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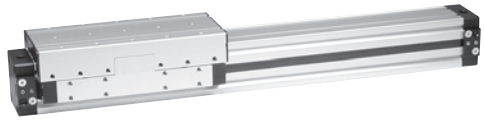
Rodless cylinders

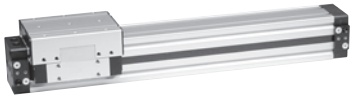
Air. Pressure. Motion.

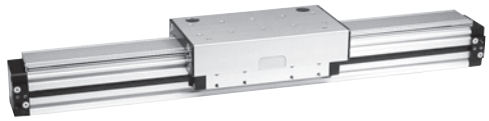
Rodless cylinders/06.15US

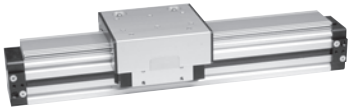
Info

Info









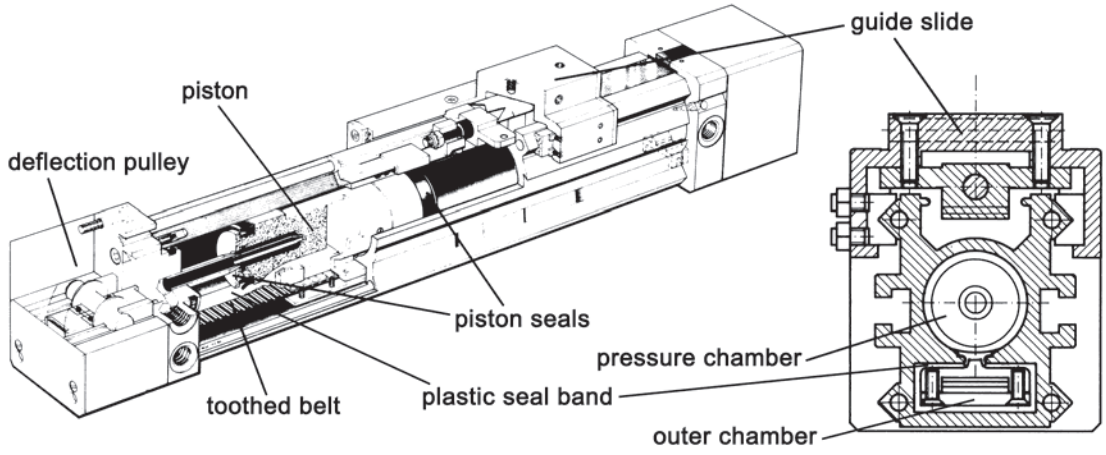
● Design and function

The toothed belt cylinder consists of an extruded cylinder tube with two chambers. They are connected to each other over the entire length of the cylinder. The pressure chamber is sealed towards the outside by a soft plastic band. Between the two piston seals a pressure-free space is created. In this space the seal band is lifted to the inside and is passed through the piston.

Simultaneously, a driver (piston bracket) grasps through the slot into the outer chamber.

Since the outer chamber encloses the longitudinal slot, it does not expand under pressure. This results in minimal leakage and better flexural and torsional stiffness.

● High operational safety through closed profile



● Contamination insensitive also in harsh environments

In the outer chamber, the piston bracket grips the toothed belt, which leads to a tension lock at the opposite side via the deflection pulley. Inside the slide, the cover belt is lifted from the slot, and the slide is connected to the tension lock.

By this principle, dirt is kept away from the sealing strip enabling use under rough operating conditions.

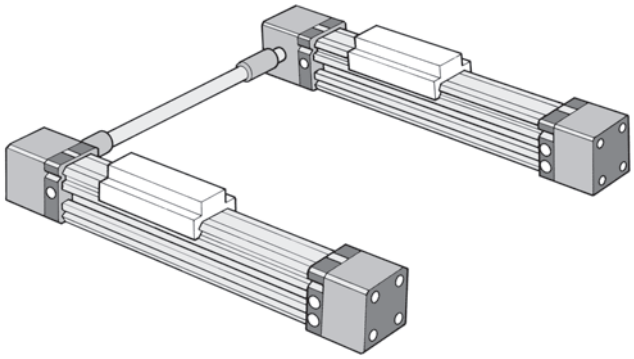
The force is transmitted, free of slip, to a shaft via the toothed belt pulley. As a result, several cylinders can be linked and operated synchronously, enabling torques from the off-center application forces.

The cylinder can also be supplied with a brake mounted on the driven shaft without the use of an additional energy transmission chain. A cylinder supplied with a **brake** and encoder results in an inexpensive **positioning system**.

Since the slide or roller guide is already integrated into the slide, a complete linear drive is available with this cylinder.

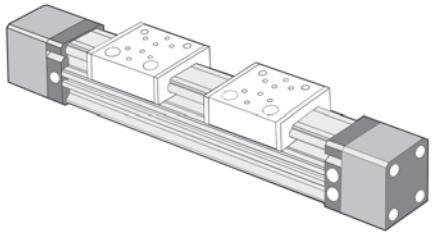
Applications

Synchronous running



Since the force is transmitted to the shaft free of slip, a positioning system can be set up with the aid of an encoder.

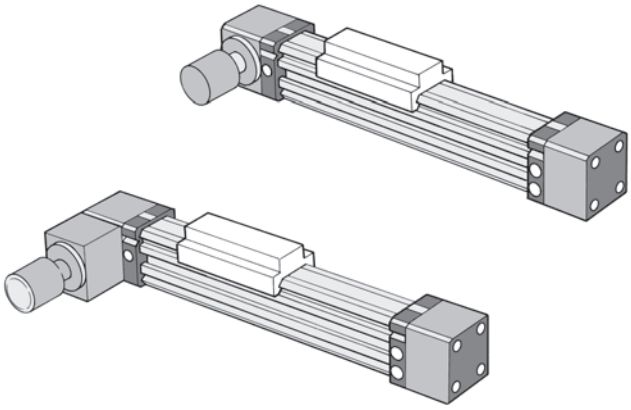
With 2 slides



By mounting a second toothed belt and using a slide in tangential feed, a central clamping long stroke gripper is created.

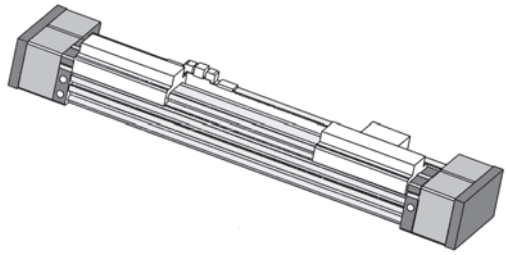
Applications

With brake



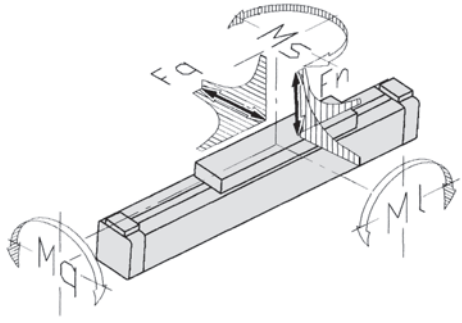
Since the force is transmitted to the shaft free of slip, a positioning system can be set up with the aid of an encoder.

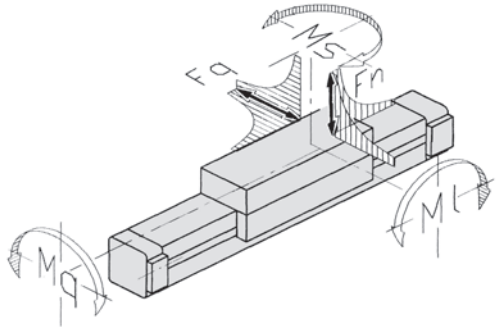
As a gripping cylinder



By mounting a second toothed belt and using a slide in tangential feed, a central clamping long stroke gripper is created.

Loads, forces and torques





Order number	Operating force*	Braking force*	Fn + Fq	Ml	Mq	Ms
ZR-25	250 N (56.2 lbf)	–	400 N (89.9 lbf)	40 Nm (29.5 ft. lbf.)	20 Nm (14.7 ft. lbf.)	30 Nm (22.1 ft. lbf.)
ZR-25-BR	250 N (56.2 lbf)	380 N (85.4 lbf)	400 N (89.9 lbf)	40 Nm (29.5 ft. lbf.)	20 Nm (14.7 ft. lbf.)	30 Nm (22.1 ft. lbf.)
ZR-25S	250 N (56.2 lbf)	–	400 N (89.9 lbf)	80 Nm (58.9 ft. lbf.)	40 Nm (29.4 ft. lbf.)	60 Nm (44.2 ft. lbf.)
ZR-25S-BR	250 N (56.2 lbf)	380 N (85.4 lbf)	400 N (89.9 lbf)	80 Nm (58.9 ft. lbf.)	40 Nm (29.4 ft. lbf.)	60 Nm (44.2 ft. lbf.)
ZR-40	640 N (143.9 lbf)	–	800 N (179.8 lbf)	75 Nm (55.2 ft. lbf.)	30 Nm (22.1 ft. lbf.)	50 Nm (36.8 ft. lbf.)
ZR-40-BR	640 N (143.9 lbf)	750 N (168.6 lbf)	800 N (179.8 lbf)	75 Nm (55.2 ft. lbf.)	30 Nm (22.1 ft. lbf.)	50 Nm (36.8 ft. lbf.)
ZR-40S	640 N (143.9 lbf)	–	800 N (179.8 lbf)	150 Nm (110.4 ft. lbf.)	60 Nm (44.2 ft. lbf.)	100 Nm (73.6 ft. lbf.)
ZR-40S-BR	640 N (143.9 lbf)	750 N (168.6 lbf)	800 N (179.8 lbf)	150 Nm (110.4 ft. lbf.)	60 Nm (44.2 ft. lbf.)	100 Nm (73.6 ft. lbf.)
ZR-40L	640 N (143.9 lbf)	–	1200 N (269.8 lbf)	95 Nm (69.9 ft. lbf.)	45 Nm (33.1 ft. lbf.)	95 Nm (69.9 ft. lbf.)
ZR-40L-BR	640 N (143.9 lbf)	750 N (168.6 lbf)	1200 N (269.8 lbf)	95 Nm (69.9 ft. lbf.)	45 Nm (33.1 ft. lbf.)	95 Nm (69.9 ft. lbf.)

* Operating force at 6 bar (87 psi), braking force at 6 bar (87 psi) static.

Force and torque data are based on the speed of the slide guideways of ≤ 0.2 m/s (0.656 ft./s), in case of roller guides of ≤ 2 m/s (6.562 ft./s).

If speed exceeds 0.2 m/s (0.656 ft./s), the permissible values of the slide guideways must be multiplied by the factors from the table below. For roller or ball guide types is no factor required.

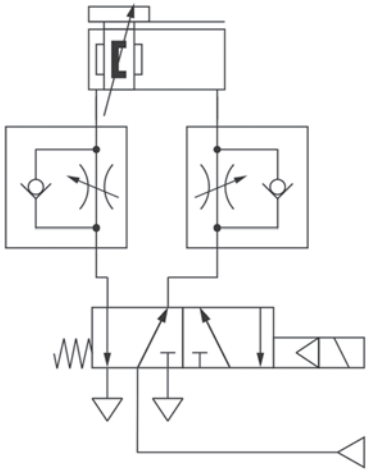
Load coefficient

V in m/s	V in ft./s	Factor
0.2	0.656	1
0.3	0.984	0.75
0.4	1.312	0.5
0.5	1.640	0.4
0.75	2.460	0.27
1	3.281	0.2

Circuit examples

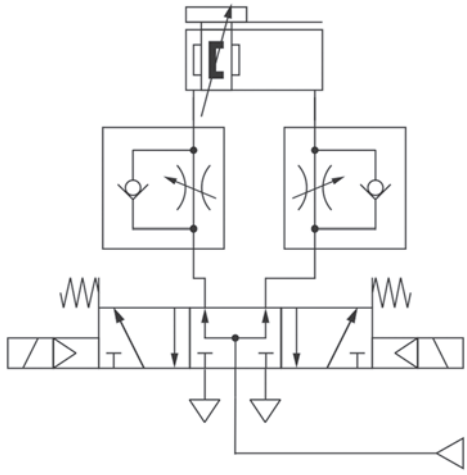
Control 1

Simple system for controlling the slide from end to end. A flow control valve can be used to adjust the cylinder speed.



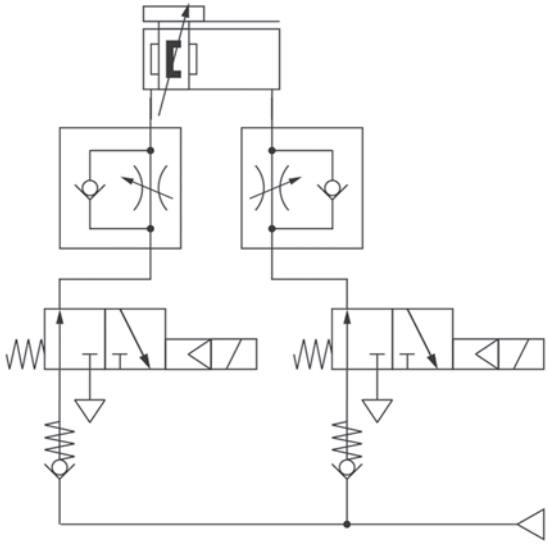
Control 2

System to stop the cylinder on intermediate position with higher tolerances.



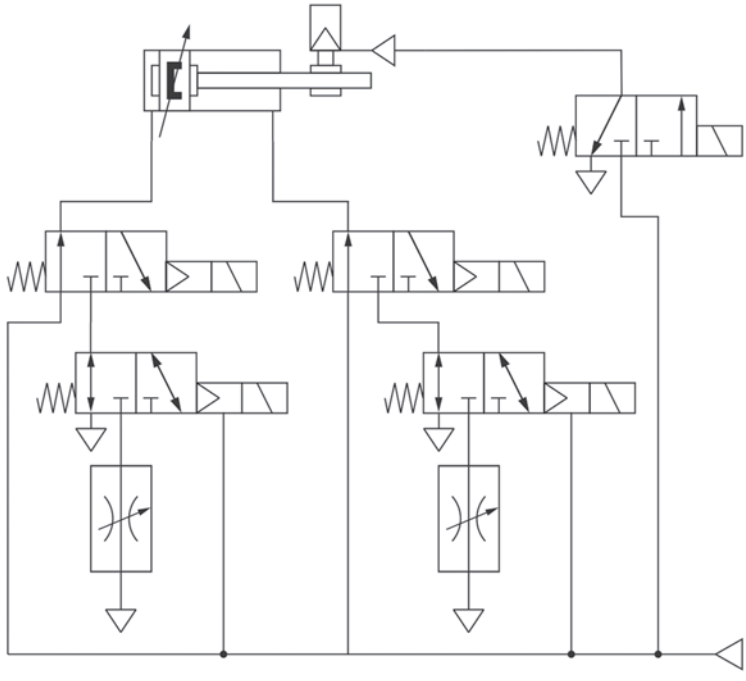
Control 3

This control circuit improves the positioning accuracy. The use of check valves reduces the stopping distance and also increases the load stiffness.



Control 4

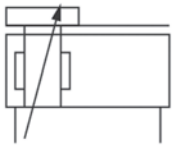
This circuit example permits the selection of different speeds (rapid or inching) for either forward or reverse motion. The brake is activated by a 3/2 solenoid valve.



For longer strokes a safety start-up valve is recommended.

Rodless toothed belt cylinders series ZR-25 and ZR-40

with adjustable slide guideway
G1/8 and G1/4 • piston Ø 25 and 40 mm



Order code

ZR-25-0250-2-D3F1

Series	Piston Ø (mm)	Stroke length (mm)	Air connection see page 10.101	Options see page 10.101

Design and function

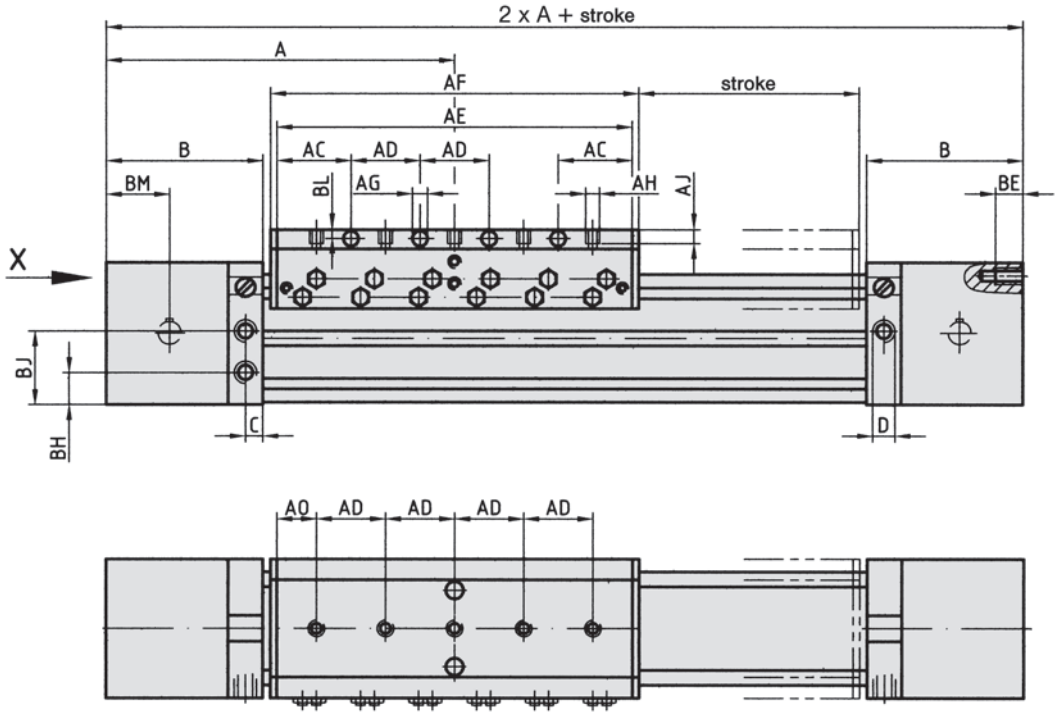
Double acting rod less toothed belt cylinder with adjustable cushions. The toothed belt is driven by the piston in a closed profile tube. The piston actuates a slide with an adjustable slide guideway.

Order number Please complete according to order code.	**ZR-25-**…	**ZR-40-**…
Piston Ø (mm)	25	40
Connection	G1/8	G1/4
Cushioning length (mm)	25 mm (1 in)	32 mm (1 1/4 in)
Operating pressure	1 … 8 bar (14.5 … 116 psi)	
Temperature range	– 15 °C … + 70 °C (+ 5 °F … + 158 °F)	
Medium	Compressed air in accordance with ISO 8573-1:2001, Class 7 4 – and free of aggressive additives. If speeds exceed 1 m/s (3.3 ft/s) lubricated air is recommended.	
Stroke length	arbitrary up to 4500 mm (177 in)	
Materials	Outer parts: Al-profile (anodized) Seals: NBR, PA, PDF	

Rodless toothed belt cylinders series ZR-25 and ZR-40

with adjustable slide guideway

G1/8 and G1/4 • piston Ø 25 and 40 mm



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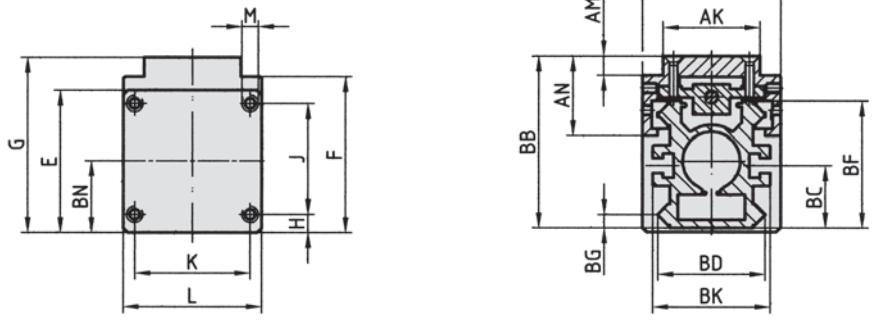


	Ø 25	Ø 40
Mass at 0 mm stroke	2.18 kg (4.806 lbs.)	3.19 kg (7.033 lbs.)
Mass for 100 mm (4 in) stroke extension	0.40 kg (0.882 lb.)	0.50 kg (1.102 lbs.)

Max. stroke length 4.500 mm (177 in).

BM and BN dimensions used for extended shaft only.

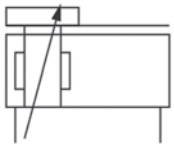
Cylinder Ø	A	B	C	D	E	F	G	H	J	K	L	M
25	150	68	7.5	G1/8	62	67.5	76	8	48	50	60	M5 (10/32 UNF)
40	150	75	10	G1/4	76.8	80.5	97.5	9	54	54	72	M6

Cylinder Ø	AC	AD	AE	AF	AG	AH	AJ	AK	AL	AM	AN
25	33	30	156	160	5.5	M5	7	42	60	8.5	34.5
40	25	30	140	148	5.5	M5	8.5	40	72	16.5	43

Cylinder Ø	BB	BC	BD	BE	BF	BG	BH	BJ	BK	BL	BM	BN
25	75	28	47	10	55.5	6	14	32	49	4	27.5	31.2
40	96.5	35.6	56	12	70.8	6.7	16	39.5	66	6	34.7	39.4

Rodless toothed belt cylinders series ZR-25S and ZR-40S

with adjustable heavy-duty slide guideway
G1/8 and G1/4 • piston Ø 25 and 40 mm



Order code

ZR-25S-0250-2-D3F1

Series	Piston Ø (mm)	Typ	Stroke length (mm)	Air connection	Options
				see page 10.101	see page 10.101

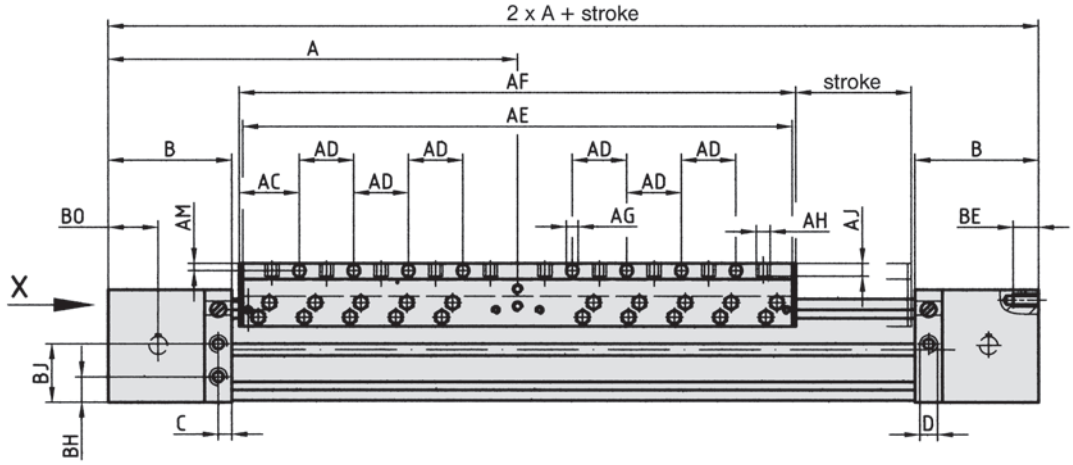
Design and function

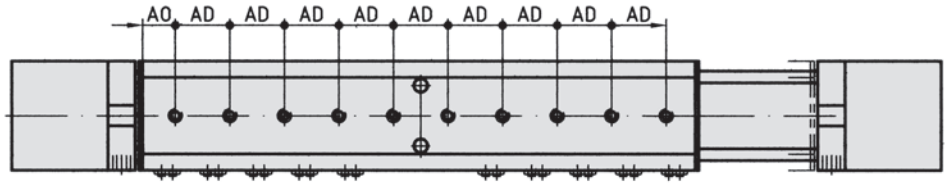
Double acting rod less toothed belt cylinder with adjustable cushions. The toothed belt is driven by the piston in a closed profile tube. The piston actuates a slide with an adjustable heavy-duty slide guideway.

Order number Please complete according to order code.	**ZR-25S-**…	**ZR-40S-**…
Piston Ø (mm)	25	40
Connection	G1/8	G1/4
Cushioning length (mm)	25 mm (1 in)	32 mm (1 1/4 in)
Operating pressure	1 … 8 bar (14.5 … 116 psi)	
Temperature range	– 15 °C … + 70 °C (+ 5 °F … + 158 °F)	
Medium	Compressed air in accordance with ISO 8573-1:2001, Class 7 4 – and free of aggressive additives. If speeds exceed 1 m/s (3.3 ft/s) lubricated air is recommended.	
Stroke length	arbitrary up to 4300 mm (169 in)	
Materials	Outer parts: Al-profile (anodized) Seals: NBR, PA, PDF	

Rodless toothed belt cylinders series ZR-25S and ZR-40S

with adjustable heavy-duty slide guideway
G1/8 and G1/4 • piston Ø 25 and 40 mm





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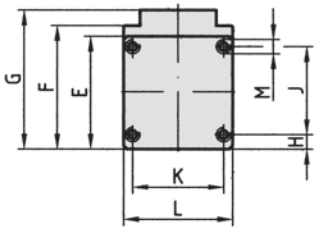
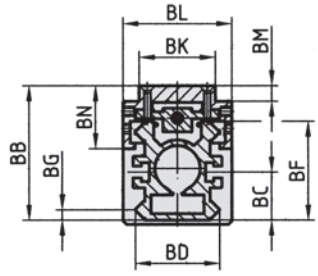




	Ø 25	Ø 40
Mass at 0 mm stroke	2.58 kg (5.688 lbs.)	3.59 kg (7.914 lbs.)
Mass for 100 mm (4 in) stroke extension	0.40 kg (0.882 lb.)	0.50 kg (1.102 lbs.)

Max. stroke length 4.300 mm (169 in).

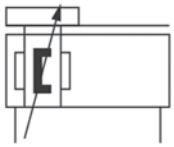
Cylinder Ø	A	B	C	D	E	F	G	H	J	K	L	M
25	225	68	7.5	G1/8	62	67.5	76	8	48	50	60	M5 (10/32 UNF)
40	225	75	10	G1/4	76.8	80.5	97.5	9	54	54	72	M6

Cylinder Ø	AC	AD	AE	AF	AG	AH	AJ	AO	AM
25	35	30	306	310	5.5	M5	7	18	4
40	29	30	290	298	5.5	M5	8.5	10	6

Cylinder Ø	BB	BC	BD	BE	BF	BG	BH	BJ	BK	BL	BM	BN	BO
25	75	28	47	10	55.5	6	14	32	42	60	8.5	34.5	27.5
40	96.5	35.6	56	12	70.8	6.7	16	39.5	40	72	16.5	43	34.7

Rodless toothed belt cylinders series ZR-40L

with roller guide
G1/4 • piston Ø 40 mm



Order code

ZR-40L-0250-2-D3F1

Series	Piston Ø (mm)	Typ	Stroke length (mm)	Air connection	Options
				see page 10.101	see page 10.101

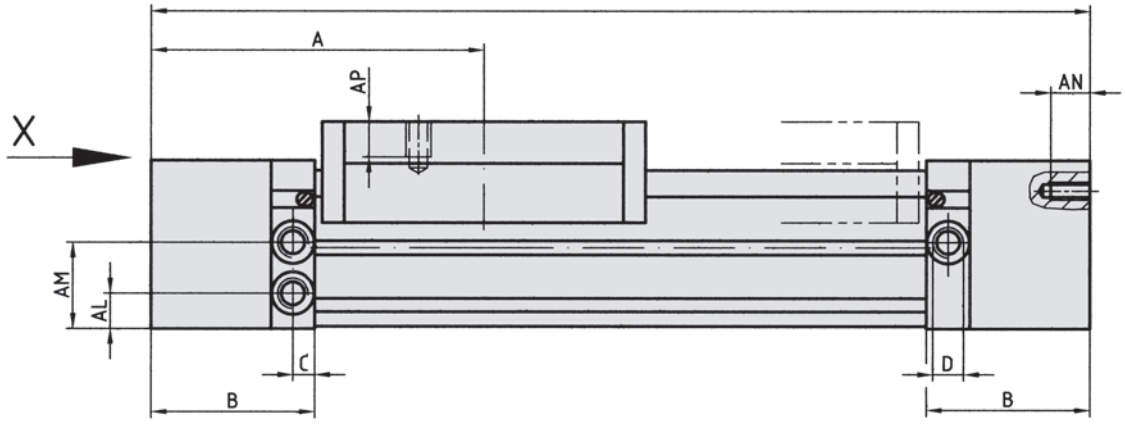
Design and function

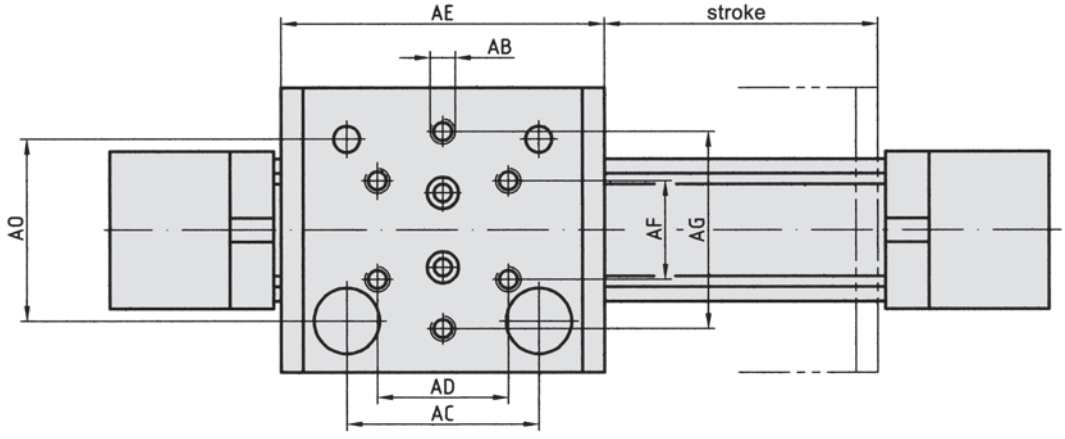
Double acting rod less toothed belt cylinder with adjustable cushions and magnet for proximity sensors. The toothed belt is driven by the piston in a closed profile tube. The piston actuates a slide with a pre-set roller guide.

Order number Please complete according to order code.	**ZR-40L-**…
Piston Ø (mm)	40
Connection	G1/4
Cushioning length (mm)	32 mm (1 1/4 in)
Operating pressure	1 … 8 bar (14.5 … 116 psi)
Temperature range	– 15 °C … + 70 °C (+ 5 °F … + 158 °F)
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives. If speeds exceed 1 m/s (3.3 ft/s) lubricated air is recommended.
Stroke length	arbitrary up to 4500 mm (177 in)
Materials	Outer parts: hardened steel, Al-profile (anodized), plastic Seals: NBR, PA, PDF

Rodless toothed belt cylinders series ZR-40L

with roller guide
G1/4 • piston Ø 40 mm





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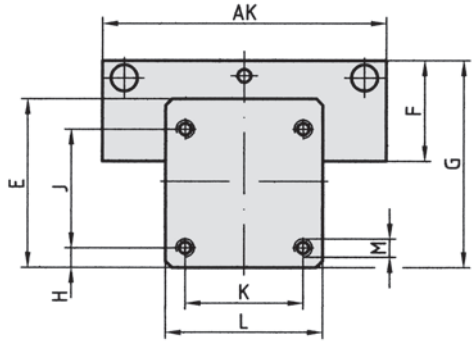
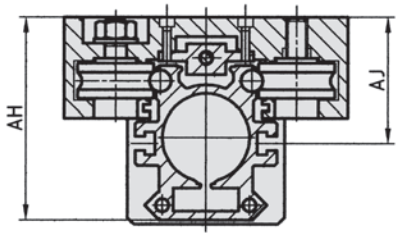




Magnetic piston is a standard feature.

Mass at 0 mm stroke . . . . . 4.84 kg (10.670 lbs.)
Mass for 100 mm (4 in) stroke extension . . . . . 0.70 kg (1.543 lbs.)

Max. stroke length 4.500 mm (177 in).

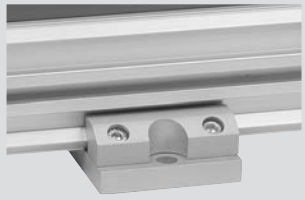
Cylinder Ø	A	B	C	D	E	F	G	H	J	K	L	M
40	150	75	10	G1/4	76.8	46.1	94.4	9	54	54	72	M6

Cylinder Ø	AB	AC	AD	AE	AF	AG	AH	AJ	AK	AL	AM	AN	AP
40	M8	88	60	148	45	90	93.4	57.7	130	16	39.5	12	15

Cylinder mountings

Head mounting
ZK-252, ZK-402
page 10.103

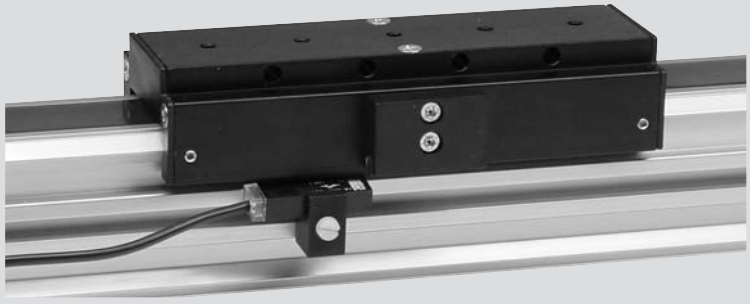
Head mounting tall
ZK-253, ZK-403
page 10.103



Center mounting
ZK-251, ZK-401
page 10.103

Nut M4
ZRM

Reed switch



Switch
ZS-100.1
page 10.105

Bracket
ZR-4007
page 10.104

Magnet
ZR-4006
page 10.104

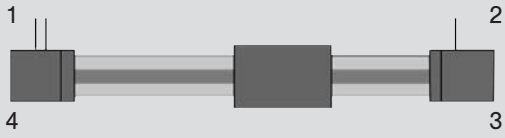
Adapter for encoder

Direct attachment to housing
ZA-37
page 10.105

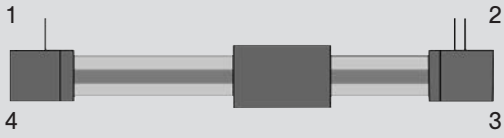
Attachment to brake
ZA-36
page 10.105

Air connections

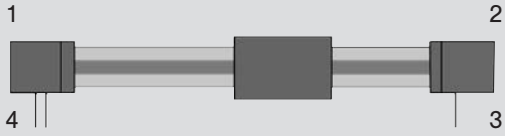
The cylinder is supplied with three air connections. Two connections are necessary for operation, while the third is closed by a plug (included in the scope of delivery). The desired position of the double connection has to be specified in the order code after the stroke length by choosing the adequate number.



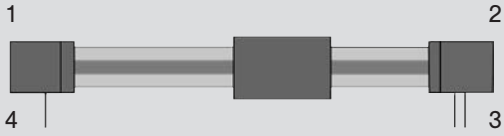
Option – 1



Option – 2



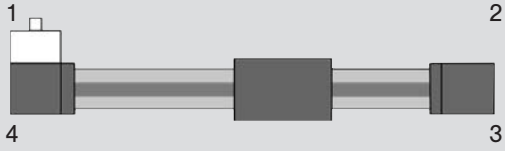
Option – 4



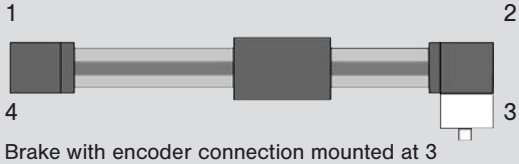
Option – 3

Brake

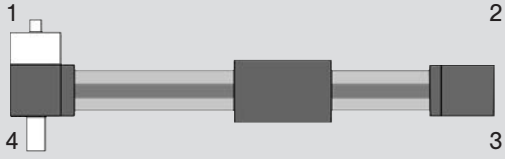
Dimensions of brakes see page 10.106



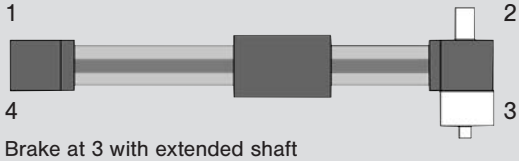
Brake with encoder connection mounted at 1
Option: A1 (BR-25-1, BR-40-1)



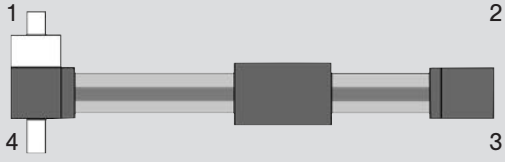
Brake with encoder connection mounted at 3
Option: A3 (BR-25-3, BR-40-3)



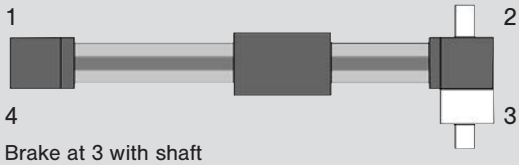
Brake at 1 with extended shaft
for synchronization at 4
Option: B1 (BR-251-1, BR-401-1)



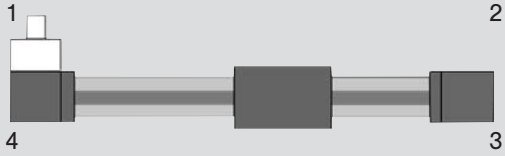
Brake at 3 with extended shaft
for synchronization at 2
Option: B3 (BR-251-3, BR-401-3)



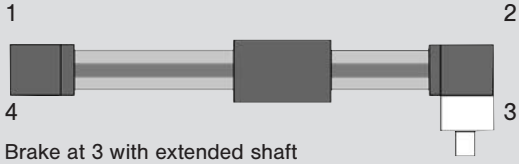
Brake at 1 with shaft
for synchronization at 1 and 4
Option: C1 (BR-252-1, BR-402-1)



Brake at 3 with shaft
for synchronization at 2 and 3
Option: C3 (BR-252-3, BR-402-3)



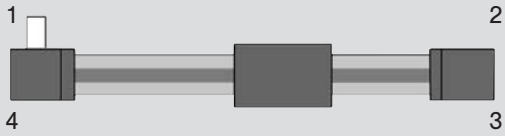
Brake at 1 with extended shaft
for synchronization at 1
Option: D1 (BR-253-1, BR-403-1)



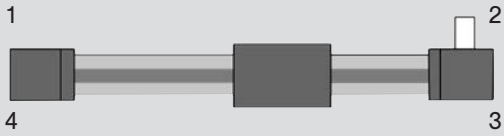
Brake at 3 with extended shaft
for synchronization at 3
Option: D3 (BR-253-3, BR-403-3)

Driven shafts

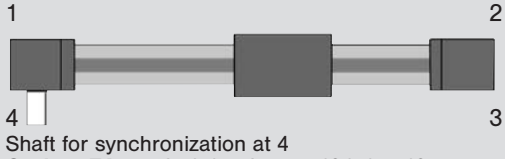
Dimensions of driven shafts see page 10.106



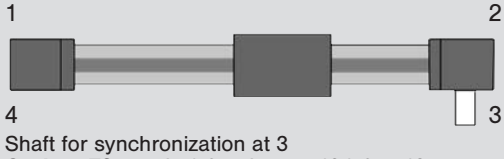
Shaft for synchronization at 1
Option: F1 (ZK-254-1 ⌀ 25, ZK-404-1 ⌀ 40)



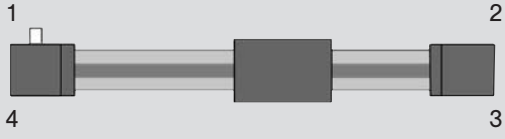
Shaft for synchronization at 2
Option: F2 (ZK-254-2 ⌀ 25, ZK-404-2 ⌀ 40)



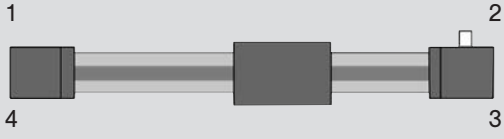
Shaft for synchronization at 4
Option: F4 (ZK-254-4 ⌀ 25, ZK-404-4 ⌀ 40)



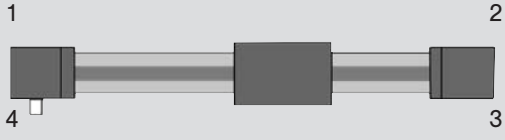
Shaft for synchronization at 3
Option: F3 (ZK-254-3 ⌀ 25, ZK-404-3 ⌀ 40)



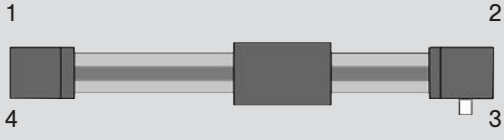
Shaft for encoder connection at 1
Option: G1 (ZK-255-1 ⌀ 25, ZK-405-1 ⌀ 40)



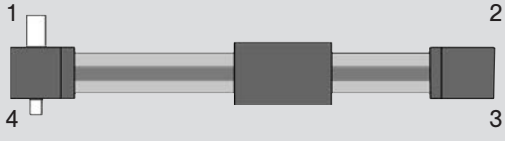
Shaft for encoder connection at 2
Option: G2 (ZK-255-2 ⌀ 25, ZK-405-2 ⌀ 40)



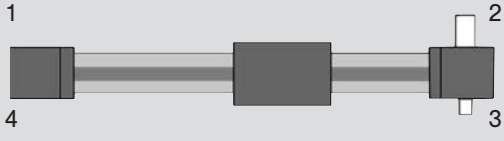
Shaft for encoder connection at 4
Option: G4 (ZK-255-4 ⌀ 25, ZK-405-4 ⌀ 40)



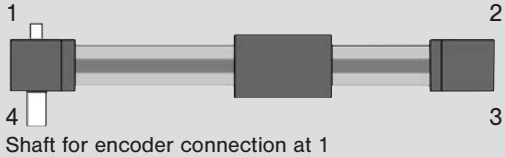
Shaft for encoder connection at 3
Option: G3 (ZK-255-3 ⌀ 25, ZK-405-3 ⌀ 40)



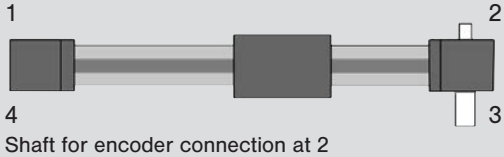
Shaft for encoder connection at 4
and synchronization at 1
Option: H1 (ZK-256-1 ⌀ 25, ZK-406-1 ⌀ 40)



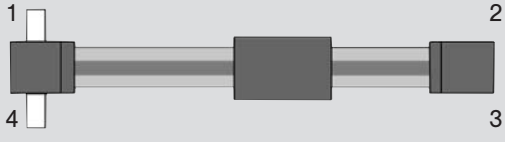
Shaft for encoder connection at 3
and synchronization at 2
Option: H2 (ZK-256-2 ⌀ 25, ZK-406-2 ⌀ 40)



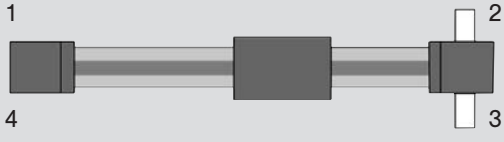
Shaft for encoder connection at 1
and synchronization at 4
Option: H4 (ZK-256-4 ⌀ 25, ZK-406-4 ⌀ 40)



Shaft for encoder connection at 2
and synchronization at 3
Option: H3 (ZK-256-3 ⌀ 25, ZK-406-3 ⌀ 40)

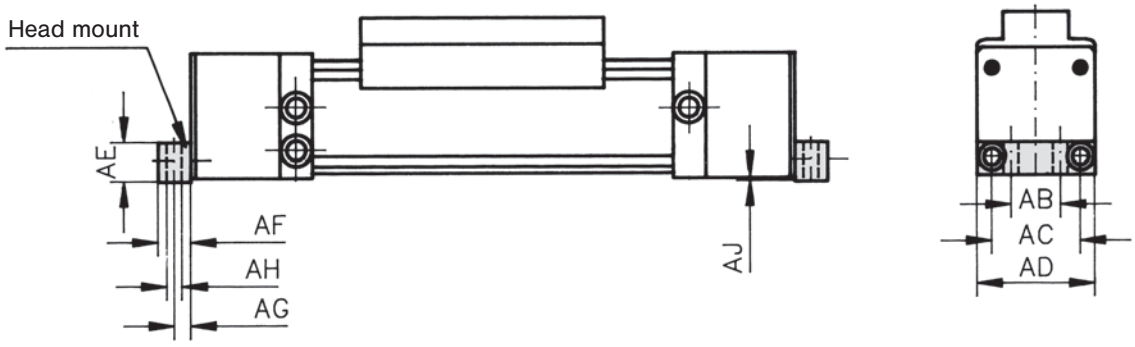


Shaft for synchronization on two sides
Option: J1 (ZK-257-1 ⌀ 25, ZK-407-1 ⌀ 40)



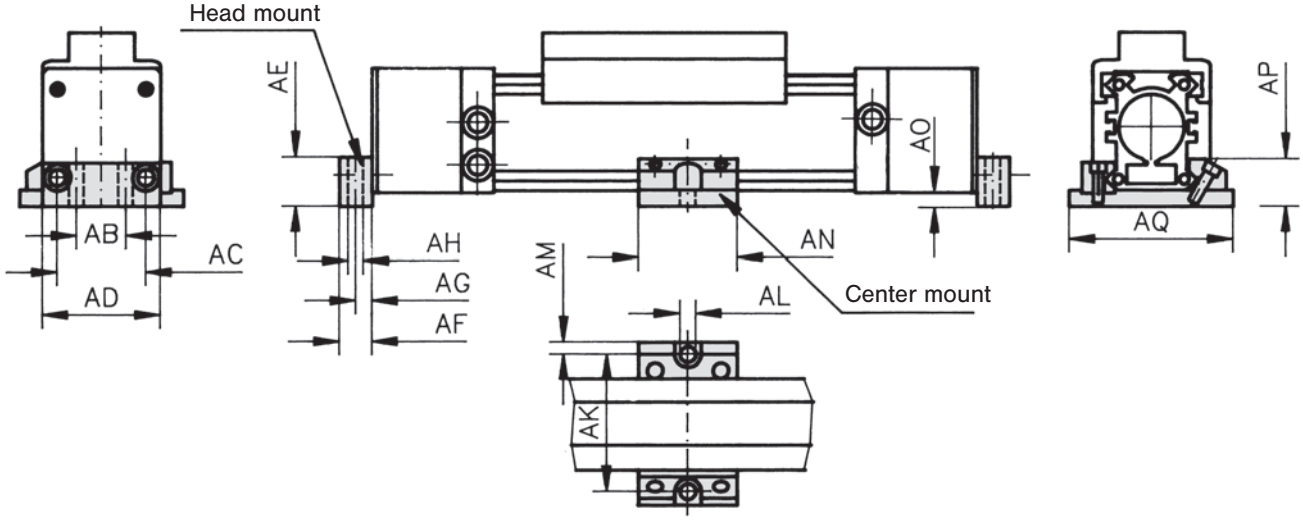
Shaft for synchronization on two sides
Option: J2 (ZK-257-2 ⌀ 25, ZK-407-2 ⌀ 40)

Head mount



Head mount									
Order number	**Cyl.-Ø**	**AB**	**AC**	**AD**	**AE**	**AF**	**AG**	**AH**	**AJ**
ZK-252	25	30	50	60	20	20	10	9	1
ZK-402	40	30	54	71	20	20	10	9	1

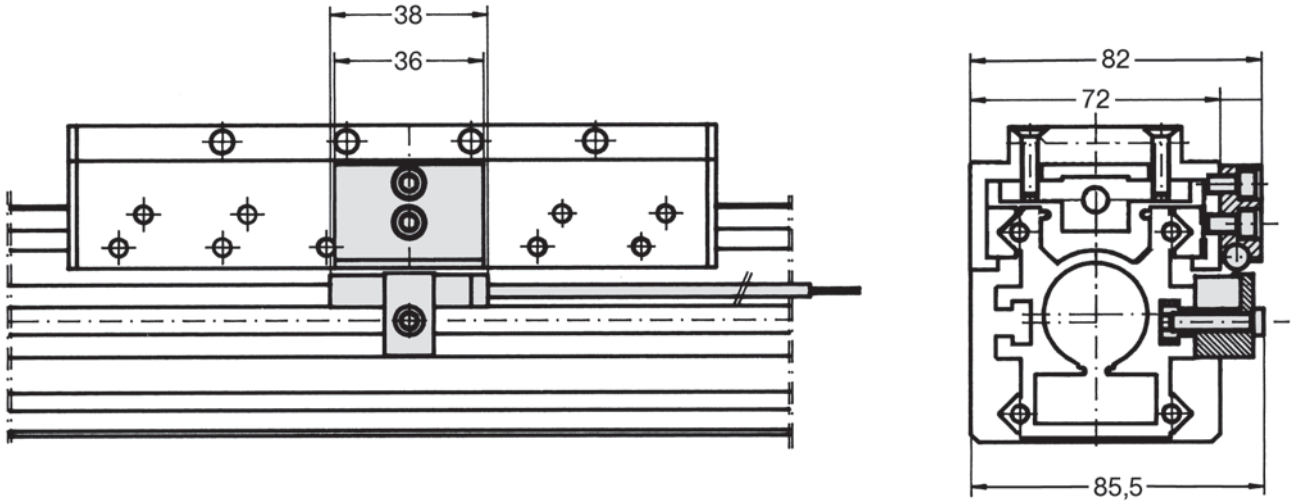
Center mount with tall head mount



Head mount tall	Center mount															
Order number	**Order number**	**Cyl.-Ø**	**AB**	**AC**	**AD**	**AE**	**AF**	**AG**	**AH**	**AK**	**AL**	**AM**	**AN**	**AO**	**AP**	**AQ**
ZK-253	**ZK-251**	25	30	50	60	30	20	10	9	75	9	7.5	60	9	25	90
ZK-403	**ZK-401**	40	30	54	71	30	20	10	9	84	9	8	60	9	30	100

For series ZR-25 / ZR-40 / ZR-25S / ZR-40S

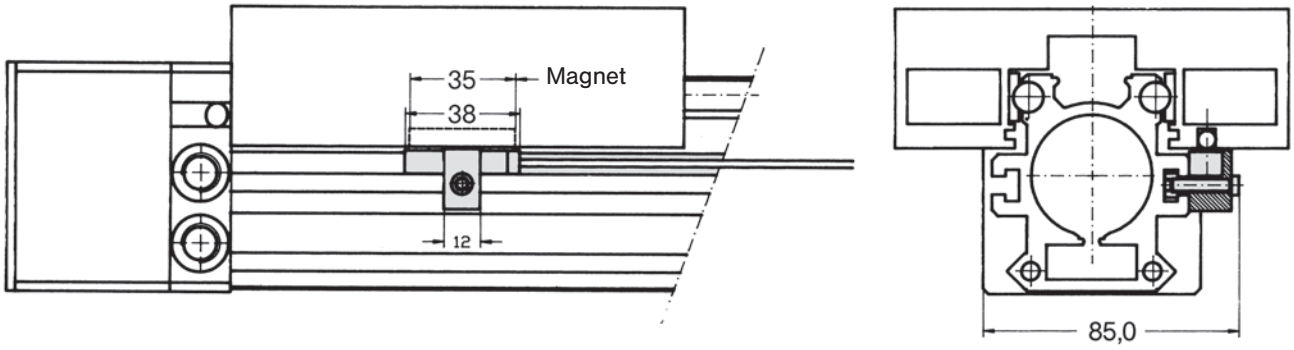
Magnet is not included.
Order number for magnet **ZR-4006.**
Order number for sensor mounting bracket **ZR-4007.**



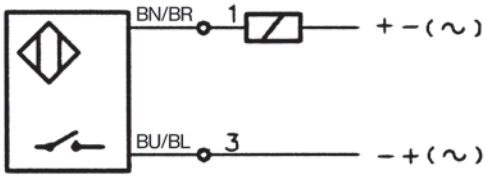
Sensors see page 10.105.

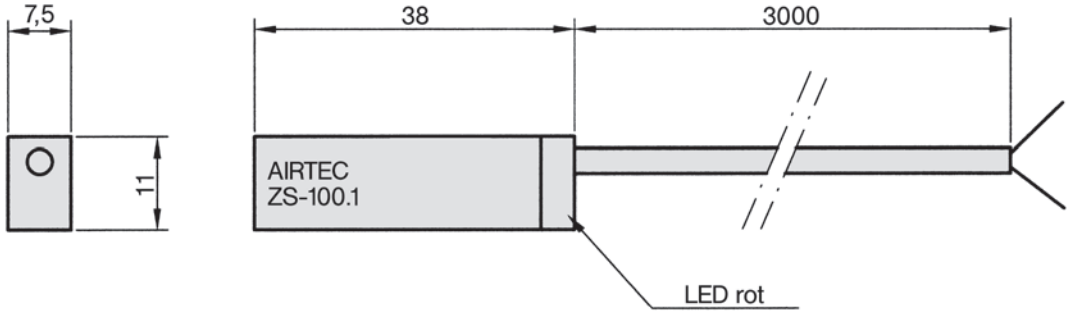
For series ZR-40L

Magnetic slide is a standard feature.
Order number for sensor mounting bracket **ZR-4007.**



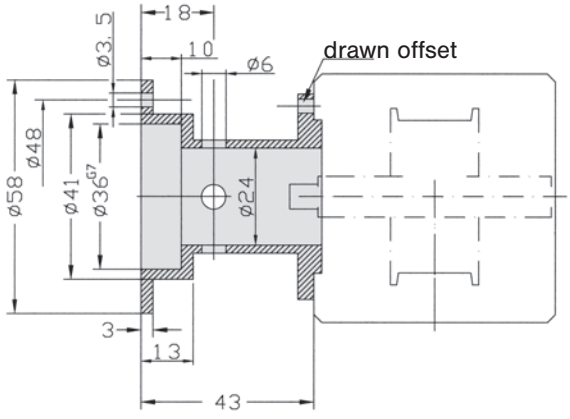
Sensors see page 10.105.





Order number	ZS 100.1
Weight	30 g
Length of cable	3 m
Temperature range	– 30 … + 80 °C (– 22 °F … + 176 °F)
Degree of protection	IP 67
Response time	≤ 0.1 ms
Switching time	≤ 2 ms
Electrical life (resistive load)	10^7
Repeatability	± 0.1 mm
Contact function	NO
Shock resistance	50 g
Vibration resistance	50 … 1000 Hz
Max. current at 25 °C (resistive load)	1 A
Max. Power DC/AC	50 W / 50 VA
Operating voltages (DC or AC)	3 … 250 V
Max. voltage drop	3 ΔV
Wire gauge	0.34 mm²

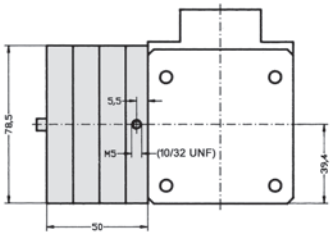
Adapter for encoder

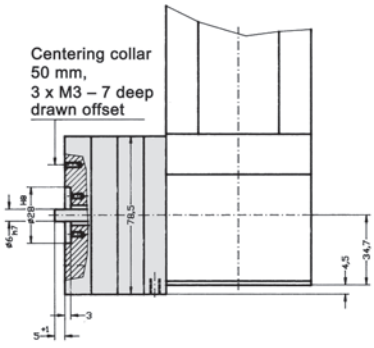


The adapters can be mounted on all cylinders of series ZR and will fit all encoders with a 36 mm centering collar.

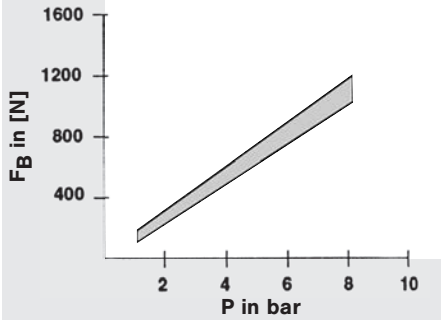
Order number	ZA-36	ZA-37
Description	Attachment to brake	Direct attachment to housing

Option A for Ø 40

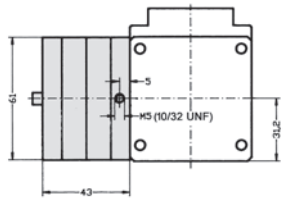


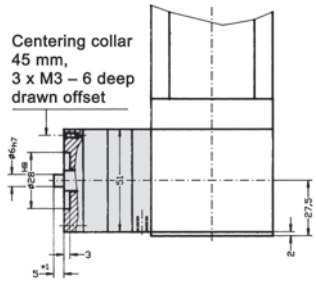


Braking force static

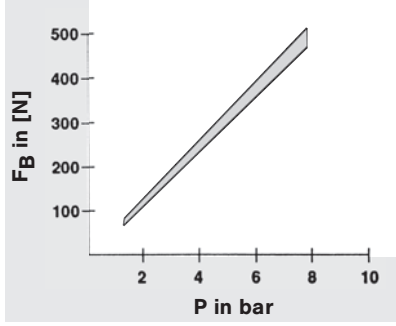


Option A for Ø 25



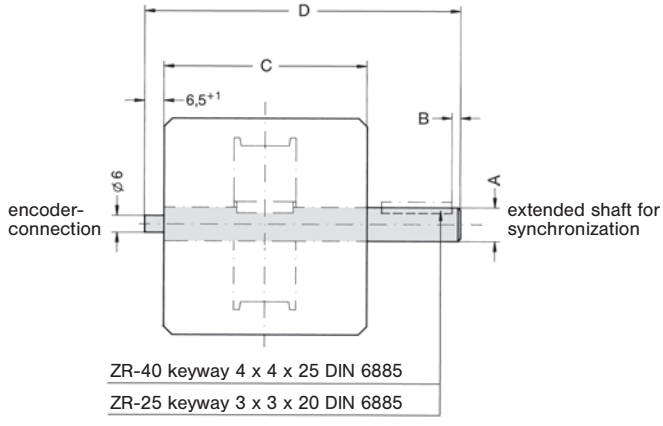


Braking force static



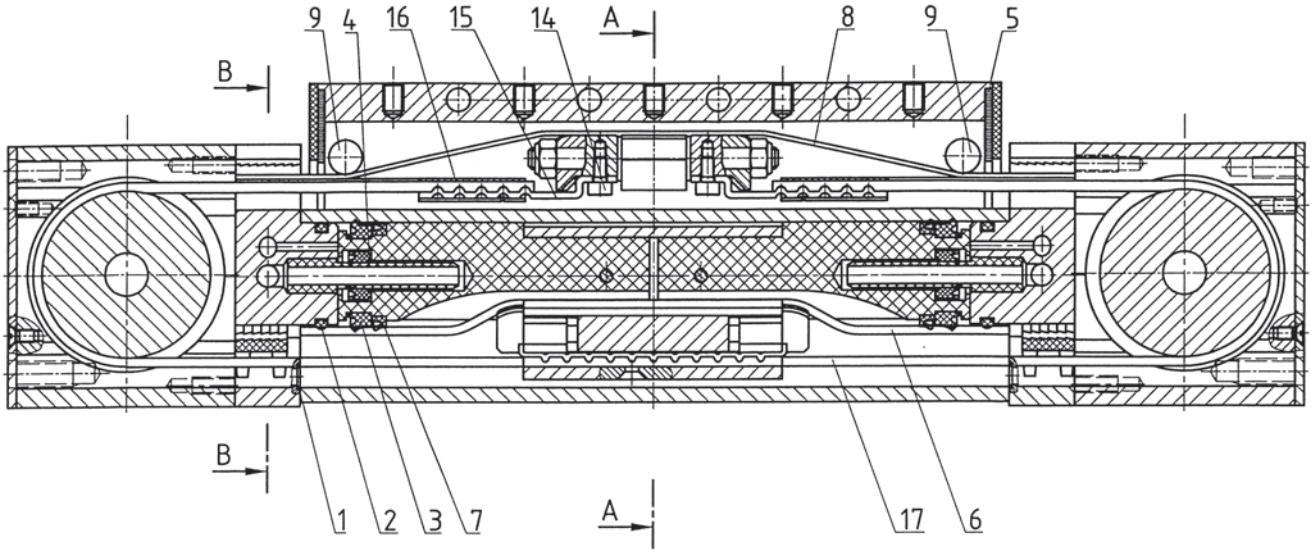
The brake is designed to hold the position. Do not use to stop the cylinder.

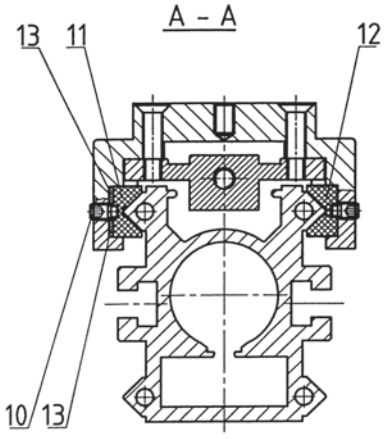
Extended shaft for series ZR

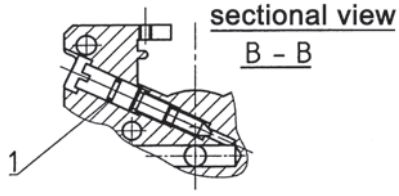


The slide travels 135 mm (ø 25) per one rotation of the shaft.
The slide travels 185 mm (ø 40) per one rotation of the shaft.

Cylinder Ø	A	B	C	D
25	10_{h7}	2	60	93
40	12_{h7}	3	72	112







Seal kit for ZR-25

Order number: **VS-ZR-25-Stroke length (for example 0500)**

0500 = stroke lengths from 0 to 500 mm
1000 = stroke lengths from 501 to 1000 mm
1500 = stroke lengths from 1001 to 1500 mm
2000 = stroke lengths from 1501 to 2000 mm
3000 = stroke lengths from 2001 to 3000 mm
4500 = stroke lengths from 3001 to 4500 mm

Pos.	Description	Quantity
1	O-ring	4
2	O-ring	2
3	Piston seal	2
4	Cushion seal	2
5	Wiper	2
6	Sealing band	400 mm + stroke
7	Piston seal	2
8	Cover band	200 mm + stroke
9	Roller	2
	Grease	30 ml

Seal kit slide guideway for ZR-25

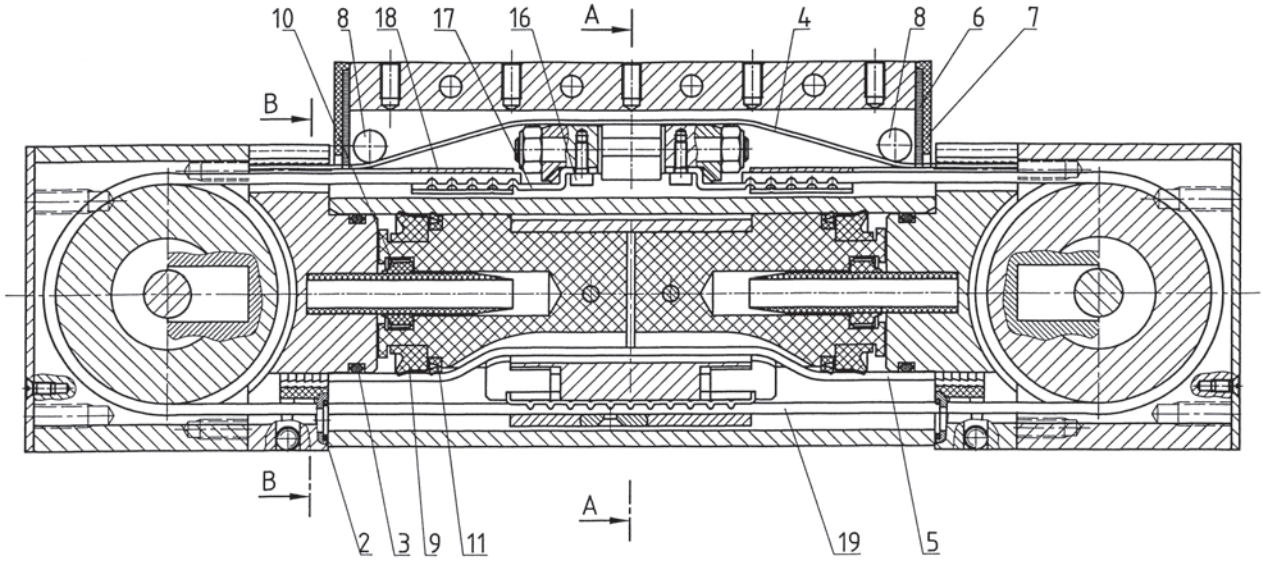
Order number: **VS-ZR-25-GL**

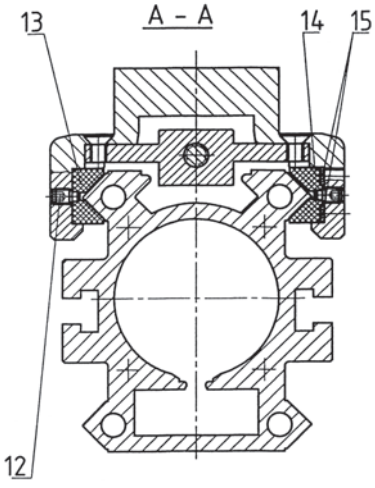
Pos.	Description	Quantity
10	Set screw	4
11	Slide 1	1
12	Slide 2	1
13	Support plate	2
	Screw M 4 x10	4
	Screw M 4 x16	2
5	Wiper	2
9	Roller	2
	Grease	30 ml

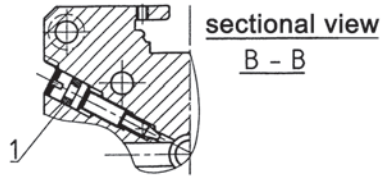
Toothed belt for ZR-25

Order number: **VS-ZR-25-ZR-stroke**

Pos.	Description	Quantity
14	Cylinder screw	4
15	Toothed plate	2
16	Clamp	2
17	Toothed belt	2 x (280 mm + stroke)







Seal kit for ZR-40

Order number: **VS-ZR-40-Stroke length (for example 0500)**

0500 = stroke lengths from 0 to 500 mm
1000 = stroke lengths from 501 to 1000 mm
1500 = stroke lengths from 1001 to 1500 mm
2000 = stroke lengths from 1501 to 2000 mm
3000 = stroke lengths from 2001 to 3000 mm
4500 = stroke lengths from 3001 to 4500 mm

Pos.	Description	Quantity
1	O-Ring	2
2	O-Ring	2
3	O-Ring	2
4	Cover band	200 mm + stroke
5	Sealing band	400 mm + stroke
6	Wiper	2
7	Cover for wiper	2
8	Roller	2
9	Piston seal	2
10	Cushion seal	2
11	Piston seal	2
	Grease	30 ml

Seal kit slide guideway for ZR-40

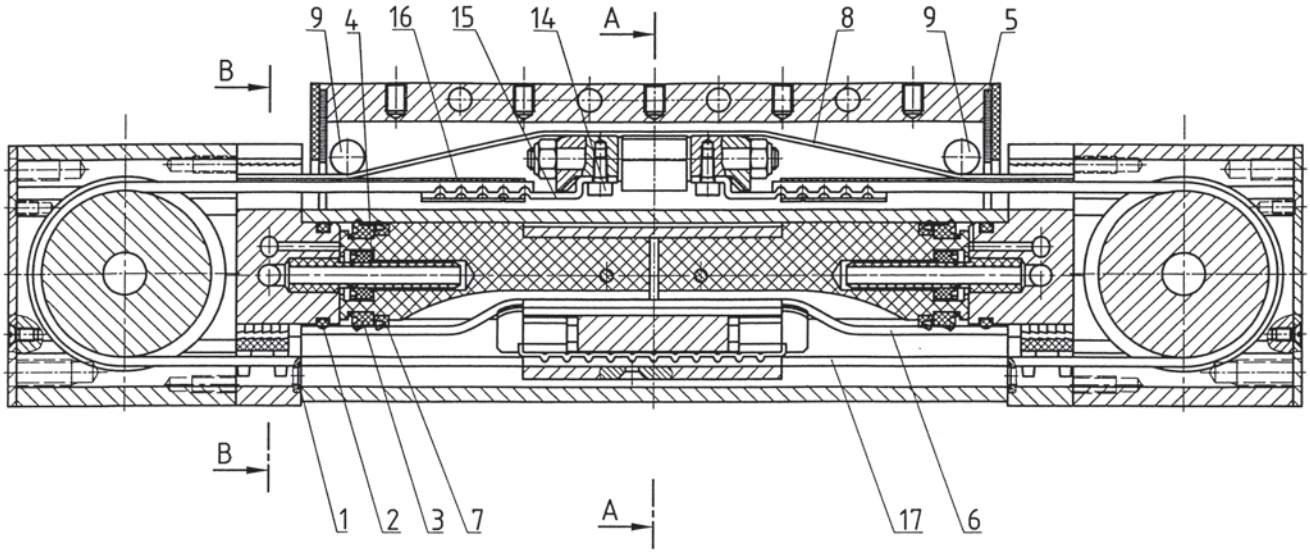
Order number: **VS-ZR-40-GL**

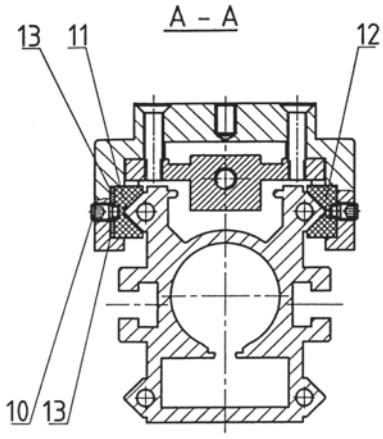
Pos.	Description	Quantity
12	Set screw	4
13	Slide 1	1
14	Slide 2	1
15	Support plate	2
	Screw M 4 x 6	2
	Screw M 4 x10	4
6	Wiper	2
7	Cover for wiper	2
8	Roller	2
	Grease	30 ml

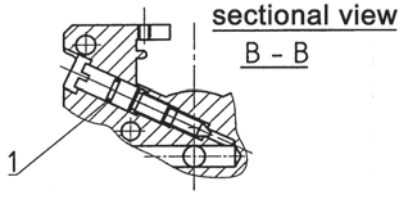
Toothed belt for ZR-40

Order number: **VS-ZR-40-ZR-stroke**

Pos.	Description	Quantity
16	Cylinder screw	4
17	Toothed plate	2
18	Clamp	2
19	Toothed belt	2 x (290 mm + stroke)







Seal kit for ZR-25S

Order number: **VS-ZR-25S-Stroke length (for example 0500)**

0500 = stroke lengths from 0 to 500 mm
1000 = stroke lengths from 501 to 1000 mm
1500 = stroke lengths from 1001 to 1500 mm
2000 = stroke lengths from 1501 to 2000 mm
3000 = stroke lengths from 2001 to 3000 mm
4500 = stroke lengths from 3001 to 4500 mm

Pos.	Description	Quantity
1	O-Ring	4
2	O-Ring	2
3	Piston seal	2
4	Cushion seal	2
5	Wiper	2
6	Sealing band	550 mm + stroke
7	Piston seal	2
8	Cover band	350 mm + stroke
9	Roller	2
	Grease	30 ml

Seal kit slide guideway for ZR-25S

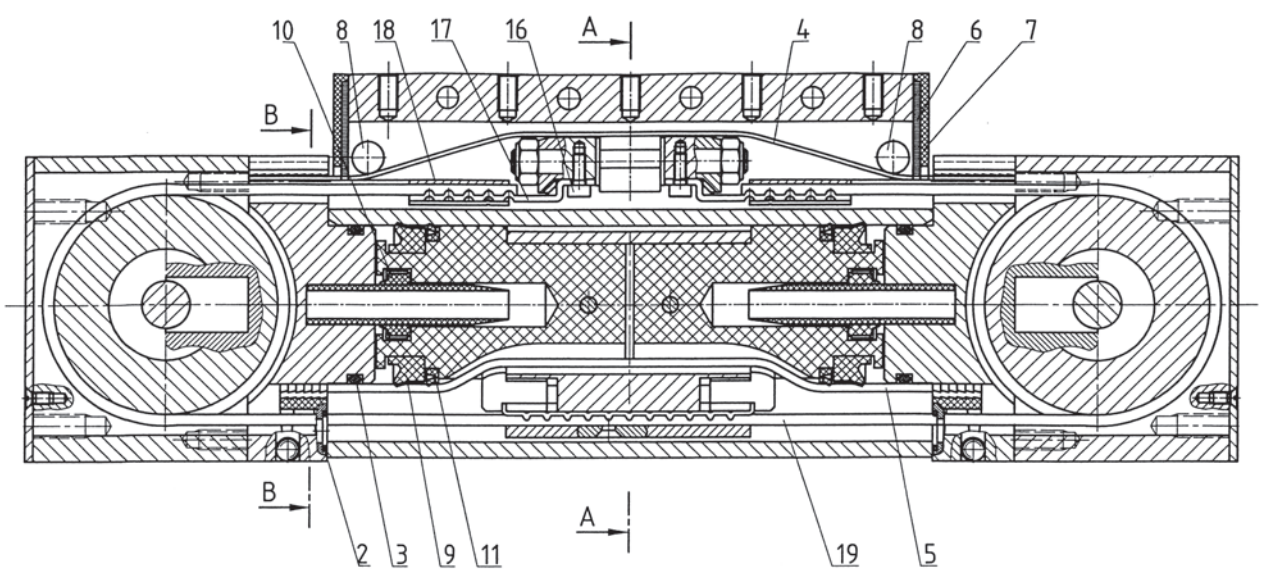
Order number: **VS-ZR-25S-GL**

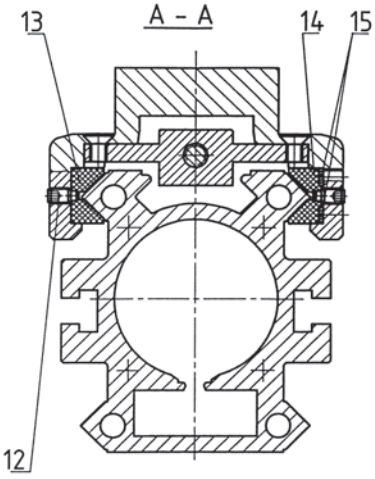
Pos.	Description	Quantity
10	Set screw	8
11	Slide 3	2
12	Slide 4	2
13	Support plate	4
	Screw M 4 x 6	4
	Screw M 4 x 10	2
5	Wiper	2
9	Roller	2
	Grease	30 ml

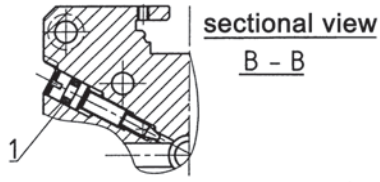
Toothed belt for ZR-25S

Order number: **VS-ZR-25S-ZR-stroke**

Pos.	Description	Quantity
14	Cylinder screw	4
15	Toothed plate	2
16	Clamp	2
17	Toothed belt	2 x (385 mm + stroke)







Seal kit for ZR-40S

Order number: **VS-ZR-40S-Stroke length (for example 0500)**

0500 = stroke lengths from 0 to 500 mm
1000 = stroke lengths from 501 to 1000 mm
1500 = stroke lengths from 1001 to 1500 mm
2000 = stroke lengths from 1501 to 2000 mm
3000 = stroke lengths from 2001 to 3000 mm
4500 = stroke lengths from 3001 to 4500 mm

Pos.	Description	Quantity
1	O-Ring	2
2	O-Ring	2
3	O-Ring	2
4	Cover band	350 mm + stroke
5	Sealing band	550 mm + stroke
6	Wiper	2
7	Cover for wiper	2
8	Roller	2
9	Piston seal	2
10	Cushion seal	2
11	Piston seal	2
	Grease	30 ml

Seal kit slide guideway for ZR-40S

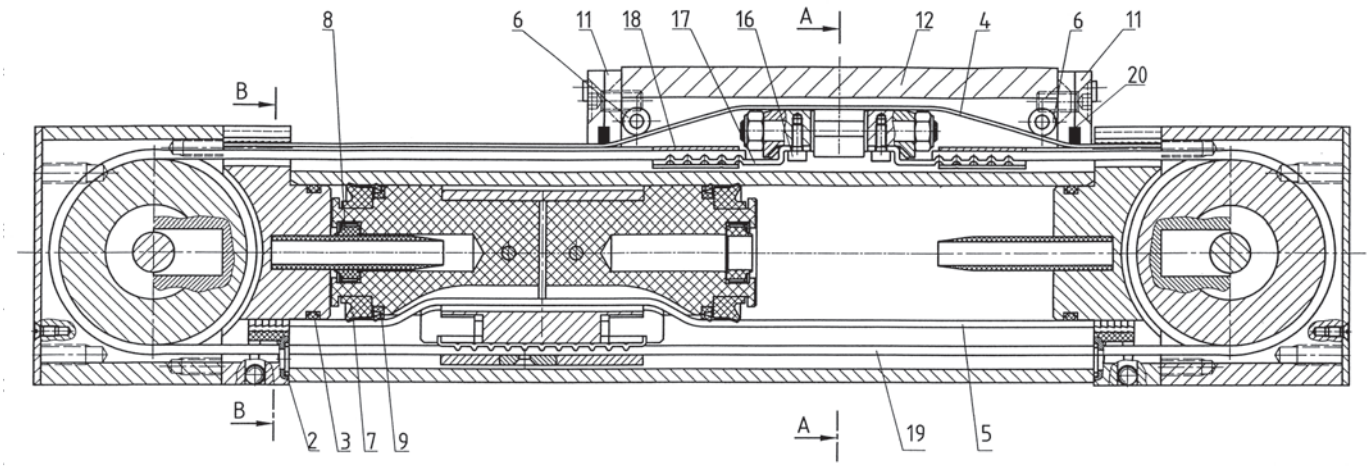
Order number: **VS-ZR-40S-GL**

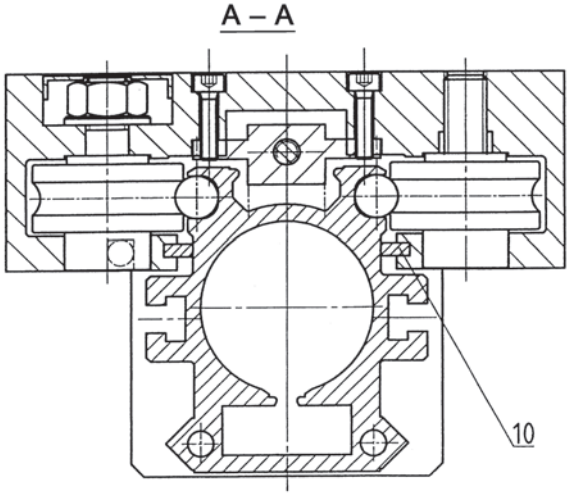
Pos.	Description	Quantity
12	Set screw	8
13	Slide 1	2
14	Slide 2	2
15	Support plate	4
	Screw M 4 x 6	2
	Screw M 4 x 10	4
6	Wiper	2
7	Cover	2
8	Roller	2
	Grease	30 ml

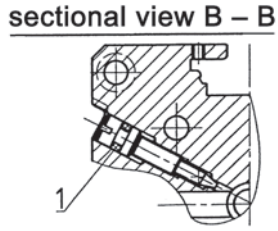
Toothed belt for ZR-40S

Order number: **VS-ZR-40S-ZR-stroke**

Pos.	Description	Quantity
16	Cylinder screw	4
17	Toothed plate	2
18	Clamp	2
19	Toothed belt	2 x (395 mm + stroke)







Seal kit for ZR-40L

Order number: **VS-ZR-40L-Stroke length (for example 0500)**

0500 = stroke lengths from 0 to 500 mm
1000 = stroke lengths from 501 to 1000 mm
1500 = stroke lengths from 1001 to 1500 mm
2000 = stroke lengths from 1501 to 2000 mm
3000 = stroke lengths from 2001 to 3000 mm
4500 = stroke lengths from 3001 to 4500 mm

Pos.	Description	Quantity
1	O-Ring	2
2	O-Ring	2
3	O-Ring	2
4	Cover band	200 mm + stroke
5	Sealing band	400 mm + stroke
6	Roller	2
7	Piston seal	2
8	Cushion seal	2
9	Piston seal	2
10	Wiper	2
20	Wiper	2
	Grease	30 ml

Cover for ZR-40L

Order number: **VS-ZR-40L-AD**

Pos.	Description	Quantity
11	Cover for wiper	2
10	Wiper	2
	Flat-head screw M6	4

Roller slide complete for ZR-40L

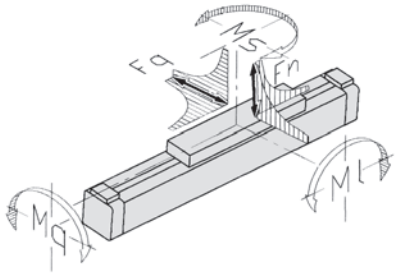
Order number: **31-40-115-52**

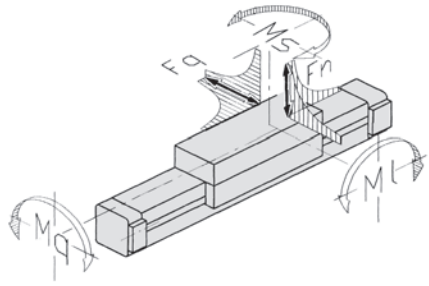
Toothed belt for ZR-40L

Order number: **VS-ZR-40-ZR-stroke**

Pos.	Description	Quantity
16	Screw	4
17	Toothed plate	2
18	Clamp	2
19	Toothed belt	2 x (290 mm + stroke)

Definition of forces and torques





Maximum Force and Torque Data

Type	Operating force*	Fn max.	Fq max.	Ml max.	Mq max.	Ms max.
ZX-25-S	255 N (57 lbf)	270 N (61 lbf)	–	13 Nm (9.59 ft. lbf.)	2.5 Nm (1.84 ft. lbf.)	11 Nm (8.11 ft. lbf.)
ZX-25-K	255 N (57 lbf)	270 N (61 lbf)	–	8 Nm (5.90 ft. lbf.)	2.0 Nm (1.47 ft. lbf.)	7 Nm (5.16 ft. lbf.)
ZX-25-SG	250 N (56 lbf)	580 N (130 lbf)	580 N (130 lbf)	23 Nm (17.0 ft. lbf.)	10.0 Nm (7.37 ft. lbf.)	23 Nm (17.0 ft. lbf.)
ZX-25-KG	250 N (56 lbf)	340 N (76 lbf)	340 N (76 lbf)	9 Nm (6.64 ft. lbf.)	5.0 Nm (3.69 ft. lbf.)	9 Nm (6.64 ft. lbf.)
ZX-25-SR	250 N (56 lbf)	850 N (191 lbf)	1300 N (292 lbf)	65 Nm (47.9 ft. lbf.)	35.0 Nm (25.8 ft. lbf.)	105 Nm (77.4 ft. lbf.)
ZX-25-KR	250 N (56 lbf)	850 N (191 lbf)	1300 N (292 lbf)	29 Nm (21.4 ft. lbf.)	35.0 Nm (25.8 ft. lbf.)	64 Nm (47.2 ft. lbf.)
ZX-32-S	420 N (94 lbf)	300 N (67 lbf)	–	30 Nm (22.1 ft. lbf.)	3.0 Nm (2.21 ft. lbf.)	24 Nm (17.7 ft. lbf.)
ZX-32-K	420 N (94 lbf)	300 N (67 lbf)	–	15 Nm (11.1 ft. lbf.)	3.0 Nm (2.21 ft. lbf.)	12 Nm (8.85 ft. lbf.)
ZX-32-SG	410 N (92 lbf)	850 N (191 lbf)	850 N (191 lbf)	33 Nm (24.3 ft. lbf.)	15.0 Nm (11.1 ft. lbf.)	33 Nm (24.3 ft. lbf.)
ZX-32-KG	410 N (92 lbf)	460 N (103 lbf)	460 N (103 lbf)	14 Nm (10.3 ft. lbf.)	6.5 Nm (4.79 ft. lbf.)	14 Nm (10.3 ft. lbf.)
ZX-32-SR	410 N (92 lbf)	900 N (202 lbf)	1500 N (337 lbf)	79 Nm (58.3 ft. lbf.)	40.0 Nm (29.5 ft. lbf.)	125 Nm (92.2 ft. lbf.)
ZX-32-KR	410 N (92 lbf)	900 N (202 lbf)	1500 N (337 lbf)	36 Nm (26.5 ft. lbf.)	40.0 Nm (29.5 ft. lbf.)	76 Nm (56.1 ft. lbf.)
ZX-40-S	655 N (147 lbf)	650 N (146 lbf)	–	60 Nm (44.2 ft. lbf.)	4.0 Nm (2.95 ft. lbf.)	54 Nm (39.8 ft. lbf.)
ZX-40-K	655 N (147 lbf)	650 N (146 lbf)	–	30 Nm (22.1 ft. lbf.)	4.0 Nm (2.95 ft. lbf.)	27 Nm (19.9 ft. lbf.)
ZX-40-SG	640 N (144 lbf)	1120 N (252 lbf)	1120 N (252 lbf)	60 Nm (44.2 ft. lbf.)	25.0 Nm (18.4 ft. lbf.)	60 Nm (44.2 ft. lbf.)
ZX-40-KG	640 N (144 lbf)	600 N (135 lbf)	600 N (135 lbf)	25 Nm (18.4 ft. lbf.)	11.0 Nm (8.11 ft. lbf.)	25 Nm (18.4 ft. lbf.)
ZX-40-SR	640 N (144 lbf)	1200 N (270 lbf)	2000 N (450 lbf)	190 Nm (140 ft. lbf.)	67.0 Nm (49.4 ft. lbf.)	118 Nm (87.0 ft. lbf.)
ZX-40-KR	640 N (144 lbf)	1200 N (270 lbf)	2000 N (450 lbf)	85 Nm (62.7 ft. lbf.)	67.0 Nm (49.4 ft. lbf.)	72 Nm (53.1 ft. lbf.)
ZX-50-S	1000 N (225 lbf)	800 N (180 lbf)	–	80 Nm (59.0 ft. lbf.)	17.0 Nm (12.5 ft. lbf.)	74 Nm (54.6 ft. lbf.)
ZX-50-K	1000 N (225 lbf)	800 N (180 lbf)	–	38 Nm (28.0 ft. lbf.)	17.0 Nm (12.5 ft. lbf.)	32 Nm (23.6 ft. lbf.)
ZX-50-SG	1000 N (225 lbf)	1550 N (348 lbf)	1500 N (337 lbf)	200 Nm (147.5 ft. lbf.)	70.0 Nm (51.6 ft. lbf.)	200 Nm (147.5 ft. lbf.)
ZX-50-KG	1000 N (225 lbf)	820 N (184 lbf)	800 N (180 lbf)	60 Nm (44.2 ft. lbf.)	40.0 Nm (29.5 ft. lbf.)	60 Nm (44.2 ft. lbf.)
ZX-50-SR	1000 N (225 lbf)	4100 N (922 lbf)	2000 N (450 lbf)	157 Nm (115.6 ft. lbf.)	45.0 Nm (33.1 ft. lbf.)	170 Nm (125.2 ft. lbf.)
ZX-50-KR	1000 N (225 lbf)	1800 N (405 lbf)	2000 N (450 lbf)	67 Nm (49.4 ft. lbf.)	45.0 Nm (33.1 ft. lbf.)	106 Nm (78.1 ft. lbf.)
ZX-63-S	1600 N (360 lbf)	1400 N (315 lbf)	–	110 Nm (81.0 ft. lbf.)	17.0 Nm (12.5 ft. lbf.)	100 Nm (73.7 ft. lbf.)
ZX-63-K	1600 N (360 lbf)	1400 N (315 lbf)	–	50 Nm (36.8 ft. lbf.)	17.0 Nm (12.5 ft. lbf.)	48 Nm (35.4 ft. lbf.)
ZX-63-SG	1600 N (360 lbf)	2000 N (450 lbf)	2000 N (450 lbf)	300 Nm (221.2 ft. lbf.)	102.0 Nm (75.2 ft. lbf.)	300 Nm (221.2 ft. lbf.)
ZX-63-KG	1600 N (360 lbf)	1100 N (247 lbf)	1100 N (247 lbf)	105 Nm (77.4 ft. lbf.)	56.0 Nm (41.3 ft. lbf.)	105 Nm (77.4 ft. lbf.)
ZX-63-SR	1600 N (360 lbf)	5000 N (1124 lbf)	2000 N (450 lbf)	196 Nm (144.4 ft. lbf.)	52.0 Nm (38.3 ft. lbf.)	208 Nm (153.2 ft. lbf.)
ZX-63-KR	1600 N (360 lbf)	2500 N (562 lbf)	2000 N (450 lbf)	99 Nm (72.9 ft. lbf.)	52.0 Nm (38.3 ft. lbf.)	134 Nm (98.7 ft. lbf.)

The mounting surface of the assembled mass should not exceed a straightness tolerance of 0.1 mm to avoid additional tension or clearance in the guiding system.

Complex loads

If more than one force and torque appear simultaneously, they have to be calculated by the formula:

$$\frac{Fn}{Fn_{max.}} + \frac{Fq}{Fq_{max.}} + \frac{Ml}{Ml_{max.}} + \frac{Mq}{Mq_{max.}} + \frac{Ms}{Ms_{max.}} \leq 1$$

Information on forces and torques refers to speeds for slide guides (series S, K, SG and KG) of ≤ 0.2 m/s (0.656 ft/s) and speeds for roller guides (series SR and KR) of ≤ 2 m/s (6.562 ft/s).
Where speeds exceed 0.2 m/s (0.656 ft/s) the permissible values of the slide guides are to be multiplied by the loading coefficient (see table on the right).
The information on torques refers to the center point of the slide which, in the case of the ZX-S and ZX-K cylinders, is the center of the tube. In versions with slide guides, the center point of the guide is in the slide.

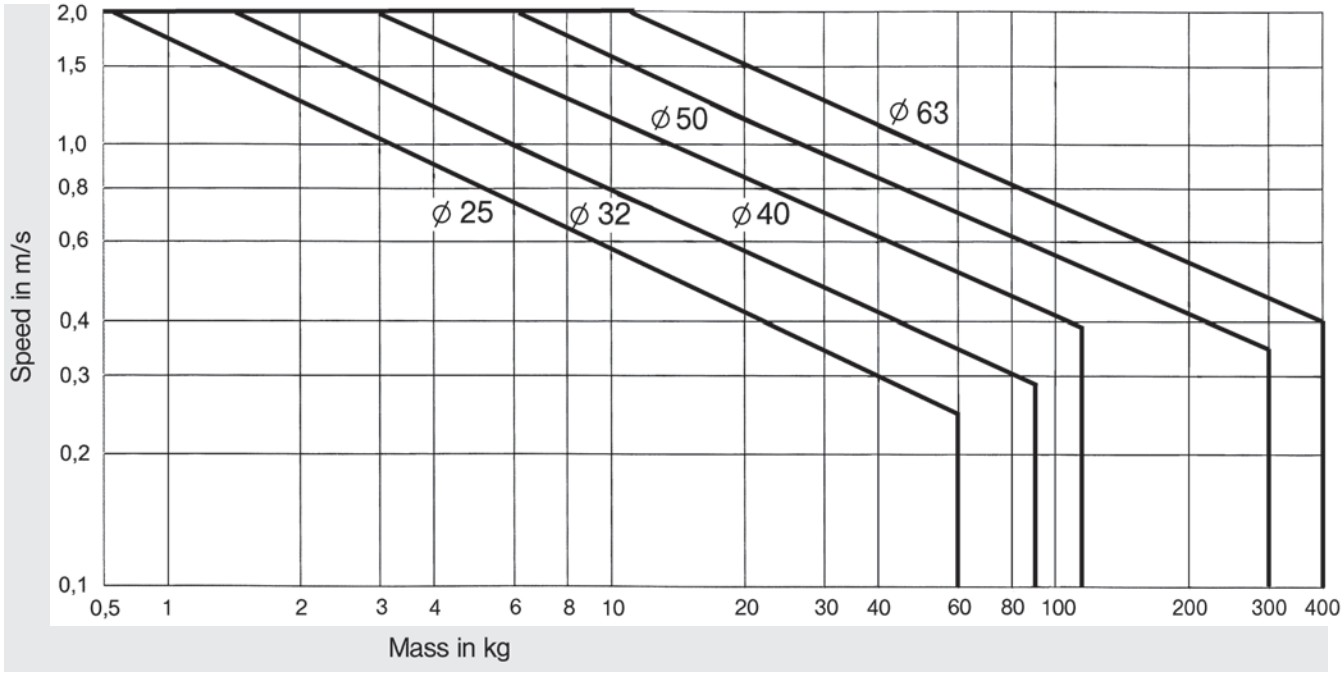
* Operating force at 6 bar (87 psi). The internal friction is considered.

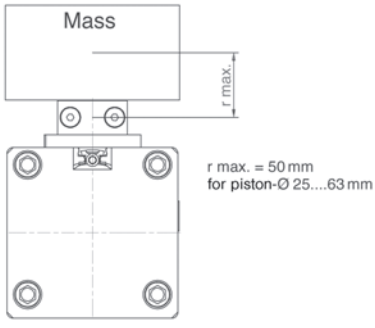
Loading coefficient

V in m/s	V in ft/s	Factor
0.2	0.656	1
0.3	0.984	0.75
0.4	1.312	0.5
0.5	1.640	0.4
0.75	2.460	0.27
1	3.281	0.2

Cushioning diagram

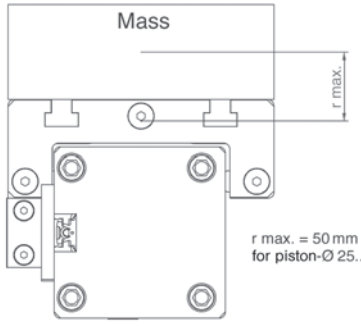
The stroke end cushion must be adjusted to hitchless driving. If the application is out of the diagram range, an external shock absorber is required. The mounting position of shock absorbers must be close to the center of the mass.
The data applies to a horizontal mounting position.





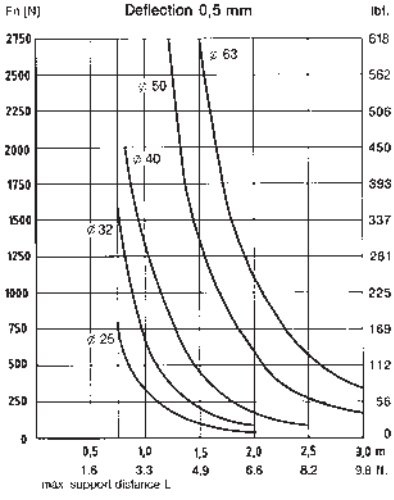
r max. = 50 mm
for piston-Ø 25....63 mm

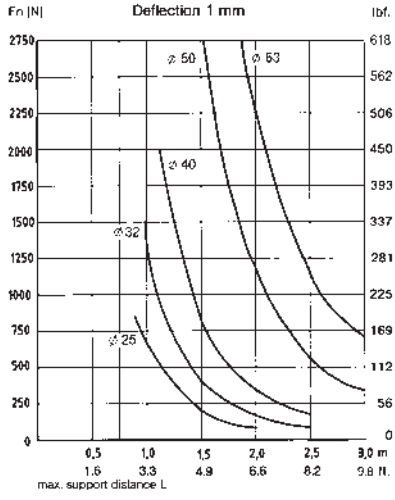
For additional loads, please consider the allowed maximum forces and torques on page 10.140.

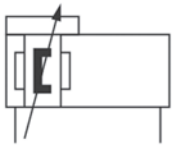


r max. = 50 mm
for piston-Ø 25....63 mm

Deflection







Order code

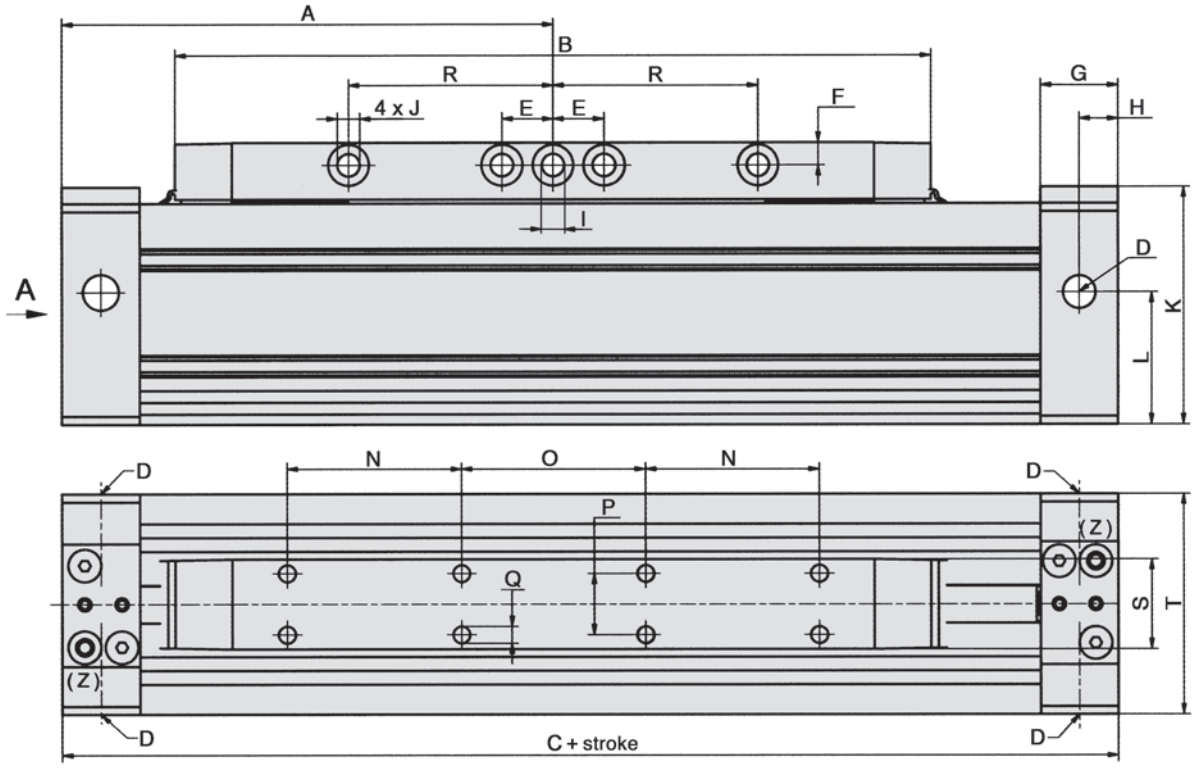
ZX-25-S-0500-01

Series	Piston Ø (mm)	Typ	Stroke length (mm)	Air connection see page 10.156

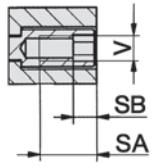
Design and function

Double acting rodless cylinder with adjustable cushion and permanent magnet. The non-rotating piston guides the moving mass.
The sensors can be installed directly into the grooves of the aluminum profile.
Cylinders of this series are available in explosion proof design in accordance with 94/9/EG (ATEX). For further details see page 10.180.

Order number Please complete according to order code.	**ZX-25-S-**…	**ZX-32-S-**…	**ZX-40-S-**…	**ZX-50-S-**…	**ZX-63-S-**…
Piston Ø (mm)	25	32	40	50	63
Connection	G1/8	G1/8	G1/4	G3/8	G3/8
Cushioning length (mm)	24	28	36	45	59
Mass at 0 mm stroke	0.88 kg (1.940 lbs.)	1.40 kg (3.086 lbs.)	2.41 kg (5.313 lbs.)	5.3 kg (11.684 lbs.)	8.1 kg (17.857 lbs.)
additional mass per 100 mm	0.30 kg (0.661 lb.)	0.39 kg (0.860 lb.)	0.52 kg (1.168 lbs.)	0.96 kg (2.116 lbs.)	1.32 kg (2.91 lbs.)
Operating pressure	1 … 8 bar (14.5 … 116 psi)				
Temperature range	– 10 °C … + 70 °C (+ 14 °F … + 158 °F)				
Medium	Compressed air in accordance with ISO 8573-1:2001, Class 7 4 –; free of aggressive additives. If speeds exceed 1 m/s (3.3 ft/s) lubricated air is recommended.				
Stroke length	arbitrary up to 6000 mm (arbitrary up to 236 in) (max. 234 in)		max. 5950 mm (max. 232 in)	max. 5910 mm (max. 230 in)	max. 5860 mm
Materials	Al (anodized), plastic Seals: NBR, PU				

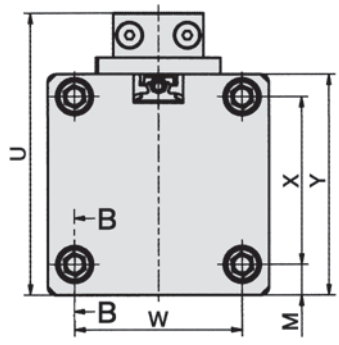


cross section B-B



SA = Depth of thread
SB = Length of hex.

view A



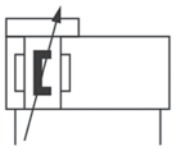
(Z) = Cushion set screw.

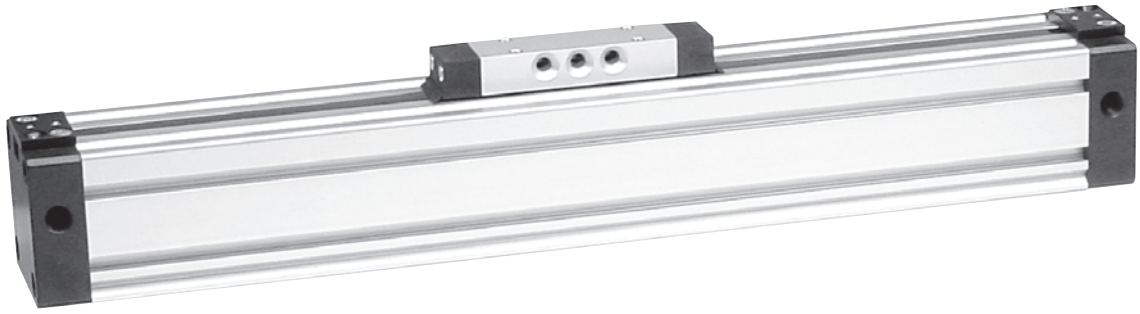
Drawing shows pressure supply type -01 for air connection on both ends.

Other types see page 10.156.

Piston Ø	A	B	C	D	E	F	G	H	I	J	K	L	M	N
25	100	149.6	200	G1/8	12.5	5	19	9.5	6 H7	4.5	49	25	4.5	20
32	120	184.5	240	G1/8	12.5	5.5	19	9.5	6 H7	5.5	58	32.3	7.5	42.5
40	150	222.6	300	G1/4	12.5	7	23	11.5	7 H7	6.5	68	38.2	7.5	35
50	175	262	350	G3/8	17.5	9	30	17	10	8.5	94	59	12.5	45
63	200	300	400	G3/8	25	9.5	30	17	10	8.5	110	68.4	14.0	80

Piston Ø	O	P	Q	R	S	T	U	V	W	X	Y	SA	SB
25	50	15	M5 x 7 mm deep	35	22	45	60	M4	36	36	45	11	3
32	45	15	M5 x 7 mm deep	50	22	54	69	M5	41	41	54	11	4
40	90	15	M5 x 9 mm deep	65	22	64	82	M6	49	49	64	12	4
50	60	34	M8 x 16 mm deep	90	46	90	115	M8	65	65	90	17	5
63	80	34	M8 x 16 mm deep	90	46	106	131	M8	78	78	106	17	5





Order code

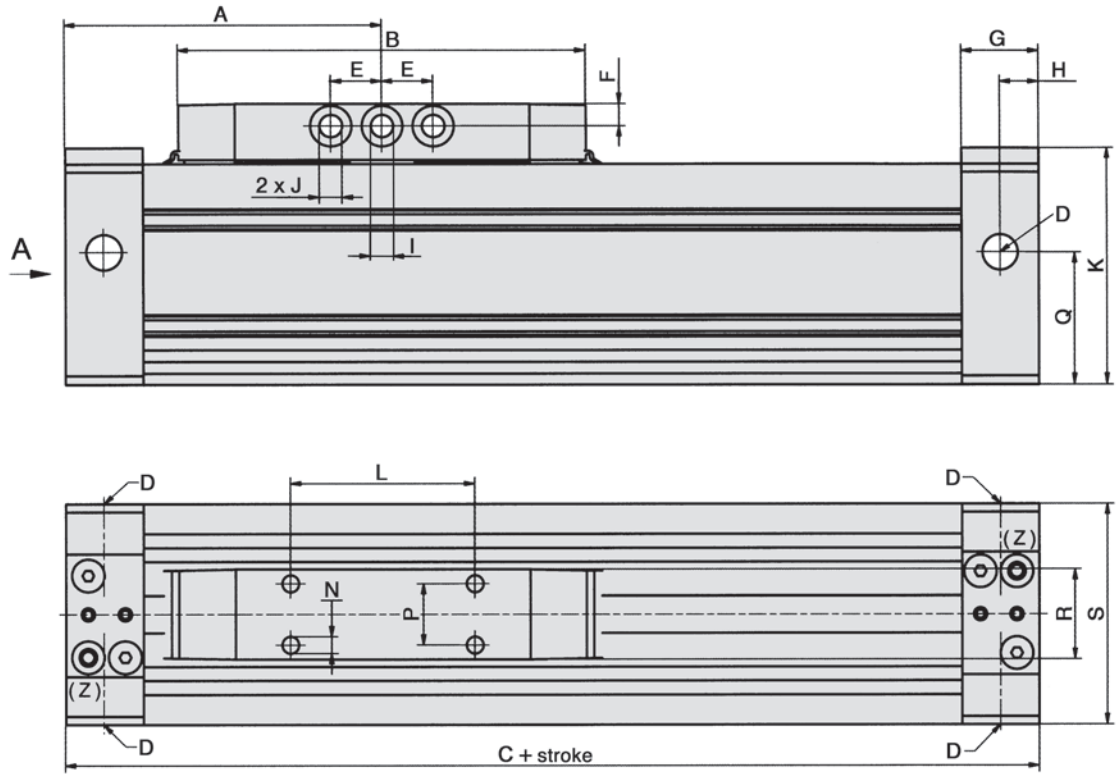
ZX-25-K-0500-01

Series	Piston Ø (mm)	Typ	Stroke length (mm)	Air connection see page 10.156

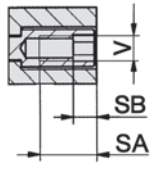
Design and function

Double acting rodless cylinder with adjustable cushion and permanent magnet. The non-rotating piston guides the moving mass.
The design of the K series significantly reduces the overall length of the cylinder (by as much as 30 %).
The sensors can be installed directly into the grooves of the aluminum profile.
Cylinders of this series are available in explosion proof design in accordance with 94/9/EG (ATEX). For further details see page 10.180.

Order number Please complete according to order code.	**ZX-25-K-**…	**ZX-32-K-**…	**ZX-40-K-**…	**ZX-50-K-**…	**ZX-63-K-**…
Piston Ø (mm)	25	32	40	50	63
Connection	G1/8	G1/8	G1/4	G3/8	G3/8
Cushioning length (mm)	24	28	36	45	59
Mass at 0 mm stroke	0.62 kg (1.367 lbs.)	0.96 kg (2.116 lbs.)	1.65 kg (3.637 lbs.)	3.5 kg (7.716 lbs.)	5.4 kg (11.905 lbs.)
additional mass per 100 mm	0.30 kg (0.661 lb.)	0.39 kg (0.860 lb.)	0.52 kg (1.168 lbs.)	0.96 kg (2.116 lbs.)	1.32 kg (2.91 lbs.)
Operating pressure	1 … 8 bar (14.5 … 116 psi)				
Temperature range	– 10 °C … + 70 °C (+ 14 °F … + 158 °F)				
Medium	Compressed air in accordance with ISO 8573-1:2001, Class 7 4 –; free of aggressive additives. If speeds exceed 1 m/s (3.3 ft/s) lubricated air is recommended.				
Stroke length	arbitrary up to 6000 mm (236 in)				
Materials	Al (anodized), plastic Seals: NBR, PU				

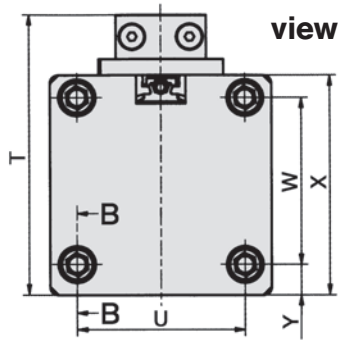


cross section B-B



SA = Depth of thread
SB = Length of hex.

view A



(Z) = Cushion set screw.

Drawing shows pressure supply type -01 for air connection on both ends.

Other types see page 10.156.

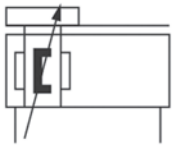
Piston Ø	A	B	C	D	E	F	G	H	I	J	K	L
25	67.5	84.6	135	G1/8	12.5	5	19	9.5	6 H7	4.5	49	35
32	77.5	99.6	155	G1/8	12.5	5.5	19	9.5	6 H7	5.5	58	45
40	95	112.6	190	G1/4	12.5	7	23	11.5	7 H7	6.5	68	50
50	105	122	210	G3/8	17.5	9	30	17	10 H7	8.5	94	64
63	125	150	250	G3/8	25	9.5	30	17	10 H7	8.5	110	80

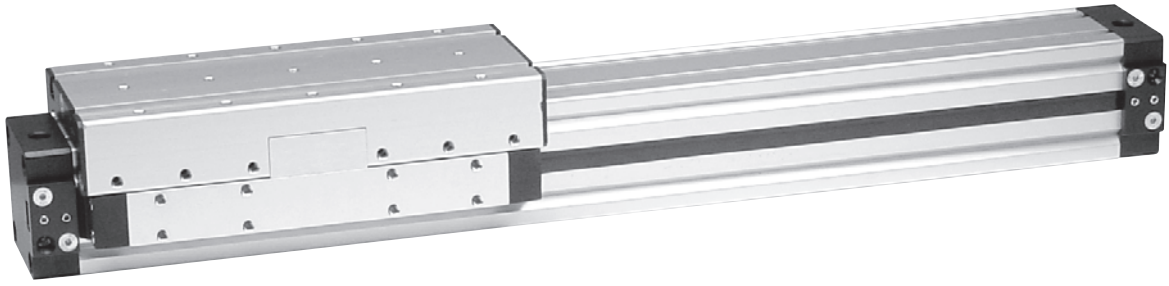
Piston Ø	N	P	Q	R	S	T	U	V	W	X	Y	SA	SB
25	M5 x 7 mm deep	15	25	22	45	60	36	M4	36	45	4.5	11	3
32	M5 x 7 mm deep	15	32.3	22	54	69	41	M5	41	54	7.5	11	4
40	M5 x 9 mm deep	15	38.3	22	64	82	49	M6	49	64	7.5	12	4
50	M8 x 16 mm deep	34	59	46	90	115	65	M8	65	90	12.5	17	5
63	M8 x 16 mm deep	34	68.4	46	106	131	78	M8	78	106	14	17	5

Rodless cylinders with slide guide

Series ZX-Ø-SG

G1/8 to G3/8 • piston Ø 25 to 63 mm





Order code

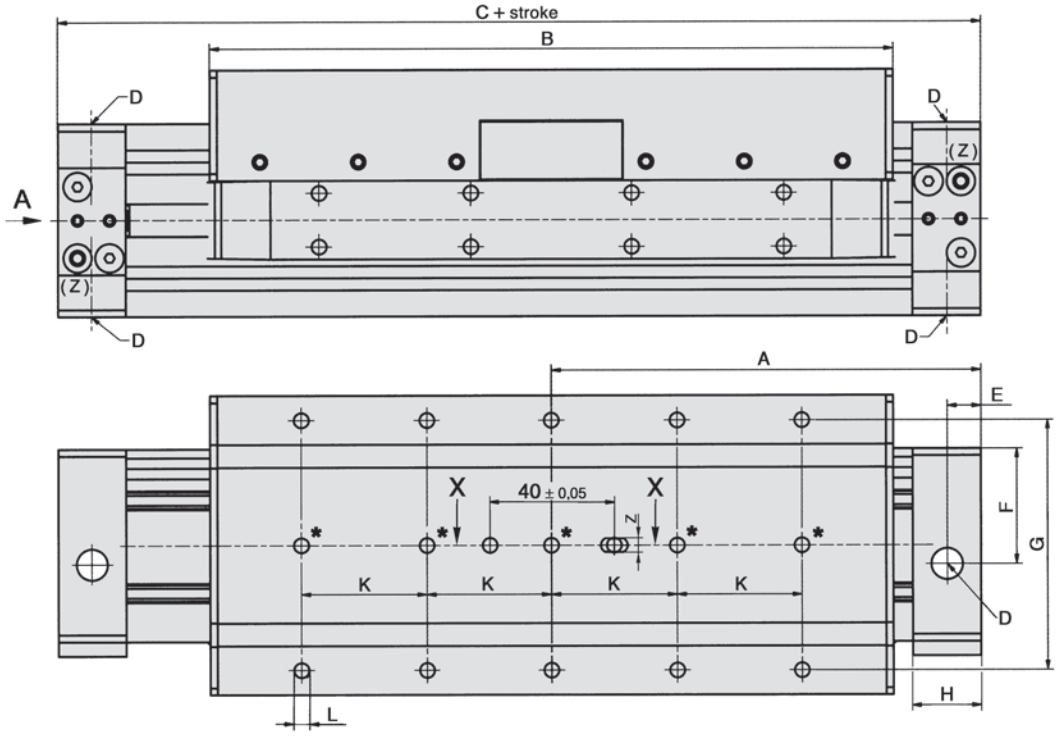
ZX-25-SG-0500-01

Series	Piston Ø (mm)	Typ	Stroke length (mm)	Air connection see page 10.156

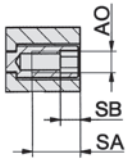
Design and function

Double acting rodless cylinder with adjustable cushion and permanent magnet. Series SG incorporates an adjustable guide system for medium loads.
The sensors can be installed directly into the grooves of the aluminum profile.
Cylinders of this series are available in explosion proof design in accordance with 94/9/EG (ATEX). For further details see page 10.180.

Order number Please complete according to order code.	**ZX-25-SG-**…	**ZX-32-SG-**…	**ZX-40-SG-**…	**ZX-50-SG-**…	**ZX-63-SG-**…
Piston Ø (mm)	25	32	40	50	63
Connection	G1/8	G1/8	G1/4	G3/8	G3/8
Cushioning length (mm)	24	28	36	45	59
Mass at 0 mm stroke	1.31 kg (2.888 lbs.)	2.09 kg (4.608 lbs.)	3.58 kg (7.892 lbs.)	7.28 kg (16.049 lbs.)	11.02 kg (24.294 lbs.)
additional mass per 100 mm	0.30 kg (0.661 lb.)	0.39 kg (0.860 lb.)	0.52 kg (1.168 lbs.)	0.96 kg (2.116 lbs.)	1.32 kg (2.91 lbs.)
Operating pressure	1 … 8 bar (14.5 … 116 psi)				
Temperature range	– 10 °C … + 70 °C (+ 14 °F … + 158 °F)				
Medium	Compressed air in accordance with ISO 8573-1:2001, Class 7 4 –; free of aggressive additives. If speeds exceed 1 m/s (3.3 ft/s) lubricated air is recommended.				
Stroke length	arbitrary up to 6000 mm (arbitrary up to 236 in)		max. 5950 mm (max. 234 in)	max. 5910 mm (max. 232 in)	max. 5860 mm (max. 230 in)
Materials	Al (anodized), plastic Seals: NBR, PU				

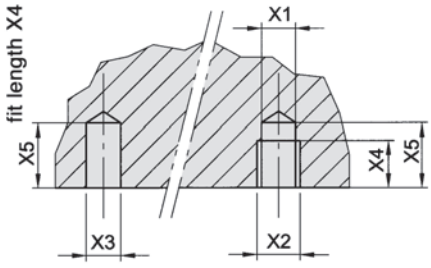


cross section B-B

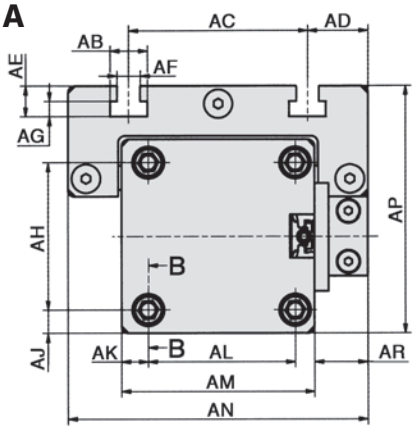


SA = Depth of thread
SB = Length of hex.

cross section X-X



view A



* = Thread only in cylinder ∅ 32 mm (depth of thread 9 mm).
(Z) = Cushion set screw.

Drawing shows pressure supply type -01 for air connection on both ends.
Other types see page 10.156.

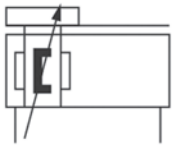
Piston Ø	A	B	C	D	E	F	G	H	K	L	AB	AC	AD	AE	AF	AG
25	100	159	200	G1/8	9.5	25	30	19	30	M5 x 8 mm deep	10.4	50	12.5	8.6	6.4	4.3
32	120	191	240	G1/8	9.5	32.3	70	19	35	M5 x 11mm deep*	10.4	50	16.9	8.6	6.4	4.3
40	150	246	300	G1/4	11.5	38.2	55	23	55	M6 x 12 mm deep	10.4	80	10	8.6	6.4	4.3
50	175	270	350	G3/8	17	59	42	30	50	M8 x 16 mm deep	10.4	94	23	8.6	6.4	4.3
63	200	320	400	G3/8	17	68.4	60	30	60	M8 x 16 mm deep	10.4	110	24	8.6	6.4	4.3

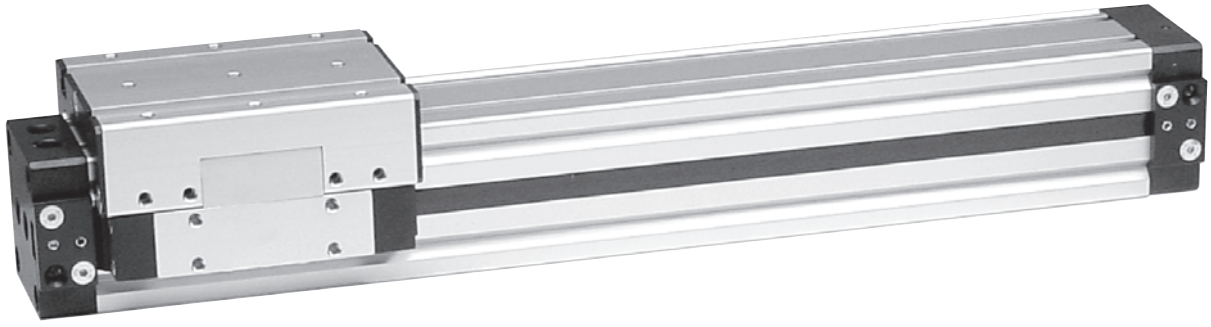
Piston Ø	AH	AJ	AK	AL	AM	AN	AO	AP	AR	SA	SB	Ø X1	X2	Ø X3	X4	X5	Z
25	36	4.5	4.5	36	45	75	M4	59	15	11	3	4	4.4 + 0.2	4 H7	4.5	5.5	4 + 0.02
32	41	6.5	7.5	41	54	83.8	M5	69	15	11	4	4	4.4 + 0.2	4 H7	7	8	4 + 0.02
40	49	7.5	7.5	49	64	100	M6	79	18	12	4	6	6.4 + 0.2	6 H7	7	8	6 + 0.02
50	65	12.5	12.5	65	90	133	M8	112.5	25	17	5	–	6.4 + 0.2	6 H7	3	3	6 + 0.02
63	78	14	14	78	106	150	M8	134.5	26	17	5	–	6.4 + 0.2	6 H7	6.5	6.5	6 + 0.02

Rodless short cylinders with slide guide

Series ZX-Ø-KG

G1/8 to G3/8 • piston Ø 25 to 63 mm





Order code

ZX-25-KG-0500-01

Series	Piston Ø (mm)	Typ	Stroke length (mm)	Air connection
				see page 10.156

Design and function

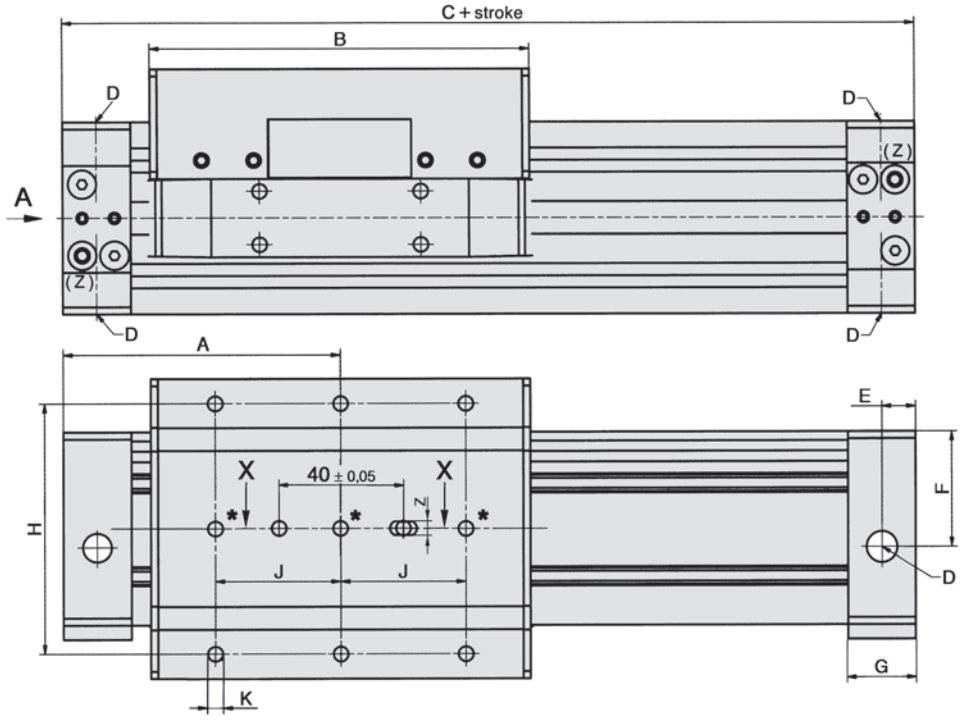
Double acting rodless cylinder with adjustable cushion and permanent magnet. Series KG incorporates an adjustable guide system for medium loads.
The design of the KG series cylinder significantly reduces the overall length of the cylinder (by as much as 30 %).
The sensors can be installed directly into the grooves of the aluminum profile.
Cylinders of this series are available in explosion proof design in accordance with 94/9/EG (ATEX). For further details see page 10.180.

Order number Please complete according to order code.	**ZX-25-KG-**…	**ZX-32-KG-**…	**ZX-40-KG-**…	**ZX-50-KG-**…	**ZX-63-KG-**…
Piston Ø (mm)	25	32	40	50	63
Connection	G1/8	G1/8	G1/4	G3/8	G3/8
Cushioning length (mm)	24	28	36	45	59
Mass at 0 mm stroke	0.88 kg (1.940 lbs.)	1.35 kg (2.976 lbs.)	2.30 kg (5.070 lbs.)	4.63 kg (10.207 lbs.)	7.1 kg (15.652 lbs.)
additional mass per 100 mm	0.30 kg (0.661 lb.)	0.39 kg (0.860 lb.)	0.52 kg (1.168 lbs.)	0.96 kg (2.116 lbs.)	1.32 kg (2.91 lbs.)
Operating pressure	1 … 8 bar (14.5 … 116 psi)				
Temperature range	– 10 °C … + 70 °C (+ 14 °F … + 158 °F)				
Medium	Compressed air in accordance with ISO 8573-1:2001, Class 7 4 –; free of aggressive additives. If speeds exceed 1 m/s (3.3 ft/s) lubricated air is recommended.				
Stroke length	arbitrary up to 6000 mm (236 in)				
Materials	Al (anodized), plastic Seals: NBR, PU				

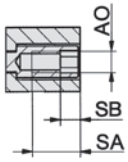
Rodless short cylinders with slide guide

Series ZX-Ø-KG

G1/8 to G3/8 • piston Ø 25 to 63 mm



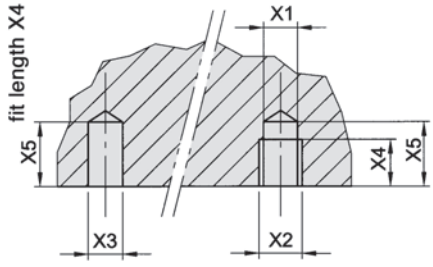
cross section B-B



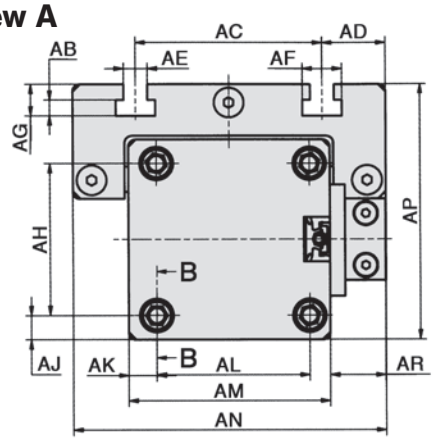
SA = Depth of thread

SB = Length of hex.

cross section X-X



view A



* = Thread only in cylinder ⌀ 32 mm (depth of thread 9 mm).

(Z) = Cushion set screw.

Drawing shows pressure supply type -01 for air connection on both ends.

Other types see page 10.156.

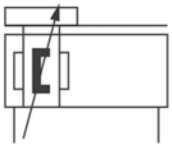
Piston Ø	A	B	C	D	E	F	G	H	J	K	AB	AC	AD	AE	AF	AG
25	67.5	94	135	G 1/8	9.5	25	19	30	30	M5 x 8 mm deep	4.3	50	12.5	6.4	10.4	8.6
32	77.5	106	155	G 1/8	9.5	32.3	19	70	35	M5 x 11 mm deep*	4.3	50	16.9	6.4	10.4	8.6
40	95	136	190	G 1/4	11.5	38.2	23	55	55	M6 x 12 mm deep	4.3	80	10	6.4	10.4	8.6
50	105	148	210	G 3/8	17	59	30	42	50	M8 x 16 mm deep	4.3	94	23	6.4	10.4	8.4
63	125	180	250	G 3/8	17	68.4	30	60	60	M8 x 16 mm deep	4.3	110	24	6.4	10.4	8.4

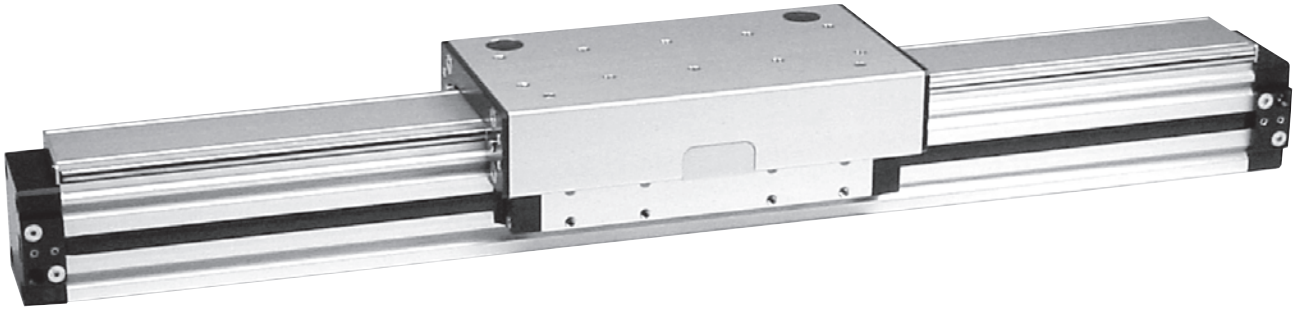
Piston Ø	AH	AJ	AK	AL	AM	AN	AO	AP	AR	SA	SB	Ø X1	X2	Ø X3	X4	X5	Z
25	36	4.5	4.5	36	45	75	M4	59	15	11	3	4	4.4 + 0.2	4 H7	4.5	5.5	4 + 0.02
32	41	6.5	7.5	41	54	83.8	M5	69	15	11	4	4	4.4 + 0.2	4 H7	7	8	4 + 0.02
40	49	7.5	7.5	49	64	100	M6	79	18	12	4	6	6.4 + 0.2	6 H7	7	8	6 + 0.02
50	65	12.5	12.5	65	90	133	M8	112.5	25	17	5	–	6.4 + 0.2	6 H7	3	3	6 + 0.02
63	78	14	14	78	106	150	M8	134.5	26	17	5	–	6.4 + 0.2	6 H7	6.5	6.5	6 + 0.02

Rodless cylinders with roller guide

Series ZX-Ø-SR

G1/8 to G3/8 • piston Ø 25 to 63 mm





Order code

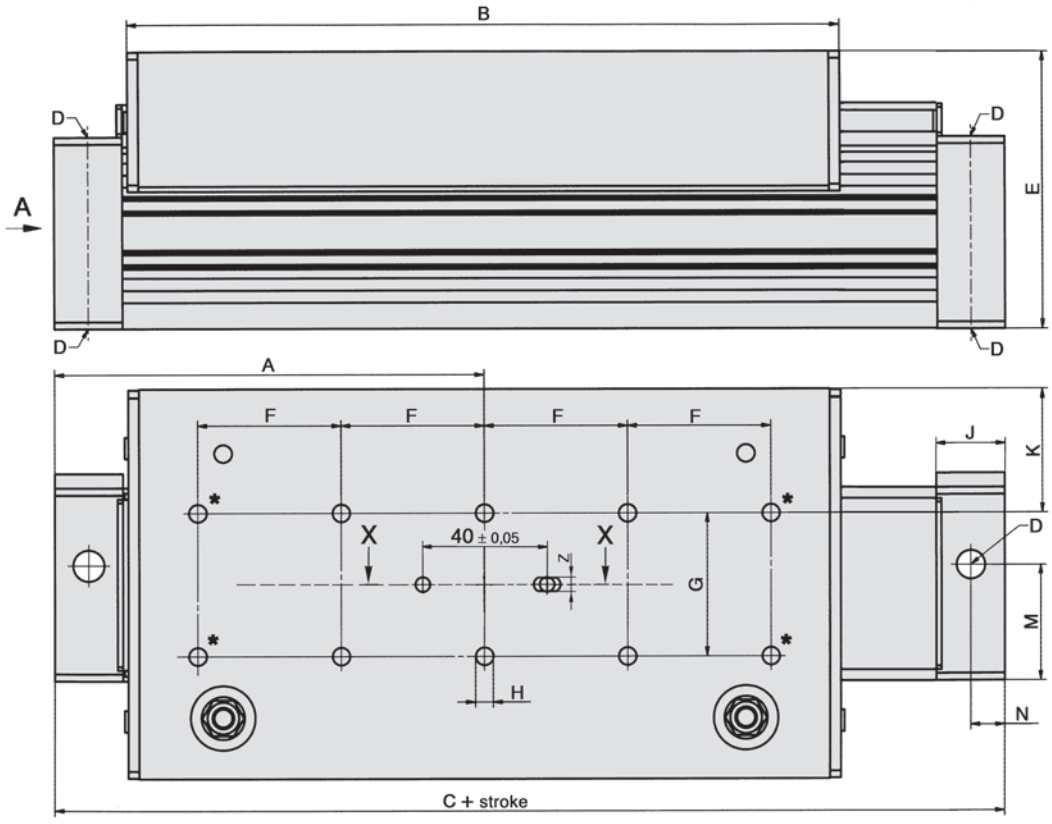
ZX-25-SR-0500-01

Series	Piston Ø (mm)	Typ	Stroke length (mm)	Air connection
				see page 10.156

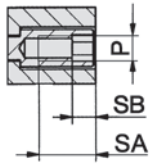
Design and function

Double acting rodless cylinder with adjustable cushion and permanent magnet. The SR series rodless cylinders includes integrated hardened steel shafts and hardened rollers for smooth and precise movement under high force and torque.
The sensors can be installed directly into the grooves of the aluminum profile.
Cylinders of this series are available in explosion proof design in accordance with 94/9/EG (ATEX). For further details see page 10.180.

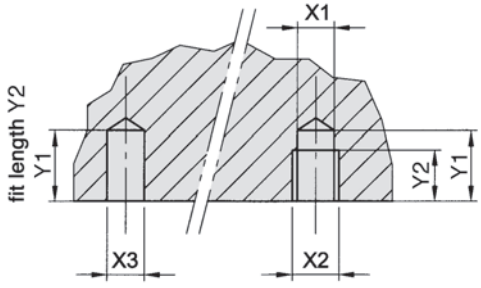
Order number Please complete according to order code.	**ZX-25-SR-**…	**ZX-32-SR-**…	**ZX-40-SR-**…	**ZX-50-SR-**…	**ZX-63-SR-**…
Piston Ø (mm)	25	32	40	50	63
Connection	G1/8	G1/8	G1/4	G3/8	G3/8
Cushioning length (mm)	24	28	36	45	59
Mass at 0 mm stroke	1.97 kg (4.343 lbs.)	2.96 kg (6.525 lbs.)	5.89 kg (12.985 lbs.)	9.10 kg (20.062 lbs.)	13.17 kg (29.035 lbs.)
additional mass per 100 mm	0.42 kg (0.926 lb.)	0.48 kg (1.058 lbs.)	0.74 kg (1.631 lbs.)	1.08 kg (2.381 lbs.)	1.42 kg (3.130 lbs.)
Operating pressure	1.5 … 8 bar (21.75 …116 psi)	1 … 8 bar (14.5 … 116 psi)			
Temperature range	– 10 °C … + 70 °C (+ 14 °F … + 158 °F)				
Medium	Compressed air in accordance with ISO 8573-1:2001, Class 7 4 –; free of aggressive additives. If speeds exceed 1 m/s (3.3 ft/s) lubricated air is recommended.				
Stroke length	arbitrary up to 6000 mm (236 in)		max. 5950 mm (234 in)	max. 5910 mm (233 in)	max. 5860 mm (231 in)
Materials	Al (anodized), plastic, hardened steel Seals: NBR, PU				



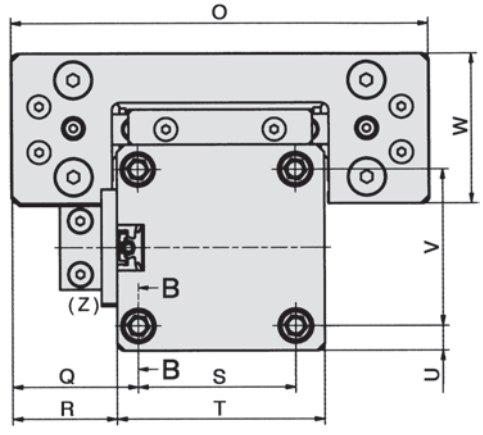
cross section B-B



cross section X-X



view A



SA = Depth of thread
SB = Length of hex.

* = not for ⌀ 25 mm cylinder.
(Z) = Cushion set screw.

Drawing shows pressure supply type -01 for air connection on both ends.
Other types see page 10.156.

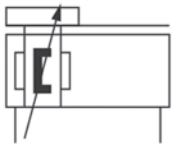
Piston Ø	A	B	C	D	E	F	G	H	J	K	M	N	O	P
25	100	160	200	G1/8	68.2	40	40	M5-7.5 mm deep	19	28.5	25	9.5	97	M4
32	120	201	240	G1/8	78	40	40	M6-9 mm deep	19	34.5	32.3	9.5	108.8	M5
40	150	252	300	G1/4	90.5	55	55	M6-12 mm deep	23	45	38.2	11.5	145	M6
50	175	270	350	G3/8	120	55	55	M8-15 mm deep	30	54.5	59	17	164	M8
63	200	320	400	G3/8	137	70	70	M8-17 mm deep	30	55	68.4	17	180	M8

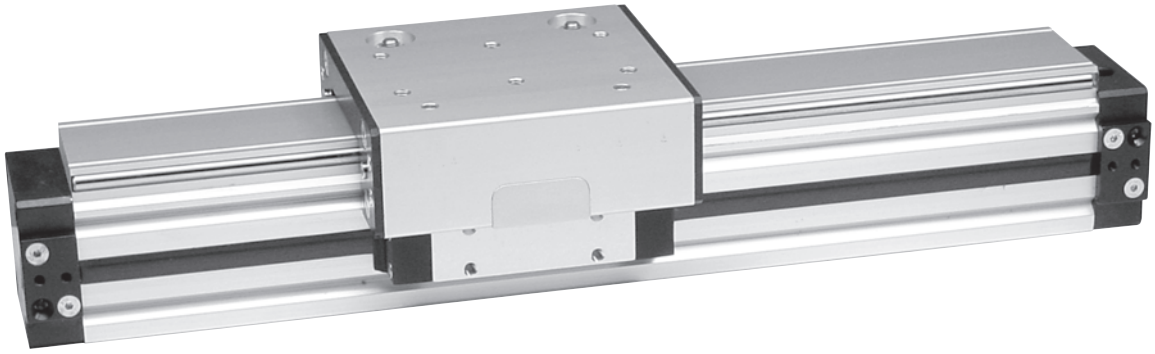
Piston Ø	Q	R	S	T	U	V	W	SA	SB	Ø X1	X2	Ø X3	Y1	Y2	Z
25	30.5	26	36	45	4.5	36	34.2	11	3	4	4.4 + 0.2	4 H7	8	7	4 + 0.02
32	32.9	27.4	41	54	6.5	41	39.5	11	4	4	4.4 + 0.2	4 H7	8	7	4 + 0.02
40	48	40.5	49	64	7.5	49	47	12	4	6	6.4 + 0.2	6 H7	8	7	6 + 0.02
50	49	36.5	65	90	12.5	65	51.5	17	5	6	6.4 + 0.2	6 H7	3.5	3	6 + 0.02
63	51	37	78	106	14	78	60.5	17	5	6	6.4 + 0.2	6 H7	7	6.5	6 + 0.02

Rodless short cylinders with roller guide

Series ZX-Ø-KR

G1/8 to G3/8 • piston Ø 25 to 63 mm





Order code

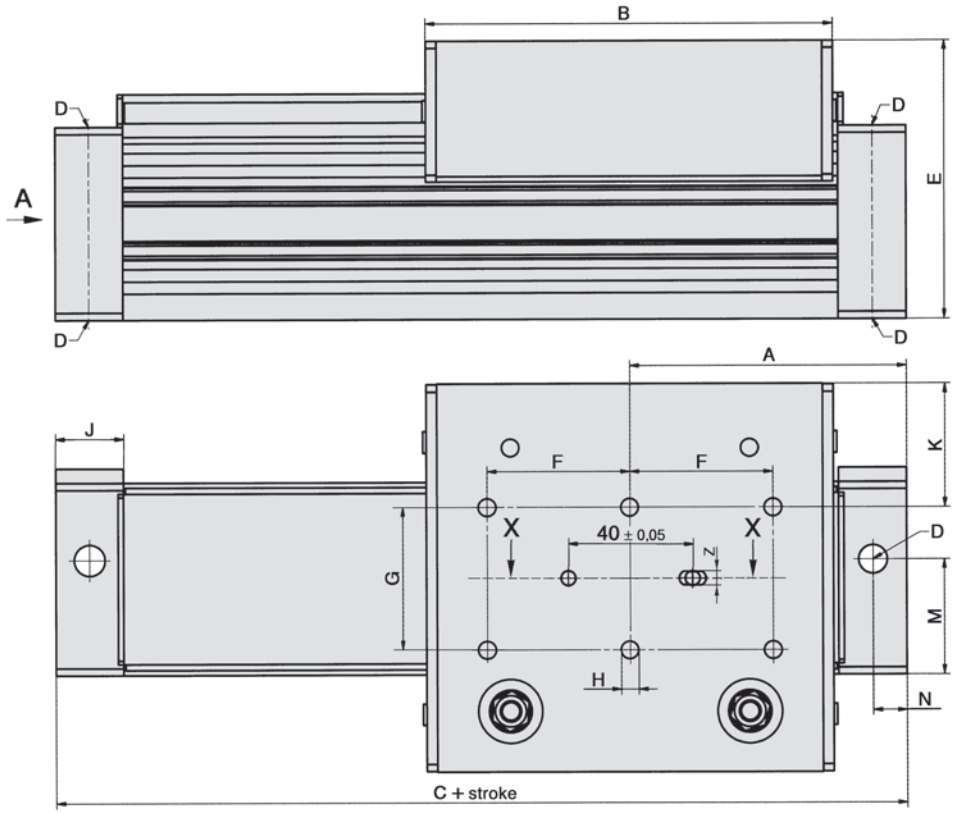
ZX-25-KR-0500-01

Series	Piston Ø (mm)	Typ	Stroke length (mm)	Air connection
				see page 10.156

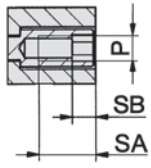
Design and function

Double acting rodless cylinder with adjustable cushion and permanent magnet. The KR series rodless cylinders includes integrated hardened steel shafts and hardened rollers for smooth and precise movement under high force and torque.
The design of the KR series cylinder significantly reduces the overall length of the cylinder (by as much as 30 %).
The sensors can be installed directly into the grooves of the aluminum profile.
Cylinders of this series are available in explosion proof design in accordance with 94/9/EG (ATEX). For further details see page 10.180.

Order number Please complete according to order code.	**ZX-25-KR-…**	**ZX-32-KR-…**	**ZX-40-KR-…**	**ZX-50-KR-…**	**ZX-63-KR-…**
Piston Ø (mm)	25	32	40	50	63
Connection	G1/8	G1/8	G1/4	G3/8	G3/8
Cushioning length (mm)	24	28	36	45	59
Mass at 0 mm stroke	1.33 kg (2.932 lbs.)	1.91 kg (4.211 lbs.)	3.84 kg (8.465 lbs.)	5.82 kg (12.831 lbs.)	8.66 kg (19.092 lbs.)
additional mass per 100 mm	0.42 kg (0.926 lb.)	0.48 kg (1.058 lbs.)	0.74 kg (1.631 lbs.)	1.08 kg (2.381 lbs.)	1.42 kg (3.130 lbs.)
Operating pressure	1.5 … 8 bar (21.75 …116 psi)	1 … 8 bar (14.5 … 116 psi)			
Temperature range	– 10 °C … + 70 °C (+ 14 °F … + 158 °F)				
Medium	Compressed air in accordance with ISO 8573-1:2001, Class 7 4 –; free of aggressive additives. If speeds exceed 1 m/s (3.3 ft/s) lubricated air is recommended.				
Stroke length	arbitrary up to 6000 mm (236 in)				
Materials	Al (anodized), plastic, hardened steel Seals: NBR, PU				

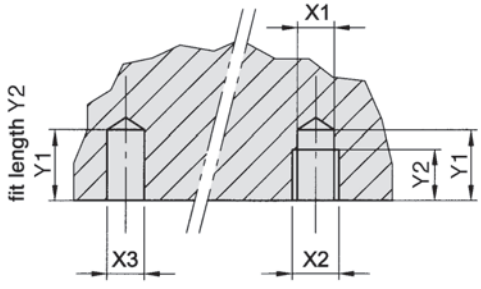


cross section B-B

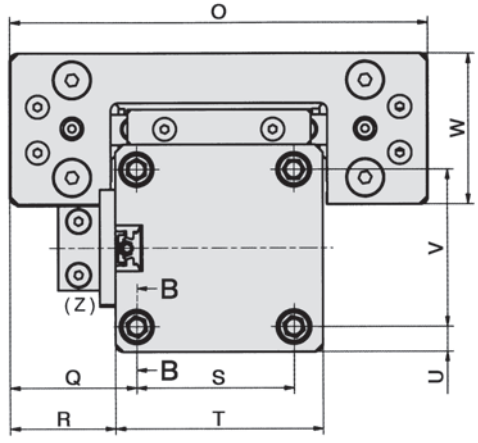


SA = Depth of thread
SB = Length of hex.

cross section X-X



view A



(Z) = Cushion set screw.

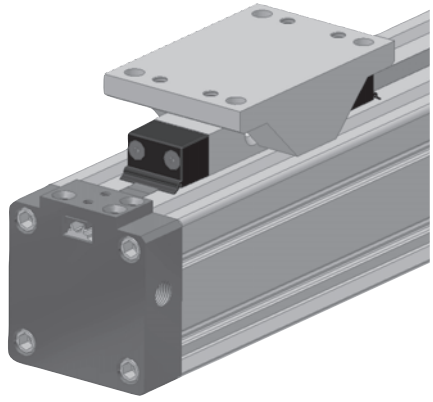
Drawing shows pressure supply type -01 for air connection on both ends.
Other types see page 10.156.

Piston Ø	A	B	C	D	E	F	G	H	J	K	M	N	O	P
25	67.5	95	135	G1/8	68.2	20	40	M5-7.5 mm deep	19	28.5	25	9.5	97	M4
32	77.5	115	155	G1/8	78	40	40	M6-9 mm deep	19	34.4	32.3	9.5	108.8	M5
40	95	143.5	190	G1/4	90.5	55	55	M6-12 mm deep	23	45	38.2	11.5	145	M6
50	105	148	210	G3/8	120	27.5	55	M8-15 mm deep	30	54.5	59	17	164	M8
63	125	188	250	G3/8	137	70	70	M8-17 mm deep	30	55	68.4	17	180	M8

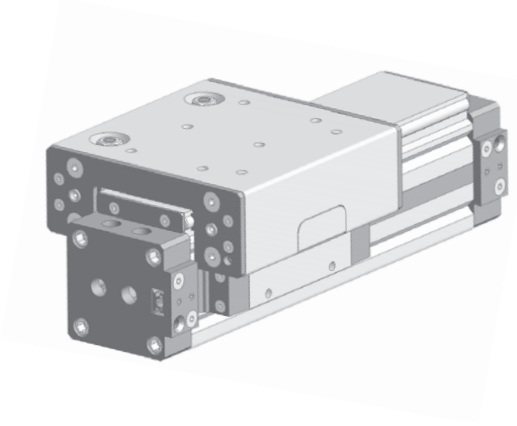
Piston Ø	Q	R	S	T	U	V	W	SA	SB	Ø X1	X2	Ø X3	Y1	Y2	Z
25	30.5	26	36	45	4.5	36	34.2	11	3	4	4.4 + 0.2	4 H7	8	7	4 + 0.02
32	32.9	27.4	41	54	6.5	41	39.5	11	4	4	4.4 + 0.2	4 H7	8	7	4 + 0.02
40	48	40.5	49	64	7.5	49	47	12	4	6	6.4 + 0.2	6 H7	8	7	6 + 0.02
50	49	36.5	65	90	12.5	65	51.5	17	5	6	6.4 + 0.2	6 H7	3.5	3	6 + 0.02
63	51	37	78	106	14	78	60.5	17	5	6	6.4 + 0.2	6 H7	7	6.5	6 + 0.02

Info

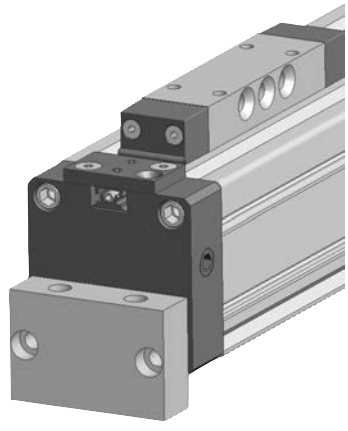
Seal kits
Page 10.157



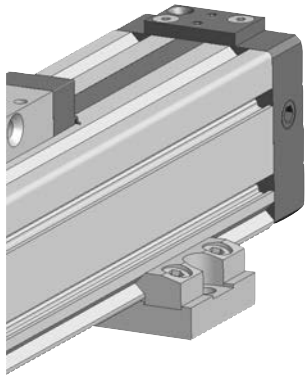
Alignment coupler
Page 10.155



Air connection options
Page 10.156



Head mount
Page 10.160

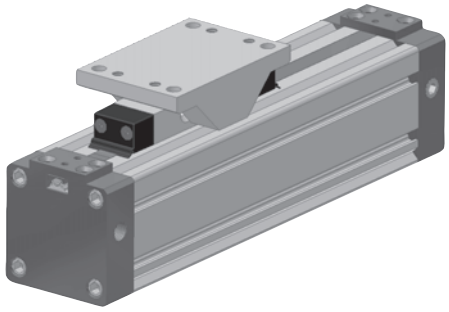


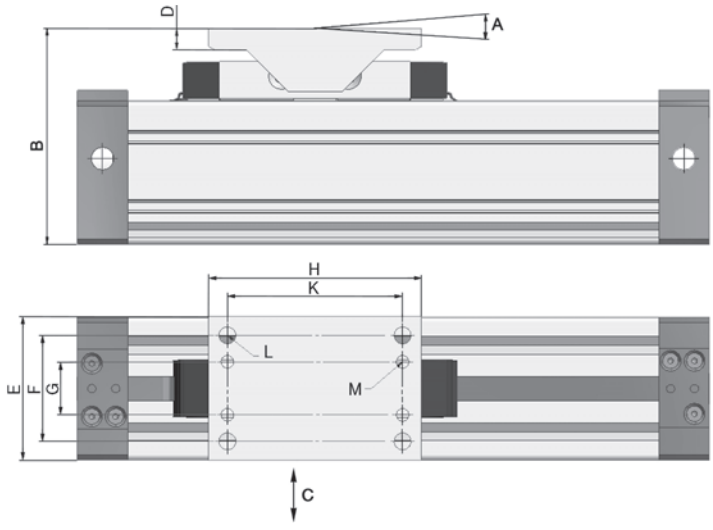
Center mount
Page 10.161

Proximity sensor
Page 10.170

Mounting parts for series ZX

Alignment coupler ZXB-Ø-20





Materials: Al (anodized)
hardened steel
brass

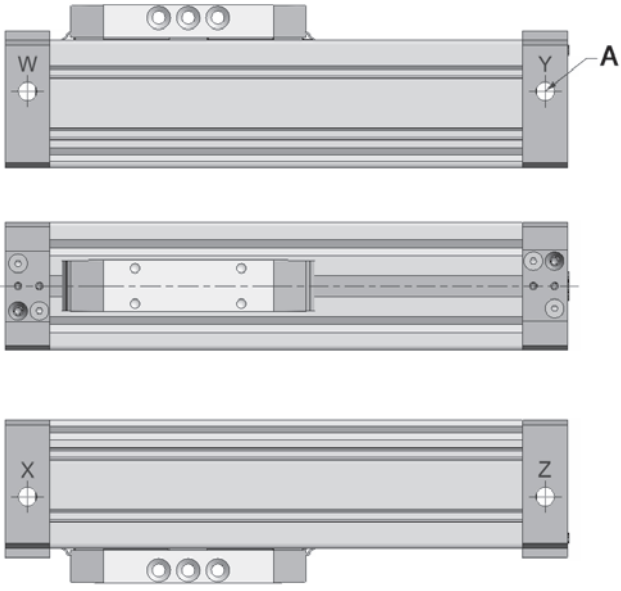
The alignment coupler is designed to be used with external guide systems. This coupler compensates for the mis-alignment between the rodless cylinder and the external guide system (supplied by customer). For use with cylinder series ZX-ø-K and ZX-ø-S.

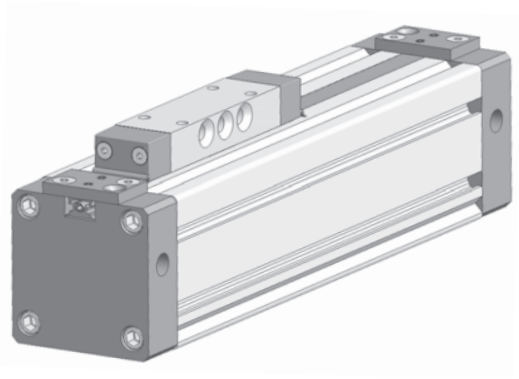
Order number	Cyl.-Ø	A	B	Radial clearance C
ZXB-25-20	25	16° (± 8°)	73 … 75	± 0.8
	32	12° (± 6°)	81.4 … 82.4	
ZXB-40-20	40	9° (± 4.5°)	93 … 95	
		12° (± 6°)	94 … 95	
ZXB-50-20	50	7° (± 3.5°)	129 … 130	
		10° (± 5°)	130 … 131	
	63	5° (± 2.5°)	144.5 … 145.5	
		9° (± 4.5°)	145.5 … 146.5	

Order number	Cyl.-Ø	D	E	F	G	H	K	L	M
ZXB-25-20	25	8	54	40	20	80	66	4 x ø 6.5	4 x M6
	32								
ZXB-40-20	40								
ZXB-50-20	50	11	80	51	23	122	102	4 x ø 9	4 x M8
	63								

Air connection for series ZX-Ø-S and ZX-Ø-K

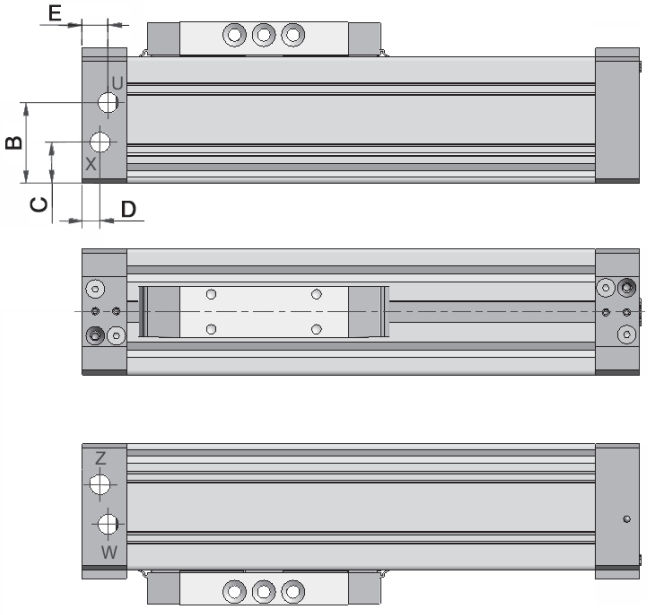
Option -01

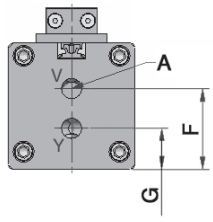


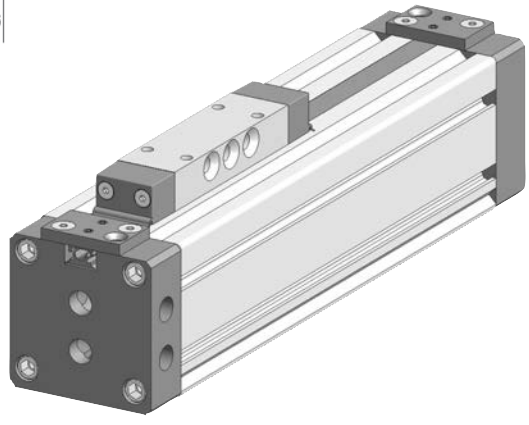


Option -01 cylinder comes with two pressure connections (W-X and Y-Z respectively) on each end. User is required to select one of two pressure connections on each end. Second port will require the installation of a sealing plug (2 plugs are supplied).

Option -02





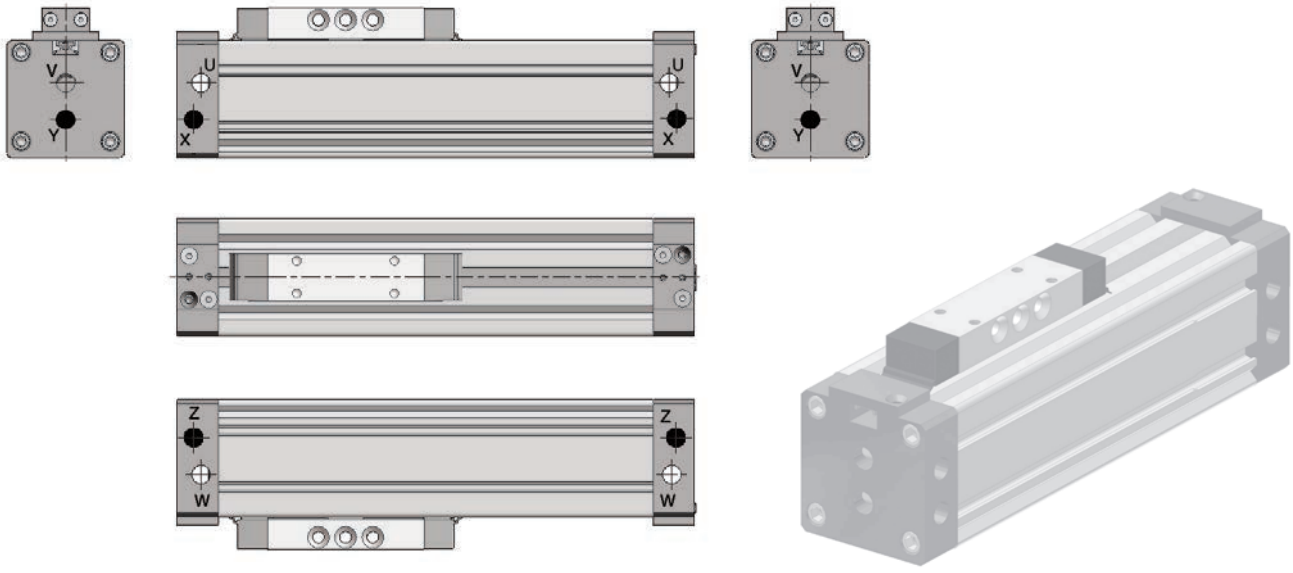


Cyl.-Ø	A	B	C	D	E	F	G
25	G1/8	28.5	13.5	8	11	29.5	13.5
32	G1/8	34.5	17.5	9.5	9.5	34.5	17.5
40	G1/4	42.5	20.5	11.5	11.5	38.2	15.5
50	G3/8	59	29	17	17	59	29.6
63	G3/8	68.4	34	17	17	68.4	34

One cylinder head is supplied with 6 ports (3 for each direction, U-V-W are for travel in one direction and X-Y-Z are for travel in the opposite direction). User is required to select one of three pressure connections for each direction. The second and third ports will require the installation of a sealing plug (4 plugs are supplied).
Ports V and Y must be plugged when using a head mount.

Air connection options for series ZX-Ø-S and ZX-Ø-K

Option -04



Option -04 enable to connect pressure at both face ends or one face and one side port.
Therefor the head with 6 ports from option -02 is used at both ends. Now it is possible to use the upper ports (U-V-W). The lower ports (X-Y-Z) are plugged.
This option is for using ports at both cylinder heads only.
The dimensions are identical to option -02.

Seal kit for series ZX

Order code

ZXV-32-0500

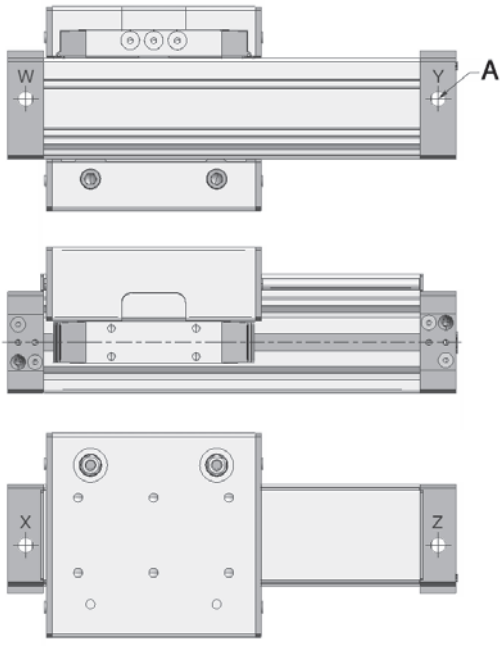
Series

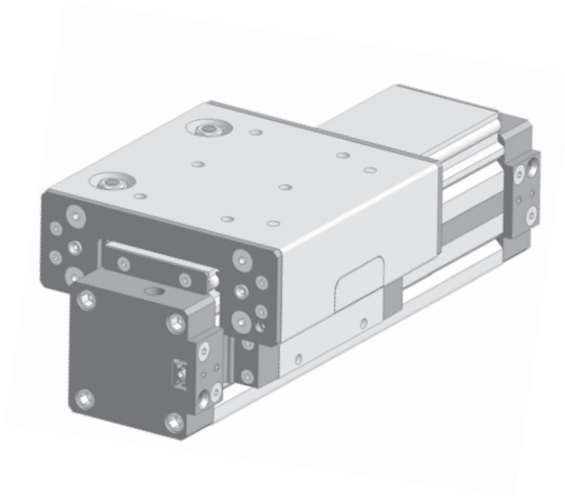
Piston Ø
(mm)

Stroke length
0500 = stroke lengths from 0 to 500 mm
1000 = stroke lengths from 501 to 1000 mm
1500 = stroke lengths from 1001 to 1500 mm
2000 = stroke lengths from 1501 to 2000 mm
3000 = stroke lengths from 2001 to 3000 mm
4000 = stroke lengths from 3001 to 4000 mm
5000 = stroke lengths from 4001 to 5000 mm
6000 = stroke lengths from 5001 to 6000 mm

Air connection options for series ZX-Ø-SG, ZX-Ø-KG, ZX-Ø-SR, ZX-Ø-KR

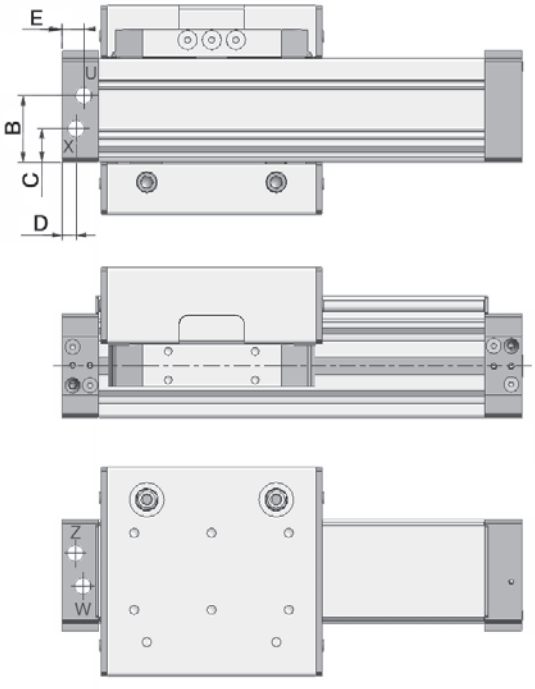
Option -01

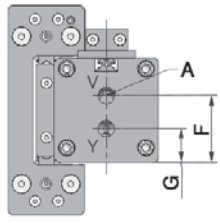




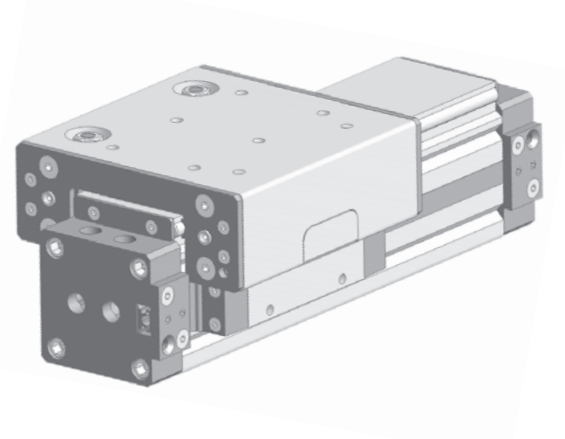
Option -01 cylinder comes with two pressure connections (W-X and Y-Z respectively) on each end. User is required to select one of two pressure connections on each end. Second port will require the installation of a sealing plug (2 plugs are supplied).

Option -02





view A



One cylinder head is supplied with 6 ports (3 for each direction, U-V-W are for travel in one direction and X-Y-Z are for travel in the opposite direction). User is required to select one of three pressure connections for each direction. The second and third ports will require the installation of a sealing plug (4 plugs are supplied).

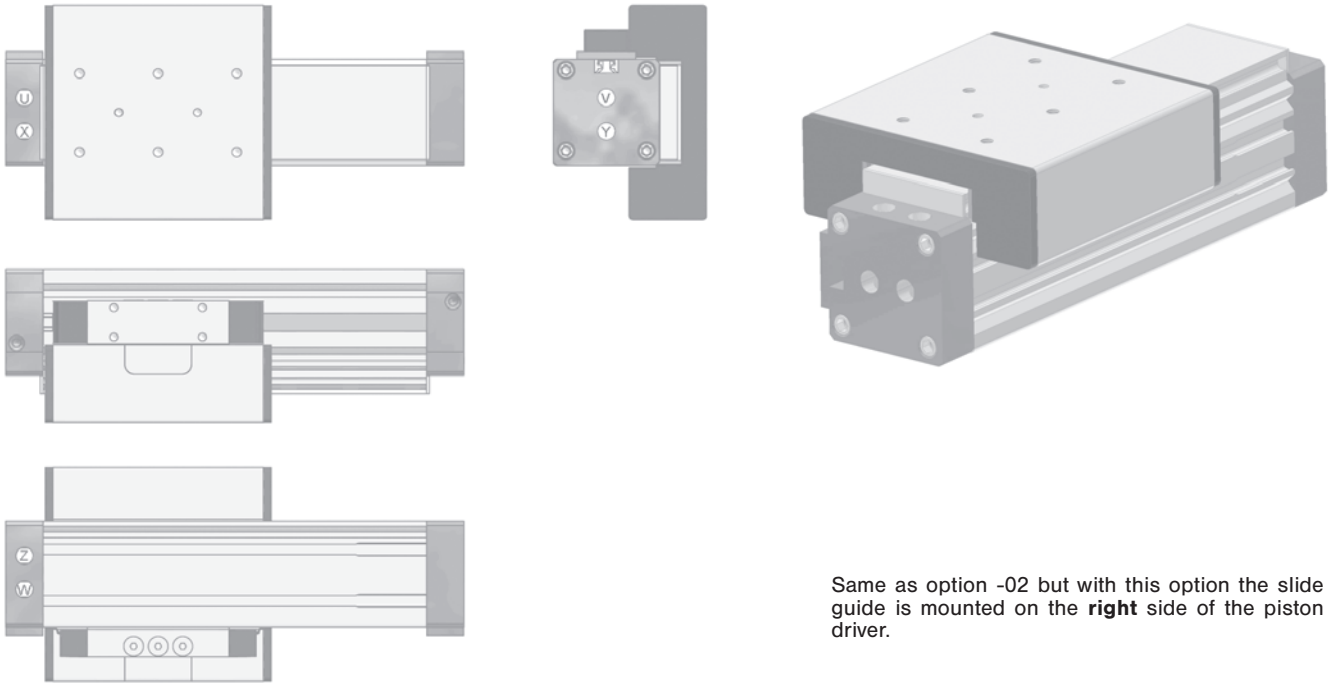
With this option the slide guide is mounted on the left side of the piston driver (see view A).

Ports V and Y must be plugged when using a head mount.

Cyl.-Ø	A	B	C	D	E	F	G
25	G1/8	28.5	13.5	8	11	29.5	13.5
32	G1/8	34.5	17.5	9.5	9.5	34.5	17.5
40	G1/4	42.5	20.5	11.5	11.5	38.2	15.5
50	G3/8	59	29	17	17	59	29.6
63	G3/8	68.4	34	17	17	68.4	34

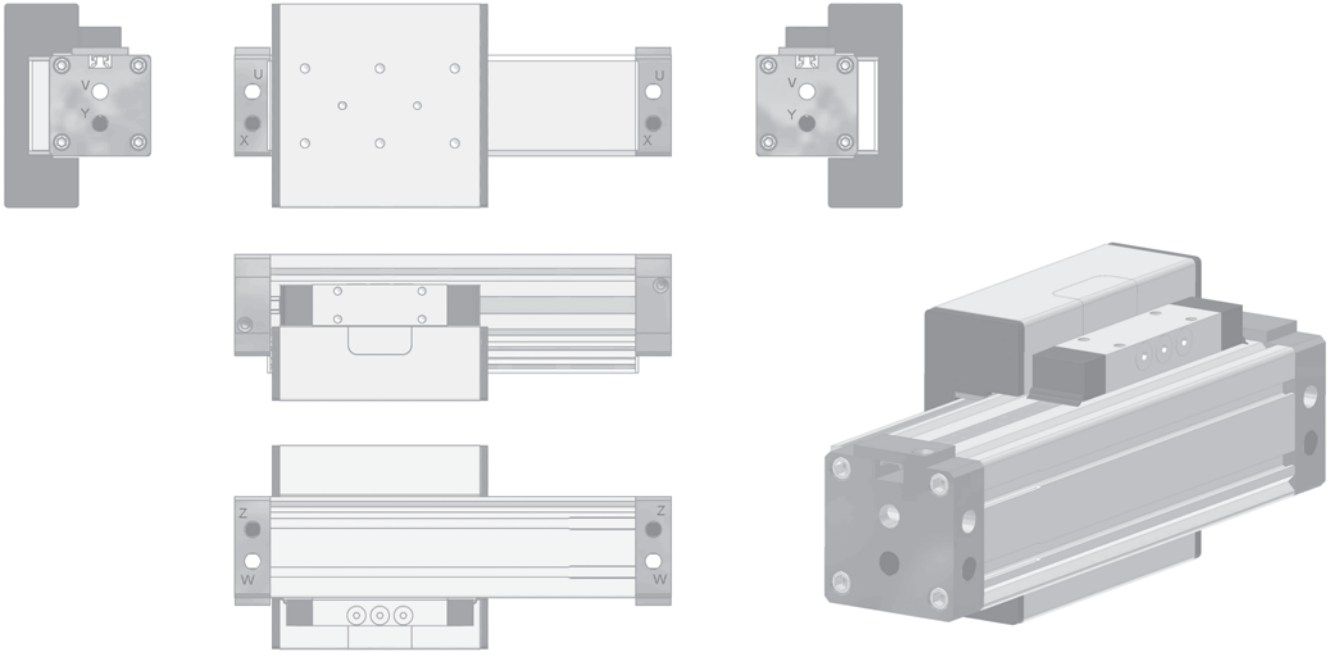
Air connection options for series ZX-Ø-SG, ZX-Ø-KG, ZX-Ø-SR, ZX-Ø-KR

Option -03



Same as option -02 but with this option the slide guide is mounted on the **right** side of the piston driver.

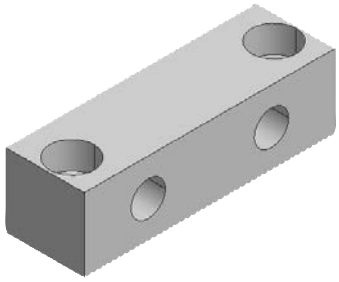
Option -04

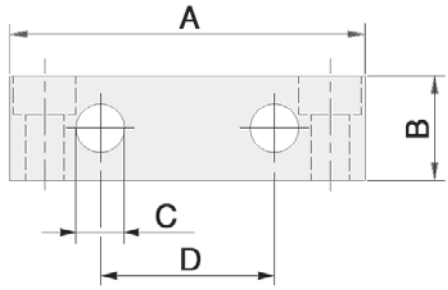


Option -04 enable to connect pressure at both face ends or one face and one side port.
Therefor the head with 6 ports from option -02 is used at both ends. Now it is possible to use the upper ports (U-V-W). The lower ports (X-Y-Z) are plugged.
This option is for using ports at both cylinder heads only.
The dimensions are identical to option -02.

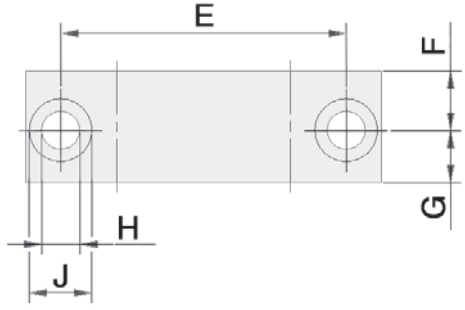
Mounting parts for series ZX

Head mount ZXB-Ø-01



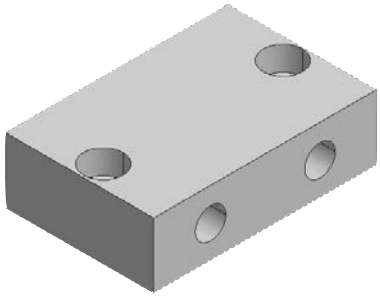


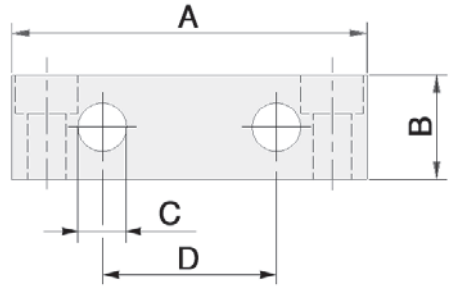
Materials: Al (anodized)
Screws to mount the head mount to the cylinder are included.
The face ports must be plugged when using a head mount.



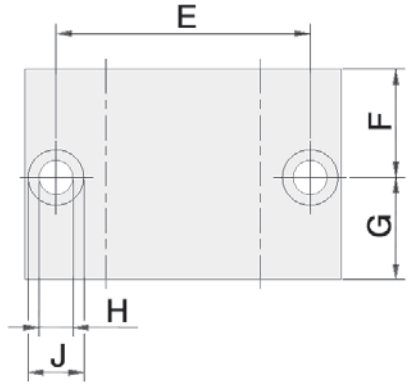
Cyl.-Ø	A	B	C	D	E	F	G	H	J
25	45	10	5.5	22	36	4.5	5.5	4.5	7.4
32	51	15	7	25	41	7.5	8.5	5.5	9
40	64	15	9	25	49	7.5	8.5	6.5	11
50	89	15	8.5	40	65	12.5	13.5	8.5	15
63	105	15	8.5	50	78	14	15	8.5	15

Head mount tall ZXB-Ø-02





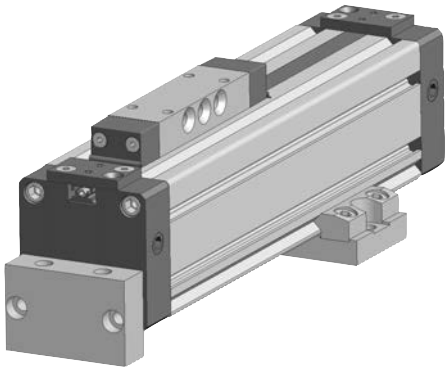
Materials: Al (anodized)
Screws to mount the head mount to the cylinder are included.
The face ports must be plugged when using a head mount.

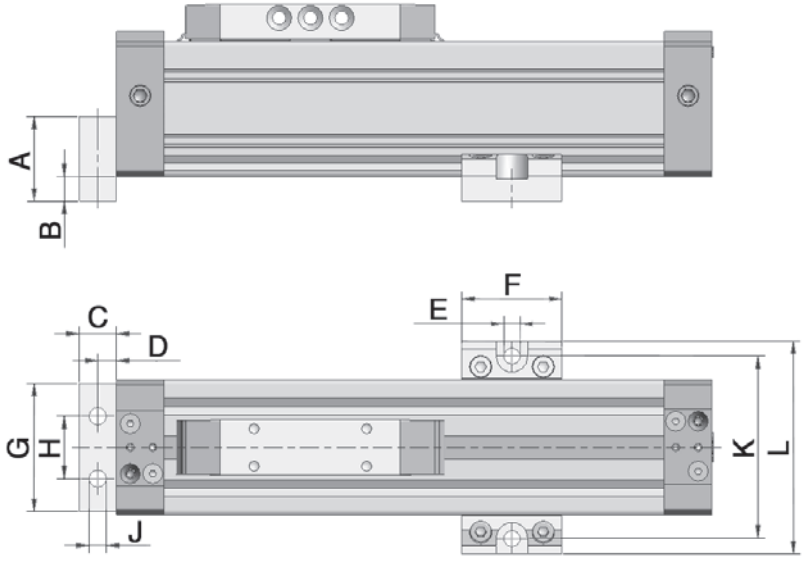


Cyl.-Ø	A	B	C	D	E	F	G	H	J
25	45	15	5.5	22	36	12.5	5.5	4.5	8
32	51	15	7	25	41	16.5	17.5	5.5	9
40	64	15	9	25	49	17.5	8.5	6.5	11
50	89	15	8.5	40	65	27.5	12.5	8.5	15
63	105	15	8.5	50	78	29	11	8.5	15

Mounting parts for series ZX

Center mount ZXB-Ø-10 with ZXB-Ø-02



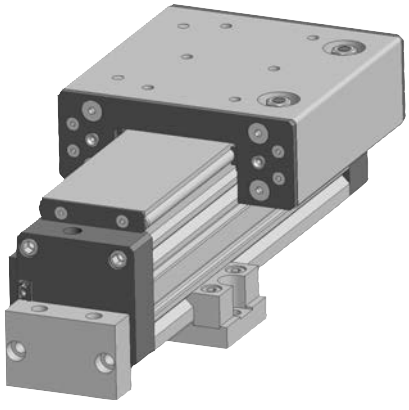


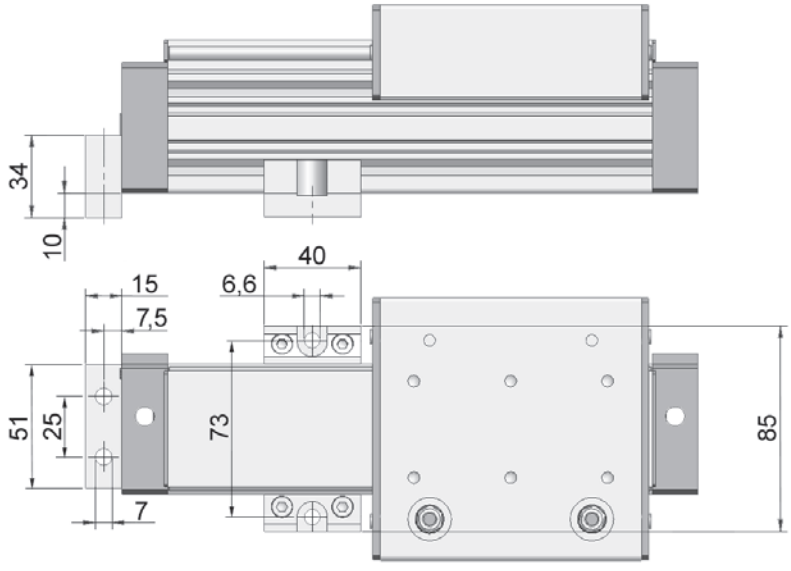
Materials: Al (anodized)
Screws to mount the head mount to the cylinder are included.
The cylinder can be securely mounted by using two center mounts without the need for head mounts.

Due to the symmetric profile of the cylinder-ø 25, 40, 50 and 63, the center mounts can be used on three sides of the profile. For ø 32 the center mount ZXB-32-10 is for use opposite of the carriage only. If mounting is required on the other two sides center mount ZXB-32-11 is required.

Cyl.-Ø	A	B	C	D	E	F	G	H	J	K	L
25	18	8	15	7.5	5.5	35	45	22	5.5	60	70
32	34	10	15	7.5	6.6	40	51	25	7	73	85
40	26	10	15	7.5	9	40	64	25	9	90.5	105
50	40	15	15	7.5	11	70	89	40	8.5	120	138
63	40	15	15	7.5	11	70	105	50	8.5	136	154

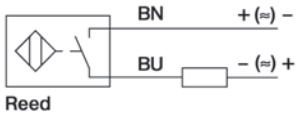
Center mount tall ZXB-32-11 with ZXB-32-02



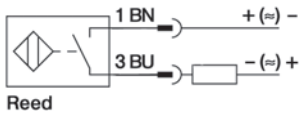


Materials: Al (anodized)
Screws to mount the head mount to the cylinder are included.
The cylinder can be securely mounted by using two center mounts without the need for head mounts.

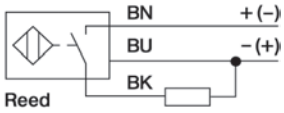
Wiring diagram



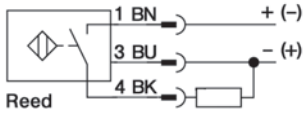
ZS-5600



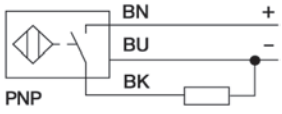
ZS-5601



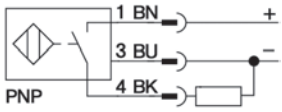
ZS-5700, ZS-5700-10



ZS-5701

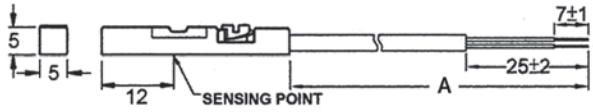


ZS-6700, ZS-7300

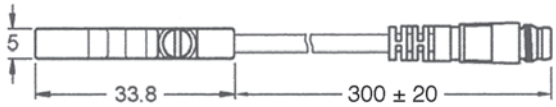


ZS-6701, ZS-7302 (dimensions for ZS-7302, page 9.221)

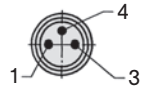
Dimensions



ZS-5600, ZS-6700, ZS-7300; A = 3.000 ± 20
ZS-5700; A = 5.000 ± 20
ZS-5700-10; A = 10.000 ± 20



ZS-5601, ZS-5701, ZS-6701



Function principles
Magnetic field sensors are actuated by magnetic fields and are especially suited for piston position detection in pneumatic cylinders. Based on the fact that magnetic fields can permeate non-magnetizable metals, it is possible to detect a permanent magnet attached to the piston through the aluminum wall of the cylinder.

Mounting tip
The sensor is firmly fixed in the groove by clockwise rotation of the screw.

Proximity sensors Reed contact

Order number	ZS-5600	ZS-5601	ZS-5700	ZS-5700-10	ZS-5701
Design	2-pole Reed sensor (non-polarized) normally open		3-pole Reed sensor* normally open		
Cable	ø 2.8, PUR				
Cable cross section	n/a				
Cable length	3 m	0.3 m	5 m	10 m	0.3 m
Cable plug	–	M 8	–	–	M 8
Overtravel speed	n/a				
Max. absolute hysteresis	n/a				
Temperature drift	n/a				
min. absolute repeat accuracy	n/a				
Operating temperature	– 10 °C … + 70 °C				
Degree of protection	IP 67				
Housing material	Plastic				
Switching status indication	LED red		LED yellow		
Rated operational voltage	5 … 240 V AC/DC	5 … 60 V AC/DC	5 … 30 V DC		
Rated operational current I_E DC	3 … 100 mA		≤ 500 mA		
Rated operational current I_E AC	3 … 100 mA		≤ 500 mA		
Breaking capacity	≤ 10 W				
No-load current	n/a		≤ 10 mA		
Max. OFF-state current	0 mA				
Max. switching frequency	≤ 0.2 kHz				
Rated insulation voltage	n/a				
Short-circuit protection	no				
Max. voltage drop at I_E	≤ 2.5 V		≤ 0.1 V		
Wire breakage	no				
Reverse polarity protection	yes				
Vibration resistance	9 g (1.5 mm, 10 – 55 Hz – 10 Hz)				
Shock resistance	30 g (11 ms)				
Explosion proof	–				

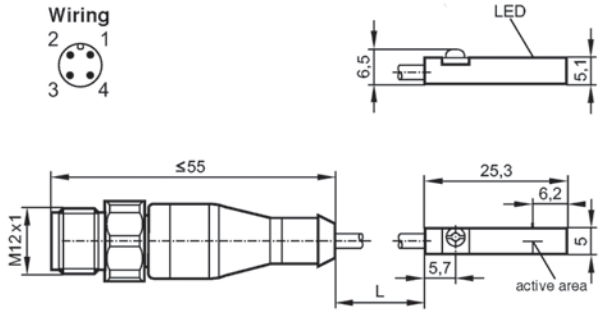
* Useable as 2-wire contact, voltage 0 … 30 V AC / 0 … 30 V DC, LED has no function.

Mounting bracket for round cylinder Ø 8 – 63 mm

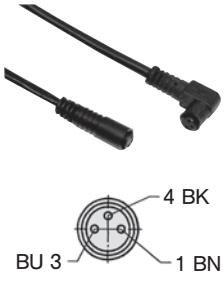
Order number	Piston Ø
NT-250	8 to 25 mm
NT-500	32 to 63 mm

Material: metal,
plastic PA GI/6T

Dimensions for ZS-7302



Connecting cable for ZS-5601, ZS-5701 and ZS-6701



Cable: PUR, black,
3 x 0.25 mm², ø 3.9,
high flexible
Operating voltage
0 … 48 V AC/DC

Order number	Length of cable	Connection
KA-30	3 m	8 mm sensor snap-in, straight
KA-50	5 m	8 mm sensor snap-in, straight
KA-51	5 m	8 mm sensor snap-in, 90°
KA-100	10 m	8 mm sensor snap-in, straight
KA-101	10 m	8 mm sensor snap-in, 90°

Proximity sensors electronic

Order number	ZS-6700	ZS-6701	ZS-7300	ZS-7302
Design	electronic, magnet-induktive sensor, normally open PNP output			
Cable	ø 2,8, PUR		n/a	
Cable cross section	n/a		3 x 0,14 mm²	
Cable lengths	3 m	0,3 m	6 m	0,3 m
Cable plug	–	M 8	–	M12
Overtravel speed	n/a		≤ 10 m/s	
Max. absolute hysteresis	n/a		n/a	
Temperatur drift	n/a		≤ 0,1 mm	
Min. absolute repeat accuracy	n/a		≤ 0,2 mm	
Operating temperature	– 10 °C … + 70 °C		– 25 °C … + 60 °C	
Degree of protection	IP 67		IP65/IP67	IP 67
Housing material	Plastic		Body: PA; Mounting band: stainless steel	
Switching status indication	LED green		LED yellow	
Rated operational voltage	5 … 30 V DC		10 … 30 V DC	
Rated operational current I_E DC	≤ 200 mA		≤ 100 mA	
Rated operational current I_E AC	–		–	
Breaking capacity	6 W		n/a	
No-load current	≤ 10 mA		≤ 10 mA	
Max. OFF-state current	n/a		n/a	
Max. switching frequency	≤ 1 kHz		> 6.000 Hz	> 10.000 Hz
Rated insulation voltage	n/a		n/a	
Short-circuit protection	yes		yes	
Max. voltage drop at I_E	≤ 1,0 V		≤ 2,5 V	
Wire breakage	yes		n/a	
Reverse polarity protection	yes		yes	
Vibration resistance	9 g (1.5 mm, 10 – 55 Hz – 10 Hz)		n/a	
Shock resistance	50 g (11 ms)		n/a	
Explosion proof	–		EX II 3G Ex nA T4 X EX II 3D Ex tD A22 IP67 T125°C X	EX II 3D Ex tc IIIC T125°C Dc X

Pneumatic and explosion protection

The directive 94/9/EC (ATEX)

ATEX derives it's name from ATmosphère EXposible and stands for the Directive 94/9/EC of the European Parliament. The Directive concerns electrical and non-electrical equipment and protection systems for use in potential explosive atmospheres.

Since 1st of July 2003, devices and protection systems for use in potentially explosive areas must satisfy the new Directive 94/9/EC.

Compared with the previons directives, it must be noted that the specification refers not only to electrical but also to mechanical equipment.

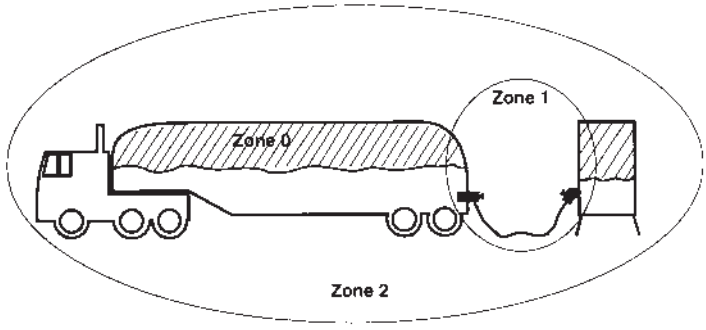
ATEX classifies explosive atmospheres and associates equipment

explosion protection document from plant manufacture	AIRTEC
Plant evaluation acc. to ATEX directive 99/92/EC	Equipment evaluation according (acc.) to ATEX directive 94/9/EC
– Zone classification – Temperature class – Explosion group – Ambient temperature	**– Equipment group** – Temperature class – Explosion group – Ambient temperature

General information

Category

The categories define which zones the devices may be used in. The classification states how frequently and in what concentration the ignitable mixture occurs. Furthermore, differentiation is made as to whether the hazard is due to gases, vapors and mists or due to dust.



Example of zone classification in gas Ex area.

Category 1

For devices, which guarantee a **very high level** of safety.
Intended for the case where an atmosphere at risk of explosion is to be expected frequently or continuously.
Devices in this category can also be used in Category 2 and 3.

Inflammable gases, vapors or mists

Zone 0 equivalent to Category 1G
Area in which an atmosphere at risk of explosion as a mixture of air and inflammable gases, vapors or mists is continuously or frequently present or present for long periods.

Inflammable dusts

Zone 20 equivalent to Category 1D
Area in which an atmosphere at risk of explosion in the form of a cloud of inflammable dust contained in the air is continuously or frequently present or present for long periods.

Category 2

For devices, which guarantee a **high level** of safety.
Intended for the case where an atmosphere at risk of explosion is to be expected.
Devices in this category can also be used in Category 3.

Inflammable gases, vapors or mists

Zone 1 equivalent to Category 2G
Area in which an atmosphere at risk of explosion as a mixture of air and inflammable gases, vapors or mists can form occasionally during normal operation.

Inflammable dusts

Zone 21 equivalent to Category 2D
Area in which an atmosphere at risk of explosion in the form of a cloud of inflammable dust contained in the air can form occasionally during normal operation.

Category 3

For devices, which guarantee a **normal level** of safety.
Intended for the case where an atmosphere at risk of explosion is to be expected rather infrequently and, if so, for only short periods.

Inflammable gases, vapors or mists

Zone 2 equivalent to Category 3G
Area in which an atmosphere at risk of explosion as a mixture of air and inflammable gases, vapors or mists does not normally occur at all or only for short periods during normal operation.

Inflammable dusts

Zone 22 equivalent to Category 3D
Area in which an atmosphere at risk of explosion in the form of a cloud of inflammable dust contained in the air does not normally occur at all or only for short periods during normal operation.

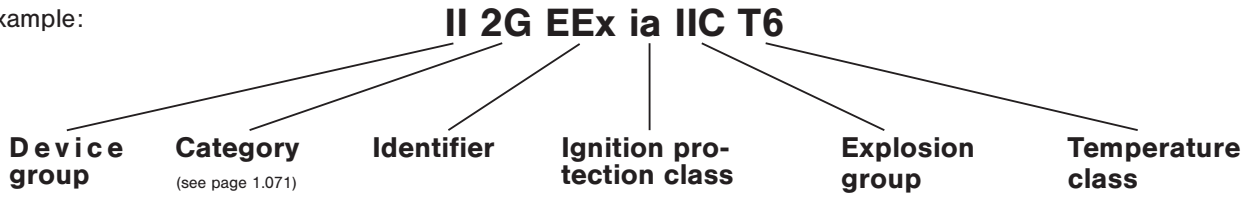
General information

According to 94/9/EC, a device that is to be used in an environment at risk of explosion may only be brought into the market if it satisfies the standards specified in the norm.

Compared with the previous directives, it must be noted that the specification refers not only to electrical but also to mechanical equipment (e.g. cylinders).

Devices are divided into categories and groups to accurately define the conditions of use. This definition is marked on the device and may appear as follows:

Example:



Device group

There are 2 groups of devices.
Devices of Group I, Category M are for use in underground mines and their above ground equipment, which are at risk from firedamp and/or inflammable dusts. (This is not given further coverage in this document).
All other areas at risk of explosion are combined in Device Group II.

Identifier

EEx defines that this is an electrical device.

Ignition protection class

This defines which measures are used to ensure explosion protection.
The following ignition protection classes are used by AIRTEC:
m = Encapsulation, **ia** = Intrinsic safety, **c** = Safe by design
Other ignition protection classes are defined in EN 50014: 1997. The abbreviations are currently under review discussion.
It should be noted that devices in ignition protection class ia may only be supplied from circuits that are certified to be intrinsically safe.

Explosion group

Device group II is sub-divided into Explosion Groups A, B or C.
This classification is dependent on the typical material properties of the gases and vapors that occur.
The hazard level of materials increases from Explosion Group IIA to IIC. The requirements for the devices increase accordingly. If a device is approved for IIC, it can be used for all other explosion groups. Alternatively, the chemical formula or the name of the material can be stated here.

Temperature class

It must be ensured that the ignition temperature of an inflammable material is not reached during operation. For this purpose, the maximum surface temperature of a device must be less than the minimum ignition temperature. For this reason, the maximum surface temperature of equipment for use with inflammable gases, vapors or mists is specified in temperature classes. For dusty environments, the maximum surface temperature is specified in °C.

Temperature class	Maximum permissible surface temperature of the equipment (°C)
T1	450
T2	300
T3	200
T4	135
T5	100
T6	85

The following AIRTEC products are available in explosion-proof design for Device Group II in accordance with 94/9/EC.

The following list is intended to provide an overview. Attention must be paid to the Operating Instructions and Declaration of Conformity before commissioning. These can be provided on request.

Electrically operated valves

Series	Functions	Classification	Special features	Catalogue/ NPTF folder page
MS-18/MS-98	310	II 2GD c T5 T 100° C	Valves are equipped with special actuators. Dimensional changes and technical data can be seen in the following pages. Compressed air in accordance with ISO 8573-1:2001 Class 74- free of any aggressive particles T_{Medium} – 10° C … + 50° C T_{amb} – 10° C … + 50° C	4.040/1.039
M-04	310, 311, 320, 510, 511, 520, 530, 533, 534			4.080
ME-04	311, 511			
M-05/M-95	310, 311, 320, 510, 511, 520, 530, 533, 534			4.110/1.040
ME-05	311, 320, 511, 520			4.110
MO-05	311			4.110
M-07/M-97	310, 311, 320, 510, 511, 520, 530, 533, 534			4.151/1.043
MO-07	311			4.151
ME-07	311, 320, 511, 520, 530			4.151
MG-07	510, 520, 530, 533, 534			–
MN-06	310, 311, 320, 510, 511, 520, 530, 533			5.020
M-22	310, 311, 320, 510, 511, 520, 530, 533, 534			4.181
ME-22	311, 520			
MO-22	310, 311			
KN-05	310, 311, 510, 511, 520, 530, 533, 534			5.040
KNE-05	511			
KM-09/KM-99	510, 511, 520, 530, 533, 534			4.120/1.027
KM-10/KM-90	510, 511, 520, 530, 533, 534			4.161/1.033
KME-10	520, 530, 533			–
MI-01	510, 511, 520, 530, 533			5.061
MI-02	510, 520, 530, 533			5.081
MI-03	510, 511, 520, 530, 533			5.101

Pneumatically operated valves

Series	Functions	Classification	Special features	Example order number	Catalogue page
P-04	311, 511, 530, 533, 534	II 2GD c T5 T 100° C	Compressed air in accordance with ISO 8573-1:2001 Class 74- free of any aggressive particles T_{Medium} – 10° C … + 50° C T_{amb} – 10° C … + 50° C	P-04-311-ATEX	–
P-05	310, 311/2, 320, 510, 511, 520, 530, 533, 534			P-05-310-ATEX	3.060
P-07	310, 311/2, 320, 510, 511, 520, 530, 533, 534			P-07-310-ATEX	3.080
PG-07	510, 520, 530, 533, 534			–	–
P-12	310, 311, 320, 510, 511, 520, 534			P-12-310-ATEX	3.100
L-25	310, 311, 320, 510, 520			L-25-310-ATEX	3.020
L-28	310, 311, 320, 510, 511, 520			L-28-310-ATEX	3.040
PI-01	510, 511, 520			PI-01-510-ATEX	–
PI-02	510, 520, 530, 533, 534			PI-02-510-ATEX	–
PI-03	510, 520, 530, 533, 534			PI-03-510-ATEX	–

Other series can be provided on request.

Manually operated valves

Series	Functions	Classification of the pneumatic valves	Special features	Example order number	Catalogue/ NPTF folder page
HF-12	310	II 2GD c T6 T 85° C	Compressed air in accordance with ISO 8573-1:2001 Class 74- free of any aggres- sive particles T_{Medium} – 10° C … + 50° C T_{amb} – 10° C … + 60° C	HF-12-310-ATEX	2.101
HF-14/HF-94	310, 510			HF-14-310-ATEX	2.101/1.002
HF-18/HF-98	310, 533			HF-18-310-ATEX	2.101/1.002
HR-12	on request			HR-12-…-ATEX	2.102
HR-14/HR-94	320, 530			HR-14-320-ATEX	2.102/1.003
HR-18/HR-98	520			HR-18-520-ATEX	2.102/1.003
T-28	311			T-28-311-ATEX	2.123
T-30	310			T-30-310-ATEX	2.125

Quick exhaust valves

Series	Functions	Classification of the pneumatic valves	Special features	Example order number	Catalogue page
SE-12	–	II 2GD c T6 T 85° C	Compressed air in accordance with ISO 8573-1:2001 Class 74- free of any aggres- sive particles T_{Medium} – 10° C … + 50° C T_{amb} – 10° C … + 50° C	SE-12-ATEX	8.160
SE-14	–			SE-14-ATEX	8.160
SE-18	–			SE-18-ATEX	8.160
SE-98	–			SE-98-ATEX	8.160

Speed regulation plates for valves acc. to NAMUR

Series	Classification	Special features	Example order number	Catalogue page
KN-063-DRH **KN-063-DRS** **KN-065-DRH** **KN-065-DRS**	II 2GD c T5 T 100° C – 10° C ≤ T_{amb} ≤ 50° C	Compressed air in accordance with ISO 8573-1:2001 Class 74- free of any aggressive particles T_{Medium} – 10° C … + 50° C T_{amb} – 10° C … + 50° C	KN-063-DRH-ATEX	5.042

The following accessories are approved for the valves:

Manifolds: R-281/n, R-283/n, R-181/n,R-183/n, R-141/n, R-143/n, RF-05, RF-07

Hollow bolt: H-281, H-283, H-183, H-143, HI-143, HI-183

Blind plates: R-281-V, R-283-V, R-181-V, R-183-V, RF-09-V, RF-10-V, R-141-V, RF-04-V, RF-C-07-V, R-143-V, MG-07-V

Brackets: R-281-W, R-181-W, R-141-W

Modular manifolds: RF-09/n, RF-10/n, RF-19-E, RF-09-E1, RF-10-E1, RF-09-E2, RF-10-E2, RF-09-Z1, RF-10-Z1, RF-09-Z4, RF-10-Z4, RF-24, RF-C/n

Seal plate: RF-19-01

Cylinders

Series	Classification	Special features	Example order number	Catalogue page
XL	II 2GD c T5 T 100° C – 20° C ≤ T_{amb} ≤ 80° C	Compressed air in accordance with ISO 8573-1:2001 Class 74- At V > 1 m/s Class 744 free of any aggressive particles T_{Medium} – 20° C … + 50° C T_{amb} – 20° C … + 80° C Max permissible energy in the end positions: ø 32 – 0,1 J, ø 40 and 50 – 0,2 J, ø 63 – 0,5 J, ø 80 – 0,9 J, ø 100 – 1,2 J, ø 125 – 5 J	XL-040-0320-000-ATEX	9.009
XG	II 2GD c T5 T 100° C – 20° C ≤ T_{amb} + 80° C	Compressed air in accordance with ISO 8573-1:2001 Class 74- At V > 1 m/s Class 744 free of any aggressive particles	XG-160-0250-000-ATEX	9.030
CX			CX-032-0250-000-ATEX	9.180
HM			HM-016-025-ATEX	9.081
CM			CM-16-025-ATEX	9.170

The following accessories are approved for the cylinders:

Flexible coupling	FK	Cylinder fixings	XLB-ø-01, XLB-ø-02, XLB-ø-03,
Rod eye	FO and RO up to Vmax 1 m/s		XLB-ø-04, XLB-ø-05, XLB-ø-06,
Rod clevis	FD and RD		XLB-ø-07, XLB-ø-08, XLB-ø-09,
Piston rod nut	FE and RL		XLB-ø-10, XLB-ø-12

Rodless cylinders

Series	Classification	Special features	Example order number	Catalogue page
ZX	II 2G T6 T 85° C, – 20° C ≤ T_{amb} ≤ 60° C	Compressed air in accordance with ISO 8573-1:2001 Class 74- free of any aggressive particles V_{max} 1 m/s T_{Medium} – 10° C … + 50° C T_{amb} – 10° C … + 60° C	ZX-25-S-0500-01ATEX	10.140

The following accessories are approved for the cylinders:

Head mount	ZXB-Ø-01	Trunnion mount	ZXB-Ø-10
Head mount tall	ZXB-Ø-02		

Proximity Sensors

Series	Classification	Order number	Catalogue page
ZS	II 3G Ex nA T4 II 3D Ex tD A22 IP67 T 125 °C	ZS-7300	9.221
	EX II 3D Ex tc IIIC T125°C Dc X	ZS-7302	

Electrically operated valves

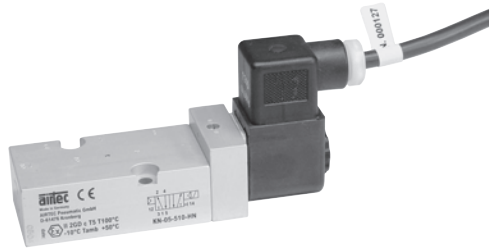
in Ex-proof design

Valves from the (e.g. **MS-98, M-95, others see table page 10.183)** ranges can be provided in explosion proof design in accordance with 94/9/EC (ATEX) for device group II.

For this purpose, special valves are equipped with alternative electrical equipment. The dimensional changes of these components, which are mounted on the valve housing, can be seen on the following pages.

The valves are supplied in an assembled state, complete with valve, as the approval relates both to the electrical and the mechanical components. Individual parts may only be supplied for replacement purposes.

When ordering, the number of the required design must be added to the valve order number, or the required version must be noted in the item text.



Example 1: M-05-510-HN-**Ex037**-24V=

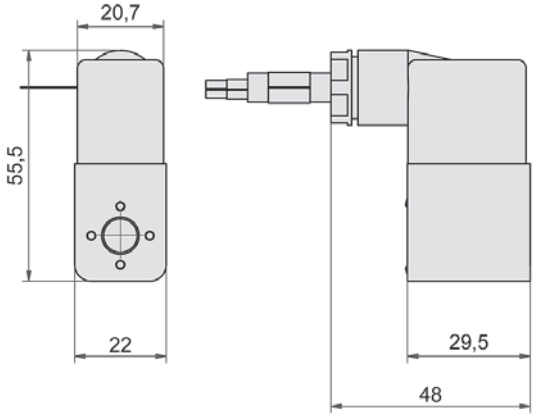
Example 2: M-95-510-HN
Solenoid valve 5/2-way 1/8 NPTF,
explosion proof design **Ex037**
Control voltage 24V=.

The specified technical boundary conditions are to enable the user to make a selection. The operating instructions for the valve and the electrical equipment must be taken into account before putting into operation. These are included with each valve and we would be pleased to send them to you on request by quoting Order No. 54-ATEX-01.

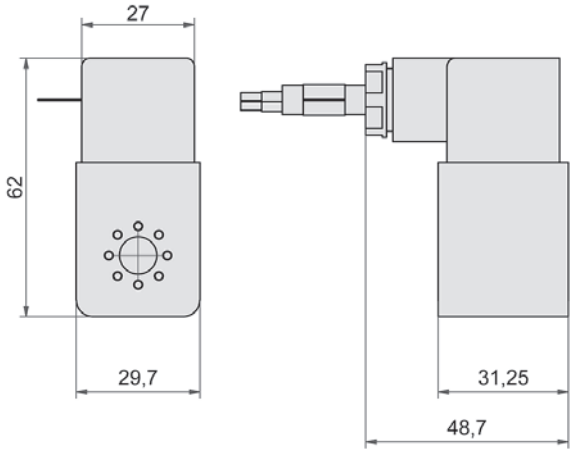
Version	23-SP-037-012-xx	23-SP-037-025-xx	23-SP-037-027-xx	23-SP-038-01-912	23-SP-040-B12	23-SP-040-B27	23-SP-041-A12
Width	30 mm						22 mm
Ignition protection class	Encapsulated with casting compound mb (gases) mb tb (dust)			Intrinsically safe ia (gases) t (dust)	Non-sparking device nA (gases) tc (dust)		
Classification	II 2G Ex mb IIC T5 II 2D Ex mb tb IIIC T95°C IP65			II 2G Ex ia IIC T6 Ga (≤ 28VDC) II 2G Ex ia IIB T6 Ga (≤ 32VDC) II 2D Ex t IIIC T80°C Db IP65	II 3G Ex nA IIC T5 Gc II 3D Ex tc IIIC T95°C Dc IP65		II 3G Ex nA IIC T5 Gc X II 3D Ex tc IIIC T5 Dc X
Rated voltage	24 VDC	110…120 VAC	230 VAC	U ≦ 28VDC / U ≦ 32VDC	24 VDC	230 VAC	24 VDC
Rated current	136 mA	27 mA	14 mA	I ≦ 115 mA / I ≦ 195 mA	112 mA	15 mA…18 mA	120 mA
Rated power	3,3 W	3 VA	3,1 VA	–	2,7 W	4 VA	3 W
Cable length	xx: 03 = 3 m (standard) xx: 05 = 5 m xx: 10 = 10 m			– incl. connector			– without connector*1
Medium	Compressed air in accordance with ISO-8573-1 : 2001, Class 7 4 - Free of any aggressive particles						
Temperature range	– 20 °C…+ 50 °C			– 40 °C…+ 50 °C	– 20 °C…+ 50 °C		– 15 °C…+ 50 °C
Ambient Battery fitted	– 20 °C…+ 40 °C			–	–		–
Temperature range Medium	– 10 °C … + 50 °C **(Mounting on manifold -10°C…+40°C)**						
Pressure range	depending on armature						

Version	23-SP-036-012-03	23-SP-036-011-03	23-SP-045-B12	23-SP-045-B27
Width	22 mm		36 mm	
Ignition protection class	Encapsulated with casting compound mb (gases) mb tb (dust)		Flame proof enclosures / Encapsulated with casting compound d mb (gases) tb (dust)	
Classification	II 2G Ex mb IIC T4 II 2D Ex mb tb IIIC T130°C IP65		II 2G Ex d mb IIC T5 Gb II 2D Ex tb IIIC T95°C Db IP66	
Rated voltage	24 VDC	12 VDC	24 VDC	230 VAC
Rated current	207 mA	375 mA	125 mA	14 mA
Rated power	5 W	4,5 W	3 W	3,8 VA
Cable length	3 m		Terminal box	
Medium	Compressed air in accordance with ISO-8573-1 : 2001, Class 7 4 - Free of any aggressive particles			
Temperature range	– 20 °C…+ 50 °C		– 50 °C…+ 50 °C	
Ambient Battery fitted	–		–	
Temperature range Medium	– 10 °C … + 50 °C **(Mounting on manifold -10°C…+40°C)**		–	
Pressure range	depending on armature			

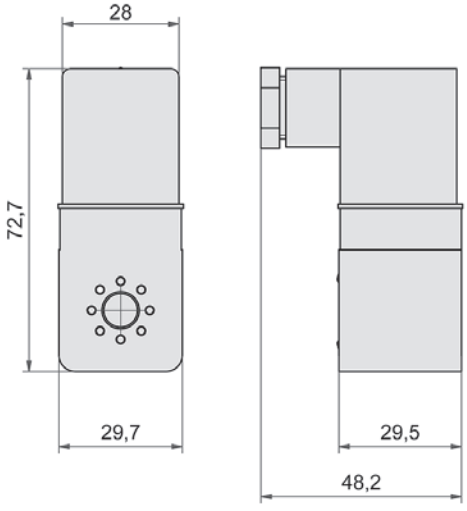
23-SP-036, Dimensions



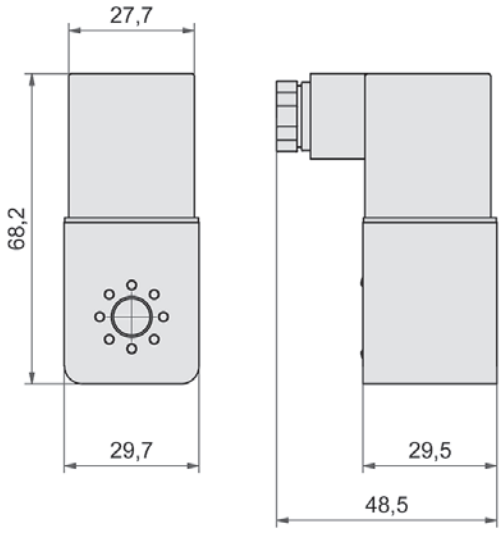
23-SP-037, Dimensions



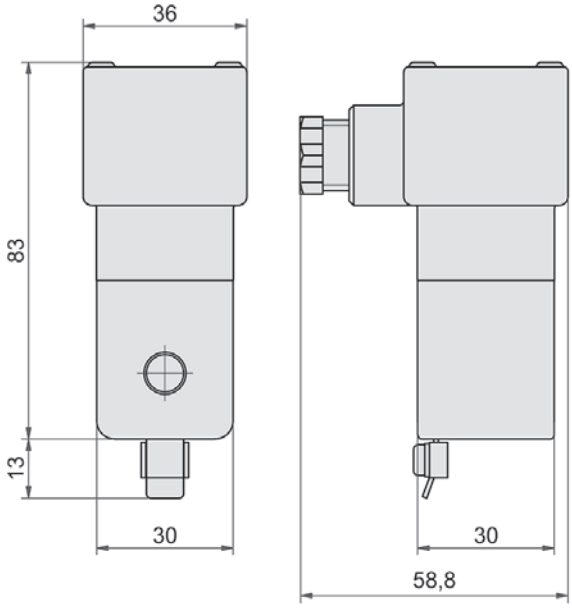
23-SP-038, Dimensions



23-SP-040, Dimensions



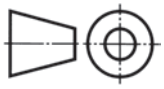
23-SP-045, Dimensions



A Drawings

The method of projection within this catalouge is the first angle projection according to DIN ISO 5456-2.

First angle projection (Used in this catalogue)
Is based on the idea that the body is turned to the side. This means that a view from left is on the right hand side of the main view.



Third angle projection
Normally used in USA and english speaking countries. Specify that a view from right has to be on the right hand side of the main view.

All dimensions in the drawings are generally in millimeters (mm) if not stated otherwise. The abbreviations SW, WS, or CH are the short form of wrench size.

B Length

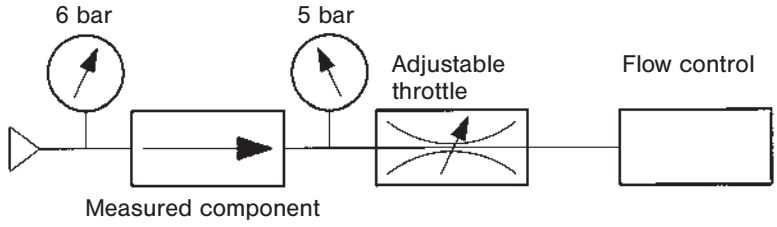
The following table assists in the conversion of the used mm dimension to inches.
For precise calculation please use the following formula:

mm to inch 1 mm = 0.03937 inch
inch to mm 1 inch = 25.4 mm

mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
0.1	0.0039	3.8	0.1496	7.5	0.2953	11.2	0.4409	14.9	0.5866	290	11.417
0.2	0.0079	3.9	0.1535	7.6	0.2992	11.3	0.4449	15.0	0.5906	300	11.811
0.3	0.0118	4.0	0.1575	7.7	0.3031	11.4	0.4488	20.0	0.7874	310	12.205
0.4	0.0157	4.1	0.1614	7.8	0.3071	11.5	0.4528	25.0	0.9843	320	12.598
0.5	0.0197	4.2	0.1654	7.9	0.3110	11.6	0.4567	30.0	1.1811	330	12.992
0.6	0.0236	4.3	0.1693	8.0	0.3150	11.7	0.4606	35.0	1.3780	340	13.386
0.7	0.0276	4.4	0.1732	8.1	0.3189	11.8	0.4646	40.0	1.5748	350	13.780
0.8	0.0315	4.5	0.1772	8.2	0.3228	11.9	0.4685	45.0	1.7717	360	14.173
0.9	0.0354	4.6	0.1811	8.3	0.3268	12.0	0.4724	50.0	1.9685	370	14.567
1.0	0.0394	4.7	0.1850	8.4	0.3307	12.1	0.4764	55.0	2.1654	380	14.961
1.1	0.0433	4.8	0.1890	8.5	0.3346	12.2	0.4803	60.0	2.3622	390	15.354
1.2	0.0472	4.9	0.1929	8.6	0.3386	12.3	0.4843	65.0	2.5591	400	15.748
1.3	0.0512	5.0	0.1969	8.7	0.3425	12.4	0.4882	70.0	2.7559	410	16.142
1.4	0.0551	5.1	0.2008	8.8	0.3465	12.5	0.4921	75.0	2.9528	420	16.535
1.5	0.0591	5.2	0.2047	8.9	0.3504	12.6	0.4961	80.0	3.1496	430	16.930
1.6	0.0630	5.3	0.2087	9.0	0.3543	12.7	0.5000	85.0	3.3465	440	17.323
1.7	0.0669	5.4	0.2126	9.1	0.3583	12.8	0.5039	90.0	3.5433	450	17.717
1.8	0.0709	5.5	0.2165	9.2	0.3622	12.9	0.5079	95.0	3.7402	460	18.110
1.9	0.0748	5.6	0.2205	9.3	0.3661	13.0	0.5118	100	3.937	470	18.504
2.0	0.0787	5.7	0.2244	9.4	0.3701	13.1	0.5157	110	4.331	480	18.898
2.1	0.0827	5.8	0.2283	9.5	0.3740	13.2	0.5197	120	4.724	490	19.291
2.2	0.0866	5.9	0.2323	9.6	0.3780	13.3	0.5236	130	5.119	500	19.685
2.3	0.0906	6.0	0.2362	9.7	0.3819	13.4	0.5276	140	5.512	510	20.079
2.4	0.0945	6.1	0.2402	9.8	0.3858	13.5	0.5315	150	5.906	520	20.472
2.5	0.0984	6.2	0.2441	9.9	0.3898	13.6	0.5354	160	6.230	530	20.866
2.6	0.1024	6.3	0.2480	10.0	0.3937	13.7	0.5394	170	6.693	540	21.260
2.7	0.1063	6.4	0.2520	10.1	0.3976	13.8	0.5433	180	7.087	550	21.654
2.8	0.1102	6.5	0.2559	10.2	0.4016	13.9	0.5472	190	7.480	560	22.047
2.9	0.1142	6.6	0.2598	10.3	0.4055	14.0	0.5512	200	7.874	570	22.441
3.0	0.1181	6.7	0.2638	10.4	0.4094	14.1	0.5551	210	8.268	580	22.835
3.1	0.1220	6.8	0.2677	10.5	0.4134	14.2	0.5591	220	8.661	590	23.228
3.2	0.1260	6.9	0.2717	10.6	0.4173	14.3	0.5630	230	9.056	600	23.622
3.3	0.1299	7.0	0.2756	10.7	0.4213	14.4	0.5669	240	9.449	700	27.559
3.4	0.1339	7.1	0.2795	10.8	0.4252	14.5	0.5709	250	9.843	750	29.528
3.5	0.1378	7.2	0.2835	10.9	0.4291	14.6	0.5748	260	10.236	800	31.496
3.6	0.1417	7.3	0.2874	11.0	0.4331	14.7	0.5787		10.630	900	35.433
3.7	0.1457	7.4	0.2913	11.1	0.4370	14.8	0.5827	280	11.024	1000	39.370

C Flow rate

The flow rate values given in the AIRTEC catalouge are in Nl/min. and based on a pressure drop from a pressure inlet 6 bar (87 psi) to a pressure outlet of 5 bar (72.5 psi). The flow rates are measured with the following experimental circuit.



The table below simplifies the calculation of Cv and Kv values.
For precise calculation please use the following formula:

Nl/min to K_V K_V = Nl/min / 1100
Nl/min to C_V C_V = Nl/min / 984

Nl/min.	K_V	C_V
10	0.0091	0.0102
20	0.0182	0.0203
30	0.0273	0.0305
40	0.0364	0.0407
50	0.0455	0.0508
60	0.0545	0.0610
70	0.0636	0.0711
80	0.0727	0.0813
90	0.0818	0.0915
100	0.0900	0.1016
110	0.1000	0.1118
120	0.1091	0.1220
130	0.1182	0.1321
140	0.1273	0.1423
150	0.1364	0.1524
160	0.1455	0.1626
170	0.1545	0.1728
180	0.1636	0.1829
190	0.1727	0.1931
200	0.1818	0.2033
250	0.2273	0.2541
300	0.2727	0.3049
350	0.3182	0.3557
400	0.3636	0.4065
450	0.4091	0.4573
500	0.4545	0.5081
550	0.5000	0.5589
600	0.5455	0.6098
650	0.5909	0.6606
700	0.6364	0.7114
750	0.6818	0.7622
800	0.7273	0.8130
850	0.7727	0.8638
900	0.8182	0.9146
950	0.8636	0.9654
1000	0.9090	1.0163
1050	0.9545	1.0671
1100	1.0000	1.1179
1150	1.0450	1.1687
1200	1.0900	1.2195
1250	1.1364	1.2703
1300	1.1818	1.3211
1350	1.2273	1.3720
1400	1.2727	1.4228
1450	1.3182	1.4736

Nl/min.	K_V	C_V
1500	1.3636	1.5244
1550	1.4091	1.5752
1600	1.4545	1.6260
1700	1.5455	1.7276
1800	1.6364	1.8293
1900	1.7273	1.9309
2000	1.8182	2.0325
2100	1.9091	2.1341
2200	2.0000	2.2358
2300	2.0909	2.3374
2400	2.1818	2.4390
2500	2.2727	2.5407
2600	2.3636	2.6423
2700	2.4545	2.7439
2800	2.5455	2.8455
2900	2.6364	2.9472
3000	2.7273	3.0488
3100	2.8182	3.1504
3200	2.9091	3.2520
3300	3.0000	3.3537
3400	3.0909	3.4553
3500	3.1818	3.5569
3750	3.4091	3.8110
4000	3.6364	4.0650
4250	3.8636	4.3191
4500	4.0909	4.5732
4750	4.3182	4.8272
5000	4.5455	5.0813
5250	4.7727	5.3354
5500	5.0000	5.5894
5750	5.2273	5.8435
6000	5.4545	6.0976
6250	5.6818	6.3516
6500	5.9091	6.6057
6750	6.1364	6.8598
7000	6.3636	7.1138
7250	6.5909	7.3679
7500	6.8182	7.6220
7750	7.0455	7.8760
8000	7.2727	8.1301
8250	7.5000	8.3841
8500	7.7273	8.6382
8750	7.9545	8.8923
9000	8.1818	9.1463

D Pressure

The data contained in the AIRTEC catalogue for pressures are given in bar.
The table below shows conversion to psi.

1 bar = 100 kPa = 14.5 psi = 10 N/cm²
1 psi = 0.069 bar = 6896.5 Pa = 1 lb./sq. in.
1 Pa = 0.00001 bar = 0.000145 psi = 1 N/m²

bar	psi	kPa	bar	psi	kPa	bar	psi	kPa
0.05	0.725	5	0.90	13.050	90	7.00	101.500	700
0.10	1.450	10	1.00	14.500	100	7.50	108.750	750
0.15	2.175	15	1.50	21.750	150	8.00	116.000	800
0.20	2.900	20	2.00	29.000	200	8.50	123.250	850
0.25	3.625	25	2.50	36.250	250	9.00	130.500	900
0.30	4.350	30	3.00	43.500	300	9.50	137.750	950
0.35	5.075	35	3.50	50.750	350	10.00	145.000	1000
0.40	5.800	40	4.00	58.000	400	10.50	152.250	1050
0.45	6.525	45	4.50	65.250	450	11.00	159.500	1100
0.50	7.250	50	5.00	72.500	500	11.50	166.750	1150
0.60	8.700	60	5.50	79.750	550	12.00	174.000	1200
0.70	10.150	70	6.00	87.000	600	14.00	203.000	1400
0.80	11.600	80	6.50	94.250	650	16.00	232.000	1600

E Temperature

The temperature values given in the AIRTEC-catalogue are in °C.
The following table assists in the conversion to °F or Kelvin (°K).

Formula °C to °F

$$\frac{C \times 9}{5} + 32 = °F$$

Formula °F to °C

$$(F - 32) \times \frac{5}{9} = °C$$

°C → °F		°C → °F	
−100	−148	75	167
−95	−139	80	176
−90	−130	85	185
−85	−121	90	194
−80	−112	100	212
−75	−103	110	230
−70	−94	120	248
−65	−85	130	266
−60	−76	140	284
−55	−67	150	302
−50	−58	160	320
−45	−49	170	338
−40	−40	180	356
−35	−31	190	374
−30	−22	200	392
−25	−13	210	410
−20	−4	220	428
−15	5	230	446
−10	14	240	464
−5	23	250	482
0	32	260	500
5	41	270	518
10	50	280	536
15	59	290	554
20	68	300	572
25	77	310	590
30	86	320	608
35	95	330	626
40	104	340	644
45	113	350	662
50	122	360	680
55	131	370	698
60	140	380	716
65	149	390	734
70	158	400	752

°F → °C		°F → °C	
−100	−73.3	70	21.1
−95	−70.6	75	23.9
−90	−67.8	80	26.7
−85	−65.0	90	32.2
−80	−62.2	100	37.8
−75	−59.4	110	43.3
−70	−56.7	120	48.9
−65	−53.9	130	54.4
−60	−51.1	140	60.0
−55	−48.3	150	65.6
−50	−45.6	160	71.1
−45	−42.8	170	76.7
−40	−40.0	180	82.2
−35	−37.2	190	87.8
−30	−34.4	200	93.3
−25	−31.7	210	98.9
−20	−28.9	220	104.4
−15	−26.1	230	110.0
−10	−23.3	240	115.6
−5	−20.6	250	121.1
0	−17.8	260	126.7
5	−15.0	270	132.2
10	−12.2	280	137.8
15	−9.4	290	143.3
20	−6.7	300	148.9
25	−3.9	310	154.4
30	−1.1	320	160.0
32	0.0	330	165.6
35	1.7	340	171.1
40	4.4	350	176.7
45	7.2	360	182.2
50	10.0	370	187.8
55	12.8	380	193.3
60	15.6	390	198.9
65	18.3	400	204.4

°C	°F	°K
−20	−4	253.15
−15	5	258.15
−10	14	263.15
−5	23	268.15
0	32	273.15
5	41	278.15
10	50	283.15
15	59	288.15
20	68	293.15
25	77	298.15
30	86	303.15
35	95	308.15
40	104	313.15
45	113	318.15
50	122	323.15
55	131	328.15
60	140	333.15
65	149	338.15
70	158	343.15
75	167	348.15
80	176	353.15
85	185	358.15
90	194	363.15
95	203	368.15
100	212	373.15
105	221	378.15
110	230	383.15
115	239	388.15
120	248	393.15
125	257	398.15
130	266	403.15
135	275	408.15
140	284	413.15
145	293	418.15
150	302	423.15

F SI – Basic units

Description	Symbol	SI-unit	SI-name
Area	A	m^2	square meter
Current intensity	I	A	Ampere
Energy (work)	W	J, Nm	Joule, Newton meter
Force	F	N	Newton
Length	l	m	meter
Mass	m	kg	kilogramme
Power	P	W	Watt
Pressure	p	Pa, bar	Pascal, bar
Speed	v	m/s	meter per second
Temperature	T	K	Kelvin
Time	t	s	second
Torque	M_t, T	Nm	Newton meter
Volume	V	m^3	cubic meter
Volume flow	$\dot{V}$	m^3/s	cubic meter per second

G Conversion chart (European/USA standards)

Area	1 sq. in.	= 6.452 cm^2
	1 cm^2	= 0.155 sq. in.
	1 sq. ft.	= 0.0929 m^2
	1 m^2	= 10.764 sq. ft.
Force	1 lbf.	= 4.44822 N
Length	1 mm	= 0.03937 in
	1 in	= 25.4 mm
	1 ft	= 12 in = 0.3048 m
	1 m	= 3.281 ft
	1 yd	= 3 ft = 0.914398 m
	1 m	= 1.09362 yd
Mass	1lb	= 0.4536 kg
	1 kg	= 2.2046 lb
	1 oz	= 28.35 g
	1 g	= 0.0353 oz
Pressure	1 bar	= 14.5 psi = 100 kPa
	1 psi	= 0.069 bar
		= 6.8965 kPa
	1 lb/sq. ft.	= 47.88 Pa
		= 0.0004788 bar
	1 bar	= 2089 lb/sq. ft.
	1 Pa	= 0.0209 lb/sq. ft.
Speed	1 ft./s.	= 0,3048 m/s
	1 m/s	= 3,281 ft./s
Temperature	Δ 1 °C	= 1,7999 °F = 1 K
	Δ 1 °F	= 0,5556 °C = 0,5556 K
	0 °C	= 32 °F = 273,15 K
Volume	1 cu. in.	= 16.387 cm^3
	1 cm^3	= 0.0610 cu. in.
	1 cu. ft.	= 28.317 dm^3
	1 dm^3	= 0.0353 cu. ft.
	1 US-gallon	= 3.785 l
	1 l	= 0.2642 US-gallon

TERMS AND CONDITIONS OF SALE

1. **Offer and Contract**

Acceptance by Seller of Buyer's order is expressly made conditional on assent to these Terms and Conditions, either by written acknowledgement or by conduct of Buyer that recognizes the existence of the contract with respect to Goods described on this acknowledgement form.

These Terms and Conditions also serve as notice of Seller's objection to and rejection of any Terms and Conditions of purchase or sale included in Buyer's purchase order or other writing that are different from or additional to these Terms and Conditions.

Sales representatives are not authorized to bind Seller.

All written quotations automatically expire thirty (30) days from the date quoted unless otherwise specified.

2. **Prices and Taxes**

Prices are subject to change without notice at any time prior to acceptance of order on Seller's acknowledgement form. All prices are F.O.B. Chicago, Illinois unless otherwise agreed by Buyer and Seller in writing. Buyer agrees to pay all present and future U.S. federal, state and local tax obligations, including but not limited to sales, use and excise taxes. If Buyer claims that the Goods are exempt from any particular tax, Buyer must provide Seller with a tax exemption certificate acceptable to the tax authorities.

3. **Cancellation Charges**

No cancellations or changes of any kind in the purchase order shall be effective unless agreed to in writing by Seller. All changes are accepted subject to adjustment in prices and delivery dates. All cancellations are accepted subject to cancellation charges which will be determined by the Seller and will reflect, among other factors, the expenses already incurred and commitments made by the Seller, sales and administrative overhead and profits.

Seller shall have the absolute right to cancel the order upon (i) material breach of any of these Terms and Conditions by Buyer, or (ii) failure by Buyer to make any payment or (iii) insolvency of Buyer, the filing of voluntary petition in bankruptcy by Buyer, the filing of an involuntary petition to have the Buyer declared bankrupt, the appointment of a receiver or trustee for Buyer, the execution by Buyer of an assignment for the benefit of creditors, or (iv) the discontinuance of business by Buyer or the sale by Buyer of the bulk of its assets other than in the usual course of business. Upon cancellation, Seller shall be entitled to a cancellation charge as described above.

4. **Shipment and Delivery**

All delivery dates are estimates only. Seller's only obligation with respect to delivery dates shall be to use reasonable effort to meet same. All shipments shall be F.O.B. Chicago, Illinois unless otherwise agreed in writing between Buyer and Seller. Title and risk of loss shall pass to Buyer at the F.O.B. point. Unless otherwise agreed in writing, Seller will ship via surface transportation. Sell will not be liable for any delays, breakage, loss or damage after having made delivery in good order to the carrier. Seller reserves the right to insure all shipments at Buyer's expense.

5. **Force Majeure, Waiver**

Seller shall not be liable for any delay to make delivery or failure to deliver due to any clause or contingency beyond the control of Seller (including but not limited to accidents, breakdowns, strikes, riots, sabotage, insurrections, war, delay or interruptions in or failure of sources of materials, supplies, labor, energy or transportation, acts of God or orders of any court, governmental body, authority or agency). Seller may, at its option, allocate available supplies among its customers, including Buyer, in any manner that Seller decides is fair and reasonable, extend the delivery time or cancel the contract for such Goods, in whole or in part. Such allocation, extension of delivery time or cancellation shall not affect the right of Seller to cover for any unpaid Goods previously delivered. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES OR FOR ANY OTHER LOSS, DAMAGE OR EXPENSE OF ANY KIND INCLUDING LOSS OF PROFITS ARISING IN CONNECTION WITH SUCH FAILURE OR DELAY IN DELIVERY.

6. **Terms of Payment**

Unless otherwise expressly agreed between Buyer and Seller in writing, terms of payment are net thirty (30) days after date of shipment. Seller reserves the right to alter or suspend credit terms and require C.O.D. or advance payment, whenever Seller has reasonable doubt as to Buyer's creditworthiness. If Buyer becomes delinquent in payment or refuses to accept C.O.D. shipments, Seller shall have the right, in addition to any other rights it may have, to cancel any order of Buyer's, without further deliveries and declare all unpaid amounts for Goods previously delivered immediately due and payable. Each shipment shall be considered a separate and independent transaction and payment therefore shall be made accordingly. Amounts past due shall be subject to a late charge of 1.5% per month. All costs and expenses incurred by Seller as result of non-payment or delinquent payment by Buyer, including collections costs, interest, and reasonable attorneys fees shall be paid by the Buyer.

7. **Claims and Remedies**

All claims for loss or damage in transit are to be made by Buyer directly to the carrier. No deduction of any kind from the invoice amount shall be made. Buyer shall inspect all Goods immediately upon their arrival and shall immediately give written notice to Seller of any claim that the Goods do not conform to the terms of the contract. Seller shall have reasonable access to inspect any allegedly non-conforming Goods. Buyer waives any right to assert any claim against Seller arising from any non-conformity of Goods which would have been observable on reasonable inspection or testing within thirty (30) days after delivery.

Written notice of any alleged defect within the warranty period must be presented t o Seller immediately upon Buyer's discovery of the defect and Seller must be allowed in inspect the Goods while they are in the alleged defective condition. Operation of the Goods must be suspended until written clearance is issued by Seller for continued operation provided that Seller, upon receipt of written notice of an alleged defect, proceeds without unreasonable delay to remedy any defects coming within the warranty.

8. **Warranty, Disclaimer, Limitation of Liability**

General Warranty Terms Applicable To All Goods:

The above warranties by Seller do not extend to any Goods subject to (i) improper installation or storage, (ii) accident, damage, abuse or misuse, (iii) abnormal or unusual operating conditions or applications, (iv) operating conditions or applications above the rated capacity of the Goods, (v) operating conditions or applications not made known to Seller prior to the date of the agreement, or (vi) a purpose or application in any way different from that for which the Goods were designed. Seller's warranty does not extend to any Good or parts thereof that are not manufactured by Seller or that Buyer alters or modifies or that Buyer adds to or incorporates into Seller's Goods (including but not limited to controls, electronics, valves and other parts or equipment and only the warranty, if any, given by the manufacturer thereof, will apply. Seller's obligation under this warranty will not apply to any product which (i) is normally consumed in operations or (ii) has a normal life inherently shorter that the warranty period stated herein.

THE WARRANTY EXPRESSED HEREIN IS IN LIEU OF ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND IS IN LIEU OF ANY AND ALL OTHER OBLIGATIONS OR LIABILITY ON THE SELLER'S PART. UNDER NO CIRCUMSTANCES WILL SELLER BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES OR FOR ANY OTHER LOSS, DAMAGE OR EXPENSE OF ANY KIND, INCLUDING LOSS OF PROFITS, ARISING IN CONNECTION WITH THE CONTRACT OR WITH THE USE OR LIABILITY TO USE SELLER'S GOODS FURNISHED UNDER THE CONTRACT. SELLER'S SOLE LIABILITY AND BUYER'S SOLE REMEDY ARE LIMITED TO EITHER (i) REPAIR OR REPLACEMENT OF DEFECTIVE PARTS OR GOODS, OR (ii) AT THE SELLER'S OPTION, RETURN OF THE GOODS TO SELLER AND REFUND OF PURCHASE PRICE. SUCH REMEDY SHALL BE BUYER'S ENTIRE AND EXCLUSIVE REMEDY, IN THE EVENT OF BREACH OF WARRANTY OR NEGLIGENCE OF SELLER.

9. **Confidentiality**

All drawings, diagrams, specifications, and other materials furnished by Seller relating to the sale, installation, service or repair of Goods furnished hereunder and the information therein are proprietary to Seller. Buyer may not reproduce or distribute such materials without the written consent of Seller except to Buyer's employees who may use the material as part of their duties. All such materials relating to the Goods supplied by Seller (except information as may be established to be in the public domain or disclosed through judicial or government action) shall be received in confidence, and Buyer shall exercise reasonable care to hold all such information in confidence.

In the event Buyer's personnel visit Seller's plant or assembly facility or otherwise receive any proprietary to confidential information from Seller, said information shall be retained as confidential by Buyer and not disclosed to any third party without the written consent of Seller.

10. **Limitation of Actions**

Any cause of action arising from this agreement or the breach thereof must be commenced within one (1) year after the cause of action accrues.

11. **Applicable Law**

The law governing the agreement and any further agreement or contractual relation between Seller and Buyer shall be the law of the State of Illinois. The invalidity of any provision of this agreement shall not affect the validity of the remaining provisions.

12. **Non-Assignment**

Buyer's rights and obligations hereunder may not be assigned without prior written consent of Seller.

AIRTEC Pneumatics, Inc.