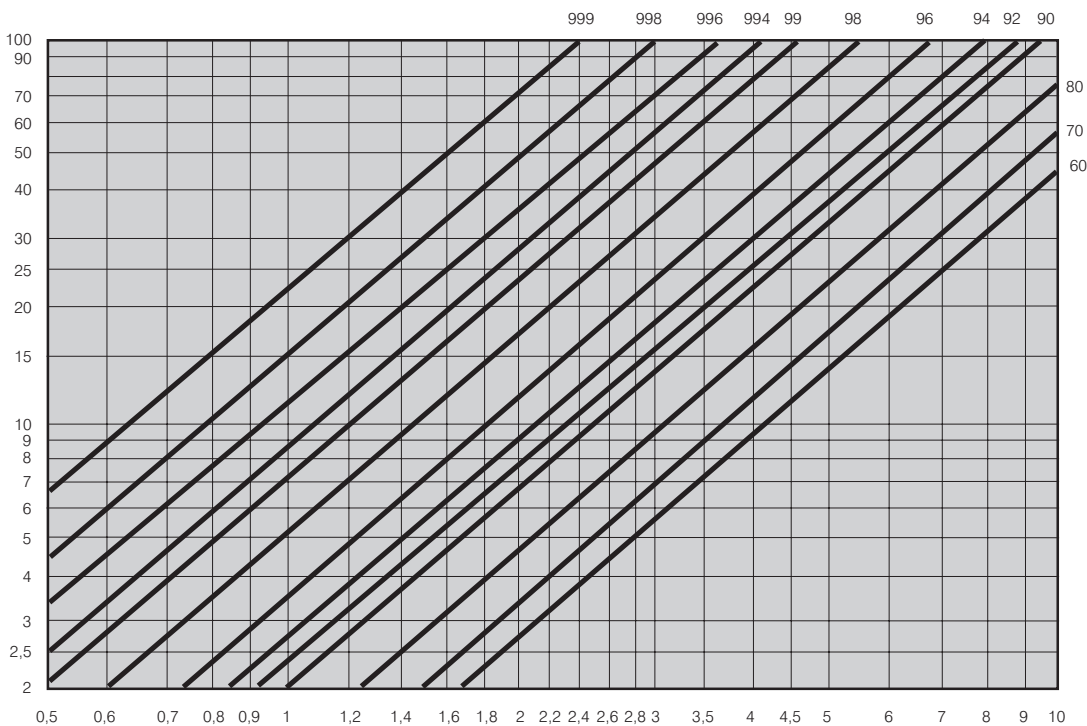
Example

1. Force required 35000N. Working air pressure 7 bar
2. Force at 1 bar is: $35000 \div 7 = 5000$ N
3. Stroke required 120 mm - Use 125 mm
4. Use 125 stroke column, 5200 N at 1 bar
5. Recommended unit is $\varnothing 300$ mm (12 inches) 3 convolutions

Vibration isolation (damping) charts

Vibration frequency Hz

Damping %



Air Bellows frequency Hz

Ø mm	Convolu-tion	Types	Frequency 6 bar Hz	Static height mm	Loading 6bar in kg
70	2	2 ^{3/4} X 2	3,8	90	150
	3	2 ^{3/4} X 3	3,2	110	156
110	1	4 ^{1/2} X 1	3,8	70	335
	2	4 ^{1/2} X 2	3	100	390
150	3	4 ^{1/2} X 3	2,6	145	378
	1	6 X 1	3,2	80	640
	2	6 X 2	2,2	140	685
200	3	6 X 3	1,9	180	660
	1	8 x 1	2,77	90	1275
	2	8 x 2	1,95	160	1225
250	3	8 x 3	1,75	210	1200
	1	10 x 1	2,63	100	1960
	2	10 x 2	1,75	170	1900
300	3	10 x 3	1,43	250	1770
	1	12 x 1	2,44	100	2975
	2	12 x 2	1,78	170	2910
370	3	12 x 3	1,44	250	2930
	1	14 ^{1/2} x 1	2,22	110	4555
	2	14 ^{1/2} x 2	1,61	200	4445
410	3	14 ^{1/2} x 3	1,31	290	4320
	2	16 x 2	1,44	200	5195
550	3	16 x 3	1,24	290	4950
	2	21 ^{1/2} x 2	1,49	200	11785

How to establish damping %

1. On the graph establish the frequency of vibration requiring damping.
2. On the chart below select the loading and size of the unit suitable for the application.
3. Having chosen the unit required, the frequency in Hz quoted should be read off the bottom axis on the graph.
4. The damping % figure is given where the figures established at point 1 and point 3 coincide, reading diagonally to the right hand top edge of the graph.

Example

1. Frequency requiring damping = 10Hz.
2. Loading of Air Bellows unit = 1500kg.
3. Suitable unit with pressure of 1 bar = Ø10" x 2, (frequency quoted = 2).
4. Produces 96,8% damping.

Mounting dimensions

Ø 70 mm (2³/₄")

Aluminium end plates version

Ø 110 mm (4¹/₂")

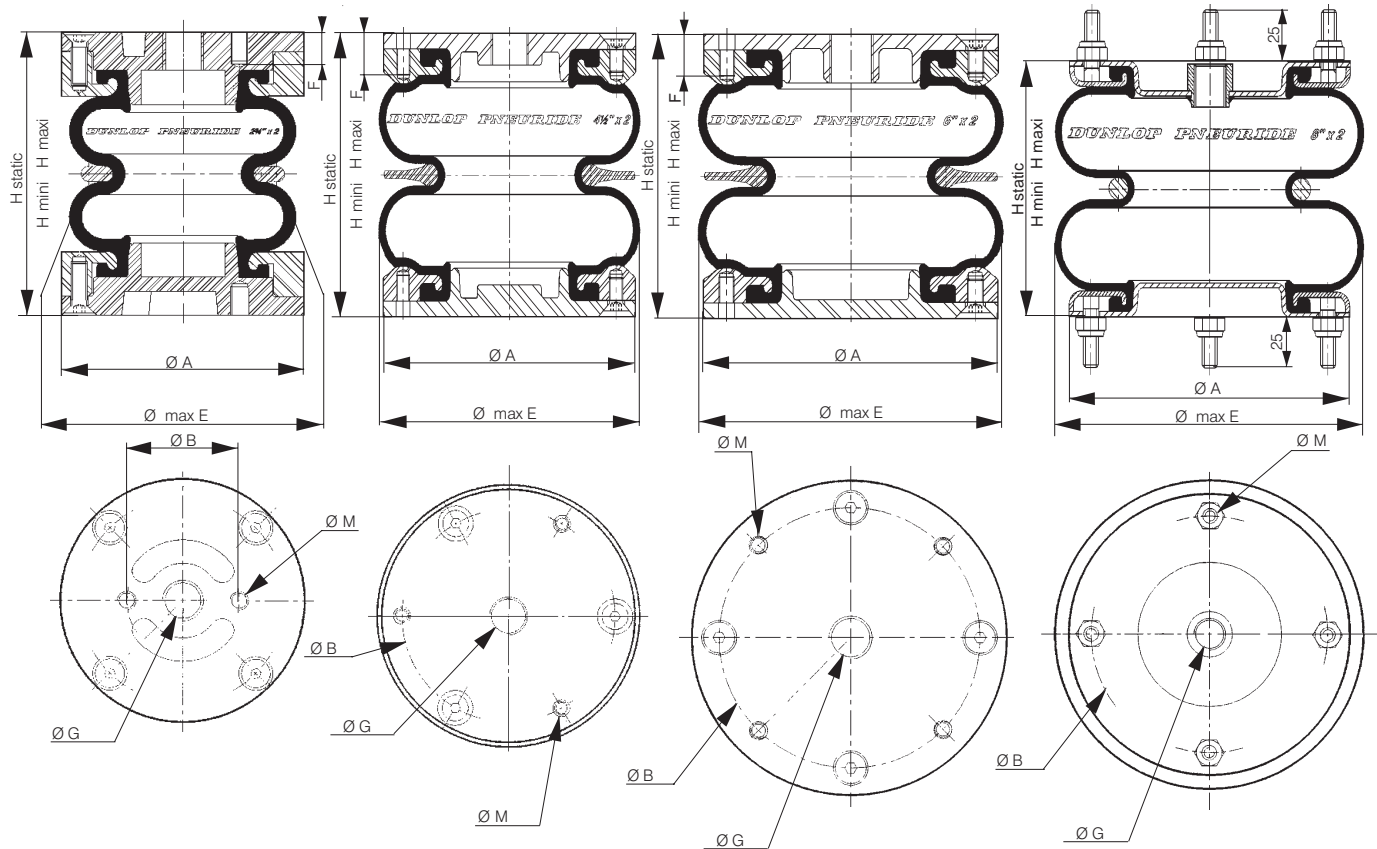
Aluminium end plates version

Ø 150 mm (6")

Aluminium end plates version

Ø 200 to 410 mm (8 to 16")

Steel end plates version



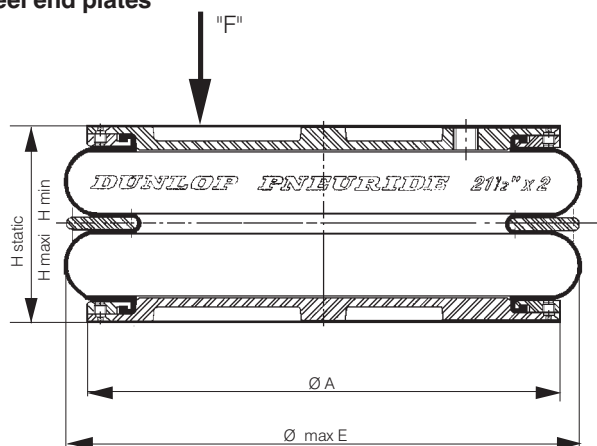
Ø mm	Convolutions	Types	Order code	H mini	H static	H maxi	Stroke maxi	Ø E maxi	Ø A	Ø B	F	Ø M	Port size Ø G	P max pressure (bar)	Weight (kg)
70	2	2 ³ / ₄ X 2	9109009	65	90	115	50	80	78	36	9	M6	G1/4	8	0,5
	3	2 ³ / ₄ X 3	9109010	80	110	145	65	80	78	36	9	M6	G1/4	8	0,6
	1	4 ¹ / ₂ X 1	9109400	45	65	90	45	125	110	93	13	M6	G3/8	8	0,8
110	2	4 ¹ / ₂ X 2	9109401	65	100	145	80	125	110	93	13	M6	G3/8	8	1
	3	4 ¹ / ₂ X 3	9109402	100	145	200	100	125	110	93	13	M6	G3/8	8	1,2
150	1	6 X 1	9109004A	50	80	105	55	175	155	127	16	M8	G1/2	8	2,4
	2	6 X 2	9109001A	78	130	190	112	175	155	127	16	M8	G1/2	8	2,7
	3	6 X 3	9109007A	102	190	275	173	175	155	127	16	M8	G1/2	8	3
200	1	8 x 1	9109014	50	90	125	75	230	184	155,5		M10	G1/2	8	3,05
	2	8 x 2	9109011	70	160	250	180	230	184	155,5		M10	G1/2	8	3,7
	3	8 x 3	9109017	100	205	325	225	230	184	155,5		M10	G1/2	8	4,4
250	1	10 x 1	9109024	50	100	150	100	280	210	181		M10	G1/2	8	3,9
	2	10 x 2	9109021	70	170	270	200	280	210	181		M10	G1/2	8	5
	3	10 x 3	9109031	100	250	400	300	280	210	181		M10	G1/2	8	5,6
300	1	12 x 1	9109044	50	100	150	100	330	260	232		M10	G1/2	8	6,2
	2	12 x 2	9109041	75	170	270	195	330	260	232		M10	G1/2	8	6,7
	3	12 x 3	9109051	100	250	430	330	330	260	232		M10	G1/2	8	8,1
370	1	14 ¹ / ₂ x 1	9109064	50	110	165	115	395	310	282,5		M10	G1/2	8	6,9
	2	14 ¹ / ₂ x 2	9109061	70	180	295	225	395	310	282,5		M10	G1/2	8	9,1
	3	14 ¹ / ₂ x 3	9109069	100	280	450	350	395	310	282,5		M10	G1/2	8	10,7
410	2	16 x 2	9109171	75	200	325	250	440	310	282,5		M10	G1/2	8	9,7
	3	16 x 3	9109177	125	300	500	375	440	310	282,5		M10	G1/2	8	12,9

Note: The burst pressure is quoted at maximum stroke.

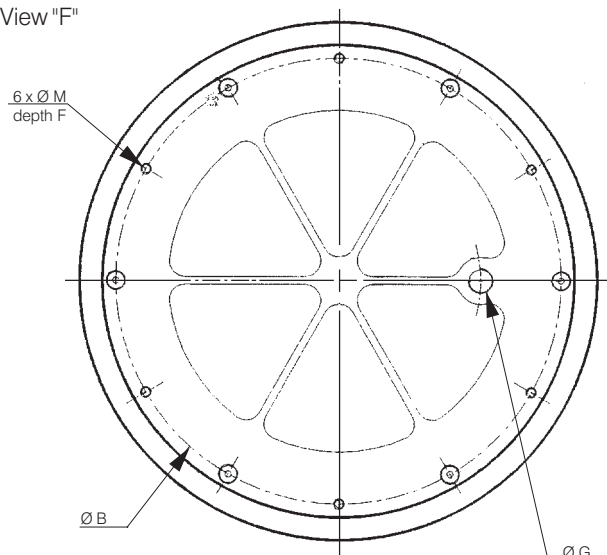
Mounting dimensions

Ø 550 mm (21^{1/2"})
Aluminium end plates

Ø 660 mm (26")
Steel end plates



View "F"



Ø mm	Convolution	Types	Order code	H mini	H static	H maxi	Maxi stroke	Ø E maxi	Ø A	Ø B	F	Ø M	Port size Ø G	P max pressure (bar)	Weight (kg)
550	2	211/2 x 2	9109150	90	200	390	300	580	498,5	470	19	M10	G3/4	8	20,6
		211/2 x 2	9109153*	90	200	390	300	580	498,5	470		M10	G3/4	8	11,5
660	2	26 x 2	9109156	90	200	400	310	700	601	470	19	M10	G3/4	8	23

Note: The burst pressure is quoted at maximum stroke.

* Air bellows less end caps

Spare parts

Ø mm	Convolution	Types	Bellows		End plates		Support ring	Central ring
			Standard	Chlorobutyl	W/o inlet port	With inlet port		
70	2	2 ^{3/4} X 2	9109152	9109303				
		2 ^{3/4} X 3	9109090	9109304	9109065	9109181	9109197	9109209
110	1	4 ^{1/2} X 1	9109145	9109288				
	2	4 ^{1/2} X 2	9109189	9109289	9109188	9109187	9109186	9109184
	3	4 ^{1/2} X 3	9109147	9109287				
150	1	6 X 1	9109191	9109391				
	2	6 X 2	9109091	9109291	9109070A	9109075A	9109080A	9109098A
	3	6 X 3	9109149	9109286				
200	1	8 x 1	9109192	9109392				
	2	8 x 2	9109092	9109292	9109071	9109076	9109086	9109099
	3	8 x 3	9109151	9109300				
250	1	10 x 1	9109146	9109393				
	2	10 x 2	9109093	9109293	9109072	9109077	9109087	9109100
	3	10 x 3	9109094	9109294				
300	1	12 x 1	9109195	9109395				
	2	12 x 2	9109095	9109295	9109073	9109078	9109088	9109101
	3	12 x 3	9109096	9109296				
370	1	14 ^{1/2} x 1	9109197	9109397				
	2	14 ^{1/2} x 2	9109097	9109297	9109074	9109178	9109089	9109170
	3	14 ^{1/2} x 3	9109148	9109301				
410	2	16 x 2	9109199	9109298				
	3	16 x 3	9109200	9109299	9109074	9109178	9109089	9109170
550	2	211/2 x 2	9109190	9109290	9109068	9109067	9109183	9109185
660	2	26 x 2	9109198	9109302	9109155	9109157	9109183	9109185