HARLEX

Hydraulic cylinder, mill type

Series CDH3 / CGH3 / CSH3

Features

- 6 types of mounting
- Piston Ø (**ØAL**): 40 to 320 mm
- Piston rod Ø (**ØMM**): 28 to 220 mm
- Stroke lengths to 6 m

Technical data (For applications outside these parameters, please consult us!)

Standards:
standard; main dimensions like piston Ø and piston rod Ø correspond to ISO 3320.

Nominal pressure: 350 bar

Static test pressure: 525 bar
Reduced test pressure: 315 bar
Higher operating pressures upon request
The specified operating pressures apply to applications with shock-free operation with regard to excess pressure and/or external loads. With extreme loads like e.g. high cycle sequence, mounting elements and threaded piston rod connections must be designed for durability.

Minimum pressure:
Depending on the application, a certain minimum pressure is required in order to guarantee good functioning of the cylinder. Without load, a minimum pressure of 10 bar is recommended for differential cylinders; for lower pressures as well as double-acting cylinders, please contact us.

Installation position: Any

Hydraulic fluid:
Mineral oils DIN 51524 HL, HLP
Oil-in-water emulsion HFA
Water glycol HFC
Phosphate ester HFD-R
Polyol ester HFD-U

Hydraulic fluid temperature range: See page 62

Ambient temperature range: See page 62

Optimum viscosity range: 20 to 100 mm^2/s

Minimum admissible viscosity: 12 mm^2/s

Maximum admissible viscosity: 380 mm^2/s

Cleanliness class according to ISO
Maximum admissible degree of contamination of the hydraulic fluid according to ISO 4406 (c) class 20/18/15.
The cleanliness classes specified for the components need to be met in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components

Bleeding by default: Secured against screwing out

Primer coat: By default, hydraulic cylinders are primed with a coating (color gentian blue RAL 5010) of min. 40 µm. Other colors upon request.
With cylinders and attachment parts, the following surfaces are not primed or painted:
- All fit diameters to the customer side
- Sealing surfaces for line connection
- Sealing surfaces for flange connection
- Connection surfaces for valve mounting
- Inductive proximity switches
- Position measurement system

The surfaces that are not painted are protected by means of a corrosion protection agent (MULTICOR LF 80).
In the online order system, more painting systems can be selected. These systems are not displayed via the type key and not automatically considered when ordering replacement cylinders. Accessories that are ordered as separate order item are not primed or painted by default. Corresponding priming and/or painting on request.

Stroke velocity: Please observe the guideline on max. stroke velocities (with recommended flow velocity of 5 m/s in the line connection) in the table. Higher stroke velocities on request.
If the extension velocity is considerably higher than the retraction velocity of the piston rod, drag-out losses of the medium may result. If necessary, please consult us.

Piston Ø (mm)	Line connection	Max. stroke velocity in m/s
40	G1/2	0,31
50	G1/2	0,20
63	G3/4	0,28
80	G3/4	0,18
100	G1	0,20
125	G1 1/4	0,20
140	G1 1/4	0,16
160	G1 1/2	0,18
180	G1 1/2	0,14
200	G1 1/2	0,11
220	G1 1/2	0,09
250	G1 1/2	0,07
280	G1 1/2	0,06
320	G1 1/2	0,04

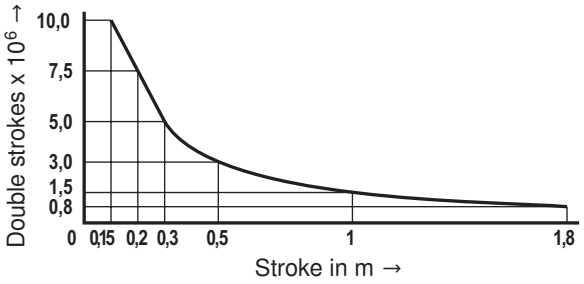
Technical data (For applications outside these parameters, please consult us!)

Boundary and application conditions:

- The mechanical alignment of the movement axis and thus the mounting points of hydraulic cylinder and piston rod must be ensured. Lateral forces on the guides of piston rod and piston are to be avoided. It may be necessary to consider the own weight of the hydraulic cylinder (MP3/MP5 or MT4) or the piston rod.
- The buckling length/buckling load of the piston rod and/or the hydraulic cylinder must be observed (see page topic Buckling).
- The maximum admissible stroke velocities with regard to the suitability/load of seals must be observed as must their compatibility with the properties of the fluid type (see page topic Seals).
- The maximum admissible velocities/kinetic energies when moving into the end positions, also considering external loads, must be observed.
  Danger: Excess pressure
- The maximum admissible operating pressure must be complied with in any operating state of the hydraulic cylinder. Possible pressure intensification resulting from the area ratio of annulus to piston area and possible throttling points are to be observed.
- Detrimental environmental influences, like e.g. aggressive finest particles, vapors, high temperatures, etc. as well as contaminations and deterioration of the hydraulic fluid are to be avoided.

Notice: This list does not claim to be complete. In case of questions regarding the compatibility with media or exceedance of the boundary or application conditions, please contact us.

Life cycle:
cylinders correspond to the reliability recommenda-tions for industrial applications.
≥ 10000000 double strokes in idle continuos operation or 3000 km piston travel at 70 % of the maximum operating pressure, without load on the piston rod, with a maximum velocity of 0.5 m/s, with a failure rate of less than 5 %.



Acceptance:
Each cylinder is tested according to standard and in compliance with ISO 10100: 2001.

Safety instructions:
For the assembly, commissioning and maintenance of hydraulic cylinders, the operating instructions have to be observed!
Service and repair works have to be performed by or by purpose. No warranty is accepted for damage as a conse-quence of assembly, maintenance or repair works not per-formed.

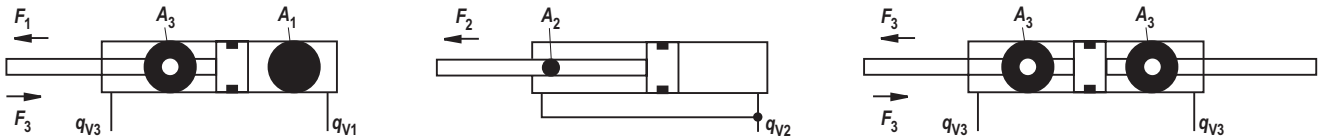
Check lists for hydraulic cylinders:
Cylinders the characteristics and/or application parameters of which deviate from the values specified in the data sheet can only be offered as special version upon request. For offers, the deviations of the characteristics and/or application param-eters must be described in the check lists for hydraulic cylin-ders

Project planning software ICS (Interactive Catalog System)

The ICS (Interactive Catalog System) is a selection and project planning help for hydraulic cylinders. The ICS allows designers for machines and systems to quickly and reliably find the perfect hydraulic cylinder solution through logic-guided type key enquiries. This software helps to solve design and project planning tasks more quickly and efficiently. After having been guided through the product selection, the user quickly and reliably gets the exact technical data of the selected components as well as 2D and 3D CAD data in the correct file format for all common CAD systems.
This allows users to reduce costs while increasing their competitiveness.

Diameters, areas, forces, flow

Piston	Piston rod	Area ratio	Areas			Force at 350 bar [1]			Flow at 0.1 m/s [2]			Max. available stroke length
			Piston	Rod	Ring	Pressure	Diff.	Pulling	Off	Diff.	On	
ØAL mm	**ØMM** mm	φ A_1/A_3	A_1 cm²	A_2 cm²	A_3 cm²	F_1 kN	F_2 kN	F_3 kN	q_{V1} l/min	q_{V2} l/min	q_{V3} l/min	mm
40	**28**	1,96	12,56	6,16	6,40	43,96	21,56	22,40	7,5	3,7	3,8	2000
50	**36**	2,08	19,63	10,18	9,45	68,71	35,63	33,08	11,8	6,1	5,7	2000
63	**45**	2,04	31,17	15,90	15,27	109,10	55,65	53,45	18,7	9,5	9,2	2000
80	**56**	1,96	50,26	24,63	25,63	175,91	86,21	89,71	30,2	14,8	15,4	2000
100	**70**	1,96	78,54	38,48	40,06	274,89	134,68	140,21	47,1	23,1	24,0	3000
125	**90**	2,08	122,72	63,62	59,10	429,52	222,67	206,85	73,6	38,2	35,4	3000
140	**100**	2,04	153,94	78,54	75,40	538,79	274,89	263,90	92,4	47,1	45,3	3000
160	**110**	1,90	201,06	95,06	106,00	703,71	332,71	371,00	120,6	57,0	63,6	3000
180	**125**	1,93	254,47	122,72	131,75	890,65	429,52	461,13	152,7	73,6	79,1	3000
200	**140**	1,96	314,16	153,96	160,20	1099,56	538,86	560,70	188,5	92,4	96,1	3000
220	**160**	2,12	380,1	201,0	179,1	1330,5	703,7	626,8	228,1	120,7	107,4	6000
250	**180**	2,08	490,8	254,4	236,4	1718,1	890,6	827,4	294,5	152,7	141,8	6000
280	**200**	2,04	615,7	314,1	301,6	2155,1	1099,6	1055,6	369,4	188,5	180,9	6000
320	**220**	1,90	804,2	380,1	424,2	2814,9	1330,5	1484,4	482,5	228,1	254,4	6000



[1] Theoretical static cylinder force (without consideration of the efficiency and admissible load for attachment parts like e.g. self-aligning clevises, plates or valves, etc.)

[2] Stroke velocity

Tolerances according to ISO 6020-1

Installation dimensions	WC	XC[2]	XO[2]	XS[1], [2]	XV[2]	ZP[2]	
Type of mounting	MF3	MP3	MP5	MS2	MT4	MF4	
Stroke length	Tolerances						Stroke tolerances
≤ 1250	±2	±1,5	±1,5	±2	±2	±1,5	+2
> 1250 – ≤ 3150	±4	±3	±3	±4	±4	±3	+5
> 3150 – ≤ 6000	±8	±5	±5	±8	±8	±5	+8

[1] Not standardized

[2] Including stroke length

Overview of types of mounting: Series CDH3 and CGH3

CDH3 MP3

see page 10, 11

CDH3 MP5

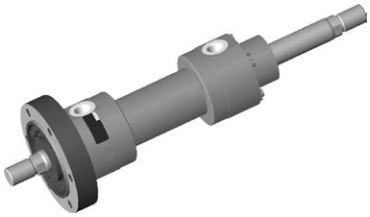
see page 12, 13

CDH3 MF3

see page 14, 15

CGH3 MF3

see page 14, 15



CDH3 MF4

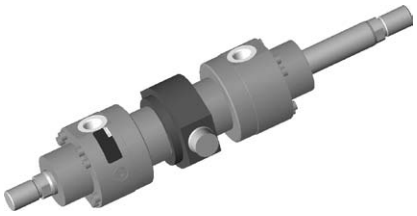
see page 16, 17

CDH3 MT4

see page 18, 19

CGH3 MT4

see page 18, 19

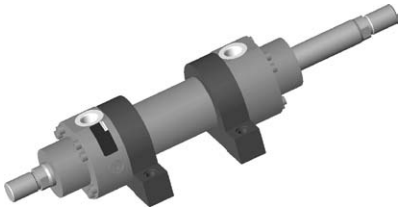


CDH3 MS2

see page 20, 21

CGH3 MS2

see page 20, 21



Ordering code series CDH3

CD	H3	/	/	/	A	3X	/							

Differential cylinder = CD

Series = H3

Types of mounting
- Swivel eye at base [1] = MP3
- Self-aligning clevis at base = MP5
- Round flange at head = MF3
- Round flange at base = MF4
- Trunnion [2] = MT4
- Foot mounting = MS2

Piston Ø (ØAL) 40 to 320 mm

Piston rod Ø (ØMM) 28 to 220 mm

Stroke length in mm [3]

Design principle
- Head and base flanged = A

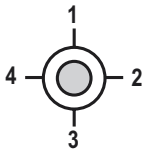
Component series
- 30 to 39 Unchanged installation and connection dimensions = 3X

Line connection / version
- According to ISO 1179-1 (pipe thread ISO 228-1) = B
- According to ISO 9974-1 (metric thread ISO 261) = M
- Flange porting pattern according to ISO 6162-2 tab. 2 type 1 (≙ SAE 6000 PSI) [4] [25] = D
- Flange porting pattern according to ISO 6164 tab. 2 [4] = H
- According to ISO 1179-1 (pipe thread ISO 228-1) with flat pipe flange [31] = C

For directional and high-response valves
- Subplate size 6 [4] [5] [27] = P
- Subplate size 10 [4] [6] [27] = T
- Subplate size 16 [4] [7] [27] = U
- Subplate size 25 [4] [8] [27] = V

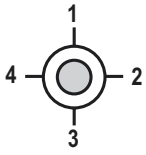
For SL and SV valves
- Subplate size 6 [4] [5] [15] [27] = A
- Subplate size 10 [4] [6] [15] [27] = E
- Subplate size 20 [4] [7] [15] [27] = L
- Subplate size 30 [4] [8] [15] [27] = N

Line connection/position at head
View to piston rod



- [30] = 1
- [30] = 2
- [30] = 3
- [30] = 4

Line connection/position at base
View to piston rod



- [30] = 1
- [30] [34] = 2
- [30] = 3
- [30] [34] = 4

Piston rod design
- Hard chromium-plated = C
- Hardened and hard chromium-plated [24] = H
- Nickel-plated and hard chromium-plated [24] = N

Piston rod end
- A = Thread for self-aligning clevis CGAS
- G = [26] Thread for self-aligning clevis CGA, CGAK, plain clevis CSA
- S = With mounted self-aligning clevis CGAS
- L = [26] With mounted self-aligning clevis CGA
- M = [26] With mounted self-aligning clevis CGAK
- N = [1] With mounted plain clevis CSA

End position cushioning
- U = Without
- D = [1] On both sides, self-adjusting
- E = On both sides, adjustable

Seal design

For mineral oil HL, HLP and HFA
- M = Standard seal system
- L = Standard seal system with guide rings
- R = Reduced friction heavy industry

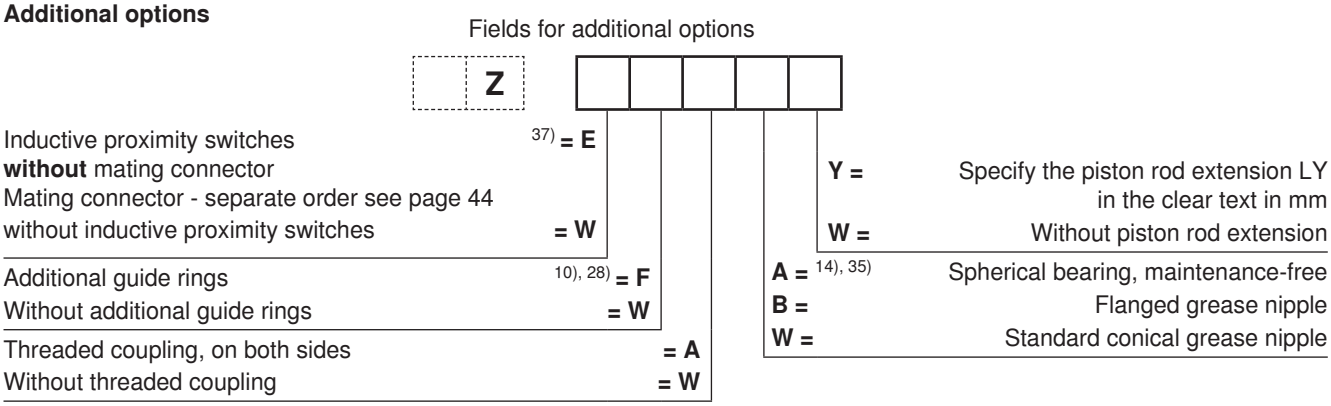
For mineral oil HL, HLP, HFA and water glycol HFC
- G = [27] Standard seal system HFC
- T = Servo quality/ reduced friction
- A = Chevron seal kits

For phosphate ester HFD-R and polyol ester HFD-U
- S = Servo quality/ reduced friction
- V = [27] Standard seal system FKM
- B = Chevron seal kits

Option
- Z = Additional options, fill fields for additional options
- W = Without additional options, do **not** fill fields for additional options

Ordering code series CDH3

Additional options



Order examples:

Without additional options: **CDH3MP5/100/56/300A3X/B11CADMW**

With additional options: **CDH3MP5/100/56/300A3X/B11CADMZ EWABW**

1) Only piston Ø 40 to 200 mm
2) Trunnion position freely selectable. When ordering, always specify the „XV“ dimension in the clear text in mm
3) Max. available stroke length page 4 and admissible stroke length (acc. to buckling calculation) observe pages 56 to 58
4) Not possible with MF4
5) Piston Ø 40 to 80 mm, only position 11, subplates only possible in combination with line connection „B“ at the head
6) Piston Ø 63 to 200 mm, only position 11, subplates only possible in combination with line connection „B“ at the head
7) Piston Ø 125 to 200 mm, only position 11, subplates only possible in combination with line connection „B“ at the head
10) Seal design A, B not possible; piston Ø 220 to 320 mm standard
13) Not with piston Ø 320 mm
14) Not possible with piston rod end „N“
15) Subplates for SL and SV valves (isolator valves) Note: Seal designs T, G, L, R, S and V are not designed for the static holding function!
24) Only piston rod Ø 28 to 140 mm
25) Only piston Ø 63 to 320 mm
26) Only piston Ø 40 to 250 mm
27) Maximum operating pressure 315 bar
28) With seal design „L“ standard
30) All graphical presentations in the data sheet show position 1
31) With MS2, only position 11 is possible
34) With MF4 and line connection B, M or C not possible
35) Not possible with MP3
37) Min. stroke length = 20 mm

Ordering code series CGH3

CG	H3		/	/	/	A	3X	/								

Double-acting cylinder [18] = CG

Series = H3

Types of mounting
- Round flange at head = MF3
- Trunnion [2] = MT4
- Foot mounting = MS2

Piston Ø (ØAL) 40 to 320 mm

Piston rod Ø (ØMM) 28 to 220 mm

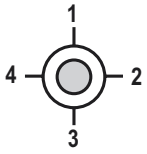
Stroke length in mm [3]

Design principle
- Head and base flanged = A

Component series
- 30 to 39 Unchanged installation and connection dimensions = 3X

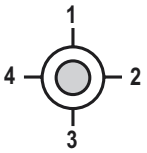
Line connection / version
- According to ISO 1179-1 (pipe thread ISO 228-1) = B
- According to ISO 9974-1 (metric thread ISO 261) = M
- Flange porting pattern according to ISO 6162-2 tab. 2 type 1 (SAE 6000 PSI) [25] = D
- Flange porting pattern according to ISO 6164 tab. 2 = H
- According to ISO 1179-1 (pipe thread ISO 228-1) with flat pipe flange [31] = C

Line connection/position at head
View to piston rod



- [30] = 1
- [30] = 2
- [30] = 3
- [30] = 4

Line connection/position at base
View to piston rod



- [30] = 1
- [30] = 2
- [30] = 3
- [30] = 4

Piston rod design
- Hard chromium-plated [36] = C
- Hardened and hard chromium-plated [24] = H
- Nickel-plated and hard chromium-plated [19] = N

Option
- Z = Additional options, fill fields for additional options
- W = Without additional options, do **not** fill fields for additional options

Seal design

For mineral oil HL, HLP and HFA
- M = Standard seal system
- L = Standard seal system with guide rings
- R = Reduced friction heavy industry

For mineral oil HL, HLP, HFA and water glycol HFC
- G = [27] Standard seal system HFC
- T = Servo quality/ reduced friction
- A = Chevron seal kits

For phosphate ester HFD-R and polyol ester HFD-U
- S = Servo quality/ reduced friction
- V = [27] Standard seal system FKM
- B = Chevron seal kits

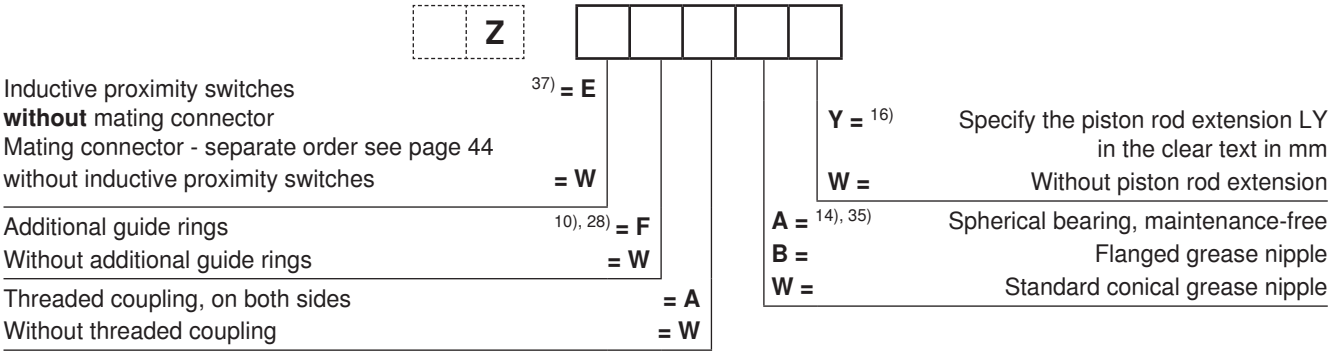
End position cushioning
- U = Without
- D = [1] On both sides, self-adjusting
- E = On both sides, adjustable

Piston rod end
- A = Thread for plain clevis CGAS
- G = [26] Thread for self-aligning clevis CGA, CGAK, plain clevis CSA
- S = [26] [17] With mounted self-aligning clevis CGAS
- L = [26] [17] With mounted self-aligning clevis CGA
- M = [26] [17] With mounted self-aligning clevis CGAK
- N = [1] [17] With mounted plain clevis CSA

Ordering code series CGH3

Additional options

Fields for additional options



Order examples:

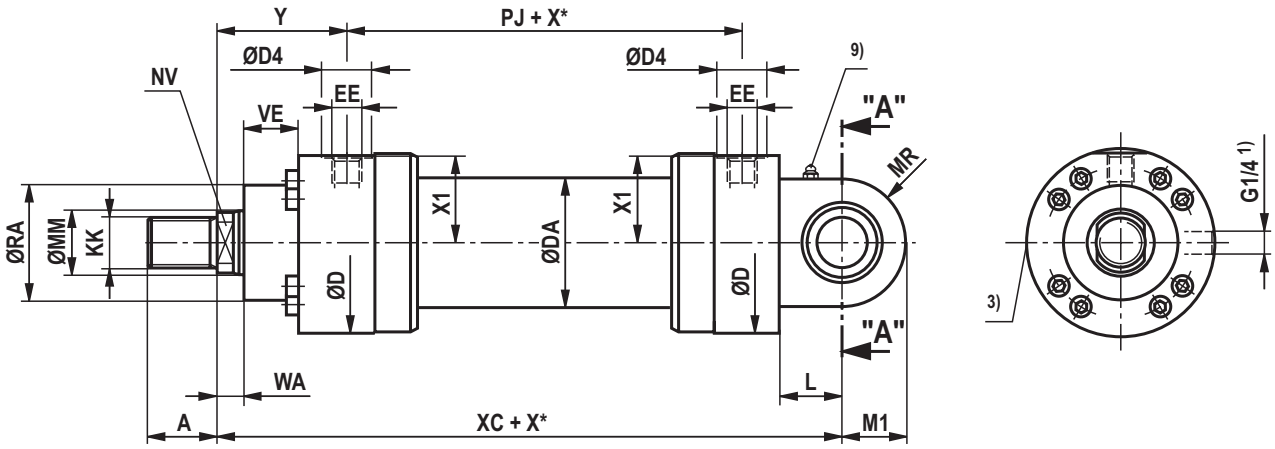
Without additional options: **CGH3MF3/100/56/300A3X/B11CADMW**

With additional options: **CGH3MF3/100/56/300A3X/B11CADMZ EWABW**

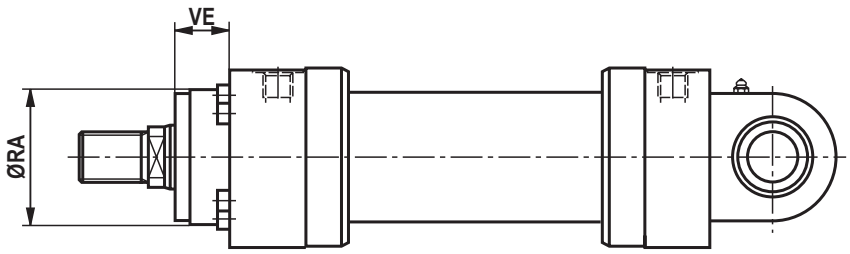
1) Only piston Ø 40 to 200 mm
2) Trunnion position freely selectable. When ordering, always specify the „XV“ dimension in the clear text in mm
3) Max. available stroke length page 4 and admissible stroke length (acc. to buckling calculation) observe pages 56 to 58
10) Seal design A, B not possible; piston Ø 220 to 320 mm standard
14) Not possible with piston rod end „N“
16) Only at left piston rod side (orientation: Catalog figures)
17) Only one plain clevis / self-aligning clevis mounted, left piston rod side (orientation: Catalog figures))
18) Not standardized
19) Only piston rod Ø 28 and 36 mm
24) Only piston rod Ø 28 to 140 mm
25) Only piston Ø 63 to 320 mm
26) Only piston Ø 40 to 250 mm
27) Maximum operating pressure 315 bar
28) With seal design „L“ standard
30) All graphical presentations in the data sheet show position 1
31) With MS2, only position 11 is possible
35) Not possible with MP3
36) Not possible with piston rod Ø 45 to 140 mm
37) Min. stroke length = 20 mm

Swivel eye at base CDH3: MP3

CDH3 MP3; 40 to 200 mm



CDH3 MP3: With seal design “A”, “B” and ØAL 160 to 200 mm



Dimensions CDH3: MP3 (dimensions in mm)

ØAL	ØMM	KK 5)	A 5)	KK 6)	A 6)	NV	ØD	ØDA	ØD4 2)	EE 4)	EE 4)	Y	PJ	X1	WA
40	**28**	M22x1,5	22	M24x2	35	22	92	52	34	G1/2	M22x1,5	91	120	43	18
50	**36**	M28x1,5	28	M30x2	45	30	108	62	34	G1/2	M22x1,5	90	120	51,5	18
63	**45**	M35x1,5	35	M39x3	55	36	140	78	42	G3/4	M27x2	117	133	67	22
80	**56**	M45x1,5	45	M50x3	75	46	148	100	42	G3/4	M27x2	124	146	71,5	22
100	**70**	M58x1,5	58	M64x3	95	60	186	125	47	G1	M33x2	119	171	90,5	25
125	**90**	M65x1,5	65	M80x3	110	75	235	160	58	G1 1/4	M42x2	170	205	114	32
140	**100**	M80x2	80	M90x3	120	85	258	175	58	G1 1/4	M42x2	186	219	126	35
160	**110**	M100x2	100	M100x3	140	95	292	200	65	G1 1/2	M48x2	210	240	142,5	40
180	**125**	M110x2	110	M110x4	150	110	325	220	65	G1 1/2	M48x2	241	264	159,5	45
200	**140**	M120x3	120	M120x4	160	120	350	245	65	G1 1/2	M48x2	262	278	172,5	45

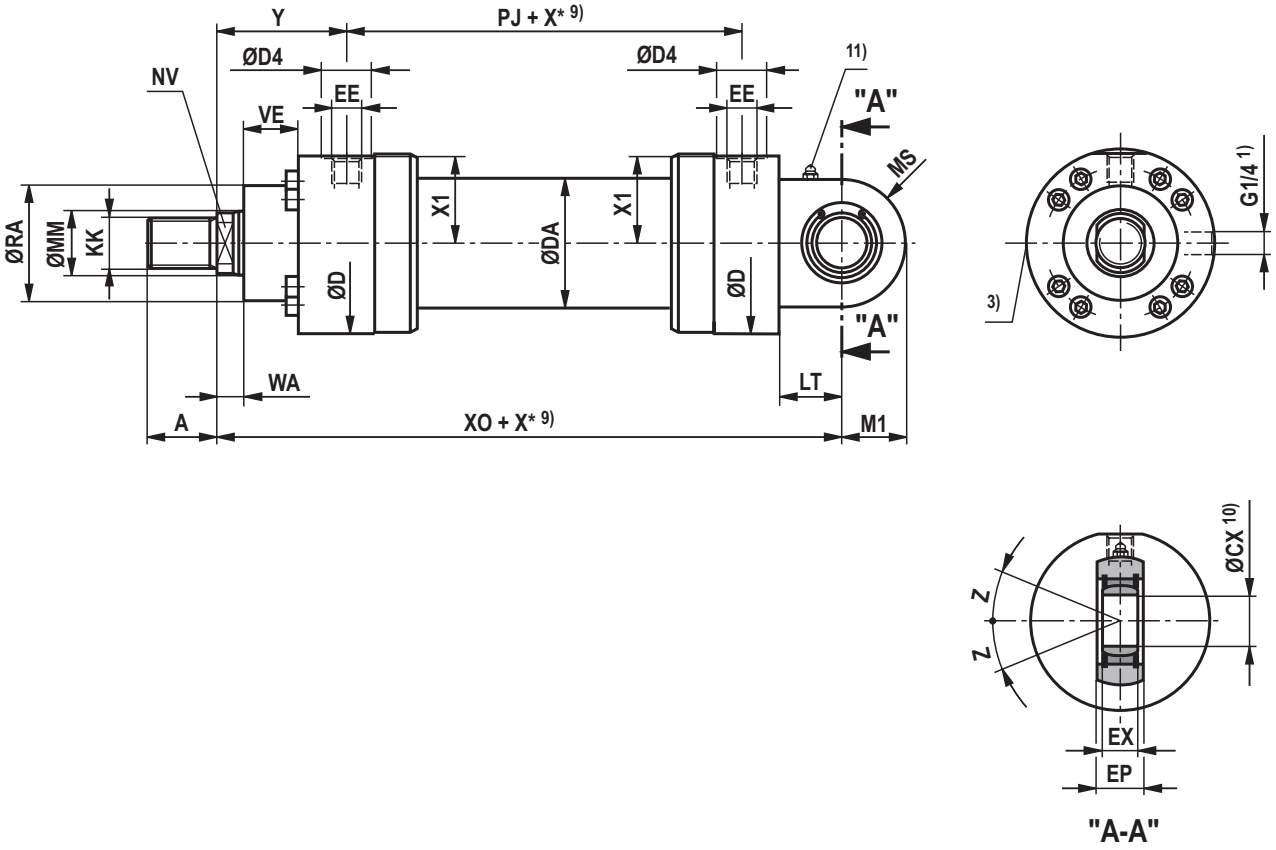
ØAL	ØMM	XC	L	MR	M1	ØCD H11	EW h12	ØRA 7)	VE 7)	ØRA 8)	VE 8)
40	**28**	268	35	36	34	30	28	52	45	52	20
50	**36**	280	45	42	40	35	30	70	47	70	19
63	**45**	330	50	52	50	40	35	88	43	88	13
80	**56**	355	55	65	62,5	50	40	98	53	98	15
100	**70**	390	65	70	70	60	50	120	55	120	17
125	**90**	495	75	82	82	70	55	150	68	150	20
140	**100**	530	80	95	95	80	60	170	75	170	23
160	**110**	600	90	113	113	90	65	200	90	200	90
180	**125**	665	105	125	125	100	70	230	100	230	100
200	**140**	710	115	142,5	142,5	110	80	250	110	250	110

ØAL = Piston Ø
ØMM = Piston rod Ø
X* = Stroke length

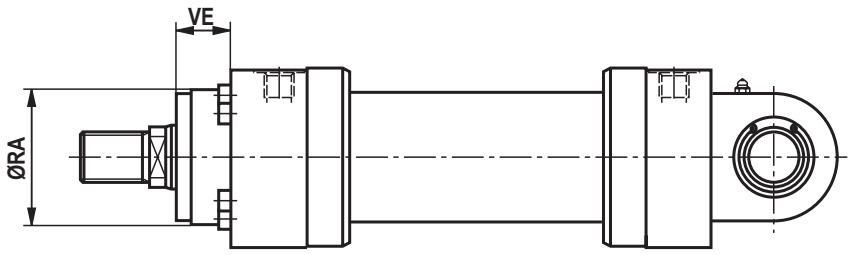
1) Bleeding: With view to the piston rod, the position is offset by 90° in relation to the line connection (clockwise)
2) Ø D4 max. 0,5 mm deep
3) Throttle valve only with end position cushioning „E“ (180° for bleeding)
4) Flange connections see separate table pages 36 and 37
5) Thread design „G”
6) Thread design „A”
7) Dimensions for cylinders with seal design M, T, G, L, R, S and V
8) Dimensions for cylinders with seal design A and B
9) Standard design „W“ grease nipple cone head form A according to DIN 71412

Self-aligning clevis at base CDH3: MP5

CDH3 MP5



CDH3 MP5: With seal design “A”, “B” and ØAL 160 to 320 mm



Dimensions CDH3: MP5 (dimensions in mm)

ØAL	ØMM	KK 5)	A 5)	KK 6)	A 6)	NV	ØD	ØDA	ØD4 2)	EE 4)	EE 4)	Y	PJ	X1	WA	X0	X* min
40	**28**	M22x1,5	22	M24x2	35	22	92	52	34	G1/2	M22x1,5	91	120	43	18	268	–
50	**36**	M28x1,5	28	M30x2	45	30	108	62	34	G1/2	M22x1,5	90	120	51,5	18	280	–
63	**45**	M35x1,5	35	M39x3	55	36	140	78	42	G3/4	M27x2	117	133	67	22	330	–
80	**56**	M45x1,5	45	M50x3	75	46	148	100	42	G3/4	M27x2	124	146	71,5	22	355	–
100	**70**	M58x1,5	58	M64x3	95	60	186	125	47	G1	M33x2	119	171	90,5	25	390	–
125	**90**	M65x1,5	65	M80x3	110	75	235	160	58	G1 1/4	M42x2	170	205	114	32	495	–
140	**100**	M80x2	80	M90x3	120	85	258	175	58	G1 1/4	M42x2	186	219	126	35	530	–
160	**110**	M100x2	100	M100x3	140	95	292	200	65	G1 1/2	M48x2	210	240	142,5	40	600	–
180	**125**	M110x2	110	M110x4	150	110	325	220	65	G1 1/2	M48x2	241	264	159,5	45	665	–
200	**140**	M120x3	120	M120x4	160	120	350	245	65	G1 1/2	M48x2	262	278	172,5	45	710	–
220	**160**	M120x3	120	M120x4	160	140	375	292	65	G1 1/2	M48x2	262	326	185	40	760	–
250	**180**	M130x3	130	M150x4	190	160	440	324	65	G1 1/2	M48x2	272	336	218	40	825	20
280	**200**	–	–	M160x4	200	180	460	368	65	G1 1/2	M48x2	282	366	228	40	895	–
320	**220**	–	–	M180x4	220	200	490	406	65	G1 1/2	M48x2	287	391	243	40	965	340

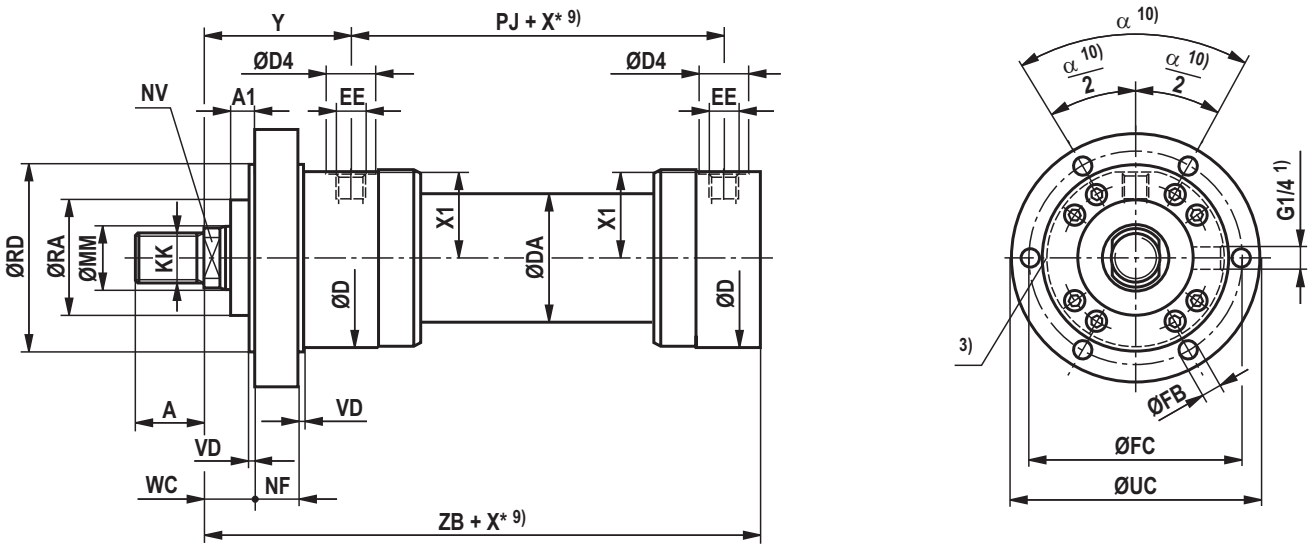
ØAL	ØMM	LT	M1	MS	ØCX	EP -0,4	EX	Z	ØRA 7)	VE 7)	ØRA 8)	VE 8)
40	**28**	35	34	36	$30_{-0,010}$	28	$22_{-0,12}$	6°	52	45	52	20
50	**36**	45	40	42	$35_{-0,012}$	30	$25_{-0,12}$	6°	70	47	70	19
63	**45**	50	50	52	$40_{-0,012}$	35	$28_{-0,12}$	7°	88	43	88	13
80	**56**	55	62,5	65	$50_{-0,012}$	40	$35_{-0,12}$	6°	98	53	98	15
100	**70**	65	70	70	$60_{-0,015}$	50	$44_{-0,15}$	6°	120	55	120	17
125	**90**	75	82	82	$70_{-0,015}$	55	$49_{-0,15}$	6°	150	68	150	20
140	**100**	80	95	95	$80_{-0,015}$	60	$55_{-0,15}$	6°	170	75	170	23
160	**110**	90	113	113	$90_{-0,020}$	65	$60_{-0,20}$	5°	200	90	200	90
180	**125**	105	125	125	$100_{-0,020}$	70	$70_{-0,20}$	7°	230	100	230	100
200	**140**	115	142,5	142,5	$110_{-0,020}$	80	$70_{-0,20}$	6°	250	110	250	110
220	**160**	115	150 12)	140 12)	$110_{-0,020}$	80	$70_{-0,20}$	6°	275	125	275	125
250	**180**	140	188 12)	178 12)	$120_{-0,020}$	90	$85_{-0,20}$	6°	320	135	320	135
280	**200**	170	210 12)	200 12)	$140_{-0,025}$	100	$90_{-0,25}$	7°	335	150	335	150
320	**220**	200	260 12)	250 12)	$160_{-0,025}$	110	$105_{-0,25}$	8°	350	165	350	165

ØAL = Piston Ø
ØMM = Piston rod Ø
X* = Stroke length
X*min = Min. stroke length

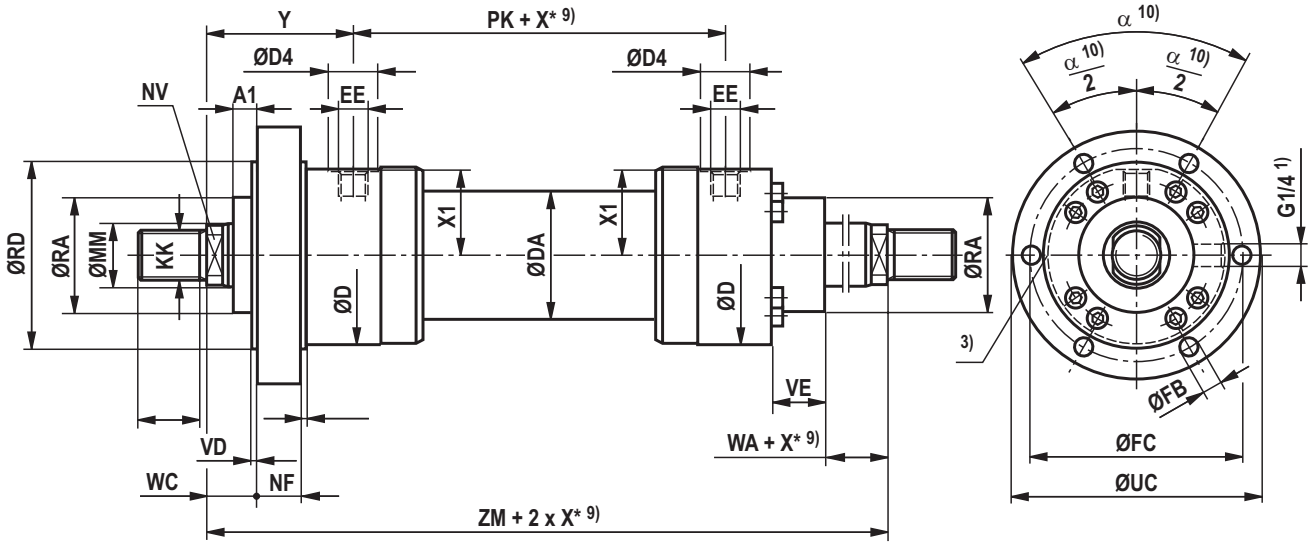
1) Bleeding: With view to the piston rod, the position is offset by 90° in relation to the line connection (clockwise)
2) Ø D4 max. 0,5 mm deep
3) Throttle valve only with end position cushioning „E“ (180° for bleeding)
4) Flange connections see separate table pages 36 and 37
5) Thread design „G”
6) Thread design „A”
7) Dimensions for cylinders with seal design M, T, G, L, R, S and V
8) Dimensions for cylinders with seal design A and B
9) Observe the min. stroke length „X*min“
10) Related bolt Ø m6;
related bolt Ø j6 with maintenance-free spherical bearing
11) Standard design „W“
grease nipple cone head form A according to DIN 71412
12) The specified dimensions are maximum values, tolerance classes 342 according to ISO 9013 Thermal cutting

Round flange at head CDH3/CGH3: MF3

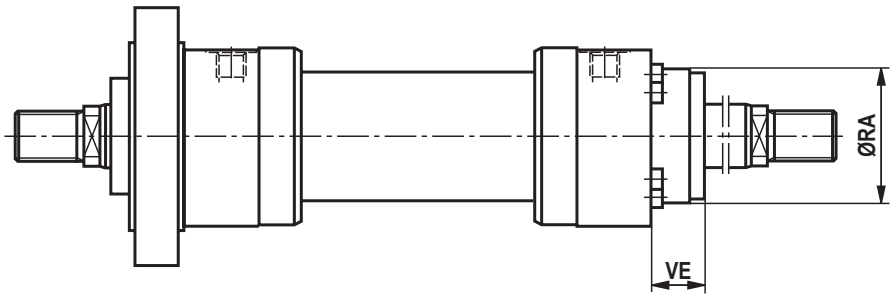
CDH3 MF3



CGH3 MF3



CGH3 MF3: With seal design “A”, “B” and ØAL 160 to 320 mm



Dimensions CDH3/CGH3: MF3 (dimensions in mm)

ØAL	ØMM	KK 5)	A 5)	KK 6)	A 6)	NV	ØD	ØDA	ØD4 2)	EE 4)	EE 4)	Y	PJ	X1	ØRD e8	WC	VD
40	**28**	M22x1,5	22	M24x2	35	22	92	52	34	G1/2	M22x1,5	91	120	43	95	23	5
50	**36**	M28x1,5	28	M30x2	45	30	108	62	34	G1/2	M22x1,5	90	120	51,5	115	20	5
63	**45**	M35x1,5	35	M39x3	55	36	140	78	42	G3/4	M27x2	117	133	67	150	20	5
80	**56**	M45x1,5	45	M50x3	75	46	148	100	42	G3/4	M27x2	124	146	71,5	160	20	5
100	**70**	M58x1,5	58	M64x3	95	60	186	125	47	G1	M33x2	119	171	90,5	200	20	5
125	**90**	M65x1,5	65	M80x3	110	75	235	160	58	G1 1/4	M42x2	170	205	114	245	25	5
140	**100**	M80x2	80	M90x3	120	85	258	175	58	G1 1/4	M42x2	186	219	126	280	30	10
160	**110**	M100x2	100	M100x3	140	95	292	200	65	G1 1/2	M48x2	210	240	142,5	300	40	10
180	**125**	M110x2	110	M110x4	150	110	325	220	65	G1 1/2	M48x2	241	264	159,5	335	40	10
200	**140**	M120x3	120	M120x4	160	120	350	245	65	G1 1/2	M48x2	262	278	172,5	360	40	10
220	**160**	M120x3	120	M120x4	160	140	375	292	65	G1 1/2	M48x2	262	326	185	400	40	10
250	**180**	M130x3	130	M150x4	190	160	440	324	65	G1 1/2	M48x2	272	336	218	450	40	10
280	**200**	–	–	M160x4	200	180	460	368	65	G1 1/2	M48x2	282	366	228	470	50	10
320	**220**	–	–	M180x4	220	200	490	406	65	G1 1/2	M48x2	287	391	243	510	55	10

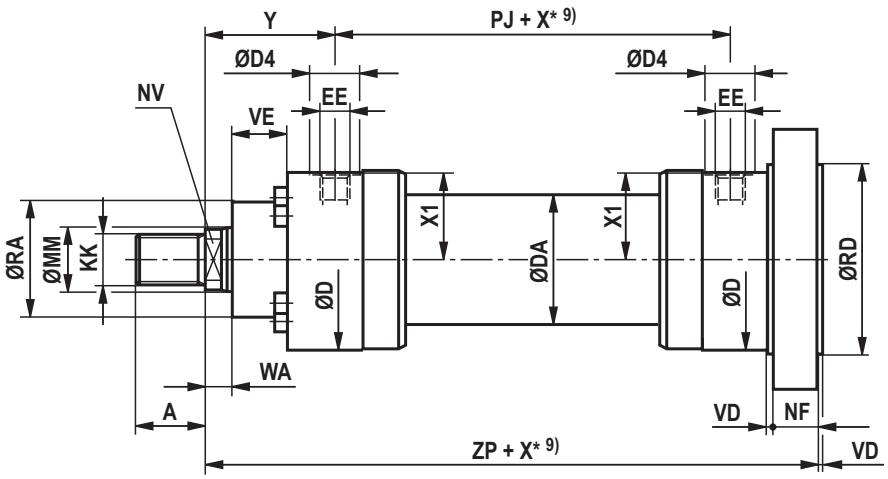
ØAL	ØMM	NF	PK	A1	ZB	ZM	X* min	ØFB H13	ØFC js13	ØUC -1	α	WA	ØRA 7)	VE 7)	ØRA 8)	VE 8)
40	**28**	35	120	0	238	302	–	13,5	120	145	60°	18	52	45	52	20
50	**36**	40	120	0	237	300	–	13,5	140	165	60°	18	70	47	70	19
63	**45**	40	133	0	285	367	–	17,5	180	210	60°	22	88	43	88	13
80	**56**	50	146	0	305	394	–	17,5	195	230	60°	22	98	53	98	15
100	**70**	55	171	0	330	409	–	22	230	270	60°	25	120	55	120	17
125	**90**	70	205	0	425	545	–	26	290	335	60°	32	150	68	150	20
140	**100**	70	219	0	457	591	–	30	330	380	60°	35	170	75	170	23
160	**110**	80	240	0	515	660	–	30	360	420	45°	40	200	90	200	90
180	**125**	95	264	0	565	746	–	36	400	470	45°	45	230	100	230	100
200	**140**	105	278	0	600	802	–	36	430	500	45°	45	250	110	250	110
220	**160**	115	326	20	655	850	–	39	475	550	45°	40	275	125	275	125
250	**180**	125	336	30	695	880	20	45	530	610	45°	40	320	135	320	135
280	**200**	130	366	25	735	930	–	45	550	630	45°	40	335	150	335	150
320	**220**	140	391	25	775	965	340	45	590	670	30°	40	350	165	350	165

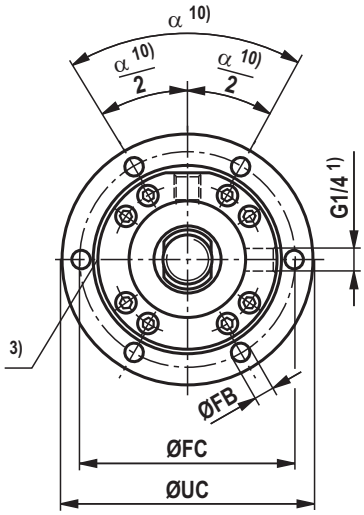
ØAL = Piston Ø
ØMM = Piston rod Ø
X* = Stroke length
X*min = Min. stroke length

1) Bleeding: With view to the piston rod, the position is offset by 90° in relation to the line connection (clockwise)
2) Ø D4 max. 0,5 mm deep
3) Throttle valve only with end position cushioning „E“ (180° for bleeding)
4) Flange connections see separate table pages 36 and 37
5) Thread design „G”
6) Thread design „A”
7) Dimensions for cylinders with seal design M, T, G, L, R, S and V
8) Dimensions for cylinders with seal design A and B
9) Observe the min. stroke length „X*min“
10) With piston Ø 160 to 280 mm 8 mounting bores
With piston Ø 320 mm 12 mounting bores

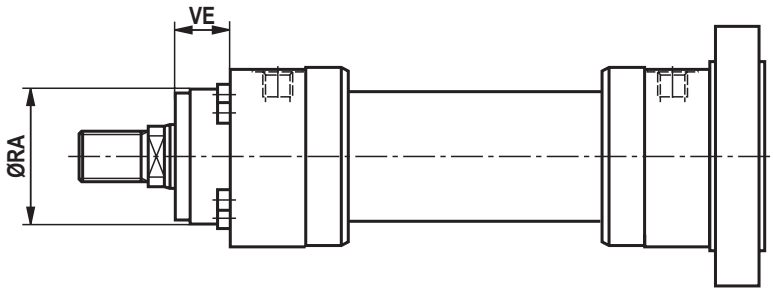
Round flange at base CDH3: MF4

CDH3 MF4





CDH3 MF4: With seal design “A”, “B” and ØAL 160 to 320 mm



Dimensions CDH3: MF4 (dimensions in mm)

ØAL	ØMM	KK 5)	A 5)	KK 6)	A 6)	NV	ØD	ØDA	ØD4 2)	EE 4)	EE 4)	Y	PJ	X1	WA
40	**28**	M22x1,5	22	M24x2	35	22	92	52	34	G1/2	M22x1,5	91	120	43	18
50	**36**	M28x1,5	28	M30x2	45	30	108	62	34	G1/2	M22x1,5	90	120	51,5	18
63	**45**	M35x1,5	35	M39x3	55	36	140	78	42	G3/4	M27x2	117	133	67	22
80	**56**	M45x1,5	45	M50x3	75	46	148	100	42	G3/4	M27x2	124	146	71,5	22
100	**70**	M58x1,5	58	M64x3	95	60	186	125	47	G1	M33x2	119	171	90,5	25
125	**90**	M65x1,5	65	M80x3	110	75	235	160	58	G1 1/4	M42x2	170	205	114	32
140	**100**	M80x2	80	M90x3	120	85	258	175	58	G1 1/4	M42x2	186	219	126	35
160	**110**	M100x2	100	M100x3	140	95	292	200	65	G1 1/2	M48x2	210	240	142,5	40
180	**125**	M110x2	110	M110x4	150	110	325	220	65	G1 1/2	M48x2	241	264	159,5	45
200	**140**	M120x3	120	M120x4	160	120	350	245	65	G1 1/2	M48x2	262	278	172,5	45
220	**160**	M120x3	120	M120x4	160	140	375	292	65	G1 1/2	M48x2	262	326	185	40
250	**180**	M130x3	130	M150x4	190	160	440	324	65	G1 1/2	M48x2	272	336	218	40
280	**200**	–	–	M160x4	200	180	460	368	65	G1 1/2	M48x2	282	366	228	40
320	**220**	–	–	M180x4	220	200	490	406	65	G1 1/2	M48x2	287	391	243	40

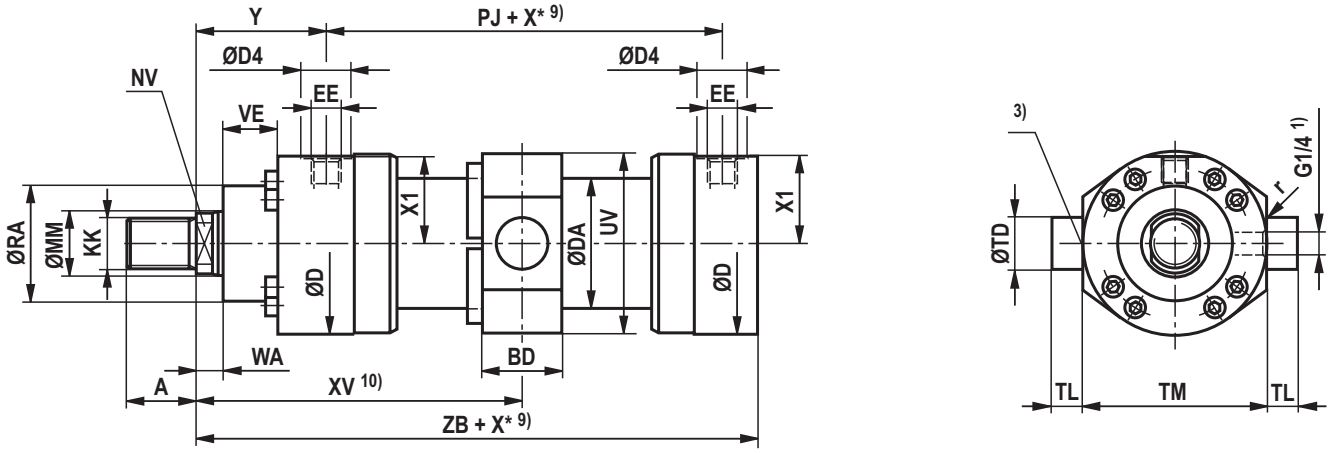
ØAL	ØMM	ZP	X* min	NF	VD	ØRD e8	ØFB H13	ØFC js13	ØUC -1	α	ØRA 7)	VE 7)	ØRA 8)	VE 8)
40	**28**	273	–	35	5	95	13,5	120	145	60°	52	45	52	20
50	**36**	277	–	40	5	115	13,5	140	165	60°	70	47	70	19
63	**45**	325	–	40	5	150	17,5	180	210	60°	88	43	88	13
80	**56**	355	–	50	5	160	17,5	195	230	60°	98	53	98	15
100	**70**	385	–	55	5	200	22	230	270	60°	120	55	120	17
125	**90**	495	–	70	5	245	26	290	335	60°	150	68	150	20
140	**100**	532	–	70	10	280	30	330	380	60°	170	75	170	23
160	**110**	600	–	80	10	300	30	360	420	45°	200	90	200	90
180	**125**	665	–	95	10	335	36	400	470	45°	230	100	230	100
200	**140**	710	–	105	10	360	36	430	500	45°	250	110	250	110
220	**160**	770	–	115	10	400	39	475	550	45°	275	125	275	125
250	**180**	820	20	125	10	450	45	530	610	45°	320	135	320	135
280	**200**	865	–	130	10	470	45	550	630	45°	335	150	335	150
320	**220**	915	340	140	10	510	45	590	670	30°	350	165	350	165

ØAL = Piston Ø
ØMM = Piston rod Ø
X* = Stroke length
X*min = Min. stroke length

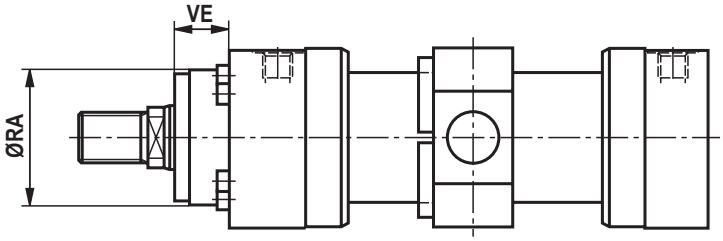
1) Bleeding: With view to the piston rod, the position is offset by 90° in relation to the line connection (clockwise)
2) Ø D4 max. 0,5 mm deep
3) Throttle valve only with end position cushioning „E“ (180° for bleeding)
4) Flange connections see separate table pages 36 and 37
5) Thread design „G”
6) Thread design „A”
7) Dimensions for cylinders with seal design M, T, G, L, R, S and V
8) Dimensions for cylinders with seal design A and B
9) Observe the min. stroke length „X*min“
10) With piston Ø 160 to 280 mm 8 mounting bores
With piston Ø 320 mm 12 mounting bores

Trunnion CDH3/CGH3: MT4

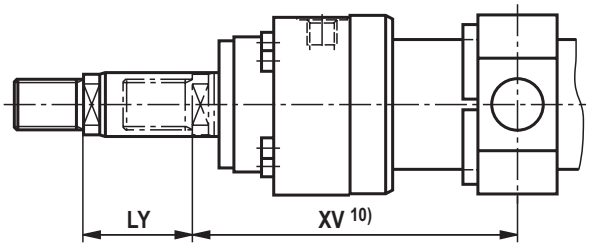
CDH3 MT4



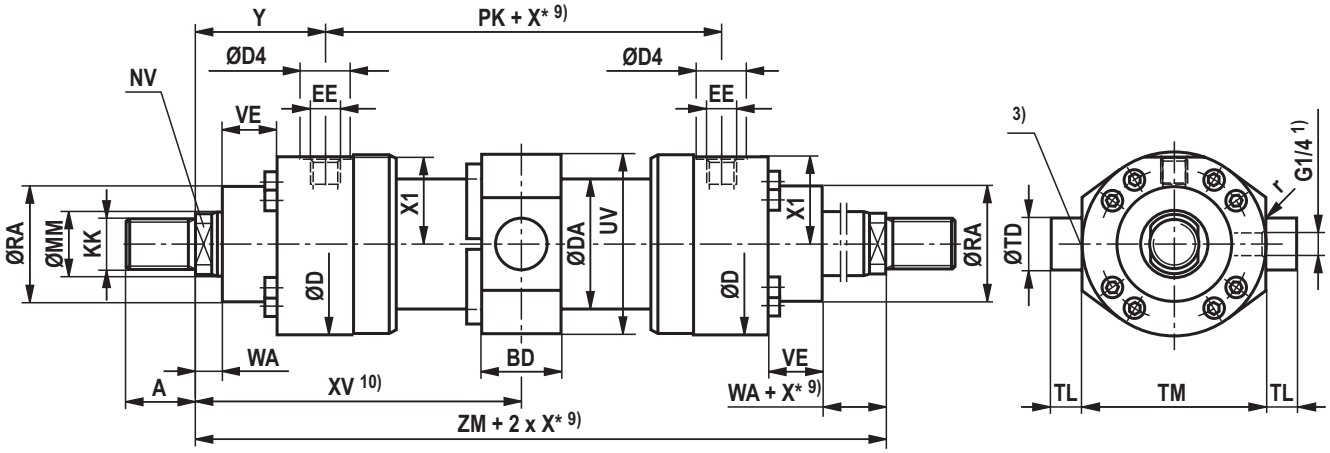
CDH3 MT4: With seal design “A”, “B” and ØAL 160 to 320 mm



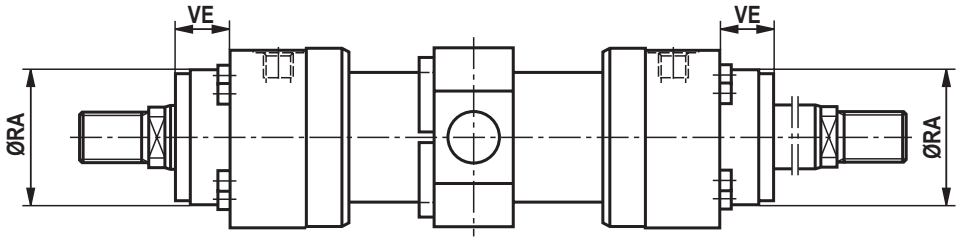
Dimensions for cylinder with piston rod extension “LY” in retracted condition



CGH3 MT4



CGH3 MT4: With seal design “A”, “B”and ØAL 160 to 320 mm



Dimensions CDH3/CGH3: MT4 (dimensions in mm)

ØAL	ØMM	KK 5)	A 5)	KK 6)	A 6)	NV	ØD	ØDA	ØD4 2)	EE 4)	EE 4)	Y	PJ	X1	WA	PK	ZB
40	**28**	M22x1,5	22	M24x2	35	22	92	52	34	G1/2	M22x1,5	91	120	43	18	120	238
50	**36**	M28x1,5	28	M30x2	45	30	108	62	34	G1/2	M22x1,5	90	120	51,5	18	120	237
63	**45**	M35x1,5	35	M39x3	55	36	140	78	42	G3/4	M27x2	117	133	67	22	133	285
80	**56**	M45x1,5	45	M50x3	75	46	148	100	42	G3/4	M27x2	124	146	71,5	22	146	305
100	**70**	M58x1,5	58	M64x3	95	60	186	125	47	G1	M33x2	119	171	90,5	25	171	330
125	**90**	M65x1,5	65	M80x3	110	75	235	160	58	G1 1/4	M42x2	170	205	114	32	205	425
140	**100**	M80x2	80	M90x3	120	85	258	175	58	G1 1/4	M42x2	186	219	126	35	219	457
160	**110**	M100x2	100	M100x3	140	95	292	200	65	G1 1/2	M48x2	210	240	142,5	40	240	515
180	**125**	M110x2	110	M110x4	150	110	325	220	65	G1 1/2	M48x2	241	264	159,5	45	264	565
200	**140**	M120x3	120	M120x4	160	120	350	245	65	G1 1/2	M48x2	262	278	172,5	45	278	600
220	**160**	M120x3	120	M120x4	160	140	375	292	65	G1 1/2	M48x2	262	326	185	40	326	655
250	**180**	M130x3	130	M150x4	190	160	440	324	65	G1 1/2	M48x2	272	336	218	40	336	695
280	**200**	–	–	M160x4	200	180	460	368	65	G1 1/2	M48x2	282	366	228	40	366	735
320	**220**	–	–	M180x4	220	200	490	406	65	G1 1/2	M48x2	287	391	243	40	391	775

ØAL	ØMM	ZM	X* min	XV 11) cent	XV min	XV max	BD	UV 12)	ØTD e8	TL js16	TM h13	r	ØRA 7)	VE 7)	ØRA 8)	VE 8)
40	28	302	42	151+X*/2	172	138+X*	48	101	40	30	95	2	52	45	52	20
50	36	300	50	150+X*/2	175	134+X*	48	117	40	30	120	2	70	47	70	19
63	45	367	64	183,5+X*/2	215,5	163,5+X*	53	153	45	35	150	2	88	43	88	13
80	56	384	82	197+X*/2	238	168+X*	68	169	55	50	160	2	98	53	98	15
100	70	409	109	204,5+X*/2	259	165+X*	88	203	60	55	200	2	120	55	120	17
125	90	545	131	272,5+X*/2	338	222+X*	118	252	75	60	245	2,5	150	68	150	20
140	100	591	147	295,5+X*/2	369	237+X*	128	282	85	70	280	2,5	170	75	170	23
160	110	660	186	330+X*/2	423	257+X*	148	310	95	80	300	2,5	200	90	200	90
180	125	746	212	373+X*/2	479	287+X*	168	348	110	90	335	2,5	230	100	230	100
200	140	802	228	401+X*/2	515	307+X*	188	373	120	100	360	2,5	250	110	250	110
220	160	850	205	425+X*/2	527,5	322,5+X*	165	398	130	100	400	2,5	275	125	275	125
250	180	880	245	440+X*/2	562,5	317,5+X*	175	463	140	100	450	5	320	135	320	135
280	200	930	245	465+X*/2	587,5	342,5+X*	205	486	170	125	480	5	335	150	335	150
320	220	965	600	482,5+X*/2	782,5	182,5+X*	245	537	200	150	500	5	350	165	350	165

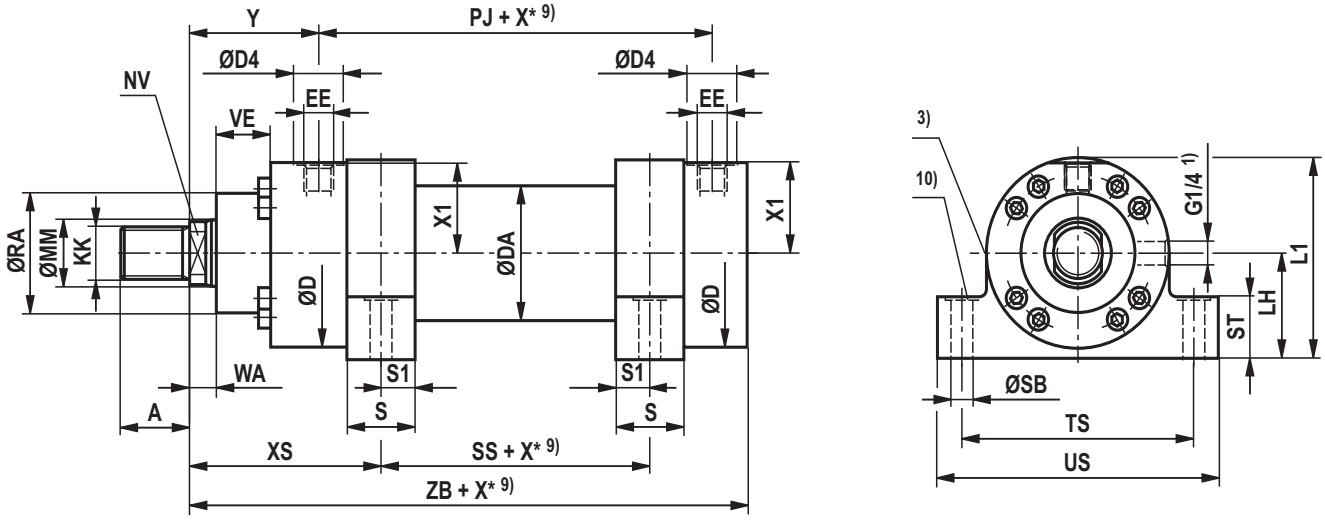
ØAL = Piston Ø
ØMM = Piston rod Ø
X* = Stroke length
X*min = Min. stroke length

1) Bleeding: With view to the piston rod, the position is offset by 90° in relation to the line connection (clockwise)
2) Ø D4 max. 0,5 mm deep
3) Throttle valve only with end position cushioning „E“ (180° for bleeding)
4) Flange connections see separate table pages 36 and 37
5) Thread design „G”
6) Thread design „A”
7) Dimensions for cylinders with seal design M, T, G, L, R, S and V
8) Dimensions for cylinders with seal design A and B
9) Observe the min. stroke length „X*min“
10) When ordering, always specify the „XV“ dimension in the clear text. Preferred XV dimension:
Observe the trunnion position in the cylinder center XVmin and XVmax
11) XVcent recommendation:
Trunnion position in cylinder center
12) The specified dimensions are maximum values, tolerance classes 342 according to ISO 9013 Thermal cutting

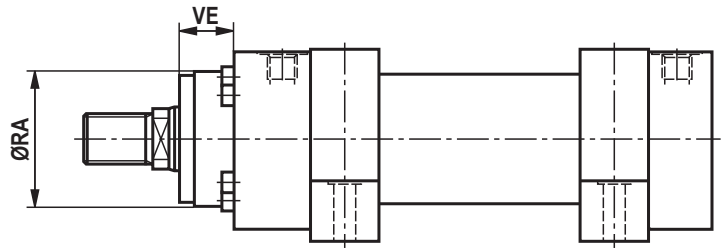
Important installation information: During installation, it must be ensured that the trunnion bearings are installed up to the trunnion shoulders. Any non-compliance may reduce the product's service life.

Foot mounting CDH3/CGH3: MS2

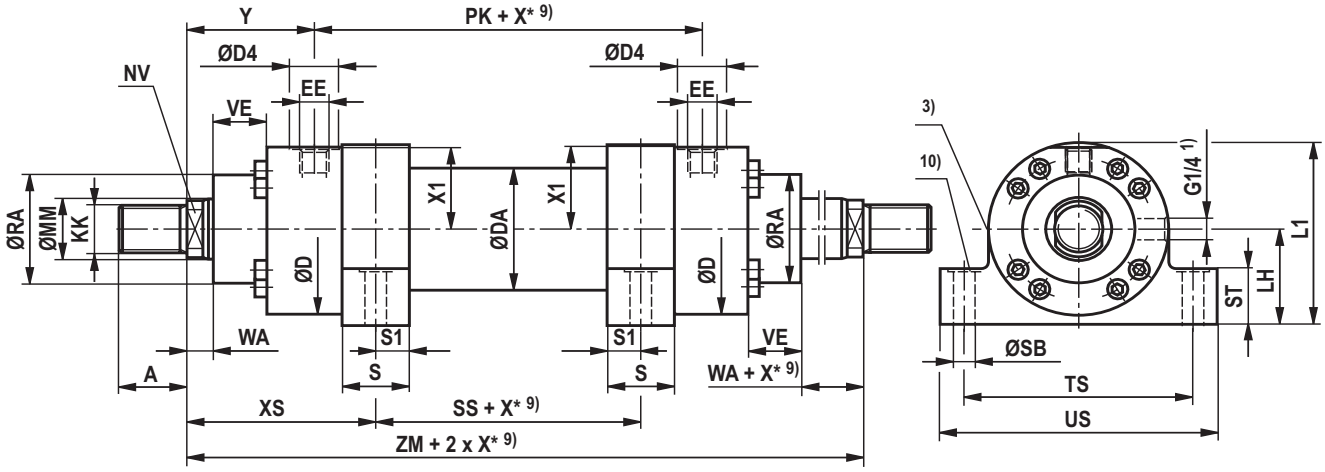
CDH3 MS2



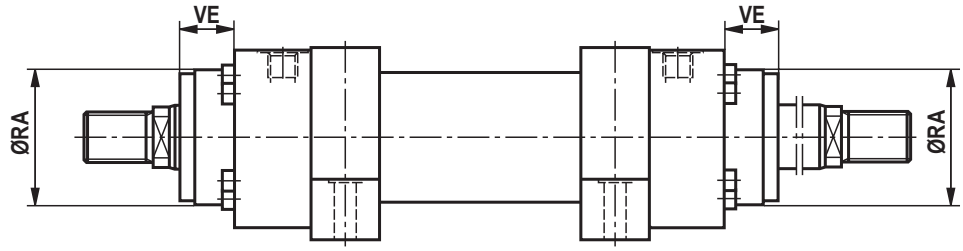
CDH3 MS2. With seal design “A”, “B” and ØAL 160 to 320 mm



CGH3 MS2



CGH3 MS2: With seal design “A”, “B” and ØAL 160 to 320 mm



Dimensions CDH3/CGH3: MS2 (dimensions in mm)

ØAL	ØMM	KK 5)	A 5)	KK 6)	A 6)	NV	ØD	ØDA	ØD4 2)	EE 4)	EE 4)	Y	PJ	X1	WA	PK	XS
40	**28**	M22x1,5	22	M24x2	35	22	92	52	34	G1/2	M22x1,5	91	120	43	18	120	126
50	**36**	M28x1,5	28	M30x2	45	30	108	62	34	G1/2	M22x1,5	90	120	51,5	18	120	130
63	**45**	M35x1,5	35	M39x3	55	36	140	78	42	G3/4	M27x2	117	133	67	22	133	164
80	**56**	M45x1,5	45	M50x3	75	46	148	100	42	G3/4	M27x2	124	146	71,5	22	146	176
100	**70**	M58x1,5	58	M64x3	95	60	186	125	47	G1	M33x2	119	171	90,5	25	171	179
125	**90**	M65x1,5	65	M80x3	110	75	235	160	58	G1 1/4	M42x2	170	205	114	32	205	245
140	**100**	M80x2	80	M90x3	120	85	258	175	58	G1 1/4	M42x2	186	219	126	35	219	265,5
160	**110**	M100x2	100	M100x3	140	95	292	200	65	G1 1/2	M48x2	210	240	142,5	40	240	302,5
180	**125**	M110x2	110	M110x4	150	110	325	220	65	G1 1/2	M48x2	241	264	159,5	45	264	353,5
200	**140**	M120x3	120	M120x4	160	120	350	245	65	G1 1/2	M48x2	262	278	172,5	45	278	379,5
220	**160**	M120x3	120	M120x4	160	140	375	292	65	G1 1/2	M48x2	262	326	185	40	326	387,5
250	**180**	M130x3	130	M150x4	190	160	440	324	65	G1 1/2	M48x2	272	336	218	40	336	397,5
280	**200**	–	–	M160x4	200	180	460	368	65	G1 1/2	M48x2	282	366	228	40	366	410
320	**220**	–	–	M180x4	220	200	490	406	65	G1 1/2	M48x2	287	391	243	40	391	440

ØAL	ØMM	ZB	ZM	SS	X* min	S	S1	ØSB H13	ST	TS js13	US 12)	LH	L1 12)	ØRA 7)	VE 7)	ØRA 8)	VE 8)
40	**28**	238	302	50	–	30	15	17,5	32	125	164	50	100	52	45	52	20
50	**36**	237	300	40	4	40	20	22	37	150	197	60	118	70	47	70	19
63	**45**	285	367	39	15	50	25	24	47	185	235	75	149	88	43	88	13
80	**56**	305	394	42	22	60	30	26	52	210	270	80	160	98	53	98	15
100	**70**	330	409	51	23	70	35	33	62	250	320	100	200	120	55	120	17
125	**90**	425	545	55	39	90	45	40	72	310	392	120	245	150	68	150	20
140	**100**	457	591	60	39	95	47,5	40	77	340	422	135	271	170	75	170	23
160	**110**	515	660	55	64	115	57,5	45	87	370	462	150	305	200	90	200	90
180	**125**	565	746	39	110	145	72,5	45	79	415	515	165	337	230	100	230	100
200	**140**	600	802	43	116	155	77,5	52	112	460	570	180	366	250	110	250	110
220	**160**	655	850	75	100	155	77,5	52	112	500	610	200	398	275	125	275	125
250	**180**	695	880	85	90	155	77,5	52	122	550	660	225	456	320	135	320	135
280	**200**	735	930	110	70	160	80	62	142	600	722	235	476	335	150	335	150
320	**220**	775	965	85	400	190	95	74	162	650	785	255	512	350	165	350	165

ØAL = Piston Ø
ØMM = Piston rod Ø
X* = Stroke length
X*min = Min. stroke length

1) Bleeding: With view to the piston rod, the position is offset by 90° in relation to the line connection (clockwise)
2) Ø D4 max. 0,5 mm deep
3) Throttle valve only with end position cushioning „E“ (180° for bleeding)
4) Flange connections see separate table pages 36 and 37
5) Thread design „G”
6) Thread design „A”
7) Dimensions for cylinders with seal design M, T, G, L, R, S and V
8) Dimensions for cylinders with seal design A and B
9) Observe the min. stroke length „X*min“
10) Recess 2 mm deep, for hexagon socket head cap screws; ISO 4762 (for spool Ø 320 mm DIN 931) – The screws must not be subjected to shear force.Force distribution via additional external fitting strips
12) The specified dimensions are maximum values, tolerance classes 342 according to ISO 9013 Thermal cutting

Ordering code series CSH3

CS	H3	/	/	/	A	3X	/							Z

Differential cylinder with position measurement system [18] **= CS**

Series **= H3**

Types of mounting
- Swivel eye at base [1] **= MP3**
- Self-aligning clevis at base **= MP5**
- Round flange at head **= MF3**
- Round flange at base **= MF4**
- Trunnion [2] **= MT4**
- Foot mounting **= MS2**

Piston Ø (ØAL) 40 to 320 mm

Piston rod Ø (ØMM) 28 to 220 mm

Stroke length in mm [3]

Design principle
- Head and base flanged **= A**

Component series
- 30 to 39 Unchanged installation and connection dimensions **= 3X**

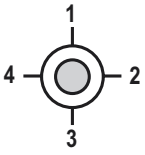
Line connection / version
- According to ISO 1179-1 (pipe thread ISO 228-1) **= B**
- According to ISO 9974-1 (metric thread ISO 261) **= M**
- Flange porting pattern according to ISO 6162-2 tab. 2 type 1 (SAE 6000 PSI) [4], [25] **= D**
- Flange porting pattern according to ISO 6164 tab. 2 [4] **= H**
- According to ISO 1179-1 (pipe thread ISO 228-1) with flat pipe flange [31] **= C**

For directional and control valves
- Subplate size 6 [4] [5] [27] **= P**
- Subplate size 10 [4] [6] [27] **= T**
- Subplate size 16 [4] [7] [27] **= U**
- Subplate size 25 [4] [7] [27] **= V**

For SL and SV valves
- Subplate size 6 [4] [5] [15] [27] **= A**
- Subplate size 10 [4] [6] [15] [27] **= E**
- Subplate size 20 [4] [7] [15] [27] **= L**
- Subplate size 30 [4] [7] [15] [27] **= N**

Line connection/position at head

View to piston rod



[30] **= 1**
[30] **= 2**
[30] **= 3**
[30] **= 4**

Option
- **Z =** Additional options, fill fields for additional options

Seal design

For mineral oil HL, HLP and HFA
- **M =** [29] Standard seal system
- **L =** Standard seal system with guide rings
- **R =** [29] Reduced friction heavy industry

For mineral oil HL, HLP, HFA and water glycol HFC
- **G =** [27] [29] Standard seal system HFC
- **T =** [29] Servo quality/reduced friction

For phosphate ester HFD-R and polyol ester HFD-U
- **S =** [29] Servo quality/reduced friction
- **V =** [27] [29] Standard seal system FKM

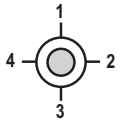
End position cushioning
- **U =** Without
- **E =** [20] On both sides, adjustable

Piston rod end
- **A =** Thread for plain clevis CGAS
- **G =** [26] Thread for self-aligning clevis CGA, CGAK, plain clevis CSA
- **S =** With mounted self-aligning clevis CGAS
- **L =** [26] With mounted self-aligning clevis CGA
- **M =** [26] With mounted self-aligning clevis CGAK
- **N =** [1] With mounted plain clevis CSA

Piston rod design
- **C =** Hard chromium-plated
- **N =** [19] Nickel-plated and hard chromium-plated

Line connection / position at base [30]

1 =
2 = [34]
3 =
4 = [34]



View to piston rod

Additional options

Fields for additional options

Z		T				

Position measurement system (magnetostrictive) **= T**
without mating connector
Mating connector - separate order, see pages 47, 49

- Analog output 4-20 mA **= C**
- Analog output 0-10 V **= F**
- Digital output SSI **= D**
- Profibus D63 **= N**
- Profibus D53 **= P**

Threaded coupling, on both sides **= A**
Without threaded coupling **= W**

- **Y =** Piston rod extension LY specify in the clear text in mm
- **W =** Without piston rod extension

- **A =** [14] [35] Spherical bearing, maintenance-free
- **B =** Flanged grease nipple
- **W =** Standard conical grease nipple

Order example:

CSH3MP5/100/70/300A3X/B11CAUMZ TFAWW

Ordering code series CSH3

1) Only piston Ø 40 to 200 mm
2) Trunnion position freely selectable. When ordering, always specify the „XV“ dimension in the clear text in mm.
3) Max. available stroke length page 4 and admissible stroke length (acc. to buckling calculation) observe pages 56 to 58
4) Not possible with MF4
5) Piston Ø 40 to 80 mm, only position 11, subplates only possible in combination with line connection “B” at the head
6) Piston Ø 63 to 200 mm, only position 11, subplates only possible in combination with line connection “B” at the head
7) Piston Ø 125 to 200 mm, only position 11, subplates only possible in combination with line connection “B” at the head
14) Not possible with piston rod end „N“
15) Subplates for SL and SV valves (isolator valves) Note: Seal designs T, G, L, R, S and V are not designed for the static holding function!
18) Not standardized
19) Only piston rod Ø 28 to 140 mm
20) Possible from piston rod Ø 45 mm
25) Only piston Ø 63 to 320 mm
26) Only piston Ø 40 to 250 mm
27) Maximum operating pressure 315 ba
29) With CSH, by default with guide belts
30) All graphical presentations in the data sheet show position 1
31) With MS2, only position 11 is possible
34) With MF4 and line connection B, M or C not possible
35) Not possible with MP3

Overview of types of mounting: Series CSH3

CSH3 MP3

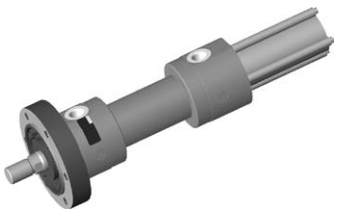
see page 24, 25

CSH3 MP5

see page 26, 27

CSH3 MF3

see page 28, 29



CSH3 MF4

see page 30, 31

CSH3 MT4

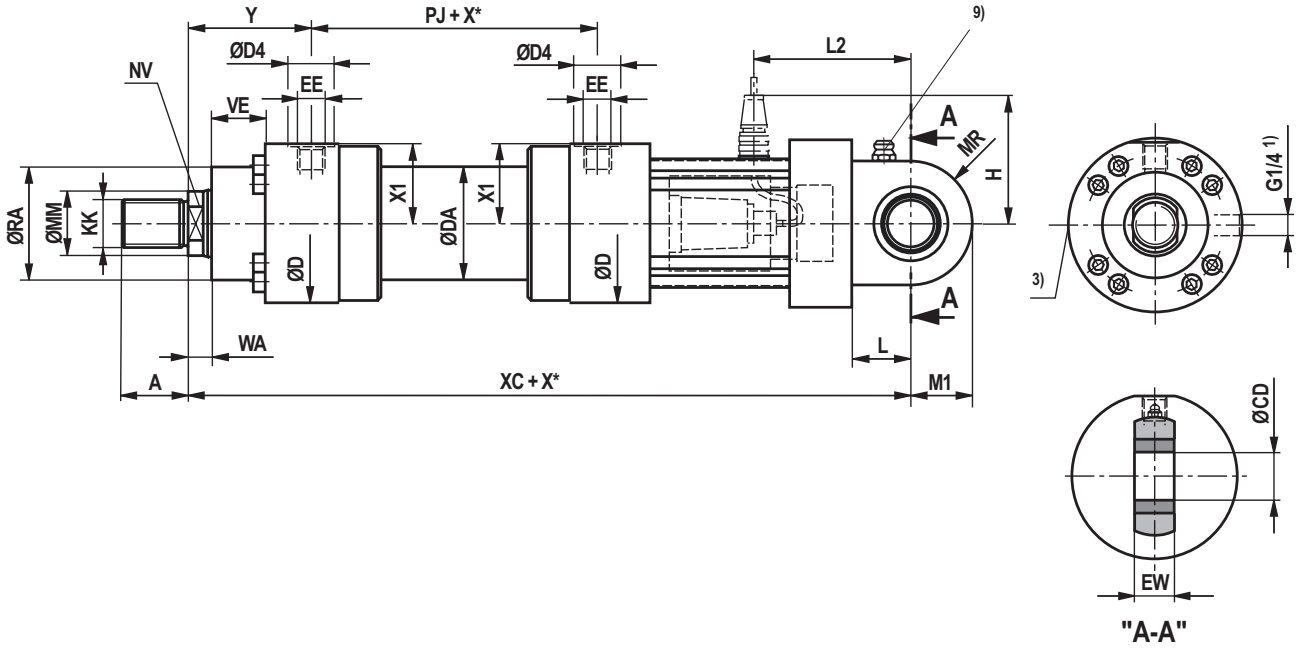
see page 32, 33

CSH3 MS2

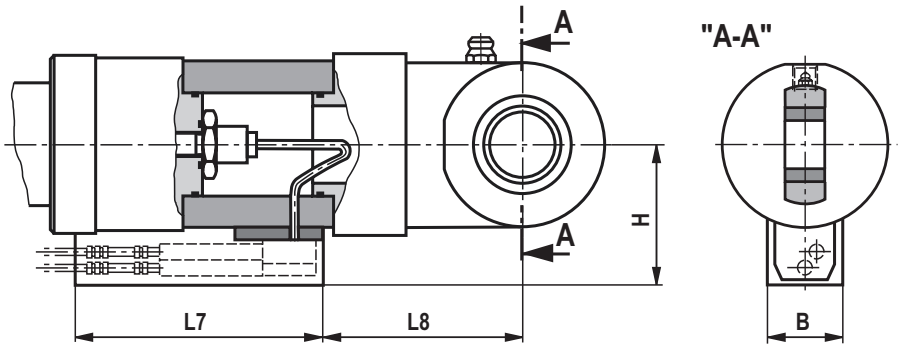
see page 34, 35

Swivel eye at base CSH3: MP3

CSH3 MP3; ØAL 40 to 200 mm
for position measurement system output “C”, “F” and “D”



CSH3 MP3; ØAL 40 to 200 mm
for position measurement system output “N” and “P”



Dimensions CSH3: MP3 (dimensions in mm)

ØAL	ØMM	KK 5)	A 5)	KK 6)	A 6)	NV	ØD	ØDA	ØD4 2)	EE 4)	EE 4)	Y	PJ	X1	WA	X* max
40	**28**	M22x1,5	22	M24x2	35	22	92	52	34	G1/2	M22x1,5	91	120	43	18	1000
50	**36**	M28x1,5	28	M30x2	45	30	108	62	34	G1/2	M22x1,5	90	120	51,5	18	1000
63	**45**	M35x1,5	35	M39x3	55	36	140	78	42	G3/4	M27x2	117	133	67	22	2000
80	**56**	M45x1,5	45	M50x3	75	46	148	100	42	G3/4	M27x2	124	146	71,5	22	2000
100	**70**	M58x1,5	58	M64x3	95	60	186	125	47	G1	M33x2	119	171	90,5	25	3000
125	**90**	M65x1,5	65	M80x3	110	75	235	160	58	G1 1/4	M42x2	170	205	114	32	3000
140	**100**	M80x2	80	M90x3	120	85	258	175	58	G1 1/4	M42x2	186	219	126	35	3000
160	**110**	M100x2	100	M100x3	140	95	292	200	65	G1 1/2	M48x2	210	240	142,5	40	3000
180	**125**	M110x2	110	M110x4	150	110	325	220	65	G1 1/2	M48x2	241	264	159,5	45	3000
200	**140**	M120x3	120	M120x4	160	120	350	245	65	G1 1/2	M48x2	262	278	172,5	45	3000

ØAL	ØMM	XC	L	MR	M1	ØCD H11	EW h12	ØRA	VE	L2	L7	L8	H 13)	H 14)	B
40	**28**	433	35	36	34	30	28	52	45	102	200	83	108	115	64
50	**36**	445	45	42	40	35	30	70	47	115	200	102	116	125	64
63	**45**	508	50	52	50	40	35	88	43	127	200	104	133	140	64
80	**56**	540	55	65	62,5	50	40	98	53	137	200	109	137	125	64
100	**70**	565	65	70	70	60	50	120	55	155	200	127	156	135	64
125	**90**	668	75	82	82	70	55	150	68	185	200	161	181	150	64
140	**100**	705	80	95	95	80	60	170	75	192	200	166	192	160	64
160	**110**	785	90	113	113	90	65	200	90	225	200	193	210	170	64
180	**125**	838	105	125	125	100	70	230	100	235	200	202	226	180	64
200	**140**	888	115	142,5	142,5	110	80	250	110	245	200	214	239	195	64

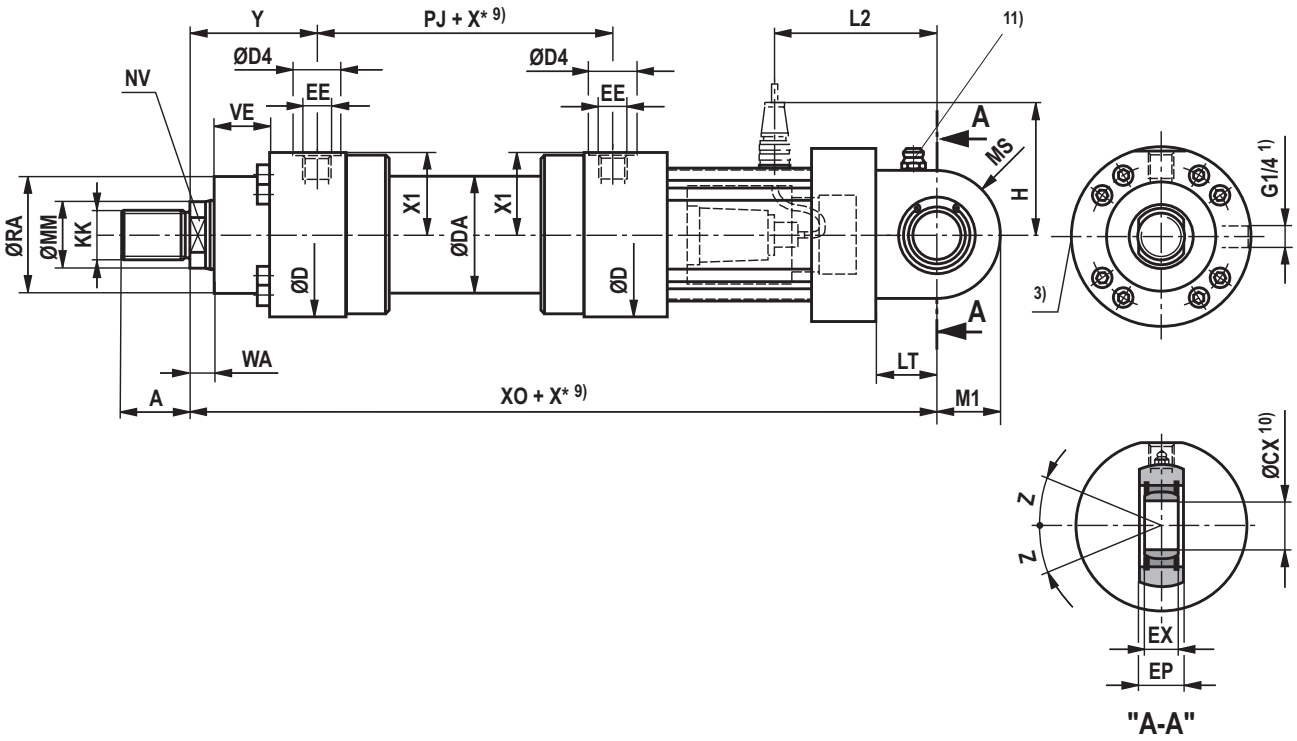
ØAL = Piston Ø
ØMM = Piston rod Ø
X* = Stroke length
X*max = Max. stroke length

1) Bleeding: With view to the piston rod, the position is offset by 90° in relation to the line connection (clockwise)
2) Ø D4 max. 0,5 mm deep
3) Throttle valve only with end position cushioning „E“ (180° for bleeding)
4) Flange connections see separate table pages 36 and 37
5) Thread design „G”
6) Thread design „A”
9) Standard design „W“ grease nipple cone head form A according to DIN 71412
13) Dimensions for position transducer output „N“ and „P“
14) Dimensions for position transducer output „C“, „F“ and „D“

Self-aligning clevis at base CSH3: MP5

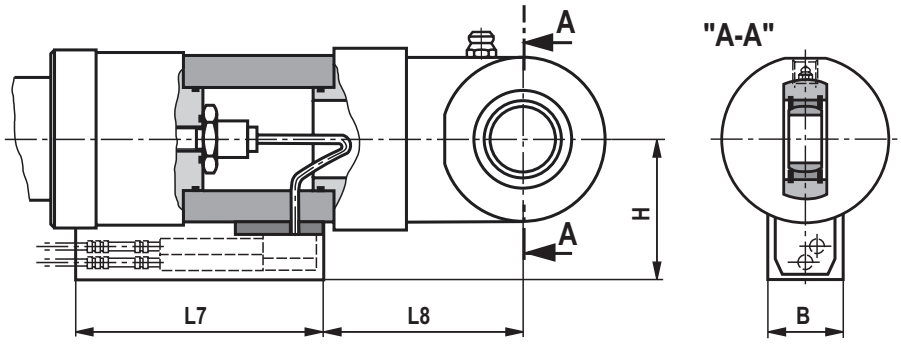
CSH3 MP5

for position measurement system output “C”, “F” and “D”



CSH3 MP5

for position measurement system output “N” and “P”



Dimensions CSH3: MP5 (dimensions in mm)

ØAL	ØMM	KK 5)	A 5)	KK 6)	A 6)	NV	ØD	ØDA	ØD4 2)	EE 4)	EE 4)	Y	PJ	X1	WA	XO	X* min
40	**28**	M22x1,5	22	M24x2	35	22	92	52	34	G1/2	M22x1,5	91	120	43	18	433	–
50	**36**	M28x1,5	28	M30x2	45	30	108	62	34	G1/2	M22x1,5	90	120	51,5	18	445	–
63	**45**	M35x1,5	35	M39x3	55	36	140	78	42	G3/4	M27x2	117	133	67	22	508	–
80	**56**	M45x1,5	45	M50x3	75	46	148	100	42	G3/4	M27x2	124	146	71,5	22	540	–
100	**70**	M58x1,5	58	M64x3	95	60	186	125	47	G1	M33x2	119	171	90,5	25	565	–
125	**90**	M65x1,5	65	M80x3	110	75	235	160	58	G1 1/4	M42x2	170	205	114	32	668	–
140	**100**	M80x2	80	M90x3	120	85	258	175	58	G1 1/4	M42x2	186	219	126	35	705	–
160	**110**	M100x2	100	M100x3	140	95	292	200	65	G1 1/2	M48x2	210	240	142,5	40	785	–
180	**125**	M110x2	110	M110x4	150	110	325	220	65	G1 1/2	M48x2	241	264	159,5	45	838	–
200	**140**	M120x3	120	M120x4	160	120	350	245	65	G1 1/2	M48x2	262	278	172,5	45	888	–
220	**160**	M120x3	120	M120x4	160	140	375	292	65	G1 1/2	M48x2	262	326	185	40	970	–
250	**180**	M130x3	130	M150x4	190	160	440	324	65	G1 1/2	M48x2	272	336	218	40	1055	20
280	**200**	–	–	M160x4	200	180	460	368	65	G1 1/2	M48x2	282	366	228	40	1115	–
320	**220**	–	–	M180x4	220	200	490	406	65	G1 1/2	M48x2	287	391	243	40	1195	340

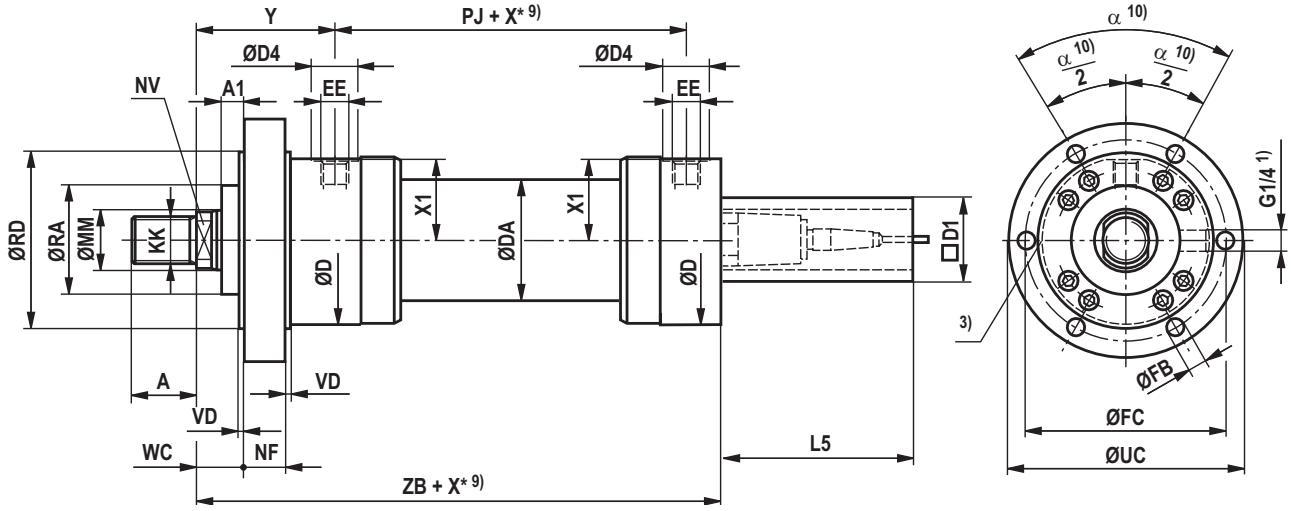
ØAL	ØMM	X* max	LT	M1	MS	ØCX	EP -0,4	EX	Z	ØRA	VE	L2	L7	L8	H 13)	H 14)	B
40	**28**	1000	35	34	36	$30_{-0,010}$	28	$22_{-0,12}$	6°	52	45	102	200	83	108	115	64
50	**36**	1000	45	40	42	$35_{-0,012}$	30	$25_{-0,12}$	6°	70	47	115	200	102	116	125	64
63	**45**	2000	50	50	52	$40_{-0,012}$	35	$28_{-0,12}$	7°	88	43	127	200	104	133	140	64
80	**56**	2000	55	62,5	65	$50_{-0,012}$	40	$35_{-0,12}$	6°	98	53	137	200	109	137	125	64
100	**70**	3000	65	70	70	$60_{-0,015}$	50	$44_{-0,15}$	6°	120	55	155	200	127	156	135	64
125	**90**	3000	75	82	82	$70_{-0,015}$	55	$49_{-0,15}$	6°	150	68	185	200	161	181	150	64
140	**100**	3000	80	95	95	$80_{-0,015}$	60	$55_{-0,15}$	6°	170	75	192	200	166	192	160	64
160	**110**	3000	90	113	113	$90_{-0,020}$	65	$60_{-0,20}$	5°	200	90	225	200	193	210	170	64
180	**125**	3000	105	125	125	$100_{-0,020}$	70	$70_{-0,20}$	7°	230	100	235	200	202	226	180	64
200	**140**	3000	115	142,5	142,5	$110_{-0,020}$	80	$70_{-0,20}$	6°	250	110	245	200	214	239	195	64
220	**160**	3000	115	150 12)	140 12)	$110_{-0,020}$	80	$70_{-0,20}$	6°	275	125	270	200	238	254	215	64
250	**180**	3000	140	188 12)	178 12)	$120_{-0,020}$	90	$85_{-0,20}$	6°	320	135	320	200	283	284	235	64
280	**200**	3000	170	210 12)	200 12)	$140_{-0,025}$	100	$90_{-0,25}$	7°	335	150	350	200	315	294	285	64
320	**220**	3000	200	260 12)	250 12)	$160_{-0,025}$	110	$105_{-0,25}$	8°	350	165	400	200	400	309	300	64

ØAL = Piston Ø
ØMM = Piston rod Ø
X* = Stroke length
X*max = Max. stroke length
X*min = Min. stroke length

1) Bleeding: With view to the piston rod, the position is offset by 90° in relation to the line connection (clockwise)
2) Ø D4 max. 0,5 mm deep
3) Throttle valve only with end position cushioning „E“ (180° for bleeding)
4) Flange connections see separate table pages 36 and 37
5) Thread design „G”
6) Thread design „A”
9) Observe the min. stroke length „X*min“
10) Related bolt Ø m6; related bolt Ø j6 with maintenance-free spherical bearing
11) Standard design „W“ grease nipple cone head form A according to DIN 71412
12) The specified dimensions are maximum values, tolerance classes 342 according to ISO 9013 Thermal cutting
13) Dimensions for position transducer output „N“ and „P“
14) Dimensions for position transducer output „C“, „F“ and „D“

Round flange at head CSH3: MF3

CSH3 MF3



Dimensions CSH3: MF3 (dimensions in mm)

ØAL	ØMM	KK 5)	A 5)	KK 6)	A 6)	NV	ØD	ØDA	ØD4 2)	EE 4)	EE 4)	Y	PJ	X1	ØRD e8
40	**28**	M22x1,5	22	M24x2	35	22	92	52	34	G1/2	M22x1,5	91	120	43	95
50	**36**	M28x1,5	28	M30x2	45	30	108	62	34	G1/2	M22x1,5	90	120	51,5	115
63	**45**	M35x1,5	35	M39x3	55	36	140	78	42	G3/4	M27x2	117	133	67	150
80	**56**	M45x1,5	45	M50x3	75	46	148	100	42	G3/4	M27x2	124	146	71,5	160
100	**70**	M58x1,5	58	M64x3	95	60	186	125	47	G1	M33x2	119	171	90,5	200
125	**90**	M65x1,5	65	M80x3	110	75	235	160	58	G1 1/4	M42x2	170	205	114	245
140	**100**	M80x2	80	M90x3	120	85	258	175	58	G1 1/4	M42x2	186	219	126	280
160	**110**	M100x2	100	M100x3	140	95	292	200	65	G1 1/2	M48x2	210	240	142,5	300
180	**125**	M110x2	110	M110x4	150	110	325	220	65	G1 1/2	M48x2	241	264	159,5	335
200	**140**	M120x3	120	M120x4	160	120	350	245	65	G1 1/2	M48x2	262	278	172,5	360
220	**160**	M120x3	120	M120x4	160	140	375	292	65	G1 1/2	M48x2	262	326	185	400
250	**180**	M130x3	130	M150x4	190	160	440	324	65	G1 1/2	M48x2	272	336	218	450
280	**200**	–	–	M160x4	200	180	460	368	65	G1 1/2	M48x2	282	366	228	470
320	**220**	–	–	M180x4	220	200	490	406	65	G1 1/2	M48x2	287	391	243	510

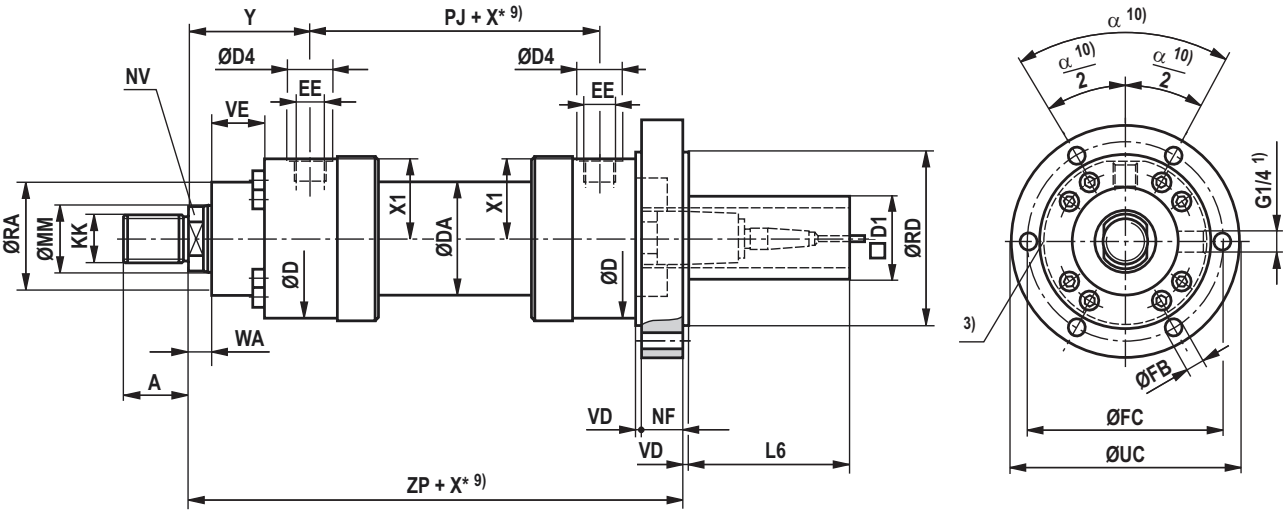
ØAL	ØMM	WC	VD	X* max	L5	D1 max	NF	A1	ZB	X* min	ØFB H13	ØFC js13	ØUC -1	α	ØRA
40	**28**	23	5	1000	166	80	35	0	247	–	13,5	120	145	60°	52
50	**36**	20	5	1000	166	96	40	0	246	–	13,5	140	165	60°	70
63	**45**	20	5	2000	166	96	40	0	304	–	17,5	180	210	60°	88
80	**56**	20	5	2000	166	96	50	0	332	–	17,5	195	230	60°	98
100	**70**	20	5	3000	166	96	55	0	347	–	22	230	270	60°	120
125	**90**	25	5	3000	166	96	70	0	427	–	26	290	335	60°	150
140	**100**	30	10	3000	166	96	70	0	460	–	30	330	380	60°	170
160	**110**	40	10	3000	166	96	80	0	515	–	30	360	420	45°	200
180	**125**	40	10	3000	166	96	95	0	565	–	36	400	470	45°	230
200	**140**	40	10	3000	166	96	105	0	600	–	36	430	500	45°	250
220	**160**	40	10	3000	166	96	115	20	655	–	39	475	550	45°	275
250	**180**	40	10	3000	166	96	125	30	695	20	45	530	610	45°	320
280	**200**	50	10	3000	166	96	130	25	735	–	45	550	630	45°	335
320	**220**	55	10	3000	166	96	140	25	775	340	45	590	670	30°	350

ØAL = Piston Ø
ØMM = Piston rod Ø
X* = Stroke length
X*max = Max. stroke length
X*min = Min. stroke length

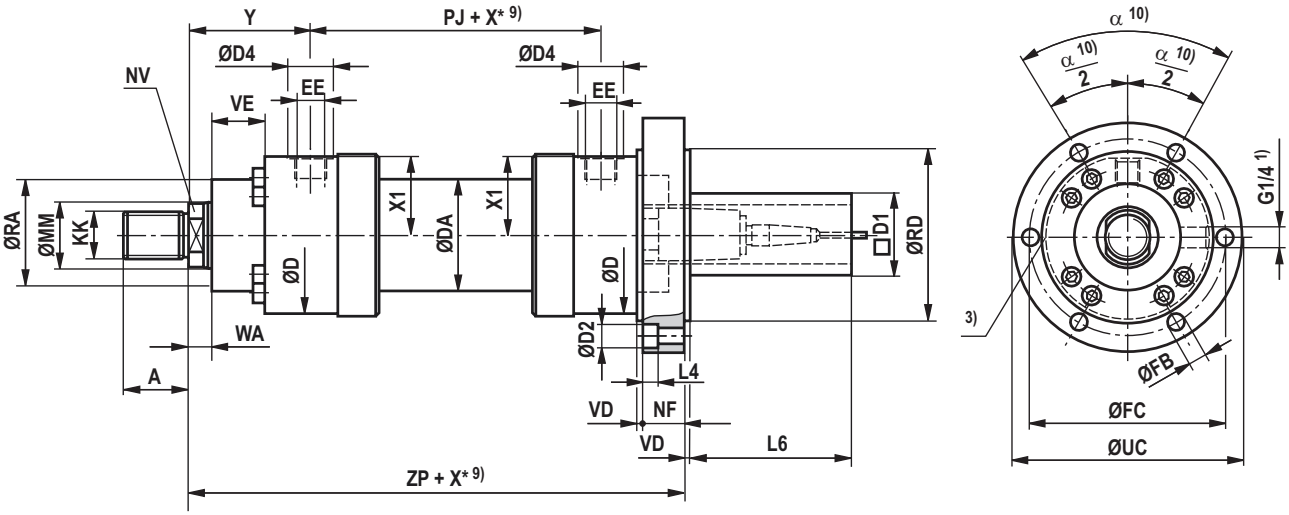
1) Bleeding: With view to the piston rod, the position is offset by 90° in relation to the line connection (clockwise)
2) Ø D4 max. 0,5 mm deep
3) Throttle valve only with end position cushioning „E“ (180° for bleeding)
4) Flange connections see separate table pages 36 and 37
5) Thread design „G”
6) Thread design „A”
9) Observe the min. stroke length „X*min“
10) With piston Ø 160 to 280 mm 8 mounting bores
With piston Ø 320 mm 12 mounting bores

Round flange at base CSH3: MF4

CSH3 MF4; ØAL 40 to 100 mm



CSH3 MF4; ØAL 125 to 320 mm



Dimensions CSH3: MF4 (dimensions in mm)

ØAL	ØMM	KK 5)	A 5)	KK 6)	A 6)	NV	ØD	ØDA	ØD4 2)	EE 4)	EE 4)	Y	PJ	X1	D1 max	ØD2	WA
40	**28**	M22x1,5	22	M24x2	35	22	92	52	34	G1/2	M22x1,5	91	120	43	80	0	18
50	**36**	M28x1,5	28	M30x2	45	30	108	62	34	G1/2	M22x1,5	90	120	51,5	96	0	18
63	**45**	M35x1,5	35	M39x3	55	36	140	78	42	G3/4	M27x2	117	133	67	96	0	22
80	**56**	M45x1,5	45	M50x3	75	46	148	100	42	G3/4	M27x2	124	146	71,5	96	0	22
100	**70**	M58x1,5	58	M64x3	95	60	186	125	47	G1	M33x2	119	171	90,5	96	0	25
125	**90**	M65x1,5	65	M80x3	110	75	235	160	58	G1 1/4	M42x2	170	205	114	96	40	32
140	**100**	M80x2	80	M90x3	120	85	258	175	58	G1 1/4	M42x2	186	219	126	96	43	35
160	**110**	M100x2	100	M100x3	140	95	292	200	65	G1 1/2	M48x2	210	240	142,5	96	43	40
180	**125**	M110x2	110	M110x4	150	110	325	220	65	G1 1/2	M48x2	241	264	159,5	96	53	45
200	**140**	M120x3	120	M120x4	160	120	350	245	65	G1 1/2	M48x2	262	278	172,5	96	53	45
220	**160**	M120x3	120	M120x4	160	140	375	292	65	G1 1/2	M48x2	262	326	185	96	57	40
250	**180**	M130x3	130	M150x4	190	160	440	324	65	G1 1/2	M48x2	272	336	218	96	66	40
280	**200**	–	–	M160x4	200	180	460	368	65	G1 1/2	M48x2	282	366	228	96	66	40
320	**220**	–	–	M180x4	220	200	490	406	65	G1 1/2	M48x2	287	391	243	96	66	40

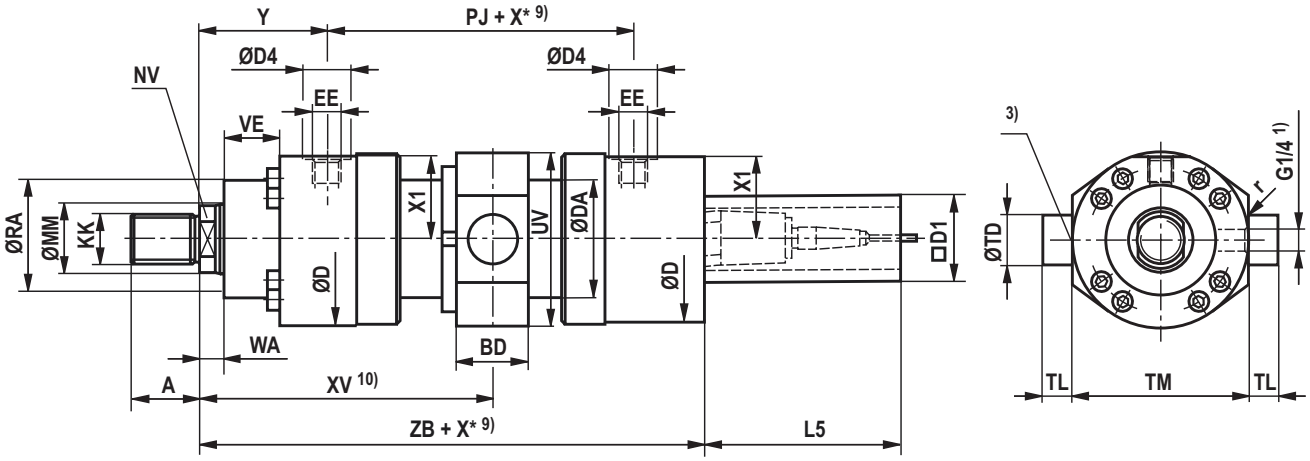
ØAL	ØMM	X* max	L4	L6	ZP	X* min	NF	VD	ØRD e8	ØFB H13	ØFC js13	ØUC -1	α	ØRA	VE
40	**28**	1000	0	166	282	–	35	5	95	13,5	120	145	60°	52	45
50	**36**	1000	0	166	285	–	40	5	115	13,5	140	165	60°	70	47
63	**45**	2000	0	153	340	–	40	5	150	17,5	180	210	60°	88	43
80	**56**	2000	0	123	370	–	50	5	160	17,5	195	230	60°	98	53
100	**70**	3000	0	106	402	–	55	5	200	22	230	270	60°	120	55
125	**90**	3000	25,5	93	495	–	70	5	245	26	290	335	60°	150	68
140	**100**	3000	28,5	84	532	–	70	10	280	30	330	380	60°	170	75
160	**110**	3000	28,5	71	600	–	80	10	300	30	360	420	45°	200	90
180	**125**	3000	35	56	665	–	95	10	335	36	400	470	45°	230	100
200	**140**	3000	35	46	710	–	105	10	360	36	430	500	45°	250	110
220	**160**	3000	38	41	770	–	115	10	400	39	475	550	45°	275	125
250	**180**	3000	44	31	820	20	125	10	450	45	530	610	45°	320	135
280	**200**	3000	44	26	865	–	130	10	470	45	550	630	45°	335	150
320	**220**	3000	44	16	915	340	140	10	510	45	590	670	30°	350	165

ØAL = Piston Ø
ØMM = Piston rod Ø
X* = Stroke length
X*max = Max. stroke length
X*min = Min. stroke length

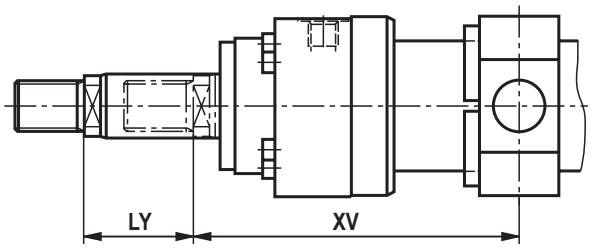
1) Bleeding: With view to the piston rod, the position is offset by 90° in relation to the line connection (clockwise)
2) Ø D4 max. 0,5 mm deep
3) Throttle valve only with end position cushioning „E“ (180° for bleeding)
4) Flange connections see separate table pages 36 and 37
5) Thread design „G”
6) Thread design „A”
9) Observe the min. stroke length „X*min“
10) With piston Ø 160 to 280 mm 8 mounting bores
With piston Ø 320 mm 12 mounting bores

Trunnion CSH3: MT4

CSH3 MT4



Dimensions for cylinder with piston rod extension “LY” in retracted condition



Dimensions CSH3: MT4 (dimensions in mm)

ØAL	ØMM	KK 5)	A 5)	KK 6)	A 6)	NV	ØD	ØDA	ØD4 2)	EE 4)	EE 4)	Y	PJ	X1	WA	ZB
40	**28**	M22x1,5	22	M24x2	35	22	92	52	34	G1/2	M22x1,5	91	120	43	18	247
50	**36**	M28x1,5	28	M30x2	45	30	108	62	34	G1/2	M22x1,5	90	120	51,5	18	246
63	**45**	M35x1,5	35	M39x3	55	36	140	78	42	G3/4	M27x2	117	133	67	22	304
80	**56**	M45x1,5	45	M50x3	75	46	148	100	42	G3/4	M27x2	124	146	71,5	22	332
100	**70**	M58x1,5	58	M64x3	95	60	186	125	47	G1	M33x2	119	171	90,5	25	347
125	**90**	M65x1,5	65	M80x3	110	75	235	160	58	G1 1/4	M42x2	170	205	114	32	427
140	**100**	M80x2	80	M90x3	120	85	258	175	58	G1 1/4	M42x2	186	219	126	35	460
160	**110**	M100x2	100	M100x3	140	95	292	200	65	G1 1/2	M48x2	210	240	142,5	40	515
180	**125**	M110x2	110	M110x4	150	110	325	220	65	G1 1/2	M48x2	241	264	159,5	45	565
200	**140**	M120x3	120	M120x4	160	120	350	245	65	G1 1/2	M48x2	262	278	172,5	45	600
220	**160**	M120x3	120	M120x4	160	140	375	292	65	G1 1/2	M48x2	262	326	185	40	655
250	**180**	M130x3	130	M150x4	190	160	440	324	65	G1 1/2	M48x2	272	336	218	40	695
280	**200**	–	–	M160x4	200	180	460	368	65	G1 1/2	M48x2	282	366	228	40	735
320	**220**	–	–	M180x4	220	200	490	406	65	G1 1/2	M48x2	287	391	243	40	775

ØAL	ØMM	X* max	L5	D1 max	X* min	XV 11) cent	XV min	XV max	BD	UV 12)	ØTD e8	TL js16	TM h13	r	ØRA	VE
40	28	1000	166	80	42	151+X*/2	172	138+X*	48	101	40	30	95	2	52	45
50	36	1000	166	96	50	150+X*/2	175	134+X*	48	117	40	30	120	2	70	47
63	45	2000	166	96	64	183,5+X*/2	215,5	163,5+X*	53	153	45	35	150	2	88	43
80	56	2000	166	96	82	197+X*/2	238	168+X*	68	169	55	50	160	2	98	53
100	70	3000	166	96	109	204,5+X*/2	259	165+X*	88	203	60	55	200	2	120	55
125	90	3000	166	96	131	272,5+X*/2	338	222+X*	118	252	75	60	245	2,5	150	68
140	100	3000	166	96	147	295,5+X*/2	369	237+X*	128	282	85	70	280	2,5	170	75
160	110	3000	166	96	186	330+X*/2	423	257+X*	148	310	95	80	300	2,5	200	90
180	125	3000	166	96	212	373+X*/2	479	287+X*	168	348	110	90	335	2,5	230	100
200	140	3000	166	96	228	401+X*/2	515	307+X*	188	373	120	100	360	2,5	250	110
220	160	3000	166	96	205	425+X*/2	527,5	322,5+X*	165	398	130	100	400	2,5	275	125
250	180	3000	166	96	245	440+X*/2	562,5	317,5+X*	175	463	140	100	450	5	320	135
280	200	3000	166	96	245	465+X*/2	587,5	342,5+X*	205	486	170	125	480	5	335	150
320	220	3000	166	96	600	482,5+X*/2	782,5	182,5+X*	245	537	200	150	500	5	350	165

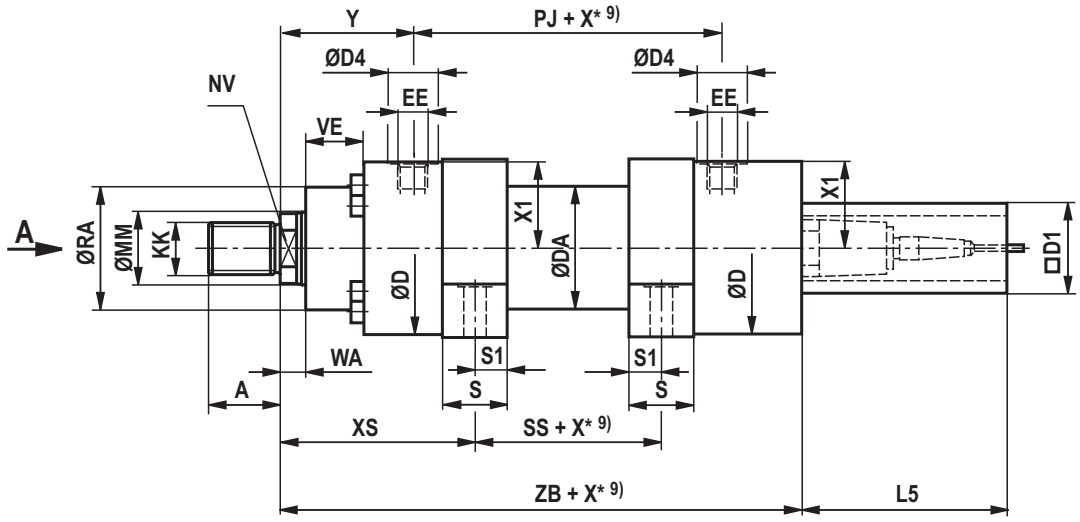
ØAL = Piston Ø
ØMM = Piston rod Ø
X* = Stroke length
X*max = Max. stroke length
X*min = Min. stroke length

1) Bleeding: With view to the piston rod, the position is offset by 90° in relation to the line connection (clockwise)
2) Ø D4 max. 0,5 mm deep
3) Throttle valve only with end position cushioning „E“ (180° for bleeding)
4) Flange connections see separate table pages 36 and 37
5) Thread design „G”
6) Thread design „A”
9) Observe the min. stroke length „X*min“
10) When ordering, always specify the „XV“ dimension in the clear text. Preferred XV dimension:
Observe the trunnion position in the cylinder center XVmin and XVmax
11) XVcent recommendation:
Trunnion position in cylinder center
12) The specified dimensions are maximum values, tolerance classes 342 according to ISO 9013 Thermal cutting

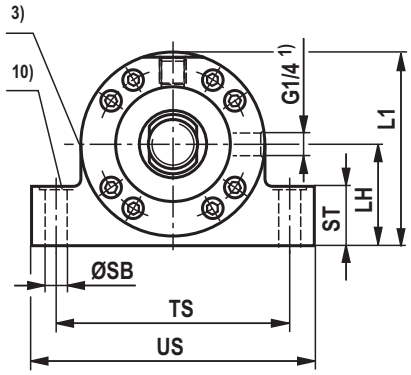
Important installation information: During installation, it must be ensured that the trunnion bearings are installed up to the trunnion shoulders. Any non-compliance may reduce the product's service life.

Foot mounting CSH3: MS2

CSH3 MS2; ØAL 40 to 320 mm



View A



Dimensions CSH3: MS2 (dimensions in mm)

ØAL	ØMM	KK 5)	A 5)	KK 6)	A 6)	NV	ØD	ØDA	ØD4 2)	EE 4)	EE 4)	Y	PJ	X1	WA	XS
40	**28**	M22x1,5	22	M24x2	35	22	92	52	34	G1/2	M22x1,5	91	120	43	18	126
50	**36**	M28x1,5	28	M30x2	45	30	108	62	34	G1/2	M22x1,5	90	120	51,5	18	130
63	**45**	M35x1,5	35	M39x3	55	36	140	78	42	G3/4	M27x2	117	133	67	22	164
80	**56**	M45x1,5	45	M50x3	75	46	148	100	42	G3/4	M27x2	124	146	71,5	22	176
100	**70**	M58x1,5	58	M64x3	95	60	186	125	47	G1	M33x2	119	171	90,5	25	179
125	**90**	M65x1,5	65	M80x3	110	75	235	160	58	G1 1/4	M42x2	170	205	114	32	245
140	**100**	M80x2	80	M90x3	120	85	258	175	58	G1 1/4	M42x2	186	219	126	35	265,5
160	**110**	M100x2	100	M100x3	140	95	292	200	65	G1 1/2	M48x2	210	240	142,5	40	302,5
180	**125**	M110x2	110	M110x4	150	110	325	220	65	G1 1/2	M48x2	241	264	159,5	45	353,5
200	**140**	M120x3	120	M120x4	160	120	350	245	65	G1 1/2	M48x2	262	278	172,5	45	379,5
220	**160**	M120x3	120	M120x4	160	140	375	292	65	G1 1/2	M48x2	262	326	185	40	387,5
250	**180**	M130x3	130	M150x4	190	160	440	324	65	G1 1/2	M48x2	272	336	218	40	397,5
280	**200**	–	–	M160x4	200	180	460	368	65	G1 1/2	M48x2	282	366	228	40	410
320	**220**	–	–	M180x4	220	200	490	406	65	G1 1/2	M48x2	287	391	243	40	440

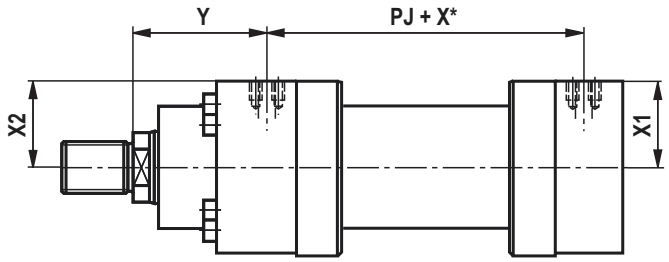
ØAL	ØMM	X* max	L5	D1 max	ZB	SS	X* min	S	S1	ØSB H13	ST	TS js13	US 12)	LH	L1 12)	ØRA	VE
40	**28**	1000	166	80	247	50	–	30	15	17,5	32	125	164	50	100	52	45
50	**36**	1000	166	96	246	40	4	40	20	22	37	150	197	60	118	70	47
63	**45**	2000	166	96	304	39	15	50	25	24	47	185	235	75	149	88	43
80	**56**	2000	166	96	332	42	22	60	30	26	52	210	270	80	160	98	53
100	**70**	3000	166	96	347	51	23	70	35	33	62	250	320	100	200	120	55
125	**90**	3000	166	96	427	55	39	90	45	40	72	310	392	120	245	150	68
140	**100**	3000	166	96	460	60	39	95	47,5	40	77	340	422	135	271	170	75
160	**110**	3000	166	96	515	55	64	115	57,5	45	87	370	462	150	305	200	90
180	**125**	3000	166	96	565	39	110	145	72,5	45	79	415	515	165	337	230	100
200	**140**	3000	166	96	600	43	116	155	77,5	52	112	460	570	180	366	250	110
220	**160**	3000	166	96	655	75	100	155	77,5	52	112	500	610	200	398	275	125
250	**180**	3000	166	96	695	85	90	155	77,5	52	122	550	660	225	456	320	135
280	**200**	3000	166	96	735	110	70	160	80	62	142	600	722	235	476	335	150
320	**220**	3000	166	96	775	85	400	190	95	74	162	650	785	255	512	350	165

ØAL = Piston Ø
ØMM = Piston rod Ø
X* = Stroke length
X*max = Max. stroke length
X*min = Min. stroke length

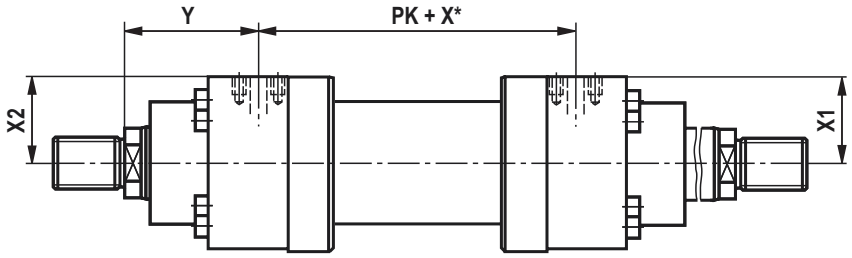
1) Bleeding: With view to the piston rod, the position is offset by 90° in relation to the line connection (clockwise)
2) Ø D4 max. 0,5 mm deep
3) Throttle valve only with end position cushioning „E“ (180° for bleeding)
4) Flange connections see separate table pages 36 and 37
5) Thread design „G”
6) Thread design „A”
9) Observe the min. stroke length „X*min“
10) Recess 2 mm deep, for hexagon socket head cap screws; ISO 4762 (for spool Ø 320 mm DIN 931) – The screws must not be subjected to shear force.Force distribution via additional external fitting strips
12) The specified dimensions are maximum values, tolerance classes 342 according to ISO 9013 Thermal cutting

Flange connections

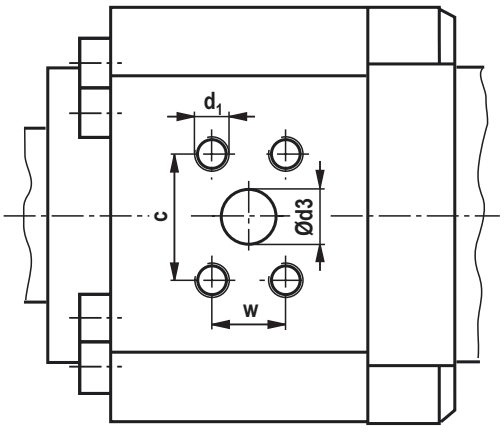
CDH3 / CSH3



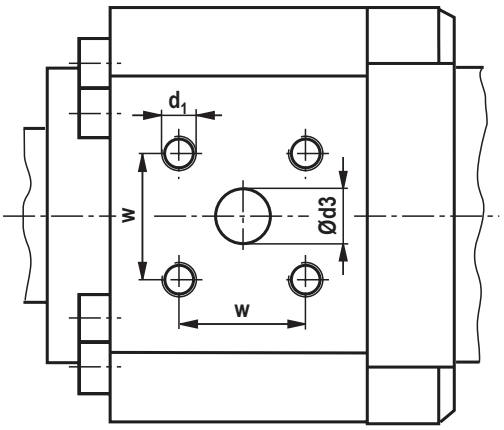
CGH3



Porting pattern for rectangular flange according to ISO 6162-2 tab. 2 type 1



Porting pattern for square flange according to ISO 6164 table 2



Flange connections

Dimensions (dimensions in mm)

ØAL	Version "D" ISO 6162-2 tab.2 type1 (400 bar) (≙ SAE 6000 PSI)											Version "H" ISO 6164 tab.2 (400 bar)							
	Y	PJ PK	X1	X2	Ød$_3$	Ød$_3$ 3)	c ±0,25	w ±0,25	d$_1$	t$_1$ 1)	p 2)	Y	PJ PK	X1	Ød$_3$	w ±0,25	d$_1$	t$_1$ 1)	p 2)
40	–	–	–	–	–	–	–	–	–	–	–	90	122	42,5	10	24,7	M6	12,5	400
50	–	–	–	–	–	–	–	–	–	–	–	89	122	51	10	24,7	M6	12,5	400
63	113	141	65	65	13	1/2“	40,5	18,2	M8	16	400	113	141	66	19	35,4	M8	16	400
80	120	154	69	69	13	1/2“	40,5	18,2	M8	16	400	120	154	70	19	35,4	M8	16	400
100	114	181	87	87	19	3/4“	50,8	23,8	M10	20	400	118	173	89,5	19	35,4	M8	16	400
125	162,5	220	111,5	111,5	25	1“	57,2	27,8	M12	24	400	162,5	220	112,5	32	51,6	M12	24	400
140	179,5	232	121,5	121,5	32	1 1/4“	66,6	31,8	M14	26	400	179,5	232	124,5	32	51,6	M12	24	400
160	197,5	265	139,5	139,5	32	1 1/4“	66,6	31,8	M14	26	400	197,5	265	140,5	38	60,1	M16	30	400
180	233,5	279	156,5	156,5	32	1 1/4“	66,6	31,8	M14	26	400	233,5	279	156,5	38	60,1	M16	30	400
200	254,5	293	167,5	167,5	38	1 1/2“	79,3	36,5	M16	30	400	254,5	293	170,5	38	60,1	M16	30	400
220	262	326	178	178	38	1 1/2“	79,3	36,5	M16	30	400	262	326	182	38	60,1	M16	30	400
250	272	336	212	212	38	1 1/2“	79,3	36,5	M16	30	400	272	336	216	38	60,1	M16	30	400
280	282	366	222	222	38	1 1/2“	79,3	36,5	M16	30	400	282	366	226	38	60,1	M16	30	400
320	287	391	236	236	51	2“	96,8	44,5	M20	36	400	287	391	240	51	69,3	M16	30	400

Main dimensions see pages 10 to 21 and/or pages 24 to 35

ØAL = Piston Ø
X* = Stroke length

1) Thread depth
2) Max. operating pressure for related flanges in bar
3) Flange porting pattern according to ISO 6162-2 tab. 2 type 1 corresponds to flange porting pattern according to SAE 6000 PSI

Subplates for valve mounting (SL and SV valve)

Note:

Valves, fittings and piping are **not** included in the scope of delivery!

1 Port B to the piston side according to ISO 6164

2 Bore for locating pin

3 Adapter plate for MT4 type of mounting (part of the scope of delivery for MT4)

4 Line connection "B" dimensions see also pages 10 to 21 and pages 24 to 35

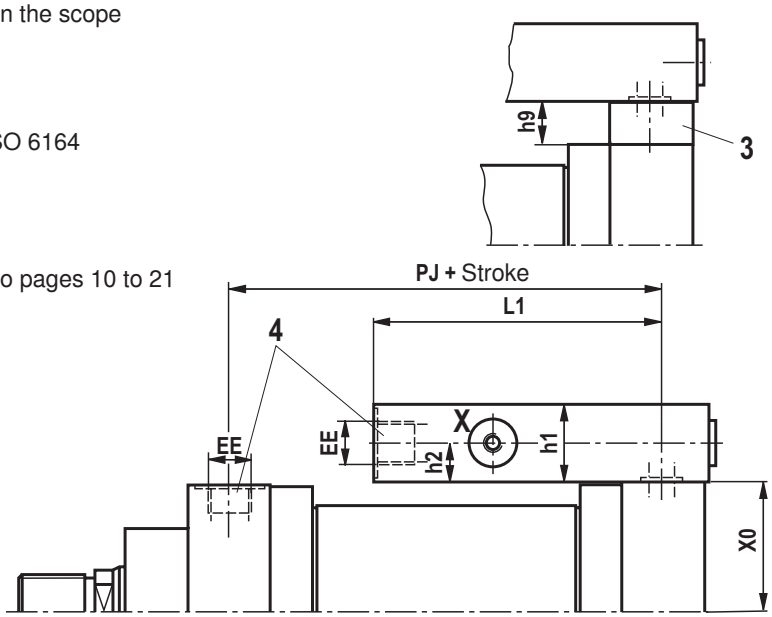
Important notice

Subplates for SL and SV valves (isolator valves)

Note:

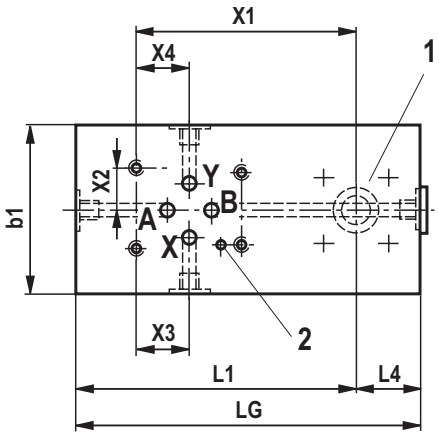
Seal designs T, G, L, R, S and V are not designed for the static holding function!

Installation situation with MT4



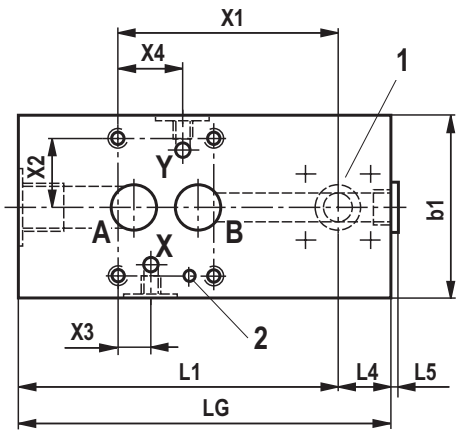
Size 6

Porting pattern according to ISO 24340 form A and ISO 4401



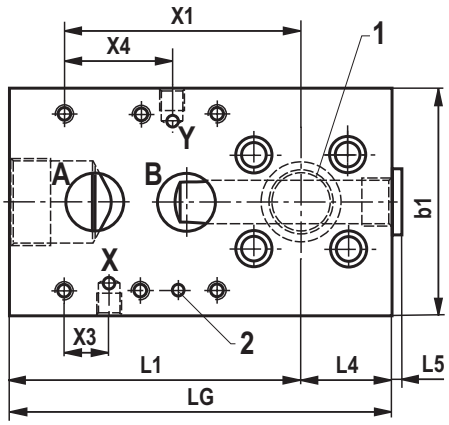
Size 10 and 20

Porting pattern according to ISO 5781

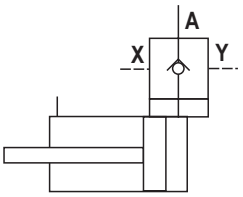


Size 30

Porting pattern according to ISO 5781



Piping symbol

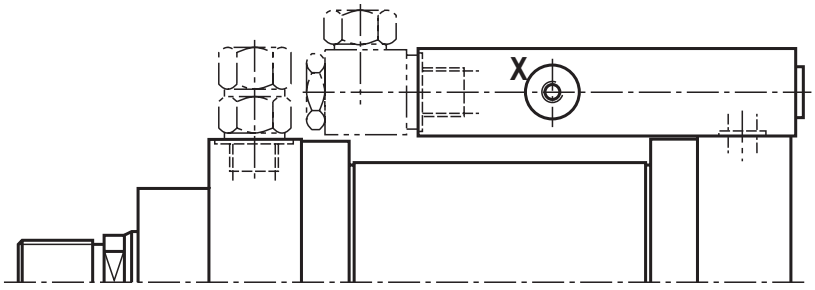


Subplates for valve mounting (SL and SV valve – dimensions in mm)

ØAL	Valve size	PJ	EE	Stroke min [1]		X0	Plate dimensions							Port size, porting pattern						Position point Valve	
				[2]	[3]		L1	L4	L5	LG	b1	h1	h9	h2	A	X	Y	X3	X4	X1	X2
40	6	121	G1/2	50	50	42,5	90	20	4	110	55	40	10	20	G1/2	G1/4	G1/4	21,5	21,5	65,5	15,5
50	6	121	G1/2	50	50	51,0	90	20	4	110	55	40	10	20	G1/2	G1/4	G1/4	21,5	21,5	65,5	15,5
63	6	137	G3/4	64	64	66,0	105	30	5	135	60	45	20	22,5	G3/4	G1/4	G1/4	21,5	21,5	75,5	15,5
	10	137	G3/4	64	64	66,0	110	30	5	140	85	45	20	22,5	G3/4	G1/4	G1/4	21,4	21,4	78	33,3
80	6	150	G3/4	58	82	70,0	105	30	5	135	60	45	20	22,5	G3/4	G1/4	G1/4	21,5	21,5	75,5	15,5
	10	150	G3/4	58	82	70,0	110	30	5	140	85	45	20	22,5	G3/4	G1/4	G1/4	21,4	21,4	78	33,3
100	10	172	G1	50	109	89,5	102	28	5	130	85	50	20	25	G1	G1/4	G1/4	21,4	21,4	70	33,3
125	10	212,5	G1 1/4	80	131	112,5	120	40	5	160	85	60	30	30	G1 1/4	G1/4	G1/4	21,4	21,4	90	33,3
	20	212,5	G1 1/4	80	131	112,5	135	50	5	185	100	60	30	30	G1 1/4	G1/4	G1/4	20,8	39,7	105	39,7
	30	212,5	G1 1/4	80	131	112,5	160	50	5	210	125	60	30	30	G1 1/4	G1/4	G1/4	24,6	59,6	130	48,4
140	10	225,5	G1 1/4	60	147	124,5	120	40	5	160	85	60	30	30	G1 1/4	G1/4	G1/4	21,4	21,4	90	33,3
	20	225,5	G1 1/4	60	147	124,5	135	50	5	185	100	60	30	30	G1 1/4	G1/4	G1/4	20,8	39,7	105	39,7
	30	225,5	G1 1/4	60	147	124,5	160	50	5	210	125	60	30	30	G1 1/4	G1/4	G1/4	24,6	59,6	130	48,4
160	10	252,5	G1 1/2	60 [4]	186	140,5	130	45	5	175	95	70	20	35	G1 1/2	G1/4	G1/4	21,4	21,4	100	33,3
	20	252,5	G1 1/2	60 [4]	186	140,5	140	45	5	185	100	70	20	35	G1 1/2	G1/4	G1/4	20,8	39,7	115	39,7
	30	252,5	G1 1/2	60 [4]	186	140,5	165	45	5	210	125	70	20	35	G1 1/2	G1/4	G1/4	24,6	59,6	140	48,4
180	10	271,5	G1 1/2	50 [4]	212	156,5	130	45	5	175	95	70	20	35	G1 1/2	G1/4	G1/4	21,4	21,4	100	33,3
	20	271,5	G1 1/2	50 [4]	212	156,5	140	45	5	185	100	70	20	35	G1 1/2	G1/4	G1/4	20,8	39,7	115	39,7
	30	271,5	G1 1/2	50 [4]	212	156,5	165	45	5	210	125	70	20	35	G1 1/2	G1/4	G1/4	24,6	59,6	140	48,4
200	10	285,5	G1 1/2	30 [4]	228	170,5	130	45	5	175	95	70	20	35	G1 1/2	G1/4	G1/4	21,4	21,4	100	33,3
	20	285,5	G1 1/2	30 [4]	228	170,5	140	45	5	185	100	70	20	35	G1 1/2	G1/4	G1/4	20,8	39,7	115	39,7
	30	285,5	G1 1/2	30 [4]	228	170,5	165	45	5	210	125	70	20	35	G1 1/2	G1/4	G1/4	24,6	59,6	140	48,4

ØAL = Piston Ø

[1] The information only applies to the following connection situation!



[2] Not for MT4

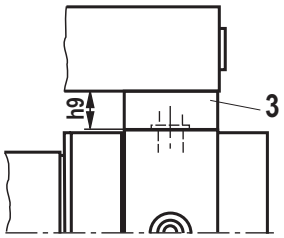
[3] Only for MT4

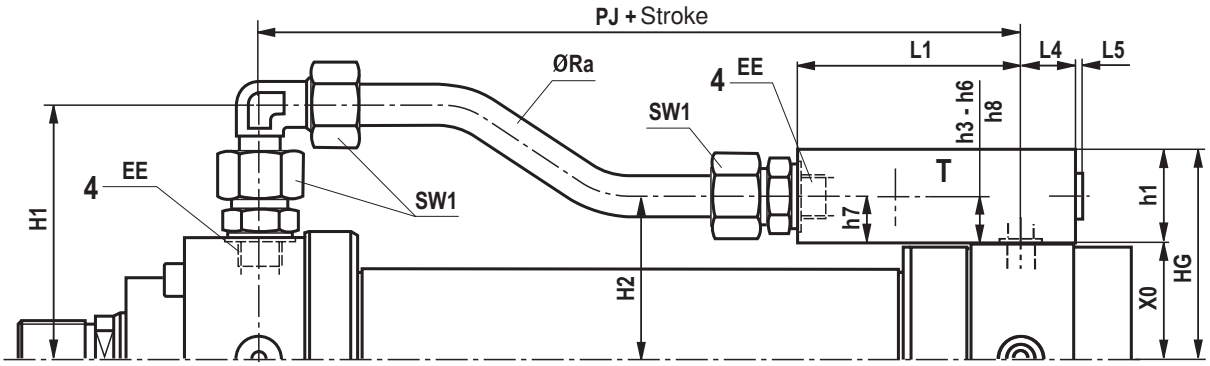
[4] With type of mounting „MS2“, observe X*min on page 21 and/or 35

Subplates for valve mounting (directional and high-response valves)

1 Port B to the piston side according to ISO 6164
2 Bore for locating pin
3 Adapter plate for MT4 type of mounting (part of the scope of delivery for MT4)
4 Line connection "B" dimensions see also pages 10 to 21 and pages 24 to 35

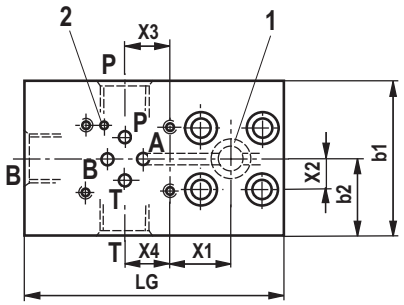
Installation situation with MT4





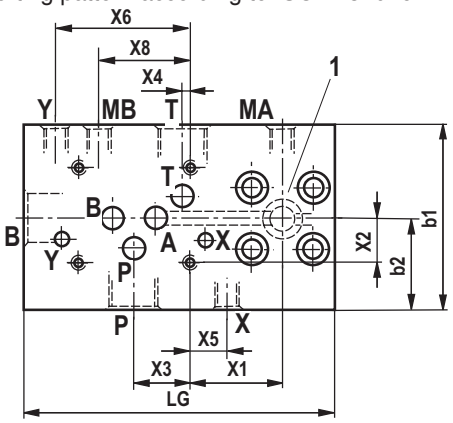
Size 6

Porting pattern according to ISO 24340 form A and ISO 4401



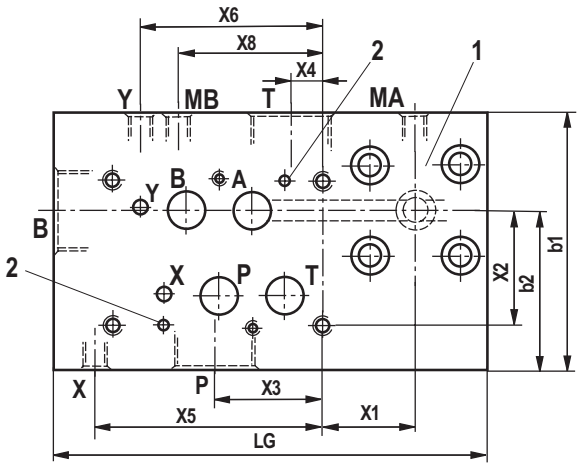
Size 10

Porting pattern according to ISO 24340 form A and ISO 4401



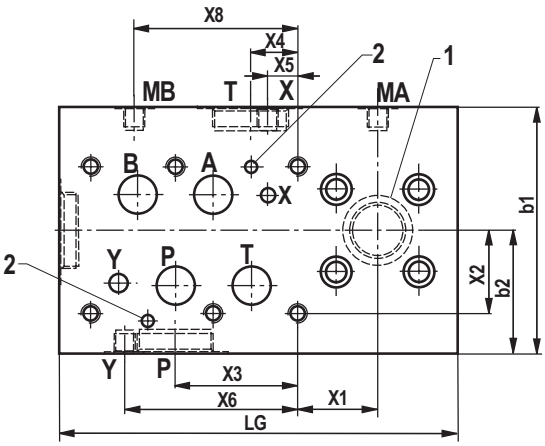
Size 16

Porting pattern according to ISO 24340 form A and ISO 4401



Size 25

Porting pattern according to ISO 24340 form A and ISO 4401



With larger stroke lengths and depending on the piston diameter, the pipeline is mounted at the cylinder pipe using pipe supports. A maximum of two sandwich plates is admissible.

Subplates for valve mounting (directional and high-response valves – dimensions in mm)

ØAL	Valve size	PJ	EE	Stroke min	Plate dimensions															
					L1	L4	L5 max	H1	H2 [1]	H2 [2]	SW1	ØRa	b1	h1	LG	HG [1]	HG [2]	b2	X0	h7	h9
40	6	121	G1/2	242	90	20	4	98,0	62,5	72,5	30	16,0x2,5	65	40	110	82,5	92,5	32,5	42,5	20	10
50	6	121	G1/2	242	90	20	4	106,5	71,0	81,0	30	16,0x2,5	65	40	110	91,0	101,0	32,5	51,0	20	10
63	6	137	G3/4	278	105	30	5	132,0	88,5	108,5	36	20,0x3,0	75	45	135	111,0	131,0	37,5	66,0	22,5	20
	10	137	G3/4	303	130	30	5	132,0	89,0	109,0	36	20,0x3,0	90	70	160	136,0	156,0	45	66,0	23	20
80	6	150	G3/4	265	105	30	5	136,5	92,5	112,5	36	20,0x3,0	75	45	135	115,0	135,0	37,5	70,0	22,5	20
	10	150	G3/4	290	130	30	5	136,5	93,0	113,0	36	20,0x3,0	90	70	160	140,0	160,0	45	70,0	23	20
100	10	172	G1	317	132	28	5	163,5	119,5	139,5	46	25,0x4,0	90	80	160	169,5	189,5	45	89,5	30	20
125	10	212,5	G1 1/4	341	150	40	5	192,5	147,5	177,5	50	30,0x5,0	105	95	190	207,5	237,5	52,5	112,5	35	30
	16	212,5	G1 1/4	371	180	40	5	192,5	162,5	192,5	50	30,0x5,0	125	105	220	217,5	247,5	62,5	112,5	50	30
	25	212,5	G1 1/4	391	200	50	0	192,5	167,5	197,5	50	30,0x5,0	155	110	250	222,5	252,5	77,5	112,5	55	30
140	10	225,5	G1 1/4	328	150	40	5	204,5	159,5	189,5	50	30,0x5,0	105	95	190	219,5	249,5	52,5	124,5	35	30
	16	225,5	G1 1/4	358	180	40	5	204,5	174,5	204,5	50	30,0x5,0	125	105	220	229,5	259,5	62,5	124,5	50	30
	25	225,5	G1 1/4	378	200	50	0	204,5	179,5	209,5	50	30,0x5,0	155	110	250	234,5	264,5	77,5	124,5	55	30
160	10	252,5	G1 1/2	394	155	50	5	231,5	175,5	195,5	60	38,0x6,0	110	95	205	235,5	255,5	55	140,5	35	20
	16	252,5	G1 1/2	429	190	50	5	231,5	190,5	210,5	60	38,0x6,0	125	105	240	245,5	265,5	62,5	140,5	50	20
	25	252,5	G1 1/2	449	210	50	0	231,5	195,5	215,5	60	38,0x6,0	155	110	260	250,5	270,5	77,5	140,5	55	20
180	10	271,5	G1 1/2	375	155	50	5	248,5	191,5	211,5	60	38,0x6,0	110	95	205	251,5	271,5	55	156,5	35	20
	16	271,5	G1 1/2	248	190	50	5	248,5	206,5	226,5	60	38,0x6,0	125	105	240	261,5	281,5	62,5	156,5	50	20
	25	271,5	G1 1/2	307	210	50	0	248,5	211,5	231,5	60	38,0x6,0	155	110	260	266,5	286,5	77,5	156,5	55	20
200	10	285,5	G1 1/2	253	155	50	5	261,5	205,5	225,5	60	38,0x6,0	110	95	205	265,5	285,5	55	170,5	35	20
	16	285,5	G1 1/2	234	190	50	5	261,5	220,5	240,5	60	38,0x6,0	125	105	240	275,5	295,5	62,5	170,5	50	20
	25	285,5	G1 1/2	293	210	50	0	261,5	225,5	245,5	60	38,0x6,0	155	110	260	280,5	300,5	77,5	170,5	55	20

ØAL	Valve size	Port size, porting pattern																Position point Valve	
		P	X3	h3	T	X4	h4	X	X5	h5	Y	X6	h6	MA	MB	X8	h8	X1	X2
40	6	G1/2	21,5	20	G1/2	21,5	20	-	-	-	-	-	-	-	-	-	-	25	15,5
50	6	G1/2	21,5	20	G1/2	21,5	20	-	-	-	-	-	-	-	-	-	-	25	15,5
63	6	G3/4	21,5	22,5	G3/4	21,5	22,5	-	-	-	-	-	-	-	-	-	-	35	15,5
	10	G3/4	27	33	G3/4	3,5	33	G1/4	18	57	G1/4	64,0	57	G1/4	G1/4	50	17	50	21,4
80	6	G3/4	21,5	22,5	G3/4	21,5	22,5	-	-	-	-	-	-	-	-	-	-	35	15,5
	10	G3/4	27	33	G3/4	3,5	33	G1/4	18	57	G1/4	64,0	57	G1/4	G1/4	50	17	50	21,4
100	10	G1	27	30	G1	3,5	40	G1/4	18	57	G1/4	65,0	57	G1/4	G1/4	58	20	52	21,4
125	10	G1 1/4	27	35	G1 1/4	3,5	45	G1/4	20	72	G1/4	62,0	72	G1/4	G1/4	55	25	60	21,4
	16	G1 1/4	57	35	G1 1/4	15	34	G1/4	76,5	80	G1/4	86,0	85	G1/4	G1/4	86	45	50	40
	25	G1 1/4	77	42	G1 1/4	30	34	G1/4	19	90	G1/4	109,0	90	G1/4	G1/4	103	50	50	52,1
140	10	G1 1/4	27	35	G1 1/4	3,5	45	G1/4	20	72	G1/4	62,0	72	G1/4	G1/4	55	25	60	21,4
	16	G1 1/4	57	35	G1 1/4	15	34	G1/4	76,5	80	G1/4	86,0	85	G1/4	G1/4	86	45	50	40
	25	G1 1/4	77	42	G1 1/4	30	34	G1/4	19	90	G1/4	109,0	90	G1/4	G1/4	103	50	50	52,1
160	10	G1 1/2	27	35	G1 1/2	3,5	45	G1/4	19	72	G1/4	62,0	72	G1/4	G1/4	50	25	72	21,4
	16	G1 1/2	57	35	G1 1/2	15	34	G1/4	76,5	80	G1/4	86,0	85	G1/4	G1/4	86	45	60	40
	25	G1 1/2	77	42	G1 1/2	30	34	G1/4	19	90	G1/4	109,0	90	G1/4	G1/4	103	50	60	52,1
180	10	G1 1/2	27	35	G1 1/2	3,5	45	G1/4	19	72	G1/4	62,0	72	G1/4	G1/4	50	25	72	21,4
	16	G1 1/2	57	35	G1 1/2	15	34	G1/4	76,5	80	G1/4	86,0	85	G1/4	G1/4	86	45	60	40
	25	G1 1/2	77	42	G1 1/2	30	34	G1/4	19	90	G1/4	109,0	90	G1/4	G1/4	103	50	60	52,1
200	10	G1 1/2	27	35	G1 1/2	3,5	45	G1/4	19	72	G1/4	62,0	72	G1/4	G1/4	50	25	72	21,4
	16	G1 1/2	57	35	G1 1/2	15	34	G1/4	76,5	80	G1/4	86,0	85	G1/4	G1/4	86	45	60	40
	25	G1 1/2	77	42	G1 1/2	30	34	G1/4	19	90	G1/4	109,0	90	G1/4	G1/4	103	50	60	52,1

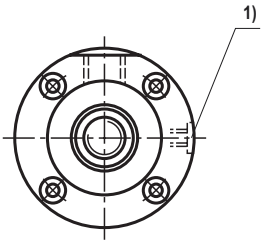
[1] Not for MT4

[2] Only for MT4

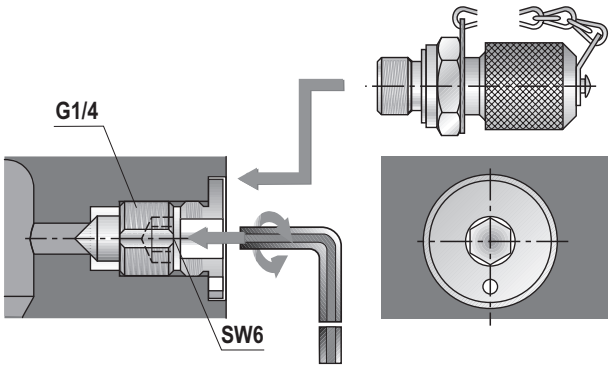
Bleeding / **threaded coupling** (dimensions in mm)

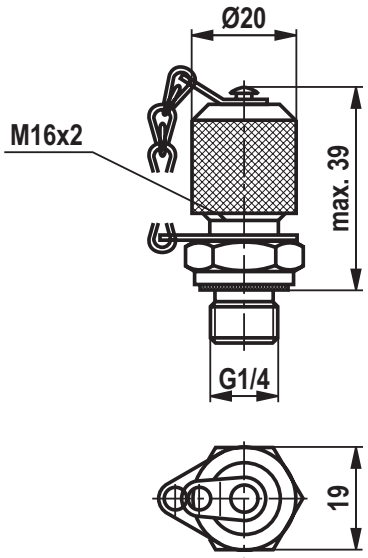
By default, a patented safety bleeding device against unintended screwing out in head and base is delivered for all cylinders.

The port allows for the installation of a threaded coupling with check valve for pressure measurement or contamination-free bleeding. Threaded coupling with check valve function, i.e. it can also be connected when the system is pressurized.



1) Bleeding: With view to the piston rod, the position is offset by 90° in relation to the line connection (clockwise)



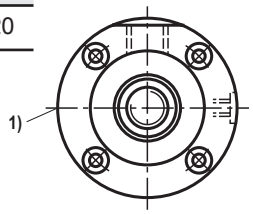


Scope of delivery: Threaded coupling **G1/4**

SCREW JOINT AB 20-11/K1 G1/4 with seal ring of NBR
SCREW JOINT AB 20-11/K1V G1/4 with seal ring of FKM

Throttle valve (dimensions in mm)

ØAL	40	50	63	80	100	125	140	160	180	200	220	250	280	320
Nominal width	4	4	4	5	5	8	8	8	8	8	20	20	20	20



ØAL = Piston Ø

1) Throttle valve only with end position cushioning „E“ (180° for bleeding)

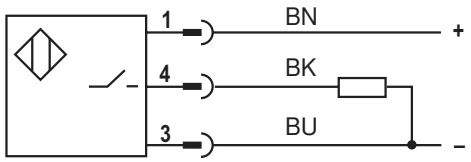
Proximity switch

Inductive proximity switches are used as reliable end position control for hydraulic cylinders. They are an important element for the safe and exact monitoring of safety equipment, lockings and/or other machine functions in their end position by means of the output of signals. The proximity switch which is high-pressure-resistant up to 500 bar works in a contactless manner. Consequently, it is wear-free. The proximity switch is set at the factory. The switching distance must not be adjusted. The lock nut of the proximity switch is marked at the factory using sealing wax. On versions with proximity switch, the cylinders are provided with proximity switches on both sides.

Technical data (For applications outside these parameters, please consult us!)

Function type			PNP normally open contact
Admissible pressure		bar	500
Operating voltage		V DC	10 … 30
	Including residual ripple	%	≤ 15
Voltage drop		V	≤ 1.5
Rated operating voltage		V DC	24
Rated operating current		mA	200
Idle current		mA	≤ 8
Residual current		µA	≤ 10
Repetition accuracy		%	≤ 5
Hysteresis		%	≤ 15
Ambient temperature range		°C	–25 … +80
Temperature drift		%	≤ 10
Switching frequency		Hz	1000
Protection class	Active area		IP 68
	Proximity switch		IP 67
Housing material			Material no. 1.4104

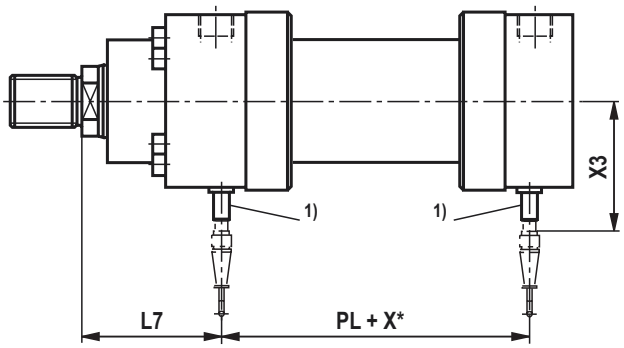
Pin assignment



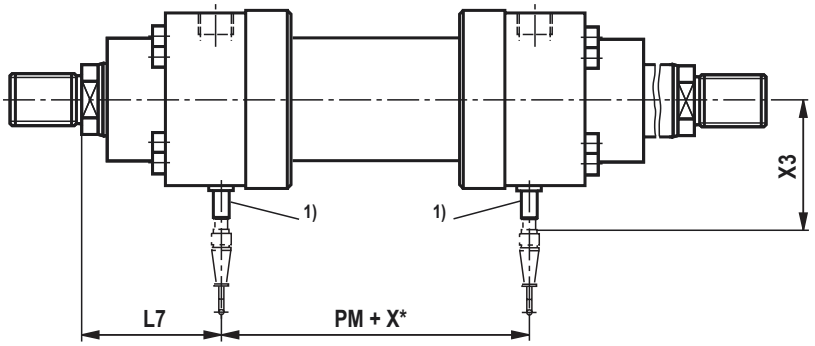
BN brown
BK black
BU blue

Proximity switch

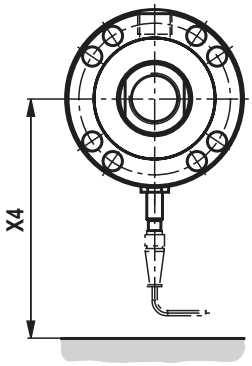
CDH3

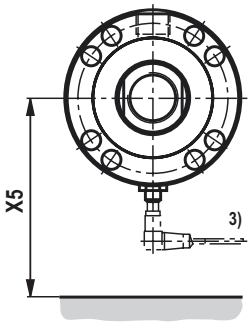


CGH3



Installation space for mating connector

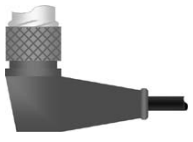




Mating connector with 5 m cable

(mating connector is **not** included in the scope of delivery, must be ordered separately)

Mating connector, angled with 5 m cable (position of the cable outlet cannot be defined)
(mating connector is **not** included in the scope of delivery, must be ordered separately)



Proximity switch

Dimensions (dimensions in mm)

ØAL	ØMM	PL	PM	L7	X3	X4	X5
40	**28**	112	112	95	94	170	125
50	**36**	110	110	95	98	175	130
63	**45**	125	125	121	103	180	135
80	**56**	138	138	128	108	185	140
100	**70**	161	161	124	116	195	150
125	**90**	189	189	178	126	205	160
140	**100**	209	209	191	146	225	180
160	**110**	228	228	216	151	230	185
180	**125**	254	254	246	159 [2)]	235	190
200	**140**	264	264	269	166 [2)]	245	200
220	**160**	310	310	270	177 [2)]	255	– [3)]
250	**180**	320	320	280	187 [2)]	265	– [3)]
280	**200**	360	360	285	199 [2)]	275	– [3)]
320	**220**	375	375	295	209 [2)]	285	– [3)]

Main dimensions see pages 10 to 21

ØAL = Piston Ø
ØMM = Piston rod Ø
X* = Stroke length

1) The proximity switch is always located opposite of the line connection
2) Piston Ø 220 - 320 mm
Proximity switch not protruding
3) Piston Ø 220 - 320 mm
Angled mating connector not possible

Position measurement system

The position measurement system that is pressure-resistant up to 500 bar works in a contactless and absolute manner. The basis of this position measurement system is the magnetostrictive effect. Here, the coincidence of two magnetic fields triggers a torsion pulse. This pulse runs on the waveguide inside the gauge from the measuring point to the sensor head. The running time is constant and almost temperature-independent. It is proportional to the position of the solenoid and thus a measure for the actual position value and is converted in the sensor into a direct analog or digital output.

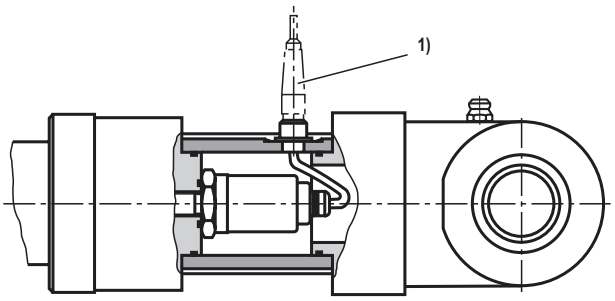
Technical data (For applications outside these parameters, please consult us!)

Operating pressure		bar	250
Analog output		V	0 to 10
	Load resistance	kΩ	≥ 5
	Resolution		unlimited
Analog output		mA	4 to 20
	Load resistance	Ω	0 to 500
	Resolution		unlimited
Digital output			SSI 24 bit gray-coded
	Resolution	µm	5
	Direction of measurement		asynchronously forward
Linearity (absolute accuracy)	Analog	% mm	≤ ±0.02 % (referred to measurement length) min. ±0.05
	Digital	% mm	≤ ±0.01 % (referred to measurement length) min. ±0.04
Reproducibility		% mm	±0.001 (referred to measurement length) min. ±0.0025
Hysteresis		mm	≤ 0.004
Supply voltage		V DC	24 (±10 % with analog output)
	Current consumption	mA	100
	Residual ripple	% s-s	≤ 1
	Current consumption	V DC mA	24 (+20 %/–15 % with digital output) 70
	Residual ripple	% s-s	≤ 1
Protection class	Pipe and flange		IP 67
	Sensor electronics		IP 65
Operating temperature	Sensor electronics	°C	–40 to +75
Temperature coefficient	Voltage	ppm/°C	70
	Current	ppm/°C	90

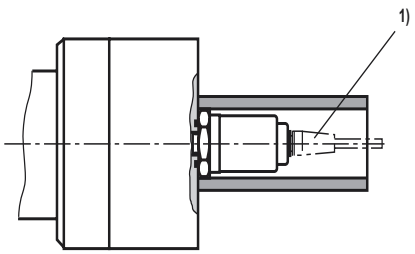
Position measurement system

Types of mounting

MP3, MP5

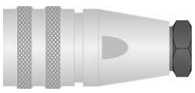


MF3, MF4, MT4, MS2



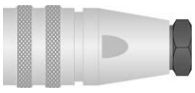
1) For analog output:
6−pole Amphenol mating connector

(mating connector is **not** included in the scope of delivery, must be ordered separately)



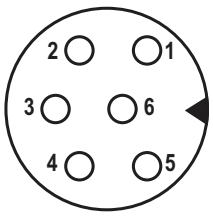
1) For digital output:
7−pole Amphenol mating connector

(mating connector is **not** included in the scope of delivery, must be ordered separately)



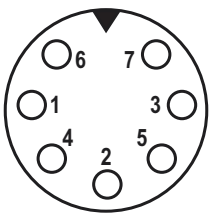
Pin assignment

Position measurement system (analog output)
Connector (view to pin side)



Pin	Cable	Signal / current	Signal / voltage
1	Gray	4 … 20 mA	0 … 10 V
2	Pink	DC ground	DC ground
3	Yellow	Not used	Not used
4	Green	DC ground	DC ground
5	Brown	+24 V DC (+20 % / –15 %)	+24 V DC (+20 % / –15 %)
6	White	DC ground (0 V)	DC ground (0 V)

Position measurement system (digital output)
Connector (view to pin side)



Pin	Cable	Signal / SSi
1	Gray	Data (–)
2	Pink	Data (+)
3	Yellow	Clock (+)
4	Green	Clock (–)
5	Brown	+24 V DC (+20 % / –15 %)
6	White	DC ground (0 V)
7	–	Not used

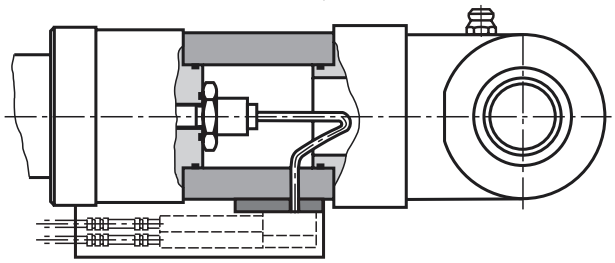
Technical data for the Profibus (For applications outside these parameters, please consult us!)

Output	Interface	Profibus-DP system
	Data record	Profibus-DP (EN 61158)
	Transmission rate	Max. 12 MB/s
Measurement accuracy	Travel resolution	1 µm to 1000 µm selectable as parameter
	Velocity	With 5 µm travel resolution: 0.64 mm/s to 500 mm; 0.43 mm/s to 2000 mm; 0.21 mm/s to 4500 mm: 0.14 mm/s to 7600 mm Measurement length With 2 µm travel resolution: 2.5 times smaller values
	Linearity	< +/–0.01 % F.S. (Minimum +/–50 µm)
	Repeatability	< +/–0.001 % F.S. (Minimum +/–2.5 µm)
	Temperature coefficient	< 15 ppm/°C
	Hysteresis	< 4 µm
Application conditions	Operating temperature	–40 °C to 75 °C
	Protection class	Profile: IP65 Rod: IP 67 with proper coupling plug assembly
	Standards, EMC test	Interference emissions according to EN 61000-6-3 Interference resistance according to EN 61000-6-2 EN 61000-4-2/3/4/6, level 3/4, criterion A, CE-tested
Electrical connection	Operating voltage	24 VDC (–15 / +20 %)

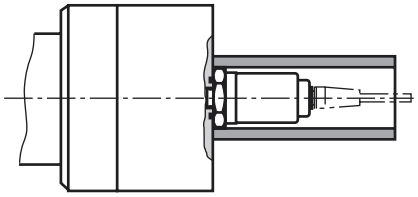
Please ask for the complete technical data!

Types of mounting

MP3, MP5



MF3, MF4, MT4, MS2

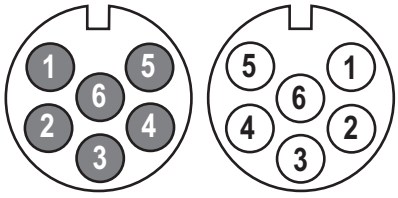


The output of the position measurement system is by default always rotated by 180° to the selected position of the hydraulic connection in the cylinder base.

Mating connector is **not** included in the scope of delivery, must be ordered separately.

Pin assignment for Profibus

Pin assignment for Profibus D63

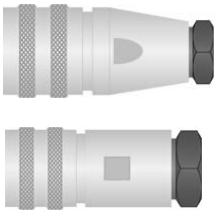


Pins Sockets

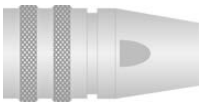
Pin	Cable	Function
1	Green	RxD/TxD-N (bus)
2	Red	RxD/TxD-P (bus)
3	—	DGND (terminating resistor) *
4	—	VP (terminating resistor) *
5	Black	+24 VDC (–15 / +20 %)
6	Blue	DC ground (0 V)
—	Yellow/ green	Shield compensating line, is usually not to be connected

* Only with sockets

Mating connectors for D63



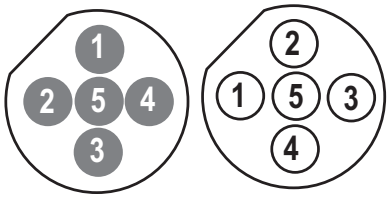
Signal input
6-pin mating connector M16
Signal output
6-pin mating connector M16



Signal output
6-pin end plug M16

Pin assignment for Profibus D53

Bus

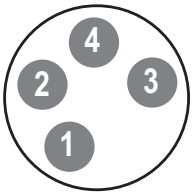


Pins Sockets

Pin	Cable	Function
1	—	VP+5 (terminating resistor) *
2	Green	RxD/TxD-N (bus)
3	—	DGND (terminating resistor) *
4	Red	RxD/TxD-P (bus)
5	Shield	Shield

* Only with sockets

Supply

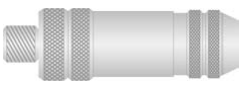


View connector side

Pin	Cable	Function
1	Brown	+24 VDC (–15 / +20 %)
2	White	Not used
3	Blue	DC ground (0 V)
4	Black	Not used

Mating connectors for D53

Signal input
5-pin mating connector M12-B



Signal output
5-pin mating connector M12-B

Signal output
5-pin end plug M12-B

Supply for D53

4-pin mating connector M8

Connection cable 5 m
with 4-pin mating connector M8

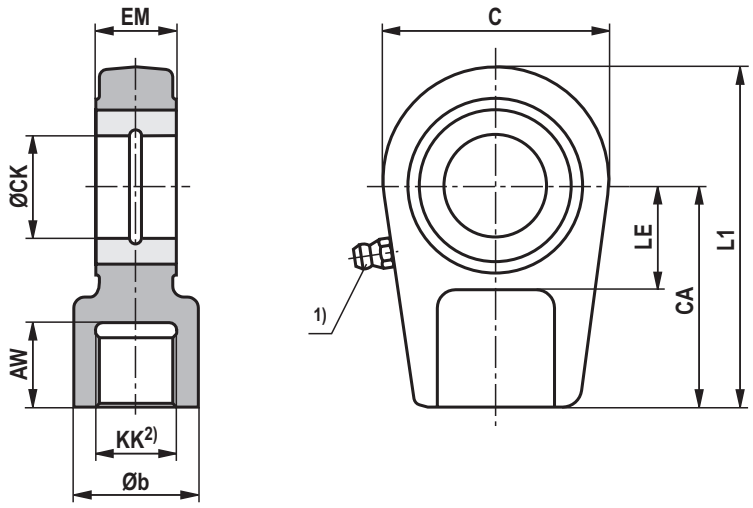
Connection cable 10 m
with 4-pin mating connector M8

Connection cable 15 m
with 4-pin mating connector M8

Mating connector is **not** included in the scope of delivery, must be ordered separately.

Plain clevis CSA (dimensions in mm)

ØAL 40 to 200 mm



ØAL	Type	AW	Øb	C	CA	ØCK H11	EM -0,4	KK	LE	L1	*m* 3) kg	C_0 4) kN	F_{adm} 5) kN
40	**CSA 22**	23	34	64	60	30	28	M22x1,5	30	94	0,7	106	38,2
50	**CSA 28**	29	44	78	70	35	30	M28x1,5	40	112	1,1	153	55,1
63	**CSA 35**	36	55	94	85	40	35	M35x1,5	45	135	2,0	250	90,0
80	**CSA 45**	46	70	116	105	50	40	M45x1,5	55	168	3,3	365	131,4
100	**CSA 58**	59	87	130	130	60	50	M58x1,5	65	200	5,5	400	144,0
125	**CSA 65**	66	93	154	150	70	55	M65x1,5	75	232	8,6	540	194,4
140	**CSA 80**	81	125	176	170	80	60	M80x2	80	265	12,2	670	241,2
160	**CSA100**	101	143	206	210	90	65	M100x2	90	323	21,5	980	352,8
180	**CSA110**	111	153	230	235	100	70	M110x2	105	360	27,5	1120	403,2
200	**CSA120**	125	176	265	265	110	80	M120x2	115	407,5	40,7	1700	612,0

The specified dimensions are maximum values and may vary depending on the manufacturer.
The following values are excluded: CA, CK, EM, KK

ØAL = Piston Ø

1) Lubricating nipple, cone head form A according to DIN 71412

2) The plain clevis must always be screwed against the piston rod shoulder

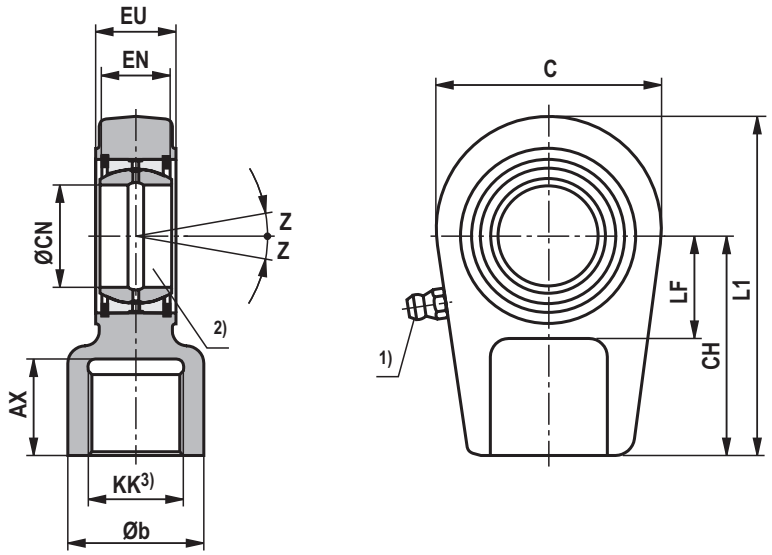
3) ***m*** = Weight plain clevis in kg

4) C_0 = Static load rating of the plain clevis

5) F_{adm} = Max. admissible load of the plain clevis with oscillatory or alternating loads

Self-aligning clevis CGA (dimensions in mm)

ØAL 40 to 250 mm



ØAL	Type	AX min	Øb max	C	CH	ØCN 2)	EN	EU -0,4	KK	L1	LF min	Z	*m* 4) kg	C_0 5) kN	F_{adm} 6) kN
40	**CGA 22**	23	33	64	60	$30_{-0,010}$	$22_{-0,12}$	28	M22x1,5	94	30	6°	0,7	106	38,2
50	**CGA 28**	29	41	78	70	$35_{-0,012}$	$25_{-0,12}$	30	M28x1,5	112	38	6°	1,1	153	55,1
63	**CGA 35**	36	50	94	85	$40_{-0,012}$	$28_{-0,12}$	35	M35x1,5	135	45	7°	2,0	250	90,0
80	**CGA 45**	46	62	116	105	$50_{-0,012}$	$35_{-0,12}$	40	M45x1,5	168	55	6°	3,3	365	131,4
100	**CGA 58**	59	76	130	130	$60_{-0,015}$	$44_{-0,15}$	50	M58x1,5	200	65	6°	5,5	400	144,0
125	**CGA 65**	66	87	154	150	$70_{-0,015}$	$49_{-0,15}$	55	M65x1,5	232	75	6°	8,6	540	194,4
140	**CGA 80**	81	106	176	170	$80_{-0,015}$	$55_{-0,15}$	60	M80x2	265	80	6°	12,2	670	241,2
160	**CGA100**	101	125	206	210	$90_{-0,020}$	$60_{-0,20}$	65	M100x2	323	90	5°	21,5	980	352,8
180	**CGA110**	111	139	230	235	$100_{-0,020}$	$70_{-0,20}$	70	M110x2	360	105	7°	27,5	1120	403,2
200	**CGA120**	125	153	265	265	$110_{-0,020}$	$70_{-0,20}$	80	M120x3	407,5	115	6°	40,7	1700	612,0
220	**CGA120**	125	153	265	265	$110_{-0,020}$	$70_{-0,20}$	80	M120x3	407,5	115	6°	40,7	1700	612,0
250	**CGA130**	135	173	340	310	$120_{-0,020}$	$85_{-0,20}$	90	M130x3	490	140	6°	76,4	2900	1044,0

The specified dimensions are maximum values and may vary depending on the manufacturer.
The following values are excluded: CH, CN, EN, EU, KK

ØAL = Piston Ø

1) Lubricating nipple, cone head form A according to DIN 71412

2) Related bolt Ø m6;
related bolt Ø j6 with maintenance-free spherical bearing

3) The self-aligning clevis must always be screwed against the shoulder of the piston rod

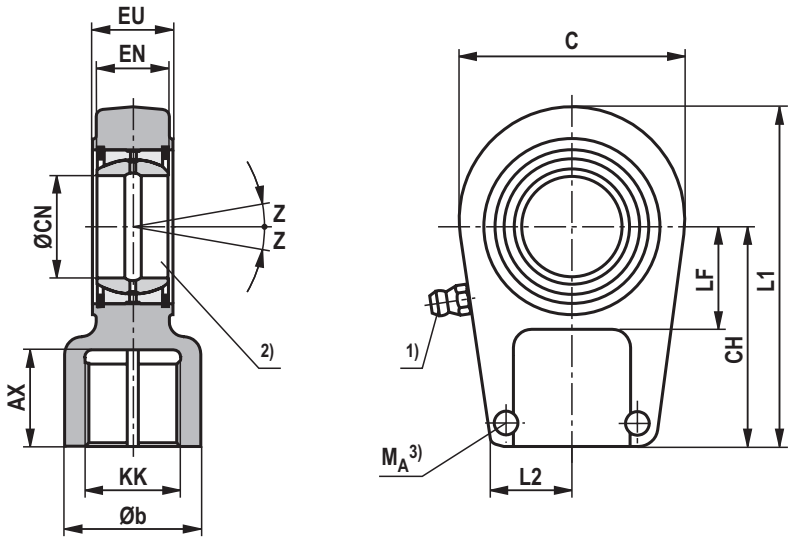
4) ***m*** = Weight self-aligning clevis in kg

5) C_0 = Static load rating of the self-aligning clevis

6) F_{adm} = Max. admissible load of the self-aligning clevis with oscillatory or alternating loads

Self-aligning clevis CGAK (clampable) (dimensions in mm)

ØAL 40 to 250 mm



ØAL	Type	AX min	Øb max	C	CH	ØCN 2)	EN	EU -0,4	KK
40	**CGAK 22**	23	33	64	60	$30_{-0,010}$	$22_{-0,12}$	28	M22x1,5
50	**CGAK 28**	29	41	78	70	$35_{-0,012}$	$25_{-0,12}$	30	M28x1,5
63	**CGAK 35**	36	50	94	85	$40_{-0,012}$	$28_{-0,12}$	35	M35x1,5
80	**CGAK 45**	46	62	116	105	$50_{-0,012}$	$35_{-0,12}$	40	M45x1,5
100	**CGAK 58**	59	76	130	130	$60_{-0,015}$	$44_{-0,15}$	50	M58x1,5
125	**CGAK 65**	66	87	154	150	$70_{-0,015}$	$49_{-0,15}$	55	M65x1,5
140	**CGAK 80**	81	106	176	170	$80_{-0,015}$	$55_{-0,15}$	60	M80x2
160	**CGAK100**	101	125	206	210	$90_{-0,020}$	$60_{-0,20}$	65	M100x2
180	**CGAK110**	111	139	231	235	$100_{-0,020}$	$70_{-0,20}$	70	M110x2
200	**CGAK120**	125	155	266	265	$110_{-0,020}$	$70_{-0,20}$	80	M120x3
220	**CGAK120**	125	153	265	265	$110_{-0,020}$	$70_{-0,20}$	80	M120x3
250	**CGAK130**	135	173	340	310	$120_{-0,020}$	$85_{-0,20}$	90	M130x3

Self-aligning clevis CGAK (clampable) (dimensions in mm)

ØAL	Type	L1	L2 max	LF	Z	Clamping screws ISO 4762-10.9	M_A [3] Nm	m [4] kg	C_0 [5] kN	F_{adm} [6] kN
40	**CGAK 22**	94	26	30	6°	M8	30	0,7	106	38,2
50	**CGAK 28**	112	34	38	6°	M10	54	1,1	153	55,1
63	**CGAK 35**	135	39	45	7°	M10	59	2,0	250	90,0
80	**CGAK 45**	168	46	55	6°	M12	100	3,3	365	131,4
100	**CGAK 58**	200	61	65	6°	M16	250	5,5	400	144,0
125	**CGAK 65**	232	66	75	6°	M16	250	8,6	540	194,4
140	**CGAK 80**	265	81	80	6°	M20	490	12,2	670	241,2
160	**CGAK100**	323	91	90	5°	M20	490	21,5	980	352,8
180	**CGAK110**	360	101	105	7°	M24	840	27,5	1120	403,2
200	**CGAK120**	407,5	111	115	6°	M24	840	40,7	1700	612,0
220	**CGAK120**	407,5	111	115	6°	M24	840	40,7	1700	612,0
250	**CGAK130**	490	129	140	6°	M24	840	76,4	2900	1044,0

The specified dimensions are maximum values and may vary depending on the manufacturer.
The following values are excluded: CH, CN, EN, EU, KK

ØAL = Piston Ø

1) Lubricating nipple, cone head form A according to DIN 71412

2) Related bolt Ø m6;
related bolt Ø j6 with maintenance-free spherical bearing

3) M_A = Tightening torque
The self-aligning clevis must always be screwed against the shoulder of the piston rod. Afterwards, the clamping screws must be tightened with the specified tightening torque.

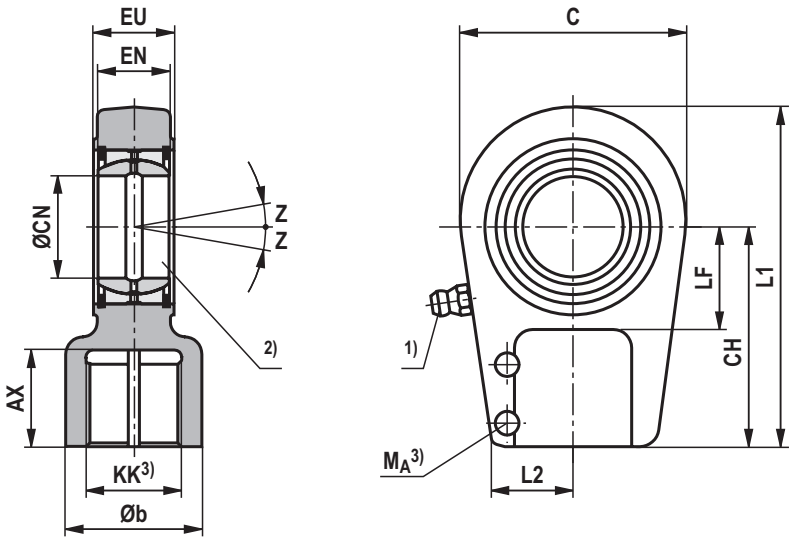
4) m = Weight self-aligning clevis in kg

5) C_0 = Static load rating of the self-aligning clevis

6) F_{adm} = Max. admissible load of the self-aligning clevis with oscillatory or alternating loads

Self-aligning clevis CGAS (clampable) (dimensions in mm)

ØAL 40 to 320 mm



ØAL	Type	AX min	Øb max	C max	CH	ØCN 2)	EN	EU -0,4	KK
40	**CGAS 30**	35	34	64	75	$30_{-0,010}$	$22_{-0,12}$	28	M24x2
50	**CGAS 35**	46	46	78	90	$35_{-0,012}$	$25_{-0,12}$	30	M30x2
63	**CGAS 40**	56	57	94	105	$40_{-0,012}$	$28_{-0,12}$	35	M39x3
80	**CGAS 50**	76	70	116	135	$50_{-0,012}$	$35_{-0,12}$	40	M50x3
100	**CGAS 60**	96	87	130	170	$60_{-0,015}$	$44_{-0,15}$	50	M64x3
125	**CGAS 70**	112	111	154	195	$70_{-0,015}$	$49_{-0,15}$	55	M80x3
140	**CGAS 80**	122	129	176	210	$80_{-0,015}$	$55_{-0,15}$	60	M90x3
160	**CGAS 90**	142	153	211	250	$90_{-0,020}$	$60_{-0,20}$	65	M100x3
180	**CGAS100**	152	170	230	275	$100_{-0,020}$	$70_{-0,20}$	70	M110x4
200	**CGAS110**	162	180	264	300	$110_{-0,020}$	$70_{-0,20}$	80	M120x4
220	**CGAS110**	162	180	264	300	$110_{-0,020}$	$70_{-0,20}$	80	M120x4
250	**CGAS120**	192	210	340	360	$120_{-0,020}$	$85_{-0,20}$	90	M150x4
280	**CGAS140**	210	230	380	420	$140_{-0,025}$	$90_{-0,25}$	110	M160x4
320	**CGAS160**	221	260	480	460	$160_{-0,025}$	$105_{-0,25}$	110	M180x4

Self-aligning clevis CGAS (clampable) (dimensions in mm)

ØAL	Type	L1 max	L2 max	LF min	Z [3]	Clamping screws ISO 4762-10.9	M_A [4] Nm	m [5] kg	C_0 [6] kN	F_{adm} [7] kN
40	**CGAS 30**	109	28	30	6-7°	M8	30	1,0	122	40,3
50	**CGAS 35**	132	36	40	6-7°	M10	59	1,5	177	58,4
63	**CGAS 40**	155	39	44	7°	M12	100	2,4	287	94,7
80	**CGAS 50**	198	45	55	6-7°	M12	100	4,8	422	139,3
100	**CGAS 60**	240	59	65	6-7°	M16	250	8,6	522	172,3
125	**CGAS 70**	279	70	75	6°	M16	250	12,2	707	233,3
140	**CGAS 80**	305	85	80	6°	M20	490	18,4	870	287,1
160	**CGAS 90**	366	91	90	5°	M20	490	31,6	1284	423,7
180	**CGAS100**	400	95	105	7°	M20	490	34	1460	481,8
200	**CGAS110**	443	106	115	6°	M24	840	44	2024	667,9
220	**CGAS110**	443	106	115	6°	M24	840	44	2024	667,9
250	**CGAS120**	540	122	140	6°	M24	840	75	2970	980,1
280	**CGAS140**	620	129	185	7°	M30	1700	160	3350	1105,5
320	**CGAS160**	710	146	200	8°	M30	1700	235	4302	1419,7

The specified dimensions are maximum values and may vary depending on the manufacturer.
The following values are excluded: CH, CN, EN, EU, KK

ØAL = Piston Ø

1) Lubricating nipple, cone head form A according to DIN 71412
2) Related bolt Ø m6;
related bolt Ø j6 with maintenance-free spherical bearing
3) Dimensions may differ depending on the manufacturer
4) M_A = Tightening torque
The self-aligning clevis must always be screwed against the shoulder of the piston rod. Afterwards, the clamping screws must be tightened with the specified tightening torque.
5) m = Weight self-aligning clevis in kg
6) C_0 = Static load rating of the self-aligning clevis
7) F_{adm} = Max. admissible load of the self-aligning clevis with oscillatory or alternating loads

Buckling

The admissible stroke length with flexibly guided load and a factor of 3.5 for safety against buckling can be seen from the relevant table. For other installation positions of the cylinder, the admissible stroke length must be interpolated. Admissible stroke length for non-guided load on request.

Buckling calculations are carried out according to the following formulas:

1. Calculation according to Euler

$$F = \frac{\pi^2 \cdot E \cdot I}{v \cdot L_K^2} \qquad \text{if } \lambda > \lambda_g$$

2. Calculation according to Tetmajer

$$F = \frac{d^2 \cdot \pi\,(335\text{-}0{,}62 \cdot \lambda)}{4 \cdot v} \qquad \text{if } \lambda \le \lambda_g$$

Explanation:

E = Module of elasticity in N/mm²
= 2.1 x 10^5 for steel

I = Geometrical moment of inertia in mm⁴

for circular cross-section = $\frac{d^4 \cdot \pi}{64} = 0{,}0491 \cdot d^4$

v = 3.5 (safety factor)

L_K = Free buckling length in mm (depending on the type of mounting see sketches A, B, C)

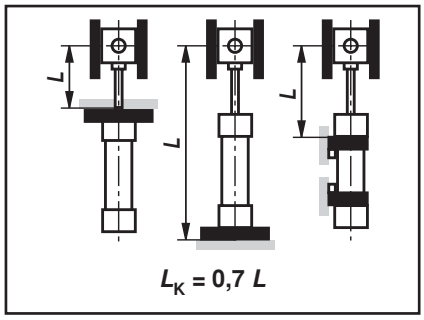
d = Piston rod Ø in mm

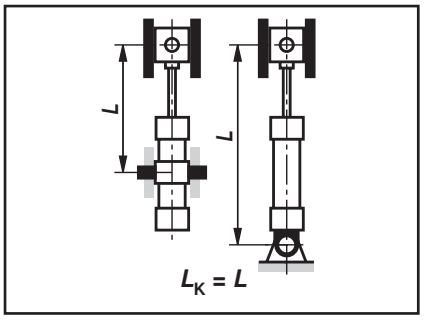
λ = Slenderness ratio

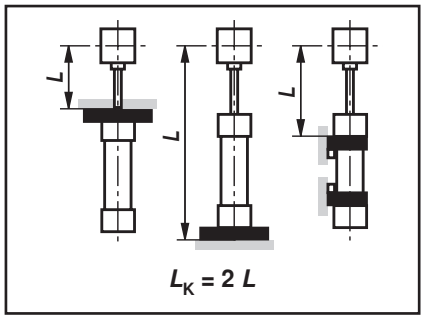
$= \frac{4 \cdot L_K}{d} \qquad \lambda_g = \pi \sqrt{\frac{E}{0.8 \cdot R_e}}$

R_e = Yield strength of the piston rod material

Influence of the type of mounting on the buckling length:







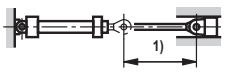
Admissible stroke length (dimensions in mm)

Type of mounting CDH3/CSH3 [2]: MP3, MP5

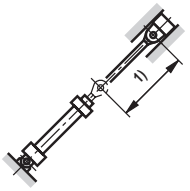
ØAL	ØMM	Admissible stroke length with 100 bar 0°	100 bar 45°	100 bar 90°	210 bar 0°	210 bar 45°	210 bar 90°	350 bar 0°	350 bar 45°	350 bar 90°
40	28	360	375	420	225	230	240	140	145	150
50	36	505	525	351	335	340	355	230	235	240
63	45	625	650	755	425	430	455	295	300	305
80	56	765	800	945	530	545	575	375	380	390
100	70	950	995	1200	680	695	745	495	500	515
125	90	1200	1270	1610	895	925	1010	665	680	705
140	100	1335	1405	1785	995	1025	1125	745	755	790
160	110	1380	1406	1865	1025	1055	1160	755	770	805
180	125	1580	1670	2150	1180	1220	1350	880	895	940
200	140	1780	1890	2470	1355	1400	1565	1035	1055	1110
220	160	1985	2110	2970	1575	1640	1900	1230	1260	1360
250	180	2190	2340	3310	1740	1820	2120	1370	1400	1510
280	200	2360	2520	3640	1890	1970	2330	1490	1530	1660
320	220	2530	2700	3830	2010	2100	2450	1320	1460	1740

Installation position

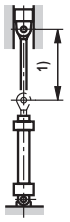
0°



45°



90°

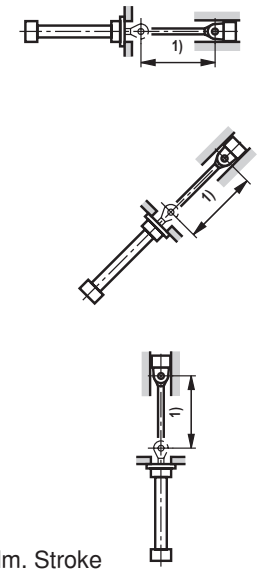


[1] Adm. Stroke length

Admissible stroke length (dimensions in mm)

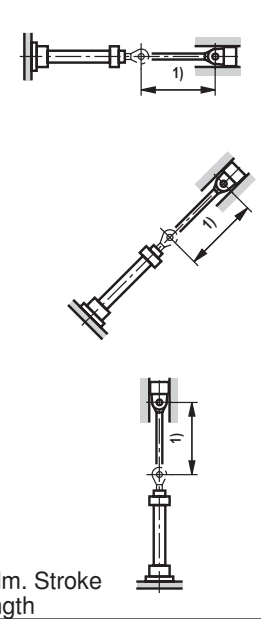
Type of mounting CDH3/CGH3/CSH3 [2]: MF3

ØAL	ØMM	Admissible stroke length with 100 bar			210 bar			350 bar			Installation position
		0°	45°	90°	0°	45°	90°	0°	45°	90°	
40	28	1370	1415	1600	1020	1035	1075	795	800	810	0°
50	36	1755	1825	2135	1345	1370	1440	1060	1070	1090	
63	45	2000	2000	2000	1660	1695	1800	1320	1330	1365	
80	56	2000	2000	2000	2000	2000	2000	1600	1620	1665	
100	70	3000	3000	3000	2470	2530	2740	1900	2010	2085	
125	90	3000	3000	3000	3000	3000	3000	2615	2660	2785	45°
140	100	3000	3000	3000	3000	3000	3000	2875	2920	3000	
160	110	3000	3000	3000	3000	3000	3000	2775	3000	3000	
180	125	3000	3000	3000	3000	3000	3000	3000	3000	3000	
200	140	3000	3000	3000	3000	3000	3000	3000	3000	3000	
220	160	6000	6000	6000	5410	5630	6000	4575	4675	5055	90°
250	180	6000	6000	6000	5950	6000	6000	4815	5160	5605	
280	200	6000	6000	6000	6000	6000	6000	5005	5565	6000	
320	220	6000	6000	6000	6000	6000	6000	4560	5060	6000	[1] Adm. Stroke length



Type of mounting CDH3/CSH3 [2]: MF4

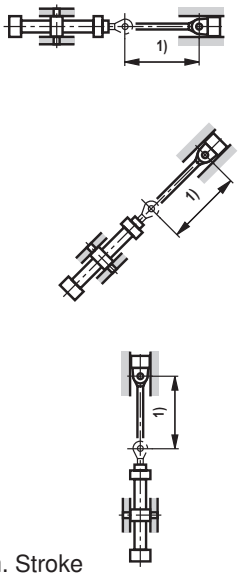
ØAL	ØMM	Admissible stroke length with 100 bar			210 bar			350 bar			Installation position
		0°	45°	90°	0°	45°	90°	0°	45°	90°	
40	28	540	565	675	380	385	410	270	275	280	0°
50	36	735	770	940	540	550	590	400	405	415	
63	45	900	945	1175	670	690	745	505	510	530	
80	56	1080	1140	1450	825	845	930	630	635	665	
100	70	1330	1400	1840	1030	1070	1190	805	820	860	
125	90	1655	1760	2450	1330	1380	1590	1060	1080	1160	45°
140	100	1830	1940	2700	1470	1530	1760	1175	1200	1285	
160	110	1905	2030	2830	1530	1590	1835	1035	1160	1300	
180	125	2210	2355	3310	1795	1870	2170	1285	1435	1585	
200	140	2400	2565	3000	1965	2050	2420	1410	1590	1765	
220	160	2655	2850	4445	2245	2360	2935	1735	1930	2160	90°
250	180	2945	3160	4950	2490	2620	3275	1840	2095	2410	
280	200	3170	3410	5455	2705	2850	3615	1870	2140	2665	
320	220	3425	3680	5775	2905	3055	3820	1675	1925	2815	[1] Adm. Stroke length



Admissible stroke length (dimensions in mm)

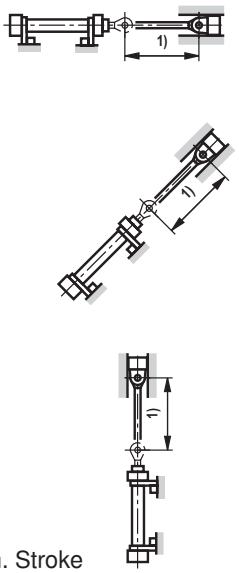
Type of mounting CDH3/CGH3/CSH3 [2]: MT4 trunnion in cylinder center

ØAL	ØMM	Admissible stroke length with									Installation position
		100 bar			210 bar			350 bar			
		0°	45°	90°	0°	45°	90°	0°	45°	90°	
40	28	560	580	640	380	385	395	265	270	275	0°
50	36	760	790	890	353	545	565	390	395	400	
63	45	930	965	1105	665	675	705	490	495	505	
80	56	1125	1170	1365	815	830	875	610	615	625	
100	70	1390	1450	1730	1030	1050	1120	785	790	810	
125	90	1755	1845	2300	1345	1380	1500	1040	1050	1090	45°
140	100	1935	2030	2545	1485	1525	1660	1150	1165	1210	
160	110	2020	2125	2660	1545	1585	1725	1190	1205	1250	
180	125	2300	2420	3000	1770	1820	1990	1370	1390	1445	
200	140	2555	2695	3000	1990	2050	2270	1555	1580	1655	
220	160	2870	3045	4185	2320	2410	2760	1865	1905	2035	90°
250	180	3180	3380	4665	2580	2680	3080	2080	2125	2270	
280	200	3430	3645	5130	2800	2915	3390	2270	2325	2500	
320	220	3700	3925	5435	3000	3115	3585	2065	2295	2640	[1] Adm. Stroke length



Type of mounting CDH3/CGH3/CSH3 [2]: MS2

ØAL	ØMM	Admissible stroke length with									Installation position
		100 bar			210 bar			350 bar			
		0°	45°	90°	0°	45°	90°	0°	45°	90°	
40	28	1265	1310	1500	920	935	970	690	695	710	0°
50	36	1650	1715	2000	1235	1260	1330	950	960	980	
63	45	1995	2000	2000	1520	1550	1655	1180	1190	1220	
80	56	2000	2000	2000	1850	1895	2000	1445	1460	1510	
100	70	2940	3000	3000	2310	2370	2585	1830	1855	1925	
125	90	3000	3000	3000	3000	3000	3000	2640	2685	2810	45°
140	100	3000	3000	3000	3000	3000	3000	2640	2690	2840	
160	110	3000	3000	3000	3000	3000	3000	2510	2760	2955	
180	125	3000	3000	3000	3000	3000	3000	2900	3000	3000	
200	140	3000	3000	3000	3000	3000	3000	3000	3000	3000	
220	160	6000	6000	6000	5065	5280	6000	4225	4330	4705	90°
250	180	6000	6000	6000	5590	5835	6000	4455	4805	5250	
280	200	6000	6000	6000	6000	6000	6000	4645	5205	5790	
320	220	6000	6000	6000	6000	6000	6000	4175	4680	6000	[1] Adm. Stroke length



With longer strokes, an extended guide and/or the use of guide rings may be reasonable for increasing the service life, depending on the respective application and installation position. Recommendation on request.

[2] With CSH3, observe the maximum stroke length „X*max“, pages 24 to 35

End position cushioning

End position cushioning:
The objective is to reduce the velocity of a moved mass, whose center of gravity lies on the cylinder axis to a level, at which neither the cylinder nor the machine into which the cylinder is installed is damaged. For velocities above 20 mm/s, we recommend the use of an end position cushioning feature, which absorbs energy without requiring the use of additional equipment. It must, however, always be verified whether end position cushioning is also required for lower velocities with large masses.

Damping capacity:
When decelerating masses via end position cushioning, the structural-inherent cushioning capacity must not be exceeded. Cylinders with end position cushioning can achieve their full cushioning capacity only over the entire stroke length.

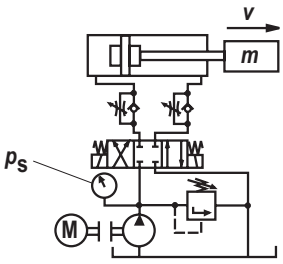
With the adjustable end position cushioning version “E”, a throttle valve is additionally provided when compared with version “D”. End position cushioning version “E” allows cycle times to be optimized. The maximum cushioning capacity can only be achieved when the throttle valve is closed.

The calculation depends on the factors weight, velocity, system pressure and installation position. For this reason, mass and velocity are used to determine the characteristic D_m and system pressure and installation position to determine the characteristic D_p.

These two characteristics are used for verifying the admissible damping capacity in the “damping capacity” diagram. The intersection point of the characteristics D_m and D_p must always be below the damping capacity curve of the selected cylinder. The values in the diagrams refer to an average oil temperature of +45 to +65 °C with the throttle valve being closed.

For special applications with very short stroke times, high velocities or large masses, cylinders with special end position cushioning versions can be offered on request.

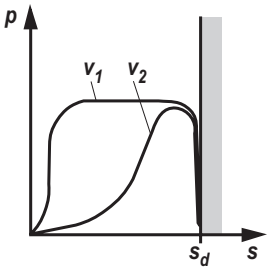
When fixed or adjustable stops are used, special measures must be taken!



Formulas:

$$D_m = \frac{m}{10^K}\ ;\ K = kv\,(0{,}5\text{–}v)$$

m = Moved weight in kg
v = Stroke velocity in m/s
kv = See table page 60



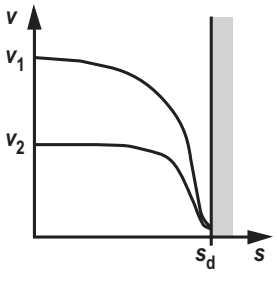
Extension for CDH3 and CSH3

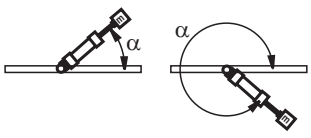
$$D_p = p_S - \frac{m \cdot 9{,}81 \cdot \sin\alpha}{A_1 \cdot 10}$$

Retraction for CDH3, CGH3 and CSH3; Extension for CGH3

$$D_p = p_S + \frac{m \cdot 9{,}81 \cdot \sin\alpha}{A_3 \cdot 10}$$

p_S = System pressure in bar
A_1 = Piston area in cm² (see page 4)
A_3 = Annulus area in cm² (see page 4)
α = Angle to the horizontal in degrees





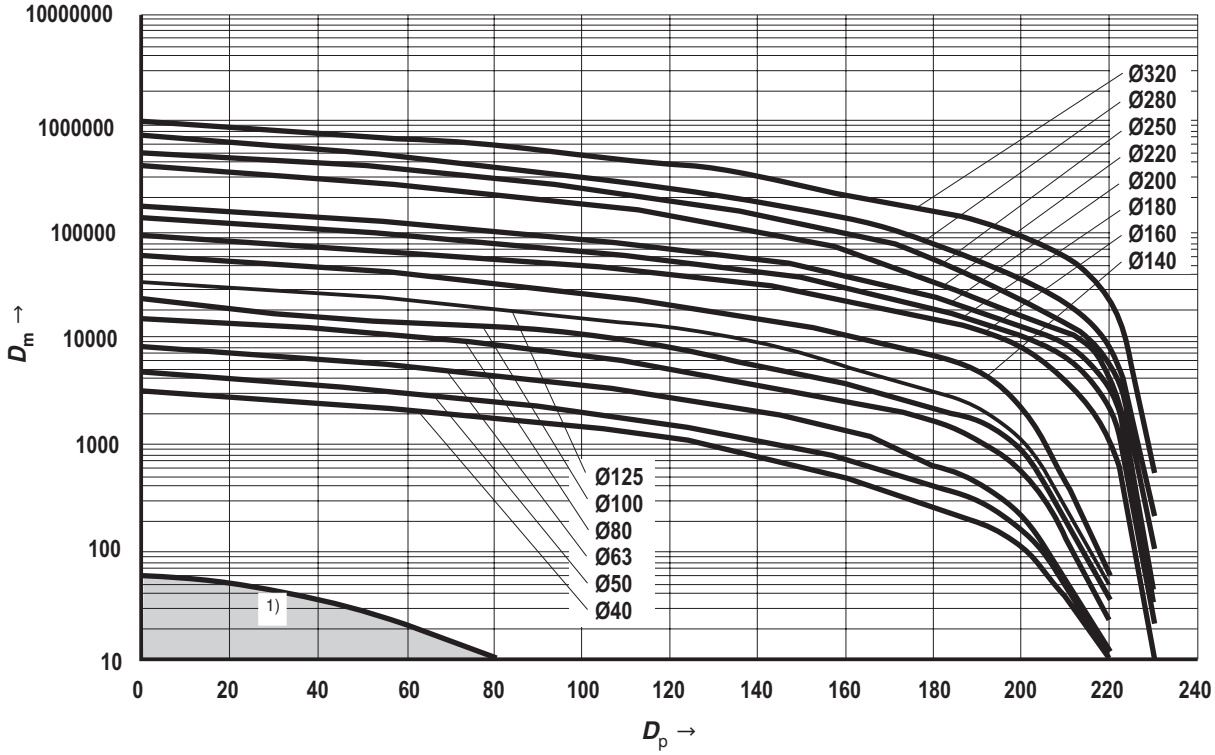
Damping length

ØAL mm	40	50	63	80	100	125	140	160	180	200	220	250	280	320
Head side	21	20	23	25	25	25	33	33	37	37	76	81	86	90
Base side	21	20	23	25	25	25	33	33	37	37	76	81	86	90

End position cushioning

ØAL mm	40	50	63	80	100	125	140	160	180	200	220	250	280	320
kv ①	1,72	1,85	1,51	1,85	2,34	2,02	1,85	1,93	1,84	1,65	1,41	1,45	1,58	1,68
kv ②	2,31	1,85	1,95	1,86	2,25	1,97	1,94	1,92	2,05	1,97	1,64	1,61	1,82	1,94

Damping capacity: Extension for CDH3 and CSH3, with *kv* ①

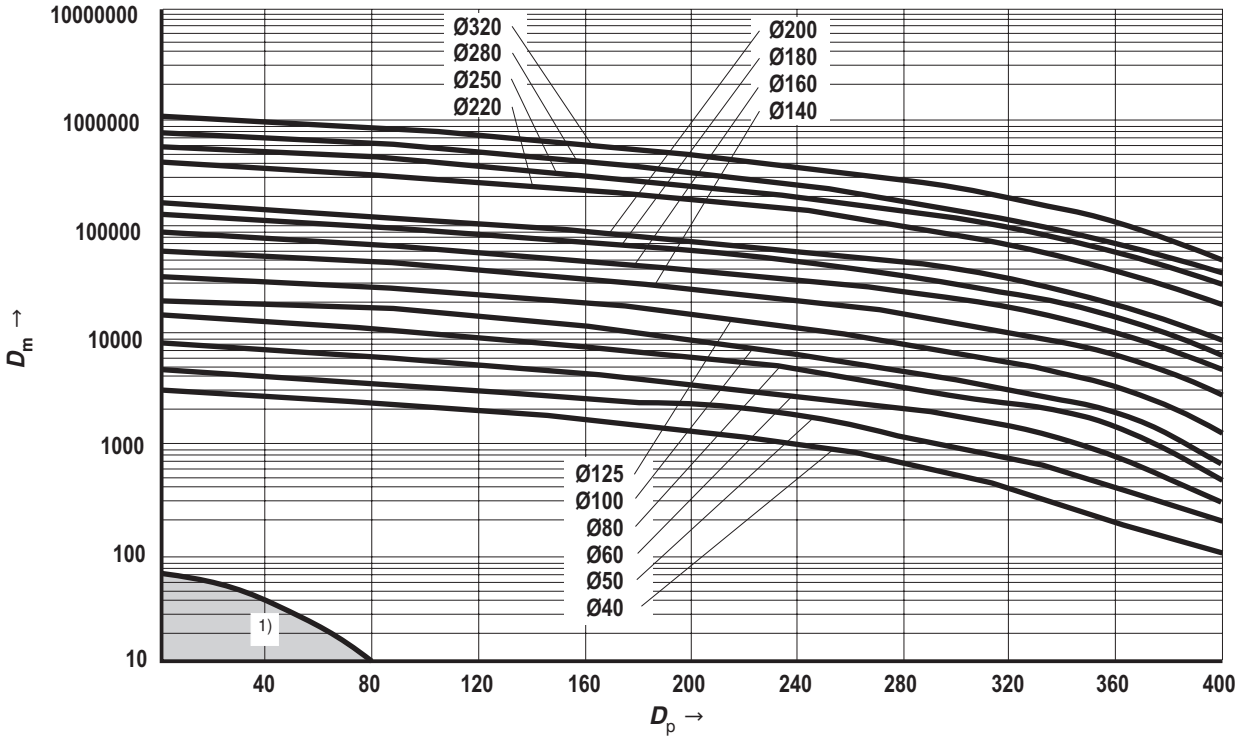


ØAL = Piston Ø

1) If with standard applications the calculated intersection point of D_m and D_p is within the marked area, we recommend designing the cylinder without end position cushioning.

End position cushioning

Damping capacity: Retraction for CDH3, CGH3 and CSH3; extension for CGH3 with *kv* ②



ØAL = Piston Ø

1) If with standard applications the calculated intersection point of D_m and D_p is within the marked area, we recommend designing the cylinder without end position cushioning.

Selection criteria for seals

	Work and environmental conditions	Seal versions								
		M	G	V	L	A	B	T	R	S
Medium / temperature	**Medium HL, HLP** / operating temperature medium –20 °C to +80 °C	++	++	++	++	++	++	++	++	++
	Medium HFA / operating temperature medium +5 °C to +55 °C	+/–	+/–	+/–	+/–	+	+/–	++	+/–	+/–
	Medium HFC / operating temperature medium –20 °C to +60 °C	–	++	–	–	+/–	–	++	–	–
	Medium HFD-R / operating temperature medium –15 °C to +80 °C	–	–	++	–	–	++	–	–	++
	Medium HFD-U / operating temperature medium –15 °C to +80 °C	–	–	++	–	–	++	–	–	++
	Ambient and rod temperature in the area of the piston rod from –20 °C to +80 °C [1]	++	+	+ [2]	++	++	+ [2]	+	++	++ [2]
	Extended ambient and rod temperature in the area of the piston rod from +80 °C to +120 °C	–	–	++	–	–	+	–	–	++
Function / velocity...	Static holding function more than 10 minutes: Attention! Application- and temperature-dependent	++	+	+	+	++	++	+	+	+
	Static holding function short-term < 1 minute	++	++	++	++	++	++	++	++	++
	Robust application conditions: Steel works, mining, thin ice	++	++	++	++	++	++	–	++	–
	Zero point control, hardly amplitude, frequency max. 5 Hz, not longer than 5 minutes	–	–	–	+/–	–	–	++	+	++
	Cylinder velocity min. 0.001 m/sec stick-slip behavior	++	+	+	++	–	–	++	++	++
	Cylinder velocity from 0.01 m/sec to 0.5 m/sec [3]	++	+	+	++	+	+	++	++	++
	Cylinder velocity > 0.5 m/sec to max. 0.8 m/sec [3]	–	+/–	+/–	++	–	–	++	+	++
	Stroke > 1.0 m	+/-	++	++	++	++	++	++	++	++
	Standstill period (wear)	++	+/–	+/–	++	+/–	–	++	++	++
	Undissolved air in the oil [4]	–	+	+	+	–	–	+	+	+

++ = very good + = good +/– = conditional, depending on the application parameters – = unsuitable

General technical data in corresponding data sheets will remain valid!

1) Moreover, observe the corresponding medium temperature range
2) Lower temperature limit –15 °C
3) Standard line connections not designed for that velocity
4) – Seal is destroyed / + Seal is not directly destroyed, leaks may occur

Generally, a medium temperature of approx. 40 °C is recommended. The specified values are to be regarded as guidelines; depending on the application, it may be necessary to check the suitability of the seal system.

Seal kits [1)]

CDH3 – Standard

ØAL	ØMM	Material no. for seal design								
		M	G	V	L	A	B	T	R	S
40	28									
50	36									
63	45									
80	56									
100	70									
125	90									
140	100									
160	110									
180	125									
200	140									
220	160									
250	180									
280	200									
320	220									

ØAL = Piston Ø
ØMM = Piston rod Ø

[1)] Seal kits for proximity switches and subplate mounting separate material no.

Seal kits [1)]

CGH3 – Standard

ØAL	ØMM	Material no. for seal design								
		M	G	V	L	A	B	T	R	S
40	28									
50	36									
63	45									
80	56									
100	70									
125	90									
140	100									
160	110									
180	125									
200	140									
220	160									
250	180									
280	200									
320	220									

ØAL = Piston Ø
ØMM = Piston rod Ø

[1)] Seal kits for proximity switches and subplate mounting separate material no.

Seal kits [1)]

CDH3 – Standard + additional option F

ØAL	ØMM	Material no. for seal design					
		M+F	G+F	V+F	T+F	R+F	S+F
40	28						
50	36						
63	45						
80	56						
100	70						
125	90						
140	100						
160	110						
180	125						
200	140						

CGH3 – Standard + additional option F

ØAL	ØMM	Material no. for seal design					
		M+F	G+F	V+F	T+F	R+F	S+F
40	28						
50	36						
63	45						
80	56						
100	70						
125	90						
140	100						
160	110						
180	125						
200	140						

ØAL = Piston Ø

ØMM = Piston rod Ø

[1)] Seal kits for proximity switches and subplate mounting separate material no.

Seal kits [2)]

CSH3

ØAL	ØMM	Material no. for seal design						
		M	G	V	L	T	R	S
40	28							
50	36							
63	45							
80	56							
100	70							
125	90							
140	100							
160	110							
180	125							
200	140							
220	160							
250	180							
280	200							
320	220							

ØAL = Piston Ø

ØMM = Piston rod Ø

[2)] Seal kits for position measurement system and subplate mounting separate material no.

Seal kits

Only for proximity switches

ØAL	Material no. for seal design								
	M / M+F	T / T+F	G / G+F	L	R / R+F	A	S / S+F	V / V+F	B
40 to 200									
220 to 320									

Only for subplate mounting

ØAL	Material no. for seal design	
	M, T, G, L, R, A	S, B, V
40		
50		
63		
80		
100		
125		
140		
160		
180		
200		

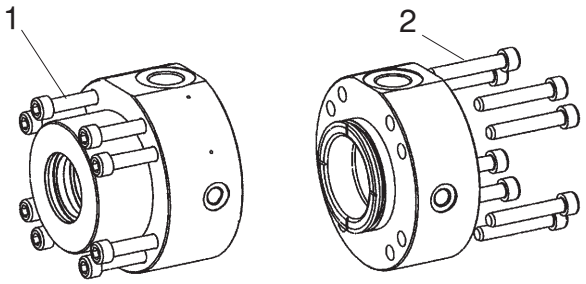
Only for position measurement system

ØAL	Material no. for seal design	
	M, T, G, L, R	S, V
40		
50		
63		
80		
100		
125		
140		
160		
180		
200		
220		
250		
280		
320		

ØAL = Piston Ø

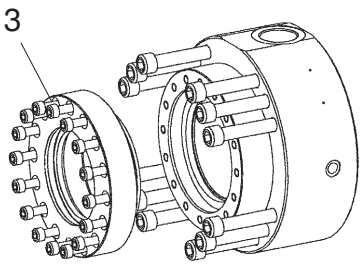
Tightening torques

Screws: Head and base (item 1 and 2)



Series	Piston Ø	Screw	Quantity	Quality class	Tightening torque
CDH3 / CGH3 / CSH3	**40**	M10	4	10.9	40 Nm
CDH3 / CGH3 / CSH3	**50**	M8	8	10.9	25 Nm
CDH3 / CGH3 / CSH3	**63**	M10	8	10.9	50 Nm
CDH3 / CGH3 / CSH3	**80**	M12	8	10.9	90 Nm
CDH3 / CGH3 / CSH3	**100**	M16	8	10.9	175 Nm
CDH3 / CGH3 / CSH3	**125**	M20	8	10.9	350 Nm
CDH3 / CGH3 / CSH3	**140**	M20	8	10.9	450 Nm
CDH3 / CGH3 / CSH3	**160**	M24	8	10.9	670 Nm
CDH3 / CGH3 / CSH3	**180**	M24	12	10.9	580 Nm
CDH3 / CGH3 / CSH3	**200**	M24	12	10.9	720 Nm
CDH3 / CGH3 / CSH3	**220**	M24	16	10.9	750 Nm
CDH3 / CGH3 / CSH3	**250**	M30	16	10.9	1400 Nm
CDH3 / CGH3 / CSH3	**280**	M30	16	10.9	1600 Nm
CDH3 / CGH3 / CSH3	**320**	M42	12	10.9	4200 Nm

Screws: Seal cover (item 3)

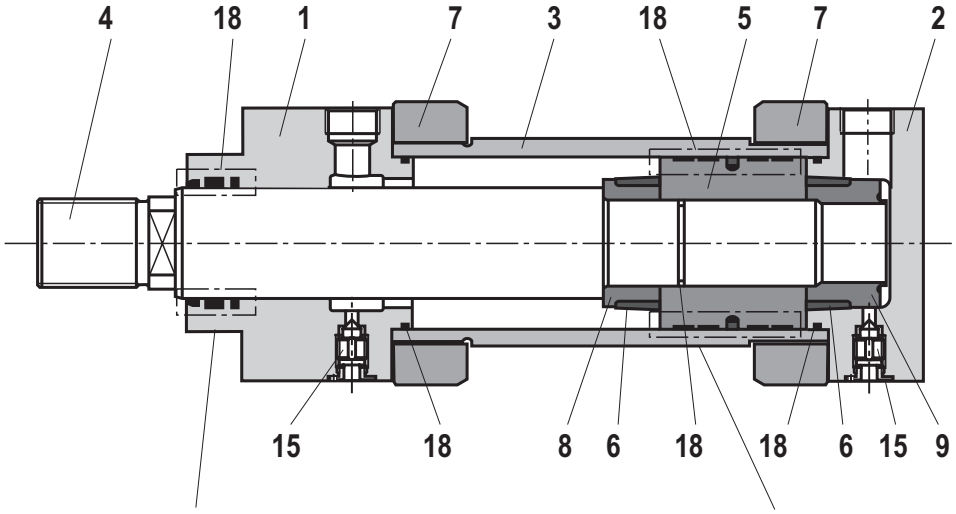


Only with seal design "A" and "B"

Series	Piston Ø	Piston rod Ø	Screw	Quantity	Quality class	Tightening torque
CDH3 / CGH3	**160**	**110**	M10	16	10.9	60 Nm
CDH3 / CGH3	**180**	**125**	M12	16	10.9	80 Nm
CDH3 / CGH3	**200**	**140**	M12	16	10.9	90 Nm
CDH3 / CGH3	**220**	**160**	M12	24	10.9	90 Nm
CDH3 / CGH3	**250**	**180**	M16	16	10.9	90 Nm
CDH3 / CGH3	**280**	**200**	M16	16	10.9	230 Nm
CDH3 / CGH3	**320**	**220**	M16	24	10.9	230 Nm

Spare parts: Series CDH3

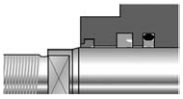
CDH3



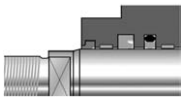
Piston rod

Piston

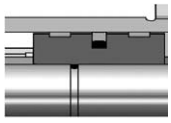
"M"



"L"



"M / T / S / G / V / L / R"



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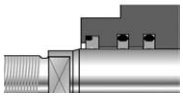
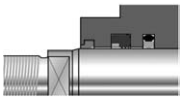
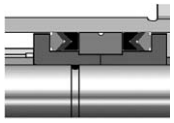


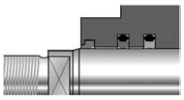
"G / V"



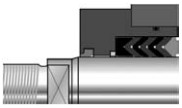
"A / B"

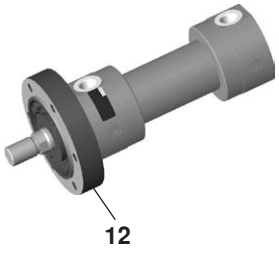


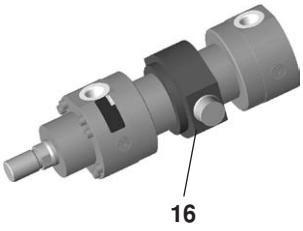
"R"

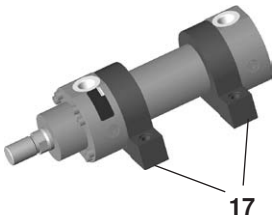


"A / B"





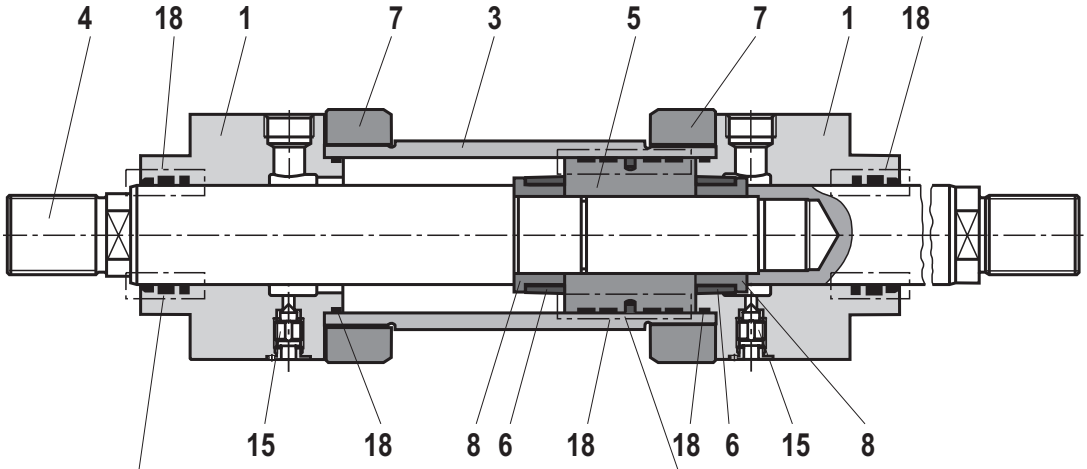


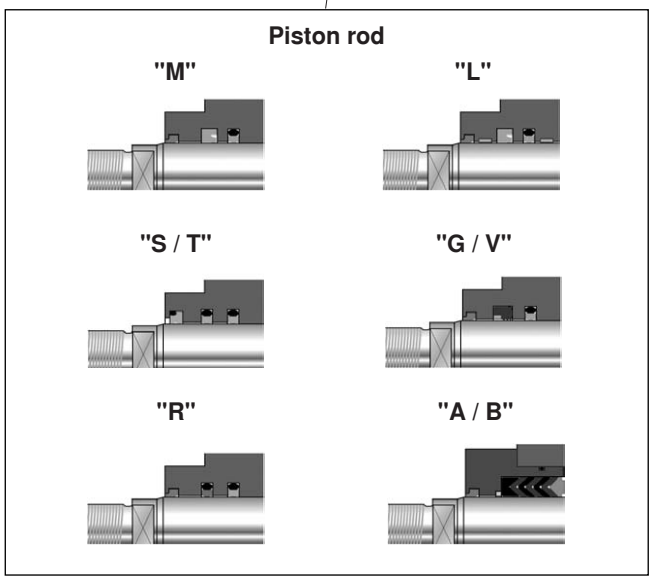


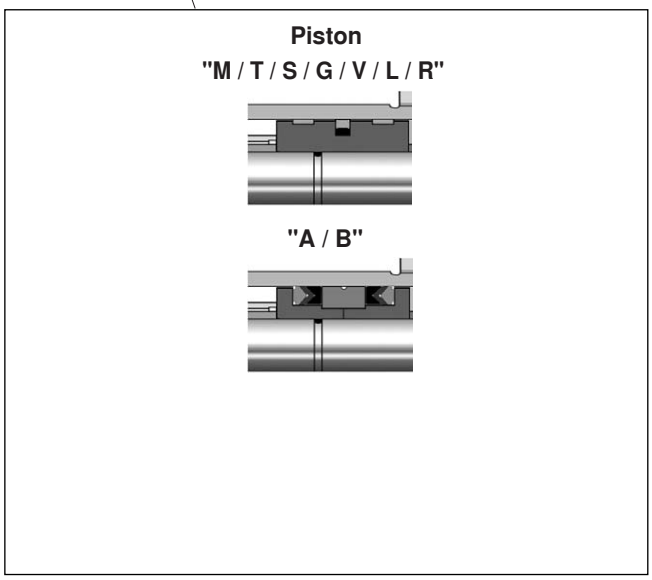
1 Head
2 Base
3 Pipe
4 Piston rod
5 Piston
6 Damping bush
7 Flange
8 Socket
9 Socket
10 Base MP3
11 Base MP5
12 Round flange MF3
14 Round flange MF4
15 Bleeding
16 Trunnion MT4
17 Foot MS2
18 Seal kit:
Scraper
Rod seal
Piston seal
O-ring
Guide ring

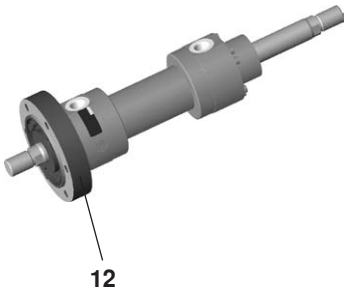
Spare parts: Series CGH3

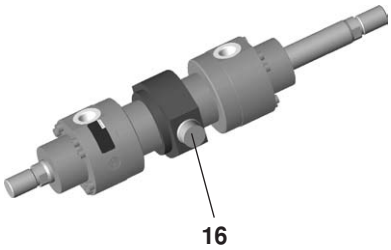
CGH3

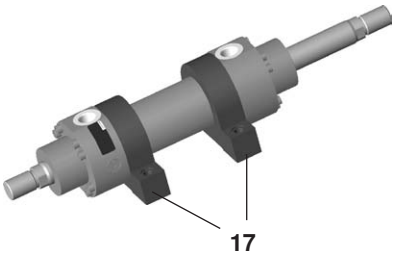








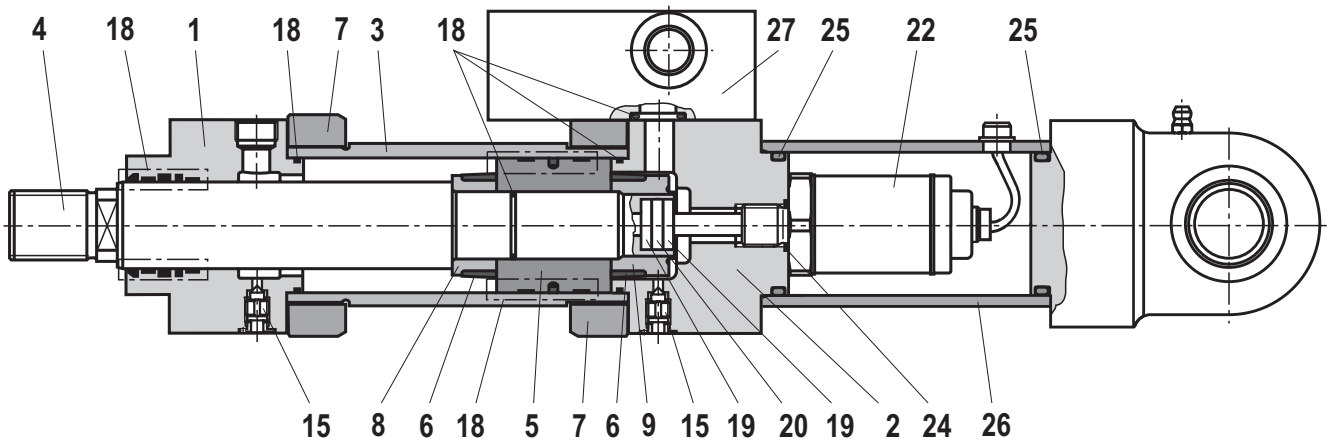




1 Head
3 Pipe
4 Piston rod
5 Piston
6 Damping bush
7 Flange
8 Socket

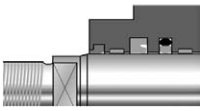
12 Round flange MF3
15 Bleeding
16 Trunnion MT4
17 Foot MS2
18 Seal kit:
Scraper
Rod seal
Piston seal
O-ring
Guide ring

Spare parts: Series CSH3 MP3 and MP5

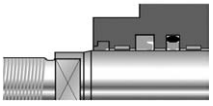


Piston rod

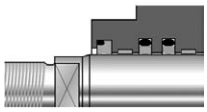
"M"



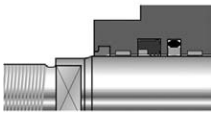
"L"



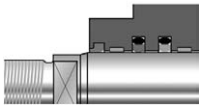
"S / T"



"G / V"

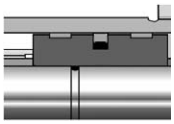


"R"



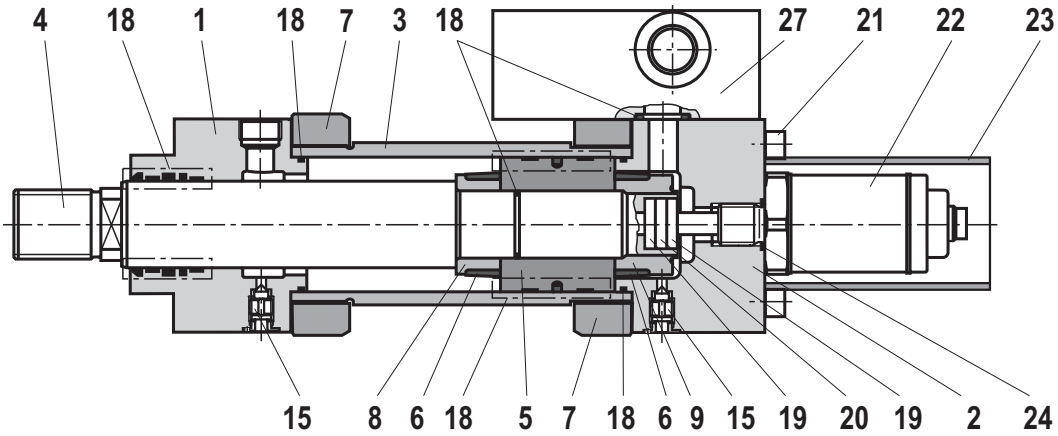
Piston

"M / T / S / G / V / L / R"



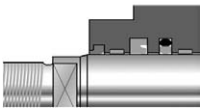
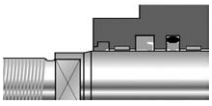
1 Head
2 Base
3 Pipe
4 Piston rod
5 Piston
6 Damping bush
7 Flange
8 Socket
9 Socket
10 Base MP3
11 Base MP 5
15 Bleeding
18 Seal kit:
Scraper
Rod seal
Piston seal
O-ring
Guide ring
19 Insulating socket
20 Solenoid
22 Position transducer
24 Seal
25 Seal
26 Protective pipe
27 Subplate

Spare parts: Series CSH3 MF3, MF4, MT4 and MS2

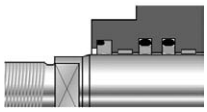
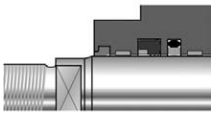


Piston rod

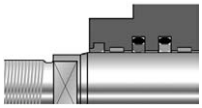
"M" "L"

"S / T" "G / V"

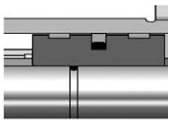



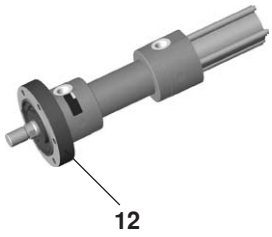
"R"

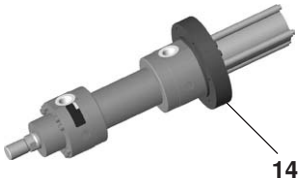


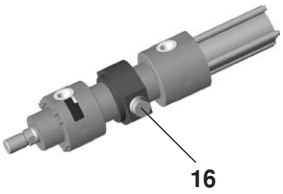
Piston

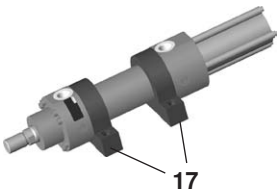
"M / T / S / G / V / L / R"











1 Head
2 Base
3 Pipe
4 Piston rod
5 Piston
6 Damping bush
7 Flange
8 Socket
9 Socket
12 Round flange MF3
14 Round flange MF4
15 Bleeding
16 Trunnion MT4
17 Foot MS2
18 Seal kit:
Scraper
Rod seal
Piston seal
O-ring
Guide ring
19 Insulating socket
20 Solenoid
21 Hexagon socket head cap screws
22 Position transducer
23 Protective pipe
24 Seal
27 Subplate

Cylinder weight

Piston	Piston rod	CD/CS cylinder with 0 mm stroke length					Per 100 mm stroke length	CG cylinder with 0 mm stroke length			Per 100 mm stroke length
ØAL	**ØMM**	**MP3** [1] **MP5** [1]	**MP3** [2] **MP5** [2]	**MF3 MF4**	**MT4**	**MS2**		**MF3**	**MT4**	**MS2**	
mm	mm	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg
40	**28**	8	14	11	11	9	1,2	12	12	10	1,6
50	**36**	12	20	17	15	15	1,6	19	17	17	2,4
63	**45**	26	41	32	30	32	2,6	37	35	36	3,8
80	**56**	33	44,5	43	40	42	4,2	49	46	48	6,1
100	**70**	58	74,5	72	71	73	5,7	80	79	81	8,8
125	**90**	120	150	148	145	149	11,1	170	166	171	16,1
140	**100**	167	203	205	202	206	13,0	236	233	236	19,1
160	**110**	229	284	276	276	275	16,3	316	316	315	23,8
180	**125**	317	383	387	386	404	19,5	456	455	473	29,1
200	**140**	425	500	506	504	531	24,4	562	560	587	36,5
220	**160**	514	623	653	570	590	37,8	753	671	690	53,6
250	**180**	777	959	939	854	829	46,2	1057	972	948	66,2
280	**200**	915	1147	1073	1028	984	59,7	1224	1179	1135	84,3
320	**220**	1200	1479	1274	1211	1211	68,3	1431	1369	1369	98,1

ØAL = Piston Ø
ØMM = Piston rod Ø
[1] Weight without position measurement system
[2] Weight with position measurement system