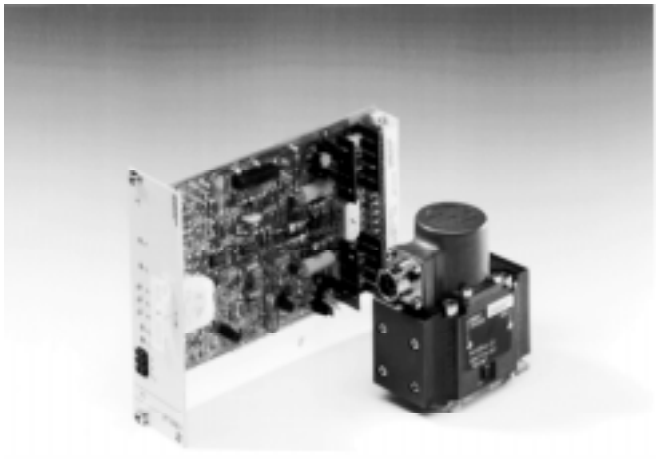
RE 29 564/03.99

Replaces: 29 563

engineering mannesmann Rexroth

Servo directional valve of 4-way design Type 4WS.2EM

Nominal size 6
Series 2X
Maximum operating pressures 210 / 315 bar
Maximum flow 40 L/min



H/A/D 5994/98

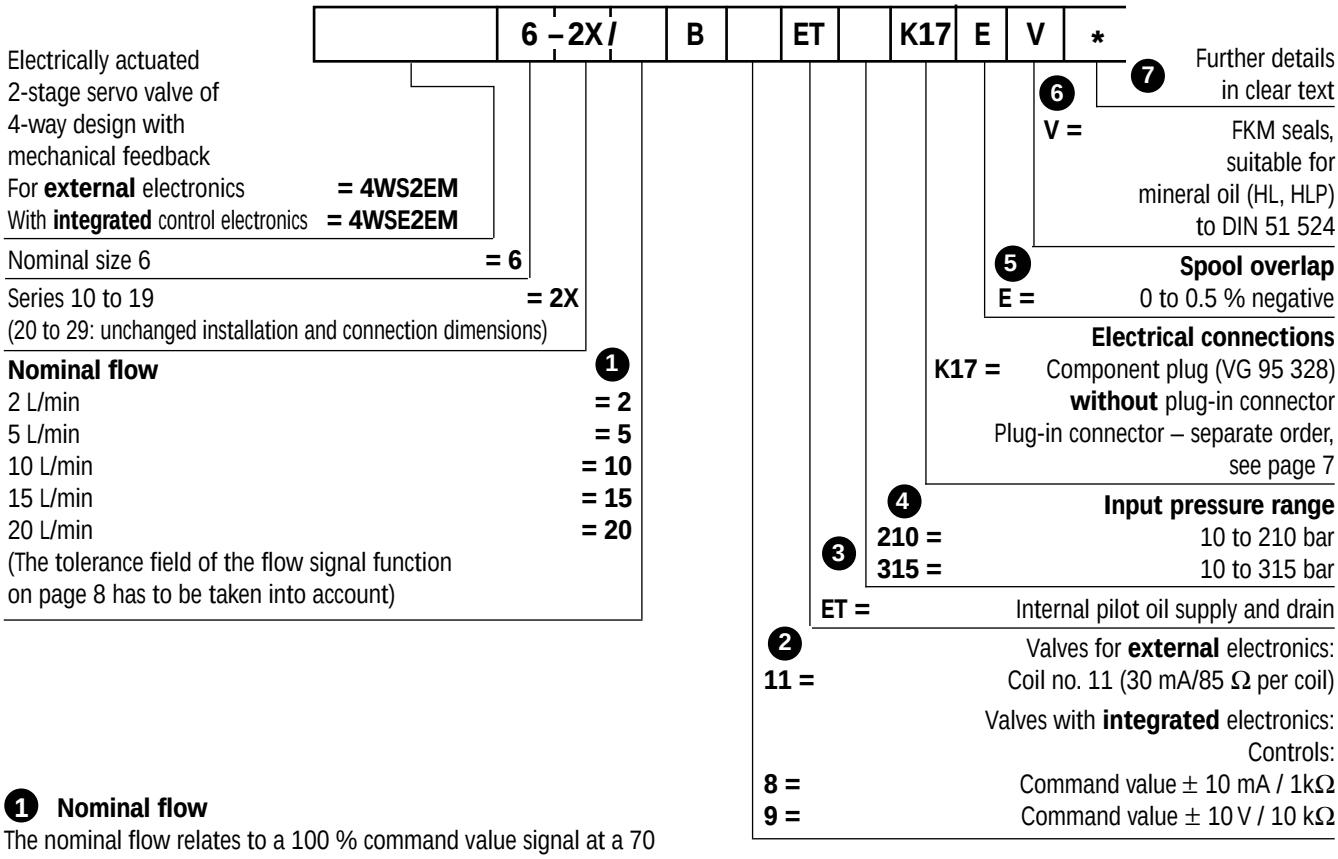
Type 4WS2EM 6-2X/…B.ET...K17EV with associated external control electronics (separate order)

Overview of contents

Features

- Valve for position, force or pressure and velocity closed loop control
- 2-stage servo valve with mechanical feedback
- 1st stage as a flapper jet amplifier
- For subplate mounting,
  porting pattern to DIN 24 340 form A6
  subplates to catalogue sheet RE 45 052
  (separate order)
- Dry torque motor, no contamination of the solenoid gap via the pressure fluid
- Can also be used as a 3-way version
- Wear-free spool feedback element
- Three control variants
- Control:
  - External control electronics in Euro card or modular design (separate order), see page 6
  - Or the control electronics are integrated into the valve
- The valve and integrated electronics are adjusted and tested
- Exchangable control bush with central fixing
- Pressure chambers at the control bush with gap seal, no o-ring wear
- The 1st stage filter is externally accessible

Ordering details



1 Nominal flow

The nominal flow relates to a 100 % command value signal at a 70 bar valve pressure differential (per land 35 bar). This valve pressure differential is to be regarded as a reference value. Other values will give a change in the flow. A possible ± 10% nominal flow tolerance must be taken into consideration (see flow signal function on page 8).

2 Electronic control data

Valves for **external** control electronics: The control signal must be generated by a current regulated ouput stage. For servo amplifier see page 6.

Valves with **integrated** control electronics: For the integrated electronics the command value can be a voltage signal, (ordering code „9“) and where there is extensive cabling (> 25 m between the control and valve) a current signal (ordering code „8“) can be used.

3 Pilot oil

These valve are only available with internal pilot oil supply and drain.

4 Input pressure range

The system pressure should be as constant as possible.

With regard to the dynamics within the permissible pressure of 10 to 210 bar or 10 to 315 bar, the frequency relationship must be taken into account.

5 Spool overlap

The spool overlap given in % refers to the nominal control spool stroke ± 0.5 mm.

Other spool overlaps available on request!

6 Seal material

Other seal materials are available on request!

7 Details in clear text

Here special requirements should be specified in clear text. Following receipt of an order these will be checked at the factory and valve code supplemented by an additional number.

Test unit (battery operated, optionally with a power supply) to catalogue sheet RE 29 681

Attention:

– Only for valves with external electronics

Test unit for servo/proportional valves that are fitted with integrated electronics

Type VT-VET-1, series 1X to catalogue sheet RE 29 685.

The test unit is used to control and functionally test servo/proportional valves with integrated electronics. It is suitable for testing valves that have an operating voltage ± 15 V or 24 V.

The following operating modes are possible:

– External operation → passing on the operating voltage and command values from the control cabinet to the valve
– Internal/external operation → command value via the test unit; operating voltage from the control cabinet
– Internal operation → operating voltage via a separate power supply; command values via the test unit
– Command values via the BNC socket → optional operational voltage

Preferred types

Valves for external control electronics,

Material no.	Type 4WS2EM
00950929	4WS2EM 6-2X/2B11ET315K17EV
00951449	4WS2EM 6-2X/5B11ET315K17EV
00951450	4WS2EM 6-2X/10B11ET315K17EV
00951451	4WS2EM 6-2X/15B11ET315K17EV
00951452	4WS2EM 6-2X/20B11ET315K17EV

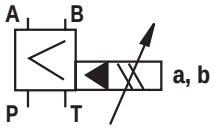
Valves for external control electronics,

Material no.	Type 4WSE2EM
00952164	4WSE2EM 6-2X/2B9ET315K17EV
00952165	4WSE2EM 6-2X/5B9ET315K17EV
00952166	4WSE2EM 6-2X/10B9ET315K17EV
00952167	4WSE2EM 6-2X/15B9ET315K17EV
00952168	4WSE2EM 6-2X/20B9ET315K17EV

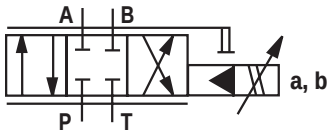
Symbols

Valves for external control electronics

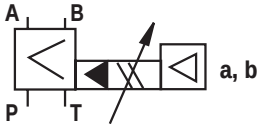
Simplified

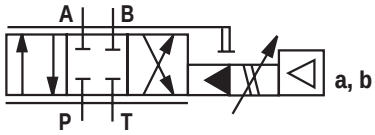


Detailed



Valves for external control electronics





Function, section

4WS(E)2EM6-2X/...

Type 4WS(E)2EM6-2X/... valves are electrically operated, 2-stage directional servo valves with a porting pattern to DIN 24 340 form A6. They are used primarily for the closed loop control of position, force or pressure and velocity.

These valves comprise of a electro-mechanical convertor (torque motor) (1), a hydraulic amplifier (flapper jet principle) (2) and a control spool (3) in a bush (2nd stage), that is connected to the torque motor via a mechanical feedback.

Via an electrical input signal at the coils (4) of the torque motor, a force is generated via a permanent magnet at the armature (5), that in conjuction with a torque tube (6) generates a torque. Due to this the flapper plate (7), which is connected with the torque tube (6) via a rod, is moved out of the central position between the control orifices (8) a pressure differential now results which acts on the front face of the control spool (3). This pressure differential causes the spool to move, whereby the pressure connection is connected to an actuator connection and at the same time the other actuator connection is connected to the return connection.

The control spool is connected via a feedback spring (mechanical feedback) (9) to the flapper plate and torque motor. The control spool continues to change position until the torque feedback, via the feedback spring and the electro-magnetic torque of the torque motor are balanced, and the pressure differential at the flapper jet system becomes zero.
The stroke of the control spool and thus the flow through the servo valve is closed loop controlled in proportional to the electrical input signal. It has, however, to be taken into account that the flow is dependent on the valve pressure drop.

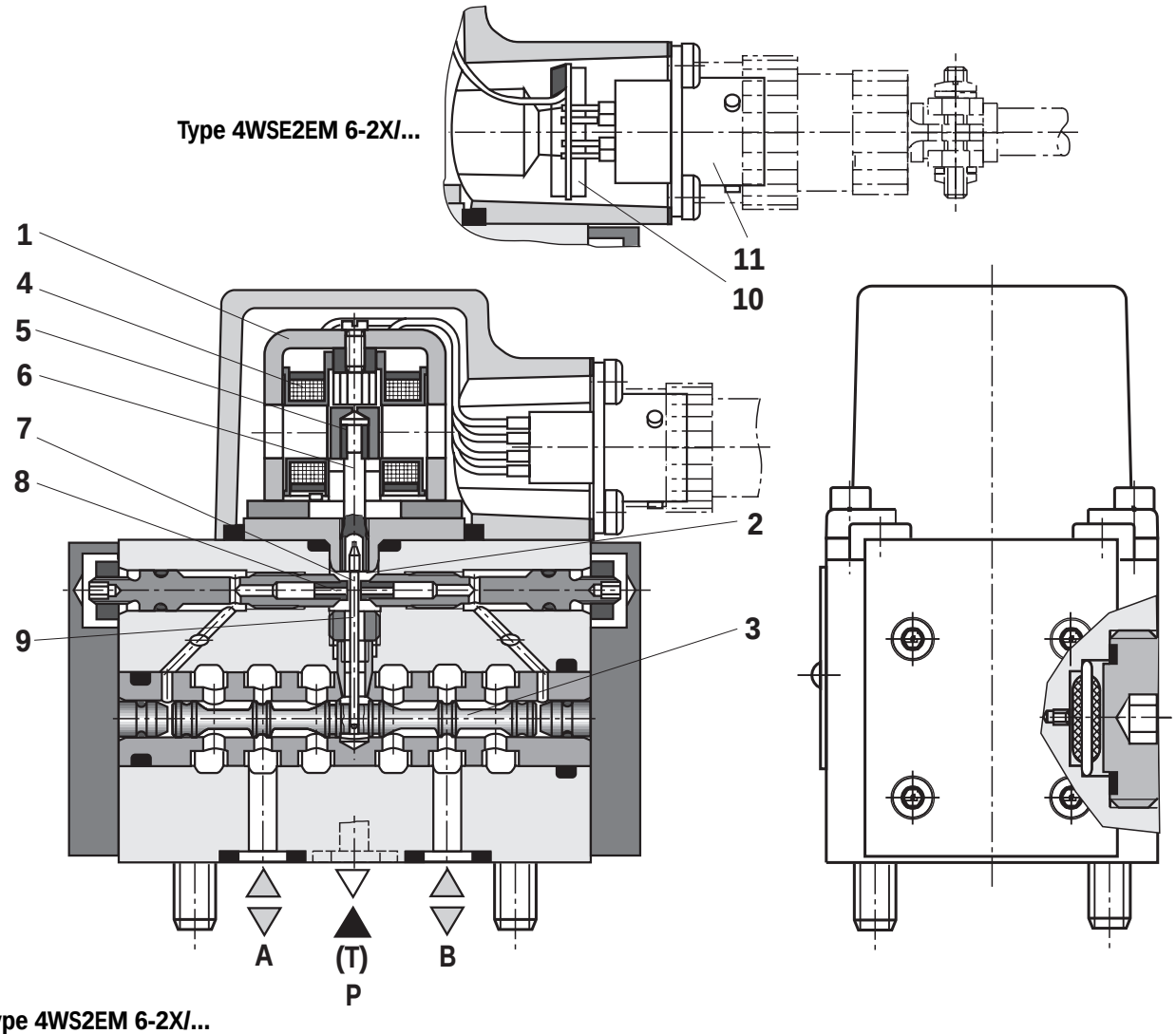
External control electronics, type 4WS2EM6-2X/... (separate order)

External control electronics (servo amplifier), are used to control the valve, they so amplifiy the analogue input signal (command value) that the controlled ouput signal is capable of driving the valve.

Integrated control electronics, type 4WSE2EM6-2X/...

For amplification of the analogue input singal control electronics (10), which are specially matched to this valve type, are integrated. They are built into the component plug (11) of the torque motor cover plate.

Type 4WSE2EM 6-2X/...



Type 4WS2EM 6-2X/...

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

General

Porting pattern		DIN 24 340 form A 6
Installation		optional, provided that during system start-up, the pilot control is supplied with sufficient pressure (≥ 10 bar)!
Storage temperature range	°C	–20 to +80
Ambient temperature range	°C	–30 to +70 valves for external control electronics
		–20 to +60 valves with integrated control electronics
Weight	kg	1.1

Hydraulic (measured at a viscosity ν = 32 mm²/s and ϑ = 40 °C)

Operating pressure (ports A, B, P)	bar	10 to 210 or 10 to 315	
Return line pressure, pressure T	bar	pressure peaks < 100, static < 10	
Pressure fluid		mineral oil (HL, HLP) to DIN 51 524, further pressure fluids on request!	
Pressure fluid temperature range	°C	–20 to +80; preferably +40 bis +50	
Viscosity range	mm²/s	15 to 380; preferably 30 to 45	
Degree of contamination		maximum permissible degree of contamination of the pressure fluid is to NAS 1638	A filter is recommended with a min. retention rate of $\beta_x \geq 75$, without bypass valve and as close as possible to the servo valve
		class 7	x = 5
Zero flow $q_{V,L}$ [1] with spool overlap E, measured without dither signal	L/min	$\sqrt{\frac{p_P}{70\ bar}}$ [2] • (0.4 L/min + 0,02 • $q_{V\,nom}$ [3])	
Nominal flow $q_{V\,nom}$ ± 10 % at a valve pressure differential Δp = 70 bar	L/min	2; 5; 10; 15; 20	
Control spool stroke	mm	± 0.5	
Max. possible control spool stroke to mechanical stops (in the case of a fault) referring to the nom. stroke	%	120 to 170	
Feedback system		mechanical	
Hysteresis (dither optimised)	%	≤ 1.5 of p_P = 210 bar [2]	
Reversal span (dither optimised)	%	≤ 0.2 of p_P = 210 bar [2]	
Response sensitivity (dither optimised)	%	≤ 0.2 of p_P = 210 bar [2]	
Pressure increase at 1 % spool stroke change (from the hydraulic zero point)	% of p_P	≥ 50	

[1] $q_{V,L}$ = nominal flow in L/min

[2] p_P = operating pressure in bar

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

Electrical

Valve protection to EN 60 529			IP65
Signal type			analogue
Nominal current per coil		mA	30
Resistance per coil		Ω	85
Inductivity at 60 Hz and 100% nominal current:			
	Series circuit	H	1.0
	Parallel circuit	H	0.25
Recommended super-imposed dither signal: f = 400 Hz			amplitude dependent on the hydraulic installation: max. ± 3 % of nominal current
Zero compensating current over the entire operating pressure range		%	≤ 3, long term ≤ 5
Zero offset with change in:			
	Pressure fluid temperature	%/20 °C	≤ 1
	Ambient temperature	%/20 °C	≤ 1
	Operating pressure 80 to 120 % of p_P [1]	%/100 bar	≤ 2
	Return line pressure 0 to 10 % of p_P	%/bar	≤ 1

Electrical, external control electronics

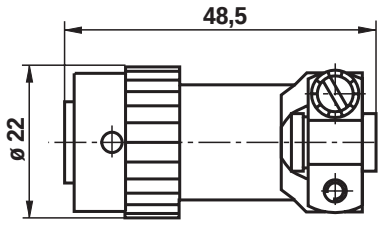
Amplifier in	Eurocard format	type VT-SR2, to catalogue sheet RE 29 980
(separate order)	Modular design	type VT 11021, to catalogue sheet RE 29 743

[1] p_P = operating pressure in bar

Note: For details regarding the **environmental simualtion test** covering EMC (electro-magnetic compatibility), climate and mechanical loading see RE 29 564-U (declaration regarding environmental compatibility).

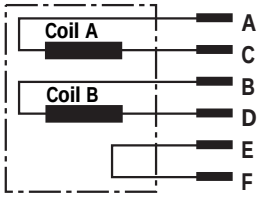
Plug-in connector

Plug-in connector to VG 95 328
Separate order under material no. **00005414**



Connection cable: 4 or 6 core, 0,75 mm^2, screened (e.g. cable type LiYCY 4 or 6 x 0.75 mm^2), to DIN VDE 0812
Outside diameter 5 to 8.5 mm

Electrical connections, external electronics



The electrical connection can either be in parallel or series. Due to reasons of operational safety and the resulting low spool inductivity, we recommend the parallel circuit.

The E-F bridge can be used for the electrical recognision of correct plug connection or can be used for cable brake recognision.

Parallel circuit: Connect contact A with B and C with D

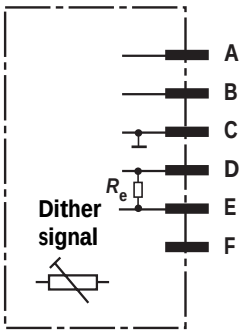
Series circuit: Contact B with C

An electrical control from A (+) to D (–) causes a flow from P to A and B to T. A reversed electrical control causes a flow from P to B and A to T.

E $\rightarrow$ F = bridge

Electrical connections, integrated electronics

Type 4WSE2EM 6-2X/…



	Plug-in connector allocation	Current controlled	Voltage controlled
		Version "**8**"	Version "**9**"
Supply voltage (± 3 %)	A	+15 V	+15 V
	B	–15 V	–15 V
	C	⊥	⊥
Command value	D	± 10 mA;	± 10 V
	E	R_e = 1 kΩ	$R_e \geq$ 10 kΩ
	F	not allocated	
Current consumption at the plug-in connector	A	maximum 150 mA	maximum 150 mA
	B		
	D	0 to ± 10 mA	≤ 0.2 mA
	E		

Supply voltage: ± 15 V ± 3 %, residual ripple < 1 %, current max. consumption 100 mA

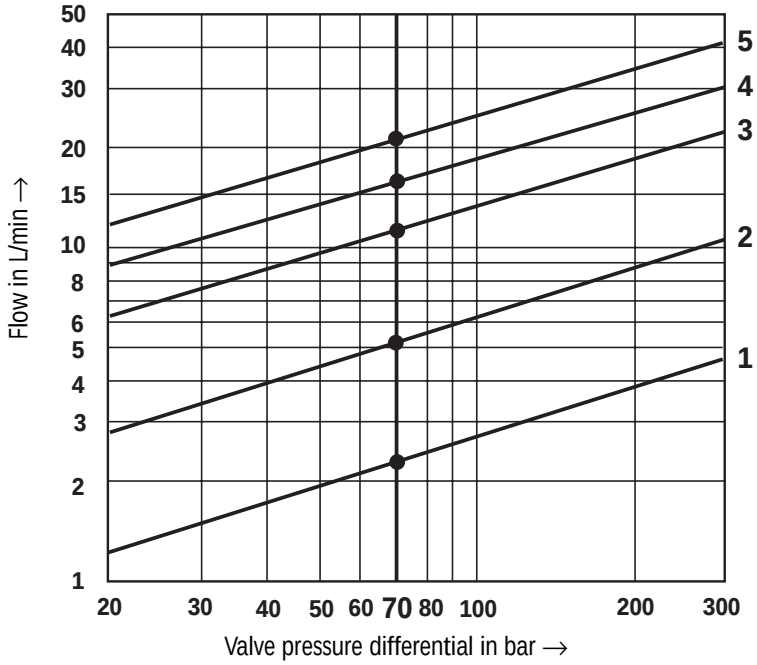
Command value: Command value at plug-in connector terminal D = positive against plug-in connector, termial E resullts in a flow from P to A and B to T.

Command value at plug-in connecter termianl D = negative against plug-in connector, terminal E results in a flow from P to B and A to T.

Note: Electrical signals (e.g. actual value) taken via valve electronics must not be used to switch off the machine safety functions!
(This is in accordance with the regualtion to the European standard "Safety requirements of fluid technology systems and components – hydraulics", EN 982!)

Characteristic curves (measured at ν = 32 mm²/s and ϑ = 40 °C)

Flow-load function (tolerance ± 10 %) at a 100 % command value signal

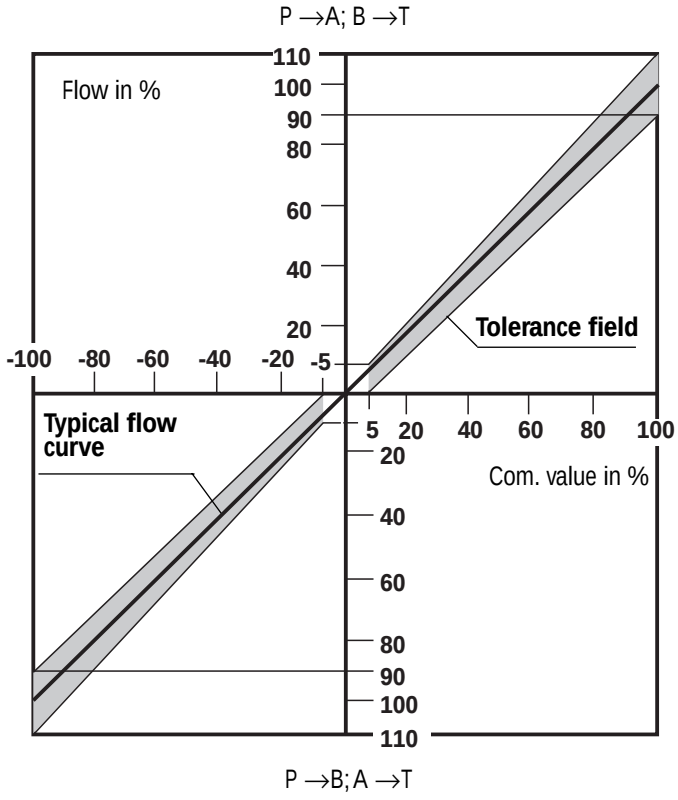


Nominal flow
2 L/min ≙ curve **1**
5 L/min ≙ curve **2**
10 L/min ≙ curve **3**
15 L/min ≙ curve **4**
20 L/min ≙ curve **5**

Δp = valve pressure differential (inlet pressure p_P minus load pressure p_L minus return line pressure p_T)

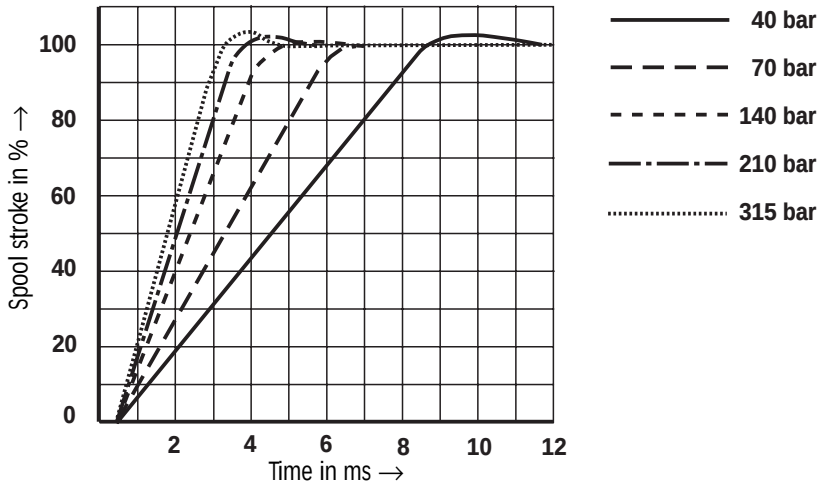
The flow signal function tolerance field

with a constant valve pressure differential

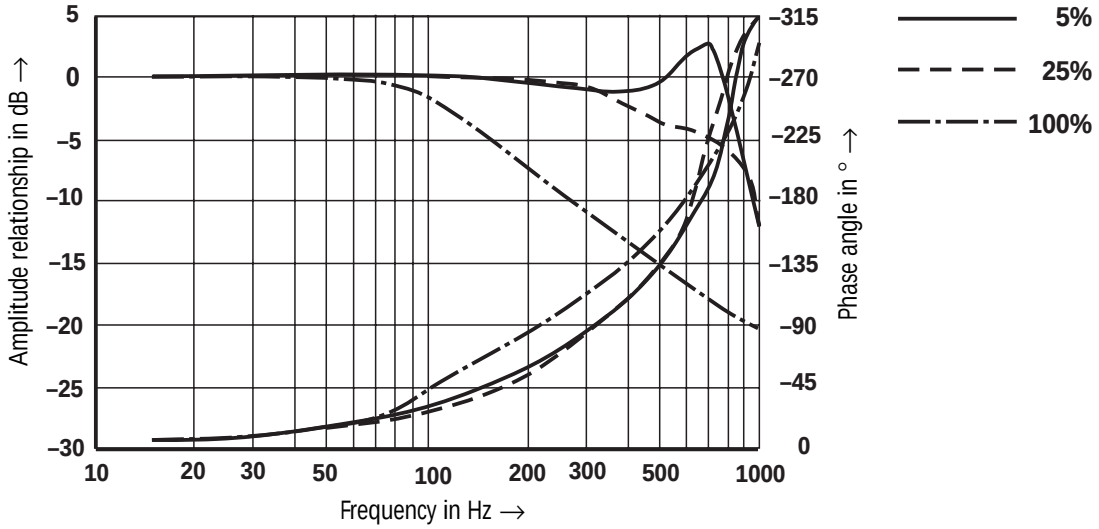


Characteristic curves (measured at ν = 32 mm²/s and ϑ = 40 °C)

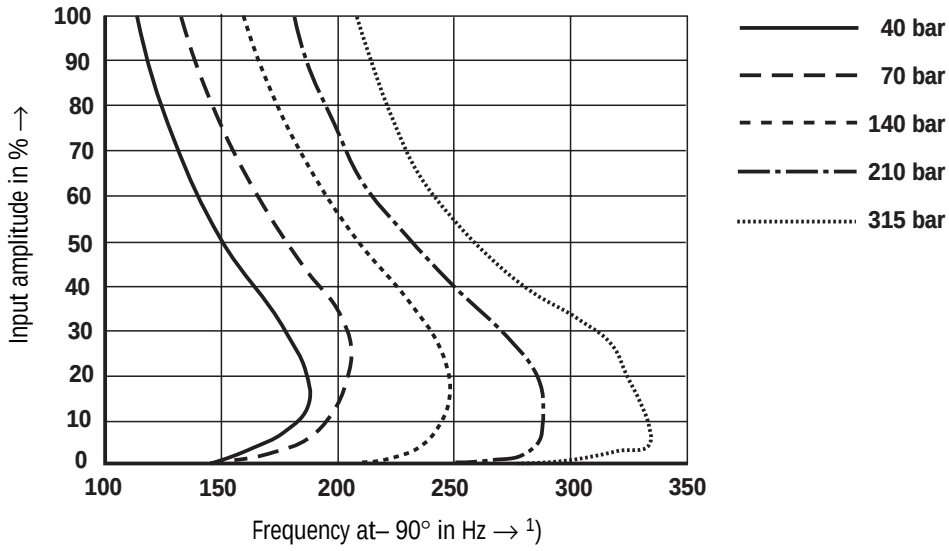
Transient function at an operating pressure = 315 bar



Frequency response at an operating pressure = 315 bar



Frequency response relationship

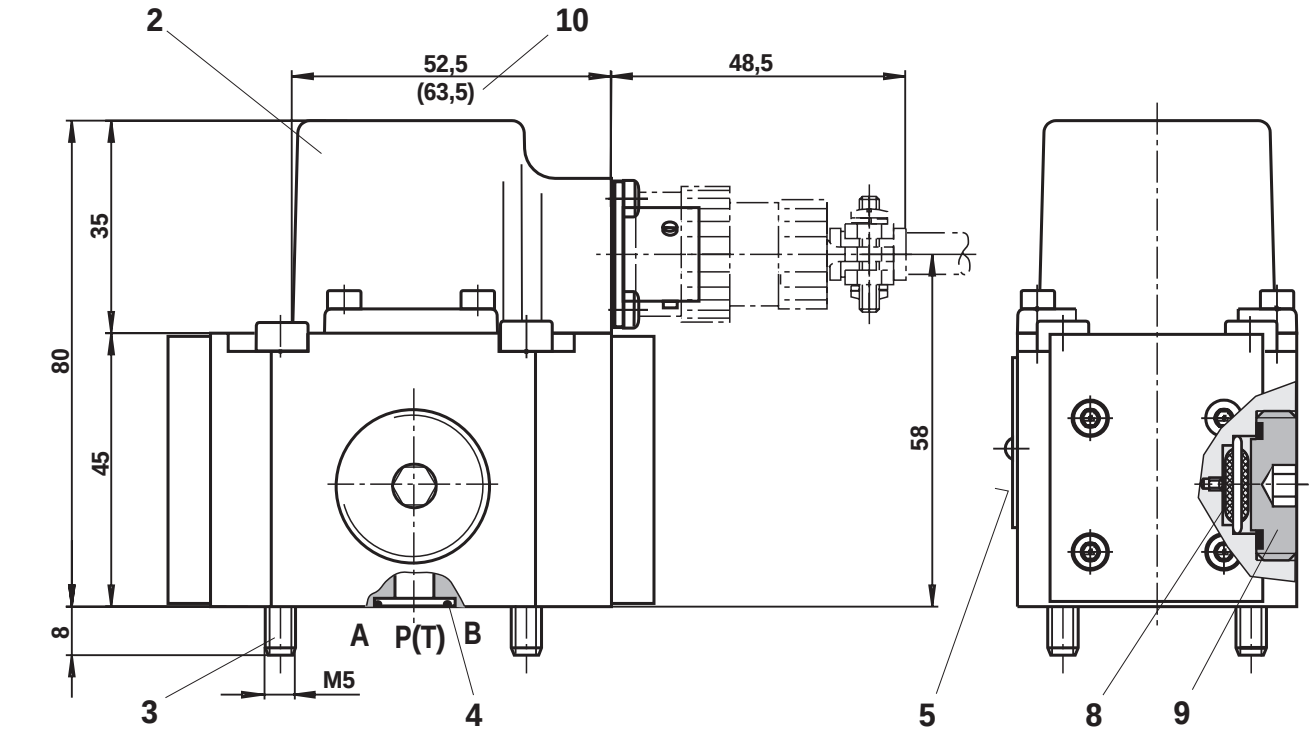


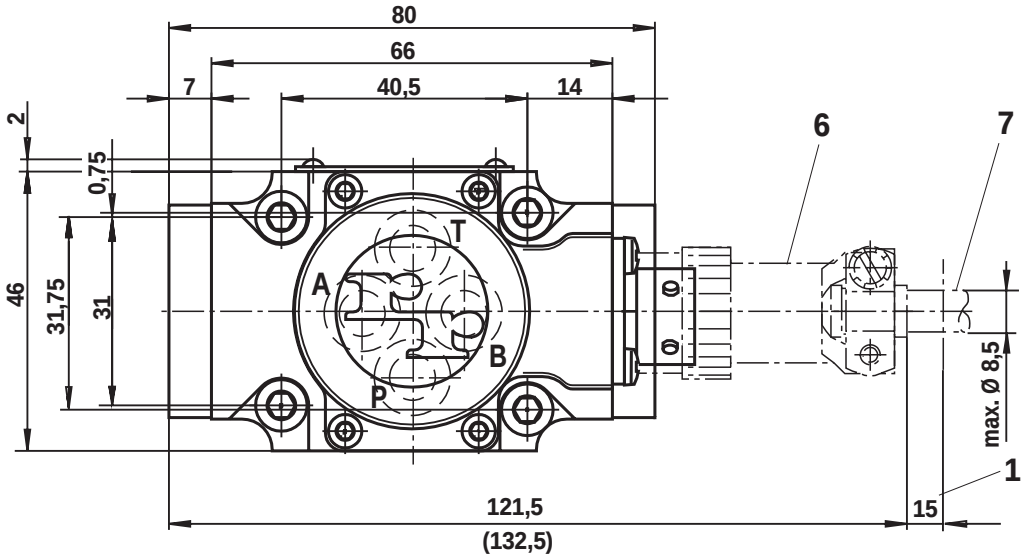
Output signal ≙ spool stroke with a flow without load pressure

1) correction value at $q_{V\,nom}$: 20 L/min = 1.00 15 L/min = 0.95
10 L/min = 0.90 5 L/min = 0.85
2 L/min = 0.80

Unit dimensions: types 4WS2E 6 and (4WSE2EM 6)

(Dimensions in mm)





1 Space required to remove plug-in connector, take the connection cable into account!

2 Cover rotatable through 180°

3 Valve fixing screws (A/F 4)
4 off M5 x 50 DIN 912–10.9 NEL; M_A= 9.3 Nm
(are included within the scope of supply)

4 O-ring 9.25 x 1.78 (P, T, A, B)

5 Name plate

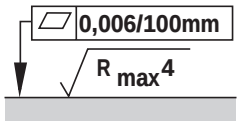
6 Plug-in connector (separate order, see page 7

7 Connection cable, see page 7

8 Filter
– Filter: Material no.:**00218621**
– Seal: Material no.:**00012505**

9 After changing the filter tighten the screws (A/F 6) to M_A= 20 Nm

10 Dim. ( ) → valve with integrated electronics



Required surface finish of mating piece

Subplates

to catalogue sheet RE 45 052 must be ordered separately.

G 341/01 (G 1/4)

G 342/01 (G 3/8)

G 502/01 (G 1/2)

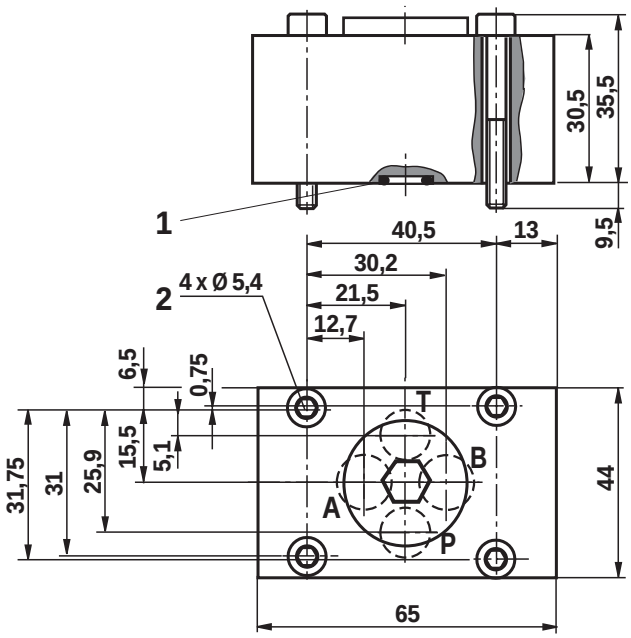
Flushing plate with porting pattern to DIN 24 340 form A6 (Dimensions in mm)

Symbol

With FKM seals material no. **00936049**
Weight: 0.6 kg

1 4 off R-rings 9.81 x 1.5 x 1.78

2 4 off S.H.C.S. M5 x 40 DIN 912– 10.9
(are included within the scope of supply); M_A = 8,9 Nm



In order to ensure correct operation of the servo valves, it is essential to flush the system prior to commissioning.
The following is a guide to the flushing time necessary for the installation:

$$t \geq \frac{V}{q_V} \bullet 5$$

t = flushing time in hours
V = tank capacity in litres
q_V = pump-flow in L/min

If the tank needs to be refilled with more than 10 % of its capacity it will be necessary to reflush the system.
A directional control valve with a porting pattern to DIN 24 340 form A6 is better suited than a flushing plate for the flushing operation, as the actuator lines can also be flushed. Also see catalogue sheet RE 07 700.

Notes

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