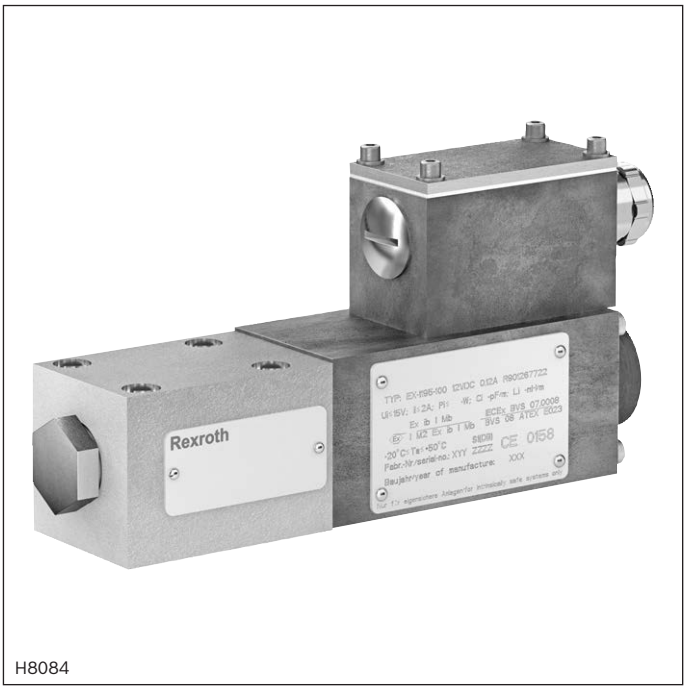
RE 22047-XH
Edition: 2019-09
Replaces: 04.16
RA78487928_AA

rexroth
A Bosch Company

Directional seat valves, direct operated with solenoid actuation

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



H8084

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

CE

ATEX units
For potentially explosive atmospheres

Information on explosion protection:

- Area of application in accordance with the Explosion Protection Directive 2014/34/EU: **I M2 (XM); II 2G (XH)**
- Type of protection valve:
  - Ex h I Mb X according to EN 80079-38 (XM)
  - Ex h IIC T6 Gb X according to EN 80079-36 (XH)
- Type of protection valve solenoid: Ex ib I Mb / Ex ib IIC T6 Gb according to EN 60079-0 / EN 60079-11
- Valve solenoid certified according to IECEx

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 (however, without locating hole)
- Blocked connection tight
- Wet-pin DC solenoid
- Safe switching also with longer standstill periods under pressure
- Electrical connection as individual connection with cable gland or connector (depending on the valve type)
- With manual override

Contents

☞ **Notice:** The documentation version with which the product was supplied is valid.

Ordering code

01		02	03	04	05	06		07	08	09	10	11	12		13	14
	–		SE	6		6X	/	420	B		N			/		V

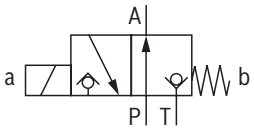
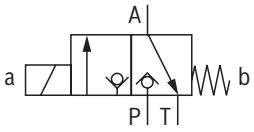
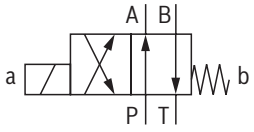
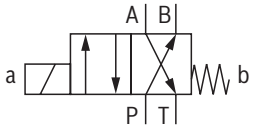
01	Oil-in-water emulsion	**E**
	Water	**W**

02	3 main ports	**3**
	4 main ports	**4**

03	Seat valve	**SE**

04	Size 6	**6**

Symbols

05	Main ports	3	4	
		✓	–	**U**
		✓	–	**C**
		–	✓	**D**
		–	✓	**Y**

06	Component series 60 ... 69 (60 ... 69: unchanged installation and connection dimensions)	**6X**

07	Operating pressure 420 bar	**420**

08	High-power solenoid (wet-pin)	**B**

Voltage (direct voltage 12 V)

09	Nominal power supply 120 mA (for version "E" only)	**G12-12**
	Nominal power supply 190 mA (for version "W" only)	**G12-19**

10	**With** manual override	**N**

Explosion protection

11	"Intrinsically safe" for device group II	**XH**
	"Intrinsically safe" for device group I	**XM**
	For details, see information on the explosion protection page 7	

Electrical connection

12	Solenoid with terminal box and cable gland (for version "E" only)	**Z2**
	Solenoid with connector facing the valve housing (for version "W" only)	**K20ZL**
	For details of electrical connections see page 14	

Ordering code

01		02	03	04	05	06		07	08	09	10	11	12		13	14
	–		**SE**	**6**		**6X**	/	**420**	**B**		**N**			/		**V**

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

Seal material (Observe compatibility of seals with hydraulic fluid used)

14	FKM seals	**V**

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

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

General

Type SE directional seat valves are direct-operated directional valves with solenoid actuation. They control start, stop and direction of flow.

The directional valves basically comprise a housing (1), the solenoid (2), the hardened valve system (3) and the balls (4.1 and 4.2) as closing element.

For unobjectionable functioning, the hydraulic system has to be bled properly.

Basic principle

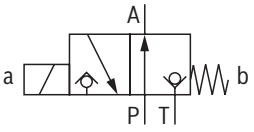
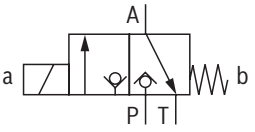
In the initial position, the ball (4.1) is pressed onto the seat by the spring (7), in spool position, the ball (4.2) is pressed onto the seat by the solenoid (2). The force of solenoid (2) acts via the ball (5) on the actuating plunger (6) that is sealed on two sides. The chamber between the two sealing 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.

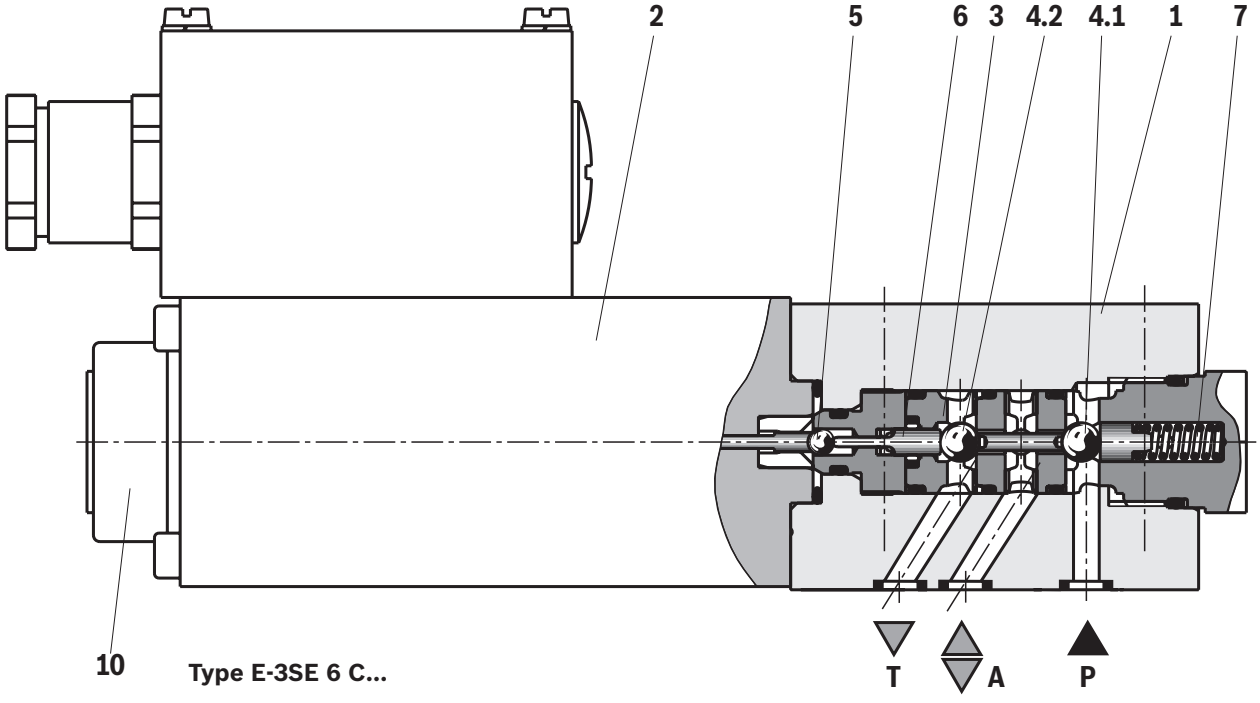
Notices

- 3/2-directional seat valves feature "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. However, this process takes place within such a short time that it is irrelevant in nearly all cases of use.
- The manual override (10) allows for the switching of the valve without solenoid energization.
- Make sure that the specified maximum flow is not exceeded. A throttle insert must be used for flow limitation, if necessary (see page 13).
- In order to switch the valve safely or maintain it in its spool position, the pressure situation at the corresponding ports must be as follows: P ≥ A ≥ T for 3/2 directional seat valves or P ≥ A ≥ B ≥ T for 4/2 directional seat valves (for design reasons).
- The ports P, A and T (3/2 directional seat valve) or P, A, B and T (4/2 directional seat valve) are clearly determined according to their tasks. They must not be exchanged or closed. The flow is only admissible in the direction of arrow.

The seat arrangement offers the following options:

Symbols

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



Type E-3SE 6 C...

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

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

Function of the Plus-1 subplate

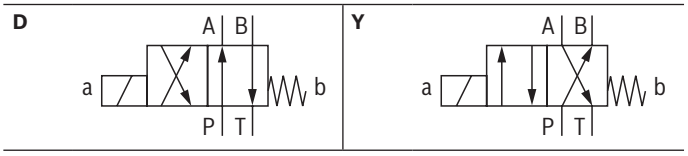
- Initial position
  The main valve is not operated. The spring (7) holds the ball (4.1) on the seat (11). Port P is blocked and A is connected to T. Apart from that, one control line is connected from A to the large area of the control spool (12), which is thus unloaded to the tank. The pressure applied 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 operated, 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 subplate has a "positive spool overlap".

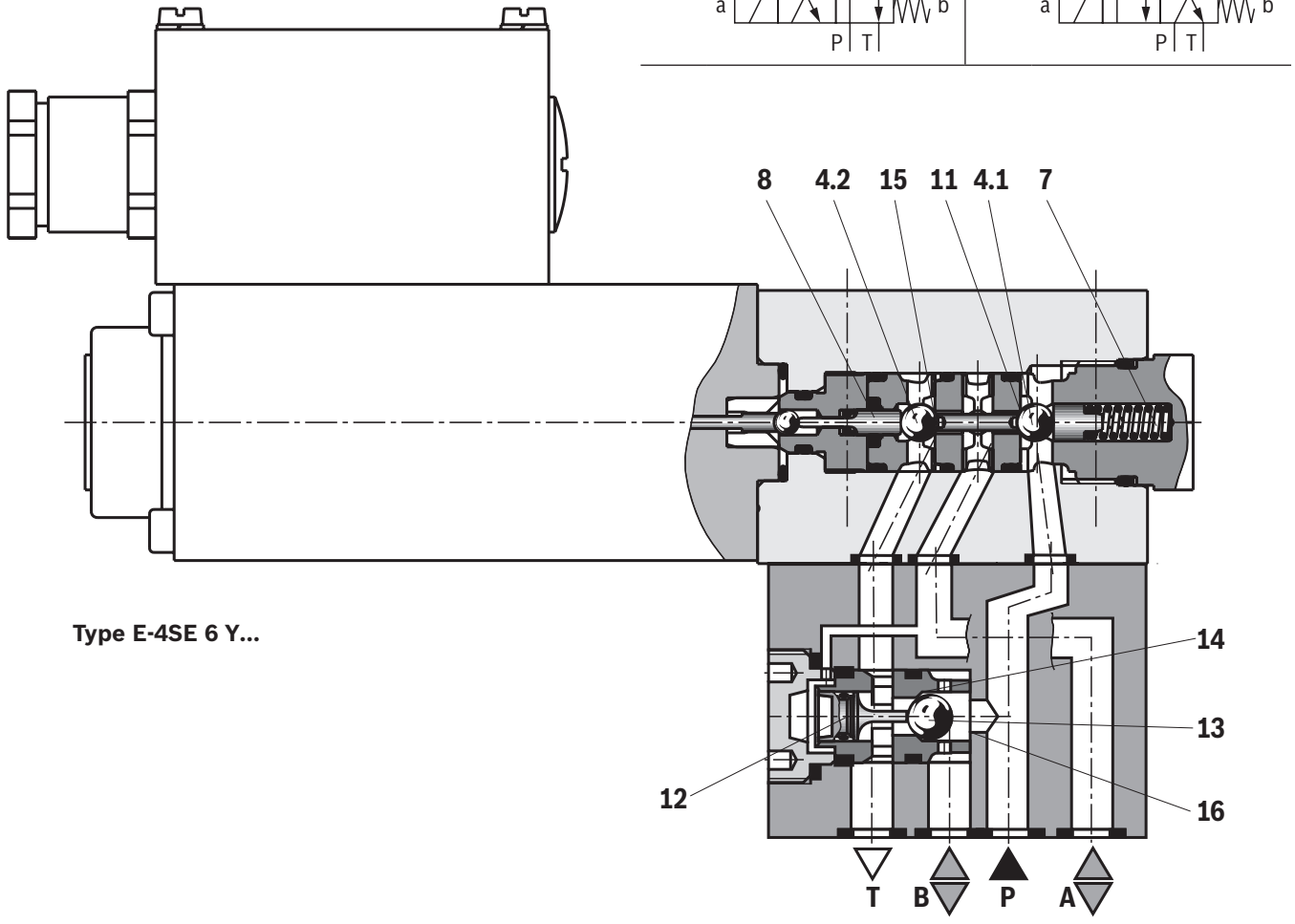
☞ **Notices:**

- When operating 4/2 directional seat valves to control differential cylinders, the annulus area of the cylinder must only be connected with connection A of the valve. Otherwise, pressure peaks can be created while switching, which will exceed the maximum operating pressure.
- When operating 4/2 directional seat valves, the minimum pressure must be 8 bar and the minimum flow must be 3 l/min.

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

Symbols





Type E-4SE 6 Y...

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

General			
Installation position			any
Ambient temperature range		°C	–20 ... +50
Storage temperature range		°C	+5 ... +40
Maximum storage time		Years	1
Maximum admissible acceleration a_{max}		g	10
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
Maximum surface temperature		°C	See information on explosion protection, page 7

Hydraulic			
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 Hydraulic fluids containing water, a comparable cleanliness is to be ensured.)

Electric			
Nominal voltage		V	12
Voltage type			Direct voltage
Voltage tolerance		%	±10
Admissible residual ripple		%	< 5
Duty cycle / operating mode according to VDE 0580			S1 (continuous operation)
Ordering code for voltage			"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		ms	See table page 7
Maximum switch-off voltage peaks solenoid [2]		V	–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 simultaneously increases the life cycle of the components.
For the selection of filters, see www.boschrexroth.com/filter.

[2] Switching off the valve solenoid results in a voltage peak due to the inductive effect. The valve solenoid already contains an interference protection circuit dampening this voltage peak. However, additional external switching measures have to be taken, if required, in order to avoid connected electric circuits being influenced by the residual voltage peak.

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

Information on explosion protection				
Ordering code for voltage		"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 according to EN 80079-36 and EN 80079-38 [3]		Ex h I Mb X	Ex h IIC T6 Gb X	Ex h I Mb X
Type of protection valve solenoid according to EN 60079-0		Ex ib I Mb	Ex ib IIC T6 Gb	Ex ib I Mb
Maximum surface temperature [4]	°C	80		88
Temperature class		–	T6	–
Type examination certificate Solenoid		BVS 08 ATEX E 023		
"IECEx Certificate of Conformity" solenoid		IECEx BVS 07.0008		

Safety-related maximum values of the solenoids dependent on the device group and the type of the electrical connection				
Device group		I		II
Ordering code for explosion protection		"XM"		"XH"
Ordering code for voltage		"G12-12"	"G12-19"	"G12-12"
Electrical connection "Z2"				
▶ Maximum voltage U_i	VDC	15	–	27
▶ Maximum current I_i	A	2	–	2
▶ Effective inner inductivity L_i [5]	nH	Neglectable	–	Neglectable
▶ Effective inner capacity C_i [5]	pF	Neglectable	–	Neglectable
▶ Ambient temperature range	°C	–20 ... +50	–	–20 ... +50
Electrical connection "K20ZL"				
▶ Maximum voltage U_i	VDC	–	15	–
▶ 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] Ex h: structural safety c according to EN 80079-37.

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

[5] Per meter of cable length

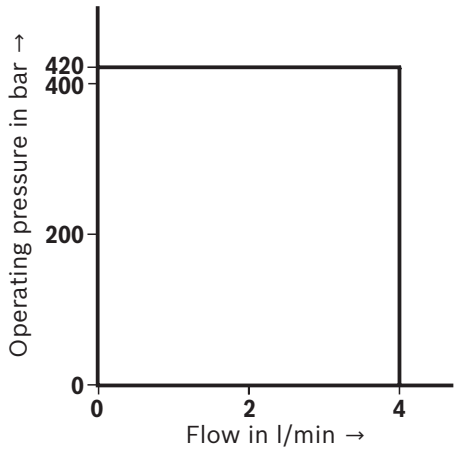
Switching times (installation position: solenoid horizontal)

Pressure p in bar	**Flow q_V** in l/min	**Switching times t** in ms															
		"G12-12"								**"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

☞ **Notice:**
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.

Performance limits

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



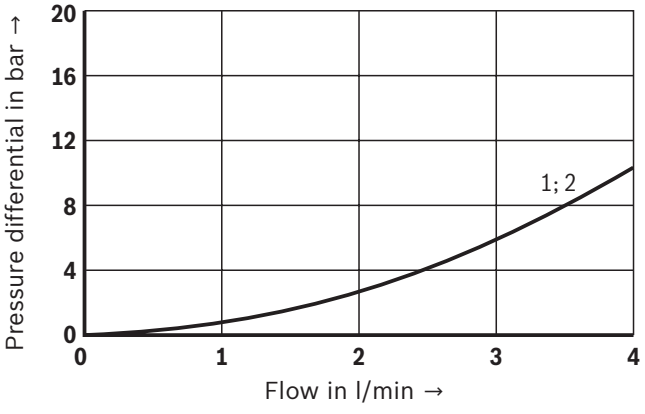
☞ **Notice:**
The performance limits were determined when the solenoids were at operating temperature, at 10% undervoltage and without tank preloading.

Characteristic curves

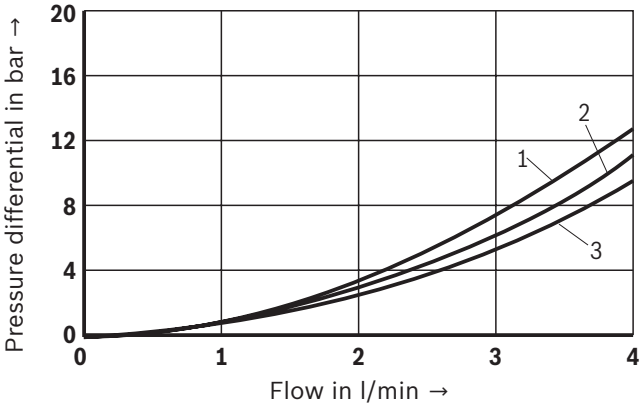
(measured with HLP46, ϑ_{oil} = 40 ±5 °C and p = 100 bar)

Δp-q_V characteristic curves

3/2 directional seat valve

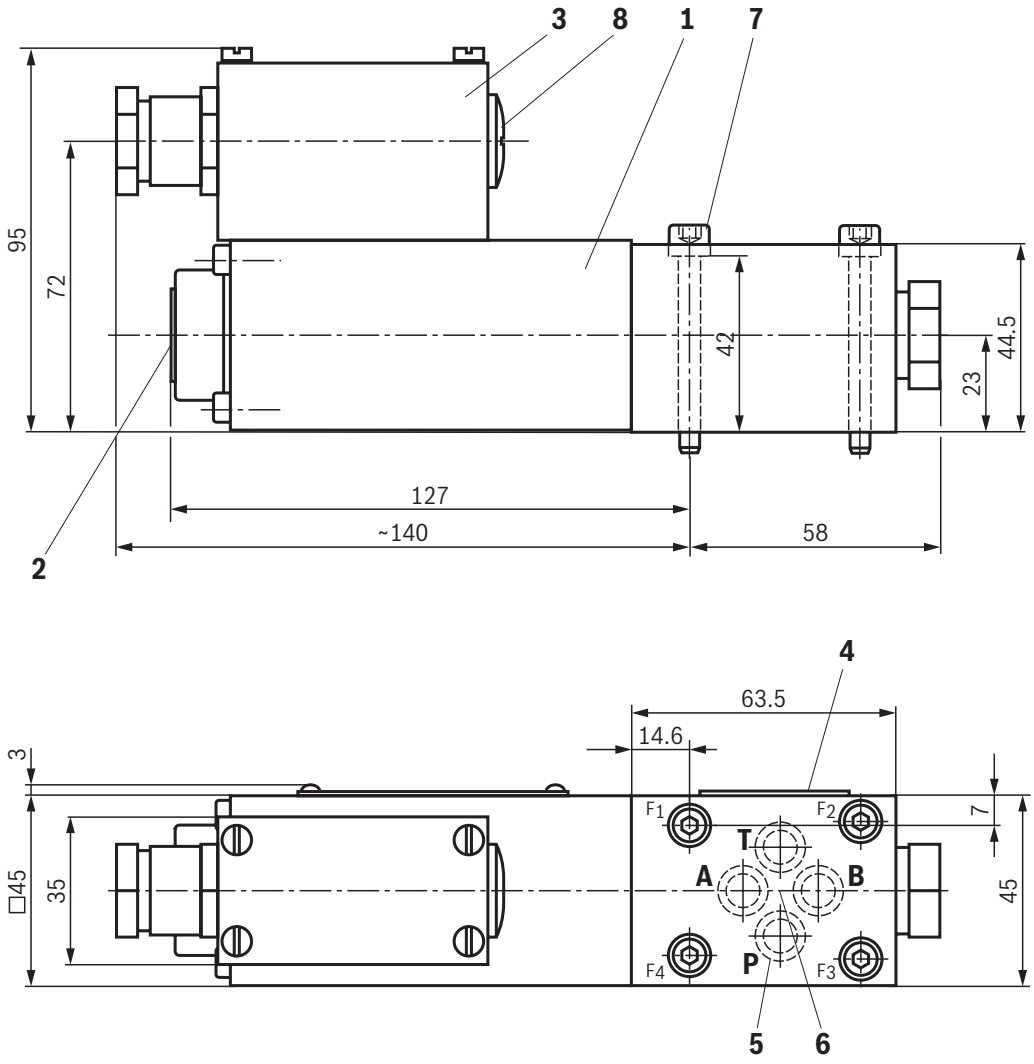


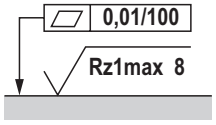
4/2 directional seat valve



1 A→T
2 P→A
3 B→T, P→B

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





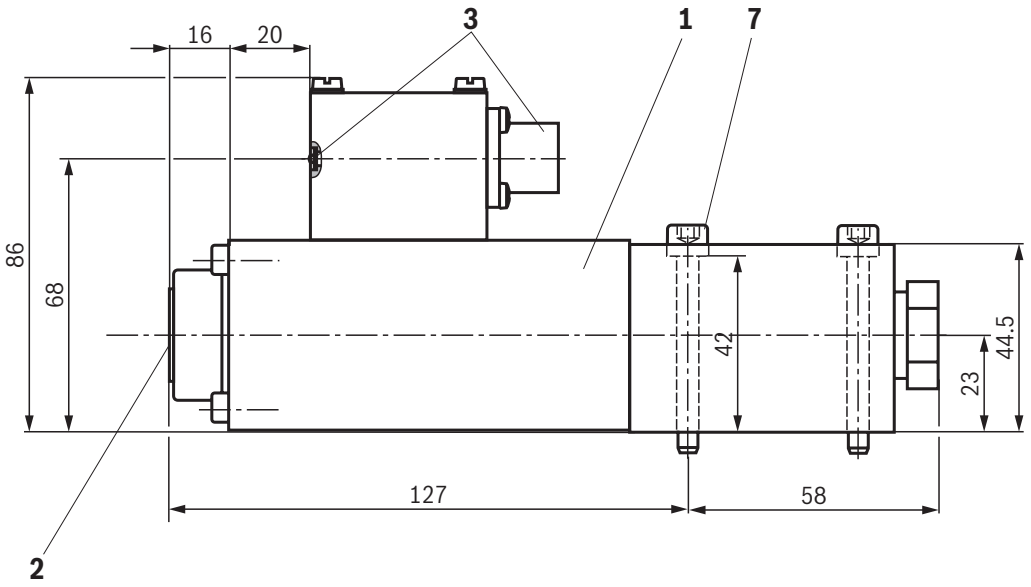
Required surface quality
of the valve contact surface

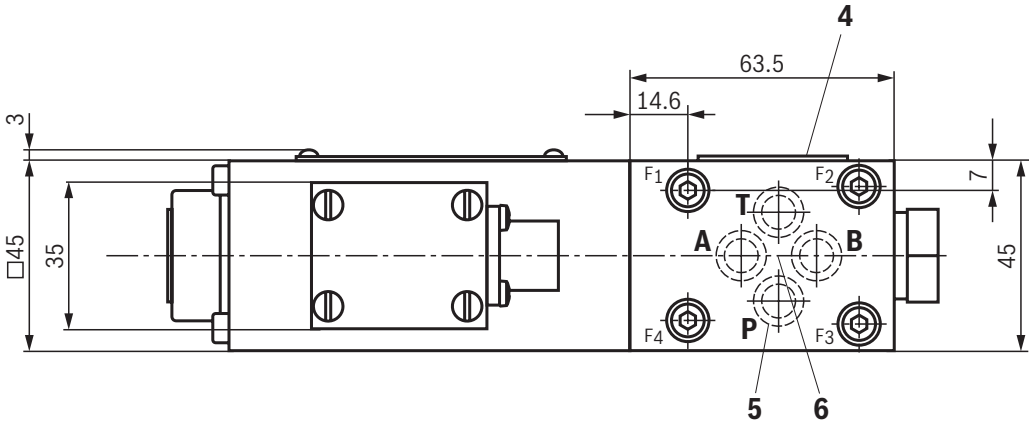
1 Valve solenoid
2 Manual override "N"
3 Terminal box
4 Name plate
5 Identical seal rings for ports A, B, T,
Seal ring for port P
6 Porting pattern according to ISO 4401-03-02-0-05
(however, without locating hole)
7 **Valve mounting screws** (included within the scope of delivery)
4 hexagon socket head cap screws
ISO 4762 - M5 x 50 - 10.9
(friction coefficient μ_{total} = 0.09 ... 0.14);
Tightening torque M_A = 7 Nm ±10%
8 Plug screw

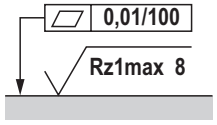
Subplates (separate order) with porting pattern according to ISO 4401-03-02-0-05, see data sheet 45100.

☞ **Notices:**
- 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.
- The dimensions are nominal dimensions which are subject to tolerances.

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







Required surface quality of the valve contact surface

1 Valve solenoid
2 Manual override "N"
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 (however, without locating hole)
7 **Valve mounting screws** (included within the scope of delivery)
4 hexagon socket head cap screws
ISO 4762 - M5 x 50 - 10.9
(friction coefficient μ_{total} = 0.09 ... 0.14);
Tightening torque M_A = 7 Nm ±10%

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

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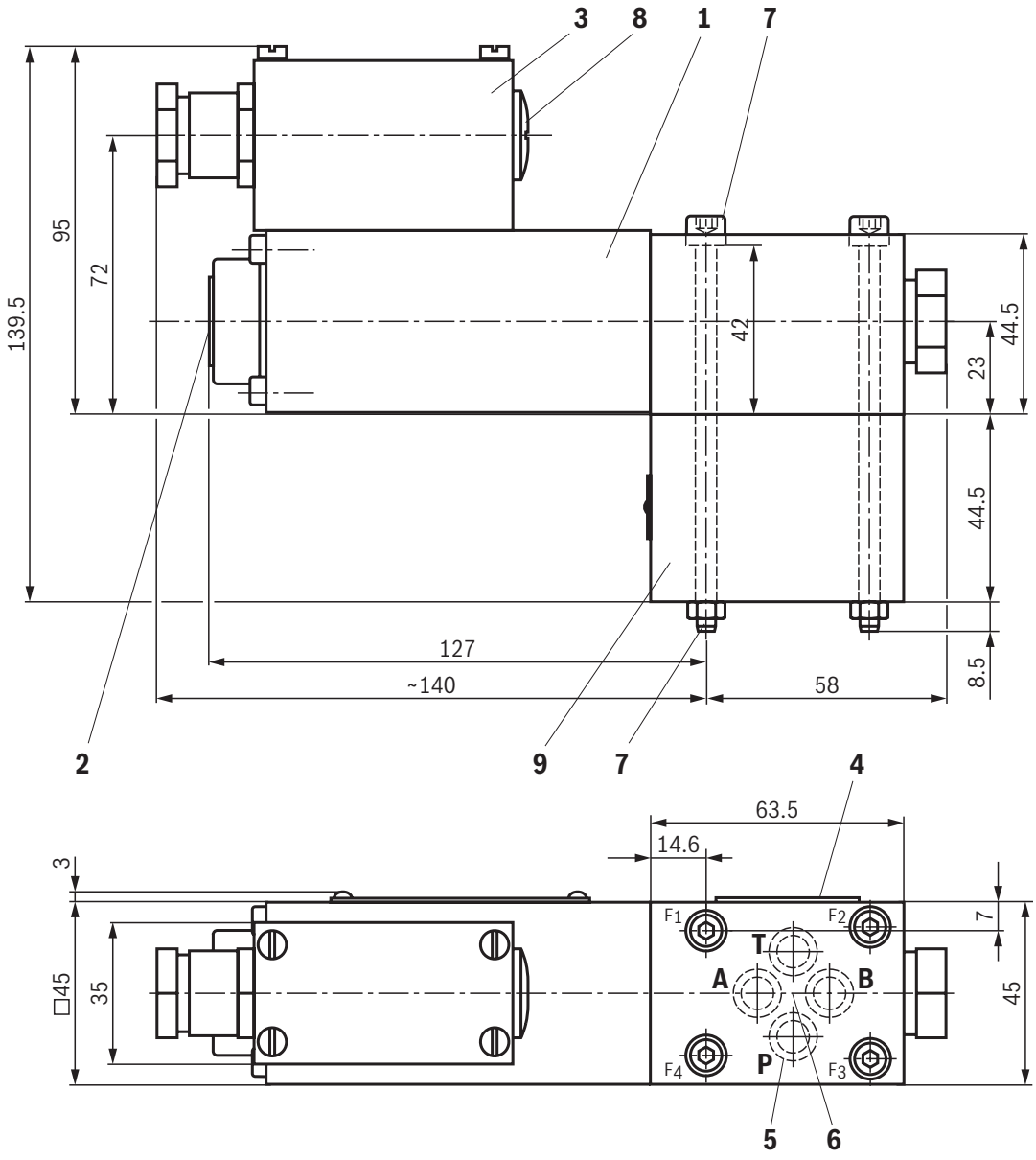
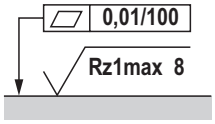
- The dimensions are nominal dimensions which are subject to tolerances.

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





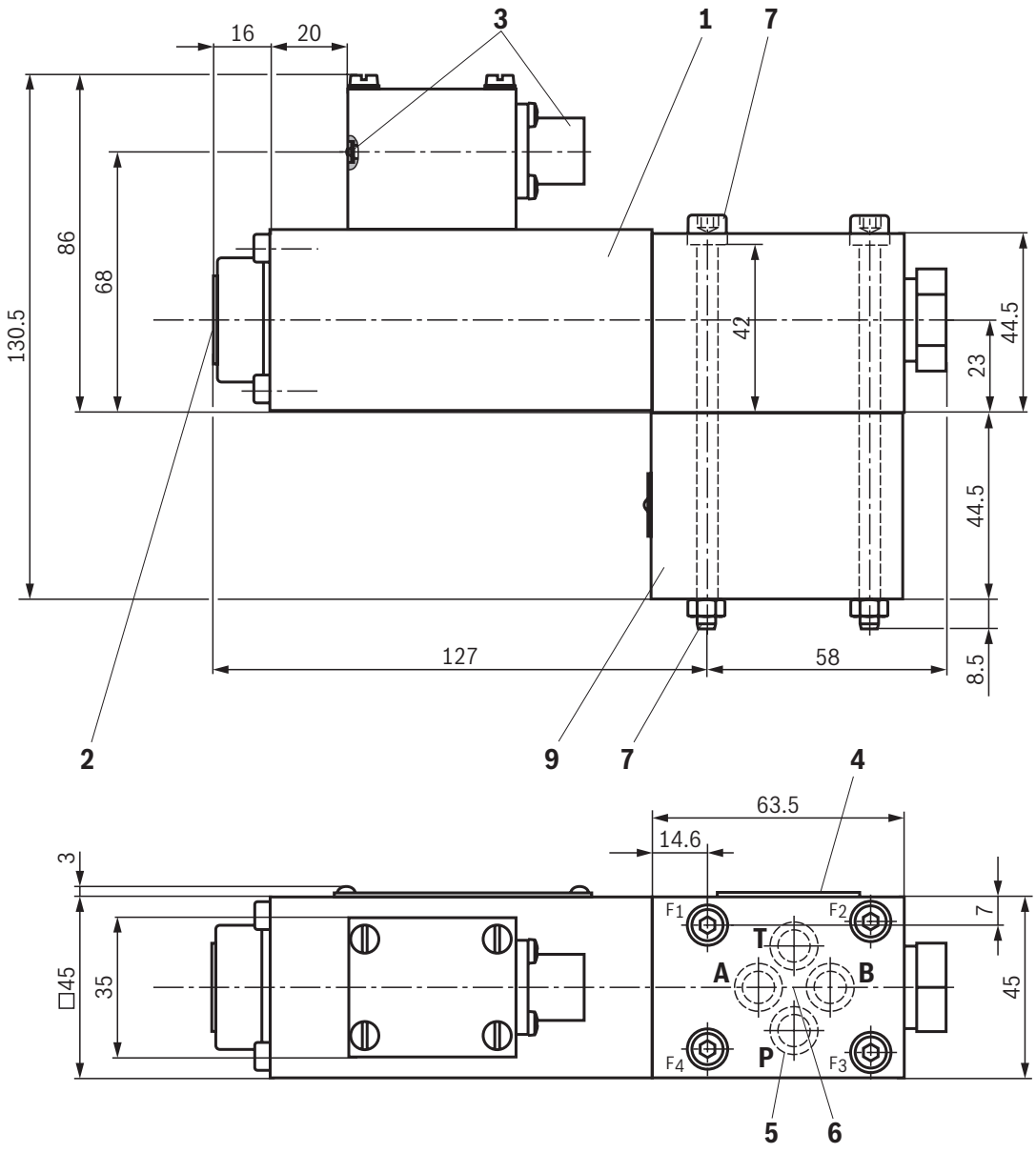
Required surface quality
of the valve contact surface

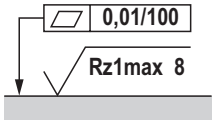
1 Valve solenoid
2 Manual override "N"
3 Terminal box
4 Name plate
5 Identical seal rings for ports A, B, T,
Seal ring for port P
6 Porting pattern according to ISO 4401-03-02-0-05
(however, without locating hole)
7 **Valve mounting screws** (included within the scope of delivery)
4 hexagon socket head cap screws
ISO 4762 - M5 x 95 - 10.9
(friction coefficient μ_{total} = 0.09 ... 0.14);
Tightening torque M_A = 7 Nm ±10%
8 Plug screw
9 Plus-1 subplate

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

☞ **Notices:**
- 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.
- The dimensions are nominal dimensions which are subject to tolerances.

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





Required surface quality of the valve contact surface

1 Valve solenoid
2 Manual override "N"
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 (however, without locating hole)
7 **Valve mounting screws** (included within the scope of delivery)
4 hexagon socket head cap screws
ISO 4762 - M5 x 95 - 10.9
(friction coefficient μ_{total} = 0.09 ... 0.14);
Tightening torque M_A = 7 Nm ±10%
9 Plus-1 subplate

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

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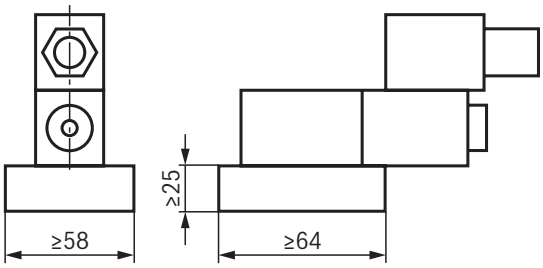
- Subplates are no components in the sense of directive 2014/34/EU and can be used after the manufacturer of the overall system has conducted an assessment of the risk of ignition. The "G...J3" versions are free from aluminum and/or magnesium and galvanized.
- The dimensions are nominal dimensions which are subject to tolerances.

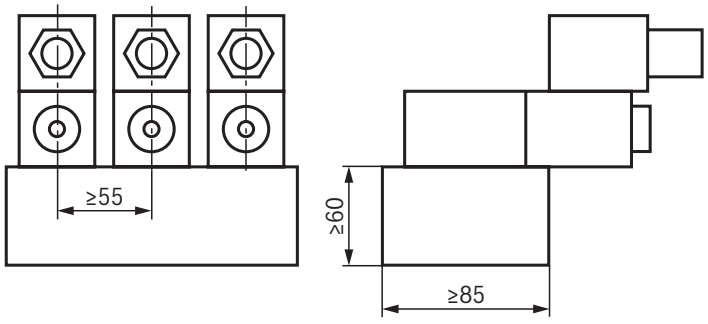
Installation conditions
(dimensions in mm)

	Individual assembly	Bank assembly
Subplate dimensions	Minimum dimensions Length ≥ 64, width ≥ 58, height ≥ 25	Minimum cross-section Height ≥ 60, width ≥ 85
Thermal conductivity of the subplate	≥ 36.2 W/mK	
Minimum distance between the longitudinal valve axes	≥ 55	

Individual assembly



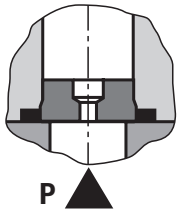
Bank assembly



Throttle insert

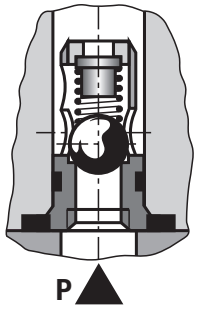
The use of a throttle insert is required when due to prevailing operating conditions, flows can occur during the switching processes, which exceed the performance limit of the valve.

Examples:
- Accumulator operation,
- Use as pilot control valve with internal pilot fluid tapping.



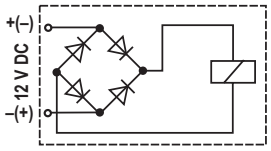
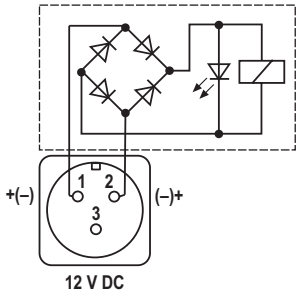
Check valve insert

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



Electrical connection

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

Ordering code Electrical connection	Type of connection, description	Circuit diagram	Ordering code 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	M20 x 1.5	
	▶ Line diameter mm	6.5 ... 9.5	
	▶ Sealing	Outer sheath sealing	
	Connection terminal solenoid		
	▶ 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 [1)] ▶ Operating display via light emitting diode (LED), red ▶ Suitable mating connector, type 845-11-8522-001 [1)]		**G12-19** (190 mA)

[1)] Separate order, company Souriau

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

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