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 actuations 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

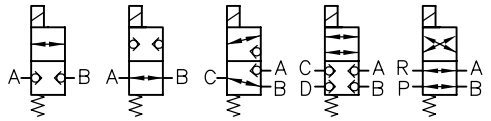
Order examples:

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

Table 1: Basic type and size

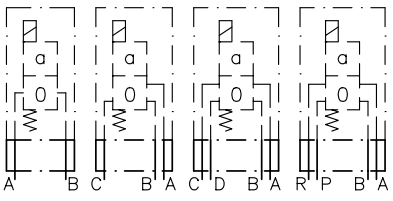
VP 1	Flow Q_{max}	= 15 lpm
	Oper. pressure p_{max}	= depending on actuation

Table 2: Flow pattern symbols

R	S	Z	G	W [1]
				

[1]) Only available with solenoid actuation

Table 4: Optional connection connection block for direct pipe mounting

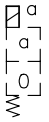
Coding	Ports A, B, C, P, R (ISO 228/1) (BSPP)	Suited for flow pattern symbol	Flow pattern symbols R, S Z G W
1/4	1/4	R, S, Z, G	
3/8	3/8		
1/2	1/2	R, S, Z	
3/4	3/4	W	

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: Central plug (serie)	Central plug with adapter without std. plug	Central plug with adapter with std. plug	For main data also see section 2.2.1
Solenoid standard p_{max} = 250 bar	**G 12**	**A 12**	**N 12**	U_N = 12V DC
	G 24	**A 24**	**N 24**	U_N = 24V DC
	WG 110 [2])	---	---	U_N = 110V AC, 50/60 Hz (98V DC) [2])
	WG 230 [2])	---	---	U_N = 230V AC, 50/60 Hz (205V DC) [2])
	coil with std. plug	coil without std. plug	coil with std. plug and LED	
Solenoid with replaceable coil p_{max} = 400 bar	**GM 12**	**XM 12**	**LM 12**	U_N = 12V DC
	GM 24	**XM 24**	**LM 24**	U_N = 24V DC
	WGM 110 [1])	**XM 98**	---	U_N = 110V AC, 50/60 Hz (98V DC) [2])
	WGM 230 [1])	**XM 205**	---	U_N = 230V AC, 50/60 Hz (205V DC) [2])
	Explosion proof			
p_{max} = 250 bar	**G 24 EX**			U_N = 24V DC
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

Symbols

Solenoid 

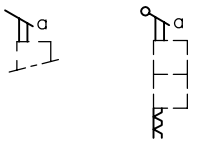
Hydraulic Pneumatic

Mechanical

roller pin

Manual

lever turn knob



[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 bar, All ports are pressure resistant up to p_{max}
Static over load capacity	approx. 2 x p_{max} (applies to valves in idle position)

Mass (weight) approx. kg

Basic valve complete with actuation:

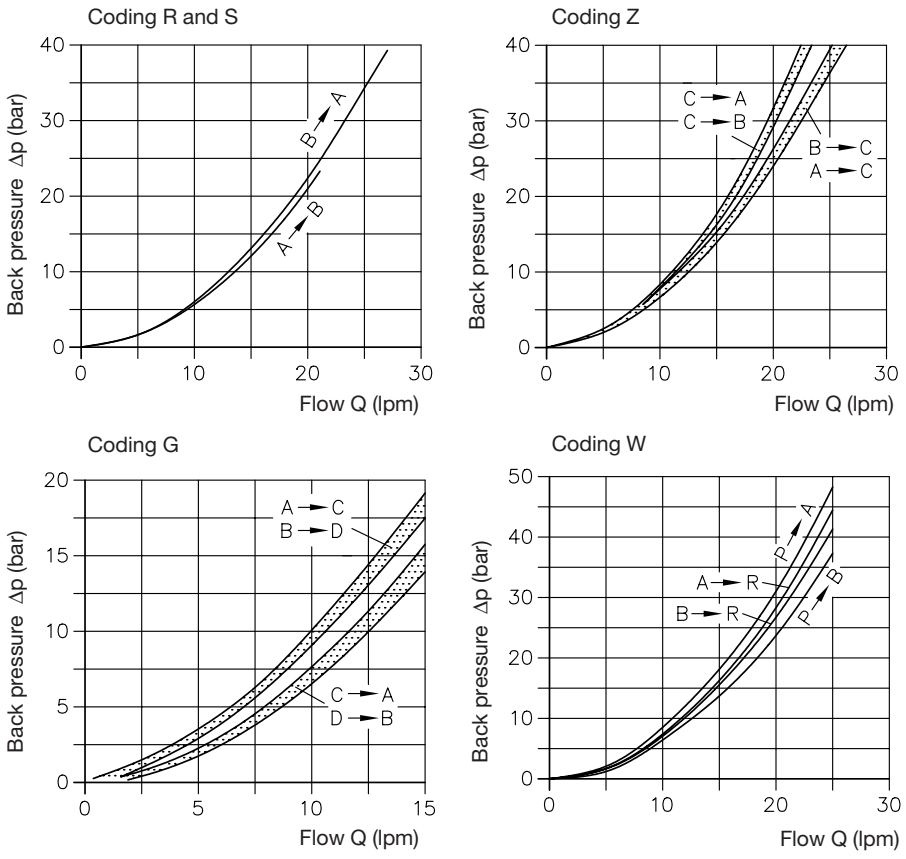
Actuation mode		Sole-noid	Hy-draulic	Pneu-matic	Mechanical (roller)	Mechanical (pin)	Manual (lever)	Manual (turn knob)
Flow pattern symbols	R, S, Z	0.7	0.5	0.4	0.4	0.4	0.4	0.4
	G	1.0	0.8	0.7	0.7	0.7	0.7	0.7
	W	1.0	---	---	---	---	---	---

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 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 mm²/s Optimal operation: approx. 10 ... 200 mm²/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 mm²/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.

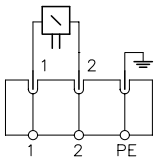
Plugs and circuitry

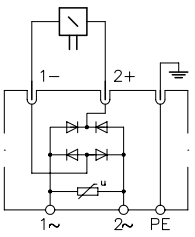
Hirschmann plug MSD 1(G..)

Adaptor + plug A
MSD 1-MSD 3 + MSD 4-209 P10

DC-voltage
Coding G...

AC-voltage
Coding WG..



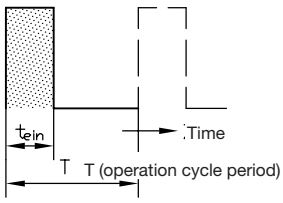


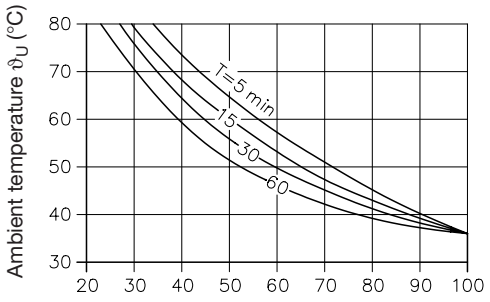
Terminal at the solenoid

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.

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 !

Relative duty cycle during operation
(100% ED stamping on the solenoid)

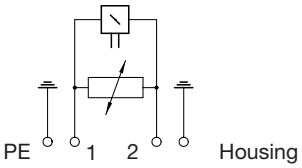




Curves in the margin apply only to non neighboring valves!
Loovers should be provided when these valves are installed in control cabinets! General rule for valve banks and ambient temperature above 40°C: It is advisable to locate at least one unactuated valve between valves actuated simultaneously or 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	Ⓔx II 2 G Ex d IIB + H2 T4 Ⓔx 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-A-T
Surface coating	Housing galvanically zinc coated Coil and connection cavity are moulded
Electrical connection	3x0.5 mm²
Cable length	3 m, option 10 m (cable ÖLFLEX-440P ® Co. LAPP, D-70565 Stuttgart)

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

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

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 (≙ U_N [V]) P ≈ 20 W	P ≈ 26,5 W	AC 50/60 Hz P ≈ 20 W	P ≈ 28 W	Explosion proof version P ≈ 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 ± 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 ≙ stamping on the solenoid!).

2.2.2 Further actuation modes

Hydraulic (coding H)

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.

Means of control	Oil
Control pressure	max = 700 bar min = 12 bar
Control displacement	0.4 cm^3
Temperature	-40 ... +80°C (ambient and control fluid)

Pneumatic (coding 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.

Means of control	Compessed air, lubed and filtered
Control pressure	max =15 bar min = 4 bar
Control displacement	1.0 cm^3
Temperature	-20 ... +70°C (ambient and compressed air)

Mechanic (coding K and T)

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).

Actuation force	= 25 ... 28 N (coding K) = 51 ... 57 N (coding T)
Actuation travel	see dimensional drawing sect. 3.2

Manual (coding F)

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.

Actuation force	= 25 ... 28 N
Actuation travel	see dimensional drawing sect. 3.2

(coding D)

Actuation with detent. The achieved switching position a or 0 changes with every 90° turn, no matter of the rotation direction.

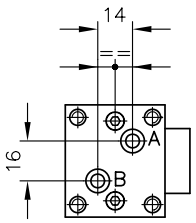
Actuation torque	= 63 Ncm
Actuation travel	see dimensional drawing sect. 3.2

3. Unit dimensions

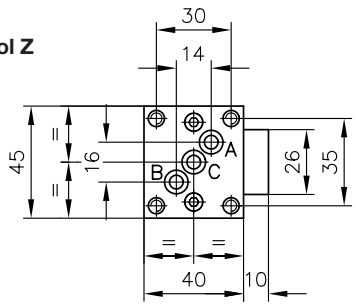
All dimensions in mm, subject to change without notice !

3.1 Valve (illustration with solenoid actuation)

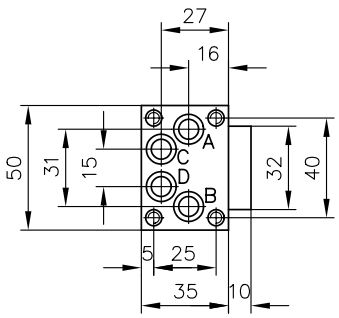
Symbol R and S



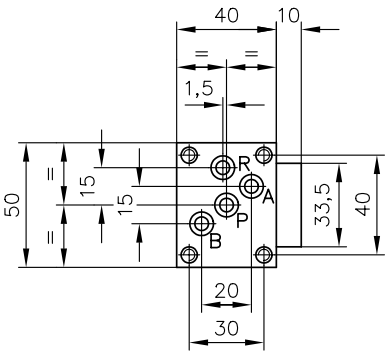
Symbol Z

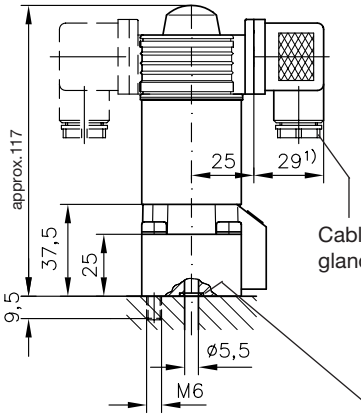


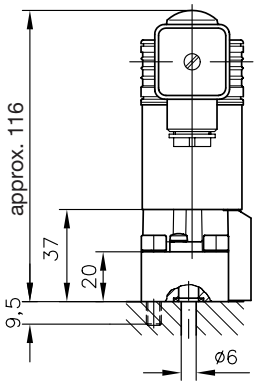
Symbol G

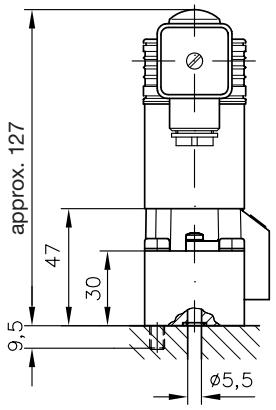


Symbol W







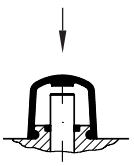


Sealing of the ports:

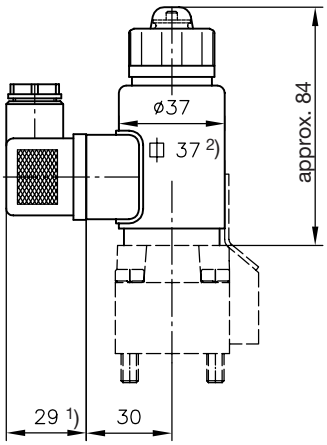
Coding R, S and Z:	A, B and C	= O-ring 6.07x1.78 NBR 90 Sh
Coding G:	A, B, C and D	= O-ring 8.73x1.78 NBR 90 Sh
Coding W:	A, B, R and P	= O-ring 6.07x1.78 NBR 90 Sh

Manual emergency actuation

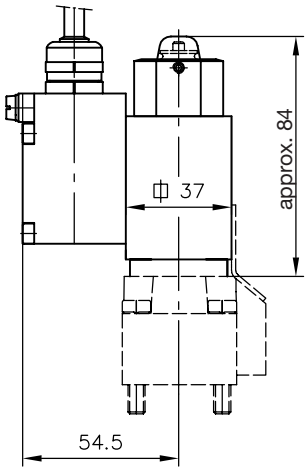
Press down the solenoid pin hidden under the rubber cap, max. actuation force 80 (N)



Versions with replaceable coil



Explosion-proof solenoid

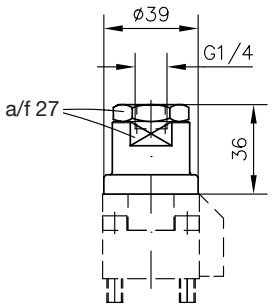


1) This dimension depends on the manufacturer and may be up to 11 mm longer acc. to DIN EN 175 301-803 A.

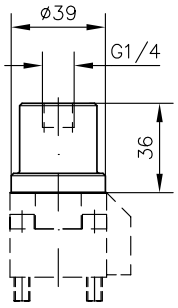
2) With symbole „W“

3.2 Further actuation modes

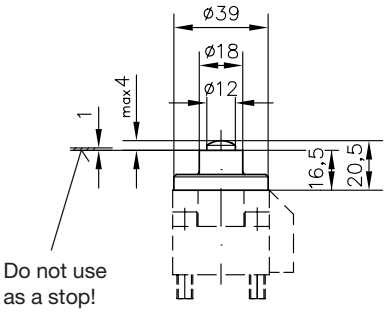
Coding H



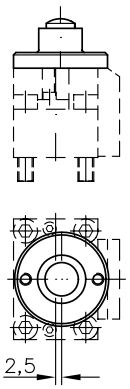
Coding P

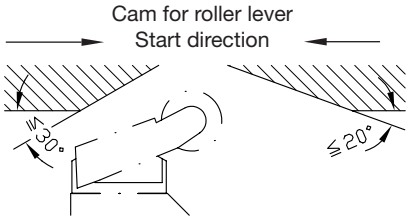


Coding T
Arrangement with flow pattern R, S and Z

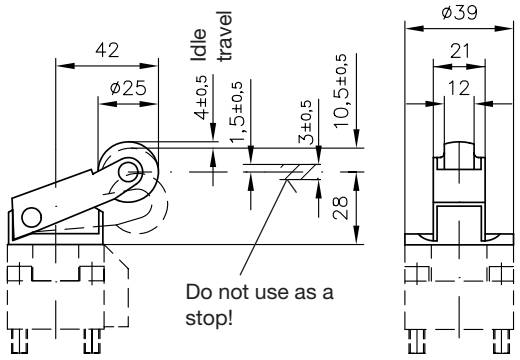


Arrangement with flow pattern G and W

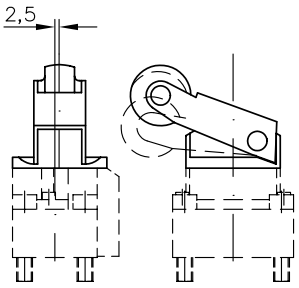




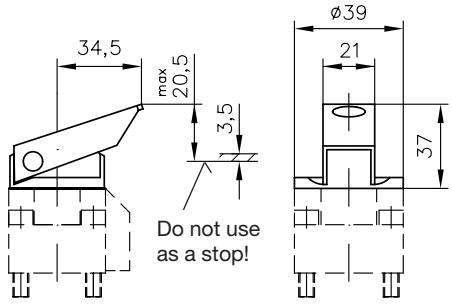
Coding K
Arrangement with flow pattern R, S and Z



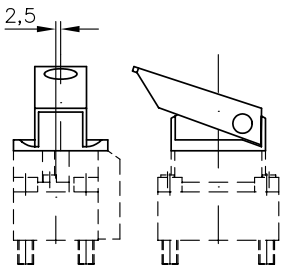
Arrangement with flow pattern G and W



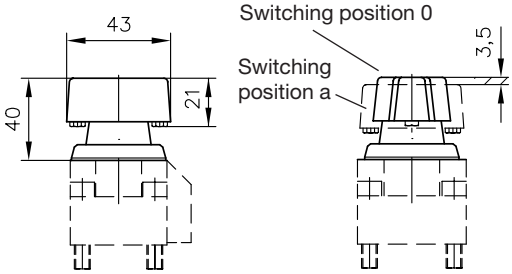
Coding F
Arrangement with flow pattern R, S and Z



Arrangement with flow pattern G and W

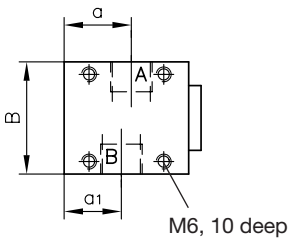


Coding D

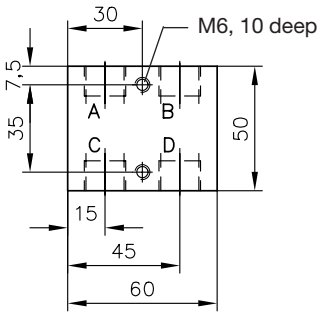


3.3 Connection blocks

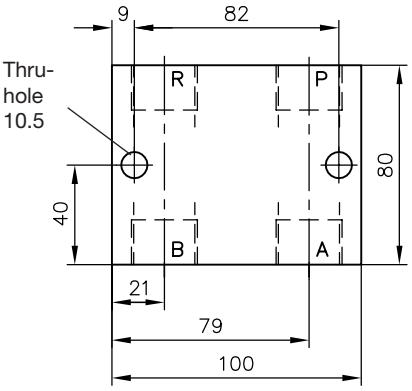
Type VP 1- R(S) - 1/4
VP 1- R(S) - 3/8
VP 1- R(S) - 1/2



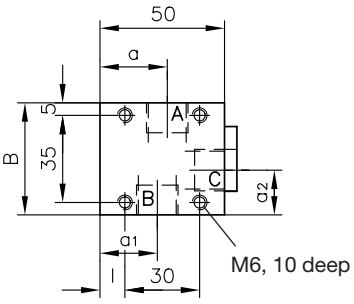
Type VP 1- G - 1/4
VP 1- G - 3/8

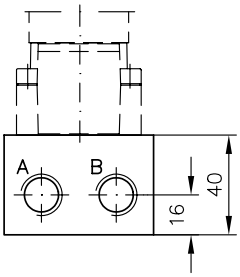


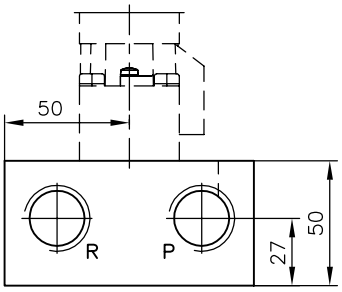
Type VP 1- W - 3/4

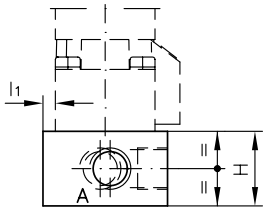


Type VP 1- Z - 1/4
VP 1- Z - 3/8
VP 1- Z - 1/2









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	--