RE 29 070/02.03

Replaces: 12.98

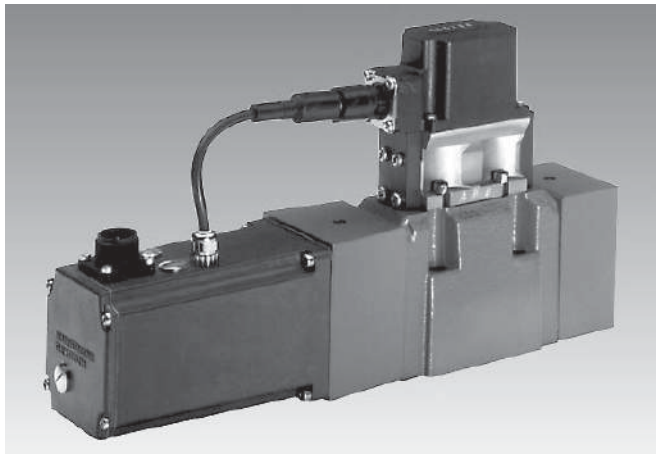
4/3-way fast response valve Type 4WRGE

Nom. size 10 – max. operating pressure 315 bar

Nom. sizes 16, 25 – max. operating pressure 350 bar

Series 1X

Maximum flow 870 L/min



H/A 5268/95

Type 4WRGE 10…L-1X/315G24..K31...

Overview of contents

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Unit dimensions	13 to 15
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Features

- Pilot operated 2-stage fast response valve with electrical closed loop position control of main spool and integrated open and closed loop control electronics
- Suitable for closed loop position, speed, pressure and force closed loop control, with simultaneous high demands on the dynamics in the small signal range and on the response sensitivity
- Pilot control valve:
  Single-stage servo valve to the orifice/flapper principle
- Position acquisition of main spool via an inductive position transducer
- High response sensitivity and low hysteresis
- Easily exchangeable filter element
- Integrated control electronics using SMD technology, output stage in thick layer hybrid technology, external zero point correction possible
- For subplate mounting:
  Porting pattern to DIN 24 340 form A
  Subplates to catalogue sheets RE 45 054 to 45 058 (separate order), see pages 13 to 15

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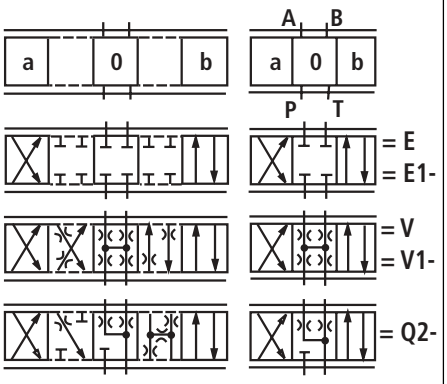
Ordering details

4WRGE				L	–	1X	/	315	G24		K31/			*

Electrically operated 2-stage fast response directional control valve of 4-way design with servo valve pilot control and integrated control electronics

Nominal size 10 **= 10**
Nominal size 16 **= 16**
Nominal size 25 **= 25**

Symbols



With symbol E1-, V1-:

P → A: q_V B → T: $q_V/2$

P → B: $q_V/2$ A → T: q_V

Note:

With the spools E and E1 there is an overlap of 15 % in the zero position, with the spools V and V1 an overlap from 0 to 0.5 %.

Further details in clear text

M = [1] NBR seals
V = FKM seals

No code = Without sandwich plate directional valve
WG152 = With sandwich plate directional valve 24 V with component plug DIN 43 650-AM2, **Without** plug-in connector Plug-in connector – separate order, see page 6

A1 = Command value input ± 10 VDC
C1 = Command value input ± 10 mA

Electrical connections

K31 = With component plug to E DIN 43 563-AM6-3, **Without** plug-in connector, Plug-in connector – separate order, see page 6

Pilot oil supply and drain

No code = Pilot oil supply, external, Pilot oil drain, external
E = Pilot oil supply, internal, Pilot oil drain, external
ET = Pilot oil supply, internal, Pilot oil drain, internal
T = Pilot oil supply, external, Pilot oil drain, internal

G24 = Supply voltage 24VDC

Pilot pressure

315 = 10 to 315 bar

1X = Series 10 to 19 (10 to 19: unchanged installation and connection dimensions)

Characteristic curve form

L = Linear

Nominal flow in L/min at 10 bar valve pressure differential

50 =	or	**100 =**	with nominal size 10
125 =	or	**200 =**	with nominal size 16
250 =	or	**350 =**	with nominal size 25

[1] Suitable for mineral oil to DIN 51 524

Preferred types

NS 10

Material no.	Type
00954120	4WRGE 10 V50L-1X/315G24ETK31/A1M
00954151	4WRGE 10 V50L-1X/315G24K31/A1M
00954152	4WRGE 10 V1-50L-1X/315G24K31/A1M
00916455	4WRGE 10 V1-50L-1X/315G24ETK31/A1M
00954153	4WRGE 10 V1-100L-1X/315G24K31/A1M

NS 16

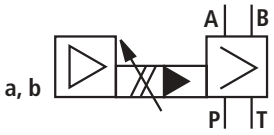
Material no.	Type
00954154	4WRGE 16 V125L-1X/315G24ETK31/A1M
00954155	4WRGE 16 V200L-1X/315G24ETK31/A1M
00954156	4WRGE 16 V200L-1X/315G24K31/A1M
00954157	4WRGE 16 V1-200L-1X/315G24ETK31/A1M
00954158	4WRGE 16 V1-200L-1X/315G24K31/A1M

NS 25

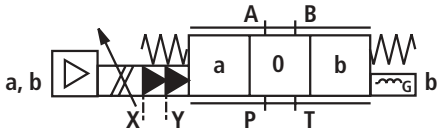
Material no.	Type
00954159	4WRGE 25 V250L-1X/315G24ETK31/A1M
00954160	4WRGE 25 V350L-1X/315G24ETK31/A1M
00954161	4WRGE 25 V350L-1X/315G24K31/A1M
00954162	4WRGE 25 V1-350L-1X/315G24ETK31/A1M
00954163	4WRGE 25 V1-350L-1X/315G24K31/A1M

Symbols

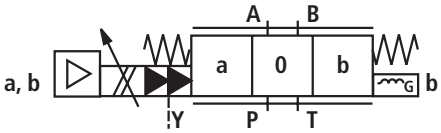
General



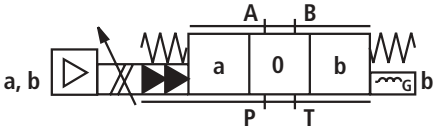
Type 4WRGE…-1X/…



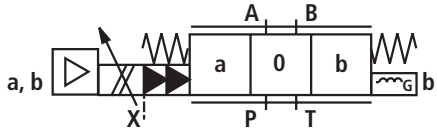
Type 4WRGE…-1X/…E…



Type 4WRGE…-1X/…ET…



Type 4WRGE…-1X/…T…



Function, section

The 4/3-way fast response valve is designed for subplate mounting with closed loop position control and integrated control electronics. It infinitely controls the flow proportional to the input signal from P to B and A to T or from P to A and B to T.

Design:

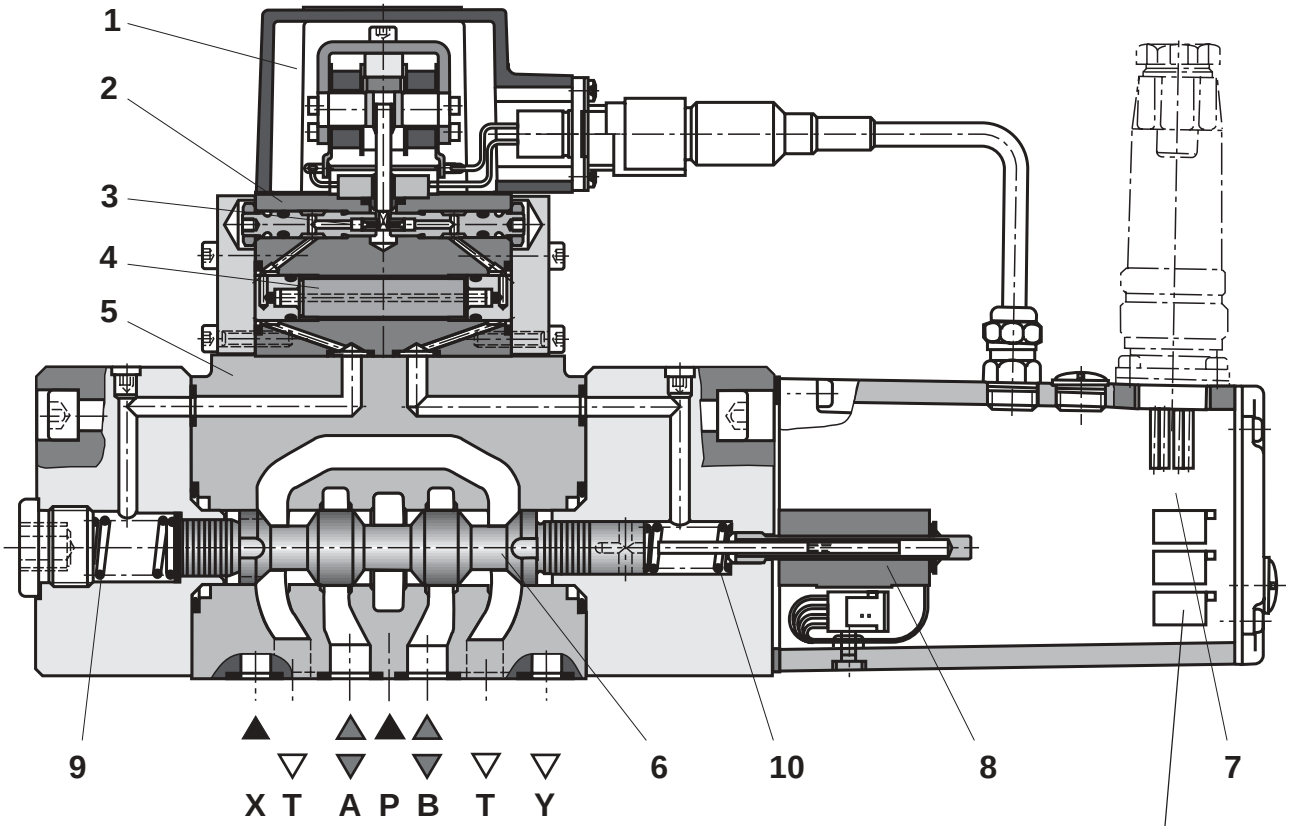
The valve consists of 4 main component groups:

– Low-friction pilot control valve (1) with a 2-gap torque motor; valve housing (2) with orifices (3) and filter (4)

– Housing of main stage (5) with spring centered spool (6)

– Control electronics (7) with amplifier for the control of the pilot control valve (1) and for closed loop position control of the main spool (6)

– Inductive position transducer (8) for position acquisition of the main spool



Type 4WRGE 10…-1X/…K31…

Functional description:

– Actuation of pilot control valve via a command value of 0 to ± 10 V or from 0 to ± 10 mA

– Comparison of the command/actual value in the control electronics → with control deviation the torque motor is operated and the flapper plate is deflected according to the control amplitude.

– Unbalancing of the pilot pressures via the variable and fixed orifices
→ movement of main spool (6)

– Reaching the position of the main spool according to the command value signal → control deviation is reduced to virtually 0 V → control process is completed

– Pilot oil supply to pilot control valve internally via port P or externally via port X. Pilot oil drain internally via port T or externally via Y to tank

⚠ Attention!

When the supply voltage fails but operating pressure remains available, the main spool (6) moves into an undefined position. The occuring accelerations may cause damage to the machinery.

By using a sandwich plate directional valve (see pages 12 to 14) both pilot lines in the main stage are short circuited when a power failure occurs.

With spool types E, E1 and Q2 the centering springs (9, 10) centre the main spool (6), V and V1 spools are moved into the preferred direction of P to B and A to T within a tolerance range of 1 % to 11 % of the spool stroke. When the operating pressure fails and sandwich plate directional valves are not used the same characteristics apply.

Technical data (for applications outside these parameters, please consult us!)

General				NS 10	NS 16	NS 25
Installation				optional, preferrably horizontal (commissioning guidelines see RE 07 700)		
Ambient temperature range			°C	– 20 to + 50		
Storage temperature range			°C	– 20 to + 80		
Weight			kg	8.0	9.8	18.0
Hydraulic (measured at p = 100 bar, ν = 32 mm²/s, ϑ = 40°C)						
Oper. pressure:	Pilot control valve, pilot oil supply		bar	10 to 315		
	Main valve, ports P, A, B		bar	up to 315	up to 350	up to 350
Return pressure:	Port T	Pilot oil drain, internal	bar	pressure peaks < 100 permissible		
		Pilot oil drain, external	bar	up to 315	up to 250	up to 250
	Port Y		bar	pressure peaks < 100 permissible		
Nominal flow $q_{V\,nom}$ ± 10 % at Δp = 10 bar [1)] [1)] Δp = valve pressure differential			L/min	50 100	125 200	250 350
Flow of main spool (max. permissible)			L/min	170	460	870
Stroke of main spool (2-stage)			mm	± 3.5	± 3.5	± 3.5
Pilot flow at ports X or Y with a jump form of input signal from 0 to 100 %			L/min	2.0	2.0	2.0
Pressure fluid				mineral oil (HL, HLP) to DIN 51 524 further pressure fluids on request!		
Filter rating of the pilot control valve				100 µm absolute		
Degree of contamination				max. permissible degree of contamination of the pressure fluid is to NAS 1638		A filter with a minimum retention rate of β_X = 75 is recommended
	Pilot control valve			class 7		x = 5
	Main valve			class 9		x = 15
Pressure fluid temperature range			°C	– 20 to 80; preferrably 40 to 50		
Viscosity range			mm²/s	20 to 380; preferrably 30 to 45		
Hysteresis			%	≤ 0.05		
Response sensitivity			%	≤ 0.02		
Reversal span			%	≤ 0.04		

Electrical

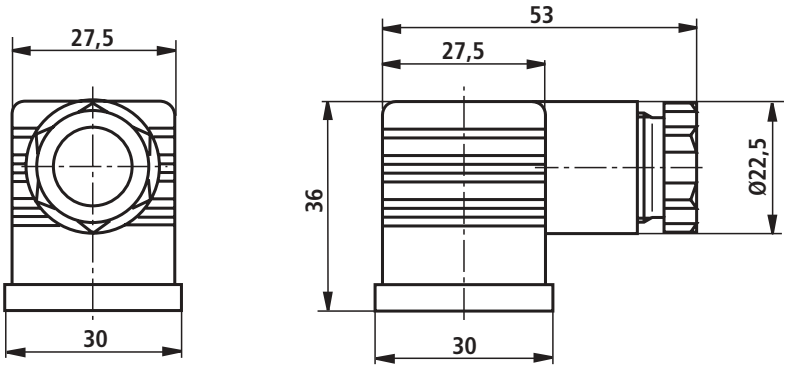
Voltage type			DC		
Signal type			analogue		
Zero balance			≤ 2		
Zero deflection with alteration of:					
	Pressure fluid temperature	%/10 K	< 0.2	< 0.2	< 0.3
	Operating pressure	%/100 bar	< 0.02	< 0.04	< 0.04
	Return pressure 0 to 10 % from p	%	< 0.01	< 0.02	< 0.02
Valve protection to DIN 40 050			IP 65		
Control electronics			VT 13037 (integrated in valve, see page 7)		

Note: For details regarding the **environmental simualtion test** covering EMC (electro-magnetic compatibility), climate and mechanical loading see RE 29 070-U (declaration regarding environmental compatibility).

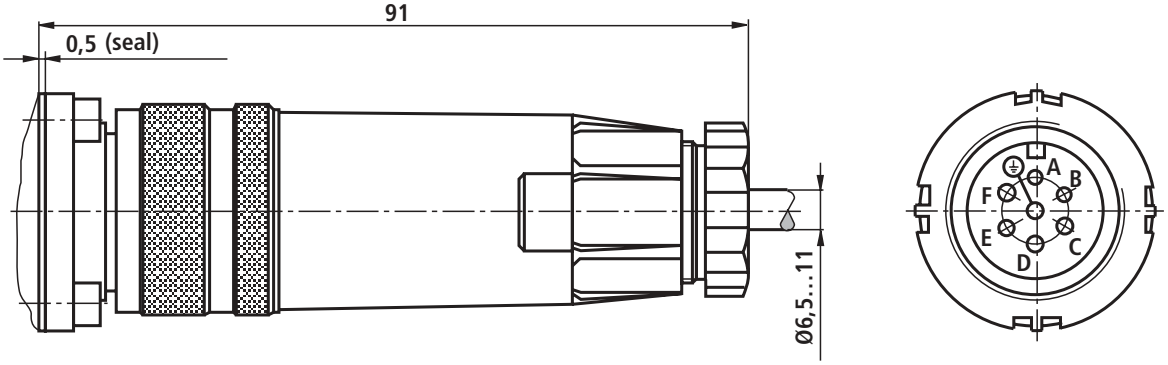
Electrical connections

Sandwich plate directional valve WG 152

Plug-in connector to DIN 43 650 -AF2/Pg11
Separate order under material no. **00074684**
(plastic version)

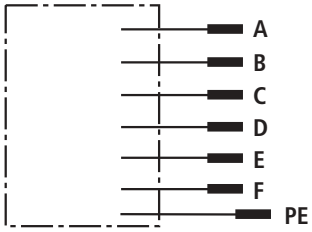


Plug-in connector to E DIN 43 563-BF6-3/Pg11
Separate order under material no. **00021267**
(plastic version)
For pin allocation see block circuit diagram on page 7



Integrated control electronics

Pin allocation, component plug



Integrated control electronics (see below)

	Pin	Signal [1]
Supply voltage	A B	24 VDC (19 to 35 VDC) GND
	C	n.c.
Differential amplifier input	D E	com. value (± 10 V or ± 10 mA) ref. potential [2]
Measurement output	F	act. value (± 10 V or ± 10 mA) against 0 V [3]
Earth	PE	connected to valve housing

[1] Supply voltage + 24 VDC ± 25 %; full bridge rectification with smoothing capacitor 2200 µF; I_{max} = 230 mA

[2] Current input ± 10 mA → input resistance 100 Ω

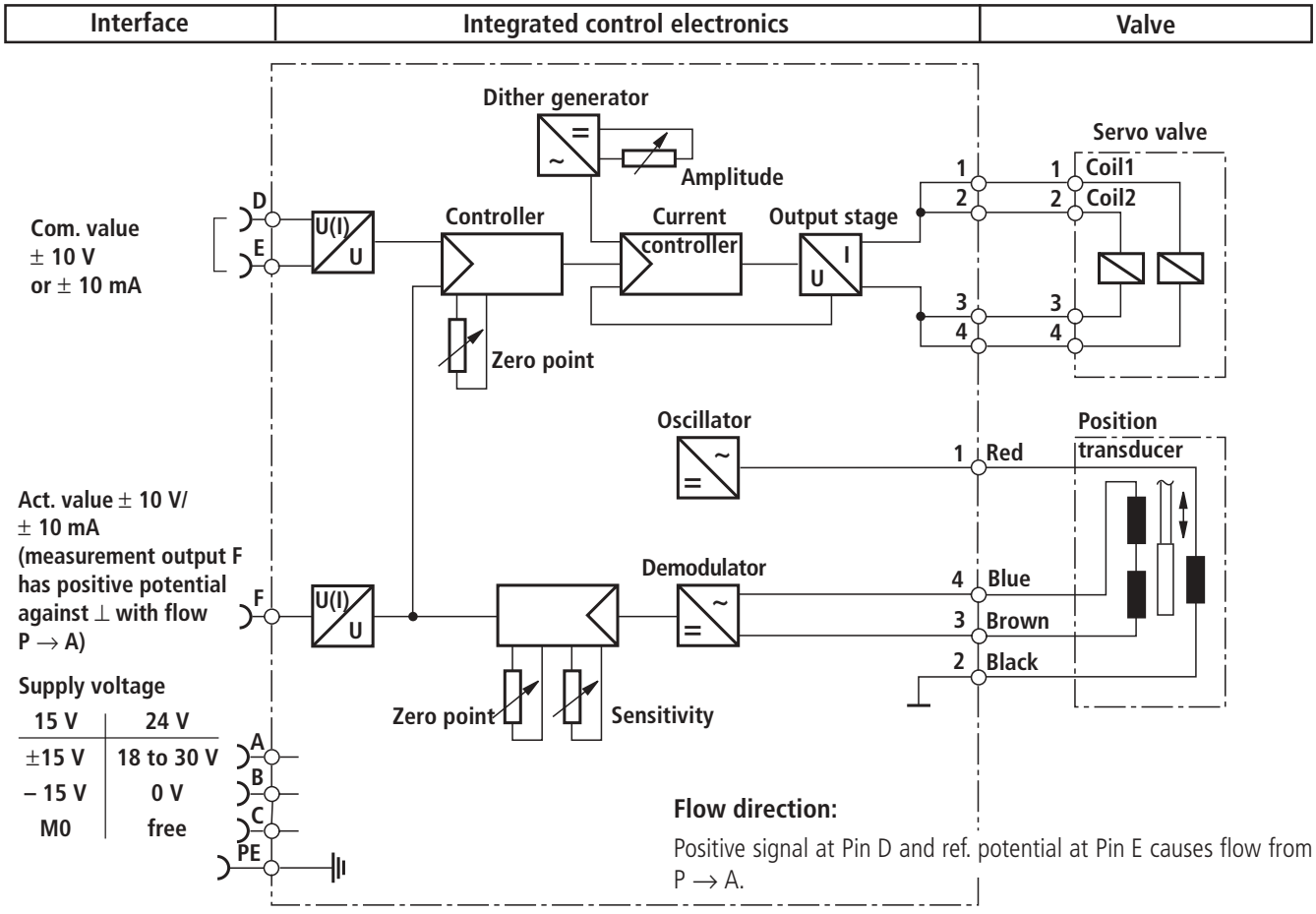
[3] ± 10 mA → max. load resistance 1 kΩ

Command value: Reference potential at E and positive command value at D causes flow from P to A and B to T.
Reference potential at E and negative command value at D causes flow from P to B and A to T.

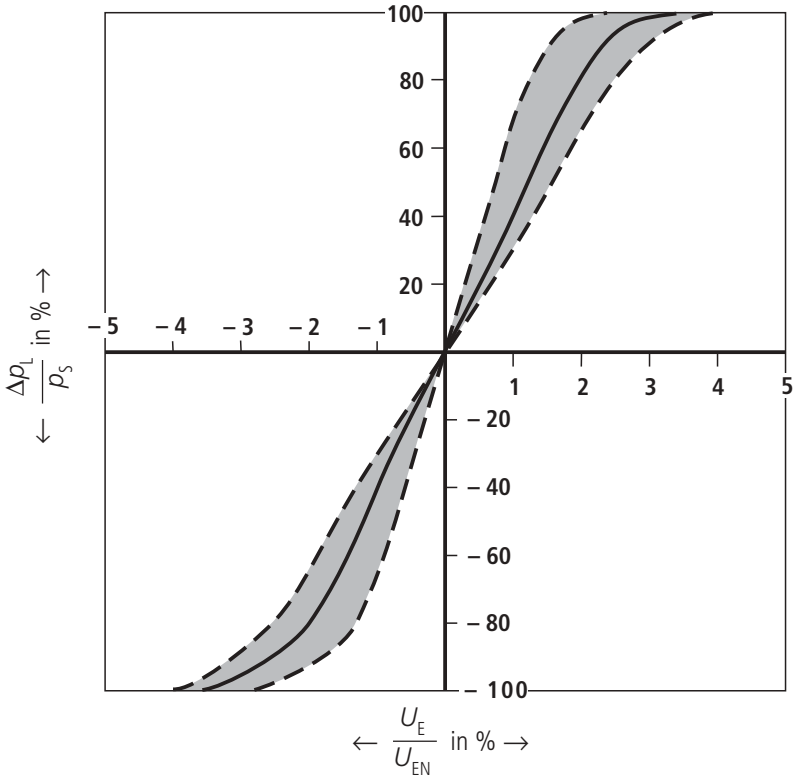
Connection cable: Recommeded: – up to 25 m cable length type LiYCY 5 x 0.75 mm²
– up to 50 m cable length type LiYCY 5 x 1.0 mm²
External diameter 6.5 to 11 mm
Connect screen to PE on supply side only.

Note: Electrical signals (e.g. actual value) which are transmitted by the valve electronics must not be used to switch off safety related machinery functions! (Please note the „Safety requirements for fluid power operated machinery and parts – hydraulics" according to European standard EN 982!)

Block circuit diagram / Terminal allocation of the integrated control electronics type VT13037

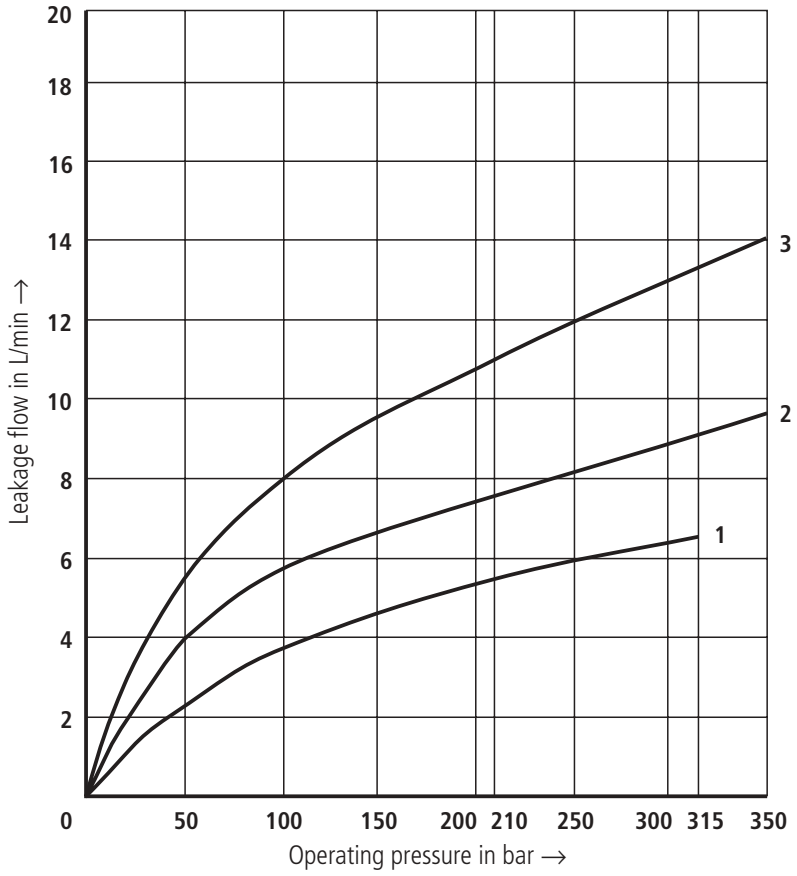


Pressure-signal-characteristic curve (V spool)



Characteristic curve measured with a pilot control pressure $p_s = 210$ bar

Leakage flow 4WRGE…V with pilot control valve in centre position of main spool

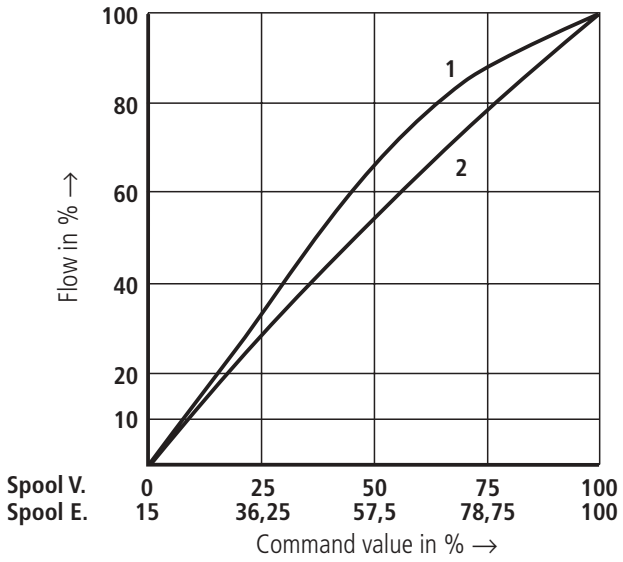


1 = Nominal size 10 (100 L/min)
2 = Nominal size 16 (200 L/min)
3 = Nominal size 25 (350 L/min)

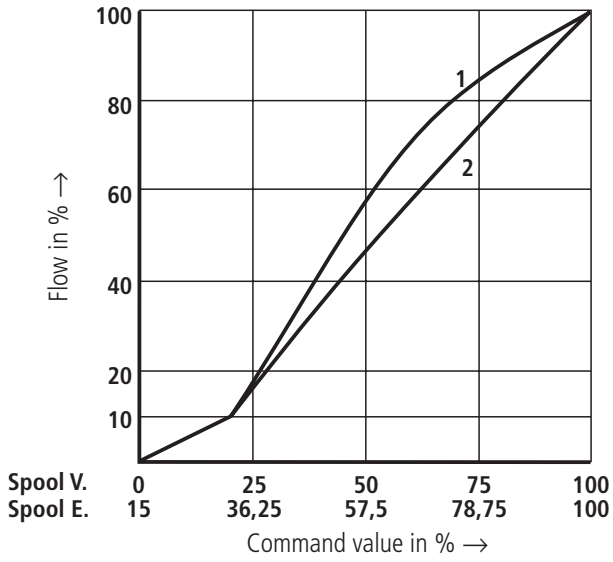
Characteristic curves (measured at Δp = 10 bar or 5 bar per control land)

Spool symbols E. and V.

Spool with characteristic curve **L**



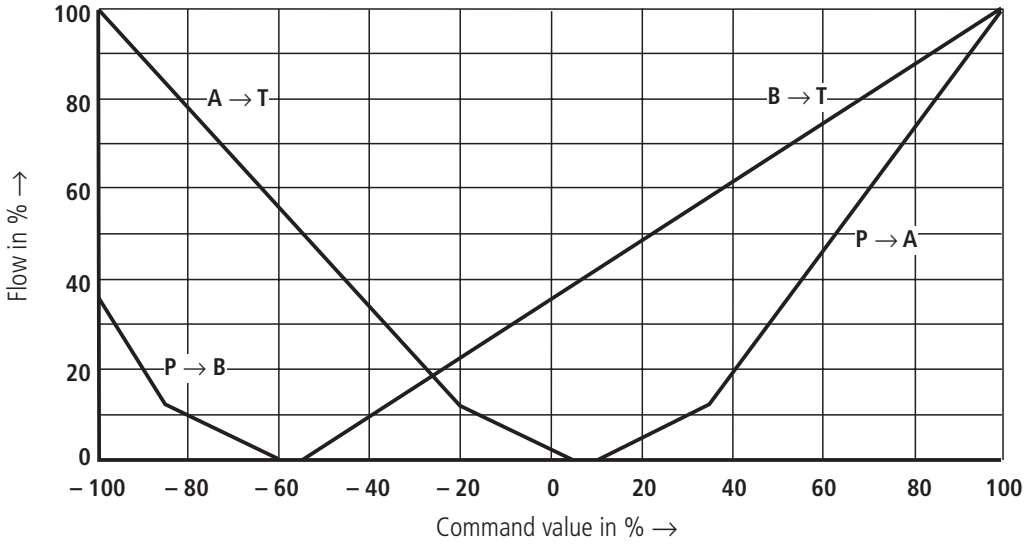
Spool with characteristic curve **P**



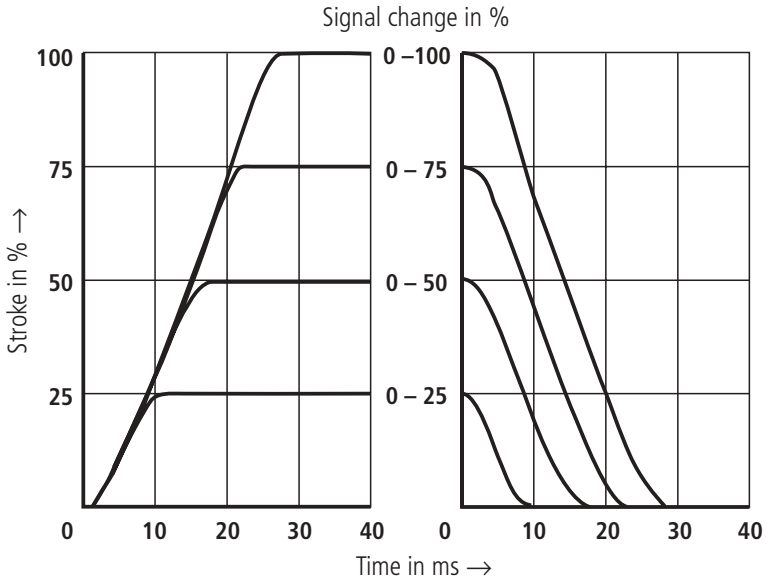
1 = Larger nominal flow

2 = Smaller nominal flow

Spool symbol Q2-

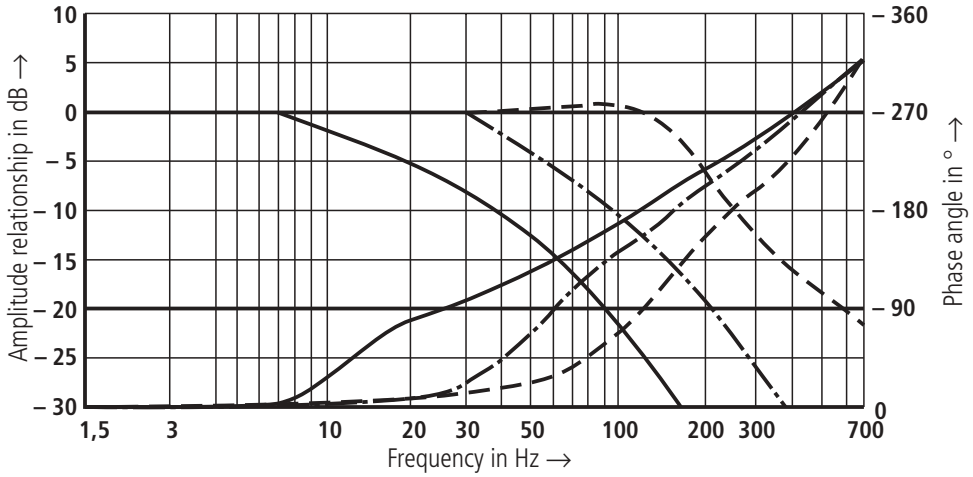


Transient function with a jump form of electrical input signal



Characteristic curve measured with a pilot control pressure $p_s = 210$ bar

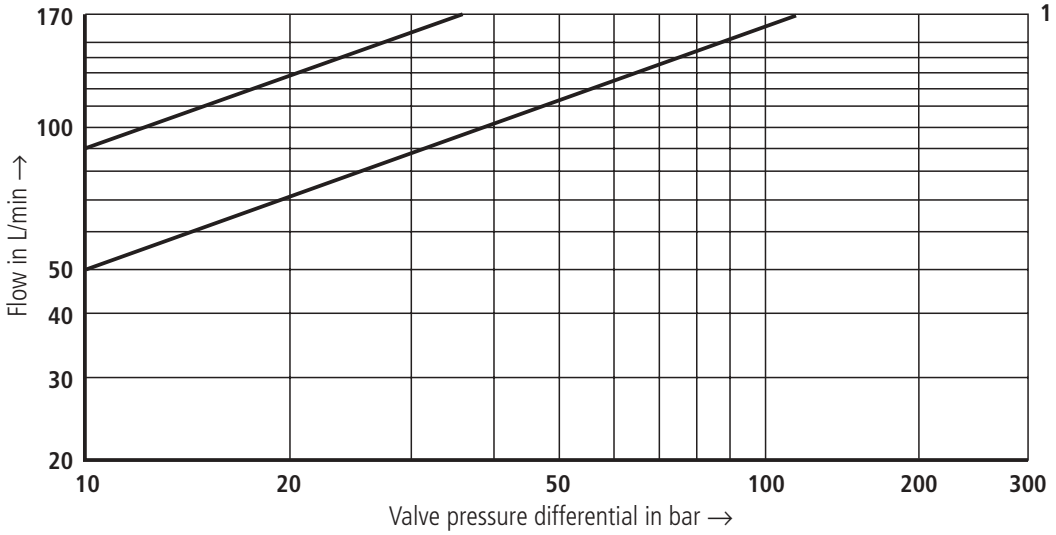
Frequency response characteristic curves



Characteristic curve measured with a pilot control pressure $p_s = 210$ bar

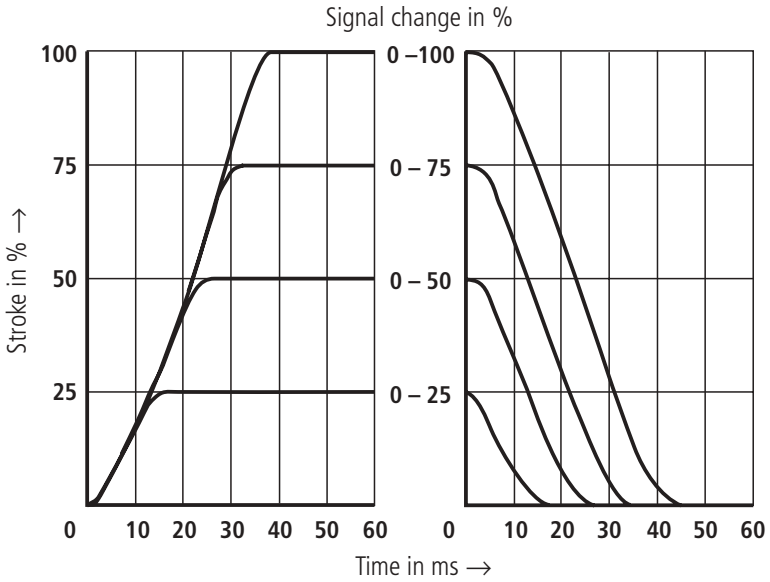
Signal ± 10 %
Signal ± 25 %
Signal ± 100 %

Flow/load function at max. valve opening (tolerance ± 10 %)



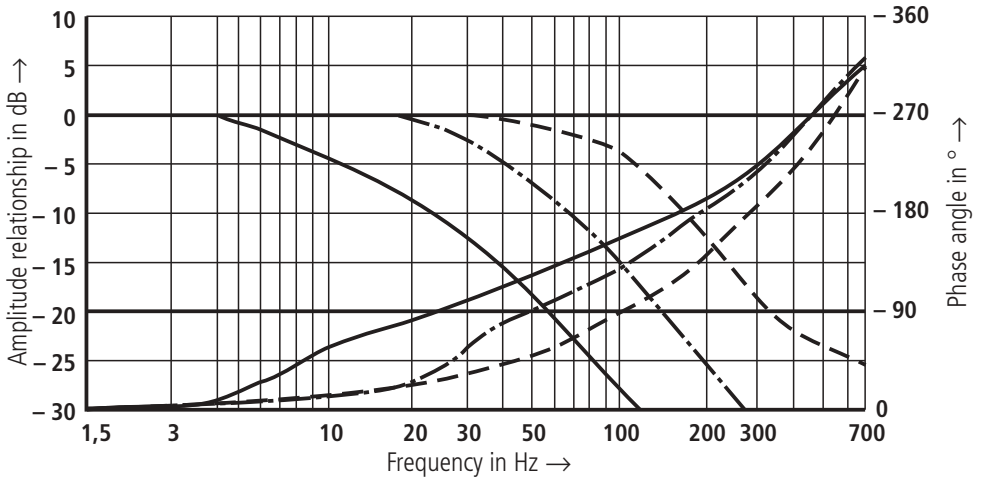
1 = Recommended flow limitation

Transient function with a jump form of input signal



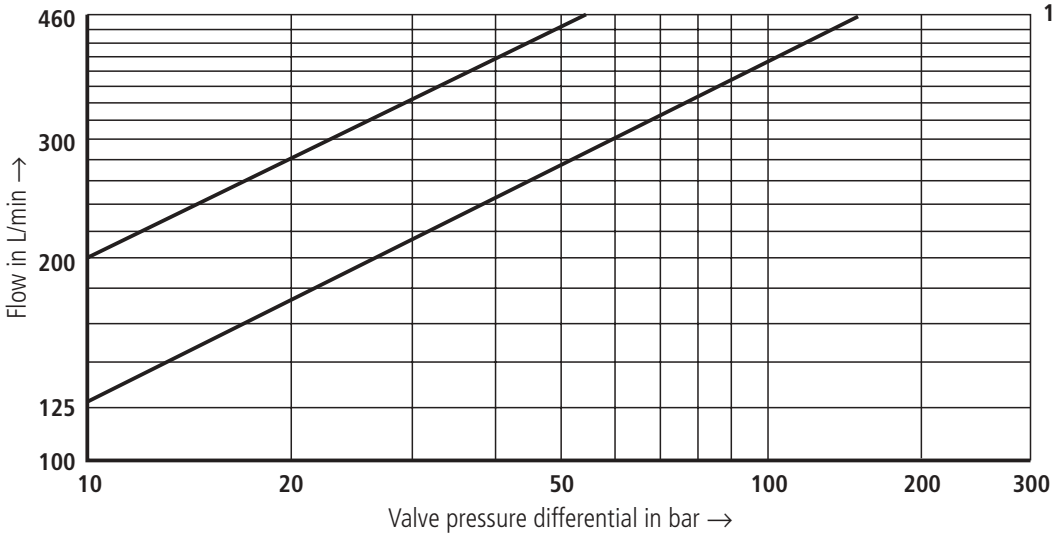
Characteristic curve measured with a pilot control pressure $p_s = 210$ bar

Frequency response characteristic curves



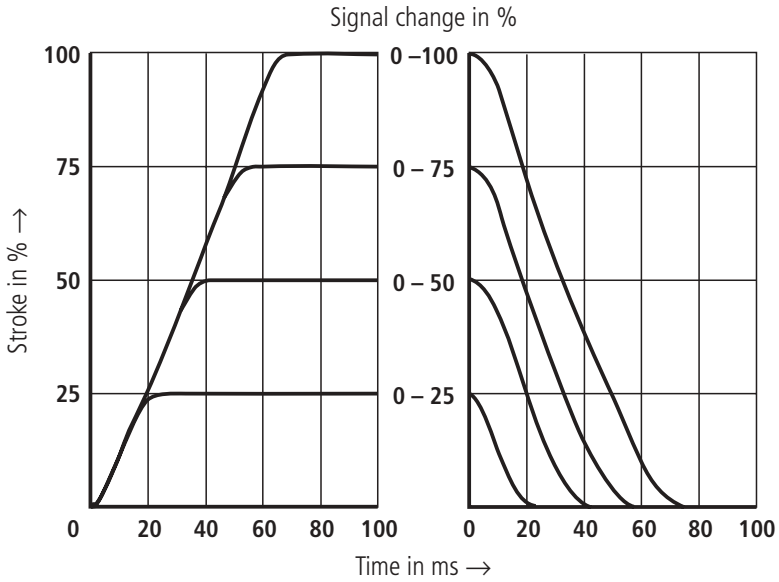
Characteristic curve measured with a pilot control pressure $p_s = 210$ bar

Flow/load function at max. valve opening (tolerance ± 10 %)



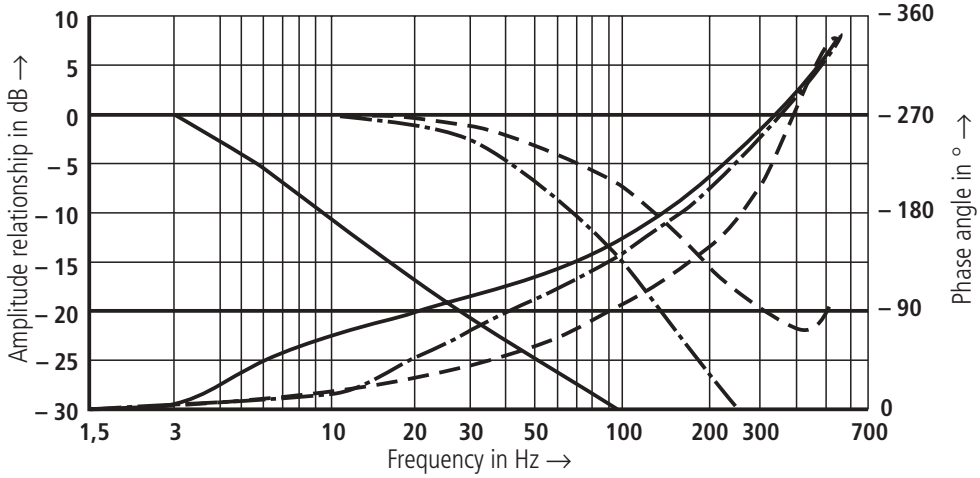
1 = Recommended flow limitation

Transient function with a jump form of electrical input signal



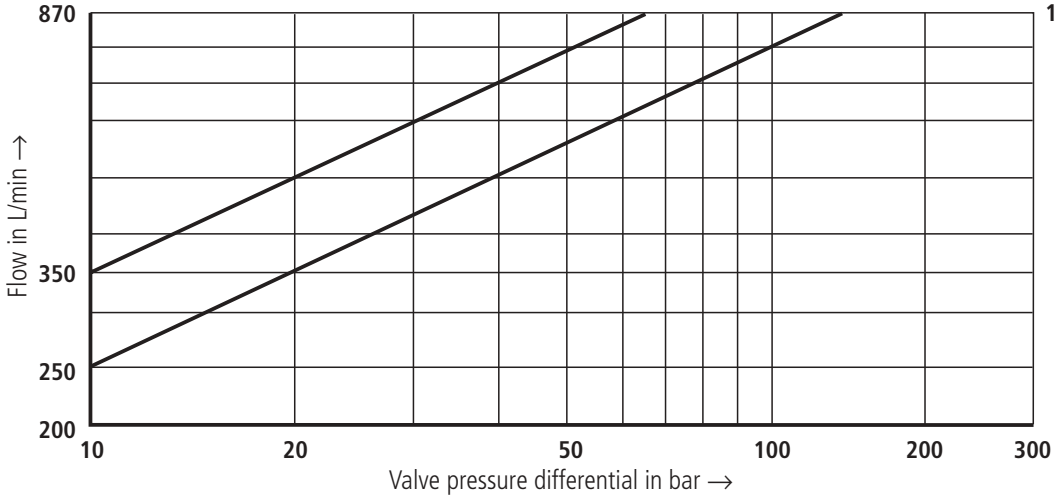
Characteristic curve measured with a pilot control pressure $p_s = 210$ bar

Frequency response characteristic curves

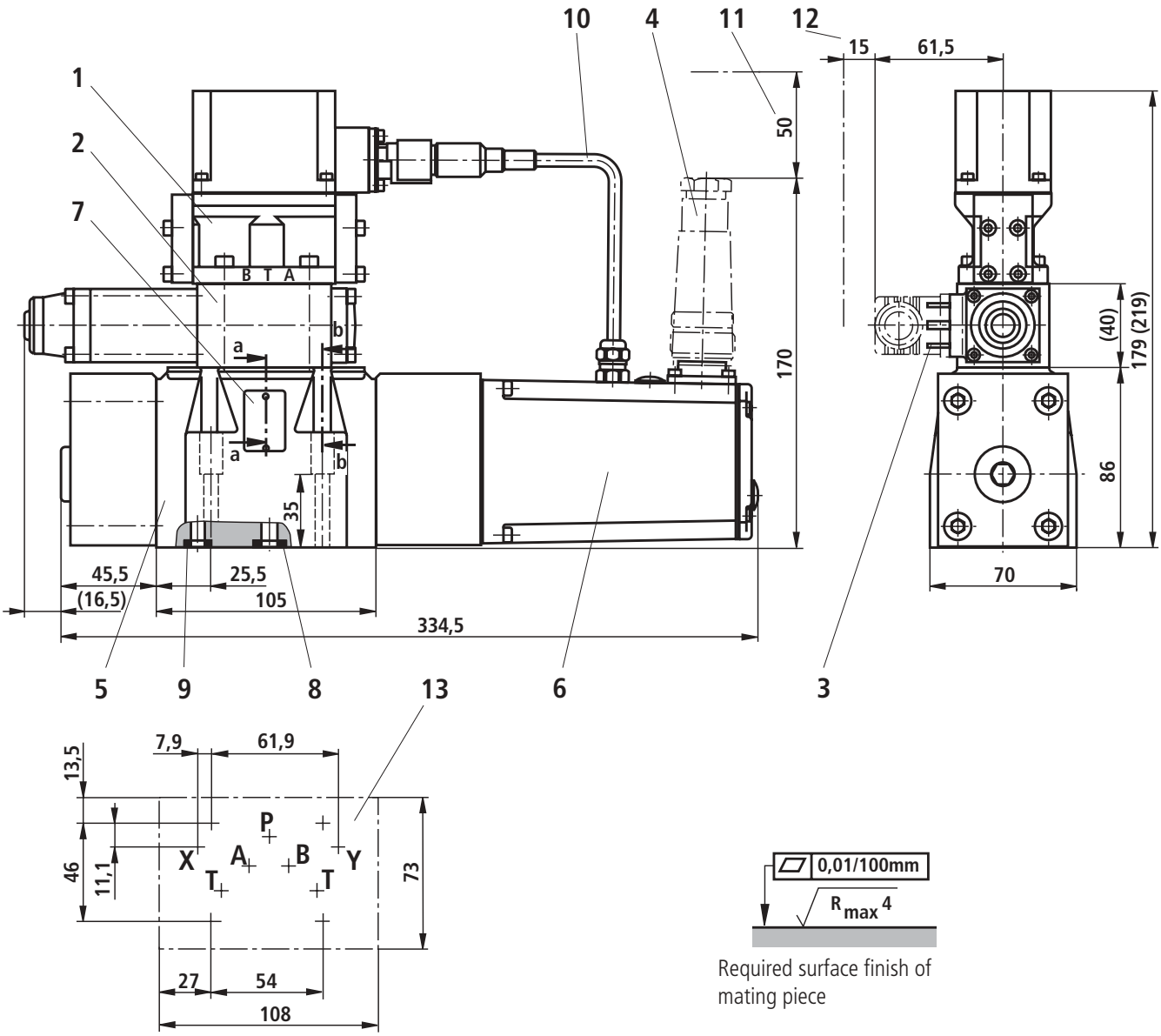


Characteristic curve measured with a pilot control pressure $p_s = 210$ bar

Flow/load function at max. valve opening (tolerance ± 10 %)



1 = Recommended flow limitation



Required surface finish of mating piece

1 Pilot control valve

2 Sandwich plate directional control valve (only included with ordering detail "…WG152")

3 Plug-in connector to DIN 43 650-AF2/Pg11 (separate order, see page 6)

4 Plug-in connector to E DIN 43 563-BF6-3/Pg11 (separate order, see page 6)

5 Main valve

6 Control electronics and inductive position transducer

7 Name plate

8 R-ring 13 x 1.6 x 2 (ports A, B, P, T)

9 R-ring 11.18 x 1.6 x 1.78 (ports X, Y)

10 Connection cable

11 Space required for connection cable and removal of plug-in connector

12 Space required to remove plug-in connector

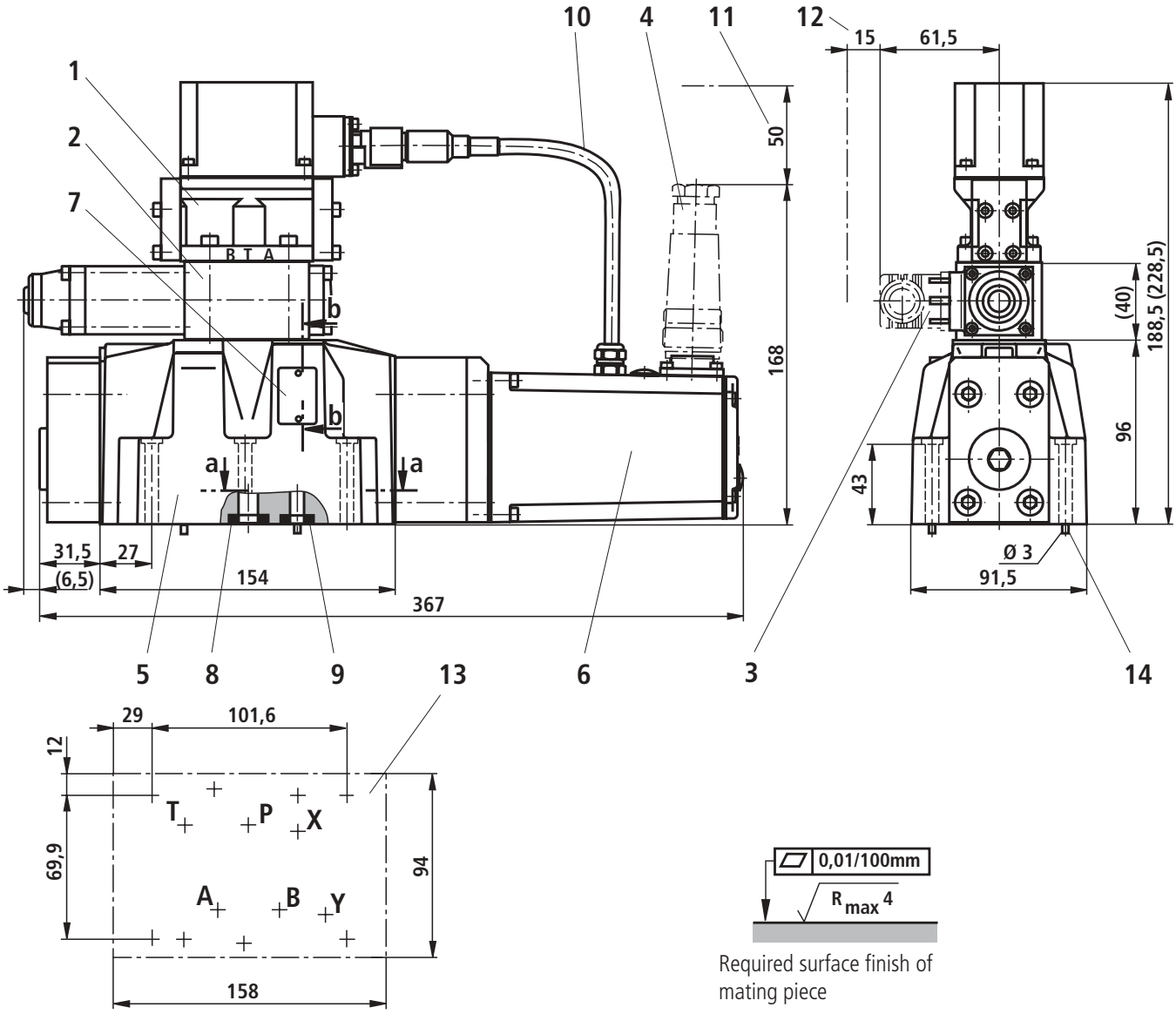
13 Valve mounting surface, porting pattern to DIN 24 340 form A (ports X, Y on request)

Subplates to catalogue sheet RE 45 054 and valve fixing screws must be ordered separately.

Subplates: G 534/01 (G 3/4)
G 535/01 (G 3/4) with ports X and Y
G 536/01 (G 1) with ports X and Y

Valve fixing screws:
4 off M6 x 45 DIN 912-10.9; M_A = 15.5 Nm

For section details see page 16.



Required surface finish of mating piece

1 Pilot control valve

2 Sandwich plate directional control valve (only included with ordering detail "…WG152")

3 Plug-in connector to DIN 43 650-AF2/Pg11 (separate order, see page 6)

4 Plug-in connector to E DIN 43 563-BF6-3/Pg11 (separate order, see page 6)

5 Main valve

6 Control electronics and inductive position transducer

7 Name plate

8 R-ring 22.53 x 2.3 x 2.62 (ports A, B, P, T)

9 R-ring 10 x 2 x 2 (ports X, Y)

10 Connection cable

11 Space required for connection cable and removal of plug-in connector

12 Space required to remove plug-in connector

13 Valve mounting surface, porting pattern to DIN 24 340 form A (ports X, Y on request)

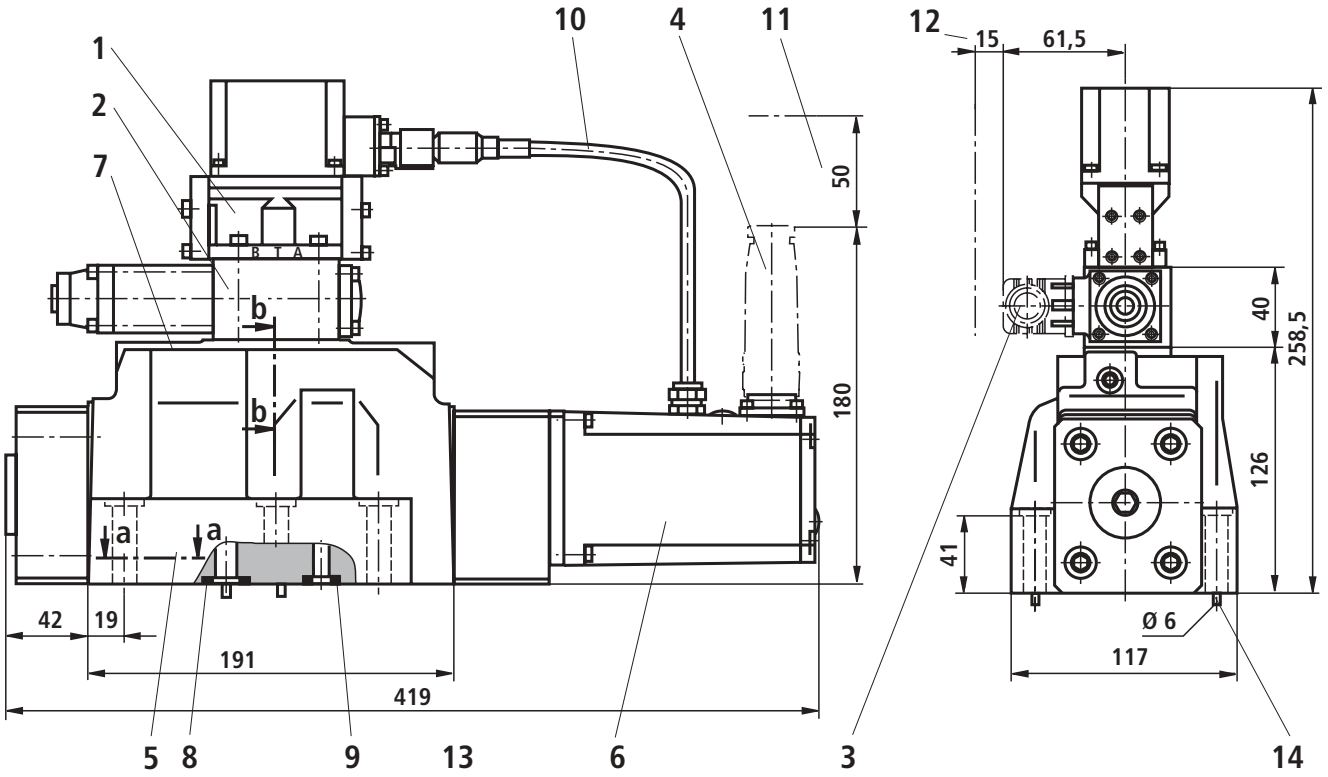
14 Locating pin (2 off)

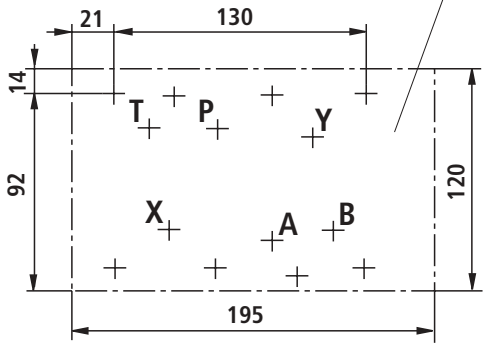
Subplates to catalogue sheet RE 45 054 and valve fixing screws must be ordered separately.

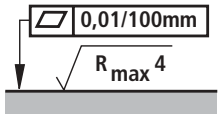
Subplates: G 172/01 (G 3/4)
G 172/02 (M27 x 2)
G 174/01 (G 1)
G 174/02 (M33 x 2)

Valve fixing screws:
2 off M6 x 60 DIN 912-10.9; M_A = 15.5 Nm
4 off M10 x 60 DIN 912-10.9; M_A = 75 Nm

For section details see page 16.







Required surface finish of mating peice

1 Pilot control valve

2 Sandwich plate directional control valve (only included with ordering detail "…WG152")

3 Plug-in connector DIN 43 650-AF2/Pg11 (separate order, see page 6)

4 Plug-in connector to E DIN 43 563-BF6-3/Pg11 (separate order, see page 6)

5 Main valve

6 Control electronics and inductive position transducer

7 Name plate

8 R-ring 27.8 x 2.6 x 3 (ports A, B, P, T)

9 R-ring 19 x 3 x 3 (ports X, Y)

10 Connection cable

11 Space required for connection cable and removal of plug-in connector

12 Space required to remove plug-in connector

13 Valve mounting surface, porting pattern to DIN 24 340 form A (ports X, Y on request)

14 Locating pin (2 off)

Subplates to catalogue sheet RE 45 054 and valve fixing screws must be ordered separately.

Subplates: G 151/01 (G 1)
G 154/01 (G 1 1/4)
G 156/01 (G 1 1/2)

Valve fixing screws:
6 off M12 x 60 DIN 912-10.9; M_A = 130 Nm

For section details see page 16.

Pilot oil supply

Type 4WRGE…-1X/… **Pilot oil supply, external**
Pilot oil drain, external

With this version the pilot oil supply is from a separate pilot pressure circuit (external).
The pilot oil drain is not into the T port of the main valve but separately into the tank via port Y (external).

Type 4WRGE…-1X/…E… **Pilot oil supply, internal**
Pilot oil drain, external

With this version the pilot oil supply is from the P port of the main valve (internal).
The pilot oil drain is not into the T port of the main valve but separately into the tank via port Y (external).
Port X must be plugged in the subplate.

Type 4WRGE…-1X/…ET… **Pilot oil supply, internal**
Pilot oil drain, internal

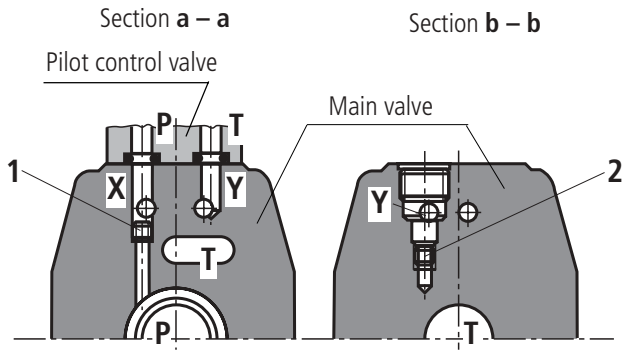
With this version the pilot oil supply is from the P port of the main valve (internal).
The pilot oil drain is directly into the T port of the main valve (internal).
Ports X and Y must be plugged in the subplate.

Type 4WRGE…-1X/…T… **Pilot oil supply, external**
Pilot oil drain, internal

With this version the pilot oil supply is from a separate pilot pressure circuit (external).
The pilot oil drain is directly into the T port of the main valve (internal).
Port Y must be plugged in the subplate.

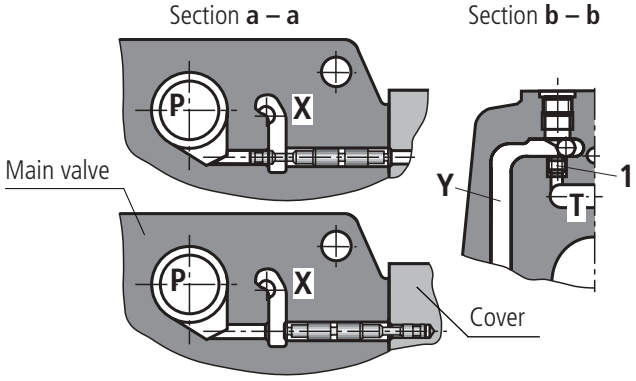
Positions **1** and **2**: Plug M6 DIN 906-8.8 A/F 3

NS 10 For section diagram see page 12



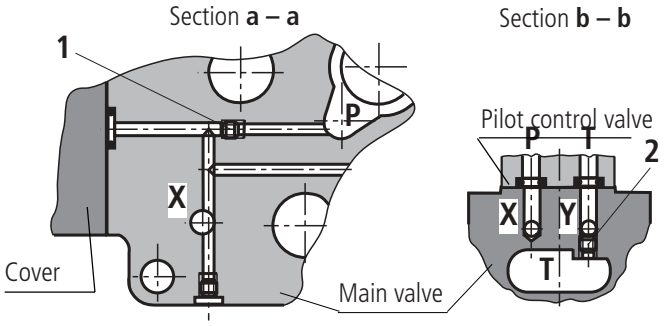
Pilot oil supply	external:	**1**	closed
(section a – a)	internal:	**1**	open
Pilot oil drain	external:	**2**	closed
(section b – b)	internal:	**2**	open

NS 16 For section diagram see page 13



Pilot oil supply	external:	**P**	closed
(section a – a)	internal:	**P**	open
Pilot oil drain	external:	**1**	closed
(section b – b)	internal:	**1**	open

NS 25 For section diagram see page 14



Pilot oil supply	external:	**1**	closed
(section a – a)	internal:	**1**	open
pilot oil drain	external:	**2**	closed
(section b – b)	internal:	**2**	open

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