

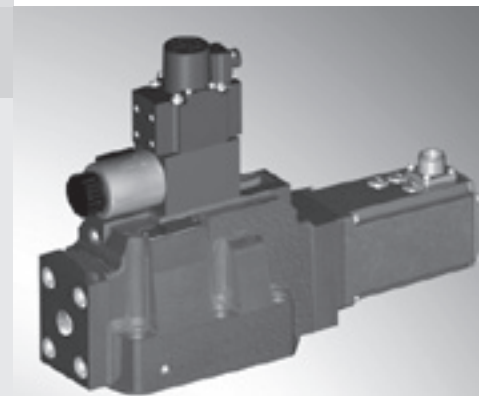
4/3 directional control valves, pilot operated, with electric position feedback

RE 29094-XN-B2/05.14

Replaces: 07.11

Type 4WRD...XN

Sizes 10, 16, 25, 27, 32, 35
Component series 5X
Maximum operating pressure 350 bar



Type 4WRD25...XN

ATEX units For explosive areas Part II Data sheet



Information on explosion protection:

Range of application in accordance with the Explosion Protection Directive 94/9/EC

II3G: Type of protection

Ex nA II T5X **without** directional sandwich plate valve

Ex nA II T3X **with** directional sandwich plate valve
according to EN 60079-0:2006 / EN 60079-15:2005

What you need to know about these operating instructions

These operating instructions apply to the explosion-proof version of Rexroth valves and consist of the following three parts:

- Part I General information 07010-X-B1
- Part II Data sheet 29094-XN-B2
- Part III Product-specific instructions 29094-XN-B3

Operating instructions 29094-XN-B0

You can find further information on the correct handling of Rexroth hydraulic products in our publication "General product information on hydraulic products" 07008.

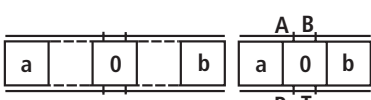



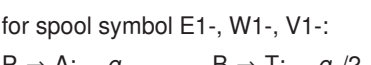

Table of contents

Content	Page
Features	2
Ordering code and scope of delivery	3
Symbols	4
Function, section	5
Technical data	6, 7
Information on explosion protection	7
Electrical connection	8, 9
Characteristic curves	10...15
Unit dimensions	16...21

Features

- Pilot operated 3-stage directional control valve for intended use in explosive areas of zone 2
- Electric position feedback of the main spool
- 2-stage pilot control valve type 4WS2EM 6-2X/...XN
- Particularly suitable for the position, velocity, pressure and force control with simultaneously high requirements on the dynamics and the response sensitivity
- For subplate mounting, porting pattern according to ISO 4401 (size 10 to size 35)
- Subplates available in FE/ZN version (see pages 16 to 21)
- The signal linking of the valve control loop, the supply of the position measurement system and the actuation of the pilot control valve are carried out via external control electronics.

Ordering code and scope of delivery

4WRD					5X/	6L	24	XN		K31/		V	R
Electrically operated 3-stage directional control valve in 3-way design												R =	R rings
Size		= 10										V =	FKM seals
		= 16										No code = without directional sandwich plate valve	
		= 25										WG152 = with directional sandwich plate valve, 24 VDC	
		= 27										without mating connector, separate order, see page 9	
		= 32										Electrical connection	
		= 35										K31 = Connector	
												without mating connector, separate order, see page 9	
Spool symbols												Pilot flow	
												No code = Pilot oil supply external, pilot oil return external	
		= E										E = Pilot oil supply internal, pilot oil return external	
		= W										ET = Pilot oil supply internal, pilot oil return internal	
		= W1-										T = Pilot oil supply external, pilot oil return internal	
		= V										XN = Explosion protection "type of protection nA"	
		= V1-										Details see information on the explosion protection, page 7	
for spool symbol E1-, W1-, V1-:												6L = Servo valve control, size 6	
P → A: q_{Vmax}												5X = Component series 50 to 59 (50 to 59: unchanged installation and connection dimensions)	
B → T: $q_V/2$												L = linear	
P → B: $q_V/2$												P = linear with fine control range	
A → T: q_{Vmax}												Rated flow in l/min – see also pages 11 to 15	
Important:												25 ¹⁾ = or 50 = or 100 = with size 10	
In the zero position, spools W and W1 have a connection from A to T and B to T with approx. 3 % of the relevant nominal cross-section.												125 = or 200 = with size 16	
												220 = or 350 = with size 25	
												500 = with size 27	
												400 = or 600 = with size 32	
												1000 = with size 35	

¹⁾ only available with E...; W... and V... spool variant and with characteristic curve form L (linear)

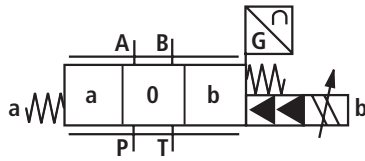
Included in the delivery:

Valve operating instructions with declaration of conformity in part III

Symbols (simplified, detailed)

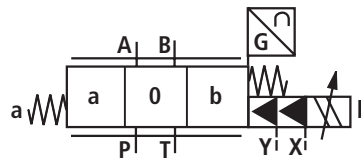
Type 4WRD...-5X/...XNET...

Pilot oil supply and pilot oil return internal



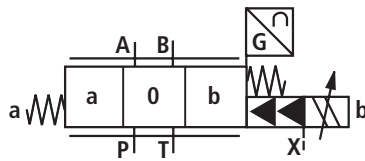
Type 4WRD...-5X/...XN...

Pilot oil supply and pilot oil return external



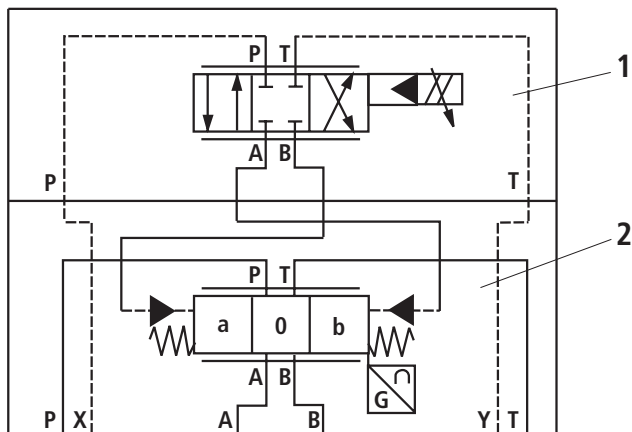
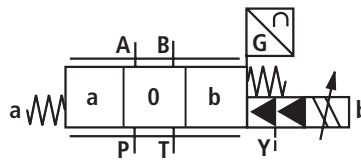
Type 4WRD ... -5X/...XNT...

Pilot oil supply external, pilot oil return internal



Type 4WRD... -5X/...XNE ...

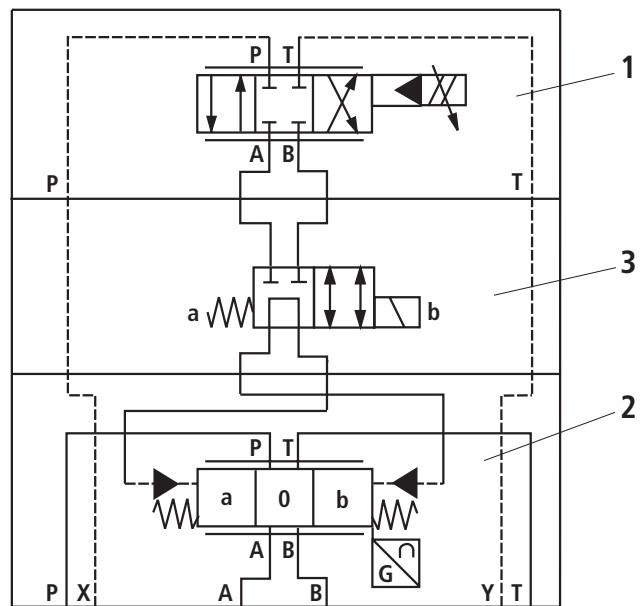
Pilot oil supply internal, pilot oil return external



Example:

Type 4WRD...-5X/...XN...

Pilot oil supply external, pilot oil return external



Example:

Type 4WRD...-5X/...XN...WG152...

Directional sandwich plate valve for centering the main stage

Pilot oil supply external, pilot oil return external

- 1 Pilot control valve
- 2 Main valve
- 3 Directional sandwich plate valve

Function, section

Valves of type 4WRD...XN 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.

It consists of the following assemblies:

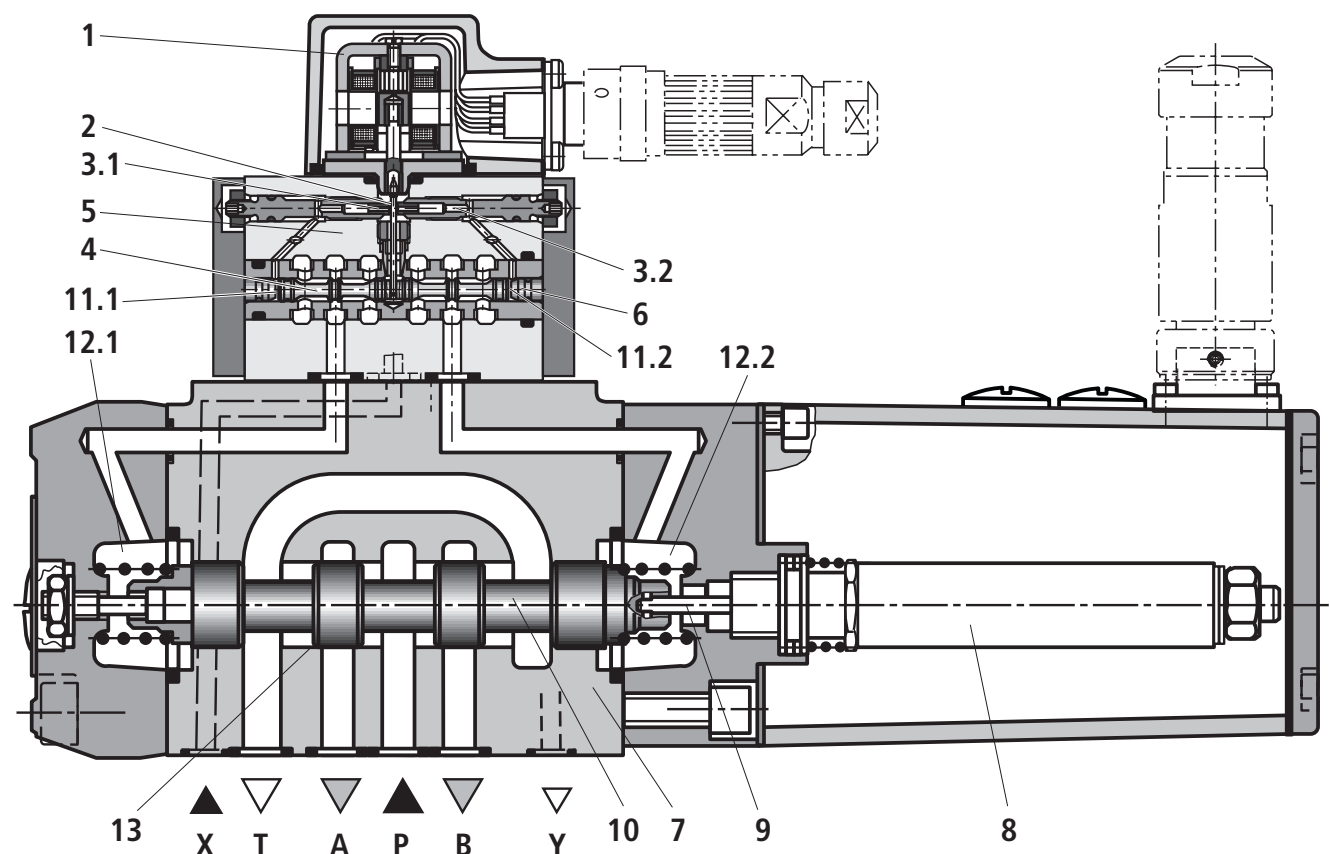
- The 2-stage pilot control valve, consisting of the control motor (1), a hydraulic amplifier (5) designed as nozzle flapper plate valve and the spool socket unit (6) as flow amplifier stage for actuating the 3rd stage (7),
- the 3rd stage (7) for flow control,
- an inductive position transducer (8)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

The position of the 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 actuation of the pilot control valve are carried out via external control electronics.

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 error. This signal deflects the flapper plate (2) between the two control nozzles (3.1, 3.2). This results in the creation of a pressure differential between the two control chambers (11.1, 11.2). The control spool (4) is displaced and releases a corresponding oil volume into the control chamber (12.1 or 12.2). The 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 spool (10) is held in the position specified by the command value.

The 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 spool (10) to the control edges, to which the flow is proportional. The valve dynamics are optimized by means of the electric gain.

Type 4WRD 10...XN



Technical data

general

Sizes		10	16	25	27	32	35
Installation position		Preferably horizontal					
Storage temperature range	°C	-20...+80					
Ambient temperature range	°C	-20...+60					
Weight	kg	6.8	8.9	15.2	15.5	35.2	71

hydraulic (measured with HLP 46, $\vartheta_{oil} = 40 \text{ °C} \pm 5 \text{ °C}$)

Max. operating pressure	Ports P, A, B	Pilot oil supply external ¹⁾	bar	up to 315	up to 350	up to 350	up to 210	up to 350	up to 350
	Port X		bar	250 (min. 25)			210 (min. 25)	250 (min. 25)	
	Ports P, A, B	Pilot oil supply internal	bar	250 (min. 25)			210 (min. 25)	250 (min. 25)	
Max. return flow pressure	Port T	Pilot oil return internal	bar	Pressure peaks < 100 permitted					
		Pilot oil return external	bar	up to 315	up to 250	up to 250	up to 210	up to 250	up to 250
	Port Y	Pilot oil return internal	bar	Pressure peaks < 100 permitted					
Rated flow $q_{\text{Vnom}} \pm 10 \text{ \%}$ with $\Delta p = 10 \text{ bar}^{2)}$			l/min	25	–	–	–	–	–
Δp = Valve pressure differential in bar				50	125	220	–	400	–
				100	200	350	500	600	1000
Flow of the main stage (max. admissible)			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				Mineral oil (HL, HLP) according to DIN 51524, Ignition temperature > 150 °C					
Hydraulic fluid temperature range			°C	-20 ... +80; preferably +40 ... +50					
Viscosity range			mm²/s	20...380					
Max. permissible degree of contamination of the hydraulic fluid									
Cleanliness class		Pilot control valve	Class 18/16/13 ³⁾						
according to ISO 4406 (c)		Main valve	Class 20/18/15 ³⁾						
Hysteresis (dither-optimized)			%	≤ 0.2					
Response sensitivity (dither-optimized)			%	≤ 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 (overall valve) in l/min with a V spool

³⁾ 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 service life of the components.

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

⁴⁾ related to the pressure-signal characteristic curve (V spool)

Technical data

electric

Voltage type	Direct voltage
Type of signal	analog
Rated current per coil	mA 30
Resistance per coil	Ω 85
Inductivity (measured with 60 Hz and I_{Rated})	H 0.25
Protection class of the valve according to EN 60529:1991+A1:2000	IP65 with mating connector correctly mounted and locked

Information on explosion protection

Range of application as per directive 94/9/EC	II 3 G
Type of protection according to EN 60079-0:2006 / EN 60079-15:2005	Ex nA II T5X without directional sandwich plate valve Ex nA II T3X with directional sandwich plate valve
Maximum surface temperature ¹⁾	°C 100 for version without directional sandwich plate valve (T5) 140 for version with directional sandwich plate valve (T3)
Ambient temperature range	°C -20 ... +60
Hydraulic fluid temperature range	°C -15 ... +80
Max. admissible operating voltage of the external control electronics	V 32 (DC)
Conditions for use in zone 2	The valve may only be used in explosive areas of device group II, category 3, with "low" risk of mechanical hazards according to the harmonized standards EN 60079-0:2006, section 26.4.2. If used in areas with a "high" risk of mechanical load according to these standards, the user must take measures with "low" risk of mechanical load.

¹⁾ Surface temperature > 50 °C, provide contact protection

External control electronics (separate order)

Amplifier in Eurocard format according to data sheet 30211	for size	Type	Material no.
	10	VT-SR11-1X/1/V002/4WRD10-5X	R901305504
	16	VT-SR11-1X/1/V002/4WRD16-5X	R901305503
	25/27	VT-SR11-1X/1/V002/4WRD25-5X	R901305502
	32	VT-SR11-1X/1/V002/4WRD32-5X	R901305501
	35	on request	

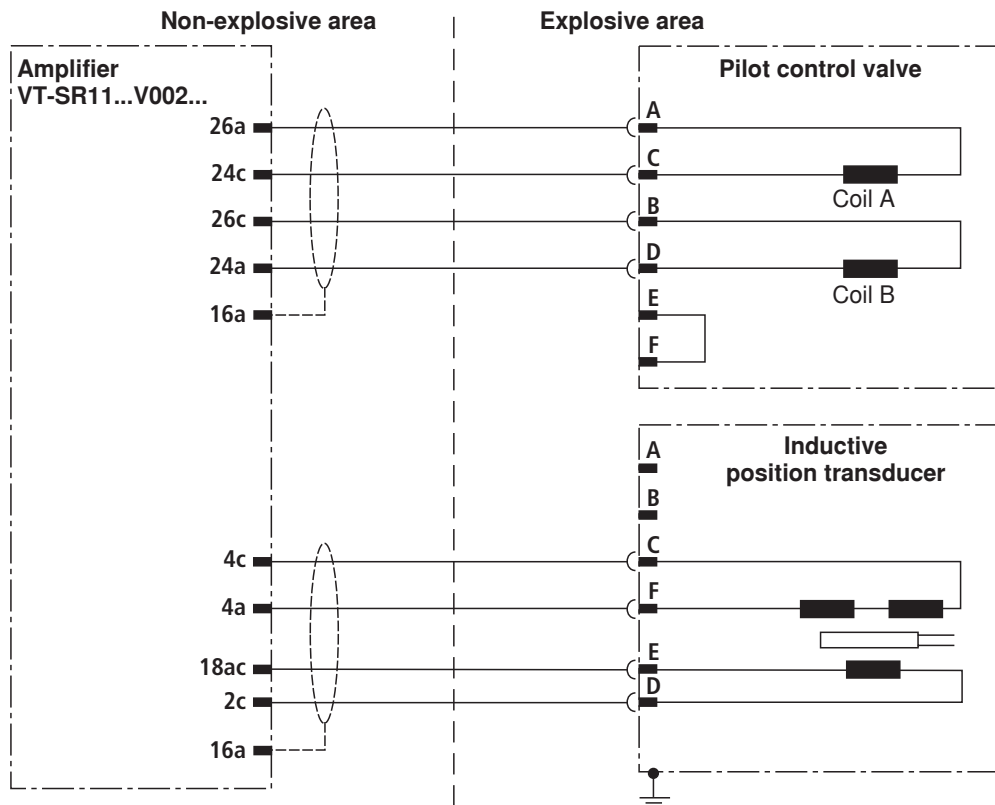
The coils of the valve may only be connected in parallel to the amplifier!

WARNING – Risk of explosion

– The external amplifier must be operated outside the explosive area!

Electrical connection

Pinout



Note:

With the VT-SR11...V002... amplifier card, the control logics differ from the standard:

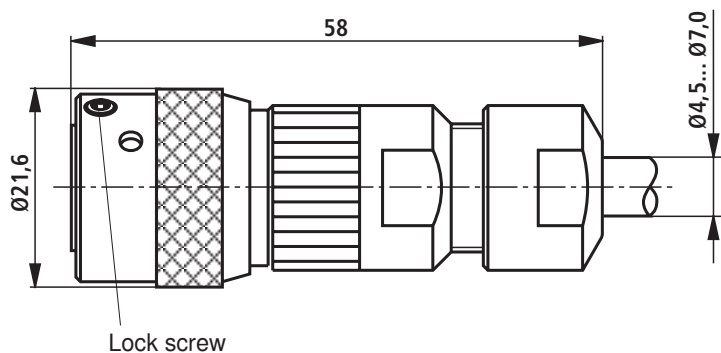
Positive command value results in flow from P → B and A → T.

Negative command value results in flow from P → A and B → T.

Mating connector for the pilot control valve

The pilot control valve may only be supplied through this mating connector.

Separate order, Material no. **R901043330**



Connection:

Contact sockets with connection cross-section for litz wires 0.4 ... 0.75 mm² are supplied unpacked.

The connection of the litz wires to the contact sockets is possible by crimping or soldering.

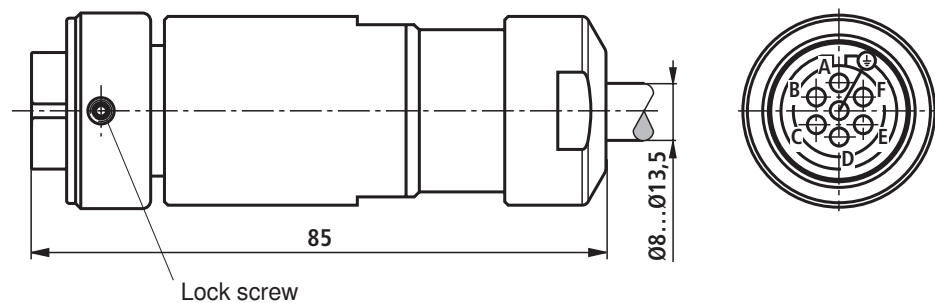
A list of the required tools for the crimping connection is available in the assembly instructions which are supplied with the mating connector.

Electrical connection

Mating connector for the inductive position transducer

The position transducer may only be supplied through this mating connector.

Separate order, Material no. **R901044595**



Mating connector according to EN 175201-804

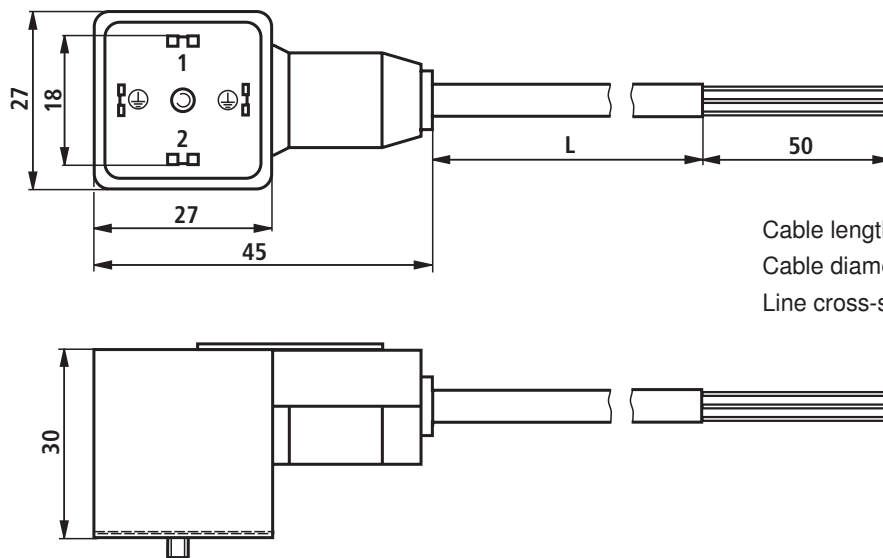
Metal version

Connection:
Contact sockets with soldered joint for litz wires 0.5...1.5 mm²

Mating connector for directional sandwich plate valve WG152

The directional sandwich plate valve may only be supplied through this mating connector.

Separate order, Material no. **R901269455**

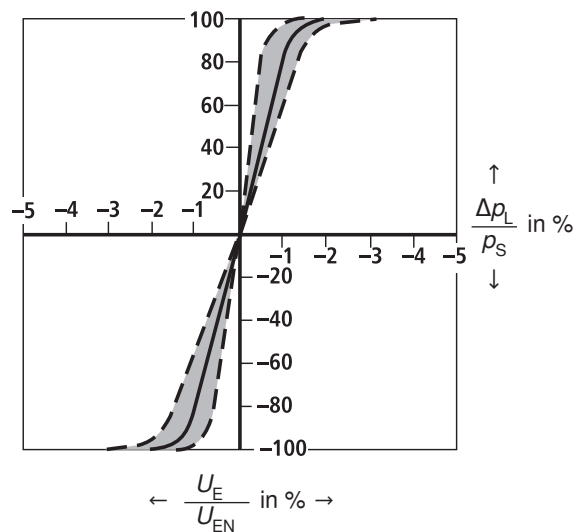


Cable length L: 10 m
Cable diameter: 5.9 mm
Line cross-section: 3 x 0.75 mm²

Characteristic curves (measured with $v = 32 \text{ mm}^2/\text{s}$ and $\vartheta = 40 \text{ °C}$)

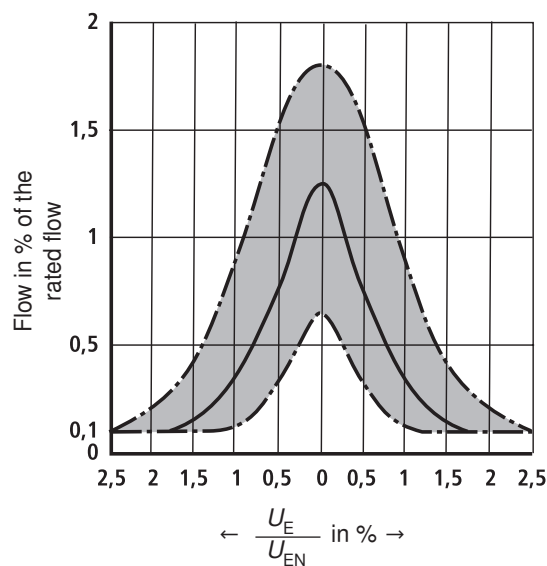
Pressure-signal characteristic curve (V spool)

measured with $p_S = 100 \text{ bar}$



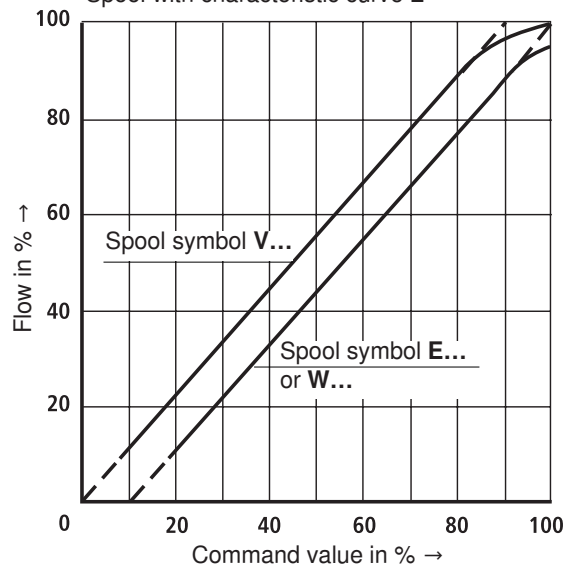
Zero flow of the main stage (V spool) without pilot control valve

measured with $p_S = 100 \text{ bar}$

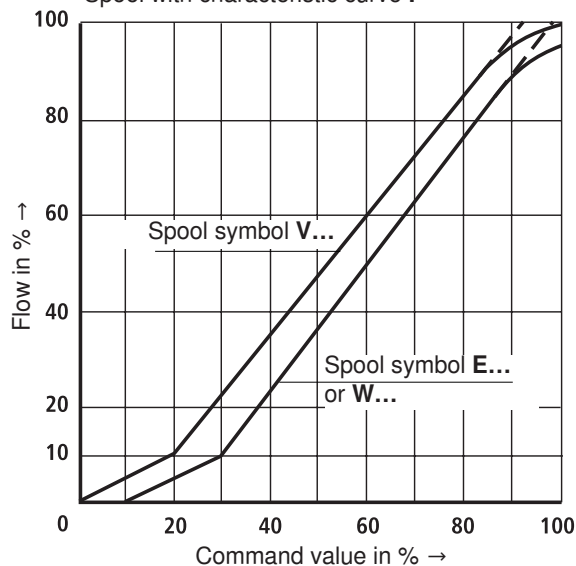


Flow command value functions (with 10 bar valve pressure differential or 5 bar per control edge)

Spool with characteristic curve L

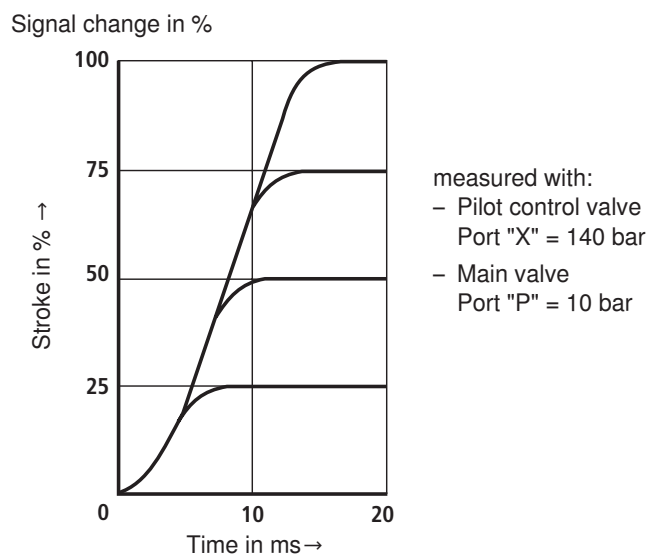


Spool with characteristic curve P

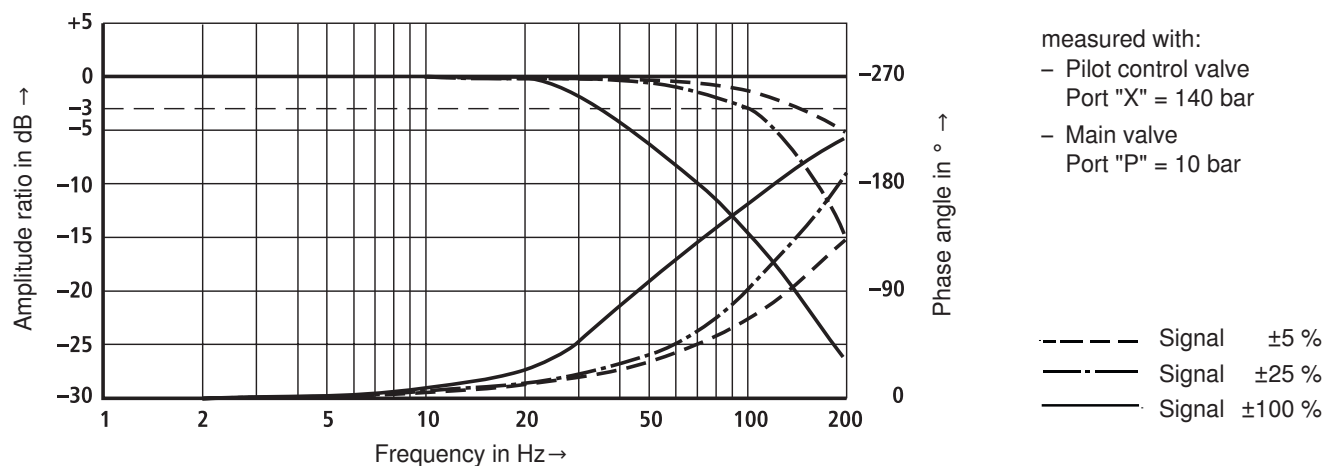


Characteristic curves size 10 (measured with HLP 46 with $40\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$)

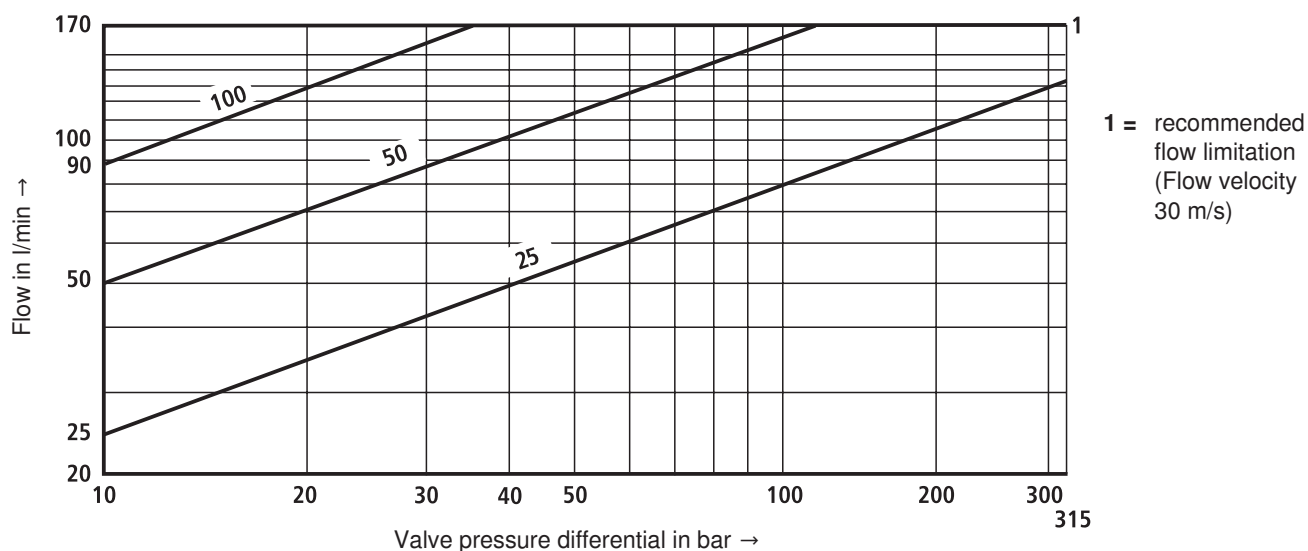
Transition function with stepped electric input signals



Frequency response characteristic curves



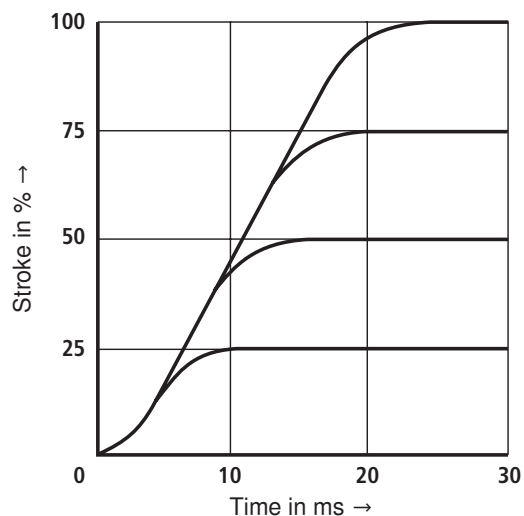
Flow load function with max. valve opening (tolerance $\pm 10\%$)



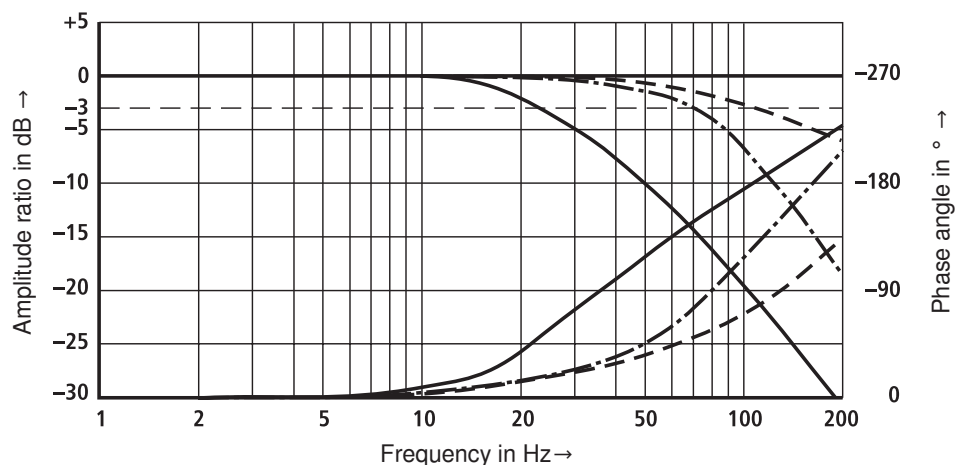
Characteristic curves size 16 (measured with HLP 46 with $40\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$)

Transition function with stepped electric input signals

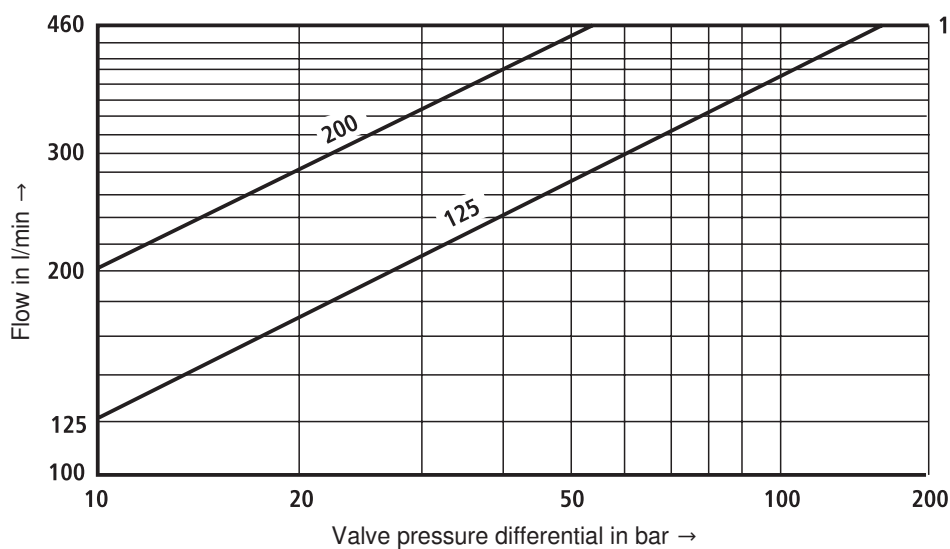
Signal change in %



Frequency response characteristic curves

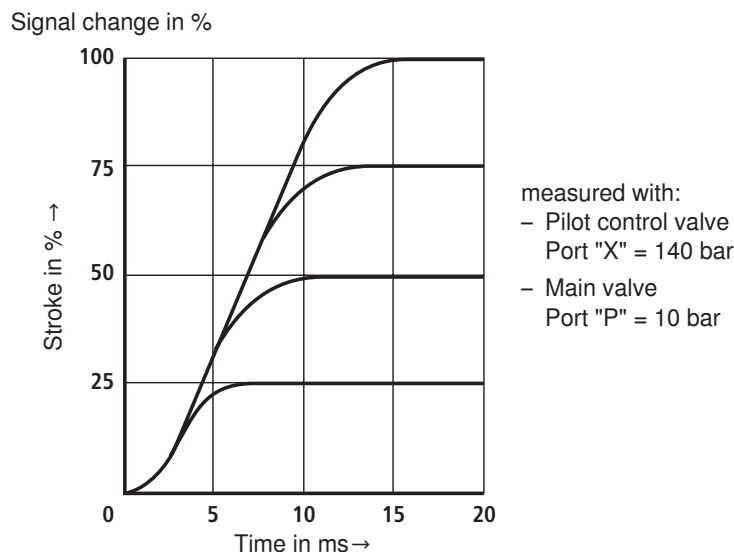


Flow load function with max. valve opening (tolerance $\pm 10\%$)

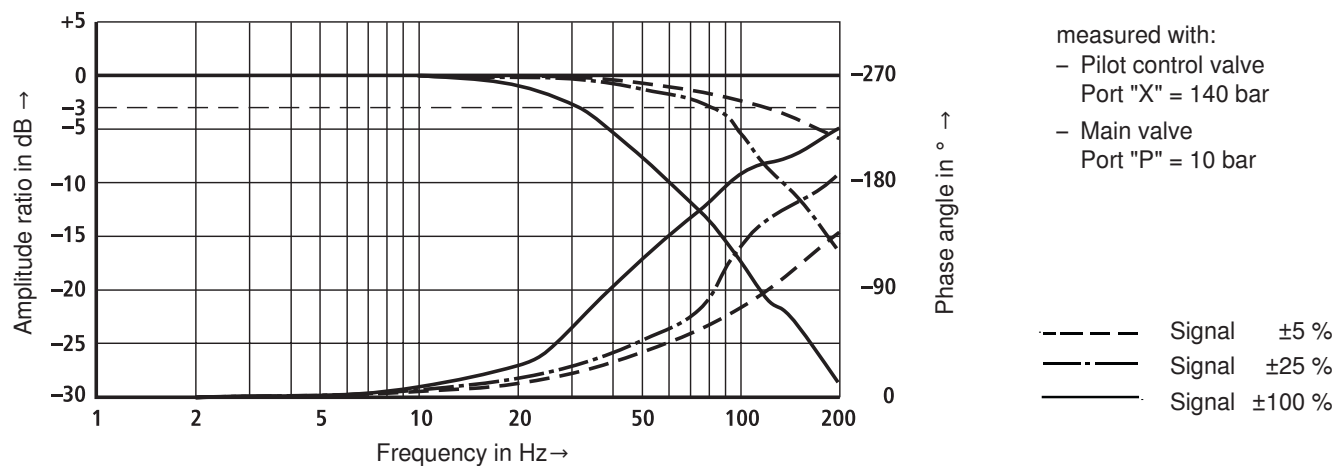


Characteristic curves size 25 and size 27 (measured with HLP 46 with $40\text{ °C} \pm 5\text{ °C}$)

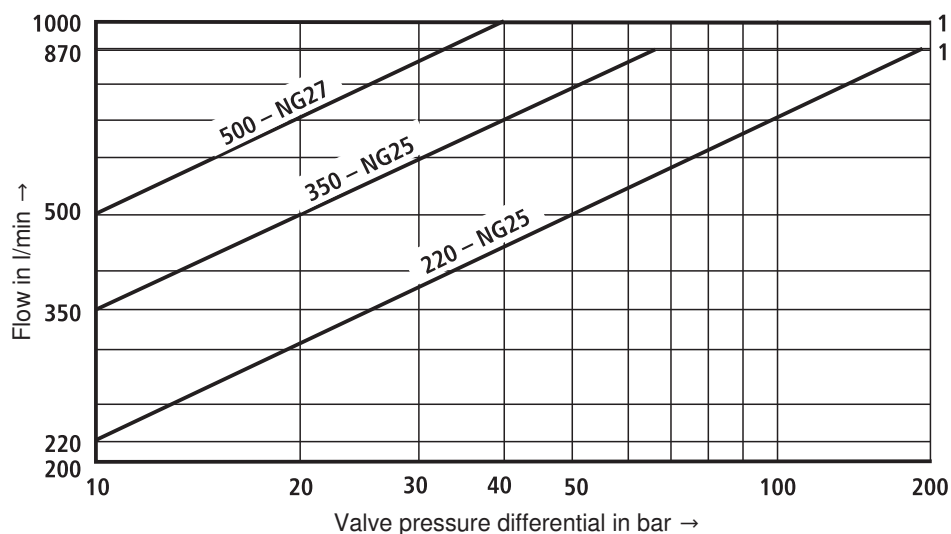
Transition function with stepped electric input signals



Frequency response characteristic curves



Flow load function with max. valve opening (tolerance $\pm 10\%$)

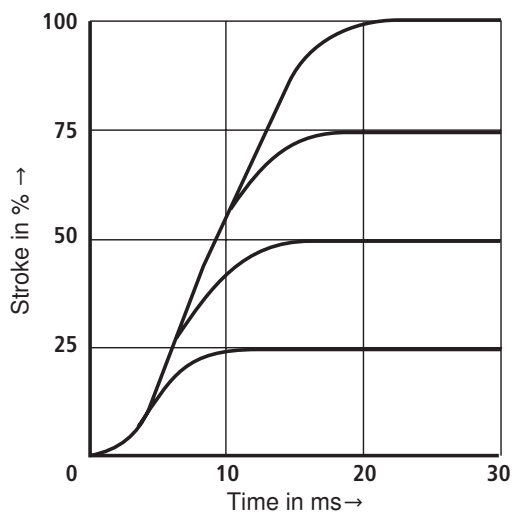


1 = recommended
flow limitation
(Flow velocity
30 m/s)

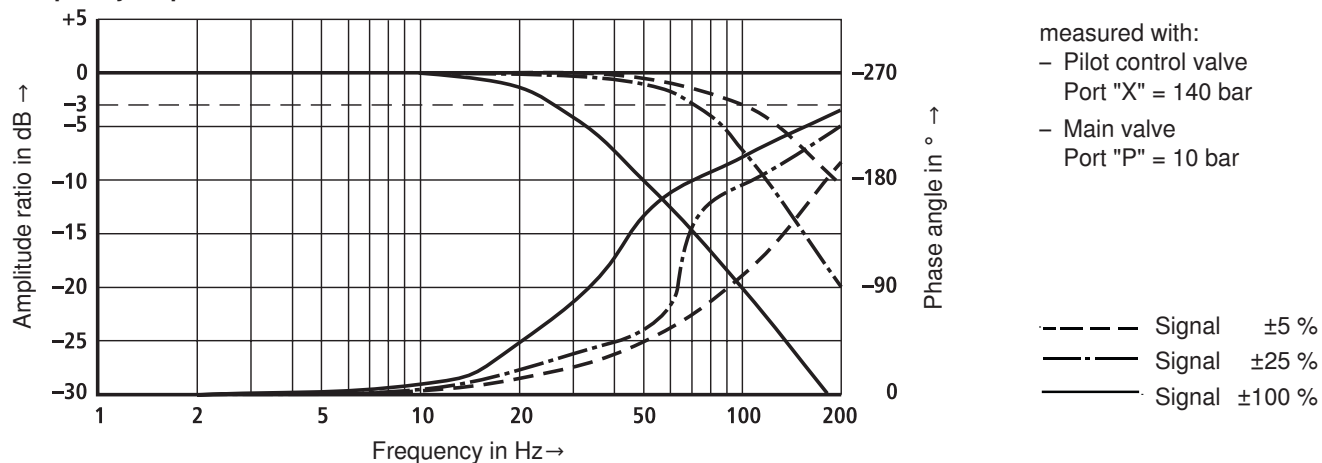
Characteristic curves size 32 (measured with HLP 46 with $40\text{ °C} \pm 5\text{ °C}$)

Transition function with stepped electric input signals

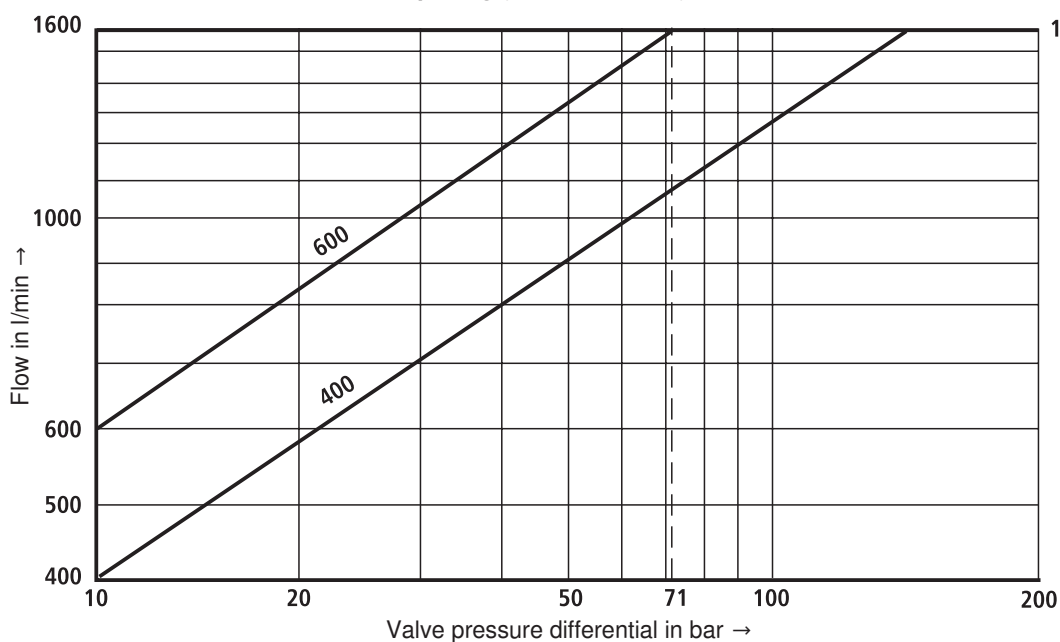
Signal change in %



Frequency response characteristic curves



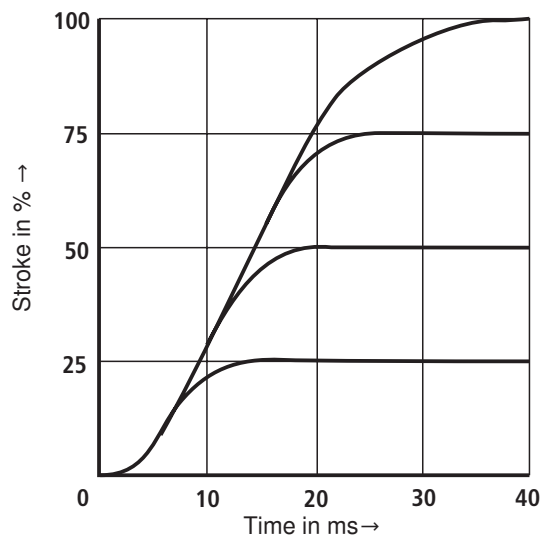
Flow load function with max. valve opening (tolerance $\pm 10\%$)



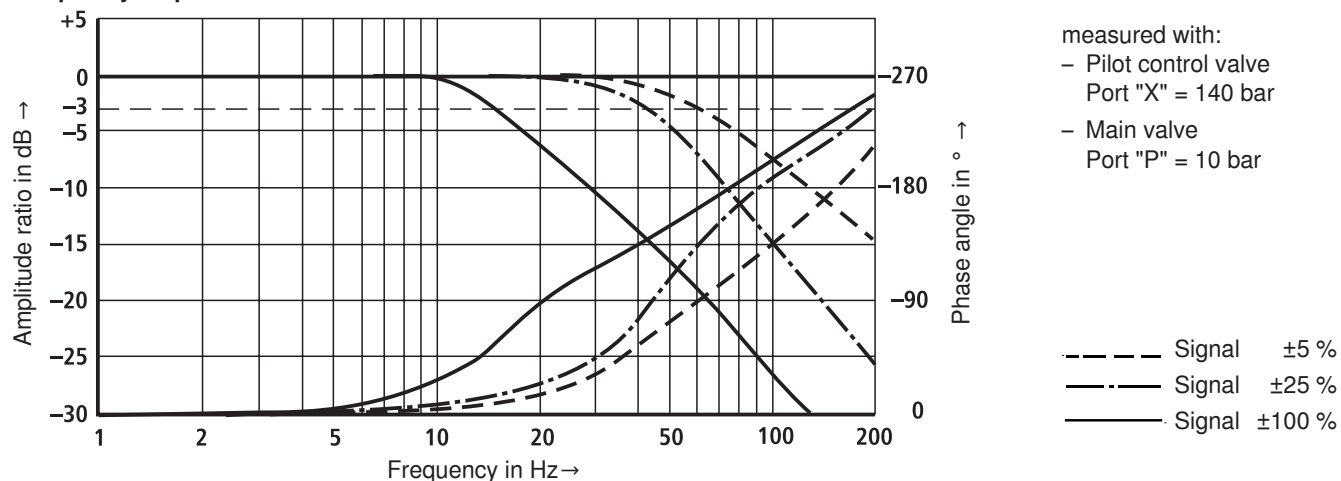
Characteristic curves size 35 (measured with HLP 46 with $40\text{ °C} \pm 5\text{ °C}$)

Transition function with stepped electric input signals

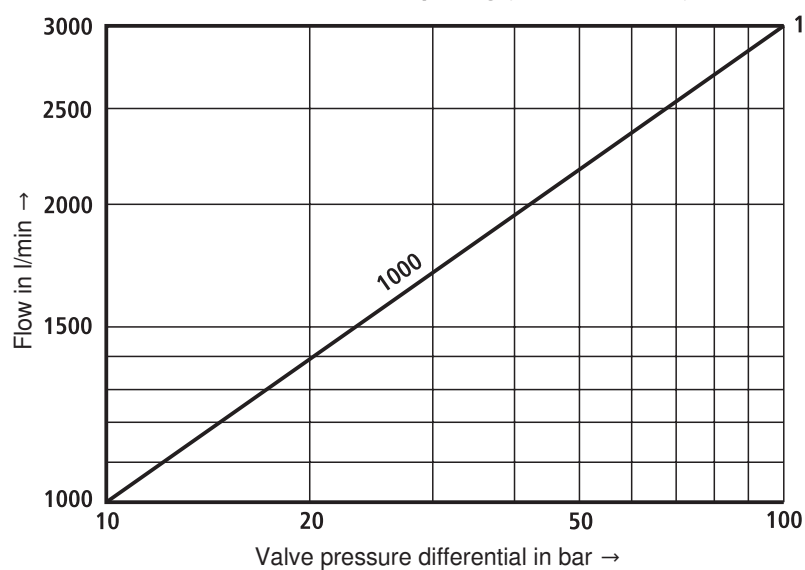
Signal change in %



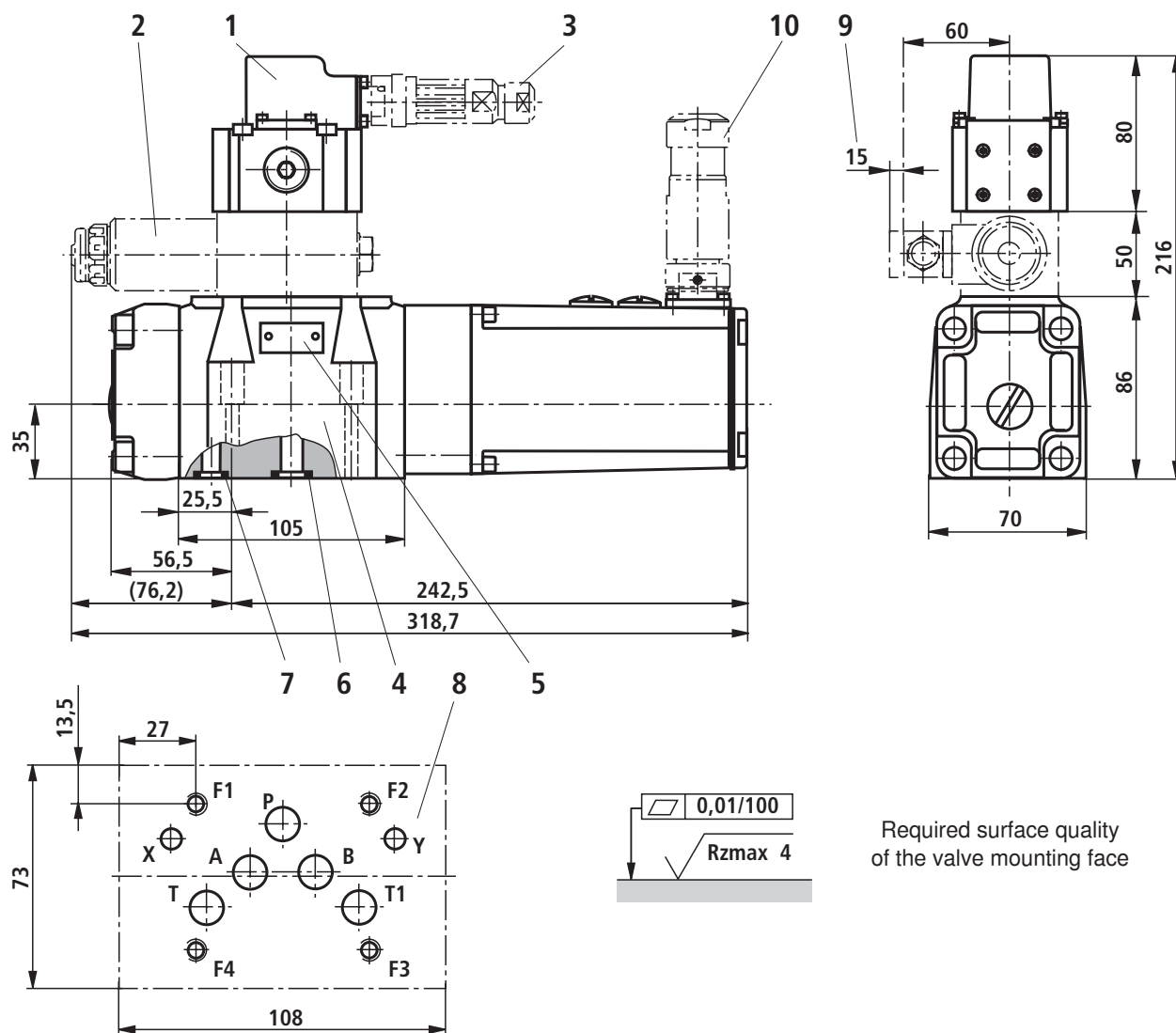
Frequency response characteristic curves



Flow load function with max. valve opening (tolerance $\pm 10\%$)



Unit dimensions size 10 (dimensions in mm)



Subplates with dimensions as in the data sheet 45054 and valve mounting screws must be ordered separately.

Subplates

without ports X, Y	G 534/01 FE/ZN (G3/4)
with ports X, Y	G 535/01 FE/ZN (G3/4)
	G 536/01 FE/ZN (G1)

Valve mounting screws

For reasons of stability, exclusively use the following valve mounting screws:

4 hexagon socket head cap screws

ISO 4762-M6x45-10.9-fIZn-240h-L,

(Friction coefficient 0.09 - 0.14

according to VDA 235-101),

Material no. R913000258

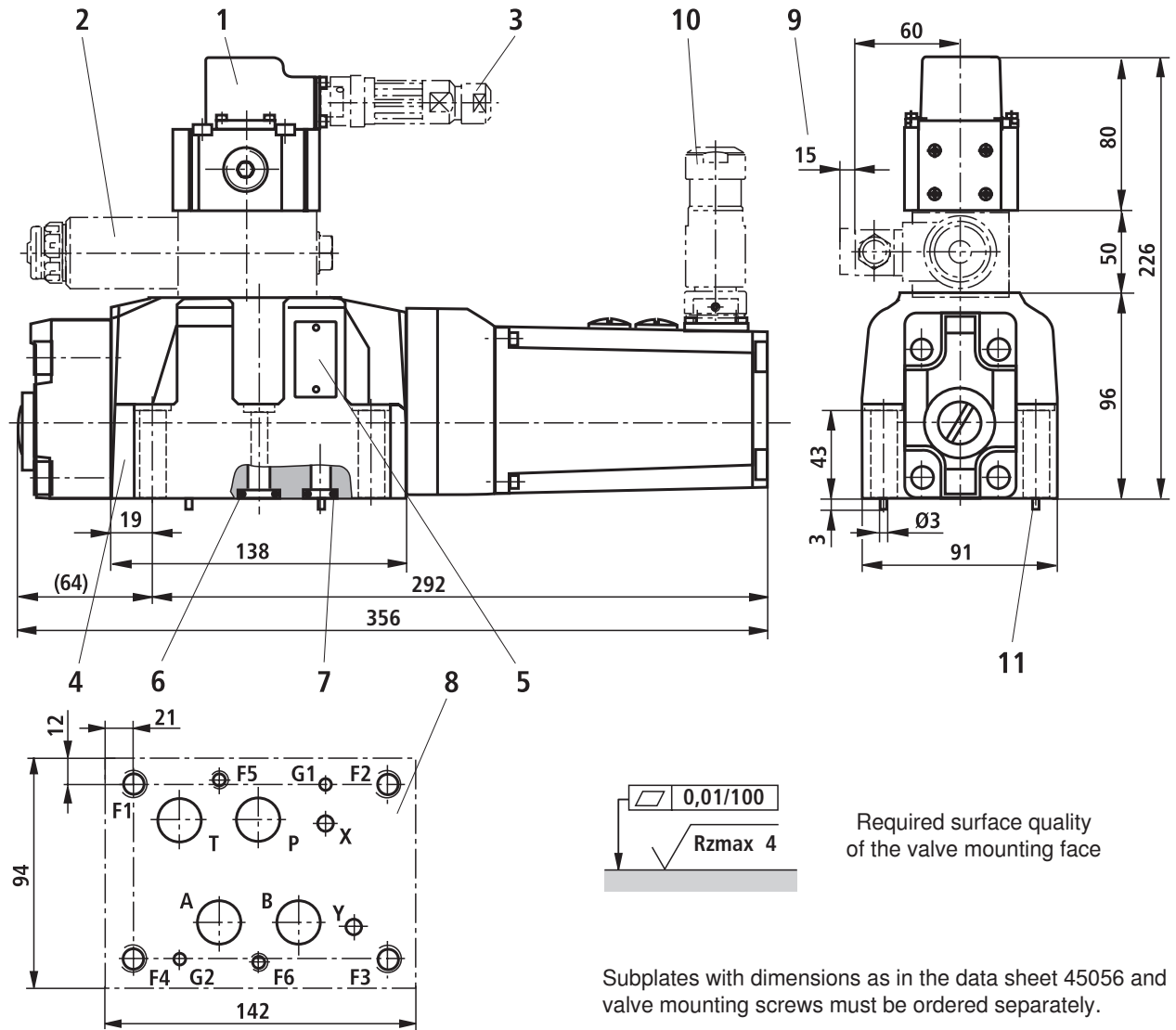
Important:

Subplates are no components in the sense of directive 94/9/EC and can be used after the manufacturer of the over-all system has assessed the risk of ignition.

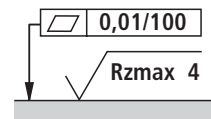
The G...FE/ZN versions are free from aluminum and/or magnesium and galvanized.

- 1 Pilot control valve
- 2 Directional sandwich plate valve
(only contained with version "...WG152")
- 3 Mating connector for pilot control valve, see page 8
- 4 Main valve
- 5 Name plate
- 6 Identical seal rings for ports P, A, B, T and T1
- 7 Identical seal rings for ports X and Y
- 8 Machined valve mounting face,
porting pattern according to ISO 4401-05-05-0-05
(ports X, Y as required)
deviating from the standard:
- ports P, A, B, T and T1 Ø 11 mm
- 9 Space required for removing the mating connector
- 10 Mating connector for inductive position transducer,
see page 9

Unit dimensions size 16 (dimensions in mm)



- 1 Pilot control valve
- 2 Directional sandwich plate valve
(only contained with version "...WG152")
- 3 Mating connector for pilot control valve, see page 8
- 4 Main valve
- 5 Name plate
- 6 Identical seal rings for ports P, A, B and T
- 7 Identical seal rings for ports X and Y
- 8 Machined valve mounting face,
porting pattern according to ISO 4401-07-07-0-05
(ports X, Y as required)
deviating from the standard:
- ports P, A, B and T $\varnothing 20$ mm
- 9 Space required for removing the mating connector
- 10 Mating connector for inductive position transducer,
see page 9
- 11 Locating pins (2x)



Required surface quality
of the valve mounting face

Subplates with dimensions as in the data sheet 45056 and valve mounting screws must be ordered separately.

Subplates

G 172/01 FE/ZN (G3/4) G 172/02 FE/ZN (M27 x 2)
G 174/01 FE/ZN (G1) G 174/02 FE/ZN (M33 x 2)

Valve mounting screws

For reasons of stability, exclusively use the following valve mounting screws:

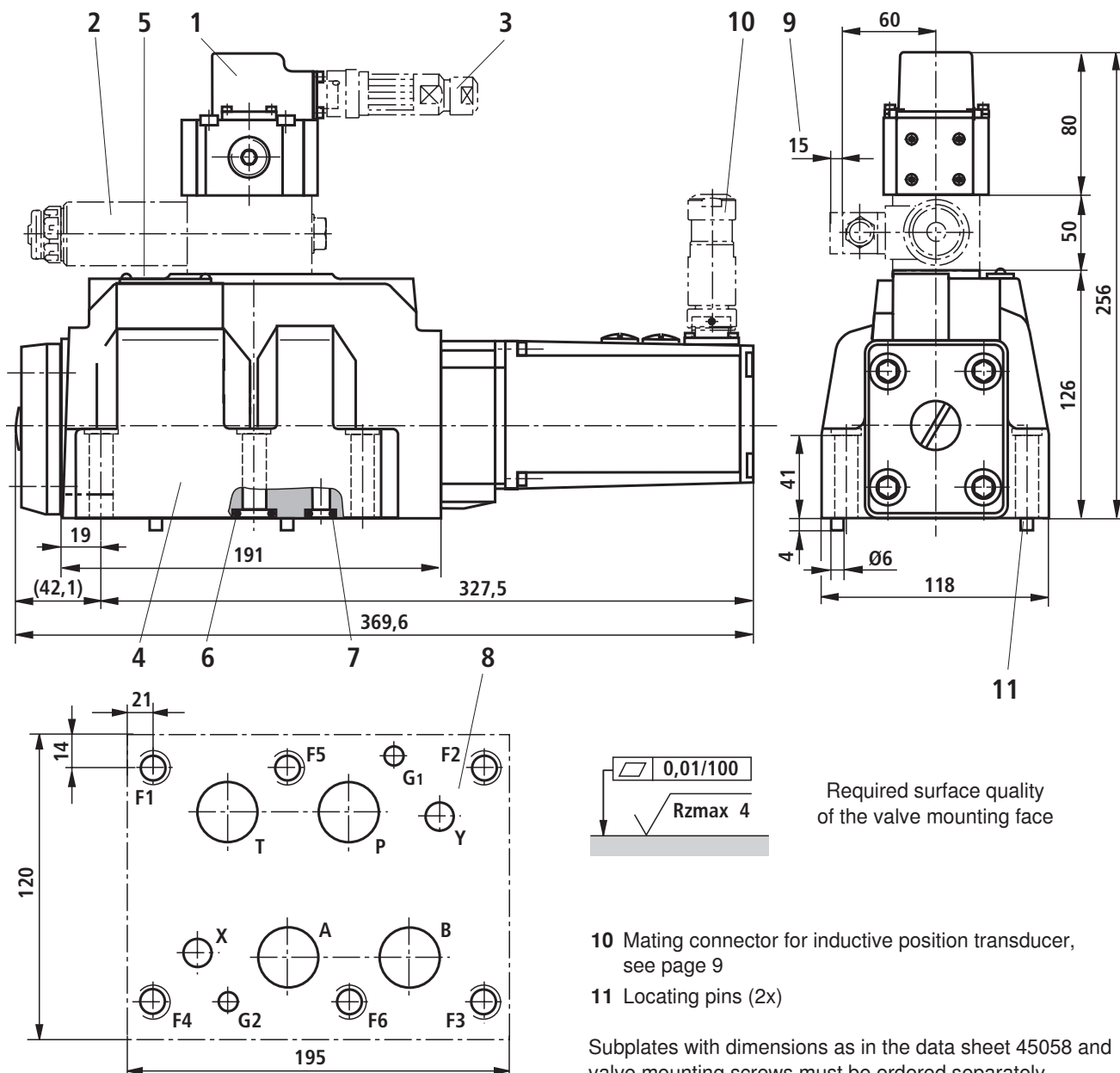
- 2 hexagon socket head cap screws
ISO 4762-M6x60-10.9-flZn-240h-L,
(Friction coefficient 0.09 - 0.14
according to VDA 235-101)
material no. **R913000115**
- 4 hexagon socket head cap screws
ISO 4762-M10x60-10.9-flZn-240h-L,
(Friction coefficient 0.09 - 0.14
according to VDA 235-101)
Material no. **R913000116**

Important:

Subplates are no components in the sense of directive 94/9/EC and can be used after the manufacturer of the over-all system has assessed the risk of ignition.

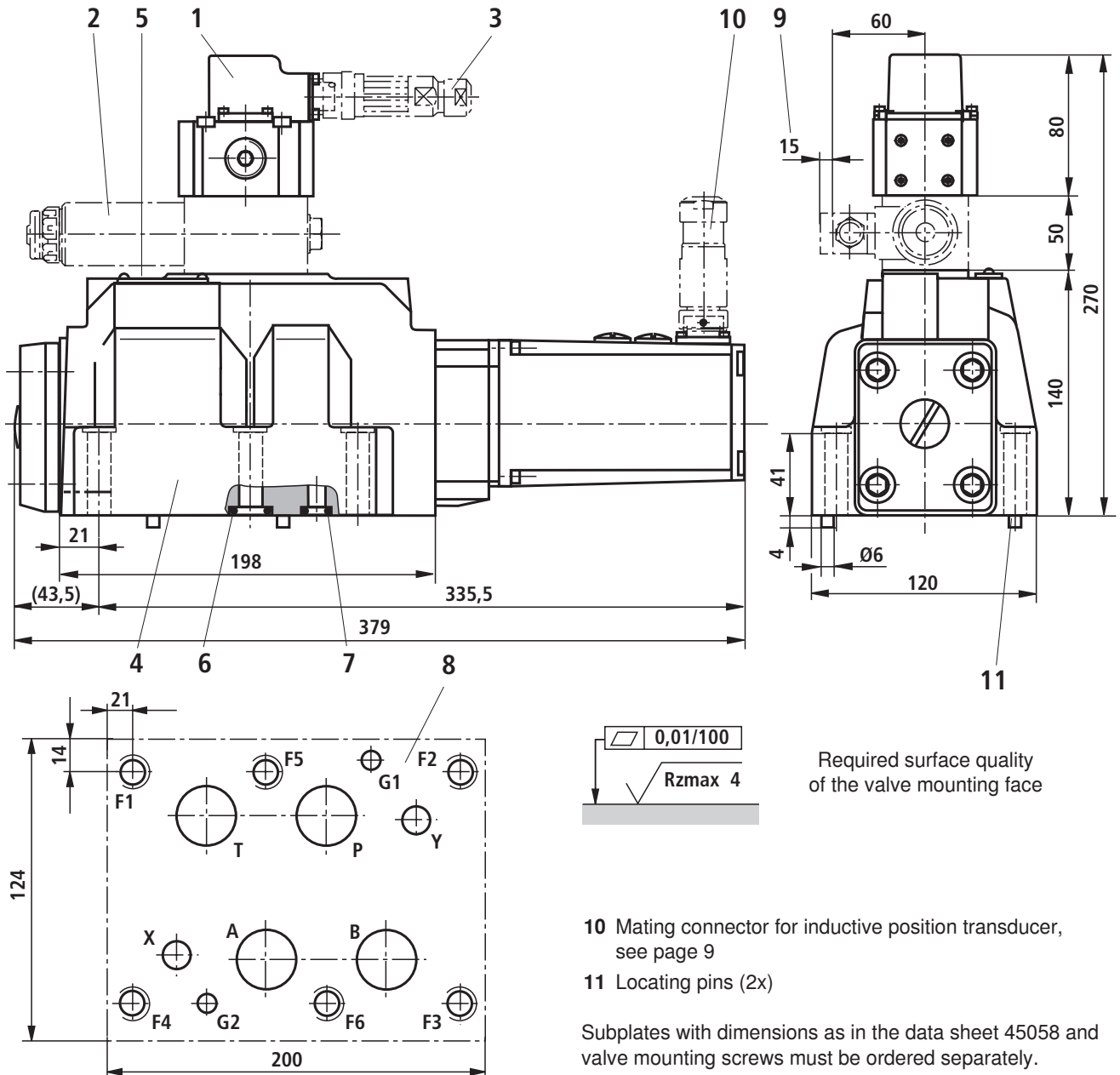
The G...FE/ZN versions are free from aluminum and/or magnesium and galvanized.

Unit dimensions size 25 (dimensions in mm)



- 1 Pilot control valve
- 2 Directional sandwich plate valve
(only contained with version "...WG152")
- 3 Mating connector for pilot control valve, see page 8
- 4 Main valve
- 5 Name plate
- 6 Identical seal rings for ports P, A, B and T
- 7 Identical seal rings for ports X and Y
- 8 Machined valve mounting face,
porting pattern according to ISO 4401-08-08-0-05
(ports X, Y as required)
deviating from the standard:
- ports A, B and T Ø 25 mm
- port P Ø 24 mm
- 9 Space required for removing the mating connector

Unit dimensions size 27 (dimensions in mm)



- 1 Pilot control valve
- 2 Directional sandwich plate valve
(only contained with version "...WG152")
- 3 Mating connector for pilot control valve, see page 8
- 4 Main valve
- 5 Name plate
- 6 Identical seal rings for ports P, A, B and T
- 7 Identical seal rings for ports X and Y
- 8 Machined valve mounting face,
porting pattern according to ISO 4401-08-08-0-05
(ports X, Y as required)
deviating from the standard:
- ports P, A, B and T Ø 32 mm
- 9 Space required for removing the mating connector

- 10 Mating connector for inductive position transducer,
see page 9
- 11 Locating pins (2x)

Subplates with dimensions as in the data sheet 45058 and valve mounting screws must be ordered separately.

Subplates

G 151/01 FE/Zn (G1) G 154/01 FE/Zn (G1 1/4)
G 154/08 FE/Zn (flange) G 156/01 FE/Zn (G1 1/2)

Valve mounting screws

For reasons of stability, exclusively use the following valve mounting screws:

6 hexagon socket head cap screws

ISO 4762-M12x60-10.9-fIZn-240h-L,

(Friction coefficient 0.09 - 0.14

according to VDA 235-101)

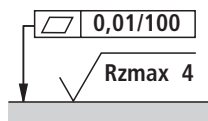
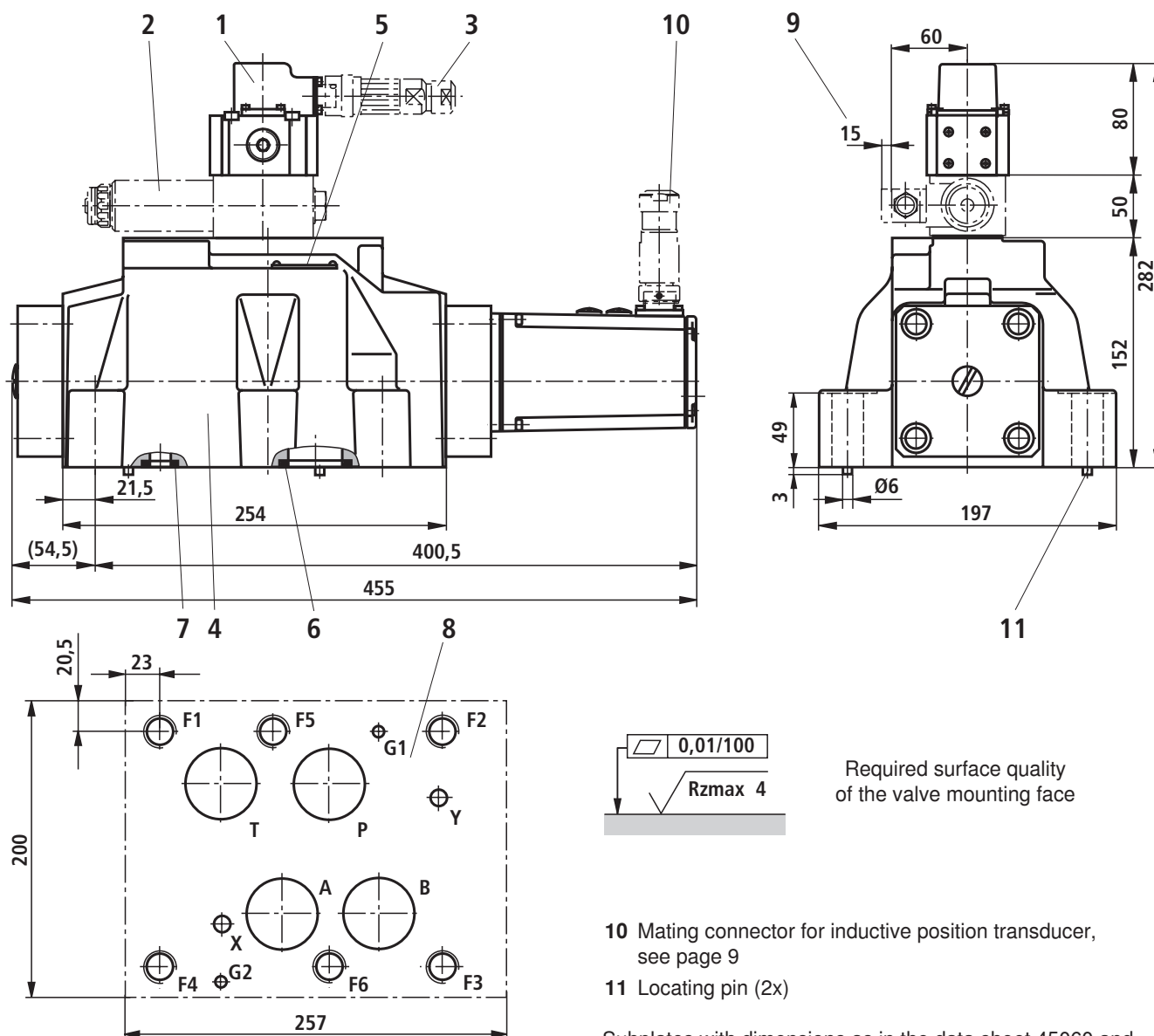
Material no. R913000121

Important:

Subplates are no components in the sense of directive 94/9/EC and can be used after the manufacturer of the over-all system has assessed the risk of ignition.

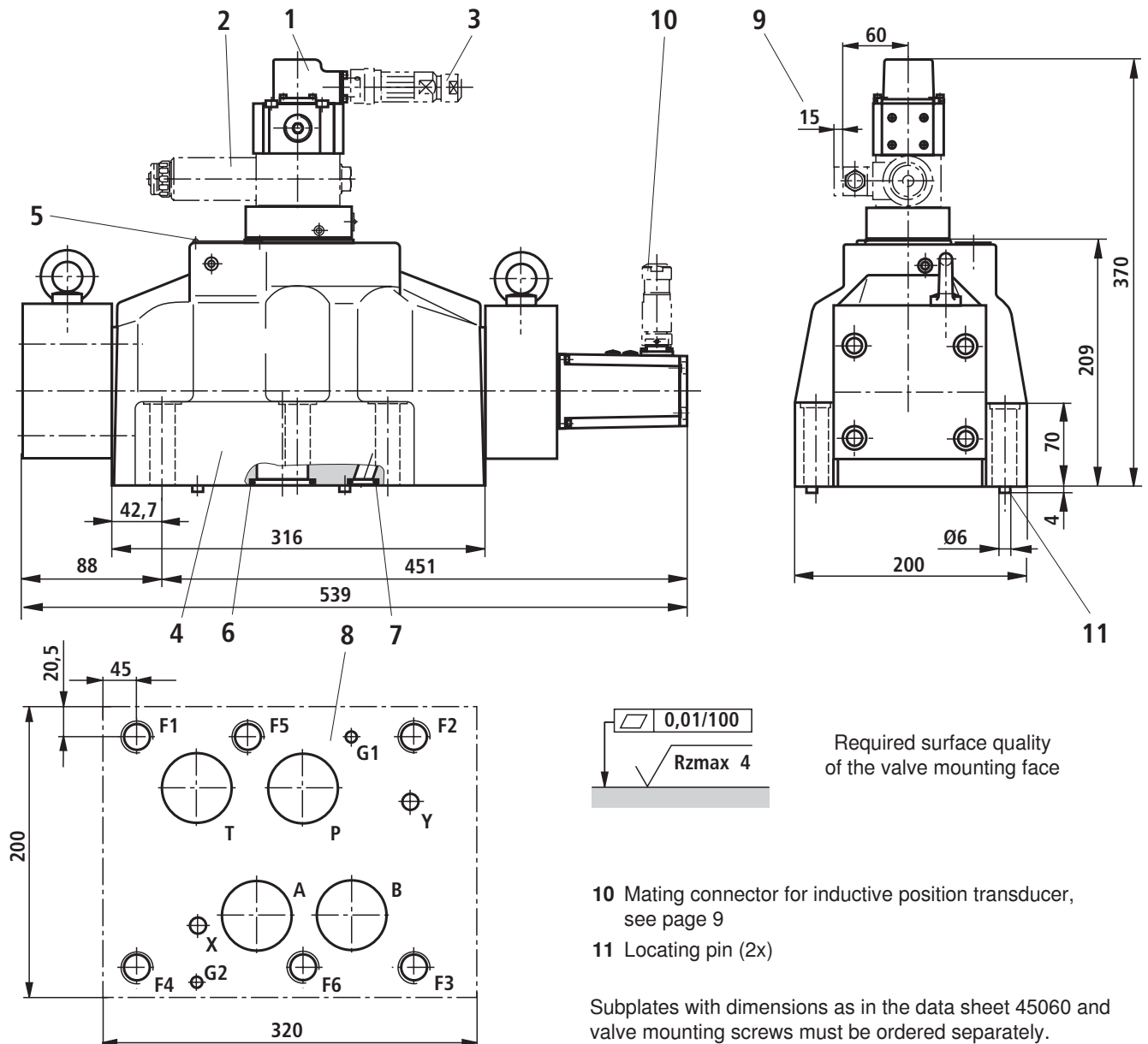
The G...FE/Zn versions are free from aluminum and/or magnesium and galvanized.

Unit dimensions size 32 (dimensions in mm)

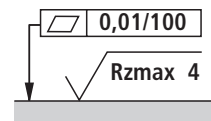


Required surface quality of the valve mounting face

Unit dimensions size 35 (dimensions in mm)



- 1 Pilot control valve
- 2 Directional sandwich plate valve
(only contained with version "...WG152")
- 3 Mating connector for pilot control valve, see page 8
- 4 Main valve
- 5 Name plate
- 6 Identical seal rings for ports P, A, B and T
- 7 Identical seal rings for ports X and Y
- 8 Machined valve mounting face,
porting pattern according to ISO 4401-10-09-0-05
(ports X, Y as required)
deviating from the standard:
- ports P, A, B and T Ø 50 mm
- 9 Space required for removing the mating connector



Required surface quality
of the valve mounting face

10 Mating connector for inductive position transducer,
see page 9

11 Locating pin (2x)

Subplates with dimensions as in the data sheet 45060 and
valve mounting screws must be ordered separately.

Subplates

G 157/01 FE/ZN (G1 1/2)
G 157/02 FE/ZN (M48 x 2)
G 158/10 FE/ZN (flange)

Valve mounting screws

**For reasons of stability, exclusively the following
valve mounting screws may be used:**

**6 hexagon socket head cap screws
ISO 4762-M20x100-10.9-fIZn-240h-L**

(Friction coefficient 0.09 - 0.14

according to VDA 235-101)

Material no. **R913000386**

Important:

Subplates are no components in the sense of directive
94/9/EC and can be used after the manufacturer of the over-
all system has assessed the risk of ignition.

The G...FE/ZN versions are free from aluminum and/or mag-
nesium and galvanized.

Notes

Notes

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Notes
