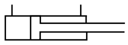
Data Sheet

Pneumatic cylinders and accessories

Miniature cylinders (10mm to 25mm bore)



The **RS** range of miniature cylinders offers a wide choice of bore sizes and stroke lengths.

All cylinders automatically come with an integral magnetic piston. It only requires that a sensor kit is fitted to convert a standard miniature cylinder to a magnetic sensing miniature cylinder.

Material specification and construction is of the highest order throughout.

The modular nature of the system allows the user to adapt or modify his miniature cylinders in line with changing automation requirements.

RS cylinders conform to ISO 6432, CETOP RP52P, BS 4662 (Part 1) and AFNOR NFE 49.030.

Technical data

Pressure range ______ 0.8 to 10 bar
Temperature range ______ –20°C to +70°C
Air condition ______ Filtered, regulated lubricated or dry

Cylinder thrusts (Newtons)

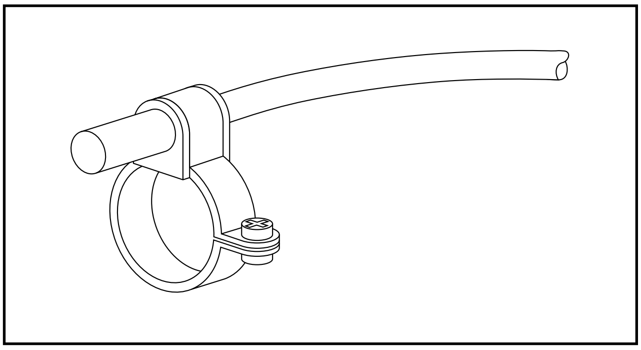
Cylinder bore mm	Piston rod Ø mm	Area cm^2		Line pressure (bar)															
				3		4		5		6		7		8		9		10	
		●	■	●	■	●	■	●	■	●	■	●	■	●	■	●	■	●	■
10	4	0.8	0.66	24	19	32	26	40	33	48	39	58	46	64	52	72	59	80	66
12	6	1.1	0.83	33	24	44	32	55	40	66	48	77	56	88	64	99	72	110	80
16	6	2	1.73	60	52	80	69	100	87	120	104	140	121	160	138	180	156	200	173
20	8	3.1	2.6	93	78	124	104	155	130	186	156	217	182	248	208	279	234	310	260
25	10	4.9	4.1	147	123	196	164	245	205	294	246	343	287	392	328	441	369	490	410

Surface of piston
● Extending side of piston
■ Retracting side of piston

Material specification

Cylinder body ______ Non magnetic stainless steel
Piston rod ______ Non magnetic stainless steel BS 304S11/12 SAE 304L
Seals ______ Nitrile
End caps ______ Anodised aluminium
Piston ______ Aluminium
Cushioning device ______ Polyurethane

Magnetic sensor – 10mm to 25mm bore



Purpose

The magnetic sensor detects when the piston is in close proximity. This detection is made without physical contact, the sensor operating through the non magnetic cylinder body. The sensor may also be used to obtain other positional information not necessarily associated with a cylinder.

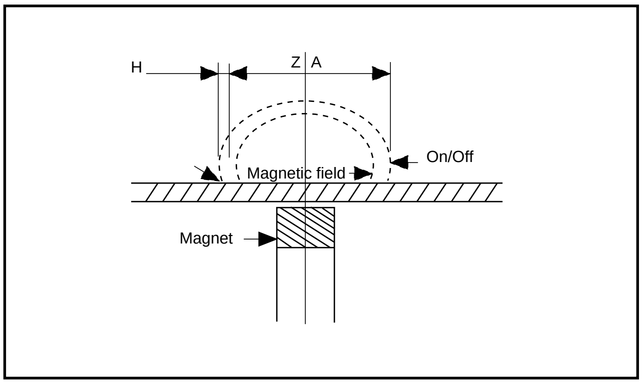
Operation

The sensor is activated magnetically. When the sensor is subjected to the influence of a magnetic field the contacts close.

When the sensor is used in ac current, with maximum current, the switching process creates an electrical arc which results in excessive corrosion of the contacts.

Mounting

The sensor must be positioned in contact with the cylinder body.

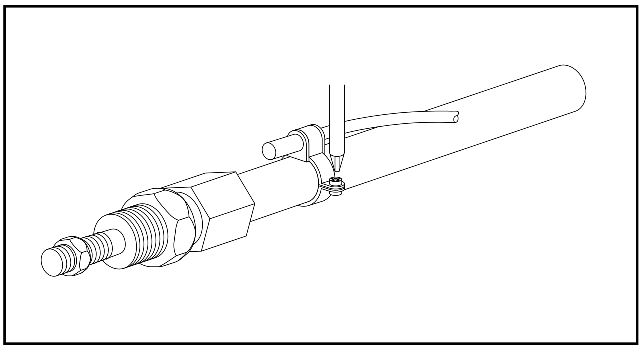


Cylinder bore mm	H (max.)	ZA (max.)
10	1.5	4
16	1.5	5
20	2	6.5
25	2	7

Switching characteristics.

The minimum distance between two sensors is 2H maximum + 4mm.

Fitting a magnetic sensor



Each cylinder has an associated clamp, dependent on bore size, with which the magnetic sensor can be attached to the cylinder body.

After attaching the sensor to the required clamp, position the sensor where sensing is required along the length of the cylinder. Then with a screwdriver tighten the clamp screw to secure in position.

Sensor clamp bore (mm)	**RS** stock no.
10	727-402
12	214-5880
16	727-418
20	727-424
25	727-430
ac/dc reed switch	727-395

Technical specification for sensors

Power	Electrical
Mounting	Clamp on
Connection	2 core cable (2 × 0.75) – length = 1.5m
Electrical connection	Blue wire – Red wire +
Repetitive precision of detection	±0.10mm
Operating position	Adjustable
Temperature range	–5°C to +70°C
Mechanical protection	IP.67
Material specification	Cased in thermoplastic Switch and power elements are coated in polyurethane resin
Type of contact	Normally open
Type of current	ac/dc
Maximum voltage	ac 110V/dc 200V
Maximum switched current at 20°C	ac 0.50A/dc 180mA*
Maximum power	10W

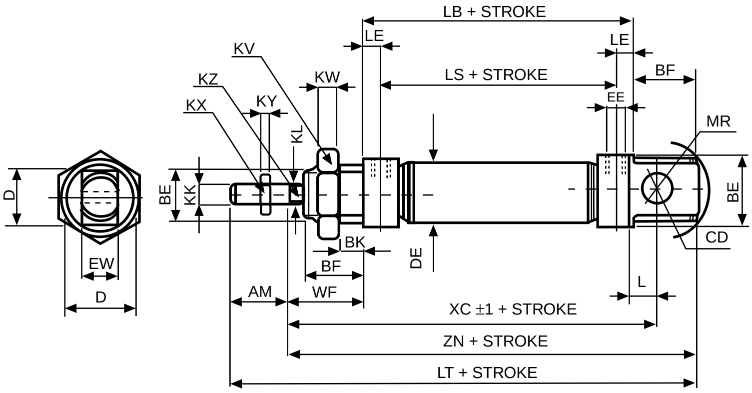
*From 25°C to 70°C switched current must be linearly derated to 90mA.

Cylinder mountings

Cylinder bore mm	RS stock no.				
	Flange	Foot	Rear hinge	Piston rod clevis	Spherical bearing
10	720-782	720-524	720-580	720-647	720-710
12	720-798	720-530	720-596	720-653	720-726
16	720-798	720-530	720-596	720-653	720-726
20	720-805	720-546	720-603	720-669	720-732
25	720-805	720-546	720-603	720-675	720-748

Dimensions

Basic cylinder



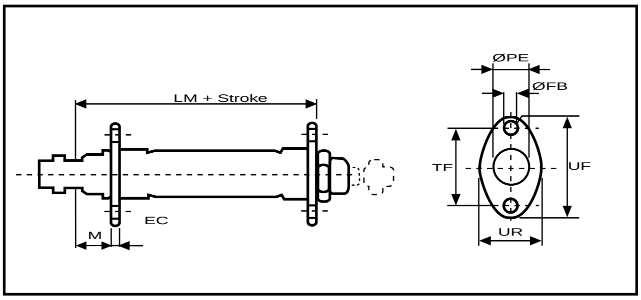
Bore size	AM	BE	BF	BK	CD	D	DE	EE
10	12.5	M12 ×1.25	13	7	4	15	11.3	M5
12	16	M16 ×1.25	17	8	6	20	13.3	M5
16	16	M16 ×1.5	17	8	6	20	17.3	M5
20	20	M22 ×1.5	20	9	8	27*	21.5	G⅛
25	22	M22 ×1.5	22	11	8	27*	26.5	G⅛

Bore size	LB	LE	LS	LT	MR	WF	XC	ZN
10	44.5	6	32.5	85.5	18	15.5	64	73
12	46	6	34	101	22	22	75	85
16	52.5	6	40.5	108	22	22.5	82	92
20	67.5	8	51.5	132	25	24.5	95	112
25	69.5	8	53.5	141.5	25	28	104	119.5

Bore size	EW	KL	KK	KV a/f	KW	KX a/f	KY	KZ a/f	L
10	8	4	M4	19	6	7	2	/	6
12	12	6	M6	23	8	10	3	5	9
16	12	6	M6	23	8	10	3	5	9
20	16	8	M8	32	11	13	4	7	12
25	16	10	M10 ×1.25	32	11	17	5	9	12

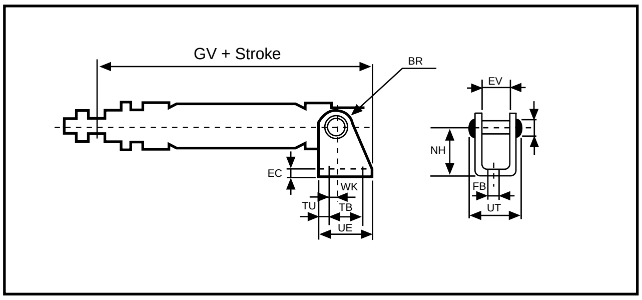
a/f Across flats

Flange mounting



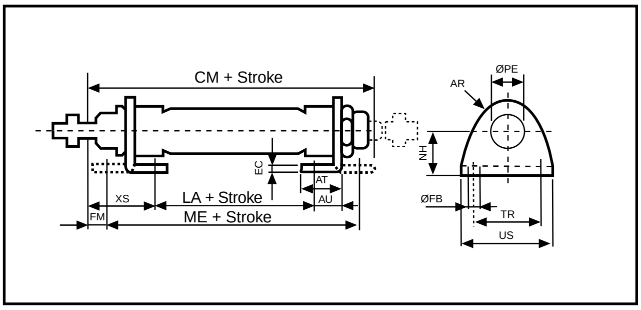
Bore size	EC	FB	LM	PE	TF	UF	UR	W
10	2.5	4.5	62.5	12.1	30	40	25	13
12	4	5.5	72	16.1	40	53	30	18
16	3	5.5	77.5	16.1	40	53	30	19
20	4	6.5	96	22.1	50	66	40	20.5
25	4	6.5	101.5	22.1	50	66	40	24

Rear hinge mounting



Bore size	BR	CC	EC	EV	FB	GV	NH	TB	TU	UE	UT	WK
10	5	4	2.5	8.1	4.5	79.5	24	12.5	3.5	20.5	16.5	1.5
12	7	6	3	12.1	5.5	93	27	15	5	25	23	2
16	7	6	3	16.1	5.5	100	27	15	5	25	22.5	2
20	10	8	4	16.1	6.5	117	30	20	6	32.5	29.5	4
25	10	8	4	16.1	6.5	125	30	20	6	32.5	29.5	4

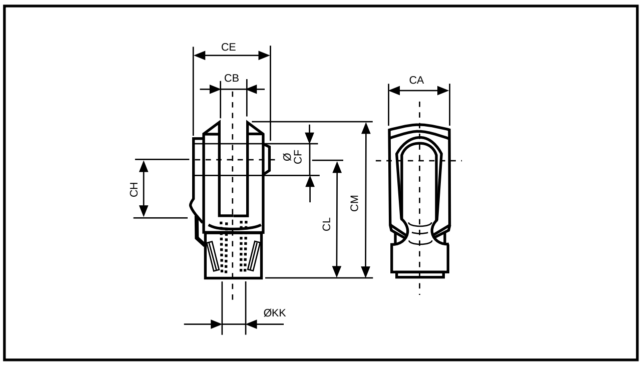
Foot mounting



Bore size	AR	AT	AU	CM	EC	FB	FM
10	10	16	10.5	76	2.5	4.5	5
12	13	20	14	87	4	5.5	8
16	13	19	13	94	3	5.5	9.5
20	20	24	18	116	4	6.5	8.5
25	20	24	18	121.5	4	6.5	12.5

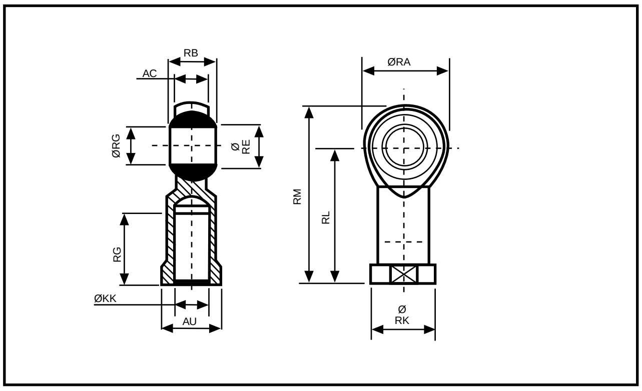
Bore size	LA	ME	NH	PE	TR	US	XS
10	28.5	65.5	16	12.1	25	35	23.5
12	26	74	20	16.1	32	42	32
16	32.5	78.5	20	16.1	32	42	32.5
20	43.5	99.5	25	22.1	40	54	36.5
25	45.5	101.5	25	22.1	40	54	40

Piston rod clevis



Bore size	CA	CB (B11)	CE	CF (D10)	CH	CL	CM	KK
10	8	4	11	4	8	16	21	M4
12-16	12	6	16	6	12	24	31	M6
20	16	8	22	8	16	32	42	M8
25	20	10	26	10	20	40	52	M10 ×1.25

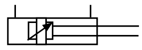
Spherical bearing



Bore size	KK	RA	RB	RC	RD	RE	RG	RK	RL	RM	RU
10	M4	16	8	6	5	7.71	14	9.5	27	35	8
12-16	M6	18	9	6.75	6	8.96	14	12	30	39	10
20	M8	22	12	9	8	10.4	17	16	36	47	13
25	M10 ×1.25	26	14	10.5	10	12.9	20	19	43	56	17

Standard cylinders

(32mm bore to 63mm bore)



The **RS** range of 32-63mm bore pneumatic cylinders is built to ISO/CETOP (ISO 6431, CETOP RP43P, BS4862 Part 2) standards. The range operates on dry, non-lubricated, or lubricated air – making it the natural choice for so many varied industrial applications.

These clean-lined non tie-rod cylinders produce the most efficient transmission of thrust and offer high performance with the maximum operation and wear resistance.

Cylinder weights (kg)

Cylinder bore	Single rod cylinder: Zero stroke	Single rod cylinder: Extra per 25mm stroke
32mm	0.41	0.05
40mm	0.68	0.07
50mm	1.05	0.11
63mm	1.54	0.13

Mounting weights (kg)

Cylinder bore	Foot (pair)	Flange	Rear hinge	Piston rod clevis	Spher bear-ing
32mm	0.09	0.16	0.20	0.10	0.08
40mm	0.14	0.18	0.32	0.15	0.12
50mm	0.21	0.34	0.42	0.35	0.23
63mm	0.31	0.70	0.97	0.35	0.23

Technical data

Pressure range (air) ______ 1 bar (100kPa) to 10 bar (1000kPa)

Temperature range ______ –20°C to +70°C
In sub-zero conditions air must be water-free to prevent icing

Air condition ______ Filtered, regulated, lubricated or dry

Recommended lubricant if used ______ Mineral oils with viscosity 20-40 centistrokes

Materials

End caps ______ Aluminium LM24

Cylinder body ______ Aluminium 6063

Piston rod ______ Stainless steel 303S21

Piston ______ Aluminium

Piston rod bearing ______ Sintered bronze (lubricated)

Wear ring ______ Nylon (self lubricating)

Cushion sleeves ______ Nylon (self lubricating)
Brass on high temp. version

Seals ______ Nitrile rubber

Finish

End caps ______ Black epoxy powder painted

Cylinder body ______ Hard anodised

Thrust calculations

It is important that the correct bore size cylinder is used for each application. It is therefore necessary to assess accurately the load to be moved. The cylinder thrust tables given overleaf shows the theoretical thrusts at different line pressures. They are the product of the effective piston area and the applied pressure. An efficiency of 80% should be assumed due to frictional losses, and so the tabulated figures should be multiplied by 0.8 to give effective thrust.

Cylinder bore mm	Stroke	Piston area m^2	Pressure-bar (kPa) 1(100) Thrust (Newtons)	2(200)	3(300)	4(400)	5(500)
32	out	$8.04{\times}10^{-4}$	80	160	241	321	402
	in	$6.9{\times}10^{-4}$	69	138	207	276	345
40	out	$1.2{\times}10^{-3}$	125	250	373	500	625
	in	$1.05{\times}10^{-3}$	105	210	315	420	525
50	out	$1.96{\times}10^{-3}$	196	392	588	784	980
	in	$1.65{\times}10^{-3}$	165	330	495	660	825
63	out	$3.11{\times}10^{-3}$	311	622	933	1244	1555
	in	$2.80{\times}10^{-3}$	280	560	840	1120	1400

Cylinder bore mm	Stroke	Piston area m^2	Pressure-bar (kPa) 6(600) Thrust (Newtons)	7(700)	8(800)	9(900)	10(1000)
32	out	$8.04{\times}10^{-4}$	482	562	643	723	804
	in	$6.9\ {\times}10^{-4}$	414	483	552	621	690
40	out	$1.25{\times}10^{-3}$	750	875	1000	1125	1250
	in	$1.05{\times}10^{-3}$	630	735	840	945	1050
50	out	$1.96{\times}10^{-3}$	1176	1372	1568	1764	1960
	in	$1.65{\times}10^{-3}$	990	1155	1320	1485	1650
63	out	$3.11{\times}10^{-3}$	1866	2177	2488	2799	3110
	in	$2.80{\times}10^{-3}$	1680	1960	2240	2520	2800

Maximum stroke calculations

Recommended maximum stroke lengths with respect to column loading of the piston rod.

These strokes are derived from Euler's formula:

$$L = \sqrt{\frac{\pi^2 EI}{F5}}$$

L = Total column length – mm

E = Modules of elasticity – N/mm^2

I = Moment of inertia – mm^4

F = Load N

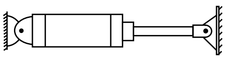
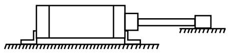
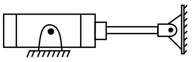
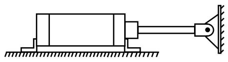
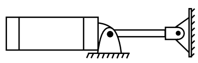
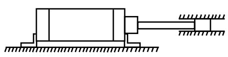
5 = Safety factory

This formula has been used to prepare the following table of recommended maximum stroke lengths in mm with respect to bore size and working pressure. Multiply the stroke length given in the table by the appropriate mounting factor indicated below. The restrictions on stroke length apply when the piston rod is subjected to progressive loads.

Example: A 50mm bore cylinder with 6 bar working pressure, when supported with foot mountings and the load guided in both planes, has a maximum stroke of 820 × 4 = 3280mm.

When pivot mounted cylinders are mounted horizontally, side loads due to the weight of the cylinder may be more significant, both on the piston and rod but also on the mounting. This is especially so on the front pivot mounting and also on the rear pivot when the cylinder is fully extended.

Cylinder bore	Working pressure (bar) 4	5	6	7	8	9	10
32	570	510	460	430	400	380	360
40	810	720	660	610	570	540	510
50	1010	900	820	760	710	670	640
63	800	720	650	610	570	530	510

Mounting style	Mounting factor	Mounting style	Mounting factor
Body and rod pivot mounted at ends 	1	Body rigidly supported but rod unguided (no gravitational load) 	0.85
Body pivoted at mid-point and rod pivoted 	1.3	Body rigidly supported. Rod guided but pivoted 	2.3
Body pivoted at front end and rod pivoted 	1.2	Body rigidly supported. Rod rigidly guided 	4

Electrical sensors

Designed for easy adjustment and simple, reliable fixing these encapsulated electrical reed switches provide electrical sensing and thus replace external limit switches. A unique encapsulated magnetic piston wear ring within the cylinder operates the switch. A choice of switch is offered, with or without LED.

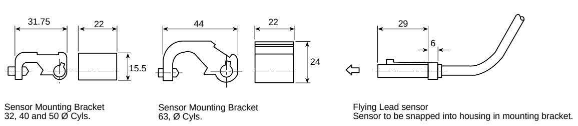
Specification

Temperature range ________ –20°C to +70°C
Protection ________ IP65
Cable entry ________ PG7
Minimum stroke approx.
fitted with two sensors ________ 10mm

Switching characteristics

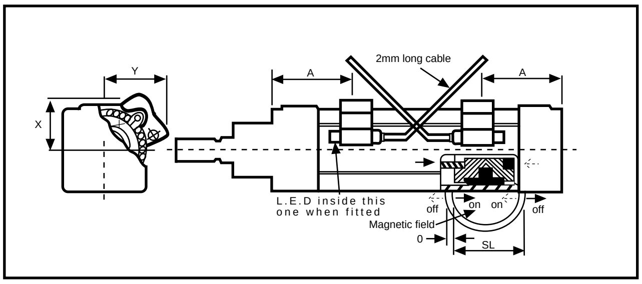
Sensor type	Maximum power	Maximum switched voltage	Maximum switched current
Basic reed switch	ac 50VA	ac 240V	500mA
	dc 50W	dc 300V	
Reed switch with LED	ac 50VA	ac 240V	380mA* up to 25°C
	dc 50W	dc 300V	

*From +25°C to +70°C switched current must be linearly derated to 20mA.
Flying leads are fitted with 2m long PVC covered cable.



Operation

The illustration below shows typical switching characteristics as the magnetic field passes the sensor.



Typical switched distance and differential

Cylinder bore	Switched length SL	Differential D	A	Dimensions X	Y
32	6	2	49	28	34
40	10	2	54.5	31	38
50	12	2	55	36	43
63	15	3	60.5	48	49

Note: Dimension A is the distance from the end cap face to the centre of the magnetic field in the end of the stroke positions. This is where the centre of the sensor should be positioned for end of stroke sensing.

If the sensor is not positioned to detect the end of the stroke of the cylinder, only a pulse output will be obtained. The duration of the pulse is dependent upon the speed of the piston. Subject to the condition in the note below, standard solenoid valves (not automatic or pressure differential return) can be directly operated by the sensor up to piston speeds of 0.5 metres/sec. Above this speed it is necessary to use the pulse extender switch, or alternatively a latching relay, electronic circuitry, etc. in order to obtain sufficient duration of signal.

Reed switch protection

When reed switches are required to switch power to inductive loads, such as solenoids, relays, and contactors, it is often necessary to protect the reed switch contacts to prevent them welding together.

A voltage dependent resistor (non-linear resistor) connected across the switch contacts provides one of the best means of protection. This reduces harmful arcing across the contacts by presenting a high resistance to the peak voltages induced at ‘switch on’.

Choose a voltage dependent resistor (VDR) with a voltage rating greater than the nominal voltage being switched (normally only two sizes are required; one for 240V and one for 110V).

When the connecting wires are long, the switches can also be damaged by surge currents caused by the capacitive effect of the wire. These currents arise in dc circuits when charge stored in the wire is allowed to discharge through the switch as the contacts are closed.

The damaging effect of the surge current can be reduced by connecting a suitable resistor in series with and close to the switch. The value of this resistor can be calculated as follows

$$\text{Series resistor } R = \frac{V \text{ (supply voltage)}}{Im} \quad \text{Ohms}$$

where Im is the maximum current rating of the switch.

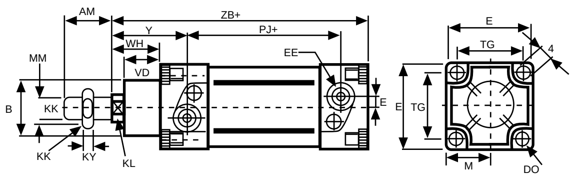
$$\text{Resistor wattage } W = (\text{load current})^2 \times R$$

An inrush current can also occur at 'switch on' when switching loads in ac circuits, and it is important that this current does not exceed the maximum current rating of the switch. Again the contacts can be partially protected by fitting a series resistor close to the switch.

These solutions will provide simple protection for most applications.

Dimensions

The cylinder



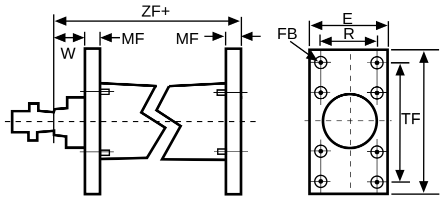
Cylinder bore	AM	B Ø	DD thread depth		E	EE ports thread depth		H	K a/f	KK	KY	KK a/f	KY a/f
32	22	28.00 27.75	M4	6.5	39	G⅛	7	5	7	M10 × 1.25	5	10	17
40	24	32.00 31.75	M5	7.5	47	G¼	10	5	8	M12 × 1.25	7	13	19
50	32	38.00 37.75	M5	7.5	58	G¼	10	7	8	M16 × 1.5	8	17	24
63	32	40.00 39.75	M8	12.5	72	G⅜	12	4	13	M16 × 1.5	8	17	24

Cylinder bore	M	MM Ø	PJ+ stroke	TG	VD	WH	Y	ZB+ stroke	ZK+ stroke	ZM+ 2 × stroke
32	24	12	64	30	18	24	41	122	122	146
40	26	16	71	36	21	28	47	137	137	165
50	31	20	76	45	26	35	52	145	145	180
63	38	20	87	55	28	37	54	158	158	195

Cushioned lengths (Nominal)				
Cylinder bore	32	40	50	63
Cushion length	19	21	21	23

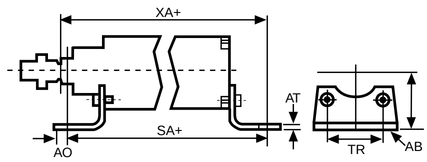
Mountings

Flange mounting



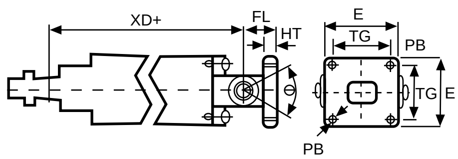
Cylinder bore	E	FB Ø (H13)	MF	R	TF	UF	W	ZF +stroke
32	45	7	8	32	64	76	16	130
40	50	9	8	36	72	86	20	145
50	60	9	10	45	90	110	25	155
63	80	9	12	50	100	120	25	170

Foot mounting



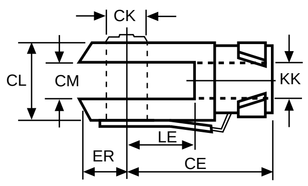
Cylinder bore	AB ø (H13)	AH	AO	AT	SA +stroke	TR	XA +stroke
32	7	32	6	3	142	32	144
40	9	36	9	3	161	36	163
50	9	45	10	4	170	45	175
63	9	50	10	4	185	50	190

Rear hinge



Cylinder bore	E	FL	HT	PB Ø	TG	XD +stroke	Θ
32	38	20	7	4.7	30	142	90°
40	46	23	6	5.7	36	160	90°
50	57	25	7	5.7	45	170	90°
63	71	32	10	8.8	55	190	90°

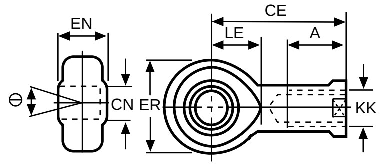
Piston rod clevis



Cylinder bore	CE	CK Ø	CL	CM	ER	KK	LE
32	40	10	20	10.15 10.25	12	M10 × 1.25	20
40	48	12	24	12.15 12.26	14	M12 × 1.25	20
50-63	64	16	32	16.15 16.26	9	M16 × 1.5	32

Material – steel, zinc plated.

Spherical bearing



Cylinder bore	A min	CE	CNØ (H9)	EN (H12)	ER Ø	KK	LE	α°
32	20	43	10	14	28	M10 × 1.25	13	6
40	22	50	12	16	32	M12 × 1.25	15	13
50-63	28	64	16	21	42	M16 × 1.5	30	30

Material – steel, zinc plated. Bearing has an integral PTFE lining which requires no lubrication.

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