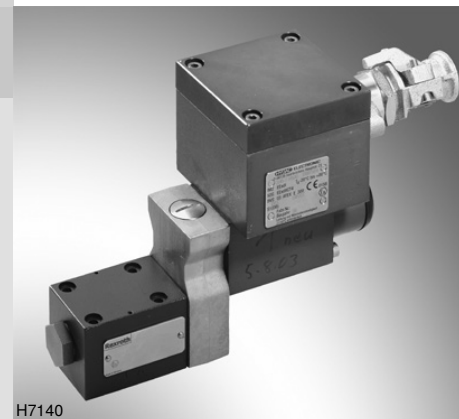


# 3/2 and 4/2 directional seat valves with solenoid actuation

**RE 22047-XD-B2/08.12**  
Replaces: 01.10

**Type M-SE 6 ...XD...**

Size 6  
Component series 6X  
Maximum operating pressure 420 bar  
Maximum flow 12 l/min



H7140

**ATEX units**  
**For explosive areas**

**Part II Data sheet**



**Information on the explosion protection:**

- Area of application in accordance with the Explosion Protection Directive 94/9/EC: **I M2; II 2G**
- Type of protection of the valve solenoid:  
Ex d I Mb / Ex d IIC T4 Gb  
according to EN 60079-0:2009 / EN 60079-1:2007

## What you need to know about these operating instructions

These operating instructions apply to the explosion-proof version of Rexroth valves and consist of the following three parts:

- Part I General information 07010-X-B1
- Part II Data sheet 22047-XD-B2
- Part III Product-specific instructions 22047-XD-B3

**Operating instructions 22047-XD-B0**

You can find further information on the correct handling of Rexroth hydraulic products in our publication "General product information on hydraulic products" 07008.

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## Features

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- Direct operated directional seat valve with solenoid actuation for proper use in explosive atmospheres
- Porting pattern according to DIN 24340-A6
- Subplates available in FE/ZN version (see pages 12/13)
- Blocked connection tight in a leak-free form
- Safe switching also with longer standstill periods under pressure
- Air-gap DC solenoids
- Electrical connection with individual connection and cable gland
- With manual override

## Ordering code and scope of delivery

| M   | SE | 6 | 6X/420 | L | G24 | N | XD | Z2/                                | V   |
|---|----|---|--------|---|-----|---|----|------------------------------------|---|
| Mineral oil = M   |    |   |        |   |     |   |    |                                    | V = FKM seals<br>(other seals upon request)<br><b>Important:</b><br>Observe compatibility of seals with hydraulic fluid used!         |
| 3 main ports = 3  |    |   |        |   |     |   |    |                                    | <b>no code =</b> Without check valve insert without throttle insert   |
| 4 main ports = 4  |    |   |        |   |     |   |    | <b>P =</b> With check valve insert |   |
| Seat valve  |    |   |        |   |     |   |    |                                    | <b>B12 =</b> Throttle Ø 1.2 mm  |
| Size 6 = 6  |    |   |        |   |     |   |    |                                    | <b>B15 =</b> Throttle Ø 1.5 mm  |
|   |    |   |        |   |     |   |    |                                    | <b>B18 =</b> Throttle Ø 1.8 mm  |
|   |    |   |        |   |     |   |    |                                    | <b>B20 =</b> Throttle Ø 2.0 mm  |
|   |    |   |        |   |     |   |    |                                    | <b>B22 =</b> Throttle Ø 2.2 mm  |
|   |    |   |        |   |     |   |    |                                    | <b>Electrical connection</b>  |
|   |    |   |        |   |     |   |    |                                    | <b>Z2 =</b> Solenoid with terminal box and cable gland,<br>For details see chapter Electrical connection                              |
|   |    |   |        |   |     |   |    |                                    | <b>XD =</b> Explosion protection<br>"Pressure-resistant enclosure"<br>For details see information on the explosion protection, page 8 |
|   |    |   |        |   |     |   |    |                                    | <b>N =</b> With manual override (standard)  |
|   |    |   |        |   |     |   |    |                                    | <b>G24 =</b> Direct voltage 24 V  |
| Main ports  |    | 3 | 4      |   |     |   |    |                                    |   |
| <b>Control spool symbols</b>  |    |   |        |   |     |   |    |                                    |   |
|   |    | • | —      |   |     |   |    |                                    | = U   |
|   |    | • | —      |   |     |   |    |                                    | = C   |
|   |    | — | •      |   |     |   |    |                                    | = D   |
|   |    | — | •      |   |     |   |    |                                    | = Y   |
|   |    |   |        |   |     |   |    |                                    | • = Available   |
| Component series 60 to 69<br>(60 to 69: Unchanged installation and connection dimensions) |    |   |        |   |     |   |    |                                    | = 6X  |
| Operating pressure up to 420 bar  |    |   |        |   |     |   |    |                                    | = 420   |
| High-power solenoid,<br>(air-gap)   |    |   |        |   |     |   |    |                                    | = L   |

### Included in the scope of delivery:

- Valve mounting screws
- Valve operating instructions with declaration of conformity in part III

## Function, section, control spool symbols: 3/2 directional seat valve

### General:

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

### Basic principle:

In the initial position, the ball (4.1) is pressed onto the seat by the spring (7), in spool position, the ball (4.2) is pressed onto the seat by the solenoid (2). The force of solenoid (2) acts via the lever (17) and 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.

### Important

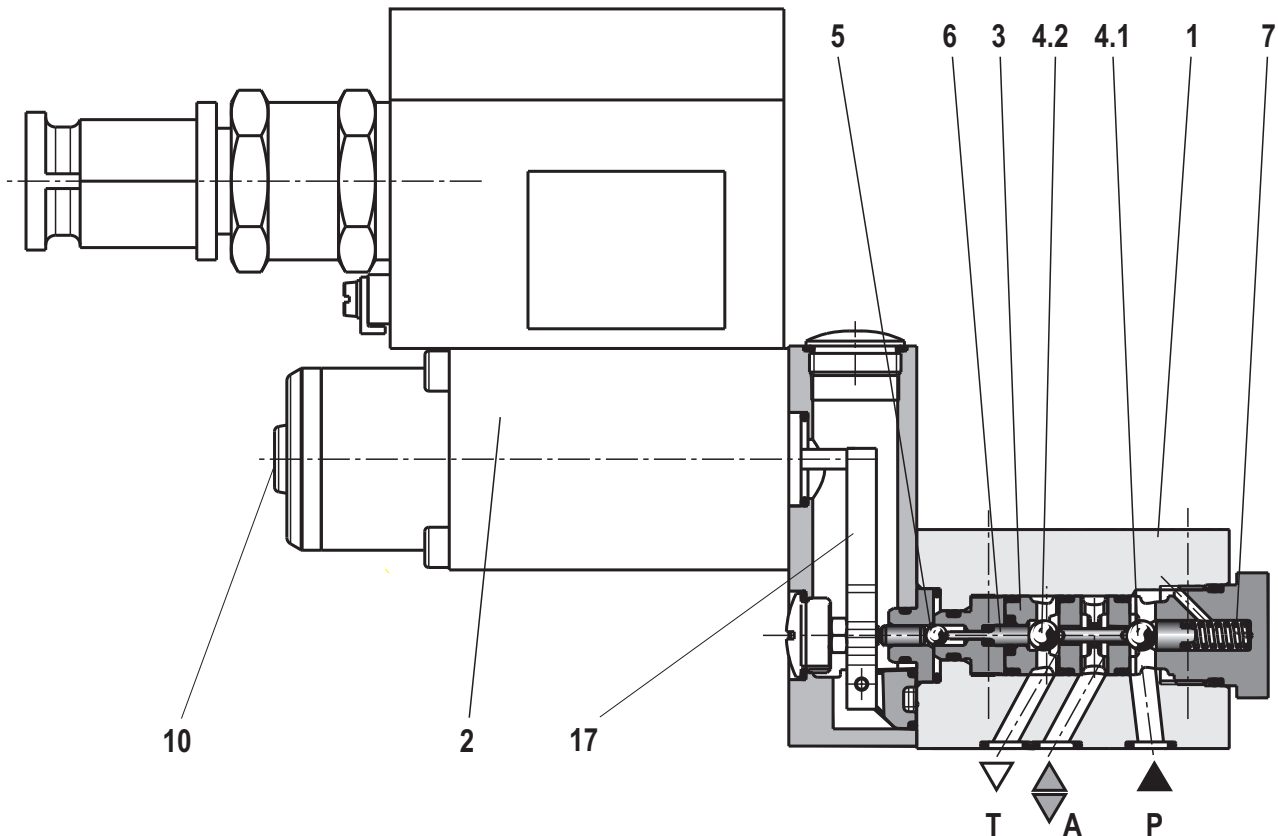
- The 3/2 directional seat valves have a "negative spool overlap". Therefore, port T must always be connected. That means that during the switching process – from the starting of the opening of one valve seat to the closing of the other valve seat – ports P–A–T are connected with each other. This process takes, however, place within such a short time that it is irrelevant in nearly all applications.

- The manual override (10) allows for the switching of the valve without solenoid energization.
- It has to be made sure that the specified maximum flow is not exceeded! A throttle insert must be used for limiting the flow, if necessary (see page 6).
- In order to switch the valve safely or maintain it in its spool position, the pressure situation must be as follows:  $P \geq A \geq T$  (for design reasons).
- The ports P, A and T (3/2 directional seat valve) are clearly determined according to the tasks. They must not be exchanged or closed. The flow is only permitted in the direction of arrow.

The seat arrangement offers the following options:

| Control spool symbol | U  | C  |
|----------------------|--|--|
|                      |  |  |
| Initial position     | P and A connected, T blocked in a leak-free form | P blocked in a leak-free form, A and T connected |
| Spool position       | P blocked in a leak-free form, A and T connected | P and A connected, T blocked in a leak-free form |

### Example: Type M-3SE 6 C6X/420L.NXD22/V



## Function, section, control spool 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 operated. The spring (7) holds the ball (4.1) on the seat (11). Port P is blocked and A 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:

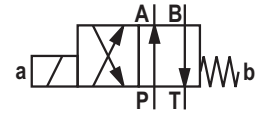
When the main valve is operated, the control spool (8) is shifted against the spring (7) and the ball (4.2) is pressed onto the seat (15). During this, port T is blocked, P, A, and B are briefly connected to each other.

### Spool position:

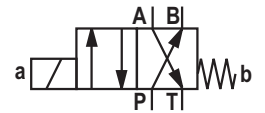
P is connected to A. As the pump pressure acts via A on the large area of the control spool (12), the ball (13) is pressed onto the seat (16). Thus, B is connected to T, and P to A. The ball (13) in the Plus-1 plate has a "positive spool overlap".

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

Control spool symbol **D**:

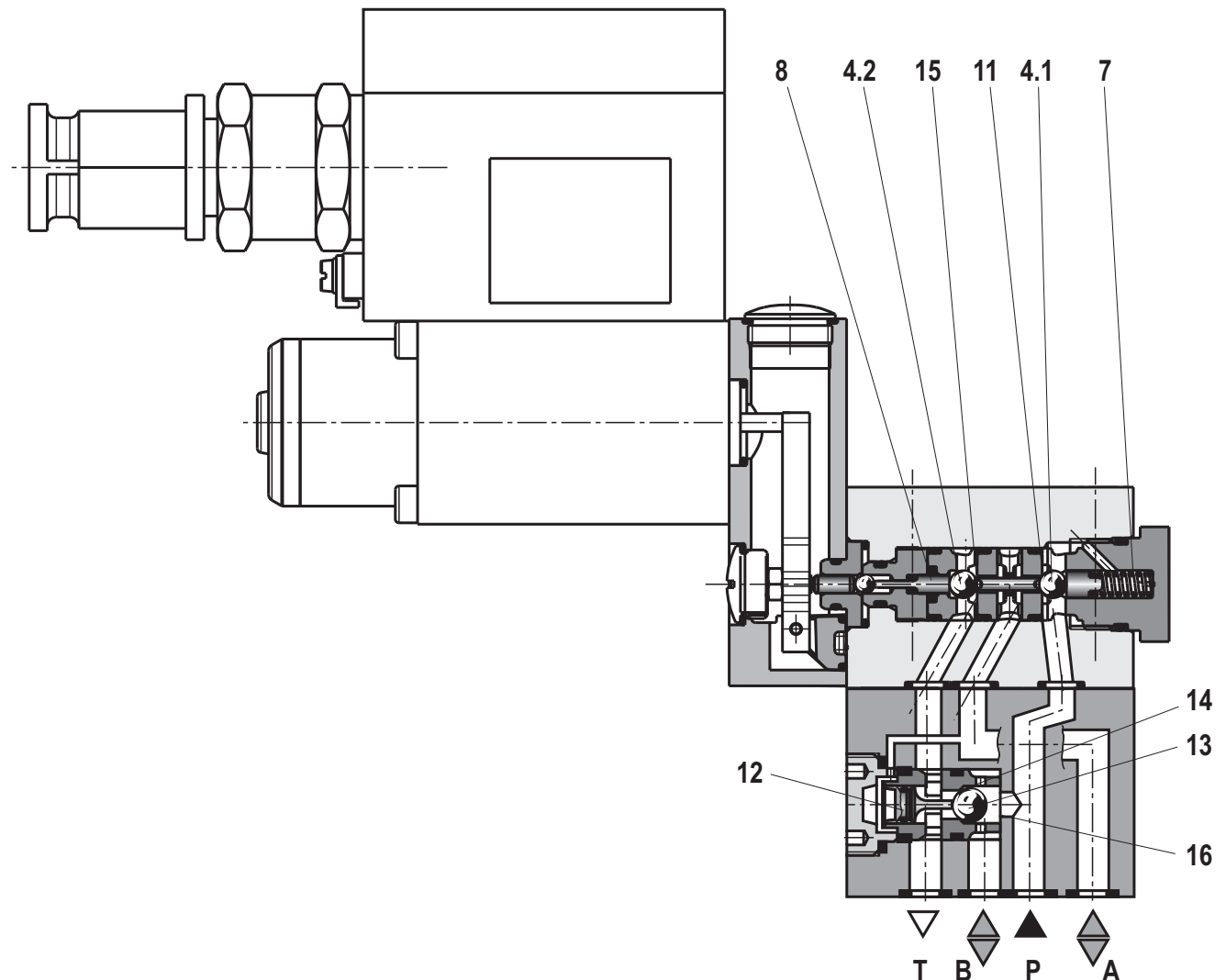


Control spool symbol **Y**:



**To prevent pressure intensification in conjunction with differential cylinders, the annulus area of the cylinder must be connected to A.**

### Example: Type M-4SE 6 Y6X/420L.NXDZ2/V



## Function, section: Throttle insert, check valve insert

### Throttle insert

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

Examples:

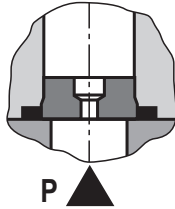
- Accumulator operation,
- Use as pilot control valve with internal pilot fluid tapping.

#### 3/2 directional seat valve (see page 4)

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

#### 4/2 directional seat valve (see page 5)

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



### Check valve insert

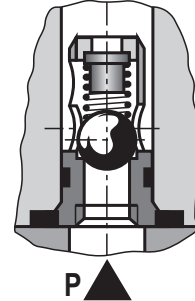
The check valve insert allows free flow from P → A and closes A → P in a leak-free form.

#### 3/2 directional seat valve (see page 4)

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

#### 4/2 directional seat valve (see page 5)

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



## Technical data

### general

|                                  |    |   |
|----------------------------------|----|---|
| Installation position            |    | Any   |
| Ambient temperature range        | °C | -20 ... +80   |
| Storage temperature range        | °C | +15 ... +30   |
| Admissible vibration load        |    |   |
| Valve axis direction             |    | 20 ... 2000 Hz amplitude 0.032 g <sup>2</sup> /Hz (8 g RMS) |
| 90 ° direction to the valve axis |    | 20 ... 2000 Hz amplitude 0.05 g <sup>2</sup> /Hz (10 g RMS) |
| Weight                           |    |   |
| 3/2 directional seat valve       | kg | 6.2   |
| 4/2 directional seat valve       | kg | 7.0   |
| Surface protection               |    | Galvanically coated   |

### hydraulic

|  |                    |  |
|--|--------------------|--|
| Maximum surface temperature  | °C                 | See information on the explosion protection on page 8  |
| Maximum operating pressure   |                    |  |
| Port P, A, B   | bar                | 420  |
| Port T   | bar                | 40   |
| Maximum flow   | l/min              | 12   |
| Hydraulic fluid  |                    | Mineral oil (HL, HLP) according to DIN 51524; fast biodegradable hydraulic fluids according to VDMA 24568 (see also data sheet 90221); HETG (rape seed oil); HEPG (polyglycols); HEES (synthetic esters), other hydraulic fluids on request, ignition temperature > 180 °C |
| Hydraulic fluid temperature range  | °C                 | -15 ... +80  |
| Viscosity range  | mm <sup>2</sup> /s | 2.8 ... 500  |
| Maximum permitted degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c) |                    | Class 20/18/15 <sup>1)</sup>   |

### electric

|  |     |                           |
|--|-----|---------------------------|
| Voltage type   |     | Direct voltage            |
| Available voltages   | V   | 24                        |
| Voltage tolerance (nominal voltage)                                    | %   | ±10                       |
| Admissible residual ripple   | %   | < 5                       |
| Duty cycle / operating mode according to VDE 0580                      |     | S1 (continuous operation) |
| Switching time according to ISO 6403                                   |     | See page 8                |
| Switching frequency  | 1/h | up to 15000               |
| Nominal power at ambient temperature 20 °C                             | W   | 13                        |
| Maximum power with 1.1 x nominal voltage and ambient temperature 20 °C | W   | 15.8                      |
| Protection class according to EN 60529 <sup>2)</sup>                   |     | IP 65                     |

<sup>1)</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).

<sup>2)</sup> With correctly installed electrical connection

## Technical data

### Information on the explosion protection

|   |  |
|---|--|
| Area of application as per directive 94/9/EC                                  | I M2, II 2G  |
| Type of protection Valve  | c (EN 13463-5:2011)  |
| Maximum surface temperature <sup>1)</sup><br>Temperature class                | °C 130<br>T4   |
| Type of protection Solenoid according to<br>EN 60079-0:2009 / EN 60079-1:2007 | Ex d I Mb<br>Ex d IIC T4 Gb  |
| Type examination certificate Solenoid   | BVS 03 ATEX E 300 X  |
| "IEC Certificate of Conformity" Solenoid                                      | IECEX BVS 11.0091 X  |
| Special conditions for safe use   | In case of bank assembly, only one solenoid of all valves<br>may be energized at a time. |
| Ambient temperature range   | °C -20 ... +80   |

<sup>1)</sup> Surface temperature > 50 °C, provide contact protection

### Switching times $t$ in ms (Installation position: Solenoid horizontal)

| Pressure $p$<br>in bar | Flow $q_v$<br>in l/min | DC solenoid                             |          |          |          |           |          |          |          |
|------------------------|------------------------|---|----------|----------|----------|-----------|----------|----------|----------|
|                        |                        | Control spool symbols <b>U, C, D, Y</b> |          |          |          |           |          |          |          |
|                        |                        | $t_{on}$ without tank pressure          |          |          |          | $t_{off}$ |          |          |          |
|                        |                        | <b>U</b>                                | <b>C</b> | <b>D</b> | <b>Y</b> | <b>U</b>  | <b>C</b> | <b>D</b> | <b>Y</b> |
| 70                     | 12                     | 35                                      | 55       | 40       | 60       | 20        | 10       | 25       | 15       |
| 140                    | 12                     | 35                                      | 55       | 40       | 60       | 25        | 10       | 30       | 15       |
| 280                    | 12                     | 35                                      | 60       | 40       | 65       | 30        | 10       | 35       | 15       |
| 320                    | 12                     | 35                                      | 65       | 40       | 70       | 30        | 12       | 35       | 17       |
| 420                    | 12                     | 35                                      | 65       | 40       | 70       | 35        | 12       | 40       | 17       |



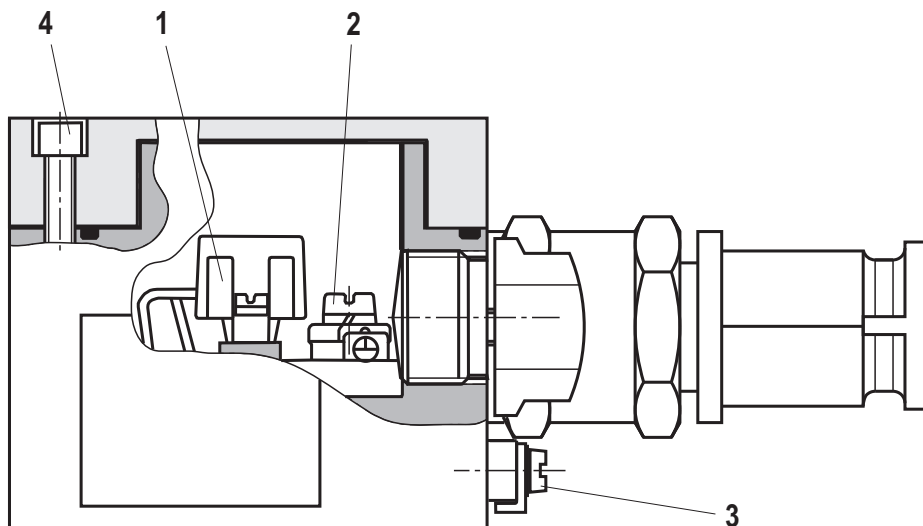
## Electrical connection

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.

### Important

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



### Properties of the connection terminals and mounting elements

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

### Cable gland

|               |    |                      |
|---------------|----|----------------------|
| Line diameter | mm | 9...12               |
| Sealing       |    | Outer sheath sealing |

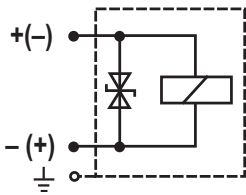
### Connection line

|                   |    |  |
|-------------------|----|--|
| Line type         |    | <b>Non-armored</b> cables and lines (outer sheath sealing) |
| Temperature range | °C | -20 ... > +110   |

## Electrical connection

### Circuit diagram

Direct voltage, polarity-independent



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

#### Important

A fuse appropriate for the solenoid's rated current (max.  $3 \times I_{\text{rated}}$  according to DIN 41571 and/or IEC 60127) or a protective motor switch with short-circuit and thermal instantaneous tripping must be connected to each valve solenoid as short-circuit protection. The cut-off capacity of this fuse must match or exceed the short-circuit current of the supply source. This fuse or protective motor switch may only be fitted outside the explosive area or must be of an explosion-proof design.

When inductivities are switched off, voltage peaks result which may cause failures in the connected control electronics. For this reason, the valve solenoids comprise a suppression circuit which dampens this voltage peak to the voltage value shown in the table.

| 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 41571 | Maximum voltage value upon switch-off | Suppression circuit             |
|-------------------------------------|--------------------------------|------------------------------|---|---------------------------------------|---------------------------------|
| G24                                 | 24 V DC                        | 0.542 A DC                   | 630 mA  | -90 V                                 | Suppressor diode bi-directional |

## General information

Seat valves can be used according to the control spool symbols and the related operating pressures and flows (see performance limits page 11).

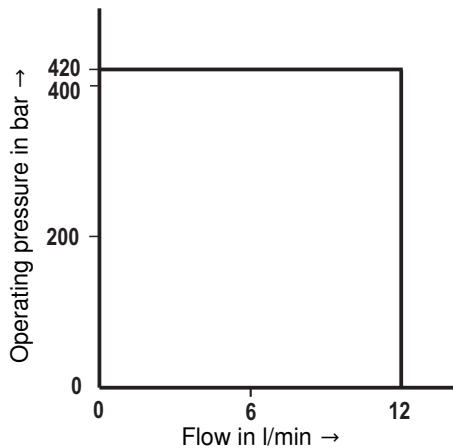
#### In order to guarantee safe functioning, the following points must imperatively be observed:

- Seat valves have negative spool overlap, i.e. leakage oil occurs during the switching process. 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 (if necessary, use a throttle insert for the flow limitation)!

#### Plus-1 plate:

- When the Plus-1 plate (4/2 directional function) is used, the following lower operating values are to be observed:  
 $p_{\text{min}} = 8 \text{ bar}$ ,  $q_V > 3 \text{ l/min}$ .
- The ports P, A, B and T are clearly determined according to the tasks. They must not be exchanged or closed arbitrarily!
- Port T must always be connected.
- Pressure level and pressure distribution are to be observed!
- The flow is only permitted in the direction of arrow!

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



**Important:**

The specified switching power limits are valid for operation with two directions of flow (e.g. from P → A and simultaneous return flow from B → T).

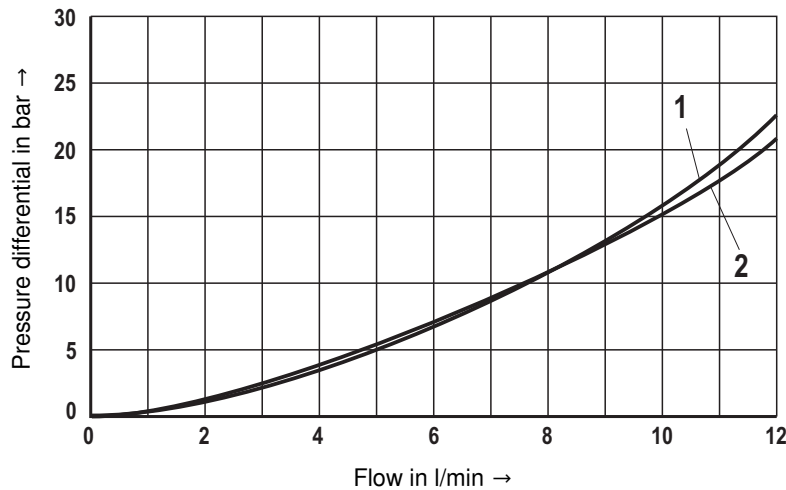
Due to the flow forces acting within the valves, the admissible switching power limit may be considerably lower with only one direction of flow (e.g. from P → A while port B is blocked)!

(In such cases, please consult us.)

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

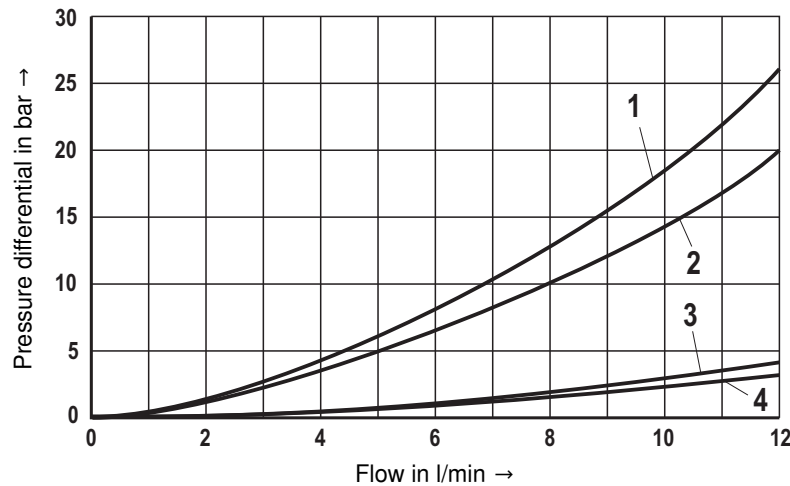
**Characteristic curves** (measured with HLP46,  $\vartheta_{oil} = 40 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$  and  $p = 100 \text{ bar}$ )

without Plus-1 plate (M-3SE..)

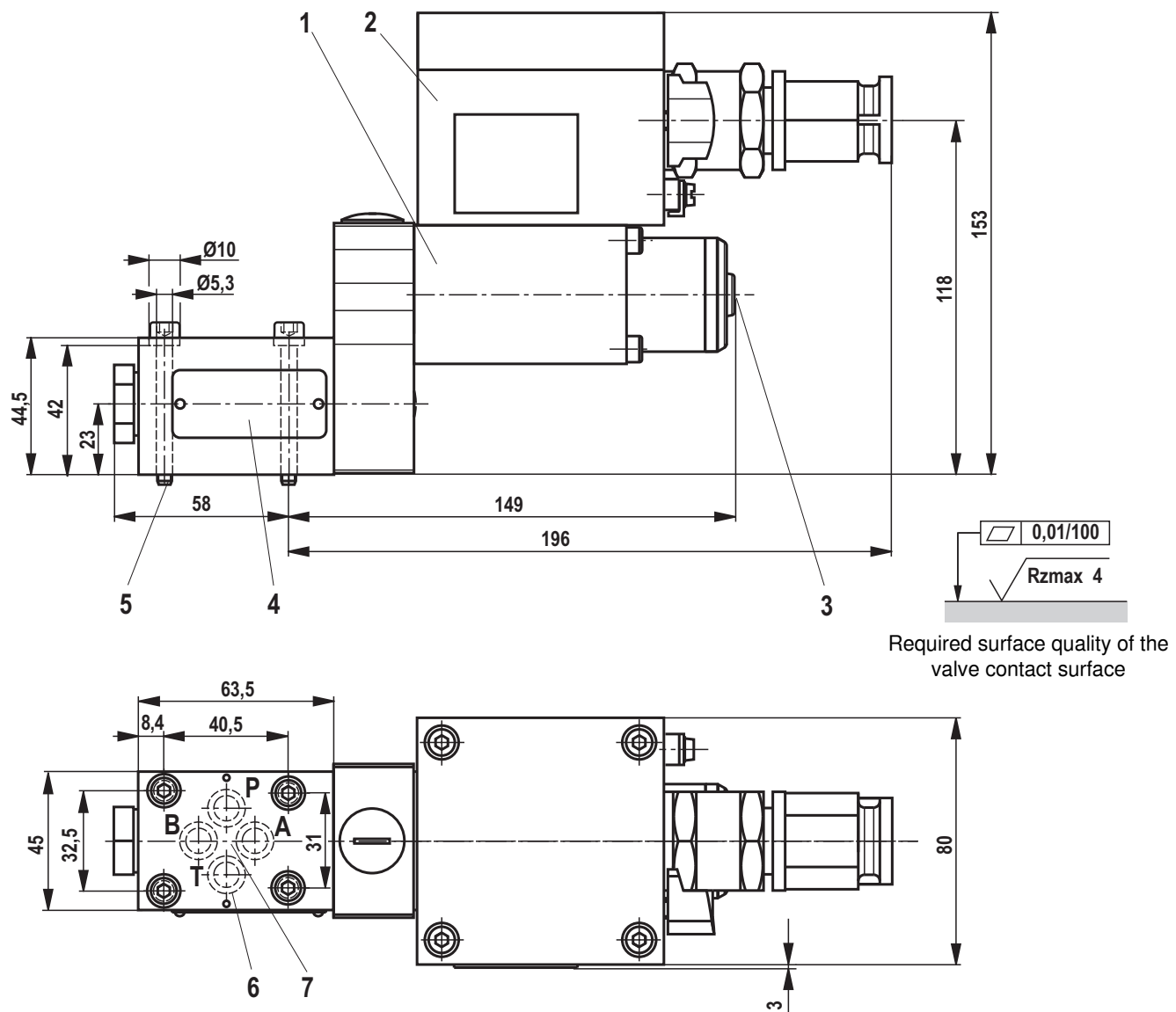


|   |     |
|---|-----|
| 1 | A-T |
| 2 | P-A |

with Plus-1 plate (M-4SE..)



|   |     |
|---|-----|
| 1 | A-T |
| 2 | P-A |
| 3 | P-B |
| 4 | B-T |

**Device dimensions** Type M-3SE 6.6X/420LG..NXDZ2/V (dimensions in mm)


Required surface quality of the valve contact surface

- 1 Valve solenoid
- 2 Terminal box
- 3 Manual override
- 4 Name plate
- 5 Valve mounting screws  
For reasons of stability, exclusively use the following valve mounting screws:  
**4 hexagon socket head cap screws  
ISO 4762-M5x50-10.9-fIZn-240h-L  
(friction coefficient 0.09 - 0.14 according to VDA 235-101)  
(included in the scope of delivery)**
- 6 Identical seal rings for ports P, A, B, T
- 7 Porting pattern according to DIN 24340-A6

**Subplates (without locating hole)**

G 341/01 FE/ZN (G1/4)  
G 342/01 FE/ZN (G3/8)  
G 502/01 FE/ZN (G1/2)

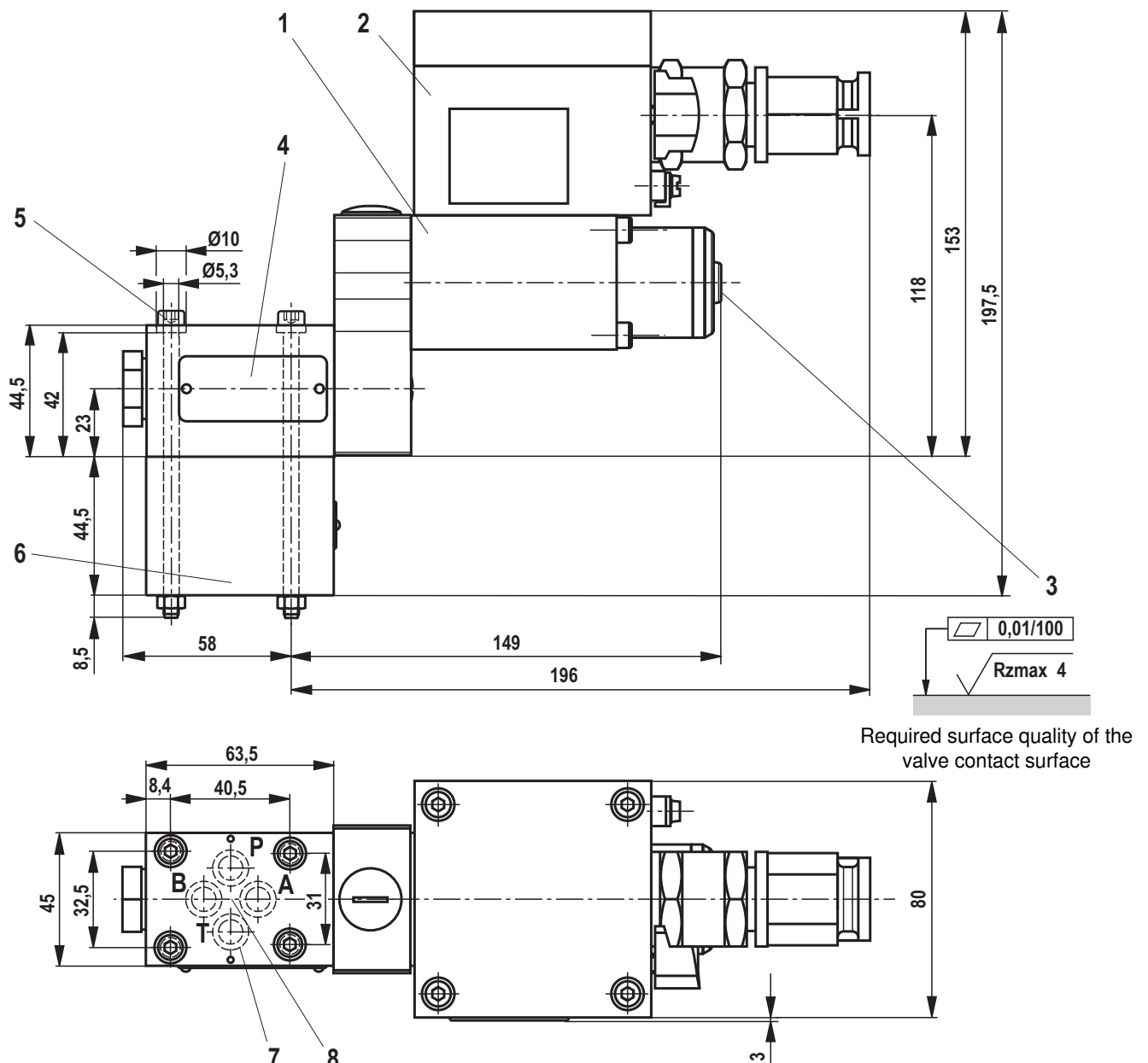
with dimensions as in the data sheet 45052 (must be ordered separately)

**Important:**

Subplates are no components in the sense of directive 94/9/EC and can be used after the manufacturer of the overall system has assessed the risk of ignition.

The G...FE/ZN versions are free from aluminum and/or magnesium and galvanized.

## Device dimensions Type M-4SE 6.6X/420LG..NXDZ2/V (dimensions in mm)



- 1 Valve solenoid
- 2 Terminal box
- 3 Manual override
- 4 Name plate
- 5 Valve mounting screws  
For reasons of stability, exclusively use the following valve mounting screws:  
**4 hexagon socket head cap screws  
ISO 4762-M5x95-10.9-fZn-240h-L  
(friction coefficient 0.09 - 0.14 according to VDA 235-101)  
(included in the scope of delivery)**
- 6 Plus-1 plate
- 7 Identical seal rings for ports P, A, B, T
- 8 Porting pattern according to DIN 24340-A6

### Subplates (without locating hole)

G 341/01 FE/ZN (G1/4)  
G 342/01 FE/ZN (G3/8)  
G 502/01 FE/ZN (G1/2)

with dimensions as in the data sheet 45052 (must be ordered separately)

### Important:

Subplates are no components in the sense of directive 94/9/EC and can be used after the manufacturer of the overall system has assessed the risk of ignition.

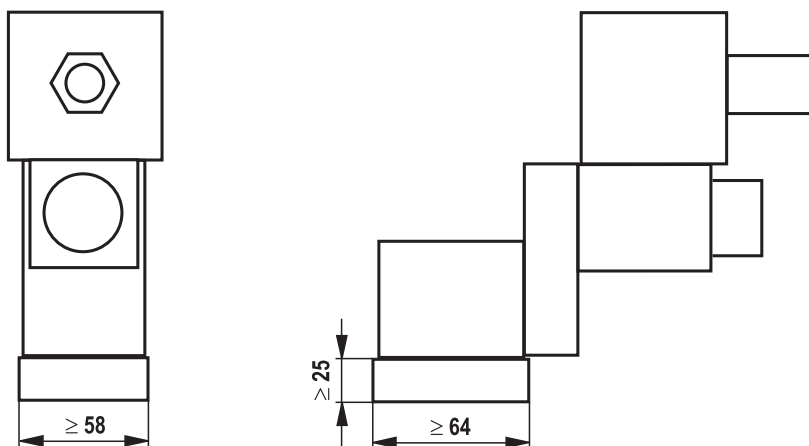
The G...FE/ZN versions are free from aluminum and/or magnesium and galvanized.

**Installation conditions** (dimensions in mm)

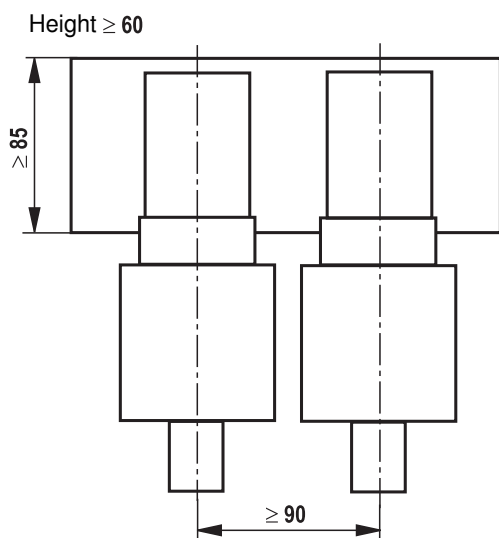
|  | Individual assembly   | Bank assembly   |
|--|---|---|
| Subplate dimensions                                  | Minimum dimensions<br>Length $\geq 64$ , width $\geq 58$ , height $\geq 25$ | Minimum cross-section<br>Height $\geq 60$ , width $\geq 85$ |
| Thermal conductivity of the subplate     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

**Schematic diagram**

Individual assembly



Bank assembly

**Important:**

In case of bank assembly, only one solenoid of all valves may be energized at a time.

## Notes

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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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## Notes

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