

Storz

HYDRAULIKSYSTEME

ZW/ZWAS 1611

Standard Hydraulic Cylinder



Description:

NP 160 bar (16 MPa)

Hydraulic cylinder series **ZW 1611**
with built-in position measuring system

Hydraulic cylinder series **ZWAS 1611**
additionally with attached valve connection plate AS

Storz hydraulic cylinders of series ZW 1611 or ZWAS 1611 are equipped with a position measuring system. Position measuring systems from various manufacturers can be selected.

The basic design of these hydraulic cylinders is derived from our standard series ZBD 1611 derived. The installation dimensions essentially correspond to ISO 6020/1 and VW 39D920.

To cover a wide range of applications, 5 mounting types are available. The nominal pressure is 160 bar (16 MPa). The cylinder series listed in this brochure listed cylinder series covers piston diameters from 32 - 200 mm, whereby from piston diameter 40 mm, two rod diameters as standard with the area ratios ϕ 1,4 and 2 are assigned.

The housing of the position measuring system is protected by a guard tube against mechanical protected from external damage.

The selected seals and the various piston rod surfaces and materials allow the hydraulic cylinders to be used under the most varied operating conditions.

The hydraulic cylinders are optionally available with an attached valve connection bar. On request, the hydraulic cylinders can also be supplied with mounted proportional or servo valve.

For the valve connection plates and any proportional and servo valves to be supplied hole patterns NG 6 and NG 10 according to ISO 4401 are available as standard.

Linearity deviation, system resolution and repeatability can be found in the data sheets of the position transducers.



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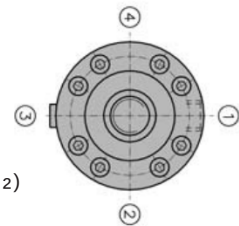
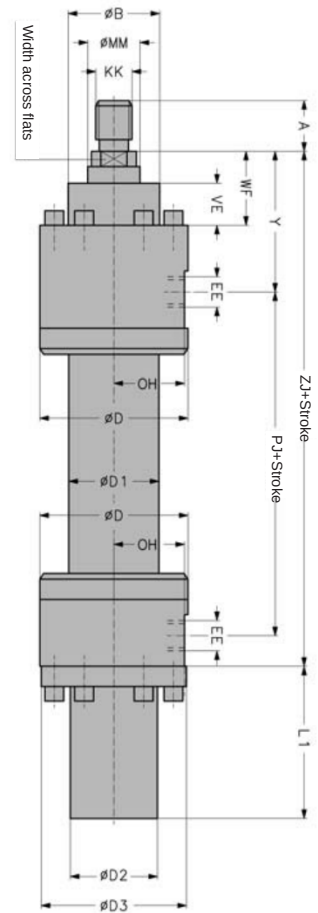
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Available mounting types

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Mounting type A basic design

PistonØ (mm)																				
Rod Ø MM (mm)																				
Piston area A 1 (cm²)																				
Annular area A 2 (cm²)																				
ZJ + stroke for position measuring system MTS																				
Pipe connection EE Whitworth pipe thr./ Metric thread																				
Rod thread KK																				
A max.																				
Ø B f 8																				
Ø D																				
Ø D1max. ¹⁾																				
Ø D2 ¹⁾																				
Ø D3 ¹⁾																				
L1 ¹⁾																				
PJ + stroke																				
VE																				
WF																				
OH																				
Y																				
Minimum stroke without connection plate ²⁾																				
Maximum stroke																				
Width across flats																				



Position of function bores 1-4
according to model code
① ② ③ ④ : side determination

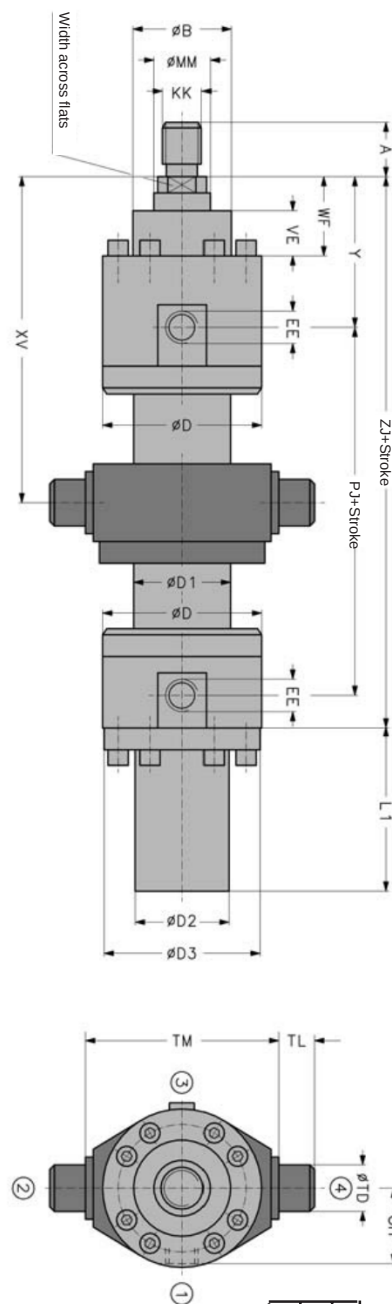
Tolerances	PJ	SS	ZJ	XS	Y	W	WC	WF	XV	Stroke
Stroke: 0 - 499	±1,5	±1,5	±2	±2	±2	±2	±2,8	±2	±2	+ 2
Stroke: 500-1000	±1,5	±2	±2	±2	±2	±2,8	±2,8	±2	±2	+ 2

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 trunnion

	32	40	50	63	80	100	125	140	160	180	200
Piston Ø (mm)	32	40	50	63	80	100	125	140	160	180	200
Rod Ø MM (mm)	22	28	36	45	56	70	90	100	110	125	140
Piston area A 1 (cm²)	8	12.6	19.6	31.2	50.3	78.5	123	154	201	254	314
Annular area A 2 (cm²)	4.2	6.4	9.5	15.3	25.6	40.1	59.1	75.4	106	132	160
ZJ + stroke for position measuring system MTS	179	193	205	224	250	300	325	360	370	425	450
Pipe connection EE Whitworth pipe thr./ Metric thread	G ^{3/8} ₁₈ M 18 x 1,5	G ^{1/2} ₂₂ M 22 x 1,5	G ^{1/2} ₂₂ M 22 x 1,5	G ^{3/4} ₂₇ M 27 x 2	G ^{3/4} ₂₇ M 27 x 2	G ¹ ₃₃ M 33 x 2	G ¹ ₃₃ M 33 x 2	G ^{1 1/4} ₄₂ M 42 x 2	G ^{1 1/4} ₄₂ M 42 x 2	G ^{1 1/4} ₄₂ M 42 x 2	G ^{1 1/2} ₄₈ M 48 x 2
Rod thread KK	M 14 x 1,5	M 16 x 1,5	M 20 x 1,5	M 27 x 2	M 33 x 2	M 42 x 2	M 48 x 2	M 56 x 2	M 64 x 3	M 72 x 3	M 80 x 3
A max.	18	22	28	36	45	56	63	75	85	90	95
Ø B_{f8}	40	50	60	70	85	106	132	145	160	185	200
Ø D	67	78	95	116	130	158	192	215	238	260	285
Ø D1^{max.1)}	42	52	62	78	95	120	150	170	190	210	235
Ø D2¹⁾	65	65	65	65	65	65	65	65	65	65	65
Ø D3¹⁾	65	65	65	65	65	65	65	65	65	65	65
L1¹⁾	91	91	95	101	101	101	101	101	101	101	101
PJ + stroke	80,5	89	111	117	134	162	174	194	191	214	224
TD_{f8}	16	20	25	32	40	50	63	70	80	90	100
TL_{js 16}	12	16	20	25	32	40	50	56	63	70	80
TM_{h 12}	75	90	105	120	135	160	195	220	240	275	295
VE	19	19	24	29	36	37	37	40	41	45	45
WF	32	32	38	45	54	57	60	64	66	75	75
OH	30,0	35,0	44,0	54,0	62,0	75,0	92,0	103,5	115,0	126,0	138,0
min XV³⁾	128	152	160	179	199	243	252	263	278	314	341
max=stroke+	62	69	79	80	95	123	158	174	174	223	236
Y	64	71	72	82	91	108	121	134	143	175	190
Minimum stroke ²⁾	66	83	81	99	104	120	94	89	104	91	105
Minimum stroke without connection plate ²⁾	26	37	30	35	29	34	0	0	0	0	0
Maximum stroke											
Width across flats	19	19	24	30	36	46	60	65	75	85	95



Position of function bores 1-4
according to model code
① ② ③ ④ : side determination

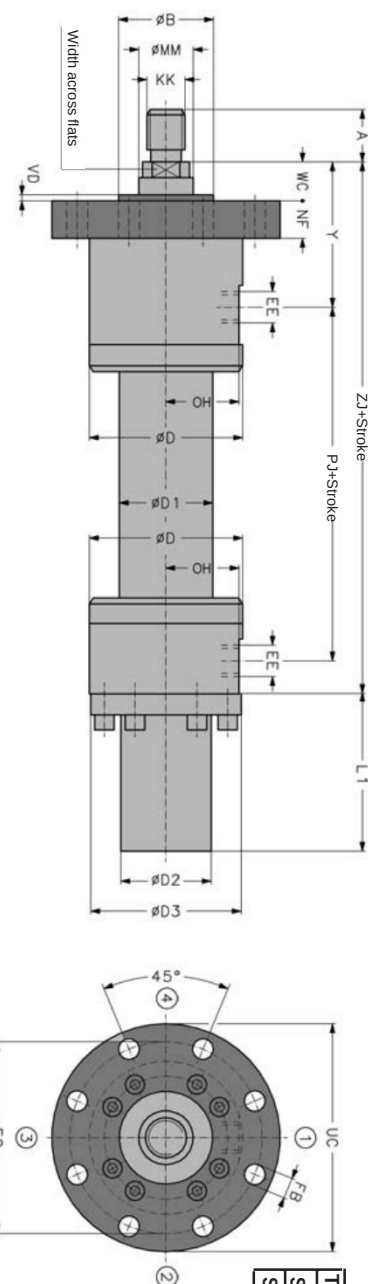
Tolerances	PJ	SS	ZJ	XS	Y	W	WC	WF	XV	Stroke
Stroke: 0 - 499	±1,5	±1,5	±2	±2	±2	±2	±2	±2	±2	+2
Stroke: 500-1000	±1,5	±2	±2	±2	±2	±2	±2	±2	±2	+2

Remarks:

- Not standardized dimensions
- Minimum stroke due to production. Shorter stroke lengths possible by using a spacer bush.
- Caution:** Observe outer dimensions of cylinder with connection plate and check for collision.
State XV dimension in plain text when ordering !
- Not standardized piston - Ø

Mounting type MF 3 - round flange at cylinder head

	200	180	160	140	125	100	80	63	50	40	32	Piston Ø (mm)
	110	100	90	80	70	56	45	36	28	22	22	Rod Ø MM (mm)
	140	125	110	100	90	78,5	50,3	31,2	19,6	12,6	8	Piston area A 1 (cm ²)
	160	132	106	75,4	59,1	40,1	25,6	15,3	9,5	6,4	4,2	Annular area A 2 (cm ²)
	450	425	370	360	325	300	250	224	205	193	179	ZJ + stroke for position measuring system MTS
	M 42 x 2	M 42 x 2	M 42 x 2	M 42 x 2	M 33 x 2	M 33 x 2	M 27 x 2	M 27 x 2	M 22 x 1,5	M 22 x 1,5	M 18 x 1,5	Pipe connection EE Whitworth pipe thr./ Metric thread
	M 80 x 3	M 72 x 3	M 64 x 3	M 56 x 2	M 48 x 2	M 42 x 2	M 33 x 2	M 27 x 2	M 20 x 1,5	M 16 x 1,5	M 14 x 1,5	Rod thread KK
	95	90	85	75	63	56	45	36	28	22	18	A max.
	200	185	160	145	132	106	85	70	60	50	40	Ø B _{f8}
	285	260	238	215	192	158	130	116	95	78	67	Ø D
	235	210	190	170	150	120	95	78	62	52	42	Ø D1 ^{max.1)}
	65	65	65	65	65	65	65	65	65	65	65	Ø D2 ¹⁾
	128	128	128	128	128	104	129	116	95	65	65	Ø D3 ¹⁾
	26	26	22	22	22	22	17,5	13,5	11	9	9	Ø FB ^{H 13}
	340	320	280	260	235	200	165	145	126	106	92	FC _{js 13}
	101	101	101	101	101	101	101	101	95	91	91	L1 ¹⁾
	40	40	36	35	32	32	32	25	20	16	16	NF
	224	214	191	194	174	162	134	117	111	89	80,5	PJ + stroke
	385	365	316	295	272	238	195	170	148	125	110	UC
	5	5	5	5	5	5	4	4	4	3	3	VD
	35	35	30	30	28	25	22	20	18	16	16	W / WC
	138,0	126,0	115,0	103,5	92,0	75,0	62,0	54,0	44,0	35,0	30,0	OH
	190	175	143	134	121	108	91	82	72	71	64	Y
	0	0	0	0	0	34	29	35	30	37	26	Minimum stroke without connection plate ²⁾
	1000 mm (longer strokes on request)											Maximum stroke
	95	85	75	65	60	46	36	30	24	19	19	Width across flats
	120	110	95	85	75	60	46	36	30	24	19	



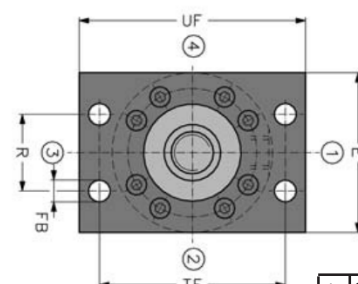
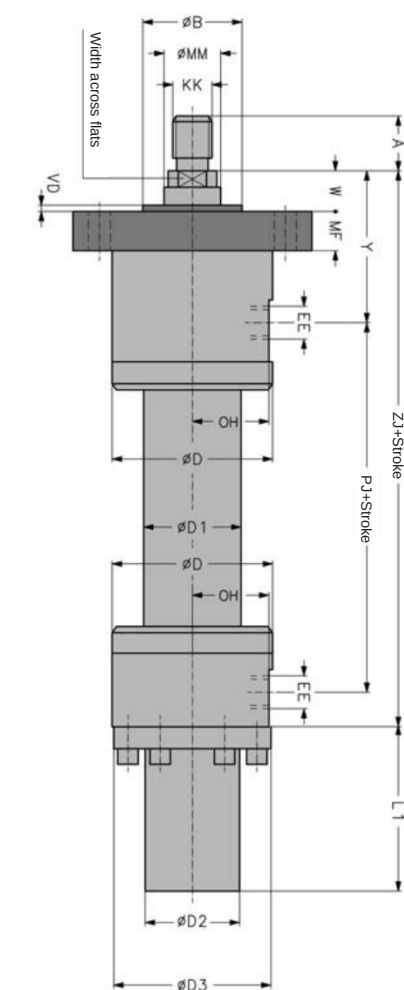
Position of function bores 1-4
according to model code
① ② ③ ④ : side determination

Tolerances	PJ	SS	ZJ	XS	Y	W	WC	WF	XV	Stroke
Stroke: 0-499	±1,5	±1,5	±2	±2	±2	±2	±2	±2	±2	+2
Stroke: 500-1000	±1,5	±2	±2	±2	±2	±2	±2	±2	±2	+2

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 MF 1 - rectangular flange at cylinder head



Position of function bores 1-4
according to model code

① ② ③ ④ : side determination

Tolerances	PJ	SS	ZJ	XS	Y	W	WC	WF	XV	Stroke
Stroke: 0 - 499	±1,5	±1,5	±2	±2	±2	±2	±2	±2	±2	±2
Stroke: 500-1000	±1,5	±2	±2	±2	±2	±2	±2	±2	±2	±2

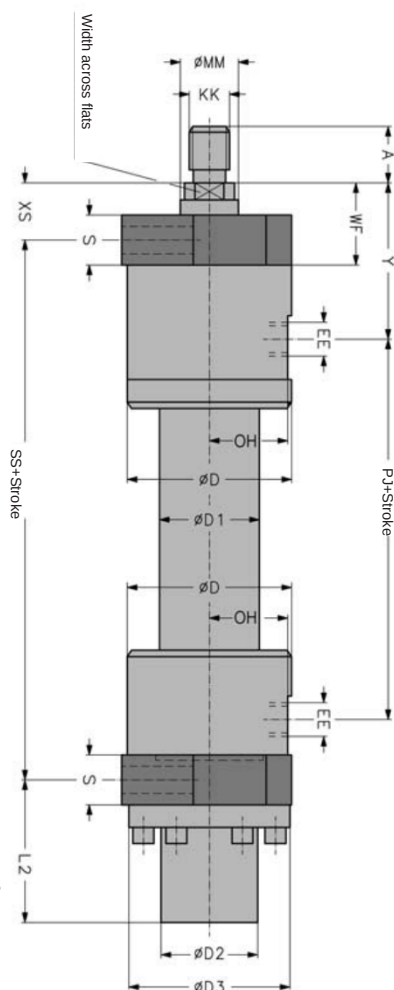
Piston Ø (mm)	Rod Ø MM (mm)	Piston area A 1 (cm²)	Annular area A 2 (cm²)	ZJ + stroke for position measuring system MTS	Pipe connection EE Whitworth pipe thr./ Metric thread	Rod thread KK	A max.	Ø B f 8	Ø D	Ø D1 max. ¹⁾	Ø D2 ¹⁾	Ø D3 ¹⁾	E max.	Ø F B ^{H 13}	L1 ¹⁾	MF	PJ + stroke	R js 13	TF js 13	UF max.	VD	W / WC	OH	Y	Minimum stroke without connection plate ²⁾	Maximum stroke	Width across flats
32	22	8	4,2	179	G 9/16 M 18 x 1,5	M 14 x 1,5	18	40	67	42	65	65	60	9	91	16	80,5	35,2	85	105	3	16	30,0	64	26	19	19
40	28	12,6	8,8	193	G 1 1/2 M 22 x 1,5	M 16 x 1,5	22	50	78	52	65	65	70	9	91	16	89	40,6	98	115	3	16	35,0	71	37	19	24
50	36	19,6	13,5	205	G 1 1/2 M 22 x 1,5	M 20 x 1,5	28	60	95	62	65	65	95	11	95	20	111	48,2	116,4	140	4	18	44,0	72	30	24	30
63	45	31,2	21	224	G 3/4 M 27 x 2	M 27 x 2	36	70	116	78	65	65	115	13,5	101	25	117	55,5	134	160	4	20	54,0	82	35	36	36
80	56	50,3	34,4	250	G 3/4 M 27 x 2	M 33 x 2	45	85	130	95	65	65	129	13,5	101	32	134	63,1	152,5	185	4	22	62,0	91	29	36	46
100	70	78,5	53,9	300	G 1 M 33 x 2	M 42 x 2	56	106	158	120	65	65	104	15,7	101	32	162	76,5	184,8	225	5	25	75,0	108	34	46	60
125	90	123	84,2	325	G 1 M 33 x 2	M 48 x 2	63	132	192	150	65	65	128	19,0	101	32	174	90,2	217,1	255	5	28	92,0	121	0	60	75
140 ⁴⁾	100	154	104	360	G 1 1/4 M 42 x 2	M 56 x 2	75	145	215	170	65	65	128	-	101	-	194	-	-	-	5	30	103,5	134	0	65	85
160	110	201	137	370	G 1 1/4 M 42 x 2	M 64 x 3	85	160	238	190	65	65	128	-	101	-	191	-	-	-	5	30	115,0	143	0	75	95
180 ⁴⁾	125	254	176	425	G 1 1/4 M 42 x 2	M 72 x 3	90	185	260	210	65	65	128	-	101	-	214	-	-	-	5	35	126,0	175	0	85	110
200	140	314	219	450	G 1 1/4 M 42 x 2	M 80 x 3	95	200	285	235	65	65	128	-	101	-	224	-	-	-	5	35	138,0	190	0	95	120

Remarks:

- Not standardized dimensions
- Minimum stroke due to production. Shorter stroke lengths possible by using a spacer bush.
- Not standardized piston - Ø

Mounting type MS 2 foot mounting

	PistonØ (mm)		Rod Ø MM (mm)		Piston area A 1(cm²)		Annular area A 2(cm²)		SS + stroke for position measuring systems		Pipe connection EE Whitworth pipe thr./ Metric thread		Rod thread KK		A max.		Ø D		Ø D1max. ¹⁾		Ø D2 ¹⁾		Ø D3 ¹⁾		LH _{h 14}		L2 ¹⁾ for position measuring systems		PJ + stroke		S _{js 13}		Ø SB ^{H 13}		ST max.		TE _{js 13}		TS _{js 13}		US		WF		XS		Y		OH		Minimum stroke without connection plate		Maximum stroke		Width across flats																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
32	22	8	4,2	169	G ^{3/8} ₁₈ x 1,5	M 14 x 1,5	18	67	42	65	65	65	45	81,5 100,5	80,5	25	11	45	87	110	130	32	19,5	64	30,0	26			19																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			



① ② ③ ④ : side determination

Position of function bores 1-4
according to model code

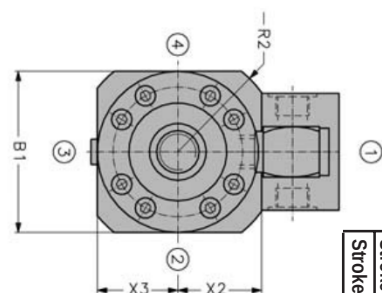
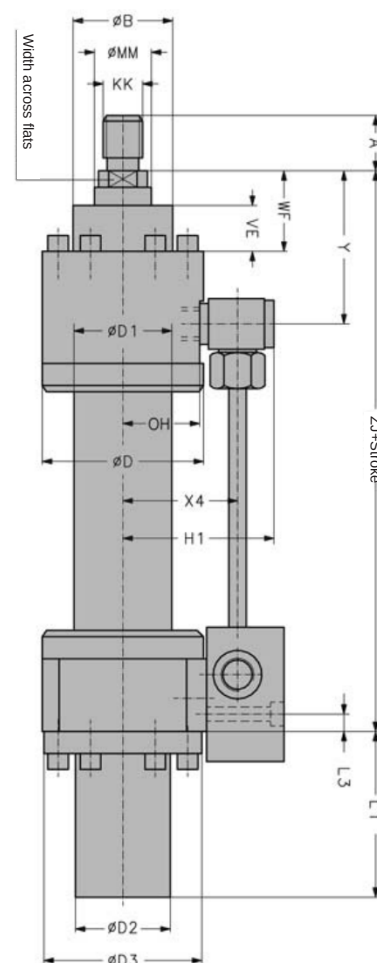
Tolerances	PJ	SS	ZJ	XS	Y	W	WC	WF	XV	Stroke
Stroke: 0 - 499	±1,5	±1,5	±2	±2	±2	±2	±2	±2	±2	±2
Stroke: 500 - 1000	±1,5	±2	±2	±2	±2	±2	±2	±2	±2	±2

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 A basic design

Piston Ø (mm)	Rod Ø MM (mm)	Piston area A 1 (cm ²)	Annular area A 2 (cm ²)	ZJ + stroke for position measuring system MTS	Pipe connection EE Whitworth pipe thr./ Metric thread	Rod thread KK	A max.	Ø B _{f8}	B1 ¹⁾	Ø D	Ø D1max. ¹⁾	Ø D2 ¹⁾	Ø D3 ¹⁾	H1 ¹⁾	L1 ¹⁾	L3 ¹⁾ for position measuring system MTS	R2 ¹⁾	VE	WF	OH	X2 ¹⁾	X3 ¹⁾	X4 ¹⁾	Y	Minimum stroke with connection plate 2)	Maximum stroke	Width across flats
32	22	8	4,2	179	G 3/8	M 14 x 1,5	18	40	85	67	42	65	65	75	91	34,5	57,5	19	32	30,0	36,5	42,5	51,5	64	190	19	19
40	28	12,6	8,8	193	G 1/2	M 16 x 1,5	22	50	89	78	52	65	65	80	91	34,5	58	19	32	35,0	41,5	44,5	56,5	71	190	19	24
50	36	19,6	13,5	205	G 3/4	M 20 x 1,5	28	60	102	95	62	65	95	89	95	18,3	67,5	24	38	44,0	50,5	51	65,5	72	160	24	30
63	45	31,2	21	224	G 3/4	M 27 x 2	36	70	116	116	78	65	116	99	101	31,3	75	29	45	54,0	60,5	58	75,5	82	160	30	36
80	56	50,3	34,4	250	G 3/4	M 33 x 2	45	85	130	130	95	65	129	107	101	31,3	82,5	36	54	62,0	68,5	65	83,5	91	145	36	46
100	70	78,5	53,9	300	G 1	M 42 x 2	56	106	156	158	120	65	104	120	101	31,3	95	37	57	75,0	81,5	78	96,5	108	120	46	60
125	90	123	84,2	325	G 1	M 48 x 2	63	132	192	192	150	65	128	137	101	26,3	115	37	60	92,0	98,5	96	113,5	121	94	60	75
140 ⁴⁾	100	154	104	360	G 1 1/4	M 56 x 2	75	145	215	215	170	65	128	148,5	101	28,3	132,5	40	64	103,5	110,0	107,5	125	134	89	65	85
160	110	201	137	370	G 1 1/4	M 64 x 3	85	160	238	238	190	65	128	160	101	32,3	145	41	66	115,0	121,5	119	136,5	143	104	75	95
180 ⁴⁾	125	254	176	425	G 1 1/4	M 72 x 3	90	185	260	260	210	65	128	171	101	32,3	162,5	45	75	126,0	133,5	130	147,5	175	91	85	110
200	140	314	219	450	G 1 1/4	M 80 x 3	95	200	285	285	235	65	128	183	101	32,3	175	45	75	138,0	144,5	142,5	159,5	190	105	95	120



Position of connection plate only side 1
 ② ③ ④ : side determination
 Bleed screw/
 Gauge coupling

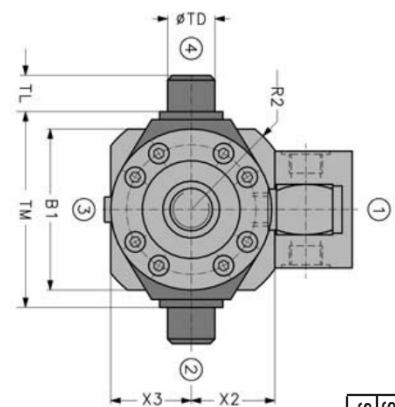
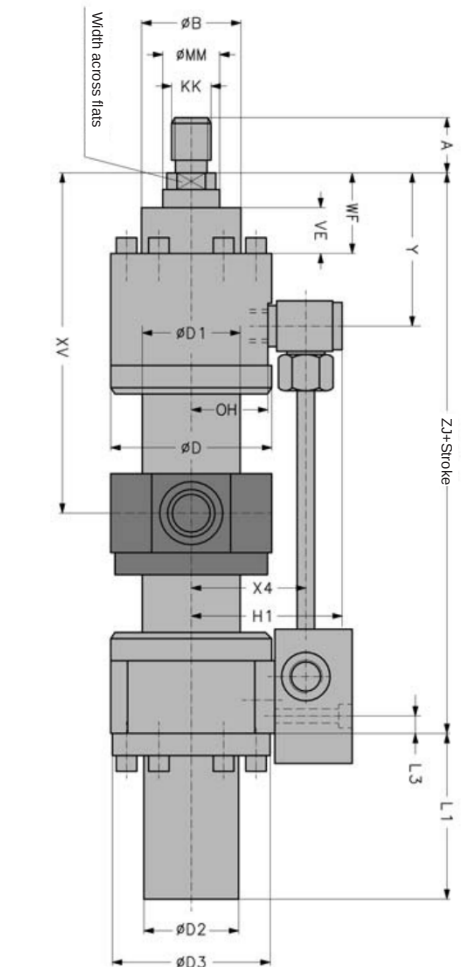
Tolerances	PJ	SS	ZJ	XS	Y	W	WC	WF	XV	Stroke
Stroke: 0 - 499	±1,5	±1,5	±2	±2	±2	±2	±2	±2	±2	+2
Stroke: 500-1000	±1,5	±2	±2	±2	±2	±2	±2	±2	±2	+2

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 trunnion

	PistonØ (mm)		Rod Ø MM (mm)		Piston area A 1 (cm²)		Annular area A 2 (cm²)		ZJ + stroke for position measuring system MTS		Pipe connection EE Whitworth pipe thr./ Metric thread		Rod thread KK		A max.		Ø B _{f8}		B1 ¹⁾		Ø D		Ø D1max. ¹⁾		Ø D2 ¹⁾		Ø D3 ¹⁾		H1 ¹⁾		L1 ¹⁾		L3 ¹⁾ for position measuring system MTS		R2 ¹⁾		Ø TD _{f8}		TL _{js 16}		TM _{h 12}		VE		WF		OH		X2 ¹⁾		X3 ¹⁾		X4 ¹⁾		min XV ³⁾ max=stroke+		Y		Minimum stroke with connection		1000 mm (longer strokes on request)		Maximum stroke		Width across flats																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
32	22	8	4,2	179	G ^{3/8} M 18 x 1,5	M 14 x 1,5	18	40	85	67	42	65	65	65	75	91	34,5 53,5	57,5	16	12	75	19	32	30,0	36,5	42,5	51,5	128	62	64	190	19																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								</



Position of connection plate only side 1

② ③ ④ : side determination
Bleed screw/
Gauge coupling

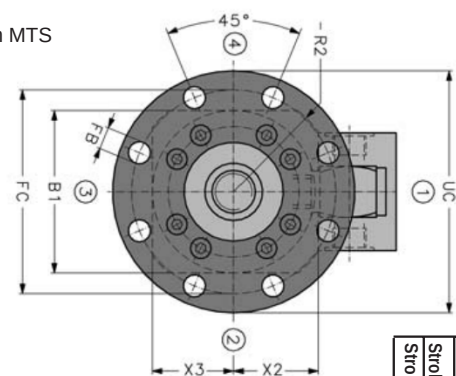
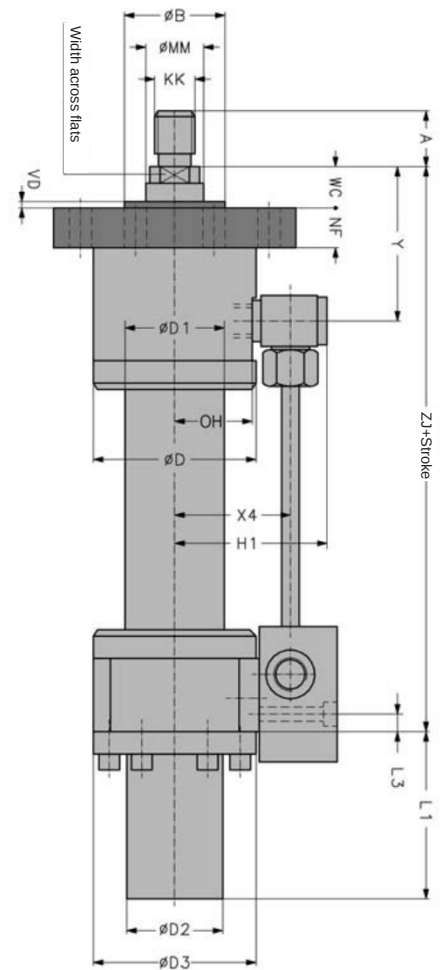
Tolerances	PJ	SS	ZJ	XS	V	W	WC	WF	XV	Stroke
Stroke: 0 - 499	±1,5	±1,5	±2	±2	±2	±2	±2	±2	±2	±2
Stroke: 500-1000	±1,5	±2	±2	±2	±2	±2	±2	±2	±2	±2

Remarks:

- 1) Not standardized dimensions
- 2) Minimum stroke due to production. Shorter stroke lengths possible by using a spacer bush.
- 3) **Caution:** Observe outer dimensions of cylinder with connection plate and check for collision.
State XV dimension in plain text when ordering !
- 4) Not standardized piston -Ø

Mounting type MF 3 round flange at cylinder head

	PistonØ (mm)		Rod Ø MM (mm)		Piston area A 1 (cm²)		Annular area A 2 (cm²)		ZJ + stroke for position measuring systems		Pipe connection EE Whitworth pipe thr./ Metric thread		Rod thread KK		A max.		Ø B _{f8}		B1 ¹⁾		Ø D		Ø D1max. ¹⁾		Ø D2 ¹⁾		Ø D3 ¹⁾		Ø FB ^{H13}		FC _{js 13}		H1 ¹⁾		L1 ¹⁾		L3 ¹⁾ for position measuring systems		NF		R2 ¹⁾		UC		VD		W/WC		OH		X2 ¹⁾		X3 ¹⁾		X4 ¹⁾		Y		Minimum stroke with connection plate		1000 mm (longer strokes on request)		Maximum stroke		Width across flats																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
32	22	8	4,2	179	G ^{3/8} ₁₈	M 18 x 1,5	M 14 x 1,5	18	40	85	67	42	65	65	9	92	75	91	34,5	16	57,5	110	3	16	30,0	36,5	42,5	51,5	64	190	19																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											



Position of connection plate only side 1
② ③ ④ : side determination
Bleed screw/
Gauge coupling

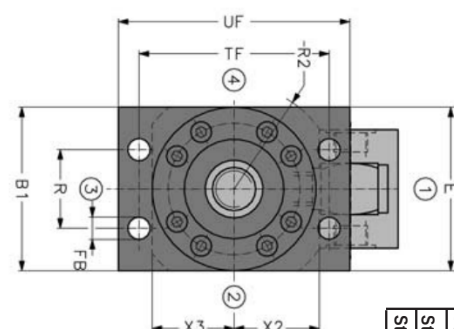
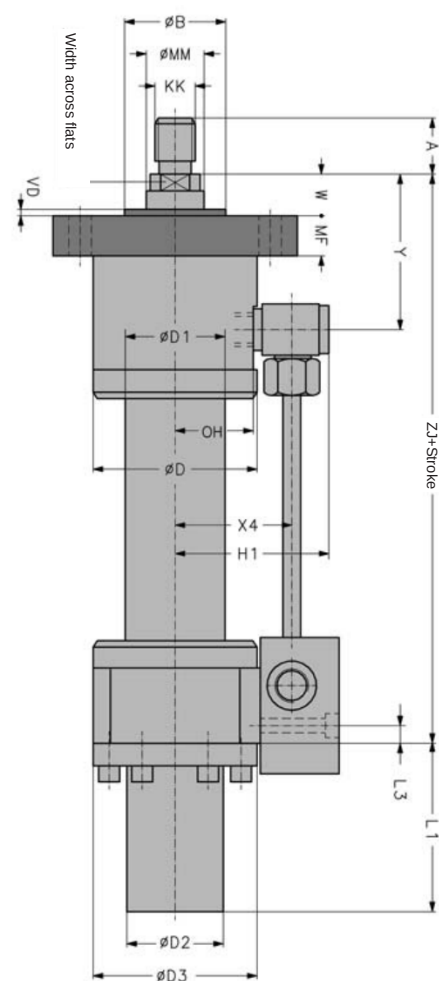
Tolerances	PJ	SS	ZJ	XS	Y	W	WC	WF	XV	Stroke
Stroke: 0 - 499	±1,5	±1,5	±2	±2	±2	±2	±2	±2	±2	±2
Stroke: 500-1000	±1,5	±2	±2	±2	±2	±2	±2	±2	±2	±2

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 MF 1 rectangular flange at cylinder head

	200	180	160	140	125	100	80	63	50	40	32	Piston Ø (mm)
	110	100	90	80	70	56	45	36	28	22	22	Rod Ø MM (mm)
	140	125	110	100	90	78.5	50.3	31.2	19.6	12.6	8	Piston area A 1 (cm²)
	160	145	137	104	84.2	53.9	34.4	21	13.5	8.8	4.2	Annular area A 2 (cm²)
	219	176	106	75.4	32.5	300	250	224	205	193	179	ZJ + stroke for position measuring system MTS
	450	425	370	360	325	300	250	224	205	193	179	Pipe connection EE Whitworth pipe thr./ Metric thread
	M 42 x 2	M 42 x 2	M 42 x 2	M 42 x 2	M 33 x 2	M 33 x 2	M 27 x 2	M 27 x 2	M 22 x 1.5	M 22 x 1.5	M 18 x 1.5	Rod thread KK
	M 80 x 3	M 72 x 3	M 64 x 3	M 56 x 2	M 48 x 2	M 42 x 2	M 33 x 2	M 27 x 2	M 20 x 1.5	M 16 x 1.5	M 14 x 1.5	A max.
	95	90	85	75	63	56	45	36	28	22	18	Ø B ₁₈
	200	185	160	145	132	106	85	70	60	50	40	B1 ¹⁾
	285	260	238	215	192	158	130	116	102	89	85	Ø D
	285	260	238	215	192	158	130	116	102	89	85	Ø D1max. ¹⁾
	235	210	190	170	150	120	95	78	62	52	42	Ø D2 ¹⁾
	65	65	65	65	65	65	65	65	65	65	65	Ø D3 ¹⁾
	128	128	128	128	128	104	95	96	95	70	60	E max.
	-	-	-	-	-	157	11.6	11.5	11	9	9	Ø FB ^{H13}
	26	26	22	22	22	22	107	99	89	80	75	H1 ¹⁾
	183	171	160	148.5	137	120	101	91	89	80	75	L1 ¹⁾
	101	101	101	101	101	101	101	101	101	101	101	L3 ¹⁾ for position measuring system MTS
	32.3	32.3	32.3	28.3	26.3	31.3	31.3	31.3	18.3	16	16	MF
	-	-	-	-	32	32	32	32	20	16	16	R _{s13}
	-	-	-	-	90.2	76.5	82.5	75	67.5	58	57.5	R2 ¹⁾
	175	162.5	145	132.5	115	95	82.5	75	67.5	58	57.5	TF _{s13}
	-	-	-	-	217.1	184.8	152.5	134	116.4	98	85	UF max.
	-	-	-	-	255	225	185	160	140	115	105	VD
	5	5	5	5	5	5	4	4	4	3	3	W/WC
	35	35	30	30	28	25	22	20	18	16	16	OH
	138.0	126.0	115.0	103.5	92.0	75.0	62.0	54.0	44.0	35.0	30.0	X2 ¹⁾
	144.5	133.5	121.5	110	98.5	81.5	68.5	60.5	50.5	41.5	36.5	X3 ¹⁾
	142.5	130	119	107.5	96	78	65	58	51	44.5	42.5	X4 ¹⁾
	159.5	147.5	136.5	125	113.5	96.5	83.5	75.5	65.5	56.5	51.5	Y
	190	175	163	154	143	121	108	91	72	64	64	Minimum stroke with connection plate ²⁾
	105	91	104	89	94	120	145	160	160	190	190	Maximum stroke
	1000 mm (longer strokes on request)											Width across flats
	120	110	95	85	75	60	46	36	30	24	19	



Position of connection plate only side 1

② ③ ④ : side determination
Bleed screw/
Gauge coupling

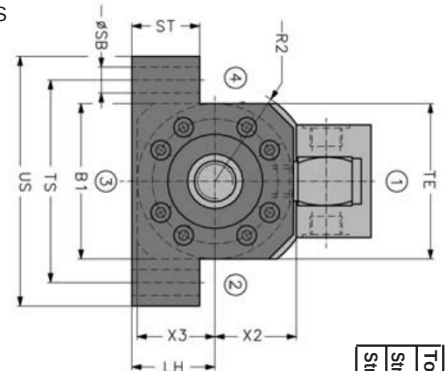
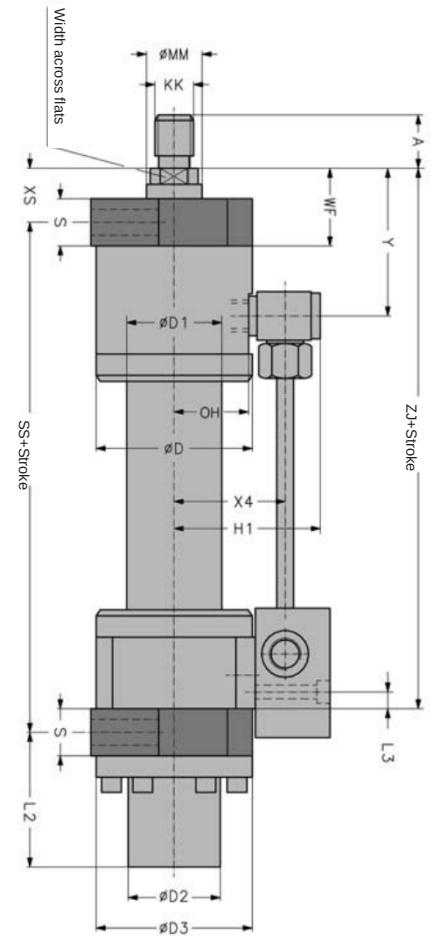
Tolerances	PJ	SS	ZJ	XS	Y	W	WC	WF	XV	Stroke
Stroke: 0 - 499	±1.5	±1.5	±2	±2	±2	±2	±2	±2	±2	±2
Stroke: 500 - 1000	±1.5	±2	±2	±2	±2	±2	±2	±2	±2	±2

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 MS 2 foot mounting

	32	40	50	63	80	100	125	140	160	180	200	
PistonØ (mm)	22	28	36	45	56	70	90	100	110	125	140	
Rod Ø MM (mm)	8	12	16	15	16	20	25	32	36	42	50	
Piston area A 1 (cm²)	4.2	8.8	13.5	21	25.6	30.0	39.1	45.2	50.1	57.4	67.8	
Annular area A 2 (cm²)	1.79	1.93	2.05	2.24	2.36	2.93	3.21	3.54	3.70	4.18	4.50	
ZJ + stroke for position measuring system MTS	169	183	199	211	236	293	321	354	364	418	447	
SS + stroke for position measuring system MTS	169	204	199	211	236	293	321	354	364	418	447	
Pipe connection EE Whitworth pipe thr./ Metric thread	M 18 x 1.5	M 22 x 1.5	M 22 x 1.5	M 27 x 2	M 33 x 2	M 33 x 2	M 33 x 2	M 42 x 2	M 42 x 2	M 42 x 2	M 42 x 2	
Rod thread KK	M 14 x 1.5	M 16 x 1.5	M 20 x 1.5	M 27 x 2	M 33 x 2	M 33 x 2	M 42 x 2	M 42 x 2	M 42 x 2	M 42 x 2	M 42 x 2	
A max.	18	22	28	36	45	56	63	75	85	90	95	
B1¹⁾	85	89	102	116	130	156	192	215	238	260	285	
Ø D	67	78	95	116	130	158	192	215	238	260	285	
Ø D1max.¹⁾	42	52	62	78	95	120	150	170	190	210	235	
Ø D2¹⁾	65	65	65	65	65	65	65	65	65	65	65	
Ø D3¹⁾	65	65	65	65	65	65	65	65	65	65	65	
H1¹⁾	75	80	89	99	107	120	137	148.5	160	171	183	
LH_{h14}	45	49	52	62	70	82	100	112	119	134	145	
L2¹⁾ for position measuring system MTS	81.5	81.5	79	85	81	76	73	72	71	67	65	
L3¹⁾ for position measuring system MTS	34.5	34.5	18.3	31.3	31.3	31.3	26.3	28.3	32.3	32.3	32.3	
R2¹⁾	57.5	58	67.5	75	82.5	95	115	132.5	145	162.5	175	
S_{js13}	25	25	32	32	40	50	56	58	60	68	72	
Ø SB^{H13}	11	11	14	18	22	26	33	33	33	39	39	
ST max.	45	49	52	62	70	82	100	112	119	134	145	
TE_{js13}	87	78	95	116	130	158	192	215	238	260	285	
TS_{js13}	110	100	120	145	170	205	245	270	295	325	350	
US	130	120	145	180	210	250	300	325	350	390	415	
WF	32	32	38	45	54	57	60	64	66	75	75	
OH	30.0	35.0	44.0	54.0	62.0	75.0	92.0	103.5	115.0	126.0	138.0	
X2¹⁾	36.5	41.5	50.5	60.5	68.5	81.5	98.5	110	121.5	133.5	144.5	
X3¹⁾	42.5	44.5	51	58	65	78	96	107.5	119	130	142.5	
X4¹⁾	51.5	56.5	65.5	75.5	83.5	96.5	113.5	125	136.5	147.5	159.5	
XS	19.5	19.5	22	29	34	32	32	35	36	41	39	
Y	64	71	72	82	91	108	121	89	104	110	105	
Minimum stroke with connection plate ²⁾	19	19	24	30	36	46	60	65	75	85	95	
Maximum stroke	19	19	24	30	36	46	60	65	75	85	95	
Width across flats	19	24	30	36	46	60	60	65	75	85	95	



Position of function bores 1-4
according to model code
② ③ ④ : side determination
Bleed screw/
Gauge coupling

Tolerances	PJ	SS	ZJ	XS	Y	W	WC	WF	XV	Stroke
Stroke: 0 - 499	±1.5	±1.5	±2	±2	±2	±2	±2	±2	±2	±2
Stroke: 500-1000	±1.5	±2	±2	±2	±2	±2	±2	±2	±2	±2

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

Seals

Position	Designation	Seal variant	Number	Piston Ø
1.1	Wiper	all	1	32 ÷ 200
1.2	U-cup seal	5	1	32 ÷ 200
1.2	U-cup seal	F	1	40 ÷ 200
1.3	Rod seal	KV	1	32 ÷ 200
1.4	Teflon seal	T; TV	2	40 ÷ 200
1.4	Teflon seal	F	1	40 ÷ 200
1.5	Teflon seal	G; GV	1	32 ÷ 200
1.8	O-ring	all	2	32 ÷ 200
1.9	Back-up ring	all	2	32 ÷ 200
1.10	O-ring	all	1	32 ÷ 200
1.11	Back-up ring	all	1	40 ÷ 200
1.12	O-ring	all	1	32 ÷ 200
1.13	Bleed screw	all	2	32 ÷ 200
2.1	O-ring	all	1	32 ÷ 200
2.2	O-ring	all	1	32 ÷ 200

Ordering complete seal kits:
Quantity and **complete** model code of the hydraulic cylinder.

Rod guide bands all variants

Position	Piston Ø	Number
1.7	50	2
1.7	$63 \div 80$	3
1.7	100	4
1.7	$125 \div 160$	3
1.7	$180 \div 200$	3

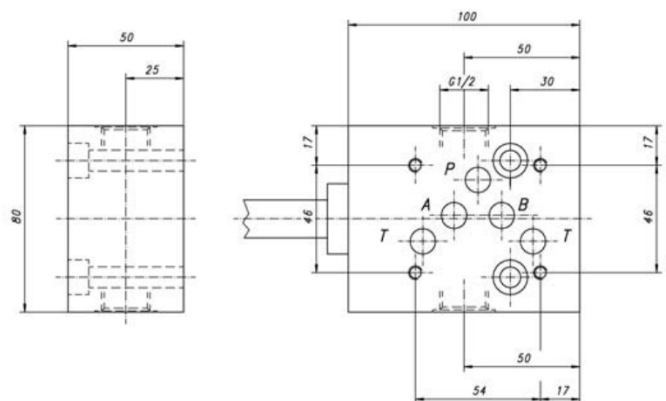
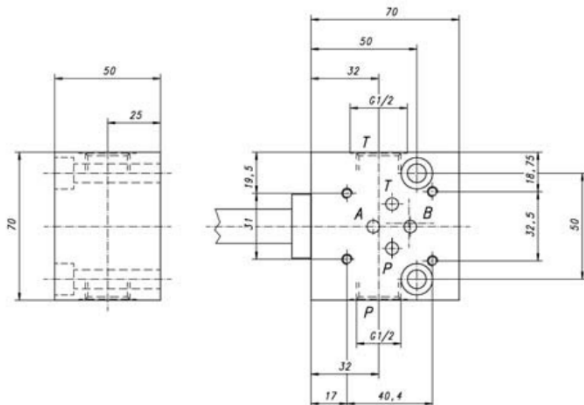
Piston guide bands all variants

Position	Piston Ø	Number
1.6	32 ÷ 40	2
1.6	50 ÷ 180	3
1.6	200	4

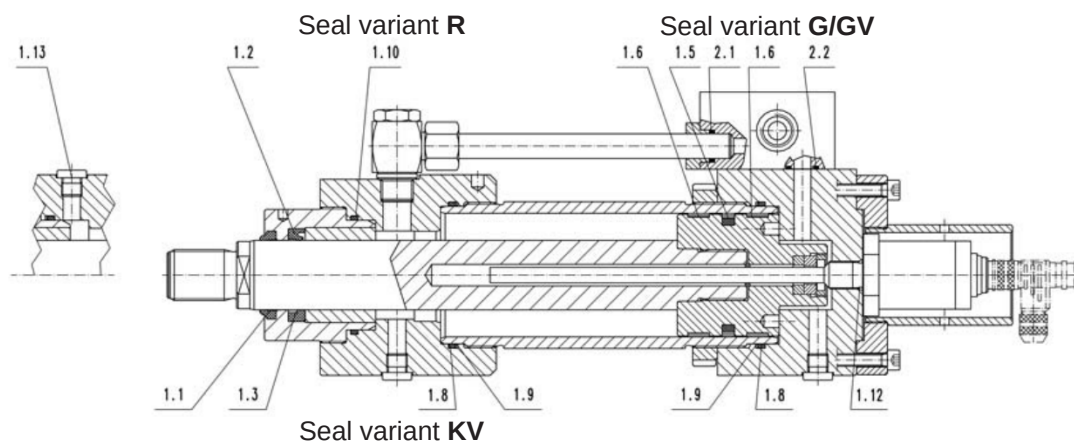
Connection hole patterns

NG 6 ISO 4401 (DIN 24340 - A6)

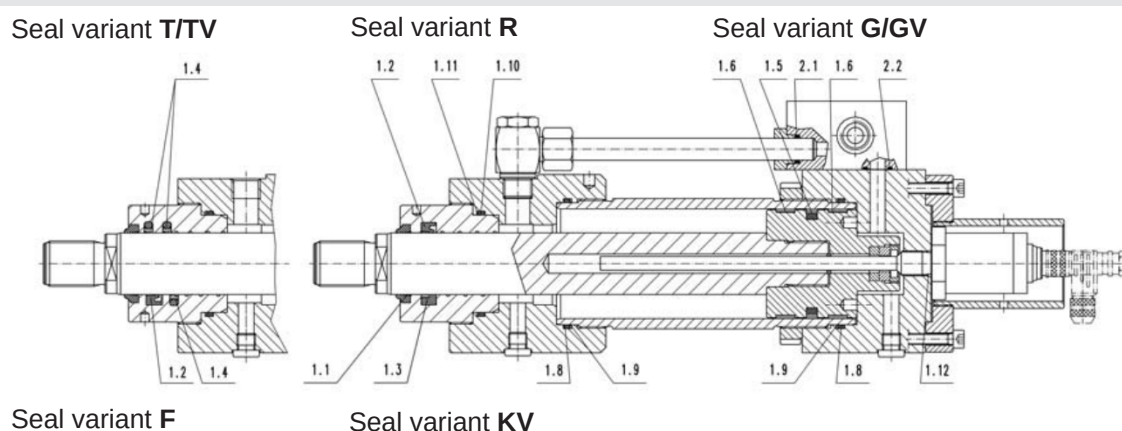
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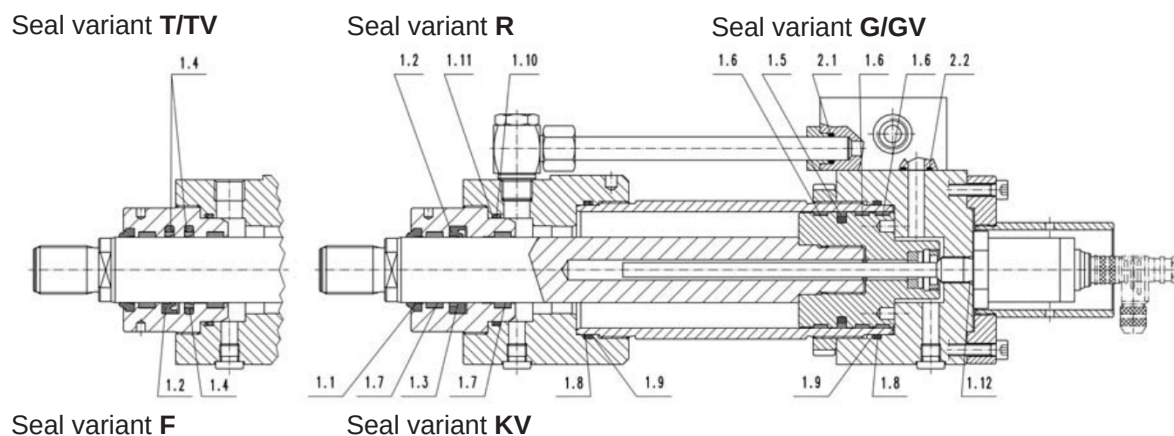
Spare parts diagrams Piston Ø 32 mm



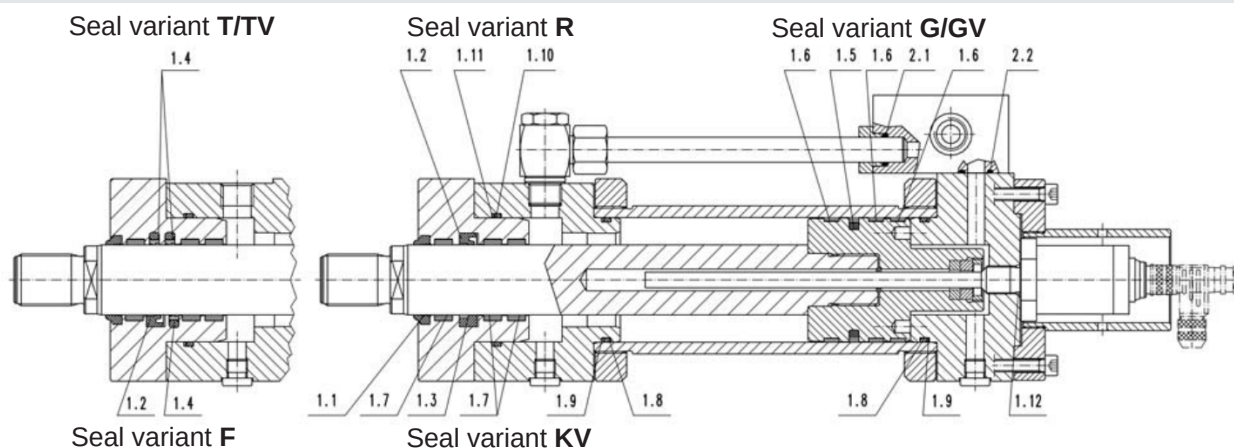
Piston Ø 40 mm



Piston Ø 50 - 100 mm



Piston Ø 125 - 200 mm



Seal variants

Schematic representation

Rod sealing

Code letter

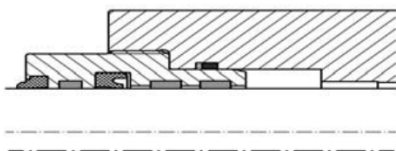
Piston sealing

RG

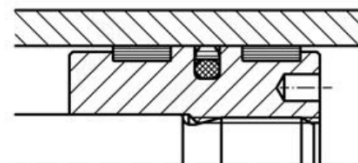
U-cup seal made of polyurethane

Standard version

Teflon seal with O-ring made of Perbunan



Temperature range: -30°C to + 80 °C
Hydraulic fluid: Mineral oil
Sliding speed: ≤0,5 m/s
Application: Universal industrial use.
Not suitable for holding function.

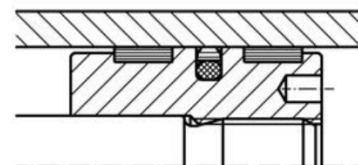
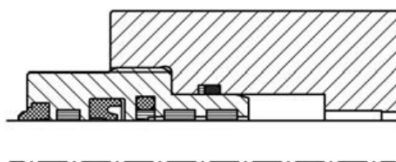


FG

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

Temperature range: -30°C to + 80 °C
Hydraulic fluid: Mineral oil
Sliding speed: ≤1 m/s
Application: Universal industrial use.
Minimal leakage.
Not suitable for holding function.

Teflon seal with O-ring made of Perbunan

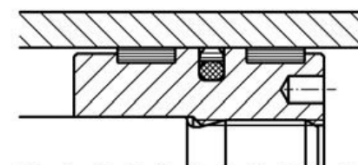
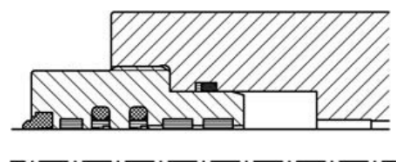


TC

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

Temperature range: -30°C to + 80 °C
Hydraulic fluid: Mineral oil
Sliding speed: ≤1 m/s
Application: Servo systems
Not suitable for holding function.

Teflon seal with O-ring made of Perbunan

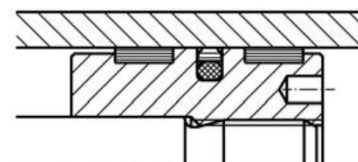
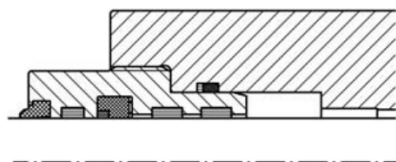


KVGV

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

Temperature range: -20°C to + 130 °C
Hydraulic fluid: Mineral oil, HFD fluids
Sliding speed: ≤1 m/s
Application: Higher operating temperatures.

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

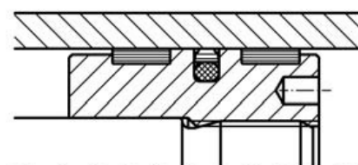
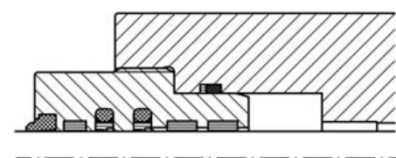


TVGV

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

Temperature range: -20°C to + 200 °C
Hydraulic fluid: Mineral oil, HFD fluids
Sliding speed: ≤1 m/s
Application: Servo systems
Higher operating temperatures.

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



[illegible]

Nominal pressure 160 bar (16 MPa)
without end position cushioning
Installation dimensions largely according to
DIN ISO 6020 part 1 and VW 39D920

AS with connection plate

Piston rod diameter in mm

A	Basic design
MT4	Trunnion (state dimension XV when ordering !)
MF3	Round flange, head end
MF1	Rectangular flange, head end
MS2	Foot mounting (not standardized)

Seal variants

RG	Standard version, U-cup seal / Teflon seal
Option	
FG	U-cup seal + Teflon slide ring / Teflon seal (from piston $\varnothing$ 40)
TG	Teflon slide ring in tandem version / Teflon seal (from piston $\varnothing$ 40)
KGVV	U-cup seal / Teflon seal (Viton version)
TVGV	Teflon slide ring in tandem version / Teflon seal (Viton version) (from piston $\varnothing$ 40)

0	without connection plate
2 NG 6	ISO 4401 (DIN 23340-A6)
3 NG 10	ISO 4401 (DIN 23340-A10)

B	Standard version, hard chrome-plated
Option	
C	induction-hardened and hard chrome-plated
D	nickel-plated and hard chrome-plated
E	multi-layer hard chrome-plated

1 External thread
3 External thread with mounted rod end spherical eye KG, see brochure 19112
4 External thread with mounted rod end plain eye KS, see brochure 19112

C Standard version, structural/tempered steel Option: N stainless steel (only with surface B)

G	Standard version, Whitworth pipe thread	Option: M	metric ISO thread
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Standard version side 1	Option: side 2; 3; 4 (connection plate only side 1 possible)
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E	Standard version bleed screw	Option: M gauge coupling
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E	Standard version, side 3	Option: 2; 4
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Manufacturer of position measuring system see data sheet for position measuring system

Type of position measuring system see data sheet for position measuring system

0	without connector
1	with straight connector
2	with angle connector

Version code(specified by the manufacturer)

Order example: Double-acting hydraulic cylinder 160 bar nominal pressure, with built-in position measuring system and attached connection plate with following data:
Piston- 63 mm, rod- 36 mm, mounting type MT4, stroke 300 mm, seal variant RG, hole pattern with connection plate NG 6.
Piston rod surface B, piston rod end 1, piston rod material C.
Pipe connection version G, Position of pipe connection side 1.
Air bleed, bleed screw E, position of bleed screw side 3.
Manufacturer of position measuring system Balluff, type of position measuring system BTL5-A11-...-B-S32. With angle connector.

Type: ZWAS 1611 - 63/36 - MT4 - 300 - RG - 2 - B1C - G1 - E3 - 11 - 2.2

Buckling load diagram

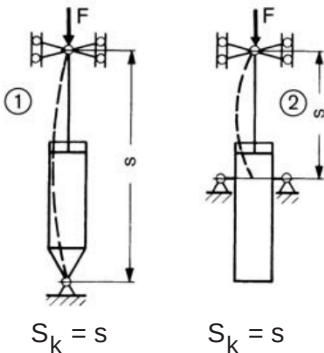
Determination of the permissible Buckling load $F_{K \text{ perm.}}$

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 $s = 4$).

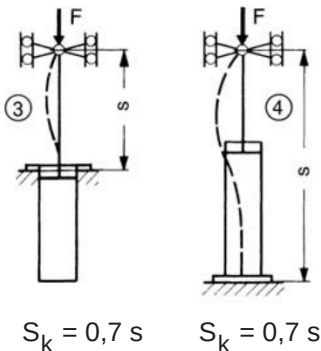
Example (see nomogram)

Mounting condition ③
 $d = 28 \text{ mm}$ $s = 1200 \text{ mm}$ (from dimensional drawing of the cylinder)
 $S_K = 0,7 \cdot s$ (see mounting condition ③)
 $= 840 \text{ mm}$
 From nomogram results $F_{K \text{ perm.}} = 22000 \text{ N}$

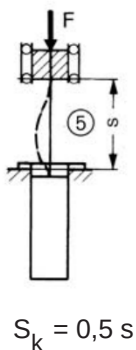
Euler case 2



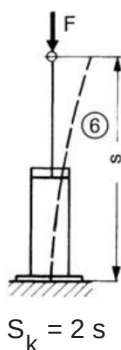
Euler case 3



Euler case 4

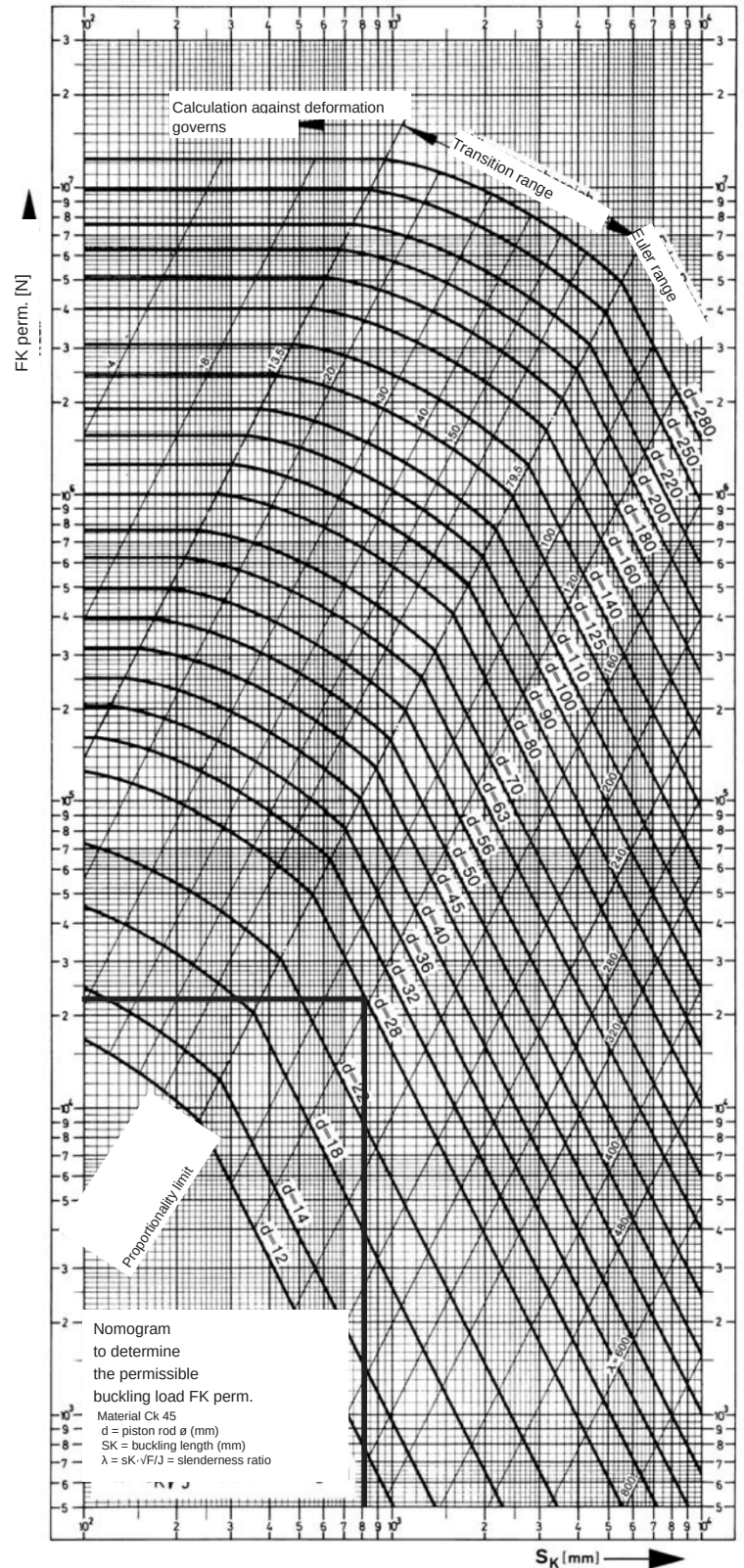


Euler case 1



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 at both ends which, with the same cross-sectional dimensions has the same ideal buckling load as as the rod under investigation.



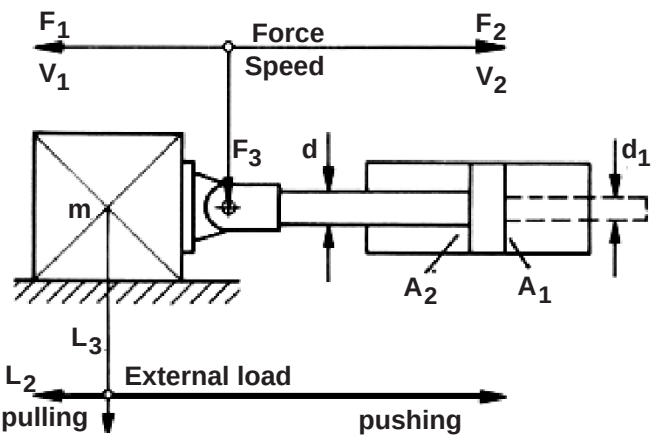
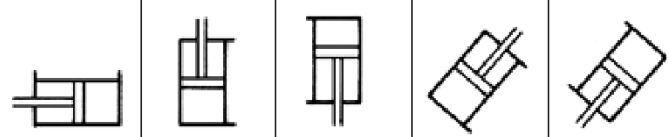
Buckling load diagram applies only to vertical cylinder installation and centrally applied force (without bending moments or lateral forces)!

Requirements list for hydraulic cylinders

Customer address..... Telephone/fax.....

..... Person in charge.....

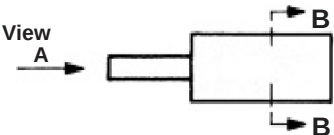
..... Department.....

Load diagram			
 F_1 V_1 Force Speed F_2 V_2 F_3 d d_1 A_2 A_1 m L_3 External load L_2 pulling pushing L_3 neither pushing nor pulling load			
Cylinder installation position			
			
a	b	c	d e
Cylinder data			
1	Operating pressure min bar max bar		
2	Piston Ø D mm		
3	Rod Ø d mm d₁ 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	

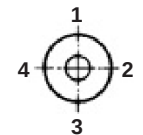
13	Required Cylinder forces	F_1	N
		F_2	N
14	max. Lateral force	F_3	N
15	Switching frequency	Double strokes per min.	
		Double strokes per sec.	
16	min. + max. Amplitude (α min; α max) + associated frequency (f)		$\alpha_{min} + f$ $\alpha_{max} + f$
17	Moving Mass		kg
18	Temperature range of hydraulic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

desired radial position of the pipe connections

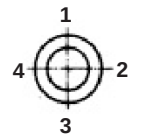
View A



View A Section B-B



Rod side



Cap end

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

Accessories

End positions

Position feedback

Clamping head

		yes	no
Position measuring system stating the Pos. accuracy	inductive		
	digital		
	Ultrasonic		
	potentiometric		
	capacitive		

○

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

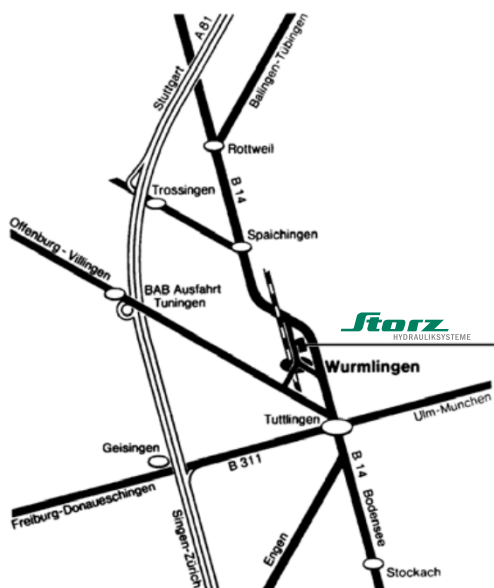
19

Subject to change without notice!

Product range



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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