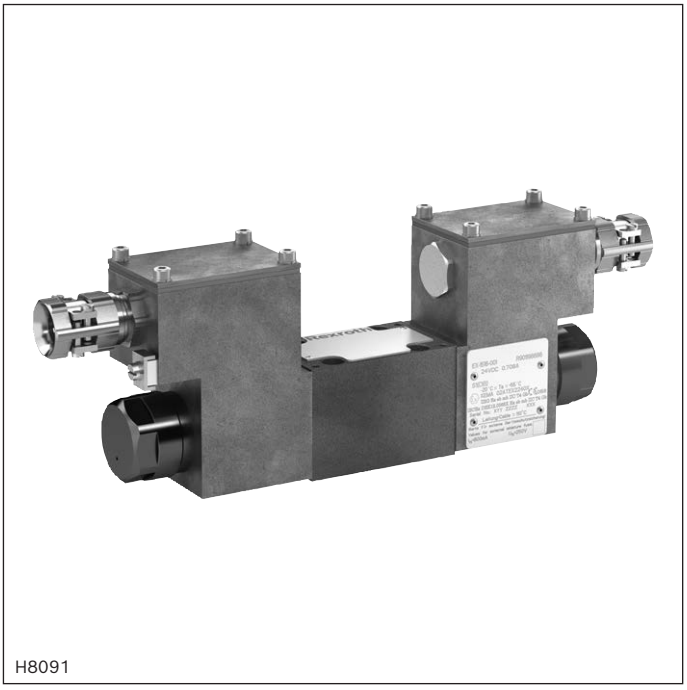
RE 29055-XE
Edition: 2021-05
Replaces: 2019-09
RA78494041_AB

rexroth
A Bosch Company

Proportional directional valve, direct operated without electrical position feedback

Type 4WRA ...XE


H8091

- Size 6
- Component series 2X
- Maximum operating pressure 315 bar
- Maximum flow 22 l/min

CE

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; II 2D**
- Type of protection valve:
  - Ex h IIC T4 Gb X according to EN 80079-36
  - Ex h IIIC T115°C Db X according to EN 80079-36
- Type of protection, solenoid coil:
  - Ex eb mb IIC T4 Gb according to EN 60079-7 / EN 60079-18
  - Ex tb IIIC T115°C Db according to EN 60079-31
- Solenoid coil 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
- Wet-pin DC solenoids
- Solenoid coil is rotatable by 90°
- Electrical connection as individual connection with cable gland

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

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Ordering code

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

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**

Explosion protection

07	"Increased safety"	**XE**
	For details, see information on the explosion protection page 6	

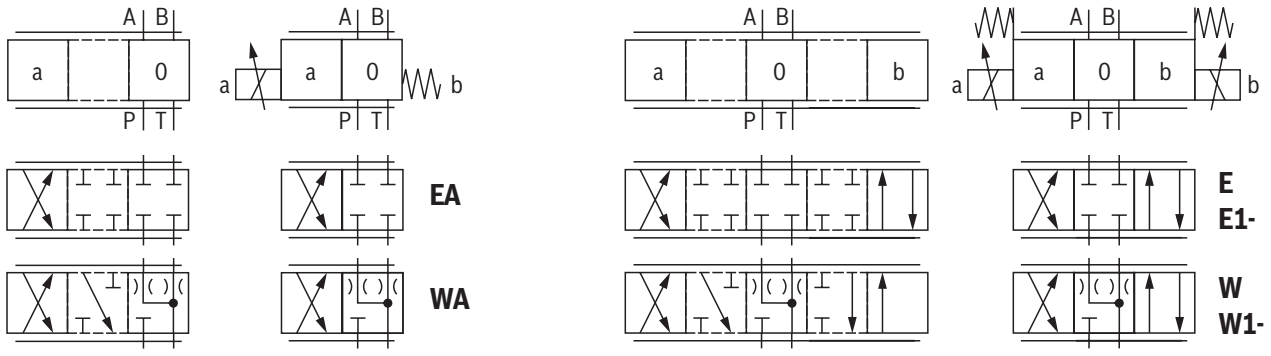
Corrosion resistance (outside)

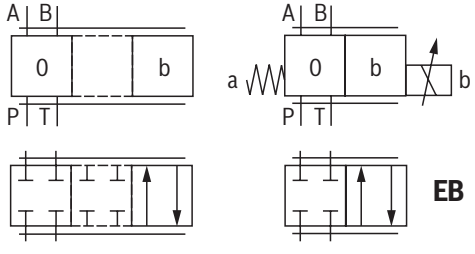
08	Galvanized	**J**

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.

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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

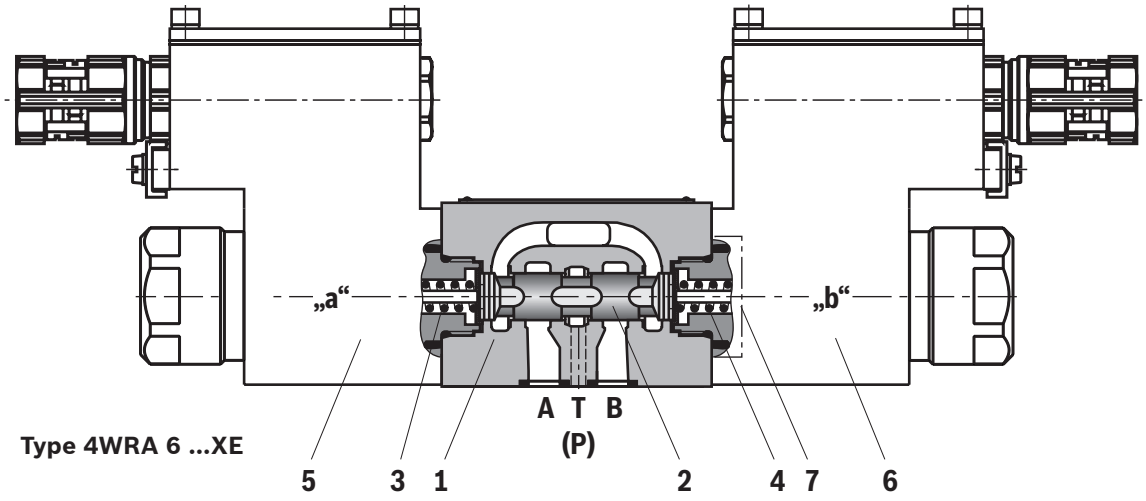
The valve basically consists of:

- 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.



Type 4WRA 6 ...XE

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.

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

General			
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

Hydraulic			
Maximum operating pressure	▶ Ports P, A, B	bar	315
	▶ Port T	bar	210
Rated flows $q_{v\ rated}$ with Δp = 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^2/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 [1]
Hysteresis		%	≤ 6
Response sensitivity		%	≤ 1
Range of inversion		%	≤ 2

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

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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	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

☞ **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.
- **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.

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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

Control electronics [2]	
Valve amplifier for proportional valves without electrical position feedback; maximum current limitation 1 A	VT-MSPA2-2X/A5/1A0/000 according to data sheet 30232-01
Module for monitoring and limiting the solenoid currents with proportional valves	VT-MUXA2-2-1X/V0/1A according to data sheet 30290

Information on explosion protection			
Area of application according to Directive 2014/34/EU		II 2G	II 2D
Type of protection of valve according to EN 80079-36 [3]		Ex h IIC T4 Gb X	Ex h IIIC T115°C Db X
Maximum surface temperature [4]	°C	115	
Temperature class		T4	–
Type of protection solenoid coil according to EN 60079-7 / EN 60079-18 / EN 60079-31		Ex eb mb IIC T4 Gb	Ex tb IIIC T115°C Db
Type examination certificate, solenoid coil		BVS 20 ATEX E 009 X	
"IECEx Certificate of Conformity" for solenoid coil		IECEx BVS 20.0007X	

[2] A monitoring circuit is to be provided for the monitoring of the solenoid current. We recommend operating the valves with the assemblies described herein. The valve amplifier and the monitoring module may only be installed outside the potentially explosive atmosphere.

[3] Ex h: structural safety c according to EN 80079-37.

[4] Surface temperature > 50 °C, provide contact protection.

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

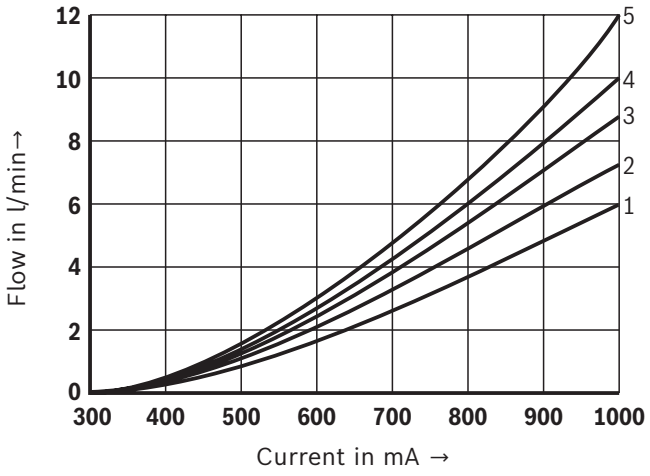
- Connection lines must be installed in a strain-relieved way. The first mounting point must be within 150 mm of the cable and line entry.
- In case of bank assembly, only one solenoid of all valves may be energized at a time.
- In case of valves with two solenoids, maximally one of the solenoids may 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.
- The maximum temperature of the surface of the valve jacket is 115 °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.

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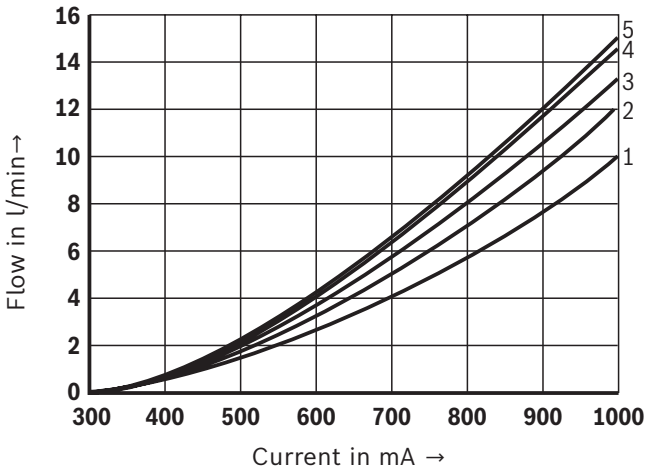
Characteristic curves

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

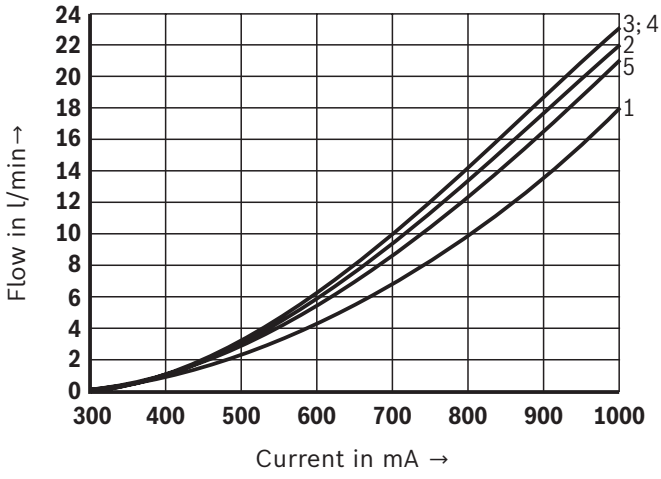
Version "07"



Version "15"



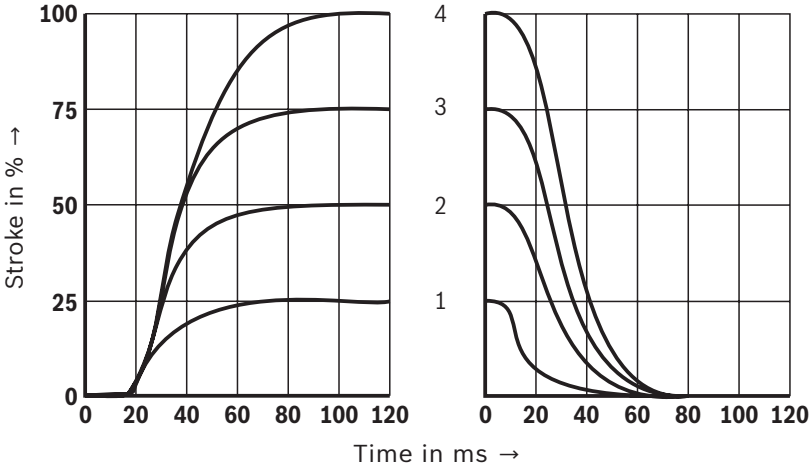
Version "30"



1 ***Δp*** = 10 bar constant
2 ***Δp*** = 20 bar constant
3 ***Δp*** = 30 bar constant
4 ***Δp*** = 50 bar constant
5 ***Δp*** = 100 bar constant

Δp = 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

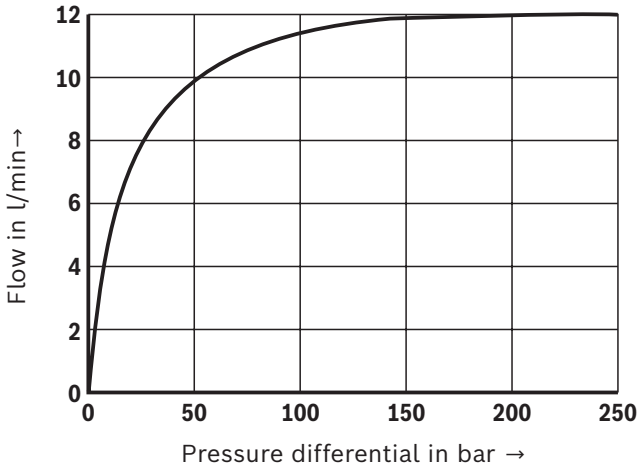
Measured with pilot pressure p_{ST} = 10 bar

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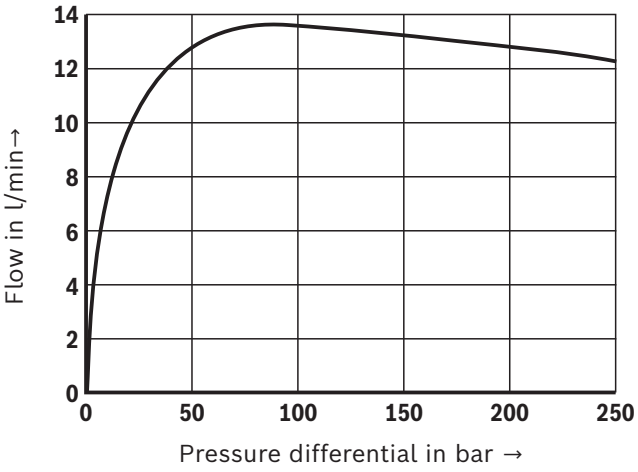
Performance limits

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

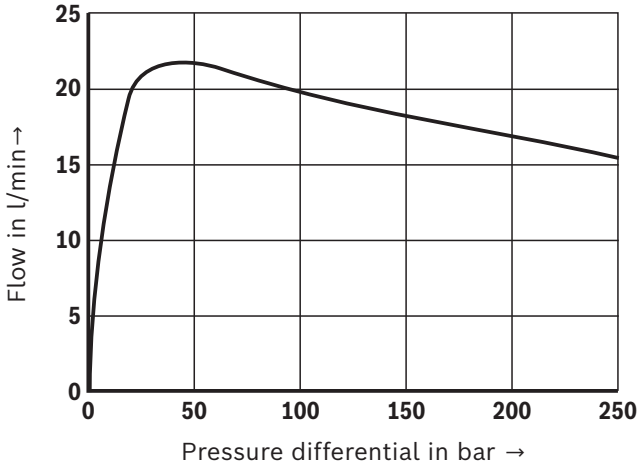
Version "07"



Version "15"

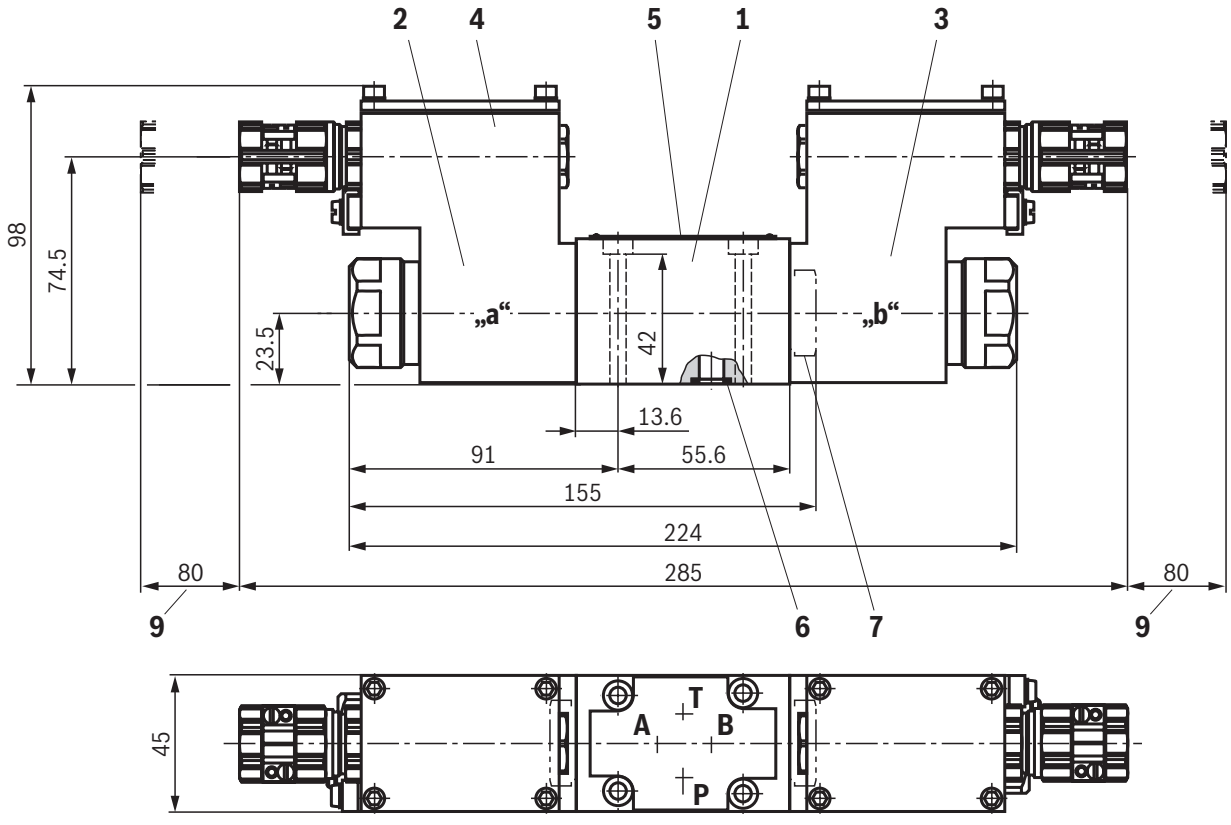


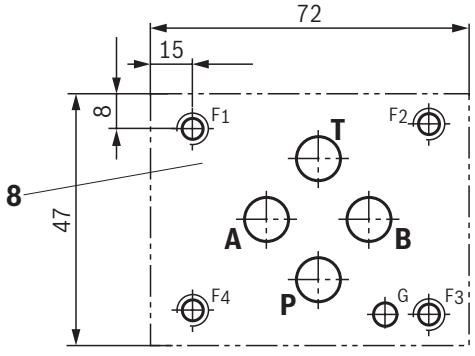
Version "30"

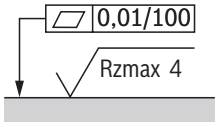


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Dimensions
(dimensions in mm)







Required surface quality of the valve contact surface

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, WA or EB)
8 Porting pattern according to ISO 4401-03-02-0-05 (however, without locating hole)
9 Space required to remove the solenoid coil

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 μ_{total} = 0.09 ... 0.14)
Tightening torque M_A = 7 Nm ±10%,
Material no. **R913043758**

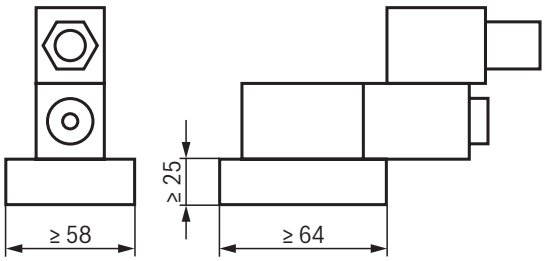
Notices:
- The dimensions are nominal dimensions which are subject to tolerances.
- Subplates are no components in the sense of Directive 2014/34/EU and can be used after the manufacturer of the overall system has conducted an assessment of the risk of ignition. The "G...J3" versions are free from aluminum and/or magnesium and galvanized.

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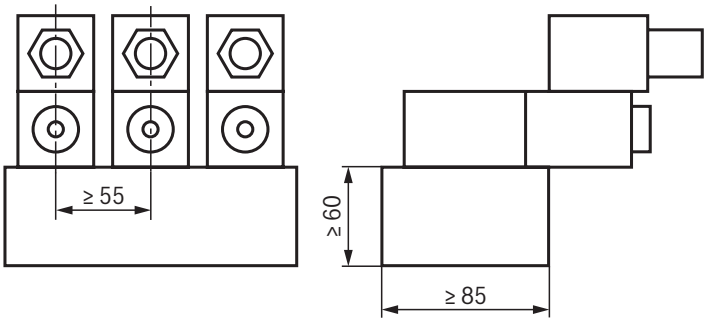
Installation conditions
(dimensions in mm)

	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 (referred to 300 °C)	≥ 36.2 W/mK	
Minimum distance between the longitudinal valve axes	≥ 55	

Individual assembly



Bank assembly



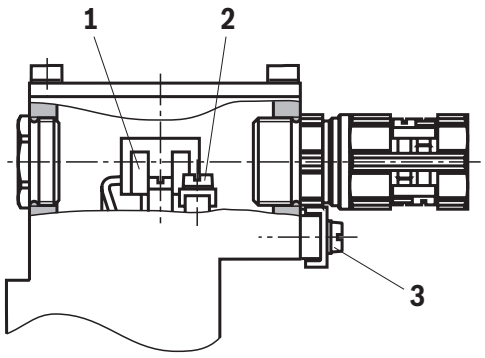
☞ **Notice:**
Observe the "Special application conditions for safe application" on page 6.

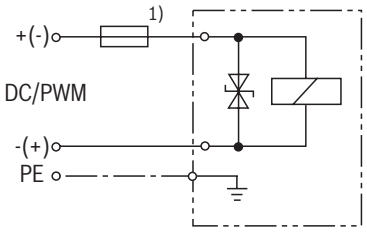
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Electrical connection

The type-examination tested solenoid coil of the valve is equipped with a terminal box, a type-examination tested cable entry and a type-examination tested blind plug. The connection is polarity-independent.

☞ **Notice:**
When establishing the electrical connection, the protective grounding conductor (PE ⏚) has to be connected properly.





Suppressor diode
47 V, 1.5 kW

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 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 max. 6 mm² finely stranded max. 4 mm²

Connection line		
Line type		non-armored and non-shielded connection lines
Temperature rating	°C	≤–20 ... ≥+110
Line diameter	mm	7 ... 10.5

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

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Over-current fuse and switch-off voltage peaks

Voltage data in the valve type code	Nominal voltage of solenoid coil	Nominal flow of solenoid coil	Rated current external miniature fuse: Medium time-lag (M) according to DIN 41571 and EN/IEC 60127	Rated voltage, external miniature fuse: Medium time-lag (M) according to DIN 41571 and EN/IEC 60127	Maximum voltage value when switching off	Interference protection circuit
G24	24 VDC	1.03 A	1.25 A	250 V	–70 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 solenoid coil (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 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. For this reason, the solenoid coils comprise an interference protection circuit which dampens this voltage peak to the voltage value shown in the table.

Further information

- Subplates — Data sheet 45100
- Hydraulic fluids on mineral oil basis — Data sheet 90220
- Environmentally compatible hydraulic fluids — Data sheet 90221
- Flame-resistant, water-free hydraulic fluids — Data sheet 90222
- Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC) — Data sheet 90223
- Use of non-electrical hydraulic components in an explosive environment (ATEX) — Data sheet 07011
- Selection of filters — www.boschrexroth.com/filter
- Information on available spare parts — www.boschrexroth.com/spc

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

Bosch Rexroth AG, RE 29055-XE, edition: 2021-05

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