Prefill valve

Type ZSF and ZSFW

RE 20478
Edition: 2017-12
Replaces: 08.11

H8128

- Size 32 ... 200
- Component series 1X; 2X
- Maximum operating pressure 350 bar
- Maximum flow 7000 l/min (***Δp*** = 0.3 bar)

Features

- Pilot operated check valve in sandwich plate design
- Directional valve set-up, optional
- High-pressure connection (NG32 ... 160)
- Integrated throttle check valve (NG50, 63, 80 and 200)

Contents

Ordering code

01	02	03	04	05		06		07		08		09	10	11
ZSF			**F**	**0**	**–**	**1**	**–**		**/**	**M**	**/**	**01**		*****

01	Prefill valve, sandwich plate design	**ZSF**

Directional valve set-up

02	Not possible	**no code**
	Possible	**W**

03	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

04	Flange connection	**F**

05	Without pre-decompression (with pre-decompression upon request)	**0**

Cracking pressure main poppet

06	$p_{Ö}$ ca. 0.12 bar	**1**

07	Component series 10 ... 19 (10 ... 19: unchanged installation and connection dimensions) – NG32 ... 100 and NG160	**1X**
	Component series 20 ... 29 (20 ... 29: unchanged installation and connection dimensions) – NG125 [1] and 200	**2X**

Seal material

08	NBR seals (preferred)	**M**
	FKM seals	**V**
	Observe compatibility of seals with hydraulic fluid used.	

Connection version

09	Mounting cavities with pipe thread according to ISO 228, DIN EN 3852 part 2	**01**
	Pipe thread “UNF/UN” according to ANSI/ASME B 1.1	**12**

Nozzle bore (see also symbols on page 3)

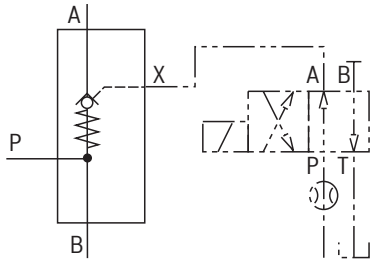
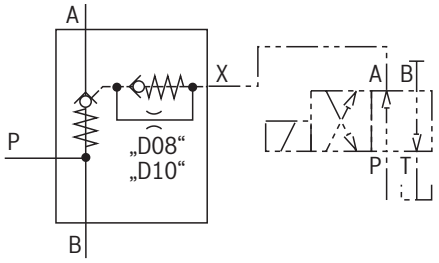
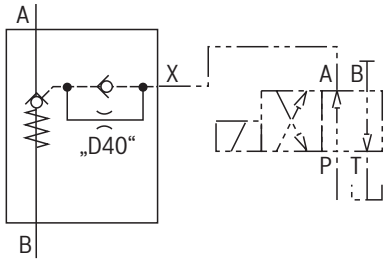
10	**– Type ZSF**	
	NG32, 40, 100, 125, 160 (**without** throttle check valve)	**no code**
	NG50, 63, 80 (Possibility to include a throttle check valve, not fitted)	**D00**
	NG50, 63 (throttle check valve Ø0.8 mm)	**D08**
	NG80 (throttle check valve Ø1 mm)	**D10**
	NG200 (throttle check valve Ø4 mm)	**D40**
	– Type ZSFW	
	NG32 ... 160 – nozzle in channel P installed at the factory	**no code**
	NG200 – nozzle in channel P installed at the factory	**D40**

11	Further details in the plain text	

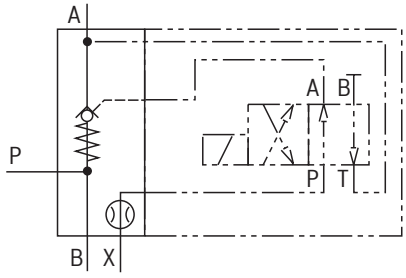
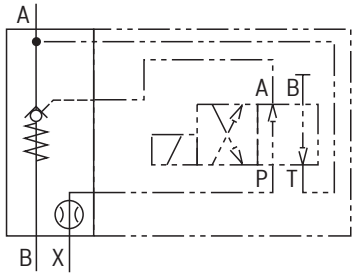
[1] Compatible with series 1X

Symbols

Type ZSF

Without throttle check valve	**With throttle check valve**	
NG32, 40, 100, 125, 160	NG50, 63, 80	NG200
		
Separate, external nozzle fitting required (nozzle diameter see at the bottom)	Throttle check valve installed at the factory; no nozzle required	

Type ZSFW

NG32 ... 160 (With high-pressure connection)	NG200 (Without high-pressure connection)
	
Nozzle in channel P installed at the factory	

Nozzle fitting

Nozzle Ø in mm

	Size								
	32	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**
Type ZSF	0.8	0.8	0.8 [1)]	0.8 [1)]	1.0 [1)]	1.0	1.2	1.5	4.0 [1)]
Type ZSFW	0.8 [2)]	0.8 [2)]	0.8 [2)]	0.8 [2)]	1.0 [2)]	1.0 [2)]	1.2 [2)]	1.5 [2)]	4.0 [2)]

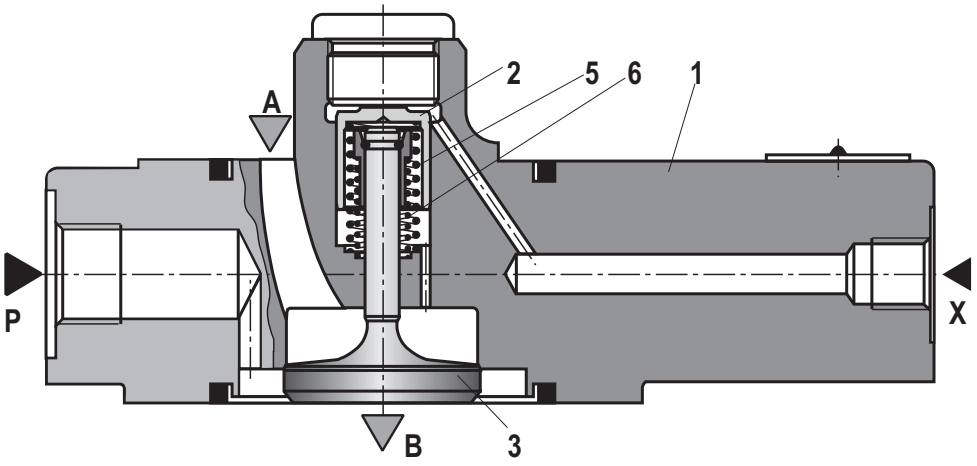
[1)] Throttle check valve installed at the factory (not version “00”); no nozzle required

[2)] Nozzle in channel P installed at the factory

Function, section: Type ZSF

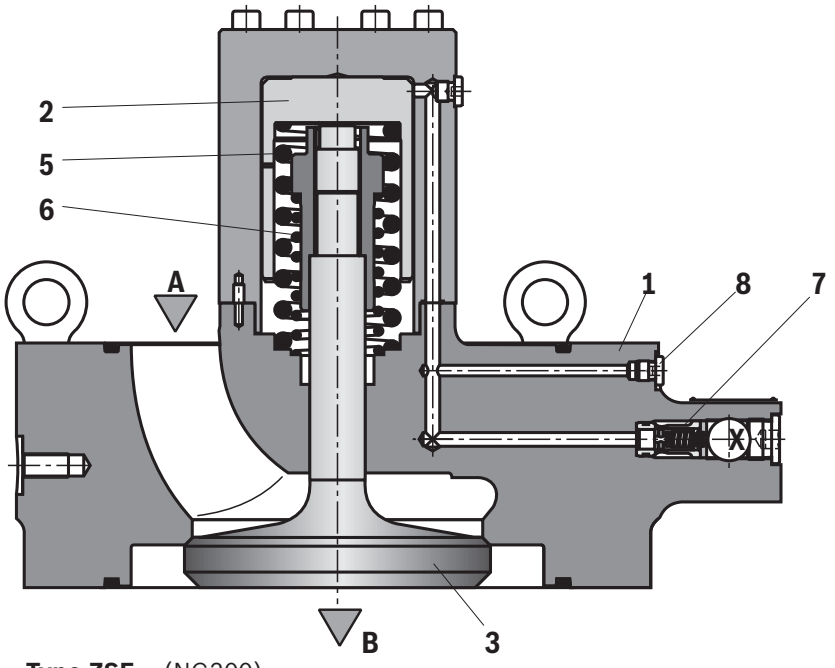
The valve type ZSF is a pilot operated check valve in sandwich plate design. It is used for the leakage-free isolation of pressurized working circuits (e.g. pressing cylinder). Due to its favorable flow characteristic values and the low cracking pressure of the main poppet (3), it is particularly suitable for the pulling function and for filling e.g. the main cylinders at presses. 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 NG50, 63, 80 and 200. The measuring point (8) allows for the recording of pressure developments.



Type ZSF... (NG32, 40, 100, 125, 160)

☞ **Notice:**
With size 32, 40, 100, 125, 160 a nozzle (separate order) must **imperatively** be provided in channel P of the upstream directional valve. The nozzle diameter is to be designed according to the prefill valve size (see page 3).
In case of non-compliance, increased dynamic loads may occur having detrimental effects on the operating time.

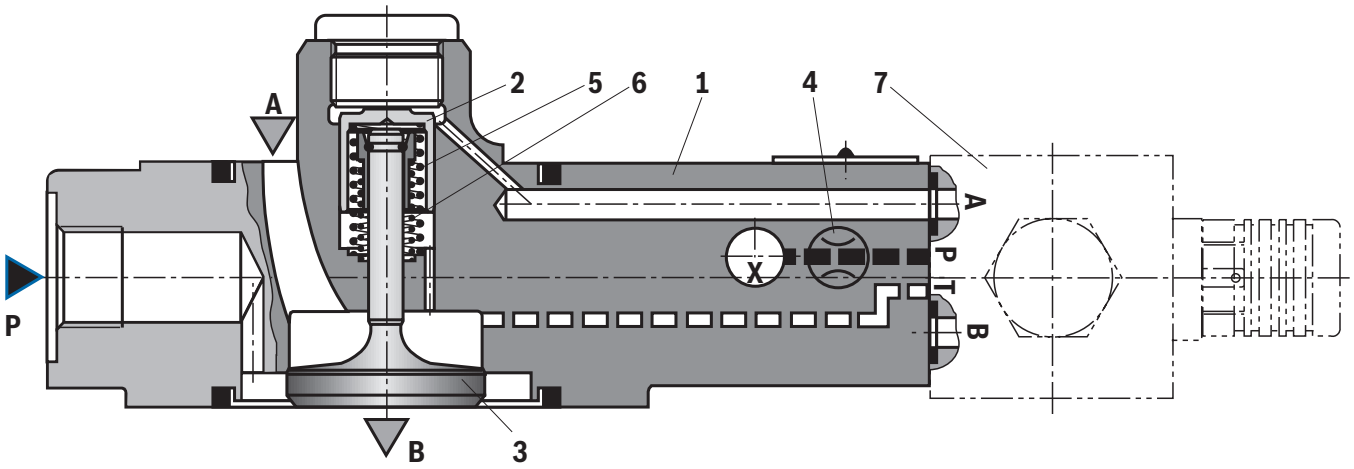


Type ZSF... (NG200)

Function, section: Type ZSFW

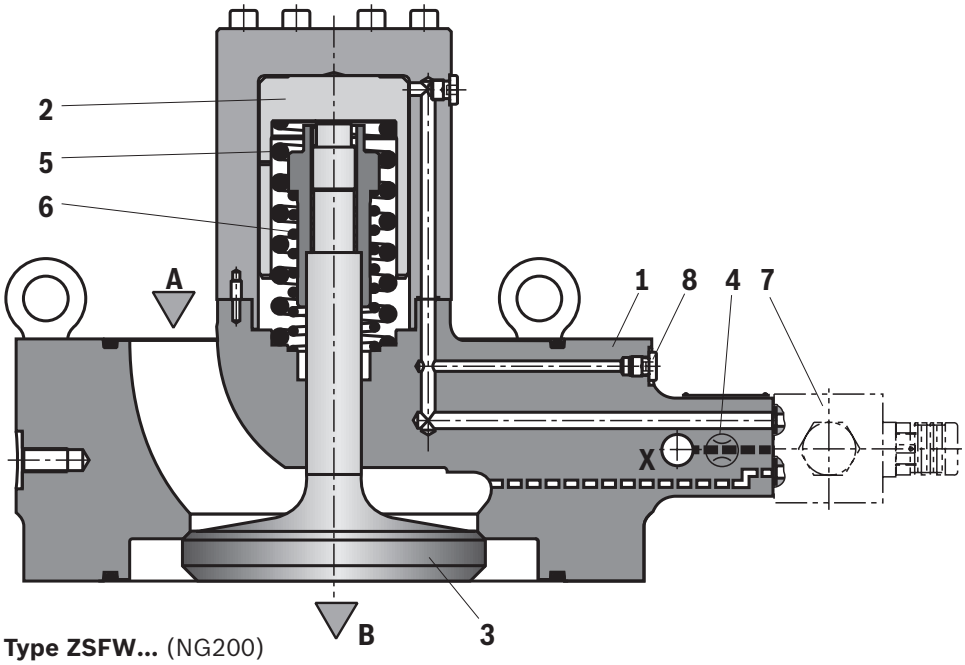
The function of valve type ZSFW basically corresponds to that of type ZSF, however with attachable directional valve (separate order).

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 at the factory (see page 3).



Type ZSFW... (NG32 ... 160)
(without pre-decompression and built-on directional valve, vertical working direction of the control spool)

☞ **Notice:**
The nozzle (4) has been installed in channel P of the directional valve port at 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 ZSFW... (NG200)
(without pre-decompression and built-on directional valve, vertical working direction of the control spool)

7 Directional valve type 4WE 6 D (separate order)

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 ... +80 [1]								
Porting pattern for directional valve set-up “W”	ISO 4401-03-02-0-05								

hydraulic			
Maximum operating pressure	▶ Port B, P	bar	350 [1]
	▶ Port X	bar	150
	▶ Port A	bar	16
Cracking pressure [2]		bar	≈ 0.12
Flow (***Δp*** = 0.3 bar))		l/min	depending on the case of application, see page 15
Hydraulic fluid			see table below
Hydraulic fluid temperature range		°C	-30 ... +70
Viscosity range		mm^2/s	10 ... 800
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 20/18/15 [3]
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**	**Data sheet**
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs Hydrotherm 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922	90223

☞ **Important information on hydraulic fluids:**
- ▶ For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- ▶ There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- ▶ The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- ▶ **Flame-resistant – containing water**:
  - – Maximum pressure differential 210 bar, otherwise, increased cavitation erosion
  - – Life cycle as compared to operation with mineral oil HL, HLP 30 ... 100%
  - – Maximum hydraulic fluid temperature 60 °C
- ▶ **Bio-degradable and flame-resistant:** If this hydraulic fluid is used, small amounts of dissolved zinc may get into the hydraulic system.

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

2) Pressure differential at the main poppet for overcoming the spring force.

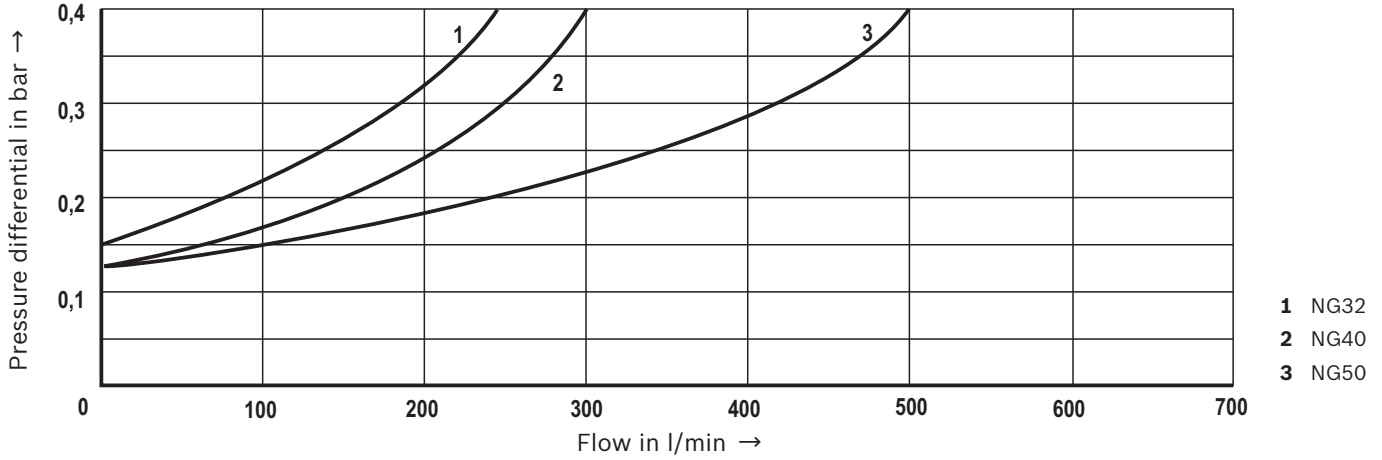
3) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.
For the selection of filters, see www.boschrexroth.com/filter.

Characteristic curves

(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

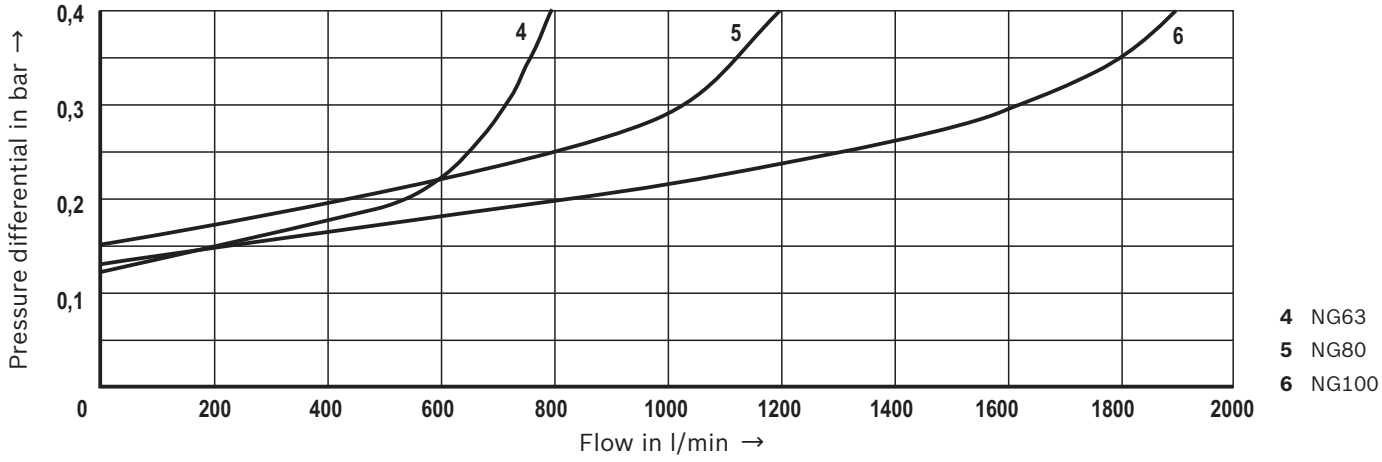
Pressure differential Δp between ports A and B against the flow q_V (A → B).

Size 32, 40, and 50



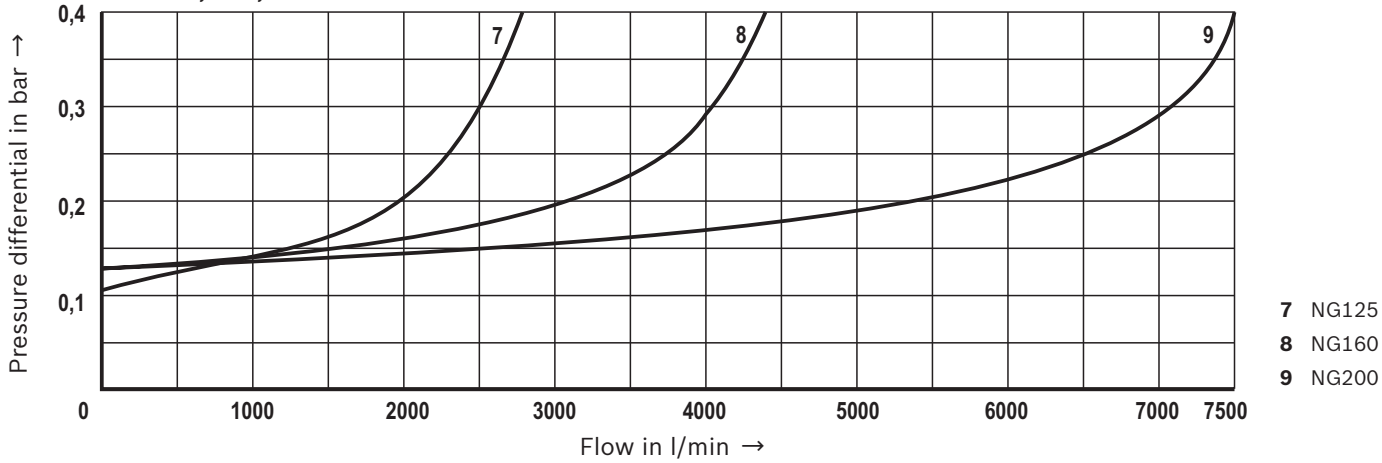
1 NG32
2 NG40
3 NG50

Size 63, 80, and 100



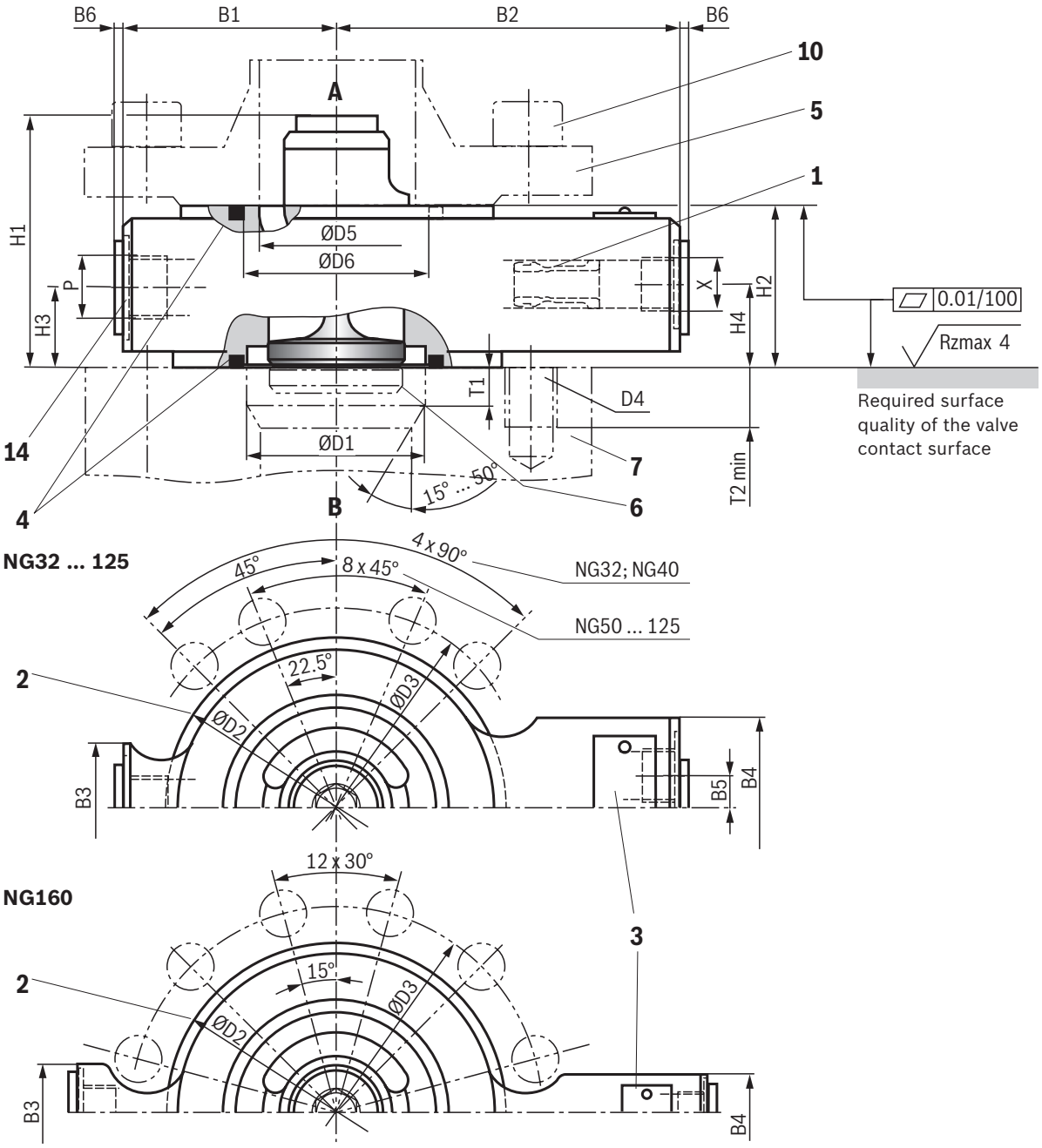
4 NG63
5 NG80
6 NG100

Size 125, 160, and 200



7 NG125
8 NG160
9 NG200

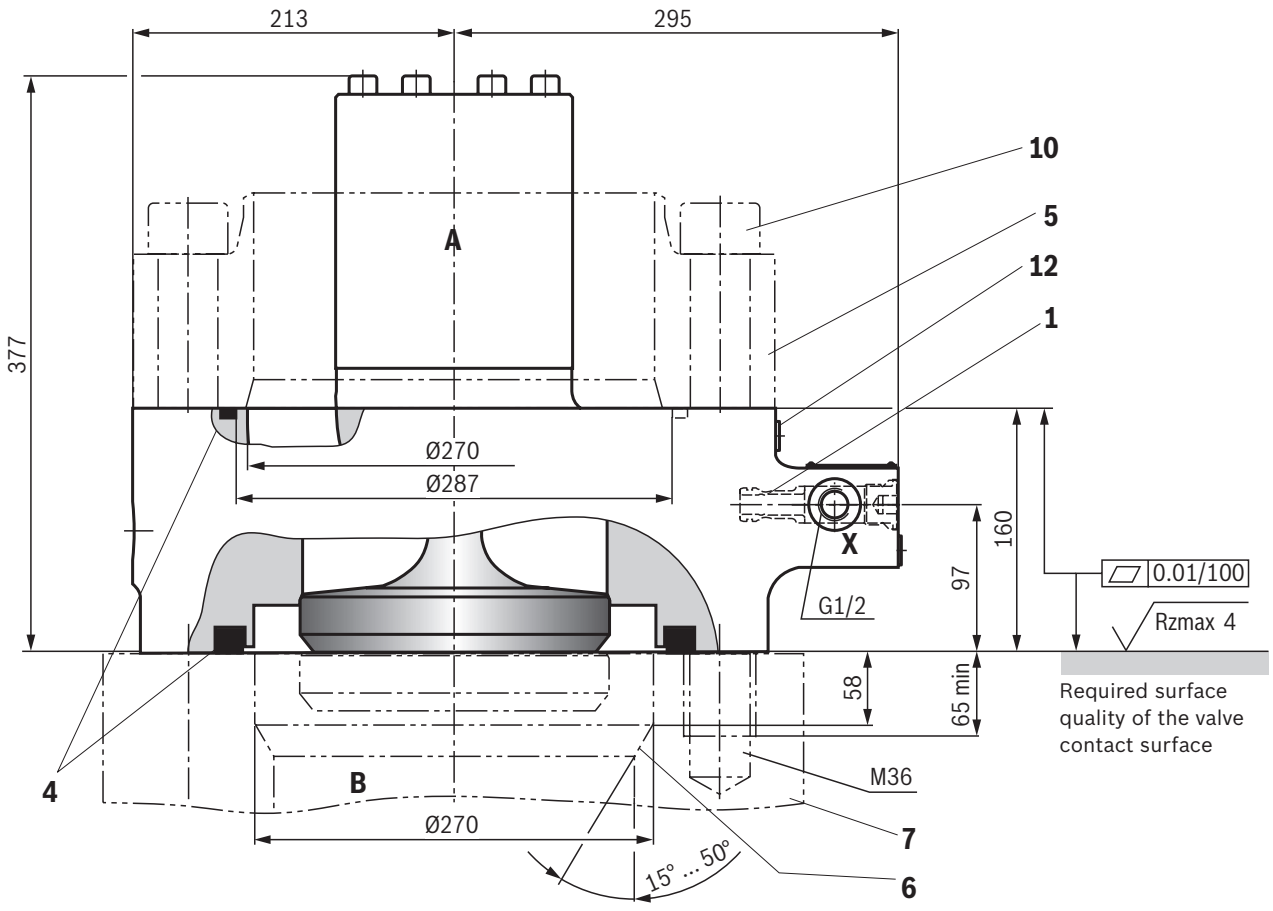
Dimensions: Type ZSF – NG32 ... 160
(dimensions in mm)

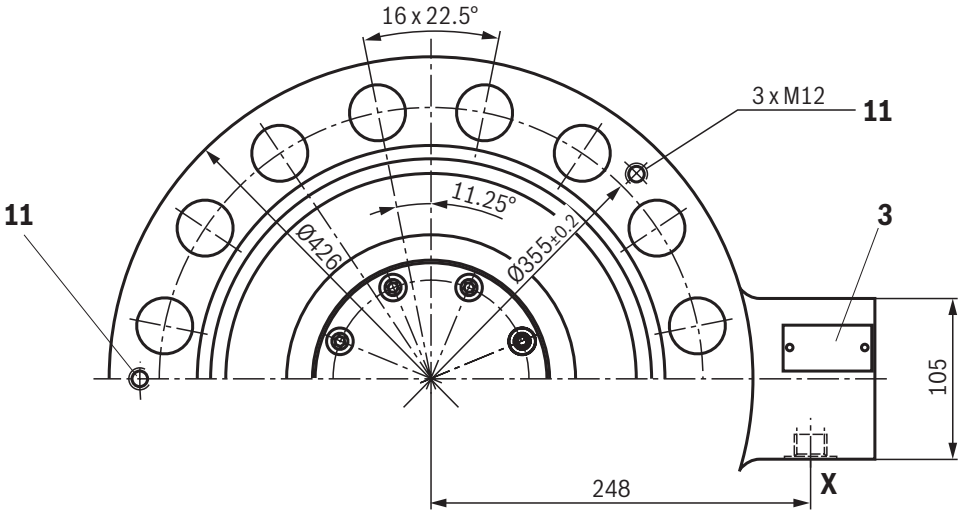


NG	B1	B2	B3	B4	B5	B6 max	ØD1	ØD2	ØD3 ±0.2	D4	ØD5	ØD6	H1	H2	H3	H4	P	T1	T2 min	X
32	65	110	40	55	7.5	1.5	46	93	110	M16	42	49.5	77	50	26.5	26.5	G1/2	8	30	G1/4
40	70	115	40	55	7.5	1.5	58	108	125	M16	52	61.5	80	50	26.5	26.5	G1/2	10	35	G1/4
50	110	140	40	55	7.5	1.5	71	128	145	M16	70	75.7	97	50	26.5	26.5	G1/2	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

Item explanation see page 13

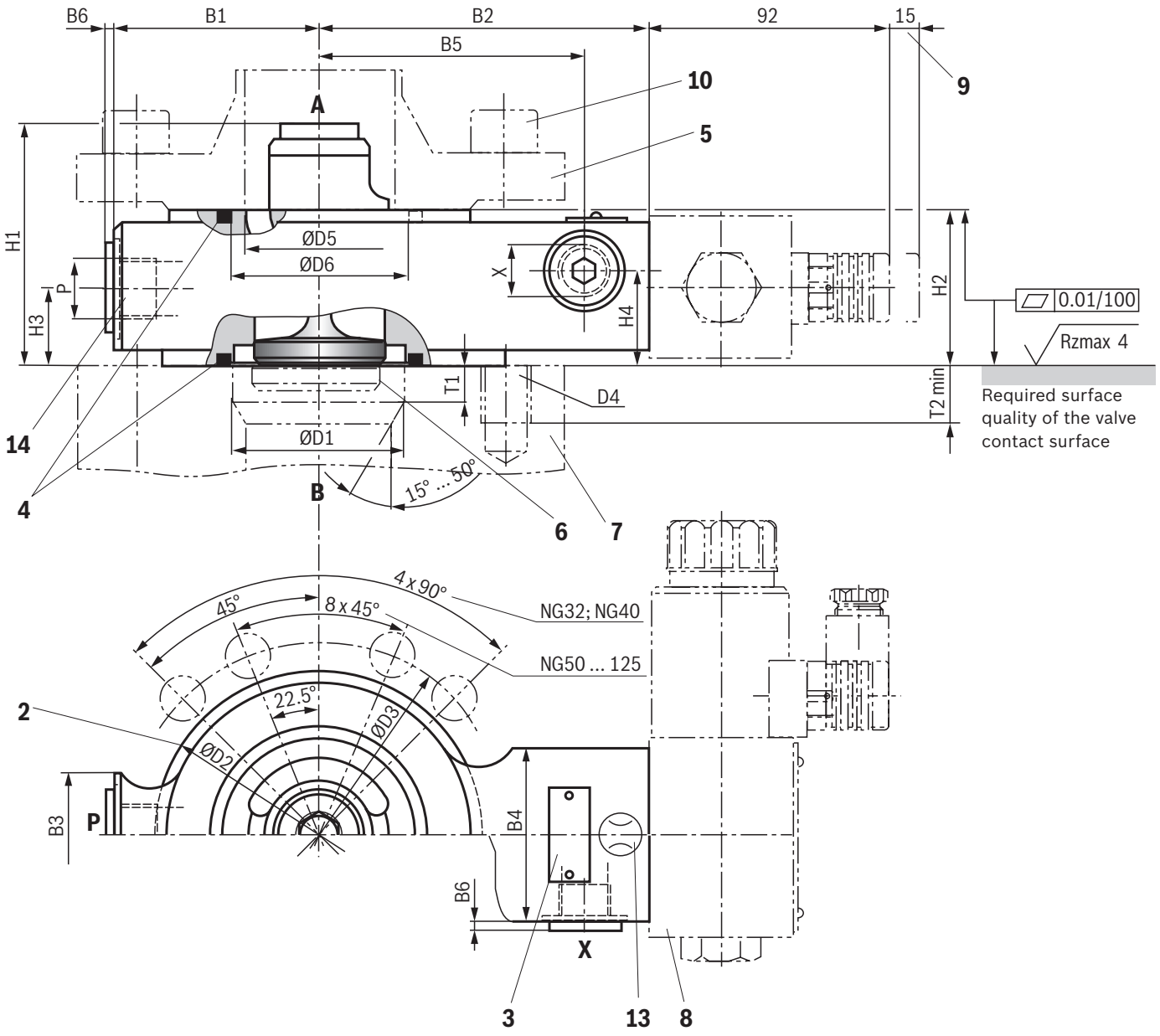
Dimensions: Type ZSF – NG200
(dimensions in mm)





Item explanation see page 13

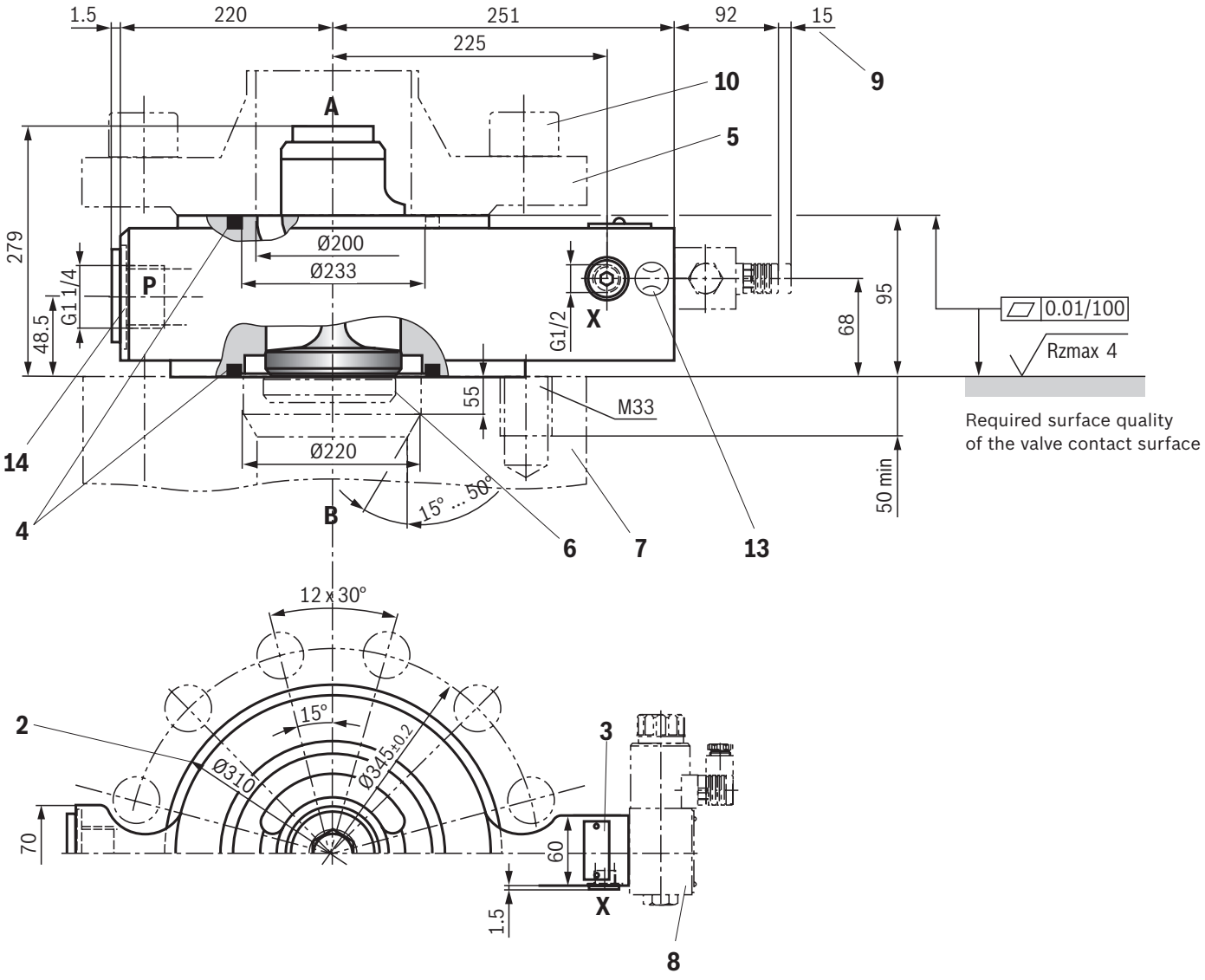
Dimensions: Type ZSFW – NG32 ... 125
(dimensions in mm)



NG	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	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

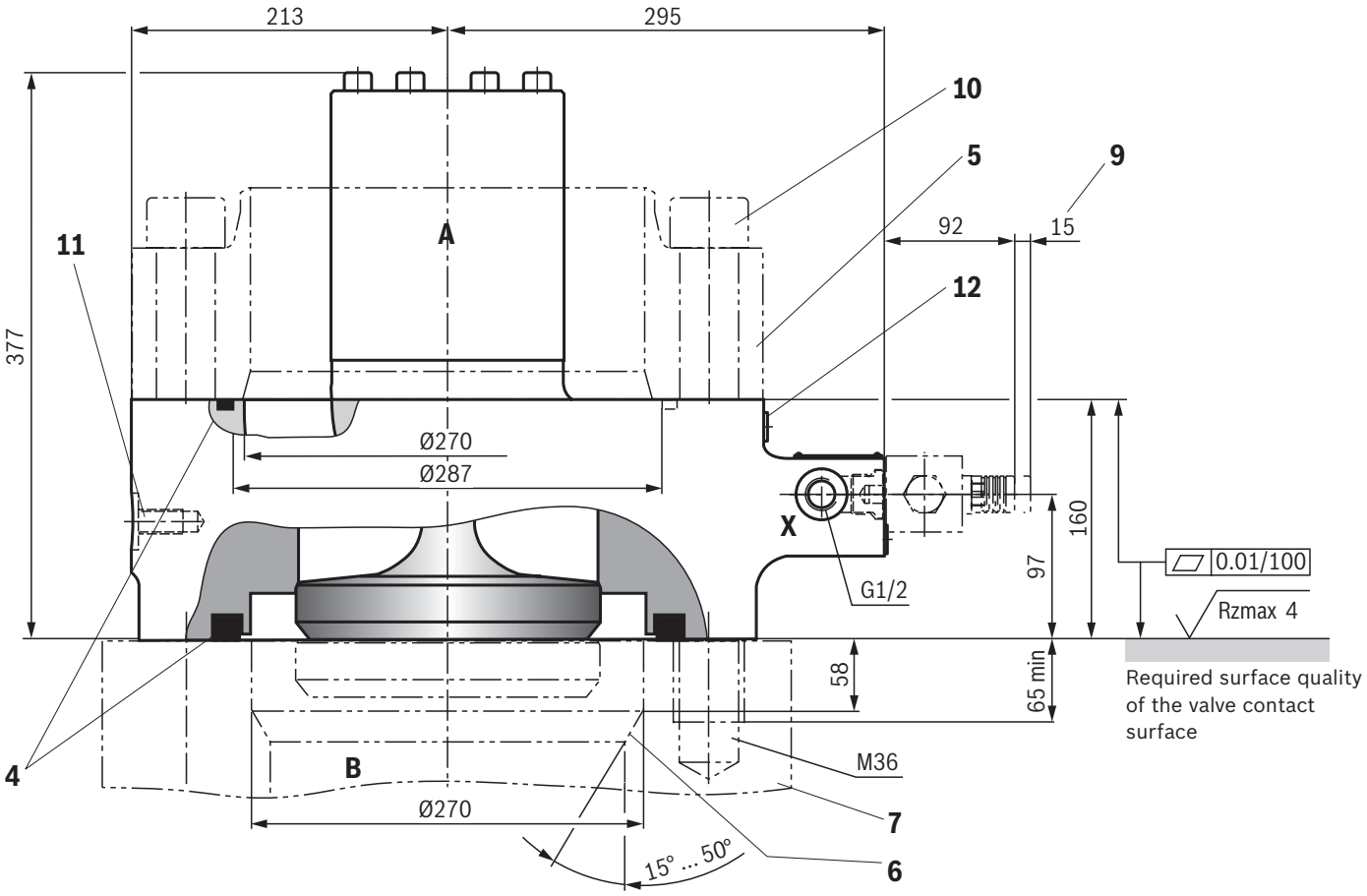
Item explanation see page 13

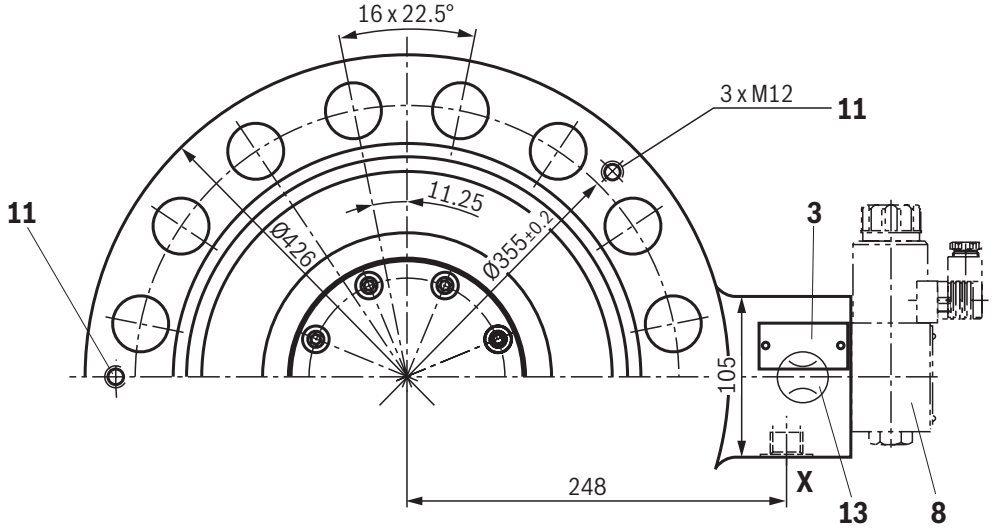
Dimensions: Type ZSFW – NG160
(dimensions in mm)



Item explanation see page 13

Dimensions: Type ZSFW – NG200
(dimensions in mm)



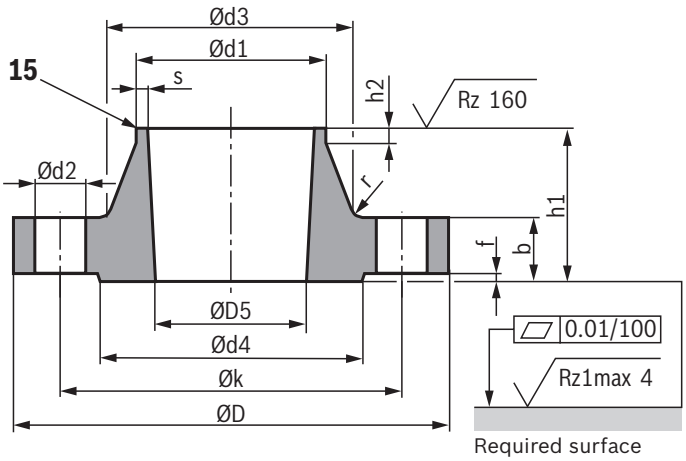


Item explanation see page 13

Dimensions

1 Throttle check valve (only NG50, 63, 80, 200)
2 Centering diameter
3 Name plate
4 Seal rings
5 Counterflange (separate order; dimensional proposal see below)
6 Stroke of the main poppet (see page 14)
7 **Notice:** Valve contact face (e.g. pressing cylinders, bearing structures, etc.) must be sufficiently rigid.
The prefill valve must not be loaded by bending.
8 Directional valve (separate order) 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 16)
11 Threads for transport device (ring bolts), evenly distributed to circumference
12 Measuring point, tightening torque M_A = 30 Nm ±10%
13 Damping 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)



Required surface quality of the valve contact surface

Maximum operating pressure p_{max}		350 bar [2]
Recommended flange material	▶ NG32 ... 160	C22
	▶ NG200	S355J2G3

15 Form of the welding gap:
- ▶ Standard version
- ▶ s ≤ 16 gap form 22 DIN 2559
- ▶ s > 16 gap form 3 DIN 2559
- ▶ Special version see DIN 2559

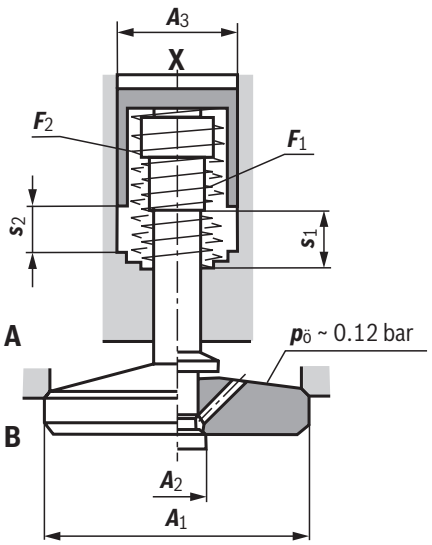
NG		Flange						Approach				Raised face	
	Ød1 [1]	Ød2	ØD	ØD5+2	b	Øk	h1	Ød3	s [1]	r	h2	Ød4	f
32	48.3	18	150	42	22	110	49	64	3.2	6	7	88	3
40	60.3	18	165	52	29	125	57	75	3.6	6	8	102	3
50	76.1	18	185	70	34	145	64	90	3.6	6	10	122	3
63	88.9	18	200	83	43	160	77	105	3.6	8	12	138	3
80	114.3	22	235	100	51	190	95	134	3.6	8	12	162	3
100	139.7	30	295	124	62	240	116	168	4.0	8	12	188	3
125	168.3	33	345	148	79	280	138	202	4.5	10	12	218	3
160	219.1	36	415	200	118	345	186	256	5.9	10	16	285	3
200	273	39	420	270	100	355	140	292	6.5	6	16	–	–

[1] For seamless steel pipes with wall thickness 16 according to DIN EN 10220

[2] When using other counterflanges than the ones specified here, it may be necessary to reduce the operating pressure.

Valve mounting screws and **ordering code for counterflange** see page 16.

Poppet geometry and determination of the minimum pilot pressure



without pre-decompression | **with** pre-decompression

- ***A***1 = Effective area of the main poppet
- ***A***2 = Effective area of the pilot poppet
- ***A***3 = Effective area of the control spool
- ***s***1 = Stroke of the main poppet
- ***s***2 = Stroke of the control spool
- ***F***1 = Spring force of the valve spring
- ***F***2 = Spring force of the compression spring of the control spool
- V_{st} = Pilot volume for opening the valve
- $p_{Ö}$ = Cracking pressure (pressure differential at the main poppet for overcoming the spring force ***F***1)
- p_{St} = Pilot pressure at port X
- p_B = System pressure at port B

NG	***A***1 in cm²	***A***2 [1] in cm²	***A***3 in cm²	***s***1 in mm	***s***2 in mm	***F***1 in N	***F***2 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 ... 22	58 ... 109	1.3	4.0	0.3
40	13.52	0.79	3.14	10.0	7.0	14 ... 29	93 ... 162	2.2	4.3	0.3
50	21.24	1.13	4.71	12.5	9.0	23 ... 49	149 ... 261	4.2	4.5	0.3
63	32.67	1.77	7.07	14.5	11.0	35 ... 63	206 ... 348	7.8	4.6	0.3
80	49.02	2.54	10.18	17.0	13.0	57 ... 127	310 ... 579	13.2	4.8	0.3
100	73.13	3.80	15.90	22.0	15.0	81 ... 193	476 ... 952	25.5	4.6	0.2
125	120.76	5.72	28.27	30.0	22.5	135 ... 319	878 ... 1667	59.4	4.3	0.2
160	196.07	9.08	45.36	40.0	27.0	241 ... 516	1335 ... 2395	122.0	4.3	0.2
200	314.16	–	78.54	48.0	34.0	425 ... 850	2389 ... 3822	267.0	4.0	–

1) Is omitted for version "without pre-decompression" (ZSF...)
2) **Without** pre-decompression
3) **With** pre-decompression (upon request)

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

Example: Type ZSF **32**...; p_B = 30 bar
p_{St} = 4.0 x 30 bar = 120 bar

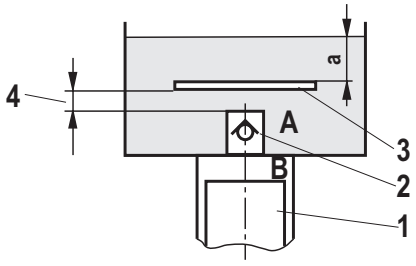
Flow q_V in l/min (A to B) for different cases of application (Δp = 0.3 bar)

NG	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

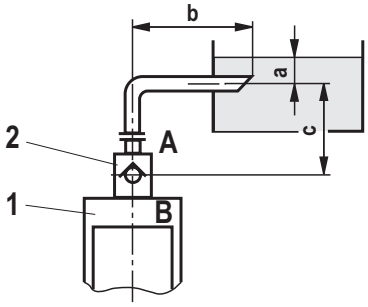
☞ **Notice:**
Wrong dimensioning of prefill valve and suction line may cause cavitation and consequential damage.

Cases of application

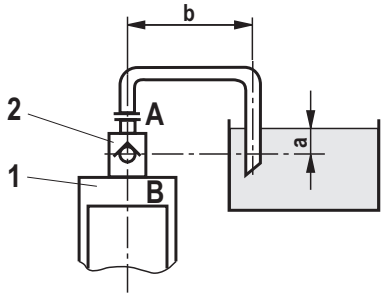
Case of application 1



Case of application 2

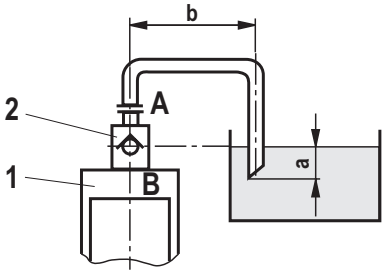


Case of application 3

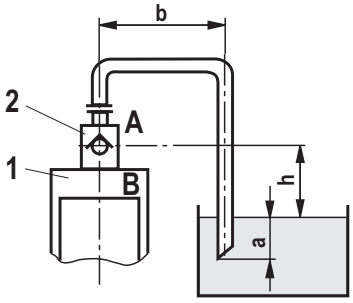


Size of the filling tank at least 1.5 x cylinder content

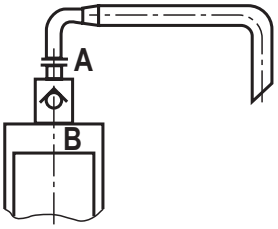
Case of application 4



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 Prefill 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 ≤ 500 mm
h 300 mm ≤ h < 500 mm

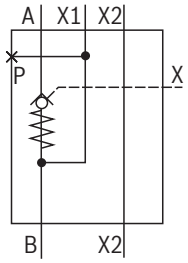
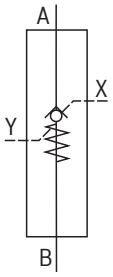
Valve mounting screws, counterflange (separate order)

	Hexagon socket head cap screw ISO 4762 - 10.9-flZn (or DIN 912 - 10.9-flZn)				**Counterflange**
NG	**Quantity**	**Dimension**	Tightening torque M_A in Nm (±5 %), friction coefficient μ_{min} = 0.09 [1)]	**Material no.**	**Material no.**
32	4	M16 x 100	240	R913015640	R900842693
40	4	M16 x 110	240	R913015642	R900825610
50	8	M16 x 110	240	R913015642	R900826441
63	8	M16 x 130	240	R913014713	R900849622
80	8	M20 x 140	460	R913015675	R900862915
100	8	M27 x 180	1150	R913059494	R900834583
125	8	M30 x 200	1600	R913015753	R900861508
160	12	M33 x 260	2200	R913001904	R900846478
200	16	M36 x 320	2600	R913050473	R901205467

☞ **Notice:**
The information on the hexagon socket head cap screws (type, length, tightening torque) refers exclusively to the use with the counterflanges listed above.

1) Please adjust in case of changed surfaces; use a manual torque wrench.

Additional functions with special numbers (upon request)

Symbol	Version	SO number	Size	Description/special characteristic
	ZSF	SO1	32, 40, 50, 63, 80, 100, 125	Channels for forwarding (X2) and high pressure (X1)
	ZSF	SO6	32, 40, 50, 63, 80, 125, 160	Spring chamber port, external
	ZSFW		125	
–	ZSF	SO12	160	Shortened stroke (cycle time) of the control spool

Further information

▶ Hydraulic valves for industrial applications	Operating instructions 07600-B
▶ Hydraulic fluids on mineral oil basis	Data sheet 90220
▶ Environmentally compatible hydraulic fluids	Data sheet 90221
▶ Flame-resistant, water-free hydraulic fluids	Data sheet 90222
▶ Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC)	Data sheet 90223
▶ Reliability characteristics according to EN ISO 13849	Data sheet 08012
▶ Hexagon socket head cap screw, metric/UNC	Data sheet 08936
▶ Mating connectors and cable sets for valves and sensors	Data sheet 08006
▶ Selection of filters	www.boschrexroth.com/filter
▶ Information on available spare parts	www.boschrexroth.com/spc

Notes

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