

Hydraulic Cylinder Tie Rod Design

RE 17016/07.03

1/78

Replaces: 08.99

Series CD 70 / CG70

Nominal pressure 70 bar
Piston dia. 25 to 200 mm
Piston rod dia. 12 to 140 mm
16 types of mounting



K4639-10

Features

- Easily serviced modular system:
 - Tie rod construction
therefore simple assembly and dis-assembly for servicing
 - Port threads available optionally in ISO 228/1 or metric ISO forms.
 - Bleed points (standard)
 - Adjustable cushioning
 - Installation length identical for models with or without cushioning.
 - Stroke freely selectable within maximum available range.

 **Note!**

When choosing cylinder type, please note definitions on page 7

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Technical Data (for applications outside these parameters, please consult us!)

general		
Installation position		Optional
Piston velocity	m/s	0,5 (dependent upon port size)
For permissible installation lengths and tolerances see page 74		Stroke lengths
		Permissible deviation
		0 to 1250
		+1 -1,5
		1251 to 2000
		+1 -2
		2001 to 3000
		+1 -3

hydraulic		
Max. Operating pressure ¹⁾	bar	105 (dependent upon piston dia. and type of mounting)
Static test pressure		Max. operating pressure x 1,3 (dependent upon piston dia. and type of mounting)
Fluid		Mineral oils to (HL, HLP) nach DIN 51 524 Phosphate ester (HFD-R)
Fluid temperature range	°C	- 20 to + 70
ISO code cleanliness class		Maximum permissible degree of contamination of fluid to ISO 4406 (C) class 20/18/15 ²⁾
Viscosity range	mm ² /s	2,8 to 380

Cylinders outside the above parameters are also available if required. Please enquire, giving exact details of the application.

¹⁾ The specified operating pressures are only valid for applications with shock-free operation.
If extreme loads occur, e.g. as happens in high sequence cycles, the fixings and piston rod thread connections need to be designed for durability (fatigue strength).

²⁾ The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, increases the service life of components.

For the selection of filters, see data sheets:
RE 50070, RE 50076 and RE 50081.

Forces, Areas

Operating pressure in bar	Piston diameter	mm	25		32			40			50		
	Piston rod diameter	mm	12	16	18	22	25	16	18	25	22	25	36
40	Force; piston end	kN	1,96		3,22			5,03			7,85		
	Force; piston rod end	kN	1,55	1,19	2,19	1,69	1,25	4,21	3,99	3,06	6,32	5,87	3,78
50	Force; piston end	kN	2,46		4,02			6,29			9,82		
	Force; piston rod end	kN	1,94	1,49	2,74	2,11	1,56	5,27	5,00	3,83	7,91	7,35	4,73
70	Force; piston end	kN	3,44		5,63			8,80			13,75		
	Force; piston rod end	kN	2,71	2,08	3,84	2,96	2,19	7,38	7,01	5,40	11,08	10,31	6,62
105	Force; piston end	kN	5,16		8,45			13,20			20,62		
	Force; piston rod end	kN	3,96	3,04	5,77	4,44	3,28	11,07	10,52	8,03	16,62	15,44	9,93
Piston area		cm ²	4,91		8,04			12,56			19,63		
Annulus area		cm ²	3,78	2,90	5,50	4,24	3,13	10,55	10,02	7,65	15,83	14,71	9,46
Cushion area	Force; piston end	cm ²	2,63		5,77			10,30			15,11		
	Force; piston rod end	cm ²	2,63	2,63	4,90	3,52	2,50	8,70	8,76	7,05	14,33	13,47	8,29

Operating pressure in bar	Piston diameter	mm	63				80			100		
	Piston rod diameter	mm	25	28	36	45	36	45	56	45	50	70
40	Force; piston end	kN	12,47				20,10			31,42		
	Force; piston rod end	kN	10,49	9,99	8,38	6,00	16,02	13,73	10,25	25,04	23,55	16,01
50	Force; piston end	kN	15,59				25,10			39,27		
	Force; piston rod end	kN	13,12	12,50	10,49	7,62	20,03	17,16	12,80	31,29	29,43	20,02
70	Force; piston end	kN	21,82				35,18			54,98		
	Force; piston rod end	kN	18,36	17,50	14,68	10,68	28,04	24,03	17,93	43,80	41,20	28,01
105	Force; piston end	kN	-				-			-		
	Force; piston rod end	kN	-	-	-	-	-	-	-	-	-	-
Piston area		cm ²	31,16				50,24			78,50		
Annulus area		cm ²	26,25	25,01	20,98	15,26	40,07	34,34	25,62	62,60	58,88	40,04
Cushion area	Force; piston end	cm ²	26,65				40,64			58,90		
	Force; piston rod end	cm ²	23,13	23,13	19,80	13,08	37,70	30,60	20,07	58,90	54,70	31,97

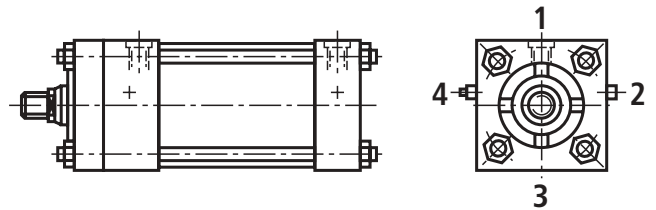
Operating pressure in bar	Piston diameter	mm	125				150				200		
	Piston rod diameter	mm	50	56	63	90	63	70	80	100	90	100	140
40	Force; piston end	kN	49,09				70,68				125,66		
	Force; piston rod end	kN	41,20	39,20	36,59	23,63	58,17	55,25	50,54	39,23	100,13	94,16	64,03
50	Force; piston end	kN	61,35				88,35				-		
	Force; piston rod end	kN	51,49	49,01	45,83	29,53	72,71	69,06	63,16	49,05	-	-	-
70	Force; piston end	kN	85,90				-				-		
	Force; piston rod end	kN	72,10	68,60	64,03	41,35	-	-	-	-	-	-	-
105	Force; piston end	kN	-				-				-		
	Force; piston rod end	kN	-	-	-	-	-	-	-	-	-	-	-
Piston area		cm ²	122,66				176,63				314,00		
Annulus area		cm ²	103,03	98,04	91,50	59,08	145,47	138,17	126,38	98,13	250,42	235,50	160,14
Cushion area	Force; piston end	cm ²	103,08				138,23				275,68		
	Force; piston rod end	cm ²	92,50	92,50	47,20	47,20	130,10	130,10	81,70	81,70	238,70	219,00	137,50

Position of ports

By rotating the cylinder cap and/or the cylinder head, the position of the ports can be changed for most types of cylinder mounting. The options can be seen in the table below.

The throttle and non return valves change their positions accordingly.

With mounting types F, L, N and T and also at the cylinder cap with mounting G, the throttle and non return valve remain in position 1 when the port position are rotated.



Mounting types	Selectable position of ports															
	B	C	D	E	F	G	H	K	L	M	N	P	Q	R	S	T
At cylinder head	1	1	1	1	1	1	1	1	1	-	1	1	1	1	1	1
	2	2	2	2	2	2	2	2	2	-	2	2	2	-	2	2
	3	3	3	3	-	3	3	3	-	3	-	3	3	3	3	-
	4	4	4	4	4	4	4	4	4	-	4	4	4	4	4	4
At cylinder cap	1	1	1	1	1	1	1	1	1	-	1	1	1	1	1	1
	2	2	2	2	2	2	2	2	2	-	2	2	2	2	2	2
	3	3	3	3	-	3	3	3	-	3	-	3	3	3	3	-
	4	4	4	4	4	4	4	4	4	-	4	4	4	4	4	4



= Positions 2 and 4 are not possible with:

- Piston dia. 25 to 100 with enlarged port threads 13 and 14
- Piston dia. 25, 32/22 and 32/25 with port threads 01 and 02
- Piston dia. 32/18, 40/25, 50/36 and 63/45 each with cushioning



= Positions 2 and 4 are not possible with:

- Piston dia. 25
- Piston dia. 32 to 100 with enlarged port threads 13 and 14



= Positions 2 and 4 are not possible with piston dia. 25



= Positions 2 and 4 are not possible with piston dia. 25 with enlarged port threads 13 and 14



= Positions 2 and 4 are not possible with:

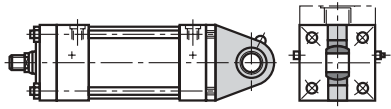
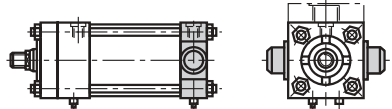
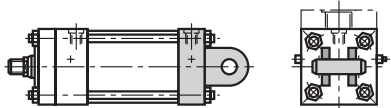
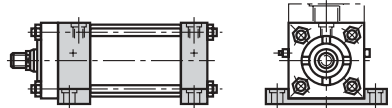
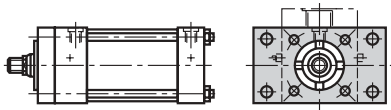
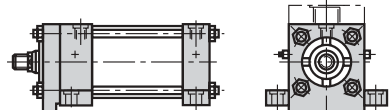
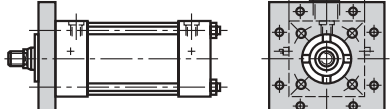
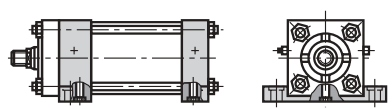
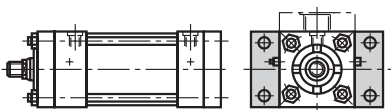
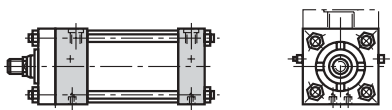
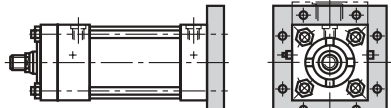
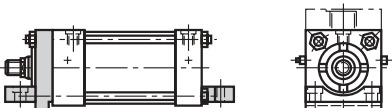
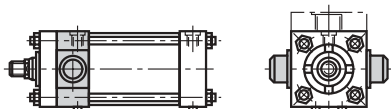
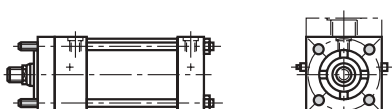
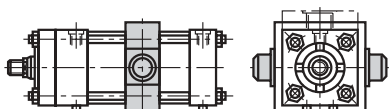
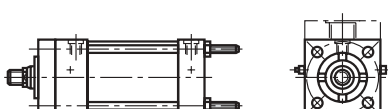
- Piston dia. 25 to 200 with enlarged port threads 13 and 14
- Piston dia. 25, 32 and 40 with port threads 01 and 02
- Piston dia. 50/36 and 63/45 with cushioning



= Positions 2 and 4 are not possible with:

- Piston dia. 25 to 63 with enlarged port threads 13 and 14

Types of mounting

<p>A/Fivel clevis at cylinder cap</p> <p>B</p>		<p>Trunnion mounting at cylinder cap</p> <p>S</p>	
<p>Clevis fork at cylinder cap</p> <p>G</p>		<p>Foot mounting</p> <p>F</p>	
<p>Rectangular flange at cylinder head</p> <p>C</p>		<p>Foot mounting with key</p> <p>L</p>	
<p>Square flange at cylinder head</p> <p>H</p>		<p>Foot mounting with O ring seals for subplate mounting</p> <p>M</p>	
<p>Rectangular flange at cylinder cap</p> <p>D</p>		<p>Threaded holes in cylinder cap and head</p> <p>N</p>	
<p>Square flange at cylinder cap</p> <p>K</p>		<p>Foot mounting with key</p> <p>T</p>	
<p>Trunnion mounting at cylinder head</p> <p>R</p>		<p>Extended tie rods at cylinder head</p> <p>P</p>	
<p>Centre trunnion mounting</p> <p>E</p>		<p>Extended tie rods at cylinder cap</p> <p>Q</p>	

Explanation of positions and definitions

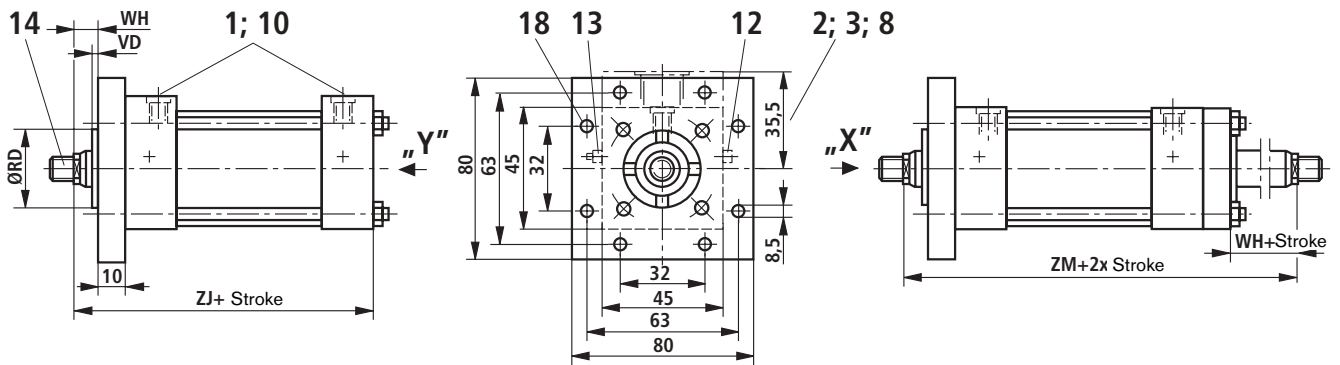
- 1 Selectable position of ports (see page 5).
- 2 Raised cylinder head face in model with enlarged port types 13 and 14.
- 3 Raised cylinder head face except for 18 mm dia. piston rod without cushioning at rod end.
- 4 Raised cylinder head face for 25 mm dia. piston rod with cushioning at rod end.
- 5 Raised cylinder head face for 36 mm dia. piston rod with cushioning at rod end.
- 6 Raised cylinder head face for 45 mm dia. piston rod with cushioning at rod end.
- 7 Raised cylinder head face by means of screw-in adaptor, in model with enlarged port types 13 and 14.
- 8 Raised cylinder cap face in model with enlarged port types 13 and 14.
- 9 Raised cylinder cap face by means of screw-in adaptor, in model with enlarged port types 13 and 14.
- 10 Counterbore dia. D1 is only suitable at head end for O ring pipe fittings.
- 11 Counterbore dia. D1 is only suitable at head end with port threads 01 and 02 for O ring pipe fittings
- 12 Non return valve and bleed point. Bleed point is standard.
- 13 Adjustable throttle for cushioning.
- 14 Threads B and C. Threads D and F together with the associated trunnion head are always on the last side of each cylinder diameter stated.
- 16 Associated clevis pin diameter – tolerance m6. Minimum pin material strength $\sigma_{0,2} = 600 \text{ N/mm}^2$ (pin not included in supply).
- 17 Clevis pins and split pins are included in supply.
- 18 6 usable fixing screw holes available with raised cylinder head.
- 19 6 usable fixing screw holes available with raised cylinder cap.
- 20 Lubricating nipple to DIN 71 412 form A. Lubricants can be normally commercially available, corrosion preventative, lithium based greases.
- 21 Re-lubrication possible via lubrication bore in housing.

Piston dia. 32 (dimensions in mm)

For the explanation of positions and definitions, see page 7

Mounting type: H

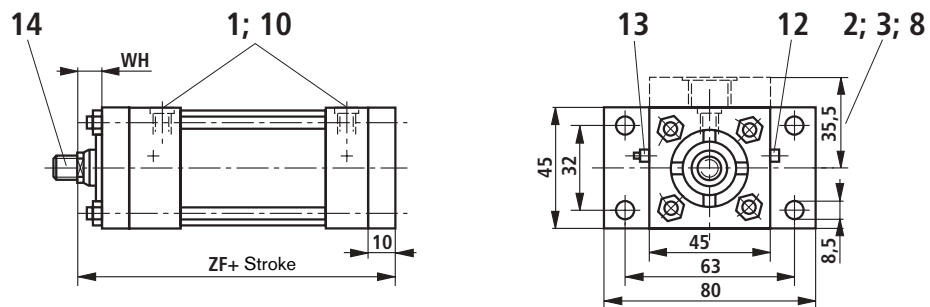
Operating Pressure 105 bar



Stroke_{min} = 25 mm for thread type „E“
(only for double rod cylinders)

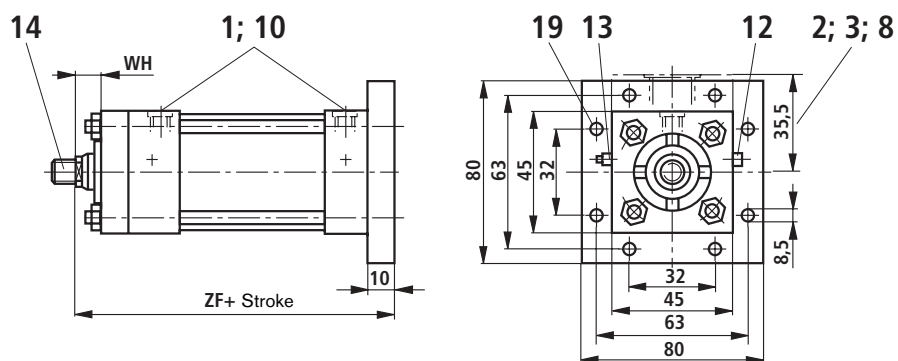
Mounting type: D

Operating Pressure 105 bar



Mounting type: K

Operating Pressure 105 bar



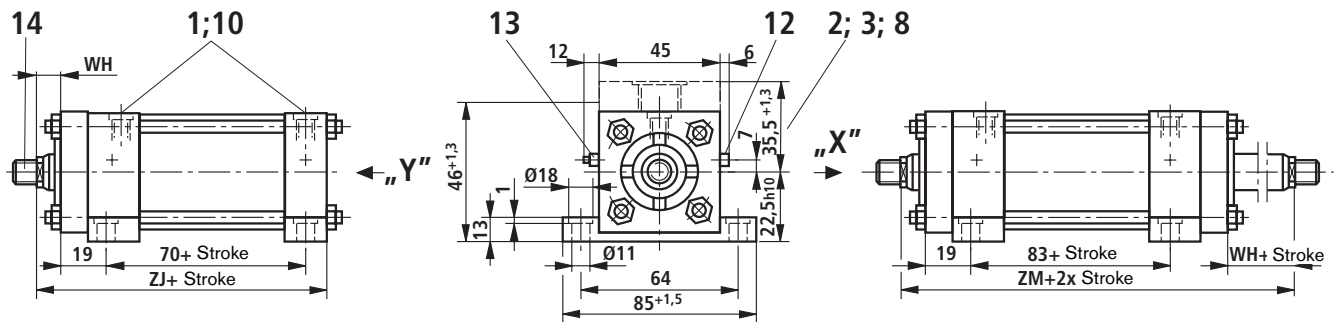
Piston rod dia	ØRD _{f7}	VD	WH	XC	XN	ZF	ZJ	ZM	B3	A/F1	Cushion length	
											Full bore end	Rod end
18	32	6	16	134	150	125	115	153	5,5	14	22	23
22	34	13	25	143	159	134	124	171	8	19		
25	38	13	25	143	159	134	124	171	8	22		

Piston dia. 32 (dimensions in mm)

For the explanation of positions and definitions, see page 7

Mounting type: F

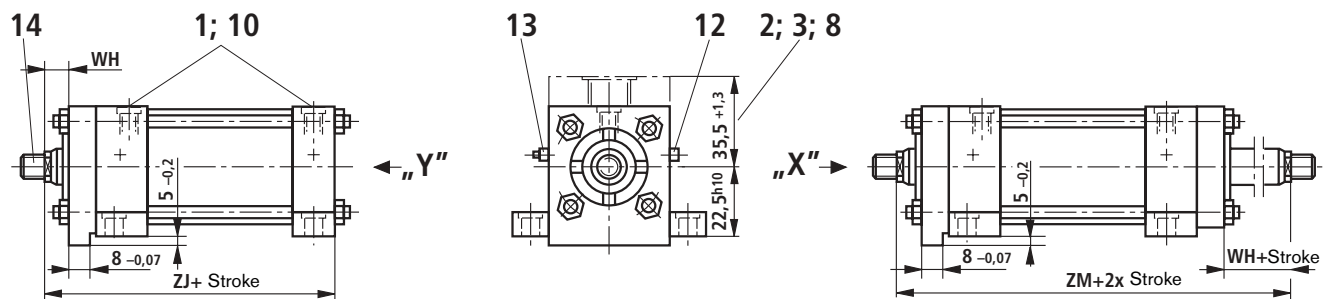
Operating Pressure 105 bar



Stroke_{min} = 25 mm for thread type „E“
(only for double rod cylinders)

Mounting type: L

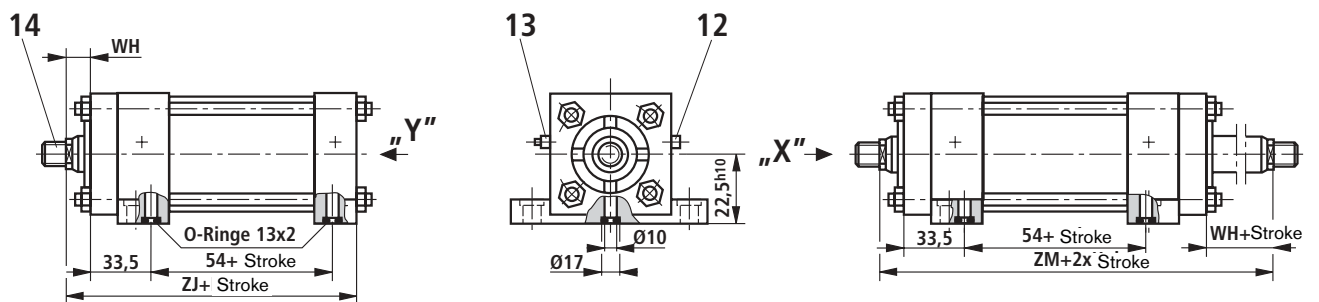
Operating Pressure 105 bar



Stroke_{min} = 25 mm for thread type „E“
(only for double rod cylinders)

Mounting type: M

Operating Pressure 105 bar



Stroke_{min} = 25 mm for thread type „E“
(only for double rod cylinders)

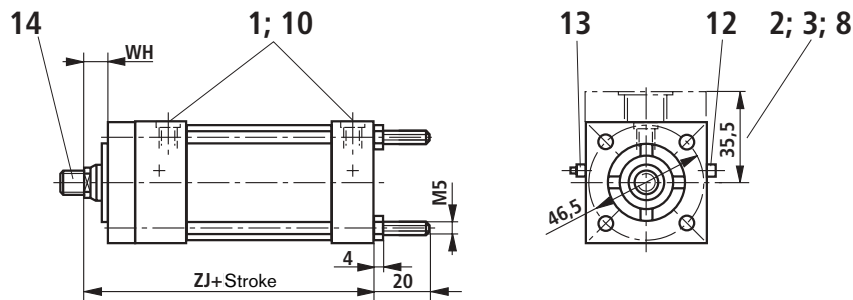
Piston rod dia	ØRD _{f7}	VD	WH	XG	XJ	XV	ZJ	ZM	B3	A/F1	Cushion length	
											Full bore end	Rod end
18	32	6	16	44,5	102	76,5	115	153	5,5	14	22	23
22	34	13	25	53,5	111	85,5	124	171	8	19		
25	38	13	25	53,5	111	85,5	124	171	8	22		

Piston dia. 32 (dimensions in mm)

For the explanation of positions and definitions, see page 7

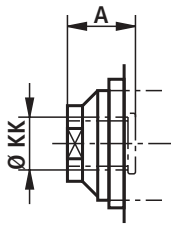
Mounting type: **Q**

Operating Pressure 105 bar

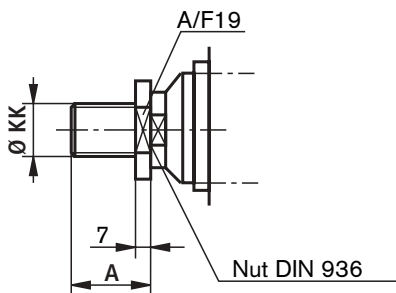


Additional thread types

Thread type „E”



Thread type „F”



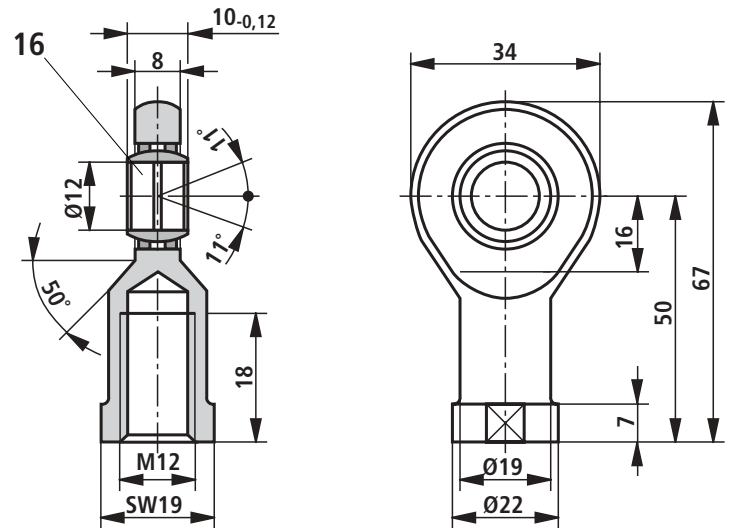
Clevis head CGK 12

to suit

Thread type „F”

Ordering code.: R900001327

Weight: 0,1 kg



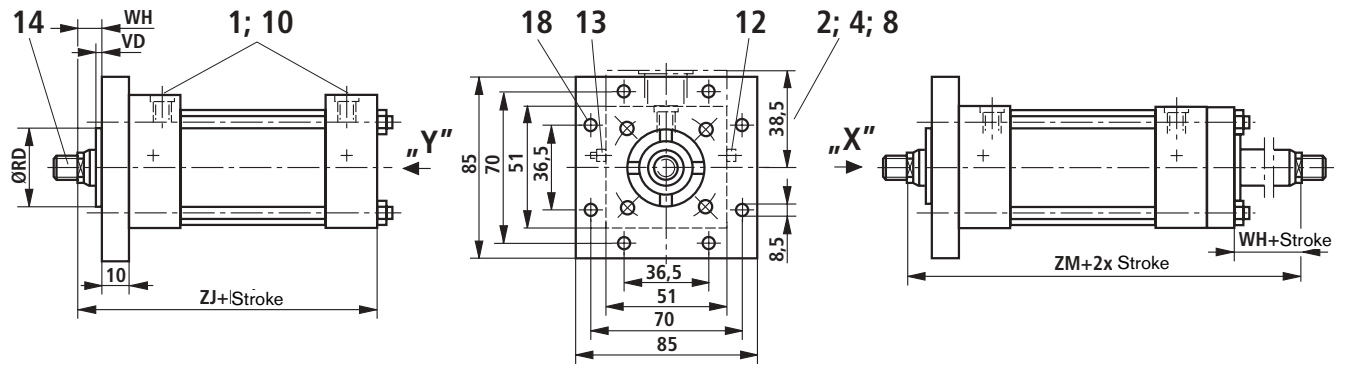
Piston rod dia	ØRD _{f7}	VD	WH	ZJ	ZM	B2	B3	A/F1	Cushion length	
									Full bore end	Rod end
18	32	6	16	115	153	9	5,5	14	22	23
22	34	13	25	124	171	7	8	19		
25	38	13	25	124	171	7	8	22		

Piston dia. 40 (dimensions in mm)

For the explanation of positions and definitions, see page 7

Mounting type: H

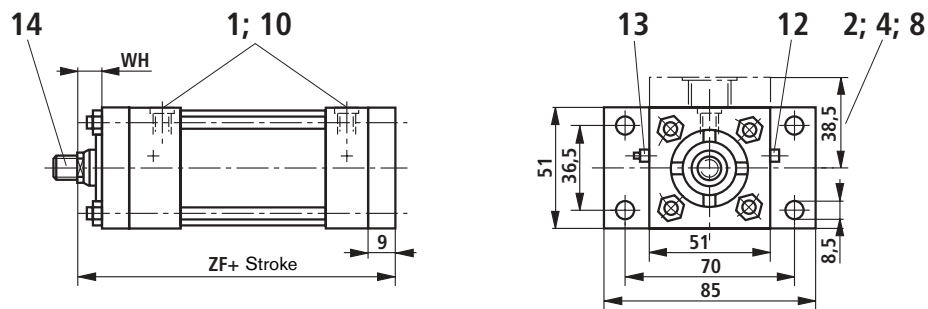
Operating Pressure 105 bar



Stroke_{min} = 25 mm for thread type „E“
(only for double rod cylinders)

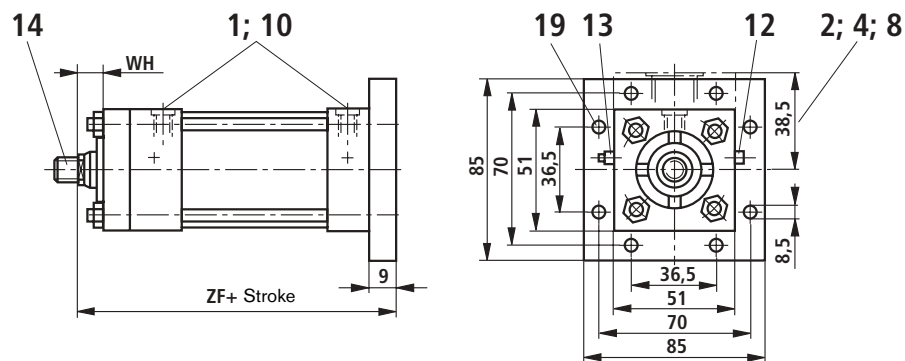
Mounting type: D

Operating Pressure 105 bar



Mounting type: K

Operating Pressure 105 bar



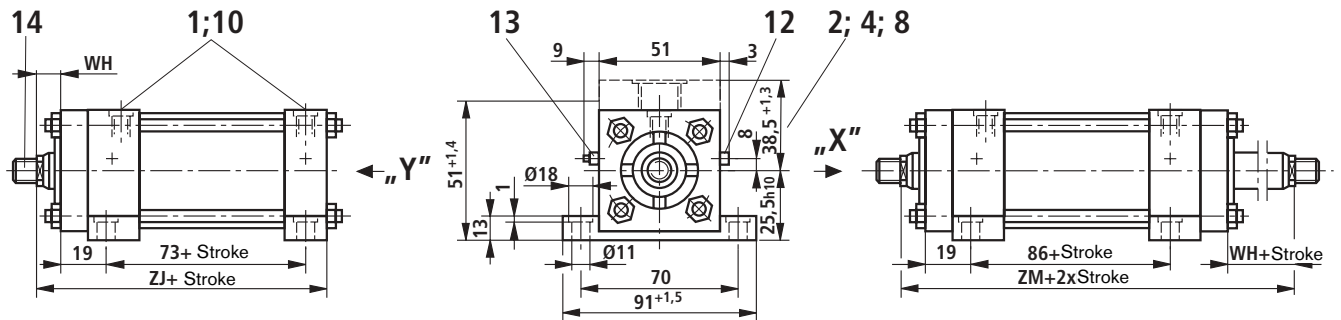
Piston rod dia	ØRD _{f7}	VD	WH	XC	XN	ZF	ZJ	ZM	B3	A/F1	Cushion length	
											Full bore end	Rod end
16	28,5	6	16	137	158	127	118	156	5,5	13	22	23
18	32	6	16	137	158	127	118	156	5,5	14		
25	38	13	25	146	167	136	127	174	8	22		

Piston dia. 40 (dimensions in mm)

For the explanation of positions and definitions, see page 7

Mounting type: F

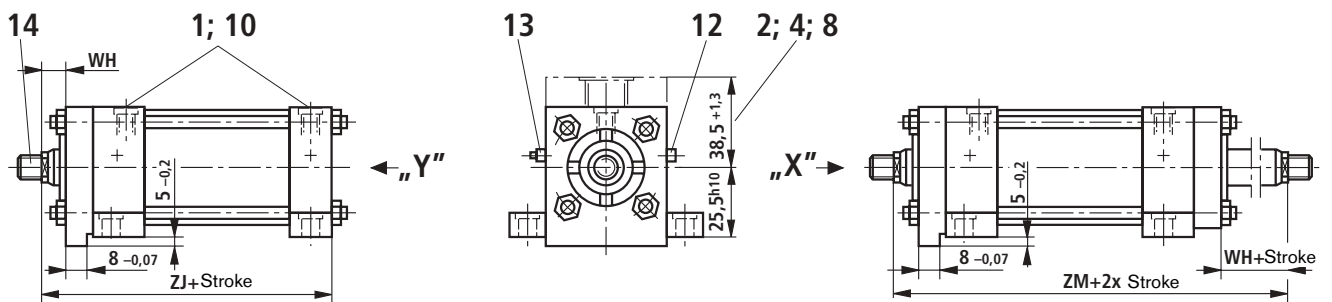
Operating Pressure 105 bar



Stroke_{min} = 25 mm for thread type „E“
(only for double rod cylinders)

Mounting type: L

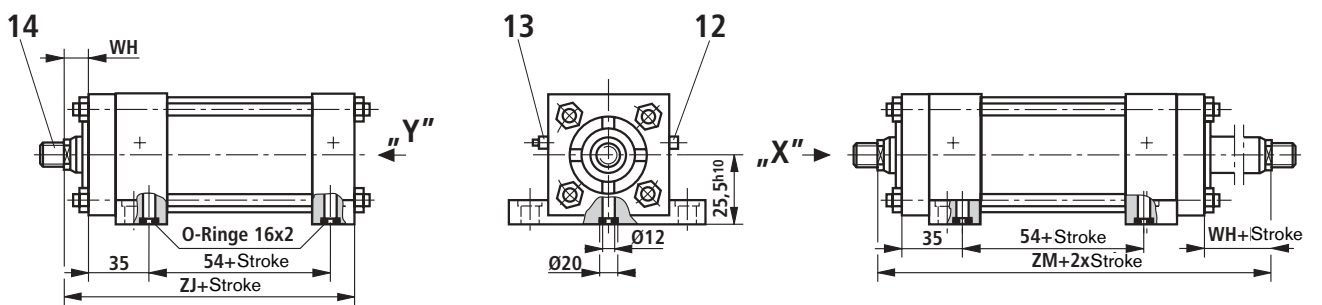
Operating Pressure 105 bar



Stroke_{min} = 25 mm for thread type „E“
(only for double rod cylinders)

Mounting type: M

Operating Pressure 105 bar



Stroke_{min} = 25 mm for thread type „E“
(only for double rod cylinders)

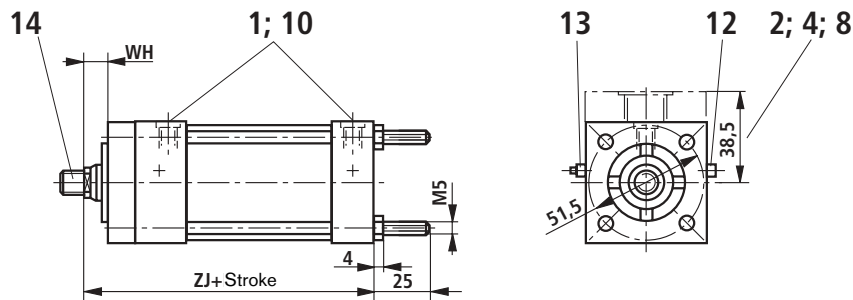
Piston rod dia	ØRD _{f7}	VD	WH	XG	XJ	XV	ZJ	ZM	B3	A/F1	Cushion length	
											Full bore end	Rod end
16	28,5	6	16	44,5	105	78	118	156	5,5	13	22	23
18	32	6	16	44,5	105	78	118	156	5,5	14		
25	38	13	25	53,5	114	87	127	174	8	22		

Piston dia. 40 (dimensions in mm)

For the explanation of positions and definitions, see page 7

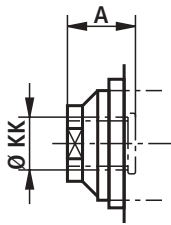
Mounting type: **Q**

Operating Pressure 105 bar

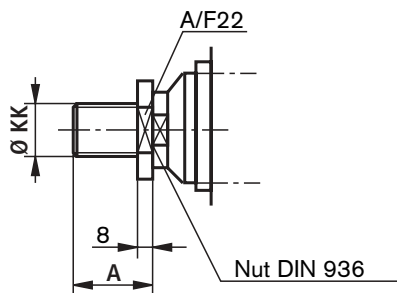


Additional thread types

Thread type „E”



Thread type „F”



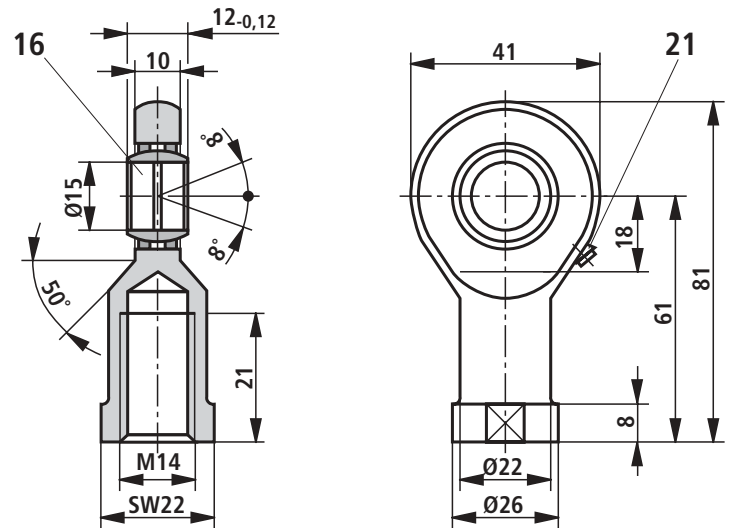
Clevis head CGK 15

to suit

Thread type „F”

Ordering code.: R900001328

Weight: 0,16 kg



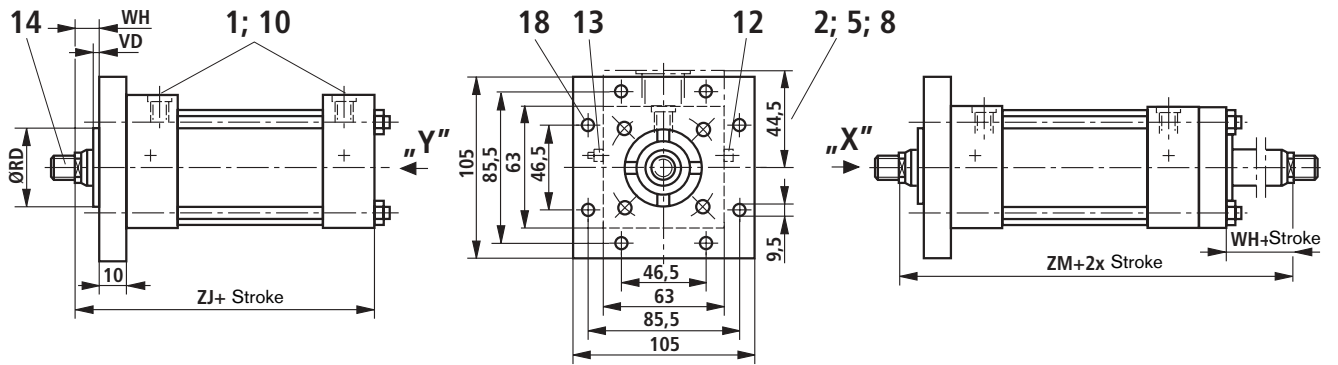
Piston rod dia	ØRD _{f7}	VD	WH	ZJ	ZM	B2	B3	A/F1	Cushion length	
									Full bore end	Rod end
16	28,5	6	16	118	156	9	5,5	13	22	23
18	32	6	16	118	156	6	5,5	14		
25	38	13	25	127	174	6	8	22		

Piston dia. 50 (dimensions in mm)

For the explanation of positions and definitions, see page 7

Mounting type: H

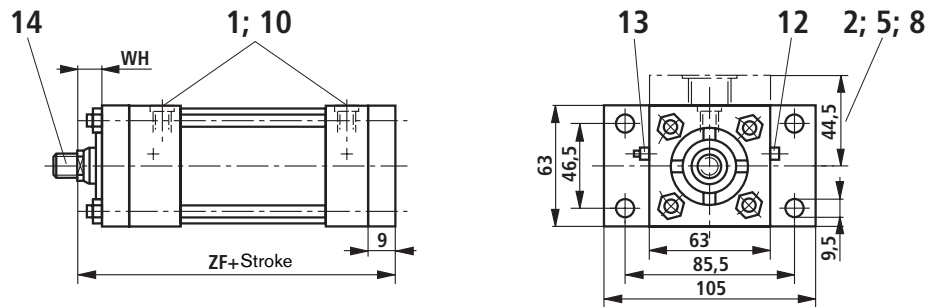
Operating Pressure 105 bar



Stroke_{min} = 30 mm for thread type „E“
(only for double rod cylinders)

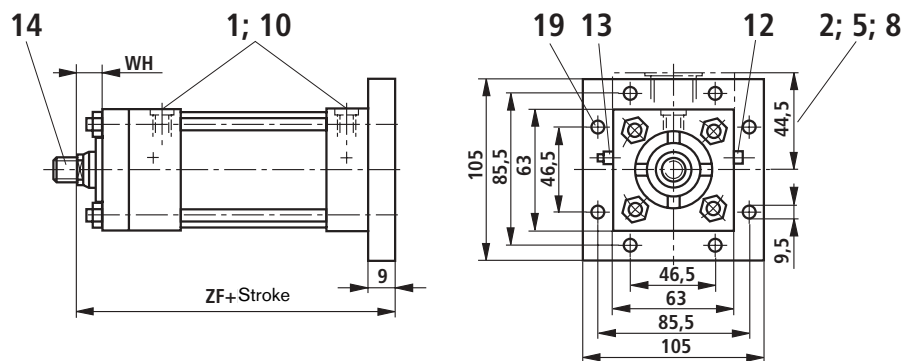
Mounting type: D

Operating Pressure 105 bar



Mounting type: K

Operating Pressure 105 bar



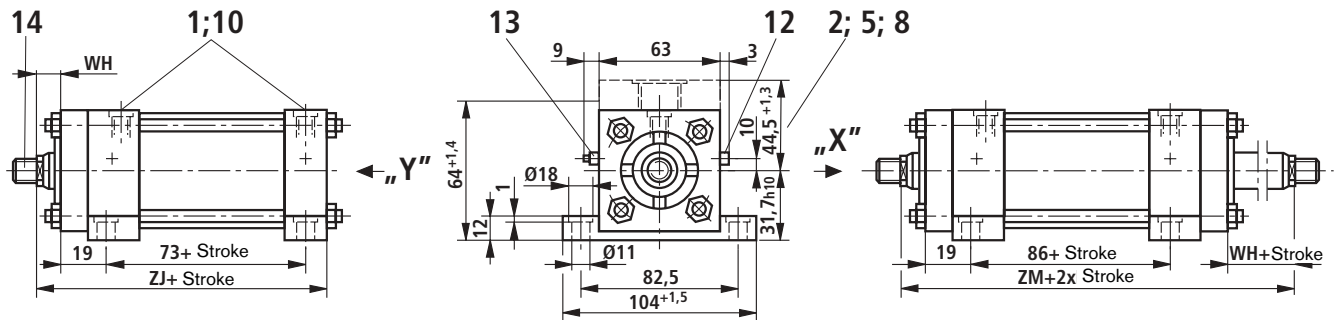
Piston rod dia	ØRD _{f7}	VD	WH	XC	XN	ZF	ZJ	ZM	B3	A/F1	Cushion length	
											Full bore end	Rod end
22	38	13	25	146	172	136	127	174	8	19	22	23
25	38	13	25	146	172	136	127	174	8	22		
36	50	16	32	153	179	143	134	188	10	30		

Piston dia. 50 (dimensions in mm)

For the explanation of positions and definitions, see page 7

Mounting type: F

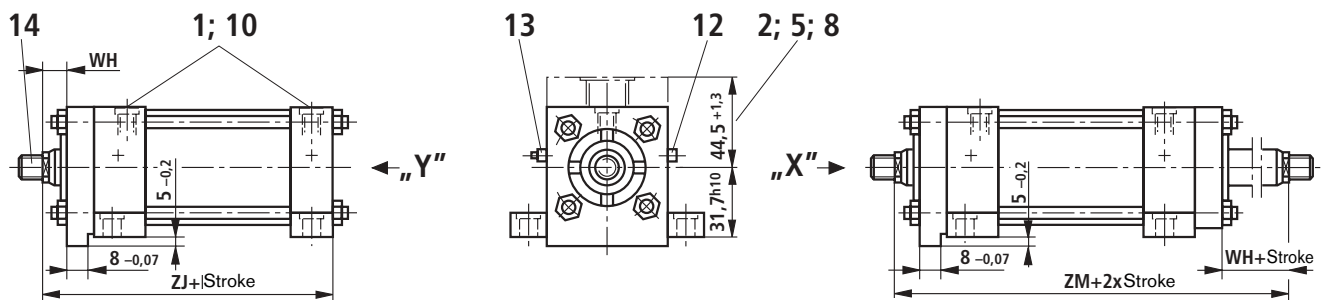
Operating Pressure 105 bar



Stroke_{min} = 30 mm for thread type „E“
(only for double rod cylinders)

Mounting type: L

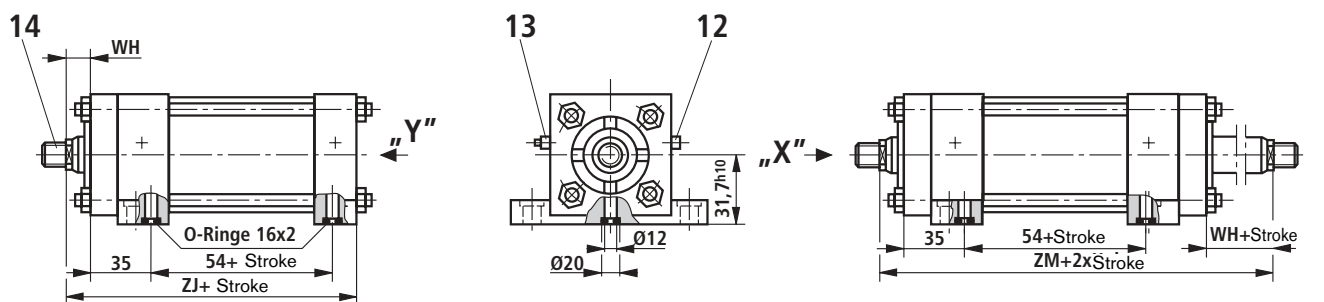
Operating Pressure 105 bar



Stroke_{min} = 30 mm for thread type „E“
(only for double rod cylinders)

Mounting type: M

Operating Pressure 105 bar



Stroke_{min} = 30 mm for thread type „E“
(only for double rod cylinders)

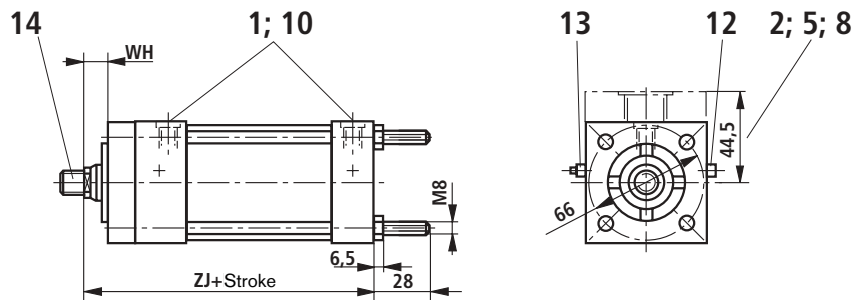
Piston rod dia	ØRD _{f7}	VD	WH	XG	XJ	XV	ZJ	ZM	B3	A/F1	Cushion length	
											Full bore end	Rod end
22	38	13	25	53,5	114	87	127	174	8	19	22	23
25	38	13	25	53,5	114	87	127	174	8	22		
36	50	16	32	60,5	121	94	134	188	10	30		

Piston dia. 50 (dimensions in mm)

For the explanation of positions and definitions, see page 7

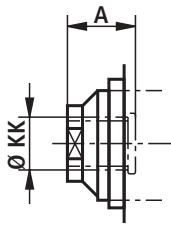
Mounting type: **Q**

Operating Pressure 105 bar

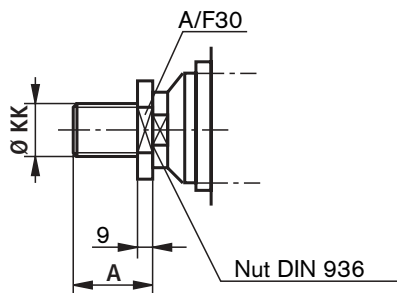


Additional thread types

Thread type „E”



Thread type „F”



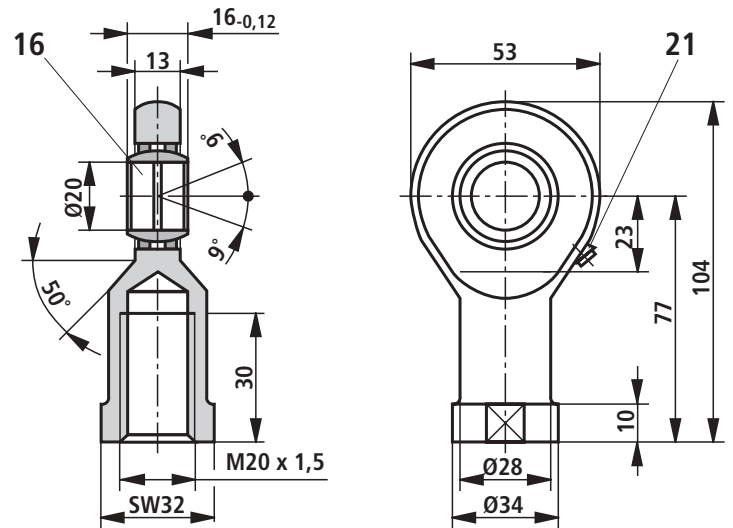
Clevis head CGK 20

to suit

Thread type „F”

Ordering code.: R900001329

Weight: 0,34 kg

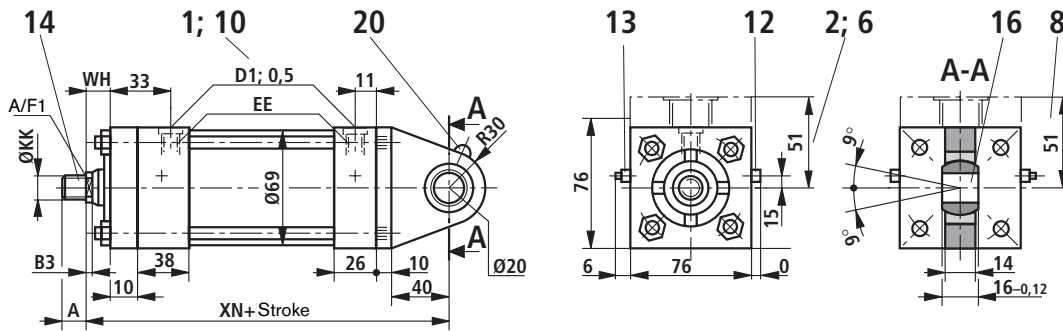


Piston rod dia	ØRD _{f7}	VD	WH	ZJ	ZM	B2	B3	A/F1	Cushion length	
									Full bore end	Rod end
22	38	13	25	127	174	12	8	19	22	23
25	38	13	25	127	174	12	8	22		
36	50	16	32	134	188	8	10	30		

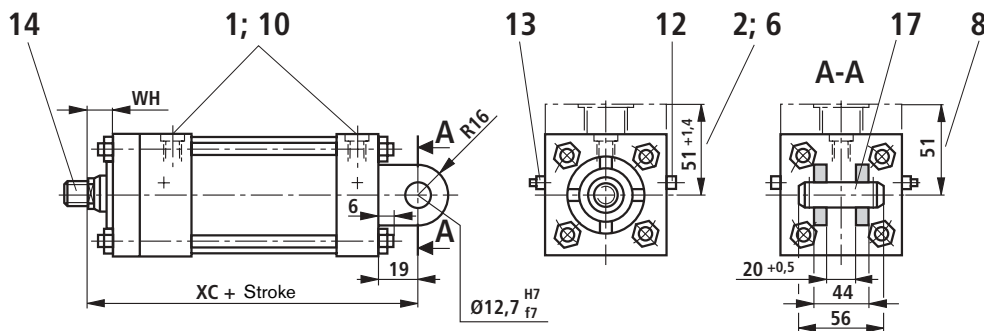
Piston dia. 63 (dimensions in mm)

For the explanation of positions and definitions, see page 7

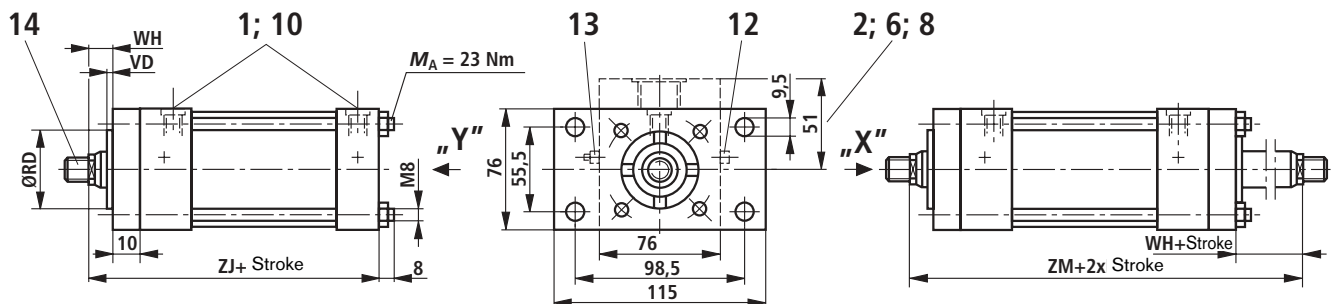
Mounting type: B **Operating Pressure 70 bar**



Mounting type: G **Operating Pressure 70 bar**



Mounting type: C **Operating Pressure** for rod dia 25 und 28: 20 bar at cap end; 70 bar Rod end
Operating Pressure for rod dia 36 und 45: 10 bar at cap end; 70 bar Rod end



Stroke_{min} = 30 mm for thread type „E“
(only for double rod cylinders)

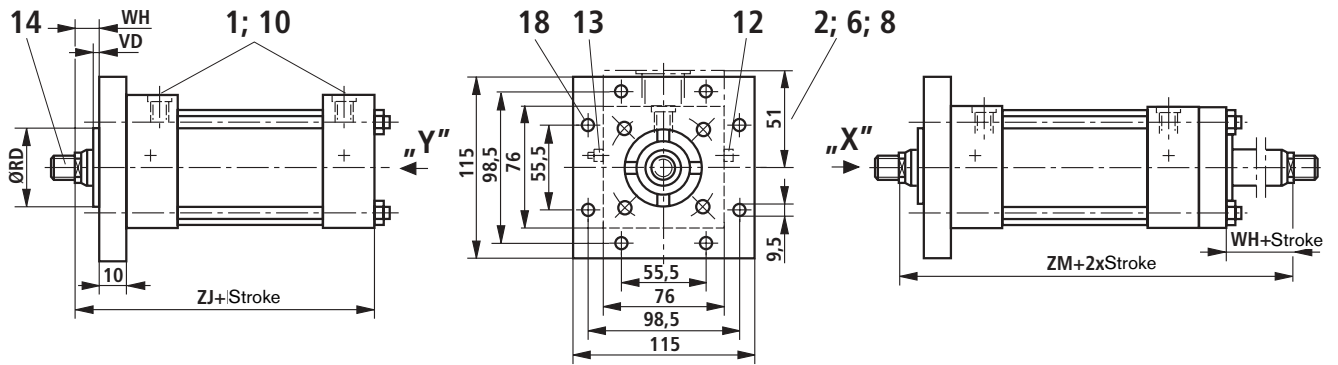
Piston rod dia	KK			A		EE				D1						
	Thread type						Port									
	C, E	B	F	C, E, B	F	01	13	02	14	01	13	02	14			
25	M20 x 1,5	M22 x 1,5	M24 x 2	28	36	G 1/4	G 3/8	M14 x 1,5	M16 x 1,5	25	28	25	28			
28	M20 x 1,5	M22 x 1,5	M24 x 2	28	36											
36	M26 x 1,5	M30 x 2	M24 x 2	41	36											
45	M33 x 2	M39 x 2	M24 x 2	51	36											

Piston dia. 63 (dimensions in mm)

For the explanation of positions and definitions, see page 7

Mounting type: H

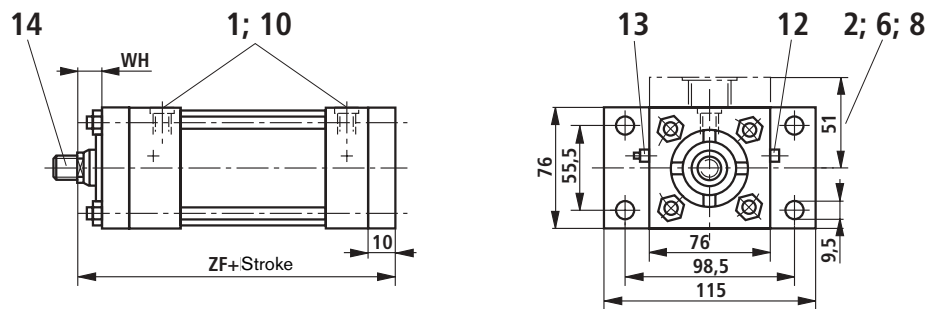
Operating Pressure 70 bar



Stroke_{min} = 30 mm for thread type „E“
(only for double rod cylinders)

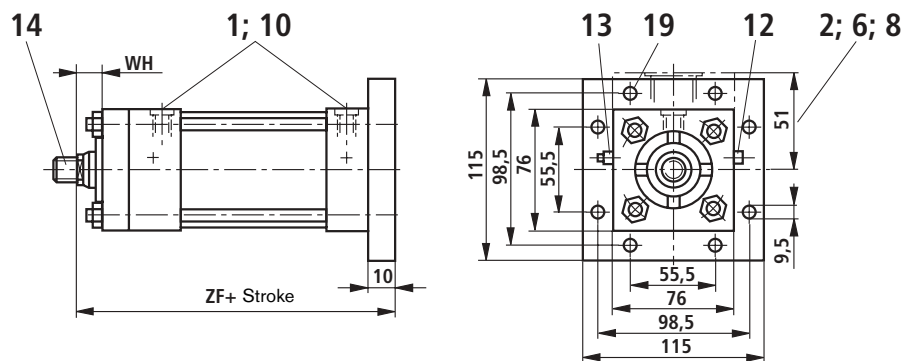
Mounting type: D

Operating Pressure 70 bar



Mounting type: K

Operating Pressure 70 bar



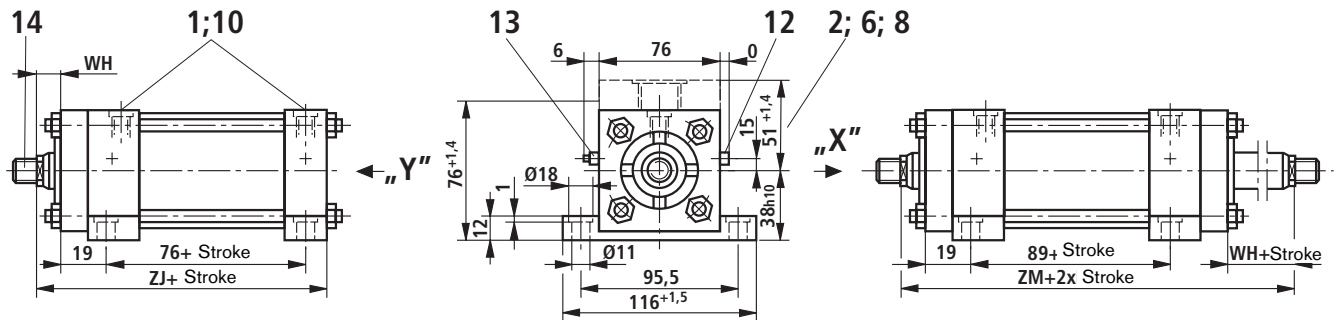
Piston rod dia	ØRD _{f7}	VD	WH	XC	XN	ZF	ZJ	ZM	B3	A/F1	Cushion length	
											Full bore end	Rod end
25	38	13	25	149	180	140	130	177	8	22	22	23
28	42	13	25	149	180	140	130	177	8	22		
36	50,7	16	32	156	187	147	137	191	10	30		
45	60	19	38	162	193	153	143	203	12	41		

Piston dia. 63 (dimensions in mm)

For the explanation of positions and definitions, see page 7

Mounting type: F

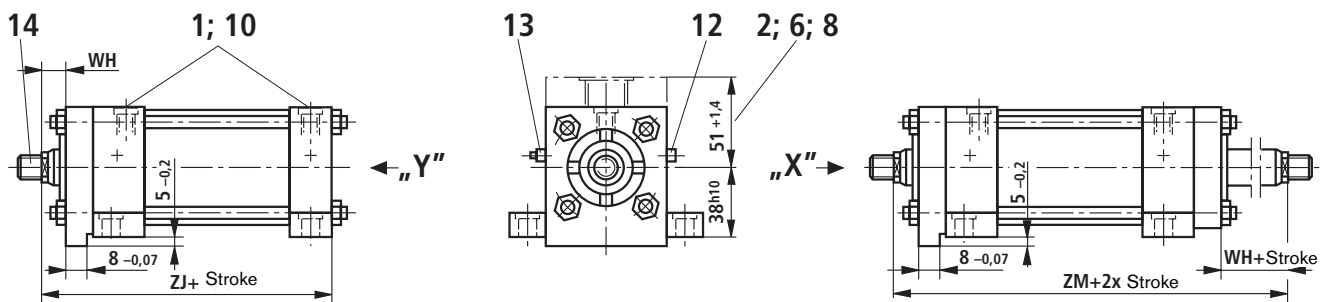
Operating Pressure 70 bar



Stroke_{min} = 30 mm for thread type „E“
(only for double rod cylinders)

Mounting type: L

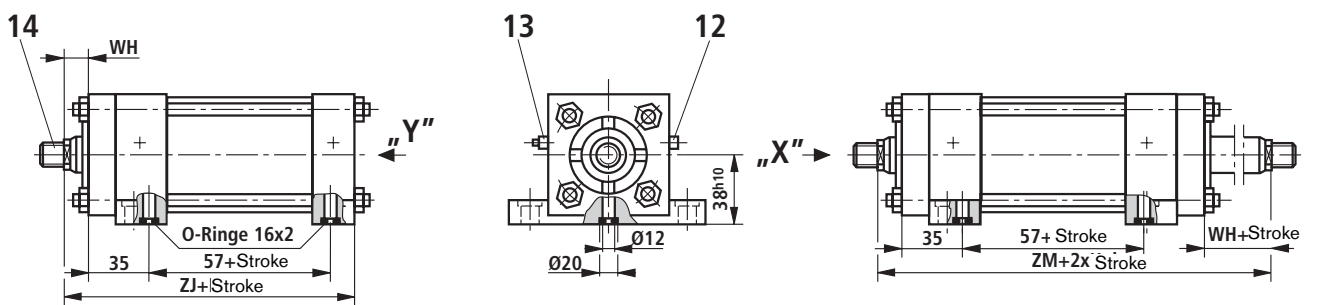
Operating Pressure 70 bar



Stroke_{min} = 30 mm for thread type „E“
(only for double rod cylinders)

Mounting type: M

Operating Pressure 70 bar

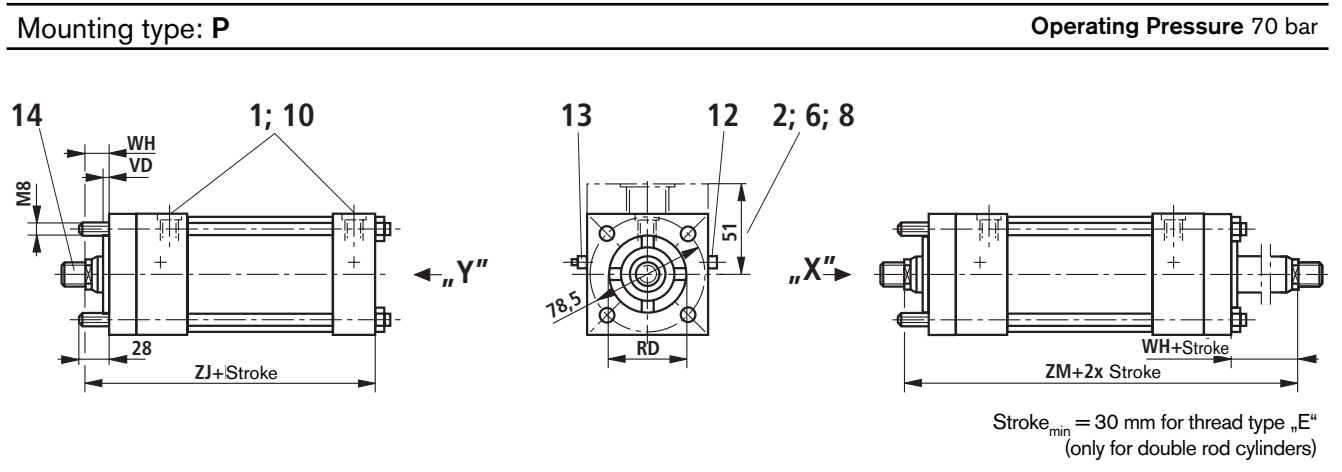
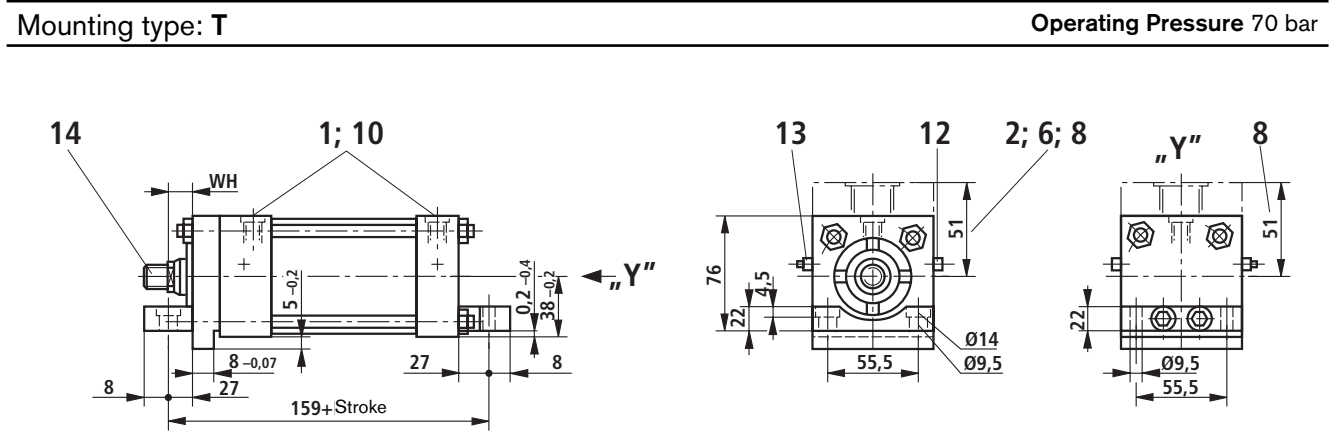
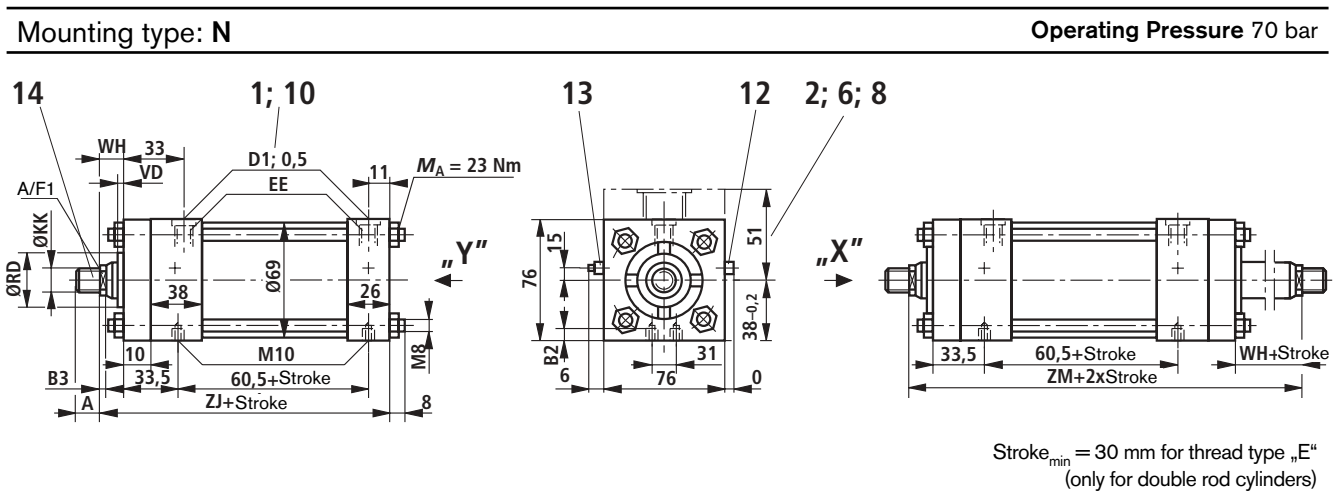


Stroke_{min} = 30 mm for thread type „E“
(only for double rod cylinders)

Piston rod dia	ØRD _{f7}	VD	WH	XG	XJ	XV	ZJ	ZM	B3	A/F1	Cushion length	
											Full bore end	Rod end
25	38	13	25	53,5	117	88,5	130	177	8	22	22	23
28	42	13	25	53,5	117	88,5	130	177	8	22		
36	50,7	16	32	60,5	124	95,5	137	191	10	30		
45	60	19	38	66,5	130	101,5	143	203	12	41		

Piston dia. 63 (dimensions in mm)

For the explanation of positions and definitions, see page 7



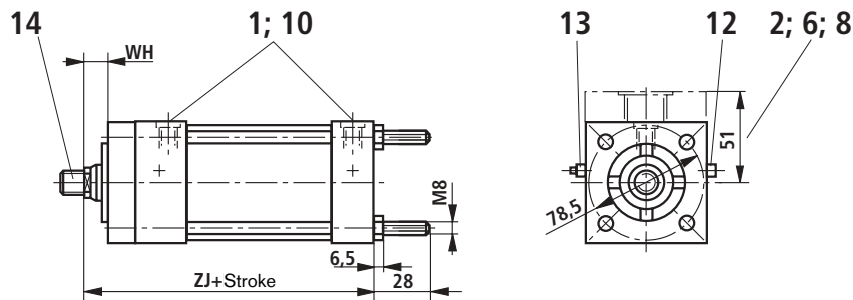
Piston rod dia	KK			A		EE				D1			
	Thread type					Port							
	C, E	B	F	C, E, B	F	01	13	02	14	01	13	02	14
25	M20 x 1,5	M22 x 1,5	M24 x 2	28	36	G 1/4	G 3/8	M14 x 1,5	M16 x 1,5	25	28	25	28
28	M20 x 1,5	M22 x 1,5	M24 x 2	28	36								
36	M26 x 1,5	M30 x 2	M24 x 2	41	36								
45	M33 x 2	M39 x 2	M24 x 2	51	36								

Piston dia. 63 (dimensions in mm)

For the explanation of positions and definitions, see page 7

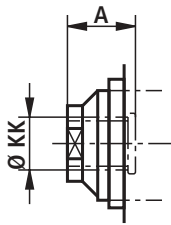
Mounting type: **Q**

Operating Pressure 70 bar

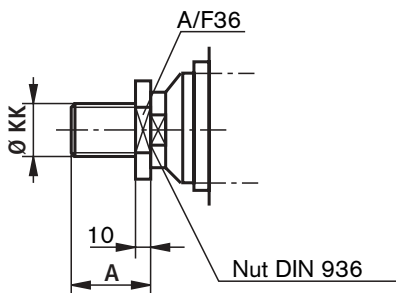


Additional thread types

Thread type „E”



Thread type „F”



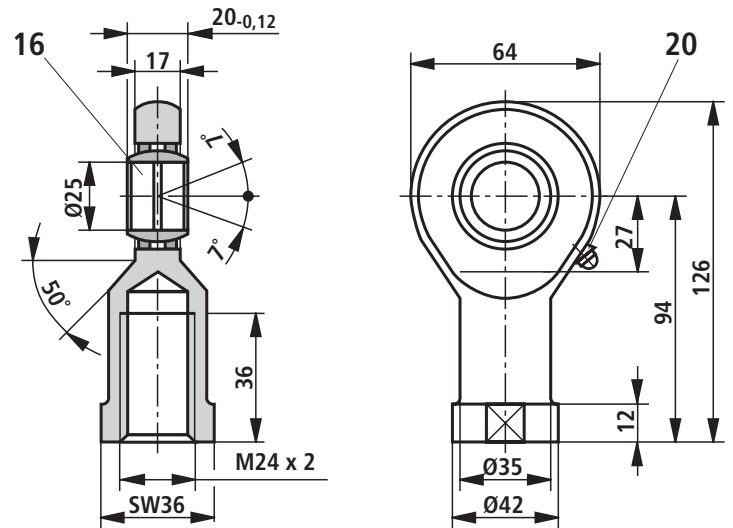
Clevis head CGK 25

to suit

Thread type „F”

Ordering code.: R900001330

Weight: 0,6 kg



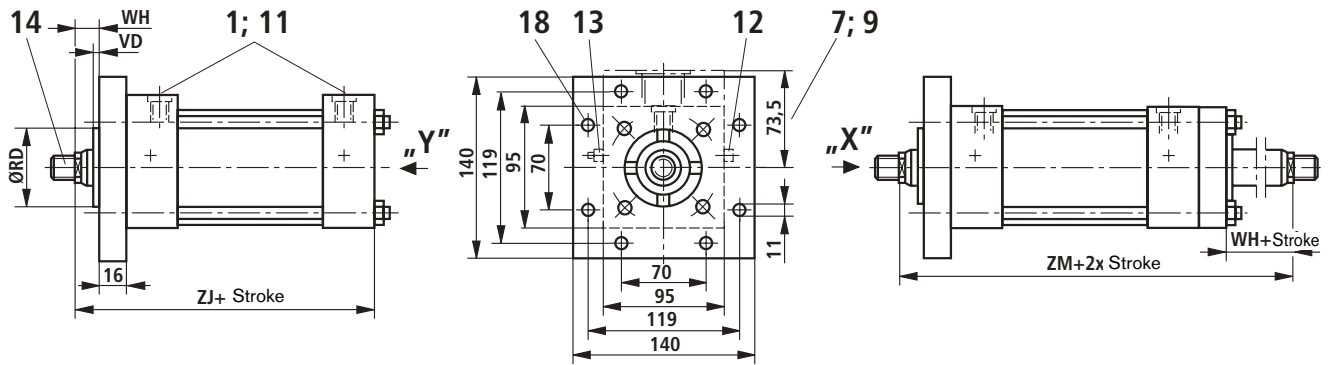
Piston rod dia	ØRD _{f7}	VD	WH	ZJ	ZM	B2	B3	A/F1	Cushion length	
									Full bore end	Rod end
25	38	13	25	130	177	15	8	22	22	23
28	42	13	25	130	177	16	8	22		
36	50,7	16	32	137	191	9	10	30		
45	60	19	38	143	203	9	12	41		

Piston dia. 80 (dimensions in mm)

For the explanation of positions and definitions, see page 7

Mounting type: H

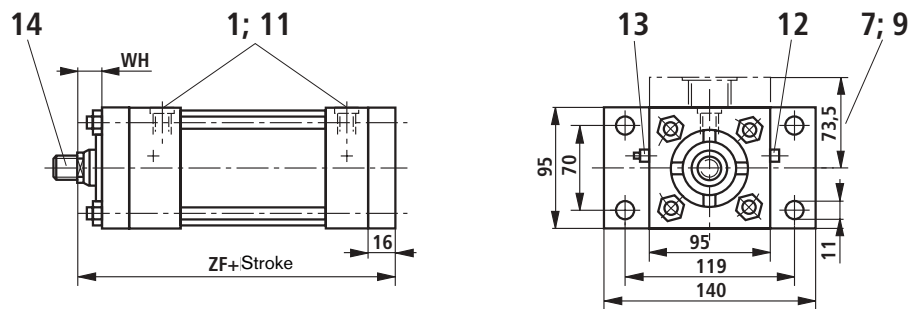
Operating Pressure 70 bar



Stroke_{min} = 30 mm for thread type „E“
(only for double rod cylinders)

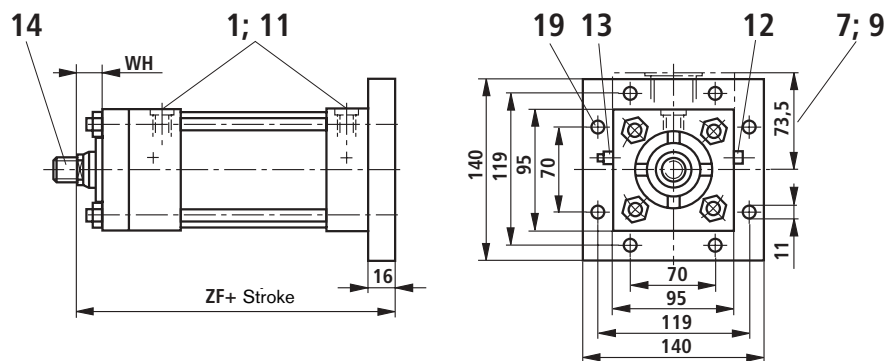
Mounting type: D

Operating Pressure 70 bar



Mounting type: K

Operating Pressure 70 bar



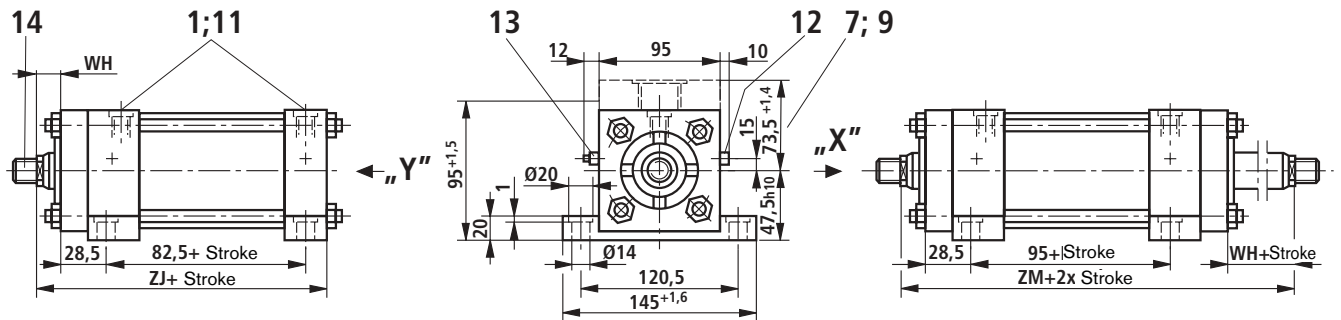
Piston rod dia	ØRD _{f7}	VD	WH	XC	XN	ZF	ZJ	ZM	B3	A/F1	Cushion length	
											Full bore end	Rod end
36	50	10	25	181	209	165	149	202	10	30	27	25
45	60	13	32	188	216	172	156	216	12	41		
36	70	13	35	191	219	175	159	222	15	46		

Piston dia. 80 (dimensions in mm)

For the explanation of positions and definitions, see page 7

Mounting type: F

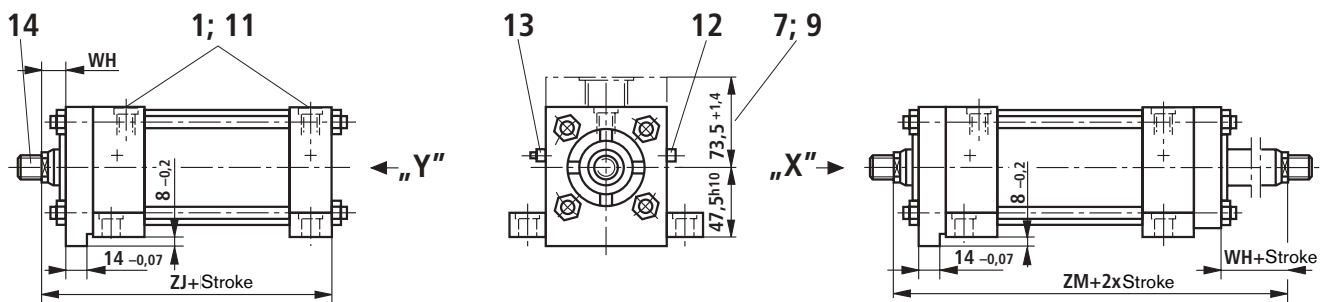
Operating Pressure 70 bar



Stroke_{min} = 30 mm for thread type „E“
(only for double rod cylinders)

Mounting type: L

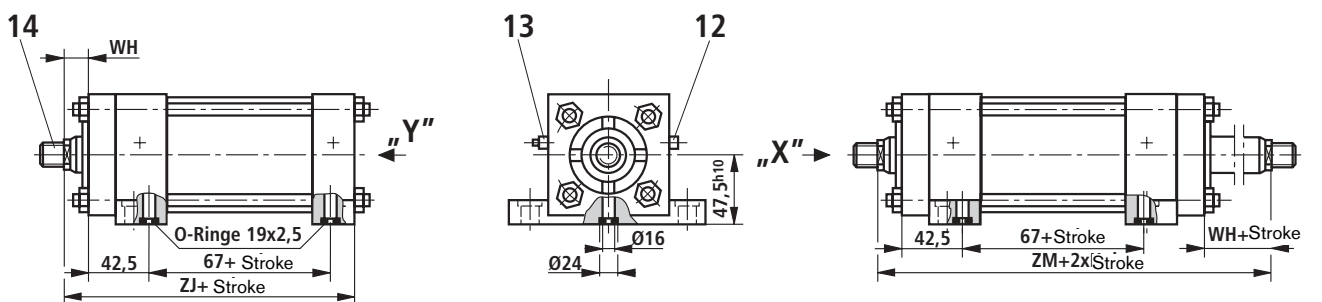
Operating Pressure 70 bar



Stroke_{min} = 30 mm for thread type „E“
(only for double rod cylinders)

Mounting type: M

Operating Pressure 70 bar



Stroke_{min} = 30 mm for thread type „E“
(only for double rod cylinders)

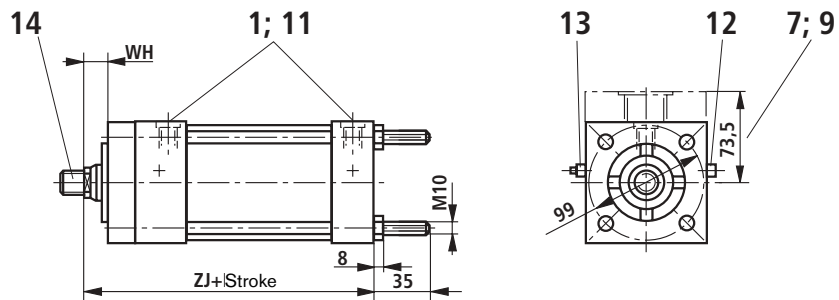
Piston rod dia	ØRD _{f7}	VD	WH	XG	XJ	XV	ZJ	ZM	B3	A/F1	Cushion length	
											Full bore end	Rod end
36	50	10	25	63,5	133	101	149	202	10	30	27	25
45	60	13	32	70,5	140	108	156	216	12	41		
56	70	13	35	73,5	143	111	159	222	15	46		

Piston dia. 80 (dimensions in mm)

For the explanation of positions and definitions, see page 7

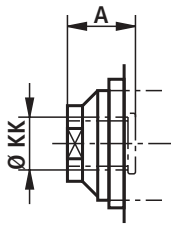
Mounting type: **Q**

Operating Pressure 70 bar

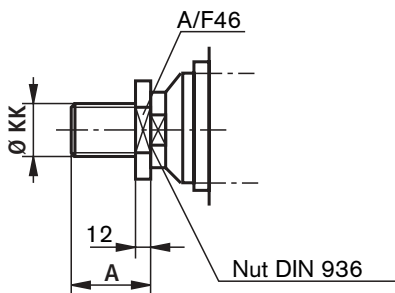


Additional thread types

Thread type „E”



Thread type „F”



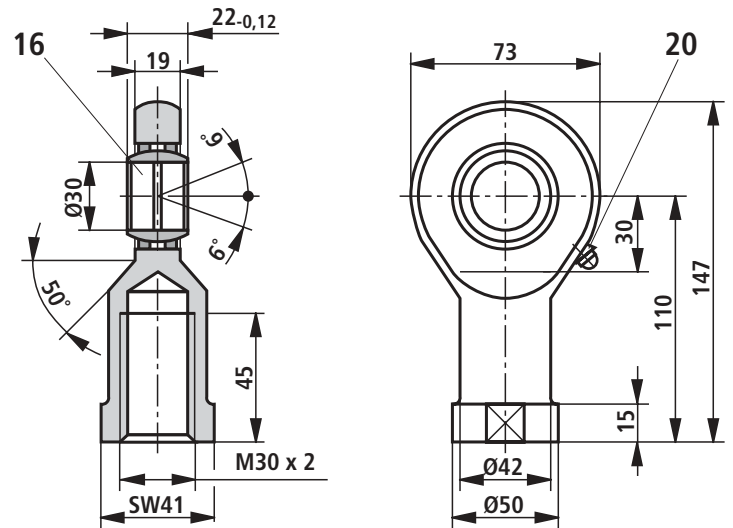
Clevis head CGK 30

to suit

Thread type „F”

Ordering code.: R900001331

Weight: 0,9 kg



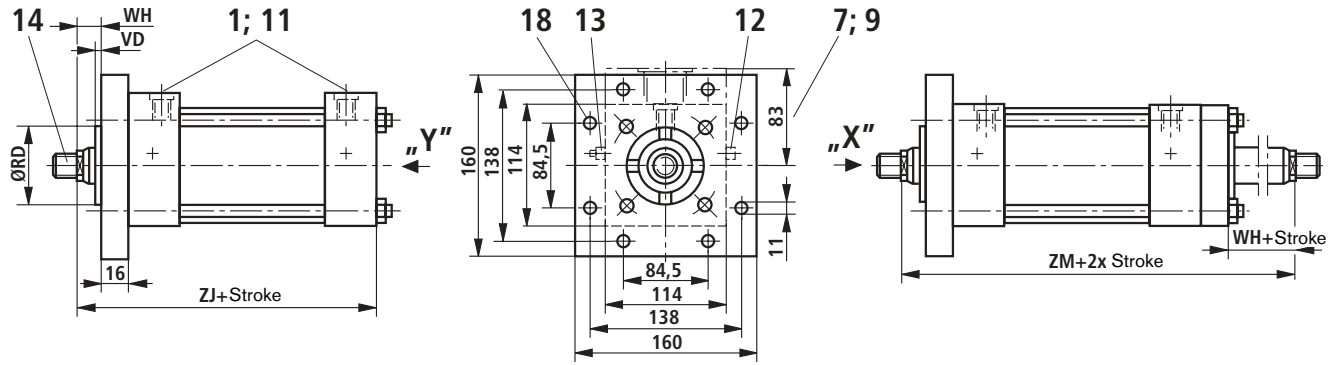
Piston rod dia	ØRD _{f7}	VD	WH	ZJ	ZM	B2	B3	A/F1	Cushion length	
									Full bore end	Rod end
36	50	10	25	149	202	20	10	30	27	25
45	60	13	32	156	216	13	12	41		
56	70	13	35	159	222	13	15	46		

Piston dia. 100 (dimensions in mm)

For the explanation of positions and definitions, see page 7

Mounting type: H

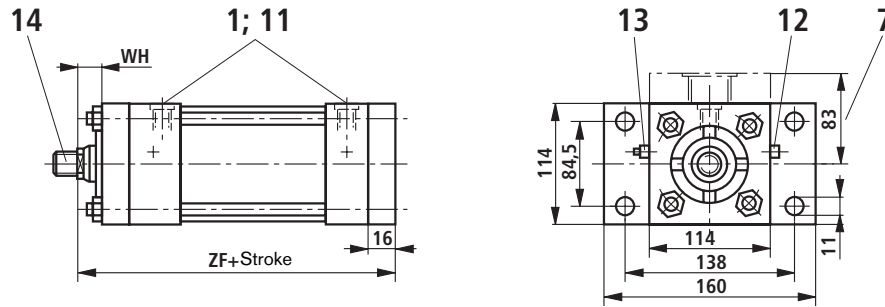
Operating Pressure 70 bar



Stroke_{min} = 45 mm for thread type „E“
(only for double rod cylinders)

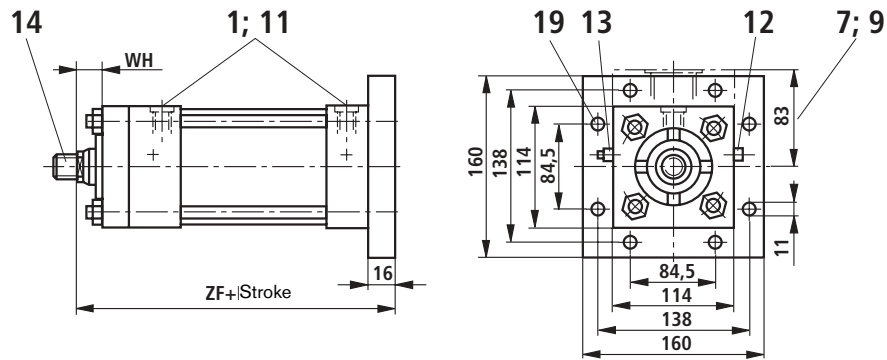
Mounting type: D

Operating Pressure 70 bar



Mounting type: K

Operating Pressure 70 bar



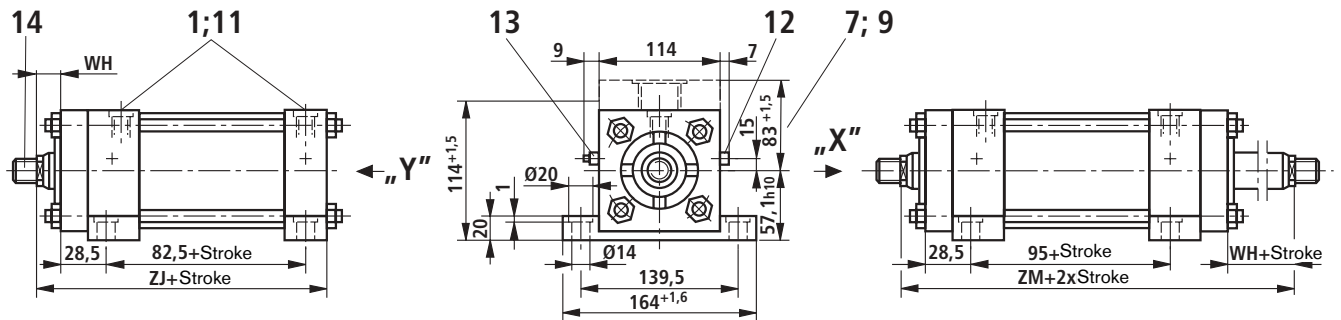
Piston rod dia	ØRD _{f7}	VD	WH	XC	XN	ZF	ZJ	ZM	B3	A/F1	Cushion length	
											Full bore end	rod end
45	60	13	32	188	226	172	156	216	12	41	27	25
50	66,6	13	35	191	229	175	159	222	15	46		
70	90	16	41	197	235	181	165	234	15	60		

Piston dia. 100 (dimensions in mm)

For the explanation of positions and definitions, see page 7

Mounting type: F

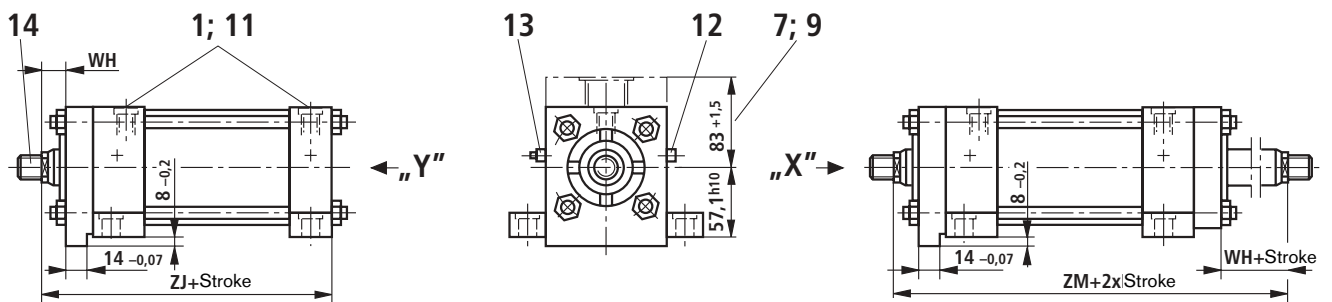
Operating Pressure 70 bar



Stroke_{min} = 45 mm for thread type „E“
(only for double rod cylinders)

Mounting type: L

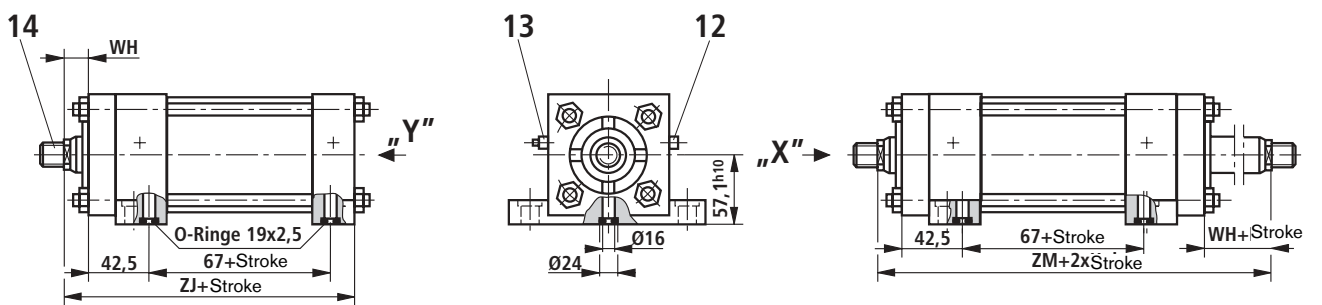
Operating Pressure 70 bar



Stroke_{min} = 45 mm for thread type „E“
(only for double rod cylinders)

Mounting type: M

Operating Pressure 70 bar



Stroke_{min} = 45 mm for thread type „E“
(only for double rod cylinders)

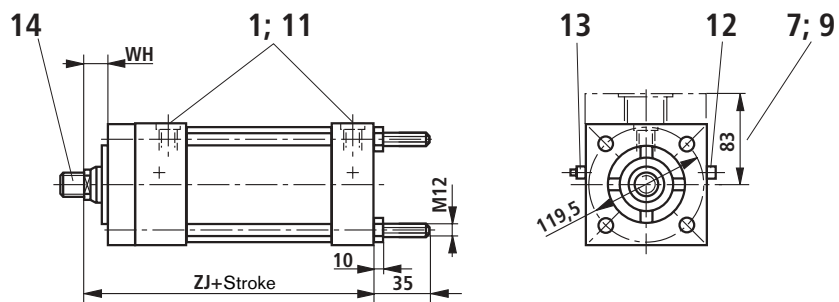
Piston rod dia	ØRD _{f7}	VD	WH	XG	XJ	XV	ZJ	ZM	B3	A/F1	Cushion length	
											Full bore end	Rod end
45	60	13	32	70	140	108	156	216	12	41	27	25
50	66,6	13	35	73	143	111	159	222	15	46		
70	90	16	41	79	149	117	165	234	15	60		

Piston dia. 100 (dimensions in mm)

For the explanation of positions and definitions, see page 7

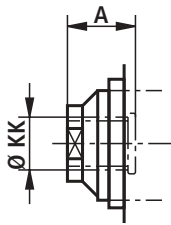
Mounting type: **Q**

Operating Pressure 70 bar

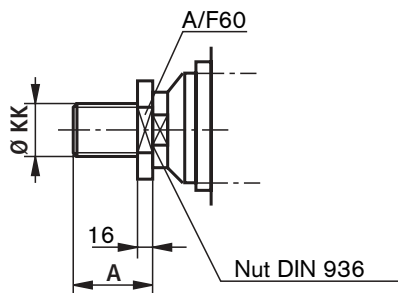


Additional thread types

Thread type „E”



Thread type „F”



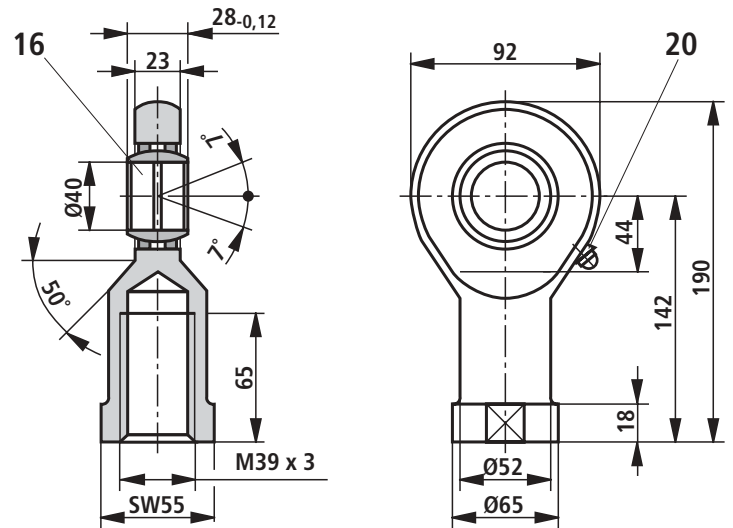
Clevis head CGK 40

to suit

Thread type „F”

Ordering code.: R900001332

Weight: 2 kg



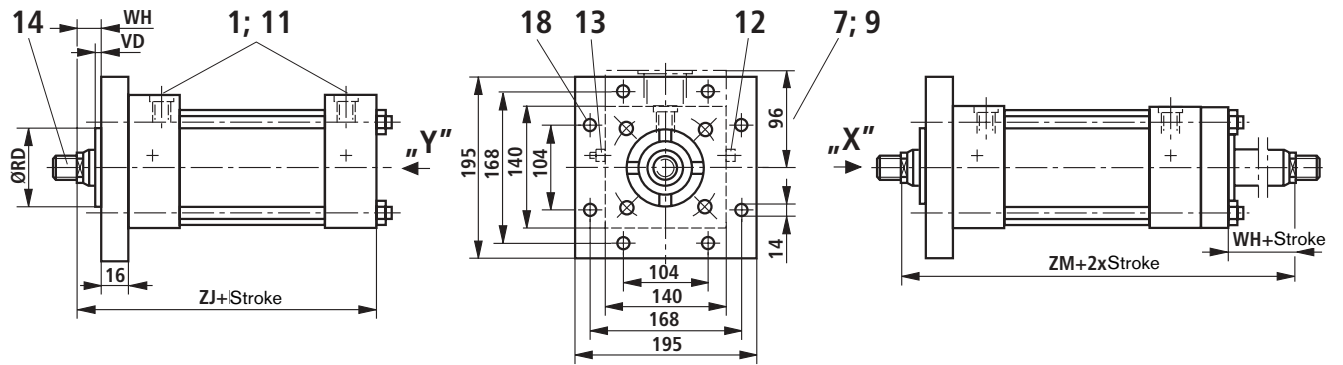
Piston rod dia	ØRD _{f7}	VD	WH	ZJ	ZM		B2	B3	A/F1	Cushion length	
										Full bore end	Rod end
45	60	13	32	156	216		25	12	41	27	25
50	66,6	13	35	159	222		20	15	46		
70	90	16	41	165	234		15	15	60		

Piston dia. 125 (dimensions in mm)

For the explanation of positions and definitions, see page 7

Mounting type: H

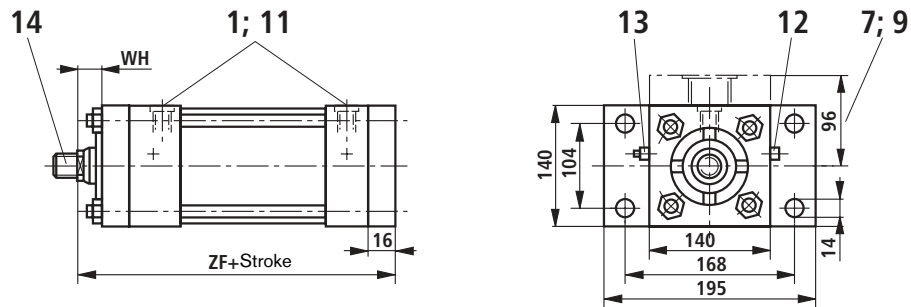
Operating Pressure 70 bar



Stroke_{min} = 55 mm for thread type „E“
(only for double rod cylinders)

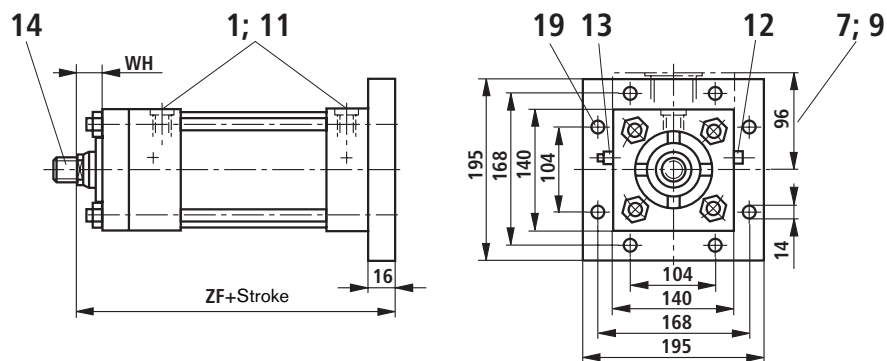
Mounting type: D

Operating Pressure 70 bar



Mounting type: K

Operating Pressure 70 bar



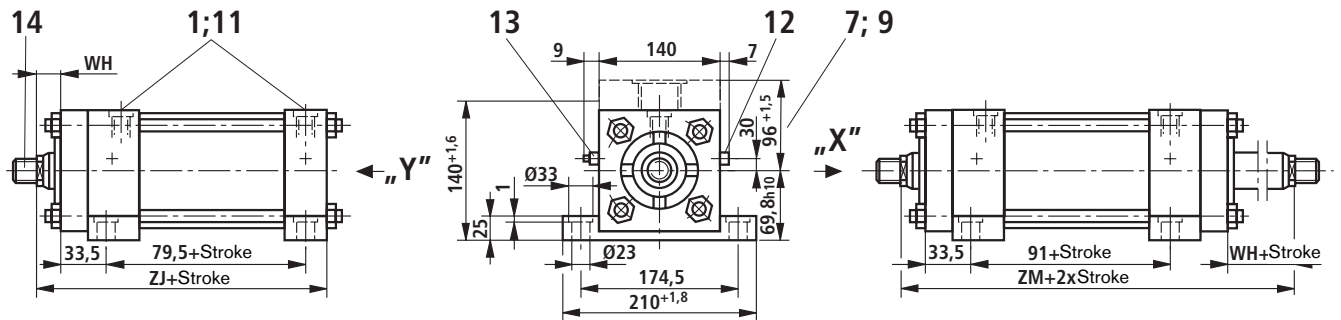
Piston rod dia	ØRD _{f7}	VD	WH	XC	XN	ZF	ZJ	ZM	A/F1	Cushion length	
										Full bore end	Rod end
50	66,6	13	35	197	245	181	165	228	46	27	25
56	70	13	35	197	245	181	165	228	46		
63	79,3	16	41	203	251	187	171	240	55		
90	108	16	41	203	251	187	171	240	75		

Piston dia. 125 (dimensions in mm)

For the explanation of positions and definitions, see page 7

Mounting type: F

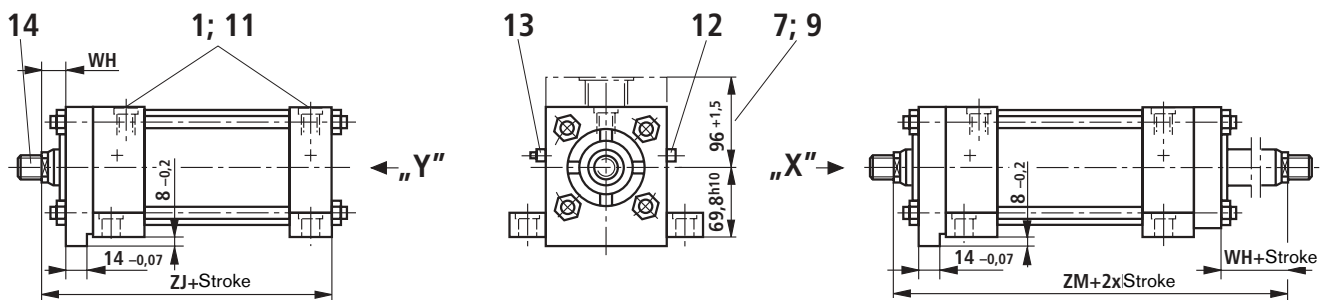
Operating Pressure 70 bar



Stroke_{min} = 55 mm for thread type „E“
(only for double rod cylinders)

Mounting type: L

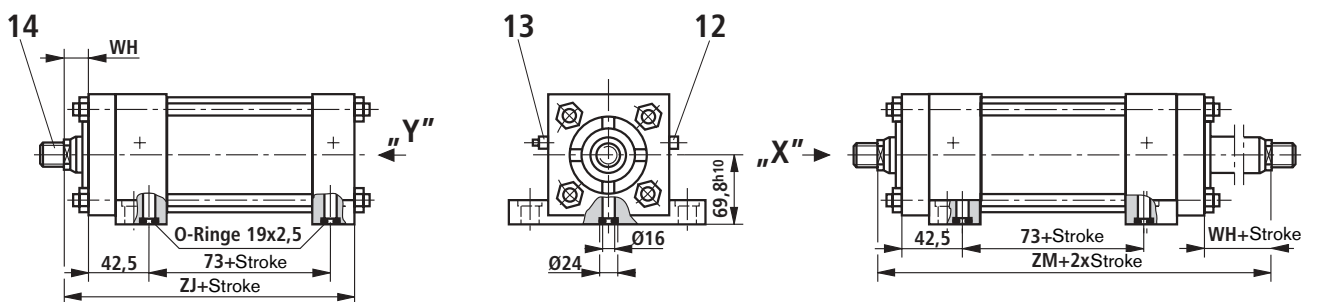
Operating Pressure 70 bar



Stroke_{min} = 55 mm for thread type „E“
(only for double rod cylinders)

Mounting type: M

Operating Pressure 70 bar



Stroke_{min} = 55 mm for thread type „E“
(only for double rod cylinders)

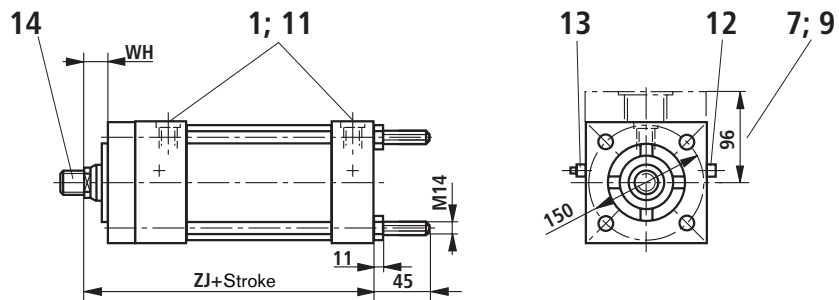
Piston rod dia	ØRD _{f7}	VD	WH	XG	XJ	XV	ZJ	ZM	A/F1	Cushion length	
										Full bore end	Rod end
50	66,6	13	35	73	149,5	114	165	228	46	27	25
56	70	13	35	73	149,5	114	165	228	46		
63	79,3	16	41	79	155,5	120	171	240	55		
90	108	16	41	79	155,5	120	171	240	75		

Piston dia. 125 (dimensions in mm)

For the explanation of positions and definitions, see page 7

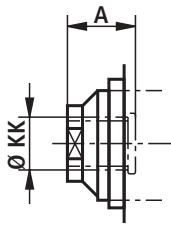
Mounting type: **Q**

Operating Pressure 70 bar

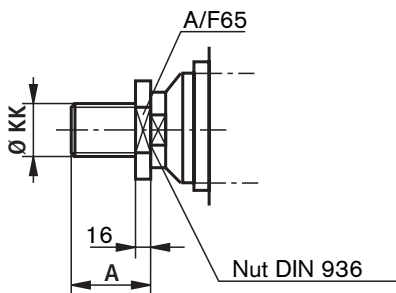


Additional thread types

Thread type „E”



Thread type „F”



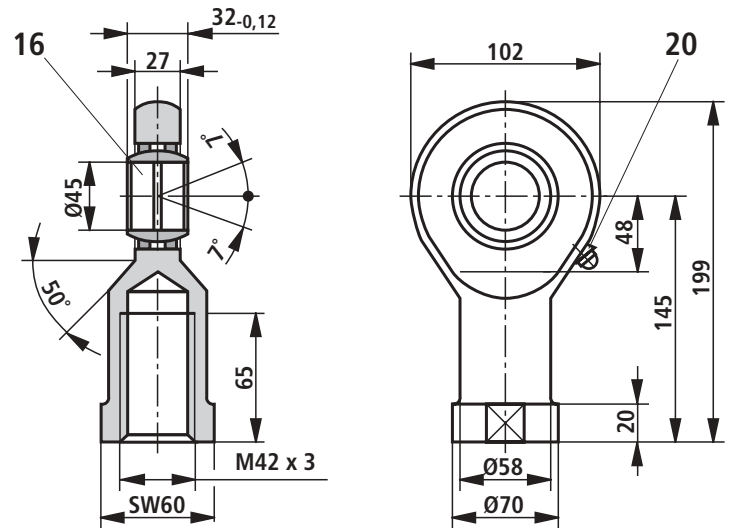
Clevis head CGK 45

to suit

Thread type „F”

Ordering code.: R900001333

Weight: 2,7 kg

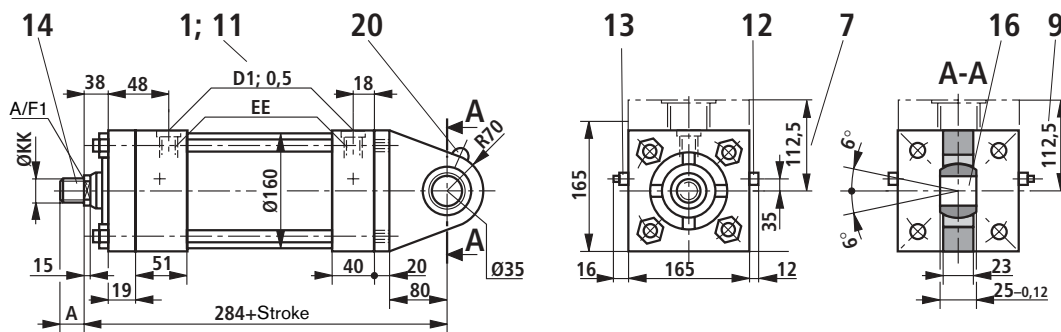


Piston rod dia	ØRD _{f7}	VD	WH	ZJ	ZM	B2	A/F1	Cushion length	
								Full bore end	Rod end
50	66,6	13	35	165	228	25	46	27	25
56	70	13	35	165	228	25	46		
63	79,3	16	41	171	240	19	55		
90	108	16	41	171	240	19	75		

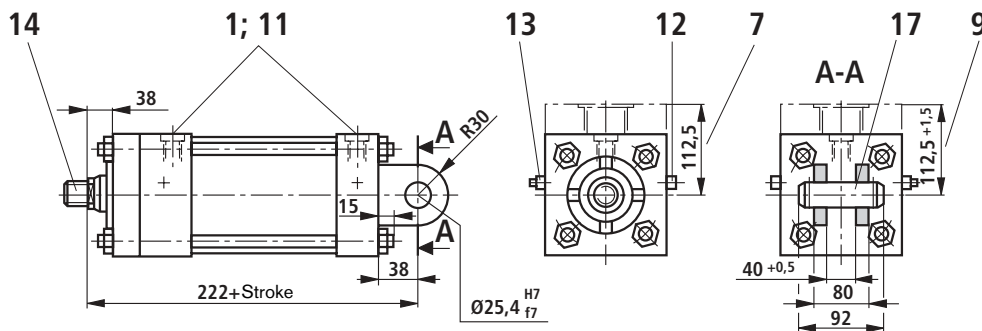
Piston dia. 150 (dimensions in mm)

For the explanation of positions and definitions, see page 7

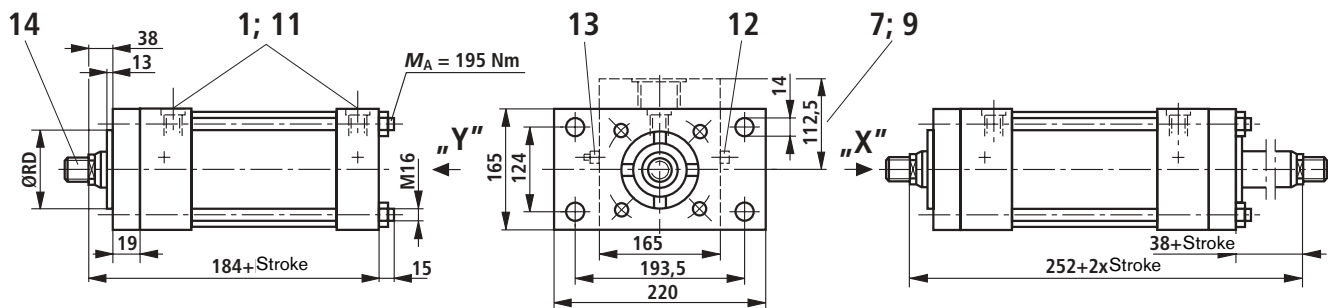
Mounting type: B **Operating Pressure 50 bar**



Mounting type: G **Operating Pressure 50 bar**



Mounting type: C **Operating Pressure** for rod dia 63 und 70: 20 bar at cap end; 50 bar Rod end
Operating Pressure for rod dia 80 und 100: 15 bar at cap end; 50 bar Rod end



Stroke_{min} = 75 mm for thread type „E“
(only for double rod cylinders)

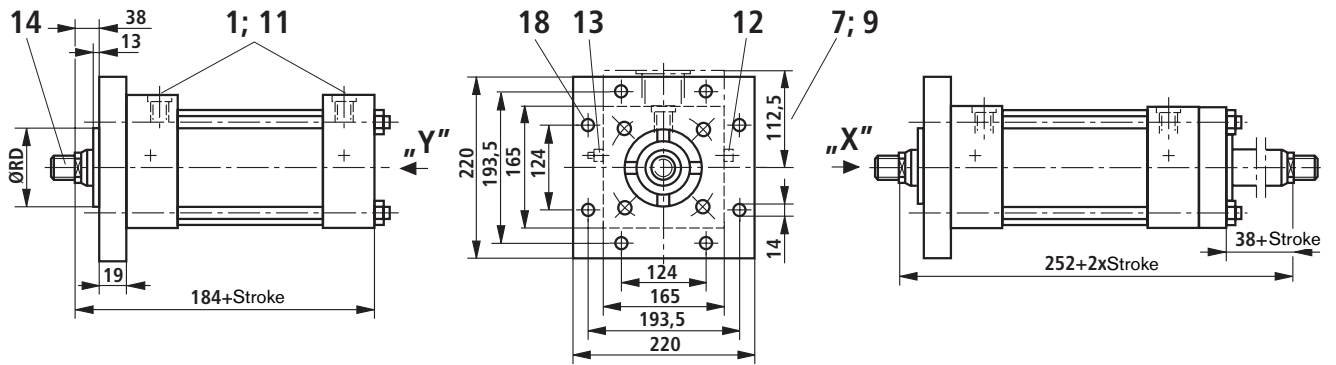
Piston rod dia	KK			A		EE				D1				
	Thread type						Port							
	C, E	B	F	C, E, B	F	01	13	02	14	01	13	02	14	
63	M48 x 2	M56 x 2	M45 x 3	76	68	G 3/4	G 1	M26 x 1,5	M33 x 2	42	42	42	42	
70	M48 x 2	M56 x 2	M45 x 3	76	68									
80	M58 x 2	M68 x 2	M45 x 3	89	68									
100	M76 x 2	M95 x 2	M45 x 3	101	68									

Piston dia. 150 (dimensions in mm)

For the explanation of positions and definitions, see page 7

Mounting type: H

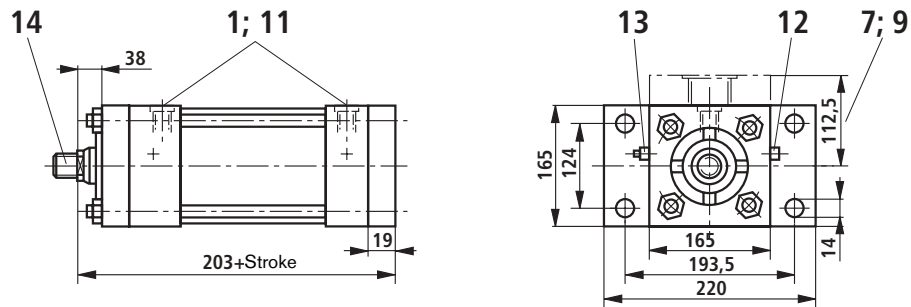
Operating Pressure 50 bar



Stroke_{min} = 75 mm for thread type „E“
(only for double rod cylinders)

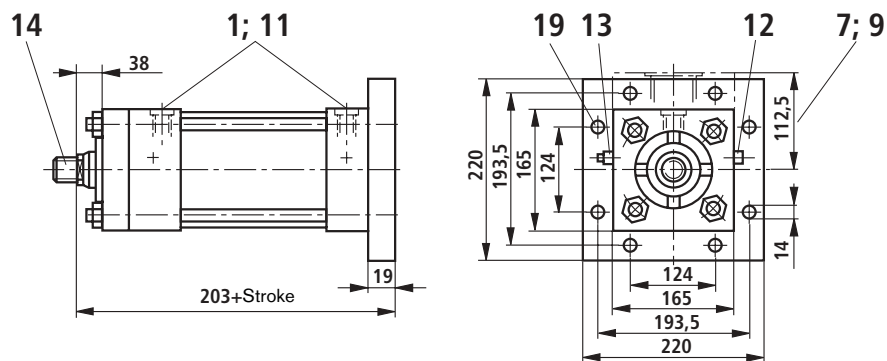
Mounting type: D

Operating Pressure 50 bar



Mounting type: K

Operating Pressure 50 bar



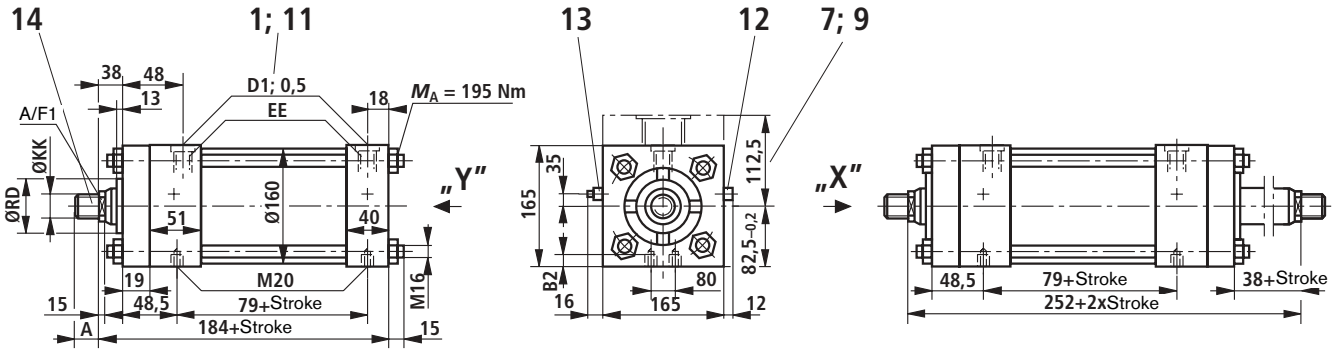
Piston rod dia	ØRD _{F1}						A/F1	Cushion length	
								Full bore end	Rod end
63	79,3						55	32	30
70	90						60		
80	95,2						75		
100	120						85		

Piston dia. 150 (dimensions in mm)

For the explanation of positions and definitions, see page 7

Mounting type: N

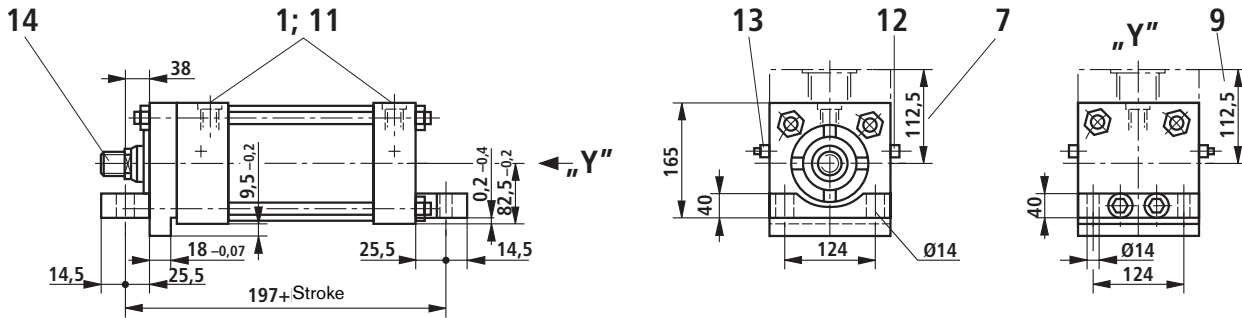
Operating Pressure 50 bar



Stroke_{min} = 75 mm for thread type „E“
(only for double rod cylinders)

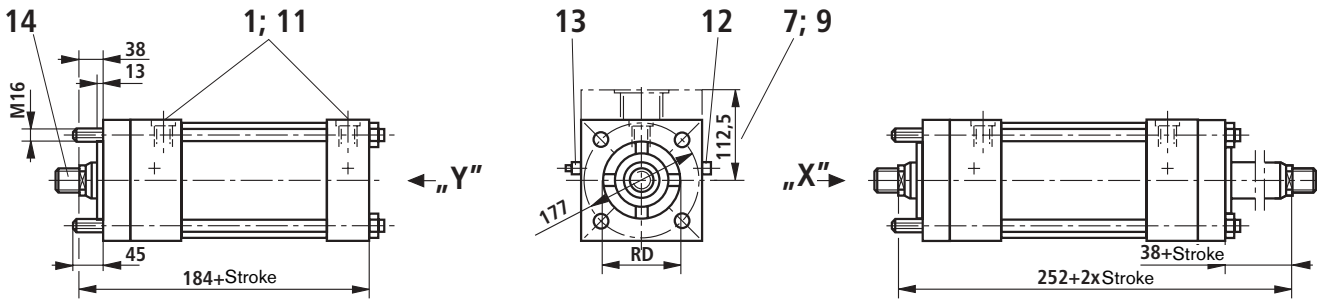
Mounting type: T

Operating Pressure 50 bar



Mounting type: P

Operating Pressure 50 bar



Stroke_{min} = 75 mm for thread type „E“
(only for double rod cylinders)

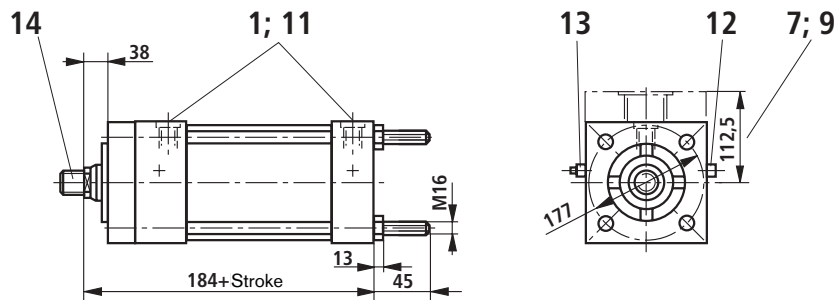
Piston rod dia	KK			A		EE				D1				
	Thread type						Port							
	C, E	B	F	C, E, B	F	01	13	02	14	01	13	02	14	
63	M48 x 2	M56 x 2	M45 x 3	76	68	G 3/4	G 1	M26 x 1,5	M33 x 2	42	42	42	42	
70	M48 x 2	M56 x 2	M45 x 3	76	68					42	42	42	42	
80	M58 x 2	M68 x 2	M45 x 3	89	68					42	42	42	42	
100	M76 x 2	M95 x 2	M45 x 3	101	68					42	42	42	42	

Piston dia. 150 (dimensions in mm)

For the explanation of positions and definitions, see page 7

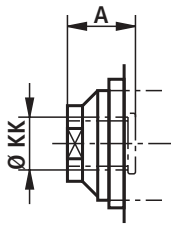
Mounting type: **Q**

Operating Pressure 50 bar

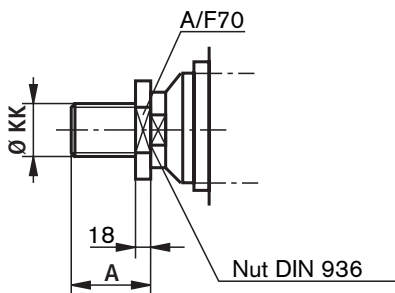


Additional thread types

Thread type „E”



Thread type „F”



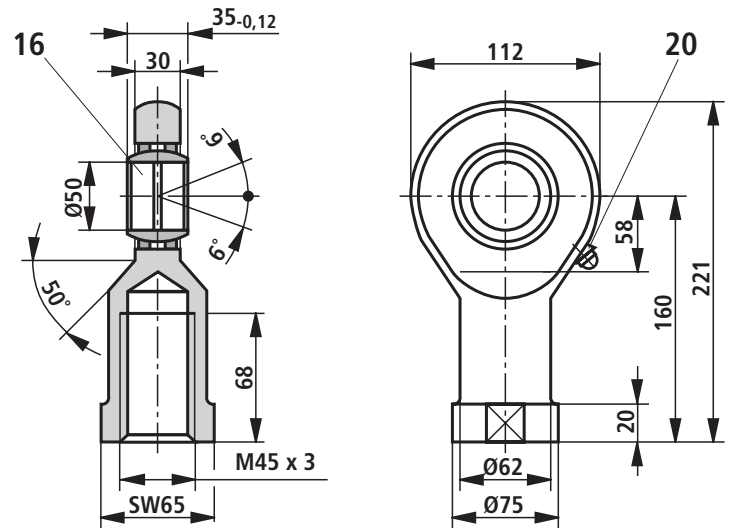
Clevis head CGK 50

to suit

Thread type „F”

Ordering code.: R900001334

Weight: 3,5 kg

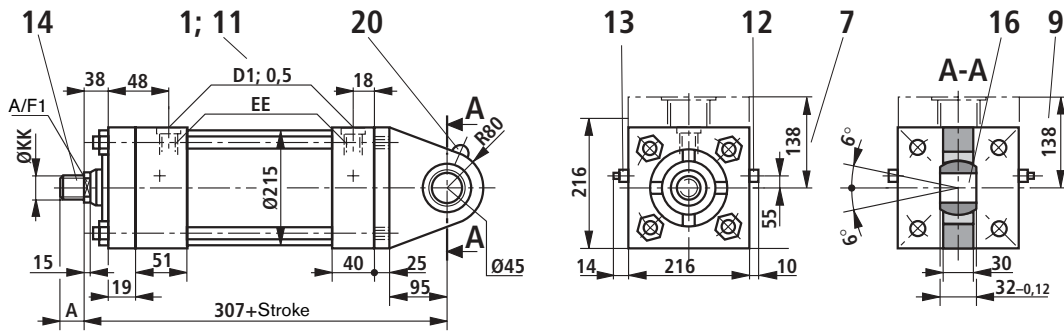


Piston rod dia	$\varnothing RD_{f7}$						B2	A/F1	Cushion length	
									Full bore end	Rod end
63	79,3						35	55	32	30
70	90						35	60		
80	95,2						30	75		
100	120						25	85		

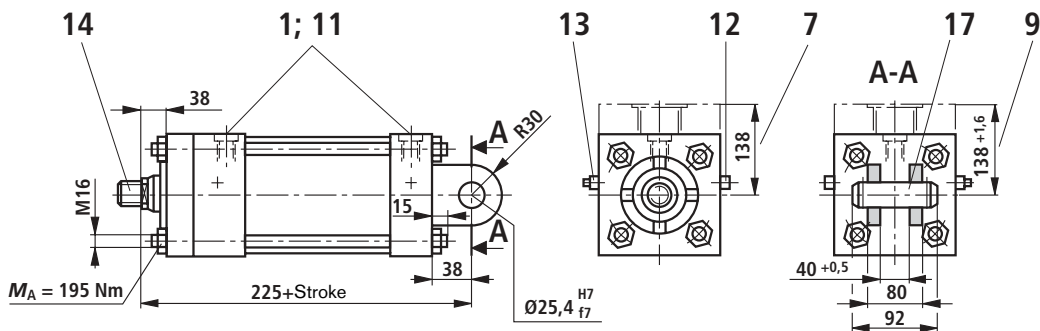
Piston dia. 200 (dimensions in mm)

For the explanation of positions and definitions, see page 7

Mounting type: B **Operating Pressure 40 bar**



Mounting type: G **Operating Pressure 40 bar**



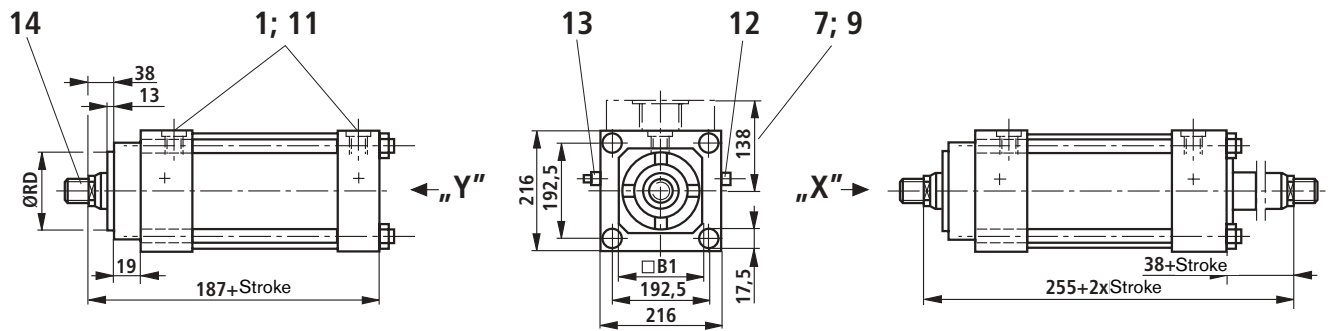
Piston rod dia	KK			A		EE				D1				
	Thread type						Port							
	C, E	B	F	C, E, B	F	01	13	02	14	01	13	02	14	
90	M64 x 2	M76 x 2	M52 x 3	89	70	G 3/4	G 1	M26 x 1,5	M33 x 2	42	42	42	42	
100	M76 x 2	M95 x 2	M52 x 3	101	70					42	42	42	42	
140	M100 x 2	M130 x 2	M52 x 3	140	70					42	42	42	42	

Piston dia. 200 (dimensions in mm)

For the explanation of positions and definitions, see page 7

Mounting type: **H**

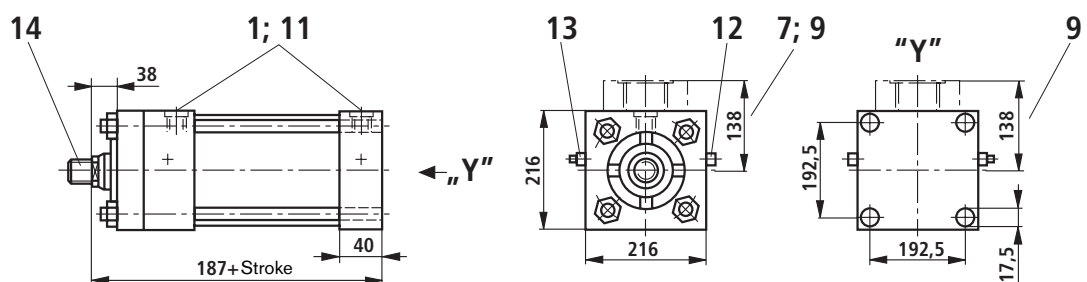
Operating Pressure 40 bar



Stroke_{min} = 115 mm for thread type „E“
(only for double rod cylinders)

Mounting type: **K**

Operating Pressure 40 bar



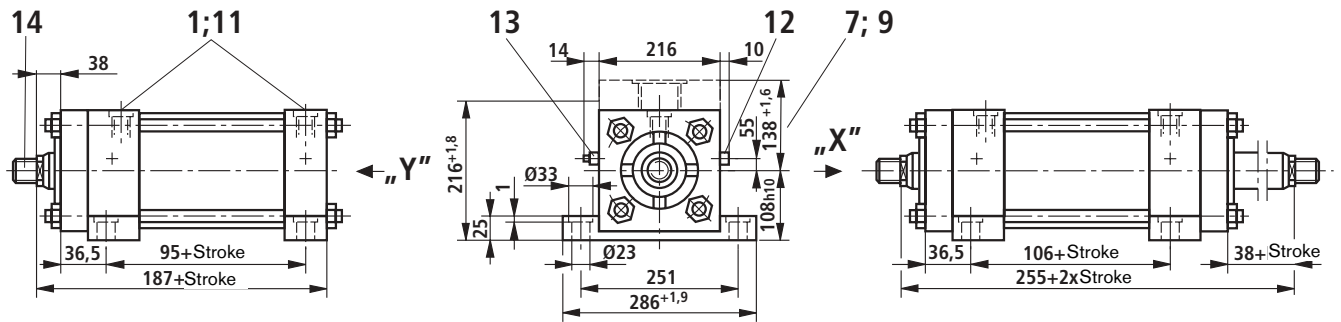
Piston rod dia	ØRD _{f7}							B1	A/F1	Cushion length	
										Full bore end	Rod end
90	108							140	75	32	30
100	120							140	85		
140	158							178	120		

Piston dia. 200 (dimensions in mm)

For the explanation of positions and definitions, see page 7

Mounting type: F

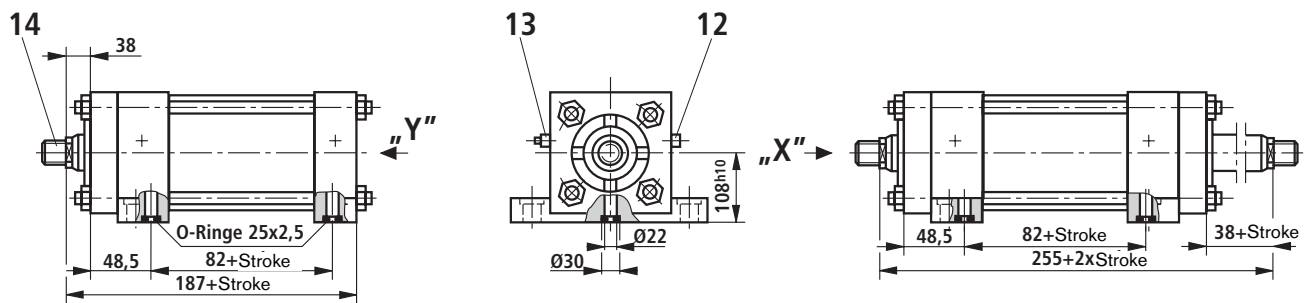
Operating Pressure 40 bar



Stroke_{min} = 115 mm for thread type „E“
(only for double rod cylinders)

Mounting type: M

Operating Pressure 40 bar



Stroke_{min} = 115 mm for thread type „E“
(only for double rod cylinders)

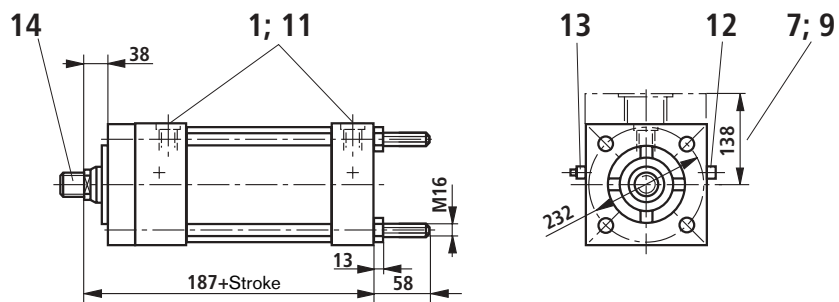
Piston rod dia	ØRD _{f7}						A/F1	Cushion length	
								Full bore end	Rod end
90	108						75	32	30
100	120						85		
140	158						120		

Piston dia. 200 (dimensions in mm)

For the explanation of positions and definitions, see page 7

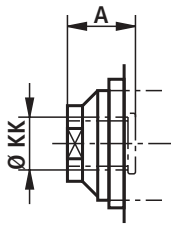
Mounting type: **Q**

Operating Pressure 40 bar

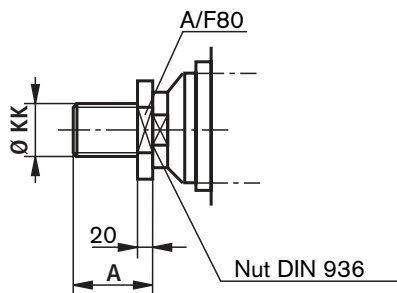


Additional thread types

Thread type „E”



Thread type „F”



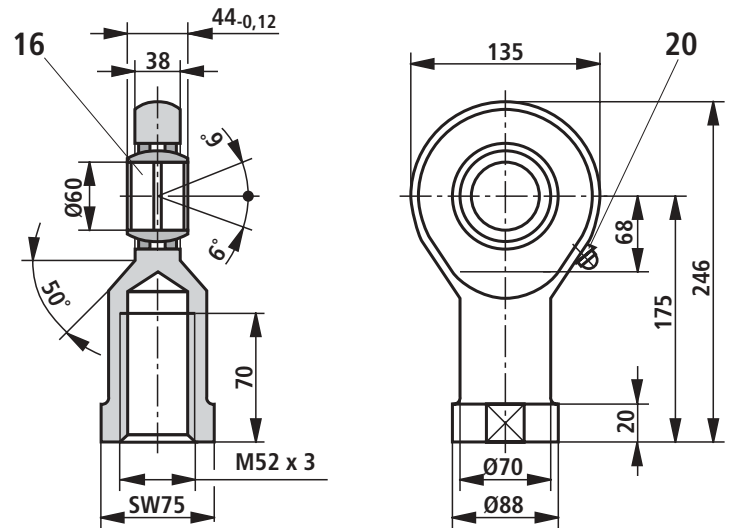
Clevis head CGK 60

to suit

Thread type „F”

Ordering code.: R900001335

Weight: 5,6 kg



Piston rod dia	$\varnothing RD_{f7}$						B2	A/F1	Cushion length	
									Full bore end	Rod end
90	108						40	75	32	30
100	120						40	85		
140	158						28	120		

Weight

Piston dia.		25		32			40			50		
Piston rod dia		12	16	18	22	25	16	18	25	22	25	36
Weight per 100 mm Stroke in kg	Single rod cylinder	0,3	0,37	0,5	0,6	0,7	0,55	0,6	0,8	0,9	1,0	1,3
	Double rod cylinder	0,4	0,52	0,7	0,9	1,0	0,75	0,8	1,2	1,2	1,3	2,1
Mounting type		CD	CG	CD	CG		CD	CG		CD	CG	
Weight bei 0-Stroke in kg	B	1,2	–	1,9	–		2,4	–		4,0	–	
	G	–	–	1,7	–		2,2	–		3,7	–	
	E	1,2	1,5	2,2	2,5		2,9	3,5		4,5	6,0	
	H	1,2	1,5	1,9	2,4		2,5	3,0		4,0	5,3	
	K, D	1,4	–	2,2	–		2,7	–		4,5	–	
	C, F, L, M, R, S, T	1,1	1,4	1,8	2,3		2,3	2,8		3,7	5,0	
	N, P, Q	1,1	1,4	1,5	2,0		2,0	2,6		3,4	4,7	

Piston dia.		63				80			100			
Piston rod dia		25	28	36	45	36	45	56	45	50	70	
Weight per 100 mm Stroke in kg	Single rod cylinder	1,1	1,2	1,5	1,9	1,7	2,2	2,8	2,4	2,7	4,1	
	Double rod cylinder	1,5	1,6	2,1	3,0	2,5	3,4	4,7	3,6	4,3	7,1	
Mounting type		CD	CG	CD	CG	CD	CG	CD	CG	CD	CG	
Weight bei 0-Stroke in kg	B	5,9	–	–	–	10,8	–	–	16,2	–	–	
	G	5,5	–	–	–	10,0	–	–	15,2	–	–	
	E	6,7	–	–	–	12,4	–	–	16,2	–	31,4	
	H	5,9	–	–	–	10,7	–	–	14,4	–	21,7	
	K, D	6,5	–	–	–	11,8	–	–	17,6	–	–	
	C, F, L, M, R, S, T	5,5	–	–	–	9,9	–	–	13,7	–	21,4	
	N, P, Q	5,2	–	–	–	9,2	–	–	12,9	–	20,0	

Piston dia.		125				150				200		
Piston rod dia		50	56	63	90	63	70	80	100	90	100	140
Weight per 100 mm Stroke in kg	Single rod cylinder	3,5	3,9	4,4	7,9	5,1	5,6	6,6	8,7	9,5	10,7	17,7
	Double rod cylinder	5,4	5,8	6,9	12,0	7,6	8,6	10,6	14,8	14,5	16,9	29,8
Mounting type		CD	CG	CD	CG	CD	CG	CD	CG	CD	CG	
Weight bei 0-Stroke in kg	B	26,7	–	–	–	40,7	–	–	–	75,4	–	
	G	25,5	–	–	–	39,0	–	–	–	72,0	–	
	E	29,3	–	–	–	47,1	–	–	–	84,8	111,1	
	H	26,9	–	–	–	40,7	–	–	–	68,2	94,5	
	K, D	29,3	–	–	–	44,8	–	–	–	70,4	–	
	C, F, L, M, R, S, T	25,2	–	–	–	38,5	–	–	–	71,6	98,0	
	N, P, Q	24,1	–	–	–	37,2	–	–	–	70,7	97,0	

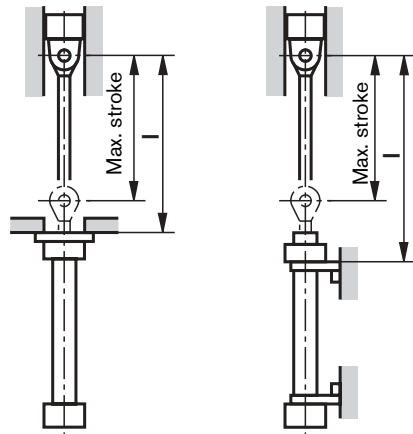
CD = Single rod cylinder

CG = Double rod cylinder

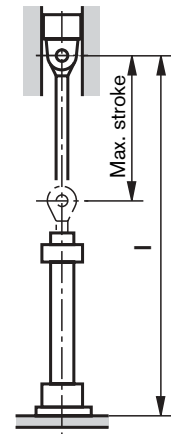
Permissible stroke lengths

Piston dia. in mm	Piston rod dia. in mm	Mounting types: C, F, H, L, M, N, P, T				Mounting types: D, K, Q				Maximum available Stroke length in mm (Standard)
		Operating Pressure in bar				Operating Pressure in bar				
		40	50	70	105	40	50	70	105	
		Max. stroke in mm				Max. stroke in mm				
25	12	600	600	530	425	460	410	330	250	600
	16	600	600	600	600	600	600	600	520	
32	18	800	800	800	800	580	500	420	325	800
	22	800	800	800	800	800	760	630	500	
	25	800	800	800	800	800	800	800	745	
40	16	805	715	585	465	350	300	240	175	1000
	18	1000	920	770	610	450	390	320	250	
	25	1000	1000	1000	1000	900	780	635	500	
50	22	1200	1090	900	720	540	460	360	280	1200
	25	1200	1200	1200	965	765	670	550	430	
	36	1200	1200	1200	1200	1200	1200	1110	890	
63	25	1255	1115	920	-	570	500	405	-	1400
	28	1400	1400	1130	-	700	610	490	-	
	36	1400	1400	1400	-	1310	1160	960	-	
	45	1400	1400	1400	-	1400	1400	1390	-	
80	36	1700	1700	1545	-	910	800	630	-	1700
	45	1700	1700	1700	-	1620	1435	1190	-	
	56	1700	1700	1700	-	1700	1700	1670	-	
100	45	2000	2000	1930	-	1170	1020	820	-	2000
	50	2000	2000	2000	-	1580	1395	1155	-	
	70	2000	2000	2000	-	2000	2000	2000	-	
125	50	2300	2300	2300	-	1220	1075	885	-	2300
	56	2300	2300	2300	-	1470	1290	1140	-	
	63	2300	2300	2300	-	2035	1805	1500	-	
	90	2300	2300	2300	-	2300	2300	2300	-	
150	63	2600	2600	-	-	1670	1465	-	-	2600
	70	2600	2600	-	-	1890	1680	-	-	
	80	2600	2600	-	-	2600	2470	-	-	
	100	2600	2600	-	-	2600	2600	-	-	
200	90	3000	-	-	-	2380	-	-	-	3000
	100	3000	-	-	-	3000	-	-	-	
	140	3000	-	-	-	3000	-	-	-	

$$s_k = l \cdot \sqrt{\frac{1}{2}}$$



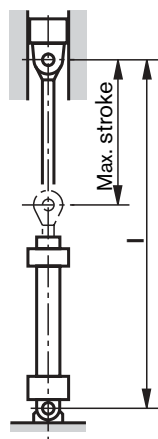
$$s_k = l \cdot \sqrt{\frac{1}{2}}$$



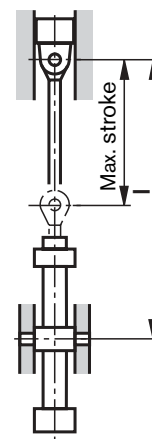
Permissible stroke lengths

Piston dia. in mm	Piston rod dia. in mm	Mounting types: B, G, S				Mounting type: E				Maximum available Stroke length in mm (standard)
		Operating Pressure in bar				Operating Pressure in bar				
		40	50	70	105	40	50	70	105	
		Max. stroke in mm				Max. stroke in mm				
25	12	175	145	110	70	460	410	330	250	600
	16	390	340	275	200	600	600	600	520	
32	18	390	340	300	200	580	500	420	325	800
	22	600	550	450	335	800	760	630	500	
	25	800	745	615	480	800	800	800	690	
40	16	200	165	120	80	320	275	215	160	1000
	18	240	220	190	100	450	390	320	250	
	25	600	550	450	335	900	780	635	500	
50	22	375	300	245	170	540	460	360	280	1200
	25	480	420	335	250	700	615	500	390	
	36	1200	1000	820	700	1200	1200	1110	890	
63	25	345	295	225	-	520	450	360	-	1400
	28	500	410	340	-	700	610	490	-	
	36	860	755	615	-	1205	1065	880	-	
	45	1400	1250	1000	-	1400	1400	1390	-	
80	36	680	580	420	-	680	580	420	-	1700
	45	1070	940	765	-	1495	1325	1095	-	
	56	1700	1500	1250	-	1700	1500	1250	-	
100	45	800	740	600	-	800	740	600	-	2000
	50	1030	900	730	-	1450	1275	1055	-	
	70	2000	1900	1600	-	2000	1900	1600	-	
125	50	775	670	535	-	1120	985	805	-	2300
	56	1050	880	750	-	1050	880	750	-	
	63	1345	1185	965	-	1880	1665	1375	-	
	90	2300	2300	2200	-	2300	2300	2200	-	
150	63	1065	925	-	-	1525	1340	-	-	2600
	70	1350	1220	-	-	1350	1220	-	-	
	80	1855	1635	-	-	2580	2285	-	-	
	100	2600	2600	-	-	2600	2600	-	-	
200	90	1750	-	-	-	1750	-	-	-	3000
	100	2175	-	-	-	3000	-	-	-	
	140	3000	-	-	-	3000	-	-	-	

$$s_K = l$$



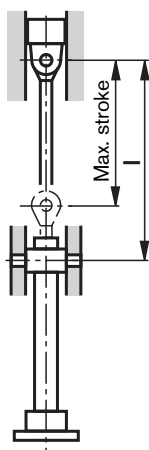
$$s_K = l$$



Permissible stroke lengths

Piston dia. in mm	Piston rod dia. in mm	Mounting type: R				Maximum available stroke in mm (standard)
		Operating Pressure in bar				
		40	50	70	105	
Max. stroke in mm						
25	12	–	–	–	–	600
	16	–	–	–	–	
32	18	800	800	670	520	800
	22	800	800	800	800	
	25	800	800	800	800	
40	16	510	445	355	270	1000
	18	720	625	510	400	
	25	1000	1000	1000	800	
50	22	865	735	575	450	1200
	25	1085	955	785	615	
	36	1200	1200	1200	1200	
63	25	810	710	575	–	1400
	28	1120	975	785	–	
	36	1400	1400	1355	–	
	45	1400	1400	1400	–	
80	36	1455	1280	1010	–	1700
	45	1700	1700	1675	–	
	56	1700	1700	1700	–	
100	45	1870	1630	1310	–	2000
	50	2000	1955	1620	–	
	70	2000	2000	2000	–	
125	50	1720	1515	1245	–	2300
	56	2300	2065	1680	–	
	63	2300	2300	2105	–	
	90	2300	2300	2300	–	
150	63	2330	2055	–	–	2600
	70	2600	2600	–	–	
	80	2600	2600	–	–	
	100	2600	2600	–	–	
200	90	3000	–	–	–	3000
	100	3000	–	–	–	
	140	3000	–	–	–	

$$s_K = l$$



Calculation for buckling

Calculations for buckling are normally carried out according to Euler, as the piston rod is normally considered as a slender column.

$$\text{Bucklingload } K = \frac{\pi^2 \cdot E \cdot J}{s_K^2} \text{ in N}$$

i.e. at this load, the rod will buckle!

$$\text{Maximum operating load } F = \frac{K}{S} \text{ in N}$$

s_K = free buckling length in mm

E = module of elasticity in N/mm² = 2,1 • 10⁵ for steel

J = moment of inertia in mm⁴ for circular cross sectional area

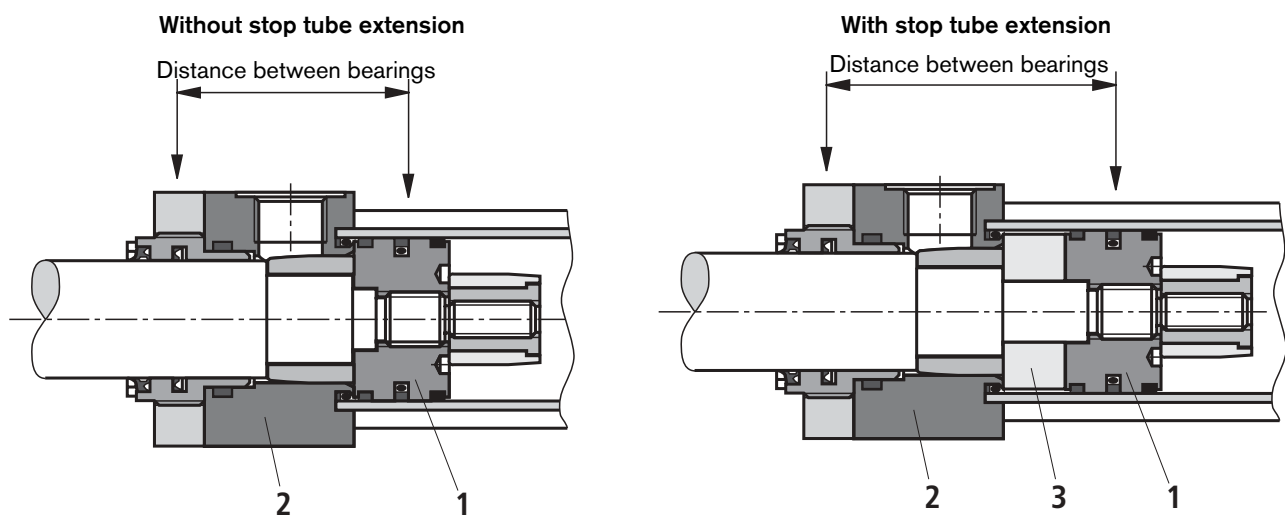
$$= \frac{d^4 \cdot \pi}{64} = 0,0491 \cdot d^4$$

S = safety factor (3,5)

Stop tube extension

With long strokes and compressive loads, a stop tube is recommended in order to reduce bearing loads when the rod is extended. In this way, a distance bush (3) is inserted between

piston (1) and cylinder head (2). This distance bush extends the lever arm and thus reduces the bearing loads.



Mounting type	Stop tube extension in mm for all piston diameters							
	-	25	50	75	100	125	150	175
	Stroke length in mm							
B, G, S	to 500	501 to 625	626 to 750	751 to 875	876 to 1000	1001 to 1125	1126 to 1250	1251 to 3000
C, F, H, L	to 1425	1426 to 1785	1786 to 2150	2151 to 2500	2501 to 2860	2861 to 3000	-	-
D, E, K, Q	to 665	666 to 835	836 to 1000	1001 to 1165	1166 to 1335	1336 to 1500	1501 to 1665	1666 to 3000
R	to 1000	1001 to 1250	1251 to 1500	1501 to 1750	1751 to 2000	2001 to 2250	2251 to 2500	2501 to 3000
M, N, P, T	to 1425	1426 to 1785	1786 to 2150	2151 to 2500	2501 to 2860	2861 to 3000	-	-

Installation length of cylinders with stop tube extensions:

Installation length of standard cylinder + stop tube extension

(The position of the trunnions is not changed).

Inductive proximity switch (please state in clear text in the order)

Inductive proximity switches are used for reliably checking the end position of hydraulic cylinders. They are an important component for reliably and precisely monitoring safety equipment, locks and/or other machinery functions in their end position by issuing corresponding signals.

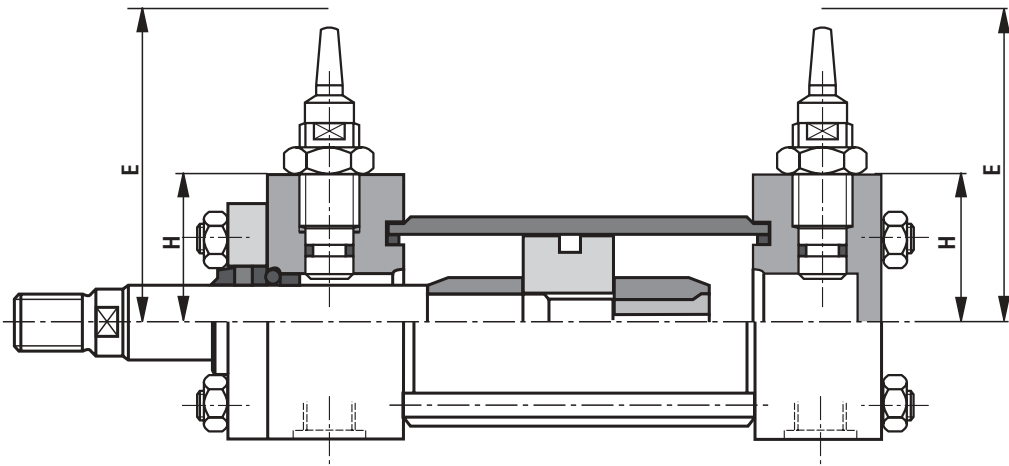
Depending on the cylinder version, the switching point is located 1 mm to 4 mm before the end of the stroke, with a repeatability of ≤ 0.5 mm.

For safety reasons, the proximity switch is protected against being screwed in too deeply. The switching distance can therefore not be changed.

- Reliable and precise check of end position
- Contactless and wear-free switching
- Pressure-tight up to max. 500 bar
- Due to integrated installation protection against damage and environmental influences
- Integrated short-circuit protection

Technical Data:

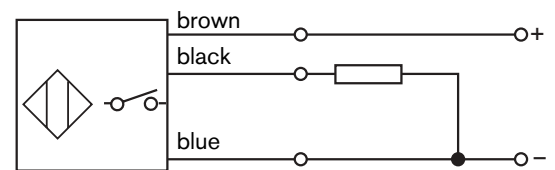
Maximum pressure resistance	500 bar
Operating voltage, incl. residual ripple content	10 to 30 V DC
Residual ripple content of the operating voltage	max. 15 %
Output technology	PNP
Switching function	Normally open
No-load current	≤ 10 mA
Load carrying capacity of the output:	≥ 200 Ω
Output resistance Ra and diode	4,7 k Ω
Reproducibility	$\leq 0,5$ mm
Maximum switching frequency	1 kHz
Short-circuit-proof version	
Type of protection	IP 67 (DIN 40050)
Ambient temperature	- 25 °C to + 70 °C
Type of connection	2 m cable, cast-in; 3 x 0,34 mm ²



Piston dia. in mm	Piston rod dia. in mm	H	E ¹⁾	Piston dia. in mm	Piston rod dia. in mm	H	E ¹⁾			
25	12	37,5	100	100	45	57	119			
	16				50					
32	18	42,5	105		125			70	83	130
	22							50	70	122
	25							56	63	-
40	16	42,5	105		150			90	96	140
	18			63		82,5	146			
	25			70		80	-	-		
50	22	44,5	105	180	80	-	-			
	25				90	-	-			
	36				100	-	-			
	45				53	115	-	-		
80	36	73,5	122	200	90	108	166			
	45				100					
	56				140					

¹⁾ Installation space

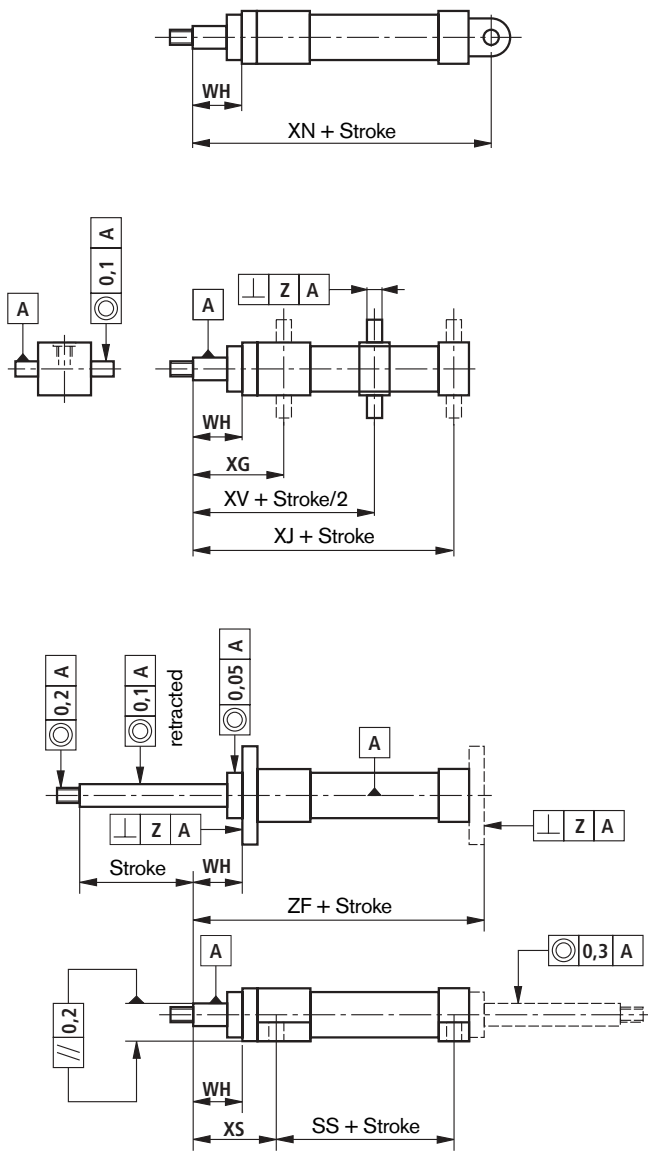
Output circuit



Note:

- Installation: 180° opposite to the line connections
- Port: For enlarged line ports, please consult us
- Mounting type: With mounting types F, L, M, N and T the installation at 180° opposite to the port is not possible
- For mounting types and unit dimensions, see pages 8 to 67

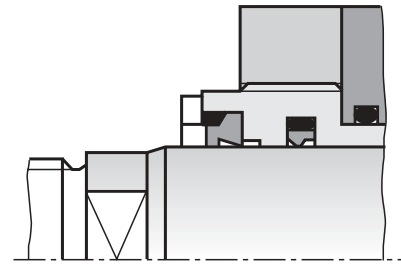
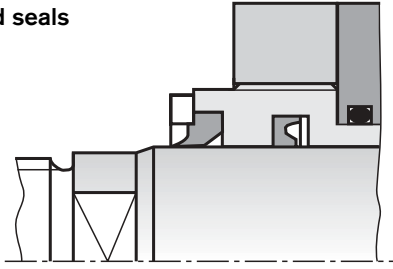
Installation Lengths, Positional Tolerances



Stroke length in mm	to 1250	1251 to 2000	2001 to 3000
Stroke tolerance in mm	+ 1	+ 1	+ 1
	- 1,5	- 2	- 3
WH	± 2	± 2	+ 3
			- 2
ZF	± 1	± 1,5	± 2
XS	± 2	± 2	+ 3
			- 2
SS	± 1,25	+ 1,5	+ 1,5
		- 2	- 3
XG	± 2	± 2	+ 3
XV	± 2	± 2	- 2
			± 2
XJ	± 2	± 2	± 2
XN	± 1,25	± 2	± 2
Z	0,1 / 100		

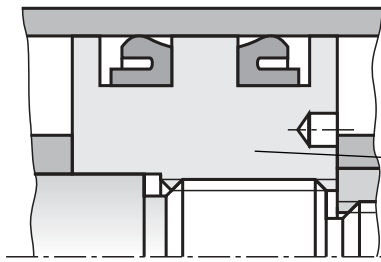
Seals (standard - version)

Piston rod seals



Version related to piston dia. 32/25 Version related to piston rod dia. 50, 63 and 80 mm

Piston seals

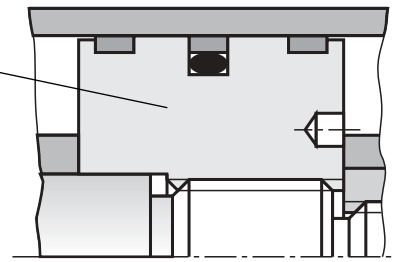


Version "T"

Glide ring for low friction operation

Version "A"

Lip ring for leak free operation under static conditions



Cushion

Cushioning at cylinder cap.

Piston (1) is threaded directly on to the cylinder rod. Cushioning bush (2) is held on to the cylinder rod by means of retaining ring (3).

As the tapered damping bush enters cylinder cap (4) the open area for the flow of oil into the cylinder cap (4) is very much reduced until it finally becomes zero. The fluid can then only flow via drilling (6) and adjustable throttle valve (7). The degree of cushioning is controlled by the setting of throttle (7). The smaller the opening to flow, the greater the degree of cushioning.

Adjustable throttle valve

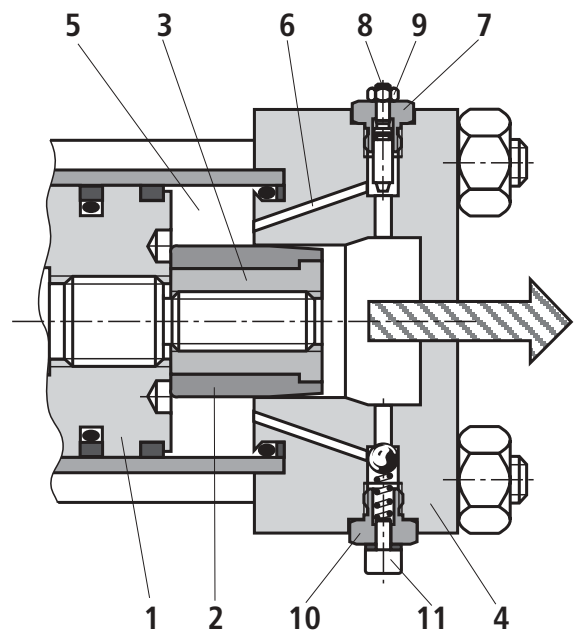
The design of the throttle valve prevents needle valve (8) from being completely screwed out when setting the cushioning. When the cushioning is correctly set, screw (8) is locked by means of nut (9).

Non return valve with bleed screw

Check valve (10) permits the throttle valve to be by-passed at the start of the outward stroke of the cylinder. The cylinder is bled of air by means of bleed screw (11).

The bleed screw is always present, even in cylinders without cushioning.

The throttle valve and check valve are interchangeable and may be interchanged in situ.



Calculation of deceleration force

The cushioning must produce a controlled deceleration of the cylinder, in both end positions.

In doing this, the total energy comprising the product of the moving mass and its velocity must not exceed the working parameters of the damping system.

The energy is converted into heat by means of throttling the outgoing fluid in the cushioning zone.

Calculation of cushioning force

When the cylinder is installed horizontally, the deceleration force can be calculated as follows:

Cylinder extending

$$F_B = m \cdot a + A_K \cdot p$$

Cylinder retracting

$$F_B = m \cdot a + A_R \cdot p$$

v = piston velocity in m/s

s = damping length in m

A_K = piston area in cm²

A_R = annulus area in cm²

p = system pressure in N/cm²

F_B = deceleration force in N

m = moving mass in kg

a = deceleration in m/s²

$$a = \frac{v^2}{2 \cdot s}$$

$$1 \text{ bar} \sim 10 \text{ N/cm}^2$$

For vertical operation of the cylinder, the pressure generated by the weight applied to the cylinder (consisting of the external load plus the cylinder rod and piston) must be added or subtracted dependent upon the direction of movement.

The cylinder friction is ignored in these calculations.

Calculation of mean damping pressure

Normally, the damping pressure may not exceed the nominal pressure of the cylinder.

$$p_D = \frac{F_B}{A_D}$$

p_D = mean damping pressure in N/cm²

F_B = deceleration force in N

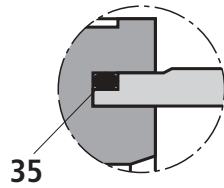
A_D = effective damping area in cm²

$$1 \text{ bar} \sim 10 \text{ N/cm}^2$$

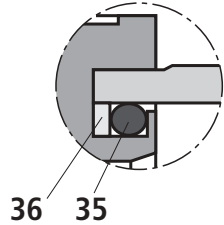
If the above calculation results in a higher value, the damping length must be increased or the system pressure reduced.

Spare parts diagram

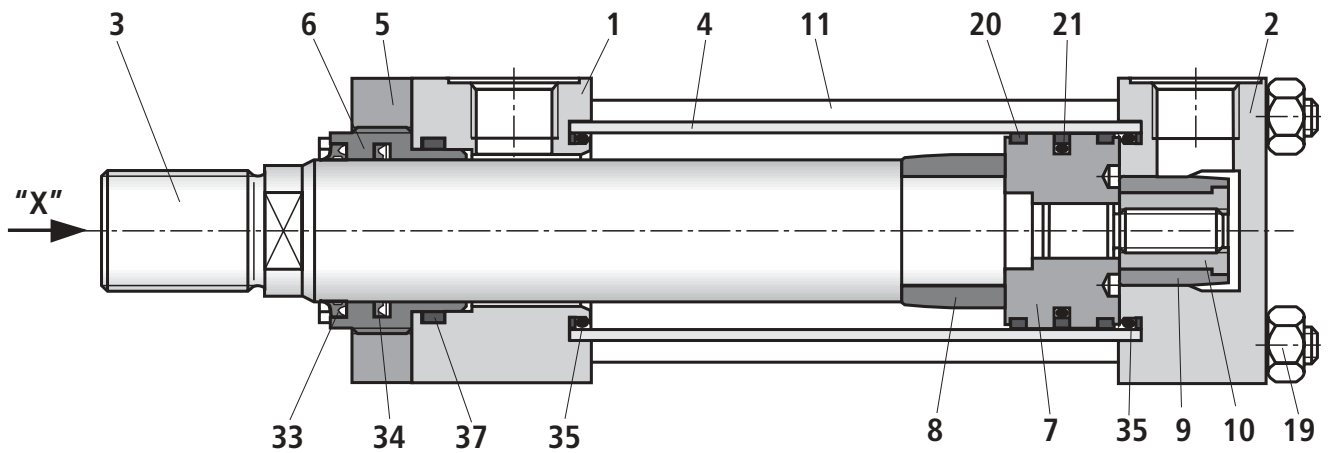
Version for
piston dia. 25 und 32



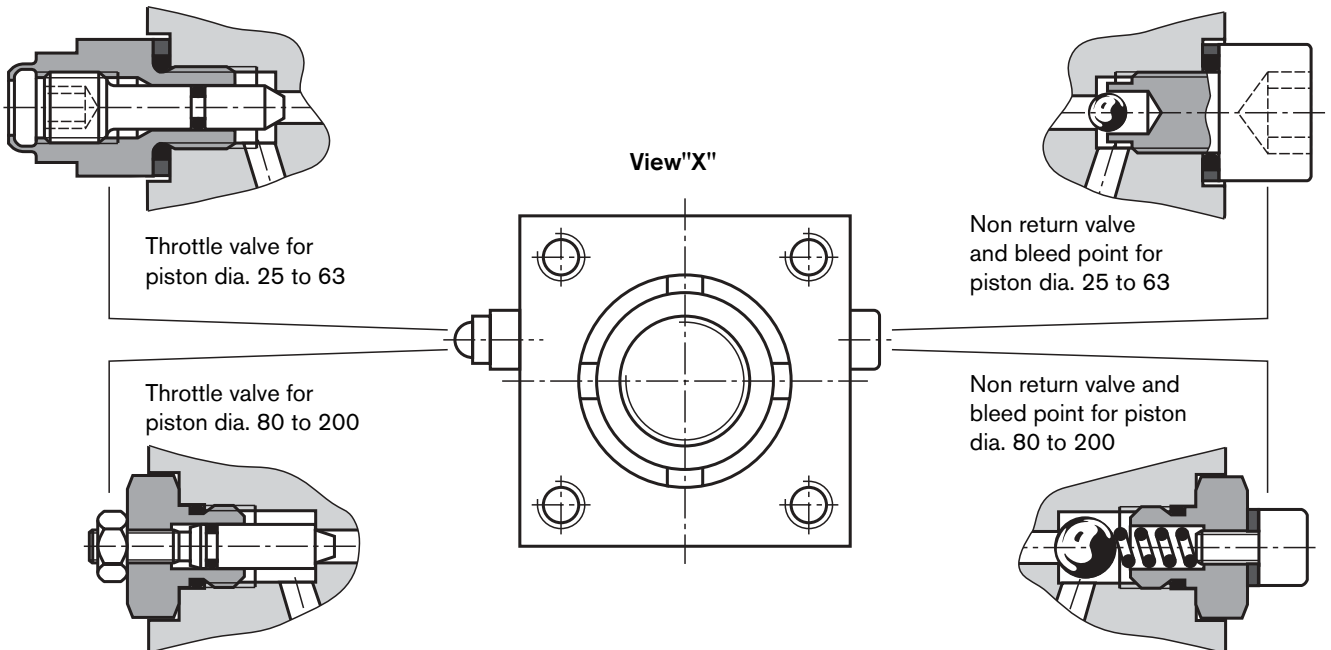
Version for
piston dia. 40 to 200



- | | |
|-------------------|--------------------|
| 1 Head | 10 Threaded ring |
| 2 Cap | 11 Tie rod |
| 3 Piston rod | 19 Nut |
| 4 Cylinder tube | 20 Guide ring |
| 5 Flange | 21 Piston seal |
| 6 Guide bush | 33 Wiper |
| 7 Piston | 34 Piston rod seal |
| 8 Cushioning bush | 35 O ring |
| 9 Cushioning bush | 36 Back-up ring |
| | 37 O ring |



Throttle and non return valve cylinder cap and cylinder head



Ordering of spare parts:

- When designating individual parts from the spare parts diagram, please give complete ordering code of the cylinder.
- For seal sets, please give complete ordering code of the cylinder.

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