GENERALE TECHNICAL DATA

Compressed air
The cylinders have been designed for use with unlubricated air, in which case no maintenance is required. If lubricated air is used, lubrication must be continuous because the additional lubrication removes the lubricant applied at the factory.
With reference to ISO/DIN 8573-1, the compressed air to use is class 3-4-3, i.e.:
- oil residue: 1 mg/m^3
- powder residue: filtering 40 um, 10 mg/m^3
- water residue: dew point -20°C, 0.88 mg/m^3.

Gasket material
Some families of Metal Work cylinders are available with gaskets made of different materials.
Polyurethane: the best in terms of long-life, resistance to wear and reduced friction.
Chemically compatible with:
- Pure aliphatic hydrocarbons (butane, propane, gasoline). Any impurities (moisture, alcohol, acid or alkaline compounds) can chemically attack polyurethane.
- Mineral oil and grease (some additives can chemically attack the material)
- Silicone oil and grease
- Water up to +50°C
- Resistance to ozone and ageing

Not compatible with:
- Ketones, esters, ethers
- Alcohos, glycols
- Hot water, steam, alkali, amines, acids.
- Good elasticity down to –35°C (for low temperature PU version only).

NBR: These gaskets have a shorter life than polyurethane gaskets. However, they are recommended for use in environments causing the formation of water condensate, such as tropical climates, where polyurethane gaskets may tend to deteriorate quickly due to hydrolysis.
Chemically compatible with:
- Methane, butane, propane, oily acids
- Aliphatic hydrocarbons
- Lubrication oils
- Gasoline

Not compatible with:
- Ozone and exposure to sunlight.
- Good elasticity down to –35°C (for low temperature NBR version only).

FKM/FPM: Can withstand temperatures as high as 150°C. This makes them ideal for use on rodless cylinders, high-speed applications, involving high temperatures at the sliding lips.
Chemically compatible with:
- Mineral oil and grease, slight swelling with oil grade ASTM no. 1 and 3.
- Silicon oil and grease
- Animal and vegetable oil and fat
- Aliphatic hydrocarbons (gasoline, butane, propane, natural gas)
- Aromatic hydrocarbons (benzol, toluene)
- Chlorinated hydrocarbons (tetrachloroethylene)
- Fuels
- Ozone, atmospheric agents, ageing

Not compatible with:
- Polar solvents (acetone, methylethylchetone, diethyl ether, dioxane)
- Glycol-based brake fluids
- Ammonia gas, amines, alkali
- Superheated water vapour
- Low molecular organic acids (formic and acetic acid)

No-stick-slip cylinders:
Standard cylinders are designed to ensure trouble-free operation under any conditions, particularly at high speed. Operation tends to be irregular and jerky at very low speeds in the presence of side loads. In this case, no-stick-slip cylinders are recommended as they allow smooth operation. These versions feature specific tribological properties and polyurethane gaskets.

Radial oscillation of the piston rod
These cylinders have been designed to apply forces in the direction of the axis and not to withstand side loads. If you intend to use the cylinder piston rod with side loads, the play between the piston rod and guide bushing must be taken into account. Indicatively, each 100-mm stroke corresponds to 1-mm radial oscillation measured at the end of the piston rod.

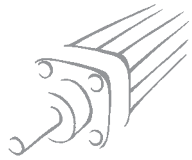
Cylinder operating life
The life of cylinders depends on numerous factors including axial and radial loads, speed, frequency of use, temperature, shocks, air loss (limits). Below are a few factors that must be taken purely as a reference. They are not binding or guaranteed due to the variability of different factors.
Without radial load:
ISO 6431 cylinders and round cylinders with polyurethane gaskets: 15,000 km.
ISO 6431 cylinders and round cylinders with NBR gaskets: 8,000 km.
ISO 6432 cylinders, SSC cylinders and compact cylinders with polyurethane gaskets: 30 million cycles.
ISO6432 cylinders and SSC cylinders with NRB gaskets: 15 million cycles
Rodless cylinders: 5,000 km

Stroke tolerances
The actual cylinder stroke has a tolerance with respect to the nominal stroke, in compliance with any applicable laws, within the following ranges:

• ISO 6431 cylinders	32-50	-0	+2	mm
	63-200	-0	+2.5	mm
• ISO 6432 6432	8-25	-1	+1	mm
• Round cylinders	32-50	-0,5	+1.5	mm
• SSC cylinders	12-50	-1	+1	mm
	63-100	-1	+1.5	mm
• Compact cylinders	12-100	-0,5	+1.5	mm
• Rodless cylinders	16-40	-1	+2	mm

Strokes exceeding the maximum value specified in the catalogue
Metal Work can supply cylinders with strokes greater than those specified in the catalogue, considering the production technological limits. The Metal Work Sales Department can provide you will full details. However, it is up to the end user to use these special cylinders properly, by guiding the piston rod, avoiding peak loads, etc.

Magnetic sensors
The magnetic field generated by permanent magnets housed in the piston assembly changes in shape and intensity depending on the presence of magnetic metal masses in the vicinity of the cylinder. These masses may prevent the sensors from switching correctly, in which case non-magnetic materials should be used. In particular, the tie rods of short-stroke and compact cylinders should preferably be made of stainless steel.



CALCULATING PEAK LOAD ON THE PISTON ROD

During operation, the piston rod of the cylinder behaves like a rod subjected to peak load (bending + compression). In the case of long strokes, it is necessary to make sure the diameter of the piston rod is correct for the load applied and the type of cylinder and piston rod mounting. The following formulae can be used to do this.

A. Calculating the maximum force with a given stroke and piston rod diameter:

$$F \leq \frac{20.350\ \varnothing^4}{C^2 .\ K^2}$$

B. Calculating the minimum acceptable piston rod diameter with a given stroke and force:

$$S \geq \sqrt[4]{\frac{F\ .\ C^2 .\ K^2}{20.350}}$$

Where:

F	force applied	[N]
∅	diameter of the piston rod	[mm]
C	stroke	[mm]
K	free length coefficient depending on the mounting – see diagrams	

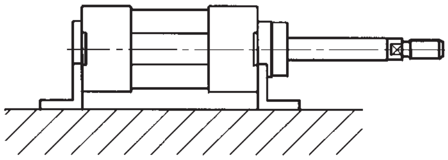
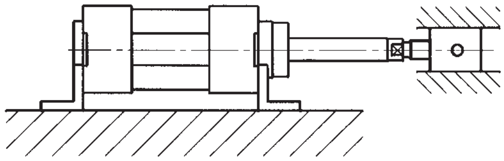
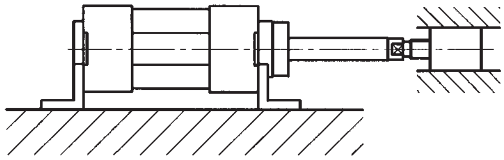
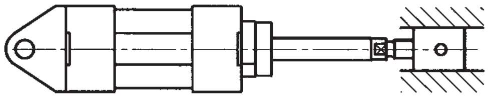
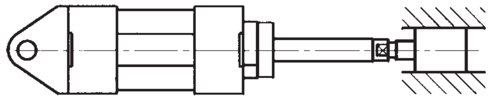
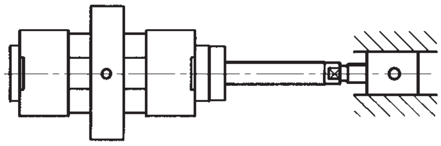
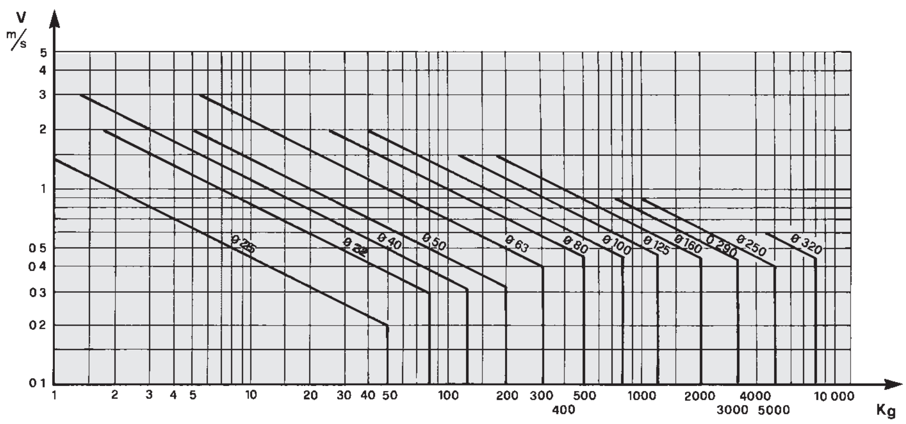
CONSTRAINT	K
	2
	0.7
	0.5
	2
	1
	1.5

CHART OF SPEED / MAXIMUM ABSORBABLE LOAD

For the cylinder to reach the end-of-stroke position without suffering damaging impact due to intensity and repetition, it is necessary to annul the kinetic energy of the moving mass and the relative work generated. The maximum absorbable load depends on the transference speed and the absorption capacity of the standard pneumatic cushion in the various cylinders. The chart gives the speed and absorbable mass in various diameters at a pressure of 6 bar.



CONSUMPTION OF AIR IN THE CYLINDERS

Cylinder bore D mm	Piston rod diameter d mm	Motion	Useful area cm²	Air consumption during thrust and traction in Nl/cm of stroke, depending on the working pressure P in bar at 20°C.									
				1 bar	2 bar	3 bar	4 bar	5 bar	6 bar	7 bar	8 bar	9 bar	10 bar
12	4	thrust	1,13	0,0023	0,0034	0,0045	0,0057	0,0068	0,0079	0,0090	0,0102	0,0113	0,0124
		traction	1,00	0,0020	0,0030	0,0040	0,0050	0,0060	0,0070	0,0080	0,0090	0,0100	0,0110
16	6	thrust	2,01	0,0040	0,0060	0,0080	0,0100	0,0121	0,0141	0,0161	0,0181	0,0202	0,0221
		traction	1,73	0,0035	0,0052	0,0069	0,0086	0,0104	0,0121	0,0138	0,0156	0,0173	0,0190
20	8	thrust	3,14	0,0063	0,0094	0,0126	0,0157	0,0188	0,0220	0,0251	0,0283	0,0314	0,0346
		traction	2,64	0,0053	0,0079	0,0106	0,0132	0,0158	0,0185	0,0211	0,0238	0,0264	0,0290
25	12	thrust	4,91	0,0098	0,0147	0,0196	0,0245	0,0295	0,0344	0,0393	0,0442	0,0491	0,0540
		traction	3,78	0,0076	0,0113	0,0151	0,0189	0,0227	0,0264	0,0302	0,0340	0,0378	0,0415
32	12	thrust	8,04	0,016	0,024	0,032	0,040	0,048	0,056	0,064	0,072	0,080	0,088
		traction	6,91	0,014	0,021	0,028	0,035	0,042	0,049	0,058	0,063	0,070	0,076
40	16	thrust	12,56	0,025	0,038	0,050	0,063	0,076	0,088	0,100	0,113	0,126	0,138
		traction	10,55	0,021	0,032	0,042	0,053	0,063	0,074	0,088	0,095	0,106	0,116
50	20	thrust	19,63	0,039	0,059	0,079	0,098	0,118	0,137	0,157	0,177	0,196	0,216
		traction	16,49	0,033	0,050	0,066	0,082	0,099	0,115	0,132	0,149	0,165	0,181
63	20	thrust	31,16	0,062	0,093	0,125	0,156	0,187	0,218	0,249	0,280	0,312	0,343
		traction	28,02	0,056	0,084	0,112	0,140	0,168	0,196	0,224	0,252	0,280	0,308
80	25	thrust	50,24	0,100	0,150	0,200	0,250	0,301	0,351	0,402	0,452	0,502	0,552
		traction	45,36	0,091	0,138	0,181	0,227	0,272	0,318	0,363	0,408	0,454	0,500
100	32	thrust	78,54	0,157	0,238	0,314	0,382	0,471	0,549	0,628	0,706	0,785	0,862
		traction	70,50	0,141	0,211	0,282	0,352	0,423	0,493	0,564	0,635	0,705	0,775
125	32	thrust	122,66	0,245	0,368	0,490	0,613	0,736	0,859	0,981	1,104	1,226	1,349
		traction	114,67	0,229	0,344	0,459	0,573	0,688	0,803	0,917	1,032	1,147	1,262
160	40	thrust	201,06	0,402	0,603	0,804	1,005	1,206	1,407	1,608	1,809	2,010	2,211
		traction	188,49	0,377	0,565	0,754	0,942	1,130	1,319	1,508	1,696	1,884	2,673
200	40	thrust	314,15	0,628	0,942	1,257	1,571	1,885	2,199	2,513	2,827	3,145	3,456
		traction	301,59	0,603	0,905	1,206	1,508	1,810	2,111	2,413	2,714	3,016	3,318

FORCE OF SPRINGS IN SINGLE-ACTING CYLINDERS (THEORETICAL)

ISO 6431 SINGLE-ACTING CYLINDERS

Bore mm	Force with spring compressed N	Max. stroke mm	Force with spring extended N
32	63	250	35
40	88	250	51
50	102	250	64
63	102	250	64

ISO 6432 SINGLE-ACTING CYLINDERS

Bore mm	Force with spring compressed N	Max. stroke mm	Force with spring extended N
8	3	50	1
10	5	50	1
12	7	50	3
16	20	50	5
20	22	50	12
25	28	50	17

$$P = P_1 + \frac{(P_2 - P_1)}{C_{max}} \cdot C_x$$

P_1 = Force with spring extended
P_2 = Force with spring compressed
C_x = Required stroke
C_{max} = Max stroke

SSC SINGLE-ACTING CYLINDERS

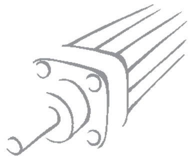
Bore mm	Force with spring compressed N	Max. stroke mm	Force with spring extended N
12	6	25	1,5
16	7	25	3
20	12	25	4
25	14	25	5
32	33	50	6
40	45	50	15
50	70	50	20
63	81	50	25

ROUND SINGLE-ACTING CYLINDERS

Bore mm	Force with spring compressed N	Max. stroke mm	Force with spring extended N
32	86	250	34
40	95	250	50
50	108	250	62

SINGLE-ACTING CARTRIDGE CYLINDERS

Bore mm	Force with spring compressed N	Stroke mm	Force with spring extended N
6	3.7	5	–
10	7.8	5	–
16	7.2	5	–
6	3.9	10	–
10	9.6	10	–
16	13.3	10	–
6	3.9	15	–
10	9.1	15	–
16	13.3	15	–



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FORCES GENERATED DURING THRUST AND TRACTION (THEORETICAL)

Cylinder bore D mm	Piston rōd diameter d mm	Motion	Useful area cm^2	Thrust and traction force in daN depending on the operating pressure in bar.									
				1 bar	2 bar	3 bar	4 bar	5 bar	6 bar	7 bar	8 bar	9 bar	10 bar
8	4	thrust	0.50	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
		traction	0.38	0.4	0.8	1.1	1.5	1.9	2.3	2.6	3.0	3.4	3.8
10	4	thrust	0.79	0.8	1.6	2.4	3.1	3.9	4.7	5.5	6.3	7.1	7.9
		traction	0.66	0.7	1.3	2.0	2.6	3.3	4.0	4.6	5.3	5.9	6.6
12	6	thrust	1.13	1.1	2.3	3.4	4.5	5.7	6.8	7.9	9.0	10.2	11.3
		traction	0.85	0.8	1.7	2.5	3.4	4.2	5.1	5.9	6.8	7.6	8.5
16	6	thrust	2.01	2.0	4.0	6.0	8.0	10.1	12.1	14.1	16.1	18.1	20.1
		traction	1.73	1.7	3.5	5.2	6.9	8.6	10.4	12.1	13.8	15.6	17.3
16	8	thrust	2.01	2.0	4.0	6.0	8.0	10.1	12.1	14.1	16.1	18.1	20.1
		traction	1.51	1.5	3.0	4.5	6.0	7.5	9.0	10.6	12.1	13.6	15.1
20	8	thrust	3.14	3.1	6.3	9.4	12.6	15.7	18.8	22.0	25.1	28.3	31.4
		traction	2.64	2.6	5.3	7.9	10.6	13.2	15.8	18.5	21.1	23.8	26.4
20	10	thrust	3.14	3.1	6.3	9.4	12.6	15.7	18.8	22.0	25.1	28.3	31.4
		traction	2.36	2.4	4.7	7.1	9.4	11.8	14.1	16.5	18.8	21.2	23.6
25	8	thrust	4.91	4.9	9.8	14.7	19.6	24.5	29.5	34.4	39.3	44.2	49.1
		traction	4.41	4.4	8.8	13.2	17.6	22.0	26.4	30.8	35.2	39.7	44.1
25	10	thrust	4.91	4.9	9.8	14.7	19.6	24.5	29.5	34.4	39.3	44.2	49.1
		traction	4.12	4.1	8.2	12.4	16.5	20.6	24.7	28.9	33.0	37.1	41.2
32	12	thrust	8.04	8.0	16.1	24.1	32.2	40.2	48.3	56.3	64.3	72.4	80.4
		traction	6.91	6.9	13.8	20.7	27.6	34.6	41.5	48.4	55.3	62.2	69.1
40	12	thrust	12.57	12.6	25.1	37.7	50.3	62.8	75.4	88.0	100.5	113.1	125.7
		traction	11.44	11.4	22.9	34.3	45.7	57.2	68.6	80.0	91.5	102.9	114.4
40	16	thrust	12.57	12.6	25.1	37.7	50.3	62.8	75.4	88.0	100.5	113.1	125.7
		traction	10.56	10.6	21.1	31.7	42.2	52.8	63.3	73.9	84.4	95.0	105.6
50	16	thrust	19.63	19.6	39.3	58.9	78.5	98.2	117.8	137.4	157.1	176.7	196.3
		traction	17.62	17.6	35.2	52.9	70.5	88.1	105.7	123.4	141.0	158.6	176.2
50	20	thrust	19.63	19.6	39.3	58.9	78.5	98.2	117.8	137.4	157.1	176.7	196.3
		traction	16.49	16.5	33.0	49.5	66.0	82.5	99.0	115.5	131.9	148.4	164.9
63	16	thrust	31.17	31.2	62.3	93.5	124.7	155.9	187.0	218.2	249.4	280.6	311.7
		traction	29.16	29.2	58.3	87.5	116.6	145.8	175.0	204.1	233.3	262.5	291.6
63	20	thrust	31.17	31.2	62.3	93.5	124.7	155.9	187.0	218.2	249.4	280.6	311.7
		traction	28.03	28.0	56.1	84.1	112.1	140.2	168.2	196.2	224.2	252.3	280.3
80	20	thrust	50.27	50.3	100.5	150.8	201.1	251.3	301.6	351.9	402.1	452.4	502.7
		traction	47.12	47.1	94.2	141.4	188.5	235.6	282.7	329.9	377.0	424.1	471.2
80	25	thrust	50.27	50.3	100.5	150.8	201.1	251.3	301.6	351.9	402.1	452.4	502.7
		traction	45.36	45.4	90.7	136.1	181.4	226.8	272.1	317.5	362.9	408.2	453.6
100	25	thrust	78.54	78.5	157.1	235.6	314.2	392.7	471.2	549.8	628.3	706.9	785.4
		traction	73.63	73.6	147.3	220.9	294.5	368.2	441.8	515.4	589.0	662.7	736.3
125	32	thrust	122.72	122.7	245.4	368.2	490.9	613.6	736.3	859.0	981.7	1104.5	1227.2
		traction	114.68	114.7	229.4	344.0	458.7	573.4	688.1	802.7	917.4	1032.1	1146.8
160	40	thrust	201.06	201.1	402.1	603.2	804.2	1005.3	1206.4	1407.4	1608.5	1809.6	2010.6
		traction	188.50	188.5	377,0	565.5	754.0	942.5	1131.0	1319.5	1508.0	1696.5	1885.0
200	40	thrust	314.16	314.2	628.3	942.5	1256.6	1570.8	1885.0	2199.1	2513.3	2827.4	3141.6
		traction	301.59	301.6	603.2	904.8	1206.4	1508.0	1809.6	2111.1	2412.7	2714.3	3015.9

NOTES

METAL WORK PNEUMATIC

WEIGHT OF CYLINDERS

Micro-cylinder series "ISO 6432"

Ø	Single-rod		Through-rod	
	Weight [g] Stroke=0	Weight [g] each mm	Weight [g] Stroke=0	Weight [g] each mm
8	40	0.234	55	0.334
10	41	0.257	59	0.371
12	77	0.419	111	0.635
16	93	0.491	133	0.708
20	181	0.732	233	1.121
25	241	1.100	334	1.722

Round cylinder series RNDC

Ø	Single-rod		Through-rod	
	Weight [g] Stroke=0	Weight [g] each mm	Weight [g] Stroke=0	Weight [g] each mm
32	404	1.44	455	2.04
40	660	1.58	808	3.14
50	1235	3.59	1507	6.03

Short-stroke cylinder series "SSCY"

Ø	Single-rod		Through-rod		Non-ratating		Oscillating	
	Weight [g] Stroke=0	Weight [g] each mm	Weight [g] Stroke=0	Weight [g] each mm	Weight [g] Stroke=0	Weight [g] each mm	Weight [g] Stroke=0	Weight [g] each mm
12	45	1.24	52	1.47	64	1.35		
16	63	1.65	72	2.05	88	1.6		
20	91	2.14	104	2.75	126	2.37		
25	144	3.04	167	3.65	189	3.25		
32	185	4.14	200	4.72	260	4.56	272	4.14
40	275	5.05	295	5.94	373	5.49	386	5.05
50	412	7.09	437	8.9	592	7.89	620	7.09
63	587	9.32	621	10.91	854	10.57	889	9.32
80	393	14.41	1485	16.9	1740	25.87		
100	673	21.94	2841	25.9	2692	30.77		

Compact cylinder

Ø	Single-rod		Through-rod		Non-ratating		Through-rod non-rotating	
	Weight [g] Stroke=0	Weight [g] each mm	Weight [g] Stroke=0	Weight [g] each mm	Weight [g] Stroke=0	Weight [g] each mm	Weight [g] Stroke=0	Weight [g] each mm
12	96	1.59	104	1.82	105	1.90	114	2.12
16	105	1.51	124	1.90	109	1.81	129	2.20
20	171	2.35	204	2.95	181	2.78	214	3.39
25	201	2.73	233	3.32	220	3.15	252	3.76
32	246	3.17	282	4.05	306	3.96	343	4.84
40	370	4.41	408	5.29	457	5.20	495	6.08
50	552	6.42	605	7.98	709	7.64	768	9.21
63	779	7.34	656	8.90	977	8.56	1054	10.13
80	1468	12.57	1624	15.02	1851	14.33	2027	16.78
100	2988	16.11	3100	19.93	3710	17.87	3850	21.70

Cylinder series "ISO 6431"

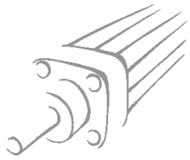
Ø	Single-rod		Through-rod	
	Weight [g] Stroke=0	Weight [g] each mm	Weight [g] Stroke=0	Weight [g] each mm
32	505	2.2	570	3.09
40	731	3.15	867	4.73
50	1180	4.57	1438	7.04
63	1557	5.03	1828	7.44
80	2913	7.49	3368	10.16
100	4099	8.79	4629	12.33
125	6869	13.42	7954	18
160	12979	22.92	13800	30
200	17000	28	18000	39

Cylinder series "ISO 6431" type A

Ø	Single-rod		Through-rod	
	Weight [g] Stroke=0	Weight [g] each mm	Weight [g] Stroke=0	Weight [g] each mm
32	542	3.09	662	3.98
40	777	4.08	990	5.66
50	1239	5.86	1594	8.33
63	1608	5.92	2025	8.33
80	2995	9.07	3639	11.74
100	4139	9.48	4955	13.02
125	6917	14.11	8499	18.69

Twin-rod cylinder series "TWNC"

Ø	Standard		Single through-rod		Through-rods	
	Weight [g] Stroke=0	Weight [g] each mm	Weight [g] Stroke=0	Weight [g] each mm	Weight [g] Stroke=0	Weight [g] each mm
32	749	2.57	1028	3.79	1028	3.45
40	1000	2.81	1348	4.03	1348	4.38
50	1498	3.96	2103	5.72	2103	6.41
63	1800	5.72	2887	8.85	2887	8.17
80	3400	9.59	5205	15.52	5205	13.4
100	4800	10.89	7557	16.8	7557	14.7



Ø	Rodless cylinder							
	Standard		Series Double		with Guide		with Guide "V"	
	Weight [g] Stroke=0	Weight [g] each mm	Weight [g] Stroke=0	Weight [g] each mm	Weight [g] Stroke=0	Weight [g] each mm	Weight [g] Stroke=0	Weight [g] each mm
16	244	0.86	561	1.72	460	1.79	-	-
25	746	1.79	1607	3.58	1.421	2.99	953	1.98
32	1707	3.84	3737	7.68	3.025	5.04	2.150	3.21
40	2911	5.55	–	–	4.434	6.75	3.210	4.67
63 (Std)	7280	9.22	–	–	10.860	10.65	9.230	9.27
63 (Heavy)	–	–	–	–	13.275	14.02	-	-

Hydraulic brake series "BRK"					
Speed adjustment		Adjustment + skip or stop		Adjustment + skip and stop	
Weight [g] Stroke=0	Weight [g] each mm	Weight [g] Stroke=0	Weight [g] each mm	Weight [g] Stroke=0	Weight [g] each mm
1290	4.2	1430	4.2	1570	4.2

Ø	Compact guided cylinder			
	Non-cushioned (approximate)		Cushioned (approximate)	
	Weight [g] Stroke=0	Weight [g] each mm	Weight [g] Stroke=0	Weight [g] each mm
16	295	4.77	414	4.77
20	486	6.38	543	6.38
25	550	10.01	735	10.01
32	942	16.51	1.354	16.51
40	1028	18.04	1.479	18.04
50	1355	23.76	1.949	23.76
63	1900	32.56	2.714	32.56
80	3910	55.77	-	-
100	5710	73.48	-	-

Ø	Guide unit			
	Type GDS		Type GDH and GDM	
	Weight [g] Stroke=0	Weight [g] each mm	Weight [g] Stroke=0	Weight [g] each mm
12	150	0.78	374	0.78
16	150	0.78	374	0.78
20	420	1.22	759	1.22
25	420	1.22	759	1.22
32	772	1.76	1200	1.76
40	1000	1.76	2000	3.13
50	1900	3.13	3300	4.9
63	2300	3.13	4750	4.9
80	3800	4.9	8500	7.26
100	7000	4.9	12000	7.26

Ø x Stroke	Compact Stopper cylinder	
	Trunnion version	Roller version
	Weight [g]	Weight [g]
20x15	210	220
32x20	420	460
50x30	1.190	1.300
80x30	-	4.500
80x40	-	4.750

NOTES