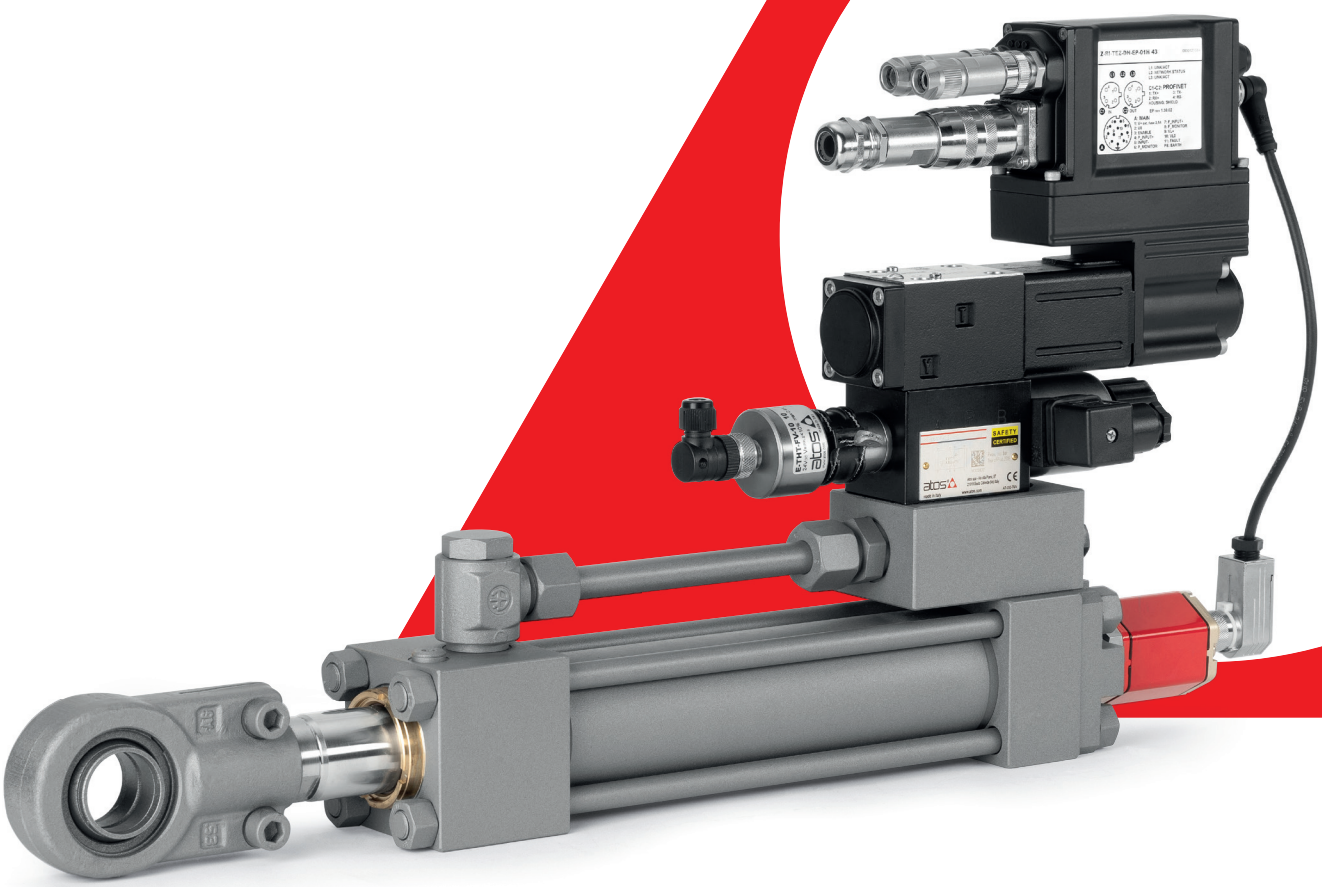
the smart electrohydraulics

CYLINDERS

CATALOG



the smart electrohydraulics

First class facilities
high level of automation
with in-line process control

Know-how
from the design to the production
of the finished product

Full product range
standard, customized, ex-proof,
stainless steel, safety certified

Advanced technology
thanks to long lasting
investments in R&D

Quality first
according to ISO 9001, including
automotive sector methods

Sales & service
worldwide network of experienced
engineers, oriented to customer care

Professional team
to quickly meet every
customer need

INDEX

CYLINDERS

		ISO	ø bores [mm]	Pmax [bar]	Table	Pag
TECHNICAL INFORMATION						
Sizing criteria for cylinders and servocylinders					B015	3
INDUSTRIAL CYLINDERS & SERVOCYLINDERS						
CK	square heads with tie rods	6020-2	25 ÷ 200	250	B137	10
CH	square heads with counterflanges	6020-2	63 ÷ 200	250	B140	18
CH	big bore sizes	6020-3	250 ÷ 400	250	B160	26
CN	round heads with counterflanges	6020-1	40 ÷ 200	250	B180	32
CC	round heads with counterflanges	6022	50 ÷ 320	320	B241	38
CK*	servocylinders with built-in position transducer	6020-2	40 ÷ 200	250	B310	44
CKS	with adjustable proximity sensors	6020-2	25 ÷ 100	150	B450	57
servoactuators						
AZC	servocylinder plus servoproportional valve with on-board driver & axis card				FS700	59
EX-PROOF CYLINDERS & SERVOCYLINDERS						
CKA	square heads with tie rods	6020-2	25 ÷ 200	250	BX500	63
STAINLESS STEEL CYLINDERS & SERVOCYLINDERS						
CNX	round heads with counterflanges	6020-1	50 ÷ 100	150	BW500	65
ACCESSORIES						
ATTACHMENTS	for hydraulic cylinders				B800	67
CONNECTORS	for CK* servocylinders				K810	71
OPERATING INFORMATION						
Operating and maintenance information for industrial cylinders & servocylinders					B900	73
Operating and maintenance information for ex-proof cylinders & servocylinders					BX900	77
Operating and maintenance information for stainless steel cylinders & servocylinders					BW900	82

Supplementary components range available on **www.atos.com**

Sizing criteria for cylinders and servocylinders

1 ON-LINE CONFIGURATOR

Accessible directly from Atos website, the **configurator** leads users through the definition of desired cylinder code, selecting step by step the characteristics and options required.The configurator guarantees free access to technical documentation and 3D view of the selected cylinders.
Users registered in MyAtos area have free access to 3D models export, which can be used to complete mechanical assembly drawings of hydraulic machineries and systems.

Main configurator features :
- Visualisation and export of 3D models in STEP format
- Technical documentation of products and spare parts
- Configuration summary in PDF format
- Configurations storing within the trolley to create parts lists and quotation requests.

Register in **MyAtos** area to have full access to configurator functionalities and contents.

2 HYDRAULIC FORCES AND DYNAMIC LIMITS

2.1 Hydraulic forces

To ensure the correct cylinder functioning it is necessary to check that the hydraulic force F_p is upper than the algebraic sum of all the counteracting forces acting on the cylinder:

$$F_p \geq m \cdot a + F_f + m \cdot g$$

F_f are the friction forces of the system, m·a the inertial forces and m·g the weight force (only for vertical loads). For gravity acceleration consider g = 9,8 m/s².
For F_p values refers to section 3 , otherwise F_p, A_1, A_2 and speed V can be calculated as follow:

Hydraulic force

$$F_p = \left| p_1 \cdot A_1 - p_2 \cdot A_2 \right| \cdot 10 \quad [N]$$

Cylinder speed

$$V = \frac{10 \cdot Q}{A \cdot 60} \left[\frac{m}{sec}\right]$$

Pushing area

$$A_1 = \frac{\pi \cdot D^2}{4 \cdot 100} \quad [cm^2]$$

Pulling area

$$A_2 = \frac{\pi \cdot (D^2 - d^2)}{4 \cdot 100} \quad [cm^2]$$

2.2 Dynamic limits due to oil elasticity

The calculation of the pulsing value ω_o of the cylinder-mass system allows to define the minimum accleration/deceleration time t_{min}, the max. speed V_{max} and the min. acceleration/deceleration space S_{min} to not affect the functional stability of the system. Calculate ω_o, t_{min}, V_{max} and S_{min} with the below formulas. Flexible piping or long distances between the directional valve and the cylinder may affect the stiffness of the system, thus the calculated values may not be reliable.

$$\omega_0 = \sqrt{\frac{40 \cdot E \cdot A_1}{c \cdot m}} \cdot \frac{1 + \sqrt{\frac{A_2}{A_1}}}{2} \left[\frac{rad}{s}\right]$$

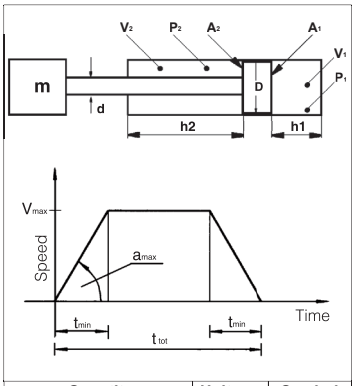
$$t_{min} = \frac{35}{\omega_o} \quad [s]$$

$$V_{max} = \frac{c}{t_{tot} - t_{min}} \quad [mm/s]$$

$$S_{min} = \frac{V_{max} \cdot t_{min}}{2} \quad [mm]$$

Note: for mineral oil consider E = 1,4•10⁷ kg/cm·s²

Symbols



Quantity	Unit	Symbol
Force	N	F_p
Pressure	bar	p
Section	cm²	A
Bore size	mm	D
Rod diameter	mm	d
Cylinder stroke	mm	c
Flow rate	l/min	Q
Speed	m/s	V
Acceleration	m/s²	a
Load mass	kg	m
Oil modulus of elasticity	kg/cm·s²	E
Total time at disposal	s	t_{tot}

3 SIZING

The table below reports the push/pull sections and forces for three different working pressures.
Once the push/pull forces are known, the size of the hydraulic cylinder can be choosen from the table below. The values have been determined using the formulas in section 2.

PULL FORCE [kN]

Bore [mm]		25		32		40			50			63			80			100		
Rod [mm]		12	18	14	22	18	22	28	22	28	36	28	36	45	36	45	56	45	56	70
A_2 Pulling area [cm²]		3,8	2,4	6,5	4,2	10,0	8,8	6,4	15,8	13,5	9,5	25,0	21,0	15,3	40,1	34,4	25,6	62,6	53,9	40,1
Pull force [kN]	p=100 bar	3,8	2,4	6,5	4,2	10,0	8,8	6,4	15,8	13,5	9,5	25,0	21,0	15,3	40,1	34,4	25,6	62,6	53,9	40,1
	p=160 bar	6,0	3,8	10,4	6,8	16,0	14,0	10,3	25,3	21,6	15,1	40,0	33,6	24,4	64,1	55,0	41,0	100,2	86,3	64,1
	p=250 bar	9,4	5,9	16,3	10,6	25,1	21,9	16	39,6	33,7	23,6	62,5	52,5	38,2	100,2	85,9	64,1	156,6	134,8	100,1

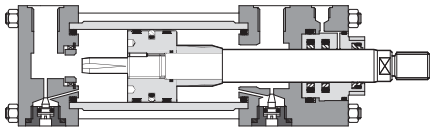
Bore [mm]		125			140	160			180	200			250		320		400	
Rod [mm]		56	70	90	90	70	90	110	110	90	110	140	140	180	180	220	220	280
A_2 Pulling area [cm²]		98,1	84,2	59,1	90,3	162,6	137,4	106,0	159,4	250,5	219,1	160,2	336,9	236,4	549,8	424,1	876,5	640,9
Pull force [kN]	p=100 bar	98,1	84,2	59,1	90,3	162,6	137,4	106,0	159,4	250,5	219,1	160,2	336,9	236,4	549,8	424,1	876,5	640,9
	p=160 bar	156,9	134,8	94,6	144,5	260,1	219,9	169,6	255,1	400,9	350,6	256,4	539,1	378,2	879,6	678,6	1.402,4	1.025,4
	p=250 bar	245,2	210,6	147,8	225,8	406,4	343,6	265,1	398,6	626,4	547,8	400,6	842,3	591,0	1.374,4	1.060,3	2.191,3	1.602,2

PUSH FORCE [kN]

Bore [mm]		25	32	40	50	63	80	100	125	140	160	180	200	250	320	400
A_1 Pushing area [cm²]		4,9	8,0	12,6	19,6	31,2	50,3	78,5	122,7	153,9	201,1	254,5	314,2	490,9	804,2	1.256,6
Push force [kN]	p=100 bar	4,9	8,0	12,6	19,6	31,2	50,3	78,5	122,7	153,9	201,1	254,5	314,2	490,9	804,2	1.256,6
	p=160 bar	7,9	12,9	20,1	31,4	49,9	80,4	125,7	196,3	246,3	321,7	407,2	502,7	785,4	1.286,8	2.010,6
	p=250 bar	12,3	20,1	31,4	49,1	77,9	125,7	196,3	306,8	384,8	502,7	636,2	785,4	1.227,2	2.010,6	3.141,6

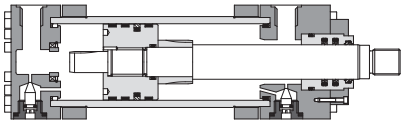
4 CHOICE OF THE CYLINDER SERIES

SERIES CK/CH - tab. B137 - B140 to ISO 6020-2



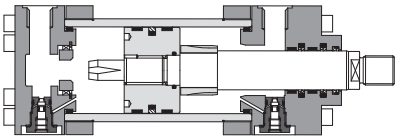
- Nominal pressure **16** MPa (160 bar) - max. **25** MPa (250 bar)
- Bore sizes from **25** to **200** mm
- Rod diameters from **12** to **140** mm

SERIES CH BIG BORE SIZE - tab. B160 to ISO 6020-3



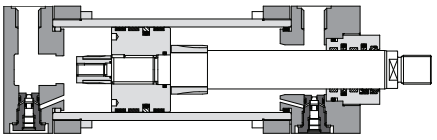
- Nominal pressure **16** MPa (160 bar) - max. **25** MPa (250 bar)
- Bore sizes from **250** to **400** mm
- Rod diameters from **140** to **220** mm

SERIES CN - tab. B180 to ISO 6020-1



- Nominal pressure **16** MPa (160 bar) - max. **25** MPa (250 bar)
- Bore sizes from **50** to **200** mm
- Rod diameters from **28** to **140** mm

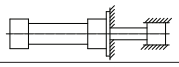
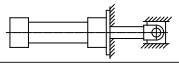
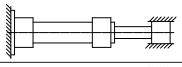
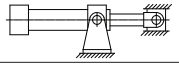
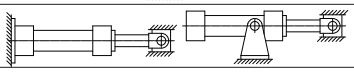
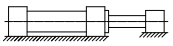
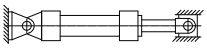
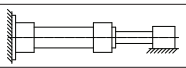
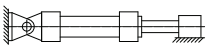
SERIES CC - tab. B241 to ISO 6022



- Nominal pressure **25** MPa (250 bar) - max. **32** MPa (320 bar)
- Bore sizes from **50** to **320** mm
- Rod diameters from **36** to **220** mm

5 CHECK OF THE BUCKLING LOAD

5.1 Calculation of the ideal lenght

Style	Rod end connection	Type of mounting	Fc
A, E, K, N, T, W, Y, Z	Fixed and rigidly guided		0,5
A, E, K, N, T, W, Y, Z	Pivoted and rigidly guided		0,7
B, P, V	Fixed and rigidly guided		1,0
G	Pivoted and rigidly guided		1,0
B, P, V, L	Pivoted and rigidly guided		1,5
A, E, K, N, T, W, Y, Z	Supported but not rigidly guided		2,0
C, D, H, S	Pivoted and rigidly guided		2,0
B, P, V	Supported but not rigidly guided		4,0
C, D, H, S	Supported but not rigidly guided		4,0

For cylinders working with push loads, the buckling load's checking has to be considered before choosing the rod size. This check is performed considering the fully extended cylinder as a bar having the same diameter of the cylinder rod (safety criteria):

1. determine the stroke factor "Fc" depending to the mounting style and to the rod end connection, see table at side

2. calculate the "ideal lenght" from the equation:

ideal length = Fc x stroke [mm]

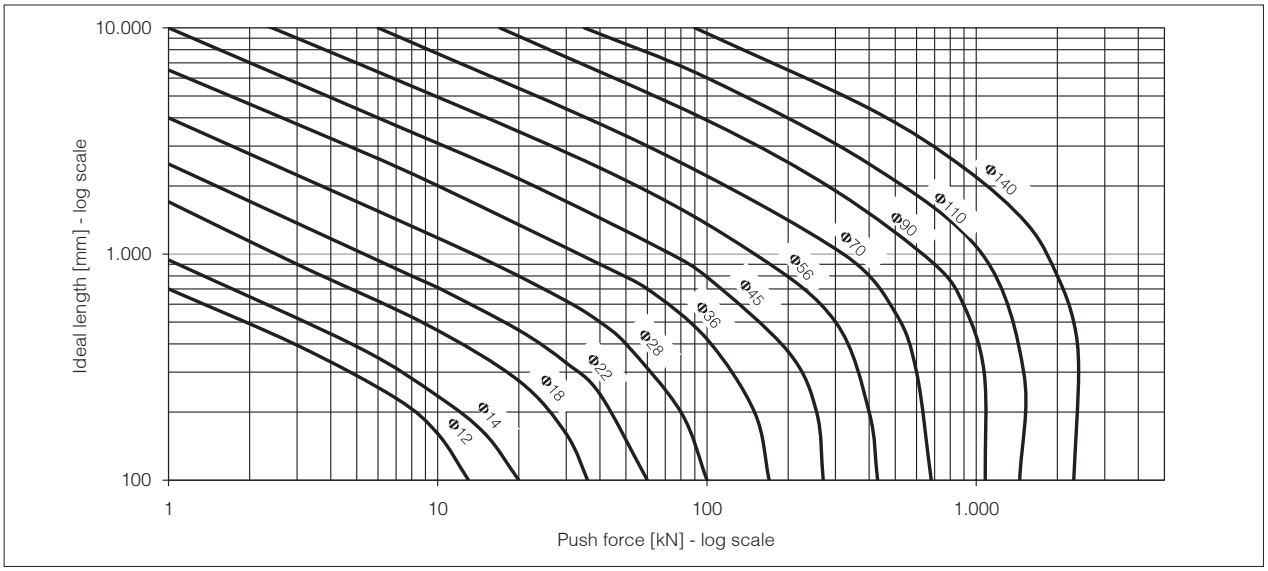
If a spacer has been selected, the spacer's length must be added to the stroke

3. calculate the F_P push force as indicated in section 3 or using the formulae indicated in section 2

4. obtain the point of intersection between the push force and the ideal length using the rod selection chart 5.2

5. obtain the minimum rod diameter from the curved line above the point of intersection

5.2 Rod selection chart



6 PREDICTION OF THE EXPECTED CYLINDER'S MECHANICAL WORKING LIFE

The rod thread is the cylinder's max critical part, thus the expected cylinder's working life can be evaluated by the prediction of the expected rod thread fatigue life. The fatigue rod fractures take place suddenly and without any warning, thus it is always recommended to check if the rod is subject to fatigue stress (not necessary if the cylinder works with push loads) and thus if the expected rod threads fatigue life may become an issue in relation to the required cylinder working life. The charts below do not include the rods which are fatigue-free for working pressures over 250 bar. The curves are referred to ideal working conditions and do not take into account misalignments and transversal loads that could decrease the predicted life cycles. The charts are intended valids for all the cylinders and servocylinders series with standard materials and sizes (section 6.2) or option **K** "Nickel and chrome plating" rods (section 6.3). For the evaluation of the expected fatigue life of stainless steel rods (CNX series), contact our technical office. For double rod executions the mechanical working life calculation does not apply to secondary rods since the thread is weaker than the primary rods.

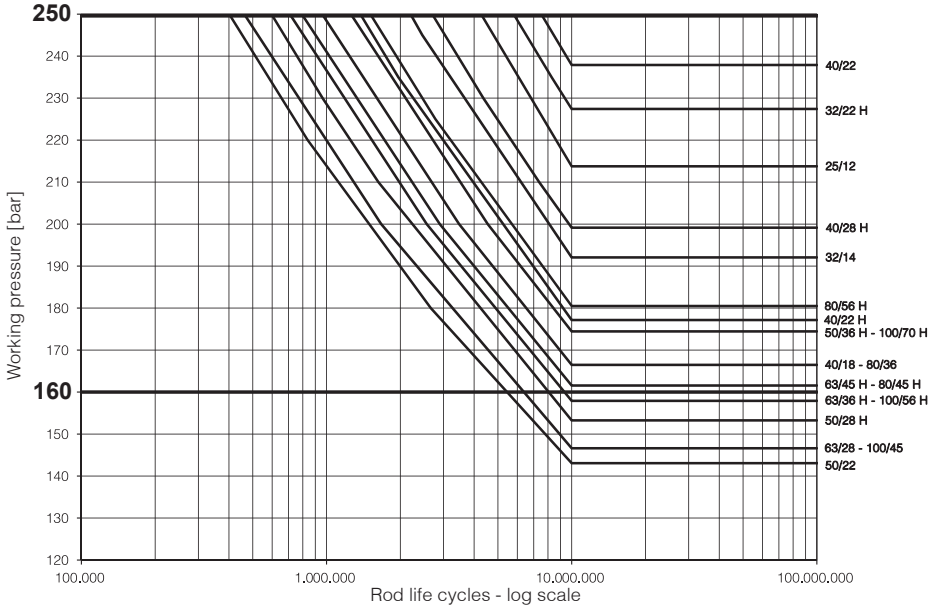
6.1 Mechanical working life calculation procedure

1. Identify the curve of proper rods fatigue life graph according to the selected bore/rod size and rod treatment. Fatigue-free bore/rod couplings are not included in the graphs.

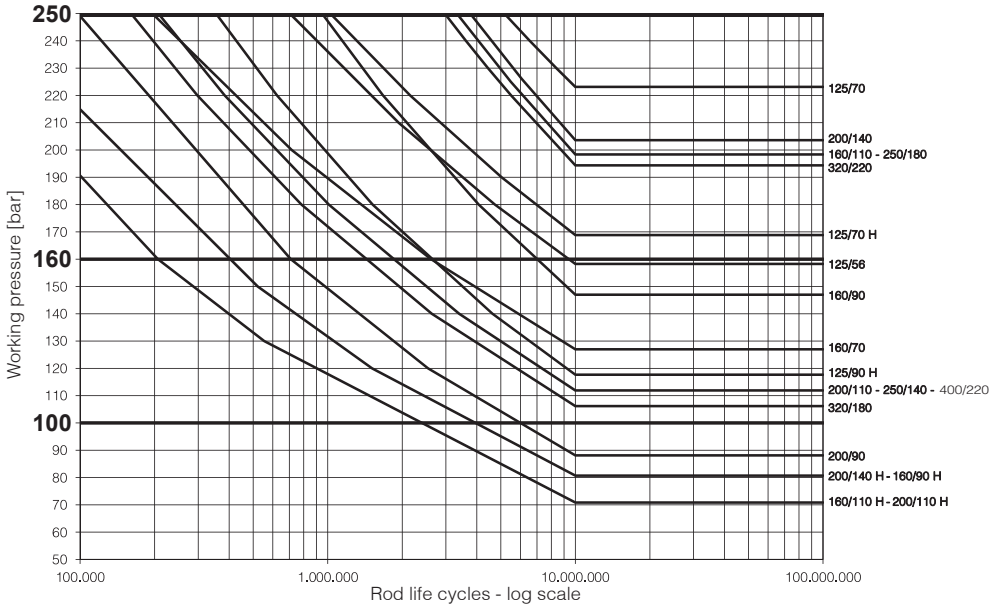
2. Intersect the working pressure with the curve corresponding to the rod under investigation and determine the expected rod life cycles. If the calculated rod fatigue life is lower than 500.000 cycles a careful analysis of our technical office is suggested.

6.2 Rods fatigue life charts for standard rod

Rods fatigue life for bore sizes from 25 to 100 mm

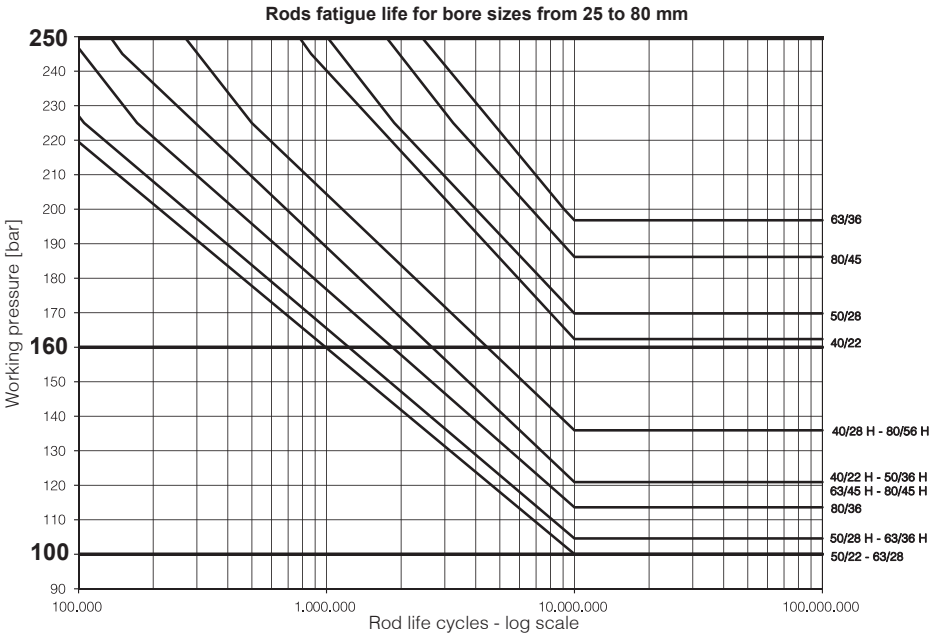


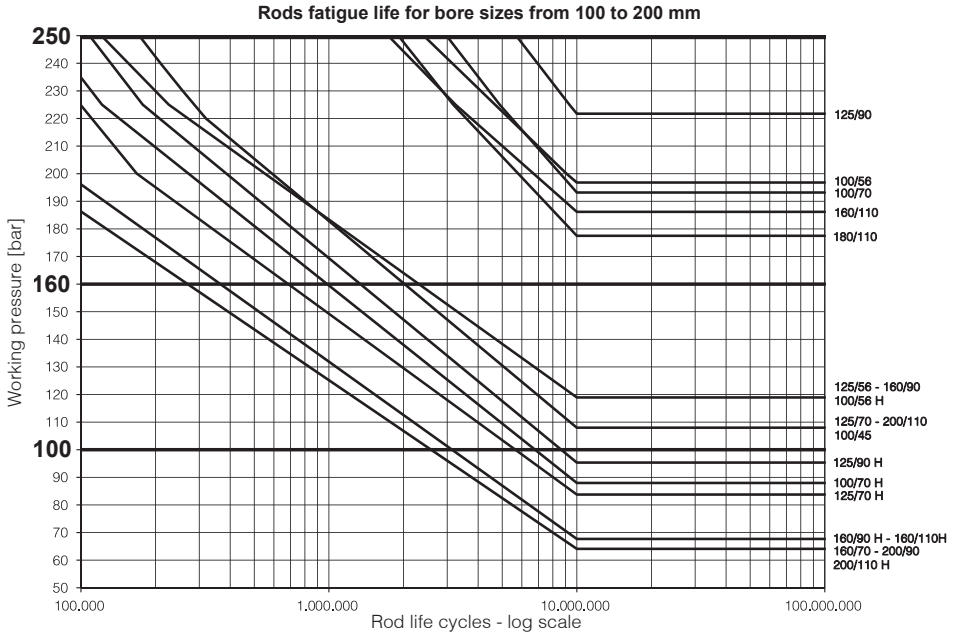
Rods fatigue life for bore sizes from 125 to 400 mm



Note: the curves are labelled according to the bore/rod size. The light male thread (option **H)** is indicated by the "H" after the rod
Example: label **125/90 H** means bore = 125 mm, rod = 90 mm and rod with option **H**

6.3 Rods fatigue life charts for Nickel and Chrome plating rod (option K)





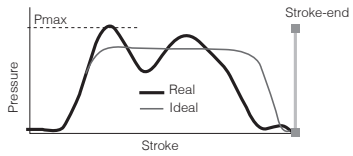
Note: the curves are labelled according to the bore/rod size. The light male thread (option **H)** is indicated by the "H" after the rod
Example: label **125/90 H** means bore = 125 mm, rod = 90 mm and rod with option **H**

7 CHECK OF THE HYDRAULIC CUSHIONING

7.1 Functioning features

Hydraulic cushioning act as "dumpers" to dissipate the energy of a mass connected to the rod and directed towards the cylinder stroke-ends, reducing its velocity before the mechanical contact, thus avoiding mechanical shocks that could reduce the average life of the cylinder and of the entire system.
Cushioning proves to be effective as much as the pressure inside the cushioning chamber gets close to the ideal profile described in the diagram at side. The diagram compares the ideal profile with typical cylinders real pressure profile.

Pressure in the cushioning chamber



7.2 Application features

The following guidelines refer to CK, CH, CN and CC cylinders: for CH big bore sizes, contact our technical office. In order to optimize the performances of cushioning in different applications, three different cushioning versions have been developed:

- slow version, with cushioning adjustment, for speed $V \leq 0,5 \cdot V_{max}$
- fast version, without adjustment, for speed $V > 0,5 \cdot V_{max}$
- fast version, with cushioning adjustment, for speed $V > 0,5 \cdot V_{max}$

Adjustable cushioning are provided with needle valve to optimize the cushioning performances. The maximum permitted speed value Vmax depends to the cylinder size, see table below.

Speed during cushioning

ø Bore [mm]	25	32	40	50	63	80	100	125	160	200
V_{max} [m/s]	1	1	1	1	0,8	0,8	0,6	0,6	0,5	0,5

7.3 Max energy calculation procedure

Check the max energy that can be absorbed by the selected cushioning as follow:

1. calculate the energy to be dissipated **E** by the algrebraic sum of the kinetic energy $\mathbf{E_c}$ and the potential energy $\mathbf{E_p}$ (for horizontal applications the potential energy is: $\mathbf{E_p} = 0$)

$$\mathbf{E} = \mathbf{E_c} + \mathbf{E_p}$$

- $\mathbf{E_c}$ (kinetic energy) due to the mass speed

$$\mathbf{E_c} = 1/2 \cdot M \cdot V^2 \quad \text{[Joule]}$$

- $\mathbf{E_p}$ (potential energy) due to the gravity and related to the cylinder inclination angle α as shown at side

For front cushioning:

$$\mathbf{E_p} = -Lf \cdot \frac{M \cdot g \cdot \text{sen}\,\alpha}{1000} \quad \text{[Joule]}$$

For rear cushioning:

$$\mathbf{E_p} = +Lf \cdot \frac{M \cdot g \cdot \text{sen}\,\alpha}{1000} \quad \text{[Joule]}$$

2. identify the proper cushioning chart depending to the rod type, the cushioning side (front or rear), and the cylinder series (section 7.4 for CK, CH, CN cylinders or section 7.5 for CC cylinders)

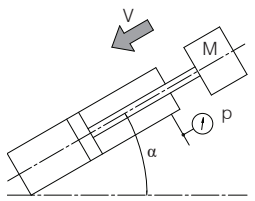
3. intersect the working pressure with the proper bore/rod size curve and extract the corresponding $\mathbf{E_{max}}$ value

4. compare the $\mathbf{E_{max}}$ value with the energy to be dissipated **E** and verify that:

$$\mathbf{E} \leq \mathbf{E_{max}}$$

5. for critical applications with high speed and short cushioning strokes an accurate cushioning evaluation is warmly suggested, contact our technical office

Symbols

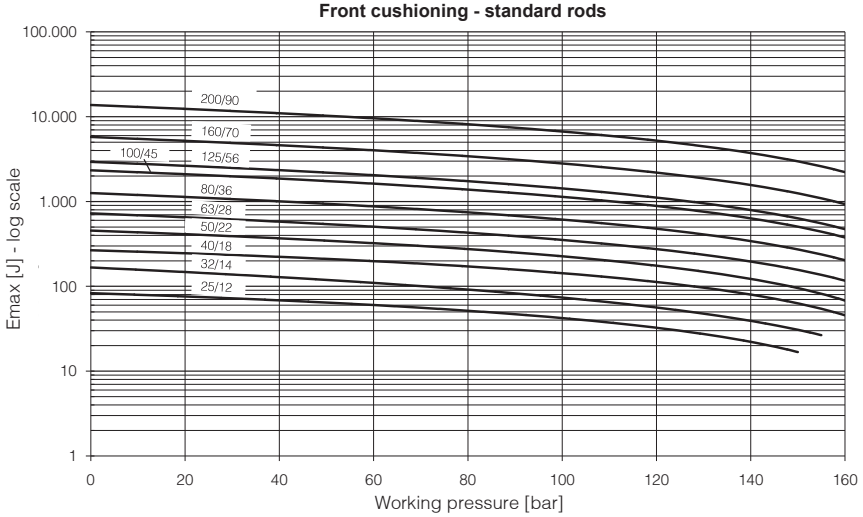


E	= energy to be dissipated	[J]
$\mathbf{E_{max}}$	= energy max dissipable	[J]
M	= mass	[kg]
V	= rod speed	[m/s]
Lf	= cushioning length (see section 12 of tables B137, B140)	[mm]
g	= acceleration of gravity consider g=9,81 m/s²	[m/s²]
α	= inclination angle	[°]

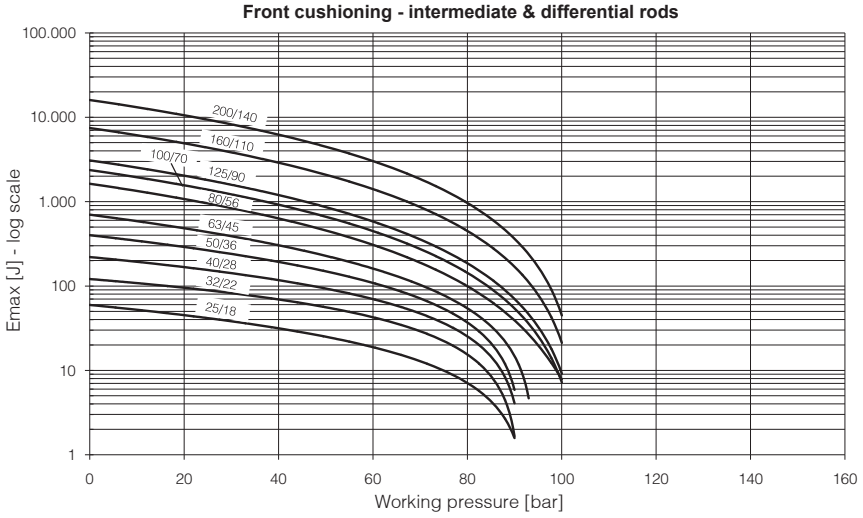
7.4 Cushioning charts for CK - CH - CN cylinders

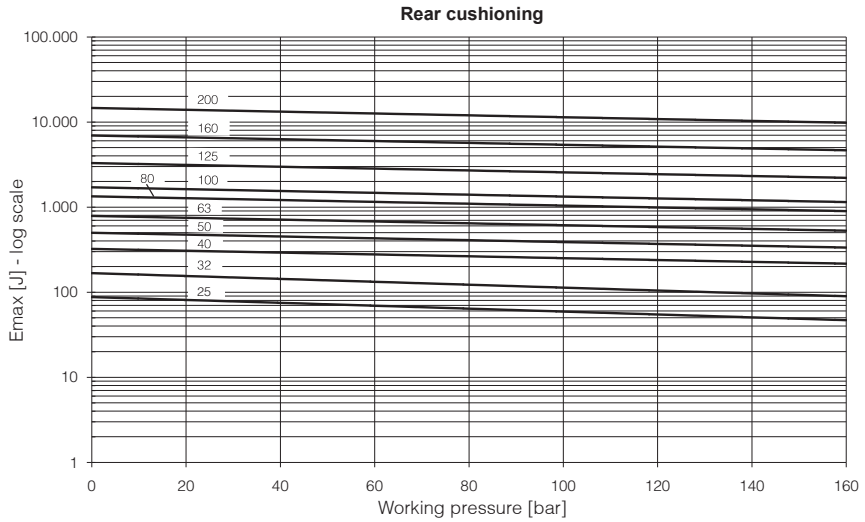
Notes:
- the front cushioning graphs are labelled according to the bore/rod size, the rear cushioning graph is labelled according to the bore size
- the curves are intended valid for mineral oil ISO 46 and a fluid temperature of 40-50 °C: the use of water or water-based fluids and higher/lower temperatures can affect the cushioning performance because of high viscosity variations respect to standard mineral oil
- for adjustable versions the E_{max} value is referred to cushioning cartridge fully closed, the max energy to be dissipated may be increased opening the cushioning cartridge, thus reducing the max pressure reached in the cushioning chamber
- the cushioning charts have been determined with 250 bar maximum pressure admitted in the cushioning chamber

Front cushioning - standard rods



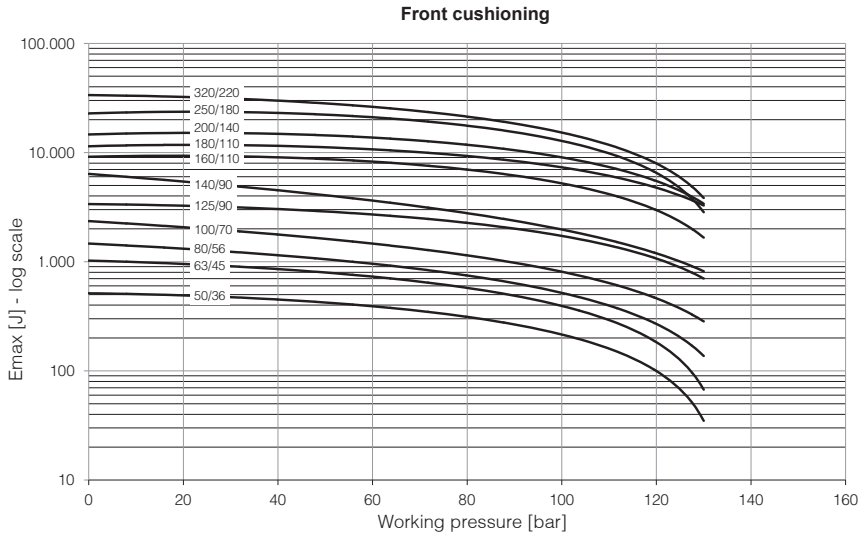
Front cushioning - intermediate & differential rods

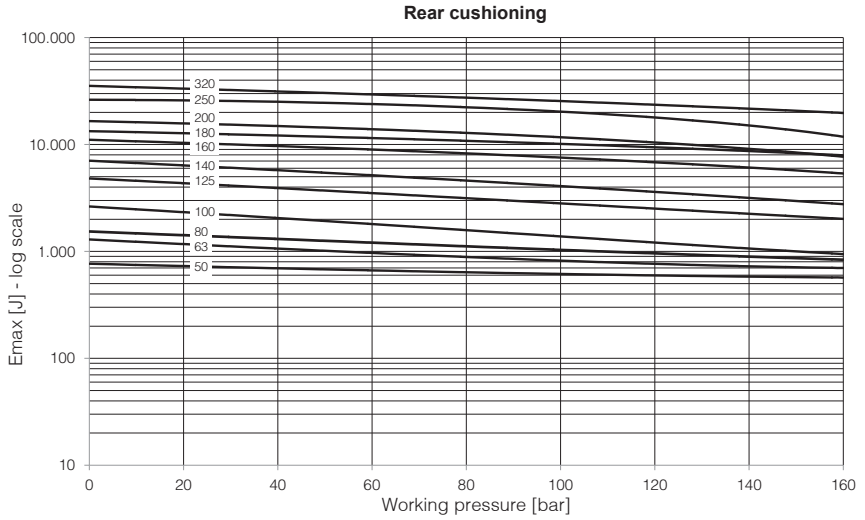




7.5 Cushioning charts for CC cylinders

Notes:
- the front cushioning graphs are labelled according to the bore/rod size, the rear cushioning graph is labelled according to the bore size
- the curves are intended valid for mineral oil ISO 46 and a fluid temperature of 40-50 °C: the use of water or water-based fluids and higher/lower temperatures can affect the cushioning performance because of high viscosity variations respect to standard mineral oil
- for adjustable versions the E_{max} value is referred to cushioning cartridge fully closed, the max energy to be dissipated may be increased opening the cushioning cartridge, thus reducing the max pressure reached in the cushioning chamber
- the cushioning charts have been determined with 320 bar maximum pressure admitted in the cushioning chamber





8 SEALING FRICTION AND IN / OUT SPEED RATIO

Basic sealing performances reported in the cylinders technical tables are not sufficient for a comprehensive evaluation of the sealing system, the following sections report additional verifications about minimum in/out rod speed ratio, static and dynamic sealing friction.

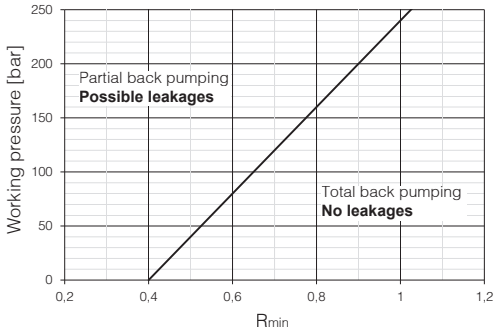
8.1 In / out speed ratio

Applications with low in/out rod speed ratio may involve leakages caused by partial "back pumping" of the oil trapped between the rod seals, thus it is recommended to check the correct back pumping with the diagram reported below.

1. Determine the in/out speed ratio **R** of the cylinder

$$R = \frac{V_{in}}{V_{out}} = \frac{Q_2 \cdot A_1}{A_2 \cdot Q_1}$$

2. Intersect the working pressure with the curve below and extract the corresponding R_{min} value admitted



3. Verify that

$$\mathbf{R} \geq \mathbf{R_{min}}$$

If the equation above is not verified contact our technical office

8.2 Static and dynamic sealing friction

Sealing systems may affect the smooth rod motion, thus the assessment of the sealing friction forces is recommended in several applications like :

- Servoactuators with closed loop control
- Servocylinders where high accuracy in rod positioning is required
- Cylinders with low speeds (<0,05 m/s)
- Low pressure hydraulic systems (<10 bar) where sealing friction forces may have significant influence

The following sections allow to calculate both static and dynamic sealing friction according to the sealing system selected for CK, CH and CK* servocylinders.

8.3 Sealing friction calculation procedure

Calculate the **dynamic** sealing friction as follow:

1. Intersect the speed with the proper curve depending to the sealing system from the chart in section 8.4.

2. Extract the corresponding **C** value

3. Identify the proper diagram according to the sealing system (section 8.5)

4. Intersect the working pressure with the curve depending to the Bore size.

5. Extract the corresponding **A** value

6. F_{sf} = **A** · (D + d) + **C** [N]
considering D= Bore size [mm]; d= Rod size [mm]

Calculate the **static** sealing friction as follow:

1. Extract the **C** value corresponding to speed **V = 0 m/s** in the chart in section 8.4

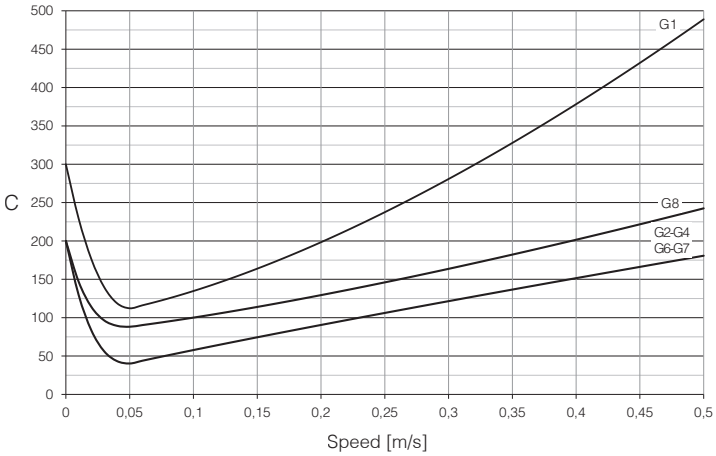
2. Identify the proper diagram according to the sealing system (section 8.5)

3. Intersect the working pressure with the curve depending to the Bore size.

4. Extract the corresponding **A** value

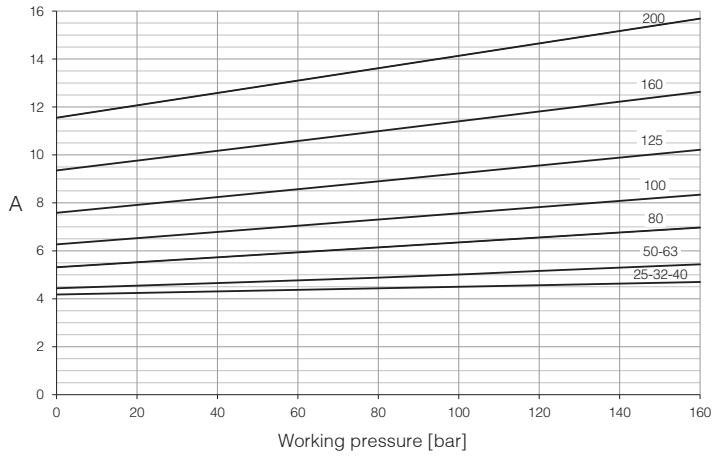
5. F_{sf} = **A** · (D + d) + **C** [N]
considering D= Bore size [mm]; d= Rod size [mm]

8.4 Friction charts - C parameter vs speed

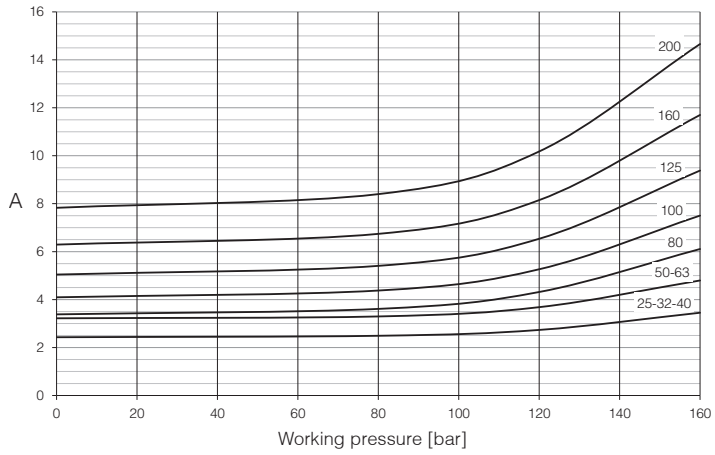


8.5 Friction charts - A parameter vs pressure

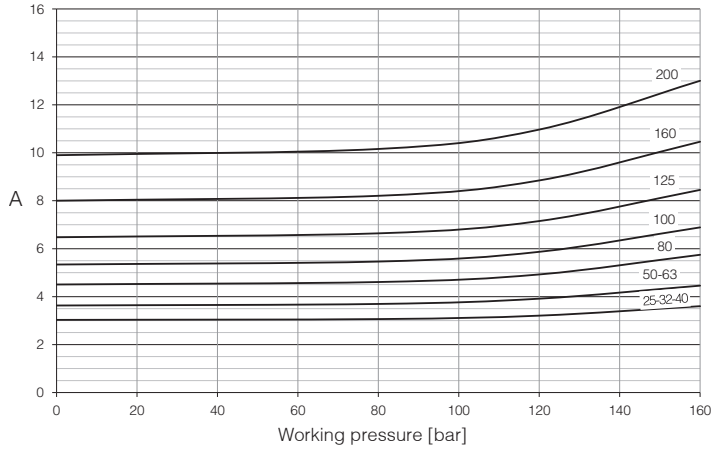
SEALING G1



SEALING G2 - G4 - G6 - G7



SEALING G8

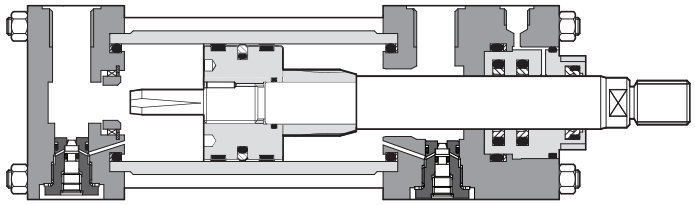


Hydraulic cylinders type CK - square heads with tie rods

to ISO 6020-2 - nominal pressure 16 MPa (160 bar) - max 25 MPa (250 bar)

EAC

SIL
IEC61508



CE

CK cylinders have engineered double acting construction, designed to suit the requirements of industrial applications: top reliability, high performances and long working life.

- Bore sizes from **25** to **200** mm
- Adjustable or fixed cushioning
- Optional built-in position transducer, **see tab. B310**
- Attachments for rods and mounting styles, **see tab. B800**
- CKA available with **ATEX certification see tab. BX500**
- CK cylinders are **SIL** compliance with IEC 61508 (TÜV certified), certification on request

For cylinder's choice and sizing criteria **see tab. B015**

1 MODEL CODE

CK	P	/	10	-	50	/	22	/	22	*	0500	-	S	3	0	1	-	A	-	B1E3X1Z3	**

Cylinder series
CK to ISO 6020 - 2

Rod position transducer
- = omit if not requested
F = magnetosonic
M = magnetosonic programmable
N = magnetostrictive
P = potentiometric
V = inductive
Dimensions and performances see tab. B310

Incorporated subplate, see section 15
- = omit if subplate is not requested
10 = size 06
20 = size 10
30 = size 16
40 = size 25

Bore size, see section 3
from **25** to **200** mm

Rod diameter, see sections 6 and 9
from **12** to **140** mm

Second rod diameter for double rod, see section 10
from **12** to **140** mm, omit for single rod

Stroke, see section 4
up to **5000** mm

Mounting style, see sections 2 and 3		**REF. ISO**
C	= fixed clevis	MP1 **(3)**
D	= fixed eye	MP3 **(3)**
E	= feet	MS2
G	= front trunnion	MT1
H	= rear trunnion	MT2 **(3)**
L	= intermediate trunnion	MT4 **(4)**
N	= front flange	ME5
P	= rear flange	ME6 **(3)**
S	= fixed eye + spherical bearing	MP5 **(3)**
T	= threaded hole+tie rods extended	MX7
V	= rear tie rods extended	MX2
W	= both end tie rods extended	MX1
X	= basic execution	-
Y	= front tie rods extended	MX3
Z	= front threaded holes	MX5

Spacer, see section 5
0 = none **2** = 50 mm **4** = 100 mm **6** = 150 mm **8** = 200 mm

Sealing system, see section 14
1 = (NBR + POLYURETHANE) high static and dynamic sealing
2 = (FKM + PTFE) very low friction and high temperatures
4 = (NBR + PTFE) very low friction and high speeds
6 = (NBR + PTFE) very low friction, single acting - pushing
7 = (NBR + PTFE) very low friction, single acting - pulling
8 = (NBR + PTFE and POLYURETHANE) low friction

Options (2):
Rod end, see section 6
F = female thread
G = light female thread
H = light male thread
Oversized oil ports, see section 11
D = front oversized oil port
Y = rear oversized oil port
Proximity sensors, see section 18
R = front sensor
S = rear sensor
Rod treatment, see section 9
K = nickel and chrome plating
T = induction surface hardening and chrome plating
Air bleeds, see section 16
A = front air bleed
W = rear air bleed
Draining, see section 17
L = rod side draining

Heads' configuration (2), see section 13
Oil ports positions
B* = front head
X* = rear head
Cushioning adjustments positions, to be entered only if adjustable cushioning are selected
E* = front head
Z* = rear head
* = selected position (1, 2, 3 or 4)

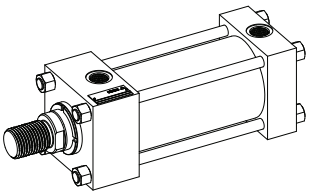
Series number **(1)**

Cushioning, see section 12
0 = none

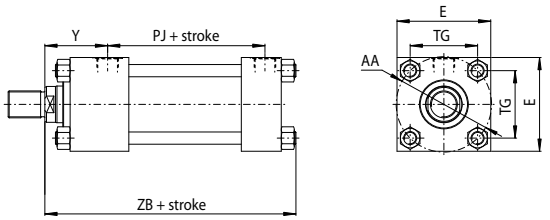
Fast adjustable	**Slow adjustable**	**Fast fixed**
1 = rear only	**4** = rear only	**7** = rear only
2 = front only	**5** = front only	**8** = front only
3 = front and rear	**6** = front and rear	**9** = front and rear

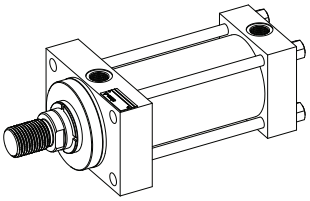
(1) For spare parts request indicate the series number printed on the nameplate only for series < 30
(2) To be entered in alphabetical order **(3)** Not available for double rod **(4)** XV dimension must be indicated in the model code, see section 3

2 MOUNTING STYLE - for dimensions see section 3

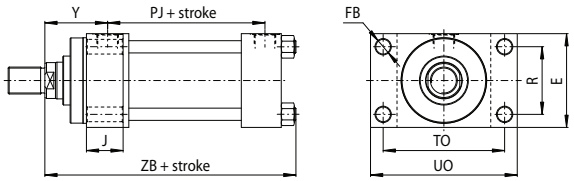


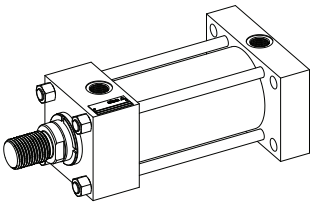
X = basic mounting



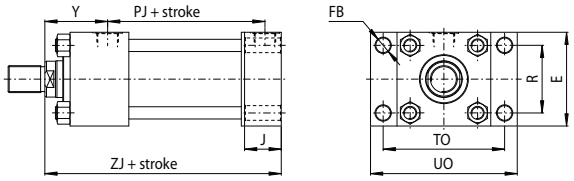


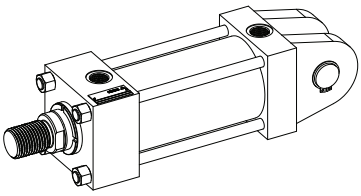
N (ISO ME5) = front flange mounting



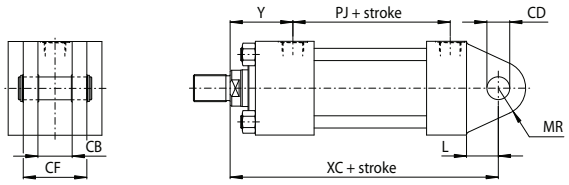


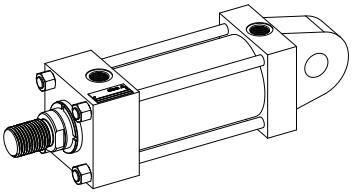
P (ISO ME6) = rear flange mounting



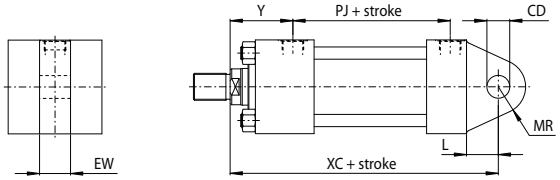


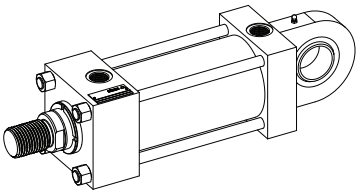
C (ISO MP1) = fixed clevis mounting - supplied with pivot pin C-145



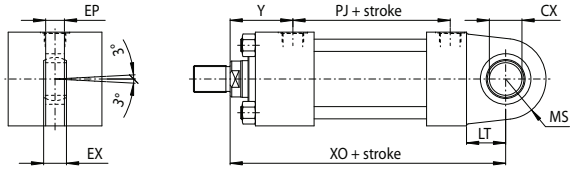


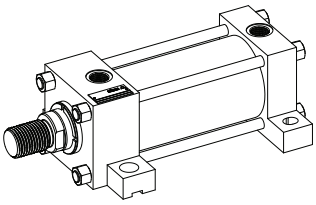
D (ISO MP3) = fixed eye mounting



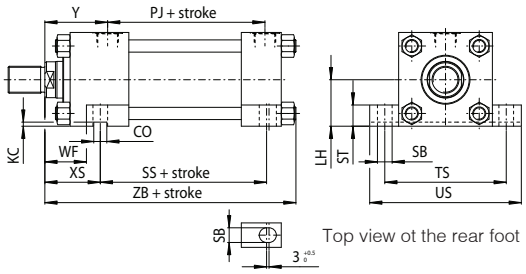


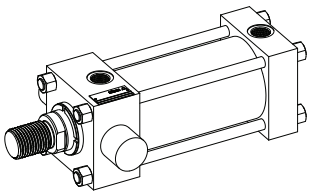
S (ISO MP5) = fixed eye with spherical bearing mounting



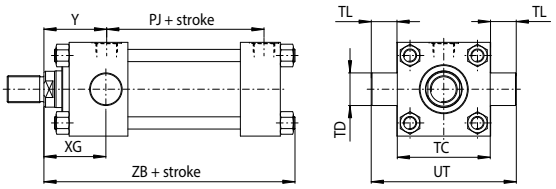


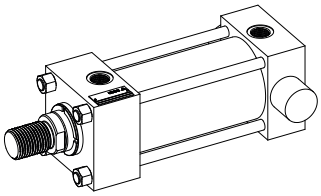
E (ISO MS2) = side feet mounting



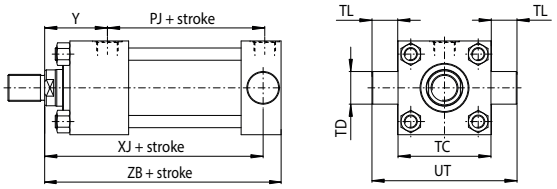


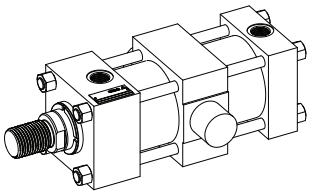
G (ISO MT1) = front trunnion mounting



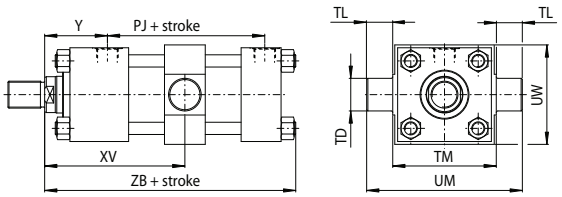


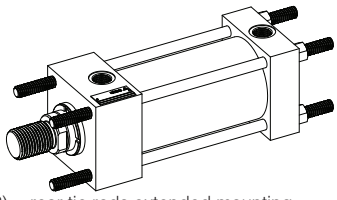
H (ISO MT2) = rear trunnion mounting



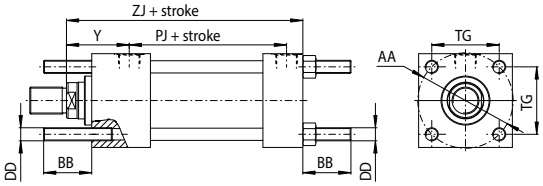


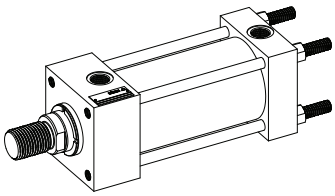
L (ISO MT4) = intermediate trunnion mounting



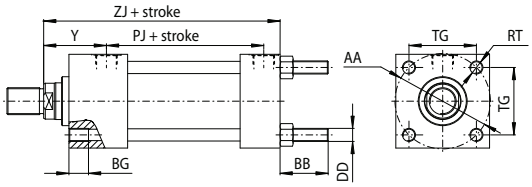


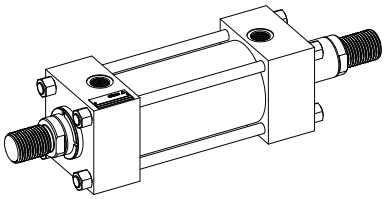
V (ISO MX2) = rear tie rods extended mounting
Y (ISO MX3) = front tie rods extended mounting
W (ISO MX1) = both end tie rods extended mounting (*)
(*) see figure



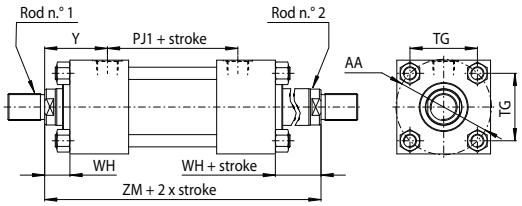


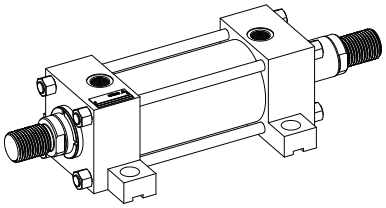
Z (ISO MX5) = front threaded holes mounting
T (ISO MX7) = threaded holes with tie rods extended mounting (*)
(*) see figure



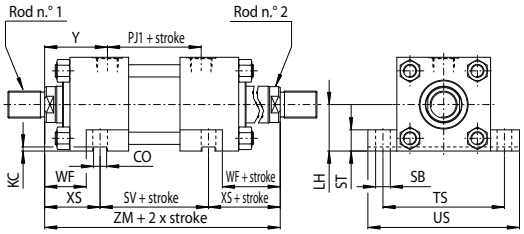


X = basic mounting for double rod





E = feet mounting for double rod



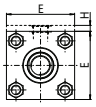
3 INSTALLATION DIMENSIONS [mm] - see figures in section 2

Ø Bore		25	32	40	50	63	80	100	125	160	200
Ø Rod	standard	12	14	18	22	28	36	45	56	70	90
	intermediate	NA	NA	22	28	36	45	56	70	90	110
	differential	18	22	28	36	45	56	70	90	110	140
AA		40	47	59	74	91	117	137	178	219	269
BB +3 / 0		19	24	35	46	46	59	59	81	92	115
BG min		8	9	12	18	18	24	24	27	32	40
CB A13		12	16	20	30	30	40	50	60	70	80
CD H9		10	12	14	20	20	28	36	45	56	70
CF max		25	34	42	62	62	83	103	123	143	163
CO N9		NA	NA	12	12	16	16	16	20	30	40
CX	value	12	16	20	25	30	40	50	60	80	100
	tolerance	0 -0,008		0 -0,012					0 -0,015		0 -0,02
DD 6g		M5x0,8	M6x1	M8x1	M12x1,25	M12x1,25	M16x1,5	M16x1,5	M22x1,5	M27x2	M30x2
E (1)		40±1,5	45±1,5	63±1,5	75±1,5	90±1,5	115±1,5	130±2	165±2	205±2	245±2
EP max		8	11	13	17	19	23	30	38	47	57
EW h14		12	16	20	30	30	40	50	60	70	80
EX		10 0/-0,12	14 0/-0,12	16 0/-0,12	20 0/-0,12	22 0/-0,12	28 0/-0,12	35 0/-0,12	44 0/-0,15	55 0/-0,15	70 0/-0,2
FB H13		5,5	6,6	11	14	14	18	18	22	26	33
H (2) max		5	5	NA	NA	NA	NA	NA	NA	NA	NA
J ref		25	25	38	38	38	45	45	58	58	76
L min		13	19	19	32	32	39	54	57	63	82
LH h10		19	22	31	37	44	57	63	82	101	122
LT min		16	20	25	31	38	48	58	72	92	116
KC min		NA	NA	4	4,5	4,5	5	6	6	8	8
M (3)		1000	1200	1500	1800	2300	3000	3500	3500	3500	3500
MR max		12	17	17	29	29	34	50	53	59	78
MS max		20	22,5	29	33	40	50	62	80	100	120
PJ (4) ±1,5 (6)		53	56	73	74	80	93	101	117	130	165
PJ1 ±1,5 (6)		54	58	71	73	81	92	101	117	130	160
PJ2 (4) ±1,5 (6)		53	57	73	76	80	93	99	121	143	167
R js13		27	33	41	52	65	83	97	126	155	190
RT		M5x0,8	M6x1	M8x1,25	M12x1,75	M12x1,75	M16x2	M16x2	M22x2,5	M27x3	M30x3,5
SB H13		6,6	9	11	14	18	18	26	26	33	39
SS ±1,25 (6)		72	72	97	91	85	104	101	130	129	171
ST js13		8,5	12,5	12,5	19	26	26	32	32	38	44
SV ±1,25 (6)		88	88	105	99	93	110	107	131	130	172
TC h14		38	44	63	76	89	114	127	165	203	241
TD f8		12	16	20	25	32	40	50	63	80	100
TG js13		28,3	33,2	41,7	52,3	64,3	82,7	96,9	125,9	154,9	190,2
TL js13		10	12	16	20	25	32	40	50	63	80
TM h14		48	55	76	89	100	127	140	178	215	279
TO js13		51	58	87	105	117	149	162	208	253	300
TS js13		54	63	83	102	124	149	172	210	260	311
UM ref		68	79	108	129	150	191	220	278	341	439
UO max		65	70	110	130	145	180	200	250	300	360
US max		72	84	103	127	161	186	216	254	318	381
UT ref		58	68	95	116	139	178	207	265	329	401
UW max		45	50	70	88	98	127	141	168	215	269
XC ±1,5 (6)		127	147	172	191	200	229	257	289	308	381
XG ±2 (6)		44	54	57	64	70	76	71	75	75	85
XJ ±1,5 (6)		101	115	134	140	149	168	187	209	230	276
XO ±1,5 (6)		130	148	178	190	206	238	261	304	337	415
XS ±2 (6)		33	45	45	54	65	68	79	79	86	92
XV (5) ±2 (6)	style L minimum stroke	5	5	5	15	20	20	35	35	35	35
	min	77	90	100	109	120	129	148	155	161	195
	max	75+stroke	86+stroke	99+stroke	98+stroke	100+stroke	115+stroke	117+stroke	134+stroke	141+stroke	166+stroke
Y (4) ±2 (6)		50	60	62	67	71	77	82	86	86	98
Y1 (4) ±2 (6)		49,5	59,5	63	65,5	70	75,5	83	84	79,5	97
ZB max		121	137	166	176	185	212	225	260	279	336
ZJ ±1 (6)		114	128	153	159	168	190	203	232	245	299
ZM ±2 (6)		154	178	195	207	223	246	265	289	302	356

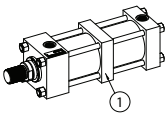
NOTES TO TABLE 3

(1) **E** - If not otherwise specified in the figures in section 2, this value is the front and rear square heads dimension for all the mounting styles (see figure below)

(2) **H** - This additional dimension has to be considered only for bores 25 and 32



(3) **M** - For strokes longer than M, one or more intermediate tie rods supports ① are fitted on the cylinder housing to maintain the radial tension on the tie rods, thus keeping them rigidly fixed to the cylinder housing. The support has the same overall dimensions of the square heads as indicated in note (1)



(4) When oversized oil ports are selected (see section 11 and 13 for dimensions and position) dimensions **PJ** and **Y** are respectively modified into **PJ2** and **Y1**

(5) **XV** - For cylinders with mounting style **L** the stroke must always exceed the minimum values reported in the table.
The requested XV value must be included between **XV min** and **XV max** and it must be always indicated, with dimension in millimeters, together with the cylinder code. See the following example:

CK - 50 / 22 * 0500 - L301 - D - B1E3X1Z3
XV = 200

(6) The tolerance is valid for strokes up to 1250 mm, for longer strokes the upper tolerance is given by the max stroke tolerance in section 4

4 STROKE SELECTION

Stroke has to be selected a few mm longer than the working stroke, to prevent to use the cylinder heads as mechanical stroke-end.

Standard strokes to ISO 4393

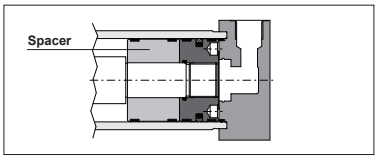
25	50	80	100	125	160	200	250
320	400	500	630	800	1000	1250	

Maximum stroke:
- 2600 mm for bores up to 40 mm
- 5000 mm for other bores

Stroke tolerances:
- 0 +2 mm for strokes up to 1250 mm
- 0 +5 mm for strokes from 1250 to 3150 mm
- 0 +8 mm for strokes over 3150 mm

5 SPACER

For strokes longer than 1000 mm, proper spacers have to be introduced in the cylinder's construction to increase the rod and piston guide and to protect them from overloads and premature wear. Spacers can be omitted for cylinders working in traction mode. The introduction of spacers increases the overall cylinder's dimensions: spacers' lenght has to be added to all stroke dependent dimensions in section 3.



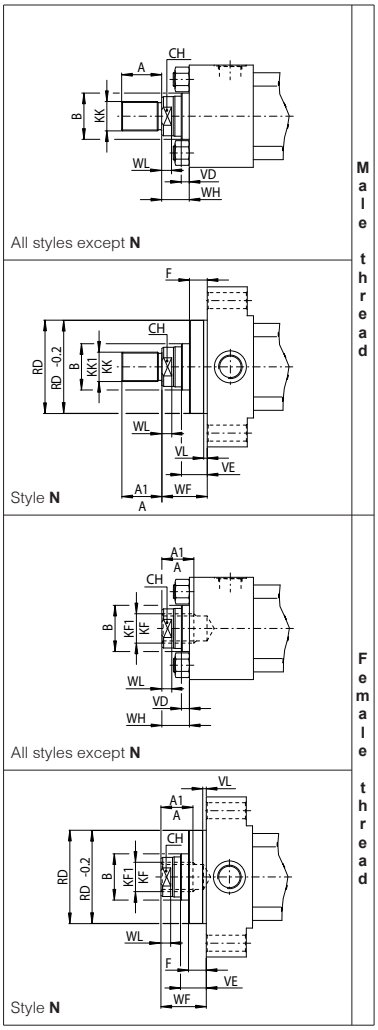
RECOMMENDED SPACERS [mm]

Stroke	1001 ÷ 1500	1501 ÷ 2000	2001 ÷ 2500	2501 ÷ 5000
Spacer code	**2**	**4**	**6**	**8**
Length	50	100	150	200

6 ROD END DIMENSIONS [mm]

Ø Bore	Ø Rod	Male thread KK 6g	Male thread KK1 (option **H**) 6g	Female thread KF (option **F**) 6H	Female thread KF1 (option **G**) 6H	A (KK or KF) (1)	A1 (KK1 or KF1) (1)	B f9	CH h14	F max	RD f8	VD	VE max	VL min	WF ±2	WH ±2	WL min
25	**12**	M10x1,25	NA	M8x1	NA	14	NA	24	10	10	38	6	16	3	25	15	5
	18	M14x1,5	M10x1,25	M12x1,25	M8x1	18	14	30	15	10	38	6	16	3	25	15	5
32	**14**	M12x1,25	NA	M10x1,25	NA	16	NA	26	12	10	42	12	22	3	35	25	5
	22	M16x1,5	M12x1,25	M16x1,5	M10x1,25	22	16	34	19	10	42	9	19	3	35	25	5
40	**18**	M14x1,5	NA	M12x1,25	NA	18	NA	30	15	10	62	6	16	3	35	25	5
	22	M16x1,5	M14x1,5	M16x1,5	NA	22	18	34	19	10	62	12	22	3	35	25	5
	28	M20x1,5	M14x1,5	M20x1,5	M12x1,25	28	18	42	22	10	62	12	22	3	35	25	7
50	**22**	M16x1,5	NA	M16x1,5	NA	22	NA	34	19	16	74	9	25	4	41	25	5
	28	M20x1,5	M16x1,5	M20x1,5	NA	28	22	42	22	16	74	9	25	4	41	25	7
	36	M27x2	M16x1,5	M27x2	M16x1,5	36	22	50	30	16	74	9	25	4	41	25	8
63	**28**	M20x1,5	NA	M20x1,5	NA	28	NA	42	22	16	75	13	29	4	48	32	7
	36	M27x2	M20x1,5	M27x2	NA	36	28	50	30	16	88	13	29	4	48	32	8
	45	M33x2	M20x1,5	M33x2	M20x1,5	45	28	60	39	16	88	13	29	4	48	32	10
80	**36**	M27x2	NA	M27x2	NA	36	NA	50	30	20	82	9	29	4	51	31	8
	45	M33x2	M27x2	M33x2	NA	45	36	60	39	20	105	9	29	4	51	31	10
	56	M42x2	M27x2	M42x2	M27x2	56	36	72	48	20	105	9	29	4	51	31	10
100	**45**	M33x2	NA	M33x2	NA	45	NA	60	39	22	92	10	32	5	57	35	10
	56	M42x2	M33x2	M42x2	NA	56	45	72	48	22	125	10	32	5	57	35	10
	70	M48x2	M33x2	M48x2	M33x2	63	45	88	62	22	125	10	32	5	57	35	10
125	**56**	M42x2	NA	M42x2	NA	56	NA	72	48	22	105	10	32	5	57	35	10
	70	M48x2	M42x2	M48x2	NA	63	56	88	62	22	150	7	29	5	57	35	10
	90	M64x3	M42x2	M64x3	M42x2	85	56	108	80	22	150	7	29	5	57	35	15
160	**70**	M48x2	NA	M48x2	NA	63	NA	88	62	25	125	7	32	5	57	32	10
	90	M64x3	M48x2	M64x3	NA	85	63	108	80	25	170	7	32	5	57	32	15
	110	M80x3	M48x2	M80x3	M48x2	95	63	133	100	25	170	7	32	5	57	32	15
200	**90**	M64x3	NA	M64x3	NA	85	NA	108	80	25	150	7	32	5	57	32	15
	110	M80x3	M64x3	M80x3	NA	95	85	133	100	25	210	7	32	5	57	32	15
	140	M100x3	M64x3	M100x3	M64x3	112	85	163	128	25	210	7	32	5	57	32	15

Notes: (1) Dimensions **A** and **A1** are according to ISO 4395 short type.
Tolerances: max for male thread; min for female thread



7 CYLINDER'S HOUSING FEATURES

The cylinder's housings are made in "cold drawn and stressed steel"; the internal surfaces are lapped: diameter tolerance H8, roughness Ra ≤ 0,25 µm.

8 TIE RODS FEATURES

The cylinder's tie rods are made in "normalized automatic steel"; end-threads are rolled to improve the fatigue working life. They are screwed to the heads or mounted by means of nuts with a prefixed tightening torque MT, see the table at side.

TIE RODS TIGHTENING TORQUES

Ø Bore	**25**	**32**	**40**	**50**	**63**
MT [Nm]	5	9	20	70	70
Wrench	8	10	13	19	19
Ø Bore	**80**	**100**	**125**	**160**	**200**
MT [Nm]	160	160	460	820	1160
Wrench	24	24	32	41	46

9 RODS FEATURES and options

The rods materials have high strength, which provide safety coefficients higher than 4 in static stress conditions, at maximum working pressure. The rod surface is chrome plated: diameter tolerances f7; roughness Ra ≤ 0,25 µm. Corrosion resistance of 200 h in neutral spray to ISO 9227 NSS

ø Rod	Material	Rs min [N/mm²]	Chrome min thickness [mm]	Chrome hardness [HV]
12÷90	hardened and tempered alloy-steel	700	0,020	850-1150
110÷140	alloy steel	450		

Rod diameters from 12 to 70 mm have rolled threads; in rolling process the component material is stressed beyond its yield point, being deformed plastically. This offers many technical advantages: higher profile accuracy, improved fatigue working life and high wear resistance. See **tab. B015** for the calculation of the expected rod fatigue life. The rod and piston are mechanically coupled by a threaded connection in which the thread on the rod is at least equal to the external thread KK, indicated in the table 6. The piston is screwed to the rod by a prefixed tightening torque in order to improve the fatigue resistance. The stop pin ① avoids the piston unscrewing. **Contact our technical office** in case of heavy duty applications.

Rod corrosion resistance and hardness can be improved selecting the options **K** and **T** (option K affects the strength of standard rod, see **tab. B015** for the calculation of the expected rod fatigue life):
K = Nickel and chrome-plating (for rods from 22 to 110 mm)
Corrosion resistance (rating 10 to ISO 10289):
- 500 h in acetic acid salt spray to ISO 9227 AASS
- 1000 h in neutral spray to ISO 9227 NSS

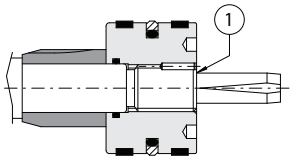
T = Induction surface hardening and chrome plating
- 56-60 HRC (613-697 HV) hardness

10 DOUBLE ROD

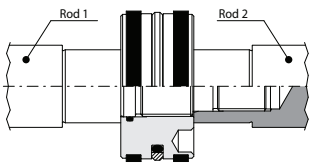
Double rod cylinders ensure the same pushing and pulling areas, thus the same speeds and forces. Rod2 (see figure at side) is screwed into the male thread of Rod1, consequently the Rod2 is weaker than the other and it is strongly recommended to use this one only to compensate the areas; the stronger rod is identified by the number '1' stamped on its end. For double rod cylinders, rod end dimensions indicated in section 6 are valid for both the rods.

ROD-PISTON COUPLING

Single rod



Double rod

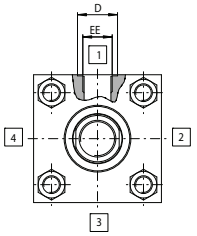


11 OIL PORTS AND ROD SPEEDS

The fluid speed in pipings connected to the cylinder oil ports should not exceed 6 m/s in order to minimize the turbolence flow, the pressure drop and water hammer. The table below shows the max recommended rod speed relative to 6 m/s flow velocity.
In high dynamic systems the rod can reach even higher speeds (after a careful check of dampable masses, **see tab. B015**): in these cases it is recommended to use piping's diameters larger than the cylinder oil ports and to introduce proper reductions just near the cylinder oil ports.

Oil ports features are threaded according to ISO 1179-1 (GAS standards) with counterbore dimension D type N (narrow).
Oil ports with SAE 3000 flanges are available on request, **contact our technical office.**

Ø Bore	Standard oil ports				Oversized oil ports **D**, **Y** options			
	D [mm]	**EE** 6g	Internal pipe Ø[mm] min	Rod speed V [m/s]	**D** [mm]	**EE** 6g	Internal pipe Ø[mm] min	Rod speed V [m/s]
25	21	G 1/4	7,5	0,54	25	G 3/8	9	0,77
32	21	G 1/4	7,5	0,33	25	G 3/8	9	0,47
40	25	G 3/8	9	0,30	29	G 1/2	14	0,73
50	29	G 1/2	14	0,47	36	G 3/4	16	0,61
63	29	G 1/2	14	0,30	36	G 3/4	16	0,39
80	36	G 3/4	16	0,18	42	G 1	20	0,37
100	36	G 3/4	16	0,15	42	G 1	20	0,24
125	42	G 1	20	0,15	52	G 1 1/4	30	0,34
160	42	G 1	20	0,09	52 (1)	G 1 1/4 (1)	30	0,21
200	52	G 1 1/4	30	0,13	58	G 1 1/2	40	0,24



Note to table:
(1) For mounting styles C, D, E, N, P, S the dimension **PJ2** reported in section 3 is modified, contact our technical office.

12 CUSHIONING

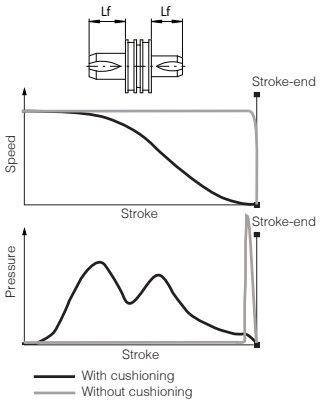
Cushioning are recommended for applications where: • the piston makes a full stroke with speed over than 0,05 m/s; • it is necessaty to reduce undesirable noise and mechanical shocks; • vertical application with heavy loads. The stroke-end cushioning are hydraulic dampers specifically designed to dissipate the energy of the mass connected to the cylinder rod, by progressively increasing the pressure in the cushioning chamber and thus reducing the rod speed before the cylinder's mechanical stroke-end (see the graphics at side). Two types of cushioning are available depending to the rod speed V:

Slow version for $V \leq 0.5 \cdot V_{max}$

Fast version for $V > 0.5 \cdot V_{max}$

See the table below for V_{max} values and **tab. B015** for the max damping energy.
When fast or slow adjustable versions are selected, the cylinder is provided with needle valve to optimize cushioning performances in different applications. The regulating screws are supplied fully screwed in (max cushioning effect).
In case of high masses and/or very high operating speeds it is recommended to back them off to optimize the cushioning effect. The adjustment screw has a special design to prevent unlocking and expulsion. The cushioning effect is highly ensured even in case of variation of the fluid viscosity.

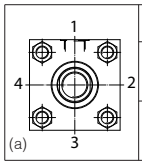
Lf is the total cushioning lenght. When the stroke-end cushioning are used as safety devices, to mechanically preserve the cylinder and the system, it is advisable to select the cylinder's stroke longer than the operating one by an amount equal to the cushioning lenght Lf; in this way the cushioning effect does not influence the movement during the operating stroke.



Ø Bore		25		32		40		50		63		80		100		125		160		200	
Ø Rod		12	18	14	22	18	22 28	22	28 36	28	36 45	36	45 56	45	56 70	56	70 90	70	90 110	90 140	110
Cushioning length [mm]	Lf front	21	17	23	17	26	25	28	27	28	27	27	29	35	27	28	25	34	34	49	34
	Lf rear	13		15		27		28		30		32		32		32		41		56	
V_{max} [m/s]		1		1		1		1		0,8		0,8		0,6		0,6		0,5		0,5	

13 POSITION COMBINATION FOR OIL PORTS AND CUSHIONING ADJUSTMENTS

FRONT HEAD: **B*** = oil port position; **E*** = cushioning adjustment position REAR HEAD: **X*** = oil port position; **Z*** = cushioning adjustment position
The table below shows all the available configurations for the oil port and cushioning adjustment positions. Bolt characters identify the standard positions. Each configuration for the front head can be variously combined with any one of the rear head. Cushioning adjustment positions **E***, **Z*** have to be entered only if adjustable cushioning are selected.
Example of model code: CK-50/22 *0100-S301 - A - **B2E3X1Z4**

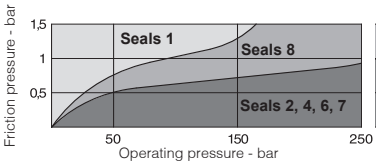


	Mounting style		C, D, S, L							E		G		H		N, P			T, V, W, X, Y, Z			
FRONT HEAD	Oil port side	**B**	**1**	1	2	1	2	4	3	**1**	1	**1**		**1**	2	**1**	1	2 ●	**1**	1	2	3
FRONT HEAD	Cushioning adjustment side	**E**	**3**	2	3	4	4	3	1	**2**	4	**3**		**3**	4	**3**	2 ●	3	**3**	4	3	1
REAR HEAD	Oil port side	**X**	**1**	1	2	1	2	4	3	**1**	1	**1**	2	**1**		**1**	1	2 ●	**1**	1	2	3
REAR HEAD	Cushioning adjustment side	**Z**	**3**	2	3	4	4	3	1	**2**	4	**3**	4	**3**		**3**	2 ●	3	**3**	4	3	1

● Not available for bores 25 and 32. Dimensions **PJ, PJ2, Y** and **Y1** change compared to the values in section 3, contact our technical office
(a) Front view rod side (rod n°1 for double rods)
Contact our technical office for combinations not included in the table.

14 SEALING SYSTEM FEATURES

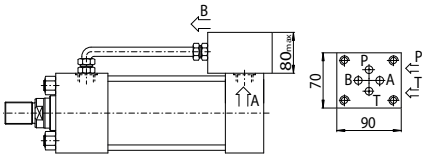
The sealing system must be choosen according to the working conditions of the system: speed, operating frequencies, fluid type and temperature. Additional verifications about minimum in/out rod speed ratio, static and dynamic sealing friction are warmly suggested, see **tab. B015**.
When single acting seals are selected (types **6** and **7**), the not pressurized cylinder's chamber must be connected to the tank. Special sealing system for low temperatures, high frequencies (up to 20 Hz), long working life and heavy duty are available, see **tab. TB020**. All the seals, static and dynamic, must be periodically replaced: proper spare kits are available, see section 23. Contact our technical office for the compatibility with other fluids not mentioned below and specify type and composition. See section 20 for fluid requirements.



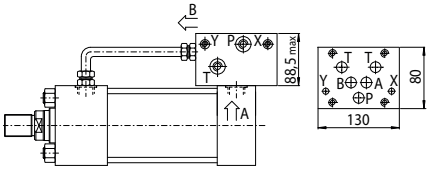
Sealing system	Material	Features	Max speed [m/s]	Fluid temperature range	Fluids compatibility	ISO Standards for seals	
						Piston	Rod
1	NBR + POLYURETHANE	**high static and dynamic sealing**	0.5	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606	ISO 7425/1	ISO 5597/1
2	FKM + PTFE	**very low friction and high temperatures**	4	-20°C to 120°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFB, HFC (water max 45%) , HFD-U,HFD-R	ISO 7425/1	ISO 7425/2
4	NBR + PTFE	**very low friction and high speeds**	4	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFC (water max 45%), HFD-U	ISO 7425/1	ISO 7425/2
6 - 7	NBR + PTFE	**very low friction single acting - pushing/pulling**	1	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFC (water max 45%), HFD-U	ISO 7425/1	ISO 7425/2
8	PTFE + NBR + POLYURETHANE	**low friction**	0,5	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606	ISO 7425/1	ISO 7425/2

15 INCORPORATED SUBPLATE

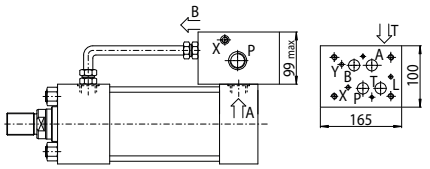
CK cylinders with oil ports positions 1 can be supplied with ISO (size 06, 10, 16 and 25) incorporated subplates for mounting of valves directly on the cylinder.



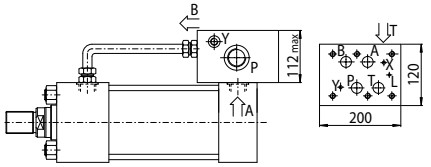
10 = subplate with mounting surface 4401-03-02-0-05 (size 06)
Oil ports P and T = G 3/8
For bores from 40 to 200 and strokes longer than 100 mm
For shorter strokes, the cylinder must be provided with suitable spacer



20 = subplate with mounting surface 4401-05-05-0-05 (size 10)
Oil ports P and T = G 3/4; X and Y = G 1/4
For bores from 40 to 200 and strokes longer than 150 mm
For shorter strokes, the cylinder must be provided with suitable spacer



30 = subplate with mounting surface 4401-07-07-0-05 (size 16)
Oil ports P and T = G 1; L, X and Y = G 1/4
For bores from 80 to 200 and strokes longer than 150 mm
For shorter strokes, the cylinder must be provided with suitable spacer

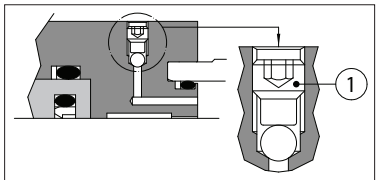


40 = subplate with mounting surface 4401-08-08-0-05 (size 25)
Oil ports P and T = G 1; L, X and Y = G 1/4
For bores from 125 to 200 and strokes longer than 150 mm
For shorter strokes, the cylinder must be provided with suitable spacer

Note: for the choice of suitable spacer see section 5. The addition of spacer length and working stroke must be at least equal or upper than the minimum stroke indicated above, see the following example:
Subplate **20**; working stroke = **70** mm; min. stroke = **150** mm ➟ select spacer **4** (lenght = **100**mm)

16 AIR BLEEDS

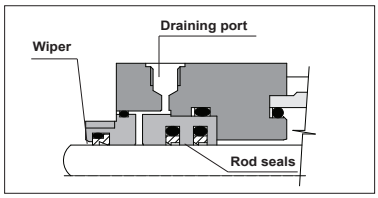
CODES: **A** = front air bleed; **W** = rear air bleed
The air in the hydraulic circuit must be removed to avoid noise, vibrations and irregular cylinder's motion: air bleed valves are recommended to realize this operation easily and safely. Air bleeds are usually positioned on the opposite side of the oil port except for front heads of mounting styles **N**, **G** (on side 3), rear heads of mounting styles **C**, **D**, **S**, **H**, **P** (on side 3) and for heads of mounting style **E** (on side 2), see section 13. For cylinders with adjustable cushioning the air bleeds are positioned on the same side of the cushioning adjustment screw. For Servocylinders, cylinders with incorporated subplates or proximity sensors, air bleeds are supplied as standard and they must not be entered in the model code. For cylinders with proximity sensors, air bleeds A, W or AW are supplied respectively depending on the selected sensors R, S or RS. For a proper use of the air-bleed (see figure on side) unlock the grub screw ① with a wrench for hexagonal head screws, bleed-off the air and retighten as indicated in table at side.



Ø Bore	Screwing	Tightening torque
25 - 40	M5 x 4	8 Nm
50 - 200	M8 x 10	20 Nm

17 DRAINING

CODE: **L** = rod side draining
The rod side draining reduces the seals friction and increases their reliability; it is mandatory for cylinders with strokes longer than 2000 mm, with rod side chamber constantly pressurized and for servocylinders.The draining is positioned on the same side of the oil port, between the wiper and the rod seals (see figure at side) and it can be supplied only with sealing system: **1**, **2**, **4**, **7** and **8**. It is recommended to connect the draining port to the tank without backpressure.
Draining port is G1/8.

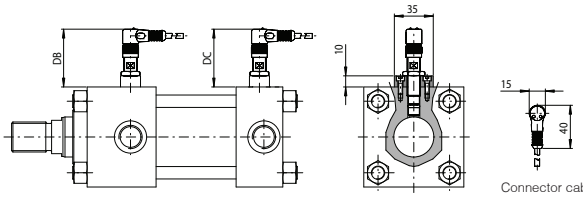


18 PROXIMITY SENSORS

CODES: **R** = front sensor; **S** = rear sensor
Proximity sensors functioning is based on the variation of the magnetic field, generated by the sensor itself, when the cushioning piston enters on its influence area, causing a change of state (on/off) of the sensors. The distance from the mechanical stroke-end of the cylinder, at which occurs the switching of the sensor's electrical contact, can be adjusted between 1 and 3 mm. For their regulation, it is necessary to position the rod where it is desired to obtain the contact switching and rotate the sensor until its LED switch-on (commutation occurred). The sensors tightening torque must be lower than 40 N/m to avoid damages. The sensors must always be coupled with fast adjustable cushioning, see section 12, to avoid pressure peaks on stroke-end. They are positioned on side 4 and they can be coupled with the standard oil ports and cushioning adjustments positions in bolt characters, see section 13. The coupling of the proximity sensors with the stroke-end cushioning imposes particular executions with limitation of the damping masses and/or speeds compared to the executions with standard cushioning.

Limitations
R, **S** options not available for cylinders with bores smaller then 40 mm.
R option not available for G and N mounting styles; **S** option not available for P and H mounting styles.

Ø Bore	40	50	63	80	100	125	160	200
DB max	60	58	71	71	71	68	68	63
DC	50	67	62	67	62	64	63	63



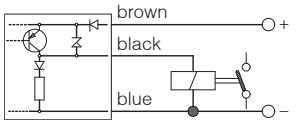
Connector cable lenght: 5m

SENSORS TECHNICAL DATA

The proximity sensors are inductive type, they supply a "NO" (Normally Open) output signal which status corresponds to the rod position:

- **R, S** = close contact = 24 Volt at output contacts = rod positioned at stroke ends
- **R**, **S** = open contact = 0 Volt at output contacts = rod not positioned at stroke ends

Ambient temperature	-20 +70°C
Nominal voltage	24 VDC
Operating voltage	10…30 VDC
Max load	□ 200 mA □
Version	PNP
Output type	NO
Repeatability	<5%
Hysteresis	<15%
Protection	IP68
Max pressure	25 MPa (250 bar)



19 SIL IEC61508 compliance with IEC 61508: 2010

CK meets the requirements of:
- **SC3** (systematic capability)
- max **SIL 2** (HFT = 0 if the hydraulic system does not provide the redundancy for the specific safety function where the component is applied)
- max **SIL 3** (HFT = 1 if the hydraulic system provides the redundancy for the specific safety function where the component is applied)

20 FLUID REQUIREMENTS

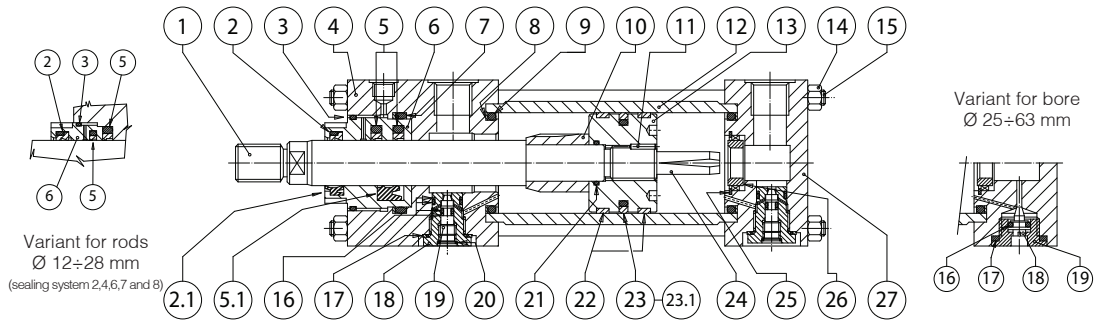
Cylinders and servocylinders are suitable for operation with mineral oils with or without additives (**HH, HL, HLP, HLP-D, HM, HV**), fire resistant fluids (**HFA** oil in water emulsion, 90-95% water and 5-10% oil; **HFB** water in oil emulsion, 40% water; **HFC** water glycol, max 45% water) and synthetic fluids (**HFD-U** organic esters, **HFD-R** phosphate esters). The fluid must have a viscosity within 15 and 100 mm²/s, a temperature within 0 and 70°C and fluid contamination class ISO 20/18/15 according to ISO 4406 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog.

21 CYLINDERS MASSES [kg] (tolerance ± 5%)

		MASS FOR STYLES X, Z Single rod		**MASS FOR STYLES X, Z** Double rod		**ADDITIONAL MASSES** according to mounting styles and options											
Ø Bore [mm]	**Ø Rod** [mm]	Stroke 100 mm	Each added 100 mm	Stroke 100 mm	Each added 100 mm	Style **C**	Style **D**	Style **E**	Style **G**	Style **L**	Style **N**	Style **P**	Style **S**	Style **V Y**	Style **W**	Each cushio-ning	Each 50 mm spacer
25	**12**	1,65	0,47	1,95	0,56	0,08	0,068	0,22	-0,02	0,19	0,18	0,18	0,08	0,01	0,02	0,03	0,38
	18	1,80	0,58	2,40	0,78												
32	**14**	2,23	0,49	2,69	0,61	0,17	0,15	0,24	0,02	0,29	0,18	0,18	0,14	0,02	0,04	0,04	0,50
	22	2,51	0,67	3,21	0,97												
40	**18**	4,90	0,79	6,78	0,99	0,27	0,22	0,256	0,08	0,78	0,76	0,76	0,57	0,06	0,12	0,07	0,79
	22	5,15	0,89	7,19	1,19												
	28	5,40	1,07	7,60	1,55												
50	**22**	6,40	1,18	7,85	1,48	0,84	0,74	0,52	0,28	1,46	1,10	1,10	0,31	0,16	0,32	0,13	1,15
	28	6,59	1,37	8,23	1,85												
	36	7,20	1,68	9,45	2,48												
63	**28**	8,70	1,62	11,08	2,10	0,52	0,41	1,54	0,26	2,17	1,34	1,34	0,46	0,16	0,32	0,25	1,68
	36	9,13	1,93	11,94	2,73												
	45	9,80	2,39	13,64	3,64												
80	**36**	17,00	2,96	20,45	3,76	1,25	0,79	1,23	1,63	3,67	2,39	2,39	0,86	0,34	0,68	0,40	2,85
	45	17,76	3,46	21,97	4,71												
	56	18,10	4,09	23,90	6,02												
100	**45**	23,80	3,90	29,85	5,15	3,05	2,31	1,63	1,00	5,46	2,94	2,94	1,77	0,34	0,68	0,60	4,15
	56	24,70	4,60	32,01	6,53												
	70	26,00	5,68	35,20	8,70												
125	**56**	43,60	6,15	53,60	8,08	3,95	2,87	4,60	1,50	8,60	5,65	5,65	4,65	0,90	1,80	1,15	6,61
	70	45,24	7,25	58,55	10,27												
	90	49,62	9,21	72,88	14,20												
160	**70**	74,55	8,75	85,96	11,77	8,33	7,63	7,56	4,66	16,58	7,97	7,97	8,21	1,50	3,00	1,85	10,75
	90	79,31	10,72	96,08	15,71												
	110	83,90	13,18	106,20	20,64												
200	**90**	123,60	12,50	136,52	17,49	10,00	13,82	14,6	9,86	37,00	16,78	16,82	14,80	2,50	5,00	2,50	15,86
	110	130,39	14,52	142,65	21,98												
	140	137,19	19,14	148,78	31,22												

Note: the masses related to the other options, not indicated in the table, don't have a relevant influence on the cylinder's mass

22 CYLINDER SECTION



POS.	DESCRIPTION	MATERIAL	POS.	DESCRIPTION	MATERIAL	POS.	DESCRIPTION	MATERIAL
1	Rod	Chrome plated steel	9	O-ring	NBR / FKM	19	Cushioning adjustment screw	Steel
2	Wiper	NBR / FKM and PTFE	10	Front cushioning piston	Steel	20	Seeger	Steel
2.1	Wiper (G1)	Polyurethane	11	Screw stop pin	Steel	21	O-ring	NBR / FKM
3	O-ring	NBR / FKM	12	Cylinder housing	Steel	22	Piston guide ring	PTFE or phenolic resin
4	Front head	Steel / cast iron	13	Piston	Steel	23	Piston seal	NBR / FKM and PTFE
5	Rod seal	NBR / FKM and PTFE	14	Nut	Steel	23.1	Piston seal (G1)	NBR and Polyurethane
5.1	Rod seal (type G1)	Polyurethane	15	Tie rod	Steel	24	Rear cushioning piston	Steel
6	Rod bearing	Bronze	16	O-ring and anti-extrusion ring	FKM and PTFE	25	Toroidal ring	Steel
7	O-ring and anti-extrusion ring	NBR / FKM and PTFE	17	Seal	FKM	26	Rear cushioning sleeve	Bronze
8	Anti-extrusion ring	PTFE	18	Cushioning adjustment plug	Steel	27	Rear head	Steel / cast iron

23 SPARE PARTS - SEE TABLE SP-B137

Example for seals spare parts code

G 8	-	C K	-	50	/	22	/	22

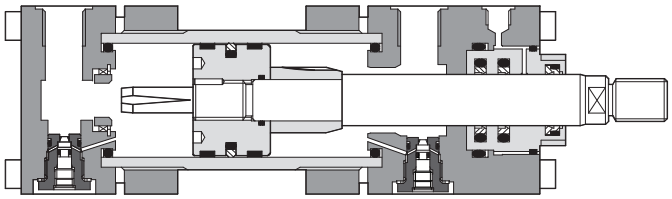
- Sealing system
- Cylinder series
- Bore size [mm]
- Rod diameter [mm]
- Second rod diameter for double rod [mm] Omit if not requested

Hydraulic cylinders type CH - square heads with counterflanges

to ISO 6020-2 - nominal pressure 16 MPa (160 bar) - max 25 MPa (250 bar)

EAC

SIL
IEC61508



CE

CH cylinders have engineered double acting construction, designed to suit the requirements of industrial applications: top reliability, high performances and long working life.

- Bore sizes from **63** to **200** mm
- Adjustable or fixed cushioning
- Optional built-in position transducer, **see tab. B310**
- Attachments for rods and mounting styles, **see tab. B800**
- CH cylinders are **SIL** compliance with IEC 61508 (TÜV certified), certification on request

For cylinder's choice and sizing criteria **see tab. B015**

1 MODEL CODE

CH | **P** / **10** - **63** / **28** / **28** * **0500** - **S** | **3** | **0** | **1** - **A** - **B1E3X1Z3** | ******

Cylinder series
CH to ISO 6020 - 2

Rod position transducer
- = omit if not requested
F = magnetosonic
M = magnetosonic programmable
N = magnetostrictive
P = potentiometric
V = inductive
Transducer available on request, contact our technical office

Incorporated subplate, see section 15
- = omit if subplate is not requested
10 = size 06
20 = size 10
30 = size 16
40 = size 25

Bore size, see section 3
from **63** to **200** mm

Rod diameter, see sections 7 and 9
from **28** to **140** mm

Second rod diameter for double rod, see section 10
from **28** to **140** mm, omit for single rod

Stroke, see section 5
up to **5000** mm

Mounting style, see sections 2 and 3

	REF. ISO
D = fixed eye	MP3 **(3)**
E = feet	MS2
G = front trunnion	MT1
H = rear trunnion	MT2 **(3)**
N = front flange	ME5
P = rear flange	ME6 **(3)**
S = fixed eye + spherical bearing	MP5 **(3)**
X = basic execution	-

Spacer, see section 6
0 = none **2** = 50 mm **4** = 100 mm **6** = 150 mm **8** = 200 mm

Cushioning, see section 12
0 = none

Fast adjustable	Slow adjustable	Fast fixed
1 = rear only	**4** = rear only	**7** = rear only
2 = front only	**5** = front only	**8** = front only
3 = front and rear	**6** = front and rear	**9** = front and rear

Sealing system, see section 14
1 = (NBR + POLYURETHANE) high static and dynamic sealing
2 = (FKM + PTFE) very low friction and high temperatures
4 = (NBR + PTFE) very low friction and high speeds
6 = (NBR + PTFE) very low friction, single acting - pushing
7 = (NBR + PTFE) very low friction, single acting - pulling
8 = (NBR + PTFE and POLYURETHANE) low friction

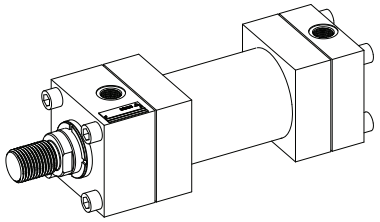
Options (2):
Rod end, see section 7
F = female thread
G = light female thread
H = light male thread
Oversized oil ports, see section 11
D = front oversized oil port
Y = rear oversized oil port
Proximity sensors, see section 18
R = front sensor
S = rear sensor
Rod treatment, see section 9
K = nickel and chrome plating
T = induction surface hardening and chrome plating
Air bleeds, see section 16
A = front air bleed
W = rear air bleed
Draining, see section 17
L = rod side draining

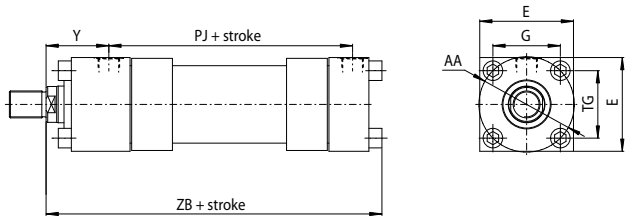
Heads' configuration (2), see section 13
Oil ports positions
B* = front head
X* = rear head
Cushioning adjustments positions, to be entered only if adjustable cushioning are selected
E* = front head
Z* = rear head
* = selected position (1, 2, 3 or 4)

Series number **(1)**

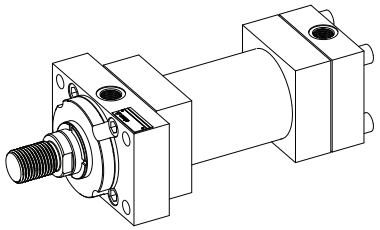
(1) For spare parts request indicate the series number printed on the nameplate only for series < 30
(2) To be entered in alphabetical order **(3)** Not available for double rod

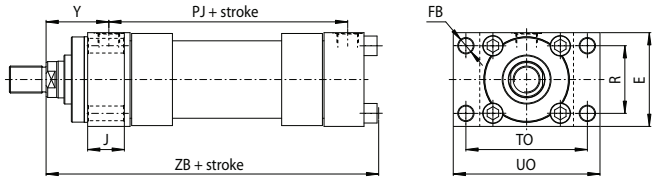
2 MOUNTING STYLE - for dimensions see section 3



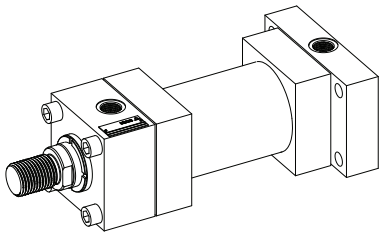


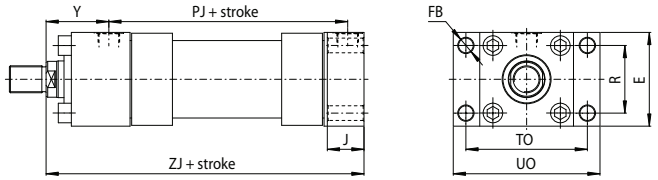
X = basic mounting



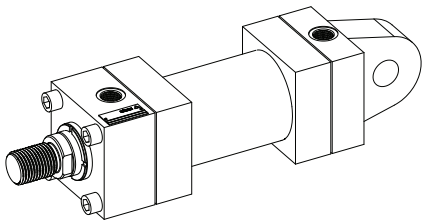


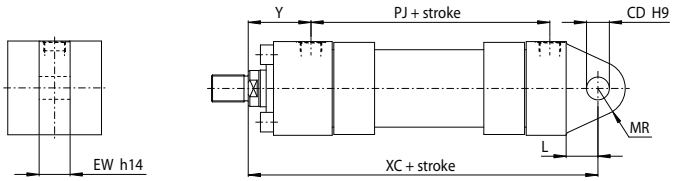
N (ISO ME5) = front flange mounting



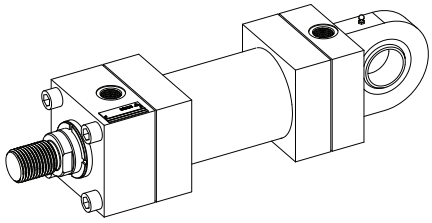


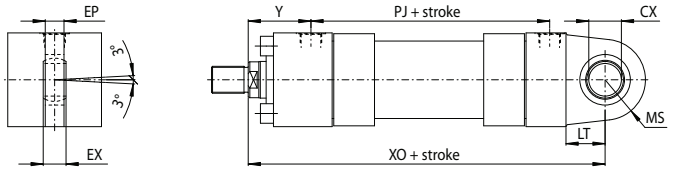
P (ISO ME6) = rear flange mounting



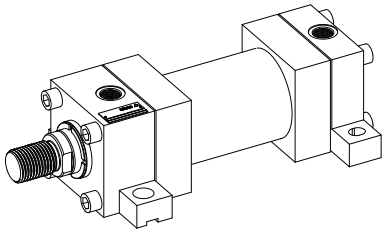


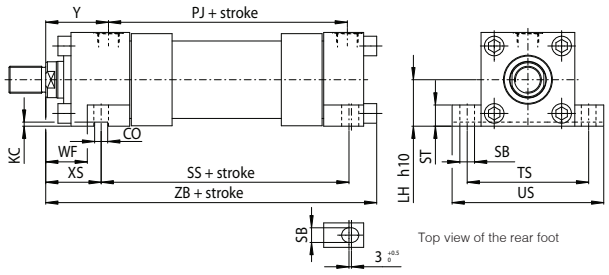
D (ISO MP3) = fixed eye mounting



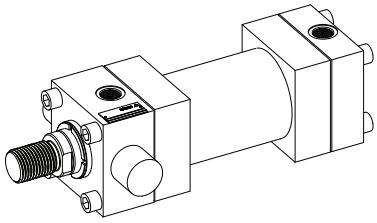


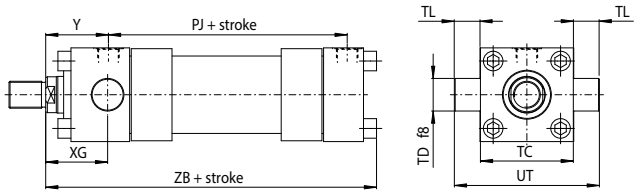
S (ISO MP5) = fixed eye with spherical bearing mounting



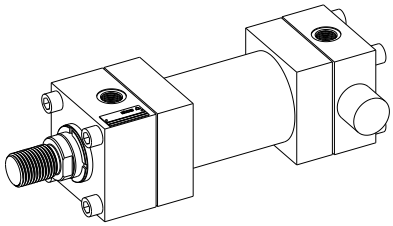


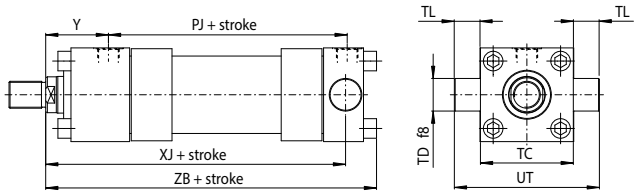
E (ISO MS2) = side feet mounting



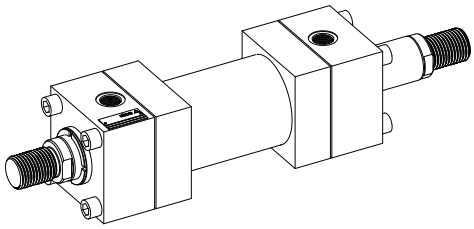


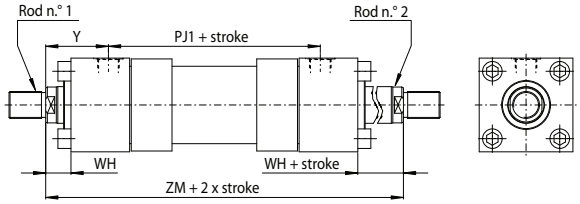
G (ISO MT1) = front trunnion mounting



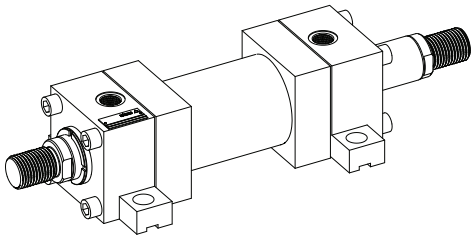


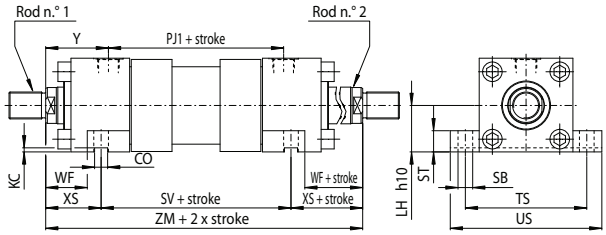
H (ISO MT2) = rear trunnion mounting





X = basic mounting for double rod





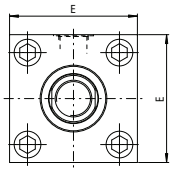
E = feet mounting for double rod

3 INSTALLATION DIMENSION [mm] - see figures in section 2

Ø Bore		63	80	100	125	160	200
Ø Rod	standard	28	36	45	56	70	90
	intermediate	36	45	56	70	90	110
	differential	45	56	70	90	110	140
AA		91	117	137	178	219	269
CD H9		20	28	36	45	56	70
CO N9		16	16	16	20	30	40
CX	value	30	40	50	60	80	100
	tolerance	0 -0,012			0 -0,015		0 -0,02
E (1)		90±1,5	115±1,5	130±2	165±2	205±2	245±2
EP max		19	23	30	38	47	57
EW h14		30	40	50	60	70	80
EX		22 0/-0,12	28 0/-0,12	35 0/-0,12	44 0/-0,15	55 0/-0,15	70 0/-0,2
FB H13		14	18	18	22	26	33
J ref		38	45	45	58	58	76
L min		32	39	54	57	63	82
LH h10		44	57	63	82	101	122
LT min		38	48	58	72	92	116
KC min		4,5	5	6	6	8	8
MR max		29	34	50	53	59	78
MS max		40	50	62	80	100	120
PJ (2) ±1,5 (3)		80	93	101	117	130	165
PJ1 ±1,5 (3)		81	92	101	117	130	160
PJ2 (2) ±1,5 (3)		80	93	99	121	143	167
R js13		65	83	97	126	155	190
SB H13		18	18	26	26	33	39
SS ±1,25 (3)		85	104	101	130	129	171
ST js13		26	26	32	32	38	44
SV ±1,25 (3)		93	110	107	131	130	172
TC h14		89	114	127	165	203	241
TD f8		32	40	50	63	80	100
TG js13		64,3	82,7	96,9	125,9	154,9	190,2
TL js13		25	32	40	50	63	80
TO js13		117	149	162	208	253	300
TS js13		124	149	172	210	260	311
UO max		145	180	200	250	300	360
US max		161	186	216	254	318	381
UT ref		139	178	207	265	329	401
XC ±1,5 (3)		200	229	257	289	308	381
XG ±2 (3)		70	76	71	75	75	85
XJ ±1,5 (3)		149	168	187	209	230	276
XO ±1,5 (3)		206	238	261	304	337	415
XS ±2 (3)		65	68	79	79	86	92
Y (2) ±2 (3)		71	77	82	86	86	98
Y1 (2) ±2 (3)		70	75,5	83	84	79,5	97
ZB max		185	212	225	260	279	336
ZJ ±1 (3)		168	190	203	232	245	299
ZM ±2 (3)		223	246	265	289	302	356

NOTES TO TABLE 3

(1) **E** - If not otherwise specified in the figures in section 2 this value is the front and rear square heads dimension for all the mounting styles (see figure below)



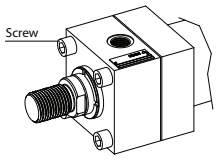
(2) When oversized oil ports are selected (see section 11 and 13 for dimensions and positions) dimensions **PJ** and **Y** are respectively modified into **PJ2** and **Y1**

(3) The tolerance is valid for strokes up to 1250 mm, for longer strokes the upper tolerance is given by the max stroke tolerance in section 5

4 SCREWS TIGHTENING TORQUES

Mounting screws must be to a minimum strength of ISO 898/2 grade 12.9.

Ø Bore	63	80	100	125	160	200
MT [Nm]	70	160	160	460	820	1160
Screw	M12	M16	M16	M22	M27	M30



5 STROKE SELECTION

Stroke has to be selected a few mm longer than the working stroke, to prevent to use the cylinder heads as mechanical stroke-end.
The table below shows the minimum stroke depending to the bore.

Minimum stroke [mm]

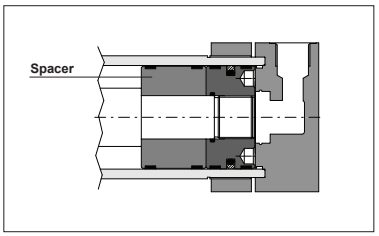
Ø Bore	63	80	100	125	160	200
Minimum stroke	55	70	70	75	70	85

Maximum stroke:
- 5000 mm

Stroke tolerances:
- 0 +2 mm for strokes up to 1250 mm
- 0 +5 mm for strokes from 1250 to 3150 mm
- 0 +8 mm for strokes over 3150 mm

6 SPACER

For strokes longer than 1000 mm, proper spacers have to be introduced in the cylinder's construction to increase the rod and piston guide and to protect them from overloads and premature wear. Spacers can be omitted for cylinders working in traction mode. The introduction of spacers increases the overall cylinder's dimensions: spacers' lenght has to be added to all stroke dependent dimensions in section 3.



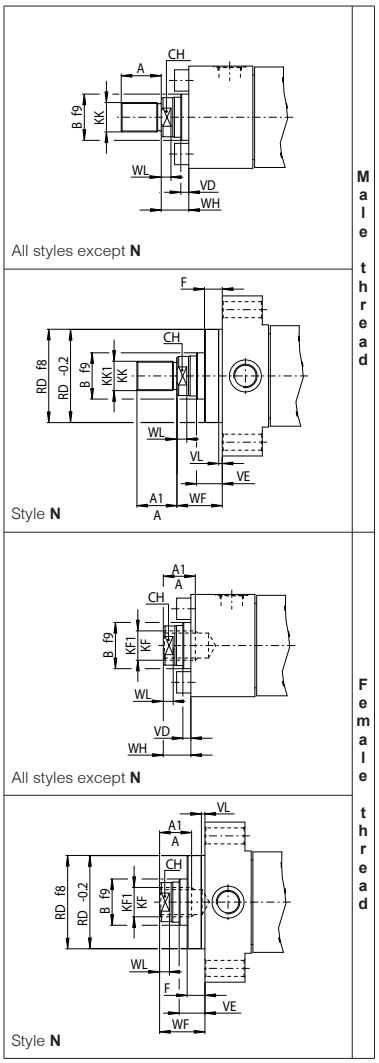
RECOMMENDED SPACERS [mm]

Stroke	1001 ÷ 1500	1501 ÷ 2000	2001 ÷ 2500	2501 ÷ 5000
Spacer code	**2**	**4**	**6**	**8**
Length	50	100	150	200

7 ROD END DIMENSIONS [mm]

Ø Bore	Ø Rod	Male thread		Female thread		A (KK or KF) (1)	A1 (KK1 or KF1) (1)	B	CH	F	RD	VD	VE	VL	WF	WH	WL
		KK	KK1 (option **H**)	KF (option **F**)	KF1 (option **G**)												
		6g	6g	6H	6H			f9	h14	max	f8		max	min	±2	±2	min
63	28	M20x1,5	NA	M20x1,5	NA	28	NA	42	22	16	75	13	29	4	48	32	7
	36	M27x2	M20x1,5	M27x2	NA	36	NA	50	30	16	88	13	29	4	48	32	8
	45	M33x2	M20x1,5	M33x2	M20x1,5	45	28	60	39	16	88	13	29	4	48	32	10
80	36	M27x2	NA	M27x2	NA	36	NA	50	30	20	82	9	29	4	51	31	8
	45	M33x2	M27x2	M33x2	NA	45	NA	60	39	20	105	9	29	4	51	31	10
	56	M42x2	M27x2	M42x2	M27x2	56	36	72	48	20	105	9	29	4	51	31	10
100	45	M33x2	NA	M33x2	NA	45	NA	60	39	22	92	10	32	5	57	35	10
	56	M42x2	M33x2	M42x2	NA	56	NA	72	48	22	125	10	32	5	57	35	10
	70	M48x2	M33x2	M48x2	M33x2	63	45	88	62	22	125	10	32	5	57	35	10
125	56	M42x2	NA	M42x2	NA	56	NA	72	48	22	105	10	32	5	57	35	10
	70	M48x2	M42x2	M48x2	NA	63	NA	88	62	22	150	7	29	5	57	35	10
	90	M64x3	M42x2	M64x3	M42x2	85	56	108	80	22	150	7	29	5	57	35	15
160	70	M48x2	NA	M48x2	NA	63	NA	88	62	25	125	7	32	5	57	32	10
	90	M64x3	M48x2	M64x3	NA	85	NA	108	80	25	170	7	32	5	57	32	15
	110	M80x3	M48x2	M80x3	M48x2	95	63	133	100	25	170	7	32	5	57	32	15
200	90	M64x3	NA	M64x3	NA	85	NA	108	80	25	150	7	32	5	57	32	15
	110	M80x3	M64x3	M80x3	NA	95	NA	133	100	25	210	7	32	5	57	32	15
	140	M100x3	M64x3	M100x3	M64x3	112	85	163	128	25	210	7	32	5	57	32	15

Notes: (1) Dimensions **A** and **A1** are according to ISO 4395 short type.
Tolerances: max for male thread; min for female thread



8 CYLINDER'S HOUSING FEATURES

The cylinder's housings are made in "cold drawn and stressed steel"; the internal surfaces are lapped; diameter tolerance H8, roughness Ra ≤ 0,25 µm.

9 RODS FEATURES and options

The rods materials have high strength, which provide safety coefficients higher than 4 in static stress conditions, at maximum working pressure. The rod surface is chrome plated: diameter tolerance f7, roughness Ra ≤ 0,25 µm. Corrosion resistance of 200h in neutral spray to ISO 9227 NSS.

ø Rod	Material	Rs min [N/mm²]	Chrome	
			min thickness [mm]	hardness [HV]
28÷90	hardened and tempered alloy-steel	700	0,020	850-1150
110÷140	alloy steel	450		

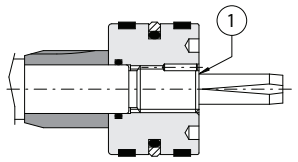
Rod diameters from 28 to 70 mm have rolled threads; in rolling process the component material is stressed beyond its yield point, being deformed plastically. This offers many technical advantages: higher profile accuracy, improved fatigue working life and high wear resistance. See **tab. B015** for the calculation of the expected rod fatigue life. The rod and piston are mechanically coupled by a threaded connection in which the thread on the rod is at least equal to the external thread KK, indicated in the table 7. The piston is screwed to the rod by a prefixed tightening torque in order to improve the fatigue resistance. The stop pin ① avoids the piston unscrewing. **Contact our technical office** in case of heavy duty applications.

Rod corrosion resistance and hardness can be improved selecting the options **K** and **T** (option K affects the strength of standard rod, see **tab. B015** for the calculation of the expected rod fatigue life):
K = Nickel and chrome-plating (for rods up to 110 mm)
Corrosion resistance (rating 10 to ISO 10289):
- 500 h in acetic acid salt spray to ISO 9227 AASS
- 1000 h in neutral spray to ISO 9227 NSS

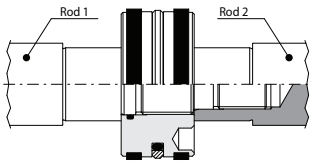
T = Induction surface hardening and chrome plating
- 56-60 HRC (613-697 HV) hardness

ROD-PISTON COUPLING

Single rod



Double rod



10 DOUBLE ROD

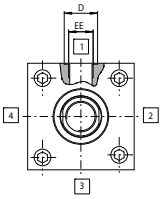
Double rod cylinders ensure the same pushing and pulling areas, thus the same speeds and forces. Rod2 (see figure at side) is screwed into the male thread of Rod1, consequently the Rod2 is weaker than the other and it is strongly recommended to use this one only to compensate the areas; the stronger rod is identified by the number '1' stamped on its end. For double rod cylinders, rod end dimensions indicated in section 7 are valid for both the rods.

11 OIL PORTS AND ROD SPEEDS

The fluid speed in pipings connected to the cylinder oil ports should not exceed 6 m/s in order to minimize the turbolence flow, the pressure drop and water hammer. The table below shows the max recommended rod speed relative to 6 m/s flow velocity.
In high dynamic systems the rod can reach even higher speeds (after a careful check of dampable masses, **see tab. B015**): in these cases it is recommended to use piping's diameters larger than the cylinder oil ports and to introduce proper reductions just near the cylinder oil ports.

Ø Bore	Standard oil ports				Oversized oil ports **D**, **Y** options			
	D [mm]	**EE** 6g	Internal pipe Ø[mm] min	Rod speed V [m/s]	**D** [mm]	**EE** 6g	Internal pipe Ø[mm] min	Rod speed V [m/s]
63	29	G 1/2	14	0,30	36	G 3/4	16	0,39
80	36	G 3/4	16	0,18	42	G 1	20	0,37
100	36	G 3/4	16	0,15	42	G 1	20	0,24
125	42	G 1	20	0,15	52	G 1 1/4	30	0,34
160	42	G 1	20	0,09	52 (1)	G 1 1/4	30	0,21
200	52	G 1 1/4	30	0,13	58	G 1 1/2	40	0,24

Oil ports features are threaded according to ISO 1179-1 (GAS standards) with counterbore dimension D type N (narrow).
Oil ports with SAE 3000 flanges are available on request, **contact our technical office.**



Note to table:
(1) For mounting styles D, E, N, P, S the dimension **PJ2** reported in section 3 is modified, contact our technical office.

12 CUSHIONING

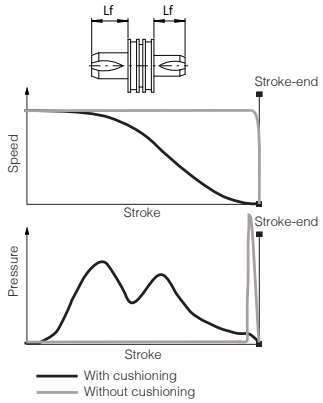
Cushioning are recommended for applications where: • the piston makes a full stroke with speed over than 0,05 m/s; • it is necessary to reduce undesirable noise and mechanical shocks; • vertical application with heavy loads. The stroke-end cushioning are hydraulic dampers specifically designed to dissipate the energy of the mass connected to the cylinder rod, by progressively increasing the pressure in the cushioning chamber and thus reducing the rod speed before the cylinder's mechanical stroke-end (see the graphics at side). Two types of cushioning are available depending to the rod speed V:

Slow version for $V \leq 0.5 \cdot V_{max}$
Fast version for $V > 0.5 \cdot V_{max}$

See the table below for V_{max} values and **tab. B015** for the max damping energy.
When fast or slow adjustable versions are selected, the cylinder is provided with needle valve to optimize cushioning performances in different applications. The regulating screws are supplied fully screwed in (max cushioning effect).
In case of high masses and/or very high operating speeds it is recommended to back them off to optimize the cushioning effect. The adjustment screw has a special design to prevent unlocking and expulsion. The cushioning effect is highly ensured even in case of variation of the fluid viscosity.

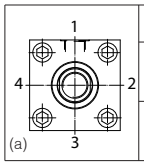
Ø Bore		**63**		**80**		**100**		**125**		**160**		**200**	
Ø Rod		**28**	**36 45**	**36**	**45 56**	**45**	**56 70**	**56**	**70 90**	**70**	**90 110**	**90 140**	**110**
Cushioning length [mm]	Lf front	28	27	27	29	35	27	28	25	34	34	49	34
	Lf rear	30		32		32		32		41		50	
Vmax [m/s]		0,8		0,8		0,6		0,6		0,5		0,5	

Lf is the total cushioning lenght. When the stroke-end cushioning are used as safety devices, to mechanically preserve the cylinder and the system, it is advisable to select the cylinder's stroke longer than the operating one by an amount equal to the cushioning lenght Lf; in this way the cushioning effect does not influence the movement during the operating stroke.



13 POSITION COMBINATION FOR OIL PORTS AND CUSHIONING ADJUSTMENTS

FRONT HEAD: **B*** = oil port position; **E*** = cushioning adjustment position REAR HEAD: **X*** = oil port position; **Z*** = cushioning adjustment position
The table below shows all the available configurations for the oil port and cushioning adjustment positions. Bolt characters identify the standard positions. Each configuration for the front head can be variously combined with any one of the rear head. Cushioning adjustment positions **E***, **Z*** have to be entered only if adjustable cushioning are selected.
Example of model code: CH-63/28 *0100-S301 - A - **B2E3X1Z4**

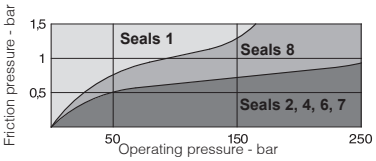


Mounting style			**D, S**							**E**		**G**		**H**		**N, P**			**X**			
FRONT HEAD	Oil port side	**B**	**1**	1	2	1	2	4	3	**1**	1	**1**		**1**	2	**1**	1	2 ●	**1**	1	2	3
	Cushioning adjustment side	**E**	**3**	2	3	4	4	3	1	**2**	4	**3**		**3**	4	**3**	2	3	**3**	4	3	1
REAR HEAD	Oil port side	**X**	**1**	1	2	1	2	4	3	**1**	1	**1**	2	**1**		**1**	1	2 ●	**1**	1	2	3
	Cushioning adjustment side	**Z**	**3**	2	3	4	4	3	1	**2**	4	**3**	4	**3**		**3**	2	3	**3**	4	3	1

● Dimensions **PJ, PJ2, Y** and **Y1** change compared to the values in section 3, contact our technical office
(a) Front view rod side (rod n°1 for double rods)
Contact our technical office for combinations not included in the table.

14 SEALING SYSTEM FEATURES

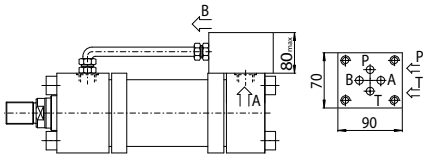
The sealing system must be choosen according to the working conditions of the system: speed, operating frequencies, fluid type and temperature.Additional verifications about minimum in/out rod speed ratio, static and dynamic sealing friction are warmly suggested, see **tab. B015**.
When single acting seals are selected (types **6** and **7**), the not pressurized cylinder's chamber must be connected to the tank. Special sealing system for low temperatures, high frequencies (up to 20 Hz), long working life and heavy duty are available, see **tab. TB020**. All the seals, static and dynamic, must be periodically replaced: proper spare kits are available, see section 23. Contact our technical office for the compatibility with other fluids not mentioned below and specify type and composition. See section 20 for fluid requirements.

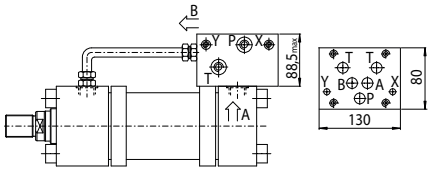


Sealing system	Material	Features	Max speed [m/s]	Fluid temperature range	Fluids compatibility	ISO Standards for seals	
						Piston	Rod
1	NBR + POLYURETHANE	**high static and dynamic sealing**	0.5	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606	ISO 7425/1	ISO 5597/1
2	FKM + PTFE	**very low friction and high temperatures**	4	-20°C to 120°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFB, HFC (water max 45%), HFD-U,HFD-R	ISO 7425/1	ISO 7425/2
4	NBR + PTFE	**very low friction and high speeds**	4	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFC (water max 45%), HFD-U	ISO 7425/1	ISO 7425/2
6 - 7	NBR + PTFE	**very low friction single acting - pushing/pulling**	1	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFC (water max 45%), HFD-U	ISO 7425/1	ISO 7425/2
8	PTFE + NBR + POLYURETHANE	**low friction**	0,5	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606	ISO 7425/1	ISO 7425/2

15 INCORPORATED SUBPLATE

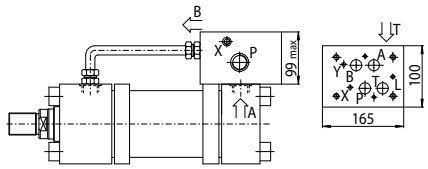
CH cylinders with oil ports positions 1 can be supplied with ISO (size 06, 10, 16 and 25) incorporated subplates for mounting of valves directly on the cylinder.

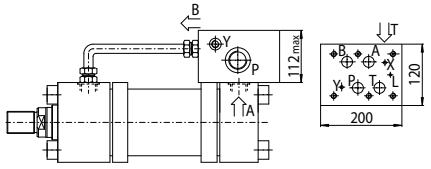




10 = subplate with mounting surface 4401-03-02-0-05 (size 06)
Oil ports P and T = G 3/8
For bores from 63 to 200 and strokes longer than 100 mm
For shorter strokes, the cylinder must be provided with suitable spacer

20 = subplate with mounting surface 4401-05-05-0-05 (size 10)
Oil ports P and T = G 3/4; X and Y = G 1/4
For bores from 63 to 200 and strokes longer than 150 mm
For shorter strokes, the cylinder must be provided with suitable spacer





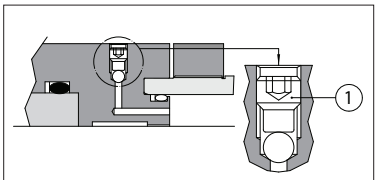
30 = subplate with mounting surface 4401-07-07-0-05 (size 16)
Oil ports P and T = G 1; L, X and Y = G 1/4
For bores from 80 to 200 and strokes longer than 150 mm
For shorter strokes, the cylinder must be provided with suitable spacer

40 = subplate with mounting surface 4401-08-08-0-05 (size 25)
Oil ports P and T = G 1; L, X and Y = G 1/4
For bores from 125 to 200 and strokes longer than 150 mm
For shorter strokes, the cylinder must be provided with suitable spacer

Note: for the choice of suitable spacer see section 6. The addition of spacer length and working stroke must be at least equal or upper than the minimum stroke indicated above, see the following example:
Subplate **20** ; working stroke = **70** mm; min. stroke = **150** mm → select spacer **4** (lenght = **100**mm)

16 AIR BLEEDS

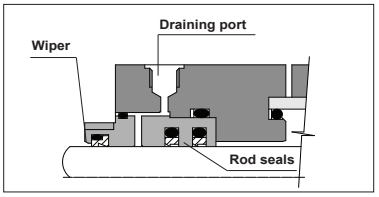
CODES: **A** = front air bleed; **W** = rear air bleed
The air in the hydraulic circuit must be removed to avoid noise, vibrations and irregular cylinder's motion: air bleed valves are recommended to realize this operation easily and safely. Air bleeds are usually positioned on the opposite side of the oil port except for front heads of mounting styles **N**, **G** (on side 3), rear heads of mounting styles **D**, **S**, **H**, **P** (on side 3) and for heads of mounting style **E** (on side 2), see section 13. For cylinders with adjustable cushioning the air bleeds are positioned on the same side of the cushioning adjustment screw. For Servocylinders, cylinders with incorporated subplates or proximity sensors, air bleeds are supplied as standard and they must not be entered in the model code. For cylinders with proximity sensors, air bleeds A, W or AW are supplied respectively depending on the selected sensors R, S or RS. For a proper use of the air-bleed (see figure on side) unlock the grub screw ① with a wrench for hexagonal head screws, bleed-off the air and retighten as indicated in table at side.



Ø Bore	Screwing	Tightening torque
63 - 200	M8 x 10	20 Nm

17 DRAINING

CODE: **L** = rod side draining
The rod side draining reduces the seals friction and increases their reliability; it is mandatory for cylinders with strokes longer than 2000 mm, with rod side chamber constantly pressurized and for servocylinder.
The draining is positioned on the same side of the oil port, between the wiper and the rod seals (see figure at side) and it can be supplied only with sealing system: **1**, **2**, **4**, **7** and **8**. It is recommended to connect the draining port to the tank without backpressure.
Draining port is G1/8.

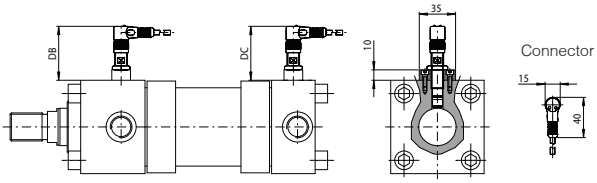


18 PROXIMITY SENSORS

CODES: **R** = front sensor; **S** = rear sensor
Proximity sensors functioning is based on the variation of the magnetic field, generated by the sensor itself, when the cushioning piston enters on its influence area, causing a change of state (on/off) of the sensors. The distance from the mechanical stroke-end of the cylinder, at which occurs the switching of the sensor's electrical contact, can be adjusted between 1 and 3 mm. For their regulation, it is necessary to position the rod where it is desired to obtain the contact switching and rotate the sensor until its LED switch-on (commutation occurred). The sensors tightening torque must be lower than 40 N/m to avoid damages. The sensors must always be coupled with fast adjustable cushioning, see section 12, to avoid pressure peaks on stroke-end. They are positioned on side 4 and they can be coupled with the standard oil ports and cushioning adjustaments positions in bolt characters, see section 13. The coupling of the proximity sensors with the stroke-end cushioning imposes particular executions with limitation of the damping masses and/or speeds compared to the executions with standard cushioning.

Limitations
R option not available for G and N mounting styles; **S** option not available for P and H mounting styles.

Ø Bore	63	80	100	125	160	200
DB max	71	71	71	68	68	63
DC	62	67	62	64	63	63



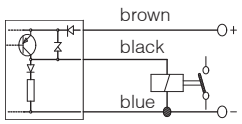
Connector cable lenght: 5m

SENSORS TECHNICAL DATA

The proximity sensors are inductive type, they supply a "NO" (Normally Open) output signal which status corresponds to the rod position:

- **R**, **S** = close contact = 24 Volt at output contacts = rod positioned at stroke ends
- **R**, **S** = open contact = 0 Volt at output contacts = rod not positioned at stroke ends

Ambient temperature	-20 +70°C
Nominal voltage	24 VDC
Operating voltage	10…30 VDC
Max load	□ 200 mA □
Version	PNP
Output type	NO
Repeatability	<5%
Hysteresis	<15%
Protection	IP68
Max pressure	25 MPa (250 bar)



19 SIL IEC61508 compliance with IEC 61508: 2010

CH meets the requirements of:
- **SC3** (systematic capability)
- max **SIL 2** (HFT = 0 if the hydraulic system does not provide the redundancy for the specific safety function where the component is applied)
- max **SIL 3** (HFT = 1 if the hydraulic system provides the redundancy for the specific safety function where the component is applied)

20 FLUID REQUIREMENTS

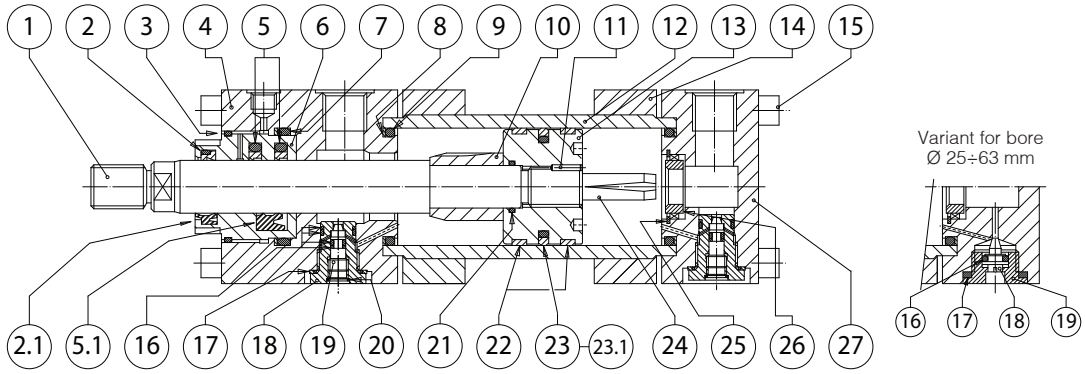
Cylinders and servocylinders are suitable for operation with mineral oils with or without additives (**HH, HL, HLP, HLP-D, HM, HV**), fire resistant fluids (**HFA** oil in water emulsion, 90-95% water and 5-10% oil; **HFB** water in oil emulsion, 40% water; **HFC** water glycol, max 45% water) and synthetic fluids (**HFD-U** organic esters, **HFD-R** phosphate esters). The fluid must have a viscosity within 15 and 100 mm²/s, a temperature within 0 and 70°C and fluid contamination class ISO 20/18/15 according to ISO 4406 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog.

21 CYLINDERS MASSES [kg] (tolerance ± 5%)

		MASS FOR STYLES X, Z Single rod		**MASS FOR STYLES X, Z** Double rod		**ADDITIONAL MASSES** according to mounting styles and options							
Ø Bore [mm]	**Ø Rod** [mm]	Stroke 100 mm	Each added 100 mm	Stroke 100 mm	Each added 100 mm	Style **D**	Style **E**	Style **G**	Style **N**	Style **P**	Style **S**	Each cushioning	Each 50 mm spacer
63	**28**	9,65	1,54	12,03	2,03	0,41	1,54	0,26	1,34	1,34	0,46	0,25	1,68
	36	10,17	1,85	12,98	2,65								
	45	10,84	2,31	14,68	3,56								
80	**36**	19,24	2,82	22,69	3,62	0,79	1,23	1,63	2,39	2,39	0,86	0,40	2,85
	45	20,00	3,32	24,21	4,57								
	56	20,34	3,95	26,14	5,88								
100	**45**	25,89	3,76	31,94	5,01	2,31	1,63	1,00	2,94	2,94	1,77	0,60	4,15
	56	26,79	4,46	34,10	6,39								
	70	28,09	5,54	37,29	8,56								
125	**56**	48,38	5,88	58,38	7,81	2,87	4,60	1,50	5,65	5,65	4,65	1,15	6,61
	70	50,02	6,98	63,33	10,00								
	90	54,40	8,94	77,66	13,93								
160	**70**	80,74	8,34	92,15	11,36	7,63	7,56	4,66	7,97	7,97	8,21	1,85	10,75
	90	85,50	10,31	102,27	15,31								
	110	90,09	12,77	112,39	20,23								
200	**90**	135,62	12,00	148,54	17,00	13,82	14,60	9,86	16,78	16,82	14,80	2,50	15,86
	110	142,41	14,01	154,67	21,47								
	140	149,21	18,63	160,80	30,72								

Note: the masses related to the other options, not indicated in the table, don't have a relevant influence on the cylinder's mass

22 CYLINDER SECTION



PART	DESCRIPTION	MATERIAL	PART	DESCRIPTION	MATERIAL	PART	DESCRIPTION	MATERIAL
1	Rod	Chromeplated steel	9	O-ring	NBR / FKM	19	Cushioning adjustment screw	Steel
2	Wiper	NBR / FKM and PTFE	10	Front cushioning piston	Steel	20	Seeger	Steel
2.1	Wiper (G1)	Polyurethane	11	Screw stop pin	Steel	21	O-ring	NBR / FKM
3	O-ring	NBR / FKM	12	Cylinder housing	Steel	22	Piston guide ring	PTFE or phenolic resin
4	Front head	Steel / Cast iron	13	Piston	Steel	23	Piston seal	NBR / FKM and PTFE
5	Rod seal	NBR / FKM and PTFE	14	Counterflange	Steel	23.1	Piston seal (G1)	NBR and polyurethane
5.1	Rod seal (type G1)	Polyurethane	15	Screw	Steel (grade12.9)	24	Rear cushioning piston	Steel
6	Rod bearing	Bronze	16	O-ring and anti-extrusion ring	FKM and PTFE	25	Toroidal ring	Steel
7	O-ring and anti-extrusion ring	NBR / FKM and PTFE	17	Seal	FKM	26	Rear cushioning sleeve	Bronze
8	Anti-extrusion ring	PTFE	18	Cushioning adjustment plug	Steel	27	Rear head	Steel / Cast iron

23 SPARE PARTS - SEE TABLE SP-B140

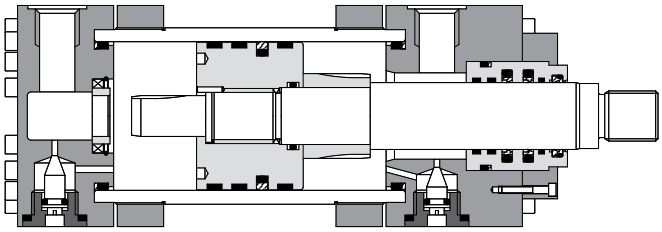
Example for seals spare parts code

G 8 - C K - 63 / 28 / 28

- G 8: Sealing system
- C K: Cylinder series
- 63: Bore size [mm]
- 28: Rod diameter [mm]
- 28: Second rod diameter for double rod [mm] Omit if not requested

Hydraulic cylinders type CH - big bore sizes

to ISO 6020-3 - nominal pressure 16 MPa (160 bar) - max 25 MPa (250 bar)



CH big bore cylinders have engineered double acting construction, designed to suit the requirements of industrial applications: top reliability, high performances and long working life.

- Bore sizes from **250** to **400** mm
- Adjustable cushioning
- Optional built-in position transducer, **see tab. B310**
- Attachments for rods and mounting styles, **see tab. B800**

For cylinder's choice and sizing criteria **see tab. B015**

1 MODEL CODE

CH	F	-	250	/	140	*	0500	-	S	3	0	8	-	A	-	B1E3X1Z3	**

Series number **(1)**

Cylinder series
CH to ISO 6020 - 3

Rod position transducer
- = omit if not requested
F = magnetosonic
M = magnetosonic programmable
N = magnetostrictive
P = potentiometric
V = inductive
Transducer available on request, contact our technical office

Bore size, see section 3
from **250** to **400** mm

Rod diameter, see sections 7
from **140** to **220** mm

Stroke, see section 4
up to **5000** mm

Mounting style, see sections 2 and 3

		REF. ISO
C	= fixed clevis	MP1
G	= front trunnion	MT1
L	= intermediate trunnion	MT4 **(3)**
N	= front flange	ME5
P	= rear flange	ME6
S	= fixed eye + spherical bearing	MX5
X	= basic execution	-

Cushioning, see section 10
0 = none
Slow adjustable
1 = rear only
2 = front only
3 = front and rear

Spacer, see section 5
0 = none **2** = 50 mm **4** = 100 mm **6** = 150 mm **8** = 200 mm

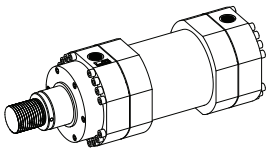
Sealing system, see section 12
2 = (FKM + PTFE) very low friction and high temperatures
8 = (NBR + PTFE) low friction

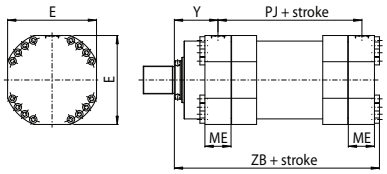
Options (2):
Rod treatment, see section 9
T = induction surface hardening and chrome plating
Air bleeds, see section 13
A = front air bleed
W = rear air bleed
Draining, see section 14
L = rod side draining
Flange oil ports, see section 6
M = front and rear SAE 6000 flange oil ports

Heads' configuration (2), see section 11
Oil ports positions
B1 = front head
X1 = rear head
Cushioning adjustments positions
E3 = front head
Z3 = rear head

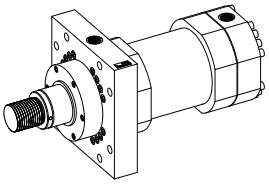
(1) For spare parts request indicate the series number printed on the nameplate only for series < 20
(2) To be entered in alphabetical order
(3) XV dimension must be indicated in the model code, see section 3

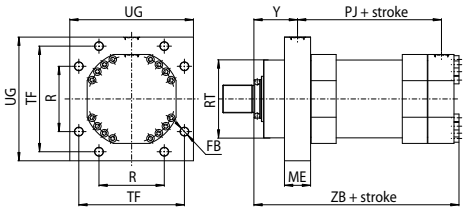
2 MOUNTING STYLE - for dimensions see section 3



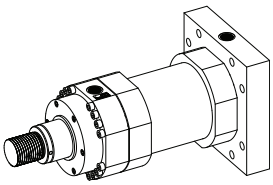


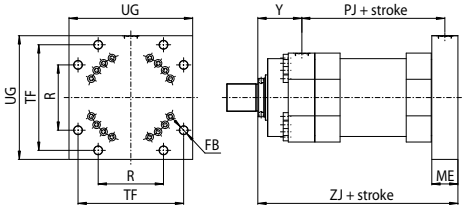
X = basic mounting



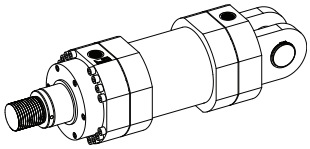


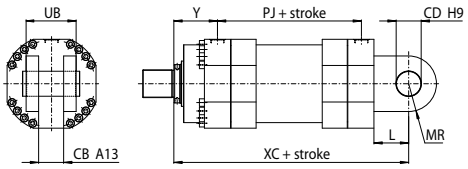
N (ISO MF5) = front flange mounting



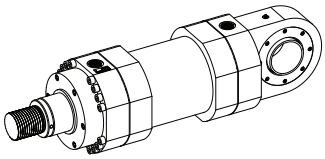


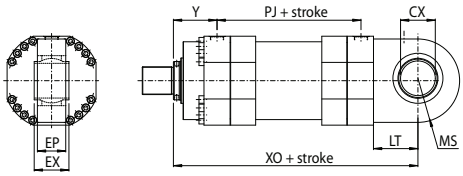
P (ISO MF6) = rear flange mounting



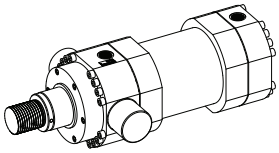


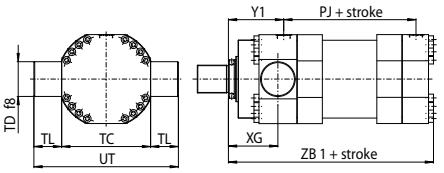
C (ISO MP1) = fixed clevis mounting - supplied with pivot pin C-145



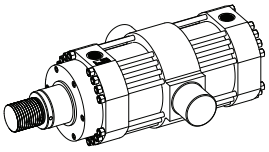


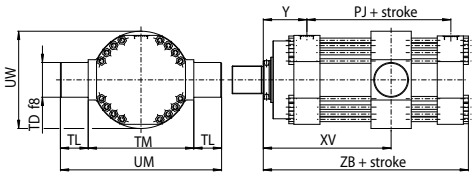
S (ISO MP5) = fixed eye with spherical bearing mounting





G (ISO MT1) = front trunnion mounting





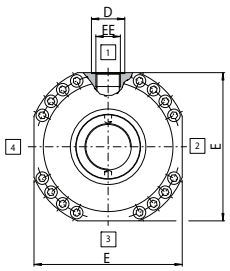
L (ISO MT4) = intermediate trunnion mounting

3 INSTALLATION DIMENSIONS [mm] - see figures in section 2

Ø Bore	250	320	400
Ø Rod	**140**	**180**	**220**
B f9 **(4)**	163	205	245
CB A13	90	110	140
CD H9	90	110	140
CX H7	125	160	200
D (1)	58	58	69
E (2) max	320	400	500
EE (1)	G 1 1/2	G 1 1/2	G 2
EP	102	130	162
EX	125	160	200
F max **(4)**	75	75	75
FB	30	36	45
L min	125	152	195
LT min	160	200	250
ME ref	94	114	140
MR max	100	120	160
MS max	160	200	250
MT (3) [Nm]	350	680	1060
PJ ±1,5 **(6)**	218	252	320
R js13	235	283	340
RD f8 **(4)**	280	325	380
TC h14	320	400	500
TD f8	125	160	200
TF	380	472	588
TL js13	100	125	160
TM h14	380	485	605
UB	180	220	280
UG max	445	549	683
UM ref	580	735	925
UT ref	520	650	820
UW max	480	600	750
VD (4)	8	8	8
VE max **(4)**	83	83	83
WF ±2	110	110	110
XC ±1,5 **(6)**	545	627	775
XG ±2 **(6)**	178	195	215
XO ±1,5 **(6)**	580	675	830
XV (5) ±2 **(6)** — **style L minimun stroke**	20	35	26
XV (5) ±2 **(6)** — **min**	275	312	358
XV (5) ±2 **(6)** — **max**	255+stroke	273+stroke	332+stroke
Y ±2 **(6)**	157	167	180
Y1 ±2 **(6)**	199	223	260
ZB max **(6)**	460	520	625
ZB1 max **(6)**	505	580	685
ZJ ±1 **(6)**	420	475	580

NOTES TO TABLE 3

(1) **D, EE** - Oil ports and drain are threaded according to GAS standard with counterbore dimension **D** according to ISO 1179-1 (see figure below)



(2) **E** - If not otherwise specified in the figures in section 2, this value is the front and rear round heads dimension for all the mounting styles (see figure above)

(3) **MT** - Screws tightening torque. Mounting screws must be to a minimum strength of ISO 898/2 grade 12.9

(4) See figures in section 7

(5) **XV** - For cylinders with mounting style **L** the stroke must always exceed the minimum values reported in the table.The requested XV value must be included between **XV min** and **XV max** and it must be always indicated, with dimension in millimeters, together with the cylinder code. See the following example:

CH - 250 / 140 * 0500 - L308 - A - B1E3X1Z3
XV = 300

(6) The tolerance is valid for strokes up to 1250 mm, for longer strokes the upper tolerance is given by the max stroke tolerance in section 4

4 STROKE SELECTION

Stroke has to be selected a few mm longer than the working stroke, to prevent to use the cylinder heads as mechanical stroke-end. The table below shows the minimum stroke depending to the bore.

Minimum stroke [mm]

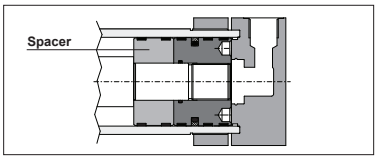
Ø Bore	250	320	400
Minimum stroke	65	70	40

Maximum stroke:
- 5000 mm

Stroke tolerances:
- 0 +2 mm for strokes up to 1250 mm
- 0 +5 mm for strokes from 1250 to 3150 mm
- 0 +8 mm for strokes over 3150 mm

5 SPACER

For strokes longer than 1000 mm, proper spacers have to be introduced in the cylinder's construction to increase the rod and piston guide and to protect them from overloads and premature wear. Spacers can be omitted for cylinders working in traction mode. The introduction of spacers increases the overall cylinder's dimensions: spacers' lenght has to be added to all stroke dependent dimensions in section 3.



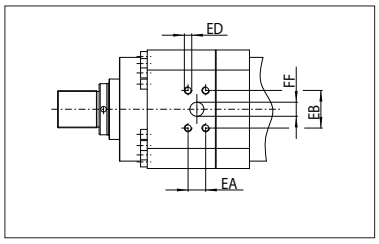
RECOMMENDED SPACERS [mm]

Stroke	1001 ÷ 1500	1501 ÷ 2000	2001 ÷ 2500	2501 ÷ 5000
Spacer code	**2**	**4**	**6**	**8**
Length	50	100	150	200

6 SAE 6000 FLANGE OIL PORTS(*) - DIMENSIONS TO ISO 6162-2 [mm]

Ø Bore	DN	EA ±0,25	EB ±0,25	ED 6g	FF 0 / -1,5
250	38	36,5	79,3	M16	38
320					
400	51	44,5	96,8	M20	51

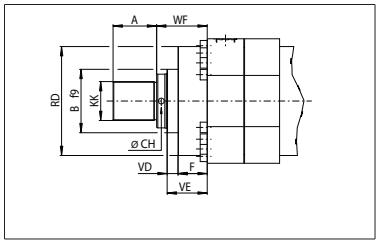
(*) out of the norm



7 ROD END DIMENSIONS [mm]

Ø Bore	250	320	400
Ø Rod	140	180	220
A	112	125	160
CH (*)	15	15	15
KK	M100x3	M125x4	M160x4

(*) n°2 holes per key
Note: for B, F, RD, VD, VE and WF dimensions see section 3



8 CYLINDER'S HOUSING FEATURES

The cylinder's housings are made in "hot rolled steel"; the internal surfaces are lapped: diameter tolerance H8, roughness Ra ≤ 0,25 µm.

9 RODS FEATURES and options

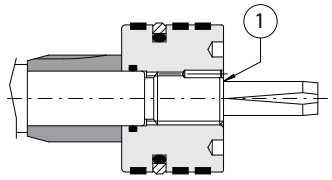
The rods materials have high strength, which provide safety coefficients higher than 4 in static stress conditions, at maximum working pressure. The rod surface is chrome plated: diameter tolerances f7; roughness Ra ≤ 0,25 µm. Corrosion resistance of 200h in neutral spray to ISO 9227 NSS.

ø Rod	Material	Rs min [N/mm²]	Chrome min thickness [mm]	Chrome hardness [HV]
140	alloy-steel	450	0,020	850-1150
180÷220	carbon steel	360	0,045	

The rod and piston are mechanically coupled by a threaded connection in which the thread on the rod is at least equal to the external thread KK, indicated in the table 7. See **tab. B015** for the calculation of the expected rod fatigue life. The piston is screwed to the rod by a prefixed tightening torque in order to improve the fatigue resistance. The stop pin ① avoids the piston unscrewing. **Contact our technical office** in case of heavy duty applications.

Rod hardness can be improved selecting the option **T**:
T = Induction surface hardening and chrome plating (only for rod 140)
• 56-60 HRC (613-697 HV) hardness

ROD-PISTON COUPLING

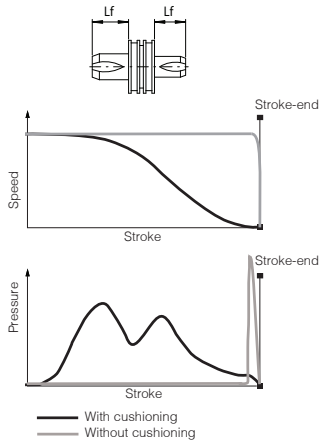


10 CUSHIONING

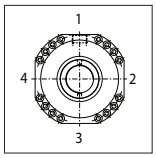
Cushioning are recommended for applications where: • the piston makes a full stroke with speed over than 0,05 m/s; • it is necessary to reduce undesirable noise and mechanical shocks; • vertical application with heavy loads. The stroke-end cushioning are hydraulic dampers specifically designed to dissipate the energy of the mass connected to the cylinder rod, by progressively increasing the pressure in the cushioning chamber and thus reducing the rod speed before the cylinder's mechanical stroke-end (see the graphics at side).
The cylinder is provided with needle valve to optimize cushioning performances in different applications. The regulating screws are supplied fully screwed in (max cushioning effect). In case of high masses and/or very high operating speeds it is recommended to back them off to optimize the cushioning effect. The adjustment screw has a special design to prevent unlocking and expulsion. The cushioning effect is highly ensured even in case of variation of the fluid viscosity.

Ø Bore		250	320	400
Ø Rod		140	180	220
Cushioning length [mm]	Lf front	50	60	70
	Lf rear	56	64	64

Lf is the total cushioning lenght. When the stroke-end cushioning are used as safety devices, to mechanically preserve the cylinder and the system, it is advisable to select the cylinder's stroke longer than the operating one by an amount equal to the cushioning lenght Lf; in this way the cushioning effect does not influence the movement during the operating stroke.



11 POSITION OF THE OIL PORTS AND CUSHIONING ADJUSTMENTS

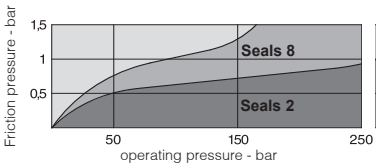


FRONT HEAD: **B1** = oil port position; **E3** = cushioning adjustment position
REAR HEAD: **X1** = oil port position; **Z3** = cushioning adjustment position.
The oil ports and cushioning adjustment positions are only available, respectively, on sides 1 and 3 (see the figure at side).

Example of model code: CH-250/140 *0100-S301 - A - **B1E3X1Z3**

12 SEALING SYSTEM FEATURES

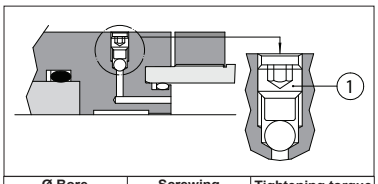
The sealing system must be choosen according to the working conditions of the system: speed, operating frequencies, fluid type and temperature. Additional verifications about minimum in/out rod speed is warmly suggested, see **tab. B015**.
Special sealing system for low temperatures, high frequencies (up to 20 Hz), long working life and heavy duty are available, see **tab. TB020**. All the seals, static and dynamic, must be periodically replaced: proper spare kits are available, see section 18. Contact our technical office for the compatibility with other fluids not mentioned below and specify type and composition. See section 15 for fluid requirements.



Sealing system	Material	Features	Max speed [m/s]	Fluid temperature range	Fluids compatibility	ISO Standards for seals	
						Piston	Rod
2	FKM + PTFE	**very low friction and high temperatures**	4	-20°C to 120°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFB, HFC (water max 45%), HFD-U,HFD-R	ISO 7425/1	ISO 7425/2
8	PTFE + NBR	**low friction**	1	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFC (water max 45%), HFD-U	ISO 7425/1	ISO 7425/2

13 AIR BLEEDS

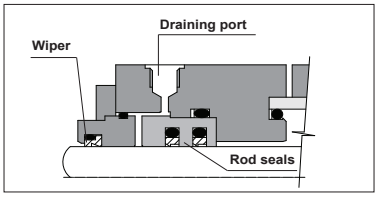
CODES: **A** = front air bleed; **W** = rear air bleed
The air in the hydraulic circuit must be removed to avoid noise, vibrations and irregular cylinder's motion: air bleed valves are recommended to realize this operation easily and safely.
Air bleeds are positioned on side 3, see section 11.
For a proper use of the air-bleed (see figure on side) unlock the grub screw ① with a wrench for hexagonal head screws, bleed-off the air and retighten as indicated in table at side.



Ø Bore	Screwing	Tightening torque
250	M8 x 10	20 Nm
320 - 400	M12 x 20	30 Nm

14 DRAINING

CODE: **L** = rod side draining
The rod side draining reduces the seals friction and increases their reliability; it is mandatory for cylinders with strokes longer than 2000 mm, with rod side chamber constantly pressurized and for servocylinders.
The draining is positioned on the same side of the oil port, between the wiper and the rod seals (see figure at side). It is recommended to connect the draining port to the tank without backpressure. Draining port is G1/8.



15 FLUID REQUIREMENTS

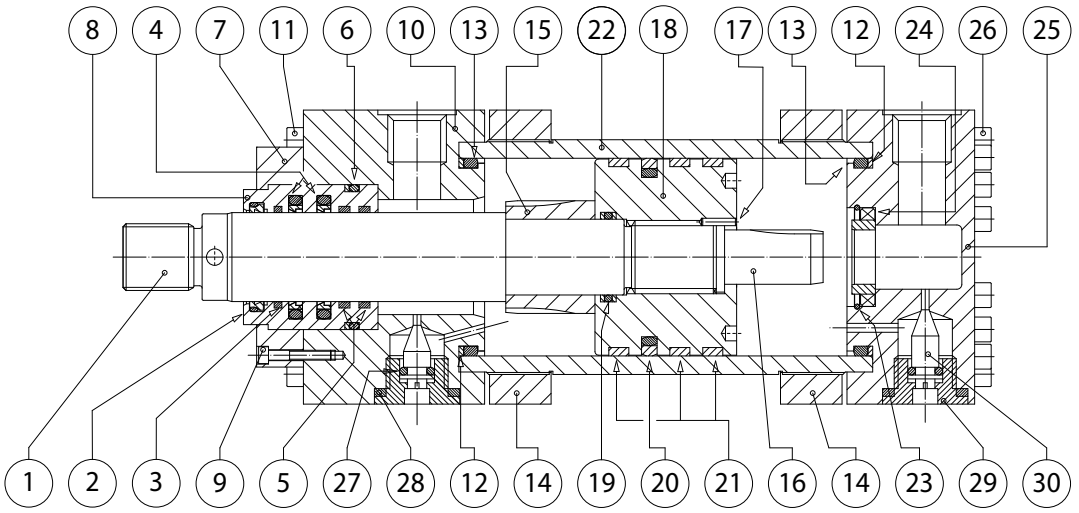
Cylinders and servocylinders are suitable for operation with mineral oils with or without additives (**HH, HL, HLP, HLP-D, HM, HV**), fire resistant fluids (**HFA** oil in water emulsion, 90-95% water and 5-10% oil; **HFB** water in oil emulsion, 40% water; **HFC** water glycol, max 45% water) and synthetic fluids (**HFD-U** organic esters, **HFD-R** phosphate esters). The fluid must have a viscosity within 15 and 100 mm^2/s, a temperature within 0 and 70°C and fluid contamination class ISO 20/18/15 according to ISO 4406 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog.

16 CYLINDERS MASSES [kg] (tolerance ± 5%)

		MASS FOR STYLE X single rod		ADDITIONAL MASSES according to mounting styles and options						
Ø Bore [mm]	**Ø Rod** [mm]	Stroke 100 mm	Each 100 mm more	Styles **C, S**	Style **G**	Style **L**	Styles **N, P**	Front cushioning	Rear cushioning	Each 50 mm spacer
250	**140**	324	27	55	9	110	83	8,5	19	28
320	**180**	485	41	82	16	160	142	11	27	44
400	**220**	902	71	155	34	360	275	17	45	72,4

Note: the masses related to the other options, not indicated in the table, don't have a relevant influence on the cylinder's mass

17 CYLINDER SECTION



POS.	DESCRIPTION	MATERIAL	POS.	DESCRIPTION	MATERIAL	POS.	DESCRIPTION	MATERIAL
1	Rod	Chrome plated steel	11	Screw	Steel (grade 12.9)	21	Piston guide ring	PTFE
2	Wiper	NBR / FKM + PTFE	12	Anti-extrusion ring	PTFE	22	Cylinder housing	Steel
3	Rod guide ring	PTFE	13	O-ring	NBR + PTFE	23	Toroidal ring	Steel
4	Rod seal	NBR + PTFE	14	Counterflange	Steel	24	Rear cushioning sleeve	Bronze
5	Rod guide ring	PTFE	15	Front cushioning piston	Steel	25	Rear head	Steel
6	O-Ring + Anti-extrusion ring	NBR / FKM + PTFE	16	Rear cushioning piston	Steel	26	Screw	Steel (grade 12.9)
7	Flange	Steel	17	Screw stop pin	Steel	27	O-Ring + Anti-extrusion ring	NBR / FKM + PTFE
8	Rod bearing	Steel	18	Piston	Steel	28	Seal	FKM
9	Screw	Steel (grade 12.9)	19	O-Ring + Anti-extrusion ring	NBR / FKM + PTFE	29	Cushioning adjustment plug	Steel
10	Front head	Steel	20	Piston seal	NBR / FKM + PTFE	30	Cushioning adjustment screw	Steel

18 SPARE PARTS - SEE TABLE SP-B160

Example for seals spare parts code

G 8 - **C H** - **250** / **140**

Sealing system

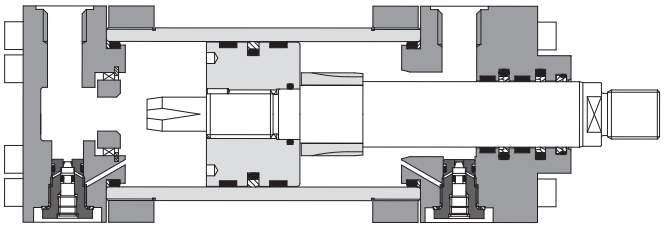
Cylinder series

Bore size [mm]

Rod diameter [mm]

Hydraulic cylinders type CN - round heads with counterflanges

to ISO 6020-1 - nominal pressure 16 MPa (160 bar) - max 25 MPa (250 bar)



CN cylinders have engineered double acting construction, designed to suit the requirements of industrial applications: top reliability, high performances and long working life.

- Bore sizes from **40** to **200** mm
- Adjustable or fixed cushioning
- Optional built-in position transducer, **see tab. B310**
- Attachments for rods and mounting styles, **see tab. B800**

For cylinder's choice and sizing criteria **see tab. B015**

1 MODEL CODE

CN	F	-	50	/	28	*	0500	-	S	3	0	8	-	A	-	B1E3X1Z3	**

Series number

Cylinder series
CN to ISO 6020 - 1

Rod position transducer
- = omit if not requested
F = magnetosonic
M = magnetosonic programmable
N = magnetostrictive
P = potentiometric
V = inductive
Transducer available on request, contact our technical office

Bore size, see section 4
from **40** to **200** mm

Rod diameter, see sections 7 and 9
from **22** to **140** mm

Stroke, see section 5
up to **5000** mm

Mounting style, see sections 2 and 4

	REF. ISO
A = front round flange	MF3
B = rear round flange	MF4
D = fixed eye	MP3
E = feet	MS2
L = intermediate trunnion	MT4 **(2)**
N = front square flange	MF1
P = rear square flange	MF2
S = fixed eye + spherical bearing	MP5
X = basic execution	-

Cushioning, see section 10
0 = none

Slow adjustable	Slow fixed
1 = rear only	**7** = rear only
2 = front only	**8** = front only
3 = front and rear	**9** = front and rear

Spacer, see section 6
0 = none **2** = 50 mm **4** = 100 mm **6** = 150 mm **8** = 200 mm

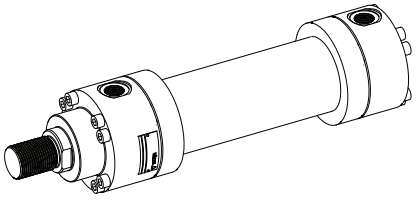
Sealing system, see section 12
2 = (FKM + PTFE) very low friction and high temperatures
4 = (NBR + PTFE) very low friction and high speeds
8 = (NBR + PTFE and POLYURETHANE) low friction

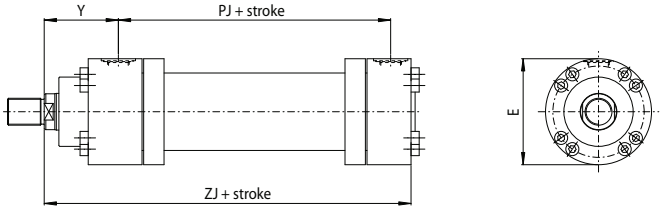
Options (1):
Oversized oil ports, see section 4
D = front oversized oil port
Y = rear oversized oil port
Rod treatment, see section 9
K = nickel and chrome plating
T = induction surface hardening and chrome plating
Air bleeds, see section 13
A = front air bleed
W = rear air bleed
Flange oil ports, see section 3
M = front and rear SAE 3000 flange oil ports

Heads' configuration (1), see section 11
Oil ports positions
B1 = front head
X1 = rear head
Cushioning adjustments positions, to be entered only if adjustable cushioning are selected
E3 = front head*
Z3 = rear head*
* = enter E2 and Z2 for mounting style E

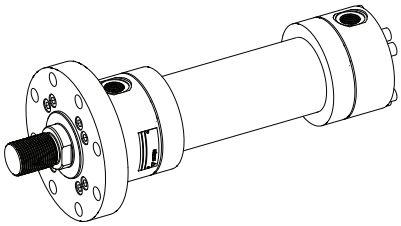
(1) To be entered in alphabetical order
(2) XV dimension must be indicated in the model code, see section 4

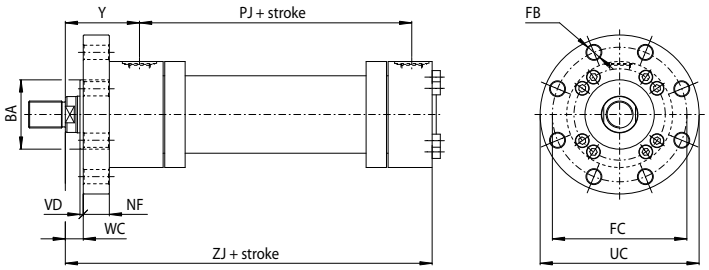
2 MOUNTING STYLE - for dimensions see section 4



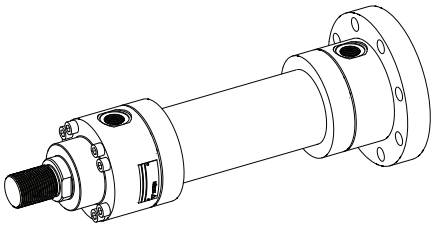


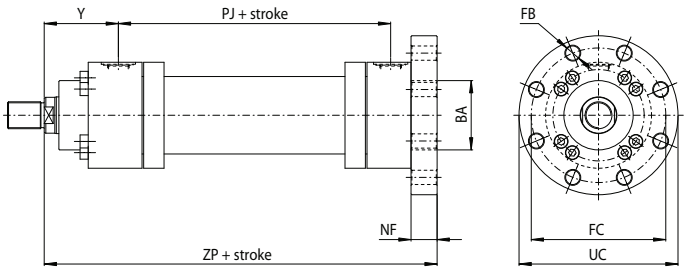
X = basic mounting



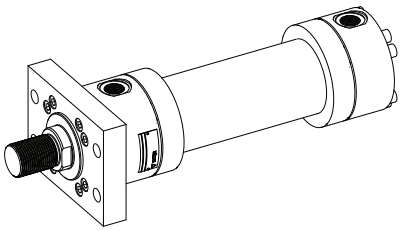


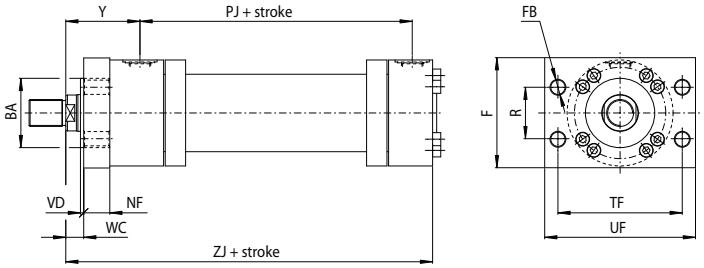
A (ISO MF3) = front round flange mounting



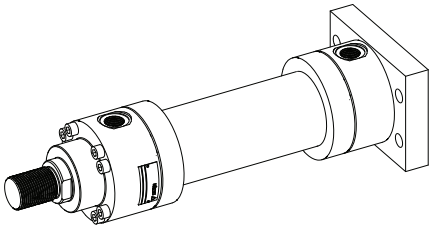


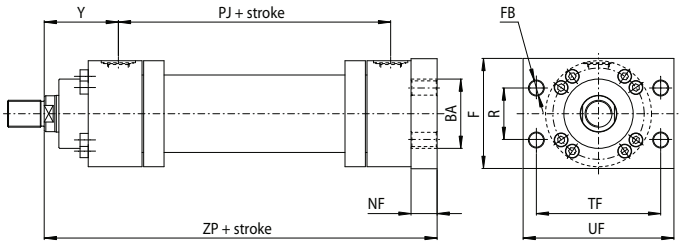
B (ISO MF4) = rear round flange mounting



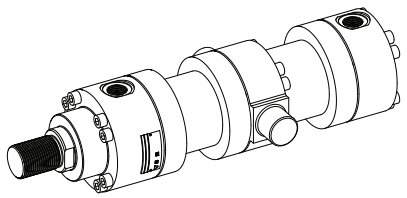


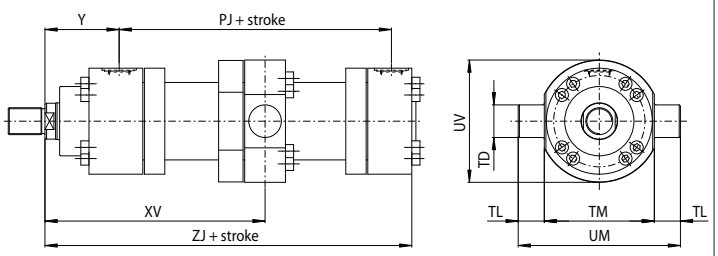
N (ISO MF1) = front square flange mounting (not for bores 160 - 200)



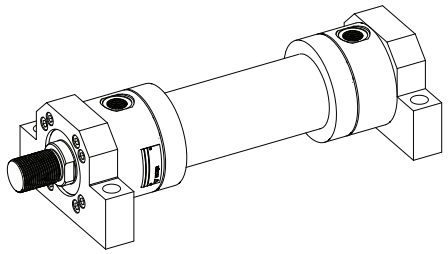


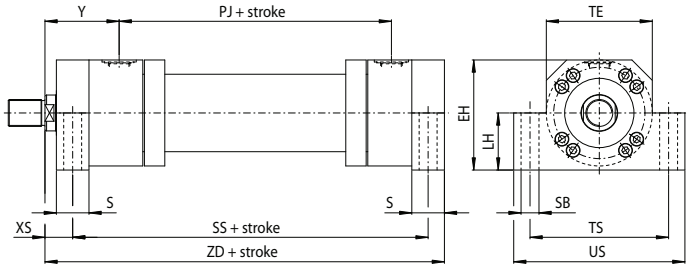
P (ISO MF2) = rear square flange mounting (not for bores 160 - 200)



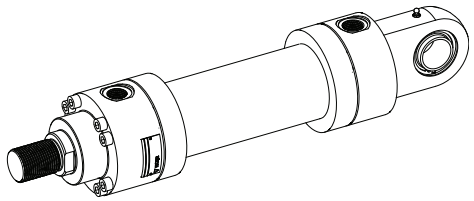


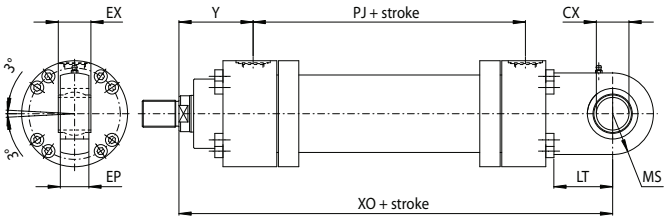
L (ISO MT4) = intermediate trunnion mounting



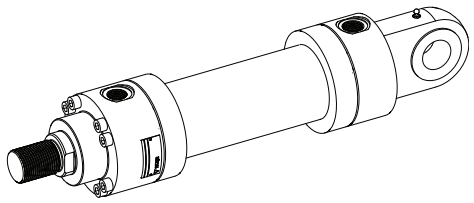


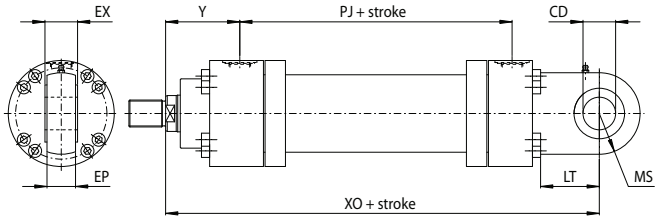
E (ISO MS2) = side feet mounting





S (ISO MP5) = fixed eye with spherical bearing mounting

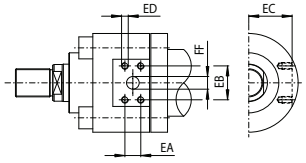




D (ISO MP3) = fixed eye mounting

3 **SAE 3000 FLANGE OIL PORTS - DIMENSIONS TO ISO 6162-1 [mm]**

Ø Bore	DN	EC	EA ±0,25	EB ±0,25	ED 6g	FF 0 / -1,5
63	13	50	17.5	38.1	M8x1.25	13
80		58				
100	19	71	22.3	47.6	M10x1.5	19
125		89				
160	25	113	26.2	52.4	M10x1.5	25
200		137				



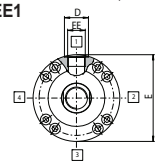
SAE 3000 flange not available for bores 40 and 50

4 INSTALLATION DIMENSIONS [mm] - see figures in section 2

Ø Bore		40	50	63	80	100	125	160	200
Ø Rod	Standard	22	28	36	45	56	70	90	110
	Differential	28	36	45	56	70	90	110	140
B / BA f8/H8		50	60	70	85	106	132	160	200
CD / CX H9/H7		20	25	32	40	50	63	80	100
D (1) min		29	29	36	36	42	42	52	52
D1 (1) min		36	36	42	42	52	52	58	58
E (2) max		78	95	116	130	158	192	238	285
EE (1)		G 1/2	G 1/2	G 3/4	G 3/4	G 1	G 1	G 1 1/4	G 1 1/4
EE1 (1)		G 3/4	G 3/4	G 1	G 1	G 1 1/4	G 1 1/4	G 1 1/2	G 1 1/2
EH max		82	100	120	135	161	196	238	288
EP		18	22	27	35	40	52	66	84
EX h12		20	25	32	40	50	63	80	100
F max		80	100	120	135	160	195	NA	NA
FB H13		9	11	13.5	17.5	22	22	22	26
FC js13		106	126	145	165	200	235	280	340
LH h10		43	52	62	70	82	100	119	145
LT min		25	32	40	50	63	71	90	112
MS max		25	32	40	50	63	71	90	112
MT [Nm] (3)		40	78	137	78	137	226	471	471
NF js13		16	20	25	32	32	32	36	40
PJ (5)		97	111	117	134	162	174	191	224
R js13		40.6	48.2	55.5	63.1	76.5	90.2	NA	NA
S js13		25	32	32	40	50	56	60	72
SB H13		11	14	18	22	26	33	33	39
SS (5)		183	199	211	236	293	321	364	447
TD f8		20	25	32	40	50	63	80	100
TE js13		78	95	116	130	158	192	238	285
TF js13		98	116.4	134	152.5	184.8	217.1	NA	NA
TL js13		16	20	25	32	40	50	63	80
TM h12		90	105	120	135	160	195	240	295
TS js13		100	120	150	170	205	245	295	350
UC max		125	148	170	195	238	272	316	385
UF max		115	140	160	185	225	255	NA	NA
UM		122	145	170	199	240	295	366	455
US max		120	145	180	210	250	300	350	415
UV		90	108	124	150	180	219	280	333
VD		3	4	4	4	5	5	5	5
WC (5)		16	18	20	22	25	28	30	35
XO (5)		231	257	289	332	395	428	505	615
XS (5)		19.5	22	29	34	32	32	36	39
XV (4) (5)	minimum stroke for style L	55	55	85	90	110	135	170	190
	min	155	160	190	215	255	290	340	420
	max	100+stroke	105+stroke	105+stroke	125+stroke	145+stroke	155+stroke	170+stroke	230+stroke
Y (5)		71	72	82	91	108	121	143	190
ZD		215	237	256	290	350	381	430	522
ZP (5)		206	225	249	282	332	357	406	490
ZJ (5)		190	205	224	250	300	325	370	450

NOTES TO TABLE 4

(1) **D, EE** - Oil ports are threaded according to GAS standard with counterbore dimension **D** according to ISO 1179-1 (see figure below). When oversized oil ports are selected (**D** = front oversized oil ports, **Y** = rear oversized oil ports) dimensions **D** and **EE** are respectively modified into **D1** and **EE1**



(2) **E** - If not otherwise specified in the figures in section 2, this value is the front and rear round heads dimension for all the mounting styles (see figure above)

(3) **MT** - Screws tightening torque. Mounting screws must be to a minimum strength of ISO 898/2 grade 12.9

(4) **XV** - For cylinders with mounting style **L** the stroke must always exceed the minimum values reported in the table. The requested XV value must be included between **XV min** and **XV max** and it must be always indicated, with dimension in millimeters, together with the cylinder code. See the following example:

CN - 50 / 28 * 0500 - L308 - A - B1E3X1Z3
XV = 200

(5) The tolerance is according to the table below

Mounting dimensions	ZJ, ZP, XO, SS, PJ	WF, WC, XV, XS, Y
stroke < 1250	±1,5	±2
1250 > stroke < 3150	±3	±4
stroke > 3150	±5	±8

5 STROKE SELECTION

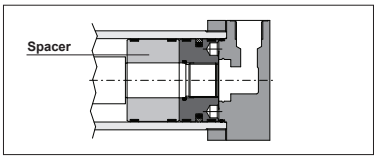
Stroke has to be selected a few mm longer than the working stroke, to prevent to use the cylinder heads as mechanical stroke-end.

Maximum stroke:
- 5000 mm

Stroke tolerances:
- 0 +2 mm for strokes up to 1250 mm
- 0 +5 mm for strokes from 1250 to 3150 mm
- 0 +8 mm for strokes over 3150 mm

6 SPACER

For strokes longer than 1000 mm, proper spacers have to be introduced in the cylinder's construction to increase the rod and piston guide and to protect them from overloads and premature wear. Spacers can be omitted for cylinders working in traction mode. The introduction of spacers increases the overall cylinder's dimensions: spacers' lenght has to be added to all stroke dependent dimensions in section 4.

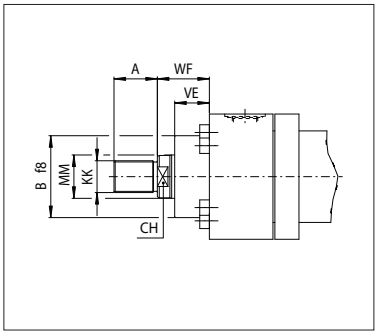


RECOMMENDED SPACERS [mm]

Stroke	1001 ÷ 1500	1501 ÷ 2000	2001 ÷ 2500	2501 ÷ 5000
Spacer code	**2**	**4**	**6**	**8**
Length	50	100	150	200

7 ROD END DIMENSIONS [mm]

Ø Bore	40	50	63	80	100	125	160	200
VE max	19	24	29	36	37	37	41	45
WF	32	38	45	54	57	60	66	75
Ø Rod Standard	**22**	**28**	**36**	**45**	**56**	**70**	**90**	**110**
A max	22	28	36	45	56	63	85	95
CH	19	22	30	39	48	62	80	100
KK 6g	M16x1,5	M20x1,5	M27x2	M33x2	M42x2	M48x2	M64x3	M80x3
Ø Rod Differential	**28**	**36**	**45**	**56**	**70**	**90**	**110**	**140**
A max	28	36	45	56	63	85	95	112
CH	22	30	39	48	62	80	100	128
KK 6g	M20x1,5	M27x2	M33x2	M42x2	M48x2	M64x3	M80x3	M100x3



8 CYLINDER'S HOUSING FEATURES

The cylinder's housings are made in "cold drawn and stressed steel"; the internal surfaces are lapped: diameter tolerance H8, roughness Ra ≤ 0,25 µm.

9 RODS FEATURES and options

The rods materials have high strength, which provide safety coefficients higher than 4 in static stress conditions, at maximum working pressure.
The rod surface is chrome plated: diameter tolerances f7, roughness Ra ≤ 0,25 µm. Corrosion resistance of 200 h in neutral spray to ISO 9227 NSS.

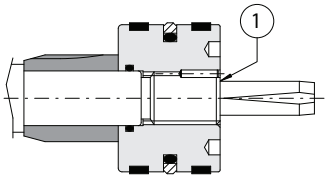
ø Rod	Material	Rs min [N/mm²]	Chrome	
			min thickness [mm]	hardness [HV]
22÷90	hardened and tempered alloy-steel	700	0,020	850-1150
110÷140	alloy steel	450		

Rod diameters from 22 to 70 mm have rolled threads; in rolling process the component material is stressed beyond its yield point, being deformed plastically. This offers many technical advantages: higher profile accuracy, improved fatigue working life and high wear resistance. See **tab. B015** for the calculation of the expected rod fatigue life. **Contact our technical office** in case of heavy duty applications.

Rod corrosion resistance and hardness can be improved selecting the options **K** and **T** (option K affects the strength of standard rod, see **tab. B015** for the calculation of the expected rod fatigue life):
K = Nickel and chrome-plating (for rods from 22 to 110 mm)
Corrosion resistance (rating 10 to ISO 10289):
- 500 h in acetic acid salt spray to ISO 9227 AASS
- 1000 h in neutral spray to ISO 9227 NSS

T = Induction surface hardening and chrome plating
- 56-60 HRC (613-697 HV) hardness

ROD-PISTON COUPLING



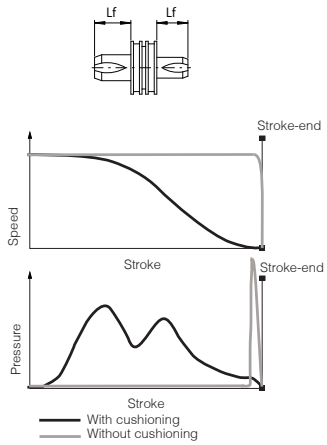
The rod and piston are mechanically coupled by a threaded connection in which the thread on the rod is at least equal to the external thread KK, indicated in the table 7. The piston is screwed to the rod by a prefixed tightening torque in order to improve the fatigue resistance. The stop pin ① avoids the piston unscrewing.

10 CUSHIONING

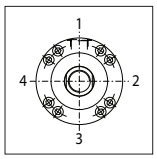
Cushioning are recommended for applications where: • the piston makes a full stroke with speed over than 0,05 m/s; • it is necessary to reduce undesirable noise and mechanical shocks; • vertical application with heavy loads. The stroke-end cushioning are hydraulic dampers specifically designed to dissipate the energy of the mass connected to the cylinder rod, by progressively increasing the pressure in the cushioning chamber and thus reducing the rod speed before the cylinder's mechanical stroke-end (see the graphics at side). See the **tab. B015** for the max damping energy.
When fast adjustable versions are selected, the cylinder is provided with needle valve to optimize cushioning peformances in different applications. The regulating screws are supplied fully screwed in (max cushioning effect).
In case of high masses and/or very high operating speeds it is recommended to back them off to optimize the cushioning effect. The adjustment screw has a special design to prevent unlocking and expulsion. The cushioning effect is highly ensured even in case of variation of the fluid viscosity.

Ø Bore		40		50		63		80		100		125		160		200	
Ø Rod		22	28	28	36	36	45	45	56	56	70	70	90	90	110	110	140
Cushioning length [mm]	Lf front	25	25	29	29	29	29	27	27	26	26	27	27	34	34	34	49
	Lf rear	30		30		32		32		32		41		56		56	

Lf is the total cushioning lenght. When the stroke-end cushioning are used as safety devices, to mechanically preserve the cylinder and the system, it is advisable to select the cylinder's stroke longer than the operating one by an amount equal to the cushioning lenght Lf; in this way the cushioning effect does not influence the movement during the operating stroke.



11 POSITION OF THE OIL PORTS AND CUSHIONING ADJUSTMENTS



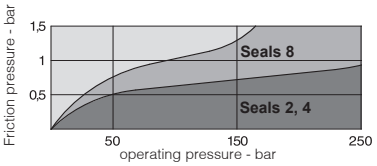
FRONT HEAD: **B1** = oil port position; **E*** = cushioning adjustment position
REAR HEAD: **X1** = oil port position; **Z*** = cushioning adjustment position.
The oil ports and cushioning adjustments positions are available , respectively, on sides 1 and 3 for all styles except E (see the figure at side): the style E has the cushioning adjustments on side 2. Cushioning adjustment positions **E***, **Z*** have to be entered only if adjustable cushioning are selected.

Example of model code: CN-50/28 *0500-S308 - A - **B1E3X1Z3**

12 SEALING SYSTEM FEATURES

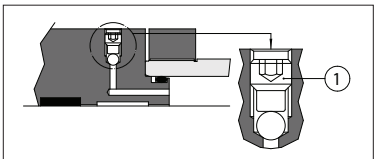
Sealing system	Material	Features	Max speed [m/s]	Fluid temperature range	Fluids compatibility	ISO Standards for seals	
						Piston	Rod
2	FKM + PTFE	very low friction and high temperatures	4	-20°C to 120°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFB, HFC (water max 45%) HFD-U, HFD-R	ISO 7425/1	ISO 7425/2
4	NBR + PTFE	very low friction and high speeds	4	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFC (water max 45%), HFD-U	ISO 7425/1	ISO 7425/2
8	NBR + PTFE + POLYURETHANE	low friction	1	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606	ISO 7425/1	ISO 7425/2

The sealing system must be choosen according to the working conditions of the system: speed, operating frequencies, fluid type and temperature. Additional verifications about minimum in/out rod speed is warmly suggested, see **tab. B015**.
Special sealing system for low temperature, high frequencies (up to 20 Hz), long working life and heavy duty are available, see **tab. TB020**. All the seals, static and dynamic, must be periodically replaced: proper spare kits are available, see section 17. Contact our technical office for the compatibility with other fluids not mentioned below and specify type and composition.
See section 14 for fluid requirements.



13 AIR BLEEDS

CODES: **A** = front air bleed; **W** = rear air bleed
The air in the hydraulic circuit must be removed to avoid noise, vibrations and irregular cylinder's motion: air bleed valves are recommended to realize this operation easily and safely.
Air bleeds are positioned on side 3 for all styles except E: the style E has the air bleeds on side 2, see section 11.
For a proper use of the air-bleed (see figure on side) unlock the grub screw ① with a wrench for hexagonal head screws, bleed-off the air and retighten as indicated in table at side.



Ø Bore	Screwing	Tightening torque
40 - 200	M8 x 10	20 Nm

14 FLUID REQUIREMENTS

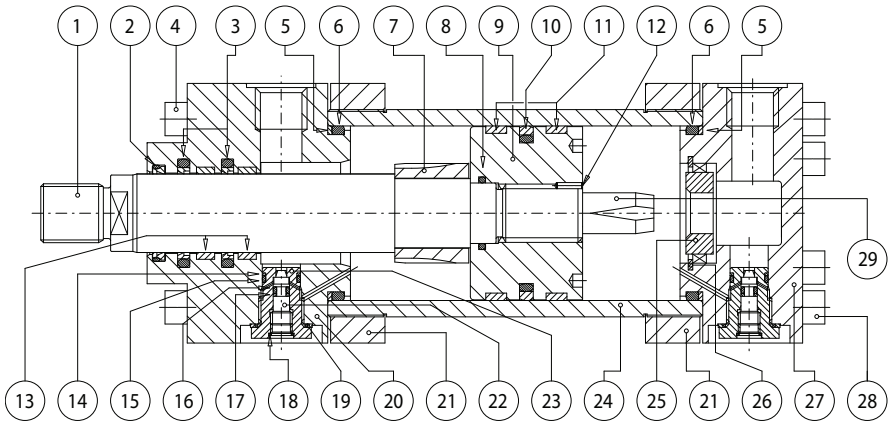
Cylinders and servocylinders are suitable for operation with mineral oils with or without additives (**HH, HL, HLP, HLP-D, HM, HV**), fire resistant fluids (**HFA** oil in water emulsion, 90-95% water and 5-10% oil; **HFB** water in oil emulsion, 40% water; **HFC** water glycol, max 45% water) and synthetic fluids (**HFD-U** organic esters, **HFD-R** phosphate esters). The fluid must have a viscosity within 15 and 100 mm²/s, a temperature within 0 and 70°C and fluid contamination class ISO 20/18/15 according to ISO 4406 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog.

15 CYLINDERS MASSES [kg] (tolerance ± 5%)

		MASS FOR STYLE X		ADDITIONAL MASSES according to mounting styles and options							
Ø Bore [mm]	**Ø Rod** [mm]	Stroke 100 mm	Each 100 mm more	Styles **A, B**	Style **E**	Style **L**	Styles **N, P**	Styles **D, S**	Front cushioning	Rear cushioning	Each 50 mm spacer
40	**22**	7,36	1,18	1,16	1,16	1,58	0,82	0,29	0,09	0,50	0,93
	28	7,60	1,36								
50	**28**	12	1,55	2	3,80	2,87	1,54	0,64	0,20	0,80	1,30
	36	12,50	1,86								
63	**36**	19,50	2,30	3,28	5,80	4,54	2,70	1,32	0,30	1	1,97
	45	20	2,75								
80	**45**	28	2,87	5,26	9,04	6,79	4,30	2,36	0,50	1	2,78
	56	28,50	3,55								
100	**56**	48,50	4,65	7,76	15,72	10,36	5,96	4,76	0,80	1,50	4,43
	70	49,50	5,73								
125	**70**	76,50	7,26	9,76	24,68	18,14	8,08	7,28	1,20	2	6,93
	90	78,50	9,23								
160	**90**	126	11,47	14,54	38,16	35	NA	15,64	1,70	3	11,13
	110	128,50	13,93								
200	**110**	233,50	18,31	22,66	63,36	58,88	NA	32,20	2,50	5	17,75
	140	238	22,94								

Note: the masses related to the other options, not indicated in the table, don't have a relevant influence on the cylinder's mass

16 CYLINDER SECTION



POS.	DESCRIPTION	MATERIAL	POS.	DESCRIPTION	MATERIAL	POS.	DESCRIPTION	MATERIAL
1	Rod	Chrome plated steel	11	Piston guide rings	PTFE	21	Counterflange	Steel
2	Wiper	NBR / FKM and PTFE	12	Screw stop pin	Steel	22	Cushioning adjustment screw	Steel
3	Rod seal	NBR / FKM and PTFE	13	Rod guide rings	Phenolic resin	23	Cushioning adjustment plug	Steel
4	Screw	Steel class 12.9	14	Anti-extrusion ring	PTFE	24	Cylinder housing	Steel
5	Anti-extrusion ring	PTFE	15	O-ring	FKM	25	Rear cushioning sleeve	Bronze
6	O-ring	NBR / FKM	16	O-ring	FKM	26	Toroidal ring	Steel
7	Front cushioning piston	Steel	17	Anti-extrusion ring	PTFE	27	Rear head	Steel / Cast iron
8	O-ring	NBR / FKM	18	Seeger	Steel	28	Screw	Steel class 12.9
9	Piston	Steel	19	Seal	FKM	29	Rear cushioning piston	Steel
10	Piston seal	NBR / FKM and PTFE	20	Front head	Steel / Cast iron			

17 SPARE PARTS - SEE TABLE SP-B180

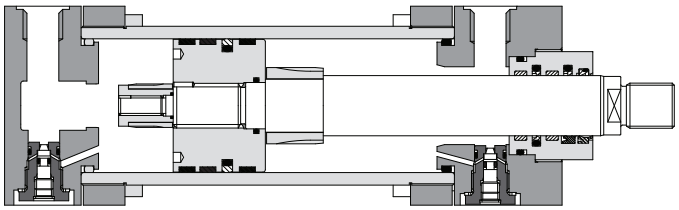
Example for seals spare parts code

G 8 - **C N** - **50** / **28**

- Sealing system
- Cylinder series
- Bore size [mm]
- Rod diameter [mm]

Hydraulic cylinders type CC - round heads with counterflanges

to ISO 6022 - nominal pressure 25 MPa (250 bar) - max 32 MPa (320 bar)



CC cylinders have engineered double acting construction, designed to suit the requirements of industrial heavy duty applications: top reliability, high performances and long working life.

- Bore sizes from **50** to **320** mm
- Adjustable cushioning
- Rod guide rings for low wear
- Optional built-in position transducer, **see tab. B310**
- Attachments for rods and mounting styles, **see tab. B800**

For cylinder's choice and sizing criteria **see tab. B015**

1 MODEL CODE

CC	P	-	50	/	36	*	0500	-	S	3	0	1	-	A	-	B1E3X1Z3	**

Series number **(1)**

Cylinder series
CC to ISO 6022

Rod position transducer
- = omit if not requested
F = magnetosonic
M = magnetosonic programmable
N = magnetostrictive
P = potentiometric
V = inductive
Transducer available on request, contact our technical office

Bore size, see section 3
from **50** to **320** mm

Rod diameter, see sections 7 and 9
from **36** to **220** mm

Stroke, see section 4
up to **5000** mm

Mounting style, see sections 2 and 3

	REF. ISO
A =front flange	MF3
B =rear flange	MF4
L =intermediate trunnion	MT4 **(3)**
S =fixed eye with spherical bearing	MP5
X =basic execution	-
Z =front threaded holes	MX5

Cushioning, see section 10
0 = none
Slow adjustable
1 = rear only
2 = front only
3 = front and rear

Spacer, see section 5
0 = none **2** = 50 mm **4** = 100 mm **6** = 150 mm **8** = 200 mm

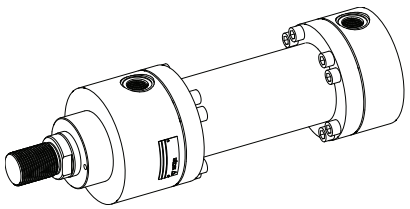
Sealing system, see section 12
1 = (NBR + PTFE + POLYURETHANE) high static and dynamic sealing
2 = (FKM + PTFE) very low friction and high temperatures
4 = (NBR + PTFE) very low friction and high speeds

Heads' configuration (2), see section 11
Oil ports positions
B1 = front head
X1 = rear head
Cushioning adjustments positions
E3 = front head
Z3 = rear head

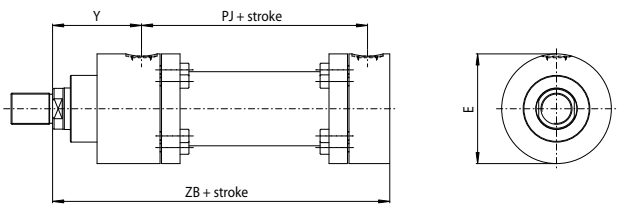
Options (2):
Oversized oil ports, see section 3
D = front oversized oil port
Y = rear oversized oil port
Flange oil ports, see section 6
M = front and rear SAE 6000 flange oil ports
Rod treatment, see section 9
K = nickel and chrome plating
T = induction surface hardening and chrome plating
Air bleeds, see section 13
A = front air bleed
W = rear air bleed
Draining, see section 14
L= rod side draining

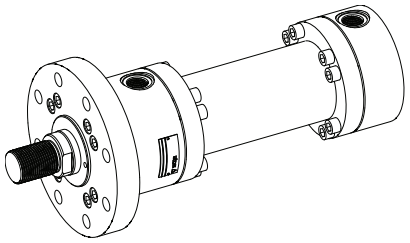
(1) For spare parts request indicate the series number printed on the nameplate only for series < 20
(2) To be entered in alphabetical order
(3) XV dimension must be indicated in the model code, see section 3

2 **MOUNTING STYLE** - for dimensions see section 3

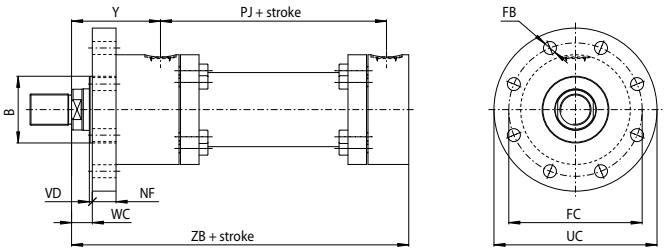


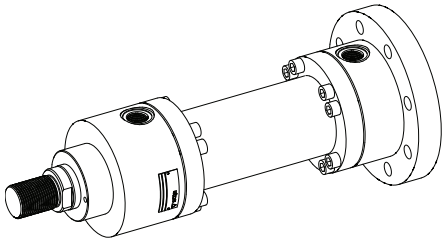
X = basic mounting



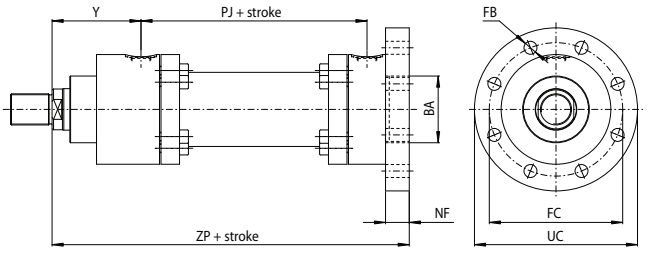


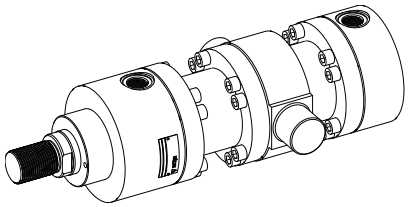
A (ISO MF3) = front flange mounting



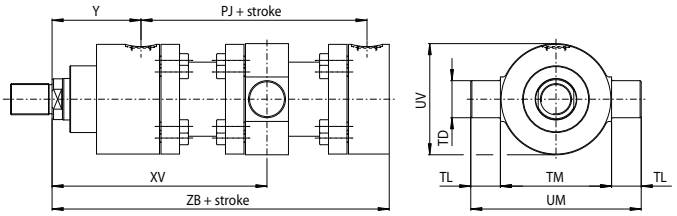


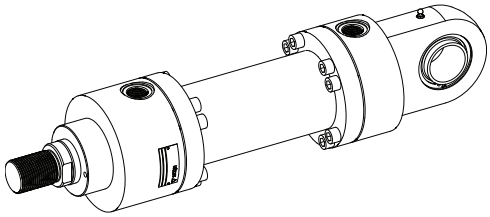
B (ISO MF4) = rear flange mounting



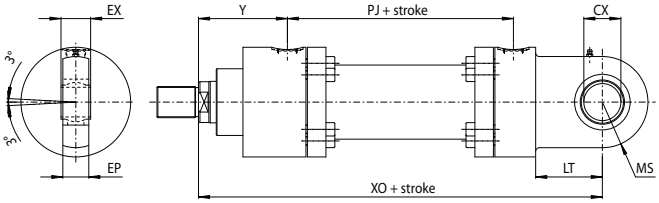


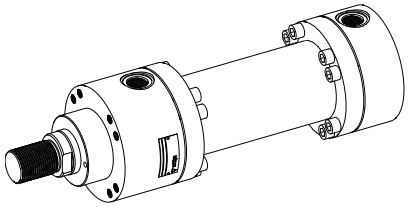
L (ISO MT4) = intermediate trunnion mounting



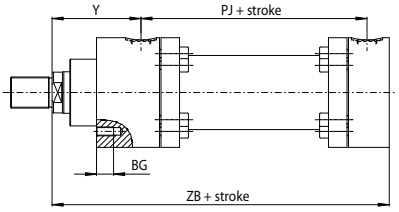


S (ISO MP5) = fixed eye with spherical bearing mounting

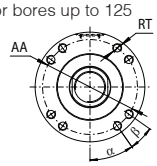




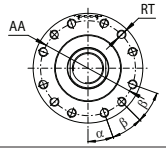
Z = front threaded holes mounting



For bores up to 125



For bores from 140 to 320

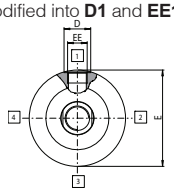


3 INSTALLATION DIMENSIONS [mm] - see figures in section 2

Ø Bore		50	63	80	100	125	140	160	180	200	250	320
Ø Rod		**36**	**45**	**56**	**70**	**90**	**90**	**110**	**110**	**140**	**180**	**220**
α, β		32,5°, 25°	32°, 26°	35°, 20°	35°, 20°	35°, 20°	27,5°, 17,5°	25°, 20°	25°, 20°	25°, 20°	27°, 18°	25°, 20°
AA		90	105	128	152	188	215	241	275	295	365	458
B / BA f8/H8 **(4)**		63	75	90	110	132	145	160	185	200	250	320
BG min		20	23	23	30	33	33	43	40	40	58	70
CX H7		32	40	50	63	80	90	100	110	125	160	200
D (1)		29	36	36	42	42	52	52	52	52	58	58
D1 (1)		36	42	42	52	52	58	58	58	58	69	69
E max **(2)**		108	124	148	175	214	255	270	315	330	412	510
EE (1) 6g		G 1/2	G 3/4	G 3/4	G 1	G 1	G 1 1/4	G 1 1/4	G 1 1/4	G 1 1/4	G 1 1/2	G 1 1/2
EE1 (1) 6g		G 3/4	G1	G 1	G 1 1/4	G 1 1/4	G 1 1/2	G 1 1/2	G 1 1/2	G 1 1/2	G 2	G 2
EP		27	35	40	52	66	65	84	88	102	130	162
EX h12		32	40	50	63	80	90	100	110	125	160	200
FB H13		13,5	13,5	17,5	22	22	26	26	33	33	39	45
FC js13		132	150	180	212	250	300 **(7)**	315	365 **(7)**	385	475	600
LT min		40	50	63	71	90	113	112	135	160	200	250
MS max		40	50	63	71	90	113	112	118	160	200	250
MT [Nm] **(3)**		30	50	85	152	255	255	304	370	490	950	1750
NF js13		25	28	32	36	40	40	45	50	56	63	80
PJ (6)		120	133	155	171	205	208	235	250	278	325	350
RT		n°8 holes M8	n°8 holes M10	n°8 holes M12	n°8 holes M14	n°8 holes M16	n°12 holes M16	n°12 holes M18	n°12 holes M20	n°12 holes M22	n°12 holes M27	n°12 holes M33
TD f8		32	40	50	63	80	90	100	110	125	160	200
TL js13		25	32	40	50	63	70	80	90	100	125	160
TM h12		112	125	150	180	224	265	280	320	335	425	530
UC max		160	180	215	260	300	340	370	425	455	545	680
UM		162	189	230	280	350	405	440	500	535	675	850
UV max		108	124	150	180	219	260	280	315	333	412	510
VD		4	4	4	5	5	5	5	5	5	8	8
VE max **(4)**		29	32	36	41	45	45	50	55	61	71	88
WC (6)		22	25	28	32	36	36	40	45	45	50	56
WF (4) (6)		47	53	60	68	76	76	85	95	101	113	136
XO (6)		305	348	395	442	520	580	617	690	756	903	1080
XV (5) (6)	**minimum stroke for style L**	175	185	150	160	245	250	260	350	390	460	560
	min	260	285	290	320	410	440	465	540	590	690	820
	max	85 + stroke	100 + stroke	140 + stroke	160 + stroke	165 + stroke	190 + stroke	205 + stroke	190 + stroke	200 + stroke	230 + stroke	260 + stroke
Y ±2		98	112	120	134	153	181	185	205	220	260	310
ZB max		244	274	305	340	396	430	467	505	550	652	764
ZP (6)		265	298	332	371	430	465	505	550	596	703	830

NOTES TO TABLE 3

(1) **D, EE** - Oil ports and drain are threaded according to GAS standard with counterbore dimension **D** according to ISO 1179-1 (see figure below).
When oversized oil ports are selected (**D** = front oversized oil ports, **Y** = rear oversized oil ports) dimensions **D** and **EE** are respectively modified into **D1** and **EE1**



(2) **E** - If not otherwise specified in the figures in section 2 this value is the front and rear round heads dimension for all the mounting styles (see figure above)

(3) **MT** - Screws tightening torque. Mounting screws must be to a minimum strength of ISO 898/2 grade 12.9

(4) **B, VE, WF** - See figure in section 7

(5) **XV** - For cylinders with mounting style **L** the stroke must always exceed the minimum values reported in the table.
The requested XV value must be included between **XV min** and **XV max** and it must be always indicated, with dimension in millimeters, together with the cylinder code. See the following example:

CC - 50 / 36 * 0500 - L308 - A -B1E3X1Z3
XV = 300

(6) The tolerance is according to the table below

Mounting dimensions	PJ, ZP, XO	WF, WC, XV
stroke < 1250	±1,5	±2
1250 > stroke < 3150	±3	±4
stroke > 3150	±5	±8

(7) The dimension is not according to ISO 6022

4 STROKE SELECTION

Stroke has to be selected a few mm longer than the working stroke, to prevent to use the cylinder heads as mechanical stroke-end. The table below shows the minimum stroke depending to the bore.

Minimum stroke [mm]

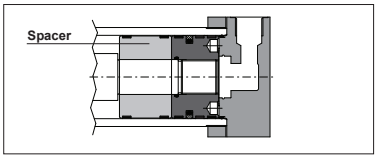
Ø Bore	**50**	**63**	**80**	**100**	**125**	**140**
Minimum stroke	70	70	20	25	50	50
Ø Bore	**160**	**180**	**200**	**250**	**320**	
Minimum stroke	50	70	70	80	120	

Maximum stroke:
- 5000 mm

Stroke tolerances:
- 0 +2 mm for strokes up to 1250 mm
- 0 +5 mm for strokes from 1250 to 3150 mm
- 0 +8 mm for strokes over 3150 mm

5 SPACER

For strokes longer than 1000 mm, proper spacers have to be introduced in the cylinder's construction to increase the rod and piston guide and to protect them from overloads and premature wear. Spacers can be omitted for cylinders working in traction mode. The introduction of spacers increases the overall cylinder's dimensions: spacers' lenght has to be added to all stroke dependent dimensions in section 3.



RECOMMENDED SPACERS [mm]

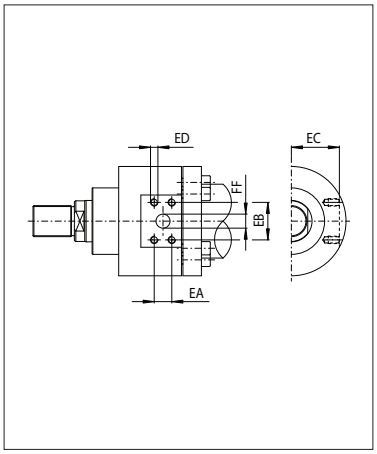
Stroke	1001 ÷ 1500	1501 ÷ 2000	2001 ÷ 2500	2501 ÷ 5000
Spacer code	**2**	**4**	**6**	**8**
Length	50	100	150	200

6 SAE 6000 FLANGE OIL PORTS - DIMENSIONS TO ISO 6162-2 [mm]

Ø Bore	DN	EC	EA ±0,25	EB ±0,25	ED 6g	FF 0 / -1,5
50 (*)	13	46	18,2	40,5	M8x1,25	13
63 (*)	19	51	23,8	50,8	M10x1,5	19
80		65				
100	25	77	27,8	57,2	M12x1,75	25
125		99				
140	32	118	31,6	66,6	M14x2 (**)	32
160		126				
180		150				
200		158				
250	38	195	36,7	79,3	M16x2	38
320	51	245	44,5	96,8	M20x2,5	51

(*) SAE flange not available for style B (ISO MF4)
(**) Not compliance to ISO 6162-2

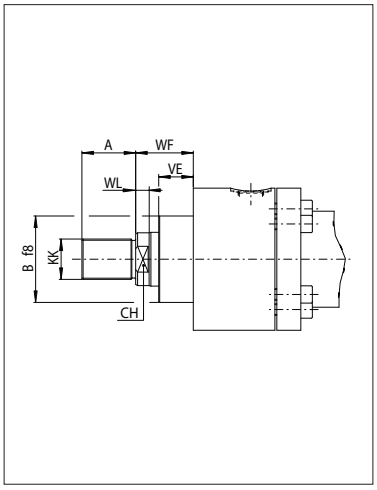
CODE: **M** = Front and rear SAE 6000 flange oil ports
Flange oil port allows an easy cylinder's connection to the piping system and it can work up to the maximum pressure 32 MPa (320 bar).



7 ROD END DIMENSIONS [mm]

Ø Bore	50	63	80	100	125	140	160	180	200	250	320
Ø Rod	**36**	**45**	**56**	**70**	**90**	**90**	**110**	**110**	**140**	**180**	**220**
A max	36	45	56	63	85	90	95	105	112	125	160
CH	30	39	48	62	80	75	100	100	128	15 (*)	20 (*)
KK 6g	M27x2	M33x2	M42x2	M48x2	M64x3	M72x3	M80x3	M90x3	M100x3	M125x4	M160x4
WL min	8	10	10	10	15	15	15	15	15	-	-

(*) n° 2 holes per key



8 CYLINDER'S HOUSING FEATURES

The cylinder's housings are made in different materials depending to the bore; the internal surfaces are lapped: diameter tolerance H8, roughness Ra ≤ 0,25 µm.

ø Bore	Material	Rs min [N/mm²]
50÷200	Cold drawn and stressed steel	450
250-320	Hot rolled steel	355

9 RODS FEATURES and options

The rods materials have high strength, which provide safety coefficients higher than 4 in static stress conditions, at maximum working pressure.
The rod surface is chrome plated: diameter tolerances f7, roughness Ra ≤ 0,25 µm. Corrosion resistance of 200h in neutral spray to ISO 9227 NSS.

ø Rod	Material	Rs min [N/mm²]	Chrome min thickness [mm]	Chrome hardness [HV]
36÷110	Hardened and tempered alloy-steel	700	0,020	850-1150
140	Alloy steel	450		
180÷220	Carbon steel	360	0,045	850-1150

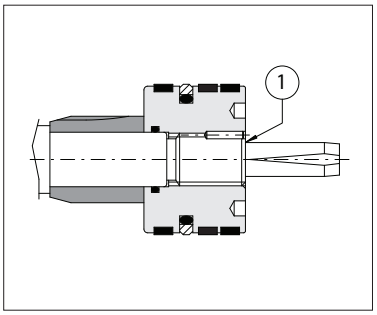
Rod diameters from 36 to 70 mm have rolled threads; in rolling process the component material is stressed beyond its yield point, being deformed plastically. This offers many technical advantages: higher profile accuracy, improved fatigue working life and high wear resistance. See **tab. B015** for the calculation of the expected rod fatigue life.
Contact our technical office in case of heavy duty applications.

Rod corrosion resistance and hardness can be improved selecting the options **K** and **T** (option K affects the strength of standard rod, see **tab. B015** for the calculation of the expected rod fatigue life):

K = Nickel and chrome-plating (for rods from 36 to 110 mm)
Corrosion resistance (rating 10 to ISO 10289):
- 500 h in acetic acid salt spray to ISO 9227 AASS
- 1000 h in neutral spray to ISO 9227 NSS

T = Induction surface hardening and chrome plating (for rods up to 140 mm)
- 56-60 HRC (613-697 HV) hardness

ROD-PISTON COUPLING

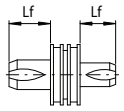


The rod and piston are mechanically coupled by a threaded connection in which the thread on the rod is at least equal to the external thread KK, indicated in the table 7. The piston is screwed to the rod by a prefixed tightening torque in order to improve the fatigue resistance. The stop pin ① avoids the piston unscrewing.

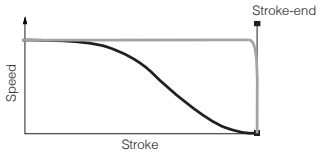
10 CUSHIONING

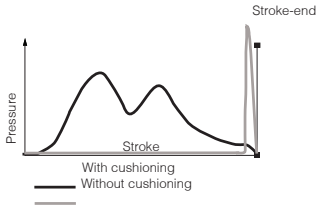
Cushioning are recommended for applications where: • the piston makes a full stroke with speed over than 0,05 m/s; • it is necessary to reduce undesirable noise and mechanical shocks; • vertical application with heavy loads. The stroke-end cushioning are hydraulic dampers specifically designed to dissipate the energy of the mass connected to the cylinder rod, by progressively increasing the pressure in the cushioning chamber and thus reducing the rod speed before the cylinder's mechanical stroke-end (see the graphics at side). See the **tab. B015** for the max damping energy.
The cylinder is provided with needle valve to optimize cushioning performances in different applications. The regulating screws are supplied fully screwed in (max cushioning effect).
In case of high masses and/or very high operating speeds it is recommended to back them off to optimize the cushioning effect. The adjustment screw has a special design to prevent unlocking and expulsion. The cushioning effect is highly ensured even in case of variation of the fluid viscosity.

Lf is the total cushioning lenght. When the stroke-end cushioning are used as safety devices, to mechanically preserve the cylinder and the system, it is advisable to select the cylinder's stroke longer than the operating one by an amount equal to the cushioning lenght Lf; in this way the cushioning effect does not influence the movement during the operating stroke.

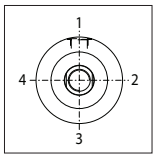


Ø Bore		50	63	80	100	125	140	160	180	200	250	320
Ø Rod		36	45	56	70	90	90	110	110	140	180	220
Cushioning length [mm]	Lf front	29	40	45	50	60	60	64	64	64	80	100
	Lf rear	35	38	45	50	60	60	64	64	64	64	64





11 POSITION OF THE OIL PORTS AND CUSHIONING ADJUSTMENTS

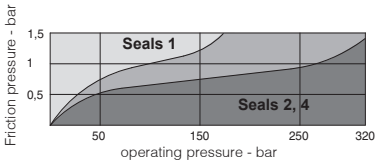


FRONT HEAD: **B1** = oil port position; **E3** = cushioning adjustment position
REAR HEAD: **X1** = oil port position; **Z3** = cushioning adjustment position.
The oil ports and cushioning adjustment positions are only available, respectively, on sides 1 and 3 (see figure at side).

Example of model code: CC-200/140 *0100-S301 - A - **B1E3X1Z3**

12 SEALING SYSTEM FEATURES

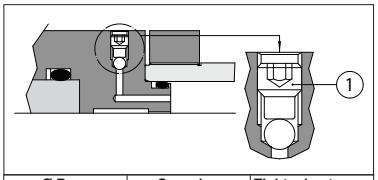
The sealing system must be choosen according to the working conditions of the system: speed, operating frequencies, fluid type and temperature. Additional verifications about minimum in/out rod speed is warmly suggested, see **tab. B015**.
Special sealing system for low temperature, high frequencies (up to 20 Hz), long working life and heavy duty are available, see **tab. TB020**. All the seals, static and dynamic, must be periodically replaced: proper spare kits are available, see section 18. Contact our technical office for the compatibility with other fluids not mentioned below and specify type and composition. See section 15 for fluid requirements.



Sealing system	Material	Features	Max speed [m/s]	Fluid temperature range	Fluids compatibility	ISO Standards for seals	
						Piston	Rod
1	NBR + PTFE + POLYURETHANE	high static and dynamic sealing	0,5	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606	ISO 7425/1	ISO 5597/1
2	FKM + PTFE	very low friction and high temperatures	4	-20°C to 120°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFB, HFC (water max 45%), HFD-U, HFD-R	ISO 7425/1	ISO 7425/2
4	NBR + PTFE	very low friction and high speeds	4	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFC (water max 45%), HFD-U	ISO 7425/1	ISO 7425/2

13 AIR BLEEDS

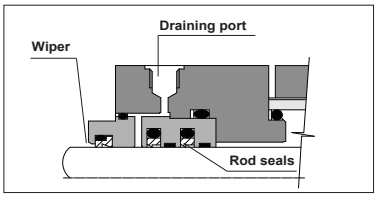
CODES: **A** = front air bleed; **W** = rear air bleed
The air in the hydraulic circuit must be removed to avoid noise, vibrations and irregular cylinder's motion: air bleed valves are recommended to realize this operation easily and safely.
Air bleeds are positioned on side 3, see section 11.
For a proper use of the air-bleed (see figure on side) unlock the grub screw ① with a wrench for hexagonal head screws, bleed-off the air and retighten as indicated in table at side.



Ø Bore	Screwing	Tightening torque
50÷200	M8 x 10	20 Nm
250÷320	M12 x 20	30 Nm

14 DRAINING

CODE: **L** = rod side draining
The rod side draining reduces the seals friction and increases their reliability; it is mandatory for cylinders with strokes longer than 2000 mm, with rod side chamber constantly pressurized and for servocylinders.
The draining is positioned on the same side of the oil port, between the wiper and the rod seals (see figure at side). It is recommended to connect the draining port to the tank without backpressure.
Draining port is G1/8.



15 FLUID REQUIREMENTS

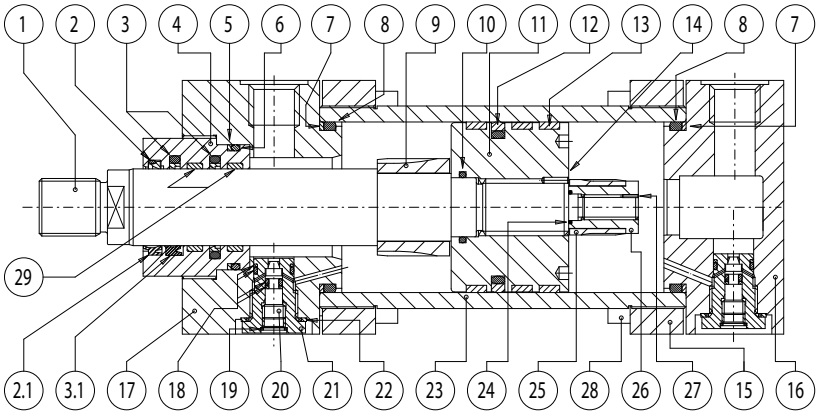
Cylinders and servocylinders are suitable for operation with mineral oils with or without additives (**HH, HL, HLP, HLP-D, HM, HV**), fire resistant fluids (**HFA** oil in water emulsion, 90-95% water and 5-10% oil; **HFB** water in oil emulsion, 40% water; **HFC** water glycol, max 45% water) and synthetic fluids (**HFD-U** organic esters, **HFD-R** phosphate esters). The fluid must have a viscosity within 15 and 100 mm²/s, a temperature within 0 and 70°C and fluid contamination class ISO 20/18/15 according to ISO 4406 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog.

16 CYLINDERS MASSES [kg] (tolerance ± 5%)

		MASS FOR STYLE **X** for single rod		ADDITIONAL MASSES depending on mounting styles and options					
Ø Bore [mm]	**Ø Rod** [mm]	for 100 mm stroke	each 100 mm more	Styles **A, B**	Style **L**	Style **S**	front cushioning	rear cushioning	each 50 mm spacer
50	**36**	18	1,9	2,77	3,15	1	0,2	1	1,3
63	**45**	20,1	2,75	3,96	4,64	2,58	0,3	1	2
80	**56**	35,5	4,15	7,17	7,81	4,54	0,5	1	3,08
100	**70**	58	6,5	11,14	13,38	7,18	0,8	1,5	4,81
125	**90**	100	10,17	16	23,68	14,02	1,2	2	7,40
140	**90**	144	10,73	22,5	41,09	23	1,2	2	8,90
160	**110**	189	15,12	29,92	47,92	27,5	1,7	5	11,72
180	**110**	262	17,32	41,66	70,16	45,9	2,5	5	14,92
200	**140**	335	22,94	54,22	81,12	69	2,5	5	17,75
250	**180**	660	42,62	86,01	167	116	2,5	5	30,58
320	**220**	1230	65,35	166	304	250	2,8	5	49,32

Note: the masses related to the other options, not indicated in the table, don't have a relevant influence on the cylinder's mass

17 CYLINDER SECTION



POS.	DESCRIPTION	MATERIAL	POS.	DESCRIPTION	MATERIAL	POS.	DESCRIPTION	MATERIAL
1	Rod	Chrome plated steel	10	O-ring	NBR / FKM	21	Cushioning adjustment plug	Steel
2	Wiper	NBR / FKM and PTFE	11	Piston	Steel	22	Seal	FKM
2.1	Wiper	Polyurethane	12	Piston seal	NBR / FKM and PTFE	23	Cylinder housing	Steel
3	Rod seal	NBR / FKM and PTFE	13	Piston guide ring	PTFE	24	O-ring	NBR / FKM
3.1	Rod seal	Polyurethane	14	Screw stop pin	Steel	25	Rear cushioning piston	Steel
4	Rod bearing	Bronze / Steel	15	Counterflange	Steel	26	Cushioning piston locking	Steel
5	Anti-extrusion ring	PTFE	16	Rear head	Steel / Cast iron	27	Screw stop pin	Steel
6	O-ring	NBR / FKM	17	Front head	Steel / Cast iron	28	Screw	Steel class 12.9
7	Anti-extrusion ring	PTFE	18	O-ring and anti-extrusion ring	FKM and PTFE	29	Rod guide	PTFE
8	O-ring	NBR /FKM	19	Seeger	Steel			
9	Front cushioning piston	Steel	20	Cushioning adjustment screw	Steel			

18 SPARE PARTS - SEE TABLE SP-B241

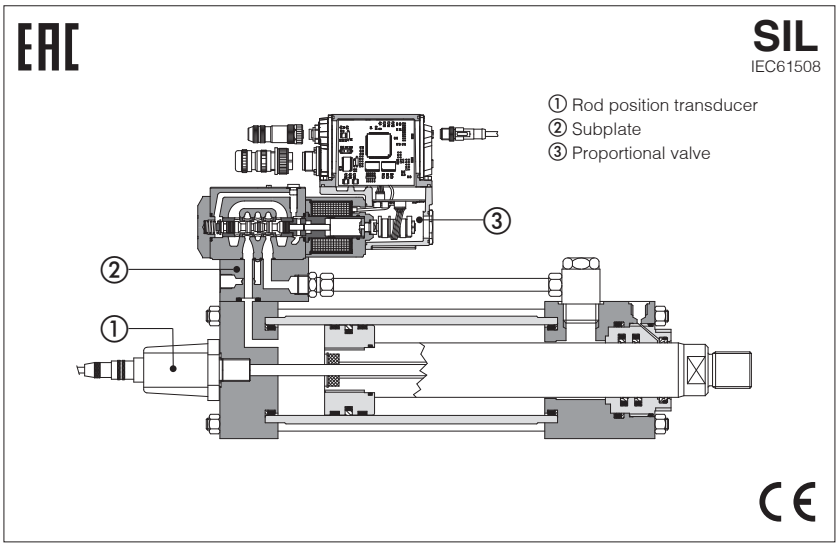
Example for seals spare parts code

G 1 - C C - 50 / 36

- G 1 — Sealing system
- C C — Cylinder series
- 50 — Bore size [mm]
- 36 — Rod diameter [mm]

Servocylinders type CK* with built-in position transducer

to ISO 6020-2 - nominal pressure 16 MPa (160 bar) - max 25 MPa (250 bar)



CK* electrohydraulic servocylinders have engineered double acting construction, designed to suit the requirements of industrial applications: top reliability, high performances and long working life.
Their compact construction allows high flexibility for use in all applications. The rod position transducer ① is well protected against shocks or external dirt, and maintenance is reduced to a minimum.

- Derived from cylinders series CK according to ISO 6020-2, **see tab. B137**
- Integral position transducers: Magnetosonic analog or digital, Magnetostrictive, Potentiometric and Inductive
- Bore sizes from **40** to **200** mm
- Rod draining and air bleeds supplied as standard
- Available with incorporated subplates ② for on-board on/off or proportional valves ③ to achieve the max hydraulic strenght, fast response time and repeatability
- Servocylinders are **SIL** compliance with IEC 61508 (TÜV certified), certification on request

For cylinder's choice and sizing criteria **see tab. B015**

1 MODEL CODE

CK	P /	10 -	63 /	45 *	0500 -	S	2	0	8 -	K -	B1E3X1	**

Cylinder series
CK to ISO 6020 - 2, see **tab. B137**
See section 29 for other cylinder series

Rod position transducer, see section 17
F = magnetosonic
M = magnetosonic programmable
N = magnetostrictive
P = potentiometric
V = inductive

Incorporated subplate, see section 26
- = omit if subplate is not requested
10 = size 06
20 = size 10
30 = size 16
40 = size 25

Bore size, see section 5, 9 and 14
from **40** to **200** mm

Rod diameter, see sections 5, 9 and 14
from **28** to **140** mm

Stroke, see section 17 and 18

Mounting style, see sections 5, 7, 9, 11, 14 and 16

		REF. ISO
C	fixed clevis	MP1 **(4)**
D	fixed eye	MP3 **(4)**
E	feet	MS2
G	front trunnion	MT1
L	intermediate trunnion	MT4
N	front flange	ME5
P	rear flange	ME6 **(4)**
S	fixed eye + spherical bearing	MP5 **(4)**
X	basic execution	-
Y	front tie rods extended	MX3
Z	front threaded holes	MX5

Cushioning, see section 23 option **2** is only available for bores from 63 to 200
0 = without cushioning **2** = front adjustable cushioning

Spacer, see section 19
0 = none **2** = 50 mm **4** = 100 mm **6** = 150 mm **8** = 200 mm

Sealing system, see section 25
2 = (FKM + PTFE) very low friction and high temperatures
4 = (NBR + PTFE) very low friction and high speeds
8 = (NBR + PTFE and POLYURETHANE) low friction

Options (2) (3):
Rod end, see section 6, 10 and 15
H = light male thread
Rod treatment, see section 22
K = nickel and chrome plating
T = induction surface hardening and chrome plating
Oversized oil ports, see section 5 and 6
D = front oversized oil port
Y = rear oversized oil port
Output for CKF, CKM, CKN, CKV, see sections 2, 3, 8 and 13
A = current output (4÷20 mA)
V = voltage output (0÷10V)
Digital SSI output for CKF, CKM, see section 2 and 3
Q = binary 24 bit **R** = binary 25 bit
S = gray 24 bit **U** = gray 25 bit
Fieldbus output, see section 4
C = PROFINET
P = PROFIBUS DP
Connector output, see section 2, 3, 8, 12 and 13
M = 90° female connector

Heads' configuration (2), see section 24
Oil ports positions
B1 = front head
X1 = rear head
Cushioning adjustments positions, to be entered only if adjustable cushioning are selected
E3 = front head *
* enter E2 only for mounting style E

Series number **(1)**

(1) For spare parts request indicate the series number printed on the nameplate only for series < 40
(2) To be entered in alphabetical order
(3) Rod draining and air bleeds supplied as standard, see sections 27 and 28
(4) Not available for CKF and CKM

2 SERVOCYLINDERS TYPE CKF

2.1 Magnetosonic transducers - basic working principles

The magnetosonic transducer is composed by: a waveguide element ① fixed to the cylinder's body, a permanent magnet ② rigidly connected to the cylinder's rod and an integral electronics signal conditioning ③ located on the rear head.
The position measurement is based upon the magnetostriction phenomenon: the electronics signal conditioning ③ generates a short current pulse that travels through the waveguide ①. When this pulse meets the magnetic field of the permanent magnet ②, a torsional wave is generated and it travels back to the electronics signal conditioning.
The position of the moving magnet is thus accurately determined by measuring the elapsed time between the application of the current pulse and the arrival of the torsional wave, thanks to their constant ultrasonic speed. Sensor electronics signal conditioning transforms this measurement into the analogic output feedback signal.
The contactless construction of the position transducer ensures a long working life and allows its use even in hard environmental conditions (shocks, vibrations etc.) or high working frequencies.
The transducer can be replaced without disassembling the cylinder, providing a great advantage of easy and quick maintenance.
Magnetosonic transducers, particularly simple and cost-effective, makes the CKF servocylinders commonly used as alternatives to external absolute encoders or to potentiometric transducers.

2.2 Output signal

The transducer integral electronics is available with the following configurations:

Analog	Digital SSI
A = 4-20 mA	**Q** = Binary 24 bit
V = 0-10 V	**R** = Binary 25 bit
	S = Gray 24 bit
	U = Gray 25 bit

Example of model code: CKF-63/45*0500-X008 -**A**-B1X1

Digital SSI output is available on request, for other output signals contact our technical office.

2.3 Transducer features

CKF are equipped with "MTS"'s magnetosonic transducers, whose main features are shown in the table at side.

2.4 Electronic connections

The 5 or 8 pin male connector M12 is located on the transducer rear head. The straight female cable connector ④ is included in the supply:

CON031 5 pin female connector for analog version
370694 8 pin female connector for digital SSI version

The 90° female connector can be supplied selecting option **M**:

CON041 5 pin 90° female connector for analog version
370699 8 pin 90° female connector for digital SSI version

See the tables at side for electronic connections.
For other connector types or cable outputs, contact our technical office.

2.5 Strokes

From 50 to 2500 mm by increments of 5 mm.
If a not standard stroke is required, contact our technical office.

2.6 Cylinder features

See sections 5, 6 and 7 for sizes, mounting style and dimensions.
See sections from 18 to 26 for materials and options.

2.7 Fluid requirements

CKF servocylinders are suitable for operation with mineral oils with or without additives (**HH, HL, HLP, HLP-D, HM, HV**), fire resistant fluids (**HFA** oil in water emulsion - 90-95% water and 5-10% oil, **HFB** water in oil emulsion - 40% water, **HFC** water glycol - max 45% water) and synthetic fluids (**HFD-U** organic esters, **HFD-R** phosphate esters).
For the proper choice of the sealing system, in relation to the fluid characteristics, see section 25.
Recommended fluid characteristics:
- Viscosity: 15 ÷ 100 mm^2/s
- Temperature range: 0 ÷ 70°C
- Fluid contamination class: for normal operation ISO4406 class 18/16/13 NAS1638 class 7. Longer life class 16/14/11 NAS1638 class 5; see also filter section at www.atos.com or KTF catalog.

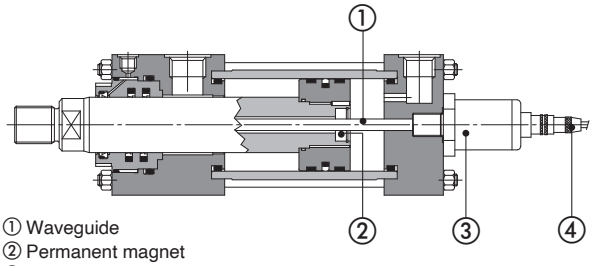
2.8 Start-up notes

During the start-up it is necessary to bleed off the air from the servocylinder as indicated in section 27.
For other details refer to the start-up instructions included in the supply.

2.9 Warnings

Ensure that the servocylinder and wirings are kept away from strong magnetic field and electrical noise to prevent noises on the feedback signal. Check the electronic connections and switch-off the power supply before connecting or disconnecting the position transducer to avoid electronic damages.
It is recommended to connect the draining port, supplied as standard, to the tank without back pressure, see section 28 for details.
For other types of resolution contact our technical office.

SERVOCYLINDER TYPE CKF



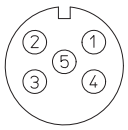
① Waveguide
② Permanent magnet
③ Integral electronics signal conditioning
④ Connector

TRANSDUCER FEATURES

	Analog	Digital SSI
Power supply	24 VDC (±15%)	
Outputs signal	0÷10 VDC/ 4÷20 mA	SSI RS 422/485 Standard
Data format (SSI)	NA	Binary / Gray
Data length (SSI)	NA	24 / 25 bit
Resolution	infinite, restricted by the output ripple	50 µm
Linearity	< ± 0,02% F.S (min ± 60 µm)	
Repeatability	< ± 0,005% F.S. (min ± 20 µm)	
Data speed (only for digital)	70kBd÷1MBd (depending to cables lenght)	
Update frequency	< 3 kHz	1,2÷3,7 kHz (depending to the stroke)
Connection type	5 pin connector M12	8 pin connector M12
Protection degree	IP67 to DIN 40050	
Shock resistance	100g (single shock) / IEC Standard 60068-2-27	
Vibration resistance	15g/10÷2000 Hz / IEC Standard 60068-2-6	
Polarity protection	up to -30 VDC	
Operating temperature	-20 ÷ +75°C	
Measuring range	50 to 2500 mm (increments of 5 mm)	
Maximum speed	1 m/s	

ELECTRONIC CONNECTIONS - ANALOG

5 PIN female connector (to solder)

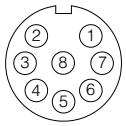


CON031
(Transducer view)

PIN	SIGNAL	NOTES
1	V+	Input - power supply 24 VDC (±15%)
2	OUTPUT	Output - analog signal
3	V0	Gnd - power supply 0 VDC
4	NC	Do not connect
5	AGND	Gnd - analog signal

ELECTRONIC CONNECTIONS - DIGITAL SSI

8 PIN female connector (to solder)



370694
(Transducer view)

PIN	SIGNAL	NOTES
1	CLOCK +	Output -serial syncronous clock (+)
2	CLOCK -	Input - serial syncronous clock (-)
3	DATA +	Output - serial position data (+)
4	DATA -	Input - serial position data (-)
5	NC	Do not connect
6	NC	Do not connect
7	V+	Input - power supply 24 VDC (±15%)
8	V0	Gnd- power supply 0 VDC

3 SERVOCYLINDERS TYPE CKM - PROGRAMMABLES

3.1 Magnetosonic transducers - basic working principles

The magnetosonic transducer is composed by: a waveguide element ① fixed to the cylinder's body, a permanent magnet ② rigidly connected to the cylinder's rod and an integral electronics signal conditioning ③ located on the rear head.
The position measurement is based upon the magnetostriction phenomenon: the electronics signal conditioning ③ generates a short current pulse that travels through the waveguide ①. When this pulse meets the magnetic field of the permanent magnet ②, a torsional wave is generated and it travels back to the electronics signal conditioning.
The position of the moving magnet is thus accurately determined by measuring the elapsed time between the application of the current pulse and the arrival of the torsional wave, thanks to their constant ultrasonic speed. Sensor electronics signal conditioning transforms this measurement into the output feedback signal.
The contactless construction of the position transducer ensures a long working life and allows its use even in hard environmental conditions (shocks, vibrations etc.) or high working frequencies.
The transducer can be replaced without disassembling the cylinder, providing a great advantage of easy and quick maintenance.
Additionally, the only electronics signal conditioning can be easily removed and replaced without removing its case; in this way the cylinder could keep on working avoiding any production-stop time.
CKM servocylinders are characterized by high performances and they are availables in several versions.

3.2 Output signal

The transducer integral electronics is available with the following configurations:

Analog	**Digital SSI**
A = 4-20 mA	**Q** = Binary 24 bit
V = 0-10 V	**R** = Binary 25 bit
	S = Gray 24 bit
	U = Gray 25 bit

Example of model code: CKM-63/45*0500-X008 -**A**D-B1X1

ETHERNET, I/O LINK and POWERLINK output are available on request, for other output signals contact our technical office.

3.3 Transducer features

CKM are equipped with "MTS"'s magnetosonic transducers, whose main features are shown in the table at side. The integral position tranducer is also available with an explosion-proof housing, ATEX certified, for use in explosion-hazardous environments and SIL certified.
Other integral position transducers brands are available on request, contact our technical office.

3.4 Electronic connections

The 6 or 7 pin male connector M16 is located on the transducer rear head. The straight female cable connector ④ is included in the supply:

STCO9131-D06-PG7 6 pin female connector for analog version
STCO9131-D07-PG9 7 pin female connector for digital SSI version

The 90° female connector can be supplied selecting option **M**:
STCO9131-6-PG7 6 pin 90° female connector for analog version
STCO9131-7-PG9 7 pin 90° female connector for digital SSI version

See the tables at side for electronic connections.
For other connector types or cable outputs, contact our technical office.

3.5 Strokes

From 25 to 3000 mm by increments of 5 mm.
If a not standard stroke is required, contact our technical office.

3.6 Cylinder features

See sections 5, 6 and 7 for sizes, mounting style and dimensions.
See sections from 18 to 26 for materials and options.

3.7 Fluid requirements

For the suitable fluids and the proper choice of the sealing system, in relation to the fluid characteristics, see sections 25.
Recommended fluid characteristics:
- Viscosity: 15 ÷ 100 mm^2/s
- Temperature range: 0 ÷ 70°C
- Fluid contamination class: for normal operation ISO4406 class 18/16/13 NAS1638 class 7. Longer life class 16/14/11 NAS1638 class 5; see also filter section at www.atos.com or KTF catalog.

3.8 Start-up notes

The output signal of the CKM analog or digital SSI versions is programmable by using proper programming tools to be ordered separately:

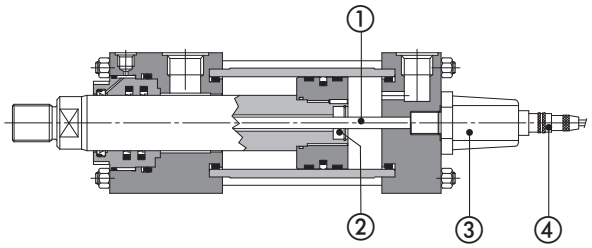
253-124 for zero/span setting of analog version
253-135 for complete re-programming of the transducers parameters (resolution, output format, length etc.) of digital SSI version

The sensor electronics case is equipped with two LED that indicate the transducer status, allowing a quick recognition of main possible faults (magnet not detected or out of set-up range).
During the start-up it is necessary to bleed off the air from the servocylinder as indicated in section 27.
For other details refer to the start-up instructions included in the supply.

3.9 Warnings

Ensure that the servocylinder and wirings are kept away from strong magnetic field and electrical noise to prevent noises on the feedback signal. Check the electronic connections and switch-off the power supply before connecting or disconnecting the position transducer to avoid electronic damages.
It is recommended to connect the draining port, supplied as standard, to the tank without back pressure, see section 28 for details.

SERVOCYLINDER TYPE CKM

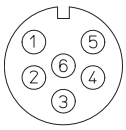


① Waveguide
② Permanent magnet
③ Integral electronics signal conditioning
④ Connector

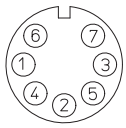
TRANSDUCER FEATURES

	Analog	Digital SSI
Power supply	24 VDC (±15%)	
Outputs signal	0÷10 VDC/ 4÷20 mA	SSI RS 422/485 Standard
Data format (SSI)	NA	Binary / Gray
Data length (SSI)	NA	24 / 25 bit
Resolution	16 bit; 0,0015% (min. 1 µm)	5 µm
Linearity	<±0,01% F.S. (min ±50 µm)	<±0,01% F.S. (min ±40 µm)
Repeatability	<±0,001% F.S. (min ±1 µm)	
Hysteresis	< 4 µm	
Data speed (only for digital)	70 kBd÷1MBd (depending to cables lenght)	
Update frequency	0,5÷2kHz (depending to the stroke)	0,5÷3,7kHz (depending to the stroke)
Temperature coefficient	< 30 ppm/°C	< 15 ppm/°C
Connection type	6 pin connector M16 to DIN45322	7 pin connector M16 to DIN45329
Protection degree	IP67 to DIN 40050	
Shock resistance	100g (single hit) / IEC Standard 60068-2-27	
Vibration resistance	15g/10÷2000 Hz / IEC Standard 60068-2-6	
Polarity protection	up to -30 VDC	
Operating temperature	-20 ÷ +75°C	
Measuring range	25 to 3000 mm (increments of 5 mm)	
Maximum speed	2 m/s	

ELECTRONIC CONNECTIONS - ANALOG

6 PIN female connector (to solder)	PIN	SIGNAL	NOTES
	1	OUTPUT	Output - analog signal
	2	AGND	Gnd - analog signal
	3	NC	Do not connect
	4	NC	Do not connect
	5	V+	Input - power supply 24 VDC (±15%)
STCO9131-D06-PG7 (Transducer view)	6	V0	Gnd - power supply 0 VDC

ELECTRONIC CONNECTIONS - DIGITAL SSI

7 PIN female connector (to solder)	PIN	SIGNAL	NOTES
	1	DATA -	Input - serial position data (-)
	2	DATA +	Output - serial position data (+)
	3	CLOCK +	Output -serial syncronous clock (+)
	4	CLOCK -	Input - serial syncronous clock (-)
	5	V+	Input - power supply 24 VDC (±15%)
	6	V0	Gnd - power supply 0 VDC
STCO9131-D07-PG9 (Transducer view)	7	NC	Do not connect

4 SERVOCYLINDERS TYPE CKM - PROGRAMMABLES with fieldbus interface PROFIBUS DP or PROFINET

4.1 Working basic principles

CKM servocylinders (see section 3 for magnetosonic working principle) are also available with fieldbus communication interface. Field communication networks allow to exchange a great amount of data among all the devices installed on the machines and industrial plants (servocylinders, valves, pumps, motors, etc.) by means of just one cable. It is so possible to connect all the devices of the system to the machine control unit (fieldbus master) avoiding expensive wirings and start-up costs.
Fieldbus provides also a more efficient connection that can speed up the installation task as well as prevent wiring errors.
The possibility to perform system level diagnostics on each node or device in the system represents an optimum maintenance tool and it has a positive impact on the system performances.
The remarkable aspect of these communication networks is the common standardized language ("interface") of all the connected devices, making the control and monitoring of the whole machine very easy.

4.2 Output signal

The available feedback interface are:

C = **PROFINET** according to IEC 61158

P = **PROFIBUS DP** according to EN 50 170 (ISO 74498)

Example of model code: CKM-63/45*0500-X008 -D**P**-B1X1

Other feedback interface are available on request, contact our technical office.

4.3 Transducer features

CKM are equipped with "MTS"'s magnetosonic transducers whose features are shown in the table at side. Other integral position transducers brands are available on request, contact our technical office.

4.4 Electronic connections

Male and female connectors are located on the transducer rear head.
The cable connectors are included in the supply:

PROFINET - 3 connectors

370523	5 pin male M12 connector for input and output
CON-031	5 pin female M12 connector for power supply

PROFIBUS DP- 4 connectors

560884	5 pin male M12 connector for bus input
560885	5 pin female M12 connector for bus output
560888	5 pin female M12 for bus terminator
560886	4 pin female M8 connector for power supply

See the table at side for electronic connections..
For other connector types, contact our technical office.

4.5 Strokes

From 25 to 3000 mm by increments of 5 mm.
If a not standard stroke is required, contact our technical office.

4.6 Cylinder features

See sections 5, 6 and 7 for sizes, mounting style and dimensions.
See sections from 18 to 26 for materials and options.

4.7 Fluid requirements

For the suitable fluids and the proper choice of the sealing system, in relation to the fluid characteristics, see sections 25.
Recommended fluid characteristics:
- Viscosity: 15 ÷ 100 mm²/s
- Temperature range: 0 ÷ 70°C
- Fluid contamination class: for normal operation ISO4406 class 18/16/13 NAS1638 class 7. Longer life class 16/14/11 NAS1638 class 5; see also filter section at www.atos.com or KTF catalog.

4.8 Start-up notes

The transducer's fieldbus configuration files and the manual for start-up are included in the supply.
The setup of the transducer's slave address is usually done by the bus standard service of the system: if the fieldbus master does not support this service, the setting and diagnostics can be done by a proper wi-fi tool to be separately ordered:

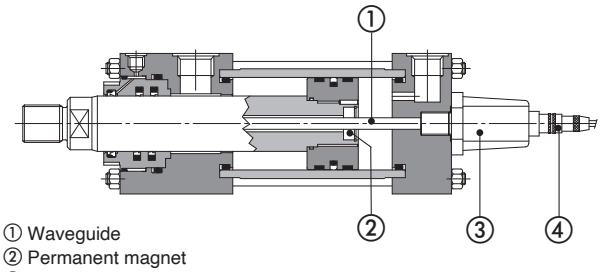
TL-1-0-EM12	for PROFINET interface
252-173-D52	for PROFIBUS DP interface

The sensor electronics case is equipped with two LED that indicate the transducer status, allowing a quick recognition of main possible faults (magnet not detected or out of set-up range).
During the start-up it is necessary to bleed off the air from the servocylinder as indicated in section 27.
For other details refer to the start-up instructions included in the supply.

4.9 Warnings

Ensure that the servocylinder and wirings are kept away from strong magnetic field and electrical noise to prevent noises on the feedback signal. Check the electronic connections and switch-off the power supply before connecting or disconnecting the position transducer to avoid electronic damages.
It is recommended to connect the draining port, supplied as standard, to the tank without back pressure, see section 28 for details.

SERVOCYLINDER TYPE CKM



① Waveguide
② Permanent magnet
③ Integral electronics signal conditioning
④ Connector

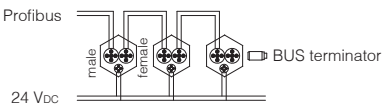
TRANSDUCER FEATURES

Power supply	24 VDC (±15%)
Data transmission rate (with cable L < 25 m and 1 node)	**PROFINET:** max. 100 MBit/s **PROFIBUS DP:** max. 12 MBit/s
Cycle time	1 ms with stroke up to 2000 mm
Resolution	0,5 µm for **PROFINET** ; 1 µm for **PROFIBUS DP**
Linearity	<±0,01% F.S. (min ±50 µm)
Repeatability	<±0,001% F.S. (min ±2,5 µm)
Hysteresis	< 4 µm
Temperature coefficient	< 15 ppm/°C
Shock resistance	150g (single hit) / IEC Standard 60068-2-27 for **PROFINET** 100g (single hit) / IEC Standard 60068-2-27 for **PROFIBUS DP**
Vibration resistance	15g/10÷2000 Hz / IEC Standard 60068-2-6
Overvoltage protection	Up to 36 VDC
Protection degree	IP67 to DIN 40050
Operating temperature	-20 ÷ +85°C for **PROFINET** ; 20 ÷ +75°C for **PROFIBUS DP**
Measuring range	25 to 3000 mm (increments of 5 mm)
Maximum speed	2 m/s

ELECTRONIC CONNECTIONS - PROFINET

	PIN	SIGNAL	NOTES
5 PIN female connectors (to screw)	1	Tx (+)	Transmitter
	2	Rx (+)	Receiver
	3	Tx (-)	Transmitter
370523 (D-codec) **370523 (D-codec)** (Transducer view)	4	Rx (-)	Receiver
	Housing	SHIELD	Shield
5 PIN female connector (to screw)	1	V+	Input - power supply 24 VDC (±15%)
	2	NC	Do not connect
	3	V0	Gnd - power supply 0 VDC
	4	NC	Do not connect
CON-031 (Transducer view)	5	NC	Do not connect

ELECTRONIC CONNECTIONS - PROFIBUS DP



	PIN	SIGNAL	NOTES
5 PIN connectors (to screw)	1	+ 5V	for bus termination *
	2	LINE-B	RxD/TxD-N (BUS)
	3	DGND	data line and termination signal zero *
560884 male **560885** female (Transducer view)	4	LINE-A	RxD/TxD-P (BUS)
	5	SCHIELD	
4 PIN female connector (to solder)	1	V+	Input - power supply 24 VDC (±15%)
	2	NC	Do not connect
	3	V0	Gnd - power supply 0 VDC
560886 (Transducer view)	4	NC	Do not connect

* Female only

5 INSTALLATION DIMENSIONS [mm] FOR SERVOCLINDERS TYPE CKF, CKM

Ø Bore		40	50	63	80	100	125	160	200
Ø Rod		**28**	**36**	**45**	**56**	**70**	**90**	**110**	**140**
A max		28	36	45	56	63	85	95	112
A1 (option **H**) max		18	22	28	36	45	56	63	85
AA		59	74	91	117	137	178	219	269
B f9		42	50	60	72	88	108	133	163
BB +3 / 0		35	46	46	59	59	81	92	115
BG min		12	18	18	24	24	27	32	40
CH h14		22	30	39	48	62	80	100	128
CO N9		12	12	16	16	16	20	30	40
DD 6g		M8x1	M12x1,25	M12x1,25	M16x1,5	M16x1,5	M22x1,5	M27x2	M30x2
D (1)		25	29	29	36	36	42	42	52
D1 (1)		29	NA	NA	42	42	52	52	58
E		63±1,5	75±1,5	90±1,5	115±1,5	130±2	165±2	205±2	245±2
EE (1) 6g		G 3/8	G 1/2	G 1/2	G 3/4	G 3/4	G 1	G 1	G 1 1/4
EE1(1) 6g		G 1/2	NA	NA	G 1	G 1	G1 1/4	G1 1/4	G 1 1/2
F max		10	16	16	20	22	22	25	25
FB H13		11	14	14	18	18	22	26	33
J		38	38	38	45	45	58	58	76
KC min		4	4,5	4,5	5	6	6	8	8
KK standard 6g		M20 x 1,5	M27 x 2	M33 x 2	M42 x 2	M48 x 2	M64 x 3	M80 x 3	M100 x 3
KK1 option **H** 6g		M14 x 1,5	M16 x 1,5	M20 x 1,5	M27 x 2	M33 x2	M42 x 2	M48 x 2	M64 x 3
LH h10		31	37	44	57	63	82	101	122
PJ ±1,5 (3)		85	74	80	93	101	117	130	165
PJ1 ±1,5 (1) (3)		87,5	NA	NA	93	99	121	143	167
R js13		41	52	65	83	97	126	155	190
RD f8		62	74	88	105	125	150	170	210
RT		M8x1,25	M12x1,75	M12x1,75	M16x2	M16x2	M22x2,5	M27x3	M30x3,5
SB H13		11	14	18	18	26	26	33	39
SS ±1,25 (3)		109	91	85	104	101	130	129	171
ST js13		12,5	19	26	26	32	32	38	44
TC h14		63	76	89	114	127	165	203	241
TD f8		20	25	32	40	50	63	80	100
TG js13		41,7	52,3	64,3	82,7	96,9	125,9	154,9	190,2
TL js13		16	20	25	32	40	50	63	80
TM h14		76	89	100	127	140	178	215	279
TO js13		87	105	117	149	162	208	253	300
TS js13		83	102	124	149	172	210	260	311
UM		108	129	150	191	220	278	341	439
UO max		110	130	145	180	200	250	300	360
US max		103	127	161	186	216	254	318	381
UT		95	116	139	178	207	265	329	401
UW max		80	100	110	140	150	200	240	300
VD		12	9	13	9	10	7	7	7
VE max		22	25	29	29	32	29	32	32
VL min		3	4	4	4	5	5	5	5
WF ±2		35	41	48	51	57	57	57	57
WH ±2		25	25	32	31	35	35	32	32
XG ±2 (3)		57	64	70	76	71	75	75	85
XS ±2 (3)		45	54	65	68	79	79	86	92
XV (2) ±2 (3)	**Minimum stroke**	5	15	20	20	35	35	35	35
	min	100	109	120	129	148	155	161	195
	max	99+stroke	98+stroke	100+stroke	115+stroke	117+stroke	134+stroke	141+stroke	166+stroke
Y ±2		62	67	71	77	82	86	86	98
Y1 ±2 (1)		61,5	NA	NA	75,5	83	84	79,5	97
ZB max		178	184	192	212	225	260	279	336

NOTES TO TABLE

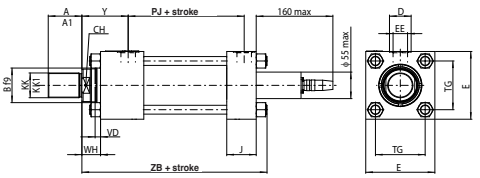
(1) Oil ports are threaded according to ISO 1179-1 (GAS standards) with counterbore dimension D. When oversized oil ports are selected, dimensions **D**, **EE**, **PJ** and **Y** are respectively modified into **D1**, **EE1**, **PJ1** and **Y1**. For bore 160 with mounting styles E, N the dimension **PJ1** reported in the table is modified, contact our technical office.

(2) **XV** - For cylinders with mounting style **L** the stroke must always exceed the minimum values reported in the table. The requested XV value must be included between **XV min** and **XV max** and it must be always indicated, with dimension in millimeters, together with the cylinder code. See the following example:

CKM-50/36*0500-L208 - D - B1E3X1 **XV = 200**

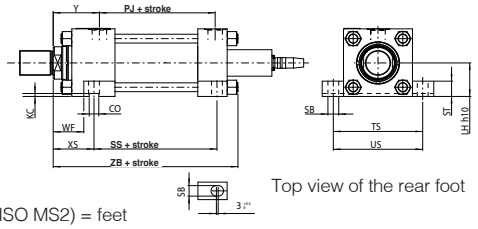
(3) The tolerance is valid for strokes up to 1250 mm, for longer strokes the upper tolerance is the max stroke tolerance reported in section 18.

6 BASIC CONFIGURATION



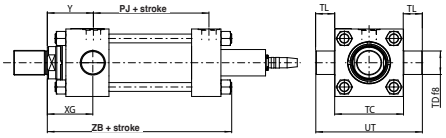
Basic configuration: X - see section 6 for dimensions

7 MOUNTING STYLE FOR SERVOCYLINDERS TYPE CKF, CKM

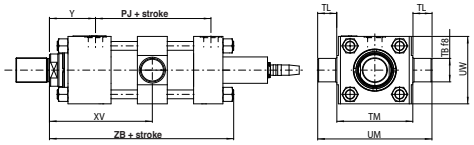


Top view of the rear foot

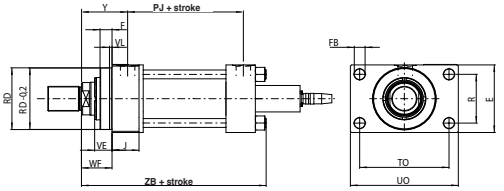
E (ISO MS2) = feet



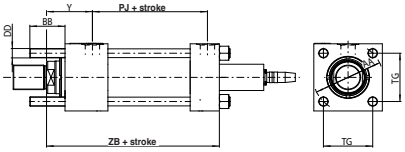
G (ISO MT1) = front trunnion



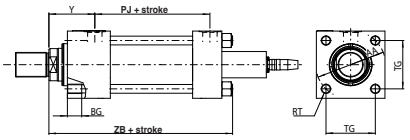
L (ISO MT4) = intermediate trunnion



N (ISO ME5) = front flange



Y (ISO MX3) = front tie rods extended



Z (ISO MX5) = front threaded holes

8 SERVOCYLINDERS TYPE CKN

8.1 Magnetostrictive transducers - basic working principles

The magnetostrictive transducer is composed by: a waveguide element ① fixed to the cylinder's body, a permanent magnet ② rigidly connected to the cylinder's rod and an integral electronics signal conditioning ③ located inside the rear head.
The position measurement is based upon the magnetostriction phenomenon: the electronics signal conditioning ③ generates a short current pulse that travels through the waveguide ①. When this pulse meets the magnetic field of the permanent magnet ②, a torsional wave is generated and it travels back to the electronics signal conditioning.
The position of the moving magnet is thus accurately determined by measuring the elapsed time between the application of the current pulse and the arrival of the torsional wave, thanks to their constant ultrasonic speed. Sensor electronics signal conditioning transforms this measurement into the analogic output feedback signal.
The contactless construction of the position transducer ensures a long working life and allows its use even in hard environmental conditions (shocks, vibrations etc.) or high working frequencies.
The small size of this magnetostrictive transducer allows the installation completely inside the cylinder, providing a very compact construction and a reduction of the overall dimensions respect to CKF and CKM servocylinders. These features make CKN servocylinders the best alternative to external absolute encoders, potentiometric and inductive transducers.

8.2 Output signal

The transducer integral electronics is available with the following configurations:

Analog

A = 4 - 20 mA
V = 0,1 - 10,1 V

The option **A** or **V** for the output signal has to be always entered in the cylinder code.

8.3 Transducer features

CKN are equipped with "GEFRAN"'s magnetostrictive transducers whose features are shown in the tables at side.

8.4 Electronic connections

The 6 pin male connector M16 is mounted on side 4 of the cylinder rear head.
The straight female cable connector ④ **STCO9131-D06-PG7** is included in the supply. The 90° female connector **STCO9131-6-PG7** can be supplied selecting option **M**. See the table at side for electronic connections.

8.5 Strokes

From 100 to 3000 mm by increments of 100 mm.
If a not standard stroke is required, contact our technical office.

8.6 Cylinder features

See sections 9, 10 and 11 for sizes, mounting style and dimensions.
See sections from 18 to 26 for materials and options.

8.7 Fluid requirements

CKN servocylinders are suitable for operation with mineral oils with or without additives (**HH, HL, HLP, HLP-D, HM, HV**), fire resistant fluids (**HFA** oil in water emulsion - 90-95% water and 5-10% oil, **HFB** water in oil emulsion - 40% water, **HFC** water glycol - max 45% water) and synthetic fluids (**HFD-U** organic esters, **HFD-R** phosphate esters).
For the proper choice of the sealing system, in relation to the fluid characteristics, see section 25.
Recommended fluid characteristics:
- Viscosity: 15 ÷ 100 mm^2/s
- Temperature range: 0 ÷ 70°C
- Fluid contamination class: for normal operation ISO4406 class 18/16/13 NAS1638 class 7. Longer life class 16/14/11 NAS1638 class 5; see also filter section at www.atos.com or KTF catalog.

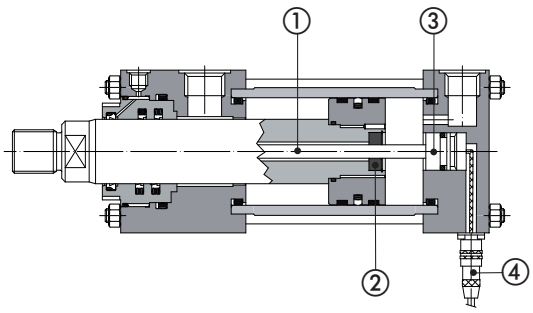
8.8 Start-up notes

CKN servocylinders are supplied with the zero/span values adjusted to the cylinder's mechanical stroke ends.
During the start-up it is necessary to bleed off the air from the servocylinder as indicated in section 27.
For other details refer to the start-up instructions included in the supply.

8.9 Warnings

Ensure that the servocylinder and wirings are kept away from strong magnetic field and electrical noise to prevent noises on the feedback signal. Check the electronic connections and switch-off the power supply before wiring, connecting or disconnecting the position transducer to avoid electronic damages.
It is recommended to connect the draining port, supplied as standard, to the tank without back pressure, see section 28 for details.

SERVOCYLINDER TYPE CKN

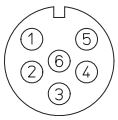


① Waveguide
② Permanent magnet
③ Integral electronics signal conditioning
④ Connector

TRANSDUCER FEATURES

Power supply	18 - 30 VDC (±15%)
Output signal	0,1 ÷10,1 VDC / 4 ÷20 mA
Resolution	infinite, restricted by the output ripple
Linearity	< ± 0,02% F.S (min ± 60 µm)
Repeatability	< ± 0,01 mm (hysteresis< ± 0,005% F.S.)
Cycle time	1 ms (1,5 for 1100 < strokes < 2000 ; 2 for strokes > 2000 mm)
Temperature coefficient	50 ppm/°C
Operating temperature	-20 ÷ +90°C (+70°C for strokes > 2500 mm)
Connection type	6 pin connector M16 to DIN 45322
Protection degree	IP67 to DIN 40050
Shock resistance	100g (single hit) / IEC Standard 60068-2-27
Vibration resistance	20g / 10÷2000 Hz / IEC Standard 60068-2-6
Measuring range	100 to 3000 mm (increments of 100 mm)
Maximum speed	1 m/s

ELECTRONIC CONNECTIONS - OPTION A,V

6 PIN female connector (to solder)	PIN	SIGNAL	NOTES
	1	V+	Input - power supply 24 VDC (±15%)
	2	V0	Gnd - power supply 0 VDC
	3	OUTPUT	Output - analog signal
	4	AGND	Gnd - analog signal
	5	NC	Not connect
STCO9131-D06-PG7 (Transducer view)	6	NC	Not connect

9 INSTALLATION DIMENSIONS [mm] FOR SERVOCLINDERS TYPE CKN

Ø Bore		40	50	63	80	100	125	160	200
Ø Rod		28	36	45	56	70	90	110	140
A max		28	36	45	56	63	85	95	112
A1 option **H** max		NA	NA	NA	36	45	56	63	85
AA ref		59	74	91	117	137	178	219	269
B f9		42	50	60	72	88	108	133	163
BB +3 / 0		35	46	46	59	59	81	92	115
BG min		12	18	18	24	24	27	32	40
CB A13		20	30	30	40	50	60	70	80
CD H9		14	20	20	28	36	45	56	70
CF max		42	62	62	83	103	123	143	163
CH h14		22	30	39	48	62	80	100	128
CO N9		12	12	16	16	16	20	30	40
CX	value	20	25	30	40	50	60	80	100
	tolerance	0 -0,012					0 -0,015		0 -0,02
D (1)		25	29	29	36	36	42	42	52
DD		M8x1	M12x1,25	M12x1,25	M16x1,5	M16x1,5	M22x1,5	M27x2	M30x2
E		63±1,5	75±1,5	90±1,5	115±1,5	130±2	165±2	205±2	245±2
EE (1) 6g		G 3/8	G 1/2	G 1/2	G 3/4	G 3/4	G 1	G 1	G 1 1/4
EP max		13	17	19	23	30	38	47	57
EW h14		20	30	30	40	50	60	70	80
EX		16 0/-0,12	20 0/-0,12	22 0/-0,12	28 0/-0,12	35 0/-0,12	44 0/-0,15	55 0/-0,15	70 0/-0,2
F max		10	16	16	20	22	22	25	25
FB H13		11	14	14	18	18	22	26	33
J ref		38	38	38	45	45	58	58	76
KC min		4	4,5	4,5	5	6	6	8	8
KK 6g		M20x1,5	M27x2	M33x2	M42x2	M48x2	M64x3	M80x3	M100x3
KK1 option **H** 6g		M14x1,5	M16x1,5	M20x1,5	M27x2	M33x2	M42x2	M48x2	M64x2
L min		19	32	32	39	54	57	63	82
LH h10		31	37	44	57	63	82	101	122
LT min		25	31	38	48	58	72	92	116
MR max		17	29	29	34	50	53	59	78
MS max		29	33	40	50	62	80	100	120
PJ ±1,5 (3)		85	74	80	143	151	167	180	190
R js13		41	52	65	83	97	126	155	190
RD f8		62	74	88	105	125	150	170	210
RT		M8x1,25	M12x1,75	M12x1,75	M16x2	M16x2	M22x2,5	M27x3	M30x3,5
SB H13		11	14	18	18	26	26	33	39
SS ±1,25 (3)		109	91	85	154	151	180	179	196
ST js13		12,5	19	26	26	32	32	38	44
TC h14		63	76	89	114	127	165	203	241
TD f8		20	25	32	40	50	63	80	100
TG js13		41,7	52,3	64,3	82,7	96,9	125,9	154,9	190,2
TL js13		16	20	25	32	40	50	63	80
TM h14		76	89	100	127	140	178	215	279
TO js13		87	105	117	149	162	208	253	300
TS js13		83	102	124	149	172	210	260	311
UM ref		108	129	150	191	220	278	341	439
UO max		110	130	145	180	200	250	300	360
US max		103	127	161	186	216	254	318	381
UT ref		95	116	139	178	207	265	329	401
UW max		80	100	110	140	150	200	240	300
VD		12	9	13	9	10	7	7	7
VE max		22	25	29	29	32	29	32	32
VL min		3	4	4	4	5	5	5	5
WF ±2		35	41	48	51	57	57	57	57
WH ±2		25	25	32	31	35	35	32	32
XC ±1,5 (3)		237	256	265	279	307	339	358	406
XG ±2 (3)		57	64	70	76	71	75	75	85
XO ±1,5 (3)		243	255	271	288	311	354	387	440
XS ±2 (3)		45	54	65	68	79	79	86	92
XV (2)	Minimum stroke	5	15	20	20	35	35	35	35
	min	100	109	120	129	148	155	161	195
±2 (3)	max	99+stroke	98+stroke	100+stroke	115+stroke	117+stroke	134+stroke	141+stroke	166+stroke
Y ±2		62	67	71	77	82	86	86	98
ZB max		231	241	250	262	275	310	329	361
ZJ ±1 (3)		218	224	233	240	253	282	295	324

NOTES TO TABLE

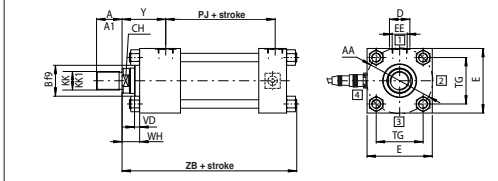
(1) Oil ports with dimension EE are threaded according to ISO 1179-1 (GAS standards) with counterbore dimension D.

(2) **XV** - For cylinders with mounting style **L** the stroke must always exceed the minimum values reported in the table.The requested XV value must be included between **XV min** and **XV max** and it must be always indicated, with dimension in millimeters, together with the cylinder code. See the following example:

CKN-50/36*0500-L208 - AK - B1E3X1 **XV = 200**

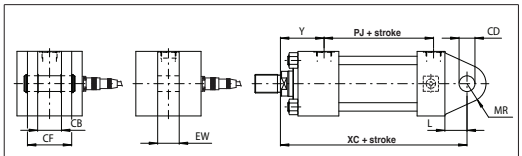
(3) The tolerance is valid for strokes up to 1250 mm, for longer strokes the upper tolerance is the max stroke tolerance reported in section 18.

10 BASIC CONFIGURATION

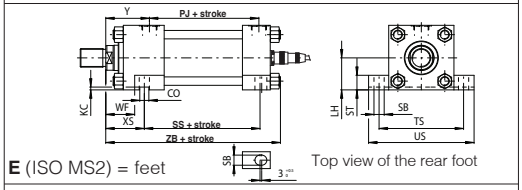


Basic configuration: X - see section 10 for dimensions
Electrical connector on side 4

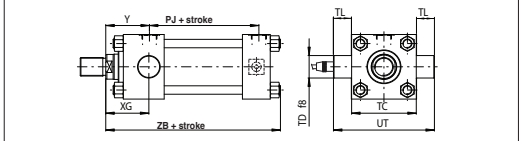
11 MOUNTING STYLES FOR SERVOCYLINDERS TYPE CKN



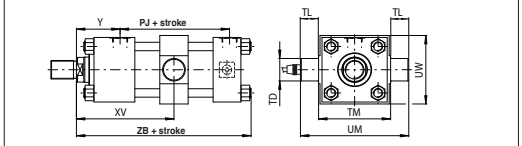
C (ISO MP1) = fixed clevis
D (ISO MP3) = fixed eye



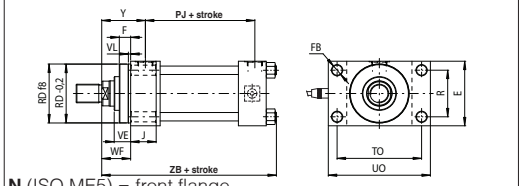
E (ISO MS2) = feet Top view of the rear foot



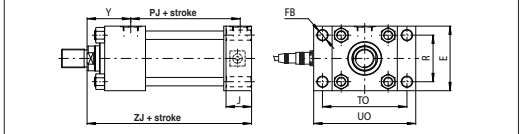
G (ISO MT1) = front trunnion



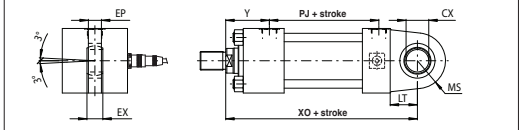
L (ISO MT4) = intermediate trunnion



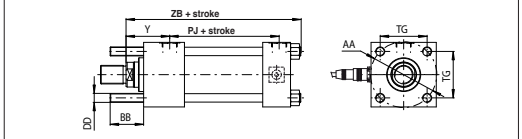
N (ISO ME5) = front flange



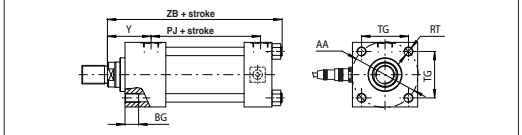
P (ISO ME6) = rear flange



S (ISO MP5) = fixed eye with spherical bearing



Y (ISO MX3) = front tie rods extended



Z (ISO MX5) = front threaded holes

12 SERVOCYLINDERS TYPE CKP

12.1 Potentiometric transducers - basic working principles

The potentiometric transducer is composed by two resistive tracks ① and a wiper ② which realizes the sliding contact through two metallic brushes. The resistive track is an aluminium element with a conductive plastic coating fixed to the cylinder's rear head. The wiper is mounted on the piston rod and moves together with it.
The tracks of the potentiometer have to be connected to a stabilized DC voltage to allow a small current flow. The two brushes of the wiper close the electronic circuit with the tracks (see figure at side), changing the resistance value and thus the voltage output proportionally to the rod position (principle of potential divider).
CKP servocylinders present the best price/performance ratio. Their compact construction allows the easy application of servocylinders in place of a standard cylinders without transducer.

12.2 Transducer features

For all the transducer features see the table at side.

12.3 Electronic connections

The 4 pin male connector is mounted on side 4 of the cylinder rear head for all mounting styles except style E (ISO MS2), where it is mounted along the cylinder axis, see section 16.
The straight female cable connector ③ **STCO9131-D04-PG7** is included in the supply. The 90° female connector **STCO9131-4-PG7** can be supplied selecting option **M**.
See the table at side for electronic connections.

12.4 Strokes

From 100 to 700 mm by increments of 100 mm.
If a not standard stroke is required, contact our technical office.

12.5 Cylinder features

See sections 14, 15 and 16 for sizes, mounting style and dimensions.
See sections from 18 to 26 for materials and options.

12.6 Fluids requirements

CKP servocylinders are suitable for operation with mineral oils with or without additives (**HH, HL, HLP, HLP-D, HM, HV**) **not compatible with glycol water and water based fluids.**

For the proper choice of the sealing system, in relation to the fluid characteristics, see section 25.
Recommended fluid characteristics:
- Viscosity: 15 ÷ 100 mm^2/s
- Temperature range: 0 ÷ 70°C
- Fluid contamination class: for normal operation ISO4406 class 18/16/13 NAS1638 class 7. Longer life class 16/14/11 NAS1638 class 5; see also filter section at www.atos.com or KTF catalog.

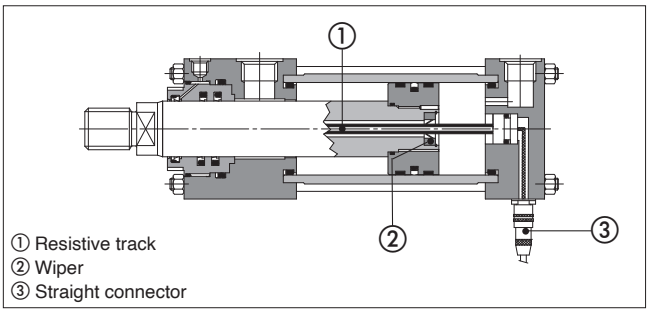
12.7 Start-up notes

During the start-up it is necessary to bleed off the air from the servocylinder. The air bleed is located on the rod end, see figure at side.
For a proper use of the air-bleed unlock the grub screw ④ M8 x 10 with a wrench for hexagonal head screws, moves the cylinder for the necessary cycles to bleed-off the air and retighten by a torque of 20 Nm.
Take care to completely bleed off the air from the inside because the compressibility effects of the air trapped-in may compromise the contact between the brushes and the resistive tracks.
Ensure to bleed off the air after every long time stop of the servocylinder.
For other details refer to the start-up instructions included in the supply.

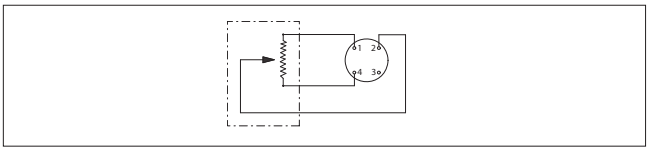
12.8 Warnings

For a correct functioning, the transducer must be exclusively used as a potential divider.
Ensure to observe the maximum rating power indicated in the table "transducer features" to avoid any component damage.
The power supply must be stabilized: variations on the voltage provided have direct influence on the output values.
It is recommended to connect the draining port, supplied as standard, to the tank without back pressure, see section 28 for details.

SERVOCYLINDER TYPE CKP



ELECTRONIC CIRCUIT



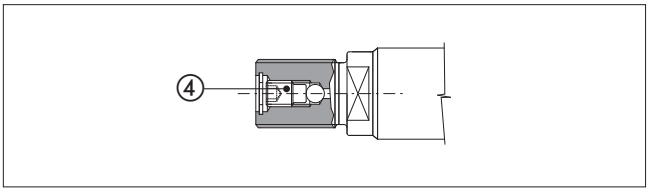
TRANSDUCER FEATURES

Supply reference	10 VDC recommended (max 30 VDC)
Dissipation	3 W at 40°C, 0 W at 120°C
Linearity	±0,1% F.S.
Repeatability	0,01 mm
Total resistance	10 kΩ at full stroke
Insulation resistance	> 100 MΩ to 500 VDC
Wiper current	Recommended: a few µA (10mA max)
Temperature limits	-20 ÷ + 100°C
Connection type	4 pin connector to Mil-C-26482
Protection degree	IP67 to DIN 40050
Measuring range	100 to 700 mm (increments of 100 mm)
Maximum speed	0,5 m/s

ELECTRONIC CONNECTIONS

4 PIN female connector (to solder)	PIN	SIGNAL	NOTES
① ② ④ ③	1	V0	Gnd - power supply 0 VDC
	2	OUTPUT	Output - 0 - 10 V
	3	NC	Do not connect
STCO9131-D04-PG7 (Transducer view)	4	Vref	Input - power supply 10 VDC

ROD AIR BLEED



13 SERVOCYLINDERS TYPE CKV

13.1 Inductive transducers - basic working principles

The transducer is composed by a single coil-winding ① and a ferromagnetic core ②. The coil-winding is integrated into a tube fixed to the cylinder's rear head, the core is fixed to the piston rod and moves together with it.
When the core moves together with the piston, the inductance of the coil-winding changes proportionally to the core position. The separate electronic conditioning card sends a sinusoidal signal to the primary coil-winding, it reads the corresponding signal of the secondary coil-winding and, from their difference, it calculates the inductance and computes the analog output feedback signal.
The contactless principle of the transducer ensures a long working life and its ruggedness construction allows to withstand high frequencies or dynamical stresses (i.e. simulators, vibropresses etc.).
The compact construction of CKV allows the easy application of the servocylinders in place of cylinders without transducer.
The separate conditioning card makes the inductive transducer ideal for all applications with high temperatures: in this case the max temperature is limited by the sealing system.

13.2 Transducer features

CKV are equipped with "Penny & Giles"'s ICT inductive transducers whose features are shown in the table at side.
The performances of the transducer indicated in the table at side refer exclusively to the use with its proper conditioning card.

13.3 Electronic conditioning card

The performance of the table on the side is guaranteed by the electronic conditioning card provided with one of the following configurations:

A = 4 - 20 mA
V = 0 - 10 V

Other output ranges are available on request, contact our technical office.

The electronic conditioning card allows to adjust the zero and gain references by a screwdriver.
The card format fits to DIN EN50022 or EN50035 rails or allows a wall mounting by 4 screws M5x30.

13.4 Electronic connections

The 4 pin male connector is mounted on side 4 of the cylinder rear head for all mounting styles except style E (ISO MS2), where it is mounted along the cylinder's axis, see section 16.
The straight female cable connector ③ **STCO9131-D04-PG7** is supplied with a cable 3 m long connected to the electronic conditioning card by wire clamp IP66 and screw terminals. The 90° female connector **STCO9131-4-PG7** can be supplied selecting option **M**.
See the table at side for electronic connections.

13.5 Strokes

From 30 to 1000 mm by increments of 10 mm.
If a not standard stroke is required, contact our technical office.

13.6 Cylinder features

See sections 14, 15 and 16 for sizes, mounting style and dimensions.
See sections from 18 to 26 for materials and options.

13.7 Fluid requirements

CKV servocylinders are suitable for operation with mineral oils with or without additives (**HH, HL, HLP, HLP-D, HM, HV**), fire resistant fluids (**HFA** oil in water emulsion - 90-95% water and 5-10% oil, **HFB** water in oil emulsion - 40% water, **HFC** water glycol - max 45% water) and synthetic fluids (**HFD-U** organic esters, **HFD-R** phosphate esters).
For the proper choice of the sealing system, in relation to the fluid characteristics, see section 25.
Recommended fluid characteristics:
- Viscosity: 15 ÷ 100 mm^2/s
- Temperature range: 0 ÷ 70°C
- Fluid contamination class: for normal operation ISO4406 class 18/16/13 NAS1638 class 7. Longer life class 16/14/11 NAS1638 class 5; see also filter section at www.atos.com or KTF catalog.

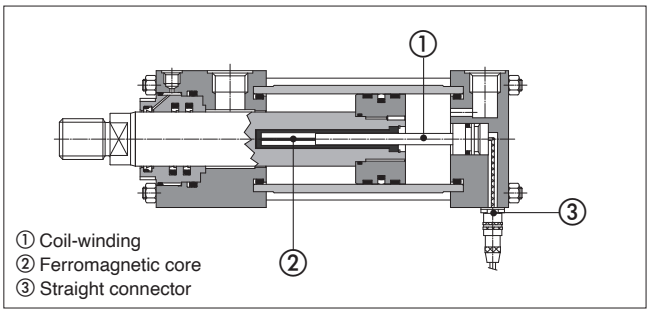
13.8 Start-up notes

CKV servocylinders are supplied with zero/span values adjusted to the cylinder's mechanical stroke ends. During the start-up it is necessary to bleed off the air from the servocylinder as indicated in section 27.
For other details refer to the start-up instructions included in the supply.

13.9 Warnings

Ensure that the maximum distance between the servocylinder and the conditioning card is lower than the recommended one: 10 m.
It is recommended to connect the draining port, supplied as standard, to the tank without back pressure, see section 28 for details.

SERVOCYLINDER TYPE CKV



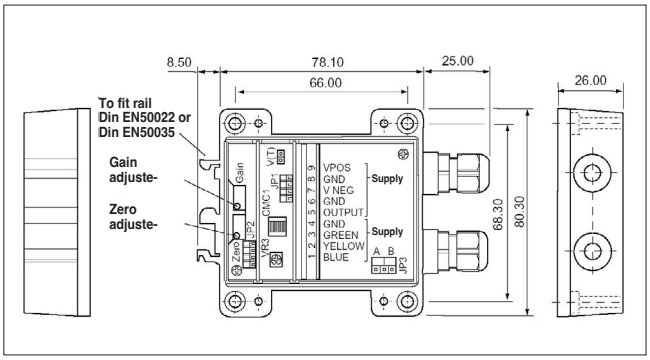
TRANSDUCER FEATURES

Linearity	±0,2%
Repeatability	±0,05%
Insulation resistance	>50 MΩ to 50 VDC
Temperature coefficient	±200 ppm/°C from -20 to +100°C
Operating temperature	-20 ÷ +120°C
Connection type	4 pin connector to Mil-C-26482
Protection degree	IP67 to DIN 40050
Measuring range	30 to 1000 mm (increments of 10 mm)
Maximum speed	1 m/s

ELECTRONIC CONNECTIONS

4 PIN female connector (to solder)	PIN	SIGNAL	NOTES
① ② ④ ③	1	Ve+	Coil V+
	2	Ve-	Coil V-
	3	NC	Do not connect
STCO9131-D04-PG7 (Transducer view)	4	V0	Sensor ground

ELECTRONIC CONDITIONING CARD



	Analog output A	Voltage output V
Supply voltage	from 10 to 30 VDC	from 13,5 to 30 VDC
Supply current	12,6 mA max	19 mA max
Output	4÷20 mA	0÷10 VDC
Zero adjustment range	-10% to +60% of span	
Gain adjustment range	+40% to +110% of span	
Output ripple	< 5 mV rms	
Output load	10 kΩ min.	
Operating temperature	0 ÷ +70°C (storage -40 ÷ +85°C)	
Temperature coefficient	300 ppm/°C	
Protection degree	IP66 to DIN 40050	

14 INSTALLATION DIMENSIONS [mm] FOR SERVOCLINDERS TYPE CKP, CKV

Ø Bore		40	50	63	80	100	125	160	200
Ø Rod		**28**	**36**	**45**	**56**	**70**	**90**	**110**	**140**
A max		28	36	45	56	63	85	95	112
A1 option **H** max		NA	NA	NA	36	45	56	63	85
AA ref		59	74	91	117	137	178	219	269
B f9		42	50	60	72	88	108	133	163
BB +3 / 0		35	46	46	59	59	81	92	115
BG min		12	18	18	24	24	27	32	40
CB A13		20	30	30	40	50	60	70	80
CD H9		14	20	20	28	36	45	56	70
CF max		42	62	62	83	103	123	143	163
CH h14		22	30	39	48	62	80	100	128
CO N9		12	12	16	16	16	20	30	40
CX	value	20	25	30	40	50	60	80	100
	tolerance	0 -0,012					0 -0,015		0 -0,02
D (1)		25	29	29	36	36	42	42	52
DD 6g		M8x1	M12x1,25	M12x1,25	M16x1,5	M16x1,5	M22x1,5	M27x2	M30x2
E		63±1,5	75±1,5	90±1,5	115±1,5	130±2	165±2	205±2	245±2
EE (1) 6g		G 3/8	G 1/2	G 1/2	G 3/4	G 3/4	G 1	G 1	G 1 1/4
EP max		13	17	19	23	30	38	47	57
EW h14		20	30	30	40	50	60	70	80
EX		16 0/-0,12	20 0/-0,12	22 0/-0,12	28 0/-0,12	35 0/-0,12	44 0/-0,15	55 0/-0,15	70 0/-0,2
F max		10	16	16	20	22	22	25	25
FB H13		11	14	14	18	18	22	26	33
J ref		38	38	38	45	45	58	58	76
KC min		4	4,5	4,5	5	6	6	8	8
KK 6g		M20x1,5	M27x2	M33x2	M42x2	M48x2	M64x3	M80x3	M100x3
KK1 option **H** 6g		M14x1,5	M16x1,5	M20x1,5	M27x2	M33x2	M42x2	M48x2	M64x2
L min		19	32	32	39	54	57	63	82
LH h10		31	37	44	57	63	82	101	122
LT min		25	31	38	48	58	72	92	116
MR max		17	29	29	34	50	53	59	78
MS max		29	33	40	50	62	80	100	120
PJ ±1,5 **(3)**		85	74	80	93	101	117	130	165
R js13		41	52	65	83	97	126	155	190
RD f8		62	74	88	105	125	150	170	210
RT		M8x1,25	M12x1,75	M12x1,75	M16x2	M16x2	M22x2,5	M27x3	M30x3,5
SB H13		11	14	18	18	26	26	33	39
SS ±1,25 **(3)**		109	91	85	104	101	130	129	171
ST js13		12,5	19	26	26	32	32	38	44
TC h14		63	76	89	114	127	165	203	241
TD f8		20	25	32	40	50	63	80	100
TG js13		41,7	52,3	64,3	82,7	96,9	125,9	154,9	190,2
TL js13		16	20	25	32	40	50	63	80
TM h14		76	89	100	127	140	178	215	279
TO js13		87	105	117	149	162	208	253	300
TS js13		83	102	124	149	172	210	260	311
UM ref		108	129	150	191	220	278	341	439
UO max		110	130	145	180	200	250	300	360
US max		103	127	161	186	216	254	318	381
UT ref		95	116	139	178	207	265	329	401
UW max		80	100	110	140	150	200	240	300
VD		12	9	13	9	10	7	7	7
VE max		22	25	29	29	32	29	32	32
VL min		3	4	4	4	5	5	5	5
WF ±2		35	41	48	51	57	57	57	57
WH ±2		25	25	32	31	35	35	32	32
XC ±1,5 **(3)**		184	191	200	229	257	289	308	381
XG ±2 **(3)**		57	64	70	76	71	75	75	85
XO ±1,5 **(3)**		190	190	206	238	261	304	337	415
XS ±2 **(3)**		45	54	65	68	79	79	86	92
XV (2) ±2 **(3)**	**Minimum stroke**	5	15	20	20	35	35	35	35
	min	100	109	120	129	148	155	161	195
	max	99+stroke	98+stroke	100+stroke	115+stroke	117+stroke	134+stroke	141+stroke	166+stroke
Y ±2		62	67	71	77	82	86	86	98
ZB max		178	184	192	212	225	260	279	336
ZJ		165	159	168	190	203	232	245	299

NOTES TO TABLE

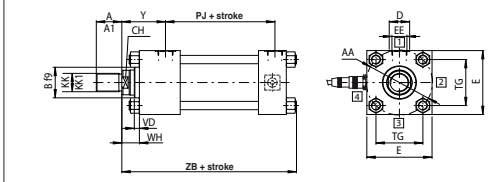
(1) Oil ports with dimension EE are threaded according to ISO 1179-1 (GAS standards) with counterbore dimension D.

(2) **XV** - For cylinders with mounting style **L** the stroke must always exceed the minimum values reported in the table.The requested XV value must be included between **XV min** and **XV max** and it must be always indicated, with dimension in millimeters, together with the cylinder code. See the following example:

CKP-50/36*0500-L208 - K - B1E3X1 **XV = 200**

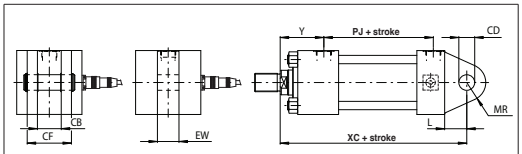
(3) The tolerance is valid for strokes up to 1250 mm, for longer strokes the upper tolerance is the max stroke tolerance reported in section 18.

15 BASIC CONFIGURATION

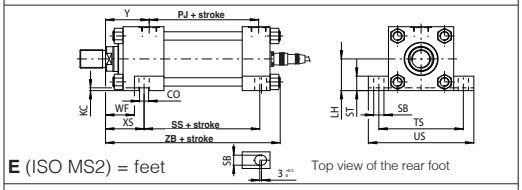


Basic configuration: X - see section 15 for dimensions
Electrical connector on side 4

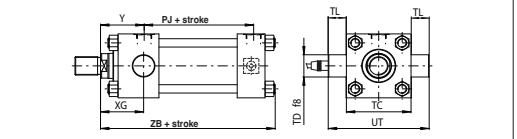
16 MOUNTING STYLES FOR SERVOCYLINDERS TYPE CKP, CKV



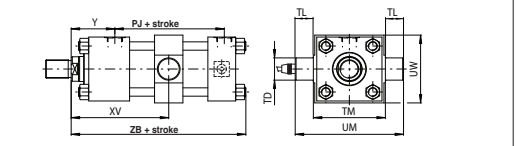
C (ISO MP1) = fixed clevis
D (ISO MP3) = fixed eye



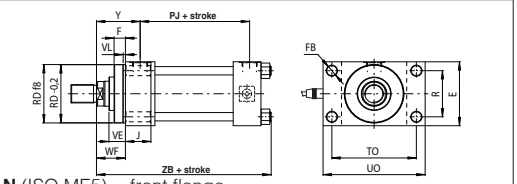
E (ISO MS2) = feet Top view of the rear foot



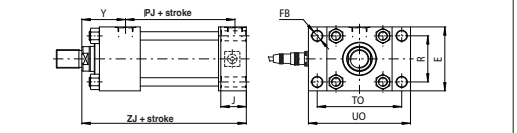
G (ISO MT1) = front trunnion



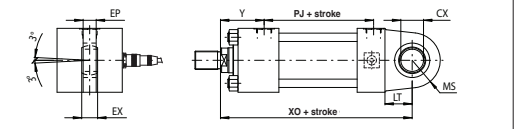
L (ISO MT4) = intermediate trunnion



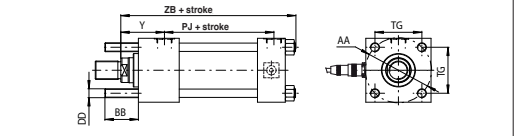
N (ISO ME5) = front flange



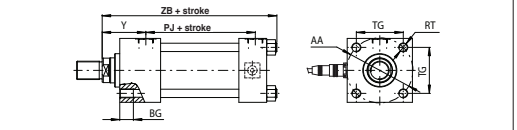
P (ISO ME6) = rear flange



S (ISO MP5) = fixed eye with spherical bearing



Y (ISO MX3) = front tie rods extended



Z (ISO MX5) = front threaded holes

17 MAIN CHARACTERISTICS OF TRANSDUCERS

Code	CKF section 2	CKM section 3	CKN section 8	CKP section 12	CKV section 13
Transducer type	Magnetosonic, analog	Magnetosonic, programmable	Magnetostrictive	Potentiometric	Inductive
Linearity error **(1)**	< ± 0,02%	< ± 0,01%	< ± 0,02%	± 0,1%	± 0,2%
Repeatability	< ± 0,001% **(1)**	< ± 0,001% **(1)**	< ± 0,005% **(1)**	0,01 mm	± 0,05% **(1)**
Strokes	50 to 2500	25 to 3000	100 to 3000	100 to 700	30 to 1000
Interface	Analog: 0 ÷ 10 V, 4 ÷ 20 mA Digital: SSI	Analog: 0 ÷ 10 V, 4 ÷ 20 mA Digital: SSI, PROFINET, PROFIBUS DP	Voltage: 0,1 ÷ 10,1 V Current: 4 ÷ 20 mA	Voltage 0 ÷ 10 V	Voltage: 0 ÷ 10 V Current: 4 ÷ 20 mA
Typical applications	Sawing or bending machines	Steel plants, plastic and rubber	Foundry and energy	Various	Simulators and energy
Temperature limits	-20°C to +75°C	-20°C to +75°C	-20°C to +90°C	-20°C to +100°C	-20°C to +120°C

(1) Percentage of the total stroke

18 STROKE SELECTION

Stroke has to be selected a few mm longer than the working stroke to prevent the use of the cylinder heads as mechanical stroke-end. The stroke tolerances are reported in the table at side.

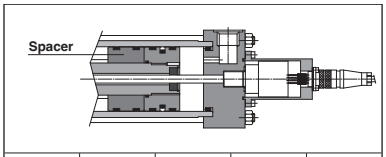
STROKE TOLERANCES

- 0 +2 mm for strokes up to 1250 mm
- 0 +5 mm for strokes from 1250 to 3150 mm
- 0 +8 mm for strokes over 3150 mm

19 SPACER

For strokes longer than 1000 mm, proper spacers have to be introduced in the cylinder's construction to increase the rod and piston guide and to protect them from overloads and premature wear. Spacers can be omitted for cylinders working in traction mode. The introduction of spacers increases the overall cylinder's dimensions: spacers' lenght has to be added to all stroke dependent dimensions in sections 5 , 9 and 14.

RECOMMENDED SPACERS [mm]



Stroke	1001 ÷ 1500	1501 ÷ 2000	2001 ÷ 2500	2501 ÷ 3000
Spacer code	**2**	**4**	**6**	**8**
Length	50	100	150	200

20 CYLINDER'S HOUSING FEATURES

The cylinder's housings are made in "cold drawn and stressed steel"; the internal surfaces are lapped: diameter tolerance H8, roughness Ra ≤ 0,25 µm.

21 TIE RODS FEATURES

The cylinder's tie rods are made in "normalized automatic steel"; end-threads are rolled to improve the fatigue working life. They are screwed to the heads or mounted by means of nuts with a prefixed tightening torque MT, see the table at side.

TIE RODS TIGHTENING TORQUES

Ø Bore	**40**	**50**	**63**	**80**
MT [Nm]	20	70	70	160
Wrench	13	19	19	24
Ø Bore	**100**	**125**	**160**	**200**
MT [Nm]	160	460	820	1160
Wrench	24	32	41	46

22 RODS FEATURES and options

The rods materials have high strength, which provide safety coefficients higher than 4 in static stress conditions, at maximum working pressure. The rod surface is chrome plated: diameter tolerances f7; roughness Ra ≤ 0,25 µm. Corrosion resistance of 100 h in neutral spray to ISO 9227 NSS

ø Rod	Material	Rs min [N/mm²]	Chrome	
			min. thickness [mm]	hardness [HV]
28÷90	hardened and tempered alloy-steel	700	0,020	850-1150
110÷140	alloy steel	450		

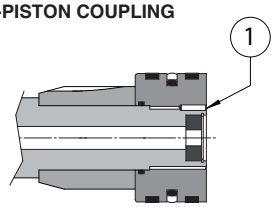
Rod diameters from 28 to 70 mm have rolled threads; in rolling process the component material is stressed beyond its yield point, being deformed plastically. This offers many technical advantages: higher profile accuracy, improved fatigue working life and high wear resistance. See **tab. B015** for the calculation of the expected rod fatigue life. The rod and piston are mechanically coupled by a threaded connection in which the thread on the rod is at least equal to the external thread KK, indicated in the tables 6 , 10 and 15.The piston is screwed to the rod by a prefixed tightening torque in order to improve the fatigue resistance. The stop pin ① avoids the piston unscrewing. **Contact our technical office** in case of heavy duty applications.

Rod corrosion resistance and hardness can be improved selecting the options **K** and **T** (option K affects the strength of standard rod, see **tab. B015** for the calculation of the expected rod fatigue life):

K = Nickel and chrome-plating (for rods from 28 to 110 mm)
Corrosion resistance (rating 10 to ISO 10289):
- 500 h in acetic acid salt spray to ISO 9227 AASS
- 1000 h in neutral spray to ISO 9227 NSS

T = Induction surface hardening and chrome plating:
- 56-60 HRC (613-697 HV) hardness

ROD-PISTON COUPLING

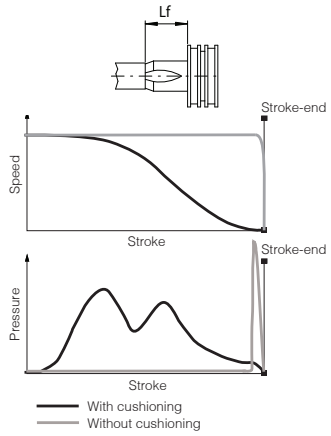


23 CUSHIONING

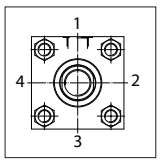
Cushioning are recommended for applications where: • the piston makes a full stroke with speed over than 0,05 m/s; • it is required to reduce undesirable noise and mechanical shocks; • vertical application with heavy loads. The stroke-end cushioning are hydraulic dampers specifically designed to dissipate the energy of the mass connected to the cylinder rod, by progressively increasing the pressure in the cushioning chamber and thus reducing the rod speed before the cylinder's mechanical stroke-end (see the graphics at side). See **tab. B015** for the max damping energy.
The cylinder is provided with needle valve to optimize cushioning performances in different applications. The regulating screws are supplied fully screwed in (max cushioning effect).
In case of high masses and/or very high operating speeds we recommend to back them off to optimize the cushioning effect. The adjustment screw has a special design to prevent unlocking and expulsion. The cushioning effect is highly ensured even in case of variation of the fluid viscosity.

Ø Bore		63	80	100	125	160	200
Ø Rod		45	56	70	90	110	140
Cushioning length [mm]	Lf	27	29	27	25	34	34

Lf is the total cushioning lenght. When the stroke-end cushioning are used as safety devices, to mechanically preserve the cylinder and the system, it is advisable to select the cylinder's stroke longer than the operating one by an amount equal to the cushioning lenght Lf; in this way the cushioning effect does not influence the movement during the operating stroke.



24 POSITION OF THE OIL PORTS AND CUSHIONING ADJUSTMENTS

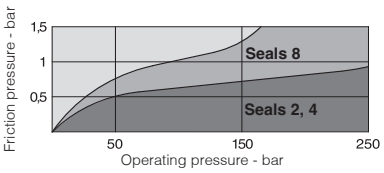


FRONT HEAD: **B1** = oil port position; **E* =** cushioning adjustment position
REAR HEAD: **X1** = oil port position.
The oil ports and cushioning adjustment positions are available, respectively, on sides 1 and 3 for all styles except E (see the figure at side): the style E has the cushioning adjustment on side 2.

Example of model code: CKM/00-50/22 *0500-S201 - D - **B1E3X1**

25 SEALING SYSTEM FEATURES

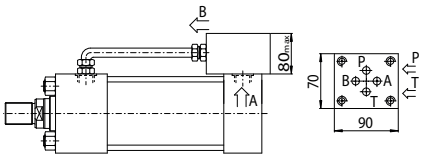
The sealing system must be choosen according to the working conditions of the system: speed, operating frequencies, fluid type and temperature. Additional verifications about minimum in/out rod speed ratio, static and dynamic sealing friction are warmly suggested, see **tab. B015**.
Seals **2** and **4** not available for CKP since they are not compatible with glycol water and water based fluids.
Special sealing system for low temperature, high frequencies (up to 20 Hz), long working life and heavy duty are available, see **tab. TB020**. All the seals, static and dynamic, must be periodically replaced: proper spare kits are available, see **tab. B137**. Contact our technical office for the compatibility with other fluids not mentioned below and specify type and composition.

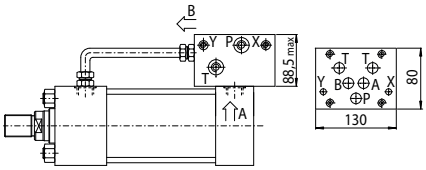


Sealing system	Material	Features	Max speed [m/s]	Fluid temperature range	Fluids compatibility	ISO Standards for seals	
						Piston	Piston
2	FKM + PTFE	**very low friction and high temperatures**	4	-20°C to 120°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFB, HFC (water max 45%), HFD-U,HFD-R	ISO 7425/1	ISO 7425/2
4	NBR + PTFE	**very low friction and high speeds**	4	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFC (water max 45%), HFD-U	ISO 7425/1	ISO 7425/2
8	NBR + PTFE + POLYURETHANE	**low friction**	0,5	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606	ISO 7425/1	ISO 7425/2

26 INCORPORATED SUBPLATE

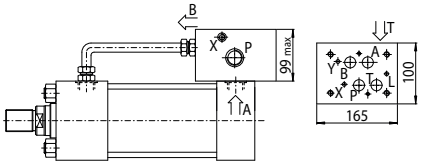
CK* cylinders with oil ports positions 1 can be supplied with ISO (size 06, 10, 16 and 25) incorporated subplates for mounting of valves directly on the cylinder.

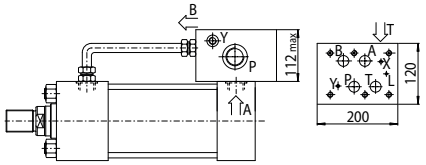




10 = subplate with mounting surface 4401-03-02-0-05 (size 06)
Oil ports P and T = G 3/8
For bores from 40 to 200 and strokes longer than 100 mm
For shorter strokes, the cylinder must be provided with suitable spacer

20 = subplate with mounting surface 4401-05-05-0-05 (size 10)
Oil ports P and T = G 3/4; X and Y = G 1/4
For bores from 40 to 200 and strokes longer than 150 mm
For shorter strokes, the cylinders must be provided with suitable spacer





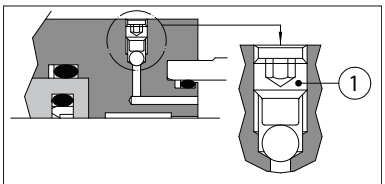
30 = subplate with mounting surface 4401-07-07-0-05 (size 16)
Oil ports P and T = G 1; L, X and Y = G 1/4
For bores from 80 to 200 and strokes longer than 150 mm
For shorter strokes, the cylinders must be provided with suitable spacer

40 = subplate with mounting surface 4401-08-08-0-05 (size 25)
Oil ports P and T = G 1; L, X and Y = G 1/4
For bores from 125 to 200 and strokes longer than 150 mm
For shorter strokes, the cylinders must be provided with suitable spacer

Note: for the choice of suitable spacer see section 19. The addition of spacer length and working stroke must be at least equal or upper than the minimum stroke indicated above, see the following example:
Subplate **20**; working stroke = **70** mm; min. stroke = **150** mm → select spacer **4** (lenght = **100** mm)

27 AIR BLEEDS

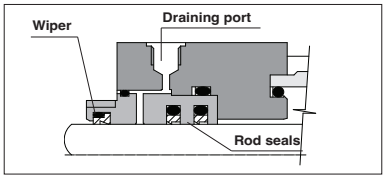
The air in the hydraulic circuit must be removed to avoid noise, vibrations and irregular cylinder's motion: air bleed valves realize this operation easily and safely.
Air bleeds are positioned on side 3 except for rear heads of CKV, CKP cylinders with bores from 80 to 200 mm (on side 2) and for heads of mounting style **E** (on side 2), see section 24.
For a proper use of the air-bleed (see figure on side) unlock the grub screw ① with a wrench for hexagonal head screws, moves the cylinder for the necessary cycles to bleed-off the air and retighten as indicated in table at side.



Ø Bore	Screwing	Tightening torque
40	M5 x 4	8 Nm
50 - 200	M8 x 10	20 Nm

28 DRAINING

The rod side draining reduces the seals friction and increases their reliability.
The draining is positioned on the same side of the oil port, between the wiper and the rod seals (see figure at side).
It is recommended to connect the draining port to the tank without backpressure.
Draining port is G1/8.

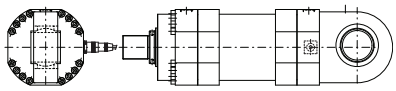
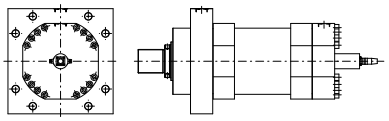
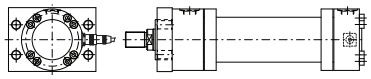
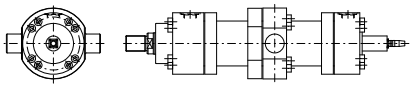
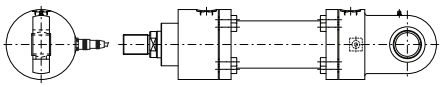
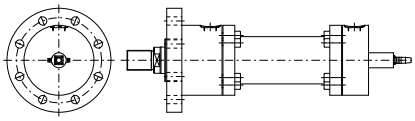


29 SIL IEC61508 compliance with IEC 61508: 2010

Servocylinders meets the requirements of:
- **SC3** (systematic capability)
- max **SIL 2** (HFT = 0 if the hydraulic system does not provide the redundancy for the specific safety function where the component is applied)
- max **SIL 3** (HFT = 1 if the hydraulic system provides the redundancy for the specific safety function where the component is applied)

30 SERVOCYLINDERS DERIVED FROM SERIES CH, CN, CC

Servocylinders derived from CH (ISO 6020-2 P = 160 bar; **tab. B140**), CH big bores (ISO 6020-3 P = 160 bar; **tab. B160**), CN (ISO 6020-1 P = 160 bar; **tab. B180**) and CC series (ISO 6022 P = 250 bar; **tab. B241**) are available on request. Contact our technical office for details.

BASIC CYLINDER	DERIVED SERVOCYLINDERS	
CH big bore (tab. B160) **ISO 6020-3** Pnom 160 bar Pmax 250 bar Ø bore 250÷400 mm Ø rod 140÷220 mm	**CHP, CHV -** example of style "S" 	**CHF, CHM -** example of style "N" 
CN (tab. B180) **ISO 6020-1** Pnom 160 bar Pmax 250 bar Ø bore 40÷200 mm Ø rod 22÷140 mm	**CNP, CNV -** example of style "N" 	**CNF, CNM -** example of style "L" 
CC (tab. B241) **ISO 6022** Pnom 250 bar Pmax 320 bar Ø bore 50÷320 mm Ø rod 36÷220 mm	**CCP, CCV -** example of style "S" 	**CCF, CCM -** example of style "A" 

31 SPARE PARTS - SEE TABLE SP-B310

Example for seals spare parts code

G 8	-	CKF	-	125	/	90

Sealing system

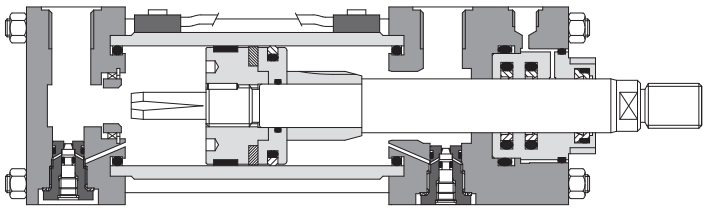
Cylinder series

Bore size [mm]

Rod diameter [mm]

Hydraulic cylinders type CKS - with adjustable proximity sensors

to ISO 6020-2 - nominal pressure 10 MPa (100 bar) - max 15 MPa (150 bar)



CKS cylinders are derived from standard CK (tab. B137) with stainless steel piston and housing and with a special design to equip external proximity sensors for rod position detection."Reed" or "Hall effect" sensors are easily assembled on one of the four tie rods by means of proper clamps which allows to position them along the cylinder housing. The sensors switch their electric circuit when they detect the permanent magnet integrated into the piston. Thus they can be used to perform motion cycles, operating sequences, fast-slow cycles and safety functions.

- Bore sizes from **25** to **100** mm
- **2** rod diameters per bore
- Piston and housing in stainless steel
- Rods and tie rods with rolled threads
- **14** standard mounting styles
- **3** seals options
- Adjustable or fixed cushioning
- **ATEX** sensors
- Attachments for rods and mounting styles, **see tab. B800**

For cylinder's dimensions and options **see tab. B137**

1 PROXIMITY SENSORS: MAIN FEATURES

Reed	Hall effect
- High switching power, up to 230 VDC or VAC - Suitable to directly pilot a power load - 2 wires circuit for easy connection	- Electronic sensor - Infinite electric life (no moving parts inside it) - High sensitivity and switching reliability - Not suitable to directly pilot a power load - 3 wires circuit to avoid voltage drop

2 PROXIMITY SENSORS: MAIN DATA

	Power supply [VDC/AC]	Max power [W]	Max current [mA]	Voltage drop [V]	Switching time [ms]		Circuit style	Contact (2)	Output	Cable section	Cable shealt	Cable shealt [mm]	Temperature range [°C]	Protection degree
					ON	OFF								
P / R (REED)	3 ÷230	10 VA	500	-	0,5	0,1	2 wires	N.O.	-	2x0,25	PVC	2500	-20 ÷+85	IP67
Q / S (HALL)	10 ÷30 **(1)**	6	250	0,7	0,2	0,1	3 wires	N.O.	PNP	3x0,14	PVC	2500	-20 ÷+85	IP67
ATEX (HALL)	8,2 **(1)**	6	250	-	0,2	0,1	3 wires	N.O.	-	2x0,14	PVC	6000	-20 ÷+70	IP67

Notes: (1) Only VDC
(2) N.O.= Normally Open

3 MODEL CODE

CKS - 50 / 22 * 0500 - S 6 0 1 - R - B1E3X1Z3 **

Cylinder series
CKS to ISO 6020 - 2
CKSA with ATEX sensors

Bore size, see section 8
from **25** to **100** mm

Rod diameter, see sections 8
from **12** to **70** mm

Stroke, see section 8
from **20** to **3000** mm

Mounting style (1)	**REF. ISO**
C = fixed clevis	MP1
D = fixed eye	MP3
E = feet	MS2
G = front trunnion	MT1
H = rear trunnion	MT2
N = front flange	ME5
P = rear flange	ME6
S = fixed eye + spherical bearing	MP5
T = threaded hole+tie rods extended	MX7
V = rear tie rods extended	MX2
W = both end tie rods extended	MX1
X = basic execution	-
Y = front tie rods extended	MX3
Z = front threaded holes	MX5

Cushioning (1)
0 = none

Slow adjustable	**Fast fixed**
4 = rear only	**7** = rear only
5 = front only	**8** = front only
6 = front and rear	**9** = front and rear

Spacer, see section 5
0 = none **1** = 25 mm **2** = 50 mm **4** = 100 mm **6** = 150 mm **8** = 200 mm

Sealing system (1)
1 = (NBR + POLYURETHANE) high static and dynamic sealing
2 = (FKM + PTFE) very low friction and high temperatures
4 = (NBR + PTFE) very low friction and high speeds

Options (3):
Rod end **(1)**
F = female thread
G = light female thread
H = light male thread

Proximity sensor type for CKS, see sections 1 and 2 **(4)**
P = REED with connector
Q = HALL with connector
R = REED with cable output
S = HALL with cable output

Air bleeds **(1)**
A = front air bleed
W = rear air bleed

Draining **(1)**
L = rod side draining

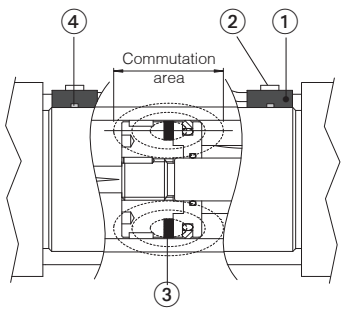
Heads' configuration (1) (3)
Oil ports positions
B* = front head
X* = rear head
Cushioning adjustments positions, to be entered only if adjustable cushioning are selected
E* = front head
Z* = rear head
* = selected position (1, 2, 3 or 4)

Series number **(2)**

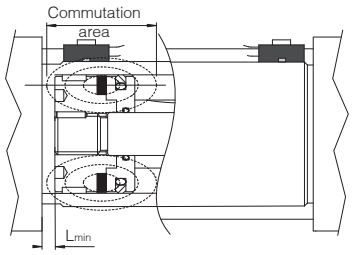
(1) For details refer to **tab. B137** **(2)** For spare parts request indicate the series number printed on the nameplate only for series < 30
(3) To be entered in alphabetical order **(4)** 2 proximity sensors are included in the supply, for spare parts see section 9

4 BASIC WORKING PRINCIPLES

The rod position detection system is composed by: one or more magnetic sensors ① fixed to a tie rod by proper clamps ② and a permanent magnet ③ integrated into the piston.
Both the "Reed" and "Hall effect" sensors are defined by a "commutation area" of variable dimension depending to the bore and sensor type (see section 6). The permanent magnet generates a magnetic field of suitable power and shape. When the piston gets close to the sensor and the magnetic field enters into its "sensitive area"④, the electric circuit is closed and the piston position detected, see figures at side. The electric circuit remains closed depending to the commutation area length, see section 6. The distance of the piston rod from the mechanical stroke-end at which the sensor commutation occurs depends to the sensor type and position, see Lmin dimension in section 6.The sensors can be assembled at any position of the cylinder stroke unscrewing the metallic clamp and moving the sensor to the desired position.
The sensors are equipped with a LED signal that indicates the commutation status.



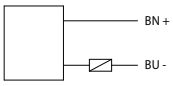
Commutation not occurred



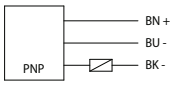
Commutation occurred

5 ELECTRIC CIRCUITS

"REED " sensors
2 wires



"HALL effect" sensors
3 wires



BN = brown BU = blue BK = black

3 PIN female connector
for sensors **P**, **Q**

(sensor view)

PIN	WIRING	SIGNAL REED	SIGNAL HALL
1	blue	V0	V0
2	black	-	V0
3	brown	V+	V+

Notes:
The sensors **P** and **Q** are supplied with 3 pin female connector
All the sensors are supplied with an output cable 2,5 m long
Reed sensors are also available with 3 wires circuit, **contact our technical office**

6 INSTALLATION AND WORKING DATA

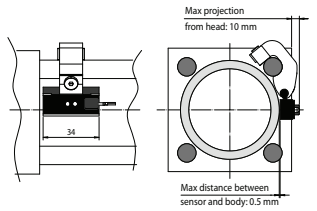
Ø Bore	Option **P / R (Reed sensors)**							Option **Q / S (Hall effect sensors)**						
	Max piston speed [m/s]	L min (1) [mm] Option P Front head	L min (1) [mm] Option P Rear head	L min (1) [mm] Option R Front head	L min (1) [mm] Option R Rear head	Commutation area [mm]	Hysteresis [mm]	Max piston speed [m/s]	L min (1) [mm] Option Q Front head	L min (1) [mm] Option Q Rear head	L min (1) [mm] Option S Front head	L min (1) [mm] Option S Rear head	Commutation area [mm]	Hysteresis [mm]
25	0.4	4	3	4	3	4	2	0.15	2.5	10	5	10	10	1
32	0.4	9	8.5	9.1	9.6	4	2	0.15	7.5	15	18	17.3	10	1
40	0.5	4	4	4	4	4	2	0.15	14	7	15	7	14	1
50	0.5	10.1	13.8	8.5	12.5	4	3	0.15	9.5	8	10	8	14	1
63	0.5	6	6	6	6	6	5	0.2	16	16	12	7	16	1
80	0.5	5	7	7	7	5	4	0.2	25	5	20	14	14	1
100	0.5	5	7	7	7	7	5	0.3	25	5	20	14	14	1

Note: (1) distance of the piston rod from the mechanical stroke-end at which the sensor commutation occurs with the sensor positioned stuck to the head, see figures in section 4

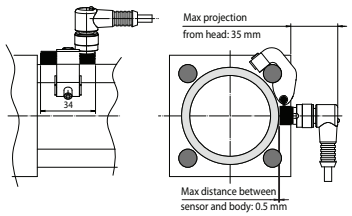
7 OPERATING LIMITS

The cylinder housing and piston are made in stainless steels to avoid dispersion and distorsion of the magnetic field generated by the permanent magnet, integrated into the piston. This limits the working pressure up to 100 bar: ensure to not exceed this pressure values.
For the proper use of the sensor and to avoid lecture faults (absence of signal or double signal) it is necessary to:
- Respect the max distance between the sensor and the body (max 0,5 mm)
- Avoid the presence of ferromagnetic objects near the sensor (minimum distance 10 mm)
- Make sure that there are no external magnetic fields around the cylinder
- Not exceed maximum piston speed shown in section 6

Proximity sensors with cable output



Proximity sensors with connector



8 BORE / ROD SIZES AND STROKE

The table shows the available bore/rod sizes, refer to **tab. B137** for installation dimensions and options.
For the proper use of proximity sensors the stroke must be selected greater than the values reported below, lower strokes can be achieved by selecting the spacer **1**.The introduction of spacers increases the overall cylinder's dimensions.

Ø Bore		25	32	40	50	63	80	100
Ø Rod	standard	12	14	18	22	28	36	45
	differential	18	22	28	36	45	56	70
Min. stroke		20	20	25	25	30	30	40

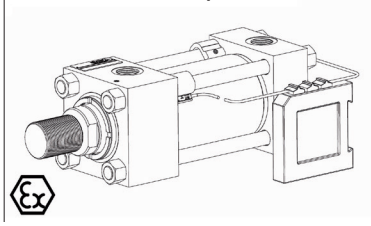
9 ATEX SENSORS FOR CKA

CKSA cylinders are supplied with magnetic sensors with ATEX certifications:

Ex II 1G Ex ia IIC T4 Ga for gas (zone 0/1/2),
Ex II 1D Ex ia IIIC t 135°C Da for dusts (zone 20/21/22)

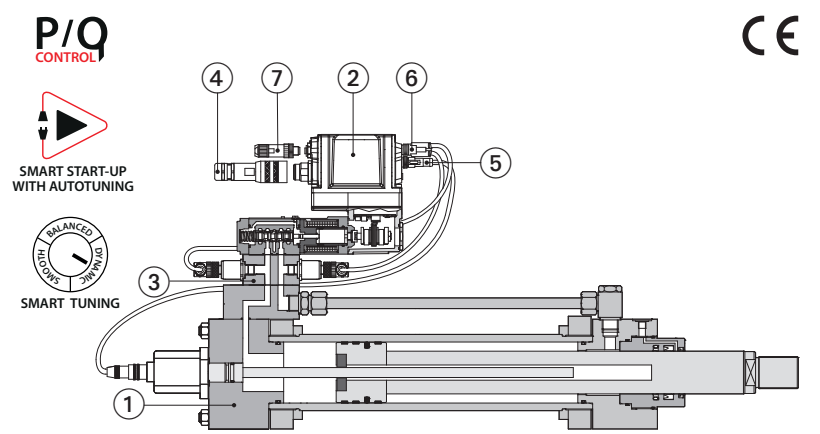
The sensors are supplied with an amplifier which it serves as the interface between eletrical signals from the hazardous area and the non-hazardous area (safe zone).
For certification and start up refer to the user's guide included in the supply.

ATEX sensors with amplifier



Digital electrohydraulic servoactuators

servocylinder plus servoproportional directional with on-board driver & axis card



***** AZC-D-SF-EH/CKM200/100D0500/V040**

① Servocylinder with on-board LVDT transducer
② Servoroportional valve with on-board digital driver + axis card
③ Block with double pressure transducer
④ Main connector
⑤ LVDT transducer connector
⑥ Pressure transducers connector
⑦ Fieldbus connectors

AZC

Digital electrohydraulic servoactuators are stand-alone units performing closed loop position controls.
The complete motion control cycle can be operated by external signals (from machine PLC) or programmed internally to the controller.
Alternated P/Q control add the force limitation to position regulation, requiring pressure or force transducers installation.
The servoacuators are made by a servocylinder with position transducer, servoproportional valve with on-board driver plus axis card, factory assembled and tested.
They can be provided with optional fieldbus interfaces for functional parameters setting, reference signals and real time diagnostics.
Smart Start-up procedure makes the commissioning quicker and easier, thanks to the Autotuning and Smart Tuning functionalities.
Multiple PID sets allows to easily switch axis behaviour according to machine cycle.

1 MODEL CODE

***	AZC	M	-	D	-	SF	-	EH	/	CK	M	200	/	100	D	0500	/	V0	40

Design number

Digital electrohydraulic servoactuator for linear axis position control

Cycle Generation type:
- **-** = none
- **I** = injection
- **M** = mold
- **P** = parison
- **S** = synchronism
- **X** = positioning
- **9** = customized

Position transducer type:
- **A** = Analog (standard, potentiometer)
- **D** = Digital (SSI, Encoder)

Alternated P/Q controls:
- **SN** = none
- **SF** = with 2 on-board pressure transducers
- **SL** = with 1 on-board load cell
- **XL** = with 1 remote load cell

Fieldbus interfaces, USB port always present:
- **NP** = Not present
- **BC** = CANopen
- **BP** = PROFIBUS DP
- **EH** = EtherCAT
- **EW** = POWERLINK
- **EI** = EtherNet/IP
- **EP** = PROFINET RT/IRT

Servocylinder Type, tech table **B310**:
- **CN** = ISO 6020-1, Pmax 250 bar - tech table **B180**
- **CK** = ISO 6020-2, Pmax 250 bar - tech table **B137**
- **CH** = ISO 6020-3, Pmax 250 bar - tech table **B160**
- **CC** = ISO 6022, Pmax 320bar - tech table **B241**

Actuator position transducer type, see section 9 :

Analog (only for AZC-A)
- **P** = potentiometer, max stroke 700mm
- **F** = analog magnetosonic, max stroke 2500mm
- **N** = analog magnetostrictive, max stroke 3000mm
- **T** = LVDT, max stroke 16mm
- **L** = LVDT, max stroke 30mm
- **V** = inductive, max stroke 1000mm

Digital (only for AZC-D)
- **M** = SSI magnetosonic, max stroke 2500mm

Analog or Digital
- **9** = special
- **X** = remoted

Bore diameter [mm]

Rod diameter [mm]

Rod:
- **S** = single rod
- **D** = double rod

Stroke [mm]

Servoproportional valve size with axis controller:
- **V0** = direct, size 06
- **V1** = direct or piloted, size 10
- **V2** = piloted size 16
- **V4** = piloted size 25 or size 27

Servoproportional valve configuration, zero spool overlap:
- **40** = with fail safe, sleeve execution, direct (tech table **FS610**)
- **60** = without fail safe, sleeve execution, direct (tech table **FS610**) or piloted (tech table **FS630**)
- **70** = spring central position, direct (tech table **FS620**) or piloted (tech table **FS630**)

2 MAIN CHARACTERISTICS

Assembly position		Any position	
Ambient temperature range		standard execution = -20°C ÷ +60°C	
Storage temperature range		Standard execution = -20°C ÷ +70°C	
Protection degree to EN60529		IP66 / IP67	
Duty factor		Continuous rating (ED=100%)	
Recommended fluid temperature		-20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C	
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

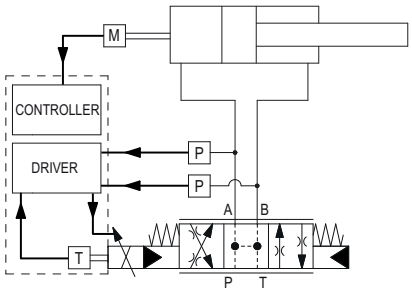
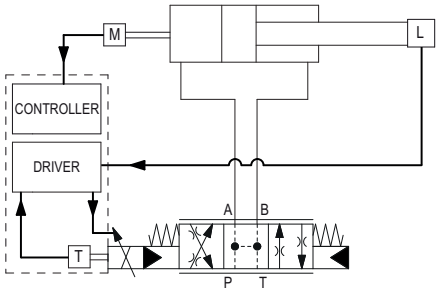
Hydraulic fluid	Classification	Ref. Standard
Mineral oils	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	HFDU, HFDR	ISO 12922
Flame resistant with water	HFC	

3 POSITION CONTROL

Digital servoproportionals direct or pilot operated include valve with on-board digital driver plus axis card to perform the position closed loop of hydraulic actuator. Axis controllers are operated by an external or internally generated reference position signal.
For detailed information about integral axis controller see tech tables **FS610**, **FS620**, **FS630**.

4 ALTERNATED POSITION / FORCE CONTROL

SF and **SL** controls add the alternated force closed loop control to the actuator standard position control.
A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions.
For detailed information about SF, SL controls, see tech table **FS500**.

SF	SL
	

T valve spool transducer	M actuator position transducer	P pressure transducer	L load cell

5 SMART START-UP

The automatic procedure supports the user during the commissioning phases of the axis control with guided procedures:

- **General setting**

It assists the user in system data setup, as like cylinder stroke, diameters, load mass, configure analog/digital signals and communication interface, position transducer setup.

- **System check**

It automatically executes position open loop movements to set axis control parameters, position transducer calibration and verify cylinder stroke.

- **Position autotuning**

It automatically determines the optimal PID parametrization of the position control adapting the dynamic response to guarantee control precision and axis stability. Once the procedure is started, the control performs few automatic position open loop movements of the actuator, during which control parameters are calculated and stored.

6 SMART TUNING

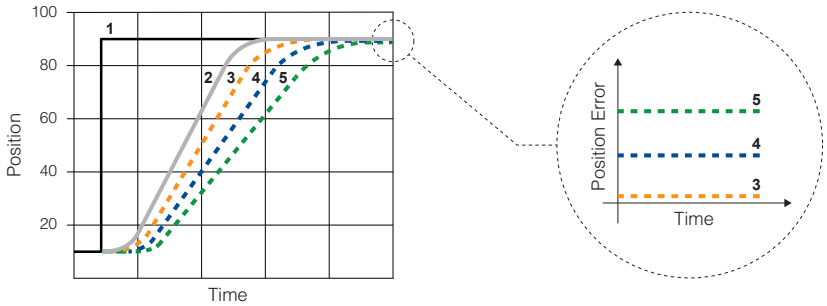
Once the Smart Start-up procedure has been completed, the Smart tuning feature allows to further refine the position control response by choosing from 3 different levels of performance in positioning:

- **dynamic** best dynamics and accuracy (default factory setting)
- **balanced** average dynamics and accuracy
- **smooth** attenuated dynamics and accuracy to improve control stability in critical applications or in environments with electrical disturbances

Settings can be changed any time via Z-SW software or fieldbus.

If required, control performance can be further customized by modifying PID parameter via Z-SW software.

1 = position reference signal
2 = generated position trajectory
3 = dynamic
4 = balanced
5 = smooth



7 MULTIPLE SETS

Multiple PID sets allows to easily switch axis behaviour according to machine cycle, selecting between independent groups of parameters for:

- **position control PID**
- **force control PID and P/Q logics switching criteria**

Settings can be changed any time via Z-SW software, fieldbus or digital input signals.

8 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

9 ACTUATOR'S TRANSDUCER CHARACTERISTICS

9.1 Position transducers

The accuracy of the position control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the axis cards, depending to the system requirements: potentiometer or analog signal (A execution), SSI or Encoder (D execution).
Transducers with digital interface allow high resolution and accurate measures, that combined with fieldbus communication grants highest performances.
Transducers with analog interface grant simple and cost effective solutions.

9.2 Pressure/force transducers

The accuracy of the force control is strongly dependent to the selected pressure/force transducer.
Alternated force controls require to install pressure transducers or load cell to measure the actual pressure/force values.
Pressure transducers allow easy system integration and cost effective solution for alternated position/force controls (see tech table **GS465** for pressure transducers details).
Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force control.
The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115%÷120% of the maximum regulated pressure/force.

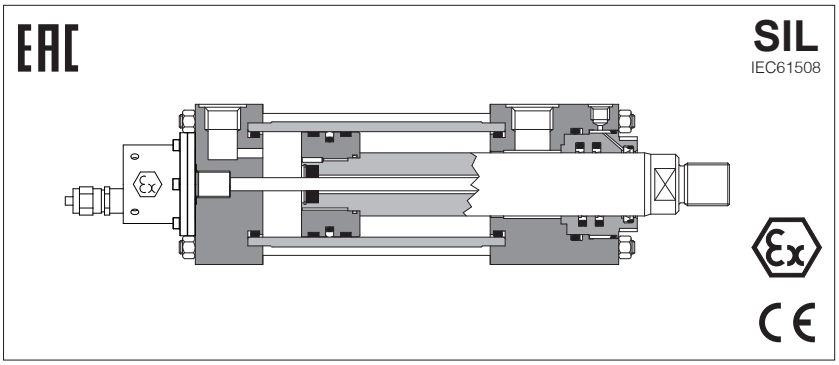
9.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

	Position				**Pressure/Force**
Execution	**A**		**D**		**SF, SL**
Input type	Potentiometer	Analog **(3)**	SSI **(4) (5)**	Incremental Encoder	Analog
Power supply **(1)**	10 ÷ 30 VDC	+24 VDC	+24 VDC	+5 VDC / +24 VDC	+24 VDC
Controller Interface	0 ÷ 10 V	0 ÷ 10V 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 VDC 4 ÷ 20 mA
Max speed	0,5 m/s	1 m/s	1 m/s	2 m/s	-
Max Resolution	< 0.4 % FS	< 0.2 % FS	5 μm	1 μm (@ 0.15 m/s)	< 0.4 % FS
Linearity error **(2)**	± 0.1% FS	< ±0.02% FS	< ± 0.02 % FS	< ± 0.001 % FS	< ±0.25% FS
Repeatability **(2)**	± 0.05% FS	< ± 0.005% FS	< ± 0.005 % FS	< ± 0.001 % FS	< ±0.1% FS

(1) power supply provided by digital controller
(2) percentage of total stroke
(3) Output derived from 4 different types of transducers, see tech table B310
(4) Output derived from 2 different types of transducers, see tech table B310
(5) Balluff BTL7 with SSI interface is not supported

Hydraulic cylinders type CKA - for potentially explosive atmospheres

ATEX - ISO 6020-2 - nominal pressure 16 MPa (160 bar) - max 25 MPa (250 bar)



CKA cylinders are derived from standard CK (tab.B137) with certification according to ATEX 2014/34/EU. They are designed to limit the external surface temperature, according to the certified class, to avoid the self-ignition of the explosive mixtures potentially present in the environment. CKAM servocylinders are equipped with ex-proof built-in digital magnetostrictive position transducer, ATEX certified.

- Optional ex-proof proximity sensors, ATEX certified
- Bore sizes from **25** to **200** mm
- Attachments for rods and mounting styles, **see tab. B800**
- CKA cylinders are **SIL** compliance with IEC 61508 (TÜV certified), certification on request

For cylinder's dimensions and options **see tab. B137**

For cylinder's choice and sizing criteria **see tab. B015**

1 ATEX CERTIFICATION

Cylinder type	Group	Equipment category	Gas/dust group	Temperature class (1)	Zone
CKA	II	2 GD	II C/III C	T85°C(T6) / T135 °C(T4)	1,2,21,22
CKA + ex-proof rod position transducer **(2)**	II	2 G	II B	T6/T5	1,2
	II	2 D	III C	T85°C/T100°C	21,22
CKA + ex-proof proximity sensors	II	3 G	II	T4	2

(1) Temperature class depends to the max fluid temperature and sealing system
(2) The rod position transducer is certified to work with explosive gas (cat. 2G) and dust (cat. 2D)

2 MODEL CODE

CKA M / 10 - 50 / 22 / 22 * 0500 - S 3 0 1 - A - B1E3X1Z3 **

Cylinder series
CKA to ATEX 2014/34/EU dimensions to ISO 6020 - 2

Ex-proof position transducer
See section 5
- = omit if not requested
M = Digital magnetostrictive

Incorporated subplate (1)
- = omit if subplate is not requested
10 = size 06
20 = size 10
30 = size 16
40 = size 25

Bore size (1)
from **25** to **200** mm

Rod diameter (1)
from **12** to **140** mm

Second rod diameter for double rod **(1)**
from **12** to **140** mm, omit for single rod

Stroke (1)
up to **5000** mm (**4000** mm for **CKAM**)

Mounting style (1)

		REF. ISO
C	= fixed clevis	MP1 **(4)**
D	= fixed eye	MP3 **(4)**
E	= feet	MS2
G	= front trunnion	MT1
H	= rear trunnion	MT2 **(4)**
L	= intermediate trunnion	MT4 **(5)**
N	= front flange	ME5
P	= rear flange	ME6 **(4)**
S	= fixed eye + spherical bearing	MP5 **(4)**
T	= threaded hole+tie rods extended	MX7
V	= rear tie rods extended	MX2
W	= both end tie rods extended	MX1
X	= basic execution	-
Y	= front tie rods extended	MX3
Z	= front threaded holes	MX5

Spacer (1)
0 = none **2** = 50 mm **4** = 100 mm **6** = 150 mm **8** = 200 mm

Cushioning (1)
0 = none

Fast adjustable	Slow adjustable	Fast fixed
1 = rear only	**4** = rear only	**7** = rear only
2 = front only	**5** = front only	**8** = front only
3 = front and rear	**6** = front and rear	**9** = front and rear

Sealing system, see section 8
1 = (NBR + POLYURETHANE) high static and dynamic sealing
2 = (FKM + PTFE) very low friction and high temperatures
4 = (NBR + PTFE) very low friction and high speeds
6 = (NBR + PTFE) very low friction, single acting - pushing
7 = (NBR + PTFE) very low friction, single acting - pulling

Heads' configuration (1)(3)
Oil ports positions
B* = front head
X* = rear head
Cushioning adjustments positions, to be entered only if adjustable cushioning are selected
E* = front head
Z* = rear head
***** = selected position (1, 2, 3 or 4)

Options (1)(3):
Rod end
F = female thread
G = light female thread
H = light male thread
Oversized oil ports
D = front oversized oil port
Y = rear oversized oil port
Ex-proof proximity sensors, see section 9
R = front sensor
S = rear sensor
Rod treatment
K = nickel and chrome plating
T = induction surface hardening and chrome plating
Air bleeds
A = front air bleed
W = rear air bleed
Draining
L = rod side draining

****** Series number **(2)**

(1) For details see table **B137**
(2) For spare parts request indicate the series number printed on the nameplate only for series < 30
(3) To be entered in alphabetical order
(4) Not available for double rod
(5) XV dimension must be indicated in the model code

3 CERTIFICATION

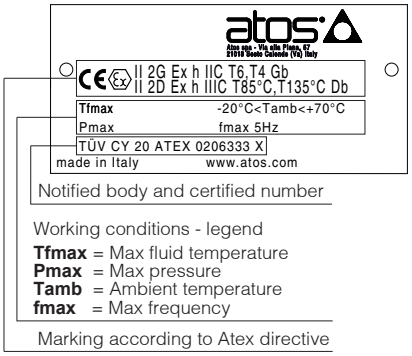
In the following are resumed the cylinders marking according to Atex certification.
Reference norm ISO 80079-36, ISO 80079-37.

II 2G Ex h IIC T6, T4 Gb (gas) **II 2D Ex h IIIC T85°C, T135°C Db (dust)**

GROUP II, Atex

II = Group II for surface plants
2 = High protection (equipment category)
G = For gas, vapours
D = For dust
Ex = Equipment for explosive atmospheres
IIC = Gas group
IIIC = Dust group
T85°C/T135°C = Surface temperature class for dust, see section 7
T6/T4 = Surface temperature class for gas, see section 7
Gb/Db = EPL Equipment group

Compliance RoHS Directive 2011/65/EU as last update by 2015/65/EU (only CKAM)
REACH Regulation (EC) no.1907/2006



4 INSTALLATION NOTES

Before installation and start-up refer to tab. BX900

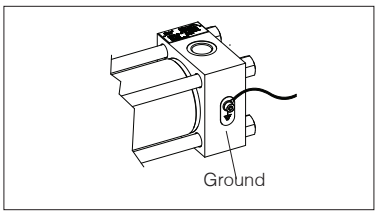
- The max surface temperature indicated in the nameplate must be lower than the following values:

GAS - **80% of gas ignition temperature**

DUST - max value between **dust layer ignition temperature - 75°C** and **2/3 of dust cloud ignition temperature**

- The ignition temperature of the fluid must be 50°C greater than the maximum surface temperature indicated in the nameplate
- The cylinder must be grounded using the threaded hole on the rear head, evidenced by the nameplate with ground symbol. The hydraulic cylinder must be put at the same electric potential of the machine

GROUNDING



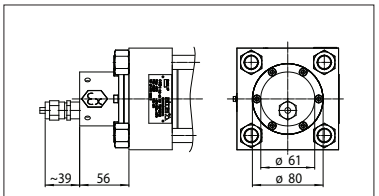
5 EX-PROOF ROD POSITION TRANSDUCER

CODE: **M**
CKA cylinders are available with "Balluff" Ex-proof rod position transducer, ATEX certified to **II 1/2 G Ex d IIC T6/T5 Ga/Gb** for gas and **II 2D Ex tb IIIC T85°C/T100°C Db IP 67 -40°C Ta +65°C (T6) -40°C Ta +80°C (T5)** for dust. Ex-proof transducers meet the requirements of the following european standard documentations:

II 1/2 G Ex d IIC T6/T5 Ga/Gb	**II 2D Ex tb IIIC T85°C/T100°C Db IP 67**
EN 60079-0	EN 61241-0
EN 60079-1	EN 61241-0/AA
EN 60079-26	EN 61241-1

For certification and start-up refer to the user's guide included in the supply
The transducer is available with SIL IEC61508 and (EAC) certifications, contact our technical office.

CKAM WITH ROD POSITION TRANSDUCER



cable connection with protection degree IP 67
Transducer housing in AISI 303

6 SIL IEC61508 compliance with IEC 61508: 2010

CKA meets the requirements of:
- **SC3** (systematic capability)
- max **SIL 2** (HFT = 0 if the hydraulic system does not provide the redundancy for the specific safety function where the component is applied)
- max **SIL 3** (HFT = 1 if the hydraulic system provides the redundancy for the specific safety function where the component is applied)
- for CKAM refer to transducer, SIL certified, for max SIL level

7 MAIN CHARACTERISTICS AND FLUID REQUIREMENTS

Ambient temperature	-20÷+70°C; -40 ÷ +65°C for **CKAM**
Fluid temperature	-20÷+70°C (**T6**); -20÷+120°C (**T4**) for seals type **2** (*)
Max surface temperature	≤ +85 °C (**T6**); ≤ +135 °C (**T4**) for seals type **2** (*)
Max working pressure	16 MPa (160 bar)
Max pressure	25 MPa (250 bar)
Max frequency	5 Hz
Max speed (see section 8)	1 m/s (seals type 2, 4, 6, 7); 0,5 m/s (seals type 1)
Recommended viscosity	15 ÷ 100 mm²/s
Max fluid contamination level	ISO4406 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog

CKA cylinders are suitable for operation with mineral oils with or without additives (**HH, HL, HLP, HLP-D, HM, HV**), fire resistant fluids (**HFA** oil in water emulsion, 90-95% water and 5-10% oil; **HFB** water in oil emulsion, 40% water; **HFC** water glycol, max 45% water) and synthetic fluids (**HFD-U** organic esters, **HFD-R** phosphate esters) depending to the sealing system.

Note: (*) Cylinders with seals type **2** may also be certified **T6** limiting the max fluid temperature to 70°C

8 SEALING SYSTEM FEATURES

The sealing system must be choosen according to the working conditions of the system: speed, operating frequencies, fluid type and temperature. Additional verifications about minimum in/out rod speed ratio, static and dynamic sealing friction are warmly suggested, see **tab. B015**
When single acting seals are selected (types **6** and **7**), the not pressurized cylinder's chamber must be connected to the tank. Contact our technical office for the compatibility with other fluids not mentioned below and specify type and composition.

Sealing system	Material	Features	Max speed [m/s]	Fluid temperature range	Fluids compatibility	ISO Standards for seals	
						Piston	Rod
1	NBR + POLYURETHANE	high static and dynamic sealing	0.5	-20°C to 70°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV	ISO 7425/1	ISO 5597/1
2	FKM + PTFE	very low friction and high temperatures	1	-20°C to 120°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, fire resistance fluids HFA, HFB, HFD-U,HFD-R	ISO 7425/1	ISO 7425/2
4	NBR + PTFE	very low friction and high speeds	1	-20°C to 70°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFC (water max 45%), HFD-U	ISO 7425/1	ISO 7425/2
6 - 7	NBR + PTFE	very low friction single acting - pushing/pulling	1	-20°C to 70°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, fire resistance fluids HFA, HFC (water max 45%), HFD-U	ISO 7425/1	ISO 7425/2

9 EX-PROOF PROXIMITY SENSORS

CODES: **R** = front sensor; **S** = rear sensor
CKA cylinders are available with ex-proof proximity sensors, ATEX certified to **Ex II 3G Ex nA II T4 -25≤Ta≤80°C**. They meet the requirements of the following european standard documentations: EN 60079-0, EN 60079-15.
Their functioning is based on the variation of the magnetic field, generated by the sensor itself, when the cushioning piston enters on its influence area, causing a change of state (on/off) of the sensors. The sensor housing is made in stainless steel.
For dimensions and details, contact our technical office.

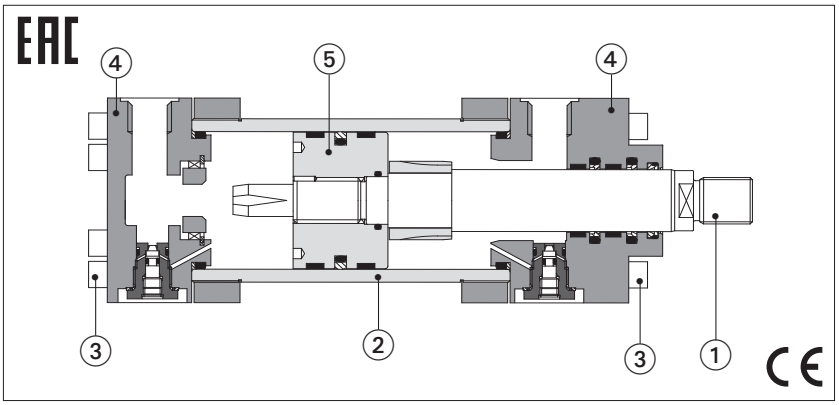
For certification and start-up refer to the user's guide included in the supply

SENSORS TECHNICAL DATA

Ambient temperature	-25 ÷ +80°C
Nominal voltage	24 VDC
Operating voltage	10 ÷ 30 VDC
Max load	200 mA
Repeatability	<5%
Protection degree	IP 68
Max frequency	1000 Hz
Max pressure	25 MPa

Stainless steel hydraulic cylinders type CNX

ISO 6020-1, round heads with counterflanges, Pnom 10 MPa (100 bar) - Pmax 15 MPa (150 bar)



CNX cylinders are derived from standard CN (tab. B180) with stainless steel construction to withstand extreme and corrosive environmental conditions and to ensure compatibility with water based fluids or pure water.
They are ideally suited for a variety of applications and industries including: pharmaceutical, marine, military, waste management, offshore and chemical processing.

- Bore sizes from **50** to **100** mm
- Strokes up to **3000** mm
- Rods with rolled threads
- **9** standard mounting styles
- **3** seals options
- Rod guide rings for low wear
- Adjustable or fixed cushioning
- Optional built-in position transducer, **see tab. B310**

Stainless steel attachments are available on request, for dimensions **see tab. B800**
For cylinder dimensions and options **see tab. B180**

1 MATERIALS AND SPECIFICATIONS

Cylinder component	Material	Features
ROD ① and PISTON ⑤	AISI 431	High strenght and good corrosion resistance
HOUSING ② and HEADS ④	AISI 316L	Optimum corrosion resistance
SCREWS ③	AISI 316 A4	Optimum corrosion resistance and high strength

2 MODEL CODE

CNX F - 63 / 45 * 0500 - S 3 0 8 - A - B1E3X1Z3 **

Series number

Cylinder series
CNX to ISO 6020 - 1

Rod position transducer
see section 4
- = omit if not requested
F = magnetosonic
M = magnetosonic programmable
N = magnetostrictive
P = potentiometric
V = inductive
Transducer available on request, contact our technical office

Bore size, see section 6
from **50** to **100** mm

Rod diameter, see sections 6
from **36** to **70** mm

Stroke (1)
up to **3000** mm

Mounting style (1)

	REF. ISO
A = front round flange	MF3
B = rear round flange	MF4
D = fixed eye	MP3
E = feet	MS2
L = intermediate trunnion	MT4 **(3)**
N = front square flange	MF1
P = rear square flange	MF2
S = fixed eye + spherical bearing	MP5
X = basic execution	-

Cushioning (1)
0 = none

Fast adjustable	Fast fixed
1 = rear only	**7** = rear only
2 = front only	**8** = front only
3 = front and rear	**9** = front and rear

Spacer (1)
0 = none **2** = 50 mm **4** = 100 mm **6** = 150 mm **8** = 200 mm

Sealing system, see section 5
3 = (FKM + PTFE) very low friction, high temperatures and water based fluids
5 = (NBR + PTFE) very low friction, high speeds and water based fluids
8 = (NBR + PTFE and POLYURETHANE) high static and dynamic sealing

Options (1) (2):
Air bleeds
A = front air bleed
W = rear air bleed

Heads' configuration (1) (2)
Oil ports positions
B1 = front head
X1 = rear head
Cushioning adjustments positions, to be entered only if adjustable cushioning are selected
E3 = front head*
Z3 = rear head*
* = enter E2 and Z2 for mounting style E

(1) For details see **tab. B180**
(2) To be entered in alphabetical order
(3) XV dimension must be indicated in the model code, see **tab. B180**

3 STAINLESS STEEL PROPERTIES

CNX cylinders are manufacured with selected stainless steel to withstand extended exposure to aggressive environments, the table at side shows the compatibility of AISI 316L and AISI 431 with the main aggressive substances.
The rod is chromeplated: chrome thickness 0,020 mm; hardness 850-1150 HV.
The low strength of AISI 316L limits the max pressure to 150 bar; for heavy duty applications AISI 630 is recommended, contact our technical office.

Material	Cylinder component	Mechanical properties Rm min [MPa]	Rs min [MPa]	Corrosion resistance (2)
AISI 316L	housing and heads	450	195	> 1200 h
AISI 316 A4 70	screws	700	450	> 1200 h
AISI 431	piston and rod	800	600	> 600 h
AISI 420	Spherical bearing of style S	700	500	< 100 h
AISI 630 (17-4 ph) **(1)**	housing and rod	860	724	> 1000 h

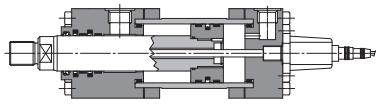
Note: (1) Available on request for heavy duty applications
(2) Corrosion resistance in neutral salt spray to ISO 9227 NSS

Corrosion index for AISI 316L and AISI 431

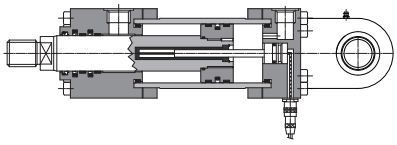
Substance	Corrosion index AISI 316L	AISI 431
Marine atmospheres	very good	good
Salt water	good	sufficient
33% Acetic acid	excellent	limited
2% Muriatic acid	good	limited
70% Phosphoric acid	limited	limited
65% Nitric acid	good	good
2% Sulfuric acid	excellent	limited
20% Sulfuric acid	limited	limited

4 CNX WITH BUILT-IN POSITION TRANSDUCER

CNXM - Magnetosonic programmable



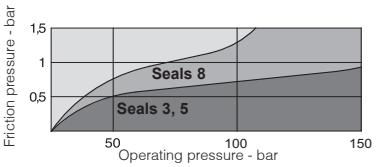
CNXV - Inductive



CNX cylinders are also available with magnetostrictive, potentiometric and inductive rod position transducers.
Stainless steel or aluminum materials used for transducers components make CNX servocylinders ideal for extreme working conditions as aggressive external environments or corrosive fluids.
For transducer performance and other details see **tab. B310**

5 SEALING SYSTEM FEATURES

The sealing system must be choosen according to the working conditions of the system: speed, fluid type and temperature.
For HFA fluids or pure water it is recommended the use of proper additives to increase the sealing working life. Contact our technical office to check the compatibility with other fluids not mentioned below and specify type and composition.



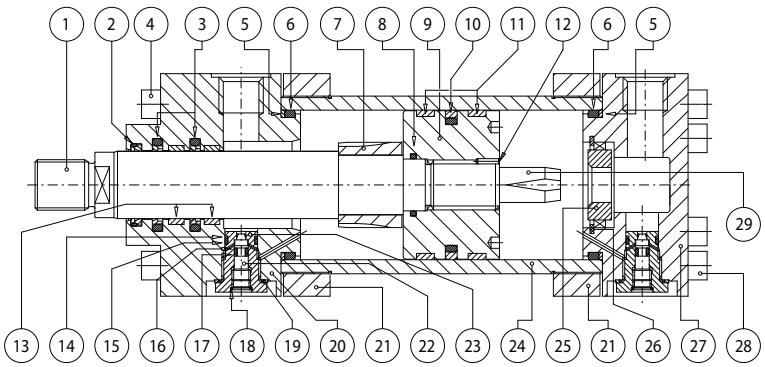
Sealing system	Material	Features	Max speed [m/s]	Fluid temperature range	Fluids compatibility	ISO Standards for seals Piston	Rod
3	FKM + PTFE	**very low friction and high temperatures**	4	-20°C to 120°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV fire resistance fluids HFA, HFB, HFD-U, HFD-R and water	ISO 7425/1	ISO 7425/2
5	NBR + PTFE	**very low friction and high speeds**	4	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606; fire resistance fluids HFA, HFC (water max 45%), HFD-U and water	ISO 7425/1	ISO 7425/2
8	NBR + PTFE + POLYURETHANE	**high static and dynamic sealing**	1	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV	ISO 7425/1	ISO 7425/2

6 BORE / ROD SIZES

Ø Bore	**50**	**63**	**80**	**100**
Ø Rod	**36**	**45**	**56**	**70**

The table at side shows the available bore/rod sizes, see **tab. B180** for installation dimensions and options.

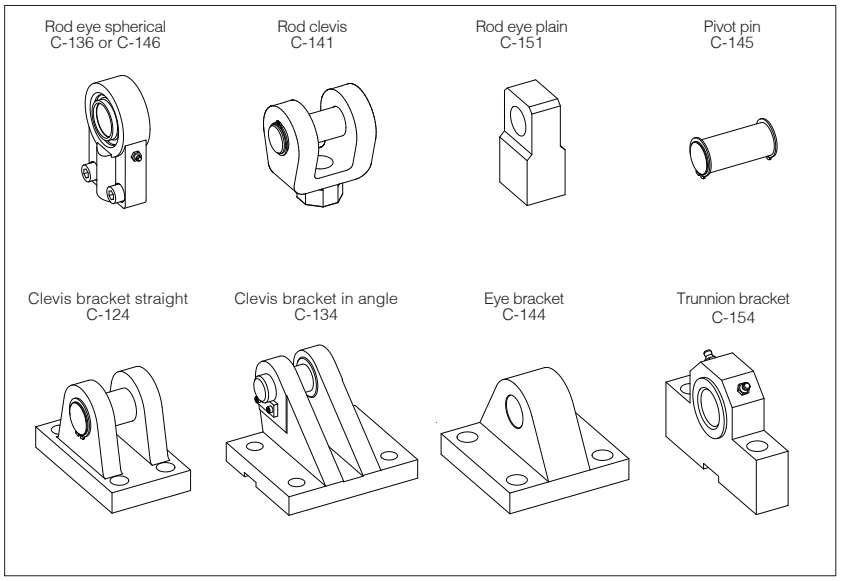
7 CYLINDER SECTION



POS.	DESCRIPTION	MATERIAL	POS.	DESCRIPTION	MATERIAL	POS.	DESCRIPTION	MATERIAL
1	Rod	AISI 431 Chromeplated	11	Piston guide rings	PTFE	21	Counterflange	AISI 316L
2	Wiper	NBR / FKM and PTFE	12	Screw stop pin	AISI 304 / AISI 316L	22	Cushioning adjustment screw	AISI 316L
3	Rod seal	NBR / FKM and PTFE	13	Rod guide rings	PTFE	23	Cushioning adjustment plug	AISI 316L
4	Screw	AISI 316 A4	14	Anti-extrusion ring	PTFE	24	Cylinder housing	AISI 316L
5	Anti-extrusion ring	PTFE	15	O-ring	FKM	25	Rear cushioning sleeve	Bronze
6	O-ring	NBR / FKM	16	O-ring	FKM	26	Toroidal ring	AISI 304 / AISI 316L
7	Front cushioning piston	AISI 431	17	Anti-extrusion ring	PTFE	27	Rear head	AISI 316L
8	O-ring	NBR / FKM	18	Seeger	AISI 304 / AISI 316L	28	Screw	AISI 316 A4
9	Piston	AISI 431	19	Seal	FKM	29	Rear cushioning piston	AISI 431
10	Piston seal	NBR / FKM and PTFE	20	Front head	AISI 316L			

Attachments for hydraulic cylinders

to ISO 6982, ISO 8132 and ISO 8133



The table at side shows the Atos range of standard rod attachments and brackets: they are available for each cylinder bore. See section 2 for possible combinations. Stainless steel attachments are available on request.

1 MODEL CODE

C	-	141	12	-	V

C: Standard attachment

141:
Rod attachments:
136= Rod eye spherical
146= Rod eye spherical
141= Rod clevis
151= Rod eye plain
145= Pivot pin
Brackets:
124 = Clevis bracket straight
134 = Clevis bracket in angle
144= Eye bracket
154= Trunnion bracket

12: **Bore** size/rod diameter [mm]

V: **Painting** see sect. 5

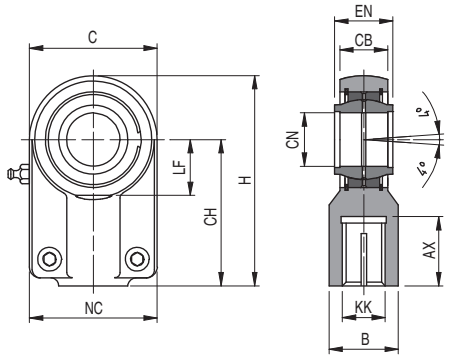
2 POSSIBLE COMBINATIONS

Ø Rod	Rod attachments codes					Ø Bore	Brackets codes			
	(b)									
12 **18** opt.**H**(a)	NA	C-14612	C-14112	C-15112	C-14512	**25**	NA	C-13425	C-14425	C-15425
14 **22** opt.**H**(a)	C-13616	C-14614	C-14114	C-15114	C-14514	**32**	NA	C-13432	C-14432	C-15432
18 **22** opt.**H**(a) **28** opt.**H**	C-13618	C-14618	C-14118	C-15118	C-14518	**40**	C-12422 (c)	C-13440	C-14440	C-15440
22 **28** opt.**H**(a) **36** opt.**H**	C-13622	C-14622	C-14122	C-15122	C-14522	**50**	C-12428 (c) C-12436 (d)	C-13450	C-14450	C-15450
28 **36** opt.**H**(a) **45** opt.**H**	C-13628	C-14628	C-14128	C-15128	C-14522	**63**	C-12436 (c) C-12445 (d)	C-13463	C-14463	C-15463
36 **45** opt.**H**(a) **56** opt.**H**	C-13636	C-14636	C-14136	C-15136	C-14536	**80**	C-12445 (c) C-12456 (d)	C-13480	C-14480	C-15480
45 **56** opt.**H**(a) **70** opt.**H**	C-13645	C-14645	C-14145	C-15145	C-14545	**100**	C-12456 (c) C-12470 (d)	C-134100	C-144100	C-154100
56 **70** opt.**H**(a) **90** opt.**H**	C-13656	C-14656	C-14156	C-15156	C-14556	**125**	C-12470 (c) C-12490 (d)	C-134125	C-144125	C-154125
70 **90** opt.**H**(a) **110** opt.**H**	C-13670	C-14670	C-14170	C-15170	C-14570	**160**	C-12490 (c) C-124100 (d)	C-134160	C-144160	C-154160
90 **110** opt.**H**(a) **140** opt.**H**	C-13690	C-14690	C-14190	C-15190	C-14590	**200**	C-124100 (c)	C-134200	C-144200	C-154200

Notes:
(**a**) Option **H** : light male thread, for details see table B137 or B140
(**b**) C-136 is also available for rods 110, 140, 180 and 220. See section 3
(**c**) For S mounting styles in CN cylinder
(**d**) For S mounting styles in CC cylinder

3 DIMENSIONS [mm]

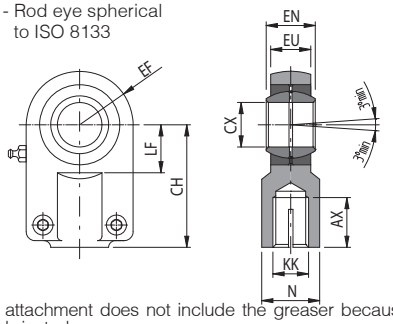
C-136 - Rod eye spherical
to ISO 6982 and 8132



Notes:
(1) This attachment does not include the greaser because it is selflubricated
(2) Dynamic loads has to be considered when the cylinders work with oscillatory motions or push-pull loads in high frequencies
(3) Attachment not compliant with ISO standard

Code	KK	AX min	B max	C max	CB max	CH js13	CN H7	EN h12	H	LF min	NC	Mass [kg]	Max load [kN] (2) Dynamic	Static	Screws torque
C-13616 (1)	M12x1,25	17	19	33	11	38	12	12	54	13	32	0,11	10,8	24,5	6 Nm
C-13618	M14x1,5	19	22	41	14	44	16	16	64	16,5	40	0,2	17,6	36,5	10 Nm
C-13622	M16x1,5	23	28	50	17,5	52	20	20	75	20,5	47	0,35	30	48	25 Nm
C-13628	M20x1,5	29	31	64	22	65	25	25	96	25,5	54	0,62	48	78	25 Nm
C-13636	M27x2	37	38	80	28	80	32	32	118	30	66	1,15	67	114	49 Nm
C-13645	M33x2	46	47	100	34	97	40	40	146	39	80	2,18	100	204	49 Nm
C-13656	M42x2	57	58	126	42	120	50	50	179	47	96	3,96	156	310	86 Nm
C-13670	M48x2	64	70	145	53,5	140	63	63	211	58	114	6,8	255	430	210 Nm
C-13690	M64x3	86	91	184	68	180	80	80	270	74	148	13	400	695	410 Nm
C-13690A (3)	M72x3	91	100	185	72	195	90	90	296	91	160	19,1	490	750	410 Nm
C-136110	M80x3	96	110	228	85,5	210	100	100	322	94	178	25	610	1.060	710 Nm
C-136110A (3)	M90x3	106	125	235	88	235	110	110	364	106	190	32	655	1.200	710 Nm
C-136140	M100x3	113	135	320	105	260	125	125	405	116	200	46	950	1.430	710 Nm
C-136180	M125x4	126	165	400	133	310	160	160	488	145	250	82,5	1.370	2.200	710 Nm
C-136220	M160x4	161	215	500	165	390	200	200	620	190	320	168	2.120	3.650	1500Nm

C-146 - Rod eye spherical
to ISO 8133

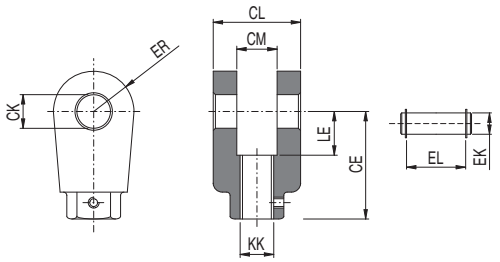


Notes:
(1) This attachment does not include the greaser because it is selflubricated
(2) Dynamic loads has to be considered when the cylinders work with oscillatory motions or push-pull loads in high frequencies
(3) Not compliant with ISO 8133

Code	KK	AX min	CH js13	CX	EF max	EN	EU max	LF min	N max	Mass [kg]	Max load [kN] (2) Dynamic	Static	Screws torque
C-14612 (1)	M10x1,25	15	42	$12^{0}_{-0,008}$	18	$10^{0}_{-0,12}$ (3)	8,5	16	19	0,12	10,8	17	10 Nm
C-14614 (1)	M12x1,25	17	48	$16^{0}_{-0,008}$	23	$14^{0}_{-0,12}$ (3)	11,5	20	22	0,22	21,1	28,5	10 Nm
C-14618 (1)	M14x1,5	19	58	$20^{0}_{-0,01}$	28	$16^{0}_{-0,12}$ (3)	13,5	25	28	0,43	30	42,5	25 Nm
C-14622	M16x1,5	23	68	$25^{0}_{-0,01}$	33	$20^{0}_{-0,12}$ (3)	18	30	31	0,67	48	67	25 Nm
C-14628	M20x1,5	29	85	$30^{0}_{-0,01}$	41	$22^{0}_{-0,12}$ (3)	20	35	37	1,25	62	108	49 Nm
C-14636	M27x2	37	105	$40^{0}_{-0,012}$	51	$28^{0}_{-0,12}$ (3)	24	45	47	2,16	100	156	49 Nm
C-14645	M33x2	46	130	$50^{0}_{-0,012}$	61	$35^{0}_{-0,12}$ (3)	31	58	57	3,9	156	245	86 Nm
C-14656	M42x2	57	150	$60^{0}_{-0,015}$	80	$44^{0}_{-0,15}$	39	68	69	7,15	245	380	210 Nm
C-14670	M48x2	64	185	$80^{0}_{-0,015}$	102,5	$55^{0}_{-0,15}$	48	92	91	15	400	585	410 Nm
C-14690	M64x3	86	240	$100^{0}_{-0,02}$	120	$70^{0}_{-0,20}$	57	116	110	27,3	610	865	710 Nm

C-141 - Rod clevis
to ISO 8133

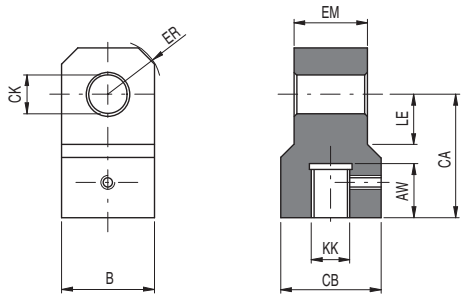
C-145 - Pivot pin



Note: Pivot pin C-145* is included in the supply

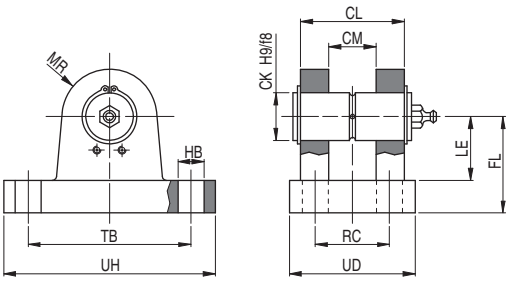
Code	KK	CE JS13	CK H9	CL max	CM A13	EK f8	EL min	ER max	LE min	Mass [kg]	Max load static [kN]
C-14112 C-14512	M10x1,25	32	10	26	12	10	29	12	13	0,1	8
C-14114 C-14514	M12x1,25	36	12	34	16	12	37	17	19	0,18	12,5
C-14118 C-14518	M14x1,5	38	14	42	20	14	45	17	19	0,23	20
C-14122 C-14522	M16x1,5	54	20	62	30	20	66	29	32	0,9	32
C-14128 C-14522	M20x1,5	60	20	62	30	20	66	29	32	0,91	50
C-14136 C-14536	M27x2	75	28	83	40	28	87	34	39	1,92	80
C-14145 C-14545	M33x2	99	36	103	50	36	107	50	54	4,92	125
C-14156 C-14556	M42x2	113	45	123	60	45	129	53	57	6,53	200
C-14170 C-14570	M48x2	126	56	143	70	56	149	59	63	10,11	320
C-14190 C-14590	M64x3	168	70	163	80	70	169	78	83	19,2	500

C-151 - Rod eye plain
to ISO 8133



Code	KK	AW min	B	CA JS13	CB max	CK H9	EM h13	ER max	LE min	Mass [kg]	Max load static [kN]
C-15112	M10x1,25	14	18	32	18	10	12	12	13	0,08	8
C-15114	M12x1,25	16	22	36	22	12	16	17	19	0,15	12,5
C-15118	M14x1,5	18	25	38	20	14	20	17	19	0,22	20
C-15122	M16x1,5	22	35	54	30	20	30	29	32	0,5	32
C-15128	M20x1,5	28	40	60	30	20	30	29	32	1,1	50
C-15136	M27x2	36	50	75	40	28	40	34	39	1,5	80
C-15145	M33x2	45	70	99	50	36	50	50	54	2,5	125
C-15156	M42x2	56	100	113	65	45	60	53	57	4,2	200
C-15170	M48x2	63	116	126	90	56	70	59	63	11,8	320
C-15190	M64x3	85	160	168	110	70	80	78	83	17	500

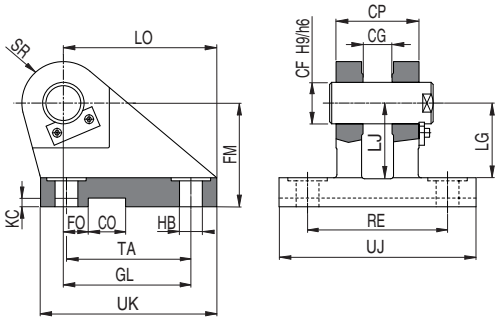
C-124 - Clevis bracket straight
to ISO 8132



Note: Pivot pin and seeger are included in the supply
Supplied with threaded holes for pivot pin locking plate (not included)

Code	CK H9	CL h16	CM A13	FL JS12	HB H13	LE min	MR max	RC JS14	TB JS14	UD max	UH max	Mass [kg]	Max load static [kN]
C-12414	12	28	12	34	9	22	12	20	50	40	70	0,31	8
C-12418	16	36	16	40	11	27	16	26	65	50	90	0,59	12,5
C-12422	20	45	20	45	11	30	20	32	75	58	98	0,9	20
C-12428	25	56	25	55	13,5	37	25	40	85	70	113	1,6	32
C-12436	32	70	32	65	17,5	43	32	50	110	85	143	2,8	50
C-12445	40	90	40	76	22	52	40	65	130	108	170	5	80
C-12456	50	110	50	95	26	65	50	80	170	130	220	10,1	125
C-12470	63	140	63	112	33	75	63	100	210	160	270	15,4	200
C-12490	80	170	80	140	39	95	80	125	250	210	320	30	320
C-124100	100	210	100	180	45	120	100	160	315	260	400	60,2	500

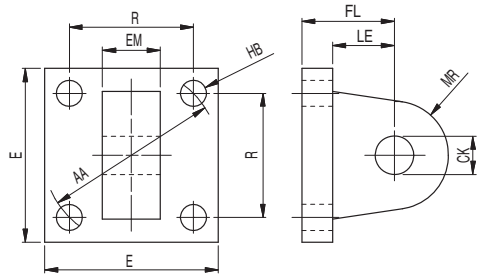
C-134 - Clevis bracket in angle
to DIN 24556 or ISO 8133 with additional machining for dimension CO



Notes:
Pivot pin with locking plate is included in the supply
(1) Not compliant with ISO 8133 and DIN 24556
(2) Not compliant with ISO 8133

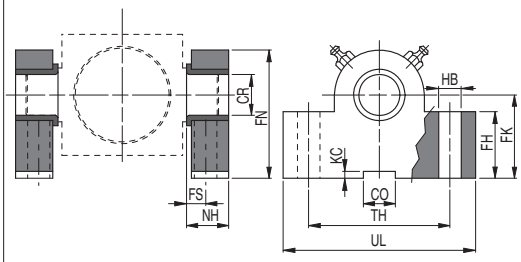
Code	CF H9 (1)	CG +0,1/+0,3	CO N9 (2)	CP h14	FM js13	FO	GL JS13	HB H13	KC (2)	LG	LJ min	LO max	RE js13	SR max	TA js13	UJ max	UK max	Mass [kg]	Max load static [kN]
C-13425	12	10	10	30	40	16	46	9	3,3	28	29	56	55	12	40	75	60	0,52	8
C-13432	16	14	16	40	50	18	61	11	4,3	37	38	74	70	16	55	95	80	1,05	12,5
C-13440	20	16	16	50	55	20	64	13,5 (1)	4,3	39	40	80	85	20	58	120	90	1,72	20
C-13450	25	20	25	60	65	22	78	15,5 (1)	5,4	48	49	98	100	25	70	140	110	2,72	32
C-13463	30	22	25	70	85	24	97	17,5 (1)	5,4	62	63	120	115	30	90	160	135	5,15	50
C-13480	40	28	36	80	100	24	123	22	8,4	72	73	148	135	40	120	190	170	9,3	80
C-134100	50	35	36	100	125	35	155	30	8,4	90	92	190	170	50	145	240	215	18,3	125
C-134125	60	44	50	120	150	35	187	39	11,4	108	110	225	200	60	185	270	260	35	200
C-134160	80	55	50	160	190	35	255	45	11,4	140	142	295	240	80	260	320	340	63	320
C-134200	100	70	63	200	210	35	285	48	12,4	150	152	335	300	100	300	400	400	109	500

C-144 - Eye bracket
to ISO 8133



Code	CK H9	AA	E max	EM h13	FL js13	HB H13	LE min	MR max	R js13	Mass [kg]	Max load static [kN]
C-14425	10	40	40	12	23	5,5	13	12	28,3	0,3	8
C-14432	12	47	46	16	29	6,6	19	17	33,2	0,45	12
C-14440	14	59	65	20	29	9	19	17	41,7	0,9	20
C-14450	20	74	79	30	48	13,5	32	29	52,3	1,3	32
C-14463	20	91	91	30	48	13,5	32	29	64,3	1,9	50
C-14480	28	117	118	40	59	17,5	39	34	82,7	4	80
C-144100	36	137	132	50	79	17,5	54	50	96,9	6,25	125
C-144125	45	178	174	60	87	24	57	53	125,9	11,4	200
C-144160	56	219	215	70	103	30	63	59	154,9	20,8	320
C-144200	70	269	256	80	132	33	82	78	190,2	38,8	500

C-154 - Trunnion bracket
(for cylinders with mounting styles G,H and L)
to ISO 8132

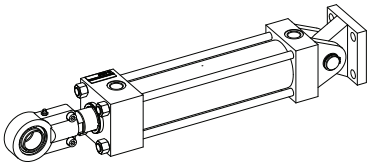


Note: The code includes two trunnion brackets
(1) To ISO 8133

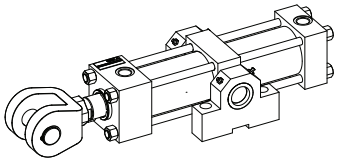
Code	CR H7	CO N9	FH max	FK JS12	FN max	FS js13	HB H13	KC 0/+0,3	NH max	TH js13	UL max	Mass [kg]	Max load static [kN]
C-15425	12	10	25	34	50	8	9	3,3	17	40	63	0,46	8
C-15432	16	16	30	40	60	10	11	4,3	21	50	80	0,83	12,5
C-15440	20	16	38	45	70	10	11	4,3	21	60	90	1,21	20
C-15450	25	25	45	55	80	12	13,5	5,4	26	80	110	2,15	32
C-15463	32	25	52	65	100	15	17,5	5,4	33	110	150	4,63	50
C-15480	40	36	60	76	120	16	22	8,4	41	125	170	7,78	80
C-154100	50	36	75	95	140	20	26	8,4	51	160	210	14,3	125
C-154125	63	50	85	112	180	25	33	11,4	61	200	265	23,4	200
C-154160	80	50	112	140	220	31	39	11,4	81	250	325	53,1	320
C-154200 (1)	100	63	150	200	300	42	52	12,4	101	320	410	112	500

4 EXAMPLES OF ATTACHMENTS

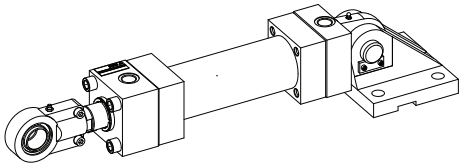
CK - mounting style **C** with rod eye **C-136** and bracket **C-144**



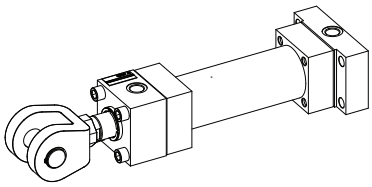
CK - mounting style **L** with rod clevis **C-141** and bracket **C-154**



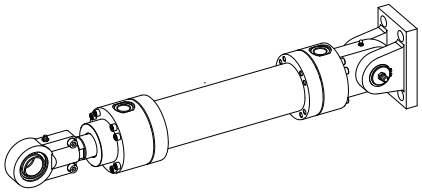
CH - mounting style **S** with rod eye **C-136** and bracket **C-134**



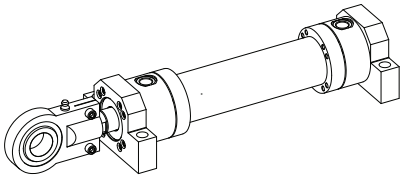
CH - mounting style **P** with rod clevis **C-141**



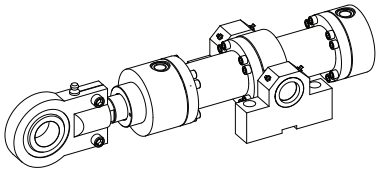
CN - mounting style **S** with rod eye **C-136** and bracket **C-124**



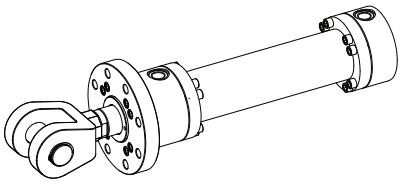
CN - mounting style **E** with rod eye **C-146**



CC - mounting style **L** with rod eye **C-146** and bracket **C-154**



CC - mounting style **A** with rod clevis **C-141**



5 SURFACE TREATMENT

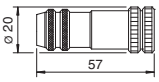
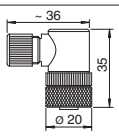
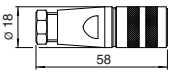
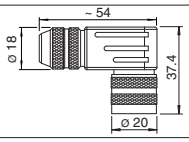
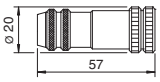
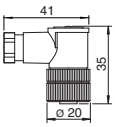
Some attachments are provided with additional surface treatment to increase the corrosion resistance (24h in neutral salt spray), see table below for details. All the attachments, except pivot pin C-145, can be supplied with standard painting RAL 9007 (200h in neutral salt spray) selecting option **-V**, special painting are available on request.

Code	Surface treatment	Code	Surface treatment
C-136 or C-146	No treatment	C-124	No treatment
C-141	No treatment	C-134	No treatment
C-151	Black phosphate	C-144	Black phosphate
C-145	Black phosphate	C-154	No treatment

Electric and electronic connectors

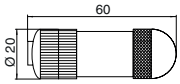
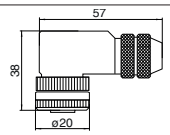
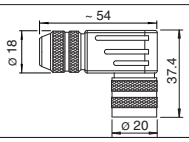
for CK* servocylinders

1 CONNECTORS FOR ANALOG POSITION TRANSDUCERS

CODE AND DIMENSIONS	APPLICATION	INTERNAL VIEW PINOUT (1)	FRONT VIEW	CABLE GLAND Ø CABLE	REFERENCE RULES
CON031 	Straight female metallic connector - 5 pin: - magnetosonic transducer for CKF servocylinders - electronic conditioning card for CKN servocylinders Transducer output signal: analog			PG9 ø 6 ÷ 8 mm	M12 IEC 61076-2-101 Protection degree IP 67 EN 60529
CON041 	Female plastic connector at 90° - 5 pin: - magnetosonic transducer for CKF servocylinders - electronic conditioning card for CKN servocylinders Transducer output signal: analog			PG9 ø 6 ÷ 8 mm	M12 IEC 61076-2-101 Protection degree IP 67 EN 60529
STCO9131-D06-PG7 	Straight female metallic connector - 6 pin: - magnetosonic transducer for CKM servocylinders - magnetostrictive transducer for CKN servocylinders Transducer output signal: analog			PG7 ø 4 ÷ 6 mm	Protection degree IP 67 EN 60529
STCO9131-6-PG7 	Female metallic connector at 90° - 6 pin: - magnetosonic transducer for CKM servocylinders - magnetostrictive transducer for CKN servocylinders Transducer output signal: analog			PG7 ø 4 ÷ 6 mm	Protection degree IP 67 EN 60529
STCO9131-D04-PG7 	Straight female metallic connector - 4 pin: - potentiometer transducer for CKP servocylinders - inductive transducer for CKV servocylinders Transducer output signal: analog			PG7 ø 4 ÷ 6 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
STCO9131-4-PG7 	Female plastic connector at 90° - 4 pin: - potentiometer transducer for CKP servocylinders - inductive transducer for CKV servocylinders Transducer output signal: analog			PG7 ø 4 ÷ 6 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529

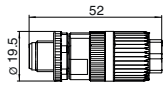
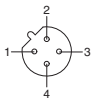
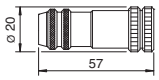
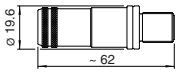
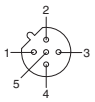
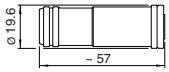
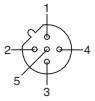
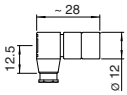
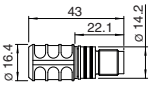
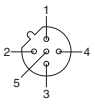
(1) the wiring of electrical terminals has to be realized according to specific servocylinder's technical table

2 CONNECTORS FOR SSI DIGITAL POSITION TRANSDUCERS

CODE AND DIMENSIONS	APPLICATION	INTERNAL VIEW PINOUT (1)	FRONT VIEW	CABLE GLAND Ø CABLE	REFERENCE RULES
370694 	Straight female metallic connector - 8 pin: - potentiometer transducer for CKF servocylinders Transducer output signal: digital SSI			PG9 ø 4 ÷ 9 mm	Protection degree IP 67 EN 60529
370699 	Female metallic connector at 90° - 8 pin: - potentiometer transducer for CKF servocylinders Transducer output signal: digital SSI			PG9 ø 6 ÷ 8 mm	Protection degree IP 67 EN 60529
STCO9131-D07-PG9	Straight female metallic connector - 7 pin: - potentiometer transducer for CKM servocylinders Transducer output signal: digital SSI			PG9 ø 6 ÷ 8 mm	Protection degree IP 67 EN 60529
STCO9131-7-PG9 	Female metallic connector at 90° - 7 pin: - potentiometer transducer for CKM servocylinders Transducer output signal: digital SSI			PG9 ø 6 ÷ 8 mm	Protection degree IP 67 EN 60529

(1) the wiring of electrical terminals has to be realized according to specific servocylinder's technical table

3 CONNECTORS FOR FIELDBUS POSITION TRANSDUCERS

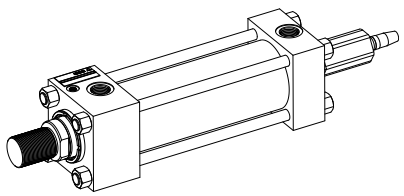
CODE AND DIMENSIONS		APPLICATION	INTERNAL VIEW PINOUT (1)	FRONT VIEW	CABLE GLAND Ø CABLE	REFERENCE RULES
370523		Straight male metallic connector - 4 pin: - PROFINET for CKM servocylinders (input and output)			PG9 ø 5,5 ÷ 7,2 mm	Protection degree IP 67 EN 60529
CON031		Straight female metallic connector - 5 pin: - PROFINET for CKM servocylinders (power supply)			PG9 ø 6 ÷ 8 mm	M12 IEC 61076-2-101 Protection degree IP 67 EN 60529
560884		Straight male metallic connector - 5 pin: - PROFIBUS DP for CKM servocylinders (input)			PG9 ø 6,5 ÷ 8,5 mm	M12 - coding B IEC 61076-2-101 Protection degree IP 67 EN 60529
560885		Straight female metallic connector - 5 pin: - PROFIBUS DP for CKM servocylinders (output)			PG9 ø 6,5 ÷ 8,5 mm	M12 - coding B IEC 61076-2-101 Protection degree IP 67 EN 60529
560886		Female plastic connector at 90° - 4 pin: - PROFIBUS DP for CKM servocylinders (power supply)			PG7 ø 3,5 ÷ 5 mm	M8 IEC 61076-2-104 Protection degree IP 67 EN 60529
560888		Straight female plastic connector - 4 pin: - PROFIBUS DP for CKM servocylinders (terminator)			PG9 ø 6,5 ÷ 8,5 mm	M12 - coding B IEC 61076-2-101 Protection degree IP 67 EN 60529

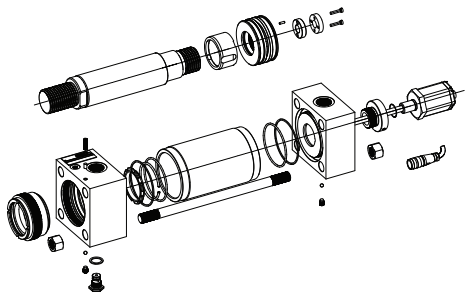
(1) the wiring of electrical terminals has to be realized according to specific servocylinder's technical table

Operating and maintenance information

for industrial cylinders & servocylinders

These operating and maintenance information are valid only for Atos hydraulic cylinders and are intended to provide useful guidelines to avoid risks when hydraulic cylinders are installed in a machine or a system. Information and notes on the transport and storage of hydraulic cylinders are also provided.
These norms must be strictly observed to avoid damages and ensure trouble-free operation. The respect of these operating and maintenance information ensures an increased working life and thus reduced repairing cost of the hydraulic cylinders and system.





1 SYMBOLS CONVENTIONS

⚠ This symbol refers to possible danger which can cause serious injuries

2 GENERAL NOTES

The cylinder operating and maintenance information are part of the operating instructions for the complete machine but they cannot replace them

Atos is not liable for damages resulting from an incorrect observance of these instructions.
All the hydraulic cylinders have 1 year warranty; the expiration of warranty results from the following operations:
- Unauthorised mechanical or electronic interventions
- The hydraulic cylinders are not used exclusively for their intended purpose as defined in these operating and maintenance instructions

3 HARMONIZED STANDARDS

Hydraulic cylinders are subject to PED directive 2014/68/UE, see sec. 6 for details. Machinery Directive 2006/42/CE does not apply to hydraulic cylinders. For an overall view relevant to application of the European directive in electrohydraulics, see www.atos.com, **tab. P004**

⚠ **Check the code in the nameplate to ensure that the hydraulic cylinder is suitable for the installation area**

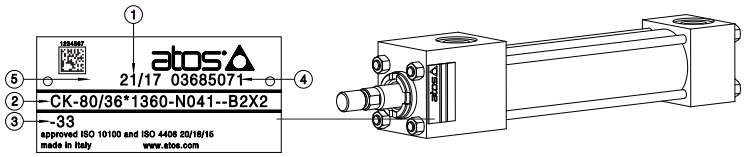
4 WORKING CONDITIONS

⚠ **The operation of hydraulic cylinders is not permitted at different operating and environmental conditions than those specified below**

Description	CK, CK*, CH, CN	CC
Ambient temperature	-20 ÷ +120°C	-20 ÷ +120°C
Fluid temperature	-20 ÷ +120°C	-20 ÷ +120°C
Max surface temperature	-	-
Max working pressure	16 MPa (160 bar)	25 MPa (250 bar)
Max pressure	25 MPa (250 bar)	32 MPa (320 bar)
Max frequency	5 Hz	5 Hz
Max speed	4 m/s	
Recommended viscosity	15 ÷ 100 mm^2/s	
Max fluid contamination level	ISO4406 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog	

5 NAMEPLATES

Nameplate - Standard



Nameplate - Standard (1)

Pos.	Description
1	Delivery date
2	Cylinder code
3	Series number
4	Customer code (only if requested)
5	CE mark (see section 6)

Notes: (1) The position of the nameplate on the rear or front heads can change due to the cylinder overall dimensions

6 CE MARKING

Hydraulic cylinders are considered as pressure vessels and thus they are subject to the PED directive (2014/68/UE), point 1 a) of article 4. Particularly they are designed to be used with fluids of group 2 (oil hydraulic fluids) and they have to be marked if the product **Pmax** x **V** (Volume under pressure) is higher than 10.000 bar x liter. Tables below show the minimum stroke over which the cylinders have to be CE marked. ATEX cylinders are CE marked according to ATEX directive (2014/34/EU).

Cylinders CK, CH and CN - Pmax = 250 bar			
Bore [mm]	Rod [mm]	Stroke min [mm] single rod	Stroke min [mm] double rod
125	56 70 90	3255	4075 4745 5000
160	70 90 110	1985	2460 2910 3770
200	90 140	1270	1595 2495
250	140	810	1185
320	180	495	725
400	220	315	455

Cylinders CC - Pmax = 320 bar			
Bore [mm]	Rod [mm]	Stroke min [mm] single rod	Stroke min [mm] double rod
100	70	3975	5000
125	90	2545	5000
140	90	2030	3455
160	110	1550	2945
180	110	1225	1960
200	140	990	1950
250	180	635	1320
320	220	385	735
400	280	245	485

7 SAFETY NOTES

7.1 General

- The presence of cushioning can lead to a peak of pressure that can reduce the cylinder working life, ensure that the dissipated energy is less than the max value reported in **tab. B015**
- Make sure that the maximum working conditions, shown in section 4, are not exceeded
- Ensure to use hydraulic fluids compatible with the selected sealing system, see **tab. B137**, **B140**, **B160**, **B180**, **B241** and **B310**
- The rod must be handled with care to prevent damages on the surface coating which can deteriorate the sealing system and lead to the corrosion of the basic material
- The mounting screws must be free from shearing stress
- Transverse forces on the rods must always be avoided
- When the cylinder has to drive a rotating structure or where little alignment errors are expected, mounting style with spherical bearing should be used
- Contact surfaces, support elements in tolerance, elastic materials and labels must be covered before painting the cylinder

7.2 Proximity sensors

- Proximity sensors are supplied already adjusted, if other regulations are necessary see **tab. B137** or contact our technical office
- Ensure not to remove the sensor while the cylinder is under pressure
- The connectors must never be plugged or unplugged when the power supply is switched-on

7.3 Position measuring system

- Position transducers must never be removed, if not otherwise specified in **tab. B310**, while the cylinder is under pressure
- Observe the information provided in **tab. B310** for the electronic connections
- The connectors must never be plugged or unplugged when the power supply is switched-on

7.4 Installation

- Consult **tab. P002** for installation, commissioning and maintenance of electrohydraulic system
- The piping have to be dimensioned according to the max pressure and max flow rate required
- All pipes and surfaces must be cleaned from dirt before mounting
- Remove all plug screws and covers before mounting
- Make sure that connections are sealed before giving pressure to the system
- Ensure to not exchange the pipe ports when connecting the cylinders
- Bleed-off the system or the hydraulic cylinder using the proper device, see the technical data sheet for details
- Ensure that the cylinder mounting allow easy of acces for the purpose of maintenance and the adjustment of cushioning

8 MAINTENANCE

⚠ **Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics**

8.1 Preliminary check and ordinary maintenance

Atos hydraulic cylinders don't require any maintenance after commissioning. Anyway it is recommended to take into account the following remarks:

- Results of maintenance and inspection must be planned and documented
- Check oil escaping from oil ports or leakages at the cylinder heads
- Check for damages of the chromeplated surface of the rod: damages may indicate oil contamination or the presence of excessive transverse load
- Determine lubricating intervals for spherical clevises, trunnion and all parts not self-lubricated
- The rod should always be retracted during long stop of the machine or system
- Remove any salt, machining residuals or other dirt cumulated on the rod surface
- Follow the maintenance instructions of the fluid manufacturer

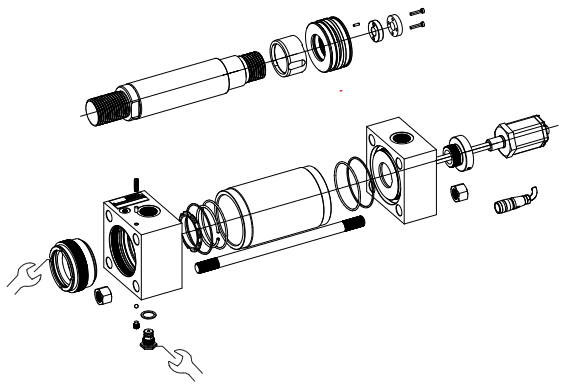
8.2 Repairing

Before beginning any repairing observe the following guidelines:

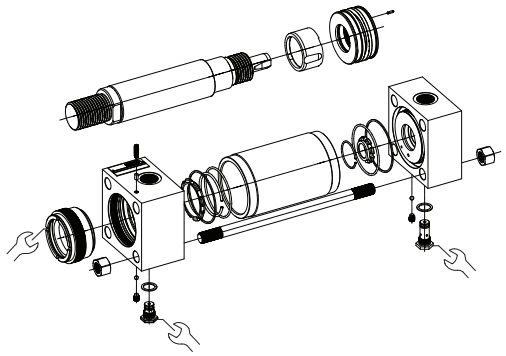
- Unauthorized opening of the cylinder during the warranty period results in the warranty expiration
- Be sure to use only original spare parts manufactured or supplied by Atos
- Provide all the required tools to make the repair operations safely and not damage the components
- Read and follow all the safety notes given in section 7
- Ensure that the cylinder is well locked before beginning any operation
- Disassembly or assembly the cylinder with the right order as indicated in section **8.3**
- When mounting rod or piston guides and seals observe the correct position as indicated in section **8.4**. Any bad positioning can result in oil leakages
- It is strongly recommended the use of expanding sleeves to insert the seals in the proper groove
- Tighten all the screws or nuts as follow: lubricates the threads, insert the screw or the nut by hand for some turns, tighten the screw crosswise with the tightening torque specified in the technical table (a pneumatic screw driver may be used)
- Rod bearing and piston must be locked respectively to the front head and to the rod by means of special pin to avoid unscrewing
- The replacement of wear parts such as seals, rod bearing and guide rings depends on the operating conditions, temperature and quality of the fluid

8.3 Cylinders exploded views

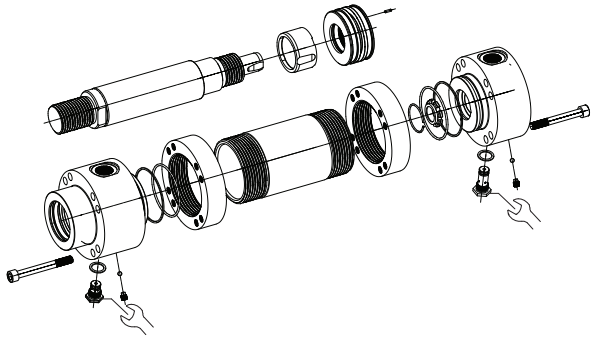
CK* servocylinder - For spare parts see tab. SP-B310



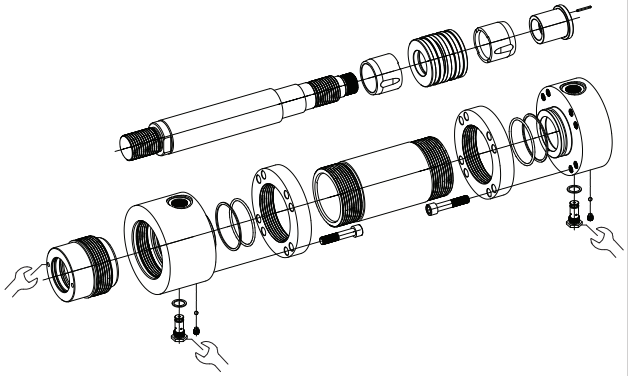
CK/CH - For spare parts see tab.SP-B137, SP-B140 and SP-B160



CN - For spare parts see tab. SP-B180



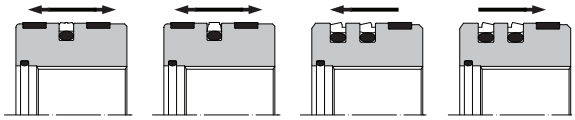
CC - For spare parts see tab. SP-B241



Note: this symbol means that a particular equipment is required for mounting, contact our technical office

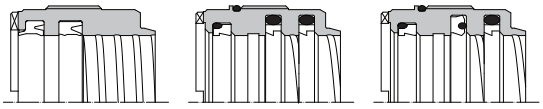
8.4 Sealing system mounting

PISTON



G1-G8 | G2-G4 | G6 Single effect pushing | G7 Single effect pulling

ROD BEARING



G1 | G2-G4-G6-G7 | G8

9 TRANSPORT AND STORAGE

9.1 Transport

Observe the following guidelines for transport of hydraulic cylinders:

- Cylinders have to be transported using a forklift truck or a lifting gear always ensuring a stable position of the cylinder
- Cylinders have to be transported in horizontal position in their original packaging
- Use soft lifting belts to move or lift the cylinders in order to avoid damages
- Before any movement check the cylinders weight (due to tolerances, the weight may be 10% greater than the values specified in the technical table)

⚠ **Additional parts such as pipes, subplates and transducers must never be used for lifting**

9.2 Storage

Corrosion protection is achieved with alkyd primer painting RAL 9007: the primer grants a storage period up to 12 months. Additionally all cylinders are tested

with mineral oil OSO 46; the oil film, presents in the cylinder chambers after testing, ensures the internal corrosion protection.

Anyway be care to observe the following remarks:

- When a storage in the open air is foreseen ensure that cylinders are well protected against water
- The cylinders must be inspected at least once a year and rotated through 90° every six months to preserve the seals

⚠ **In case of storage period longer than 12 months, contact our technical office**

10 CYLINDERS TROUBLESHOOTING

TROUBLE	POSSIBLE CAUSES	SOLUTIONS
Oil leakage	High lateral loads involve a premature wear of the bronze bushing, seals and wear rings	a) Improve the precision of the machine alignment b) Decrease lateral loads c) Install a pivoted mounting style **C**-**D**-**G**-**H**-**S**-**L**
	Fluid contaminants produce scratch and score marks on the seals	Check the fluid contamination class is < 20/18/15
	Chemical attack cause the deterioration of seals compound	Check seals compatibility with operating fluid
	High temperatures (fluid/ambient) the seals dark and flaked	a) Decrease the fluid temperature b) Install **G2** sealings for high temperatures
	Low temperature (ambient) make the seals brittle	a) Move the cylinder in a higher temperature zone b) Install **G9** seals for low temperatures
	High rod speed reduce the lubricant capacity of the seals	For rod speed > 0,5 m/s Install **G2** – **G4** seals
	High frequency reduce the lubricant capacity of the seals	For rod frequency > 5 hz Install **G0** seals
	Output rod speed higher than the input one	Check the rod speed ratio in/out complies with the minimum R_{min} value, see tech.table **B015**
	The pressurization of the mixture air/mineral oil may involve self combustion dangerous for the seals (Diesel effect)	Bleed off completely the air inside the hydraulic circuit
Wiper or seal extrusion	Overpressure	a) Limit the pressure of the system b) Install **G2**-**G4**-**G8** seals if overpressure cannot be reduced
	Rod seals leakages may involve overpressures among wiper and rod seal, causing their extrusion	a) See possible causes and solutions for oil leakage troubles b) Install draining option **L**
Lose of cushioning effect	Rod speed too low at end stroke	a) Check the cushioning adjustment is not fully open, regulate it if necessary b) Replace "fast" cushioning **1**-**2**-**3**, with "slow" cushioning **4**-**5**-**6** if the cushioning is not effective with cushioning adjustment fully closed
	Cushioning adjustment cartridge with improper regulation	Close the cushioning adjustment screw till restoring the cushioning effect
	Fluid contaminants produce scratch and score marks on the cushioning piston	Check the fluid contamination class is < 20/18/15
Rod locked or impossible to move	Overpressure in the cushioning chamber could involve the cushioning piston locking	a) Replace "fixed" cushioning **7**-**9** with "adjustable" cushioning **1**-**3** b) For adjustable cushioning, open the cushioning adjustment to decrease the max pressure inside the cushioning chamber c) Check the energy dissipated by the cushioning is lower than max energy dissipable, see tech.table **B015**
	Fluid contaminants may lock the piston because of its tight tolerances	Check the fluid contamination class is < 20/18/15
Rod failure	Overload/overpressure involves ductile rod failure	a) Check the overpressure inside the cylinder and decrease it b) Check the compliance with the admitted operating pressure according to the cylinder series
	High load/pressure coupled to high frequencies or long life expectation involves fatigue rod failure	a) Check the expected rod fatigue working life proposed in tech. table **B015** b) Decrease the operating pressure
Rod vibration	Seals with excessive friction could involve rod vibration and noise	Install low friction PTFE seals **G2**-**G4**, see tech.table **B015**
	Air in the circuit may involve a jerky motion of the rod	Bleed off completely the air inside the hydraulic circuit
Rod motion without oil pressure	Variations in the fluid temperature involve the fluid expansion / compression thus the rod moving	a) Decrease the temperature variations in the oil b) Change the fluid type to decrease the coefficient of thermal expansion
	Excessive oil leakage from the piston or rod seals	See likely causes and solutions for oil leakage troubles
Noisy cylinder	Impact of the piston with the heads caused by high speed (>0,05 m/s)	a) Decrease the rod speed b) Install external or internal cushioning system **1**-**9**, see tech.table **B015** for the max energy that can be dissipated
	Fluid contaminants, foreign particles inside the cylinder may generate unusual noise	Check the fluid contamination class is < 20/18/15
	High oil flow speed > 6 m/s	a) Increase the piping diameters to reduce the oil flow speed b) Install oversized oil ports, options **D**-**Y**

11 SERVOCYLINDERS TROUBLESHOOTING

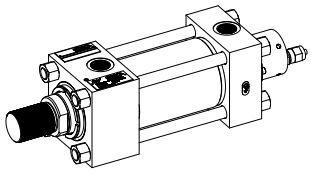
TROUBLE	POSSIBLE CAUSES	SOLUTIONS
Transducer malfunctioning / failure	Improper electronic connections may involve the transducer malfunctioning	Check the electronic connections scheme in tech table **B310**
	Not stabilized power supply may involve dangerous peak of voltage	Install a voltage stabilizer
	Uncontrolled disconnection and connection of plug-in connectors may damage the transducer	Be carefull to switch off the power supply before connecting the position transducer

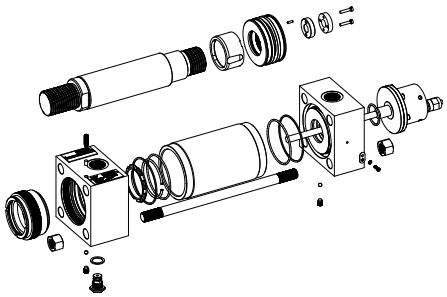
Note: for cylinders troubleshooting refer to section 10

Operating and maintenance information

for ex-proof cylinders & servocylinders

These operating and maintenance information are valid only for Atos ex-proof cylinders & servocylinders; they are intended to provide useful guidelines to avoid risks when hydraulic cylinders are installed in a machine or a system. Information and notes about transportation and storage of hydraulic cylinders are also provided.
These norms must be strictly observed to avoid damages and ensure trouble-free operation. The respect of these operating and maintenance information ensures an increased working life and thus reduced repairing cost of the hydraulic cylinders and system.





1 SYMBOLS CONVENTIONS

⚠ This symbol refers to possible danger which can cause serious injuries

2 GENERAL NOTES

The cylinder operating and maintenance information are part of the operating instructions for the complete machine but they cannot replace them

Atos is not liable for damages resulting from an incorrect observance of these instructions.
All the hydraulic cylinders have 1 year warranty; the expiration of warranty results from the following operations:
- Unauthorised mechanical or electronic interventions
- The hydraulic cylinders are not used exclusively for their intended purpose as defined in these operating and maintenance instructions

3 HARMONIZED STANDARDS

CKA cylinders meet the requirements laid down in the Explosion protection directive 2014/34/EU with reference to European standards documentations:

ISO 80079-36 "Non electrical equipment for potentially explosive atmospheres - Basic method and requirements"
ISO 80079-37 "Non electrical equipment for explosive atmospheres - Protection constructional safety 'c', liquid immersion 'k'"

The hydraulic cylinder must be exclusively used in areas and zones assigned to the equipment group and category. Also observe the other details about explosion protection given as follow. See section 6 for zones in relation to equipment groups and category.

⚠ **Check the code in the nameplate to ensure that the hydraulic cylinder is suitable for the installation area**

4 WORKING CONDITIONS

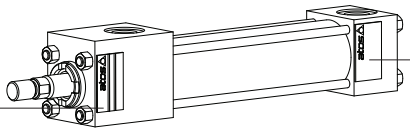
⚠ **The operation of hydraulic cylinders is not permitted at different operating and environmental conditions than those specified below**

Description	CKA, CKAM	
Ambient temperature	-20 ÷ +70°C	-40 ÷ +65°C for **CKAM**
Fluid temperature	-20 ÷ +70°C (**T6**)	-20 ÷ +120°C (**T4**) for seals type **G2** (1)
Max surface temperature	≤ +85 °C (**T6**)	≤ +135 °C (**T4**) for seals type **G2** (1)
Max working pressure	16 MPa (160 bar)	
Max pressure	25 MPa (250 bar)	
Max frequency	5 Hz	
Max speed	1 m/s	0,5 m/s for seals type **G1**
Recommended viscosity	15 ÷ 100 mm²/s	
Max fluid contamination level	ISO4406 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog	

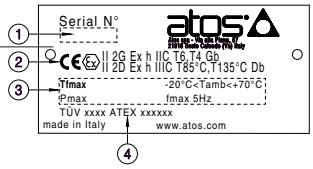
Note: (1) Cylinders with seals type **G2** may also be certified **T6** limiting the max fluid temperature to 70°C

5 NAMEPLATES

Nameplate 1 - Standard



Nameplate 2 - ATEX



Nameplate 1 - Standard (2)

Pos.	Description
①	Delivery date
②	Cylinder code
③	Series number
④	Customer code (only if requested)
⑤	CE mark

Nameplate 2 - ATEX (1)(2)

Pos.	Description
①	Cylinder serial number
②	Marking according to ATEX directive
③	Working limit conditions
④	Notified body and certified number

Working conditions - legend

Sym.	Meaning
Tfmax	Max fluid temperature
Pmax	Max pressure
Tamb	Ambient temperature
fmax	Max frequency

Notes: (1) ATEX cylinders are supplied with 2 nameplates: standard and ATEX
(2) The position of the nameplate on the rear or front heads can change due to the cylinder overall dimensions

6 ATEX CERTIFICATION

The user must define the overall areas of the system into different explosive atmospheres zones in accordance with directive EN 60079-10-1/2. The table below shows the available installation zones related to the equipment group and category.

EN 60079-0		Directive 2014/34/EU		Application, properties (exerpt from Directives)	Zones EN 60079-10-1/2
EPL	Group	Equipment group	Category		
Gb	II	II	2G	Potentially explosive atmospheres, in which explosive gases, mists or vapors are likely to occur occasionally. **High level of protection**	1, 2
Gc		II	3G	Potentially explosive atmospheres, in which explosive gases, mists or vapors are likely to occur for short periods. **Normal level of protection**	2
Db	III	II	2D	Potentially explosive atmospheres, in which explosive dust/air mixtures are likely to occur occasionally. **High level of protection**	21,22
Dc		II	3D	Potentially explosive atmospheres, in which explosive dust/air mixtures are likely to occur rarely or for short periods. **Normal level of protection**	22

⚠ **The cylinder group and category may change when rod position transducers or proximity sensors are provided, see table below and tab. BX500. For details about certification and safety notes consult the user's guides included in the supply**

Cylinder type		Group	Equipment category	Gas/dust group	Temperature class	Zone
CKA		II	2 GD	II C/III C	T85°C(T6) / T135°C(T4)	1,2,21,22
CKA with ex-proof rod position transducer	**GAS**	II	2 G	II B	T6/T5	1,2
	DUST	II	2 D	IIIC	T85°C/T100°C	21,22
CKA with ex-proof proximity sensors		II	3 G	II	T4	2

II 2G Ex h IIC T6,T4 Gb (gas) **II 2D Ex h IIIC T85°C, T135°C Db (dust)**

GROUP II, Atex

II = Group II for surface plants
2 = High protection (equipment category)
G = For gas, vapours
D = For dust
Ex = Equipment for explosive atmospheres
IIC = Gas group
IIIC = Dust group
T85°C/T135°C = Surface temperature class for dust
T6/T4 = Surface temperature class for gas
Gb/Db = EPL Equipment group

7 SAFETY NOTES

7.1 General

- The presence of cushioning can lead to a peak of pressure that can reduce the cylinder working life, ensure that the dissipated energy is less than the max value reported in **tab. B015**
- Make sure that the maximum working conditions, shown in section 4, are not exceeded
- Ensure to use hydraulic fluids compatible with the selected sealing system, see **tab. BX500**
- The rod must be handled with care to prevent damages on the surface coating which can deteriorate the sealing system and lead to the corrosion of the basic material
- The mounting screws must be free from shearing stress
- Transverse forces on the rods must always be avoided
- When the cylinder has to drive a rotating structure or where little alignment errors are expected, mounting style with spherical bearing should be used
- Contact surfaces, support elements in tolerance, elastic materials and labels must be covered before painting the cylinder

7.2 Proximity sensors

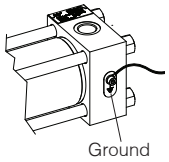
- Proximity sensors are supplied already adjusted, if other regulations are necessary see **tab. BX500** or contact our technical office
- Ensure not to remove the sensor while the cylinder is under pressure
- The connectors must never be plugged or unplugged when the power supply is switched-on

7.3 Position measuring system

- Position transducers must never be removed, if not otherwise specified in **tab. BX500**, while the cylinder is under pressure
- Observe the information provided in **tab. BX500** for the electronic connections
- The connectors must never be plugged or unplugged when the power supply is switched-on

7.4 Installation

- Consult **tab. P002** for installation, commissioning and maintenance of electrohydraulic system
- The piping have to be dimensioned according to the max pressure and max flow rate required
- All pipes and surfaces must be cleaned from dirt before mounting
- Remove all plug screws and covers before mounting
- Make sure that connections are sealed before giving pressure to the system
- Ensure to not exchange the pipe ports when connecting the cylinders
- Bleed-off the system or the hydraulic cylinder using the proper device, see the technical data sheet for details
- Ensure that the cylinder mounting allow easy of acces for the purpose of maintenance and the adjustment of cushioning
- The max surface temperature indicated in the nameplate must be lower than the following values:
  GAS - **80% of gas ignition temperature**
  DUST - max value between **dust layer ignition temperature - 75°C** and **2/3 of dust cloud ignition temperature**
- The ignition temperature of the fluid must be 50°C greater than the maximum surface temperature indicated in the nameplate
- The cylinder must be grounded using the threaded hole on the rear head, evidenced by the nameplate with ground symbol. The hydraulic cylinder must be put at the same electric potential of the machine
- It is responsibility of the user to verify that the maximum inlet fluid temperature does not exceed the value reports in the technical data



⚠ **For details about ex-proof proximity sensors or position transducer refer to the user's guide included in the supply**

8 MAINTENANCE

- Ordinary maintenance of the cylinder consist of cleaning of the external surfaces using a wet cloth to avoid accumulation of dust layer > 5 mm
- Do not use compressed air for cleaning to avoid any dangerous dust dispersion on the surrounding atmosphere
- Any sudden increment in temperature requires immediate stop of the system and inspection of the relevant components

⚠ **Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics**

8.1 Preliminary check and ordinary maintenance

Atos hydraulic cylinders don't require any maintenance after commissioning. Anyway it is recommended to take into account the following remarks:

- Results of maintenance and inspection must be planned and documented
- Check oil escaping from oil ports or leakages at the cylinder heads
- Check for damages of the chromeplated surface of the rod: damages may indicate oil contamination or the presence of excessive transverse load
- Determine lubricating intervals for spherical clevises, trunnion and all parts not self-lubricated
- The rod should always be retracted during long stop of the machine or system

⚠ **Any repairing must be performed only by experienced personnel, authorized by Atos**

- Remove any salt, machining residuals or other dirt cumulated on the rod surface
- Follow the maintenance instructions of the fluid manufacturer

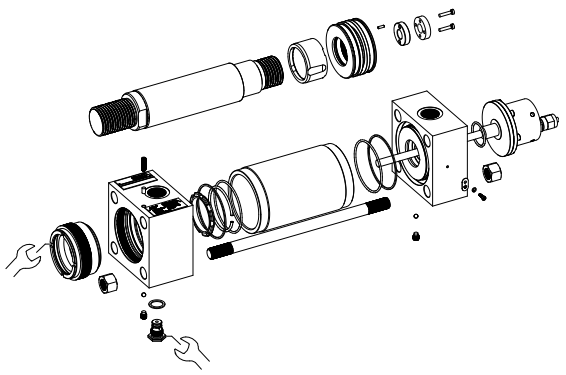
8.2 Repairing

Before beginning any repairing observe the following guidelines:

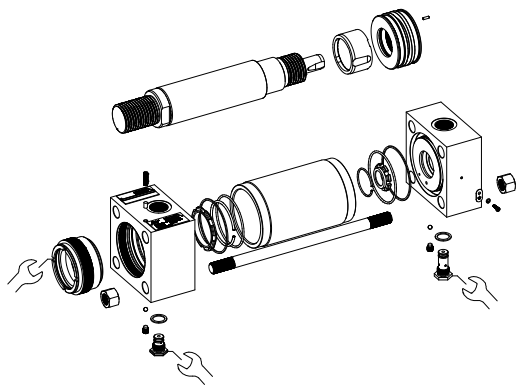
- Unauthorized opening of the cylinder during the warranty period results in the warranty expiration
- Be sure to use only original spare parts manufactured or supplied by Atos
- Provide all the required tools to make the repair operations safely and not damage the components
- Read and follow all the safety notes given in section 7
- Ensure that the cylinder is well locked before beginning any operation
- Disassembly or assembly the cylinder with the right order as indicated in section **8.3**
- When mounting rod or piston guides and seals observe the correct position as indicated in section **8.4**. Any bad positioning can result in oil leakages
- It is strongly recommended the use of expanding sleeves to insert the seals in the proper groove
- Tighten all the screws or nuts as follow: lubricates the threads, insert the screw or the nut by hand for some turns, tighten the screw crosswise with the tightening torque specified in the technical table (a pneumatic screw driver may be used)
- Rod bearing and piston must be locked respectively to the front head and to the rod by means of special pin to avoid unscrewing
- The replacement of wear parts such as seals, rod bearing and guide rings depends on the operating conditions, temperature and quality of the fluid

8.3 Cylinders exploded views

CKAM servocylinder - For spare parts contact our technical office



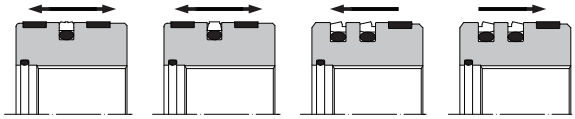
CKA - For spare parts contact our technical office



Note: this symbol means that a particular equipment is required for mounting, contact our technical office

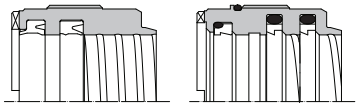
8.4 Sealing system mounting

PISTON



G1 | G2-G4 | G6 Single effect pushing | G7 Single effect pulling

ROD BEARING



G1 | G2-G4-G6-G7

9 TRANSPORT AND STORAGE

9.1 Transport

Observe the following guidelines for transport of hydraulic cylinders:

- Cylinders have to be transported using a forklift truck or a lifting gear always ensuring a stable position of the cylinder
- Cylinders have to be transported in horizontal position in their original packaging
- Use soft lifting belts to move or lift the cylinders in order to avoid damages
- Before any movement check the cylinders weight (due to tolerances, the weight may be 10% greater than the values specified in the technical table)

⚠ **Additional parts such as pipes, subplates and transducers must never be used for lifting**

9.2 Storage

Corrosion protection is achieved with alkyd primer painting RAL 9007: the primer grants a storage period up to 12 months. Additionally all cylinders are tested with mineral oil OSO 46; the oil film, presents in the cylinder chambers after testing, ensures the internal corrosion protection.

Anyway be care to observe the following remarks:

- When a storage in the open air is foreseen ensure that cylinders are well protected against water
- The cylinders must be inspected at least once a year and rotated through 90° every six months to preserve the seals

⚠ **In case of storage period longer than 12 months, contact our technical office**

10 CYLINDERS TROUBLESHOOTING

TROUBLE	POSSIBLE CAUSES	SOLUTIONS
Oil leakage	High lateral loads involve a premature wear of the bronze bushing, seals and wear rings	a) Improve the precision of the machine alignment b) Decrease lateral loads c) Install a pivoted mounting style **C**-**D**-**G**-**H**-**S**-**L**
	Fluid contaminants produce scratch and score marks on the seals	Check the fluid contamination class is < 20/18/15
	Chemical attack cause the deterioration of seals compound	Check seals compatibility with operating fluid
	High temperatures (fluid/ambient) the seals dark and flaked	a) Decrease the fluid temperature b) Install **G2** sealings for high temperatures
	Low temperature (ambient) make the seals brittle	a) Move the cylinder in a higher temperature zone b) Install **G9** seals for low temperatures
	High rod speed reduce the lubricant capacity of the seals	For rod speed > 0,5 m/s Install **G2** – **G4** seals
	High frequency reduce the lubricant capacity of the seals	For rod frequency > 5 hz Install **G0** seals
	Output rod speed higher than the input one	Check the rod speed ratio in/out complies with the minimum R_{min} value, see tech.table **B015**
	The pressurization of the mixture air/mineral oil may involve self combustion dangerous for the seals (Diesel effect)	Bleed off completely the air inside the hydraulic circuit
Wiper or seal extrusion	Overpressure	a) Limit the pressure of the system b) Install **G2**-**G4**-**G8** seals if overpressure cannot be reduced
	Rod seals leakages may involve overpressures among wiper and rod seal, causing their extrusion	a) See possible causes and solutions for oil leakage troubles b) Install draining option **L**
Lose of cushioning effect	Rod speed too low at end stroke	a) Check the cushioning adjustment is not fully open, regulate it if necessary b) Replace "fast" cushioning **1**-**2**-**3**, with "slow" cushioning **4**-**5**-**6** if the cushioning is not effective with cushioning adjustment fully closed
	Cushioning adjustment cartridge with improper regulation	Close the cushioning adjustment screw till restoring the cushioning effect
	Fluid contaminants produce scratch and score marks on the cushioning piston	Check the fluid contamination class is < 20/18/15
Rod locked or impossible to move	Overpressure in the cushioning chamber could involve the cushioning piston locking	a) Replace "fixed" cushioning **7**-**9** with "adjustable" cushioning **1**-**3** b) For adjustable cushioning, open the cushioning adjustment to decrease the max pressure inside the cushioning chamber c) Check the energy dissipated by the cushioning is lower than max energy dissipable, see tech.table **B015**
	Fluid contaminants may lock the piston because of its tight tolerances	Check the fluid contamination class is < 20/18/15
Rod failure	Overload/overpressure involves ductile rod failure	a) Check the overpressure inside the cylinder and decrease it b) Check the compliance with the admitted operating pressure according to the cylinder series
	High load/pressure coupled to high frequencies or long life expectation involves fatigue rod failure	a) Check the expected rod fatigue working life proposed in tech. table **B015** b) Decrease the operating pressure
Rod vibration	Seals with excessive friction could involve rod vibration and noise	Install low friction PTFE seals **G2**-**G4**, see tech.table **B015**
	Air in the circuit may involve a jerky motion of the rod	Bleed off completely the air inside the hydraulic circuit
Rod motion without oil pressure	Variations in the fluid temperature involve the fluid expansion / compression thus the rod moving	a) Decrease the temperature variations in the oil b) Change the fluid type to decrease the coefficient of thermal expansion
	Excessive oil leakage from the piston or rod seals	See likely causes and solutions for oil leakage troubles
Noisy cylinder	Impact of the piston with the heads caused by high speed (>0,05 m/s)	a) Decrease the rod speed b) Install external or internal cushioning system **1**-**9**, see tech.table **B015** for the max energy that can be dissipated
	Fluid contaminants, foreign particles inside the cylinder may generate unusual noise	Check the fluid contamination class is < 20/18/15
	High oil flow speed > 6 m/s	a) Increase the piping diameters to reduce the oil flow speed b) Install oversized oil ports, options **D**-**Y**

11 SERVOCYLINDERS TROUBLESHOOTING

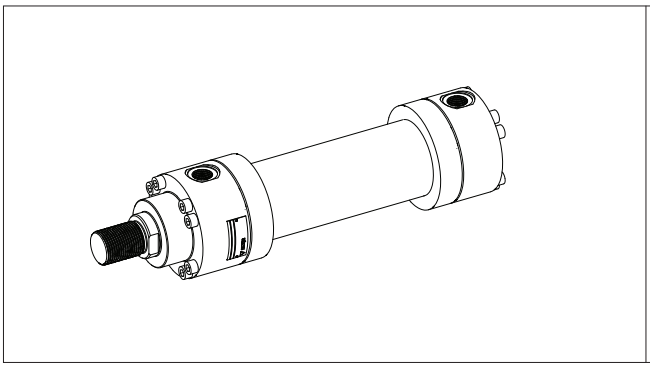
TROUBLE	POSSIBLE CAUSES	SOLUTIONS
Transducer malfunctioning / failure	Improper electronic connections may involve the transducer malfunctioning	Check the electronic connections scheme in tech table **B310**
	Not stabilized power supply may involve dangerous peak of voltage	Install a voltage stabilizer
	Uncontrolled disconnection and connection of plug-in connectors may damage the transducer	Be carefull to switch off the power supply before connecting the position transducer

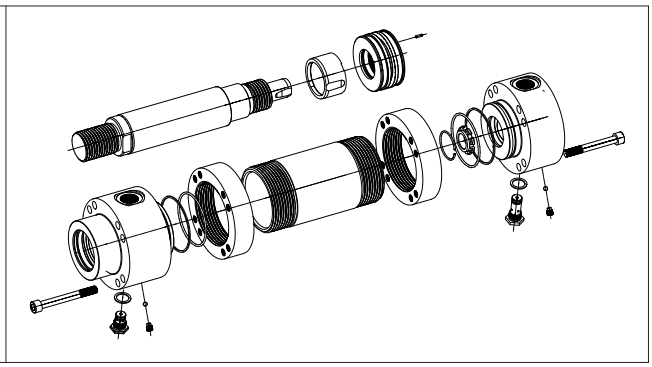
Note: for cylinders troubleshooting refer to section 10

Operating and maintenance information

for stainless steel cylinders

These operating and maintenance information are valid only for Atos hydraulic cylinders and are intended to provide useful guidelines to avoid risks when hydraulic cylinders are installed in a machine or a system. Information and notes on the transport and storage of hydraulic cylinders are also provided.
These norms must be strictly observed to avoid damages and ensure trouble-free operation. The respect of these operating and maintenance information ensures an increased working life and thus reduced repairing cost of the hydraulic cylinders and system.





1 SYMBOLS CONVENTIONS

⚠ This symbol refers to possible danger which can cause serious injuries

2 GENERAL NOTES

The cylinder operating and maintenance information are part of the operating instructions for the complete machine but they cannot replace them

Atos is not liable for damages resulting from an incorrect observance of these instructions.
All the hydraulic cylinders have 1 year warranty; the expiration of warranty results from the following operations:
- Unauthorised mechanical or electronic interventions
- The hydraulic cylinders are not used exclusively for their intended purpose as defined in these operating and maintenance instructions

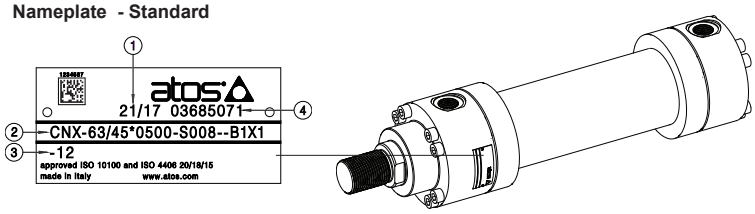
3 WORKING CONDITIONS

⚠ **The operation of hydraulic cylinders is not permitted at different operating and environmental conditions than those specified below**

Description	CNX
Ambient temperature	-20 ÷ +120°C
Fluid temperature	-20 ÷ +120°C
Max surface temperature	-
Max working pressure	10 MPa (100 bar)
Max pressure	15 MPa (150 bar)
Max frequency	5 Hz
Max speed	4 m/s
Recommended viscosity	15 ÷ 100 mm²/s
Max fluid contamination level	ISO4406 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog

4 NAMEPLATES

Nameplate - Standard



Nameplate - Standard (1)

Pos.	Description
①	Delivery date
②	Cylinder code
③	Series number
④	Customer code (only if requested)

Notes: (1) The position of the nameplate on the rear or front heads can change due to the cylinder overall dimensions

5 SAFETY NOTES

5.1 General

- The presence of cushioning can lead to a peak of pressure that can reduce the cylinder working life, ensure that the dissipated energy is less than the max value reported in **tab. B015**
- Make sure that the maximum working conditions, shown in section 3, are not exceeded
- Ensure to use hydraulic fluids compatible with the selected sealing system, see **tab. BW500**
- The rod must be handled with care to prevent damages on the surface coating which can deteriorate the sealing system and lead to the corrosion of the basic material
- The mounting screws must be free from shearing stress
- Transverse forces on the rods must always be avoided
- When the cylinder has to drive a rotating structure or where little alignment errors are expected, mounting style with spherical bearing should be used
- Contact surfaces, support elements in tolerance, elastic materials and labels must be covered before painting the cylinder

5.2 Position measuring system

- Position transducers must never be removed, if not otherwise specified in **tab. B310**, while the cylinder is under pressure
- Observe the information provided in **tab. B310** for the electronic connections
- The connectors must never be plugged or unplugged when the power supply is switched-on

5.3 Installation

- Consult **tab. P002** for installation, commissioning and maintenance of electrohydraulic system
- The piping have to be dimensioned according to the max pressure and max flow rate required
- All pipes and surfaces must be cleaned from dirt before mounting
- Remove all plug screws and covers before mounting
- Make sure that connections are sealed before giving pressure to the system
- Ensure to not exchange the pipe ports when connecting the cylinders
- Bleed-off the system or the hydraulic cylinder using the proper device, see the technical data sheet for details
- Ensure that the cylinder mounting allow easy of acces for the purpose of maintenance and the adjustment of cushioning

6 MAINTENANCE

⚠ **Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics**

6.1 Preliminary check and ordinary maintenance

Atos hydraulic cylinders don't require any maintenance after commissioning. Anyway it is recommended to take into account the following remarks:

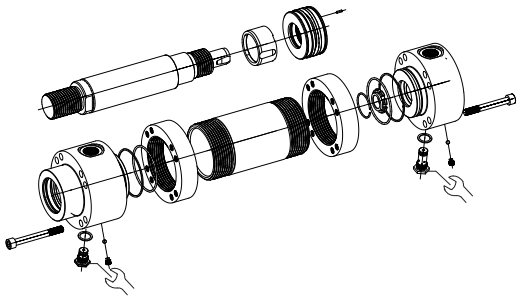
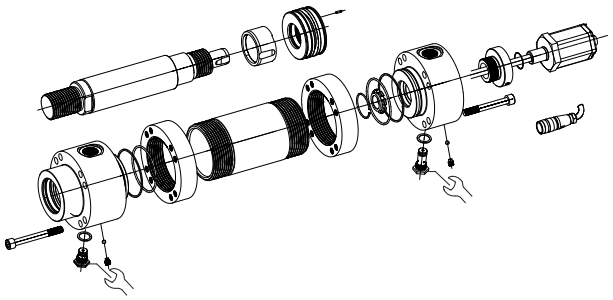
- Results of maintenance and inspection must be planned and documented
- Check oil escaping from oil ports or leakages at the cylinder heads
- Check for damages of the chromeplated surface of the rod: damages may indicate oil contamination or the presence of excessive transverse load
- Determine lubricating intervals for spherical clevises, trunnion and all parts not self-lubricated
- The rod should always be retracted during long stop of the machine or system
- Remove any salt, machining residuals or other dirt cumulated on the rod surface
- Follow the maintenance instructions of the fluid manufacturer

6.2 Repairing

Before beginning any repairing observe the following guidelines:

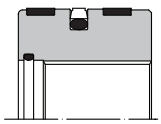
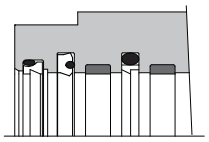
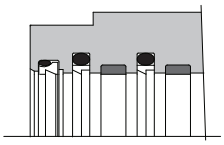
- Unauthorized opening of the cylinder during the warranty period results in the warranty expiration
- Be sure to use only original spare parts manufactured or supplied by Atos
- Provide all the required tools to make the repair operations safely and not damage the components
- Read and follow all the safety notes given in section 5
- Ensure that the cylinder is well locked before beginning any operation
- Disassembly or assembly the cylinder with the right order as indicated in section **6.3**
- When mounting rod or piston guides and seals observe the correct position as indicated in section **6.4**. Any bad positioning can result in oil leakages
- It is strongly recommended the use of expanding sleeves to insert the seals in the proper groove
- Tighten all the screws or nuts as follow: lubricates the threads, insert the screw or the nut by hand for some turns, tighten the screw crosswise with the tightening torque specified in the technical table (a pneumatic screw driver may be used)
- Rod bearing and piston must be locked respectively to the front head and to the rod by means of special pin to avoid unscrewing
- The replacement of wear parts such as seals, rod bearing and guide rings depends on the operating conditions, temperature and quality of the fluid

6.3 Cylinders exploded views

CNX - For spare parts contact our technical office	**CNX* -** For spare parts contact our technical office
	

Note: this symbol means that a particular equipment is required for mounting, contact our technical office

6.4 Sealing system mounting

PISTON	**ROD BEARING**	
		
G3-G5-G8	G8	G3-G5

7 TRANSPORT AND STORAGE

7.1 Transport

Observe the following guidelines for transport of hydraulic cylinders:
- Cylinders have to be transported using a forklift truck or a lifting gear always ensuring a stable position of the cylinder
- Cylinders have to be transported in horizontal position in their original packaging
- Use soft lifting belts to move or lift the cylinders in order to avoid damages
- Before any movement check the cylinders weight (due to tolerances, the weight may be 10% greater than the values specified in the technical table)

⚠ **Additional parts such as pipes, subplates and transducers must never be used for lifting**

7.2 Storage

Corrosion protection is achieved with alkyd primer painting RAL 9007: the primer grants a storage period up to 12 months. Additionally all cylinders are tested with mineral oil OSO 46; the oil film, presents in the cylinder chambers after testing, ensures the internal corrosion protection.
Anyway be care to observe the following remarks:
- When a storage in the open air is foreseen ensure that cylinders are well protected against water
- The cylinders must be inspected at least once a year and rotated through 90° every six months to preserve the seals

⚠ **In case of storage period longer than 12 months, contact our technical office**

8 CYLINDERS TROUBLESHOOTING

TROUBLE	POSSIBLE CAUSES	SOLUTIONS
Oil leakage	High lateral loads involve a premature wear of the bronze bushing, seals and wear rings	a) Improve the precision of the machine alignment b) Decrease lateral loads c) Install a pivoted mounting style **D**-**S**-**L**
	Fluid contaminants produce scratch and score marks on the seals	Check the fluid contamination class is < 20/18/15
	Chemical attack cause the deterioration of seals compound	Check seals compatibility with operating fluid
	High temperatures (fluid/ambient) the seals dark and flaked	a) Decrease the fluid temperature b) Install **G3** sealings for high temperatures
	Low temperature (ambient) make the seals brittle	Move the cylinder in a higher temperature zone
	High rod speed reduce the lubricant capacity of the seals	For rod speed > 5 m/s Install **G3**-**G5** seals
	Output rod speed higher than the input one	Check the rod speed ratio in/out complies with the minimum R_{min} value, see tech.table **B015**
	The pressurization of the mixture air/mineral oil may involve self combustion dangerous for the seals (Diesel effect)	Bleed off completely the air inside the hydraulic circuit
Wiper or seal extrusion	Overpressure	a) Limit the pressure of the system b) Install **G3**-**G5** seals if overpressure cannot be reduced
	Rod seals leakages may involve overpressures among wiper and rod seal, causing their extrusion	See possible causes and solutions for oil leakage troubles
Lose of cushioning effect	Rod speed too low at end stroke	Check the cushioning adjustment is not fully open, regulate it if necessary
	Cushioning adjustment cartridge with improper regulation	Close the cushioning adjustment screw till restoring the cushioning effect
	Fluid contaminants produce scratch and score marks on the cushioning piston	Check the fluid contamination class is < 20/18/15
Rod locked or impossible to move	Overpressure in the cushioning chamber could involve the cushioning piston locking	a) Replace "fixed" cushioning **7**-**9** with "adjustable" cushioning **1**-**3** b) For adjustable cushioning, open the cushioning adjustment to decrease the max pressure inside the cushioning chamber c) Check the energy dissipated by the cushioning is lower than max energy dissipable, see tech.table **B015**
	Fluid contaminants may lock the piston because of its tight tolerances	Check the fluid contamination class is < 20/18/15
Rod failure	Overload/overpressure involves ductile rod failure	a) Check the overpressure inside the cylinder and decrease it b) Check the compliance with the admitted operating pressure according to the cylinder series
	High load/pressure coupled to high frequencies or long life expectation involves fatigue rod failure	a) Check the expected rod fatigue working life proposed in tech. table **B015** b) Decrease the operating pressure
Rod vibration	Seals with excessive friction could involve rod vibration and noise	Install low friction PTFE seals **G3**-**G5**
	Air in the circuit may involve a jerky motion of the rod	Bleed off completely the air inside the hydraulic circuit
Rod motion without oil pressure	Variations in the fluid temperature involve the fluid expansion / compression thus the rod moving	a) Decrease the temperature variations in the oil b) Change the fluid type to decrease the coefficient of thermal expansion
	Excessive oil leakage from the piston or rod seals	See likely causes and solutions for oil leakage troubles
Noisy cylinder	Impact of the piston with the heads caused by high speed (>0,05 m/s)	a) Decrease the rod speed b) Install external or internal cushioning system **1**-**9**, see tech.table **B015** for the max energy that can be dissipated
	Fluid contaminants, foreign particles inside the cylinder may generate unusual noise	Check the fluid contamination class is < 20/18/15
	High oil flow speed > 6 m/s	Increase the piping diameters to reduce the oil flow speed

9 SERVOCYLINDERS TROUBLESHOOTING

TROUBLE	POSSIBLE CAUSES	SOLUTIONS
Transducer malfunctioning / failure	Improper electronic connections may involve the transducer malfunctioning	Check the electronic connections scheme in tech table **B310**
	Not stabilized power supply may involve dangerous peak of voltage	Install a voltage stabilizer
	Uncontrolled disconnection and connection of plug-in connectors may damage the transducer	Be carefull to switch off the power supply before connecting the position transducer

Note: for cylinders troubleshooting refer to section 8

Worldwide Sales Organization

A sales network with 25 branches, 120 sales professionals and distributors in more than 80 countries, together with great responsiveness and focus on customers

Atos spa
Italy - 21018 Sesto Calende
Phone +39 0331 922078
info@atos.com
www.atos.com

Atos Cylinders Division
Italy - 41122 Modena
infocylinder@atos.com

atos
the smart electrohydraulics