GRICES

HYDRAULIC CYLINDERS

www.grices.it

1978 years 2008

assofluid

GRICES

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Pressione massima 25 MPa

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Series COA OT58/AISI316
Max. pressure 12 Mpa
Series COB OT58/AISI316
Max. pressure 12 Mpa

Dal 1978 la Grices s.r.l. progetta produce e commercializza cilindri oleodinamici operando in svariati settori produttivi. L'esperienza acquisita unita alla continua ricerca tecnologica, consente di proporre cilindri oleodinamici in grado di garantire funzionalità, sicurezza ed affidabilità in condizioni di lavoro esasperate. La progettazione modulare e l'impiego di attrezzature e processi produttivi all'avanguardia consentono di proporre alla clientela soluzioni "su misura" in grado di soddisfare ogni esigenza. La produzione comprende cilindri standard conformi alla norme internazionali, assemblati modularmente con particolari di serie e cilindri speciali di nostra progettazione e a disegno del cliente, equipaggiati su richiesta di frenature progressive di fine corsa, sensori magnetici di prossimità induttivi e trasduttori lineari di posizione. Trovano impiego su: macchine utensili, macchine per cartotecnica, macchine per la lavorazione del filo metallico, macchine per la lavorazione della lamiera, macchine per materie plastiche, nel settore siderurgico, nel settore aereo spaziale, nel settore navale ecc.

Since 1978 Grices s.r.l. has specialized in the design and manufacture of quality hydraulic cylinders for various sectors of the European market. Thanks to continuous technological reinvestements in research and the expertise of our employees, Grices offers a diversified hydraulic cylinder product line guaranteed to provide product durability and reliability in any working condition, Grices modular (cad) designs, advanced equipment and compressed manufacturing process provide the customer with "Made to Measure Product Solutions". Our products include standard cylinders manufactured to international standards and special cylinders that are manufactured to customer or codesigned specifications. Cylinders are available with gradual braking and proximity pickups on request. Grices cylinders are udes in board, wuire, sheet metal and plastic materials manufacturing equipment as well as in naval, industrial and mobile manufacturing equipment and/or applications.

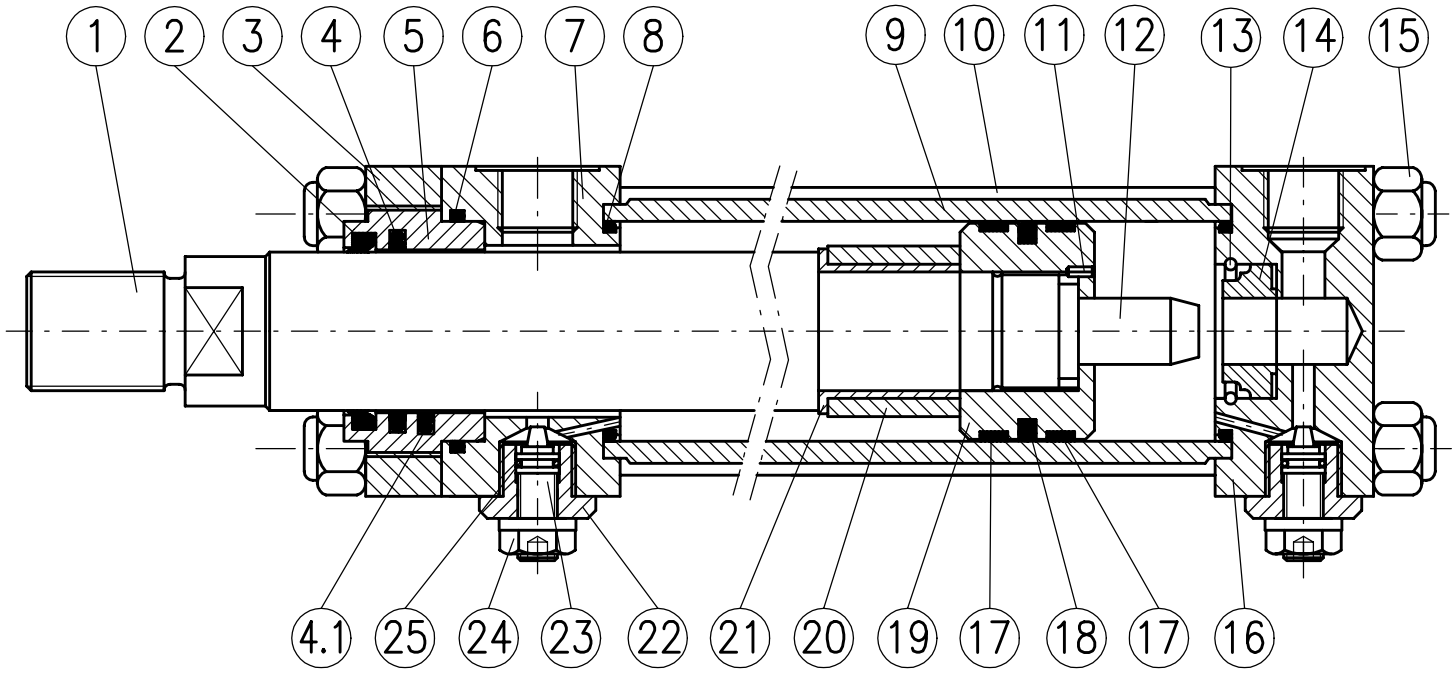
GRICES

CYLINDERS SERIES CH

According to ISO 6020/2 – 1991 – DIN 24554, compact series 160 bar

Working pressure up to 21 Mpa
Maximum pressure 25 Mpa
Working temperature –20 to 80°C
Stroke tolerance 0 to 1.2mm for strokes up to 1000mm, 0 to 2.5mm for longer strokes
10 bores, 25 to 200mm
up to 3 rods per bore

ON DEMAND:
End of stroke braking, adjustable on both ends
Drainage on the rod
Double rod seals
Special seals fit for a wide range of fluids and temperatures
Inductive proximity sensors for end of stroke control
Air vents on both ends



POS	ITEM	MATERIAL	POS	ITEM	MATERIAL
1	Rod	Chromium-plated steel	13	Rear flashing ring	Steel
2	Dust scraper	Polyurethane	14	Rear brake bushing	Bronze
3	Flange	Steel	15	Self-braking nut	Steel
4	Rod seal	Polyurethane/PTFE	16	Rear head	Steel
4,1	2nd Rod seal (option L)	Nitrile rubber and PTFE	17	Anti-friction slide	PTFE
5	Guide bushing	Cast iron	18	Piston seal	Polyurethane/PTFE
6	O-Ring + PBK	Nitrile rub.+polyurethane	19	Piston	Steel
7	Head	Steel	20	Front brake bushing	Steel
8	O-Ring + PBK	Nitrile rub.+polyurethane	21	Spacer	Steel
9	Liner	Steel	22	Safety plug	Steel
10	Tie rod	Steel	23	Adjustment needle	Steel
11	Safety pin	Steel	24	Locknut	Steel
12	Brake spur	Steel	25	O-Ring	Nitrile rubber

TECHNICAL CHARACTERISTICS

CHOOSING THE PRODUCTION SERIES

In order to identify the production series, make sure that, while the plant is working, the operating pressures indicated for each series are not exceeded. The general dimensioning of the cylinder ensures wide safety margins. Do not exceed the maximum pressure value that corresponds to the test pressure, considering also any overpressure caused by throttle valves in the circuits and/or by vertical loads (with downward rods) and end of stroke braking (see paragraph 1.7). We recommend that you adopt strokes longer (by a few millimeters) than the working stroke, in order to prevent the use of the use of the cylinder's internal stops as a mechanical end of stroke. Also check that the expected working temperature and speed are consistent with the type of seals installed.

1.1 HYDRAULIC CYLINDERS – SERIES CH

The CH hydraulic cylinders, dimensioned according to standard ISO 6020/2 – DIN 24554, represent the future use of hydraulic actuators.

- manufactured according to CNC technology, with top-quality materials, they provide maximum reliability and duration
- the use of standard components during assembly facilitates the replacement of any worn components
- they can be equipped with progressive braking of rear and front end of stroke, consisting of self-centering spurs that can slow-down gradually the masses concerned, even of considerable size. Dynamic reliable standard seals are used, that are easy to find on the market and can be modified according to the requested application.

1.2 RANGE OF USE OF CH CYLINDERS

- maximum pressure 25 Mpa (250 bar)
- pressure up to 21 Mpa (210 bar)

1.3 CYLINDER LINER

The cylinder liner is made up of a top-quality thick steel pipe, either cold-drawn or hot-rolled, provided with internal micro-finish (roughness RA $\leq$ 0.4 micron, diameter tolerance H9).

1.4 ROD

Rods are made with top-quality steel, minimum yield point 700 N/mm^2, coated with hard chrome. This surface treatment ensures proper protection against any damage and long-life seals. The minimum surface finish is 0.2 micron. Rods with strong chrome filling, induction-hardened or made of special steel, can be manufactured on demand.

1.5 HEADS

Heads are made of steel and are manufactured in such a way that they can ensure perfect concentricity between the cylinder liner, the rod bushing and the rod. Wide inner passages are manufactured to minimize any load loss when the fluid is conveyed.

1.6 POSITION OF CONNECTIONS, AIR VENTS AND DAMPING REGULATION

In all models, apart from PI, connections are arranged on side 1, damping regulations on side 3 and air vents on side 2.
For PI execution, connections are positioned on side 1, the damping adjustment on side 4, the air vents on side 2.
For special positioning requirements, contact our Technical Department.

1.7 PISTON

The piston is made with a special material, specially processed to ensure a concentric guide between rod damping bushing, cylinder liner and head damping bushing.

Moreover, a large part of its radial surface touches the cylinder liner. This confers considerable stability, so that any rod bending, caused by external radial loads, is minimized.

1.8 END OF STROKE BRAKING

The end of stroke braking is usually adopted on all cylinders working at a speed > 0.1 m/sec., or when loads in vertical direction are activated.
This braking is also a safety device in case of failure of control equipment (such as servosystems).
The ratio below makes it possible to promptly calculate, based on the cylinder bore (braking section), the supply pressure, the braking length and the working speed, as well as the mass that can be damped by every single cylinder.
This reaction limits the overpressure value to 250 bar, protecting the cylinder's components that are under stress during braking.

$$M = \frac{(p_2 \cdot S - p_1 \cdot A) \cdot 2 \cdot L_f}{V_0^2} \cdot 10^{-2} \text{ [kg]}$$

p_1 = supply pressure (bar)
V_0 = working speed (m/sec.)
L_1 = Braking length L_{f1} or L_{f2} (mm)
p_2 = maximum pressure 250 bar
S = braking section S_1 or S_2 (cm^2)
A = piston area (cm^2)

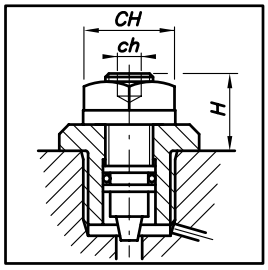
The damped mass values obtained from this ratio are simply theoretical, and Grices may not be held liable for the use of this ratio.
The data to be inserted in the ratio to calculate the mass that can be damped may be obtained from the following table

Bore (mm)	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**
S_1 (cm^2) rod forward	1,77	3,52	5,50	7,68	13,07	21,98	35,51	51,81	98,94	144,37
S_2 (cm^2) rod backward	4,52	6,91	11,43	18,5	29,39	46,45	74,70	118,86	190,79	303,83
L_{f1} (mm) rod forward	19	19	28	29	29	29	31	31	35	38
L_{f2} (mm) rod backward	19	19	28	29	29	29	29	29	40	40
A (cm^2)	4,9	8	12,6	19,6	31,2	50,3	78,5	122,7	201,1	314,2

1.9 DAMPING ADJUSTMENT

For a precise damping adjustment, both ends of the cylinder are equipped with needle valves, as indicated in the figures below. These devices are provided with a system that prevents their accidental removal. They are also equipped with a SEAL-LOCK locknut, that must be carefully tightened after adjustment, to ensure perfect sealing. The table below shows the dimensions and typology of such devices, based on the cylinder bore.

Bores	**H** (mm)	**CH** (mm)	**ch** (mm)
25-32	Fixed braking		
40 to 200	18	17	5



1.10 SPACERS

Cylinders with strokes > 1000mm should feature spacers of adequate design, so as increase the rod and piston guide, in order to reduce any overload phenomena, resulting in early wear.
The table on the right indicates the spacer length based on stroke; for the stroke values not included in the table, contact our technicians. As a general rule, spacers are not mounted on cylinders when strokes are < 1000mm and on cylinders subjected to only one pulling action.

STROKE (mm)	**1001 to 1500**	**1501 to 2000**	**2001 to 2500**	**2501 to 3000**
Spacer symbol	1	2	3	4
Length (mm)	50	100	150	200

1.11 SEALS

On the basis of particular working conditions of the cylinders, such as speed, fluid used and temperature, the relevant seal shall be chosen in conformity with the manufacturer's recommendations.
Our cylinders feature seals provided with seats conforming to the provisions of ISO 7425, that allow our cylinders to work under the heaviest conditions, such as very low or high speed, heavy working, mineral or synthetic fluids.
The type of seals to be used in the relevant working conditions are indicated below.

TYPE A (STANDARD), usually supplied in the absence of particular recommendations, considerable sealing at low pressure, to be used for speeds up to 0.5 m/sec., at temperatures ranging between –20 and +80°C, operation with mineral oil, air, nitrogen.

TYPE B (LOW FRICTION), anti-friction, not recommended when loads are to be held in position, and recommended at speeds up to 4 m/sec., at temperatures ranging between –20 and +80°C, operation with mineral oil, air, nitrogen.

TYPE C (LOW FRICTION, VITON), anti-friction, not recommended when loads are to be held in position, and recommended at speeds up to 4 m/sec., at temperatures ranging between –20 and +135°C, operation with phosphoric ester-based fire-retardant fluids.

TYPE E (CGR + PTFE), anti-friction, not recommended when loads are to be held in position, and recommended at speeds up to 4 m/sec., at temperatures ranging between –20 and +60°C, operation with water-glycol.

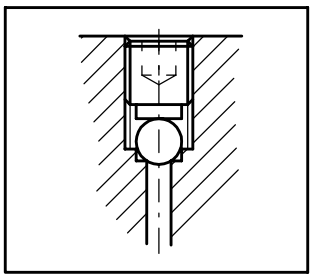
1.12 OIL PORTS

In order to reduce any turbulence and water hammer in the cylinder's connecting pipes as much as possible, we recommend that you ensure that the oil speed does not exceed 6 m/sec. The maximum flow rates that can be obtained with these criteria are shown in the table below.

OIL PORT ∅	1/4"	3/8"	1/2"	3/4"	1"	1 ¼"
MAX. FLOW RATE. (l/min)	14	28	48	63	102	162

1.13 AIR VENTS

Air vents are provided on demand on both ends of the cylinder. Vents are mounted inside the head and the bottom, so as to be protected from any accidental removal, as shown in the figure on the right.
To drain the system, unscrew the nut, discharge the air and close it again, carefully checking its sealing.



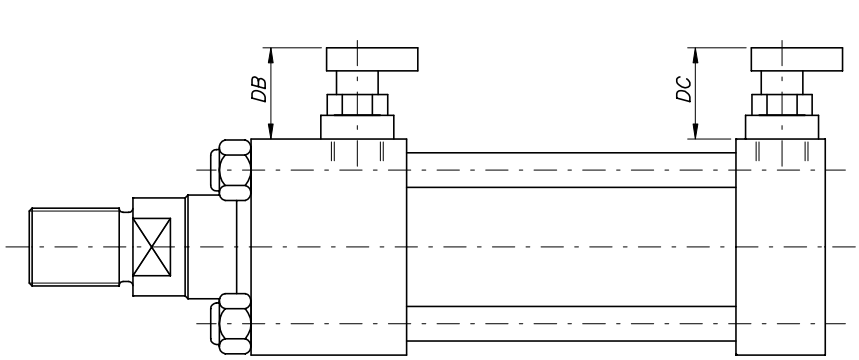
1.14 DRAINAGE

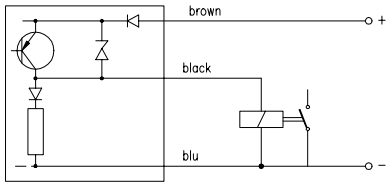
The drainage on the rod seal ensures better sealing at high speed, in particular in cylinders with strokes > 2000mm or in applications where the chamber, rod side, is constantly under pressure.
The drainage port (1/8") is usually positioned on the same axis of the supply port and must be directly connected to the tank. For any further explanations on this matter, please contact our Technical Department.

1.15 PROXIMITY SENSORS

When the piston position is to be detected in any hydraulic system, some proximity sensors can be directly mounted in the cylinder heads. The mounting temperature is –25 to +80°C. Permissible dynamic pressure 350 bar. The sensor is provided with a built-in amplifier, with direct supply (10 to 30Vdc), analog output PNP for 200mA max., supplied complete with connector with cable (4m long).
Sensors can be mounted on head and bottom, for bores up to 200mm, and are arranged on side 2 of the cylinder. They make it possible to obtain an electric signal near the end of stroke positioning of the piston.

Bore (mm)	DB_{max} (mm)	DC_{max} (mm)
40	77	67
50	75	71
63	72	65
80	74	71
100	73	65
125	71	51
160	71	34
200	67	20





Thechnical data of sensor:

Working temperature	−25 +80 °C
Supply voltage	10−30 V dc
Load	200 mA
Execution	PNP
Output type	NA

RESTRICTIONS

- in OA and FA execution, the sensor is mounted on the head on side 3, facing the supply, and does not allow the mounting of damping adjustment;
- in PI execution (bores 40 – 50 – 63), sensors are removed for fastening the feet's screws and then re-mounted, for all bores, in the presence of air vents they are arranged on the side of the damping adjustment;
- in Op and FP execution, the sensor is mounted on the bottom on side 3 facing the supply, and does not allow the mounting of damping adjustment;
- for 25 and 32mm bores, the proximity sensors are not provided.

2.1 PEAK LOAD

When the cylinder is working under compression, check the peak load. Table **1** shows the most common types of restriction. Each of them is associated to a coefficient **K**. The maximum stroke of cylinder L multiplied by coefficient **K** produces the L_v value (virtual length, $L_v = L*K$). Graph **2** indicates the rod's minimum diameter, based on load. The point of intersection between L_v in mm. and pushing force F in KN must be below the characteristic curve of the rod to be checked.
Example:
cylinder CD63/28/750/FA/00B (front flange), that exerts a 55 KN pressure. Table **1** shows coefficient **K**, determined by the type of restriction **K = 2**, the virtual length is $L_v = L*K$ $L_v = 750*2 = 1500$ **mm**
In graph **2** you can check whether the point of intersection between L_v and **F** is below the curve of rod Ø 28. Since the stability condition has not been met, adopt the differential rod Ø 45. The cylinder CD63/45/750FA00B will be therefore selected, for which the stability condition has been met.

Graph 2

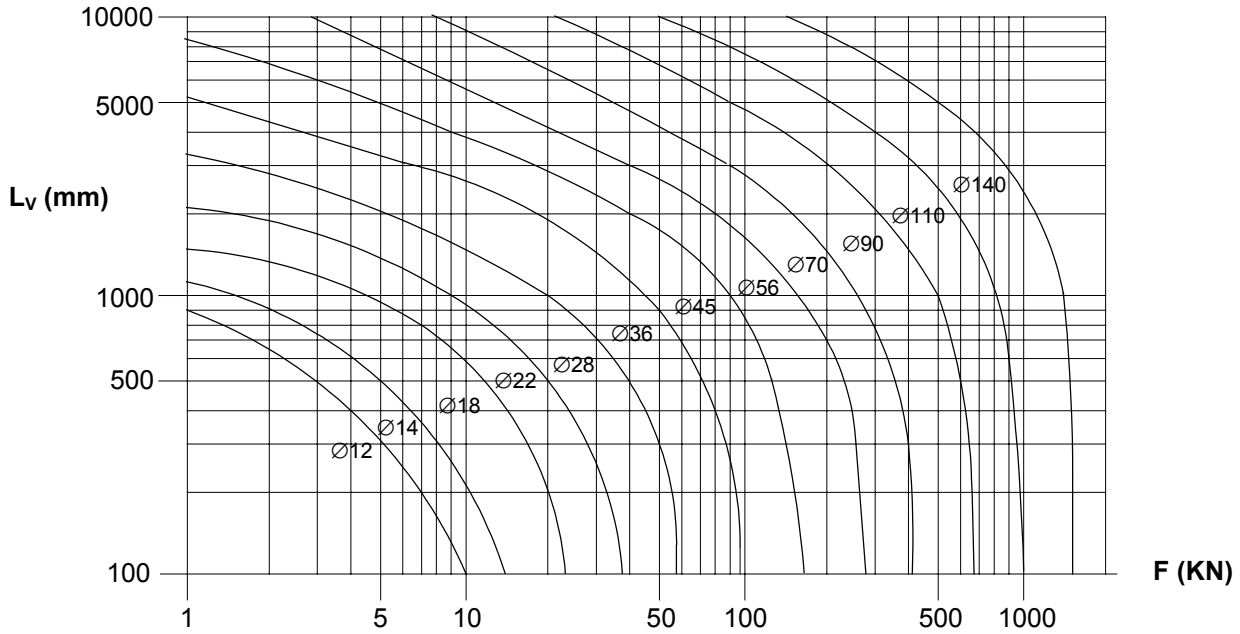
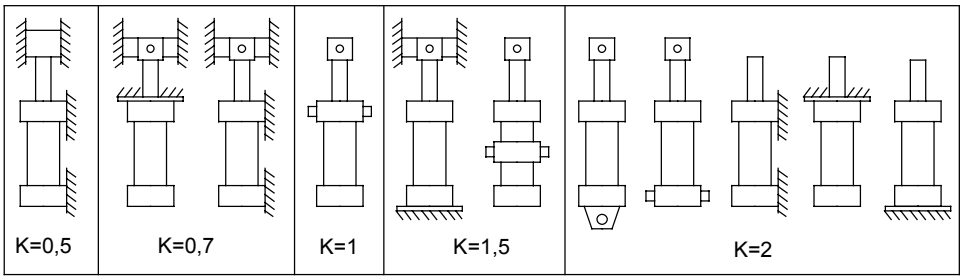
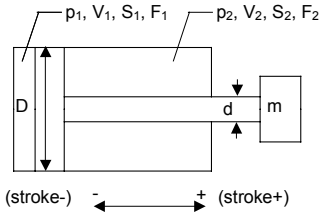


Table 1





2.2 PRACTICAL UNIT OF MEASUREMENT FOR FORCE AND SPEED CALCULATION

DESCRIPTION	SYMBOL	UNIT OF MEASURE
Section	S	cm^2
Pressure	p	bar
∅ piston	D	mm
∅ rod	d	mm
Speed	V	m/s
Capacity	Q	l/min
Load	m	kg

PUSHING FORCE (**STROKE +**)

$F_1=(p_1 \bullet S_1)$ (Kg)

PULLING FORCE (**STROKE -**)

$F_2=(p_2 \bullet S_2)$ (Kg)

PUSHING SPEED (**STROKE +**)

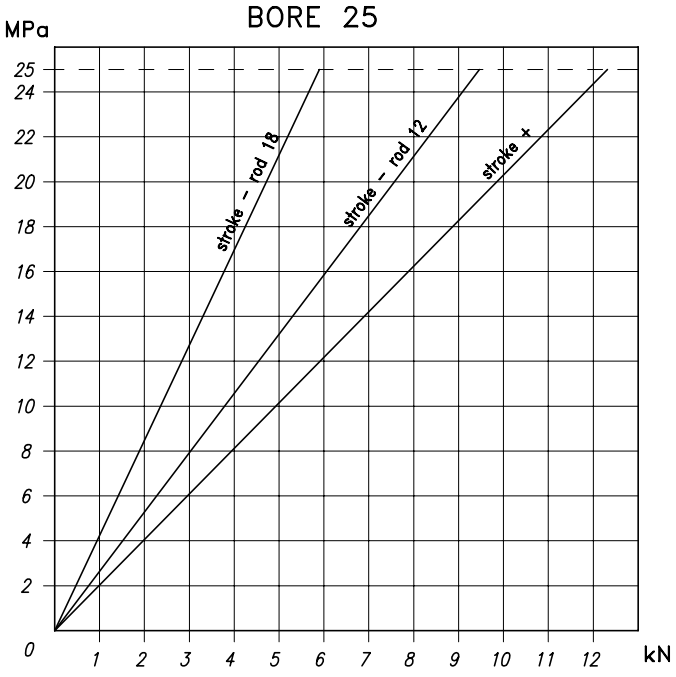
$V_1=Q/(6 \bullet S_1)$ (m/s)

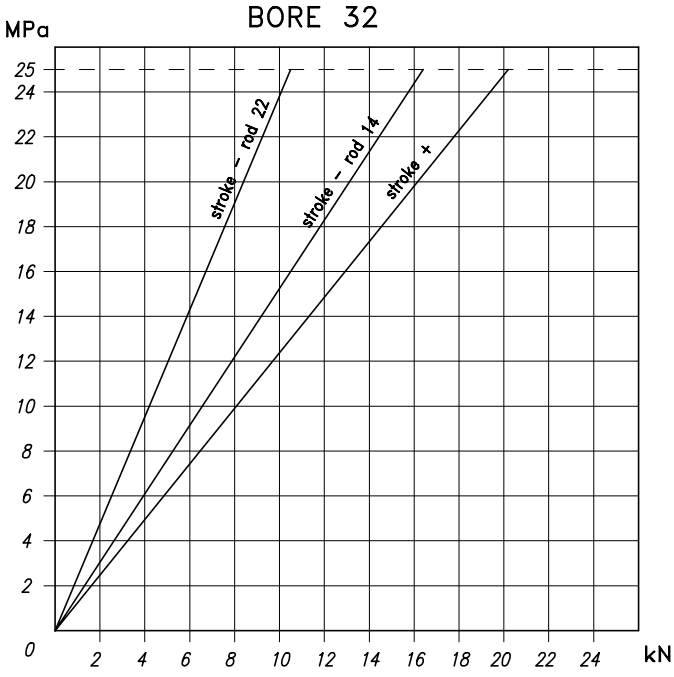
PULLING SPEED (**STROKE -**)

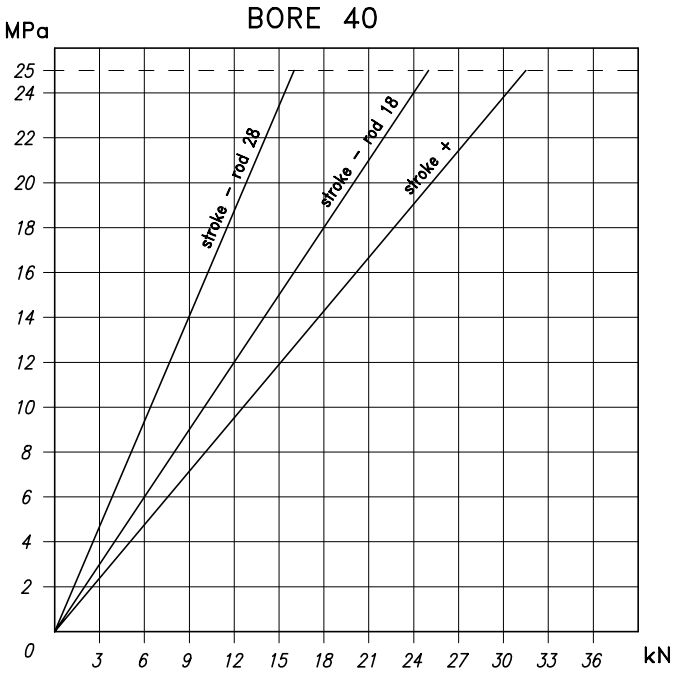
$V_2=Q/(6 \bullet S_2)$ (m/s)

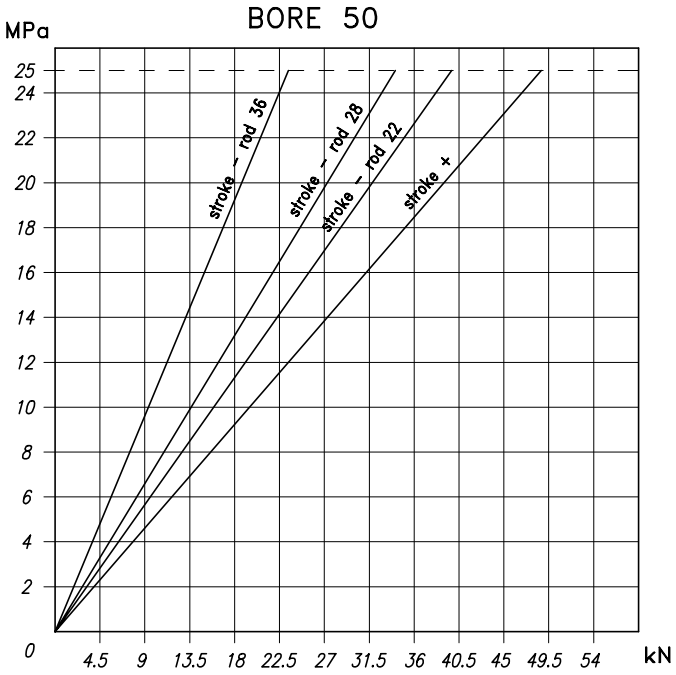
$$S_1 = \frac{\pi \bullet D^2}{4 \bullet 100} \text{ (cm}^2\text{)} \qquad S_2 = \frac{\pi \bullet (D^2 - d^2)}{4 \bullet 100} \text{ (cm}^2\text{)}$$

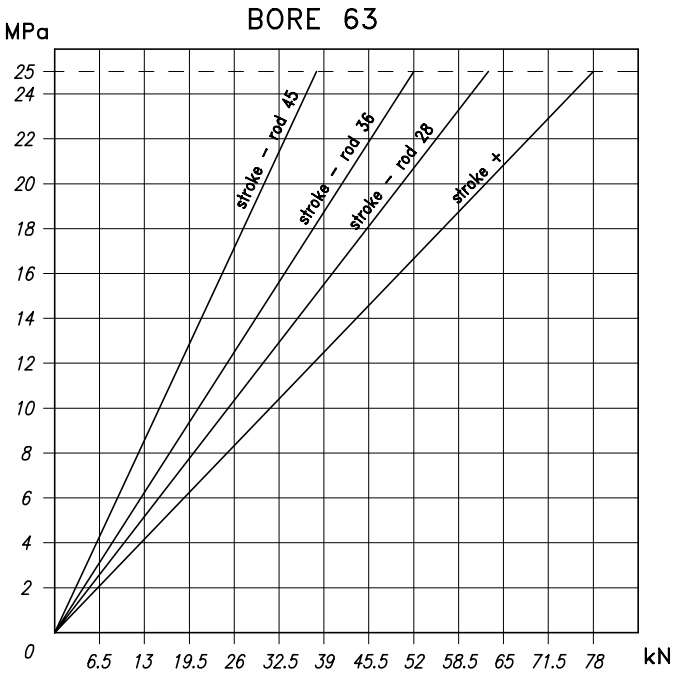
2.3 FORCE/PRESSURE DIAGRAMS

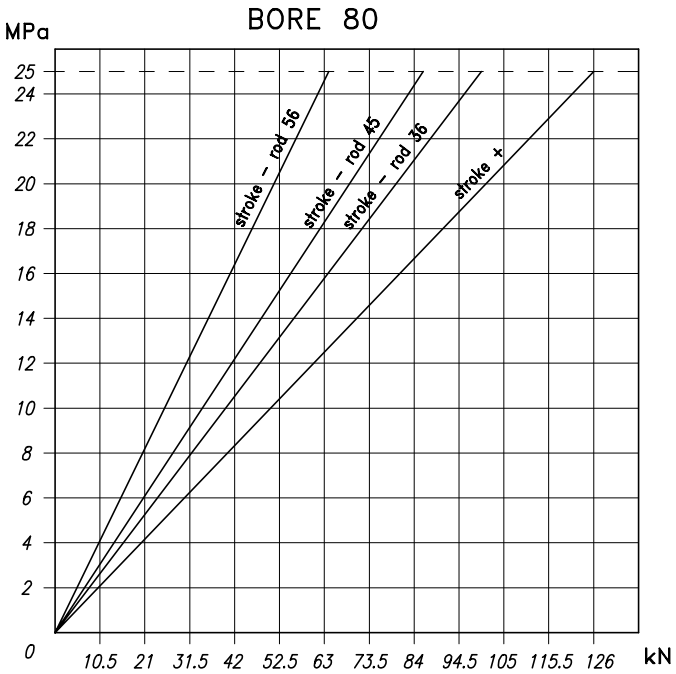


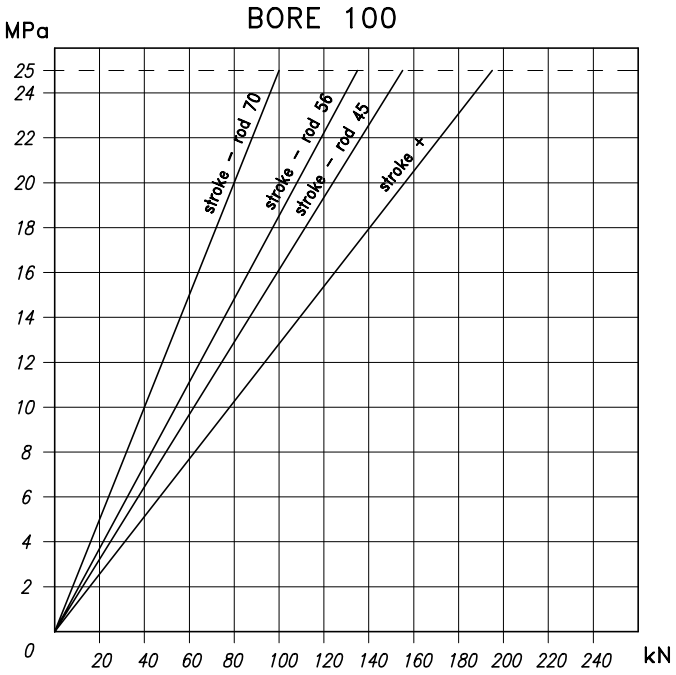


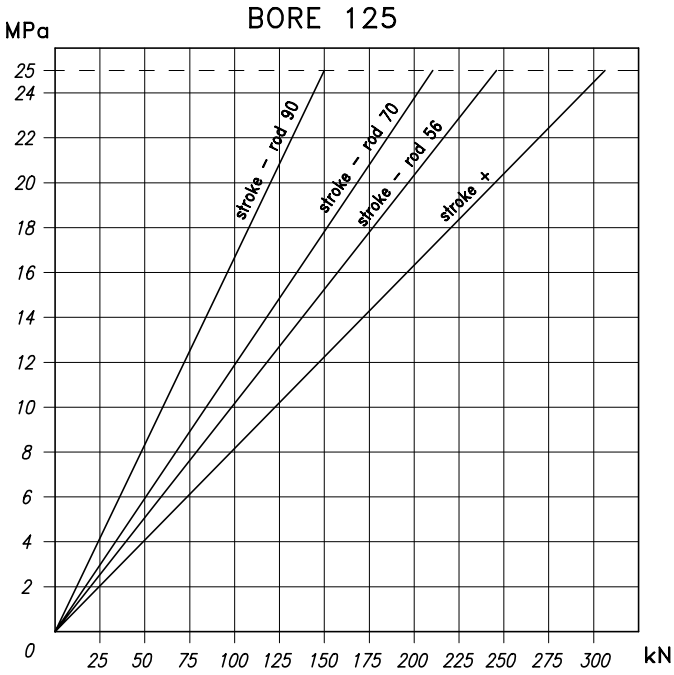

BORE 40
MPa
25
24
22
20
18
16
14
12
10
8
6
4
2
0
stroke – rod 28
stroke – rod 18
stroke +
3 6 9 12 15 18 21 24 27 30 33 36
kN

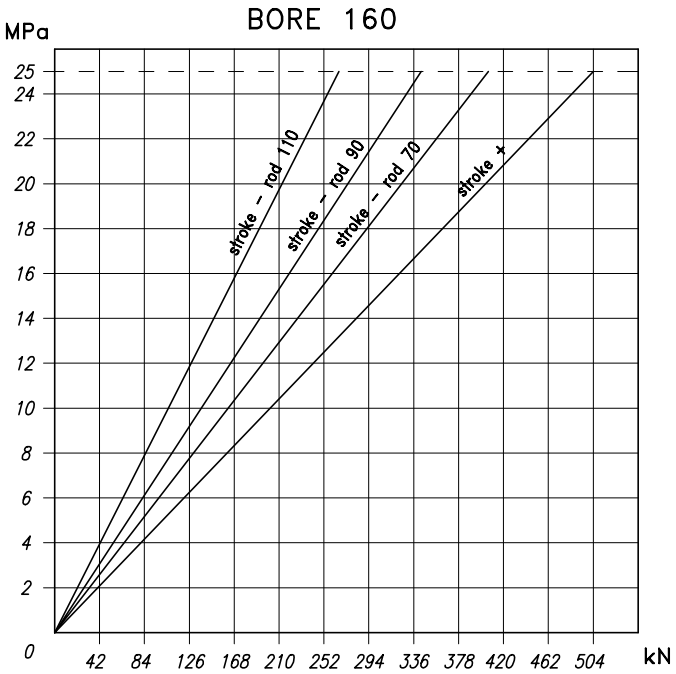

BORE 50
MPa
25
24
22
20
18
16
14
12
10
8
6
4
2
0
stroke – rod 36
stroke – rod 28
stroke – rod 22
stroke +
4.5 9 13.5 18 22.5 27 31.5 36 40.5 45 49.5 54
kN

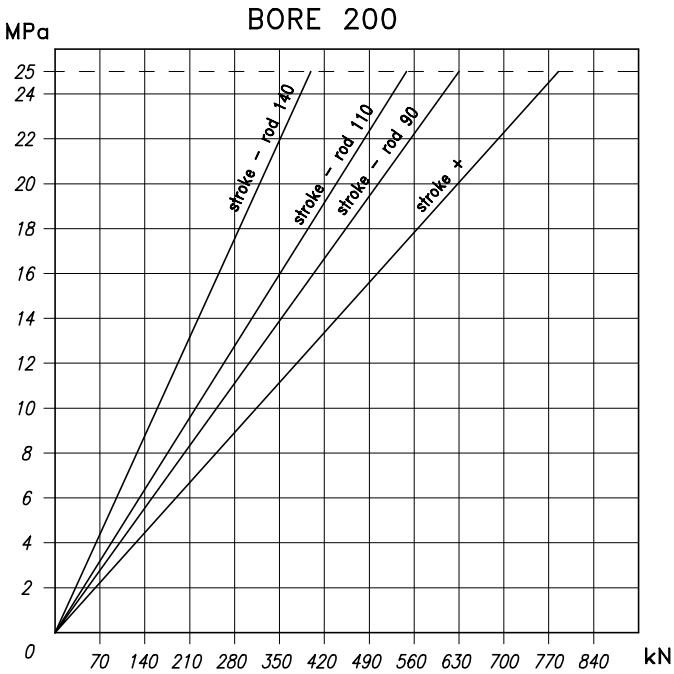

BORE 63
MPa
25
24
22
20
18
16
14
12
10
8
6
4
2
0
stroke – rod 45
stroke – rod 36
stroke – rod 28
stroke +
6.5 13 19.5 26 32.5 39 45.5 52 58.5 65 71.5 78
kN


BORE 80
MPa
25
24
22
20
18
16
14
12
10
8
6
4
2
0
stroke – rod 56
stroke – rod 45
stroke – rod 36
stroke +
10.5 21 31.5 42 52.5 63 73.5 84 94.5 105 115.5 126
kN


BORE 100
MPa
25
24
22
20
18
16
14
12
10
8
6
4
2
0
20 40 60 80 100 120 140 160 180 200 220 240
kN
stroke - rod 70
stroke - rod 56
stroke - rod 45
stroke +


BORE 125
MPa
25
24
22
20
18
16
14
12
10
8
6
4
2
0
25 50 75 100 125 150 175 200 225 250 275 300
kN
stroke - rod 90
stroke - rod 70
stroke - rod 56
stroke +


BORE 160
MPa
25
24
22
20
18
16
14
12
10
8
6
4
2
0
42 84 126 168 210 252 294 336 378 420 462 504
kN
stroke - rod 110
stroke - rod 90
stroke - rod 70
stroke +

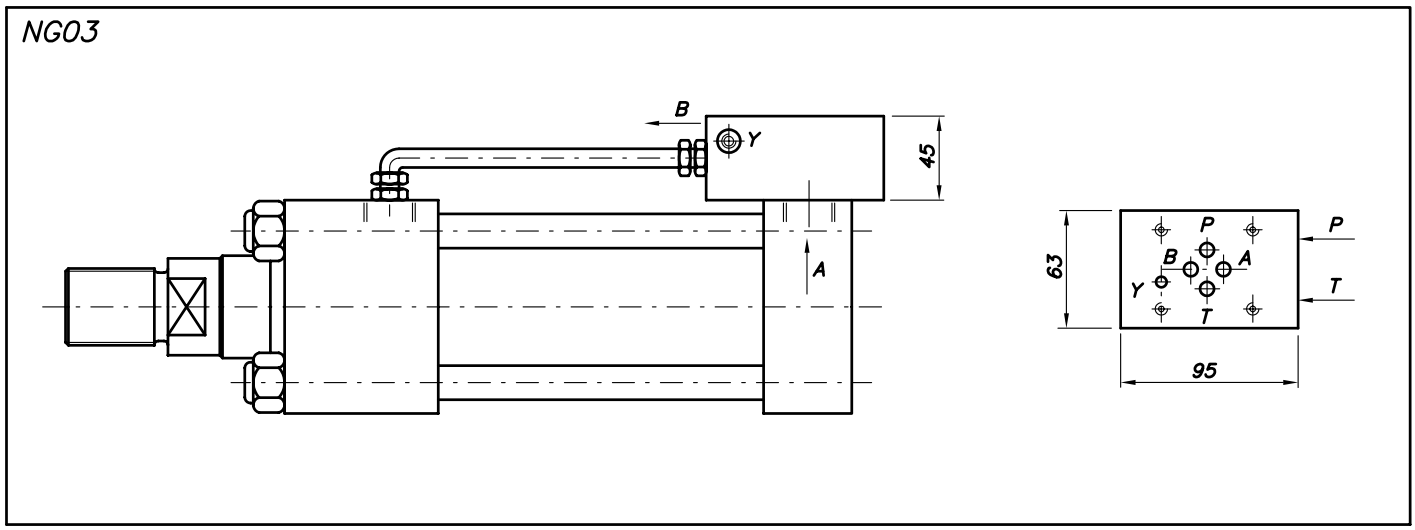

BORE 200
MPa
25
24
22
20
18
16
14
12
10
8
6
4
2
0
70 140 210 280 350 420 490 560 630 700 770 840
kN
stroke - rod 140
stroke - rod 110
stroke - rod 90
stroke +

3.1 BUILT-IN PLATES

The CH cylinders can be provided with ISO/Cetop plate (03, 05), for mounting the valves directly on the cylinder.

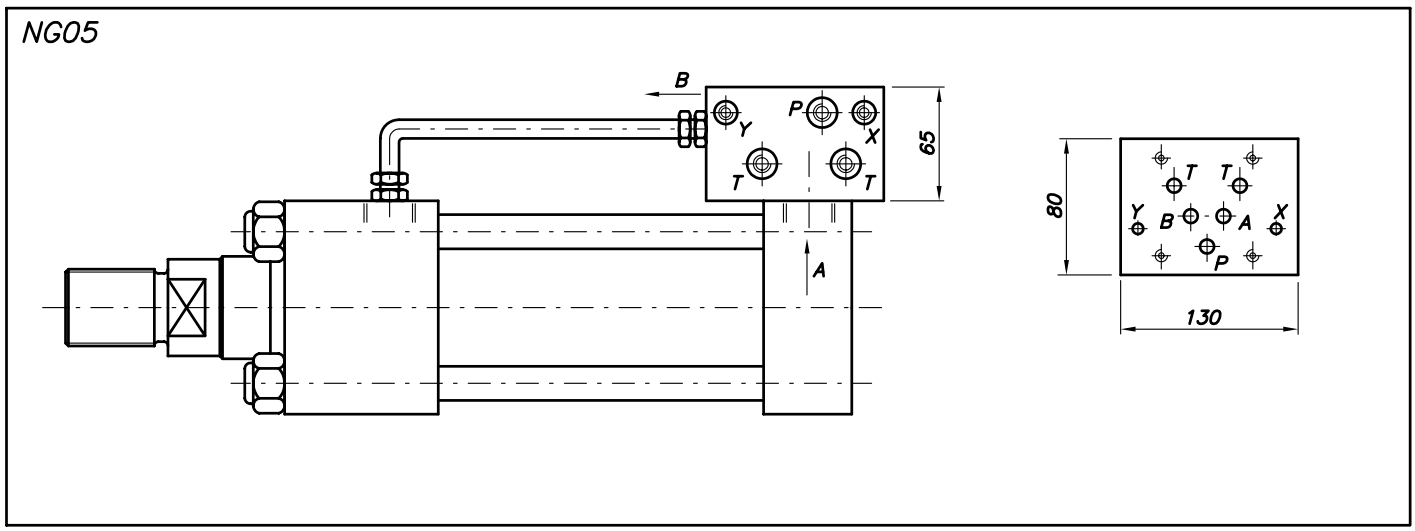
- CH cylinder with ISO/Cetop plate 03

Can be mounted on cylinders with 40 to 200mm bores (minimum stroke 100mm).
P and T connections are of 3/8" BSP type, the Y connection is of 1/8" BSP type.
For further details, contact our Technical Department



- CH cylinder with ISO/Cetop plate 05

Can be mounted on cylinders with 40 to 200mm bores (minimum stroke 150mm).
P and T connections are of ¾ P type, the X and Y connections are of 1/4" BSP type.
For further details, contact our Technical Department



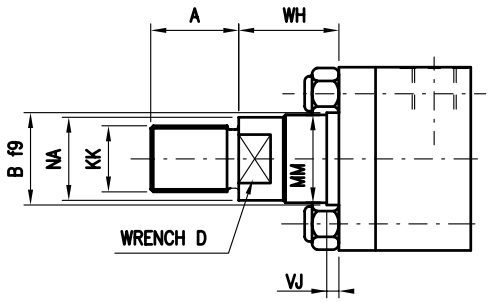
EXAMPLE: DETERMINING THE ACRONYM FOR THE ORDER

CHARACTERISTIC	DESCRIPTION	SYM.	EXAMPLE
SERIES	tie rod execution	CH	CH/50/22/.../100/EB/10 A....
BORE	indicate mm		
ROD	indicate mm		
ROD N° 2	indicate mm (piston rod only)		
STROKE	indicate mm		
EXECUTION	rear + front protruding tie rods	AP	
	front flange	FA	
	rear flange	FP	
	feet	PI	
	female hinge	CF	
	male hinge	CM	
	joint hinge	CS	
	front trunnion	OA	
	intermediate trunnion	OI	
	rear trunnion	OP	
	front protruding tie rods	TA	
	rear protruding tie rods	TP	
	front treaded holes	ZA	
	rear treaded holes	ZP	
BRAKING	without braking	0	
	front braking	1	
	rear braking	2	
	front + rear braking	3	
SPACER	without spacer	0	
	50mm	1	
	100mm	2	
	150mm	3	
	200mm	4	
SEALS	polyurethane (standard)	A	
	nitrile + PTFE (anti-friction)	B	
	viton + PTFE (high temperatures)	C	
	nitrile+carbographite(anti-friction water glycol)	E	
OPTIONS*			
ROD ENDS	type D	D	
	type F	F	
AIR VENTS	front	G	
	rear	H	
	front + rear	I	
DOUBLE ROD SEAL		L	
DRAINAGE	rod side	W	
ROD TREATMENT	heavy chromium-plated, 0.045mm thick, 100h salt mist ISO 3768	P	
	hardening and chromium-plating	T	
	Ni-CROMAX30 chromium-plated, nickel-plated, ASTM B 117 1000h	N	
PROXIM. SENSORS	front	X1	
	rear	X2	
	front + rear	X3	
HYDRAULIC PLATE	ISO/Ceto 03	NG03	
	ISO/Ceto 05	NG05	

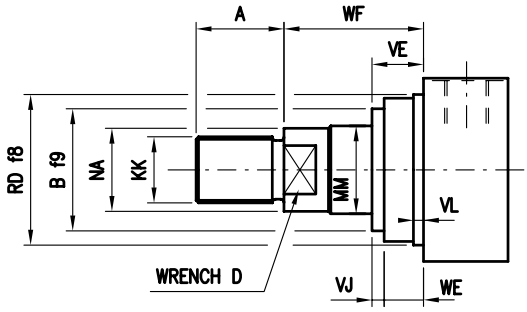
* to be reported in alphabetic order

DIMENSIONS OF THE ROD ENDS

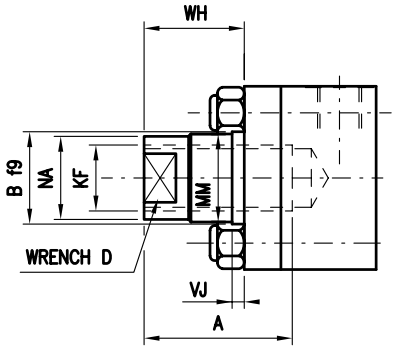
Rod end, type M and D
All, apart from FA fastening (ISO ME5)



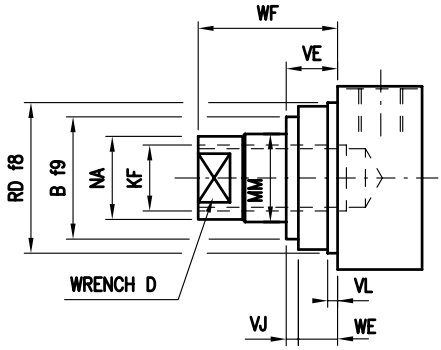
Rod end, type M and D
FA fastening (ISO ME5)



Rod end, type F
All, apart from FA fastening (ISO ME5)

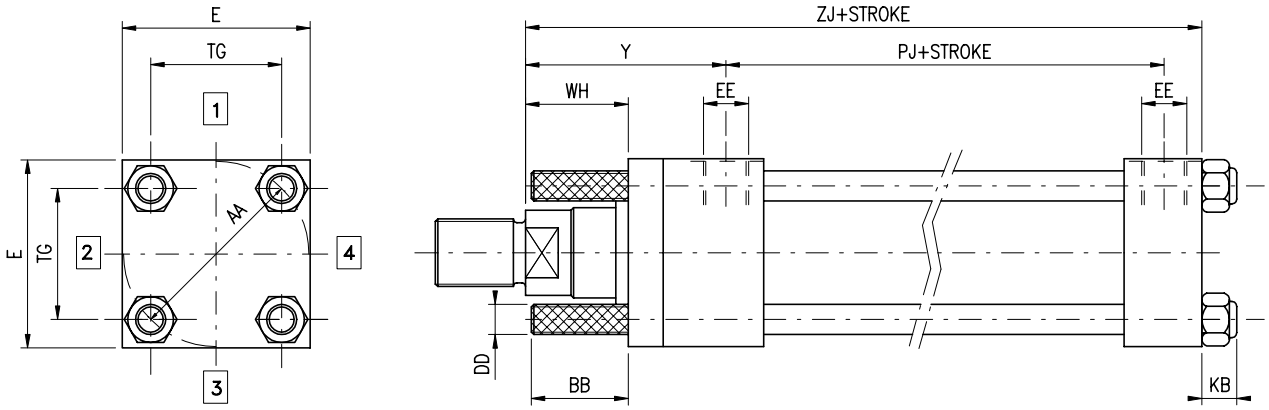


Rod end, type F
FA fastening (ISO ME5)

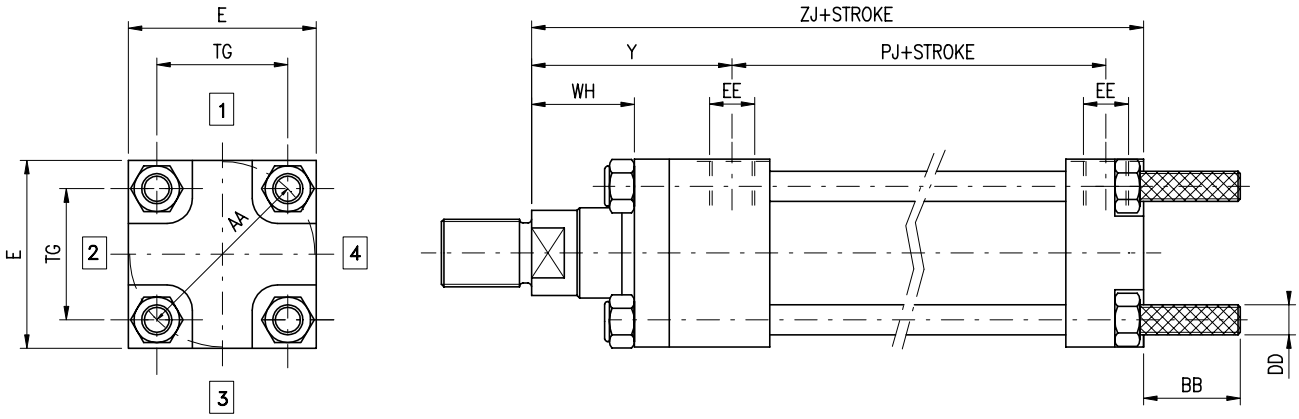


BORE	N°	MM	**Type M** ISO 6020/2 (1991)		Type D DIN 24554		Type F		B	D	NA	WF	WH	VE	VJ	FA fastening only			
	rod	rod	KK	A	KK	A	KF	A								VL_{min}	RD	VJ	WE
25	1	12	M10x1,25	14	M10x1,25	14	M8x1	14	24	10	11	25	15	16	6	3	38	6	10
	2	18	M14x1,5	18	M10x1,25	14	M12x1,25	18	30	15	17	25	15	16	6				
32	1	14	M12x1,25	16	M12x1,25	16	M10x1,25	16	26	12	13	35	25	22	12	3	42	12	10
	2	22	M16x1,5	22	M12x1,25	16	M16x1,5	22	34	18	21	35	25	22	12				
40	1	18	M14x1,5	18	M14x1,5	18	M12x1,25	18	30	15	17	35	25	22	6	3	62	12	10
	2	28	M20x1,5	28	M14x1,5	18	M20x1,5	28	42	22	26	35	25	22	12				
50	1	22	M16x1,5	22	-	-	M16x1,5	22	34	18	21	41	25	25	9	4	74	9	16
	2	36	M27x2	36	M16x1,5	22	M27x2	36	50	30	34	41	25	25	9				
	3*	28*	M20x1,5	28	M16x1,5	22	M20x1,5	28	42	22	26	41	25	25	9				
63	1	28	M20x1,5	28	-	-	M20x1,5	28	42	22	26	48	32	28	12	4	75	12	16
	2	45	M33x2	45	M20x1,5	28	M33x2	45	60	39	43	48	32	29	13		88	13	
	3*	36*	M27x2	36	M20x1,5	28	M27x2	36	50	30	34	48	32	29	13				
80	1	36	M27x2	36	-	-	M27x2	36	50	30	34	51	31	29	9	4	82	9	20
	2	56	M42x2	56	M27x2	36	M42x2	56	72	48	54	51	31	29	9		105		
	3*	45*	M33x2	45	M27x2	36	M33x2	45	60	39	43	51	31	29	9				
100	1	45	M33x2	45	-	-	M33x2	45	60	39	43	57	35	32	10	5	92	10	22
	2	70	M48x2	63	M33x2	45	M48x2	63	88	62	68	57	35	32	10		125		
	3*	56*	M42x2	56	M33x2	45	M42x2	56	72	48	54	57	35	32	10				
125	1	56	M42x2	56	-	-	M42x2	56	72	48	54	57	35	32	10	5	105	10	22
	2	90	M64x3	85	M42x2	56	M64x3	85	108	80	88	57	35	32	10		150		
	3*	70*	M48x2	63	M42x2	56	M48x2	63	88	62	68	57	35	32	10				
160	1	70	M48x2	63	-	-	M48x2	63	88	62	68	57	32	32	7	5	125	7	25
	2	110	M80x3	95	M48x2	63	M80x3	95	133	100	108	57	32	32	7		170		
	3*	90*	M64x3	85	M48x2	63	M64x3	85	108	80	88	57	32	32	7				
200	1	90	M64x3	85	-	-	M64x3	85	108	80	88	57	32	32	7	5	150	7	25
	2	140	M100x3	112	M64x3	85	M100x3	112	163	128	138	57	32	32	7		210		
	3*	110*	M80x3	95	M64x3	85	M80x3	95	133	100	108	57	32	32	7				

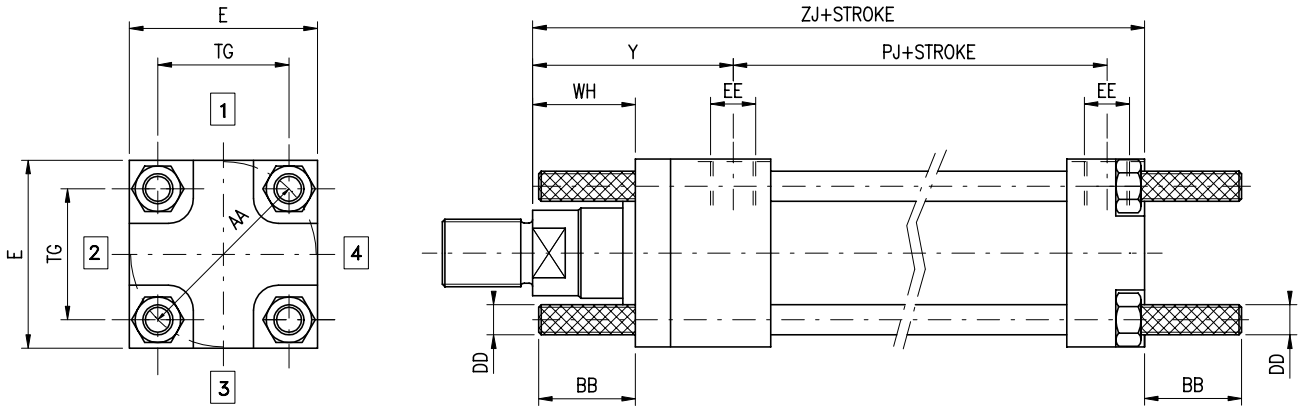
* Diameters not provided for by ISO-DIN



TA: (ISO type MX3)



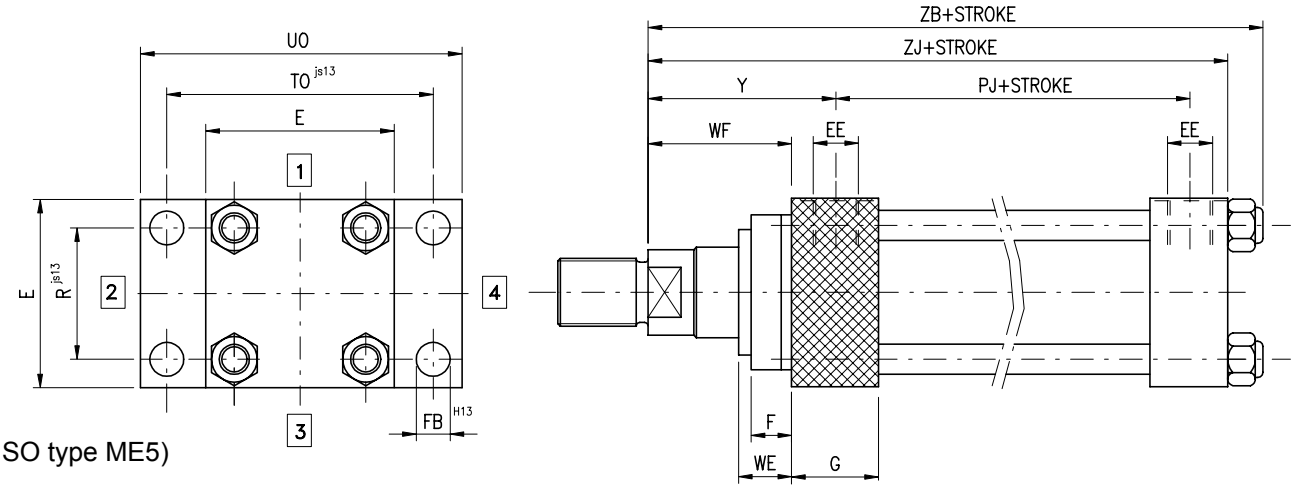
TP: (ISO type MX2)



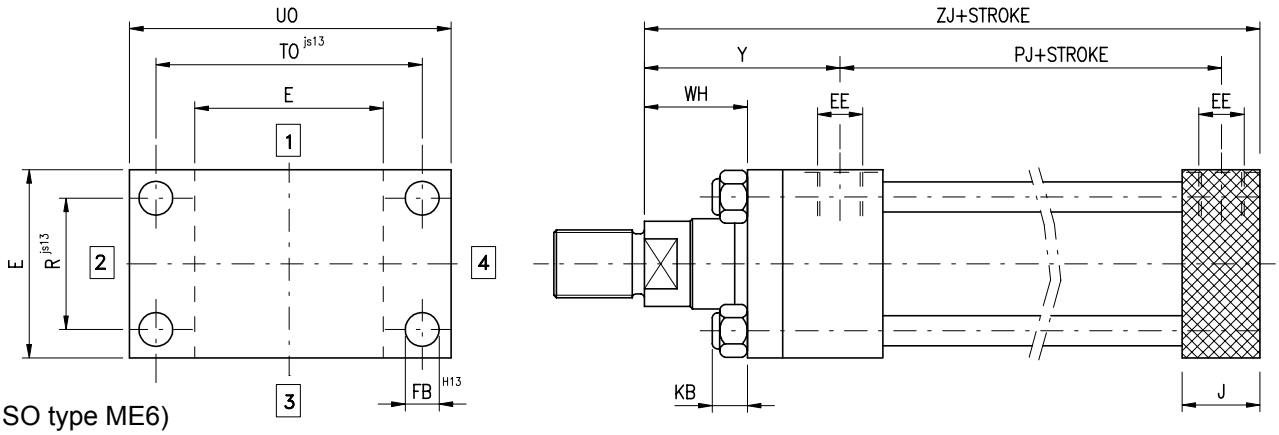
AP: (ISO type MX1)

Bore	AA	BB	DD	E	EE	KB	TG	WH	ZJ	Y	PJ
25	40	19	M5x0,8	40*	1/4"	6,8	28,3	15	114	50	53
32	47	24	M6x1	45*	1/4"	7,8	33,2	25	128	60	56
40	59	35	M8x1	60	3/8"	10,6	41,7	25	153	62	73
50	74	46	M12x1,25	75	1/2"	14,8	52,3	25	159	67	74
63	91	46	M12x1,25	90	1/2"	14,8	64,3	32	168	71	80
80	117	59	M16x1.5	115	3/4"	18	82,7	31	190	77	93
100	137	59	M16X1,5	126	3/4"	18	96,9	35	203	82	101
125	178	81	M22x1,5	165	1"	25	125,9	35	232	86	117
160	219	92	M27x2	196	1"	30,8	154,9	32	245	86	121
200	269	115	M30x2	240	1 1/4"	33,2	190,2	32	299	98	158,5

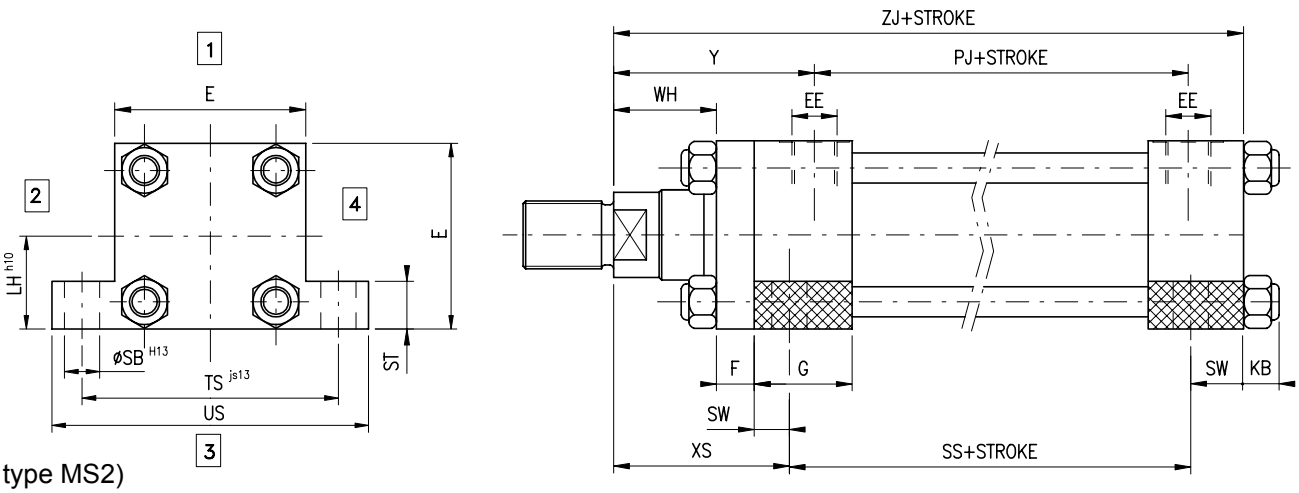
* On 25 and 32 bore cylinders, the head is increased by 5mm to house the connection



FA: (ISO type ME5)



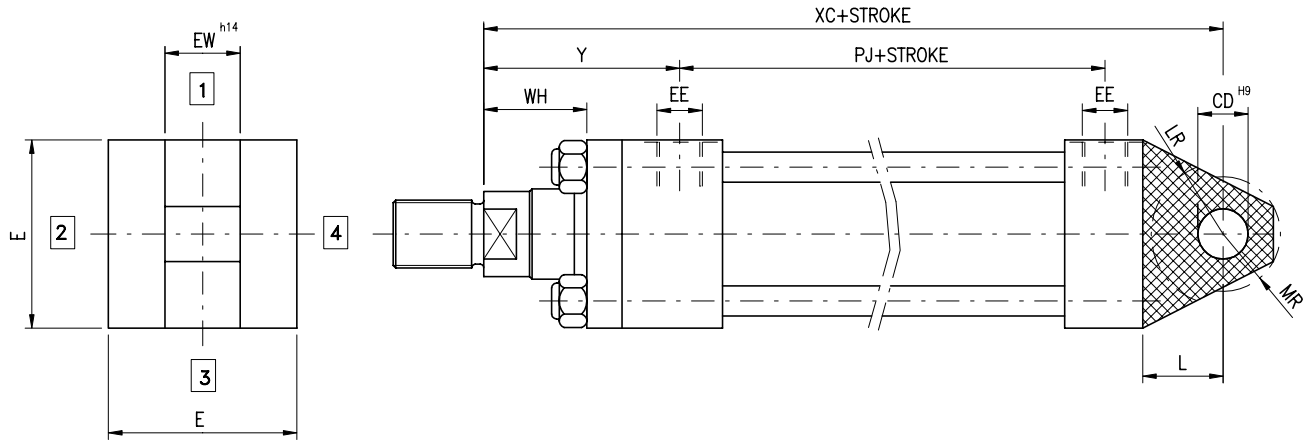
FP: (ISO type ME6)



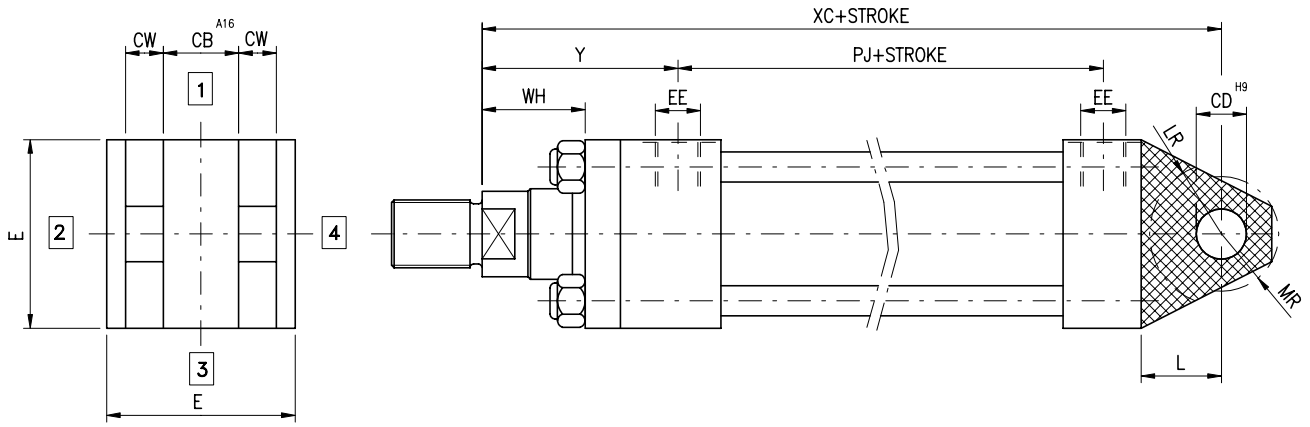
PI: (ISO type MS2)

Bore	E	EE	F	FB	G	J	KB	LH	R	SB	SS	ST	SW	TO	TS	UO	US	WE	WF	WH	XS	ZB	ZJ	Y	PJ
25	40*	1/4"	10	5,5	25	25	6,8	19	27	6,6	73	8,5	8	51	54	65	72	16	25	15	33	121	114	50	53
32	45*	1/4"	10	6,6	25	25	7,8	22	33	9	73	12,5	10	58	63	70	84	22	35	25	45	136	128	60	56
40	60	3/8"	10	11	38	38	10,6	31	41	11	98	12,5	10	87	83	110	103	22	35	25	45	164	153	62	73
50	75	1/2"	16	14	38	38	14,8	37	52	14	92	19	13	105	102	130	127	25	41	25	54	174	159	67	74
63	90	1/2"	16	14	38	38	14,8	44	65	18	86	26	17	117	124	145	161	29	48	32	65	183	168	71	80
80	115	3/4"	20	18	45	45	18	57	83	18	105	26	17	149	149	180	186	29	51	31	68	208	190	77	93
100	126	3/4"	22	18	45	45	18	63	97	26	102	32	22	162	172	200	216	32	57	35	79	221	203	82	101
125	165	1"	22	22	58	58	25	82	126	26	131	32	22	208	210	250	254	32	57	35	79	257	232	86	117
160	196	1"	25	26	58	58	30,8	101	155	33	130	38	29	253	260	300	318	32	57	32	86	276	245	86	121
200	240	1 1/4"	25	33	76	76	33,2	122	190	39	172	44	35	300	311	360	381	32	57	32	92	332	299	98	158,5

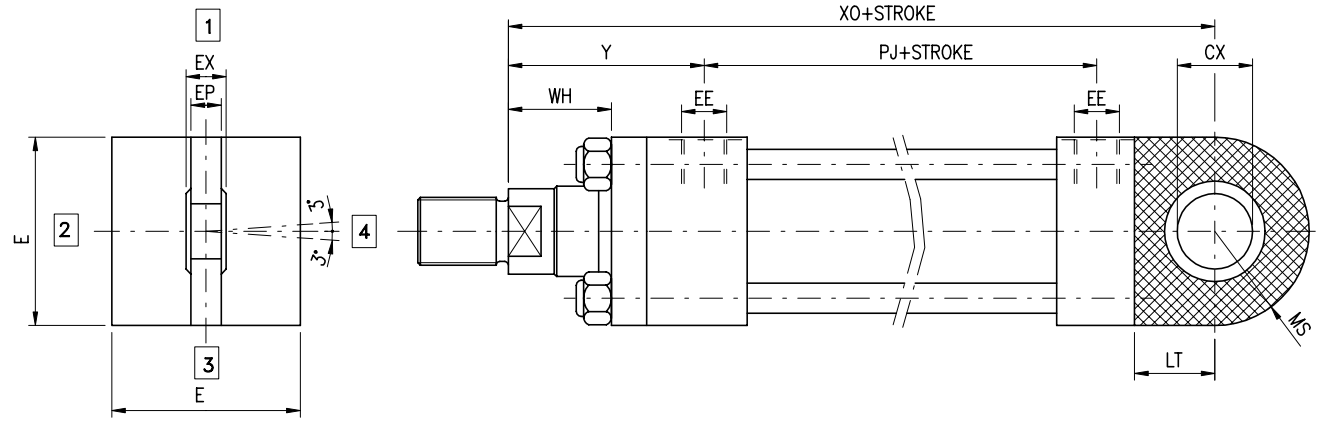
* On 25 and 32 bore cylinders, the head is increased by 5mm to house the connection



CM: (ISO type MP3)



CF: (ISO type MP1)

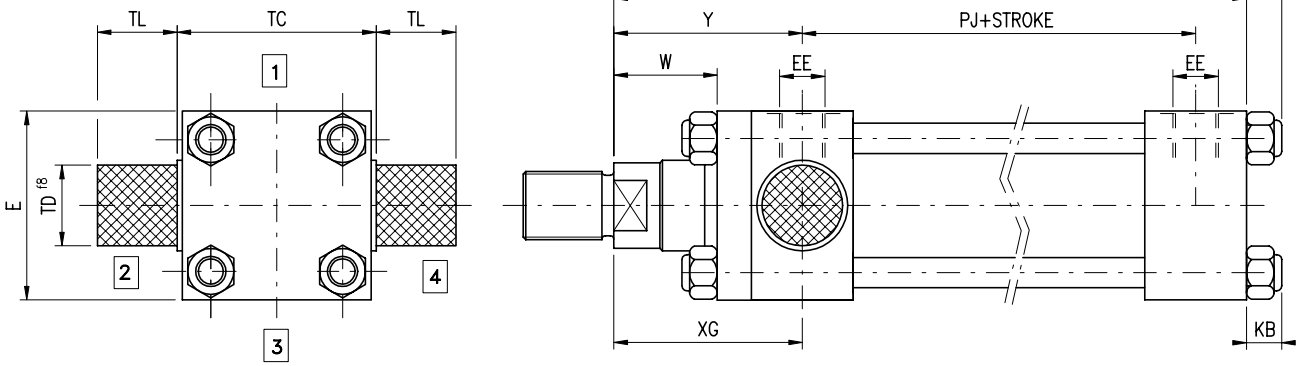


CS: (ISO type MP5)

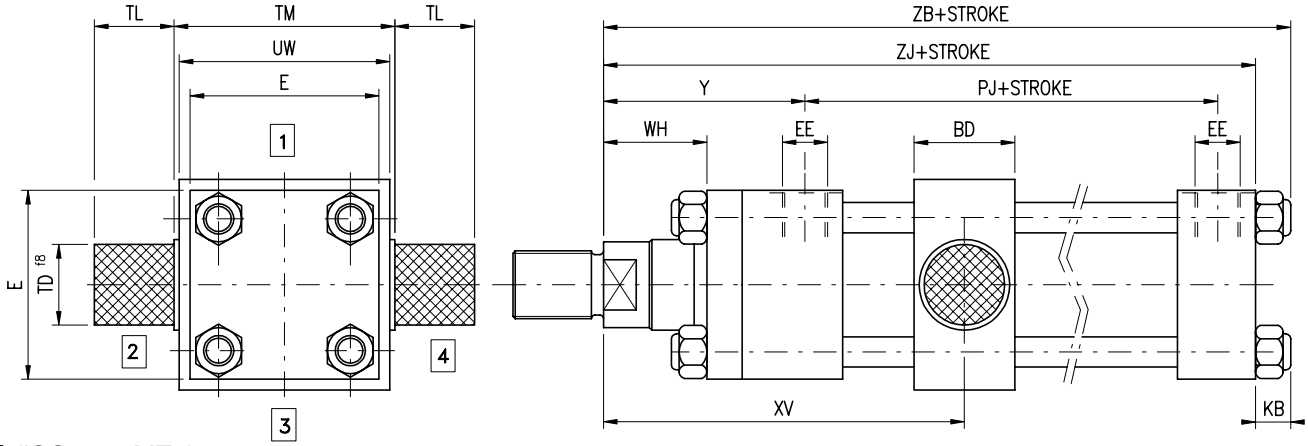
Bore	CB	CD	CW	CX	E	EE	EP	EW	EX	L	LR	LT	MR	MS	WH	XC	XO	Y	PJ
25	12	10	6	12	40*	1/4"	8	12	10	13	12	16	12	20	15	127	130	50	53
32	16	12	8	16	45*	1/4"	11	16	14	19	17	20	17	22,5	25	147	148	60	56
40	20	14	14	20	60	3/8"	13	20	16	19	17	25	17	29	25	172	178	62	73
50	30	20	15	25	75	1/2"	17	30	20	32	29	31	29	33	25	191	190	67	74
63	30	20	15	30	90	1/2"	19	30	22	32	29	38	29	40	32	200	206	71	80
80	40	28	20	40	115	3/4"	23	40	28	39	34	48	34	50	31	229	238	77	93
100	50	36	25	50	126	3/4"	30	50	35	54	50	58	50	62	35	257	261	82	101
125	60	45	30	60	165	1"	38	60	44	57	53	72	53	80	35	289	304	86	117
160	70	56	35	80	196	1"	47	70	55	78	59	107	59	98	32	308	337	86	121
200	80	70	40	100	240	1 1/4"	57	80	70	97	78	131	78	120	32	381	415	98	158,5

* On 25 and 32 bore cylinders, the head is increased by 5mm to house the connection

Note: for 100 to 200mm bores, the head and flange consist of 1 piece only, and tie rods are screwed.

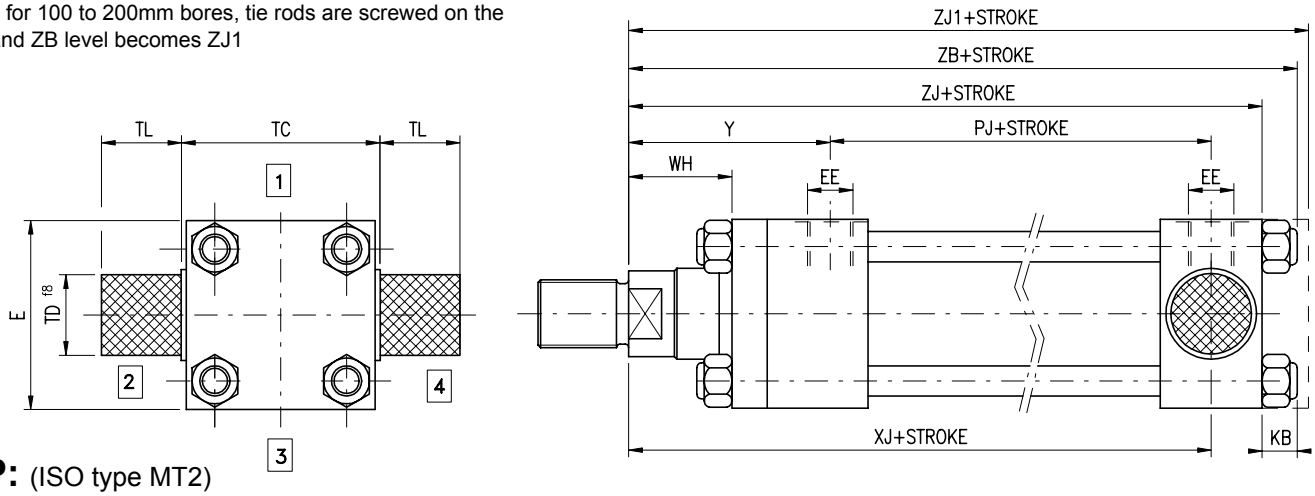


OA: (ISO type MT1)



OI: (ISO type MT4)

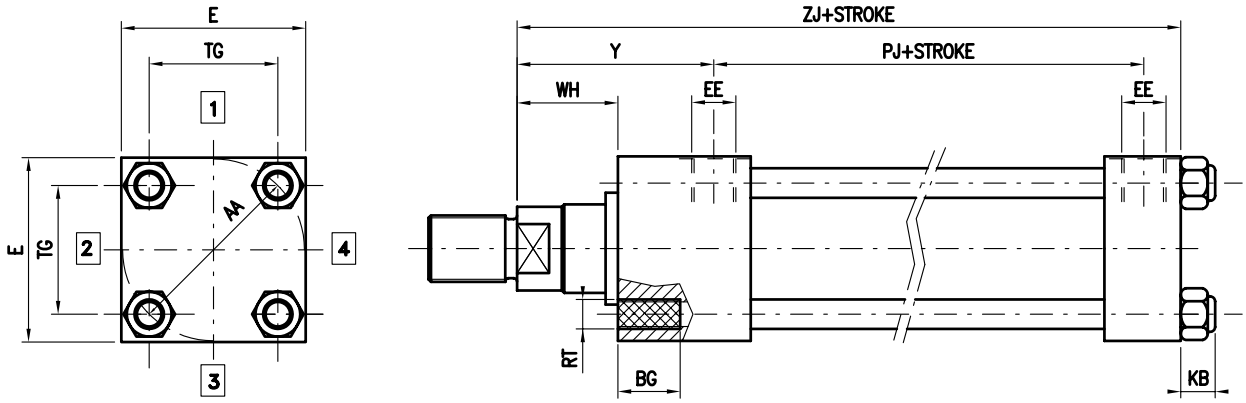
Note: for 100 to 200mm bores, tie rods are screwed on the cap and ZB level becomes ZJ1



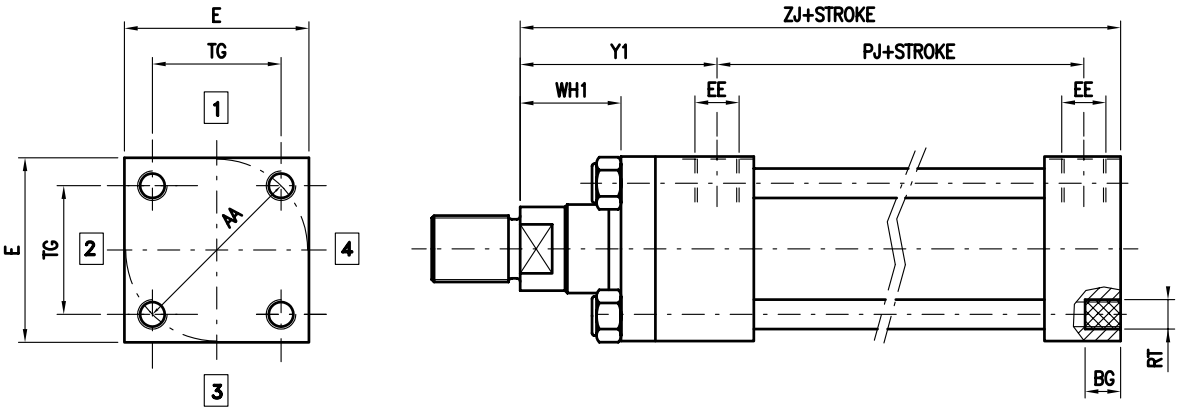
OP: (ISO type MT2)

Bore	BD	E	EE	KB	TC	TD	TL	TM	UW	WH	XG	XJ	XV_{min}	XV_{max}	ZJ	ZJ1	ZB	Y	PJ
25	20	40*	1/4"	6,8	38	12	10	48	46	15	44	101	82	72+stroke	114	-	121	50	53
32	25	45*	1/4"	7,8	44	16	12	55	53	25	54	115	96	82+stroke	128	-	136	60	56
40	30	60	3/8"	10,6	63	20	16	76	74	25	57	134	107	88+stroke	153	-	164	62	73
50	40	75	1/2"	14,8	76	25	20	89	87	25	64	140	117	90+stroke	159	-	174	67	74
63	40	90	1/2"	14,8	89	32	25	100	98	32	70	149	132	91+stroke	168	-	183	71	80
80	48	115	3/4"	18	114	40	32	127	125	31	76	168	147	99+stroke	190	-	200	77	93
100	58	126	3/4"	18	127	50	40	140	138	35	71	187	158	107+stroke	203	216	-	82	101
125	68	165	1"	25	165	63	50	178	175	35	75	209	180	109+stroke	232	244	-	86	117
160	88	196	1"	30,8	203	80	63	215	212	32	75	230	198	104+stroke	245	273	-	86	121
200	108	240	1 1/4"	33,2	241	100	80	279	276	32	85	276	226	130+stroke	299	331	-	98	158,5

* On 25 and 32 bore cylinders, the head is increased by 5mm to house the connection



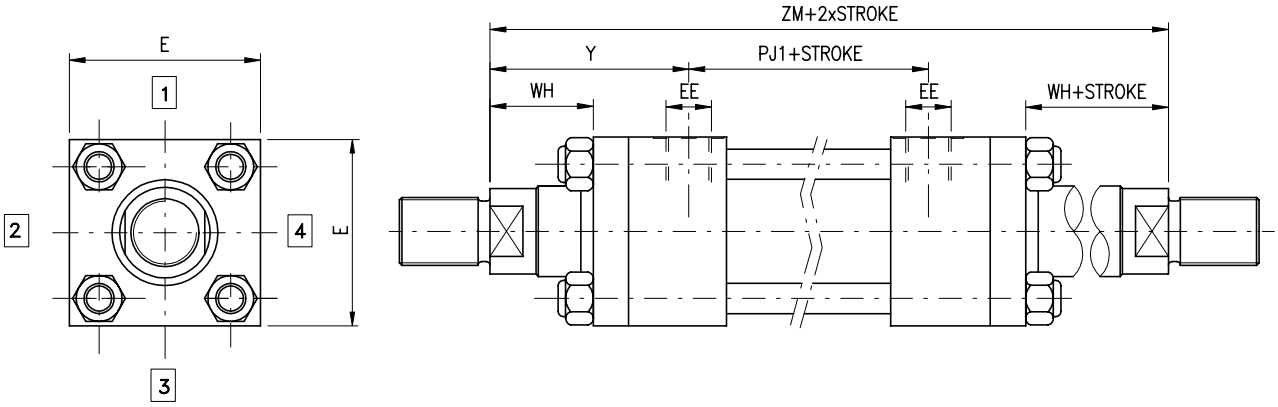
ZA



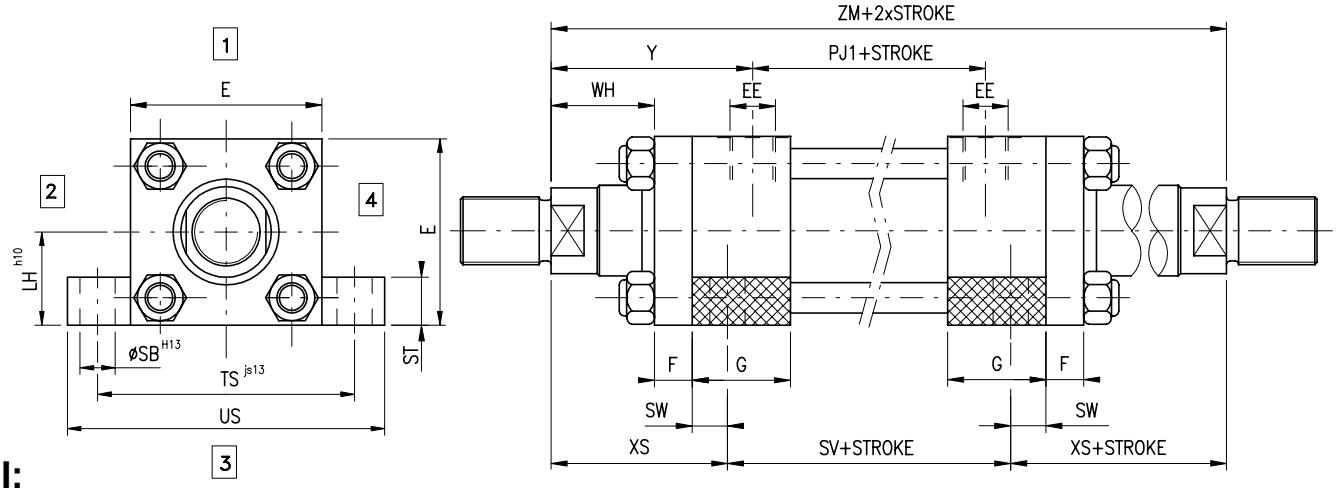
ZP

BORE	AA	BG min	E	EE	KB	RT	TG	WH	WH1	ZJ	Y	Y1	PJ
25	40	8	40*	1/4"	6,8	M5x0,8	28,3	15	15	114	50	50	53
32	47	9	45*	1/4"	7,8	M6x1	33,2	25	25	128	60	60	56
40	59	12	60	3/8"	10,6	M8x1,25	41,7	25	25	153	62	62	73
50	74	18	75	1/2"	14,8	M12x1,75	52,3	25	25	159	67	67	74
63	91	18	90	1/2"	14,8	M12x1,75	64,3	32	32	168	71	71	80
80	117	24	115	3/4"	18	M16x2	82,7	31	31	190	77	77	93
100	137	24	126	3/4"	18	M16X2	96,9	35	35	203	82	82	101
125	178	27	165	1"	25	M22x2,5	125,9	35	35	232	86	86	117
160	219	32	196	1"	30,8	M27x3	154,9	32	25	245	86	79	121
200	269	40	240	1 1/4"	33,2	M30x3,5	190,2	32	28	299	98	94	158,5

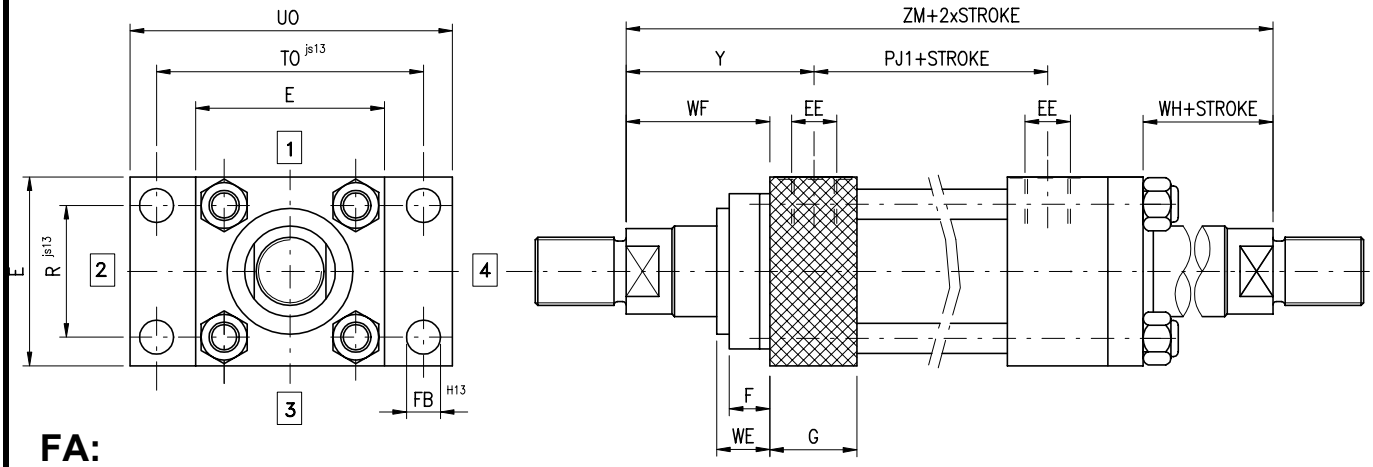
*On 25 and 32 bore cylinders, the head is increased by 5mm to house the connection.



EB:



PI:

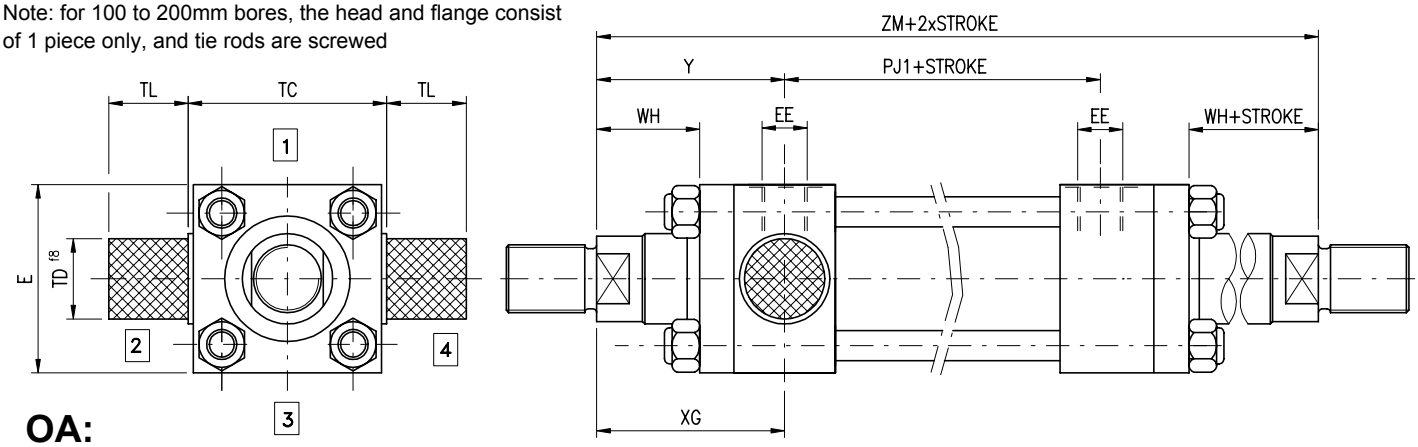


FA:

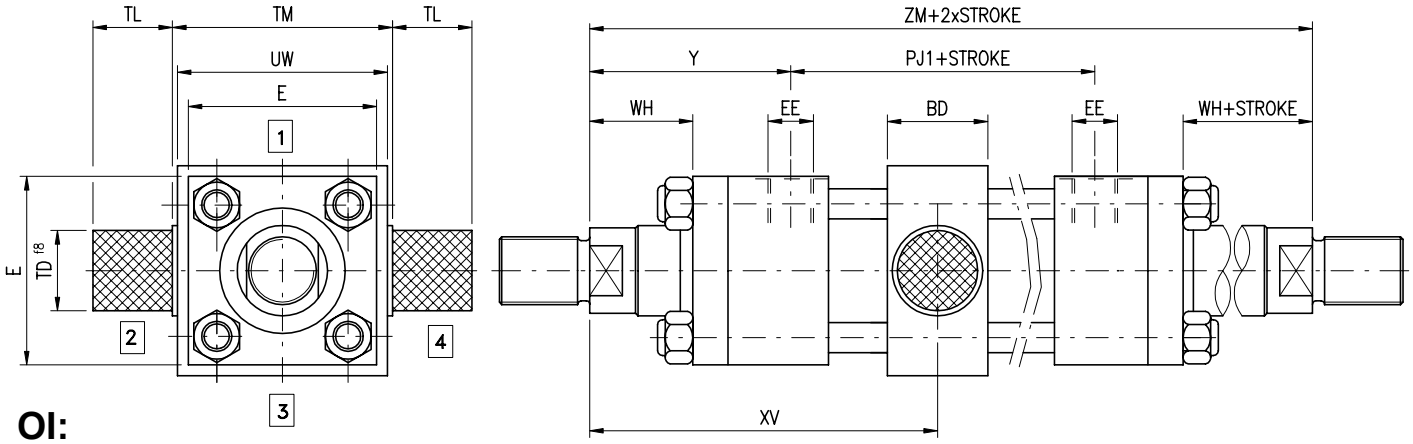
Bore	E	EE	F	FB	G	LH	R	SB	ST	SV	SW	TO	TS	UO	US	WE	WF	WH	XS	ZM	Y	PJ1
25	40*	1/4"	10	5,5	40	19	27	6,6	8,5	88	8	51	54	65	72	16	25	15	33	154	50	54
32	45*	1/4"	10	6,6	40	22	33	9	12,5	88	10	58	63	70	84	22	35	25	45	178	60	58
40	60	3/8"	10	11	45	31	41	11	12,5	105	10	87	83	110	103	22	35	25	45	195	62	71
50	75	1/2"	16	14	45	37	52	14	19	99	13	105	102	130	127	25	41	25	54	207	67	73
63	90	1/2"	16	14	45	44	65	18	26	93	17	117	124	145	161	29	48	32	65	223	71	81
80	115	3/4"	20	18	50	57	83	18	26	110	17	149	149	180	186	29	51	31	68	246	77	92
100	126	3/4"	22	18	50	63	97	26	32	107	22	162	172	200	216	32	57	35	79	265	82	101
125	165	1"	22	22	58	82	126	26	32	131	22	208	210	250	254	32	57	35	79	289	86	117
160	196	1"	25	26	58	101	155	33	38	121	29	253	260	300	318	32	57	32	86	293	86	121
200	240	1 1/4"	25	33	76	122	190	39	44	169	35	300	311	360	381	32	57	32	92	353	98	157

* On 25 and 32 bore cylinders, the head is increased by 5mm to house the connection

Note: for 100 to 200mm bores, the head and flange consist of 1 piece only, and tie rods are screwed



OA:



OI:

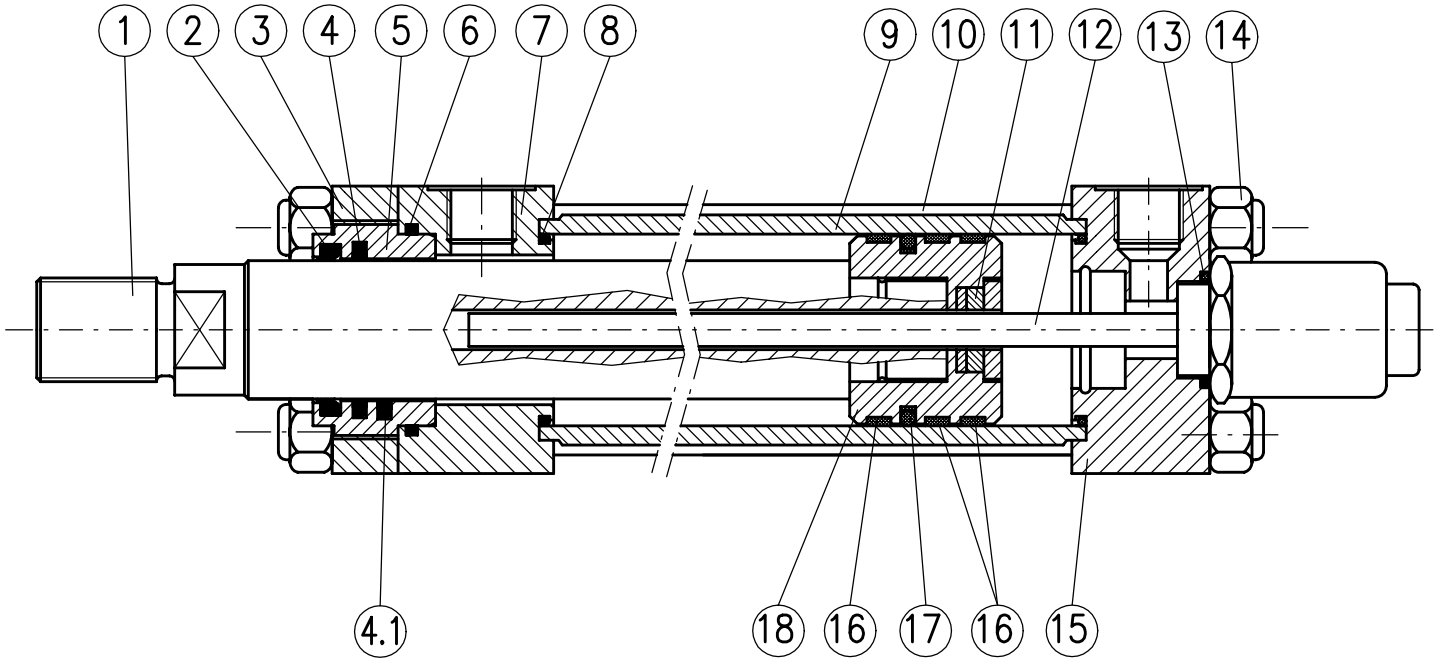
Bore	BD	E	EE	TC	TD	TL	TM	UW	WH	XG	XV_{min}	XV_{max}	ZM	Y	PJ1
25	20	40*	1/4"	38	12	10	48	46	15	44	82	72+stroke	154	50	54
32	25	45*	1/4"	44	16	12	55	53	25	54	96	82+stroke	178	60	58
40	30	60	3/8"	63	20	16	76	74	25	57	107	88+stroke	195	62	71
50	40	75	1/2"	76	25	20	89	87	25	64	117	90+stroke	207	67	73
63	40	90	1/2"	89	32	25	100	98	32	70	132	91+stroke	223	71	81
80	48	115	3/4"	114	40	32	127	125	31	76	147	99+stroke	246	77	92
100	58	126	3/4"	127	50	40	140	138	35	71	158	107+stroke	265	82	101
125	68	165	1"	165	63	50	178	175	35	75	180	109+stroke	289	86	117
160	88	196	1"	203	80	63	215	212	32	75	198	104+stroke	293	86	121
200	108	240	1 1/4"	241	100	80	279	276	32	85	226	125+stroke	353	98	157

* On 25 and 32 bore cylinders, the head is increased by 5mm to house the connection

CYLINDERS SERIES CHT

Working pressure 21 Mpa
Maximum pressure 25 Mpa
Working temperature –20 to 80°C
Stroke tolerance 0 to 1.2mm for strokes up to 1000mm, 0 to 2.5mm for longer strokes
8 bores, 40 to 200mm

ON DEMAND:
Drainage on the rod
Double rod seals
Special seals fit for a wide range of fluids and temperatures
Air vents on both ends



POS	ITEM	MATERIAL	POS	ITEM	MATERIAL
1	Rod	Chromium-plated steel	10	Tie rod	Steel
2	Dust scraper	Nitrile rubber	11	Position indicator	-
3	Flange	Steel	12	Measuring shaft	Steel
4	Rod seal	Nitrile rubber and PTFE	13	O-Ring	Nitrile rubber
4.1	2nd Rod seal (option L)	Nitrile rubber and PTFE	14	Self-braking nut	Steel
5	Guide bushing	Cast iron	15	Rear head	Steel
6	O-Ring + PBK	Nitrile rubber	16	Anti-friction slide	PTFE
7	Head	Steel	17	Piston B seal	Nitrile rubber and PTFE
8	O-Ring + PBK	Nitrile rubber	18	Piston	Steel
9	Liner	Steel	19		

LINEAR POSITION TRANSDUCERS

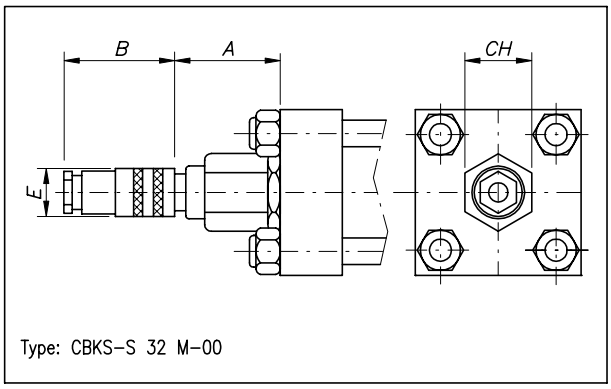
To immediately check the rod position, install a linear position transducer. Its working principle is based on the magnetorestrictive effect that causes a short elastic strain in the molecular structure of a wave guide, through the interaction of two magnetic fields, and generates a torsion pulse on the position indicator.
This pulse runs along the wave guide inside the measuring shaft, from the point of measurement to the sensor's head. The constant response time not affected by the temperature is proportional to the indicator position, and is therefore a position measure, directly converted in the sensor into an analog voltage or current output.

TECHNICAL CHARACTERISTICS	
Resolution	**0,01 mm**
Independent linearity	**±0,05 % (%of the total stroke)**
Repeatability	**±0,01 % (%of the total stroke)**
Max. speed	**2 m/sec**
Working temperature	**-20 +80 °C**
Analog signal*	**0÷10 V 10÷0 V or 4÷20 mA**
Strokes	**50÷3850 mm**
Max. transducer pressure	**35 MPa (350 Bar)**
Power supply	**24 V DC ±10 %**
Protection degree (connector installed)	**IP-67**

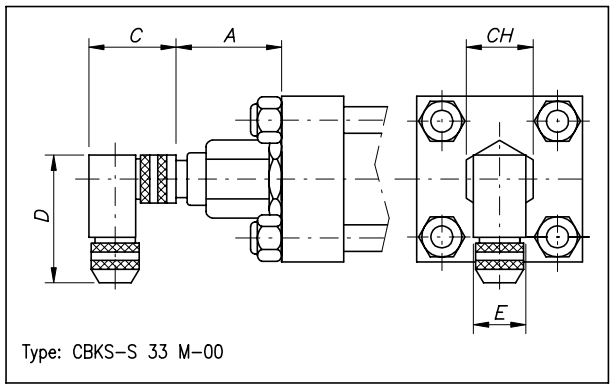
* Available in digital pulse version (for more details, contact our Technical Department)

AVAILABLE MODELS

- In TA, FA, PI, OA and OI execution, transducers can be mounted starting from 40mm bore, rod Ø 28mm; sensors are available in the version with straight or 90° connectors (see the dimensions specified below).

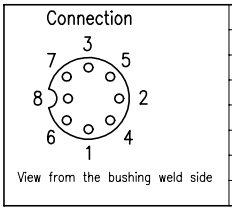


Type: CBKS-S 32 M-00



Type: CBKS-S 33 M-00

DIMENSIONS (mm)						
Type	**A**	**B**	**C**	**D**	**E**	**CH**
CBKS-S 32 M-00	74	69	-	-	18	46
CBKS-S 33 M-00	74	-	48	54	20	46

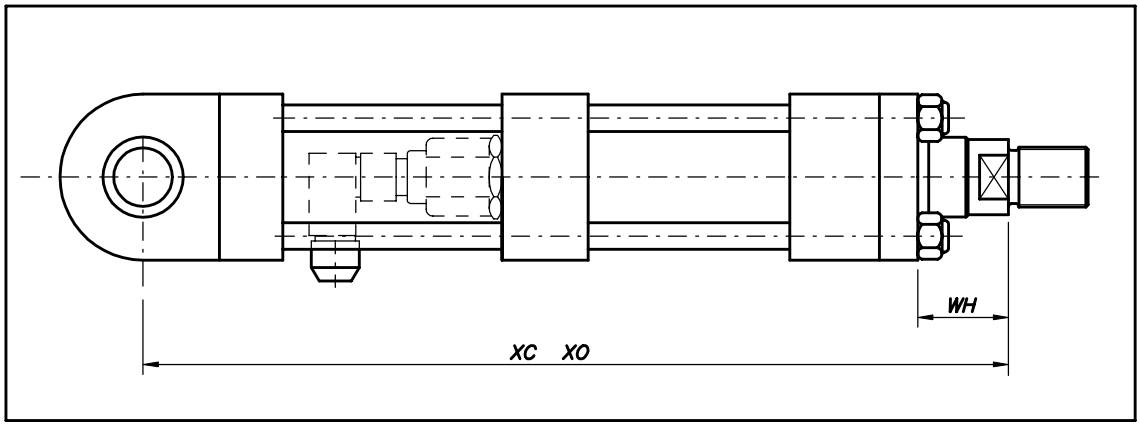


Pin	Color
1	Yellow
2	Grey
3	Pink
5	Green
6	Blue
7	Brown
8	White

The volume of cylinders with transducers are increased compared to ISO tables, as specified below.

Bore	40	50	63	80	100	125	160	200
ZJ (mm)	187	193	200	270	221	242	255	299

- In CF, CM and CS execution, transducers can be mounted starting from 63mm bore, fitting the sensor into a distance pipe, as shown in the figure below.



The cylinder volumes are increased compared to ISO tables, according to the dimensions indicated below.

Bore	63	80	100	125	160	200
WH	32	31	35	35	32	32
XC	444	494	536	575	607	694
XO	450	503	540	590	636	728

AP, FP and TP execution is not available.

EXAMPLE: DETERMINING THE ACRONYM FOR THE ORDER

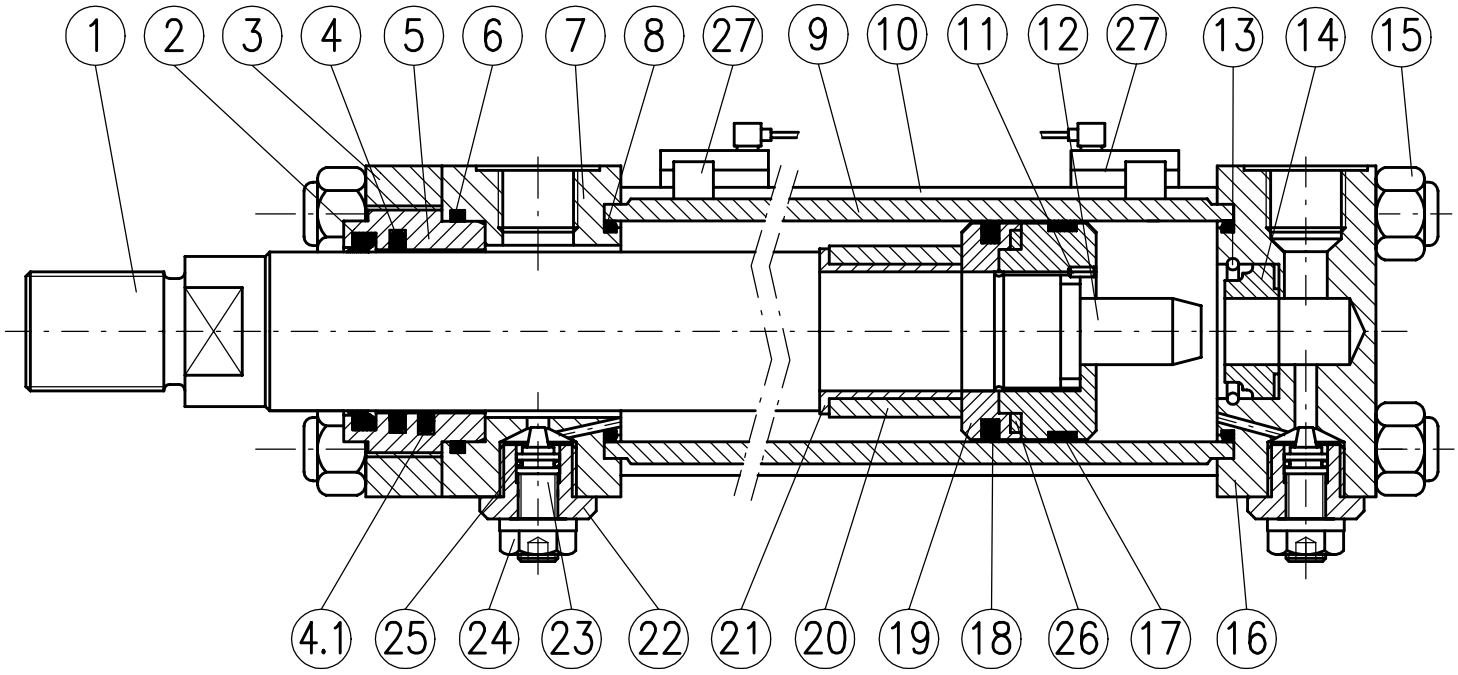
CHARACTERISTIC	DESCRIPTION	SYM.	EXAMPLE
SERIES	tie rod execution with transducers	CHT	CHT/50/36/100/FA/00BUT…
BORE	indicate mm		
ROD	indicate mm		
STROKE	indicate mm		
EXECUTION	front flange	FA	
	feet	PI	
	female hinge	CF	
	male hinge	CM	
	joint hinge	CS	
	front trunnion	OA	
	intermediate trunnion	OI	
	rear trunnion	OP	
	front protruding tie rods	TA	
	front treaded holes	ZA	
BRAKING	without braking	0	
SPACER	without spacer	0	
	50mm	1	
	100mm	2	
	150mm	3	
	200mm	4	
SEALS	nitrile+PTFE (anti-friction)	B	
TRANSDUCER OUTPUT	Tension 0-10 V	UT	
	Current 4-20 Ma	UC	
OPTIONS*			
ROD ENDS	type D	D	
	type F	F	
AIR VENTS	front	G	
	rear	H	
	front + rear	I	
DOUBLE ROD SEAL		L	
DRAINAGE	rod side	W	
ROD TREATMENT	heavy chromium-plated, 0.045mm thick, 100h salt mist ISO 3768	P	
	hardening and chromium-plating	T	
	Ni-CROMAX30 chromium-plated, nickel-plated, ASTM B 117 1000h	N	
CONNECTOR	straight CBKS-S 32 M-00	Y1	
	90° CBKS-S 33 M-00	Y2	

* to be reported in alphabetic order

CYLINDERS SERIES CHM

Working pressure 12 Mpa
Maximum pressure 16 Mpa
Working temperature –10 to 80°C
Stroke tolerance 0 to 1.2mm for strokes up to 1000mm, 0 to 2.5mm for longer strokes
6 bores, 25 to 100mm
up to 3 rods per bore

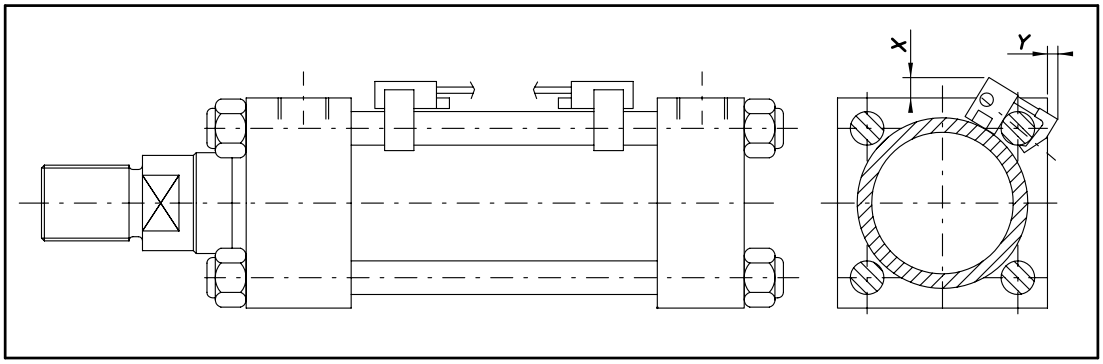
ON DEMAND:
End of stroke braking, adjustable on both ends
Drainage on the rod
Double rod seals
Air vents on both ends



POS	ITEM	MATERIAL	POS	ITEM	MATERIAL
1	Rod	Chromium-plated steel	14	Rear brake bushing	Bronze
2	Dust scraper	Polyurethane	15	Self-braking nut	Steel
3	Flange	Steel	16	Rear head	Steel
4	Rod seal	Polyurethane/PTFE	17	Anti-friction slide	PTFE
4.1	2nd Rod seal (option L)	Polyurethane/PTFE	18	Piston seal	PTFE nitrile rubber./polyuret.
5	Guide bushing	Cast iron	19	Piston	Nonmagnetic steel
6	O-Ring + PBK	Nitrile rubber + polyuret.	20	Front brake bushing	Steel
7	Head	Steel	21	Spacer	Steel
8	O-Ring + PBK	Nitrile rubber + polyuret.	22	Safety plug	Steel
9	Liner	Nonmagnetic steel	23	Adjustment needle	Steel
10	Tied rod	Steel	24	Locknut	Steel
11	Safety pin	Steel	25	O-Ring	Nitrile rubber
12	Brake spur	Steel	26	Position indicator	-
13	Rear flashing ring	Steel	27	Switch	-

ADJUSTABLE POSITION SENSORS

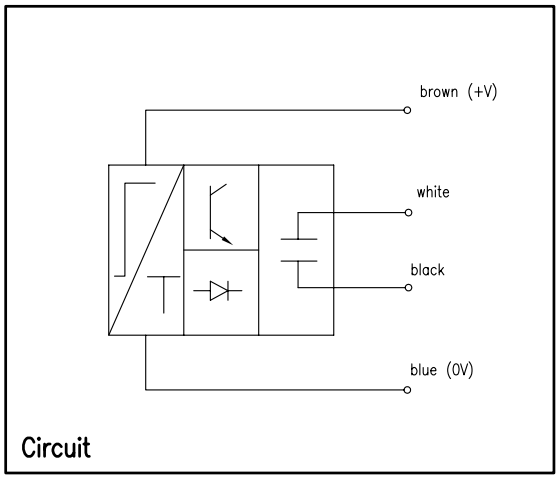
The sensors mounted on the cylinder liner detect the presence of the magnetic field created by the magnet inside the cylinder. The sensor is a switch and accordingly must be always mounted in series to a load (of inductive, resistive or capacitive type), without exceeding the limits of its electrical characteristics. The LED sensors work at a minimum voltage of 20V, because of their display circuit. Sensors are provided with 3 m long cable.



The sensor dimensions are indicated in the table on the right, and must be added to dimensions E, specified for series CH.

BORE	25	32	40	50	63	80	100
X (mm)	28,5	29	26	24	21	14,5	19
Y (mm)	16	17	15,5	14,5	10,5	6,5	10,5

TECHNICAL CHARACTERISTICS		
PARAMETER	**Unit**	**SFM01**
Nominal voltage DC	V	24 ±20%
Visual signal led	-	SI
Relè output	-	SI
PNP output	-	SI
NPN output	-	SI
Reverse polarity protection	-	SI
Short circuit protection	-	SI
Inductive load protection	-	SI
Power supply noise protection	-	SI
Electrical nominale life (worst case)	n	200.000
Mechanical nominal life (worst case)	n	10E7
Position repeatability const. temp.	mm	0,1
Hysteresis		0,3
Switch off time (15-80ms)	-	SI
Max working temperature	°C	70
Protection level	-	IP67
Max. admitted current	A	1 30W
Deleted	msec	15
Cable armoured 4x0.25	-	-



Circuit

AVAILABLE MODELS

- The OI execution is not available. Any other execution is manufactured with 25 to 100mm bore.

EXAMPLE: DETERMINING THE ACRONYM FOR THE ORDER

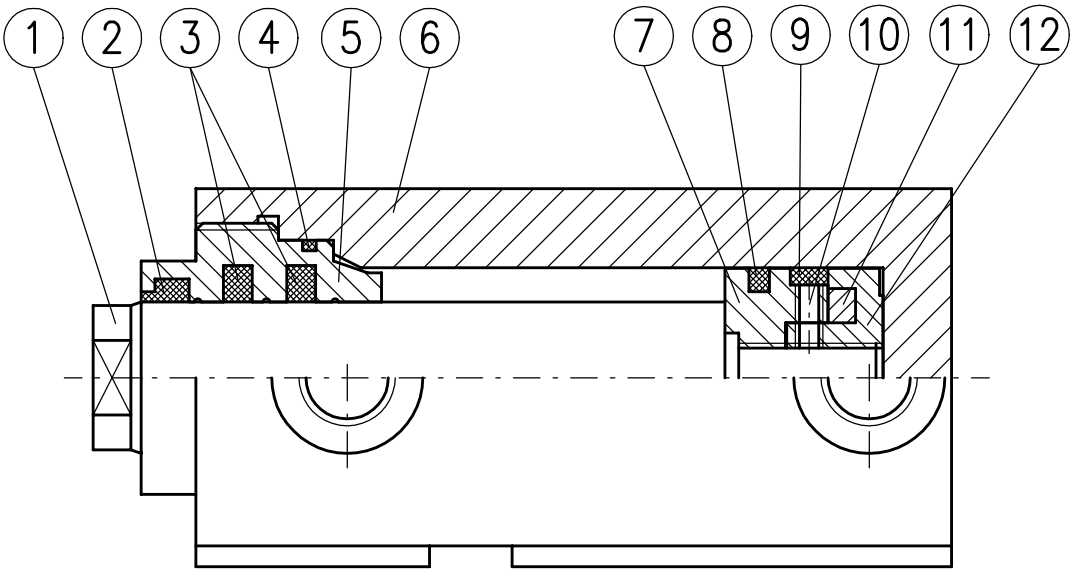
CHARACTERISTIC	DESCRIPTION	SYM.
SERIES	Tie rod execution, with magnetic sensors	CHM
BORE	indicate mm	
ROD	indicate mm	
ROD No. 2	indicate mm (piston rod only)	
STROKE	indicate mm	
EXECUTION	rear + front protruding tie rods	AP
	front flange	FA
	rear flange	FP
	feet	PI
	female hinge	CF
	male hinge	CM
	joint hinge	CS
	front trunnion	OA
	rear trunnion	OP
	front protruding tie rods	TA
	rear protruding tie rods	TP
	front treaded holes	ZA
	rear treaded holes	ZP
BRAKING	without braking	0
	front braking	1
	rear braking	2
	front + rear braking	3
SPACER	without spacer	0
	50mm	1
	100mm	2
	150mm	3
	200mm	4
SEALS	elastomer + nitrile (standard)	A
	nitrile + PTFE (anti-friction)	B
OPTIONS*		
ROD ENDS	type D	D
	type F	F
AIR VENTS	front	G
	rear	H
	front + rear	I
DOUBLE ROD SEAL		L
DRAINAGE	rod side	W
ROD TREATMENT	heavy chromium-plated, 0.045mm thick, 100h salt mist ISO 3768	P
	hardening and chromium-plating	T
	Ni-CROMAX30 chromium-plated, nickel-plated, ASTM B 117 1000h	N
SWITCHES	SFM01	KPN
N° of SWITCHES	indicate quantity	

EXAMPLE

CHM/50/22/.../50/AP/10 A...

* To be reported in alphabetic order

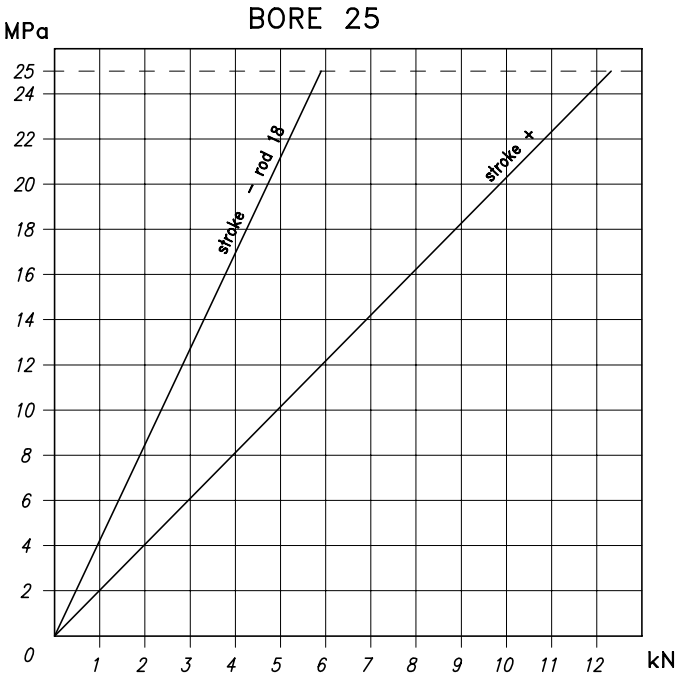
CYLINDERS SERIES CB

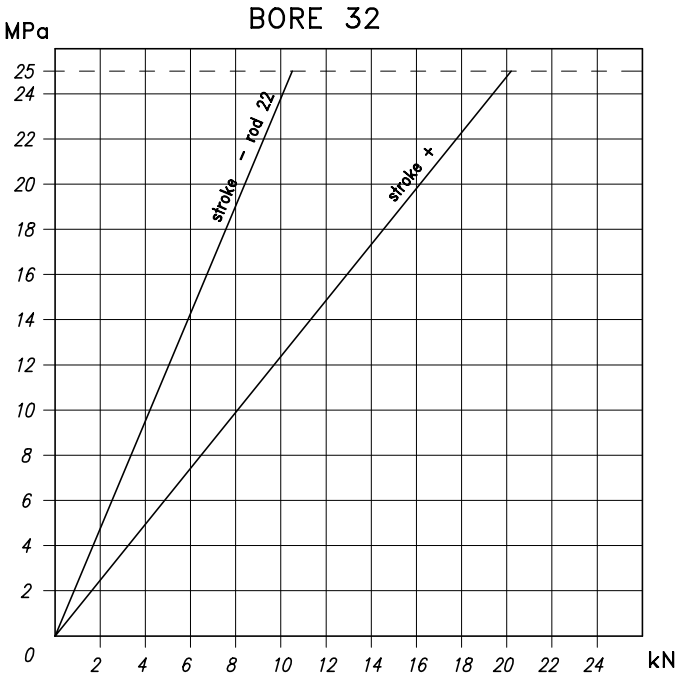


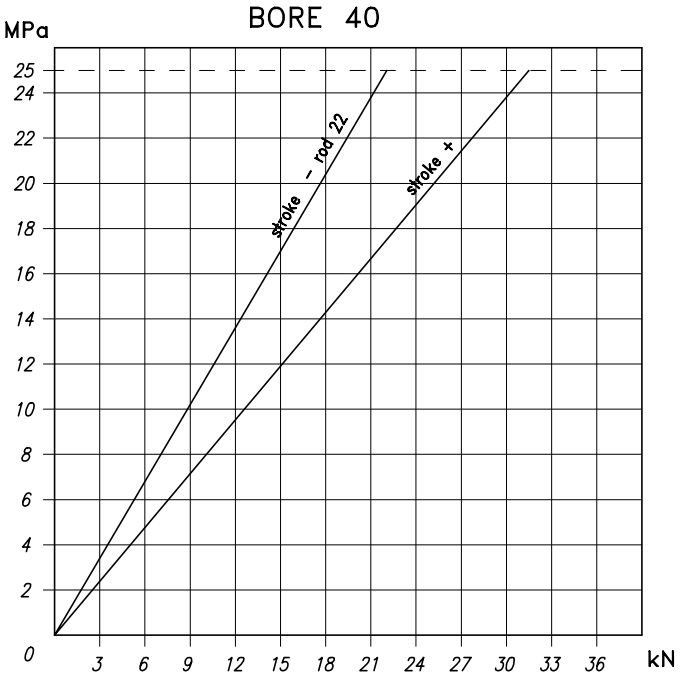
POS	ITEM	MATERIAL	POS	ITEM	MATERIAL
1	Rod	Steel	7	Front seal holder	Light alloy
2	Dust scraper	Nitrile rubber	8	Piston seal	Nitrile rubber + PTFE
3	Rod seals	Nitrile rubber + PTFE	9	Piston guide	PTFE
4	O-Ring	Nitrile rubber	10	O-Ring	Nitrile rubber
5	Guide bushing	Cast iron	11	Permanent magnet	-
6	Body	Light alloy	12	Rear seal holder	Light alloy

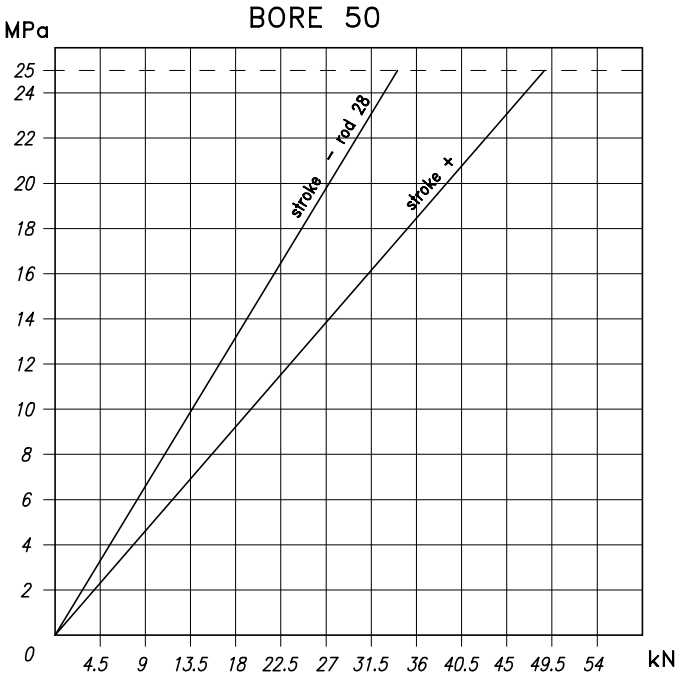
BORE		**mm**	**25**	**32**	**40**	**50**	**63**	**80**	**100**
OIL PORTS		**gas**	1/4"	1/4"	1/4"	1/4"	3/8"	1/2"	1/2"
ROD DIAMETER		**mm**	18	22	22	28	28	36	45
TEMPERATURE		**°C**	-20°c to +80°c, normal and magnetic version -20°C to +135°C, normal version only						
TOLERANCE ON STROKE		**mm**	+/- 0,5						
CONTINUOUS WORKING PRESSURE		**Mpa**	16						
		(bar)	160						
MAXIMUM INTERMITTENT PRESSURE		**Mpa**	25						
		(bar)	250						
MAXIMUM SPEED		**m/s**	0,5 Limit the maximum speed of end of stroke piston to 0.1m/sec. It is always recommendable to limit speed with flow limiters For any further explanations, contact our Technical Department						
MAXIMUM CAPACITY		**l/s**	2	3	5	7	12	20	30
NET WEIGHT	**Stroke 20 mm**	**Kg**	0,8	1,2	1,6	2,5	3,9	6,5	10,5
	Stroke 50 mm		1	1,5	1,9	3	4,5	7,5	12

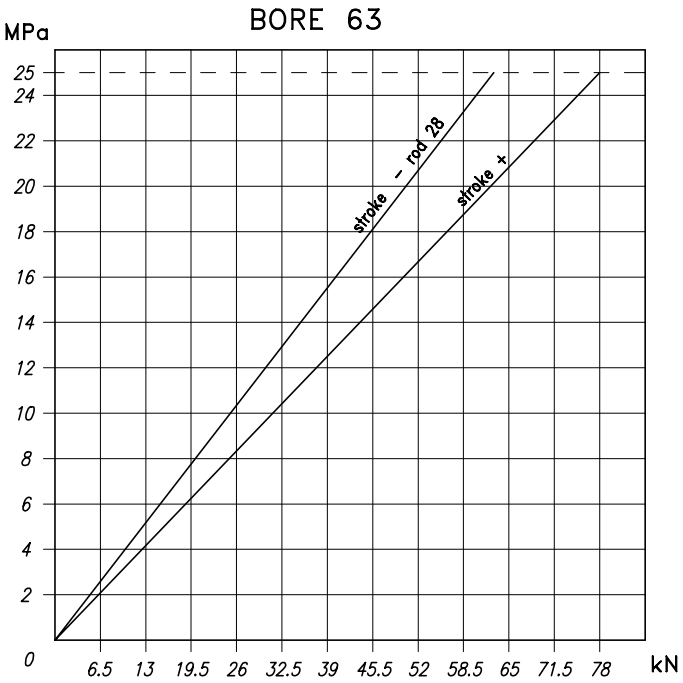
FORCE/PRESSURE DIAGRAMS

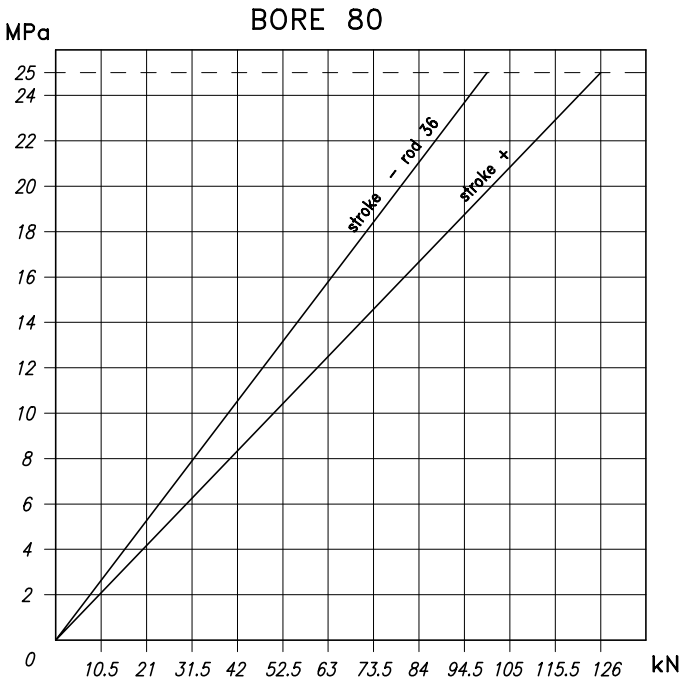


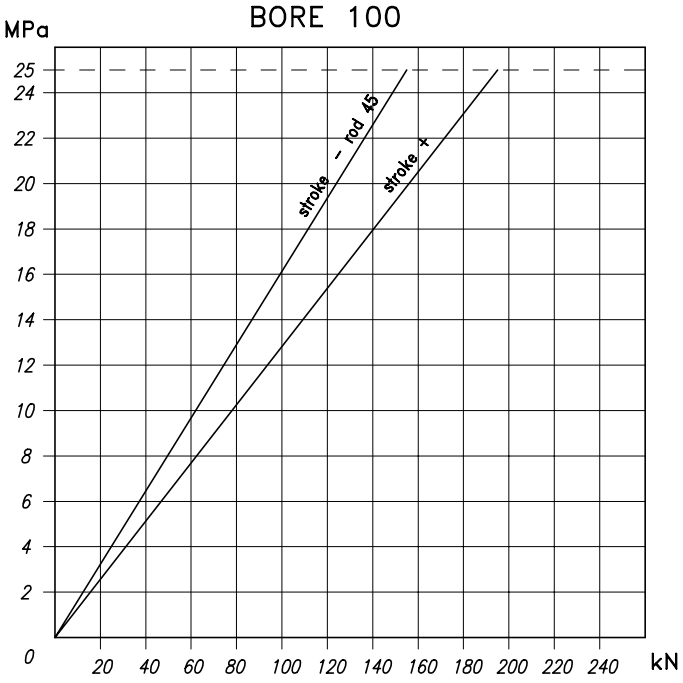







BORE 63
MPa
25
24
22
20
18
16
14
12
10
8
6
4
2
0
stroke - rod 28
stroke +
6.5 13 19.5 26 32.5 39 45.5 52 58.5 65 71.5 78
kN


BORE 80
MPa
25
24
22
20
18
16
14
12
10
8
6
4
2
0
stroke - rod 36
stroke +
10.5 21 31.5 42 52.5 63 73.5 84 94.5 105 115.5 126
kN


BORE 100
MPa
25
24
22
20
18
16
14
12
10
8
6
4
2
0
stroke - rod 45
stroke +
20 40 60 80 100 120 140 160 180 200 220 240
kN

EXAMPLE: DETERMINING THE ACRONYM FOR THE ORDER

CHARACTERISTIC	DESCRIPTION	SYM.	EXAMPLE
SERIES	Short stroke	CB	CB/50/20/EB/B/M
BORE	indicate mm		
STROKE	indicate mm		
ESECUTION	standard	EB	
	front feeding	AF	
	rear feeding	AP	
	side feeding	AL	
SEALS	low friction (standard) –20 +80°C	B	
	viton, low friction–20 +135°C*	C	
MODEL	normal	N	
	magnetic	M	

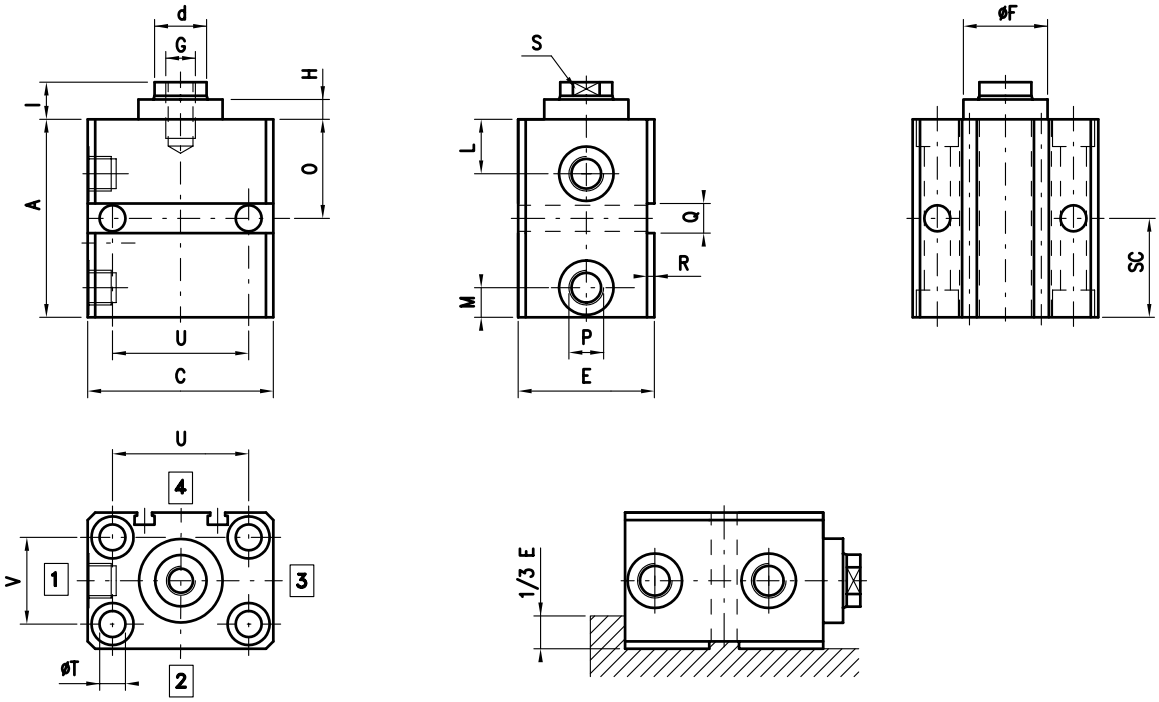
* normal model N only

ACRONYM FOR SPARE PART ORDERS

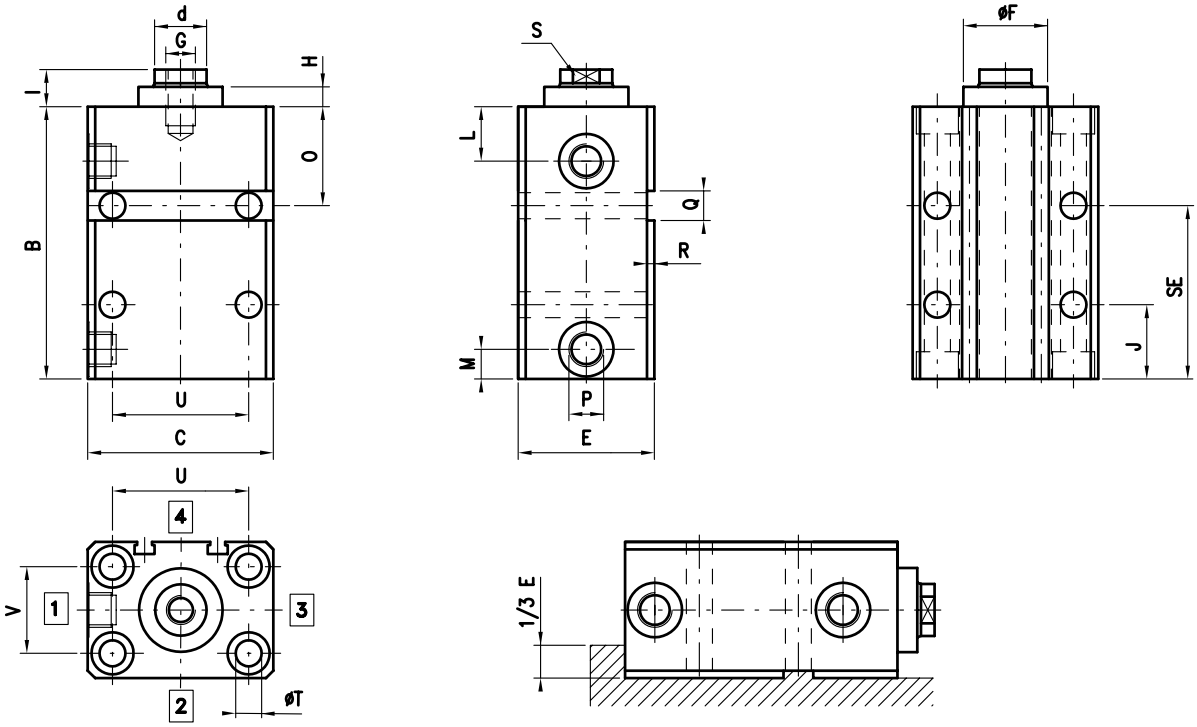
CHARACTERISTIC	DESCRIPTION	SYM.	EXAMPLE
SEAL KIT	Short stroke	KCB	KCB/50/C/N
BORE	indicate mm		
SEALS	low friction (standard) –20 +80°C	B	
	viton, low friction–20 +135°C*	C	
MODEL	normal	N	
	magnetic	M	
ROD COMPLETE WITH PRE-MOUNTED PISTON	Short stroke	SCB	SCB/50/20/B/M
BORE	indicate mm		
STROKE	indicate mm		
SEALS	low friction (standard) –20 +80°C	B	
	viton, low friction–20 +135°C*	C	
MODEL	normal	N	
	magnetic	M	

* normal model N only

CHARACTERISTIC	DESCRIPTION	EXAMPLE
REED SWITCH	Magnetic sensor REED with cable 2,5m (standard)	SER25
	Magnetic sensor REED with connector	SER00
	Cable with connector 2,5 m for REED sensor	CAR25
PNP SWITCH	Magnetic hall effect sensor PNP with cable 2,5m	SEP25
	Magnetic hall effect sensor PNP with connector	SEP00
	Cable with connector 2,5 m for PNP sensor	CAP25

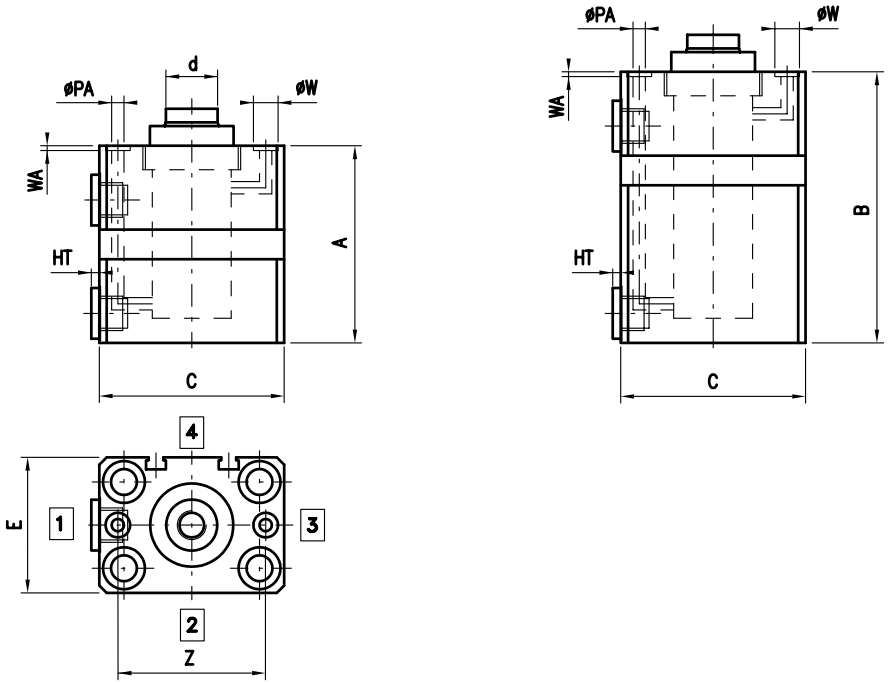


EB: (base stroke 20 mm)

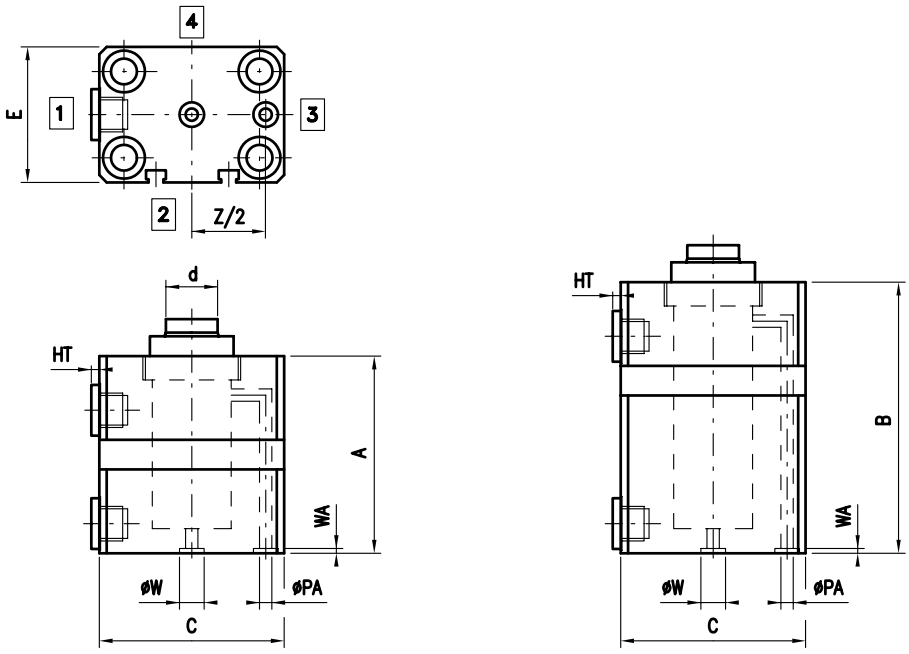


EB: (base stroke 50 mm)

Bore	d	A	B	C	E	F	G	H	I	J	L	M	O	P	Q	R	S	SC	SE	T	U	V
25	18	77	107	65	45	32	M10	6,5	14	30	22	12	37	1/4"	10	2	14	40	70	9	50	30
32	22	80	110	75	55	34	M12	8	15	30	22	12	40	1/4"	12	3	18	40	70	11	55	35
40	22	93	123	85	63	34	M14	7	17	35	24	14	43	1/4"	12	3	18	50	80	11	63	40
50	28	95	125	100	75	42	M20	8	20	35	25	14,5	45	1/4"	15	5	24	50	80	13	76	45
63	28	105	135	115	90	50	M20	7	20	40	29	21	55	3/8"	15	5	24	50	80	13	90	55
80	36	120	150	140	110	60	M27	7	20	50	35	25	60	1/2"	20	5	32	60	90	17	110	75
100	45	130	160	170	140	72	M33	8	25	60	37	28	70	1/2"	20	5	40	60	90	17	135	95



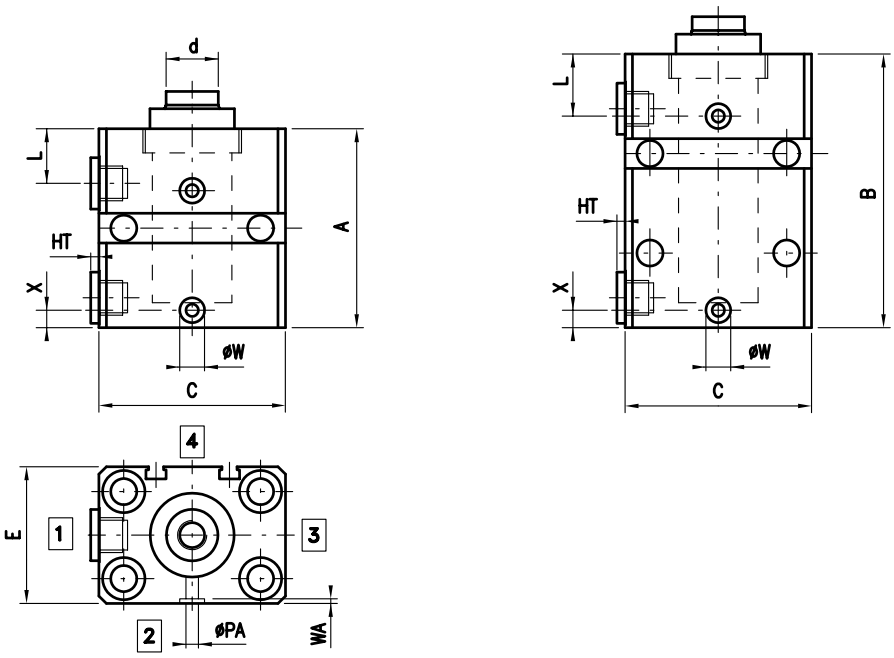
AL: (front feeding)



AP: (rear feeding)

Bore	d	A	B	C	E	HT	PA	W	WA	Z
25	18	77	107	65	45	5	5	10	1,9	51
32	22	80	110	75	55	5	5	10	1,9	60
40	22	93	123	85	63	5	5	10	1,9	65
50	28	95	125	100	75	5	5	10	1,9	80
63	28	105	135	115	90	5	6	13	1,9	95
80	36	120	150	140	110	5	6	13	1,9	118
100	45	130	160	170	140	5	6	13	1,9	140

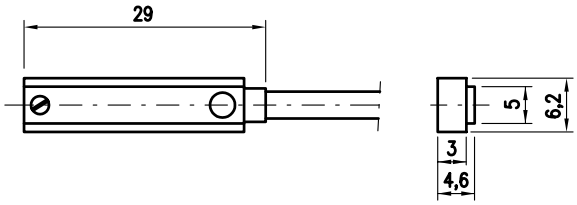
For any missing data, see the basic execution table



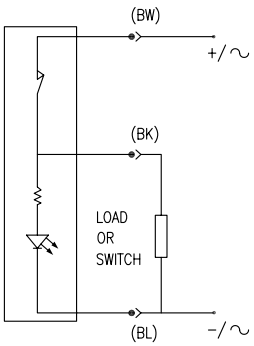
AL: (side feeding)

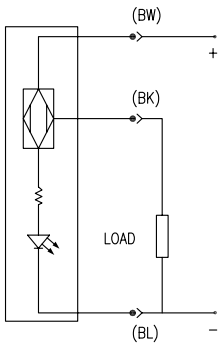
Bore	d	A	B	C	E	HT	L	PA	W	WA	X
25	18	77	107	65	45	5	22	5	10	1,9	7
32	22	80	110	75	55	5	22	5	10	1,9	7
40	22	93	123	85	63	5	24	5	10	1,9	10
50	28	95	125	100	75	5	25	5	10	1,9	10
63	28	105	135	115	90	5	29	6	13	1,9	15
80	36	120	150	140	110	5	35	6	13	1,9	17
100	45	130	160	170	140	5	37	6	13	1,9	20

For any missing data, see the basic execution table

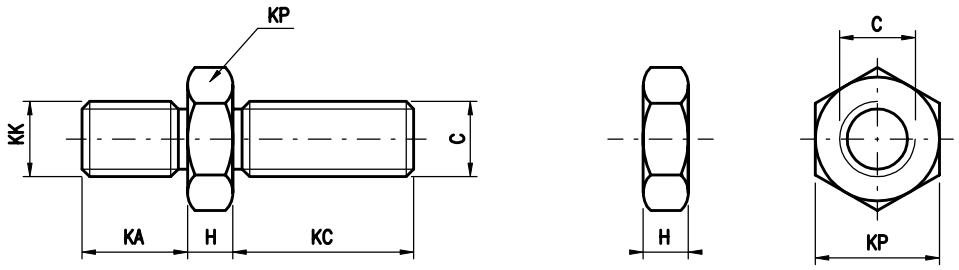


Switch



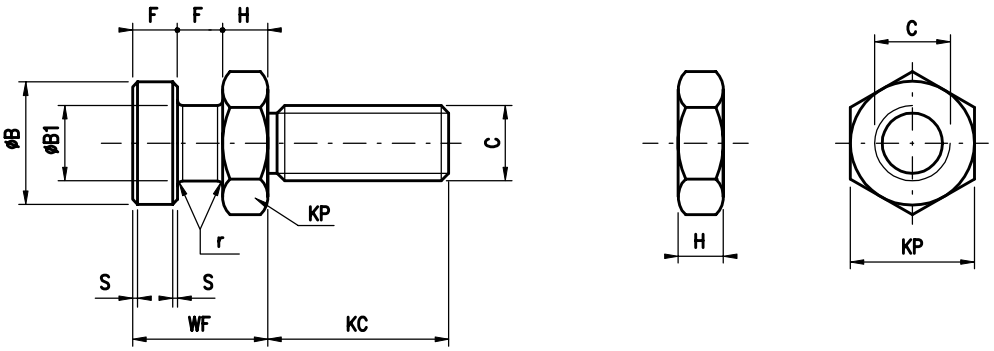


TECHNICAL DATA		REED	PNP
Max. switching current at 25°C	A	0,1	0,2
Voltage range DC	V	3-30	6-30
Voltage range AC	V	3-30	-
Temperature of use	°C	-10 +70	-10 +70
Power	VA-W	6 VA	4 W
On voltage drop	V	<3	<3
Electric life, with resistive load	N°	10^7	10^9



TFD: (male terminal with nut)

Code	C	H	KA	KC	KK	KP
TFD25	M10	6	14	24	M10x1,25	17
TFD32	M12	7	16	28	M12x1,25	19
TFD40	M14	8	18	33	M14x1,5	22
TFD50	M20	9	28	39	M20x1,5	30
TFD63	M20	9	28	39	M20x1,5	30
TFD80	M27	12	36	52	M27x2	36
TFD100	M33	14	45	64	M33x2	46



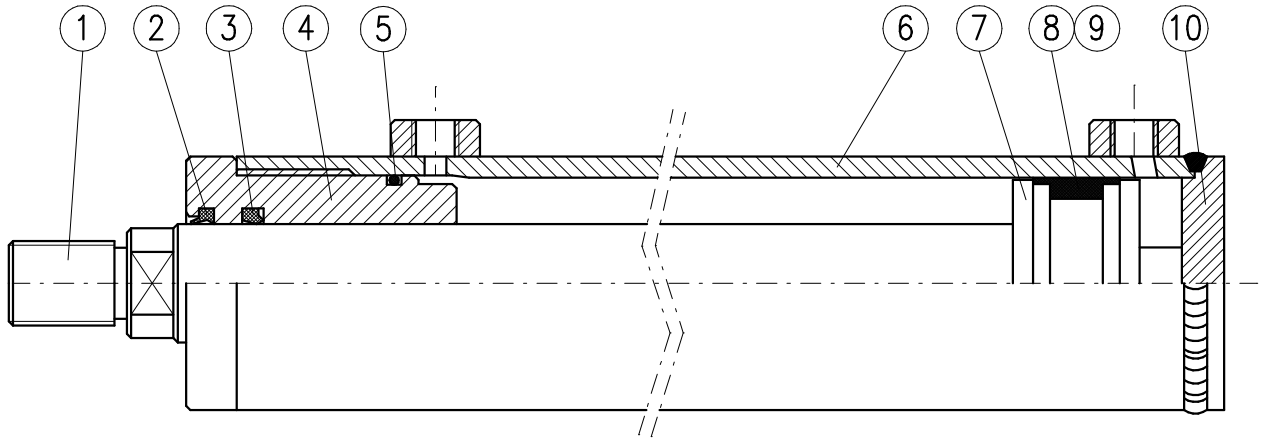
TMD: (hammer head with nut)

Code	B	B1	C	F	H	KC	KP	r	s	WF
TMD25	16	10	M10	7	6	24	17	0,5	0,5	20
TMD32	18	11	M12	8	7	28	19	0,5	0,5	23
TMD40	18	11	M14	8	8	33	22	0,5	0,5	24
TMD50	22	14	M20	10	9	39	30	0,5	0,5	29
TMD63	22	14	M20	10	9	39	30	0,5	0,5	29
TMD80	28	18	M27	12,5	12	52	36	0,8	0,8	37
TMD100	35	22	M33	16	14	64	46	0,8	0,8	46

CYLINDERS SERIES CE

Working pressure 16 Mpa
Maximum pressure 25 Mpa

Working temperature –10 to 75°C
8 bores, 40 to 200mm



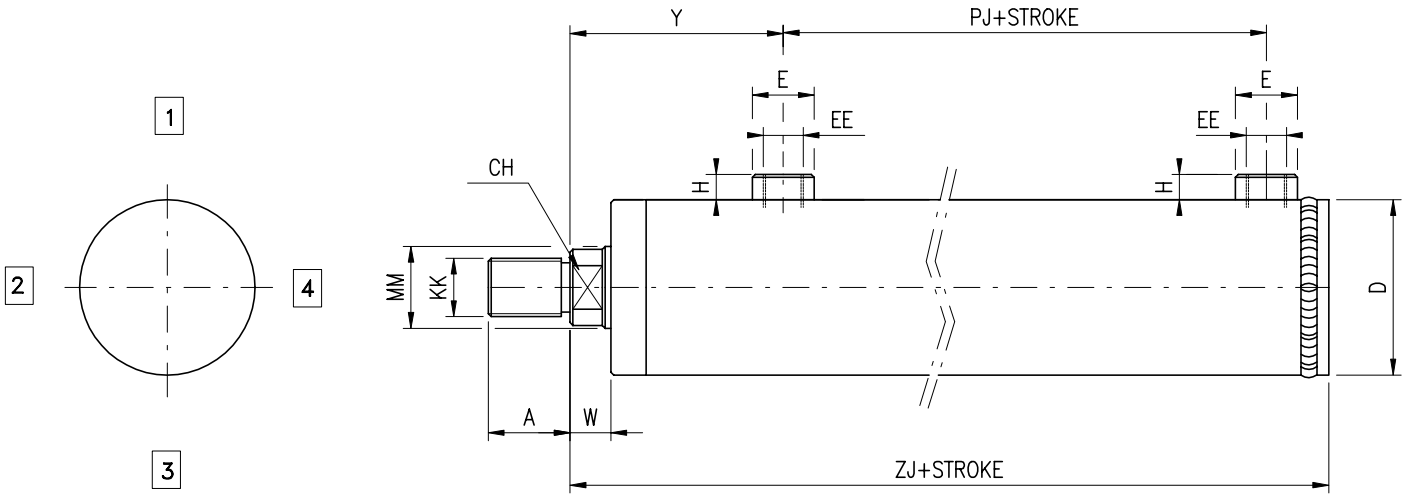
POS	ITEM	MATERIAL	POS	ITEM	MATERIAL
1	Rod	Chrom.-plated st.	6	Liner	Steel
2	Dust scraper	Nitrile rubber	7	Piston	Steel
3	Rod seal	Nitrile rubber	8	Piston seal	Nitrile rubber
4	Guide	Cast iron	9	Guide rings	Acetal resin
5	O-Ring	Nitrile rubber	10	Cap	Steel

EXAMPLE: DETERMINING THE ACRONYM FOR THE ORDER

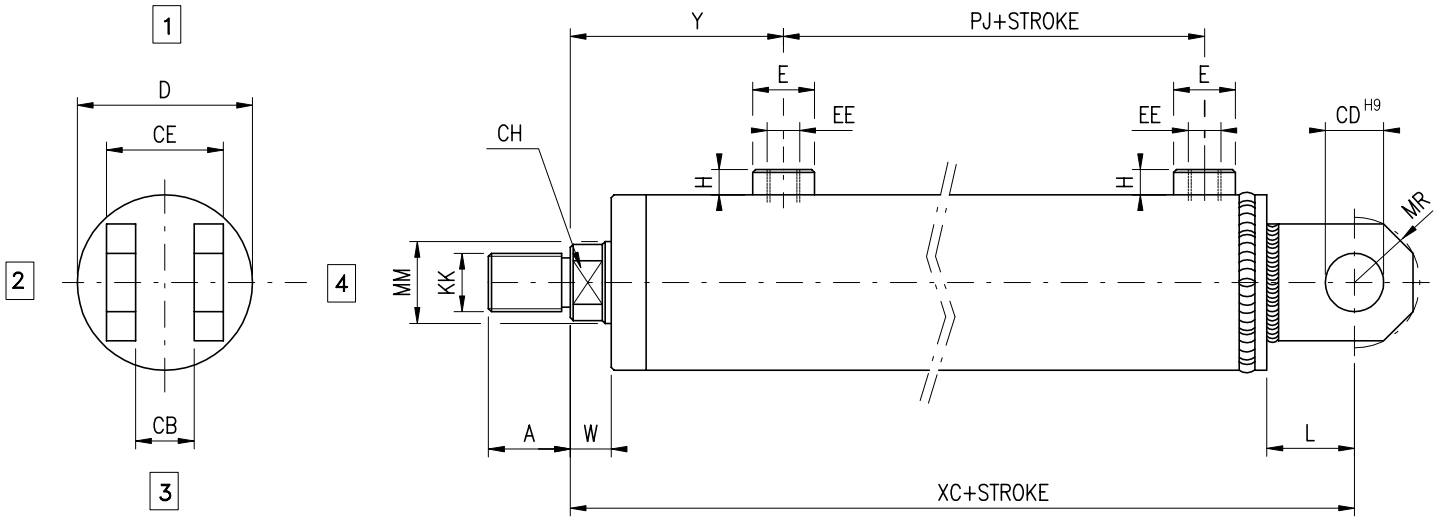
CHARACTERISTIC	DESCRIPTION	SYM.
SERIES	welded cylinders	CE
BORE	indicate mm	
ROD	indicate mm	
STROKE	indicate mm	
EXECUTION	base	EB
	front flange	FA
	rear flange	FP
	feet	PI
	female hinge	CF
	male hinge	CM
	joint hinge	CS
	intermediate trunnion	OI
SPACER	without spacer	0
	50mm	1
	100mm	2
	150mm	3
	200mm	4
SEALS	elastomer + nitrile (low pressure sealing)	A
OPTIONS		
ROD ENDS	type F (request dim. to Technical Dept.)	F

EXAMPLE

CE/50/22/100/EB/0A....

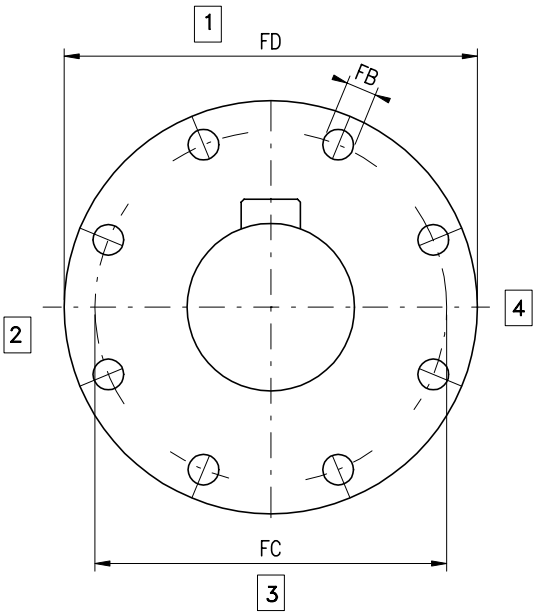


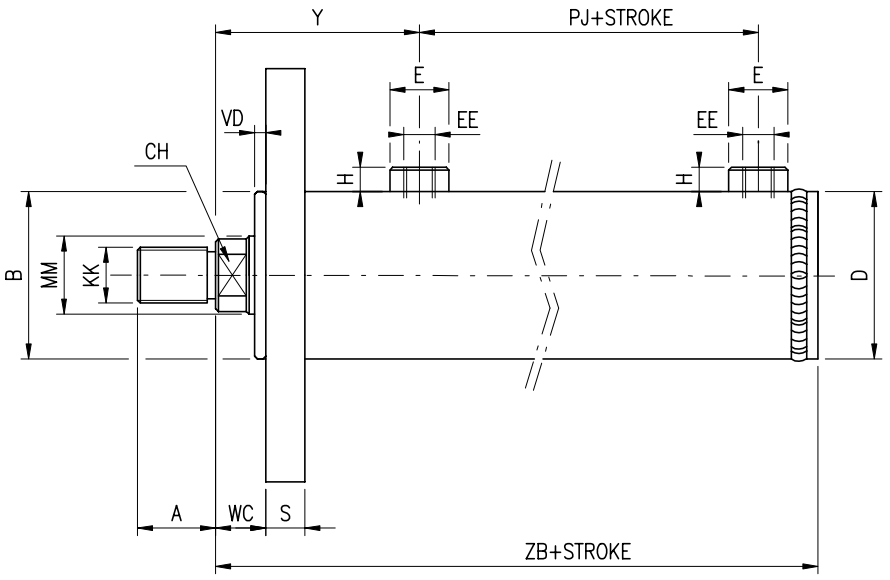
EB: (BASE)



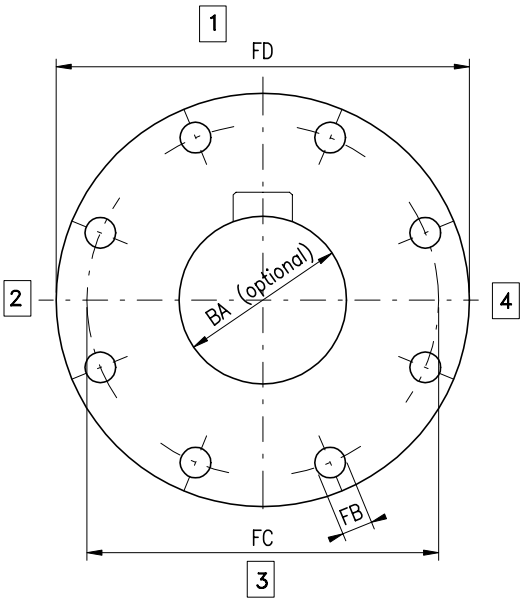
CF: (FEMALE INGE)

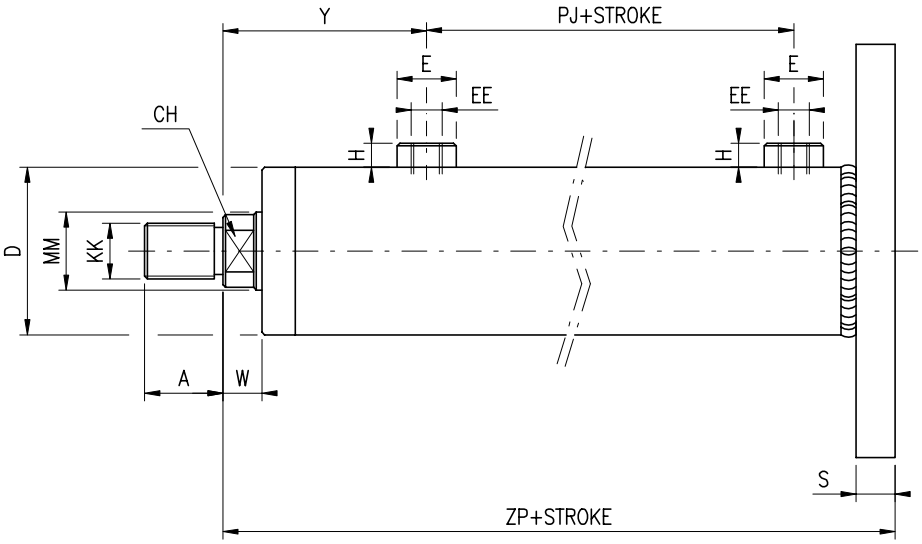
Bore	MM Rod	CH	KK	A	CB	CD	CE	D	E	EE	H	L	MR	PJ	W	ZJ	XC	Y
40	22	18	M16x1,5	22	15	15	31	50	25	3/8"	16	25	16,5	48,5	13	130	155	64
	28	22	M20x1,5	28														
50	28	22	M20x1,5	28	20	20	40	60	25	3/8"	16	30	20	52	14	143	173	73
	36	30	M27x2	36														
63	36	30	M27x2	36	25	25	49	73	30	1/2"	18	35	25	49	16	150	185	79
	45	39	M33x2	45														
80	45	39	M33x2	45	30	30	60	95	30	1/2"	18	45	32	56	18	173	218	94
	56	48	M42x2	56														
100	56	48	M42x2	56	40	40	80	115	35	3/4"	20	55	42	57	20	190	245	105
	70	62	M48x2	63														
125	70	62	M48x2	63	50	50	90	140	35	3/4"	20	70	50	75	23	228	298	123
	90	80	M64x3	85														
160	90	80	M64x3	85	60	60	130	180	45	1"	25	80	58	76	25	260	340	140
	110	100	M80x3	95														
200	110	100	M80x3	95	70	70	140	240	45	1"	25	90	68	111	30	290	380	140
	140	128	M100x3	112														





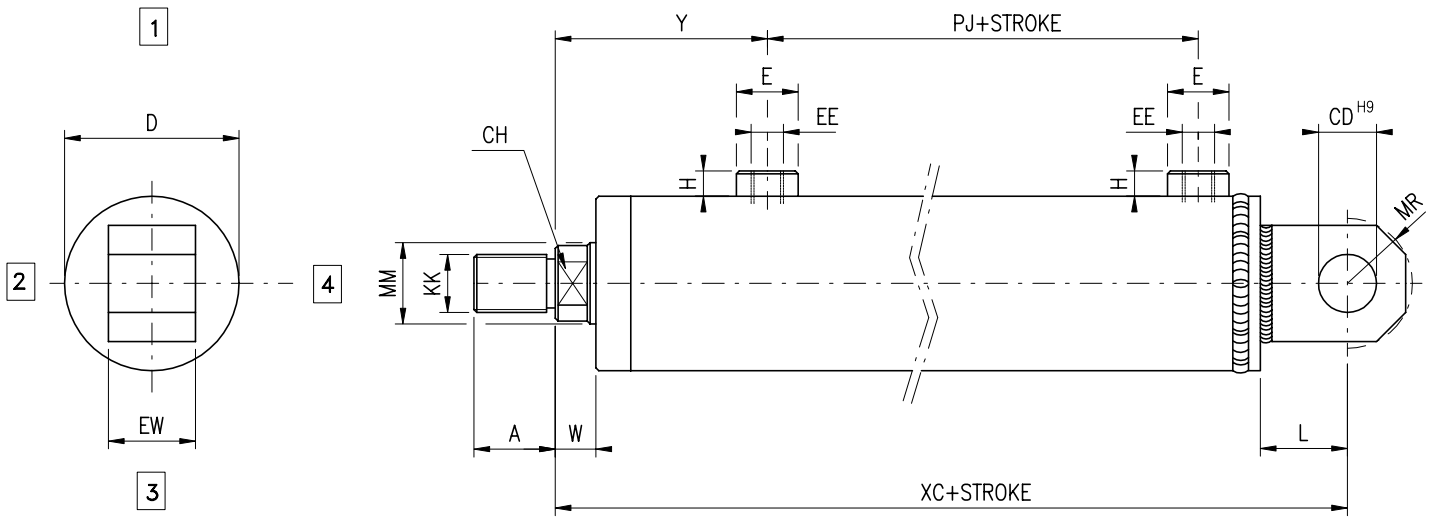
FA: (FRONT FLANGE)



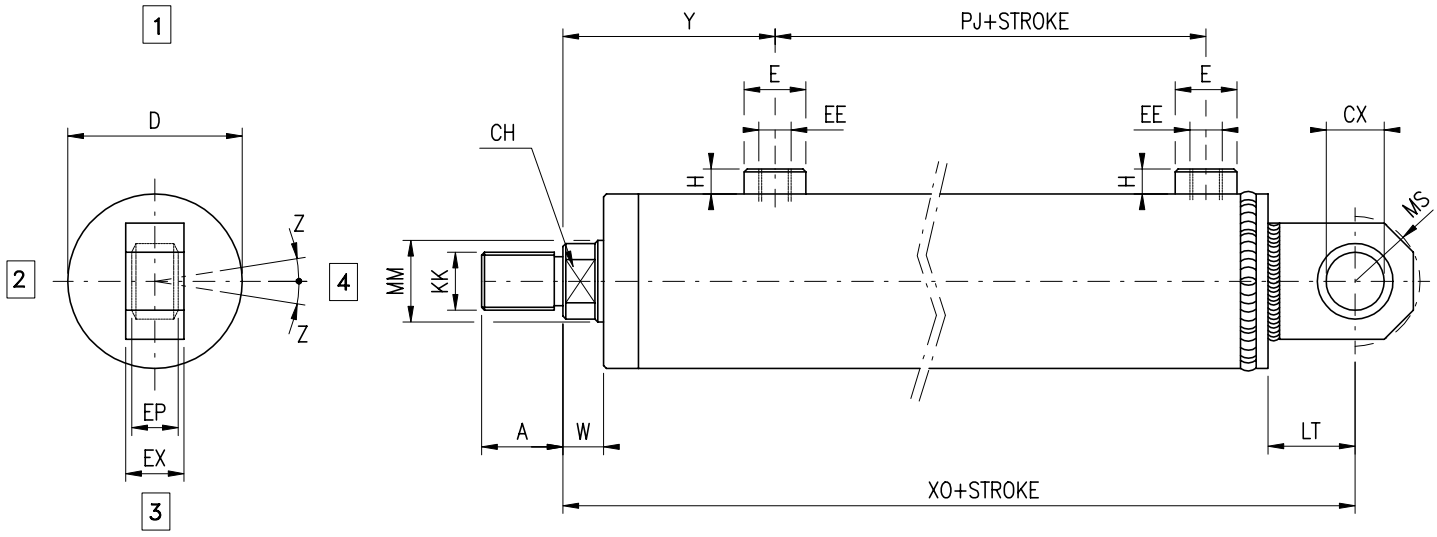


FP: (REAR FLANGE)

Bore	MM Rod	CH	KK	A	B	BA	D	E	EE	FB	FC	FD	H	PJ	S	VD	W	WC	Y	ZB	ZP
40	22	18	M16x1,5	22	50	50	50	25	3/8"	9	106	124	16	48,5	14	3	13	16	64	130	139
	28	22	M20x1,5	28																	
50	28	22	M20x1,5	28	60	60	60	25	3/8"	11	126	148	16	52	14	4	14	18	73	143	150
	36	30	M27x2	36																	
63	36	30	M27x2	36	70	70	73	30	1/2"	13,5	145	172	18	49	14	4	16	20	79	150	155
	45	39	M33x2	45																	
80	45	39	M33x2	45	85	85	95	30	1/2"	17,5	165	200	18	56	20	4	18	22	94	173	183
	56	48	M42x2	56																	
100	56	48	M42x2	56	106	106	115	35	3/4"	22	200	244	20	57	25	5	20	25	105	190	200
	70	62	M48x2	63																	
125	70	62	M48x2	63	132	132	140	35	3/4"	22	235	280	20	75	30	5	23	28	123	228	243
	90	80	M64x3	85																	
160	90	80	M64x3	85	160	160	180	45	1"	22	280	324	25	76	35	5	25	30	140	260	275
	110	100	M80x3	95																	
200	110	100	M80x3	95	200	200	240	45	1"	26	340	390	25	111	40	5	30	35	140	290	305
	140	128	M100x3	112																	

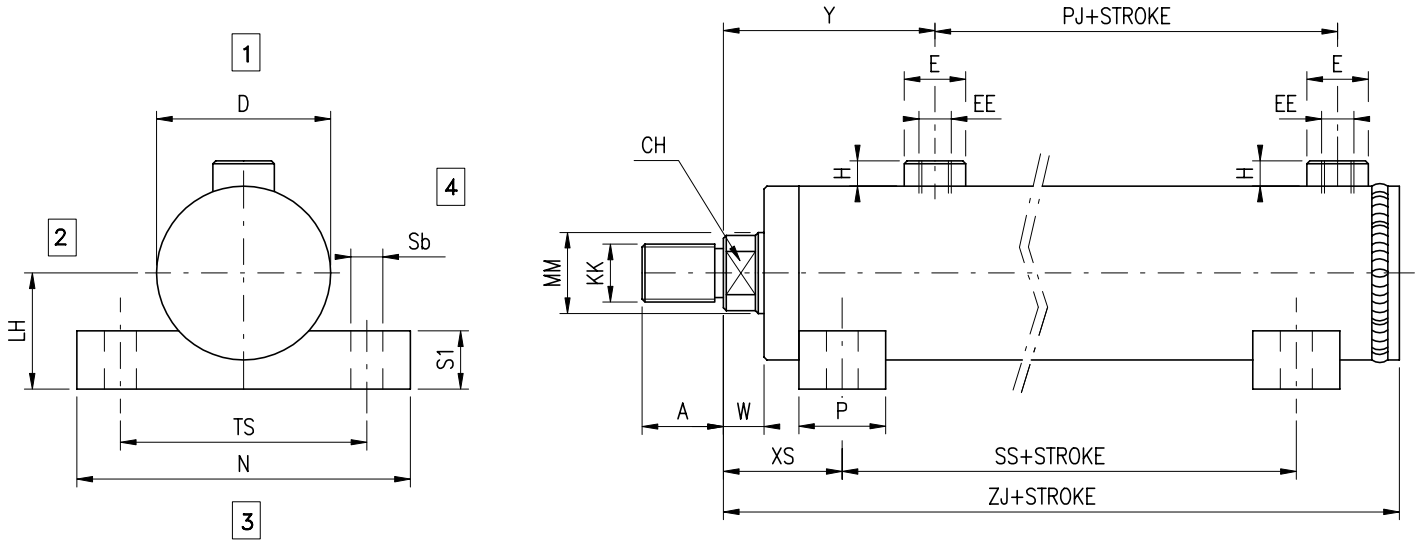


CM: (MALE HINGE)

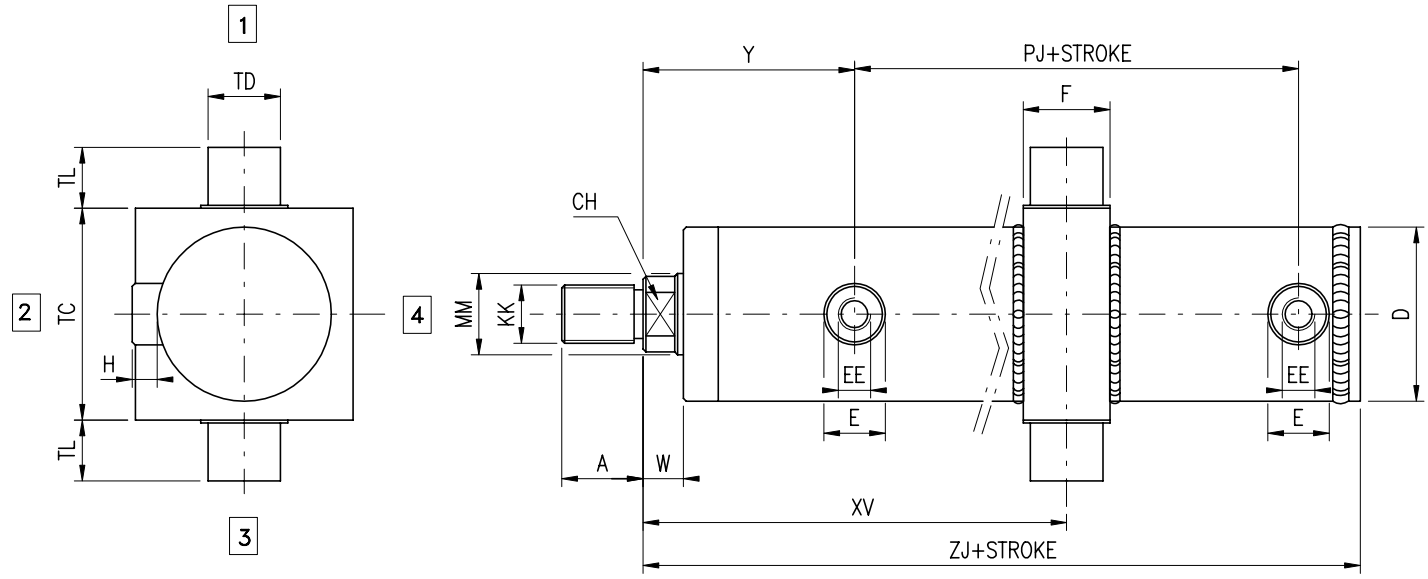


CS: (JOINT HINGE)

Bore	MM Rod	CH	KK	A	CD	CX	D	E	EE	EW	EX	EP	H	L	LT	MR	MS	PJ	W	XC	XO	Y	Z
40	22	18	M16x1,5	22	15	20	50	25	3/8"	28	19	16	16	25	38	16,5	25	48,5	13	155	168	64	9°
	28	22	M20x1,5	28																			
50	28	22	M20x1,5	28	20	20	60	25	3/8"	30	19	16	16	30	38	20	25	52	14	173	181	73	9°
	36	30	M27x2	36																			
63	36	30	M27x2	36	25	25	73	30	1/2"	36	23	20	18	35	45	24,5	27,5	49	16	185	195	79	7°
	45	39	M33x2	45																			
80	45	39	M33x2	45	30	30	95	30	1/2"	42	28	22	18	45	51	31,5	32,5	56	18	218	224	94	6°
	56	48	M42x2	56																			
100	56	48	M42x2	56	40	40	115	35	3/4"	56	35	28	20	55	69	42	50	57	20	245	259	105	7°
	70	62	M48x2	63																			
125	70	62	M48x2	63	50	50	140	35	3/4"	68	40	35	20	70	88	50	61,5	75	23	298	316	123	6°
	90	80	M64x3	85																			
160	90	80	M64x3	85	60	60	180	45	1"	80	50	44	25	80	100	58	70	76	25	340	360	140	6°
	110	100	M80x3	95																			
200	110	100	M80x3	95	70	70	240	45	1"	85	55	49	25	90	115	68	82	111	30	380	405	140	6°
	140	128	M100x3	112																			



PI: (FEET)



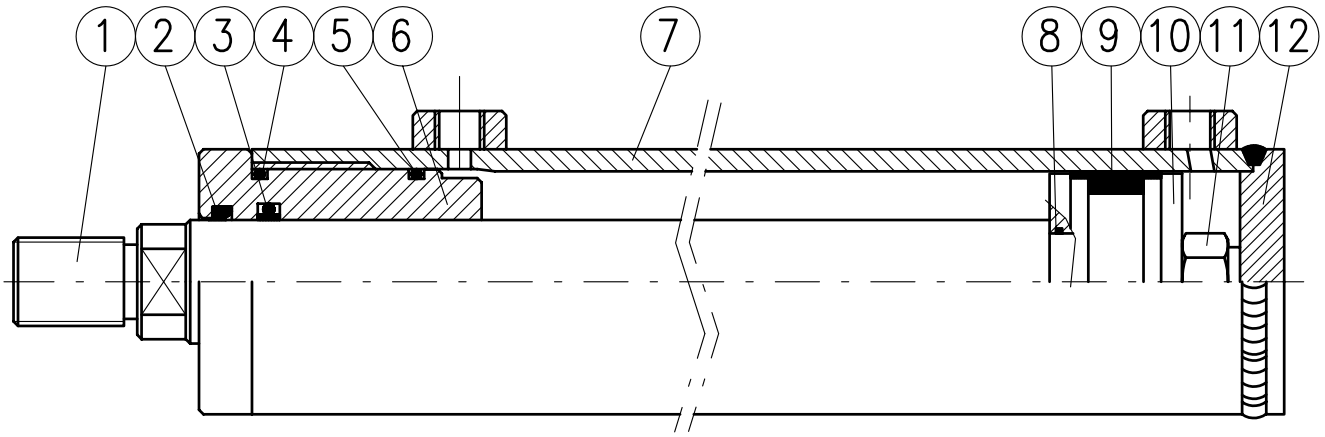
OI: (TRUNNION)

Bore	MM Rod	CH	KK	A	D	E	EE	F	H	LH	N	P	PJ	Sb	SS	S1	TC	TD	TL	TS	W	XS	XV_{MIN}	XV_{MAX}	Y	ZJ
40	22	18	M16x1,5	22	50	25	3/8"	30	16	35	100	35	48,5	11	44	16	65	20	15	75	13	35	107	70+ stoke	64	130
	28	22	M20x1,5	28																						
50	28	22	M20x1,5	28	60	25	3/8"	35	16	40	110	40	52	13	45	18	75	25	20	85	14	40	119	80+ stoke	73	143
	36	30	M27x2	36																						
63	36	30	M27x2	36	73	30	1/2"	40	18	48	130	45	49	15	59	20	100	30	25	100	16	45	129	78+ stoke	79	150
	45	39	M33x2	45																						
80	45	39	M33x2	45	95	30	1/2"	50	18	60	160	50	56	17	69	22	115	40	35	125	18	50	149	95+ stoke	94	173
	56	48	M42x2	56																						
100	56	48	M42x2	56	115	35	3/4"	60	20	74	185	55	57	19	77	25	145	50	40	148	20	55	157	89+ stoke	105	190
	70	62	M48x2	63																						
125	70	62	M48x2	63	140	35	3/4"	70	20	90	240	70	75	25	82	30	170	60	50	190	23	70	173	113+ stoke	123	228
	90	80	M64x3	85																						
160	90	80	M64x3	85	180	45	1"	80	25	115	295	75	76	28	103	35	220	70	60	245	25	75	220	136+ stoke	140	260
	110	100	M80x3	95																						
200	110	100	M80x3	95	240	45	1"	90	25	155	380	100	111	39	143	45	270	80	70	311	30	100	225	156+ stoke	140	290
	140	128	M100x3	112																						

CYLINDERS SERIES CL

Working pressure 14 Mpa
Maximum pressure 21 Mpa

Working temperature -10 to 75°C
6 bores, 40 to 100 mm



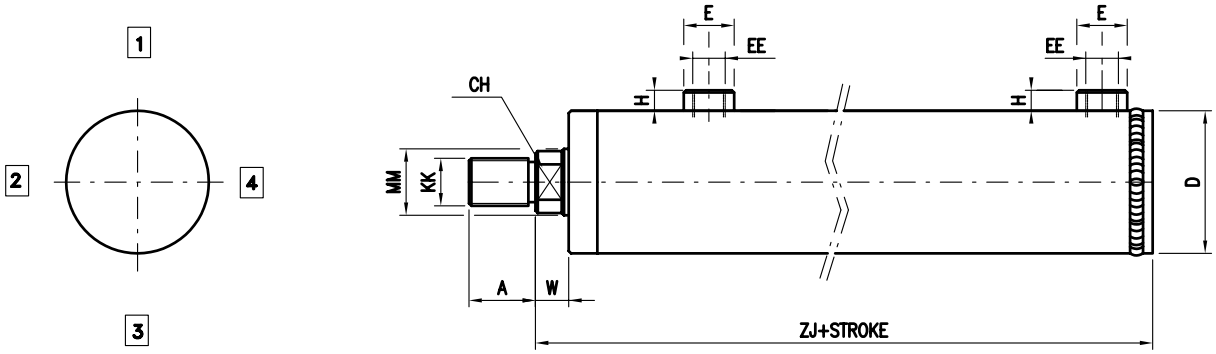
POS.	ITEM	MATERIAL	POS.	ITEM	MATERIAL
1	Rod	Chrom. plated st.	7	Liner	Steel
2	Dust scraper	Poyuretane	8	O-ring	Nitrile rubber
3	Rod seal	Nitrile rubber	9	Piston seal	Nitrile rubber
4	O-ring	Nitrile rubber	10	Piston	Steel
5	O-ring	Nitrile rubber	11	Nut	Steel
6	Guide	Cast iron	12	Cap	Steel

EXAMPLE: DETERMINING THEACRONYM FOR THE ORDER

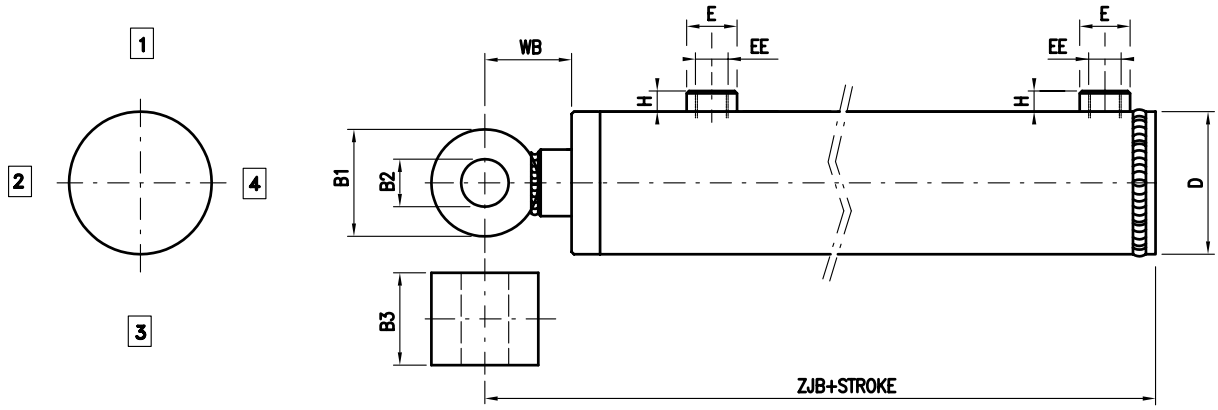
CHARACTERISTIC	DESCRIPTION	SYM.
SERIES	welded cylinders	**CL**
BORE	indicate mm	
ROD	indicate mm	
STROKE	indicate mm stroke to fast delivery 100-200-300-400-500	
EXECUTION	base	**EB**
	front flange	**FA**
	eye hinge	**OC**
	male hinge	**CM**
	joint hinge	**CS**
	intermediate trunnion	**OI**
ROD END	male tread	**M**
	with ring welded	**B**
	with joint welded	**N**
SPACER	without spacer	**0**
	50mm	**1**
	100mm	**2**
	150mm	**3**
	200mm	**4**
SEALS	elastomer+nitrile (low pressure sealig)	**A**

EXAMPLE

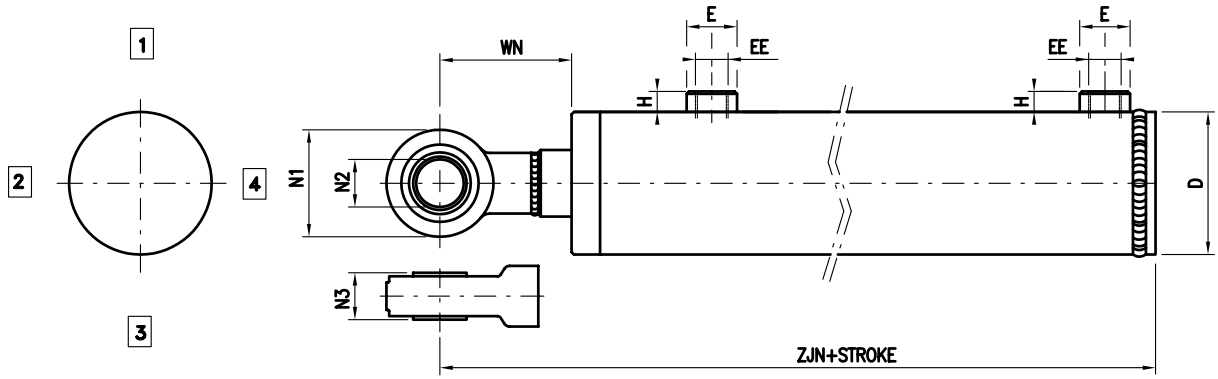
CL/50/25/100/EBM0A



EBM: (BASE MALE TREAD)

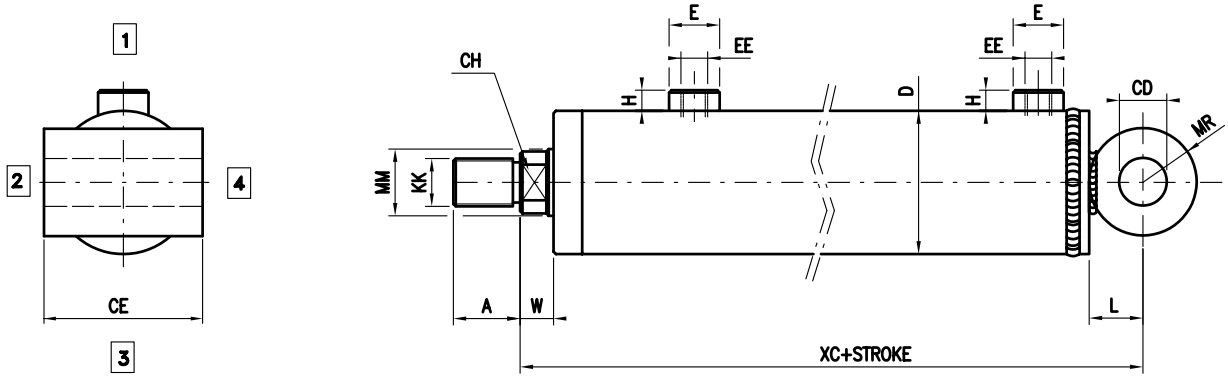


EBB: (BASE RING WELDED)

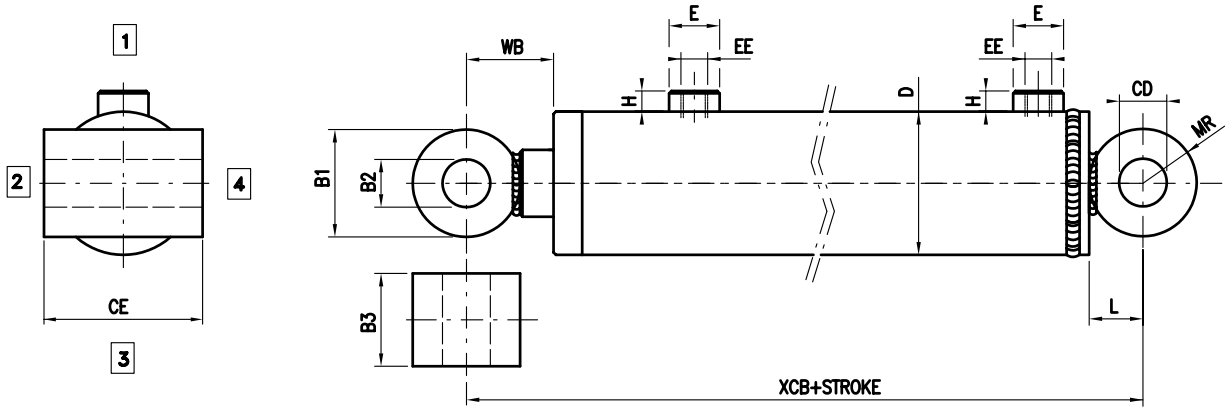


EBN: (BASE JOINT WELDED)

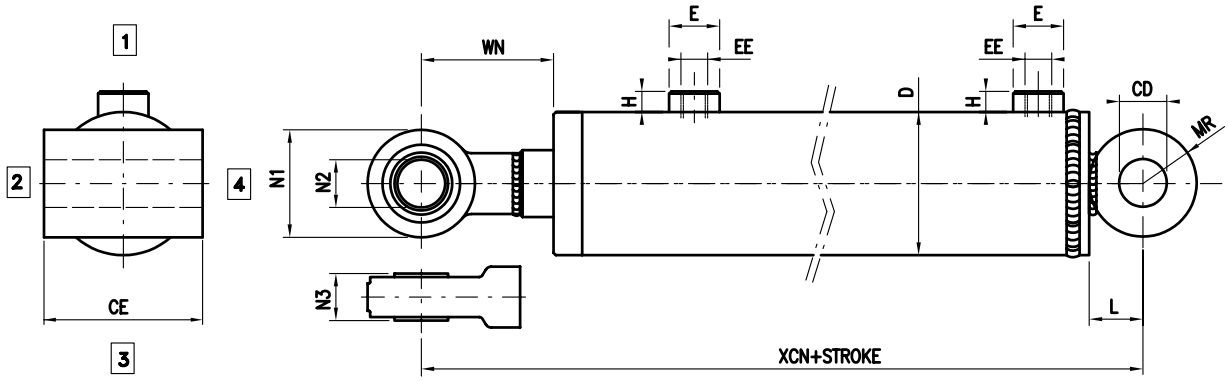
Bore	MM Rod	CH	KK	A	B1	B2	B3	D	E	EE	H	N1	N2	N3	W	WB	WN	ZJ	ZJB	ZJN
40	20	18	M16x1,5	22	40	20,5	40	50	22	1/4"	16	53	20	15	13	42	60	121	150	168
	25	22	M20x1,5	28																
50	25	22	M20x1,5	28	40	20,5	40	60	26	3/8"	17	53	20	15	14	42	60	132	160	178
	30	24	M20x1,5	28																
60	30	24	M20x1,5	28	50	25,5	45	70	26	3/8"	17	64	25	20	16	48	68	153	185	205
	35	29	M27x2	36																
70	35	29	M27x2	36	50	30,5	55	80	26	3/8"	17	73	30	22	16	48	74	153	185	211
	40	34	M27x2	36																
80	40	34	M27x2	36	50	30,5	55	95	30	1/2"	18	73	30	22	18	50	76	176	208	234
	50	44	M33x2	45																
100	50	44	M33x2	45	70	40,25	70	115	30	1/2"	18	92	40	28	20	57	94	210	250	284
	60	52	M42x2	56																



OCM: (EYE HINGE MALE TREAD)

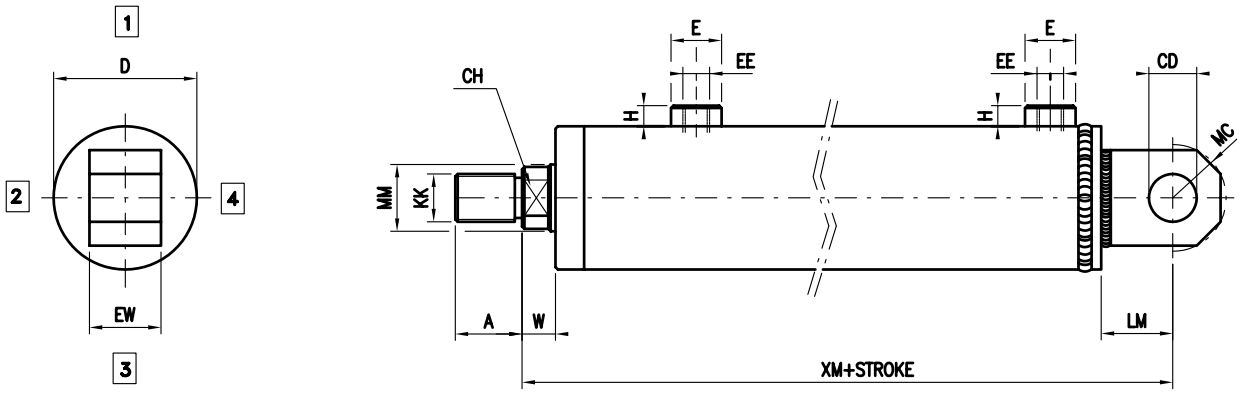


OCB: (EYE HINGE RING WELDED)

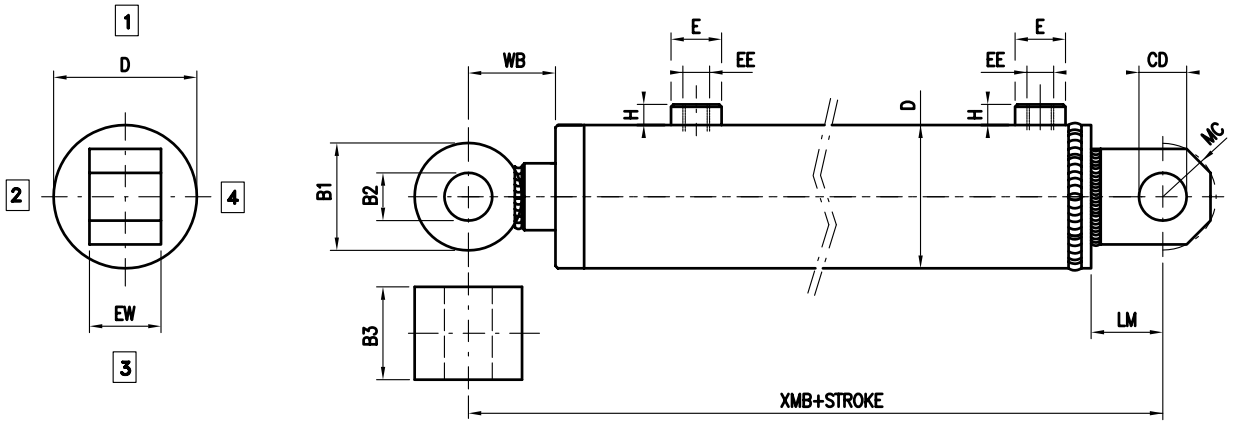


OCN: (EYE HINGE JOINT WELDED)

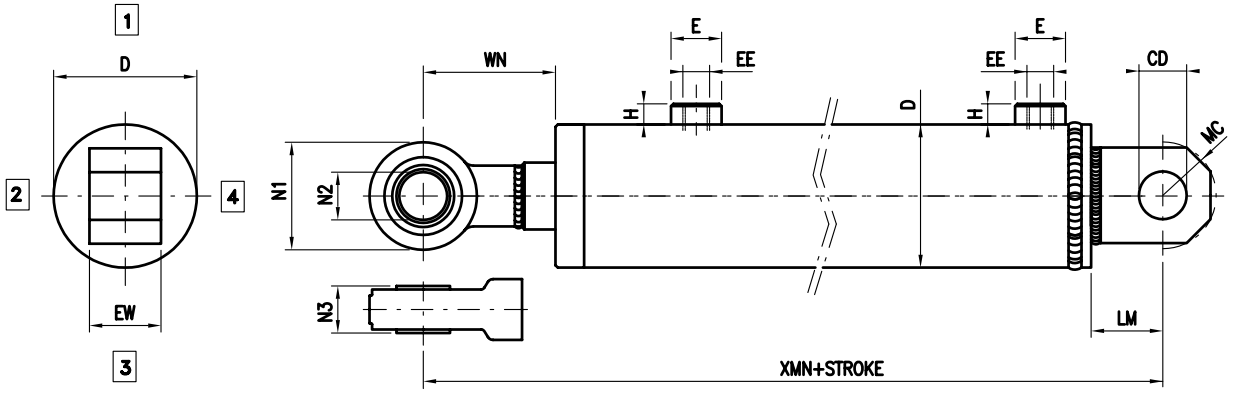
Bore	MM Rod	CH	KK	A	B1	B2	B3	CD	CE	D	E	EE	H	L	MR	N1	N2	N3	W	WB	WN	XC	XCB	XCN
40	20	18	M16x1,5	22	40	20,5	40	20,25	70	50	22	1/4"	16	20	20	53	20	15	13	42	60	141	170	188
	25	22	M20x1,5	28																				
50	25	22	M20x1,5	28	40	20,5	40	20,25	70	60	26	3/8"	17	20	20	53	20	15	14	42	60	152	180	198
	30	24	M20x1,5	28																				
60	30	24	M20x1,5	28	50	25,5	45	25,25	80	70	26	3/8"	17	25	25	64	25	20	16	48	68	178	210	230
	35	29	M27x2	36																				
70	35	29	M27x2	36	50	30,5	55	30,25	110	80	26	3/8"	17	30	30	73	30	22	16	48	74	183	215	241
	40	34	M27x2	36																				
80	40	34	M27x2	36	50	30,5	55	30,25	110	95	30	1/2"	18	30	30	73	30	22	18	50	76	206	238	264
	50	44	M33x2	45																				
100	50	44	M33x2	45	70	40,25	70	40,25	130	115	30	1/2"	18	35	35	92	40	28	20	57	94	245	285	319
	60	52	M42x2	56																				



CMM: (MALE HINGE MALE TREAD)

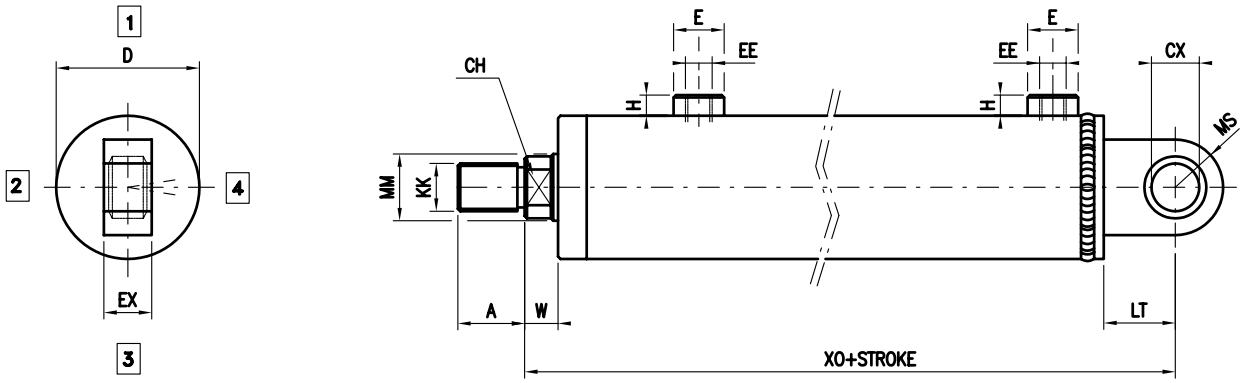


CMB: (MALE HINGE RING WELDED)

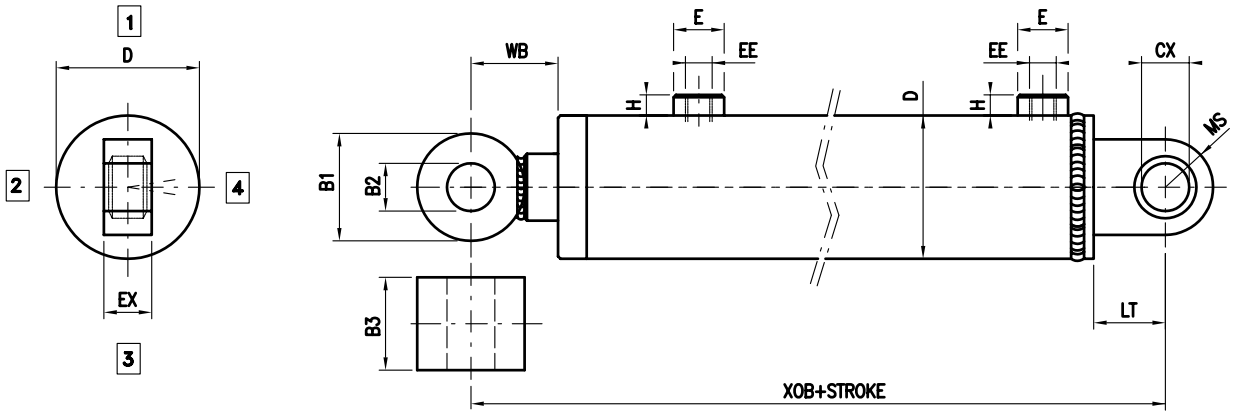


CMN: (MALE HINGE JOINT WELDED)

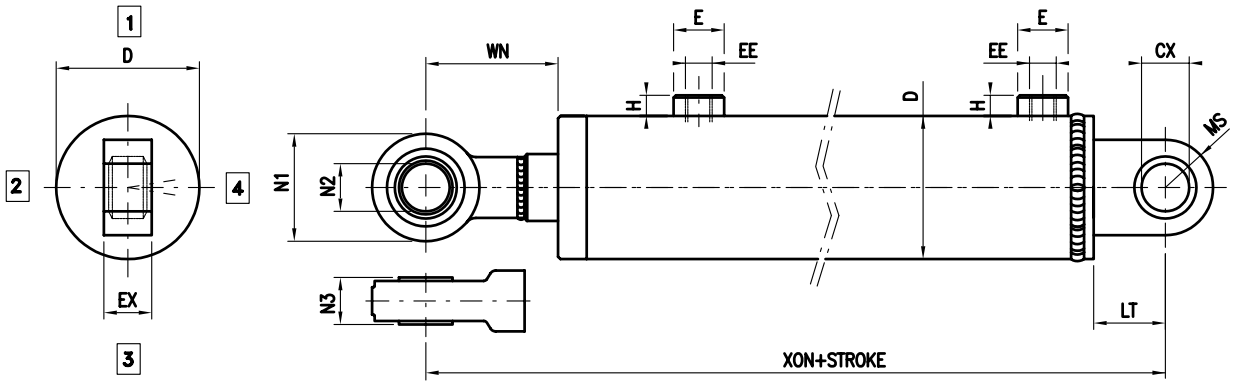
Bore	MM Rod	CH	KK	A	B1	B2	B3	CD	D	E	EE	EW	H	LM	MC	N1	N2	N3	W	WB	WN	XM	XMB	XMN
40	20	18	M16x1,5	22	40	20,5	40	20,25	50	22	1/4"	25	16	30	26	53	20	15	13	42	60	151	180	198
	25	22	M20x1,5	28																				
50	25	22	M20x1,5	28	40	20,5	40	20,25	60	26	3/8"	25	17	30	26	53	20	15	14	42	60	162	190	208
	30	24	M20x1,5	28																				
60	30	24	M20x1,5	28	50	25,5	45	25,25	70	26	3/8"	30	17	35	30	64	25	20	16	48	68	188	220	240
	35	29	M27x2	36																				
70	35	29	M27x2	36	50	30,5	55	30,25	80	26	3/8"	35	17	45	35	73	30	22	16	48	74	198	230	256
	40	34	M27x2	36																				
80	40	34	M27x2	36	50	30,5	55	30,25	95	30	1/2"	35	18	45	35	73	30	22	18	50	76	221	253	279
	50	44	M33x2	45																				
100	50	44	M33x2	45	70	40,25	70	40,25	115	30	1/2"	56	18	55	42	92	40	28	20	57	94	265	305	339
	60	52	M42x2	56																				



CSM: (JOINT HINGE MALE TREAD)

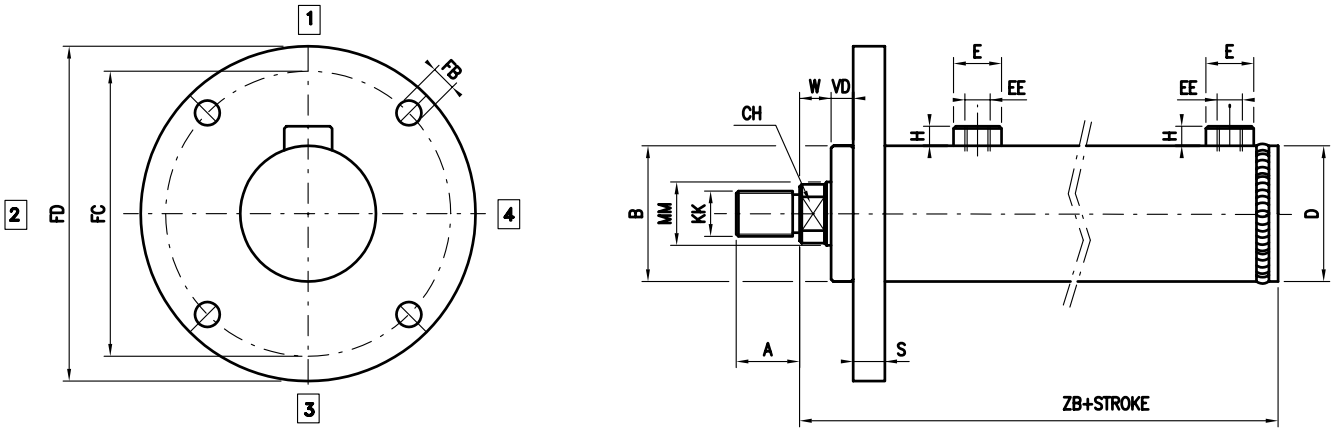


CSB: (JOINT HINGE RING WELDED)

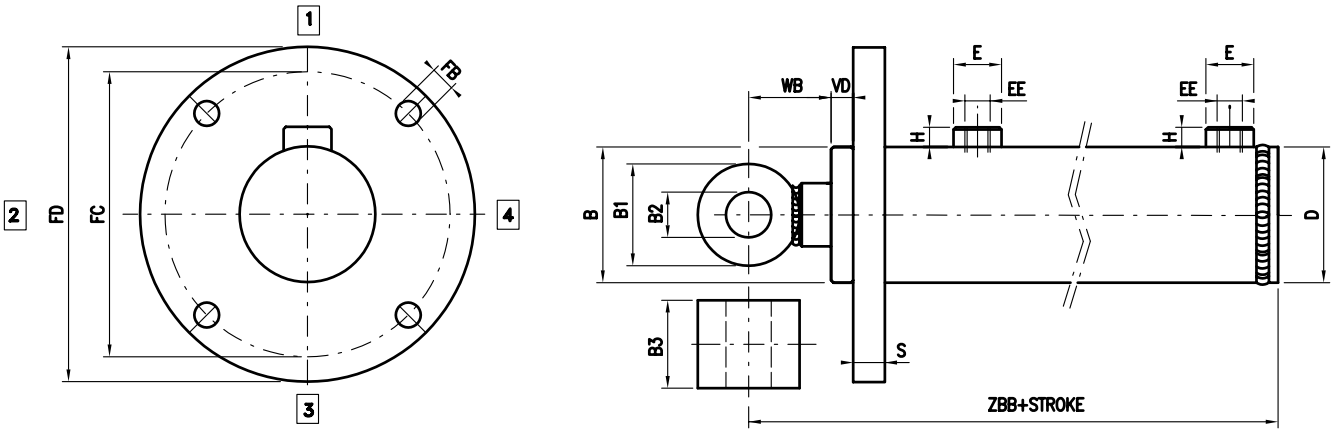


CSN: (JOINT HINGE JOINT WELDED)

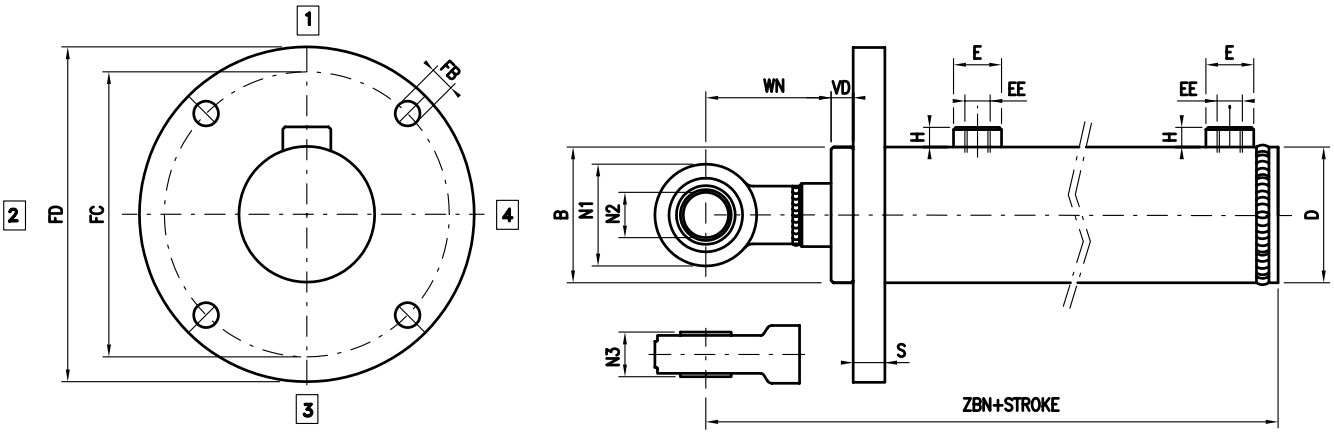
Bore	MM Rod	CH	KK	A	B1	B2	B3	CX	D	E	EE	EX	H	LT	MS	N1	N2	N3	W	WB	WN	XO	XOB	XON
40	20	18	M16x1,5	22	40	20,5	40	20	50	22	1/4"	19	16	38	25	53	20	15	13	42	60	159	188	206
	25	22	M20x1,5	28																				
50	25	22	M20x1,5	28	40	20,5	40	20	60	26	3/8"	19	17	38	25	53	20	15	14	42	60	170	198	216
	30	24	M20x1,5	28																				
60	30	24	M20x1,5	28	50	25,5	45	25	70	26	3/8"	23	17	45	27,5	64	25	20	16	48	68	198	230	250
	35	29	M27x2	36																				
70	35	29	M27x2	36	50	30,5	55	30	80	26	3/8"	28	17	51	32,5	73	30	22	16	48	74	204	236	262
	40	34	M27x2	36																				
80	40	34	M27x2	36	50	30,5	55	30	95	30	1/2"	28	18	51	32,5	73	30	22	18	50	76	224	259	285
	50	44	M33x2	45																				
100	50	44	M33x2	45	70	40,25	70	40	115	30	1/2"	35	18	69	50	92	40	28	20	57	94	279	319	353
	60	52	M42x2	56																				



FAM: (FRONT FLANGE MALE TREAD)

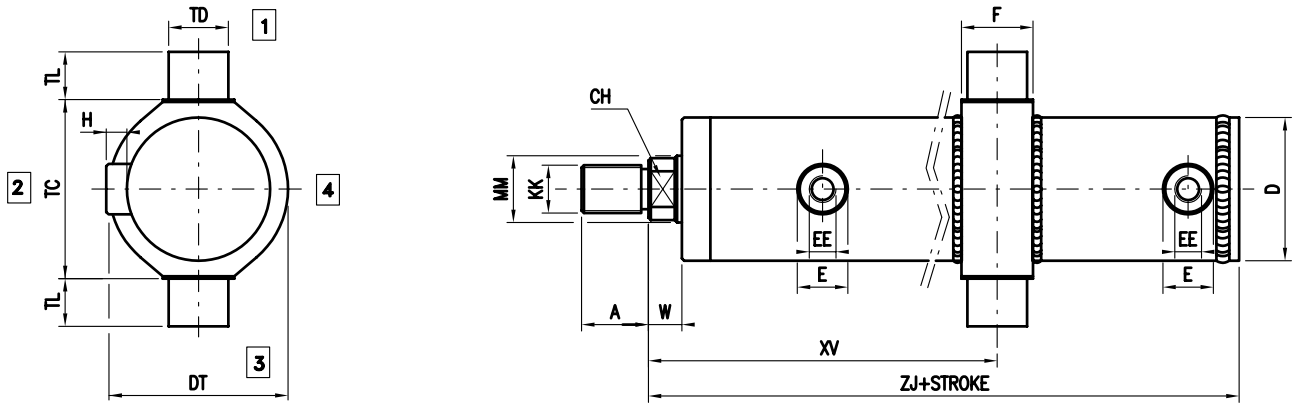


FAB: (FRONT FLANGE RING WELDED)

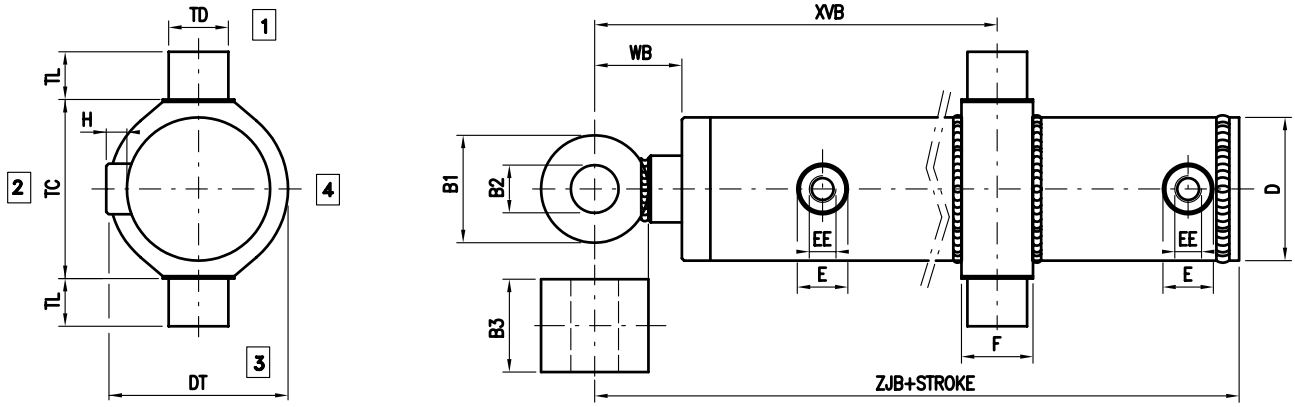


FAN: (FRONT FLANGE JOINT WELDED)

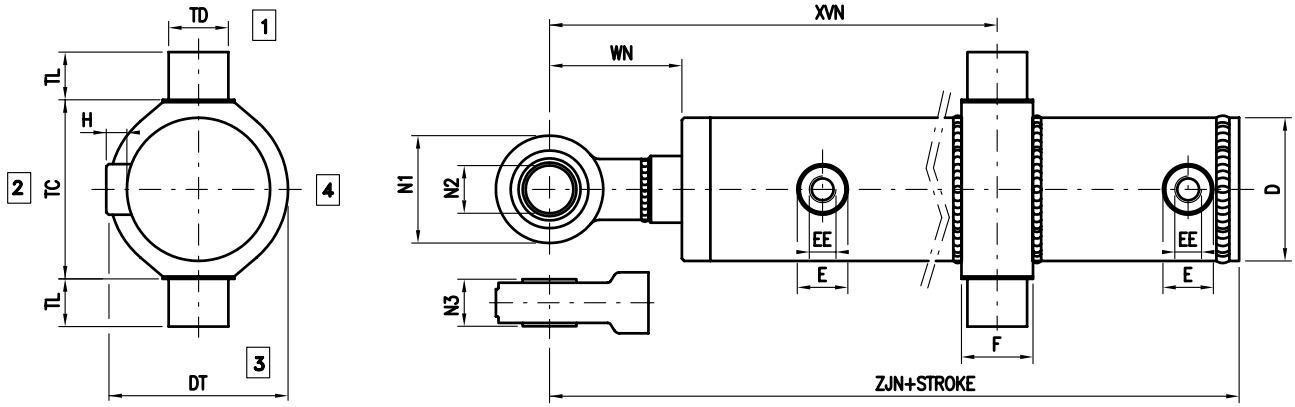
Bore	MM Rod	CH	KK	A	B	B1	B2	B3	D	E	EE	FB	FC	FD	H	N1	N2	N3	S	VD	W	WB	WN	ZB	ZBB	ZBN
40	20	18	M16x1,5	22	49	40	20,5	40	50	22	1/4"	11	87	109	20	53	20	15	12,5	8	13	42	60	123	152	170
	25	22	M20x1,5	28																						
50	25	22	M20x1,5	28	59	40	20,5	40	60	26	3/8"	13	105	128	20	53	20	15	14,5	8	14	42	60	134	162	180
	30	24	M20x1,5	28																						
60	30	24	M20x1,5	28	69	50	25,5	45	70	26	3/8"	13	117	142	25	64	25	20	16,5	10	16	48	68	156	188	208
	35	29	M27x2	36																						
70	35	29	M27x2	36	79	50	30,5	55	80	26	3/8"	15	127	162	30	73	30	22	16,5	10	16	48	74	156	188	214
	40	34	M27x2	36																						
80	40	34	M27x2	36	94	50	30,5	55	95	30	1/2"	17	149	181	30	73	30	22	18,5	10	18	50	76	178	210	236
	50	44	M33x2	45																						
100	50	44	M33x2	45	114	70	40,25	70	115	30	1/2"	17 n°6	162	194	35	92	40	28	24,5	12	20	57	94	210	250	284
	60	52	M42x2	56																						



OIM: (INTERMEDIATE TRUNNION MALE TREAD)



OIB: (INTERMEDIATE TRUNNION RING WELDED)

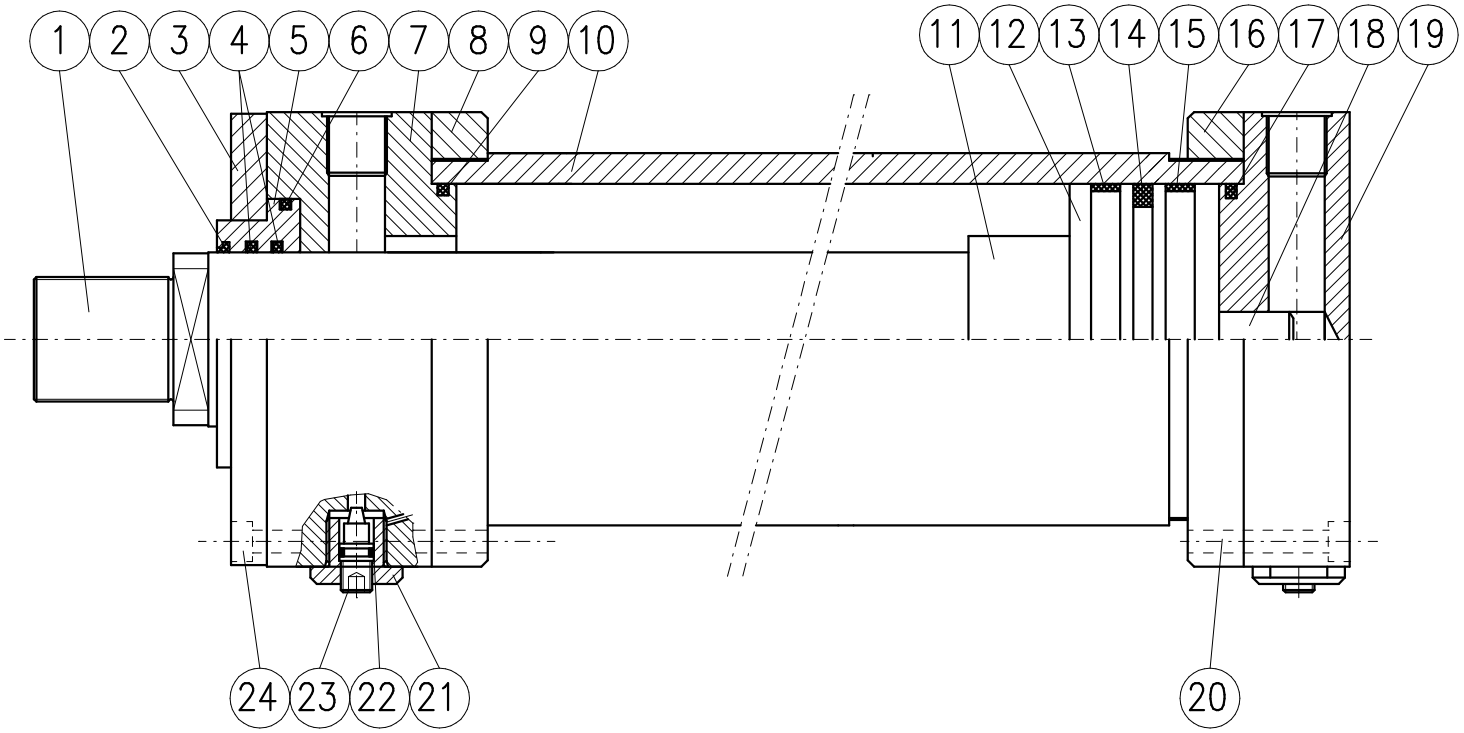


OIN: (INTERMEDIATE TRUNNION JOINT WELDED)

Bore	MM Rod	CH	KK	A	B1	B2	B3	D	DT	E	EE	H	N1	N2	N3	TC	TD	TL	XV MIN	XV MAX	XVB MIN	XVB MAX	XVN MIN	XVN MAX	W	WB	WN	ZJ	ZJB	ZJN
40	20	18	M16x1,5	22	40	20,5	40	50	65	22	1/4"	20	53	20	15	70	20	20	100	50 +STROKE	129	79 +STROKE	147	97 +STROKE	13	42	60	121	150	168
	25	22	M20x1,5	28																										
50	25	22	M20x1,5	28	40	20,5	40	60	75	26	3/8"	20	53	20	15	80	25	25	110	52 +STROKE	138	80 +STROKE	156	98 +STROKE	14	42	60	132	160	178
	30	24	M20x1,5	28																										
60	30	24	M20x1,5	28	50	25,5	45	70	90	26	3/8"	25	64	25	20	100	30	30	120	62 +STROKE	152	94 +STROKE	172	114 +STROKE	16	48	68	153	185	205
	35	29	M27x2	36																										
70	35	29	M27x2	36	50	30,5	55	80	100	26	3/8"	30	73	30	22	110	35	35	125	65 +STROKE	157	99 +STROKE	183	123 +STROKE	16	48	74	153	185	211
	40	34	M27x2	36																										
80	40	34	M27x2	36	50	30,5	55	95	115	30	1/2"	30	73	30	22	115	40	40	140	75 +STROKE	172	107 +STROKE	198	133 +STROKE	18	50	76	176	208	234
	50	44	M33x2	45																										
100	50	44	M33x2	45	70	40,25	70	115	145	30	1/2"	35	92	40	28	145	50	50	172	95 +STROKE	209	132 +STROKE	246	169 +STROKE	20	57	94	210	250	285
	60	52	M42x2	56																										

CYLINDERS SERIES CC

according to ISO 6022



POS	ITEM	MATERIAL	POS	ITEM	MATERIAL
1	Rod	Chromium-plated steel	13	Anti-friction slide	PTFE
2	Dust scraper	Nitrile rubber	14	Piston b seal	PTFE
3	Guide flange	Steel	15	Anti-friction slide	Nitrile rubber + PTFE
4	Rod seal	Nitrile rubber + PTFE	16	Pipe flange	PTFE
5	Guide bushing	Steel	17	O-Ring + anti-extrusion	Steel
6	O-Ring + anti-extrusion	Nitrile rubber + sealon	18	Rear brake	Nitrile rubber + sealon
7	Front head	Steel	19	Rear head	Steel
8	Pipe flange	Steel	20	Cap screw	Steel
9	O-Ring + anti-extrusion	Nitrile rubber + sealon	21	Safety plug	Steel
10	Liner	Steel	22	O-Ring	Steel
11	Front brake bushing	Steel	23	Adjustment needle	Nitrile rubber
12	Piston	Steel	24	Position indicator	Steel

BORE	**mm**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**
OIL PORTS	**gas**	1/2"	3/4"	3/4"	1"	1"	1" 1/4"	1" 1/4"	1" 1/2"	2"
ROD DIAMETER	**mm**	36	45	56	70	90	110	140	180	220
BRAKING LENGTH	**mm**	30	30	32	40	45	50	65	95	100
TEMPERATURE	**°C**	-10°C +75°C (high temperature VITON)								
TOLERANCE ON STROKE	**mm**	0 – 500 +/– 1 mm		501 – 1500 +/– 2 mm		1501 – 3000 +/– 3 mm		> 3001 +/– 4,5 mm		
WORKING PRESSURE	**MPa (bar)**	25 (250)								
MAXIMUM PRESSURE	**MPa (bar)**	32 (320)								

TECHNICAL CHARACTERISTICS

CHOOSING THE PRODUCTION SERIES

In order to identify the production series, make sure that, while the plant is working, the operating pressures indicated for each series are not exceeded. The general dimensioning of the cylinder ensures wide safety margins. Do not exceed the maximum pressure value that corresponds to the test pressure, considering also any overpressure caused by throttle valves in the circuits and/or by vertical loads (with downward rods) and end of stroke braking (see paragraph 1.7). We recommend that you adopt strokes longer (by a few millimeters) than the working stroke, in order to prevent the use of the cylinder's internal stops as a mechanical end of stroke. Also check that the expected working temperature and speed are consistent with the type of seals installed.

1.1 HYDRAULIC CYLINDERS – SERIES CC

The CC hydraulic cylinders are dimensioned according to standard ISO 6022 – DIN 24333,

- manufactured according to CNC technology, with top-quality materials, they provide maximum reliability and duration
- the use of standard components during assembly facilitates the replacement of any worn components
- they can be equipped with progressive braking of rear and front end of stroke, consisting of self-centering spurs that can slow-down gradually the masses concerned, even of considerable size. Dynamic reliable standard seals are used, that are easy to find on the market and can be modified according to the requested application.

1.2 RANGE OF USE OF CC CYLINDERS

- maximum pressure 32 Mpa (320 bar)
- pressure up to 25 Mpa (250 bar), recommended for normal use

1.3 CYLINDER LINER

The cylinder liner is made up of a top-quality thick steel pipe, either cold-drawn or hot-rolled, provided with internal micro-finish (roughness RA ≤ 0.4 micron, diameter tolerance H8).

1.4 ROD

Rods are made with top-quality steel, minimum yield point 700 N/mm^2, coated with hard chrome. This surface treatment ensures a proper protection against any damage and long-life seals. The minimum surface finish is 0.2 micron. Rods with strong chrome filling, induction-hardened or made of special steel, can be manufactured on demand.

1.5 HEADS

Heads are made of steel and are manufactured in such a way that they can ensure perfect concentricity between the cylinder liner, the rod bushing and the rod. Wide inner passages are manufactured to minimize any load loss when the fluid is conveyed.

1.6 PISTON

The piston is made with a special material, specially processed to ensure a concentric guide between rod damping bushing, cylinder liner and head damping bushing. Moreover, a large part of
its radial surface touches the cylinder liner. This confers considerable stability, so that any rod bending, caused by external radial loads, are minimized.

1.7 END OF STROKE BRAKING

The end of stroke braking is usually adopted on all cylinders working at a speed > 0.1 m/sec., or when loads in vertical direction are activated.
This braking is also a safety device in case of failure of control equipment (such as servosystems).

The ratio below makes it possible to promptly calculate, based on the cylinder bore (braking section), the supply pressure, the braking length and the working speed, as well as the mass that can be damped by every single cylinder.
This reaction limits the overpressure value to 320 bar, protecting the cylinder's components that are under stress during braking.

$$M = \frac{\left(p_2 \cdot S - p_1 \cdot A\right) \cdot 2 \cdot L_f}{V_0^2} \cdot 10^{-2} \text{ [kg]}$$

p_1 = supply pressure (bar)
V_0 = working speed (m/sec.)
L_1 = Braking length (mm)
p_2 = maximum pressure 320 bar
S = braking section S_1 or S_2 (cm^2)
A = piston area (cm^2)

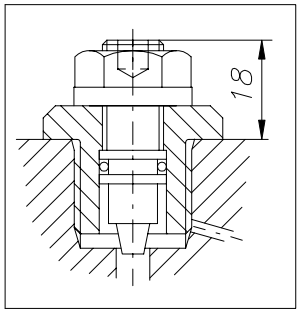
The damped mass values obtained from this ratio are simply theoretical, and Grices may not be held liable for the use of this ratio.
The data to be inserted in the ratio to calculate the mass that can be damped may be obtained from the following table.

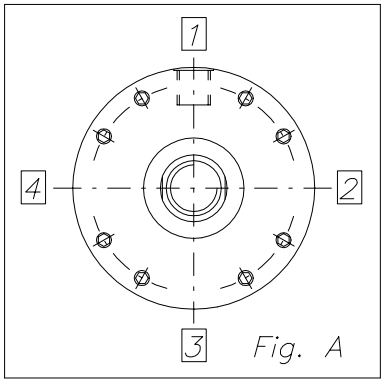
Bore (mm)	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**
Ø rod (mm)	**36**	**45**	**56**	**70**	**90**	**110**	**140**	**180**	**220**
S_1 (cm^2) rod forward	8,2	13,8	23,8	37,8	56	102	151	177	352
S_2 (cm^2) rod backward	18,5	29,1	46,4	73,2	114	189	294	471	748
L_f (mm)	30	30	30	32	32	40	46	95	100
A (cm^2)	19,6	31,2	50,3	78,5	122,7	201,1	314,2	490,6	803,8

This standard brake position is No. 3 in figure A; the equipment can be mounted in another position on demand.

1.8 DAMPING ADJUSTMENT

For a precise damping adjustment, both ends of the cylinder are equipped with needle valves, as indicated in the figures below. These devices are provided with a system that prevents their accidental removal.





1.9 SPACERS

Cylinders with strokes > 1000mm should feature spacers of adequate design, so as increase the rod and piston guide, in order to reduce any overload phenomena, resulting in early wear.
The table on the right indicates the spacer length based on stroke; for the stroke values not included in the table, contact our technicians. As a general rule, spacers are not mounted on cylinders when strokes are < 1000mm and on cylinders subjected to only one pulling action.

STROKE (mm)	**1001 to 1500**	**1501 to 2000**	**2001 to 2500**	**2501 to 3000**
Spacer symbol	1	2	3	4
Length (mm)	50	100	150	200

1.10 SEALS

On the basis of particular working conditions of the cylinders, such as speed, fluid used and temperature, the relevant seal shall be chosen in conformity with the manufacturer's recommendations.
Our cylinders feature low-friction seals with seats conforming to the provisions of ISO 7425, that allow our cylinders to work under the heaviest conditions, such as very low or high speed, high working frequency, mineral or synthetic fluids.

The type of seals to be used in the relevant working conditions are indicated below.

TYPE B standard: (NITRILE+PTFE) anti-friction, not recommended when loads are to be held in position, and recommended at speeds ≤ 4 m/sec., at temperatures ranging between –10 and +75°C, operation with mineral oil or glycol water.

TYPE C: (VITON+PTFE) anti-friction, for high-temperature fluids, up to+135°C, maximum speed 4m/sec. Can be used also with phosphoric esters.

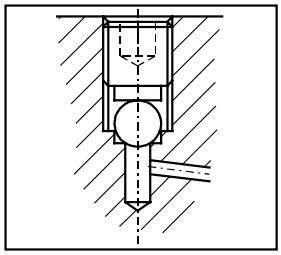
1.11 OIL PORTS

Oil ports are BSP threaded, with boring conforming to DIN 3852/2, standard position 1 in figure A; other alternative positions can be provided on demand.
Optional presetting for mounting SAE 6000 flanges (contact our Technical Department).
In order to reduce as much as possible any turbulence and water hammer in the cylinder's connecting pipes, we recommend that you ensure that the oil speed does not exceed 6 m/sec. The maximum flow rates that can be obtained with these criteria are shown in the table below.

OIL PORT Ø	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
MAX. FLOW RATE (l./min.)	40	53	85	136	212	320

1.12 AIR VENTS

Air vents are provided on demand on both ends of the cylinder. Vents are mounted inside the head and the bottom, so as to be protected from any accidental removal, as shown in the figure on the right.
Standard position: 2 in figure A; other alternative positions can be provided on demand.

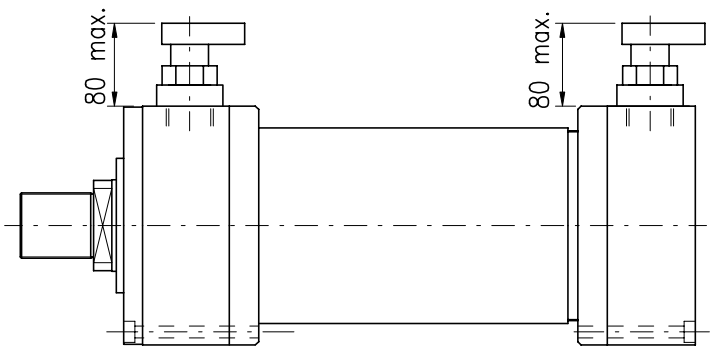


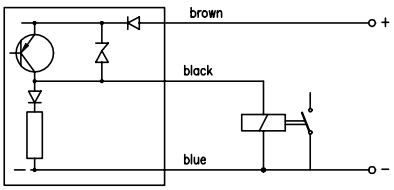
1.13 DRAINAGE

The drainage on the rod seal ensures better sealing at high speed, in particular in cylinders with strokes > 2000mm or in applications where the chamber, rod side, is constantly under pressure.
The drainage port (1/8") is usually positioned on the same axis of the supply port and must be directly connected to the tank.

1.14 PROXIMITY SENSORS

When the piston position is to be detected in any hydraulic system, proximity sensors can be directly mounted in the cylinder heads. The mounting temperature is –25 to +80°C. Permissible dynamic pressure 350 bar. The sensor is provided with a built-in amplifier, with direct supply (10 to 30Vdc), analog output PNP NA for 200mA max., supplied complete with connector with cable (approx. 4m long).
Sensors can be mounted on head and bottom, usually arranged in position 4, figure A; other alternative positions can be provided on demand. They make it possible to obtain an electric signal near the end of stroke positioning of the piston.





Technical data of the sensor:

Working temperature	–25 +80 °C
Supply voltage	10–30 V cc
Load	200 mA
Execution	PNP
Output type	NA

2.1 PEAK LOAD

When the cylinder is working under compression, check the peak load. Table **1** shows the most common types of restriction. Each of them is associated to a coefficient **K**. The maximum stroke of cylinder L multiplied by coefficient K produces the L_v value (virtual length, $L_v = L*K$). The graph **2** indicates the rod's minimum diameter, based on load. The point of intersection between L_v in mm. and pushing force F in KN must be below the characteristic curve of the rod to be checked.
Example:
cylinder CD63/45/750/FA/00B (front flange), that exerts a 40 KN pressure. Table **1** shows coefficient K, determined by the type of restriction **K = 2**, the virtual length is $L_v = L*K$ $L_v = 750*2 = 1500$ mm
In graph **2** you can check whether the point of intersection between L_v and **F** is below the curve of rod Ø 45. Since the stability condition has been met, adopt the differential rod Ø 45. If the result of this check is negative (point of intersection between L_v and **F** above the curve), choose a cylinder with a wider rod.

Graph 2

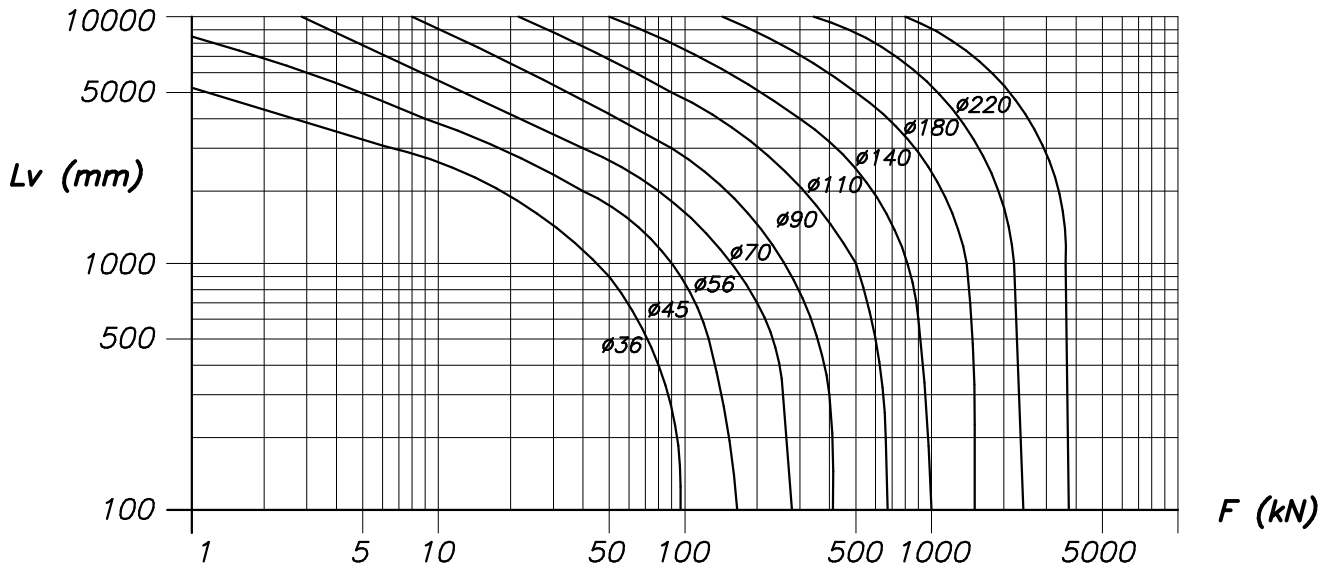
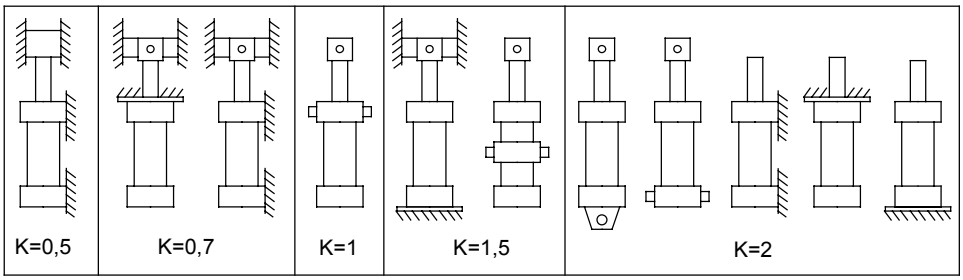
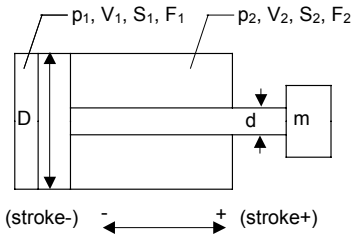


Table 1





2.2 PRACTICAL UNIT OF MEASUREMENT FOR FORCE AND SPEED CALCULATION

DESCRIPTION	SYMBOL	UNIT OF MEASURE.
Section	S	cm^2
Pressure	p	bar
Piston Ø	D	mm
Rod Ø	d	mm
Speed	V	m/s
Capacity	Q	l/min
Load	m	kg

PUSHING FORCE (**STROKE +**)

$F_1=(p_1 \bullet S_1)$ (Kg)

PULLING FORCE (**STROKE -**)

$F_2=(p_2 \bullet S_2)$ (Kg)

PUSHING SPEED (**STROKE +**)

$V_1=Q/(6 \bullet S_1)$ (m/s)

PULLING SPEED (**STROKE -**)

$V_2=Q/(6 \bullet S_2)$ (m/s)

$$S_1 = \frac{\pi \bullet D^2}{4 \bullet 100} \ (cm^2) \qquad S_2 = \frac{\pi \bullet (D^2 - d^2)}{4 \bullet 100} \ (cm^2)$$

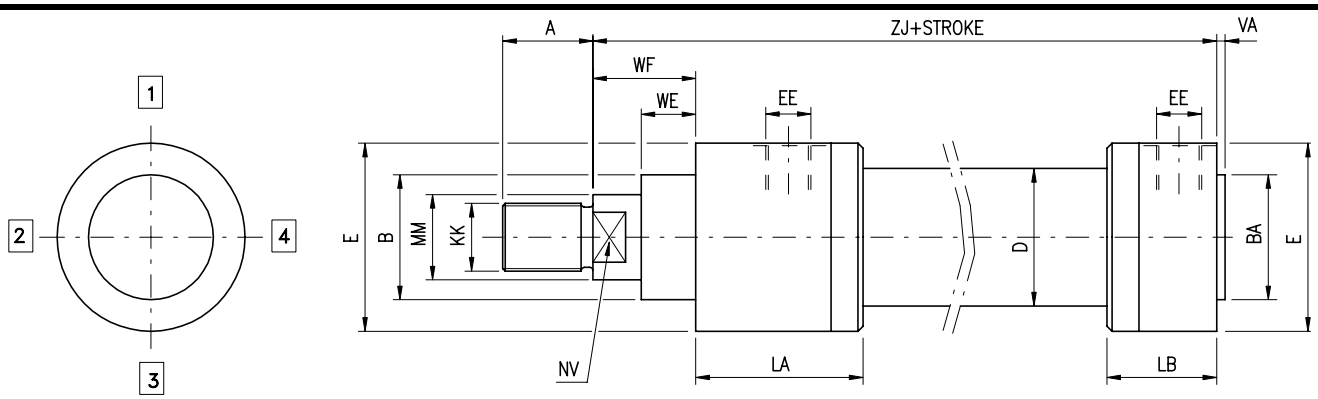
EXAMPLE: DETERMINING THE ACRONYM FOR THE ORDER

CHARACTERISTIC	DESCRIPTION	SYM.
SERIES	execution ISO 6022	CC
BORE	indicate mm	
ROD	indicate mm	
STROKE	indicate mm	
EXECUTION	base	EB
	front flange	FA
	rear flange	FP
	joint hinge	CS
	intermediate trunnion	OI
BRAKING	without braking	0
	front braking	1
	rear braking	2
	front + rear braking	3
SPACER	without spacer	0
	50mm	1
	100mm	2
	150mm	3
	200mm	4
SEALS	**nitrile + PTFE (anti-friction, standard)**	B
	viton + PTFE (high temperatures)	C
OPTIONS*		
AIR VENTS	front	G
	rear	H
	front+rear	I
DRAINAGE	rod side	W
ROD TREATMENT	heavy chromium-plated, 0.045mm thick, 100h salt mist ISO 3768	P
	hardening and chromium-plating	T
	Ni-CROMAX30 chromium-plated, nickel-plated, ASTM B 117 1000h	N
PROXIMITY SENSORS	front	X1
	rear	X2
	front + rear	X3

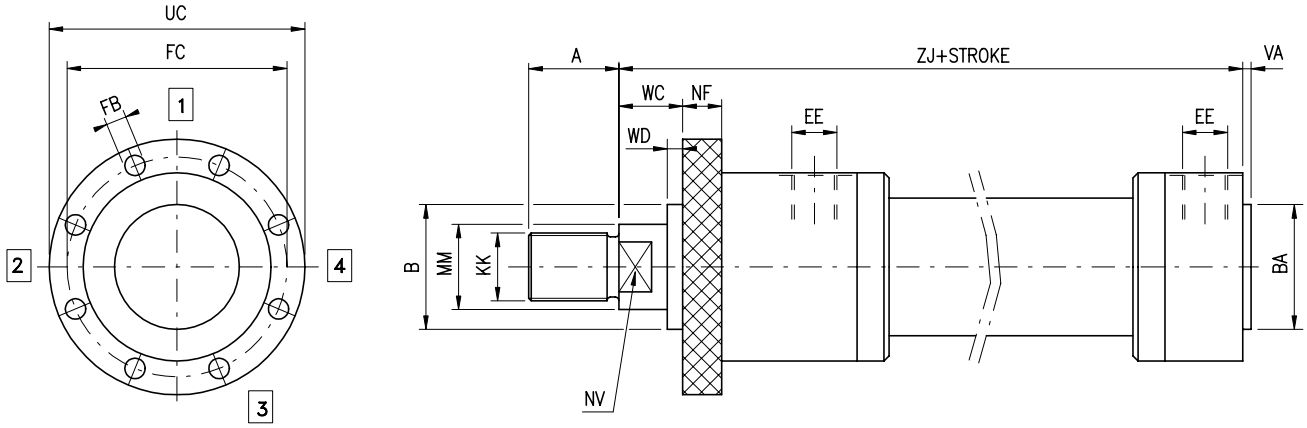
EXAMPLE

CC/50/36/100/EB/10 B....

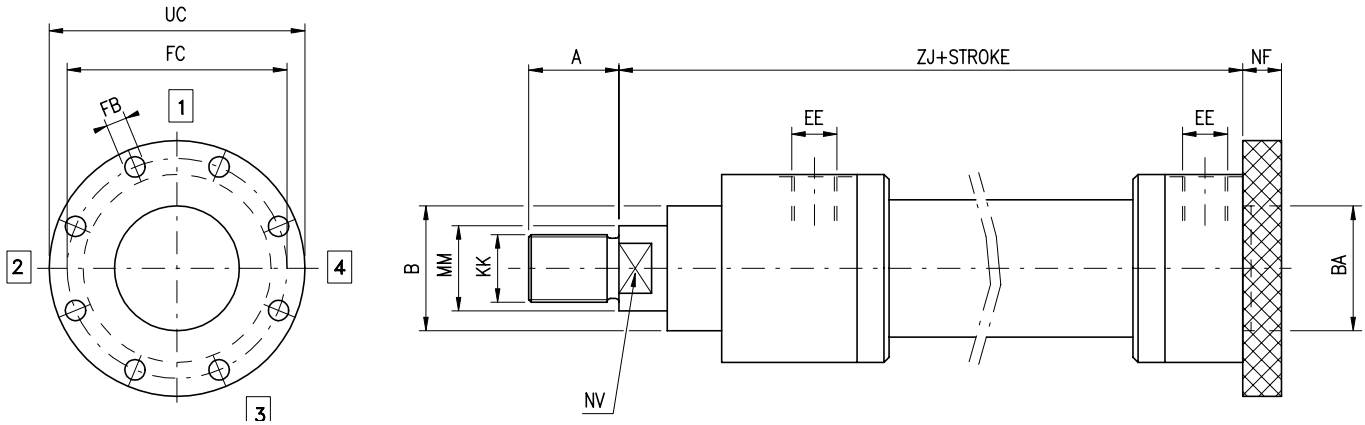
* to be reported in alphabetic



EB: (Base)

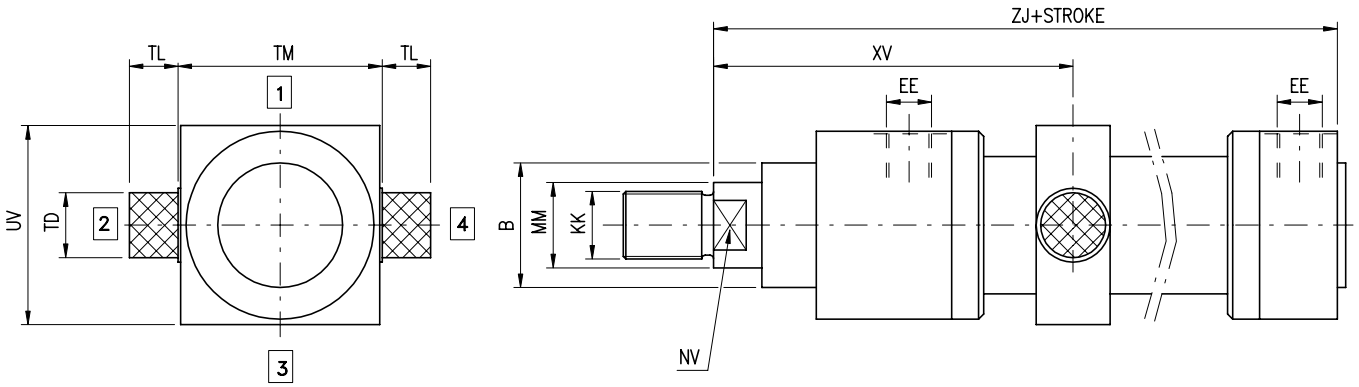


FA: (ISO type MF3)

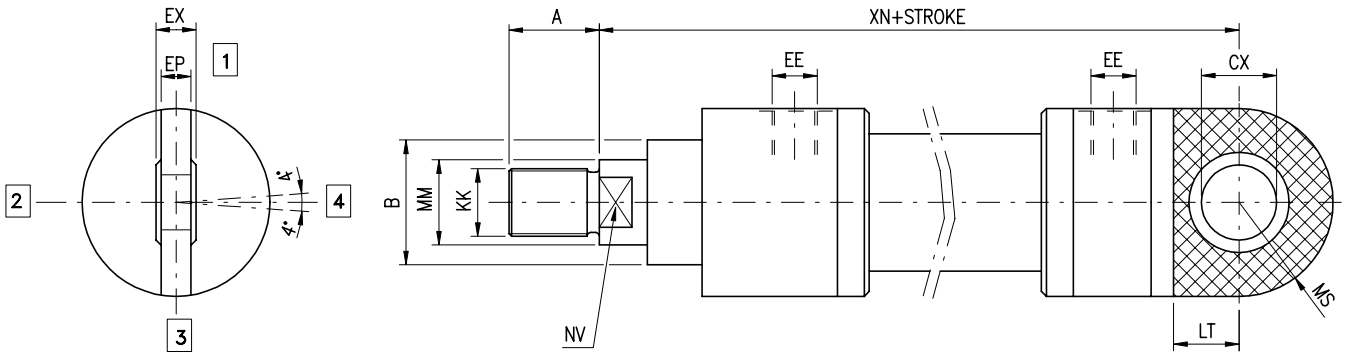


FP: (ISO type MF4)

Bore	MM	KK	A	B	BA	E	EE	FB	FC	NF	NV	UC	VA	VD	WC	WE	WF	ZJ	ZP
50	36	M27x2	36	63	63	108	1/2"	14	132	25	28	165	4	4	22	29	47	240	265
63	45	M33x2	45	75	75	124	3/4"	14	150	28	36	180	5	4	25	32	53	270	298
80	56	M42x2	56	90	90	148	3/4"	18	180	32	46	220	5	4	28	36	60	300	332
100	70	M48x2	63	110	110	175	1"	22	212	36	60	260	6	5	32	41	68	335	371
125	90	M64x3	85	132	132	210	1"	22	250	40	75	295	6	5	36	45	76	390	430
160	110	M80x3	95	160	160	270	1 1/4"	26	315	45	95	370	7	5	40	50	85	460	505
200	140	M100x3	112	200	200	330	1 1/4"	33	385	56	120	460	8	5	45	61	101	540	596
250	180	M125x4	125	250	250	410	1 1/2"	39	475	63	–	540	8	8	50	71	113	640	703
320	220	M160x4	160	320	320	510	1 1/2"	45	600	80	–	680	8	8	56	88	136	750	830



OI: (ISO type MT4)

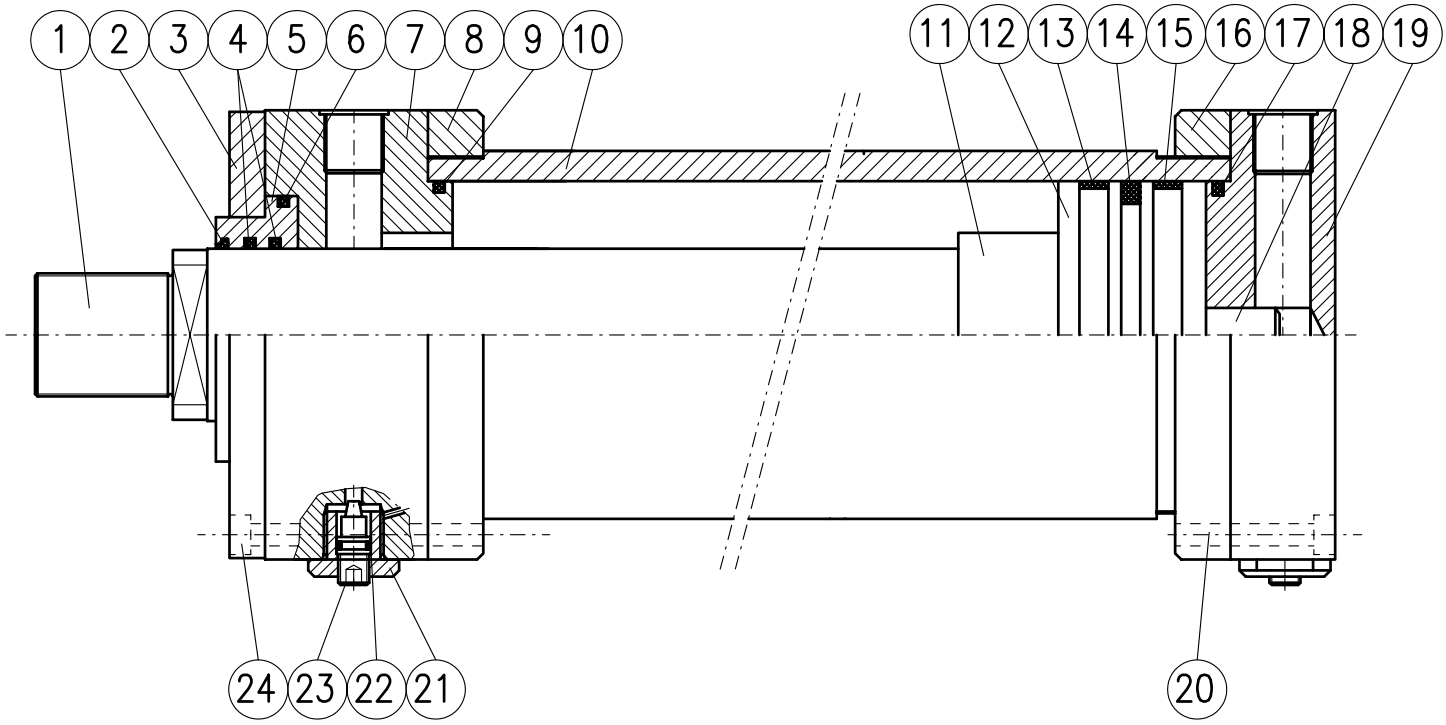


CS: (ISO type MP6)

Bore	MM	KK	B	CX	EE	EP	EX	LT	MS	NV	TD	TL	TM	UV	ZJ	XN	XV min.	XV+stroke max.
50	36	M27x2	63	32	1/2"	27	32	40	40	28	32	25	112	112	240	305	177	120
63	45	M33x2	75	40	3/4"	35	40	50	50	36	40	32	125	135	270	348	206	140
80	56	M42x2	90	50	3/4"	40	50	63	63	46	50	40	150	162	300	395	236	155
100	70	M48x2	110	63	1"	52	63	71	80	60	63	50	180	196	335	442	277	170
125	90	M64x3	132	80	1"	60	80	90	100	75	80	63	224	250	390	520	321	190
160	110	M80x3	160	100	1 1/4"	80	100	112	125	95	100	80	280	270	460	617	398	220
200	140	M100x3	200	125	1 1/4"	102	125	160	160	120	125	100	335	320	540	756	452	250
250	180	M125x4	250	160	1 1/2"	130	160	200	200	–	160	125	425	–	640	903	500	270
320	220	M160x4	320	200	1 1/2"	162	200	250	250	–	200	160	530	–	750	1080	630	280

CYLINDERS SERIES CA

according to ISO 6020/1



POS	ITEM	MATERIAL	POS	ITEM	MATERIAL
1	Rod	Chromium-plated steel	13	Anti-friction slide	PTFE
2	Dust scraper	Nitrile rubber	14	Piston b seal	PTFE
3	Guide flange	Steel	15	Anti-friction slide	Nitrile rubber + PTFE
4	Rod seal	Nitrile rubber + PTFE	16	Pipe flange	PTFE
5	Guide bushing	Steel	17	O-Ring + anti-extrusion	Steel
6	O-Ring + anti-extrusion	Nitrile rubber + sealon	18	Rear brake	Nitrile rubber + sealon
7	Front head	Steel	19	Rear head	Steel
8	Pipe flange	Steel	20	Cap screw	Steel
9	O-Ring + anti-extrusion	Nitrile rubber + sealon	21	Safety plug	Steel
10	Liner	Steel	22	O-Ring	Steel
11	Front brake bushing	Steel	23	Adjustment needle	Nitrile rubber
12	Piston	Steel	24	Position indicator	Steel

BORE	**mm**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**
OIL PORTS	**gas**	1/2"	1/2"	3/4"	3/4"	1"	1"	1" 1/4"	1" 1/4"	1" 1/2"	1" 1/2"
BRAKING LENGTH	**mm**	28	30	30	32	40	45	50	65	95	100
TEMPERATURE	**°C**	-10°C +75°C (high temperature VITON)									
TOLERANCE ON STROKE	**mm**	0 – 500 +/– 1 mm			501 – 1500 +/– 2 mm		1501 – 3000 +/– 3 mm		> 3001 +/– 4,5 mm		
WORKING PRESSURE	**MPa (bar)**	16 (160)									
MAXIMUM PRESSURE	**MPa (bar)**	25 (250)									

TECHNICAL CHARACTERISTICS

CHOOSING THE PRODUCTION SERIES

In order to identify the production series, make sure that, while the plant is working, the operating pressures indicated for each series are not exceeded. The general dimensioning of the cylinder ensures wide safety margins. Do not exceed the maximum pressure value that corresponds to the test pressure, considering also any overpressure caused by throttle valves in the circuits and/or by vertical loads (with downward rods) and end of stroke braking (see paragraph 1.7). We recommend that you adopt strokes longer (by a few millimeters) than the working stroke, in order to prevent the use of the cylinder's internal stops as a mechanical end of stroke. Also check that the expected working temperature and speed are consistent with the type of seals installed.

1.1 HYDRAULIC CYLINDERS – SERIES CA

The CA hydraulic cylinders are dimensioned according to standard ISO 6020/1

- manufactured according to CNC technology, with top-quality materials, they provide maximum reliability and duration
- the use of standard components during assembly facilitates the replacement of any worn components
- they can be equipped with progressive braking of rear and front end of stroke, consisting of self-centering spurs that can slow-down gradually the masses concerned, even of considerable size. Dynamic reliable standard seals are used, that are easy to find on the market and can be modified according to the requested application.

1.2 RANGE OF USE OF CA CYLINDERS

- maximum pressure 25 Mpa (250 bar)
- pressure up to 16 Mpa (160 bar), recommended for normal use

1.3 CYLINDER LINER

The cylinder liner is made up of a top-quality thick steel pipe, either cold-drawn or hot-rolled, provided with internal micro-finish (roughness RA ≤ 0.4 micron, diameter tolerance H8).

1.4 ROD

Rods are made with top-quality steel, minimum yield point 700 N/mm^2, coated with hard chrome. This surface treatment ensures a proper protection against any damage and long-life seals. The minimum surface finish is 0.2 micron. Rods with strong chrome filling, induction-hardened or made of special steel, can be manufactured on demand.

1.5 HEADS

Heads are made of steel and are manufactured in such a way that they can ensure perfect concentricity between the cylinder liner, the rod bushing and the rod. Wide inner passages are manufactured to minimize any load loss when the fluid is conveyed.

1.6 PISTON

The piston is made with a special material, specially processed to ensure a concentric guide between rod damping bushing, cylinder liner and head damping bushing. Moreover, a large part of
its radial surface touches the cylinder liner. This confers considerable stability, so that any rod bending, caused by external radial loads, are minimized.

1.7 END OF STROKE BRAKING

The end of stroke braking is usually adopted on all cylinders working at a speed > 0.1 m/sec., or when loads in vertical direction are activated.
This braking is also a safety device in case of failure of control equipment (such as servosystems).

The ratio below makes it possible to promptly calculate, based on the cylinder bore (braking section), the supply pressure, the braking length and the working speed, as well as the mass that can be damped by every single cylinder.
This reaction limits the overpressure value to 250 bar, protecting the cylinder's components that are under stress during braking.

$$M = \frac{\left(p_2 \cdot S - p_1 \cdot A\right) \cdot 2 \cdot L_f}{V_0^2} \cdot 10^{-2} \text{ [kg]}$$

p_1 = supply pressure (bar)
V_0 = working speed (m/sec.)
L_1 = Braking length (mm)
p_2 = maximum pressure 250 bar
S = braking section S_1 or S_2 (cm^2)
A = piston area (cm^2)

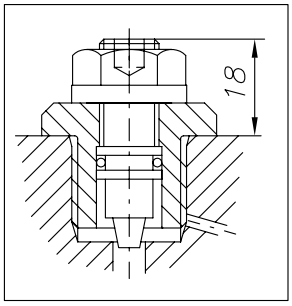
The damped mass values obtained from this ratio are simply theoretical, and Grices may not be held liable for the use of this ratio.
The data to be inserted in the ratio to calculate the mass that can be damped may be obtained from the following table.

Bore (mm)	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**
S_1 (cm^2) rod forward	5,5	8,2	13,8	23,8	37,8	56	102	151	177	352
S_2 (cm^2) rod backward	11,4	18,5	29,1	46,4	73,2	114	189	294	471	748
L_f (mm)	28	30	30	30	32	32	40	46	95	100
A (cm^2)	17,6	19,6	31,2	50,3	78,5	122,7	201,1	314,2	490,6	803,8

This standard brake position is No. 3 in figure A; the equipment can be mounted in another position on demand.

1.8 DAMPING ADJUSTMENT

For a precise damping adjustment, both ends of the cylinder are equipped with needle valves, as indicated in the figures below. These devices are provided with a system that prevents their accidental removal.



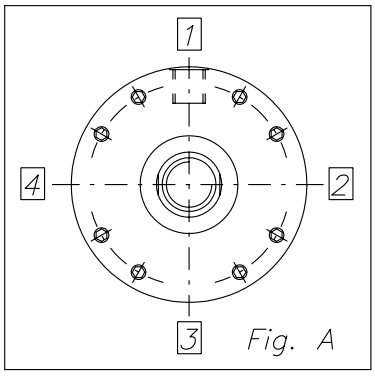


Fig. A

1.9 SPACERS

Cylinders with strokes > 1000mm should feature spacers of adequate design, so as increase the rod and piston guide, in order to reduce any overload phenomena, resulting in early wear.
The table on the right indicates the spacer length based on stroke; for the stroke values not included in the table, contact our technicians. As a general rule, spacers are not mounted on cylinders when strokes are < 1000mm and on cylinders subjected to only one pulling action.

STROKE (mm)	**1001 to 1500**	**1501 to 2000**	**2001 to 2500**	**2501 to 3000**
Spacer symbol	1	2	3	4
Length (mm)	50	100	150	200

1.10 SEALS

On the basis of particular working conditions of the cylinders, such as speed, fluid used and temperature, the relevant seal shall be chosen in conformity with the manufacturer's recommendations.
Our cylinders feature low-friction seals with seats conforming to the provisions of ISO 7425, that allow our cylinders to work under the heaviest conditions, such as very low or high speed, high working frequency, mineral or synthetic fluids.
The type of seals to be used in the relevant working conditions are indicated below.

TYPE B standard: (NITRILE+PTFE) anti-friction, not recommended when loads are to be held in position, and recommended at speeds ≤ 4 m/sec., at temperatures ranging between –10 and +75°C, operation with mineral oil or glycol water.

TYPE C: (VITON+PTFE) anti-friction, for high-temperature fluids, up to+135°C, maximum speed 4m/sec. Can be used also with phosphoric esters.

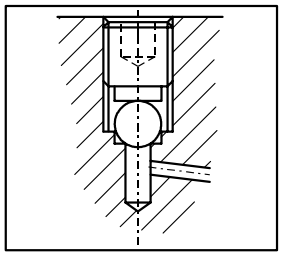
1.11 OIL PORTS

Oil ports are BSP threaded, with boring conforming to DIN 3852/2, standard position 1 in figure A; other alternative positions can be provided on demand.
Optional presetting for mounting SAE 6000 flanges (contact our Technical Department).
In order to reduce as much as possible any turbulence and water hammer in the cylinder's connecting pipes, we recommend that you ensure that the oil speed does not exceed 6 m/sec. The maximum flow rates that can be obtained with these criteria are shown in the table below.

OIL PORT Ø	1/2"	3/4"	1"	1 1/4"	1 1/2"
MAX. FLOW RATE (l./min.)	40	53	85	136	212

1.12 AIR VENTS

Air vents are provided on demand on both ends of the cylinder. Vents are mounted inside the head and the bottom, so as to be protected from any accidental removal, as shown in the figure on the right.
Standard position: 2 in figure A; other alternative positions can be provided on demand.

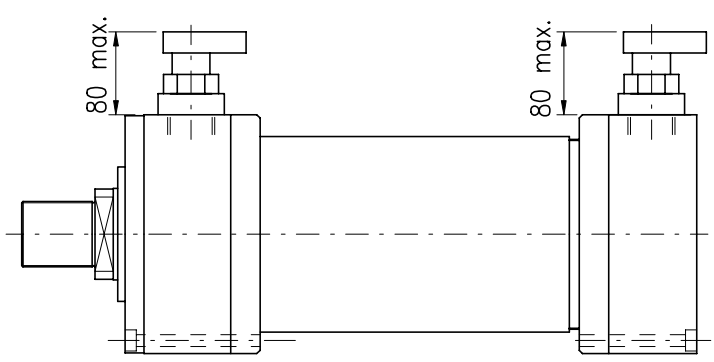


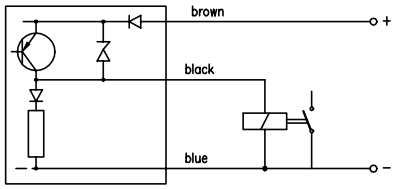
1.13 DRAINAGE

The drainage on the rod seal ensures better sealing at high speed, in particular in cylinders with strokes > 2000mm or in applications where the chamber, rod side, is constantly under pressure.
The drainage port (1/8") is usually positioned on the same axis of the supply port and must be directly connected to the tank.

1.14 PROXIMITY SENSORS

When the piston position is to be detected in any hydraulic system, proximity sensors can be directly mounted in the cylinder heads. The mounting temperature is –25 to +80°C. Permissible dynamic pressure 350 bar. The sensor is provided with a built-in amplifier, with direct supply (10 to 30Vdc), analog output PNP NA for 200mA max., supplied complete with connector with cable (approx. 4m long).
Sensors can be mounted on head and bottom, usually arranged in position 4, figure A; other alternative positions can be provided on demand. They make it possible to obtain an electric signal near the end of stroke positioning of the piston.





Technical data of the sensor:

Working temperature	–25 +80 °C
Supply voltage	10–30 V cc
Load	200 mA
Execution	PNP
Output type	NA

2.1 PEAK LOAD

When the cylinder is working under compression, check the peak load. Table **1** shows the most common types of restriction. Each of them is associated to a coefficient **K**. The maximum stroke of cylinder L multiplied by coefficient K produces the L_v value (virtual length, $L_v = L*K$). The graph **2** indicates the rod's minimum diameter, based on load. The point of intersection between L_v in mm. and pushing force F in KN must be below the characteristic curve of the rod to be checked.
Example:
cylinder CA63/45/750/FA/00B (front flange), that exerts a 40 KN pressure. Table **1** shows coefficient K, determined by the type of restriction **K = 2**, the virtual length is $L_v = L*K$ $L_v = 750*2 = 1500$ mm
In graph **2** you can check whether the point of intersection between L_v and **F** is below the curve of rod Ø 45. Since the stability condition has been met, adopt the differential rod Ø 45. If the result of this check is negative (point of intersection between L_v and **F** above the curve), choose a cylinder with a wider rod.

Graph 2

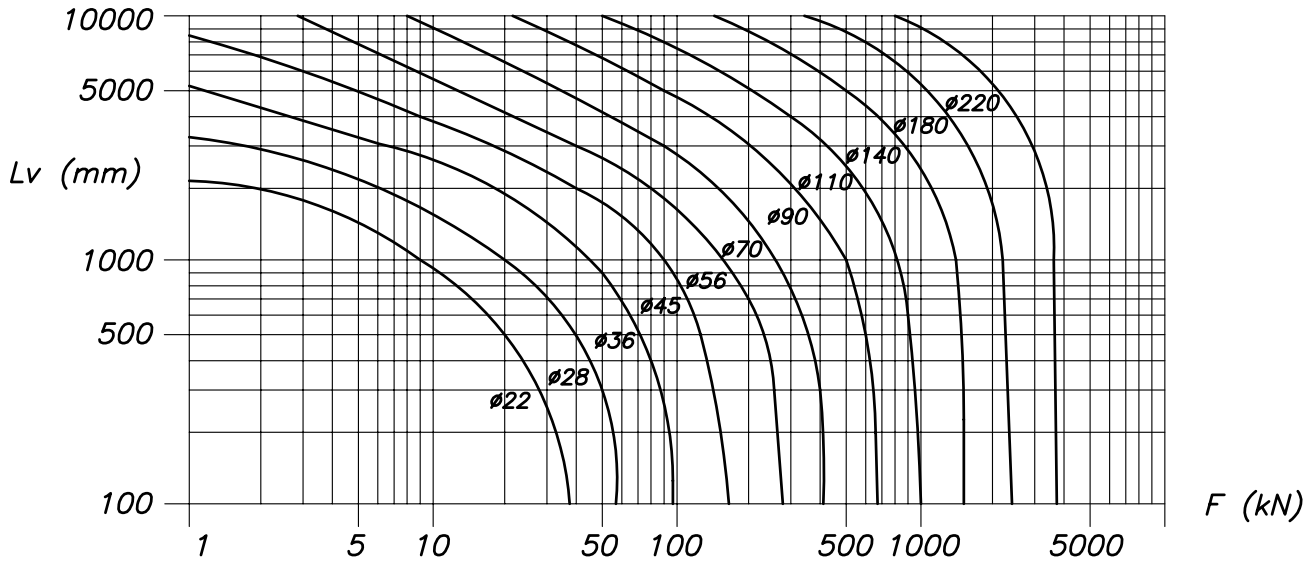
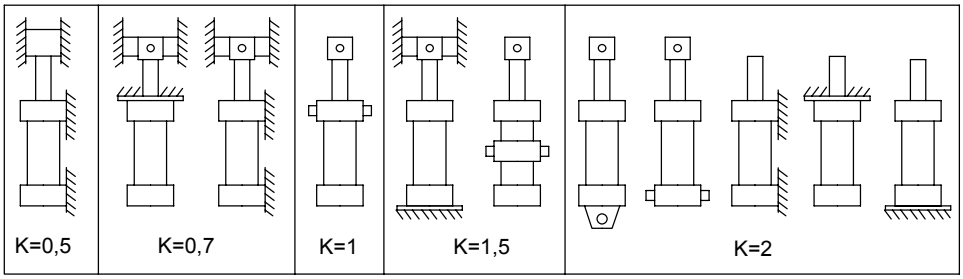
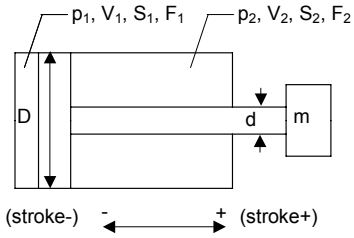


Table 1





2.2 PRACTICAL UNIT OF MEASUREMENT FOR FORCE AND SPEED CALCULATION

DESCRIPTION	SYMBOL	UNIT OF MEASURE.
Section	S	cm^2
Pressure	p	bar
Piston Ø	D	mm
Rod Ø	d	mm
Speed	V	m/s
Capacity	Q	l/min
Load	m	kg

PUSHING FORCE (**STROKE +**)

$F_1=(p_1 \bullet S_1)$ (Kg)

PULLING FORCE (**STROKE -**)

$F_2=(p_2 \bullet S_2)$ (Kg)

PUSHING SPEED (**STROKE +**)

$V_1=Q/(6 \bullet S_1)$ (m/s)

PULLING SPEED (**STROKE -**)

$V_2=Q/(6 \bullet S_2)$ (m/s)

$$S_1 = \frac{\pi \bullet D^2}{4 \bullet 100} \text{ (cm}^2\text{)} \qquad S_2 = \frac{\pi \bullet (D^2 - d^2)}{4 \bullet 100} \text{ (cm}^2\text{)}$$

EXAMPLE: DETERMINING THE ACRONYM FOR THE ORDER

CHARACTERISTIC	DESCRIPTION	SYM.
SERIES	execution ISO 6020/1	CA
BORE	indicate mm	
ROD	indicate mm	
STROKE	indicate mm	
EXECUTION	rectangular front flange	QA
	rectangular rear flange	QP
	front flange	FA
	rear flange	FP
	male hinge	CM
	joint hinge	CS
	intermediate trunnion	OI
	feet	PI
BRAKING	without braking	0
	front braking	1
	rear braking	2
	front + rear braking	3
SPACER	without spacer	0
	50mm	1
	100mm	2
	150mm	3
	200mm	4
SEALS	**nitrile + PTFE (anti-friction, standard)**	B
	viton + PTFE (high temperatures)	C
OPTIONS*		
ROD ENDS	type D	D
	type F	F
AIR VENTS	front	G
	rear	H
	front+rear	I
DRAINAGE	rod side	W
ROD TREATMENT	heavy chromium-plated, 0.045mm thick, 100h salt mist ISO 3768	P
	hardening and chromium-plating	T
	Ni-CROMAX30 chromium-plated, nickel-plated, ASTM B 117 1000h	N
PROXIMITY SENSORS	front	X1
	rear	X2
	front + rear	X3

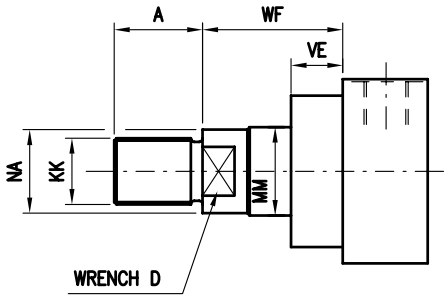
EXAMPLE

CA/50/36/100/FA/10 B....

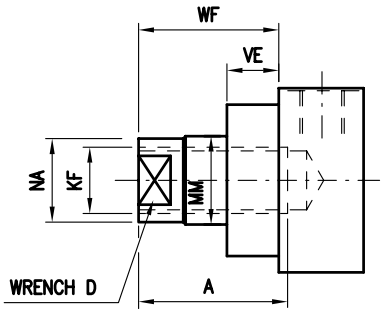
* to be reported in alphabetic

DIMENSIONS OF THE ROD ENDS

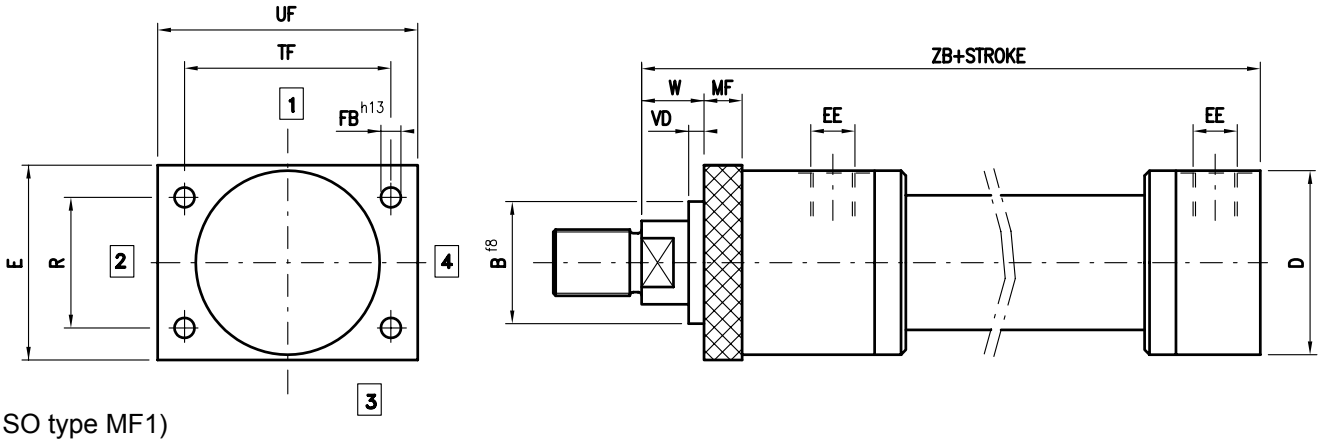
Rod end, type M and D



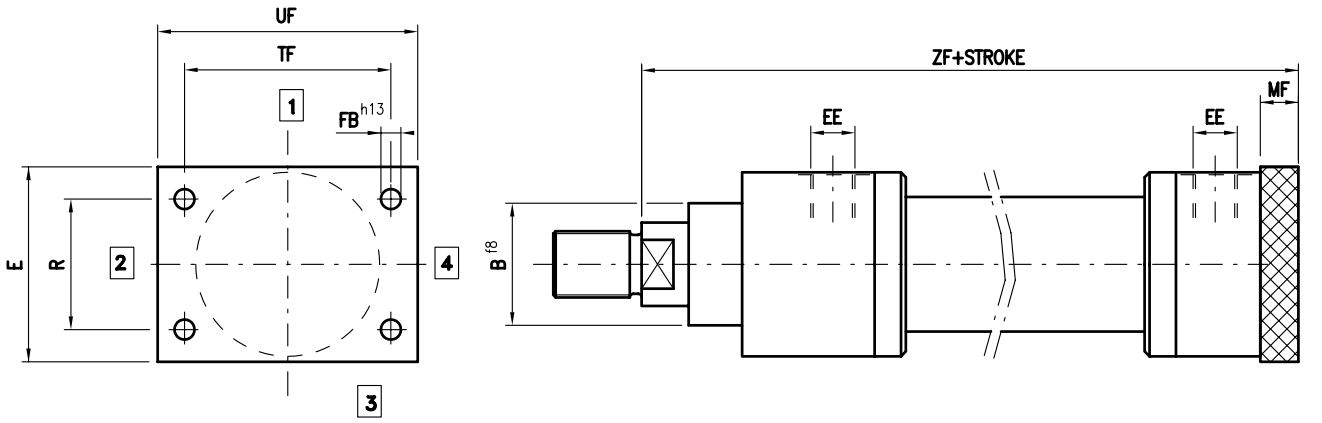
Rod end, type F



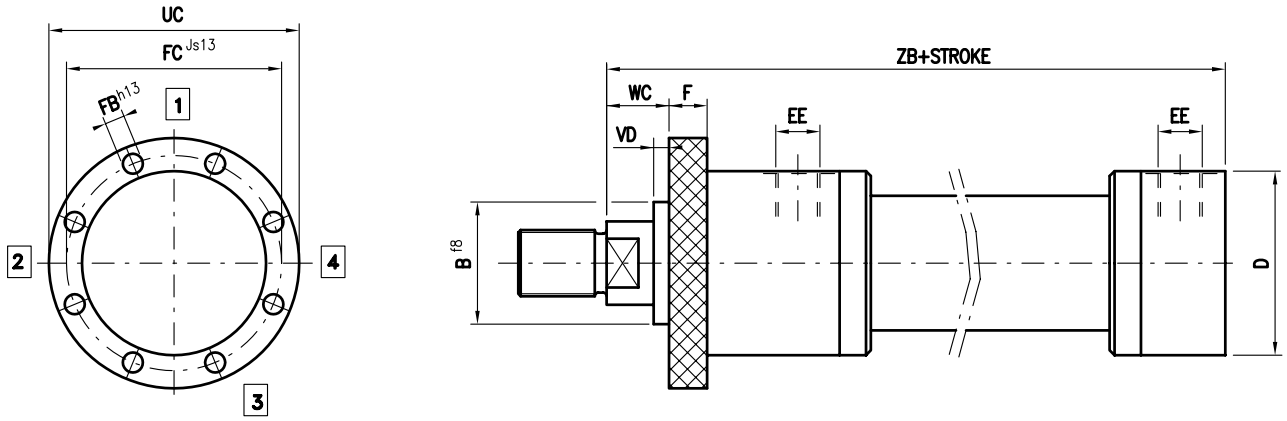
BORE	N° rod	MM rod	Type M ISO 6020/1 KK	Type M ISO 6020/1 A	Type D KK	Type D A	Type F KF	Type F A	D	NA	WF	VE
40	1	22	M16x1,5	22	-	-	M16x1,5	22	18	21	32	19
	2	28	M20x1,5	28	M16x1,5	22	M20x1,5	28	22	26	32	19
50	1	28	M20x1,5	28	-	-	M20x1,5	28	22	26	38	24
	2	36	M27x2	36	M20x1,5	28	M27x2	36	30	34	38	24
63	1	36	M27x2	36	-	-	M27x2	36	30	34	45	29
	2	45	M33x2	45	M27x2	36	M33x2	45	39	43	45	29
80	1	45	M33x2	45	-	-	M33x2	45	39	43	54	36
	2	56	M42x2	56	M33x2	45	M42x2	56	48	54	54	36
100	1	56	M42x2	56	-	-	M42x2	56	48	54	57	37
	2	70	M48x2	63	M42x2	56	M48x2	63	62	68	57	37
125	1	70	M48x2	63	-	-	M48x2	63	62	68	60	37
	2	90	M64x3	85	M48x2	63	M64x3	85	80	88	60	37
160	1	90	M64x3	85	-	-	M64x3	85	80	88	66	41
	2	110	M80x3	95	M64x3	85	M80x3	95	100	108	66	41
200	1	110	M80x3	95	-	-	M80x3	95	100	108	75	45
	2	140	M100x3	112	M80x3	95	M100x3	112	128	138	75	45
250	1	140	M100x3	112	-	-	M100x3	112	128	138	96	64
	2	180	M125x4	125	M100x3	112	M125x4	125	-	175	96	64
320	1	180	M125x4	125	-	-	M125x4	125	-	175	108	71
	2	220	M160x4	160	M125x4	125	M160x4	160	-	214	108	71



QA: (ISO type MF1)

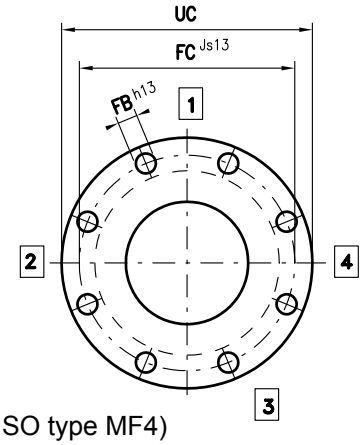


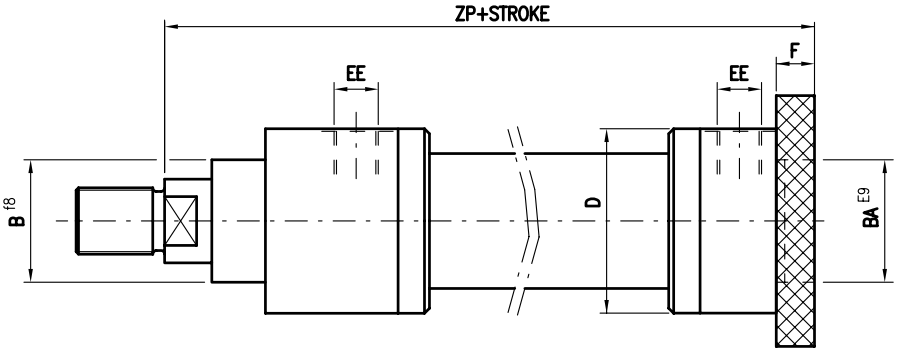
QP: (ISO type MF2)



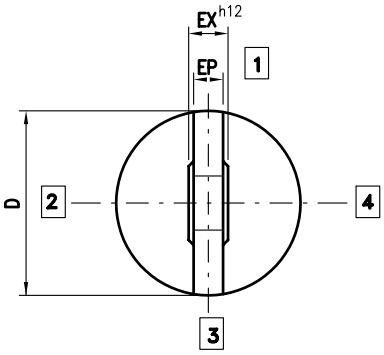
FA: (ISO type MF3)

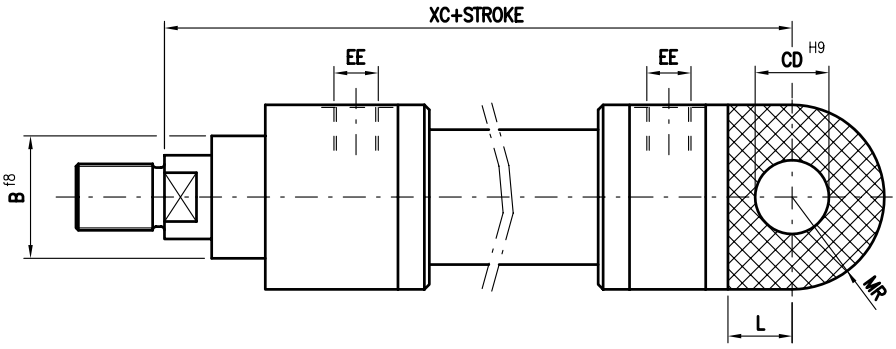
Bore	B	D	E	EE	F	FB	FC	MF	R	TF	UC	UF	VD	W	WC	ZB	ZF
40	50	78	80	1/2"	16	9	106	16	40,6	98	125	115	3	16	16	198	206
50	60	95	100	1/2"	20	11	126	20	48,2	116,4	148	140	4	18	18	213	225
63	70	116	120	3/4"	25	13,5	145	25	55,5	134	170	160	4	20	20	236	249
80	85	130	135	3/4"	32	17,5	165	32	63,1	152,5	195	185	4	22	22	262	282
100	106	158	160	1"	32	22	200	32	76,5	184,8	238	225	5	25	25	314	332
125	132	192	195	1"	32	22	235	32	90,2	217,1	272	255	5	28	28	341	357
160	160	232	-	1 1/4"	36	22	280	-	-	-	316	-	5	-	30	386	-
200	200	285	-	1 1/4"	40	26	340	-	-	-	385	-	5	-	35	466	-
250	250	365	-	1 1/2"	56	33	420	-	-	-	500	-	8	-	40	570	-
320	320	450	-	1 1/2"	63	39	520	-	-	-	620	-	8	-	45	684	-



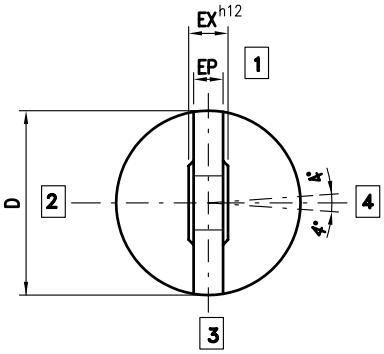


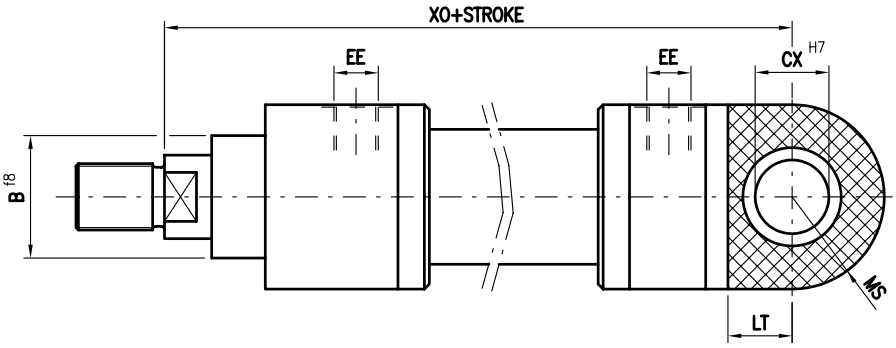
FP: (ISO type MF4)





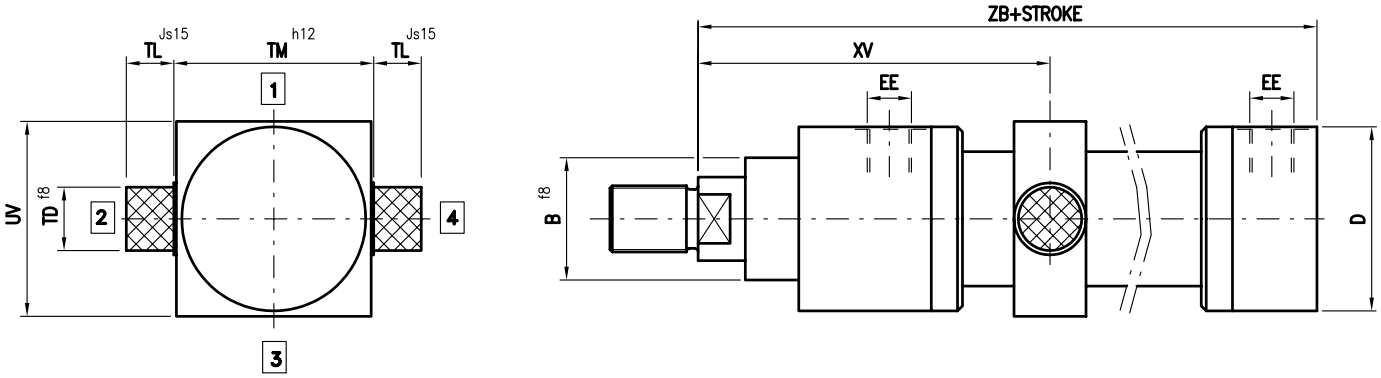
CM: (ISO type MP3)



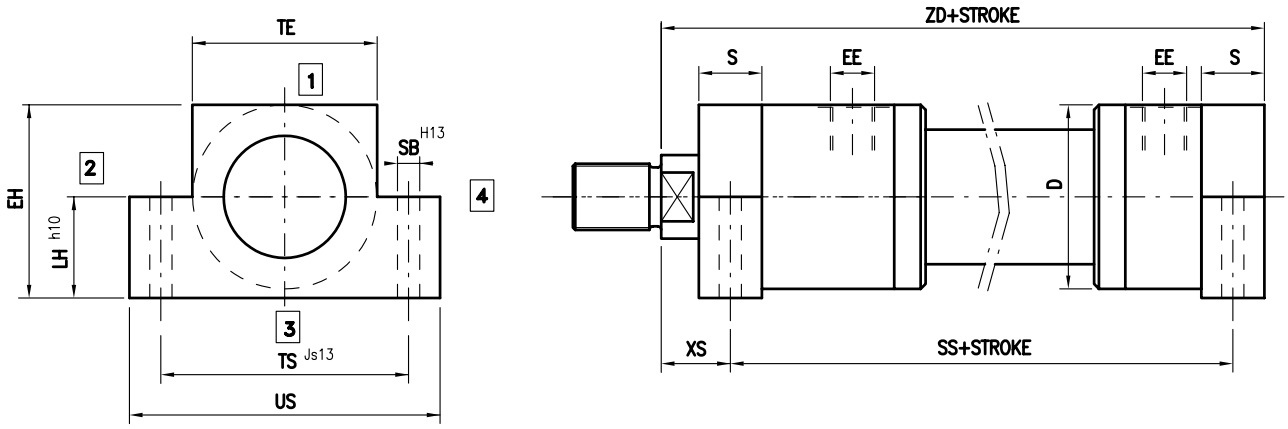


CS: (ISO type MP5)

Bore	B	BA	CD	CX	D	EE	EX	EP	F	FB	FC	L	LT	MS	MR	UC	ZP	XC	XO
40	50	50	20	20	78	1/2"	20	18	16	9	106	41	41	25	25	125	206	231	231
50	60	60	25	25	95	1/2"	25	22	20	11	126	52	52	32	32	148	225	257	257
63	70	70	32	32	116	3/4"	32	27	25	13,5	145	65	65	40	40	170	249	289	289
80	85	85	40	40	130	3/4"	40	35	32	17,5	165	82	82	50	50	195	282	332	332
100	106	106	50	50	158	1"	50	40	32	22	200	95	95	63	63	238	332	395	395
125	132	132	63	63	192	1"	63	52	32	22	235	103	103	71	71	272	357	428	428
160	160	160	80	80	232	1 1/4"	80	66	36	22	280	135	135	90	90	316	406	505	505
200	200	200	100	100	285	1 1/4"	100	84	40	26	340	165	165	112	112	385	490	615	615
250	250	250	125	125	365	1 1/2"	125	102	56	33	420	223	223	160	160	500	606	773	773
320	320	320	160	160	450	1 1/2"	160	130	63	39	520	270	270	200	200	620	723	930	930



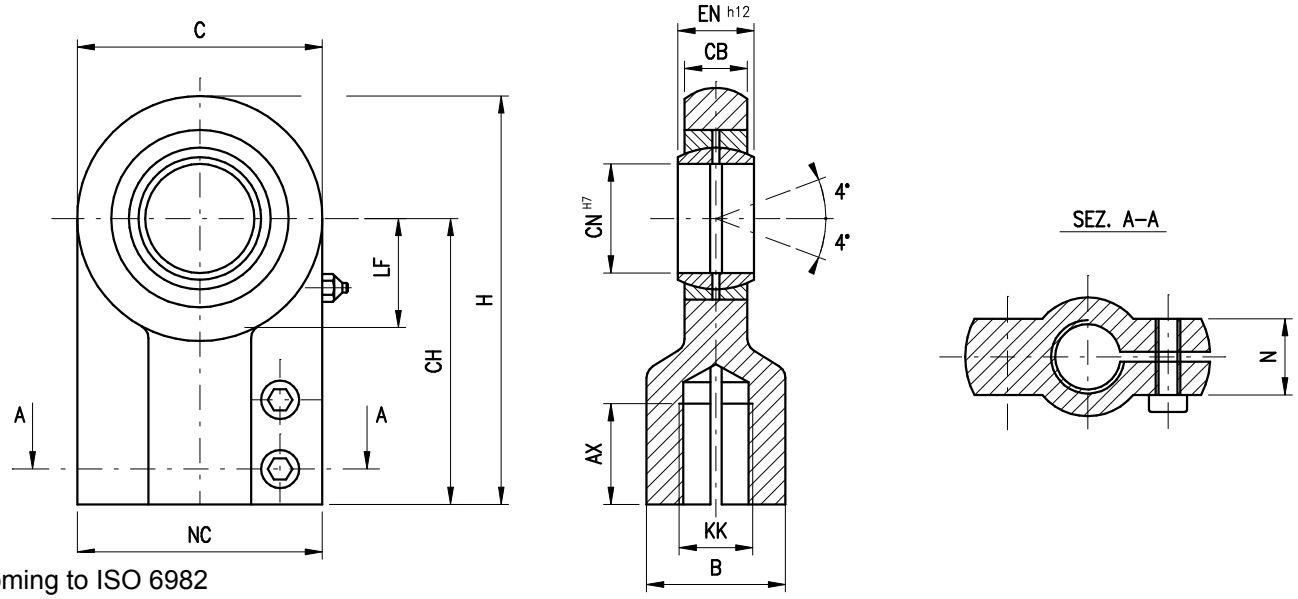
OI: (ISO type MT4)



PI: (ISO type MS2)

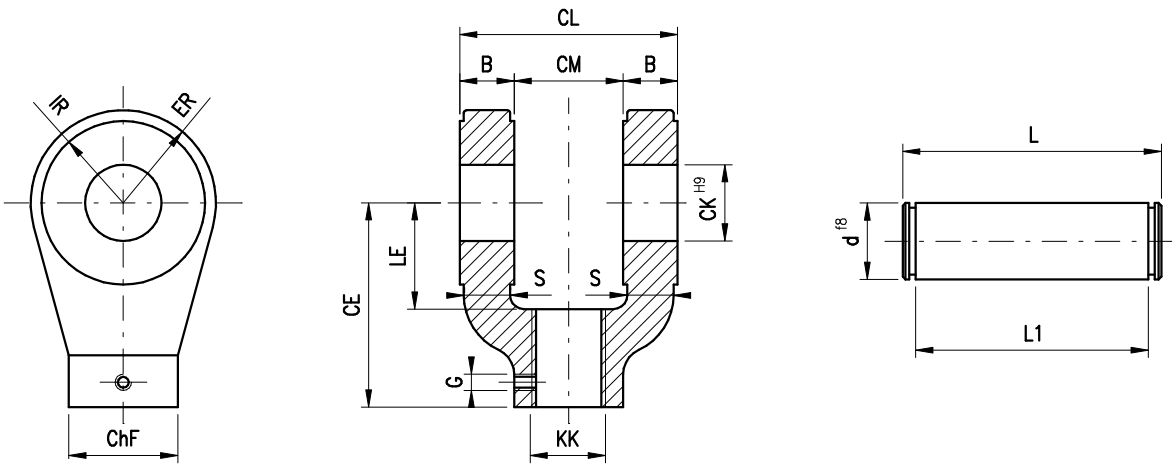
Bore	B	D	EE	EH	LH	S	SB	SS	TD	TE	TL	TM	TS	UV	ZB	ZD	XS	XV_{min}	XV_{max}
40	50	78	1/2"	82	43	25	11	183	20	78	16	90	100	78	198	215	19,5	130	93+STROKE
50	60	95	1/2"	100	52	32	14	199	25	95	20	105	120	95	213	237	22	142	102+STROKE
63	70	116	3/4"	120	62	32	18	211	32	116	25	120	150	116	236	256	29	160	107+STROKE
80	85	130	3/4"	135	70	40	22	236	40	130	32	135	170	130	262	290	34	180	122+STROKE
100	106	158	1"	161	82	50	26	293	50	158	40	160	205	158	314	350	32	210	152+STROKE
125	132	192	1"	196	100	56	33	321	63	192	50	195	245	195	341	381	32	235	157+STROKE
160	160	232	1 1/4"	238	119	60	33	364	80	238	63	240	295	240	386	430	36	273	177+STROKE
200	200	285	1 1/4"	288	145	72	39	447	100	285	80	295	350	390	466	522	39	337	267+STROKE
250	250	365	1 1/2"	-	-	-	-	-	125	-	100	370	-	480	570	-	-	393	298+STROKE
320	320	450	1 1/2"	-	-	-	-	-	160	-	125	470	-	600	684	-	-	486	370+STROKE

ACCESSORIES



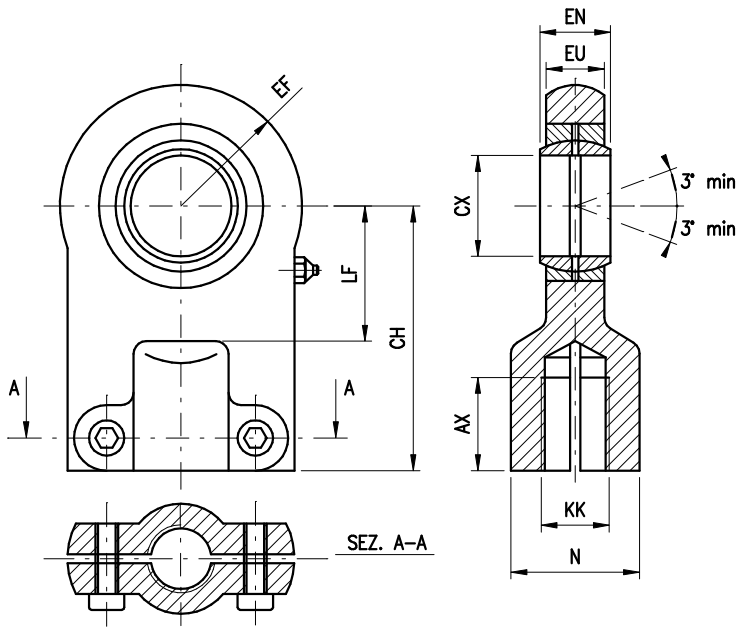
AS confoming to ISO 6982

Code	Ø$_{rod}$	KK	B	AX$_{min}$	C	CB	CH	CN	H	LF	N	NC	EN	Tight. screw	Torque (Nm)	Mass (kg)	Force (kN)
AS14	14	M12x1,25	16	17	32	10,5	38	12	54	14	10.6	32	12	M5x12	6	0,12	8
AS18	18	M14X1,5	21	19	40	13	44	16	64	18	13	40	16	M6x14	10	0,23	12,5
AS22	22	M16x1,5	25	23	47	17	52	20	77	22	17	47	20	M8x18	25	0,42	20
AS28	28	M20x1,5	30	29	58	21	65	25	96	27	17	54	25	M8x18	25	0,68	32
AS36	36	M27x2	38	37	70	27	80	32	118	32	22	66	32	M10x22	49	1,14	50
AS45	45	M33x2	47	46	89	32	97	40	146	41	26	80	40	M10x25	49	2,08	80
AS56	56	M42x2	58	57	108	40	120	50	179	50	32	96	50	M12x35	86	4,47	125
AS70	70	M48x2	70	64	132	52	140	63	211	62	38	114	63	M16x40	210	7,65	200
AS90	90	M64x3	90	86	168	66	180	80	270	78	48	148	80	M20x50	410	14,55	320
AS110	110	M80x3	110	96	210	84	210	100	322	98	62	178	100	M24x65	710	28,2	500
AS140	140	M100x3	135	113	264	103	260	125	405	120	72	200	125	M24x75	710	43,5	780



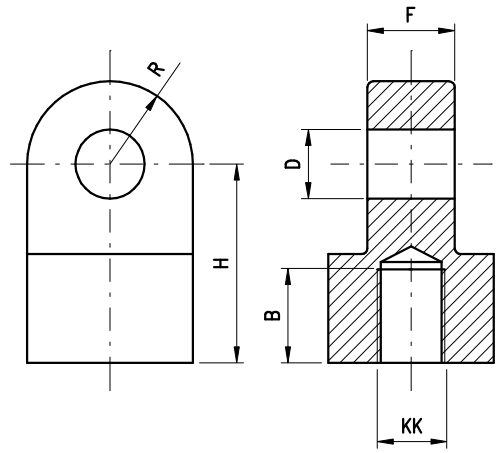
FI conforming to ISO 8133

Code	CM	KK	CK	CE	CL	ChF	LE	ER	B	IR	L	L$_1$	S	G	d
FI12	12	M10x1,25	10	32	24	19	13	12	6	10	34	29	5	M5x5	10
FI14	16	M12x1,25	12	36	32	21	19	17	8	15	43	37	7	M5x5	12
FI18	20	M14x1,5	14	38	40	21	19	17	10	15	51	45	8	M5x5	14
FI22	30	M16x1,5	20	54	60	32	32	29	15	26	73	66	13	M6x6	20
FI28	30	M20x1,5	20	60	60	32	32	29	15	26	73	66	13	M6x6	20
FI36	40	M27x2	28	75	80	40	39	34	20	30	95	87	17	M6x6	28
FI45	50	M33x2	36	99	100	56	54	50	25	46	117	107	22	M8x8	36
FI56	60	M42x2	45	113	120	56	57	53	30	49	139	129	27	M8x8	45
FI70	70	M48x2	56	126	140	75	63	59	35	38	161	149	31	M8x8	56
FI90	80	M64x3	70	168	160	95	83	78	40	45	181	169	37	M12x12	70
FI110	80	M80x3	70	168	160	95	83	78	40	74	181	169	37	M12x12	70



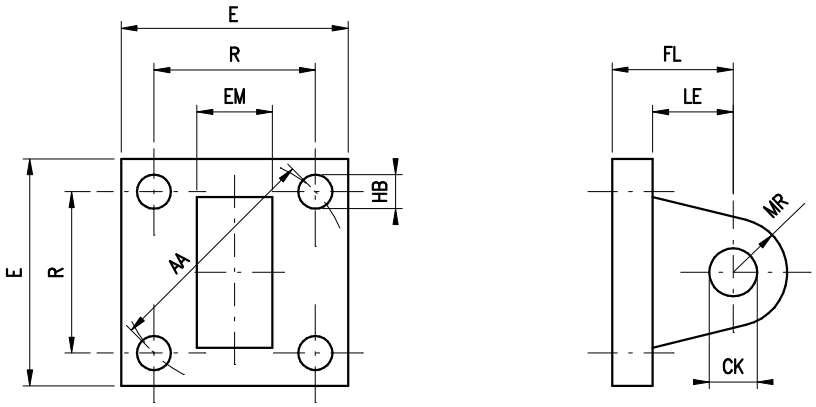
OS conforming to ISO 8133 DIN 24555

Code	Ø Rod	KK	CX	tol mm	EN	tol mm	EF max	CH js 13	AX min	LF min	EU h13	N max	Mass kg	F kN
OS12	12	M10x1,25	12	0 -0,008	10	0 -0,12	20	42	15	16	8	17	0,12	8
OS14	14	M12x1,25	16		14		22,5	48	17	20	11	21	0,215	12,5
OS18	18	M14x1,5	20	0 -0,012	16		27,5	58	19	25	13	25	0,38	20
OS22	22	M16x1,5	25		20		32,5	68	23	30	17	30	0,66	32
OS28	28	M20x1,5	30		22		40	85	29	35	19	36	1,16	50
OS36	36	M27x2	40		28		50	105	37	45	23	45	2,1	80
OS45	45	M33x2	50		35		62,5	130	46	58	30	55	3,85	125
OS56	56	M42x2	60	0 -0,015	44	0 -0,15	80	150	57	68	38	68	8,05	200
OS70	70	M48x2	80		55		103	185	64	92	47	90	19	320
OS90	90	M64x3	100	0 -0,02	70	0 -0,2	120	240	86	116	57	110	28	500



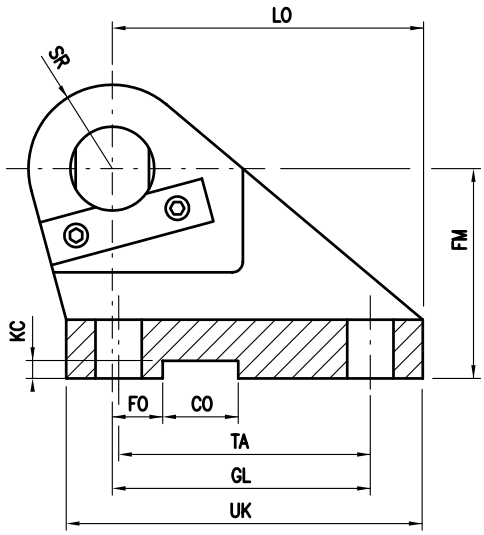
OF

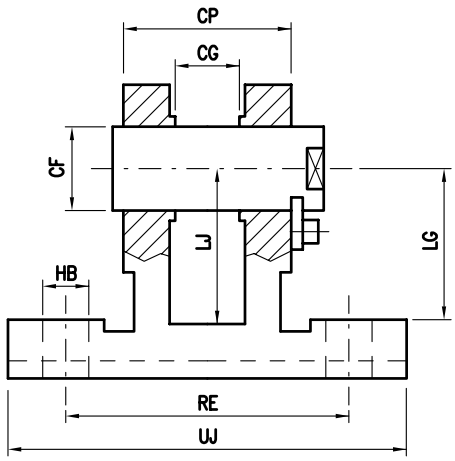
Code	Ø Rod	KK	B	H	D	F	R
OF22	22	M16x1,5	24	38	15	25	16,5
OF28	28	M20x1,5	30	50	20	30	20
OF36	36	M27x2	37	62	25	36	24,5
OF45	45	M33x2	46	76	30	42	31,5
OF56	56	M42x2	59	101	40	56	42



AM conforming to ISO 8133

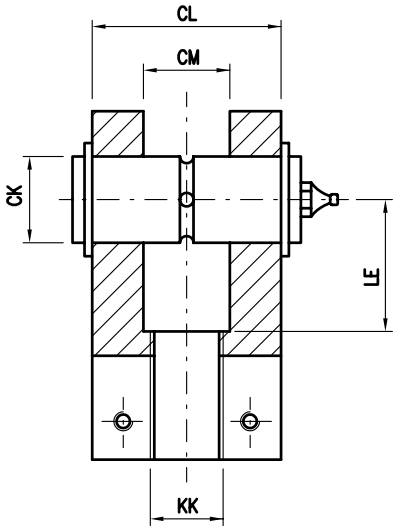
Code	Ø Piston	CK H8	EM h13	FL JS14	MR max	LE min	AA	HB H13	R JS14	E	Mass kg	Nominal force N
AM25	25	10	12	23	12	13	40	5,5	28,3	40	0,3	8000
AM32	32	12	16	29	17	19	47	6,6	33,2	45	0,45	12500
AM40	40	14	20	29	17	19	59	9	41,7	60	0,9	20000
AM50	50	20	30	48	29	32	74	13,5	52,3	75	1,3	32000
AM63	63	20	30	48	29	32	91	13,5	64,3	90	1,9	50000
AM80	80	28	40	59	34	39	117	17,5	82,7	115	4	80000
AM100	100	36	50	79	50	54	137	17,5	96,9	126	6,25	125000
AM125	125	45	60	87	53	57	178	26	125,9	165	11,4	200000
AM160	160	56	70	103	59	63	219	30	154,9	205	20,8	320000
AM200	200	70	80	132	78	82	269	33	190,2	245	38,8	500000

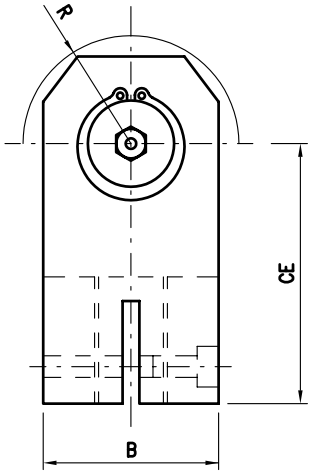




AP conforming to DIN24-556

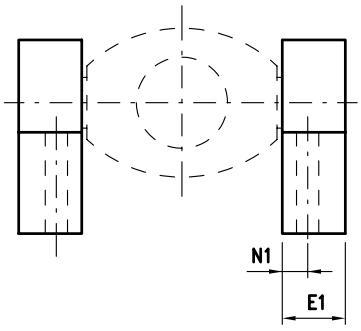
Code	Ø Bore	CP	CG	FM	CF (K7)	LJ	LG	LO	SR	UJ	UK	GL	TA	RE	FO	CO	KC	HB	Mass kg	Force KN
AP25	25	30	10	40	12	29	28	56	12	75	60	46	40	55	16	10	3,3	9	0,52	8
AP32	32	40	14	50	16	38	37	74	16	95	80	61	55	70	18	16	4,3	11	1,05	12,5
AP40	40	50	16	55	20	40	39	80	20	120	90	64	58	85	20	16	4,3	13,5	1,72	20
AP50	50	60	20	65	25	49	48	98	25	140	110	78	70	100	22	25	5,4	15,5	2,72	32
AP63	63	70	22	85	30	63	62	120	30	160	135	97	90	115	24	25	5,4	17,5	5,15	50
AP80	80	80	28	100	40	73	72	148	40	190	170	123	120	135	24	36	8,4	22	9,3	80
AP100	100	100	35	125	50	92	90	190	50	240	215	155	145	170	35	36	8,4	30	18,3	125
AP125	125	120	44	150	60	110	108	225	60	270	260	187	185	200	35	50	11,4	39	35	200
AP160	160	160	55	190	80	142	140	295	80	320	340	255	260	240	35	50	11,4	45	63	320
AP200	200	200	70	210	100	152	150	335	100	400	400	285	300	300	35	63	12,4	48	109	500

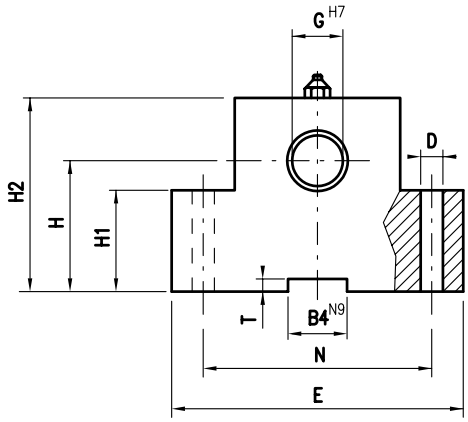




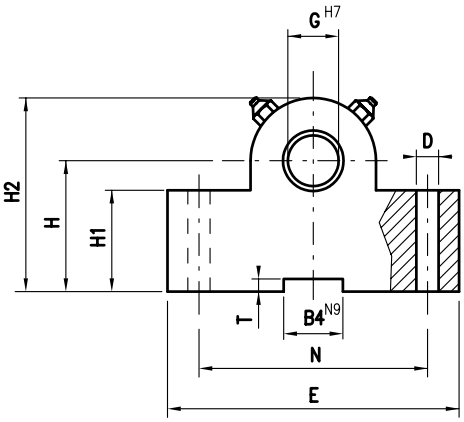
AF conforming to ISO 8132

Code	Ø Rod	CK (H9)	CL	CM	CE	LE min.	KK	B	R max.	Mass kg	Force KN
AF12	12	10	24	10	37	18	M10x1,25	20	11	0,1	5
AF14	14	12	28	12	38	18	M12x1,25	25	16	0,16	8
AF18	18	16	36	16	44	22	M14x1,5	30	20	0,27	12,5
AF22	22	20	45	20	52	27	M16x1,5	40	25	0,53	20
AF28	28	25	56	25	65	34	M20x1,5	50	32	1,12	32
AF36	36	32	70	32	80	42	M27x2	65	40	2,18	50
AF45	45	40	90	40	97	52	M33x2	80	50	4,4	80
AF56	56	50	110	50	120	64	M42x2	100	63	7,6	125
AF70	70	63	140	63	140	75	M48x2	120	71	17,7	200
AF90	90	80	170	80	180	94	M64x3	150	90	30,6	320





OISH25-40



OISH50-160

*CODE	H	H1	H2	G	E	E1	N	D	N1	B4	T	F (KN)	Mass(KG)
OISH25	34	25	49	12	63	17	40	9	8	10	3,3	8	0,46
OISH32	40	30	59	16	80	21	50	11	10	16	4,3	12,5	0,83
OISH40	45	38	69	20	90	21	60	11	10	16	4,3	20	1,21
OISH50	55	45	80	25	110	26	80	13,5	12	25	5,4	32	2,15
OISH63	65	52	100	32	150	33	110	17,5	15	25	5,4	50	4,63
OISH80	76	60	120	40	170	41	125	22	16	36	8,4	80	7,78
OISH100	95	75	140	50	210	51	160	26	20	36	8,4	125	14,3
OISH125	112	85	177	63	265	61	200	33	25	50	11,4	200	23,4
OISH160	140	112	220	80	325	81	250	39	31	50	11,4	320	53,1

*Coupled provided

CYLINDERS SERIES *MXO*

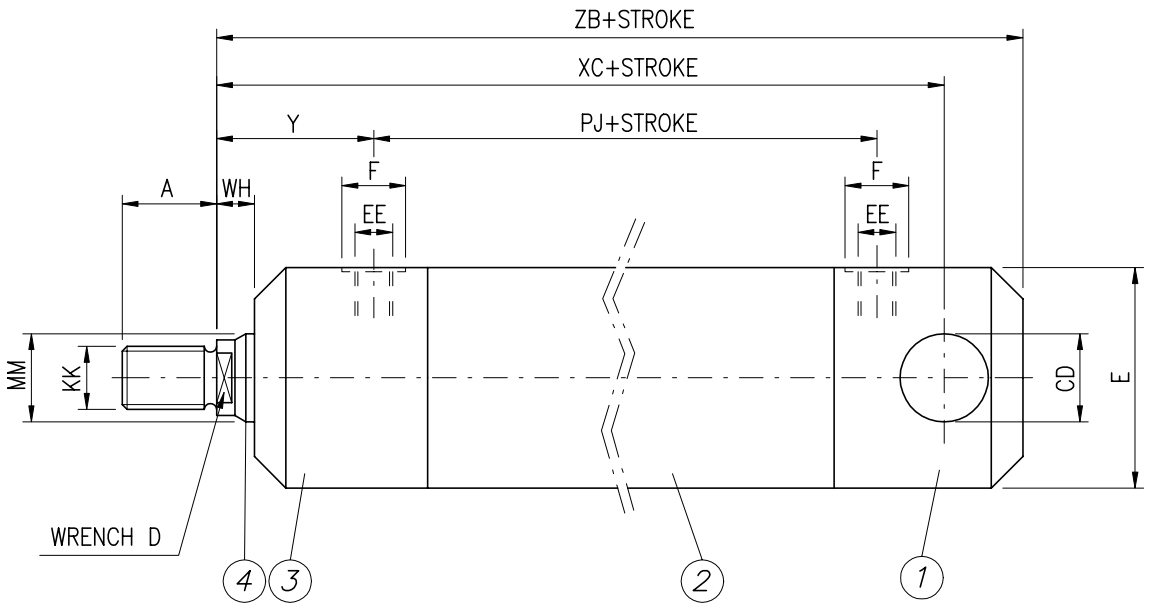
TECHNICAL CHARACTERISTICS

Working pressure 12 Mpa (120 bar)
Maximum pressure 16 Mpa (160 bar)
Working temperature –10 to 75°C
Stroke tolerance 0 to 1.2mm for strokes up to 1000mm, 0 to 2.5mm for longer strokes
2 bores
seal

The seals (ELASTOMER + NITRILE) ensure unparalleled sealing, even at low pressure, and make it possible to hold a load in position; to be used at speeds <0.5m/sec. and temperatures ranging between –10 and +75°C.

MATERIALS

POS	ITEM	MATERIAL
1	Rear head	Chromium-plated brass
2	Pipe	AISI 316 stainless steel
3	Front head	Chromium-plated brass
4	Rod	Ground AISI 316 stainless steel



ACRONYM	Bore	MM	A	CD	D	E	F	EE	KK	PJ	WH	XC	Y	ZB
MXO	**40**	28	28	20	22	60	22	1/4"	M20x1,5	119	12	194	53	214
MXO	**50**	28	28	20	22	70	22	1/4"	M20x1,5	124	12	199	53	219

ACRONYM FOR THE ORDER

Every order shall mention the acronym, followed by the stroke length in mm.

CYLINDERS SERIES *MXP*

TECHNICAL CHARACTERISTICS

Pressures:

Side H Working pressure 12 Mpa (120 bar) (STROKE+)
Maximum pressure 15 Mpa (150 bar)

Side L Working pressure 10 Mpa (100 bar) (STROKE-)
Maximum pressure 12 Mpa (120 bar)

Working temperature –10 to 75°C

Stroke tolerance 0 to 1.2mm for strokes up to 1000mm, 0 to 2.5mm for longer strokes

2 bores

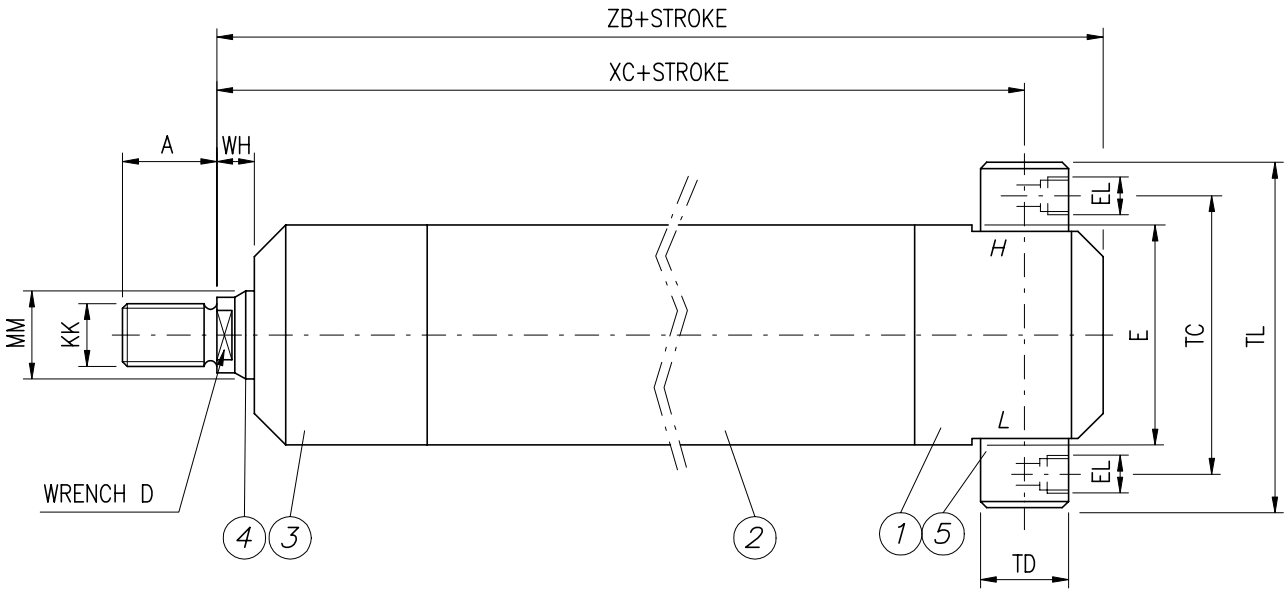
The seals (ELASTOMER + NITRILE) ensure unparalleled sealing, even at low pressure, and make it possible to hold a load in position; to be used at speeds <0.5m/sec. and temperatures ranging between –10 and +75°C.

ACCESSORIES

STP fasteners

MATERIALS

POS	ITEM	MATERIAL
1	Rear head	Chromium-plated brass 58
2	Pipe	AISI 316 stainless steel
3	Front head	Chromium-plated brass 58
4	Rod	Ground AISI 316 stainless steel
5	Pin	Ground AISI 316 stainless steel



ACRONYM	Bore	MM	A	D	E	EL	KK	TC	TD	TL	WH	XC	ZB
MXP	**40**	28	28	22	60	1/8"	M20x1,5	87	28	117	12	216	240
MXP	**50**	28	28	22	70	1/8"	M20x1,5	98	28	128	12	221	245

ACRONYM FOR THE ORDER

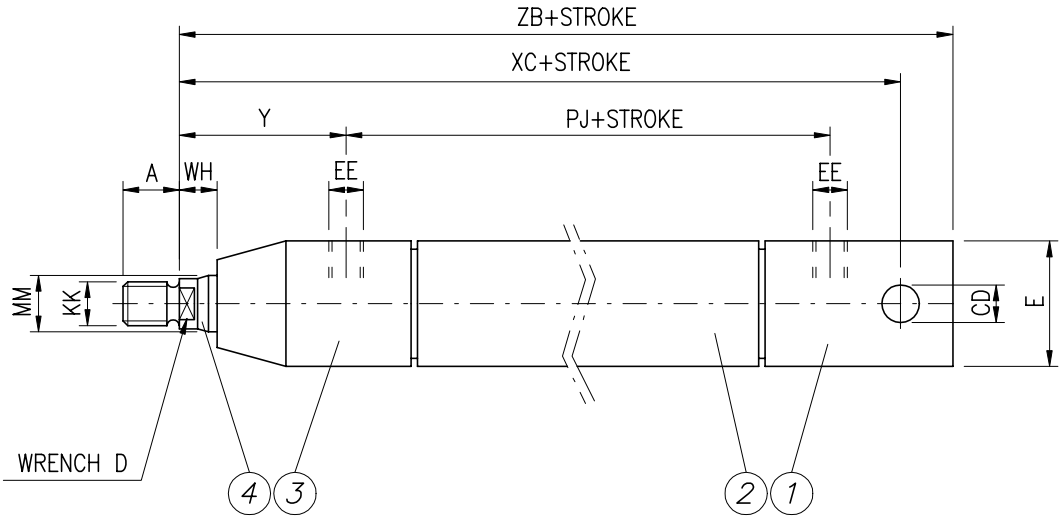
Every order shall mention the acronym, followed by the stroke length in mm.

TECHNICAL CHARACTERISTICS

Working pressure 8 Mpa (80 bar)
Maximum pressure 12 Mpa (120 bar)
Working temperature –10 to 75°C
Stroke tolerance 0 to 1.2mm for strokes up to 1000mm, 0 to 2.5mm for longer strokes
The seals (ELASTOMER + NITRILE) ensure unparalleled sealing, even at low pressure, and make it possible to hold a load in position; to be used at speeds < 0.5m/sec. and temperatures ranging between –10 and +75°C.

MATERIALS

POS	ITEM	MATERIAL
1	Rear head	Brass
2	Pipe	Brass
3	Front head	Brass
4	Rod	Ground AISI 316 stainless steel



ACRONYM	Bore	A	CD	D	E	EE	KK	MM	PJ	WH	XC	Y	ZB
COA	**30**	18	12	15	40	1/8"	M14x1,5	18	69	12	119	48	136
COA	**40**	22	14	17	55	1/4"	M16x1,5	22	59	12	106	45	123

ACRONYM FOR THE ORDER

Every order shall mention the acronym, followed by the stroke length in mm.

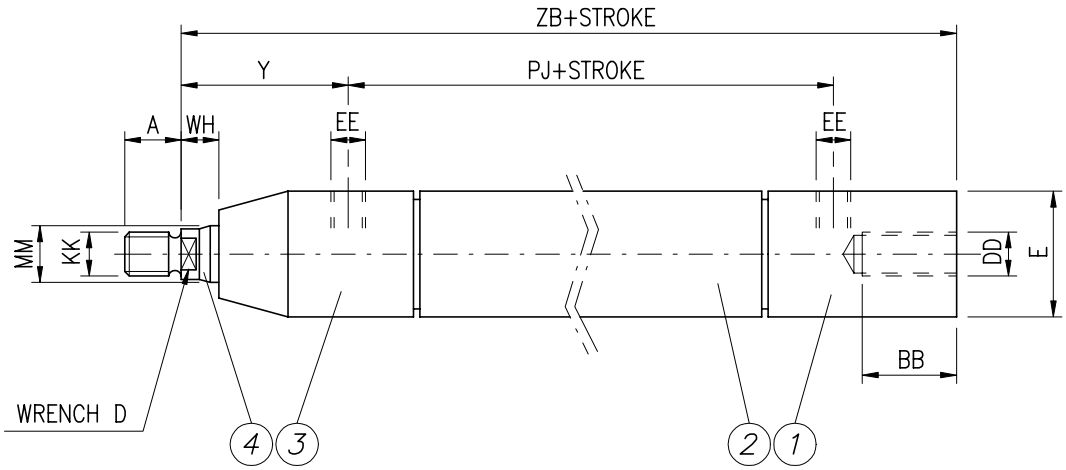
CYLINDERS SERIES COB

TECHNICAL CHARACTERISTICS

Working pressure 8 Mpa (80 bar)
Maximum pressure 12 Mpa (120 bar)
Working temperature –10 to 75°C
Stroke tolerance 0 to 1.2mm for strokes up to 1000mm, 0 to 2.5mm for longer strokes
The seals (ELASTOMER + NITRILE) ensure unparalleled sealing, even at low pressure, and make it possible to hold a load in position; to be used at speeds < 0.5m/sec. and temperatures ranging between –10 and +75°C.

MATERIALS

POS	ITEM	MATERIAL
1	Rear head	Brass
2	Pipe	Brass
3	Front head	Brass
4	Rod	Ground AISI 316 stainless steel



ACRONYM	Bore	A	BB	D	DD	E	EE	KK	MM	PJ	WH	Y	ZB
COB	**30**	18	20	15	M14	40	1/8"	M14x1,5	18	69	12	48	136
COB	**40**	22	20	17	M16	55	1/4"	M16x1,5	22	59	12	45	123

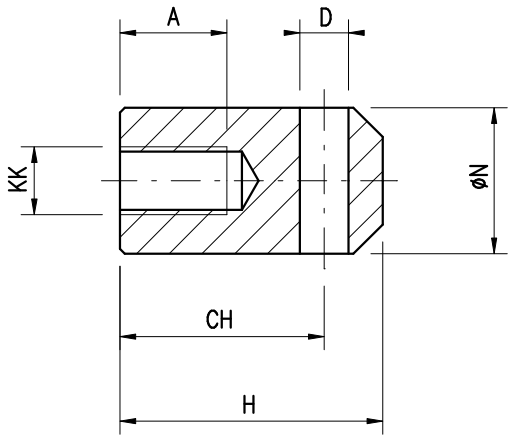
ACRONYM FOR THE ORDER

Every order shall mention the acronym, followed by the stroke length in mm.

MALE COUPLING OF THE ROD

MATERIAL

Chromium-plated brass

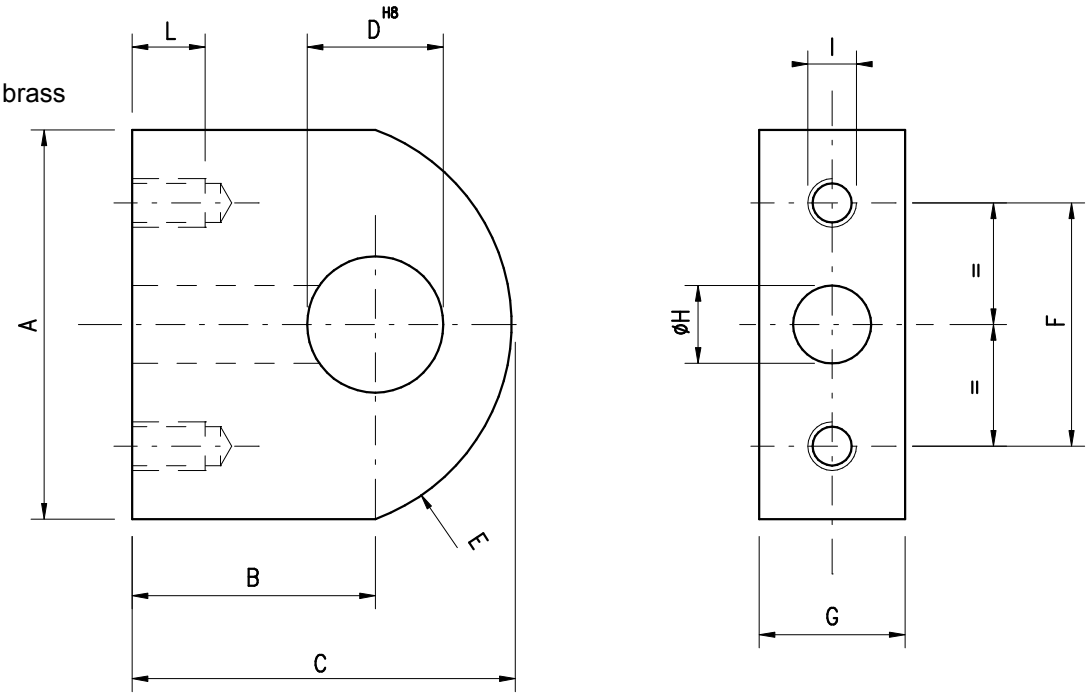


ACRONIM	A	CH	D	H	KK	Ø N
TS18	22	42	12	54	M14x1,5	30
TS22	24	46	14	60	M16x1,5	40
TS28	30	50	20	75	M20x1,5	40

FASTENERS *(To be used only for MXP cylinders)*

MATERIAL

Chromium-plated brass



ACRONYM	A	B	C	Ø D	E	F	G	Ø H	I	L
STP28	70	50	78	28	35	50	30	16	M10	20

Programma di produzione

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- Cilindri a tiranti secondo normative CNOMO
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- Cilindri a semplice effetto e tuffanti
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- Cilindri bilanciamento
- Cilindri sincronizzatori
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- Valvole di riempimento
- Cilindri certificati RINA

Production program

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- *Telescopic single and double effect cylinders*
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- *Custom designed cylinders to customer specifications or co-designed*
- *Turning cylinders*
- *Input valve*
- *Hydraulic cylinders RINA certified*