

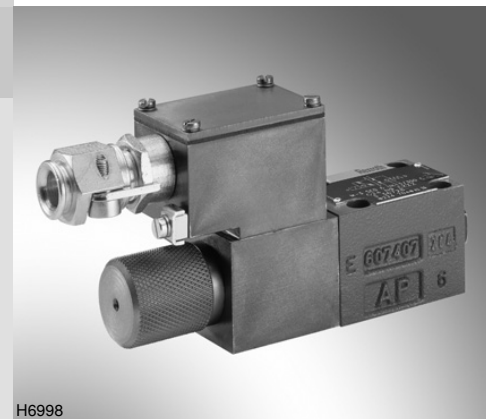
3/2 and 4/2 directional seat valves with solenoid actuation

RE 22049-XE-B2/09.13

Replaces: 01.10

Type M-.SED 6...XE...

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



H6998

Actual product may differ

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: **II 2G**
- Type of protection of the valve solenoid:
Ex e mb IIC T4 Gb according to
EN 60079-7: 2007 / EN 60079-18: 2009

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 | } | Operating instructions 22049-XE-B0 |
| Part II | Data sheet 22049-XE-B2 | | |
| Part III | Product-specific instructions 22049-XE-B3 | | |

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

- 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 to 15)
- Blocked port is tight
- Safe switching also with longer standstill periods under pressure
- Wet-pin DC and AC solenoids
- Solenoid coil can be rotated by 90°
- Electrical connection as individual connection with cable gland
- With concealed manual override, optional

Ordering code and scope of delivery

M	SED	6	1X/350	C	XE	Z2	
3 main ports = 3 4 main ports = 4 Seat valve, electric, direct operated Size 6 = 6						no code = NBR seals V = FKM seals Important: Observe compatibility of seals with hydraulic fluid used!	
Main ports		3	4				
Control spool symbols							
		•	—	= UK			
		•	—	= CK			
		—	•	= D			
		—	•	= Y			
		• = Available					
Component series 10 to 19 (10 to 19: Unchanged installation and connection dimensions)		= 1X					
Operating pressure up to 350 bar		= 350					
Solenoid, wet-pin		= C					
Direct voltage 24 V		= G24					
AC voltage 230 V, 50/60 Hz		= W230R					
For further ordering codes for other voltages, see page 9.							

Included in the scope of delivery:

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-SED is a direct operated directional seat valve with solenoid actuation. It controls the start, stop and direction of flow and basically comprises a 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:

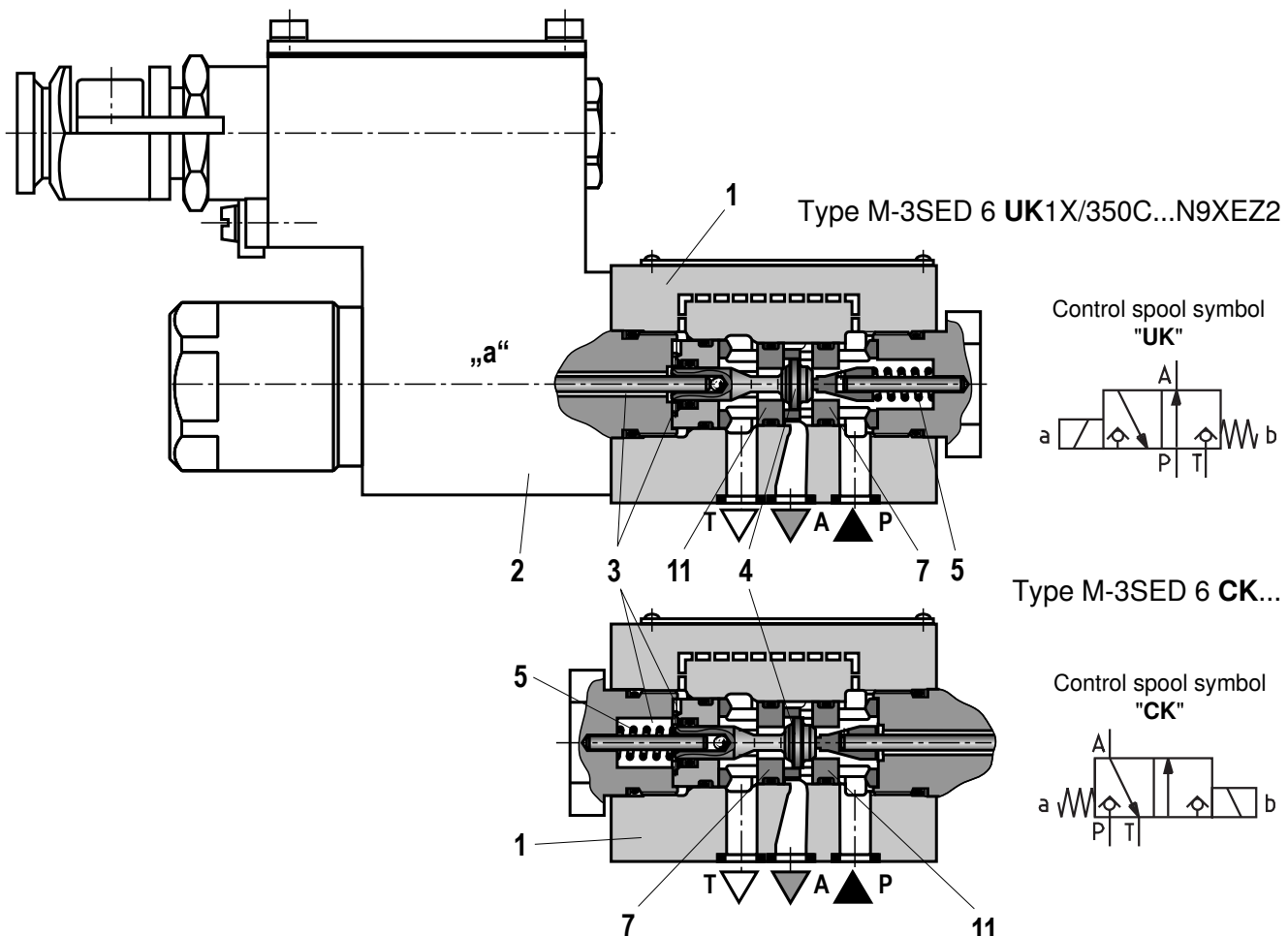
The initial position of the valve (normally open "UK" or normally closed "CK") is determined by the arrangement of the spring (5). The chamber (3) behind the control spool (4) is connected to port P and sealed against port T. Thus, the

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 control spool 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 in a leak-free manner.

Seat valves can be used according to the control spool symbols and the related operating pressures and flows (see Performance limits page 10).



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 (5) holds the control spool (4) 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 (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 operated, 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:

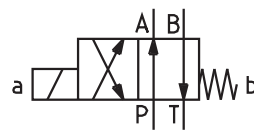
P is connected to A. As the pump pressure acts via A on the large area of the control spool (8), the ball (9) is pressed onto the seat (12). Thus, B is connected to T, and P to A. The ball (9) in the Plus-1 plate has a "positive spool overlap".

Important:

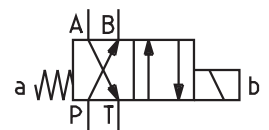
To prevent pressure intensification in conjunction with differential cylinders, the annulus area of the cylinder must be connected to A.

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

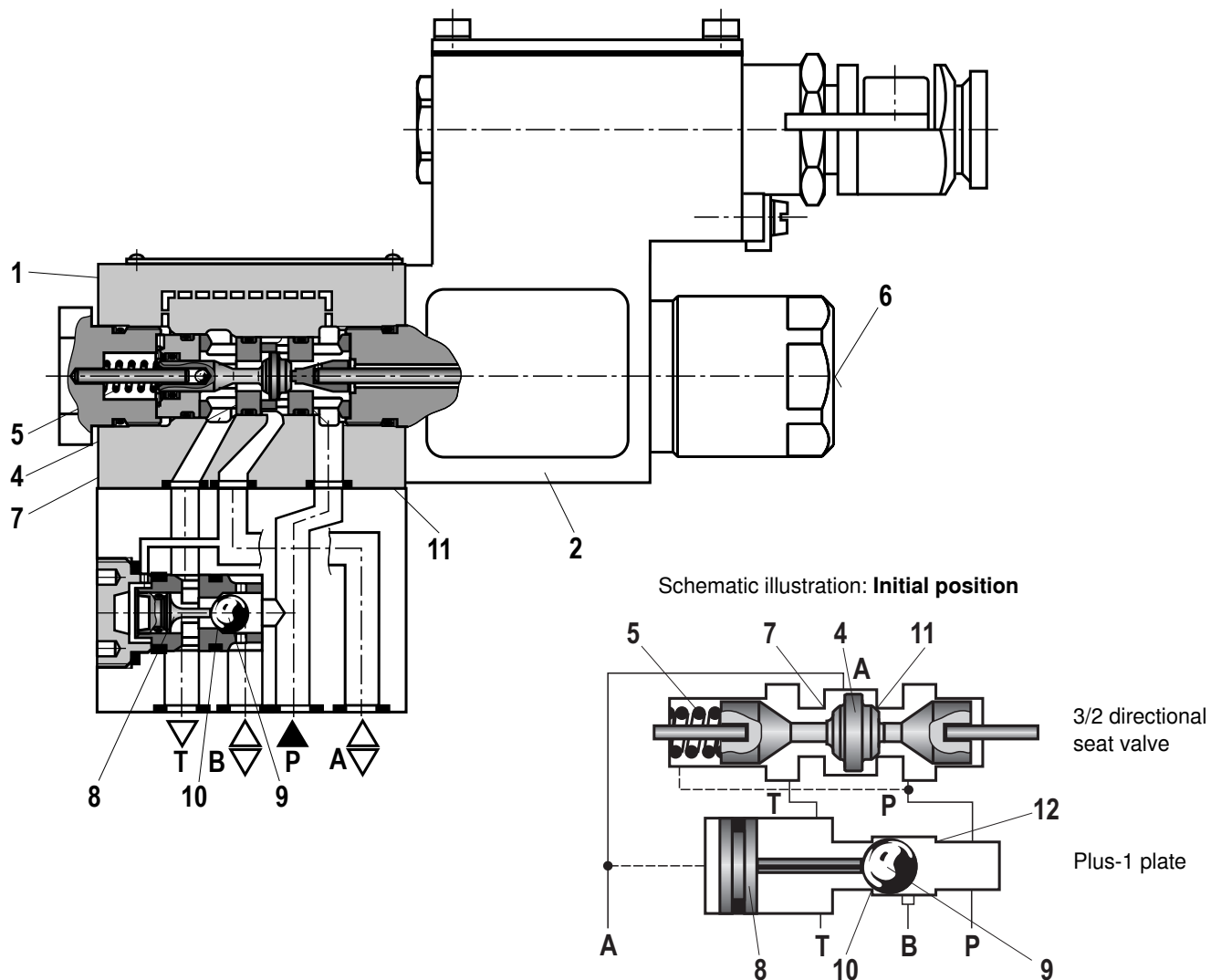
Control spool symbol "D"



Control spool symbol "Y"



Type M-4SED 6 Y1X/350C...N9XEZ2



Function, section: Throttle insert, check valve insert

Throttle insert

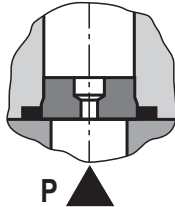
The use of a throttle insert is required when due to prevailing operating conditions, flows can occur during the switching processes, which exceed the performance limit of the valve.

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

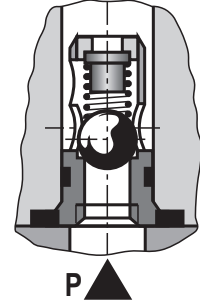
The check valve insert allows free flow from P → A and closes A → P in a leak-free way.

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 ... +70 ¹⁾
Storage temperature range			°C –20 ... +50
Admissible vibration load			20 ... 2000 Hz amplitude 0.05 g ² /Hz (10 g RMS)
Weight	3/2 directional seat valve	kg	3.1
	4/2 directional seat valve	kg	3.9
Surface protection			Galvanized coating

hydraulic

Maximum operating pressure	bar	See table on page 10
Maximum flow	l/min	25
Hydraulic fluid	Mineral oil (HL, HLP) according to DIN 51524 ²⁾ ; fast bio-degradable hydraulic fluids according to VDMA 24568 (see also RE 90221); HETG (rape seed oil) ²⁾ ; HEPG (polyglycols) ³⁾ ; HEES (synthetic esters) ³⁾ ; Other hydraulic fluids upon request Ignition temperature > 180 °C	
Hydraulic fluid temperature range	°C	–20 ... +80 (for NBR seals)
		–15 ... +80 (for 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 ⁴⁾	

¹⁾ Observe the "Special conditions for safe use" on page 7.

²⁾ Suitable for NBR **and** FKM seals

³⁾ Suitable **only** for FKM seals

⁴⁾ 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

electric

Voltage type		Direct voltage	Alternating voltage 50/60 Hz
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		100 % / S1 (continuous operation)	
Switching time according to ISO 6403		See table below	
Switching frequency	1/h	up to 15000	up to 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 ¹⁾	

¹⁾ If the electrical connection is correctly installed

Information on the explosion protection

Area of application as per directive 94/9/EC	II 2G
Type of protection Valve	c (EN 13463-5:2011)
Maximum surface temperature ¹⁾	135
Temperature class	T4
Type of protection Valve solenoid according to EN 60079-7:2007 / EN 60079-18:2009	Ex e mb IIC T4 Gb
Type examination certificate Solenoid	KEMA 02ATEX2240 X
"IECEx Certificate of Conformity" Solenoid	IECEx DEK 12.0068X
Ambient temperature range	°C –20 ... +70 ²⁾
Special conditions for safe use	– 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 at a time: +60 °C – The maximum temperature of the valve casing surface is 120 °C. This has to be considered when selecting the connection cable and contact of the connection cable with the casing surface is to be prevented.

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

²⁾ Observe the "Special conditions for safe use"

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

Pressure p in bar	Flow q_v in l/min	DC solenoid						AC solenoid							
		Control spool symbols UK, CK, D and Y						Control spool symbols UK, CK, D and Y							
		t_{on}				t_{off}		t_{on}				t_{off}			
		without tank pressure				UK	D	without tank pressure				UK	CK	D	Y
		UK	CK	D	Y	CK	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

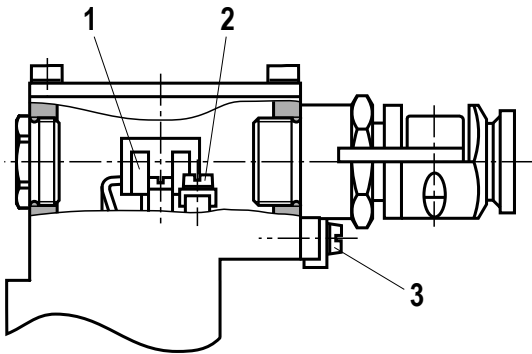
Electrical connection

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

The connection is polarity-independent.
Solenoids to be connected to AC voltage are equipped with an integrated rectifier.

Important

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



Properties of the connection terminals

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

Cable gland

Type approval	II 2G Ex e IIC Gb
Threaded connection	M20 x 1.5
Protection class according to EN 60529	IP66 ¹⁾
Line diameter	mm 9 ... 11
Sealing	Outer sheath sealing

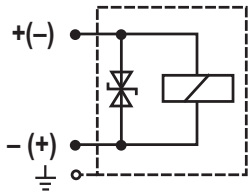
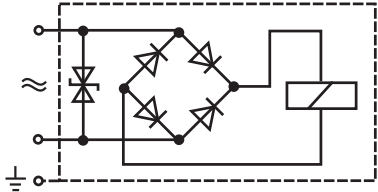
Connection line

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

¹⁾ If installed properly

Electrical connection

Circuit diagrams

Direct voltage, polarity-independent	Alternating voltage
	

Over-current fuse and switch-off voltage peaks

Important:

Corresponding to the rated current, a fuse according to DIN 41571 and EN / IEC 60127 has to be connected ahead 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 explosive area or must be of an explosion-proof design.

When inductivities are switched off, voltage peaks are the result which may cause faults in the connected control electronics. For this reason, the valve solenoids comprise an interference protection 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	Rated current external miniature fuse: Medium time-lag (M) according to DIN 41571 and EN/IEC 60127	Rated voltage of 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	

General information

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

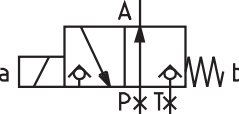
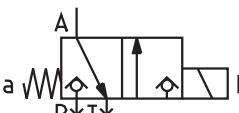
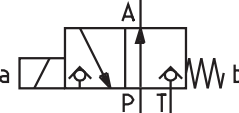
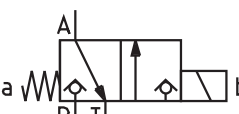
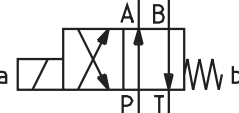
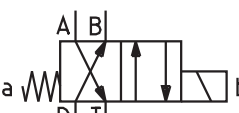
In order to guarantee safe functioning, the following points must imperatively be observed:

- Seat valves have negative spool overlap, i.e. leakage oil occurs during the switching process. However, this process takes 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 have to be observed:
 $p_{\min} = 8 \text{ bar}$, $q_v > 3 \text{ l/min}$.
- The ports P, A, B and T are clearly determined according to the tasks. They must not be exchanged or closed.
- Port T must always be connected.
- Pressure level and pressure distribution are to be observed.
- The flow is only admissible in the direction of the arrow.

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

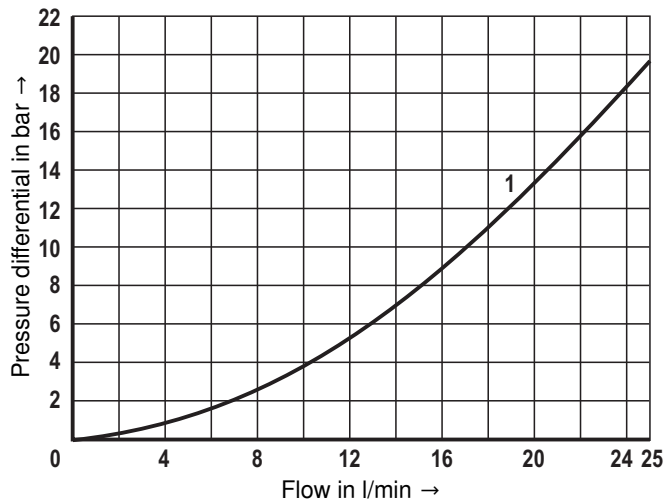
	Control spool symbol	Comment	Operating pressure in bar				Flow in l/min
			P	A	B	T	
2-way circuit	"UK" 	With 2/2-way circuits, port P or T must be closed by the customer!	350	350		350	25
	"CK" 		350	350		350	25
3-way circuit	"UK" 		350	350		350	25
	"CK" 		350	350		350	25
4-way circuit (flow only possible 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/A/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/A/B -40	25

Important

The switching power limits were established while the solenoids were at operating temperature, at 10% undervoltage and without tank preloading.

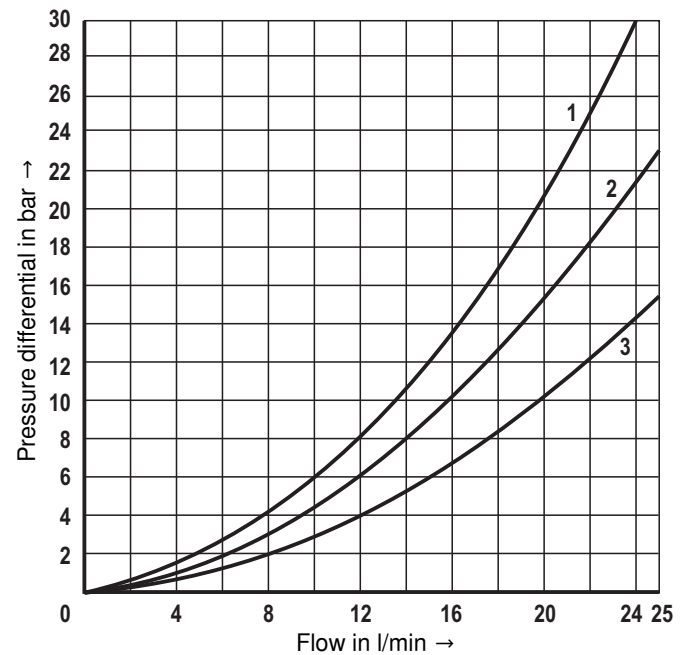
Characteristic curves (measured with HLP46, $\vartheta_{oil} = 40\text{ °C} \pm 5\text{ °C}$)

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



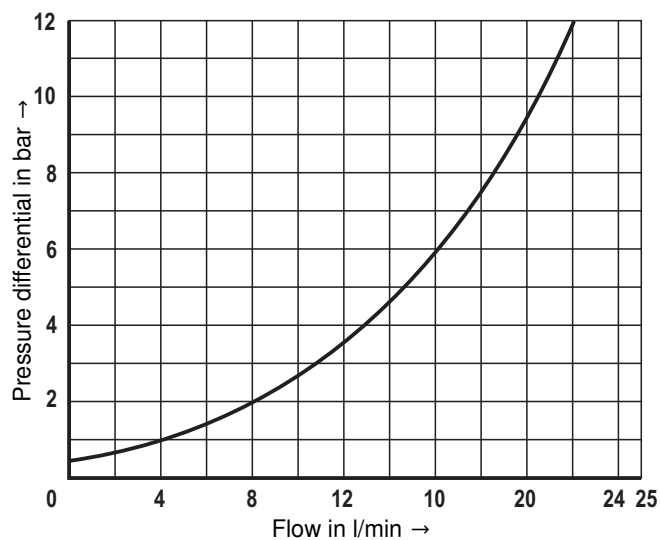
1 M-3SED 6 UK(CK)..., P → A and A → T

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

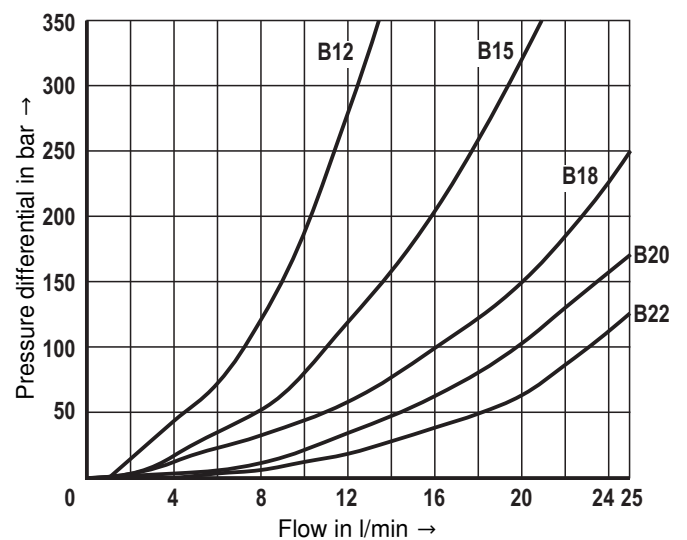


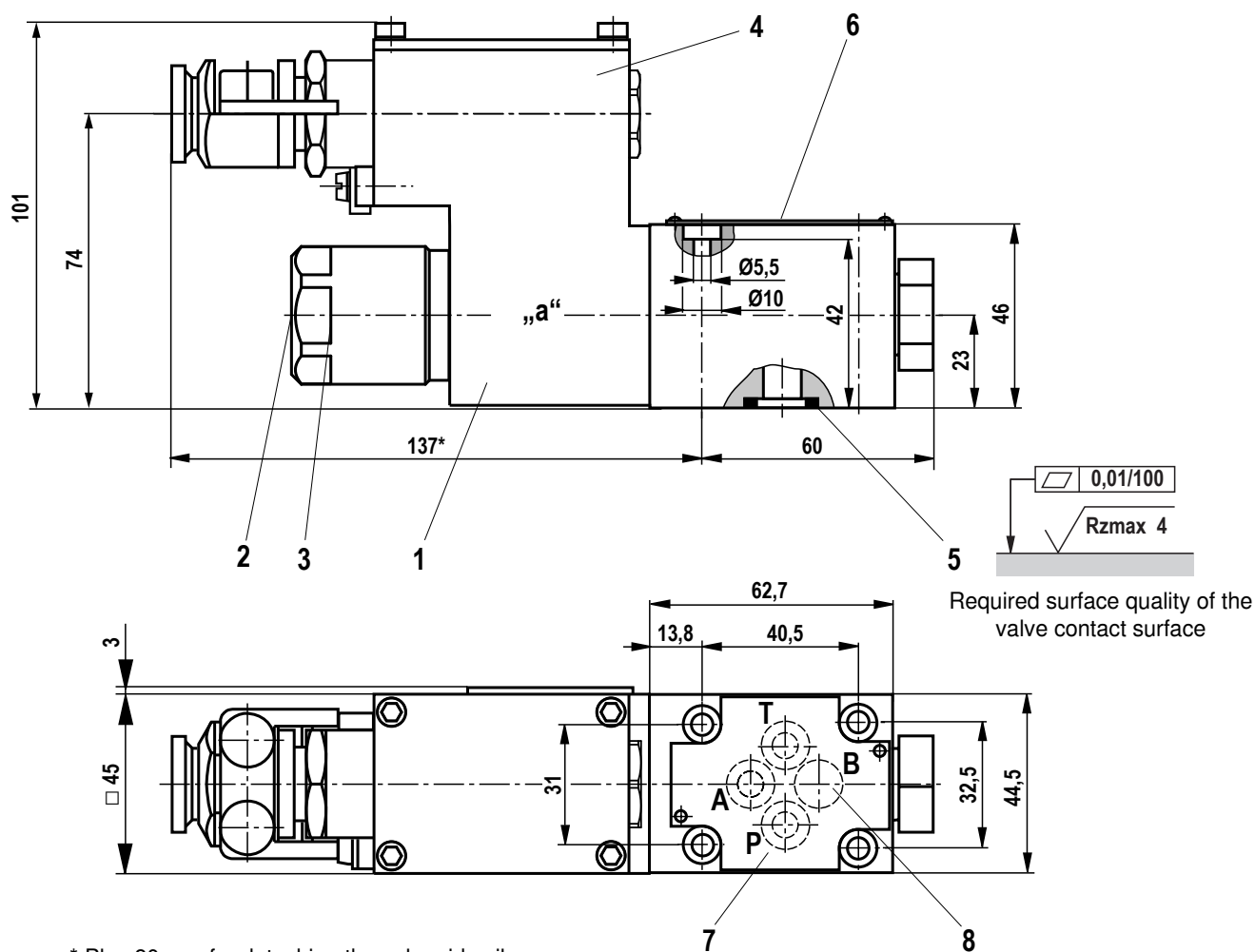
1 M-4SED 6 D(Y)..., A → T
2 M-4SED 6 D(Y)..., P → A
3 M-4SED 6 D(Y)..., B → T, P → B

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



$\Delta p - q_v$ characteristic curves
Throttle insert



Dimensions: 3/2 directional seat valve – design "UK" (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, T
seal ring for port P
- 6 Name plate
- 7 Porting pattern according to DIN 24340-A6
- 8 Port B is designed as blind counterbore

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-flZn-240h-L

(friction coefficient 0.09 - 0.14 according to VDA 235-101)

(must be ordered separately)

Subplates

G 341/01 FE/Zn (G1/4)

G 342/01 FE/Zn (G3/8)

G 502/01 FE/Zn (G1/2)

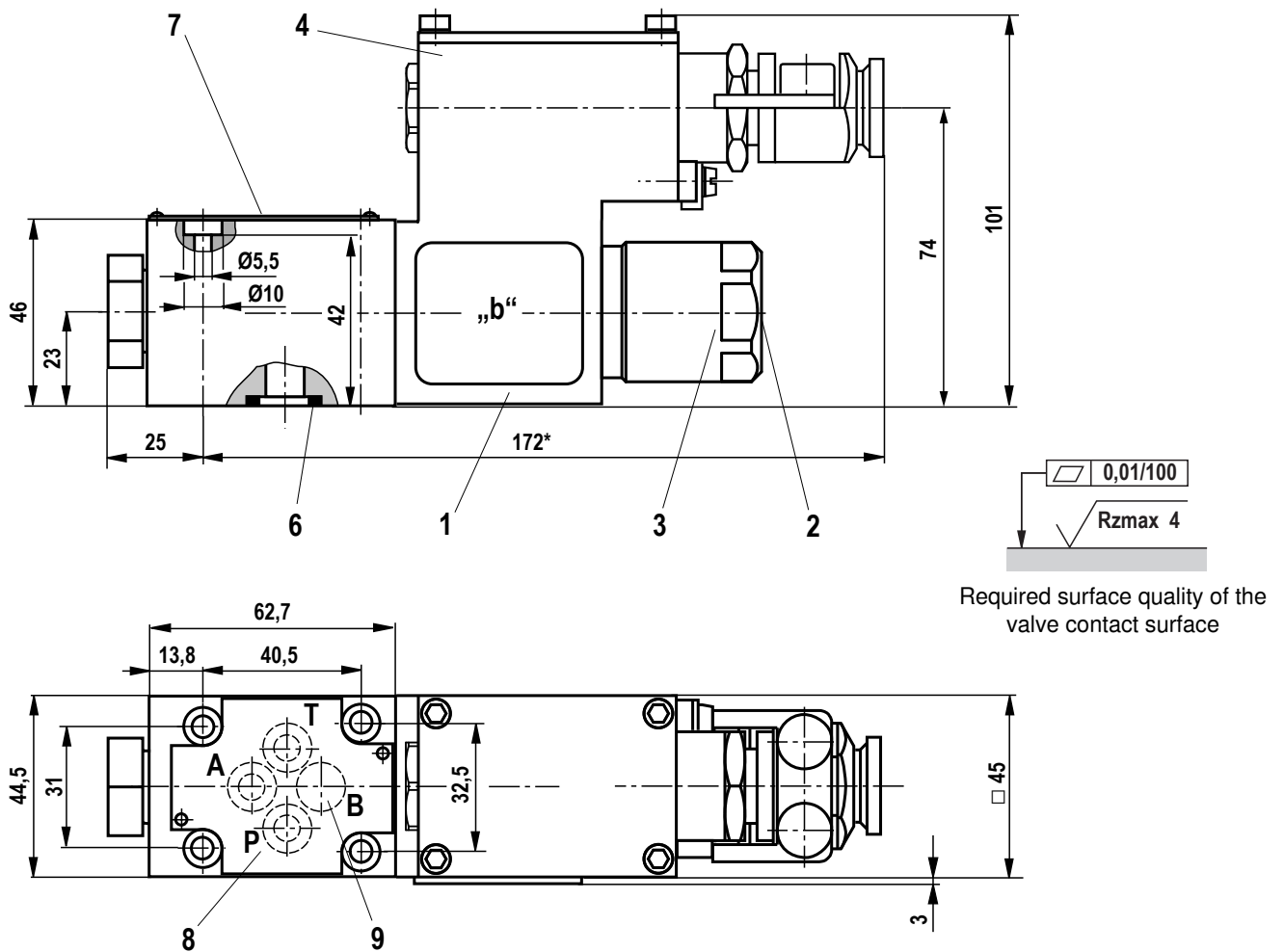
with dimensions as in the data sheet 45052

(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.

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

* Plus 80 mm for detaching the solenoid coil

- 1 Solenoid coil
- 2 Concealed manual override "N9"
- 3 Mounting nut with hexagon SW32
- 4 Terminal box
- 5 Space required to remove the solenoid coil
- 6 Identical seal rings for ports A, B, T
seal ring for port P
- 7 Name plate
- 8 Porting pattern according to DIN 24340-A6
- 9 Port B is designed as blind counterbore

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-fZn-240h-L

(friction coefficient 0.09 - 0.14 according to VDA 235-101)

(must be ordered separately)

Subplates

G 341/01 FE/Zn (G1/4)

G 342/01 FE/Zn (G3/8)

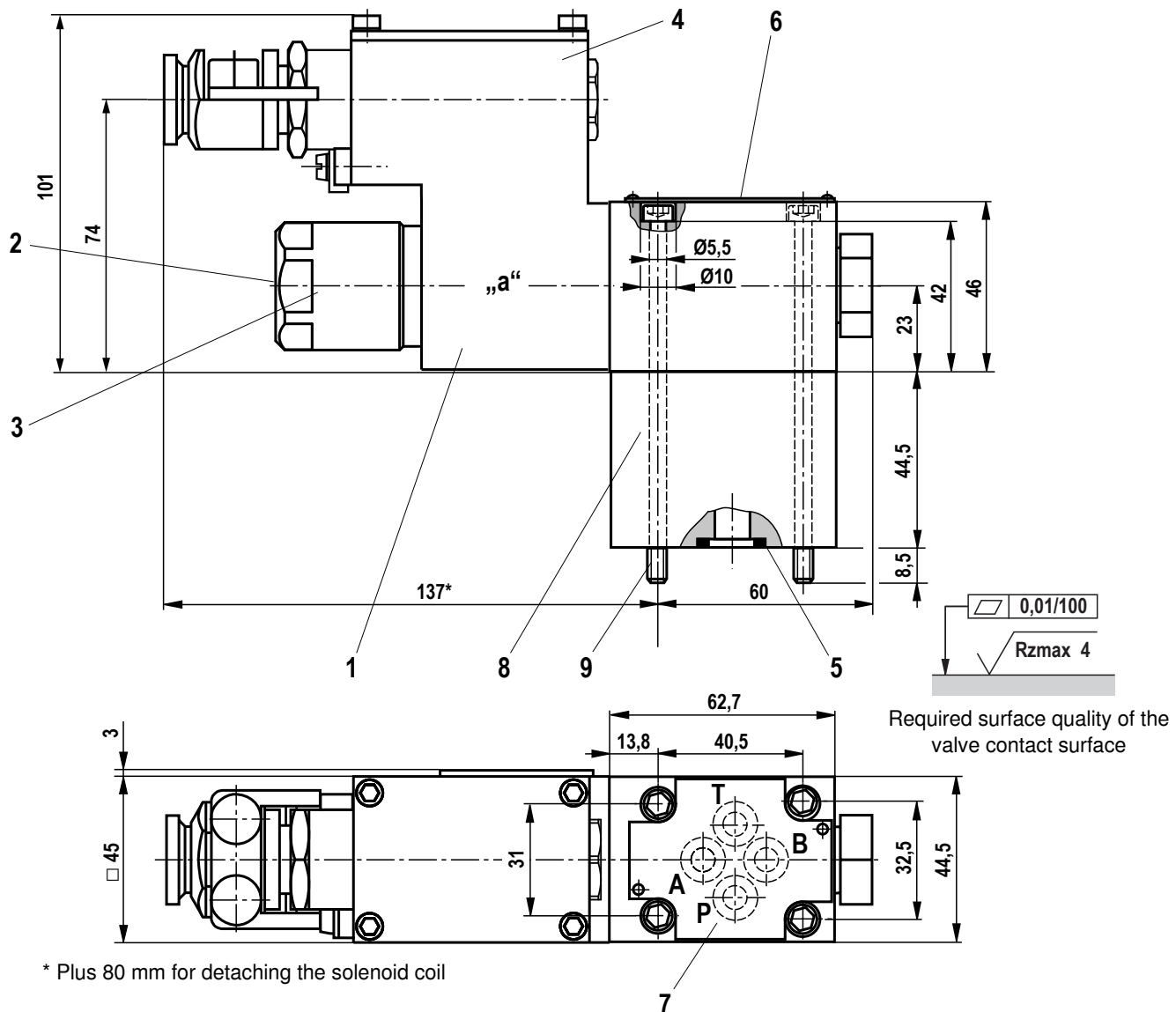
G 502/01 FE/Zn (G1/2)

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.

Dimensions: 4/2 directional seat valve – design "D" (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, T
seal ring for port P
- 6 Name plate
- 7 Porting pattern according to DIN 24340-A6
- 8 Plus-1 plate
- 9 **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)

Subplates

G 341/01 FE/Zn (G1/4)

G 342/01 FE/Zn (G3/8)

G 502/01 FE/Zn (G1/2)

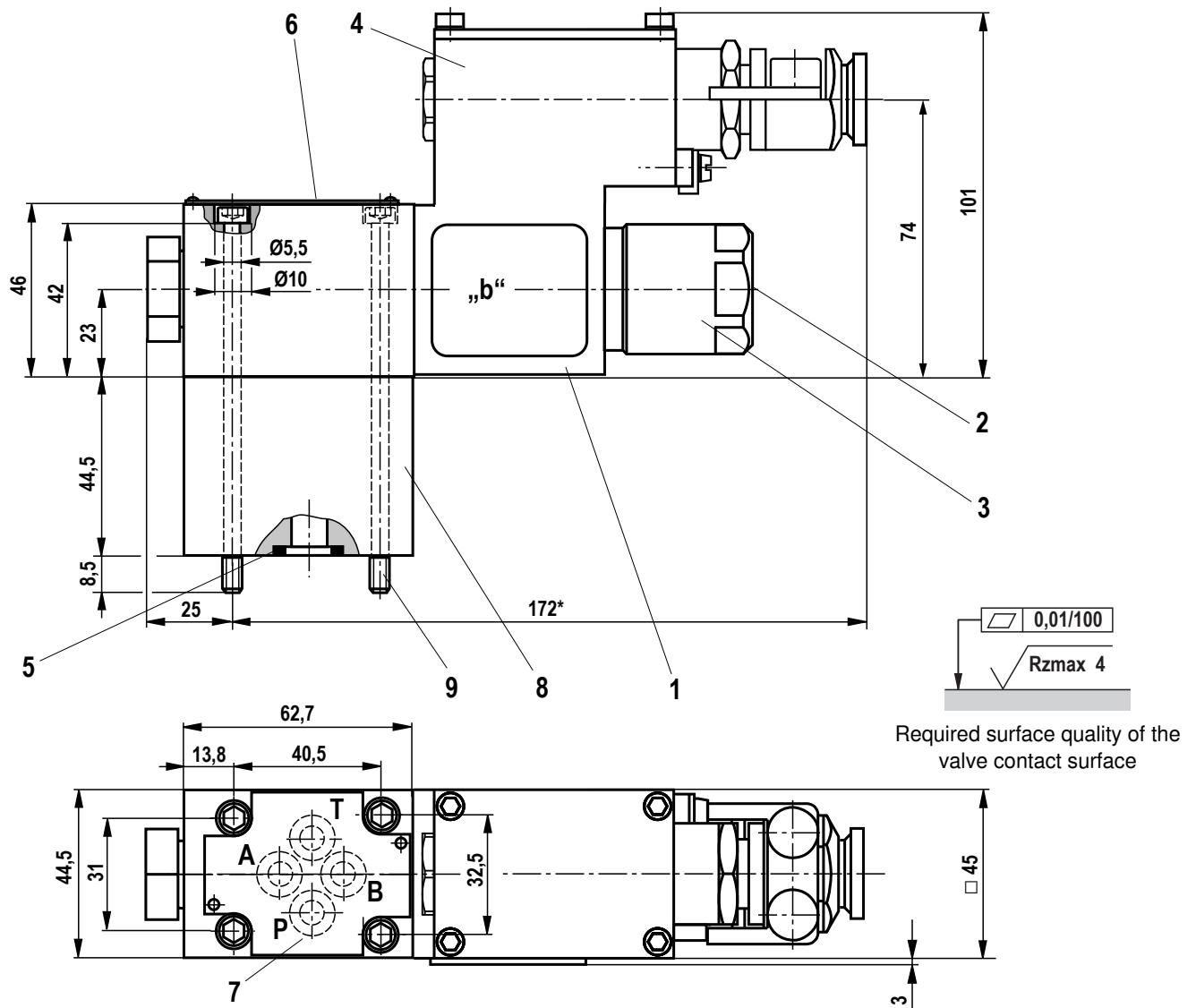
with dimensions as in the data sheet 45052

(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.

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

* Plus 80 mm for detaching the solenoid coil

- 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 DIN 24340-A6
- 8 Plus-1 plate
- 9 **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-fIZn-240h-L
(friction coefficient 0.09 - 0.14 according to VDA 235-101)
(included in the scope of delivery)

Subplates

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:

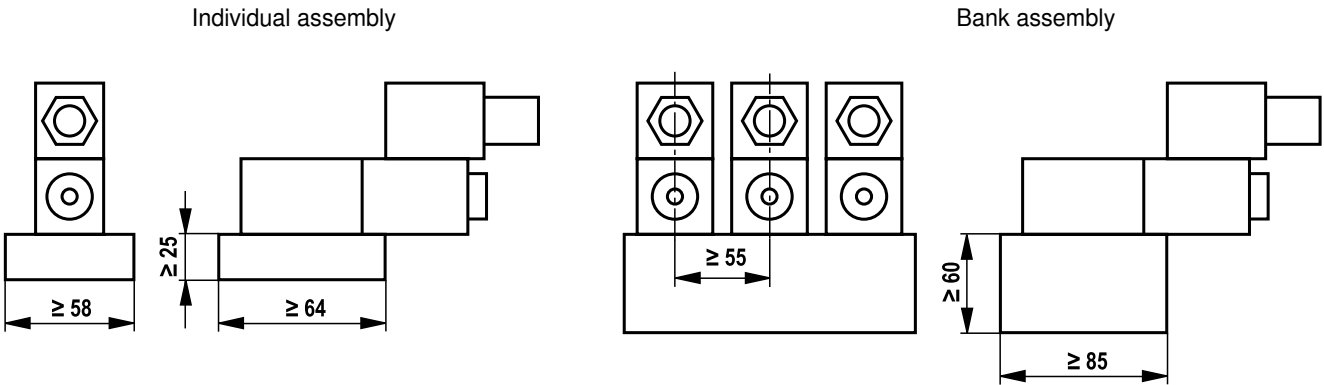
Subplates are no components in the sense of directive 94/9/EC and can be used after the manufacturer of the overall system has assessed the risk of ignition.

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 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 mm	

Schematic diagram



Important:
Observe the "Special conditions for safe use" on page 7.