4/3 directional high-response valves, pilot operated, with electrical position feedback and integrated electronics (OBE)

Type 4WRDE

RE 29093
Edition: 2012-11
Replaces: 09.07

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

Features

- Pilot operated 3-stage directional control valve with electrical position feedback of the main control spool and integrated electronics (OBE)
- Position sensing of the main control spool by means of an inductive position transducer
- 2-stage pilot control valve type 4WS2EM 6-2X/...
- Particularly suitable for position, velocity, pressure and force control where there are at the same time high requirements on the dynamics and the response sensitivity
- Subplate mounting:
  Porting pattern according to ISO 4401

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	High-response 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 design see page 4	

Rated flow size 10 with 10 bar valve pressure differential

05	25 l/min	**25** [1]
	50 l/min	**50**
	90 l/min	**100**

Rated flow size 16 with 10 bar valve pressure differential

05	125 l/min	**125**
	200 l/min	**200**

Rated flow size 25 with 10 bar valve pressure differential

05	220 l/min	**220**
	350 l/min	**350**

Rated flow size 27 with 10 bar valve pressure differential

05	500 l/min	**500**

Rated flow size 32 with 10 bar valve pressure differential

05	400 l/min	**400**
	600 l/min	**600**

Rated flow size 35 with 10 bar valve pressure differential

05	1000 l/min	**1000**

Flow characteristics

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 size 6 (data sheet 29564)	**6L**
09	Direct voltage 24 V	**24**

[1] Only available with E, W and V control spool variant and with characteristic curve form L (linear)

Ordering code

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

Pilot oil supply and return

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** [1]

12	**Without** directional sandwich plate valve	**no code**
	With directional sandwich plate valve 24 V = mating connector Z4	**WG152** [1]

Seal material

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

14	R rings	**R**

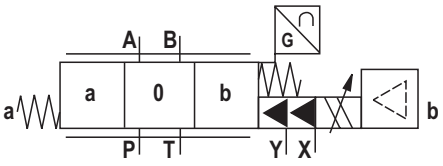
15	Further details in the plain text	

[1] Mating connectors, separate order, see page 21

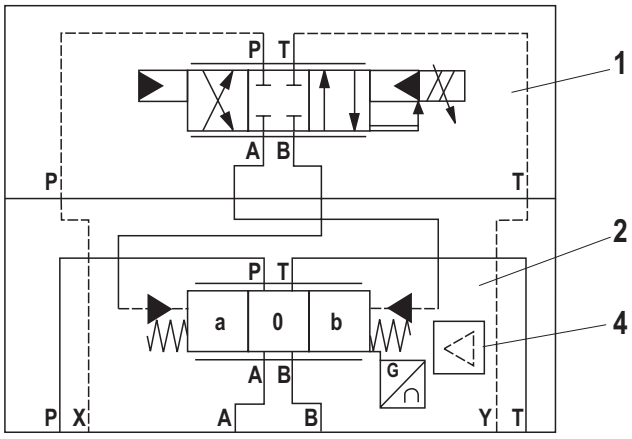
Symbols

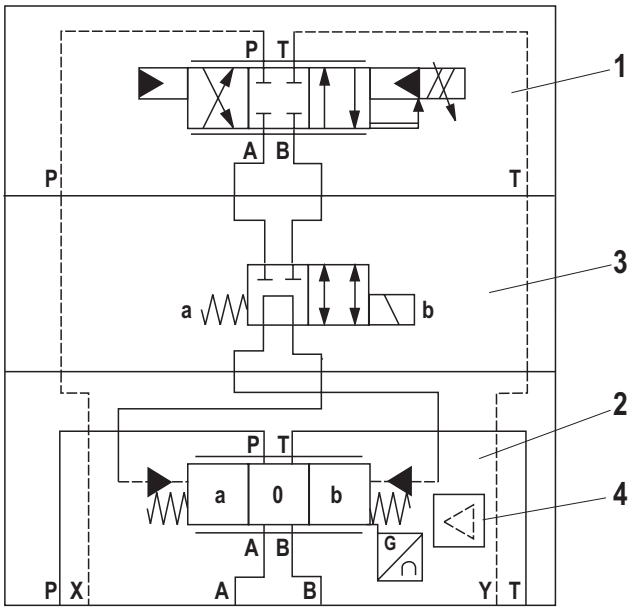
Simplified

Example:
Pilot oil supply external
pilot oil return external



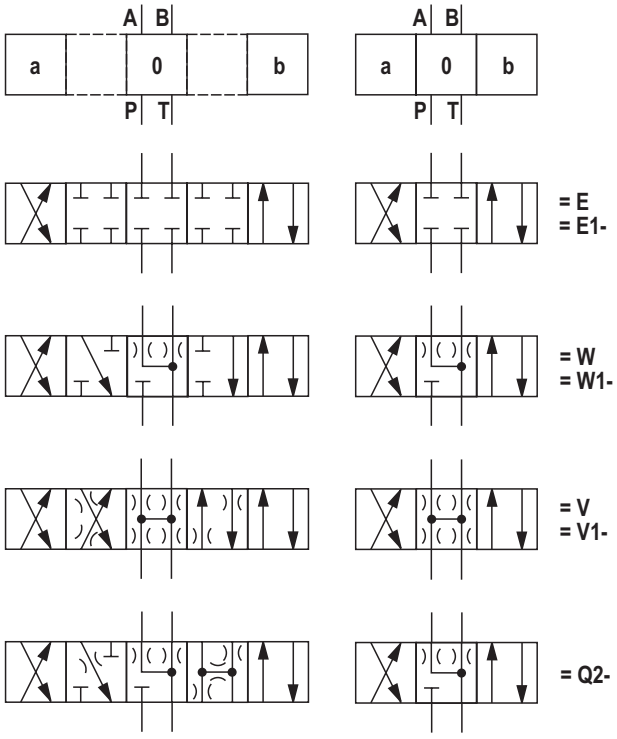
Detailed





1 Pilot control valve
2 Main valve
3 Directional sandwich plate valve
4 Integrated electronics (OBE)

Control spool symbols



With control spool symbol E1-, W1- and V1-:

P→A:	q_{Vmax}	B→T:	$q_V/2$
P→B:	$q_V/2$	A→T:	q_{Vmax}

Notice!
In the zero position, control spools W and W1- have a connection from A to T and B to T with approx.3 % of the relevant nominal cross-section.

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.

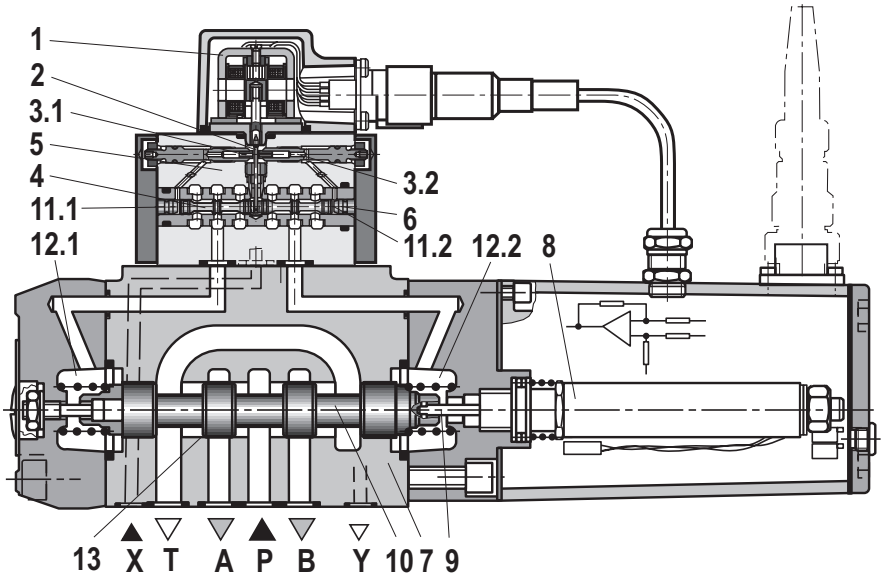
The position of the control spool (10) is measured by an inductive position transducer (8). The signal linking of the valve control loop, the supply of the position measurement system and the control of the pilot control valve are carried out via control electronics integrated in the valve.
The voltage 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 difference 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 is 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 is 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 the 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 applications outside these parameters, please consult us!)

general				**Size 10**	**Size 16**	**Size 25**	**Size 27**	**Size 32**	**Size 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 (measured with HLP46, ϑ_{Oil}= 40 ±5 °C)									
Maximum operating pressure	– Port A, B, P	Pilot oil supply external [1]	bar	350	350	350	250	350	350
	– Port X		bar	25 to 250			25 to 210	25 to 250	
	– Port A, B, P	Pilot oil supply internal	bar	25 to 250			25 to 210	25 to 250	
Maximum return flow pressure	– Port T	Pilot oil supply internal	bar	Pressure peaks < 100 admissible					
		Pilot oil supply external	bar	315	250	250	210	250	250
	– Port Y	Pilot oil supply internal	bar	Pressure peaks < 100 admissible					
Rated flow q_{Vnom} ±10 % with valve pressure differential Δp = 10 bar [2]			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
Hydraulic fluid				See table page 6					
Hydraulic fluid temperature range (at the valve working ports)			°C	–20 ... +80; preferably +40 ... +50					
Viscosity range			mm^2/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 to 10 % of p		%	≤ 0.2					

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

2) q_{Vnom} = rated flow (complete valve) in l/min with a V control spool.

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.
For the selection of the filters see www.boschrexroth.com/filter.

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

Technical data

(For applications outside these parameters, please consult us!)

Hydraulic fluid	Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons	HL, HLP	NBR, FKM	DIN 51524
Flame-resistant – containing water	HFC (Fuchs HYDROTHERM 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922

☞ **Important information on hydraulic fluids!**

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 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, allocation

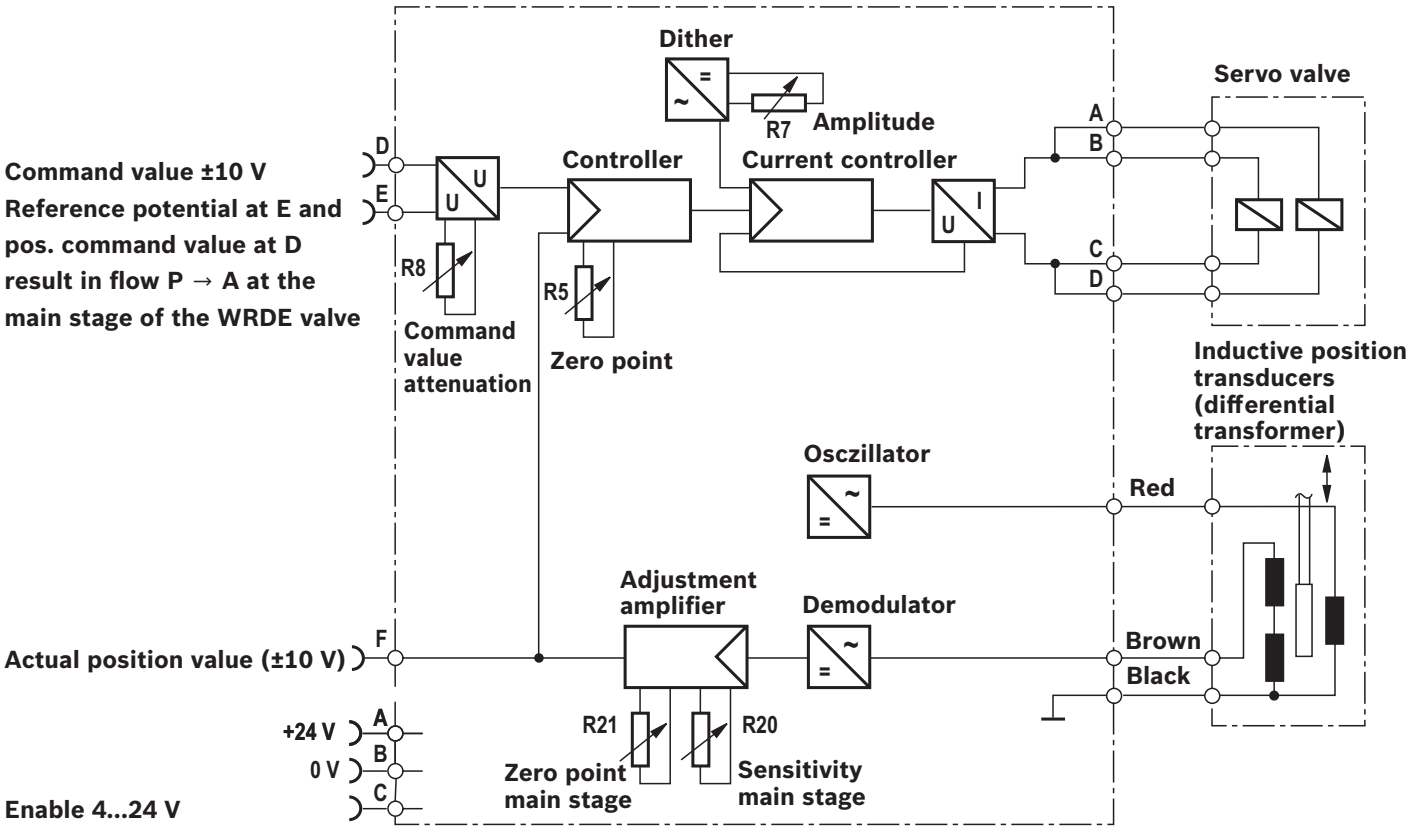
Contact	Signal	Device connector allocation
A	24 VDC (20 to 28 VDC); full bridge rectification smoothened with 2200 μF; I_{max} = 270 mA	Supply voltage
B	0 V	
C	4 to 24 VDC	Enable [1] (activates the valve control loop)
D	±10 V [2; 3]	Differential amplifier input (command value)
E		
F	±10 V (to contact "B")	Actual value

1) With pending hydraulic pressure and **deactivated enable**, the control spool of the main stage is moved into 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".

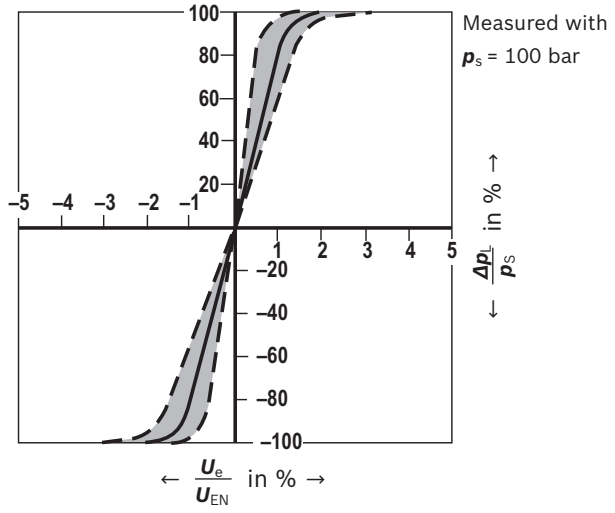
Block diagram of the integrated electronics (OBE)



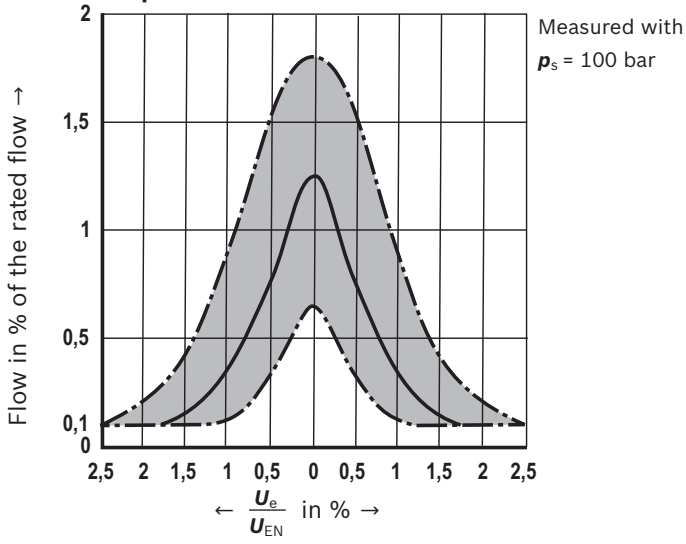
☞ **Notice!**
Electric signals taken out via control electronics (e.g. actual value or enable) must not be used for switching off safety-relevant machine functions!

Characteristic curves (measured with v = 32 mm²/s and ϑ_{Oil} = 40 ±5 °C)

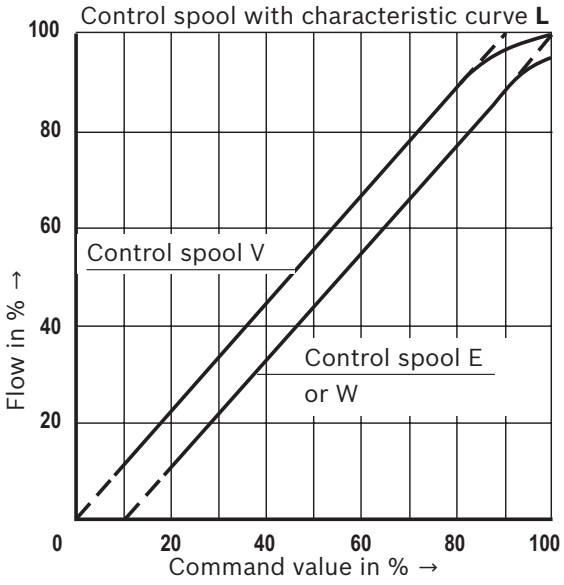
Pressure-signal characteristic curve (control spool V)

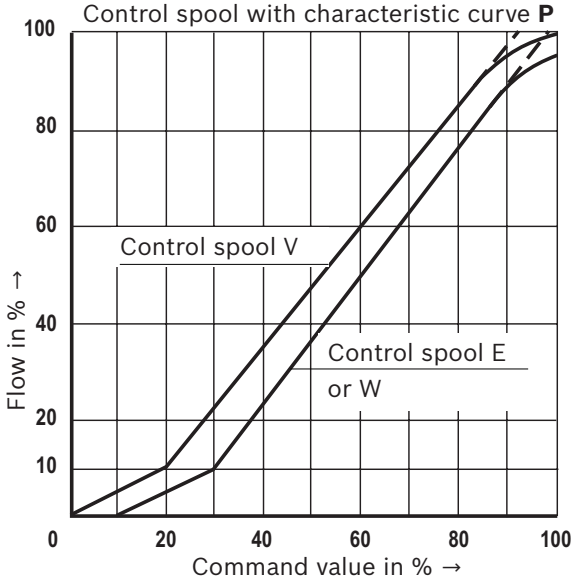


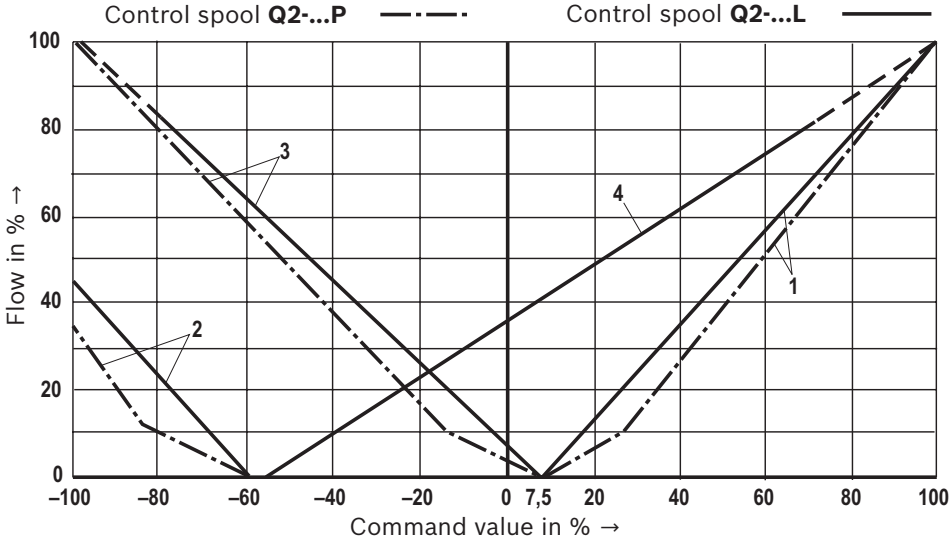
Zero flow of the main stage (control spool V) without pilot control valve



Flow command value function e.g. with
P → A / B → T 10 bar valve pressure differential or
P → A or A → T 5 bar per control edge





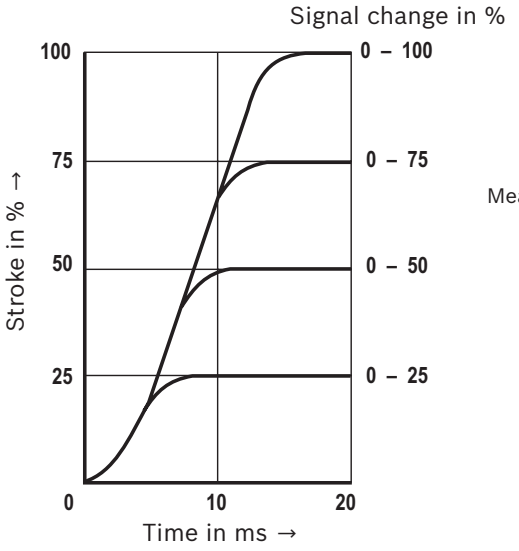


1 P → A
2 P → B
3 A → T
4 B → T

Characteristic curves size 10

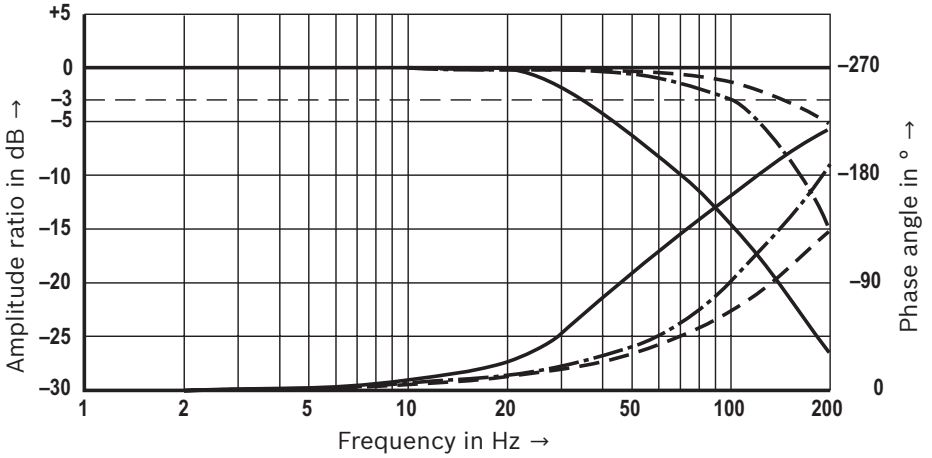
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Transition function with stepped electric input signals



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

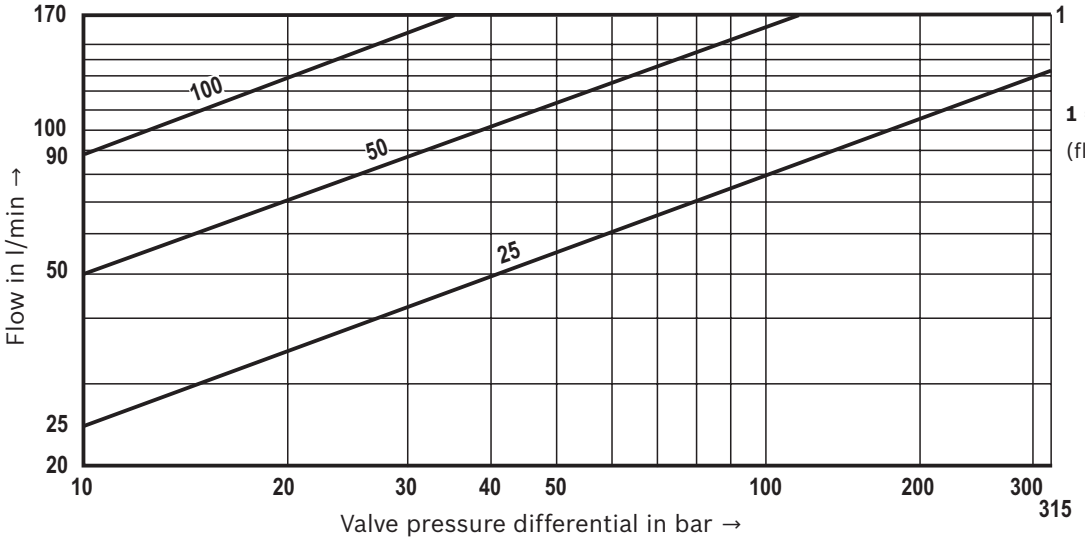
Frequency response characteristic curves



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 %)

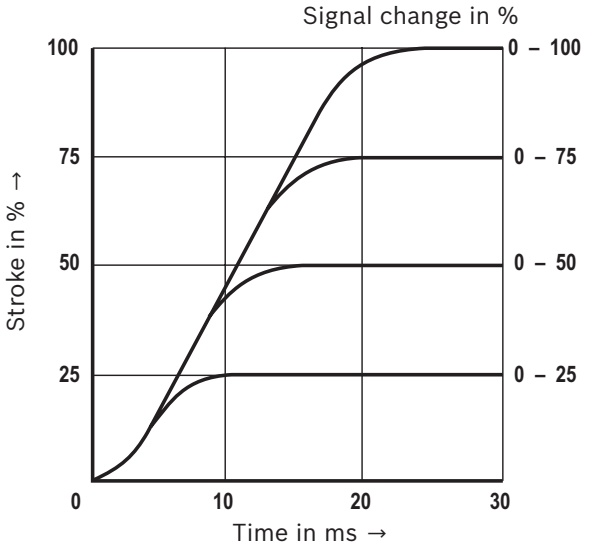


1 = recommended flow limitation
(flow velocity 30 m/s)

Characteristic curves size 16

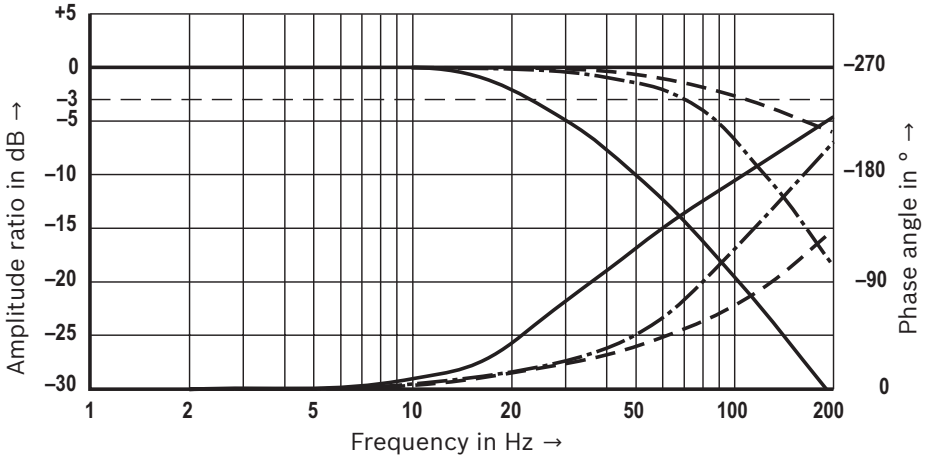
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Transition function with stepped electric input signals



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

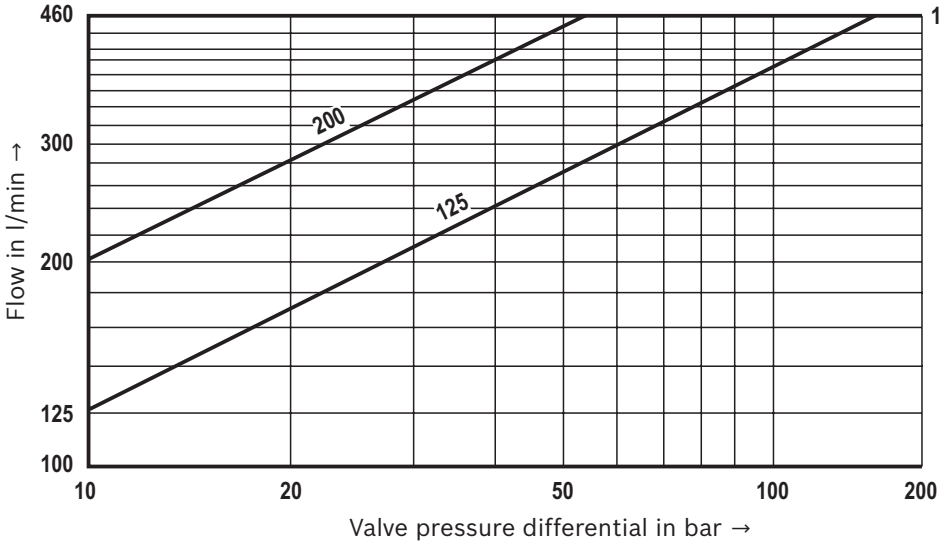
Frequency response characteristic curves



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

Signal ±100 %
Signal ±25 %
Signal ±5 %

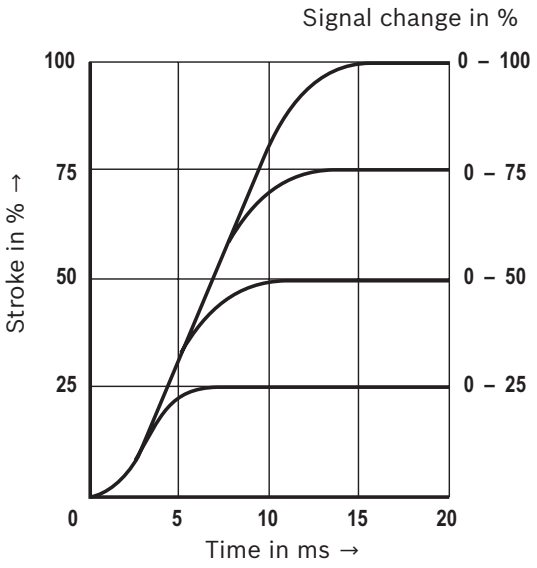
Flow/load function with maximum valve opening (tolerance ±10 %)



1 = recommended flow limitation
(flow velocity 30 m/s)

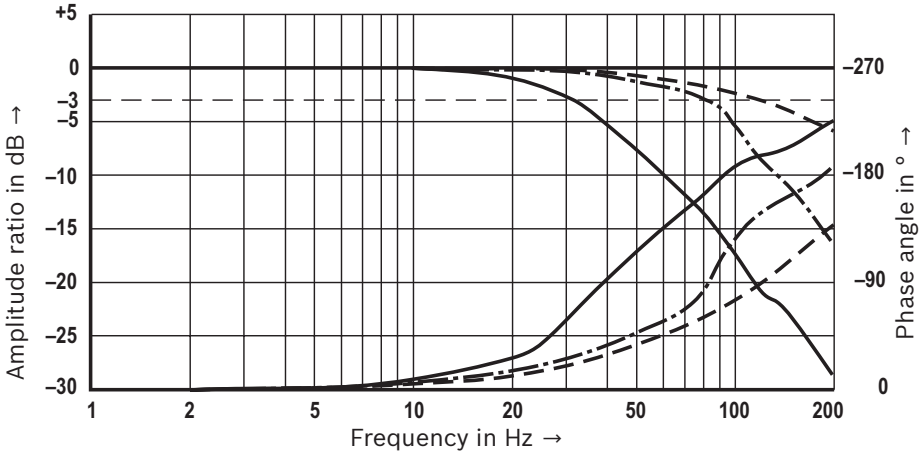
Characteristic curves size 25 and 27
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Transition function with stepped electric input signals



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

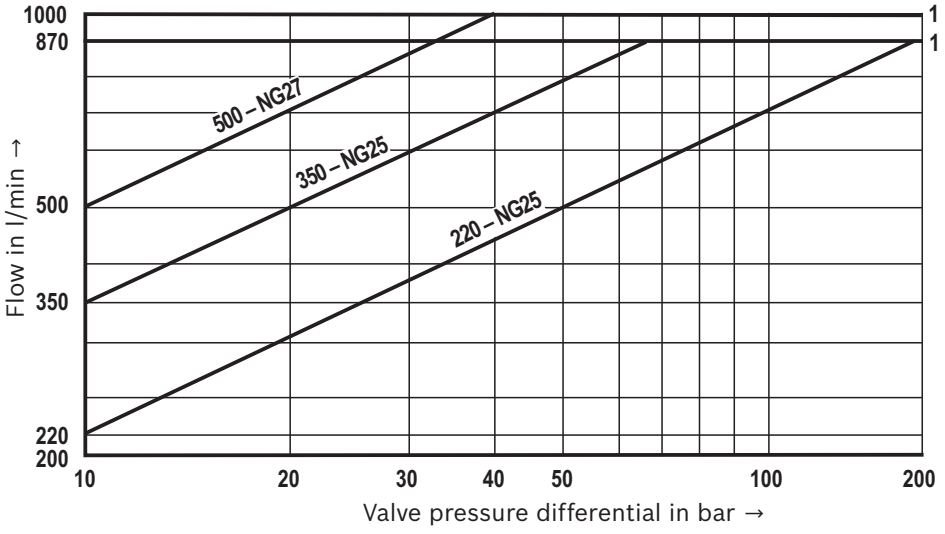
Frequency response characteristic curves



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 %)

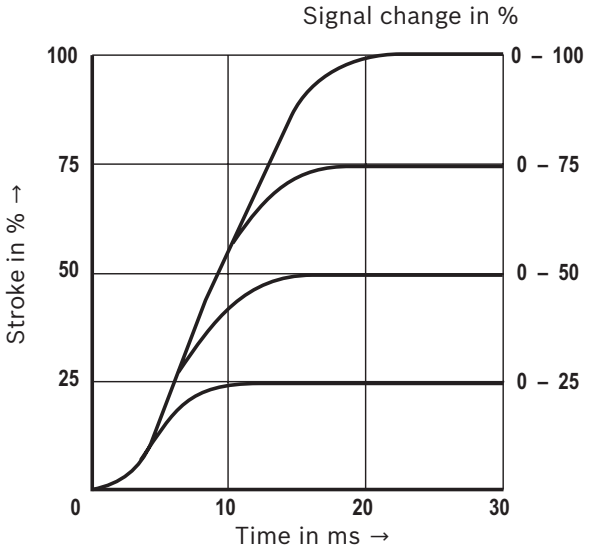


1 = recommended flow limitation
(flow velocity 30 m/s)

Characteristic curves size 32

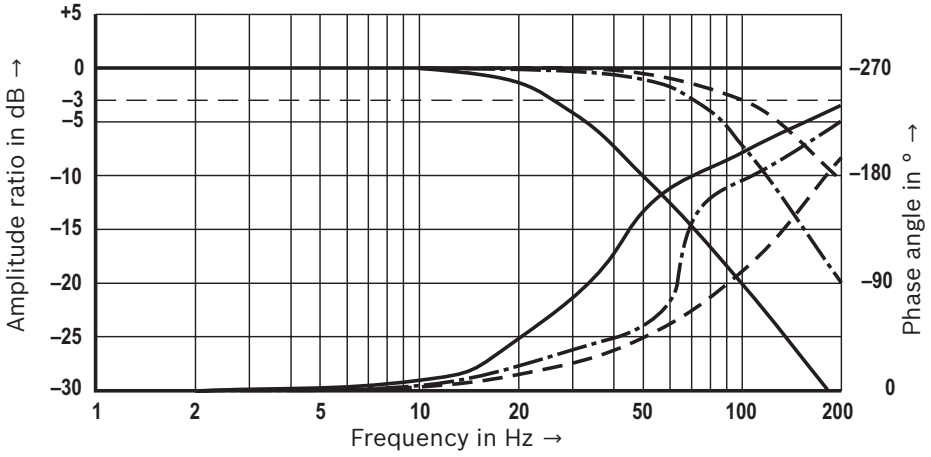
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Transition function with stepped electric input signals



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

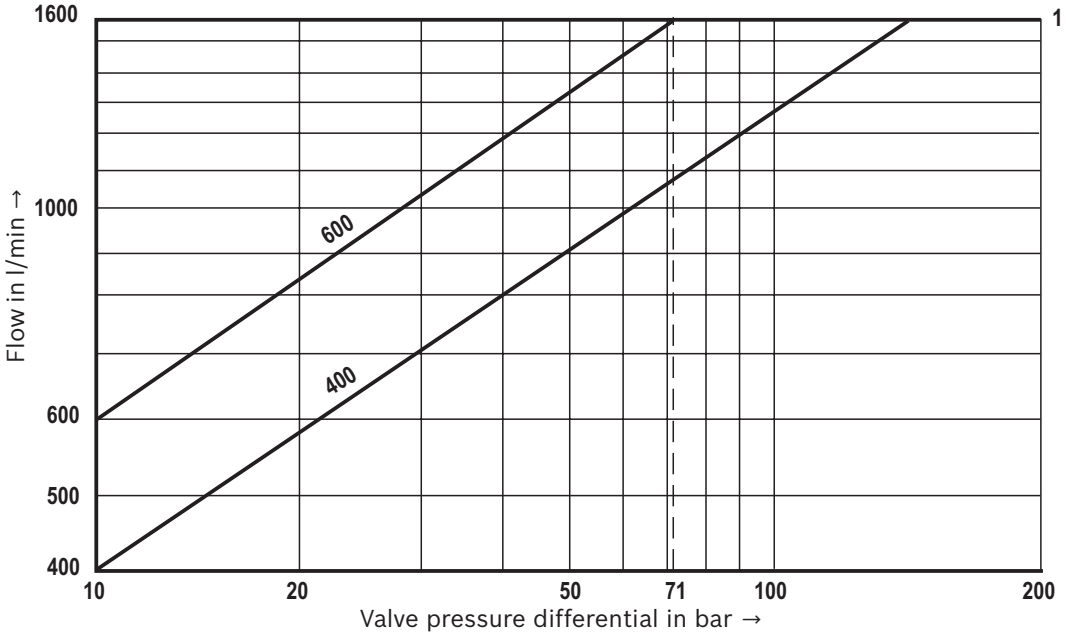
Frequency response characteristic curves



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 %)

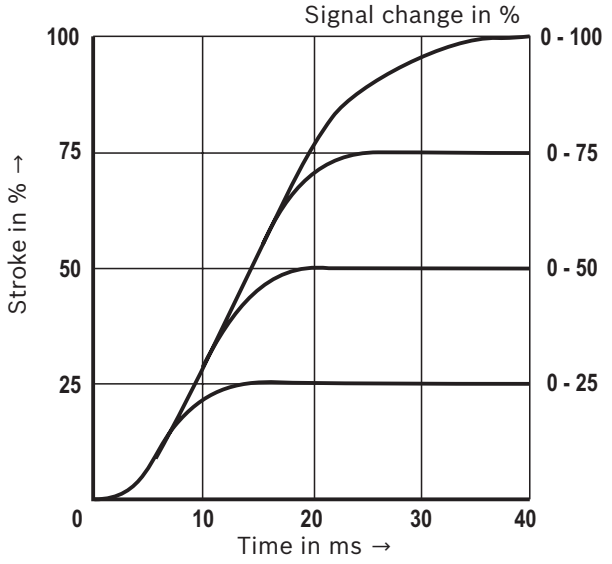


1 = recommended flow limitation
(flow velocity 30 m/s)

Characteristic curves size 35

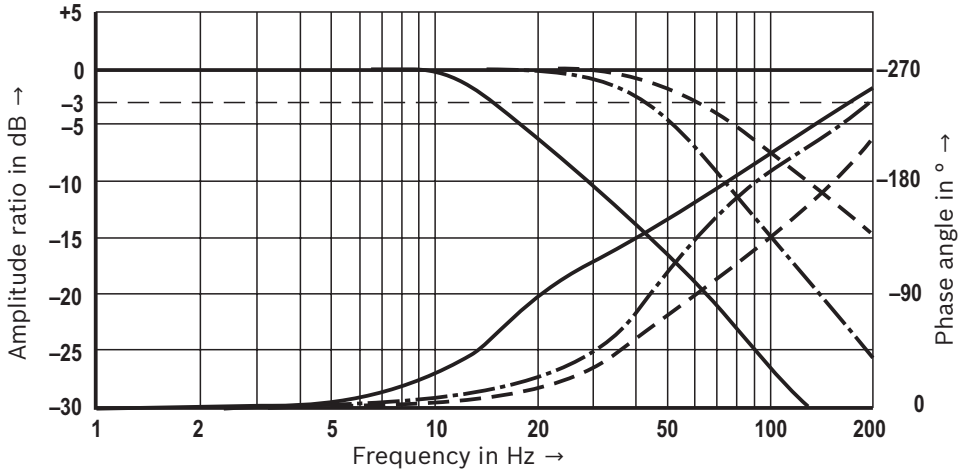
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Transition function with stepped electric input signals



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

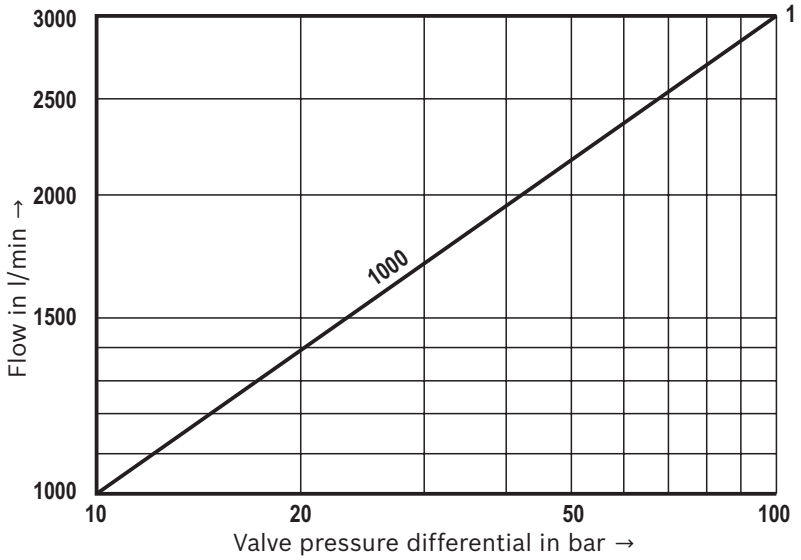
Frequency response characteristic curves



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

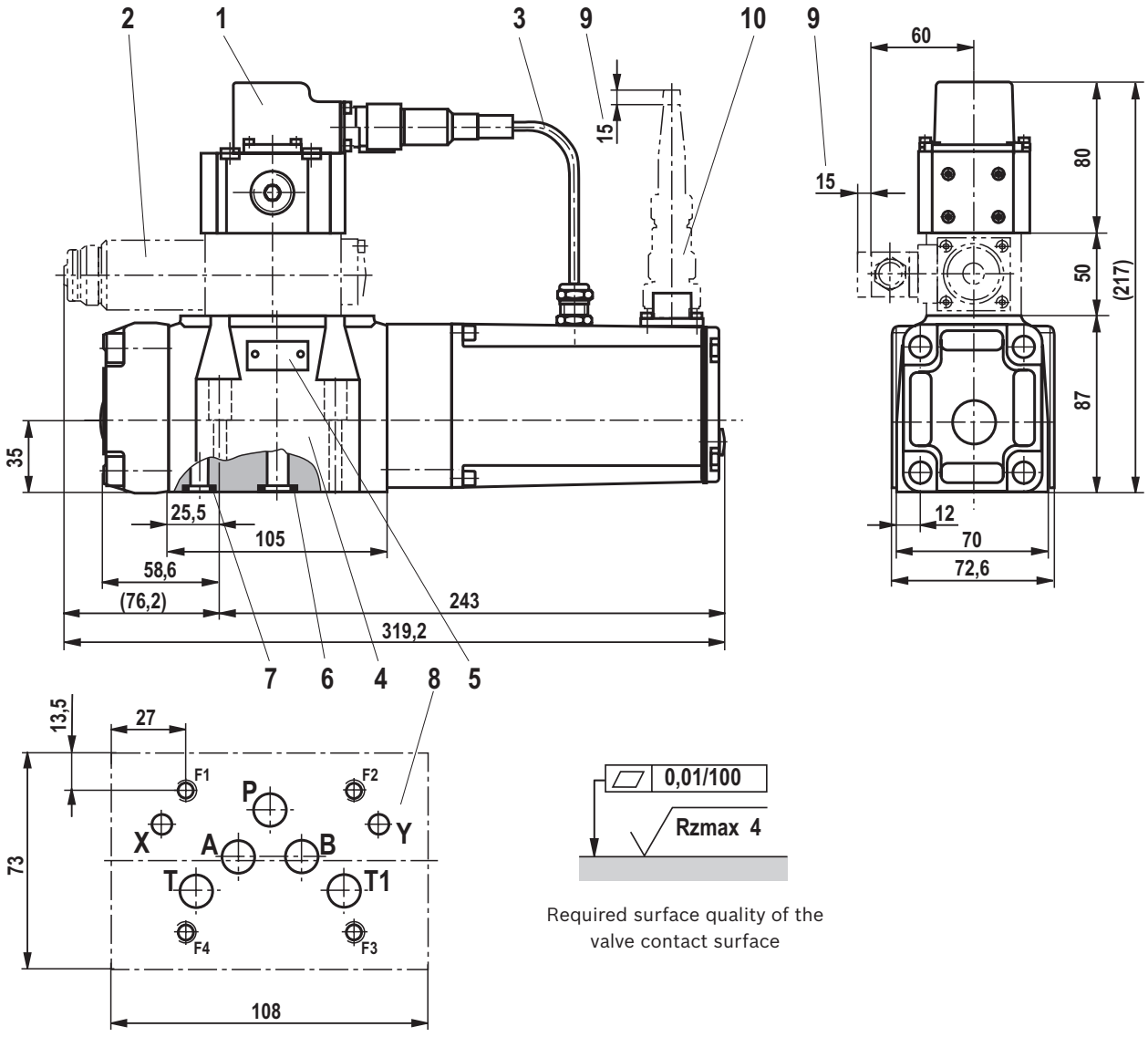
Signal ±100 %
Signal ±25 %
Signal ±5 %

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



1 = recommended flow limitation
(flow velocity 30 m/s)

Device dimensions size 10 (dimensions in mm)



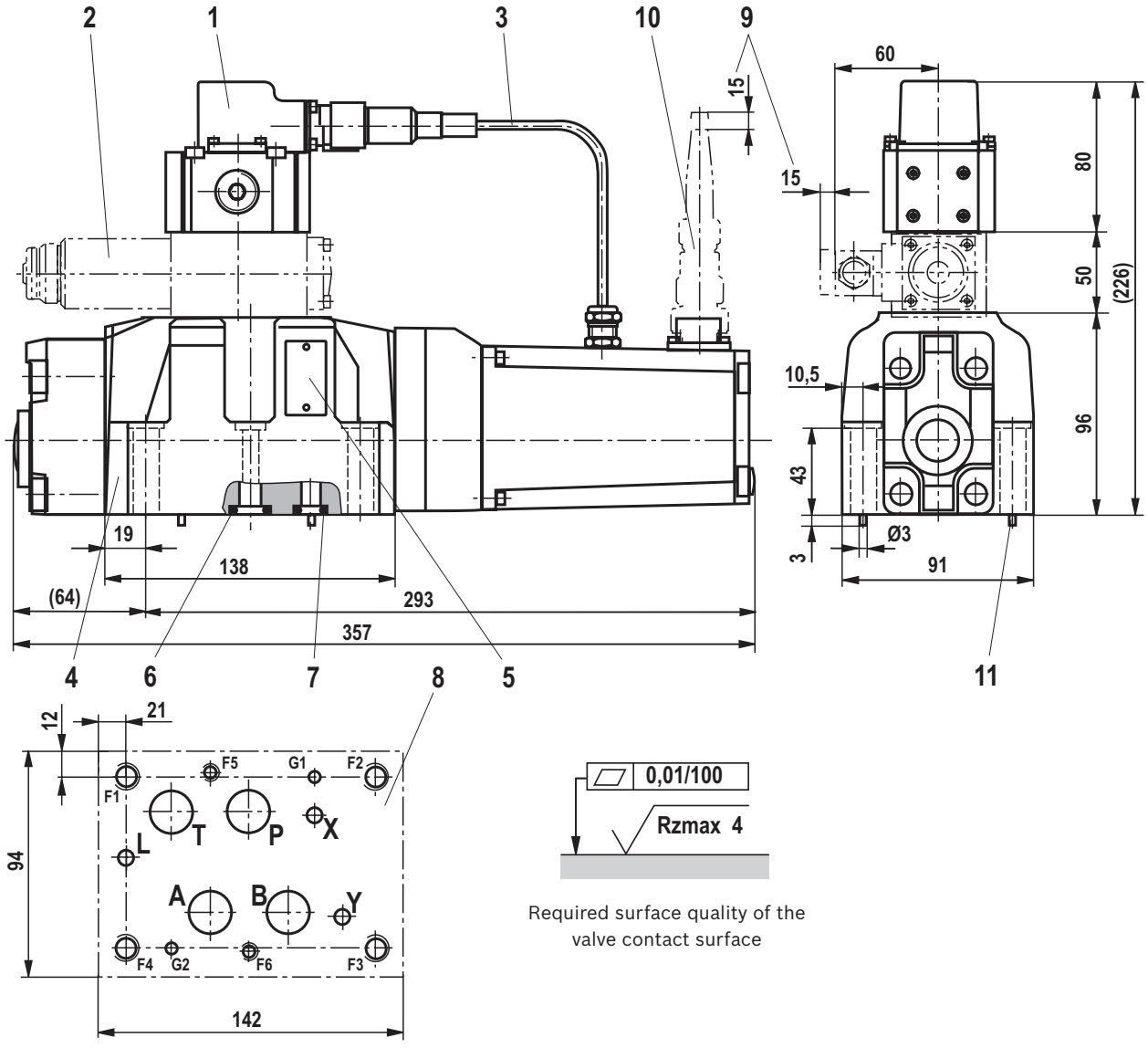
Required surface quality of the valve contact surface

1 Pilot control valve
2 Directional sandwich plate valve (only contained 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

☞ **Notice!**
The dimensions are nominal dimensions which may be subject to tolerance deviations.

Valve mounting screws and subplates see page 21

Device dimensions size 16 (dimensions in mm)



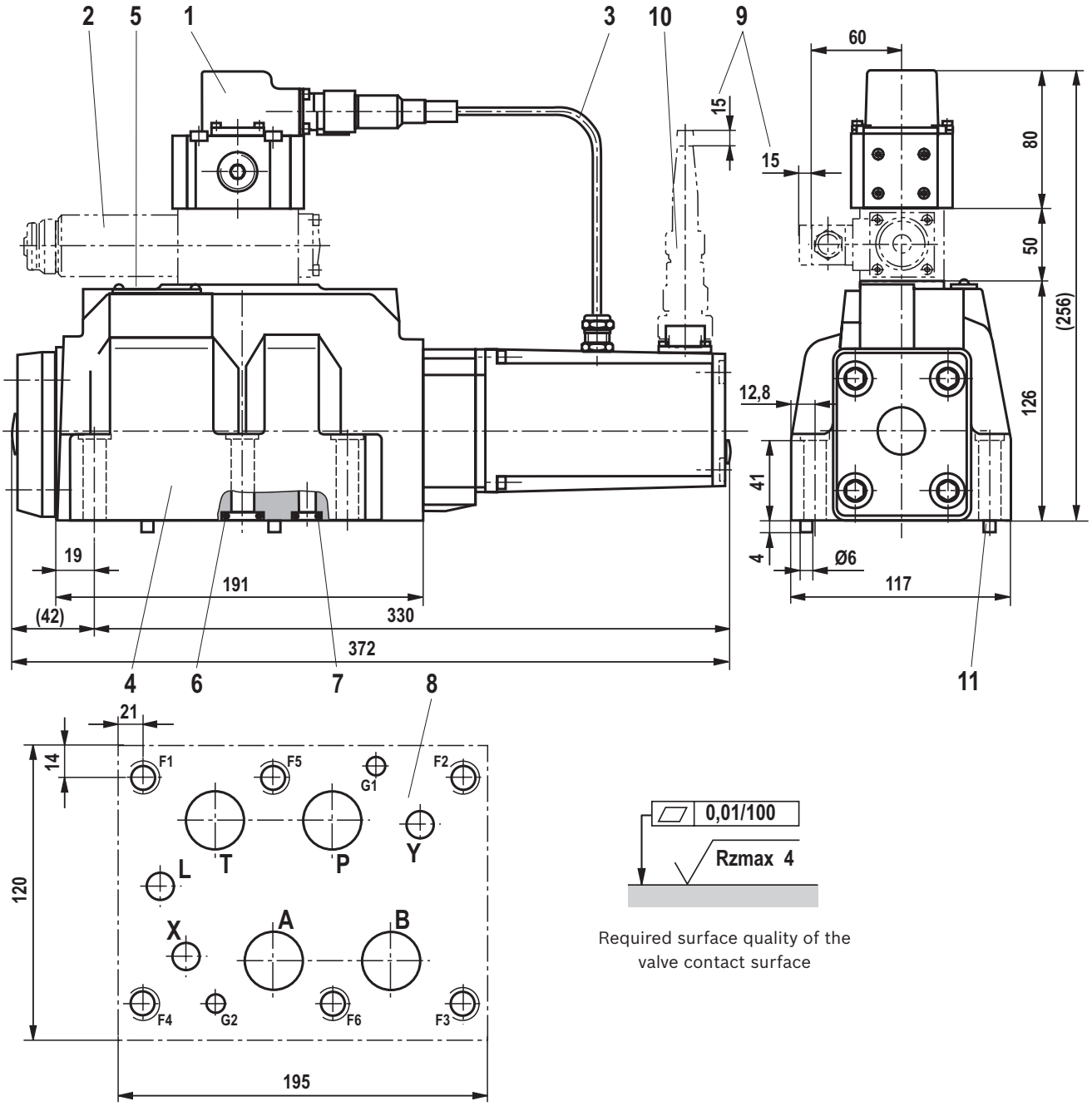
Required surface quality of the valve contact surface

1 Pilot control valve
2 Directional sandwich plate valve (only contained 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 and Y as required)
9 Space required to remove the mating connectors
10 Mating connector, separate order, see page 21
11 Locking pin

Notice!
The dimensions are nominal dimensions which may be subject to tolerance deviations.

Valve mounting screws and subplates see page 21

Device dimensions size 25 (dimensions in mm)



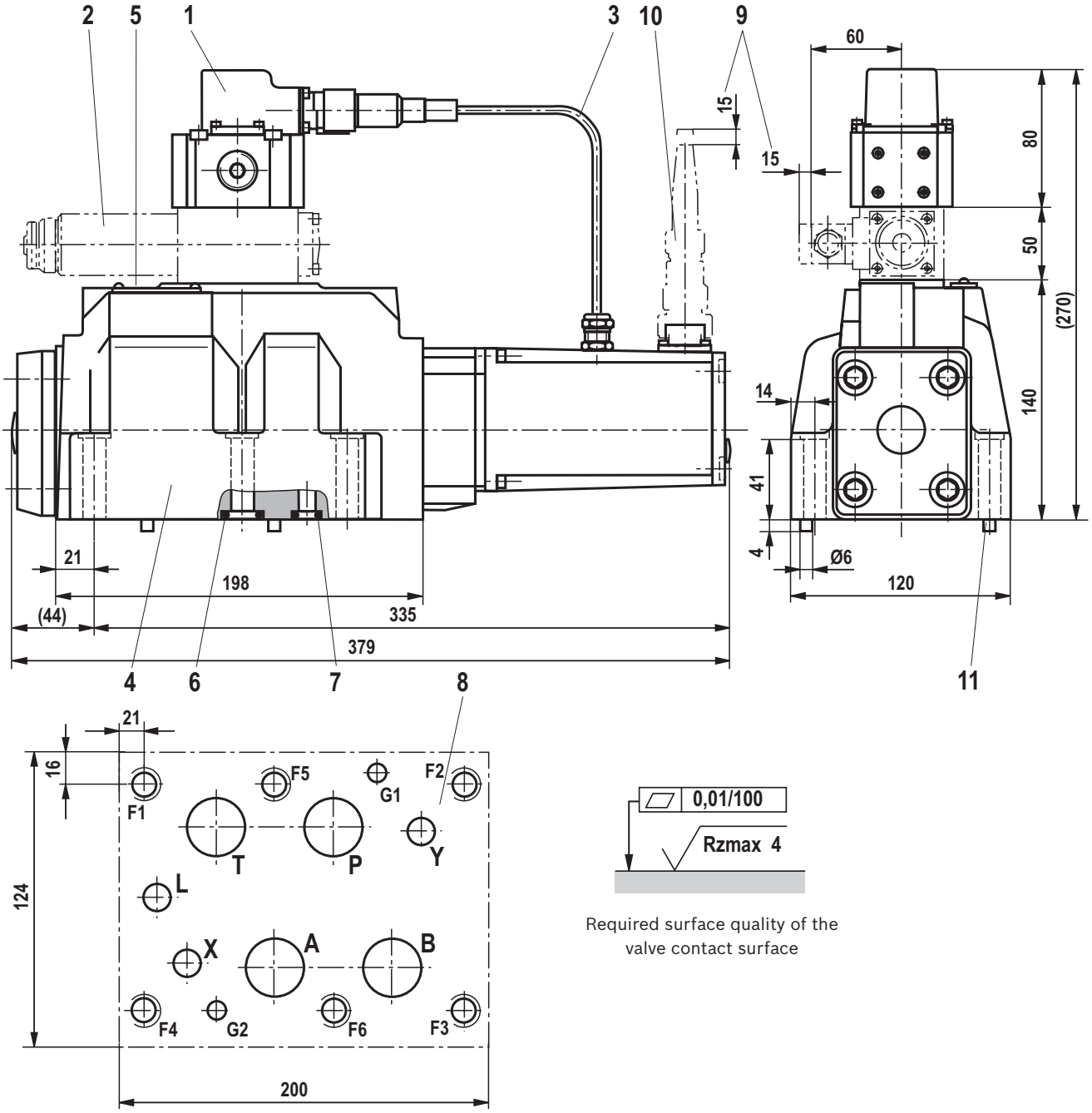
Required surface quality of the valve contact surface

1 Pilot control valve
2 Directional sandwich plate valve (only contained 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 and Y as required)
9 Space required to remove the mating connectors
10 Mating connector, separate order, see page 21
11 Locking pin

☞ **Notice!**
The dimensions are nominal dimensions which may be subject to tolerance deviations.

Valve mounting screws and subplates see page 21

Device dimensions size 27 (dimensions in mm)



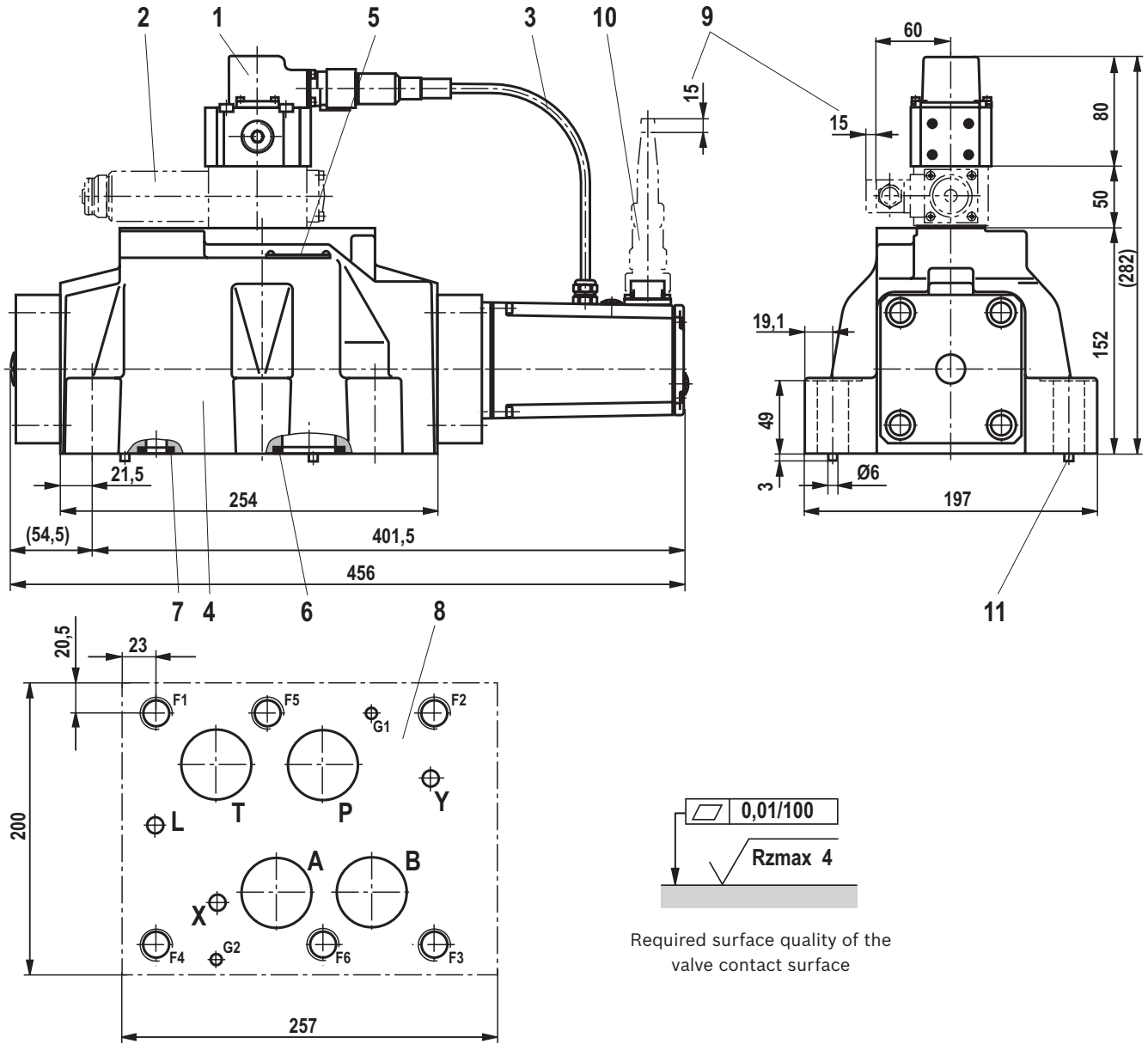
Required surface quality of the valve contact surface

1 Pilot control valve
2 Directional sandwich plate valve (only contained 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 and Y as required)
9 Space required to remove the mating connectors
10 Mating connector, separate order, see page 21
11 Locking pin

☞ **Notice!**
The dimensions are nominal dimensions which may be subject to tolerance deviations.

Valve mounting screws and subplates see page 21

Device dimensions size 32 (dimensions in mm)



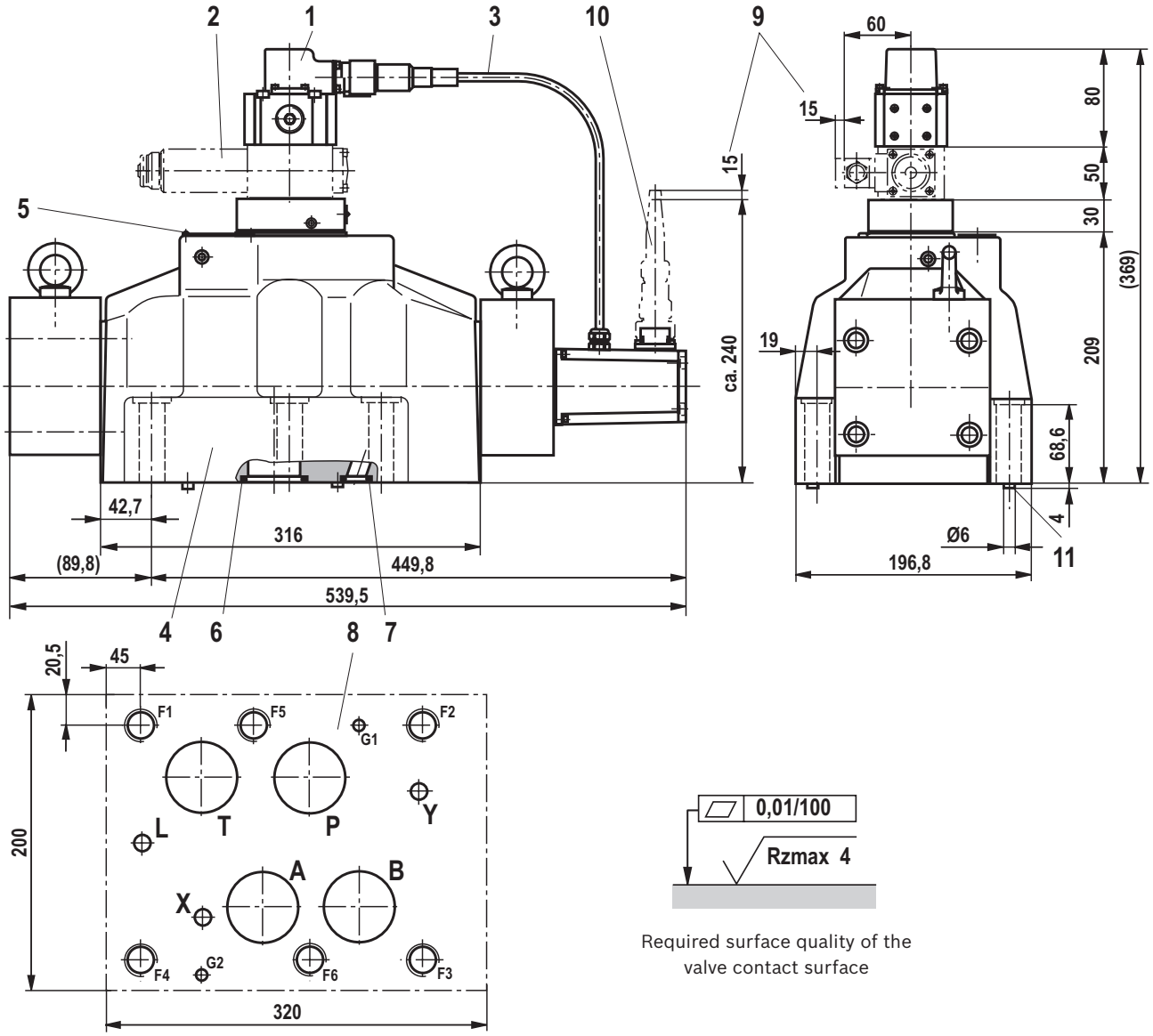
Required surface quality of the valve contact surface

1 Pilot control valve
2 Directional sandwich plate valve (only contained 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 and Y as required)
9 Space required to remove the mating connectors
10 Mating connector, separate order, see page 21
11 Locking pin

☞ **Notice!**
The dimensions are nominal dimensions which may be subject to tolerance deviations.

Valve mounting screws and subplates see page 21

Device dimensions size 35 (dimensions in mm)



Required surface quality of the valve contact surface

1 Pilot control valve
2 Directional sandwich plate valve (only contained 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 and Y as required)
9 Space required to remove the mating connectors
10 Mating connector, separate order, see page 21
11 Locking pin

☞ **Notice!**
The dimensions are nominal dimensions which may be subject to tolerance deviations.

Valve mounting screws and subplates see page 21

Device dimensions

Hexagon socket head cap screws (separate order)		**Material number**
Size 10	4x ISO 4762 - M6 x 45 - 10.9-flZn-240h-L Tightening torque M_A = 13.5 Nm ±10 %	R913000258
Size 16	2x ISO 4762 - M6 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 12.2 Nm ±10 % 4x ISO 4762 - M10 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 58 Nm ±20 %	R913000115 R913000116
Sizes 25 and 27	6x ISO 4762 - M12 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 100 Nm ±20 %	R913000121
Size 32	6x ISO 4762 - M20 x 80 - 10.9-flZn-240h-L Tightening torque M_A = 340 Nm ±20 %	R901035246
Size 35	6x ISO 4762 - M20 x 100 - 10.9-flZn-240h-L Tightening torque M_A = 360 Nm ±20 %	R913000386

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

Subplates	**Data sheet**
Size 10	45054
Size 16	45056
Sizes 25 and 27	45058
Size 32	45060

Accessories (not included in the scope of delivery)

Mating connectors (details see page 7)	**Data sheet**	**Material number**
For high-response valve: Mating connector according to DIN EN 175201-804	08006	e.g. R900021267 (plastic) e.g. R900223890 (metal)
compatible with VG95328 size 14-6S		e.g. R900013159 (plastic)
For sandwich plate: Mating connector according to DIN EN 175301-803, ISO 4400		e.g. R901017011 (plastic)

Miscellaneous	**Material number**
Filter element and seal	R961001949

Notes

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Notes

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