

Directional spool valves, direct operated, with solenoid actuation

Type WE ...VP1

RE 23178-VP1

Edition: 2017-06

Replaces: 2016-06



- ▶ Size 6
- ▶ Component series 5X
- ▶ Maximum operating pressure 350 bar
- ▶ Maximum flow 70 l/min



Devices

For potentially explosive areas

Information on explosion protection:

- ▶ Area of application according to
 - NEC500 and CEC Annex J:
Class I, Division 1, Groups B, C, D T4
 - NEC502 and CEC Section 18:
Class II/III, Division 1, Groups E, F, G T4

Features

- ▶ 4/3-, 4/2- or 3/2-way version
- ▶ For intended use in a potentially explosive atmosphere
- ▶ Porting pattern according to ISO 4401-03-02-0-05
- ▶ Wet-pin DC or AC solenoids
- ▶ Electrical connection with individual connection or piping connection (NPT 1/2")
- ▶ With manual override

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Ordering code

01	02	03	04	05	06	07	08	09	10	11	12	13	
	WE	6		5X	/		B		N	VP1	Z2	/	

01	3 main ports	3
	4 main ports	4
02	Directional valve	WE
03	Size 6	6
04	Symbols e.g. E, G, J, D, Y, etc.; possible design see page 3	
05	Component series 50 ... 59 (50 ... 59: unchanged installation and connection dimensions)	5X
06	With spring return	no code
	Without spring return	O
	Without spring return with detent	OF
07	High-power solenoid (wet-pin)	B

Voltage

08	Direct voltage 24 V	G24
	Alternating voltage 120 V	W120R
09	With manual override	N

Explosion protection

10	NEC500, NEC502, CEC Annex J and CEC Section 18	VP1
	For details, see information on explosion protection, page 6	

Electrical connection

11	Individual connection	
	Solenoid with terminal box and cable gland	Z2
	For details of electrical connections, see page 11	
12	Without throttle insert	no code
	Throttle Ø 0.8 mm	B08
	Throttle Ø 1.0 mm	B10
	Throttle Ø 1.2 mm	B12
	Use with flows which exceed the performance limit of the valve (see page 4)	

Seal material

13	NBR seals	no code
	FKM seals	V
	Observe compatibility of seals with hydraulic fluid used.	

**Notice:**

The manual override cannot be allocated a safety function and may only be used up to a tank pressure of 50 bar.

Function, section

Directional valves of type WE are solenoid-actuated directional spool valves. They control start, stop and direction of a flow.

The directional valves basically consist of housing (1), one or two solenoids (2), control spool (3), and one or two return springs (4).

In the de-energized condition, the control spool (3) is held in the central position or in the initial position by the return springs (4) (except for impulse spools). The control spool (3) is actuated by wet-pin solenoids in hydraulic fluid (2).

To ensure proper functioning, make sure that the pressure chamber of the solenoid is filled with hydraulic fluid.

The force of solenoid (2) acts via plunger (5) on control spool (3) and pushes the latter from its rest position to the required end position. This enables the necessary direction of flow from P → A and B → T or P → B and A → T.

After de-excitation of the solenoid (2), the return spring (4) pushes the control spool (3) back to its rest position. A manual override (6) allows control spool (3) to be moved without solenoid energization.

Without spring return "O" (only possible with symbol D)

This version is a directional valve with two spool positions and two solenoids without detent. In the de-energized condition, there is no defined spool position.

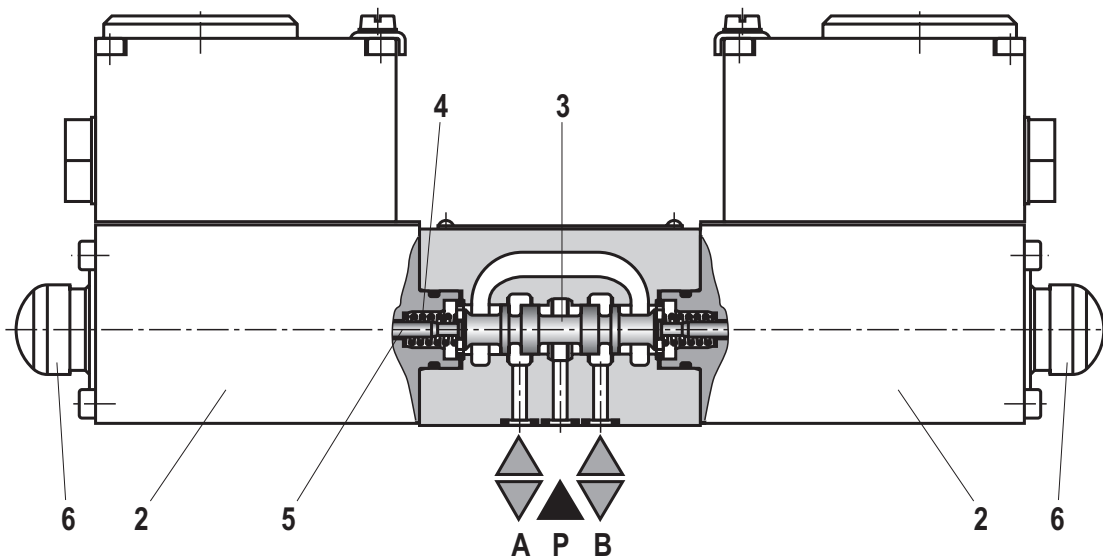
Without spring return, with detent "OF" (impulse spool, only possible with symbol D)

This version is a directional valve with two spool positions, two solenoids and one detent.

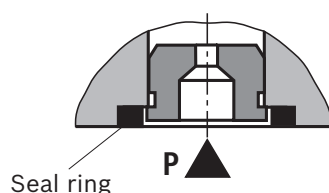
It alternately locks the two spool positions and the solenoid therefore does not need to be permanently energized.

Notice:

For design reasons, internal leakage, which may increase over the life cycle, is inherent to the valves.



Type 4WE 6 E5X/.B..NVP122



Throttle insert "...B"

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

Technical data

(For applications outside these parameters, please consult us!)

general		
Installation position		any
Ambient temperature range	°C	–20 ... +60
Storage temperature range	°C	+5 ... +40
Maximum storage time	Years	1
Weight	kg	3.5 (with 1 solenoid); 5.8 (with 2 solenoids)
Surface protection	► Valve body	galvanized
	► Solenoid	galvanized
MTTF _d value according to EN ISO 13849	Years	150 (for further details see data sheet 08012)

hydraulic		
Maximum operating pressure	► Port A, B, P	bar 350
	► Port T	bar 210 With symbols A and B, port T must be used as leakage oil connection if the operating pressure exceeds the admissible tank pressure.
Maximum flow	l/min	70
Hydraulic fluid		See table below
Hydraulic fluid temperature range		°C –20 ... +70 (NBR seals)
		–15 ... +70 (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 ¹⁾
Maximum surface temperature	°C	See information on explosion protection, page 6

Hydraulic fluid	Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils	HL, HLP, HLPD	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, HFDR	ISO 12922	90222
	► Containing water	HFC (Fuchs Hydrotherm 46M, Petrofer Ultra Safe 620) ²⁾	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.).
- Ignition temperature > 180 °C

► Flame-resistant – containing water:

- Maximum pressure differential per control edge 50 bar
- Pressure pre-loading at the tank port >20% of the pressure differential, otherwise increased cavitation erosion
- Life cycle as compared to operation with mineral oil HL, HLP 30 ... 100%

- **Bio-degradable and flame-resistant:** If these hydraulic fluids are used, small amounts of dissolved zinc may get into the hydraulic system. (700 mg zinc per pole tube).

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.

For the selection of the filters, see www.boschrexroth.com/filter.

²⁾ Maximum ambient temperature for individual operation 50 °C and 50% duty cycle, for manifold operation 40 °C and 50% duty cycle.

Technical data

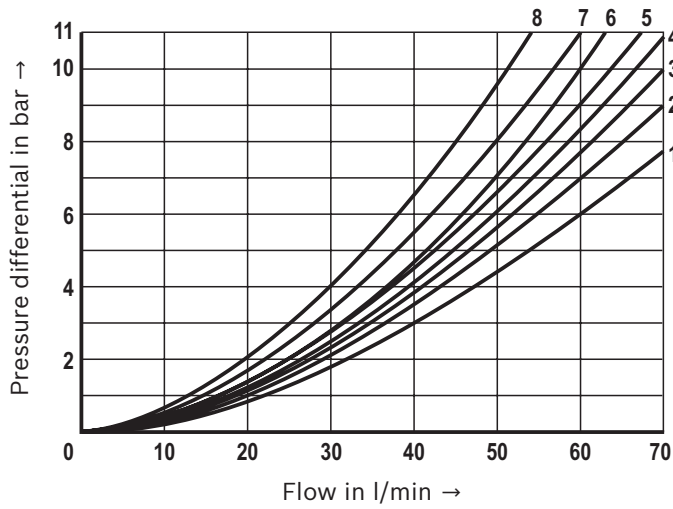
(For applications outside these parameters, please consult us!)

electrical				
Voltage type		Direct voltage		Alternating voltage 50/60 Hz
Available voltages		V	24	120
Voltage tolerance (nominal voltage)		%	±10	
Admissible residual ripple		%	< 5	
Duty cycle/operating mode according to VDE 0580			S1 (continuous operation)	
Switching time according to ISO 6403 ²⁾	► ON	ms	20 ... 70	35 ... 90
	► OFF	ms	15 ... 30	30 ... 80
Maximum switching frequency		1/h	3600	
Nominal power at ambient temperature 20°C		W	20	
Maximum power with 1.1 x nominal voltage and an ambient temperature of 20 °C		W	20.6	
Protection class according to	► NEMA 250		NEMA type 4X (with correctly installed electrical connection)	
	► DIN EN 60529		IP 65 (with correctly installed electrical connection)	

Information on explosion protection				
Area of application according to	► NEC500 and CEC Annex J		Class I, Division 1, Groups B, C, D T4	
	► NEC502 and CEC Section 18		Class II/III, Division 1, Groups E, F, G T4	
Maximum surface temperature ³⁾		°C	130	
Temperature class			T4	
Type of protection valve solenoid			XP (explosion-proof); DIP (dust ignition protection)	
FM certificate	► US		3055770	
	► Canada		3055770C	
Special application conditions for safe application			► The connection line requires a minimum temperature rating of 105 °C. When selecting the connection line, please observe the requirements regarding the temperature rating and avoid contact of the connection line with the solenoid surface. ► In case of valves with two solenoids, maximally one of the solenoids may be energized at a time. ► In case of bank assembly, the maximum ambient temperature may not exceed 50 °C. ► Ensure unobstructed heat dissipation at the solenoid. The solenoid may not be covered or exposed to direct sunlight. ► For use of the valve in the intended explosion protection atmosphere, a conduit seal has to be installed in the pipeline within 450 mm (downstream of the valve solenoid).	
Ambient temperature range		°C	-20 ... +60	

²⁾ 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.

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

Characteristic curves(measured with HLP46, $\vartheta_{\text{oil}} = 40 \pm 5^\circ\text{C}$) **Δp - q_v characteristic curves**

Symbol	Direction of flow					
	P - A	P - B	A - T	B - T	B - A	P - T
D, Y	5	5	3	3	–	–
E	3	3	1	1	–	–
J	1	1	2	1	–	–
G	6	6	9	9	–	8
C	3	3	5	3	–	–
H	2	1	2	2	–	–
T	8	8	4	4	–	–

Other symbols upon request

Performance limits

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



Notice:

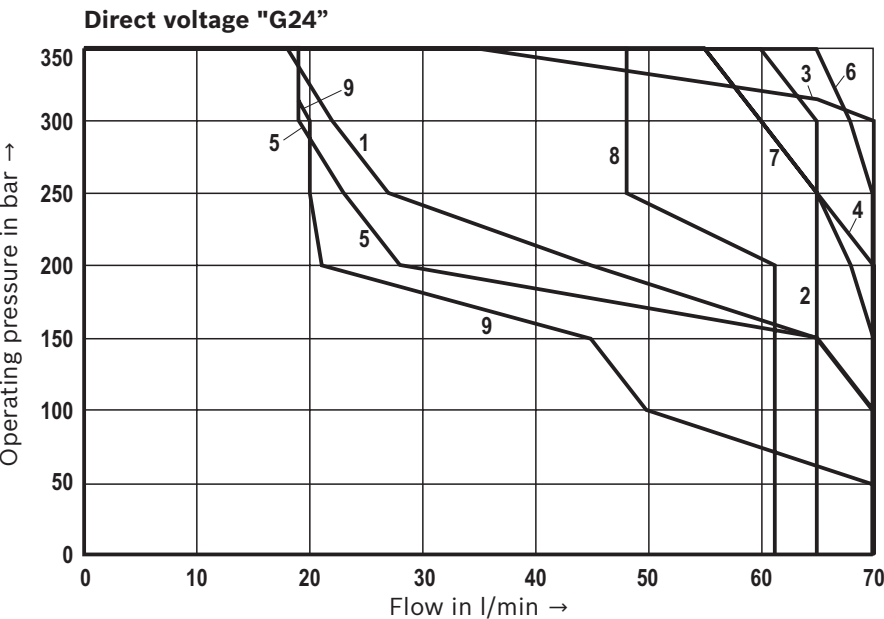
The specified performance limits are valid for use with two directions of flow (e.g. from P → A and simultaneous return flow from B to T).

Due to the flow forces acting within the valves, the admissible performance limit may be considerably lower

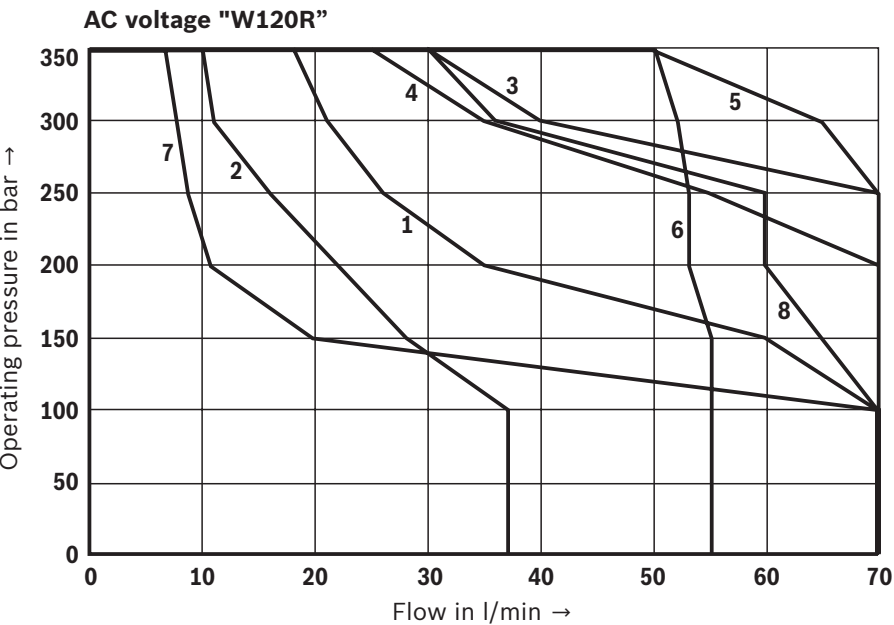
with only one direction of flow (e.g. from P → A while port B is blocked)!

In such cases of use, please consult us!

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



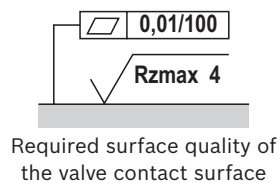
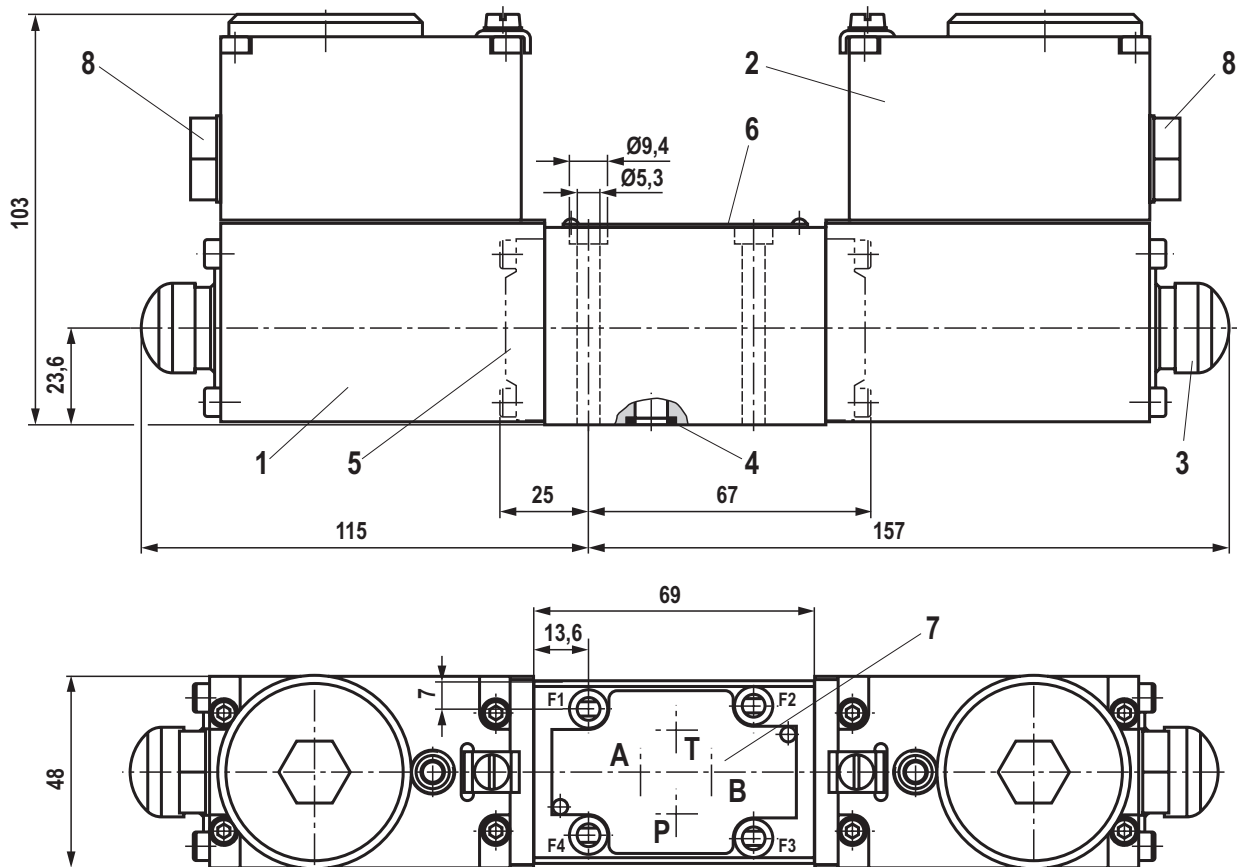
Characteristic curve	Symbol
1	J
2	G
3	E
4	D
5	C
6	H
7	Y
8	D/OF
9	T



Characteristic curve	Symbol
1	J
2	G
3	E
4	D
5	C
6	H
7	Y
8	D/OF

Dimensions

(dimensions in mm)



- 1 Solenoid
- 2 Terminal box
- 3 Manual override "N"
- 4 Identical seal rings for ports P, A, B, T
- 5 Cap for valves with one solenoid
- 6 Name plate
- 7 Porting pattern according to ISO 4401-03-02-0-05 (with locating hole for locking pin ISO 8752-3x8-St, material no. **R900005694**, separate order)
- 8 Piping connection NPT 1/2"

Valve mounting screws (separate order)

For reasons of stability, use exclusively the following valve mounting screws:

4 hexagon socket head cap screws

ISO 4762 - M5 x 50 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B

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

material no. **R913043758**

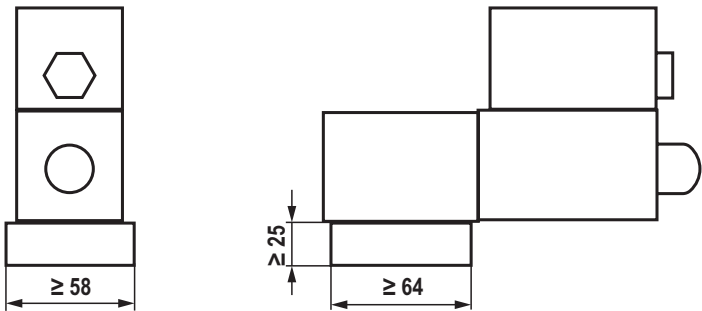
Subplates (separate order) with porting pattern according to ISO 4401-03-02-0-05, see data sheet 45100.

Installation conditions
(dimensions in mm)

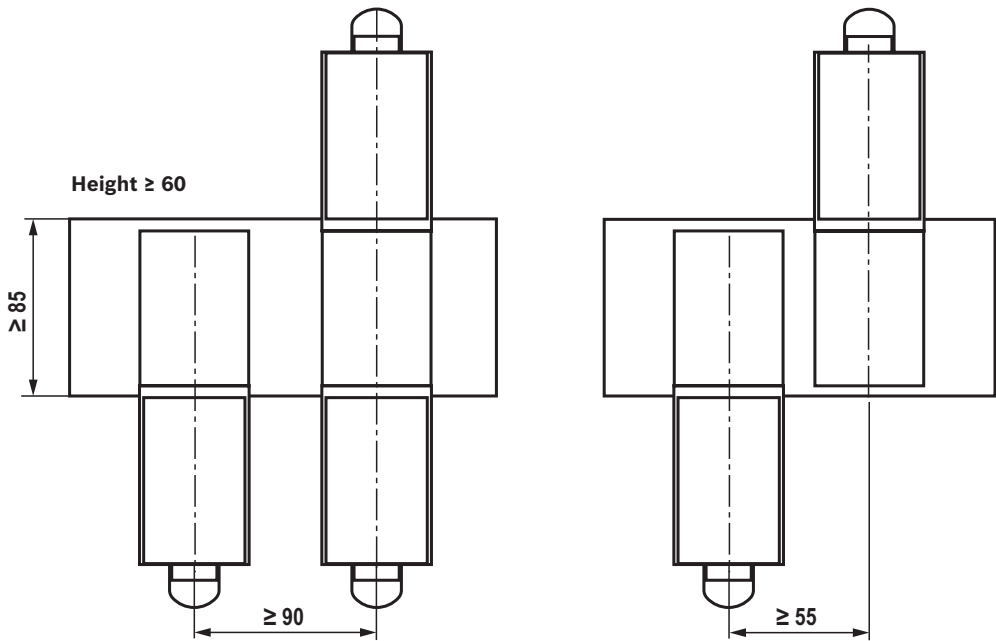
	Individual assembly	Bank assembly
Subplate dimensions	Minimum dimensions Length ≥ 64, width ≥ 58, height ≥ 25	Minimum cross-section Height ≥ 60, width ≥ 85
Thermal conductivity of the subplate	≥ 38 W/mK (EN-GJS-500-7)	
Minimum distance between the longitudinal valve axes	see schematic diagram below	

Schematic diagram

Individual assembly



Bank assembly



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

Electrical connection

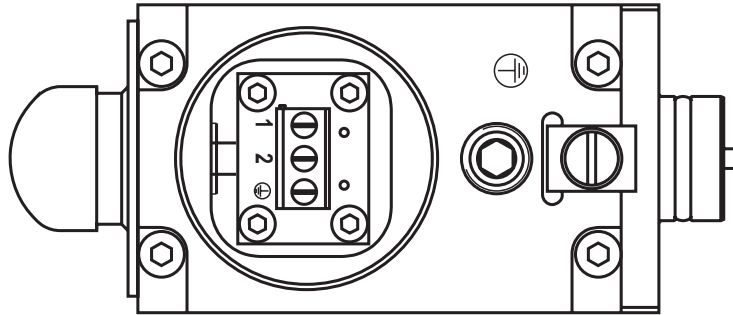
The FM-tested valve solenoid of the valve is equipped with a connection compartment and an NPT connection thread (NPT 1/2") for pipelines.

The connection is polarity-independent.



Notice:

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

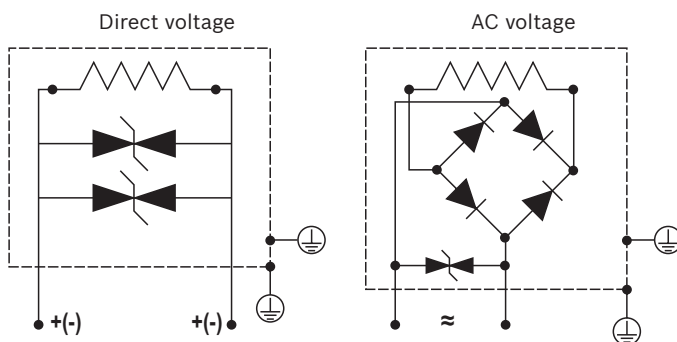


Connectable operating voltage conductors and protective grounding conductors

Function	Maximum connectable line cross-section
Terminal area, rated connection (min. 0.13 mm ²)	2.5 mm ²
Conductor connection cross-section AWG (min. AWG 26)	AWG 14
Single-wire, min. H05(07) V-U 0.13 mm ²	2.5 mm ²
Finely stranded, min. H05(07) V-K 0.13 mm ²	2.5 mm ²
Wire end ferrule with collar DIN 46 228/4 (min. 0.25 mm ²)	1.5 mm ²
Wire end ferrule according to DIN 46 228/1 (min. 0.25 mm ²)	1.5 mm ²

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

Circuit diagram



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 characteristic: medium time-lag according to DIN 41571	Maximum voltage value when switching off	Rated current	Interference protection circuit
G24	24 V DC	0.899 A DC	100 mA	-36 V	1.65 A	Suppressor diode bi-directional
W120R	120 V AC	0.221 A AC	200 mA	–	0.384 A	Bridge rectifier 1000 V

**Notice:**

Corresponding to the rated current, a fuse according to DIN 41571 and EN / IEC 60127 has to be connected upstream of every valve solenoid (max. $3 \times I_G$).

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 area 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.

Further information

- ▶ Subplates
- ▶ Use of non-electrical hydraulic components in an explosive environment (ATEX)
- ▶ Hydraulic fluids on mineral oil basis
- ▶ Environmentally compatible hydraulic fluids
- ▶ Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC)
- ▶ Directional spool valves, direct operated, with solenoid actuation
- ▶ Selection of the filters
- ▶ Information on available spare parts

Data sheet 45100

Data sheet 07011

Data sheet 90220

Data sheet 90221

Data sheet 90223

Operating instructions 23178-VP1-B

www.boschrexroth.com/filter

www.boschrexroth.com/spc

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