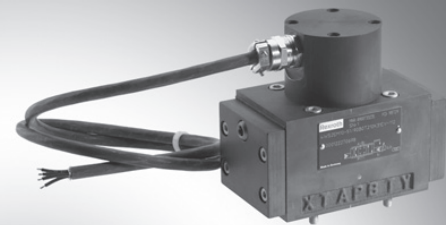


4/3 directional servo valve with mechanical position feedback

RE 29583-XD5-100-B2/05.14
Replaces: 04.12

Type 4WS2EM 10...XD5...-100

Size 10
Component series 5X
Maximum operating pressure 315 bar
Maximum flow 180 l/min



H7684

For explosive areas

Part II Data sheet



Information on the explosion protection:

- Type of protection: Ex d IIB T4 Gb according to IEC 60079-0:2011 / IEC 60079-1:2007
- Ambient temperature range $-30\text{ °C} \leq T_a \leq +80\text{ °C}$

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-XD5-B1
- Part II Data sheet 29583-XD5-100-B2
- Part III Product-specific instructions 29583-XD5-100-B3

Operating instructions 29583-XD5-100-B0

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

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Features

- Directional servo valve
- Valve to control position, force, pressure or velocity
- 2-stage servo valve in 4-way version with mechanical feedback
- 1st stage as nozzle flapper plate amplifier
- For subplate mounting,
porting pattern according to ISO 4401-05-05-0-05
with ports X and Y
Subplates available in FE/ZN version (see page 12)
- Dry control motor, no contamination of the solenoid gaps by
the hydraulic fluid
- Wear-free control spool return element
- Control:
External control electronics in Euro-card format or in modular design (separate order, see page 6)
- Valve is adjusted and tested
- Internal/external pilot oil supply and return can be ordered individually
- Control spool with flow force compensation
- Control sleeve centrally fixed, thus low susceptibility to temperature and pressure
- Pressure chambers at the control sleeve with gap seal, therefore no wear of the seal ring
- Filter for 1st stage freely accessible from the outside

Ordering code and scope of delivery

| | | | | | | | |
|-------------------------------------------------------------------------------------------------------------|----------|-------------------------------------------------|----------|----------------------|------------|-----------------------------------------------------------------------------------------------------------------------------|--------------|
| 4WS2E | M | 10-5X/ | B | 11 | XD5 | C | V-100 |
| Electrically operated 2-stage servo valve in 4/3 directional design for external control electronics | | Mechanical feedback = M | | Size 10 = 10 | | Component series 50 to 59 (50 to 59: Unchanged installation and connection dimensions) = 5X | |
| Rated flow ¹⁾ | | 5 l/min = 5 | | 10 l/min = 10 | | 20 l/min = 20 | |
| | | 30 l/min = 30 | | 45 l/min = 45 | | 60 l/min = 60 | |
| | | 75 l/min = 75 | | 90 l/min = 90 | | | |
| Valve for external control electronics | | Coil no. 11 (30 mA/85 Ω per coil) ²⁾ | | | | = 11 | |
| | | | | | | 100 = Special number ⁶⁾ | |
| | | | | | | V = Seal material FKM seals Suitable for mineral oil (HL, HLP) according to DIN 51524 | |
| | | | | | | E = Control spool overlap ⁵⁾ 0 ... 0.5 % negative | |
| | | | | | | D = 0 ... 0.5 % positive | |
| | | | | | | C = Electrical connection Cable connection, see page 7 | |
| | | | | | | 210 = Inlet pressure range to the 1st stage ⁴⁾ 10 ... 210 bar | |
| | | | | | | 315 = 10 ... 315 bar | |
| | | | | | | - = Pilot oil supply and return ³⁾ Supply external, return external | |
| | | | | | | E = Supply internal, return external | |
| | | | | | | T = Supply external, return internal | |
| | | | | | | ET = Supply internal, return internal (ET = standard version) | |
| | | | | | | XD5 = Explosion protection "flameproof enclosure" For details see information on the explosion protection, page 6 | |

Included in the scope of delivery:

- Valve mounting screws
- Valve operating instructions with declaration of conformity in part III

1) Rated flow

The rated flow refers to a 100 % command value signal at 70 bar valve pressure differential (35 bar per control edge). The valve pressure differential must be regarded as reference. Other values result in the flow being changed. A possible rated flow tolerance of ±10 % must be taken into account (see flow signal function page 8).

2) External control electronics

The actuating signal must be created from a flow-controlled output stage with a superimposed dither signal. Control electronics (servo amplifier) see page 6.

3) Pilot oil

Care should be taken that the pilot pressure is as constant as possible. An external pilot control via port X is thus often advantageous. The valve can be operated with a higher pressure at X than at P in order to influence the dynamics in a positive form.

Important:

The ports X and Y are also pressurized in case of "internal" pilot oil supply and return.

4) Inlet pressure range

Care should be taken that the system pressure is as constant as possible. Pilot pressure range: 10 ... 210 bar or 10 ... 315 bar

With regard to the dynamics, the frequency response dependency must be observed within the admissible pressure range.

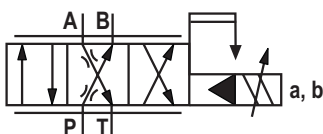
5) Control spool overlap

The control spool overlap is specified in % of the control spool stroke. Others upon request

6) Special number "100"

Without actuation (de-energized condition), channels P → B and A → T are open for 10 % of the nominal quantity.

Symbol



Function, section

4WS2EM 10...XD5...-100

Valves of this type are electrically operated, 2-stage directional servo valves with porting pattern according to ISO 4401-05-05-0-05. They are mainly used to control position, force, pressure or velocity.

These valves are made of an electro-mechanical converter (torque motor) (1), a hydraulic amplifier (principle: nozzle flapper plate) (2) and a control spool (3) in a sleeve (2nd stage) which is connected with the torque motor via a mechanical feedback.

An electrical input signal at the coils (4) of the torque motor generates a force by means of a permanent magnet which acts on the armature (5), and in connection with a torque tube (6) results in a torque. This causes the flapper plate (7) which is connected to the torque tube (6) via a pin to move from the central position between the two control nozzles (8), and a pressure differential is created across the front faces of the control spool (3). The pressure differential results in the control spool changing its position, which results in the pressure port being connected to one actuator port and, at the same time, the other actuator port being connected to the return flow port.

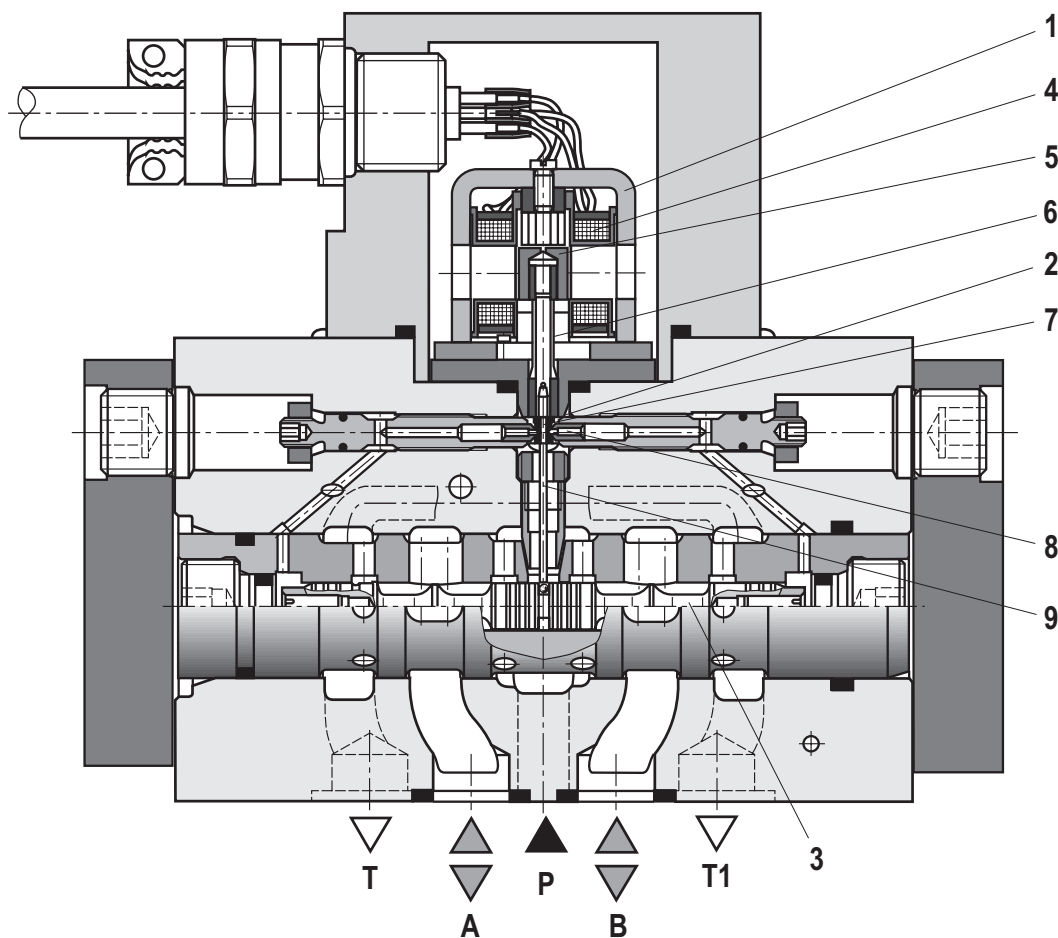
The control spool is connected to the flapper plate or the torque motor by means of a bending spring (mechanical feedback) (9). The position of the control spool is changed until the feedback torque across the bending spring and the electro-magnetic torque of the torque motor are balanced and the pressure differential at the nozzle flapper plate system becomes zero.

The stroke of the control spool and consequently the flow of the servo valve are controlled in proportion to the electrical input signal. It must be noted that the flow depends on the valve pressure drop.

External control electronics (separate order)

External control electronics (servo amplifier) serve the actuation of the valve, amplifying an analog input signal (command value) so that with the output signal, the servo valve is actuated in a flow-controlled form.

Type 4WS2EM 10...XD5...-100



Technical data

general

| | | |
|---------------------------|----|---------------------------------------------------------------------------------------------------------------------------|
| Porting pattern | | ISO 4401-05-05-0-05 |
| Installation position | | Any (ensure that during start-up of the system, the pilot control is supplied with sufficient pressure (≥ 10 bar!)) |
| Surface protection | | Nitro-carburated |
| Storage temperature range | °C | -20 ... +80 |
| Ambient temperature range | °C | -30 ... +80 |
| Weight | kg | 3.97 |

hydraulic (measured with HLP 32, $\vartheta_{oil} = 40 \text{ °C} \pm 5 \text{ °C}$)

| | | | | | | | | | | |
|----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|-----|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|-----------|----|----|
| Operating pressure | Pilot control stage, pilot oil supply | bar | 10 ... 210 or 10 ... 315 | | | | | | | |
| | Main valve, ports P, A, B | bar | up to 315 | | | | | | | |
| Return flow pressure | Port T | | | | | | | | | |
| | Pilot oil return internal | bar | Pressure peaks < 100 permitted, static < 10 | | | | | | | |
| | Pilot oil return external | bar | Up to 315 | | | | | | | |
| | Port Y | bar | Pressure peaks < 100 permitted, static < 10 | | | | | | | |
| 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 | mm ² /s | | 15 ... 380; preferably 30 ... 45 | | | | | | | |
| Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c) | | | Class 18/16/13 ¹⁾ | | | | | | | |
| Zero flow $q_{V,L}^{2)}$ with control spool overlap E measured without dither signal | l/min | | $\sqrt{\frac{p_p^{4)}}{70 \text{ bar}}} \cdot 0.7 \frac{\text{l}}{\text{min}}$ | $\sqrt{\frac{p_p^{4)}}{70 \text{ bar}}} \cdot 0.9 \frac{\text{l}}{\text{min}}$ | $\sqrt{\frac{p_p^{4)}}{70 \text{ bar}}} \cdot 1.2 \frac{\text{l}}{\text{min}}$ | $\sqrt{\frac{p_p^{4)}}{70 \text{ bar}}} \cdot 1.5 \frac{\text{l}}{\text{min}}$ | $\sqrt{\frac{p_p^{4)}}{70 \text{ bar}}} \cdot 1.7 \frac{\text{l}}{\text{min}}$ | | | |
| Rated flows $q_{v, rated}^{3)}$, tolerance $\pm 10 \%$ with valve pressure differential $\Delta p = 70$ bar (35 bar/edge) | l/min | | 5 | 10 | 20 | 30 | 45 | 60 | 75 | 90 |
| Max. control spool stroke possible with mechanical end position (in case of error) related to nominal stroke | % | | 120 ... 170 | | | 120 ... 150 | | | | |
| Feedback system | | | Mechanical | | | | | | | |
| Hysteresis (dither-optimized) | % | | ≤ 1.5 | | | | | | | |
| Range of inversion (dither-optimized) | % | | ≤ 0.3 | | | | | | | |
| Response sensitivity (dither-optimized) | % | | ≤ 0.2 | | | | | | | |
| Pressure gain with 1 % control spool stroke change (from the hydraulic zero point) | % of $p_p^{4)}$ | | ≥ 30 | | | ≥ 60 | | ≥ 80 | | |
| Zero adjustment flow over the entire operating pressure range | % | | ≤ 3 , long-term ≤ 5 | | | | | | | |
| Zero shift upon change of: | | | | | | | | | | |
| Hydraulic fluid temperature | % / 20 K | | ≤ 1 | | | | | | | |
| Ambient temperature | % / 20 K | | ≤ 1 | | | | | | | |
| Operating pressure 80 ... 120 % of $p_p^{4)}$ | % / 100 bar | | ≤ 2 | | | | | | | |
| Return flow pressure 0 ... 10 % of $p_p^{4)}$ | % / bar | | ≤ 1 | | | | | | | |

¹⁾ 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.

²⁾ $q_{V,L}$ = zero flow in l/min

³⁾ $q_{v, rated}$ = rated flow in l/min

⁴⁾ p_p = operating pressure in bar

Technical data

electric

| | | |
|-----------------------------------------------------------------------------------------------|---------------------|--------|
| Protection class according to EN 60529 | | IP 65 |
| Type of signal | | Analog |
| Rated current per coil | mA | 30 |
| Resistance per coil | Ω | 85 |
| Inductivity with 60 Hz and 100 % rated current | Serial connection | H 1.0 |
| | Parallel connection | H 0.25 |
| In case of actuation using non-Rexroth amplifiers, we recommend a superimposed dither signal. | | |

Information on the explosion protection

| | | |
|------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| KCs examination certificate | | 14-KB4BO-0119X |
| IECEX Certificate of Conformity | | IECEX BVS 13.0120 X |
| Type of protection according to IEC 60079-0:2011 / IEC 60079-1:2007 | | Ex d IIB T4 Gb |
| Ambient temperature range | $^{\circ}\text{C}$ | -30 ... +80 |
| Hydraulic fluid temperature range | $^{\circ}\text{C}$ | -20 ... +80 |
| Maximum current per coil | I_{\max} mA | 100 |
| Conditions for use | <p>⚠ DANGER – Risk of explosion</p> <p>For ensuring the type of protection "flameproof enclosure" the occurrence of explosive atmospheres in the hydraulic area of the valve must be securely avoided. This may be ensured by applying a sufficiently high control pressure (≥ 10 bar in channel P and/or X) before applying an electrical signal at the coils or the electronics.</p> | |

External control electronics

| | | | |
|-------------------------------------|--------------------------------|--------|--------------------------------------------------|
| Servo amplifier (separate order) | Euro-card format ¹⁾ | Analog | Type VT-SR2-1X/.60 according to data sheet 29980 |
| | Modular design ¹⁾ | Analog | Type VT 11021 according to data sheet 29743 |

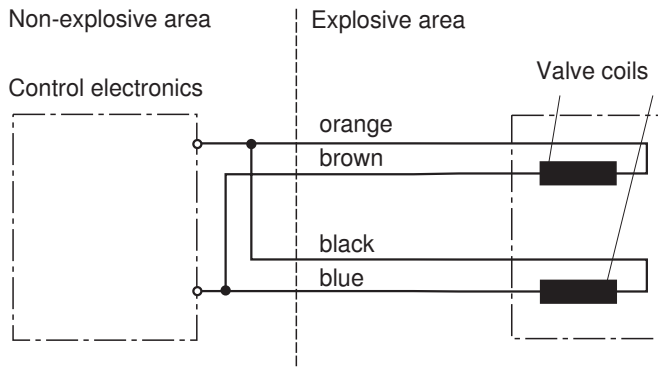
⚠ DANGER – Risk of explosion

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

¹⁾ Order separately

Electrical connection

Example: Parallel connection



The connection cable is 3 m long and fixedly attached to the valve.

It may be shortened.

It must not be exchanged.

The electrical connection can be designed as parallel or serial connection. For reasons of operational safety and the resulting lower coil inductivity, we recommend the parallel connection.

Parallel connection:

Connect the

"orange" cable litz with "black"

and

"brown" with "blue".

Serial connection:

Connect the "brown" cable litz with "black".

The electrical control to "orange" (+) and "blue" (-) provides

for the flow direction $P \rightarrow A$ and $B \rightarrow T$. Inverted electrical

control provides for the flow direction $P \rightarrow B$ and $A \rightarrow T$.

⚠ DANGER – Risk of explosion

The free end of the connection cable must be connected as follows according to the construction provisions:

- Outside the explosive area

or

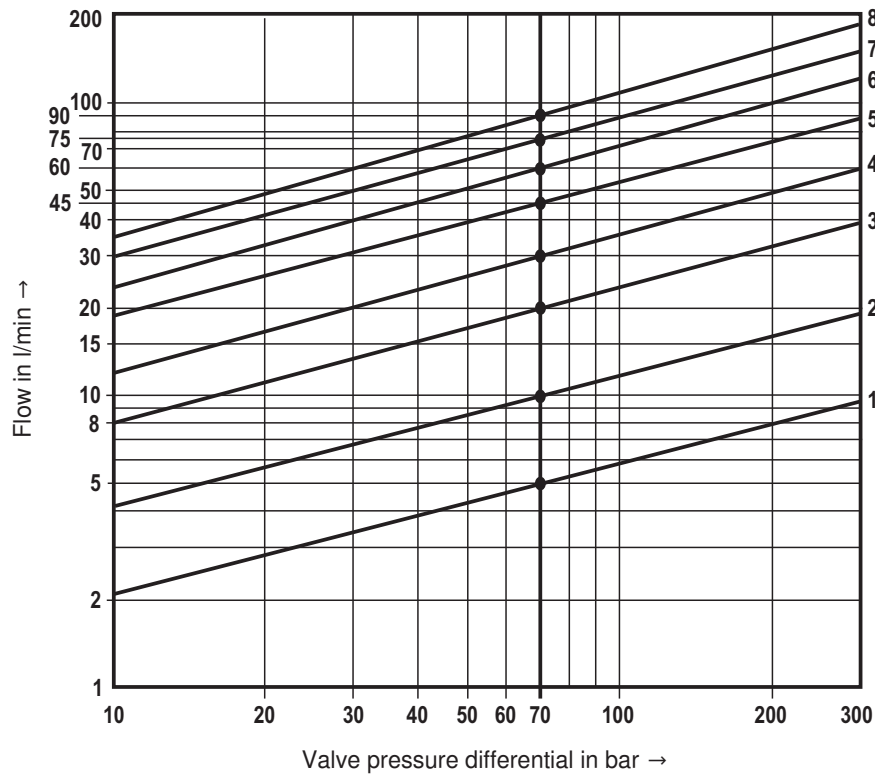
- Within the explosive area in terminal boxes of an acknowledged protection type

Characteristic curves (measured with HLP32, $\vartheta_{oil} = 40 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$)

Flow/load function (tolerance $\pm 10 \%$) with 100 % command value signal

Important:

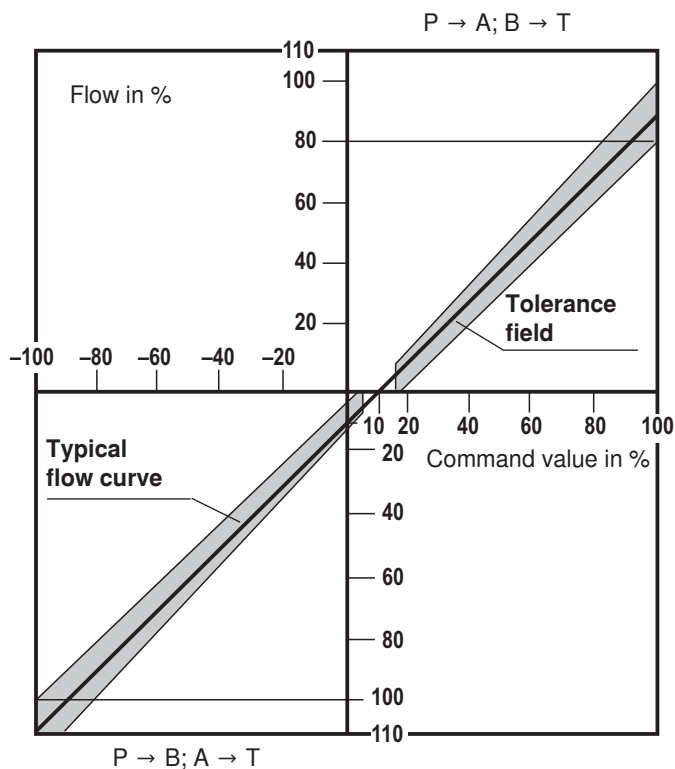
Observe the flow values in the max. command value range (see tolerance field of the flow/signal function)



| Ordering code | Rated flow | Curve |
|---------------|------------|-------|
| 5 | 5 l/min | 1 |
| 10 | 10 l/min | 2 |
| 20 | 20 l/min | 3 |
| 30 | 30 l/min | 4 |
| 45 | 45 l/min | 5 |
| 60 | 60 l/min | 6 |
| 75 | 75 l/min | 7 |
| 90 | 90 l/min | 8 |

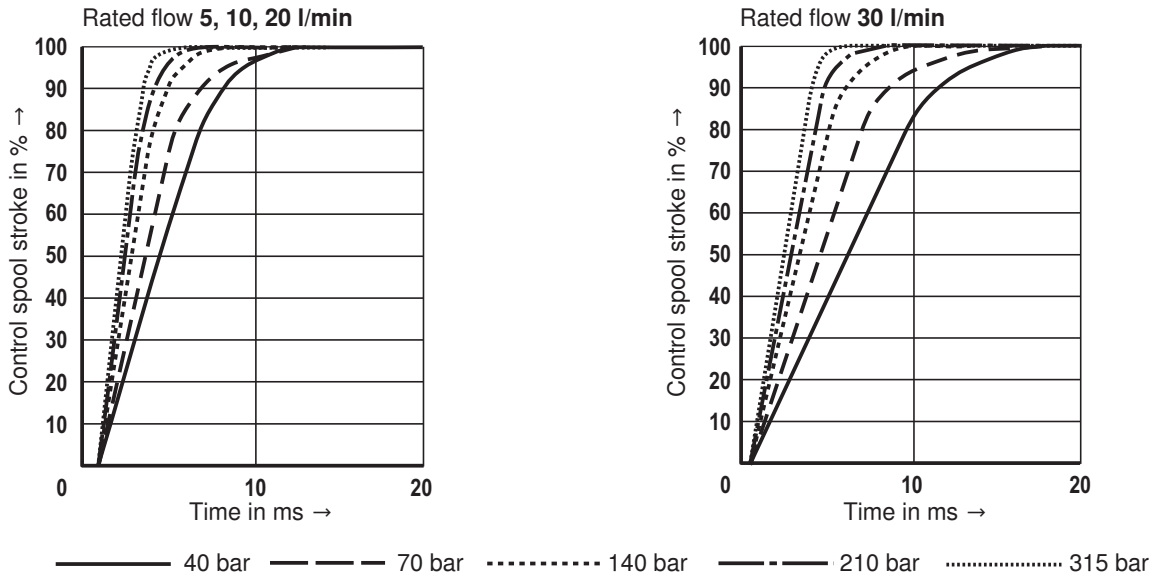
Δp = Valve pressure differential
 (inlet pressure p_p
 minus load pressure p_L minus
 return flow pressure p_T)

Tolerance field of the flow/signal function with constant valve pressure differential Δp

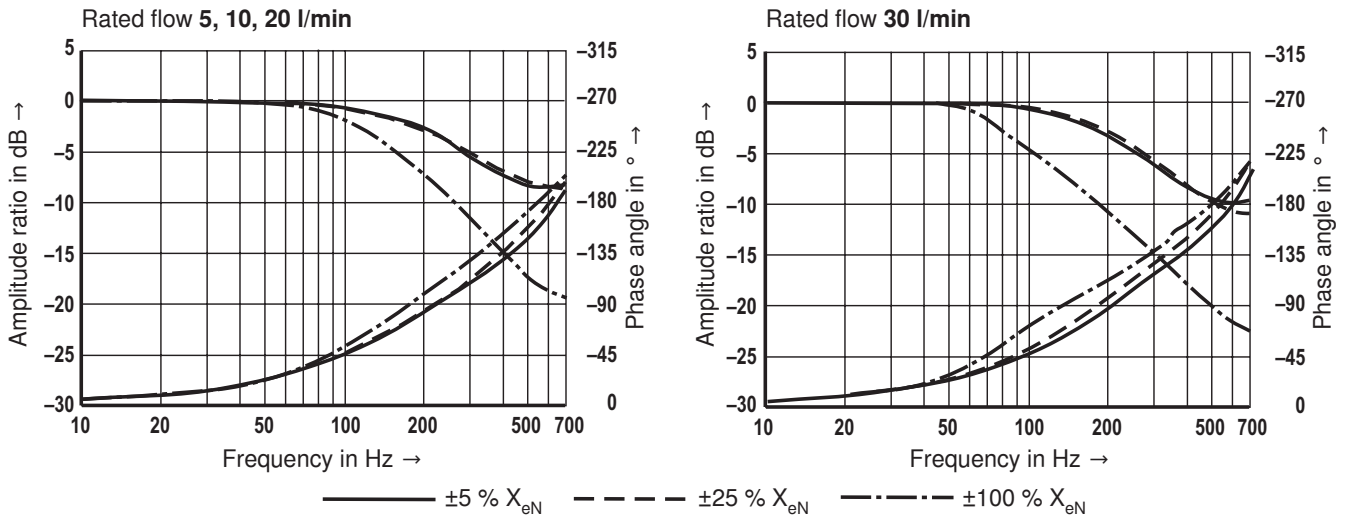


Characteristic curves (measured with HLP 32, $\vartheta_{oil} = 40 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$)

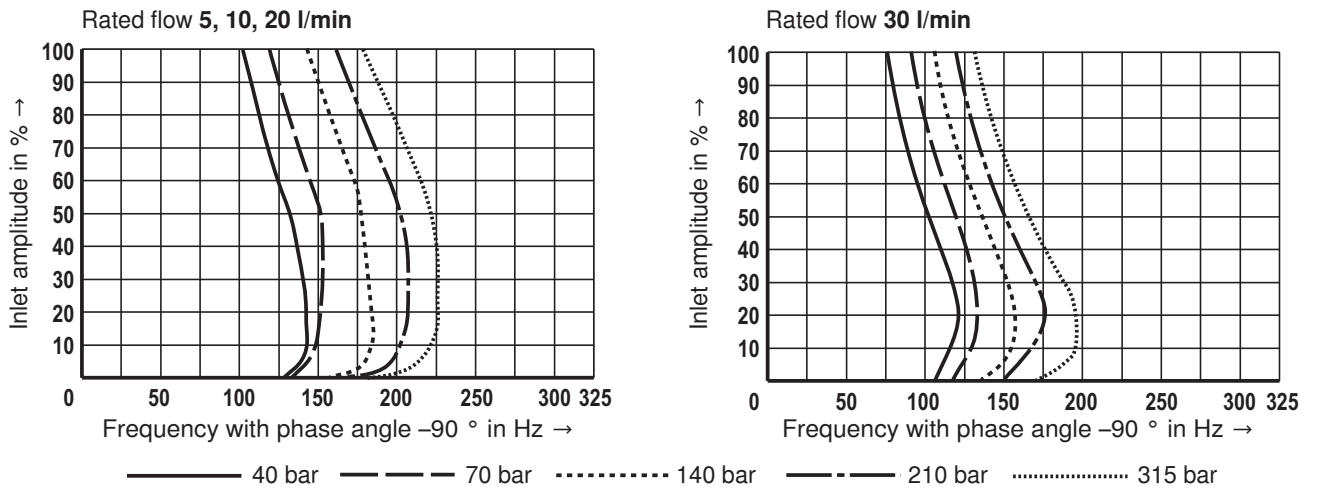
Transition function with pressure rating 315 bar, step response without flow



Frequency response with pressure rating 315 bar, stroke frequency without flow

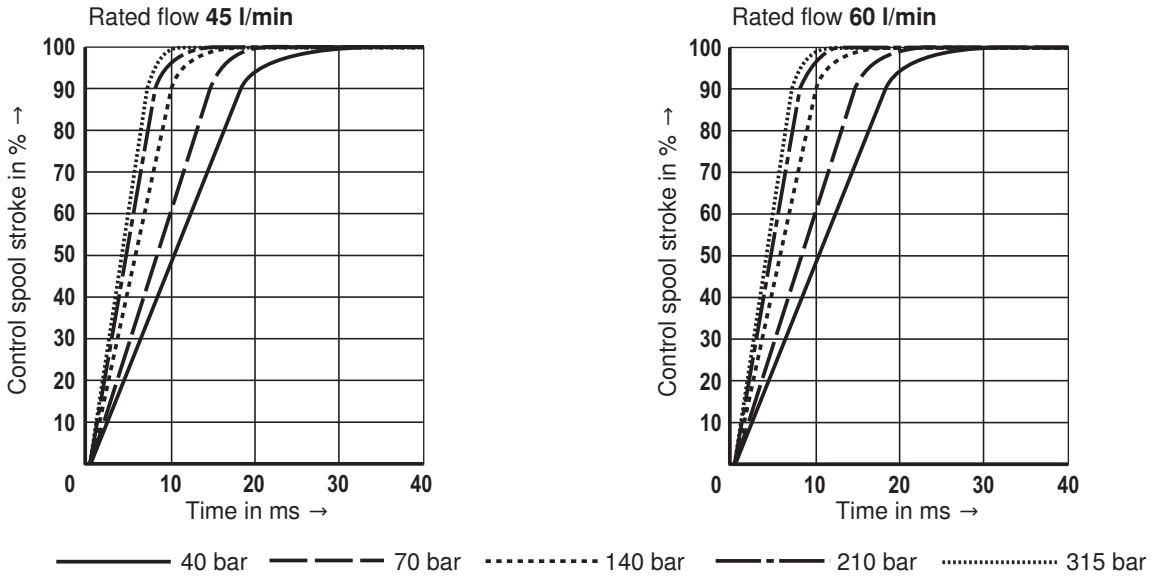


Dependency of the frequency f at -90° on the operating pressure p and the inlet amplitude

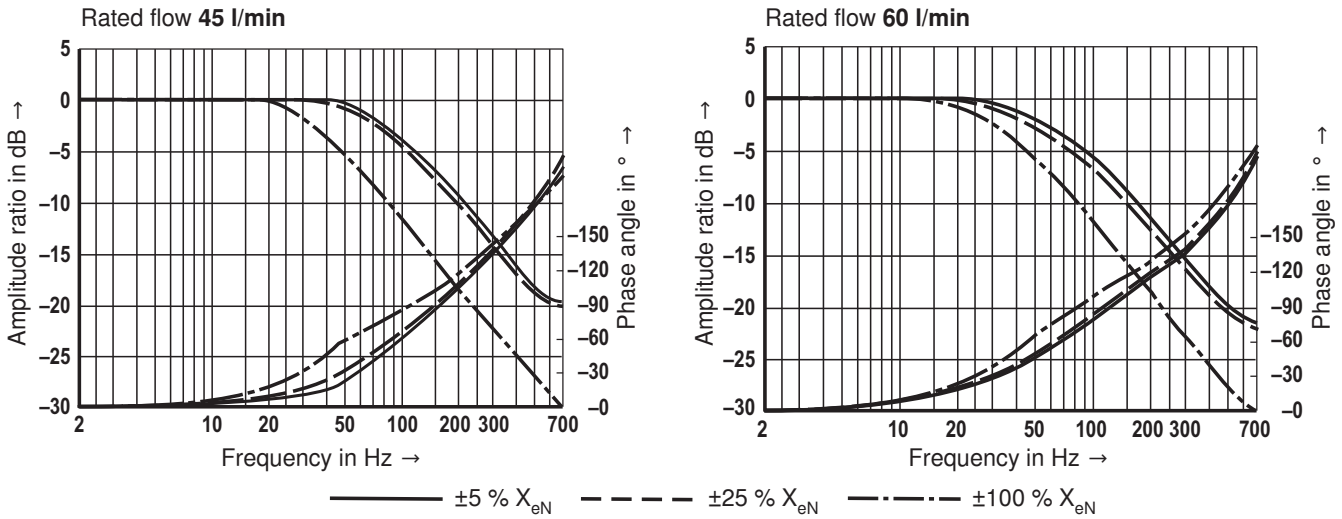


Characteristic curves (measured with HLP 32, $\hat{v}_{oil} = 40 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$)

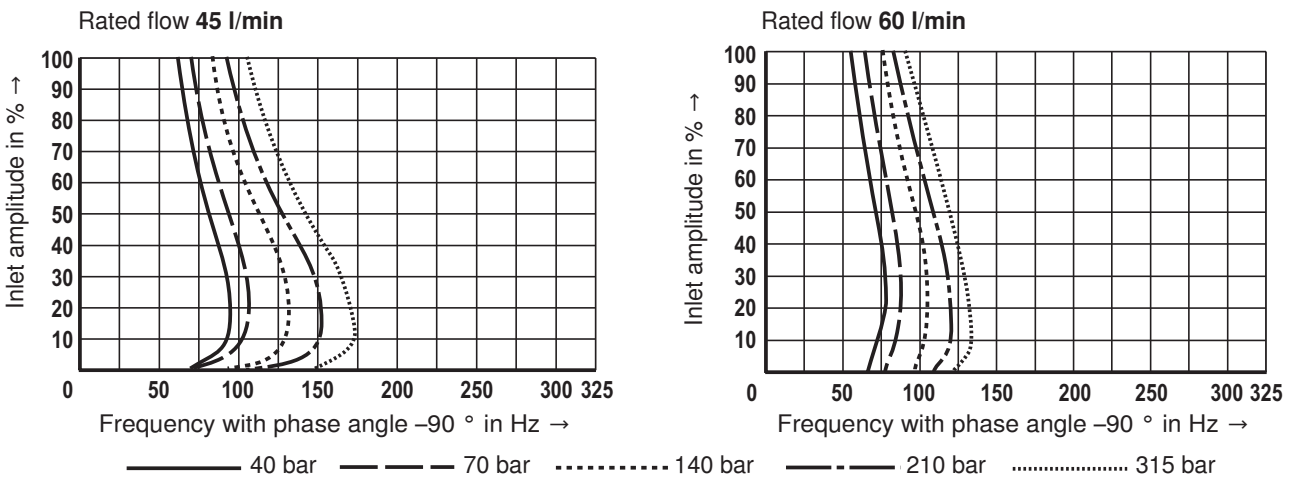
Transition function with pressure rating 315 bar, step response without flow



Frequency response with pressure rating 315 bar, stroke frequency without flow

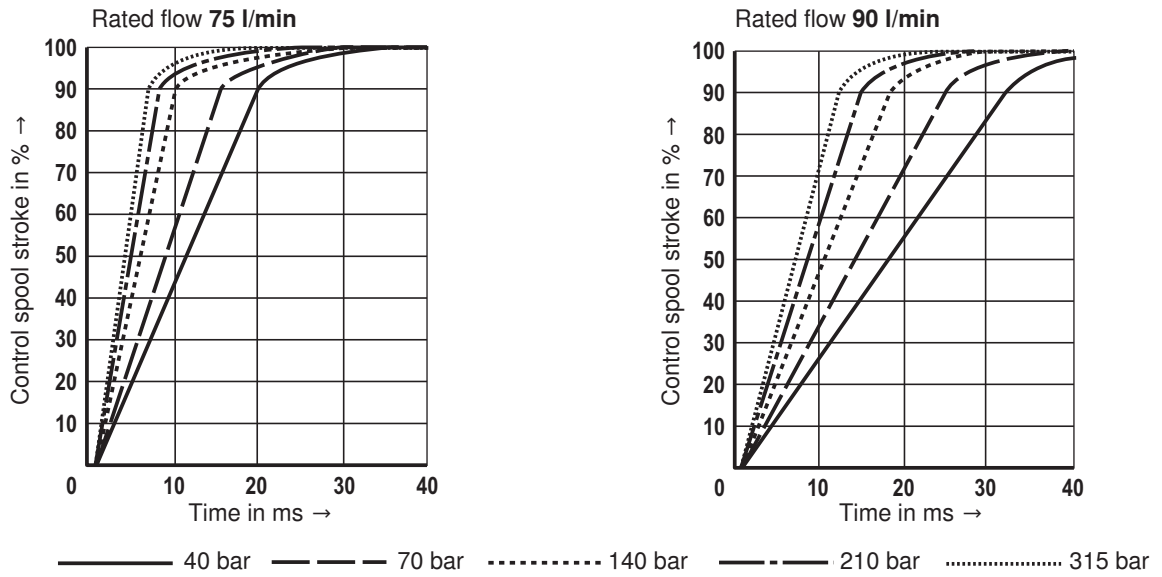


Dependency of the frequency f at -90° on the operating pressure p and the inlet amplitude

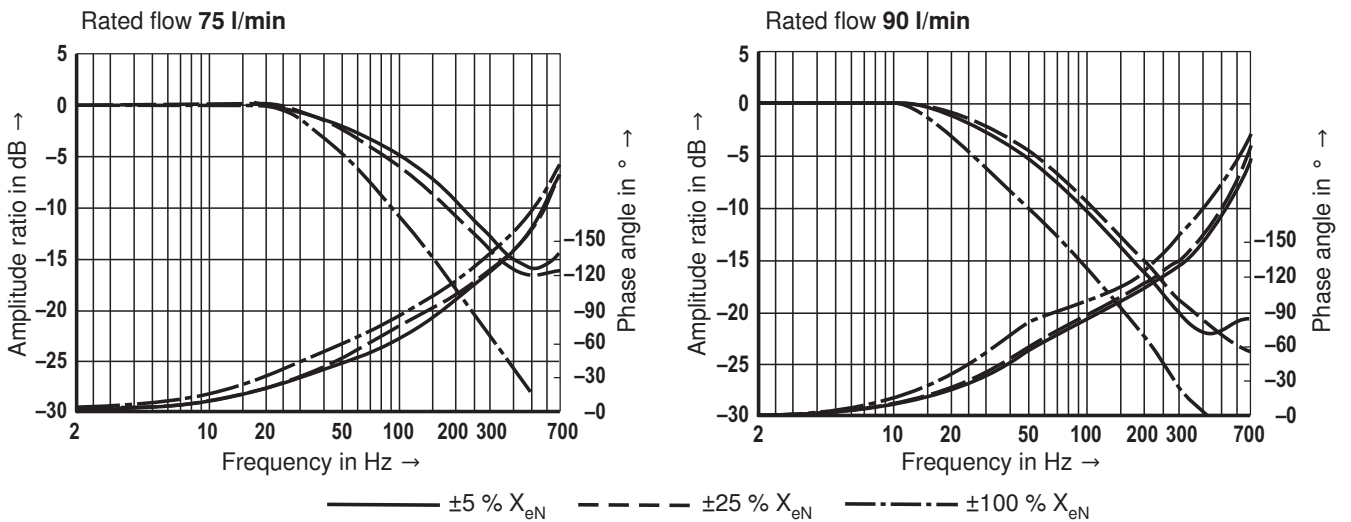


Characteristic curves (measured with HLP 32, $\vartheta_{oil} = 40 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$)

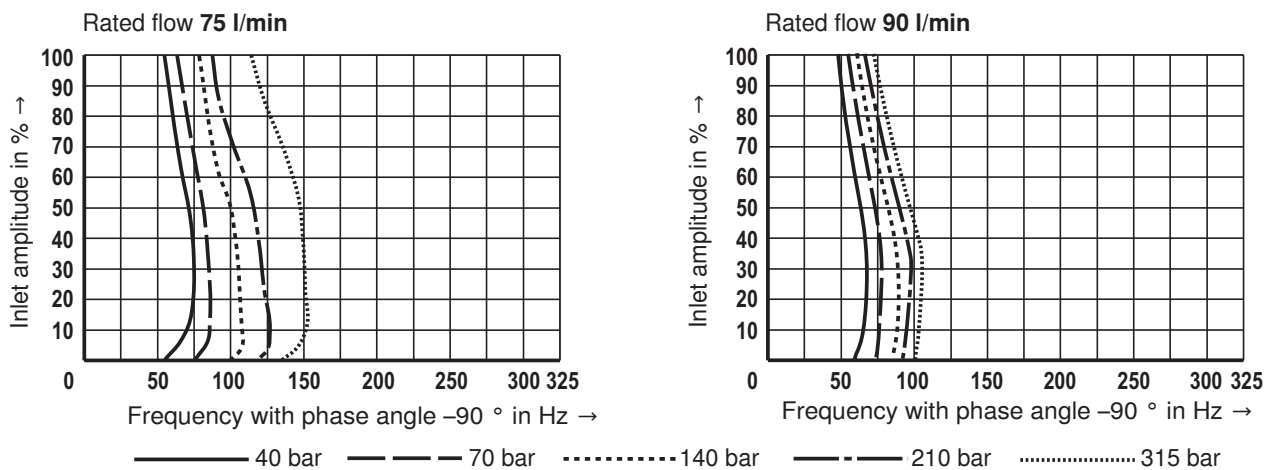
Transition function with pressure rating 315 bar, step response without flow



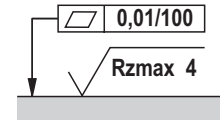
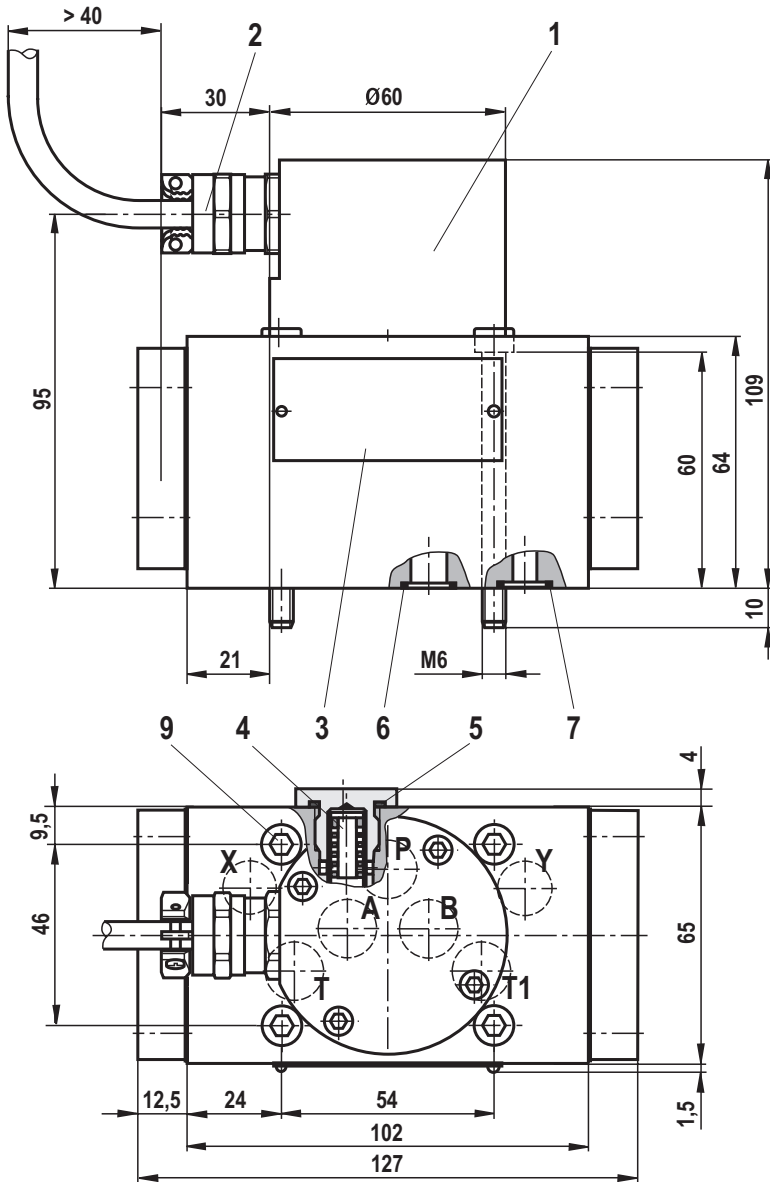
Frequency response with pressure rating 315 bar, stroke frequency without flow



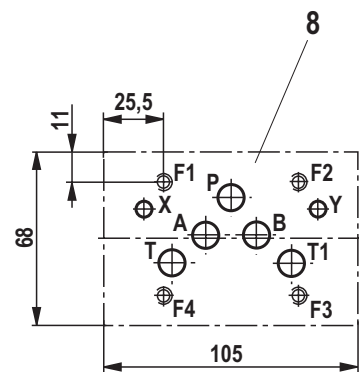
Dependency of the frequency f at -90° on the operating pressure p and the inlet amplitude



Unit dimensions (dimensions in mm)



Required surface quality of the valve mounting face



- 9 Valve mounting screws**
For reasons of stability, exclusively use the following valve mounting screws:
4 hexagon socket head cap screws
ISO 4762-M6x70-10.9-fZn-240h-L
(friction coefficient 0.09 - 0.14 according to VDA 235-101)
(included in the scope of delivery)

- 1 Cap
- 2 Cable gland with cable 3 m long
- 3 Name plate
- 4 Exchangeable filter element
Material no.: **R961001950**
- 5 Profile seal for filter screw 16 x 1.5,
part of item 4
- 6 Identical seal rings for ports P, A, B, T and T1
- 7 Ports X and Y are also pressurized in case of "internal" pilot oil supply and return.
- 8 Machined valve mounting face
Porting pattern according to ISO 4401-05-05-0-05
Port T1 is optional and is recommended for reducing the pressure drop from B → T with rated flows > 45 l/min.

Subplates

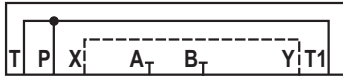
G 66/01 FE/ZN (G3/8)
G 67/01 FE/ZN (G1/2)

with ports X and Y:
G 535/01 FE/ZN (G3/4)
G 535/02 FE/ZN (M27 x 2)
G 536/01 FE/ZN (G1)
G 536/02 FE/ZN (M33 x 2)

with dimensions like in data sheet 45054 (must be ordered separately)

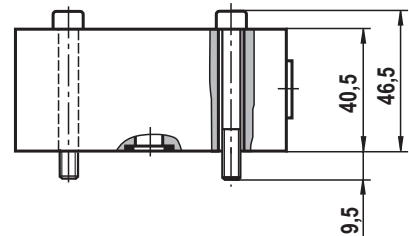
Flushing plate with porting pattern according to ISO 4401-05-05-0-05 (dimensions in mm)

Symbol



Ordering code and more information

- Material number: **R900912450**
- Weight: 2 kg
- Identical seal rings for ports P, A, B, T and T1
- Identical seal rings for ports X and Y
- Mounting screws
For reasons of stability, exclusively use the following mounting screws:
4 hexagon socket head cap screws
ISO 4762-M6x50-10.9-fZn-240h-L
(friction coefficient 0.09 - 0.14 according to VDA 235-101)
(included in the scope of delivery)



Important

Before the assembly, observe the information in the Product-specific instructions 29583-XD5-100-B3, section 3.2.

Notes

Notes

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Notes
