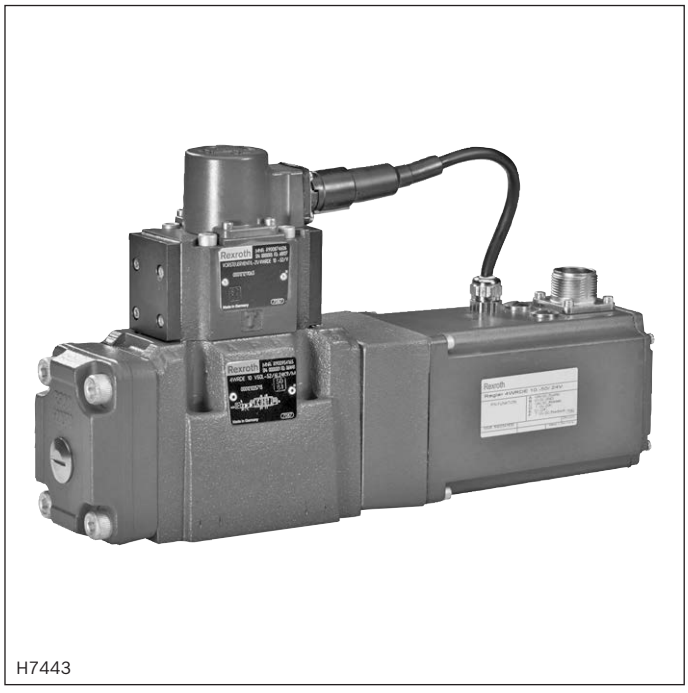
Directional control valves, pilot-operated, with electrical position feedback and integrated electronics (OBE)

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

Contents

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

Ordering code

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

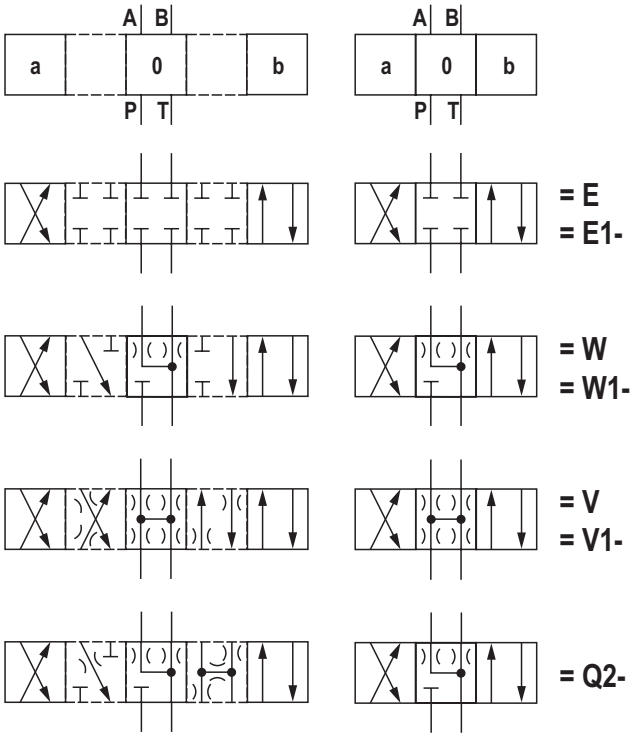
13	NBR seals	**M**
	FKM seals	**V**

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–:

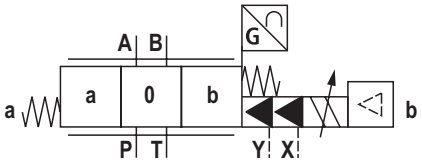
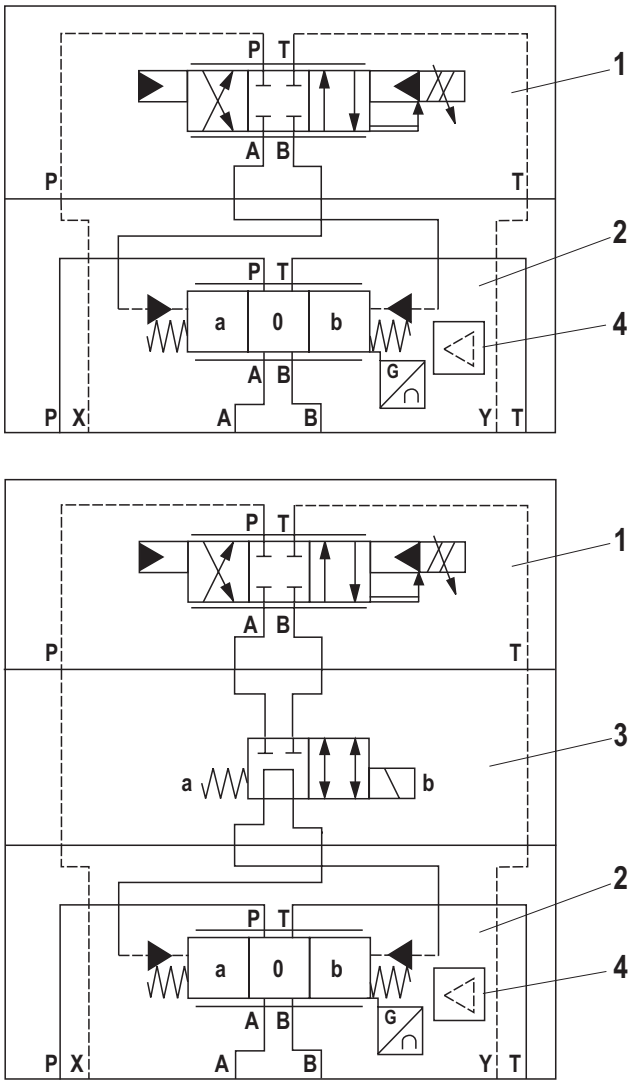
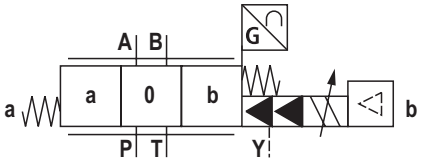
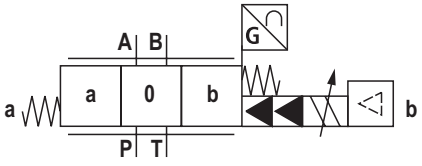
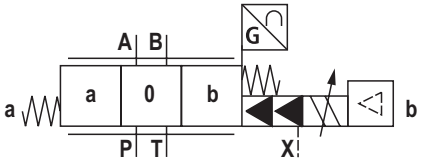
P → A: $q_{V\,max}$ B → T: $q_V/2$

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"		

1 Pilot control valve
2 Main valve
3 Directional sandwich plate valve
4 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.

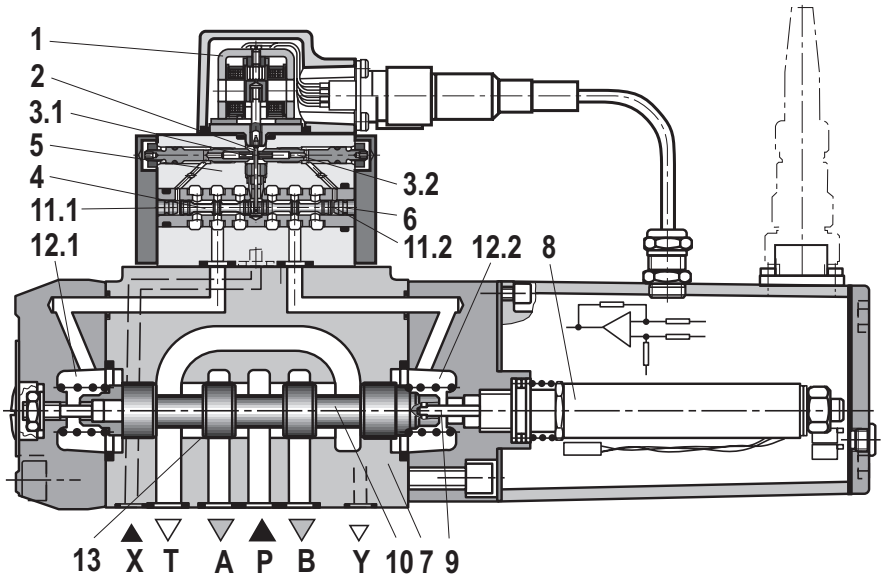
The position of the control spool (10) is measured by an inductive position transducer (8). The signal linking of the valve control loop, the supply of the position measurement system and the control of the pilot control valve are carried out via control electronics integrated in the valve. The voltage 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.



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	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	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	12.8
	– Symbol Q2	l/min	2.2	2.9	4.1	4.1	5.4	6.4
	▶ Main stage and pilot control valve							
	– Symbol V, V1	l/min	5.5	6.6	9	9	11.7	13.8
	– 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 Cleanliness class according to ISO 4406 (c)			Pilot control valve: Class 18/16/13 [3] 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, ϑ_{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

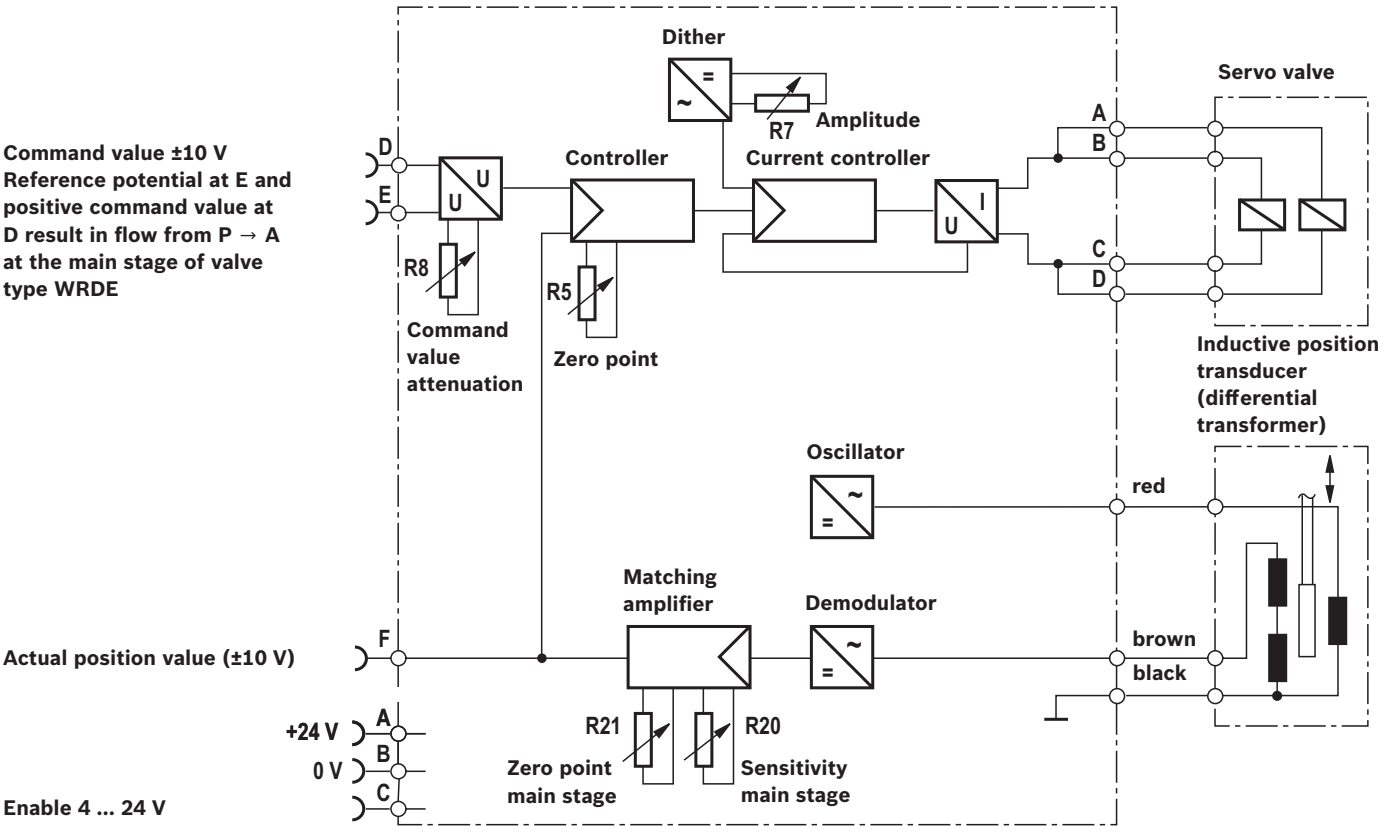
Contact	Signal	Connector pin assignment
A	24 VDC (20 ... 28 VDC); full bridge rectification smoothened with 2200 μF; I_{max} = 270 mA	Supply voltage
B	0 V	
C	4 to 24 VDC	Enable [1] (activates the valve control loop)
D	±10 V [2; 3]	Differential amplifier input (command value)
E		
F	±10 V (to contact "B")	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 kΩ; in the ordering code, extend the type by "– 280".

Block diagram of the integrated electronics (OBE)

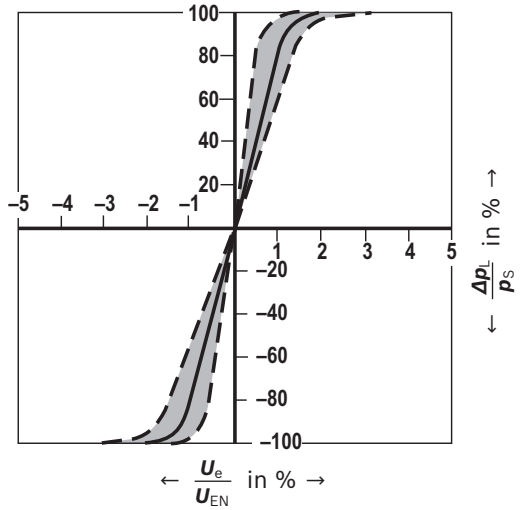


☞ **Notice:**
Electrical signals provided via control electronics (e.g. actual value or enable) must not be used to switch off safety-relevant machine functions.

Characteristic curves

(measured with HLP46, $\boldsymbol{v}$ = 32 mm²/s and $\boldsymbol{\vartheta_{Oil}}$ = 40 ± 5 °C)

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



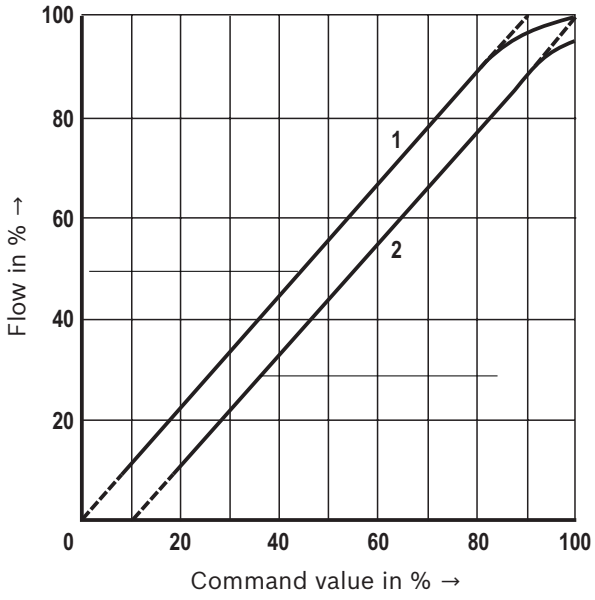
Characteristic curves

(measured with HLP46, $\boldsymbol{v}$ = 32 mm²/s and ϑ_{Oil} = 40 ± 5 °C)

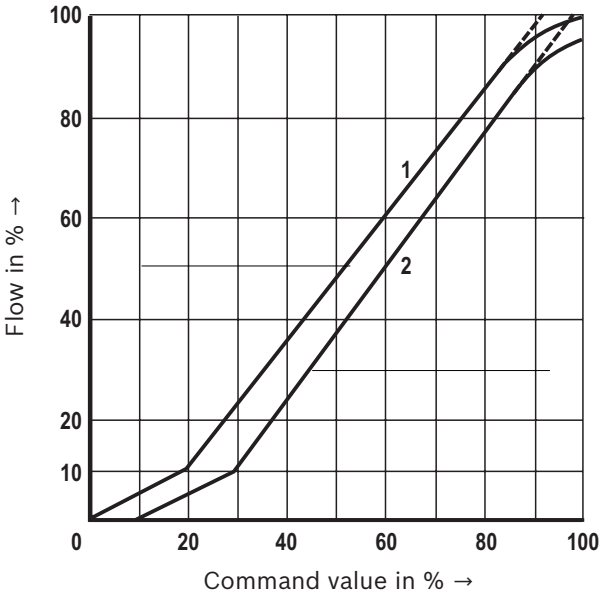
Flow command value function

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

Version "L"

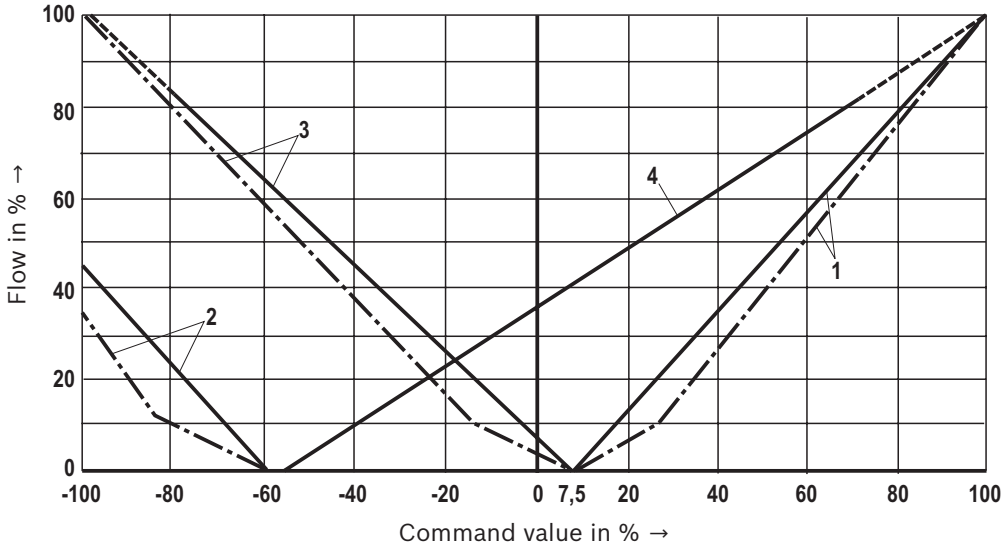


Version "P"



1 Symbol V
2 Symbol E or W

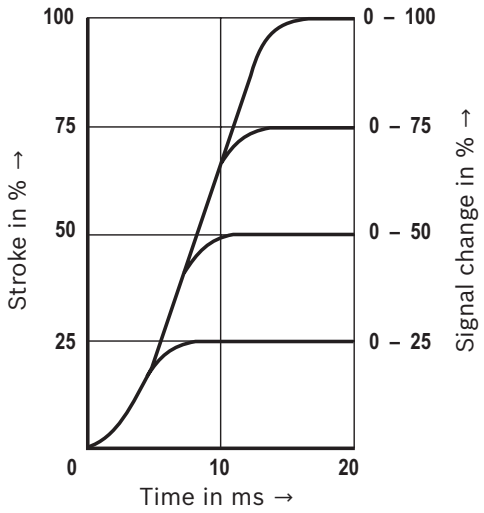
Version "Q2-...P" - — - — **Version "Q2-...L" ———**



1 P → A
2 P → B
3 A → T
4 B → T

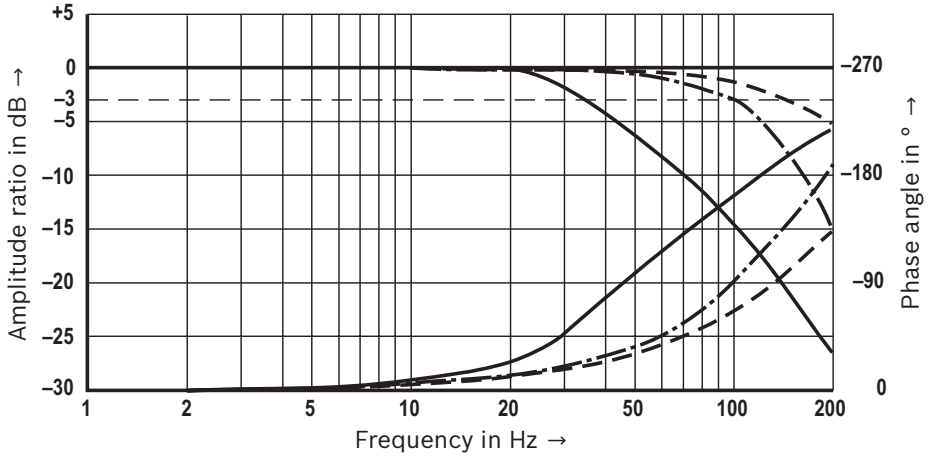
Characteristic curves: Size 10
(measured with HLP46, ϑ_{Oil} = 40 ± 5 °C)

Transition function with stepped electric input signals



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

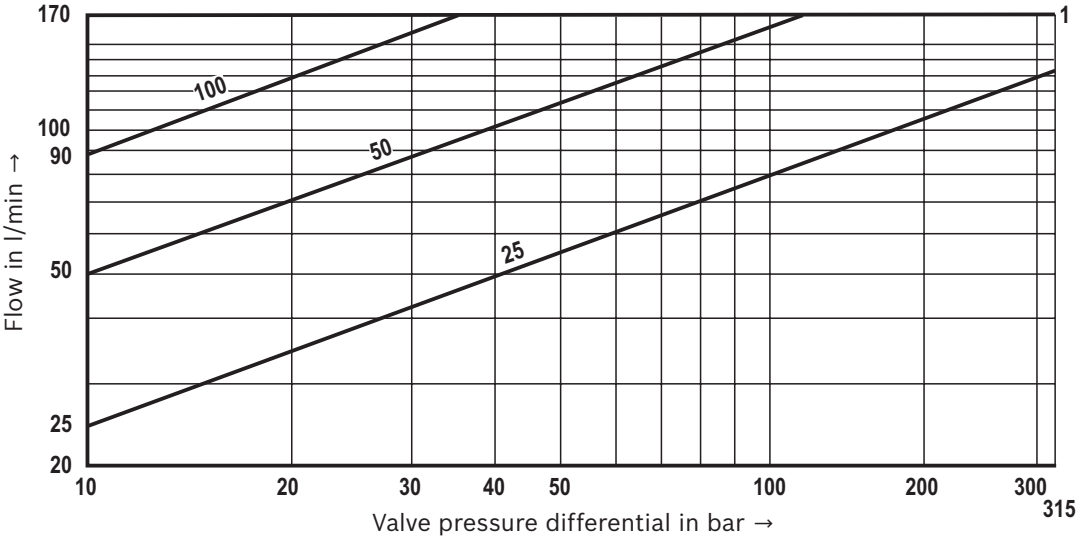
Frequency response characteristic curves



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

Signal ±100%
Signal ±25%
Signal ±5%

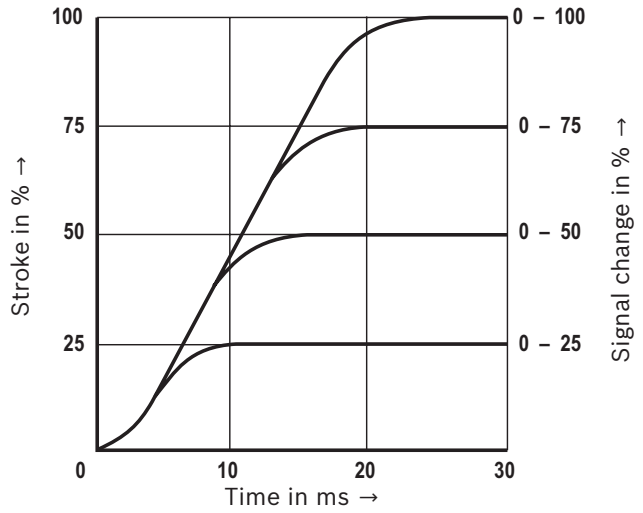
Flow/load function with maximum valve opening (tolerance ±10%)



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

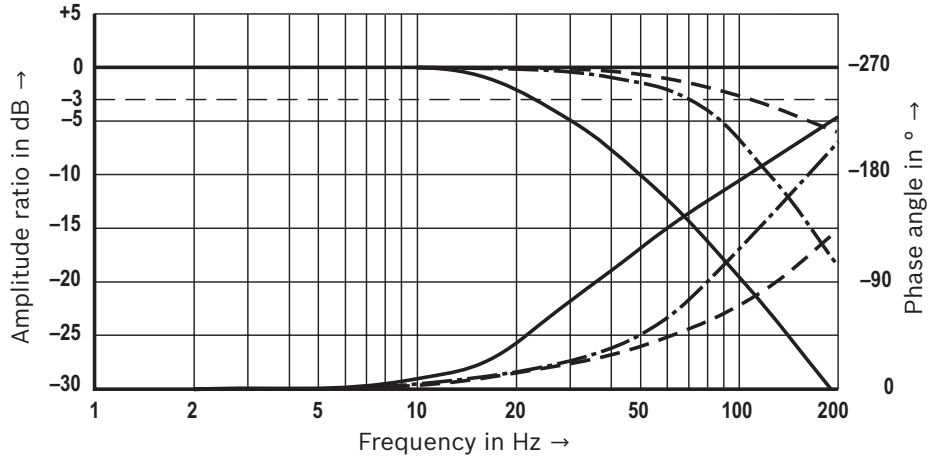
Characteristic curves: Size 16
(measured with HLP46, ϑ_{Oil} = 40 ± 5 °C)

Transition function with stepped electric input signals



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

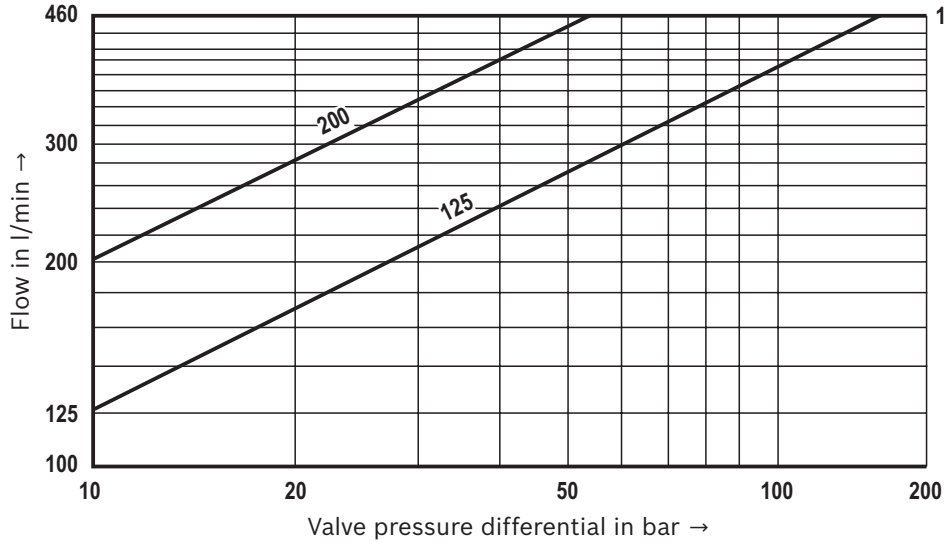
Frequency response characteristic curves



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

Signal ±100%
Signal ±25%
Signal ±5%

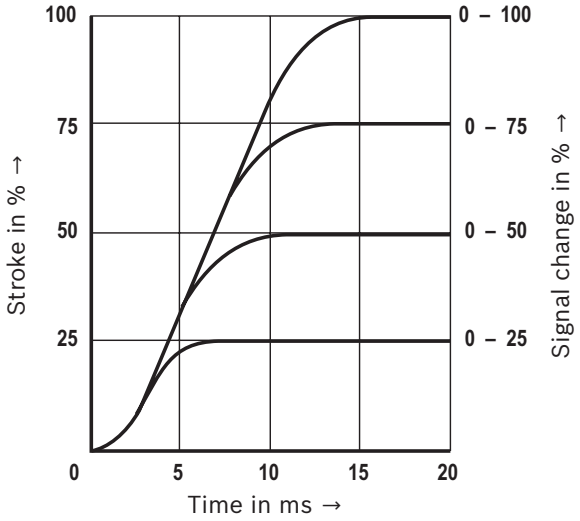
Flow/load function with maximum valve opening (tolerance ±10%)



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

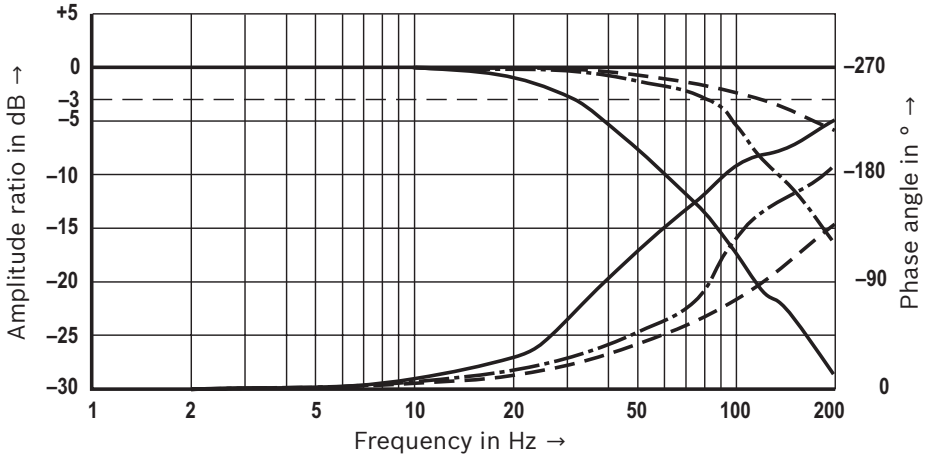
Characteristic curves: Size 25 and 27 (measured with HLP46, ϑ_{Oil} = 40 ± 5 °C)

Transition function with stepped electric input signals



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

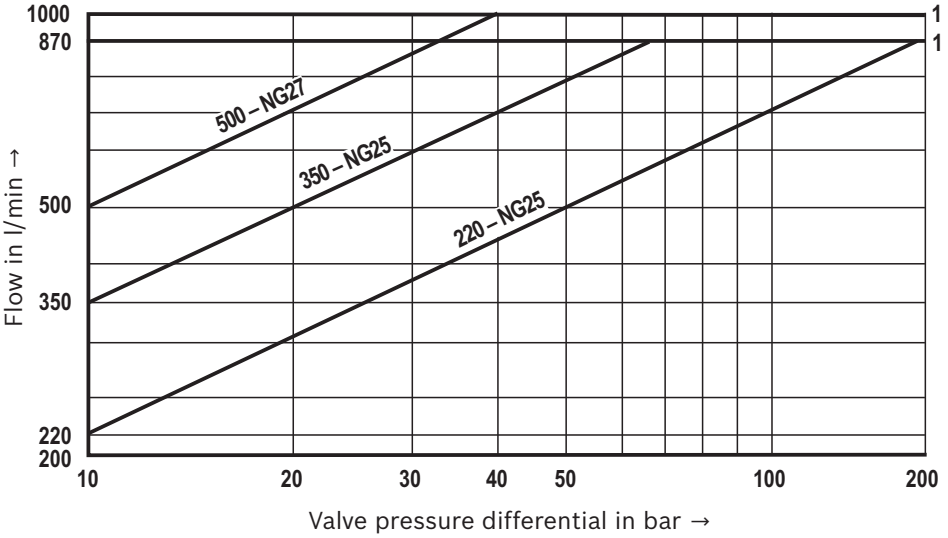
Frequency response characteristic curves



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

Signal ±100%
Signal ±25%
Signal ±5%

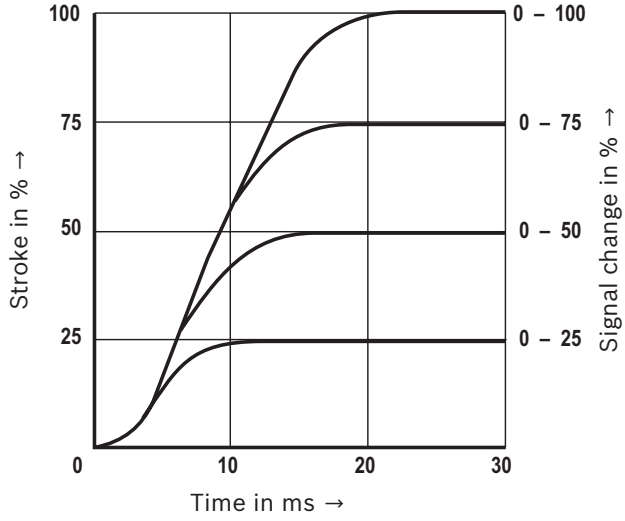
Flow/load function with maximum valve opening (tolerance ±10%)



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

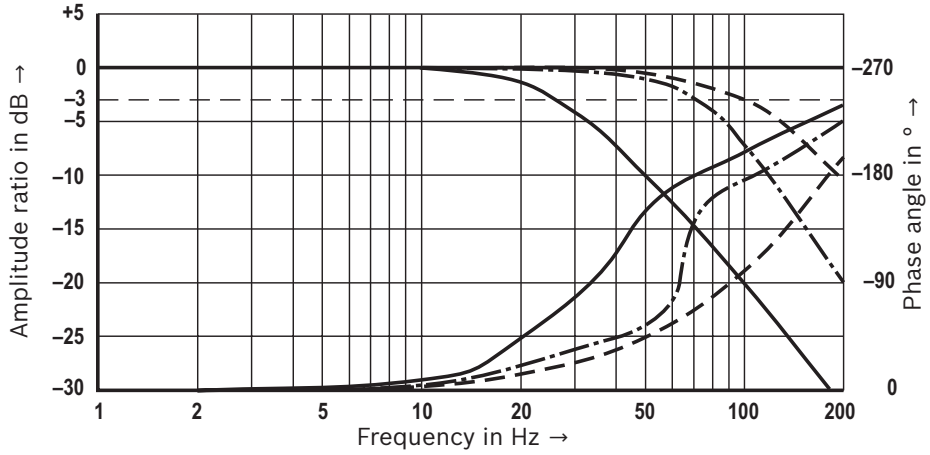
Characteristic curves: Size 32
(measured with HLP46, ϑ_{Oil} = 40 ± 5 °C)

Transition function with stepped electric input signals



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

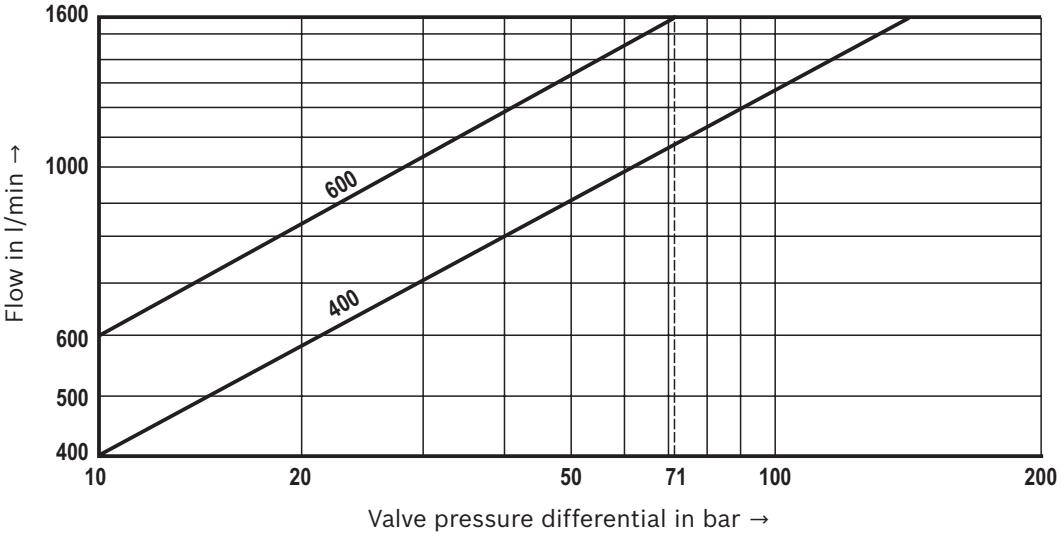
Frequency response characteristic curves



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

Signal ±100%
Signal ±25%
Signal ±5%

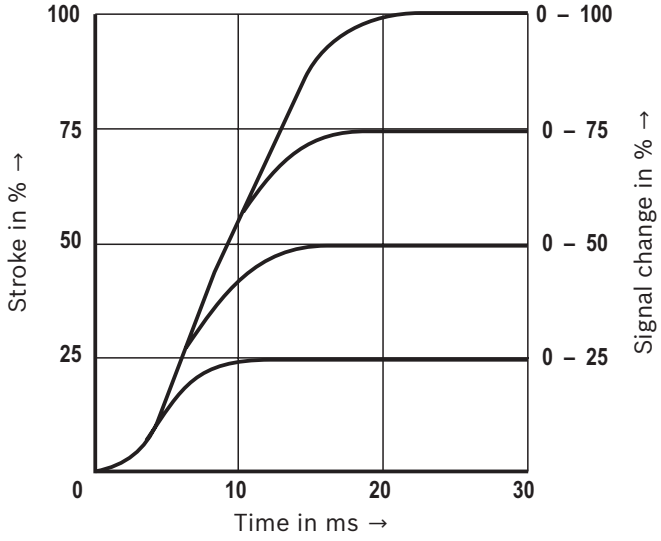
Flow/load function with maximum valve opening (tolerance ±10%)



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

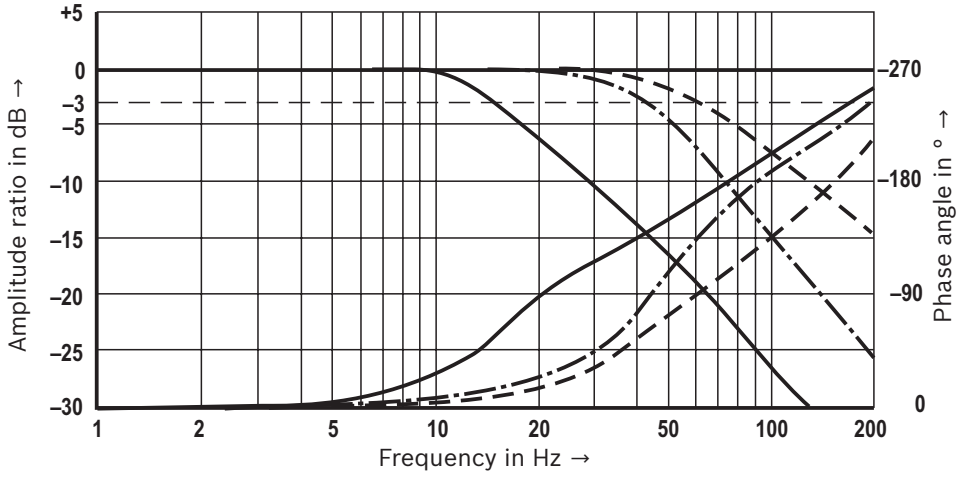
Characteristic curves: Size 35
(measured with HLP46, ϑ_{Oil} = 40 ± 5 °C)

Transition function with stepped electric input signals



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

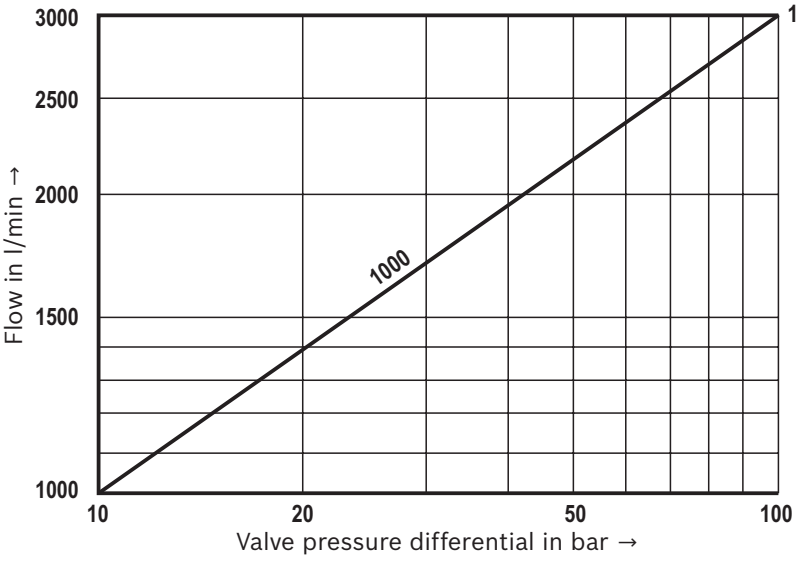
Frequency response characteristic curves



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

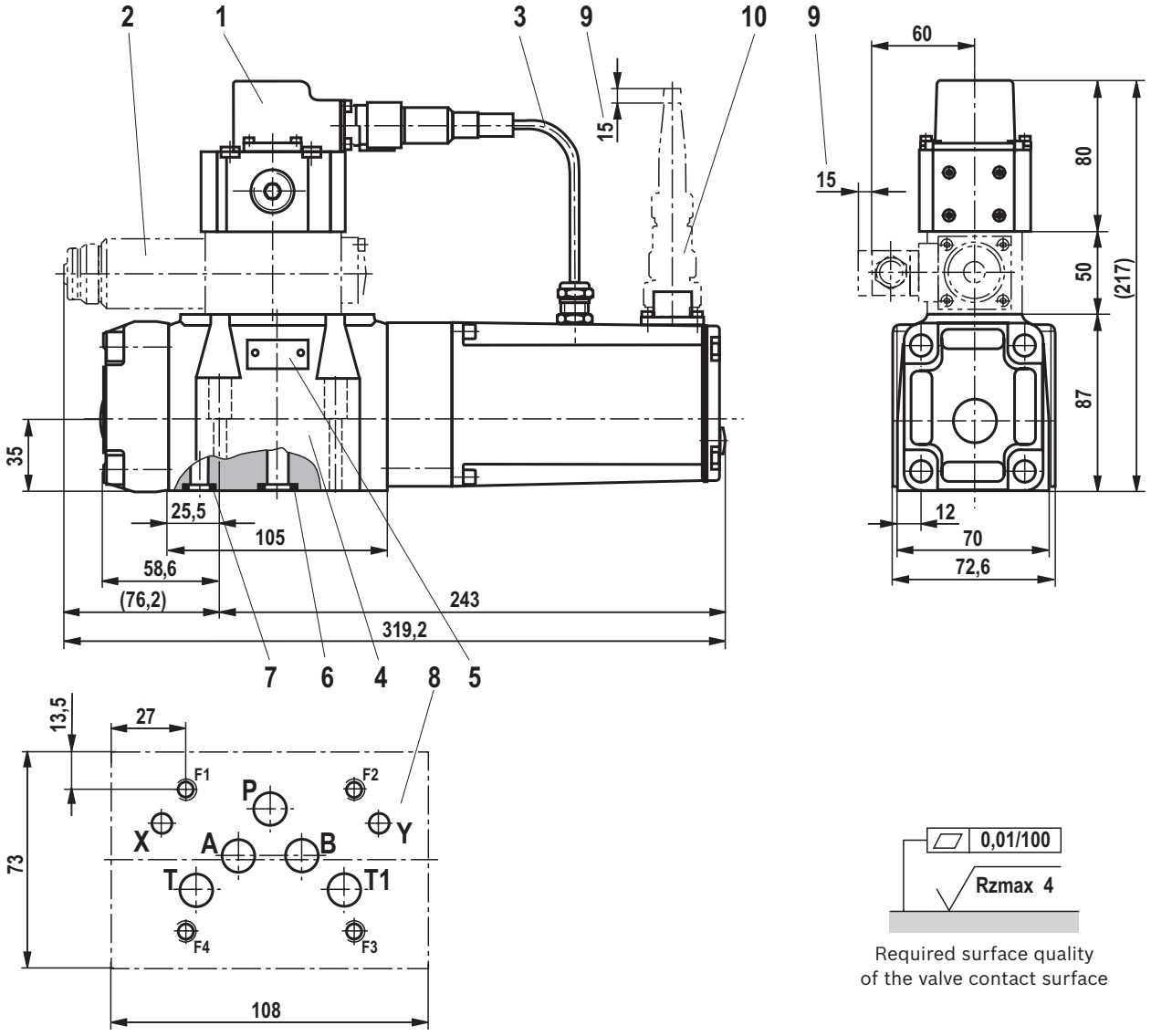
Signal ±100%
Signal ±25%
Signal ±5%

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



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

Dimensions: Size 10
(dimensions in mm)



Required surface quality
of the valve contact surface

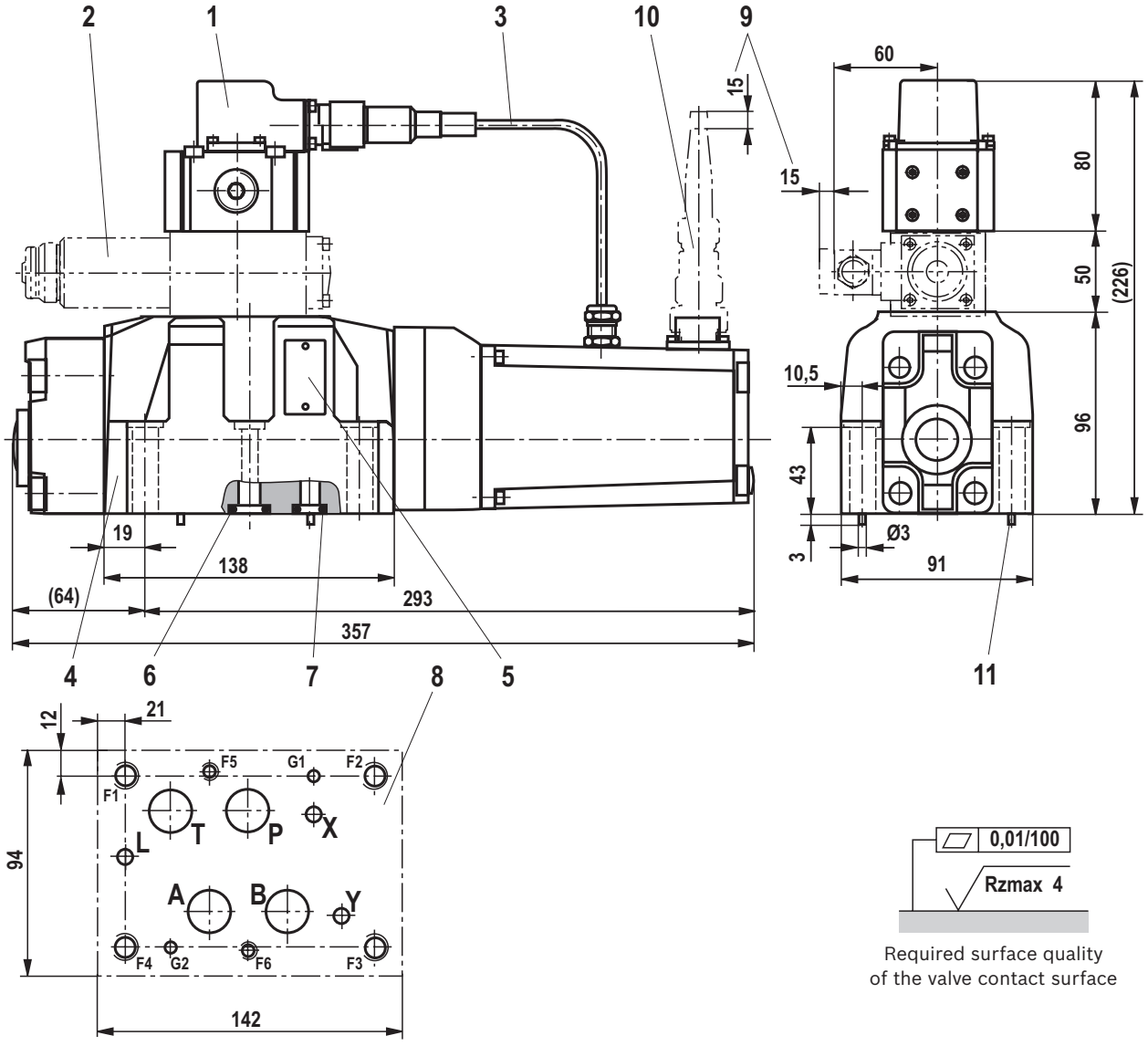
1 Pilot control valve
2 Directional sandwich plate valve (only included with version "WG152")
3 Cabling
4 Main stage
5 Name plate
6 Identical seal rings for ports A, B, P, T and T1
7 Identical seal rings for ports X and Y
8 Machined valve contact surface; porting pattern according to ISO 4401-05-05-0-05 (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.

Dimensions: Size 16
(dimensions in mm)



Required surface quality
of the valve contact surface

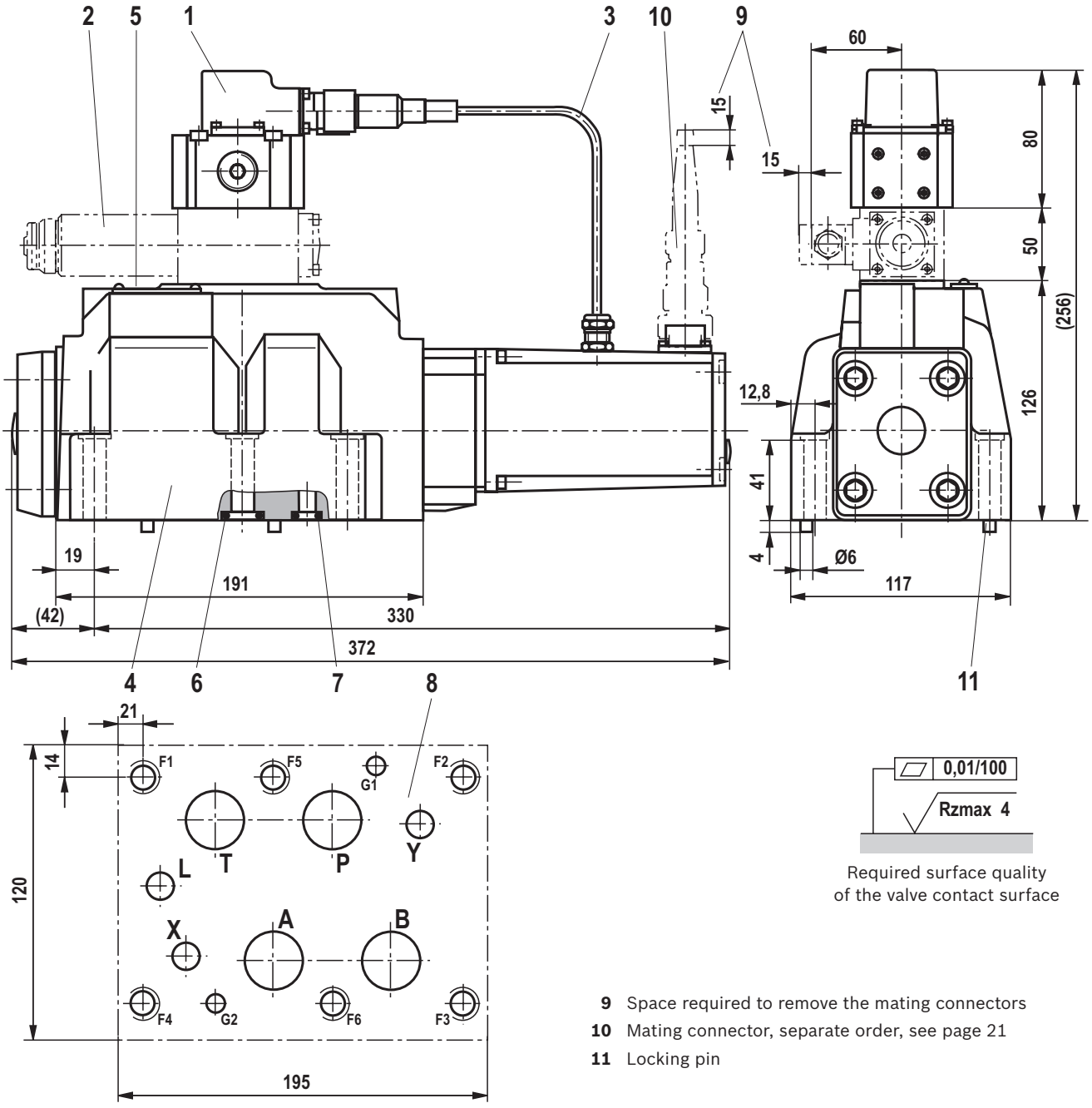
1 Pilot control valve
2 Directional sandwich plate valve (only included with version “WG152”)
3 Cabling
4 Main stage
5 Name plate
6 Identical seal rings for ports A, B, P, T
7 Identical seal rings for ports X, Y, and L
8 Machined valve contact surface; porting pattern according to ISO 4401-07-07-0-05 (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.

Dimensions: Size 25
(dimensions in mm)



Required surface quality
of the valve contact surface

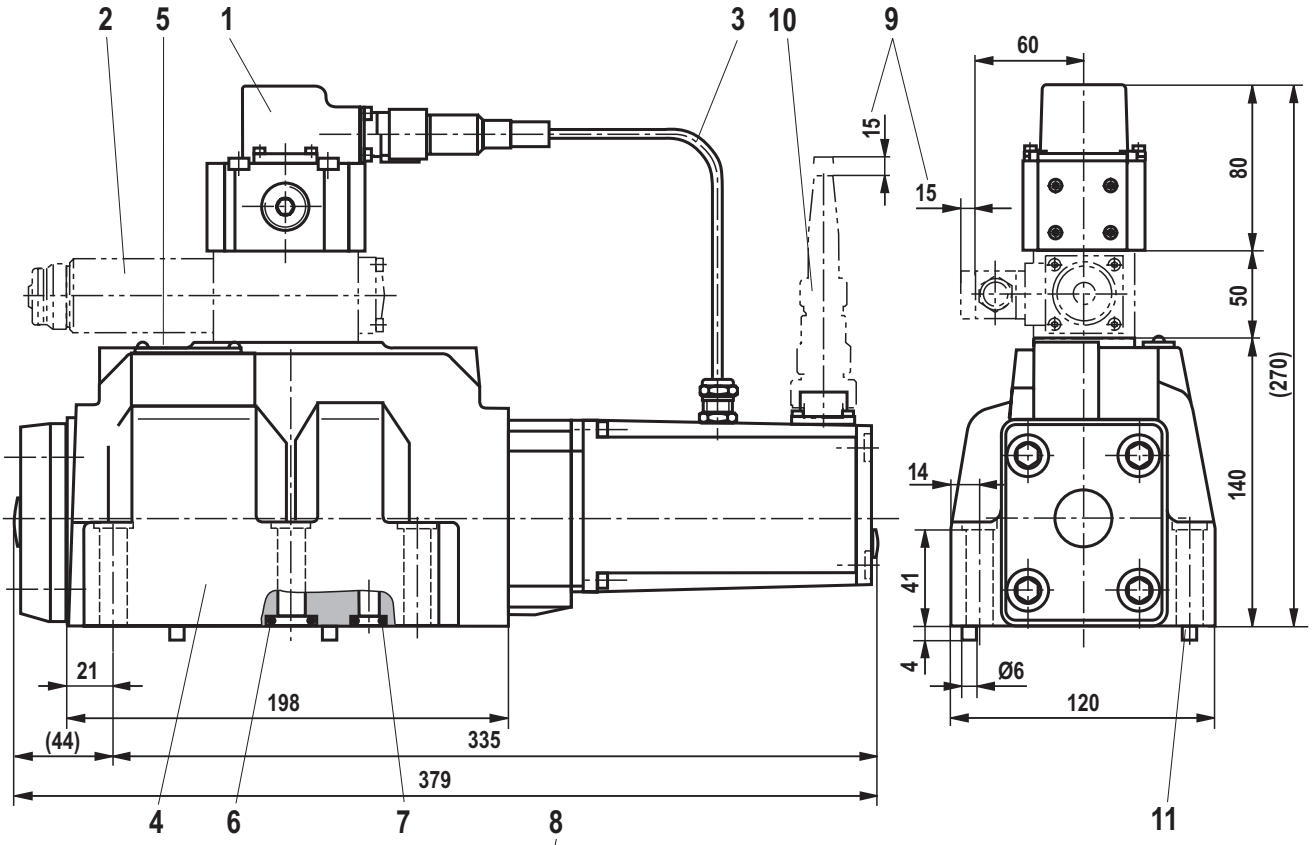
1 Pilot control valve
2 Directional sandwich plate valve (only included with version “WG152”)
3 Cabling
4 Main stage
5 Name plate
6 Identical seal rings for ports A, B, P, T
7 Identical seal rings for ports X, Y, and L
8 Machined valve contact surface; porting pattern according to ISO 4401-08-08-0-05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

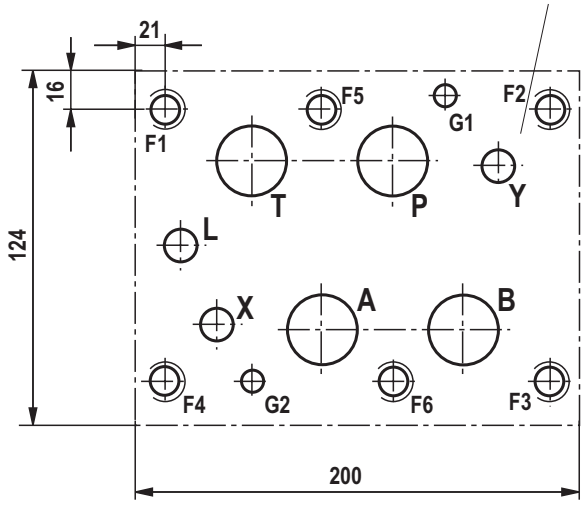
Subplates (separate order) with porting pattern according to ISO 4401-08-08-0-05, see data sheet 45100.

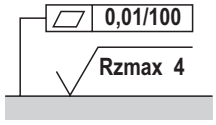
☞ **Notice:**
The dimensions are nominal dimensions which are subject to tolerances.

Valve mounting screws, see page 21.

Dimensions: Size 27
(dimensions in mm)







Required surface quality
of the valve contact surface

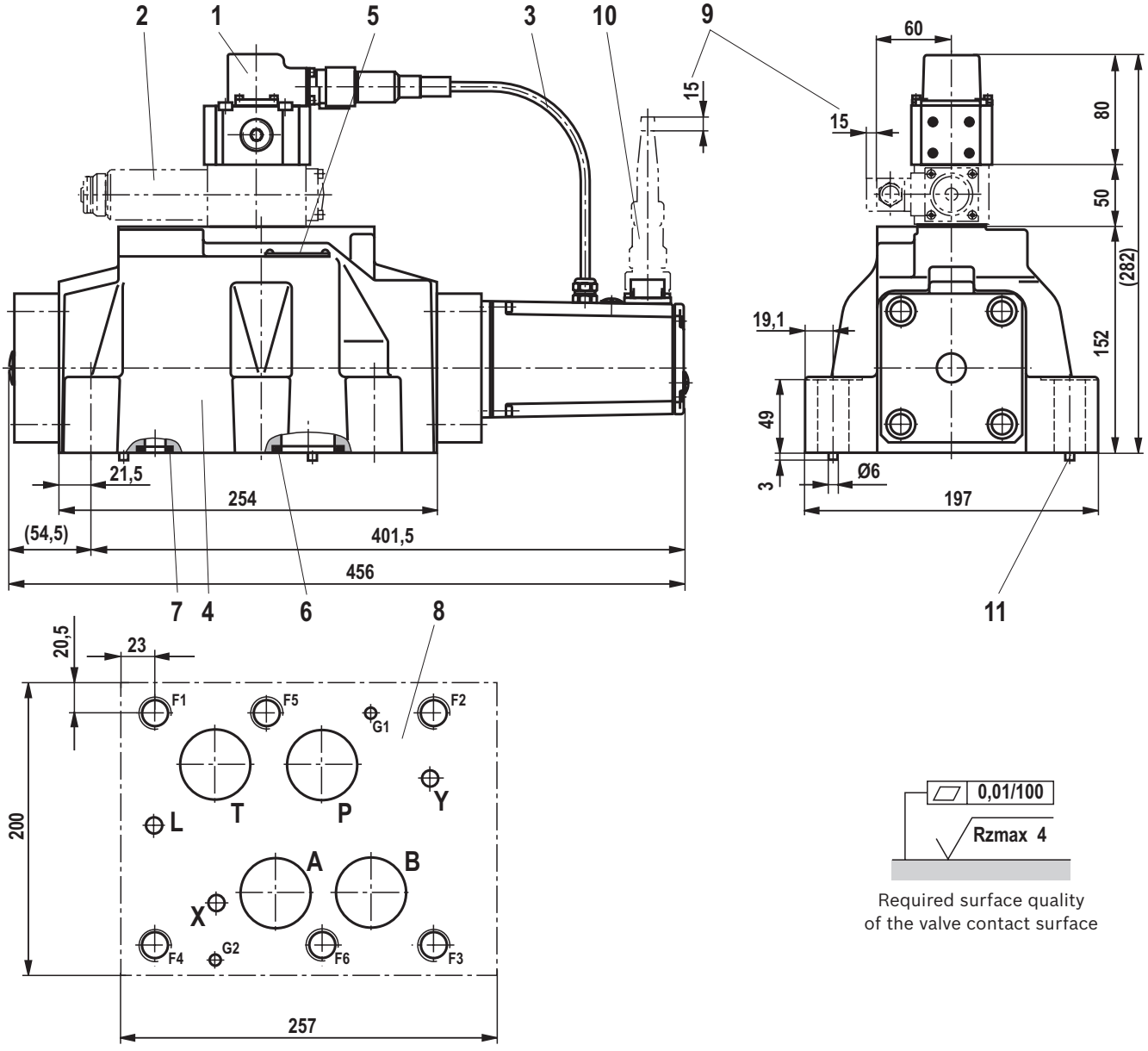
1 Pilot control valve
2 Directional sandwich plate valve (only included with version “WG152”)
3 Cabling
4 Main stage
5 Name plate
6 Identical seal rings for ports A, B, P, T
7 Identical seal rings for ports X, Y, and L
8 Machined valve contact surface; porting pattern according to ISO 4401-08-07-0-05 (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.

Dimensions: Size 32
(dimensions in mm)



Required surface quality
of the valve contact surface

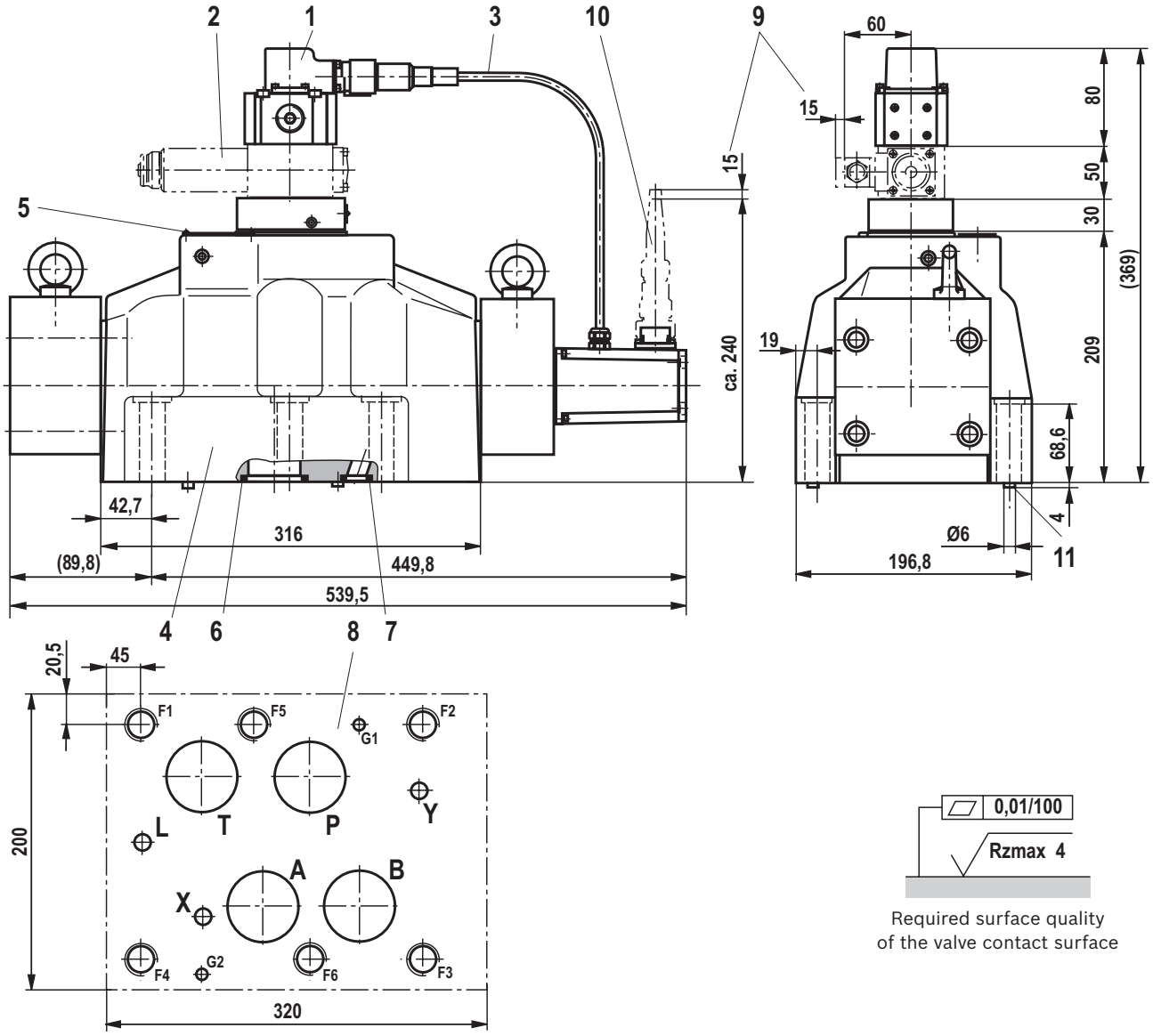
1 Pilot control valve
2 Directional sandwich plate valve (only included with version “WG152”)
3 Cabling
4 Main stage
5 Name plate
6 Identical seal rings for ports A, B, P, T
7 Identical seal rings for ports X, Y, and L
8 Machined valve contact surface, porting pattern according to ISO 4401-10-09-0-05 (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.

Dimensions: Size 35
(dimensions in mm)



Required surface quality
of the valve contact surface

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.

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 Nm ± 10%	**R913000258**
16	2	**ISO 4762 - M6 x 60 - 10.9-flZn-240h-L** Tightening torque M_A = 12.2 Nm ± 10%	**R913000115**
	4	**ISO 4762 - M10 x 60 - 10.9-flZn-240h-L** Tightening torque M_A = 58 Nm ± 20%	**R913000116**
25, 27	6	**ISO 4762 - M12 x 60 - 10.9-flZn-240h-L** Tightening torque M_A = 100 Nm ± 20%	**R913000121**
32	6	**ISO 4762 - M20 x 80 - 10.9-flZn-240h-L** Tightening torque M_A = 340 Nm ± 20%	**R901035246**
35	6	**ISO 4762 - M20 x 100 - 10.9-flZn-240h-L** Tightening torque M_A = 360 Nm ± 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**

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	