

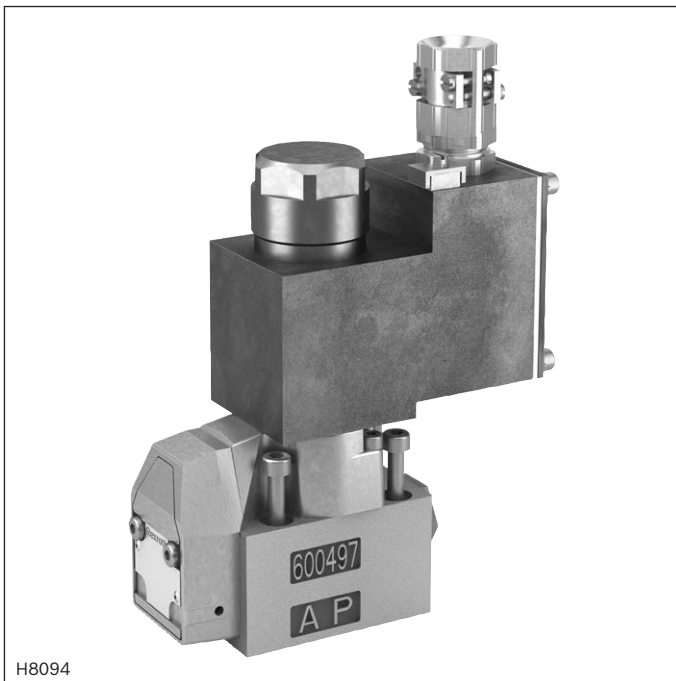
# Directional seat valves, direct operated, with solenoid actuation

## Type SEW ... XE

**RE 22058-XE**

Edition: 2016-04

Replaces: 09.13



- ▶ Size 6
- ▶ Component series 3X
- ▶ Maximum operating pressure 420 bar
- ▶ Maximum flow 25 l/min



### 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

- ▶ 2/2-, 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)
- ▶ Safe switching also with longer standstill periods under pressure
- ▶ Air-gap DC and AC solenoids
- ▶ Solenoid coil is rotatable by 90°
- ▶ Electrical connection with individual connection and cable gland
- ▶ With concealed manual override, optional

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### Ordering code

01	02	03	04	05	06	07	08	09	10	11	12	13	14
<b>M</b>	-	<b>SEW</b>	<b>6</b>		<b>3X</b>	<b>/</b>	<b>420</b>	<b>M</b>		<b>XE</b>	<b>Z2</b>	<b>/</b>	

01	Mineral oil	<b>M</b>
02	2 main ports	<b>2</b>
	3 main ports	<b>3</b>
	4 main ports	<b>4</b>
03	Seat valve	<b>SEW</b>
04	Size 6	<b>6</b>

### Symbols

05	Main ports	2	3	4	
		✓	-	-	<b>P</b>
		✓	-	-	<b>N</b>
		-	✓	-	<b>U</b>
		-	✓	-	<b>C</b>
		-	-	✓	<b>D</b>
		-	-	✓	<b>Y</b>

06	Component series 30 ... 39 (30 ... 39: unchanged installation and connection dimensions)	<b>3X</b>
07	Operating pressure 420 bar	<b>420</b>
08	Solenoid (air-gap)	<b>M</b>
09	Direct voltage 24 V	<b>G24</b>
	AC voltage 230 V, 50/60 Hz	<b>W230R</b>
	For further ordering codes for other voltages and frequencies, see page 7	
10	<b>With</b> concealed manual override	<b>N9</b>
	<b>Without</b> manual override	<b>no code</b>

## Ordering code

01	02	03	04	05	06	07	08	09	10	11	12	13	14			
M	-		SEW	6		3X	/	420	M			XE	Z2	/		

### 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		

13	<b>Without</b> check valve insert, <b>without</b> throttle insert	<b>no code</b>
	<b>With</b> check valve insert	<b>P</b>
	Throttle Ø 0.8 mm	<b>B08</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. (Other seals upon request)	



#### Notice:

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

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

**General**

Directional valves of the type SEW are direct operated directional seat valves with solenoid actuation. It controls the start, stop and direction of flow.

The directional valves basically comprise a housing (1), the solenoid (2), the hardened valve system (3) and the control spool (8).

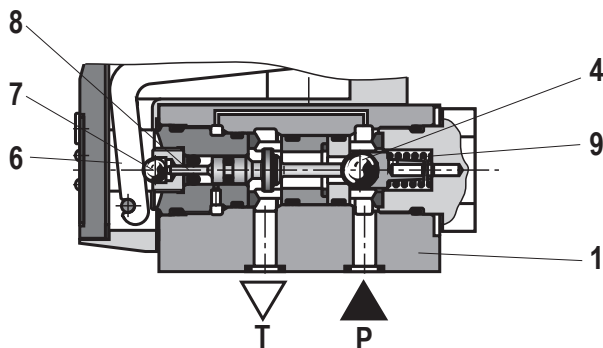
**Basic principle**

In the initial position, the control spool (8) is pressed onto the seat by the spring (9) and in spool position by the solenoid (2). The force of the solenoid (2) acts via the angled lever (6) and the ball (7) on the control spool (8) 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).

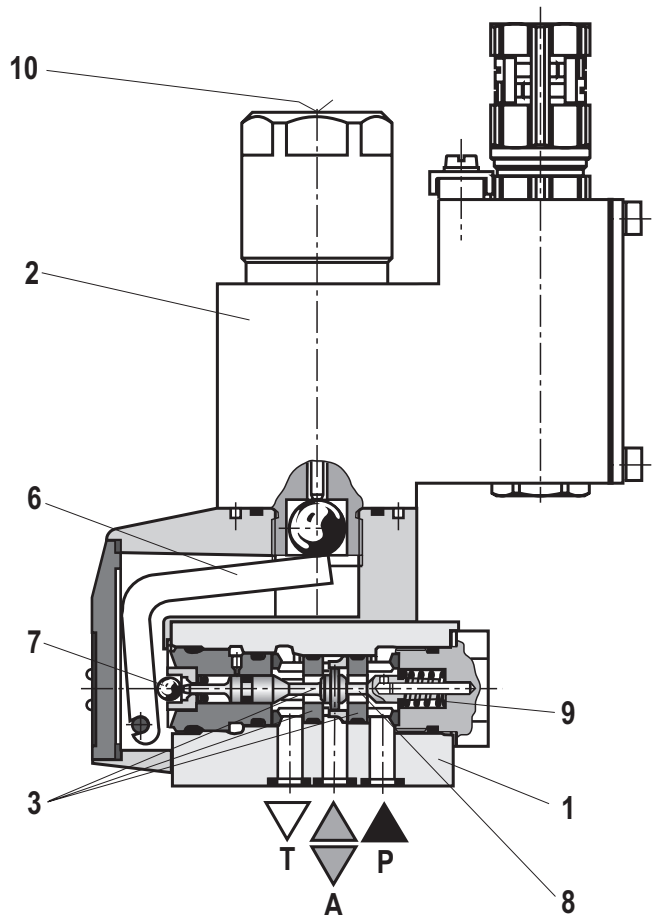
- Notices:**
- ▶ The 3/2 directional seat valves have a "negative spool overlap". Therefore, port T must always be connected. That means that during the switching process – from the starting of the opening of one valve seat to the closing of the other valve seat – ports P–A–T are connected with each 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.
  - ▶ Make sure that the specified maximum flow is not exceeded. A throttle insert must be used for flow limitation, if necessary (see page 14).

The seat arrangement offers the following options:

	2/2 directional seat valve	3/2 directional seat valve
<b>Symbol</b>		
<b>Initial position</b>	P and T connected	P and A connected, T blocked
<b>Spool position</b>	P blocked	P blocked, A and T connected
<b>Symbol</b>		
<b>Initial position</b>	P blocked	P blocked, A and T connected
<b>Spool position</b>	P and T connected	P and A connected, T blocked



Type M-2SEW 6 N...XE...



Type M-3SEW 6 U...N9XE...

**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**

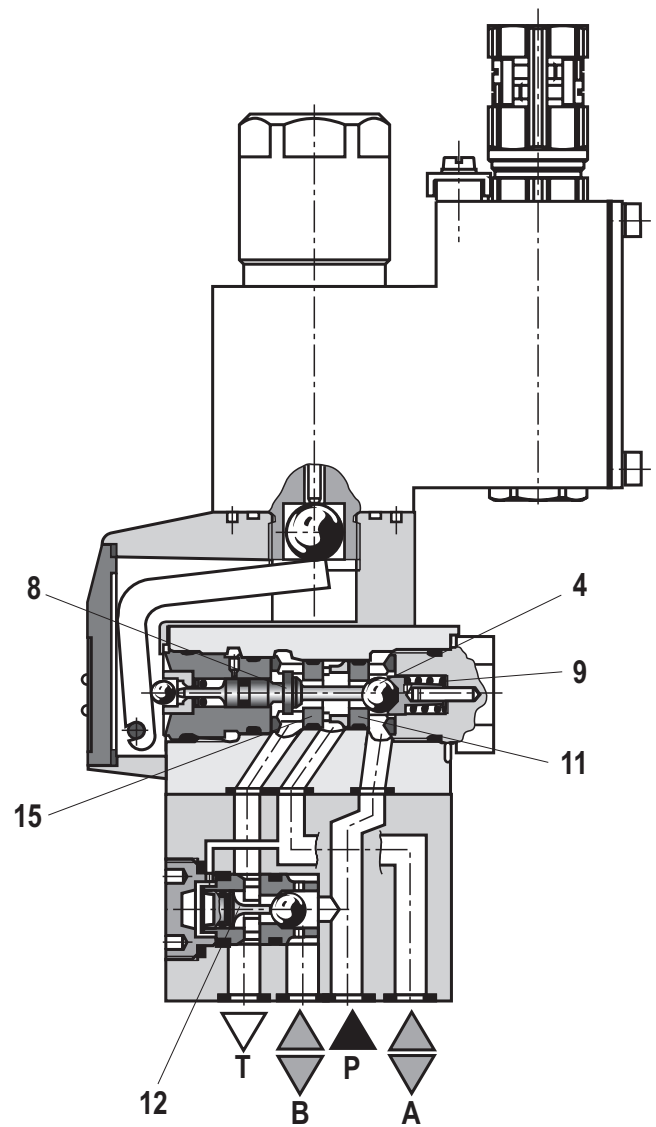
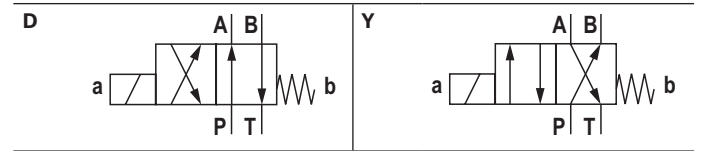
- ▶ **Initial position**  
The main valve is not actuated. The spring (9) holds the ball (4) on the seat (11). Port P is blocked and A is connected to T. Apart from that, one control line is connected from A to the large area of the control spool (12), which is thus unloaded to the tank. The pressure 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 (9) and 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".

**Notices:**

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!

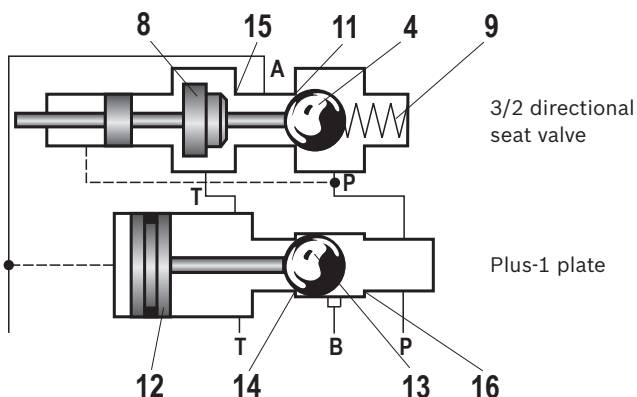
The use of the Plus-1 plate and the seat arrangement offer the following options:

**Symbols**



**Type M-4SEW 6 Y...N9XE...**

**Schematic illustration: Initial position**



**Technical data**

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

general		
Installation position	Any	
Ambient temperature range	°C –20 ... +70 <sup>1)</sup>	
Storage temperature range	°C +5 ... +40	
Maximum storage time	Years 1	
Weight	▶ 2/2 and 3/2 directional seat valve	kg 3.2
	▶ 4/2 directional seat valve	kg 4.1
Surface protection	Galvanized	

hydraulic	
Maximum operating pressure	bar See table page 9
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 <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>2)</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		
Flame-resistant	▶ Containing water	HFC (Fuchs Hydrotherm 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922	90223

**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

**▶ Flame-resistant – containing water:**

- Maximum operating pressure 210 bar
- Pressure differential <15 bar
- Pressure pre-loading at the tank port >20% of the pressure differential, otherwise increased cavitation erosion
- Life cycle as compared to operation with mineral oil HL, HLP 50 ... 100%
- Maximum hydraulic fluid temperature 60°C

<sup>1)</sup> Observe the "Special application conditions for safe application" on page 7.

<sup>2)</sup> 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                      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 <sup>3)</sup>	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)

<b>Information on the explosion protection</b>	
Area of application according to directive 2014/34/EU	II 2G
Type of protection valve	c (EN 13463-5)
Maximum surface temperature <sup>4)</sup>	°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 a safe application	<ul style="list-style-type: none"> <li>▶ 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</li> <li>▶ 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.</li> </ul>
Ambient temperature range	°C -20 ... +70 <sup>5)</sup>


<sup>3)</sup> 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.

<sup>4)</sup> Surface temperature > 50°C, provide contact protection.

<sup>5)</sup> Observe the "Special application conditions for safe application" in the above table.

**Switching times** (installation position: solenoid horizontal)

Pres- sure $p$ 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)				$t_{OFF}$			
		U	C	D	Y	U, C	D, Y	U	C	D	Y	U	C	D	Y
<b>70</b>	25	30	40	30	40	15	15	25	40	25	40	45	65	45	65
<b>140</b>	25	30	50	30	50	15	15	25	40	25	40	65	65	65	65
<b>280</b>	25	35	60	35	60	15	15	25	45	25	45	75	65	75	65
<b>320</b>	25	40	70	40	70	15	15	25	45	25	45	80	65	80	65
<b>420</b>	25	45	70	45	70	15	15	30	45	30	45	100	65	100	65

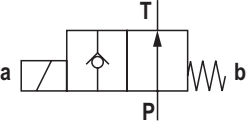
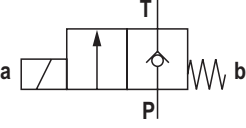
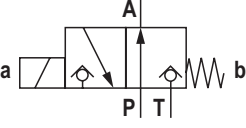
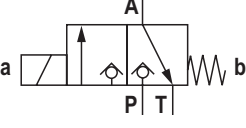
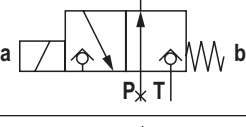
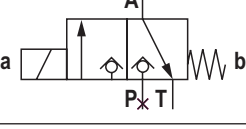
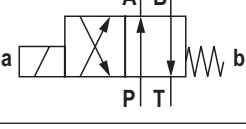
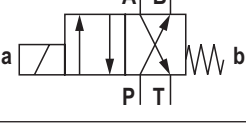
 **Notice:**

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

	Symbol	Comment	Operating pressure in bar				Flow in l/min
			P	A	B	T	
2-way circuit	<b>P</b> 	Pressure at $P \geq T$	420			100	25
	<b>N</b> 		420			100	25
3-way circuit	<b>U</b> 	Pressure at $P \geq A \geq T$	420	420		100	25
	<b>C</b> 		420	420		100	25
2-way circuit (only for unloading)	<b>U</b> 	Before switching from the initial position to the spool position, pressure must be applied to port A. Pressure at $A \geq T$		420		100	25
	<b>C</b> 	Pressure at $A \geq T$		420		100	25
4-way circuit (flow only possible in the direction of arrow)	<b>D</b> 	Valve (symbol "U") in connection with Plus-1 plate $P > A \geq B > T$	420	420	420	100	25
	<b>Y</b> 	Valve (symbol "C") in connection with Plus-1 plate $P > A \geq B > T$	420	420	420	100	25

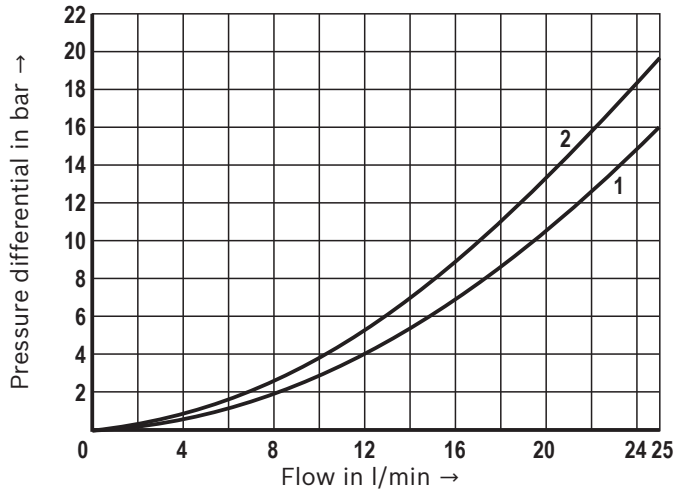
**Notices:**

- ▶ Please observe the general notes, page 11.
- ▶ The performance limits were determined when the solenoids were at operating temperature, at 10% undervoltage and without tank preloading.

### Characteristic curves

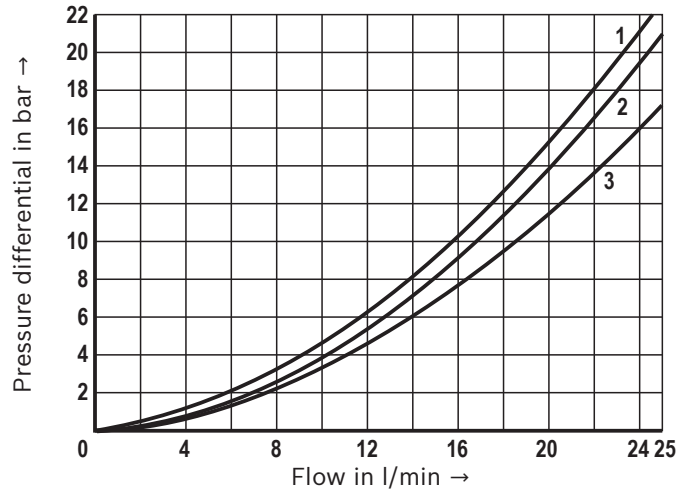
(measured with HLP46,  $\vartheta_{oil} = 40 \pm 5^\circ\text{C}$ )

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



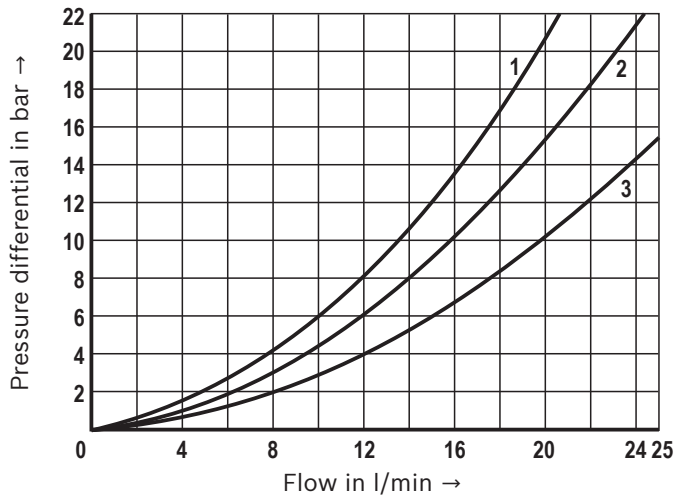
- 1 Symbol **N**, P → T
- 2 Symbol **P**, P → T

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



- 1 Symbol **U** and **C**, A → T
- 2 Symbol **U**, P → A
- 3 Symbol **C**, P → A

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

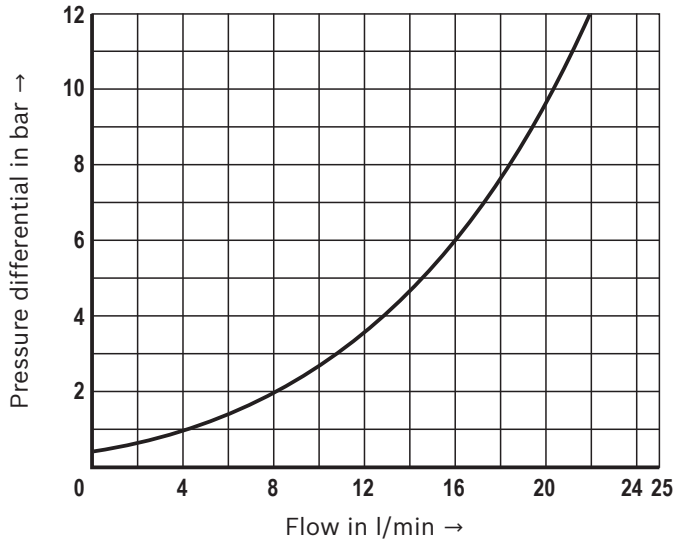


- 1 Symbol **D** and **Y**, A → T
- 2 Symbol **D** and **Y**, P → A
- 3 Symbol **D** and **Y**, P → B, B → T

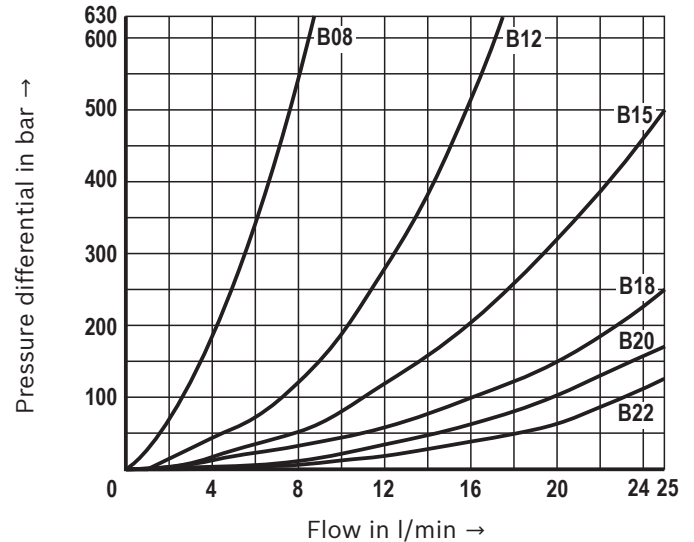
## Characteristic curves

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

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



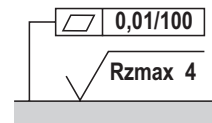
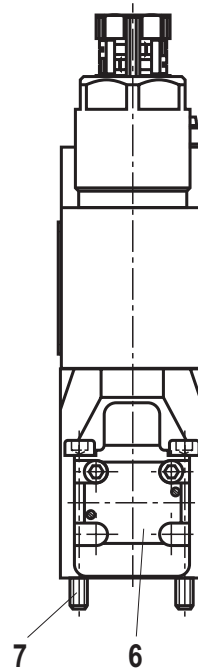
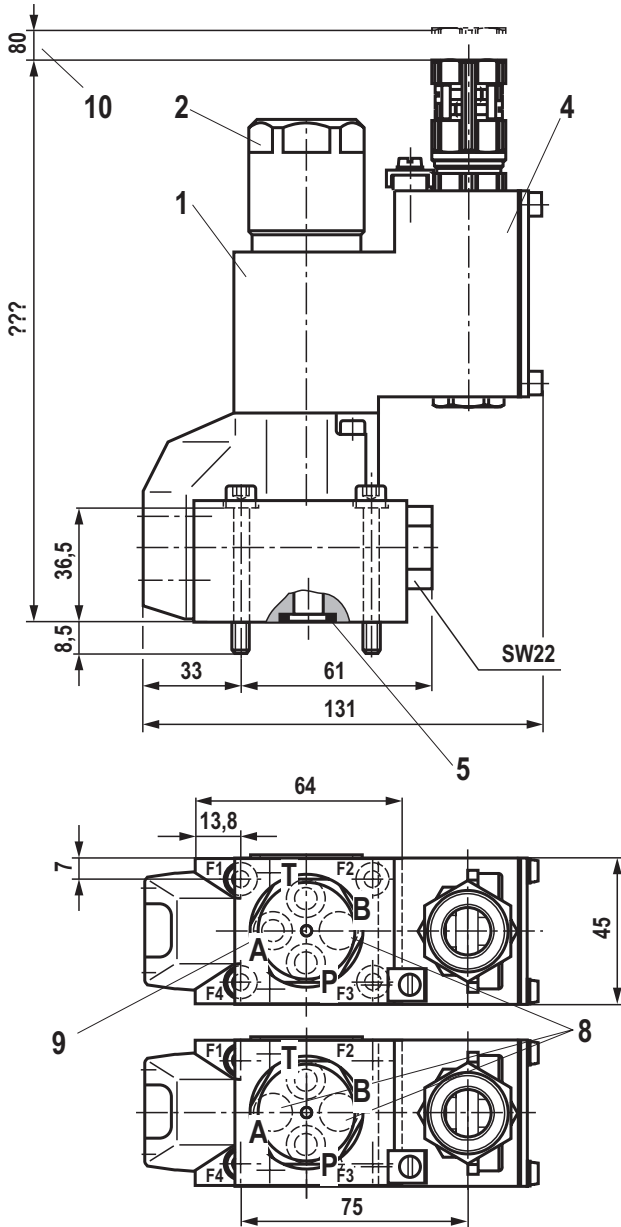
$\Delta p$ - $q_V$  characteristic curves  
Throttle insert



## General information

- ▶ In order to switch the valve safely or maintain it in its spool position, the pressure situation must be as follows:  $P \geq A \geq T$  (for design reasons).
- ▶ The ports P, A and T (3/2 directional seat valve) as well as 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 permitted in the direction of arrow.
- ▶ 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 specified maximum flow must not be exceeded (use a throttle insert for flow limitation, if necessary).

**Dimensions:** 2/2 and 3/2 directional seat valve (dimensions in mm)



Required surface quality of the valve contact surface

- 1 Solenoid coil
- 2 Concealed manual override "N9"
- 3 Mounting nut with hexagon wrench size 32
- 4 Terminal box
- 5 Identical seal rings for ports A, B, and T, seal ring for port P
- 6 Name plate
- 7 **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-M5x45-10.9-flZn-240h-L**  
(friction coefficient  $\mu_{total} = 0.09 \dots 0.14$ )

**8 Notice**

With 3/2 directional seat valves, port B is designed as blind counterbore. With 2/2 directional seat valves, ports A and B are designed as blind counterbores.

**9**

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

**10**

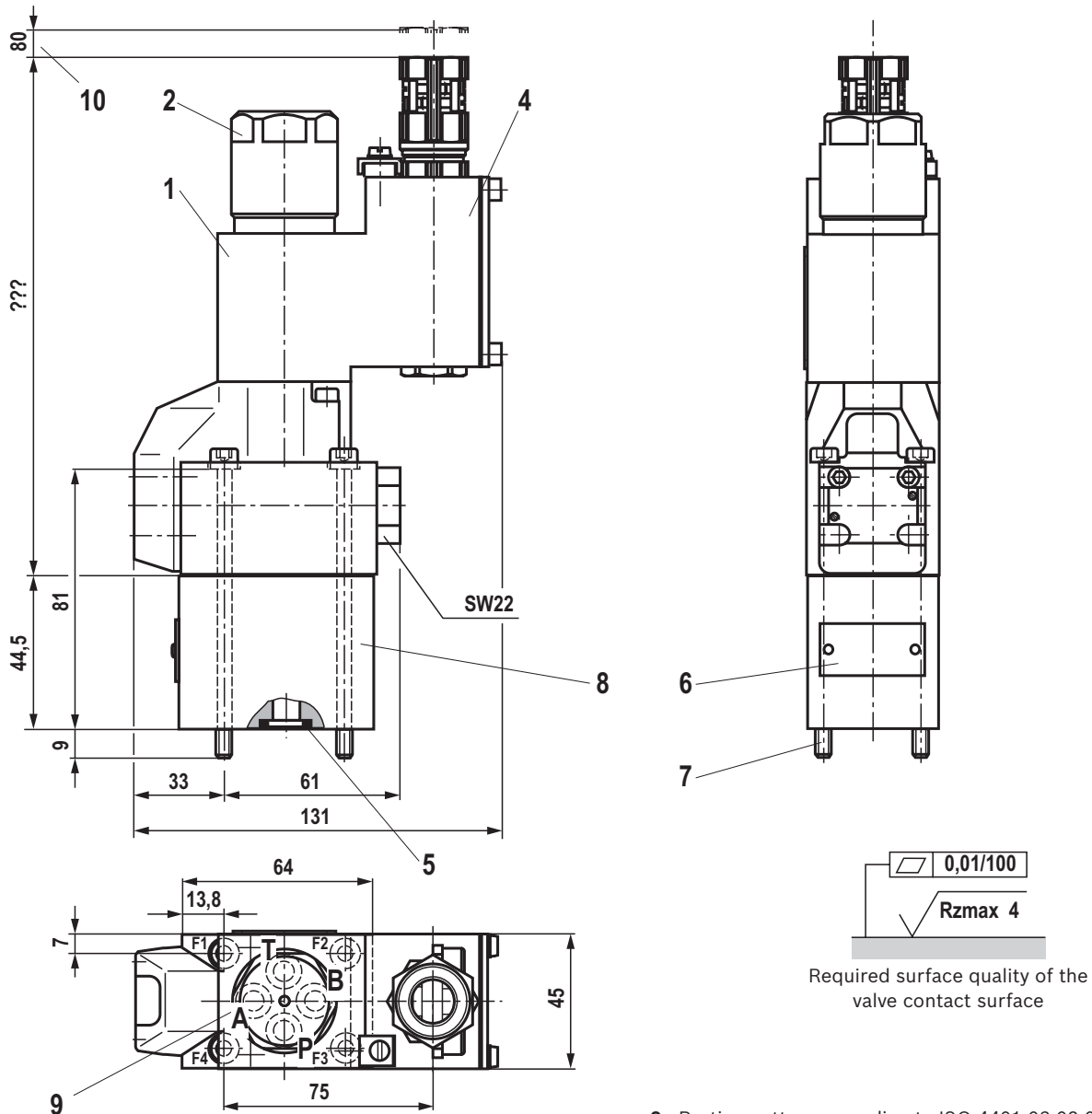
Space required to remove the solenoid coil

**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  
(dimensions in mm)



- 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, and T, seal ring for port P
- 6 Name plate
- 7 **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-M5x45-10.9-fZn-240h-L**  
(friction coefficient  $\mu_{\text{total}} = 0.09 \dots 0.14$ )
- 8 Plus-1 plate

- 9 Porting pattern according to ISO 4401-03-02-0-05 (but without locating hole)
- 10 Space required to remove the solenoid coil

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



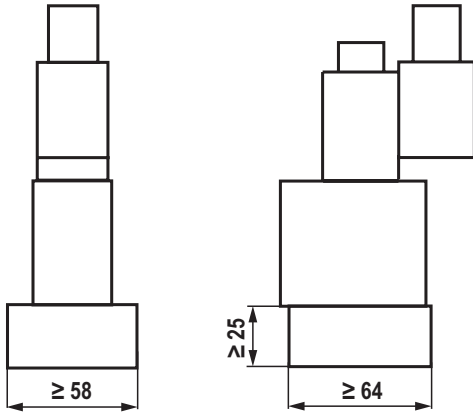
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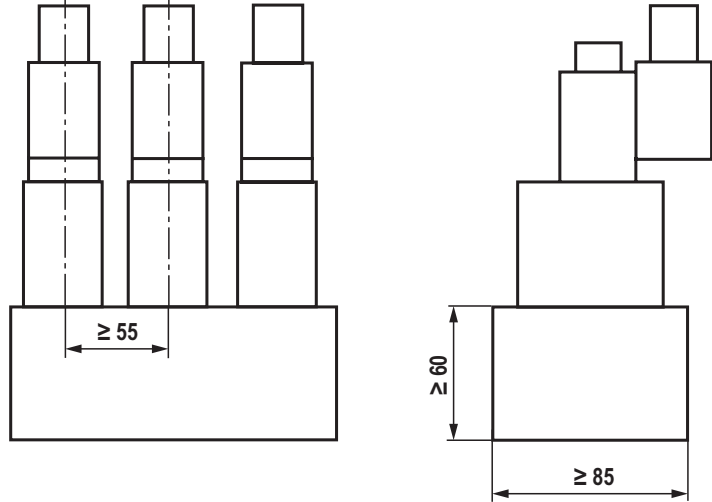
## Installation conditions (dimensions in mm)

	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:**

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:

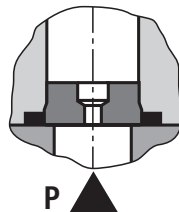
- ▶ Accumulator operation,
- ▶ use as pilot control valve with internal pilot fluid tapping.

**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

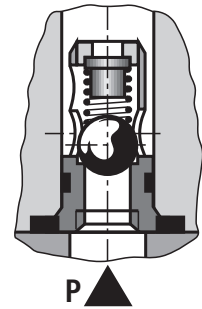
The check valve insert allows a free flow from P to A and closes A to P.

**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.



## Electrical connection

The type-examination tested valve solenoid of the valve is equipped with one terminal box and a type-tested cable entry.

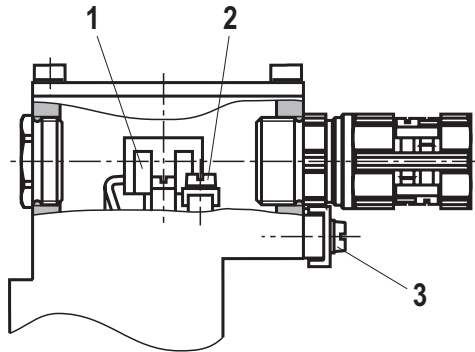
The connection is polarity-independent.

Solenoids to be connected to AC voltage are equipped with an integrated rectifier.



### Notice:

When establishing the electrical connection, the protective earthing conductor (PE  $\perp$ ) has to be connected properly.

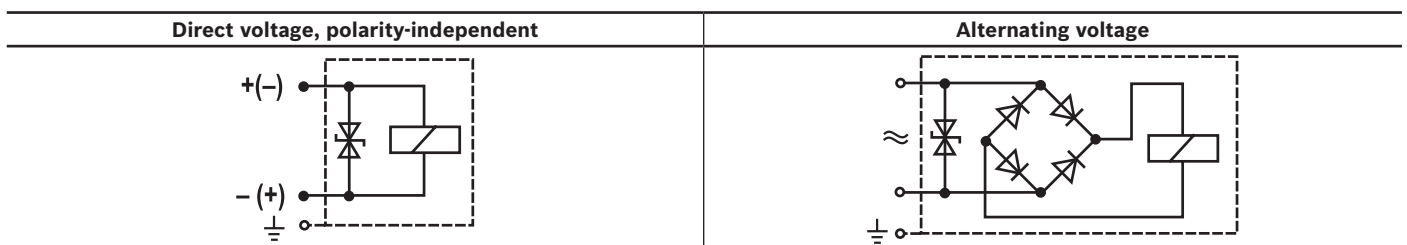


### Properties of the connection terminals and mounting elements

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

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	<b>Non-armored</b> cables and lines (outer sheath sealing)
Temperature range	°C -30 ... > +110



## 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 for external miniature fuse: medium time-lag (M) according to DIN 41571 and EN/IEC 60127	Rated voltage for 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.  $3 \times I_{rated}$ ). 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
- ▶ Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC) Data sheet 90223
- ▶ Directional seat valves, direct operated, with solenoid actuation Operating instructions 22058-XE-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](mailto:documentation@boschrexroth.de)  
[www.boschrexroth.de](http://www.boschrexroth.de)

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