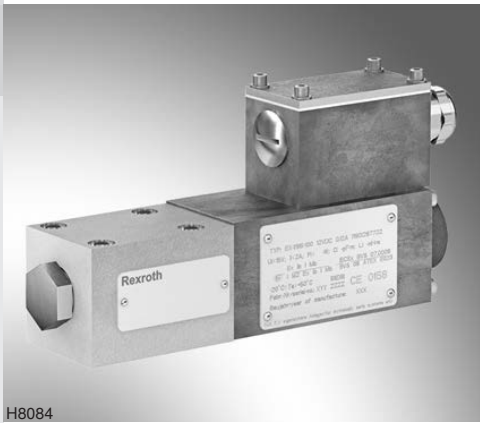
Directional seat valves, direct operated, with solenoid actuation

RE 22047-XH/04.16
Replaces: 09.12

Type SE ...XH... and SE ...XM...

Size 6
Component series 6X
Maximum operating pressure 420 bar
Maximum flow 4 l/min



H8084

ATEX units – For potentially explosive atmospheres

Information on the explosion protection:

- Area of application in accordance with the Explosion Protection Directive 2014/34/EU: **I M2; II 2G**
- Type of protection of the valve solenoids:
  Ex ib I Mb / Ex ib IIC T6 Gb according to EN 60079-0 / EN 60079-11

Table of contents

Features

- 3/2- or 4/2-way version
- For intended use in potentially explosive atmosphere
- Porting pattern according to ISO 4401-03-02-0-05 (but without locating hole)
- Blocked connection tight
- Safe switching also with longer standstill periods under pressure
- Wet-pin DC solenoids
- Electrical connection (depending on the valve type):
  - Individual connection with cable gland
  - Connector
- With manual override

Ordering code

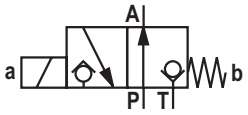
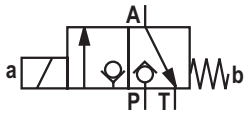
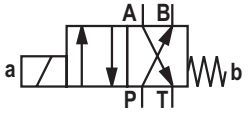
–	SE	6		6X/420	B		N		/	V

Oil-in-water emulsion **= E**
Water **= W**

3 main ports **= 3**
4 main ports **= 4**

Seat valve

Size 6 **= 6**

Main ports	3	4	
Symbols			
	•	—	**= U**
	•	—	**= C**
	—	•	**= D**
	—	•	**= Y**

• = available

Component series 60 to 69 **= 6X**
(60 to 69: unchanged installation and connection dimensions)

Operating pressure up to 420 bar **= 420**

High-power solenoid, (switching in hydraulic fluid) **= B**

V = FKM seals (other seals upon request)
Notice: Observe compatibility of seals with hydraulic fluid used!

No code = Without check valve insert, without throttle insert
P = With check valve insert
B12 = Throttle Ø 1.2 mm
B15 = Throttle Ø 1.5 mm
B18 = Throttle Ø 1.8 mm
B20 = Throttle Ø 2.0 mm
B22 = Throttle Ø 2.2 mm

Electrical connection
Z2 = Solenoid with terminal box and cable gland, (only with version "**E**")
K20ZL = Solenoid with connector facing the valve housing (only with version "**W**")
For details, see chapter Electrical connection

XH = Explosion protection "intrinsically safe" for device group II (all, except for mining)
XM = Explosion protection "intrinsically safe" for device group I (mining)
For details, see information on the explosion protection, page 8

N = With manual override (standard)

Direct voltage 12 V
G12-12 = Nominal power supply 120 mA (only with version "**E**")
G12-19 = Nominal power supply 190 mA (only with version "**W**")

Notice:
Representation of the symbols according to DIN ISO 1219-1.

Function, section, symbols: 3/2 directional seat valve

General:

The directional valve type .-SE.. is a directional seat valve with solenoid actuation. It controls start, stop and direction of flow. It basically comprises a housing (1), the solenoid (2), the hardened valve system (3) and the balls (4.1 and 4.2) as closing element.

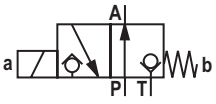
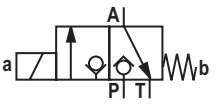
Basic principle:

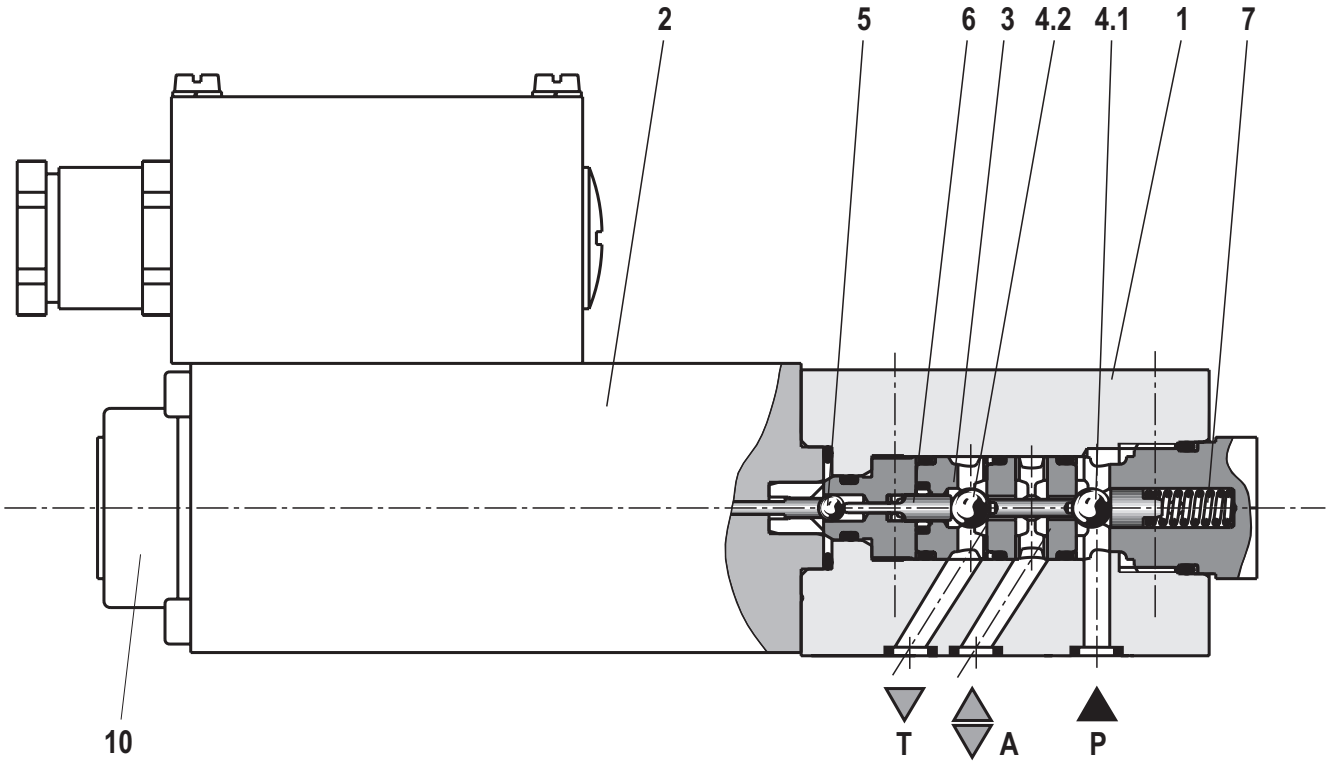
In the initial position, the ball (4.1) is pressed onto the seat by the spring (7), in spool position, the ball (4.2) is pressed onto the seat by the solenoid (2). The force of the solenoid (2) acts via the ball (5) on the actuating plunger (6) that is sealed on two sides. The chamber between the two sealing elements is connected to port P. Thus, the valve system (3) is pressure-compensated in relation to the actuating forces (solenoid or return spring). Thus, the valves can be used up to 420 bar.

Notices

- The 3/2 directional seat valves have a "negative spool overlap". Therefore, port T must always be connected. That means that during the switching process – from the starting of the opening of one valve seat to the closing of the other valve seat – ports P–A–T are connected with each other. This process takes, however, place within such a short time that it is irrelevant in nearly all applications.
- The manual override (10) allows for the switching of the valve without solenoid energization.
- It has to be made sure that the specified maximum flow is not exceeded! A throttle insert must be used for flow limitation, if necessary (see page 6).
- In order to switch the valve safely or maintain it in its spool position, the pressure situation must be as follows: P ≥ A ≥ T (for design reasons).
- The ports P, A and T (3/2 directional seat valve) are clearly determined according to the tasks. They must not be exchanged or closed. The flow is only permitted in the direction of arrow.

The seat arrangement offers the following options:

Symbol	**U**	**C**
		
Initial position	P and A connected, T blocked	P blocked, A and T connected
Switching position	P blocked, A and T connected	P and A connected, T blocked



Example: Type E-3SE 6 C6X/420BG12-12NX.Z2/V

Function, section, symbols: 4/2 directional seat valve

With a sandwich plate, the **Plus-1 plate**, under the 3/2 directional seat valve, the function of a 4/2 directional seat valve is achieved.

Function of the Plus-1 plate:

Initial position:
The main valve is not actuated. The spring (7) holds the ball (4.1) on the seat (11). Port P is blocked and A is connected to T. Apart from that, one control line is connected from A to the large area of the control spool (12), which is thus unloaded to the tank. The pressure applied via P now pushes the ball (13) onto the seat (14). Now, P is connected to B, and A to T.

Transition position:
When the main valve is actuated, the control spool (8) is shifted against the spring (7) and the ball (4.2) is pressed onto the seat (15). During this, port T is blocked, P, A, and B are briefly connected to each other.

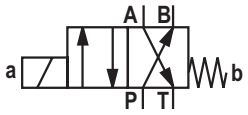
Spool position:

P is connected to A. As the pump pressure acts via A on the large area of the control spool (12), the ball (13) is pressed onto the seat (16). Thus, B is connected to T, and P to A. The ball (13) in the Plus-1 plate has a "positive spool overlap".

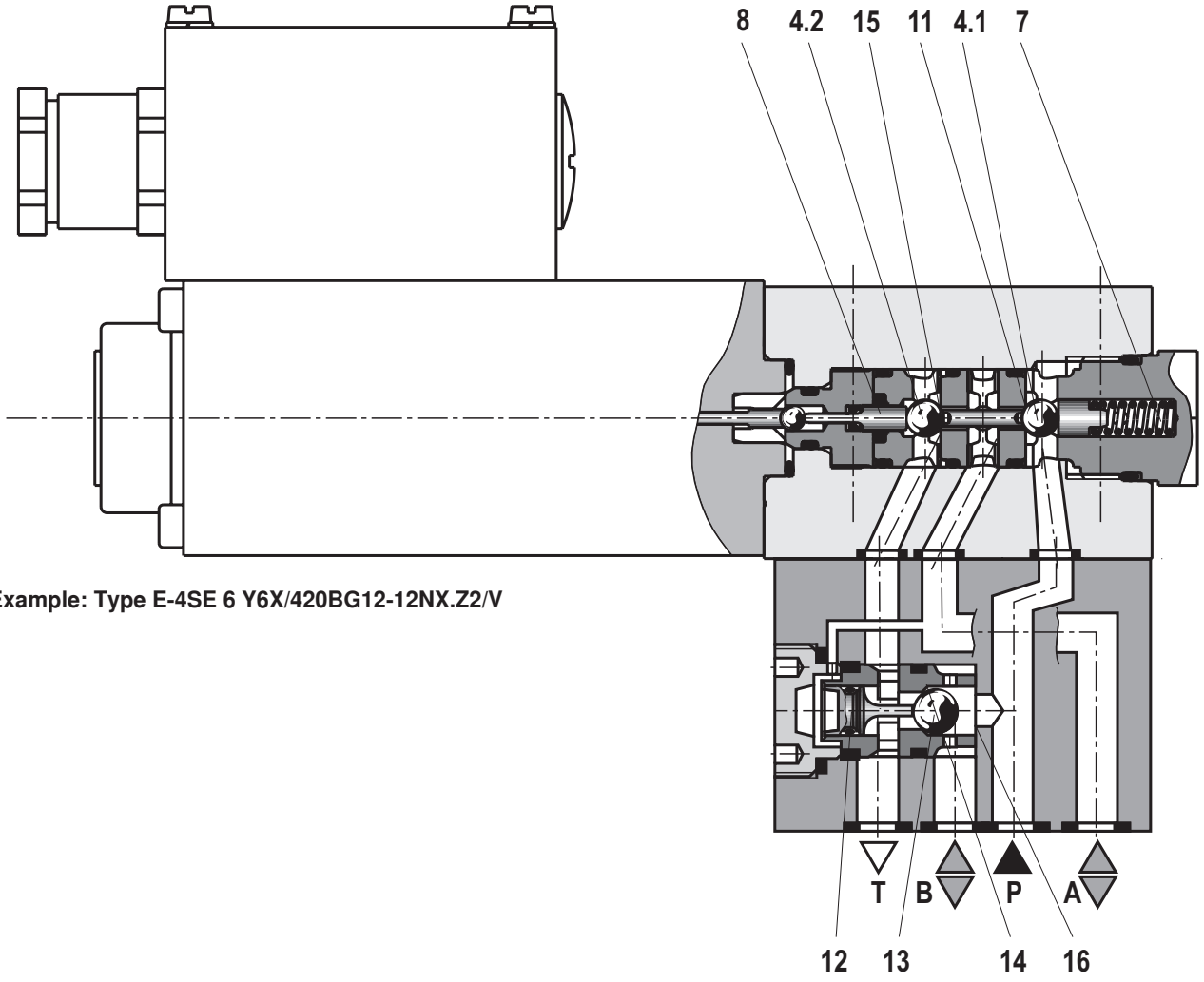
The use of the Plus-1 plate and the seat arrangement offer the following options:

Symbol **D:**

Symbol **Y:**



If the annulus area of differential cylinders is not connected to port A, a pressure peak is created in port B during the switching process, which may exceed the maximum operating pressure over the permissible limit.



Example: Type E-4SE 6 Y6X/420BG12-12NX.Z2/V

Function, section: Throttle insert, check valve insert

Throttle insert

The use of a throttle insert is required when due to prevailing operating conditions, flows can occur during the switching processes, which exceed the performance limit of the valve.

Examples:

– Accumulator operation,

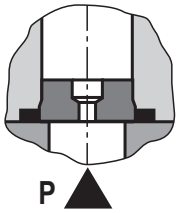
– use as pilot control valve with internal pilot fluid tapping.

3/2 directional seat valve (see page 4)

The throttle insert is inserted in port P of the seat valve.

4/2 directional seat valve (see page 5)

The throttle insert is inserted in port P of the Plus-1 plate.



Check valve insert

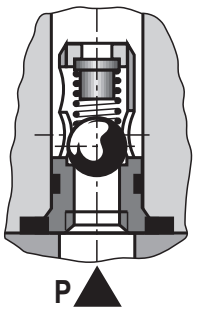
The check valve insert allows free flow from P → A and closes from A → P.

3/2 directional seat valve (see page 4)

The check valve insert is inserted in port P of the seat valve.

4/2 directional seat valve (see page 5)

The check valve insert is inserted in port P of the Plus-1 plate.



Technical data

general

Installation position				Any
Ambient temperature range			°C	–20 … +50
Storage temperature range			°C	+5 … +40
Maximum storage time			Years	1
Weight	3/2 directional seat valve		kg	2.6
	4/2 directional seat valve		kg	3.4
Surface protection	Valve body	Version "E"		Galvanized
		Version "W"		Stainless steel
	Solenoid			Galvanized

hydraulic

Maximum surface temperature		°C	See information on the explosion protection on page 8
Maximum operating pressure	Port P, A, B	bar	420
	Port T	bar	40
Maximum flow		l/min	4
Hydraulic fluid	Version "E"		HL, HLP, HLPD, HFA, HFB, HFD
	Version "W"		Water, HL, HLP, HLPD, HFA, HFB, HFD
Hydraulic fluid temperature range		°C	+5 … +50
Viscosity range		mm^2/s	1 … 380
Maximum admissible degree of contamination of the hydraulic fluid Cleanliness class according to ISO 4406 (c)			Class 20/18/15 [1] For liquids containing water, a comparable cleanliness is to be ensured.

electric

Nominal voltage		V	12
Voltage type			Direct voltage (DC)
Admissible residual ripple		%	< 5
Voltage tolerance		%	± 10
Duty cycle / operating mode according to VDE 0580			100% / S1 (DB)
Information on the rated current in the ordering code			**"G12-12"** / **"G12-19"**
Rated current		mA	120 / 190
Coil resistance with solenoid temperature 20 °C		Ω	89 / 59
Minimum current for achieving the hydraulic switching power		mA	88 / 143
Switching times according to ISO 6403 [2]		ms	See table page 9
Switch-off voltage peak Solenoid		V	Max. –3
Protection class according to EN 60529			IP 65 (with correctly installed electrical connection)

[1] 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 life cycle of the components. For the selection of the filters, see www.boschrexroth.com/filter.

[2] The switching times were determined at a hydraulic fluid temperature of 40 °C and a viscosity of 46 cSt. Deviating hydraulic fluid temperatures can result in different switching times. Switching times change dependent on operating time and application conditions.

Technical data

Information on the explosion protection

Ordering code for solenoid		**"G12-12"**		**"G12-19"**
Ordering code for explosion protection		"XM"	"XH"	"XM"
Area of application according to directive 2014/34/EU		I M2	II 2G	I M2
Type of protection valve solenoid according to EN 60079-0 / EN 60079-11		Ex ib I Mb	Ex ib IIC T6 Gb	Ex ib I Mb
Maximum surface temperature [3]	°C	80		88
Temperature class		–	T6	–
Type examination certificate Solenoid		BVS 08 ATEX E 023		
"IEC Certificate of Conformity" solenoid		IECEx BVS 07.0008		
Type of protection valve		c (EN 13463-5)		
Special application conditions for safe application		–		

Safety-related maximum values of the solenoids dependent on the device group and the type of the electrical connection

Device group		**I (mining)**		**II (all, except for mining)**
Ordering code for explosion protection		"XM"		"XH"
Ordering code for solenoid		"G12-12"	"G12-19"	"G12-12"
Electrical connection Z2				
Maximum voltage U_i	V DC	15	Version not available	27
Maximum current I_i	A	2		2
Effective inner inductivity L_i	nH	Neglectable		Neglectable
Effective inner capacity C_i	pF	Neglectable		Neglectable
Ambient temperature range	°C	–20 … +50		–20 … +50
Electrical connection K20ZL				
Maximum voltage U_i	V DC	Version not available	15	Version not available
Maximum current I_i	A		2	
Effective inner inductivity L_i	nH		Neglectable	
Effective inner capacity C_i	pF		Neglectable	
Ambient temperature range	°C		–20 … +50	

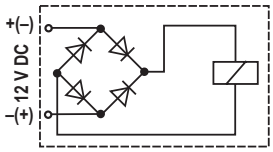
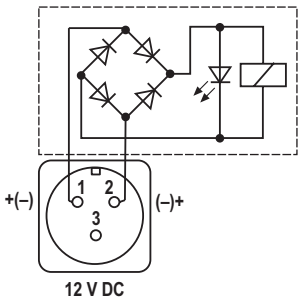
[3] Surface temperature > 50 °C, provide contact protection

Switching times t in ms (installation position: solenoid horizontal)

Pressure p in bar	Flow q_V in l/min	with solenoid **G12-12**								with solenoid **G12-19**							
		t_{on} without tank pressure				t_{off}				t_{on} without tank pressure				t_{off}			
		C	**U**	**Y**	**D**	**C**	**U**	**Y**	**D**	**C**	**U**	**Y**	**D**	**C**	**U**	**Y**	**D**
70	4	220	265	230	275	95	85	105	95	140	160	150	170	110	100	120	110
140	4	260	265	270	275	100	90	110	100	150	165	160	175	120	110	130	120
280	4	320	260	330	270	115	110	125	120	170	170	180	180	125	135	135	145
320	4	350	260	360	270	120	115	130	125	175	170	185	180	130	140	140	150
420	4	360	260	370	270	120	130	130	140	185	170	195	180	135	145	145	155

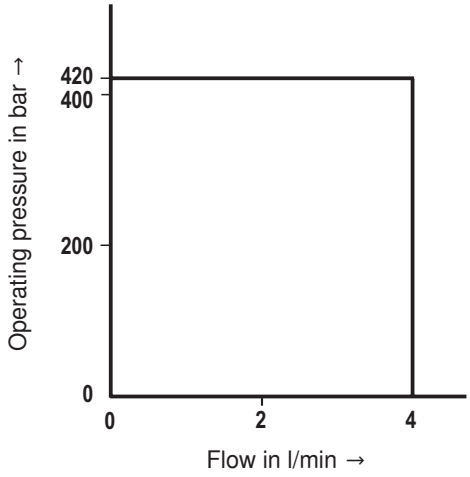
Electrical connection

The type-examination tested valve solenoid of the valve is equipped with an electrical connection according to the following table. The electrical connection of the solenoid is polarity-independent.

Ordering code for the electrical connection	Type of connection Description		Circuit diagram	Ordering code for the solenoid, availability
Z2 (version "E" only)	– Electrical connection via 2-pole terminal in terminal box – With cable gland – Without operating display			**G12-12** (120 mA)
	Cable gland			
	Threaded connection		M20x1.5	
	Line diameter	mm	6.5 ... 9.5 [1]	
	Sealing		Outer sheath sealing	
	Connection terminal solenoid			
	for line cross-section	mm^2	0.75 … 1.5	
K20ZL (version "W" only)	– Electrical connection via connector, 3-pole with pin contacts, type 845-11-1125-001, FCI/Souriau – Connector facing the valve housing – Operating display via light emitting diode (LED), red – Suitable mating connector, type 845-11-8522-001, FCI/Souriau, must be ordered separately			**G12-19** (190 mA)

[1] Larger diameters upon request

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



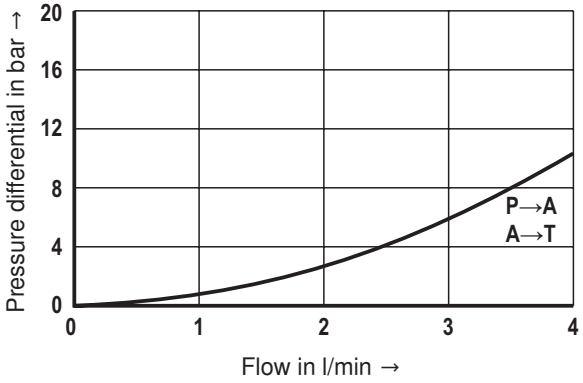
Notice:

The switching power limit was established while the solenoids were at operating temperature, at 10 % undervoltage and without tank preloading.

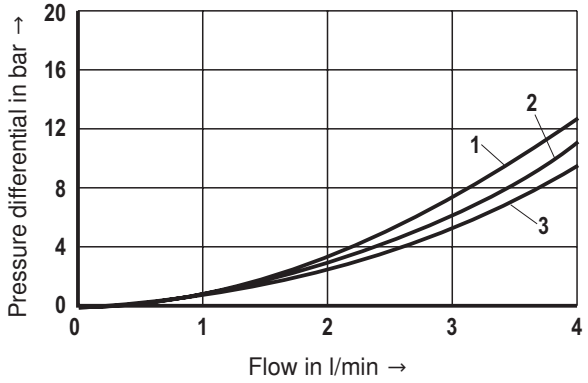
Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C and p = 100 bar)

***Δp-q*$_V$ characteristic curves**

Version ".-3…"

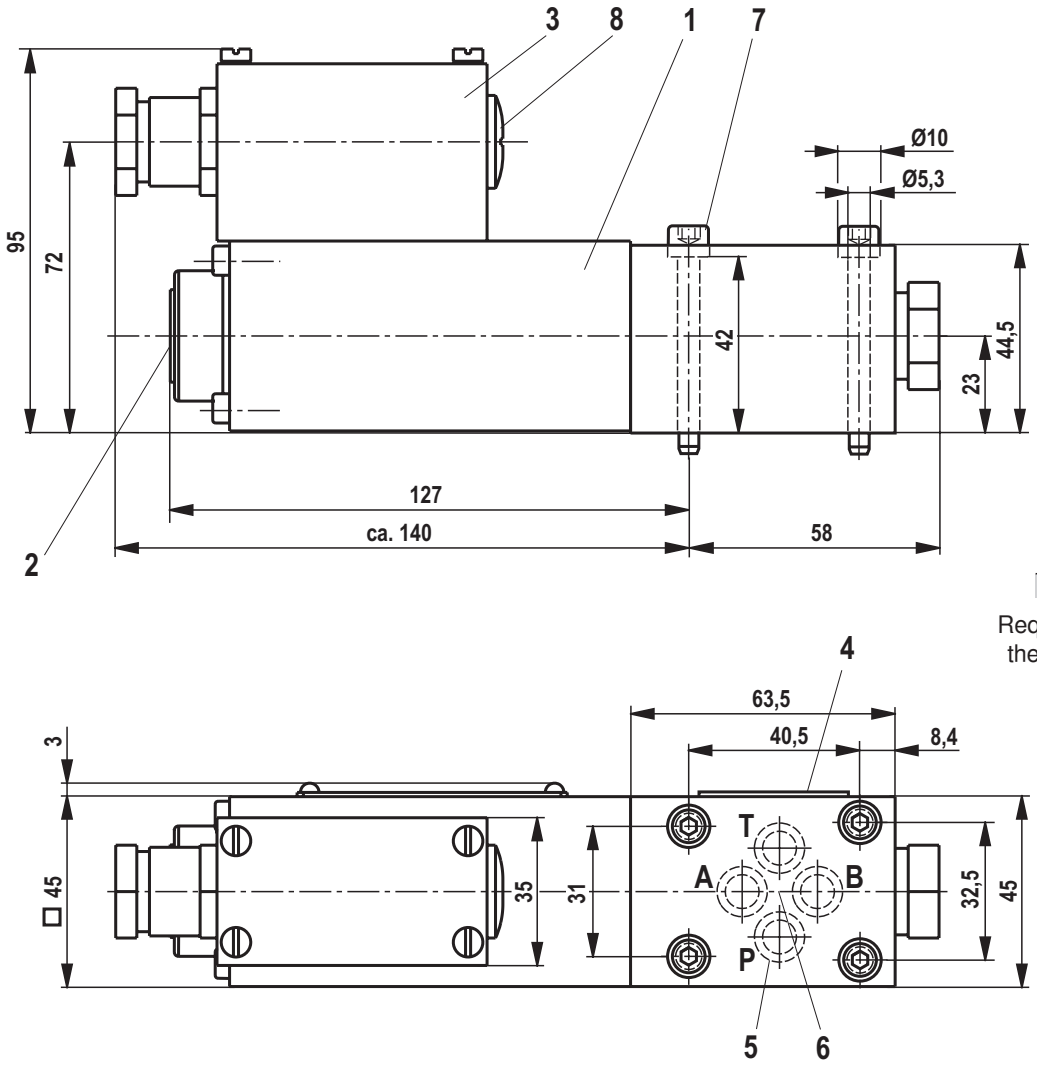


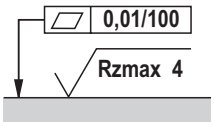
Version ".-4…"



1 A→T
2 P→A
3 B→T, P→B

Dimensions: Version "E-3…G12-12..Z2…" (dimensions in mm)





Required surface quality of the valve contact surface

1 Valve solenoid
2 Manual override
3 Terminal box
4 Name plate
5 Identical seal rings for ports A, B, T; seal ring for port P
6 Porting pattern according to ISO 4401-03-02-0-05 (but without locating hole)
7 Valve mounting screws
For reasons of stability, exclusively use the following valve mounting screws:
4 hexagon socket head cap screws ISO 4762 - M5 x 50 - 10.9 - flZn/nc/L/240h/C (friction coefficient 0.09 - 0.14 according to VDA 235-101)
(included in the scope of delivery)
8 Plug screw

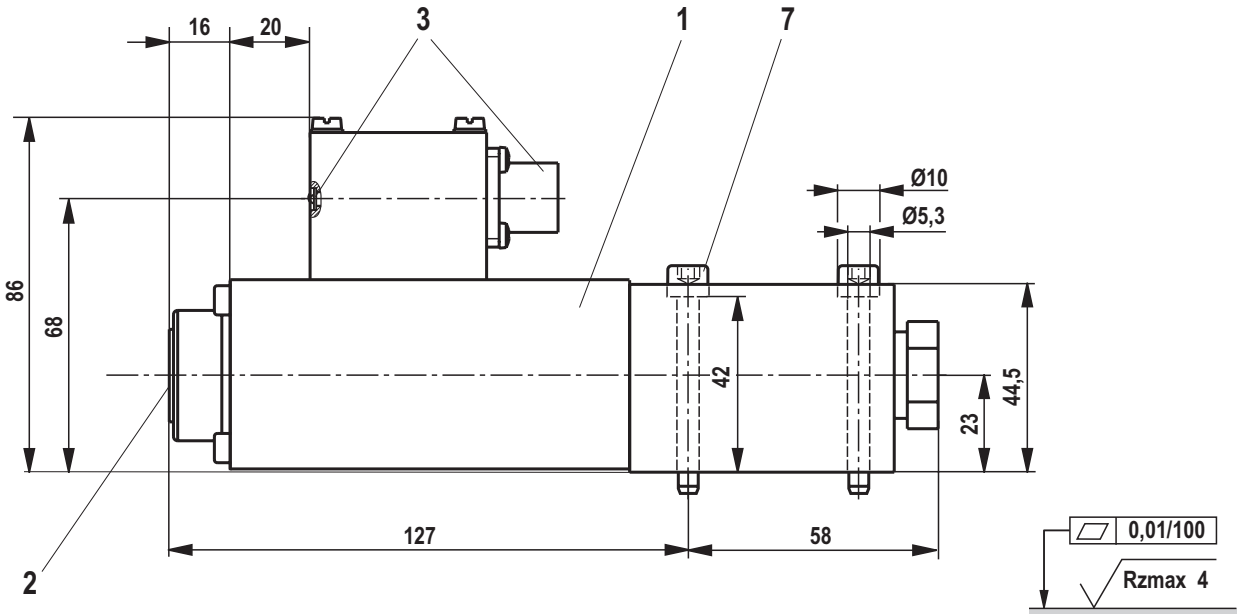
Subplates (separate order) with porting pattern according to ISO 4401-03-02-0-05, see data sheet 45100.

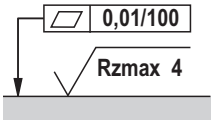
Notice:

Subplates are no components in the sense of directive 2014/34/EU and can be used after the manufacturer of the overall system has conducted an assessment of the risk of ignition.

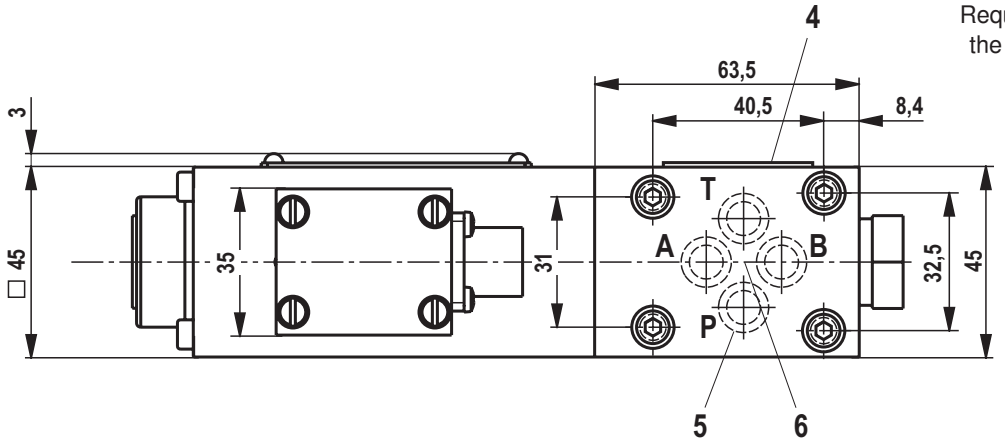
The "G...J3" versions are free from aluminum and/or magnesium and galvanized.

Dimensions: Version "W-3…G12-19..K20ZL…" (dimensions in mm)





Required surface quality of the valve contact surface



1 Valve solenoid
2 Manual override
3 Operating display and connector
4 Name plate
5 Identical seal rings for ports A, B, T; seal ring for port P
6 Porting pattern according to ISO 4401-03-02-0-05 (but without locating hole)
7 Valve mounting screws
For reasons of stability, exclusively use the following valve mounting screws:
4 hexagon socket head cap screws ISO 4762 - M5 x 50 - 10.9 - flZn/nc/L/240h/C (friction coefficient 0.09 - 0.14 according to VDA 235-101)
(included in the scope of delivery)

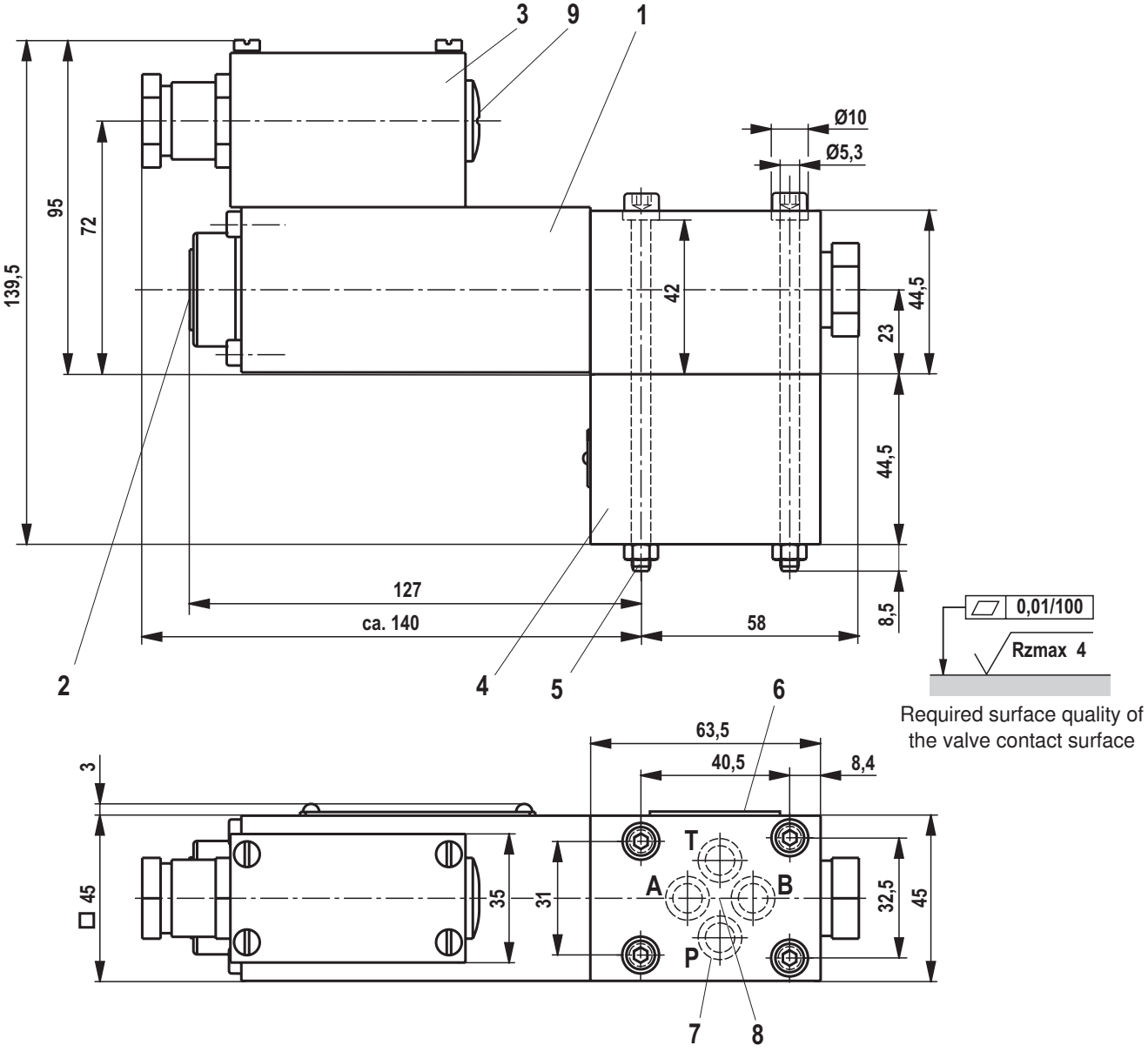
Subplates (separate order) with porting pattern according to ISO 4401-03-02-0-05, see data sheet 45100.

Notice:

Subplates are no components in the sense of directive 2014/34/EU and can be used after the manufacturer of the overall system has conducted an assessment of the risk of ignition.

The "G...J3" versions are free from aluminum and/or magnesium and galvanized.

Dimensions: Version "E-4…G12-12..Z2…" (dimensions in mm)



1 Valve solenoid
2 Manual override
3 Terminal box
4 Plus-1 plate
5 Valve mounting screws
For reasons of stability, exclusively use the following valve mounting screws:
4 hexagon socket head cap screws ISO 4762 - M5 x 95 - 10.9 - flZn-240h-L (friction coefficient 0.09 - 0.14 according to VDA 235-101)
(included in the scope of delivery)
6 Name plate
7 Identical seal rings for ports A, B, T; seal ring for port P
8 Porting pattern according to ISO 4401-03-02-0-05 (but without locating hole)
9 Plug screw

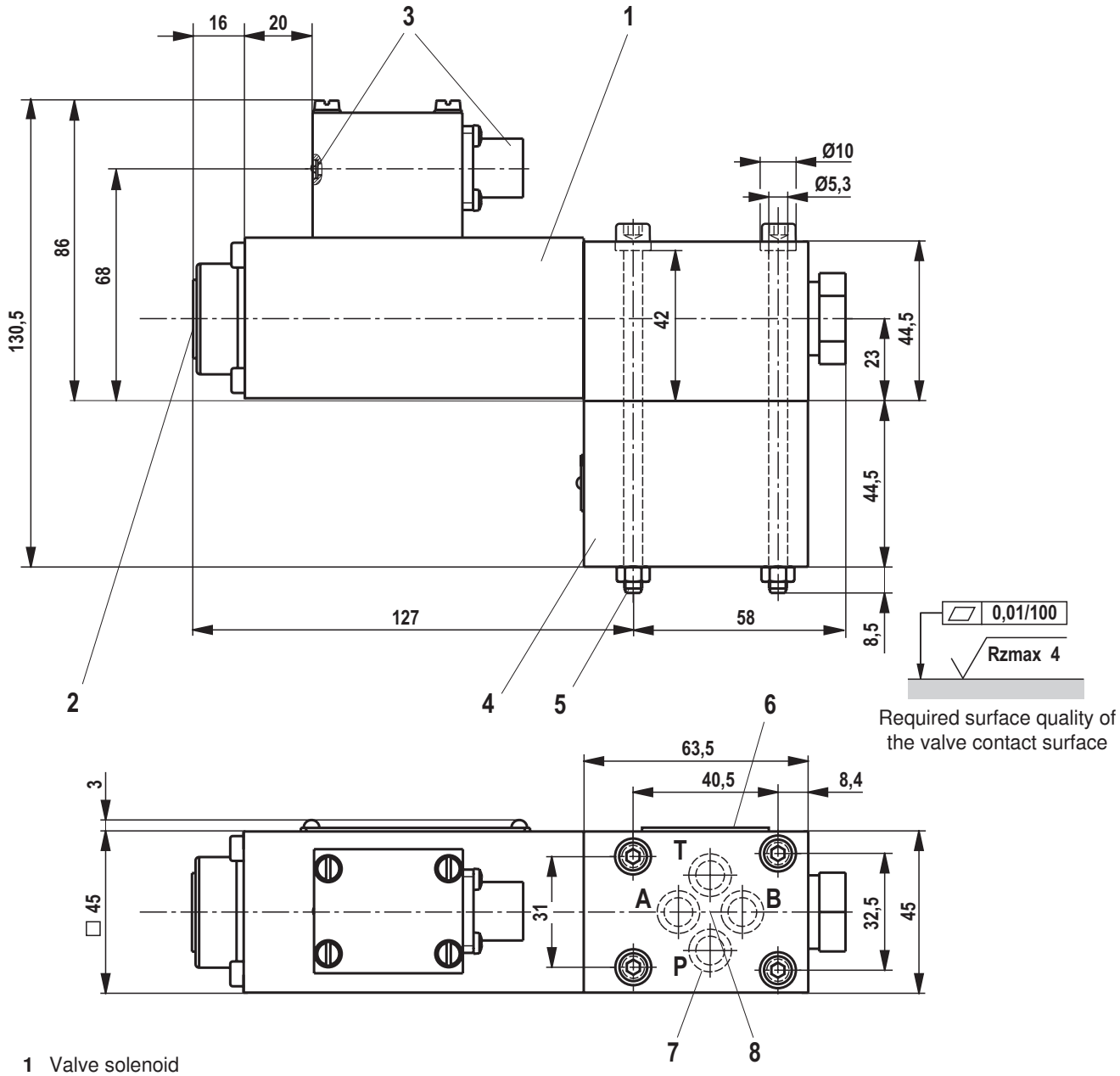
Subplates (separate order) with porting pattern according to ISO 4401-03-02-0-05, see data sheet 45100.

Notice:

Subplates are no components in the sense of directive 2014/34/EU and can be used after the manufacturer of the overall system has conducted an assessment of the risk of ignition.

The "G...J3" versions are free from aluminum and/or magnesium and galvanized.

Dimensions: Version "W-4…G12-19..K20ZL…" (dimensions in mm)



1 Valve solenoid

2 Manual override

3 Operating display and connector

4 Plus-1 plate

5 Valve mounting screws
For reasons of stability, exclusively use the following valve mounting screws:
4 hexagon socket head cap screws ISO 4762 - M5 x 95 - 10.9 - flZn-240h-L (friction coefficient 0.09 - 0.14 according to VDA 235-101)
(included in the scope of delivery)

6 Name plate

7 Identical seal rings for ports A, B, T; seal ring for port P

8 Porting pattern according to ISO 4401-03-02-0-05 (but without locating hole)

Subplates (separate order) with porting pattern according to ISO 4401-03-02-0-05, see data sheet 45100.

Notice:

Subplates are no components in the sense of directive 2014/34/EU and can be used after the manufacturer of the overall system has conducted an assessment of the risk of ignition.

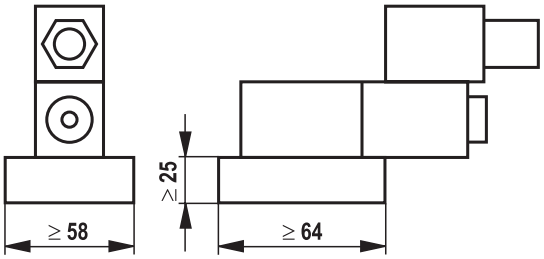
The "G...J3" versions are free from aluminum and/or magnesium and galvanized.

Installation conditions (dimensions in mm)

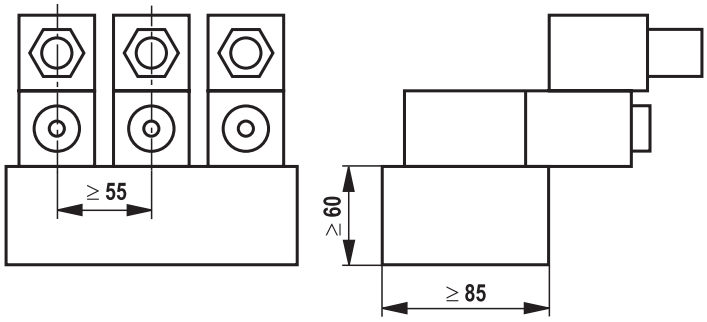
	Individual assembly	Bank assembly
Dimensions of the subplate	Minimum dimensions Length ≥ 64, width ≥ 58, height ≥ 25	Minimum cross-section Height ≥ 60, width ≥ 85
Thermal conductivity of the subplate	≥ 38 W/mK (EN-GJS-500-7)	
Minimum distance between the longitudinal valve axes	≥ 55 mm	

Schematic diagram

Individual assembly



Bank assembly



Further information

Subplates	Data sheet 45100
Use of non-electrical hydraulic components in an explosive environment (ATEX)	Data sheet 07011
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
Directional seat valves, direct operated, with solenoid actuation	Operating instructions 22047-XH
Selection of filters	www.boschrexroth.com/filter
Information on available spare parts	www.boschrexroth.com/spc

Notes

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