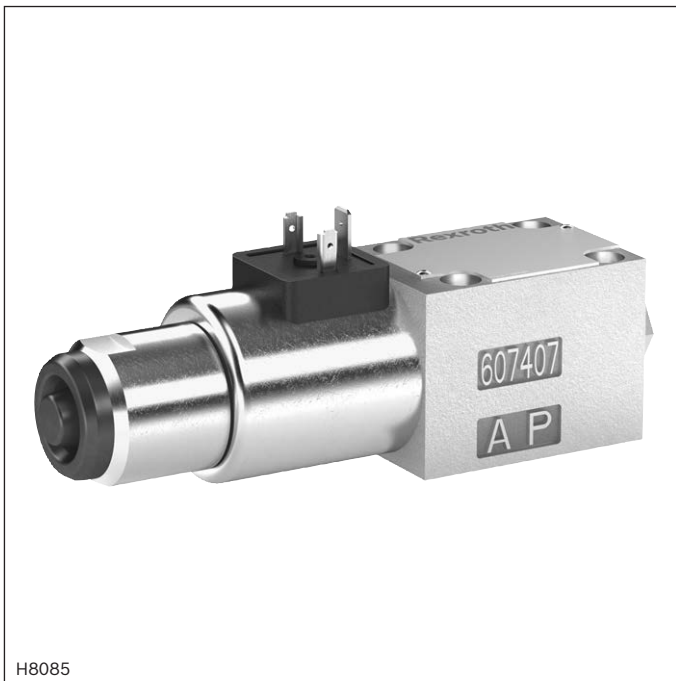


# Directional seat valves, direct operated, with solenoid actuation

## Type SED ...XN

**RE 22049-XN**  
 Edition: 2016-04  
 Replaces: 08.12



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



### ATEX units

#### For potentially explosive areas



#### Information on the explosion protection:

- ▶ Area of application in accordance with the Explosion Protection Directive 2014/34/EU: **II 3G; II 3D**
- ▶ Type of protection of the valve solenoids:
  - Ex nA IIC T3 Gc according to EN 60079-15 and
  - Ex tc IIIC T140 °C Dc according to EN 60079-31

### 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 solenoids
- ▶ Safe switching also with longer standstill periods under pressure
- ▶ Solenoid coil rotatable by 90°
- ▶ Electrical connection with individual connection
- ▶ With manual override, optional

### Contents

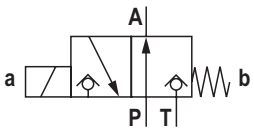
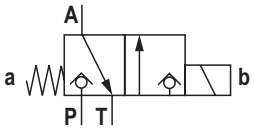
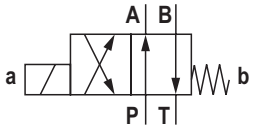
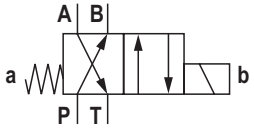
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**Ordering code**

01	02	03	04	05	06	07	08	09	10	11	12	13	14	
<b>M</b>	<b>-</b>	<b>SED</b>	<b>6</b>		<b>1X</b>	<b>/</b>	<b>350</b>	<b>C</b>	<b>G24</b>		<b>XN</b>	<b>K4</b>	<b>/</b>	

01	Mineral oil	<b>M</b>
02	3 main ports	<b>3</b>
	4 main ports	<b>4</b>
03	Seat valve	<b>SED</b>
04	Size 6	<b>6</b>

**Symbols**

05	Main ports	3	4	
		✓	-	<b>UK</b>
		✓	-	<b>CK</b>
		-	✓	<b>D</b>
		-	✓	<b>Y</b>

06	Component series 10 ... 19 (10 ... 19: unchanged installation and connection dimensions)	<b>1X</b>
07	Operating pressure 350 bar	<b>350</b>
08	Wet-pin solenoid with detachable coil	<b>C</b>

**Voltage**

09	Direct voltage 24 V	<b>G24</b>
10	<b>With</b> manual override	<b>N</b>
	<b>Without</b> manual override	<b>no code</b>

**Explosion protection**

11	"Not igniting", For details, see information on the explosion protection page 7	<b>XN</b>
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**Electrical connection**

12	<b>Individual connection</b>	
	Solenoid without mating connector	<b>K4</b>
	For details of electrical connections, see page 15	

**Ordering code**

01	02	03	04	05	06	07	08	09	10	11	12	13	14
<b>M</b>	<b>-</b>	<b>SED</b>	<b>6</b>	<b>1X</b>	<b>/</b>	<b>350</b>	<b>C</b>	<b>G24</b>	<b>XN</b>	<b>K4</b>	<b>/</b>		

13	<b>Without</b> check valve insert, <b>without</b> throttle insert	<b>no code</b>
	Throttle Ø 1.2 mm	<b>B12</b>
	Throttle Ø 1.5 mm	<b>B15</b>
	Throttle Ø 1.8 mm	<b>B18</b>
	Throttle Ø 2.0 mm	<b>B20</b>
	Throttle Ø 2.2 mm	<b>B22</b>

**Seal material**

14	NBR seals	<b>no code</b>
	FKM seals	<b>V</b>
	Observe compatibility of seals with hydraulic fluid used.	

 **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**

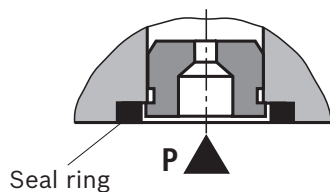
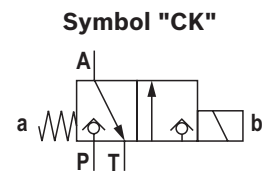
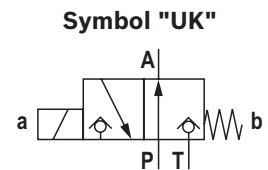
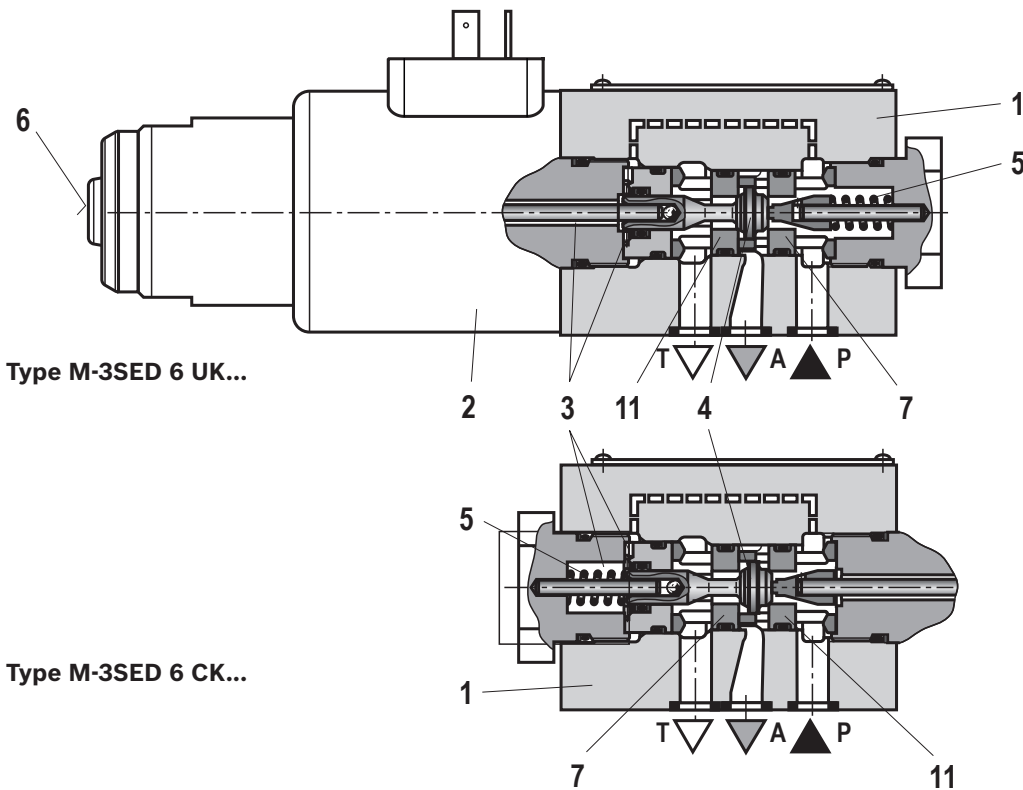
The initial position of the valve (normally open "UK" or normally closed "CK") is determined by the arrangement of the spring (5). The chamber (3) behind the control spool (4) is connected to port P and sealed against port T.

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).



**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.

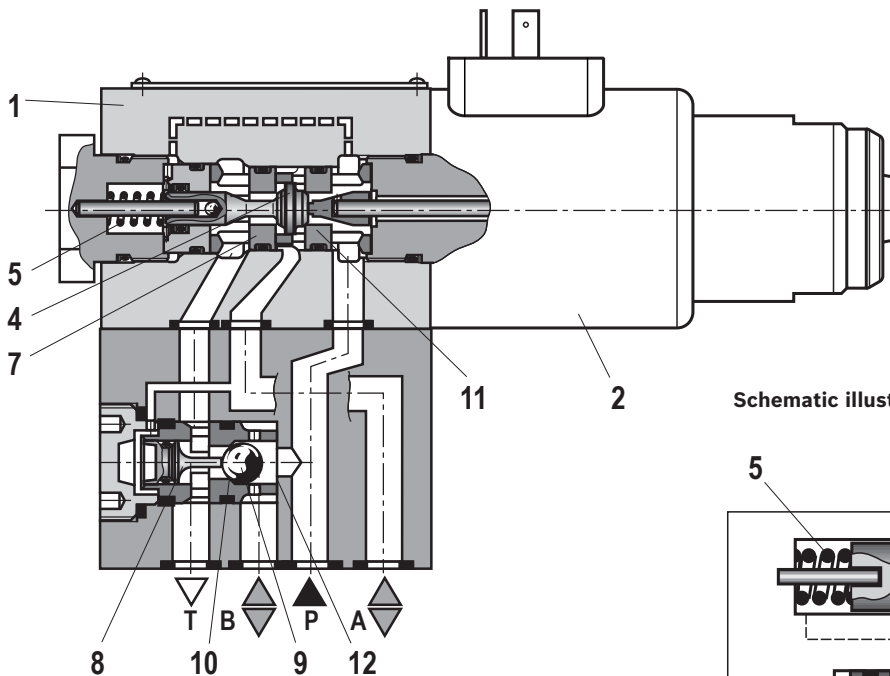
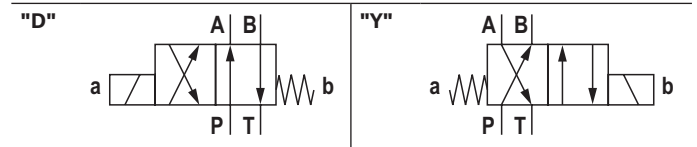
- ▶ **Spool position:**  
P is connected to A. As the pump pressure acts via A on the large area of the control spool (8), the ball (9) is pressed onto the seat (12). Thus, B is connected to T, and P to A. The ball (9) in the Plus-1 plate has a "positive spool overlap".

**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.

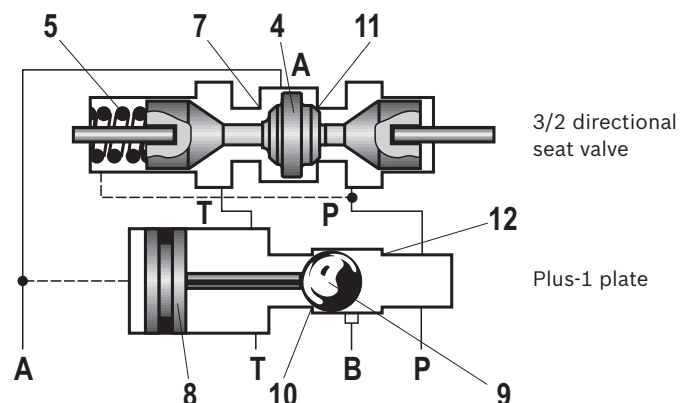
The use of the Plus-1 plate and the seat arrangement offer the following options:

**Symbols**



Type M-4SED 6 Y...

**Schematic illustration (initial position)**



**Technical data**

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

<b>general</b>							
Installation position	Any						
Ambient temperature range	°C -20 ... +50 <sup>1)</sup>						
Storage temperature range	°C +5 ... +40						
Maximum storage time	Years 1						
Weight	<table border="0"> <tr> <td>▶ 3/2 directional seat valve</td> <td>kg</td> <td>2.2</td> </tr> <tr> <td>▶ 4/2 directional seat valve</td> <td>kg</td> <td>3.2</td> </tr> </table>	▶ 3/2 directional seat valve	kg	2.2	▶ 4/2 directional seat valve	kg	3.2
▶ 3/2 directional seat valve	kg	2.2					
▶ 4/2 directional seat valve	kg	3.2					
Surface protection	Galvanized						

<b>hydraulic</b>	
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) <sup>2)</sup> -15 ... +80 (FKM seals) <sup>2)</sup>
Viscosity range	mm <sup>2</sup> /s 2.8 ... 500
Maximum admissible degree of contamination of the hydraulic fluid Cleanliness class according to ISO 4406 (c)	Class 20/18/15 <sup>3)</sup>
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	ISO 15380	90221
		HEES		
	▶ Soluble in water	HEPG	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 > 190 °C

- 1) Maximum 40 °C when using the cable sets DS2513 (see page 16)
- 2) Observe the "Special application conditions for safe application" on page 7.
- 3) 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](http://www.boschrexroth.com/filter).

**Technical data**

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

<b>electric</b>	
Voltage type	Direct voltage
Available voltages	V 24
Voltage tolerance (nominal voltage)	% $\pm 10$
Admissible residual ripple	% < 5
Duty cycle / operating mode according to VDE 0580	S1 (continuous operation)
Rated current	mA 950
Switching times according to ISO 6403 <sup>4)</sup>	ms See table on page 8
Maximum switching frequency	Hz 1
Switch-off voltage peak Solenoid	V 500, suitable damping by user required
Nominal power at ambient temperature 20 °C	W 23
Maximum power with 1.1 x nominal voltage and ambient temperature 20 °C	W 28.8
Protection class according to EN 60529	IP 65 <sup>5)</sup>

<b>Information on the explosion protection</b>		
Area of application according to directive 2014/34/EU	II 3G	II 3D
Type of protection valve	c (EN 13463-5)	
Maximum surface temperature <sup>6)</sup>	°C 140	
Temperature class	T3	
Type of protection valve solenoid according to EN 60079-15 / EN 60079-31	Ex nA IIC T3 Gc	Ex tc IIIC T140 °C Dc
Type examination certificate Solenoid	BVS 12 ATEX E 062 X	
Special application conditions for safe application	<ul style="list-style-type: none"> <li>▶ Connection lines must be passed in a pull-relieved way.</li> <li>▶ The valve is to be installed so that no impact stresses &gt; 4 J can take effect.</li> <li>▶ In order to avoid dangers caused by static charge, the base and/or subplate on which the valve is to be fitted must be electrically conductive and included in the equipotential bonding.</li> <li>▶ The valve solenoid must not be installed close to charge generating processes.</li> <li>▶ Dust layers with a thickness &gt; 50 mm are not admissible.</li> <li>▶ Maximum hydraulic fluid temperature: In case of bank assembly, as long as only one solenoid is energized at a time, and in case of individual assembly: +80 °C In case of bank assembly when more than one solenoid is energized simultaneously: +65 °C</li> <li>▶ The maximum temperature of the surface of the valve jacket is 110 °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.</li> </ul>	
Ambient temperature range	°C -20 ... +50 <sup>1)</sup>	
<b>Requirements for the mating connector</b>		
Temperature at the connector of the valve solenoid	°C $\geq 100$ <sup>7)</sup>	
Area of application according to directive 2014/34/EU	II 3G; II 3D	
Protection class in plugged condition	IP 65 <sup>5)</sup>	

4) 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.


5) If a suitable mating connector - with sealing device, if required - and a correctly mounted electric connection are used.

6) Surface temperature > 50 °C, provide contact protection.

7) Transfer temperature at the connector of the valve solenoid 85 °C at ambient temperature 40 °C.

## Switching times (installation position: solenoid horizontal)

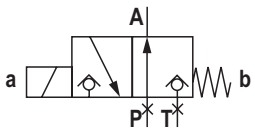
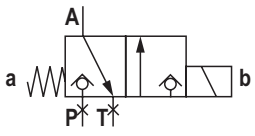
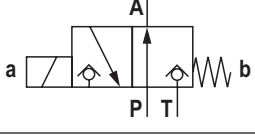
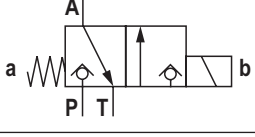
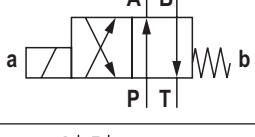
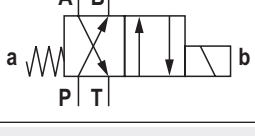
Pressure $p$ in bar	Flow $q_V$ in l/min	Switching times $t$ in ms					
		$t_{ON}$ (without tank pressure)				$t_{AUS}$	
		UK	CK	D	Y	CK, UK	D, Y
70	25	40	45	45	50	10	10
140	25	45	45	50	50	10	15
210	25	50	45	55	50	15	20
280	25	55	50	60	55	20	20
315	25	60	50	65	55	20	20
350	25	70	50	75	55	20	25


 **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,  $\vartheta_{oil} = 40 \pm 5 \text{ °C}$ )

	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 information, page 15.

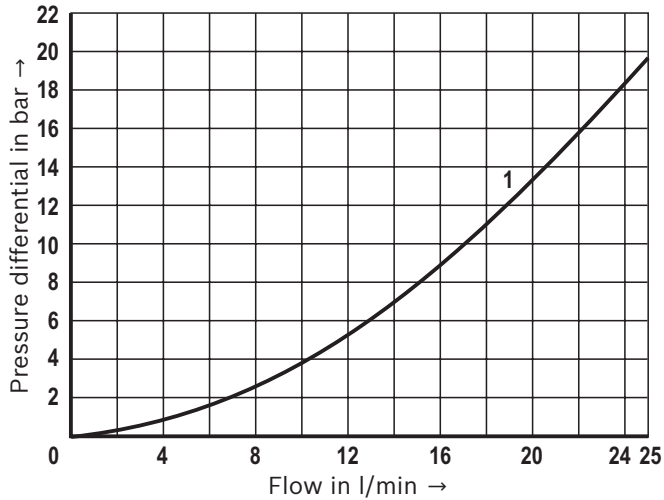
► The performance limits were determined when the solenoids were at operating temperature, at 10 % undervoltage and without tank preloading.



### Characteristic curves

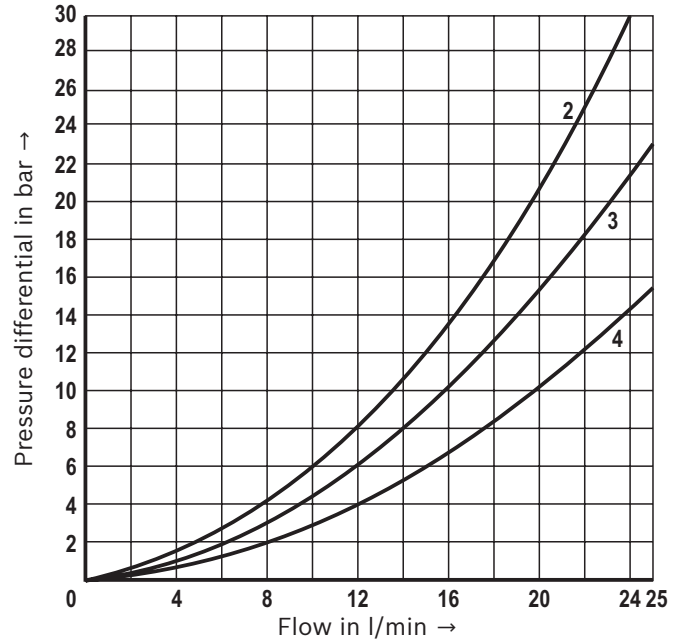
(measured with HLP46,  $\vartheta_{oil} = 40 \pm 5 \text{ }^\circ\text{C}$ )

$\Delta p$ - $q_v$  characteristic curves  
3/2 directional seat valve



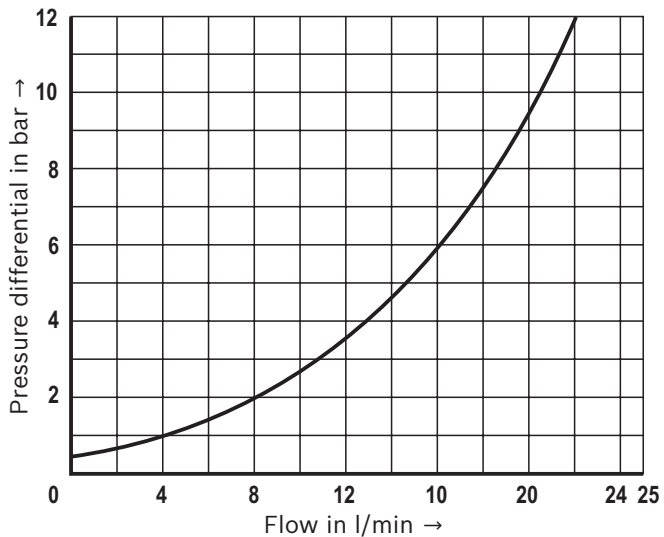
1 P → A, A → T

$\Delta p$ - $q_v$  characteristic curves  
4/2 directional seat valve

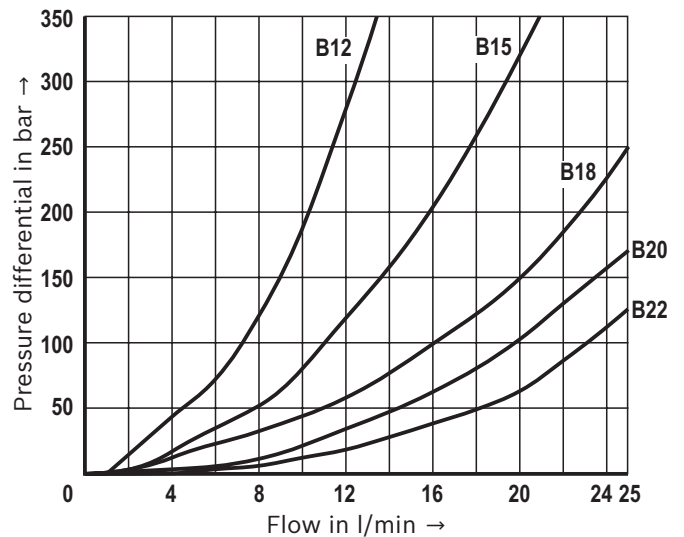


2 A → T  
3 P → A  
4 B → T, P → B

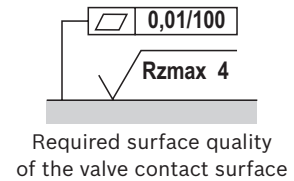
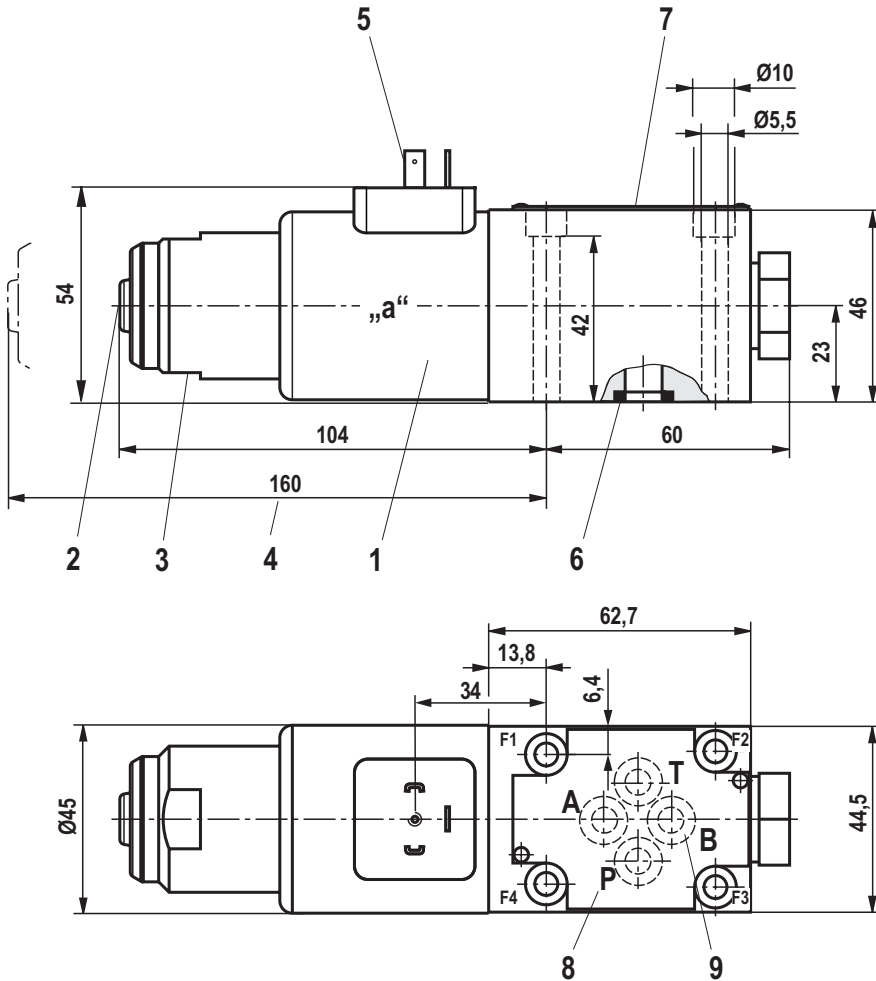
$\Delta p$ - $q_v$  characteristic curves  
Check valve insert



$\Delta p$ - $q_v$  characteristic curves  
Throttle insert



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



- 1 Solenoid coil
- 2 Manual override "N"
- 3 Mounting nut with double edge, wrench size 32
- 4 Space required to remove the solenoid coil
- 5 Plug-in connector according to EN 175301-803, design A
- 6 Identical seal rings for ports A, B, T, seal ring for port P
- 7 Name plate
- 8 Porting pattern according to ISO 4401-03-02-0-05 (but without locating hole)
- 9 Port B is designed as blind counterbore

**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-fIZn-240h-L**

(friction coefficient  $\mu_{\text{total}} = 0.09$  to  $0.14$ );

material no. **R913000064**

**Subplates** (separate order) with porting pattern according to

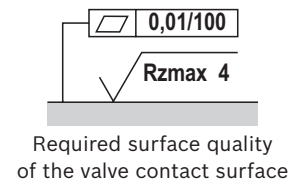
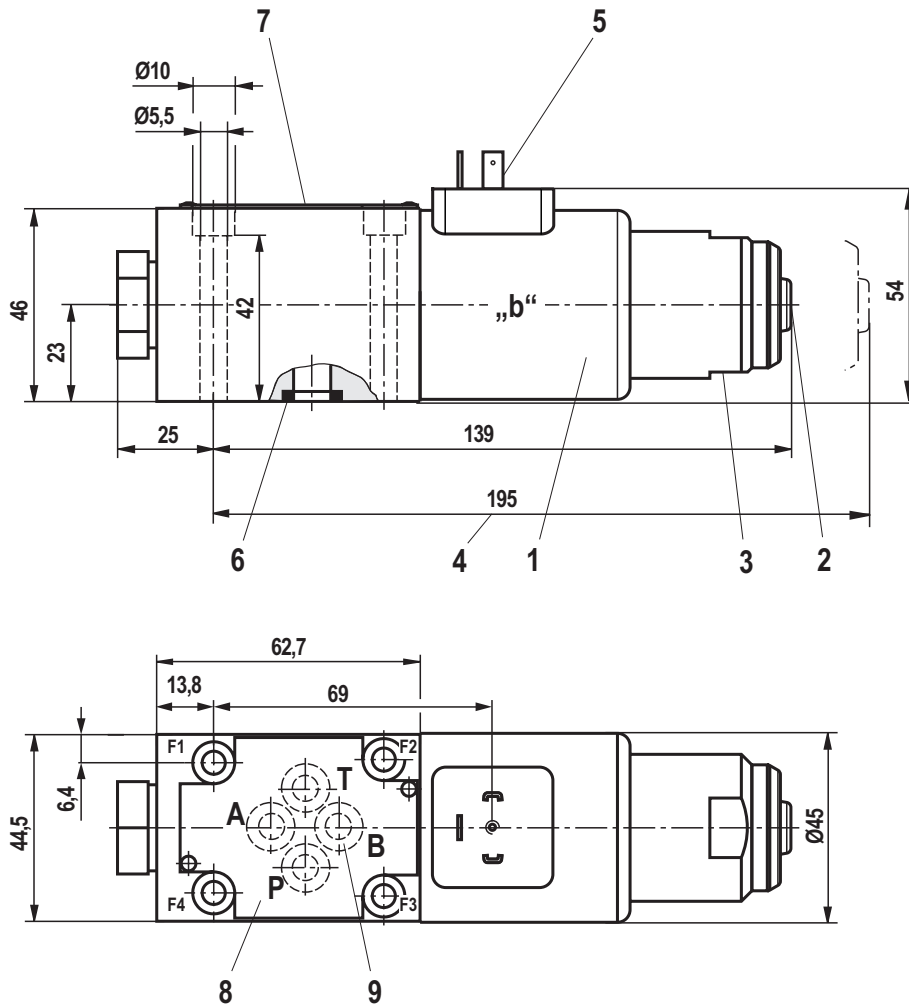
ISO 4401-03-02-0-05, see data sheet 45100.

**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)



- 1 Solenoid coil
- 2 Manual override "N"
- 3 Mounting nut with double edge, wrench size 32
- 4 Space required to remove the solenoid coil
- 5 Plug-in connector according to EN 175301-803, design A
- 6 Identical seal rings for ports A, B, T, seal ring for port P
- 7 Name plate
- 8 Porting pattern according to ISO 4401-03-02-0-05 (but without locating hole)
- 9 Port B is designed as blind counterbore

**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-f1Zn-240h-L**

(friction coefficient  $\mu_{\text{total}} = 0.09$  to  $0.14$ );

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.

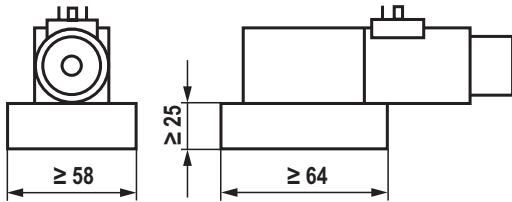




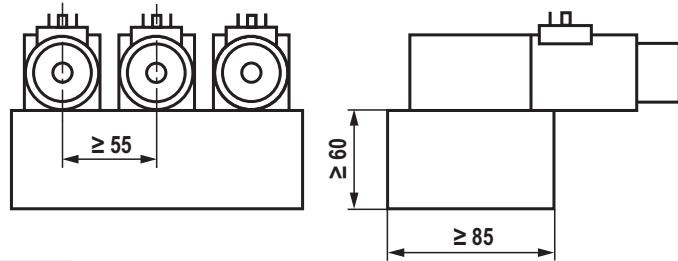
## Installation conditions (dimensions in mm)

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

Individual assembly



Bank assembly



**Notice:**

With regard to the hydraulic fluid temperature, observe the "Special application conditions for safe application" on page 7.

## 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:

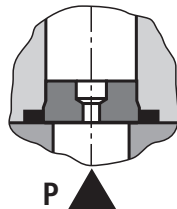
- ▶ Accumulator operation,
- ▶ use as pilot control valve with internal pilot fluid tapping.

### 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

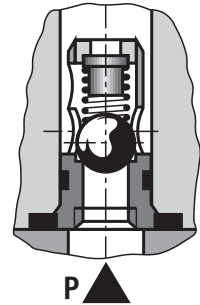
The check valve insert allows a free flow from P to A and closes A to P.

### 3/2 directional seat valve

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

### 4/2 directional seat valve

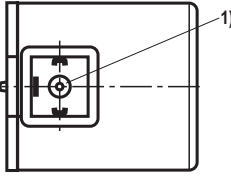
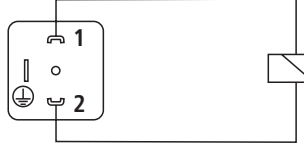
The check valve insert is inserted in port P of the Plus-1 plate.



## 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.

### Electrical connections and coil connection combinations

Connector ordering code	Top view	Circuit diagram	Pin	Connections, assignment
Connector, 3-pole (2+PE) according to DIN EN 175301-803 (IP65)			1 2 ⊕	Solenoid coil, polarity-independent Earthing

1) M3, maximum tightening torque  $M_{A \max} = 1 \text{ Nm}$

## Over-current fuse and switch-off voltage peaks

Voltage data in the valve type code	Nominal voltage Valve solenoid	Rated current Valve solenoid	Recommended pre-fuse characteristics medium time-lag according to DIN EN 60127-1
G24	24 V DC	0.95 A DC	1 A

### 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.  $3 \times I_{\text{rated}}$ ).  
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.

## 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:  $p_{\min} = 8 \text{ bar}$ ;  $q_V > 3 \text{ l/min}$ .
- ▶ 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.

**Accessories** (separate order)**Mating connector**

<b>Cable set DS2513</b>	<b>Length</b> in m	<b>Material number</b>
Plug-in connection with securely potted-in cable according to DIN EN 175301-803, see data sheet 08006	3.0	<b>R901200418</b>
	5.0	<b>R901200460</b>
	12.0	<b>R901200582</b>

**Further information**

- ▶ Subplates Data sheet 45100
- ▶ Use of non-electrical hydraulic components in an potentially 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-XN-B
- ▶ Selection of filters [www.boschrexroth.com/filter](http://www.boschrexroth.com/filter)
- ▶ Information on available spare parts [www.boschrexroth.com/spc](http://www.boschrexroth.com/spc)

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

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