

Description

- Tie rod cylinder with hydraulic interlock; dimensions according to ISO 6020/2, DIN 24554
- Stroke up to 2000 mm
- Piston diameter: 40 - 200 mm
- With / without cushioning (identical dimensions)
- Two area ratios $\phi = 1.4$ and $\phi = 2.0$
- 16 mounting types as well as the choice between 2 piston area ratios and various seals enable an optimal adaptation to each individual case
- More mounting types and special designs are available
- The installation dimensions are according to DIN 24554, the installation spaces of the seals are realized according to DIN ISO 5597 and DIN ISO 6547
- The cushioning is precisely adjustable
- Large sized check valves enable extending with high speed at full impact to the effective piston area
- The mounting type, the tie rod design, large sized guide lengths at the piston rod and piston as well as high quality materials enable the use of the cylinder under most severe conditions
- The guide bush and the piston rod seal can be disassembled from the rod outlet side which enables quick and simple maintenance
- The hydraulic interlock allows locking of the piston rod in the front end position by default. For pushing operation, the interlock is also available in the rear end position on request
- The functional principle assures reliable interlocking in the desired end position
- Pre-stressing with operating pressure provides high stiffness even at large forces

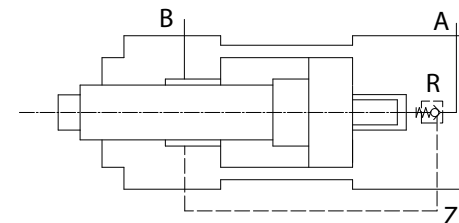
Technical data

- Operating pressure: 160 bar (16 MPa)
- Test pressure: 240 bar (24 MPa)
- Temperature range of hydraulic fluid: - 20 ... + 80 °C
- Viscosity range: (20 ... 80) $10^{-6} \text{ m}^2/\text{s}$
- Piston speed: $\leq 0.5 \text{ m/s}$

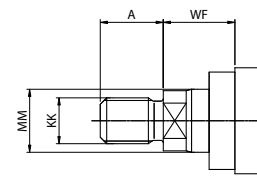
Hydraulic fluids:

- Mineral oils, HFD liquids in conjunction with seals of PTFE and fluoroelastomers
- HFA, HFB and HFC liquids on request

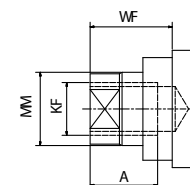
Function



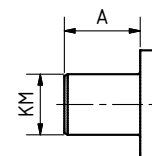
Piston rod end



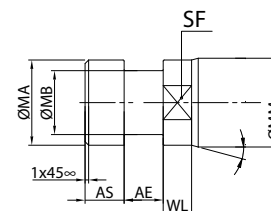
External thread, ref. no. 0
External thread, ref. no. 4



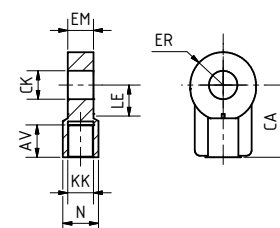
Inside thread, ref. no. 1



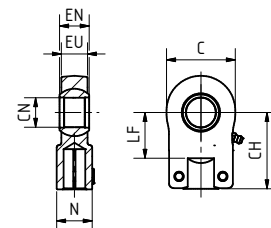
Cylindrical, ref. no. 2



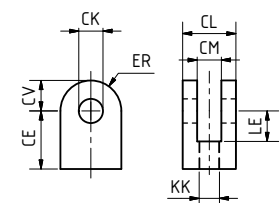
Clutch element, ref. no. 3



Plain rod eye, ref. no. 5

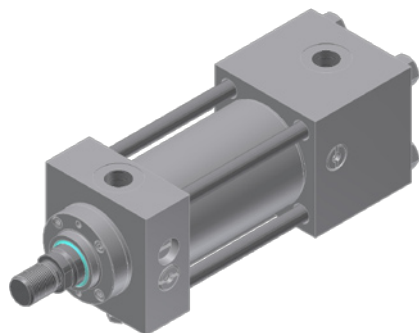


Swivel head, ref. no. 8

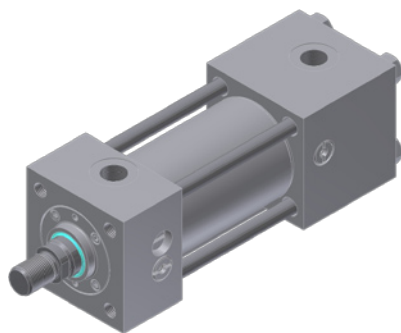


Clevis, ref. no. 9

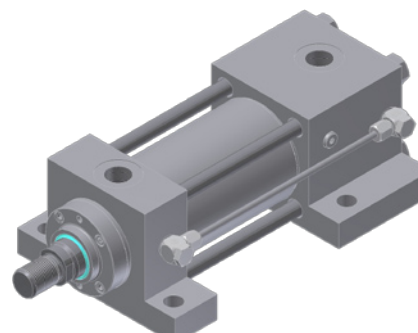
**Special design
on request!**



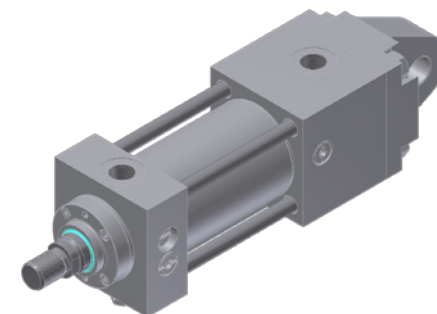
Mounting type: 00
Description: Basic form
ISO-des.: --



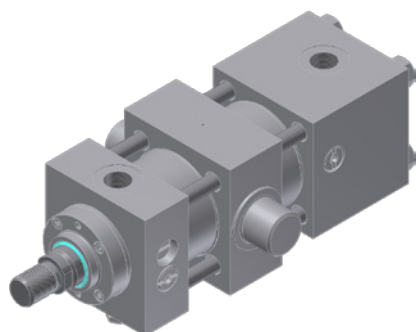
Mounting type: 01
Description: Threaded holes head end
ISO-des.: MX 5



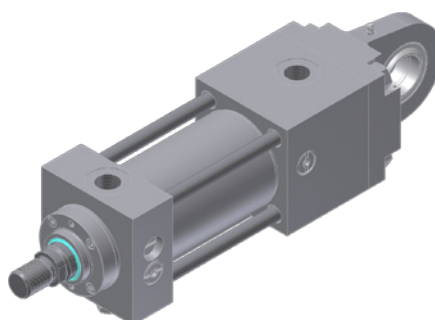
Mounting type: 02
Description: Foot mounting
ISO-des.: MS 2



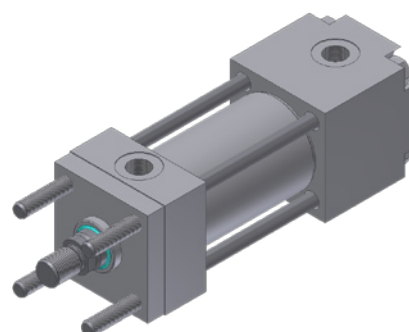
Mounting type: 05
Description: Rod eye
ISO-des.: MP 3



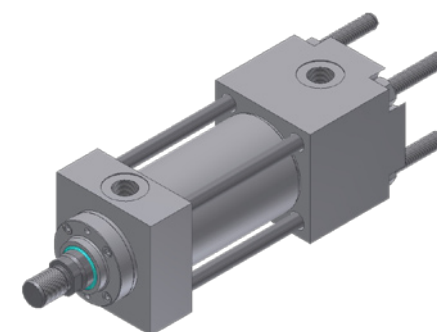
Mounting type: 06
Description: Trunnion
ISO-des.: MT 4



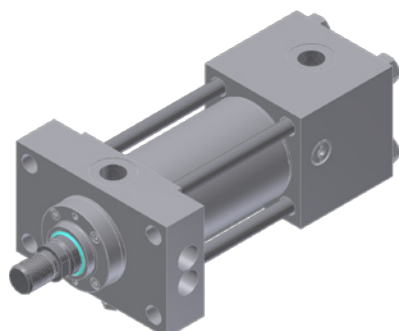
Mounting type: 08
Description: Rod end bearing
ISO-des.: MP 5



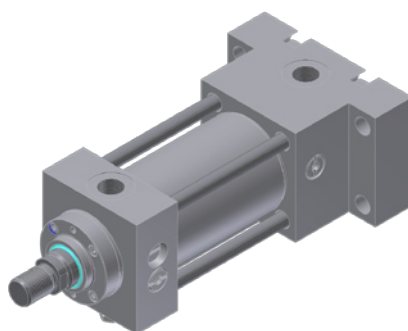
Mounting type: 11
Description: Tie rods elongated head end
ISO-des.: MX 3



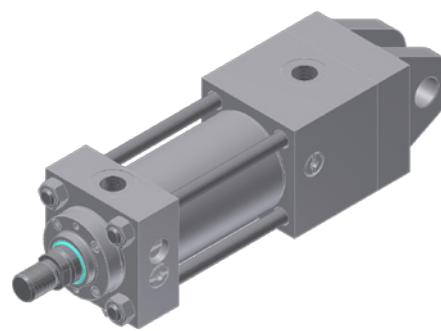
Mounting type: 12
Description: Tie rods elongated cap end
ISO-des.: MX 2



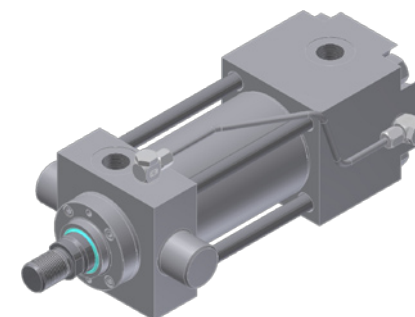
Mounting type: 13
Description: Rectangular flange head end
ISO-des.: ME 5



Mounting type: 14
Description: Rectangular flange cap end
ISO-des.: ME 6

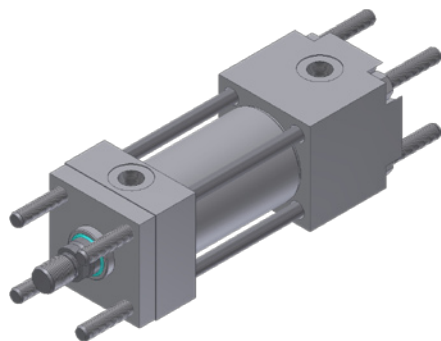


Mounting type: 15
Description: Clevis mounting
ISO-des.: MP 1



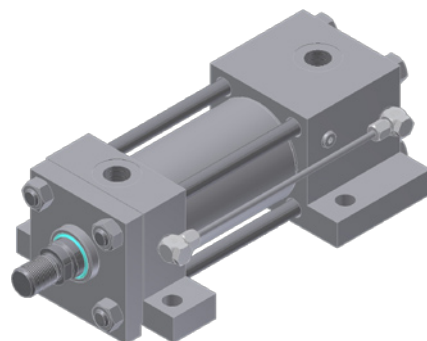
Mounting type: 16
Description: Trunnion on the head
ISO-des.: MT 1

Mounting types



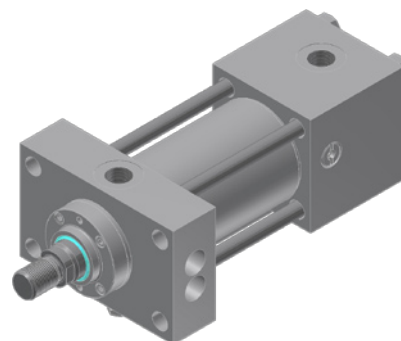
Mounting type: 19

Description: Tie rods elongated both ends
ISO-des.: MX 1



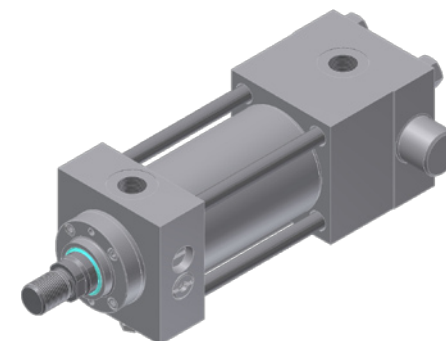
Mounting type: 22

Description: Foot mounting with fit-in key
ISO-des.: MS 2



Mounting type: 23

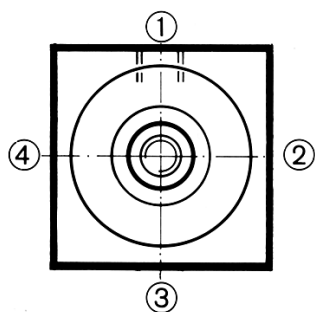
Description: Rectangular flange head end
ISO-des.: --



Mounting type: 26

Description: Trunnion on the bottom
ISO-des.: MF 4

Position of connections



Piston rod view

Connections: Standard position of connections is side 1 for all mounting types.
Connections in different positions are available on request.

Cushioning: Standard position of the adjustment screw for cushioning is side 2, except for:

Mounting type 02, ISO MS 2: side 4
Mounting type 16, ISO MT 1: side 3
Mounting type 22, ISO MS 2: side 4

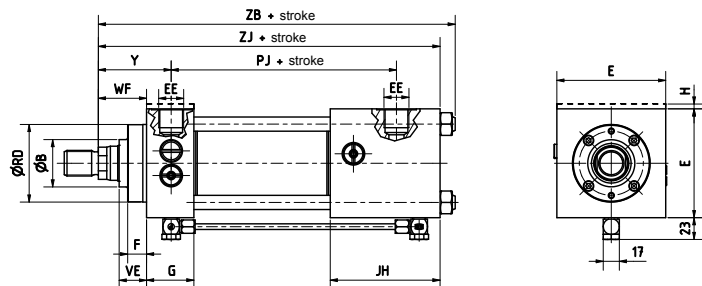
Different positions are available on request.

Air bleed: Standard position of the air bleed screw is side 4 for all mounting types.
Air bleed screws in different positions are available on request.

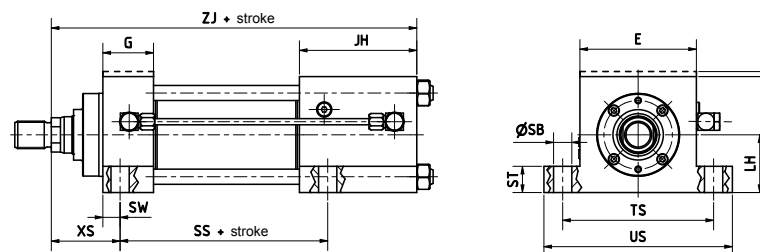
Control line: Standard position of the connections for the control line is side 3, except for:

Mounting type 02, ISO MS 2: side 2
Mounting type 16, ISO MT 1: cylinder head side 1 (not central), cylinder cover side 2
Mounting type 22, ISO MS 2: side 2

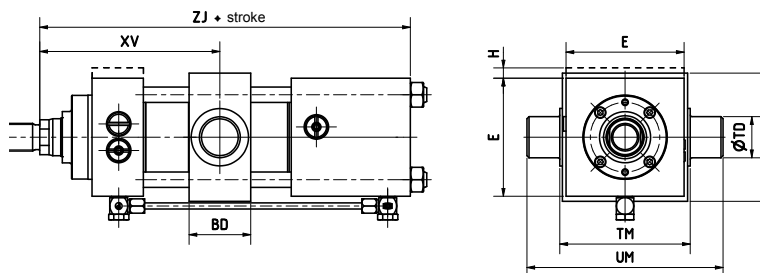
If the connections are ordered on a position deviating from side 1, then the position of the adjustment screw for cushioning, the position of the air bleed screw and the position of the connections for the control line change accordingly (to the extent permitted by the mounting type). If you wish differing positions, please specify when ordering.



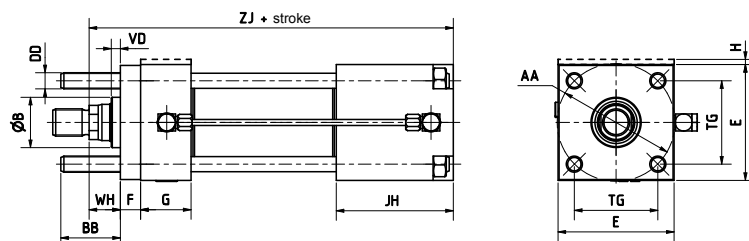
Mounting type 00: Basic form; ISO-des.: --



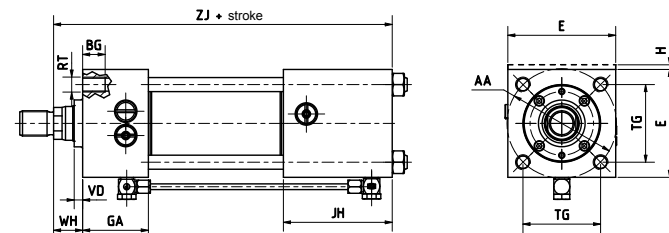
Mounting type 02: Foot mounting; ISO- des.: MS 2



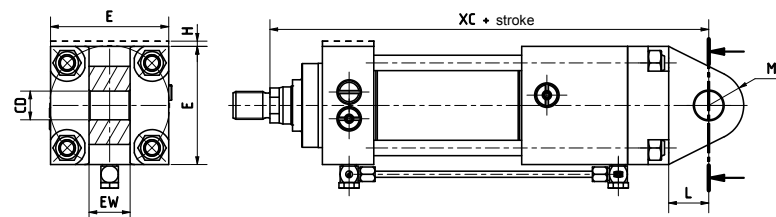
Mounting type 06: Trunnion; ISO- des.: MT 4



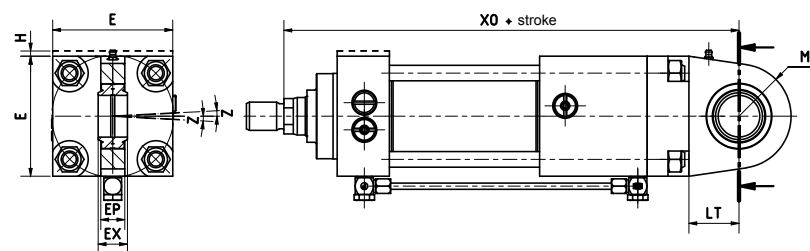
Mounting type 11: Tie rods elongated head end; ISO- des.: MX 3



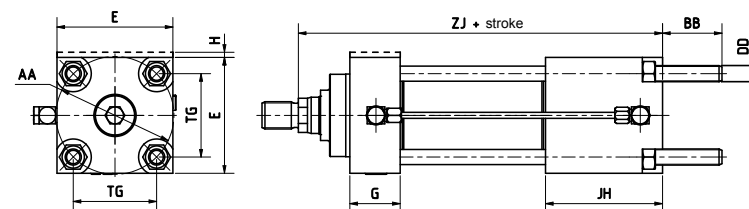
Mounting type 01: Threaded holes head end; ISO- des.: MX 5



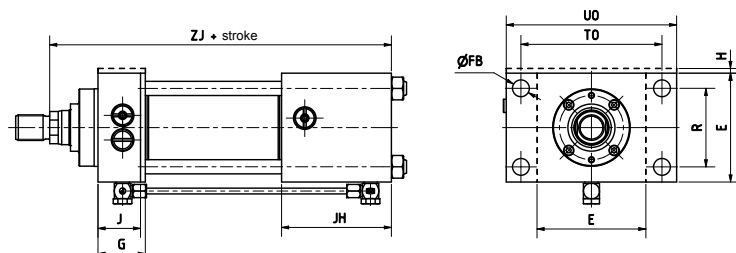
Mounting type 05: Rod eye; ISO- des.: MP 3



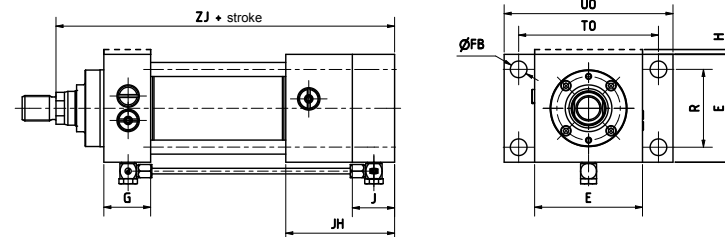
Mounting type 08: Rod end bearing; ISO- des.: MP 5



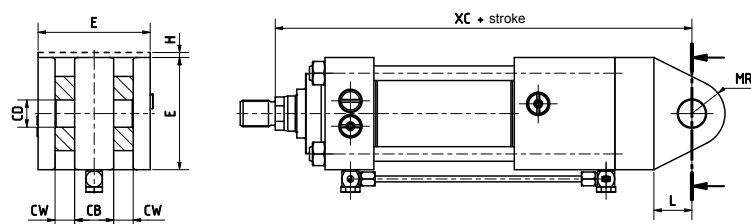
Mounting type 12: Tie rods elongated cap end; ISO- des.: MX 2



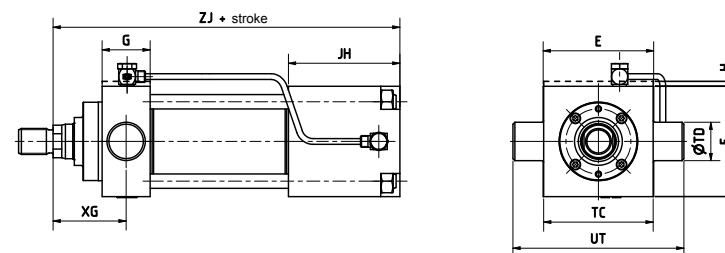
Mounting type 13: Rectangular flange head end; ISO- des.: ME 5



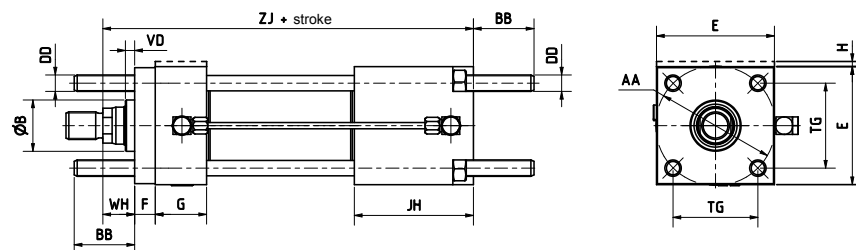
Mounting type 14: Rectangular flange cap end; ISO- des.: ME 6



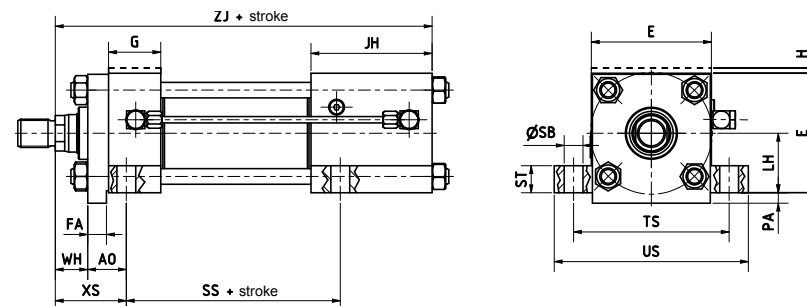
Mounting type 15: Clevis mounting; ISO- des.: MP 1



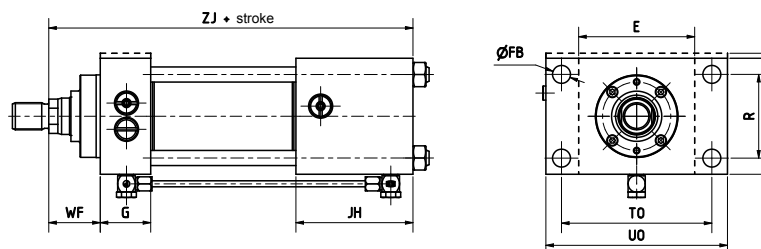
Mounting type 16: Trunnion on the head; ISO- des.: MT 1



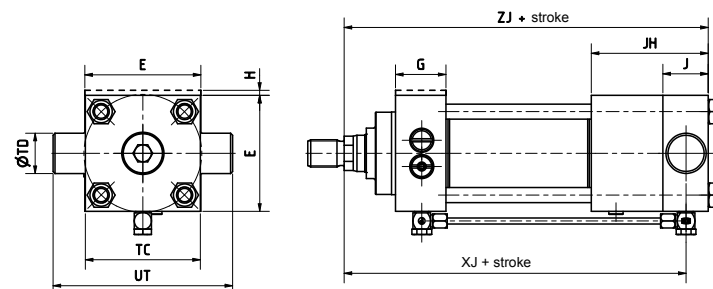
Mounting type 19: Tie rods elongated both ends; ISO- des.: MX 1



Mounting type 22: Foot mounting with fit-in key; ISO- des.: MS 2



Mounting type 23: Rectangular flange head end, wide; ISO-des.: --



Mounting type 26: Trunnion on the bottom; ISO-des.: MF 4

Piston rod dimensions

Piston Ø	Rod design	Tol.	40			50			63			80			100			125			140			160			180			200		
Piston rod Ø MM			18	28	22	28	36	28	36	45	36	45	56	45	56	70	56	70	90	63	80	100	70	90	110	80	100	125	90	110	140	
A	0	h15	18		22		22		28			36			45			56			63			63			85			85		
A	4			28		28	36		36	45		45	56		56	63		63	85		85	95		85	95		95	112		95	112	
A	1		18	28	22	28	36	28	36	45	36	45	56	45	56	63	56	63	85	63	85	95	63	85	95	85	95	112	85	95	112	
AE	3	+0.1	11			17.5			20			25			27.5			40			40			40			50			50		
AS	3	-0.1	11			17.5			20			25			27.5			40			40			40			50			50		
C	8		55			65			80			100			125			160			205			205			240			240		
CH	8	js13	58			68			85			105			130			150			185			185			240			240		
CK	5, 9		20 -0.012			25 -0.012			30 -0.012			40 -0.012			50 -0.012			60 -0.015			80 -0.015			80 -0.015			100 -0.020			100 -0.020		
CN	8		20 -0.012			25 -0.012			30 -0.012			40 -0.012			50 -0.012			60 -0.015			80 -0.015			80 -0.015			100 -0.020			100 -0.020		
SF	0		15	24	19	24	30	24	30	36	30	36	46	36	46	60	46	60	75	50	70	85	60	75	95	70	85	100	75	95	120	
EN	8		16 -0.12			20 -0.12			22 -0.12			28 -0.12			35 -0.12			44 -0.15			55 -0.15			55 -0.15			70 -0.20			70 -0.20		
EU	8	h13	13			17			19			23			30			38			47			47			57			57		
KF	1		M12x1.25	M20x1.5	M16x1.5	M20x1.5	M27x2	M20x1.5	M27x2	M33x2	M27x2	M33x2	M42x2	M33x2	M42x2	M48x2	M42x2	M48x2	M64x3	M48x2	M64x3	M80x3	M48x2	M64x3	M80x3	M64x3	M80x3	M100x3	M64x3	M80x3	M100x3	
KK	0		M14x1.5			M16x1.5			M20x1.5			M27x2			M33x2			M42x2			M48x2			M64x3			M80x3			M100x3		
KK	4			M20x1.5		M20x1.5	M27x2		M27x2	M33x2		M33x2	M42x2		M42x2	M48x2		M48x2	M64x3		M64x3	M80x3		M64x3	M80x3		M80x3	M100x3		M80x3	M100x3	
LF	8	min	25			30			35			45			58			68			92			92			116			116		
MA	3		17	26	21	26	34	26	34	42	34	42	53	42	53	67	53	67	87	60	77	97	67	87	107	77	97	122	87	107	137	
MB	3	-0.1	11.8	19.8	15.8	19.8	23.8	19.8	23.8	31.8	23.8	31.8	40.8	31.8	40.8	45.8	40.8	45.8	59.8	44.8	55.8	69.8	45.8	59.8	79.8	55.8	69.8	89.8	59.8	79.8	99.8	
N	8	max	25			30			36			45			55			68			90			90			110			110		
RK	3		0.6			1			1.6			1.6			2			2.5			3			3			3.5			3.5		
W	3		15			15			15			30			30			30			30			30			30			30		
WL	3		6	9	8	9	9	9	9	12	9	12	16	12	16	17	16	17	17	17	17	18	17	17	18	17	18	18	17	18	18	

Rod end = piston rod ends which correspond to dimensions

Cylinder dimensions

Piston Ø	Mt.	Tol.	40			50			63			80			100			125			140			160			180			200		
Piston rod Ø MM			18	28	22	28	36	28	36	45	36	45	56	45	56	70	56	70	90	63	80	100	70	90	110	80	100	125	90	110	140	
Piston area A ₁ (cm²)			12.6			19.6			31.2			50.3			78.5			122.7			153.9			201.1			254.5			314.2		
Annulus area A ₂ (cm²)			10	6.4	15.8	13.5	9.4	25	21	15.3	40.1	34.4	25.6	62.6	53.9	40.1	98.1	84.2	59.1	122.7	103.7	75.4	162.6	137.4	106	204.2	175.9	131.8	250.5	219.1	160	
AA	11,12,19		59			74			91			117			137			178			200			219			246			269		
AO	22		10			16			16			20			22			22			25			25			25			25		
Ø B	00		30	42	34	42	50	42	50	60	50	60	72	60	72	88	72	88	108	80	108	122	88	108	133	98	133	154	108	133	163	
BB	11,12,19		35			46			46			59			59			81			92			92			115			115		
BD	06		30			40			50			60			70			90			100			110			120			130		
BG	01		12			18			18			24			24			27			32			32			40			40		
CB	15	A16	20			30			30			40			50			60			70			70			80			80		
CD	05,15	H9	14			20			20			28			36			45			56			56			70			70		
CW	15		10			15			15			20			25			30			35			35					40			
CX	08		20 -0.012			25 -0.012			30 -0.012			40 -0.012			50 -0.012			60 -0.015			80 -0.015			80 -0.015			100 -0.020			100 -0.020		
DD	11,12,19		M8x1			M12x1.25			M16x1.25			M16x1.5			M16x1.5			M22x1.5			M27x2			M27x2			M30x2			M30x2		
E	00	±1.5	63			75			90			115			130			165			190			205			230			245		
EE (Whitworth pipe thread)	00		G 3/8"			G 1/2"			G 1/2"			G 3/4"			G 3/4"			G 1"			G 1"			G 1"			G 1 1/4"			G 1 1/4"		
EP	08	h15	13			17			19			23			30			38			47			47			57			57		
EW	05	h14	20			30			30			40			50			60			70			70			80			80		
EX	08		16 -0.12			20 -0.12			22 -0.12			28 -0.12			35 -0.12			44 -0.15			55 -0.15			55 -0.15			70 -0.2			70 -0.2		
F	00		10			16			16			20			22			22			25			25			25			25		
FA	22	-0.075	8			14			14			18			22			22			25			25			25			25		
Ø FB	13,14	H13	11			14			14			18			18			22			26			26			33			33		
G	00		53			45			45			50			50			58			58			58			76			76		
GA	01		63			61			61			70			72			80			83			83			101			101		
J	00		38			38			38			45			45			58			58			58			76			76		
JH	0		85			89			100			116			120			135			175			175			180			180		

Piston Ø	Mt.	Tol.	40			50			63			80			100			125			140			160			180			200		
Piston rod Ø MM			18	28	22	28	36	28	36	45	36	45	56	45	56	70	56	70	90	63	80	100	70	90	110	80	100	125	90	110	140	
Annulus area A ₁ (cm²)			12.6			19.6			31.2			50.3			78.5			122.7			153.9			201.1			254.5			314.2		
Annulus area A ₂ (cm²)			10	6.4	15.8	13.5	9.4	25	21	15.3	40.1	34.4	25.6	62.6	53.9	40.1	98.1	84.2	59.1	122.7	103.7	75.4	162.6	137.4	106	204.2	175.9	131.8	250.5	219.1	160	
LT	08	min	25			31			38			48			58			72			92			92			116			116		
MR	05,15		16			25			29			34			44			53			59			59			76			76		
MS	08	max	29			33			40			50			62			80			100			100			120			120		
PA	22	-0.2	5			8			8			10			10			10			12			12			12			12		
PJ + stroke	00	±1.25	96			105			118			138			150			171			201			205			223			233		
R	13,14	js13	41			52			65			83			97			126			140			155			180			190		
Ø RD	00	f8	62			74		75	88	88	82	105	105	92	125	125	105	150	150	125	160	160	125	170	170	135	200	200	150	210	210	
RT	01		M8x1.25			M12x1.75			M12x1.75			M16x2			M16x2			M22x2.5			M27x3			M27x3			M30x3.5			M30x3.5		
Ø SB	02,22	H13	11			14			18			18			26			26			33			33			39			39		
SS + stroke	02,22	±1.25	98			92			86			105			102			131			126			130			162			172		
ST	02,22		12.5			19			26			26			32			32			38			38			44			44		
SW	02,22		10			13			17			17			22			22			29			29			35			35		
TC	16,26	h14	63			76			89			114			127			165			190			203			230			241		
Ø TD	06,16,26	f8	20			25			32			40			50			63			70			80			90			100		
TG	11,12,19		41.7			52.3			64.3			82.7			96.9			125.9			141.3			154.9			174			190.2		
TM	06	h14	76			89			100			127			140			178			200			215			248			279		
TO	13,14	js13	87			105			117			149			162			208			238			253			290			300		
TS	02,22	js13	83			102			124			149			172			210			245			260			301			311		
UM	06		108			129			150			191			220			278			312			341			388			439		
UO	13,14		110			130			145			180			200			250			285			300			340			360		
US	02,22		103			127			161			186			216			254			303			318			371			381		
UT	16,26		95			116			139			178			207			265			316			329			390			401		
UW	06		70			85			100			125			150			190			205			230			260			280		
VD	11,19		12			9			13			9			10			9			7			7			7			7		
VE	00		22			25			29			29			32			32			32			32			32			32		
WF	00	±2	35			41			48			51			57			57			57			57			57			57		
WH	11,19,22		25			25			32			31			35			35			32			32			32			32		
XC + stroke	05,15	±1.25	240			263			280			327			359			406			420			459			528			537		
XG	16	±2	57			64			70			76			71			75			75			75			85			85		
XO + stroke	08	±1.25	246			262			286			336			363			421			449			488			562			571		
XS	02,22	±2	45			54			65			68			79			79			86			86			92			92		
XV min	06		107			117			132			147			158			180			198			198			226			226		
XV max + stroke	06		88			90			91			99			107			109			99			104			121			130		
XJ + stroke	26	±1.5	180			190			210			239			256			281			291			330			354			363		
Y	00	±2	62			67			71			77			82			86			86			86			98			98		
Z	08		3°			3°			3°			3°			3°			3°			3°			3°			3°			3°		
ZB max + stroke	00		208			222			242			277			294			331			345			384			419			428		
ZJ + stroke	00	±1	199			209			229			261			278			310			320			359			392			401		
Cushining path	00		16			18			20			22			26			28			30			30			38			38		
min. stroke Mt.06 ISO MT4	06		19			27			41			48			51			71			94			94			96			96		

Mt. = mounting types which correspond to dimensions

Hydraulic interlock										
Forces (kN) at 160 bar	20.16	31.36	49.92	80.48	125.6	196.32	246.24	321.76	407.2	502.72

Weight (kg) m = m ₀ + (m _h / 10 x stroke)																																
Weight m ₀ (Mt. 13 ISO ME 5)	5.1	5.1	7.2	7.2	7.3	9.3	9.8	10.1	16.9	17.1	17.7	22.9	23.1	23.5	42.3	42.7	43.9															
Weight m ₀ (Mt. 14 ISO ME 6)	5	5	7.1	7.1	7.2	9.2	9.7	10	16.3	16.6	17.1	22.2	22.4	22.8	39.5	39.9	41.1											120		125		
Weight m ₀ (Mt. 08 ISO MP 5)	4.3	4.3	5.8	5.8	5.8	8.5	8.7	9.1	15.1	15.4	15.9	21.2	21.4	21.8	38.4	38.8	40											114		119		
Weight m ₀ (Mt. 02 ISO MS 2)	4.6	4.6	6.7	6.7	6.8	9.1	9.5	9.9	15.9	16.2	16.7	21.6	21.8	22.2	38	39.3	39.6											113		118		
Weight m ₀ (Mt. 06 ISO MT 4)	5.8	5.8	8.9	8.9	9	11.4	11.6	11.9	20	20.3	20.8	26.6	26.8	27.2	45.9	46.3	47.5											154		159		
Weight m _h / 10 mm stroke	0.1	0.13	0.14	0.16	0.19	0.19	0.23	0.28	0.33	0.36	0.44	0.48	0.53	0.67	0.76	0.84	1.02											1.05		1.5		2.3

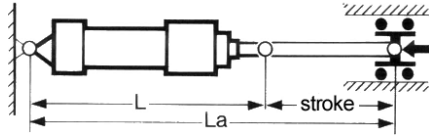
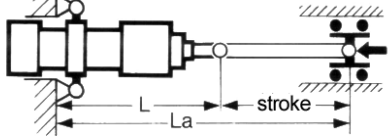
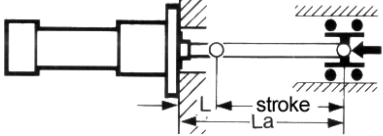
Calculation of buckling strength

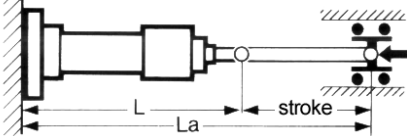
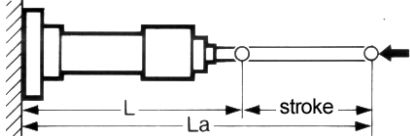
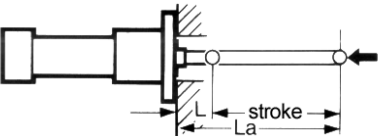
Proceeding:

- 1. Determine the necessary length L_a of the piston rod (including stroke).
- 2. Define the effective buckling length S_{kv} with the help of the table.
- 3. Identify the allowable buckling length $S_{k,zul.}$ using the diagram.
- 4. The effective buckling length must be less than or equal to the allowable buckling length.

$$S_{kv} \leq S_{k,zul.}$$

Effective buckling length S_{kv}

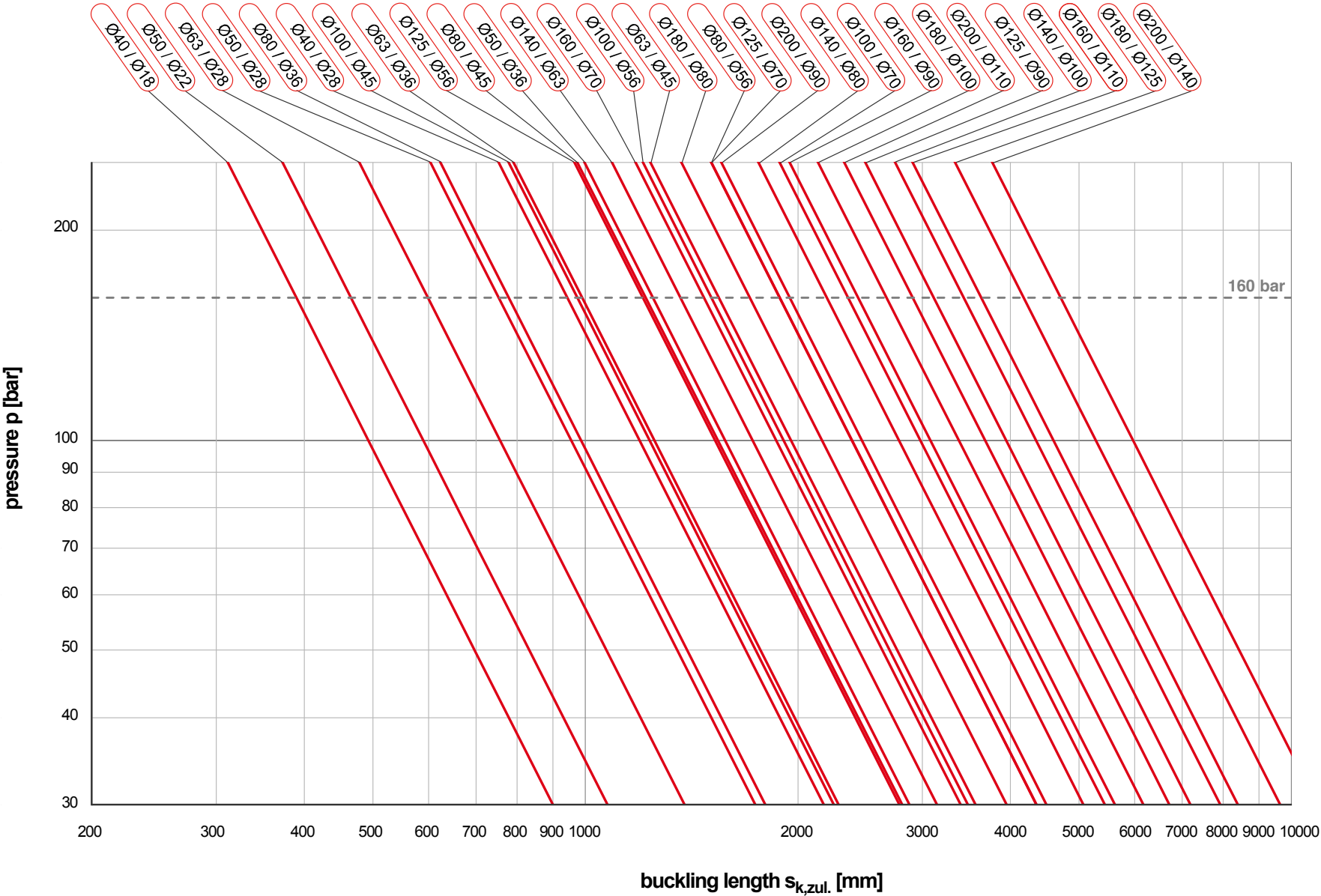
Type of fixing			
Mounting type	05, 08, 15	06, 16, 26	01, 02, 11, 13, 19*, 22, 23
Effective buckling length	$S_{kv}=L_a$	$S_{kv}=L_a$	$S_{kv}=0.7 L_a$

Type of fixing			
Mounting type	12, 14, 19*	12, 14, 19*	01, 02, 11, 13, 19*, 22, 23
Effective buckling length	$S_{kv}=0.7 L_a$	$S_{kv}=2 L_a$	$S_{kv}=2 L_a$

*depends on the mounting of the cylinder

Buckling

Allowable buckling length $s_{k,zul.}$



(safety factor $S = 3.5$)

Datasheet Type 53 · Single rod cylinder with hydraulic interlock



Ordering Code Standard Cylinders / Standard Cylinders DIN/ISO

Classification / order number

TYP	KST	KSTH	KSTV	BEA	BAA	DAE	DKO	MM	HUB	KDI	KSDI	EE	EEV	EEH	DAEV	DAEH	ELV	ELH	S	SZA	SVO	SHI
51	0	0	8	02	2	1	050	022	0350	5	0	0	1	1	2	0	0	0	N	0	3	3

Example

Abbr.	Characteristics	Types of cylinders									
TYP	Type of cylinder	41	44	46	47	48	51	53	55	57	

KST	Piston rod	41	44	46	47	48	51	53	55	57
0	single	X	X	X	X	X	X	X	X	X
1	on both sides (double rod cylinder)	X					X		X	
2	on both sides, small rear rod						X		X	
3	on both sides, large rear rod						X		X	
4	on both sides, medium rear rod						X		X	

KSTH	Piston rod end, rear	41	44	46	47	48	51	53	55	57
0	external thread	X	X	X	X	X	X		X	
1	internal thread	X					X		X	
2	cylindrical	X								
4	external thread ISO 4395						X		X	
5	plain rod eye	X								
8	swivel head (Type 51, 55: DIN 24555)	X					X		X	

KSTV	Piston rod end, front	41	44	46	47	48	51	53	55	57
0	external thread	X	X	X	X	X	X	X	X	X
1	internal thread	X	X	X	X	X	X	X	X	X
2	cylindrical	X	X	X	X	X	X	X	X	X
3	coupling	X	X	X	X	X	X	X	X	X
4	external thread ISO 4395	X	X	X	X	X	X	X	X	X
5	plain rod eye	X	X	X	X	X	X	X	X	X
8	swivel head (Type 51, 55: DIN 24555)	X	X	X	X	X	X	X	X	X
9	clevis	X	X	X	X	X	X	X	X	X

BEA	Mounting type	ISO-des.	41	44	46	47	48	51	53	55	57
00	basic form		X		X	X	X	X	X	X	
01	threaded flange head end		X								
	threaded holes head end	MX5						X	X	X	
02	foot mounting	MS2	X	X	X	X	X	X	X	X	X
03	flange head end	MF3	X	X	X	X	X				
04	flange cap end	MF4	X	X	X	X	X				
05	rod eye	MP3	X	X	X	X	X	X	X	X	
06	trunnion	MT4	X		X	X	X	X	X	X	
08	rod end bearing	MP5	X		X	X	X	X	X	X	
11	threaded holes head end	MX5				X	X	X			X
	tie rods elongated head end	MX3						X	X	X	
12	threaded holes cap end										X
	tie rods elongated cap end	MX2						X	X	X	
13	rectangular flange head end ^{1), 3)}	MF1/ME5			X	X	X	X	X	X	X
14	rectangular flange cap end ^{2), 3)}	MF2/ME6			X	X	X	X	X	X	X
15	clevis mounting	MP1						X	X	X	
16	trunnion on the head	MT1						X	X	X	
19	tie rods elongated both ends	MX1						X	X	X	
22	foot mounting with fit-in key	MS2						X	X	X	X
23	rectangular flange head end (wide)							X	X	X	
26	trunnion on the bottom	MT2						X	X	X	
33	flange on cylinder		X		X	X	X				
43	longitudinal bores, sinks on both sides										X

BAA	Type of construction	41	44	46	47	48	51	53	55	57
2	double-acting	X	X	X	X	X	X	X	X	X
3+4	single-acting (3=pushing; 4=pulling)	X	X	X	X	X	X	X	X	X
5+6	single-acting with spring (5=pushing; 6=pulling)	X		X	X	X	X	X	X	X

DAE	Cushioning	41	44	46	47	48	51	53	55	57
0	without cushioning	X	X	X	X	X	X	X	X	X
1	cushioning in the front	X	X	X	X	X	X	X	X	
2	cushioning in the head	X	X	X	X	X	X	X	X	
3	cushioning on both sides	X	X	X	X	X	X	X	X	

DKO	Piston diameter	41	44	46	47	48	51	53	55	57
	see measuring index									

MM	Piston rod diameter	41	44	46	47	48	51	53	55	57
	see measuring index									

HUB	Stroke	41	44	46	47	48	51	53	55	57
	consider buckling									

KDI	Piston seal	41	44	46	47	48	51	53	55	57
0	NBR lip seals / PUR lip seals	X _s	X	X	X	X	X	X	X	X
2	PUR lip seal / Viton®	X	X							
3	piston ring / casting	X _s								
5*	sleeve ring/o-ring; tefl./NBR	X _(S)	X	X _s	X _s	X _s	X _s	X	X _s	X _s
6	sleeve ring/o-ring; tefl./Viton®	X	X	X	X	X	X	X	X	X
7	compact seal / NBR	X		X	X	X	X	X	X _s	X

KSDI	Piston rod seal	41	44	46	47	48	51	53	55	57
0	NBR lip seals / PUR lip seals	X _s		X	X _s	X _s	X _s	X _s	X _s	X _s
1	PUR lip seal, u-seal				X	X	X	X	X	X _s
2	lip seal / Viton®	X			X	X	X	X	X	X
3	chevron ring NBR		X _s	X _s						
4	chevron ring Viton®		X	X						
5	stepseal/o-ring; tefl./NBR			X	X	X	X	X	X	
6	stepseal/o-ring; tefl./Viton®			X	X	X	X	X	X	
9	PUR lip seal, u-seal+scraper Viton®				X		X	X	X	X

EE	Hydraulic connections	41	44	46	47	48	51	53	55	57
0	pipe thread (DIN/ISO 228)	X _s	X _s	X _s	X _s	X _s	X _s	X _s	X _s	X _s
1	metrical ISO thread	X		X	X	X	X	X	X	
2	UNF thread	X		X	X	X	X	X	X	
3	flange connection			X	X	X	X	X	X	

EEV	Hydr. connection, front position	41	44	46	47	48	51	53	55	57
1	0 degrees (at top)	X _s	X _s	X _s	X _s	X _s	X _s	X _s	X _s	X
2	45 / 60 degrees (clockwise)			X	X	X				
2 / 3	90 degrees (clockwise)			3	3	3	2	2	2	X
4	135 degrees (clockwise)			X	X	X				
3 / 5	180 degrees (clockwise)			5	5	5	3	3	3	
6	225 degrees (clockwise)			X	X	X				
4 / 7	270 degrees (clockwise)			7	7	7	4	4	4	
8	315 degrees (clockwise)			X	X	X				

¹⁾ MF 1 for 44, 46, 47, 48; ME 5 for 51, 53, 55

²⁾ MF 2 for 44, 46, 47, 48; ME 6 for 51, 53, 55

³⁾ mounting type 13 (14) for type 57: longitudinal bores, sinks on rear (front)

* type 41: standard for piston diameter = 12, 15, 20

s = standard design

(S) = standard design, not for all forms of construction

RC = rear center

EEH	Hydr. Connection, rear position	41	44	46	47	48	51	53	55	57
RC			X _s	X _s	X _s	X _s	X _s	X _s	X _s	X
1	0 degrees (at top)			X	X	X				
2	45 / 60 degrees (clockwise)			X	X	X				
2 / 3	90 degrees (clockwise)			3	3	3	2	2	2	X
4	135 degrees (clockwise)			X	X	X				
3 / 5	180 degrees (clockwise)			5	5	5	3	3	3	
6	225 degrees (clockwise)			X	X	X				
4 / 7	270 degrees (clockwise)			7	7	7	4	4	4	
8	315 degrees (clockwise)			X	X	X				

DAEV	Cushioning, front position	41	44	46	47	48	51	53	55	57
0	without cushioning	X		X	X	X	X	X	X	
1	0 degrees (at top)			X	X	X	X	X	X	
2	45 / 60 degrees (clockwise)	X		X	X	X				
2 / 3	90 degrees (clockwise)	X _s		3 _s	3 _s	3 _s	2 _s	2 _s	2 _s	
4	135 degrees (clockwise)			X	X	X				
3 / 5	180 degrees (clockwise)	X		5	5	5	3	3 _s	3	
6	225 degrees (clockwise)			X	X	X				
4 / 7	270 degrees (clockwise)	X		7	7	7	4	4	4	
8	315 degrees (clockwise)			X	X	X				

DAEH	Cushioning, rear position	41	44	46	47	48	51	53	55	57
0	without cushioning	X		X	X	X	X	X	X	
1	0 degrees (at top)			X	X	X	X	X	X	
2	45 / 60 degrees (clockwise)	X		X	X	X				
2 / 3	90 degrees (CW: 51/55; Br. 02->S)	X _s		3 _s	3 _s	3 _s	2 _(S)	2 _(S)	2 _(S)	
4	135 degrees (clockwise)			X	X	X				
3 / 5	180 degrees (clockwise)	X		5	5	5	3 _s	3 _s	3 _s	
6	225 degrees (clockwise)			X	X	X				
4 / 7	270 degrees (clockwise)	X		7	7	7	4	4	4	
8	315 degrees (clockwise)			X	X	X				

ELV	Air bleed, front position	41	44	46	47	48	51	53	55	57
0	without air bleed	X	X							X
1 - 8	see cushioning position	X	X	X	X	X	X	X	X	X

ELH	Air bleed, rear position	41	44	46	47	48	51	53	55	57
0	without air bleed	X	X							X
1 - 8	see cushioning position	X	X	X	X	X	X	X	X	X

S	Position detection	41	44	46	47	48	51	53	55	57
Z	attached proximity switches									X
N	built-in proximity switches	X	X	X	X	X	X	X	X	X

SZA	Number of switches	41	44	46	47	48	51	53	55	57
	1 - 9 for S = Z								X	
	1 - 2 for S = N	X	X	X	X	X	X	X		X