

Directional seated valves type VP 1

zero leakage, intended for general hydraulic applications and grease lubing systems

Flow Q_{\max} = 15 lpm
Operation pressure p_{\max} = 400 bar

Individual valve



Individual valve with connection block for pipe connection



1. General information

The valves type VP 1 are zero leakage, seated cone valves available as 2/2-, 3/2- and 4/2-way directional valves.

The internal pressure balance enables an arbitrary flow direction and maximum pressure for all ports.

The essential internal parts operate maintenance-free in the medium and are hardened and ground.

The actuation is separated from the hydraulic fluid, therefore any interaction between control elements and the pressure fluid is prevented, i.e. a temperature dependant fluid viscosity won't harm the movement of the control elements, side effect is that gumming due to excessive fluid temperature is prevented.

Gumming or sticking caused by higher temperature cannot occur.

The individual manifold mounting valves (2/2- and 3/2-way functions) feature the same connection hole pattern and actuation as the directional valves sizes 1 acc. to D 7300, i.e. all connection blocks and actuators listed there may be utilized.

Main field of application for these valves are lube systems especially when lubricants with high viscosity e.g. oil or grease are used. Any other fluid with similar viscosity may be suited as well, as long as it is compatible with the seal material.

Note: Observe restriction, when outside use is intended. The valve has to be protected from intruding moisture.

2. Available versions, main data

Order examples:

VP 1 - R - D
VP 1 - W - 3/4 - G 24

Table 1: Basic type and size

| | |
|-------------|---|
| VP 1 | Flow Q_{max} = 15 lpm |
| | Oper. pressure p_{max} = depending on actuation |

Table 2: Flow pattern symbols

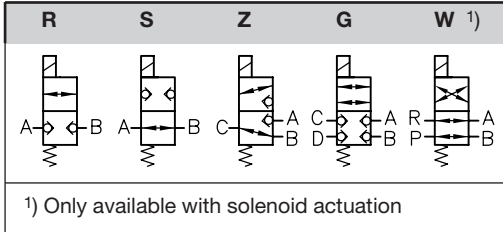


Table 4: Optional connection connection block for direct pipe mounting

| Cod- ing | Ports A, B, C, P, R (ISO 228/1) (BSPP) | Suited for flow pattern symbol | Flow pattern symbols | | | |
|-------------|---|---|----------------------|---|---|---|
| | | | R, S | Z | G | W |
| 1/4 | 1/4 | R, S, Z, G | | | | |
| 3/8 | 3/8 | | | | | |
| 1/2 | 1/2 | R, S, Z | | | | |
| 3/4 | 3/4 | W | | | | |

Note: Valves with flow pattern R, S and Z can be also combined with connections blocks intended for directional seated valves size 1 acc. to D 7300.

Table 3: Actuation modes

| For other voltage, see sect. 2.2.1 | Coding | | | For main data also see section 2.2.1 | Symbols | | |
|---|--|---|---|---|-----------------|-----------|-----------|
| | Central plug (serie) | Central plug with adapter without std. plug | Central plug with adapter with std. plug | | Solenoid | Hydraulic | Pneumatic |
| Solenoid standard $p_{max} = 250$ bar | G 12 G 24 WG 110 ²⁾ WG 230 ²⁾ | A 12 A 24 --- --- | N 12 N 24 --- --- | $U_N = 12V$ DC $U_N = 24V$ DC $U_N = 110V$ AC, 50/60 Hz (98V DC) ²⁾ $U_N = 230V$ AC, 50/60 Hz (205V DC) ²⁾ | | | |
| Solenoid with replaceable coil $p_{max} = 400$ bar | GM 12 GM 24 WGM 110 ¹⁾ WGM 230 ¹⁾ | XM 12 XM 24 XM 98 XM 205 | LM 12 LM 24 --- --- | $U_N = 12V$ DC $U_N = 24V$ DC $U_N = 110V$ AC, 50/60 Hz (98V DC) ²⁾ $U_N = 230V$ AC, 50/60 Hz (205V DC) ²⁾ | | | |
| $p_{max} = 250$ bar | Explosion proof | | | $U_N = 24V$ DC | Manual lever | turn knob | |
| Hydraulic | H | $p_{max} = 400$ bar | | Control pressure: $p_{St min} = 12$ bar $p_{St max} = 700$ bar | | | |
| Pneumatic | P | $p_{max} = 400$ bar | | Control pressure: $p_{St min} = 4$ bar $p_{St max} = 15$ bar | | | |
| Mechanical (roller) | K | $p_{max} = 400$ bar | | Actuation force: 25 ... 28 N | | | |
| Mechanical (pin) | T | $p_{max} = 400$ bar | | Actuation force: 51 ... 57 N | | | |
| Manual (lever) | F | $p_{max} = 400$ bar | | Actuation force: 25 ... 28 N | | | |
| Manual (turn knob) | D | $p_{max} = 400$ bar | | Actuation torque: 63 Ncm | | | |

²⁾ DC-solenoid (98V DC, 205V DC) with bridge rectifier in the plug

2.1 Further parameters

General and hydraulic parameters

| | |
|--------------------|--|
| Nomenclature | 2/2-, 3/2- and 4/2-way directional valve |
| Design | Seated cone valve |
| Mounting and | Manifold mounting, optional via connection block, see dimensional drawings at sect. 3.1 and 3.3 |
| Installed position | Any; Best Vertically with actuation upwards |
| Flow direction | Any, conf. flow pattern symbol in table 2 |
| Over lapping | negative (transverse of one into the other switching position is gradual and only completed when the final position is achieved). All passages are interconnected during the switching operation (3/2-way directional valves). |

| | |
|--------------------------------|--|
| Permissible operation pressure | $p_{max} = 400 \text{ bar}$, All ports are pressure resistant up to p_{max} |
| Static over load capacity | approx. $2 \times p_{max}$ (applies to valves in idle position) |
| Mass (weight) approx. kg | Basic valve complete with actuation: |

| Actuation mode | Sole-noid | Hy-draulic | Pneu-matic | Mechanical (roller) | Manual (pin) | Manual (lever) | Manual (turn knob) |
|----------------------|-----------|------------|------------|---------------------|--------------|----------------|--------------------|
| Flow pattern symbols | R, S, Z | 0.7 | 0.5 | 0.4 | 0.4 | 0.4 | 0.4 |
| | G | 1.0 | 0.8 | 0.7 | 0.7 | 0.7 | 0.7 |
| | W | 1.0 | --- | --- | --- | --- | --- |

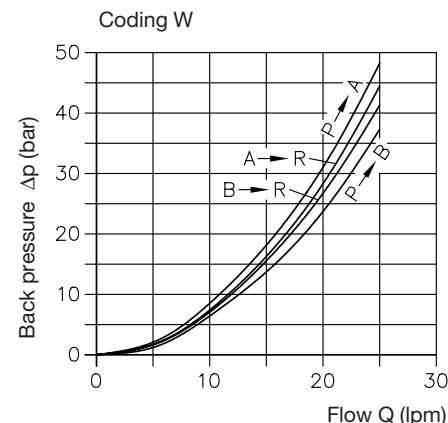
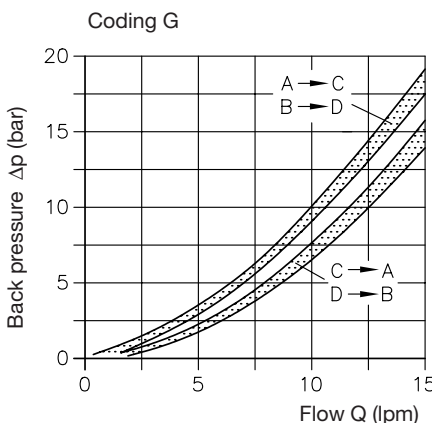
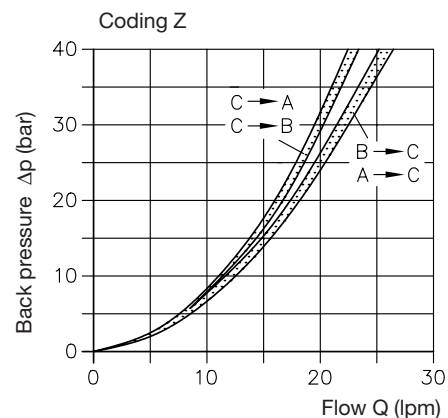
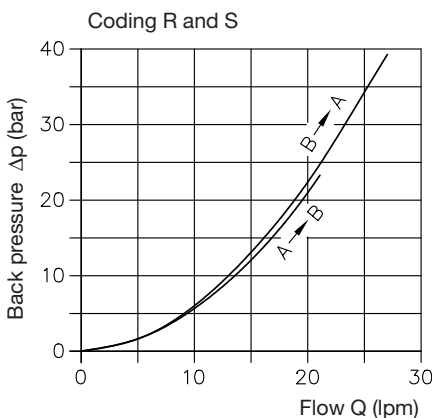
Connection block (without valve):
 Coding 1/4 = 0.5
 3/8 = 0.5
 1/2 = 1.0
 3/4 = 1.2

| | |
|------------------|---|
| Permissible flow | $Q_{max} = 15 \text{ lpm}$; Observe the area ratio with double acting consumers (differential cylinders) as the reflow might be higher than the inflow. |
| Pressure fluid | Hydraulic oil conf. DIN 51524 part 1 to 3: ISO VG 10 to 68 conf. DIN 51519 Viscosity limits: min. approx. 4, max. approx. 800 mm^2/s Optimal operation: approx. 10 ... 200 mm^2/s Also suitable for biological degradable pressure fluids types HEPG (Polyalkylenglycol) and HEES (Synth. Ester) at service temperatures up to approx. +70°C Grease, based on mineral or synthetic oils, with NLGI-classification 000 ... 2 acc. to DIN 51818 up to operation temperature of approx. +70°C. |

Temperature Ambient: approx. -40...+80°C; Fluid: -25...+80°C, pay attention to the viscosity range!
 Start temperature down to -40°C are allowable (Pay attention to the viscosity range during start!), as long as the operation temperature during subsequent running is at least 20K higher.
 Biological degradable pressure fluids: Pay attention to manufacturer's information. With regard to the compatibility with sealing materials do not exceed +70°C.

Restrictions for version with ex-proof solenoid!

Δp -Q curves (guideline)



Fluid viscosity during tests approx.. 60 mm^2/s

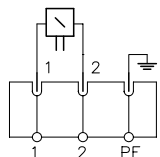
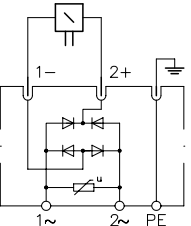

2.2 Actuation modes

2.2.1 Solenoid actuation (standard)

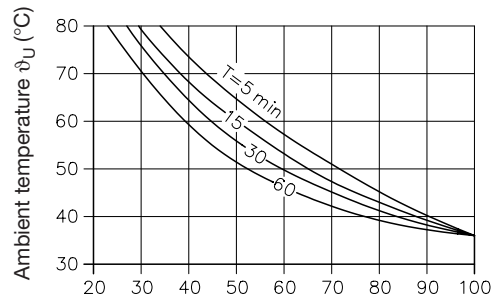
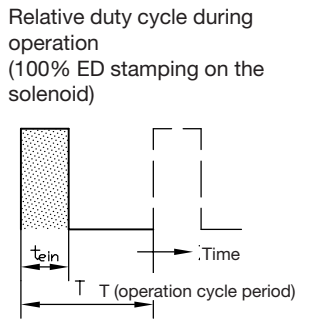
All solenoids are manufactured and tested conforming DIN VDE 0580.

| | | | | | | | | | |
|-------------------------|------------------------------|------------------------------|-------------------------|-------------------------|-----------------------|----------------------|--------------------------|----------------------|--------------------------|
| Coding | G 12 A 12 N 12 L 12 | G 24 A 24 N 24 L 24 | GM 12 XM 12 LM 12 | GM 24 XM 24 LM 24 | G 24 EX --- --- | WG 110 --- --- | WGM 110 1) --- --- | WG 230 --- --- | WGM 230 1) --- --- |
| Nom. voltage U_N | 12V DC | 24V DC | 12V DC | 24V DC | 24V DC | 110V DC | 110V AC (50/60 Hz) | 230V AC | 230V AC (50/60 Hz) |
| Nominal power P_N (W) | 20 | 20 | 26.2 | 26 | 23 | 28.6 | 20 | 30.2 | 20 |
| Current I_N (A) | 1.7 | 0.83 | 2.2 | 1.1 | 0.9 | 0.2 | 0.2 | 0.1 | 0.1 |

Note: The electric data for G and WG solenoids are only guideline and may very slightly depend on manufacture.

| | |
|---|--|
| Plugs and circuitry | <p>DC-voltage Coding G...</p>  <p>AC-voltage Coding WG..</p>  <p>Terminal at the solenoid</p>  <p>The given device sockets are automatically contained in the valve coding. For other plugs e.g. with clamp diode, economy circuits or LED's, see D 7163.</p> |
| Hirschmann plug MSD 1(G..) Adaptor + plug A MSD 1-MSD 3 + MSD 4-209 P10 | |

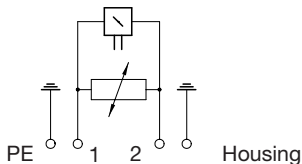
| | |
|---|---|
| Switching time (reference value) | On: approx. 100 ms, Off: 50 ms (G..) and 125 ms (WG..) |
| Switching/hour | approx. 2000, approximately evenly distributed |
| Protection class G.., A.., N.., L..: GM.., XM.., LM..: G..EX: | IP 54 acc. to IEC 60529 (plug properly mounted) IP 65 acc. to IEC 60529 (plug properly mounted) IP 67 acc. to IEC 60529 with explosion-proof solenoid |
| Insulation material class | F |
| Contact temperature | approx. 98°C, with ambient temperature 20°C |
| Switch-off energy | 0.24 Ws (max. guideline figure + approx. 10% acc. to measurements at U_N and 20°C) |
| Relative duty cycle | 100% ED (stamping on the solenoid), but observe the max. duty cycle ! |



Curves in the margin apply only to non neighboring valves!
Loovers should be provided when these valves are installed in control cabinets!
General rule for valve banks and ambient temperature above 40°C: It is advisable to locate at least one unactuated valve between valves actuated simultaneously or for longer periods. Otherwise neighboring valves would hinder heat dissipation and heat each other up.

Relative duty cycle

$$tr = \frac{t_{on}}{T} \cdot 100 (\%ED)$$



Note:

Only 40% ED are permissible if the valves are neighboring, it is additionally recommended that neighboring valves are not actuated simultaneously.

Electrical data for explosion-proof solenoids

| | |
|--------------------------------|--|
| ATEX-Certificate of conformity | TÜV-A-03 ATEX 0017 X |
| Coding | ⊕ II 2 G Ex d IIB + H2 T4 ⊕ II 2 D Ex mbD 21 T135°C |
| Oper. duration | 100% ED |
| Duty cycle | IP 67 (IEC 60529) |
| Nom. voltage U_N | 24 V DC |
| Power P_N | 23 W |

Restrictions for use:

| | |
|---|--|
| Ambient temperature | -35 ... +40°C |
| max. fluid temperature | +70°C |
| el. protection against overload (conf. IEC 60127) | $I_F < 1.6 \cdot A \cdot T$ |
| Surface coating | Housing galvanically zinc coated Coil and connection cavity are moulded |
| Electrical connection | 3x0.5 mm ² |
| Cable length | 3 m, option 10 m (cable ÖLFLEX-440P ® Co. LAPP, D-70565 Stuttgart) |

1) Only with adaptor, see sect. 2, table 2.

Attention: Protect the complete valve against direct sun light.

Observe the operation manuals B 03/2004 and B ATEX!
Electrical lay-out and testing conforming EN 60079-0, VDE 0170-1, VDE 0170-5

Special voltage

The table below lists all voltage available incl. the one listed on page 2.

Examples: VP1 - R - G 48
 VP 1 - Z - X 110
 VP 1 - W - WG 200

The specified power ratings are only guide line figures, they may vary slightly depending on voltage and manufacturer.
 The cold current can be calculated: $I_{20} = P_N/U_N$ (see examples)

Voltage specification

| DC (ΔU_N [V]) | | AC 50/60 Hz | | Explosion proof version |
|---------------------------|--------------------|------------------|------------------|-------------------------------|
| $P \approx 20$ W | $P \approx 26,5$ W | $P \approx 20$ W | $P \approx 28$ W | $P \approx 23$ W |
| G 12 | GM 12 | | | |
| G 24 | GM 24 | WG 24 | WGM 24 | G 24 EX |
| G 36 | GM 36 | WG 42 | WGM 42 | |
| G 42 | GM 42 | WG 48 | WGM 48 | |
| G 48 | GM 48 | | | |
| G 80 | GM 80 | | | |
| G 98 | GM 98 | WG 110 | WGM 110 | |
| G 110 | GM 110 | | | |
| G 125 | | | | |
| G 185 | | WG 200 | | |
| G 205 | GM 205 | WG 230 | WGM 230 | |
| G 220 | GM 230 | | | |

Notes to the lay-out:

DC-voltage:
 The voltage specification (solenoid lay-out) shall correspond to the actual supply voltage (perm. tolerance $\pm 5...10\%$).

A reduced voltage leads to reduced solenoid force, an exceeded voltage causes an unpermissible solenoid heat built-up.

AC-voltage:
 The voltage specification shall correspond to the actual supply voltage (50/60 Hz).
 The solenoid DC-voltage is approx. $0.9 U_{AC}-2V$ because of the utilized rectifier plug.
 The table above lists the corresponding DC-solenoids for various AC supply voltage (e.g. for 110V AC 50 Hz, solenoid with $U_N = 98V$ DC Δ stamping on the solenoid!).

2.2.2 Further actuation modes

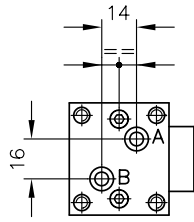
| | | |
|------------------|------------------|--|
| Hydraulic | (coding H) | <p>The actuation element is a single acting control piston with spring return. The switching position is maintained as long as the control pressure is applied. The valve will return automatically to its idle position (0) when the control pressure is removed. The control piston is sealed and shows zero leakage.</p> <p>Means of control Oil Control pressure max = 700 bar min = 12 bar Control displacement 0,4 cm³ Temperature -40 ... +80°C (ambient and control fluid)</p> |
| Pneumatic | (coding P) | <p>The actuation element is a single acting control piston with spring return. The switching position is maintained as long as the control pressure is applied. The valve will return automatically to its idle position 0 when the control pressure is removed. The control piston is sealed and shows zero leakage.</p> <p>Means of control Compressed air, lubed and filtered Control pressure max =15 bar min = 4 bar Control displacement 1,0 cm³ Temperature -20 ... +70°C (ambient and compressed air)</p> |
| Mechanic | (coding K and T) | <p>The actuation element is a pin with spring return. This pin is either directly actuated or via lever with roller following a cam. Switching position a of the valve is achieved when the pin is pressed down (see dimensional drawing sect. 3.2).</p> <p>Actuation force = 25 ... 28 N (coding K) = 51 ... 57 N (coding T) Actuation travel see dimensional drawing sect. 3.2</p> |
| Manual | (coding F) | <p>The actuation element is a lever acting on a pin with spring return. Switching position a of the valve is achieved when the pin is pressed down.</p> <p>Actuation force = 25 ... 28 N Actuation travel see dimensional drawing sect. 3.2</p> |
| | (coding D) | <p>Actuation with detent. The achieved switching position a or 0 changes with every 90° turn, no matter of the rotation direction.</p> <p>Actuation torque = 63 Ncm Actuation travel see dimensional drawing sect. 3.2</p> |

3. Unit dimensions

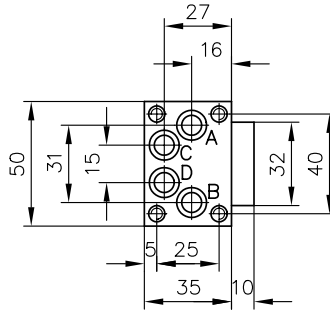
All dimensions in mm, subject to change without notice !

3.1 Valve (illustration with solenoid actuation)

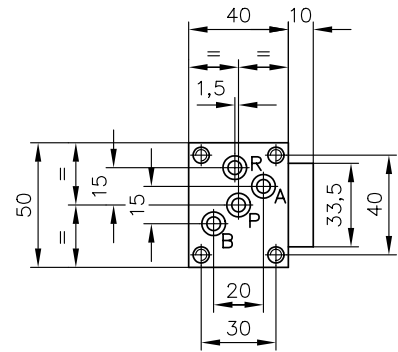
Symbol R and S



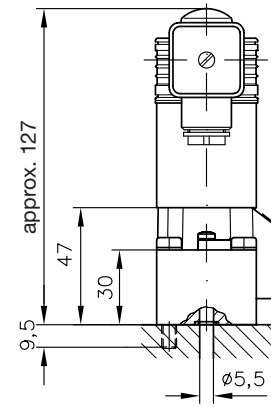
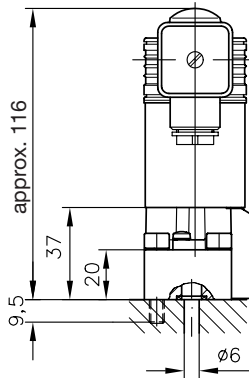
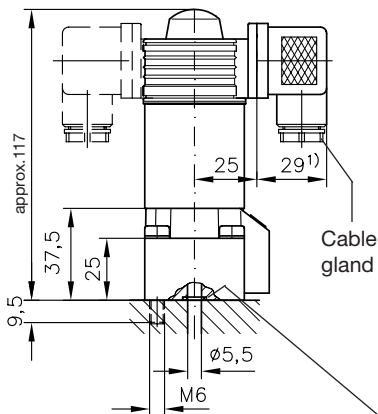
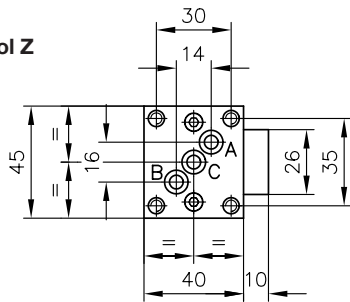
Symbol G



Symbol W



Symbol Z

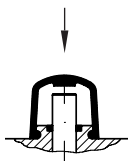


Sealing of the ports:

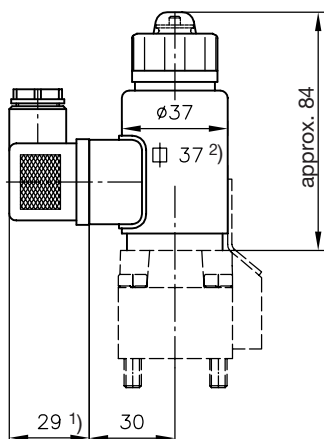
- Coding R, S and Z: A, B and C = O-ring 6.07x1.78 NBR 90 Sh
- Coding G: A, B, C and D = O-ring 8.73x1.78 NBR 90 Sh
- Coding W: A, B, R and P = O-ring 6.07x1.78 NBR 90 Sh

Manual emergency actuation

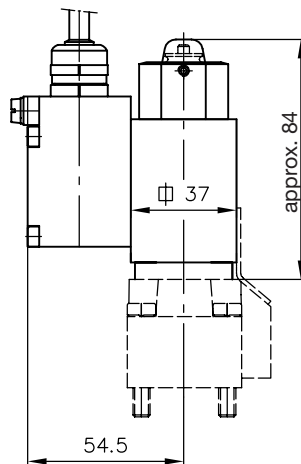
Press down the solenoid pin hidden under the rubber cap, max. actuation force 80 (N)



Versions with replaceable coil



Explosion-proof solenoid

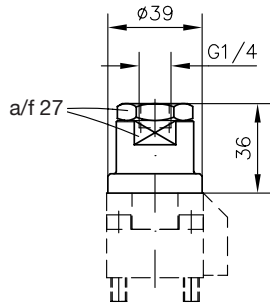


1) This dimension depends on the manufacturer and may be up to 11 mm longer acc. to DIN EN 175 301-803 A.

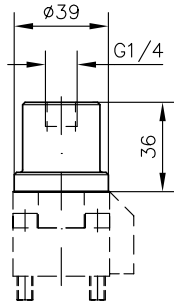
2) With symbole „W“

3.2 Further actuation modes

Coding H

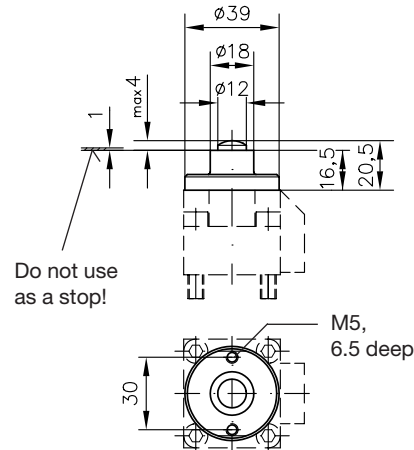


Coding P

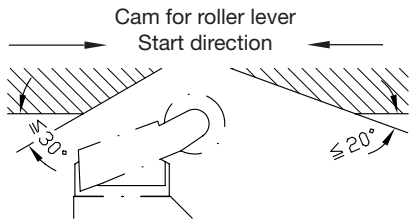
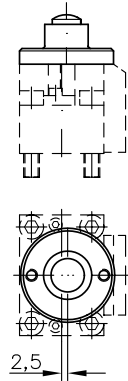


Coding T

Arrangement with flow pattern R, S and Z

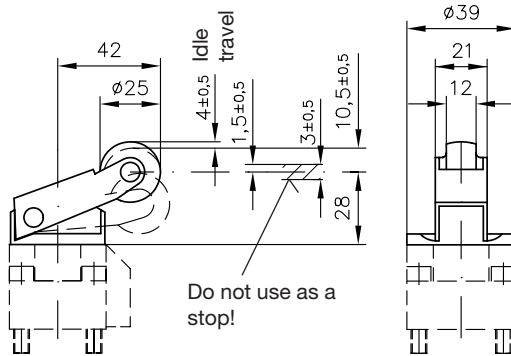


Arrangement with flow pattern G and W

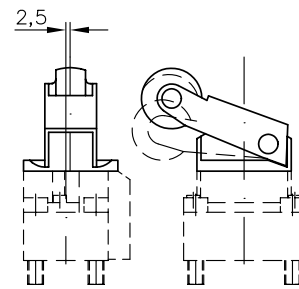


Coding K

Arrangement with flow pattern R, S and Z

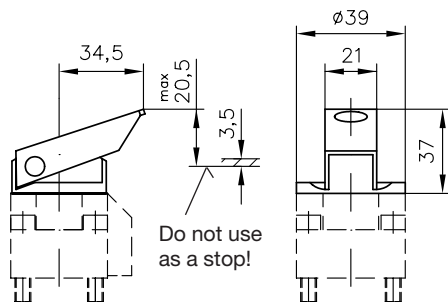


Arrangement with flow pattern G and W

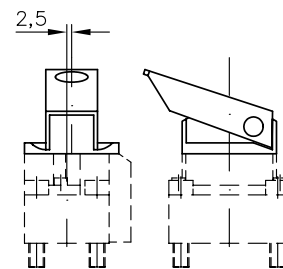


Coding F

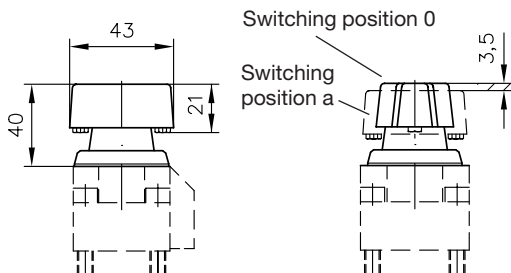
Arrangement with flow pattern R, S and Z



Arrangement with flow pattern G and W

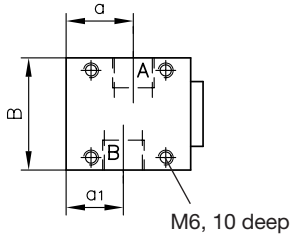


Coding D

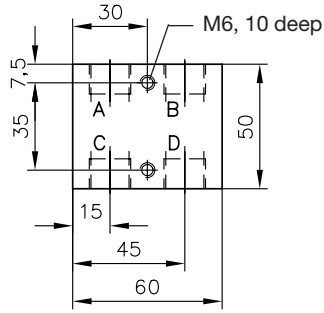


3.3 Connection blocks

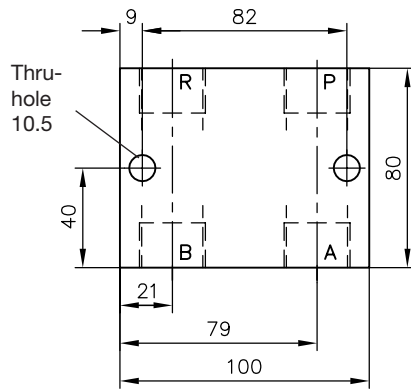
Type VP 1- R(S) - 1/4
 VP 1- R(S) - 3/8
 VP 1- R(S) - 1/2



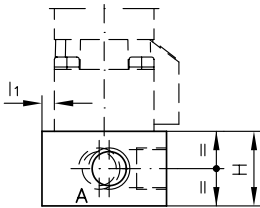
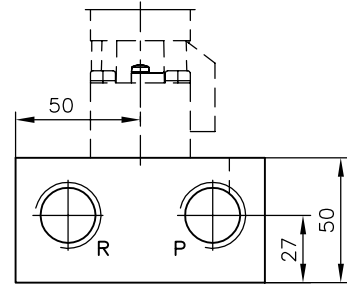
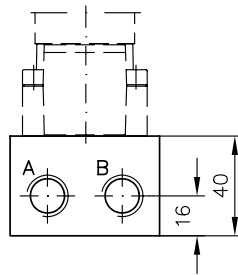
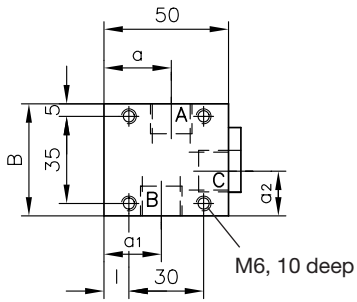
Type VP 1- G - 1/4
 VP 1- G - 3/8



Type VP 1- W - 3/4



Type VP 1- Z - 1/4
 VP 1- Z - 3/8
 VP 1- Z - 1/2



| Type | Ports A, B, C, P, R conforming ISO 228/1: (BSPP) | H | B | a | a1 | a2 | l | l1 |
|-----------------|--|----|----|----|----|----|----|----|
| VP1-R(S, Z)-1/4 | G 1/4 | 30 | 45 | 29 | 21 | 20 | 10 | 5 |
| VP1-R(S, Z)-3/8 | G 3/8 | 30 | 45 | 27 | 23 | 18 | 10 | 5 |
| VP1-R(S)-1/2 | G 1/2 | 45 | 50 | 25 | 25 | -- | 10 | 5 |
| VP1-Z-1/2 | G 1/2 | 45 | 50 | 20 | 20 | 25 | 5 | -- |