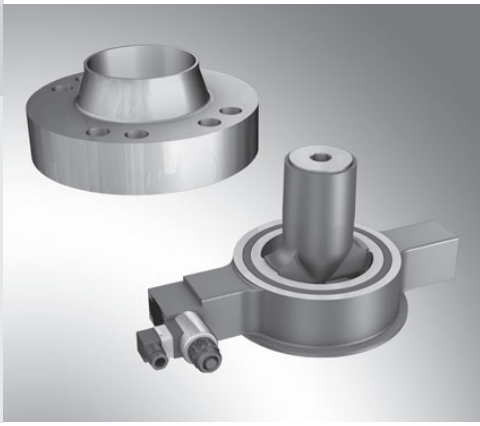
Rexroth
Bosch Group

Prefill valve – sandwich plate

RE 20478/06.06 1/12
Replaces: 02.03

Type ZSF and ZSFW



Sizes 32 to 160
Component series 1X; 2X
Maximum operating pressure 350 bar

Table of contents

Information on available spare parts:
www.boschrexroth.com/spc

Features

- Hydraulic pilot operated check valve of sandwich plate design
  - for flanged connection
  - for in-pipe installation
- With or without pre-decompression
- Integrated high-pressure port
- Solenoid operated decompression through built-on directional valve

- Further information:
  Directional valve type 4WE 6 D … RE 23178

Ordering code

ZSF			F	– 1 –	/ M	01	*

Prefill valve – sandwich plate

For directional valve mounting [1] = **W**

Size 32 = **32**
Size 40 = **40**
Size 50 = **50**
Size 63 = **63**
Size 80 = **80**
Size 100 = **100**
Size 125 = **125**
Size 160 = **160**

Type of connection

For flanged connection = **F**

With pre-decompression = **1**
Without pre-decompression = **0**

Further details in clear text

Connection version

01 = Mounting cavities with pipe thread to ISO 228, DIN EN 3852 part 2

M = NBR seals (other seals on enquiry)

⚠ Caution!
Observe compatibility of seals with hydraulic fluid used!

Sizes 32 to 100 and size 160:

1X = Component series 10 to 19 (10 to 19: unchanged installation and connection dimensions)

Size 125 [2]:

2X = Component series 20 to 29 (20 to 29: unchanged installation and connection dimensions)

Spring return of main poppet

1 = Cracking pressure ≈ 0.12 bar

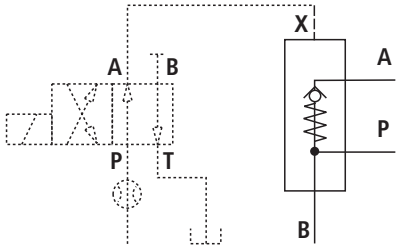
[1] Ordering code "W" required only in conjunction with version for directional valve mounting.

Directional valve type 4WE 6 D…, separate order, see data sheet RE 23178.

[2] Compatible with series 1X

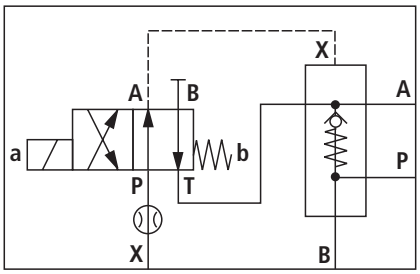
Symbols

Prefill valve without directional valve type ZSF



Provide for installation of orifices!

Prefill valve with built-on directional valve type ZSFW



Orifice included in the scope of supply

Function, section: Type ZSF …

Valves of type ZSF are hydraulic pilot operated check valves of sandwich plate design. They are used for the leak-free closure of pressurised working circuits (e.g. press cylinder). Due to their design with favourable flow characteristics and the relatively small closing force of compression spring (5) at the main poppet they are ideal for anti-cavitation and filling functions, e.g. for main cylinders on presses during fast closing movements. The integrated pressure port P allows high pressure to be built up in the pressing cylinder!

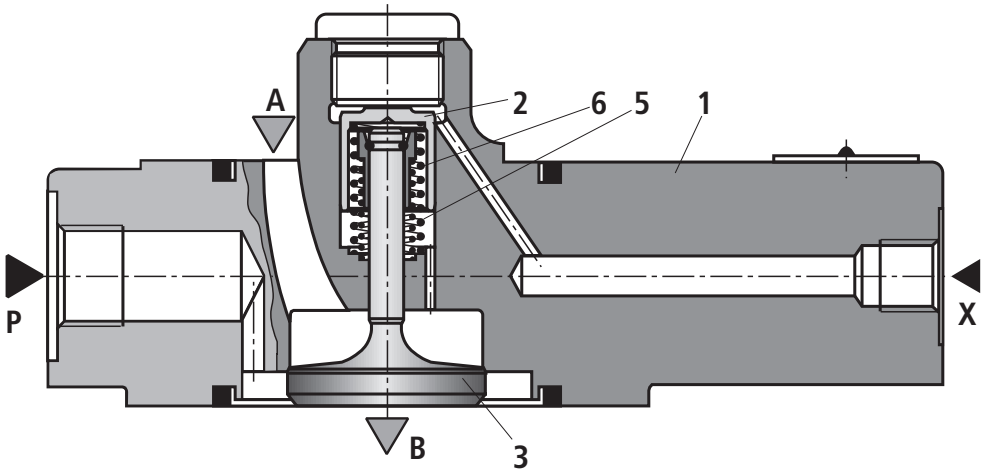
The valve basically consists of housing (1), pilot piston (2), main poppet (3), pilot poppet (4) and compression springs (5) and (6).

Version without pre-decompression feature

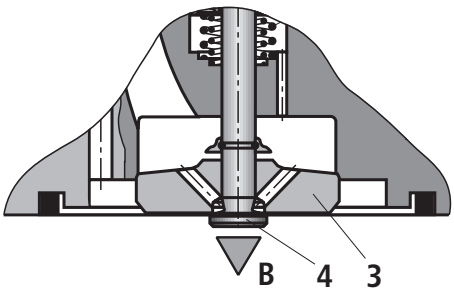
The valve allows free flow from A to B. In the opposite direction, main poppet (3) is held on its seat by compression spring (5) and the pressure acting on port B. Due to the pressure in pilot port X, pilot piston (2) is shifted downwards by compression spring (6) and pushes main poppet (3) off its seat. The fluid can now also flow through the valve in the opposite direction.

Version with pre-decompression feature

The operating principle of this version basically corresponds to that of the version without pre-decompression feature.
When pressure is applied to pilot port X, pilot piston (2) initially only opens pilot poppet (4). This ensures a shock-free decompression of the compressed hydraulic fluid.



Type ZSF…F0…
(without pre-decompression, vertical installation orientation)



Type ZSF…F1… (with pre-decompression feature)

Generally, the following is valid:

An orifice in channel P of the directional valve is **imperative** (separate order). The orifice Ø must be selected according to the size of the prefill valve (see table below).

Orifices to be fitted

Size	32	40	50	63	80	100	125	160
Orifice Ø in mm	0.8	0.8	0.8	0.8	1.0	1.0	1.2	1.5

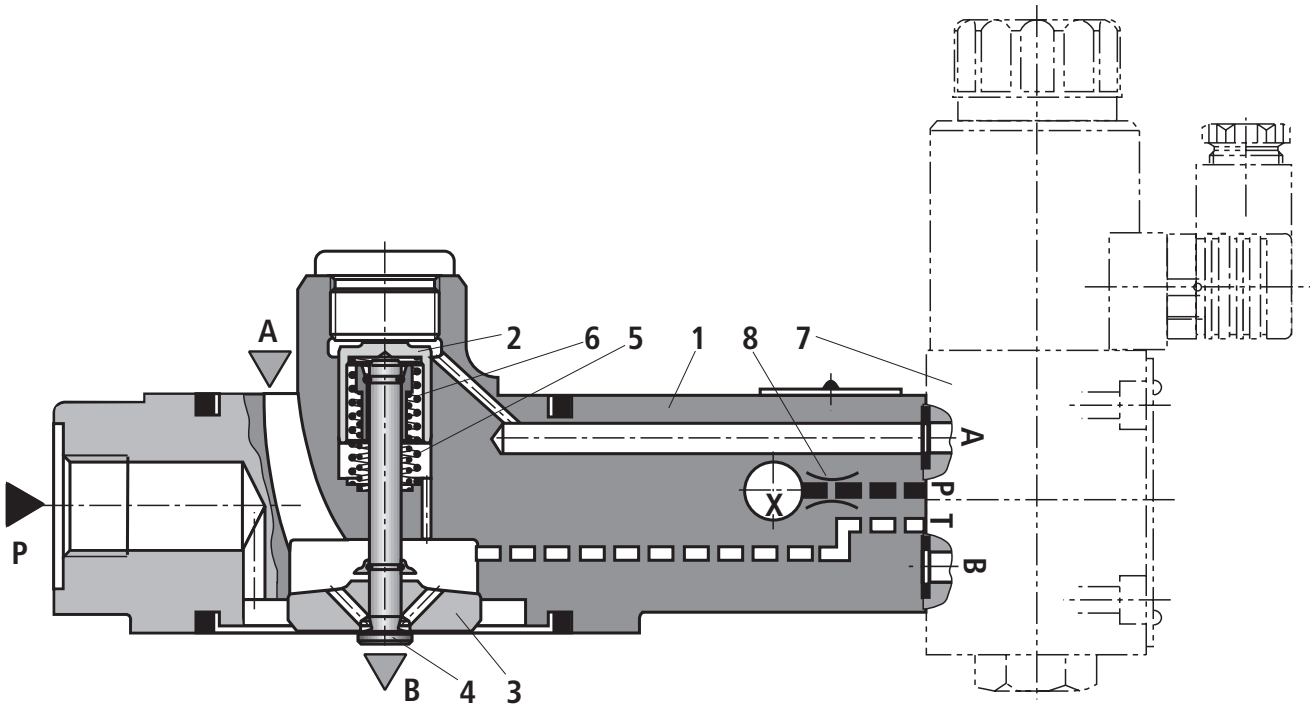
Function, section: Type ZSFW …

The operating principle of valve type ZSFW basically corresponds to that of type ZSF.

Pilot piston (2) is unloaded by the operation of the directly built-on directional valve (optional).

Generally, the following is valid:

The required orifice (8) is installed in channel P. Unloading of pilot piston (2) is achieved by operation of the built-on directional valve (see “Orifices to be fitted” on page 3).



Type ZSFW…F1…
(with pre-decompression feature and built-on directional valve, vertical installation orientation)

Directional valve type 4WE 6 D
(separate order)
drawn rotated through 90°!

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

General									
Size			32	40	50	63	80	100	125	160
Weight		kg	3.5	4.2	5.5	7	10	15	26	47
Installation orientation			Optional							Vertical
Ambient temperature range	– Type ZSF	°C	–30 to +80							
	– Type ZSFW	°C	–30 to +50							

Hydraulic			
Maximum operating pressure	– Ports B, P	bar	350
	– Port X	bar	150
	– Port A	bar	16
Cracking pressure [1]		bar	≈ 0.12
Maximum flow		l/min	See Applications on page 11
Hydraulic fluid			Mineral oil (HL, HLP) to DIN 51524; fast bio-degradable hydraulic fluids to VDMA 24568 (see also RE 90221); HETG (rape seed oil); other hydraulic fluids on enquiry
Hydraulic fluid temperature range		°C	–30 to +80
Viscosity range		mm^2/s	10 to 800
Max. permissible degree of contamination of the hydraulic fluid - cleanliness class to ISO 4406 (c)			Class 20/18/15 [2]
Technical data of the directional valve			See data sheet RE 23178

[1] Pressure differential across the main poppet for overcoming the spring force.

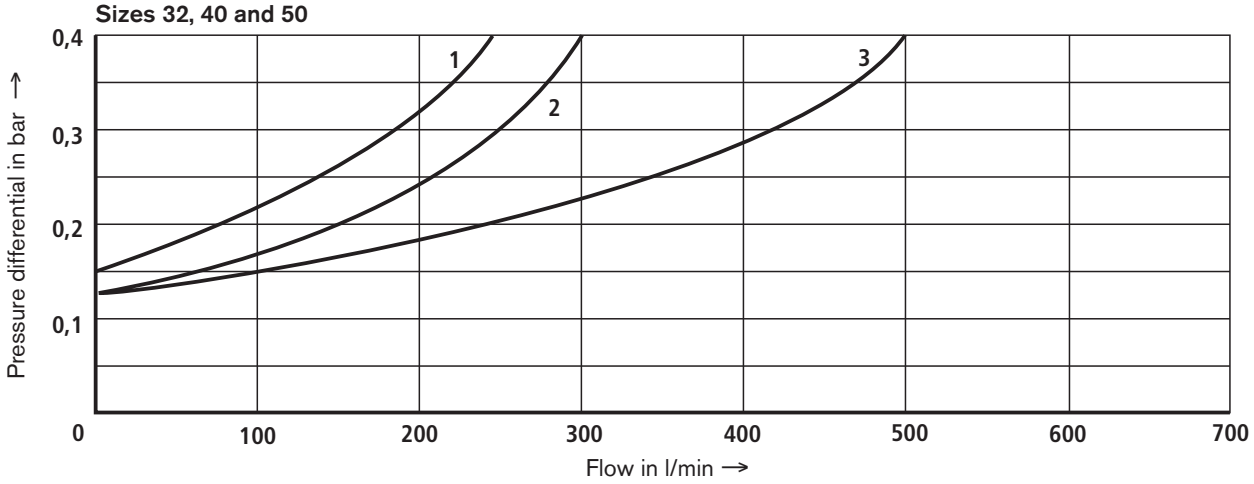
[2] The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.

For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

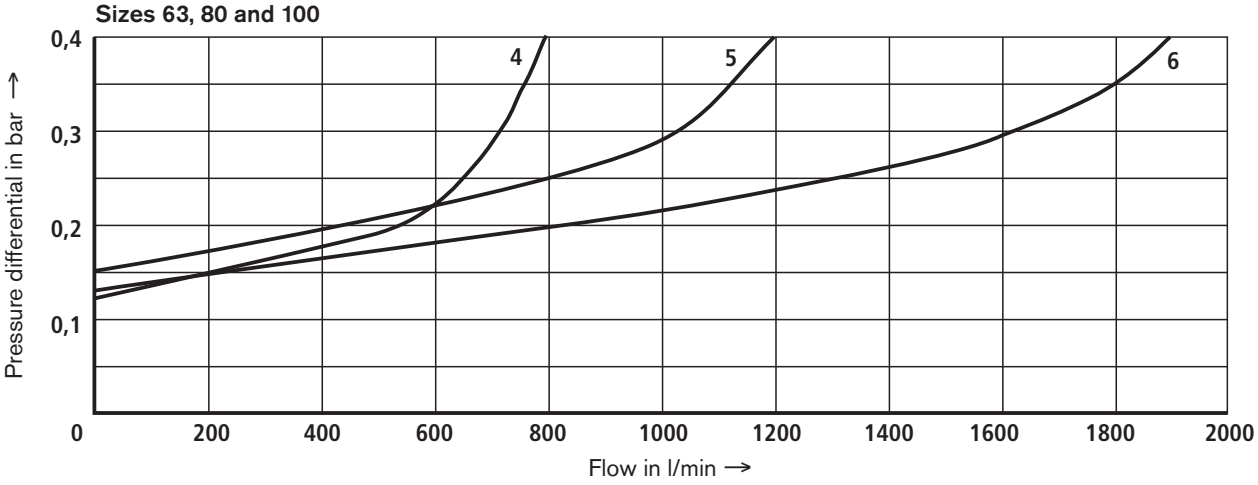
Characteristic curves (measured with HLP46, $\vartheta_{oil} = 40\ °C \pm 5\ °C$)

Pressure differential Δp between ports A and B in dependence upon flow q_V
with flow in suction direction A to B.

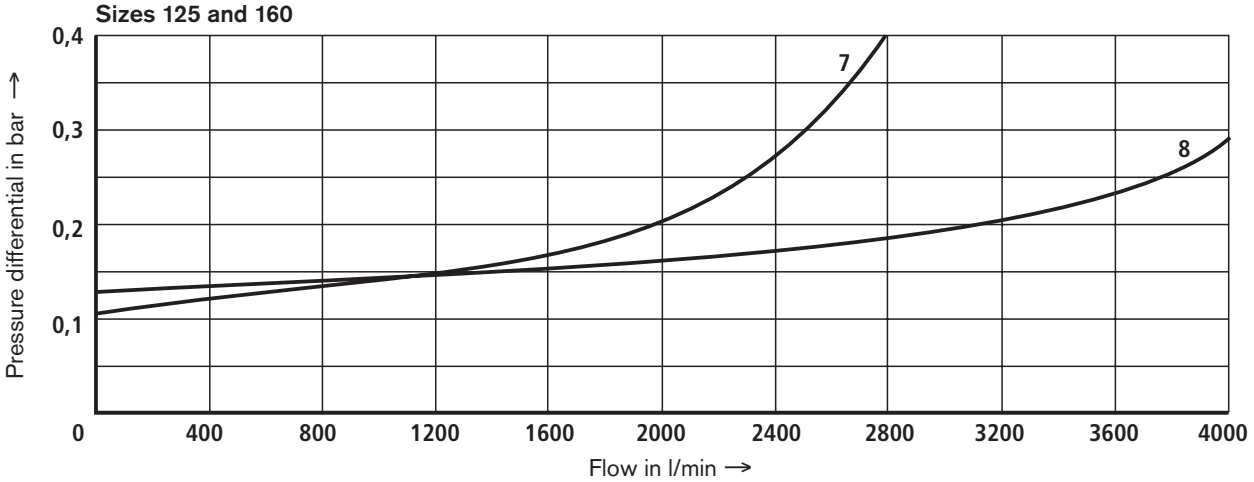
Sizes 32, 40 and 50



Sizes 63, 80 and 100

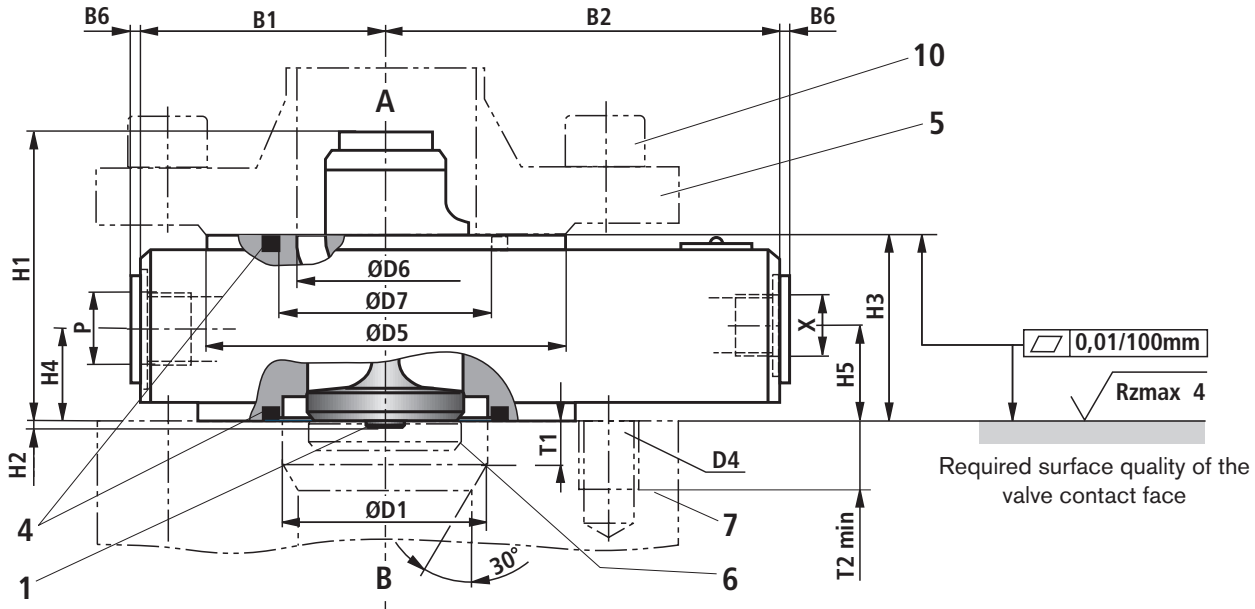


Sizes 125 and 160

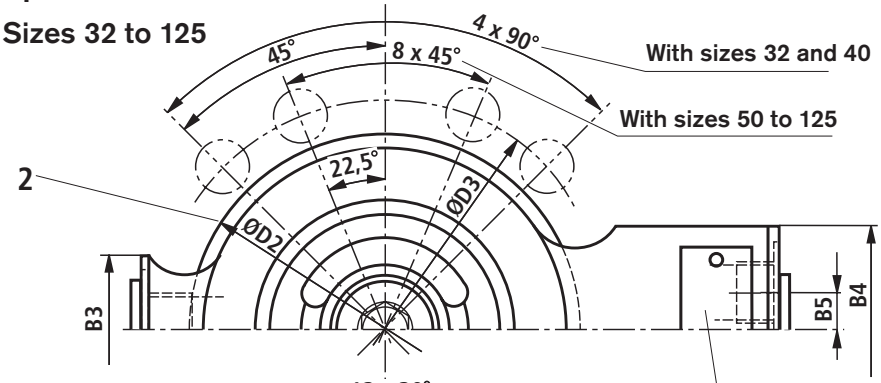


1	Size 32	**4**	Size 63	**7**	Size 125
2	Size 40	**5**	Size 80	**8**	Size 160
3	Size 50	**6**	Size 100		

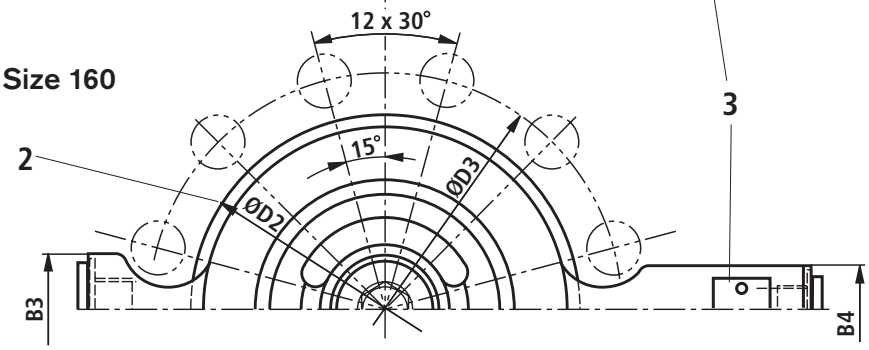
Unit dimensions: Type ZSF… (nominal dimensions in mm)



Sizes 32 to 125



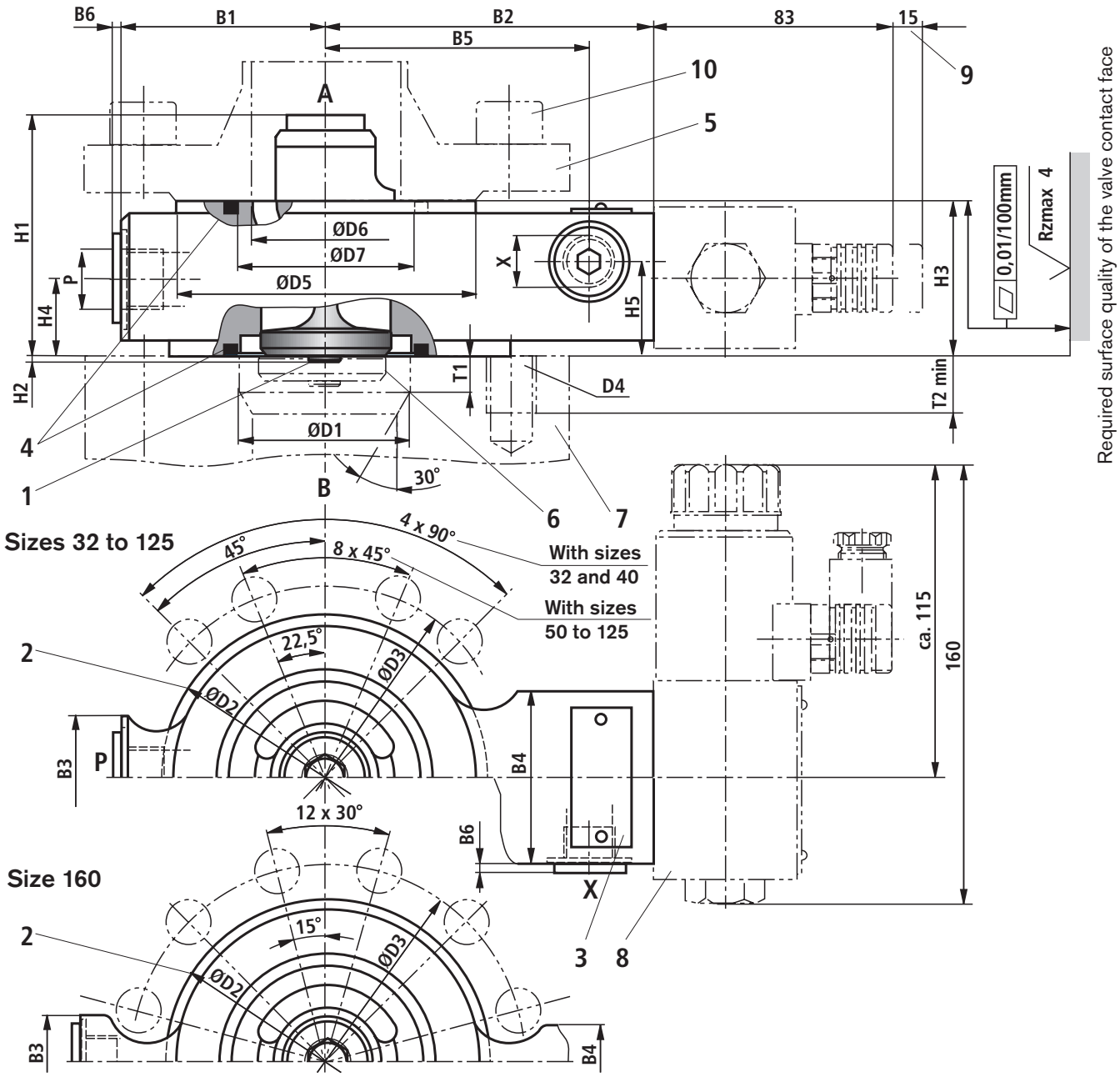
Size 160



For the explanation of items, see page 9

NG	B1	B2	B3	B4	B5	B6 max	ØD1	ØD2	ØD3 ±0.2	D4	ØD5	ØD6	ØD7	H1	H2	H3	H4	H5	P	T1	T2 min	X
32	65	110	40	55	7.5	1.5	46	93	110	M16	88	42	49.5	77	3.5	50	26.5	26.5	G1/2	8	30	G1/4
40	70	115	40	55	7.5	1.5	58	108	125	M16	102	52	61.5	80	3.5	50	26.5	26.5	G1/2	10	35	G1/4
50	110	140	40	55	7.5	1.5	71	128	145	M16	122	70	75.7	97	4	50	26.5	26.5	G1/2	12	30	G1/4
63	115	145	45	55	7.5	1.5	90	143	160	M16	138	83	97.7	110	4.5	55	27.5	27.5	G3/4	14	35	G1/4
80	125	160	45	55	7.5	1.5	107	169	190	M20	162	100	112	123	5	60	30	30	G3/4	16	30	G1/4
100	140	190	55	55	7.5	1.5	132	212	240	M27	188	124	138.5	145	6	65	32.5	40	G1	25	55	G3/8
125	180	210	65	60	0	1.5	170	248	280	M30	218	148	176	215	9	75	37.5	50	G1	33	50	G3/8
160	220	255	70	60	0	1.5	220	310	345	M33	285	200	233	279	12	95	48.5	68	G1 1/4	55	50	G1/2

Unit dimensions: Type ZSFW… (nominal dimensions in mm)



For the explanation of items, see page 9

NG	B1	B2	B3	B4	B5	B6 max	ØD1	ØD2	ØD3 ±0.2	D4	ØD5	ØD6	ØD7	H1	H2	H3	H4	H5	P	T1	T2 min	X
32	65	107	40	55	85	1.5	46	93	110	M16	88	42	49.5	77	3.5	50	26.5	34	G1/2	8	30	G1/4
40	70	112	40	55	90	1.5	58	108	125	M16	102	52	61.5	80	3.5	50	26.5	34	G1/2	10	35	G1/4
50	110	137	40	55	115	1.5	71	128	145	M16	122	70	75.7	97	4	50	26.5	34	G1/2	12	30	G1/4
63	115	142	45	55	120	1.5	90	143	160	M16	138	83	97.7	110	4.5	55	27.5	34.5	G3/4	14	35	G1/4
80	125	157	45	55	135	1.5	107	169	190	M20	162	100	112	123	5	60	30	37.5	G3/4	16	30	G1/4
100	140	186	55	55	165	1.5	132	212	240	M27	188	124	138.5	145	6	65	32.5	40	G1	25	55	G3/8
125	180	206	65	60	184	1.5	170	248	280	M30	218	148	176	215	9	75	37.5	50	G1	33	50	G3/8
160	220	251	70	60	225	1.5	220	310	345	M33	285	200	233	279	12	95	48.5	68	G1 1/4	55	50	G1/2

Unit dimensions

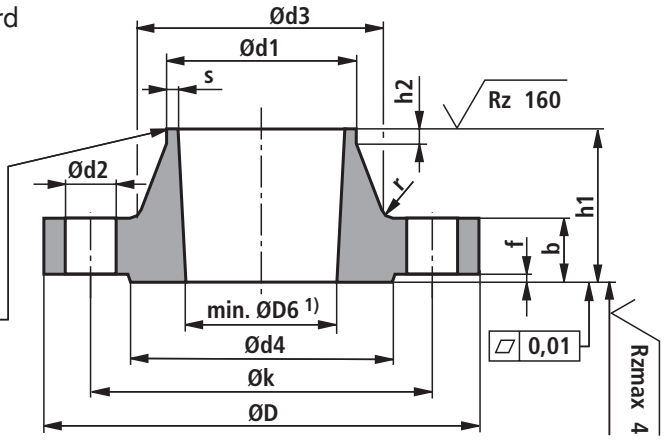
1 Pilot poppet (pre-decompression)
2 Centring diameter
3 Nameplate
4 Seal rings
5 Mating flange (separate order; proposed dimension, see below
6 Stroke of main poppet (see page 10)
7 ⚠ **Caution!**
Provide valve contact face (e.g. press cylinder, carrier structures, etc.) with a sufficient bending resistance!
The prefill valve must not be subjected to bending stress!
8 Directional valve type 4WE 6 D… to RE 23178 (separate order)
9 Space required to remove plug-in connector
10 Valve fixing screws (separate order, see page 10)

Proposed dimension for mating flange (item 5) (nominal dimensions in mm)

Calculation according to ISO 2505/preliminary standard

p_{max} = **350 bar**
Material: C 22

Shape of welding groove:
Standard version
s ≤ 16 welding groove 22 DIN 2559
s > 16 welding groove 3 DIN 2559
Special version, see DIN 2559



1) See drawing and dimensional table on pages 7 and 8
2) For seamless steel tubes, wall thickness 16 to DIN EN 10220

Size		Flange					Neck				Raised face	
	Ød1 2)	Ød2	ØD	b	Øk	h1	Ød3	s 2)	r	h2	Ød4	f
32	48.3	18	150	22	110	49	64	3.2	6	7	88	3
40	60.3	18	165	29	125	57	75	3.6	6	8	102	3
50	76.1	18	185	34	145	64	90	3.6	6	10	122	3
63	88.9	18	200	43	160	77	105	3.6	8	12	138	3
80	114.3	22	235	51	190	95	134	3.6	8	12	162	3
100	139.7	30	295	62	240	116	168	4.0	8	12	188	3
125	168.3	33	345	79	280	138	202	4.5	10	12	218	3
160	219.1	36	415	118	345	186	256	5.9	10	16	285	3

For valve fixing screws and ordering code for mating flange, see page 10.

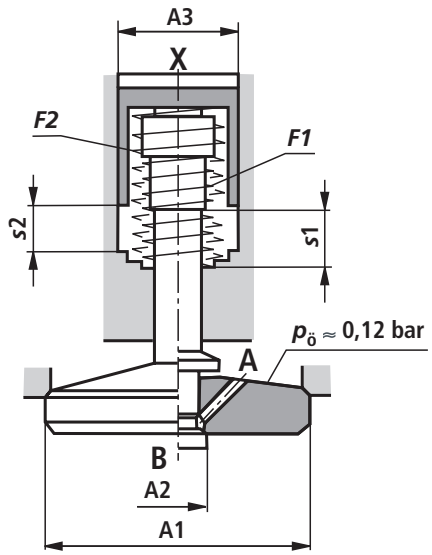
Valve fixing screws, mating flanges

Valve fixing screws (separate order)
The following valve fixing screws are recommended:

Socket head cap screws ISO 4762 - 10.9 or DIN 912 - 10.9
Friction coefficient μ_{total} = 0.12 to 0.17

Size	Valve fixing screws				Mating flange
	Qty	Dimension	Tightening torque M_T in Nm (±4 %)		Material no.
			Socket head cap screws ISO 4762 - 10.9	Socket head cap screws DIN 912 - 10.9	
32	4	M16 x 100	280	–	R900842693
40	4	M16 x 110	280	–	R900825610
50	8	M16 x 110	280	–	R900826441
63	8	M16 x 130	280	–	R900849622
80	8	M20 x 140	560	–	R900862915
100	8	M27 x 180	–	1400	R900834583
125	8	M30 x 200	1900	–	R900861508
160	12	M33 x 260	–	2600	R900846478

Poppet geometry and determination of minimum pilot pressure



Without pre-decompression | **With** pre-decompression

A1 = Effective area of main poppet
A2 = Effective area of pilot poppet
A3 = Effective area of pilot piston
s1 = Main poppet stroke
s2 = Pilot poppet stroke
F1 = Spring force of valve spring
F2 = Spring force of pilot piston compression spring
V_{st} = Pilot oil volume for opening the valve
$p_{Ö}$ = Cracking pressure (pressure differential across main poppet for overcoming spring force ***F1***)
p_p = Pilot pressure in port X
p_B = System pressure in port B

$$\text{Unchecking ratio} = \frac{\text{Pilot pressure } p_p}{\text{System pressure } p_B}$$

Size	*A1* in cm²	*A2* [1] in cm²	*A3* in cm²	*s1* in mm	*s2* in mm	*F1* in N	*F2* in N	V_{st} in cm³	Unchecking ratio [2] in bar	Unchecking ratio [3] in bar
32	8.04	0.50	2.01	8.5	6.5	9 to 22	58 to 109	1.3	4.0	0.3
40	13.52	0.79	3.14	10.0	7.0	14 to 29	93 to 162	2.2	4.3	0.3
50	21.24	1.13	4.71	12.5	9.0	23 to 49	149 to 261	4.2	4.5	0.3
63	32.67	1.77	7.07	14.5	11.0	35 to 63	206 to 348	7.8	4.6	0.3
80	49.02	2.54	10.18	17.0	13.0	57 to 127	310 to 579	13.2	4.8	0.3
100	73.13	3.80	15.90	22.0	16.0	81 to 193	476 to 952	25.5	4.6	0.2
125	120.76	5.72	28.27	30.0	22.5	135 to 319	878 to 1667	59.4	4.3	0.2
160	196.07	9.08	45.36	40.0	27.0	241 to 516	1335 to 2395	122.0	4.3	0.2

[1] Not provided for version “withou pre-decompression" (ZSF...**0**...)
[2] Without pre-decompression
[3] With pre-decompression

Example: Type ZSF**32**…F**0**; p_B = 30 bar
p_p = 4.0 x 30 bar = 120 bar

Maximum flow q_V in l/min (A to B) for various applications

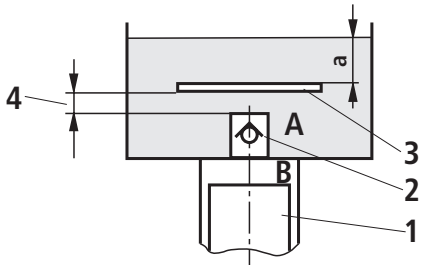
Size	32	40	50	63	80	100	125	160
Application 1	200	300	500	800	1200	1900	3000	4200
Application 2	170	250	400	650	1000	1600	2600	3900
Application 3	140	220	360	560	900	1400	2200	3400
Application 4	100	150	240	380	620	950	1500	2300
Application 5	70	110	170	280	450	700	1100	1690

⚠ Caution!

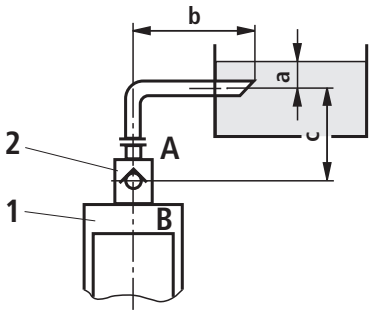
Too small a prefill valve or an insufficiently dimensioned pipe results in gas escaping from the hydraulic fluid with the associated consequences and frequently to long-term damage to cylinder seals.

Applications

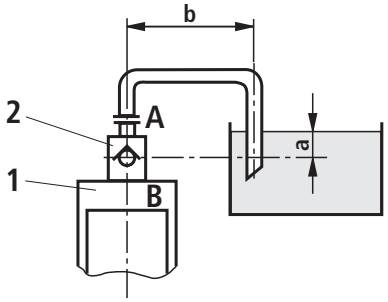
Application 1



Application 2

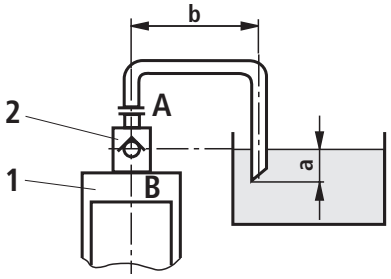


Application 3

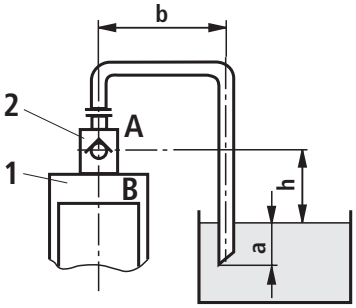


Size of the prefill tank
min. 1.5 x cylinder volume

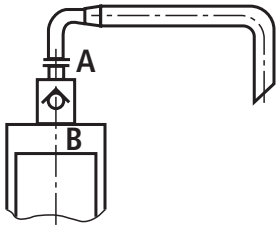
Application 4



Application 5



Note on applications 2 to 5



For applications close to the limiting parameters, please consult us. It is, however, often sufficient to select the pipe one size larger.

1 Cylinder

2 Prefill valve

3 The metal sheet is not included in the scope of supply. In the case of small tank dimensions and minimum pressure level (a) it prevents the formation of funnels.

4 Observe supply cross-section!

a Min. 300 mm with extended cylinder

b Up to 1000 mm with the specified maximum flows

c $h \leq 500$ mm

h $300 \text{ mm} \leq h < 500 \text{ mm}$

Notes

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