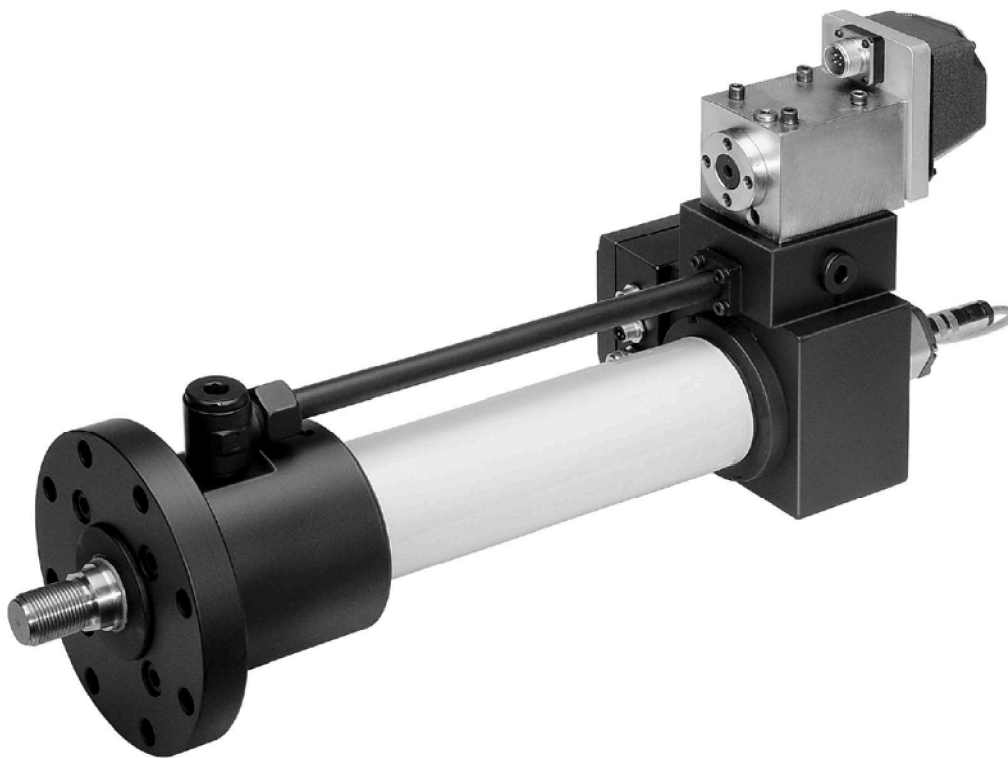


ZW/ZWAS 2511

Standard Hydraulic Cylinder



Description:

NP 250 bar (25 MPa)

Hydraulic cylinder series **ZW 2511**
with built-in position measuring system

Hydraulic cylinder series **ZWAS 2511**
additionally with attached valve connection plate AS

Storz hydraulic cylinders of series ZW 2511 or ZWAS 2511 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 2511. The installation dimensions essentially correspond to ISO 6022, DIN 24333 and VW 39D921.

To cover a wide range of applications, 3 mounting types are available. The nominal pressure is 250 bar (25 MPa). The cylinder series listed in this brochure covers piston diameters from 40 - 250 mm, whereby each piston diameter is assigned two rod diameters as standard, with the area ratios ϕ 1,6 and 2.

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

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 plate. On request, the hydraulic cylinders can also be supplied with a mounted proportional or servo valve.

For the valve connection plates and any proportional and servo valves to be supplied, the 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.



Table of contents

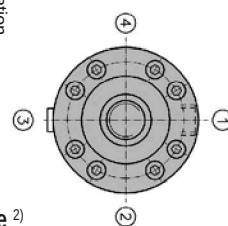
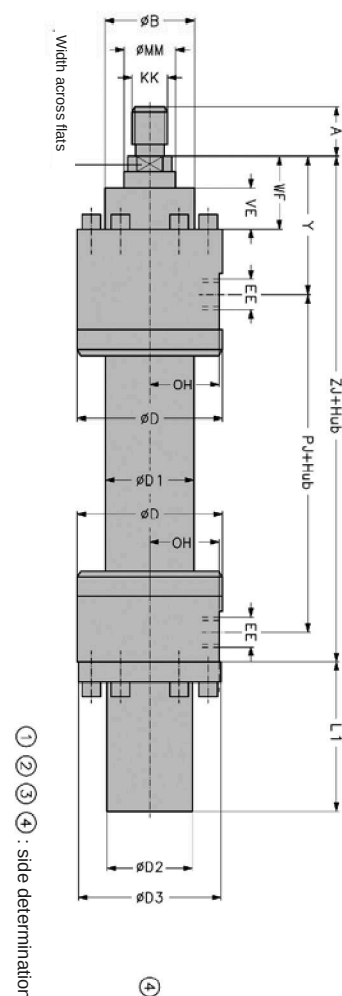
	Page
Dimension tables	4 - 9
Spare parts drawing, spare parts,	10
Seal variants	11
Model code	12
Miscellaneous	13 - 14
Requirements list	15

Available mounting types

ZW	A Basic design	4
ZW	MT 4 Trunnion	5
ZW	MF 3 Round flange at cylinder head	6
ZWAS	A Basic design	7
ZWAS	MT 4 Trunnion	8
ZWAS	MF 3 Round flange at cylinder head	9

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		Pipe connection EE Whitworth pipe thr./ Metric thread		Rod thread KK Metric thread		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		Maximum stroke		Width across flats																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
40 ⁴⁾	25	28	12,6	7,7 6,4	210	M 22 x 1,5	M 20 x 1,5	28	56	88	55	65	87	95	97	25	40	41	91	10	21 24																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
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250	160	180	491	290 236	640	M 50 x 2	M 125 x 4	125	250	385	324	65	128	104	335	71	113	189	250	0	135 150																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
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Position of function bores 1-4
according to model code

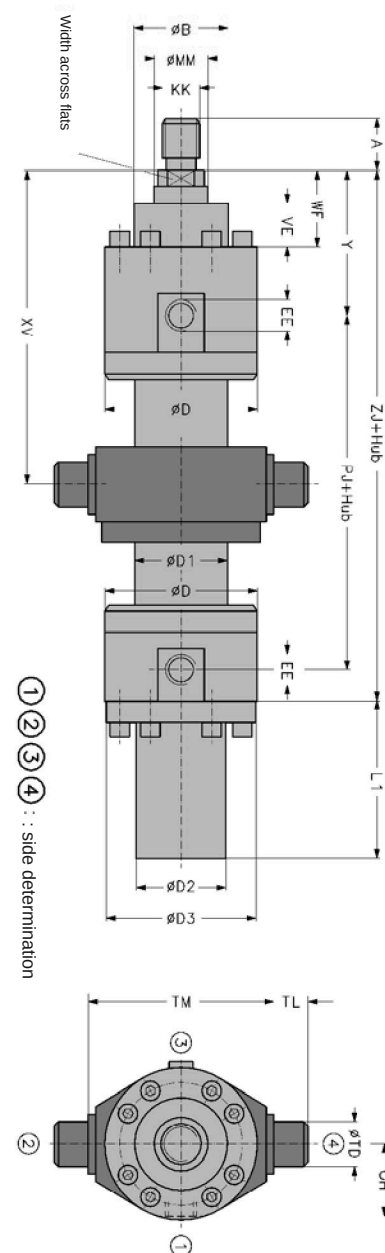
Tolerances	PJ	ZJ	Y	WC	WF	XV	Stroke
Stroke: 0 - 499	±1,5	±1,5	±2	±2			+2
Stroke: 500-1000	±1,5	±2	±2	±2,8			+2

Remarks:

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

Mounting type MT 4 trunnion

Piston Ø (mm)																								
Rod Ø MM (mm)																								
Piston area A 1 (cm²)																								
Annular area A 2 (cm²)																								
ZJ + stroke																								
Pipe connection EE Whitworth pipe thr./ Metric thread																								
Rod thread KK Metric thread																								
A max.																								
Ø B f 8																								
Ø D																								
Ø D1max. ¹⁾																								
Ø D2 ¹⁾																								
Ø D3 ¹⁾																								
L1 ¹⁾																								
PJ + stroke																								
Ø TD f 8																								
TL js 16																								
TM h12																								
VE																								
WF																								
OH																								
min XV ³⁾ max=stroke+																								
Y																								
Minimum stroke ²⁾																								
Maximum stroke																								
Width across flats																								



Position of function bores 1-4
according to model code

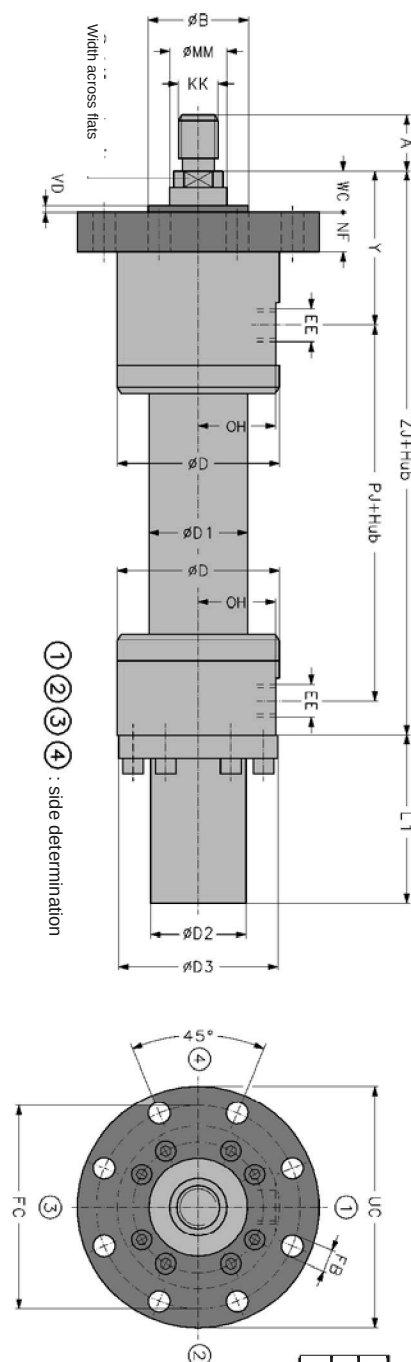
Tolerances	PJ	ZJ	Y	WC	WF	XV	Stroke
Stroke: 0 - 499	±1.5	±1.5	±2	±2	±2	±2	+2
Stroke: 500-1000	±1.5	±2	±2	±2.8	±2.8	±2.8	+2

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

Piston Ø (mm)	Rod Ø MM (mm)	Piston area A 1 (cm²)	Annular area A 2 (cm²)	ZJ + stroke	Pipe connection EE Whitworth pipe thr./ Metric thread	Rod thread KK Metric thread	A max.	Ø B f 8	Ø D	Ø D1max. ¹⁾	Ø D2 ¹⁾	Ø D3 ¹⁾	Ø FB H 13	FC js 13	NF	L1 ¹⁾	PJ + stroke	UC	VD	WC	OH	Y	Minimum stroke without connection plate ²⁾	Maximum stroke	Width across flats
40 ⁴⁾	25	12,6	7,7	210	G ^{1/2} M 22 x 1,5	M 20 x 1,5	28	56	88	55	65	87	11	122	22	95	97	145	3	18	41	91	10	21	24
50	32	19,6	11,6	240	G ^{3/4} M 22 x 1,5	M 27 x 2	36	63	102	65	65	101	14	132	25	101	120	155	4	22	49	98	5	27	30
63	40	31,2	18,6	270	G ^{3/4} M 27 x 2	M 33 x 2	45	75	120	83	65	119	14	150	28	101	133	175	4	25	56	112	0	32	36
80	50	50,3	30,6	300	G ^{3/4} M 27 x 2	M 42 x 2	56	90	145	100	65	141	18	180	32	101	155	210	4	28	69	120	0	41	46
100	63	78,5	47,4	335	G ¹ M 33 x 2	M 48 x 2	63	110	170	125	65	104	22	212	36	101	171	250	5	32	81	134	0	55	60
125	80	123	72,5	390	G ¹ M 33 x 2	M 64 x 3	85	132	206	160	65	104	22	250	40	101	205	290	5	36	100	153	0	75	85
140 ⁴⁾	90	154	90,3	425	G ^{1 1/4} M 42 x 2	M 72 x 3	90	145	226	180	65	128	26	285	43	101	229	330	5	37	109	158	0	85	95
160	100	201	123	460	G ^{1 1/4} M 42 x 2	M 80 x 3	95	160	265	200	65	128	26	315	45	101	235	360	5	40	128	185	0	95	110
180 ⁴⁾	110	254	159	490	G ^{1 1/4} M 42 x 2	M 90 x 3	106	185	290	220	65	128	30	348	50	101	252	400	5	43	141	198	0	110	120
200	125	314	191	540	G ^{1 1/4} M 42 x 2	M 100 x 3	112	200	306	254	65	128	33	385	56	101	278	440	5	45	150	220	0	120	135
220 ⁴⁾	140	380	226	600	G ^{1 1/4} M 42 x 2	M 125 x 4	125	225	350	273	65	128	36	415	60	102	307	490	6	46	171	240	0	135	150
250	160	491	290	640	G ^{1 1/2} M 50 x 2	M 125 x 4	125	250	385	324	65	128	39	475	63	104	335	540	8	50	189	250	0	135	150

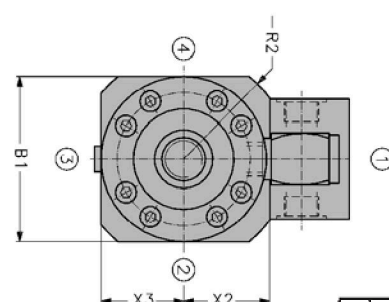
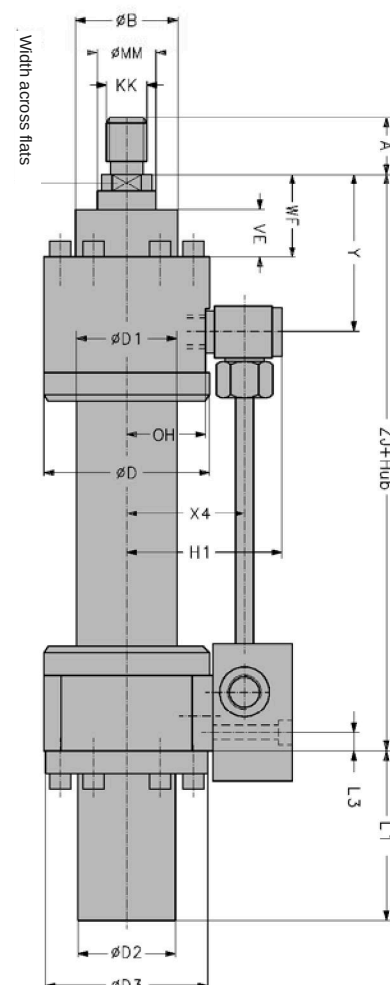


Position of function bores 1-4
according to model code

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

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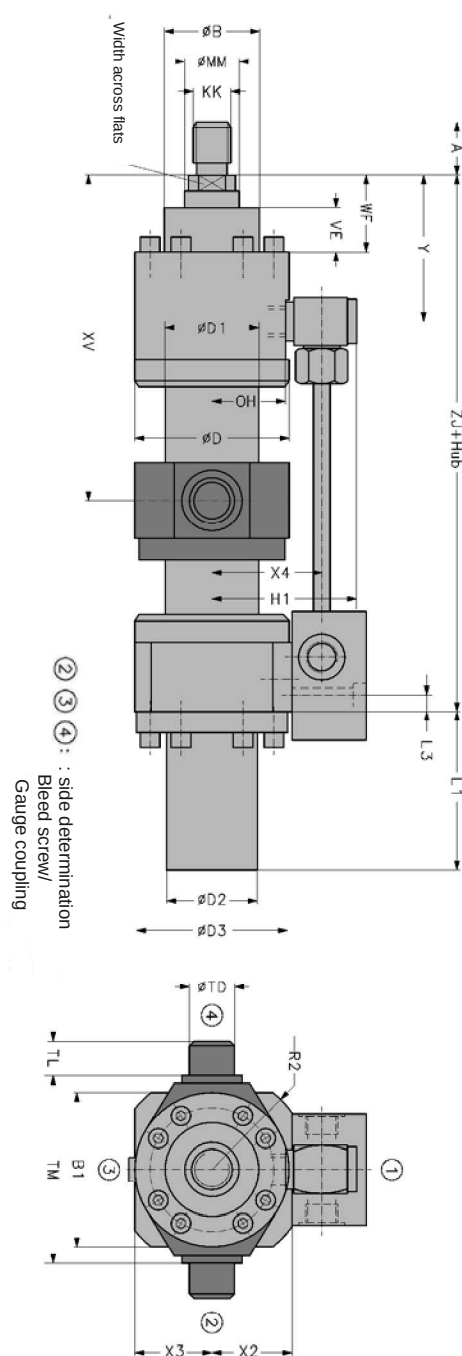
Tolerances	PJ	ZJ	Y	WC	WF	XV	Stroke
Stroke: 0 - 499	±1,5	±1,5	±2	±2			+ 2
Stroke: 500-1000	±1,5	±2	±2	±2,8			+ 2

Position of connection plate only page 1

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

	250	220	200	180	160	140	125	100	80	63	50	40	Piston Ø (mm)
	160	140	125	110	100	90	80	70	56	45	36	28	Rod Ø MM (mm)
	491	380	314	254	201	154	123	78,5	50,3	31,2	19,6	12,6	Piston area A 1 (cm ²)
	236	179	160	132	106	75,4	59,1	40,1	25,6	15,3	9,5	6,4	Annular area A 2 (cm ²)
	640	600	540	490	460	425	390	335	300	270	240	210	ZJ + stroke
	M 50 x 2	G 1 1/4 x 2	M 125 x 4	M 100 x 3	M 80 x 3	M 72 x 3	M 64 x 3	M 48 x 2	M 42 x 2	M 33 x 2	M 27 x 2	M 20 x 1,5	Pipe connection EE Whitworth pipe thr./ Metric thread
	M 125 x 4	M 125 x 4	M 100 x 3	M 90 x 3	M 80 x 3	M 72 x 3	M 64 x 3	M 48 x 2	M 42 x 2	M 33 x 2	M 27 x 2	M 20 x 1,5	Rod thread KK Metric thread
	125	125	112	106	95	90	85	63	56	45	36	28	A max.
	250	225	200	185	160	145	132	110	90	75	63	56	Ø B f 8
	385	350	306	290	265	226	206	170	145	120	102	88	B1 ¹⁾
	385	350	306	290	265	226	206	170	145	120	102	88	Ø D
	324	273	254	220	200	180	160	125	100	83	65	55	Ø D1max. ¹⁾
	65	65	65	65	65	65	65	65	65	65	65	65	Ø D2 ¹⁾
	128	128	128	128	128	128	128	128	128	128	128	128	Ø D3 ¹⁾
	234	216	195	186	173	154	145	126	114	101	94	86	H1 ¹⁾
	104	102	101	101	101	101	101	101	101	101	101	95	L1 ¹⁾
	51,3	49,3	38,3	36,3	36,3	34,3	28,3	26,3	21,3	25,3	31,3	33,3	L3 ¹⁾
	205	185	165	156	145	124	117,5	100	87,5	78	70	63	R2 ¹⁾
	160	140	125	110	90	90	80	63	50	40	32	25	Ø TD f 8
	125	110	100	90	80	70	63	50	40	32	25	20	TL js 16
	425	390	335	305	280	240	224	180	150	125	112	100	TM h 12
	71	66	61	55	50	48	45	41	36	32	29	25	VE
	113	106	101	93	85	80	76	68	60	53	47	40	WF
	189	171	150	141	128	109	100	81	69	56	49	41	OH
	195,5	177,5	156,5	147,5	134,5	115,5	106,5	87,5	75,5	62,5	55,5	47,5	X2 ¹⁾
	192,5	175	153	145	132,5	113	103	85	72,5	60	51	44	X3 ¹⁾
	210,5	192,5	171,5	162,5	149,5	130,5	121,5	102,5	90,5	77,5	70,5	62,5	X4 ¹⁾
	495	470	455	390	330	297	280	261	227	205	185	165	min XV ³⁾
	340	315	260	255	240	218	202	162	158	133	120	97	max=stroke+
	250	240	220	198	185	158	153	134	120	112	98	91	Y
	155	155	140	135	90	79	78	100	115	140	160	190	Minimum stroke with connection plate ²⁾
													Maximum stroke
													Width across flats



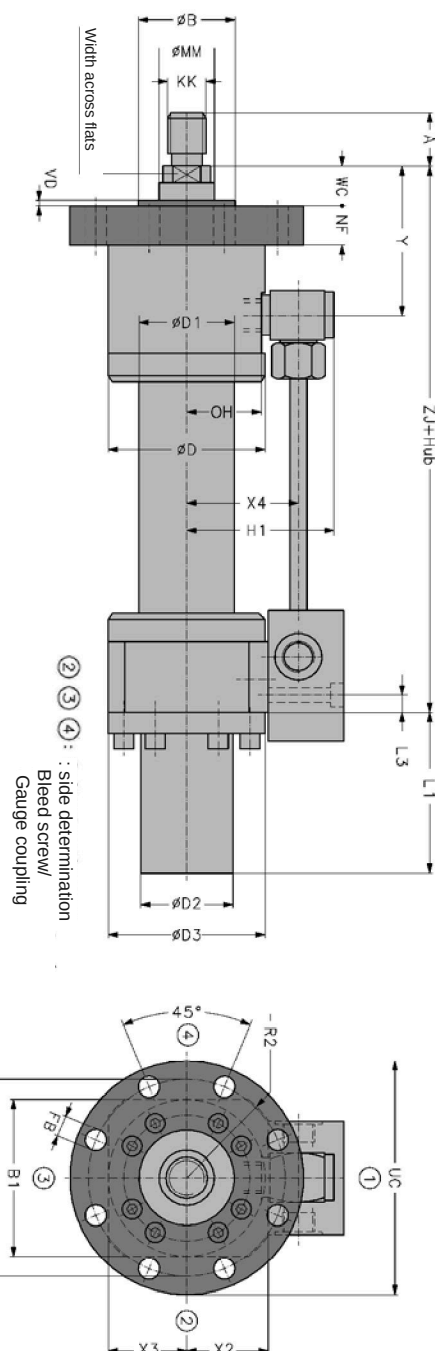
Tolerances	PJ	ZJ	Y	WC	WF	XV	Stroke
Stroke: 0 - 499	±1,5	±1,5	±2	±2	±2	±2	+2
Stroke: 500-1000	±1,5	±2	±2	±2,8	±2,8	±2,8	+2

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

	250	220	200	180	160	140	125	100	80	63	50	40	Piston Ø (mm)
	160	140	125	110	100	90	80	70	56	45	36	28	Rod Ø MM (mm)
	491	380	314	254	201	154	123	78.5	50.3	41.2	32	25	Piston area A 1 (cm ²)
	236	179	160	132	106	80.3	59.1	40.1	28.6	15.3	9.5	6.4	Annular area A 2 (cm ²)
	640	600	540	490	460	425	390	335	300	270	240	210	ZJ + stroke
	M 50 x 2	G 1 1/2	M 42 x 2	G 1 1/4	M 42 x 2	G 1 1/4	M 33 x 2	G 1	M 27 x 2	G 3/4	M 22 x 1.5	G 1 1/2	Pipe connection EE
													Whitworth pipe thr./
													Metric thread
	M 125 x 4	M 125 x 4	M 100 x 3	M 90 x 3	M 80 x 3	M 72 x 3	M 64 x 3	M 48 x 2	M 42 x 2	M 33 x 2	M 27 x 2	M 20 x 1.5	Rod thread KK
													Metric thread
	125	125	112	106	95	90	85	63	56	45	36	28	A max.
	250	225	200	185	160	145	132	110	90	75	63	56	Ø B f8
	385	350	306	290	265	226	206	170	145	120	102	88	B1 ¹⁾
	385	350	306	290	265	226	206	170	145	120	102	88	Ø D
	324	273	254	220	200	180	160	125	100	83	65	55	Ø D1max. ¹⁾
	65	65	65	65	65	65	65	65	65	65	65	65	Ø D2 ¹⁾
	128	128	128	128	128	128	104	104	141	119	101	87	Ø D3 ¹⁾
	39	36	33	30	26	26	22	22	18	14	14	11	Ø FB H 13
	475	415	385	348	315	285	250	212	180	150	132	122	FC js 13
	234	216	195	186	173	154	145	126	114	101	94	86	H1 ¹⁾
	104	102	101	101	101	101	101	101	101	101	101	95	L1 ¹⁾
	51.3	49.3	38.3	36.3	36.3	34.3	28.3	26.3	21.3	25.3	31.3	33.3	L3 ¹⁾
	63	60	56	50	45	43	40	36	32	28	25	22	NF
	205	185	165	156	145	124	117.5	100	87.5	78	70	63	R2 ¹⁾
	540	490	440	400	360	330	290	250	210	175	155	145	UC
	8	6	5	5	5	5	5	5	4	4	4	3	VD
	50	46	45	43	40	37	36	32	28	25	22	18	WC
	189	171	150	141	128	109	100	81	69	56	49	41	OH
	195.5	177.5	156.5	147.5	134.5	115.5	106.5	87.5	75.5	62.5	55.5	47.5	X2 ¹⁾
	192.5	175	153	145	132.5	113	103	85	72.5	60	51	44	X3 ¹⁾
	210.5	192.5	171.5	162.5	149.5	130.5	121.5	102.5	90.5	77.5	70.5	62.5	X4 ¹⁾
	250	240	220	198	185	158	153	134	120	112	98	91	Y
	155	155	140	135	90	79	78	100	115	140	160	190	Minimum stroke with connection plate ²⁾
													Maximum stroke
													Width across flats

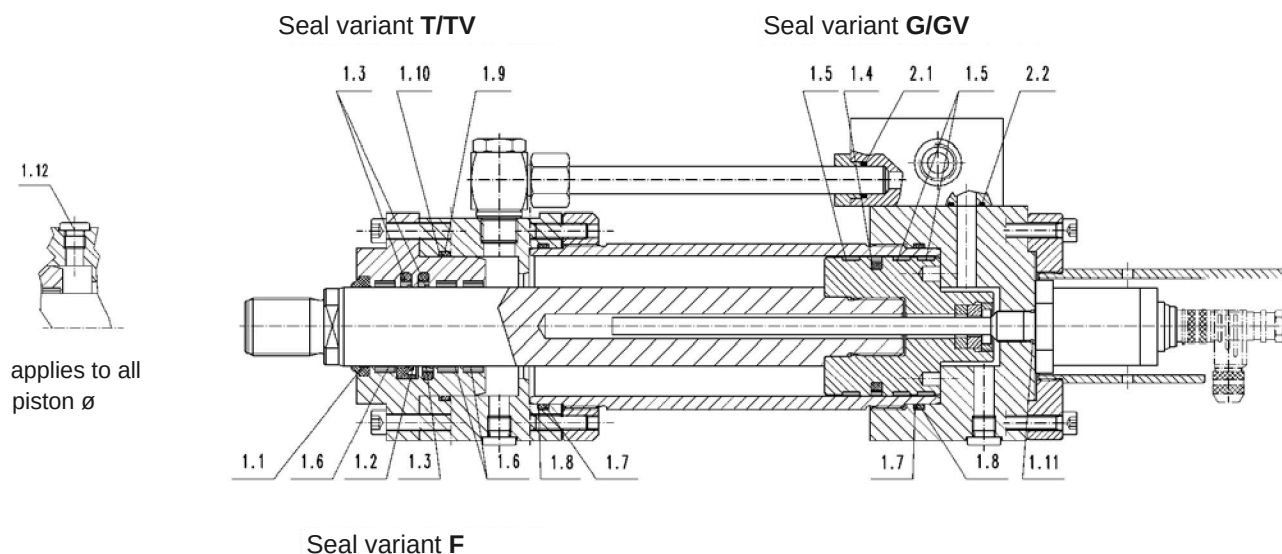
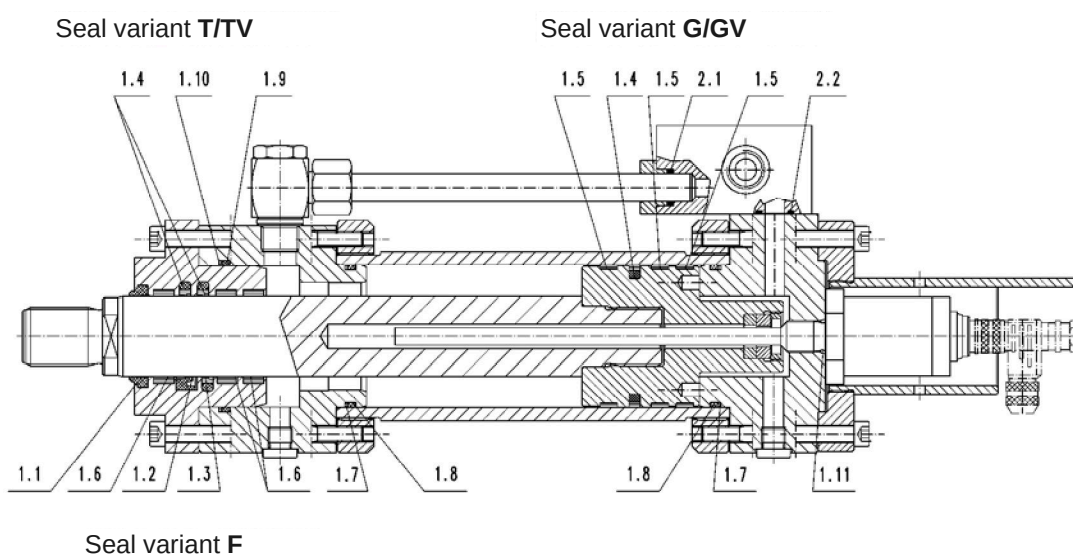


Position of connection plate only page 1

Tolerances	PJ	ZJ	Y	WC	WF	XV	Stroke
Stroke: 0 - 499	±1.5	±1.5	±2	±2	±2	±2	+2
Stroke: 500-1000	±1.5	±2	±2	±2.8	±2.8	±2.8	+2

Remarks:

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

Spare parts diagram piston $\varnothing 40 \div 100$ mm

Spare parts diagram piston $\varnothing 125 \div 250$ mm


Spare parts

Seals

Position	Designation	Seal variant	Number
1.1	Wiper	all	1
1.2	U-cup seal	F	1
1.3	Teflon seal	T, TV	2
1.3	Teflon seal	F	1
1.4	Teflon seal	all	1
1.7	Back-up ring	all	2
1.8	O-ring	all	2
1.9	O-ring	all	2
1.10	Back-up ring	all	1
1.11	O-ring	all	1
1.12	Bleed screw	all	2
2.1	O-ring	all	1
2.2	O-ring	all	1

Rod guide bands
all variants

Position	Piston $\varnothing$	Number
1.6	50 $\div$ 63	3
1.6	80 $\div$ 160	4
1.6	180 $\div$ 200	5
1.6	220 $\div$ 250	4

Piston guide bands
all variants

Position	Piston $\varnothing$	Number
1.5	40 $\div$ 50	2
1.5	63	3
1.5	80	4
1.5	100	3
1.5	125 $\div$ 160	4
1.5	180	5
1.5	200	4
1.5	220 $\div$ 250	5

Ordering complete seal kits;

State quantity and **complete** model code of the hydraulic cylinder.

Seal variants

Schematic representation

Rod sealing

Code letter

FG

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

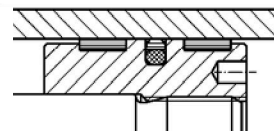
Standard version

Temperature range:
Hydraulic fluid:
Sliding speed:
Application:

-30°C to + 80 °C
Mineral oil,
≤ 1 m/s
Universal industrial use
Minimal leakage.
Not suitable for holding function.

Piston sealing

Teflon seal with O-ring
made of Perbunan



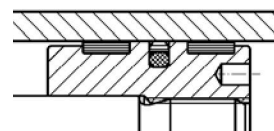
TC

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

Temperature range:
Hydraulic fluid:
Sliding speed:
Application:

-30°C to + 80 °C
Mineral oil,
≤ 1 m/s
Servo systems
Not suitable for holding function.

Teflon seal with O-ring
made of Perbunan



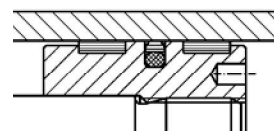
TVGV

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

Temperature range:
Hydraulic fluid:
Sliding speed:
Application:

-20°C to + 200 °C
Mineral oil, HFD fluids
≤ 1 m/s
Servo systems
Higher operating temperatures.

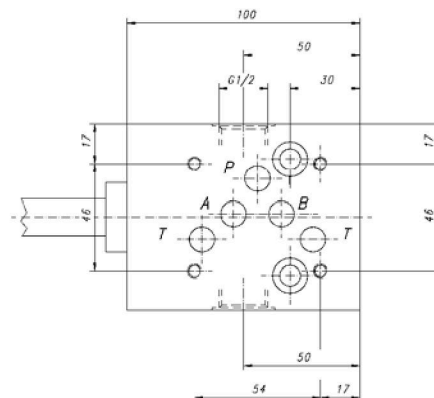
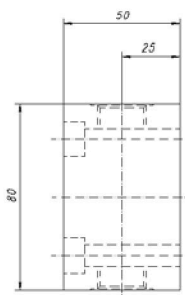
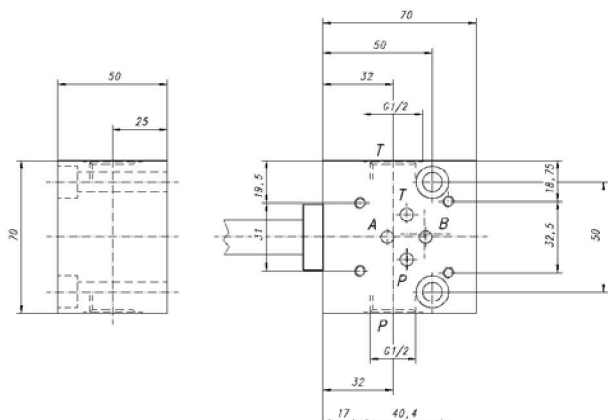
Teflon seal with O-ring
made of fluoro rubber (FPM)



Connection hole patterns

NG 6 ISO 4401 (DIN 24340 - A6)

NG 10 ISO 4401 (DIN 24340 - A10)



[illegible]

Nominal pressure 250 bar (25MPa)
without end position cushioning
Installation dimensions largely according to
DIN ISO 6022, DIN 24333 and VW 39D921

AS with connection plate

Piston rod diameter in mm

Mounting types	
A	Basic design

MT4 Trunnion (state dimension XV when ordering)

MF3 Round flange, head end

Seal variant

FG	Standard version, U-cup seal + Teflon slide ring / Teflon seal
----	--

Standard
Option

TG Teflon slide ring in tandem version / Teflon seal

TVGV Teflon slide ring in tandem version / Teflon seal

0 without connection plate

2 NG 6 ISO 4401 (DIN 24340-A 6)

3	NG10	ISO 4401 (DIN 24340-A 10)
---	------	---------------------------

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 see brochure 19112

4 External thread with mounted rod end plain eyeKS, see brochure 19112

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

G Standard version Whitworth nine thread Option: M **M** metric ISO thread

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

Standard version side	3	Option: side 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)

Double-acting hydraulic cylinder 250 bar nominal pressure, with built-in position measuring system and attached connection plate with the following data:

Piston $\varnothing$ 80 mm, rod $\varnothing$ 50 mm, mounting type MT4, stroke 300 mm, seal variant FG, hole pattern of the connection plate NG 6. Piston rod surface B. piston rod end 1. piston rod material C.

Version of pipe connection 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 2511 - 80/50 - MT4 - 300 - FG - 2 - B1C - G1 - E3 - 11 - 2.2

Buckling load diagram

Determination of the permissible Buckling load F_k perm.

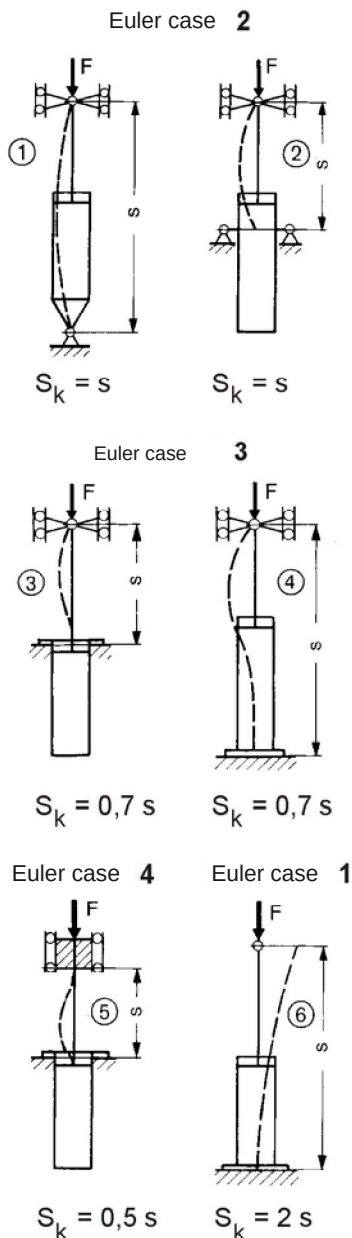
1. Buckling length S_k from mounting ① ⑥)
condition and mounting length s .
2. Using S_k , rod diameter d and
nomogram to determine the permissible buckling load
(safety factor in the elastic range
is $s = 4$).

Example (see nomogram)

Mounting condition ③
 $d = 28$ mm $s = 1200$ mm (from dimen-
sional drawing of the cylinder)

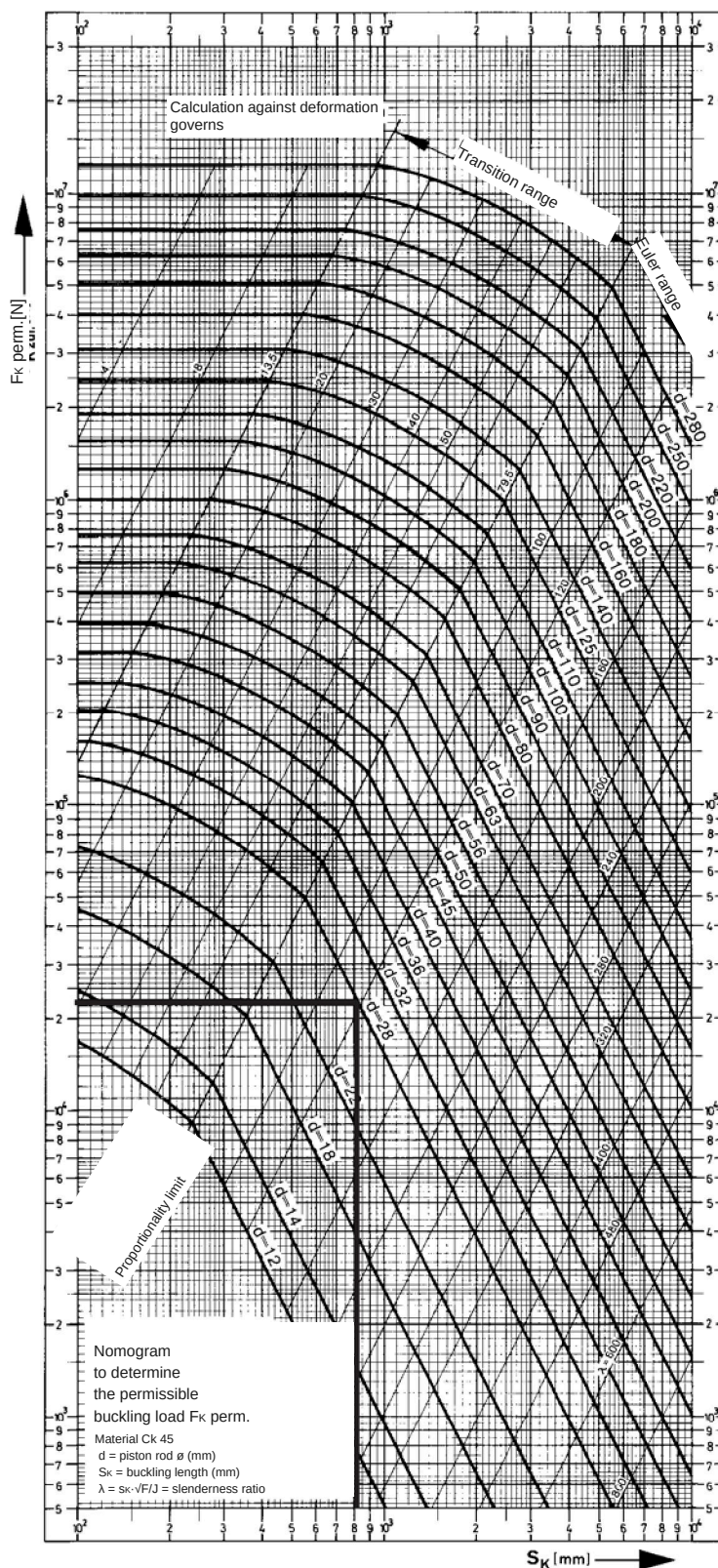
$S_k = 0,7 s$ (see mounting condition ③
= 840 mm

From nomogram results F_k perm. = 22000 N



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 the rod under investigation.



Notes - remarks - comments - special requests

Notes area with horizontal lines for text entry.

Sketch

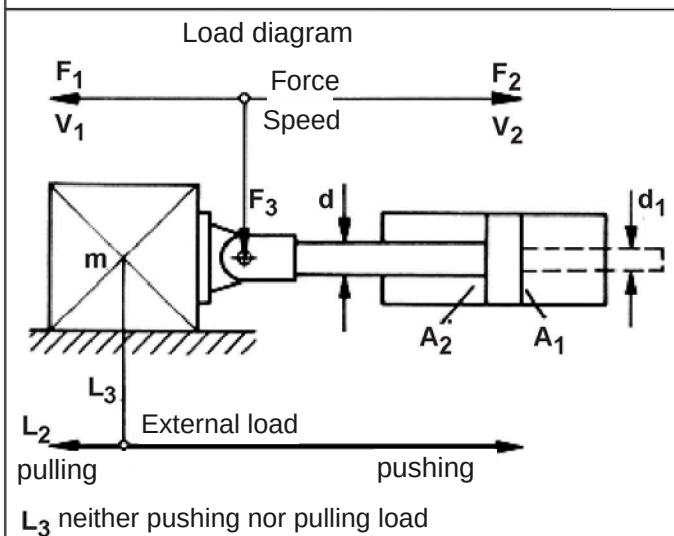
Sketch area with a grid for technical drawing.

Requirements list for hydraulic cylinders

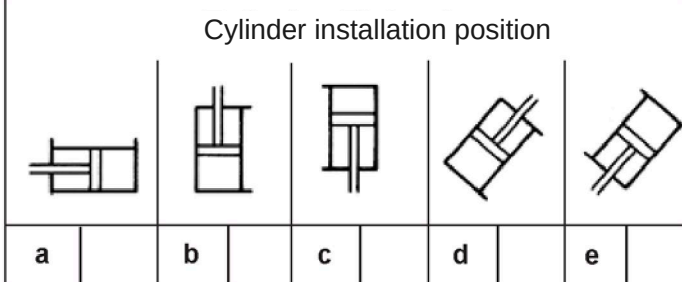
Customer address Telephone/Fax

..... Contact person

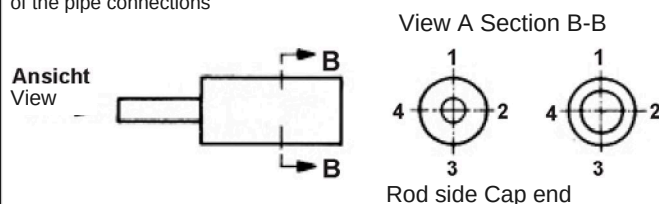
..... Department



13	Required cylinder forces	F_1	N
		F_2	N
14	max. Side 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 $\vartheta_{min} \dots \vartheta_{max}$	°C	
	Ambient temperature range $\vartheta_{min} \dots \vartheta_{max}$	°C	



desired radial position of the pipe connections



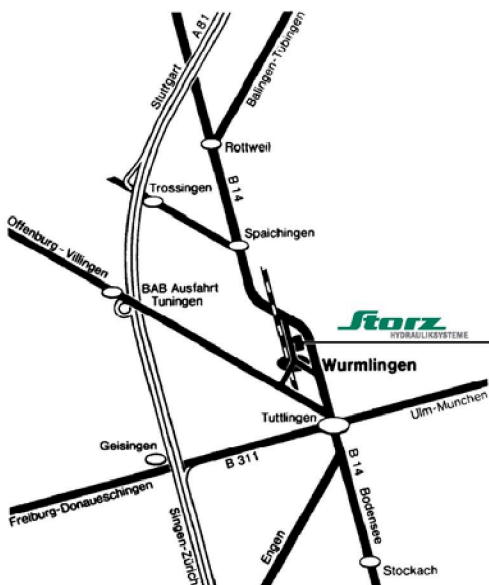
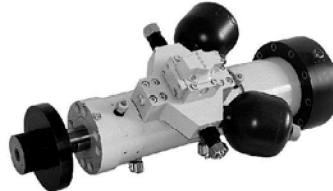
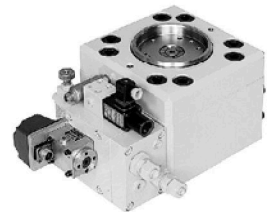
Cylinder data				
1	Operating pressure	min	bar	
		max	bar	
2	Piston Ø	D	mm	
3	Rod Ø	d	mm	
		d_1	mm	
4	Mounting type			
5	Stroke	S	mm	
6	Stroke speed max.	V_{1max}	m/s	
		V_{2max}	m/s	
7	Pressure medium			
8	Rod seal Wiper			
9	Piston seal			
10 Piston rod end				
11	Air bleed yes		M 8x1 R 1/4"	no
12	End position cushioning		Cap end	
			Rod side	

19	Size of pipe connections	Cap end Rod side													
20	Piston rod material	Standard Stainless													
21	Painting	Standard	without												
		Special													
Accessories															
End positions															
Position feedback															
Clamping head															
Position measuring system with indication of the Pos. accuracy		<table><tr><td>yes</td><td>no</td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table>		yes	no										
		yes	no												
inductive			○												
digital															
Ultrasonic															
potentiometric															
capacitive															
Remarks and notes on the application or special re- quests please with date and signature!															

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



Storz
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