

Directional seat valves, direct operated, with solenoid actuation

Type SED ...XN



- ▶ Size 10
- ▶ Component series 1X
- ▶ Maximum operating pressure 350 bar
- ▶ Maximum flow 40 l/min



ATEX units

For potentially explosive atmospheres



Information on explosion protection:

- ▶ Area of application in accordance with the Explosion Protection Directive 2014/34/EU: **II 3G; II 3D**
- ▶ Area of application according to technical rules EAC TR CU 012/2011: **II 3G; II 3D**
- ▶ Type of protection valve:
 - Ex h IIC T3 Gc X according to EN 80079-36
 - Ex h IIIC T140°C Dc X according to EN 80079-36
- ▶ Type of protection, solenoid coil:
 - Ex ec IIC T3 Gc according to EN 60079-7
 - Ex tc IIIC T140°C Dc according to EN 60079-31

Features

- ▶ 3/2 or 4/2-way version
- ▶ For intended use in potentially explosive atmosphere
- ▶ Porting pattern according to ISO 4401-05-04-0-05
- ▶ Wet-pin DC solenoids
- ▶ Safe switching also with longer standstill periods under pressure
- ▶ Solenoid coil rotatable by 90°
- ▶ Electrical connection with individual connection
- ▶ With manual override, optional

Contents

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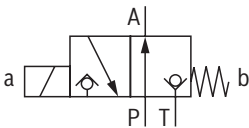
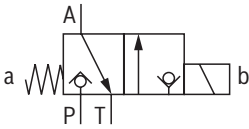
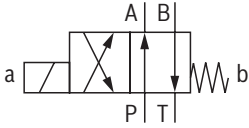
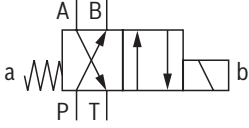
 **Notice:** The documentation version with which the product was supplied is valid.

Ordering code

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

01	Mineral oil	
02	3 main ports	3
	4 main ports	4
03	Seat valve	SED
04	Size 10	10

Symbols

05	Main ports	3	4	
		✓	-	UK
		✓	-	CK
		-	✓	D
		-	✓	Y

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

Voltage

09	Direct voltage 24 V	G24
10	With concealed manual override	N9
	Without manual override	no code

Explosion protection

11	"Not igniting", For details, see information on the explosion protection page 7	XN
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Electrical connection

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

Ordering code

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

13	Without check valve insert, without throttle insert	no code
	Throttle Ø 0.8 mm	B08
	Throttle Ø 1.0 mm	B10
	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
	Throttle Ø 2.5 mm	B25

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

14	NBR seals	no code
	FKM seals	V

**Notice:**

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

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

Directional valves of the type SED are direct operated directional seat valves with solenoid actuation.

They control start, stop and direction of flow.

Directional valves basically comprise the housing (1), the solenoid (2), the valve seats (7) and (11) and the control spool (4).

The manual override (6) allows for the switching of the valve without solenoid energization.

For unobjectionable functioning, the hydraulic system has to be bled properly.

Basic principle

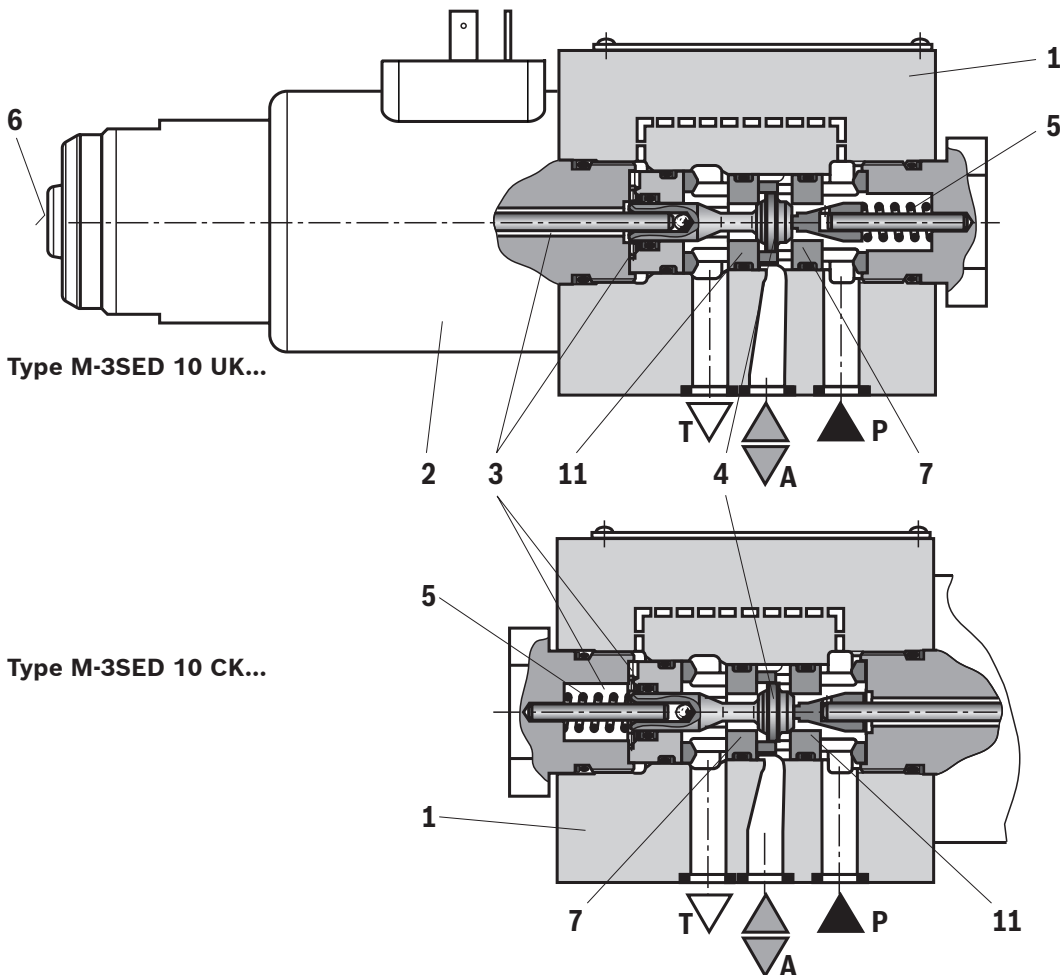
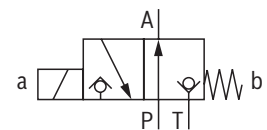
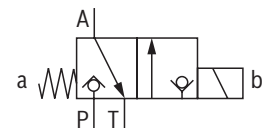
The initial position of the valve (normally open "UK" or normally closed "CK") is determined by the arrangement

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), ports P, A and T can be loaded with the maximum operating pressure (350 bar), and the flow can be directed in both directions (see symbols).

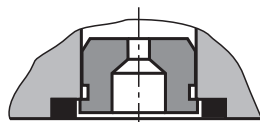
In the initial position, the control spool (4) is pressed onto the seat (11) by the spring (5); in spool position, it is pressed onto the seat (7) by the solenoid (2).

The flow is blocked.

Seat valves can be used according to the symbols as well as the assigned operating pressures and flows (see performance limits, page 8).

**Symbol "UK"****Symbol "CK"****Throttle insert**

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



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 (5) holds the control spool (4) on the seat (11). Port P is blocked, and A is connected to T. Apart from that, one control line is connected from A to the large area of the control spool (8), which is thus unloaded to the tank. The pressure applied via P now pushes the ball (9) onto the seat (10). Now, P is connected to B, and A to T.

► Transition position:

When the main valve is 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 subplate has a "positive spool overlap".

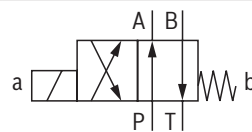
Notice:

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.

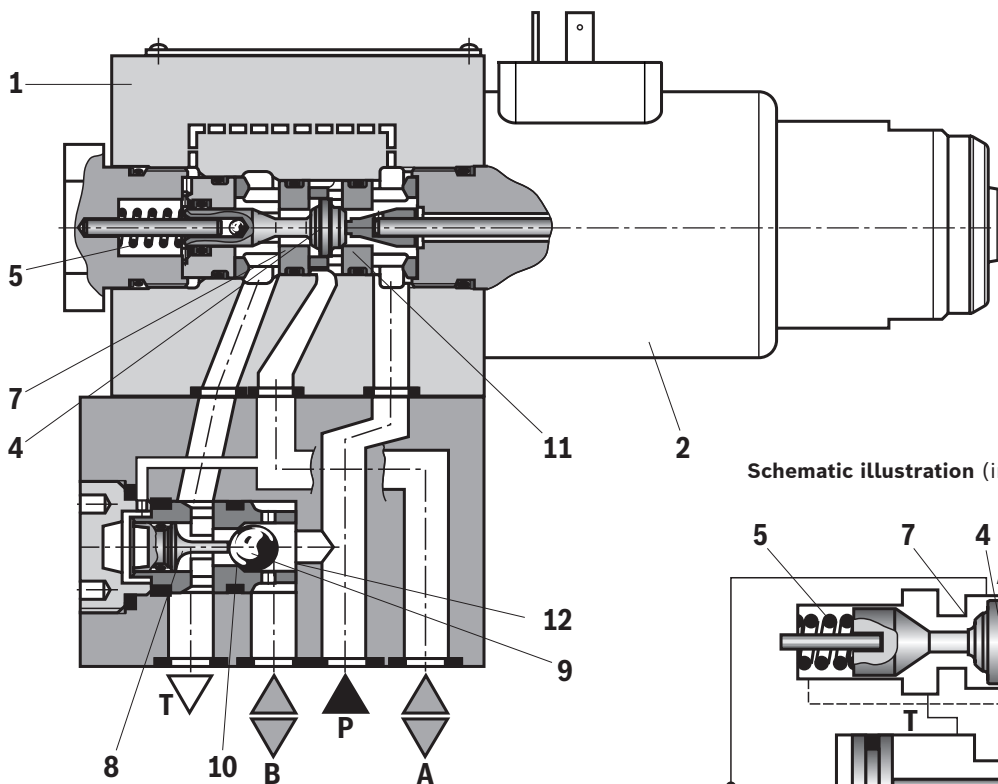
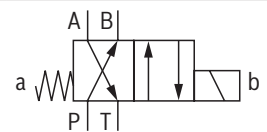
The use of the Plus-1 subplate and the seat arrangement offer the following options:

Symbols

"D"

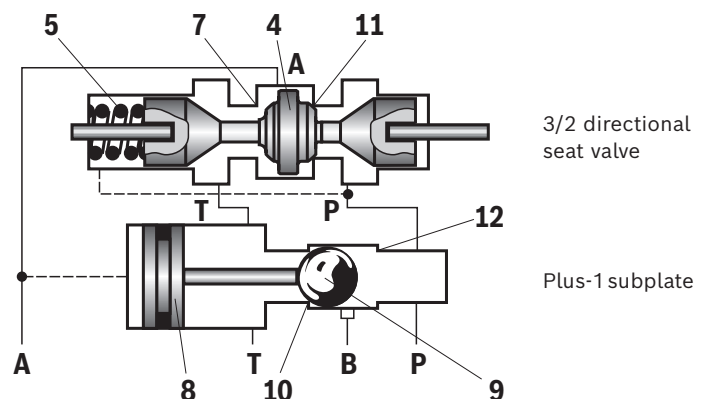


"Y"



Type M-4SED 10 Y...

Schematic illustration (initial position)



Technical data

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

General		
Installation position		any
Ambient temperature range	°C	–20 ... +50 ¹⁾
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 3.3
	► 4/2 directional seat valve	kg 4.7
Surface protection		galvanized
Maximum surface temperature	°C	See information on explosion protection, page 7

Hydraulic		
Maximum operating pressure	bar	See table page 8
Maximum flow	l/min	40
Hydraulic fluid		See table below
Hydraulic fluid temperature range	°C	–20 ... +80 (NBR seals) ²⁾
		–15 ... +80 (FKM seals) ²⁾
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 ³⁾

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

**Important information on hydraulic fluids:**

- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- 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⁾ Maximum 40 °C when using the cable sets DS2513, see page 16

²⁾ Observe the "Special conditions for safe use" on page 7.

³⁾ 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.
Available filters can be found at www.boschrexroth.com/filter.

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)
Rated current	mA	950
Switching times according to ISO 6403 ⁴⁾	► ON	ms 40 ... 80
	► OFF	ms 10 ... 25
Maximum switching frequency	Hz	1
Maximum switch-off voltage peaks Solenoid	V	500, suitable damping by user required
Nominal power at ambient temperature 20 °C	W	23
Maximum power with 1.1 x nominal voltage and ambient temperature 20 °C	W	28.8
Protection class according to EN 60529		IP65 (With correctly installed electrical connection)

Information on explosion protection – Directive 2014/34/EU		
Area of application	II 3G	II 3D
Type of protection of valve EN 80079-36 5)	Ex h IIC T3 Gc X	Ex h IIIC T140 °C Dc X
Type of protection valve solenoid according to EN 60079-7 / EN 60079-31	Ex ec IIC T3 Gc	Ex tc IIIC T140 °C Dc
Maximum surface temperature 6; 7)	°C 140	
Temperature class	T3	–
Type examination certificate solenoid	BVS 12 ATEX E 062 X	
Information on explosion protection – Technical rules EAC TR CU 012/2011		
Area of application	II 3G	II 3D
Type of protection marking of valve	2Ex nA II T3 Gc X	Ex tc IIIC T140°C Dc X
Maximum surface temperature 6; 7)	°C 140	
Temperature class	T3	–
Certificate of conformity	№ TC RU C-DE.ГБ08.В.02161	

⁴⁾ The switching times were determined at a hydraulic fluid temperature of 40 °C and a viscosity of 46 cSt. Deviating hydraulic fluid temperatures can result in different switching times. Switching times change dependent on operating time and application conditions.

⁵⁾ Ex h: structural safety c according to EN 80079-37.

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

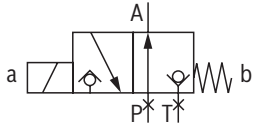
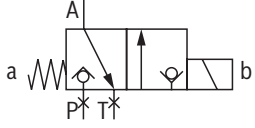
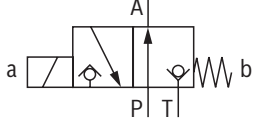
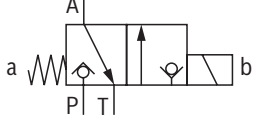
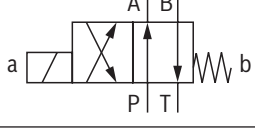
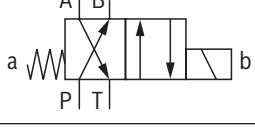
⁷⁾ The transfer temperature from the connector of the valve solenoid to the mating connector is 100 °C at an ambient temperature of 50 °C



Special application conditions for safe application:

- Connection lines must be installed in a strain-relieved way. The first mounting point must be within 150 mm of the mating connector.
- The valve is to be installed so that no impact stresses > 4 J can take effect.
- 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.
- Maximum admissible dust layer thickness 5 mm
- Maximum hydraulic fluid temperature:
In case of bank assembly, as long as only one solenoid is energized at a time, and in case of individual assembly +80 °C
In case of bank assembly when more than one solenoid is energized at a time +65 °C
- The maximum temperature of the surface of the valve jacket is 110 °C. This has to be considered when selecting the connection cable and/or contact of the connection cable with the surface of the jacket is to be prevented.

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

	Symbol		Comment	Operating pressure in bar				Flow in l/min
				P	A	B	T	
2-way circuit	UK		With 2/2-way circuits, port P or T must be closed.	350	350		350	40
	CK			350	350		350	40
3-way circuit	UK			350	350		350	40
	CK			350	350		350	40
4-way circuit (flow only possible in the direction of arrow)	D		3/2 directional valve (symbol "UK") in connection with Plus-1 subplate: $p_P \geq p_A \geq p_B \geq p_T$	350	350	350	$p_P/p_A/p_B$ -40	40
	Y		3/2 directional valve (symbol "CK") in connection with Plus-1 subplate: $p_P \geq p_A \geq p_B \geq p_T$	350	350	350	$p_P/p_A/p_B$ -40	40



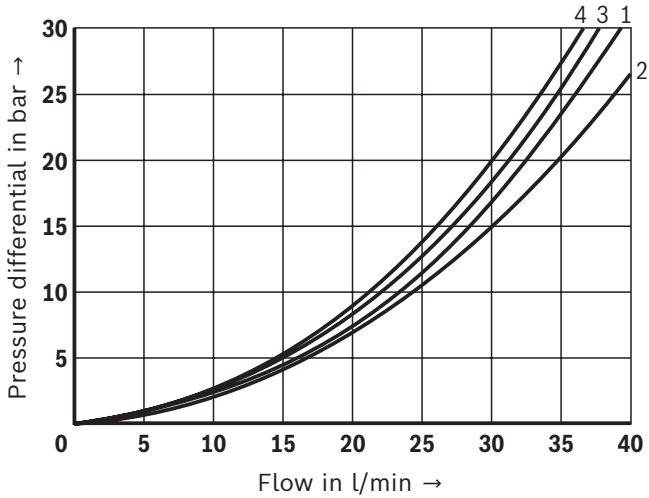
Notices:

- ▶ Please observe the general information, page 16.
- ▶ The performance limits were determined when the solenoids were at operating temperature, at 10% undervoltage and without tank preloading.

Characteristic curves

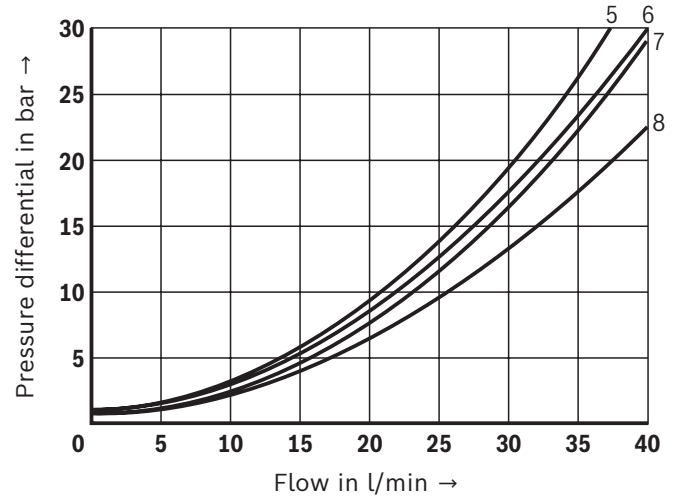
(measured with HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$)

Δp - q_v characteristic curves
3/2 directional seat valve



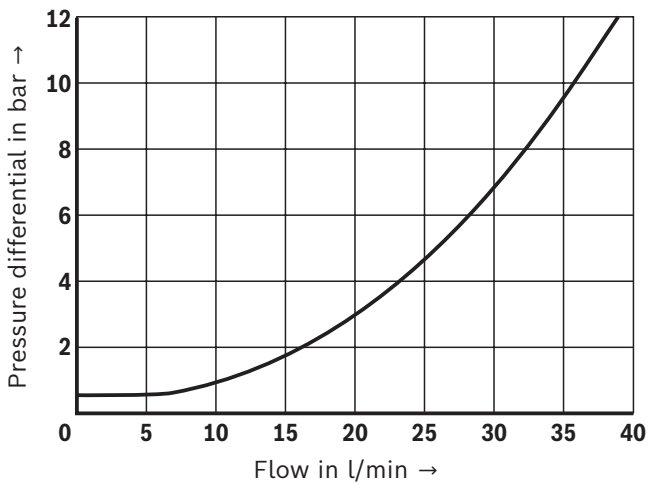
- 1 P → A (CK)
- 2 A → T (CK)
- 3 P → A (UK)
- 4 A → T (UK)

Δp - q_v characteristic curves
4/2 directional seat valve

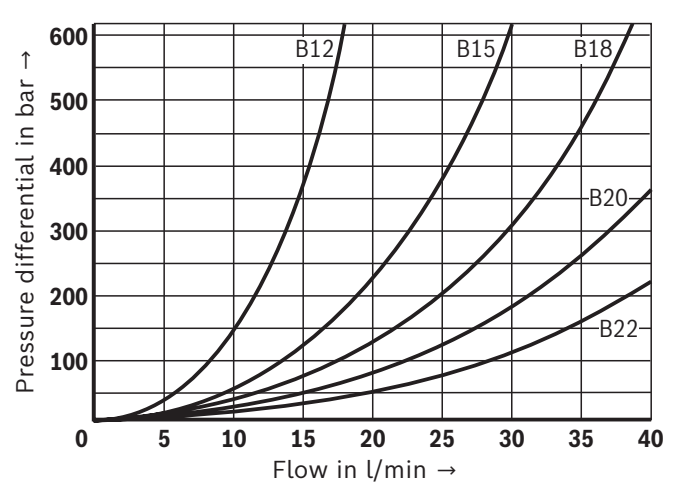


- 5 A → T
- 6 P → A
- 7 B → T
- 8 P → B

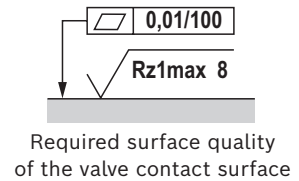
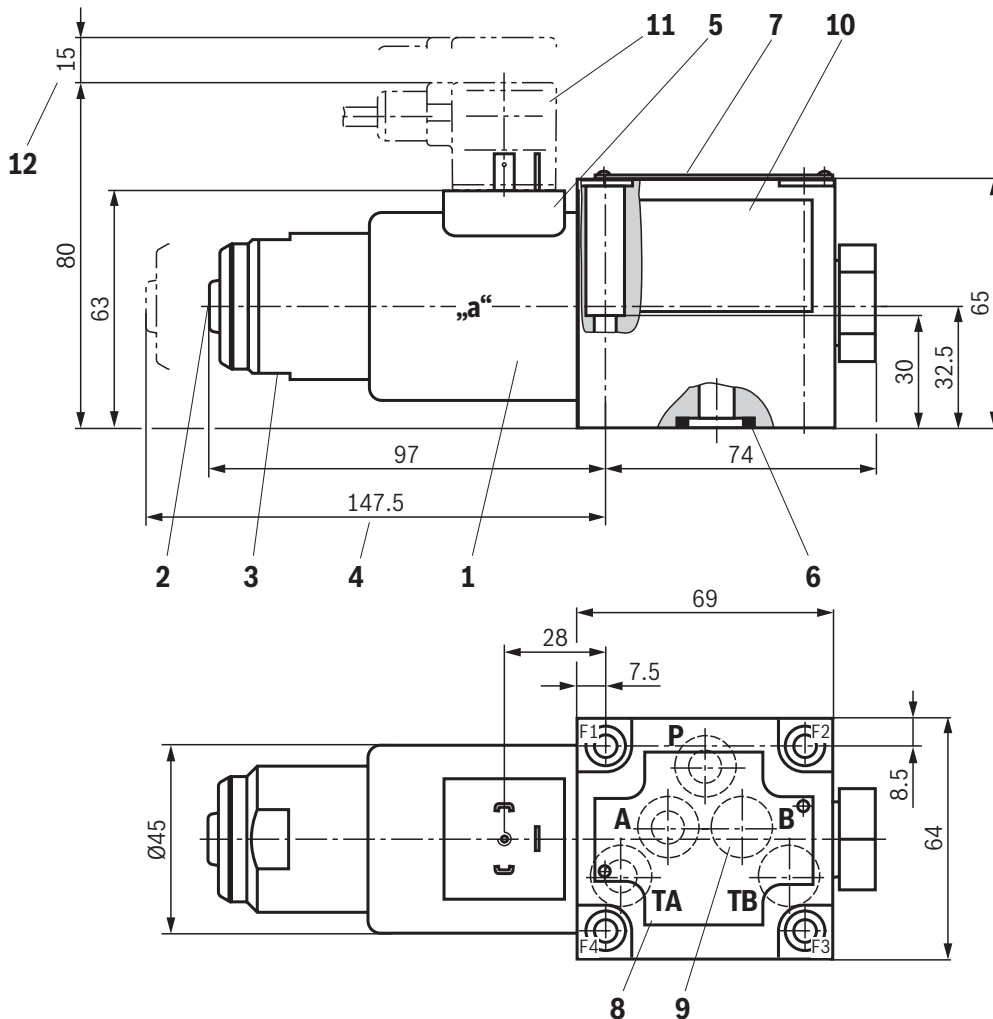
Δp - q_v characteristic curves
Check valve insert



Δp - q_v characteristic curves
Throttle insert



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



- 1 Solenoid coil
- 2 Concealed manual override "N9"
- 3 Mounting nut with double edge, wrench size 32
- 4 Space required to remove the solenoid coil
- 5 Plug-in connector according to EN 175301-803, design A (cable sets, separate order, see page 16 and data sheet 08006)
- 6 Identical seal rings for ports A, B, T, seal ring for port P
- 7 Name plate
- 8 Porting pattern according to ISO 4401-05-04-0-05
- 9 Ports B and TB are designed as blind counterbore
- 10 Name plate sticker
- 11 Cable set DS2513 **without** circuitry for connector "K4" (separate order, see page 16 and data sheet 08006)
- 12 Space required to remove the cable set

Valve mounting screws (separate order)

Only use valve mounting screws with the subsequently listed thread diameters and strength properties. Observe the screw-in depth.

4 hexagon socket head cap screws

ISO 4762 - M6 x 40 - 10.9

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

Tightening torque $M_A = 12.5\text{ Nm} \pm 10\%$,

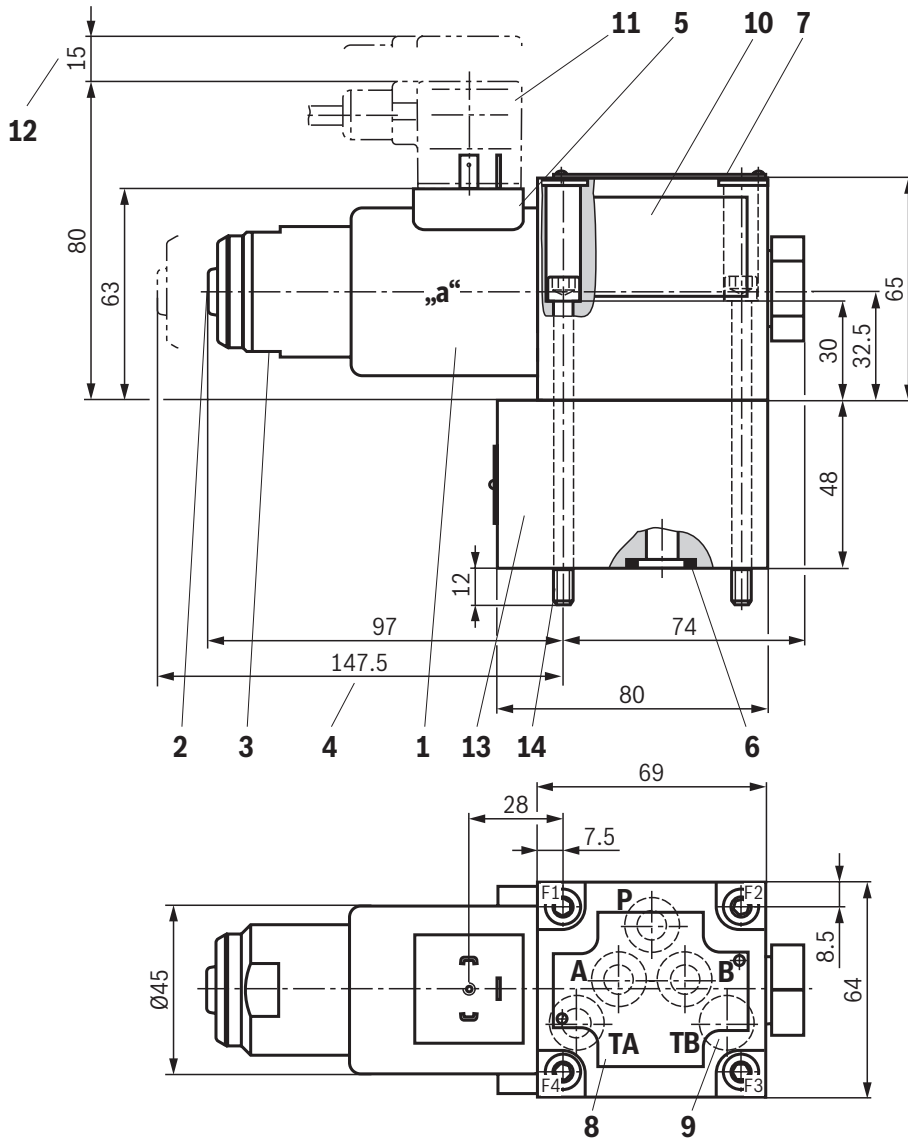
Material no. **R913051533**

Subplates (separate order) with porting pattern according to ISO 4401-05-04-0-05, 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.
- In this data sheet and deviating from ISO 4401, port T is referred to with TA and port T1 with TB.
- The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: 4/2 directional seat valve – version "D"
(dimensions in mm)



0,01/100
Rz1max 8
Required surface quality
of the valve contact surface

- 1 Solenoid coil
- 2 Concealed manual override "N9"
- 3 Mounting nut with double edge, wrench size 32
- 4 Space required to remove the solenoid coil
- 5 Plug-in connector according to EN 175301-803, design A (cable sets, separate order, see page 16 and data sheet 08006)
- 6 Identical seal rings for ports A, B, T, seal ring for port P
- 7 Name plate
- 8 Porting pattern according to ISO 4401-05-04-0-05
- 9 Port TB is designed as blind counterbore
- 10 Name plate sticker
- 11 Cable set DS2513 **without** circuitry for connector "K4" (separate order, see page 16 and data sheet 08006)
- 12 Space required to remove the cable set
- 13 Plus-1 subplate
- 14 Valve mounting screws

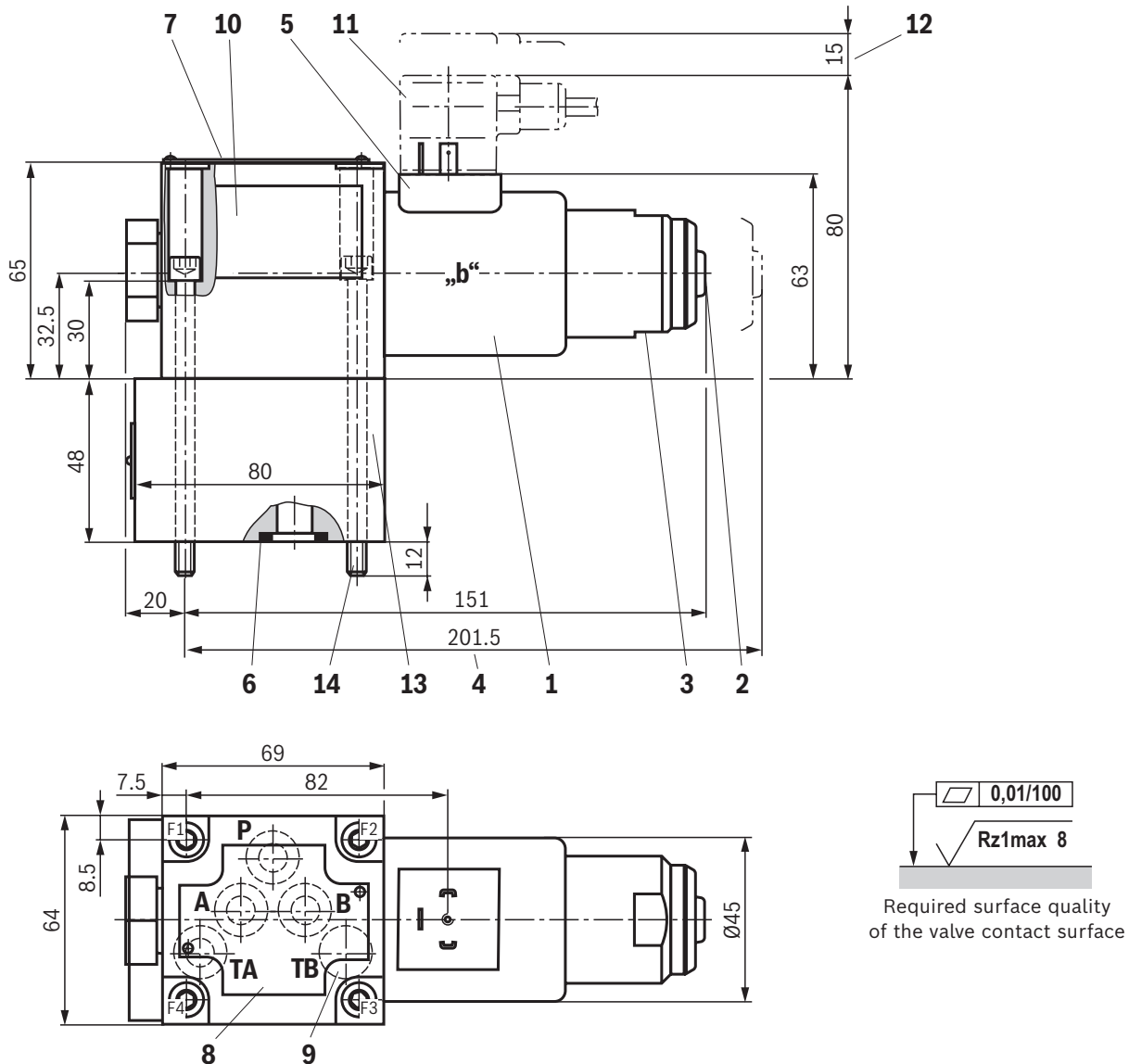
Valve mounting screws (included in the scope of delivery)
4 hexagon socket head cap screws
ISO 4762 - M6 x 90 - 10.9
(friction coefficient $\mu_{\text{total}} = 0.09 \dots 0.14$);
Tightening torque $M_A = 12.5 \text{ Nm} \pm 10\%$,
Material no. **R913048089**

Subplates (separate order) with porting pattern according to ISO 4401-05-04-0-05, 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.
- In this data sheet and deviating from ISO 4401, port T is referred to with TA and port T1 with TB.
- The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: 4/2 directional seat valve, version "Y"
(dimensions in mm)



- 1 Solenoid coil
- 2 Concealed manual override "N9"
- 3 Mounting nut with double edge, wrench size 32
- 4 Space required to remove the solenoid coil
- 5 Plug-in connector according to EN 175301-803, design A (cable sets, separate order, see page 16 and data sheet 08006)
- 6 Identical seal rings for ports A, B, T, seal ring for port P
- 7 Name plate
- 8 Porting pattern according to ISO 4401-05-04-0-05
- 9 Port TB is designed as blind counterbore
- 10 Name plate sticker
- 11 Cable set DS2513 **without** circuitry for connector "K4" (separate order, see page 16 and data sheet 08006)
- 12 Space required to remove the cable set
- 13 Plus-1 subplate
- 14 Valve mounting screws

Valve mounting screws (included in the scope of delivery)

4 hexagon socket head cap screws

ISO 4762 - M6 x 90 - 10.9

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

Tightening torque $M_A = 12.5 \text{ Nm} \pm 10\%$,

Material no. **R913048089**

Subplates (separate order) with porting pattern according to ISO 4401-05-04-0-05, see data sheet 45100.



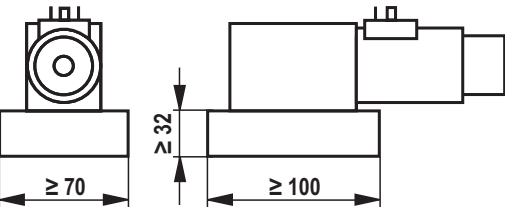
Notices:

- 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.
- In this data sheet and deviating from ISO 4401, port T is referred to with TA and port T1 with TB.
- The dimensions are nominal dimensions which are subject to tolerances.

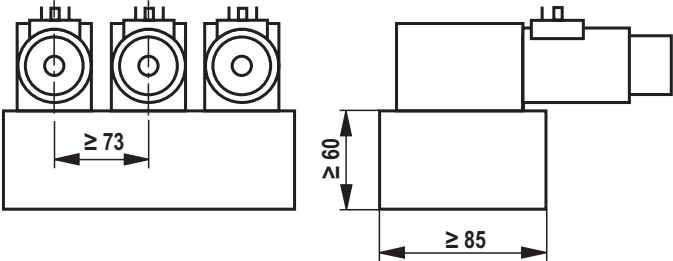
Installation conditions
(dimensions in mm)

	Individual assembly	Bank assembly
Subplate dimensions	Minimum dimensions Length ≥ 100, width ≥ 70, height ≥ 32	Minimum cross-section height ≥ 60, width ≥ 85
Thermal conductivity of the subplate	≥ 36.2 W/mK	
Minimum distance between the longitudinal valve axes	≥ 73	

Individual assembly



Bank assembly



 Notice:

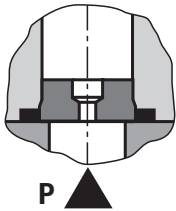
With regard to the hydraulic fluid temperature, observe the "Special conditions for safe use" on page 7.

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.

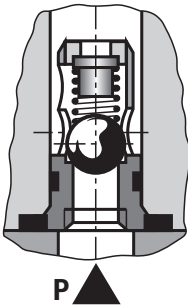
Examples:

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



Check valve insert

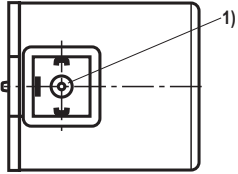
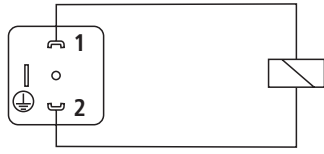
The check valve insert allows a free flow from P to A and closes A to P.



Electrical connection

The type-examination tested valve solenoid of the valve is equipped with an electrical connection according to the following table. The electrical connection of the solenoid is polarity-independent.

Electrical connections and coil connection combinations

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

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

Requirements for cable sets and mating connectors not listed under "Accessories"			
Temperature rating (cables, connectors, seals)	°C	≤-30 ... ≥+100	
Minimum wire cross-section	mm²	0.75	
Protection class according to EN 60529		IP65	



Notice:

All three contacts of the solenoid coil (1, 2 and grounding) must be properly connected (3-wire line)

Over-current fuse and switch-off voltage peaks

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



Notice:

A fuse which corresponds to the rated current according to DIN 41571 and EN / IEC 60127 has to be connected upstream of every valve solenoid (max. $3 \times I_{rated}$).
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 atmospheres or must be of an explosion-proof design. When inductivities are switched off, voltage peaks result which may cause faults in the connected control electronics. The voltage peak must be damped by a suitable external circuitry. We recommend a circuitry with a suppressor diode with a limitation voltage of approx. 50 V.

General information

Seat valves can be used according to the symbols as well as the assigned operating pressures and flows (see performance limits, 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).

Plus-1 subplate:

- ▶ If the Plus-1 subplate (4/2 directional function) is used, the following lower operating values have to be observed:
 $p_{\min} = 8 \text{ bar}$, $q_v > 3 \text{ l/min}$.
- ▶ The ports P, A, B and T are clearly specified according to their tasks. They must not be exchanged or closed.
- ▶ Port T must always be connected.
- ▶ Observe the pressure level and pressure distribution.
- ▶ The flow is only admissible in the direction of arrow.

Accessories (separate order)

Mating connectors and cable sets

Item 1)	Designation	Version	Short designation	Material number	Data sheet
11	Cable sets; for ATEX valves with "K4" connector, 2-pole + PE, design A (large cubic connector) 2)	3.0 m	DS2513...ATEX	R901200418	08006
		5.0 m		R901200460	
		12.0 m		R901200582	

1) See dimensions on page 10 ... 13.

2) Maximum ambient temperature range 40 °C.
Not admissible for bank assembly with simultaneous power supply of several solenoids.

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 22045-XN-B |
| ▶ Selection of filters | www.boschrexroth.com/filter |
| ▶ Information on available spare parts | www.boschrexroth.com/spc |

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