HARLEX

Hydraulic cylinder mill type

Series CDH1 / CGH1 / CSH1

Component series 3X
Nominal pressure 250 bar (25 MPa)

Features

- 6 types of mounting
- Piston Ø (**ØAL**): 40 to 320 mm
- Piston rod Ø (**ØMM**): 22 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: 250 bar
Static test pressure: 375 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

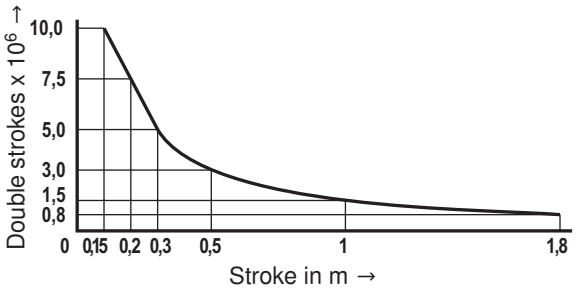
Technical data (For applications outside these parameters, please consult us!)

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 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 personnel especially trained for this purpose. No warranty is accepted for damage as a conse-quence of assembly, maintenance or repair works not per-formed

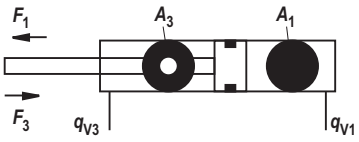
Check lists for hydraulic cylinders:
Cylinders the characteristics and/or application parameters of which deviate from the values specified in the data sheet can only be offered as special version upon request. For offers, the deviations of the characteristics and/or application param-eters must be described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

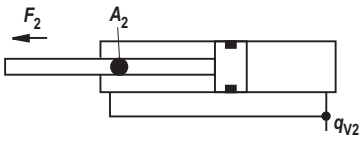
Project planning software ICS (Interactive Catalog System)

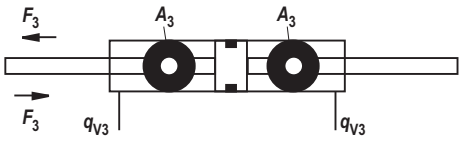
The ICS (Interactive Catalog System) is a selection and project planning aid for hydraulic cylinders. The ICS allows designers for machines and systems to quickly and reliably find the perfect hydraulic cylinder solution through logic-guided type key enquiries. This software helps to solve design and 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 250 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	**22** **28**	1,43 1,96	12,56	3,80 6,16	8,76 6,40	31,40	9,50 15,40	21,90 16,00	7,5	2,3 3,7	5,3 3,8	2000
50	**28** **36**	1,46 2,08	19,63	6,16 10,18	13,47 9,45	49,10	15,40 25,45	33,70 23,65	11,8	3,7 6,1	8,1 5,7	2000
63	**36** **45**	1,48 2,04	31,17	10,18 15,90	20,99 15,27	77,90	25,45 39,75	52,45 38,15	18,7	6,1 9,5	12,6 9,2	2000
80	**45** **56**	1,46 1,96	50,26	15,90 24,63	34,36 25,63	125,65	39,75 61,55	85,90 64,10	30,2	9,5 14,8	20,7 15,4	2000
100	**56** **70**	1,46 1,96	78,54	24,63 38,48	53,91 40,06	196,35	61,55 96,20	134,80 100,15	47,1	14,8 23,1	32,3 24,0	3000
125	**70** **90**	1,46 2,08	122,72	38,48 63,62	84,24 59,10	306,75	96,20 159,05	210,55 147,70	73,6	23,1 38,2	50,5 35,4	3000
140	**90** **100**	1,70 2,04	153,94	63,62 78,54	90,32 75,40	384,75	159,05 196,35	225,70 188,40	92,4	38,2 47,1	54,2 45,3	3000
160	**100** **110**	1,64 1,90	201,06	78,54 95,06	122,50 106,00	502,50	196,35 237,65	306,15 264,85	120,6	47,1 57,0	73,5 63,6	3000
180	**110** **125**	1,60 1,93	254,47	95,06 122,72	159,43 131,75	636,17	237,65 306,80	398,52 329,37	152,7	57,0 73,6	95,7 79,1	3000
200	**125** **140**	1,64 1,96	314,16	122,72 153,96	191,44 160,20	785,25	306,80 384,90	478,45 400,35	188,5	73,6 92,4	114,9 96,1	3000
220	**140** **160**	1,68 2,12	380,1	153,9 201,0	226,2 179,1	950,3	384,8 502,6	565,5 447,7	228,1	92,4 120,7	135,7 107,4	6000
250	**160** **180**	1,69 2,08	490,8	201,0 254,4	289,8 236,4	1227,2	502,7 636,2	724,5 591,0	294,5	120,7 152,7	173,8 141,8	6000
280	**180** **200**	1,70 2,04	615,7	254,4 314,1	361,3 301,6	1539,4	636,2 785,4	903,2 753,9	369,4	152,7 188,5	216,7 180,9	6000
320	**200** **220**	1,64 1,90	804,2	314,1 380,1	490,1 424,2	2010,6	785,4 950,3	1225,2 1060,3	482,5	188,5 228,1	294,0 254,4	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 CDH1 and CGH1

CDH1 MP3
see page 10, 11

CDH1 MP5
see page 12, 13

CDH1 MF3
see page 14, 15

CGH1 MF3
see page 14, 15

CDH1 MF4
see page 16, 17

CDH1 MT4
see page 18, 19

CGH1 MT4
see page 18, 19

CDH1 MS2
see page 20, 21

CGH1 MS2
see page 20, 21

Ordering code series CDH1

CD	H1	/	/	/	A	3X	/							

Differential cylinder = CD

Series = H1

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) 22 to 220 mm

Stroke length in mm [3]

Design principle
- Head and base flanged = A

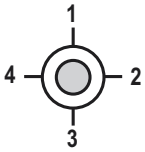
Component series
- 30 to 39 Unchanged installation and connection dimensions = 3X

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] [9] = 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] = P
- Subplate size 10 [4] [6] = T
- Subplate size 16 [4] [7] = U
- Subplate size 25 [4] [8] = V

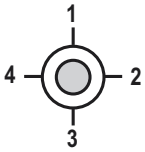
For SL and SV valves
- Subplate size 6 [4] [5] [15] = A
- Subplate size 10 [4] [6] [15] = E
- Subplate size 20 [4] [7] [15] = L
- Subplate size 30 [4] [8] [15] = N

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 [12] = H
- Nickel-plated and hard chromium-plated [12] = N

Piston rod end
- A = Thread for self-aligning clevis CGAS
- G = [13] Thread for self-aligning clevis CGA, CGAK, plain clevis CSA
- S = With mounted self-aligning clevis CGAS
- L = [13] With mounted self-aligning clevis CGA
- M = [13] 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

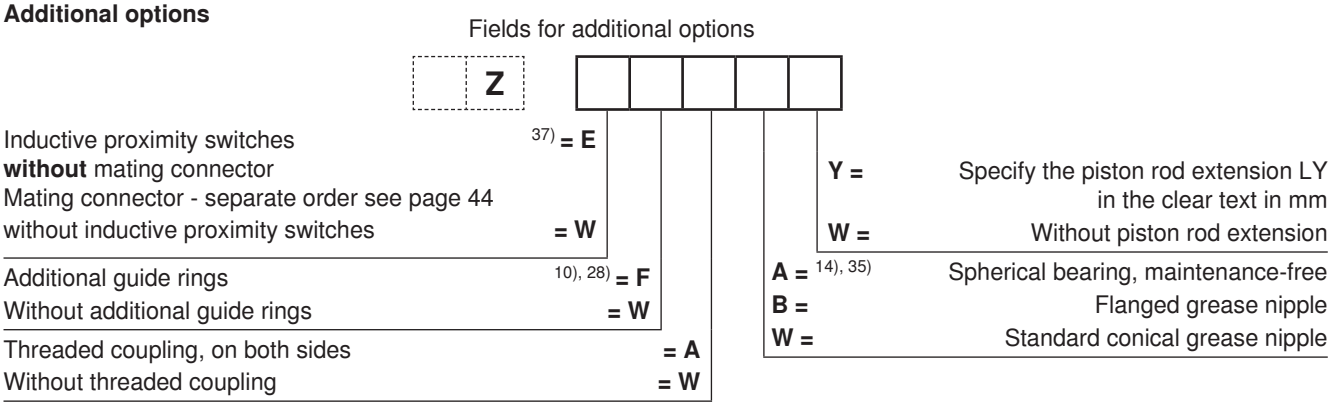
For mineral oil HL, HLP, HFA and water glycol HFC
- G = Standard seal system HFC
- T = Servo quality/ reduced friction
- A = Chevron seal kits

For phosphate ester HFD-R and polyol ester HFD-U
- S = Servo quality/ reduced friction
- V = 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 CDH1

Additional options



Order examples:

Without additional options: **CDH1MP5/100/56/300A3X/B11CADMW**

With additional options: **CDH1MP5/100/56/300A3X/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) Observe the max. available stroke length page 4 and admissible stroke length (acc. to buckling calculation) 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
8) Piston Ø 160 to 200 mm, only position 11, subplates only possible in combination with line connection "B" at the head
9) Only piston Ø 80 to 320 mm
10) Seal design A, B not possible; piston Ø 220 to 320 mm standard
12) Only piston rod Ø 22 to 140 mm
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!
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 CGH1

CG	H1	/ / /	A	3X /								

Double-acting cylinder [18] **= CG**

Series **= H1**

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) 22 to 220 mm

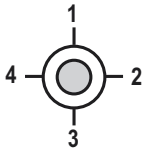
Stroke length in mm [3]

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

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

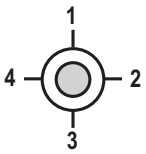
Line connection / version
- According to ISO 1179-1 (pipe thread ISO 228-1) **= B**
- According to ISO 9974-1 (metric thread ISO 261) **= M**
- Flange porting pattern according to ISO 6162-2 tab. 2 type 1 (≙ SAE 6000 PSI) [9] **= D**
- Flange porting pattern according to ISO 6164 tab. 2 **= H**
- According 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 [12] **= H**
- Nickel-plated and hard chromium-plated [11] **= 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 =** 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 =** Standard seal system FKM
- **B =** Chevron seal kits

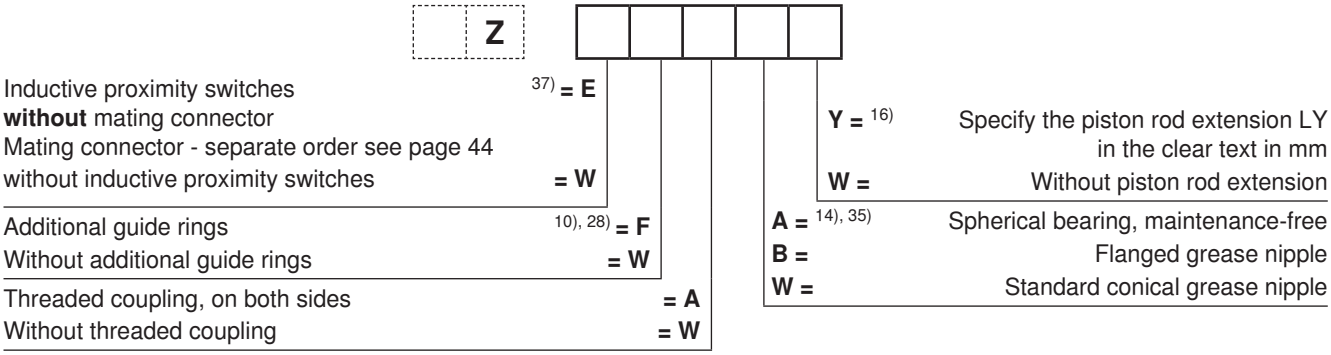
End position cushioning
- **U =** Without
- **D =** [1] On both sides, self-adjusting
- **E =** On both sides, adjustable

Piston rod end
- **A =** Thread for plain clevis CGAS
- **G =** [13] Thread for plain clevis CGA, CGAK, plain clevis CSA
- **S =** [17] With mounted self-aligning clevis CGAS
- **L =** [13] [17] With mounted self-aligning clevis CGA
- **M =** [13] [17] With mounted self-aligning clevis CGAK
- **N =** [1] [17] With mounted plain clevis CSA

Ordering code series CGH1

Additional options

Fields for additional options



Order examples:

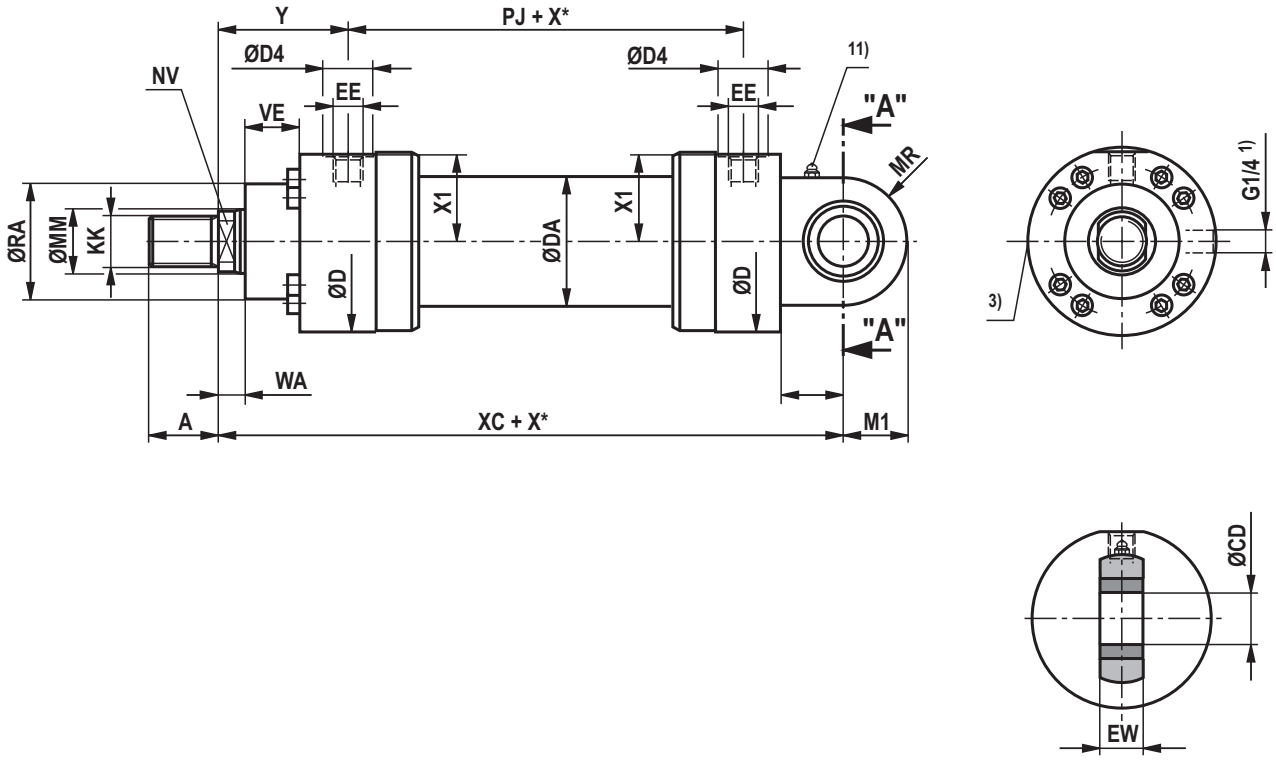
Without additional options: **CGH1MF3/100/56/300A3X/B11CADMW**

With additional options: **CGH1MF3/100/56/300A3X/B11CADMZ EWABW**

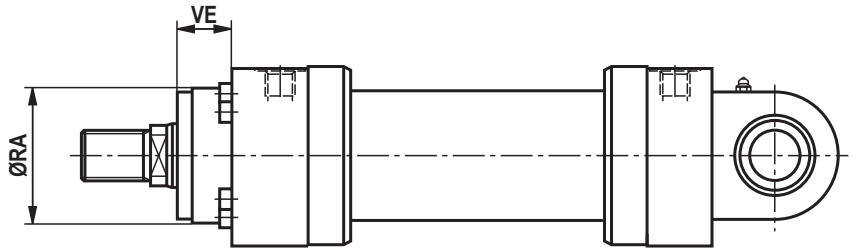
1) Only piston Ø 40 to 200 mm
2) Trunnion position freely selectable. When ordering, always specify the "XV" dimension in the clear text in mm
3) Observe the max. available stroke length page 4 and admissible stroke length (acc. to buckling calculation) pages 56 to 58
9) Only piston Ø 80 to 320 mm
10) Seal design A, B not possible; piston Ø 220 to 320 mm standard
11) Only piston rod Ø 22 to 36 mm
12) Only piston rod Ø 22 to 140 mm
13) Not with piston Ø 320 mm
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
28) With seal design "L" standard
30) All graphical presentations in the data sheet show position 1
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 CDH1: MP3

CDH1 MP3; ØAL 40 to 200 mm



CDH1 MP3: With seal design "A", "B" and AL Ø 160 to 200 mm



Dimensions CDH1: 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
40	**22/28**	M16x1,5	16	M18x2	30	16/22	88	52	34	G1/2	M22x1,5	79	120
50	**28/36**	M22x1,5	22	M24x2	35	22/30	102	62	34	G1/2	M22x1,5	87	120
63	**36/45**	M28x1,5	28	M30x2	45	30/36	120	78	42	G3/4	M27x2	100	133
80	**45/56**	M35x1,5	35	M39x3	55	36/46	140	95	42	G3/4	M27x2	104	146
100	**56/70**	M45x1,5	45	M50x3	75	46/60	170	125	47	G1	M33x2	124	171
125	**70/90**	M58x1,5	58	M64x3	95	60/75	206	150	58	G1 1/4	M42x2	135	205
140	**90/100**	M65x1,5	65	M80x3	110	75/85	226	170	58	G1 1/4	M42x2	156	219
160	**100/110**	M80x2	80	M90x3	120	85/95	265	190	65	G1 1/2	M48x2	185	240
180	**110/125**	M100x2	100	M100x3	140	95/110	292	210	65	G1 1/2	M48x2	199	264
200	**125/140**	M110x2	110	M110x4	150	110/120	310	235	65	G1 1/2	M48x2	205	278

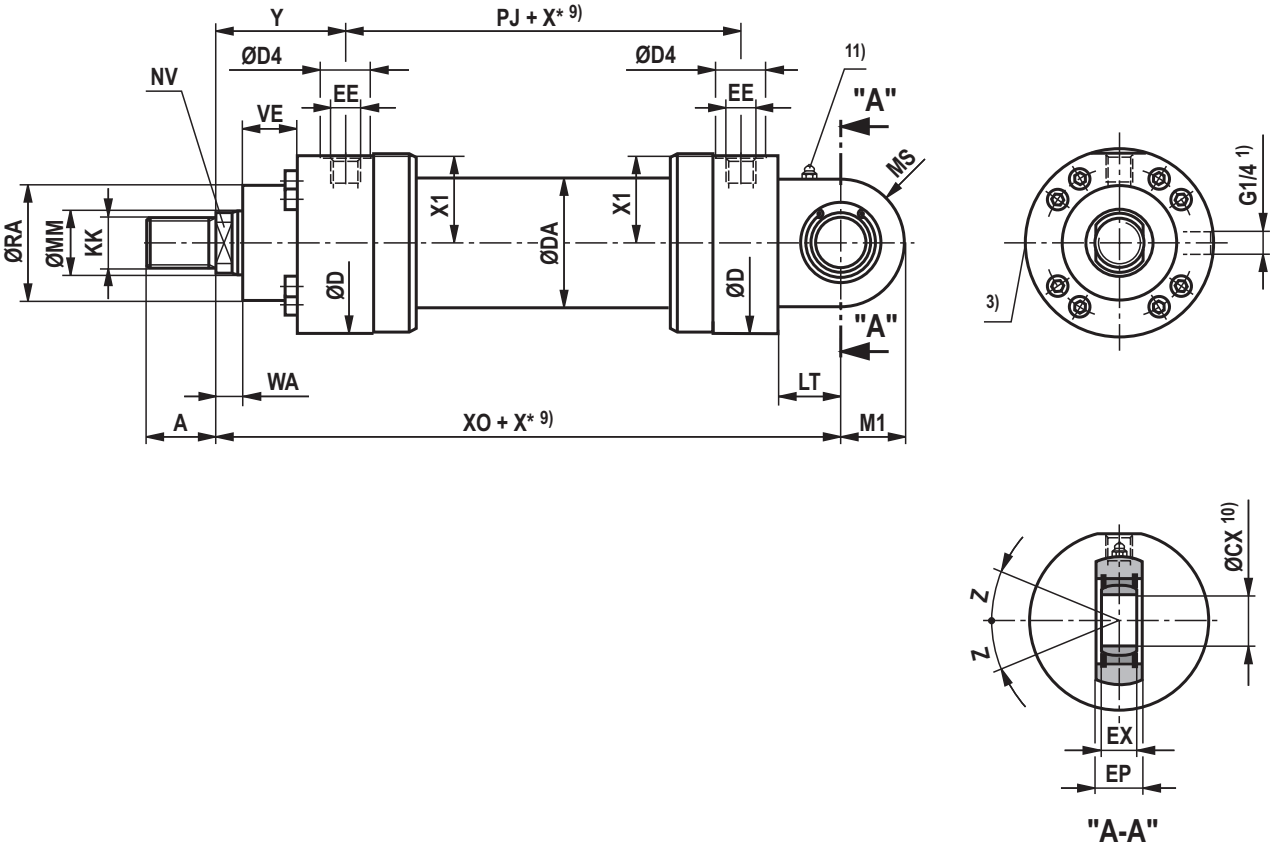
ØAL	ØMM	X1	WA	XC	L	MR	M1	ØCD H11	EW -0,4	ØRA 7)	VE 7)	ØRA 8)	VE 8)
40	**22/28**	41	14	252	32,5	31	28	25	23	52	40	52	20
50	**28/36**	48,5	18	265	37,5	36	32,5	30	28	65	40	65	16
63	**36/45**	56,5	22	302	45	42	40	35	30	75	45	75	17
80	**45/56**	67	20	330	50	52	50	40	35	95	45	95	13
100	**56/70**	82	30	385	60	65	62,5	50	40	115	55	115	20
125	**70/90**	99	32	447	70	70	70	60	50	135	60	135	17
140	**90/100**	109,5	35	490	75	82	82	70	55	155	70	155	22
160	**100/110**	129	40	550	85	95	95	80	60	200	80	200	80
180	**110/125**	142,5	40	610	90	113	113	90	65	220	90	220	90
200	**125/140**	152	40	645	115	125	125	100	70	235	95	235	95

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

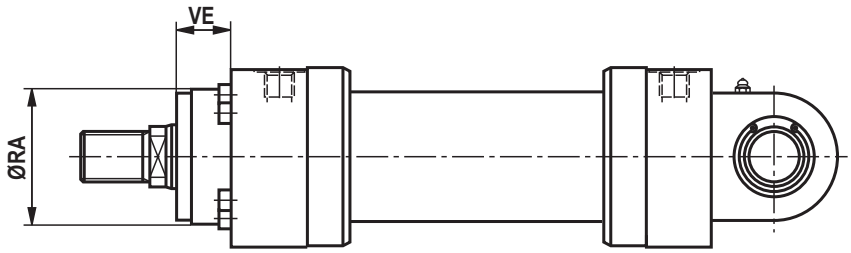
1) Bleeding: With view to the piston rod, the position is offset by 90° in relation to the line connection (clockwise)
2) Ø D4 max. 0.5 mm deep
3) Throttle valve only with end position cushioning "E" (180° for bleeding)
4) Flange connections see separate table pages 36 and 37
5) Thread design „G"
6) 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
11) Standard design „W"
Grease nipple cone head form A according to DIN 71412

Self-aligning clevis at base CDH1: MP5

CDH1 MP5



CDH1 MP5: With seal design "A", "B" and AL Ø 160 to 320 mm



Dimensions CDH1: 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
40	**22/28**	M16x1,5	16	M18x2	30	16/22	88	52	34	G1/2	M22x1,5	79	120	41
50	**28/36**	M22x1,5	22	M24x2	35	22/30	102	62	34	G1/2	M22x1,5	87	120	48,5
63	**36/45**	M28x1,5	28	M30x2	45	30/36	120	78	42	G3/4	M27x2	100	133	56,5
80	**45/56**	M35x1,5	35	M39x3	55	36/46	140	95	42	G3/4	M27x2	104	146	67
100	**56/70**	M45x1,5	45	M50x3	75	46/60	170	125	47	G1	M33x2	124	171	82
125	**70/90**	M58x1,5	58	M64x3	95	60/75	206	150	58	G1 1/4	M42x2	135	205	99
140	**90/100**	M65x1,5	65	M80x3	110	75/85	226	170	58	G1 1/4	M42x2	156	219	109,5
160	**100/110**	M80x2	80	M90x3	120	85/95	265	190	65	G1 1/2	M48x2	185	240	129
180	**110/125**	M100x2	100	M100x3	140	95/110	292	210	65	G1 1/2	M48x2	199	264	142,5
200	**125/140**	M110x2	110	M110x4	150	110/120	310	235	65	G1 1/2	M48x2	205	278	152
220	**140/160**	M120x3	120	M120x4	160	120/140	355	273	65	G1 1/2	M48x2	242	326	174
250	**160/180**	M120x3	120	M120x4	160	140/160	395	305	65	G1 1/2	M48x2	266	326	194
280	**180/200**	M130x3	130	M150x4	190	160/180	425	343	65	G1 1/2	M48x2	282	375	210
320	**200/220**	–	–	M160x4	200	180/200	490	394	65	G1 1/2	M48x2	287	431	242

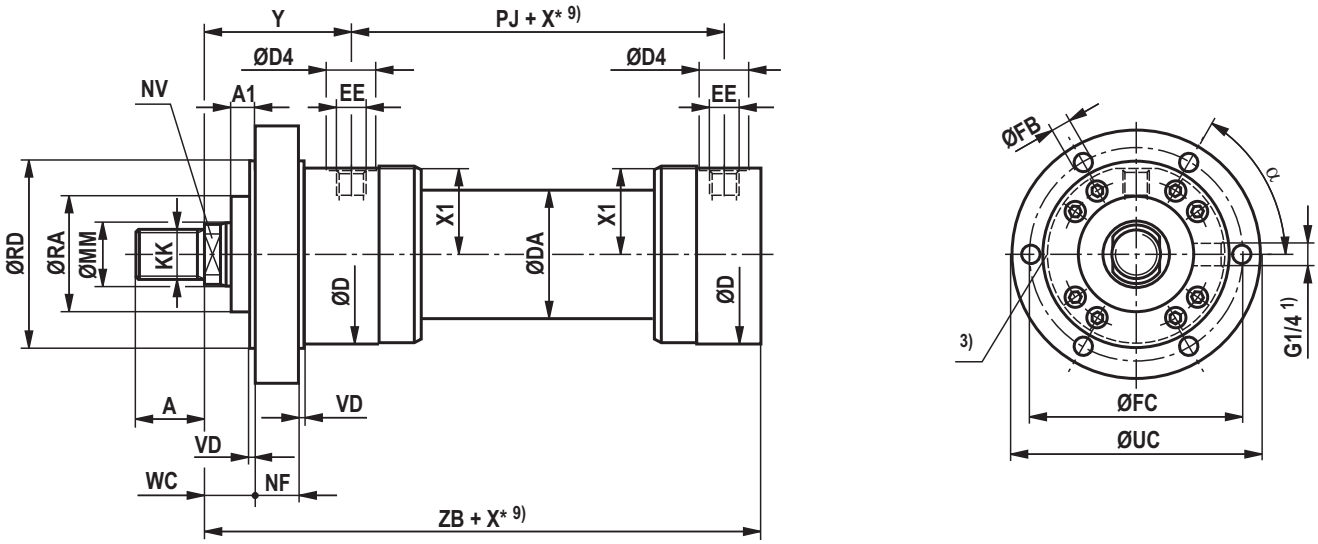
ØAL	ØMM	WA	XO	X* min	LT	M1	MS	ØCX	EP -0,4	EX	Z	ØRA 7)	VE 7)	ØRA 8)	VE 8)
40	**22/28**	14	252	–	32,5	28	31	$25_{-0,010}$	23	$20_{-0,12}$	7°	52	40	52	20
50	**28/36**	18	265	–	37,5	32,5	36	$30_{-0,010}$	28	$22_{-0,12}$	6°	65	40	65	16
63	**36/45**	22	302	–	45	40	42	$35_{-0,012}$	30	$25_{-0,12}$	6°	75	45	75	17
80	**45/56**	20	330	–	50	50	52	$40_{-0,012}$	35	$28_{-0,12}$	7°	95	45	95	13
100	**56/70**	30	385	–	60	62,5	65	$50_{-0,012}$	40	$35_{-0,12}$	6°	115	55	115	20
125	**70/90**	32	447	–	70	70	70	$60_{-0,015}$	50	$44_{-0,15}$	6°	135	60	135	17
140	**90/100**	35	490	–	75	82	82	$70_{-0,015}$	55	$49_{-0,15}$	6°	155	70	155	22
160	**100/110**	40	550	–	85	95	95	$80_{-0,015}$	60	$55_{-0,15}$	6°	200	80	200	80
180	**110/125**	40	610	–	90	113	113	$90_{-0,020}$	65	$60_{-0,20}$	5°	220	90	220	90
200	**125/140**	40	645	–	115	125	125	$100_{-0,020}$	70	$70_{-0,20}$	7°	235	95	235	95
220	**140/160**	40	750	–	125	150 12)	140 12)	$110_{-0,020}$	80	$70_{-0,20}$	6°	270	115	270	115
250	**160/180**	40	789	–	140	168 12)	158 12)	$110_{-0,020}$	80	$70_{-0,20}$	6°	300	125	300	125
280	**180/200**	40	884	31	150	188 12)	178 12)	$120_{-0,020}$	90	$85_{-0,20}$	6°	325	130	325	130
320	**200/220**	40	980	–	175	210 12)	200 12)	$140_{-0,020}$	110	$90_{-0,20}$	7°	365	155	365	155

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

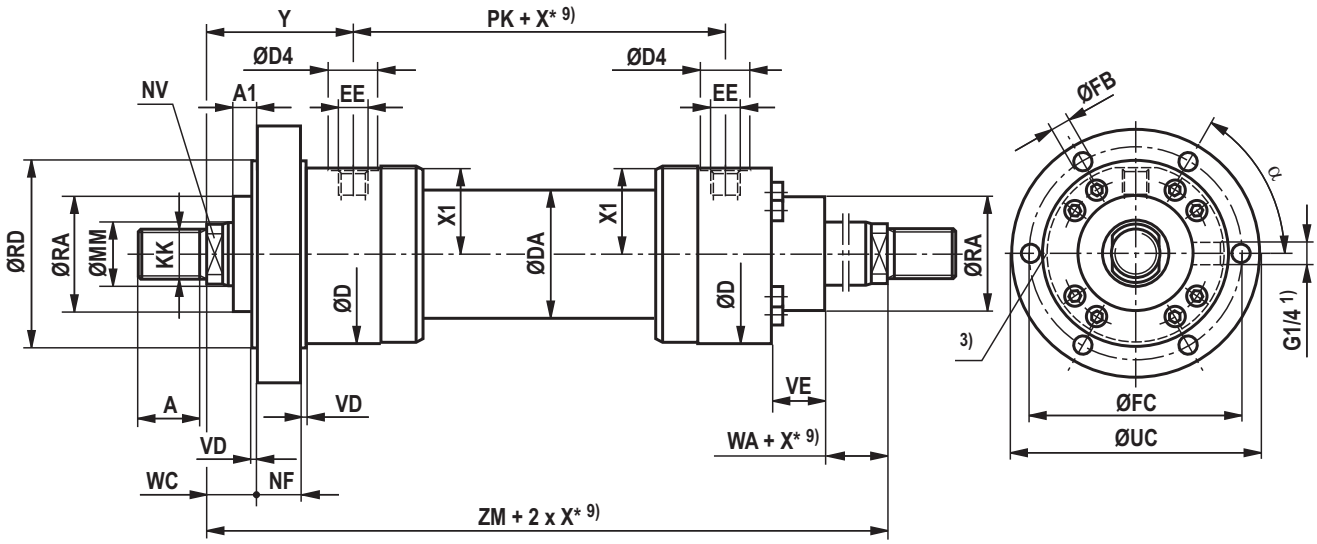
1) Bleeding: With view to the piston rod, the position is offset by 90° in relation to the line connection (clockwise)
2) Ø D4 max. 0.5 mm deep
3) Throttle valve only with end position cushioning "E" (180° for bleeding)
4) Flange connections see separate table pages 36 and 37
5) Thread design „G"
6) 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 CDH1/CGH1: MF3

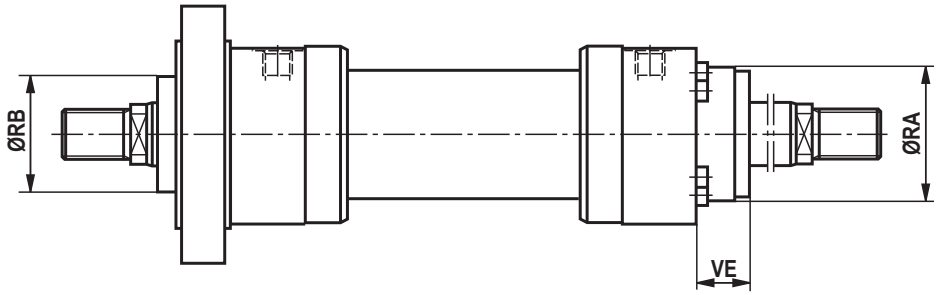
CDH1 MF3



CGH1 MF3



CGH1 MF3: With seal design "A", "B" and AL Ø 160 to 320 mm



Dimensions CDH1/CGH1: 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
40	**22/28**	M16x1,5	16	M18x2	30	16/22	88	52	34	G1/2	M22x1,5	79	120	41
50	**28/36**	M22x1,5	22	M24x2	35	22/30	102	62	34	G1/2	M22x1,5	87	120	48,5
63	**36/45**	M28x1,5	28	M30x2	45	30/36	120	78	42	G3/4	M27x2	100	133	56,5
80	**45/56**	M35x1,5	35	M39x3	55	36/46	140	95	42	G3/4	M27x2	104	146	67
100	**56/70**	M45x1,5	45	M50x3	75	46/60	170	125	47	G1	M33x2	124	171	82
125	**70/90**	M58x1,5	58	M64x3	95	60/75	206	150	58	G1 1/4	M42x2	135	205	99
140	**90/100**	M65x1,5	65	M80x3	110	75/85	226	170	58	G1 1/4	M42x2	156	219	109,5
160	**100/110**	M80x2	80	M90x3	120	85/95	265	190	65	G1 1/2	M48x2	185	240	129
180	**110/125**	M100x2	100	M100x3	140	95/110	292	210	65	G1 1/2	M48x2	199	264	142,5
200	**125/140**	M110x2	110	M110x4	150	110/120	310	235	65	G1 1/2	M48x2	205	278	152
220	**140/160**	M120x3	120	M120x4	160	120/140	355	273	65	G1 1/2	M48x2	242	326	174
250	**160/180**	M120x3	120	M120x4	160	140/160	395	305	65	G1 1/2	M48x2	266	326	194
280	**180/200**	M130x3	130	M150x4	190	160/180	425	343	65	G1 1/2	M48x2	282	375	210
320	**200/220**	–	–	M160x4	200	180/200	490	394	65	G1 1/2	M48x2	287	431	243

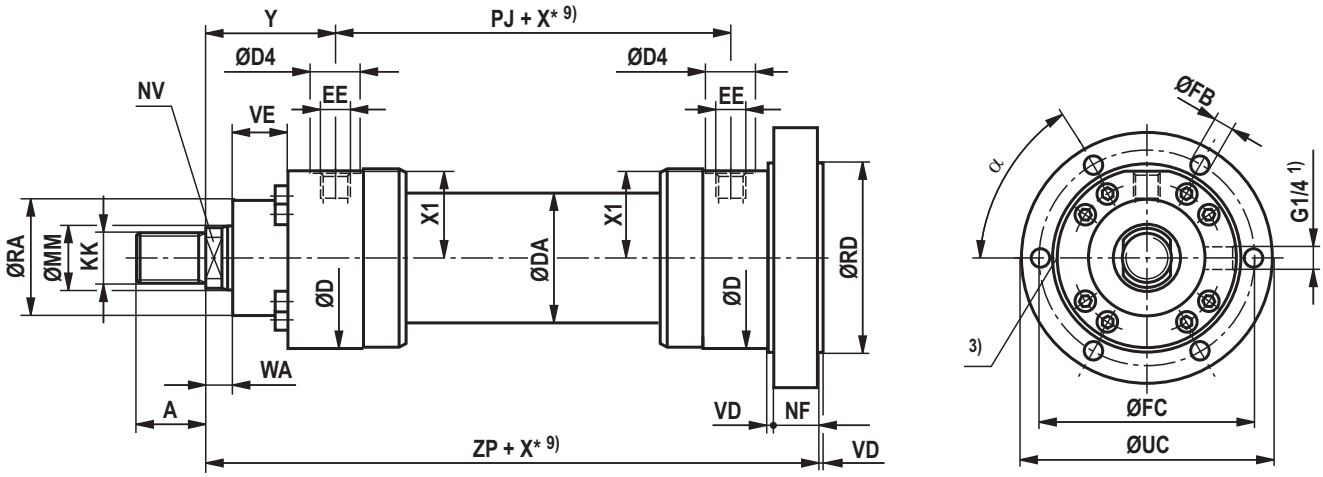
ØAL	ØMM	ØRD e8	WC	VD	NF	PK	A1	ZB	ZM	X* min	ØFB H13	ØFC js13	ØUC -1	α	WA	ØRA 7)	VE 7)	ØRA 8)	VE 8)	ØRB 8) max
40	**22/28**	90	19	5	30	120	0	226	278	–	9	108	130	60°	14	52	40	52	20	–
50	**28/36**	110	23	5	30	120	0	233	294	–	11	130	160	60°	18	65	40	65	16	–
63	**36/45**	130	27	5	35	133	0	262	333	–	13,5	155	185	60°	22	75	45	75	17	–
80	**45/56**	145	25	5	35	146	0	280	354	–	13,5	170	200	60°	20	95	45	95	13	–
100	**56/70**	175	35	5	45	171	0	330	419	–	17,5	205	245	60°	30	115	55	115	20	–
125	**70/90**	210	37	5	50	205	0	382	475	–	22	245	295	60°	32	135	60	135	17	–
140	**90/100**	230	45	10	50	219	0	420	531	–	22	265	315	60°	35	155	70	155	22	–
160	**100/110**	275	50	10	60	240	0	475	610	–	30	325	385	60°	40	200	80	200	80	–
180	**110/125**	300	50	10	70	264	0	515	662	–	30	360	420	60°	40	220	90	220	90	–
200	**125/140**	320	50	10	75	278	0	535	688	–	33	375	445	60°	40	235	95	235	95	–
220	**140/160**	370	60	10	85	326	20	635	810	–	33	430	490	60°	40	270	115	270	115	270
250	**160/180**	415	70	10	85	326	30	659	858	–	39	485	555	60°	40	300	125	300	125	300
280	**180/200**	450	65	10	95	375	25	744	939	31	39	520	590	60°	40	325	130	325	130	325
320	**200/220**	510	65	10	120	431	25	815	1005	–	45	600	680	60°	40	365	155	365	155	365

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

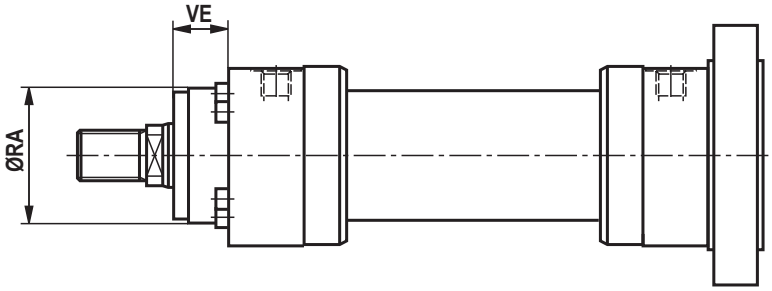
1) Bleeding: With view to the piston rod, the position is offset by 90° in relation to the line connection (clockwise)
2) Ø D4 max. 0.5 mm deep
3) Throttle valve only with end position cushioning "E" (180° for bleeding)
4) Flange connections see separate table pages 36 and 37
5) Thread design „G"
6) 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"

Round flange at base CDH1: MF4

CDH1 MF4



CDH1 MF4: With seal design "A", "B" and AL Ø 160 to 320 mm



Dimensions CDH1: 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
40	**22/28**	M16x1,5	16	M18x2	30	16/22	88	52	34	G1/2	M22x1,5	79	120	41
50	**28/36**	M22x1,5	22	M24x2	35	22/30	102	62	34	G1/2	M22x1,5	87	120	48,5
63	**36/45**	M28x1,5	28	M30x2	45	30/36	120	78	42	G3/4	M27x2	100	133	56,5
80	**45/56**	M35x1,5	35	M39x3	55	36/46	140	95	42	G3/4	M27x2	104	146	67
100	**56/70**	M45x1,5	45	M50x3	75	46/60	170	125	47	G1	M33x2	124	171	82
125	**70/90**	M58x1,5	58	M64x3	95	60/75	206	150	58	G1 1/4	M42x2	135	205	99
140	**90/100**	M65x1,5	65	M80x3	110	75/85	226	170	58	G1 1/4	M42x2	156	219	109,5
160	**100/110**	M80x2	80	M90x3	120	85/95	265	190	65	G1 1/2	M48x2	185	240	129
180	**110/125**	M100x2	100	M100x3	140	95/110	292	210	65	G1 1/2	M48x2	199	264	142,5
200	**125/140**	M110x2	110	M110x4	150	110/120	310	235	65	G1 1/2	M48x2	205	278	152
220	**140/160**	M120x3	120	M120x4	160	120/140	355	273	65	G1 1/2	M48x2	242	326	174
250	**160/180**	M120x3	120	M120x4	160	140/160	395	305	65	G1 1/2	M48x2	266	326	194
280	**180/200**	M130x3	130	M150x4	190	160/180	425	343	65	G1 1/2	M48x2	282	375	210
320	**200/220**	–	–	M160x4	200	180/200	490	394	65	G1 1/2	M48x2	287	431	243

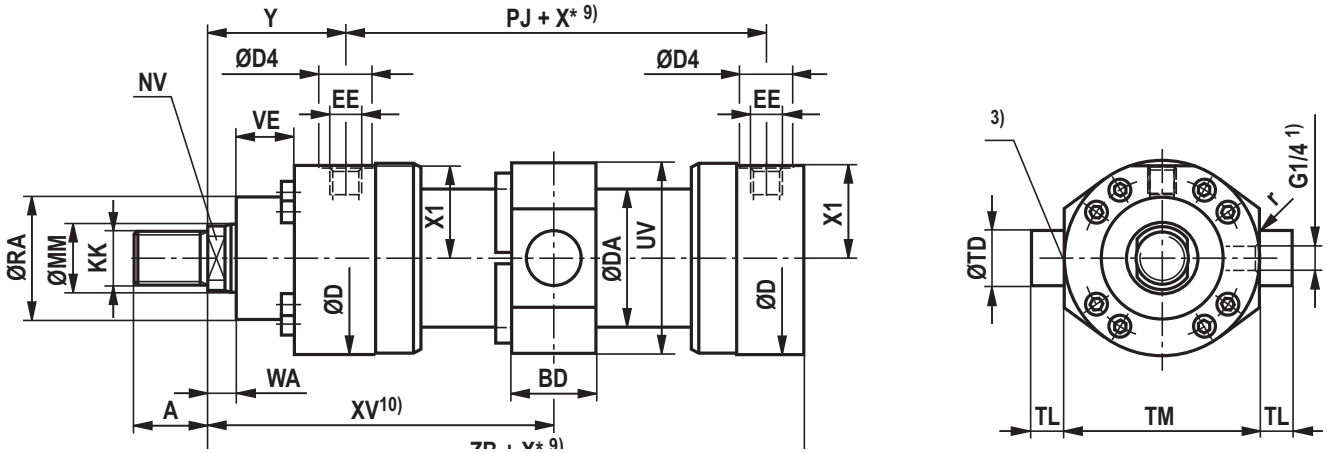
ØAL	ØMM	WA	ZP	X* min	NF	VD	ØRD e8	ØFB H13	ØFC js13	ØUC -1	α	ØRA 7)	VE 7)	ØRA 8)	VE 8)
40	**22/28**	14	256	–	30	5	90	9	108	130	60°	52	40	52	20
50	**28/36**	18	264	–	30	5	110	11	130	160	60°	65	40	65	16
63	**36/45**	22	297	–	35	5	130	13,5	155	185	60°	75	45	75	17
80	**45/56**	20	315	–	35	5	145	13,5	170	200	60°	95	45	95	13
100	**56/70**	30	375	–	45	5	175	17,5	205	245	60°	115	55	115	20
125	**70/90**	32	432	–	50	5	210	22	245	295	60°	135	60	135	17
140	**90/100**	35	475	–	50	10	230	22	265	315	60°	155	70	155	22
160	**100/110**	40	535	–	60	10	275	30	325	385	60°	200	80	200	80
180	**110/125**	40	585	–	70	10	300	30	360	420	60°	220	90	220	90
200	**125/140**	40	615	–	75	10	320	33	375	445	60°	235	95	235	95
220	**140/160**	40	720	–	85	10	370	33	430	490	60°	270	115	270	115
250	**160/180**	40	744	–	85	10	415	39	485	555	60°	300	125	300	125
280	**180/200**	40	839	31	95	10	450	39	520	590	60°	325	130	325	130
320	**200/220**	40	935	–	120	10	510	45	600	680	60°	365	155	365	155

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

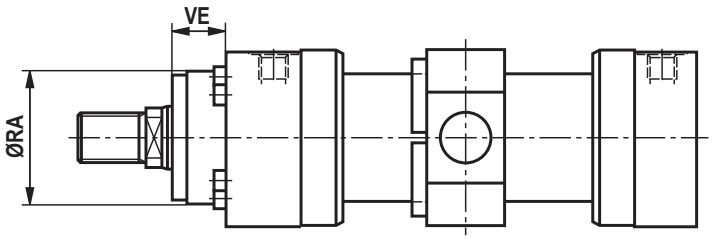
1) Bleeding: With view to the piston rod, the position is offset by 90° in relation to the line connection (clockwise)
2) Ø D4 max. 0.5 mm deep
3) Throttle valve only with end position cushioning "E" (180° for bleeding)
4) Flange connections see separate table pages 36 and 37
5) Thread design „G”
6) 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"

Trunnion CDH1/CGH1: MT4

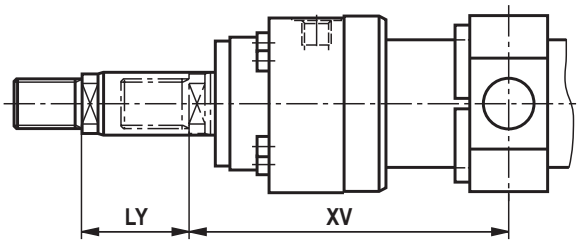
CDH1 MT4



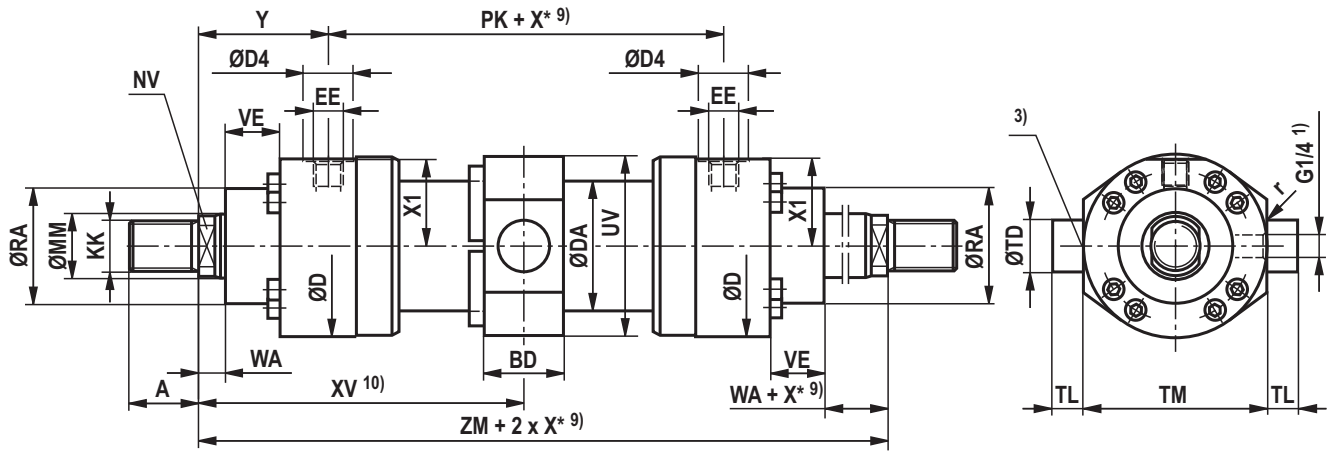
CDH1 MT4: With seal design "A", "B" and AL Ø 160 to 320 mm



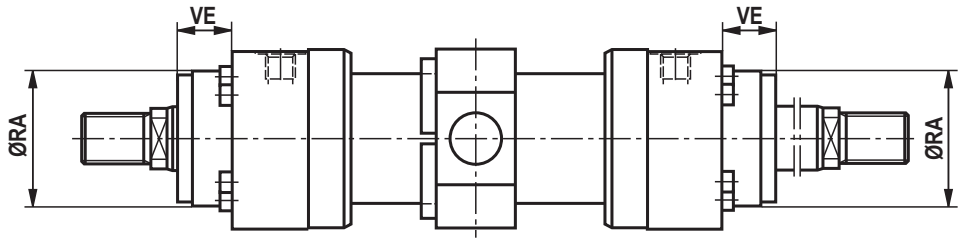
Dimensions for cylinder with piston rod extension "LY" in retracted condition



CGH1 MT4



CGH1 MT4: With seal design "A", "B" and AL Ø 160 to 320 mm



Dimensions CDH1/CGH1: 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
40	**22/28**	M16x1,5	16	M18x2	30	16/22	88	52	34	G1/2	M22x1,5	79	120	41	14
50	**28/36**	M22x1,5	22	M24x2	35	22/30	102	62	34	G1/2	M22x1,5	87	120	48,5	18
63	**36/45**	M28x1,5	28	M30x2	45	30/36	120	78	42	G3/4	M27x2	100	133	56,5	22
80	**45/56**	M35x1,5	35	M39x3	55	36/46	140	95	42	G3/4	M27x2	104	146	67	20
100	**56/70**	M45x1,5	45	M50x3	75	46/60	170	125	47	G1	M33x2	124	171	82	30
125	**70/90**	M58x1,5	58	M64x3	95	60/75	206	150	58	G1 1/4	M42x2	135	205	99	32
140	**90/100**	M65x1,5	65	M80x3	110	75/85	226	170	58	G1 1/4	M42x2	156	219	109,5	35
160	**100/110**	M80x2	80	M90x3	120	85/95	265	190	65	G1 1/2	M48x2	185	240	129	40
180	**110/125**	M100x2	100	M100x3	140	95/110	292	210	65	G1 1/2	M48x2	199	264	142,5	40
200	**125/140**	M110x2	110	M110x4	150	110/120	310	235	65	G1 1/2	M48x2	205	278	152	40
220	**140/160**	M120x3	120	M120x4	160	120/140	355	273	65	G1 1/2	M48x2	242	326	174	40
250	**160/180**	M120x3	120	M120x4	160	140/160	395	305	65	G1 1/2	M48x2	266	326	194	40
280	**180/200**	M130x3	130	M150x4	190	160/180	425	343	65	G1 1/2	M48x2	282	375	210	40
320	**200/220**	–	–	M160x4	200	180/200	490	394	65	G1 1/2	M48x2	287	431	243	40

ØAL	ØMM	PK	ZB	ZM	X* min	XV 11) cent	XV 10) min	XV 10) max	BD	UV 12)	ØTD e8	TL js16	TM h13	r	ØRA 7)	VE 7)	ØRA 8)	VE 8)
40	**22/28**	120	226	278	22	139+X*/2	150	136+X*	38	97	30	20	95	1,6	52	40	52	20
50	**28/36**	120	233	294	32	147+X*/2	163	140+X*	38	111	30	20	115	1,6	65	40	65	16
63	**36/45**	133	262	333	47	166,5+X*/2	190	155+X*	48	129	35	20	130	2	75	45	75	17
80	**45/56**	146	280	354	58	177+X*/2	206	160+X*	58	153	40	25	145	2	95	45	95	13
100	**56/70**	171	330	419	79	209,5+X*/2	249	185+X*	78	183	50	30	175	2	115	55	115	20
125	**70/90**	205	382	475	91	237,5+X*/2	283	207+X*	98	220	60	40	210	2,5	135	60	135	17
140	**90/100**	219	420	531	121	265,5+X*/2	326	220+X*	118	243	65	42,5	230	2,5	155	70	155	22
160	**100/110**	240	475	610	142	305+X*/2	376	254+X*	128	282	75	52,5	275	2,5	200	80	200	80
180	**110/125**	264	515	661	158	331+X*/2	410	272+X*	138	310	85	55	300	2,5	220	90	220	90
200	**125/140**	278	535	688	194	344+X*/2	441	267+X*	168	331	90	55	320	2,5	235	95	235	95
220	**140/160**	326	635	810	155	405+X*/2	482,5	327,5+X*	135	377	100	60	370	2,5	270	115	270	115
250	**160/180**	326	659	858	175	429+X*/2	516,5	341,5+X*	145	417	110	65	410	2,5	300	125	300	125
280	**180/200**	375	744	939	336	469,5+X*/2	637,5	301,5+X*	165	448	130	70	450	2,5	325	130	325	130
320	**200/220**	431	815	1005	180	502,5+X*/2	592,5	412,5+X*	195	513	160	90	510	2,5	365	155	365	155

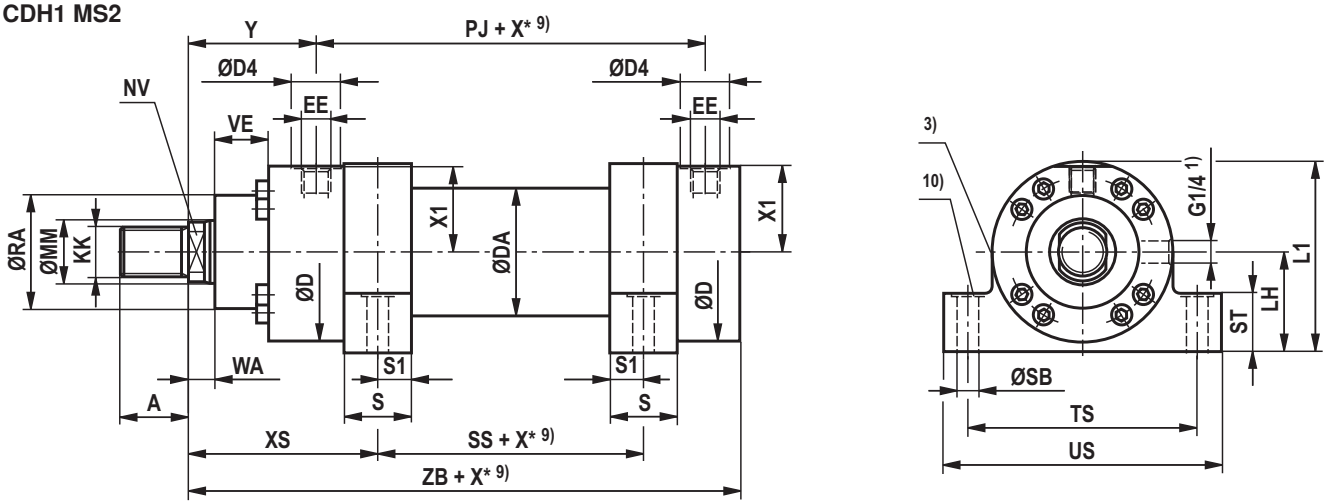
ØAL = Piston Ø
ØMM = Piston rod Ø
X* = Stroke length
X*min = Min. stroke length

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

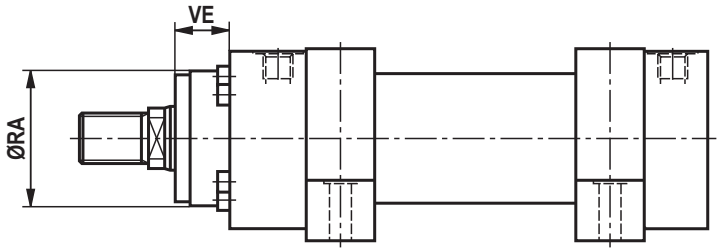
Important installation information: During installation, it must be ensured that the trunnion bearings are installed up to the trunnion shoulders. Any non-compliance may reduce the product's service life.

Foot mounting CDH1/CGH1: MS2

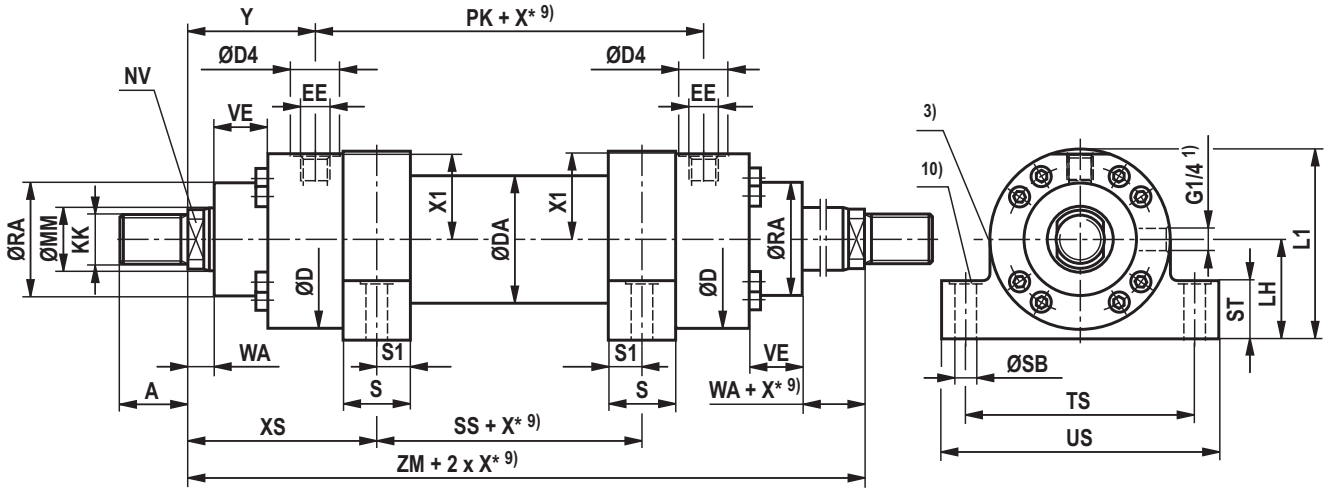
CDH1 MS2



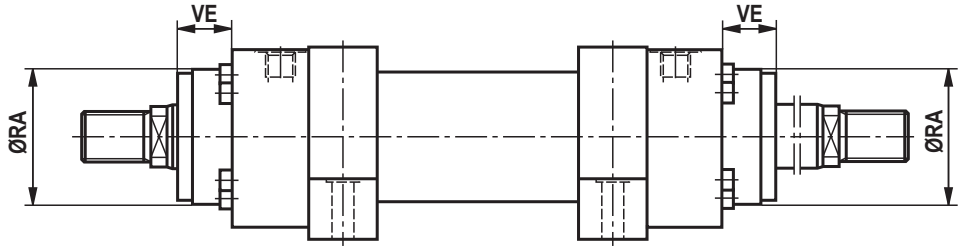
CDH1 MS2: With seal design "A", "B" and AL Ø 160 to 320 mm



CGH1 MS2



CGH1 MS2: With seal design "A", "B" and AL Ø 160 to 320 mm



Dimensions CDH1/CGH1: 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
40	**22/28**	M16x1,5	16	M18x2	30	16/22	88	52	34	G1/2	M22x1,5	79	120	41	14
50	**28/36**	M22x1,5	22	M24x2	35	22/30	102	62	34	G1/2	M22x1,5	87	120	48,5	18
63	**36/45**	M28x1,5	28	M30x2	45	30/36	120	78	42	G3/4	M27x2	100	133	56,5	22
80	**45/56**	M35x1,5	35	M39x3	55	36/46	140	95	42	G3/4	M27x2	104	146	67	20
100	**56/70**	M45x1,5	45	M50x3	75	46/60	170	125	47	G1	M33x2	124	171	82	30
125	**70/90**	M58x1,5	58	M64x3	95	60/75	206	150	58	G1 1/4	M42x2	135	205	99	32
140	**90/100**	M65x1,5	65	M80x3	110	75/85	226	170	58	G1 1/4	M42x2	156	219	109,5	35
160	**100/110**	M80x2	80	M90x3	120	85/95	265	190	65	G1 1/2	M48x2	185	240	129	40
180	**110/125**	M100x2	100	M100x3	140	95/110	292	210	65	G1 1/2	M48x2	199	264	142,5	40
200	**125/140**	M110x2	110	M110x4	150	110/120	310	235	65	G1 1/2	M48x2	205	278	152	40
220	**140/160**	M120x3	120	M120x4	160	120/140	355	273	65	G1 1/2	M48x2	242	326	174	40
250	**160/180**	M120x3	120	M120x4	160	140/160	395	305	65	G1 1/2	M48x2	266	326	194	40
280	**180/200**	M130x3	130	M150x4	190	160/180	425	343	65	G1 1/2	M48x2	282	375	210	40
320	**200/220**	–	–	M160x4	200	180/200	490	394	65	G1 1/2	M48x2	287	431	243	40

ØAL	ØMM	PK	XS	ZB	ZM	SS	X* min	S	S1	ØSB H13	ST	TS js13	US 12) -1	LH	L1 12)	ØRA 7)	VE 7)	ØRA 8)	VE 8)
40	**22/28**	120	114	226	278	50	–	30	15	11	32	110	140	45	93	52	40	52	20
50	**28/36**	120	124,5	233	294	45	–	35	17,5	11	37	130	161	55	110	65	40	65	16
63	**36/45**	133	142	262	333	49	–	40	20	13,5	42	150	183	65	129	75	45	75	17
80	**45/56**	146	151	280	354	52	2	50	25	17,5	47	180	220	75	149	95	45	95	13
100	**56/70**	171	179	330	419	61	3	60	30	22	57	210	260	90	181	115	55	115	20
125	**70/90**	205	200	382	475	75	–	70	35	26	67	255	313	105	215	135	60	135	17
140	**90/100**	219	230,5	420	531	70	19	85	42,5	30	72	290	359	115	235	155	70	155	22
160	**100/110**	240	272,5	475	610	65	44	105	52,5	33	77	330	402	135	277	200	80	200	80
180	**110/125**	264	296,5	515	662	69	50	115	57,5	40	92	360	445	150	305	220	90	220	90
200	**125/140**	278	307,5	535	688	73	56	125	62,5	40	97	385	471	160	322	235	95	235	95
220	**140/160**	326	367,5	635	810	75	100	155	77,5	45	102	445	541	185	373	270	115	270	115
250	**160/180**	326	391,5	659	858	75	100	155	77,5	52	112	500	610	205	414	300	125	300	125
280	**180/200**	375	407,5	744	939	124	171	155	77,5	52	127	530	641	225	449	325	130	325	130
320	**200/220**	431	440	815	1005	125	85	190	95	62	142	610	732	255	512	365	155	365	155

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 – 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 CSH1

CS	H1	/	/	/	A	3X	/							Z

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

Series **= H1**

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**

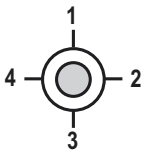
Line connection / version
- According to ISO 1179-1 (pipe thread ISO 228-1) **= B**
- According to ISO 9974-1 (metric thread ISO 261) **= M**
- Flange porting pattern according to ISO 6162-2 tab. 2 type 1 (≙ SAE 6000 PSI) [4], [9] **= D**
- Flange porting pattern according to ISO 6164 tab. 2 [4] **= 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] **= P**
- Subplate size 10 [4], [6] **= T**
- Subplate size 16 [4], [7] **= U**
- Subplate size 25 [4], [8] **= V**

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

Line connection/position at head

View to piston rod



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

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 =** [29] Standard seal system HFC
- **T =** [29] Servo quality/ reduced friction

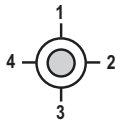
For phosphate ester HFD-R and polyol ester HFD-U
- **S =** [29] Servo quality/ reduced friction
- **V =** [29] Standard seal system FKM

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

Piston rod end
- **A =** Thread for plain clevis CGAS
- **G =** [13] Thread for plain clevis CGA, CGAK, plain clevis CSA
- **S =** With mounted self-aligning clevis CGAS
- **L =** [13] With mounted self-aligning clevis CGA
- **M =** [13] 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

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

Additional options

Fields for additional options

Z		T				

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

CSH1MP5/100/56/300A3X/T11CAEMZ TCAWW

Ordering code Series CSH1

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) Observe the max. available stroke length page 4 and admissible stroke length (acc. to buckling calculation) 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
8) Piston Ø 160 to 200 mm, only position 11, subplates only possible in combination with line connection "B" at the head
9) Only piston Ø 80 to 320 mm
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!
18) Not standardized
19) Only piston rod Ø 28 to 140 mm
20) Possible from piston rod Ø 45 mm
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 CSH1

CSH1 MP3
see page 24, 25

CSH1 MP5
see page 26, 27

CSH1 MF3
see page 28, 29

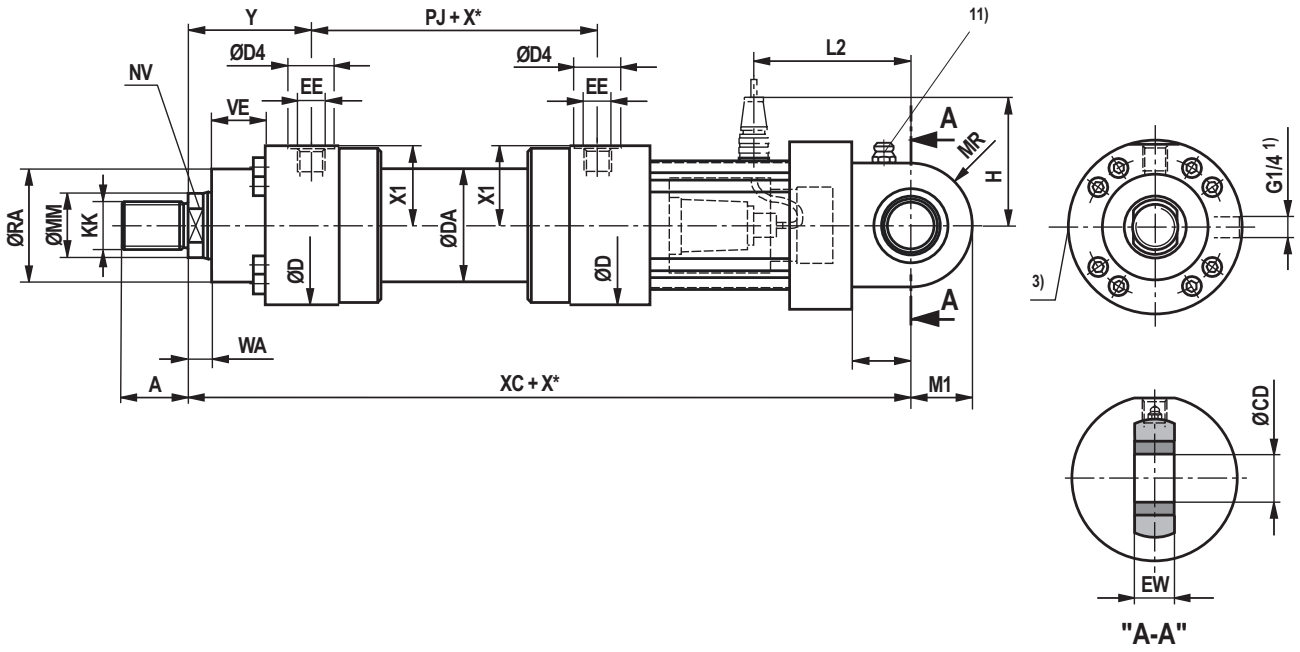
CSH1 MF4
see page 30, 31

CSH1 MT4
see page 32, 33

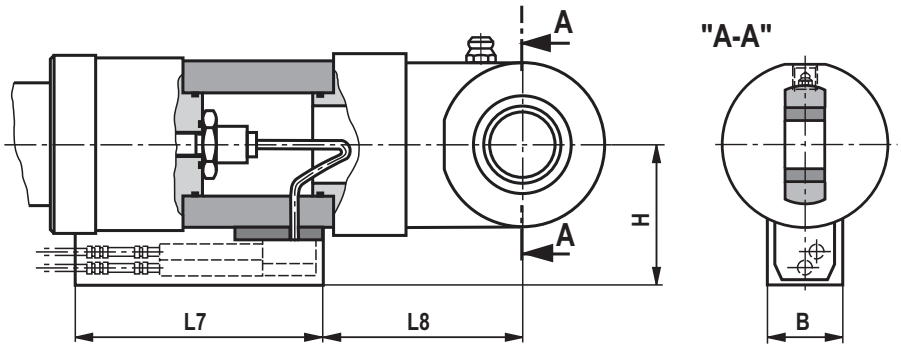
CSH1 MS2
see page 34, 35

Swivel eye at base CSH1: MP3

CSH1 MP3; AL-Ø 40 to 200 mm
for position measurement system output "C", "F" and "D"



CSH1 MP3; AL-Ø 40 to 200 mm
for position measurement system output "N" and "P"



Dimensions CSH1: 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	X* max
40	**28**	M16x1,5	16	M18x2	30	16/22	88	52	34	G1/2	M22x1,5	79	120	1000
50	**28/36**	M22x1,5	22	M24x2	35	22/30	102	62	34	G1/2	M22x1,5	87	120	1000
63	**36/45**	M28x1,5	28	M30x2	45	30/36	120	78	42	G3/4	M27x2	100	133	2000
80	**45/56**	M35x1,5	35	M39x3	55	36/46	140	95	42	G3/4	M27x2	104	146	2000
100	**56/70**	M45x1,5	45	M50x3	75	46/60	170	125	47	G1	M33x2	124	171	3000
125	**70/90**	M58x1,5	58	M64x3	95	60/75	206	150	58	G1 1/4	M42x2	135	205	3000
140	**90/100**	M65x1,5	65	M80x3	110	75/85	226	170	58	G1 1/4	M42x2	156	219	3000
160	**100/110**	M80x2	80	M90x3	120	85/95	265	190	65	G1 1/2	M48x2	185	240	3000
180	**110/125**	M100x2	100	M100x3	140	95/110	292	210	65	G1 1/2	M48x2	199	264	3000
200	**125/140**	M110x2	110	M110x4	150	110/120	310	235	65	G1 1/2	M48x2	205	278	3000

ØAL	ØMM	X1	WA	XC	L	MR	M1	ØCD H11	EW -0,4	ØRA	VE	L2	H 14)	H 13)	L7	L8	B
40	**28**	41	14	417	32,5	31	28	25	23	52	40	98	115	106	200	75	64
50	**28/36**	48,5	18	430	37,5	36	32,5	30	28	65	40	103	120	113	200	80	64
63	**36/45**	56,5	22	480	45	42	40	35	30	75	45	116	130	122	200	93	64
80	**45/56**	67	20	515	50	52	50	40	35	95	45	132	125	133	200	104	64
100	**56/70**	82	30	560	60	65	62,5	50	40	115	55	145	135	148	200	117	64
125	**70/90**	99	32	620	70	70	70	60	50	135	60	172	145	166	200	148	64
140	**90/100**	109,5	35	665	75	82	82	70	55	155	70	182	155	176	200	156	64
160	**100/110**	129	40	720	85	95	95	80	60	200	80	200	165	196	200	168	64
180	**110/125**	142,5	40	775	90	113	113	90	65	220	90	222	175	210	200	189	64
200	**125/140**	152	40	815	115	125	125	100	70	235	95	237	190	217	200	206	64

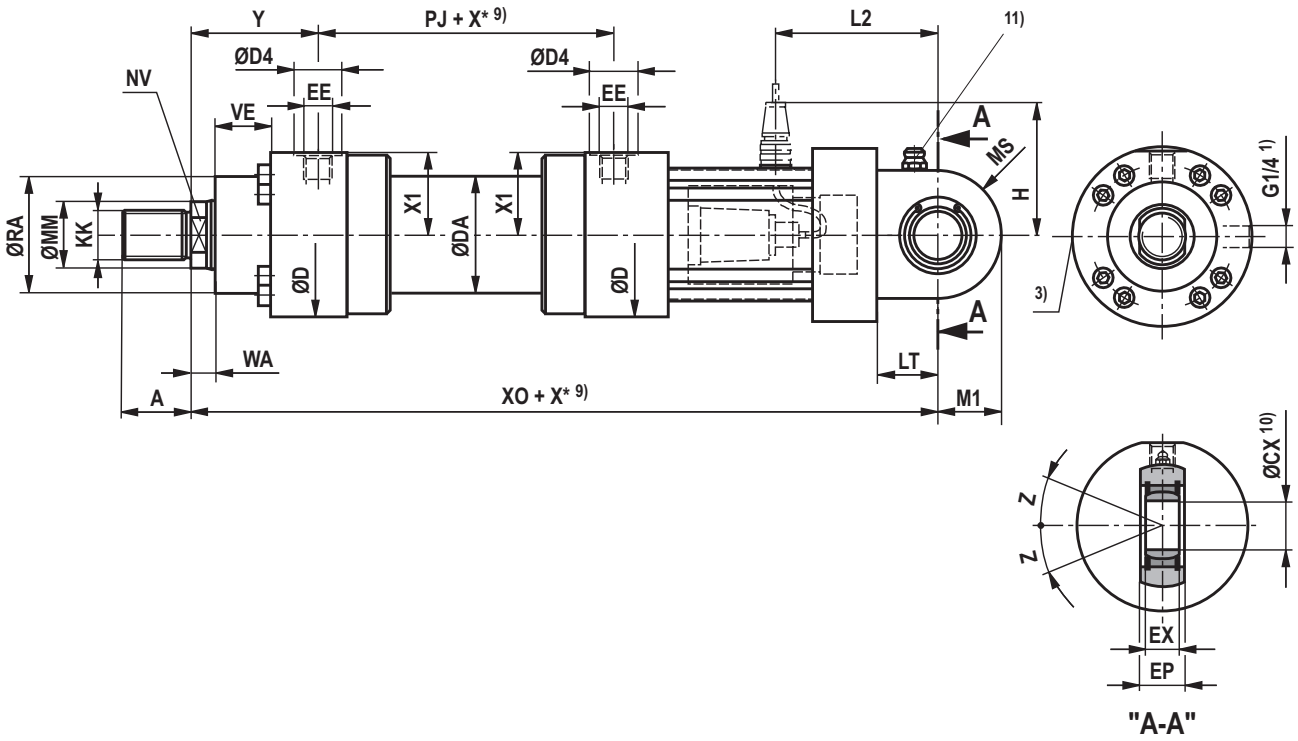
ØAL = Piston Ø
ØMM = Piston rod Ø
X* = Stroke length
X*max = Max. stroke length

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"
11) 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 CSH1: MP5

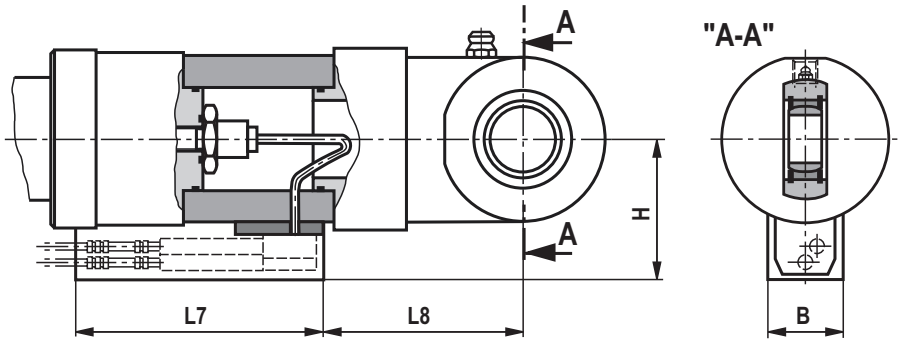
CSH1 MP5

for position measurement system output "C", "F" and "D"



CSH1 MP5

for position measurement system output "N" and "P"



Dimensions CSH1: 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	X* max
40	**28**	M16x1,5	16	M18x2	30	16/22	88	52	34	G1/2	M22x1,5	79	120	41	1000
50	**28/36**	M22x1,5	22	M24x2	35	22/30	102	62	34	G1/2	M22x1,5	87	120	48,5	1000
63	**36/45**	M28x1,5	28	M30x2	45	30/36	120	78	42	G3/4	M27x2	100	133	56,5	2000
80	**45/56**	M35x1,5	35	M39x3	55	36/46	140	95	42	G3/4	M27x2	104	146	67	2000
100	**56/70**	M45x1,5	45	M50x3	75	46/60	170	125	47	G1	M33x2	124	171	82	3000
125	**70/90**	M58x1,5	58	M64x3	95	60/75	206	150	58	G1 1/4	M42x2	135	205	99	3000
140	**90/100**	M65x1,5	65	M80x3	110	75/85	226	170	58	G1 1/4	M42x2	156	219	109,5	3000
160	**100/110**	M80x2	80	M90x3	120	85/95	265	190	65	G1 1/2	M48x2	185	240	129	3000
180	**110/125**	M100x2	100	M100x3	140	95/110	292	210	65	G1 1/2	M48x2	199	264	142,5	3000
200	**125/140**	M110x2	110	M110x4	150	110/120	310	235	65	G1 1/2	M48x2	205	278	152	3000
220	**140/160**	M120x3	120	M120x4	160	120/140	355	273	65	G1 1/2	M48x2	242	326	174	3000
250	**160/180**	M120x3	120	M120x4	160	140/160	395	305	65	G1 1/2	M48x2	266	326	194	3000
280	**180/200**	M130x3	130	M150x4	190	160/180	425	343	65	G1 1/2	M48x2	282	375	210	3000
320	**200/220**	–	–	M160x4	200	180/200	490	394	65	G1 1/2	M48x2	287	431	242	3000

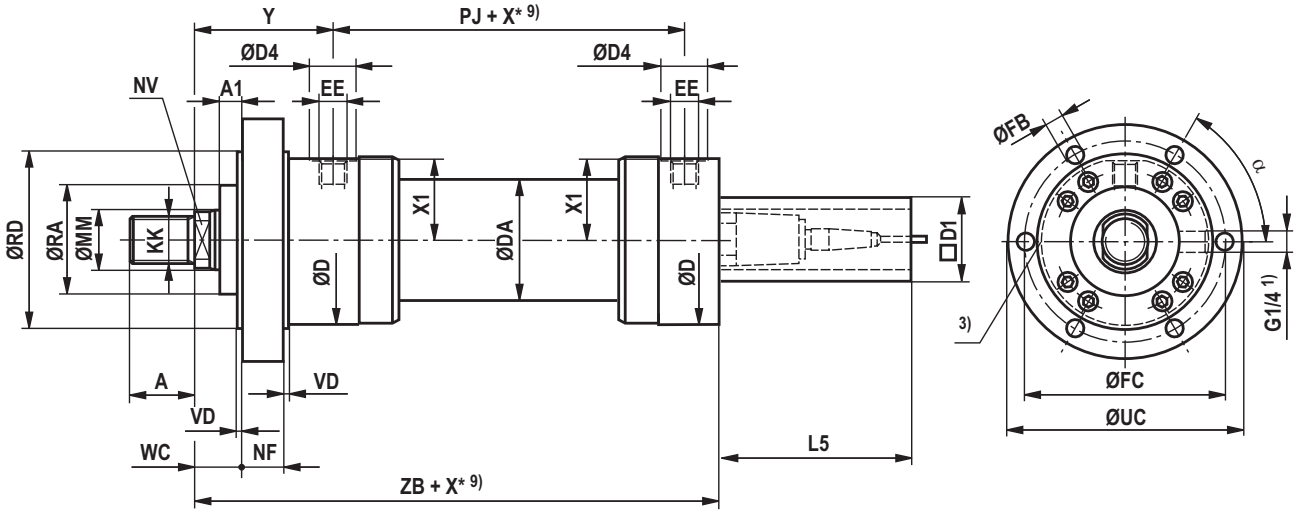
ØAL	ØMM	WA	XO	X* min	LT	M1	MS	ØCX	EP -0,4	EX	Z	ØRA	VE	L2	H 14)	H 13)	L7	L8	B
40	**28**	14	417	–	32,5	28	31	$25_{-0,010}$	23	$20_{-0,12}$	7°	52	40	98	115	106	200	75	64
50	**28/36**	18	430	–	37,5	32,5	36	$30_{-0,010}$	28	$22_{-0,12}$	6°	65	40	103	120	113	200	80	64
63	**36/45**	22	480	–	45	40	42	$35_{-0,012}$	30	$25_{-0,12}$	6°	75	45	116	130	122	200	93	64
80	**45/56**	20	515	–	50	50	52	$40_{-0,012}$	35	$28_{-0,12}$	7°	95	45	132	125	133	200	104	64
100	**56/70**	30	560	–	60	62,5	65	$50_{-0,012}$	40	$35_{-0,12}$	6°	115	55	145	135	148	200	117	64
125	**70/90**	32	620	–	70	70	70	$60_{-0,015}$	50	$44_{-0,15}$	6°	135	60	172	145	166	200	148	64
140	**90/100**	35	665	–	75	82	82	$70_{-0,015}$	55	$49_{-0,15}$	6°	155	70	182	155	176	200	156	64
160	**100/110**	40	720	–	85	95	95	$80_{-0,015}$	60	$55_{-0,15}$	6°	200	80	200	165	196	200	168	64
180	**110/125**	40	775	–	90	113	113	$90_{-0,020}$	65	$60_{-0,20}$	5°	220	90	222	175	210	200	189	64
200	**125/140**	40	815	–	115	125	125	$100_{-0,020}$	70	$70_{-0,20}$	7°	235	95	237	190	217	200	206	64
220	**140/160**	40	960	–	125	150 12)	140 12)	$110_{-0,020}$	80	$70_{-0,20}$	6°	270	115	280	205	254	200	248	64
250	**160/180**	40	1000	–	140	168 12)	158 12)	$110_{-0,020}$	80	$70_{-0,20}$	6°	300	125	300	220	269	200	263	64
280	**180/200**	40	1105	31	150	188 12)	178 12)	$120_{-0,020}$	90	$85_{-0,20}$	6°	325	130	330	270	276	200	295	64
320	**200/220**	40	1210	–	175	210 12)	200 12)	$140_{-0,020}$	110	$90_{-0,20}$	7°	365	155	375	300	309	200	340	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 CSH1: MF3

CSH1 MF3



Dimensions CSH1: 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	L5	X* max
40	**28**	M16x1,5	16	M18x2	30	16/22	88	52	34	G1/2	M22x1,5	79	120	41	166	1000
50	**28/36**	M22x1,5	22	M24x2	35	22/30	102	62	34	G1/2	M22x1,5	87	120	48,5	166	1000
63	**36/45**	M28x1,5	28	M30x2	45	30/36	120	78	42	G3/4	M27x2	100	133	56,5	166	2000
80	**45/56**	M35x1,5	35	M39x3	55	36/46	140	95	42	G3/4	M27x2	104	146	67	166	2000
100	**56/70**	M45x1,5	45	M50x3	75	46/60	170	125	47	G1	M33x2	124	171	82	166	3000
125	**70/90**	M58x1,5	58	M64x3	95	60/75	206	150	58	G1 1/4	M42x2	135	205	99	166	3000
140	**90/100**	M65x1,5	65	M80x3	110	75/85	226	170	58	G1 1/4	M42x2	156	219	109,5	166	3000
160	**100/110**	M80x2	80	M90x3	120	85/95	265	190	65	G1 1/2	M48x2	185	240	129	166	3000
180	**110/125**	M100x2	100	M100x3	140	95/110	292	210	65	G1 1/2	M48x2	199	264	142,5	166	3000
200	**125/140**	M110x2	110	M110x4	150	110/120	310	235	65	G1 1/2	M48x2	205	278	152	166	3000
220	**140/160**	M120x3	120	M120x4	160	120/140	355	273	65	G1 1/2	M48x2	242	326	174	166	3000
250	**160/180**	M120x3	120	M120x4	160	140/160	395	305	65	G1 1/2	M48x2	266	326	194	166	3000
280	**180/200**	M130x3	130	M150x4	190	160/180	425	343	65	G1 1/2	M48x2	282	375	210	166	3000
320	**200/220**	–	–	M160x4	200	180/200	490	394	65	G1 1/2	M48x2	287	431	243	166	3000

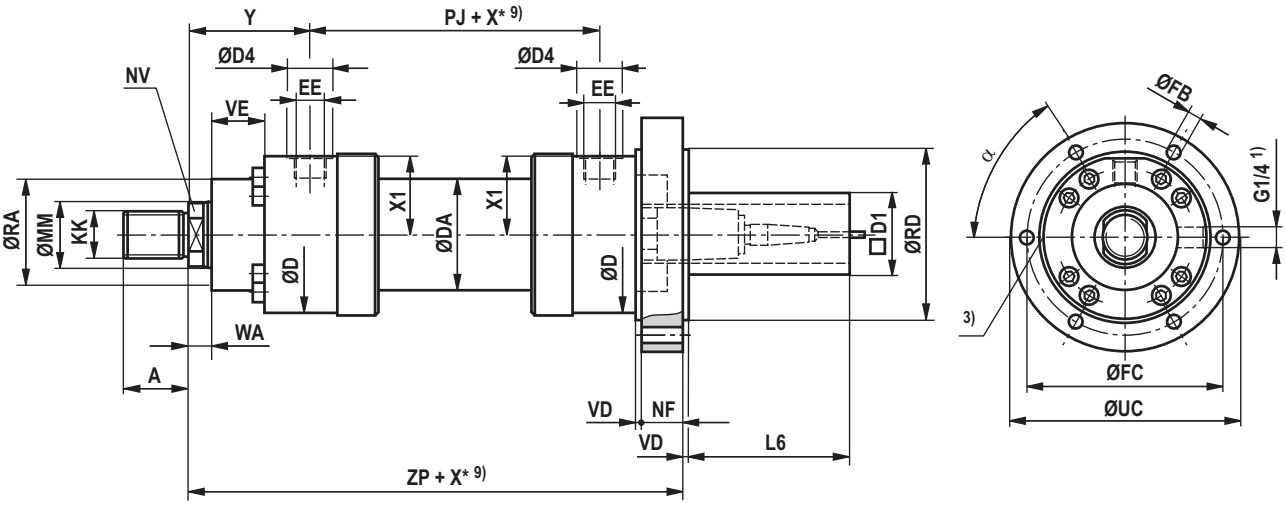
ØAL	ØMM	ØRD e8	WC	VD	NF	A1	ZB	X* min	ØFB H13	ØFC js13	ØUC -1	α	ØRA	D1 max
40	**28**	90	19	5	30	0	235	–	9	108	130	60°	52	80
50	**28/36**	110	23	5	30	0	243	–	11	130	160	60°	65	96
63	**36/45**	130	27	5	35	0	287	–	13,5	155	185	60°	75	96
80	**45/56**	145	25	5	35	0	312	–	13,5	170	200	60°	95	96
100	**56/70**	175	35	5	45	0	352	–	17,5	205	245	60°	115	96
125	**70/90**	210	37	5	50	0	392	–	22	245	295	60°	135	96
140	**90/100**	230	45	10	50	0	430	–	22	265	315	60°	155	96
160	**100/110**	275	50	10	60	0	475	–	30	325	385	60°	200	96
180	**110/125**	300	50	10	70	0	515	–	30	360	420	60°	220	96
200	**125/140**	320	50	10	75	0	535	–	33	375	445	60°	235	96
220	**140/160**	370	60	10	85	20	635	–	33	430	490	60°	270	96
250	**160/180**	415	70	10	85	30	659	–	39	485	555	60°	300	96
280	**180/200**	450	65	10	95	25	744	31	39	520	590	60°	325	96
320	**200/220**	510	65	10	120	25	815	–	45	600	680	60°	365	96

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

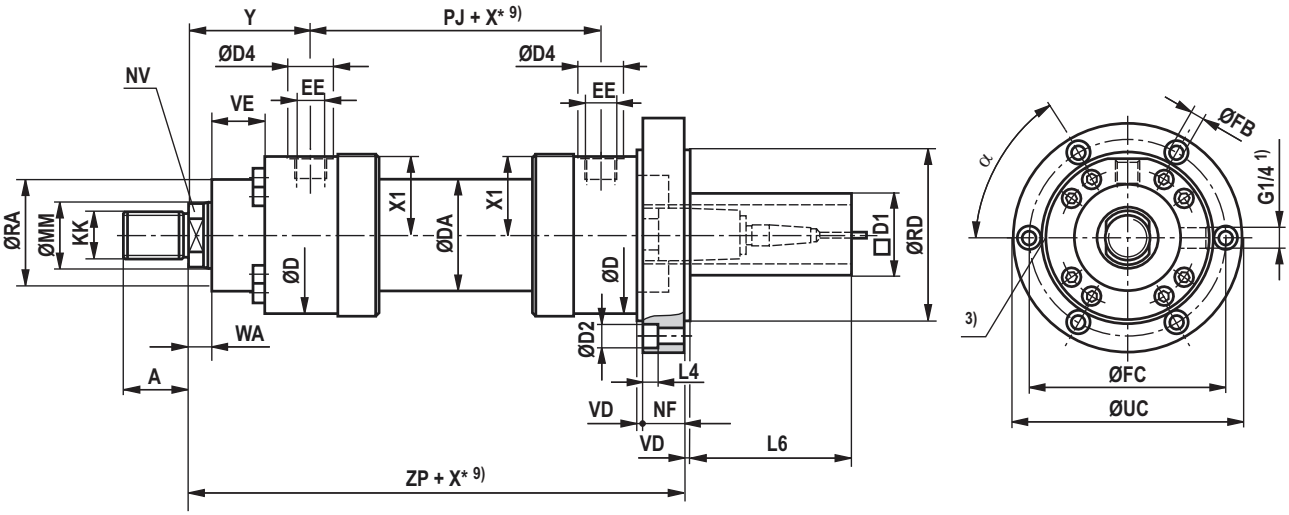
1) Bleeding: With view to the piston rod, the position is offset by 90° in relation to the line connection (clockwise)
2) Ø D4 max. 0.5 mm deep
3) Throttle valve only with end position cushioning "E" (180° for bleeding)
4) Flange connections see separate table pages 36 and 37
5) Thread design „G"
6) Thread design „A"
9) Observe the min. stroke length "X*min"

Round flange at base CSH1: MF4

CSH1 MF4; ØAL 40 to 100 mm



CSH1 MF4; ØAL 125 to 320 mm



Dimensions CSH1: 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	L4	ØD2	X* max
40	**28**	M16x1,5	16	M18x2	30	16/22	88	52	34	G1/2	M22x1,5	79	120	41	0	0	1000
50	**28/36**	M22x1,5	22	M24x2	35	22/30	102	62	34	G1/2	M22x1,5	87	120	48,5	0	0	1000
63	**36/45**	M28x1,5	28	M30x2	45	30/36	120	78	42	G3/4	M27x2	100	133	56,5	0	0	2000
80	**45/56**	M35x1,5	35	M39x3	55	36/46	140	95	42	G3/4	M27x2	104	146	67	0	0	2000
100	**56/70**	M45x1,5	45	M50x3	75	46/60	170	125	47	G1	M33x2	124	171	82	0	0	3000
125	**70/90**	M58x1,5	58	M64x3	95	60/75	206	150	58	G1 1/4	M42x2	135	205	99	21,5	33	3000
140	**90/100**	M65x1,5	65	M80x3	110	75/85	226	170	58	G1 1/4	M42x2	156	219	109,5	21,5	33	3000
160	**100/110**	M80x2	80	M90x3	120	85/95	265	190	65	G1 1/2	M48x2	185	240	129	28,5	43	3000
180	**110/125**	M100x2	100	M100x3	140	95/110	292	210	65	G1 1/2	M48x2	199	264	142,5	28,5	43	3000
200	**125/140**	M110x2	110	M110x4	150	110/120	310	235	65	G1 1/2	M48x2	205	278	152	32	48	3000
220	**140/160**	M120x3	120	M120x4	160	120/140	355	273	65	G1 1/2	M48x2	242	326	174	32	48	3000
250	**160/180**	M120x3	120	M120x4	160	140/160	395	305	65	G1 1/2	M48x2	266	326	194	38	57	3000
280	**180/200**	M130x3	130	M150x4	190	160/180	425	343	65	G1 1/2	M48x2	282	375	210	38	57	3000
320	**200/220**	–	–	M160x4	200	180/200	490	394	65	G1 1/2	M48x2	287	431	243	44	66	3000

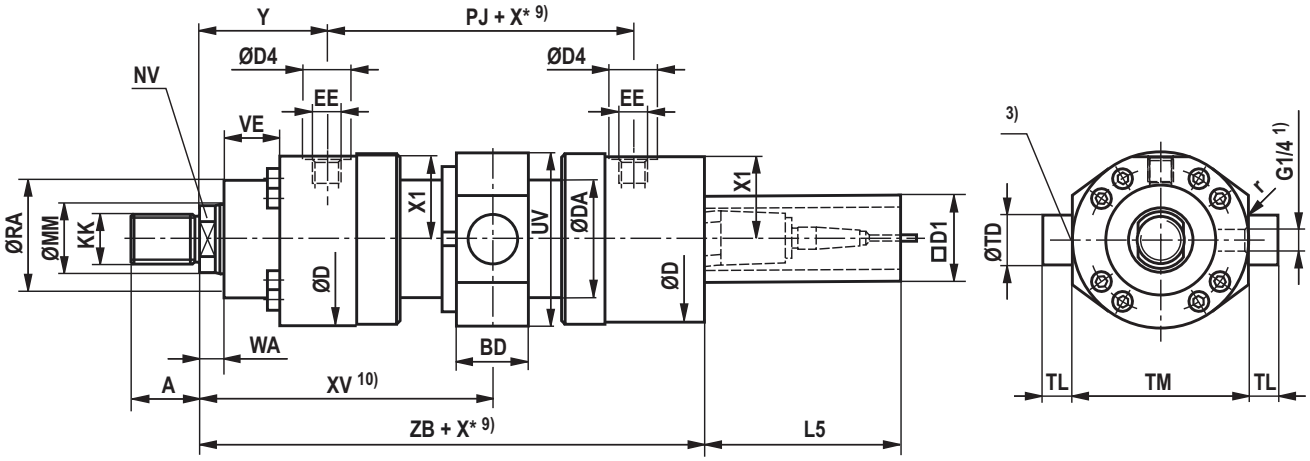
ØAL	ØMM	WA	ZP	X* min	NF	VD	ØRD e8	ØFB H13	ØFC js13	ØUC -1	α	ØRA	VE	L6	D1 max
40	**28**	14	265	–	30	5	90	9	108	130	60°	52	40	166	80
50	**28/36**	18	274	–	30	5	110	11	130	160	60°	65	40	166	96
63	**36/45**	22	310	–	35	5	130	13,5	155	185	60°	75	45	166	96
80	**45/56**	20	330	–	35	5	145	13,5	170	200	60°	95	45	143	96
100	**56/70**	30	390	–	45	5	175	17,5	205	245	60°	115	55	123	96
125	**70/90**	32	432	–	50	5	210	22	245	295	60°	135	60	121	96
140	**90/100**	35	475	–	50	10	230	22	265	315	60°	155	70	111	96
160	**100/110**	40	535	–	60	10	275	30	325	385	60°	200	80	96	96
180	**110/125**	40	585	–	70	10	300	30	360	420	60°	220	90	86	96
200	**125/140**	40	615	–	75	10	320	33	375	445	60°	235	95	76	96
220	**140/160**	40	720	–	85	10	370	33	430	490	60°	270	115	71	96
250	**160/180**	40	744	–	85	10	415	39	485	555	60°	300	125	71	96
280	**180/200**	40	839	31	95	10	450	39	520	590	60°	325	130	61	96
320	**200/220**	40	935	–	120	10	510	45	600	680	60°	365	155	36	96

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

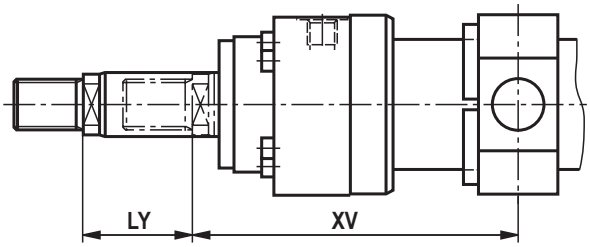
1) Bleeding: With view to the piston rod, the position is offset by 90° in relation to the line connection (clockwise)
2) Ø D4 max. 0.5 mm deep
3) Throttle valve only with end position cushioning "E" (180° for bleeding)
4) Flange connections see separate table pages 36 and 37
5) Thread design „G"
6) Thread design „A"
9) Observe the min. stroke length "X*min"

Trunnion CSH1: MT4

CSH1 MT4



Dimensions for cylinder with piston rod extension "LY"
in retracted condition



Dimensions CSH1: 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	L5	X* max
40	**28**	M16x1,5	16	M18x2	30	16/22	88	52	34	G1/2	M22x1,5	79	120	41	14	166	1000
50	**28/36**	M22x1,5	22	M24x2	35	22/30	102	62	34	G1/2	M22x1,5	87	120	48,5	18	166	1000
63	**36/45**	M28x1,5	28	M30x2	45	30/36	120	78	42	G3/4	M27x2	100	133	56,5	22	166	2000
80	**45/56**	M35x1,5	35	M39x3	55	36/46	140	95	42	G3/4	M27x2	104	146	67	20	166	2000
100	**56/70**	M45x1,5	45	M50x3	75	46/60	170	125	47	G1	M33x2	124	171	82	30	166	3000
125	**70/90**	M58x1,5	58	M64x3	95	60/75	206	150	58	G1 1/4	M42x2	135	205	99	32	166	3000
140	**90/100**	M65x1,5	65	M80x3	110	75/85	226	170	58	G1 1/4	M42x2	156	219	109,5	35	166	3000
160	**100/110**	M80x2	80	M90x3	120	85/95	265	190	65	G1 1/2	M48x2	185	240	129	40	166	3000
180	**110/125**	M100x2	100	M100x3	140	95/110	292	210	65	G1 1/2	M48x2	199	264	142,5	40	166	3000
200	**125/140**	M110x2	110	M110x4	150	110/120	310	235	65	G1 1/2	M48x2	205	278	152	40	166	3000
220	**140/160**	M120x3	120	M120x4	160	120/140	355	273	65	G1 1/2	M48x2	242	326	174	40	166	3000
250	**160/180**	M120x3	120	M120x4	160	140/160	395	305	65	G1 1/2	M48x2	266	326	194	40	166	3000
280	**180/200**	M130x3	130	M150x4	190	160/180	425	343	65	G1 1/2	M48x2	282	375	210	40	166	3000
320	**200/220**	–	–	M160x4	200	180/200	490	394	65	G1 1/2	M48x2	287	431	243	40	166	3000

ØAL	ØMM	ZB	X* min	XV 11) cent	XV 10) min	XV 10) max	BD	UV 12)	ØTD e8	TL js16	TM h13	r	ØRA	VE	D1 max
40	**28**	235	22	139+X*/2	150	136+X*	38	97	30	20	95	1,6	52	40	80
50	**28/36**	243	32	147+X*/2	163	140+X*	38	111	30	20	115	1,6	65	40	96
63	**36/45**	287	47	166,5+X*/2	190	155+X*	48	129	35	20	130	2	75	45	96
80	**45/56**	312	58	177+X*/2	206	160+X*	58	153	40	25	145	2	95	45	96
100	**56/70**	352	79	209,5+X*/2	249	185+X*	78	183	50	30	175	2	115	55	96
125	**70/90**	392	91	237,5+X*/2	283	207+X*	98	220	60	40	210	2,5	135	60	96
140	**90/100**	430	121	265,5+X*/2	326	220+X*	118	243	65	42,5	230	2,5	155	70	96
160	**100/110**	475	142	305+X*/2	376	254+X*	128	282	75	52,5	275	2,5	200	80	96
180	**110/125**	515	158	331+X*/2	410	272+X*	138	310	85	55	300	2,5	220	90	96
200	**125/140**	535	194	344+X*/2	441	267+X*	168	331	90	55	320	2,5	235	95	96
220	**140/160**	635	155	405+X*/2	482,5	327,5+X*	135	377	100	60	370	2,5	270	115	96
250	**160/180**	659	175	429+X*/2	516,5	341,5+X*	145	417	110	65	410	2,5	300	125	96
280	**180/200**	744	336	469,5+X*/2	637,5	301,5+X*	165	448	130	70	450	2,5	325	130	96
320	**200/220**	815	180	502,5+X*/2	592,5	412,5+X*	195	513	160	90	510	2,5	365	155	96

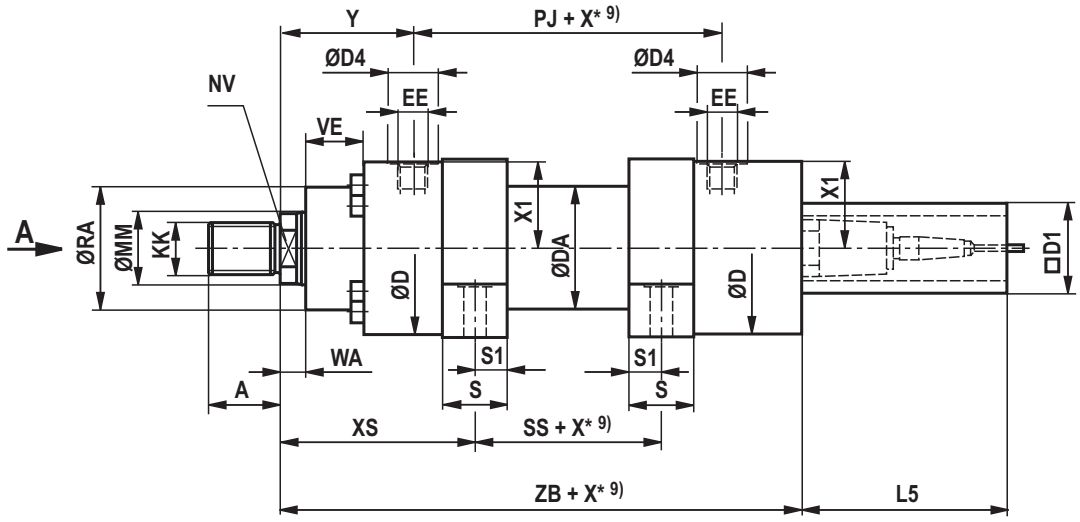
ØAL = Piston Ø
ØMM = Piston rod Ø
X* = Stroke length
X*max = Max. stroke length
X*min = Min. stroke length

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

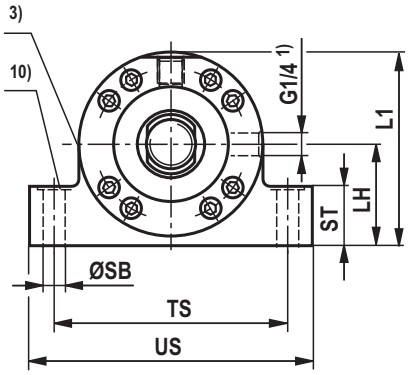
Important installation information: During installation, it must be ensured that the trunnion bearings are installed up to the trunnion shoulders. Any non-compliance may reduce the product's service life.

Foot mounting CSH1: MS2

CSH1 MS2; ØAL 40 to 320 mm



View A



Dimensions CSH1: 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	L5	X* max
40	**28**	M16x1,5	16	M18x2	30	16/22	88	52	34	G1/2	M22x1,5	79	120	41	14	166	1000
50	**28/36**	M22x1,5	22	M24x2	35	22/30	102	62	34	G1/2	M22x1,5	87	120	48,5	18	166	1000
63	**36/45**	M28x1,5	28	M30x2	45	30/36	120	78	42	G3/4	M27x2	100	133	56,5	22	166	2000
80	**45/56**	M35x1,5	35	M39x3	55	36/46	140	95	42	G3/4	M27x2	104	146	67	20	166	2000
100	**56/70**	M45x1,5	45	M50x3	75	46/60	170	125	47	G1	M33x2	124	171	82	30	166	3000
125	**70/90**	M58x1,5	58	M64x3	95	60/75	206	150	58	G1 1/4	M42x2	135	205	99	32	166	3000
140	**90/100**	M65x1,5	65	M80x3	110	75/85	226	170	58	G1 1/4	M42x2	156	219	109,5	35	166	3000
160	**100/110**	M80x2	80	M90x3	120	85/95	265	190	65	G1 1/2	M48x2	185	240	129	40	166	3000
180	**110/125**	M100x2	100	M100x3	140	95/110	292	210	65	G1 1/2	M48x2	199	264	142,5	40	166	3000
200	**125/140**	M110x2	110	M110x4	150	110/120	310	235	65	G1 1/2	M48x2	205	278	152	40	166	3000
220	**140/160**	M120x3	120	M120x4	160	120/140	355	273	65	G1 1/2	M48x2	242	326	174	40	166	3000
250	**160/180**	M120x3	120	M120x4	160	140/160	395	305	65	G1 1/2	M48x2	266	326	194	40	166	3000
280	**180/200**	M130x3	130	M150x4	190	160/180	425	343	65	G1 1/2	M48x2	282	375	210	40	166	3000
320	**200/220**	–	–	M160x4	200	180/200	490	394	65	G1 1/2	M48x2	287	431	243	40	166	3000

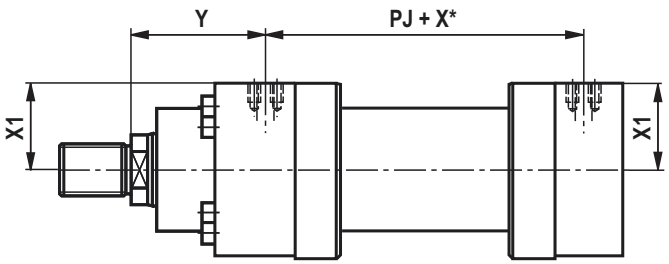
ØAL	ØMM	XS	ZB	SS	X* min	S	S1	ØSB H13	ST	TS js13	US 12) -1	LH	L1 12)	ØRA	VE	D1 max
40	**28**	114	235	50	–	30	15	11	32	110	140	45	93	52	40	80
50	**28/36**	124,5	243	45	–	35	17,5	11	37	130	161	55	110	65	40	96
63	**36/45**	142	287	49	–	40	20	13,5	42	150	183	65	129	75	45	96
80	**45/56**	151	312	52	2	50	25	17,5	47	180	220	75	149	95	45	96
100	**56/70**	179	352	61	3	60	30	22	57	210	260	90	181	115	55	96
125	**70/90**	200	392	75	–	70	35	26	67	255	313	105	215	135	60	96
140	**90/100**	230,5	430	70	19	85	42,5	30	72	290	359	115	235	155	70	96
160	**100/110**	272,5	475	65	44	105	52,5	33	77	330	402	135	277	200	80	96
180	**110/125**	296,5	515	69	50	115	57,5	40	92	360	445	150	305	220	90	96
200	**125/140**	307,5	535	73	56	125	62,5	40	97	385	471	160	322	235	95	96
220	**140/160**	367,5	635	75	100	155	77,5	45	102	445	541	185	373	270	115	96
250	**160/180**	391,5	659	75	100	155	77,5	52	112	500	610	205	414	300	125	96
280	**180/200**	407,5	744	124	171	155	77,5	52	127	530	641	225	449	325	130	96
320	**200/220**	440	815	125	85	190	95	62	142	610	732	255	512	365	155	96

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

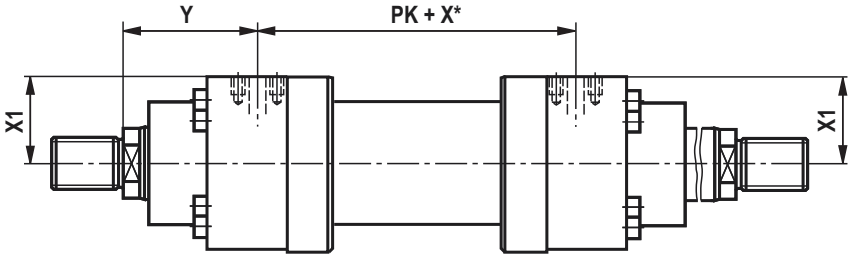
1) Bleeding: With view to the piston rod, the position is offset by 90° in relation to the line connection (clockwise)
2) Ø D4 max. 0.5 mm deep
3) Throttle valve only with end position cushioning "E" (180° for bleeding)
4) Flange connections see separate table pages 36 and 37
5) Thread design „G"
6) Thread design „A"
9) Observe the min. stroke length "X*min"
10) Recess 2 mm deep, for hexagon socket head cap screws; ISO 4762 – 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

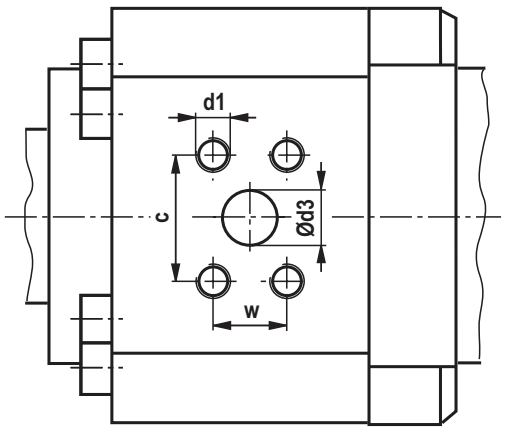
CDH1/CSH1



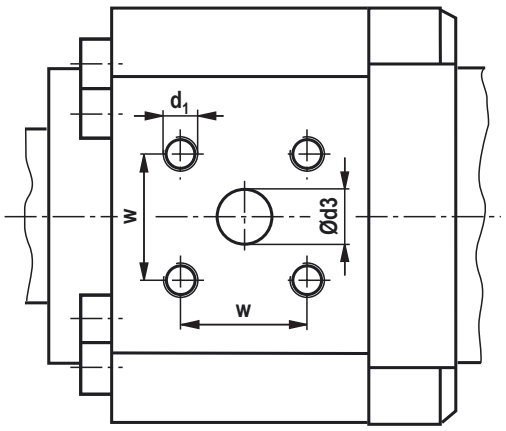
CGH1



Porting pattern for rectangular flange according to ISO 6162-2 table 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	Ød$_3$	Ød$_3$ [4]	c ±0,25	w ±0,25	d$_1$	t$_1$ [1]	t$_1$ [2]	p [3]	Y	PJ PK	X1	Ød$_3$	w ±0,25	d1	t$_1$ [1]	t$_1$ [2]	p [3]
40	–	–	–	–	–	–	–	–	–	–	–	78	122	40,5	10	24,7	M6	12,5	10	400
50	–	–	–	–	–	–	–	–	–	–	–	86	122	48	10	24,7	M6	12,5	10	400
63	–	–	–	–	–	–	–	–	–	–	–	99	135	57	13	29,7	M8	16	13	400
80	102,5	149	65	13	1/2“	40,5	18,2	M8	16	14	400	103	148	67	13	29,7	M8	16	15	400
100	124	171	80,5	13	1/2“	40,5	18,2	M8	16	16	400	123	173	81,5	19	35,4	M8	16	16	400
125	135	205	97,5	19	3/4“	50,8	23,8	M10	20	20	400	131,5	212	99	25	43,8	M10	20	20	400
140	152	227	107	25	1“	57,2	27,8	M12	24	24	400	152	227	109	25	43,8	M10	20	20	400
160	184	242	127	25	1“	57,2	27,8	M12	24	24	400	182,5	245	128	32	51,6	M12	24	24	400
180	199	264	139,5	32	1 1/4“	66,6	31,8	M14	26	26	400	199	264	142	32	51,6	M12	24	24	400
200	205	278	149	32	1 1/4“	66,6	31,8	M14	26	26	400	201,5	285	149,5	38	60,1	M16	30	30	400
220	242	326	168	38	1 1/2“	79,3	36,5	M16	30	30	400	242	326	171	38	60,1	M16	30	30	400
250	266	326	189	38	1 1/2“	79,3	36,5	M16	30	30	400	266	326	192	38	60,1	M16	30	30	400
280	282	375	204	38	1 1/2“	79,3	36,5	M16	30	30	400	282	375	207	38	60,1	M16	30	30	400
320	287	431	236	51	2“	96,8	44,5	M20	36	36	400	287	431	240	51	69,3	M16	30	30	400

Dimensions see page 10 to 21, and/or pages 24 to 35

ØAL = Piston Ø
X* = Stroke length

[1] Thread depth for seal design M, T, G, L, R, S and V

[2] Thread depth for seal design A and B

[3] Max. operating pressure for related flanges in bar

[4] 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)

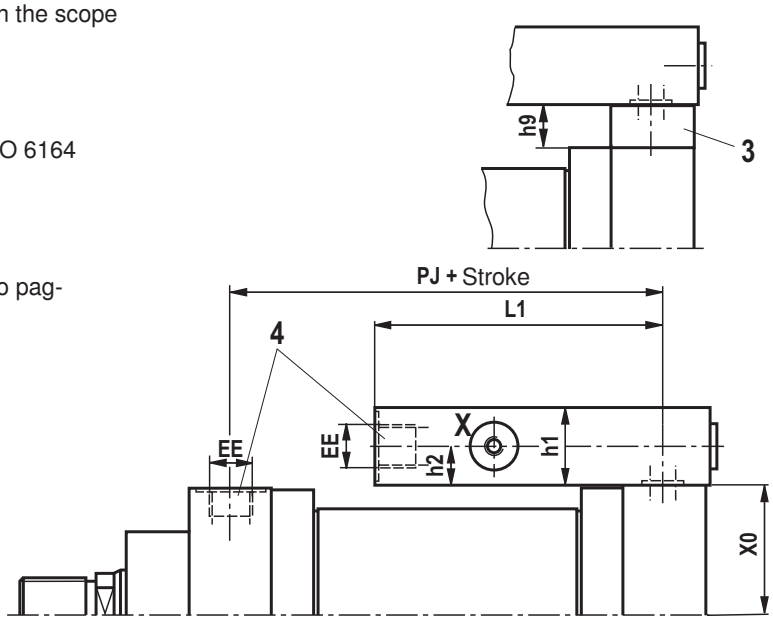
Note:
Valves, fittings and piping are **not** included in the scope of delivery!

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 as well as pages 24 to 35

Important notice
Subplates for SL and SV valves (isolator valves)

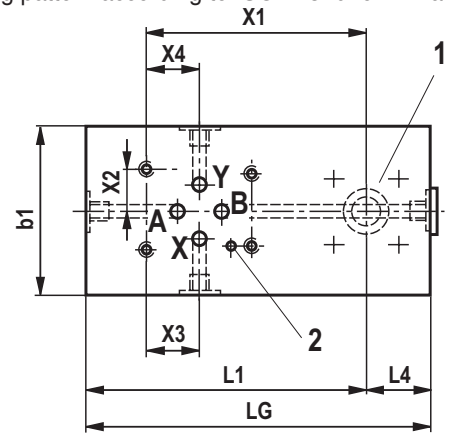
Note:
Seal designs T, G, L, R, S and V are not designed for the static holding function!

Installation situation with MT4



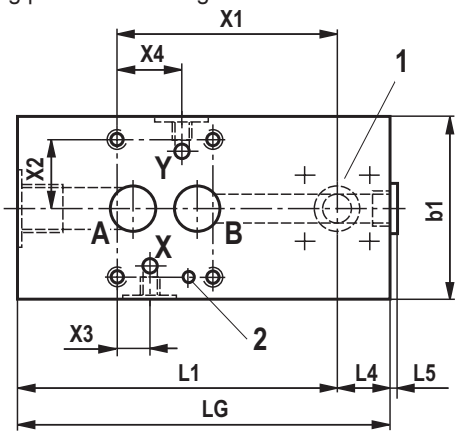
Size 6

Porting pattern according to ISO 24340 form A and ISO 4401



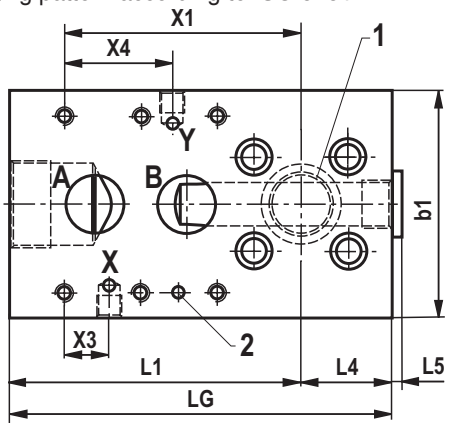
Size 10 and 20

Porting pattern according to ISO 5781

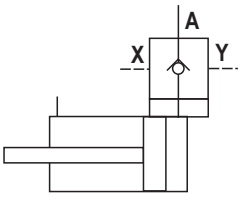


Size 30

Porting pattern according to ISO 5781



Piping symbol

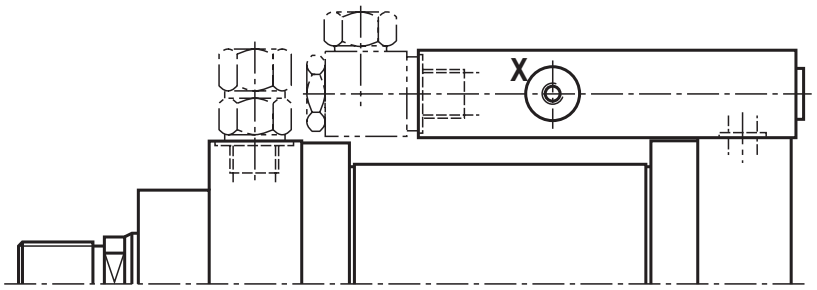


Subplates for valve mounting (SL and SV valve – dimensions in mm)

ØAL	Valve size	PJ	EE	Stroke min [1] 2)	Stroke min [1] 3)	X0	Plate dimensions L1	L4	L5	LG	b1	h1	h9	Port size, porting pattern h2	A	X	Y	X3	X4	Position point Valve X1	X2
40	6	121	G1/2	50	50	40,5	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	48,0	90	20	4	110	55	40	10	20	G1/2	G1/4	G1/4	21,5	21,5	65,5	15,5
63	6	134	G3/4	64	64	57,0	100	25	5	125	55	47	20	23,5	G3/4	G1/4	G1/4	21,5	21,5	70,5	15,5
	10	134	G3/4	64	64	57,0	105	25	5	130	85	47	20	23,5	G3/4	G1/4	G1/4	21,4	21,4	73	33,3
80	6	147	G3/4	58	58	67,0	100	25	5	125	55	47	20	23,5	G3/4	G1/4	G1/4	21,5	21,5	70,5	15,5
	10	147	G3/4	58	58	67,0	105	25	5	130	85	47	20	23,5	G3/4	G1/4	G1/4	21,4	21,4	73	33,3
100	10	172	G1	50	79	81,5	102	28	5	130	85	50	20	25	G1	G1/4	G1/4	21,4	21,4	70	33,3
125	10	208,5	G1 1/4	60	91	99,0	115	35	5	150	85	60	30	30	G1 1/4	G1/4	G1/4	21,4	21,4	80	33,3
	20	208,5	G1 1/4	60	91	99,0	140	35	5	175	100	60	30	30	G1 1/4	G1/4	G1/4	20,8	39,7	95	39,7
140	10	223	G1 1/4	50	121	109,0	115	35	5	150	85	60	30	30	G1 1/4	G1/4	G1/4	21,4	21,4	80	33,3
	20	223	G1 1/4	50	121	109,0	140	35	5	175	100	60	30	30	G1 1/4	G1/4	G1/4	20,8	39,7	95	39,7
160	10	242,5	G1 1/2	60	142	128,0	120	40	5	160	85	70	30	35	G1 1/2	G1/4	G1/4	21,4	21,4	90	33,3
	20	242,5	G1 1/2	60	142	128,0	135	50	5	185	100	70	30	35	G1 1/2	G1/4	G1/4	20,8	39,7	105	39,7
	30	242,5	G1 1/2	60	142	128,0	160	50	5	210	125	70	30	35	G1 1/2	G1/4	G1/4	24,6	59,6	130	48,4
180	10	264	G1 1/2	50	158	142,0	120	40	5	160	85	70	30	35	G1 1/2	G1/4	G1/4	21,4	21,4	90	33,3
	20	264	G1 1/2	50	158	142,0	135	50	5	185	100	70	30	35	G1 1/2	G1/4	G1/4	20,8	39,7	105	39,7
	30	264	G1 1/2	50	158	142,0	160	50	5	210	125	70	30	35	G1 1/2	G1/4	G1/4	24,6	59,6	130	48,4
200	10	281,5	G1 1/2	30 [4]	194	149,5	130	45	5	175	95	70	20	35	G1 1/2	G1/4	G1/4	21,4	21,4	100	33,3
	20	281,5	G1 1/2	30 [4]	194	149,5	140	45	5	185	100	70	20	35	G1 1/2	G1/4	G1/4	20,8	39,7	115	39,7
	30	281,5	G1 1/2	30 [4]	194	149,5	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

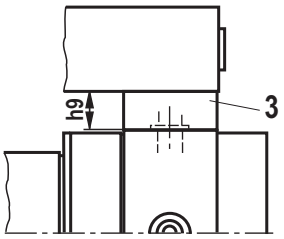
3) Only for MT4

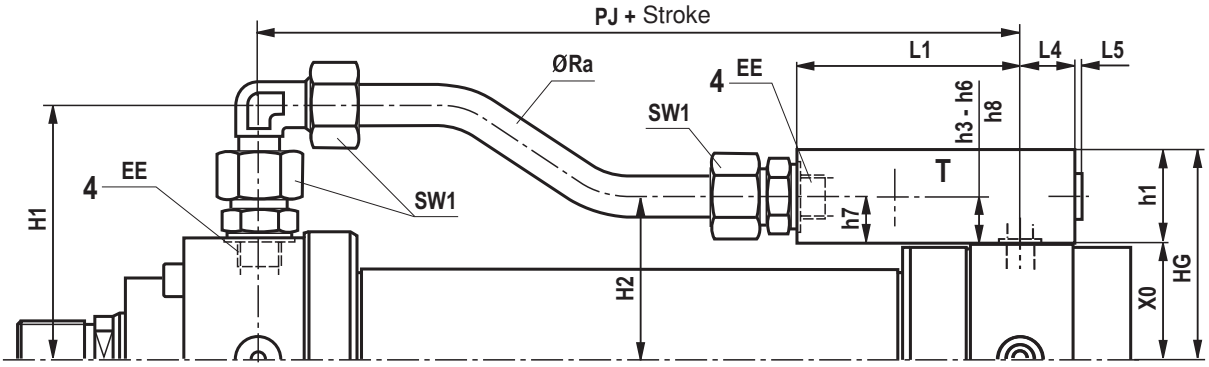
4) With type of mounting "MS2", observe X*min on page 21 and/or 35

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 as well as pages 24 to 35

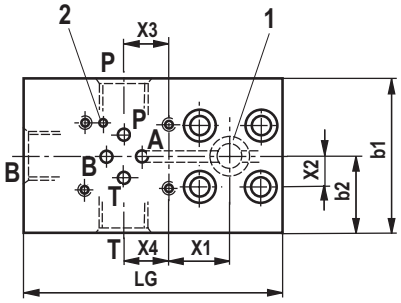
Installation situation with MT4





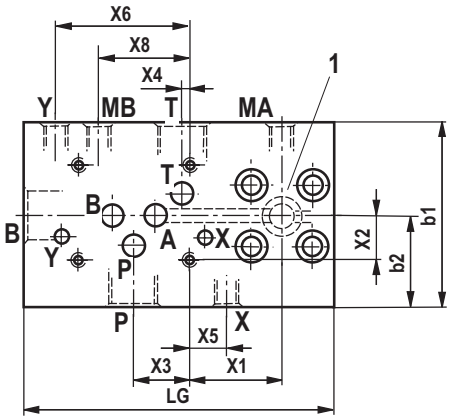
Size 6

Porting pattern according to ISO 24340 form A and ISO 4401



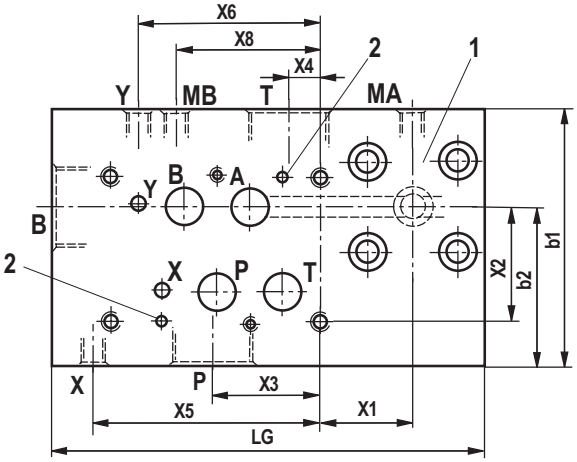
Size 10

Porting pattern according to ISO 24340 form A and ISO 4401



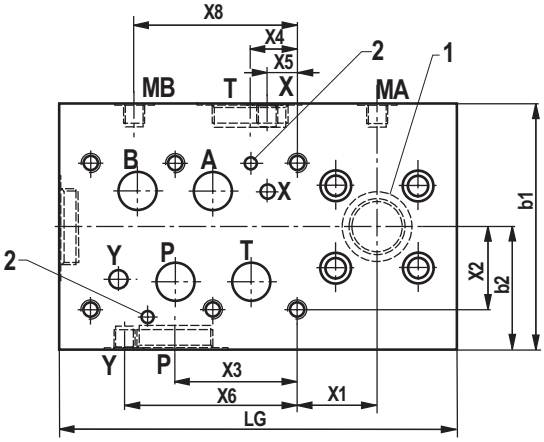
Size 16

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	96,0	60,5	70,5	30	16,0x2,5	65	40	110	80,5	90,5	32,5	40,5	20	10
50	6	121	G1/2	242	90	20	4	103,5	68,0	78,0	30	16,0x2,5	65	40	110	88,0	98,0	32,5	48,0	20	10
63	6	134	G3/4	276	100	25	5	121,5	80,5	100,5	36	20,0x3,0	75	47	125	104,0	124,0	37,5	57,0	23,5	20
	10	134	G3/4	301	125	25	5	121,5	80,0	100,0	36	20,0x3,0	90	70	150	127,0	147,0	45	57,0	23	20
80	6	147	G3/4	263	100	25	5	132,0	90,5	110,5	36	20,0x3,0	75	47	125	114,0	134,0	37,5	67,0	23,5	20
	10	147	G3/4	288	125	25	5	132,0	90,0	110,0	36	20,0x3,0	90	70	150	137,0	157,0	45	67,0	23	20
100	10	172	G1	317	132	28	5	155,0	111,5	131,5	46	25,0x4,0	90	80	160	161,5	181,5	45	81,5	30	20
125	10	208,5	G1 1/4	330	135	35	5	177,5	134,0	164,0	50	30,0x5,0	105	95	170	194,0	224,0	52,5	99,0	35	30
	16	208,5	G1 1/4	370	175	35	5	177,5	144,0	174,0	50	30,0x5,0	120	100	210	199,0	229,0	60	99,0	45	30
140	10	223	G1 1/4	315	135	35	5	188,0	144,0	174,0	50	30,0x5,0	105	95	170	204,0	234,0	52,5	109,0	35	30
	16	223	G1 1/4	355	175	35	5	188,0	154,0	184,0	50	30,0x5,0	120	100	210	209,0	239,0	60	109,0	45	30
160	10	242,5	G1 1/2	399	150	40	5	218,0	163,0	193,0	60	38,0x6,0	105	95	190	223,0	253,0	52,5	128,0	35	30
	16	242,5	G1 1/2	429	180	40	5	218,0	178,0	208,0	60	38,0x6,0	125	105	220	233,0	263,0	62,5	128,0	50	30
	25	242,5	G1 1/2	449	200	50	0	218,0	183,0	213,0	60	38,0x6,0	155	110	250	238,0	268,0	77,5	128,0	55	30
180	10	264	G1 1/2	377	150	40	5	231,5	177,0	207,0	60	38,0x6,0	105	95	190	237,0	267,0	52,5	142,0	35	30
	16	264	G1 1/2	407	180	40	5	231,5	192,0	222,0	60	38,0x6,0	125	105	220	247,0	277,0	62,5	142,0	50	30
	25	264	G1 1/2	427	200	50	0	231,5	197,0	227,0	60	38,0x6,0	155	110	250	252,0	282,0	77,5	142,0	55	30
200	10	281,5	G1 1/2	365	155	50	5	241,0	184,5	204,5	60	38,0x6,0	110	95	205	244,5	264,5	55	149,5	35	20
	16	281,5	G1 1/2	400	190	50	5	241,0	199,5	219,5	60	38,0x6,0	125	105	240	254,5	274,5	62,5	149,5	50	20
	25	281,5	G1 1/2	420	210	50	0	241,0	204,5	224,5	60	38,0x6,0	155	110	260	259,5	279,5	77,5	149,5	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	23,5	G3/4	21,5	23,5	-	-	-	-	-	-	-	-	-	-	30	15,5
	10	G3/4	27	33	G3/4	3,5	33	G1/4	18	47	G1/4	65,0	47	G1/4	G1/4	60	17	45	21,4
80	6	G3/4	21,5	23,5	G3/4	21,5	23,5	-	-	-	-	-	-	-	-	-	-	30	15,5
	10	G3/4	27	33	G3/4	3,5	33	G1/4	18	47	G1/4	65,0	47	G1/4	G1/4	60	17	45	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	65,0	72	G1/4	G1/4	55	25	55	21,4
	16	G1 1/4	52	32	G1 1/4	15	32	G1/4	76,5	75	G1/4	88,0	80	G1/4	G1/4	88	40	45	40
140	10	G1 1/4	27	35	G1 1/4	3,5	45	G1/4	20	72	G1/4	65,0	72	G1/4	G1/4	55	25	55	21,4
	16	G1 1/4	52	32	G1 1/4	15	32	G1/4	76,5	75	G1/4	88,0	80	G1/4	G1/4	88	40	45	40
160	10	G1 1/2	27	35	G1 1/2	3,5	45	G1/4	20	72	G1/4	65,0	72	G1/4	G1/4	55	25	60	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	50	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	50	52,1
180	10	G1 1/2	27	35	G1 1/2	3,5	45	G1/4	20	72	G1/4	65,0	72	G1/4	G1/4	55	25	60	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	50	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	50	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

ØAL = Piston Ø

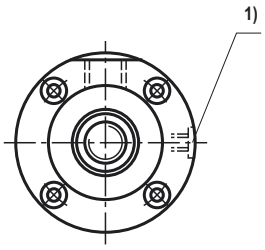
[1] Not for MT4

[2] Only for MT4

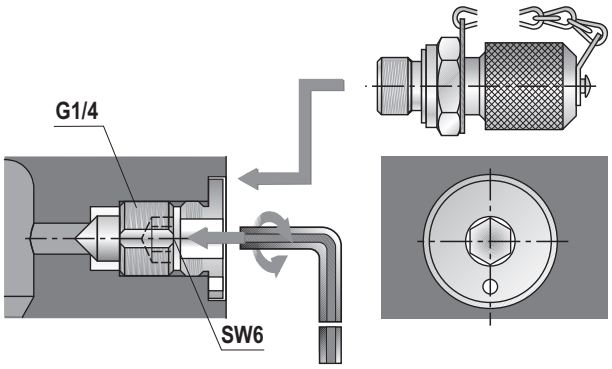
Bleeding / **threaded coupling** (dimensions in mm)

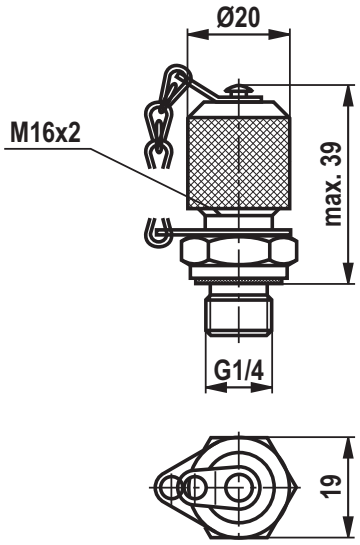
By default, a patented safety bleeding device against unintended screwing out in head and base is delivered for all cylinders.

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)



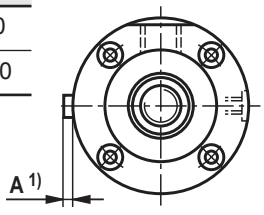


Scope of delivery: Threaded coupling **G1/4**

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**
Protrusion A 1)	1	0	0	0	0	0	0	0	0	0	9,5	0	0	0
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) Protrusion A in closed condition

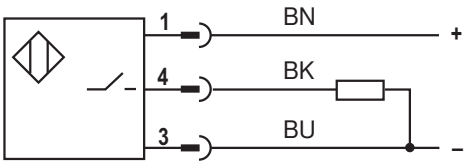
Proximity switch

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			

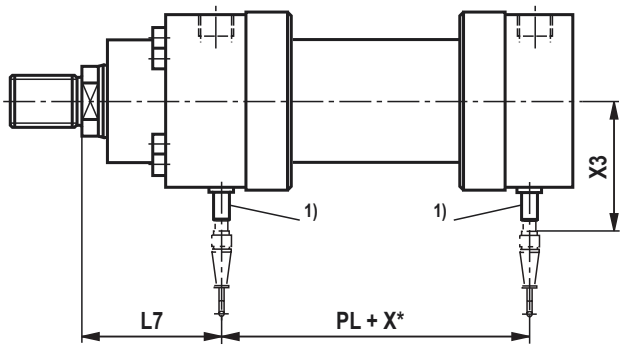
Pin assignment



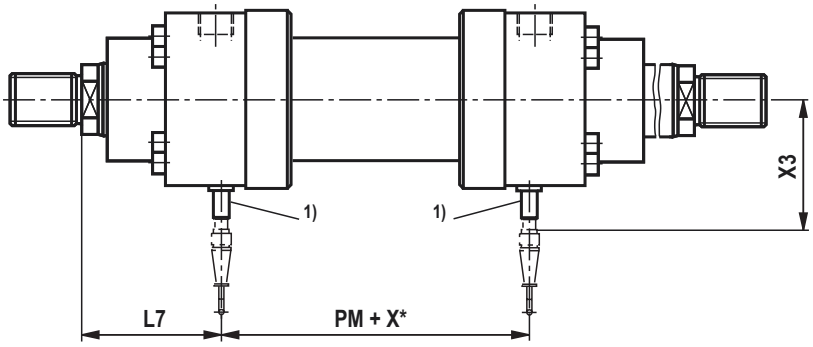
BN brown
BK black
BU blue

Proximity switch

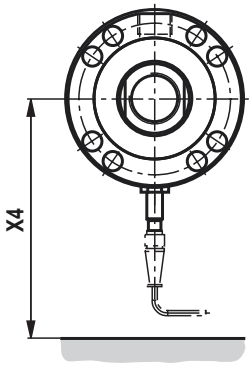
CDH1

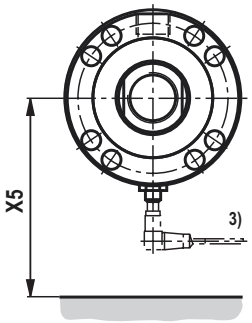


CGH1



Installation space for mating connector

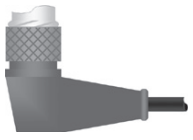




Mating connector with 5 m cable

(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	**22** **28**	112	112	83	94	170	125
50	**28** **36**	110	110	92	98	175	130
63	**36** **45**	125	125	104	103	180	135
80	**45** **56**	138	138	108	108	185	140
100	**56** **70**	161	161	129	116	195	150
125	**70** **90**	189	189	143	126	205	160
140	**90** **100**	209	209	161	146	225	180
160	**100** **110**	228	228	191	151	230	185
180	**110** **125**	254	254	204	159	235	190
200	**125** **140**	264	264	212	166	245	200
220	**140** **160**	310	310	250	177 [2)]	255	– [3)]
250	**160** **180**	310	310	274	187 [2)]	265	– [3)]
280	**180** **200**	369	369	285	189 [2)]	275	– [3)]
320	**200** **220**	415	415	295	209 [2)]	285	– [3)]

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.

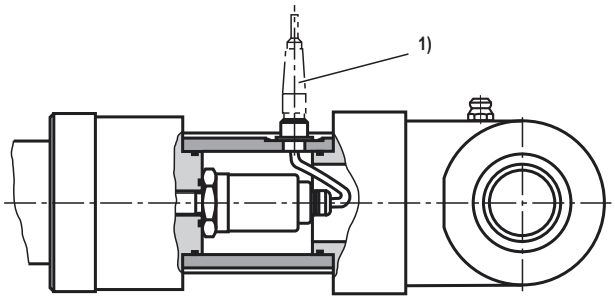
Technical data (For applications outside these parameters, please consult us!)

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

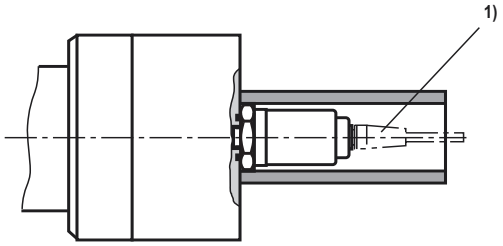
Position measurement system

Types of mounting

MP3, MP5

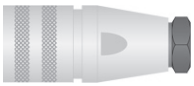


MF3, MF4, MT4, MS2



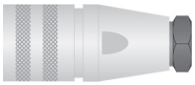
1) For analog output:
6-pole Amphenol mating connector

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



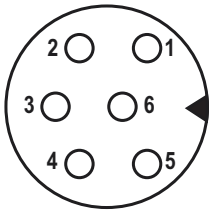
1) For digital output:
7-pole Amphenol mating connector

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



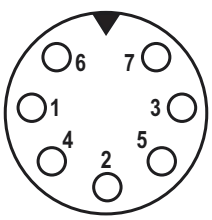
Pin assignment

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

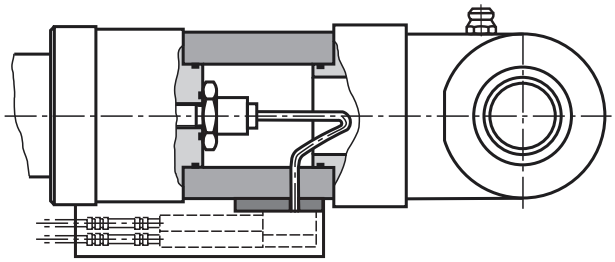
Technical data for the Profibus (For applications outside these parameters, please consult us!)

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 %)

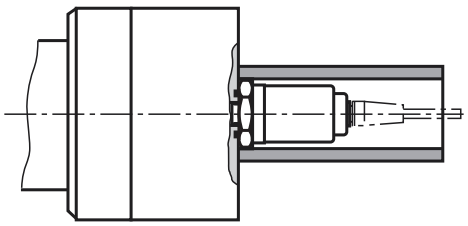
Please ask for the complete technical data!

Types of mounting

MP3, MP5



MF3, MF4, MT4, MS2

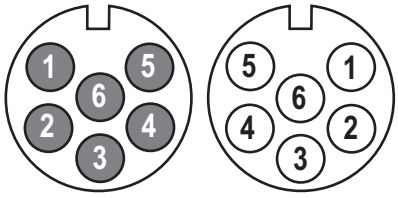


The output of the position measurement system is by default always rotated by 180° to the selected position of the hydraulic connection in the cylinder base.

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

Pin assignment for Profibus

Pin assignment for Profibus D63

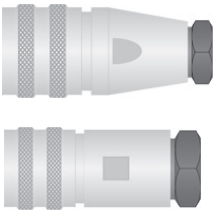


Pins Sockets

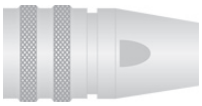
Pin	Cable	Function
1	Green	RxD/TxD-N (bus)
2	Red	RxD/TxD-P (bus)
3	—	DGND (terminating resistor) *
4	—	VP (terminating resistor) *
5	Black	+24 VDC (–15 / +20 %)
6	Blue	DC ground (0 V)
—	Yellow/ green	Shield compensating line, is usually not to be connected

* Only with sockets

Mating connectors for D63



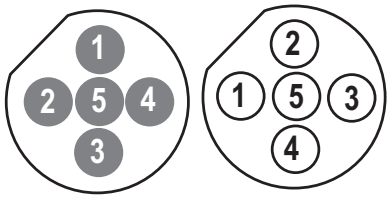
Signal input
6-pin mating connector M16
Signal output
6-pin mating connector M16



Signal output
6-pin end plug M16

Pin assignment for Profibus D53

Bus

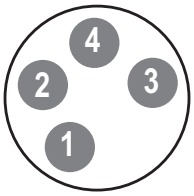


Pins Sockets

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

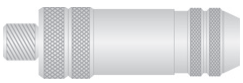


View connector side

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

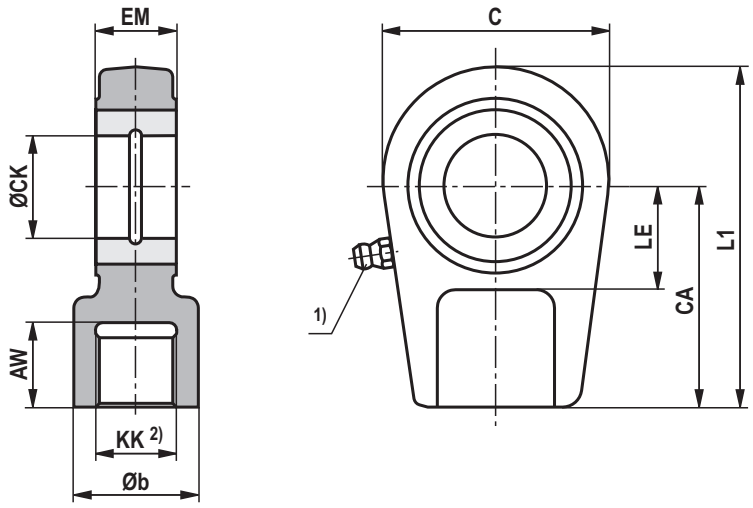
Connection cable 10 m
with 4-pin mating connector M8

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 16**	17	28	56	50	25	23	M16x1,5	25	80	0,43	72	25,9
50	**CSA 22**	23	34	64	60	30	28	M22x1,5	30	94	0,7	106	38,2
63	**CSA 28**	29	44	78	70	35	30	M28x1,5	40	112	1,1	153	55,1
80	**CSA 35**	36	55	94	85	40	35	M35x1,5	45	135	2,0	250	90,0
100	**CSA 45**	46	70	116	105	50	40	M45x1,5	55	168	3,3	365	131,4
125	**CSA 58**	59	87	130	130	60	50	M58x1,5	65	200	5,5	400	144,0
140	**CSA 65**	66	93	154	150	70	55	M65x1,5	75	232	8,6	540	194,4
160	**CSA 80**	81	125	176	170	80	60	M80x2	80	265	12,2	670	241,2
180	**CSA100**	101	143	206	210	90	65	M100x2	90	323	21,5	980	352,8
200	**CSA110**	111	153	230	235	100	70	M110x2	105	360	27,5	1120	403,2

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

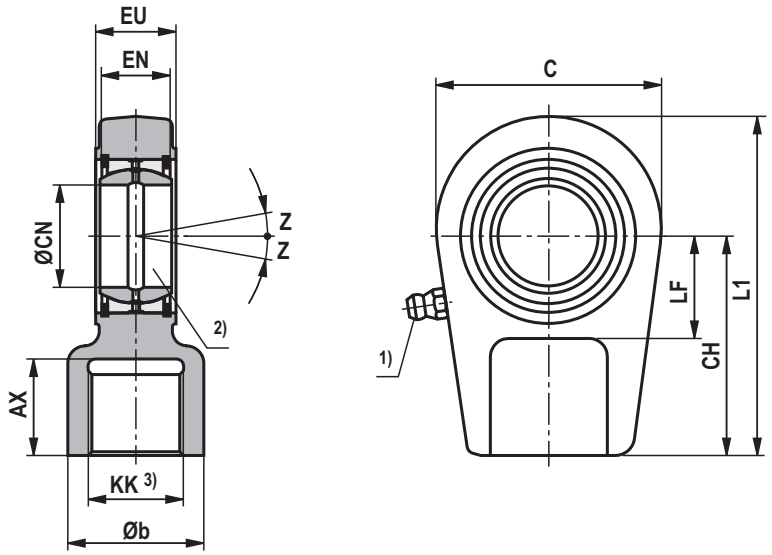
3) ***m*** = Weight plain clevis in kg

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 280 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 16**	17	26	56	50	$25_{-0,010}$	$20_{-0,12}$	23	M16x1,5	80	28	7°	0,43	72	25,9
50	**CGA 22**	23	33	64	60	$30_{-0,010}$	$22_{-0,12}$	28	M22x1,5	94	30	6°	0,7	106	38,2
63	**CGA 28**	29	41	78	70	$35_{-0,012}$	$25_{-0,12}$	30	M28x1,5	112	38	6°	1,1	153	55,1
80	**CGA 35**	36	50	94	85	$40_{-0,012}$	$28_{-0,12}$	35	M35x1,5	135	45	7°	2,0	250	90,0
100	**CGA 45**	46	62	116	105	$50_{-0,012}$	$35_{-0,12}$	40	M45x1,5	168	55	6°	3,3	365	131,4
125	**CGA 58**	59	76	130	130	$60_{-0,015}$	$44_{-0,15}$	50	M58x1,5	200	65	6°	5,5	400	144,0
140	**CGA 65**	66	87	154	150	$70_{-0,015}$	$49_{-0,15}$	55	M65x1,5	232	75	6°	8,6	540	194,4
160	**CGA 80**	81	106	176	170	$80_{-0,015}$	$55_{-0,15}$	60	M80x2	265	80	6°	12,2	670	241,2
180	**CGA100**	101	125	206	210	$90_{-0,020}$	$60_{-0,20}$	65	M100x2	323	90	5°	21,5	980	352,8
200	**CGA110**	111	139	230	235	$100_{-0,020}$	$70_{-0,20}$	70	M110x2	360	105	7°	27,5	1120	403,2
220	**CGA120**	125	153	265	265	$110_{-0,020}$	$70_{-0,20}$	80	M120x3	407,5	115	6°	40,7	1700	612,0
250	**CGA120**	125	153	265	265	$110_{-0,020}$	$70_{-0,20}$	80	M120x3	407,5	115	6°	40,7	1700	612,0
280	**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

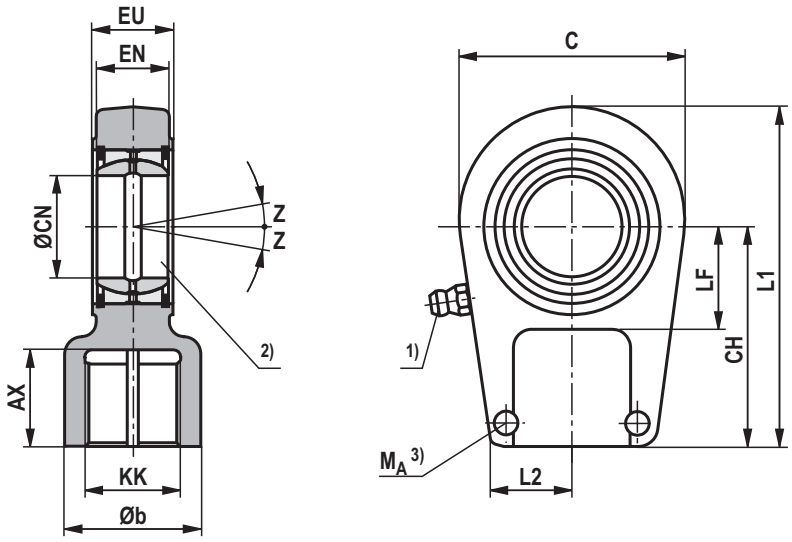
4) ***m*** = Weight self-aligning clevis in kg

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 280 mm



ØAL	Type	AX min	Øb max	C	CH	ØCN 2)	EN	EU -0,4	KK
40	**CGAK 16**	17	26	56	50	$25_{-0,010}$	$20_{-0,12}$	23	M16x1,5
50	**CGAK 22**	23	33	64	60	$30_{-0,010}$	$22_{-0,12}$	28	M22x1,5
63	**CGAK 28**	29	41	78	70	$35_{-0,012}$	$25_{-0,12}$	30	M28x1,5
80	**CGAK 35**	36	50	94	85	$40_{-0,012}$	$28_{-0,12}$	35	M35x1,5
100	**CGAK 45**	46	62	116	105	$50_{-0,012}$	$35_{-0,12}$	40	M45x1,5
125	**CGAK 58**	59	76	130	130	$60_{-0,015}$	$44_{-0,15}$	50	M58x1,5
140	**CGAK 65**	66	87	154	150	$70_{-0,015}$	$49_{-0,15}$	55	M65x1,5
160	**CGAK 80**	81	106	176	170	$80_{-0,015}$	$55_{-0,15}$	60	M80x2
180	**CGAK100**	101	125	206	210	$90_{-0,020}$	$60_{-0,20}$	65	M100x2
200	**CGAK110**	111	139	231	235	$100_{-0,020}$	$70_{-0,20}$	70	M110x2
220	**CGAK120**	125	155	266	265	$110_{-0,020}$	$70_{-0,20}$	80	M120x3
250	**CGAK120**	125	153	265	265	$110_{-0,020}$	$70_{-0,20}$	80	M120x3
280	**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 16**	80	24	28	7°	M8	30	0,43	72	25,9
50	**CGAK 22**	94	26	30	6°	M8	30	0,7	106	38,2
63	**CGAK 28**	112	34	38	6°	M10	54	1,1	153	55,1
80	**CGAK 35**	135	39	45	7°	M10	59	2,0	250	90,0
100	**CGAK 45**	168	46	55	6°	M12	100	3,3	365	131,4
125	**CGAK 58**	200	61	65	6°	M16	250	5,5	400	144,0
140	**CGAK 65**	232	66	75	6°	M16	250	8,6	540	194,4
160	**CGAK 80**	265	81	80	6°	M20	490	12,2	670	241,2
180	**CGAK100**	323	91	90	5°	M20	490	21,5	980	352,8
200	**CGAK110**	360	101	105	7°	M24	840	27,5	1120	403,2
220	**CGAK120**	407,5	111	115	6°	M24	840	40,7	1700	612,0
250	**CGAK120**	407,5	111	115	6°	M24	840	40,7	1700	612,0
280	**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.

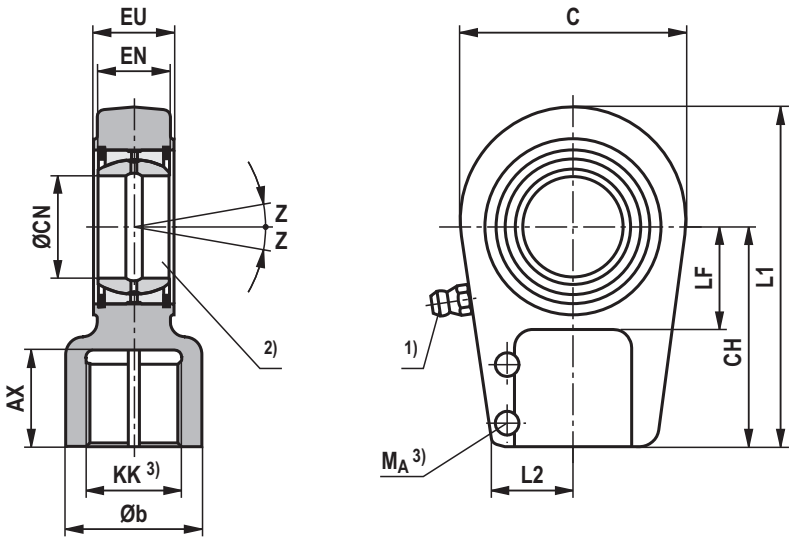
4) m = Weight self-aligning clevis in kg

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 25**	30	28	56	65	$25_{-0,010}$	$20_{-0,12}$	23	M18x2
50	**CGAS 30**	35	34	64	75	$30_{-0,010}$	$22_{-0,12}$	28	M24x2
63	**CGAS 35**	46	46	78	90	$35_{-0,012}$	$25_{-0,12}$	30	M30x2
80	**CGAS 40**	56	57	94	105	$40_{-0,012}$	$28_{-0,12}$	35	M39x3
100	**CGAS 50**	76	70	116	135	$50_{-0,012}$	$35_{-0,12}$	40	M50x3
125	**CGAS 60**	96	87	130	170	$60_{-0,015}$	$44_{-0,15}$	50	M64x3
140	**CGAS 70**	112	111	154	195	$70_{-0,015}$	$49_{-0,15}$	55	M80x3
160	**CGAS 80**	122	129	176	210	$80_{-0,015}$	$55_{-0,15}$	60	M90x3
180	**CGAS 90**	142	153	211	250	$90_{-0,020}$	$60_{-0,20}$	65	M100x3
200	**CGAS100**	152	170	230	275	$100_{-0,020}$	$70_{-0,20}$	70	M110x4
220	**CGAS110**	162	180	264	300	$110_{-0,020}$	$70_{-0,20}$	80	M120x4
250	**CGAS110**	162	180	264	300	$110_{-0,020}$	$70_{-0,20}$	80	M120x4
280	**CGAS120**	192	210	340	360	$120_{-0,020}$	$85_{-0,20}$	90	M150x4
320	**CGAS140**	210	230	380	420	$140_{-0,025}$	$90_{-0,25}$	110	M160x4

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 25**	95	24	25	7-8°	M8	30	0,65	82	27,1
50	**CGAS 30**	109	28	30	6-7°	M8	30	1,0	122	40,3
63	**CGAS 35**	132	36	40	6-7°	M10	59	1,5	177	58,4
80	**CGAS 40**	155	39	44	7°	M12	100	2,4	287	94,7
100	**CGAS 50**	198	45	55	6-7°	M12	100	4,8	422	139,3
125	**CGAS 60**	240	59	65	6-7°	M16	250	8,6	522	172,3
140	**CGAS 70**	279	70	75	6°	M16	250	12,2	707	233,3
160	**CGAS 80**	305	85	80	6°	M20	490	18,4	870	287,1
180	**CGAS 90**	366	91	90	5°	M20	490	31,6	1284	423,7
200	**CGAS100**	400	95	105	7°	M20	490	34	1460	481,8
220	**CGAS110**	443	106	115	6°	M24	840	44	2024	667,9
250	**CGAS110**	443	106	115	6°	M24	840	44	2024	667,9
280	**CGAS120**	540	122	140	6°	M24	840	75	2970	980,1
320	**CGAS140**	620	129	185	7°	M30	1700	160	3350	1105,5

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)

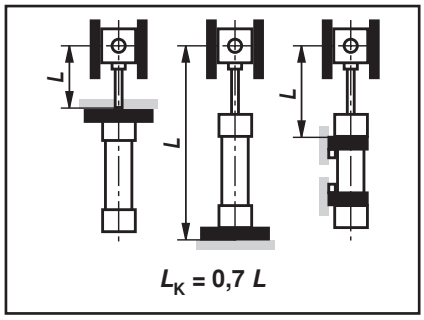
d = Piston rod Ø in mm

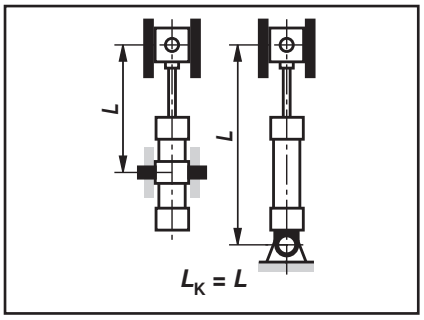
λ = Slenderness ratio

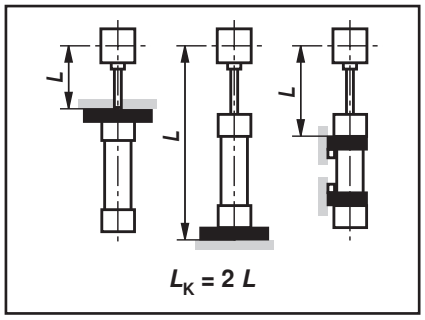
$= \frac{4 \cdot L_K}{d} \qquad \lambda_g = \pi \sqrt{\frac{E}{0.8 \cdot R_e}}$

R_e = Yield strength of the piston rod material

Influence of the type of mounting on the buckling length:







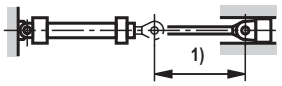
Admissible stroke length (dimensions in mm)

Type of mounting CDH1/CSH1 [2]: MP3, MP5

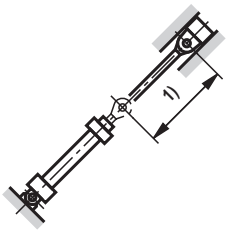
ØAL	ØMM	Admissible stroke length with 100 bar 0°	100 bar 45°	100 bar 90°	160 bar 0°	160 bar 45°	160 bar 90°	250 bar 0°	250 bar 45°	250 bar 90°
40	22	195	200	215	130	135	140	40	45	55
	28	385	400	445	295	300	320	215	220	225
50	28	285	295	310	205	210	215	120	130	135
	36	535	555	625	425	430	460	320	325	335
63	36	390	400	440	290	295	305	200	205	210
	45	655	685	790	530	545	585	410	415	430
80	45	500	515	560	375	385	400	240	260	280
	56	815	850	980	665	680	735	520	525	545
100	56	610	630	705	470	480	505	280	295	355
	70	985	1030	1240	820	845	930	650	660	695
125	70	770	800	900	600	615	650	360	380	465
	90	1295	1360	1670	1095	1130	1265	885	900	955
140	90	1145	1200	1430	945	970	1070	740	755	790
	100	1400	1475	1840	1190	1230	1390	965	985	1050
160	100	1230	1285	1530	1010	1040	1140	790	800	840
	110	1480	1555	1930	1250	1290	1455	1005	1030	1090
180	110	1305	1365	1630	1065	1095	1200	825	840	880
	125	1675	1765	2210	1420	1470	1670	1150	1175	1260
200	125	1500	1580	1930	1240	1290	1430	985	1005	1060
	140	1865	1965	2520	1590	1660	1910	1305	1340	1440
220	140	1620	1710	2180	1360	1415	1630	1090	1120	1200
	160	2075	2200	3000	1810	1890	2280	1510	1560	1730
250	160	1885	1990	2570	1600	1670	1930	1300	1330	1440
	180	2330	2475	3370	2040	2135	2570	1710	1770	1960
280	180	2075	2200	2900	1775	1880	2170	1450	1490	1620
	200	2510	2670	3700	2200	2310	2820	1850	1920	2140
320	200	2170	2300	3070	1850	1940	2290	1500	1550	1700
	220	2590	2760	3850	2260	2380	2920	1890	1960	2200

Installation position

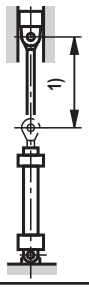
0°



45°



90°



[1] Adm. Stroke length

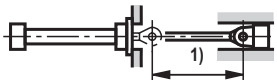
Admissible stroke length (dimensions in mm)

Type of mounting CDH1/CGH1/CSH1 [2]: MF3

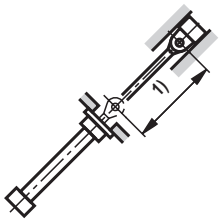
ØAL	ØMM	Admissible stroke length with 100 bar 0°	100 bar 45°	100 bar 90°	160 bar 0°	160 bar 45°	160 bar 90°	250 bar 0°	250 bar 45°	250 bar 90°
40	22	895	915	980	730	735	760	440	450	510
	28	1400	1415	1630	1180	1205	1275	970	980	1010
50	28	1180	1200	1280	955	965	995	700	730	780
	36	1785	1855	2160	1530	1570	1695	1275	1290	1340
63	36	1520	1560	1690	1250	1270	1315	1010	1015	1035
	45	2000	2000	2000	1875	1925	2000	1570	1595	1670
80	45	1855	1905	2000	1540	1560	1630	1140	1180	1280
	56	2000	2000	2000	2000	2000	2000	1910	1940	2000
100	56	2250	2320	2500	1880	1910	2010	1300	1360	1580
	70	3000	3000	3000	2770	2860	3000	2360	2400	2550
125	70	2760	2860	3000	2330	2375	2520	1580	1680	1990
	90	3000	3000	3000	3000	3000	3000	3000	3000	3000
140	90	3000	3000	3000	3000	3000	3000	2770	2820	2980
	100	3000	3000	3000	3000	3000	3000	3000	3000	3000
160	100	3000	3000	3000	3000	3000	3000	2980	3000	3000
	110	3000	3000	3000	3000	3000	3000	3000	3000	3000
180	110	3000	3000	3000	3000	3000	3000	3000	3000	3000
	125	3000	3000	3000	3000	3000	3000	3000	3000	3000
200	125	3000	3000	3000	3000	3000	3000	3000	3000	3000
	140	3000	3000	3000	3000	3000	3000	3000	3000	3000
220	140	5400	5680	6000	4800	4980	5780	4120	4220	4560
	160	6000	6000	6000	5820	6000	6000	5150	5330	6000
250	160	6000	6000	6000	5450	5660	6000	4720	4840	5290
	180	6000	6000	6000	6000	6000	6000	5730	5920	6000
280	180	6000	6000	6000	6000	6000	6000	5270	5420	5970
	200	6000	6000	6000	6000	6000	6000	6000	6000	6000
320	200	6000	6000	6000	6000	6000	6000	6000	6000	6000
	220	6000	6000	6000	6000	6000	6000	6000	6000	6000

Installation position

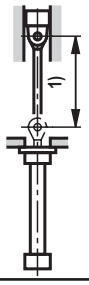
0°



45°



90°



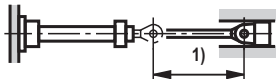
[1] Adm. Stroke length

Type of mounting CDH1/CSH1 [2]: MF4

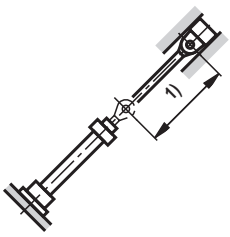
ØAL	ØMM	Admissible stroke length with 100 bar 0°	100 bar 45°	100 bar 90°	160 bar 0°	160 bar 45°	160 bar 90°	250 bar 0°	250 bar 45°	250 bar 90°
40	22	325	340	370	245	250	260	105	110	140
	28	565	590	695	465	475	520	365	370	385
50	28	455	470	515	350	360	375	220	230	265
	36	770	805	960	640	660	725	515	525	550
63	36	600	620	710	475	490	520	350	370	380
	45	930	975	1210	790	820	920	645	660	700
80	45	760	785	895	610	625	670	395	420	495
	56	1150	1210	1495	985	1020	1145	810	825	875
100	56	905	945	1120	745	765	835	420	460	620
	70	1370	1445	1880	1190	1235	1440	995	1020	1100
125	70	1175	1225	1460	980	1010	1105	580	620	835
	90	1815	1920	2560	1600	1670	1980	1365	1400	1540
140	90	1600	1695	2190	1390	1440	1670	1150	1180	1275
	100	1915	2030	2770	1695	1770	2130	1440	1490	1650
160	100	1730	1825	2350	1490	1550	1790	1235	1265	1365
	110	2030	2155	2910	1790	1870	2240	1520	1565	1720
180	110	1850	1950	2510	1590	1655	1900	1310	1340	1450
	125	2295	2440	3000	2030	2130	2570	1730	1785	1980
200	125	2110	2230	2270	1835	1910	2250	1530	1575	1720
	140	2540	2700	3000	2265	2380	2930	1945	2010	2260
220	140	2250	2400	3350	1990	2090	2550	1685	1740	1950
	160	2800	2990	4500	2530	2680	3480	2220	2310	2700
250	160	2615	2780	3900	2320	2435	3000	1980	2050	2300
	180	3140	3360	5050	2850	3010	3910	2500	2610	3050
280	180	2850	3050	4400	2550	2680	3370	2190	2270	2600
	200	3370	3610	5550	3070	3250	4300	2700	2820	3330
320	200	3000	3210	4700	2680	2830	3590	2100	2390	2750
	220	3500	3750	5800	3180	3370	4480	2790	2920	3460

Installation position

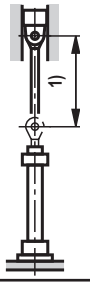
0°



45°



90°



[1] Adm. Stroke length

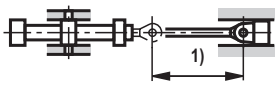
Admissible stroke length (dimensions in mm)

Type of mounting CDH1/CGH1/CSH1 [2]: MT4 trunnion in cylinder center

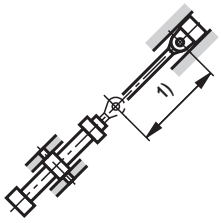
ØAL	ØMM	Admissible stroke length with 100 bar 0°	100 bar 45°	100 bar 90°	160 bar 0°	160 bar 45°	160 bar 90°	250 bar 0°	250 bar 45°	250 bar 90°
40	22	340	345	365	250	255	260	130	135	145
	28	590	605	665	470	480	500	365	370	375
50	28	460	470	495	350	355	365	245	250	260
	36	790	815	910	645	655	690	510	515	525
63	36	610	625	675	475	485	500	360	365	370
	45	965	1000	1140	800	815	870	635	645	665
80	45	770	790	850	605	615	635	440	455	475
	56	1190	1235	1410	990	1010	1080	795	805	830
100	56	930	955	1060	745	755	795	490	510	595
	70	1430	1490	1770	1210	1240	1360	985	1000	1045
125	70	1185	1225	1360	960	980	1030	640	670	780
	90	1885	1970	2390	1620	1665	1850	1340	1360	1430
140	90	1675	1710	2060	1410	1415	1575	1140	1155	1205
	100	2020	2115	2610	1735	1790	2010	1440	1465	1555
160	100	1805	1880	2210	1510	1550	1680	1215	1230	1285
	110	2140	2240	2740	1830	1885	2100	1505	1535	1620
180	110	1925	2005	2360	1605	1650	1790	1290	1310	1360
	125	2420	2540	3000	2080	2150	2420	1720	1755	1865
200	125	2130	2230	2690	1790	1840	2040	1440	1465	1540
	140	2610	2750	3000	2250	2330	2670	1865	1910	2050
220	140	2490	2510	3150	2050	2120	2400	1685	1720	1835
	160	3000	3170	4230	2640	2750	3260	2240	2310	2530
250	160	2750	2900	3660	2380	2460	2810	1970	2020	2160
	180	3350	3540	4750	2960	3090	3670	2520	2600	2850
280	180	3040	3210	4140	2640	2750	3170	2210	2260	2440
	200	3620	3840	5210	3210	3360	4040	2750	2830	3140
320	200	3210	3390	4410	2790	2900	3380	2320	2380	2580
	220	3770	4000	5450	3340	3490	4200	2850	2930	3250

Installation position

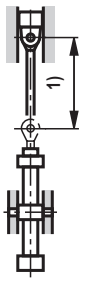
0°



45°



90°



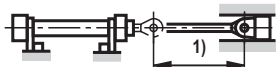
[1] Adm. Stroke length

Type of mounting CDH1/CGH1/CSH1 [2]: MS2

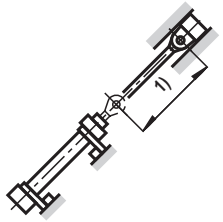
ØAL	ØMM	Admissible stroke length with 100 bar 0°	100 bar 45°	100 bar 90°	160 bar 0°	160 bar 45°	160 bar 90°	250 bar 0°	250 bar 45°	250 bar 90°
40	22	825	840	885	645	650	665	370	375	410
	28	1305	1350	1535	1085	1110	1180	875	885	910
50	28	1075	1100	1175	855	865	890	610	625	675
	36	1680	1750	2000	1430	1465	1590	1175	1190	1240
63	36	1405	1440	1570	1135	1155	1200	895	900	920
	45	2000	2000	2000	1760	1810	1990	1460	1480	1555
80	45	1730	1780	1960	1410	1435	1500	1000	1050	1155
	56	2000	2000	2000	2000	2000	2000	1785	1820	1920
100	56	2110	2180	2440	1740	1770	1870	1140	1220	1440
	70	3000	3000	3000	2620	2710	3000	2210	2260	2400
125	70	2600	2695	3000	2170	2210	2360	1400	1480	1820
	90	3000	3000	3000	3000	3000	3000	2890	2970	3000
140	90	3000	3000	3000	3000	3000	3000	2585	2635	2800
	100	3000	3000	3000	3000	3000	3000	3000	3000	3000
160	100	3000	3000	3000	3000	3000	3000	2760	2810	2990
	110	3000	3000	3000	3000	3000	3000	3000	3000	3000
180	110	3000	3000	3000	3000	3000	3000	2940	3000	3000
	125	3000	3000	3000	3000	3000	3000	3000	3000	3000
200	125	3000	3000	3000	3000	3000	3000	3000	3000	3000
	140	3000	3000	3000	3000	3000	3000	3000	3000	3000
220	140	5090	5370	6000	4490	4670	5470	3820	3910	4260
	160	6000	6000	6000	5510	5800	6000	4850	5020	5750
250	160	5790	6000	6000	5150	5370	6000	4420	4540	4990
	180	6000	6000	6000	6000	6000	6000	5420	5630	6000
280	180	6000	6000	6000	5700	5960	6000	4930	5070	5630
	200	6000	6000	6000	6000	6000	6000	6000	6000	6000
320	200	6000	6000	6000	6000	6000	6000	5200	5400	6000
	220	6000	6000	6000	6000	6000	6000	6000	6000	6000

Installation position

0°



45°



90°

[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 CSH1, 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.

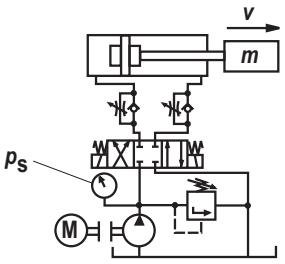
With the adjustable end position cushioning version "E", a throttle valve is additionally provided when compared with version "D". End position cushioning version "E" allows cycle times to be optimized. The maximum cushioning capacity can only be achieved when the throttle valve is closed.

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.

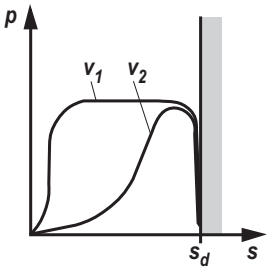
When fixed or adjustable stops are used, special measures must be taken!



Formulas:

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

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



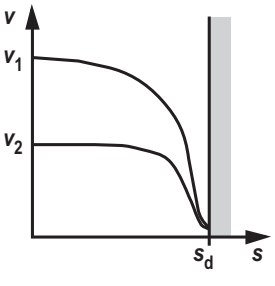
Extension for CDH1 and CSH1

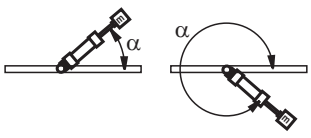
$$D_p = p_S - \frac{m \cdot 9{,}81 \cdot \sin\alpha}{A_1 \cdot 10}$$

Retraction for CDH1, CGH1 and CSH1; extension for CGH1

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

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





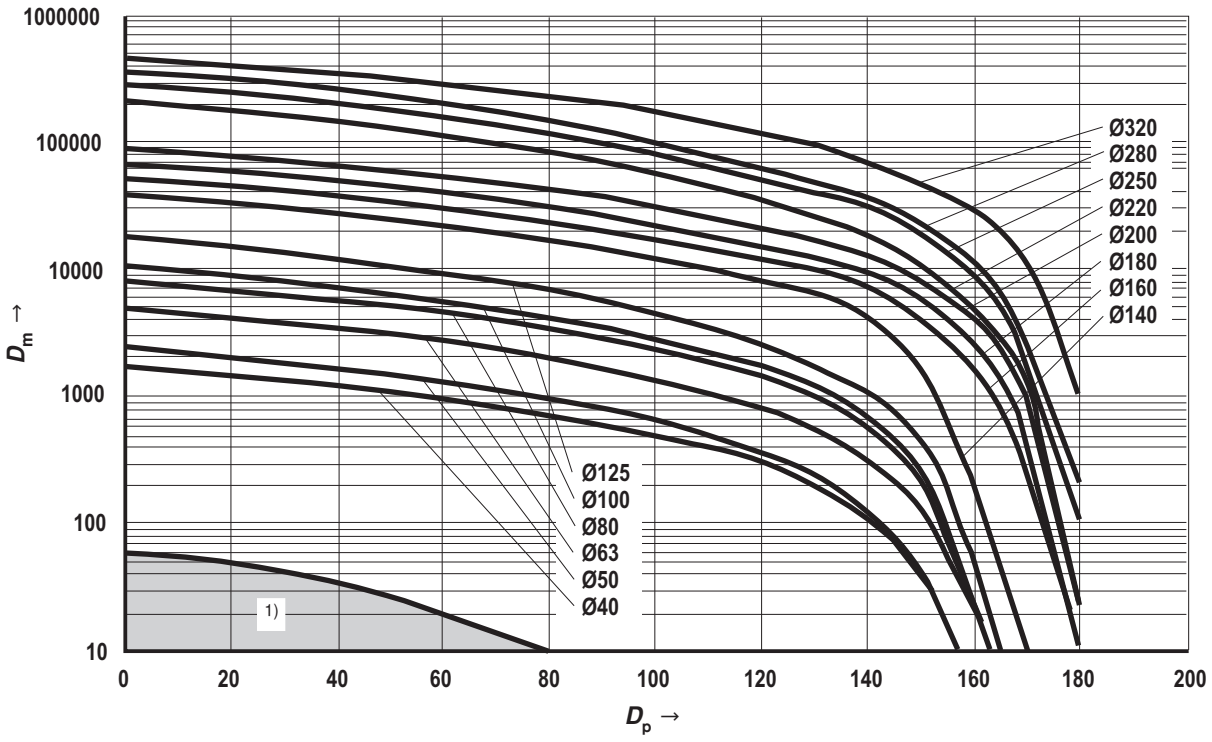
Damping length

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	2,85	2,97	2,56	2,82	3,51	3,02	2,53	2,65	2,91	2,76	2,85	2,95	3,11	3,13
kv ②	3,1	3,25	2,85	2,85	3,52	2,91	2,53	2,93	2,95	2,95	2,93	3,1	3,12	3,07
kv ③	2,95	3,1	2,73	3,1	3,51	2,95	2,51	2,91	2,95	2,91	2,93	2,93	3,15	3,25

Damping capacity: Extension for CDH1 and CSH1, with *kv* ①

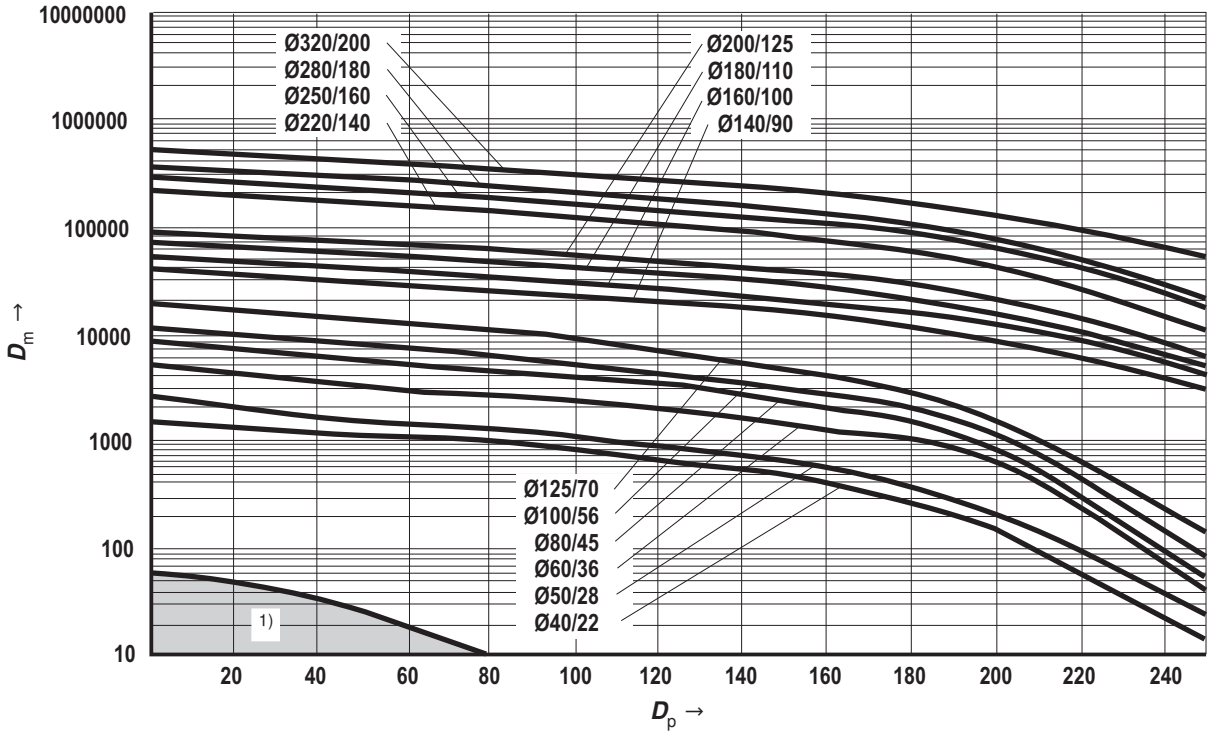


ØAL = Piston Ø

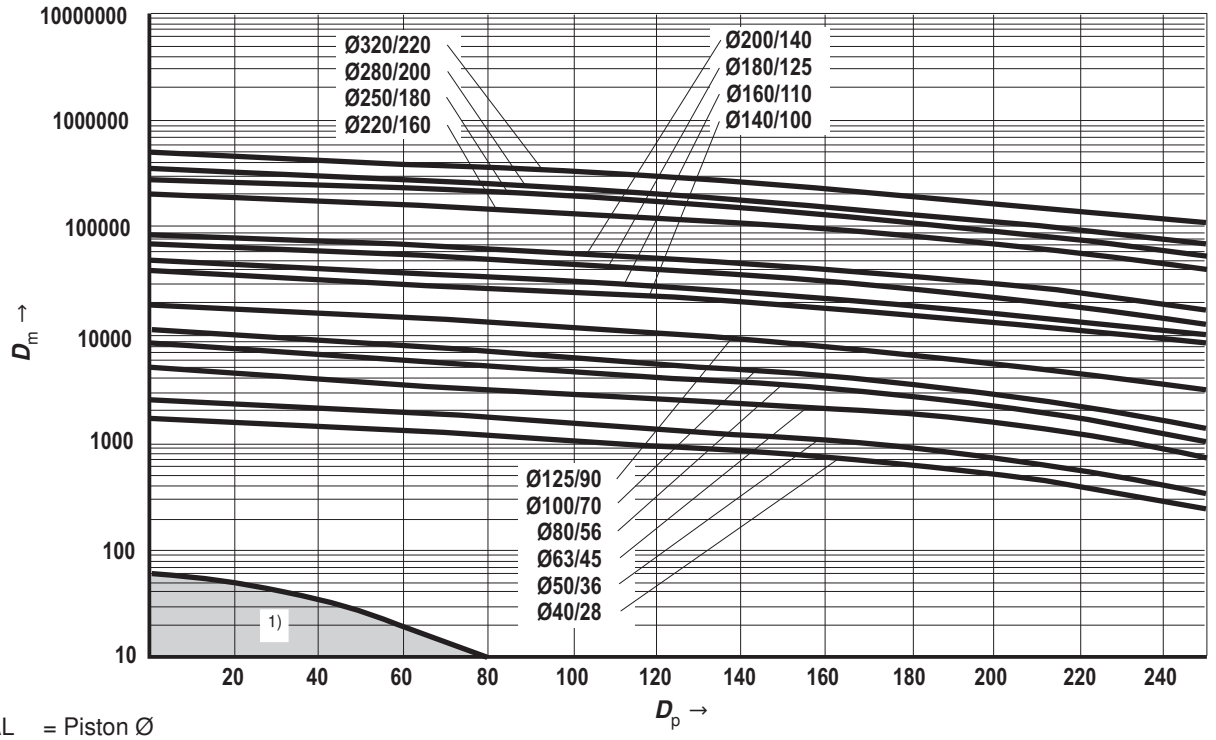
1) If with standard applications the calculated intersection point of D_m and D_p is within the marked area, we recommend designing the cylinder without end position cushioning.

End position cushioning

Damping capacity: Retraction for CDH1, CGH1 and CSH1; extension for CGH1 with *kv* ②



Damping capacity: Retraction for CDH1, CGH1 and CSH1; extension for CGH1 with *kv* ③



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 velocityt
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)]

CDH1 – Standard

ØAL	ØMM	Material no. for seal design								
		M	G	V	L	A	B	T	R	S
40	22									
	28									
50	28									
	36									
63	36									
	45									
80	45									
	56									
100	56									
	70									
125	70									
	90									
140	90									
	100									
160	100									
	110									
180	110									
	125									
200	125									
	140									
220	140									
	160									
250	160									
	180									
280	180									
	200									
320	200									
	220									

ØAL = Piston Ø
ØMM = Piston rod Ø
[1)] Seal kits for proximity switches and subplate mounting separate material no.

Seal kits [1)]

CGH1 – Standard

ØAL	ØMM	Material no. for seal design								
		M	G	V	L	A	B	T	R	S
40	22									
	28									
50	28									
	36									
63	36									
	45									
80	45									
	56									
100	56									
	70									
125	70									
	90									
140	90									
	100									
160	100									
	110									
180	110									
	125									
200	125									
	140									
220	140									
	160									
250	160									
	180									
280	180									
	200									
320	200									
	220									

ØAL = Piston Ø

ØMM = Piston rod Ø

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

Seal kits [1)]

CDH1 – Standard + additional option F

ØAL	ØMM	Material no. for seal design					
		M+F	G+F	V+F	T+F	R+F	S+F
40	22						
	28						
50	28						
	36						
63	36						
	45						
80	45						
	56						
100	56						
	70						
125	70						
	90						
140	90						
	100						
160	100						
	110						
180	110						
	125						
200	125						
	140						

CGH1 – Standard + additional option F

ØAL	ØMM	Material no. for seal design					
		M+F	G+F	V+F	T+F	R+F	S+F
40	22						
	28						
50	28						
	36						
63	36						
	45						
80	45						
	56						
100	56						
	70						
125	70						
	90						
140	90						
	100						
160	100						
	110						
180	110						
	125						
200	125						
	140						

ØAL = Piston Ø
ØMM = Piston rod Ø

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

Seal kits [2)]

CSH1

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

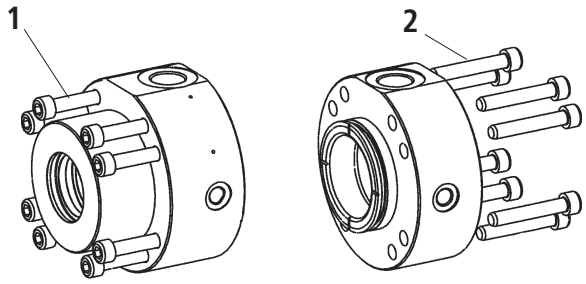
Only for position measurement system

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

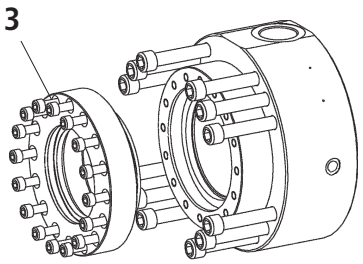
Tightening torques

Screws: Head and base (item 1 and 2)



Series	Piston Ø	Screw	Quantity	Quality class	Tightening torque
CDH1 / CGH1 / CSH1	**40**	M8	4	10.9	23 Nm
CDH1 / CGH1 / CSH1	**50**	M8	8	10.9	20 Nm
CDH1 / CGH1 / CSH1	**63**	M8	8	10.9	30 Nm
CDH1 / CGH1 / CSH1	**80**	M10	8	10.9	55 Nm
CDH1 / CGH1 / CSH1	**100**	M12	8	10.9	100 Nm
CDH1 / CGH1 / CSH1	**125**	M16	8	10.9	200 Nm
CDH1 / CGH1 / CSH1	**140**	M16	12	10.9	170 Nm
CDH1 / CGH1 / CSH1	**160**	M16	12	10.9	220 Nm
CDH1 / CGH1 / CSH1	**180**	M20	12	10.9	350 Nm
CDH1 / CGH1 / CSH1	**200**	M20	12	10.9	410 Nm
CDH1 / CGH1 / CSH1	**220**	M20	16	10.9	460 Nm
CDH1 / CGH1 / CSH1	**250**	M24	16	10.9	700 Nm
CDH1 / CGH1 / CSH1	**280**	M24	16	10.9	800 Nm
CDH1 / CGH1 / CSH1	**320**	M30	16	10.9	1500 Nm

Screws: Seal cover (item 3))

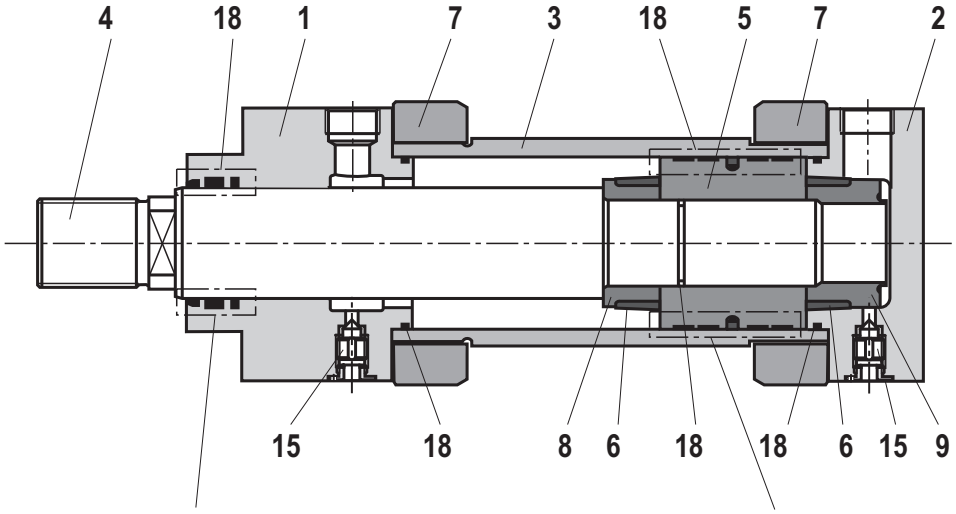


Only with seal design "A" and "B"

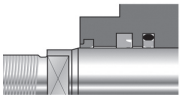
Series	Piston Ø	Piston rod Ø	Screw	Quantity	Quality class	Tightening torque
CDH1 / CGH1	**160**	**100**	M10	16	10.9	60 Nm
		110				
CDH1 / CGH1	**180**	**110**	M12	16	10.9	80 Nm
		125				
CDH1 / CGH1	**200**	**125**	M12	16	10.9	90 Nm
		140				
CDH1 / CGH1	**220**	**140**	M12	16	10.9	90 Nm
		160		24		
CDH1 / CGH1	**250**	**160**	M12	24	10.9	90 Nm
		180				
CDH1 / CGH1	**280**	**180**	M12	24	10.9	90 Nm
		200				
CDH1 / CGH1	**320**	**200**	M12	24	10.9	90 Nm
		220	M16	16		230 Nm

Spare parts: Series CDH1

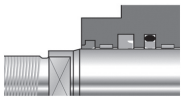
CDH1



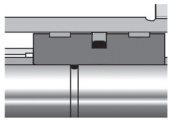
"M"



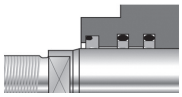
"L"



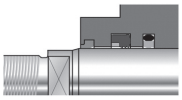
"M / T / S / G / V / L / R"



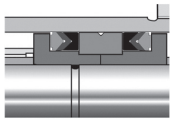
"S / T"



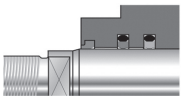
"G / V"



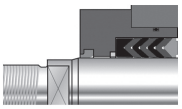
"A / B"

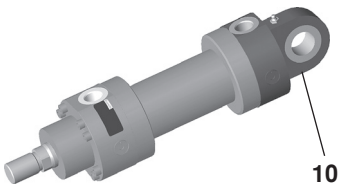


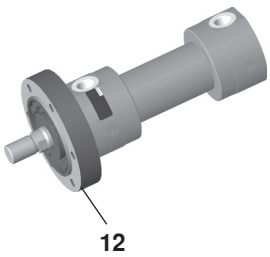
"R"

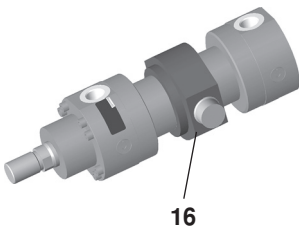


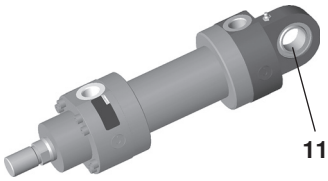
"A / B"

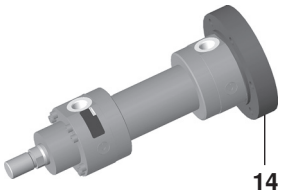


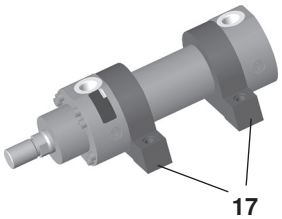








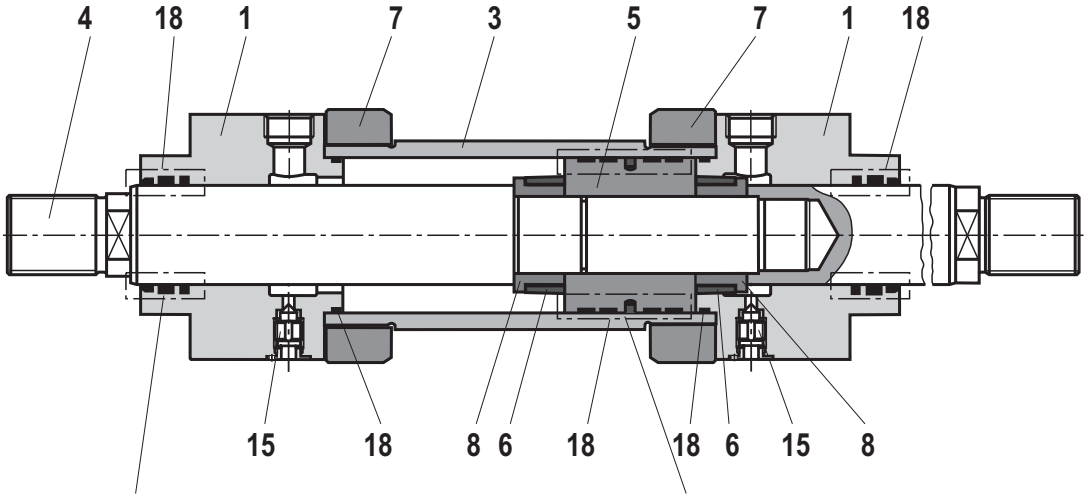




1 Head
2 Base
3 Pipe
4 Piston rod
5 Piston
6 Damping bush
7 Flange
8 Socket
9 Socket
10 Base MP3
11 Base MP5
12 Round flange MF3
14 Round flange MF4
15 Bleeding
16 Trunnion MT4
17 Foot MS2
18 Seal kit:
Scraper
Rod seal
Piston seal
O-ring
Guide ring

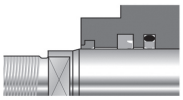
Spare parts: Series CGH1

CGH1

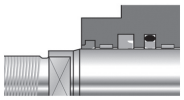


Piston rod

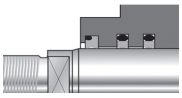
"M"



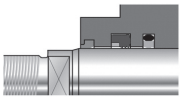
"L"



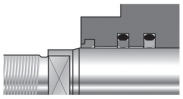
"S / T"



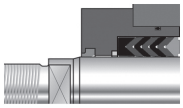
"G / V"



"R"

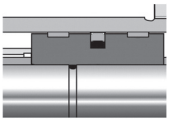


"A / B"

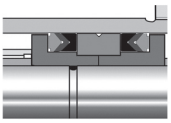


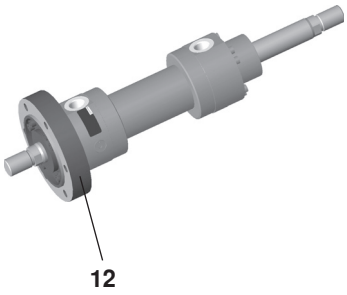
Piston

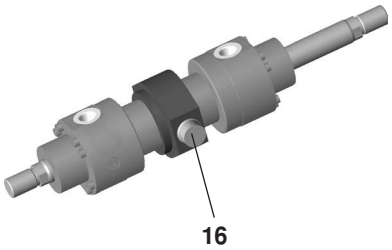
"M / T / S / G / V / L / R"

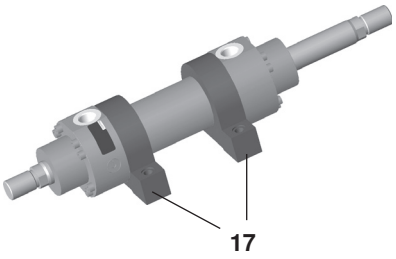


"A / B"





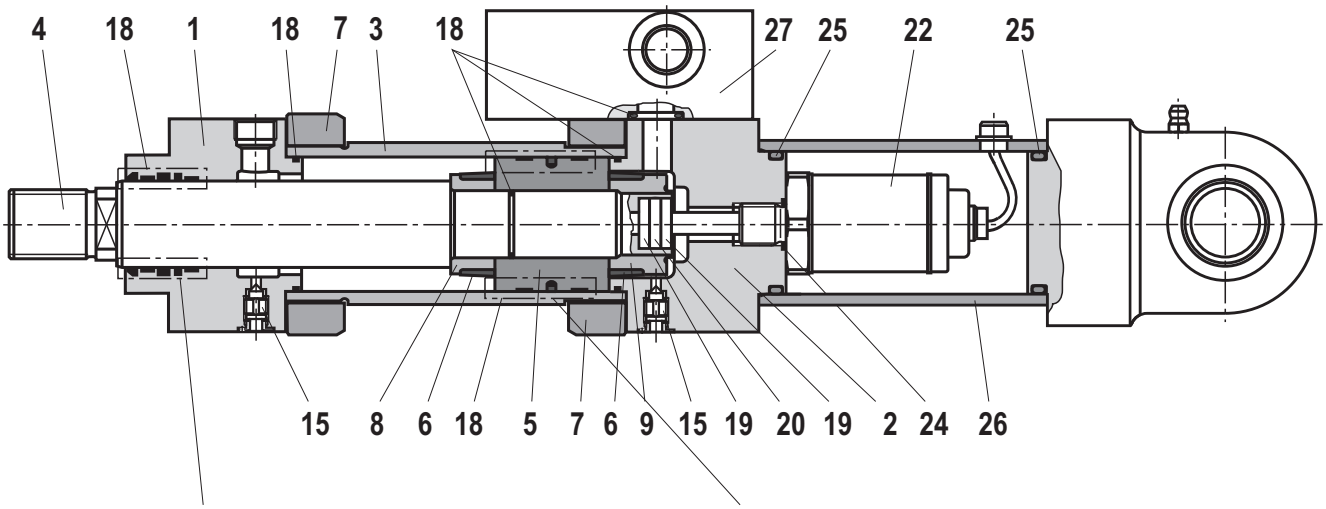




1 Head
3 Pipe
4 Piston rod
5 Piston
6 Damping bush
7 Flange
8 Socket

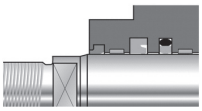
12 Round flange MF3
15 Bleeding
16 Trunnion MT4
17 Foot MS2
18 Seal kit:
Scraper
Rod seal
Piston seal
O-ring
Guide ring

Spare parts: Series CSH1 MP3 and MP5

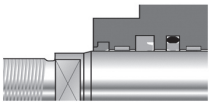


Piston rod

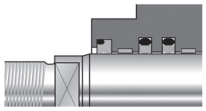
"M"



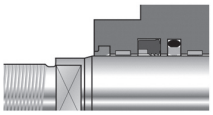
"L"



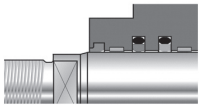
"S / T"



"G / V"

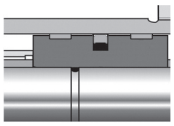


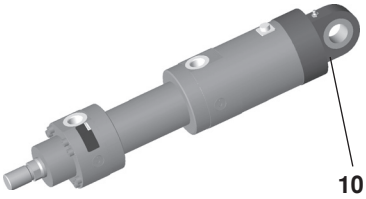
"R"

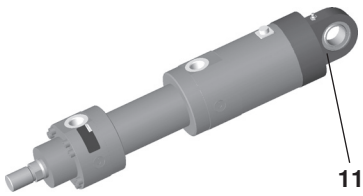


Piston

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

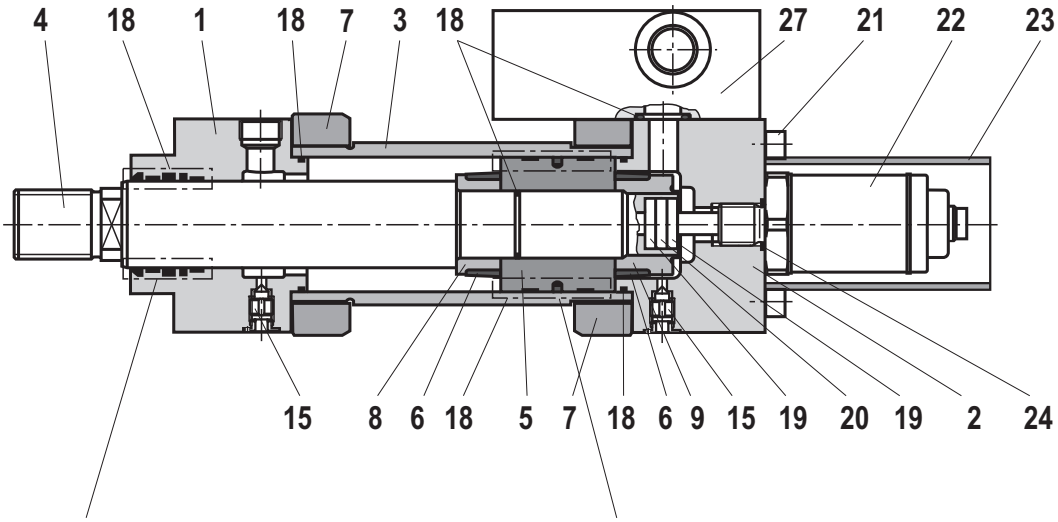






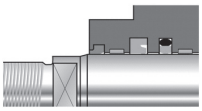
1 Head
2 Base
3 Pipe
4 Piston rod
5 Piston
6 Damping bush
7 Flange
8 Socket
9 Socket
10 Base MP3
11 Base MP5
15 Bleeding
18 Seal kit:
Scraper
Rod seal
Piston seal
O-ring
Guide ring
19 Insulating socket
20 Solenoid
22 Position transducer
24 Seal
25 Seal
26 Protective pipe
27 Subplate

Spare parts: Series CSH1 MF3, MF4, MT4 and MS2

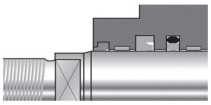


Piston rod

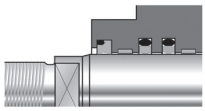
"M"



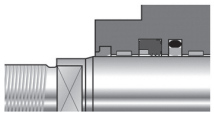
"L"



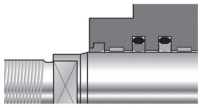
"S / T"



"G / V"

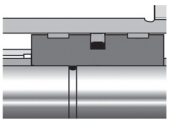


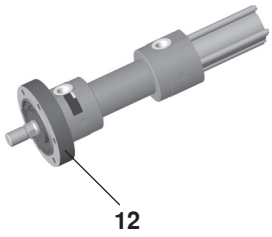
"R"

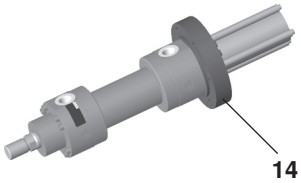


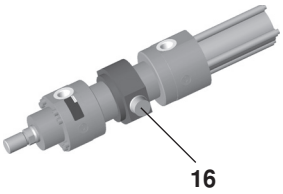
Piston

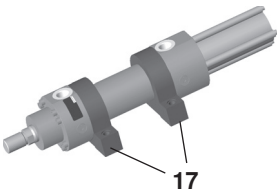
"M / T / S / G / V / L / R"











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	**22** **28**	7 7	12 12	9 9	9 9	9 9	0,9 1,0	10 10	9 9	9 10	1,2 1,5
50	**28** **36**	10 10	16,5 16,5	14 14	12 12	12 13	1,2 1,5	15 15	14 14	14 14	1,6 2,3
63	**36** **45**	16 16	25,5 25,5	22 22	19 19	19 20	2,1 2,6	24 24	21 22	21 22	2,9 3,8
80	**45** **56**	25 26	35 36	30 31	29 30	31 32	2,9 3,6	34 35	33 34	35 36	4,1 5,5
100	**56** **70**	43 44	58,5 59,5	52 53	50 51	52 53	4,6 5,7	59 60	56 58	58 60	6,6 8,8
125	**70** **90**	79 80	99 100	93 95	91 93	90 92	7,3 9,2	103 106	101 105	100 104	10,3 14,2
140	**90** **100**	111 112	137 138	127 128	130 131	131 132	10,7 11,9	145 146	147 149	148 150	15,7 18,1
160	**100** **110**	168 169	205 206	198 200	200 202	209 210	12,6 13,9	230 234	233 236	241 244	18,8 21,4
180	**110** **125**	236 239	283 286	270 272	269 271	278 281	14,7 16,8	314 319	312 318	322 327	22,1 26,5
200	**125** **140**	306 309	361 364	348 351	346 349	358 361	19,0 21,5	369 376	367 373	380 386	28,6 33,5
220	**140** **160**	452	556	515	479	509	27,1 30,9	598	562	593	39,1 46,7
250	**160** **180**	582	710	664	618	649	32,7 36,9	784	739	770	48,5 56,9
280	**180** **200**	753	950	846	784	822	44,2 48,8	981	919	957	64,2 73,4
320	**200** **220**	1125	1404	1290	1180	1222	55,2 60,4	1452	1343	1385	79,8 90,2

ØAL = Piston Ø

ØMM = Piston rod Ø

[1] Weight without position measurement system

[2] Weight with position measurement system