



Hydraulic cylinder, mill type

Series CDM1 / CGM1 / CSM1

- ▶ Component series 2X
- ▶ Nominal pressure 160 bar [16 MPa]

Features

- ▶ Installation dimensions according to ISO 6020/1 and VW 39 D 920
- ▶ 9 types of mounting
- ▶ Piston Ø (**ØAL**) 25 to 200 mm
- ▶ Piston rod Ø (**ØMM**) 14 to 140 mm
- ▶ Stroke lengths up to 3,000 mm
- ▶ Self-adjusting or adjustable end position cushioning

Ordering code: Series CDM1

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
CD	M1		/		/		/		A	2X	/					

01	Differential cylinders	CD
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02	Series	M1
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Types of mounting

03	No mounting	M00 ²⁾
	Rectangular flange at head	MF1 ³⁾
	Rectangular flange at base	MF2 ³⁾
	Round flange at head	MF3
	Round flange at base	MF4
	Swivel eye at base	MP3
	Self-aligning clevis at base	MP5
	Trunnion	MT4 ⁴⁾
	Foot mounting	MS2

04	Piston Ø (ØAL) 25 ... 200 mm, see page 10	...
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05	Piston rod Ø (ØMM) 14 ... 140 mm, see page 10	...
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06	Stroke length in mm	...
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Design principle

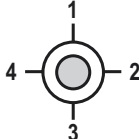
07	Head and base flanged	A
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08	Component series 20 ... 29 (20 ... 29: unchanged installation and connection dimensions)	2X
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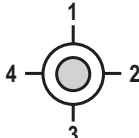
Line connection / version

09	Pipe thread ISO 1179-1	B
	Metric ISO thread (DIN/ISO 6149-1)	R
	Enlarged pipe thread ISO 1179-1, page 40	S ^{5; 6)}
	Rectangular flange connection ISO 6162, page 41	F ^{6; 7)}
	Square flange connection ISO 6164, page 41	H ^{6; 8)}
	For directional and control valves, page 44, 45	Subplate size 6 Subplate size 10 Subplate size 16
		P ^{6; 9; 14)} T ^{6; 10; 14)} U ^{6; 11; 14)}
	For SL and SV valves ¹⁶⁾ , page 42, 43	Subplate size 6 Subplate size 10 Subplate size 20
		A ^{6; 9; 14)} E ^{6; 10; 14)} L ^{6; 11; 14)}

Line connection/position at head

10	View to piston rod ¹⁸⁾		1
			2
			3
			4

Line connection/position at base

11	View to piston rod ¹⁸⁾		1
			2
			3
			4

Ordering code: Series CDM1

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
CD	M1		/		/		/		A	2X	/					

Piston rod design

12	Hard chromium-plated	C
	Hardened and hard chromium-plated	H ¹²⁾
	Stainless steel, hard chromium-plated	L

Piston rod end

13	Thread (ISO 6020-1) for swivel head CGKD	G
	Thread (VW standard) for swivel head CGKD	H ¹⁷⁾
	Internal thread, page 40	E ¹³⁾
	Piston rod end H with mounted swivel head CGKD	F ¹⁷⁾
	Piston rod end G with mounted swivel head CGKD	K

End position cushioning

14	Without end position cushioning	U
	Both sides, self-adjusting	D
	Head side, self-adjusting	S
	Base side, self-adjusting	K
	Both sides, adjustable	E

Seal design

15	Suitable for mineral oil according to 51524 HL, HLP	Standard seal system	M
		Servo quality / reduced friction	T ⁸⁾
		Chevron seal kits	A ⁷⁾
	Suitable for phosphoric acid esters HFDR	Standard seal system	V
		Servo quality / reduced friction	S ⁸⁾

Option 1

16	Without option	W
	Measuring coupling, on both sides	A
	Inductive proximity switch without mating connector, mating connector – separate order see page 48	E ⁸⁾

Option 2

17	Without option	W
	Specify the piston rod extension LY in the plain text in mm	Y

Order examples:

CDM1MT4/50/28/550A2X/B11CGDMWW, XV = 175 mm
CDM1MF3/200/140/950A2X/B11CHKAWW

Note:

Replacement cylinder for series 1X

In the event of an exchange to series 2X, the bearing blocks (trunnions) must also be replaced!

- 2) Only available on request
- 3) Piston Ø 25 up to 125 mm
- 4) When ordering, always specify the "XV" dimension in the clear text in mm
- 5) Piston Ø 63 up to 200 mm
- 6) Not for MF2; MF4
- 7) Piston Ø 50 up to 200 mm
- 8) Piston Ø 40 up to 200 mm
- 9) Piston Ø 40 to 80 mm, only position 11

- 10) Piston Ø 63 to 200 mm, only position 11
- 11) Piston Ø 125 to 200 mm, only position 11
- 12) Piston rod Ø 14 up to 110 mm
- 13) Piston rod Ø 22 up to 140 mm
- 14) Subplates only possible with pipe thread (ISO 1179-1)
- 15) Subplates for SL and SV valves (isolator valves)
Note: Seal design T and S are not designed for the static holding function!
- 17) Per piston Ø, only possible with large piston rod Ø
- 18) All graphical presentations in the data sheet show position 1

Ordering code: Series CGM1

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
CG	M1		/		/		/	A	2X	/						

01	Double-acting cylinders	CG ¹⁾
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02	Series	M1
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Types of mounting

03	Rectangular flange at head	MF1 ³⁾
	Round flange at head	MF3
	Trunnion	MT4 ⁴⁾
	Foot mounting	MS2

04	Piston Ø (ØAL) 25 ... 200 mm, see page 10	...
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05	Piston rod Ø (ØMM) 14 ... 140 mm, see page 10	...
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06	Stroke length in mm	...
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Design principle

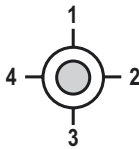
07	Head and base flanged	A
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08	Component series 20 ... 29 (20 ... 29: unchanged installation and connection dimensions)	2X
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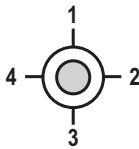
Line connection / version

09	Pipe thread ISO 1179-1	B
	Metric ISO thread (DIN/ISO 6149-1)	R
	Enlarged pipe thread ISO 1179-1, page 40	S ⁵⁾
	Rectangular flange connection ISO 6162, page 41	F ⁷⁾
	Square flange connection ISO 6164, page 41	H ⁸⁾
	For directional and control valves, page 44, 45	Subplate size 6 Subplate size 10 Subplate size 16
		P 6; 9; 14) T 6; 10; 14) U 6; 11; 14)
	For SL and SV valves ¹⁶⁾, page 42, 43	Subplate size 6 Subplate size 10 Subplate size 20
		A 6; 9; 14) E 6; 10; 14) L 6; 11; 14)

Line connection/position at head

10	View to piston rod ¹⁸⁾	1
		2
		3
		4

Line connection/position at base

11	View to piston rod ¹⁸⁾	1
		2
		3
		4

Piston rod design

12	Hard chromium-plated	C
	Hardened and hard chromium-plated	H ¹²⁾
	Stainless steel, hard chromium-plated	L

Ordering code: Series CGM1

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
CG	M1		/		/		/		A	2X	/					

Piston rod end

13	Thread (ISO 6020-1) for swivel head CGKD	G
	Thread (VW standard) for swivel head CGKD	H ¹⁷⁾
	Piston rod end H with mounted swivel head CGKD	F ¹⁷⁾
	Piston rod end G with mounted swivel head CGKD	K

End position cushioning

14	Without end position cushioning	U
	Both sides, self-adjusting	D
	Both sides, adjustable	E

Seal design

15	Suitable for mineral oil according to HL, HLP	Standard seal system	M
		Servo quality / reduced friction	T ⁸⁾
		Chevron seal kits	A ⁷⁾
	Suitable for phosphoric acid esters HFDR	Standard seal system	V
		Servo quality / reduced friction	S ⁸⁾

Option 1

16	Without option	W
	Measuring coupling, on both sides	A
	Inductive proximity switch without mating connector, mating connector – separate order see page 48	E ⁸⁾

Option 2

17	Without option	W
	Specify the piston rod extension LY in the plain text in mm	Y

Order examples:

CGM1MT4/50/28/550A2X/B11CGDMWW, XV = 175 mm

CGM1MF3/200/140/950A2X/B11CHDAWW

Note:

Replacement cylinder for series 1X

In the event of an exchange to series 2X, the bearing blocks (trunnions) must also be replaced!

¹⁾ Not standardized

³⁾ Piston Ø 25 up to 125 mm

⁴⁾ When ordering, always specify the "XV" dimension in the clear text in mm

⁵⁾ Piston Ø 63 up to 200 mm

⁷⁾ Piston Ø 50 up to 200 mm

⁸⁾ Piston Ø 40 up to 200 mm

⁹⁾ Piston Ø 40 to 80 mm, only position 11

¹⁰⁾ Piston Ø 63 to 200 mm, only position 11

¹¹⁾ Piston Ø 125 to 200 mm, only position 11

¹²⁾ Piston rod Ø 14 up to 110 mm

¹⁴⁾ Subplates only possible with pipe thread ISO 1179-1

¹⁶⁾ Subplates for SL and SV valves (isolator valves)

Note: Seal design T and S are not designed for the static holding function!

¹⁷⁾ Per piston Ø, only possible with large piston rod Ø

¹⁸⁾ All graphical presentations in the data sheet show position 1

Ordering code: Series CSM1

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
CS	M1		/		/		A	2X	/						T	

01	Differential cylinder with position measurement system	CS ¹⁾
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02	Series	M1
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Types of mounting

03	Rectangular flange at head	MF1 ³⁾
	Round flange at head	MF3
	Swivel eye at base	MP3
	Self-aligning clevis at base	MP5
	Trunnion	MT4 ⁴⁾
	Foot mounting	MS2

04	Piston Ø (ØAL) 40 ... 200 mm, see page 10	...
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05	Piston rod Ø (ØMM) 28 ... 140 mm, see page 10	...
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06	Stroke length in mm	...
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Design principle

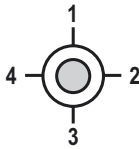
07	Head and base flanged	A
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08	Component series 20 ... 29 (20 ... 29: unchanged installation and connection dimensions)	2X
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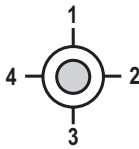
Line connection / version

09	Pipe thread ISO 1179-1		B
	Metric ISO thread (DIN/ISO 6149-1)		R
	Enlarged pipe thread ISO 1179-1, page 40		S ⁵⁾
	Rectangular flange connection ISO 6162, page 41		F ⁷⁾
	Square flange connection ISO 6164, page 41		H
	For directional and control valves, page 44, 45	Subplate size 6	P ^{6; 9; 14)}
		Subplate size 10	T ^{6; 10; 14)}
		Subplate size 16	U ^{6; 11; 14)}
	For SL and SV valves ¹⁶⁾ , page 42, 43	Subplate size 6	A ^{6; 9; 14)}
		Subplate size 10	E ^{6; 10; 14)}
		Subplate size 20	L ^{6; 11; 14)}

Line connection/position at head

10	View to piston rod ¹⁸⁾		1
			2
			3
			4

Line connection/position at base

11	View to piston rod ¹⁸⁾		1
			2
			3
			4

Piston rod design

12	Hard chromium-plated	C
	Stainless steel, hard chromium-plated	L

Ordering code: Series CSM1

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
CS	M1		/		/		/		A	2X	/					T

Piston rod end

13	Thread (ISO 6020-1) for swivel head CGKD	G
	Thread (VW standard) for swivel head CGKD	H ¹⁷⁾
	Internal thread, page 40	E
	Piston rod end H with mounted swivel head CGKD	F ¹⁷⁾
	Piston rod end G with mounted swivel head CGKD	K

End position cushioning

14	Without end position cushioning	U
	Both sides, adjustable	E ¹⁵⁾

Seal design

15	Suitable for mineral oil according to HL, HLP	Standard seal system	M
		Servo quality / reduced friction	T
	Suitable for phosphoric acid esters HFDR	Servo quality / reduced friction	S

Option 1

16	Position measurement system (magnetostrictive) without mating connector, mating connector – separate order, see page 51	T
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Option 2

17	Analog output 4 ... 20 mA	C
	Analog output 0 ... 10 V	F
	Digital output SSI	D

Order example:

CSM1MT4/50/36/300A2X/B11CHUMTC, XV = 175 mm

- 1) Not standardized
- 3) Piston Ø 40 up to 125 mm
- 4) When ordering, always specify the "XV" dimension in the clear text in mm
- 5) Piston Ø 63 up to 200 mm
- 6) Not for MF2; MF4
- 7) Piston Ø 50 up to 200 mm
- 9) Piston Ø 40 to 80 mm, only position 11

- 10) Piston Ø 63 to 200 mm, only position 11
- 11) Piston Ø 125 to 200 mm, only position 11
- 14) Subplates only possible with pipe thread (ISO 1179-1)
- 15) Piston Ø 80 up to 200 mm
- 16) Subplates for SL and SV valves (isolator valves)
Note: Seal design T and S are not designed for the static holding function!
- 17) Per piston Ø, only possible with large piston rod Ø
- 18) All graphical presentations in the data sheet show position 1

General information on series CSM1

The series CSM1...2X is based on the series CDM1...2X (according to ISO 6020/1).

The same general instructions apply for series CSM1...2X as for series CDM1...2X.

Dimensional differences or deviations in the type code caused by the integrated position measurement system are shown on the pages for the dimensions.

Technical data

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

General		
Weight	kg	see page 75
Installation position		any
Ambient temperature range	°C [°F]	-20 ... +80 [-4 ... +176]
Primer coat ¹⁾	µm	min. 40

Hydraulic		
Nominal pressure ²⁾	bar [MPa]	160 [16]
Minimum operating pressure ³⁾ (without load)	bar [MPa]	10 [1]
Static test pressure	bar [MPa]	240 [24]
Hydraulic fluid		see table below
Hydraulic fluid temperature range	°C [°F]	-20 ... +80 [-4 ... +176]
Viscosity range	mm ² /s	2.8 ... 380
Maximum permissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)		Class 20/18/15 ⁴⁾
Stroke speed ⁵⁾ (depending on line connection)	m/s	up to 0.5
Bleeding		standard, from piston Ø 40 mm secured against unscrewing

Hydraulic fluid ⁶⁾	Classification	Suitable sealing materials	Standards
Mineral oils	HL, HLP	NBR, FKM	DIN 51524
Phosphoric acid esters	HFDR	FKM	ISO 12922
Water glycol	HFC	upon request	

¹⁾ By default, hydraulic cylinders are primed with a coating (color gentian blue RAL 5010). 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
- ▶ Position measurement system

The areas that are not painted are protected by means of a solvent-free corrosion protection agent.

²⁾ Higher operating pressures up to 200 bar available on request. With extreme loads, mounting elements and threaded piston rod connections must be designed for durability.

³⁾ 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.

⁴⁾ The cleanliness classes stated for the components has to be maintained in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.

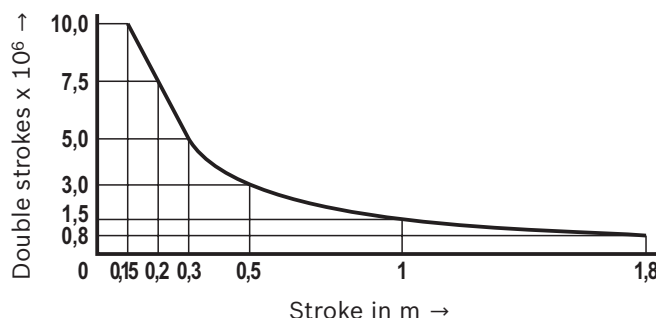
⁵⁾ If the extension velocity is considerably higher than the retraction velocity of the piston rod, drag-out losses of the medium may result. If necessary, please consult us.

⁶⁾ For further information on hydraulic fluids, see data sheet.

Life cycle:

cylinders correspond to the reliability recommendations for industrial applications.

≥ 10,000,000 double strokes in idle continuous 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%.



Technical data

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

Notices:

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 kinking length/kinking load of the piston rod and/or the hydraulic cylinder must be observed (see page topic Kinking).
- ▶ 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 area 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.

Standards:

The installation dimensions and types of mounting of the cylinder comply with the standards ISO 6020/1 and VW 39 D 920.

Acceptance:

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

For assembly, commissioning and maintenance of hydraulic cylinders, observe the operating instructions 07100-B!

Service and repair works have to be performed personnel especially trained for this purpose. No warranty is accepted for damage as a consequence of assembly, maintenance or repair work not performed.

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 parameters must be described in the check lists for hydraulic cylinders.

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.

All graphical presentations in the data sheet are an example. The product supplied may therefore differ from the photo shown.

Project planning software ICS (Interactive Catalog System)

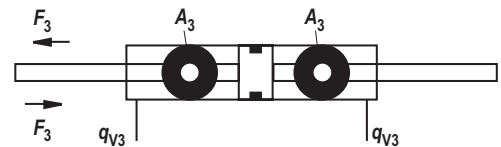
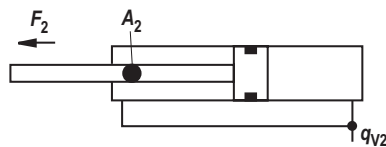
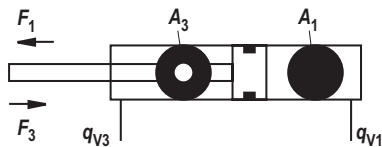
The ICS (Interactive Catalog System) is a selection and project planning help for hydraulic cylinders. The ICS allows designers for machines and systems to quickly and reliably find the perfect hydraulic cylinder solution through logic-guided type key enquiries. This software helps to solve design and project planning tasks more quickly and efficiently. After having been guided through the product

selection, the user quickly and reliably gets the exact technical data of the selected component 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	Piston	Areas		Force at 160 bar ¹⁾			Flow at 0.1 m/s ²⁾			max. available stroke length
				Rod	Ring	pressure	Diff.	Pulling	From	Diff.	On	
ØAL mm	ØMM mm	φ A ₁ /A ₃	A ₁ cm ²	A ₂ cm ²	A ₃ cm ²	F ₁ kN	F ₂ kN	F ₃ kN	q _{v1} l/min	q _{v2} l/min	q _{v3} l/min	mm
25	14 18	1.46 2.08	4.91	1.54 2.54	3.37 2.36	7.85	2.44 4.07	5.37 3.76	2.9	0.9 1.5	2.0 1.4	600
32	18 22	1.46 1.90	8.04	2.54 3.80	5.50 4.24	12.80	4.07 6.08	8.78 6.76	4.8	1.5 2.3	3.3 2.5	800
40	22 28	1.43 1.96	12.56	3.80 6.16	8.76 6.41	20.00	6.08 9.82	14.03 10.24	7.5	2.3 3.7	5.2 3.8	1000
50	28 36	1.46 2.08	19.63	6.16 10.18	13.47 9.46	31.30	9.82 16.29	21.55 15.10	11.8	3.7 6.1	8.1 5.6	1200
63	36 45	1.48 2.04	31.17	10.18 15.90	20.99 15.27	49.80	16.29 25.40	33.56 24.41	18.7	6.1 9.5	12.6 9.2	1400
80	45 56	1.46 1.96	50.26	15.90 24.63	34.36 25.63	80.30	25.40 39.30	54.96 40.99	30.2	9.5 14.8	20.7 15.4	1700
100	56 70	1.46 1.96	78.54	24.63 38.48	53.91 40.06	125.00	39.30 61.50	86.22 64.04	47.1	14.8 23.1	32.3 24.0	2000
125	70 90	1.46 2.08	122.72	38.48 63.62	84.24 59.10	196.00	61.50 101.00	134.7 94.49	73.6	23.1 38.2	50.5 35.4	2300
160	90 110	1.46 1.90	201.06	63.62 95.06	137.44 106.00	321.00	101.00 151.00	219.8 169.5	120.6	38.2 57.0	82.4 63.6	2600
200	110 140	1.43 1.96	314.16	95.06 153.96	219.09 160.20	502.60	152.00 246.30	350.6 256.3	188.5	57.0 92.4	131.5 96.1	3000



¹⁾ Theoretical static cylinder force
(without consideration of the efficiency and admissible load for attachment parts like e.g. swivel heads, plates or valves, etc.)

²⁾ Stroke velocity

Tolerances according to ISO 6020-1

Installation dimensions	WF	W	WC	XC ¹⁾	XO ¹⁾	XS	SS	XV	ZF ¹⁾	ZP ¹⁾	Stroke tolerances in mm
Type of mounting	M00	MF1	MF3	MP3	MP5	MS2	MS2	MT4	MF2	MF4	
Stroke length in mm	Tolerances in mm										
≤ 1250	± 2	± 2	± 2	± 1.5	± 1.5	± 2	± 1.5	± 2	± 1.5	± 1.5	+ 2
> 1250 to ≤ 3000	± 4	± 4	± 4	± 3	± 3	± 4	± 3	± 4	± 3	± 3	+ 5

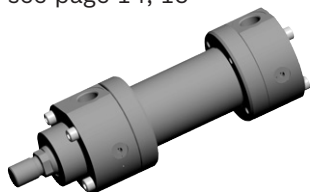
¹⁾ Not standardized

²⁾ Including stroke length

Overview types of mounting: Series CDM1

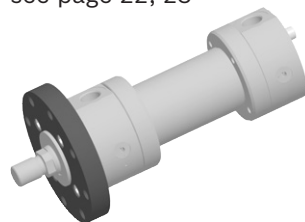
CDM1: M00

see page 14, 15



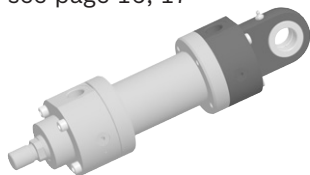
CDM1: MF3

see page 22, 23



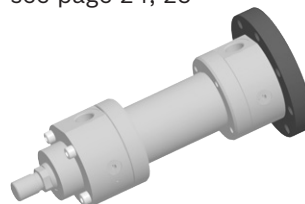
CDM1: MP3

see page 16, 17



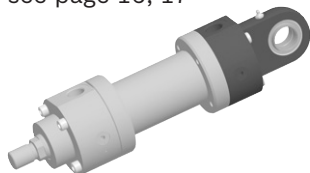
CDM1: MF4

see page 24, 25



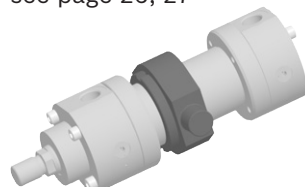
CDM1: MP5

see page 16, 17



CDM1: MT4

see page 26, 27



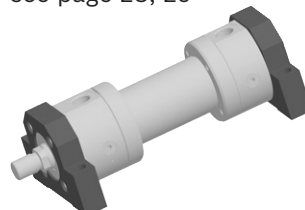
CDM1: MF1

see page 18, 19



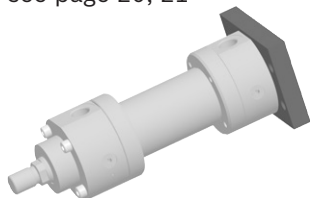
CDM1: MS2

see page 28, 29



CDM1: MF2

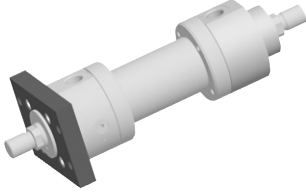
see page 20, 21



Overview types of mounting: Series CGM1

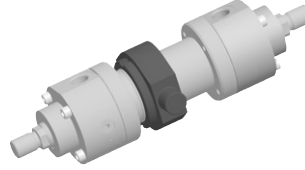
CGM1: MF1

see page 18, 19



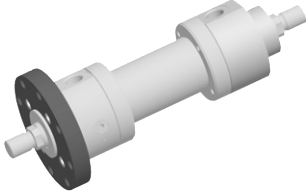
CGM1: MT4

see page 26, 27



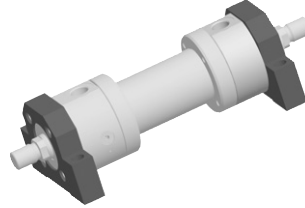
CGM1: MF3

see page 22, 23



CGM1: MS2

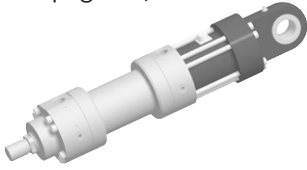
see page 28, 29



Overview types of mounting: Series CSM1

CSM1: MP3

see page 30, 31



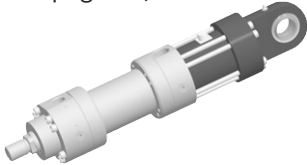
CSM1: MF3

see page 34, 35



CSM1: MP5

see page 30, 31



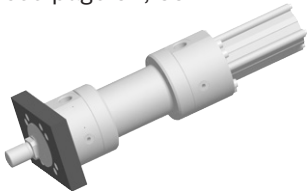
CSM1: MT4

see page 36, 37



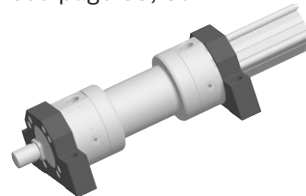
CSM1: MF1

see page 32, 33



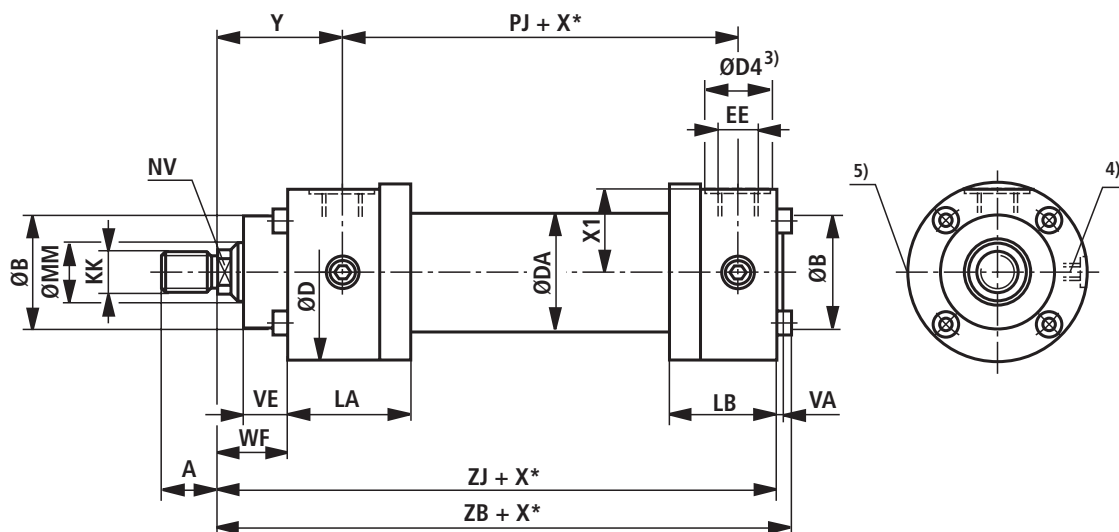
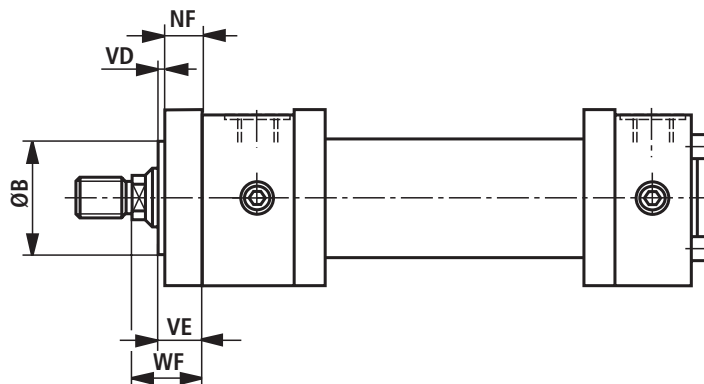
CSM1: MS2

see page 38, 39



Dimensions CDM1: M00

(dimensions in mm)

CDM1: M00

CDM1: M00...2X/...A: as sleeve design and AL- $\emptyset$ 50 ... 200 mm


Dimensions CDM1: M00

(dimensions in mm)

ØAL	ØMM	KK ¹⁾ ISO 6020/1	A ¹⁾	KK ²⁾ VW 39 D 920	A ²⁾	NV	ØB f8	ØD	ØDA	ØD4 3; 8)	EE 8)	ØD4 3; 9)	EE 9)
25	14 18	M12 x 1.25 M14 x 1.5	16 18	— M12 x 1.25	— 16	12 14	32	56	35	25	G1/4	21	M14x1.5
32	18 22	M14 x 1.5 M16 x 1.5	18 22	— M14 x 1.5	— 18	14 18	40	67	42	28	G3/8	26	M18x1.5
40	22 28	M16 x 1.5 M20 x 1.5	22 28	— M16 x 1.5	— 22	18 22	50	78	50	34	G1/2	29	M22x1.5
50	28 36	M20 x 1.5 M27 x 2	28 36	— M20 x 1.5	— 28	22 30	60	95	60	34	G1/2	29	M22x1.5
63	36 45	M27 x 2 M33 x 2	36 45	— M27 x 2	— 36	30 36	70	116	78	42	G3/4	34	M27x2
80	45 56	M33 x 2 M42 x 2	45 56	— M33 x 2	— 45	36 46	85	130	95	42	G3/4	34	M27x2
100	56 70	M42 x 2 M48 x 2	56 63	— M42 x 2	— 56	46 60	106	158	120	47	G1	43	M33x2
125	70 90	M48 x 2 M64 x 3	63 85	— M48 x 2	— 63	60 75	132	192	150	47	G1	43	M33x2
160	90 110	M64 x 3 M80 x 3	85 95	— M64 x 3	— 85	75 95	160	237	190	58	G1 1/4	52	M42x2
200	110 140	M80 x 3 M100 x 3	95 112	— M80 x 3	— 95	95 120	200	285	230	58	G1 1/4	52	M42x2
ØAL	ØMM	Y	PJ	X1	PI	VE	VD	NF	WF	ZB	ZJ	LA	LB
25	14 18	58	77	26	3	15	—	—	28	156	150	58	43
32	18 22	64	89	30.5	3	19	—	—	32	176	170	62	47
40	22 28	71	97	35.5	3	19	—	—	32	196	190	73	56
50	28 36	72	111	44.5	4	24	4	20	38	213	205	74	62
63	36 45	82	117	54.5	4	29	4	25	45	234	224	84	72
80	45 56	91	134	62.5	4	36	4	32	54	260	250	93	81
100	56 70	108	162	75.5	5	37	5	32	57	310	300	117	96
125	70 90	121	174	92.5	5	37	5	32	60	335	325	143	112
160	90 110	143	191	115.5	8	41	5	36	66	380	370	171	130
200	110 140	190	224	138.5	15	45	5	40	75	466	450	230	151

ØAL = Piston Ø

ØMM = Piston rod Ø

X* = Stroke length

1) Thread for piston rod ends "G" and "K"

2) Thread for piston rod ends "H" and "F"

3) ØD4 recess max. 0.5 mm deep

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

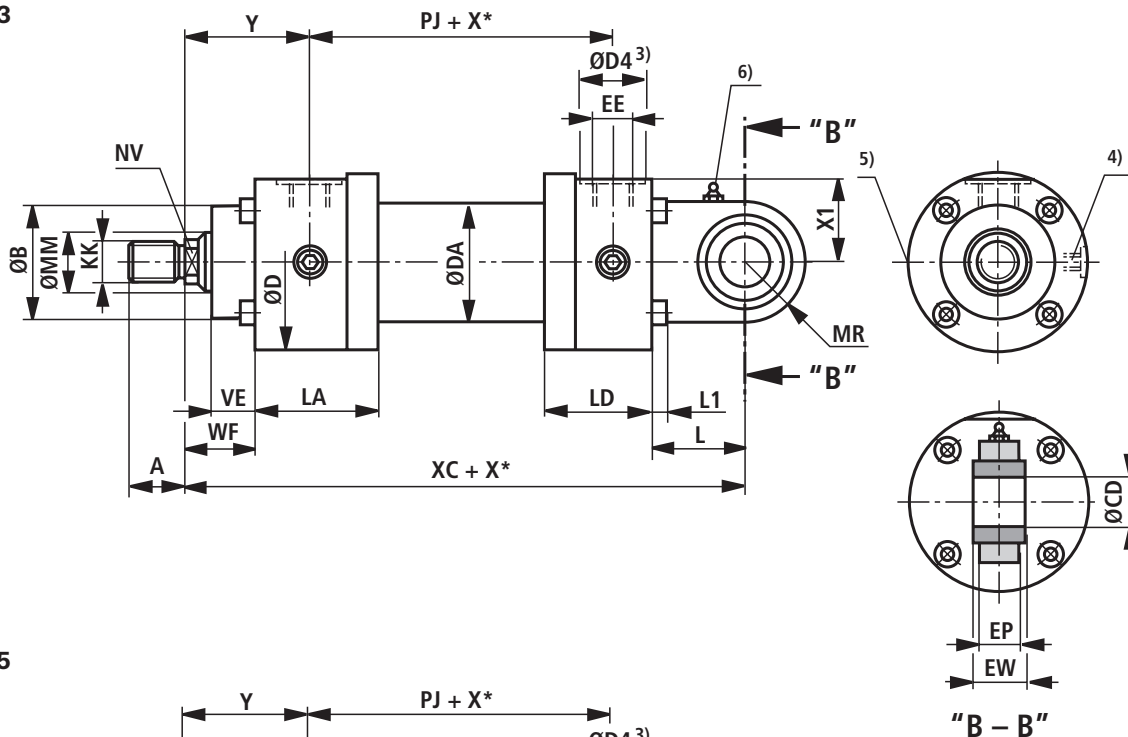
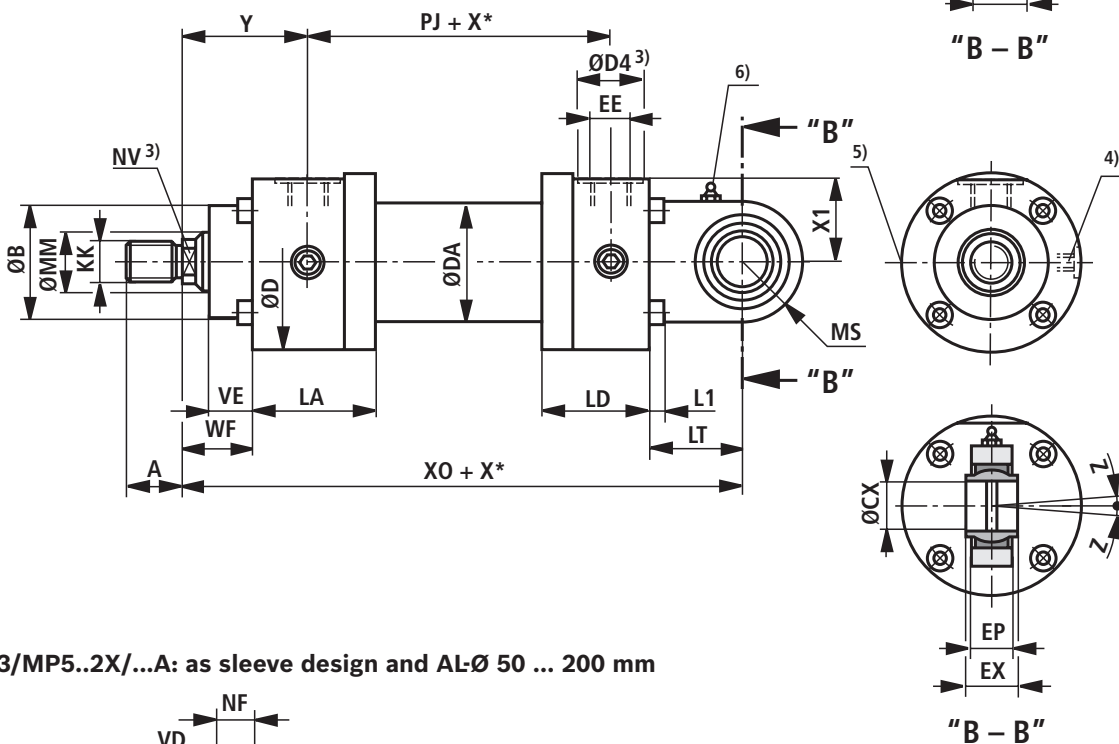
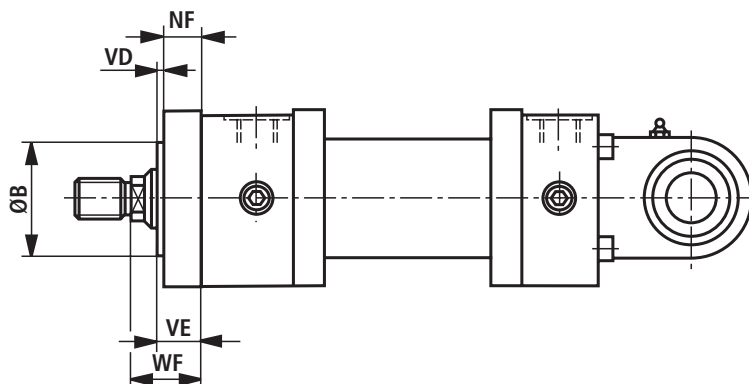
5) Throttle valve only with end position cushioning "E" (180° for bleeding)

8) Line connection "B"

9) Line connection "R"

Dimensions CDM1: MP3 / MP5

(dimensions in mm)

CDM1: MP3

CDM1: MP5

CDM1: MP3/MP5..2X/...A: as sleeve design and AL-Ø 50 ... 200 mm


Dimensions CDM1: MP3 / MP5

(dimensions in mm)

Ø AL	Ø MM	KK ¹⁾ ISO 6020/1	A ¹⁾	KK ²⁾ VW 39 D 920	A ²⁾	NV	ØB f8	ØD	ØDA	ØD4 3; 8)	EE 8)	ØD4 3; 9)	EE 9)	Y	PJ
25	14 18	M12 x 1.25 M14 x 1.5	16 18	– M12 x 1.25	– 16	12 14	32	56	35	25	G1/4	21	M14x1.5	58	77
32	18 22	M14 x 1.5 M16 x 1.5	18 22	– M14 x 1.5	– 18	14 18	40	67	42	28	G3/8	26	M18x1.5	64	89
40	22 28	M16 x 1.5 M20 x 1.5	22 28	– M16 x 1.5	– 22	18 22	50	78	50	34	G1/2	29	M22x1.5	71	97
50	28 36	M20 x 1.5 M27 x 2	28 36	– M20 x 1.5	– 28	22 30	60	95	60	34	G1/2	29	M22x1.5	72	111
63	36 45	M27 x 2 M33 x 2	36 45	– M27 x 2	– 36	30 36	70	116	78	42	G3/4	34	M27x2	82	117
80	45 56	M33 x 2 M42 x 2	45 56	– M33 x 2	– 45	36 46	85	130	95	42	G3/4	34	M27x2	91	134
100	56 70	M42 x 2 M48 x 2	56 63	– M42 x 2	– 56	46 60	106	158	120	47	G1	43	M33x2	108	162
125	70 90	M48 x 2 M64 x 3	63 85	– M48 x 2	– 63	60 75	132	192	150	47	G1	43	M33x2	121	174
160	90 110	M64 x 3 M80 x 3	85 95	– M64 x 3	– 85	75 95	160	237	190	58	G1 1/4	52	M42x2	143	191
200	110 140	M80 x 3 M100 x 3	95 112	– M80 x 3	– 95	95 120	200	285	230	58	G1 1/4	52	M42x2	190	224

ØAL	MM	X1	VE	WF	NF	VD	XC/XO	CD/CX H9/H7	EP	EW/EX h12	L/LT	MR/MS	LA	LD	L1	Z
25	14 18	26	15	28	–	–	178	12	11	12	25	16	58	46	6	2°
32	18 22	30.5	19	32	–	–	206	16	13	16	33	20	62	50	6	2°
40	22 28	35.5	19	32	–	–	231	20	17	20	38	25	73	59	6	2°
50	28 36	44.5	24	38	20	4	257	25	22	25	48	32	74	66	8	2°
63	36 45	54.5	29	45	25	4	289	32	27	32	61	40	84	76	10	4°
80	45 56	62.5	36	54	32	4	332	40	32	40	78	50	93	85	10	4°
100	56 70	75.5	37	57	32	5	395	50	40	50	90	63	117	101	10	4°
125	70 90	92.5	37	60	32	5	428	63	52	63	98	71	143	117	12	4°
160	90 110	115.5	41	66	36	5	505	80	66	80	127	90	171	138	12	4°
200	110 140	138.5	45	75	40	5	615	100	84	100	150	112	230	166	16	4°

ØAL = Piston Ø

ØMM = Piston rod Ø

X* = Stroke length

1) Thread for piston rod ends "G" and "K"

2) Thread for piston rod ends "H" and "F"

3) ØD4 recess max. 0.5 mm deep

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

5) Throttle valve only with end position cushioning "E" (180° for bleeding)

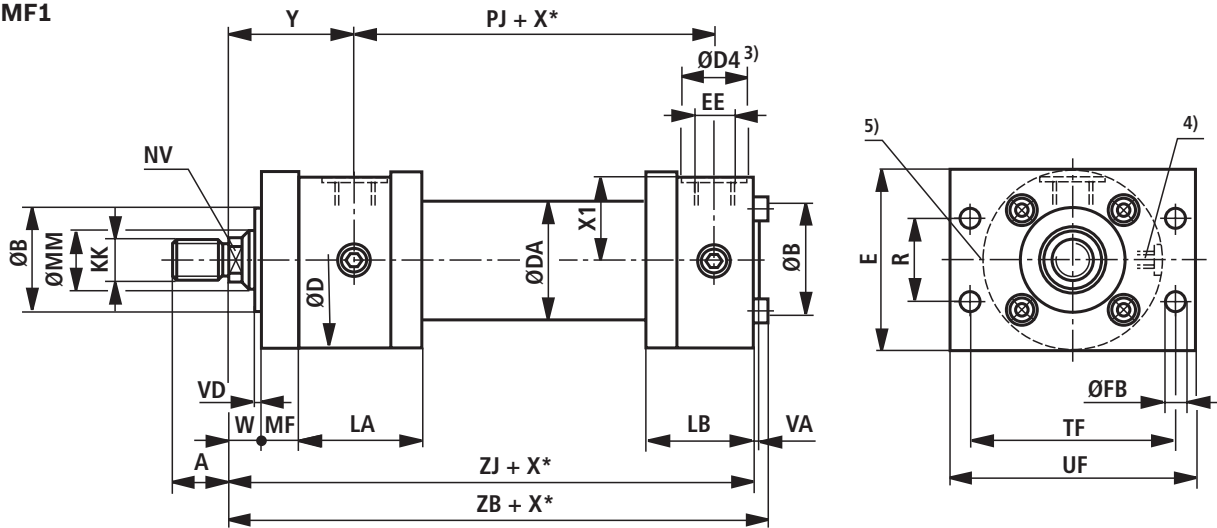
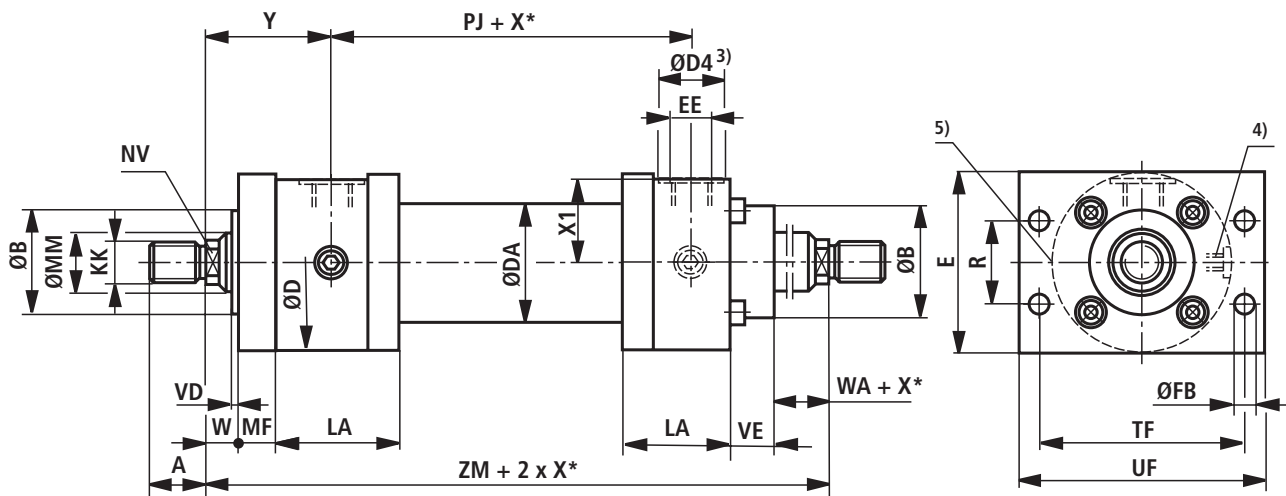
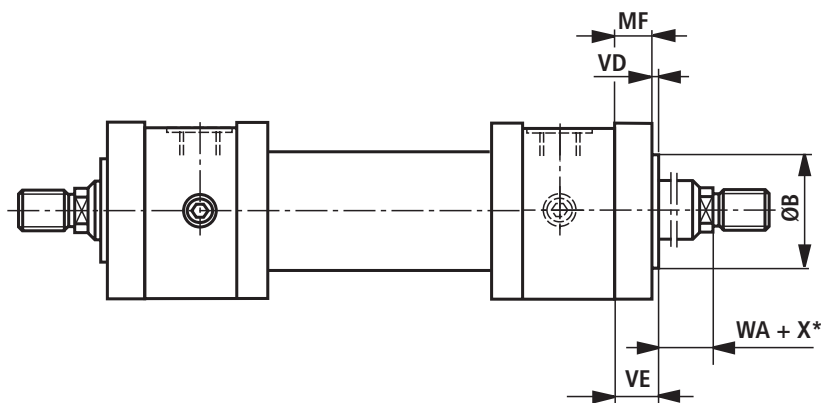
6) Lubricating nipple, cone head form A according to DIN 71412 (with pistons Ø 25 mm bearings cannot be lubricated)

8) Line connection "B"

9) Line connection "R"

Dimensions CDM1 / CGM1: MF1

(dimensions in mm)

CDM1: MF1

CGM1: MF1

CGM1: MF1..2X/...A: as sleeve design and AL- $\varnothing$ 50 ... 200 mm


Dimensions CDM1 / CGM1: MF1

(dimensions in mm)

ØAL	ØMM	KK ¹⁾ ISO 6020/1	A ¹⁾	KK ²⁾ VW 39 D 920	A ²⁾	NV	ØB	ØD	ØDA	ØD4 3; 8)	EE 8)	ØD4 3; 9)	EE 9)	Y	PJ	X1
25	14 18	M12x1.25 M14x1.5	16 18	— M12x1.25	— 16	12 14	32	56	35	25	G1/4	21	M14x1.5	58	77	26
32	18 22	M14x1.5 M16x1.5	18 22	— M14x1.5	— 18	14 18	40	67	42	28	G3/8	26	M18x1.5	64	89	30.5
40	22 28	M16x1.5 M20x1.5	22 28	— M16x1.5	— 22	18 22	50	78	50	34	G1/2	29	M22x1.5	71	97	35.5
50	28 36	M20x1.5 M27x2	28 36	— M20x1.5	— 28	22 30	60	95	60	34	G1/2	29	M22x1.5	72	111	44.5
63	36 45	M27x2 M33x2	36 45	— M27x2	— 36	30 36	70	116	78	42	G3/4	34	M27x2	82	117	54.5
80	45 56	M33x2 M42x2	45 56	— M33x2	— 45	36 46	85	130	95	42	G3/4	34	M27x2	91	134	62.5
100	56 70	M42x2 M48x2	56 63	— M42x2	— 56	46 60	106	158	120	47	G1	43	M33x2	108	162	75.5
125	70 90	M48x2 M64x3	63 85	— M48x2	— 63	60 75	132	192	150	47	G1	43	M33x2	121	174	92.5

ØAL	ØMM	VE	WA	MF	PI	VD	W	ZJ	ZB	ZM	E	R js13	TF js13	UF	ØFB H13	LA	LB
25	14 18	15	13	12	3	3	16	150	156	193	60	28.7	69.2	85	6.6	58	43
32	18 22	19	13	16	3	3	16	170	176	217	70	35.2	85	105	9	62	47
40	22 28	19	13	16	3	3	16	190	196	239	80	40.6	98	115	9	73	56
50	28 36	24	14	20	4	4	18	205	213	255	100	48.2	116.4	140	11	74	62
63	36 45	29	16	25	4	4	20	224	234	281	120	55.5	134	160	13.5	84	72
80	45 56	36	18	32	4	4	22	250	260	316	135	63.1	152.5	185	17.5	93	81
100	56 70	37	20	32	5	5	25	300	310	378	160	76.5	184.8	225	22	117	96
125	70 90	37	23	32	5	5	28	325	335	416	195	90.2	217.1	255	22	143	112

ØAL = Piston Ø

ØMM = Piston rod Ø

X* = Stroke length

1) Thread for piston rod ends "G" and "K"

2) Thread for piston rod ends "H" and "F"

3) ØD4 recess max. 0.5 mm deep

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

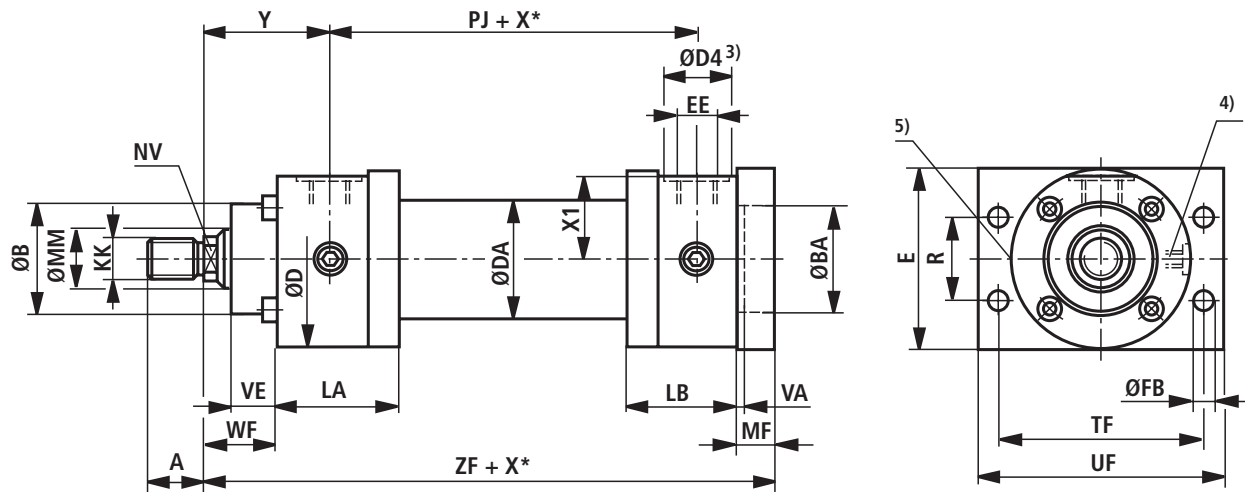
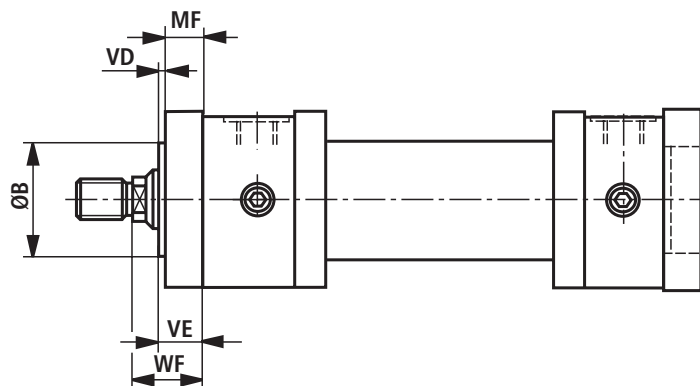
5) Throttle valve only with end position cushioning "E" (180° for bleeding)

8) Line connection "B"

9) Line connection "R"

Dimensions CDM1: MF2

(dimensions in mm)

CDM1: MF2

CDM1: MF2..2X/...A: as sleeve design and AL- $\varnothing$ 50 ... 200 mm


Dimensions CDM1: MF2

(dimensions in mm)

ØAL	ØMM	KK ¹⁾ ISO 6020/1	A ¹⁾	KK ²⁾ VW 39 D 920	A ²⁾	NV	ØB f8	ØD	ØDA	ØD4 3; 8)	EE 8)	ØD4 3; 9)	EE 9)	Y	PJ
25	14 18	M12 x 1.25 M14 x 1.5	16 18	– M12 x 1.25	– 16	12 14	32	56	35	25	G1/4	21	M14x1.5	58	77
32	18 22	M14 x 1.5 M16 x 1.5	18 22	– M14 x 1.5	– 18	14 18	40	67	42	28	G3/8	26	M18x1.5	64	89
40	22 28	M16 x 1.5 M20 x 1.5	22 28	– M16 x 1.5	– 22	18 22	50	78	50	34	G1/2	29	M22x1.5	71	97
50	28 36	M20 x 1.5 M27 x 2	28 36	– M20 x 1.5	– 28	22 30	60	95	60	34	G1/2	29	M22x1.5	72	111
63	36 45	M27 x 2 M33 x 2	36 45	– M27 x 2	– 36	30 36	70	116	78	42	G3/4	34	M27x2	82	117
80	45 56	M33 x 2 M42 x 2	45 56	– M33 x 2	– 45	36 46	85	130	95	42	G3/4	34	M27x2	91	134
100	56 70	M42 x 2 M48 x 2	56 63	– M42 x 2	– 56	46 60	106	158	120	47	G1	43	M33x2	108	162
125	70 90	M48 x 2 M64 x 3	63 85	– M48 x 2	– 63	60 75	132	192	150	47	G1	43	M33x2	121	174

ØAL	ØMM	X1	WF	MF	PI	VE	VD	ØBA H8	ZF	E	R js13	TF js13	UF	ØFB H13	LA	LB
25	14 18	26	28	12	3	15	–	32	162	60	28.7	69.2	85	6.6	58	43
32	18 22	30.5	32	16	3	19	–	40	186	70	35.2	85	105	9	62	47
40	22 28	35.5	32	16	3	19	–	50	206	80	40.6	98	115	9	73	56
50	28 36	44.5	38	20	4	24	4	60	225	100	48.2	116.4	140	11	74	62
63	36 45	54.5	45	25	4	29	4	70	249	120	55.5	134	160	13.5	84	72
80	45 56	62.5	54	32	4	36	4	85	282	135	63.1	152.5	185	17.5	93	81
100	56 70	75.5	57	32	5	37	5	106	332	160	76.5	184.8	225	22	117	96
125	70 90	92.5	60	32	5	37	5	132	357	195	90.2	217.1	255	22	143	112

ØAL = Piston Ø

ØMM = Piston rod Ø

X* = Stroke length

1) Thread for piston rod ends "G" and "K"

2) Thread for piston rod ends "H" and "F"

3) ØD4 recess max. 0.5 mm deep

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

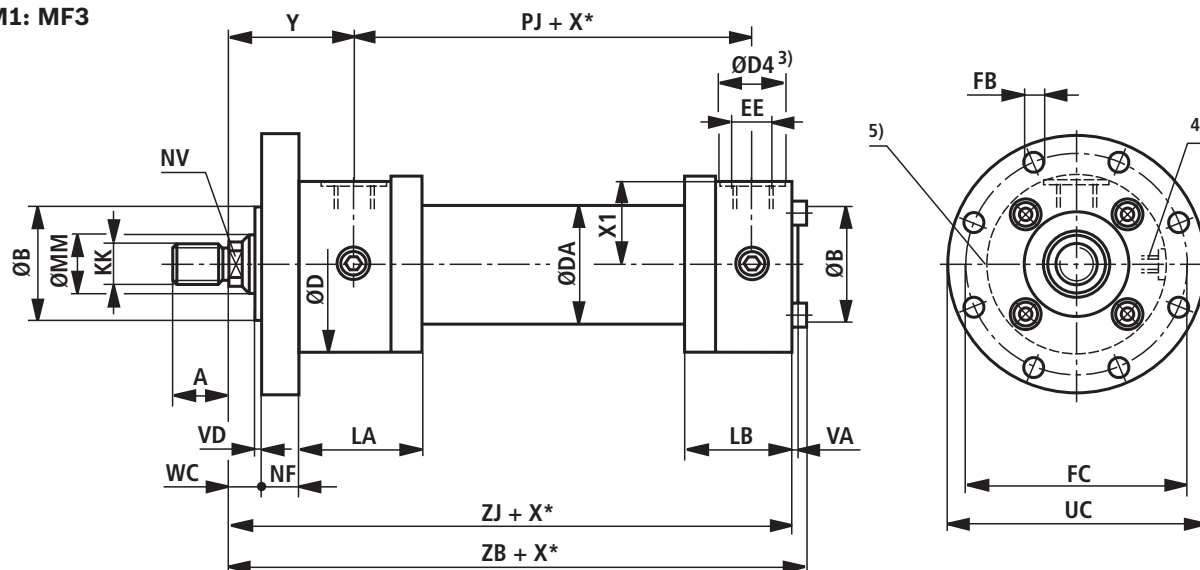
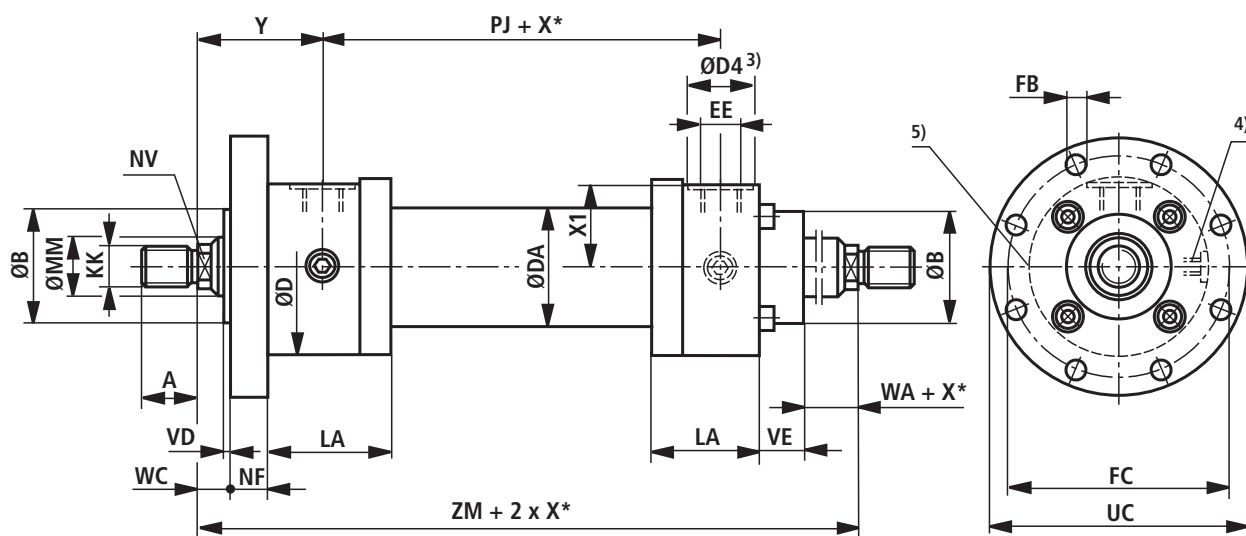
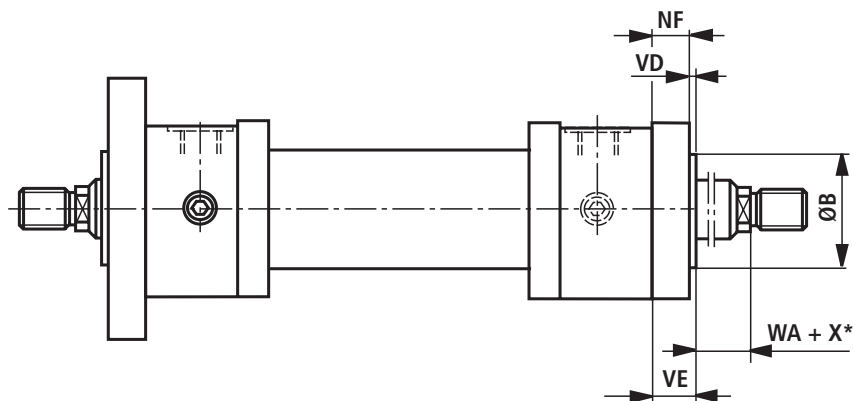
5) Throttle valve only with end position cushioning "E" (180° for bleeding)

8) Line connection "B"

9) Line connection "R"

Dimensions CDM1 / CGM1: MF3

(dimensions in mm)

CDM1: MF3

CGM1: MF3

CGM1: MF3..2X/...A: as sleeve design and AL-Ø 50 ... 200 mm


Dimensions CDM1 / CGM1: MF3

(dimensions in mm)

ØAL	ØMM	KK ¹⁾ ISO 6020/1	A ¹⁾	KK ²⁾ VW 39 D 920	A ²⁾	NV	ØB f8	ØD	ØDA	ØD4 3; 8)	EE 8)	ØD4 3; 9)	EE 9)	Y	PJ	
25	14 18	M12x1.25 M14x1.5	16 18	– M12x1.25	– 16	12 14	32	56	35	25	G1/4	21	M14x1.5	58	77	
32	18 22	M14x1.5 M16x1.5	18 22	– M14x1.5	– 18	14 18	40	67	42	28	G3/8	26	M18x1.5	64	89	
40	22 28	M16x1.5 M20x1.5	22 28	– M16x1.5	– 22	18 22	50	78	50	34	G1/2	29	M22x1.5	71	97	
50	28 36	M20x1.5 M27x2	28 36	– M20x1.5	– 28	22 30	60	95	60	34	G1/2	29	M22x1.5	72	111	
63	36 45	M27x2 M33x2	36 45	– M27x2	– 36	30 36	70	116	78	42	G3/4	34	M27x2	82	117	
80	45 56	M33x2 M42x2	45 56	– M33x2	– 45	36 46	85	130	95	42	G3/4	34	M27x2	91	134	
100	56 70	M42x2 M48x2	56 63	– M42x2	– 56	46 60	106	158	120	47	G1	43	M33x2	108	162	
125	70 90	M48x2 M64x3	63 85	– M48x2	– 63	60 75	132	192	150	47	G1	43	M33x2	121	174	
160	90 110	M64x3 M80x3	85 95	– M64x3	– 85	75 95	160	237	190	58	G1 1/4	52	M42x2	143	191	
200	110 140	M80x3 M100x3	95 112	– M80x3	– 95	95 120	200	285	230	58	G1 1/4	52	M42x2	190	224	
ØAL	ØMM	X1	VE	WA	NF	PI	VD	WC	ZJ	ZB	ZM	ØFC js13	ØUC –1	ØFB H13	LA	LB
25	14 18	26	15	13	12	3	3	16	150	156	193	75	90	6.6	58	43
32	18 22	30.5	19	13	16	3	3	16	170	176	217	92	110	9	62	47
40	22 28	35.5	19	13	16	3	3	16	190	196	239	106	125	9	73	56
50	28 36	44.5	24	14	20	4	4	18	205	213	255	126	150	11	74	62
63	36 45	54.5	29	16	25	4	4	20	224	234	281	145	170	13.5	84	72
80	45 56	62.5	36	18	32	4	4	22	250	260	316	165	195	17.5	93	81
100	56 70	75.5	37	20	32	5	5	25	300	310	378	200	240	22	117	96
125	70 90	92.5	37	23	32	5	5	28	325	335	416	235	275	22	143	112
160	90 110	115.5	41	25	36	8	5	30	370	380	477	280	320	22	171	130
200	110 140	138.5	45	30	40	15	5	35	450	466	604	340	385	26	230	151

ØAL = Piston Ø

ØMM = Piston rod Ø

X* = Stroke length

1) Thread for piston rod ends "G" and "K"

2) Thread for piston rod ends "H" and "F"

3) ØD4 recess max. 0.5 mm deep

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

5) Throttle valve only with end position cushioning "E" (180° for bleeding)

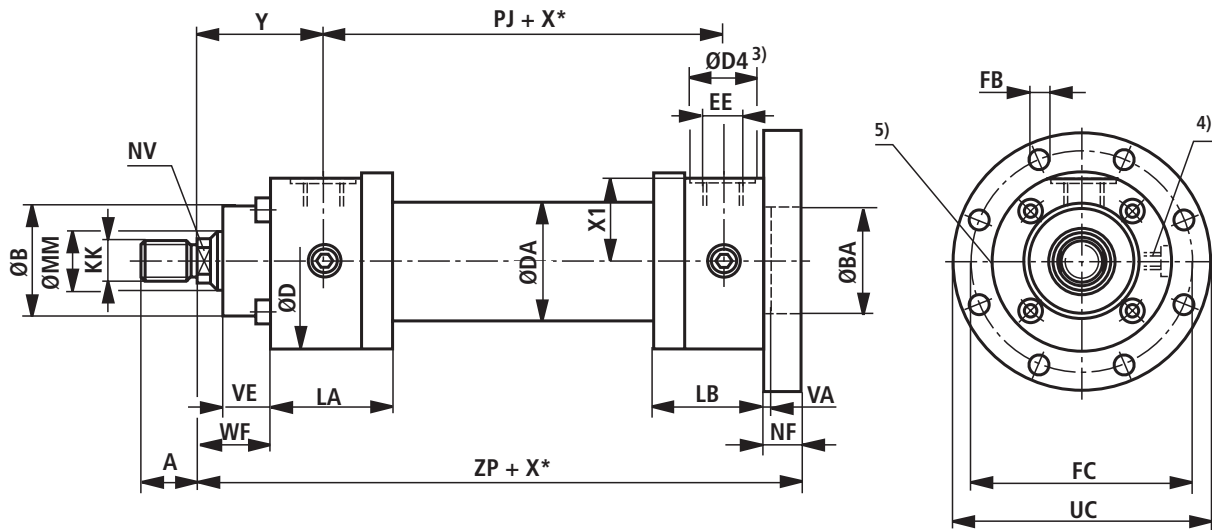
8) Line connection "B"

9) Line connection "R"

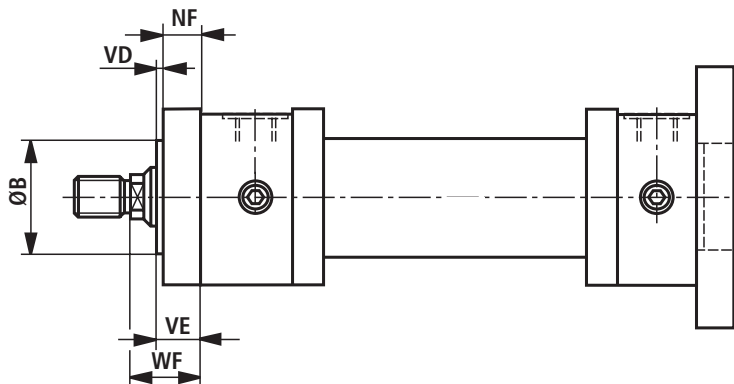
Dimensions CDM1: MF4

(dimensions in mm)

CDM1: MF4



CDM1: MF4..2X/...A: as sleeve design and AL-Ø 50 ... 200 mm



Dimensions CDM1: MF4

(dimensions in mm)

AL Ø	MM Ø	KK ¹⁾ ISO 6020/1	A ¹⁾	KK ²⁾ VW 39 D 920	A ²⁾	NV	ØD	ØDA	ØD4 3; 8)	EE 8)	ØD4 3; 9)	EE 9)	Y	PJ
25	14 18	M12x1.25 M14x1.5	16 18	– M12x1.25	– 16	12 14	56	35	25	G1/4	21	M14x1.5	58	77
32	18 22	M14x1.5 M16x1.5	18 22	– M14x1.5	– 18	14 18	67	42	28	G3/8	26	M18x1.5	64	89
40	22 28	M16x1.5 M20x1.5	22 28	– M16x1.5	– 22	18 22	78	50	34	G1/2	29	M22x1.5	71	97
50	28 36	M20x1.5 M27x2	28 36	– M20x1.5	– 28	22 30	95	60	34	G1/2	29	M22x1.5	72	111
63	36 45	M27x2 M33x2	36 45	– M27x2	– 36	30 36	116	78	42	G3/4	34	M27x2	82	117
80	45 56	M33x2 M42x2	45 56	– M33x2	– 45	36 46	130	95	42	G3/4	34	M27x2	91	134
100	56 70	M42x2 M48x2	56 63	– M42x2	– 56	46 60	158	120	47	G1	43	M33x2	108	162
125	70 90	M48x2 M64x3	63 85	– M48x2	– 63	60 75	192	150	47	G1	43	M33x2	121	174
160	90 110	M64x3 M80x3	85 95	– M64x3	– 85	75 95	237	190	58	G1 1/4	52	M42x2	143	191
200	110 140	M80x3 M100x3	95 112	– M80x3	– 95	95 120	285	230	58	G1 1/4	52	M42x2	190	224
ØAL	ØMM	X1	WF	NF	PI	VE	VD	ØB/BA f8/H8	ZP	ØFC js13	ØUC –1	ØFB H13	LA	LB
25	14 18	26	28	12	3	15	–	32	162	75	90	6.6	58	43
32	18 22	30.5	32	16	3	19	–	40	186	92	110	9	62	47
40	22 28	35.5	32	16	3	19	–	50	206	106	125	9	73	56
50	28 36	44.5	38	20	4	24	4	60	225	126	150	11	74	62
63	36 45	54.5	45	25	4	29	4	70	249	145	170	13.5	84	72
80	45 56	62.5	54	32	4	36	4	85	282	165	195	17.5	93	81
100	56 70	75.5	57	32	5	37	5	106	332	200	240	22	117	96
125	70 90	92.5	60	32	5	37	5	132	357	235	275	22	143	112
160	90 110	115.5	66	36	8	41	5	160	406	280	320	22	171	130
200	110 140	138.5	75	40	15	45	5	200	490	340	385	26	230	151

ØAL = Piston Ø

ØMM = Piston rod Ø

X* = Stroke length

1) Thread for piston rod ends "G" and "K"

2) Thread for piston rod ends "H" and "F"

3) ØD4 recess max. 0.5 mm deep

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

5) Throttle valve only with end position cushioning "E" (180° for bleeding)

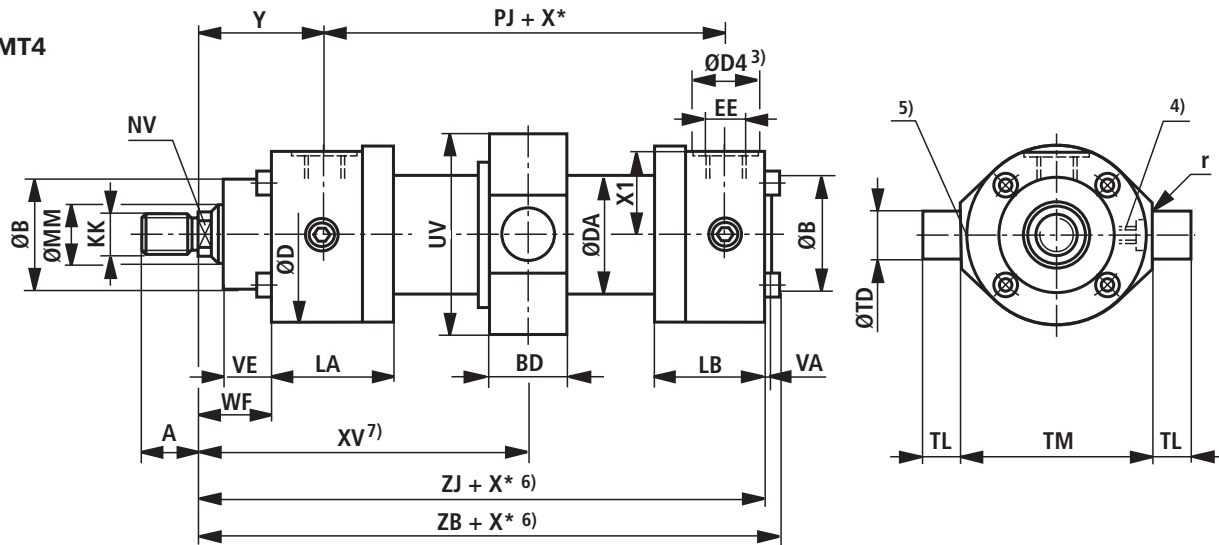
8) Line connection "B"

9) Line connection "R"

Dimensions CDM1 / CGM1: MT4

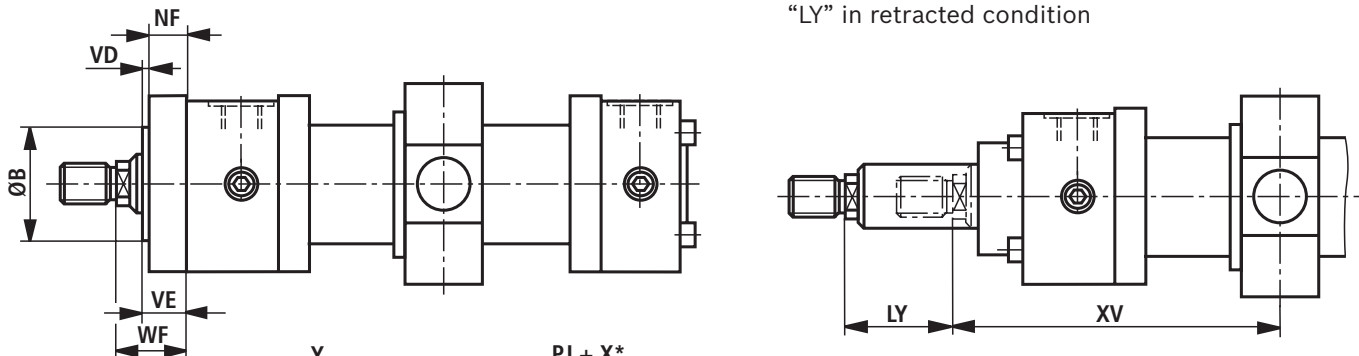
(dimensions in mm)

CDM1: MT4

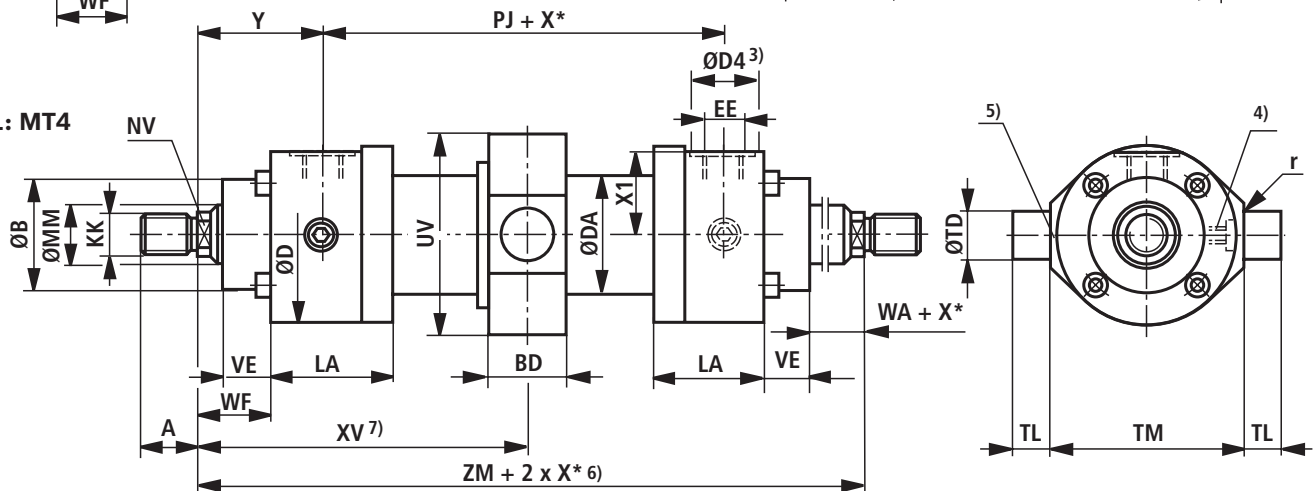


CDM1: MT4..2X/...A: as sleeve design and AL-Ø 50 ... 200 mm

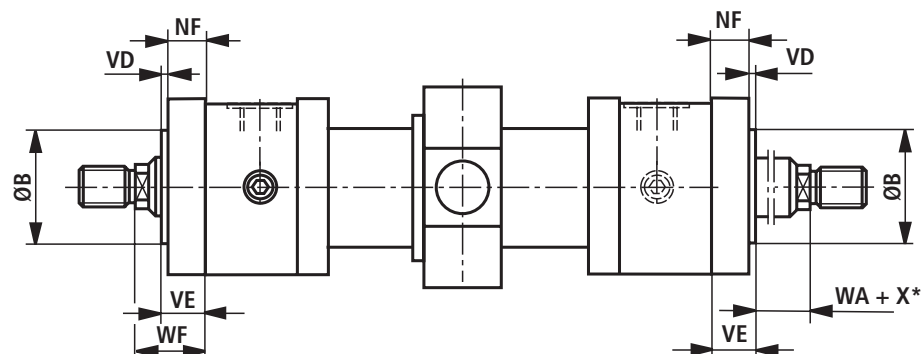
Dimensions for cylinder with piston rod extension "LY" in retracted condition



CGM1: MT4



CGM1: MT4..2X/...A: as sleeve design and AL-Ø 50 ... 200 mm



Dimensions CDM1 / CGM1: MT4

(dimensions in mm)

AL Ø	MM Ø	KK ¹⁾ ISO 6020/1	A ¹⁾	KK ²⁾ VW 39 D 920	A ²⁾	NV	ØB f8	ØD	ØDA	ØD4 3); 8)	EE 8)	ØD4 3); 9)	EE 9)	Y	PJ	X1	VE
25	14 18	M12x1.25 M14x1.5	16 18	— M12x1.25	— 16	12 14	32	56	35	25	G1/4	21	M14x1.5	58	77	26	15
32	18 22	M14x1.5 M16x1.5	18 22	— M14x1.5	— 18	14 18	40	67	42	28	G3/8	26	M18x1.5	64	89	30.5	19
40	22 28	M16x1.5 M20x1.5	22 28	— M16x1.5	— 22	18 22	50	78	50	34	G1/2	29	M22x1.5	71	97	35.5	19
50	28 36	M20x1.5 M27x2	28 36	— M20x1.5	— 28	22 30	60	95	60	34	G1/2	29	M22x1.5	72	111	44.5	24
63	36 45	M27x2 M33x2	36 45	— M27x2	— 36	30 36	70	116	78	42	G3/4	34	M27x2	82	117	54.5	29
80	45 56	M33x2 M42x2	45 56	— M33x2	— 45	36 46	85	130	95	42	G3/4	34	M27x2	91	134	62.5	36
100	56 70	M42x2 M48x2	56 63	— M42x2	— 56	46 60	106	158	120	47	G1	43	M33x2	108	162	75.5	37
125	70 90	M48x2 M64x3	63 85	— M48x2	— 63	60 75	132	192	150	47	G1	43	M33x2	121	174	92.5	37
160	90 110	M64x3 M80x3	85 95	— M64x3	— 85	75 95	160	237	190	58	G1 1/4	52	M42x2	143	191	115.5	41
200	110 140	M80x3 M100x3	95 112	— M80x3	— 95	95 120	200	285	230	58	G1 1/4	52	M42x2	190	224	138.5	45

AL Ø	MM Ø	WF	WA	NF	PI	VD	ZJ	ZB	ZM	BD	UV 10)	r	ØTD f8	TL js13	TM h12	XV ⁷⁾ min.	XV ⁷⁾ max.	X* ⁶⁾ min.	LA	LB
25	14 18	28	13	—	3	—	150	156	193	19	58	0.8	12	10	63	107.5	93.5+X*	22	58	43
32	18 22	32	13	—	3	—	170	176	217	24	67	0.8	16	12	75	118	107+X*	19	62	47
40	22 28	32	13	—	3	—	190	196	239	28	78	1	20	16	90	131	116+X*	23	73	56
50	28 36	38	14	20	4	4	205	213	255	33	95	1	25	20	105	141.5	122.5+X*	28	74	62
63	36 45	45	16	25	4	4	224	234	281	38	116	1.5	32	25	120	164	129+X*	47	84	72
80	45 56	54	18	32	4	4	250	260	316	53	130	2	40	32	135	189.5	138.5+X*	63	93	81
100	56 70	57	20	32	5	5	300	310	378	68	158	2	50	40	160	224	166+X*	70	117	96
125	70 90	60	23	32	5	5	325	335	416	78	210	2.5	63	50	195	261	170+X*	106	143	112
160	90 110	66	25	36	8	5	370	380	477	118	250	3	80	63	240	320	177+X*	163	171	130
200	110 140	75	30	40	15	5	450	466	604	148	300	3	100	80	295	403	221+X*	202	230	151

ØAL = Piston Ø

ØMM = Piston rod Ø

X* = Stroke length

1) Thread for piston rod ends "G" and "K"

2) Thread for piston rod ends "H" and "F"

3) ØD4 recess max. 0.5 mm deep

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

5) Throttle valve only with end position cushioning "E" (180° for bleeding)

6) Observe the min. stroke length "X*_{min.}"

7) When ordering, always specify the "XV" dimension in the plain text (XV_{min.} and XV_{max.})

8) Line connection "B"

9) Line connection "R"

10) Tolerance according to EN ISO 9013: Thermal cutting

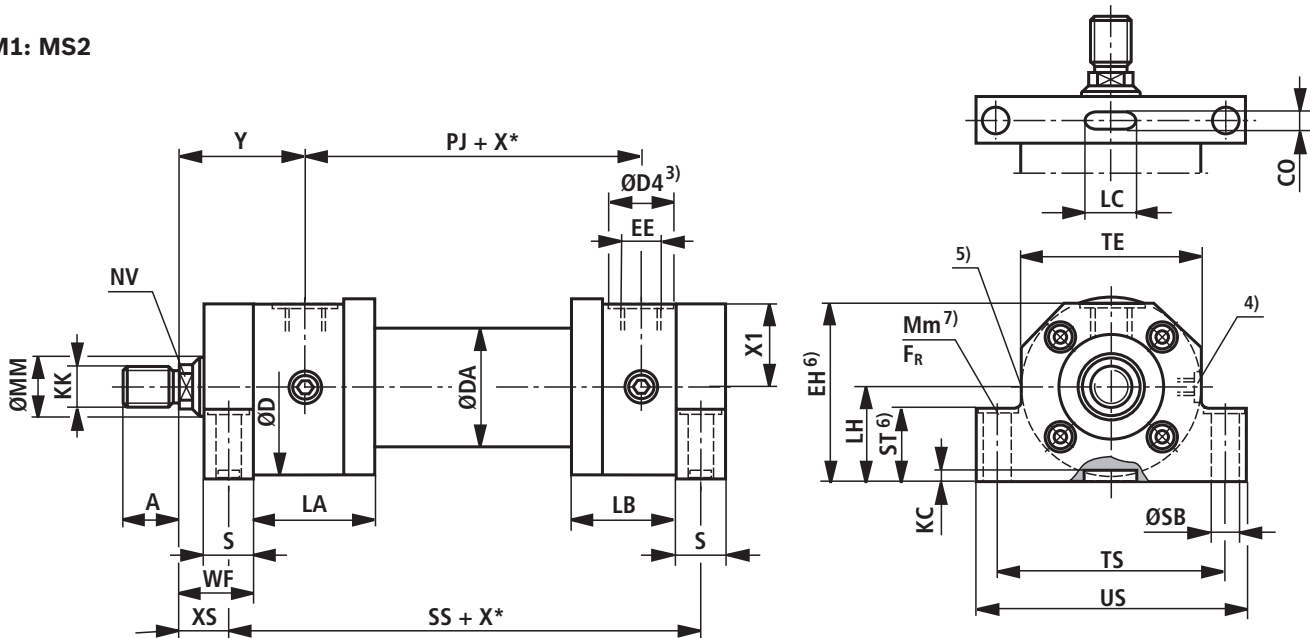
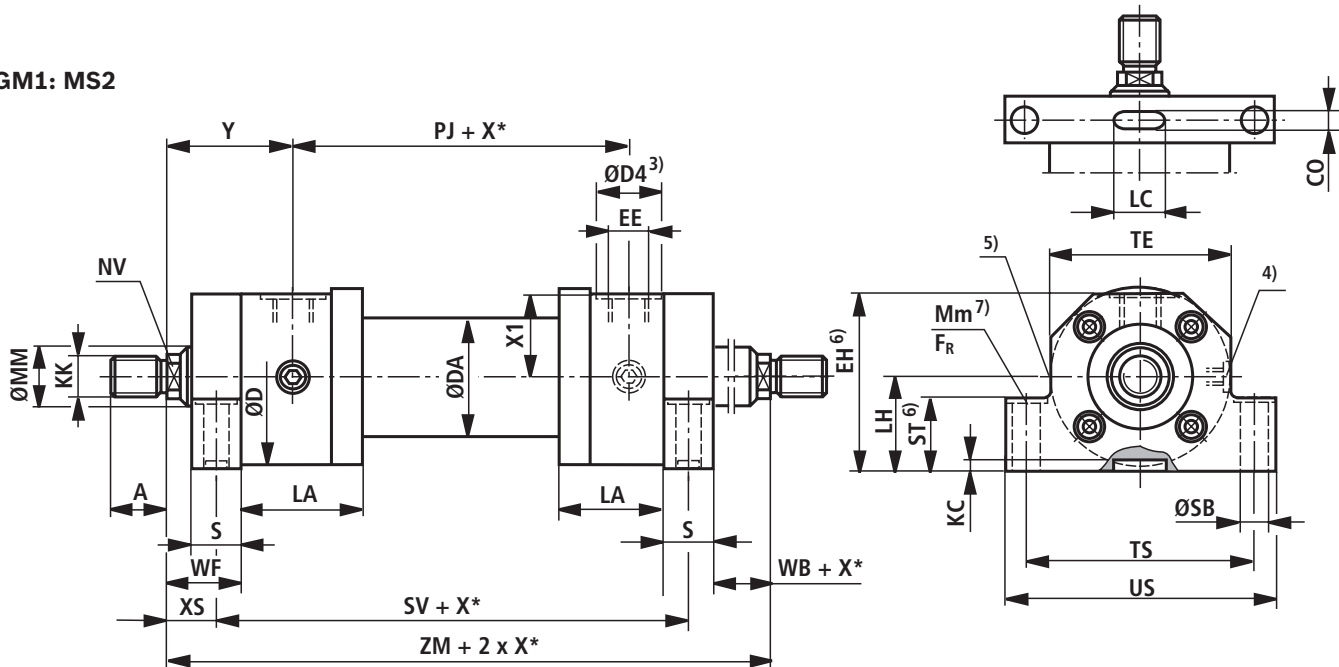
Note: Replacement cylinder for series 1X

In the event of an exchange to series 2X, the bearing blocks (trunnions) must also be replaced!

Comply with XV_{min.}, XV_{max.} and X*_{min.}!

Dimensions CDM1 / CGM1: MS2

(dimensions in mm)

CDM1: MS2

CGM1: MS2

 $\varnothing AL$ = Piston $\varnothing$
 $\varnothing MM$ = Piston rod $\varnothing$
 X^* = Stroke length

1) Thread for piston rod ends "G" and "K"

2) Thread for piston rod ends "H" and "F"

 3) $\varnothing D4$ recess max. 0.5 mm deep

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

 5) Throttle valve only with end position cushioning "E" (180° for bleeding)

6) Specified dimensions are smaller than the max. dimensions in ISO 6020/1

7) Recess max. 2 mm deep, for hexagon socket head cap screws according to ISO 4762

The mounting screws must not be subjected to shear force. The mounting screws according to ISO 4762 (property class 10.9) must be tightened with the specified torque M_m . If the calculated frictional force F_R is lower than the maximum cylinder force, a key must be used on the head.

Calculation basis:

► The specified frictional force F_R refers to a friction factor of 0.2 (steel / steel)

► Foot on the head side as fixed bearing

► Foot on the base side as floating bearing

8) Line connection "B"

9) Line connection "R"

Dimensions CDM1 / CGM1: MS2

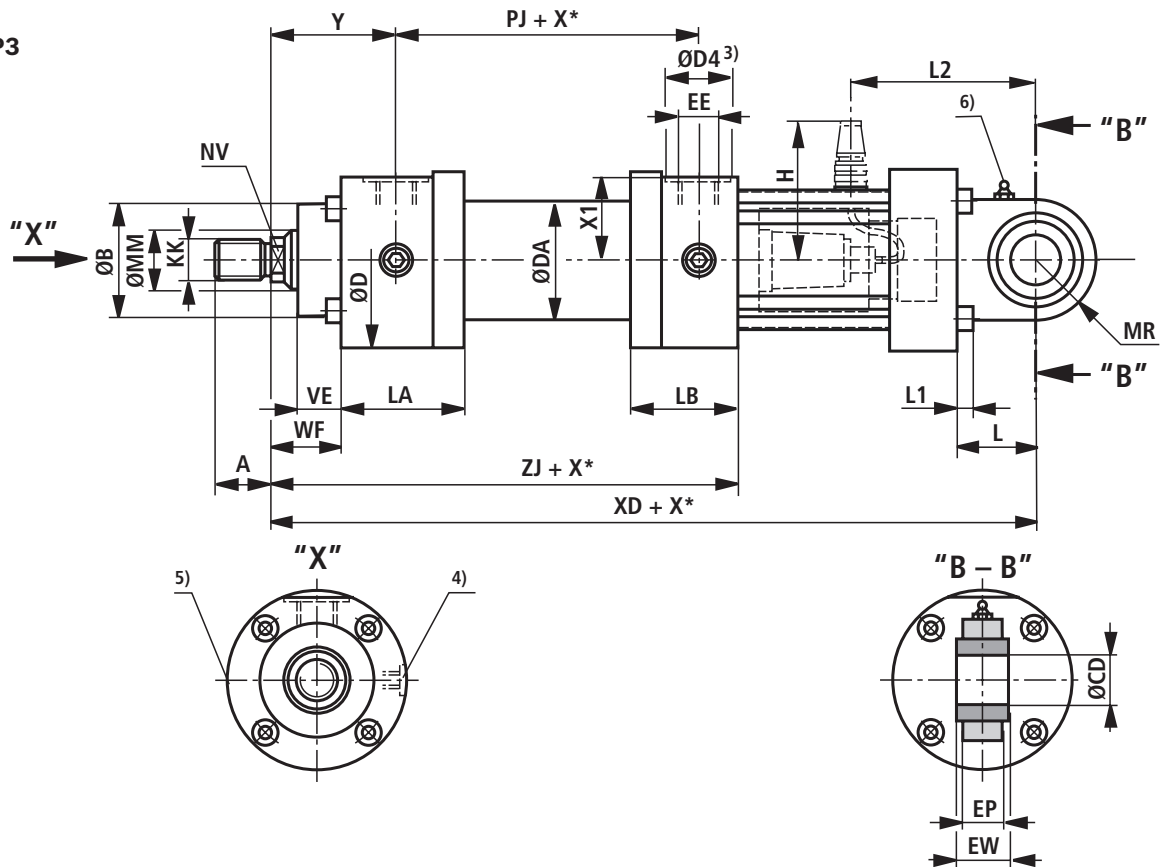
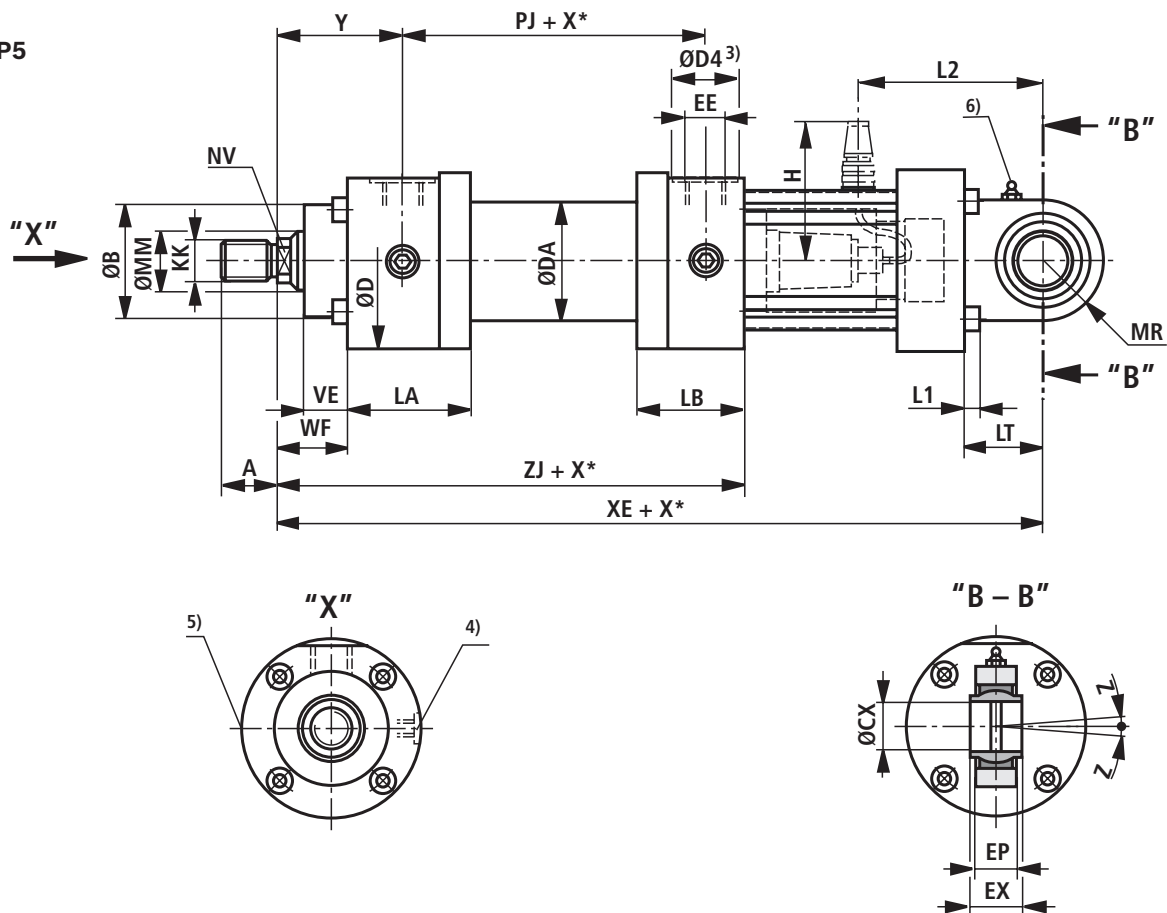
(dimensions in mm)

AL Ø	MM Ø	KK ¹⁾ ISO 6020/1	A ¹⁾	KK ²⁾ VW 39 D 920	A ²⁾	NV	ØD	ØDA	ØD4 3; 8)	EE 8)	ØD4 3; 9)	EE 9)	Y	PJ	X1	WF	WB
25	14 18	M12x1.25 M14x1.5	16 18	— M12x1.25	— 16	12 14	56	35	25	G1/4	21	M14x1.5	58	77	26	28	8
32	18 22	M14x1.5 M16x1.5	18 22	— M14x1.5	— 18	14 18	67	42	28	G3/8	26	M18x1.5	64	89	30.5	32	7
40	22 28	M16x1.5 M20x1.5	22 28	— M16x1.5	— 22	18 22	78	50	34	G1/2	29	M22x1.5	71	97	35.5	32	7
50	28 36	M20x1.5 M27x2	28 36	— M20x1.5	— 28	22 30	95	60	34	G1/2	29	M22x1.5	72	111	44.5	38	6
63	36 45	M27x2 M33x2	36 45	— M27x2	— 36	30 36	116	78	42	G3/4	34	M27x2	82	117	54.5	45	13
80	45 56	M33x2 M42x2	45 56	— M33x2	— 45	36 46	130	95	42	G3/4	34	M27x2	91	134	62.5	54	14
100	56 70	M42x2 M48x2	56 63	— M42x2	— 56	46 60	158	120	47	G1	43	M33x2	108	162	75.5	57	7
125	70 90	M48x2 M64x3	63 85	— M48x2	— 63	60 75	192	150	47	G1	43	M33x2	121	174	92.5	60	4
160	90 110	M64x3 M80x3	85 95	— M64x3	— 85	75 95	237	190	58	G1 1/4	52	M42x2	143	191	115.5	66	6
200	110 140	M80x3 M100x3	95 112	— M80x3	— 95	95 120	285	230	58	G1 1/4	52	M42x2	190	224	138.5	75	3

AL Ø	MM Ø	XS	SS	SV	CO N9	LC +0.5	ZM	KC +0.5	EH ⁶⁾ -1	LH h10	S js13	ØSB H13	ST ⁶⁾	TE	TS js13	US -1	LA	LB	FR ⁷⁾ kN	Mm ⁷⁾ Nm
25	14 18	18	142	157	6	25	193	3.5	57	32	20	9	24	56	75	92	58	43	4.90	30
32	18 22	19.5	163	178	8	36	217	4	67	38	25	11	32	67	90	110	62	47	7.90	60
40	22 28	19.5	183	200	8	36	239	4	77.5	43	25	11	32	78	100	120	73	56	7.90	60
50	28 36	22	199	211	10	40	255	4.5	95	52	32	14	42	95	120	145	74	62	11.10	100
63	36 45	29	211	223	10	40	281	4.5	113	62	32	18	50	116	150	180	84	72	21.15	250
80	45 56	34	236	248	14	63	316	5	129	70	40	22	60	130	170	210	93	81	33.35	490
100	56 70	32	293	314	16	70	378	6	153	82	50	26	70	158	205	250	117	96	48.30	850
125	70 90	32	321	352	18	80	416	6	190	100	56	33	80	192	245	300	143	112	77.80	1710
160	90 110	36	364	405	22	125	477	8	232	119	60	33	90	238	295	350	171	130	77.80	1710
200	110 140	39	447	526	28	160	604	9	282	145	72	39	110	285	350	415	230	151	113.25	2970

Dimensions CSM1: MP3 / MP5

(dimensions in mm)

CSM1: MP3

CSM1: MP5


Dimensions CSM1: MP3 / MP5

(dimensions in mm)

ØAL	ØMM	KK ¹⁾ ISO 6020/1	A ¹⁾	KK ²⁾ VW 39 D 920	A ²⁾	NV	ØB f8	ØD	ØDA	ØD4 3; 8)	EE 8)	ØD4 3; 9)	EE 9)	Y	PJ
40	28	M20x1.5	28	M16x1.5	22	22	50	78	50	34	G1/2	29	M22x1.5	71	97
50	28 36	M20x1.5 M27x2	28 36	– M20x1.5	– 28	22 30	60	95	60	34	G1/2	29	M22x1.5	72	111
63	36 45	M27x2 M33x2	36 45	– M27x2	– 36	30 36	70	116	78	42	G3/4	34	M27x2	82	117
80	45 56	M33x2 M42x2	45 56	– M33x2	– 45	36 46	85	130	95	42	G3/4	34	M27x2	91	134
100	56 70	M42x2 M48x2	56 63	– M42x2	– 56	46 60	106	158	120	47	G1	43	M33x2	108	162
125	70 90	M48x2 M64x3	63 85	– M48x2	– 63	60 75	132	192	150	47	G1	43	M33x2	121	174
160	90 110	M64x3 M80x3	85 95	– M64x3	– 85	75 95	160	237	190	58	G1 1/4	52	M42x2	143	191
200	110 140	M80x3 M100x3	95 112	– M80x3	– 95	95 120	200	285	230	58	G1 1/4	52	M42x2	190	224

ØAL	ØMM	X1	VE	WF	ZJ	XD/XE	CD/CX H9/H7	EP	EW/EX h12	L/LT	L1	MR/MS	H	L2	LA	LB	Z
40	28	35.5	19	32	190	381	20	17	20	38	6	25	110	102	73	56	2°
50	28 36	44.5	24	38	205	407	25	22	25	48	8	32	120	120	74	62	2°
63	36 45	54.5	29	45	224	439	32	27	32	61	10	40	130	138	84	72	4°
80	45 56	62.5	36	54	250	482	40	32	40	78	10	50	120	165	93	81	4°
100	56 70	75.5	37	57	300	545	50	40	50	90	10	63	135	200	117	96	4°
125	70 90	92.5	37	60	325	578	63	52	63	98	12	71	145	208	143	112	4°
160	90 110	115.5	41	66	370	655	80	66	80	127	12	90	165	245	171	130	4°
200	110 140	138.5	45	75	450	765	100	84	100	150	16	112	185	278	230	151	4°

ØAL = Piston Ø

ØMM = Piston rod Ø

X* = Stroke length

1) Thread for piston rod ends "G" and "K"

2) Thread for piston rod ends "H" and "F"

3) ØD4 recess max. 0.5 mm deep

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

5) Throttle valve only with end position cushioning "E" (180° for bleeding)

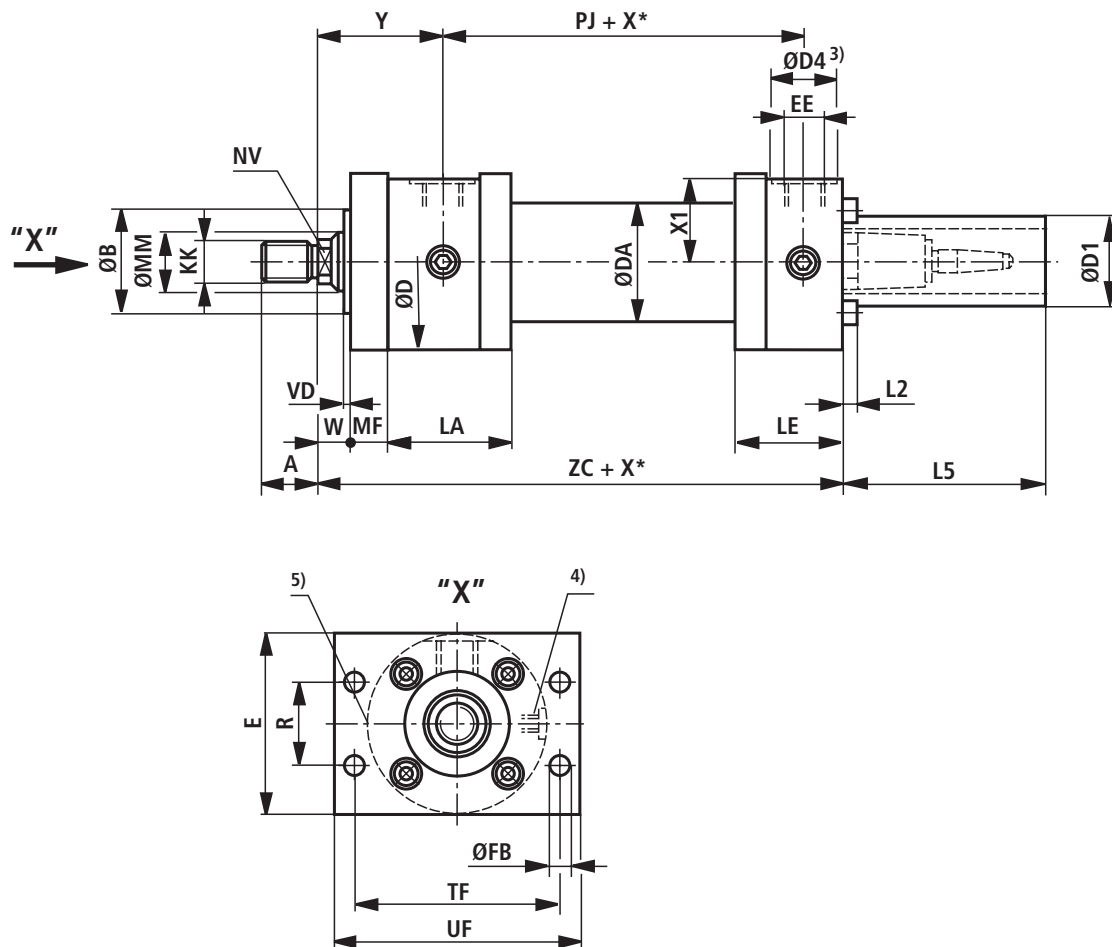
6) Lubricating nipple, cone head form A according to DIN 71412

8) Line connection "B"

9) Line connection "R"

Dimensions CSM1: MF1

(dimensions in mm)

CSM1: MF1


Dimensions CSM1: MF1

(dimensions in mm)

ØAL	Ø MM	KK ¹⁾ ISO 6020/1	A ¹⁾	KK ²⁾ VW 39 D 920	A ²⁾	NV	ØB f8	ØD	ØDA	ØD4 3; 8)	EE 8)	ØD4 3; 9)	EE 9)	Y	PJ
40	28	M20x1.5	28	M16x1.5	22	22	50	78	50	34	G1/2	29	M22x1.5	71	97
50	28 36	M20x1.5 M27x2	28 36	– M20x1.5	– 28	22 30	60	95	60	34	G1/2	29	M22x1.5	72	111
63	36 45	M27x2 M33x2	36 45	– M27x2	– 36	30 36	70	116	78	42	G3/4	34	M27x2	82	117
80	45 56	M33x2 M42x2	45 56	– M33x2	– 45	36 46	85	130	95	42	G3/4	34	M27x2	91	134
100	56 70	M42x2 M48x2	56 63	– M42x2	– 56	46 60	106	158	120	47	G1	43	M33x2	108	162
125	70 90	M48x2 M64x3	63 85	– M48x2	– 63	60 75	132	192	150	47	G1	43	M33x2	121	174

ØAL	ØMM	X1	MF	VD	W	ZC	E	R js13	TF js13	UF	ØFB H13	ØD1	L5	LA	LE	L2
40	28	35.5	16	3	16	211	80	40.6	98	115	9	80	166	73	77	0
50	28 36	44.5	20	4	18	224	100	48.2	116.4	140	11	96	166	74	81	0
63	36 45	54.5	25	4	20	237	120	55.5	134	160	13.5	96	166	84	85	0
80	45 56	62.5	32	4	22	281	135	63.1	152.5	185	17.5	96	166	93	112	10
100	56 70	75.5	32	5	25	322	160	76.5	184.8	225	22	96	166	117	118	0
125	70 90	92.5	32	5	28	347	195	90.2	217.1	255	22	96	166	143	134	0

ØAL = Piston Ø

ØMM = Piston rod Ø

X* = Stroke length

1) Thread for piston rod ends "G" and "K"

2) Thread for piston rod ends "H" and "F"

3) ØD4 recess max. 0.5 mm deep

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

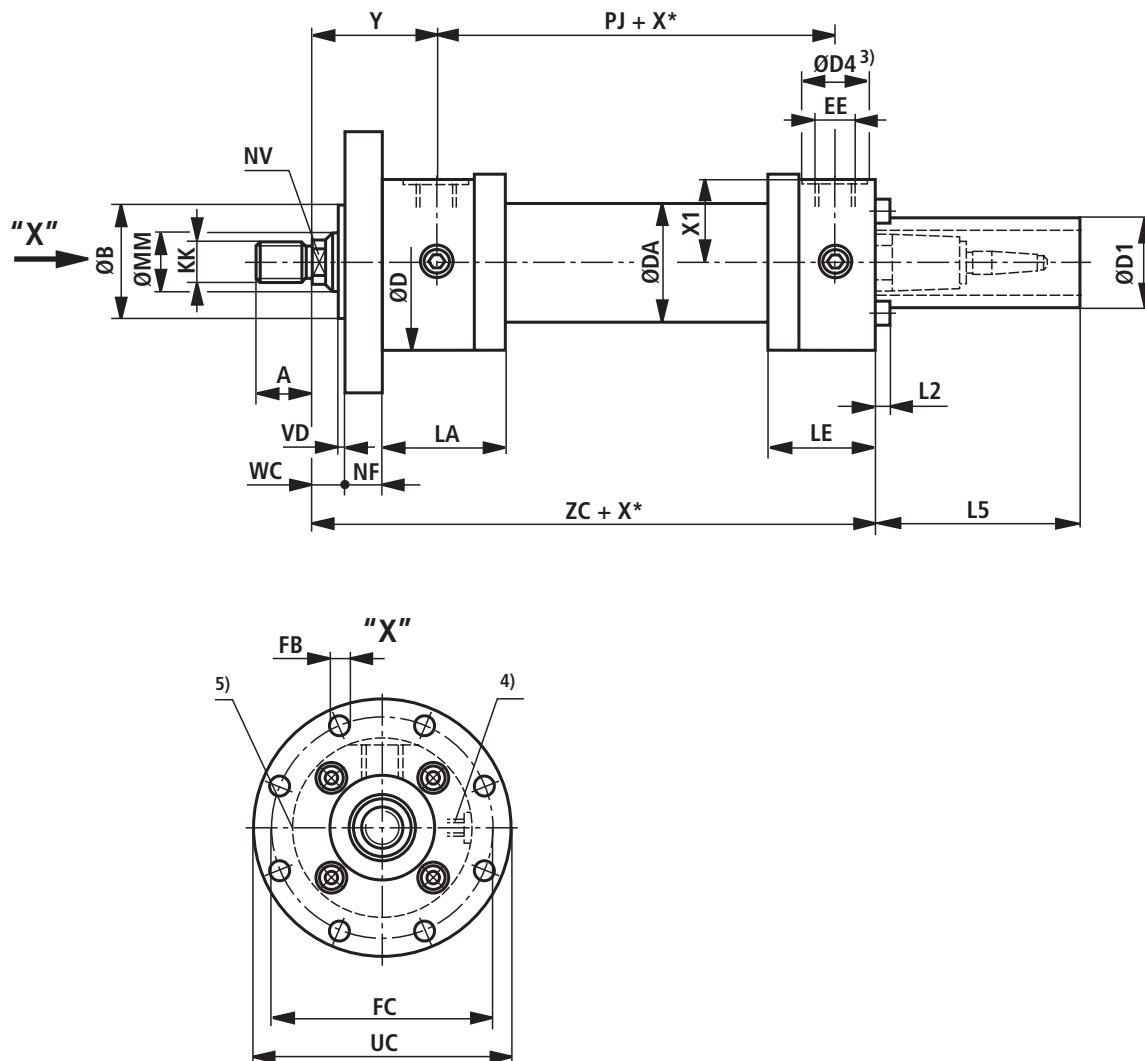
5) Throttle valve only with end position cushioning "E" (180° for bleeding)

8) Line connection "B"

9) Line connection "R"

Dimensions CSM1: MF3

(dimensions in mm)

CSM1: MF3


Dimensions CSM1: MF3

(dimensions in mm)

ØAL	ØMM	KK ¹⁾ ISO 6020/1	A ¹⁾	KK ²⁾ VW 39 D 920	A ²⁾	NV	ØB f8	ØD	ØDA	ØD4 3; 8)	EE 8)	ØD4 3; 9)	EE 9)	Y	PJ
40	28	M20x1.5	28	M16x1.5	22	22	50	78	50	34	G1/2	29	M22x1.5	71	97
50	28 36	M20x1.5 M27x2	28 36	– M20x1.5	– 28	22 30	60	95	60	34	G1/2	29	M22x1.5	72	111
63	36 45	M27x2 M33x2	36 45	– M27x2	– 36	30 36	70	116	78	42	G3/4	34	M27x2	82	117
80	45 56	M33x2 M42x2	45 56	– M33x2	– 45	36 46	85	130	95	42	G3/4	34	M27x2	91	134
100	56 70	M42x2 M48x2	56 63	– M42x2	– 56	46 60	106	158	120	47	G1	43	M33x2	108	162
125	70 90	M48x2 M64x3	63 85	– M48x2	– 63	60 75	132	192	150	47	G1	43	M33x2	121	174
160	90 110	M64x3 M80x3	85 95	– M64x3	– 85	75 95	160	237	190	58	G1 1/4	52	M42x2	143	191
200	110 140	M80x3 M100x3	95 112	– M80x3	– 95	95 120	200	285	230	58	G1 1/4	52	M42x2	190	224

ØAL	ØMM	X1	NF	VD	WC	ZC	ØFC js13	ØUC –1	ØFB H13	ØD1	L5	LA	LE	L2
40	28	35.5	16	3	16	211	106	125	9	80	166	73	77	0
50	28 36	44.5	20	4	18	224	126	150	11	96	166	74	81	0
63	36 45	54.5	25	4	20	237	145	170	13.5	96	166	84	85	0
80	45 56	62.5	32	4	22	281	165	195	17.5	96	166	93	112	10
100	56 70	75.5	32	5	25	322	200	240	22	96	166	117	118	0
125	70 90	92.5	32	5	28	347	235	275	22	96	166	143	134	0
160	90 110	115.5	36	5	30	390	280	320	22	96	166	171	150	0
200	110 140	138.5	40	5	35	472	340	385	26	96	166	230	173	0

ØAL = Piston Ø

ØMM = Piston rod Ø

X* = Stroke length

1) Thread for piston rod ends "G" and "K"

2) Thread for piston rod ends "H" and "F"

3) ØD4 recess max. 0.5 mm deep

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

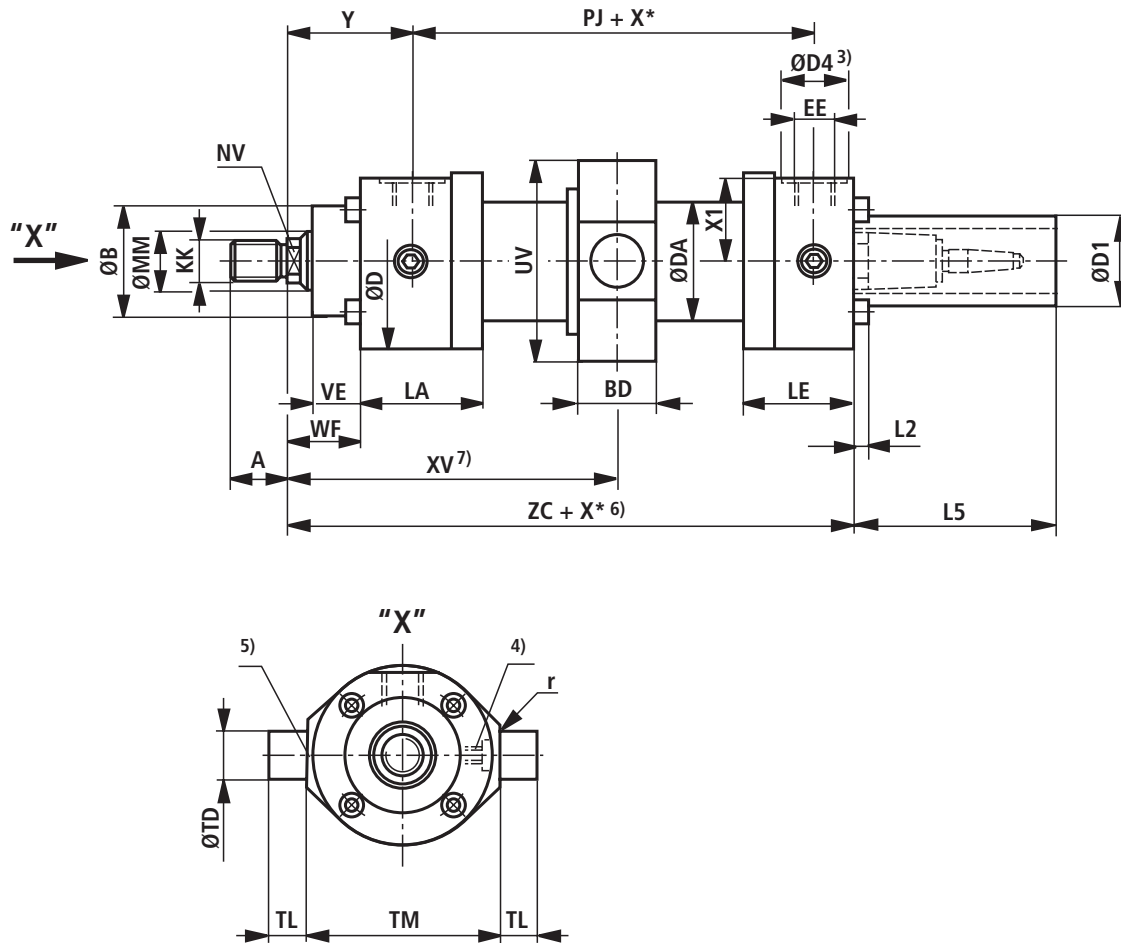
5) Throttle valve only with end position cushioning "E" (180° for bleeding)

8) Line connection "B"

9) Line connection "R"

Dimensions CSM1: MT4

(dimensions in mm)

CSM1: MT4


Dimensions CSM1: MT4

(dimensions in mm)

ØAL	ØMM	KK ¹⁾ ISO 6020/1	A ¹⁾	KK ²⁾ VW 39 D 920	A ²⁾	NV	ØB f8	ØD	ØDA	ØD4 3; 8)	EE 8)	ØD4 3; 9)	EE 9)	Y	PJ	X1
40	28	M20x1.5	28	M16x1.5	22	22	50	78	50	34	G1/2	29	M22x1.5	71	97	35.5
50	28 36	M20x1.5 M27x2	28 36	– M20x1.5	– 28	22 28	60	95	60	34	G1/2	29	M22x1.5	72	111	44.5
63	36 45	M27x2 M33x2	36 45	– M27x2	– 36	28 36	70	116	78	42	G3/4	34	M27x2	82	117	54.5
80	45 56	M33x2 M42x2	45 56	– M33x2	– 45	36 46	85	130	95	42	G3/4	34	M27x2	91	134	62.5
100	56 70	M42x2 M48x2	56 63	– M42x2	– 56	46 60	106	158	120	47	G1	43	M33x2	108	162	75.5
125	70 90	M48x2 M64x3	63 85	– M48x2	– 63	60 75	132	192	150	47	G1	43	M33x2	121	174	92.5
160	90 110	M64x3 M80x3	85 95	– M64x3	– 85	75 95	160	238	190	58	G1 1/4	52	M42x2	143	191	115.5
200	110 140	M80x3 M100x3	95 112	– M80x3	– 95	95 120	200	285	230	58	G1 1/4	52	M42x2	190	224	138.5

ØAL	ØMM	VE	WF	ZC	BD	UV 10)	r	ØTD f8	TL js13	TM h12	XV ⁷⁾ min.	XV ⁷⁾ max.	X* ⁶⁾ min.	ØD1	L5	LA	LE	L2
40	28	19	32	211	28	78	1	20	16	90	131	116+X*	23	80	166	73	77	0
50	28 36	24	38	224	33	95	1	25	20	105	141.5	122.5+X*	28	96	166	74	81	0
63	36 45	29	45	237	38	116	1.5	32	25	120	164	129+X*	47	96	166	84	85	0
80	45 56	36	54	281	53	130	2	40	32	135	189.5	138.5+X*	63	96	166	93	112	10
100	56 70	37	57	322	68	158	2	50	40	160	224	166+X*	70	96	166	117	118	0
125	70 90	37	60	347	78	210	2.5	63	50	195	261	170+X*	106	96	166	143	134	0
160	90 110	41	66	390	118	250	3	80	63	240	320	177+X*	163	96	166	171	150	0
200	110 140	45	75	472	148	300	3	100	80	295	403	221+X*	202	96	166	230	173	0

ØAL = Piston Ø

ØMM = Piston rod Ø

X* = Stroke length

1) Thread for piston rod ends "G" and "K"

2) Thread for piston rod ends "H" and "F"

3) ØD4 recess max. 0.5 mm deep

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

5) Throttle valve only with end position cushioning "E" (180° for bleeding)

6) Observe the min. stroke length "X*_{min.}"

7) When ordering, always specify the "XV" dimension in the plain text (XV_{min.} and XV_{max.})

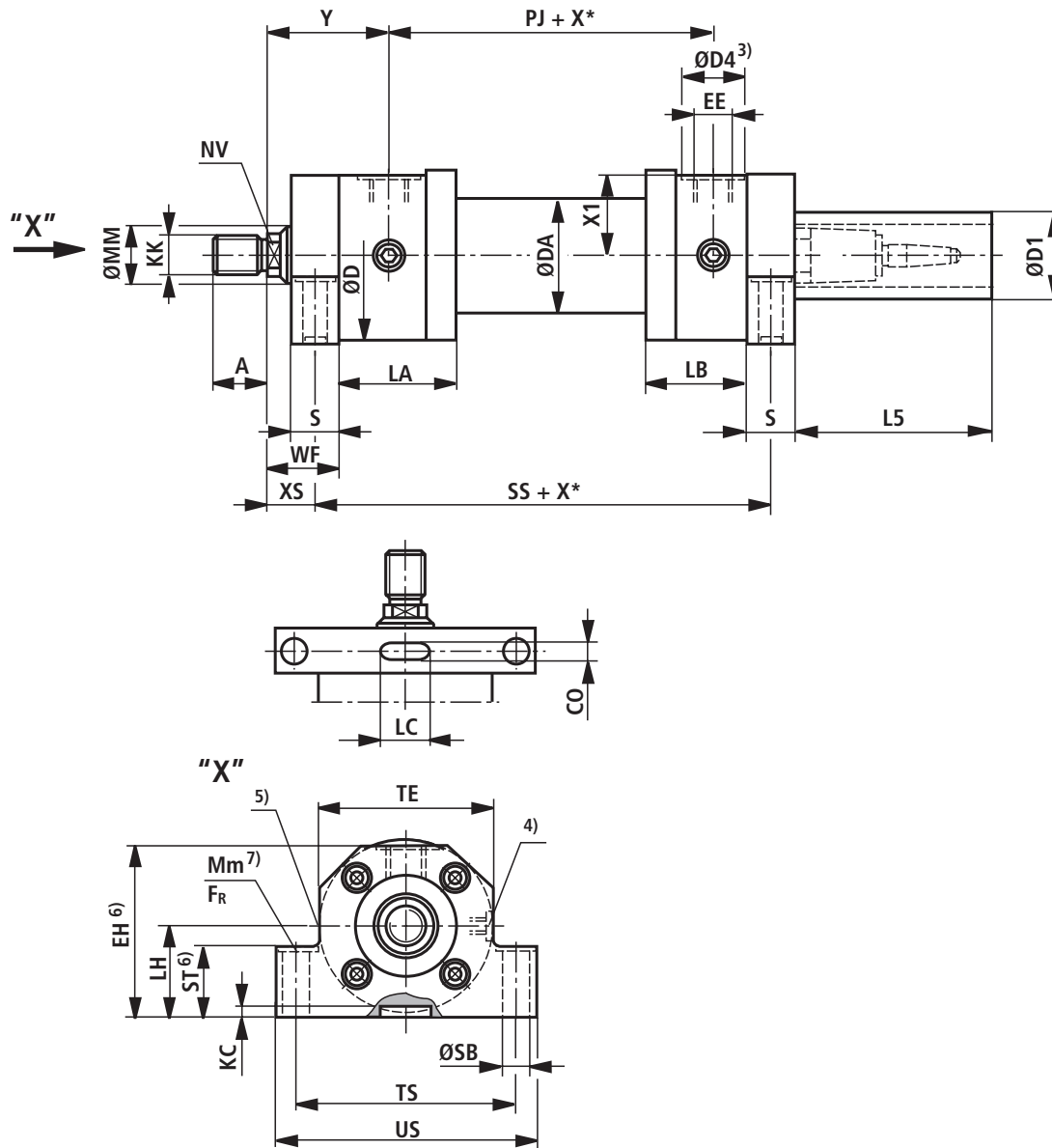
8) Line connection "B"

9) Line connection "R"

10) Tolerance according to EN ISO 9013: Thermal cutting

Dimensions CSM1: MS2

(dimensions in mm)

CSM1: MS2


Dimensions CSM1: MS2

(dimensions in mm)

AL Ø	MM Ø	KK ¹⁾ ISO 6020/1	A ¹⁾	KK ²⁾ VW 39 D 920	A ²⁾	NV	ØD	ØDA	ØD4 3; 8)	EE 8)	ØD4 3; 9)	EE 9)	Y	PJ	X1	WF	XS
40	28	M20x1.5	28	M16x1.5	22	22	78	50	34	G1/2	29	M22x1.5	71	97	35.5	32	19.5
50	28 36	M20x1.5 M27x2	28 36	– M20x1.5	– 28	22 30	95	60	34	G1/2	29	M22x1.5	72	111	44.5	38	22
63	36 45	M27x2 M33x2	36 45	– M27x2	– 36	30 36	116	78	42	G3/4	34	M27x2	82	117	54.5	45	29
80	45 56	M33x2 M42x2	45 56	– M33x2	– 45	36 46	130	95	42	G3/4	34	M27x2	91	134	62.5	54	34
100	56 70	M42x2 M48x2	56 63	– M42x2	– 56	46 60	158	120	47	G1	43	M33x2	108	162	75.5	57	32
125	70 90	M48x2 M64x3	63 85	– M48x2	– 63	60 75	192	150	47	G1	43	M33x2	121	174	92.5	60	32
160	90 110	M64x3 M80x3	85 95	– M64x3	– 85	75 95	237	190	58	G1 1/4	52	M42x2	143	191	115.5	66	36
200	110 140	M80x3 M100x3	95 112	– M80x3	– 95	95 120	285	230	58	G1 1/4	52	M42x2	190	224	138.5	75	39

ØAL	ØMM	SS	CO N9	LC +0.5	KC +0.5	EH ⁶⁾ –1	LH h10	S js13	ØSB H13	ST 6)	TE	TS js13	US –1	ØD1	L5	LA	LB	FR ⁷⁾ kN	Mm ⁷⁾ Nm
40	28	183	8	36	4	77.5	43	25	11	32	78	100	120	80	166	73	56	7.90	60
50	28 36	199	10	40	4.5	95	52	32	14	42	95	120	145	96	166	74	62	11.10	100
63	36 45	211	10	40	4.5	113	62	32	18	50	116	150	180	96	166	84	72	21.15	250
80	45 56	236	14	63	5	129	70	40	22	60	130	170	210	96	166	93	81	33.35	490
100	56 70	293	16	70	6	153	82	50	26	70	158	205	250	96	138	117	96	48.30	850
125	70 90	321	18	80	6	190	100	56	33	80	192	245	300	96	132	143	112	77.80	1710
160	90 110	364	22	125	8	232	119	60	33	90	238	295	350	96	126	171	130	77.80	1710
200	110 140	447	28	160	9	282	145	72	39	110	285	350	415	96	116	230	151	113.25	2970

ØAL = Piston Ø

ØMM = Piston rod Ø

X* = Stroke length

1) Thread for piston rod ends "G" and "K"

2) Thread for piston rod ends "H" and "F"

3) ØD4 recess max. 0.5 mm deep

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

5) Throttle valve only with end position cushioning "E" (180° for bleeding)

6) Specified dimensions are smaller than the max. dimensions in ISO 6020/1

7) Recess max. 2 mm deep, for hexagon socket head cap screws according to ISO 4762

The mounting screws must not be subjected to shear force. The mounting screws according to ISO 4762 (property class 10.9) must be tightened with the specified torque M_m .

If the calculated frictional force F_R is lower than the maximum cylinder force, a key must be used on the head.

Calculation basis:

► The specified frictional force F_R refers to a friction factor of 0.2 (steel / steel)

► Foot on the head side as fixed bearing

► Foot on the base side as floating bearing

8) Line connection "B"

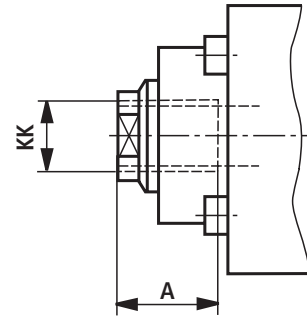
9) Line connection "R"

Piston rod end E

(dimensions in mm)

ØAL	ØMM	KK	A
ISO 6020/1			
32	22	M16x1.5	22
40	22	M16x1.5	22
	28	M20x1.5	28
50	28	M20x1.5	28
	36	M27x2	36
63	36	M27x2	36
	45	M33x2	45
80	45	M33x2	45
	56	M42x2	56

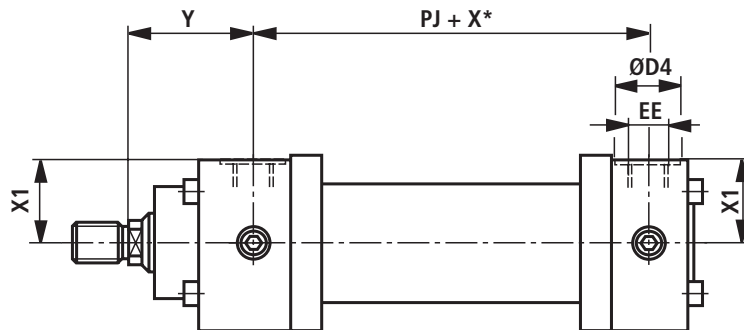
ØAL	ØMM	KK	A
ISO 6020/1			
100	56	M42x2	56
	70	M48x2	63
125	70	M48x2	63
	90	M64x3	85
160	90	M64x3	85
	110	M80x3	95
200	110	M80x3	95
	140	M100x3	112



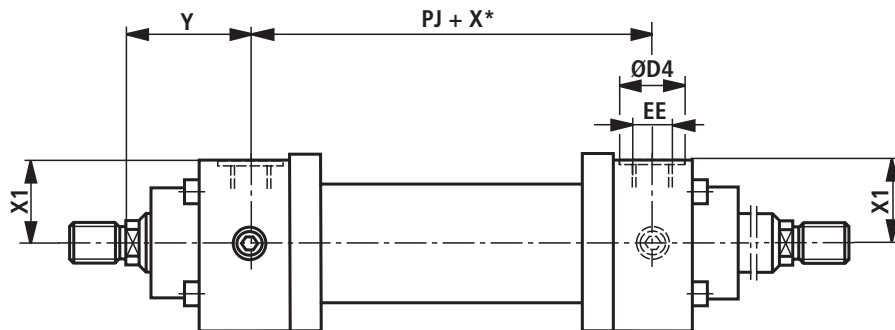
Enlarged line connections

(dimensions in mm)

CDM1



CGM1



Ø AL	Version "S"				
	ISO 1179-1				
	EE	ØD4 ¹⁾	Y	PJ	X1
25	-	-	-	-	-
32	-	-	-	-	-
40	-	-	-	-	-
50	-	-	-	-	-
63	G1	47	80	121	53.5
80	G1	47	91	134	60.5
100	G1 1/4	58	108	162	74
125	G1 1/4	58	121	174	92
160	G1 1/2	65	143	191	114.5
200	G1 1/2	65	190	224	138.5

Main dimensions see pages 14 ... 39

ØAL = Piston Ø

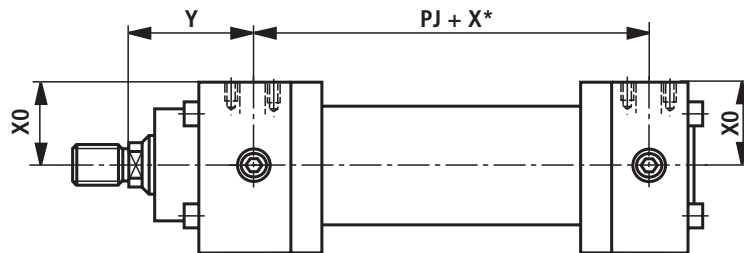
ØMM = Piston rod Ø

X* = Stroke length

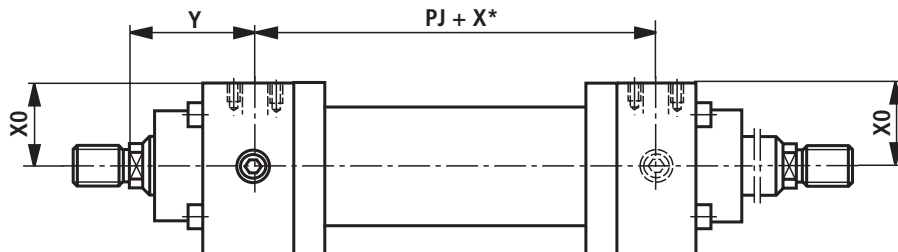
1) ØD4 recess max. 0.5 mm deep

Flange ports (dimensions in mm)

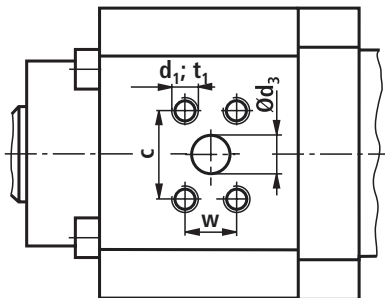
CDM1



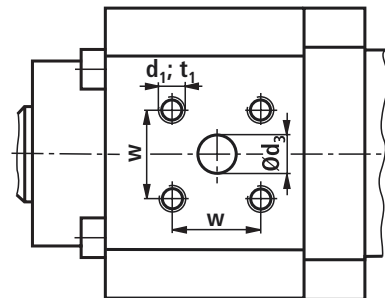
CGM1



Dimensions for rectangular flange
according to ISO 6162-1 ($\hat{=}$ SAE 3000 PSI)



Dimensions for square flange
according to ISO 6164



ØAL	Version "F" ISO 6162-1 ($\hat{=}$ SAE 3000 PSI) ¹⁾									Version "H" ISO 6164						
	Y	PJ	X0	Ød ₃	Ød ₃ ¹⁾	c ±0.25	w ±0.25	d ₁	t ₁ ²⁾	Y	PJ	X0	Ød ₃	w ±0.25	d ₁	t ₁ ²⁾
25	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
32	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
40	—	—	—	—	—	—	—	—	—	69	101	34.5	10	24.7	M6	13
50	72	111	41	13	1/2"	38.1	17.5	M8	14	72	111	44	10	24.7	M6	13
63	82	117	52	13	1/2"	38.1	17.5	M8	16	82	117	52	13	29.7	M8	16
80	91	134	60	13	1/2"	38.1	17.5	M8	16	91	134	60	13	29.7	M8	16
100	108	162	72	19	3/4"	47.6	22.3	M10	20	108	162	72	19	35.4	M8	16
125	121	174	91	19	3/4"	47.6	22.3	M10	20	121	174	91	19	35.4	M8	16
160	143	191	114	25	1"	52.4	26.2	M10	20	143	191	114	25	43.8	M10	20
200	190	224	138	25	1"	52.4	26.2	M10	20	190	224	138	25	43.8	M10	20

Main dimensions see pages 14 ... 39

ØAL = Piston Ø

X* = Stroke length

¹⁾ Flange connection according to ISO 6162-1 corresponds to flange connection according to SAE 3000 PSI

²⁾ Thread depth

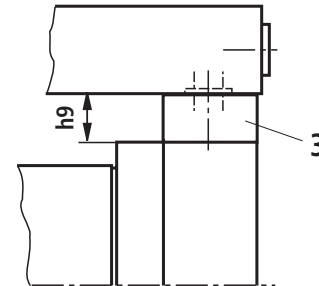
Subplates for valve mounting (SL and SV valve)

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 locking pin
- 3 Adapter plate for MT4 type of mounting
(part of the scope of delivery for MT4)
- 4 Line connection "B" dimensions, see also page 14 ... 39

Installation situation with MT4

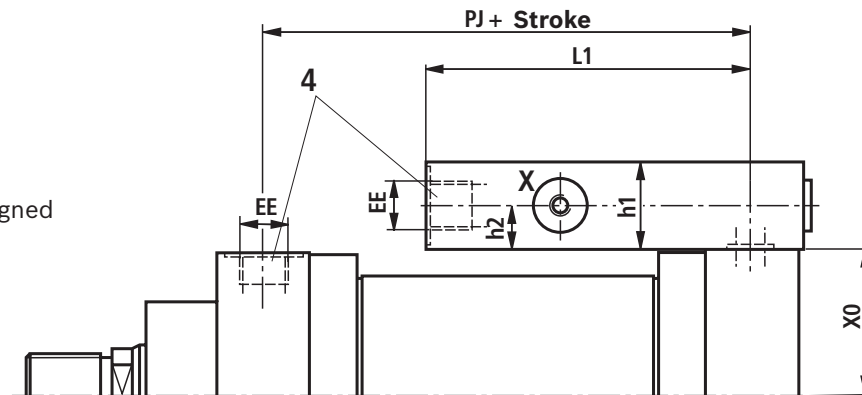


Important note:

Subplates for SL and SV valves
(isolator valves)

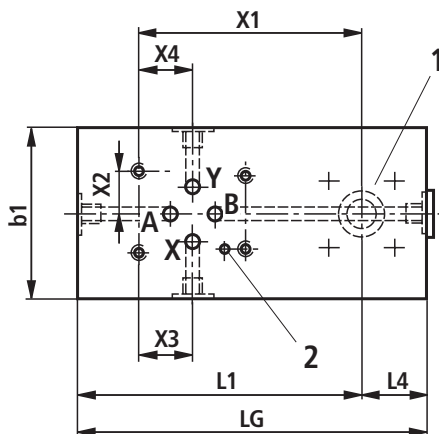
Note:

Seal design T and S are not designed for the static holding function!



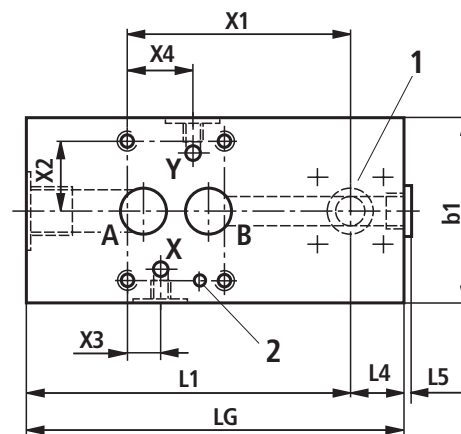
Size 6

Dimensions according to DIN 24340 form A and ISO 4401

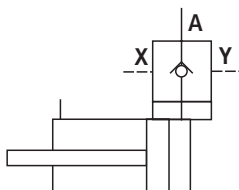


Size 10 and 20

Dimensions according to DIN 24340 form D and ISO 5781



Piping symbol



Subplates for valve mounting

(SL and SV valve – dimensions in mm)

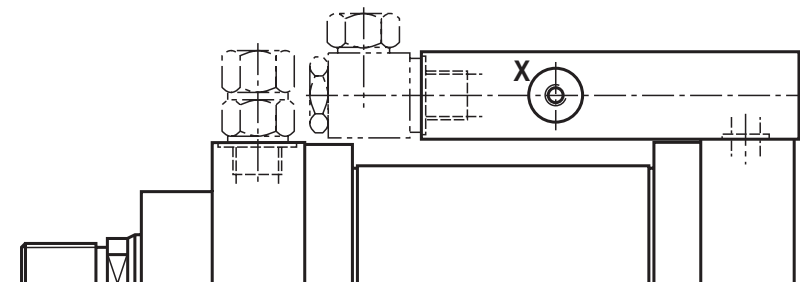
ØAL	Valve size	PJ	EE	Minimum stroke ¹⁾		X0	Plate dimensions							Port size, Porting pattern						Position point Valve	
				²⁾	³⁾		L1	L4	L5	LG	b1	h1	h9	h2	A	X	Y	X3	X4	X1	X2
40	6	97	G1/2	100	100	34.5	90	20	4	110	55	40	10	20	G1/2	G1/4	G1/4	21.5	21.5	65.5	15.5
50	6	111	G1/2	100	100	44	90	20	4	110	55	40	10	20	G1/2	G1/4	G1/4	21.5	21.5	65.5	15.5
63	6	117	G3/4	100	100	52	100	25	5	125	55	45	10	22.5	G3/4	G1/4	G1/4	21.5	21.5	70.5	15.5
	10	117	G3/4	100	100	52	105	25	5	130	85	45	10	22.5	G3/4	G1/4	G1/4	21.5	21.5	73	33.35
80	6	134	G3/4	100	100	60	100	25	5	125	55	45	10	22.5	G3/4	G1/4	G1/4	21.5	21.5	70.5	15.5
	10	134	G3/4	100	100	60	105	25	5	130	85	45	10	22.5	G3/4	G1/4	G1/4	21.5	21.5	73	33.35
100	10	162	G1	100	100	72	102	28	5	130	85	50	10	25	G1	G1/4	G1/4	21.5	21.5	70	33.35
125	10	174	G1	100	106	91	102	28	5	130	85	50	20	25	G1	G1/4	G1/4	21.5	21.5	70	33.35
	20	174	G1	100	106	91	137	28	5	165	100	50	20	25	G1	G1/4	G1/4	20.6	39.5	92	39.7
160	10	191	G1 1/4	100	163	114	115	35	5	150	85	60	20	30	G1 1/4	G1/4	G1/4	21.5	21.5	80	33.35
	20	191	G1 1/4	100	163	114	140	35	5	175	100	60	20	30	G1 1/4	G1/4	G1/4	20.6	39.5	95	39.7
200	10	224	G1 1/4	100	202	138	115	35	5	150	85	60	20	30	G1 1/4	G1/4	G1/4	21.5	21.5	80	33.35
	20	224	G1 1/4	100	202	138	140	35	5	175	100	60	20	30	G1 1/4	G1/4	G1/4	20.6	39.5	95	39.7

ØAL = Piston Ø

²⁾ Not for MT4

³⁾ Not for MT4

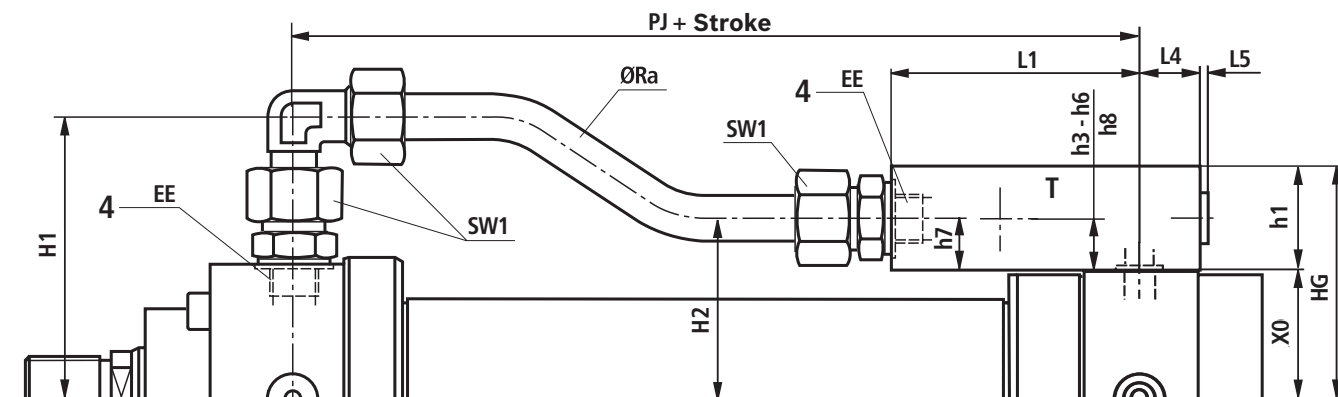
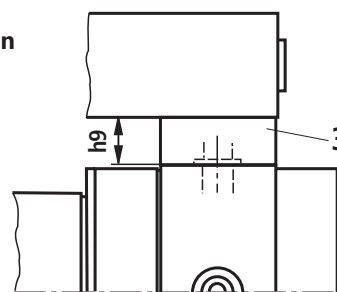
¹⁾ The information only applies to the following connection situation!



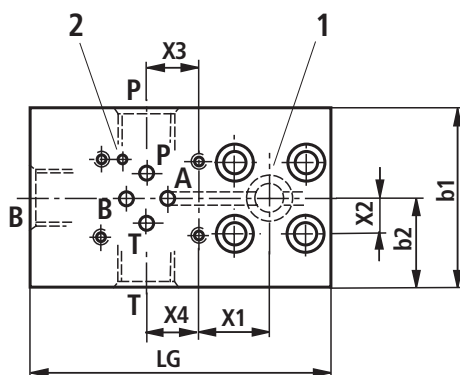
Subplates for valve mounting (directional and high-response valves)

- 1 Port B to the piston side according to ISO 6164
- 2 Bore for locking pin
- 3 Adapter plate for MT4 type of mounting
(part of the scope of delivery for MT4)
- 4 Line connection "B" dimensions, see also page 14 ... 39

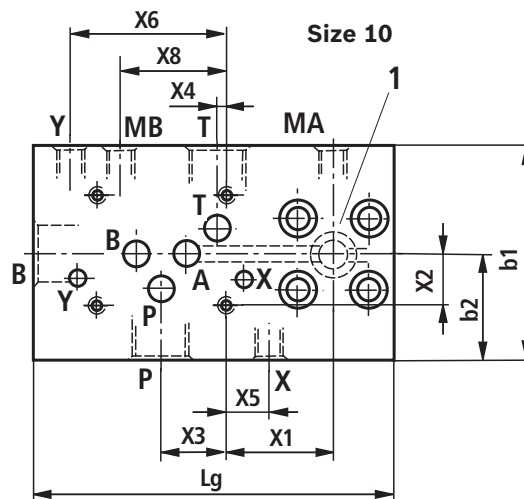
Installation situation
with MT4



Size 6



Size 10



Subplates for valve mounting

(directional and high-response valves – dimensions in mm)

ØAL	Valve size	PJ	EE	Minimum stroke	Plate and piping dimensions																
					L1	L4	L5 _{max.}	H1	H2 ¹⁾	H2 ²⁾	Wrench size 1 mm	ØRa	b1	h1	lg	HG ¹⁾	HG ²⁾	b2	X0	h7	h9
40	6	101	G1/2	225	90	20	4	90	54.5	64.5	30	16.0 x 2.5	65	40	110	74.5	84.5	32.5	34.5	20	10
50	6	111	G1/2	215	90	20	4	99	64	74	30	16.0 x 2.5	65	40	110	84	94	32.5	44	20	10
63	6	117	G3/4	250	100	25	5	119	74.5	84.5	36	20.0 x 3.0	75	45	125	97	107	37.5	52	22.5	10
	10	117	G3/4	275	125	25	5	119	75	85	36	20.0 x 3.0	90	70	150	122	132	45	52	23	10
80	6	134	G3/4	235	100	25	5	127	82.5	92.5	36	20.0 x 3.0	75	45	125	105	115	37.5	60	22.5	10
	10	134	G3/4	260	125	25	5	127	83	93	36	20.0 x 3.0	90	70	150	130	140	45	60	23	10
100	10	162	G1	280	132	28	5	148	102	112	46	25.0 x 4.0	90	80	160	152	162	45	72	30	10
125	10	174	G1	270	132	28	5	165	121	141	46	25.0 x 4.0	90	80	160	171	191	45	91	30	20
	16	174	G1	300	162	28	5	165	131	151	46	25.0 x 4.0	120	90	190	181	201	77.5	91	40	20
160	10	191	G1 1/4	295	135	35	5	193.5	149	169	50	30.0 x 5.0	105	95	170	209	229	55	114	35	20
	16	191	G1 1/4	335	175	35	5	193.5	159	179	50	30.0 x 5.0	125	100	210	214	234	77.5	114	45	20
200	10	224	G1 1/4	260	135	35	5	216.5	173	193	50	30.0 x 5.0	105	95	170	233	253	55	138	35	20
	16	224	G1 1/4	300	175	35	5	216.5	183	203	50	30.0 x 5.0	125	100	210	238	258	77.5	138	45	20

ØAL	Valve size	Connection size, position of connections															
		P	X3	h3	T	X4	h4	X	X5	h5	Y	X6	h6	MA	MB	X8	h8
40	6	G1/2	21.5	20	G1/2	21.5	20	–	–	–	–	–	–	–	–	–	–
50	6	G1/2	21.5	20	G1/2	21.5	20	–	–	–	–	–	–	–	–	–	–
63	6	G3/4	21.5	22.5	G3/4	21.5	22.5	–	–	–	–	–	–	–	–	–	–
	10	G3/4	27	33	G3/4	3.5	33	G1/4	18	47	G1/4	65	47	G1/4	G1/4	60	17
80	6	G3/4	21.5	22.5	G3/4	21.5	22.5	–	–	–	–	–	–	–	–	–	–
	10	G3/4	27	33	G3/4	3.5	33	G1/4	18	47	G1/4	65	47	G1/4	G1/4	60	17
100	10	G1	27	30	G1	3.5	40	G1/4	18	57	G1/4	65	57	G1/4	G1/4	58	20
125	10	G1	27	30	G1	3.5	40	G1/4	18	57	G1/4	65	57	G1/4	G1/4	58	20
	16	G1	50	26	G1	17.0	25	G1/4	105	45	G1/4	88	70	G1/4	G1/4	88	35
160	10	G1 1/4	27	35	G1 1/4	3.5	45	G1/4	20	72	G1/4	65	72	G1/4	G1/4	55	25
	16	G1 1/4	52	32	G1 1/4	15.0	32	G1/4	110	55	G1/4	88	80	G1/4	G1/4	88	40
200	10	G1 1/4	27	35	G1 1/4	3.5	45	G1/4	20	72	G1/4	65	72	G1/4	G1/4	55	25
	16	G1 1/4	52	32	G1 1/4	15.0	32	G1/4	110	55	G1/4	88	80	G1/4	G1/4	88	40

ØAL	Valve size	Position point Valve	
		X1	X2
40	6	25	15.5
50	6	25	15.5
63	6	30	15.5
	10	45	21.4
80	6	30	15.5
	10	45	21.4
100	10	52	21.4
125	10	52	21.4
	16	37	55.6
160	10	55	21.4
	16	45	55.6
200	10	55	21.4
	16	45	55.6

1) Not for MT4

2) Not for MT4

The dimensions h3, h4, h5, h6, h8 and X3, X4, X5, X6, define the position of connections P, T, B, X, Y.

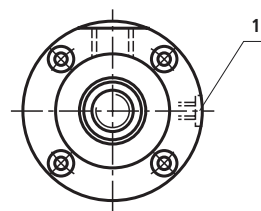
Bleeding / measuring coupling

(dimensions in mm)

By default, a patented safety bleeding device against unintended screwing out in head and base is delivered for piston $\varnothing \geq 40$ mm.

For piston $\varnothing 25$ and 32 mm, a bleed screw G1/8 is installed in head and base which is **not** secured against screwing out.

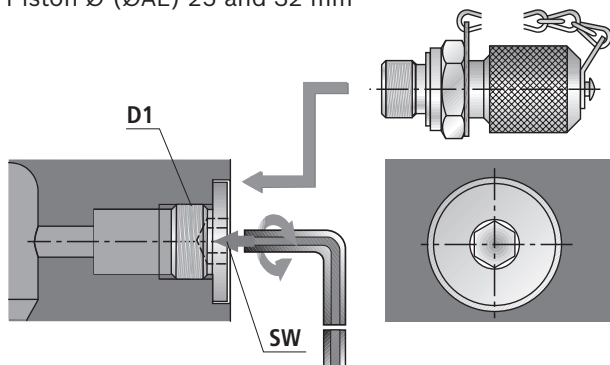
The port allows for the installation of a measuring coupling with check valve for pressure measurement or contamination-free bleeding. Measuring coupling with check valve function, i.e. it can also be connected when the system is pressurized.



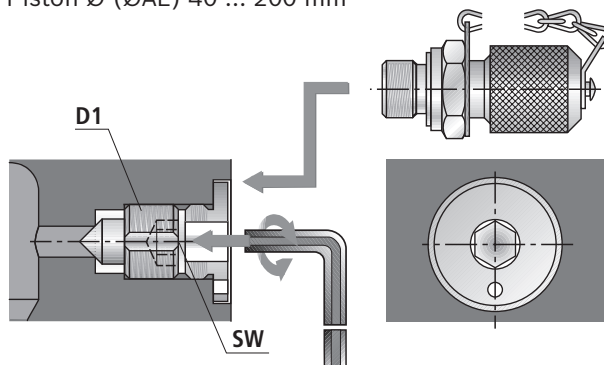
- 1) Bleeding: With view to the piston rod, the position is offset by 90° in relation to the line connection (clockwise)

Connection possibility for measuring coupling

Piston $\varnothing$ ($\varnothing$ AL) 25 and 32 mm



Piston $\varnothing$ ($\varnothing$ AL) 40 ... 200 mm



$\varnothing$ AL	Bleed screw			Measuring coupling
	D1	Fuse	SW	D2
25 and 32	G1/8	not secured	5	G1/8
40 and 50	G1/8	secured	5	G1/8
63 ... 200	G1/4	secured	6	G1/4

Scope of delivery: Measuring coupling **G1/8**

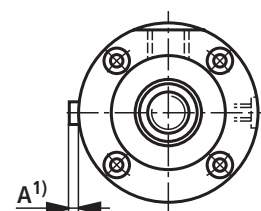
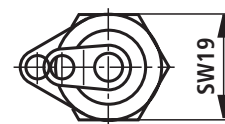
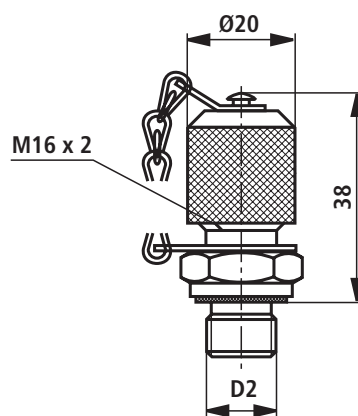
MEASURING COUPLING AB 20-11/K3 G1/8 with seal ring made from NBR

MEASURING COUPLING AB 20-11/K3V G1/8 with seal ring made from FKM

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

MEASURING COUPLING AB 20-11/K1 G1/4 with seal ring made from NBR

MEASURING COUPLING AB 20-11/K1V G1/4 with seal ring made from FKM



Throttle valve

(dimensions in mm)

$\varnothing$ AL	25	32	40	50	63	80	100	125	160	200
Protrusion A ¹⁾	6.5	4	5.5	1.5	0	0	0	0	0	0

$\varnothing$ AL = Piston $\varnothing$

¹⁾ Throttle valve only with end position cushioning "E" (180° for bleeding) Protrusion A in closed condition

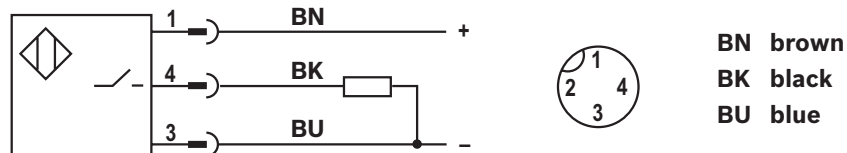
Proximity switch

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, locks 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 has been 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 equipped with proximity switches.

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 according to DIN 40050
	– Proximity switch	IP	67 according to DIN 40050
Housing material			

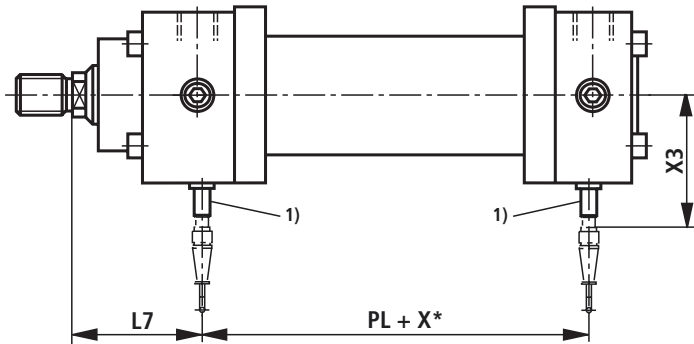
Pin assignment



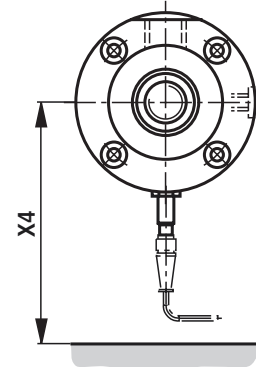
Proximity switch

(dimensions in mm)

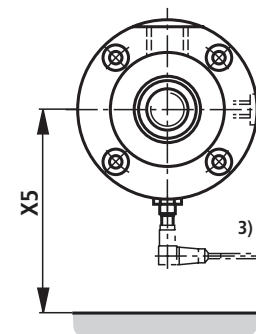
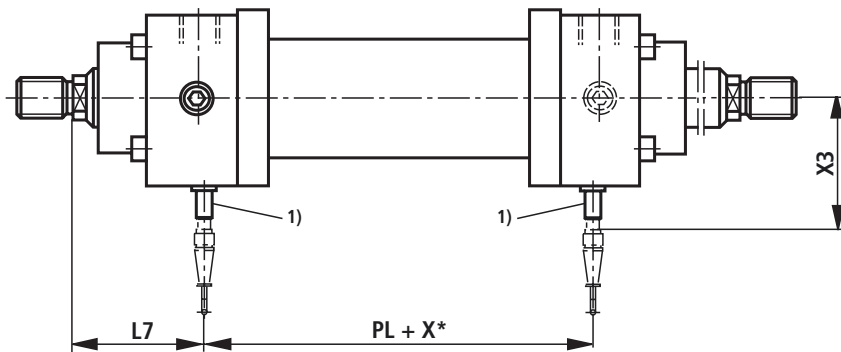
CDM1



Installation space for mating connector

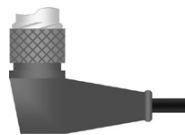


CGM1



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 in mm)

ØAL	ØMM	PL	L7	X3	X4	X5
25 ²⁾	14 18	–	–	–	–	–
32 ²⁾	18 22	–	–	–	–	–
40	22 28	97	71	94	170	125
50	28 36	103	76	98	175	130
63	36 45	113	84	103	180	135
80	45 56	124	96	109	185	140
100	56 70	150	114	116	195	150
125	70 90	158	129	126	205	160
160	90 110	181	148	136	215	170
200	110 140	214	195	151	230	185

Main dimensions see pages 14 ... 39

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 25 to 32 mm
proximity switch 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 torsional impulse.

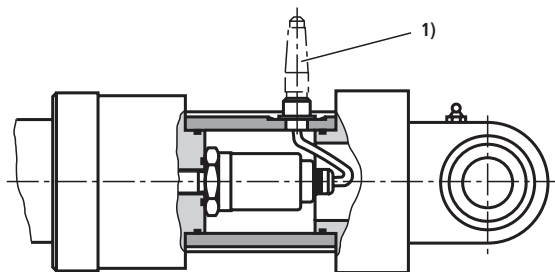
This impulse runs on the wave guide inside the scale from the measuring point to the sensor head. The running time is constant and almost independent of temperature. It is proportional to the solenoid position and thus a measure for the actual position value and is converted within the sensor into a direct analog or digital output.

Technical data (For applications outside these parameters, please consult us!)			
Admissible pressure	bar		500
Analog output		V	0 ... 10
	– Load resistance	kΩ	≥ 5
	– Resolution		unlimited
Analog output		mA	4 ... 20
	– Load resistance	Ω	0 ... 500
	– Resolution		unlimited
Digital output			SSI 24 bit gray-coded
	– Resolution	μm	5
	– Direction of measurement		forwards
Linearity (absolute accuracy)	– Analog	%	≤ ±0.02 (referred to measurement length)
		mm	min. ±0.05
	– Digital	%	≤ ±0.01 (referred to measurement length)
		mm	min. ±0.04
Reproducibility		%	±0.001 (referred to measurement length)
		mm	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
		V DC	24 (+ 20 %/– 15 % with digital output)
	– Current consumption	mA	70
	– Residual ripple	% s-s	≤ 1
Protection class	– Pipe and flange	IP	67
	– Sensor electronics	IP	65
Operating temperature	– Sensor electronics	°C	–40 ... +75
Temperature coefficient	– Voltage	ppm/°C	70
	– Current	ppm/°C	90

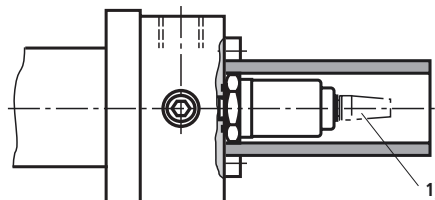
Position measurement system

Types of mounting

MP3, MP5



MF3, MF4, MT4, MS2



- 1) For analog output:
 6-pin mating connector
 (mating connector is **not**
 included in the scope of delivery,
 must be ordered separately)
 Protection class: IP 67



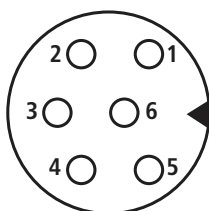
- 2) For digital output:
 7-pin mating connector Material
 (mating connector is **not**
 included in the scope of delivery,
 must be ordered separately)
 Protection class: IP 67



Pin assignment

Position measurement system (analog output)

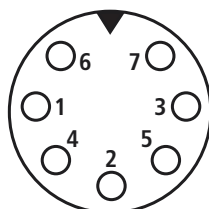
Connector (view to pin side)



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)

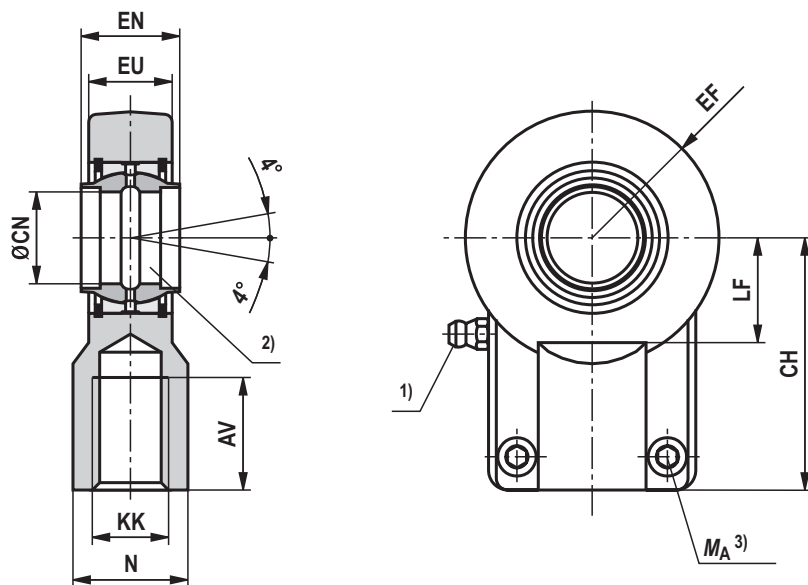
Position measurement system (digital output)

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

Dimensions: Swivel head CGKD(clampable)
 (dimensions in mm)

ISO 8132


ØAL	ØMM	Type	Nominal force kN	AV min.	N max.	CH js13	EF max.	ØCN H7 2)	EN h12	EU max.
25	14 / 18	CGKD 12 7)	8	17	19	38	16.5	12	12	11
25	18	CGKD 16	12.5	19	22	44	20.5	16	16	14
32	18 / 22									
32	22	CGKD 20	20	23	28	52	25	20	20	17.5
40	22 / 28									
40	28	CGKD 25	32	29	31	65	32	25	25	22
50	28 / 36									
50	36	CGKD 32	50	37	38	80	40	32	32	28
63	36 / 45									
63	45	CGKD 40	80	46	47	97	50	40	40	34
80	45 / 56									
80	56	CGKD 50	125	57	58	120	63	50	50	42
100	56 / 70									
100	70	CGKD 63	200	64	70	140	72.5	63	63	53.5
125	70 / 90									
125	90	CGKD 80	320	86	91	180	92	80	80	68
160	90 / 110									
160	110	CGKD 100	500	96	110	210	114	100	100	85.5
200	110 / 140									
200	140	CGKD 125	800	113	135	260	160	125	125	105

Dimensions: Swivel head CGKD(clampable)
(dimensions in mm)

ØAL	ØMM	Type	KK	LF min.	Clamping screw ISO 4762-10.9	$M_A^{3)}$ Nm	$m^{4)}$ kg	$C_0^{5)}$ kN	$F_{adm}^{6)}$ kN
25	14 / 18	CGKD 12 ⁷⁾	M12x1.25	13	M5x16	6	0.1	24.5	9.0
25	18	CGKD 16	M14x1.5	16.5	M6x14	10	0.2	36.5	13.5
32	18 / 22								
32	22	CGKD 20	M16x1.5	20.5	M8x20	25	0.35	48	17.7
40	22 / 28								
40	28	CGKD 25	M20x1.5	25.5	M8x20	30	0.65	78	28.8
50	28 / 36								
50	36	CGKD 32	M27x2	30	M10x25	59	1.15	114	42.1
63	36 / 45								
63	45	CGKD 40	M33x2	39	M10x30	59	2.1	204	75.3
80	45 / 56								
80	56	CGKD 50	M42x2	47	M12x35	100	4	310	114.4
100	56 / 70								
100	70	CGKD 63	M48x2	58	M16x40	250	7.2	430	158.7
125	70 / 90								
125	90	CGKD 80	M64x3	74	M20x50	490	15	695	265.5
160	90 / 110								
160	110	CGKD 100	M80x3	94	M24x60	840	25.5	1060	391.1
200	110 / 140								
200	140	CGKD 125	M100x3	116	M24x70	840	52.5	1430	527.7

ØAL = Piston Ø

ØMM = Piston rod Ø

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

2) Related bolt Ø m6

3) M_A = tightening torque

The swivel head 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 swivel head in kg

5) C_0 = static load rating of the swivel head

6) F_{adm} = max. admissible load of the swivel head with oscillatory or alternating loads

7) Bearings cannot be re-lubricated

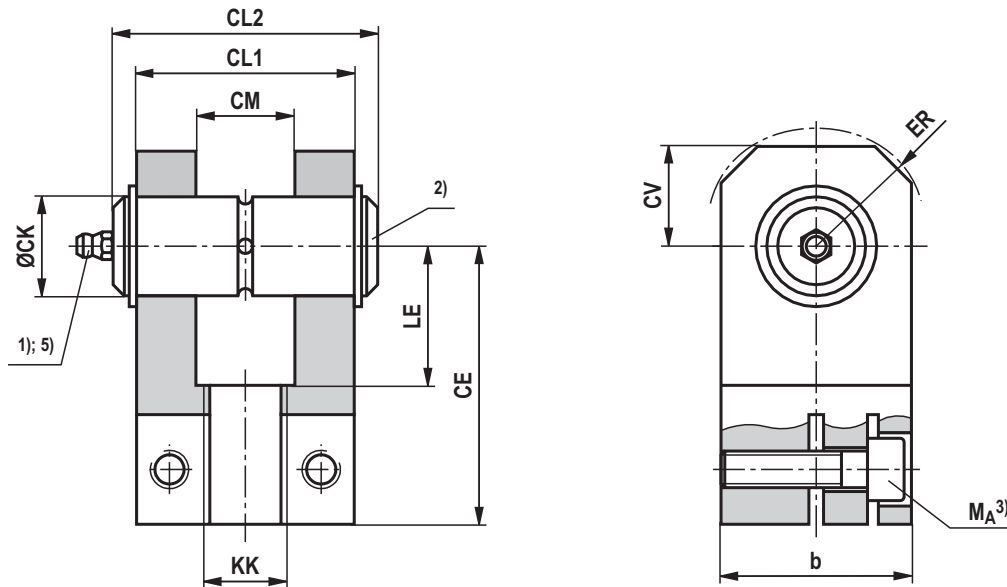


Notice:

Geometry and dimensions may differ depending on the manufacturer. All graphical presentations are examples. In case of combination with other mounting elements, the usability must be checked.

Dimensions: Fork clevis CCKB (clampable)
 (dimensions in mm)

ISO 8132



ØAL	ØMM	Type	Nominal force kN	b max.	CE js13	ØCK H9 2)	CL1 h16	CL2 max.	CM A13	ER max.
25	14 / 18	CCKB 12 ⁵⁾	8	25	38	12	28	49	12	16
25	18	CCKB 16	12.5	30	44	16	36	57	16	20
32	18 / 22									
32	22	CCKB 20	20	40	52	20	45	72	20	25
40	22 / 28									
40	28	CCKB 25	32	50	65	25	56	84	25	32
50	28 / 36									
50	36	CCKB 32	50	65	80	32	70	105	32	40
63	36 / 45									
63	45	CCKB 40	80	80	97	40	90	133	40	50
80	45 / 56									
80	56	CCKB 50	125	100	120	50	110	165	50	63
100	56 / 70									
100	70	CCKB 63	200	140	140	63	140	185	63	71
125	70 / 90									
125	90	CCKB 80	320	180	180	80	170	225	80	90
160	90 / 110									
160	110	CCKB 100	500	220	210	100	210	6)	100	110
200	110 / 140									

Dimensions: Fork clevis CCKB (clampable)

(dimensions in mm)

ØAL	ØMM	Type	KK	LE min.	CV max.	Clamping screw ISO 4762-10.9	M_A ³⁾ Nm	m ⁴⁾ kg
25	14 / 18	CCKB 12 ⁵⁾	M12x1.25	18	16	M4x16	2.9	0.2
25	18	CCKB 16	M14x1.5	22	20	M6x20	10	0.35
32	18 / 22							
32	22	CCKB 20	M16x1.5	27	25	M8x30	25	0.7
40	22 / 28							
40	28	CCKB 25	M20x1.5	34	32	M10x35	49	1.4
50	28 / 36							
50	36	CCKB 32	M27x2	41	40	M12x40	85	2.8
63	36 / 45							
63	45	CCKB 40	M33x2	51	50	M16x50	210	5.2
80	45 / 56							
80	56	CCKB 50	M42x2	63	63	M20x60	425	9.5
100	56 / 70							
100	70	CCKB 63	M48x2	75	71	M24x80	730	21.5
125	70 / 90							
125	90	CCKB 80	M64x3	94	90	M30x100	1450	38.2
160	90 / 110							
160	110	CCKB 100	M80x3	114	110	M36x130	2480	⁶⁾
200	110 / 140							

ØAL = Piston Ø

ØMM = Piston rod Ø

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

²⁾ Bolt Ø m6 required
(bolt and bolt lock are included in the scope of delivery and are not mounted upon delivery)

³⁾ M_A = tightening torque
The fork 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 fork clevis in kg

⁵⁾ Without lubrication bore

⁶⁾ On request



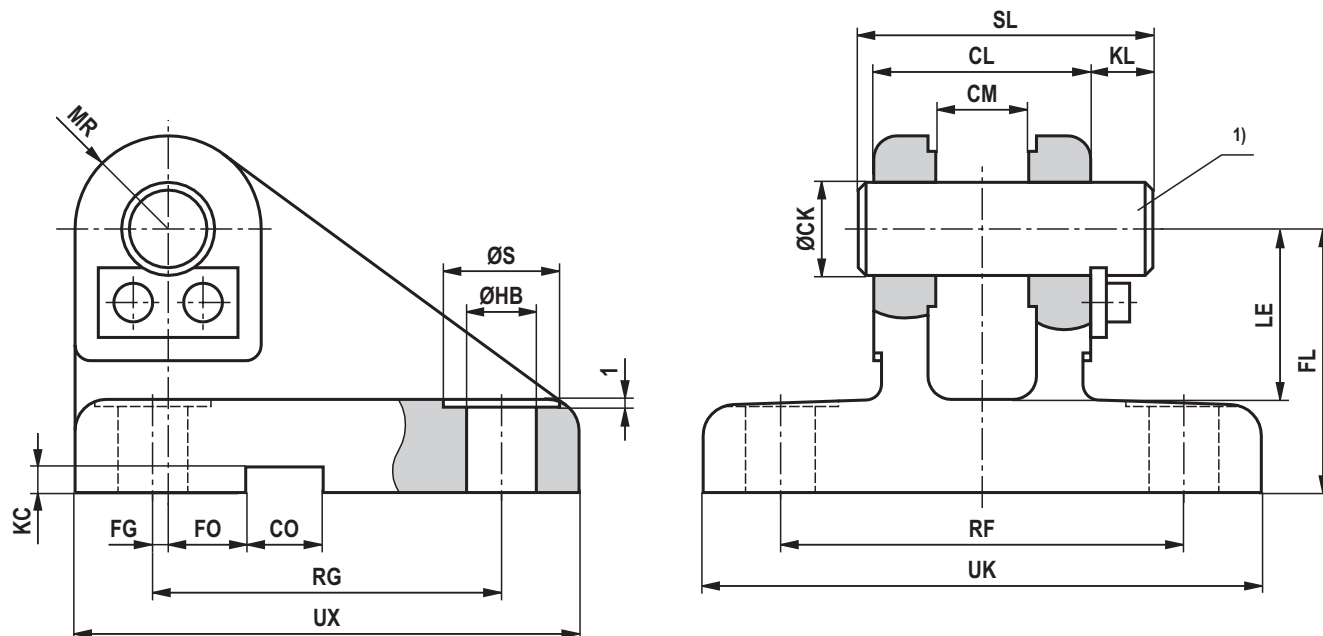
Notice:

Geometry and dimensions may differ depending on the manufacturer. All graphical presentations are examples. In case of combination with other mounting elements, the usability must be checked.

Dimensions: Clevis bracket CLCA

(dimensions in mm)

ISO 8132, form B



ØAL	ØAL	ØMM	Type	Nominal force kN	ØCK H9 1)	CL h16	CM A12	CO N9	FG js14	FL js12	FO js14
25	25	14 / 18	CLCA 12	8	12	28	12	10	2	34	10
32	25	18	CLCA 16	12.5	16	36	16	16	3.5	40	10
	32	18 / 22									
40	32	22	CLCA 20	20	20	45	20	16	7.5	45	10
	40	22 / 28									
50	40	28	CLCA 25	32	25	56	25	25	10	55	10
	50	28 / 36									
63	50	36	CLCA 32	50	32	70	32	25	14.5	65	6
	63	36 / 45									
80	63	45	CLCA 40	80	40	90	40	36	17.5	76	6
	80	45 / 56									
100	80	56	CLCA 50	125	50	110	50	36	25	95	0
	100	56 / 70									
125	100	70	CLCA 63	200	63	140	63	50	33	112	0
	125	70 / 90									
160	125	90	CLCA 80	320	80	170	80	50	45	140	0
	160	90 / 110									
200	160	110	CLCA 100	500	100	210	100	63	52.5	180	0
	200	110 / 140									
—	200	140	CLCA 125	800	125	270	125	80	75	230	0

Dimensions: Clevis bracket CLCA

(dimensions in mm)

ØAL	ØAL	ØMM	Type	ØHB H13	KC +0.3	KL	LE min.	MR max.	RF js14	RG js14	ØS	SL	UK max.	UX max.	m ²⁾ kg
25	25	14 / 18	CLCA 12	9	3.3	8	22	12	52	45	15	38	72	65	0.45
32	25	18	CLCA 16	11	4.3	8	27	16	65	55	18	46	90	80	1
	32	18 / 22													
40	32	22	CLCA 20	11	4.3	10	30	20	75	70	18	58	100	95	1.5
	40	22 / 28													
50	40	28	CLCA 25	13.5	5.4	10	37	25	90	85	20	69	120	115	3
	50	28 / 36													
63	50	36	CLCA 32	17.5	5.4	13	43	32	110	110	26	87	145	145	5
	63	36 / 45													
80	63	45	CLCA 40	22	8.4	16	52	40	140	125	33	110	185	170	9.6
	80	45 / 56													
100	80	56	CLCA 50	26	8.4	19	65	50	165	150	40	133	215	200	15.5
	100	56 / 70													
125	100	70	CLCA 63	33	11.4	20	75	63	210	170	48	164	270	230	27.5
	125	70 / 90													
160	125	90	CLCA 80	39	11.4	26	95	80	250	210	57	202	320	280	47
	160	90 / 110													
200	160	110	CLCA 100	52	12.4	30	120	100	315	250	76	246	405	345	3)
	200	110 / 140													
—	200	140	CLCA 125	52	15.4	32	170	125	365	350	76	310	455	450	3)

ØAL = Piston Ø

ØMM = Piston rod Ø

1) Bolt Ø m6 required

(bolt and bolt lock are included in the scope of delivery and are not mounted upon delivery)

2) **m** = weight clevis bracket in kg

3) On request

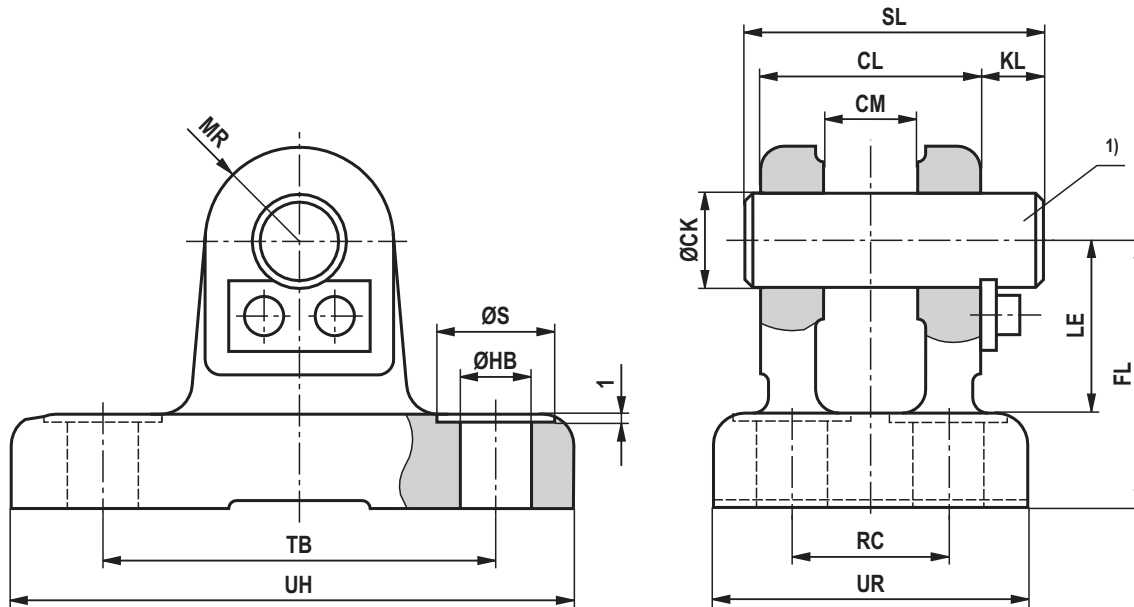


Notice:

Geometry and dimensions may differ depending on the manufacturer. All graphical presentations are examples. In case of combination with other mounting elements, the usability must be checked.

Dimensions: Clevis bracket CLCD (dimensions in mm)

ISO 8132, form A



ØAL	ØAL	ØMM	Type	Nominal force kN	ØCK H9 1)	CL h16	CM A13	FL js12	ØHB H13	KL
25	25	14 / 18	CLCD 12	8	12	28	12	34	9	8
32	25	18	CLCD 16	12.5	16	36	16	40	11	8
	32	18 / 22								
40	32	22	CLCD 20	20	20	45	20	45	11	10
	40	22 / 28								
50	40	28	CLCD 25	32	25	56	25	55	13.5	10
	50	28 / 36								
63	50	36	CLCD 32	50	32	70	32	65	17.5	13
	63	36 / 45								
80	63	45	CLCD 40	80	40	90	40	76	22	16
	80	45 / 56								
100	80	56	CLCD 50	125	50	110	50	95	26	19
	100	56 / 70								
125	100	70	CLCD 63	200	63	140	63	112	33	20
	125	70 / 90								
160	125	90	CLCD 80	320	80	170	80	140	39	26
	160	90 / 110								
200	160	110	CLCD 100	500	100	210	100	180	45	30
	200	110 / 140								
—	200	140	CLCD 125	800	125	270	125	230	52	32

Dimensions: Clevis bracket CLCD

(dimensions in mm)

ØAL	ØAL	ØMM	Type	LE min.	MR max.	RC js14	ØS	SL	TB js14	UR max.	UH max.	m ²⁾ kg
25	25	14 / 18	CLCD 12	22	12	20	15	38	50	40	70	0.35
32	25	18	CLCD 16	27	16	26	18	46	65	50	90	0.7
	32	18 / 22										
40	32	22	CLCD 20	30	20	32	18	58	75	58	98	0.95
	40	22 / 28										
50	40	28	CLCD 25	37	25	40	20	69	85	70	113	1.9
	50	28 / 36										
63	50	36	CLCD 32	43	32	50	26	87	110	85	143	3
	63	36 / 45										
80	63	45	CLCD 40	52	40	65	33	110	130	108	170	5.5
	80	45 / 56										
100	80	56	CLCD 50	65	50	80	40	133	170	130	220	10.6
	100	56 / 70										
125	100	70	CLCD 63	75	63	100	48	164	210	160	270	17
	125	70 / 90										
160	125	90	CLCD 80	95	80	125	57	202	250	210	320	32
	160	90 / 110										
200	160	110	CLCD 100	120	100	160	66	246	315	260	400	3)
	200	110 / 140										
—	200	140	CLCD 125	170	125	200	76	310	385	320	470	3)

ØAL = Piston Ø

ØMM = Piston rod Ø

1) Bolt Ø m6 required
(bolt and bolt lock are included in the scope of delivery and are not mounted upon delivery)

2) **m** = weight clevis bracket in kg

3) On request



Notice:

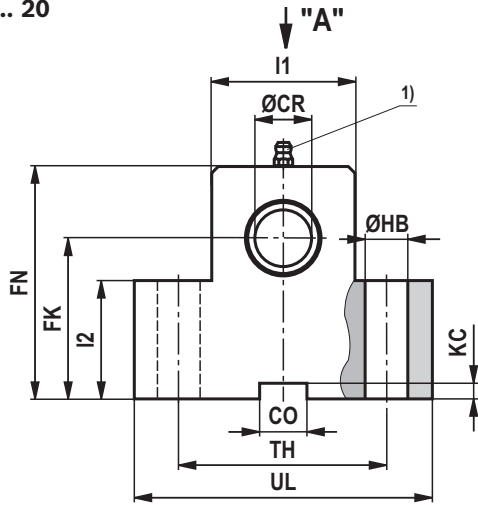
Geometry and dimensions may differ depending on the manufacturer. All graphical presentations are examples. In case of combination with other mounting elements, the usability must be checked.

Dimensions: Trunnion bearing block CLTB

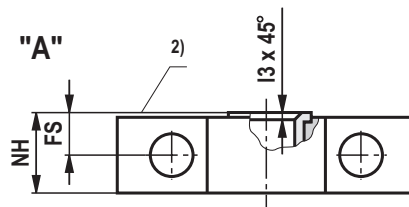
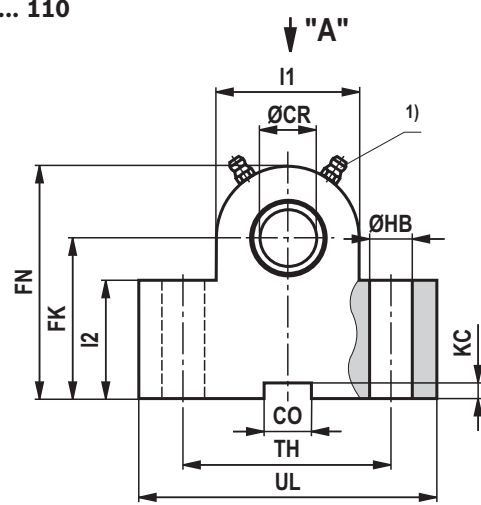
(dimensions in mm)

ISO 8132

CLTB 12 ... 20



CLTB 25 ... 110



ØAL	Type ³⁾	Nominal force kN ⁴⁾	ØCR H7	CO N9	FK js12	FN max.	FS js14	ØHB H13	KC +0.3
25	CLTB 12	8	12	10	34	50	8	9	3.3
32	CLTB 16	12.5	16	16	40	60	10	11	4.3
40	CLTB 20	20	20	16	45	70	10	11	4.3
50	CLTB 25	32	25	25	55	80	12	13.5	5.4
63	CLTB 32	50	32	25	65	100	15	17.5	5.4
80	CLTB 40	80	40	36	76	120	16	22	8.4
100	CLTB 50	125	50	36	95	140	20	26	8.4
125	CLTB 63	200	63	50	112	180	25	33	11.4
160 ⁶⁾	CLTB 80	320	80	50	140	220	31	39	11.4
200 ⁶⁾	CLTB 100	500	100	63	180	280	45	52	12.4

Dimensions: Trunnion bearing block CLTB

(dimensions in mm)

ØAL	Type ³⁾	I1	I2	I3	NH max.	TH js14	UL max.	m ⁵⁾ kg
25	CLTB 12	25	25	1	17	40	63	0.4
32	CLTB 16	30	30	1	21	50	80	0.85
40	CLTB 20	40	38	1.5	21	60	90	1.2
50	CLTB 25	56	45	1.5	26	80	110	2.1
63	CLTB 32	70	52	2	33	110	150	4.55
80	CLTB 40	88	60	2.5	41	125	170	7.3
100	CLTB 50	100	75	2.5	51	160	210	14.5
125	CLTB 63	130	85	3	61	200	265	23.1
160 ⁶⁾	CLTB 80	160	112	3.5	81	250	325	52.3
200 ⁶⁾	CLTB 100	200	145	4.5	102	295	385	⁷⁾

ØAL = Piston Ø

- 1) Lubricating nipple, cone head form A according to DIN 71412
- 2) Contact surface trunnion (inside)
- 3) Bearing blocks are always supplied in pairs
- 4) Nominal force applies to applications in pairs
- 5) **m** = weight of trunnion bracket in kg (specified per pair)
- 6) Bearing blocks for piston Ø 160 and 200 mm, dimensions differ for replacement transactions (CDM1 / CGM1 / CSM1 series 1X). Please consult us!
- 7) On request



Notice:

Geometry and dimensions may differ depending on the manufacturer. All graphical presentations are examples. In case of combination with other mounting elements, the usability must be checked.

The trunnion brackets are suitable for mounting type MT4.

Kinking

For the admissible stroke length with flexibly guided load and a factor of 3.5 for safety against kinking, please refer to 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.

Kinking calculations are carried out according to the following formulas:

1. Calculation according to Euler

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

2. Calculation according to Tetmajer

$$F = \frac{d^2 \cdot \pi (335 - 0.62 \cdot \lambda)}{4 \cdot \nu} \quad \text{if } \lambda \leq \lambda_g$$

Explanation:

E = Module of elasticity in N/mm²

= 2.1×10^5 for steel

I = Geometrical moment of inertia in mm⁴

for circular cross-section = $\frac{d^4 \cdot \pi}{64} = 0.0491 \cdot d^4$

ν = 3.5 (safety factor)

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

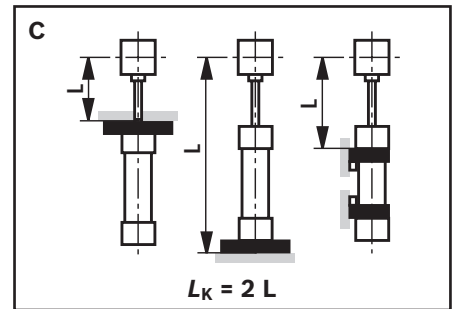
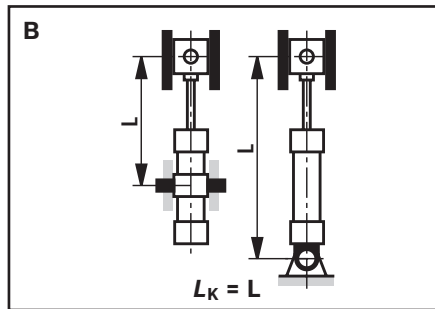
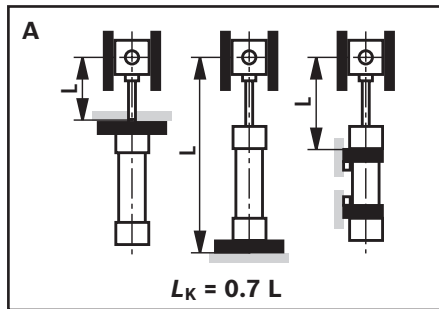
d = Piston rod Ø in mm

λ = Slenderness ratio

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

R_e = yield strength of the piston rod material

Influence of the type of mounting on the kinking length:



Admissible stroke length

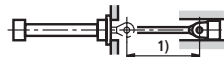
(dimensions in mm)

Type of mounting MF2, MF4, MT4 trunnion (with XV_{max.})

ØAL	ØMM	admissible stroke length with									Installation position	
		70 bar			100 bar			160 bar				
		0°	45°	90°	0°	45°	90°	0°	45°	90°		
25	14	260	270	305	215	220	240	160	165	170	0°	
	18	435	455	485	385	400	460	310	315	340		
32	18	340	355	410	290	295	325	215	220	230		
	22	510	535	665	450	465	535	365	370	400		
40	22	405	425	495	345	355	395	265	270	285	90°	
	28	640	680	875	575	600	710	475	490	535		
50	28	540	560	665	465	480	535	365	370	390		
	36	845	895	1180	765	805	970	645	665	735		
63	36	705	740	900	620	640	725	500	510	540		
	45	1030	1100	1480	945	990	1220	805	830	930		
80	45	855	900	1120	760	790	905	615	630	680		
	56	1230	1310	1700	1130	1190	1490	975	1010	1140		
100	56	1030	1090	1390	925	965	1130	760	780	850		
	70	1500	1590	2000	1380	1460	1880	1200	1250	1440		
125	70	1280	1360	1770	1160	1210	1450	970	995	1090		
	90	1900	2030	2300	1770	1880	2300	1570	1640	1950		
160	90	1620	1710	2320	1470	1540	1900	1250	1290	1440		
	110	2200	2350	2600	2060	2180	2600	1820	1900	2280		
200	110	1890	2010	2760	1730	1820	2260	1470	1520	1720		
	140	2720	2910	3000	2560	2720	3000	2290	2400	2980		

Admissible stroke length (dimensions in mm)

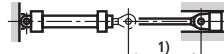
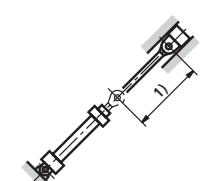
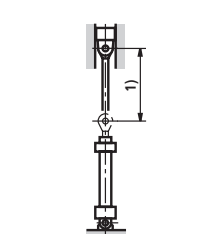
Type of mounting MF1, MF3, MS2

ØAL	ØMM	admissible stroke length with									Installation position	
		70 bar			100 bar			160 bar				
		0°	45°	90°	0°	45°	90°	0°	45°	90°		
25	14	350	355	380	300	305	315	235	240	240	0°	
	18	530	550	645	470	485	535	390	400	415		
32	18	445	455	495	385	390	410	310	315	320	45°	
	22	615	640	660	550	570	625	460	465	490		
40	22	530	545	590	460	470	490	370	375	380	90°	
	28	775	810	980	700	725	815	590	600	635		
50	28	670	690	770	590	600	640	475	485	495	160 bar	
	36	975	1020	1300	890	925	1080	765	785	845		
63	36	845	880	1000	750	770	830	615	625	645	160 bar	
	45	1170	1230	1400	1070	1120	1330	920	950	1040		
80	45	1020	1060	1240	910	935	1020	750	765	795	160 bar	
	56	1390	1470	1700	1280	1340	1620	1110	1150	1270		
100	56	1240	1290	1540	1110	1150	1280	930	940	990	160 bar	
	70	1680	1780	2000	1560	1640	2000	1370	1410	1590		
125	70	1510	1570	1920	1360	1400	1590	1140	1160	1240	160 bar	
	90	2090	2220	2300	1960	2060	2300	1740	1810	2110		
160	90	1880	1980	2500	1720	1780	2070	1460	1500	1610	160 bar	
	110	2430	2580	2600	2280	2400	2600	2600	2110	2460		
200	110	2210	2320	2980	2020	2100	2470	1730	1770	1920	160 bar	
	140	2980	3000	3000	2810	2980	3000	2540	2650	3000		

1) adm. stroke

¹⁾ adm. stroke

Type of mounting: MP3, MP5

ØAL	ØMM	admissible stroke length with									Installation position	
		70 bar			100 bar			160 bar				
		0°	45°	90°	0°	45°	90°	0°	45°	90°		
25	14	155	160	175	120	125	130	75	80	85	0°	
	18	300	310	360	250	260	285	190	195	220		
32	18	210	220	240	165	170	180	110	115	120	45°	
	22	345	360	420	290	300	330	220	225	235		
40	22	255	265	295	205	210	225	140	145	150	90°	
	28	445	465	560	385	395	445	295	305	320		
50	28	350	360	405	285	290	315	205	210	215	160 bar	
	36	600	630	770	525	540	615	415	425	455		
63	36	470	490	560	395	405	440	290	292	310	160 bar	
	45	740	780	970	650	680	780	525	535	580		
80	45	575	600	700	490	505	555	370	375	390	160 bar	
	56	890	935	1190	790	820	960	640	660	715		
100	56	705	735	880	600	620	695	460	470	495	160 bar	
	70	1085	1150	1500	970	1015	1215	800	825	910		
125	70	890	935	1135	770	800	905	605	615	655	160 bar	
	90	1400	1490	2030	1270	1340	1660	1070	1110	1250		
160	90	1130	1190	1490	990	1030	1190	790	810	870	160 bar	
	110	1620	1720	2370	1470	1550	1930	1240	1290	1450		
200	110	1320	1390	1770	1160	1210	1420	930	955	1040	160 bar	
	140	2010	2140	3000	1850	1950	2520	1580	1650	1910		

1) adm. stroke

¹⁾ adm. stroke

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 the end position cushioning, the structural-inherent cushioning capacity must not be exceeded. Cylinders with end position cushioning can achieve their full damping 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 max. damping 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 65

Extension:

$$D_p = p_s - \frac{m \cdot 9.81 \cdot \sin \alpha}{A_1 \cdot 10}$$

Retraction:

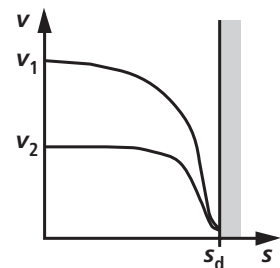
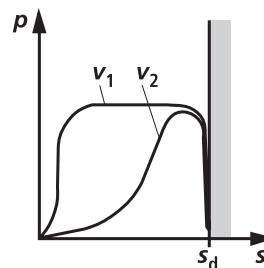
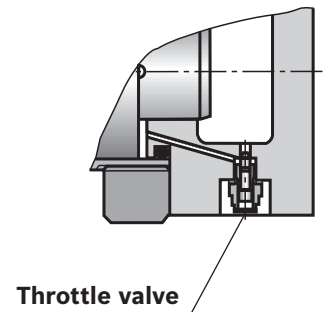
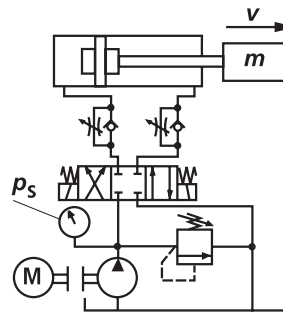
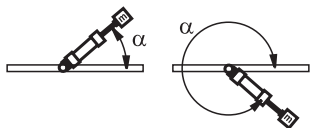
$$D_p = p_s + \frac{m \cdot 9.81 \cdot \sin \alpha}{A_3 \cdot 10}$$

p_s = system pressure in bar

A_1 = piston area in cm² (see page 10)

A_3 = annulus area in cm² (see page 10)

α = angle to the horizontal in degree



Damping length

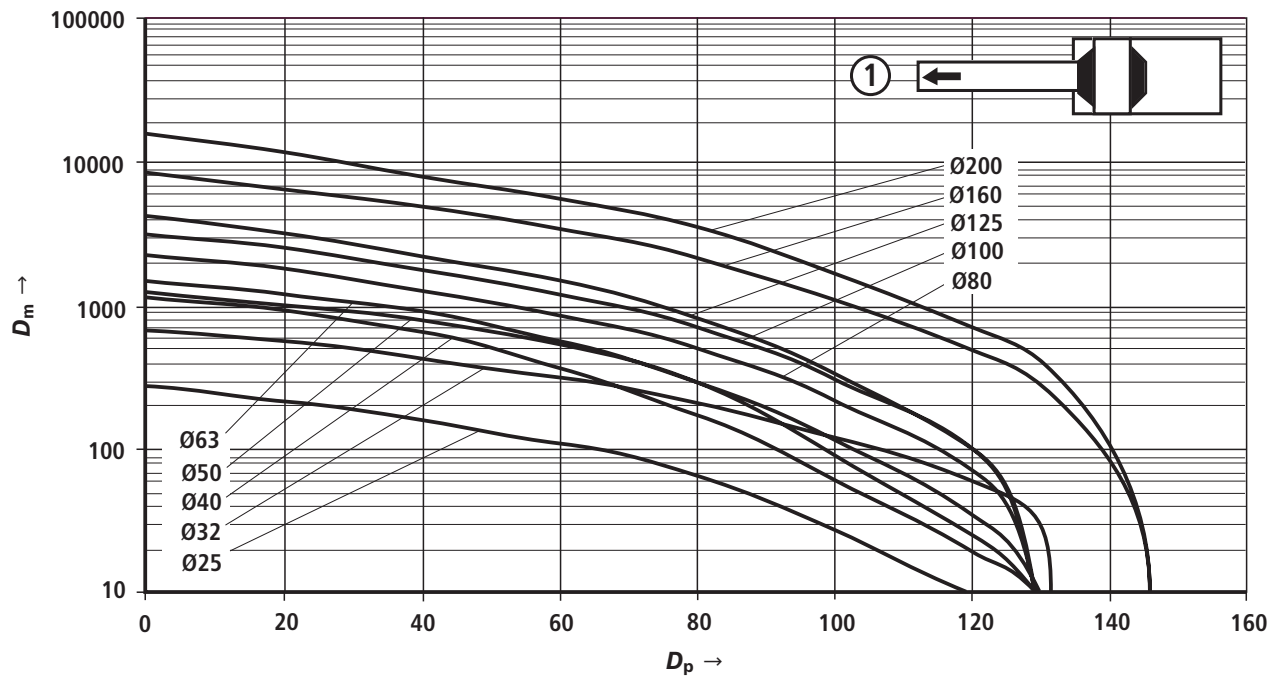
ØALmm	25	32	40	50	63	80	100	125	160	200
Head side	15	19	23	22	27	27	32	33	40	46
Base side	15	19	23	22	27	27	32	33	40	46

End position cushioning / damping capacity

AL Ø mm	25	32	40	50	63	80	100	125	160	200
kv ①	2.97	2.56	2.82	3.51	3.02	2.53	2.65	2.91	2.76	2.95
kv ②	3.15	2.93	2.95	3.45	2.95	2.53	2.93	2.95	2.95	3.1
kv ③	3.1	2.73	3.1	3.51	2.95	2.51	2.91	2.95	2.91	2.93

Damping capacity:

Extension for CDM1 and CSM1 with kv ①

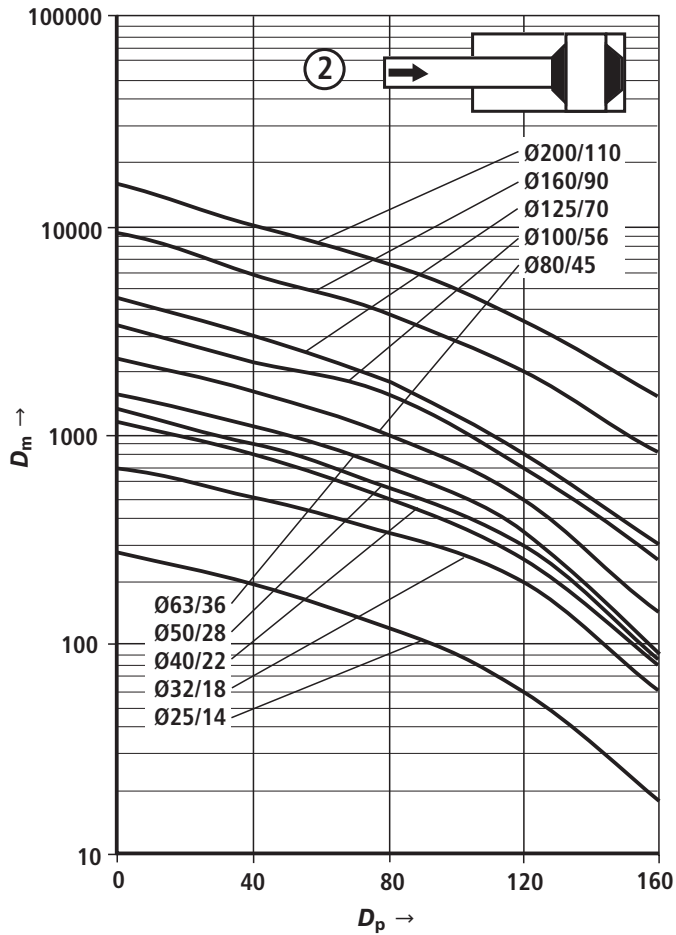


End position cushioning / damping capacity

Damping capacity:

Retraction for CDM1, CGM1 and CSM1 with k_v ②;

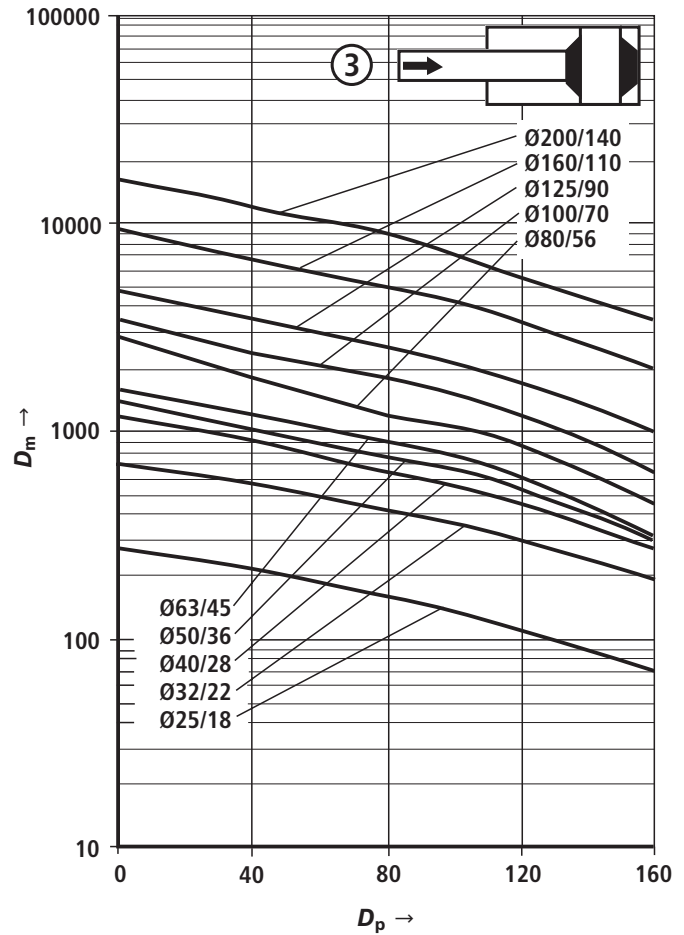
Extension for CGM1 with k_v ②



Damping capacity:

Retraction for CDM1, CGM1 and CSM1 with k_v ③;

Extension for CGM1 with k_v ③

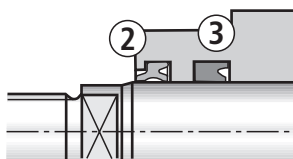


Seal (piston rod / piston)

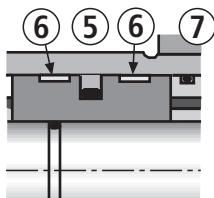
Version “M and V”

Piston Ø (ØAL) 25 and 32 mm

Seal piston rod

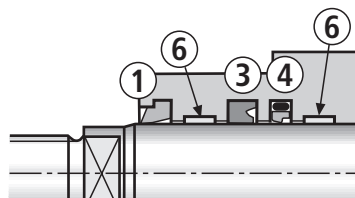


Seal piston

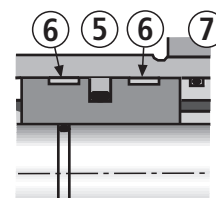


Piston Ø (ØAL) 40 ... 200 mm

Seal piston rod



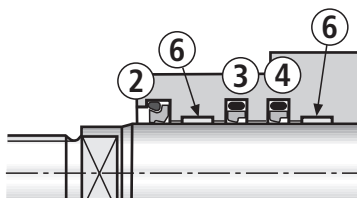
Seal piston



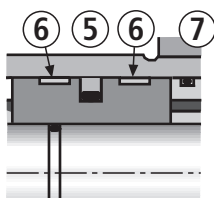
Version “T and S”

Piston Ø (ØAL) 40 ... 200 mm

Seal piston rod



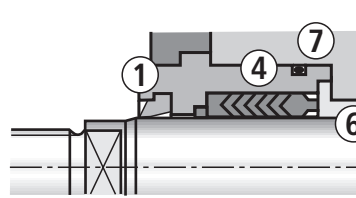
Seal piston



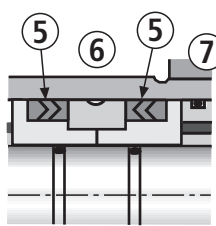
Version “A”

Piston Ø (ØAL) 50 ... 200 mm

Seal piston rod



Seal piston

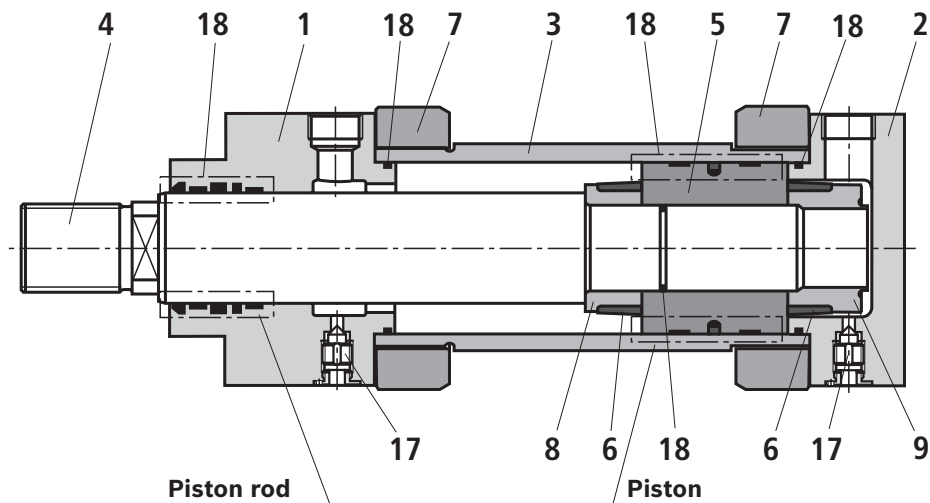


Medium	Seal version	Compatibility of the medium used / seal materials						
		① Wiper	② Double wiper		③ Rod seal		④ Rod seal (primary)	⑤ Piston seal
			Piston Ø 25 and 32	Piston Ø 40 ... 200	Piston Ø 25 and 32	(secondary) piston Ø 40 ... 200		
HL, HLP	M	TPE	AU	–	AU	AU	PTFE / NBR	TPE / NBR
HL, HLP, HFC	T	–	–	PTFE / NBR	–	PTFE / NBR	PTFE / NBR	PTFE / NBR
HFDR	V	TPE	FKM	–	FKM	PTFE / FKM	PTFE / FKM	PTFE / FKM
HFDR	S	–	–	PTFE / FKM	–	PTFE / FKM	PTFE / FKM	PTFE / FKM
HL, HLP, HFC	A	TPE	–	–	–	–	POM / NBR	POM / NBR

Medium	Seal version	⑥ Guide	⑦ Seal ring	Features
HL, HLP	M	Fabric composite	NBR	Holding function on the piston
HL, HLP, HFC	T	Fabric composite	NBR	low friction
HFDR	V	Fabric composite	FKM	high temperature
HFDR	S	Fabric composite	FKM	low friction and high temperature
HL, HLP, HFC	A	Red brass	NBR	Holding function

HL, HLP, HFDR: -20 °C ... +80 °C

HFC: -20 °C ... +60 °C

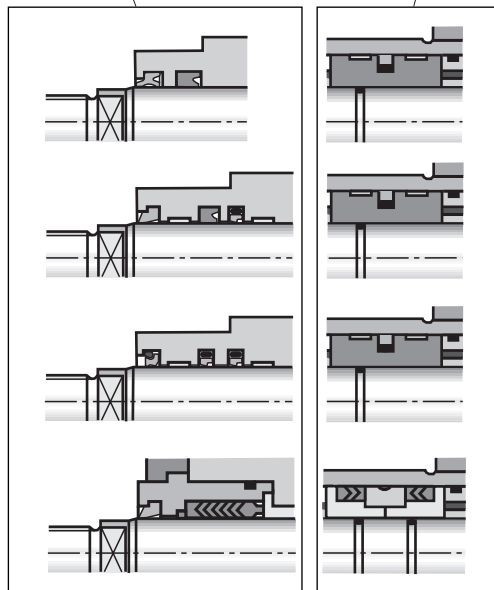
Spare parts drawing: Series: CDM1


Seal "M and V"
 piston Ø (Ø AL) 25 and 32

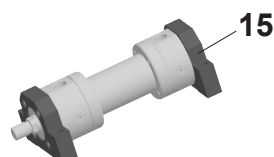
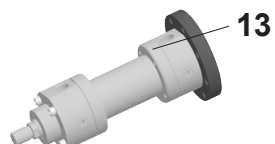
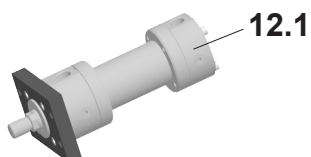
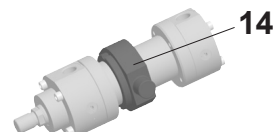
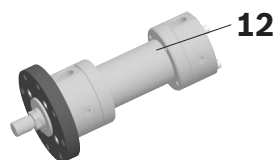
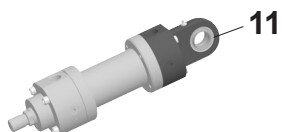
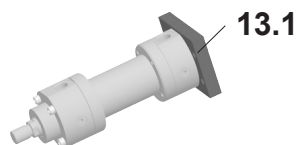
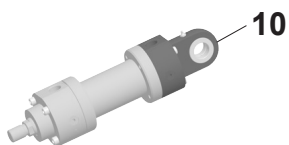
Seal "M and V"
 piston Ø (Ø AL) 40 ... 200

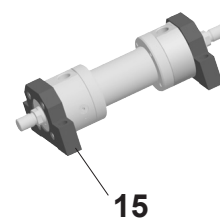
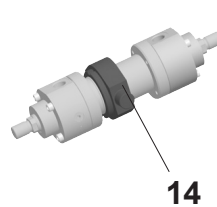
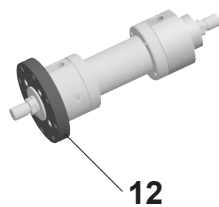
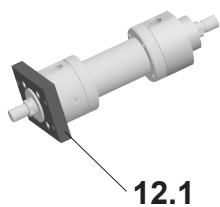
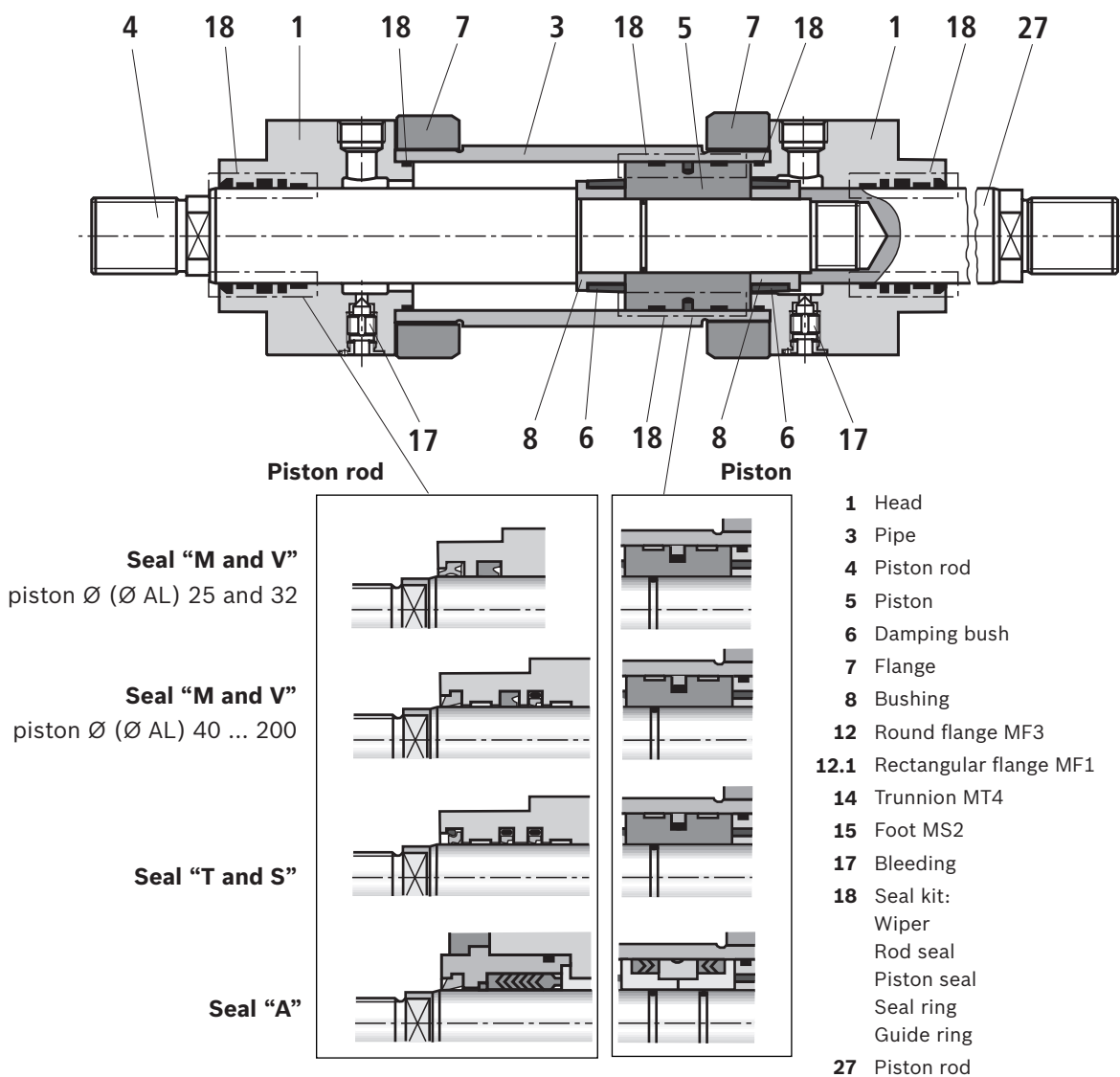
Seal "T and S"

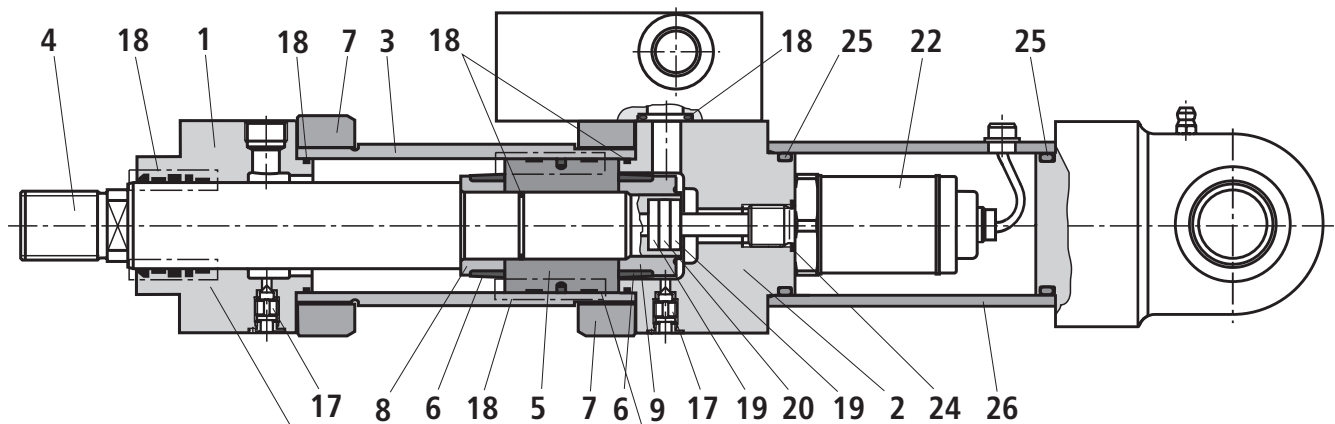
Seal "A"



- 1 Head
- 2 Base
- 3 Pipe
- 4 Piston rod
- 5 Piston
- 6 Damping bush
- 7 Flange
- 8 Bushing
- 9 Bushing
- 10 Base MP3
- 11 Base MP5
- 12 Round flange MF3
- 12.1 Rectangular flange MF1
- 13 Round flange MF4
- 13.1 Rectangular flange MF2
- 14 Trunnion MT4
- 15 Foot MS2
- 17 Bleeding
- 18 Seal kit:
 Wiper
 Rod seal
 Piston seal
 Seal ring
 Support ring
 Guide ring



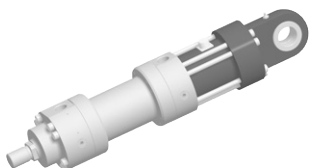
Spare parts drawing: Series: CGM1


Spare parts drawing: Series CSM1: MP3 and MP5


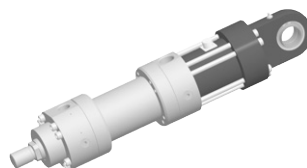
- | | Piston rod | Piston | |
|----------------|------------|--------|---|
| Seal "M" | | | 1 Head |
| Seal "T and S" | | | 2 Base |
| | | | 3 Pipe |
| | | | 4 Piston rod |
| | | | 5 Piston |
| | | | 6 Damping bush |
| | | | 7 Flange |
| | | | 8 Bushing |
| | | | 9 Bushing |
| | | | 17 Bleeding |
| | | | 18 Seal kit:
Wiper
Rod seal
Piston seal
Seal ring
Support ring
Guide ring |
| | | | 19 Insulating socket |
| | | | 20 Solenoid |
| | | | 22 Position transducer |
| | | | 24 Seal |
| | | | 25 Seal |
| | | | 26 Protective pipe |

CSM1: MP3

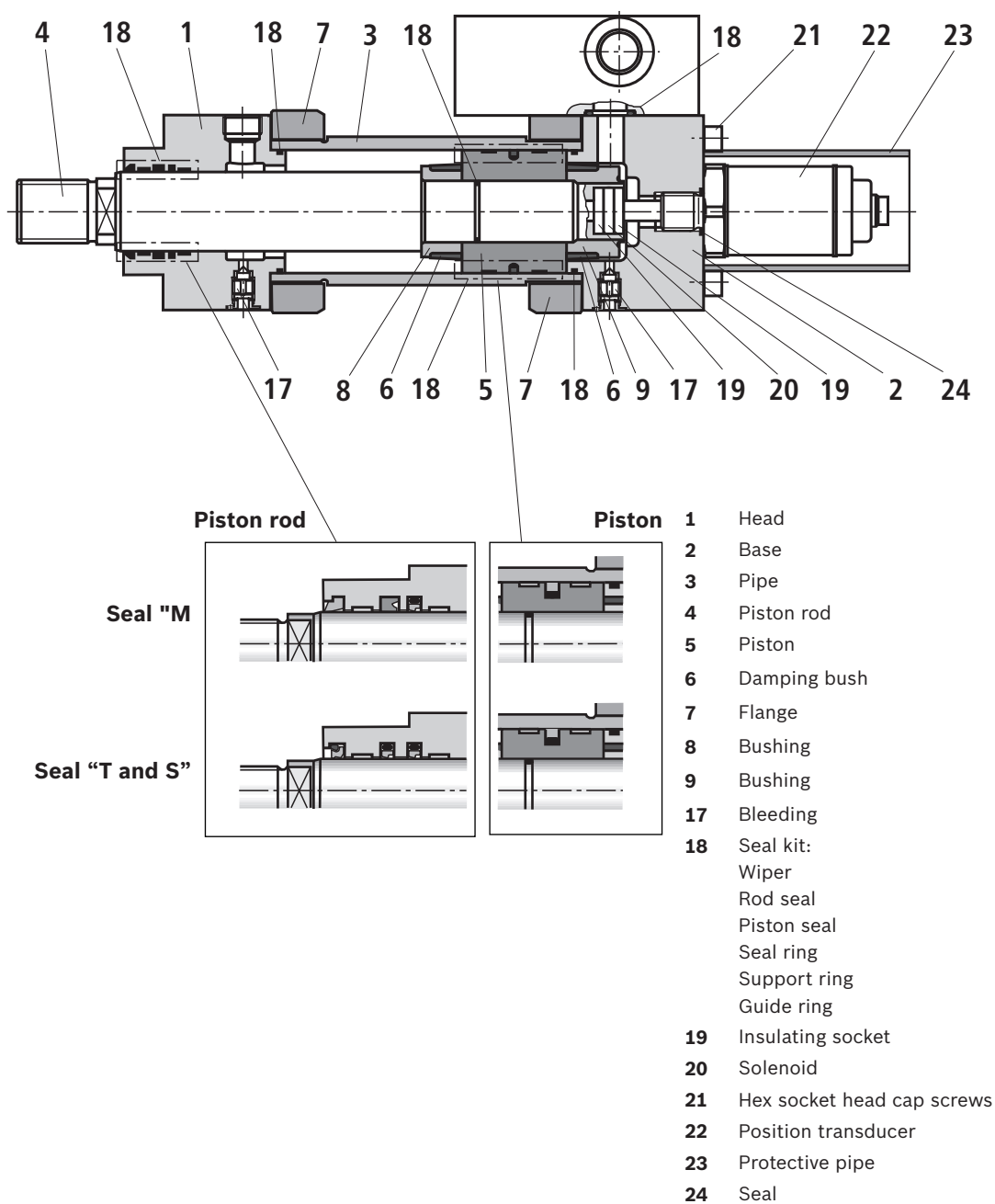
Swivel eye at base


CSM1: MP5

Self-aligning clevis at base

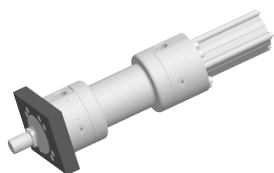


Spare parts drawing: Series CSM1: MF, MT4 and MS2



CSM1: MF1

Rectangular flange at head



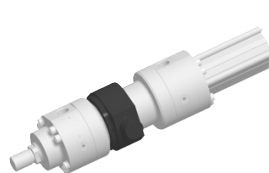
CSM1: MF3

Round flange at head



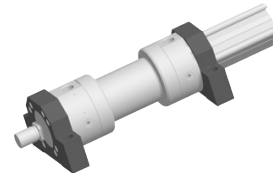
CSM1: MT4

Trunnion



CSM1: MS2

Foot mounting



Seal kits: Series CDM1 ¹⁾ / CSM1 ²⁾

ØAL	ØMM	Material no. for seal design				
		M	T	V	S	A
25	14					
	18					
32	18					
	22					
40	22					
	28					
50	28					
	36					
63	36					
	45					
80	45					
	56					
100	56					
	70					
125	70					
	90					
160	90					
	110					
200	110					
	140					

ØAL = Piston Ø

ØMM = Piston rod Ø

¹⁾ Seal kits for proximity switches separate material no. see page 73

²⁾ Seal kits for position transducers separate material no. see page 73

Seal kits: Series CGM1 ³⁾

ØAL	ØMM	Material no. for seal design				
		M	T	V	S	A
25	14					
	18					
32	18					
	22					
40	22					
	28					
50	28					
	36					
63	36					
	45					
80	45					
	56					
100	56					
	70					
125	70					
	90					
160	90					
	110					
200	110					
	140					

³⁾ Seal kits for proximity switches separate material no. see below

Only for proximity switches

ØAL	Material no. for seal design	
	M, T, A	V, S
25 and 32		
40 ... 200		

Only for position transducers

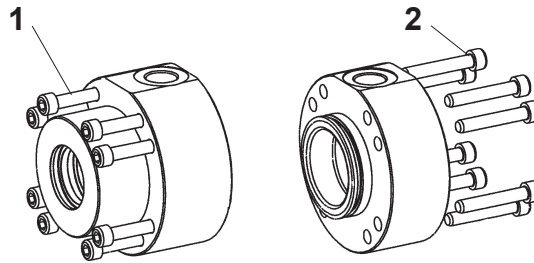
ØAL	Material no. for seal design	
	M, T	S
40		
50		
63		
80		
100		
125		
160		
200		

ØAL = Piston Ø

ØMM = Piston rod Ø

Tightening torques

Screws: Head and base
(Pos. 1 and 2)



Series	ØAL	Screw	Quantity	Quality class	Tightening torque Nm
CDM1 / CGM1 / CSM1	25	M6	4	10.9	13
CDM1 / CGM1 / CSM1	32	M6	4	10.9	13
CDM1 / CGM1 / CSM1	40	M6	4	10.9	13
CDM1 / CGM1 / CSM1	50	M8	4	10.9	30
CDM1 / CGM1 / CSM1	63	M10	4	10.9	60
CDM1 / CGM1 / CSM1	80	M10	8	10.9	50
CDM1 / CGM1 / CSM1	100	M10	8	10.9	60
CDM1 / CGM1 / CSM1	125	M12	12	10.9	100
CDM1 / CGM1 / CSM1	160	M12	16	10.9	100
CDM1 / CGM1 / CSM1	200	M16	16	10.9	200

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	M00	MP3 ¹⁾ MP5 ¹⁾	MP3 ²⁾ MP5 ²⁾	MF1 MF2	MF3 MF4	MT4	MS2		MF1	MF3	MT4	MS2	
mm	mm	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg
25	14	2.2	2.3	–	2.6	2.7	2.6	3.2	0.5	3.0	3.1	3.0	3.6	0.6
	18	2.2	2.3	–	2.6	2.7	2.6	3.2	0.6	3.0	3.1	3.0	3.6	0.8
32	18	3.1	3.3	–	3.8	4.0	3.7	4.7	0.7	4.3	4.5	4.2	5.2	0.9
	22	3.1	3.3	–	3.8	4.0	3.7	4.7	0.8	4.3	4.5	4.2	5.2	1.1
40	22	5.5	5.9	–	6.4	6.7	6.5	7.6	0.9	7.1	7.5	7.3	8.4	1.2
	28	5.6	6.0	10.2	6.5	6.8	6.6	7.7	1.1	7.1	7.5	7.3	8.4	1.5
50	28	8.1	8.9	14.4	9.7	10.2	9.8	12.0	1.2	11.0	11.5	11.1	13.3	1.7
	36	8.3	9.1	14.6	9.9	10.4	10.0	12.2	1.5	11.0	11.5	11.1	13.3	2.3
63	36	14.0	15.5	25.0	17.0	17.5	17.0	20.0	2.1	18.5	19.0	18.5	22.0	2.9
	45	14.0	15.5	25.0	17.0	17.5	17.0	20.0	2.6	18.5	19.0	18.5	22.0	3.8
80	45	20.0	22.5	30.5	24.0	25.0	24.0	29.0	2.9	27.0	28.0	27.0	32.0	4.1
	56	20.0	22.5	30.5	24.0	25.0	24.0	29.0	3.6	27.0	28.0	27.0	32.0	5.5
100	56	36.0	41.0	53.0	42.5	44.5	43.5	52.0	5.4	48.0	50.0	49.0	57.5	7.4
	70	37.0	42.0	54.0	43.5	45.5	44.5	53.0	6.5	50.0	52.0	51.0	59.5	9.5
125	70	60.0	66.0	84.0	68.0	70.0	73.5	86.0	7.3	78.0	80.0	83.0	96.0	10.3
	90	61.0	67.0	85.0	69.0	71.0	74.5	87.0	9.3	81.0	83.0	86.0	99.0	14.2
160	90	107.0	122.0	150.0	–	121.0	136.0	148.0	11.5	–	143.0	158.0	170.0	16.5
	110	108.0	123.0	151.0	–	122.0	137.0	149.0	14.0	–	145.0	160.0	172.0	21.4
200	110	193.0	222.0	262.0	–	217.0	245.0	259.0	15.4	–	267.0	295.0	309.0	22.9
	140	196.0	225.0	265.0	–	220.0	248.0	262.0	20.1	–	273.0	301.0	315.0	32.1

¹⁾ Mass for CD cylinder

²⁾ Mass for CS cylinder