

The Drive & Control Company

Rexroth
Bosch Group

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

Type 4WRDE

RE 29093

Edition: 2016-04

Replaces: 2012-11



H7443

- ▶ Size 10 ... 35
- ▶ Component series 5X
- ▶ Maximum operating pressure 350 bar
- ▶ Maximum flow 3000 l/min

Features

- ▶ 4/3-way version
- ▶ Subplate mounting
- ▶ Porting pattern according to ISO 4401
- ▶ Position sensing of the main control spool by means of an inductive position transducer
- ▶ 2-stage pilot control valve type 4WS2EM 6-2X/...
- ▶ It is particularly suitable for the position, velocity, pressure and force control with high requirements on the dynamics and the response sensitivity

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RE 29093, edition: 2016-04, **Bosch Rexroth AG**

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2/22 4WRDE | Directional control valves

Ordering code

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
4	WRDE					5X	/	6L	24		K9	/		R *

01	4 main ports	4
02	Directional control valve	WRDE
03	Size 10	10
	Size 16	16
	Size 25	25
	Size 27	27
	Size 32	32
	Size 35	35
04	Symbols e.g. E, E1, W etc.; possible version, see page 3	

Rated flow

05	- Size 10	
	25 l/min	25 ¹⁾
	50 l/min	50
	90 l/min	100
	- Size 16	
	125 l/min	125
	200 l/min	200
	- Size 25	
	220 l/min	220
	350 l/min	350
	- Size 27	
	500 l/min	500
	- Size 32	
	400 l/min	400
	600 l/min	600
	- Size 35	
	1000 l/min	1000

Flow characteristic

06	Linear	L
	Linear with fine control range	P
07	Component series 50 ... 59 (50 ... 59: unchanged installation and connection dimensions)	5X

Pilot control valve

08	Servo valve control NG6 (data sheet 29564)	6L
09	Direct voltage 24 V	24

Pilot oil flow

10	Pilot oil supply external, pilot oil return external	no code
	Pilot oil supply internal, pilot oil return external	E
	Pilot oil supply internal, pilot oil return internal	ET
	Pilot oil supply external, pilot oil return internal	T

Electrical connection

11	Without mating connector, with connector	K9 ²⁾
12	Without directional sandwich plate valve	no code
	With directional sandwich plate valve 24 V = mating connector Z4	WG152 ²⁾

Seal material

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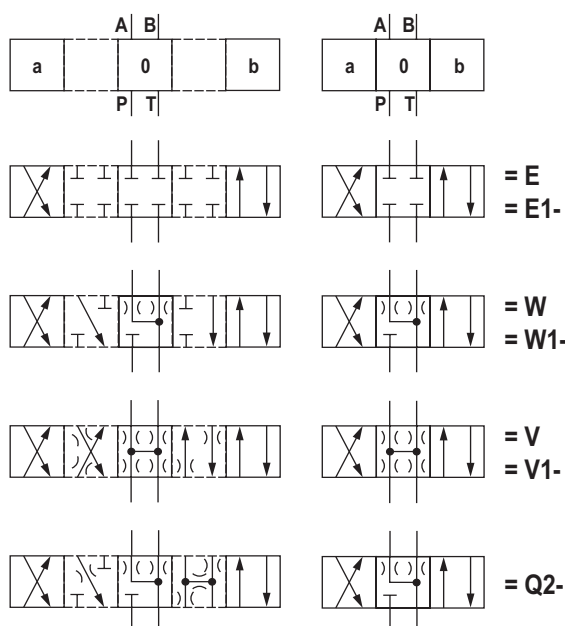
Ordering code

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
4	WRDE					— 5X /	6L 24		K9 /				R	*

13	NBR seals	M
	FKM seals	V
14	R-rings	R
15	For further information, see the plain text	

- 1) Only with symbols E-, W- and V and with version "L".
 2) Mating connectors, separate order, see page 21.

Symbols



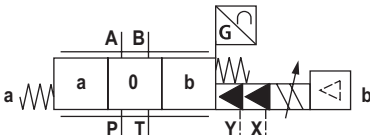
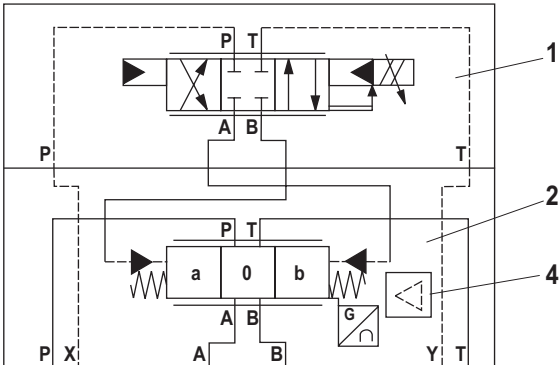
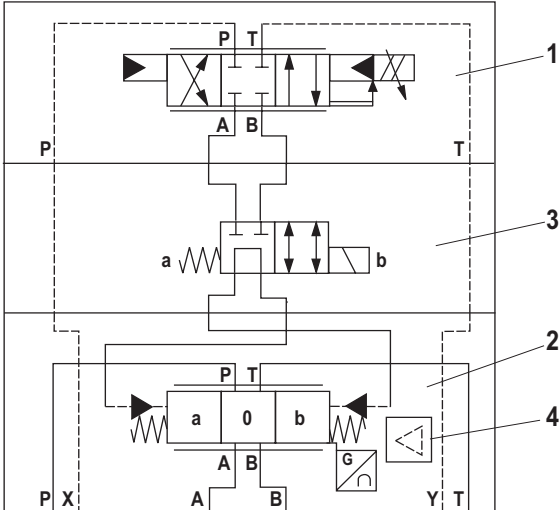
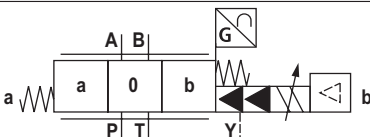
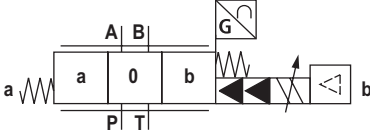
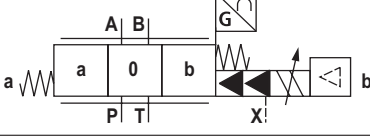
With symbol E1-, W1- and V1-:

P → A: $q_{V \max}$ B → T: $q_V/2$
 P → B: $q_V/2$ A → T: $q_{V \max}$

Notices:

- Representation according to DIN ISO 1219-1. Hydraulic interim positions are shown by dashes.
- With symbols W and W1- there is a connection from A to T and B to T with approx. 3% of the relevant nominal cross-section in zero position.

Symbols

Version	simplified	detailed
"no code"		 
"E"		
"ET"		
"T"		<ul style="list-style-type: none">1 Pilot control valve2 Main valve3 Directional sandwich plate valve4 Integrated electronics (OBE)

Function, section

Valves of type 4WRDE are 3-stage directional control valves.

They control the quantity and direction of a flow and are mainly used in control loops for different tasks.

They consist of the following assemblies:

- ▶ The 2-stage pilot control valve consisting of the control motor (1) and a hydraulic amplifier (5) designed as nozzle flapper plate valve and the control spool socket unit (6) as flow amplifier stage for actuating the 3rd stage (7).
- ▶ The 3rd stage (7) for flow control.
- ▶ An inductive position transducer (8) the core (9) of which is attached to the control spool (10) of the 3rd stage.

The position of the control spool (10) is measured by an inductive position transducer (8). The signal linking of the valve control loop, the supply of the position measurement system and the control of the pilot control valve are carried out via control electronics integrated in the valve. The voltage difference created by the command/actual value comparison is amplified in the control electronics and supplied to the 1st stage of the valve as control deviation. This signal deflects the flapper plate (2) between the two control nozzles (3.1, 3.2). This creates a pressure differential between the two control chambers (11.1, 11.2). The control spool (4) is moved and releases a corresponding flow into the control chamber (12.1 or 12.2). The control spool (10) with the core (9) of the inductive position transducer (8) attached to it is displaced until the actual value corresponds to the command value. In the compensated condition, the control spool (10) is held in the position specified by the command value.

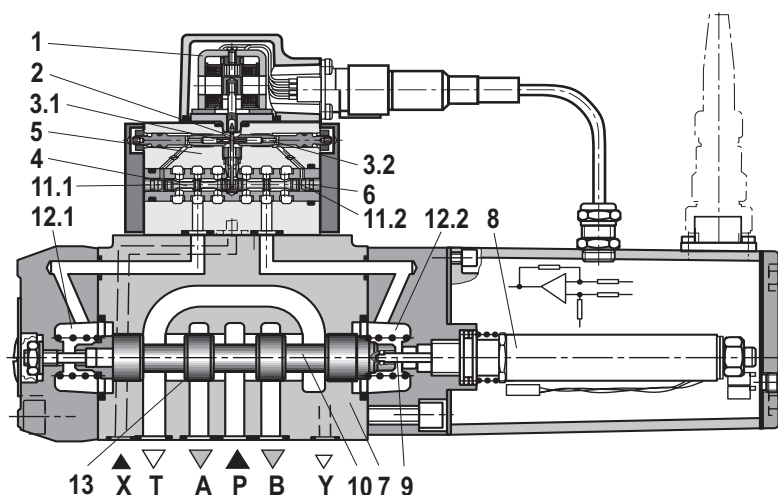
The control spool stroke is proportional to the command value. For the control of the flow, a corresponding control opening results, depending on the position of the control spool (10) to the control edges (13), to which the flow is proportional. The valve dynamics are optimized via the electric gain. The control electronics is integrated in the valve (oscillator, demodulator).

Valve particularities

- ▶ The 3rd stage is basically set-up of modules of our proportional valves.
- ▶ With V control spools, the control edges of control spools and housings are ground in to each other.
- ▶ 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.
- ▶ The pilot control valve may only be maintained by Bosch Rexroth employees. An exception to this is the replacement of the filter and the sealing according to accessories list. It has to be ensured that during the assembly, the sealing is properly seated and the plug screw is tightened. The tightening torque for the plug screw is 30 Nm.

Notice:

Changes in the zero point may result in damage to the system and may only be implemented by instructed specialists.



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6/22 **4WRDE** | Directional control valves

Technical data

(For application outside these values, please consult us!)

general							
Size		10	16	25	27	32	35
Weight	kg	6.8	8.9	15.2	15.5	35.2	71
Installation position and commissioning information		Preferably horizontal, see data sheet 07700					
Storage temperature range	°C	−20 ... +80					
Ambient temperature range	°C	−20 ... +60					
hydraulic ¹⁾							
Maximum operating pressure	► Port A, B, P – External pilot oil supply ²⁾	bar	350	350	350	250	350
	► Port X	bar	25 ... 250			25 ... 210	25 ... 250
	► Port A, B, P – Internal pilot oil supply	bar	25 ... 250			25 ... 210	25 ... 250
Maximum return flow pressure	► Port T – Internal pilot oil supply	bar	Pressure peaks < 100 admissible				
	– External pilot oil supply	bar	315	250	250	210	250
	► Port Y – Internal pilot oil supply	bar	Pressure peaks < 100 admissible				
Rated flow q_{Vnom} (complete valve) ±10% with valve pressure differential Δp = 10 bar and symbol V	l/min	25 50 90	– 125 200	– 220 350	– – 500	– 400 600	– – 1000
Recommended maximum flow	l/min	170	460	870	1000	1600	3000
Pilot oil flow at port X or Y with stepped input signal from 0 to 100% (250 bar)	l/min	8.8	13.5	17.4	17.4	32.5	45.3
Zero flow (at 100 bar)	► Main stage						
	– Symbol V, V1	l/min	4.3	5.8	8.1	8.1	10.7
	– Symbol Q2	l/min	2.2	2.9	4.1	4.1	5.4
	► Main stage and pilot control valve						
	– Symbol V, V1	l/min	5.5	6.6	9	9	11.7
– Symbol Q2	l/min	2.9	3.8	4.9	4.9	6.3	7.4
Hydraulic fluid		See table page 7					
Hydraulic fluid temperature range (at the valve working ports)	°C	−20 ... +80; preferably +40 ... +50					
Viscosity range	mm²/s	20 ... 380					
Maximum admissible degree of contamination of the hydraulic fluid		Pilot control valve: Class 18/16/13 ³⁾					
Cleanliness class according to ISO 4406 (c)		Main stage: Class 20/18/15 ³⁾					
Hysteresis	%	≤ 0.2					
Response sensitivity	%	≤ 0.1					
Zero point calibration (ex works) ⁴⁾	%	≤ 1					
Zero shift upon change of:	► Hydraulic fluid temperature	%/20 °K	≤ 0.7				
	► Operating pressure	%/100 bar	≤ 0.5				
	► Return flow pressure 0 ... 10% of p	%	≤ 0.2				

¹⁾ Measured with HLP46, $\theta_{oil} = 40$ °C ± 5 °C.

²⁾ For a perfect system behavior, we recommend an external pilot oil supply for pressures above 210 bar.

³⁾ The cleanliness classes stated for the components need to be maintained in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.

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

⁴⁾ Related to the pressure-signal characteristic curve (symbol V).

Technical data

(For application outside these values, please consult us!)

Hydraulic fluid	Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils	HL, HLP	NBR, FKM	DIN 51524	90220
Flame-resistant ▶ Containing water	HFC (Fuchs Hydrotherm 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922	90223



Important information 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 flash point of the hydraulic fluid used must be 40 K higher than the maximum solenoid surface temperature.

▶ Flame-resistant – containing water:

- Maximum pressure differential per control edge 175 bar
- Pressure pre-loading at the tank port > 20% of the pressure differential, otherwise increased cavitation
- Life cycle as compared to operation with mineral oil HL, HLP 50 to 100%

electric	
Voltage type	Direct voltage
Type of signal	Analog
Protection class according to EN 60529	IP 65 with mating connector mounted and locked
Control electronics	Integrated in the valve

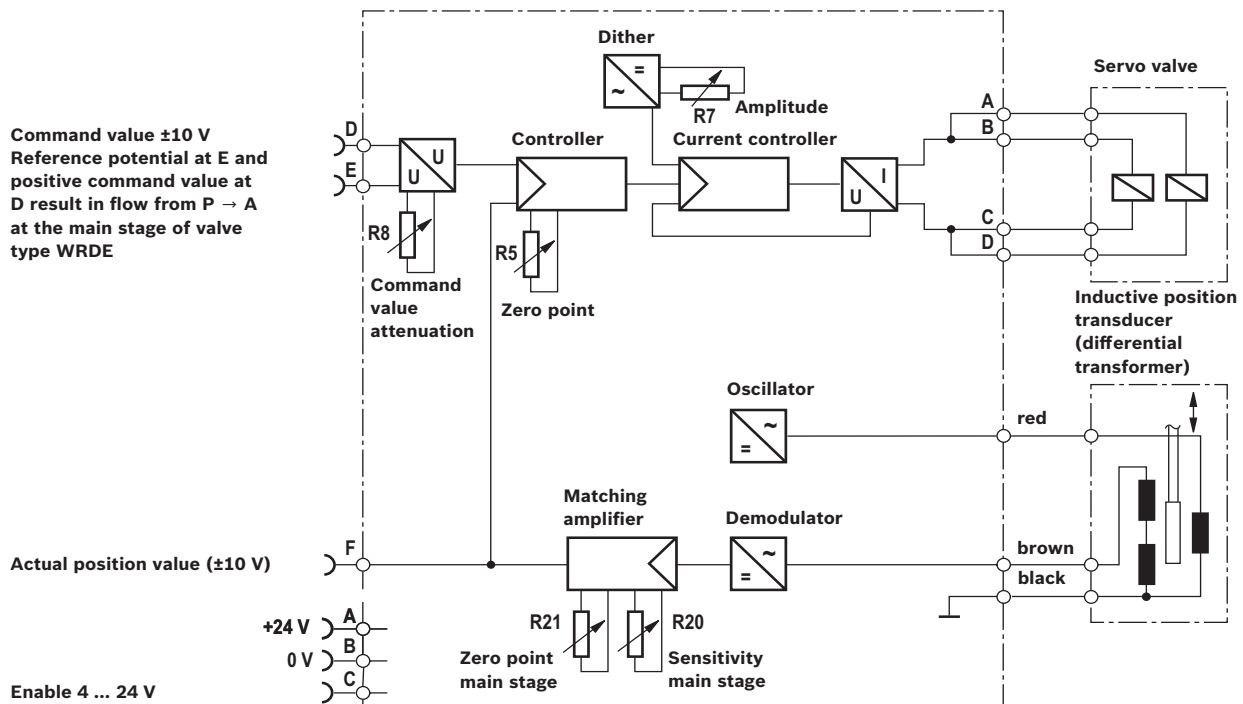
Electrical connections, assignment

Contact	Signal	Connector pin assignment
A	24 VDC (20 ... 28 VDC); full bridge rectification smoothened with 2200 μ F; I_{\max} = 270 mA	Supply voltage
B	0 V	
C	4 to 24 VDC	Enable ¹⁾ (activates the valve control loop)
D	± 10 V ^{2; 3)}	Differential amplifier input (command value)
E		
F		Actual value

- ¹⁾ With supplied hydraulic pressure and **deactivated enable**, the control spool of the main stage is moved into the end position and the cylinder axis leaves its position at **maximum velocity**. If a "WG152" directional sandwich plate valve is used between pilot control valve and main stage, the control chambers are unloaded from the pilot control valve to the main control spool and the control spool of the main stage is centered in central position or in a preferred position by springs. Consequently, the cylinder axis leaves its position at **minimum velocity**.
- ²⁾ Positive command value at D vis-à-vis E results in flow from P to A at the main stage.
- ³⁾ Current input ± 10 mA as option, input resistance 1 k Ω ; in the ordering code, extend the type by "- 280".

8/22 4WRDE | Directional control valves

Block diagram of the integrated electronics (OBE)



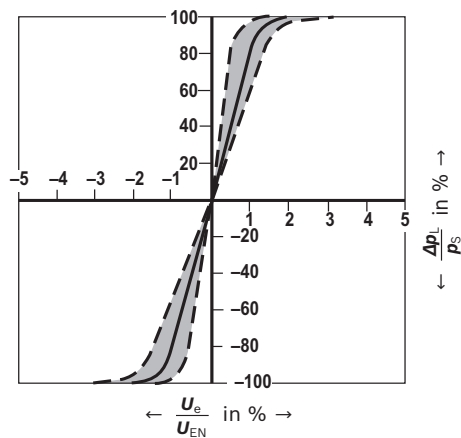
Notice:

Electrical signals provided via control electronics (e.g. actual value or enable) must not be used to switch off safety-relevant machine functions.

Characteristic curves

(measured with HLP46, $v = 32 \text{ mm}^2/\text{s}$ and $\vartheta_{oil} = 40 \pm 5 \text{ }^\circ\text{C}$)

Pressure-signal characteristic curve (symbol V;
measured with $p_s = 100 \text{ bar}$)



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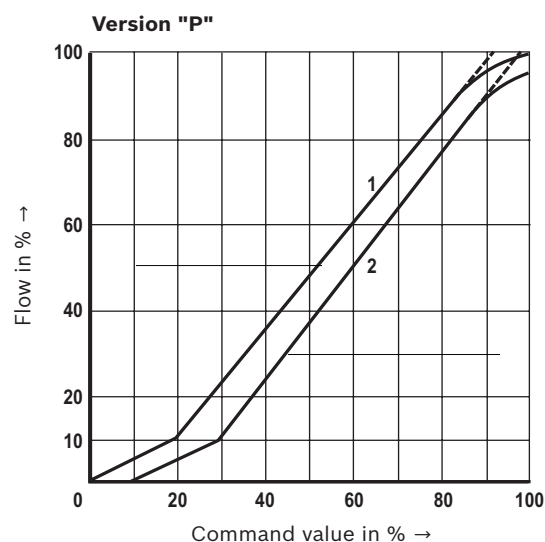
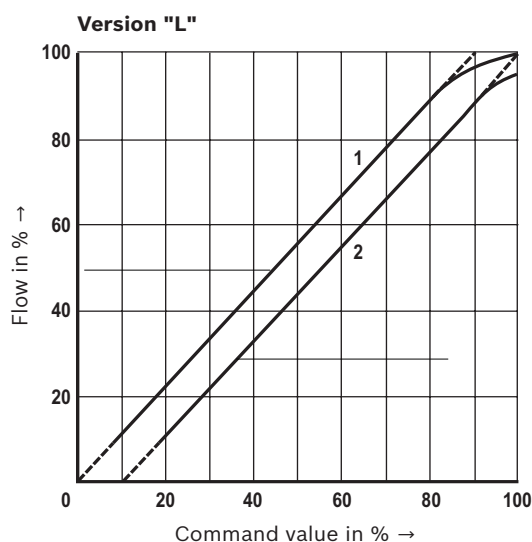
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Characteristic curves

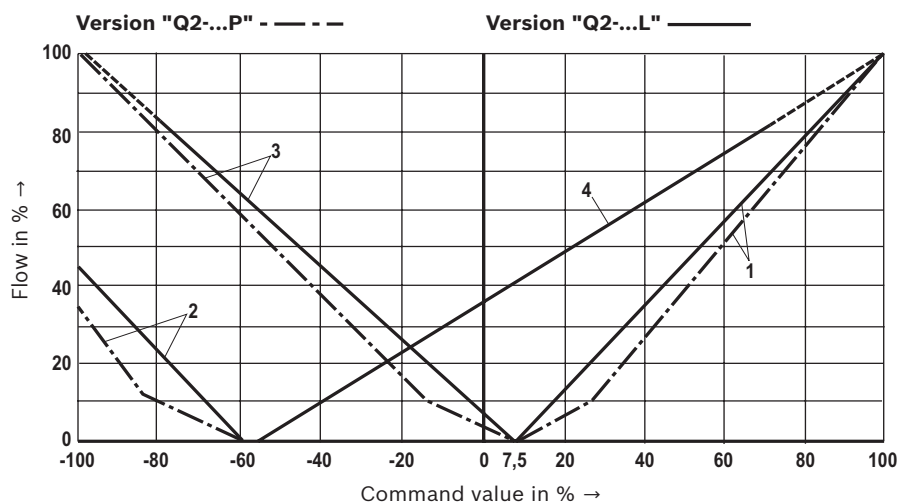
(measured with HLP46, $\nu = 32 \text{ mm}^2/\text{s}$ and $\vartheta_{\text{oil}} = 40 \pm 5 \text{ }^\circ\text{C}$)

Flow command value function

(at e.g. $P \rightarrow A / B \rightarrow T$ and 10 bar valve pressure differential or $P \rightarrow A$ or $A \rightarrow T$ and 5 bar per control edge)



- 1 Symbol V
- 2 Symbol E or W

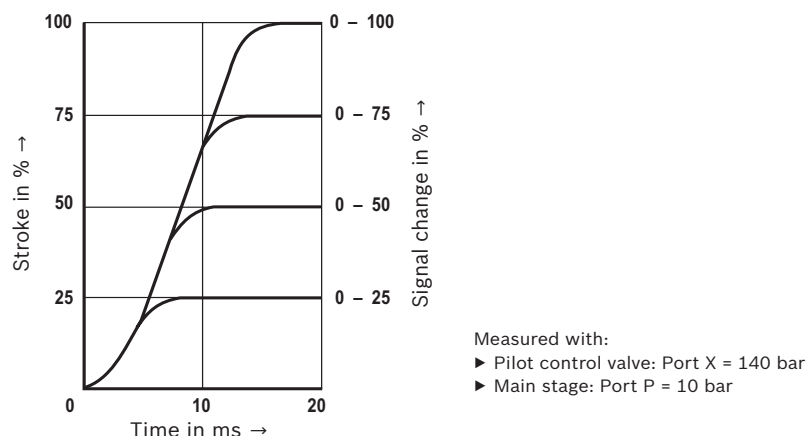


- 1 $P \rightarrow A$
- 2 $P \rightarrow B$
- 3 $A \rightarrow T$
- 4 $B \rightarrow T$

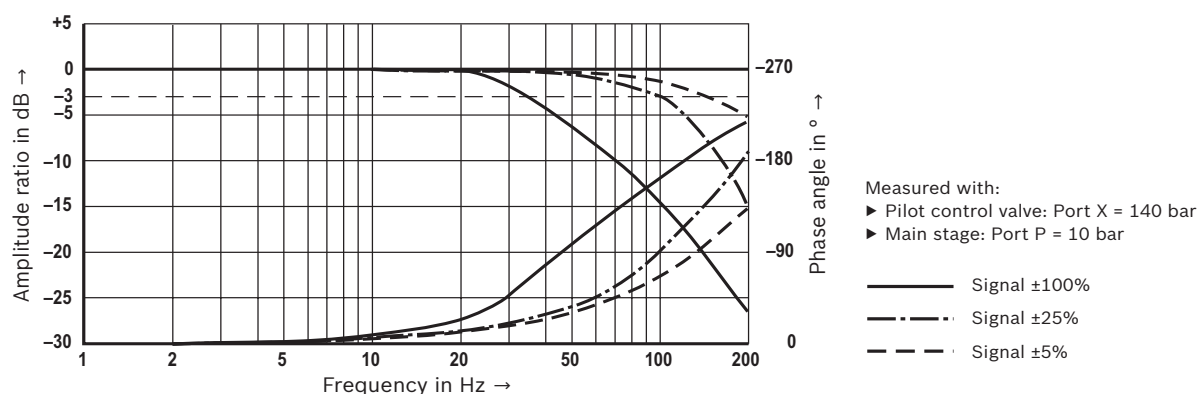
10/22 **4WRDE** | Directional control valves

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

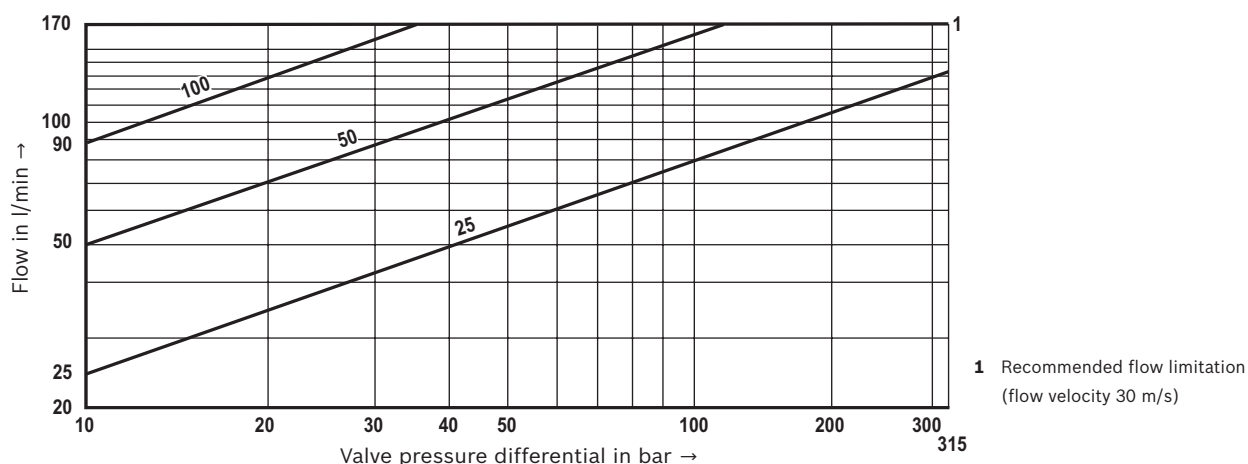
Transition function with stepped electric input signals



Frequency response characteristic curves



Flow/load function with maximum valve opening (tolerance ±10%)



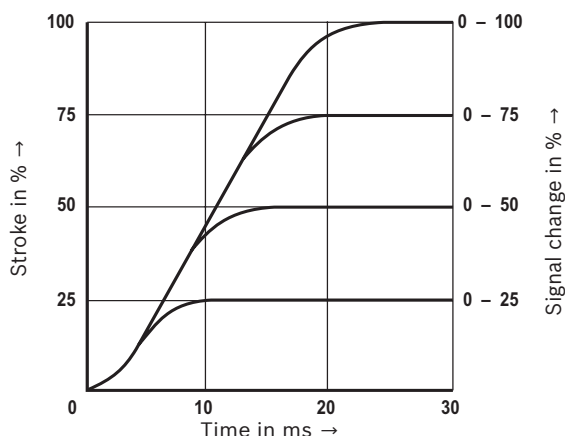
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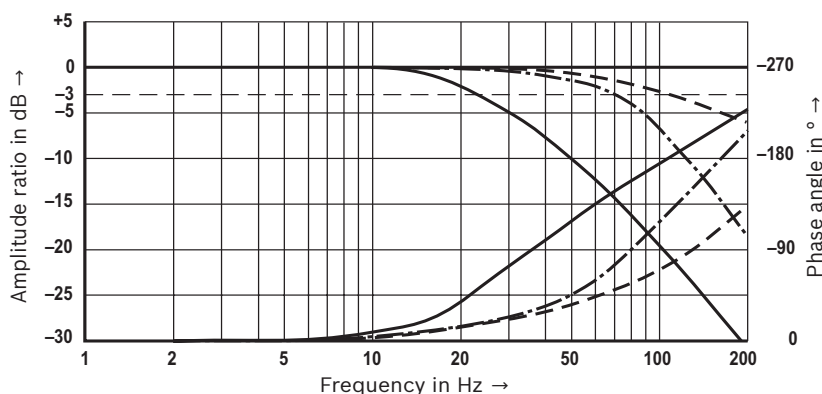
Characteristic curves: Size 16 (measured with HLP46, $\theta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$)

Transition function with stepped electric input signals



Measured with:
► Pilot control valve: Port X = 140 bar
► Main stage: Port P = 10 bar

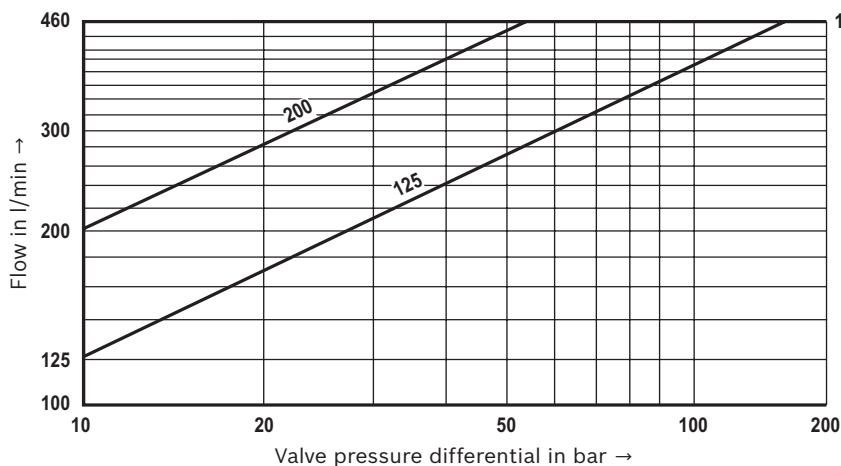
Frequency response characteristic curves



Measured with:
► Pilot control valve: Port X = 140 bar
► Main stage: Port P = 10 bar

— Signal $\pm 100\%$
- - - Signal $\pm 25\%$
- · - Signal $\pm 5\%$

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

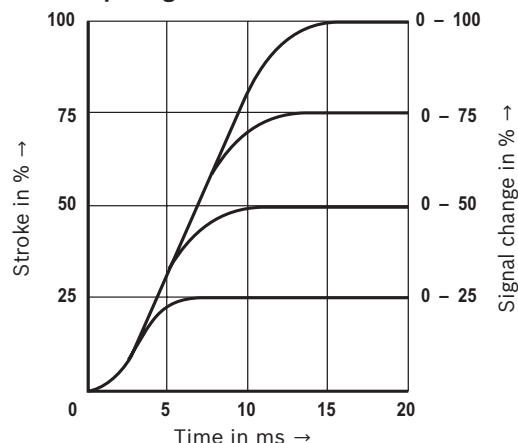


1 Recommended flow limitation
(flow velocity 30 m/s)

12/22 **4WRDE** | Directional control valves

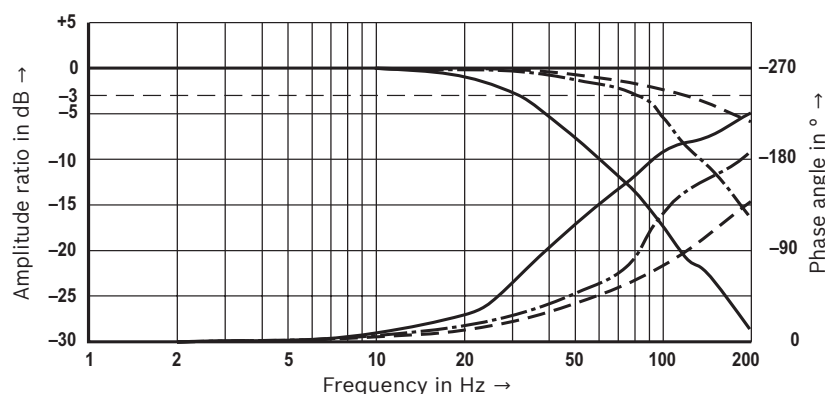
Characteristic curves: Size 25 and 27
(measured with HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$)

Transition function with stepped electric input signals



Measured with:
▶ Pilot control valve: Port X = 140 bar
▶ Main stage: Port P = 10 bar

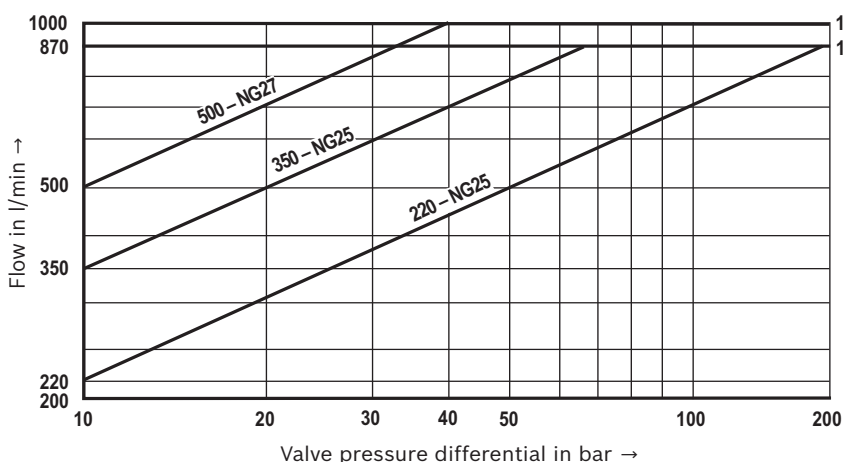
Frequency response characteristic curves



Measured with:
▶ Pilot control valve: Port X = 140 bar
▶ Main stage: Port P = 10 bar

— Signal ±100%
- - - Signal ±25%
- · - Signal ±5%

Flow/load function with maximum valve opening (tolerance ±10%)



1 Recommended flow limitation
(flow velocity 30 m/s)

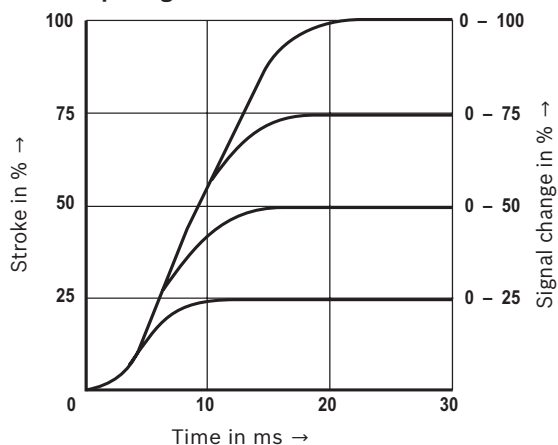
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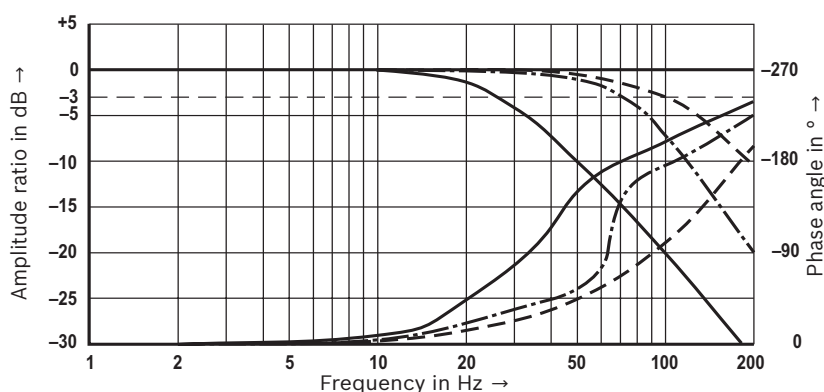
Characteristic curves: Size 32
(measured with HLP46, $\theta_{oil} = 40 \pm 5^\circ\text{C}$)

Transition function with stepped electric input signals



Measured with:
▶ Pilot control valve: Port X = 140 bar
▶ Main stage: Port P = 10 bar

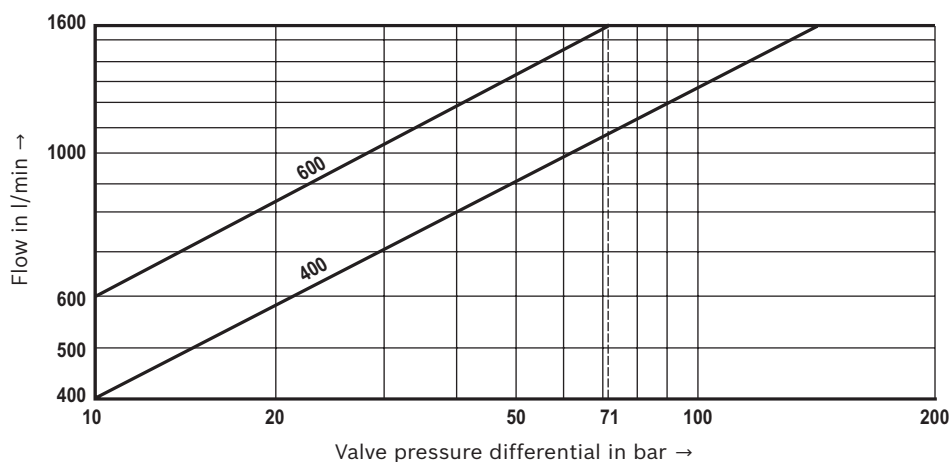
Frequency response characteristic curves



Measured with:
▶ Pilot control valve: Port X = 140 bar
▶ Main stage: Port P = 10 bar

— Signal ±100%
- - - Signal ±25%
- · - Signal ±5%

Flow/load function with maximum valve opening (tolerance ±10%)



1 Recommended flow limitation
(flow velocity 30 m/s)

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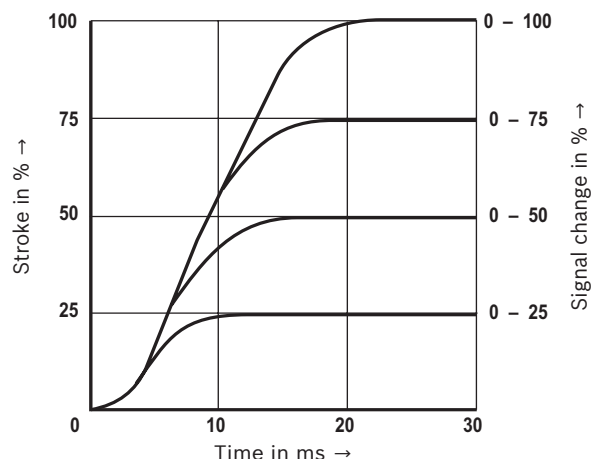
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14/22 4WRDE | Directional control valves

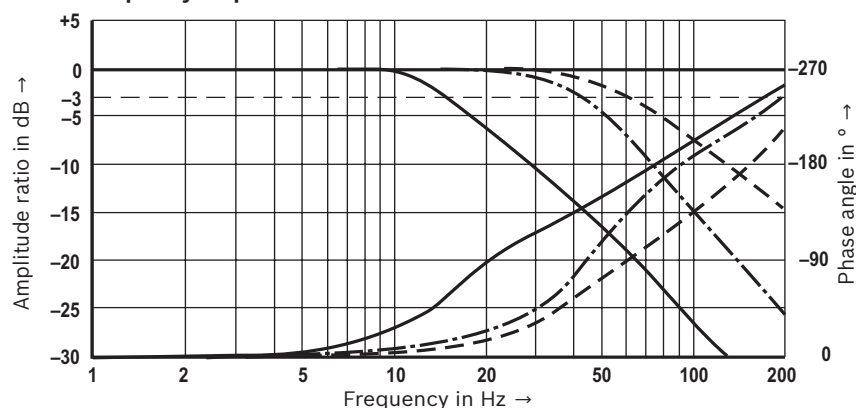
Characteristic curves: Size 35
(measured with HLP46, $\theta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$)

Transition function with stepped electric input signals



Measured with:
► Pilot control valve: Port X = 140 bar
► Main stage: Port P = 10 bar

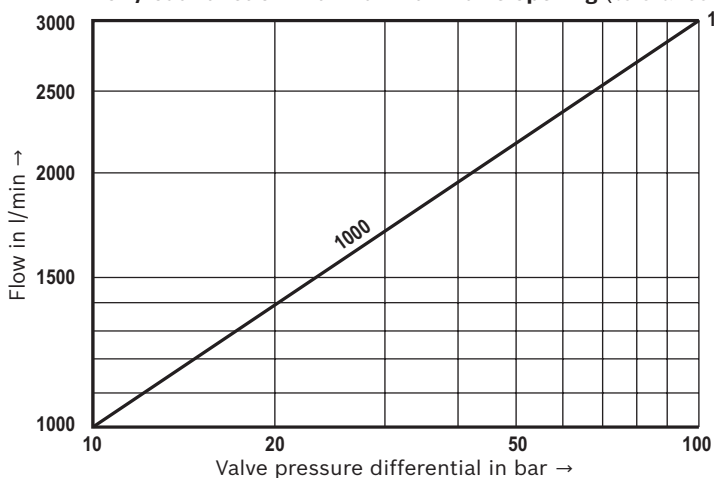
Frequency response characteristic curves



Measured with:
► Pilot control valve: Port X = 140 bar
► Main stage: Port P = 10 bar

— Signal $\pm 100\%$
- - - Signal $\pm 25\%$
... Signal $\pm 5\%$

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



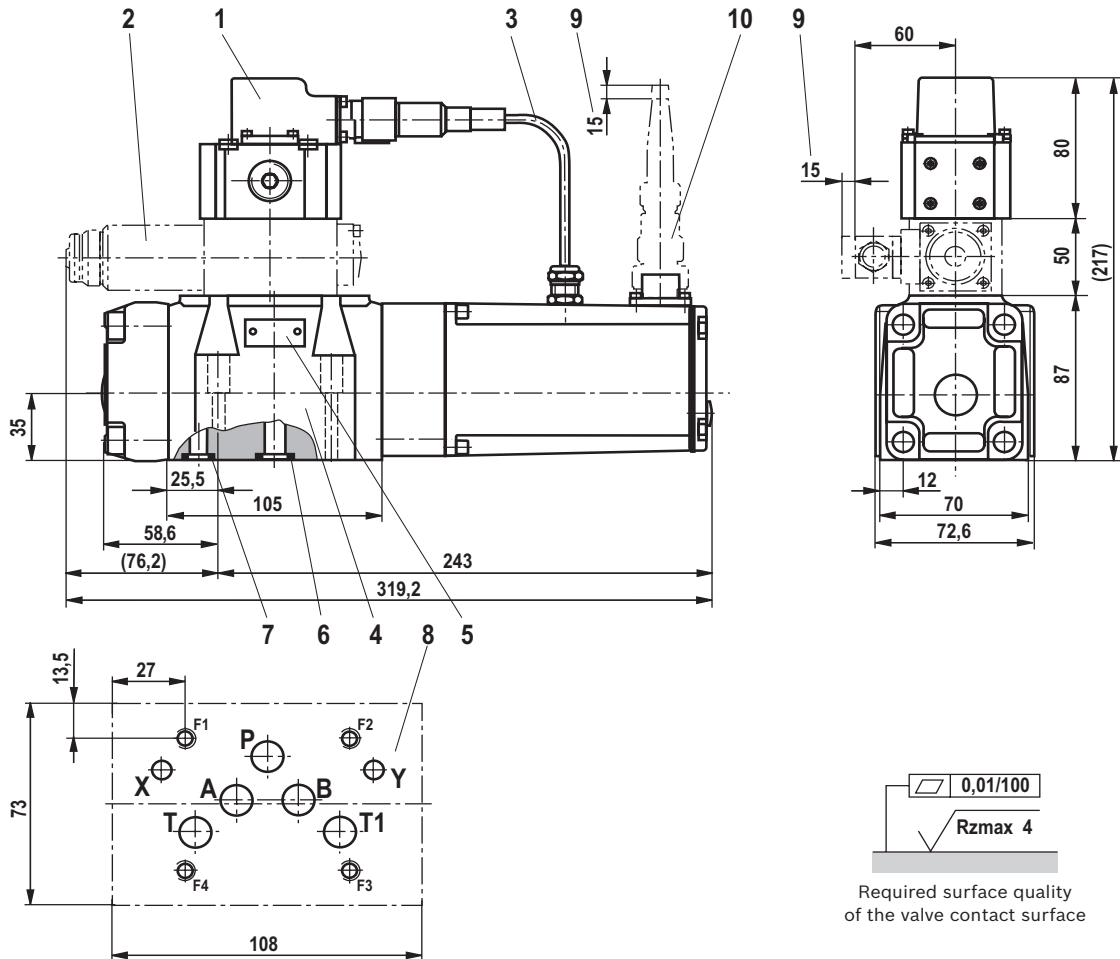
1 Recommended flow limitation
(flow velocity 30 m/s)

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Dimensions: Size 10
(dimensions in mm)



- 1 Pilot control valve
- 2 Directional sandwich plate valve (only included with version "WG152")
- 3 Cabling
- 4 Main stage
- 5 Name plate
- 6 Identical seal rings for ports A, B, P, T and T1
- 7 Identical seal rings for ports X and Y
- 8 Machined valve contact surface; porting pattern according to ISO 4401-05-05-0-05 (ports X and Y as required)
- 9 Space required to remove the mating connectors
- 10 Mating connector, separate order, see page 21

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



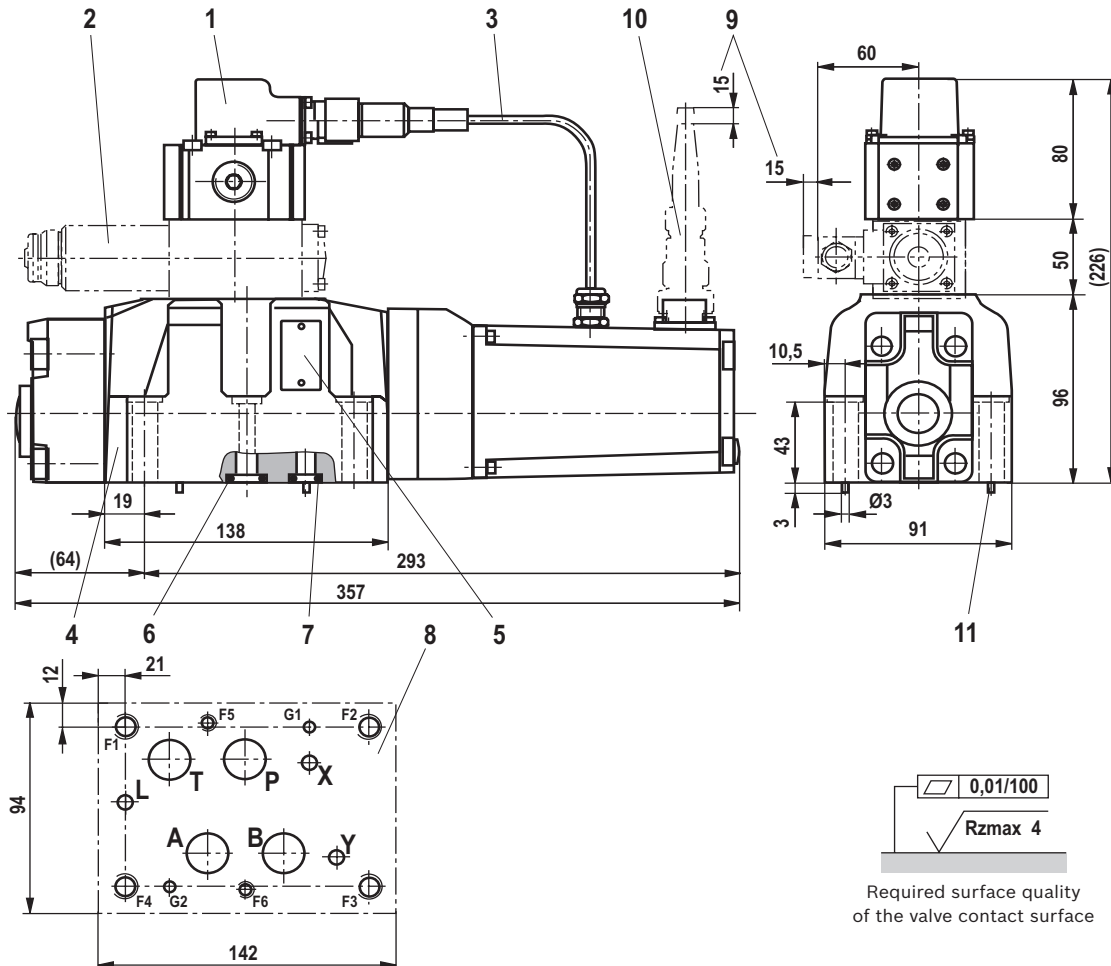
Notice:

The dimensions are nominal dimensions which are subject to tolerances.

Valve mounting screws, see page 21.

16/22 4WRDE | Directional control valves

Dimensions: Size 16
(dimensions in mm)



- 1 Pilot control valve
- 2 Directional sandwich plate valve (only included with version "WG152")
- 3 Cabling
- 4 Main stage
- 5 Name plate
- 6 Identical seal rings for ports A, B, P, T
- 7 Identical seal rings for ports X, Y, and L
- 8 Machined valve contact surface; porting pattern according to ISO 4401-07-07-0-05 (ports X, Y and L as required)
- 9 Space required to remove the mating connectors
- 10 Mating connector, separate order, see page 21
- 11 Locking pin

Subplates (separate order) with porting pattern according to ISO 4401-07-07-0-05, see data sheet 45100.

Notice:

The dimensions are nominal dimensions which are subject to tolerances.

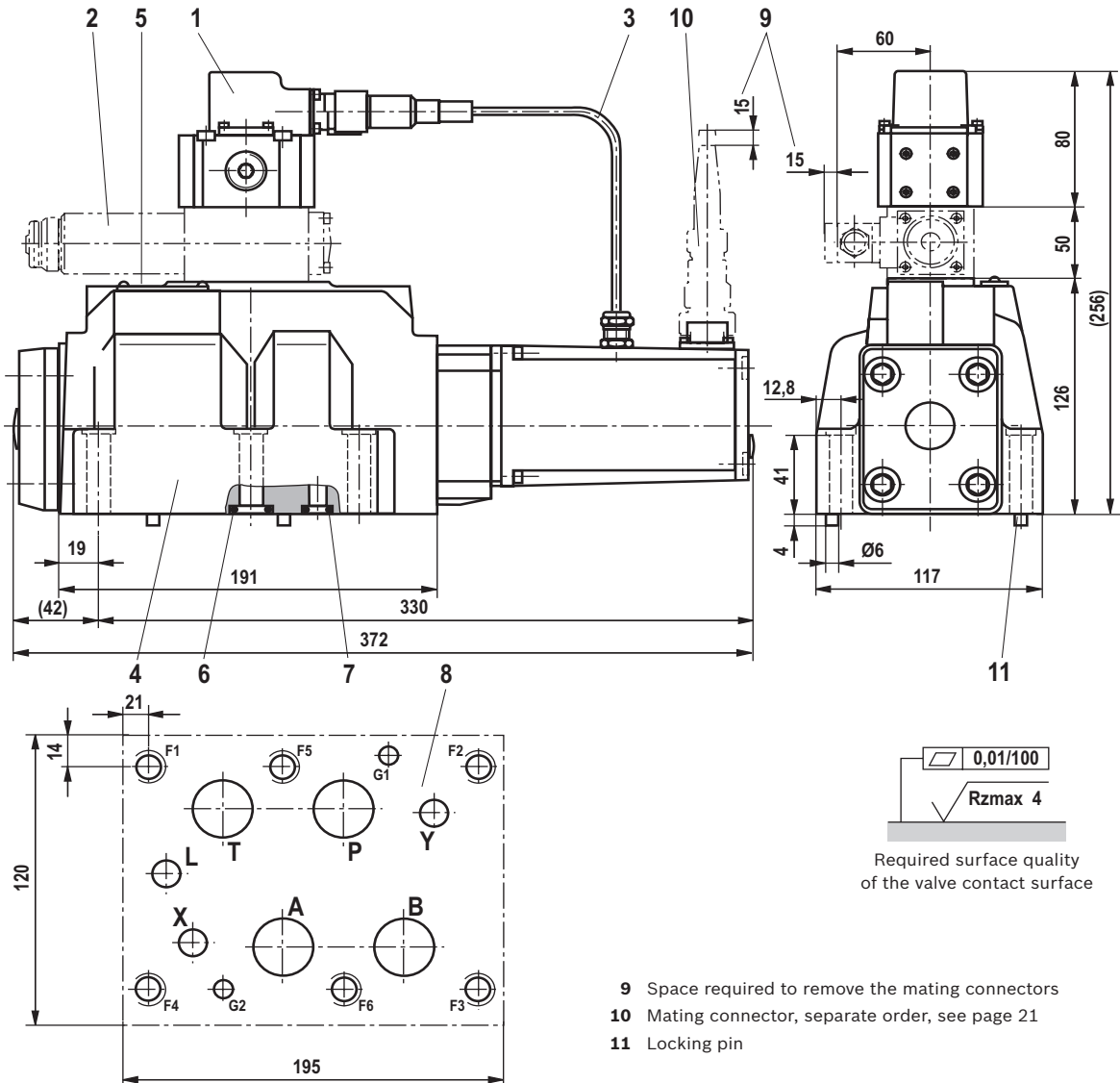
Valve mounting screws, see page 21.

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Dimensions: Size 25
(dimensions in mm)



- 1 Pilot control valve
- 2 Directional sandwich plate valve (only included with version "WG152")
- 3 Cabling
- 4 Main stage
- 5 Name plate
- 6 Identical seal rings for ports A, B, P, T
- 7 Identical seal rings for ports X, Y, and L
- 8 Machined valve contact surface; porting pattern according to ISO 4401-08-08-0-05 (ports X, Y and L as required)

- 9 Space required to remove the mating connectors
- 10 Mating connector, separate order, see page 21
- 11 Locking pin

Subplates (separate order) with porting pattern according to ISO 4401-08-08-0-05, see data sheet 45100.



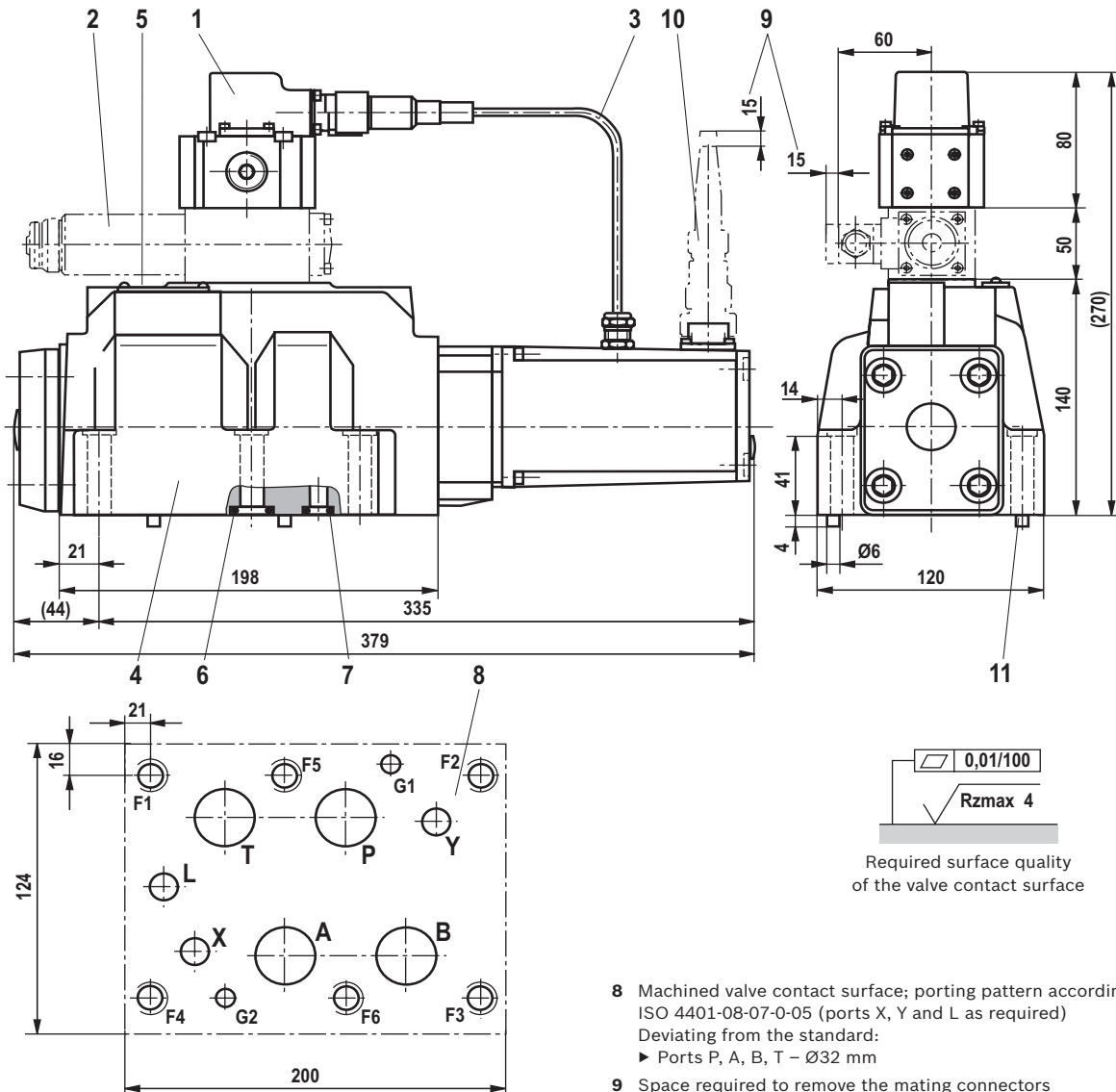
Notice:

The dimensions are nominal dimensions which are subject to tolerances.

Valve mounting screws, see page 21.

18/22 4WRDE | Directional control valves

Dimensions: Size 27
(dimensions in mm)



- 1 Pilot control valve
- 2 Directional sandwich plate valve (only included with version "WG152")
- 3 Cabling
- 4 Main stage
- 5 Name plate
- 6 Identical seal rings for ports A, B, P, T
- 7 Identical seal rings for ports X, Y, and L

- 8 Machined valve contact surface; porting pattern according to ISO 4401-08-07-0-05 (ports X, Y and L as required)
Deviating from the standard:
► Ports P, A, B, T – Ø32 mm
- 9 Space required to remove the mating connectors
- 10 Mating connector, separate order, see page 21
- 11 Locking pin

Subplates (separate order) with porting pattern according to ISO 4401-08-07-0-05, see data sheet 45100.

Notice:

The dimensions are nominal dimensions which are subject to tolerances.

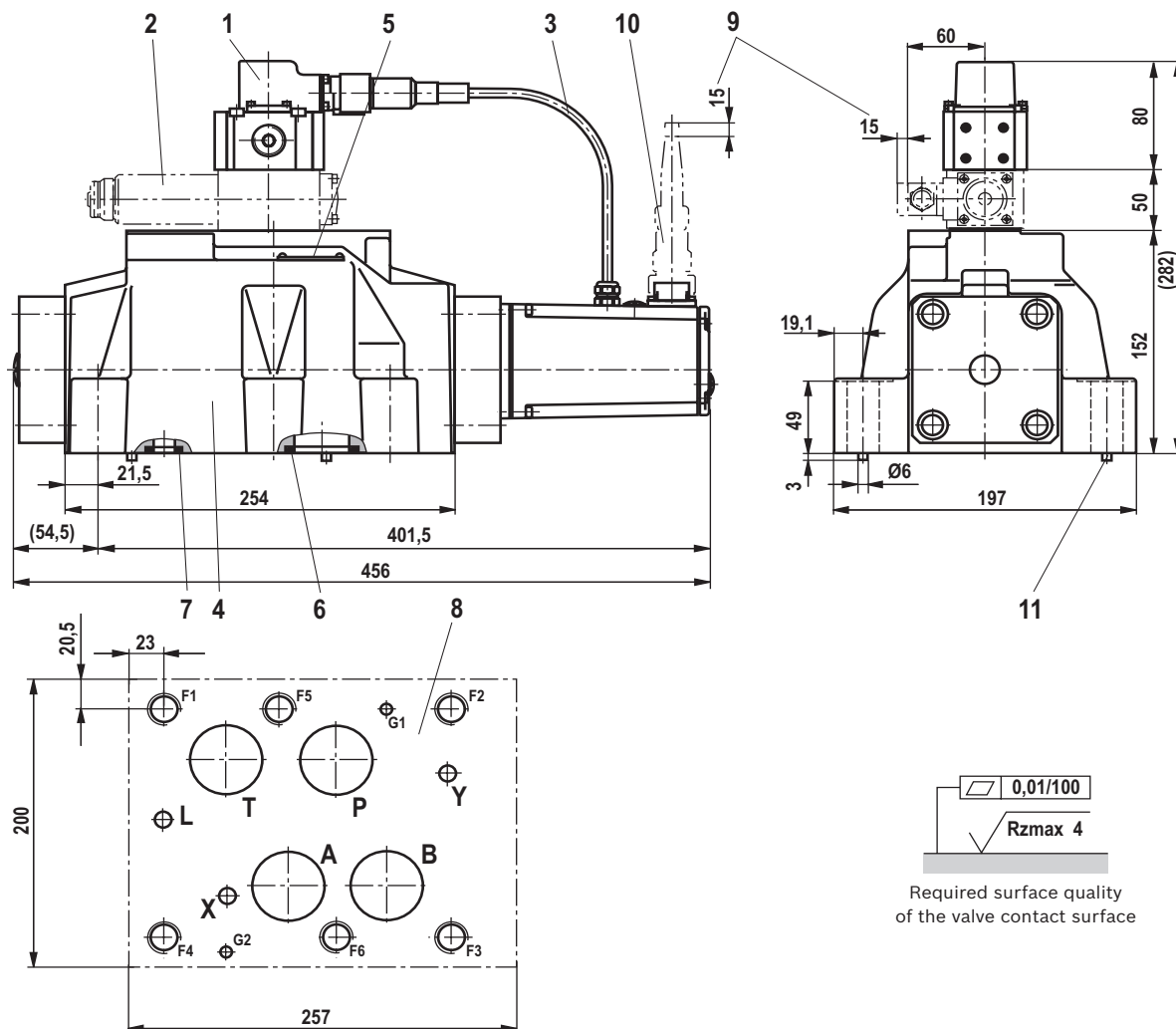
Valve mounting screws, see page 21.

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Dimensions: Size 32
(dimensions in mm)



- 1 Pilot control valve
- 2 Directional sandwich plate valve (only included with version "WG152")
- 3 Cabling
- 4 Main stage
- 5 Name plate
- 6 Identical seal rings for ports A, B, P, T
- 7 Identical seal rings for ports X, Y, and L
- 8 Machined valve contact surface, porting pattern according to ISO 4401-10-09-0-05 (ports X, Y and L as required)
- 9 Space required to remove the mating connectors
- 10 Mating connector, separate order, see page 21
- 11 Locking pin

Subplates (separate order) with porting pattern according to ISO 4401-10-09-0-05, see data sheet 45100.



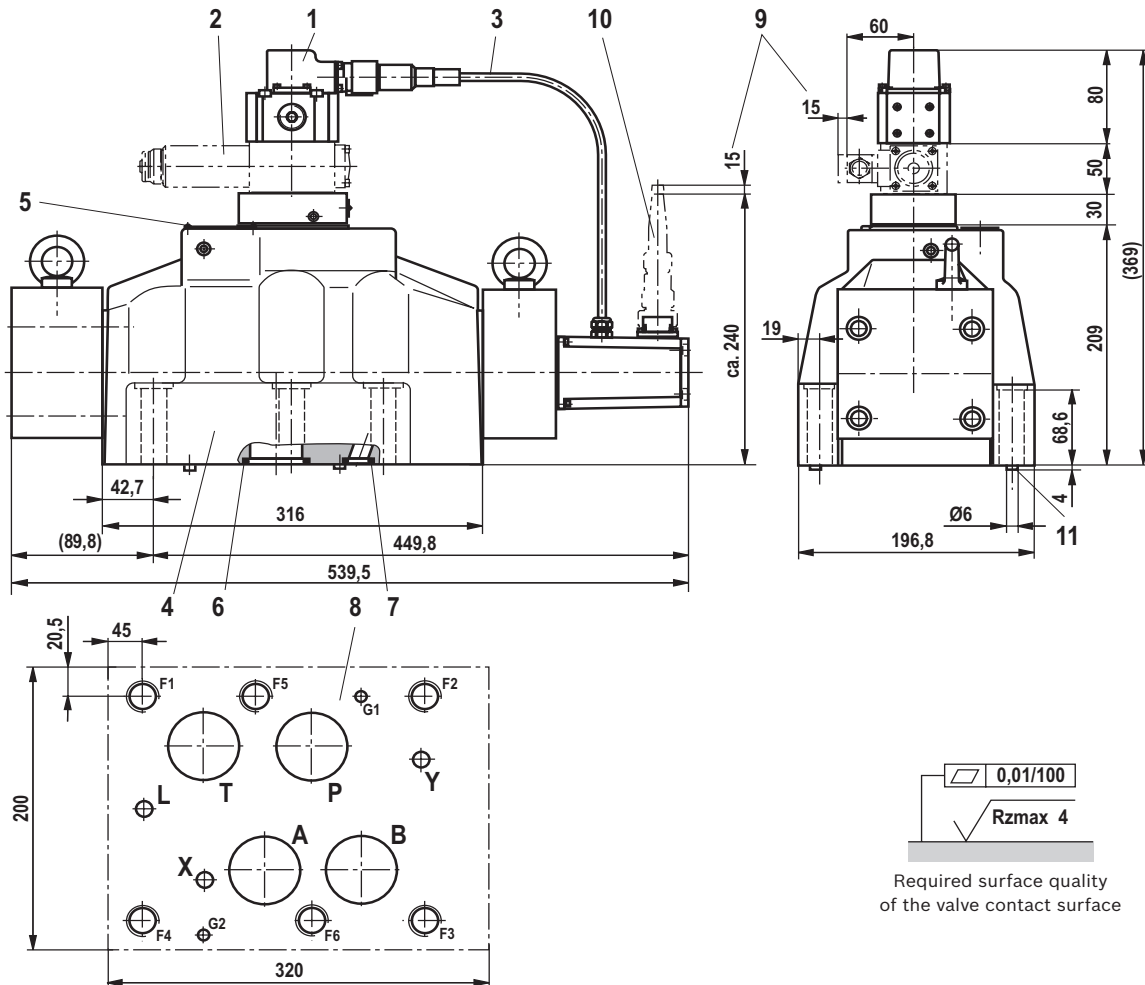
Notice:

The dimensions are nominal dimensions which are subject to tolerances.

Valve mounting screws, see page 21.

20/22 4WRDE | Directional control valves

Dimensions: Size 35
(dimensions in mm)



- 1 Pilot control valve
- 2 Directional sandwich plate valve (only included with version "WG152")
- 3 Cabling
- 4 Main stage
- 5 Name plate
- 6 Identical seal rings for ports A, B, P, T
- 7 Identical seal rings for ports X, Y, and L
- 8 Machined valve contact surface; porting pattern according to ISO 4401-10-09-0-05 (ports X, Y and L as required)
Deviating from the standard:
► Ports P, A, B, T – Ø50 mm
- 9 Space required to remove the mating connectors
- 10 Mating connector, separate order, see page 21
- 11 Locking pin

Subplates (separate order) with porting pattern according to ISO 4401-10-09-0-05, see data sheet 45100.

Notice:

The dimensions are nominal dimensions which are subject to tolerances.

Valve mounting screws, see page 21.

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Dimensions

Valve mounting screws (separate order)

Size	Quantity	Hexagon socket head cap screws	Material number
10	4	ISO 4762 - M6 x 45 - 10.9-flZn-240h-L Tightening torque $M_A = 13.5 \text{ Nm} \pm 10\%$	R913000258
16	2	ISO 4762 - M6 x 60 - 10.9-flZn-240h-L Tightening torque $M_A = 12.2 \text{ Nm} \pm 10\%$	R913000115
	4	ISO 4762 - M10 x 60 - 10.9-flZn-240h-L Tightening torque $M_A = 58 \text{ Nm} \pm 20\%$	R913000116
25, 27	6	ISO 4762 - M12 x 60 - 10.9-flZn-240h-L Tightening torque $M_A = 100 \text{ Nm} \pm 20\%$	R913000121
32	6	ISO 4762 - M20 x 80 - 10.9-flZn-240h-L Tightening torque $M_A = 340 \text{ Nm} \pm 20\%$	R901035246
35	6	ISO 4762 - M20 x 100 - 10.9-flZn-240h-L Tightening torque $M_A = 360 \text{ Nm} \pm 20\%$	R913000386



Notice:

For reasons of stability, exclusively these valve mounting screws may be used. The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure.

Accessories (separate order)

Mating connectors		Data sheet	Material number
Directional control valve	Round connector according to EN 175201-804, 6-pole + PE and 6-pole, compatible with VG 95328	08006	e.g. R900021267 (plastic) e.g. R900223890 (metal)
	Compatible with VG95328, size 14-6S		e.g. R900013159 (plastic)
Sandwich plate valve	Mating connector according to DIN EN 175301-803, ISO 4400		e.g. R901017011 (plastic)
Miscellaneous			Material number
Filter element and seal			R961001949

22/22 **4WRDE** | Directional control valves

Further information

▶ Directional servo valve with mechanical position feedback	Data sheet 29564
▶ 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
▶ Hydraulic valves for industrial applications	Data sheet 07600-B
▶ Assembly, commissioning and maintenance of hydraulic systems	Data sheet 07900
▶ Selection of the filters	
▶ Information on available spare parts	

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