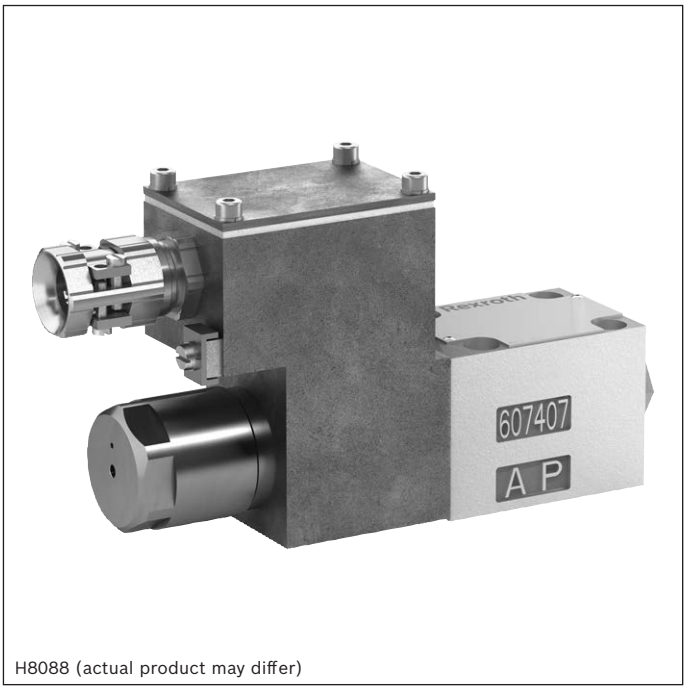
Directional seat valves, direct operated, with solenoid actuation

Type SED ...XE

RE 22049-XE
Edition: 2016-09
Replaces: 2016-04



H8088 (actual product may differ)

- Size 6
- Component series 1X
- Maximum operating pressure 350 bar
- Maximum flow 25 l/min

CE

ATEX units
For potentially explosive atmospheres

Information on the explosion protection:

- Area of application in accordance with the Explosion Protection Directive 2014/34/EU: **II 2G**
- Type of protection of the valve solenoids: Ex eb mb IIC T4 Gb according to EN 60079-7 / EN 60079-18

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)
- Wet-pin DC or AC solenoids
- Electrical connection with individual connection and cable gland
- With concealed manual override, optional

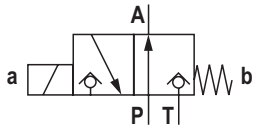
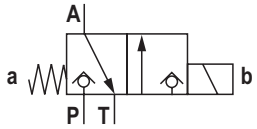
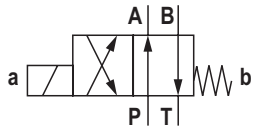
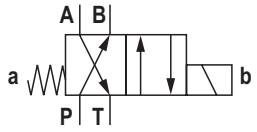
Contents

Ordering code

01	02	03	04	05	06		07	08	09	10	11	12		13	14
M	**–**		**SED**	**6**		**1X**	**/**	**350**	**C**			**XE**	**Z2**	**/**		

01	Mineral oil	**M**
02	3 main ports	**3**
	4 main ports	**4**
03	Seat valve	**SED**
04	Size 6	**6**

Symbols

05	Main ports	3	4	
		✓	–	**UK**
		✓	–	**CK**
		–	✓	**D**
		–	✓	**Y**

06	Component series 10 ... 19 (10 ... 19: unchanged installation and connection dimensions)	**1X**
07	Operating pressure 350 bar	**350**
08	Wet-pin solenoid with detachable coil	**C**
09	Direct voltage 24 V	**G24**
	AC voltage 230 V, 50/60 Hz	**W230R**
	For further ordering codes for other voltages and frequencies, see page 7	
10	**With** concealed manual override	**N9**
	Without manual override	**no code**

Explosion protection

11	"Increased safety"	**XE**
	For details, see information on the explosion protection, page 7	

Electrical connection

12	Solenoid with terminal box and cable gland	**Z2**
	For details of electrical connections, see page 15.	

Ordering code

01		02	03	04	05	06		07	08	09	10	11	12		13	14
M	**–**		**SED**	**6**		**1X**	**/**	**350**	**C**			**XE**	**Z2**	**/**		

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**

Seal material

14	NBR seals	**no code**
	FKM seals	**V**
	Observe compatibility of seals with hydraulic fluid used. (Other seals upon request)	

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

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

General

Directional valves of the type SED are direct operated directional seat valves with solenoid actuation. They control start, stop and direction of flow.

Directional valves basically comprise the housing (1), the solenoid (2), the valve seats (7) and (11) and the control spool (4).

The manual override (6) allows for the switching of the valve without solenoid energization.

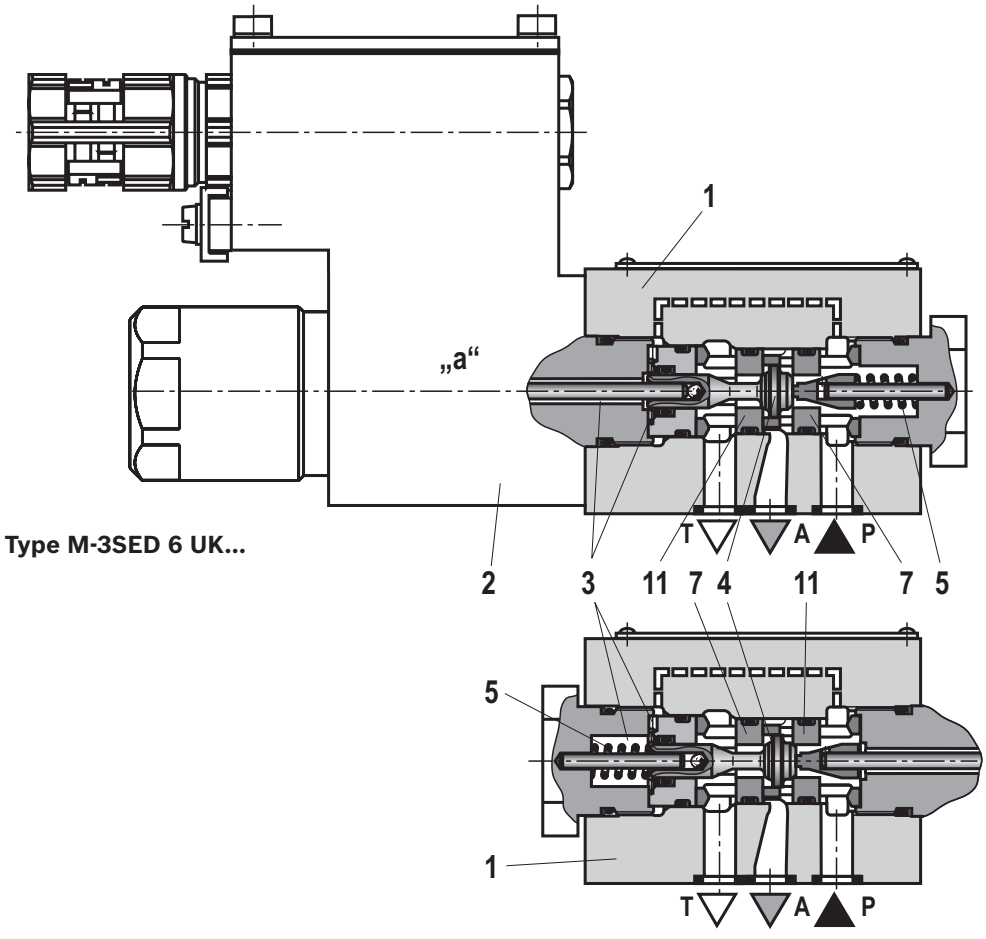
Basic principle

The initial position of the valve (normally open "UK" or normally closed "CK") is determined by the arrangement of the spring (5). The chamber (3) behind the control spool (4) is connected to port P and sealed against port T. Thus, the valve is pressure-compensated in relation to the actuating forces (solenoid and spring).

By means of the control spool (4), the ports P, A and T can be loaded with the maximum operating pressure (350 bar) and the flow can be directed in both directions (see symbols).

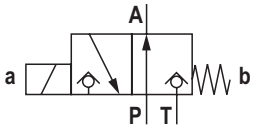
In the initial position, the control spool (4) is pressed onto the seat (11) by the spring (5); in spool position, it is pressed onto the seat (7) by the solenoid (2). The flow is blocked.

Seat valves can be used according to the symbols as well as the assigned operating pressures and flows (see performance limits on page 8).

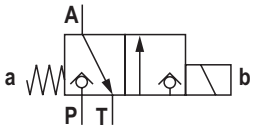


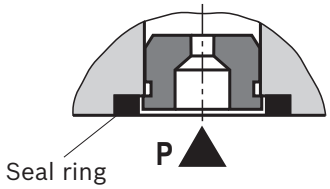
Type M-3SED 6 UK...

Symbol "UK"



Symbol "CK"





Throttle insert "...B"

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

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.

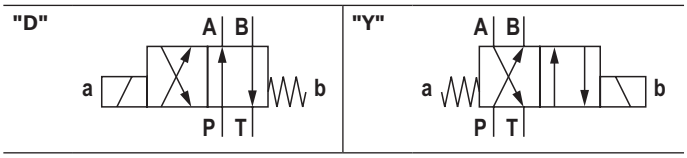
Function of the Plus-1 plate

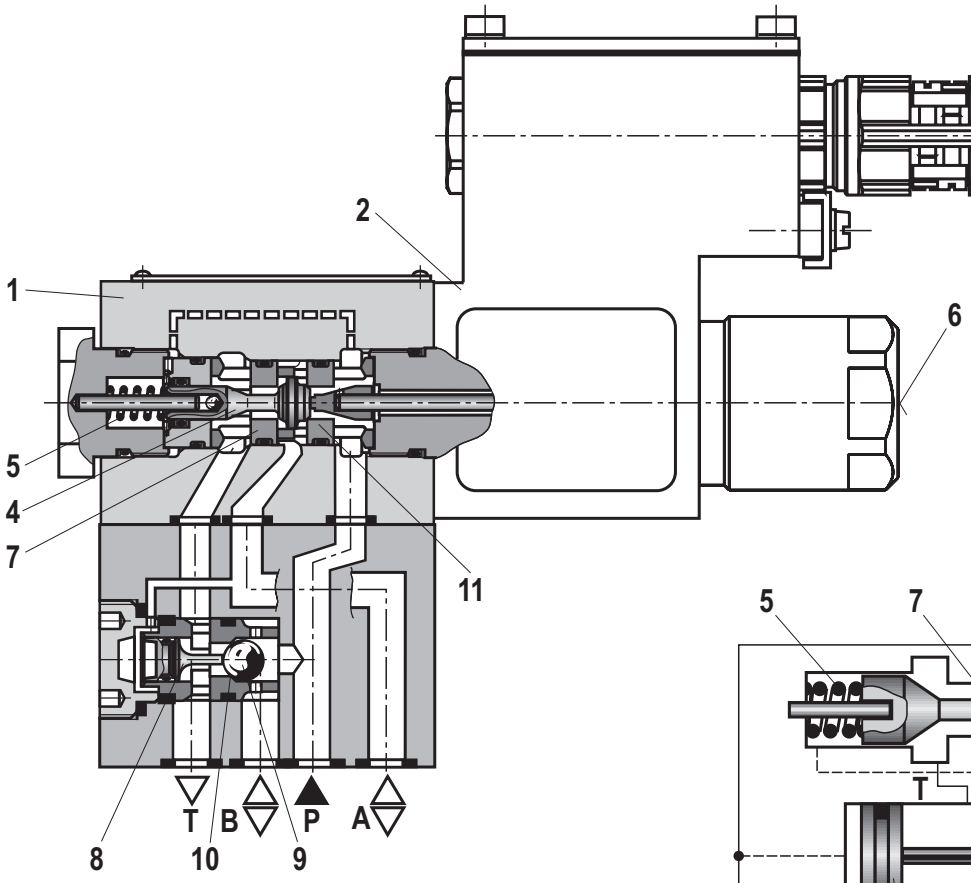
- Initial position:
  The main valve is not actuated. The spring (5) holds the control spool (4) on the seat (11). Port P is blocked and A is connected to T. Apart from that, one control line is connected from A to the large area of the control spool (8), which is thus unloaded to the tank. The pressure applied via P now pushes the ball (9) onto the seat (10). Now, P is connected to B, and A to T.
- Transition position:
  When the main valve is actuated, the control spool (4) is shifted against the spring (5) and pressed onto the seat (7). 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 (8), the ball (9) is pressed onto the seat (12). Thus, B is connected to T, and P to A. The ball (9) in the Plus-1 plate has a "positive spool overlap".

☞ **Notice:**
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. This pressure peak may exceed the maximum admissible operating pressure over the permissible limit!

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

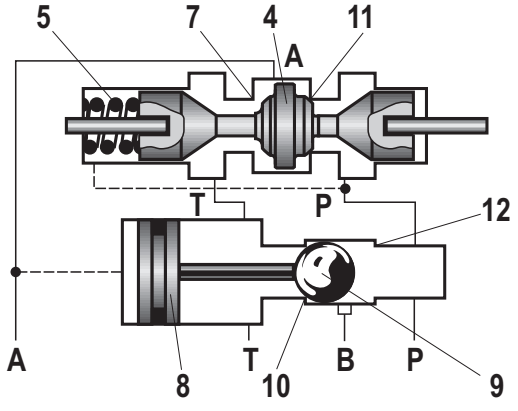
Symbols





Type M-4SED 6 Y...

Schematic illustration (initial position)



3/2 directional seat valve

Plus-1 plate

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

general			
Installation position			Any
Ambient temperature range		°C	–20 ... +70 [1]
Storage temperature range		°C	+5 ... +40
Maximum storage time		Years	1
Weight	▶ 3/2 directional seat valve	kg	3.1
	▶ 4/2 directional seat valve	kg	3.9
Surface protection			Galvanized

hydraulic		
Maximum operating pressure	bar	See table page 8
Maximum flow	l/min	25
Hydraulic fluid		See table below
Hydraulic fluid temperature range	°C	–20 ... +80 (NBR seals) –15 ... +50 (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 [2]
Maximum surface temperature	°C	See information on the explosion protection, page 7

Hydraulic fluid		**Classification**	**Suitable sealing materials**	**Standards**	**Data sheet**
Mineral oils		HL, HLP, HLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	NBR, FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	

☞ **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.)!
- ▶ Ignition temperature > 180 °C

[1] Observe the "Special application conditions for safe application" on page 7.

[2] 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.

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

electric			
Voltage type		Direct voltage	Alternating voltage
Available voltages	V	24, 48, 96, 110	110, 230
Voltage tolerance (nominal voltage)	%	-5/+10	
Admissible residual ripple	%	< 5	–
Duty cycle / operating mode according to VDE 0580		S1 (continuous operation)	
Switching times according to ISO 6403 [3]	ms	See table page 8	
Maximum switching frequency	1/h	15000	7200
Nominal power at ambient temperature 20 °C	W	17	
Maximum power with 1.1 x nominal voltage and ambient temperature 20 °C	W	20.6	
Protection class according to EN 60529		IP 66 (with correctly installed electrical connection)	

Information on the explosion protection		
Area of application according to directive 2014/34/EU		II 2G
Type of protection valve		c (EN 13463-5)
Maximum surface temperature [4]	°C	135
Temperature class		T4
Type of protection valve solenoid according to EN 60079-7 / EN 60079-18		Ex eb mb IIC T4 Gb
Type examination certificate Solenoid		KEMA 02ATEX2240 X
"IECEx Certificate of Conformity" solenoid		IECEx DEK 12.0068X
Special application conditions for safe application		▶ Maximum ambient temperature: In case of bank assembly, as long as only one solenoid is energized at a time, and in case of individual assembly: +70 °C In case of bank assembly when more than one solenoid is energized simultaneously: +60 °C ▶ The maximum temperature of the surface of the valve jacket is 120 °C. This has to be considered when selecting the connection cable and/or contact of the connection cable with the surface of the jacket is to be prevented.
Ambient temperature range	°C	–20 ... +70 [5]

[3] 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.

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

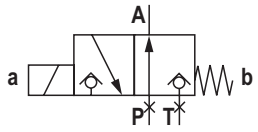
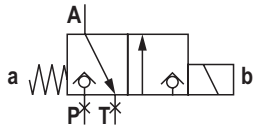
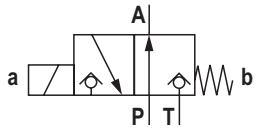
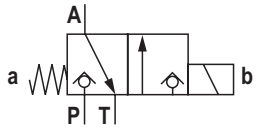
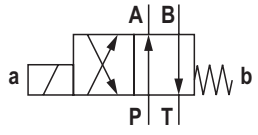
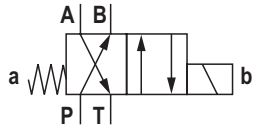
[5] Observe the "Special application conditions for safe application" in the above table.

Switching times (installation position: solenoid horizontal)

Pressure *p* in bar	**Flow q_V** in l/min	**Switching times *t*** in ms													
		Direct voltage						Alternating voltage							
		t_{ON} (without tank pressure)				t_{OFF}		t_{ON} (without tank pressure)				t_{OFF}			
		UK	**CK**	**D**	**Y**	**CK, UK**	**D, Y**	**UK**	**CK**	**D**	**Y**	**UK**	**CK**	**D**	**Y**
70	25	50	45	55	50	10	10	50	65	55	70	50	45	55	50
140	25	65	45	70	50	10	15	55	65	60	70	50	50	55	55
210	25	75	55	80	60	10	15	65	65	70	70	50	55	55	60
280	25	90	55	95	60	15	20	80	65	85	70	50	65	55	70
315	25	95	55	100	60	15	20	95	65	100	70	50	65	55	70
350	25	100	55	105	60	20	25	110	65	115	70	50	65	55	70

☞ **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.

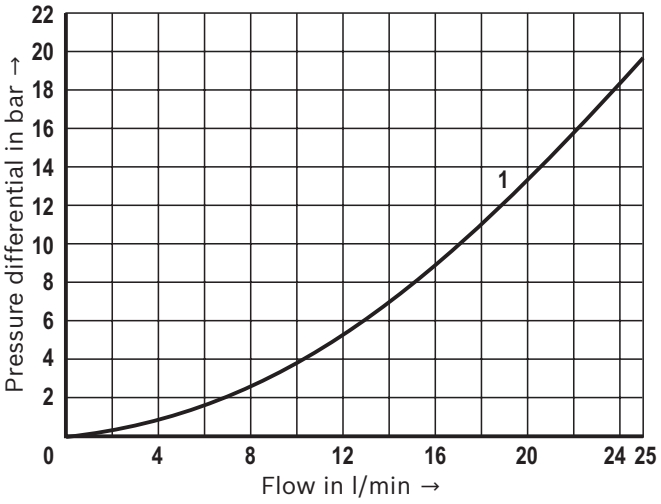
Performance limits
(measured with HLP46, ϑ_{Oil} = 40 ± 5 °C)

	Symbol		**Comment**	**Operating pressure** in bar				**Flow** in l/min
				P	**A**	**B**	**T**	
2-way circuit	**UK**		With 2/2-way circuits, port P **or** T must be closed by the customer!	350	350		350	25
	CK			350	350		350	25
3-way circuit	**UK**			350	350		350	25
	CK			350	350		350	25
4-way circuit (flow only possible in the direction of arrow)	**D**		3/2 directional valve (symbol "UK") in connection with Plus-1 plate: $p_P \geq p_A \geq p_B \geq p_T$	350	350	350	$p_P/p_A/p_B$ –40	25
	Y		3/2 directional valve (symbol "CK") in connection with Plus-1 plate: $p_P \geq p_A \geq p_B \geq p_T$	350	350	350	$p_P/p_A/p_B$ –40	25

☞ **Notices:**
- Please observe the general notes, page 14.
- The performance limits were determined when the solenoids were at operating temperature, at 10 % undervoltage and without tank preloading.

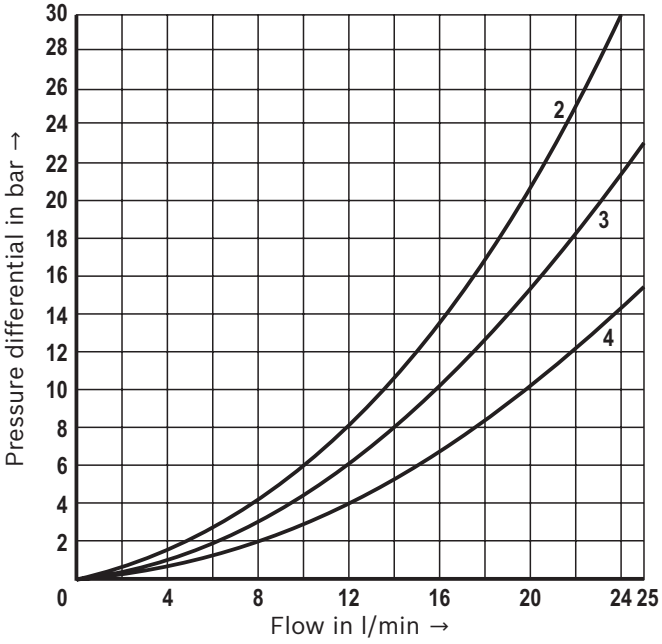
Characteristic curves
(measured with HLP46, ϑ_{Oil} = 40 ± 5 °C)

Δp-q_V characteristic curves
3/2 directional seat valve



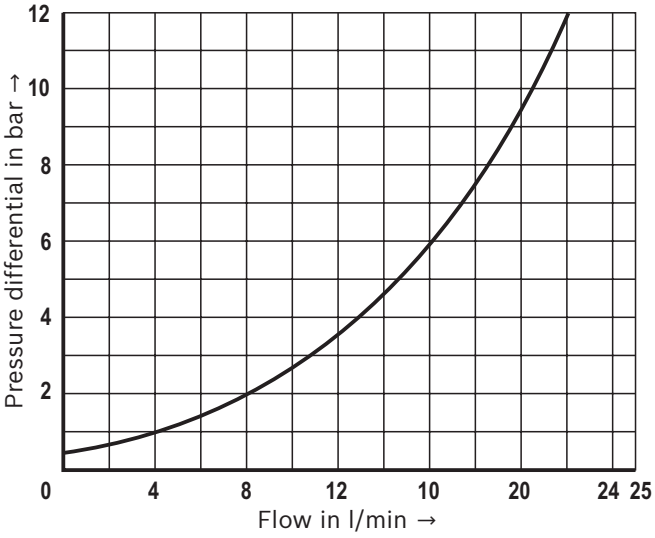
1 P → A, A → T

Δp-q_V characteristic curves
4/2 directional seat valve

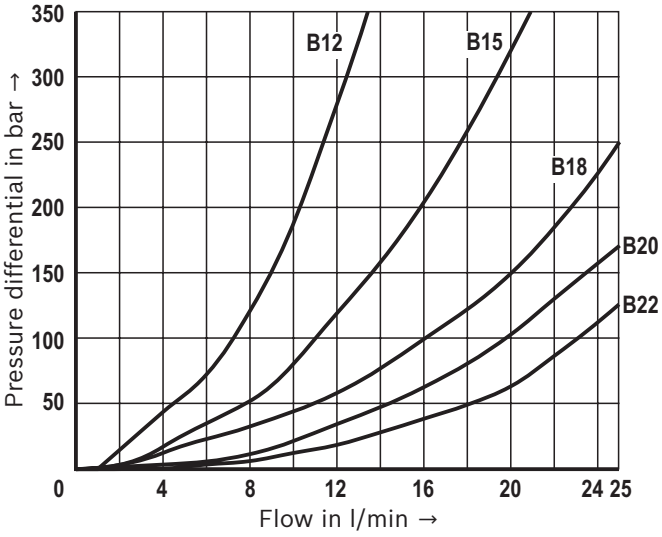


2 A → T
3 P → A
4 B → T, P → B

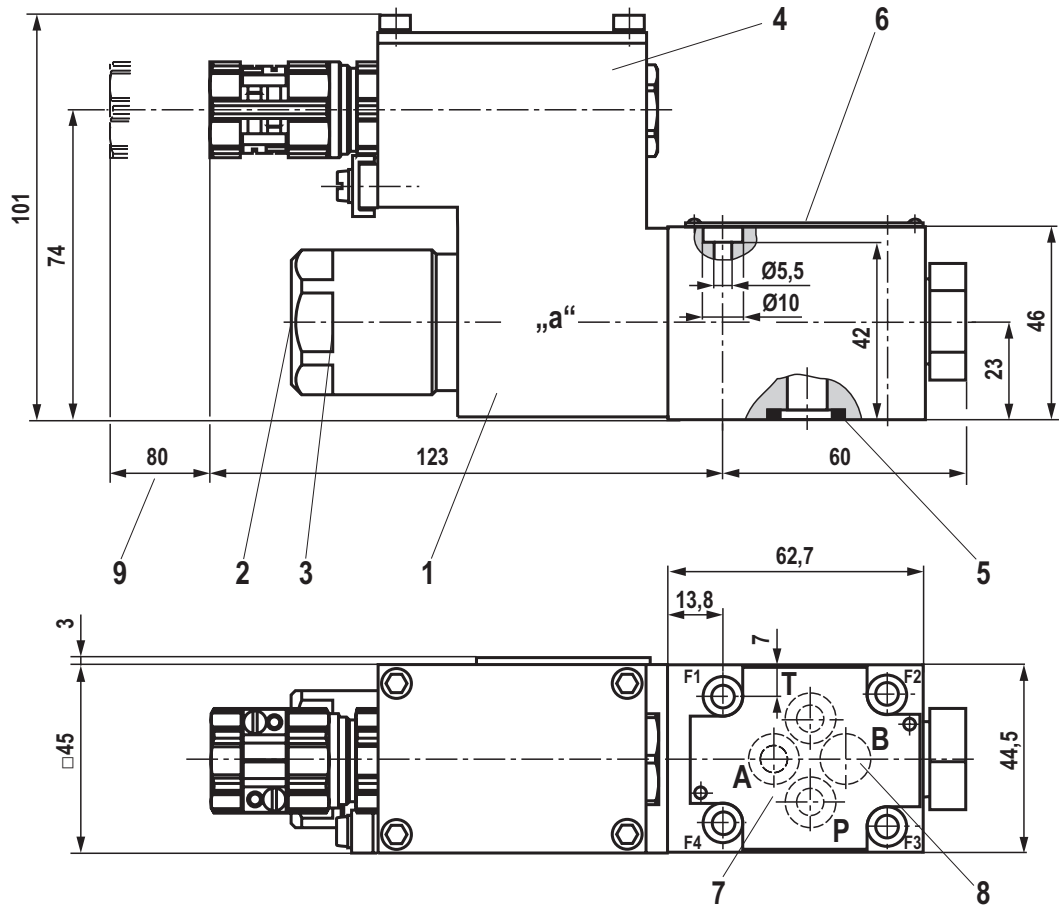
Δp-q_V characteristic curves
Check valve insert

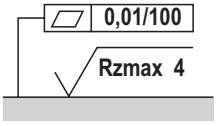


Δp-q_V characteristic curves
Throttle insert



Dimensions: 3/2 directional seat valve – version "UK" (dimensions in mm)





Required surface quality
of the valve contact surface

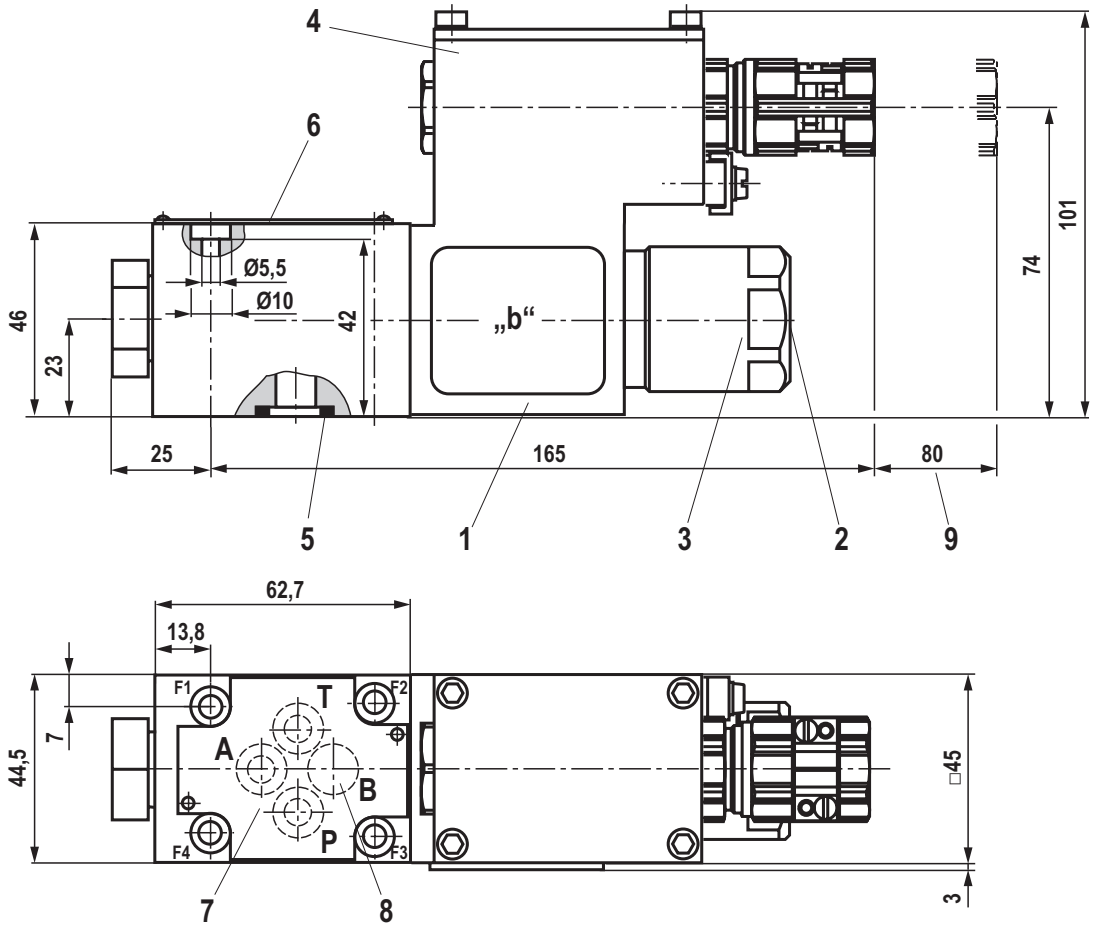
1 Solenoid coil
2 Concealed manual override “N9”
3 Mounting nut with hexagon SW32
4 Terminal box
5 Identical seal rings for ports A, B, T, seal ring for port P
6 Name plate
7 Porting pattern according to ISO 4401-03-02-0-05 (but without locating hole)
8 Port B is designed as blind counterbore
9 Space required to remove the solenoid coil

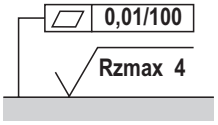
Valve mounting screws (separate order)
For reasons of stability, exclusively use the following valve mounting screws:
4 hexagon socket head cap screws
ISO 4762 - M5 x 50 - 10.9-flZn-240h-L
(friction coefficient μ_{total} = 0.09 ... 0.14);
material no. **R913000064**

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: 3/2 directional seat valve – version "CK"
(dimensions in mm)





Required surface quality
of the valve contact surface

1 Solenoid coil
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5 Identical seal rings for ports A, B, T, seal ring for port P
6 Name plate
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(friction coefficient μ_{total} = 0.09 ... 0.14);
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Subplates (separate order) with porting pattern according to ISO 4401-03-02-0-05, see data sheet 45100.

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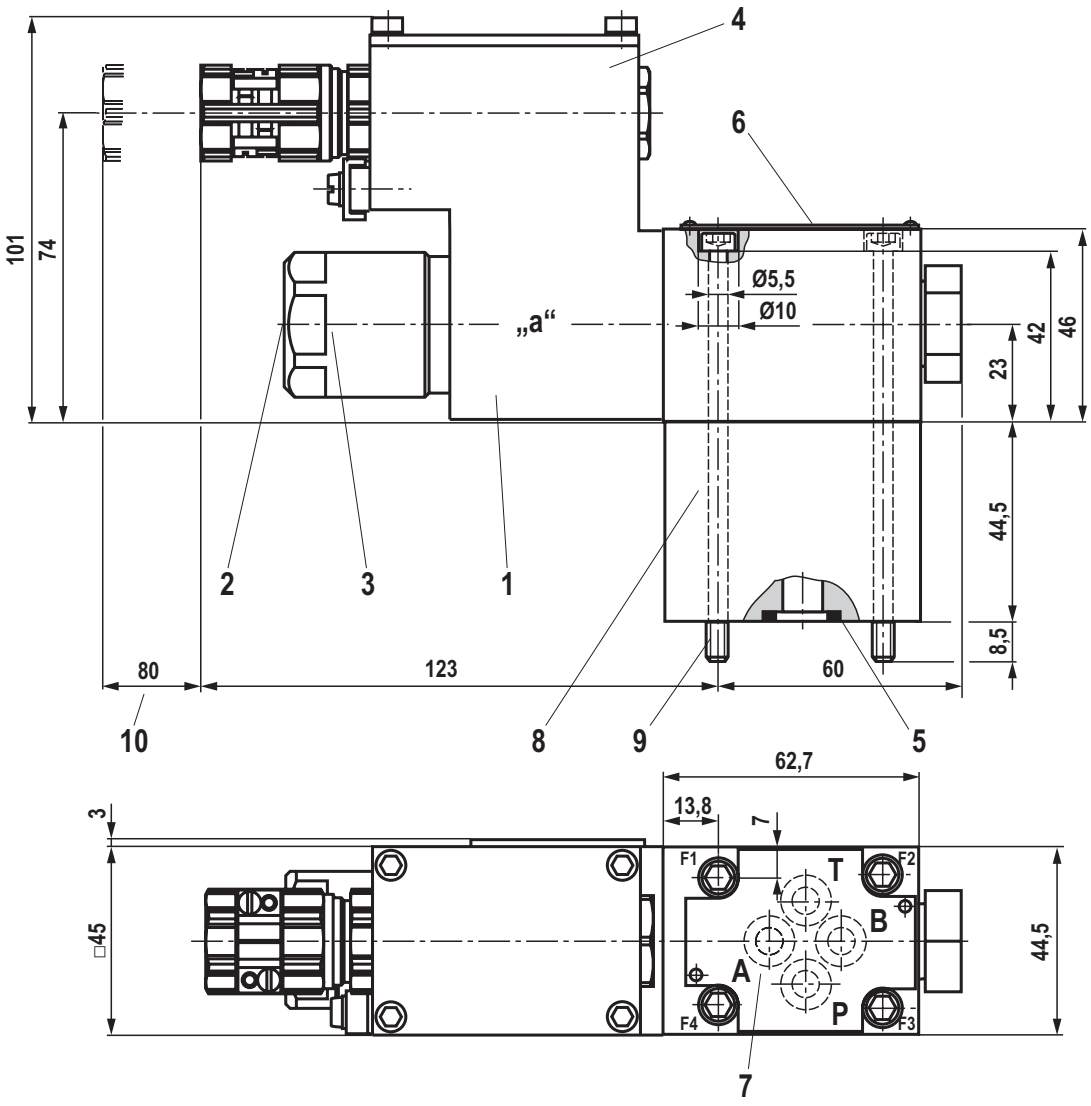
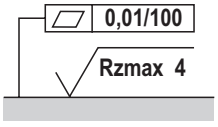
The "G...J3" versions are free from aluminum and/or magnesium and galvanized.

Dimensions: 4/2 directional seat valve – version "D" (dimensions in mm)





Required surface quality of the valve contact surface

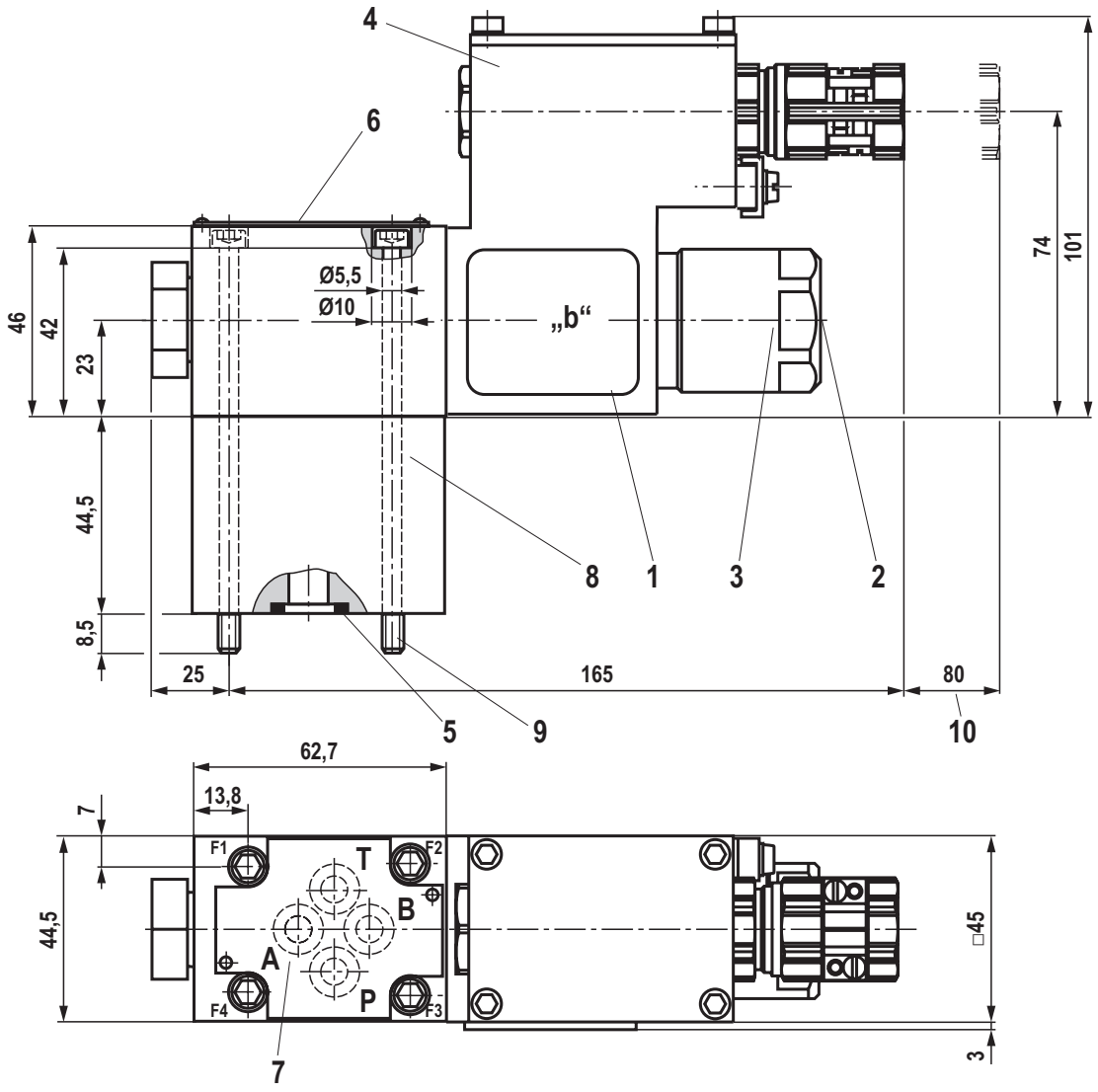
1 Solenoid coil
2 Concealed manual override “N9”
3 Mounting nut with hexagon SW32
4 Terminal box
5 Identical seal rings for ports A, B, T, seal ring for port P
6 Name plate
7 Porting pattern according to ISO 4401-03-02-0-05 (but without locating hole)
8 Plus-1 plate
9 Valve mounting screws
10 Space required to remove the solenoid coil

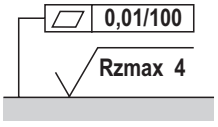
Valve mounting screws (included within the scope of delivery)
For reasons of stability, exclusively use the following valve mounting screws:
4 hexagon socket head cap screws
ISO 4762 - M5 x 95 - 10.9-flZn-240h-L
(friction coefficient μ_{total} = 0.09 ... 0.14)

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: 4/2 directional seat valve – version "Y"
(dimensions in mm)





Required surface quality
of the valve contact surface

1 Solenoid coil
2 Concealed manual override “N9”
3 Mounting nut with hexagon SW32
4 Terminal box
5 Identical seal rings for ports A, B, T, seal ring for port P
6 Name plate
7 Porting pattern according to ISO 4401-03-02-0-05 (but without locating hole)
8 Plus-1 plate
9 Valve mounting screws
10 Space required to remove the solenoid coil

Valve mounting screws (included within the scope of delivery)
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 μ_{total} = 0.09 ... 0.14)

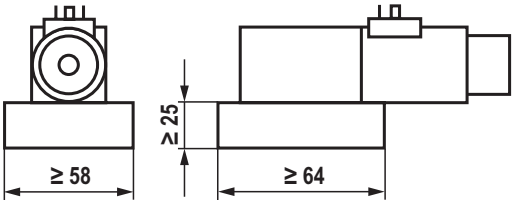
Subplates (separate order) with porting pattern according to ISO 4401-03-02-0-05 see data sheet 45100.

☞ **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.

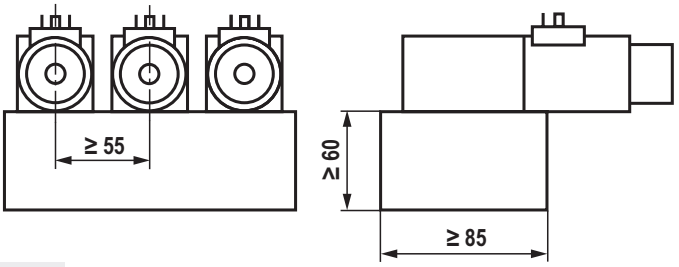
Installation conditions
(dimensions in mm)

	Individual assembly	Bank assembly
Subplate dimensions	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	

Individual assembly



Bank assembly



☞ **Notice:**
Observe the "Special application conditions for safe application" on page 7 with regard to the hydraulic fluid temperature.

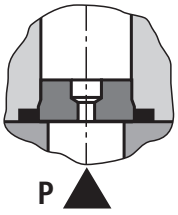
Throttle insert

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

4/2 directional seat valve
The throttle insert is inserted in port P of the Plus-1 plate.

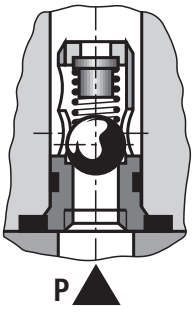


Check valve insert

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

3/2 directional seat valve
The check valve insert is inserted in port P of the seat valve.

4/2 directional seat valve
The check valve insert is inserted in port P of the Plus-1 plate.



General information

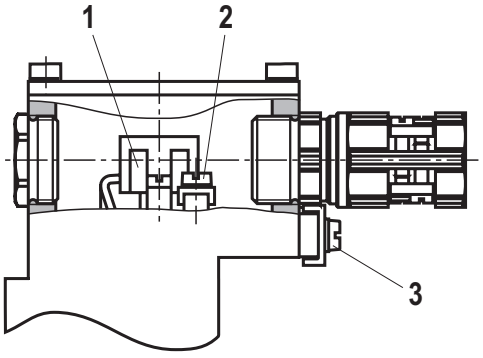
Seat valves can be used according to the spool symbols as well as the assigned operating pressures and flows (see performance limits on page 8).
In order to ensure safe functioning, it is absolutely necessary to observe the following:
- Seat valves have a negative spool overlap, i.e. during the switching process, there is leakage oil. This process takes, however, place within such a short time that it is irrelevant in nearly all applications.
- The specified maximum flow must not be exceeded (use a throttle insert for flow limitation, if necessary).

Plus-1 plate:
- If the Plus-1 plate (4/2 directional function) is used, the following lower operating values have to be observed: $\boldsymbol{p}_{min}$ = 8 bar; $\boldsymbol{q}_V$ > 3 l/min.
- The ports P, A, B and T are clearly specified according to their tasks. They must not be exchanged or closed.
- Port T must always be connected.
- Observe the pressure level and pressure distribution.
- The flow is only permitted in the direction of arrow.

Electrical connection

The type-examination tested valve solenoid of the valve is equipped with one terminal box and a type-tested cable entry.
The connection is polarity-independent.
Solenoids to be connected to AC voltage are equipped with an integrated rectifier.

☞ **Notice:**
When establishing the electrical connection, the protective earthing conductor (PE ⏚) has to be connected properly.

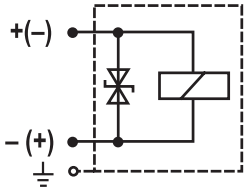
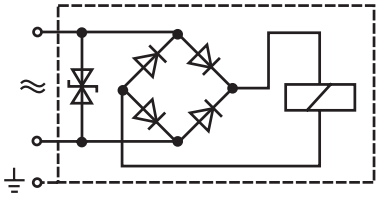


Properties of the connection terminals and mounting elements

Position	Function	Connectable line cross-section
1	Operating voltage connection	Single-wire 0.75 ... 2.5 mm² Finely stranded 0.75 ... 1.5 mm²
2	Connection for protective earthing conductor	Single-wire max. 2.5 mm² Finely stranded max. 2.5 mm²
3	Connection for potential equalization conductor	Single-wire 4 ... 6 mm² Finely stranded min. 4 mm²

Cable gland		
Type approval		II 2G Ex e IIC Gb
Threaded connection		M20 x 1.5
Protection class according to EN 60529		IP66 (with correctly installed electrical connection)
Line diameter	mm	7 ... 10.5
Sealing		Outer sheath sealing

Connection line		
Line type		**Non-armored** cables and lines (outer sheath sealing)
Temperature range	°C	–30 ... > +110

Direct voltage, polarity-independent	Alternating voltage
	

Over-current fuse and switch-off voltage peaks

Voltage data in the valve type code	Nominal voltage valve solenoid	Rated current valve solenoid	Rated current external miniature fuse: medium time-lag (M) according to DIN 41571 and EN/IEC 60127	Rated voltage external miniature fuse: medium time-lag (M) according to DIN 41571 and EN/IEC 60127	Maximum voltage value upon switch-off	Interference protection circuit
G24	24 V DC	0.708 A DC	800 mA	250 V	–90 V	Suppressor diode bi-directional
G48	48 V DC	0.354 A DC	400 mA	250 V	–200 V	
G96	96 V DC	0.177 A DC	200 mA	250 V	–370 V	
G110	110 V DC	0.155 A DC	200 mA	250 V	–390 V	
W110R	110 V AC	0.163 A AC	200 mA	250 V	–3 V	Bridge rectifier and suppressor diode
W230R	230 V AC	0.078 A AC	80 mA	250 V	–3 V	

☞ **Notice:**
A fuse which corresponds to the rated current according to DIN 41571 and EN / IEC 60127 has to be connected upstream of every valve solenoid (max. 3 x I_{rated}).
The shut-off threshold of the fuse has to match the prospective short-circuit current of the supply source.
The prospective short-circuit current of the supply source may amount to a maximum of 1500 A.
This fuse may only be installed outside the potentially explosive atmosphere or must be of an explosion-proof design.
When inductivities are switched off, voltage peaks result which may cause faults in the connected control electronics.
The voltage peak must be damped by a suitable external circuitry.
We recommend a circuitry with a suppressor diode with a limitation voltage of approx. 50 V.

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
▶ Directional seat valves, direct operated, with solenoid actuation	Operating instructions 22049-XE-B
▶ Selection of filters	www.boschrexroth.com/filter
▶ Information on available spare parts	www.boschrexroth.com/spc

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