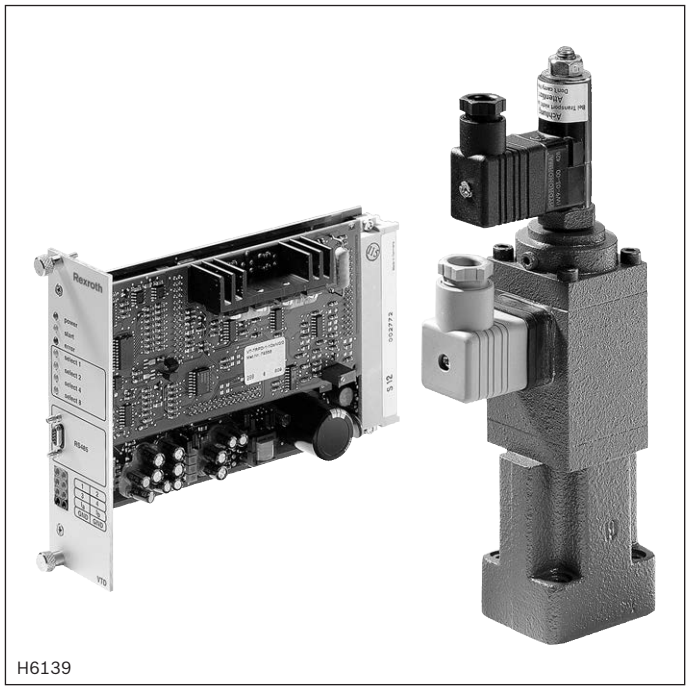
Proportional flow control valve

Type 2FRE

RE 29188
Edition: 2016-05
Replaces: 02.07



H6139

- Size 6
- Component series 2X
- Maximum operating pressure 210 bar
- Maximum flow 25 l/min

Features

- 2-way version
- Valve with pressure compensator for pressure-compensated flow control
- Actuation via proportional solenoid
- For subplate mounting
- Porting pattern according to ISO 4401-03-02-0-05
- With electrical position control for the metering orifice
- Axially movable position transducer coil, therefore an easy zero point calibration of the metering orifice is possible without having to interfere with the control electronics (electrical-hydraulic)
- Low manufacturing tolerance of the valve and electric amplifier VT-VRPA1-150-1X (analog) and amplifier module VT-MRPA1-150-1X (analog), optional
- Flow control in both directions by means of rectifier sandwich plate

Contents

Ordering code: Proportional flow control valve

01	02	03		04		05	06	07	08	09
2FRE	**6**		**–**	**2X**	**/**		**K4**		**V**	*****

01	Proportional flow control valve, 2-way version	**2FRE**
02	Size 6	**6**
03	**With** external closing of the pressure compensator (suppression of the start-up jump)	**A**
	Without external closing of the pressure compensator	**B**
04	Component series 20 ... 29 (20 ... 29: unchanged installation and connection dimensions)	**2X**

Rated flow A → B / flow characteristic

05	**– Linear**	
	Up to 1 l/min	**1L**
	Up to 2 l/min	**2L**
	Up to 8 l/min	**8L**
	– Progressive	
	Up to 3 l/min	**3Q**
	Up to 6 l/min	**6Q**
	Up to 10 l/min	**10Q**
	Up to 16 l/min	**16Q**
	Up to 25 l/min	**25Q**
	– Progressive with rapid traverse	
	Fine control range up to 2 l/min	**2QE**

Electrical connection

06	**Individual connection**	
	Without mating connector; connector DIN EN 175301-803-A (proportional solenoid) and GSA20 (position transducer)	**K4** [1]
07	**With** check valve	**R**
	Without check valve	**M**

Seal material

08	FKM seals	**V**
	Observe compatibility of seals with hydraulic fluid used. (Other seals upon request)	
09	Further details in the plain text	

[1] Mating connectors, separate order, see page 12 and data sheet 08006.

☞ **Notice:** Preferred types and standard units are contained in the EPS (standard price list).

Ordering code: Rectifier sandwich plate

01	02		03		04	05
Z4S	**6**	**–**	**1X**	**/**	**V**	*****

Material no. **R900489356**

01	Rectifier sandwich plate	**Z4S**
02	Size 6	**6**
03	Component series 10 ... 19 (10 ... 19: unchanged installation and connection dimensions)	**1X**

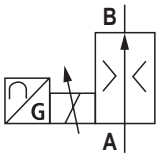
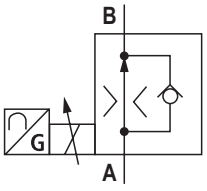
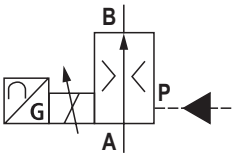
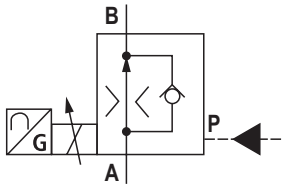
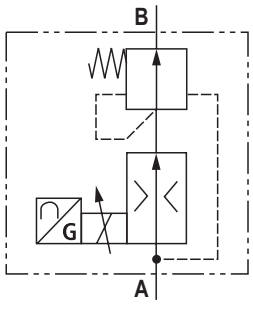
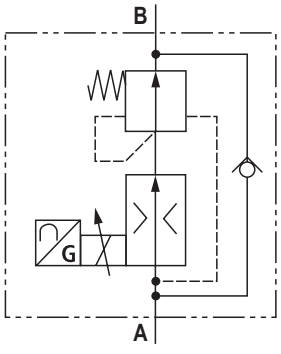
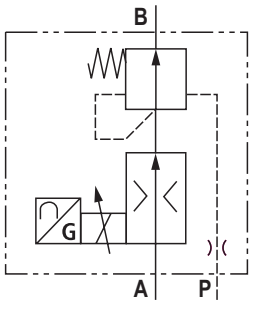
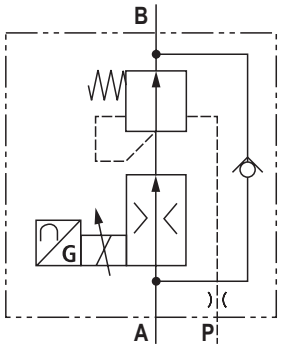
Seal material

08	FKM seals	**V**
	Observe compatibility of seals with hydraulic fluid used. (Other seals upon request)	
09	Further details in the plain text	

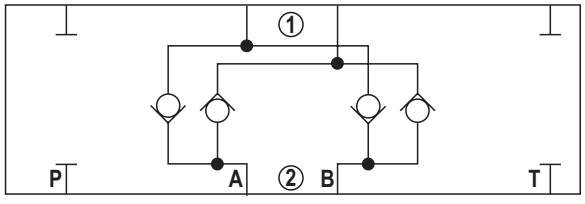
☞ **Notice:**
Rectifier sandwich plate **impossible** with proportional flow control valve, version "A" (with external closing of the pressure compensator).

Symbols (① = component side, ② = plate side)

Proportional flow control valve (simplified, detailed)

	Version "B...MV"	Version "B...RV"	Version "A...MV"	Version "A...RV"
simplified				
detailed				

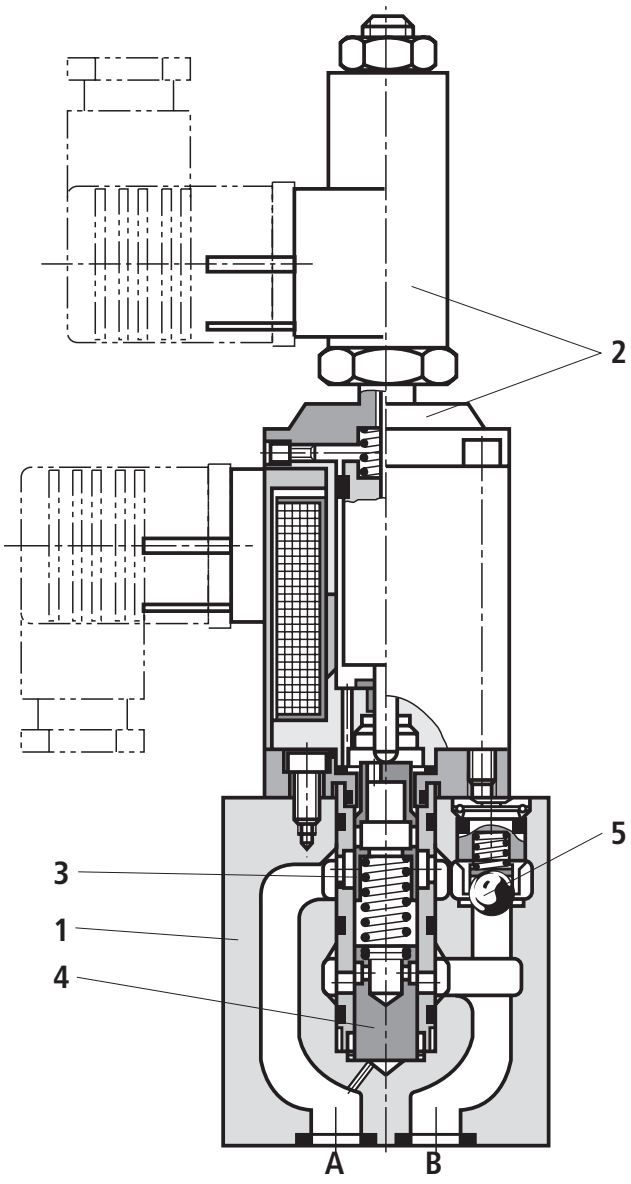
Rectifier sandwich plate



Function, section

Proportional flow control valves of the 2FRE ... type comprise a 2-way function. They are capable of controlling a flow indicated by the electrical command value in a pressure- and temperature-compensated manner.
The set-up basically consists of a housing (1), proportional solenoid with inductive position transducer (2), metering orifice (3), pressure compensator (4) as well as check valve (5), optional.

Proportional flow control valve, version "B...RV" (**without** external closing, **with** check valve)
The flow setting is determined by the indication (0 ... 100%) at the command value potentiometer. Via the amplifier as well as the proportional solenoid, the indicated command value has an effect on the adjustment of the metering orifice (3). The position of the metering orifice (3) is recorded by the inductive position transducer. Any existing variations from the command value are corrected by the position control.
The pressure compensator (4) keeps the pressure drop at the metering orifice (3) at a constant value at all times. Thus, the flow is load-compensated. The low temperature drift is the result of the favorable design of the metering orifice.
With a command value of 0%, the metering orifice is closed. In the event of a power failure or cable break at the inductive position transducer, the metering orifice closes.
From the command value 0%, a smooth start-up is possible. Via two ramps in the electric amplifier, the metering orifice can be opened and closed with delay.
Via the check valve (5), a free return flow from B to A is possible.
With an additional rectifier sandwich plate of the Z4S 6 type under the proportional flow control valve, the supply and return flow from the actuator can be regulated.

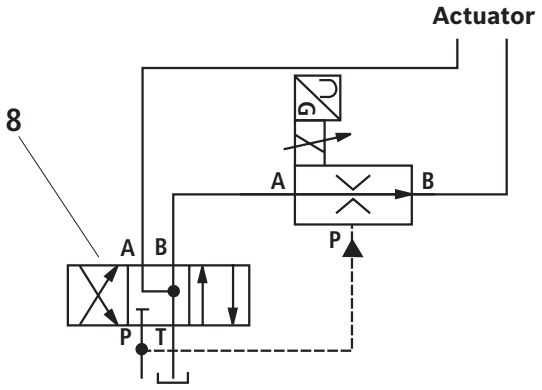


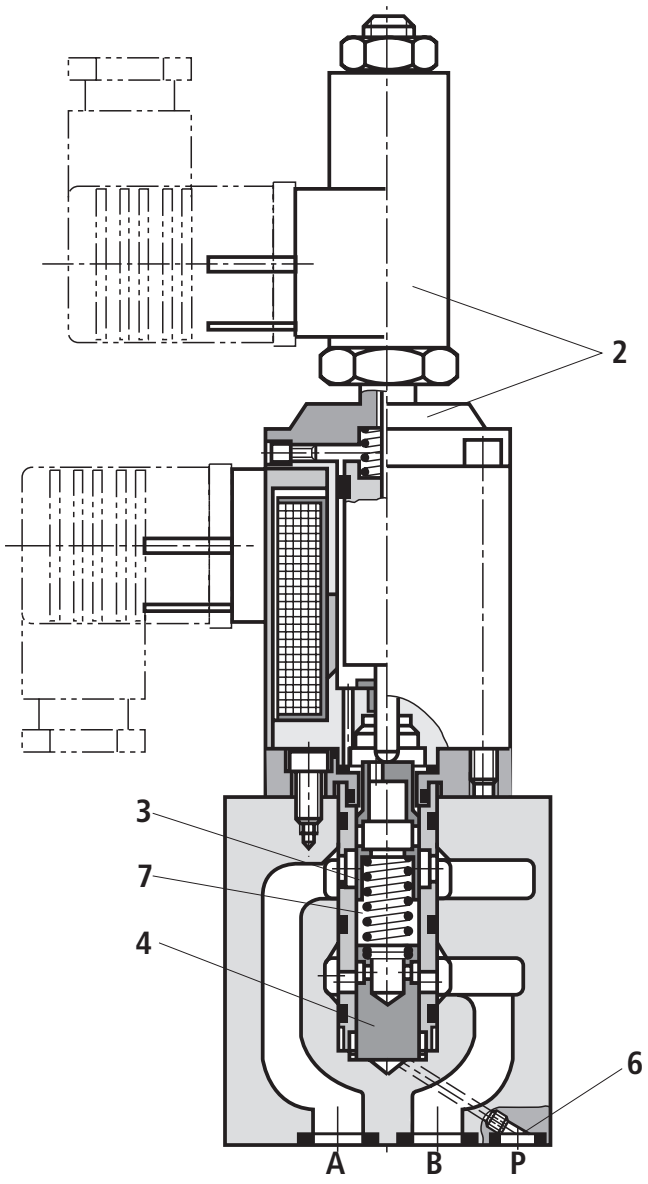
Type 2FRE 6 B-2X/.K4RV

Nozzle

Function, section

Proportional flow control valve, version "A...MV"
(**with** external closing, **without** check valve)
In principle, the function of this valve corresponds to the function of version "B...RV".
For the start-up jump suppression with open metering orifice (3) (command value > 0%), a closing of the pressure compensator (4) is provided via port P (6). The internal connection between port A and the pressure compensator (4) is abandoned. Via the external port P (6), the pressure in P upstream to the directional valve (8) has an impact on the pressure compensator (4) and keeps the latter in its closed position against the spring force (7).
If the directional valve (8) is switched from P to B, the pressure compensator (4) moves from the closed position into the control position and the start-up jump is thus prevented.





Type 2FRE 6 A-2X/.K4MV

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

general			
Weight	▶ Proportional flow control valve	kg	1.8
	▶ Rectifier sandwich plate	kg	0.9
Installation position			Any
Storage temperature range		°C	–20 ... +80
Ambient temperature range		°C	–20 ... +50

hydraulic – Proportional flow control valve [1]										
Maximum operating pressure	▶ Port A	bar	210							
Version			**1L**	**2L**	**8L**	**3Q**	**6Q**	**10Q**	**16Q**	**25Q**	**2QE**
Maximum flow volume		l/min	1	2	8	3	6	10	16	25	25
Minimum flow	▶ 100 bar	cm³/min	25	25	50	15	25	50	70	100	15
	▶ 210 bar	cm³/min	25	25	50	25	25	50	70	100	25
Maximum leakage flow, $\Delta p_{A \rightarrow B}$ with a command value of 0% [2]	▶ 50 bar	cm³/min	4	4	6	4	4	6	7	10	4
	▶ 100 bar	cm³/min	5	5	8	5	5	8	10	15	5
	▶ 210 bar	cm³/min	7	7	12	7	7	12	15	22	7
Minimum pressure differential		bar	6 ... 10								
Pressure differential with free return flow B → A			See characteristic curve, page 9								
Pressure/flow-dependence of input/output pressure			See characteristic curve, page 9								
Temperature dependence Temperature drift, hydraulic and electric			See characteristic curve, page 9								
Hydraulic fluid			See table, page 7								
Maximum admissible degree of contamination of the hydraulic fluid Cleanliness class according to ISO 4406 (c)			Class 20/18/15 [3]								
Hydraulic fluid temperature range		°C	–20 ... +80								
Viscosity range		mm²/s	15 ... 380								
Hysteresis		%	< ±1 of q_{Vmax}								
Repetition accuracy		%	< 1 of q_{Vmax}								
Manufacturing tolerance	▶ Valve, type 2FRE 6		≤ ±3% with command value 33% ≤ ±5% with command value 100%								
	▶ Amplifier VT-VRPA1-150 (analog)		The amplifier is to be adapted to the valve [4]								
	▶ Amplifier module VT-MRPA1-150 (analog)		The amplifier is to be adapted to the valve [4]								

Hydraulic – Rectifier sandwich plate		
Maximum operating pressure	bar	210
Cracking pressure	bar	0.7
Rated flow	l/min	25

[1] Measured with HLP46 and with ϑ_{oil} = 40°C ±5°C

[2] Measured with ν = 41 mm²/s and ϑ = 50°C

[3] The cleanliness classes stated for the components need to be maintained 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.

[4] Due to tolerances of the oscillator frequency (supply of the position transducer), amplifiers comprise manufacturing tolerances.
In new systems or when replacing the amplifier, an adaptation of the amplifier setting may be necessary.

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

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP	FKM	DIN 51524	90220
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222

☞ **Important notices on hydraulic fluids:**
- ▶ For more 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 solenoid surface temperature.

electrical – Proportional solenoid					
Voltage type			Direct voltage		
Coil resistance	▶ Cold value at 20°C	Ω	5.4		
	▶ Maximum hot value	Ω	8.2		
Duty cycle		%	100		
Maximum current per solenoid		A	1.5		
Electrical connection			Connector according to DIN EN 175301-803-A [5]		
Protection class according to EN 60529 [6]			IP 65 with mating connector mounted and locked		
electrical – Inductive position transducer					
Coil resistance (total resistance of the coils between PIN) at 20°C (see page 11)			1 and 2	2 and earthing	Earthing and 1
			31.5	45.5	31.5
Electrical connection			Connector GSA20 [5]		
Protection class according to EN 60529 [6]			IP 65 with mating connector mounted and locked		
Inductivity		mH	6 ... 8		
Oscillator frequency		kHz	2.5		
Electrical position measurement system			Differential throttle		
Nominal stroke		mm	3.5		

Control electronics (separate order)	
Related amplifier in euro-card format	Type VT-VRPA1-150-1X (analog) according to data sheet 30118
Related amplifier module	Type VT-MRPA1-150-1X (analog) according to data sheet 30221

[5] Mating connector, separate order, see page 12.

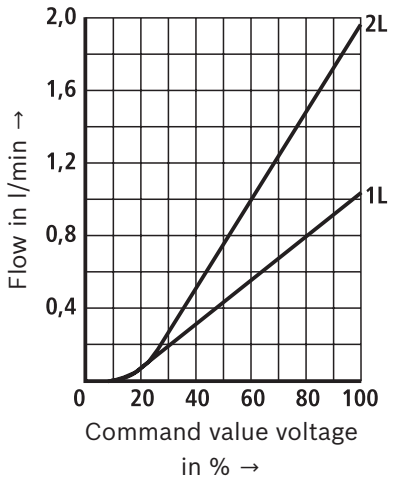
[6] Due to the arising surface temperatures of the solenoid coils, the standards ISO 13732-1 and ISO 4413 are to be observed.

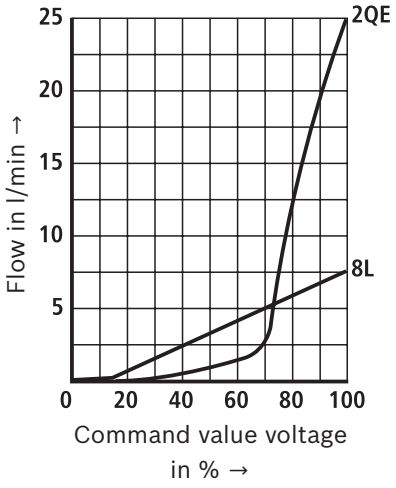
Characteristic curves

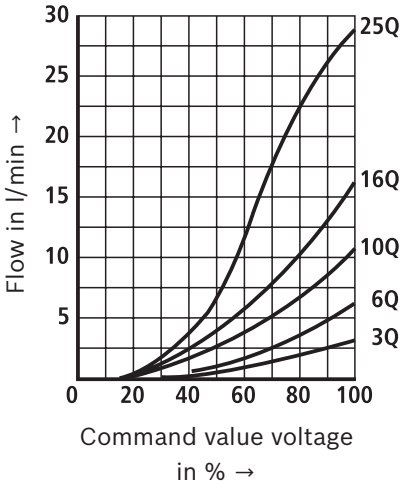
(measured with HLP46, ϑ_{oil} = 40 ± 5°C)

Dependency of the flow from the command value voltage

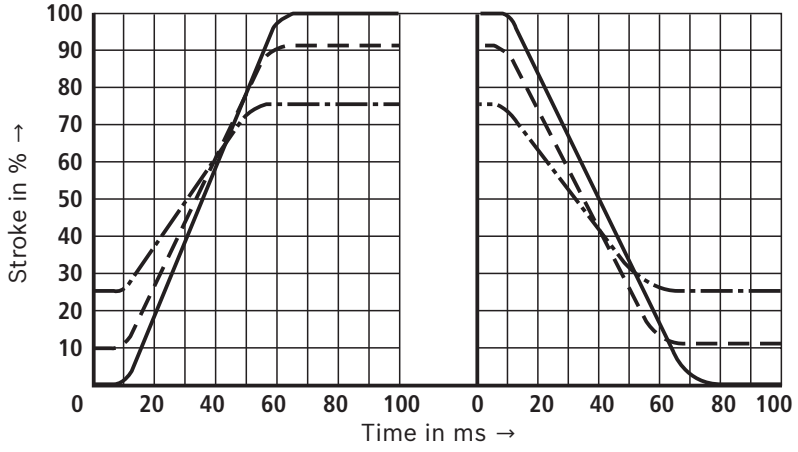
(Flow control of A → B); p_{nom} = 50 bar



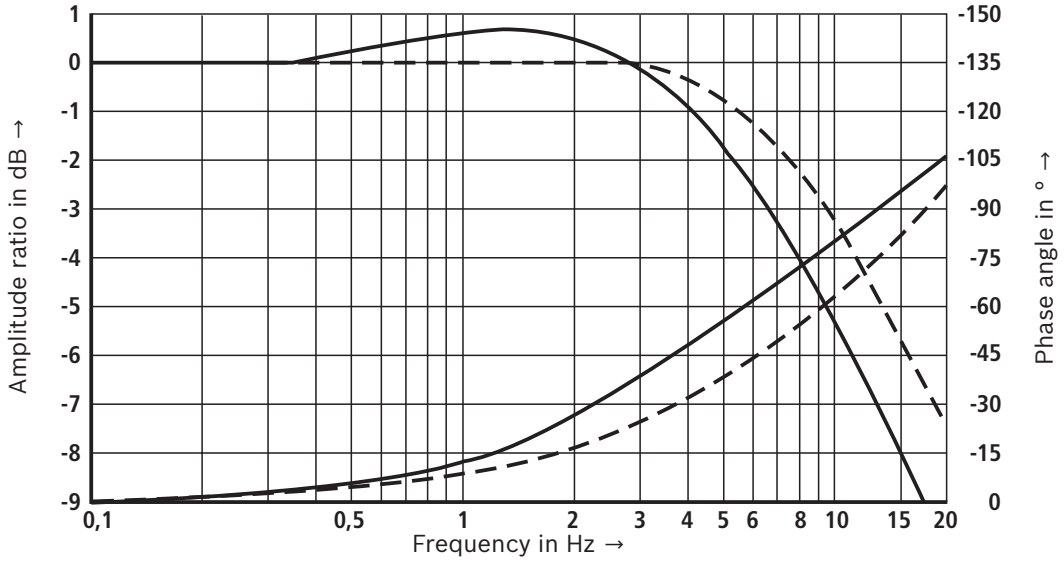




Transition function with stepped command value modification; p_{nom} = 100 bar; version "25Q"



Frequency response characteristic curves; p_{nom} = 100 bar; version "25Q"



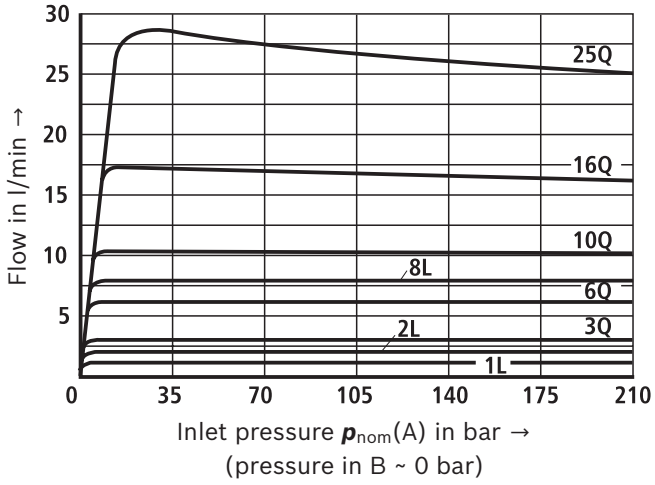
Command value amplitude 45 ... 55% (50% ±5%)

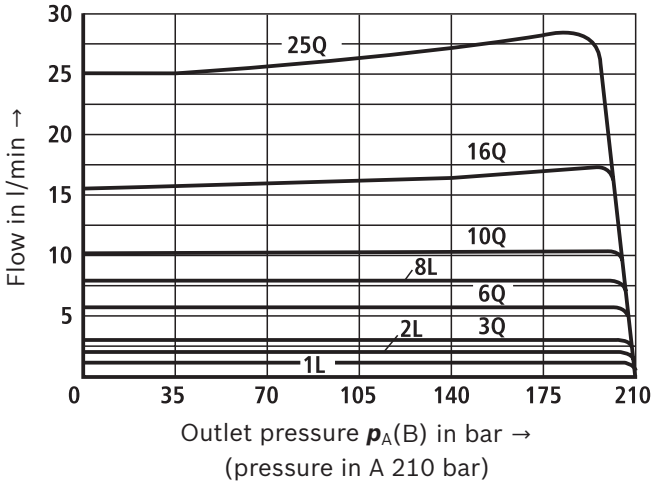
Command value amplitude 0 ... 100% (50% ±50%)

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

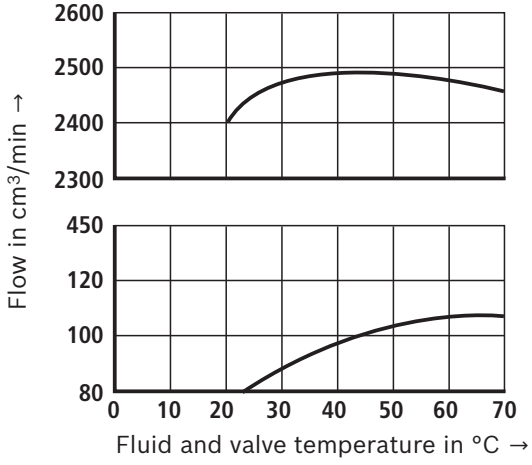
Proportional flow control valve

Flow-dependent pressure

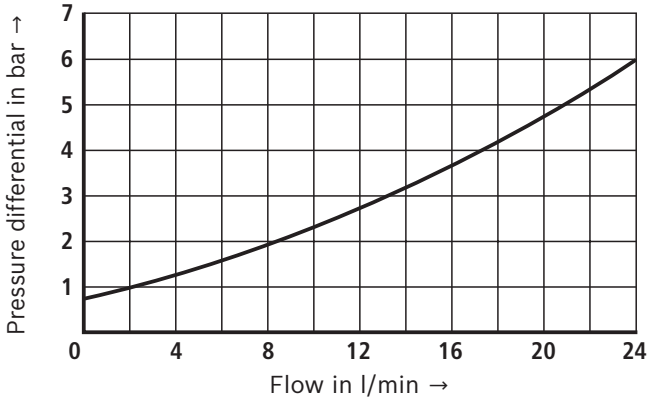




Temperature dependence (version "25Q" – greatest variation) at Δp = 30 bar

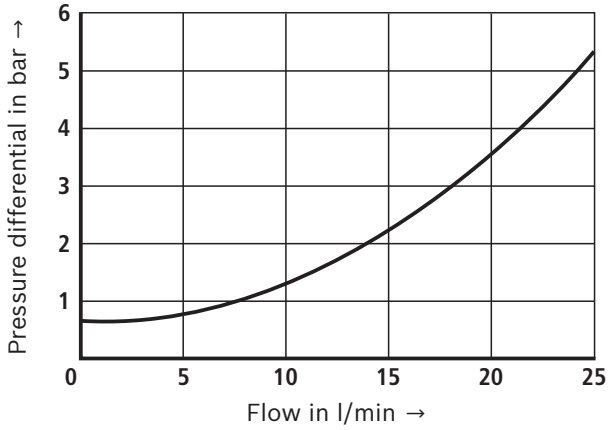


Pressure differential via check valve B → A orifice closed

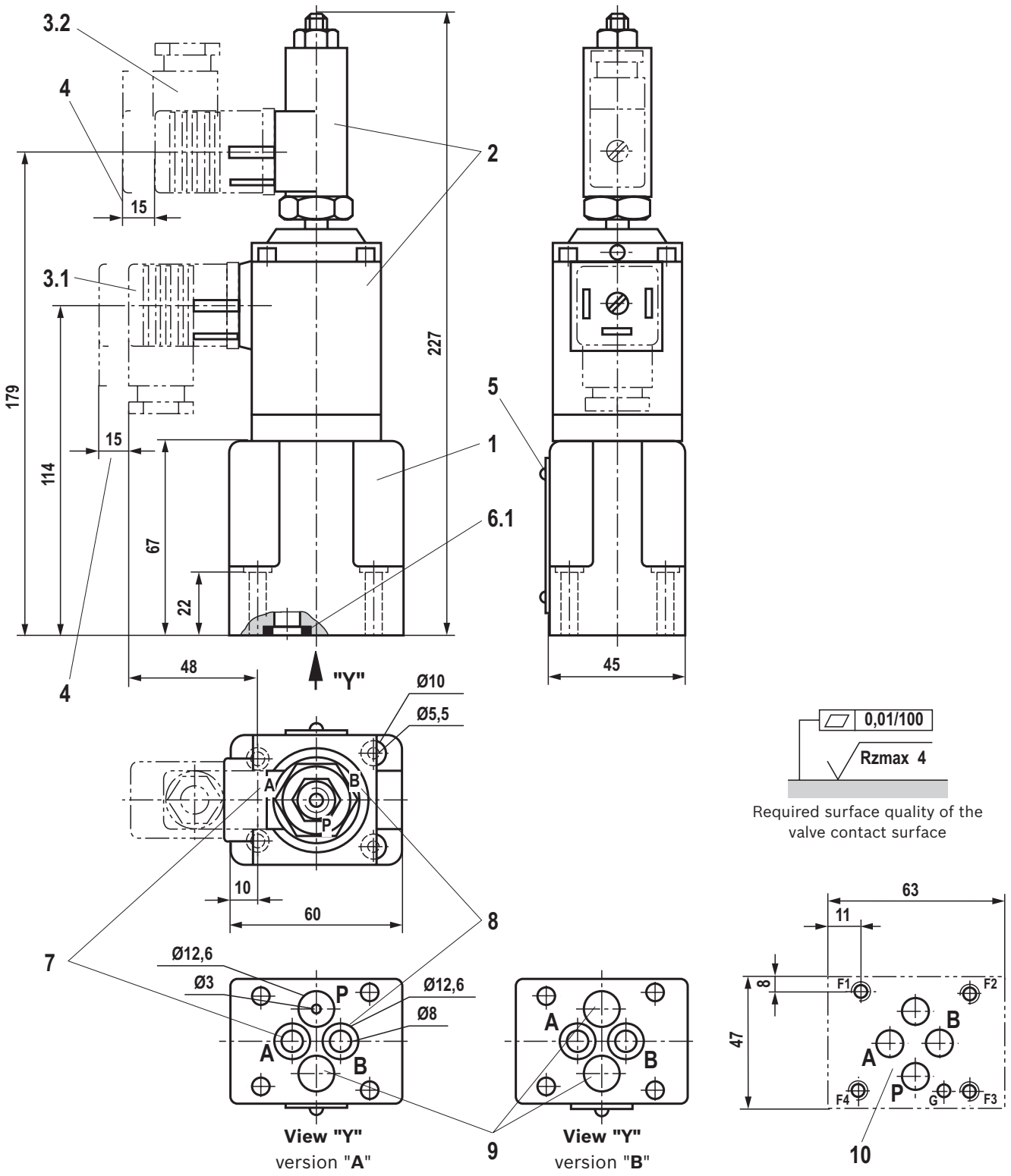


Rectifier sandwich plate

Δp-q_V characteristic curve



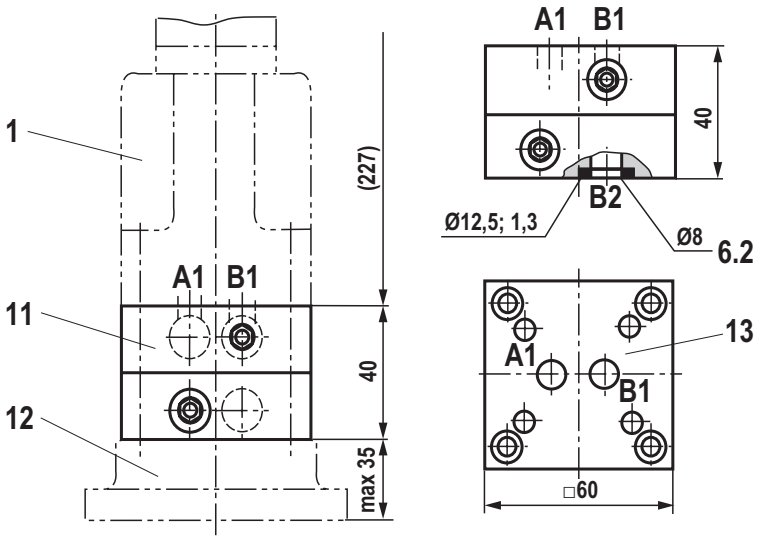
Dimensions: Proportional flow control valve
(dimensions in mm)

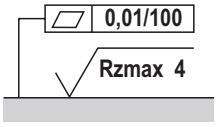


For item explanations, valve mounting screws and **subplates,** see page 11.

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

Dimensions: Rectifier sandwich plate (dimensions in mm)





Required surface quality of the valve contact surface

1 Valve housing
2 Proportional solenoid with inductive position transducer
3.1 Mating connector for proportional solenoid, separate order, see page 12
3.2 Mating connector for position transducer, separate order, see page 12
4 Space required for removing the mating connector
5 Name plate
6.1 Same seal rings for ports A, B, P and blind counterbore
6.2 Same seal rings for ports A2 and B2
7 Port A
8 Port B
9 Blind counterbore Ø12.6 mm
10 Machined valve contact surface, porting pattern according to ISO 4401-03-02-0-05
11 Rectifier sandwich plate
12 Subplate
13 Valve contact surface for proportional flow control valve, type 2FRE 6...

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

Valve mounting screws (separate order)
The following valve mounting screws are recommended:

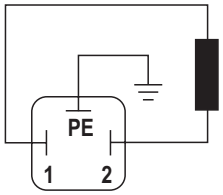
- **Proportional flow control valve**
  - **4 hexagon socket head cap screws ISO 4762 - M5 x 30 - 10.9-flZn240h-L** (friction coefficient 0.09 ... 0.14 according to VDA 235-101) tightening torque M_A = 7 Nm ±10%, material no. **R913048086**
  - **4 hexagon socket head cap screws ISO 4762 - M5 x 30 - 10.9** (friction coefficient 0.08 ... 0.16 according to VDI 2230 – black) tightening torque M_A = 8.1 Nm ±10%, material no. **2910150205**

- **Rectifier sandwich plate**
  - **4 tie rods M5 x 70** material no. **R901318602**
  - **4 hexagon nuts ISO 4032 - M5 - 10-CM-FE-ZN-5-AN-T0-H-B** (friction coefficient 0.08 ... 0.16 according to VDI 2230 – black) tightening torque M_A = 8.1 Nm ±10%, material no. **R913016628**

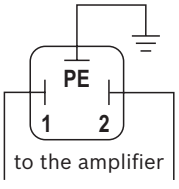
☞ **Notices:**
- Rectifier sandwich plate **impossible** with proportional flow control valve, version "A" (with external closing of the pressure compensator).
- The dimensions are nominal dimensions which are subject to tolerances.

Electrical connections and assignment

Connection at the connector

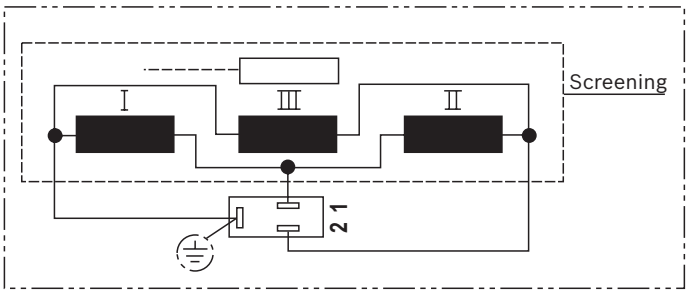


Connection at mating connector

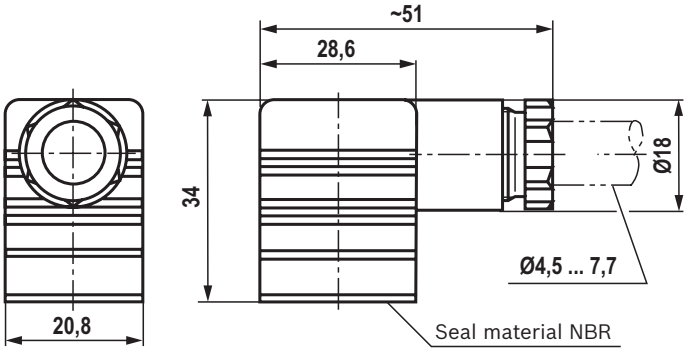


Mating connectors (separate order)

Mating connector according to DIN EN 175301-803-A,
material no. **R901017011** (plastic version),
see data sheet 08006



Mating connector GM209N (Pg 9),
material no. **R900013674** (plastic version)



Further information

▶ Analog amplifiers	Data sheet 30118
▶ Valve amplifier for proportional valves with electrical position feedback	Data sheet 30221
▶ Subplates	Data sheet 45100
▶ Hydraulic fluids on mineral oil basis	Data sheet 90220
▶ Flame-resistant, water-free hydraulic fluids	Data sheet 90222
▶ Hydraulic valves for industrial applications	Operating instructions 07600-B
▶ Selection of the filters	
▶ Information on available spare parts	