

Proportional flow control valve, 2-way version

1/12

Type 2FRE 6

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



Table of contents

Contents	Page
Features	1
Ordering code	2
Standard types	2
Symbols	3
Function, section	4
Technical data	5, 6
Electrical connection, cable sockets	7
Characteristic curves	8, 9
Unit dimensions	10, 11

Features

- Valve with pressure compensator for the pressure-compensated control of a flow
- Actuation by means of proportional solenoid
- For subplate mounting:
Position of ports to ISO 4401-03-02-0-94
- With electrical closed-loop position control of the metering orifice
- The position transducer coil can be axially shifted, which simplifies zero point balancing of the metering orifice (electrical-hydraulic) without the need for intervening into the control electronics
- Low manufacturing tolerances of the valve and the electrical amplifier types VT-VRPA1-150-1X (analogue) and amplifier module types VT-MRPA1-150-1X (analogue), separate order, see page 6
- Flow control in both directions due to rectifier sandwich plate

Ordering code: Proportional flow control valve

2FRE	6	-2X/	K4	V	*
------	---	------	----	---	---

Size 6	= 6	Further details in clear text
With external closing of the pressure compensator (suppression of start-up jump)	= A	V = FKM seals, suitable for mineral oil (HL, HLP) to DIN 51524
Without external closing of the pressure compensator	= B	R = With check valve
Component series 20 to 29 (20 to 29: unchanged installation and connection dimensions)	= 2X	M = Without check valve
Nominal flow A → B /		Electrical connection
Flow characteristics		Without cable socket
Linear:		with component socket to DIN EN 175301-803-A for proportional solenoid and GSA20 for position transducer
up to 1 l/min	= 1L	Cable sockets – separate order see page 7
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	
Progressiv with rapid speed		
Fine control range up to 2 l/min	= 2QE	
		K4 =

Ordering code: Rectifier sandwich plate

Z4S	6	-1X/	V	*
-----	---	------	---	---

Size 6	= 6	Further details in clear text
Component series 10 to 19 (10 to 19: unchanged installation and connection dimensions)	= 1X	
FKM seals, suitable for mineral oil (HL, HLP) to DIN 51524	= V	

⚠ Attention!

Rectifier sandwich plate type Z4S 6-1X/V can **not** be used in conjunction with a proportional flow control valve of type 2FRE 6 A-2X/... (with external closing of the pressure compensator).

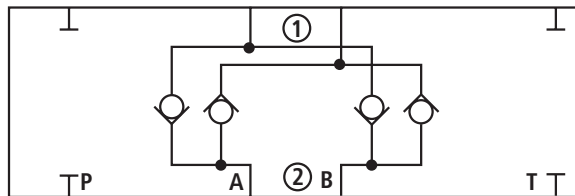
Symbols

Proportional flow control valve (simplified, detailed)

	Type 2FRE 6 B-2X/...MV	Type 2FRE 6 B-2X/...RV	Type 2FRE 6 A-2X/...MV	Type 2FRE 6 A-2X/...RV
Simplified				
Detailed				

Rectifier sandwich plate (① = component side, ② = plate side)

Type Z4S 6-1X/V



Function, section

Proportional flow control valves of type 2FRE ... feature a 2-way function. They can control a flow, which is determined by an electrical command value, with pressure and temperature compensation.

They basically consist of housing (1), proportional solenoid with inductive position transducer (2), metering orifice (3), pressure compensator (4) and optional check valve (5).

Proportional flow control valve type 2FRE 6 B-2X/.K4RV
(without external closing, with check valve)

The setting of the flow is determined by the setting (0 to 100 %) on the command value potentiometer. The selected command value causes metering orifice (3) to be adjusted via the amplifier and the proportional solenoid. The inductive position transducer senses the position of metering orifice (3). Any deviations from the command value are corrected by the closed-loop position control.

Pressure compensator (4) keeps the pressure differential across metering orifice (3) always at a constant value. This ensures load-compensation of the flow.

The low temperature drift is a result of the favourable design of the metering orifice.

At a command value of 0 % the metering orifice is closed.

In the event of a power failure or cable break on the inductive position transducer, the metering orifice closes.

Starting from a 0 % command value, a jump-free start-up is possible. The metering orifice can be opened and closed with a delay provided by two ramps in the electrical amplifier.

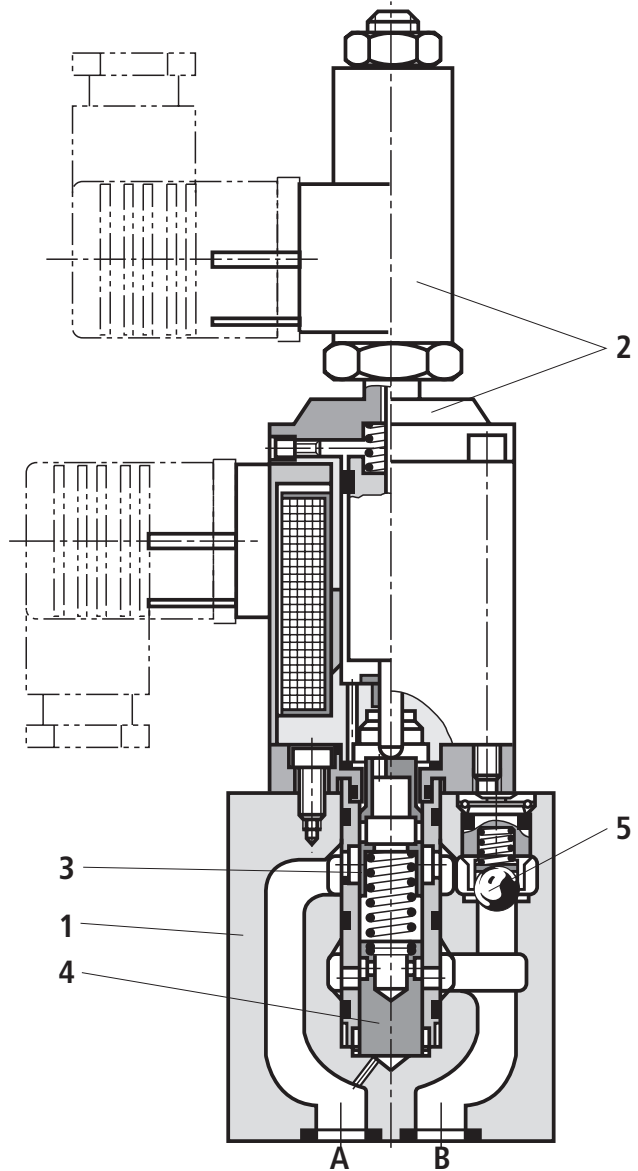
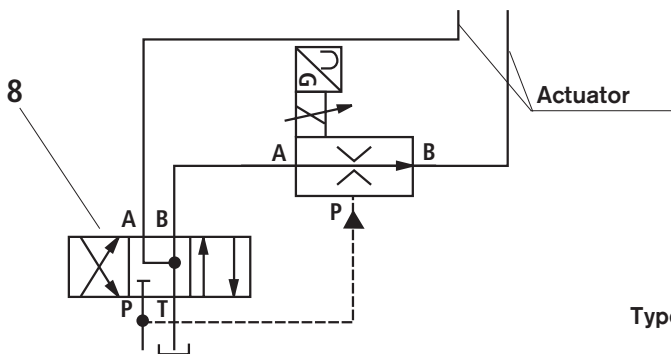
Check valve (5) allows the free return flow from B to A.

The supply and return flow to and from the actuator can be controlled with the help of an additional rectifier sandwich plate of type Z4S 6... under the proportional flow control valve.

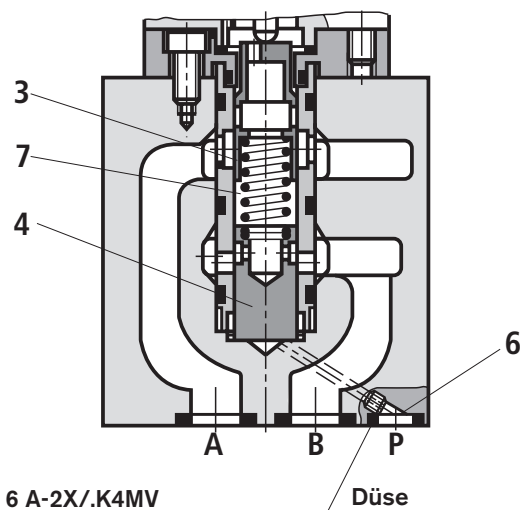
Proportional flow control valve type 2FRE 6 A-2X/.K4MV
(with external closing, without check valve)

In principle, the function of this valve is the same as that of valve type 2FRE 6 B-2X/.K4RV.

To suppress the start-up jump when metering orifice (3) is open (command value > 0 %), closing of pressure compensator (4) is provided via port P (6). There is no internal connection between port A and pressure compensator (4). The pressure in P upstream of directional valve (8) acts on pressure compensator (4) and holds it in the closed position against the force of spring (7). When directional valve (8) is switched from P to B, pressure compensator (4) moves from the closed position to the control position, thus preventing a start-up jump.



Type 2FRE 6 B-2X/.K4RV



Type 2FRE 6 A-2X/.K4MV

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

General

Weight	– Proportional flow control valve	kg	1,8
	– Rectifier sandwich plate	kg	0,9
Installation orientation			Optional
Storage temperature range			°C –20 to +80
Ambient temperature range			°C –20 to +50

Hydraulisch – proportional flow control valve (measured with HLP46 and at $\vartheta_{oil} = 40\text{ °C} \pm 5\text{ °C}$)

Max. operating pressure in port A			bar up to 210										
Version			1L	2L	8L	3Q	6Q	10Q	16Q	25Q	2QE		
Max. flow			l/min		1	2	8	3	6	10	16	25	25
Min. flow	– up to 100 bar	cm ³ /min	25	25	50	15	25	50	70	100	15		
			– up to 210 bar	cm ³ /min	25	25	50	25	25	50	70	100	25
Max. leakage flow at 0 % command value $\Delta p\ A \rightarrow B$ (measured at $v = 41\text{ mm}^2/\text{s}$ and $\vartheta = 50\text{ °C}$)	50 bar	cm ³ /min	4	4	6	4	4	6	7	10	4		
	100 bar	cm ³ /min	5	5	8	5	5	8	10	15	5		
	210 bar	cm ³ /min	7	7	12	7	7	12	15	22	7		
Minimum pressure differential			bar 6 to 10										
Pressure differential with free return flow B → A			see characteristic curve on page 9										
Pressure/flow relationship: Inlet/outlet pressure			see characteristic curve on page 9										
Dependence upon temperature Temperature drift, hydraulic and electrical			see characteristic curve on page 9										
Hydraulics fluid			Mineral oil (HL, HLP) to DIN 51524 Further hydraulic fluids on enquiry!										
Max. permissible degree of contamination of the hydraulic fluid – cleanliness class to ISO 4406 (c)			Class 20/18/15 ¹⁾										
Hydraulic fluid temperature range			°C –20 to +80										
Viscosity range			mm ² /s 15 to 380										
Hysteresis			% < ±1 of q_{Vmax}										
Repeatability			% < 1 of q_{Vmax}										
Manufacturing tolerances	– Valve 2FRE 6	$\leq \pm 3\%$ at 33 % command value											
		$\leq \pm 5\%$ at 100 % command value											

Hydraulic – rectifier sandwich plate

Operating pressure			bar up to 210							
Cracking pressure			bar 0,7							
Nominal flow			l/min 25							

¹⁾ The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.

²⁾ Due to tolerances of the oscillator frequency (position transducer supply), amplifiers are subject to tolerances. When installing new systems or replacing an amplifier, the amplifier settings may have to be adjusted.

Technical data (for applications outside these parameters, please consult us!)**Electrical** – proportional solenoid

Type of voltage	DC		
Coil resistance	– Cold value at 20 °C	Ω	5.4
	– Max. hot value	Ω	8.2
Duty cycle	%	100	
Max. current per solenoid	A	1.5	
Electrical connection	With component plug to DIN EN 175301-803-A		
	Cable socket to DIN EN 175301-803-A ¹⁾		
Type of protection to EN 60529	IP 65 ²⁾ with cable socket mounted and locked		

Electrical – inductive position transducer

Coil resistance at 20 °C (see page 7)	Total resistance of coil between	1 and 2	2 and $\frac{1}{2}$	$\frac{1}{2}$ and 1
		31,5	45,5	31,5
Electrical connection	With component plug GSA20			
	Cable socket GM209N (Pg9) ¹⁾			
Type of protection to EN 60529	IP 65 ²⁾ with cable socket mounted and locked			
Inductance	mH	6 to 8		
Oscillator frequency	kHz	2.5		
Electrical position measuring system	Differential throttle			
Nominal stroke	mm	3.5		

Control electronics (separate order)

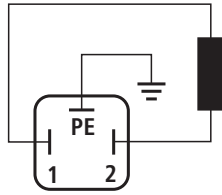
¹⁾ Separate order, see page 7

²⁾ Due to the surface temperatures of solenoid coils, observe European standards DIN EN 563 and DIN EN 982!

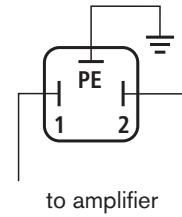
Electrical connection, cable sockets (nominal dimensions in mm)

Proportional solenoid

Connection to component plug



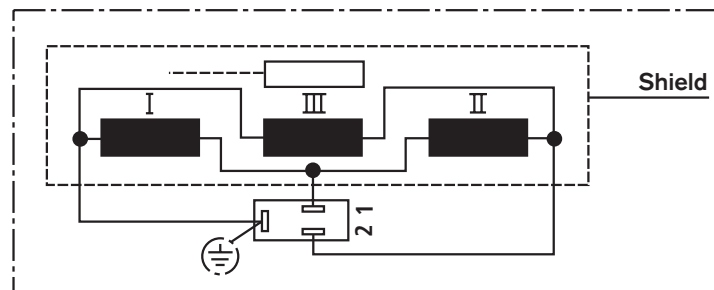
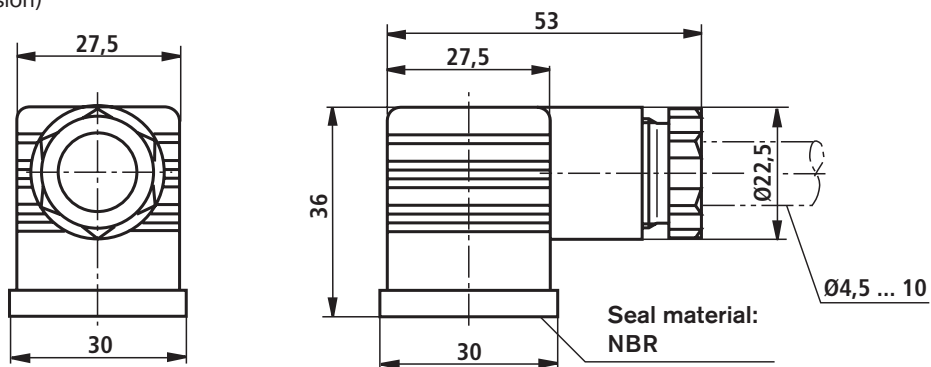
Connection to cable socket



Cable socket to DIN EN 175301-803-A

Separate order stating material no. **R901017011**

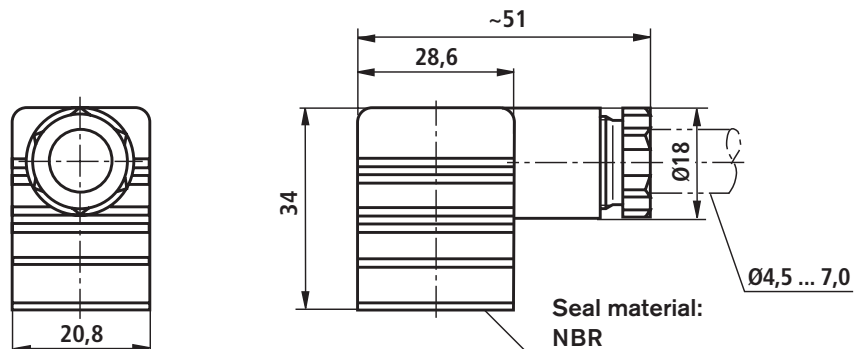
(plastic version)



Cable socket Pg 9

Separate order stating material no. **R900013674**

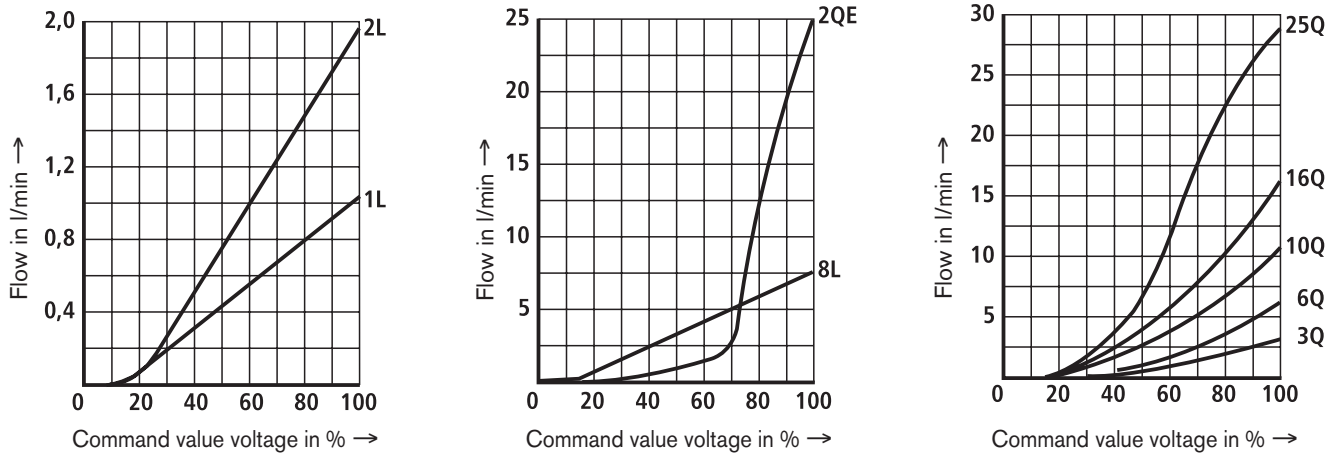
(plastic version)



Characteristic curves (measured with HLP46 and at $\vartheta_{oil} = 40 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$)

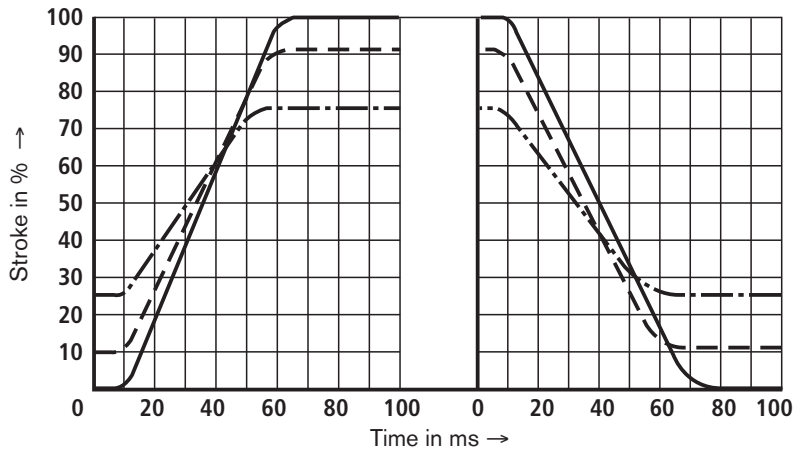
Dependence of flow on command value voltage

(flow control from A \rightarrow B); $p_{nom} = 50 \text{ bar}$

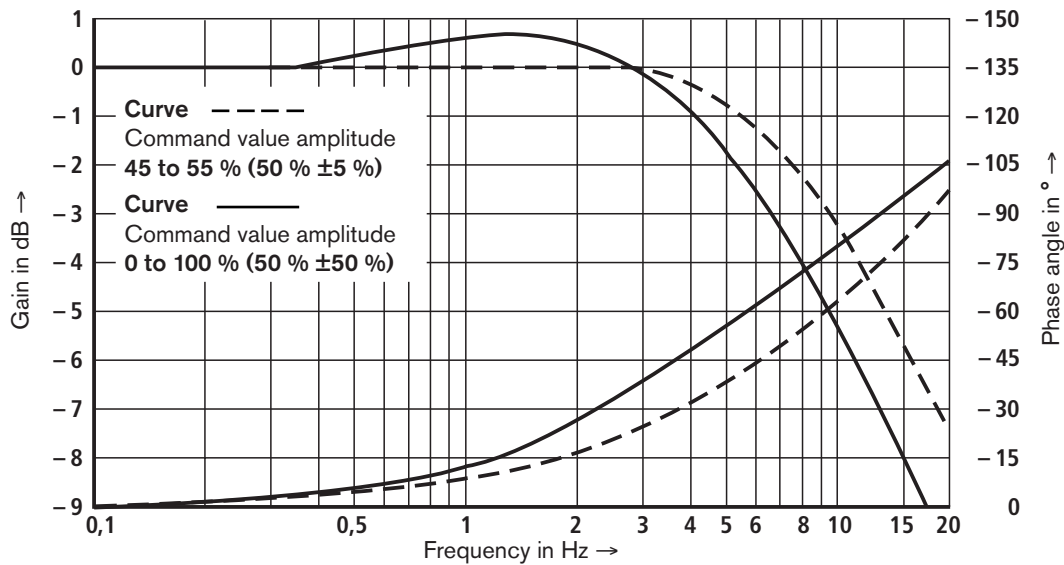


Transient function

at stepped command value change ; $p_{nom} = 100 \text{ bar}$; valve type 25Q



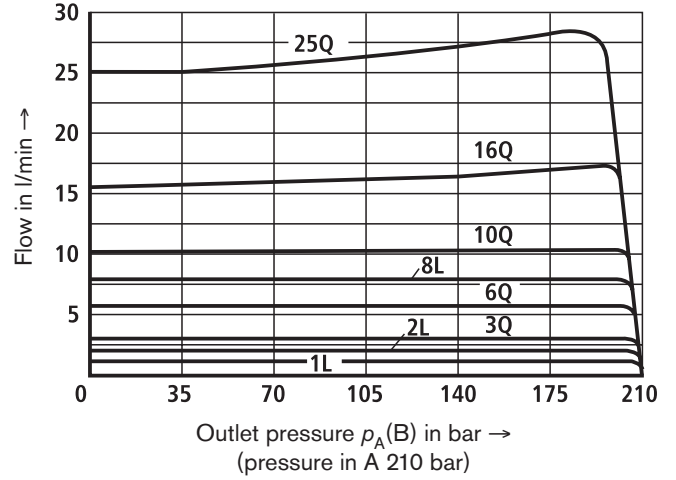
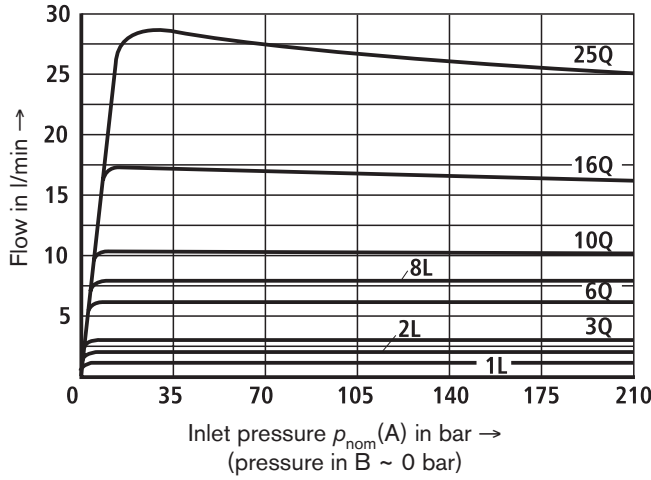
Frequency response characteristic curves; $p_{nom} = 100 \text{ bar}$; valve type 25Q



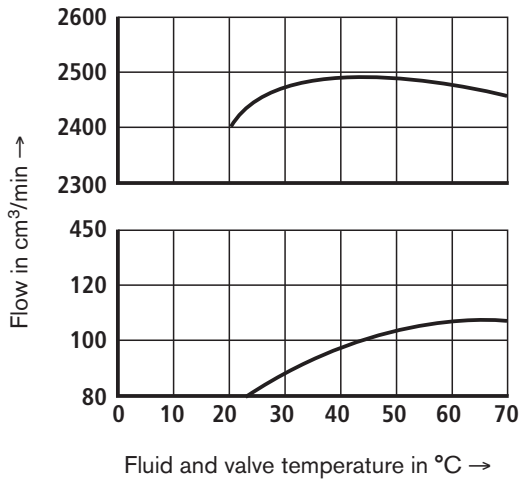
Characteristic curves (measured with HLP46 and at $\vartheta_{oil} = 40 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$)

Proportional flow control valve

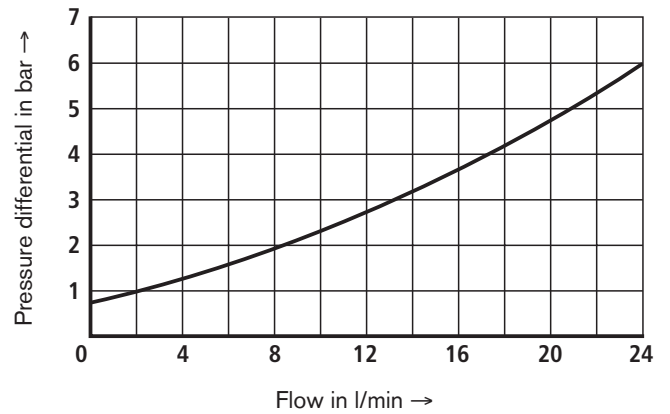
Pressure/flow relationship



Dependence on temperature (flow characteristic 25Q – largest deviation) at $\Delta p = 30 \text{ bar}$

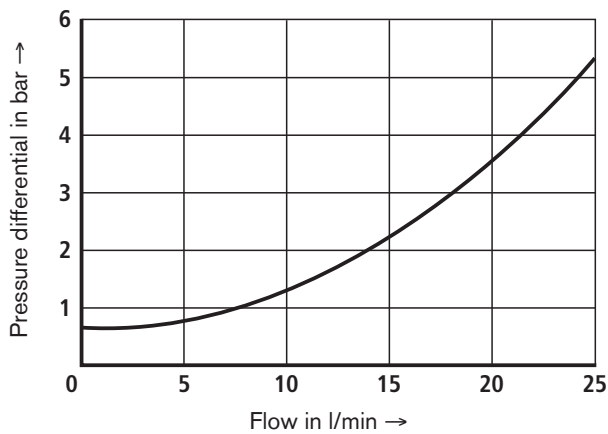


Pressure differential across check valve B → A
Orifice closed

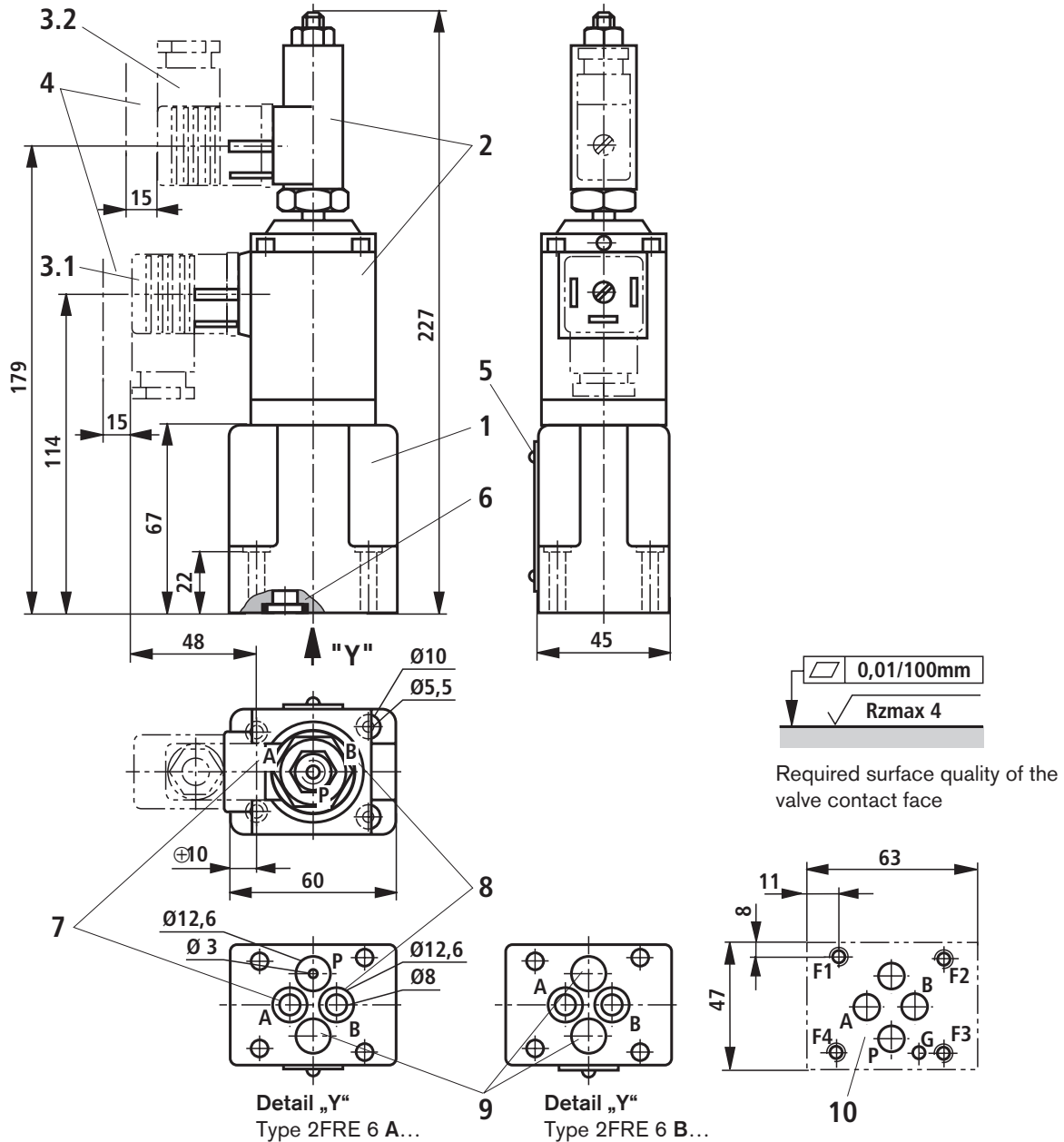


Rectifier sandwich plate

Δp - q_v characteristic curve



Unit dimensions: Proportional flow control valve (nominal dimensions in mm)



- 1 Valve housing
- 2 Proportional solenoid with inductive position transducer
- 3.1 Cable socket for proportional solenoid, separate order, see page 7
- 3.2 Cable socket for proportional solenoid, separate order, see page 7
- 4 Space required to remove cable socket
- 5 Nameplate
- 6 Identical seal rings for ports A, B, P and blind hole
- 7 Port A
- 8 Port B
- 9 Blind hole Ø 12.6 mm
- 10 Machined valve contact face, position of ports to ISO 4401 (with locating bore) (Code: 4401-03-02-0-94 – explanation to ISO 5783)

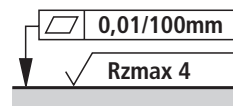
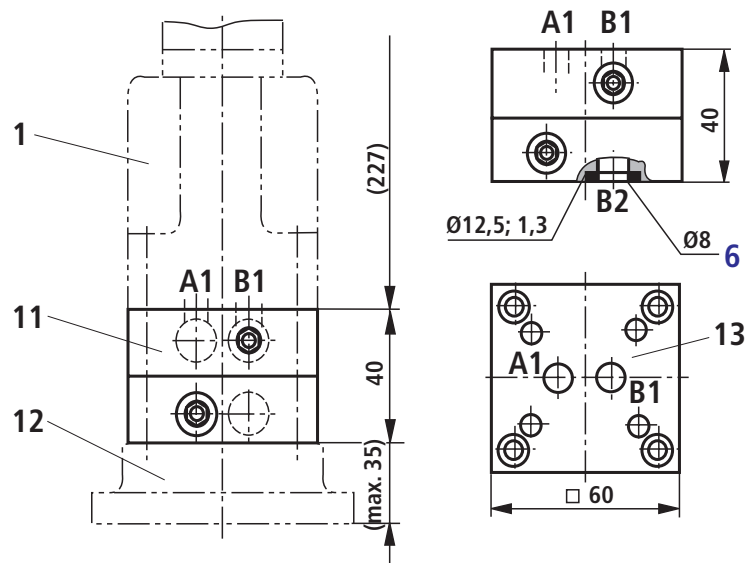
Tolerances to: – General tolerances to ISO 2768-mK

Valve fixing screws (separate order)

The following valve fixing screws are recommended:

- 4 socket head cap screws to ISO 4762 - M5x30 - 10.9-fIZn240h-L (friction coefficient 0.09 to 0.14 to VDA 235-101); tightening torque $M_T = 7 \text{ Nm} \pm 10\%$, material no. R913000316
- 4 socket head cap screws to ISO 4762 - M5x30 - 10.9 (friction coefficient 0.08 to 0.16 to VDI 2230 – tempering, black) tightening torque $M_T = 8.1 \text{ Nm} \pm 10\%$

Unit dimensions: Rectifier sandwich plate (nominal dimensions in mm)



Required surface quality of valve contact face

- 1 Valve housing
- 6 Identical seal rings for ports A2 and B2
- 11 Rectifier sandwich plate
- 12 Subplate (separate order), see page 10
- 13 Valve contact face for 2FRE 6...

⚠ Attention!

Rectifier sandwich plate type Z4S 6-1X/V can **not** be used in conjunction with a proportional flow control valve of type 2FRE 6 A-2X/... (with external closing of the pressure compensator).

Tolerances to: – General tolerances ISO 2768-mK

Valve fixing screws (separate order)

The following valve fixing screws are recommended:

- 4 socket head cap screws to ISO 4762 - M5x70 - 10.9-flZn-240h-L (friction coefficient 0.09 to 0.14 to VDA 235-101); tightening torque $M_T = 7 \text{ Nm} \pm 10\%$, material no. R913000325
- 4 socket head cap screws to ISO 4762 - M5x70 - 10.9 (friction coefficient 0.08 to 0.16 to VDI 2230 – tempering, black) tightening torque $M_T = 8.1 \text{ Nm} \pm 10\%$

Notes
