

# Filling valve – sandwich plate

**RE 20478/08.11**  
Replaces: 06.06

1/14

## Type ZSF and ZSFW

Size 32 to 200  
 Component series 1X; 2X  
 Maximum operating pressure 350 bar  
 Flow up to 7000 l/min ( $\Delta p = 0.3$  bar)



## Table of contents

Contents	Page
Features	1
Ordering code	2
Symbols	2
Function, section	3, 4
Nozzle fitting	3
Technical data	5
Characteristic curves	6
Unit dimensions	7 to 12
Dimensional proposal for counterflange	12
Valve mounting screws, counterflange	13
Poppet geometry and determination of the minimum pilot pressure	13
Flow for different cases of application	14

## Features

- Pilot operated check valve in sandwich plate design
- with or without pre-opening, optional
- Control by built-on directional spool valve or directional seat valve, optional
- Integrated high-pressure connection (size 32 to 160)
- Integrated throttle check valve (size 200)
- More information: 

	Data sheet
• High-power directional valves	23178, 22058
• Hydraulic fluids on mineral oil basis	90220

Information on available spare parts:  
[www.boschrexroth.com/spc](http://www.boschrexroth.com/spc)

### Ordering code

ZSF			F	0	1	/	M	/	01		*
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Filling valve – sandwich plate

For directional valve set-up <sup>1)</sup> = 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
Size 200	= 200

**Type of connection**

For flange connection	= F
Without pre-decompression	= 0
With pre-decompression upon request	

<sup>1)</sup> Ordering code "W" only necessary with version for directional valve set-up. Directional spool valve type 4WE 6 D... (data sheet 23178) or directional seat valve type M-.SEW 6... (data sheet 22058), separate order

<sup>2)</sup> Compatible with series 1X

Further details in the plain text

**Nozzle bore**

No code =	Size 32 to 160
D40 =	Size 200 (Ø4 mm)

**Connection version**

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

**Seal material**

M = NBR seals (other seals upon request)  
Attention!  
Observe compatibility of seals with hydraulic fluid used!

**Size 32 to 100 and size 160**

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

**Size 125 and 200 <sup>2)</sup>**

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

**Cracking pressure main poppet**

1 =  $p_C \approx 0.12 \text{ bar}$

### Symbols

Filling valve type ZSF	<p><b>Size 32 to 160,</b> with remote control port (port X)</p> <p>Separate, external nozzle fitting necessary!</p>	<p><b>Size 200</b></p> <p>Throttle check valve installed in the factory</p>
Filling valve type ZSFW	<p><b>Size 32 to 200,</b> with built-on directional valve size 6 (separate order)</p> <p>Nozzle in channel P installed in the factory</p>	

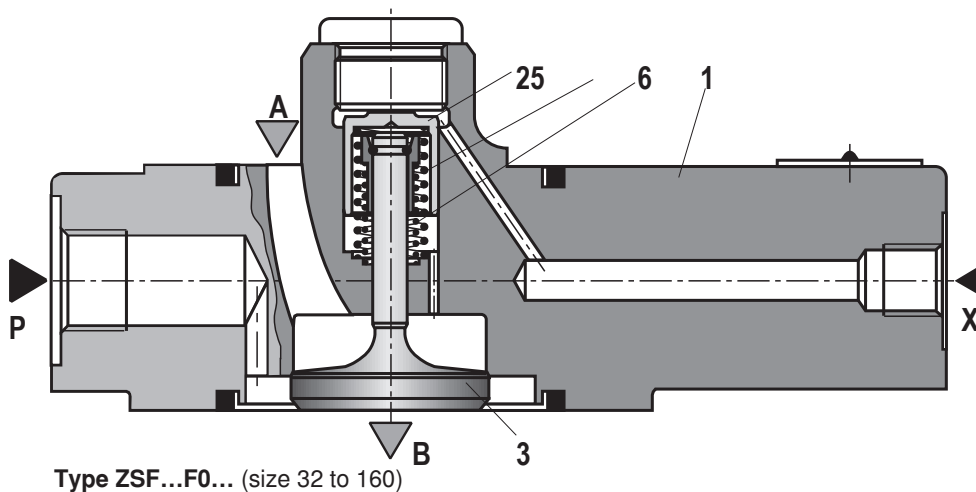
## Function, section: Type ZSF ...

The valve type ZSF is a pilot operated check valve in sandwich plate design. It is used for the leakage-free isolation of pressurized working circuits (e. g. pressing cylinders). Due to its favorable flow characteristics and the low cracking pressure of the main poppet (3), it is particularly suitable for the pulling function and for filling e.g. the main cylinders at pressures. The integrated pressure port P (not for size 200) reduces the piping necessary for the high-pressure build-up.

The valve basically comprises of a housing (1), control spool (2), main poppet (3), and the compression springs (5) and (6).

The valve allows for free flow from A to B. In the opposite direction, the main poppet (3) is held on the seat by the compression spring (5) and the pressure available at port B. The pressure at the control port X pushes the control spool (2) downwards, against the compression spring (6), and pushes the main poppet (3) off the seat. Now, the valve can also be flown through in the opposite direction.

In order to dampen the opening velocity and to limit the dynamic load, a throttle check valve (7) is installed in size 200. The measuring point (8) allows for the recording of pressure developments.

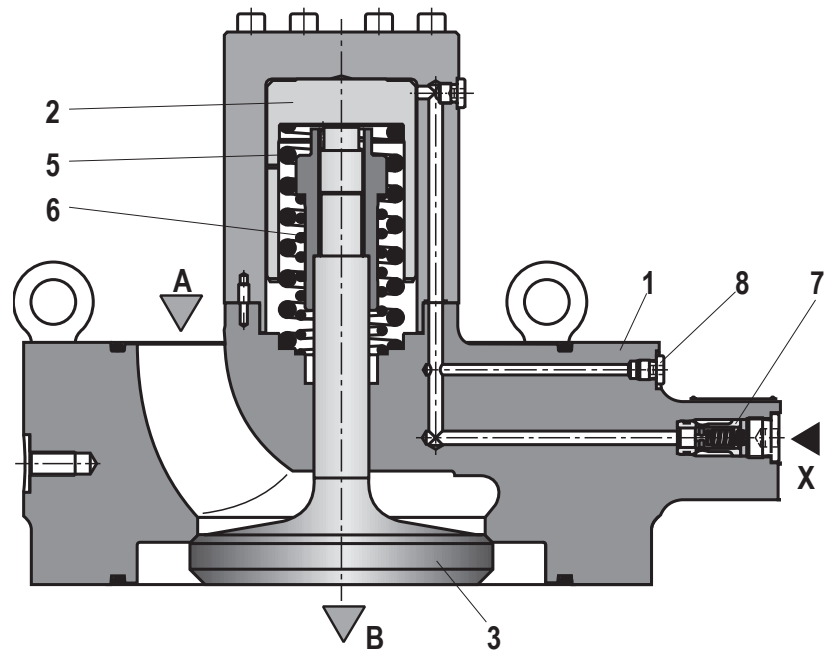


Type ZSF...F0... (size 32 to 160)

### In general:

In channel P of the upstream directional valve, you must **imperatively** provide a nozzle (separate order) (not for size 200). The nozzle  $\varnothing$  is to be designed according to the filling valve size (see below).

In case of non-compliance, increased dynamic loads may occur having detrimental effects on the operating time.



Type ZSF ... (size 200)

## Nozzle fitting

Size	32	40	50	63	80	100	125	160	200 <sup>1)</sup>
Nozzle $\varnothing$ in mm	0.8	0.8	0.8	0.8	1.0	1.0	1.2	1.5	4.0

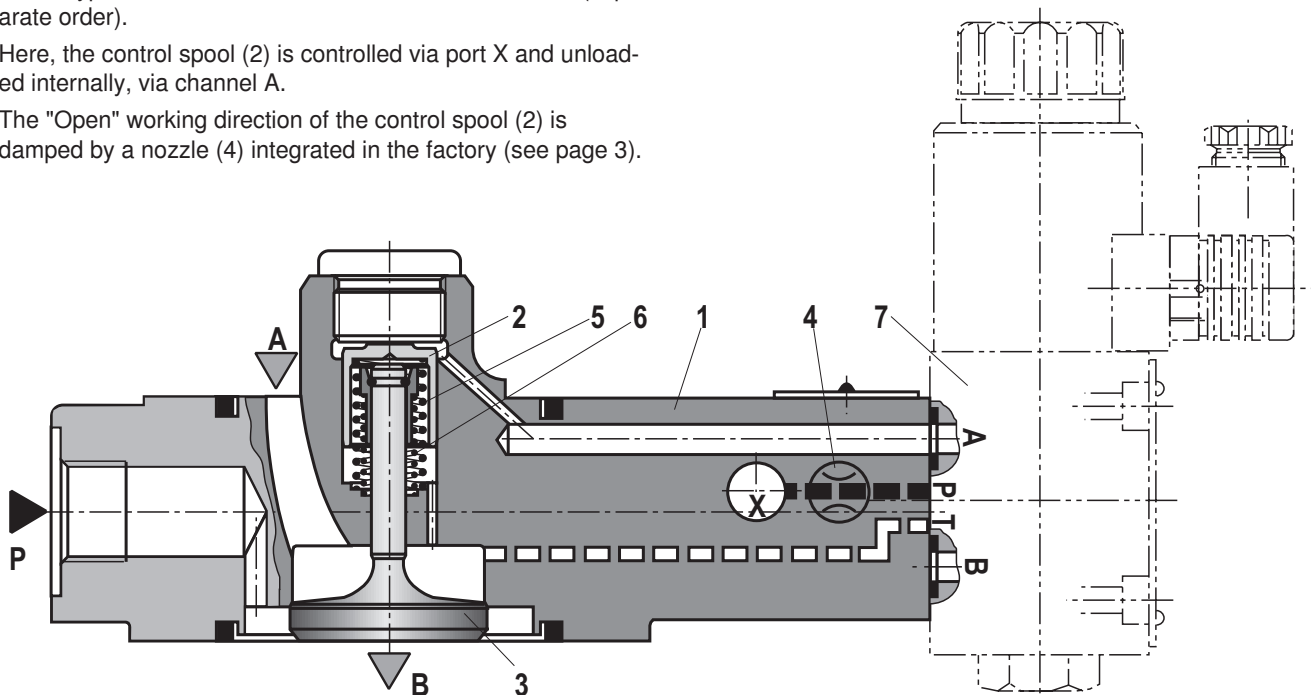
<sup>1)</sup> Only for version "W"

## Function, section: Type ZSFV ...

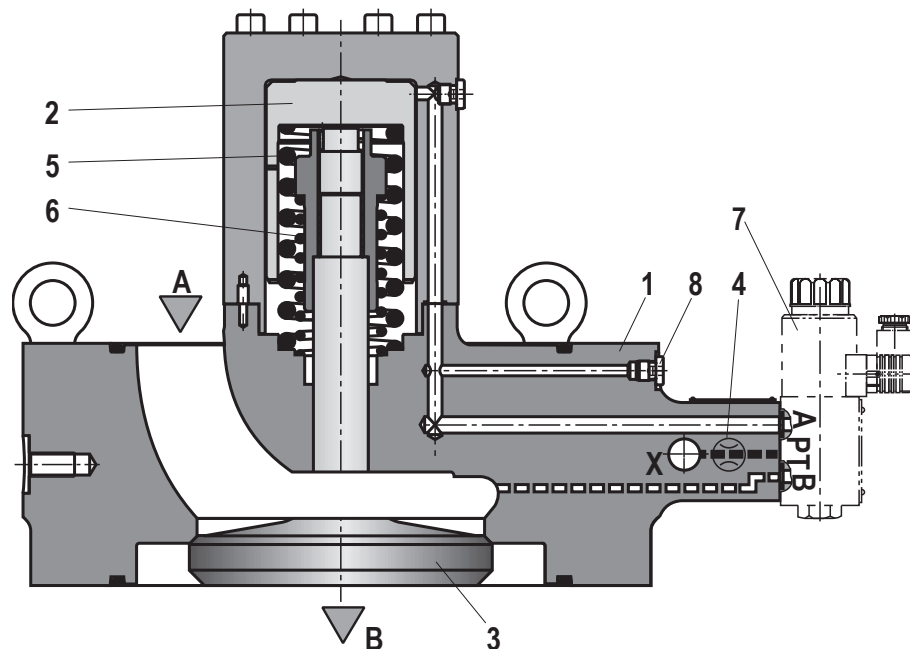
The function of valve type ZSFV basically corresponds to that of type ZSF, however with built-on directional valve (separate order).

Here, the control spool (2) is controlled via port X and unloaded internally, via channel A.

The "Open" working direction of the control spool (2) is damped by a nozzle (4) integrated in the factory (see page 3).



**Type ZSFV...F0...** (size 32 to 160)  
(without pre-decompression and built-on directional valve, vertical working direction of the control spool)



### In general:

The nozzle (4) has been installed in channel P of the directional valve port in the factory.

In case of changes in the nozzle fitting, there may be increased dynamic loads which may have detrimental effects on the operating time.

**Type ZSFV...F0...** (size 200)  
(without pre-decompression and built-on directional valve, vertical working direction of the control spool)


- 7 Directional valve type 4WE 6 D (separate order)  
– Simplified representation (installation orientation and size ratio)!

**Technical data** (For applications outside these parameters, please consult us!)**general**

Size		32	40	50	63	80	100	125	160	200
Weight	kg	3.5	4.2	5.5	7	10	15	26	47	150
Installation position (working direction of the control spool)		Any								
Ambient temperature range	°C	-30 to +80 <sup>1)</sup>								
Porting pattern	- Version "W"	DIN 24340 form A								

**hydraulic**

Maximum operating pressure	- Port B, P	bar	350 <sup>1)</sup>
	- Port X	bar	150
	- Port A	bar	16
Cracking pressure <sup>2)</sup>		bar	≈ 0.12
Flow ( $\Delta p = 0.3$ bar)		l/min	Depending on the case of application, see page 14
Hydraulic fluid			See table below
Hydraulic fluid temperature range		°C	-30 to +70
Viscosity range		mm <sup>2</sup> /s	10 to 800
Maximum permitted degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c)			Class 20/18/15 <sup>3)</sup>
Technical data of the directional valve	- Directional spool valve		See data sheet 23178
	- Directional seat valve		See data sheet 22058

Hydraulic fluid	Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons	HL, HLP, HVLP	NBR	DIN 51524
Environmentally compatible - Insoluble in water	HEES	NBR	ISO 15380
Flame-resistant - Water-containing	HFC	NBR	ISO 12922
 <b>Important information on hydraulic fluids!</b> - For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!		- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!	

<sup>1)</sup> Observe the technical data of the directional valve, see data sheet 23178 (type 4WE 6 D...) or 22058 (type M-.SEW 6...)

<sup>2)</sup> Pressure differential at the main poppet for overcoming the spring force.

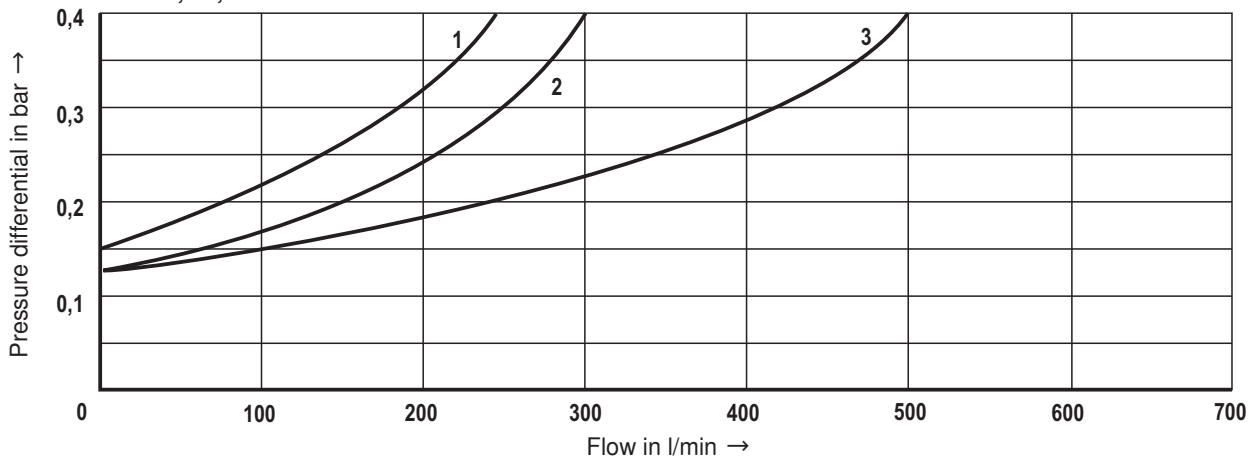
<sup>3)</sup> The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.

For selecting the filters, see [www.boschrexroth.com/filter](http://www.boschrexroth.com/filter).

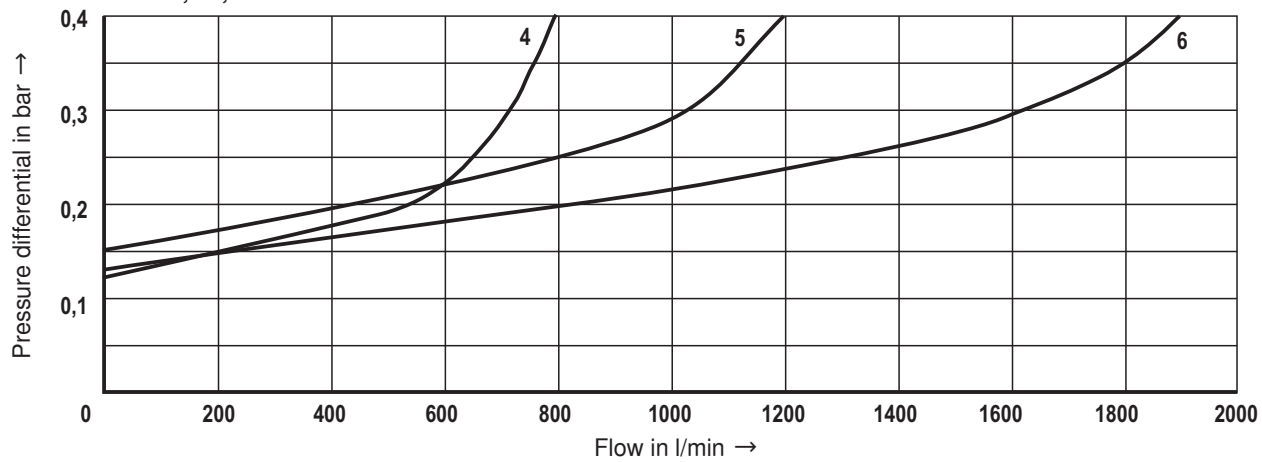
## Characteristic curves (measured with HLP46, $\vartheta_{oil} = 40 \text{ °C} \pm 5 \text{ °C}$ )

Pressure differential  $\Delta p$  between ports A and B against the flow  $q_V$  (A to B).

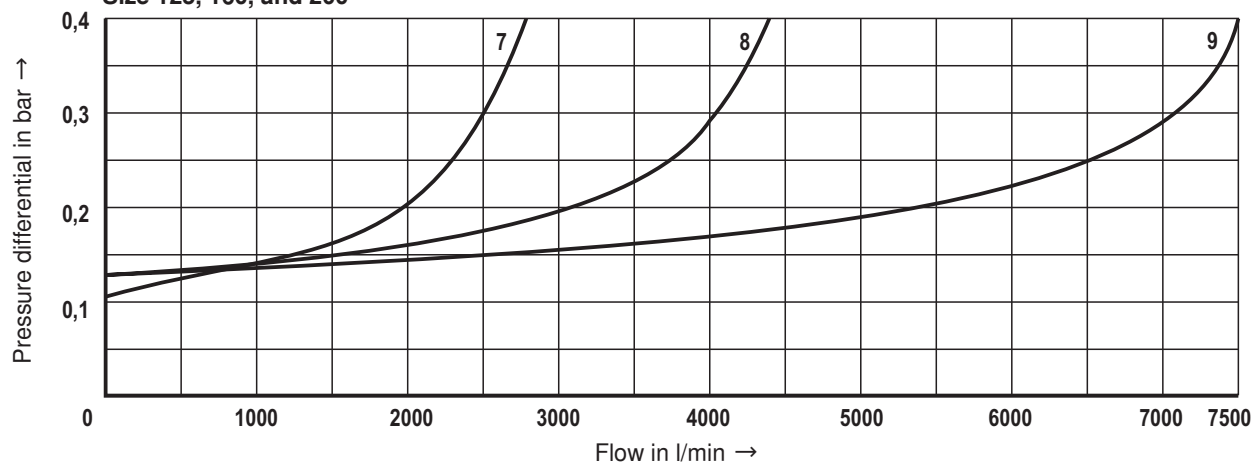
Size 32, 40, and 50



Size 63, 80, and 100

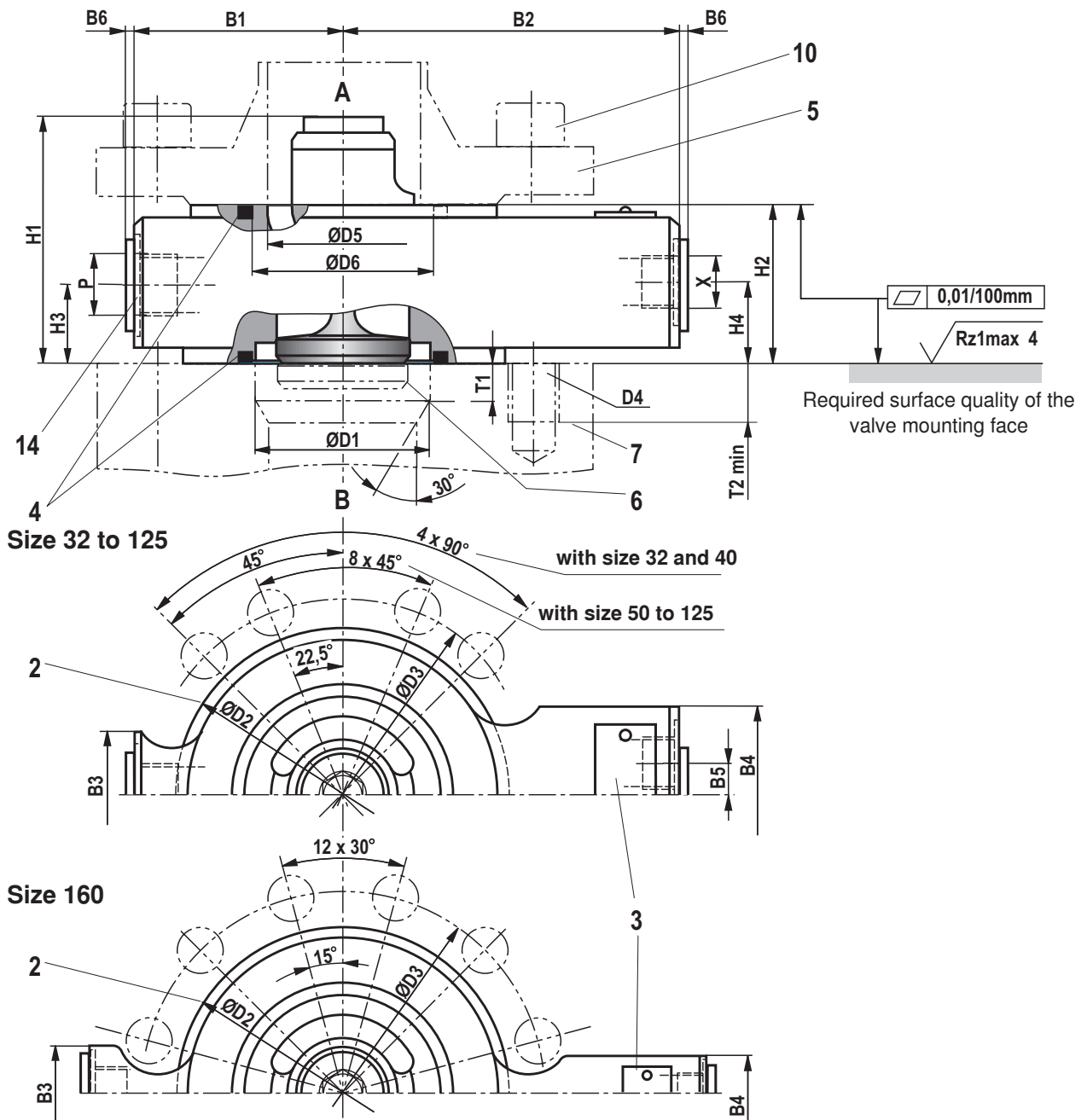


Size 125, 160, and 200



- |           |            |            |
|-----------|------------|------------|
| 1 Size 32 | 4 Size 63  | 7 Size 125 |
| 2 Size 40 | 5 Size 80  | 8 Size 160 |
| 3 Size 50 | 6 Size 100 | 9 Size 200 |

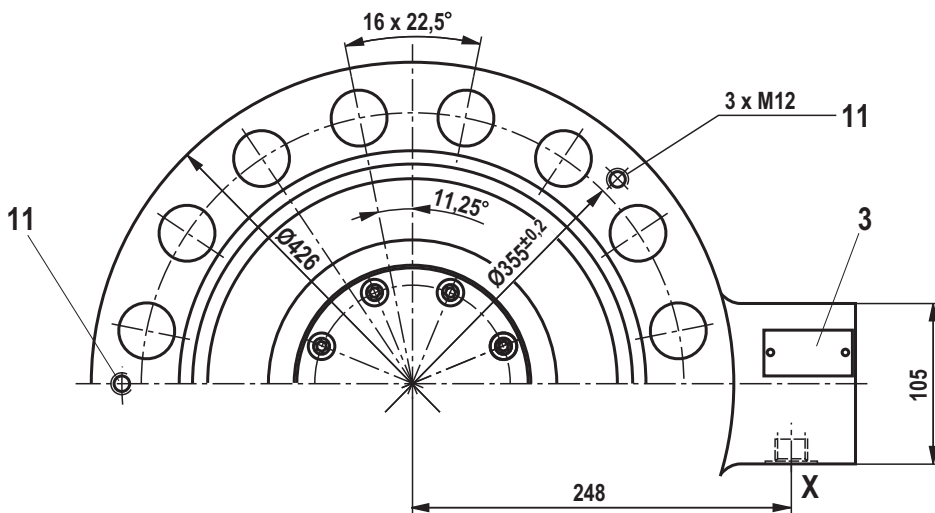
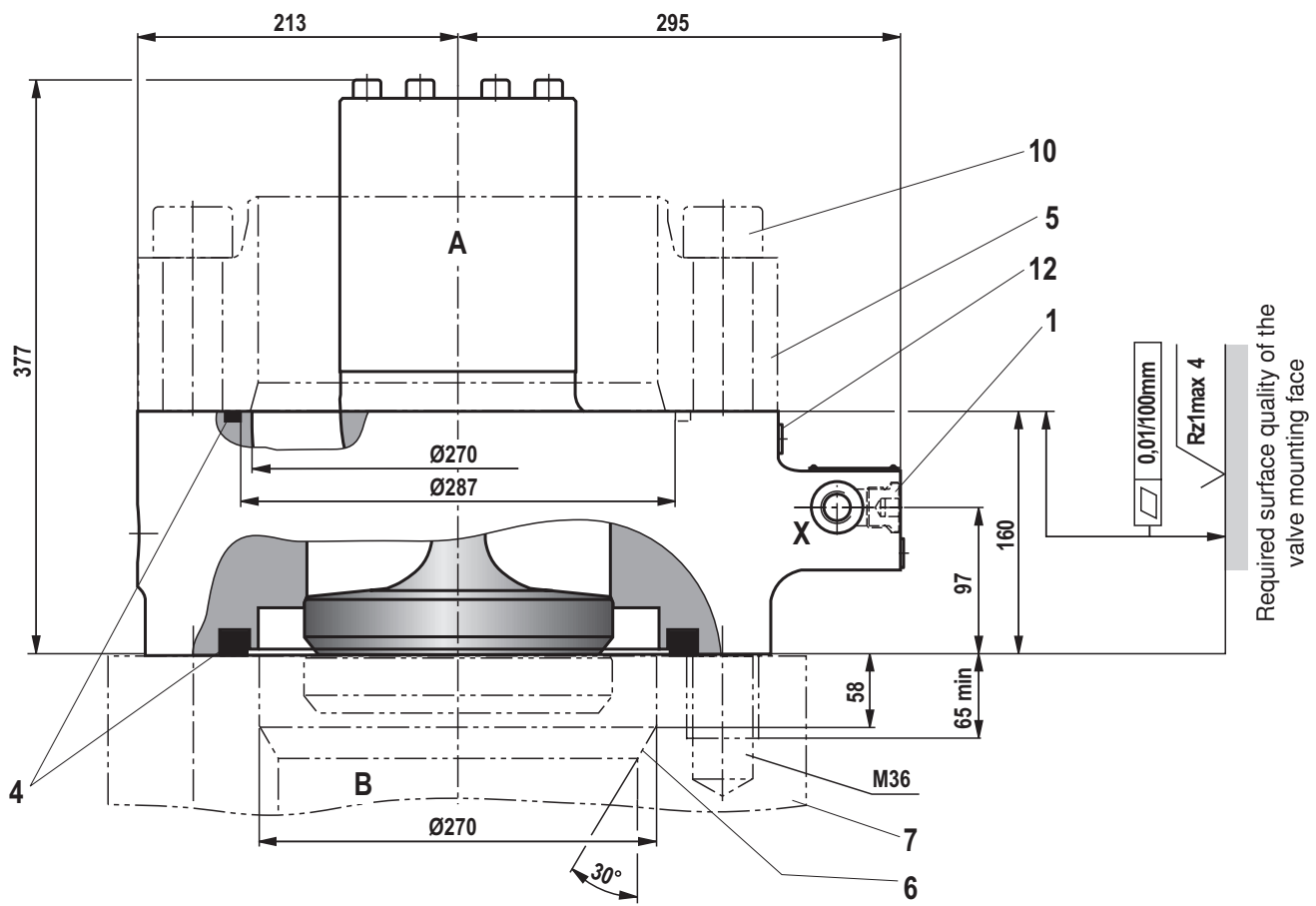
**Unit dimensions: Type ZSF, size 32 to 160 (dimensions in mm)**



Item explanations see page 12

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

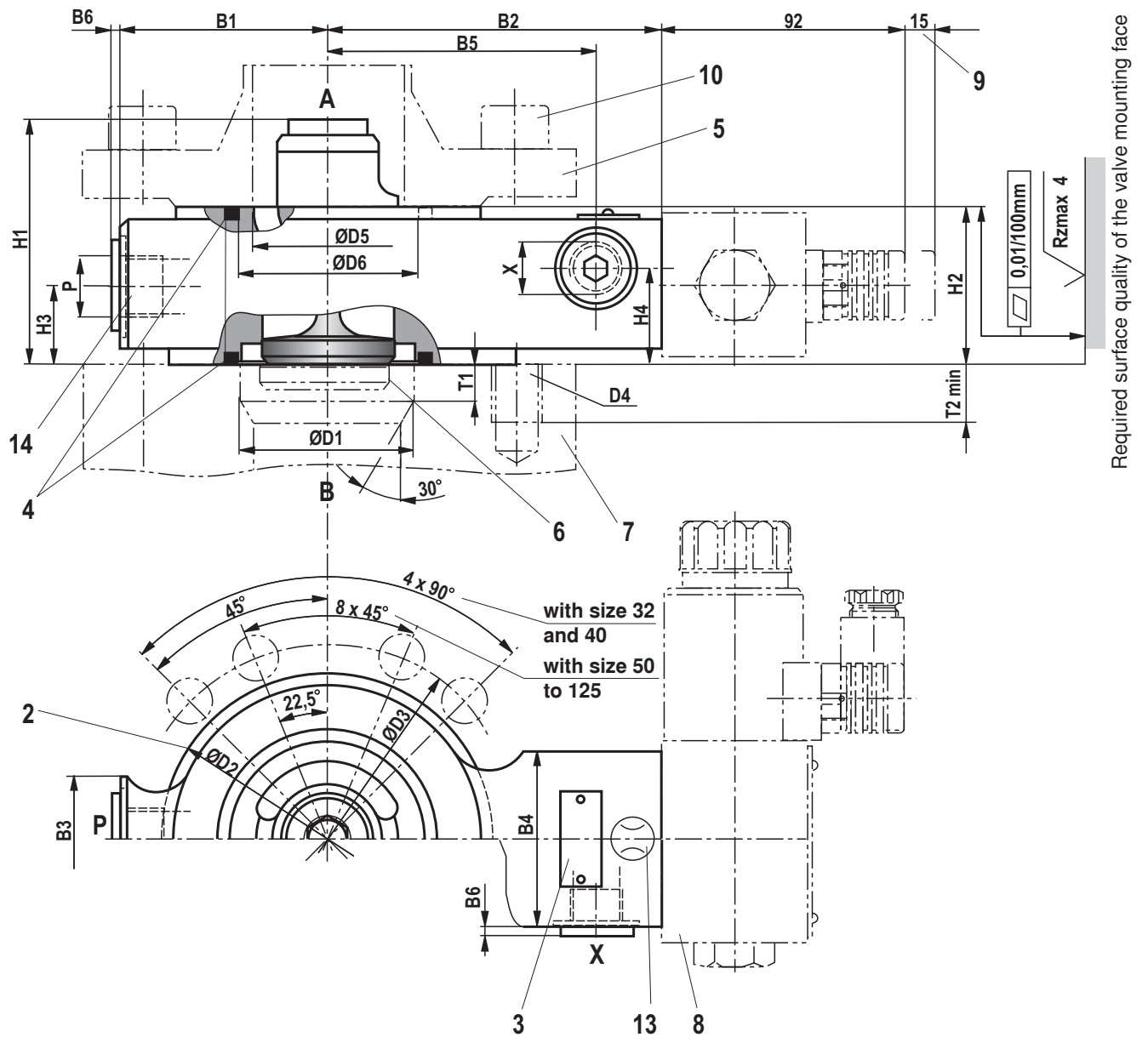
Unit dimensions: Type ZSF, size 200 (dimensions in mm)



Item explanations see page 12



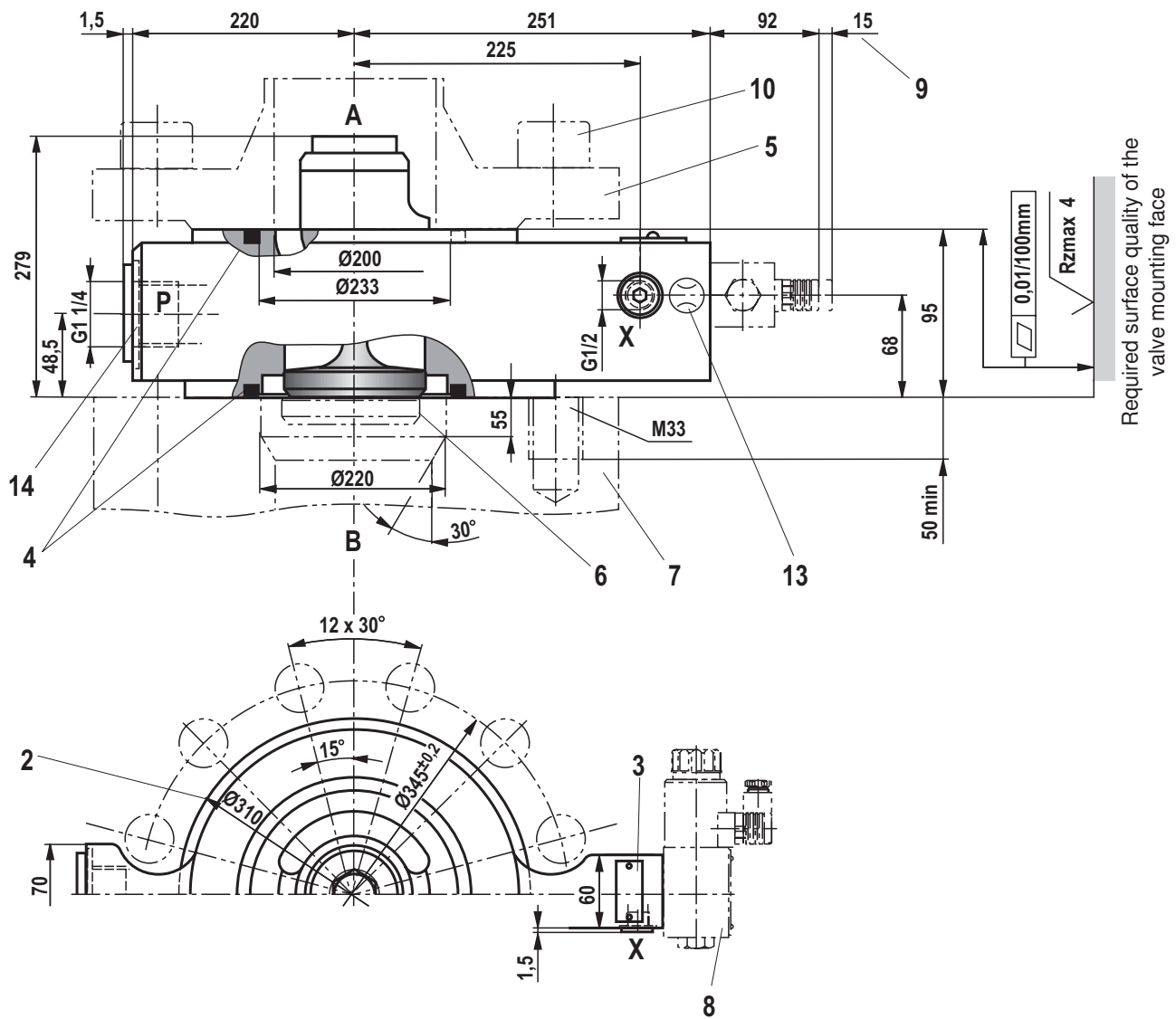
**Unit dimensions: Type ZSFW, size 32 to 125 (dimensions in mm)**



Item explanations see page 12

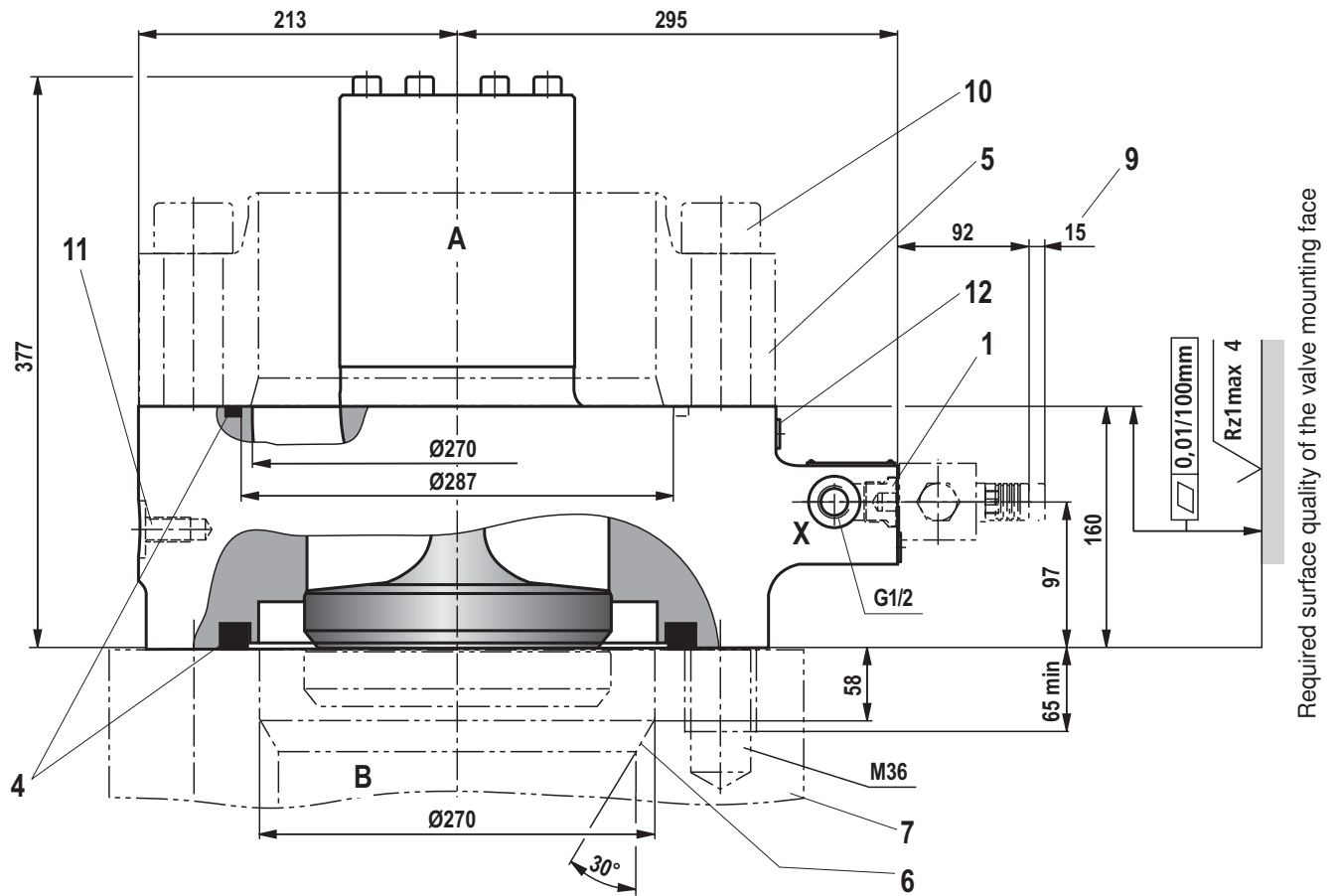
Size	B1	B2	B3	B4	B5	B6 max	ØD1	ØD2	ØD3 ±0.2	D4	ØD6	ØD7	H1	H2	H3	H4	P	T1	T2 min	X
32	65	107	40	55	85	1.5	46	93	110	M16	42	49.5	77	50	26.5	34	G1/2	8	30	G1/4
40	70	112	40	55	90	1.5	58	108	125	M16	52	61.5	80	50	26.5	34	G1/2	10	35	G1/4
50	110	137	40	55	115	1.5	71	128	145	M16	70	75.7	97	50	26.5	34	G1/2	12	30	G1/4
63	115	142	45	55	120	1.5	90	143	160	M16	83	97.7	110	55	27.5	34.5	G3/4	14	35	G1/4
80	125	157	45	55	135	1.5	107	169	190	M20	100	112	123	60	30	37.5	G3/4	16	30	G1/4
100	140	186	55	55	165	1.5	132	212	240	M27	124	138.5	145	65	32.5	40	G1	25	55	G3/8
125	180	206	65	60	184	1.5	170	248	280	M30	148	176	215	75	37.5	50	G1	33	50	G3/8

**Unit dimensions: Type ZSFV, size 160 (dimensions in mm)**

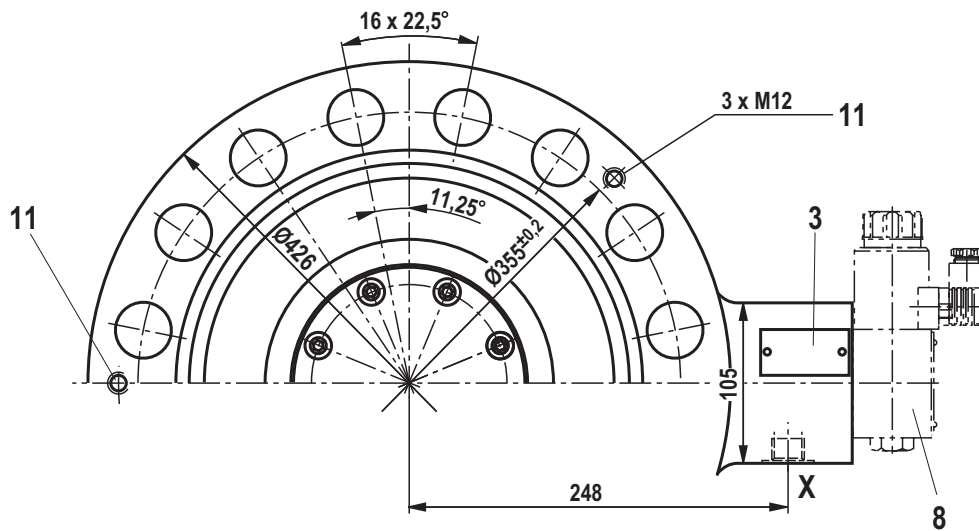


Item explanations see page 12

**Unit dimensions: Type ZSFW, size 200 (dimensions in mm)**



Required surface quality of the valve mounting face

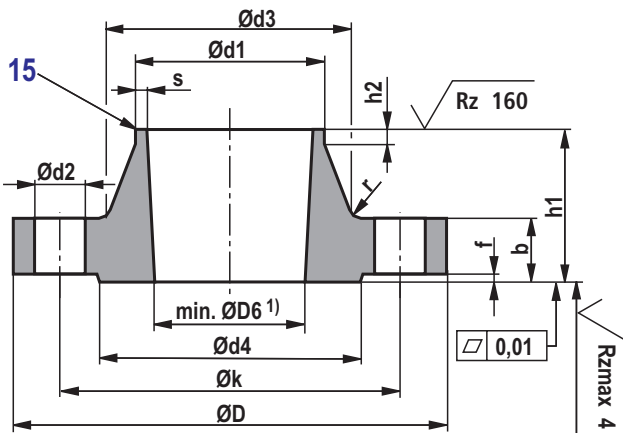


Item explanations see page 12

## Unit dimensions

- 1 Throttle check valve, tightening torque  $M_A = 135 \text{ Nm} \pm 5 \%$
- 2 Centering diameter
- 3 Name plate
- 4 Seal rings
- 5 Counterflange (separate order; dimensional proposal see below)
- 6 Main poppet stroke (see page 11)
- 7 **Attention!**  
Design of the valve mounting face (e. g. press cylinders, bearing structures, etc.) must be sufficiently rigid!  
The filling valve must not be loaded by bending!
- 8 Directional valve (separate order); dimensions see data sheet 23178 (type 4WE 6 D...) or 22058 (type M-SEW 6...)
- 9 Space required for removing the mating connector
- 10 Valve mounting screws (separate order, see page 13)
- 11 Threads for transport device (ring bolts), evenly distributed to circumference
- 12 Measuring point, tightening torque  $M_A = 30 \text{ Nm} \pm 10 \%$
- 13 Cushioning nozzle M8 x 1
- 14 Additional pressure port; if not used, seal in a hydraulically tight way by means of suitable plug screws!

### Dimensional proposal for counterflange (item 5) (dimensions in mm)



Maximum operating pressure $p_{max}$	350 bar <sup>3)</sup>
Recommended flange material	– Size 32 to 160 C22
	– Size 200 S355J2G3

#### Form of the welding gap:

##### Standard version

$s \leq 16$  gap form 22 DIN 2559

$s > 16$  gap form 3 DIN 2559

Special version see DIN 2559

Size	Flange						Neck				Raised face	
	$\text{Ød1}^{2)}$	$\text{Ød2}$	$\text{ØD}$	b	$\text{Øk}$	h1	$\text{Ød3}$	$s^{2)}$	r	h2	$\text{Ød4}$	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
200	273	39	420	100	355	140	292	6.5	6	16	–	–

<sup>1)</sup> See drawing and dimensional table page 7 to 12

<sup>2)</sup> For seamless steel tubes wall thickness 16 according to DIN EN 10220

<sup>3)</sup> When using other counterflanges than the ones specified here, it may be necessary to reduce the operating pressure.

Valve mounting screws and ordering codes for counterflange see page 13.

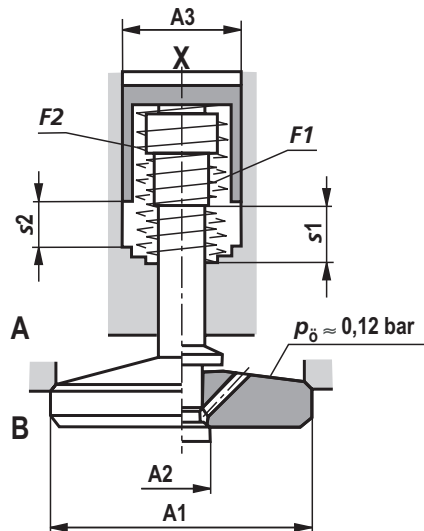
## Valve mounting screws, counterflange (separate order)

Size	Quantity	Hexagon socket head cap screws ISO 4762 - 10.9 (or DIN 912 - 10.9)			Counterflange	
		Dimension	Tightening torque $M_A$ in Nm ( $\pm 5\%$ ), friction coefficient $\mu_{\min} = 0.14$ <sup>1)</sup>	Material no.	Material no.	
32	4	M16 x 100	280	R900008843	R900842693	
40	4	M16 x 110	280	R900003271	R900825610	
50	8	M16 x 110	280	R900003271	R900826441	
63	8	M16 x 130	280	R900017028	R900849622	
80	8	M20 x 140	560	R900006624	R900862915	
100	8	M27 x 180	1400	On request	R900834583	
125	8	M30 x 200	1900	On request	R900861508	
160	12	M33 x 260	2600	On request	R900846478	
200	16	M36 x 320	2600	On request	R901205467	

The information on the hexagon socket head cap screws (type, length, tightening torque) refer exclusively to the use with the counterflanges listed below!

<sup>1)</sup> Please adjust in case of changed surfaces; use a torque wrench!

## Poppet geometry and determination of the minimum pilot pressure



without pre-decompression | with pre-decompression

- A1** = Effective area of the main poppet
- A2** = Effective area of the pilot poppet
- A3** = Effective area of the control spool
- s1** = Stroke of the main poppet
- s2** = Stroke of the control spool
- F1** = Spring force of the valve spring
- F2** = Spring force of the control spool compression spring
- $V_{st}$  = Pilot volume for opening the valve
- $p_0$  = Cracking pressure (pressure differential at the main poppet for overcoming the spring force **F1**)
- $p_{St}$  = Pilot pressure at port X
- $p_B$  = System pressure at port B

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

Size	A1 in cm <sup>2</sup>	A2 <sup>1)</sup> in cm <sup>2</sup>	A3 in cm <sup>2</sup>	s1 in mm	s2 in mm	F1 in N	F2 in N	V <sub>st</sub> in cm <sup>3</sup>	Unchecking ratio	
									<sup>2)</sup> in bar	<sup>3)</sup> 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
200	314.16	–	78.54	48.0	34.0	425 to 850	2389 to 3822	267.0	4.0	–

<sup>1)</sup> Is omitted for version "without pre-decompression" (ZSF ...0...)

<sup>2)</sup> Without pre-decompression

<sup>3)</sup> With pre-decompression (on request)

**Example:** Type ZSF32...F0;  $p_B = 30$  bar

$$p_{St} = 4.0 \times 30 \text{ bar} = 120 \text{ bar}$$

**Flow  $q_V$  in l/min (A to B) for different cases of application ( $\Delta p = 0.3 \text{ bar}$ )**

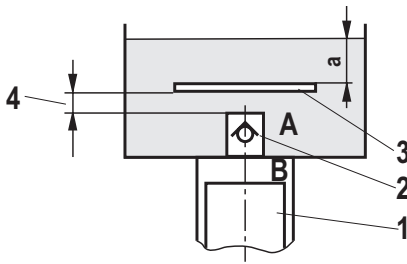
Size	32	40	50	63	80	100	125	160	200
Case of application 1	200	300	500	800	1200	1900	3000	4200	7000
Case of application 2	170	250	400	650	1000	1600	2600	3900	6510
Case of application 3	140	220	360	560	900	1400	2200	3400	5670
Case of application 4	100	150	240	380	620	950	1500	2300	3850
Case of application 5	70	110	170	280	450	700	1100	1690	2800

**Attention!**

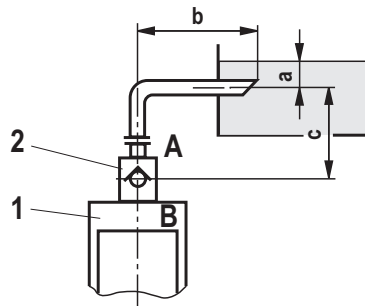
Wrong dimensioning of filling valve and suction line may cause cavitation and consequential damage!

**Cases of application**

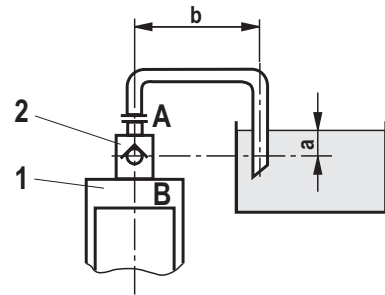
Case of application 1



Case of application 2

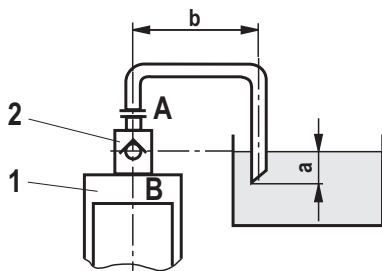


Case of application 3

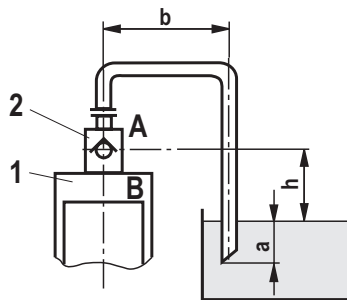


Size of the filling tank at least 1.5 x cylinder capacity

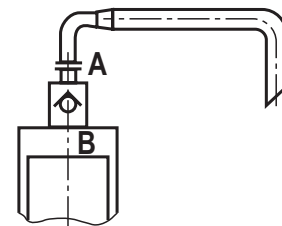
Case of application 4



Case of application 5



Information on case of application 2 to 5



For limit areas, please ask us. It is often enough, to select a pipeline which is one size larger.

- 1 Cylinder
- 2 Filling valve
- 3 This sheet is not included in the scope of delivery. With smaller tank dimensions and minimum hydraulic fluid level (a), it prevents the formation of tunnels.

- 4 Observe the supply cross-section!
  - a Min. 300 mm with extended cylinder
  - b up to 1000 mm with the specified maximum flows
  - c  $h \leq 500 \text{ mm}$
  - h  $300 \text{ mm} \leq h < 500 \text{ mm}$

## Notes

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Bosch Rexroth AG  
Hydraulics  
Zum Eisengießer 1  
97816 Lohr am Main, Germany  
Phone +49 (0) 93 52 / 18-0  
Fax +49 (0) 93 52 / 18-23 58  
documentation@boschrexroth.de  
www.boschrexroth.de

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## Notes

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Bosch Rexroth AG  
Hydraulics  
Zum Eisengießer 1  
97816 Lohr am Main, Germany  
Phone +49 (0) 93 52 / 18-0  
Fax +49 (0) 93 52 / 18-23 58  
documentation@boschrexroth.de  
www.boschrexroth.de

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