

Proportional directional control valves, pilot-operated, with electrical position feedback and integrated electronics (OBE)

Type 4WRKE ... 909



- ▶ Size 10 ... 27
- ▶ Component series 3X
- ▶ Maximum operating pressure 250 bar
- ▶ Maximum flow 1000 l/min

Features

- ▶ Operation by means of proportional solenoids
- ▶ Control of flow direction and size
- ▶ For subplate mounting
- ▶ Porting pattern according to ISO 4401
- ▶ Electrical position feedback
- ▶ Spring-centered main control spool
- ▶ Pilot control valve: proportional directional valve, single-stage
- ▶ Main stage with position control

Contents

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Ordering code

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
4	WRK	E					- 3X	/	6E	G24		K31	/	-909

01	4 main ports	4
02	Proportional directional control valves, pilot-operated	WRK
03	With integrated electronics (OBE)	E
04	Size 10	10
	Size 16	16
	Size 25	25
	Size 27	27
05	Symbols; possible version see page 3	

Rated flow

06	- Size 10	
	50 l/min	050
	100 l/min	100
	- Size 16	
	150 l/min	150
	220 l/min	220
	- Size 25	
	350 l/min	350
	- Size 27	
	500 l/min	500

Flow characteristic

07	Linear	L
	Linear with fine control range (only symbol W6-)	P
08	Component series 30 ... 39 (30 ... 39: unchanged installation and connection dimensions)	3X
09	Proportional solenoid with detachable coil	6E
10	Direct voltage 24 V	G24

Pilot oil flow

11	External pilot oil supply, external pilot oil return	no code
	Internal pilot oil supply, external pilot oil return	E
	Internal pilot oil supply, internal pilot oil return	ET
	External pilot oil supply, internal pilot oil return	T

Electrical connection

12	Connector, 7-pole (6 + PE) according to EN 175201-804	K31 ¹⁾
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Interfaces of the control electronics

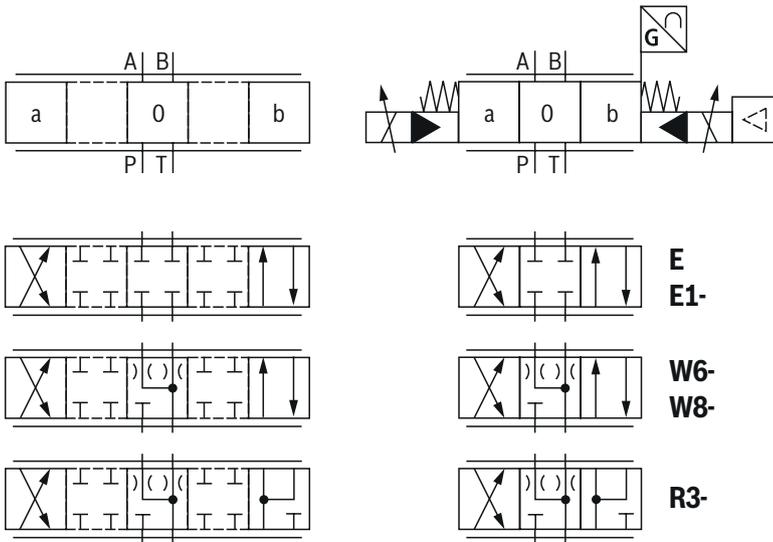
13	Command value input ± 10 V; actual value output ± 10 V	A1
	Command value input 4 ... 20 mA; actual value output 4 ... 20 mA	F1

Seal material (observe compatibility of seals with hydraulic fluid used, see page 7)

14	NBR seals	M
15	Reduced maximum operating pressure	-909

¹⁾ Mating connectors can be ordered separately, see page 21.

Symbols



With symbols E1- and W8-:

P→A: q_V max B→T: $q_V/2$
 P→B: $q_V/2$ A→T: q_V max

With symbol R3-:

P→A: q_V max B→P: $q_V/2$
 P→B: $q_V/2$ A→T: q_V max

Notice:

- ▶ Representation according to ISO 1219-1. Hydraulic interim positions are shown by dashes.
- ▶ With symbols W6-, W8- and R3-, there is a connection from A→T and B→T with approx. 2% of the relevant nominal cross-section in the zero position.

Version	simple	detailed
"no code"		
"E"		
"ET"		
"T"		

- 1 Pilot control valve type 4WRAP 6...
- 2 Main valve
- 3 Integrated electronics (OBE)

Function, section

Valves of type 4WRKE are 2-stage proportional directional control valves. They control the flow direction and size. The main stage is position-controlled so that the control spool position is independent from flow forces also in the case of bigger flows.

The valves mainly consist of the pilot control valve (1), the housing (8), the main control spool (7), the covers (5 and 6), the centering spring (4), and the inductive position transducer (9).

If there is no input signal, the main control spool (7) will be kept in the central position by the centering spring (4).

Both control chambers in the covers (5 and 6) are connected to port T via the valve control spool (2).

The main control spool (7) is connected to suited control electronics via the inductive position transducer (9).

Both the position change of the main control spool (7) and the change of the command value at the junction summing of the amplifier create a voltage difference.

During the comparison of command value and actual value, a possible control deviation is determined via the electronics and the proportional solenoid of the pilot control valve (1) is supplied with current. The current induces a force in the solenoid which operates the control spool via a plunger in a row. The flow which is activated via the control cross-sections leads to an adjustment of the main control spool.

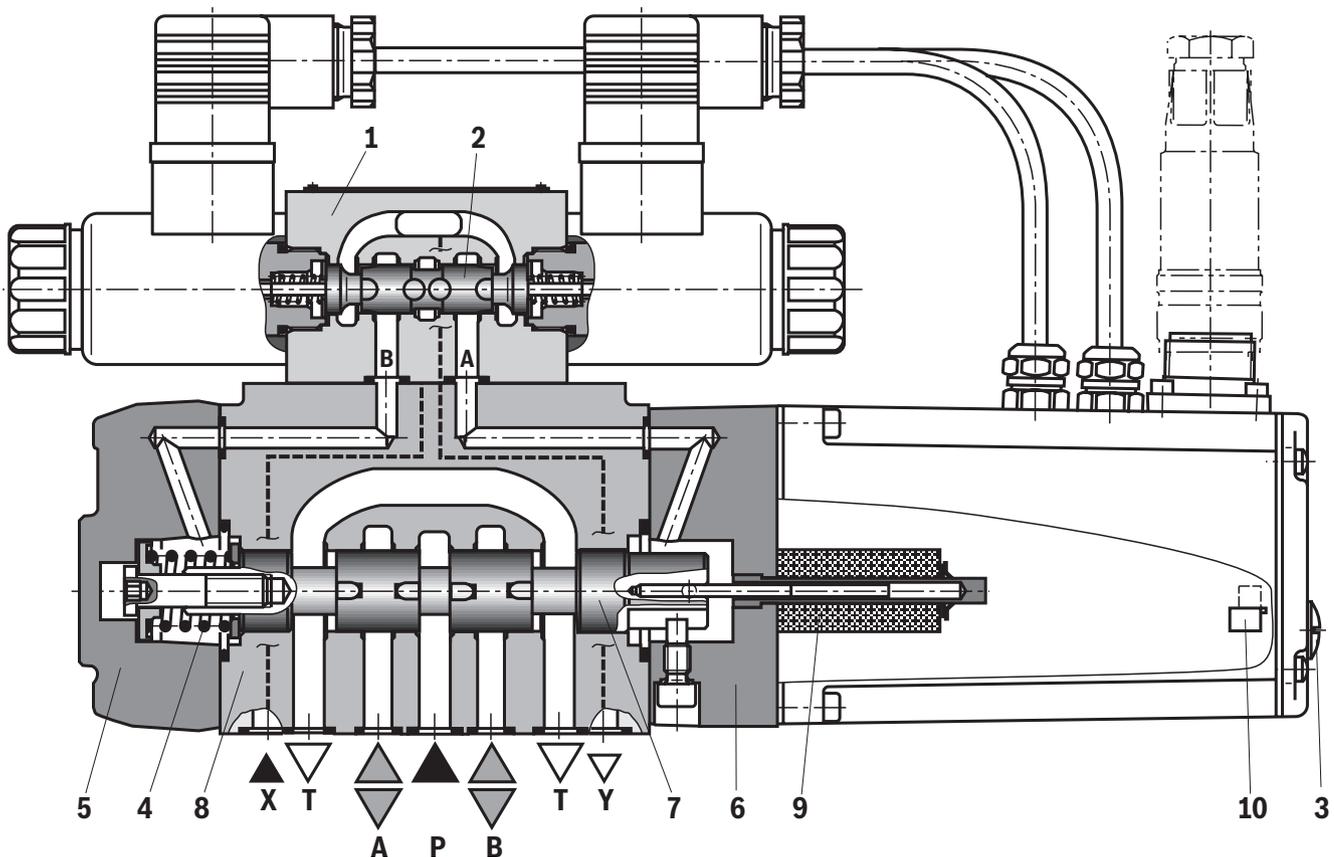
The main control spool (7) with the core of the inductive position transducer (9) attached to it is displaced until the actual value corresponds to the command value.

In controlled state, the main control spool (7) is force-balanced and kept in this controlled position.

The control spool stroke and the control opening change proportionally to the command value.

The control electronics is integrated in the valve.

By adjusting the valve and electronics, the deviation in series production of the devices is kept low.



Function, section

Notice:

- ▶ The tank lines must not be allowed to run empty; with corresponding installation conditions, a preload valve (preload pressure approx. 2 bar) must be installed.
- ▶ The zero point adjustment at **"zero point main stage"** (10) is made at the factory and can be adjusted in a range of $\pm 30\%$ of the nominal stroke via a potentiometer in the control electronics. Access with the integrated control electronics by removing a front-side plug screw (3) on the cover housing.
- ▶ When the pilot control valve or the control electronics are exchanged, they are to be re-adjusted. All adjustments may be implemented by instructed experts only.
- ▶ Changes in the zero point may result in damage to the system and may only be implemented by instructed specialists.

Technical data

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

General					
Size	NG	10	16	25	27
Type of connection	Subplate mounting				
Porting pattern		ISO 4401-05-05-0-05	ISO 4401-07-07-0-05	ISO 4401-08-08-0-05	ISO 4401-08-08-0-05
Weight	kg	9	11	18	19.5
Installation position	Any				
Ambient temperature range	°C	-20 ... +50			
Storage temperature range (with UV protection)	°C	+5 ... +40			
Maximum storage time	Years	1 (if the storage conditions are observed, refer to the operating instructions 07600-B)			
Maximum relative humidity (no condensation)	%	95			
Protection class according to EN 60529	IP65 (if suitable and correctly mounted mating connectors are used)				
Maximum surface temperature	°C	150			
MTTF _D values according to EN ISO 13849	Years	75 (for further details see data sheet 08012)			
Sine test according to EN 60068-2-6	10 ... 2000 Hz / maximum of 10 g / 10 cycles / 3 axes				
Noise test according to EN 60068-2-64	20 ... 2000 Hz / 10 g _{RMS} / 30 g peak / 24 h / 3 axes				
Transport shock according to EN 60068-2-27	15 g / 11 ms / 3 shocks / 3 axes				
Conformity	▶ CE according to EMC Directive 2014/30/EU, tested according to		EN 61000-6-2 and EN 61000-6-3		
	▶ RoHS Directive		2011/65/EU ¹⁾		

¹⁾ The product fulfills the substance requirements of the RoHS Directive 2011/65/EU.

Technical data

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

Hydraulic							
Size	NG	10	16	25	27		
Maximum operating pressure	▶ Ports A, B, P						
	– Pilot control valve	Pilot oil supply	bar	25 ... 250			
	– Main valve		bar	250	250	250	250
	▶ Port T	External pilot oil supply	bar	250	250	250	210
		Internal pilot oil supply	bar	Static < 10 (pilot control valve)			
	▶ Port Y		bar	Static < 10 (pilot control valve)			
Hydraulic fluid		See table, page 7					
Hydraulic fluid temperature range	°C	–20 ... +80					
Viscosity range	mm ² /s	20 ... 380					
Maximum admissible degree of contamination of the hydraulic fluid; cleanliness class according to ISO 4406 (c)		Class 20/18/15 ²⁾					
Nominal flow ($\Delta p = 5$ bar per control edge; $\pm 10\%$)		50 100	150 220	350	500		
Maximum flow	l/min	170	460	870	1000		
Maximum leakage flow (inlet pressure 100 bar)	▶ Symbol E, E1-						
	– Main valve	l/min	0.09	0.22	0.26	0.26	
	– Main valve + pilot control valve	l/min	0.39	0.52	0.56	0.56	
	▶ Symbol W6-, W8-, R3-						
– Main valve	l/min	0.18	0.44	0.52	0.52		
– Main valve + pilot control valve	l/min	0.48	0.74	0.82	0.82		
Pilot flow (at port X and Y with stepped input signal from 0 ... 100%; 250 bar)	l/min	4.1	8.5	11.7	11.7		

²⁾ The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.

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	DIN 51524	90220
Flame-resistant ▶ 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.

▶ Flame-resistant – containing water:

- Due to the 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 – backing 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.

Static/dynamic		
Hysteresis	%	≤1
Range of inversion	%	<0.5
Response sensitivity	%	≤0.5

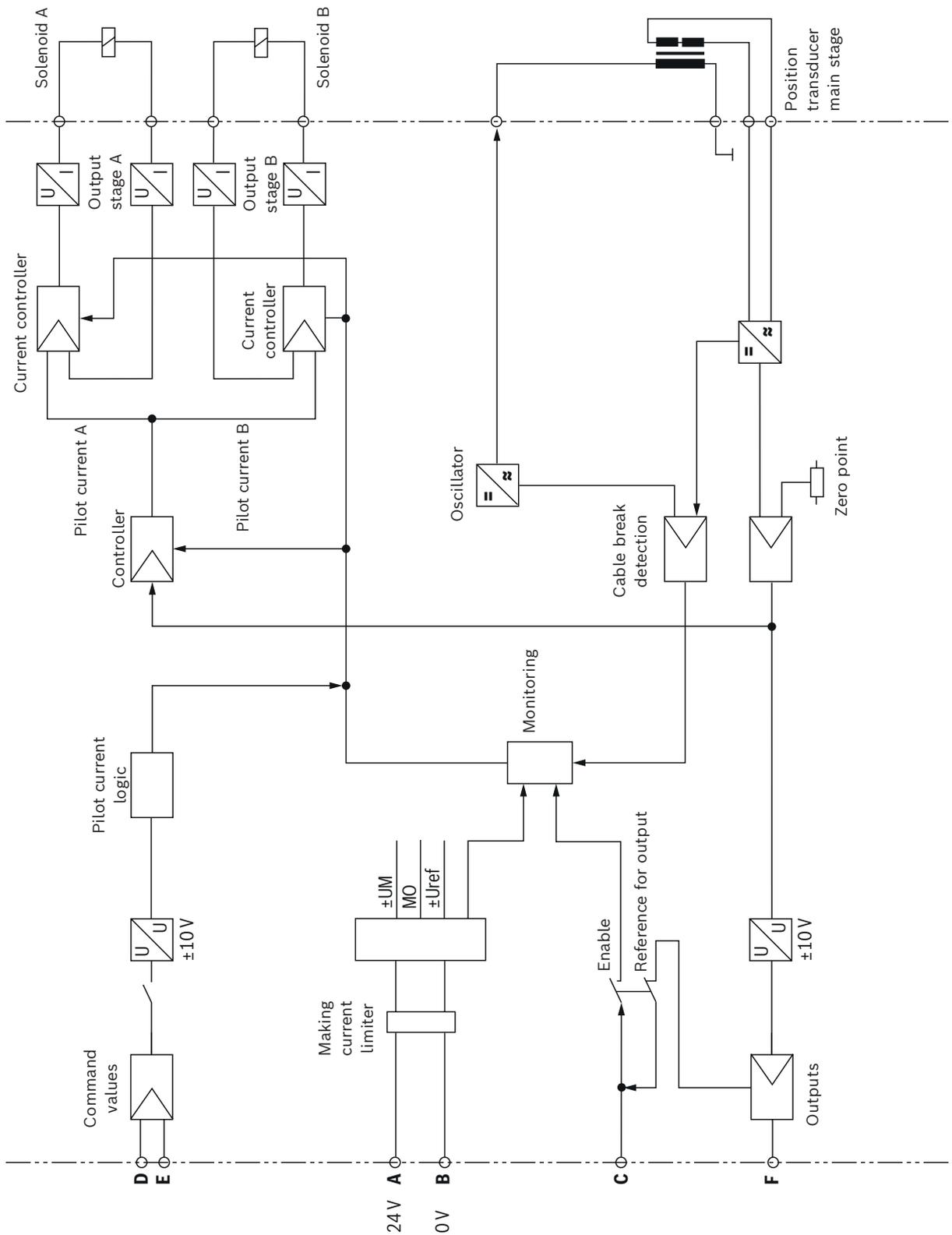
Technical data

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

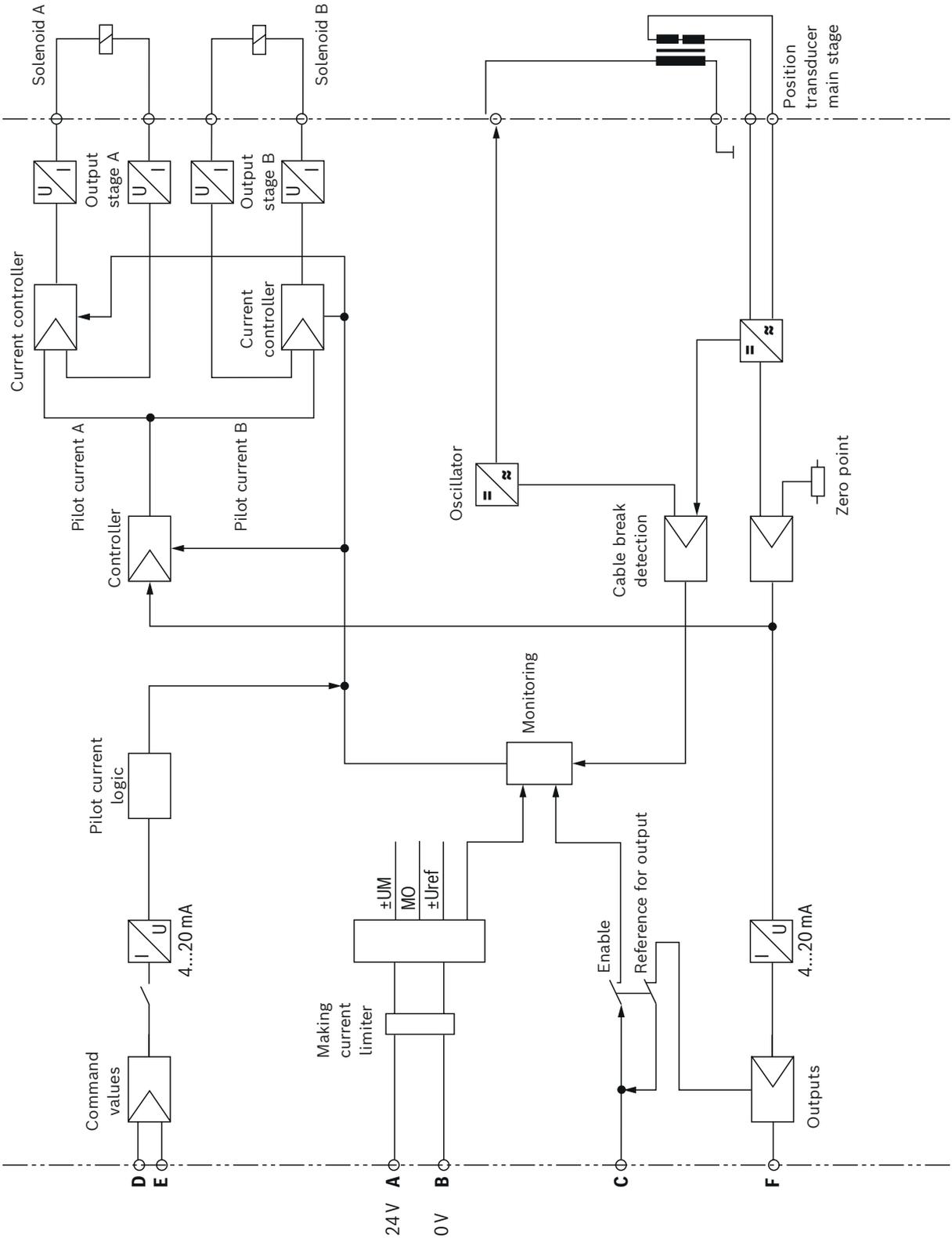
Electrical, integrated electronics (OBE) – interface "A1"				
Supply voltage	▶ Nominal value	VDC	24	
	▶ Minimum	VDC	18	
	▶ Maximum	VDC	36	
	▶ Maximum residual ripple	V _{pp}	2.5	
	▶ Maximum power consumption	VA	40	
	▶ Current consumption	Maximum	A	<2
		Impulse current	A	3
	▶ Fuse protection, external	A _T	2.5 (time-lag)	
Relative duty cycle time according to VDE 0580			S1 (continuous operation)	
Functional ground and screening			See pin assignment, page 11	
Maximum voltage of the differential inputs against 0 V			D→B; E→B (max. 18 V)	
Command value (differential amplifier)	▶ Measurement range	V	±10	
	▶ Input resistance	kΩ	>100	
Actual value (test signal)	▶ Output range	V	±10	
	▶ Minimum load impedance	kΩ	>1	

Electrical, integrated electronics (OBE) – interface "F1"				
Supply voltage	▶ Nominal value	VDC	24	
	▶ Minimum	VDC	19	
	▶ Maximum	VDC	36	
	▶ Maximum residual ripple	V _{pp}	2.5	
	▶ Maximum power consumption	VA	40	
	▶ Current consumption	Maximum	A	<2
		Impulse current	A	3
	▶ Fuse protection, external	A _T	2.5 (time-lag)	
Relative duty cycle time according to VDE 0580			S1 (continuous operation)	
Functional ground and screening			See pin assignment, page 11	
Maximum voltage of the differential inputs against 0 V			D→B; E→B (max. 18 V)	
Command value	▶ Input current range	mA	4 ... 20	
	▶ Input resistance	Ω	200	
Actual value (test signal)	▶ Output range	mA	4 ... 20	
	▶ Maximum load	Ω	500	

Block diagram/controller function block: Version "A1"



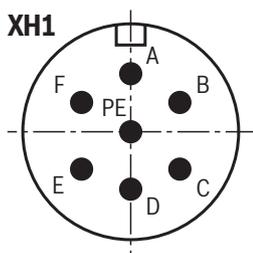
Block diagram/controller function block: Version "F1"



Electrical connections and assignment

Connector pin assignment "XH1", 6-pole + PE according to DIN 43563

Pin	Interface assignment	
	"A1"	"F1"
A	Supply voltage	Supply voltage
B	GND	GND
C	Reference potential actual value	Reference potential actual value
D	Command value	Command value
E	Reference potential command value	Reference potential command value
F	Actual value	Actual value
PE	Functional ground (directly connected to the valve housing)	



Command value	Positive	0 ... +10 V; 12 ... 20 mA	P→A; B→T
	Negative	0 ... -10 V; 12 ... 4 mA	P→B; A→T
Actual value	Positive	0 ... +10 V; 12 ... 20 mA	P→A; B→T
	Negative	0 ... -10 V; 12 ... 4 mA	P→B; A→T
Connection cable	▶ Up to 20 m cable length type LiYCY 7 x 0.75 mm ²		
	▶ Up to 40 m cable length type LiYCY 7 x 1.0 mm ²		
	▶ EMC-compliant installation: – Apply screening to both line ends – Use metal mating connector (see page 21) ▶ Alternatively up to 30 m cable length admissible – Apply screening on supply side – Plastic mating connector (see page 21) can be used		



Notice:

Mating connectors, separate order, see page 21 and data sheet 08006.



Notice:

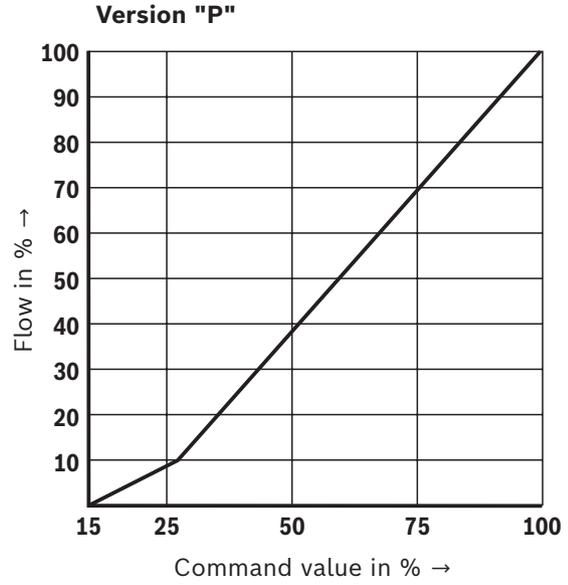
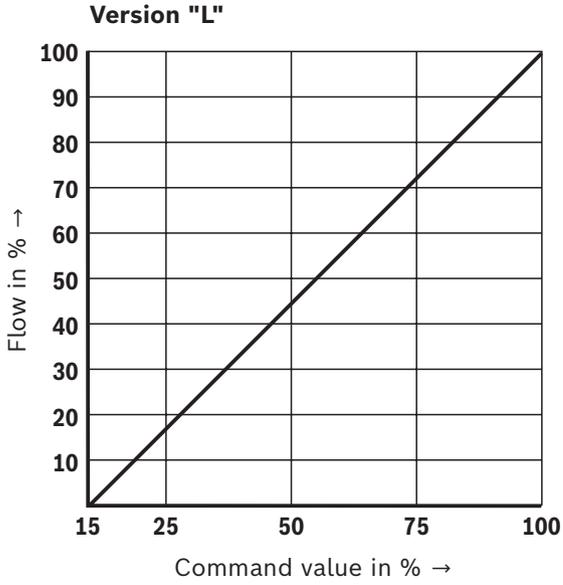
- ▶ Electrical signals provided via valve electronics (e.g. actual value) must not be used to switch off safety-relevant machine functions.
- ▶ As a consequence of overvoltage at the inputs, the inputs will be overridden.
- ▶ Override of the inputs may lead to uncontrolled valve movements.
- ▶ Reference signals not correctly connected may cause overvoltage or override.

Characteristic curves

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

Flow command value function

($\Delta p = 10 \text{ bar}$ (P→A / B→T) or $\Delta p = 5 \text{ bar}$ per control edge (P→A / A→T))

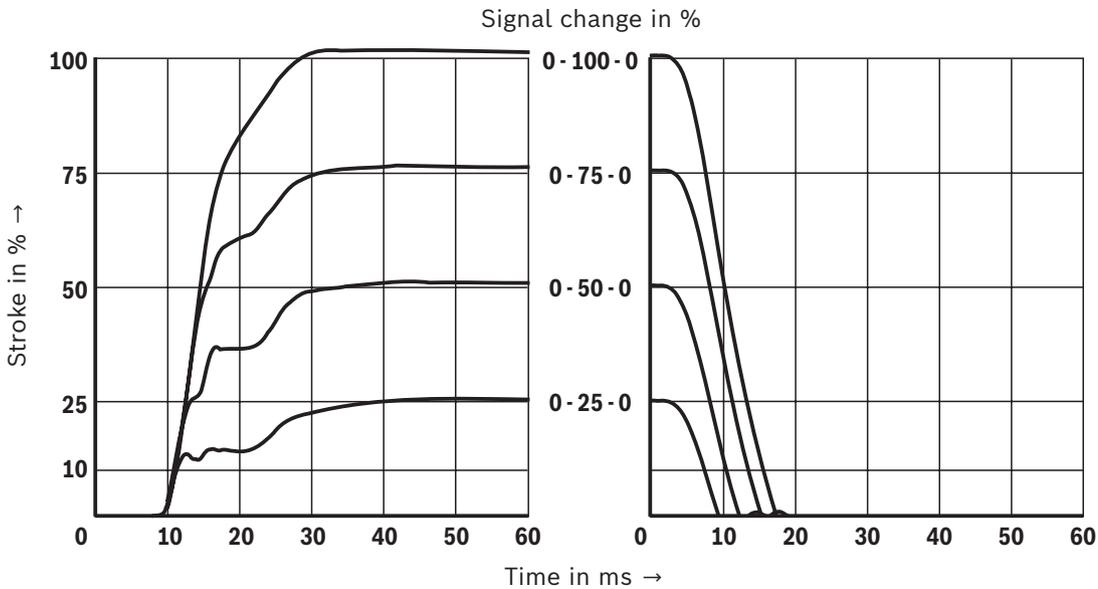


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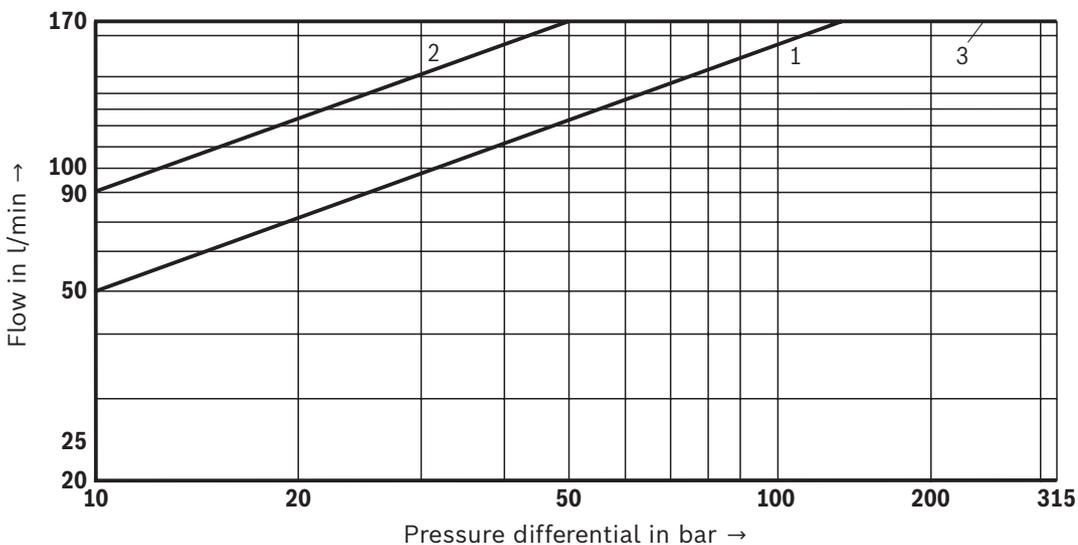
Typical characteristic curves which are subject to tolerance variations.

Characteristic curves: Size 10
(measured with HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ } ^\circ\text{C}$)

Transition function with stepped electric input signals
(measured at a pilot pressure of 100 bar)



Flow/load function with maximum valve opening (tolerance $\pm 10\%$)



Rated flow

- 1 50 l/min
- 2 100 l/min
- 3 Recommended flow limitation (flow velocity 30 m/s)

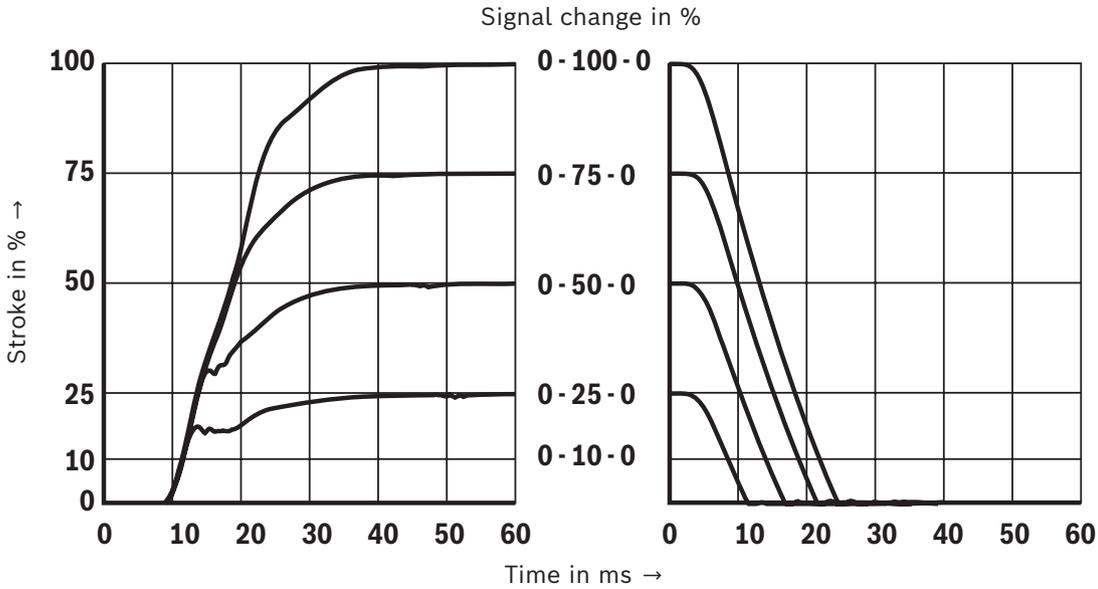


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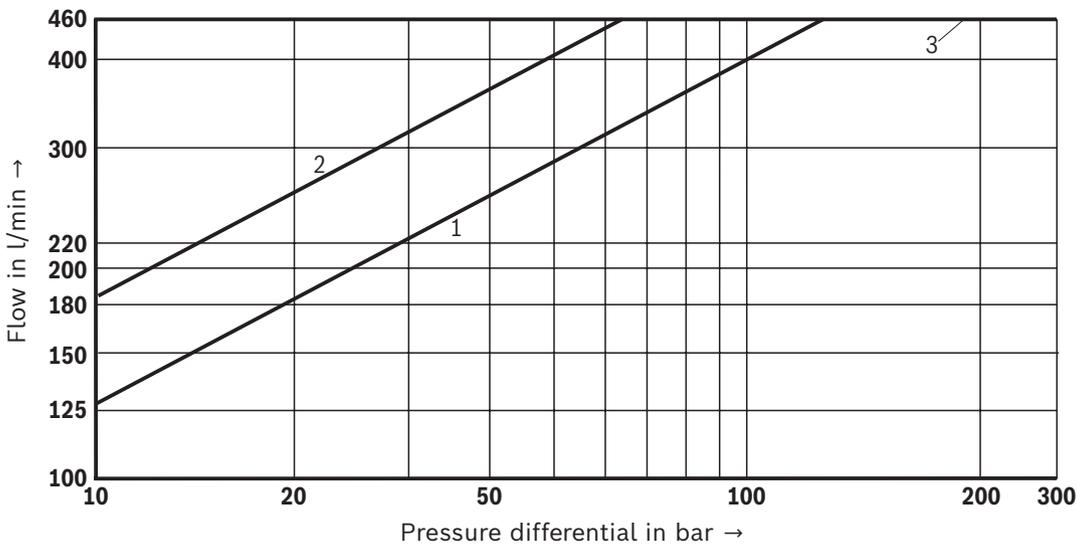
Typical characteristic curves which are subject to tolerance variations.

Characteristic curves: Size 16
(measured with HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ } ^\circ\text{C}$)

Transition function with stepped electric input signals
(measured at a pilot pressure of 100 bar)



Flow/load function with maximum valve opening (tolerance $\pm 10\%$)



Rated flow

- 1 150 l/min
- 2 220 l/min
- 3 Recommended flow limitation (flow velocity 30 m/s)

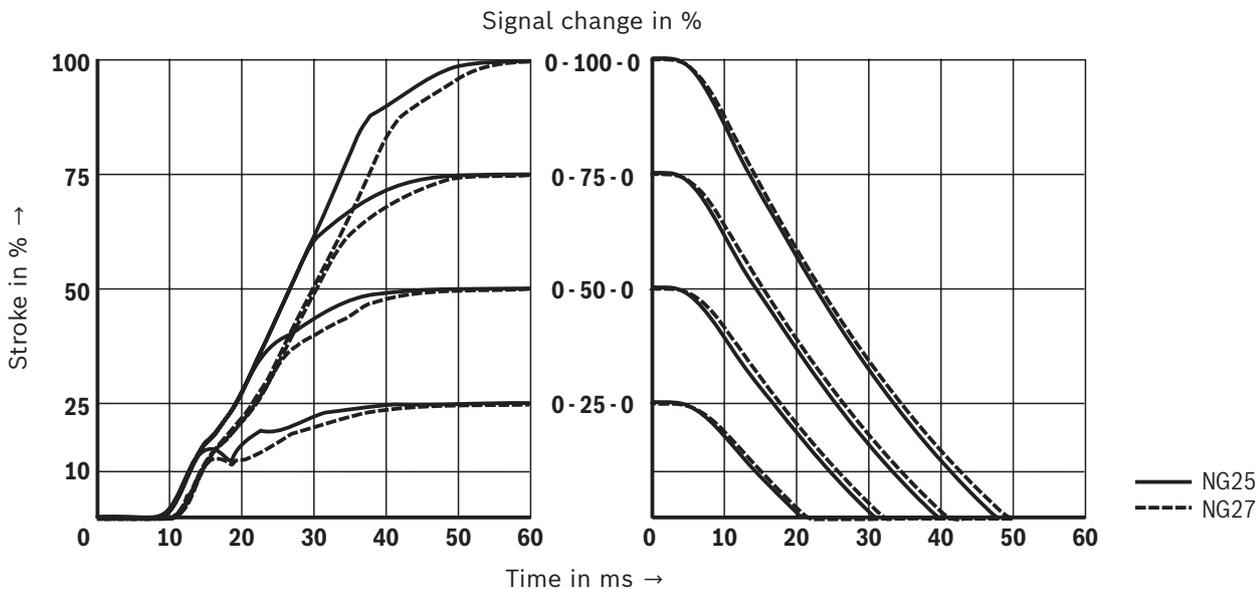


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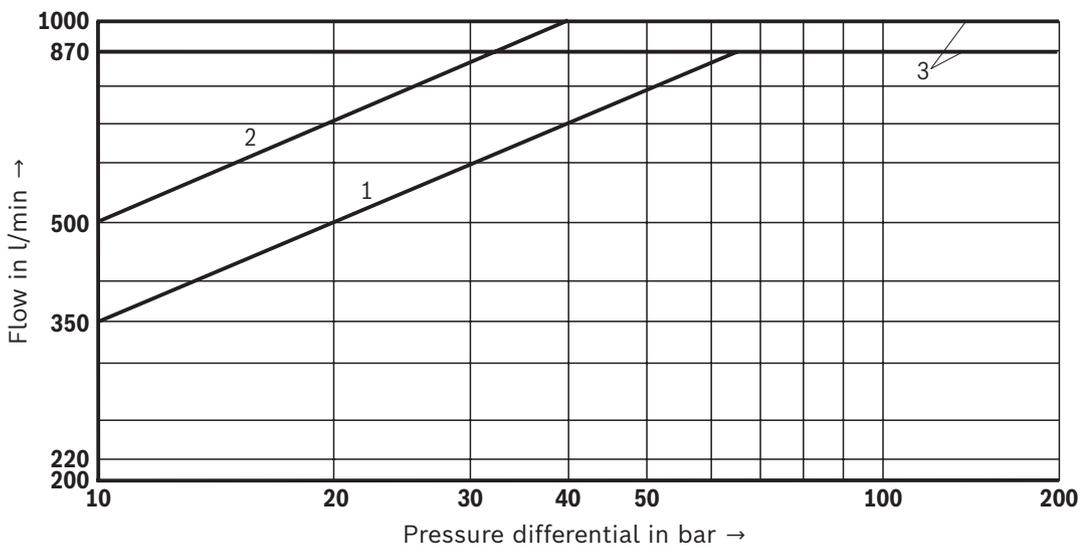
Typical characteristic curves which are subject to tolerance variations.

Characteristic curves: Sizes 25 and 27
 (measured with HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ } ^\circ\text{C}$)

Transition function with stepped electric input signals
 (measured at a pilot pressure of 100 bar)



Flow/load function with maximum valve opening (tolerance $\pm 10\%$)

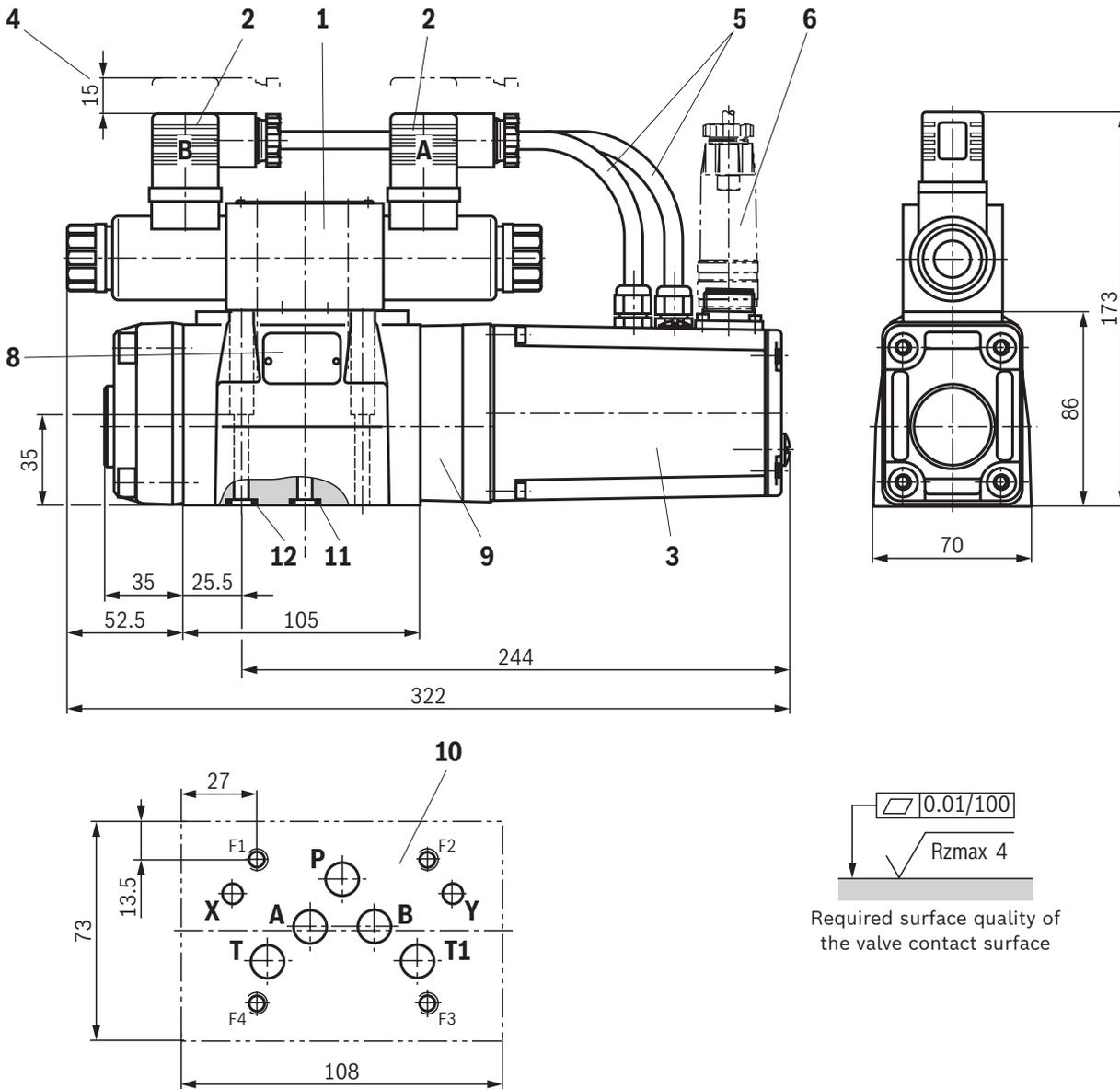


Rated flow

- 1 350 l/min
- 2 500 l/min
- 3 Recommended flow limitation (flow velocity 30 m/s)

Notice:
 Typical characteristic curves which are subject to tolerance variations.

Dimensions: Size 10
(dimensions in mm)



- 1 Pilot control valve
- 2 Mating connector (A gray; B black)
- 3 Integrated electronics (OBE)
- 4 Space required for connection cable and to remove the mating connector
- 5 Wiring
- 6 Mating connector for connector "K31" (separate order, see page 21 and data sheet 08006)
- 7 Locking pin
- 8 Name plate
- 9 Main valve
- 10 Machined valve contact surface, porting pattern according to ISO 4401-05-05-0-05 (port X, Y as required)
- 11 Identical seal rings for connection A, B, P, T
- 12 Identical seal rings for connection X, Y

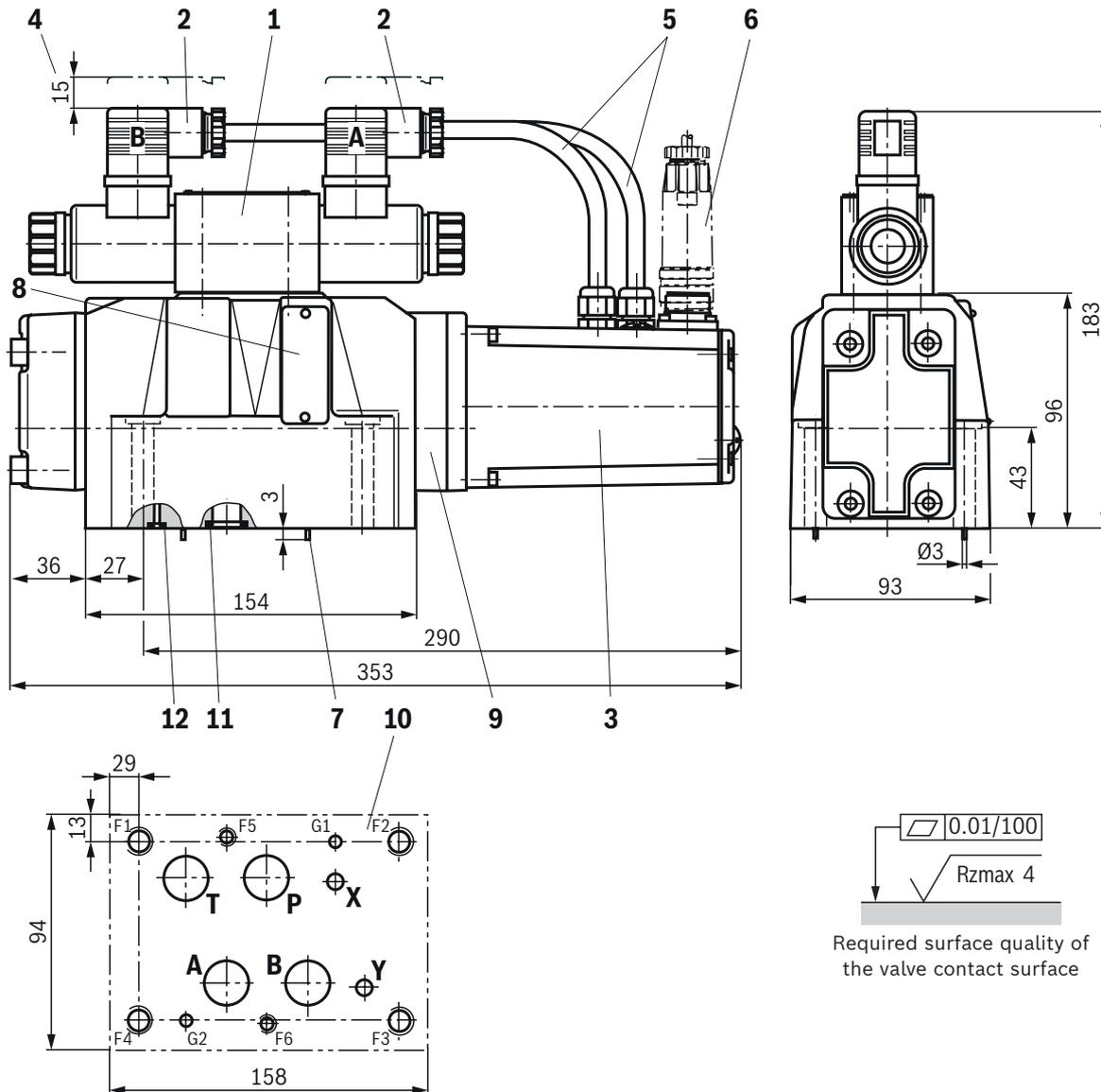
Required surface quality of the valve contact surface

Valve mounting screws and subplates, see page 20.

Notice:

The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Size 16
(dimensions in mm)



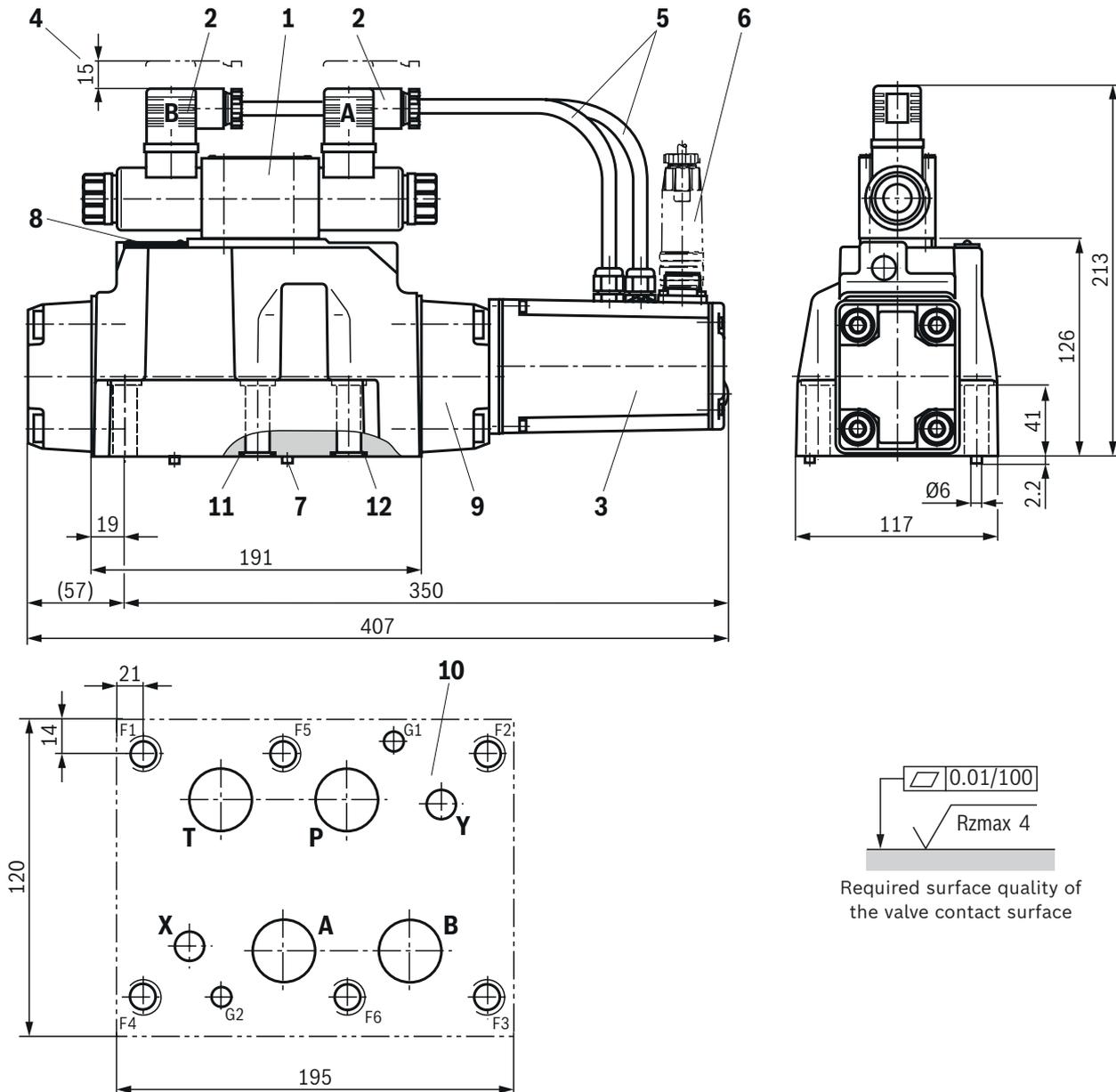
- 1 Pilot control valve
- 2 Mating connector (A gray; B black)
- 3 Integrated electronics (OBE)
- 4 Space required for connection cable and to remove the mating connector
- 5 Wiring
- 6 Mating connector for connector "K31" (separate order, see page 21 and data sheet 08006)
- 7 Locking pin
- 8 Name plate
- 9 Main valve
- 10 Machined valve contact surface; porting pattern according to ISO 4401-07-07-0-05 (ports X and Y as required), deviating from the standard: Ports A, B, T and P with $\varnothing 20$ mm
- 11 Identical seal rings for connection A, B, P, T
- 12 Identical seal rings for connection X, Y

Valve mounting screws and subplates, see page 20.

Notice:

The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Size 25
(dimensions in mm)



- 1 Pilot control valve
- 2 Mating connector (A gray; B black)
- 3 Integrated electronics (OBE)
- 4 Space required for connection cable and to remove the mating connector
- 5 Wiring
- 6 Mating connector for connector "K31" (separate order, see page 21 and data sheet 08006)
- 7 Locking pin
- 8 Name plate
- 9 Main valve
- 10 Machined valve contact surface, porting pattern according to ISO 4401-08-08-0-05 (port X, Y as required)

- 11 Identical seal rings for connection A, B, P, T
- 12 Identical seal rings for connection X, Y

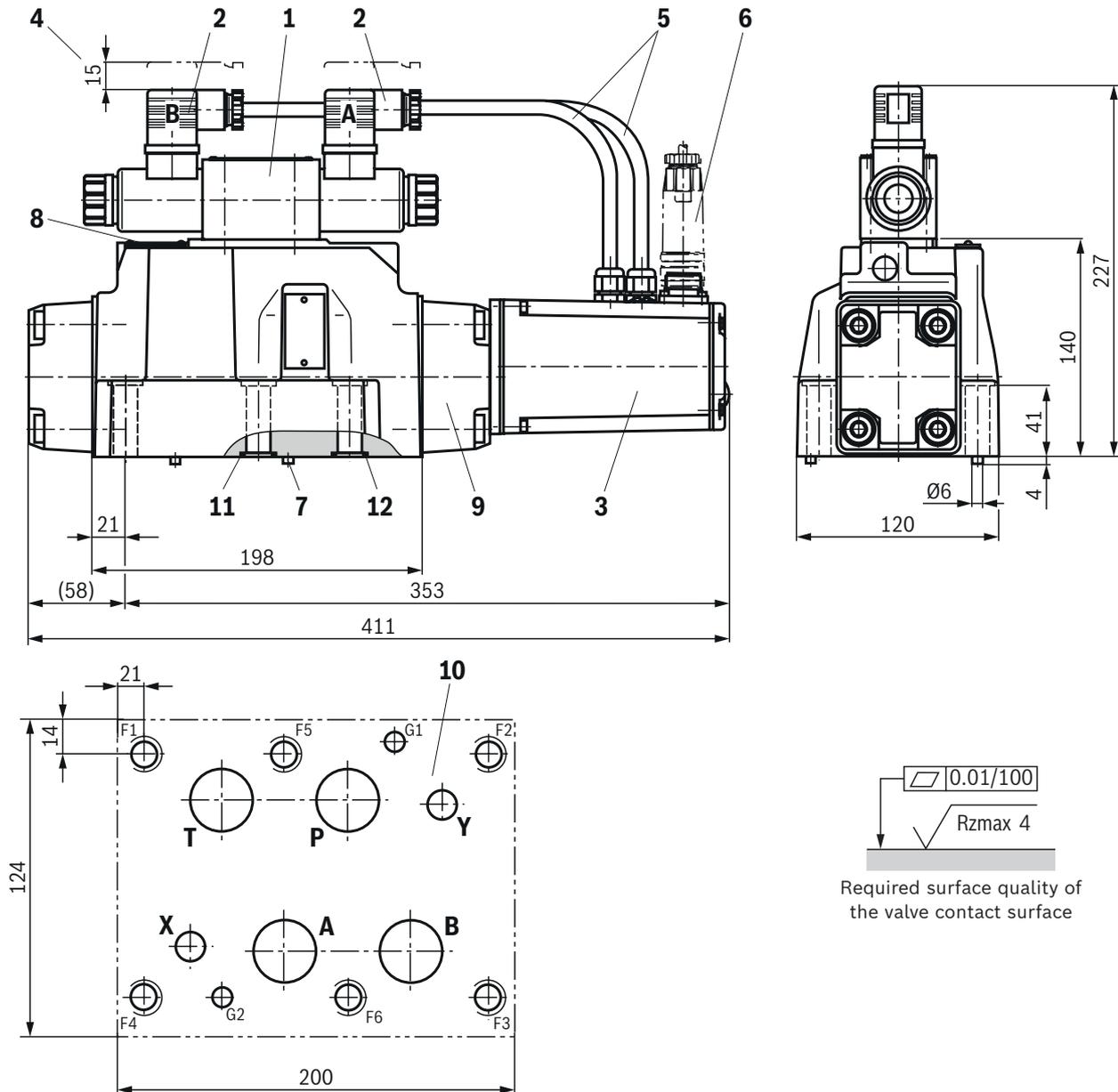
Valve mounting screws and subplates, see page 20.



Notice:

The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Size 27
(dimensions in mm)



- 1 Pilot control valve
- 2 Mating connector (A gray; B black)
- 3 Integrated electronics (OBE)
- 4 Space required for connection cable and to remove the mating connector
- 5 Wiring
- 6 Mating connector for connector "K31" (separate order, see page 21 and data sheet 08006)
- 7 Locking pin
- 8 Name plate
- 9 Main valve
- 10 Machined valve contact surface; porting pattern according to ISO 4401-08-08-0-05 (ports X and Y as required), deviating from the standard: Ports A, B, T and P with $\varnothing 32$ mm

- 11 Identical seal rings for connection A, B, P, T
- 12 Identical seal rings for connection X, Y

Valve mounting screws and subplates, see page 20.



Notice:

The dimensions are nominal dimensions which are subject to tolerances.

Dimensions

Valve mounting screws (separate order)

Size	Quantity	Hexagon socket head cap screws	Material number
10	4	ISO 4762 - M6 x 45 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B Friction coefficient $\mu_{\text{total}} = 0.09 \dots 0.14$; tightening torque $M_A = 13.5 \text{ Nm} \pm 10\%$	R913043777
	or		
	4	ISO 4762 - M6 x 45 - 10.9 Friction coefficient $\mu_{\text{total}} = 0.12 \dots 0.17$; tightening torque $M_A = 15.5 \text{ Nm} \pm 10\%$	Not included in the Rexroth delivery range
16	2	ISO 4762 - M6 x 60 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B Friction coefficient $\mu_{\text{total}} = 0.09 \dots 0.14$; tightening torque $M_A = 12.2 \text{ Nm} \pm 10\%$	R913043410
	4	ISO 4762 - M10 x 60 - 10.9-fLZn/nc/480h/C Friction coefficient $\mu_{\text{total}} = 0.09 \dots 0.14$; tightening torque $M_A = 58 \text{ Nm} \pm 20\%$	R913014770
	or		
	2	ISO 4762 - M6 x 60 - 10.9 Friction coefficient $\mu_{\text{total}} = 0.12 \dots 0.17$; tightening torque $M_A = 15.5 \text{ Nm} \pm 10\%$	Not included in the Rexroth delivery range
4	ISO 4762 - M10 x 60 - 10.9 Friction coefficient $\mu_{\text{total}} = 0.12 \dots 0.17$; tightening torque $M_A = 75 \text{ Nm} \pm 10\%$		
25, 27	6	ISO 4762 - M12 x 60 - 10.9-fLZn/nc/480h/C Friction coefficient $\mu_{\text{total}} = 0.09 \dots 0.14$; tightening torque $M_A = 100 \text{ Nm} \pm 20\%$	R913015613
	or		
	6	ISO 4762 - M12 x 60 Friction coefficient $\mu_{\text{total}} = 0.12 \dots 0.17$; tightening torque $M_A = 100 \text{ Nm} \pm 10\%$	Not included in the Rexroth delivery range
32	6	ISO 4762 - M20 x 80 - 10.9-fLZn/nc/480h/C Friction coefficient $\mu_{\text{total}} = 0.09 \dots 0.14$; tightening torque $M_A = 340 \text{ Nm} \pm 20\%$	R913008472
	or		
	6	ISO 4762 - M20 x 80 Friction coefficient $\mu_{\text{total}} = 0.12 \dots 0.17$; tightening torque $M_A = 430 \text{ Nm} \pm 10\%$	Not included in the Rexroth delivery range



Notice:

The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure.

Subplates (separate order) with porting pattern according to ISO 4401, see data sheet 45100.

Accessories (separate order)**Mating connectors**

Pos. 1)	Designation	Version	Short designation	Material number	Data sheet
6	Mating connector; for valves with round connector, 6-pole + PE	Straight, metal	7PZ31...M	R900223890	08006
		Straight, plastic	7PZ31...K	R900021267	
		Angled, plastic	–	R900217845	–
	Cable sets; for valves with round connector, 6-pole + PE	Plastic, 3.0 m	7P Z31 BF6	R901420483	08006
		Plastic, 5.0 m		R901420491	
		Plastic, 10.0 m		R901420496	
		Plastic, 20.0 m	–	R901448068	

1) See dimensions page 16 ... 19.

Further information

- ▶ Hydraulic valves for industrial applications Data sheet 07600-B
- ▶ Subplates Data sheet 45100
- ▶ Hydraulic fluids on mineral oil basis Data sheet 90220
- ▶ Flame-resistant hydraulic fluids – containing water (HFAE, HFAS, HFB, HFC) Data sheet 90223
- ▶ Reliability characteristics according to EN ISO 13849 Data sheet 08012
- ▶ Hexagon socket head cap screw, metric/UNC Data sheet 08936
- ▶ General product information on hydraulic products Data sheet 07008
- ▶ Installation, commissioning and maintenance of servo valves and high-response valves Data sheet 07700
- ▶ Assembly, commissioning and maintenance of hydraulic systems Data sheet 07900
- ▶ Information on available spare parts www.boschrexroth.com/spc

Notes

Notes

Notes

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