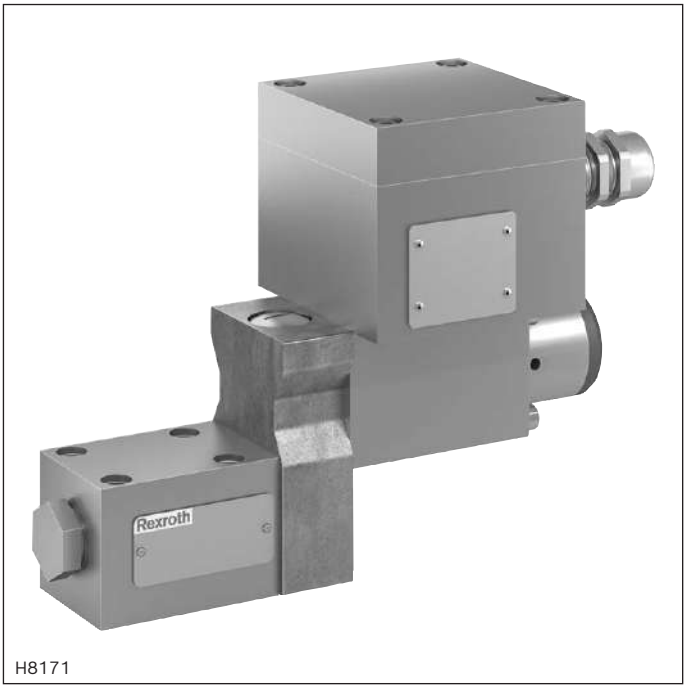
RE 22047-XD
Edition: 2021-12
Replaces: 2020-07
RA78487871_AC

rexroth
A Bosch Company

Directional seat valves, direct-operated, with solenoid actuation

Type SE ...XD



H8171

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

CE

For potentially explosive atmospheres

Information on explosion protection:

- Area of application in accordance with the Explosion Protection Directive 2014/34/EU: **I M2; II 2G**
- Type of protection valve:
  - Ex h I Mb X according to EN 80079-38
  - Ex h IIC T4 Gb X according to EN 80079-36
- Type of protection valve solenoid:
  - Ex db I Mb according to EN 60079-1
  - Ex db IIC T4 Gb according to EN 60079-1
- Valve solenoid certified according to IECEx

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 (however, without locating hole)
- Blocked connection tight
- Air-gap DC solenoids
- Safe switching also with longer standstill periods under pressure
- Electrical connection with individual connection and cable gland
- With manual override

Contents

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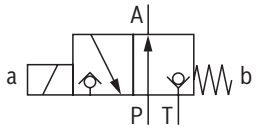
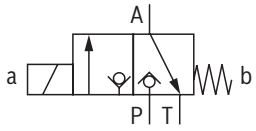
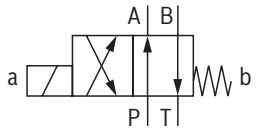
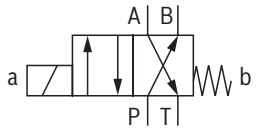
☞ **Notice:** The documentation version with which the product was supplied is valid.

Ordering code

01		02	03	04	05	06		07	08	09	10	11	12		13	14
M	**–**		**SE**	**6**		**6X**	**/**	**420**	**L**	**G24**	**N**	**XD**	**Z2**	**/**		**V**

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

Symbols

05 Main ports	3	4	
	✓	–	**U**
	✓	–	**C**
	–	✓	**D**
	–	✓	**Y**

06	Component series 60 ... 69 (60 ... 69: unchanged installation and connection dimensions)	**6X**
07	Operating pressure 420 bar	**420**
08	High-power solenoid (air-gap)	**L**

Voltage

09	Direct voltage 24 V	**G24**
10	**With** manual override	**N**

Explosion protection

11	"Flameproof enclosure"	**XD**
	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 13	

Ordering code

01	02	03	04	05	06	07	08	09	10	11	12	13	14
M	**–**	**SE**	**6**		**6X**	**/**	**420**	**L**	**G24**	**N**	**XD**	**Z2**	**/**		**V**

13	**Without** check valve insert, **without** throttle insert	**no code**
	With check valve insert	**P**
	Throttle Ø 1.2 mm	**B12**
	Throttle Ø 1.5 mm	**B15**
	Throttle Ø 1.8 mm	**B18**
	Throttle Ø 2.0 mm	**B20**
	Throttle Ø 2.2 mm	**B22**

Seal material (observe compatibility of seals with hydraulic fluid used, see page 6)

14	FKM seals	**V**

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

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

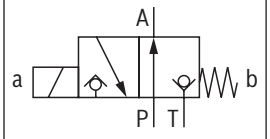
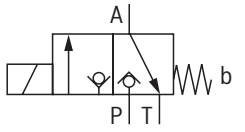
General
Type SE directional seat valves are direct-operated directional valves with solenoid actuation. They control start, stop and direction of flow.
The directional valves basically comprise a housing (1), the solenoid (2), the hardened valve system (3) and the balls (4.1 and 4.2) as closing element.
For unobjectionable functioning, the hydraulic system has to be bled properly.

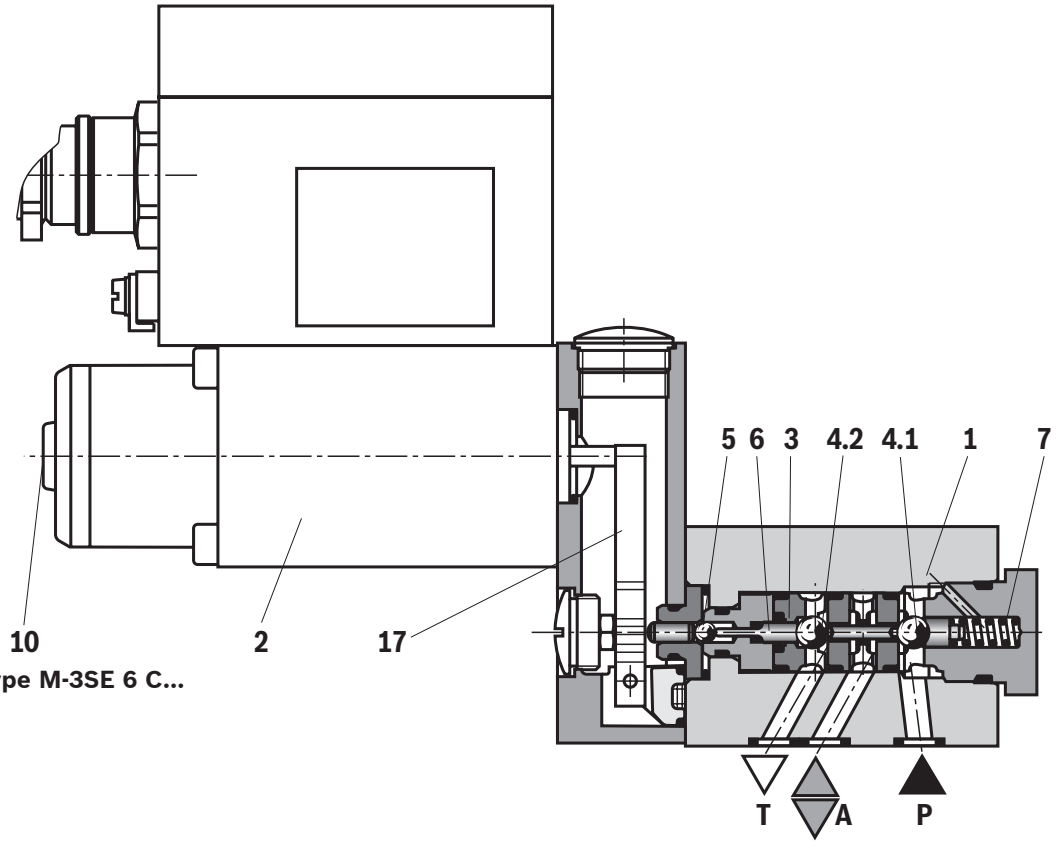
Basic principle
In the initial position, the ball (4.1) is pressed onto the seat by the spring (7), in spool position, the ball (4.2) is pressed onto the seat by the solenoid (2). The force of solenoid (2) acts via the lever (17) and the ball (5) on the actuating plunger (6) that is sealed on two sides.
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.

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. However, this process takes 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 12).
- In order to switch the valve safely or maintain it in its spool position, the pressure situation at the corresponding ports must be as follows: P ≥ A ≥ T for 3/2 directional seat valves or P ≥ A ≥ B ≥ T for 4/2 directional seat valves (for design reasons).
- The ports P, A and T (3/2 directional seat valve) or 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 admissible in the direction of arrow.

The seat arrangement offers the following options:

Symbols

	U	**C**
		
Initial position	P and A connected, T blocked	P blocked, A and T connected
Spool position	P blocked, A and T connected	P and A connected, T blocked



Type M-3SE 6 C...

Function, section, symbols: 4/2 directional seat valve

With a sandwich plate, the **Plus-1 subplate**, under the 3/2 directional seat valve, the function of a 4/2 directional seat valve is achieved.

Function of the Plus-1 subplate

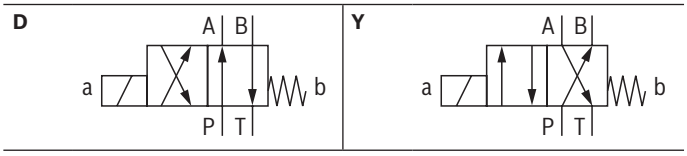
- Initial position
  The main valve is not actuated. The spring (7) holds the ball (4.1) on the seat (11). Port P is blocked and A is connected to T. Apart from that, one control line is connected from A to the large area of the control spool (12), which is thus unloaded to the tank.
  The pressure applied 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 (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 subplate has a "positive spool overlap".

☞ **Notices:**

- When operating 4/2 directional seat valves to control differential cylinders, the annulus area of the cylinder must only be connected with connection A of the valve. Otherwise, pressure peaks can be created while switching, which will exceed the maximum operating pressure.
- When operating 4/2 directional seat valves, the minimum pressure must be 8 bar and the minimum flow must be 3 l/min.

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

Symbols



Type M-4SE 6 Y...

Technical data
(for applications outside these values, please consult us!)

General			
Installation position			any
Ambient temperature range		°C	–20 ... +80
Storage temperature range		°C	+5 ... +40
Maximum storage time		Years	1
Maximum admissible acceleration a_{max}		g	10
Weight	▶ 3/2 directional seat valve	kg	6.2
	▶ 4/2 directional seat valve	kg	7.0
Surface protection			galvanized
Maximum surface temperature		°C	See information on explosion protection, page 7

Hydraulic			
Maximum operating pressure	▶ Port P, A, B	bar	420
	▶ Port T	bar	40
Maximum flow		l/min	12
Hydraulic fluid			See table below
Hydraulic fluid temperature range		°C	–15 ... +80
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 [1]

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

☞ **Important information on hydraulic fluids:**
- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:** If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves – particularly in connection with local heat input.

[1] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

Technical data
(for applications outside these values, please consult us!)

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 times according to ISO 6403	ms	See table page 8
Maximum switching frequency	1/h	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		IP65 (with correctly installed electrical connection)

Information on explosion protection – Directive 2014/34/EU			
Area of application		I M2	II 2G
Type of protection of valve according to EN 80079-36 / EN 80079-38 [2)]		Ex h I Mb X	Ex h IIC T4 Gb X
Type of protection valve solenoid according to EN 60079-1		Ex db I Mb	Ex db IIC T4 Gb
Maximum surface temperature [3)]	°C	105	
Temperature class		–	T4
Type examination certificate solenoid		BVS 03 ATEX E 300 X	
"IECEx Certificate of Conformity" solenoid		IECEx BVS 11.0091X	

2) Ex h: structural safety c according to EN 80079-37.

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

☞ **Special application conditions for safe application:**

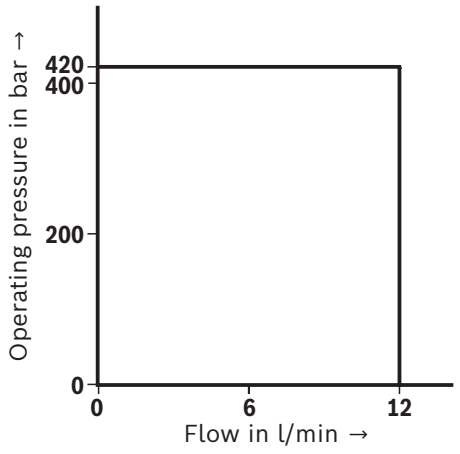
- Connection lines must be passed in a strain-relieved way. The first mounting point must be within 150 mm of the cable and line entry.
- In order to avoid dangers caused by static charge, the base and/or subplate on which the valve is to be fitted must be electrically conductive and included in the equipotential bonding.
- The valve solenoid must not be installed close to charge generating processes.
- Contact of the connection cable with the casing surface is to be prevented.
- In case of bank assembly, only one solenoid of all valves may be energized at a time.

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_{OFF}			
		U	**C**	**D**	**Y**	**U**	**C**	**D**	**Y**
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

☞ **Notice:**
The switching times were determined at a hydraulic fluid temperature of 40 °C and a viscosity of 46 cSt. Deviating hydraulic fluid temperatures can result in different switching times. Switching times change dependent on operating time and application conditions.

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

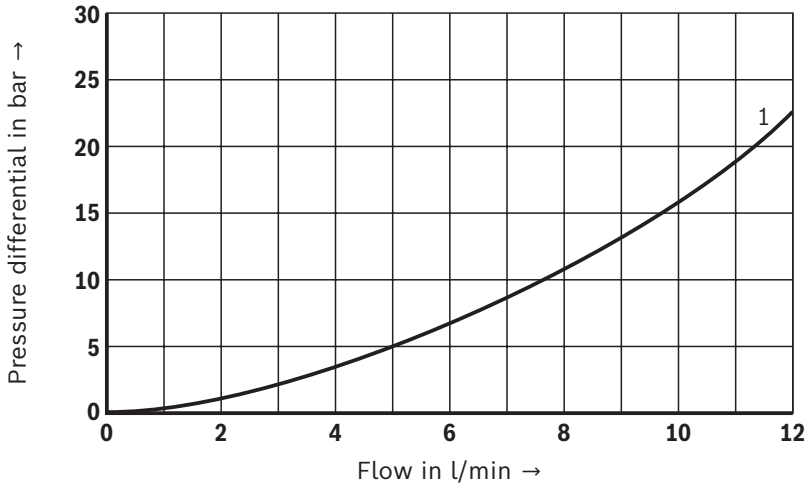


☞ **Notice:**
The performance limits were determined when the solenoids were at operating temperature, at 10% undervoltage and without tank preloading.

Characteristic curves

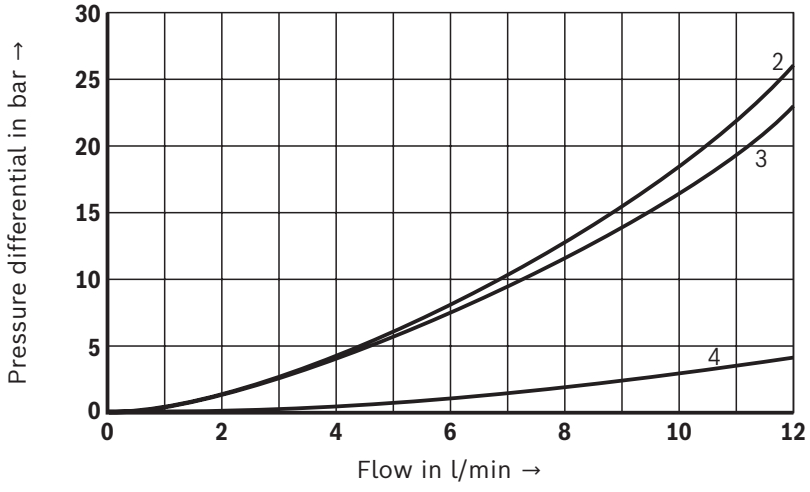
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Δp-q_V characteristic curves
3/2 directional seat valve



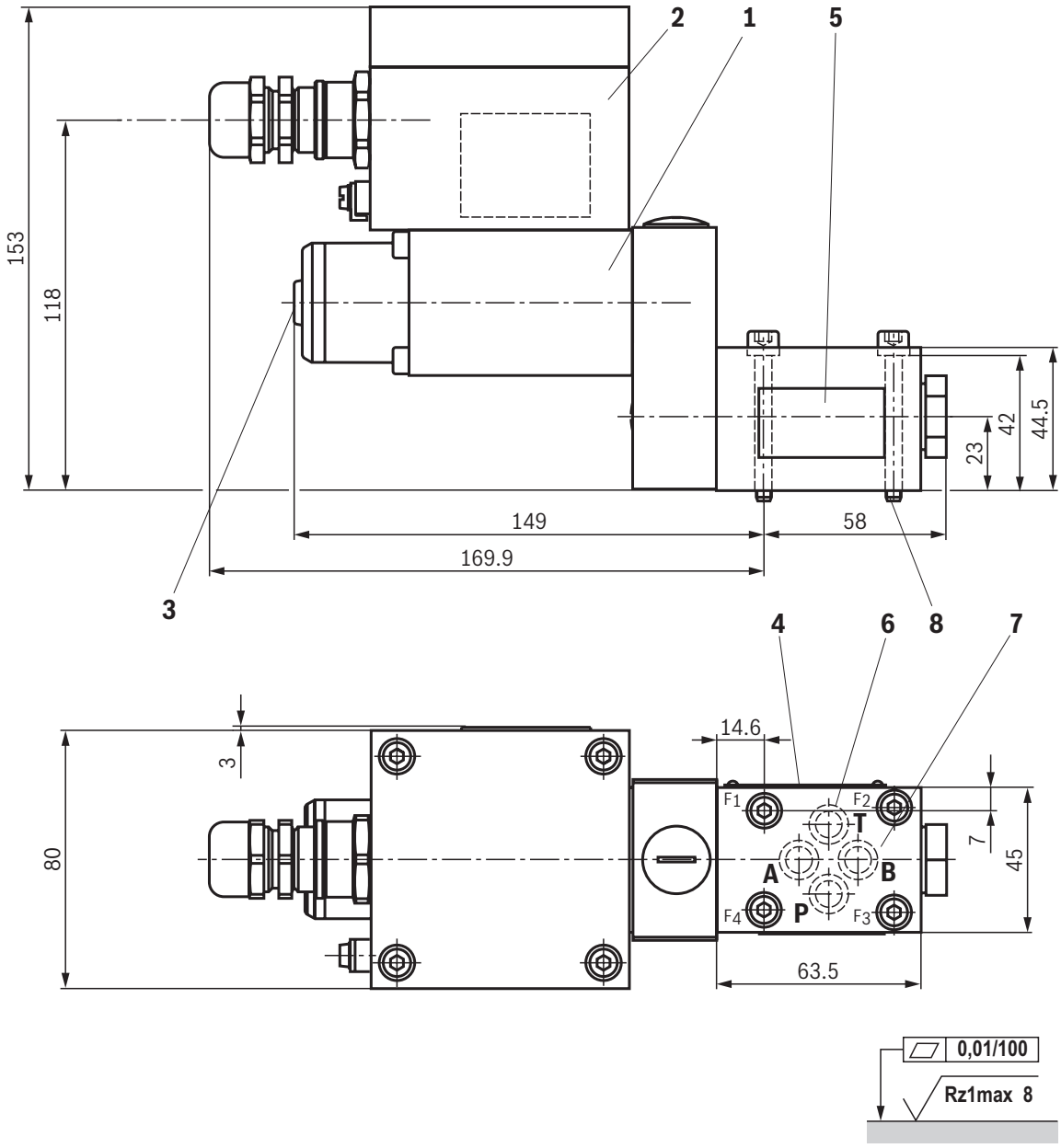
1 A → T, P → A

Δp-q_V characteristic curves
4/2 directional seat valve



2 A → T
3 P → A
4 P → B, B → T

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



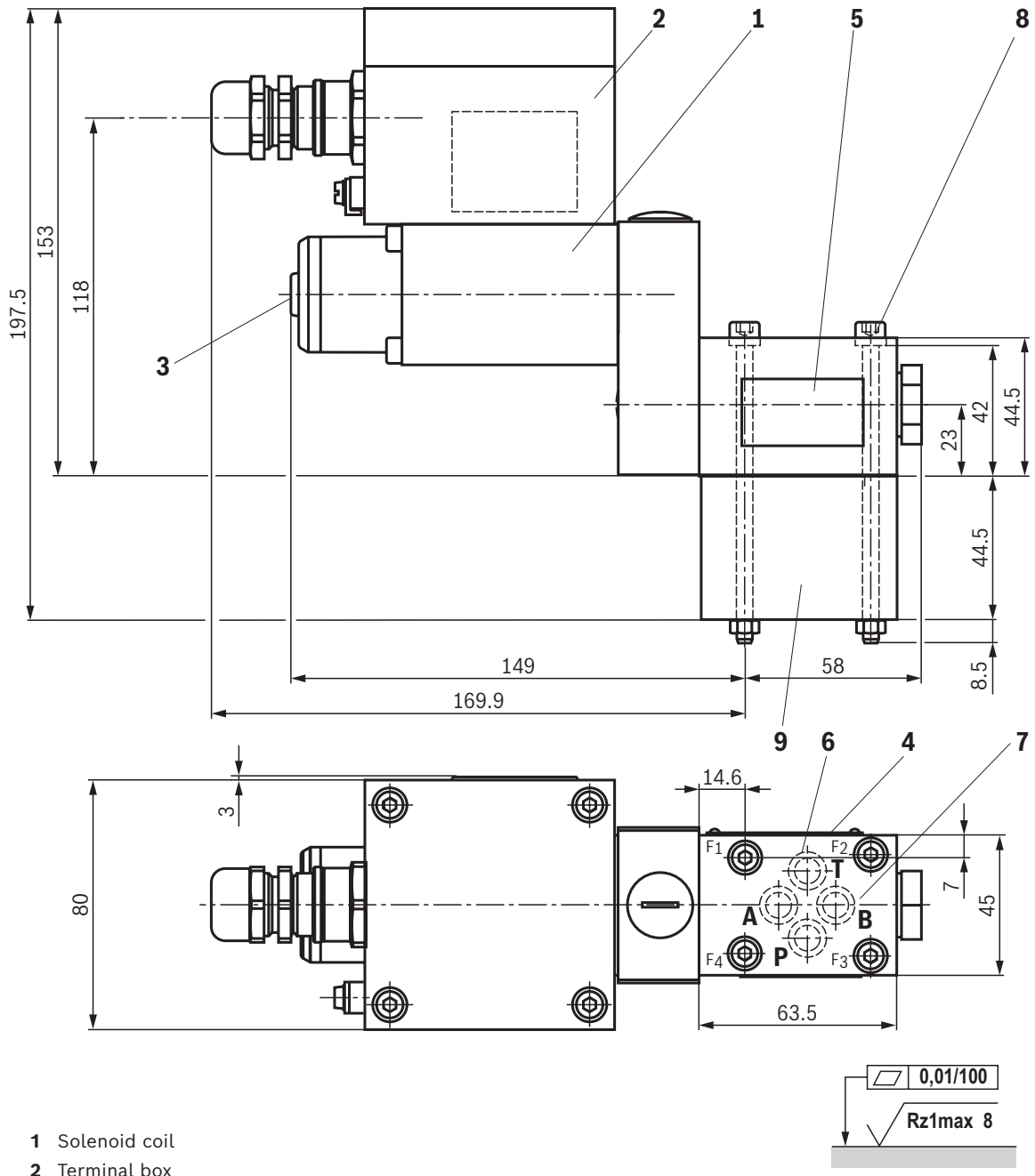
Required surface quality of the valve contact surface

1 Solenoid coil
2 Terminal box
3 Manual override "N"
4 Name plate
5 Name plate sticker
6 Identical seal rings for ports A, B, T, seal ring for port P
7 Porting pattern according to ISO 4401-03-02-0-05 (however, without locating hole)
8 **Valve mounting screws** (included in the scope of delivery) **4 hexagon socket head cap screws ISO 4762 - M5 x 50 - 10.9** (friction coefficient μ_{total} = 0.09 ... 0.14); Material no. **R913043758**

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

☞ **Notices:**
- 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.
- The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: 4/2 directional seat valve
(dimensions in mm)



Required surface quality of the valve contact surface

1 Solenoid coil
2 Terminal box
3 Manual override "N"
4 Name plate
5 Name plate sticker
6 Identical seal rings for ports A, B, T, seal ring for port P
7 Porting pattern according to ISO 4401-03-02-0-05 (however, without locating hole)
8 **Valve mounting screws** (included in the scope of delivery) **4 hexagon socket head cap screws ISO 4762 - M5 x 95 - 10.9** (friction coefficient μ_{total} = 0.09 ... 0.14); Material no. **R913051579**
9 Plus-1 subplate

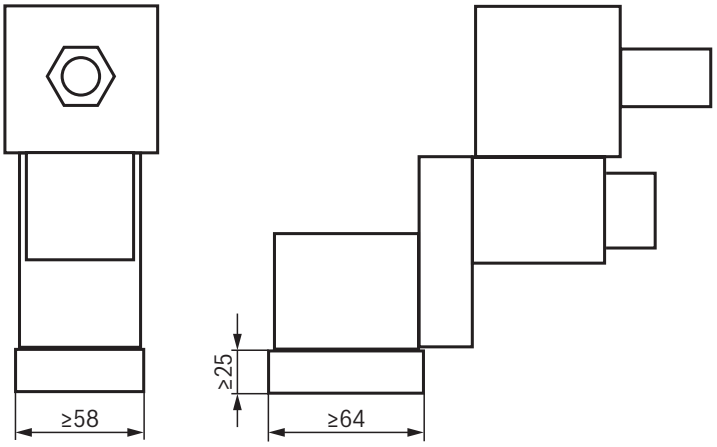
Subplates (separate order) with porting pattern according to ISO 4401-03-02-0-05, see data sheet 45100.

Notices:
- 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.
- The dimensions are nominal dimensions which are subject to tolerances.

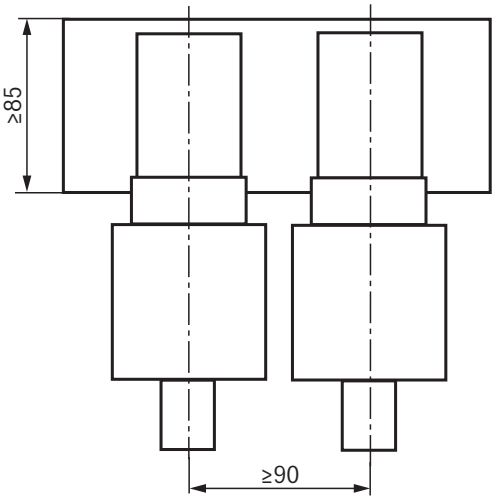
Installation conditions
(dimensions in mm)

	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	≥ 36.2 W/mK	
Minimum distance between the longitudinal valve axes	see drawing	

Individual assembly



Bank assembly

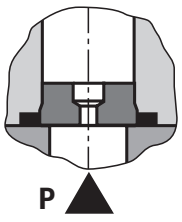


☞ **Notice:**
With regard to the hydraulic fluid temperature, observe the "Special conditions for safe use" on page 7.

Throttle insert

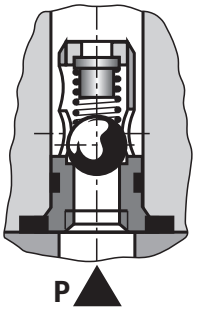
The use of a throttle insert is required when due to prevailing operating conditions, flows can occur during the switching processes, which exceed the performance limit of the valve.

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



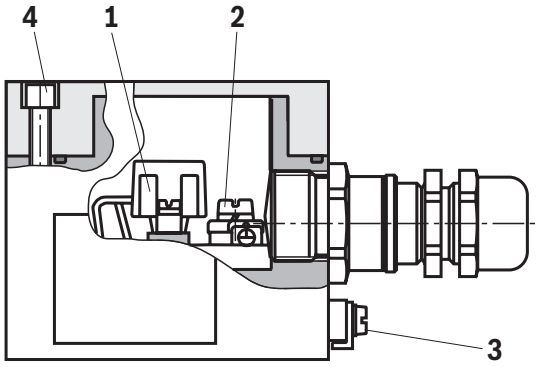
Check valve insert

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



Electrical connection

The type-examination tested valve solenoid is equipped with a terminal box and a type-tested cable and line entry. The connection is polarity-independent.

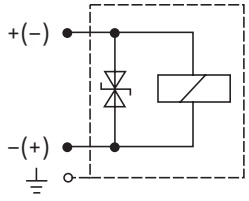


Properties of the connection terminals and mounting elements

Position	Function	Connectable line cross-section
1	Operating voltage connection	single-wire 0.75 ... 2.5 mm² finely stranded 0.75 ... 1.5 mm²
2	Connection for protective grounding conductor	single-wire max. 2.5 mm² finely stranded max. 1.5 mm²
3	Connection for potential equalization conductor	single-wire 4 ... 6 mm² finely stranded min. 4 mm²
4	Screws for cover	–

Cable gland		
Line diameter	mm	6.1 ... 11.7
Sealing		Outer sheath sealing

Connection line		
Line type		**non-armored** cables and lines (outer sheath sealing)
Temperature range	°C	–20 ... +110

Direct voltage, polarity-independent


☞ **Notice:**
Only use finely stranded conductors if they have pressed-on wire end ferrules.

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 41571	Maximum voltage value when switching off	Interference protection circuit
G24	24 VDC	0.542 A	630 mA	–90 V	Suppressor diode bi-directional

☞ **Notice:**
A fuse which corresponds to the rated current according to DIN 41571 and EN / IEC 60127 has to be connected upstream of every valve solenoid (max. 3 x I_{rated}).
The shut-off threshold of the fuse has to match the prospective short-circuit current of the supply source.
The short-circuit current of the supply source to be expected may amount to a maximum of 1500 A.
This fuse may only be installed outside the potentially explosive atmospheress 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.

General information

Seat valves can be used according to the 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. 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 (use a throttle insert for flow limitation, if necessary).

4 main ports:

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

Further information

▶ Subplates	Data sheet 45100
▶ Use of non-electrical hydraulic components in an explosive environment (ATEX)	Data sheet 07011
▶ Hydraulic fluids on mineral oil basis	Data sheet 90220
▶ Environmentally compatible hydraulic fluids	Data sheet 90221
▶ Directional seat valves, direct operated, with solenoid actuation	Operating instructions 22047-XD-B
▶ Information on available spare parts	www.boschrexroth.com/spc

Notes

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It must be remembered that our products are subject to a natural process of wear and aging.