

Check valve,
pilot operated

Type SV and SL

RE 21468

Edition: 2017-03

Replaces: 2017-01



H5558

- ▶ Size 10, 20, and 32
- ▶ Component series 4X
- ▶ Maximum operating pressure 315 bar
- ▶ Maximum flow 550 l/min

Features

- ▶ For subplate mounting
- ▶ Porting pattern according to ISO 5781-06-07-0-00 (NG10), ISO 5781-08-10-0-00 (NG20), ISO 5781-10-13-0-00 (NG32)
- ▶ For threaded connection
- ▶ For the leakage-free blocking of one actuator port
- ▶ Attachment possibility for directional spool valve or directional seat valve, optional
- ▶ With internal or external pilot oil return, optional
- ▶ Version with pre-opening for dampened release, optional
- ▶ Various cracking pressures, optional
- ▶ Check valve cartridge separately available
- ▶ Corrosion-resistant housing design, optional

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Ordering code

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	
S						-	4X	/			-									*

01	Check valve	S
02	Internal pilot oil return	V
	External pilot oil return	L
03	Size 10	10
	Size 20	20
	Size 32	30

Type of connection

04	Subplate mounting	P
	Threaded connection	G
05	With pre-opening	A
	Without pre-opening	B

Cracking pressure

06	See characteristic curves (A → B), page 8 and 9	1
		2
		3
		4
07	Component series 40 ... 49 (40 ... 49: unchanged installation and mounting dimensions)	4X
08	Without attachment possibility for directional spool or seat valve	no code
	With attachment possibility for directional spool or seat valve (NG6)	6U¹⁾

Spool position monitoring

09	Without position switch	no code
	With position switch	QMG24
	For more information see page 16	

Orifice fitting channel A (version "6U" only)

10	Orifice Ø0.8 mm in channel A (standard)	A08
	Orifice Ø** in channel A ²⁾	A**

Orifice fitting channel B (version "6U" only)

11	Channel B closed (standard)	B99
	Orifice Ø** in channel B ²⁾	B**

Orifice fitting channel T (version "6U" only)

12	Without orifice (standard)	T00
	Orifice Ø** in channel T ²⁾	T**

Orifice fitting channel P (version "6U" only)

13	Without orifice (standard)	P00
	Orifice Ø** in channel P ²⁾	P**

Orifice fitting channel X (version "6U" only)

14	Channel X closed (standard)	X99
	Orifice Ø** in channel X ²⁾	X**

Orifice fitting channel Y

15	Channel Y closed (standard, version "SV" only)	Y99
	Channel Y open (standard, versions "SL" and "SL...6U" only)	Y00
	Orifice Ø** in channel XY ²⁾	Y**

Ordering code

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	
S						-	4X	/												*

Seal material

16	NBR seals	N
	FKM seals	V
	Observe compatibility of seals with hydraulic fluid used. (Other seals upon request)	


Corrosion resistance

17	None	no code
	Improved corrosion protection (240 h salt spray test according to EN ISO 9227)	J3
18	Standard	no code
	Pilot pressure p_{pilot} from channel X	SO168
	Control open spool with shaft sealing (between channel X-Y and Y-A)	SO286

Connection thread (versions with threaded connection "G" only)

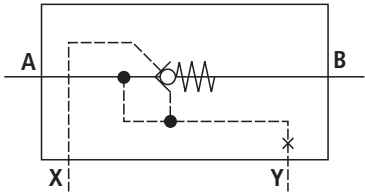
19	Pipe thread "G" according to ISO 228-1	no code
	Pipe thread "UNF/UN" according to ANSI/ASME B 1.1	/12
20	Further details in the plain text	*

- 1) Version "SL" and sizes 20 and 32 only.
- 2) Order example:
****** = dimension in mm x 10 – e.g. orifice Ø1.2 mm in channel
T = "**T12**"

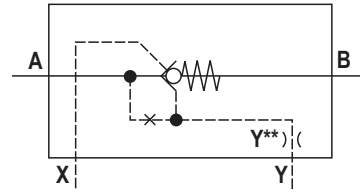
 **Notice:** Preferred types and standard units are contained in the EPS (standard price list).

Symbols

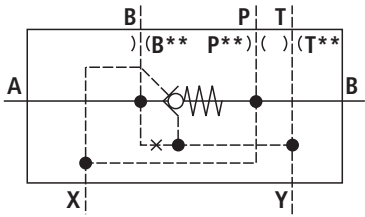
Version "SV" (internal pilot oil return)



Version "SL" (external pilot oil return)

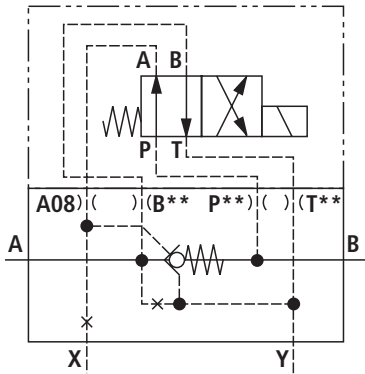


Version "SO168"

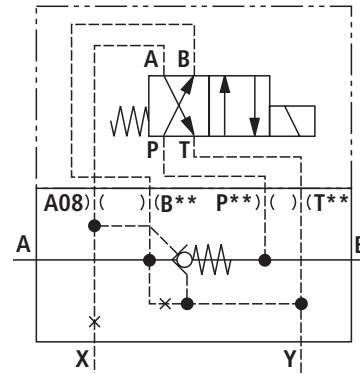


Version "SL ...6U"

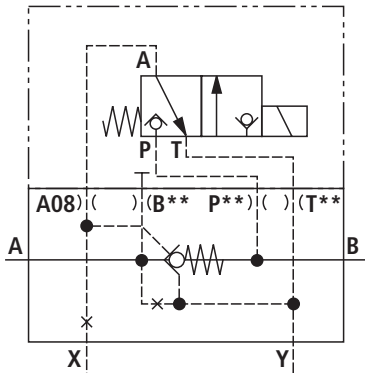
With directional spool valve type 4WE 6 D...



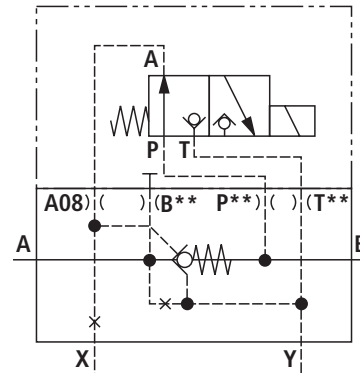
With directional spool valve type 4WE 6 Y...



With directional seat valve type M-3SEW 6 C...



With directional seat valve type M-3SEW 6 U...



Function, section

The isolator valve type SV/SL is a pilot operated check valve for subplate mounting or threaded connection. It is used for the leakage-free blocking of one actuator port, also in case of longer standstill times.

The valve basically consists of a housing (1), a seat poppet (2), a compression spring (3), a control spool (4) as well as of an optional pre-opening as ball seat valve (5). The seat valve can be flown through from A to B without external pilot pressure. In the opposite direction, the seat valve closes hydraulically tight.

Condition: $p_A > p_B + \text{cracking pressure (compression spring)}$.

A sufficiently high pilot pressure at port X moves the control spool (4) in the direction of the ball seat valve (5) (version "A") and pushes the seat poppet (2) out of its seat. This allows for a free flow in both directions (active keeping open).

In order to ensure that the seat valve actively opens, the pressure ratios on both sides of the control spool (4) are just as important as the area ratios at the control spool (4) or seat poppet (2).

This results in the following available options for the types

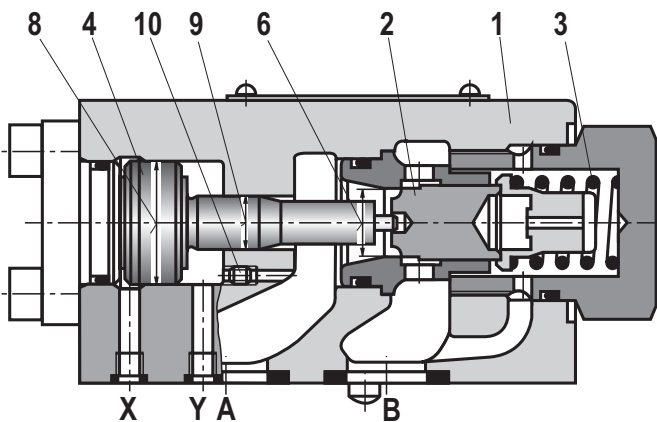
- ▶ SV (large annulus area A_3 (8) connected with p_A) or
 - ▶ SL (small annulus area A_4 (9))
- as well as for the versions with pre-opening "A" and without pre-opening "B".

Version "A" (with pre-opening)

This valve is provided with an additional pre-opening. By pressurization at the X port, the control spool (4) is moved to the right. As a result, the ball (5) is pushed off the seat first and the seat poppet (2) afterwards.

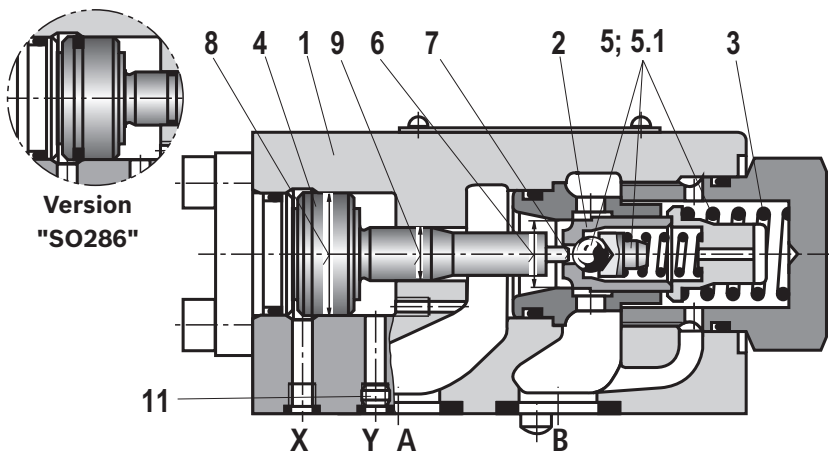
Notices:

- ▶ Version "A":
 - The two-stage set-up with an increased control open ratio means even low pilot pressure can be unloaded securely.
 - Avoidance of switching shocks due to dampened decompression of the pressure volume on the actuator side.
- ▶ Version "B":
 - In case of valves without pre-opening, the included pressure volume may be unloaded suddenly. Resulting switching shocks may lead to premature wear on installed components, as well as noise formation.



Type SL..PB.-4X/... (with pilot oil return, without pre-opening)

The modification of type SV to type SL is possible by exchange of plugs (10) and (11). One of the both plugs must always be installed.



Type SV 10 PA.-4X/... (without pilot oil return, with pre-opening)

NG	Plug (10)	Plug (11)
10	M3	M6
20	M4	M6
32	M4	M6

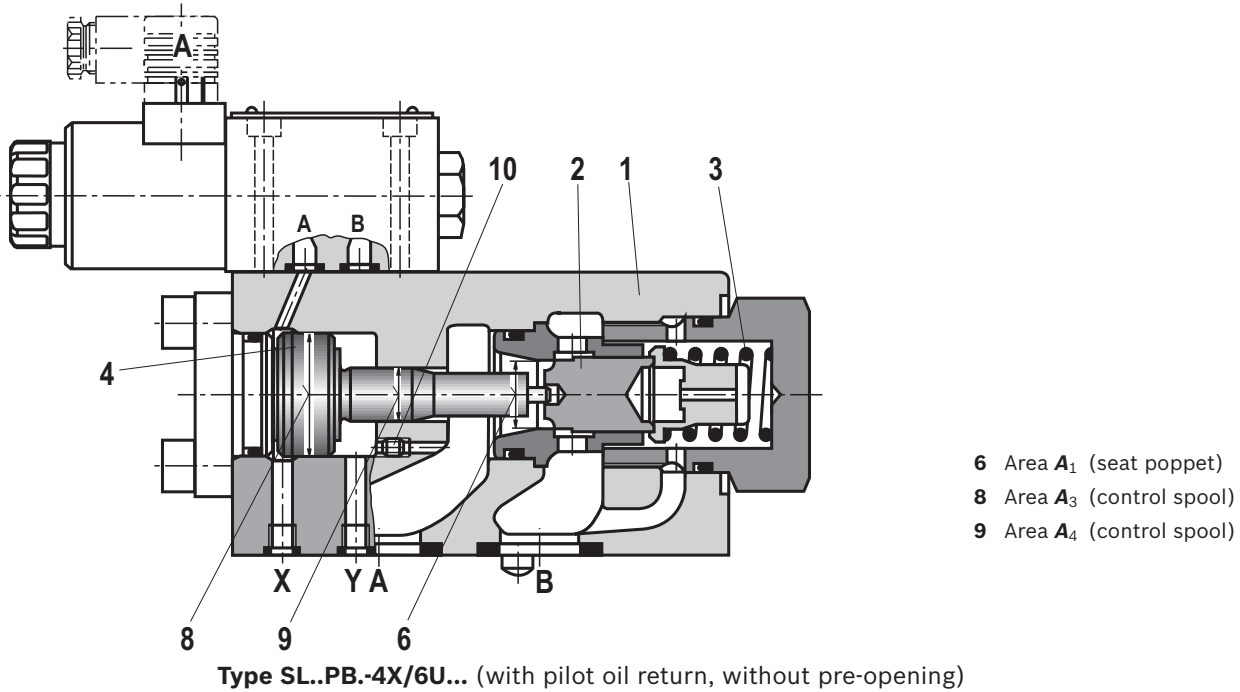
- 6 Area A_1 (seat poppet)
- 7 Area A_2 (ball)
- 8 Area A_3 (control spool)
- 9 Area A_4 (control spool)

Function, section: Version "6U" (with built-on directional valve)

At direct operated, pilot operated check valves type SL with built-on directional valve, the control spool (4) may be controlled directly via the directional valve to open the seat poppet (2) against the system pressure, i.e. the blocking direction.

Notice:

When ordering the directional valve, please observe the different position of port A at versions "P" and "G" (porting pattern rotated by 180° at version "G", see pages 13 and 14).



Technical data

(For applications outside these parameters, please consult us!)

general				
Sizes	NG	10	20	32
Weight	▶ Subplate mounting	kg	1.8	4.7
	▶ Threaded connection	kg	2.1	5.4
Installation position	Any			
Ambient temperature range	°C	-30 ... +80 (NBR seals) -20 ... +80 (FKM seals)		
MTTFd values according to EN ISO 13849	Years	150 (for further details, see data sheet 08012)		
Maximum storage time	Months	12 (if the storage conditions are observed; refer to the operating instructions 07600-B)		

hydraulic				
Maximum operating pressure	bar	315		
Maximum flow	l/min	See characteristic curves on page 8 and 9		
Pilot pressure	bar	5 ... 315		
Hydraulic fluid	see table below			
Hydraulic fluid temperature range	°C	-30 ... +80 (NBR seals) -20 ... +80 (FKM seals)		
Viscosity range	mm ² /s	2.8 ... 500		
Maximum admissible degree of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c)	Class 20/18/15 ¹⁾			
Direction of flow	Free from A → B, from B → A by opening			
Pilot volume	▶ Port X	cm ³	2.5	10.8
	▶ Port Y (version "L" only)	cm ³	2.0	9.6
Control areas (areas according to sectional drawing on pages 5 and 6)	▶ Area A ₁	cm ²	1.33	3.46
	▶ Area A ₂	cm ²	0.33	0.7
	▶ Area A ₃	cm ²	3.8	10.17
	▶ Area A ₄	cm ²	0.79	1.13

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	ISO 15380	90221
		HEES		
	▶ Soluble in water	HEPG	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	ISO 12922	90222
		HFDU (ester base)		
	▶ containing water	HFC (Fuchs Hydrotherm 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922

**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

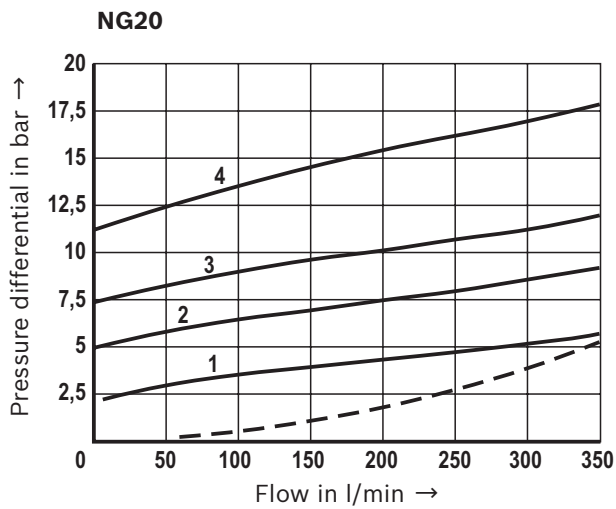
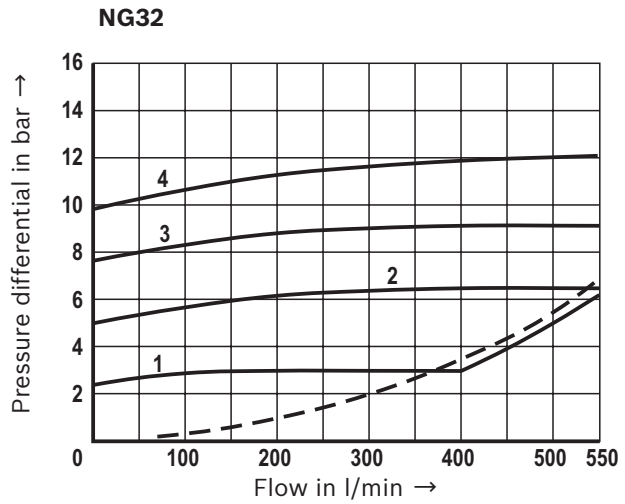
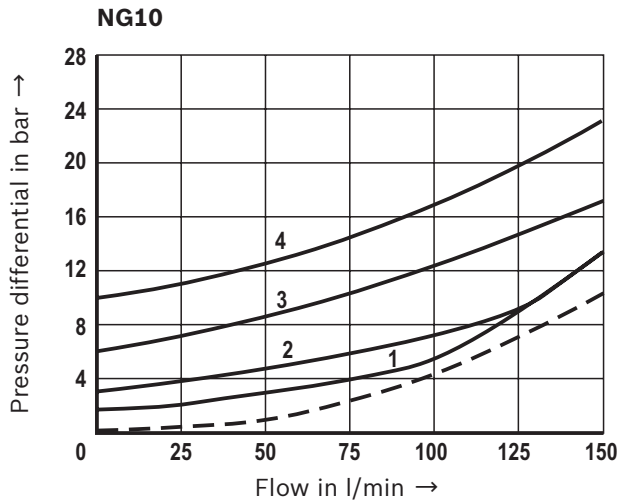
- ▶ **Bio-degradable and flame-resistant:** If this hydraulic fluid is used, small amounts of dissolved zinc may get into the hydraulic system.

¹⁾ 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: Subplate mounting
(measured with HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^\circ\text{C}$)

Δp - q_v characteristic curves



Cracking pressure in bar

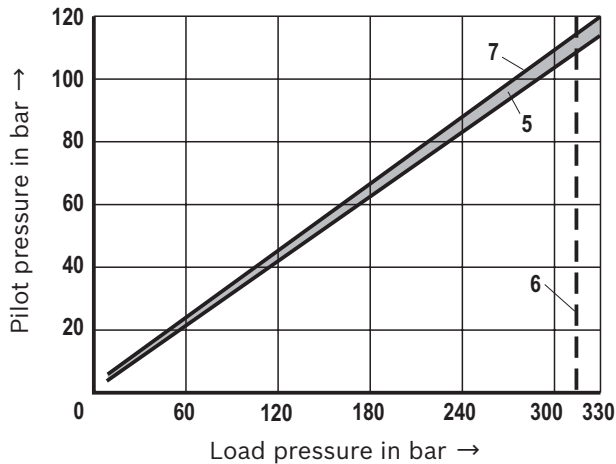
	NG10	NG20	NG32
1	1.5	2.5	2.5
2	3	5	5
3	6	7.5	8
4	10	10	10

—
A \rightarrow B

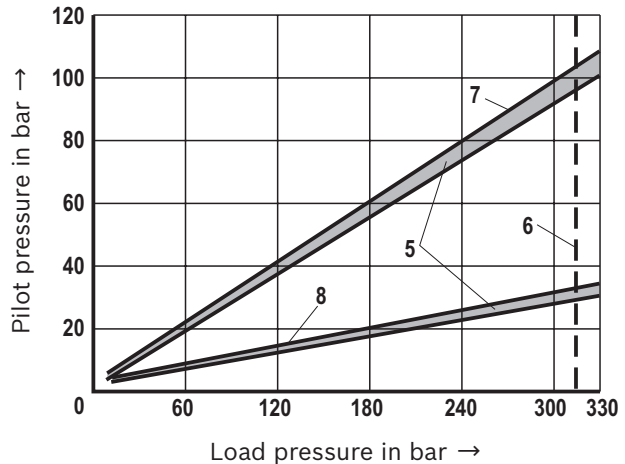
- - -
B \rightarrow A

Pilot pressure/load pressure characteristic curves

without pre-opening



with pre-opening



5 Scatter range

6 Limit value

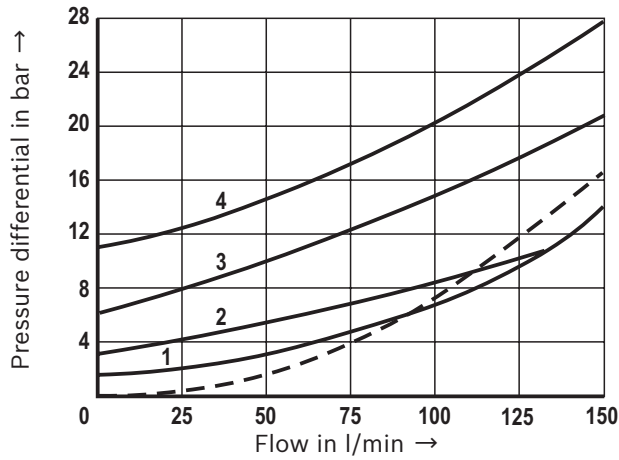
7 Valve poppet

8 Pre-opening

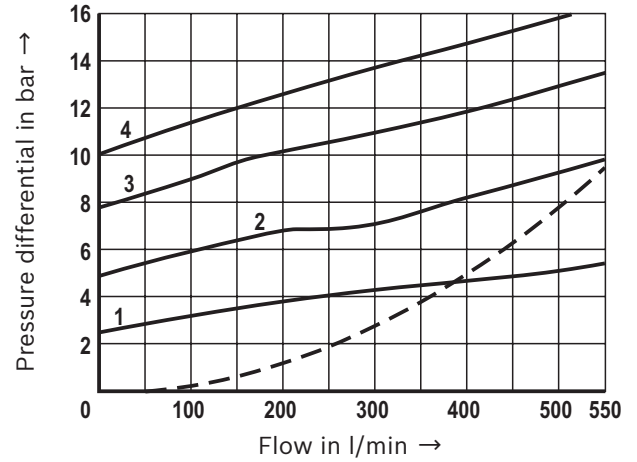
Characteristic curves: Threaded connection
(measured with HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^\circ\text{C}$)

Δp - q_v characteristic curves

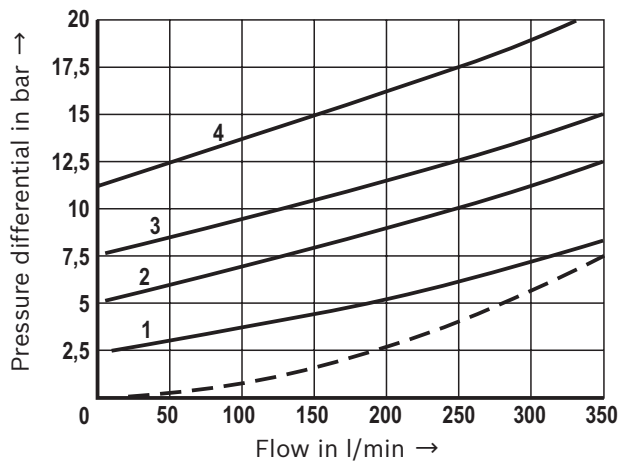
NG10



NG32



NG20



Cracking pressure in bar

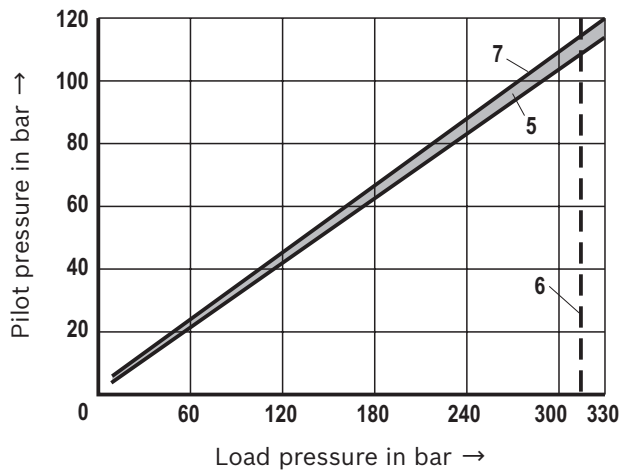
	NG10	NG20	NG32
1	1.5	2.5	2.5
2	3	5	5
3	6	7.5	8
4	10	10	10

—
A → B

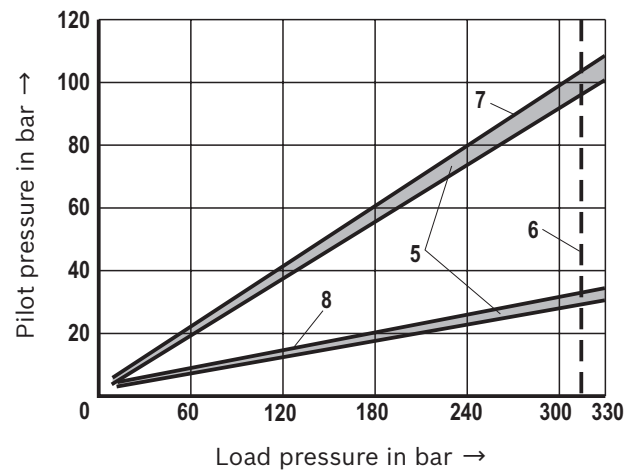
- - -
B → A

Pilot pressure/load pressure characteristic curves

without pre-opening



with pre-opening



5 Scatter range

6 Limit value

7 Valve poppet

8 Pre-opening

Calculation of the pilot pressure p_{pilot} depending on p_A and p_B

Version "A" (with pre-opening)

Balance of forces:

► Detailed formula

$$p_A \cdot A_1 + p_{\text{pilot}} \cdot A_3 - p_B \cdot A_2 - p_F \cdot A_1 - p_A \cdot A_4 - p_A^* \cdot (A_2 - A_4) = 0$$

$$\rightarrow p_{\text{pilot}} = p_B \cdot \frac{A_2}{A_3} + p_F \cdot \frac{A_1}{A_3} + p_A \cdot \frac{A_4 - A_1}{A_3} + p_A^* \cdot \frac{A_2 - A_4}{A_3}$$

► Simplified formula (Assumption $p_A = 0$)

$$p_{\text{pilot}} \approx \frac{1}{3} \cdot p_F + \frac{1}{13} \cdot p_B$$

Version "B" (without pre-opening)

Balance of forces:

► Detailed formula

$$p_A \cdot A_1 + p_{\text{pilot}} \cdot A_3 - p_B \cdot A_1 - p_F \cdot A_1 - p_A \cdot A_4 - p_A^* \cdot (A_2 - A_4) = 0$$

$$\rightarrow p_{\text{pilot}} = p_B \cdot \frac{A_1}{A_3} + p_F \cdot \frac{A_1}{A_3} + p_A \cdot \frac{A_4 - A_1}{A_3} + p_A^* \cdot \frac{A_2 - A_4}{A_3}$$

► Simplified formula (Assumption $p_A = 0$)

$$p_{\text{pilot}} \approx \frac{1}{3} \cdot p_F + \frac{1}{3} \cdot p_B$$

p_A^* Depending on the type (for type SL: $p_A^* = 0$)

p_{pilot} Pilot pressure

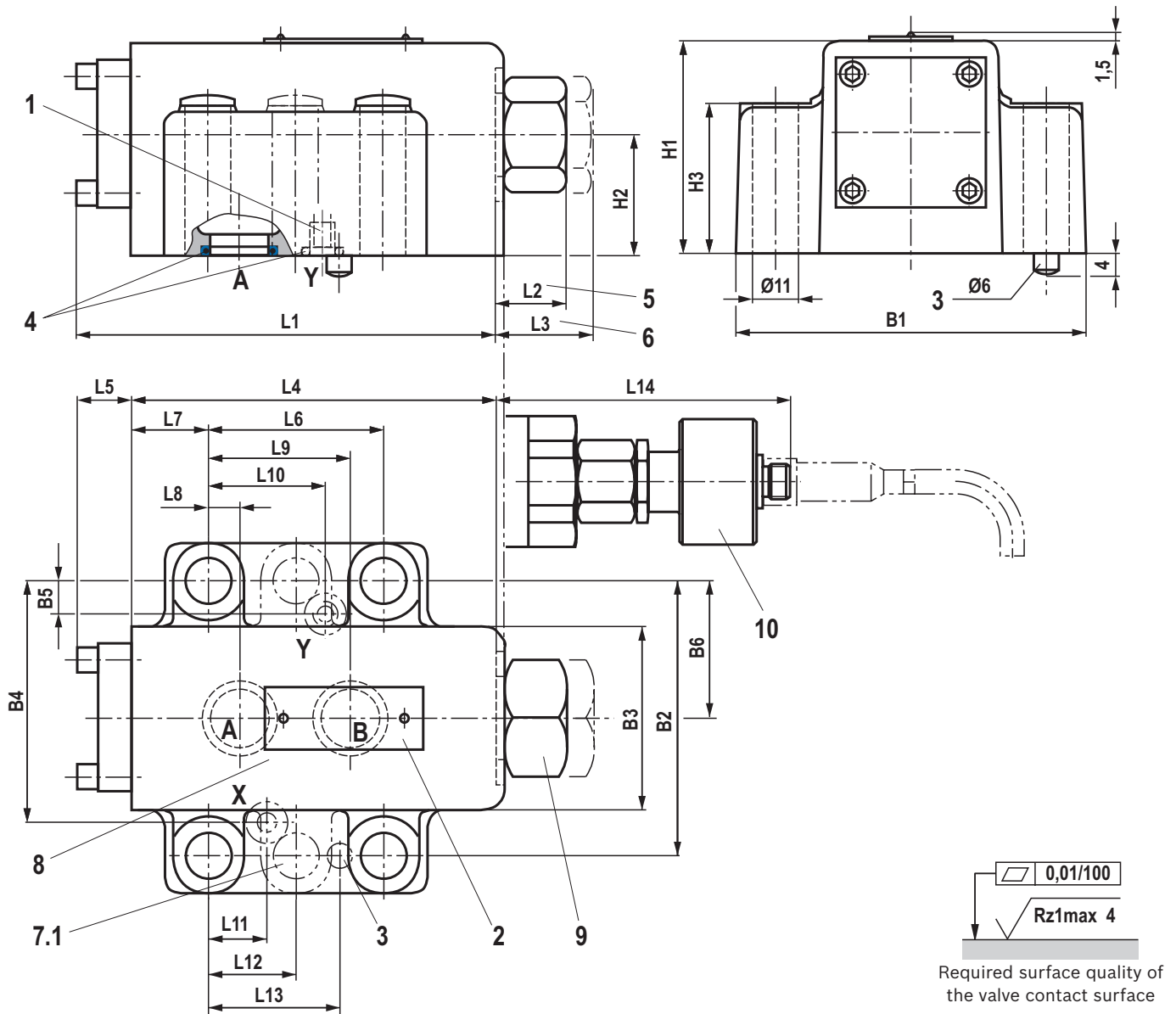
p_A Working pressure in A

p_B Working pressure in B

p_F Cracking pressure (spring)

$A_1 - A_4$ For areas, see sectional drawing on page 5;
Control area ratios, see page 7

Dimensions: Subplate mounting
(dimensions in mm)

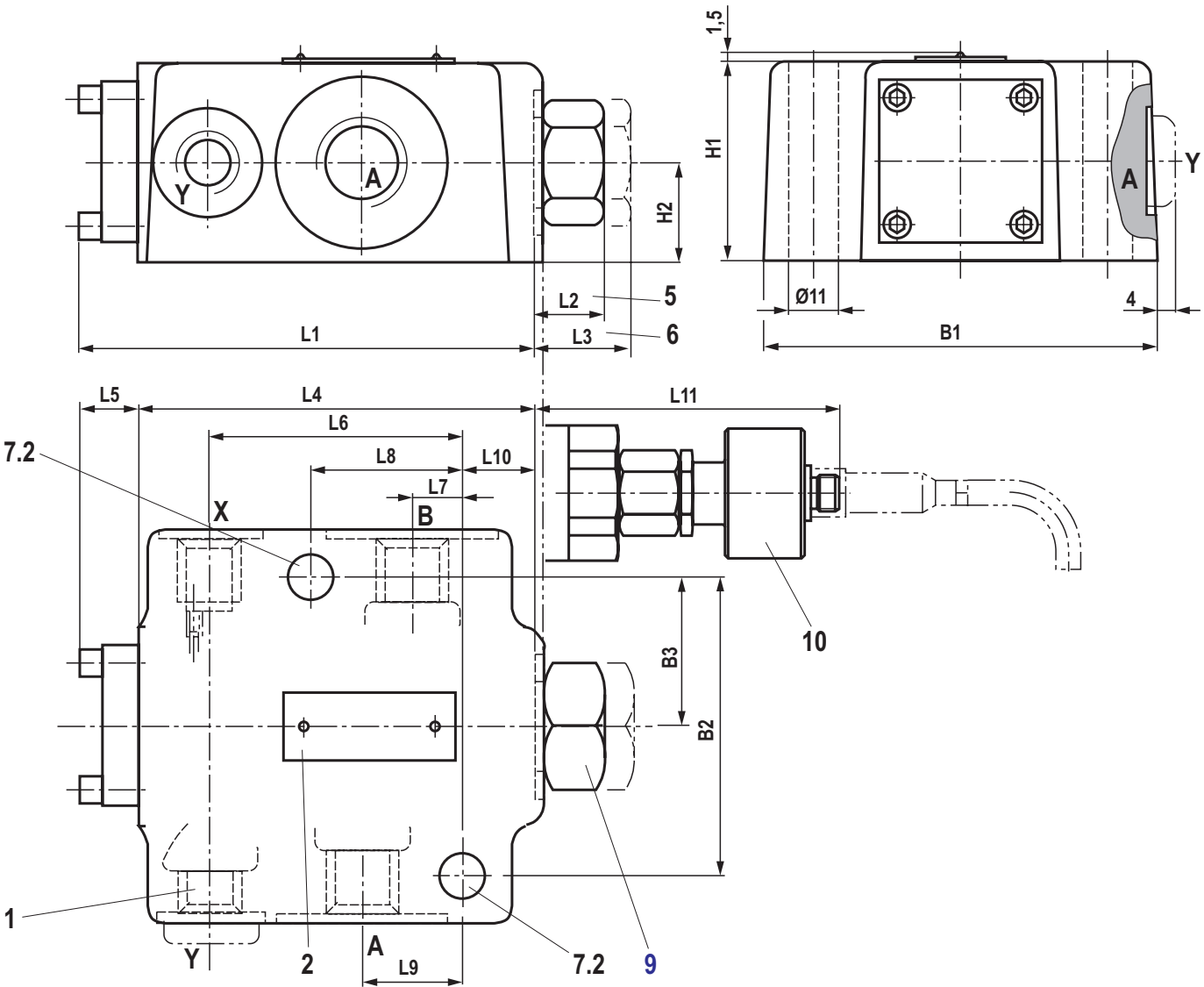


Type	NG	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14
SV	10	100.8	15.5	15.5	87.8	13	42.9	18.5	7.2	35.8	-	21.5	-	31.8	105
	20	135	17.7	47.7	117	18	60.3	27.5	11.1	49.2	-	20.6	-	44.5	96.5
	32	156.1	36.1	46.1	134	22.1	84.2	39	16.7	67.5	-	24.6	42.1	62.7	117
SL	10	100.8	15.5	15.5	87.8	13	42.9	18.5	7.2	35.8	21.5	21.5	-	31.8	105
	20	135	17.7	47.7	117	18	60.3	27.5	11.1	49.2	39.5	20.6	-	44.5	96.5
	32	156.1	36.1	46.1	134	22.1	84.2	39	16.7	67.5	59.5	24.6	42.1	62.7	117

Type	NG	B1	B2	B3	B4	B5	H1	H2	H3	B6
SV	10	84	66.7	44	58.8	-	51	29	36	33.3
	20	100	79.4	67	73	-	81	45	55	39.7
	32	118	96.8	75	92.8	-	85	42.5	70	48.4
SL	10	84	66.7	44	58.8	7.9	51	29	36	33.3
	20	100	79.4	67	73	6.4	81	45	55	39.7
	32	118	96.8	75	92.8	3.8	85	42.5	70	48.4

For item explanations, valve mounting screws and subplates see page 15.

Dimensions: Threaded connection
(dimensions in mm)



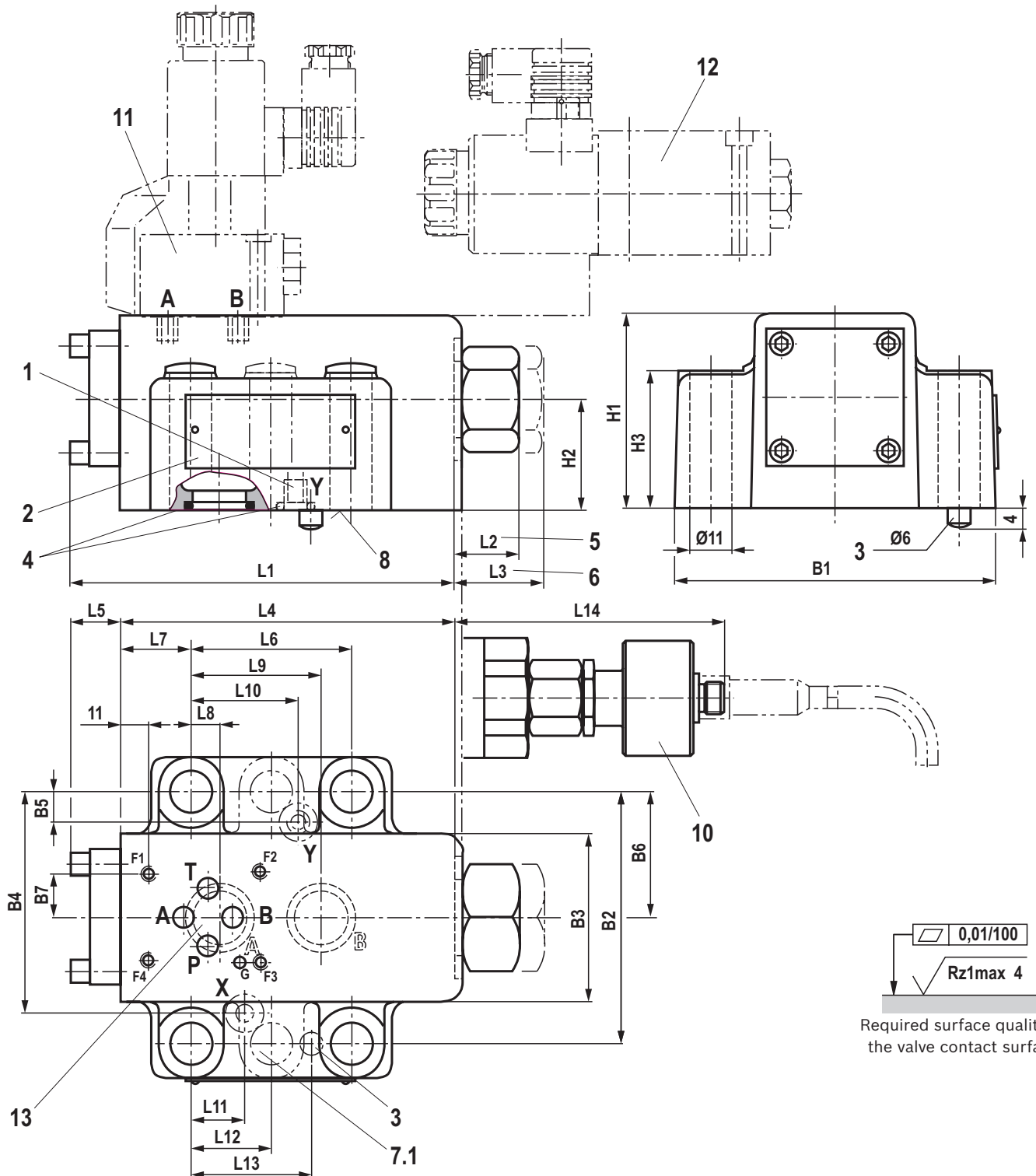
Connections

NG	A, B		X, Y	
	"G"	"UNF/UN"	"G"	"UNF/UN"
10	G1/2	3/4-16 UNF	G1/4	7/16-20 UNF
20	G1	1 5/16-12 UN		
32	G1 1/2	1 7/8-12 UN		

Type	NG	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	B1	B2	B3	H1	H2
SV	10	100.8	15.5	15.5	87.8	13	56.5	10.5	33.5	22.5	17.3	105	87	66.7	33.4	44	22
	20	133	17.7	47.7	115	18	74.5	17	50.5	36	27	96.5	105	79.4	39.7	68	34
	32	156.1	35.7	45.7	134	22.1	101	24	84	49	18	117	130	96.8	48.4	85	42.5
SL	10	100.8	15.5	15.5	87.8	13	56.5	10.5	33.5	22.5	17.3	105	87	66.7	33.4	44	22
	20	133	17.7	47.7	115	18	74.5	17	50.5	36	27	96.5	105	79.4	39.7	68	34
	32	156.1	35.7	45.7	134	22.1	101	24	84	49	18	117	130	96.8	48.4	85	42.5

For item explanations, valve mounting screws and connection adapters see page 15.

Dimensions: Version "6U", subplate mounting
(dimensions in mm)



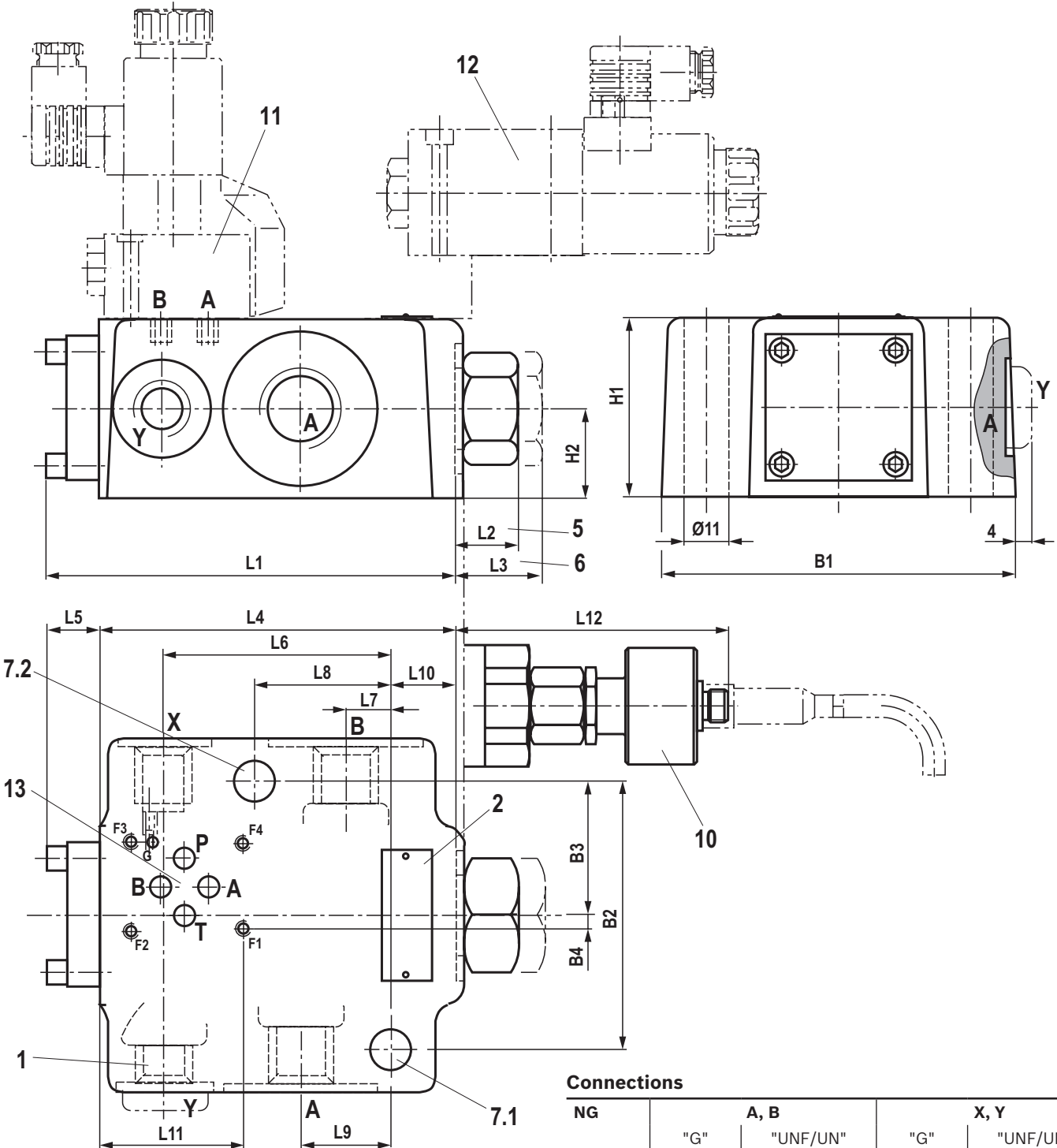
Required surface quality of the valve contact surface

NG	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12
20	135	17.7	47.7	117	18	60.3	27.5	11.1	49.2	39.7	20.6	-
32	156.1	36.1	46.1	134	22.1	84.2	39	16.7	67.5	-	24.6	42.1

NG	L13	L14	B1	B2	B3	B4	B5	B6	B7	H1	H2	H3
20	44.5	96.5	100	79.4	61	73	6.4	39.7	11	81	45	55
32	62.7	117	118	96.8	75	92.8	-	48.4	11	85	42.5	70

For item explanations, valve mounting screws and subplates see page 15.

Dimensions: Version "6U", threaded connection
(dimensions in mm)



Connections

NG	A, B		X, Y	
	"G"	"UNF/UN"	"G"	"UNF/UN"
20	G1	1 5/16-12 UN	G1/4	7/16-20 UNF
32	G1 1/2	1 7/8-12 UN		

NG	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	B1	B2	B3	B4	H1	H2
20	133	17.7	47.7	115	18	74.5	17	50.5	36	27	53	96.5	105	79.4	39.7	8.25	68	34
32	156.1	35.7	45.7	134	22.1	101	24	84	49	18	59	117	130	96.8	48.4	3.25	85	42.5

For item explanations, valve mounting screws and connection adapters see page 15.

Dimensions

- 1 Port Y at version "SL" (closed at version "SV")
- 2 Name plate
- 3 Locking pin
- 4 Identical seal rings for ports
 - ▶ A and B
 - ▶ X and Y
- 5 Valve with cracking pressure version "1" and "2" (dimension L2)
- 6 Valve with cracking pressure version "3" and "4" (dimension L3)
- 7.1 6 valve mounting bores at NG32
- 7.2 2 valve mounting bores
- 8 Porting pattern according to ISO 5781
- 9 Version without position switch
Tightening torque $M_A = 40 \text{ Nm}$ (NG10), screwed in
- medium-strength thread locker;
Tightening torque $M_A = 70 \text{ Nm}$ (NG20 and 30), screwed in
- medium-strength thread locker;
- 10 Version with position switch "QMG24"
(circuitry see page 16)
- 11 Directional seat valve type M-3SEW 6 ... (data sheet 22058)
- 12 Directional spool valve type 4WE 6 ... (data sheet 23178)
- 13 Porting pattern according to ISO 4401-03-02-0-05

Subplates (separate order) with porting pattern according to ISO 5781-06-07-0-00 (NG10), ISO 5781-08-10-0-00 (NG20), ISO 5781-10-13-0-00 (NG32) see data sheet 45100.

Valve mounting screws (separate order)

- ▶ **NG10**
4 x ISO 4762 - M10 x 50 - 10.9
- ▶ **NG20**
4 x ISO 4762 - M10 x 70 - 10.9
- ▶ **NG32**
6 x ISO 4762 - M10 x 85 - 10.9

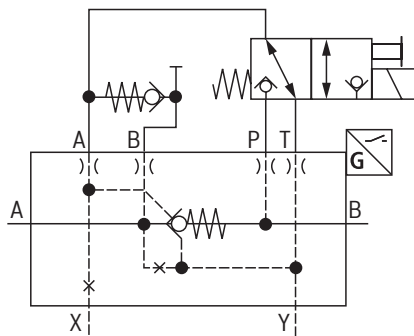
(at friction coefficient $\mu_{\text{total}} = 0.14$);
tightening torque $M_A = 75 \text{ Nm} \pm 10\%$
(please adjust for different surface)

Connection adapter / reducing pieces

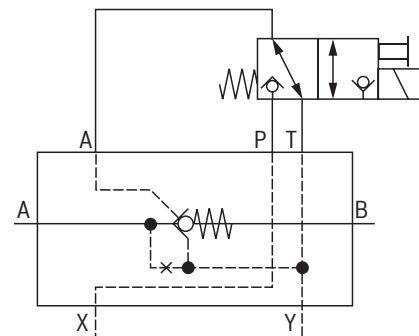
Material number	Male thread	Internal thread	Seal (separate order)	
			NBR	FKM
R900173685	G1	G3/4	R900012475	R900012509
R900173689	G1 1/2	G1 1/4	R900012477	R900012511

Circuit examples

Function: "Load locking"; inlet side unloading

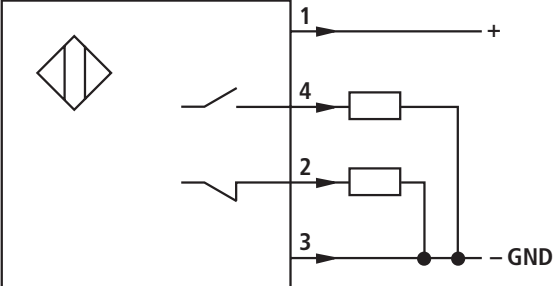
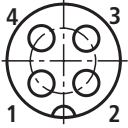


Function: Unlocking with external pilot pressure
(version "SO168")

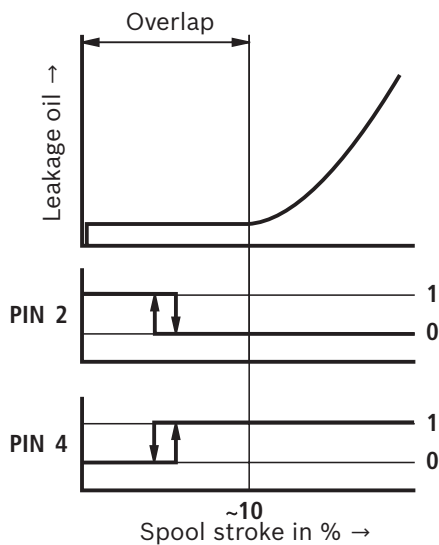


Inductive position switch type QM: Electrical connection

The electric connection is realized via a 4-pole mating connector (separate order, see page 17) with connection thread M12 x 1.

Connection voltage:	24 V +30%/-15%, direct voltage								
Admissible residual ripple:	≤ 10%								
Load capacity:	Maximum 400 mA								
Switching outputs:	PNP transistor outputs, load between switching outputs and GND								
									
Pinout:	<table border="1"> <tr> <td>1</td> <td>+24 V</td> </tr> <tr> <td>2</td> <td>Switching output: 400 mA</td> </tr> <tr> <td>3</td> <td>0 V, GND</td> </tr> <tr> <td>4</td> <td>Switching output: 400 mA</td> </tr> </table>	1	+24 V	2	Switching output: 400 mA	3	0 V, GND	4	Switching output: 400 mA
1	+24 V								
2	Switching output: 400 mA								
3	0 V, GND								
4	Switching output: 400 mA								
									

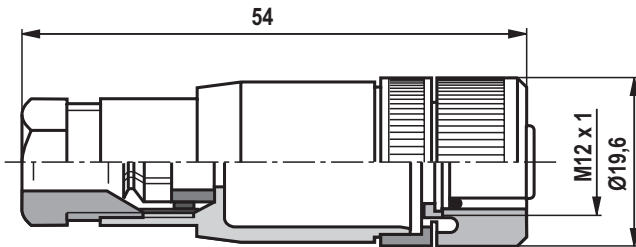
Inductive position switch type QM: Switching logics



Mating connectors (dimensions in mm)

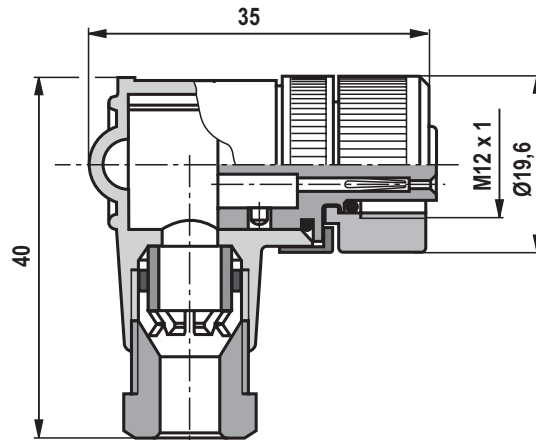
Mating connector suitable for K24 4-pole, M12 x 1 with screw connection, cable gland Pg 9.

Material no. **R900031155**



Mating connector suitable for K24 4-pole, M12 x 1 with screw connection, cable gland Pg 9, angled. Housing rotatable by 4 x 90° in relation to the contact insert.

Material no. **R900082899**



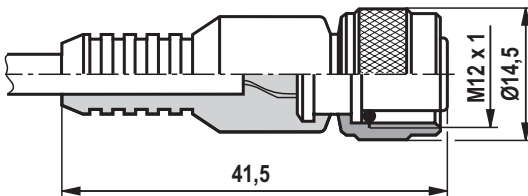
Mating connector suitable for K24-3m 4-pole, M12 x 1 with potted-in PVC cable, 3 m long.

Line cross-section: 4 x 0.34 mm²

Core marking:

1	brown
2	white
3	blue
4	black

Material no. **R900064381**



For further information refer to data sheet 08006.

Further information

- ▶ Check valves, pilot operated (NG6) Data sheet 21460
- ▶ Check valves, pilot operated (NG52) Data sheet 21482
- ▶ Directional spool valve Data sheet 23178
- ▶ Directional seat valve Data sheet 22058
- ▶ Subplates Data sheet 45062
- ▶ 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
- ▶ Hydraulic valves for industrial applications Operating instructions 07600-B
- ▶ Selection of filters www.boschrexroth.com/filter
- ▶ Information on available spare parts www.boschrexroth.com/spc

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