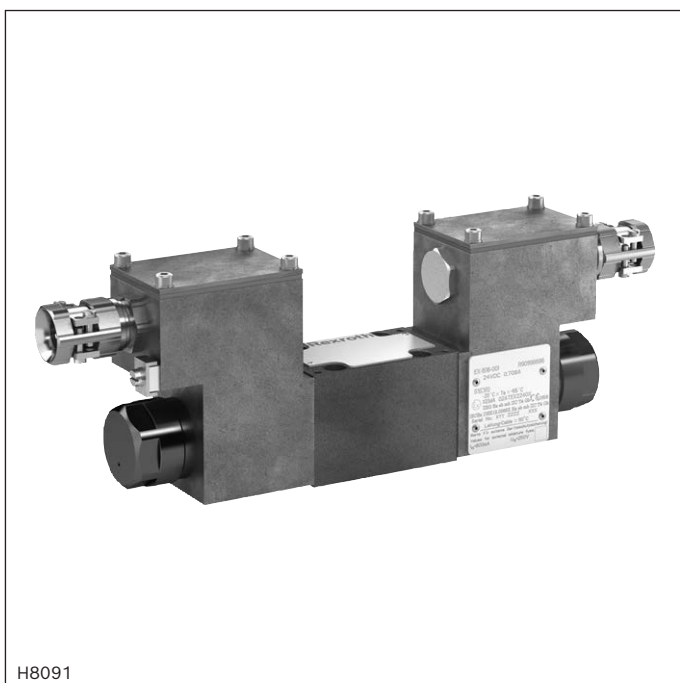


# Proportional directional valve, direct operated without electrical position feedback

## Type WRA ...XE



- ▶ Size 6
- ▶ Component series 2X
- ▶ Maximum operating pressure 315 bar
- ▶ Maximum flow 22 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 2G**
- ▶ Type of protection valve:  
Ex h IIC T4 Gb X according to EN 80079-36
- ▶ Type of protection valve solenoids:  
Ex eb mb IIC T4 Gb according to  
EN 60079-7 / EN 60079-18
- ▶ Valve solenoid certified according to IECEx

### Features

- ▶ 4/2 or 4/3-way version
- ▶ For intended use in potentially explosive atmosphere
- ▶ Controlling the direction and size of a flow
- ▶ For subplate mounting
- ▶ Porting pattern according to ISO 4401-03-02-05 (but without locating hole)
- ▶ Spring-centered control spool
- ▶ Seawater-resistant
- ▶ Wet-pin DC solenoids
- ▶ Solenoid coil is rotatable by 90°
- ▶ Electrical connection as individual connection with Cable gland

### Contents

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### Ordering code

01	02	03	04	05	06	07	08	09		
4WRA	6		-	2X	/	G24	XE	J	/	V

01	Proportional directional valve, for external control electronics	4WRA
02	Size 6	6
03	Symbols; possible versions, see below	

#### Rated flow

04	6 l/min	07
	10 l/min	15
	18 l/min	30
05	Component series 20 ... 29 (20 ... 29: unchanged installation and connection dimensions)	2X

#### Supply voltage of the control electronics

06	Direct voltage 24 V	G24
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#### Explosion protection

07	"Increased safety" For details, see information on the explosion protection page 6	XE
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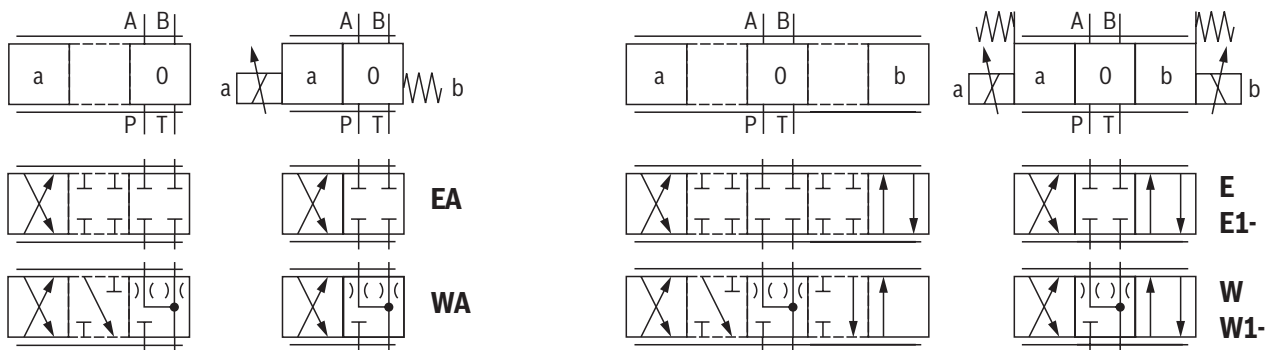
#### Corrosion resistance (outside)

08	Seawater-resistant, galvanized	J
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#### Seal material (observe compatibility of seals with hydraulic fluid used, see page 5)

09	NBR seals	M
	FKM seals	V

### Symbols



#### With symbol E1- and W1-:

P → A:  $q_{V \max}$     B → T:  $q_{V/2}$   
 P → B:  $q_{V/2}$     A → T:  $q_{V \max}$

#### Notice:

- ▶ In spool position "0", symbols W, W1-, and WA have a connection from A → T and B → T with approx. 3% of the relevant nominal cross-section.
- ▶ Representation according to DIN ISO 1219-1.
- ▶ Hydraulic interim positions are shown by dashes.

## Function, section

Valves Type 4WRA ...XE are direct operated proportional directional valves in plate design. Operation is effected by means of proportional solenoids for potentially explosive atmospheres. The solenoids are actuated by external control electronics.

### Set-up

The valve basically consists of:

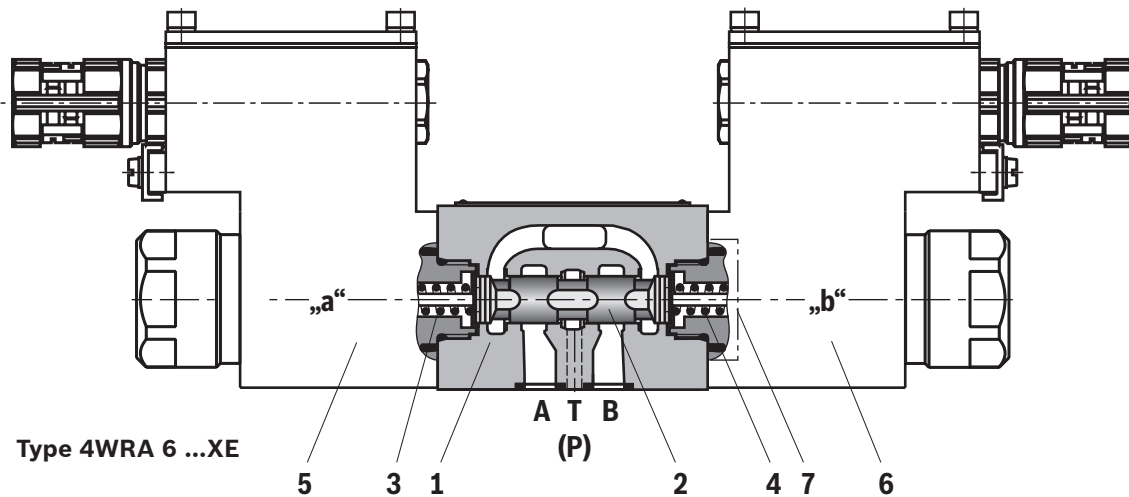
- ▶ Housing (1) with connection surface
- ▶ Control spool (2) with compression springs (3 and 4)
- ▶ Solenoids (5 and 6) with central thread

### Functional description

- ▶ With de-energized solenoids (5 and 6), central position of the control spool (2) by compression springs (3 and 4)
- ▶ Direct actuation of the control spool (2) by energization of a proportional solenoid e.g. control of solenoid "b" (6)
  - Movement of the control spool (2) to the left proportionally to the electrical input signal
  - Connection from P → A and B → T via orifice-type cross-sections with progressive flow characteristic
- ▶ De-excitation of the solenoid (6)
  - The compression spring (3) brings the control spool (2) back into the central position

### Notice:

Regarding the 4/3-way version of the valves, only one solenoid may be actuated at a time.



### Valve with 2 spool positions (type 4WRA 6 .A...)

The function of this valve version basically corresponds to the valve with three spool positions. The 2 spool position valves are, however, only equipped with solenoid "a" (5). Instead of the 2nd proportional solenoid, there is a plug screw (7).

### Notice:

The tank line must not be allowed to run empty. With corresponding installation conditions, a preload valve (preload pressure approx. 2 bar) must be installed.

**Technical data**

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

<b>General</b>		
Installation position	Any, preferably horizontal	
Storage temperature range	°C +5 ... +40	
Maximum storage time	Years 1	
Ambient temperature range	°C -20 ... +60	
Weight	▶ 3 spool positions	kg 4.4
	▶ 2 spool positions	kg 2.7
Surface protection	galvanized	
Maximum surface temperature	°C See information on explosion protection, page 6	

<b>Hydraulic</b>		
Maximum operating pressure	▶ Ports P, A, B	bar 315
	▶ Port T	bar 210
Rated flows $q_{v \text{ rated}}$ with $\Delta p = 10$ bar	l/min	6; 10; 18
Maximum flow	l/min	22
Hydraulic fluid		see table page 5
Hydraulic fluid temperature range	°C	-20 ... +80 (NBR seals)
		-15 ... +80 (FKM seals)
Viscosity range	mm <sup>2</sup> /s	20 ... 380 (preferably 30 ... 46)
Maximum admissible degree of contamination of the hydraulic fluid; cleanliness class according to ISO 4406 (c)		Class 17/15/12 <sup>1)</sup>
Hysteresis	%	≤ 6
Response sensitivity	%	≤ 1
Range of inversion	%	≤ 2

<sup>1)</sup> 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](http://www.boschrexroth.com/filter).

## Technical data

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

Hydraulic fluid	Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils	HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	ISO 15380	90221
		HEES		
	▶ Soluble in water	HEPG	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	ISO 12922	90222
		HFDU (ester base)		
		HFDR		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	ISO 12922	90223



### Important notices 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.

### ▶ Flame-resistant – containing water:

- Due to increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30% as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended – if possible specific to the installation – to back up the return flow pressure in ports T to approx. 20% of the pressure differential at the component.
- Dependent on the hydraulic fluid used, the maximum ambient and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

**Technical data**

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

Electric	
Voltage type	Direct voltage
Type of signal	analog
Maximum current per solenoid	A 1.03
Duty cycle	% 100

Information on explosion protection	
Area of application of Directive 2014/34/EU	II 2G
Type of protection of valve according to EN 80079-36 <sup>2)</sup>	Ex h IIC T4 Gb X
Type of protection valve solenoid according to EN 60079-7 / EN 60079-18	Ex eb mb IIC T4 Gb
Maximum surface temperature <sup>3)</sup>	°C 120
Temperature class	T4
Type examination certificate solenoid	KEMA 02ATEX2240 X
"IECEX Certificate of Conformity" solenoid	IECEX DEK 12.0068X

<sup>2)</sup> Ex h: structural safety c according to EN 80079-37.

<sup>3)</sup> 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 case of bank assembly, only one solenoid of all valves may be energized at a time.
- ▶ In case of valves with two solenoids, maximally one of the solenoids may be energized at a time.
- ▶ Only direct voltage or a pulse-width modulated signal with a pulse voltage ≤ 28 V and a frequency ≥ 160 Hz ... maximum 500 Hz may be used for operation.

Control electronics <sup>4)</sup>	
Amplifier module for the control of explosion-proof proportional directional valves 4WRA...XE, 3DREP 6...XE and 4WRZ...XE	VT-MSPA2-200-1X/V0/0 according to data sheet 30228-200
Module for monitoring and limiting the solenoid currents with proportional valves	VT-MUXA2-2-1X/V0/1A according to data sheet 30290

<sup>4)</sup> A monitoring circuit is to be provided for the monitoring of the solenoid current. We recommend operating the valves with the assemblies described herein.

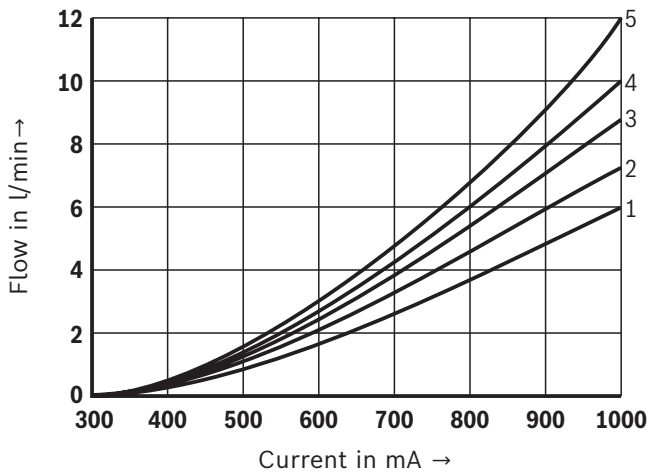
**Notice:**

The control electronics must be operated outside the potentially explosive atmosphere!

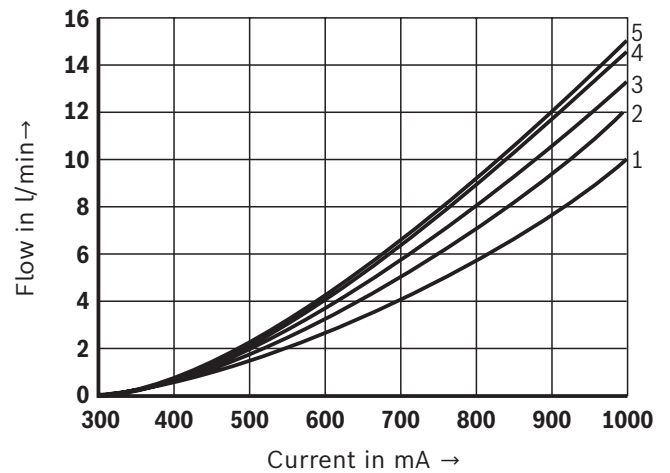
### Characteristic curves

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

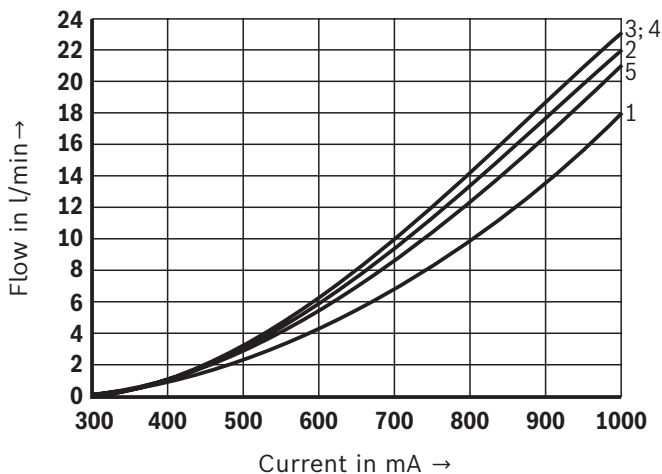
Version "07"



Version "15"



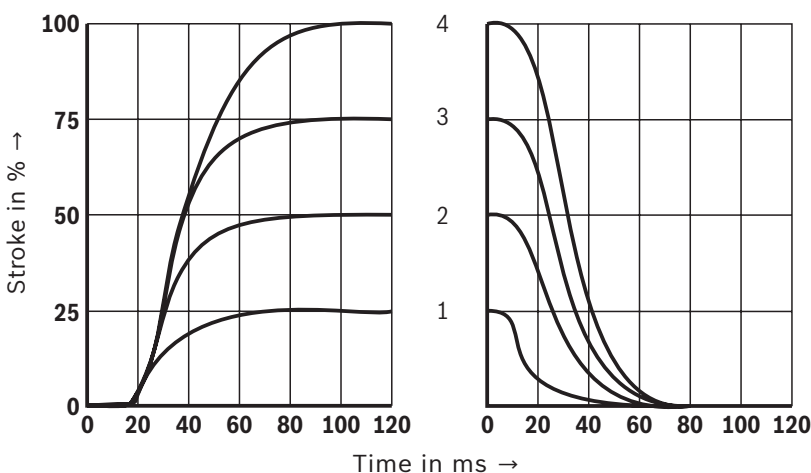
Version "30"



- 1  $\Delta p = 10 \text{ bar constant}$
- 2  $\Delta p = 20 \text{ bar constant}$
- 3  $\Delta p = 30 \text{ bar constant}$
- 4  $\Delta p = 50 \text{ bar constant}$
- 5  $\Delta p = 100 \text{ bar constant}$

$\Delta p$  = valve pressure differential according to DIN 24311 (inlet pressure minus load pressure and minus return flow pressure)

### Transition function with stepped electric input signals

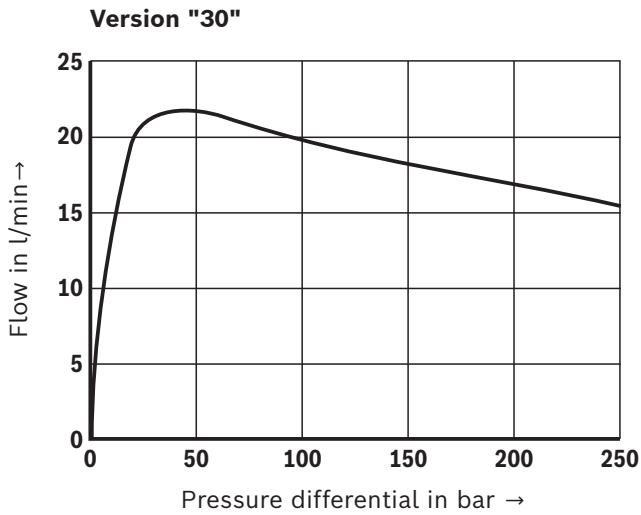
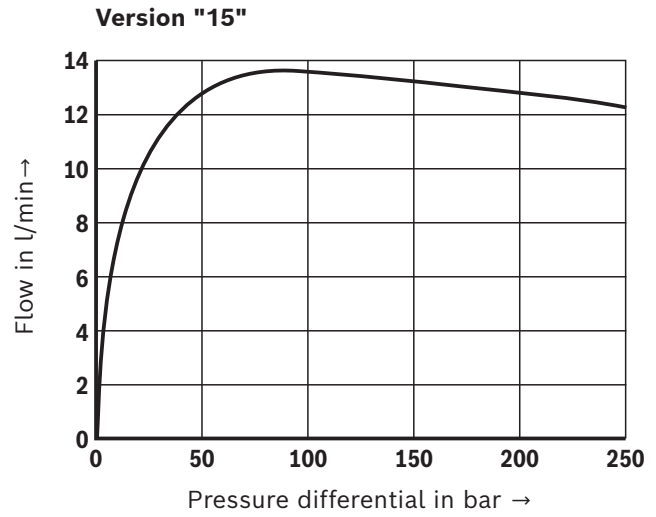
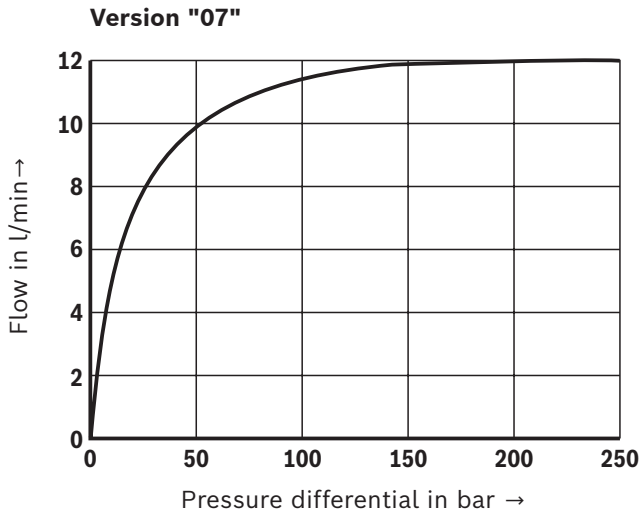


	Change of input signal in %
1	0 → 25 → 0
2	0 → 50 → 0
3	0 → 75 → 0
4	0 → 100 → 0

Measured with pilot pressure  $p_{ST} = 10 \text{ bar}$

### Performance limits

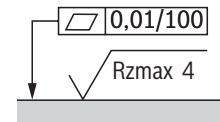
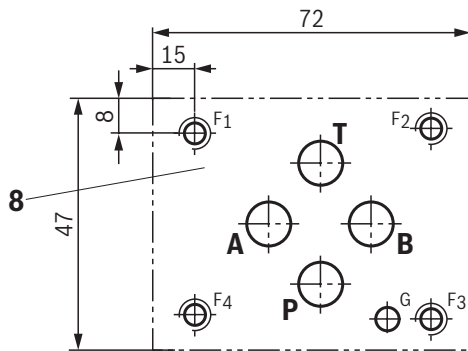
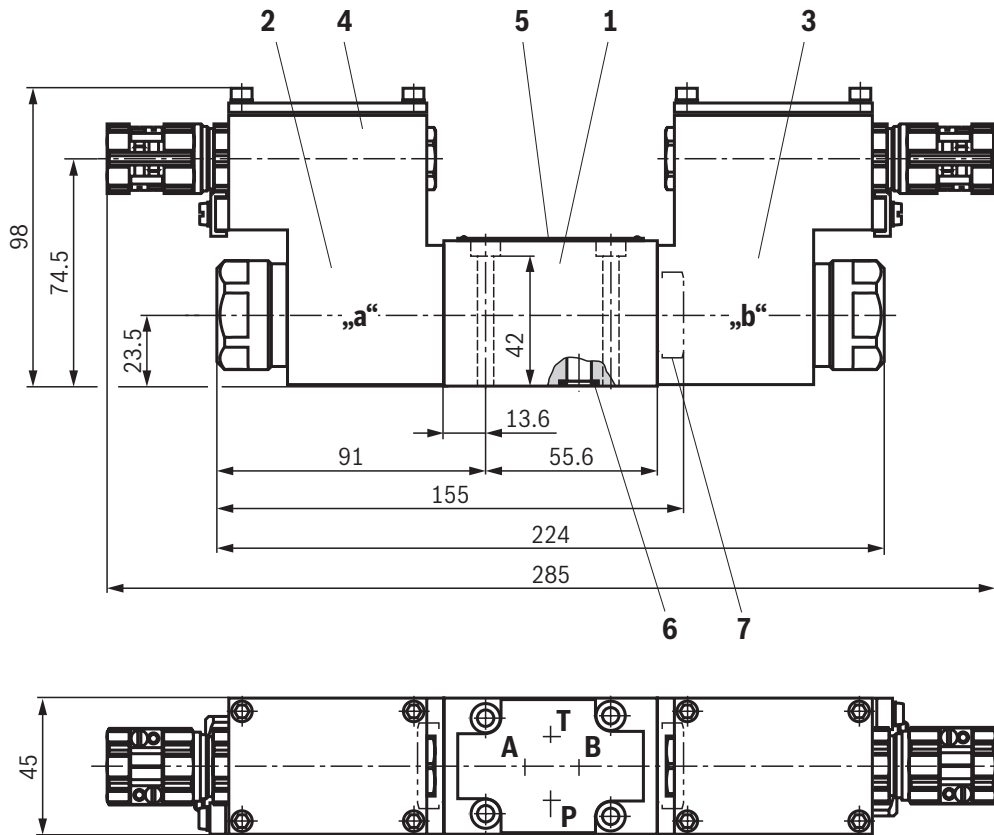
(measured with HLP46,  $\vartheta_{oil} = 40 \pm 5 \text{ }^\circ\text{C}$ )





## Dimensions

(dimensions in mm)



Required surface quality of the valve contact surface

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

**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 - M5 x 50 - 10.9**

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

Tightening torque  $M_A = 7 \text{ Nm} \pm 10\%$ ,

Material no. **R913043758**

**Notice:**

Subplates are no components in the sense of Directive 2014/34/EU and can be used after the manufacturer of the overall system has conducted an assessment of the risk of ignition.

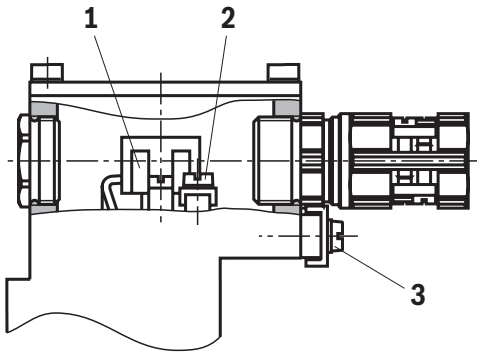
The "G...J3" versions are free from aluminum and/or magnesium and galvanized.

- 1 Valve housing
- 2 Proportional solenoid "a"
- 3 Proportional solenoid "b"
- 4 Terminal box
- 5 Name plate
- 6 Identical seal rings for A, B, P and T
- 7 Plug screw for valve with one solenoid (2 spool positions, version EA or WA)
- 8 Porting pattern according to ISO 4401-03-02-0-05 (however, without locating hole)

## Electrical connection

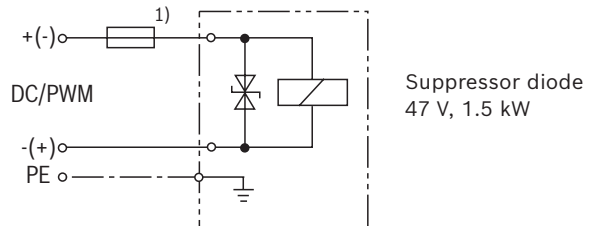
The type-examination tested valve solenoid of the valve is equipped with one terminal box and a type-tested cable entry.

The connection is polarity-independent.



### Notice:

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



1) Recommended pre-fuse characteristics medium time-lag according to DIN 41571, 1.25 A.

## Properties of the connection terminals and mounting elements

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

### Cable gland

Type approval	II 2G Ex e IIC Gb
Threaded connection	M20 x 1.5
Protection class according to EN 60529	IP66 (With correctly installed electrical connection)
Line diameter	mm 7 ... 10.5
Sealing	Outer sheath sealing

### Connection line

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

### 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.

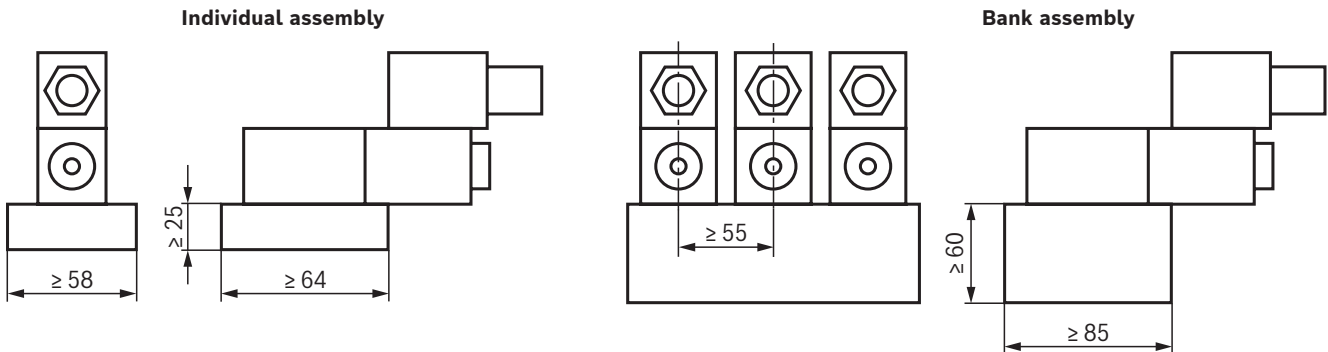
### Notice:

Only use finely stranded conductors if they have pressed-on wire end ferrules.

## Installation conditions

(dimensions in mm)

	Individual assembly	Bank assembly
Subplate dimensions	Minimum dimensions Length $\geq 64$ , width $\geq 58$ , height $\geq 25$	Minimum cross-section Height $\geq 60$ , width $\geq 85$
Thermal conductivity of the subplate (referred to 300 °C)	$\geq 36.2$ W/mK	
Minimum distance between the longitudinal valve axes	$\geq 55$	



**Notice:**

Observe the "Special application conditions for safe application" on page 6.

## Further information

- ▶ Subplates
- ▶ Hydraulic fluids on mineral oil basis
- ▶ Environmentally compatible hydraulic fluids
- ▶ Flame-resistant, water-free hydraulic fluids
- ▶ Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC)
- ▶ Proportional directional valve, direct operated, without electrical position feedback
- ▶ Selection of filters
- ▶ Information on available spare parts

Data sheet 45100

Data sheet 90220

Data sheet 90221

Data sheet 90222

Data sheet 90223

Operating instructions 29055-XE-B

[www.boschrexroth.com/filter](http://www.boschrexroth.com/filter)

[www.boschrexroth.com/spc](http://www.boschrexroth.com/spc)

## Notes

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