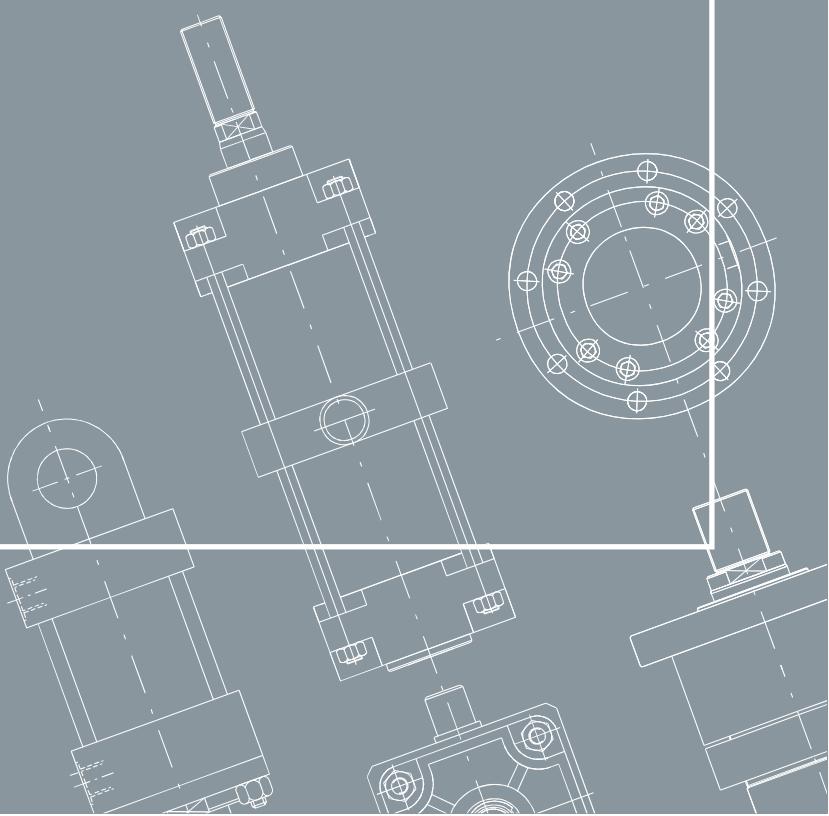


HYDRAULIC CYLINDERS
ISO 6020/1



ISO 6020/1 05 Series

Presentation

The range of CMB 05 series double-acting hydraulic cylinders and servo-cylinders has been developed to specifically meet the most demanding drive unit requirements of the iron and steel industry in accordance with ISO 6020/1 construction standards.

The compact construction with round heads, the care taken in choosing the materials and seals used, combined with strict final testing which reproduces the cylinders' normal working conditions, make these hydraulic actuators a good choice in the field of hydraulic drive units for all types of industrial applications, in particular for critical requirements such as those of the iron and steel field which require strong, reliable and easily-maintained products.



Technical features

- **Interchangeable dimensions:** in accordance with standard ISO 6020/1
- **Nominal working pressure (continuous service):** 160 bar (16 MPa)
- **Maximum working pressure:** 240 bar (24 MPa)
- **Bores available:** from 25 to 320 mm.
- **Rod diameters:** 2 diameters depending on the bore are available from 14 to 220 mm which enable the following cross-section ratios to be obtained:
 - a) 1:1,5 standard rod
 - b) 1:4 big-size rod
- **Rod material:** high-resistance, hardened and tempered steel alloy, chromed and honed with a rugosity of $Ra = 0,2 \mu m$. On request the rod can be constructed using induction tempering heat treatment, in stainless steel or with Ni-Cr surface treatment
- **Stroke:** on request from the customer with dimensional tolerances from 0 to 1 mm for sizes up to 1000 mm and from 0 to 4 mm up to 5000 mm
- **Coupling connections:** produced as standard with BSP screw-threaded cylindrical connections and housing for sealing washers according to ISO 1179; on request SAE flange coupling in accordance with DIN 3852-2
- **Standard maximum speed:** 0.5 m/s
- **Standard temperature:** from -20 °C to +100 °C
- **Standard hydraulic fluid:** mineral oil in accordance with ISO 6743/4 - 1982 standard with degree of purity in compliance with ISO 4406 standard
- **Mountings and accessories available:** 7 difference of standard mounting compliant with ISO standards and one non-compliant completed by a range of accessories for connecting to the rod

ISO 6020/1 05 Series

How to order a CMB 05 series cylinder compliant with ISO 6020/1

The CMB 05 series cylinders compliant with ISO 6020/1 standards are provided with an identification code which describes the construction specifications in a non-ambiguous way.

To make up the code for the order, follow the code diagram set out below and insert the letters identifying the various features of the desired cylinder in the sequence given below.

Cylinder ordering code		
Features	Description	Code
Series	To ISO 6020/1 standards To ISO 6020/1 standards for taking transducer !	05 T5
Bore	Specify bore in mm (indicate 3 figures)	-
Rod	Rod diameter 14 mm (bore 25) Rod diameter 18 mm (bores 25 and 32) Rod diameter 22 mm (bores 32 and 40) Rod diameter 28 mm (bores 40 and 50) Rod diameter 36 mm (bores 50 and 63) Rod diameter 45 mm (bores 63 and 80) Rod diameter 56 mm (bores 80 and 100) Rod diameter 70 mm (bores 100 and 125) Rod diameter 90 mm (bores 125 and 160) Rod diameter 110 mm (bores 160 and 200) Rod diameter 140 mm (bores 200 and 250) Rod diameter 180 mm (bores 250 and 320) Rod diameter 220 mm (bore 320)	B D F H L M P R T V Z X Y
Stroke	Specify the stroke in mm (indicate 4 figures)	-
Rod type	Without cushioning Front cushioning Rear cushioning Cushioning on both ends Double rod without cushioning Double rod with cushioning	C E G P S T
Special machining	Female rod threading Customised machining	w z
Mounting type	Basic version (not in line to ISO 6020/1) Side foot (not in line to ISO 6020/1) Intermediate fixed trunnion (ISO MT4) Rear clevis (ISO MP3) Rear spherical bearing (ISO MP5) Rectangular front flange (ISO MF1) Rectangular rear flange (ISO MF2) Front flange (ISO MF3) Rear flange (ISO MF4)	00 03 06 07 08 13 14 15 16

! Not available for bores 25, 32, 40 (Rods 18 and 22) and 50 (rod 22), see page 23

Example of cylinder code: **05080P0200P15**

05 series cylinder to ISO 6020/1 standards - bore 80 - rod 56 - stroke 200 - cushioning on both ends - front flange (ISO MF3). The input connection and cushioning positions are standard so they are not specified in the ordering code (oil feeding inlets side 1 on head and cap, cushioning side 3 as specified in Table 13 on page 40).

Example of cylinder code: **05125T0800Pw06/FU P14 K22**

05 series cylinder to ISO 6020/1 standards - bore 125 - rod 90 - stroke 800 - cushioning on both ends - female rod threading - intermediate fixed trunnion (ISO MT4) - front and rear inductive sensor - low friction seals - position of connections side 1 on head and side 4 on cap - position of inductive sensor side 2 on head and cap - braking adjustment standard side 3 on head and cap (see Table 13 on page 40).

When issuing the order for the cylinder, provide the following information:

- code identifying the model
- quantity
- special features (if requested) with any enclosed sketches and/or construction drawings
- operating conditions for special uses
- delivery date with type of priority

Code	Description	Features
K00	Specificare la posizione dei sensori induttivi anteriori e posteriori	Position of inductive sensors
S00	Specify the position of the front and rear inductive sensors	Position of air bleeds
R00	Specify the position of the front and rear braking adjustment devices	Position of braking adjustment devices
P00	Specify the position of front and rear connections	Position of connections
-	Specify the number of spacers (multiples of 50 mm)	Spacers
T	Seals for water and glycol mixtures	Seals
U	Low friction seals	
V*	Seals for high temperatures and/or aggressive fluids	
D*	Front inductive sensor	Inductive sensors
E*	Rear inductive sensor	
F*	Front and rear inductive sensor	
A	Front air bleed	Air bleeds
B	Rear air bleed	
C [△]	Front and rear air bleeds	

* Maximum working temperature for T5 and 05 series cylinders fitted with inductive sensors: 70 °C

△ Compulsory for T5 series cylinders

• Using inductive sensors, the cylinder must be provided with cushioning (front or rear)

Seals and hydraulic fluids

The working limits of the mixes used to produce the seals installed in the rod guide bush, piston and cylinder tube are given in the chart below in relation to the hydraulic fluid used, temperature, speed and minimum working pressure. Standard seals may work at a temperature of between -20 °C and +100 °C inclusive. When particular working conditions are required, in which temperatures exceed these limits, CMB offers special high-temperature seals. Should hydraulic fluids with a water and glycol mixtures or special fluid base be used, specially designed seals are available.

For applications in which low friction coefficients and the absence of stick-slip are required, low friction seals can be supplied.

Please indicate the identification code (omit if standard) of the type of mix required for the seals in the order code given on page 2.

On request, special type seals are available for uses not covered by the chart below and guide rings for high radial loads.

For further information, contact our Technical Department.

Code	Description	Seals material	Hydraulic fluid (standards ISO 6743/4-1982)	Minimum pressure	Temperature range	Maximum speed
	Standard	Nitrile rubber (NBR), Polyurethane (AU), Charged bronze PTFE	Mineral oil HH, HL, HLP, HLPD and HM	10 bar	from -20 °C to +100 °C	0,5 m/s
T	Water and glicol mixtures	Nitrile rubber (NBR), Charged bronze PTFE	Water and glicol mixtures (HFC)	10 bar	from -20 °C to +85 °C	0,5 m/s
U	Low friction	Nitrile rubber (NBR), Charged bronze PTFE	HH, HL, HLP, HLPD, HM mineral oil and water and glycol mixtures (HFC)	10 bar	from -20 °C to +100 °C	15 m/s
V	High temperature and/or aggressive fluids	Fluoroelastomer (FKM), Charged bronze PTFE	Non-inflammable hydraulic fluids with phosphoric ester base (HFD-R), high temperature hydraulic oil and/or environments with temperatures over 100 °C. Special hydraulic fluids.	10 bar	from -20 °C to +150 °C	1 m/s

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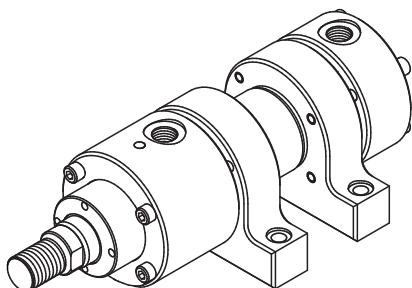
Mountings choice for the 05 series

The complete range of ISO 6020/1 05 series cylinders manufactured by CMB offers 8 different mounting types capable of meeting most working requirements. On the following pages the general criteria to be used in choosing the type and space requirements of the mounting types for single rod and double rod cylinders with their corresponding accessories are described.

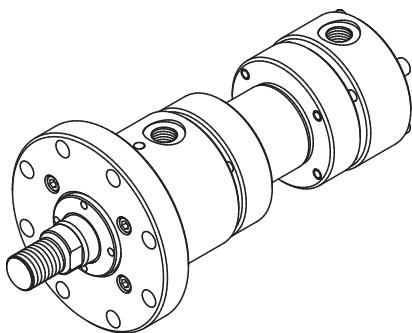
As regards special applications, our Technical Department is at your complete disposal for the construction of cylinders to particular requirements.

Main categories of mounting types

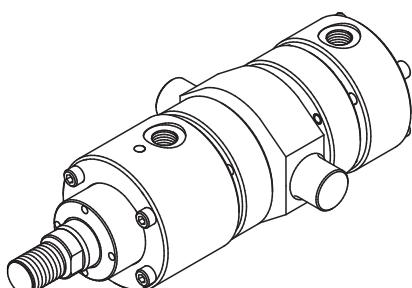
Side foot mounting



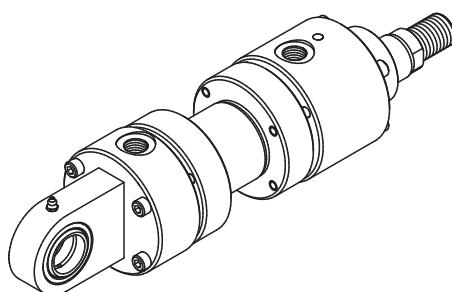
End mounting



Trunnion mounting



Pivot mounting



Side foot mounting

Cylinders with side foot mounting do not absorb loads around the rod axis and consequently the thrust generated by the cylinder creates a torque that tends to make it rotate around the bolting screws.

With this mounting type, stable support and effective guiding of the load must be guaranteed to reduce as far as possible the weight bearing down on the guide bush.

This mounting type is available in just one construction shape which is identified by the code **03 (not in line to ISO 6020/1)** and should be used exclusively in cases in which the cylinder stroke measures at least half of bore or where working pressure is lower than 160 bar.

End mounting

This mounting type is indicated for cylinders that transmit power along their own axis and are therefore suitable for moving loads in a straight line.

It is available in four different construction shapes which are identified by the following codes:

- 13 - Rectangular front flange (ISO MF1)**
- 14 - Rectangular rear flange (ISO MF2)**
- 15 - Front flange (ISO MF3)**
- 16 - Rear flange (ISO MF4)**

The choice amongst the different types of mounting available depends not only on the overall dimensions but also on the direction of the reaction force generated on the support according to whether the cylinder works by pushing or pulling.

Hinge mounting

Cylinders with hinge mounting are suitable for both pushing and pulling applications in which the load to be moved follows a curvilinear course which enables the forces around its own axis to be absorbed.

Two forms of construction are available for the version with rear hinge and one for the oscillating version, which can be identified by the following codes:

Pivot mounting

- 07 - Rear clevis (ISO MP3)**
- 08 - Rear spherical bearing (ISO MP5)**

Trunnion mounting

- 06 - Intermediate fixed trunnion (ISO MT4)**

Double rod cylinders mounting

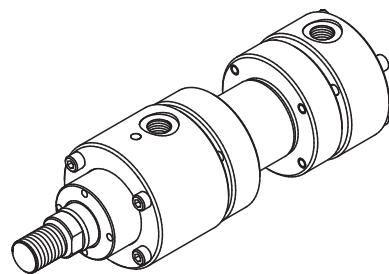
Double rod cylinders are available for all mounting types except for the following versions:

- 07 - Rear clevis (ISO MP3)**
- 08 - Rear spherical bearing (ISO MP5)**

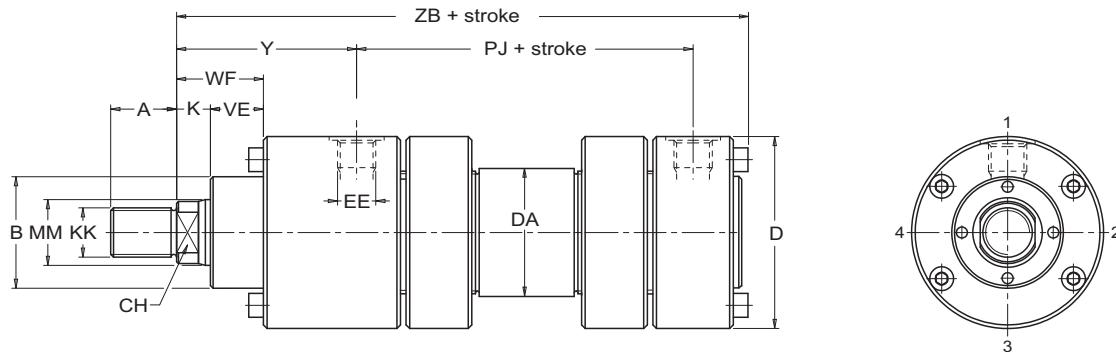
ISO 6020/1 05 Series

Type 00

(Not to ISO standards)



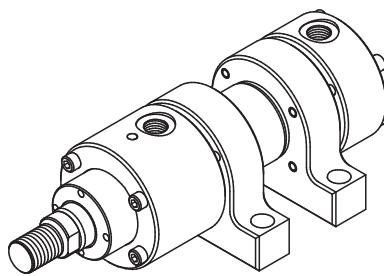
Basic version



Bore Ø	MM Ø	A	B^{f8} Ø	CH	$D_{max.}$ Ø	EE (BSP)	DA Ø	KK (Metric)	K	VE	WF	Y	PJ	$ZB_{max.}$
025	14	16	32	12	56	1/4"	35	M12x1,25	13	15	28	58	77	155
	18	18		15				M14x1,5						
032	18	18	40	15	67	3/8"	40	M14x1,5	13	19	32	64	89	176
	22	22		17				M16x1,5						
040	22	22	50	17	78	1/2"	50	M16X1,5	13	19	32	71	97	198
	28	28		22				M20x1,5						
050	28	28	60	22	95	1/2"	60	M20x1,5	14	24	38	72	111	213
	36	36		28				M27x2						
063	36	36	70	28	116	3/4"	75	M27x2	16	29	45	82	117	234
	45	45		36				M33x2						
080	45	45	85	36	130	3/4"	95	M33x2	18	36	54	91	134	260
	56	56		46				M42x2						
100	56	56	106	46	158	1"	115	M42x2	20	37	57	108	162	310
	70	70		63				M48x2						
125	70	70	132	60	192	1"	145	M48x2	23	37	60	121	174	335
	90	90		85				M64x3						
160	90	90	85	75	232	1 1/4"	185	M64x3	25	41	66	143	191	380
	110	110		95				M80x3						
200	110	110	95	90	285	1 1/4"	230	M80x3	30	45	75	190	224	480
	140	140		112				M100x3						
250	140	140	112	120	365	1 1/2"	298	M100x3	32	64	96	205	290	580
	180	180		125				M125x4						
320	180	180	125	160	450	1 1/2"	368	M125x4	37	71	108	250	358	710
	220	220		160				M160x4						

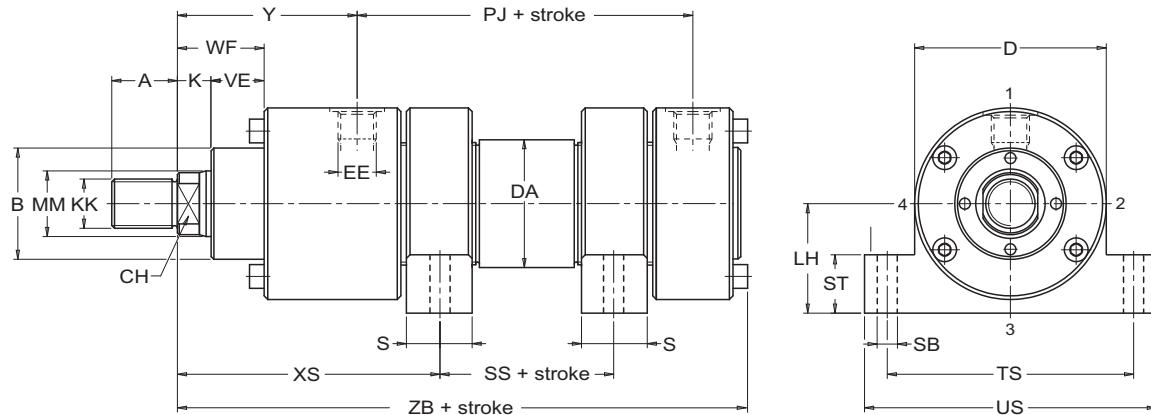
Unless otherwise specified, all dimensions are given in millimetres.

Side foot



Type 03

(Not to ISO standards)

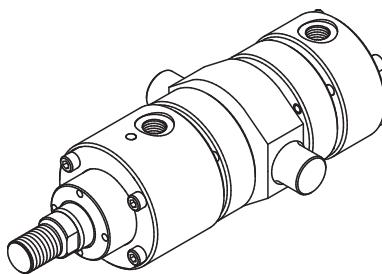


Bore Ø	MM Ø	A	B ^{f8} Ø	CH	D _{max.} Ø	EE (BSP)	DA Ø	KK (Metric)	K	VE	WF	LH ^{h10}	S	SB ^{H13} Ø	SS	ST	TS ^{js13}	US	XS	Y	PJ	ZB _{max.}	Stroke minimum
025	14	16	32	12	56	1/4"	35	M12x1,25	13	15	28	32	20	9	19	20	75	92	87	58	77	155	25
	18	18	32	15				M14x1,5															
032	18	18	40	15	67	3/8"	40	M14x1,5	13	19	32	38	25	11	22	20	90	110	97.5	64	89	176	30
	22	22	40	17				M16x1,5															
040	22	22	50	17	78	1/2"	50	M16X1,5	13	19	32	48	25	11	24	20	110	130	106	71	97	198	35
	28	28	50	22				M20x1,5															
050	28	28	60	22	95	1/2"	60	M20x1,5	14	24	38	52	32	14	26	25	120	145	116	72	111	213	60
	36	36	60	28				M27x2															
063	36	36	70	28	116	3/4"	75	M27x2	16	29	45	62	32	18	33	25	145	180	123	82	117	234	60
	45	45	70	36				M33x2															
080	45	45	85	36	130	3/4"	95	M33x2	18	36	54	70	40	22	42	30	170	210	136	91	134	260	100
	56	56	85	46				M42x2															
100	56	56	106	46	158	1"	115	M42x2	20	37	57	82	50	26	49	35	200	245	164	108	162	310	100
	70	70	106	60				M48x2															
125	70	70	132	60	192	1"	145	M48x2	23	37	60	100	56	33	55	35	245	300	180	121	174	335	140
	90	90	132	75				M64x3															
160	90	90	160	75	232	1 1/4"	185	M64x3	25	41	66	142	56	33	66	45	320	400	206	143	191	380	250
	110	110	160	90				M80x3															
200	110	110	200	90	285	1 1/4"	230	M80x3	30	45	75	170	60	36	90	50	400	500	257	190	224	480	275
	140	140	200	120				M100x3															
250	140	140	250	120	365	1 1/2"	298	M100x3	32	64	96	195	70	45	125	60	480	570	283	205	290	580	300
	180	180	250	160				M125x4															
320	180	180	320	160	450	1 1/2"	368	M125x4	37	71	108	245	80	52	156	70	580	680	350	250	358	710	400
	220	220	320	200				M160x4															

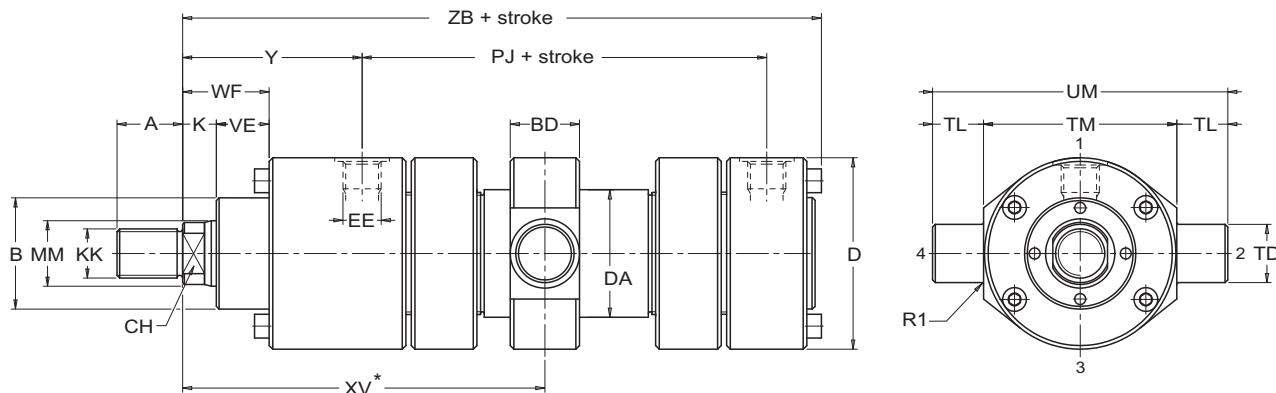
Unless otherwise specified, all dimensions are given in millimetres.

ISO 6020/1 05 Series

Type 06
(ISO MT4)



Intermediate fixed trunnion



Bore Ø	MM Ø	A	B ^{f8} Ø	CH	D _{max.} Ø	EE (BSP)	DA Ø	KK (Metric)	K	VE	WF	TD ^{f8} Ø	TL ^{js16}	TM ^{h13}	UM	BD	XV minimum	XV+stroke maximum	R1	Y	PJ	ZB _{max.}	Stroke minimum
025	14	16	32	12	56	1/4"	35	M12x1,25	13	15	28	12	10	63	83	20	107	75	1	58	77	155	40
	18	18	32	15				M14x1,5															
032	18	18	40	15	67	3/8"	42	M14x1,5	13	19	32	16	12	75	99	25	120	85	1	64	89	176	40
	22	22	40	17				M16x1,5															
040	22	22	50	17	78	1/2"	55	M16X1,5	13	19	32	20	16	90	122	30	135	90	1,5	71	97	198	45
	28	28	50	22				M20x1,5															
050	28	28	60	22	95	1/2"	65	M20x1,5	14	24	38	25	20	105	145	35	145	100	1,5	72	111	213	50
	36	36	60	28				M27x2															
063	36	36	70	28	116	3/4"	78	M27x2	16	29	45	32	25	120	170	45	165	107	2	82	117	234	55
	45	45	70	36				M33x2															
080	45	45	85	36	130	3/4"	100	M33x2	18	36	54	40	32	135	199	50	180	125	2,5	91	134	260	60
	56	56	85	46				M42x2															
100	56	56	106	46	158	1"	120	M42x2	20	37	57	50	40	160	240	60	215	150	2,5	108	162	310	70
	70	63	106	60				M48x2															
125	70	63	132	60	192	1"	150	M48x2	23	37	60	63	50	195	295	75	240	160	3	121	174	335	80
	90	85	132	75				M64x3															
160	90	85	160	75	232	1 1/4"	190	M64x3	25	41	66	80	63	240	366	90	280	177	3	143	191	380	103
	110	95	160	90				M80x3															
200	110	95	200	90	285	1 1/4"	230	M80x3	30	45	75	100	80	295	455	110	350	235	3,5	190	224	480	115
	140	112	200	120				M100x3															
250	140	112	250	120	365	1 1/2"	298	M100x3	32	64	96	125	100	370	570	135	395	297	3,5	205	290	580	120
	180	125	250	160				M125x4															
320	180	125	320	160	450	1 1/2"	368	M125x4	37	71	108	160	125	470	720	175	495	361	3,5	250	358	710	134
	220	160	320	200				M160x4															

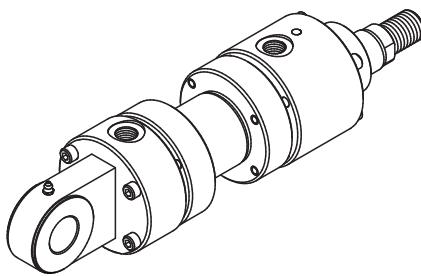
* Specify the dimension in case of order.

Unless otherwise specified, all dimensions are given in millimetres.

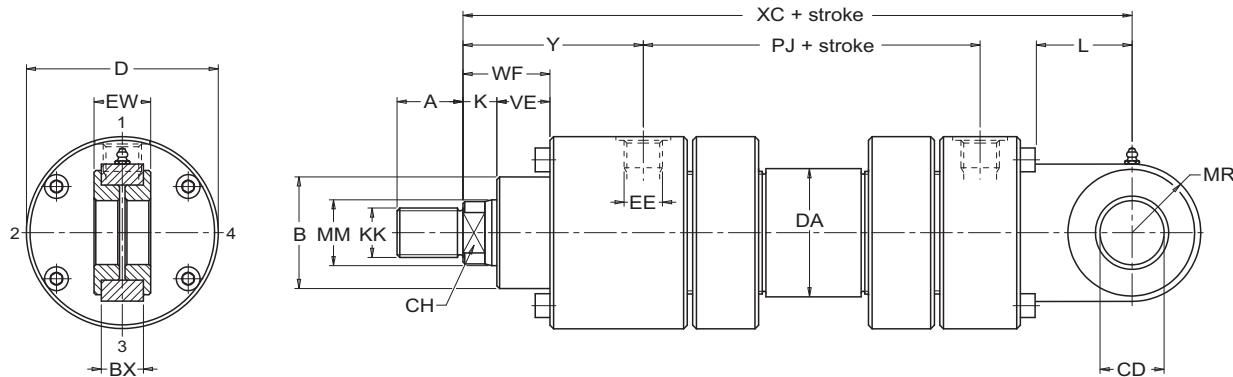


Hydraulic and pneumatic cylinders

Rear clevis



Type 07
(ISO MP3)

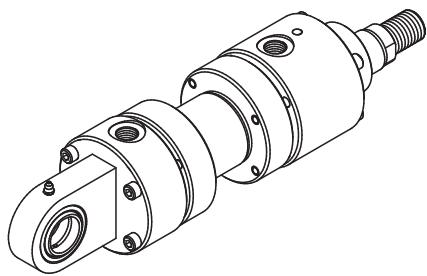


Bore Ø	MM Ø	A	B ^{f8} Ø	CH	D _{max} Ø	EE (BSP)	DA Ø	KK (Metric)	K	VE	WF	BX	CD ^{H9} Ø	EW ^{h12}	L	MR _{max}	Y	PJ	XC _{max}
025	14	16	32	12	56	1/4"	35	M12x1,25	13	15	28	10	12	12	23	16	58	77	178
	18	18	32	15				M14x1,5											
032	18	18	40	15	67	3/8"	40	M14x1,5	13	19	32	14	16	16	30	20	64	89	206
	22	22	40	17				M16x1,5											
040	22	22	50	17	78	1/2"	50	M16X1,5	13	19	32	18	20	20	33	25	71	97	231
	28	28	50	22				M20x1,5											
050	28	28	60	22	95	1/2"	60	M20x1,5	14	24	38	22	25	25	42	32	72	111	257
	36	36	60	28				M27x2											
063	36	36	70	28	116	3/4"	75	M27x2	16	29	45	27	32	32	53	40	82	117	289
	45	45	70	36				M33x2											
080	45	45	85	36	130	3/4"	95	M33x2	18	36	54	35	40	40	70	50	91	134	332
	56	56	85	46				M42x2											
100	56	56	106	46	158	1"	115	M42x2	20	37	57	40	50	50	83	63	108	162	395
	70	70	106	60				M48x2											
125	70	70	132	60	192	1"	145	M48x2	23	37	60	52	63	63	89	71	121	174	428
	90	90	132	75				M64x3											
160	90	90	160	75	232	1 1/4"	185	M64x3	25	41	66	66	80	80	117	90	143	191	505
	110	110	160	90				M80x3											
200	110	110	200	90	285	1 1/4"	230	M80x3	30	45	75	84	100	100	141	112	190	224	615
	140	140	200	120				M100x3											
250	140	140	250	120	365	1 1/2"	298	M100x3	32	64	96	102	125	125	193	160	205	290	773
	180	180	250	160				M125x4											
320	180	180	320	160	450	1 1/2"	368	M125x4	37	71	108	130	160	160	234	200	250	358	930
	220	220	320	200				M160x4											

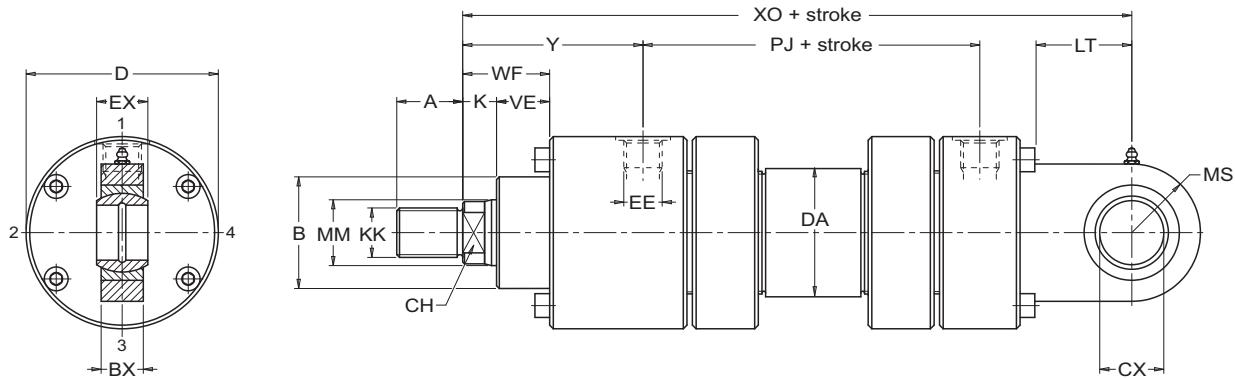
Unless otherwise specified, all dimensions are given in millimetres.

ISO 6020/1 05 Series

Type 08
(ISO MP5)



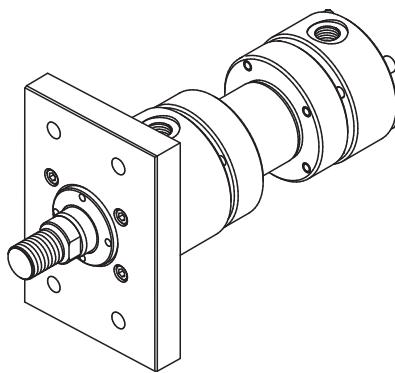
Rear spherical bearing



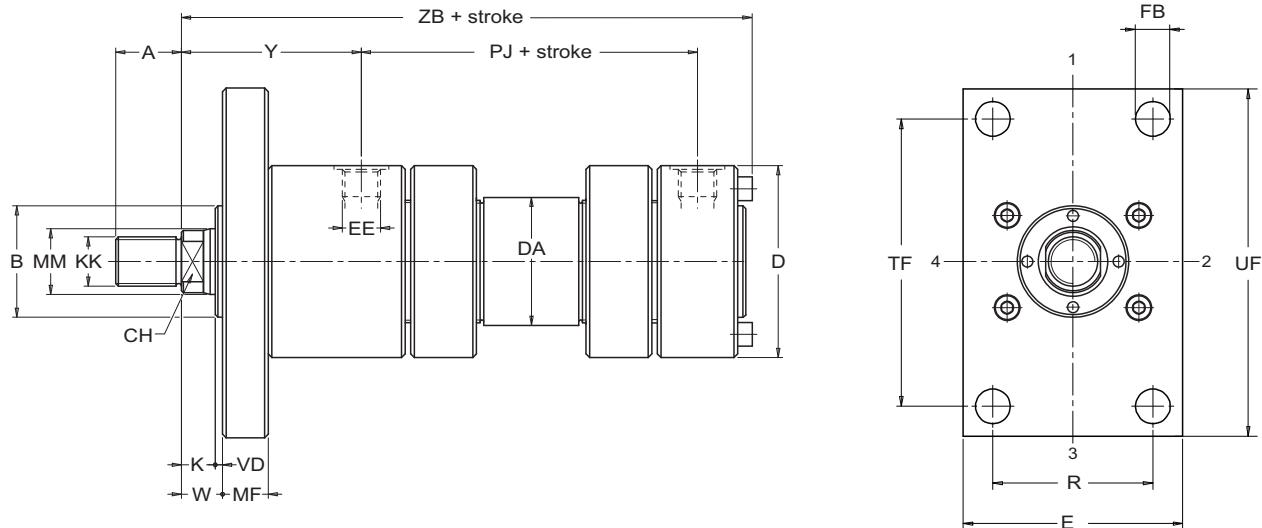
Bore Ø	MM Ø	A	B ^{f8} Ø	CH	D _{max.} Ø	EE (BSP)	DA Ø	KK (Metric)	K	VE	WF	BX	CX ^{H7} Ø	EX ^{h12}	LT	MS _{max}	Y	PJ	XO _{max}
025	14	16	32	12	56	1/4"	35	M12x1,25	13	15	28	10	12	12	23	16	58	77	178
	18	18	32	15				M14x1,5											
032	18	18	40	15	67	3/8"	40	M14x1,5	13	19	32	14	16	16	30	20	64	89	206
	22	22	40	17				M16x1,5											
040	22	22	50	17	78	1/2"	50	M16X1,5	13	19	32	18	20	20	33	25	71	97	231
	28	28	50	22				M20x1,5											
050	28	28	60	22	95	1/2"	60	M20x1,5	14	24	38	22	25	25	42	32	72	111	257
	36	36	60	28				M27x2											
063	36	36	70	28	116	3/4"	75	M27x2	16	29	45	27	32	32	53	40	82	117	289
	45	45	70	36				M33x2											
080	45	45	85	36	130	3/4"	95	M33x2	18	36	54	35	40	40	70	50	91	134	332
	56	56	85	46				M42x2											
100	56	56	106	46	158	1"	115	M42x2	20	37	57	40	50	50	83	63	108	162	395
	70	70	106	60				M48x2											
125	70	70	132	60	192	1"	145	M48x2	23	37	60	52	63	63	89	71	121	174	428
	90	90	132	75				M64x3											
160	90	90	160	75	232	1 1/4"	185	M64x3	25	41	66	66	80	80	117	90	143	191	505
	110	110	160	90				M80x3											
200	110	110	200	90	285	1 1/4"	230	M80x3	30	45	75	84	100	100	141	112	190	224	615
	140	140	200	120				M100x3											
250	140	140	250	120	365	1 1/2"	298	M100x3	32	64	96	102	125	125	193	160	205	290	773
	180	180	250	160				M125x4											
320	180	180	320	160	450	1 1/2"	368	M125x4	37	71	108	130	160	160	234	200	250	358	930
	220	220	320	200				M160x4											

Unless otherwise specified, all dimensions are given in millimetres.

Rectangular front flange



Type 13
(ISO MF1)

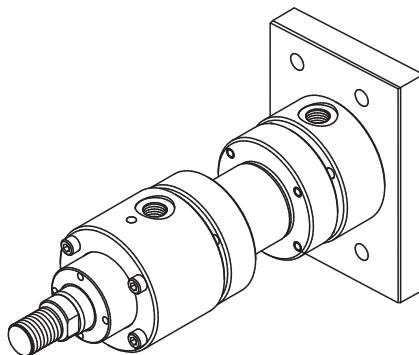


Bore Ø	MM Ø	A	B $\frac{f}{8}$ Ø	CH	D _{max} Ø	EE (BSP)	DA Ø	KK (Metric)	K	W	VD	MF	R js_{13}	TF	js ₁₃	FB Ø	H13	E	UF	Y	PJ	ZB _{max}
025	14	16	32	12	56	1/4"	35	M12x1,25	13	16	3	12	28,7	69,2	6,6	60	85	58	77	155		
	18	18	32	15				M14x1,5														
032	18	18	40	15	67	3/8"	40	M14x1,5	13	16	3	16	35,2	85	9	70	105	64	89	176		
	22	22	40	17				M16x1,5														
040	22	22	50	17	78	1/2"	50	M16x1,5	13	16	3	16	40,6	98	9	80	115	71	97	198		
	28	28	50	22				M20x1,5														
050	28	28	60	22	95	1/2"	60	M20x1,5	14	18	4	20	48,2	116,4	11	100	140	72	111	213		
	36	36	60	28				M27x2														
063	36	36	70	28	116	3/4"	75	M27x2	16	20	4	25	55,5	134	13,5	120	160	82	117	234		
	45	45	70	36				M33x2														
080	45	45	85	36	130	3/4"	95	M33x2	18	22	4	32	63,1	152,2	17,5	135	185	91	134	260		
	56	56	85	46				M42x2														
100	56	56	106	46	158	1"	115	M42x2	20	25	5	32	76,5	184,8	22	160	225	108	162	310		
	70	63	106	60				M48x2														
125	70	63	132	60	192	1"	145	M48x2	23	28	5	32	90,2	217,1	22	195	255	121	174	335		
	90	85	132	75				M64x3														

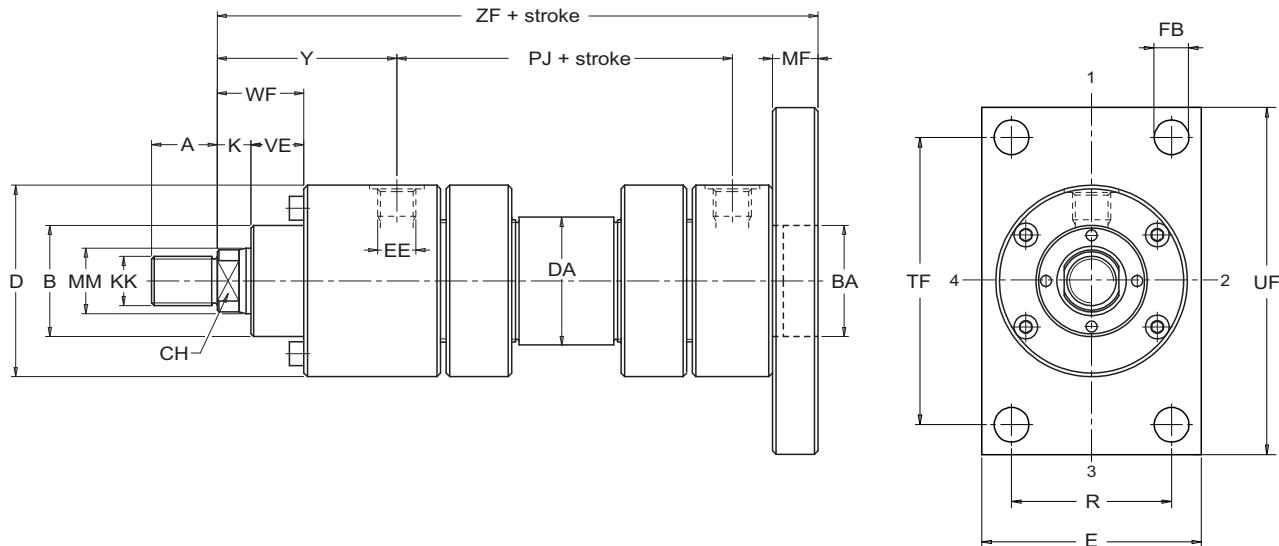
Unless otherwise specified, all dimensions are given in millimetres.

ISO 6020/1 05 Series

Type 14
(ISO MF2)



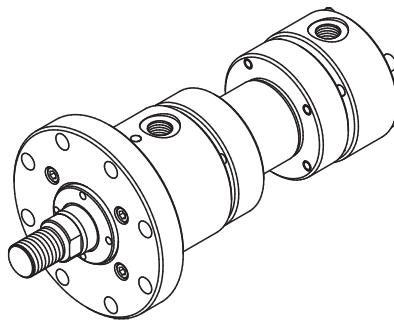
Rectangular rear flange



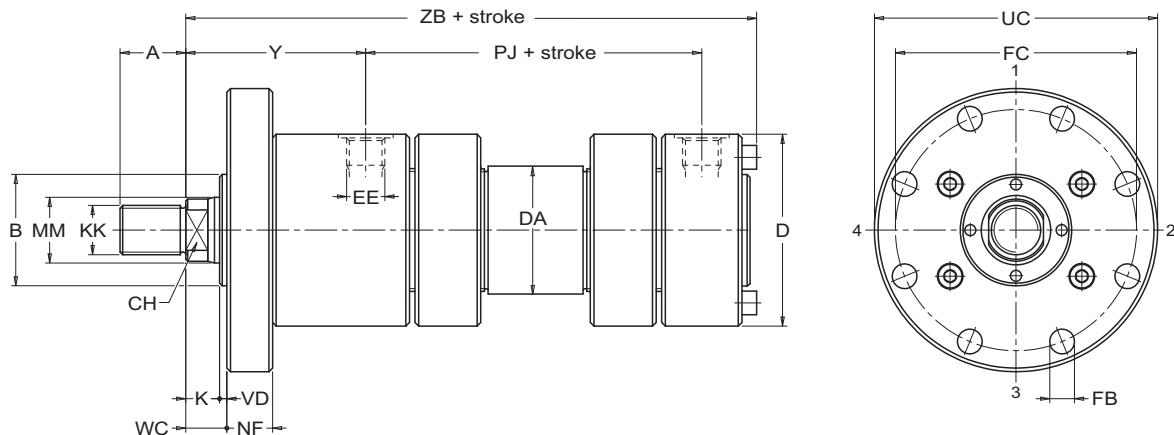
Bore Ø	MM Ø	A	B ^{f8} Ø	CH	D _{max} Ø	EE (BSP)	DA Ø	KK (Metric)	K	VE	WF	MF	R	js13	TF	js13	H13 Ø	E	UF	B ^{H8} Ø	Y	PJ	ZF
025	14	16	32	12	56	1/4"	35	M12x1,25	13	15	28	12	28,7	69,2	6,6	60	85	32	58	77	162		
	18	18		15				M14x1,5															
032	18	18	40	15	67	3/8"	40	M14x1,5	13	19	32	16	35,2	85	9	70	105	40	64	89	186		
	22	22		17				M16x1,5															
040	22	22	50	17	78	1/2"	50	M16X1,5	13	19	32	16	40,6	98	9	80	115	50	71	97	206		
	28	28		22				M20x1,5															
050	28	28	60	22	95	1/2"	60	M20x1,5	14	24	38	20	48,2	116,4	11	100	140	60	72	111	225		
	36	36		28				M27x2															
063	36	36	70	28	116	3/4"	75	M27x2	16	29	45	25	55,5	134	13,5	120	160	70	82	117	249		
	45	45		36				M33x2															
080	45	45	85	36	130	3/4"	95	M33x2	18	36	54	32	63,1	152,2	17,5	135	185	85	91	134	282		
	56	56		46				M42x2															
100	56	56	106	46	158	1"	115	M42x2	20	37	57	32	76,5	184,8	22	160	225	106	108	162	332		
	70	70		60				M48x2															
125	70	70	132	60	192	1"	145	M48x2	23	37	60	32	90,2	217,1	22	195	255	132	121	174	357		
	90	90		75				M64x3															

Unless otherwise specified, all dimensions are given in millimetres.

Front flange



Type 15
(ISO MF3)

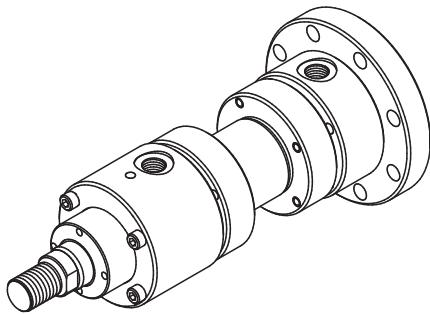


Bore Ø	MM Ø	A	B $\frac{f8}{Ø}$	CH	$D_{max} Ø$	EE (BSP)	DA Ø	KK (Metric)	K	VD	WC	NF	$FB^{H13} Ø$	FC^{js13}	UC	Y	PJ	ZB_{max}
025	14	16	32	12	56	1/4"	35	M12x1,25	13	3	16	12	6,6 N° 8 holes	75	90	58	77	155
	18	18	32	15				M14x1,5										
032	18	18	40	15	67	3/8"	40	M14x1,5	13	3	16	16	9 N° 8 holes	92	110	64	89	176
	22	22	40	17				M16x1,5										
040	22	22	50	17	78	1/2"	50	M16X1,5	13	3	16	16	9 N° 8 holes	106	125	71	97	198
	28	28	50	22				M20x1,5										
050	28	28	60	22	95	1/2"	60	M20x1,5	14	4	18	20	11 N° 8 holes	126	148	72	111	213
	36	36	60	28				M27x2										
063	36	36	70	28	116	3/4"	75	M27x2	16	4	20	25	13.5 N° 8 holes	145	170	82	117	234
	45	45	70	36				M33x2										
080	45	45	85	36	130	3/4"	95	M33x2	18	4	22	32	17.5 N° 8 holes	165	195	91	134	260
	56	56	85	46				M42x2										
100	56	56	106	46	158	1"	115	M42x2	20	5	25	32	22 N° 8 holes	200	238	108	162	310
	70	70	106	60				M48x2										
125	70	70	132	60	192	1"	145	M48x2	23	5	28	32	22 N° 8 holes	235	272	121	174	335
	90	90	132	75				M64x3										
160	90	90	85	75	232	1 1/4"	185	M64x3	25	5	30	36	22 N° 8 holes	280	316	143	191	380
	110	110	85	90				M80x3										
200	110	110	95	160	285	1 1/4"	230	M80x3	30	5	35	40	26 N° 8 holes	340	385	190	224	480
	140	140	95	120				M100x3										
250	140	140	112	120	365	1 1/2"	298	M100x3	32	8	40	56	33 N° 8 holes	420	500	205	290	580
	180	180	125	160				M125x4										
320	180	180	125	160	450	1 1/2"	368	M125x4	37	8	45	63	39 N° 8 holes	520	620	250	358	710
	220	220	160	200				M160x4										

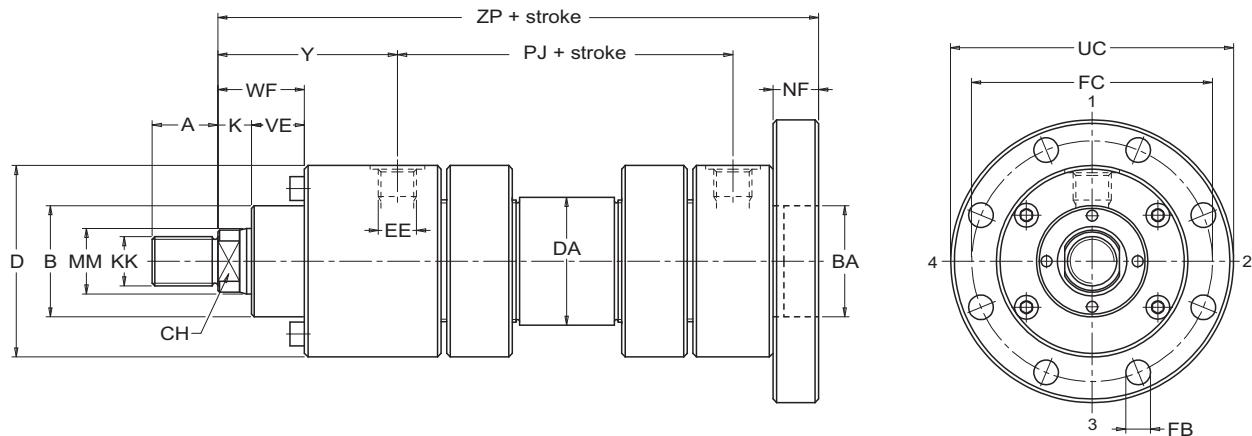
Unless otherwise specified, all dimensions are given in millimetres.

ISO 6020/1 05 Series

Type 16
(ISO MF4)



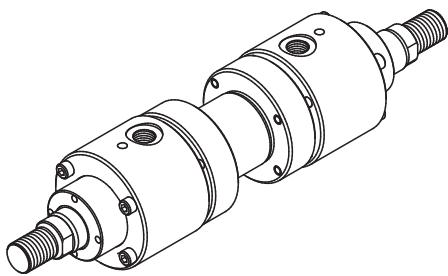
Rear flange



Bore Ø	MM Ø	A	B f8 Ø	CH	D _{max} Ø	EE (BSP)	DA Ø	KK Metric	K	VE	WF	NF	FB H13 Ø	j8 13	FC	UC	BA H8 Ø	Y	PJ	ZP
025	14	16	32	12	56	1/4"	35	M12x1,25	13	15	28	12	6,6 N° 8 holes	75	90	32	58	77	162	
	18	18	32	15				M14x1,5												
032	18	18	40	15	67	3/8"	40	M14x1,5	13	19	32	16	9 N° 8 holes	92	110	40	64	89	186	
	22	22	40	17				M16x1,5												
040	22	22	50	17	78	1/2"	50	M16x1,5	13	19	32	16	9 N° 8 holes	106	125	50	71	97	206	
	28	28	50	22				M20x1,5												
050	28	28	60	22	95	1/2"	60	M20x1,5	14	24	38	20	11 N° 8 holes	126	148	60	72	111	225	
	36	36	60	28				M27x2												
063	36	36	70	28	116	3/4"	75	M27x2	16	29	45	25	13,5 N° 8 holes	145	170	70	82	117	249	
	45	45	70	36				M33x2												
080	45	45	85	36	130	3/4"	95	M33x2	18	36	54	32	17,5 N° 8 holes	165	195	85	91	134	282	
	56	56	85	46				M42x2												
100	56	56	106	46	158	1"	115	M42x2	20	37	57	32	22 N° 8 holes	200	238	106	108	162	332	
	70	70	106	60				M48x2												
125	70	70	132	60	192	1"	145	M48x2	23	37	60	32	22 N° 8 holes	235	272	132	121	174	357	
	90	90	132	75				M64x3												
160	90	90	160	75	232	1 1/4"	185	M64x3	25	41	66	36	22 N° 8 holes	280	316	160	143	191	406	
	110	110	160	90				M80x3												
200	110	110	200	90	285	1 1/4"	230	M80x3	30	45	75	40	26 N° 8 holes	340	385	200	190	224	490	
	140	140	200	120				M100x3												
250	140	140	112	120	365	1 1/2"	298	M100x3	32	64	96	56	33 N° 8 holes	420	500	250	205	290	606	
	180	180	125	160				M125x4												
320	180	180	125	160	450	1 1/2"	368	M125x4	37	71	108	63	39 N° 8 holes	520	620	320	250	358	723	
	220	220	160	200				M160x4												

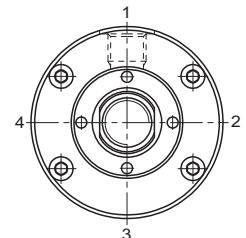
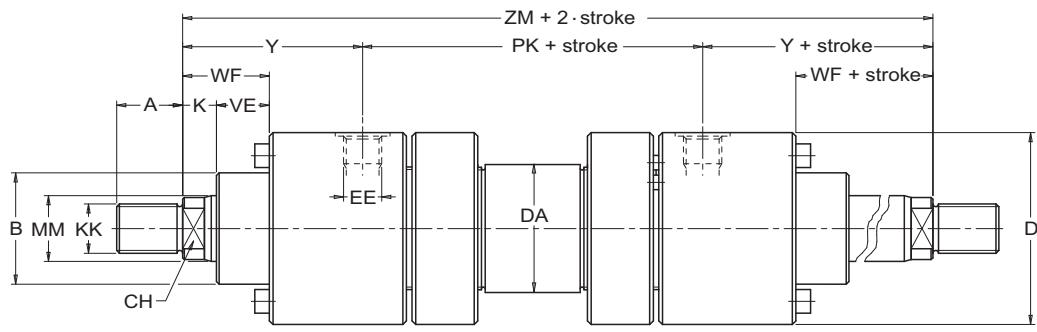
Unless otherwise specified, all dimensions are given in millimetres.

Double rod basic version



Type 00

(Not to ISO standards)



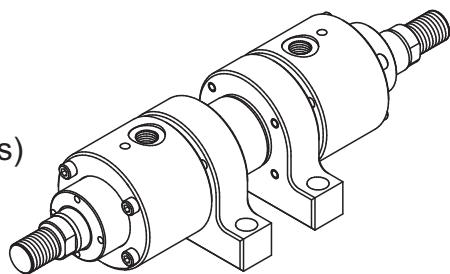
Bore Ø	MM Ø	A	B^{f8} Ø	CH	D_{max} Ø	EE (BSP)	DA Ø	KK (Metric)	K	VE	WF	Y	PK	ZM
025	14	16	32	12	56	1/4"	35	M12x1,25	13	15	28	58	77	193
	18	18		15				M14x1,5						
032	18	18	40	15	67	3/8"	40	M14x1,5	13	19	32	64	89	217
	22	22		17				M16x1,5						
040	22	22	50	17	78	1/2"	50	M16X1,5	13	19	32	71	94	236
	28	28		22				M20x1,5						
050	28	28	60	28	95	1/2"	60	M20x1,5	14	24	38	72	114	258
	36	36		36				M27x2						
063	36	36	70	28	116	3/4"	75	M27x2	16	29	45	82	115	279
	45	45		36				M33x2						
080	45	45	85	36	130	3/4"	95	M33x2	18	36	54	91	132	314
	56	56		46				M42x2						
100	56	56	106	46	158	1"	115	M42x2	20	37	57	108	161	377
	70	70		60				M48x2						
125	70	70	132	60	192	1"	145	M48x2	23	37	60	121	173	415
	90	90		75				M64x3						
160	90	90	160	75	232	1 1/4"	185	M64x3	25	41	66	143	192	478
	110	110		90				M80x3						
200	110	110	200	90	285	1 1/4"	230	M80x3	30	45	75	190	224	604
	140	140		120				M100x3						
250	140	140	250	120	365	1 1/2"	298	M100x3	32	64	96	205	281	691
	180	180		160				M125x4						
320	180	180	320	160	450	1 1/2"	368	M125x4	37	71	108	250	356	856
	220	220		200				M160x4						

Unless otherwise specified, all dimensions are given in millimetres.

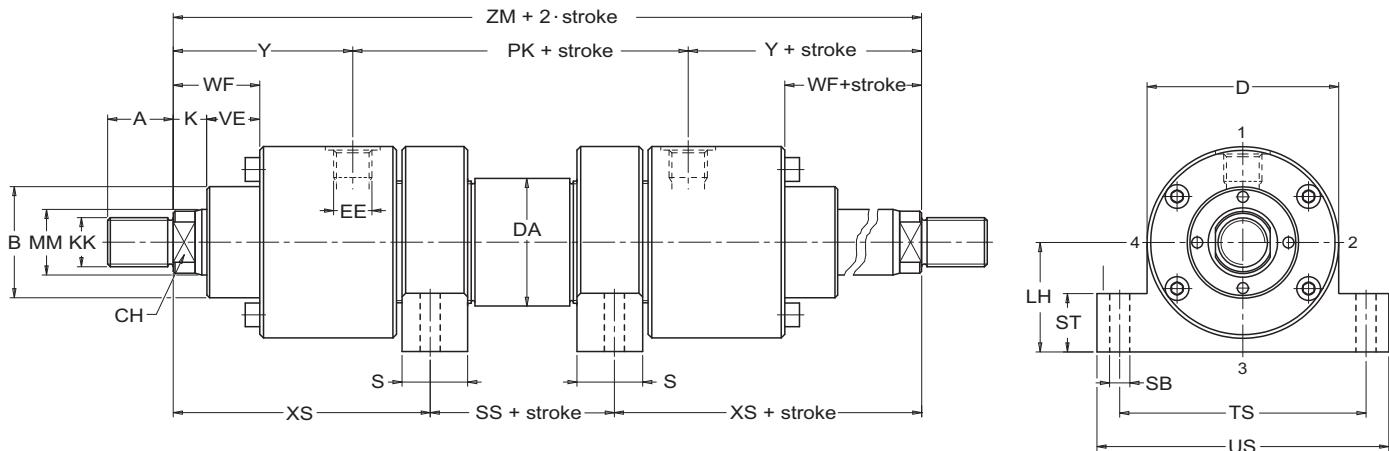
ISO 6020/1 05 Series

Type 03

(Not to ISO standards)



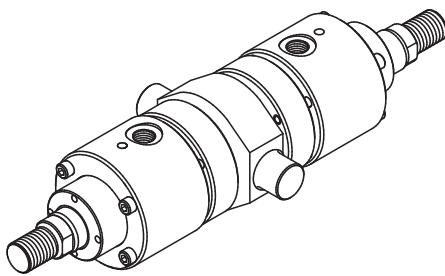
Double rod
side foot



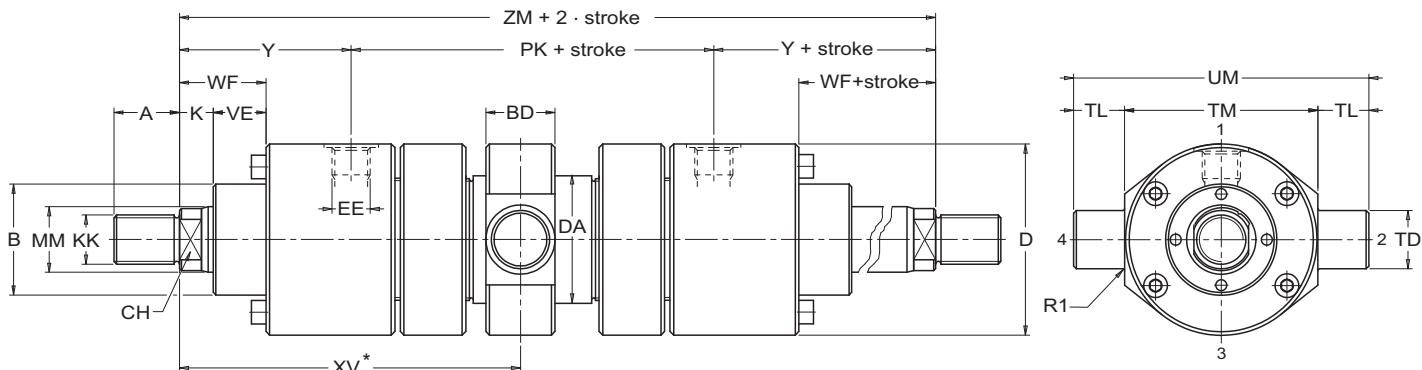
Bore Ø	MM Ø	A	B ^{f8} Ø	CH	D _{max} Ø	EE (BSP)	DA Ø	KK (Metric)	K	VE	WF	LH ^{h10}	S	SB ^{H13} Ø	SS	ST	TS ^{js13}	US	XS	Y	PK	ZM	Stroke minimum
025	14	16	32	12	56	1/4"	35	M12x1,25	13	15	28	32	20	9	19	20	75	92	87	58	77	193	25
	18	18	40	15				M14x1,5															
032	18	18	40	15	67	3/8"	40	M14x1,5	13	19	32	38	25	11	22	20	90	110	97,5	64	89	217	30
	22	22	40	17				M16x1,5															
040	22	22	50	17	78	1/2"	50	M16X1,5	13	19	32	48	25	11	24	20	110	130	106	71	94	236	35
	28	28	50	22				M20x1,5															
050	28	28	60	22	95	1/2"	60	M20x1,5	14	24	38	52	32	14	26	25	120	145	116	72	114	258	60
	36	36	60	28				M27x2															
063	36	36	70	28	116	3/4"	75	M27x2	16	29	45	62	32	18	33	25	145	180	123	82	115	279	60
	45	45	70	36				M33x2															
080	45	45	85	36	130	3/4"	95	M33x2	18	36	54	70	40	22	42	30	170	210	136	91	132	314	100
	56	56	85	46				M42x2															
100	56	56	106	46	158	1"	115	M42x2	20	37	57	82	50	26	49	35	200	245	164	108	161	377	100
	70	70	106	60				M48x2															
125	70	70	132	60	192	1"	145	M48x2	23	37	60	100	56	33	55	35	245	300	180	121	173	415	140
	90	90	132	75				M64x3															
160	90	90	160	75	232	1 1/4"	185	M64x3	25	41	66	142	56	33	66	45	320	400	206	143	192	478	250
	110	110	160	90				M80x3															
200	110	110	200	90	285	1 1/4"	230	M80x3	30	45	75	170	60	36	90	50	400	500	257	190	224	604	275
	140	140	200	120				M100x3															
250	140	140	250	120	365	1 1/2"	298	M100x3	32	64	96	195	70	45	125	60	480	570	283	205	281	691	300
	180	180	250	160				M125x4															
320	180	180	320	160	450	1 1/2"	368	M160x4	37	71	108	245	80	52	156	70	580	680	350	250	356	856	400
	220	220	320	200				M160x4															

Unless otherwise specified, all dimensions are given in millimetres.

Double rod intermediate fixed trunnion



Type 06
(ISO MT4)



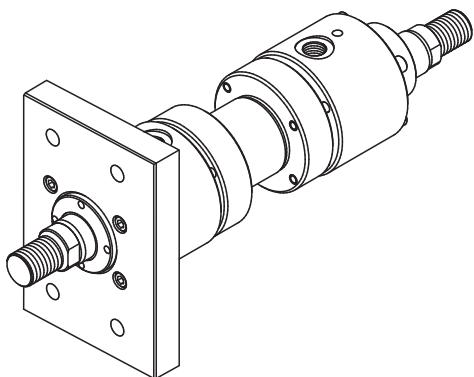
Bore Ø	MM Ø	A	B^{f8} Ø	CH	D_{max} Ø	EE (BSP)	DA Ø	KK (Metric)	K	VE	WF	TD^{f8} Ø	TL^{js16}	TM^{h13}	UM	BD	XV_{minimum}	$XV + \text{stroke}_{\text{maximum}}$	R1	Y	PK	ZM	Stroke minimum
025	14	16	32	12	56	1/4"	35	M12x1,25	13	15	28	12	10	63	83	20	107	86	1	58	77	193	40
	18	18	32	15				M14x1,5															
032	18	18	40	15	67	3/8"	42	M14x1,5	13	19	32	16	12	75	99	25	120	97	1	64	89	217	40
	22	22	40	17				M16x1,5															
040	22	22	50	17	78	1/2"	55	M16X1,5	13	19	32	20	16	90	122	30	135	101	1,5	71	94	236	45
	28	28	50	22				M20x1,5															
050	28	28	60	22	95	1/2"	65	M20x1,5	14	24	38	25	20	105	145	35	145	113	1,5	72	114	258	50
	36	36	60	28				M27x2															
063	36	36	70	28	116	3/4"	78	M27x2	16	29	45	32	25	120	170	45	165	114	2	82	115	279	55
	45	45	70	36				M33x2															
080	45	45	85	36	130	3/4"	100	M33x2	18	36	54	40	32	135	199	50	180	134	2,5	91	132	314	60
	56	56	85	46				M42x2															
100	56	56	106	46	158	1"	120	M42x2	20	37	57	50	40	160	240	60	215	162	2,5	108	161	377	70
	70	63	106	60				M48x2															
125	70	63	132	60	192	1"	150	M48x2	23	37	60	63	50	195	295	75	240	175	3	121	173	415	80
	90	85	132	75				M64x3															
160	90	85	160	75	232	1 1/4"	190	M64x3	25	41	66	80	63	240	366	90	280	198	3	143	192	478	103
	110	95	160	90				M80x3															
200	110	95	200	90	285	1 1/4"	230	M80x3	30	45	75	100	80	295	455	110	350	254	3,5	190	224	604	115
	140	112	200	120				M100x3															
250	140	112	250	120	365	1 1/2"	298	M100x3	32	64	96	125	100	370	570	135	395	296	3,5	205	281	691	120
	180	125	320	160				M125x4															
320	180	125	320	200	450	1 1/2"	368	M160x4	37	71	108	160	125	470	720	175	495	361	3,5	250	356	856	134
	220	160	320	200				M160x4															

* Specify the dimension in case of order.

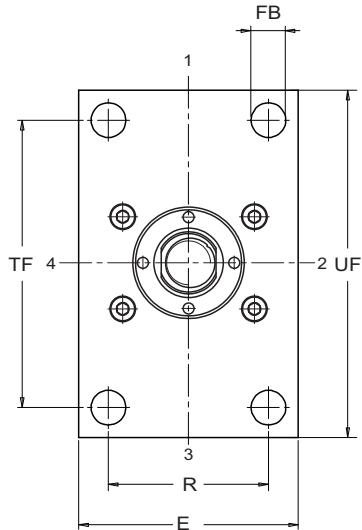
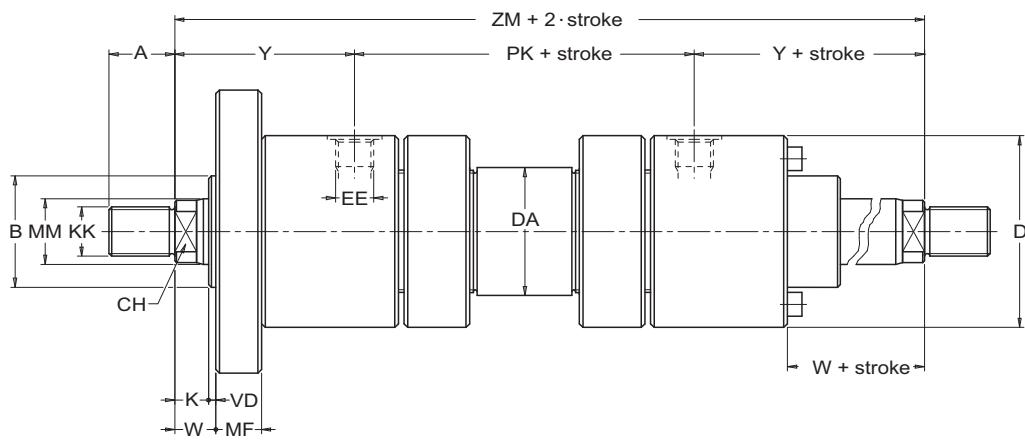
Unless otherwise specified, all dimensions are given in millimetres.

ISO 6020/1 05 Series

Type 13
(ISO MF1)



Double rod
rectangular
front flange

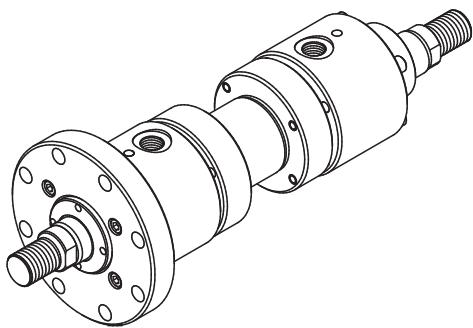


Bore Ø	MM Ø	A	B ^{f8} Ø	CH	D _{max} Ø	EE (BSP)	DA Ø	KK (Metric)	K	W	VD	MF	R	js13	TF	js13	H13 Ø	E	UF	Y	PK	ZM
025	14	16	32	12	56	1/4"	35	M12x1,25	13	16	3	12	28,7	69,2	6,6	60	85	58	77	193		
	18	18	32	15				M14x1,5														
032	18	18	40	15	67	3/8"	40	M14x1,5	13	16	3	16	35,2	85	9	70	105	64	89	217		
	22	22	40	17				M16x1,5														
040	22	22	50	17	78	1/2"	50	M16X1,5	13	16	3	16	40,6	98	9	80	115	71	94	236		
	28	28	50	22				M20x1,5														
050	28	28	60	22	95	1/2"	60	M20x1,5	14	18	4	20	48,2	116,4	11	100	140	72	114	258		
	36	36	60	28				M27x2														
063	36	36	70	28	116	3/4"	75	M27x2	16	20	4	25	55,5	134	13,5	120	160	82	115	279		
	45	45	70	36				M33x2														
080	45	45	85	36	130	3/4"	95	M33x2	18	22	4	32	63,1	152,2	17,5	135	185	91	132	314		
	56	56	85	46				M42x2														
100	56	56	106	46	158	1"	115	M42x2	20	25	5	32	76,5	184,8	22	160	225	108	161	377		
	70	70	106	60				M48x2														
125	70	70	132	60	192	1"	145	M48x2	23	28	5	32	90,2	217,1	22	195	255	121	173	415		
	90	90	132	75				M64x3														

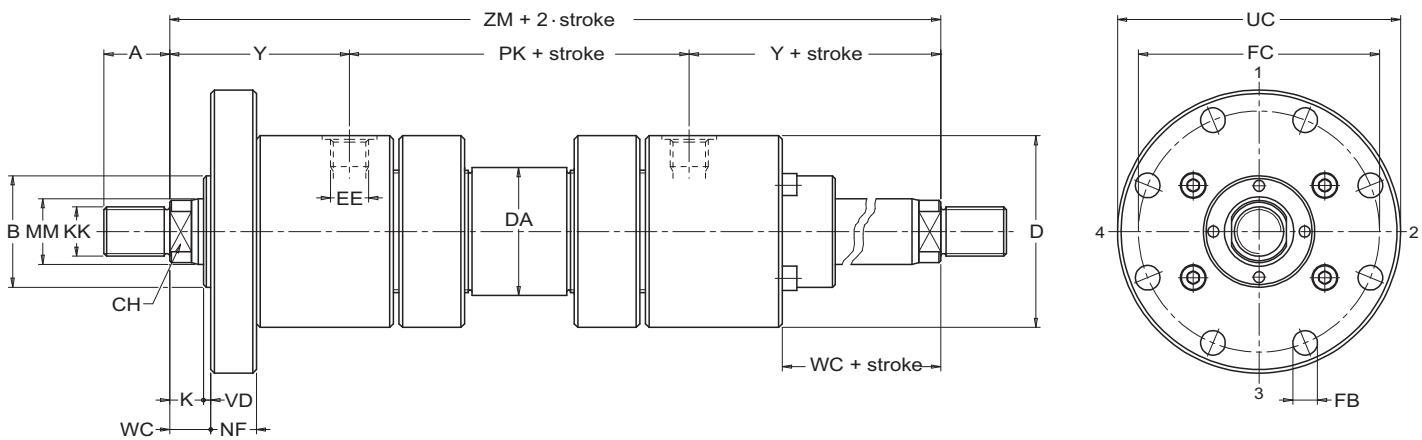
Unless otherwise specified, all dimensions are given in millimetres.

Type 15

(ISO MF3)



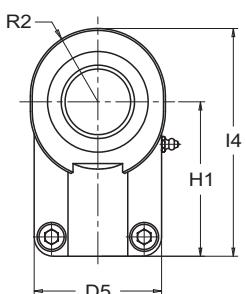
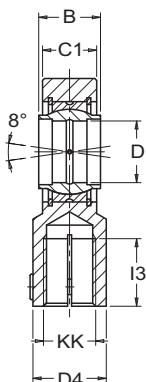
Double rod
front flange



Bore Ø	MM Ø	A	B $\frac{f}{8}$ Ø	CH	D_{max} Ø	EE (BSP)	DA Ø	KK (Metric)	K	VD	WC	NF	FB^{H13} Ø	FC^{js13}	UC	Y	PK	ZM
025	14	16	32	12	56	1/4"	35	M12x1,25	13	3	16	12	6,6 N°8 holes	75	90	58	77	193
	18	18	32	15				M14x1,5										
032	18	18	40	15	67	3/8"	40	M14x1,5	13	3	16	16	9 N°8 holes	92	110	64	89	217
	22	22	40	17				M16x1,5										
040	22	22	50	17	78	1/2"	50	M16X1,5	13	3	16	16	9 N°8 holes	106	125	71	94	236
	28	28	50	22				M20x1,5										
050	28	28	60	22	95	1/2"	60	M20x1,5	14	4	18	20	11 N°8 holes	126	148	72	114	258
	36	36	60	28				M27x2										
063	36	36	70	28	116	3/4"	75	M27x2	16	4	20	25	13.5 N°8 holes	145	170	82	115	279
	45	45	70	36				M33x2										
080	45	45	85	36	130	3/4"	95	M33x2	18	4	22	32	17.5 N°8 holes	165	195	91	132	314
	56	56	85	46				M42x2										
100	56	56	106	46	158	1"	115	M42x2	20	5	25	32	22 N°8 holes	200	238	108	161	377
	70	70	106	60				M48x2										
125	70	70	132	60	192	1"	145	M48x2	23	5	28	32	22 N°8 holes	235	272	121	173	415
	90	90	132	75				M64x3										
160	90	90	160	75	232	1 1/4"	185	M64x3	25	5	30	36	22 N°8 holes	280	316	143	192	478
	110	110	160	90				M80x3										
200	110	110	200	90	285	1 1/4"	230	M80x3	30	5	35	40	26 N°8 holes	340	385	190	224	604
	140	140	200	120				M100x3										
250	140	140	250	120	365	1 1/2"	298	M100x3	32	8	40	56	33 N°8 holes	420	500	205	281	691
	180	180	250	160				M125x4										
320	180	180	320	160	450	1 1/2"	368	M125x4	37	8	45	63	39 N°8 holes	520	620	250	356	856
	220	220	320	200				M160x4										

Unless otherwise specified, all dimensions are given in millimetres.

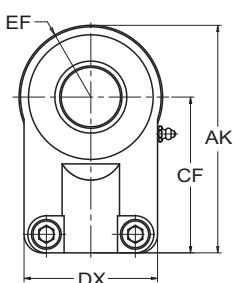
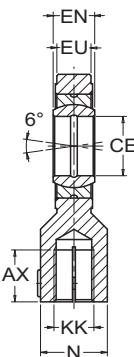
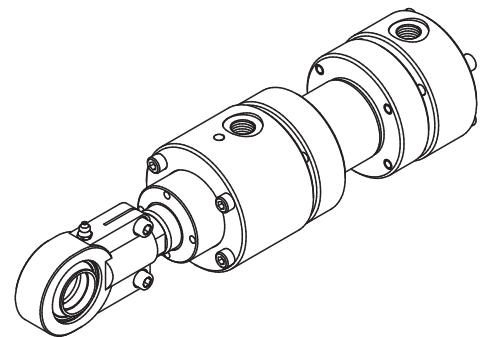
ISO 6020/1 05 Series



Rod eye with spherical bearing (ISO 6982/DIN 24338)

Rod Ø	KK (Metric)	B ^{h12}	C1	D ^{H7} Ø	R2	D4	D5 _{max}	H1	I3 _{min}	I4	Code
14	M12x1,25	12	11	12	16	16	32	38	17	54	0205004000012
18	M14x1,5	16	13	16	20	21	40	44	19	64	0205004000016
22	M16x1,5	20	17	20	23,5	25	47	52	23	75	0205004000020
28	M20x1,5	25	22	25	29	30	54	65	29	96	0205004000025
36	M27x2	32	28	32	35,5	38	66	80	37	118	0205004000032
45	M33x2	40	33	40	45	47	80	97	46	146	0205004000040
56	M42x2	50	41	50	54,5	58	96	120	57	179	0205004000050
70	M48x2	63	53	63	68	70	114	140	64	211	0205004000063
90	M64x3	80	67	80	85	90	148	180	86	270	0205004000080
110	M80x3	100	85	100	105,5	110	178	210	96	322	0205004000100
140	M100x3	125	103	125	132,5	135	200	260	113	405	0205004000125
180	M125x4	160	130	160	163	165	250	310	126	488	0205004000160
220	M160x4	200	162	200	209	215	320	390	161	620	0205004000200

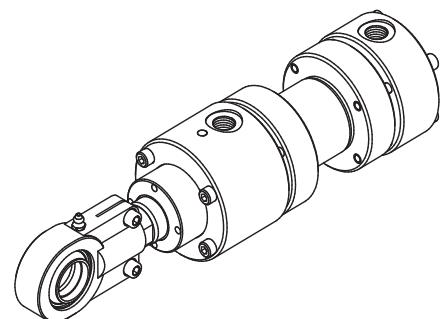
All dimensions are given in millimetres.



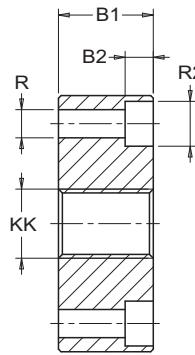
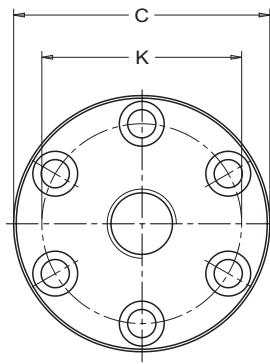
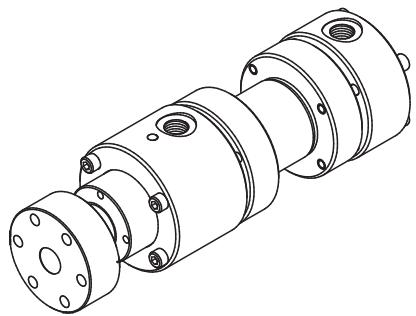
Rod eye with spherical bearing (ISO 8133/DIN 24555)

Rod	KK (Metric)	EN	EU	Ø CE	EF _{max}	N _{max}	DX	CF ^{js13}	AK	AX _{min}	Code
14	M12x1,25	14 ⁻⁰ _{-0,12}	11	16 ⁻⁰ _{-0,008}	21	21	45	48	69	17	0205003000016
18	M14x1,5	16 ⁻⁰ _{-0,12}	13	20 ⁻⁰ _{-0,010}	25	25	55	58	83	19	0205003000020
22	M16x1,5	20 ⁻⁰ _{-0,12}	17	25 ⁻⁰ _{-0,010}	31	30	62	68	99	23	0205003000025
28	M20x1,5	22 ⁻⁰ _{-0,12}	19	30 ⁻⁰ _{-0,010}	38	36	80	85	123	29	0205003000030
36	M27x2	28 ⁻⁰ _{-0,12}	23	40 ⁻⁰ _{-0,012}	48	45	90	105	153	37	0205003000040
45	M33x2	35 ⁻⁰ _{-0,15}	30	50 ⁻⁰ _{-0,012}	58	55	105	130	188	46	0205003000050
56	M42x2	44 ⁻⁰ _{-0,15}	38	60 ⁻⁰ _{-0,015}	75	68	134	150	225	57	0205003000060
70	M48x2	55 ⁻⁰ _{-0,15}	47	80 ⁻⁰ _{-0,015}	97,5	78	156	185	282,5	64	0205003000080
90	M64x3	70 ⁻⁰ _{-0,20}	57	100 ⁻⁰ _{-0,020}	117,5	100	190	240	357,5	86	0205003000100

All dimensions are given in millimetres.



Rod end accessory (ISO 8132)

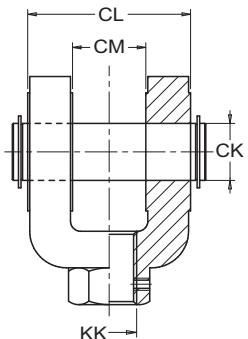
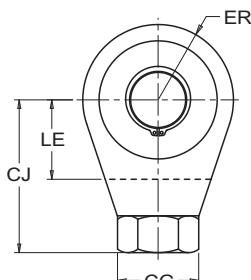
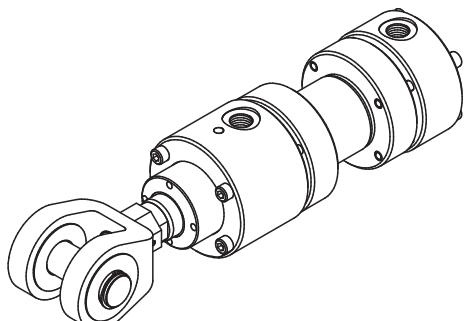


Rod
14 B
18 D
22 F
28 H
36 L
45 M
56 P
70 R
90 T

KK (Metric)	B1	B2	C Ø	K Ø	R x N° Ø Qty	R2 Ø	Code
M12x1,25	17	6,8	56	40	6,6 4	11	0205031000025
M14x1,5	19	9	63	45	9 4	14,5	0205031000032
M16x1,5	23	9	72	54	9 6	14,5	0205031000040
M20x1,5	29	9	82	63	9 6	14,5	0205031000050
M27x2	37	11	100	78	11 6	17,5	0205031000063
M33x2	46	13	120	95	13,5 8	20	0205031000080
M42x2	57	17,5	150	120	17,5 8	26	0205031000100
M48x2	64	21,5	190	150	22 8	33	0205031000125
M64x3	86	25	230	180	26 8	40	0205031000160

All dimensions are given in millimetres.

Fork joint hinge with pin (ISO 8133)

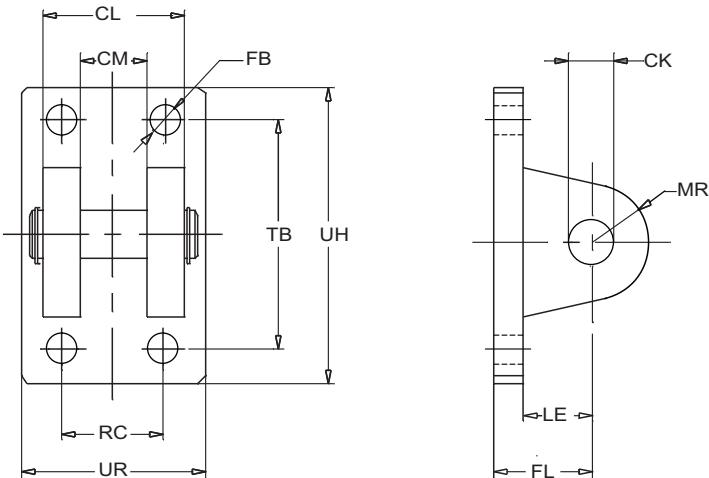


Rod
14 B
18 D
22 F
28 H
36 L
45 M
56 P
70 R
90 T
110 V
140 Z

KK (Metric)	CK f8 Ø	CL _{max}	b ¹²	c _J ^{js13}	LE _{min}	ER _{max}	CG	Code
M12x1,25	12	32	16	36	19	17	21	0205007000012
M14x1,5	14	40	20	38	19	17	21	0205007000014
M16x1,5	20	60	30	54	32	29	32	0205007000016
M20x1,5	20	60	30	60	32	29	32	0205007000020
M27x2	28	80	40	75	39	34	40	0205007000027
M33x2	36	100	50	99	54	50	56	0205007000033
M42x2	45	120	60	113	57	53	56	0205007000042
M48x2	56	140	70	126	63	59	75	0205007000048
M64x3	70	160	80	168	83	78	95	0205007000064
M80x3	70	160	80	168	83	78	95	0205007000080
M100x3	100	230	100	250	90	95	160	0205007000100

All dimensions are given in millimetres.

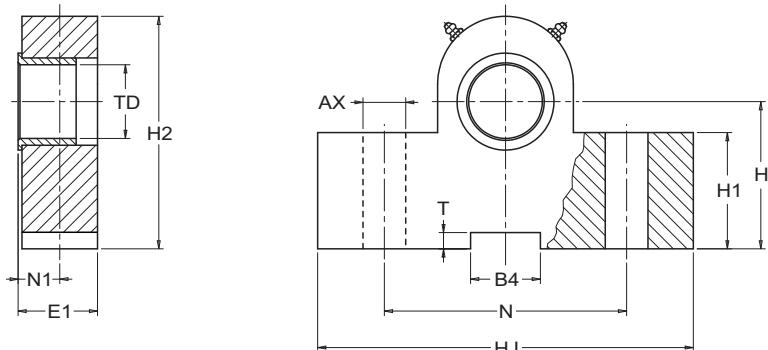
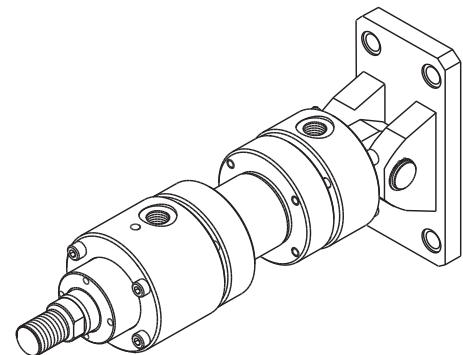
ISO 6020/1 05 Series



**Clevis Bracket
(ISO 8132)**

CK H9 Ø	A16 CM	CL	h13 FL	js14	LE	FB Ø	js14 TB	UH	js14 RC	UR	MR	Code
12	12	28	34	22	9	50	70	20	40	12	0205054000012	
16	16	36	40	27	11	65	90	26	50	16	0205054000016	
20	20	45	45	30	11	75	98	32	58	20	0205054000020	
25	25	56	55	37	13,5	85	113	40	70	25	0205054000025	
32	32	70	65	43	17,5	110	143	50	85	32	0205054000032	
40	40	90	76	52	22	130	170	65	108	40	0205054000040	
50	50	110	95	65	26	170	22	80	130	50	0205054000050	
63	63	140	112	75	33	210	270	100	160	63	0205054000063	
80	80	170	140	95	39	250	320	125	210	80	0205054000080	

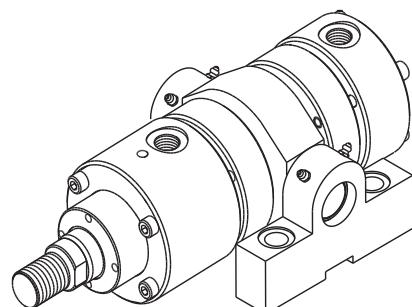
All dimensions are given in millimetres.



**Trunnion mounting
block (ISO 8132)**

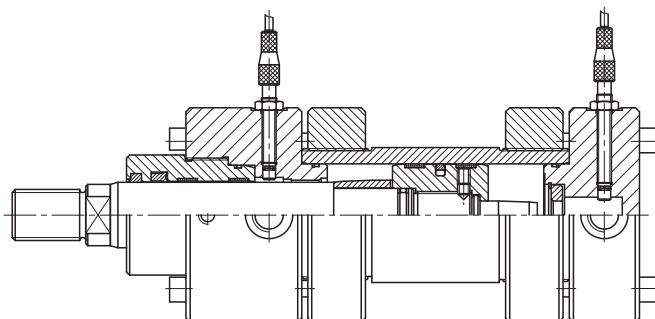
Bore	AX ^{H13} Ø	js13 H	H1	H2 _{max}	H7	HJ	E1	N	N1	B4	+0,3 T +0	Code
25	9	34	25	49	12	63	17	40	8	10	3,3	0205033000025
32	11	40	30	59	16	80	21	50	10	16	4,3	0205033000032
40	11	45	38	69	20	90	21	60	10	16	4,3	0205033000040
50	13,5	55	45	80	25	110	26	80	12	25	5,4	0205033000050
63	17,5	65	52	100	32	150	33	110	15	25	5,4	0205033000063
80	22	76	60	120	40	170	41	125	16	36	8,4	0205033000080
100	26	95	75	140	50	210	51	160	20	36	8,4	0205033000100
125	33	112	85	177	63	265	61	200	25	50	11,4	0205033000125
160	39	140	112	220	80	325	81	250	31	50	11,4	0205033000160

All dimensions are given in millimetres.



Inductive proximity sensors

The end-of-stroke sensors use technology of the Hall effect inductive type for reading and can be mounted both on the head and the cap as long as the mounting and other types of connection present on the same side allow for this in accordance with information given in Table 13 on page 40. The sensors can be applied to all mounting types of ISO 6020/1 cylinders and to both heads for every available bore.



The working principle of the inductive proximity sensor is based on the interaction of the metal conductors with their own alternative electromagnetic field.

When the piston arrives at the end of stroke, the sensor detects the presence of the conductor material of which the cushion is made and gives the signal for movement to be performed.

The cylinders must therefore necessarily be provided with cushion in proximity of the sensor.

The end-of-stroke sensors installed on CMB cylinders are tested to work correctly in temperatures ranging from -20°C to +70°C, are not influenced by vibrations and can be supplied on request with steel guards covering the outer part of the sensor.

Cylinders equipped with inductive sensors can also be fitted with fluoroelastomer seals (identified by the letter V) exclusively for use with aggressive hydraulic fluids and not for use at high temperatures.

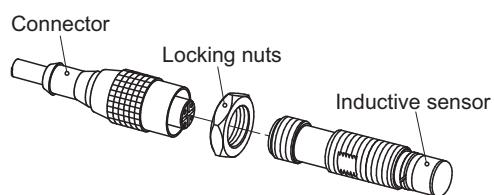
Features of inductive sensors

CMB ISO 6020/1 05 series cylinders with end of stroke sensors are supplied with PNP type inductive sensors (the charge is connected to the supply positive) and with outlet of the normally open type (N.O.).

These devices cannot be used to directly pilot a power load but only to provide the switching signal (pure contact).

Inductive sensor technical specifications:

- Sensor screw thread: M12x1
- Coupling torque: 15 Nm
- Reading signal space: 1÷1,2 mm
- Working voltage: 10÷30 V CC
- Current capacity: 200 mA
- Working frequency: 1000 Hz
- Circuit protection: si
- Max. pressure: 500 bar
- Repeatability accuracy: < 5%



CMB supplies straight connectors without LED (code **02990030000003**) as standard together with inductive sensors. These present the following technical features:

- connector: M12 pre-cabled - IP68
- cable type: with 3 x 0,34 mm leads ²
- cable length: 3 mt.
- cable material: polyurethane (oil resistant)

90° angled connectors with LED are available as an optional, enabling the dismantling space and outer overall dimensions of the cylinder to be reduced to which however the steel guards cannot be applied; when placing an order, specify the quantity followed by the following code:

- **02990030000001** - 90° angled connector

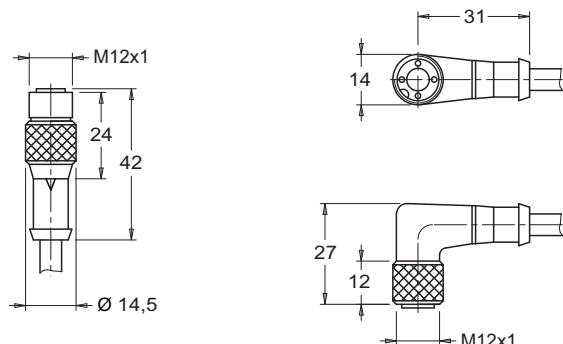
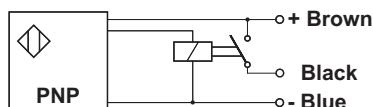


Fig. 1 - Straight and 90° angled connector space requirements



ISO 6020/1 05 Series

Introduction to T5 series cylinders

T5 series ISO 6020/1 hydraulic cylinders are hydraulic actuators designed to take linear position transducers and return the rod to its starting position.

These hydraulic devices combined with a magnetostrictive transducer and suitable electronic conditioning enable a reliable, accurate and compact control system to be achieved which allows for great flexibility of use in all types of applications.

T5 series cylinders are fitted as standard with air bleeds on the head and cap to enable air present in the rod cavity in which the transducer wave guide is housed to be released. This range of cylinders is equipped with a special piston which allows the cylinder to be fitted with cushioning on the side of the cap even when a linear transducer is present. The following bores and rod are available for transducer version:

Bore										
	40	50	63	80	100	125	160	200	250	320
Rod	-	28	36	45	56	70	90	110	140	180
	28	36	45	56	70	90	110	140	180	220

On request, special protective covers can be produced to cover the exposed part of the transducer.

Mounting type

T5 series cylinders are available for all the mounting types except for the pivot mounting versions.

For special applications however, CMB can also supply these mounting types as a custom-built product. For more detailed information, please contact our Technical Department.

Magnetostrictive transducer

A magnetostrictive transducer is a device made up of a special alloy pipe through which a connector solidly fixed to the cap of the cylinder is threaded and along which a permanent magnet inside the piston slides.

The measuring process begins with a short electrical impulse emitted by the lead head which is transmitted at a constant speed along the wave guide until it reaches the position reader (permanent magnet), which causes it to invert due its magnetostrictive effect.

The time for the wave to carry out the return trip from its original point to the signal emitter is directly proportional to the distance present between the position reader (therefore the position of the piston) and the emitter.

The absence of sliding contact elements between the moving parts of the transducer guarantees a long working life reducing all kinds of maintenance to a minimum. The transducer can easily be removed from its housing without having to dismantle the cylinder.

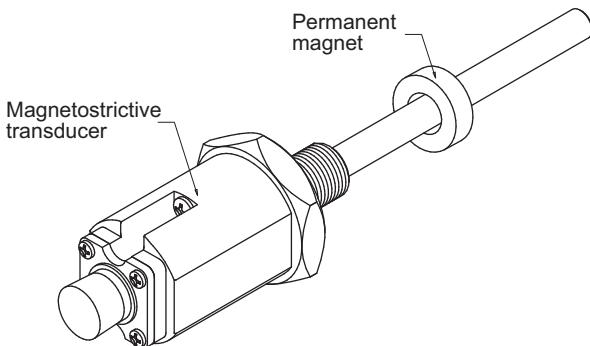


Fig. 2 - Magnetostrictive transducer complete with permanent magnet

Types of output signals available

CMB offers a wide range of magnetostrictive transducers equipped with conversion electronics that provide three different types of output signal:

- **Linear-analog (Start/Stop)**
- **Serial-Synchronous (SSI)**
- **Can-Bus**

The **Linear-analog (Start/Stop)** output provides a signal which can be analog (leak voltage or current) or digital (Start/Stop); leak analog outputs are preferable to voltage outputs when electrical disturbances are present which may distort the signal.

With the **Sincrono-Seriale (SSI)** output, the position of the permanent magnet along the stretch being measured is transmitted directly to the controller or electronic axis adjustment circuits using SSI input by means of a train of synchronised clock impulses.

Can-Bus is a type of digital data transmission produced using controllers fitted with a module at the head connected to the various devices present on the machine (actuators with linear transducers, drive systems, sensors etc.) by means of a quite normal two-way adaptor; the output signal is according to ISO 11898 specifications.

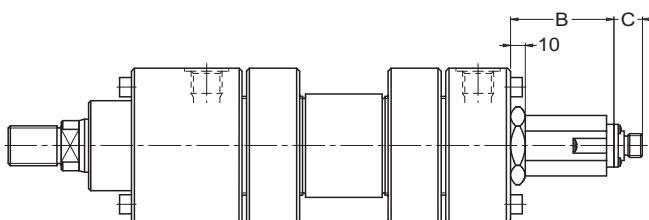
In order to increase the efficiency of the actuator, software functions can be implemented in the transducers with Can-Bus, which enable not only the position readings and piston speeds to be determined but also movement profile and speed to be measured.

CE mark

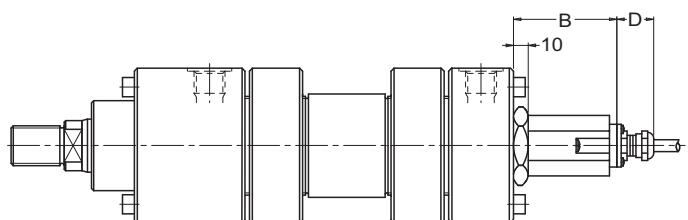
All magnetostrictive transducers and sensors (both magnetic and inductive) supplied by CMB respect the electromagnetic compatibility requirements of standard **EN 60 947-5-2** appendix ZA.

The CE mark applied to the connectors and electronic devices supplied by us indicates that the products marketed comply with the requirements of **CEE 89/336/CEE** directive (directive **EMV**) and relevant legislation.

Rear dimensions of transducer with flying connector



Rear dimensions of transducer integral cable



Types and dimensions of connectors

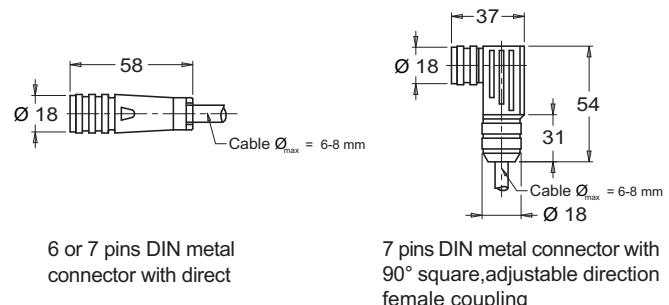
CMB hydraulic cylinders equipped with magnetostrictive transducers can be supplied with four models of connectors to be ordered separately (connection cable not supplied). Models with 6 pins are used exclusively for Analog-linear transducers and Can-Bus while those with 7 pins are used for the SSI:

- Cod. **02990060000001** - 6 pins DIN metal connector with direct female coupling
- Cod. **02990060000002** - 6 pins DIN metal connector with 90° square, adjustable direction female coupling
- Cod. **02990060000003** - 7 pins DIN metal connector with direct female coupling
- Cod. **02990060000004** - 7 pins DIN metal connector with 90° square, adjustable direction female coupling

Chart showing dimensions of magnetostrictive transducers:

B GH analog-digital	B RH analog, SSI and Can-Bus	C _{max}	D _{max}
65	83,5*	13	20

* To add 10 millimeter with electrical stroke greater of 3500 millimeter



Technical features of Linear-analog transducer

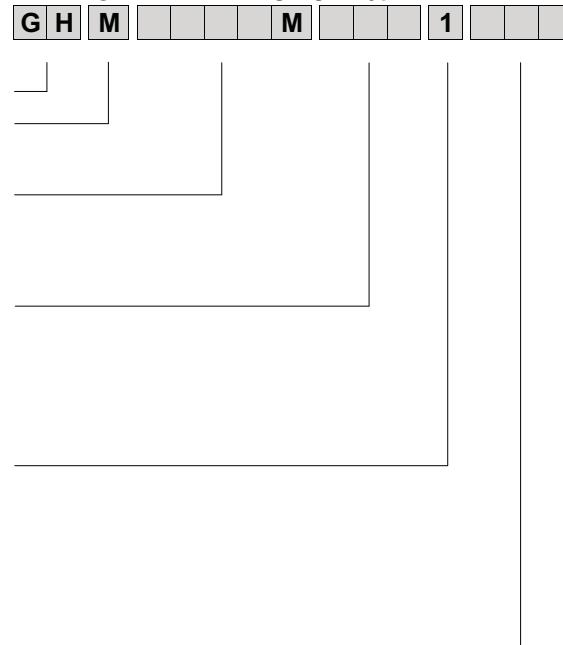
Features	
Measured variable	Displacement
Measuring range	Analog: 50-2500 mm Digital(Start/Stop): 50-7600 mm
Output signal voltage	0...+10 / 10...+0 / -10...+10 / +10...-10 V C.C. Load resistance R _L > 5 kOhm
Output signal current	4 ... 20 mA e 20 ... 4 mA 0 ... 20 mA e 20 ... 0 mA Load resistance R _L : from 0 to 500 Ohm
Resolution	Analog: Infinite Digital (Start/Stop): 0,1 mm; 0,01; 0,005 mm
Linearity tollerance	≤ ± 0,02 % F.S. (minimum ± 50 µm)
Repeatability	≤ ± 0,001 % F.S. (minimum ± 2,5 µm)
Hysteresis	≤ 4 µm
Connection type	Integrated connector or cable
Input voltage	24 V d.c. (± 25 %)
Current drain	100 mA typical
Ripple	≤ 1 % s-s
Operating temperature	- 40° C ...+ 80°C
Mounting position	Any orientation
Magnet speed	Any
Sensor head	Aluminium diecasting housing
Sensor rod with flange	Stainless steel
Pressure rating	350 bar / 700 peak pressure)
Protection degree	IP 67 (Rod, flange) IP 65 (Sensor head)
Threaded flange	M 18 x 1,5
Magnet type	GF plastic with permanent magnets

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Ordering code for analog-digital type GH transducer

Features	Description	Code
Transducer type	Linear-analog with rod housing	GH
Flange type	Threaded flange M 18 x 1,5 (standard)	M
Misure range	Analog: from 50 to 2500 mm	-
	Digital (Start/Stop): from 50 to 7600 mm	
Connection type	Screw connector with 6 pins M16	D60
	Cable PVC 2 mt. with or without connector Option: R01-R10 (Cable length 1-10 m)	R02
	Cable PUR 2 mt. with or without connector Option: H01-H10 (Cable length 1-10 m)	H02
Input voltage	+ 24 V C.C.	1
Output	0 ... 10 V	V0
	10 ... 0 V	V1
	-10 ... +10 V	V2
	+10 ... -10 V	V3
	4 ... 20 mA	A0
	20 ... 4 mA	A1
	0 ... 20 mA	A2
	20 ... 0 mA	A3
	Start/Stop (ask the builder)	R01

Ordering code for analog-digital type GH transducer



Technical features of RH analog, SSI and Can-Bus transducers

Features	Measured variable (analog and SSI transducer)	Position
Measured variable (Can-Bus transducer)		Displacement and position
Measuring range		50 - 7600 mm
Output signal (SSI transducer)		SSI (Synchronous Serial Interface) - RS 422/485 Standard
Output signal (Can-Bus transducer)		Can-Bus system according ISO 11898
Output signal (analog transducer)		Voltage or current
Data format (SSI transducer)		Binary or Gray encodes
Data length (SSI transducer)		25 o 24 bit (on request)
Data format (Can-Bus transducer)		CAN Base 2.0 A
Resolution (SSI and Can-Bus transducer)		2 µm maximum
Resolution (analog transducer)		16 bit; 0,0015% (Minimum 1 µm)
Baud Rate (Can-Bus transducer)		Selectable: 1000, 500, 250 and 125 Kbit/sec.
Linearity tollerance (uncorrected)		< ± 0,01 % F.S. (minimum ± 40 µm) indipendent of external temperature influence
Repeatability		< ± 0,001 % F.S. (minimum ± 2,5 µm)
Hysteresis		< 4 µm
Connection type		Integrated connector or cable
Input voltage		24 V d.c. (+ 20 % / - 15%)
Current drain (analog transducer)		100 mA typical
Current drain (SSI transducer)		70 mA typical
Current drain (Can-Bus transducer)		90 mA typical
Ripple		< 1 % peak to peak
Temperature coefficient		< 15 ppm/° C
Electric strength		500 V (D.C. ground to machine ground)
Operating temperature		- 40° C ... + 75° C
EMC-Test		DIN IEC 801-4 / type 4 / CE qualified
Shock rating		100 g (single hit) / IEC-Standard 68-2-27
Vibration rating		5 g / 10 -150 Hz / IEC-Standard 68-2-6
Pressure rating		350 bar / 700 peak pressure)
Protection degree		IP 67 (if mating connector is correctly fitted)
Threaded flange		M 18 x 1,5
Magnet type		GF plastic with permanent magnets



Ordering code for analog type RH transducer

Features	Descriptions	Code
Transducer type	Linear-analog with rod housing	RH
Flange type	Threaded flange M 18 x 1,5 (standard)	M
Measuring range	Analog: from 50 to 7600 mm (steps 50 mm up to 1000 mm stroke; greater step of 250 mm)	-
Connection type	Screw connector with 6 pins M16 Cable PVC 2 mt. with or without connector Option: R01-R10 (Cable length 1-10 m) Cable PUR 2 mt. with or without connector Option: H01-H10 (Cable length 1-10 m)	D60 R02 H02
Input voltage	+ 24 V C.C.	1
Output	0 ... 10 V 10 ... 0 V -10 ... +10 V +10 ... -10 V 4 ... 20 mA 20 ... 4 mA 0 ... 20 mA 20 ... 0 mA	V01 V11 V21 V31 A01 A11 A21 A31

Ordering code for analog type RH transducer

R	H	M			M		1		
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Ordering code for Sincrono-Serial type RH transducer

Features	Description	Code
Transducer type	Sincrono-Serial (SSI) with rod housing	RH
Flange type	Threaded flange M 18 x 1,5 (standard)	M
Stroke length	Standard from 25 to 7600 mm	-
Connection type	Connector with 6 pins Complete of PUR cable 2mt (max 10m on request) without connector, option P01-P10 (1-10m)	D70 P02
Input voltage	+ 24 V d.c.	1
Data length	25 bit 24 bit 26 bit	1 2 3
Data format	Binary Gray	B G
Resolution	0,005 mm 0,01 mm 0,05 mm 0,1 mm 0,02 mm 0,002 mm 0,001 mm	1 2 3 4 5 6 8
Performance	Standard	1
Options	Measuring direction forward Measuring direction reverse Measuring direction forward, synchronized measurement	00 01 02

Ordering code for SSI type RH transducer

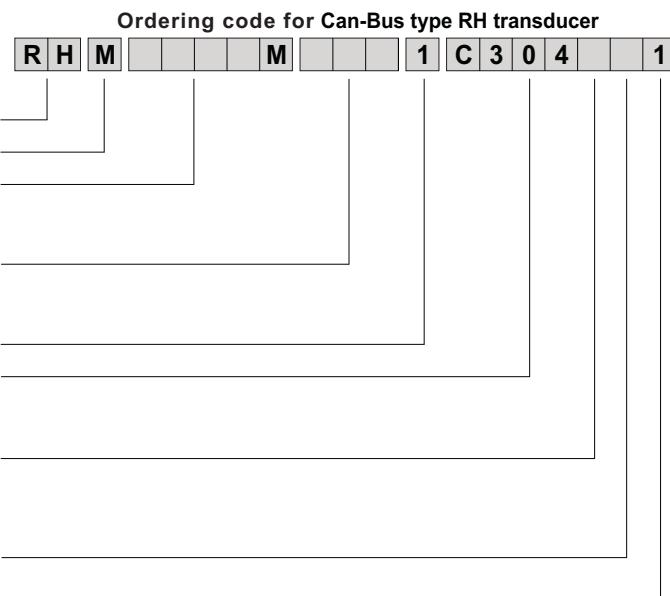
R	H	M			M		1	S		1	
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ISO 6020/1 05 Series

Ordering code for Can-Bus type RH transducer

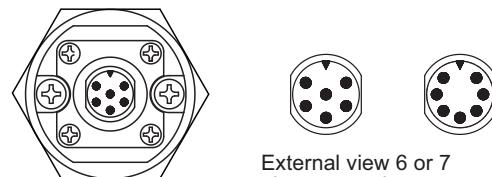
Features	Description	Code
Transducer type	Can-Bus with rod housing	RH
Flange type	Threaded flange M 18 x 1,5 (standard)	M
Measuring range	Standard from 25 to 7600 mm	-
Connection type	Screw connector with 6 pins Connectors (2) IN/OUT-Bus Complete of PUR cable 2 mt. Option: P01-P10 (Cable length 1-10 m)	D60 D62 P02
Input voltage	+ 24 V d.c.	1
Protocol	Can-Open protocol	304
Baud rate	1000 KBit/s 500 KBit/s 250 KBit/s 125 KBit/s	1 2 3 4
Resolution	5 µm (Standard) 2 µm	1 2
Cycle time	Standard	1



Electrical connections

T5 series CMB hydraulic cylinders come complete with all the manufacturer's technical documentation regarding the identification and wiring of transducer connectors.

For all further technical information regarding the installation and/or electrical connection of transducers, contact our Technical Department.



External view 6 or 7 pins connection

Storage and maintenance

To guarantee the cylinders a long life, CMB recommends you follow the following maintenance rules extremely carefully:

- Store the cylinders in a closed, dry environment in a vertical position with the rod pointing upwards to reduce the chance of corrosion taking place inside due to condensation.
- The rod, screw threads, centres and all the accessories applied to the rod and cap must be protected not only from aggressive agents but also from knocks which could compromise their proper working.
- The protective caps fitted on the connections must not be removed until the time of installation in order to prevent dirt and/or foreign bodies from entering the cylinder.
- After installation, periodically check the cylinder to make sure there are no traces of oil due to the seals wearing out or any damage to mechanical parts. If there are, provide for their replacement as soon as possible.
- When in function, make sure the rod does not rotate around its own axis. In the event that rotation becomes necessary, remove supply pressure and proceed with the operation.
- The seals kits supplied by CMB as well as spare parts must be stocked in a dry environment and direct contact with sources of heat and direct exposure to sunlight must be avoided.
- If it becomes necessary to re-mount the cylinders, tighten the screws diagonally, applying a gradual coupling torque until the maximum value given in the chart is reached (values refer to dry threads):

Bore (mm)	25	32	40	50	63	80	100	125	160	200	250	320
Screw in class 12.9	M5	M6	M8	M10	M12	M12	M12	M14	M18	M22	M27	M30
Coupling torque (Nm)	9.5	16	39	77	135	135	135	215	455	870	1650	2250

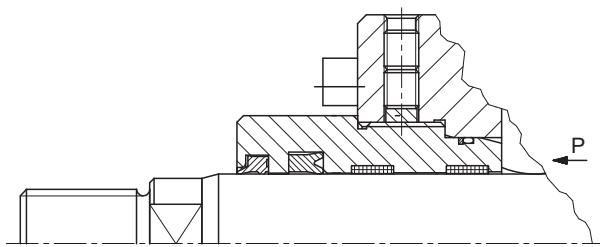


Replacing bush seals

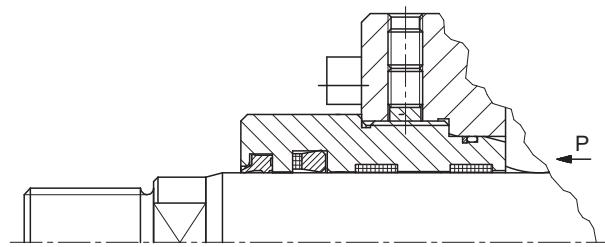
The presence of leaking fluid in proximity of the bush means that the seals need replacing.

To replace these, dismantle the mechanical parts and worn out seals making sure you follow the recommendations given below very carefully, remembering that in many cases poor functioning is due exclusively to the seals not being fitted properly:

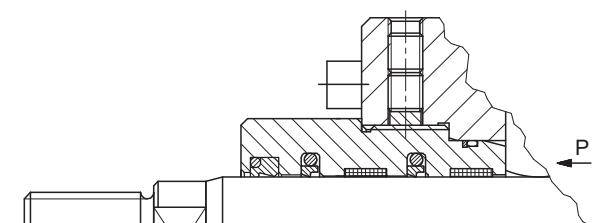
- Remove the supply pressure and drain off the remaining hydraulic fluid present in the cylinder chamber.
- Unscrew the retention grub screw and dismantle the flange bush, sliding it along the rod to extract it.
- After dismantling the worn-out seals, wash the bush carefully so that it is perfectly clean, making sure it is free from all metal particles and that there is no scoring or surface flaws of any kind on it; if these are present, replace it by requesting the spare part from CMB.
- Lubricate the new seals and bush using the same hydraulic fluid used in the installation or another type of compatible fluid.
- Carefully check the direction the seals lie in with respect to the direction the hydraulic thrust fluid works in as highlighted in the figures below.



Standard bush



Bush for water and glycol mixtures,
high temperatures and/or aggressive fluids

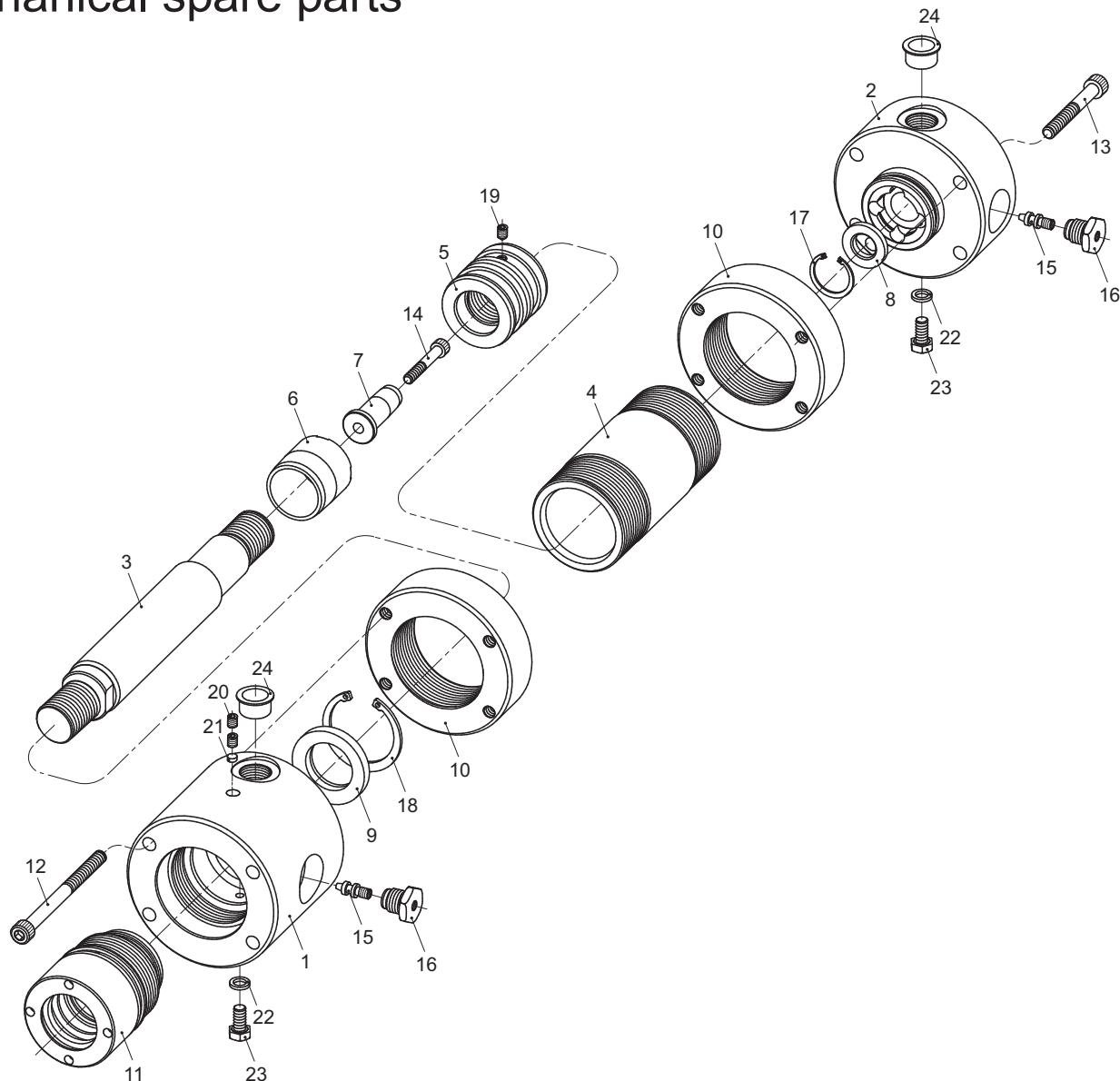


Low friction bush

- Install the seals in the bush, fitting them evenly without the use of metal tools with sharp edges making sure the seals do not remain deformed for long periods of time.
- When mounting the bush, be careful not to damage the seals by these coming into contact with the rod thread screw and rotate the bush to facilitate fitting it onto the rod.
- Slide the bush along the rod and screw it down into the flange locking it into position using the retention grub screw.

ISO 6020/1 05 Series

Exploded view showing 05 series cylinders mechanical spare parts

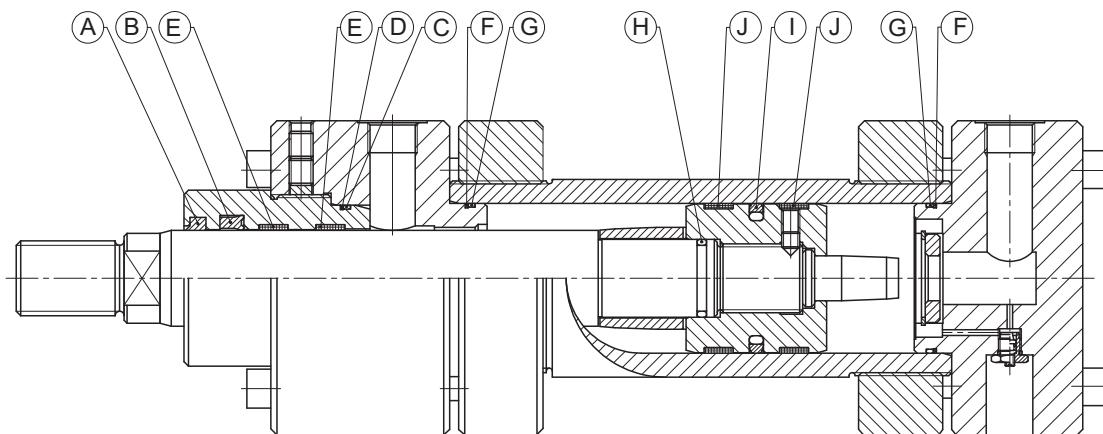


Tab.1 - Mechanical spare parts for 05 series cylinders

Pos.	Description	Notes
1	Head	-
2	Cap	-
3	Rod	-
4	Cylinder tube	-
5	Piston	-
6	Front cushioning sleeve	Only if fitted with cushion
7	Rear cushioning sleeve	Only if fitted with cushion
8	Rear cushioning bush	Only if fitted with cushion
9	Front cushioning bush	Bores 160, 180, 200, 250, 320 only if fitted with cushion
10	Locking flange	-
11	Rod bushing	-
12	Screw fixing head	-
13	Screw fixing cap	-

Pos.	Description	Notes
14	Screw fixing rear cushioning	Bores 160, 180, 200, 250 and 320 only if fitted with cushion
15	Adjustment cushioning screw	Only if fitted with cushion
16	Cushion needle valve cartridge	Only if fitted with cushion
17	Rear cushioning elastic ring	Only if fitted with cushion
18	Front cushioning elastic ring	Bores 160, 180, 200, 250 and 320 only if fitted with cushion
19	Grub screw locking piston	-
20	Grub screw locking rod bushing	-
21	Bushing thread-braking pellet	-
22	Copper washer	Only if fitted with air bleeds
23	Air bleeds screw	Only if fitted with air bleeds
24	Screw thread protection cap	-

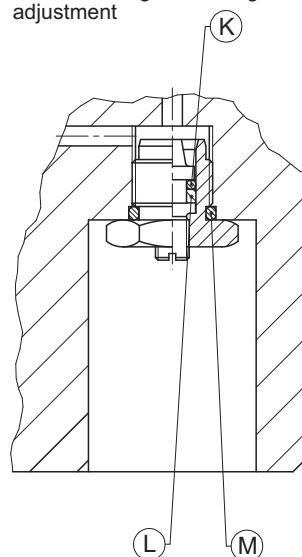
Spare seals kit for standard 05 series cylinders and for 05 series with inductive sensors



Tab.2 - Spare seals kit for standard 05 series cylinders and for 05 series with inductive sensors

Pos.	Description	Notes
A	Scraper	-
B	Rod lipseal	-
C	Rod bushing O-Ring	-
D	Rod bushing O-Ring back up washer	-
E	Rod guide ring	-
F	Tube cylinder O-Ring	-
G	Tube cylinder O-Ring back up washer	-
H	Piston O-Ring	-
I	Piston seal	-
J	Piston guide ring	-
K	Cushioning screw O-Ring	Only if fitted with cushion
L	Cushioning needle valve cartridge O-Ring back up washer	Only if fitted with cushion
M	Cushioning needle valve cartridge O-Ring	Only if fitted with cushion

Detail showing cushioning adjustment

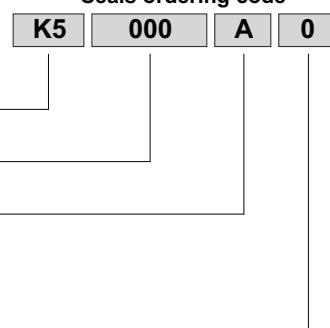


The following tables describe the procedure for ordering complete spare seals kit:

Tab.3 - Complete seals kit for standard 05 series cylinders and for 05 series with inductive sensors

Features	Description	Code
Kit series	Complete seals kit for 05 series cylinders compliant with ISO 6020/1 standards and for 05 series with inductive sensors	K5
Bore	Specify bore in mm	-
Rod	Specify rod diameter by letter (see cylinder ordering code at page 2)	A
Seals type	Normal (Nitrile rubber, Polyurethane, PTFE charged bronze) High temperature and/or aggressive fluid (Fluoroelastomer, PTFE charged bronze) Water and glycol mixtures (Nitrile rubber, PTFE charged bronze) Low friction (Nitrile rubber, PTFE charged bronze)	0 1* 7 9

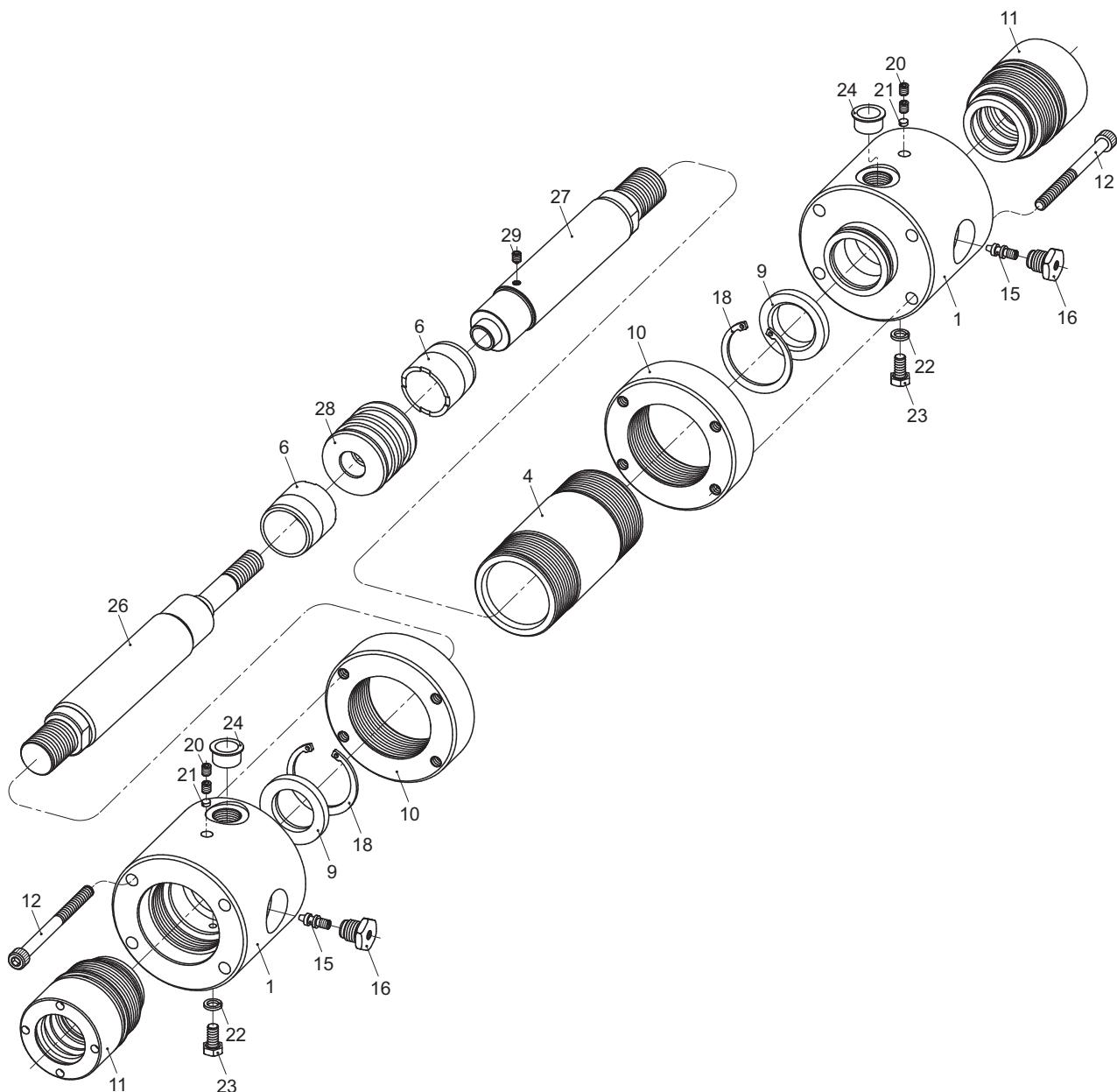
Seals ordering code



* Maximum working temperature for 05 series cylinders equipped with inductive sensors: 70 °C

ISO 6020/1 05 Series

Exploded view showing mechanical spare parts for 05 series double rod cylinders

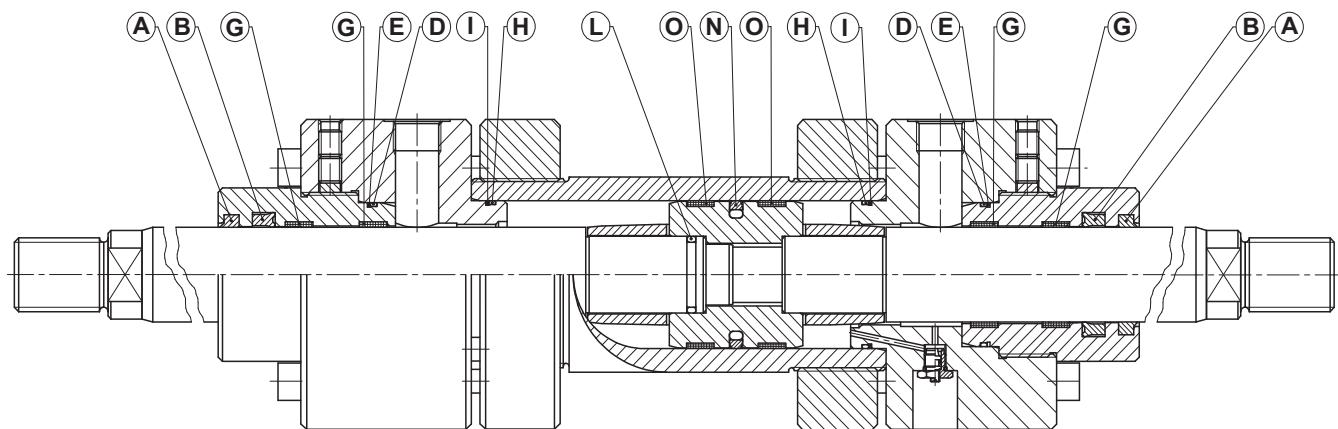


Tab.4 - Mechanical spare parts for 09 series double rod cylinders

Pos.	Description	Notes
1	Head	-
4	Cylinder tube	-
6	Front cushioning sleeve	Only if fitted with cushion
9	Front cushioning bush	Bores 160, 180, 200, 250 and 320 only if fitted with cushion
10	Locking flange	-
11	Rod bushing	-
12	Screw fixing head	-
15	Adjustment cushioning screw	Only if fitted with cushion
16	Cushion needle valve cartridge	Only if fitted with cushion
18	Front cushioning elastic ring	Bores 160, 180, 200, 250 and 320 only if fitted with cushion

Pos.	Description	Notes
20	Grub screw locking rod bushing	-
21	Bushing thread-braking pellet	-
22	Copper washer	Only if fitted with air bleeds
23	Air bleeds screw	Only if fitted with air bleeds
24	Screw thread protection cap	-
25	Grub screw locking rod	-
26	Front rod	-
27	Rear rod	-
28	Piston	-

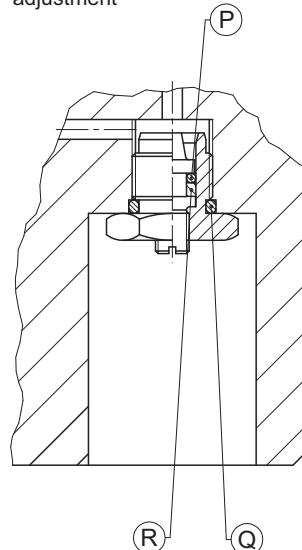
Spare seals kit for standard 05 series double rod cylinders and for 05 series double rod with inductive sensors



Tab.5 - Spare seals kit for standard 05 series double rod cylinders and for 05 series double rod with inductive sensors

Pos.	Description	Notes
A	Scraper	-
B	Rod lipseal	-
D	Rod bushing O-Ring	-
E	Rod bushing O-Ring back up washer	-
G	Rod guide ring	-
H	Tube cylinder O-Ring	-
I	Tube cylinder O-Ring back up washer	-
L	Piston O-Ring	-
N	Piston seal	-
O	Piston guide ring	-
P	Cushioning screw O-Ring	Only if fitted with cushion
Q	Cushioning needle valve cartridge O-Ring	Only if fitted with cushion
R	Cushioning needle valve cartridge O-Ring back up washer	Only if fitted with cushion

Detail showing cushioning adjustment

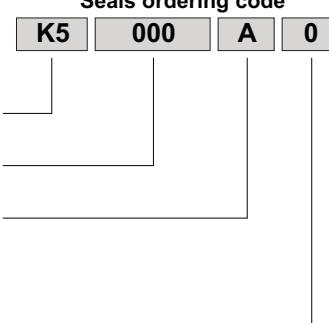


The following tables describe the procedure for ordering complete spare seals kit:

Tab.6 - Complete seals kit for standard 05 series double rod cylinders and for 05 series double rod with inductive sensors

Features	Description	Code
Kit series	Complete seals kit for 05 series double rod cylinders compliant with ISO 6020/1 standards and for 05 series double rod with inductive sensors	K5
Bore	Specify bore in mm	-
Rod	Specify rod diameter by letter (see cylinder ordering code at page 2)	A
Seals type	Normal (Nitrile rubber, Polyurethane, PTFE charged bronze) High temperature and/or aggressive fluid (Fluoroelastomer, PTFE charged bronze) Water and glycol mixtures (Nitrile rubber, PTFE charged bronze) Low friction (Nitrile rubber, PTFE charged bronze)	2 3* 8 10

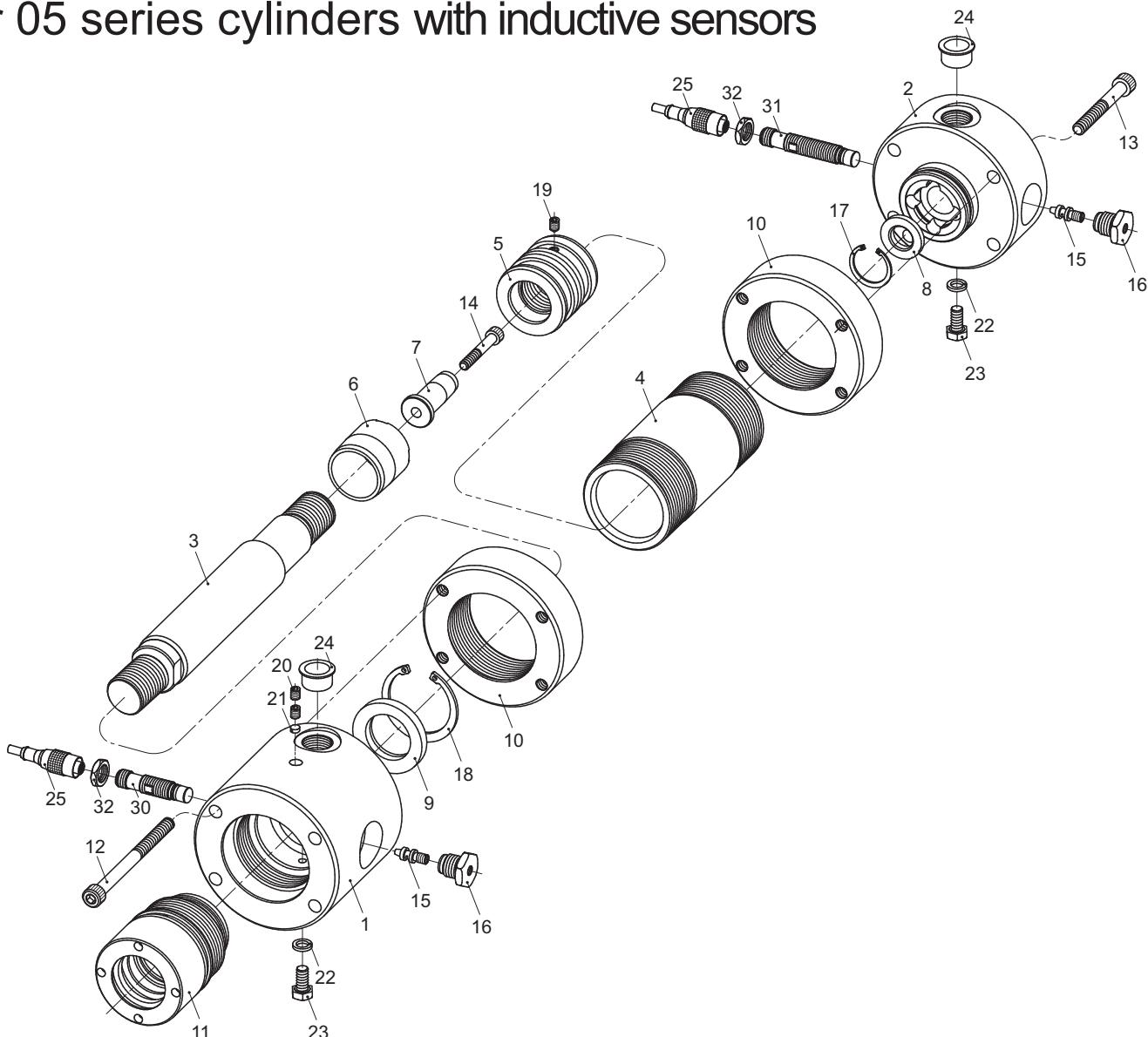
Seals ordering code



* Maximum working temperature for 09 series double rod cylinders equipped with inductive sensors: 70 °C

ISO 6020/1 05 Series

Exploded view showing mechanical spare parts for 05 series cylinders with inductive sensors

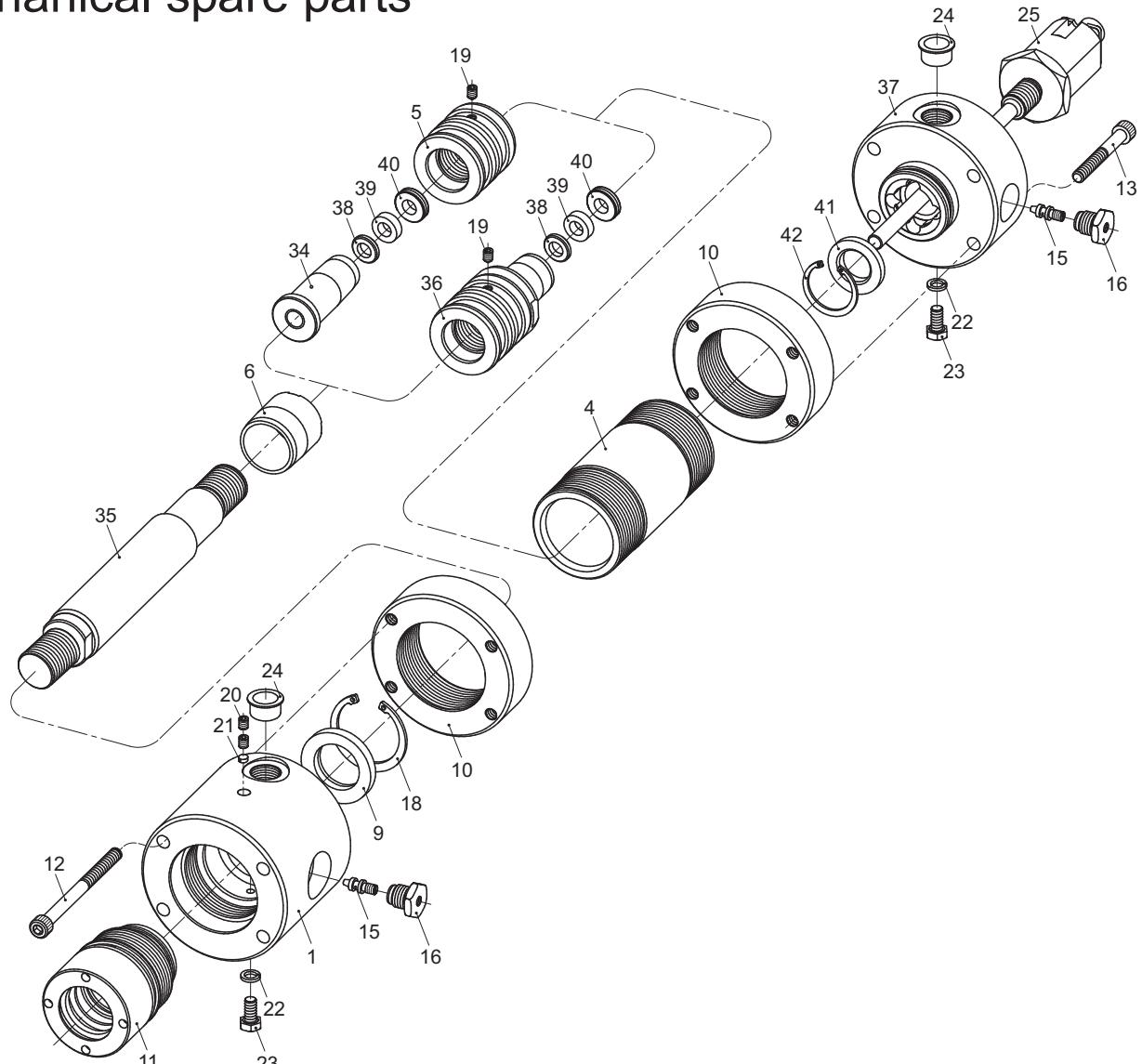


Tab.7 - Mechanical spare parts for 05 series cylinders with inductive sensors

Pos.	Description	Notes
1	Head	-
2	Cap	-
3	Rod	-
4	Cylinder tube	-
5	Piston	-
6	Front cushioning sleeve	-
7	Rear cushioning sleeve	-
8	Rear cushioning bush	-
9	Front cushioning bush	Bores 160, 180, 200, 250 and 320 only if fitted with cushion
10	Locking flange	-
11	Rod bushing	-
12	Screw fixing head	-
13	Screw fixing cap	-
14	Screw fixing rear cushioning	Bores 160, 180, 200, 250 and 320 only if fitted with cushion
15	Adjustment cushioning screw	-

Pos.	Description	Notes
16	Cushion needle valve cartridge	-
17	Rear cushioning elastic ring	-
18	Front cushioning elastic ring	Bores 160, 180, 200, 250 and 320 only if fitted with cushion
19	Grub screw locking piston	-
20	Grub screw locking rod bushing	-
21	Bushing thread-braking pellet	-
22	Copper washer	Only if fitted with air bleeds
23	Air bleeds screw	Only if fitted with air bleeds
24	Screw thread protection cap	-
25	Connector	-
30	Head inductive sensor	-
31	Cap inductive sensor	-
32	Nut locking sensor into position	-

Exploded view showing T5 series cylinders mechanical spare parts



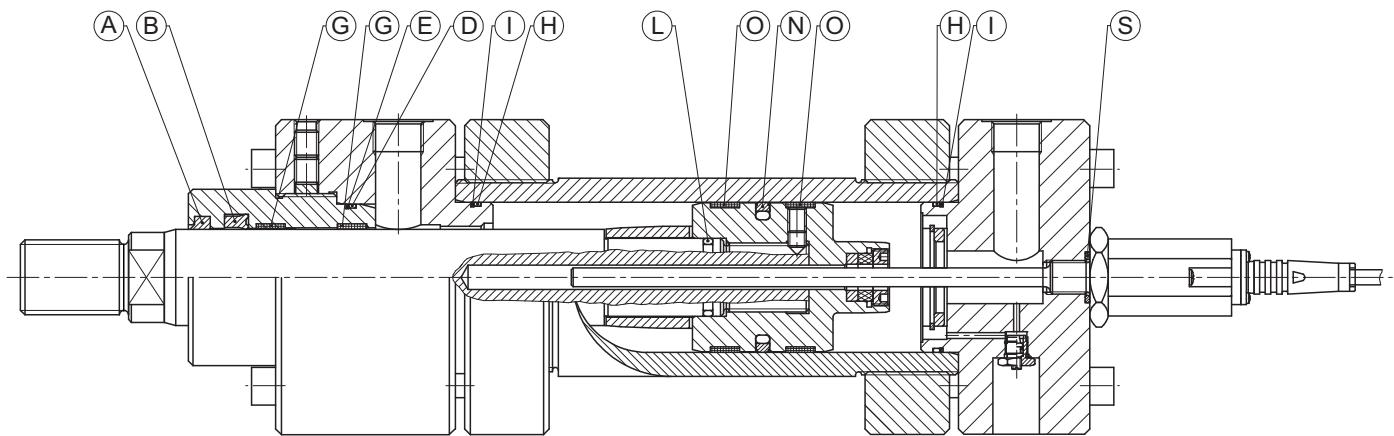
Tab.8 - Mechanical spare parts for T5 series cylinders

Pos.	Description	Notes
1	Head	-
4	Cylinder tube	-
5	Piston	Bores 160, 180, 200, 250 and 320 only if fitted with cushion
6	Front cushioning sleeve	Only if fitted with cushion
9	Front cushioning bush	Bores 160, 180, 200, 250 and 320 only if fitted with cushion
10	Locking flange	-
11	Rod bushing	-
12	Screw fixing head	-
13	Screw fixing cap	-
15	Adjustment cushioning screw	Only if fitted with cushion
16	Cushion needle valve cartridge	Only if fitted with cushion
18	Front cushioning elastic ring	Bores 160, 180, 200, 250 and 320 only if fitted with cushion
19	Grub screw locking piston	-
20	Grub screw locking rod bushing	-
21	Bushing thread-braking pellet	-

Pos.	Description	Notes
22	Copper washer	-
23	Air bleeds screw	-
24	Screw thread protection cap	-
25	Linear position transducer	Optional (supplied only on request)
34	Cushioning sleeve with magnet holder for linear transducer	Bores 160, 180, 200, 250 and 320 only if fitted with cushion
35	Rod for linear transducer	-
36	Piston for linear transducer	Bores 50, 63, 80, 100 and 125
37	Cap for linear transducer	-
38	Amagnetic front spacer	-
39	Toroidal positioning magnet	-
40	Ring locking magnet	-
41	Rear cushioning bush	Only if fitted with cushion
42	Rear cushioning elastic ring	Only if fitted with cushion

ISO 6020/1 05 Series

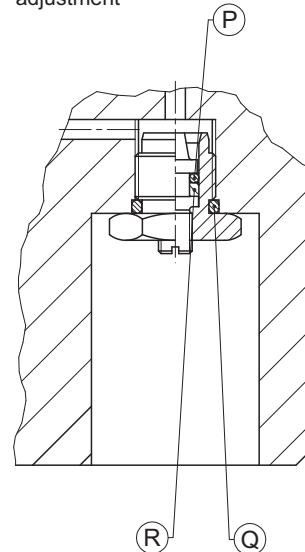
Spare seals kit for T5 series cylinders



Tab.9 - Spare seals kit for T5 series cylinders

Pos.	Description	Notes
A	Raschiatore	-
B	Rod lipseal	-
D	Rod bushing O-Ring	-
E	Rod bushing O-Ring back up washer	-
G	Rod guide ring	-
H	Tube cylinder O-Ring	-
I	Tube cylinder O-Ring back up washer	-
L	Piston O-Ring	-
N	Piston seal	-
O	Piston guide ring	-
P	Cushioning screw O-Ring	Only if fitted with cushion
Q	Cushioning needle valve cartridge O-Ring	Only if fitted with cushion
R	Cushioning needle valve cartridge O-Ring back up washer	Only if fitted with cushion
S	Position transducer O-Ring	Only if fitted with cushion

Detail showing cushioning adjustment

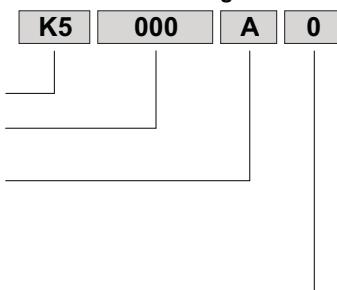


The following tables describe the procedure for ordering complete spare seals kit:

Tab.10 - Complete seals kit for T9 series (designed to take magnetostrictive transducer)

Features	Description	Code
Kit series	Complete seals kit for T5 cylinders compliant with ISO 6020/1 standards	K5
Bore	Specify bore in mm	-
Rod	Specify rod diameter by letter (see cylinder ordering code at page 2)	A
Seals type	Normal (Nitrile rubber, Polyurethane, PTFE charged bronze) High temperature and/or aggressive fluid (Fluoroelastomer, PTFE charged bronze) Water and glycol mixtures (Nitrile rubber, PTFE charged bronze) Low friction (Nitrile rubber, PTFE charged bronze)	19 18* 6 13

Seals ordering code



* Maximum working temperature: 70 °C

Standard and large-sized connections

The cylinders in the 05 series are supplied with BSP screw-threaded cylindrical connections with housing for sealing washers. In the event that it is necessary to use oil inlets different from the ones illustrated in the sizing tables of this catalogue, larger-sized connections, SAE flange couplings and screw threading not covered by ISO 6020/1 standards are available. The table below gives all the possible inlet connections available for the 05 series.

Bore Ø mm	Oil inlets thread										
	Standard	On request									
		BSP	Metric	NPT	UNF-2B	Flange ISO 6162.2	BSP	Metric	NPT	UNF-2B	Flange ISO 6162.2
25	1/4"	M12x1.5	1/4"	7/16" - 20	-	3/8"	M16x1.5	3/8"	9/16" - 18	-	-
32	3/8"	M16x1.5	3/8"	9/16" - 18	-	1/2"	M22x1.5	1/2"	3/4" - 16	-	-
40	1/2"	M22x1.5	1/2"	3/4" - 16	-	3/4"	M27x2	3/4"	1" 1/16 - 12	-	-
50	1/2"	M22x1.5	1/2"	3/4" - 16	-	3/4"	M27x2	3/4"	1" 1/16 - 12	-	-
63	3/4"	M27x2	3/4"	1" 1/16 - 12	13	1"	M33x2	1"	1" 5/16 - 12	-	-
80	3/4"	M27x2	3/4"	1" 1/16 - 12	13	1"	M33x2	1"	1" 5/16 - 12	-	-
100	1"	M33x2	1"	1" 5/16 - 12	19	1" 1/4	M42x2	1" 1/4	1" 5/8 - 12	25	-
125	1"	M33x2	1"	1" 5/16 - 12	19	1" 1/4	M42x2	1" 1/4	1" 5/8 - 12	25	-
160	1" 1/4	M42x2	1" 1/4	1" 5/8 - 12	25	1" 1/2	M48x2	1" 1/2	1" 7/8 - 12	32	-
200	1" 1/4	M42x2	1" 1/4	1" 5/8 - 12	25	1" 1/2	M48x2	1" 1/2	1" 7/8 - 12	32	-
250	1" 1/2	M48x2	1" 1/2	1" 7/8 - 12	32	2"	M60x2	2"	2" 1/2-12	38	-
320	1" 1/2	M48x2	1" 1/2	1" 7/8 - 12	32	2"	M60X2	2"	2" 1/2-12	38	-

Single-acting cylinders

CMB cylinders are supplied as standard with double-acting function.

They may however be used as single-acting cylinders by feeding the cylinder from just one side of the piston and delegating the task of repositioning the rod to an outside load when the feeding pressure ceases to work. The unused connection must be connected to a source of external lubrication to allow lubricated air in and out of the chamber not supplied with hydraulic oil.

Double rod cylinders

Double rod cylinders are produced using two separate rods, one screwed onto the end of the other.

As a consequence of this type of connection, on all double rod cylinders, the rod into which the other one is screwed is inevitably less resistant.

For identification purposes, the stronger rod is marked at the end with the letter "M".

CMB recommends the use of the weaker rod only for less demanding applications.

Choice of diameter of rod

To guarantee sufficient resistance at peak loading, cylinder rods undergoing certain conditions of pushing force must be checked following the calculation procedure given below:

- Establish the mounting type and most suitable rod connection to be used for the application the cylinder is to be used for. Using the table below (Tab.11), establish the stroke factor corresponding to the conditions the cylinder is to work in.
- Calculate the basic length by multiplying the working stroke by the stroke factor determined above.
- Determine the push force by multiplying the total cross-section of the cylinder by the working pressure or by using Table 12 on page 39.
- On the diagram in Fig. 3 on page 38, find the intersection point between the coordinates relating to the pushing force and the basic length.
- The rod diameter to be chosen is the one given by the curve immediately above the previously found intersection point.
- Rods of smaller diameter than the one given by the diagram do not ensure sufficient mechanical resistance.

Spacers

Spacers prevent the piston from hitting against the head when the rod is completely extended and guarantee the presence of a space that can be varied by the number of limiting devices inserted between the piston and cylinder head.

Tab. 11 - Stroke factor choice table

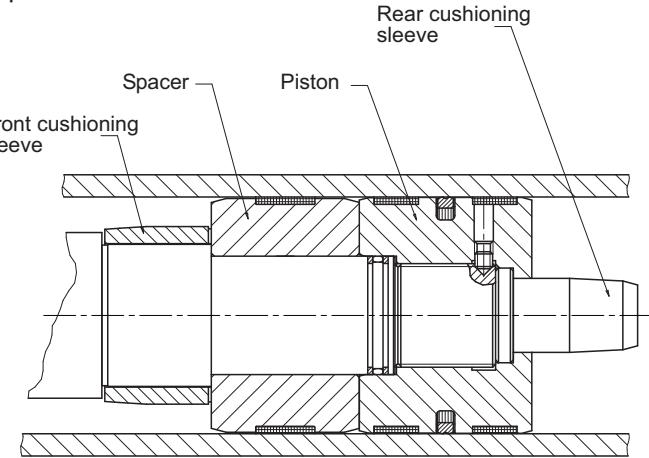
Mounting style	Rod connection	Mounting	Stroke factor
13 15	Fixed and supported		2
	Fixed and rigidly guided		0,5
	Jointed and rigidly guided		0,7
14 16	Fixed and supported		4
	Fixed and rigidly guided		1
	Jointed and rigidly guided		1,5

This enables the lever arm present between the bush and piston to be increased, thereby increasing as a consequence the rigidity of the rod. The number of spacers to be used depends on the loading conditions and the mounting style, set out in the right-hand column of the diagram in Fig. 3; each spacer has a length of 50 mm.

Remember that the dimensions of the cylinder are increased by 50 mm multiplied by the number of spacers used with respect to the figures given in the support tables. If the number of spacers required falls in the grey area, please consult our Technical Department so that a more specific cylinder can be designed to your requirements.

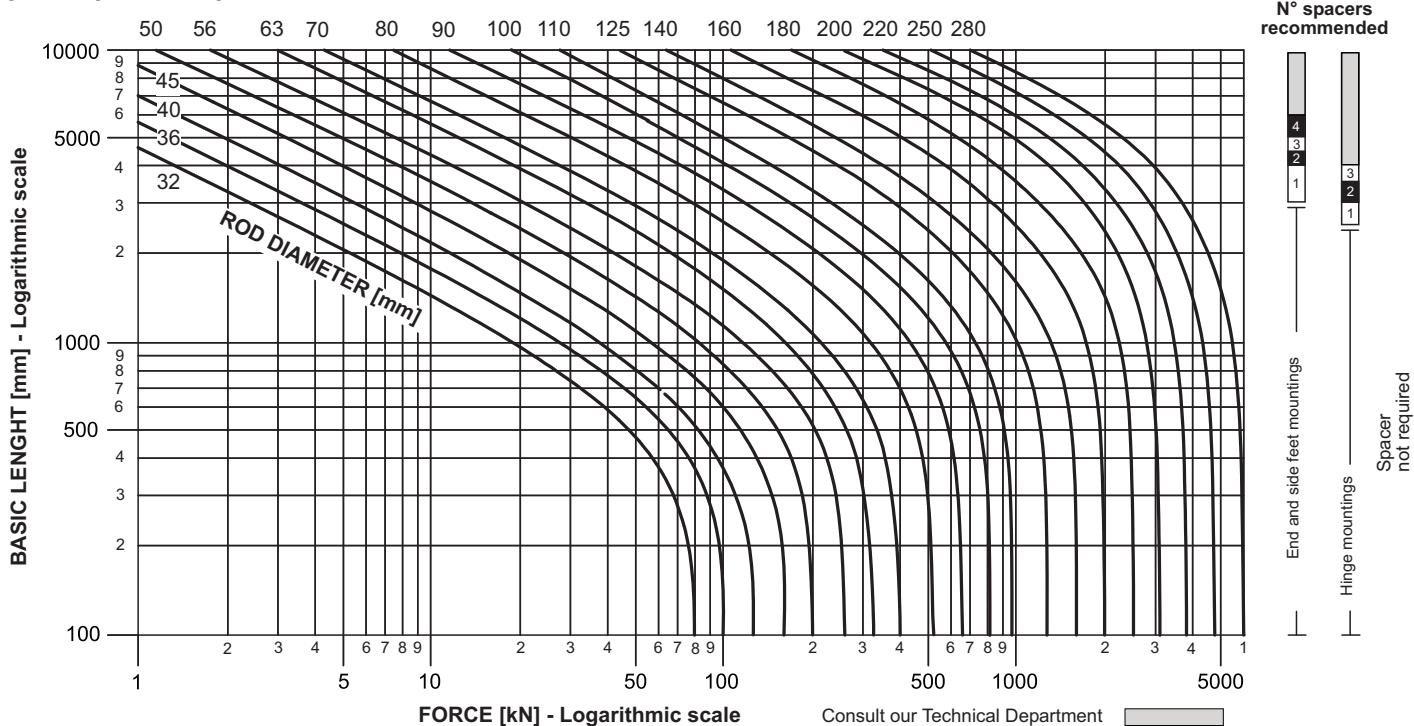
Example of code: **05125T2250P06/2**

Cylinder to ISO 6020/1 standards - bore 125 - rod 90 - working stroke 2250 - cushioning on both ends - intermediate fixed trunnion (ISO MT4) - N° 2 spacers ($L=50\times 2=100$ mm). The quotas ZB, ZJ and PJ obtained from the support tables must be increased by 100 mm due to the presence of four spacers.



Mounting style	Rod connection	Mounting	Stroke factor
07	Jointed and supported		4
	Jointed and rigidly guided		2
03	Fixed and supported		2
	Fixed and rigidly guided		0,5
	Jointed and rigidly guided		0,7
06	Jointed and supported		3
	Jointed and rigidly guided		1,5

Fig. 3 - Diagram showing choice of rod



Theoretical velocities

The drawing in Fig.4 represents the conventional hydraulic diagram of a cylinder: note how the fluid alternately feeds the front chamber through the 4/2 distributor when the rear chamber is discharging and vice versa.

The theoretical speeds generated by the cylinder can be obtained from the following correlations:

Rod speed when pushing:

$$V_s = \frac{Q \cdot 1000}{A_p \cdot 60}$$

Rod speed when pulling:

$$V_t = \frac{Q \cdot 1000}{A_a \cdot 60}$$

where:

V_s = Rod pushing speed in m/s

V_t = Rod pulling speed in m/s

Q = Flow rate in l/mm

A_p = Piston area in mm²

A_a = Annular area in mm²

A_s = Rod area in mm²

Q_d = Flow rate through directional control valve in l/min

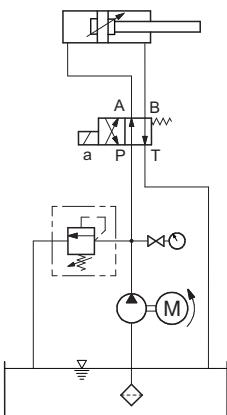


Fig. 4

The drawing in Fig.5 represents the diagram of the regenerative hydraulic circuit of a cylinder.

This diagram finds application in systems which require high speeds combined with relatively low degrees of force: note that the ring chamber is always in communication with the pump while the total chamber is connected alternately by means of the 4/2 distributor to the pump and therefore the rod protrudes by the difference in the areas or on discharge and therefore the rod re-enters.

The theoretical speeds generated by the cylinder can be obtained from the following correlations:

Rod speed when pushing:

$$V_s = \frac{Q \cdot 1000}{A_s \cdot 60}$$

Rod speed when pulling:

$$V_t = \frac{Q \cdot 1000}{A_p \cdot 60}$$

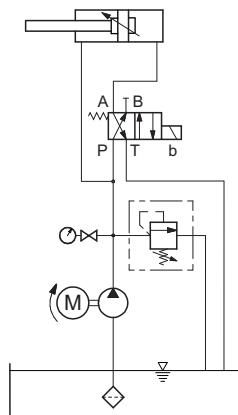


Fig. 5

In installations with a regenerating circuit the distributor must be correctly sized. The capacity transiting through the distributor is calculated as follows:

$$Q_d = \frac{V_s \cdot A_p \cdot 60}{1000}$$

ISO 6020/1 05 Series

Theoretical forces developed by the cylinder

When choosing a hydraulic cylinder, it is necessary to check that on the installation the nominal pressure values indicated for this series of products are not exceeded. These for continuous service are equal to 160 bar even if the sizing of the cylinders allows maximum working peaks of 240 bar to be achieved for short periods of time. Having established the load and working pressure, and after having determined the most suitable diameter of the rod to guarantee resistance at peak loads (see pages 37 and 38), the cylinder bore may be chosen from the table below by identifying the working pressure and the closest pushing or pulling force generated to the one required.

Tab. 12 - Theoretical forces developed by the cylinder

Bore Ø mm	Rod Ø mm	Working Area		25 bar**		50 bar**		75 bar**		100 bar**		150 bar**		200 bar**		250 bar**	
		Push	Pull	Push	Pull	Push	Pull	Push	Pull	Push	Pull	Push	Pull	Push	Pull	Push	Pull
		mm²	mm²	kN*	kN*	kN*	kN*	kN*	kN*	kN*	kN*	kN*	kN*	kN*	kN*	kN*	kN*
25	14	490,87	336,94	1,2	0,8	2,5	1,7	3,7	2,5	4,9	3,4	7,4	5,1	9,8	6,7	12,3	8,4
	18		236,40		0,6		1,2		1,8		2,4		3,5		4,7		5,9
32	18	804,25	549,78	2,0	1,4	4,0	2,7	6,0	4,1	8,0	5,5	12,1	8,2	16,1	11,0	20,1	13,7
	22		424,11		1,1		2,1		3,2		4,2		6,4		8,5		10,6
40	22	1256,64	876,51	3,1	2,2	6,3	4,4	9,4	6,6	12,6	8,8	18,8	13,1	25,1	17,5	31,4	21,9
	28		640,88		1,6		3,2		4,8		6,4		9,6		12,8		16,0
50	28	1963,49	1347,74	4,9	3,4	9,8	6,7	14,7	10,1	19,6	13,5	29,5	20,2	39,3	27,0	49,1	33,7
	36		945,62		2,4		4,7		7,1		9,5		14,2		18,9		23,6
63	36	3117,24	2099,37	7,8	5,2	15,6	10,5	23,4	15,7	31,2	21,0	46,8	31,5	62,3	42,0	77,9	52,5
	45		1526,8		3,8		7,6		11,5		15,3		22,9		30,5		38,2
80	45	5026,54	3436,11	12,6	8,6	25,1	17,2	37,7	25,8	50,3	34,4	75,4	51,5	100,5	68,7	125,7	85,9
	56		2563,54		6,4		12,8		19,2		25,6		38,5		51,3		64,1
100	56	7853,98	5390,97	19,6	13,5	39,3	27,0	58,9	40,4	78,5	53,9	117,8	80,9	157,1	107,8	196,3	134,8
	70		4005,53		10,0		20,0		30,0		40,1		60,1		80,1		100,1
125	70	12271,84	8423,39	30,7	21,1	61,4	42,1	92,0	63,2	122,7	84,2	184,1	126,4	245,4	168,5	306,8	210,6
	90		5910,12		14,8		29,6		44,3		59,1		88,7		118,2		147,8
160	90	20106,18	13744,46	50,3	34,4	100,5	68,7	150,8	103,1	201,1	137,4	301,6	206,2	402,1	274,9	502,7	343,6
	110		10602,87		26,5		53,0		79,5		106,0		159,0		212,1		265,1
200	110	31415,90	21912,59	78,5	54,8	157,1	109,6	235,6	164,3	314,2	219,1	471,2	328,7	628,3	438,3	785,4	547,8
	140		16022,11		40,1		80,1		120,2		160,2		240,3		320,4		400,6
250	140	49087,3	33693,58	122,7	84,2	245,4	168,5	368,2	252,7	490,9	336,9	736,3	505,4	981,7	673,9	1227,2	842,3
	180		23640,48		59,1		118,2		177,3		236,4		354,6		472,8		591,0
320	180	80424,78	54977,87	201,1	137,4	402,1	274,9	603,2	412,3	804,2	549,8	1206,4	824,7	1608,5	1099,6	2010,6	1374,4
	220		42411,50		106,0		212,1		318,1		424,1		636,2		848,2		1060,3

* 1kN = 100 Kg

** 1bar = 100000 Pa

Cushioning cones length

Bore Ø	Front cushioning cone length	Rear cushioning cone length
25	17	17
32	17	17
40	28	26
50	28	26
63	28	26
80	28	28

Bore Ø	Front cushioning cone length	Rear cushioning cone length
100	30	30
125	30	30
160	38	38
200	45	55
250	80	101
320	100	99



End of stroke cushioning

End of stroke cushioning is provided by optional braking devices available for all bores and recommended to control deceleration at the end of stroke of the load applied to the rod when the piston speed exceeds 0.1 m/s.

End of stroke braking is in all circumstances recommended because it reduces peaks in pressure and thrust transmitted through the installation thereby guaranteeing greater resistance of the cylinder to fatigue as well as of the hydraulic devices connected to the installation.

Cushioning can be provided to the head and cap or both sides without the size of the cylinder being altered. The braking speed is adjustable by means of needle valves provided with a safety anti-expulsion system to prevent the adjustment needle from being inadvertently removed from the cartridge during adjustment operations.

In comparison with cylindrical and conical cushioning systems present on the market, CMB uses special cushioning cones with 3 tapers, sized to absorb the energy developed during the end of stroke braking in a constant way, thereby drastically reducing thrust and guaranteeing progressive braking action, bringing the pressure states in the chamber up to a value that provides ideal cushioning. For cylinders with bores greater than 160 mm fitted with suspension, the heads can be fitted on request with an additional entrance which connects directly with the braking chamber. We recommend this type of coupling connected to a maximum pressure valve set at 240 bar to limit overpressure during braking.

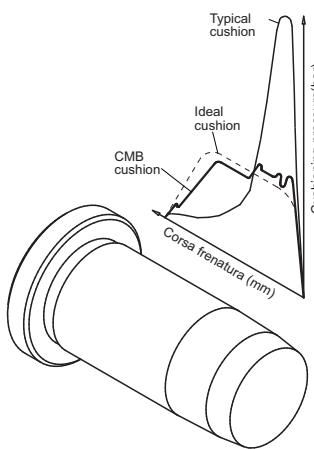


Fig. 6 - Theoretical pressure states in the braking chamber

Air bleeds

On request air bleeds on the heads can be supplied which allow for the elimination of air generated when the whole cylinder stroke is not used or when the coupling connections are not turned upwards.

Position of connections

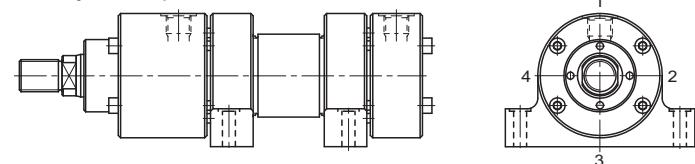
The standard positions of the input connections (**P**), end of stroke braking (**R**), air bleeds (**S**), inductive sensors (**K**) and supplementary coupling (**Y**) for the maximum pressure valve are highlighted in bold print in Table 13 at the bottom of the page.

In the event that rotated positions are required, this must be specified during the ordering stage, indicating in the order code the letter corresponding to the type of connection (**P, R, S, K or Y**) to be rotated with respect to the standard followed by the new position side (**1,2,3 or 4**) of the head and coupling respectively consistent with the sides available in the table.

In the event that no specification is made in the order code, connections will be the standard ones highlighted in the table.

Example of code: **05050L0200P08/CE R23S42K30**

Cylinder to ISO 6020/1 standards - bore 50 - rod 36 - stroke 200 - cushioning on both ends - rear spherical bearing (MP5) - standard oil feeder inlets side 1 (see table below) - cushioning side 2 on head and side 3 on cap - air bleeds side 4 on head and side 2 on cap - inductive sensor side 3 only on cap.

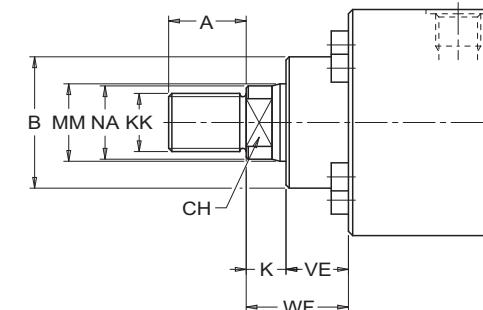


Tab. 13 - Position of available connections

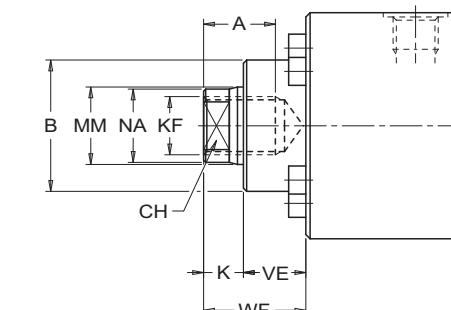
Mounting types									
00		03		06 - 07 - 08		13 - 14 - 15 - 16			
Head	Cap	Head	Cap	Head	Cap	Head	Cap	CH	KK (Metric)
1	1	1	1	1	1	1	1	16	M12x1,25
2	2	2	2	2	2	2	2	18	M14x1,5
3	3	-	-	3	3	3	3	18	M14x1,5
4	4	4	4	4	4	4	4	22	M16x1,5
1	1	1	1	1	1	1	1	22	M16X1,5
2	2	2	2	2	2	2	2	28	M20x1,5
3	3	-	-	3	3	3	3	28	M20X1,5
4	4	4	4	4	4	4	4	36	M20x1,5
1	1	1	1	1	1	1	1	36	M27x2
2	2	2	2	2	2	2	2	45	M27x2
3	3	-	-	3	3	3	3	45	M33x2
4	4	4	4	4	4	4	4	56	M33x2
1	1	1	1	1	1	1	1	56	M42x2
2	2	2	2	2	2	2	2	63	M42x2
3	3	-	-	3	3	3	3	70	M48x2
4	4	4	4	4	4	4	4	70	M48x2
1	1	1	1	1	1	1	1	85	M64x3
2	2	2	2	2	2	2	2	132	M64x3
3	3	-	-	3	3	3	3	132	M64x3
4	4	4	4	4	4	4	4	160	M80x3
1	1	-	-	1	1	1	1	160	M80x3
2	2	-	-	2	2	2	2	112	M100x3
3	3	-	-	3	3	3	3	112	M100x3
4	4	-	-	4	4	4	4	125	M125x4

DIMENSIONS OF ROD ENDS

Standard thread rod end



Style w: female thread rod end



Rod ends

ISO 6020/1 series cylinders are available with both male and female rod ends in accordance with ISO 4395 - 91 standard.

Non-regulation screw threading such as Whitworth, British Standard and American Standard Unified are also available.

On request rod ends can be produced from drawings by attaching a sketch with the sizes to be produced to the cylinder order.

Area for tightening with tools

Rods with a diameter of less than 110 mm inclusive have a flat area at the end to facilitate tightening the accessory connected to the rod using an adjustable wrench with CH opening.

Rods with a diameter of more than 140 mm inclusive are provided instead with N° 4 holes Ø at 90° produced on the diameter Ø NA indicated in the tablet to allow for tightening using a UNI 6752 - DIN 1810 hook wrench with round nose end.

Bore Ø	MM Ø	A	B ^{f8} Ø	K	VE	WF	CH	KK (Metric)	KF (Metric)
25	14	16	32	13	15	28	12	M12x1,25	M12x1,25
	18	18					15	M14x1,5	M14x1,5
32	18	18	40	13	19	32	15	M14x1,5	M14x1,5
	22	22					17	M16x1,5	M16x1,5
40	22	22	50	13	19	32	17	M16X1,5	M16X1,5
	28	28					22	M20x1,5	M20x1,5
50	28	28	60	14	24	38	22	M20x1,5	M20x1,5
	36	36					28	M27x2	M27x2
63	36	36	70	16	29	45	28	M27x2	M27x2
	45	45					36	M33x2	M33x2
80	45	45	85	18	36	54	36	M33x2	M33x2
	56	56					46	M42x2	M42x2
100	56	56	106	20	37	57	46	M42x2	M42x2
	70	63					60	M48x2	M48x2
125	70	63	132	23	37	60	60	M48x2	M48x2
	90	85					75	M64x3	M64x3
160	90	85	160	25	41	66	75	M64x3	M64x3
	110	95					90	M80x3	M80x3
200	110	95	200	30	45	75	90	M80x3	M80x3
	140	112					120	M100x3	M100x3
250	140	112	250	32	64	96	120	M100x3	M100x3
	180	125					160	M125x4	M125x4
320	180	125	250	37	71	108	160	M125x4	M125x4
	220	160					200	M160x4	M160x4

All dimensions are given in millimetres.

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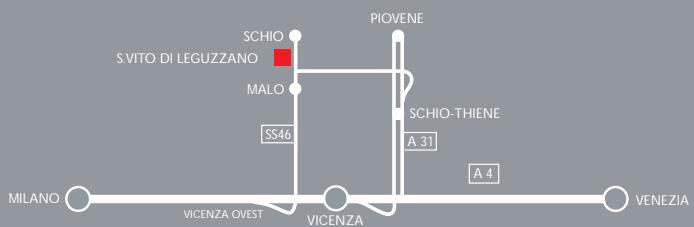
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