

Storz

HYDRAULIKSYSTEME

ZBD 1611

Standard Hydraulic Cylinder



Description:

Hydraulic cylinders to DIN/ISO **ZBD 1611**

NP 160 bar (16MPa)

ISO 6020/1, VW 39D920

The STORZ hydraulic cylinder series ZBD 1611 for a nominal pressure of 160 bar corresponds to ISO standard 6020/1 and VW standard 39D920.

By defining the mounting dimensions, installation length, area ratios, piston rod ends and connection threads, international interchangeability of these hydraulic cylinders is ensured.

The same installation dimensions apply to cylinders with and without end position cushioning.

Two rod diameters are assigned as standard to each piston diameter assigned (corresponding area ratios $\phi = 1.4$ and $\phi = 2$).

8 standardized mounting types and 6 seal variants are available.

Technical data:

Nominal pressure	160 bar (16 MPa)
Static test pressure	240 bar (24 MPa)
Piston ϕ	25 - 200 mm
Area ratio ϕ	1,4 and 2
Temperature range (of the hydraulic fluid) ϑ min. ... ϑ max.	- 20° ... + 80° C
Viscosity range v min. ... v max.	(10... 600) 10⁻⁶ m²/s
Stroke speed range v min. ... v max.	0 - 0.5 m/s or 0 - 1 m/s depending on seal variant. Higher speed on request.
Hydraulic fluid	Mineral oil according to DIN 51524, HFD fluids. For HFA, HFB and HFC fluids please please consult us.



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Available mounting types

A Basic design 4

MT 4 Trunnion 5

MF 3 Round flange at cylinder head 6

MF 4 Round flange at cylinder cap 7

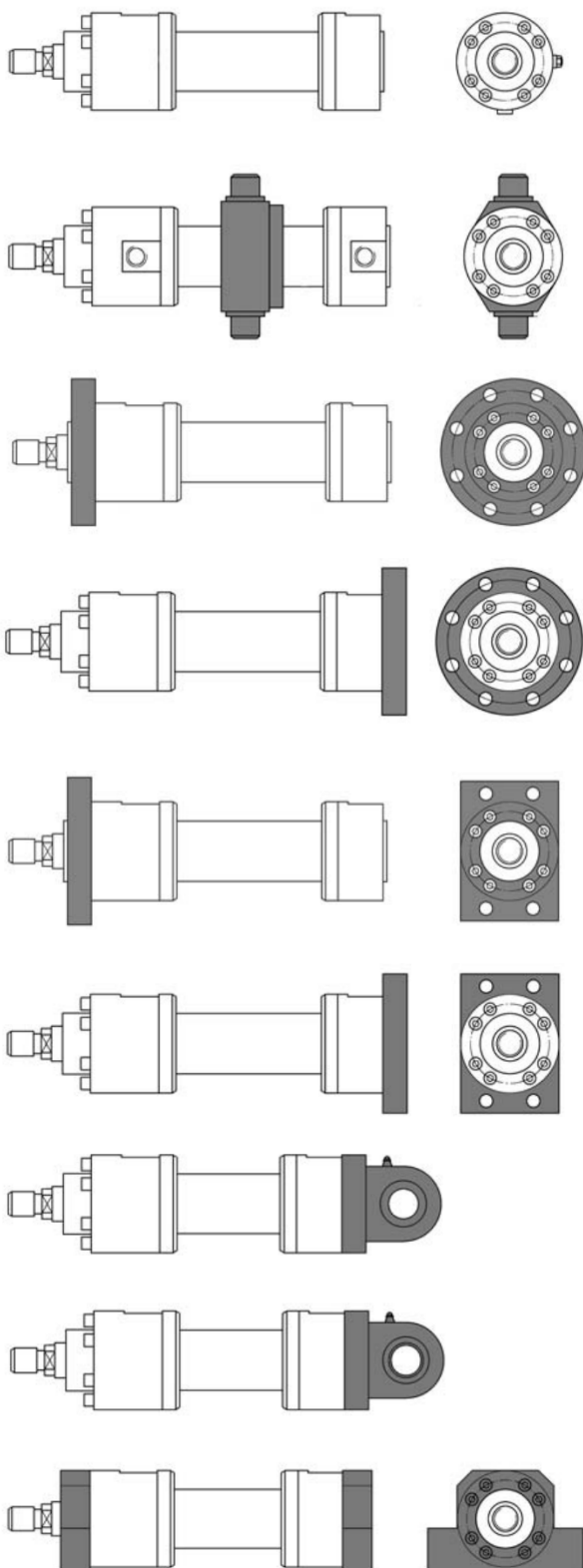
MF 1 Rectangular flange at cylinder head 8

MF 2 Rectangular flange at cylinder cap 9

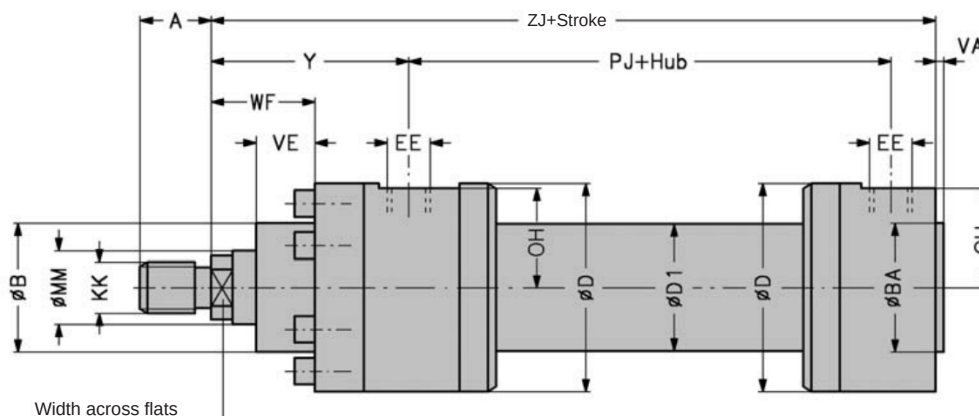
MP 4 Swivel eye at cylinder cap 10

MP 6 Spherical eye at cylinder cap 11

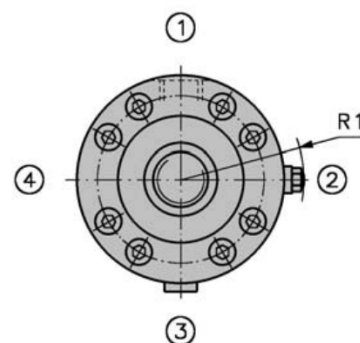
MS 2 Foot mounting 12



Mounting type A - basic design



Position of function bores 1-4 according to model code
Start-up valve head end only;
is placed on the free side



Dimension R1 applies to all mounting types!

① ② ③ ④ : side determination

Piston Ø (mm)	Rod Ø MM (mm)	Piston area A ₁ (cm ²)	Annular area A ₂ (cm ²)	ZJ + stroke	Pipe connection EE Whitworth pipe thr./ Metric thread	Rod thread KK	A max.	Ø B _{f8} / Ø BA ^{H8/f8}	Ø D	Ø D1 max. ¹⁾	PJ + stroke	R1 ¹⁾	VA	VE	WF	OH	Y	Minimum stroke ²⁾	Width across flats
25	14 18	4,9	3,4 2,4	150	G ¼ M 14 x 1,5	M 12 x 1.25	16	32	56	33	77	42	3	15	28	25,5	58	30	12 15
32	18 22	8,0	5,5 4,2	170	G ½ M 18 x 1,5	M 14 x 1,5	18	40	67	42	89	44	3	19	32	30,0	64	26	15 19
40	22 28	12,6	8,8 6,4	190	G ½ M 22 x 1,5	M 16 x 1,5	22	50	78	52	97	56	3	19	32	35,0	71	37	19 24
50	28 36	19,6	13,5 9,5	205	G ½ M 22 x 1,5	M 20 x 1,5	28	60	95	62	111	60	4	24	38	44,0	72	30	24 30
63	36 45	31,2	21,0 15,3	224	G ¾ M 27 x 2	M 27 x 2	36	70	116	78	117	70	4	29	45	54,0	82	35	30 36
80	45 56	50,3	34,4 25,6	250	G ¾ M 27 x 2	M 33 x 2	45	85	130	95	134	80	4	36	54	62,0	91	29	36 46
100	56 70	78,5	53,9 40,1	300	G 1 M 33 x 2	M 42 x 2	56	106	158	120	162	90	5	37	57	75,0	108	34	46 60
125	70 90	123	84,2 59,1	325	G 1 M 33 x 2	M 48 x 2	63	132	192	150	174	108	5	37	60	92,0	121	0	60 75
140 ⁴⁾	80 100	154	104 75,4	360	G 1¼ M 42 x 2	M 56 x 2	75	145	215	170	194	125	5	40	64	103,5	134	0	65 85
160	90 110	201	137 106	370	G 1¼ M 42 x 2	M 64 x 3	85	160	238	190	191	130	5	41	66	115,0	143	0	75 95
180 ⁴⁾	100 125	254	176 132	425	G 1¼ M 42 x 2	M 72 x 3	90	185	260	210	214	150	5	45	75	126,0	175	0	85 110
200	110 140	314	219 160	450	G 1¼ M 42 x 2	M 80 x 3	95	200	285	235	224	160	5	45	75	138,0	190	0	95 120

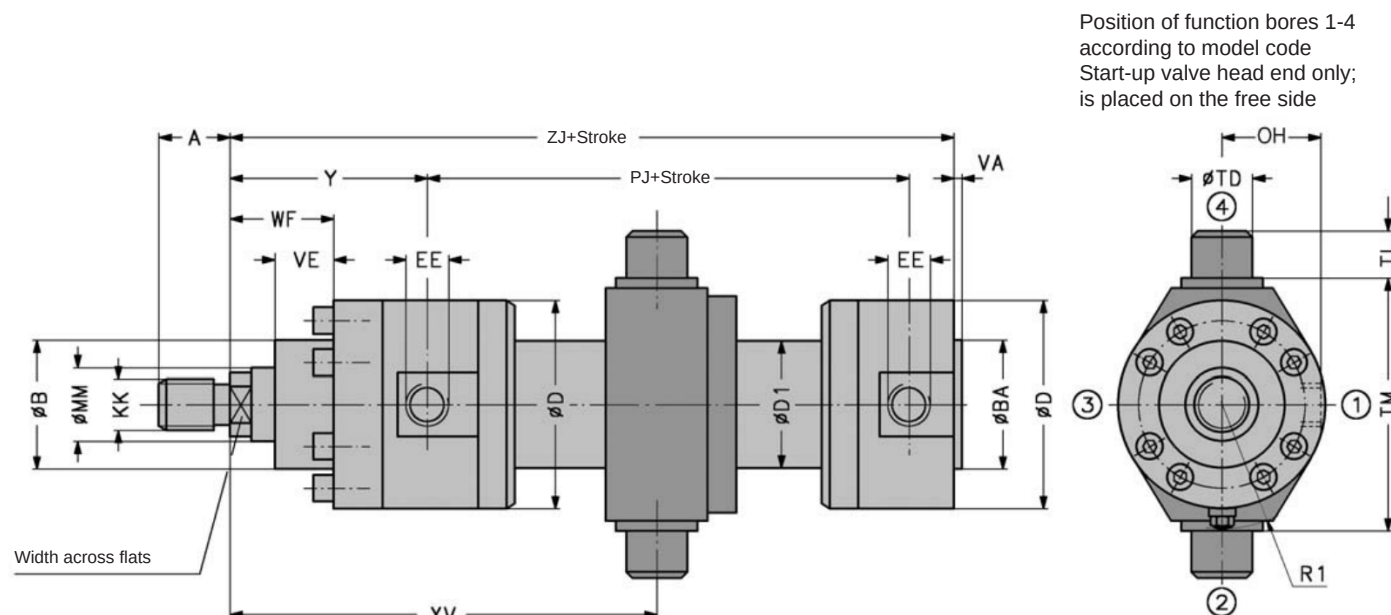
Remarks:

1) Not standardized dimensions

2) Minimum stroke due to production. Shorter stroke lengths possible by using a spacer bush.

4) Not standardized piston Ø

Mounting type MT 4 - cylinder with trunnion



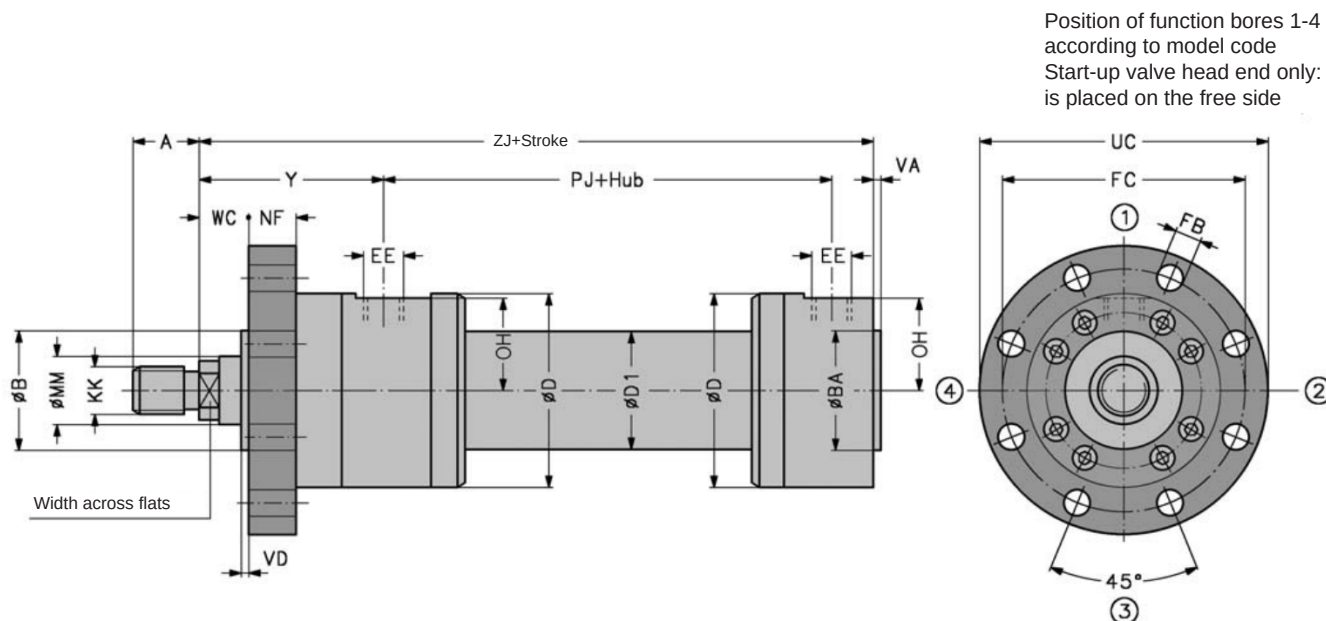
① ② ③ ④ : side determination

Piston Ø (mm)	Rod Ø MM (mm)	Piston area A ₁ (cm ²)	Annular area A ₂ (cm ²)	ZJ + stroke	Pipe connection EE Whitworth pipe thr./ Metric thread	Rod thread KK	A max.	Ø B _{fg} / Ø BA H8/f8	Ø D	Ø D1 max. ¹⁾	PJ + stroke	R1 ^{1) 5)}	Ø TD _{fg}	TL _{js16}	TM _{h12}	VA	VE	WF	OH	XV ³⁾ 5) min. max = stroke +	Y	Minimum stroke ²⁾	Width across flats
25	14 18	4,9	3,4 2,4	150	M 14 x 1,5 G 1/4	M 12 x 1,25	16	32	56	33	77	42	12	10	63	3	15	28	25,5	113	53	58	60 12 15
32	18 22	8,0	5,5 4,2	170	M 18 x 1,5 G 1/2	M 14 x 1,5	18	40	67	42	89	44	16	12	75	3	19	32	30,0	128	62	64	66 15 19
40	22 28	12,6	8,8 6,4	190	M 22 x 1,5 G 1/2	M 16 x 1,5	22	50	78	52	97	56	20	16	90	3	19	32	35,0	152	69	71	83 19 24
50	28 36	19,6	13,5 9,5	205	M 22 x 1,5 G 1/2	M 20 x 1,5	28	60	95	62	111	60	25	20	105	4	24	38	44,0	160	79	72	81 24 30
63	36 45	31,2	21,0 15,3	224	M 27 x 2 G 3/4	M 27 x 2	36	70	116	78	117	70	32	25	120	4	29	45	54,0	179	80	82	99 30 36
80	45 56	50,3	34,4 25,6	250	M 27 x 2 G 3/4	M 33 x 2	45	85	130	95	134	80	40	32	135	4	36	54	62,0	199	95	91	104 36 46
100	56 70	78,5	53,9 40,1	300	M 33 x 2 G 1	M 42 x 2	56	106	158	120	162	90	50	40	160	5	37	57	75,0	243	123	108	120 46 60
125	70 90	123	84,2 59,1	325	M 33 x 2 G 1	M 48 x 2	63	132	192	150	174	108	63	50	195	5	37	60	92,0	252	158	121	94 60 75
140 ⁴⁾	80 100	154	104 75,4	360	M 42 x 2 G 1 1/4	M 56 x 2	75	145	215	170	194	125	70	56	220	5	40	64	103,5	263	174	134	89 65 85
160	90 110	201	137 106	370	M 42 x 2 G 1 1/4	M 64 x 3	85	160	238	190	191	130	80	63	240	5	41	66	115,0	278	174	143	104 75 95
180 ⁴⁾	100 125	254	176 132	425	M 42 x 2 G 1 1/4	M 72 x 3	90	185	260	210	214	150	90	70	275	5	45	75	126,0	314	223	175	91 85 110
200	110 140	314	219 160	450	M 42 x 2 G 1 1/4	M 80 x 3	95	200	285	235	224	160	100	80	295	5	45	75	138,0	341	236	190	105 95 120

Remarks

- 1) Not standardized dimensions
- 2) Minimum stroke due to production. Shorter stroke lengths possible by using a spacer bush.
- 3) State XV dimension in plain text when ordering.
- 4) Not standardized piston Ø
- 5) If position 2 or 4 of the throttle screw is selected, there is a risk of collision between trunnion bracket and throttle screw. This must be checked by the user.

Mounting type MF 3 - cylinder with round flange at cylinder head



Position of function bores 1-4 according to model code
Start-up valve head end only:
is placed on the free side

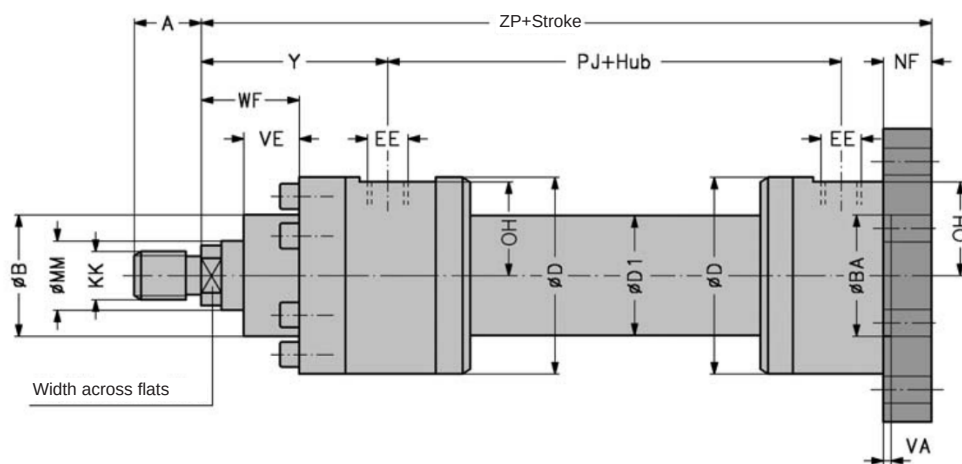
① ② ③ ④ : side determination

Piston Ø (mm)	Rod Ø MM (mm)	Piston area A ₁ (cm ²)	Annular area A ₂ (cm ²)	ZJ + stroke	Pipe connection EE Whitworth pipe thr./ Metric thread	Rod thread KK	A max.	Ø B ₁₈ / Ø BA H8/f8	Ø D	Ø D1 max. ¹⁾	FB H13	FC JS13	NF	PJ + stroke	R1 ^{1) 6)}	UC	VA / VD	WC	OH	Y	Minimum stroke ²⁾	Width across flats
25	14 18	4,9	3,4 2,4	150	G ¼ M 14 x 1,5	M 12 x 1.25	16	32	56	33	6,6	75	12	77	42	90	3	16	25,5	58	30	12 15
32	18 22	8,0	5,5 4,2	170	G ½ M 18 x 1,5	M 14 x 1,5	18	40	67	42	9	92	16	89	44	110	3	16	30,0	64	26	15 19
40	22 28	12,6	8,8 6,4	190	G ½ M 22 x 1,5	M 16 x 1,5	22	50	78	52	9	106	16	97	56	125	3	16	35,0	71	37	19 24
50	28 36	19,6	13,5 9,5	205	G ½ M 22 x 1,5	M 20 x 1,5	28	60	95	62	11	126	20	111	60	148	4	18	44,0	72	30	24 30
63	36 45	31,2	21,0 15,3	224	G ¾ M 27 x 2	M 27 x 2	36	70	116	78	13,5	145	25	117	70	170	4	20	54,0	82	35	30 36
80	45 56	50,3	34,4 25,6	250	G ¾ M 27 x 2	M 33 x 2	45	85	130	95	17,5	165	32	134	80	195	4	22	62,0	91	29	36 46
100	56 70	78,5	53,9 40,1	300	G 1 M 33 x 2	M 42 x 2	56	106	158	120	22	200	32	162	90	238	5	25	75,0	108	34	46 60
125	70 90	123	84,2 59,1	325	G 1 M 33 x 2	M 48 x 2	63	132	192	150	22	235	32	174	108	272	5	28	92,0	121	0	60 75
140 ⁴⁾	80 100	154	104 75,4	360	G 1¼ M 42 x 2	M 56 x 2	75	145	215	170	22	260	35	194	125	295	5	30	103,5	134	0	65 85
160	90 110	201	137 106	370	G 1¼ M 42 x 2	M 64 x 3	85	160	238	190	22	280	36	191	130	316	5	30	115,0	143	0	75 95
180 ⁴⁾	100 125	254	176 132	425	G 1¼ M 42 x 2	M 72 x 3	90	185	260	210	26	320	40	214	150	365	5	35	126,0	175	0	85 110
200	110 140	314	219 160	450	G 1¼ M 42 x 2	M 80 x 3	95	200	285	235	26	340	40	224	160	385	5	35	138,0	190	0	95 120

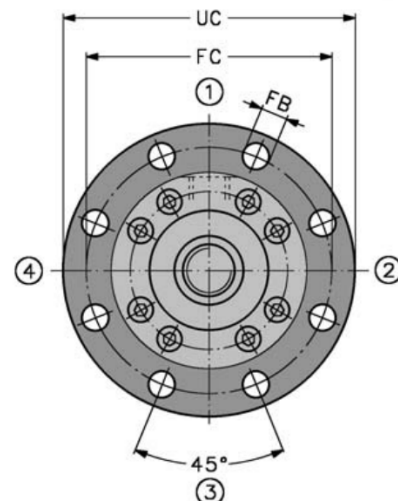
Remarks

- 1) Not standardized dimensions
- 2) Minimum stroke due to production. Shorter stroke lengths possible by using a spacer bush.
- 4) Not standardized piston Ø
- 6) For dimension R1 see basic design A

Mounting type MF 4 - cylinder with round flange at cylinder cap



Position of function bores 1-4 according to model code
Start-up valve head end only;
is placed on the free side



① ② ③ ④ : side determination

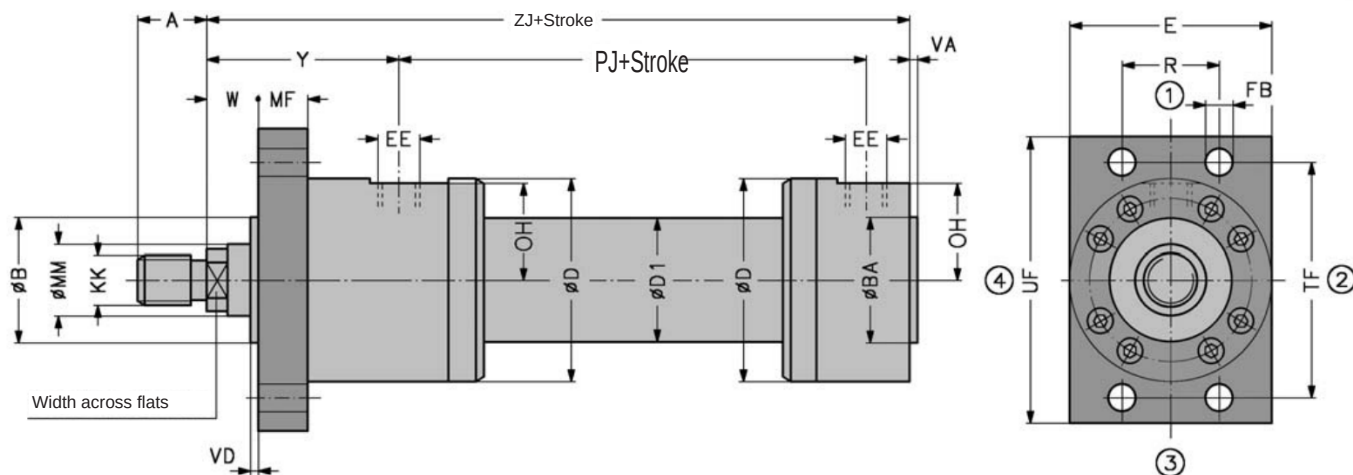
Piston Ø (mm)	Rod Ø MM	Piston area A ₁ (cm ²)	Annular area A ₂ (cm ²)	ZP + stroke	Pipe connection EE Whitworth pipe thr./ Metric thread	Rod thread KK	A max.	Ø B _{fg} / Ø BA ^{H8/f8}	Ø D	Ø D1 max. ¹⁾	FB ^{H13}	FC ^{js13}	NF	PJ + stroke	R1 ¹⁾⁶⁾	UC	VA	VE	WF	OH	Y	Minimum stroke ²⁾	Width across flats
25	14 18	4,9	3,4 2,4	162	M 14 x 1,5 G 1/4	M 12 x 1,25	16	32	56	33	6,6	75	12	77	42	90	3	15	28	25,5	58	30	12 15
32	18 22	8,0	5,5 4,2	186	M 18 x 1,5 G 1/2	M 14 x 1,5	18	40	67	42	9	92	16	89	44	110	3	19	32	30,0	64	26	15 19
40	22 28	12,6	8,8 6,4	206	M 22 x 1,5 G 1/2	M 16 x 1,5	22	50	78	52	9	106	16	97	56	125	3	19	32	35,0	71	37	19 24
50	28 36	19,6	13,5 9,5	225	M 22 x 1,5 G 1/2	M 20 x 1,5	28	60	95	62	11	126	20	111	60	148	4	24	38	44,0	72	30	24 30
63	36 45	31,2	21,0 15,3	249	M 27 x 2 G 3/4	M 27 x 2	36	70	116	78	13,5	145	25	117	70	170	4	29	45	54,0	82	35	30 36
80	45 56	50,3	34,4 25,6	282	M 27 x 2 G 3/4	M 33 x 2	45	85	130	95	17,5	165	32	134	80	195	4	36	54	62,0	91	29	36 46
100	56 70	78,5	53,9 40,1	332	M 33 x 2 G 1	M 42 x 2	56	106	158	120	22	200	32	162	90	238	5	37	57	75,0	108	34	46 60
125	70 90	123	84,2 59,1	357	M 33 x 2 G 1	M 48 x 2	63	132	192	150	22	235	32	174	108	272	5	37	60	92,0	121	0	60 75
140 ⁴⁾	80 100	154	104 75,4	395	M 42 x 2 G 1 1/4	M 56 x 2	75	145	215	170	22	260	35	194	125	295	5	40	64	103,5	134	0	65 85
160	90 110	201	137 106	406	M 42 x 2 G 1 1/4	M 64 x 3	85	160	238	190	22	280	36	191	130	316	5	41	66	115,0	143	0	75 95
180 ⁴⁾	100 125	254	176 132	465	M 42 x 2 G 1 1/4	M 72 x 3	90	185	260	210	26	320	40	214	150	365	5	45	75	126,0	175	0	85 110
200	110 140	314	219 160	490	M 42 x 2 G 1 1/4	M 80 x 3	95	200	285	235	26	340	40	224	160	385	5	45	75	138,0	190	0	95 120

Remarks

- 1) Not standardized dimensions
- 2) Minimum stroke due to production. Shorter stroke lengths possible by using a spacer bush.
- 4) Not standardized piston Ø
- 6) For dimension R1 see basic design A

Mounting type MF1 - cylinder with rectangular flange at cylinder head

Position of function bores 1-4 according to model code
Start-up valve head end only; is placed on the free side



① ② ③ ④ : side determination

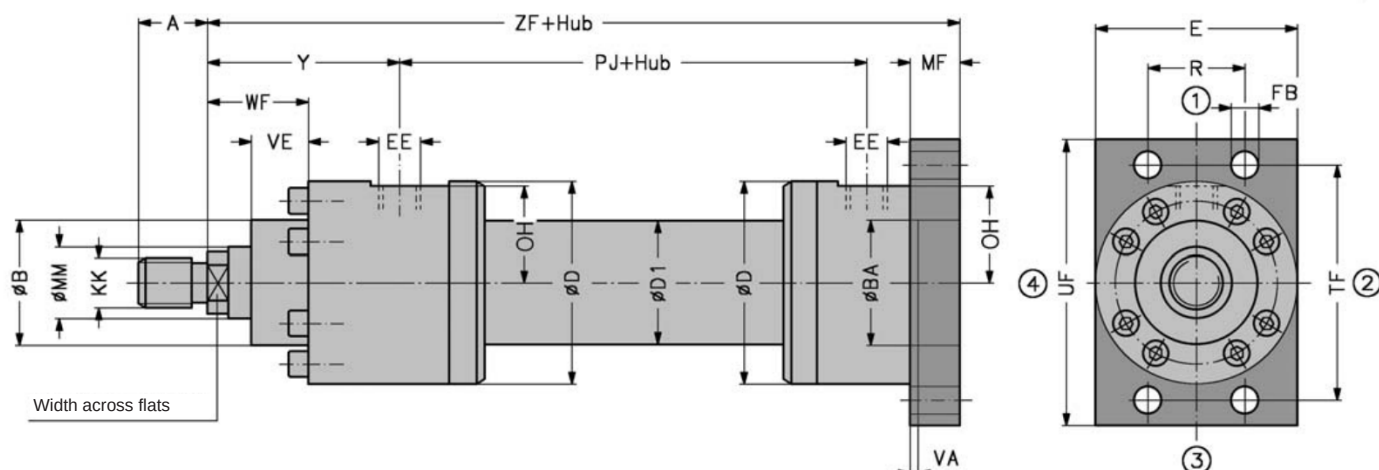
Piston Ø (mm)	Rod Ø MM (mm)	Piston area A ₁ (cm ²)	Annular area A ₂ (cm ²)	ZJ + stroke	Pipe connection EE Whitworth pipe thr./ Metric thread	Rod thread KK	A max.	Ø B _{fg} /Ø BA ^{H8/f8}	Ø D	Ø D1 max. ¹⁾	E max.	FB ^{H13}	MF	PJ + stroke	R ^{js13}	R1 ¹⁾⁶⁾	TF ^{js13}	UF max.	VAVD	W	OH	Y	Minimum stroke ²⁾	Width across flats
25	14 18	4,9	3,4 2,4	150	M 14 x 1,5 G ¼	M 12 x 1.25	16	32	56	33	50	6,6	12	77	28,7	42	69,2	85	3	16	25,5	58	30	12 15
32	18 22	8,0	5,5 4,2	170	M 18 x 1,5 G ·	M 14 x 1,5	18	40	67	42	60	9,0	16	89	35,2	44	85,0	105	3	16	30,0	64	26	15 19
40	22 28	12,6	8,8 6,4	190	M 22 x 1,5 G ½	M 16 x 1,5	22	50	78	52	70	9,0	16	97	40,6	56	98,0	115	3	16	35,0	71	37	19 24
50	28 36	19,6	13,5 9,5	205	M 22 x 1,5 G½	M 20 x 1,5	28	60	95	62	96	11,0	20	111	48,2	60	116,4	140	4	18	44,0	72	30	24 30
63	36 45	31,2	21,0 15,3	224	M 27 x 2 G ¾	M 27 x 2	36	70	116	78	115	13,5	25	117	55,5	70	134,0	160	4	20	54,0	82	35	30 36
80	45 56	50,3	34,4 25,6	250	M 27 x 2 G ¾	M 33 x 2	45	85	130	95	132	17,5	32	134	63,1	80	152,5	185	4	22	62,0	91	29	36 46
100	56 70	78,5	53,9 40,1	300	M 33 x 2 G 1	M 42 x 2	56	106	158	120	157	22,0	32	162	76,5	90	184,8	225	55	25	75,0	108	34	46 60
125	70 90	123	84,2 59,1	325	M 33 x 2 G 1	M 48 x 2	63	132	192	150	190	22,0	32	174	90,2	108	217,1	255	5	28	92,0	121	0	60 75
140 ⁴⁾	80 100	154	104 75,4	360	M 42 x 2 G 1¼	M 56 x 2	75	145	215	170	-	22,0	-	194	-	125	-	-	5	30	103,5	134	0	65 85
160	90 110	201	137 106	370	M 42 x 2 G 1¼	M 64 x 3	85	160	238	190	-	22,0	-	191	-	130	-	-	5	30	115,0	143	0	75 95
180 ⁴⁾	100 125	254	176 132	425	M 42 x 2 G 1¼	M 72 x 3	90	185	260	210	-	26,0	-	214	-	150	-	-	5	35	126,0	175	0	85 110
200	110 140	314	219 160	450	M 42 x 2 G 1¼	M 80 x 3	95	200	285	235	-	26,0	-	224	-	160	-	-	35	138,0	190	0	95 120	

Remarks

- 1) Not standardized dimensions
- 2) Minimum stroke due to production. Shorter stroke lengths possible by using a spacer bush.
- 4) Not standardized piston Ø
- 6) For dimension R1 see basic design A

Mounting type MF 2 - cylinder with rectangular flange at cylinder cap

Position of function bores 1-4 according to model code
Start-up valve head end only:
is placed on the free side



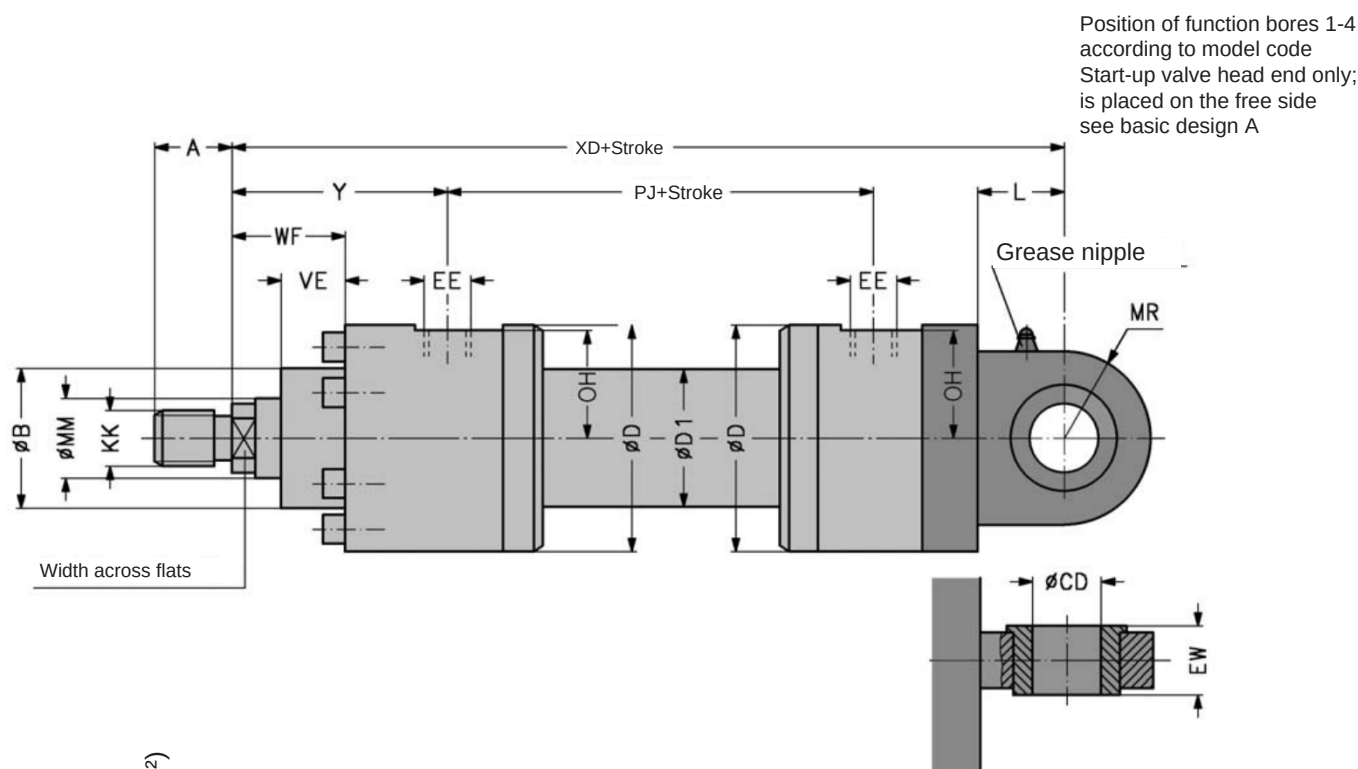
① ② ③ ④ : side determination

Piston Ø (mm)	Rod Ø MM (mm)	Piston area A ₁ (cm ²)	Annular area A ₂ (cm ²)	ZF + stroke	Pipe connection EE Whitworth pipe thr./ Metric thread	Rod thread KK	A max.	Ø B ₁₈ / Ø BA H8/f8	Ø D	Ø D1 max. ¹⁾	E max.	FB ^{H13}	MF	PJ + stroke	R _{js13}	R1 ¹⁾⁶⁾	TF _{js13}	UF max.	VA	VE	WF	OH	Y	Minimum stroke ²⁾	Width across flats
25	14 18	4,9	3,4 2,4	162	M 14 x 1,5 G 1/4	M 12 x 1,25	16	32	56	33	50	6,6	12	77	28,7	42	69,2	85	3	15	28	25,5	58	30	12 15
32	18 22	8,0	5,5 4,2	186	M 18 x 1,5 G 1/2	M 14 x 1,5	18	40	67	42	60	9,0	16	89	35,2	44	85,0	105	3	19	32	30,0	64	26	15 19
40	22 28	12,6	8,8 6,4	206	M 22 x 1,5 G 1/2	M 16 x 1,5	22	50	78	52	70	9,0	16	97	40,6	56	98,0	115	3	19	32	35,0	71	37	19 24
50	28 36	19,6	13,5 9,5	225	M 22 x 1,5 G 3/4	M 20 x 1,5	28	60	95	62	96	11,0	20	111	48,2	60	116,4	140	4	24	38	44,0	72	30	24 30
63	36 45	31,2	21,0 15,3	249	M 27 x 2 G 3/4	M 27 x 2	36	70	116	78	115	13,5	25	117	55,5	70	134,0	160	4	29	45	54,0	82	35	30 36
80	45 56	50,3	34,4 25,6	282	M 27 x 2 G 1	M 33 x 2	45	85	130	95	132	17,5	32	134	63,1	80	152,5	185	4	36	54	62,0	91	29	36 46
100	56 70	78,5	53,9 40,1	332	M 33 x 2 G 1	M 42 x 2	56	106	158	120	157	22,0	32	162	76,5	90	184,8	225	5	37	57	75,0	108	34	46 60
125	70 90	123	84,2 59,1	357	M 33 x 2 G 1	M 48 x 2	63	132	192	150	190	22,0	32	174	90,2	108	217,1	255	5	37	60	92,0	121	0	60 75
140 ⁴⁾	80 100	154	104 75,4	395	M 42 x 2 G 1 1/4	M 56 x 2	75	145	215	170	-	22,0	-	194	-	125	-	-	5	40	64	103,5	134	0	65 85
160	90 110	201	137 106	406	M 42 x 2 G 1 1/4	M 64 x 3	85	160	238	190	-	22,0	-	191	-	130	-	-	5	41	66	115,0	143	0	75 95
180 ⁴⁾	100 125	254	176 132	465	M 42 x 2 G 1 1/4	M 72 x 3	90	185	260	210	-	26,0	-	214	-	150	-	-	5	45	75	126,0	175	0	85 110
200	110 140	314	219 160	490	M 42 x 2 G 1 1/4	M 80 x 3	95	200	285	235	-	26,0	-	224	-	160	-	-	5	45	75	138,0	190	0	95 120

Remarks

- 1) Not standardized dimensions
- 2) Minimum stroke due to production. Shorter stroke lengths possible by using a spacer bush.
- 4) Not standardized piston Ø
- 6) For dimension R1 see basic design A

Mounting type MP 4 - cylinder with swivel eye at cylinder cap



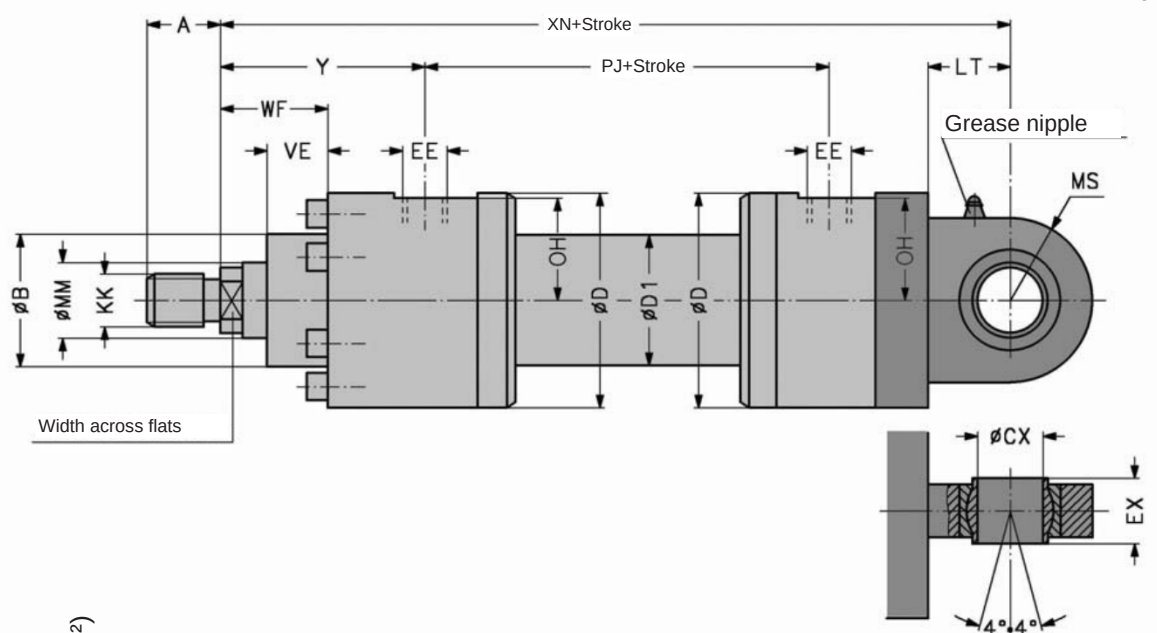
Piston Ø (mm)	Rod Ø MM (mm)	Piston area A ₁ (cm ²)	Annular area A ₂ (cm ²)	XD + stroke	Pipe connection EE Whitworth pipe thr./ Metric thread	Rod thread KK	A max.	Ø B ₁₈	Ø CD ^{H9}	Ø D	Ø D1 max. 1)	EW ^{h12}	L min.	MR max.	PJ + stroke	R1 ^{1/6)}	VE	WF	OH	Y	Minimum stroke 2)	Width across flats
25	14 18	4,9	3,4 2,4	178	G 1/4 M 14 x 1,5	M 12 x 1.25	16	32	12	56	33	12	16	16	77	42	15	28	25,5	58	30	12 15
32	18 22	8,0	5,5 4,2	206	G 1/2 M 18 x 1,5	M 14 x 1,5	18	40	16	67	42	16	20	20	89	44	19	32	30,0	64	26	15 19
40	22 28	12,6	8,8 6,4	231	G 1/2 M 22 x 1,5	M 16 x 1,5	22	50	20	78	52	20	25	25	97	56	19	32	35,0	71	37	19 24
50	28 36	19,6	13,5 9,5	257	G 1/2 M 22 x 1,5	M 20 x 1,5	28	60	25	95	62	25	32	32	111	60	24	38	44,0	72	30	24 30
63	36 45	31,2	21,0 15,3	289	G 3/4 M 27 x 2	M 27 x 2	36	70	32	116	78	32	40	40	117	70	29	45	54,0	82	35	30 36
80	45 56	50,3	34,4 25,6	332	G 3/4 M 27 x 2	M 33 x 2	45	85	40	130	95	40	50	50	134	80	36	54	62,0	91	29	36 46
100	56 70	78,5	53,9 40,1	395	G 1 M 33 x 2	M 42 x 2	56	106	50	158	120	50	63	63	162	90	37	57	75,0	108	34	46 60
125	70 90	123	84,2 59,1	428	G 1 M 33 x 2	M 48 x 2	63	132	63	192	150	63	71	71	174	108	37	60	92,0	121	0	60 75
140 ⁴⁾	80 100	154	104 75,4	485	G 1 1/4 M 42 x 2	M 56 x 2	75	145	70	215	170	70	85	85	194	125	40	64	103,5	134	0	65 85
160	90 110	201	137 106	505	G 1 1/4 M 42 x 2	M 64 x 3	85	160	80	238	190	80	90	90	191	130	41	66	115,0	143	0	75 95
180 ⁴⁾	100 125	254	176 132	580	G 1 1/4 M 42 x 2	M 72 x 3	90	185	90	260	210	90	101	101	214	150	45	75	126,0	175	0	85 110
200	110 140	314	219 160	615	G 1 1/4 M 42 x 2	M 80 x 3	95	200	100	285	235	100	112	112	224	160	45	75	138,0	190	0	95 120

Remarks

- 1) Not standardized dimensions
- 2) Minimum stroke due to production. Shorter stroke lengths possible by using a spacer bush.
- 4) Not standardized piston Ø
- 6) For dimension R1 see basic design A

Mounting type MP 6 - cylinder with spherical eye at cylinder cap

Position of function bores 1-4 according to model code
Start-up valve head end only; is placed on the free side see basic design A



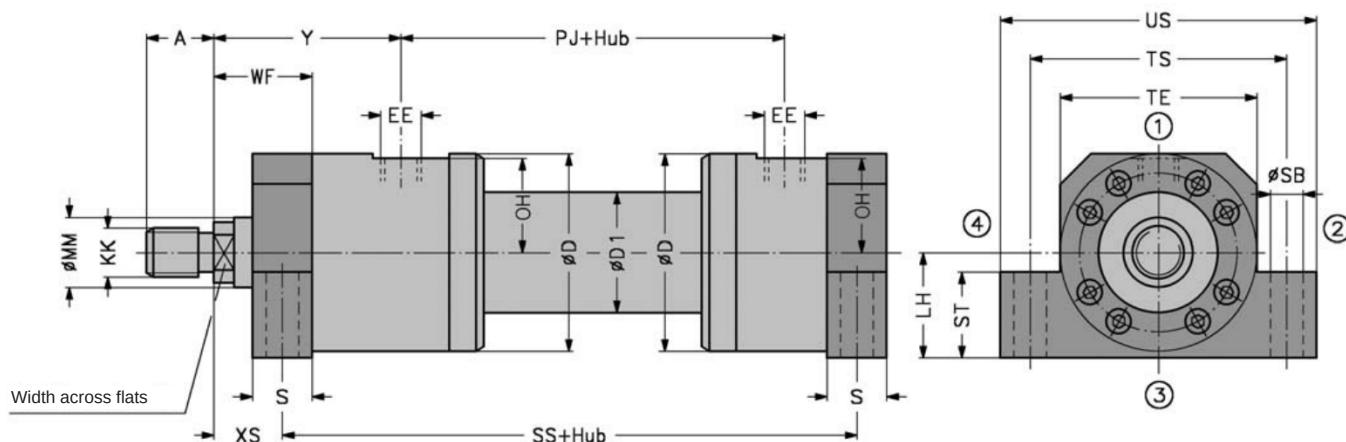
Piston Ø (mm)	Rod Ø MM	Piston area A ₁ (cm ²)	Annular area A ₂ (cm ²)	XN + stroke	Pipe connection EE Whitworth pipe thr./ Metric thread	Rod thread KK	A max.	Ø B _{f8}	Ø CX ^{H9}	Ø D	Ø D1 max. ¹⁾	EX ^{h12}	LT min.	MS max.	PJ + stroke	R1 ¹⁾⁶⁾	VE	WF	OH	Y	Minimum stroke ²⁾	Width across flats
25	14 18	4,9	3,4 2,4	178	M 14 x 1,5	M 12 x 1,25	16	32	12	56	33	12	16	16	77	42	15	28	25,5	58	30	12 15
32	18 22	8,0	5,5 4,2	206	M 18 x 1,5	M 14 x 1,5	18	40	16	67	42	16	20	20	89	44	19	32	30,0	64	26	15 19
40	22 28	12,6	8,8 6,4	231	M 22 x 1,5	M 16 x 1,5	22	50	20	78	52	20	25	25	97	56	19	32	35,0	71	37	19 24
50	28 36	19,6	13,5 9,5	257	M 22 x 1,5	M 20 x 1,5	28	60	25	95	62	25	32	32	111	60	24	38	44,0	72	30	24 30
63	36 45	31,2	21,0 15,3	289	M 27 x 2	M 27 x 2	36	70	32	116	78	32	40	40	117	70	29	45	54,0	82	35	30 36
80	45 56	50,3	34,4 25,6	332	M 27 x 2	M 33 x 2	45	85	40	130	95	40	50	50	134	80	36	54	62,0	91	29	36 46
100	56 70	78,5	53,9 40,1	395	M 33 x 2	M 42 x 2	56	106	50	158	120	50	63	63	162	90	37	57	75,0	108	34	46 60
125	70 90	123	84,2 59,1	428	M 33 x 2	M 48 x 2	63	132	63	192	150	63	71	71	174	108	37	60	92,0	121	0	60 75
140⁴⁾	80 100	154	104 75,4	485	M 42 x 2	M 56 x 2	75	145	70	215	170	70	85	85	194	125	40	64	103,5	134	0	65 85
160	90 110	201	137 106	505	M 42 x 2	M 64 x 3	85	160	80	238	190	80	90	90	191	130	41	66	115,0	143	0	75 95
180⁴⁾	100 125	254	176 132	580	M 42 x 2	M 72 x 3	90	185	90	260	210	90	101	101	214	150	45	75	126,0	175	0	85 110
200	110 140	314	219 160	615	M 42 x 2	M 80 x 3	95	200	100	285	235	100	112	112	224	160	45	75	138,0	190	0	95 120

Remarks

- 1) Not standardized dimensions
- 2) Minimum stroke due to production. Shorter stroke lengths possible by using a spacer bush.
- 4) Not standardized piston Ø
- 6) For dimension R1 see basic design A

Mounting type MS 2 - cylinder with foot mounting

Position of function bores 1-4 according to model code
Start-up valve head end only;
is placed on the free side

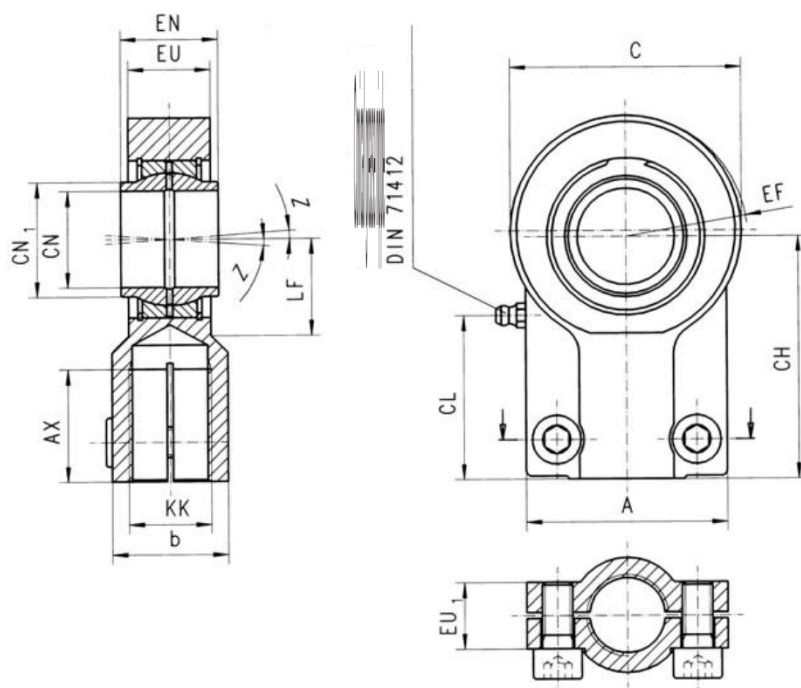


① ② ③ ④ : side determination

Piston Ø (mm)	Rod Ø MM (mm)	Piston area A ₁ (cm ²)	Annular area A ₂ (cm ²)	SS + stroke	Pipe connection EE Whitworth pipe thr. / Metric thread	Rod thread KK	A max.	Ø D	Ø D 1 max. ¹⁾	LH ^{h14}	PJ + stroke	R1 ¹⁾⁶⁾	S ^{js13}	Ø SB ^{h13}	ST max.	TE ^{js13}	TS ^{js13}	US max.	WF	OH	XS	Y	Minimum stroke ²⁾	Width across flats
25	14 18	4,9	3,4 2,4	142	M 14 x 1,5 G ¼	M 12 x 1,25	16	56	33	32	77	42	20	9	32	56	75	92	28	25,5	18,0	58	30	12 15
32	18 22	8,0	5,5 4,2	163	M 18 x 1,5 G ½	M 14 x 1,5	18	67	42	38	89	44	25	11	38	67	90	110	32	30,0	19,5	64	26	15 19
40	22 28	12,6	8,8 6,4	183	M 22 x 1,5 G ½	M 16 x 1,5	22	78	52	43	97	56	25	11	43	78	100	120	32	35,0	19,5	71	37	19 24
50	28 36	19,6	13,5 9,5	199	M 22 x 1,5 G ½	M 20 x 1,5	28	95	62	52	111	60	32	14	52	95	120	145	38	44,0	22,0	72	30	24 30
63	36 45	31,2	21,0 15,3	211	M 27 x 2 G ¾	M 27 x 2	36	116	78	62	117	70	32	18	62	116	150	180	45	54,0	29,0	82	35	30 36
80	45 56	50,3	34,4 25,6	236	M 27 x 2 G ¾	M 33 x 2	45	130	95	70	134	80	40	22	70	130	170	210	54	62,0	34,0	91	29	36 46
100	56 70	78,5	53,9 40,1	293	M 33 x 2 G 1	M 42 x 2	56	158	120	82	162	90	50	26	82	158	205	250	57	75,0	32,0	108	34	46 60
125	70 90	123	84,2 59,1	321	M 33 x 2 G 1	M 48 x 2	63	192	150	100	174	108	56	33	100	192	245	300	60	92,0	32,0	121	0	60 75
140 ⁴⁾	80 100	154	104 75,4	354	M 42 x 2 G 1¼	M 56 x 2	75	215	170	112	194	125	58	33	112	215	270	325	64	103,5	35,0	134	0	65 85
160	90 110	201	137 106	364	M 42 x 2 G 1¼	M 64 x 3	85	238	190	119	191	130	60	33	119	238	295	350	66	115,0	36,0	143	0	75 95
180 ⁴⁾	100 125	254	176 132	418	M 42 x 2 G 1¼	M 72 x 3	90	260	210	134	214	150	68	39	134	260	325	390	75	126,0	41,0	175	0	85 110
200	110 140	314	219 160	447	M 42 x 2 G 1¼	M 80 x 3	95	285	235	145	224	160	72	39	145	285	350	415	75	138,0	39,0	190	0	95 120

Remarks

- 1) Not standardized dimensions
- 2) Minimum stroke due to production. Shorter stroke lengths possible by using a spacer bush.
- 4) Not standardized piston Ø
- 6) For dimension R1 see basic design A



for piston Ø for rod Ø	Order designation	(N) Nominal force	A	AX min. max.	C	CH	CN ²⁾ H7	CN ₁	EF	EN h12	EU	EU ₁	KK	LF	Z	Cylinder Screw with Hex socket		Weight (kg)	b	CL ~
																ISO 4762-8.8	MA (Nm)			
25 / ¹⁴ / ₁₈	KG-12 ¹⁾	8 000	32	17	32	38	12	15,5	16	12	10,5	12	M 12 x 1,25	14	4°	M 5 x 15	6	0,11	16	-
32 / ¹⁸ / ₂₂	KG-16	12 500	40	19	40	44	16	20	20	16	13	11,5	M 14 x 1,5	18	4°	M 6 x 14	6	0,21	21	30,0
40 / ²² / ₂₈	KG-20	20 000	47	23	50	52	20	25	25	20	17	14	M 16 x 1,5	22	4°	M 8 x 20	10	0,40	25	34,5
50 / ²⁸ / ₃₆	KG-25	32 000	54	29	62	65	25	30,5	32	25	21	17	M 20 x 1,5	27	4°	M 8 x 20	10	0,66	30	44,0
63 / ³⁶ / ₄₅	KG-32	50 000	66	37	76	80	32	38,0	40	32	27	22	M 27 x 2	32	4°	M 10 x 25	25	1,19	38	54,0
80 / ⁴⁵ / ₅₆	KG-40	80 000	80	46	97	97	40	46,0	50	40	32	26	M 33 x 2	41	4°	M 10 x 25	25	2,05	47	66,0
100 / ⁵⁶ / ₇₀	KG-50	125 000	96	57	118	120	50	57,0	63	50	40	32	M 42 x 2	50	4°	M 12 x 35	49	4,45	58	82,5
125 / ⁷⁰ / ₉₀	KG-63	200 000	114	64	142	140	63	71,5	71	63	52	38	M 48 x 2	62	4°	M 16 x 40	86	7,60	70	92,5
140 / ⁸⁰ / ₁₀₀	KG-70*	250 000	135	76	155	160	70	79,0	85	70	57	42	M 56 x 2	70	4°	M 16 x 40	210	9,50	80	115,0
160 / ⁹⁰ / ₁₁₀	KG-80	320 000	148	86	180	180	80	91,0	90	80	66	48	M 64 x 3	78	4°	M 20 x 50	210	14,50	90	120,0
180 / ¹⁰⁰ / ₁₂₅	KG-90*	400 000	160	91	185	195	90	99,0	101	90	72	52	M 72 x 3	85	4°	M 20 x 50	210	17,00	100	140,0
200 / ¹¹⁰ / ₁₄₀	KG-100	500 000	178	96	224	210	100	113,0	112	100	84	62	M 80 x 3	98	4°	M 24 x 60	410	28,00	110	135,0
220 / ¹²⁵ / ₁₆₀	KG-110*	635 000	190	106	235	235	110	124,0	129	110	88	62	M 90 x 3	105	4°	M 24 x 60	410	32,00	125	155,0
250 / ¹⁴⁰ / ₁₈₀	KG-125	800 000	200	113	290	260	125	138,0	160	125	102	72	M 100 x 3	120	4°	M 24 x 70	410	43,00	135	170,0
280 / ¹⁶⁰ / ₂₀₀	KG-140																			
320 / ¹⁸⁰ / ₂₂₀	KG-160	1250 000	250	126	346	310	160	177,0	200	160	130	82	M 125 x 4	150	4°	M 24 x 80	710	80,00	165	195,0
360 / ²⁰⁰ / ₂₅₀	KG-180																			
400 / ²²⁰ / ₂₈₀	KG-200	2000 000	320	161	460	390	200	221,0	250	200	162	102	M 160 x 4	195	4°	M 30 x 100	1450	165,00	215	245,0
450 / ²⁵⁰ / ₃₂₀	KG-220																			
500 / ²⁸⁰ / ₃₆₀	KG-250	3200 000	420	205	640	530	250	315,0	320	250	192	142	M 200 x 4	265	4°	M 36 x 140	2450	425,00	300	330,0

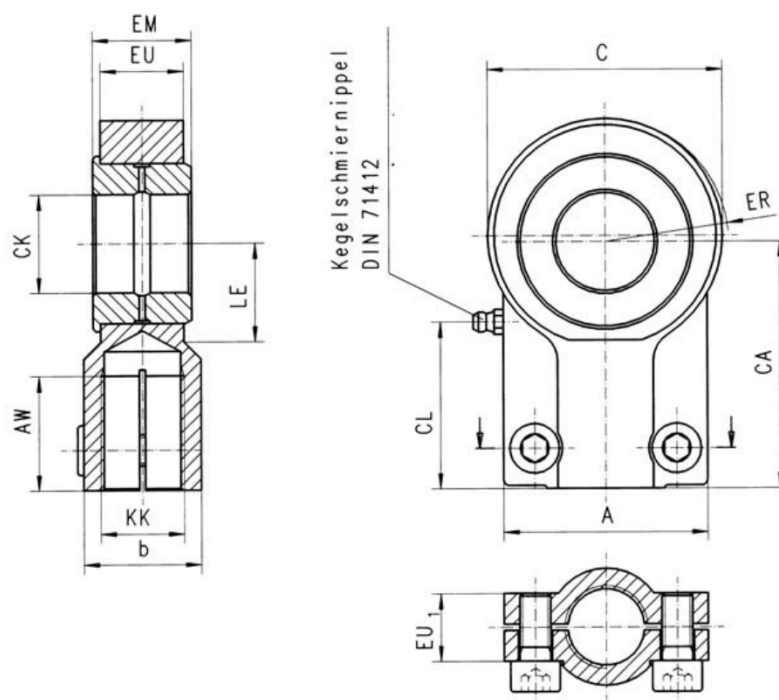
Remarks

1) Type KG-12 without grease nipple

2) Pin with tolerance f8

* not standardized intermediate sizes

Cylinder accessories rod end plain eyes type KS - ISO 6981, DIN 24 337



for piston Ø for rod Ø	Order designation	(N) Nominal force	A	AW min.	C max.	CA	CK ²⁾ H9	ER	EM h12	EU	EU ₁	KK	LE	Cylinder screw with hex socket		Weight (kg)	b	CL ~
														ISO 4762-8.8	MA (Nm)			
25 / ¹⁴ / ₁₈	KS-12 ¹⁾	8 000	32	17	32	38	12	16	12	10,5	12	M 12 x 1.25	14	M 5 x 15	6	0,11	16	-
32 / ¹⁸ / ₂₂	KS-16	12 500	40	19	40	44	16	20	16	13	11,5	M 14 x 1,5	18	M 6 x 14	6	0,21	21	30,0
40 / ²² / ₂₈	KS-20	20 000	47	23	50	52	20	25	20	17	14	M 16 x 1,5	22	M 8 x 20	10	0,40	25	34,5
50 / ²⁸ / ₃₆	KS-25	32 000	54	29	62	65	25	32	25	21	17	M 20 x 1,5	27	M 8 x 20	10	0,66	30	44,0
63 / ³⁶ / ₄₅	KS-32	50 000	66	37	76	80	32	40	32	27	22	M 27 x 2	32	M 10 x 25	25	1,19	38	54,0
80 / ⁴⁵ / ₅₆	KS-40	80 000	80	46	97	97	40	50	40	32	26	M 33 x 2	41	M 10 x 25	25	2,05	47	66,0
100 / ⁵⁶ / ₇₀	KS-50	125 000	96	57	118	120	50	63	50	40	32	M 42 x 2	50	M 12 x 35	49	4,45	58	82,5
125 / ⁷⁰ / ₉₀	KS-63	200 000	114	64	142	140	63	71	63	52	38	M 48 x 2	62	M 16 x 40	86	7,60	70	92,5
140 / ⁸⁰ / ₁₀₀	KS-70*	250 000	135	76	155	160	70	85	70	57	42	M 56 x 2	70	M 16 x 40	210	9,50	80	115,0
160 / ⁹⁰ / ₁₁₀	KS-80	320 000	148	86	180	180	80	90	80	66	48	M 64 x 3	78	M 20 x 50	210	14,50	90	120,0
180 / ¹⁰⁰ / ₁₂₅	KS-90*	400 000	160	91	185	195	90	101	90	72	52	M 72 x 3	85	M 20 x 50	210	17,00	100	140,0
200 / ¹¹⁰ / ₁₄₀	KS-100	500 000	178	96	224	210	100	112	100	84	62	M 80 x 3	98	M 24 x 60	410	28,00	110	135,0
220 / ¹²⁵ / ₁₆₀	KS-110*	635 000	190	106	235	235	110	129	110	88	62	M 90 x 3	105	M 24 x 60	410	32,00	125	155,0
250 / ¹⁴⁰ / ₁₈₀	KS-125	800 000	200	113	290	260	125	160	125	102	72	M 100 x 3	120	M 24 x 70	410	43,00	135	170,0
280 / ¹⁶⁰ / ₂₀₀	KS-140																	
320 / ¹⁸⁰ / ₂₂₀	KS-160	1250 000	250	126	346	310	160	200	160	130	82	M 125 x 4	150	M 24 x 80	710	80,00	165	195,0
360 / ²⁰⁰ / ₂₅₀	KS-180																	
400 / ²²⁰ / ₂₈₀	KG-200	2000 000	320	161	460	390	200	250	200	162	102	M 160 x 4	195	M 30 x 100	1450	165,00	215	245,0
450 / ²⁵⁰ / ₃₂₀	KG-220																	
500 / ²⁸⁰ / ₃₆₀	KG-250	3200 000	420	205	640	530	250	320	250	192	142	M 200 x 4	265	M 36 x 140	2450	425,00	300	330,0

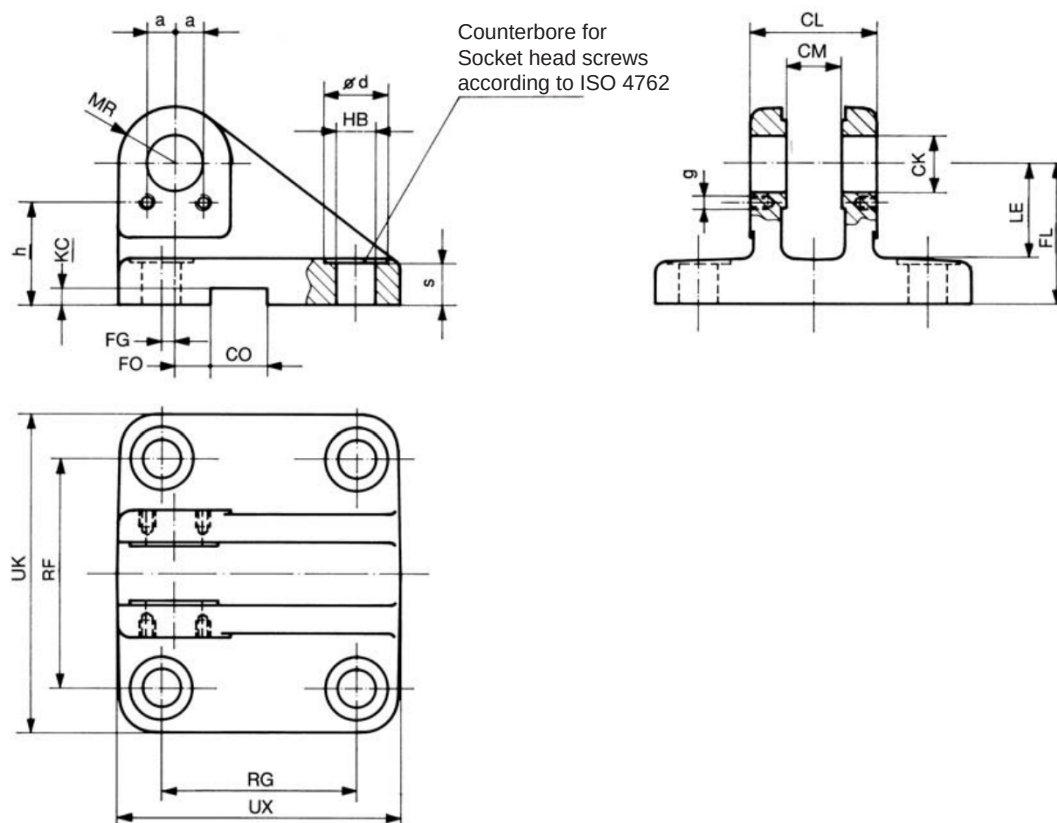
Remarks:

1) Type KS-12 without grease nipple

2) Pin with tolerance **m6**

* not standardized intermediate sizes

Cylinder accessories clevis brackets 90° type CBB - ISO 8132



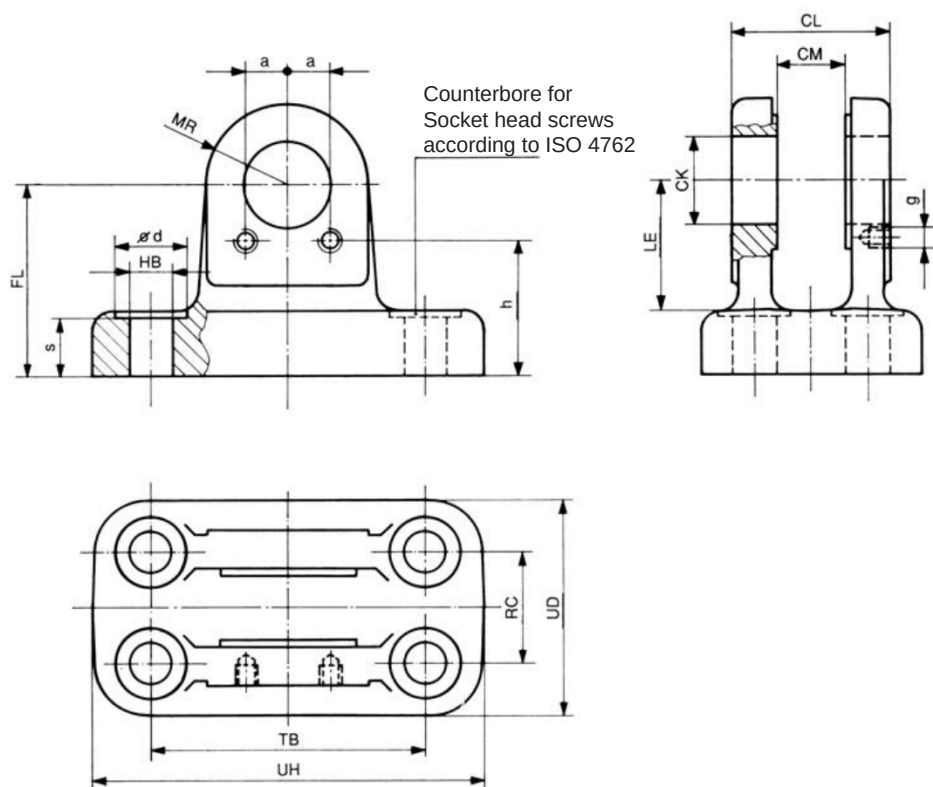
for piston Ø for rod Ø	Order designation	Nominal force (N)	CK H9	CL h16	CM A12	FL js 12	HB H13	Ød ²⁾	s ²⁾	CO N9	LE min.	MR max.	RG js 14	RF js 14	UX max.	UK max.	FG js 14	KC + 0,3	FO js 14	a ²⁾	g ²⁾	h ²⁾	Weight (kg)
25 / 14 18	CBB-12	8 000	12	28	12	34	9,0	15	11,0	10	22	12	45	52	65	72	2,0	3,3	10	5,5	M 5	24,5	0,5
32 / 18 22	CBB-16	12 500	16	36	16	40	11,0	18	12,0	16	27	16	55	65	80	90	3,5	4,3	10	8,0	M 6	28,5	0,9
40 / 22 28	CBB-20	20 000	20	45	20	45	11,0	18	13,5	16	30	20	70	75	95	100	7,5	4,3	10	12,5	M 6	31,0	1,5
50 / 28 36	CBB-25	32 000	25	56	25	55	13,5	20	16,5	25	37	25	85	90	115	120	10,0	5,4	10	12,5	M 6	38,5	2,7
63 / 36 45	CBB-32	50 000	32	70	32	65	17,5	26	20,0	25	43	32	110	110	145	145	14,5	5,4	6	15,0	M 6	45,0	4,5
80 / 45 56	CBB-40	80 000	40	90	40	76	22,0	33	22,0	36	52	40	125	140	170	185	17,5	8,4	6	21,0	M 8	53,0	8,5
100 / 56 70	CBB-50	125 000	50	110	50	95	26,0	40	28,0	36	65	50	150	165	200	215	25,0	8,4	0	22,5	M 8	65,5	13,5
125 / 70 90	CBB-63	200 000	63	140	63	112	33,0	48	35,0	50	75	63	170	210	230	270	33,0	11,4	0	27,5	M 10	77,0	23,4
140 / 80 100	CBB-70*	250 000	70	150	70	130	33,0	48	38,0	50	90	70	190	230	250	290	40,0	11,4	0	30,0	M 10	90,0	-
160 / 90 110	CBB-80	320 000	80	170	80	140	39,0	57	43,0	50	95	80	210	250	280	320	45,0	11,4	0	30,0	M 10	96,0	38,5
180 / 100 125	CBB-90*	400 000	90	190	90	160	45,0	66	50,0	63	108	90	235	280	320	360	47,5	12,4	0	35,0	M 10	112,0	-
200 / 110 140	CBB-100*	500 000	100	210	100	180	52,0	76	57,0	63	120	100	250	315	345	405	52,5	12,4	0	45,0	M 10	124,0	-
220 / 125 160	CBB-110*	635 000	110	240	110	200	52,0	76	59,0	80	138	110	305	335	400	425	62,5	15,4	0	50,0	M 12	140,0	-
250 / 140 180	CBB-125*	800 000	125	270	125	230	52,0	76	57,0	80	170	125	350	365	450	455	75,0	15,4	0	60,0	M 12	159,0	-

Remarks

2) not standardized

*not standardized intermediate sizes

Cylinder accessories clevis brackets 180° type CBA - ISO 8132



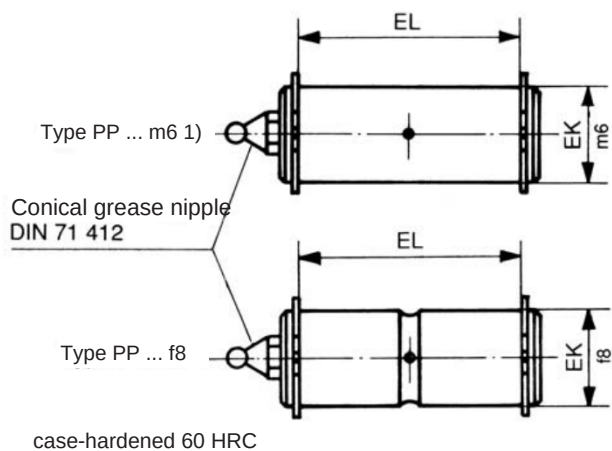
for piston Ø for rod Ø	Order designation	Nominal force (N)	CK H9	CL h16	CM A12	FL js 12	HB H13	Ød ²⁾	s ²⁾	LE min.	MR max.	RC js 14	TB js 14	UD max.	UH max.	a ²⁾	g ²⁾	h ²⁾	Weight (kg)
25 / 14 18	CBA-12	8 000	12	28	12	34	9,0	15	11,0	22	12	20	50	40	70	5,5	M 5	24,5	0,31
32 / 18 22	CBA-16	12 500	16	36	16	40	11,0	18	12,0	27	16	26	65	50	90	8,0	M 6	28,5	0,59
40 / 22 28	CBA-20	20 000	20	45	20	45	11,0	18	13,5	30	20	32	75	58	98	12,5	M 6	31,0	0,90
50 / 28 36	CBA-25	32 000	25	56	25	55	13,5	20	16,5	37	25	40	85	70	113	12,5	M 6	38,5	1,58
63 / 36 45	CBA-32	50 000	32	70	32	65	17,5	26	20,0	43	32	50	110	85	143	15,0	M 6	45,0	2,88
80 / 45 56	CBA-40	80 000	40	90	40	76	22,0	33	22,0	52	40	65	130	108	170	21,0	M 8	53,0	5,04
100 / 56 70	CBA-50	125 000	50	110	50	95	26,0	40	28,0	65	50	80	170	130	220	22,5	M 8	65,5	10,15
125 / 70 90	CBA63	200 000	63	140	63	112	33,0	48	35,0	75	63	100	210	160	270	27,5	M 10	77,0	16,40
140 / 80 100	CBA-70*	250 000	70	150	70	130	33,0	48	38,0	90	70	110	230	175	300	30,0	M 10	90,0	-
160 / 90 110	CBA-80	320 000	80	170	80	140	39,0	57	43,0	95	80	125	250	210	320	30,0	M 10	96,0	30,00
180 / 100 125	CBA-90*	400 000	90	190	90	160	45,0	66	50,0	108	90	140	290	230	370	35,0	M 10	112,0	-
200 / 110 140	CBA-100*	500 000	100	210	100	180	45,0	66	57,0	120	100	160	315	260	400	45,0	M 10	124,0	-
220 / 125 160	CBA-110*	635 000	110	240	110	200	52,0	76	59,0	138	110	180	350	290	445	50,0	M 12	140,0	-
250 / 140 180	CBA-125*	800 000	125	270	125	230	52,0	66	57,0	170	125	200	385	320	470	60,0	M 12	159,0	-

Remarks

2) not standardized

*not standardized intermediate sizes

Cylinder accessories pin type PP - ISO 8132

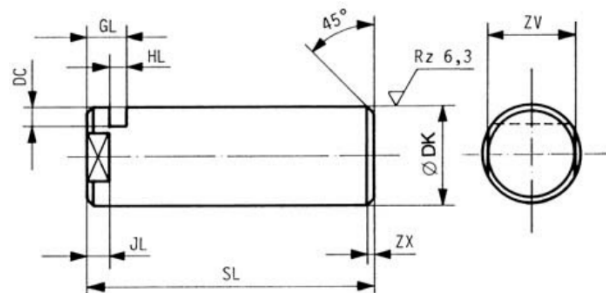


for piston Ø for rod Ø	Order designation ²⁾		Nominal force (N)	EK ¹⁾ f8/ m6	EL H16	Weight (kg)
25 / 14 18	PP-12 f8	PP-12 m6	8 000	12	29	0,030
32 / 18 22	PP-16 f8	PP-16 m6	12 500	16	37	0,065
40 / 22 28	PP-20 f8	PP-20 m6	20 000	20	46	0,130
50 / 28 36	PP-25 f8	PP-25 m6	32 000	25	57	0,250
63 / 36 45	PP-32 f8	PP-32 m6	50 000	32	72	0,500
80 / 45 56	PP-40 f8	PP-40 m6	80 000	40	92	1,000
100 / 56 70	PP-50 f8	PP-50 m6	125 000	50	112	1,900
125 / 70 90	PP-63 f8	PP-63 m6	200 000	63	142	3,800
160 / 90 110	PP-80 f8	PP-80 m6	320 000	80	172	7,600

1) Tolerance m6 for spherical bearings

2) Type PP-12 without grease nipple

Pin type PPA



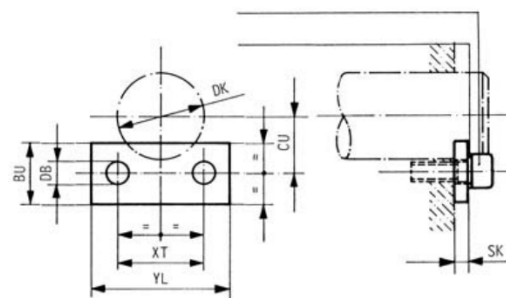
case-hardened 60 HRC

Order designation	Ø DK m 6	SL	GL	HL ±0,2	JL	ZV ¹⁾	DC	ZK	Weight (kg)
PPA-10	10	34	8	3,3	4,5	8	3,0	1,0	0,02
PPA-12	12	38	8	3,3	4,5	10	4,0	1,0	0,03
PPA-16	16	46	8	3,3	5,5	13	4,0	1,0	0,07
PPA-20	20	58	10	4,5	5,5	17	5,0	1,5	0,14
PPA-25	25	69	10	4,5	6,5	21	5,0	1,5	0,30
PPA-32	32	87	13	5,5	8,5	27	6,0	2,0	0,50
PPA-40	40	110	16	6,5	8,5	32	7,0	2,0	1,00
PPA-50	50	133	19	9,0	8,5	41	8,0	2,0	2,00
PPA-63	63	164	20	9,0	8,5	55	9,0	2,0	4,00
PPA-70 ²⁾	70	183	25	11,0	11,5	60	10,0	2,0	5,50
PPA-80	80	202	26	11,0	11,5	65	11,0	3,0	8,00
PPA-90 ²⁾	90	224	28	11,0	14,0	75	12,0	3,0	11,00
PPA-100 ²⁾	100	246	30	13,0	14,0	85	14,0	3,0	16,00
PPA-110 ²⁾	110	277	31	13,0	14,0	95	15,0	3,0	21,00
PPA-125 ²⁾	125	310	32	13,0	14,0	110	16,5	4,0	30,00

1) according to DIN 475 part 1

2) not standardized

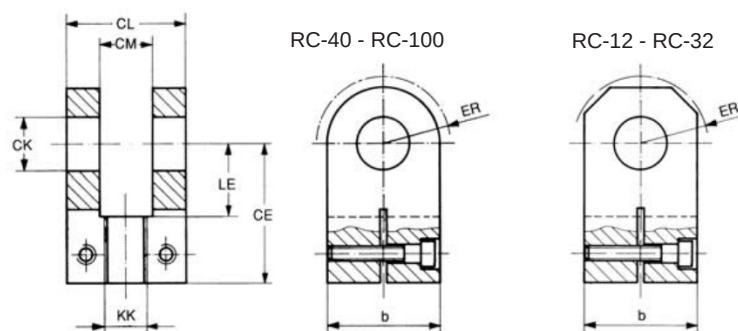
Pivot pin fixing type A



Order designation	Ø DB	Ø DK m 6	BU	CU	SK	YL	XT ± 0,2	Soc. screw ISO 4762-10.9	Lock washer	Weight (kg)
A-10 ¹⁾	5,4	10	15	9,5	3	20	11	M 5 x 12	5	0,015
A-16	6,4	16	15	11,5	3	30	16	M 6 x 12	6	0,020
A-20/A-25	6,4	20	18	14,0	4	40	25	M 6 x 16	6	0,030
A-25/A-20	6,4	25	18	16,5	4	40	25	M 6 x 16	6	0,030
A-32	6,4	32	20	20,0	5	45	30	M 6 x 16	6	0,050
A-40	8,4	40	20	23,0	6	62	42	M 8 x 20	6	0,080
A-50	8,4	50	25	29,5	8	65	45	M 8 x 20	8	0,120
A-60/A-63	10,5	63	25	35,0	8	80	55	M 10 x 25	10	0,160
A-70/A-80	10,5	70	30	40,0	10	90	60	M 10 x 25	10	0,240
A-80/A-70	10,5	80	30	44,0	10	90	60	M 10 x 25	10	0,240
A-90	10,5	90	30	48,0	10	100	70	M 10 x 25	10	0,270
A-100	10,5	100	40	56,0	12	120	90	M 10 x 25	10	0,500
A-110	13,0	110	40	60,0	12	140	100	M 12 x 30	12	0,600
A-125	13,0	125	50	71,0	12	160	120	M 12 x 30	12	1,000

1) Pivot pin fixing A-10 also suitable for PPA-12, CBA-12 CBB-12

Cylinder accessories rod clevises type RC - ISO 8132



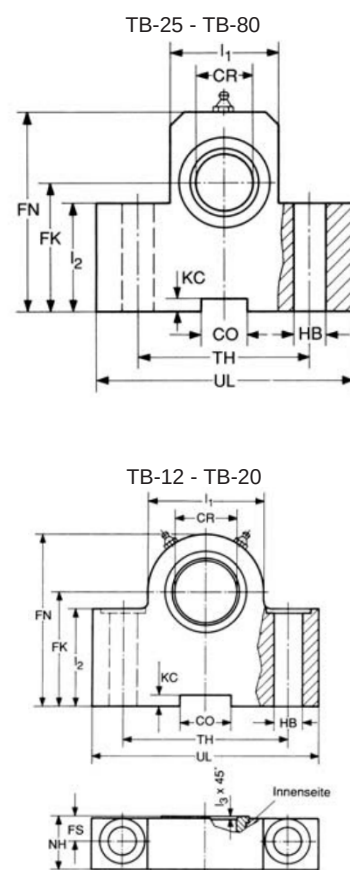
for piston Ø	25	32	40	50	63	80	100	125	140	160	180	200
for rod Ø	14-18	18-22	22-28	28-36	36-45	45-56	56-70	70-90	80-100	90-110	100-125	110-140
Order designation	RC-12	RC-16	RC-20	RC-25	RC-32	RC-40	RC-50	RC-63	RC-70²⁾	RC-80	RC-90²⁾	RC-100²⁾
Nominal force (N)	8 000	12 500	20 000	32 000	50 000	80 000	125 000	200 000	250 000	320 000	400 000	500 000
CK H9	12	16	20	25	32	40	50	63	70	80	90	100
CL h16	28	36	45	56	70	90	110	140	150	170	190	210
CM A12	12	16	20	25	32	40	50	63	70	80	90	100
CE js 12	38	44	52	65	80	97	120	140	160	180	195	210
KK	M12x1,25	M14x1,5	M16x1,5	M20x1,5	M27x2	M33x2	M42x2	M48x2	M56x2	M64x3	M72x3	M80x3
LE min.	18	22	27	34	42	52	64	75	90	94	108	120
ER max.	16	20	25	32	40	50	63	71	80	90	100	110
Weight (kg)	0,15	0,27	0,53	1,13	2,18	4,40	7,60	17,70	-	30,60	-	61,40
b max.	25	30	40	50	65	80	100	140	160	180	200	220
Clamping screw	M4x16	M6x20	M8x30	M10x35	M12x40	M16x50	M20x60	M24x80	M24x90	M30x100	M36x120	M36x180

2) not standardized intermediate size

Trunnion brackets type TB - ISO 8132

for piston Ø	25	32	40	50	63	80	100	125	160
for rod Ø	14-18	18-22	22-28	28-36	36-45	45-56	56-70	70-90	90-110
Order designation ¹⁾	TB-12	TB-16	TB-20	TB-25	TB-32	TB-40	TB-50	TB-63	TB-80
Nominal force (N)	80 000	12 500	20 000	32 000	50 000	80 000	125 000	200 000	320 000
CR H7	12	16	20	25	32	40	50	63	80
FK js12	34	40	45	55	65	76	95	112	140
FN	49	59	69	80	100	120	140	177	220
HB H13	9	11	11	13,5	17,5	22	26	33	39
NH max.	17	21	21	26	33	41	51	61	81
TH js14	40	50	60	80	110	125	160	200	250
UL	63	80	90	110	150	170	210	265	325
CO N9	10	16	16	25	25	36	36	50	50
KC + 0,3	3,3	4,3	4,3	5,4	5,4	8,4	8,4	11,4	11,4
FS js 14	8	10	10	12	15	16	20	25	31
I ₁	25	30	40	56	70	88	100	130	160
I ₂	25	30	38	45	52	60	75	85	112
I ₃	1	1	1,5	1,5	2,0	2,5	2,5	3,0	3,5
Weight ¹⁾ (kg)	0,46	0,83	1,21	2,15	4,70	7,80	14,20	23,40	53,10

1) for one pair (2 pieces)



Spare parts

Position in the Detail drawing	Designation	Quantity	Remark
1	Wiper	1	
2	U-cup seal	1	Seal variant R
3	Rod seal	1	Seal variant KV
4	Slide ring K	2	Seal variant T/TV, only for piston Ø 40-200mm
5	Slide ring K	1	Seal variant F, only for piston Ø 40-200mm
9	Rod guide ring	see table (*)	depending on piston ø and seal variant
6	Slide ring K	1	Seal variant G / GV
7	Compact seal kit	1	Seal variant H
8	Piston guide ring	see table (*)	depending on piston ø and seal variant
10	O-ring	2	
11	Back-up ring	2	
12	O-ring	1	
13	Back-up ring	1	only for piston Ø 40-200mm
14	O-ring	2 or 1	for all piston ø
15	Usit ring	3,2 or 1	for all piston ø
16	Plug screw	2	for all piston ø

Positions 14 and 15 only with end position cushioning

(*) Piston diameter in mm		25-32	40	50	63-80	100	125	140-160	180	200
Number of piston guide rings	Seal variant H	0	1	1	1	1	0	1	1	1
	Seal variant G/GV	2	2	3	3	3	3	3	3	4
Number of Rod guide rings	Seal variant R	0	0	2	3	4	3	3	4	4
	Seal variant KV	0	0	2	3	4	3	3	4	4
	Seal variant T/TV/F	0	0	2	3	4	3	3	4	4

Ordering seal kits

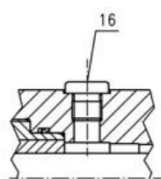
State quantity and complete model code of the hydraulic cylinder.

Weight table

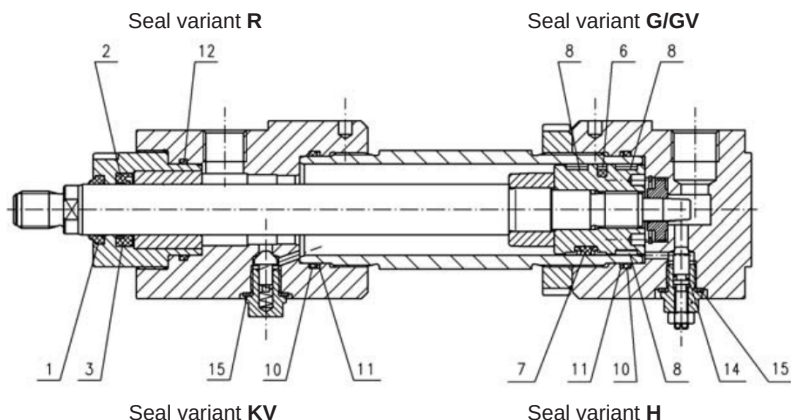
The weight is calculated as follows: $G \text{ (kg)} = G_1 \text{ (kg)} + G_2 \text{ (kg/mm)} \times \text{stroke (mm)}$

Piston Ø	Rod Ø	G ₁						G ₂	
		Mounting type						1 mm stroke	
		A	MT4	MF3/MF4	MF1/MF2	MP4/MP6	MS2		
25	14	2,8	3,1	3,3	3,1	3,0	3,9	0,0049	
	18	2,8	3,1	3,3	3,1	3,0	3,9	0,0057	
32	18	4,5	5,0	5,4	5,1	4,9	6,4	0,0065	
	22	4,5	5,0	5,4	5,1	4,9	6,4	0,0075	
40	22	6,7	7,9	7,9	7,4	7,4	9,0	0,0098	
	28	6,7	7,9	7,9	7,4	7,4	9,0	0,0116	
50	28	10,8	12,9	12,9	12,4	12,1	15,1	0,0131	
	36	11,0	13,1	13,1	12,6	12,3	15,3	0,0163	
63	36	17,5	20,6	20,9	20,2	20,1	24,0	0,0210	
	45	17,7	20,8	21,1	24,0	20,3	24,2	0,0255	
80	45	24,2	28,3	29,7	28,6	28,2	34,2	0,0286	
	56	24,6	28,7	30,1	29,0	28,6	34,6	0,0355	
100	56	43,2	50,5	51,4	49,4	49,8	60,0	0,0464	
	70	44,0	51,3	52,2	50,2	50,6	60,8	0,0573	
125	70	60,2	73,0	70,6	68,5	69,9	87,0	0,0635	
	90	62,0	74,8	72,4	70,3	71,7	88,8	0,0832	
140	80	82,2	100,5	95,6	-	98,0	117,2	0,0968	
	100	84,2	102,5	97,6	-	100,0	119,2	0,1190	
160	90	107,0	128,5	122,6	-	127,6	149,0	0,1147	
	110	109,5	131,0	125,1	-	130,1	151,5	0,1393	
180	100	139,0	169,0	162,0	-	167,4	196,0	0,1338	
	125	143,0	173,0	166,0	-	171,4	200,0	0,1684	
200	110	184,0	225,0	209,0	-	220,0	255,0	0,1541	
	140	189,0	230,0	214,0	-	225,6	260,0	0,2003	

Spare parts diagrams pistonØ 25 - 32 mm

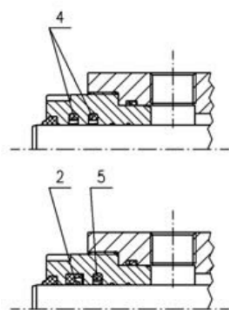


applies to all
PistonØ



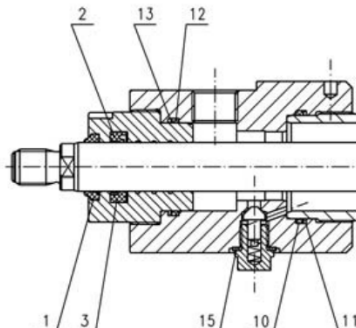
PistonØ 40 mm

Seal variant **T/TV**



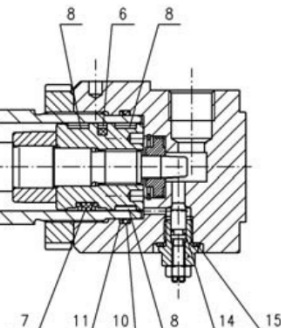
Seal variant **F**

Seal variant **R**



Seal variant **KV**

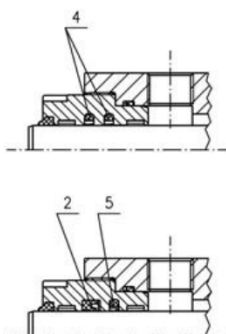
Seal variant **G/GV**



Seal variant **H**

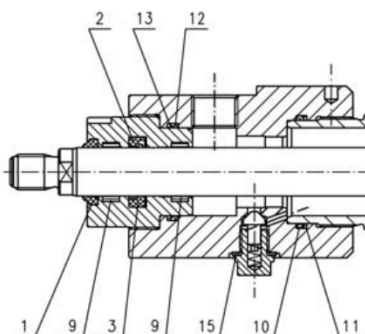
PistonØ 50 - 100 mm

Seal variant **T/TV**



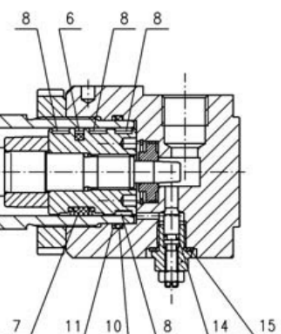
Seal variant **F**

Seal variant **R**



Seal variant **KV**

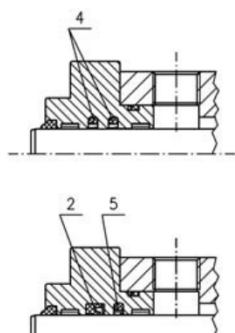
Seal variant **G/GV**



Seal variant **H**

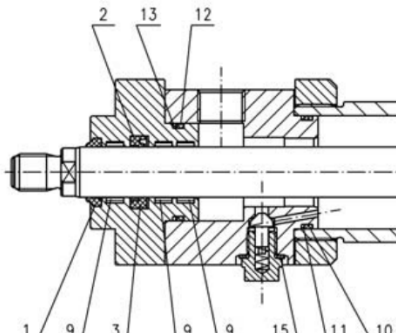
PistonØ 125 - 200 mm

Seal variant **T/TV**



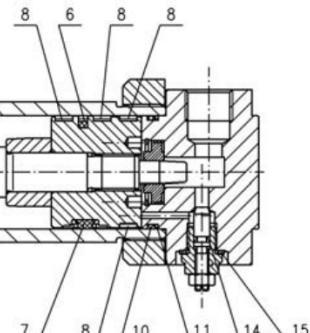
Seal variant **F**

Seal variant **R**



Seal variant **KV**

Seal variant **G/GV**



Seal variant **H**

Calculation basis

SI Units Overview (Selection)

Quantity	Formula symbol	SI units Name	Symbol	Conversion	Base units
Force	F	Newton	N		$1 \cdot \frac{\text{kg} \cdot \text{m}}{\text{s}^2}$
Length	s	Metre	m		$1 \cdot \text{m}$
Velocity	v	Metre per sec.	$\frac{\text{m}}{\text{s}}$		$1 \cdot \frac{\text{m}}{\text{s}}$
Acceleration	a	Metre per sec. ²	$\frac{\text{m}}{\text{s}^2}$		$1 \cdot \frac{\text{m}}{\text{s}^2}$
Work	A, W	Joule	J	$1 \text{ J} = \text{Ws} = 1 \text{ Nm}$	$1 \cdot \frac{\text{kg} \cdot \text{m}^2}{\text{s}^2}$
Energy / heat quantity	E, W	Joule	J		
Power	Q, W P	Watt	W	$1 \text{ W} = 1 \text{ J/s} = 1 \text{ Nm/s}$	$1 \cdot \frac{\text{kg} \cdot \text{m}^2}{\text{s}^3}$
Area	A	Square metre	m ²		$1 \cdot \text{m}^2$
Volume	V	Cubic metre	m ³		$1 \cdot \text{m}^3$
Volumetric flow rate	Q	Cubic metre per second	$\frac{\text{m}^3}{\text{s}}$	$1 \text{ l/min} = 1/(6 \cdot 10^{-4}) \text{ m}^3/\text{s}$	$1 \cdot \frac{\text{m}^3}{\text{s}}$
Mass	m	Kilogram	kg		$1 \cdot \text{kg}$
dyn. viscosity	η	Pascal-second	Pa·s	$1 \text{ Pa} \cdot \text{s} = 1 \text{ N} \cdot \text{s/m}^2$	$1 \cdot \frac{\text{kg}}{\text{m} \cdot \text{s}}$
kin. viscosity	ν	Square metre per second	$\frac{\text{m}^2}{\text{s}}$		$1 \cdot \frac{\text{m}^2}{\text{s}}$
Density	ρ	Kilogram per cubic metre	$\frac{\text{kg}}{\text{m}^3}$		$1 \cdot \frac{\text{kg}}{\text{m}^3}$
spec. heat	c	Joule per kilogram kelvin	$\frac{\text{J}}{\text{kg} \cdot \text{K}}$		$1 \cdot \frac{\text{J}}{\text{kg} \cdot \text{K}}$
Pressure	p	Pascal Bar	Pa bar	$1 \text{ Pa} = 10^{-5} \text{ bar}$ $1 \text{ bar} = 10^5 \text{ N/m}^2$	$1 \cdot \frac{\text{kg}}{\text{m} \cdot \text{s}^2}$ $10^5 \cdot \frac{\text{kg}}{\text{m} \cdot \text{s}^2}$
Strength	σ, τ	Pascal	$\frac{\text{N}}{\text{m}^2}$	$1 \text{ N/m}^2 = 10^{-6} \text{ N/mm}^2$	$1 \cdot \frac{\text{kg}}{\text{m} \cdot \text{s}^2}$
Stress					
E-modulus	E				
Time	t	Second	s		$1 \cdot \text{s}$

***Note:** The effective cylinder force acting to the "outside" depends on the overall efficiency. This is influenced among others by:
 – seal variant and friction
 – operating pressure
 – residual pressure on the respective opposing surface

Theoretical Basic Formulas for the Application of Hydraulic Cylinders

*Cylinder force $F [\text{N}] = p [\text{bar}] \cdot A [\text{cm}^2] \cdot 10$
 A = effective piston area

Extension and retraction speed

$$v \left[\frac{\text{m}}{\text{s}} \right] = \frac{Q [\text{l/min}]}{A [\text{cm}^2]} \cdot \frac{1}{6}$$

Q = volumetric flow rate

Required flow rate

$$Q [\text{l/min}] = A [\text{cm}^2] \cdot v \left[\frac{\text{m}}{\text{s}} \right] \cdot 6$$

Required pump power

$$P [\text{kW}] = \frac{Q [\text{l/min}] \cdot p [\text{bar}]}{\eta} \cdot \frac{1}{600}$$

η = pump efficiency

Acceleration

$$a \left[\frac{\text{m}}{\text{s}^2} \right] = \frac{(v_2 - v_1)^2 [\text{m}^2/\text{s}^2]}{2 (s_2 - s_1) [\text{m}]}$$

valid only for $a = \text{const.}$!

v_2 = final velocity,

v_1 = initial velocity

Acceleration force

$$F [\text{N}] = m [\text{kg}] \cdot a \left[\frac{\text{m}}{\text{s}^2} \right]$$

m = accelerated mass

Kinetic energy

$$E [\text{J}] = \frac{m [\text{kg}]}{2} \cdot v^2 \left[\frac{\text{m}^2}{\text{s}^2} \right]$$

End position cushioning:

With end position cushioning the kinetic energy is converted into heat energy.

At constant deceleration:

$$\frac{m}{2} v^2 = A \cdot p \cdot s \quad (\text{energy equation})$$

m = moved mass in kg

v = velocity in m/s

A = effective cushioning area in m²

p = **mean** cushioning pressure in $\frac{\text{N}}{\text{m}^2}$

s = cushioning stroke in m

this yields the cushioning pressure

$$p = \frac{m \cdot v^2}{2 \cdot A \cdot s}$$

Effective areas and cushioning travel on the hydraulic cylinder

Piston $\varnothing D$ [mm]	25	32	40	50	63	80	100	125	140	160	180	200
Rod $\varnothing d$ [mm]	14 18	18 22	22 28	28 36	36 45	45 56	56 70	70 90	80 100	90 110	100 125	110 140
A1 [cm ²]	4,9	8,0	12,6	19,6	31,2	50,3	78,5	123	154	201	254	314
A2 [cm ²]	3,4 2,4	5,5 4,2	8,8 6,4	13,5 9,5	21 15,3	34,4 25,6	53,9 40,1	84,2 59,1	104 75,4	137 106	176 132	219 160
A3 [cm ²]	1,8	3,5	4,5	7,7	12,3	22,0	34,4	53,3	65,7	93,5	120	144
A4 [cm ²]	4,4	7,5	11,8	18,1	28,0	45,4	71,0	113	141	182	228	282
s [mm] approx.	14	14	19	21	25	28	34	41	46	47	57	57

s (mm) approx. = cushioning travel

A1 [cm²] = piston area

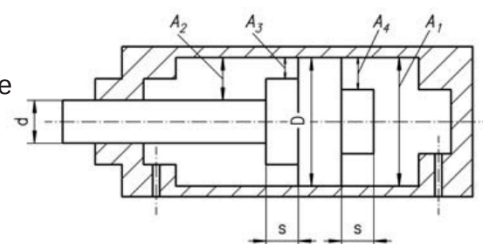
A3 [cm²] = effective cushioning area at rod end

A2 [cm²] = piston annular area

A4 [cm²] = effective cushioning area at cap end

Tolerances

Installation dimension	PJ	SS	XD	XN	ZF	ZJ	ZP	XS	Y	W	WC	WF	XV	Stroke
Stroke: 0 - 499	±1,5		±1,5					± 2		± 2				+ 2
Stroke: 500 - 1249	±1,5		± 2					± 2		± 2,8				+ 2
Stroke: 1250 - 3149	± 3		± 3					± 4		± 4				+ 5
Stroke: 3150 - 8000	± 5		± 5					± 8		± 8				+ 8



Recommended mean flow velocity of the hydraulic fluid in the connection cross-sections

	Suction lines	Return lines	Pressure lines up to 25 bar	25 - 63 bar	63 - 160 bar	160 - 250 bar	>250 bar
Flow velocity (guide values)	$\leq 1,5 \frac{\text{m}}{\text{s}}$	$\leq 3 \frac{\text{m}}{\text{s}}$	$\leq 3 \frac{\text{m}}{\text{s}}$	3-5 $\frac{\text{m}}{\text{s}}$	4-6 $\frac{\text{m}}{\text{s}}$	5-8 $\frac{\text{m}}{\text{s}}$	$\leq 10 \frac{\text{m}}{\text{s}}$

Buckling load diagram

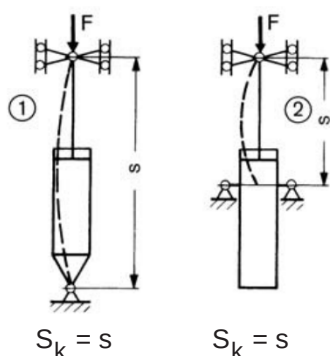
Determination of the permissible Buckling load $F_{K \text{ perm}}$

1. Buckling length s_K from mounting condition ① ⑥ and mounting length s .
2. Using s_K , rod diameter d and nomogram to determine the permissible buckling load (safety factor in the elastic range is $s = 4$).

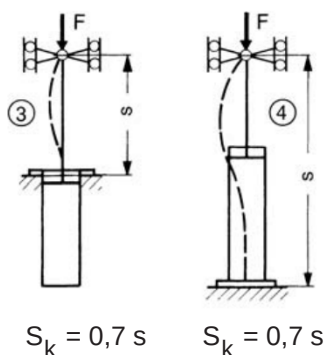
Example (see nomogram)

Mounting condition ③
 $d = 28 \text{ mm}$ $s = 1200 \text{ mm}$ (from dimensional drawing of the cylinder)
 $s_K = 0.7s$ (see mounting condition ③)
 $s_K = 840 \text{ mm}$
 From nomogram results $F_{K \text{ perm}} = 22000 \text{ N}$

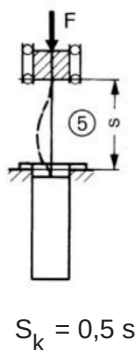
Euler case 2



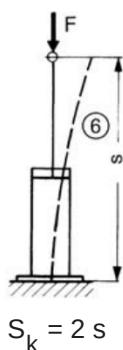
Euler case 3



Euler case 4

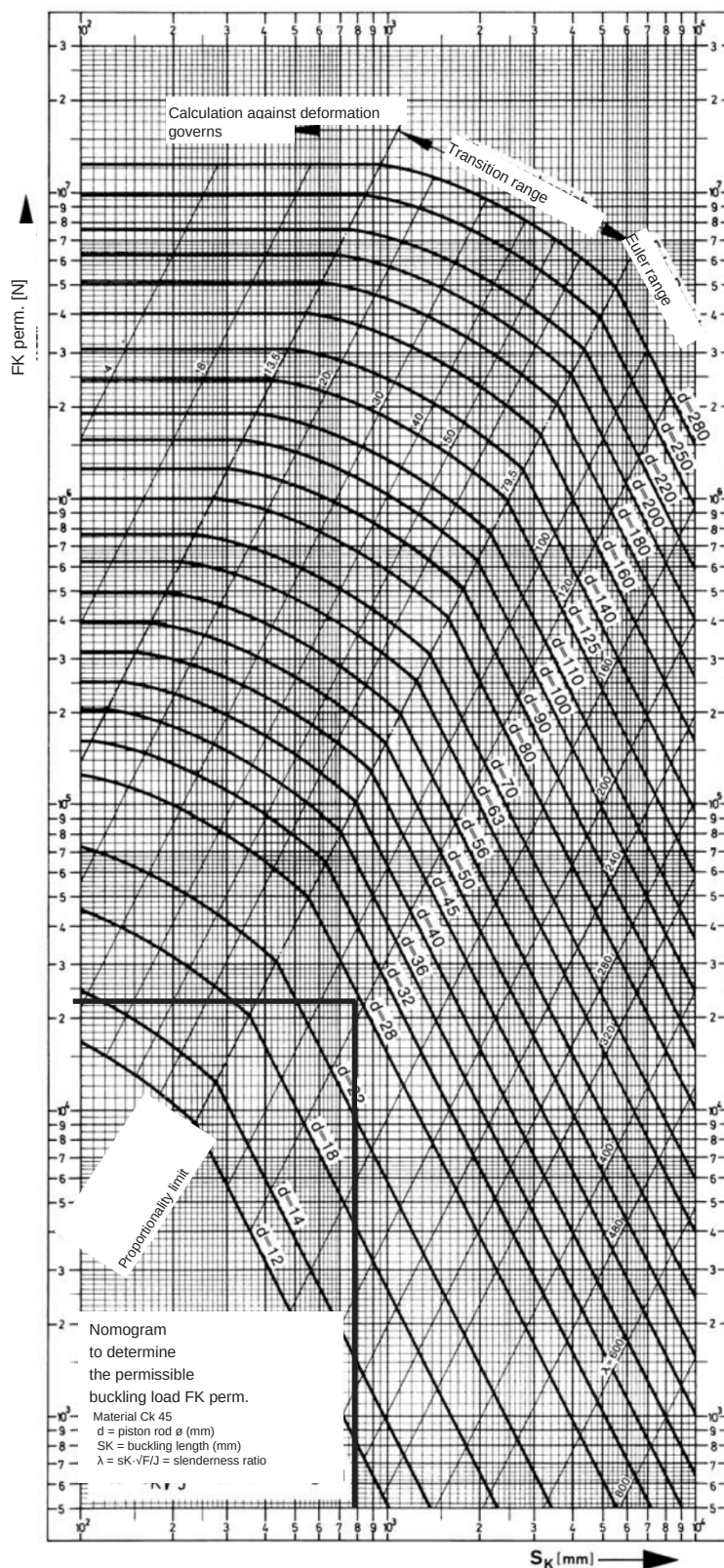


Euler case 1



Determination of buckling length s_K for the various mounting conditions.

Explanation: The buckling length s_K is the length of that imaginary rod, hinged rod which, with the same cross-sectional dimensions, has the same ideal buckling load as the rod under investigation.



Buckling load diagram applies only to vertical cylinder installation and centrally applied force (without bending moments or lateral forces)!

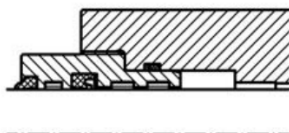
Seal variants / Schematic representation

Rod sealing

Code letter

Piston sealing

U-cup seal made of polyurethane



RG

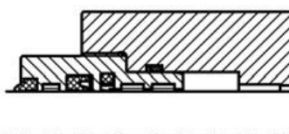
Standard version

Temperature range: -30° C to +80° C
Hydraulic fluid: Mineral oil
Sliding speed: 0,5 m/s
Application: Universal industrial use
 Very high wear resistance.
 Not suitable if absolute tightness is required at the piston.

Teflon seal with O-ring made of Perbunan



U-cup seal made of polyurethane and Teflon seal with O-ring made of Perbunan



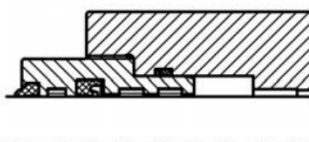
FG

Temperature range: -30° C to +80° C
Hydraulic fluid: Mineral oil
Sliding speed: ≤1 m/s
Application: Higher speeds, for low-stick-slip stroke motion with minimal leakage.
 Not suitable if absolute tightness is required at the piston.

Teflon seal with O-ring made of Perbunan



U-cup seal made of polyurethane



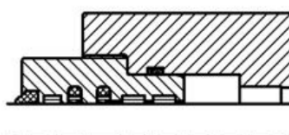
RH

Temperature range: -30° C to +80° C
Hydraulic fluid: Mineral oil
Sliding speed: 0,5 m/s
Application: Universal industrial use.
 Very high wear resistance.
 Suitable for applications in which absolute tightness at the piston is required; as well as general industrial applications, as long as stick-slip-free feed motion must be guaranteed.

Compact seal made of Perbunan with polyamide angle version rings



Teflon seal with O-ring made of Perbunan in tandem version



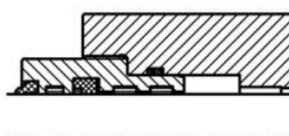
TG

Temperature range: -30° C to +80° C
Hydraulic fluid: Mineral oil
Sliding speed: ≤1 m/s
Application: For servo systems; at high sliding speed, for stick-slip-free stroke motion and with poorly bled systems. Note: leakage at the rod higher than with variants R and F. Not suitable if absolute tightness is required at the piston.

Teflon seal with O-ring made of Perbunan



Rod seal made of fluoro rubber (FPM) with back-up ring made of PTFE



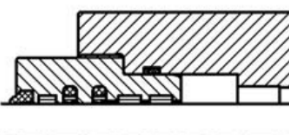
KVGV

Temperature range: -20° C to +130° C
Hydraulic fluid: Mineral oil, HFD fluids
Sliding speed: ≤1 m/s
Application: At higher operating temperatures (up to +130°C) and with HFD fluids (e.g. phosphate ester).

Teflon seal with O-ring with fluoro rubber (FPM)



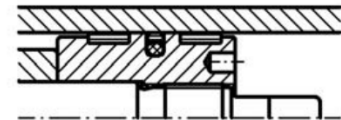
Teflon seal with O-ring made of fluoro rubber (FPM) in tandem version



TVGV

Temperature range: -20° C to +200° C
Hydraulic fluid: Mineral oil, HFD fluids
Sliding speed: ≤1 m/s
Application: At higher operating temperatures (up to +200°C) and with HFD fluids suitable.
 Not suitable if absolute tightness is required at the piston.

Teflon seal with O-ring made of fluoro rubber (FPM)



[illegible]

Order example: Double-acting hydraulic cylinder 160 bar nominal pressure with the following data:
Piston $\varnothing$ 63 mm, rod $\varnothing$ 36 mm, mounting type MT4, stroke 300 mm, seal variant RG.
End position cushioning yes, position of throttle screw head end side 2, cap end side 2.
Piston rod surface B, piston rod end 1, piston rod material C.
Pipe connection version G. Position of pipe connection head end side 1, cap end side 1.
Bleed screw E, position of bleed screw head end side 3, cap end side 3.

Type: ZBD 1611 - 63/36 - MT4 - 300 - RG - 22 - B1C - G11 - E33.

Notes - remarks - comments - special requests

Lined area for notes and remarks.

Sketch

Grid area for sketching.

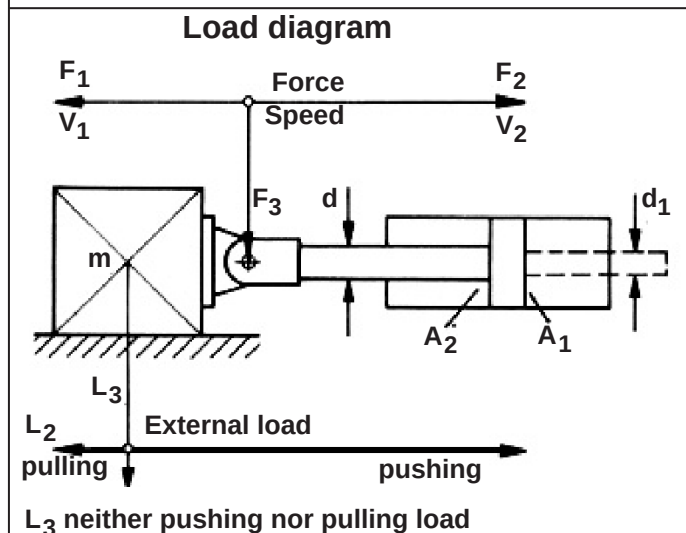
Notes - remarks - comments - special requests

Notes section with horizontal lines for writing.

Sketch

Sketch section with a grid for drawing.

..... Department.....



a		b		c		d		e	

1	Operating pressure	min		bar		
		max		bar		
2	Piston Ø	D		mm		
3	Rod Ø	d		mm		
		d ₁		mm		
4	Mounting type					
5	Stroke	S		mm		
6	Stroke speed max.	V _{1max}		m/s		
		V _{2max}		m/s		
7	Pressure medium					
8	Rod seal Wiper					
9	Piston seal					
10	Piston rod end					
11	Air bleed	yes		M 8x1 R 1/4"	no	
12	End position cushioning		Cap end			
			Rod side			

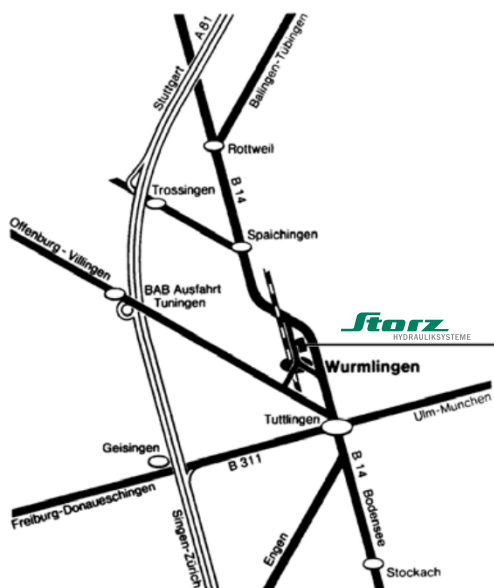
13	Required Cylinder forces	F_1	N	
		F_2	N	
14	max. Lateral force	F_3	N	
15	Switching frequency		Double strokes per min	
			Double strokes per sec	
16	min. + max. Amplitude ($\alpha_{\min}$; $\alpha_{\max}$) + associated frequency (f)	$\alpha_{\min} + f$		
		$\alpha_{\max} + f$		
17	Moving Mass			kg
18	Temperature range of hydraulic fluid $\vartheta_{\min} \dots \vartheta_{\max}$		$^{\circ}\text{C}$	
	Ambient temperature range $\vartheta_{\min} \dots \vartheta_{\max}$		$^{\circ}\text{C}$	

19	Size of Port connections	Cap end	Rod side
20	Piston rods Material	Standard	Stainless
21	Painting	Standard	without
		Special	

Remarks and notes on the application or special requests please with date and signature!



Hydraulic cylinders to DIN/ISO
Hydraulic standard cylinders
Hydraulic telescopic cylinders
Hydraulic cylinders with position measuring systems
Test-machine cylinders
Special cylinders for all fields of application
Standardized mounting parts
Hydraulic power units and components
Plant engineering



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