

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

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.

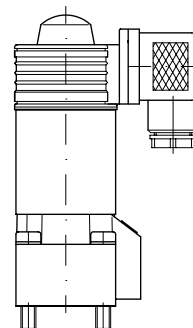
The essential internal parts operate maintenance-free in the medium and are hardened and ground.

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 sub-plates 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.



2. Available versions, main data

Order examples: **VP 1 - R - D**
VP 1 - W - 3/4 - G24

Table 1: Basic type and size

VP 1	Flow Q_{\max} = 15 lpm
	Oper. pressure p_{\max} = 400 bar

Table 2: Flow pattern symbols

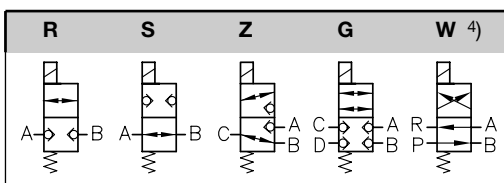


Table 3: Actuation modes

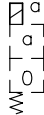






	Coding			For main data also see section 2.2.1	Symbols	Notes:
		①	②			
Solenoid ²⁾	G 12	A 12	N 12	U_N = 12V DC		① Valve features only an adaptor, a plug conforming A DIN 43650 (ISO 4400) is customer furnished. ② Valve features adaptor and plug conforming A DIN 43650 (ISO 4400) MSD 3-309 (see sect. 2.2.1 "Plugs and circuitry" or D 7163)
	G 24	A 24	N 24	U_N = 24V DC		
	G 24 Ex ³⁾	---	---	U_N = 24V DC		
	WG 110	---	---	U_N = 110VAC, 50/60 Hz (98VDC) ¹⁾		
	WG 230	---	---	U_N = 230VAC, 50/60 Hz (205VDC) ¹⁾		
Hydraulic	H			Control pressure: $p_{St\ min} = 12\ bar$ $p_{St\ max} = 700\ bar$	 	
Pneumatic	P			Control pressure: $p_{St\ min} = 4\ bar$ $p_{St\ max} = 15\ bar$	 	
Mechanical (roller)	K			Actuation force: 25 ... 28 N		
Mechanical (pin)	T			Actuation force: 51 ... 57 N		
Manual (lever)	F			Actuation force: 25 ... 28 N	 	
Manual (turn knob)	D			Actuation torque: 63 Ncm		

Table 4: Optional connection sub-plate for direct pipe mounting

Cod-ing	Ports A, B, C, P, R (DIN 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	

2.1 Further parameters

General and hydraulic parameters

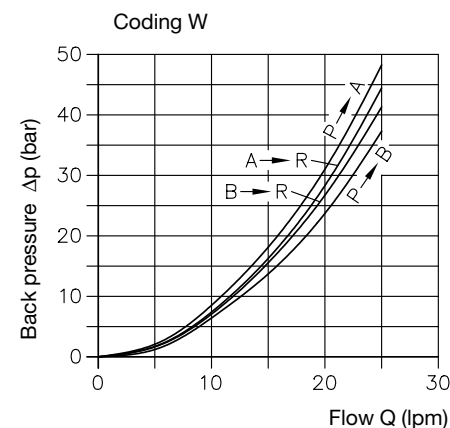
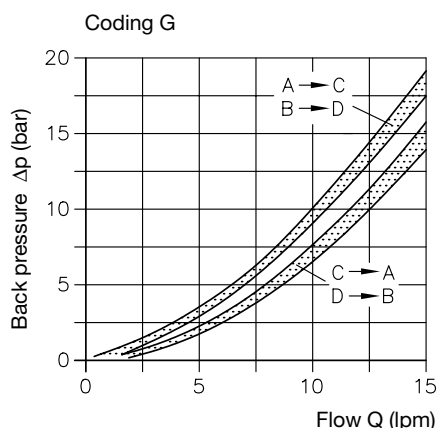
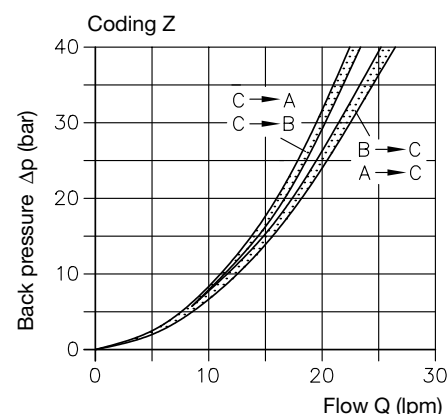
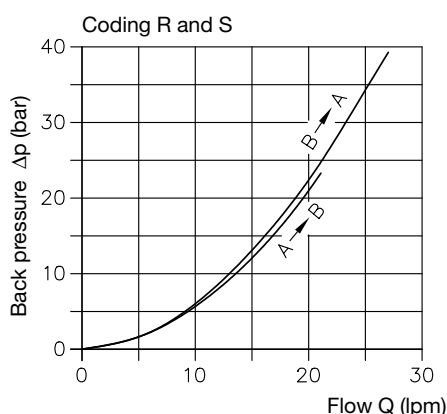
Nomenclature	2/2-, 3/2- and 4/2-way directional valve
Design	Seated cone valve
Mounting and	Manifold mounting, optional via connection sub-plate, see dimensional drawings at sect. 3.1 and 3.3
Installed position	Any; Best Vertically with actuation upwards
Flow direction	Any, conf. flow pattern symbol 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. $2 \times p_{\max}$ (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	0.7
W	1.0	---	---	---	---	---	---

Connection sub-plate (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 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 range	Ambient: approx. -40 ... +80 °C; Fluid: -25 ... +80°C, Note the viscosity range Restriction for version with ex-proof solenoid: Ambient: -35 ... +40°C; Fluid: max. 70°C Permissible temperature during start: -40°C (observe start-viscosity!), as long as the service temperature is at least 20K higher for the following operation Biological degradable pressure fluids: Observe manufacturer's specifications. Considering the compatibility with seal material not over +70 °C. Attention: Observe the restrictions regarding the perm. duty cycles of the solenoids in sect. 2.2.1 !

Δp -Q curves (guideline)



Fluid viscosity during tests approx.. 60 mm²/s

2.2 Actuation modes

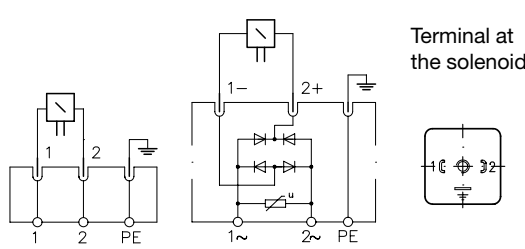
2.2.1 Solenoid actuation (standard)

All solenoids are manufactured and tested conforming VDE 0580.

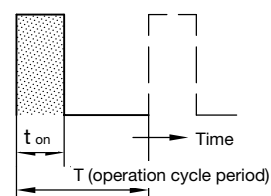
Coding		G 12 A 12 N 12	G 24 A 24 N 24	G 24 Ex --- ---	WG 110 ¹⁾ --- ---	WG 230 ¹⁾ --- ---
Nom. voltage	U_N (V)	12	24	24	110	230
		DC-voltage			AC-voltage, 50 and 60 Hz	
Nominal power	P_N (W)	20	20	23	20	20
Current	I_N (A)	1.7	0.83	0.9	0.2	0.1

Note:

The electric data of G- and WG solenoids are only (max) guideline figures and may vary slightly depending on manufacturer.

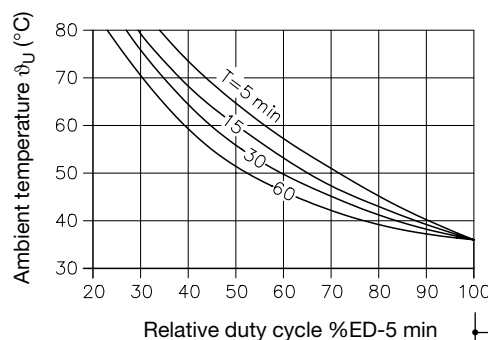
Plugs and circuitry DIN 43 650 Pg 9	DC-voltage Coding G...	AC-voltage Coding WG..
Hirschmann plug MSD 1(G..) ²⁾ Adaptor + plug A MSD 1-MSD 3 + MSD 4-209 P10 ²⁾		
Switching time (reference value)	On: approx. 100 ms, Off: 50 ms (G..) and 125 ms (WG..)	
Switching/hour	approx. 2000, approximately evenly distributed	
Protection class	IP 54 acc. to DIN EN 60529 / IEC 60529 (plug properly mounted) IP 67 acc. to DIN EN 60529 / 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)	
Permissible operation conditions for use in the open	Our current state of information permits exposure of these valves to usual ambient conditions	
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)



Relative duty cycle

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



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.

Electrical data for explosion-proof magnet

Letter of conformity	TÜV-A-03 ATEX 0017 X
Protection class	EEx d II B T4
Duty cycle	100% ED
Protection class	IP 67 (DIN EN 60529 / IEC 60529)
Nom. voltage U_N	24 V DC
Power, hot P_N	23 W

Restrictions for use:

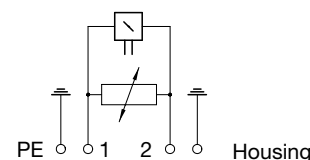
Temperature	Ambient: max. +40°C Fluid: max. +70°C
Required external fuse (conf. DIN IEC 127)	$I_N < 1.6$ A-medium
Surface protection	Housing zinc galvanized Coil and armature cavity moulded.

Attention:

Electrical connection	Protect against direct sun light (see also restrictions at "Temperature") 3x0.5 mm ²
Cable length	3 m, Option 10 m

Observe the operation manuals B 03/2004 and B ATEX!

Electrical lay-out and testing conforming EN 50014, VDE 0170/0171 T1 and T9.



Note:

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

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

²⁾ Specify the exact coding of the plug, when ordering as a spare part

Special voltages

The table below lists all voltages available additional to the standard versions listed on page 3.

Attention: The requested voltage must be specified !

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
G 12		
G 24	WG 24	G 24 Ex
G 36	WG 42	
G 42	WG 48	
G 48		
G 80		G 80 Ex
G 98	WG 110	
G 110		G 110 Ex
G 125		
G 185	WG 200	
G 205	WG 230	
G 220		

Nominal
power
 P_N

20 W

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)

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	Compressed 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.

(coding D)

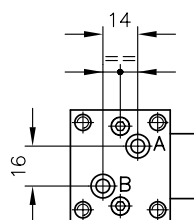
Actuation force	= 25 ... 28 N
Actuation travel	see dimensional drawing sect. 3.2
Actuation with detent.	The achieved switching position a or 0 changes with every 90° turn, no matter of the rotation direction.
Actuation torque	= 63 Ncm
Actuation travel	see dimensional drawing sect. 3.2

3. Unit dimensions

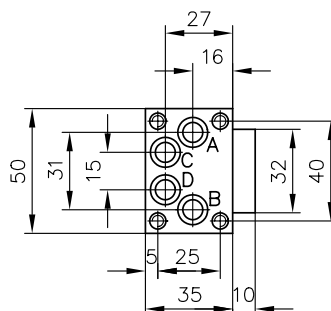
All dimensions in mm, subject to change without notice !

3.1 Valve (illustration with solenoid actuation)

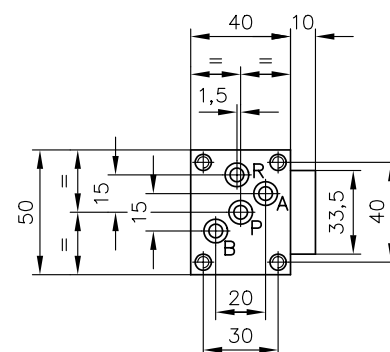
Symbol
R and S



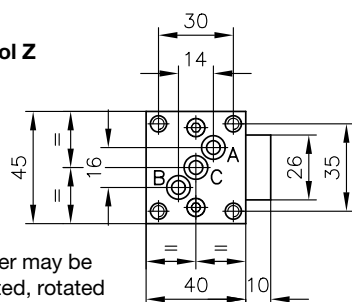
Symbol G



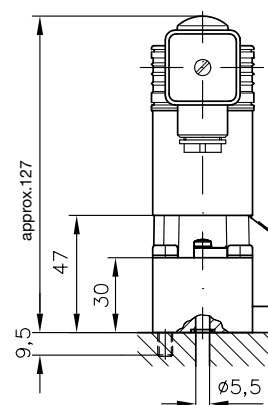
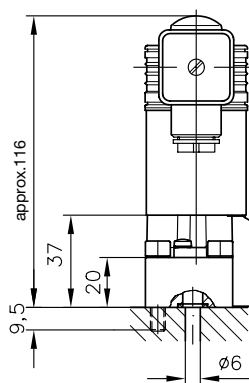
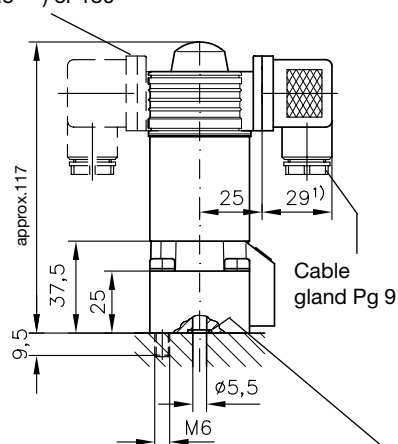
Symbol W



Symbol Z



Adapter may be mounted, rotated by 22.5°²⁾ or 180°

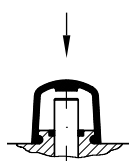


Sealing of the ports :

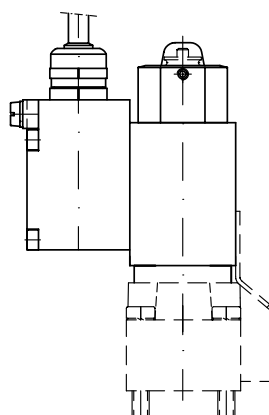
Coding R, S and Z: A, B and C = O-ring 6.07x1.78 NBR 90 Sh
Coding G: A, B, C and D = O-ring 8.73x1.78 NBR 90 Sh
Coding W: A, B, R and P = O-ring 6.07x1.78 NBR 90 Sh

Manual emergency actuation

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



Explosion-proof solenoid

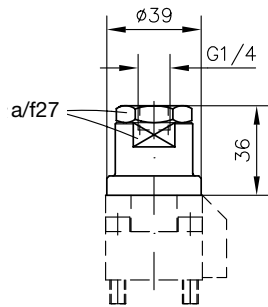


¹⁾ This dimension depends on the manufacturer and may be up to 11 mm longer acc. to DIN 43650

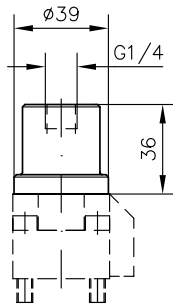
²⁾ Not all angled positions are possible, when the valves are neighboring

3.2 Further actuation modes

Coding H

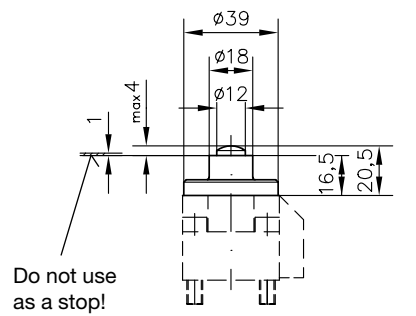


Coding P

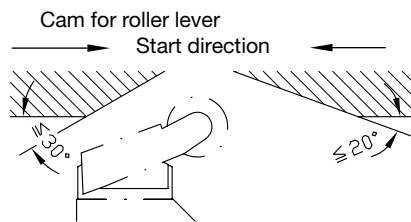
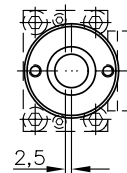
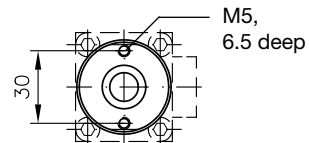
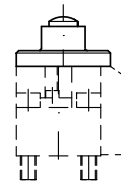


Coding T

Arrangement with flow pattern R, S and Z

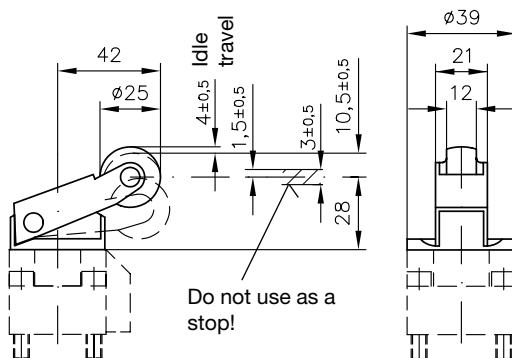


Arrangement with flow pattern G and W

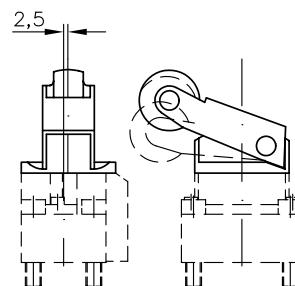


Coding K

Arrangement with flow pattern R, S and Z

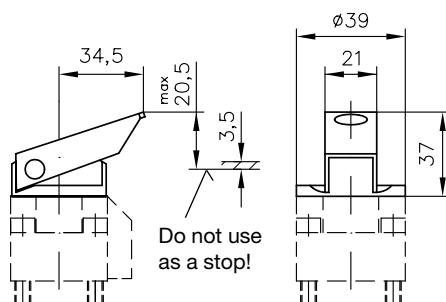


Arrangement with flow pattern G and W

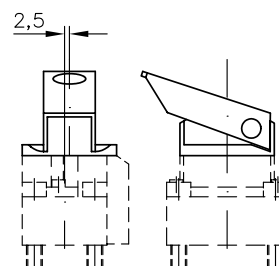


Coding F

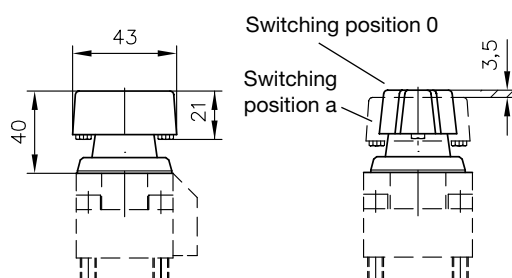
Arrangement with flow pattern R, S and Z



Arrangement with flow pattern G and W

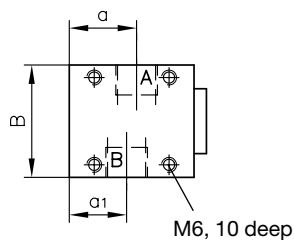


Coding D

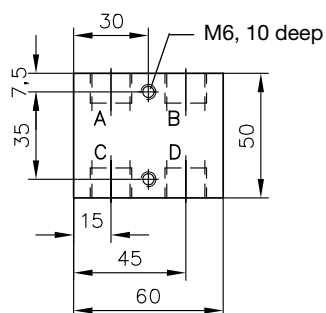


3.3 Connection blocks

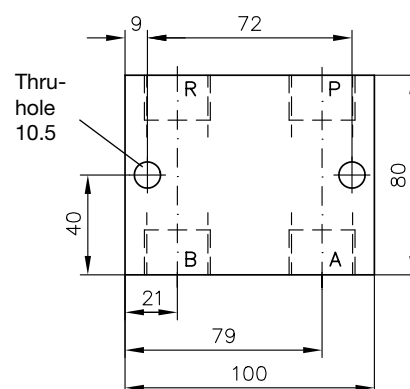
Type VP 1- R(S) - 1/4
VP 1- R(S) - 3/8
VP 1- R(S) - 1/2



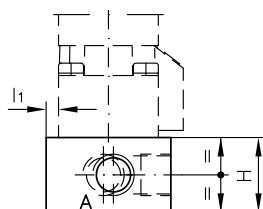
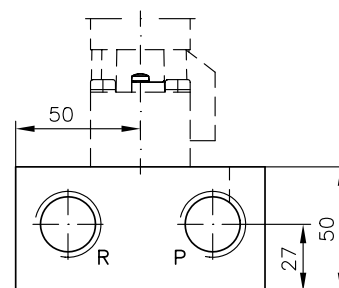
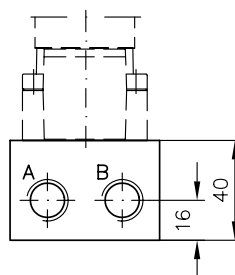
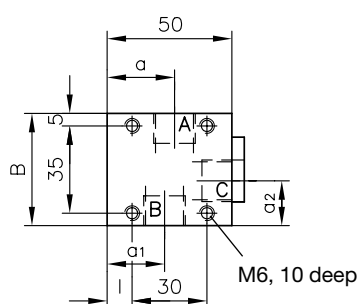
Type VP 1- G - 1/4
VP 1- G - 3/8



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 DIN 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	---

2/2-, 3/2-, and 4/3-way seated valves type NBVP 16 with industrial standard connection pattern Cetop 3 conforming DIN 24 340-A6

for any flow direction, zero leakage

Pressure $p_{\max} = 400 \text{ bar}$
Flow $Q_{\max} = 20 \text{ lpm}$

Additional valves with same function

Type BVG 1 and BVP 1	see D 7765	($Q_{\max} = 20 \text{ lpm}$, $p_{\max} = 400 \text{ bar}$)
Type BVG 3 and BVP 3	see D 7400	($Q_{\max} = 60 \text{ lpm}$, $p_{\max} = 315 \text{ bar}$)
Type BVE	see D 7921	($Q_{\max} = 70 \text{ lpm}$, $p_{\max} = 400 \text{ bar}$, Cartridge valve)
Valve bank type BA	see D 7788	
Intermediate plates type NZP	see D 7788 Z	

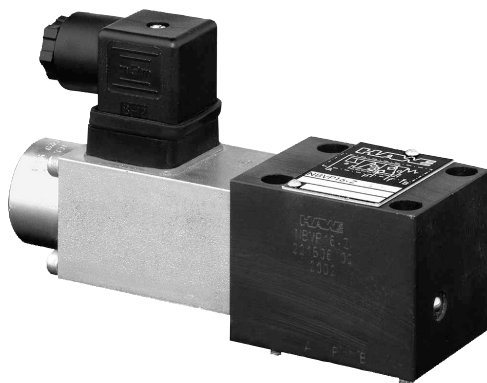
1. General, brief description

The 2/2-, 3/2- and 4/3-way directional seated valves type NBVP 16 are cone seated valves and available with solenoid, hydraulic, pneumatic, or manual actuation. All ports of the 2/2- and 3/2-way directional valves are pressure resistant due to the internal pressure compensation.

Valves featuring a spring return will return automatically into their idle position when not activated. Versions with detent will achieve their idle or working position whenever the opposing solenoid is briefly actuated.

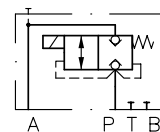
The 2/2- and 3/2-way directional valves may be optionally equipped with directly mounted pressure switches. Whereas pressure switches or gauges can be mounted via the pick-up ports (G1/8) connected to the consumer ports A and B at the 4/3-versions.

● Basic version

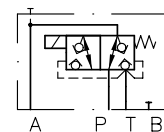


Example:

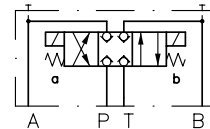
Type NBVP 16 R/2-G 24



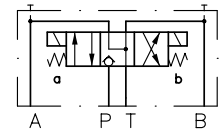
Type NBVP 16 Y/2-WG 230



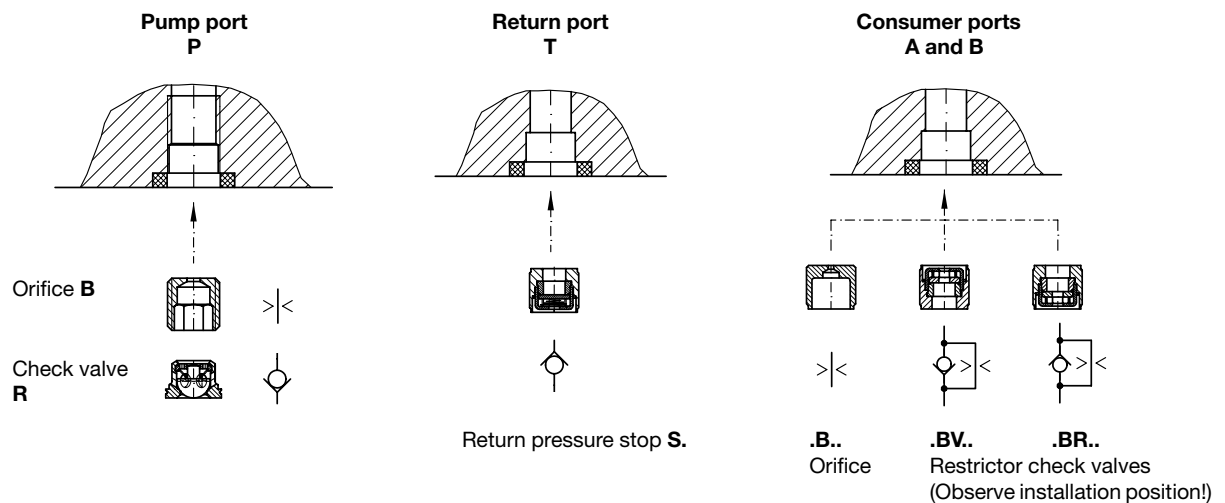
Type NBVP 16 G-GM 24



Type NBVP 16 D-WGM 230



● Additional elements for pump-, consumer- and return port

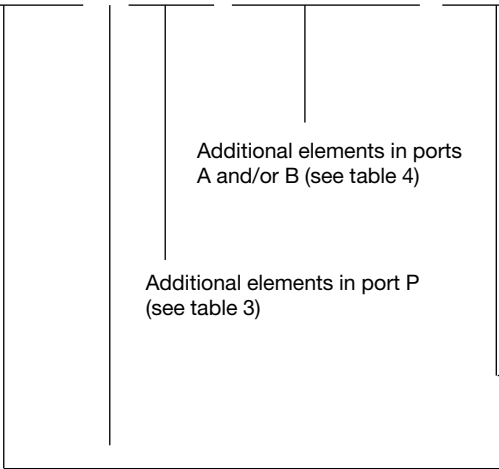


2. Available versions

2.1 Type coding, main data

Order examples:

NBVP 16 S/B 0,8 /2 - WG 110 ①
NBVP 16 G/B 0,8 R/ABR2,0 BBR1,5 /A3 B9/400/S - GM 24 - 3/8 ②



Sub-plate for pipe connection (sect. 4.3)

Actuation (see table 7)

Additional element in port T (see table 6)

Pressure switches and/or pressure gauges (see table 5)

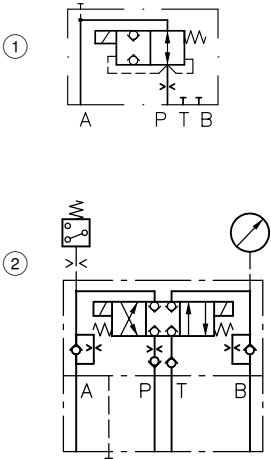


Table 1: Basic type

Coding, description		Flow Q _{max} (lpm)	Pressure p _{max} (bar)
NBVP 16	With industrial standard hole pattern DIN 24 340-A6	20	400 / 250 ¹⁾

Table 2: Symbols
(All valves are illustrated with solenoid actuation, for symbols with other actuations, see table 7)

R	S	Z	Y	ZD ²⁾ with detent

Q ²⁾	K ²⁾	RS ²⁾	SR ²⁾	W ²⁾ p _{max} = 250 bar

J ²⁾	G ²⁾	D ²⁾	DS ²⁾
a+b = 4. switching position, when both solenoids are energized simultaneously			

1) 250 bar with solenoid actuation coding GM..., WGM... acc. to table 7
2) Only with solenoid actuation

Table 3: Additional elements in port P



Additional element (also in combination)	Coding ³⁾	Ø (mm)
	B 0,8	0.8
	B 1,0	1.0
	B 1,2	1.2
	B 1,5	1.5
	B 2,0	2.0
Check valve 	R	---

Table 4: Additional elements in consumer ports A and/or B




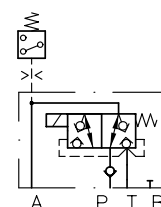
Additional element	Coding ^{3) 4)}		Ø (mm)
	all flow pattern symbols	only flow pattern symbols G, D	
Orifice in A and/or B 	AB 0,7	BB 0,7	0.7
	AB 0,9	BB 0,9	0.9
	AB 1,0	BB 1,0	1.0
	AB 1,5	BB 1,5	1.5
	AB 2,0	BB 2,0	2.0
	AB 2,5	BB 2,5	2.5
Restrictor check valve at A and/or B throttling the flow to the consumer 	ABV 0,7	BBV 0,7	0.7
	ABV 1,0	BBV 1,0	1.0
	ABV 1,5	BBV 1,5	1.5
	ABV 2,0	BBV 2,0	2.0
Restrictor check valve at A and/or B throttling the flow from the consumer 	ABR 0,7	BBR 0,7	0.7
	ABR 1,0	BBR 1,0	1.0
	ABR 1,5	BBR 1,5	1.5
	ABR 2,0	BBR 2,0	2.0

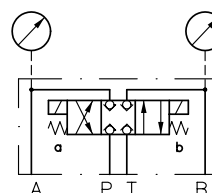
Table 5: Pressure switches and/or pressure gauges at ports A and/or B


	Coding dep. on flow pattern symbols		
	R, S, Z, Y ¹⁾	ZD, G, D, DS W, Q, RS, SR, K, J Connection A	G, D, DS, Q RS, SR, W, K Connection B
Pressure switch/metering range (adjustable range (bar))			
without DG (prepared for retrofiting)	2	---	---
DG33 (200...700) acc. to D 5440	3	A3	B3
DG34 (100...400)	4	A4	B4
DG35 (20...250)	5	A5	B5
DG36 (4...12)	6	A6	B6
DG365 (12...170)	7	A7	B7
DG364 (4...50)	8	A8	B8
DG5E-250 acc. to D 5440 E/1	E2	AE2	BE2
DG5E-400	E4	AE4	BE4
DG5E-600	E6	AE6	BE6
Pressure gauge acc. to D 7077 with scale up to (bar)			
100	---	A9/100	B9/100
160	---	A9/160	B9/160
250	---	A9/250	B9/250
400	---	A9/400	B9/400
600	---	A9/600	B9/600

Examples :
NBVP 16 Y/R/5-GM 24




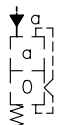




NBVP 16 G/A9/400 B9/400-G 24

**Table 6:** Additional elements at port T

Additional element	Coding	Open-up pressure
without	---	
Return pressure stop (Check valve) 	S	approx. 0.07 bar
	S1	approx. 1.0 bar

- 1) Mounting of a pressure gauge or another additional element instead of the pressure switches is possible via the fitting Y9-X84.. acc. to D 7077
- 2) With ports G 1/8 (BSPP) for pressure gauge
- 3) Part No. for spare parts order etc. see section 5.1 "Appendix"
- 4) Versions A(B) BR.. and A(B) BV.. are identical, only install position differs (see illustration sect. 1)

Table 7: Actuation modes

Actuation	Pressure p _{max} (bar) ⁴⁾	for Symbols	Coding With plug	Plug with LED	Without plug	Main data, also see section 3.2	
Solenoid	400	R, S, Z, Y, ZD Q, K, RS, SR, W ⁵⁾ J, G, D, DS	G 12	L 12	X 12	U _N = 12 V DC	
			G 24	L 24	X 24	U _N = 24 V DC	
			WG 110 ²⁾	---	X 98	U _N = 110 V AC, 50/60 Hz (98 V DC)	
			WG 230 ²⁾	---	X 205	U _N = 230 V AC, 50/60 Hz (205 V DC)	
	250	R, S, Z, Y, ZD Q, K, RS, SR, J, G, D, DS	GM 12 ³⁾	LM 24	XM 12	U _N = 12 V DC	
			GM 24 ³⁾	LM 24	XM 24	U _N = 24 V DC	
WGM 110 ^{2) 3)}			---	XM 98	U _N = 110 V AC, 50/60 Hz (98 V DC)		
250	Rs S, Z, Y, ZD, K, RS, SR, J, G, D, DS	WGM 230 ^{2) 3)}	---	XM 205	U _N = 230 V AC, 50/60 Hz (205 V DC)		
		M 24/8W	---	---	U _N = 24 V DC, 8 Watt		
			G 24ex ¹⁾	---	---	U _N = 24 V DC	
Hydraulic	400	R, S, Z, Y, J	H 1/4	External control G 1/4		Control pressure: p _{St min} = 24 bar p _{St max} = 400 bar	
Pneumatic	400		P	External control G 1/4		Control pressure: p _{St min} = 3 bar p _{St max} = 15 bar	
Manual	400		A			Actuation moment: appr. 1.5 ... 3 Nm	
Mechanical	400		T	Pin		Actuation force: F = appr. 80 ... 190 N	
		K	Roller		Actuation force: F = appr. 22 ... 35 N		
Symbols							
		Solenoid	Hydraulic H 1/4	Pneumatic P	Manual A	Pin T	Mechanical Roller K
							

¹⁾ Explosion-proof version

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

³⁾ Versions GM, WGM, LM, XM are priced lower than version G, WG etc.; Observe their reduced pressure rating!

⁴⁾ observe the max. pressure specification at T (see sect. 3.1)

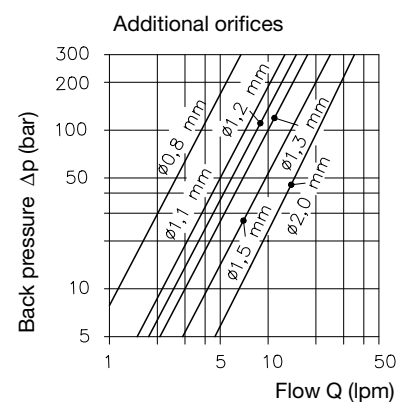
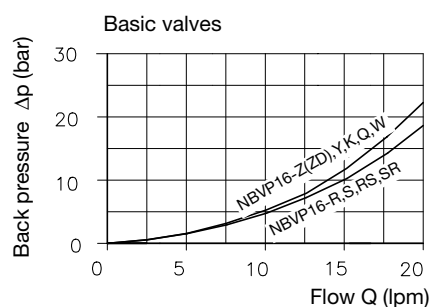
⁵⁾ Permissible pressure $p_{\max} = 250 \text{ bar}$

3. Further characteristic data

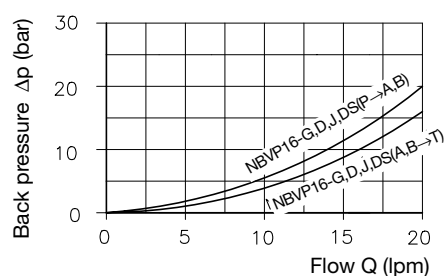
3.1 General and hydraulic data

Installed position	Any																																																			
Overlap at 3/2-way valves	Negative (overlap only apparent during transition from one to the other end position). All ports are interconnected during the switching process.																																																			
Operating pressure	p_{\max} acc. to table 7, sect. 2.1 static overload capacity of ports P, A, and B approx $2 \times p_{\max}$ $p_{\max}T = 2 \times p_{\max}$ - symbols R, S, Z, Y = 400 bar - symbol ZD = 50 bar - symbols Q, K, RS, SR, W, G, D, DS The pressure at T has to be always be lower than the pressure apparent at P or. A and B																																																			
Housing material and surface coating	Steel, gas nitrided (basic valve)																																																			
Mass (weight) approx. kg	<table><tr><td colspan="2">Complete with actuation</td><td>NBVP 16 R NBVP 16 S</td><td>NBVP 16 Z NBVP 16 Y</td><td>NBVP 16 ZD (Q, K, RS, SR, W)</td><td>NBVP 16 G (J) NBVP 16 D (DS)</td></tr><tr><td rowspan="2">Solenoid</td><td>G..., G 24ex, L..., X..., WG..., M..</td><td>1.5</td><td>1.7</td><td>2.1</td><td>2.4</td></tr><tr><td>GM...,LM..., XM..., WGM..</td><td>1.4</td><td>1.6</td><td>1.9</td><td>2.2</td></tr><tr><td>Hydraulic</td><td>H 1/4</td><td>1.1</td><td>1.3</td><td>---</td><td>---</td></tr><tr><td>Pneumatic</td><td>P</td><td>1.0</td><td>1.2</td><td>---</td><td>---</td></tr><tr><td>Manual</td><td>A</td><td>1.4</td><td>1.6</td><td>---</td><td>---</td></tr><tr><td rowspan="2">Mechanical</td><td>T</td><td>1.1</td><td>1.3</td><td>---</td><td>---</td></tr><tr><td>K</td><td>1.4</td><td>1.6</td><td>---</td><td>---</td></tr></table> per pressure switch + 0.3						Complete with actuation		NBVP 16 R NBVP 16 S	NBVP 16 Z NBVP 16 Y	NBVP 16 ZD (Q, K, RS, SR, W)	NBVP 16 G (J) NBVP 16 D (DS)	Solenoid	G..., G 24ex, L..., X..., WG..., M..	1.5	1.7	2.1	2.4	GM...,LM..., XM..., WGM..	1.4	1.6	1.9	2.2	Hydraulic	H 1/4	1.1	1.3	---	---	Pneumatic	P	1.0	1.2	---	---	Manual	A	1.4	1.6	---	---	Mechanical	T	1.1	1.3	---	---	K	1.4	1.6	---	---
Complete with actuation		NBVP 16 R NBVP 16 S	NBVP 16 Z NBVP 16 Y	NBVP 16 ZD (Q, K, RS, SR, W)	NBVP 16 G (J) NBVP 16 D (DS)																																															
Solenoid	G..., G 24ex, L..., X..., WG..., M..	1.5	1.7	2.1	2.4																																															
	GM...,LM..., XM..., WGM..	1.4	1.6	1.9	2.2																																															
Hydraulic	H 1/4	1.1	1.3	---	---																																															
Pneumatic	P	1.0	1.2	---	---																																															
Manual	A	1.4	1.6	---	---																																															
Mechanical	T	1.1	1.3	---	---																																															
	K	1.4	1.6	---	---																																															
Pressure fluid	Hydraulic oil conforming DIN 51524 part 1 to 3: ISO VG 10 to 68 conforming DIN 51519. Viscosity limits: min. approx. 4, max. approx. 1500 mm ² /s; opt. operation approx. 10... 500 mm ² /s. Also suitable are biologically degradable pressure fluids types HEPG (Polyalkylenglycol) and HEES (Synth. Ester) at service temperatures up to approx. +70 °C.																																																			
Temperature	Ambient: approx. -40 ... +80 °C; Fluid: -25 ... +80°C, Note the viscosity range ! Restriction regarding ex-proof solenoids Ambient: -35 ... +40°C; Fluid: max. 70°C Permissible temperature during start: -40°C (observe start-viscosity!), as long as the service temperature is at least 20 K (Kelvin) higher for the following operation. Biological degradable pressure fluids: Observe manufacturer's specifications. Considering the compatibility with seal material not over +70°C. Attention: Observe the restrictions regarding the perm. duty cycles of the solenoids in sect. 3.2!																																																			
Flow	$Q_{\max} = 20 \text{ lpm}$																																																			
Flow limitation	It is necessary to limit the flow down to the permissible range depending on the system pressure via orifices (see sect. 2.1). This applies to all circuits fed by an accumulator or when connected to high pressure circuits fed by high delivery pumps. The orifice must be located on the accumulator side always. For more detailed information, see table 3 and 4, section 2.1. The check valves (see table 3 and 6 in sect. 2.1) prevent an undesired reversal of the flow direction.																																																			

Δp -Q curve

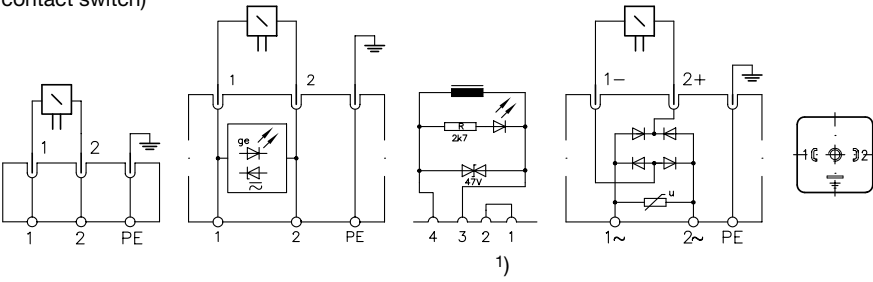



Viscosity during measurements approx. 60 mm²/sec

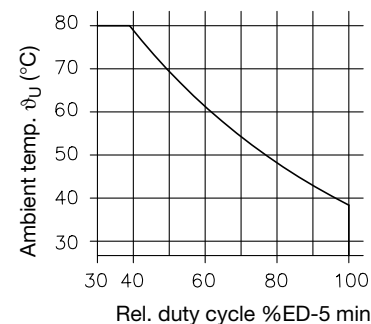


3.2 Actuators

Solenoid

		All solenoids are built and tested acc. to DIN VDE 0580									
Coding		G 12 L 12 X 12	GM 12 LM 12 XM 12	G 24 L 24 X 24	GM 24 LM 24 XM 24	G 24ex --- ---	M 24/8W --- ---	WG 110 --- ---	WGM 110 --- ---	WG 230 --- ---	WGM 230 --- ---
Nom. voltage U_N (V)		12	12	24	24	24	24	110	110	230	230
		DC-voltage						AC-voltage, 50 and 60 Hz			
Nom. power P_N (W)		29.4	26.2	27.6	26.5	23.4	8	28.6	24.8	30.2	28
Connection and circuitry Vers. G, GM, L, LM, WG, WGM: Plug DIN EN 175301-803 All plugs Pg 9 For additional plugs, see D 7163 Version G 24ex: Cable cross section 4x0.5 mm ² , Cable length 3 m, Option 10 m Cable spec. ÖLFLEX-440 P Version M 24/8W: Plug M12x1 - DESINA		DC-voltage Type G... (applies also to contact switch)  AC-voltage Type WG..  1) Terminals 1 + 2 optionally for diagnosis									
Switching time (reference value)		On or Off: approx. 50...60 ms, longer with WG...									
Switching/hour		approx. 2000, approximately evenly distributed									
Min. pulse duration		approx. 500 ms with flow pattern ZD									
Protection class		IP 65 (acc. to DIN EN 60529 / IEC 60529) (plug properly mounted) IP 67 with G 24ex and M 24/8W									
Insulation material class		F									
Contact temperature		approx. 120°C, with ambient temperature 20°C									
Switch-off energy		$W_A \leq 0.4$ Ws									
Surface coating (solenoid)		DIN 50961-Fe/Zn 12 bk cC									

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



Notes regarding versions with ex-proof solenoid:

Letter of conformity

TÜV-A-03 ATEX 0017 X

Protection class

EEx d II B T4

Required external fuse (conf. DIN IEC 127)

$I_N < 1.6$ A-T

Mounting

Protect against direct sun light (see also restrictions at "Temperature")

Observe the operation manuals B 03/2004 and B ATEX!

Electrical lay-out and testing conforming EN 50014, VDE 0170/0171 T1 and T9.

Coil and armature cavity moulded.

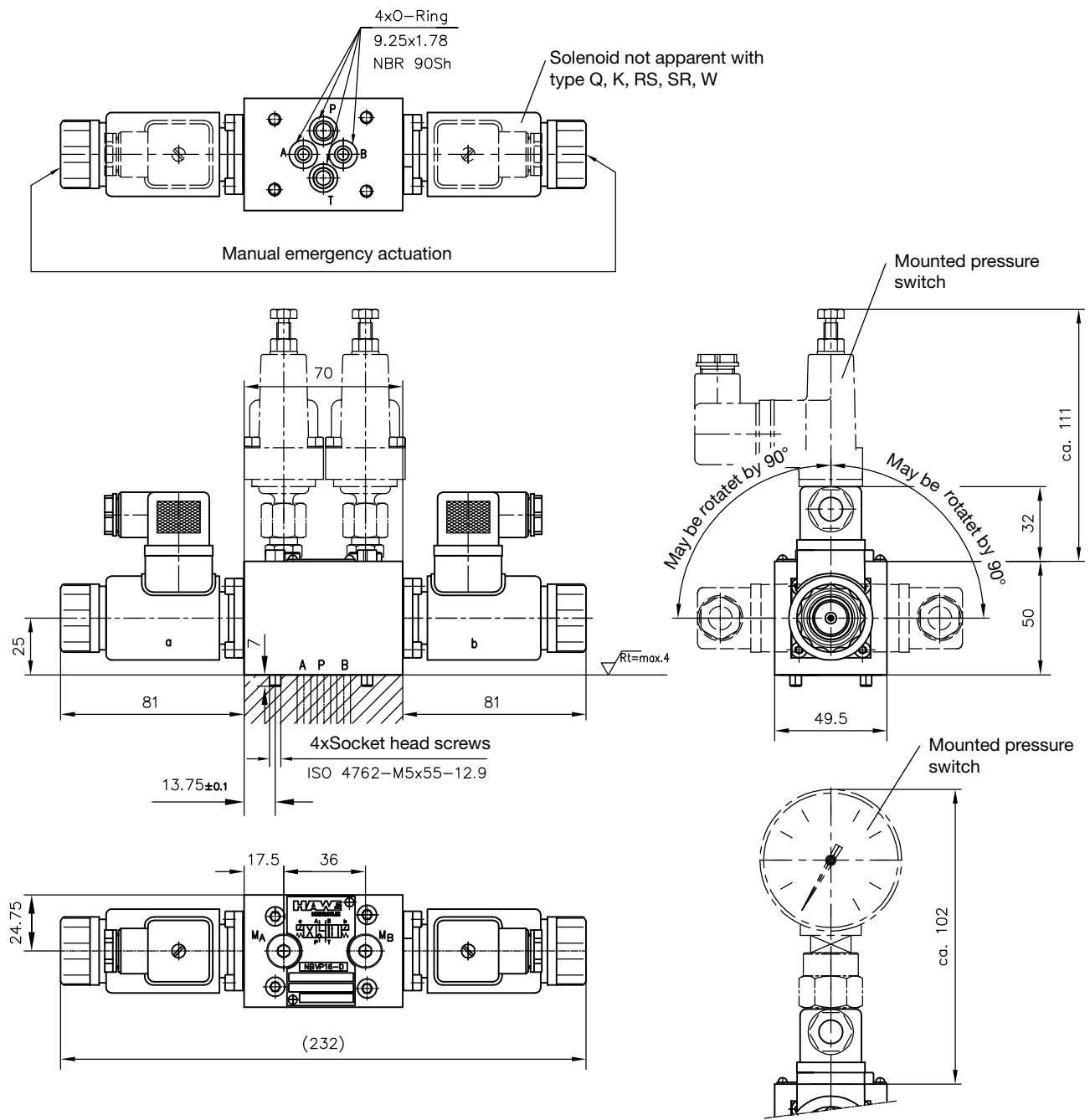
		Hydraulic (coding H 1/4)	Pneumatic (coding P)	Manual (coding A)	Mechanical (coding T) (coding K)	
Control pressure	$p_{\text{contr min}}$	24 bar	3 bar	---	---	---
	$p_{\text{contr max}}$	400 bar	15 bar	---	---	---
Permissible residual pressure in the control line for save return into the idle position		< 2 bar	---	---	---	---
Z static overload capacity		appr. 1.5 $p_{\text{contr max}}$ bar	appr. 1.5 $p_{\text{contr max}}$ bar	---	---	---
Control displacement (geometric)		1.4 cm ³	9.3 cm ³	---	---	---
Housing material and surface coating		Steel (control housing) zinc galvanized	Light alloy (control housing) black anodized	Steel (lever housing) gas nitrided	Steel (control housing) gas nitrided	
Actuation moment		---	---	appr. 1.5 ... 3 Nm	---	---
Actuation force		---	---	---	appr. 80...190 N	appr. 22...35 N

4. Unit dimensions

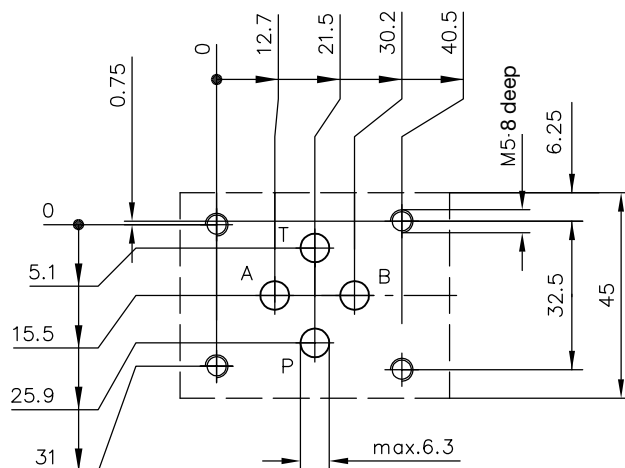
All dimension in mm and subject to change without notice!

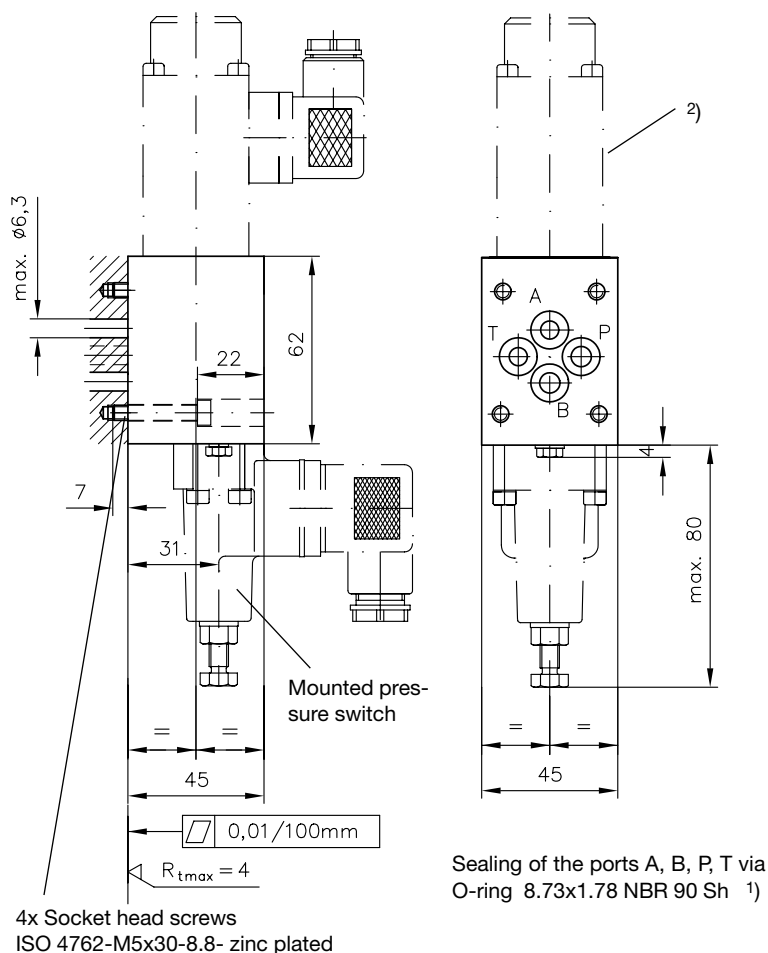
4.1 Valve section

Type NBVP 16 G, D, DS, J, Q, K, RS, SR, W

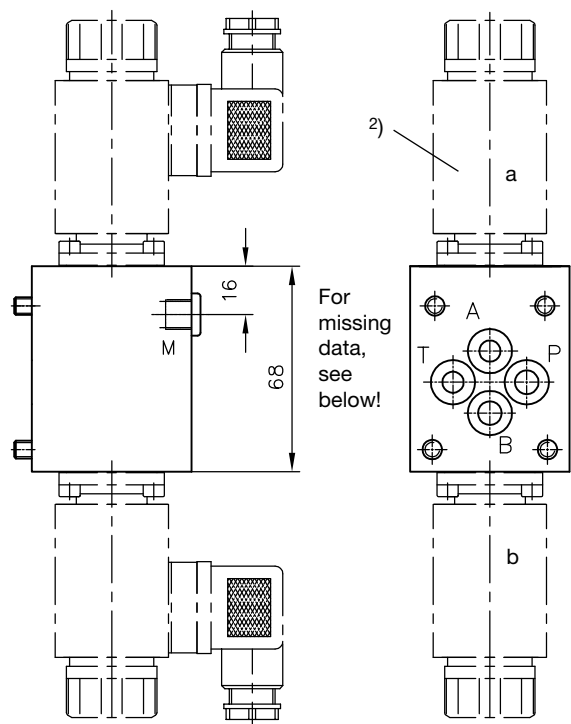


Hole pattern at the manifold (top view)



Type NBVP 16 R, S, Z, Y**Type NBVP 16 ZD**

4x Socket head screws
ISO 4762-M5x30-8.8- zinc plated



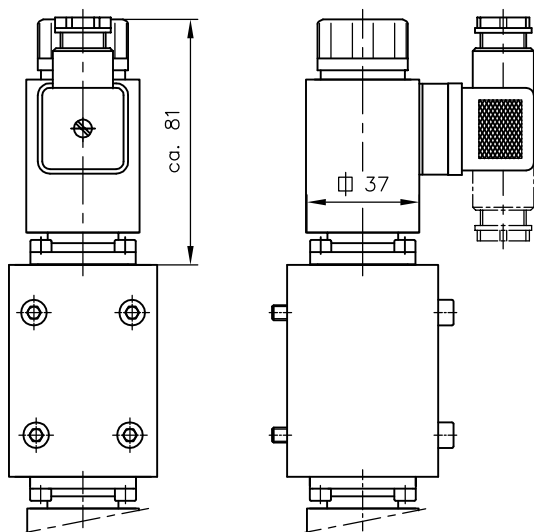
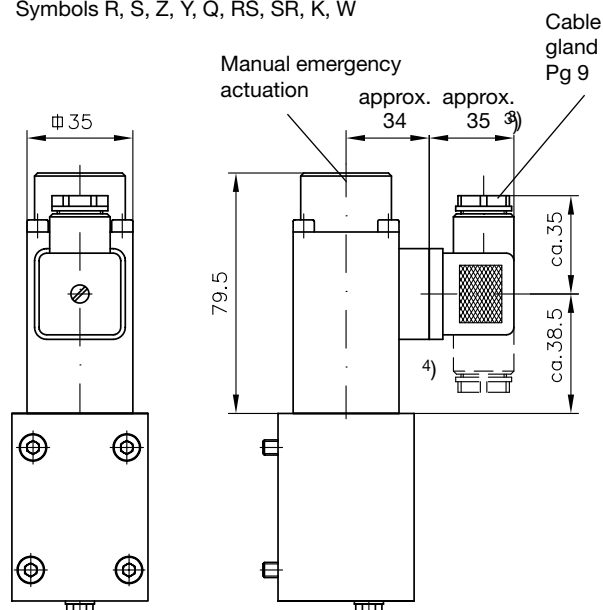
1) Part of seal kit DS 7765-2 (including O-rings for actuation, H 1/4)

2) For dimension of the differing actuations, see section 4.2!

4.2 Control elements**Electrical actuation****Coding G and WG**

Symbols R, S, Z, Y, Q, RS, SR, K, W

Symbols Q, RS, SR, K, W, ZD, G, D, DS, J



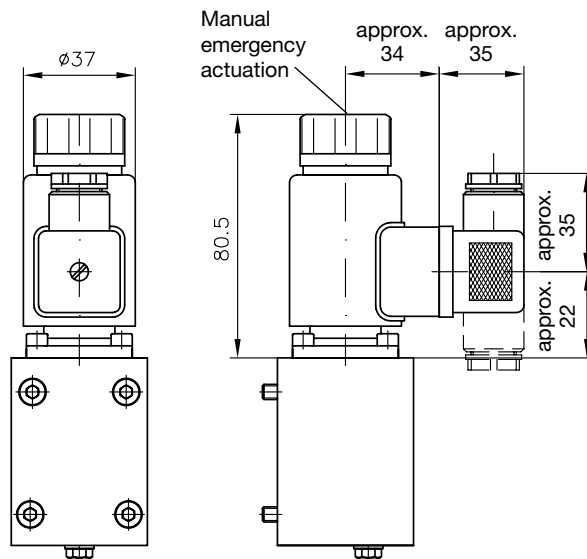
3) Attention: This dimension depends on the manufacturer and may be max. 40 mm acc. DIN EN 175301-803 to (DIN 43650)!

4) Solenoid may be installed off-set by 4x90°. Plug may be installed off-set by 2x180°.

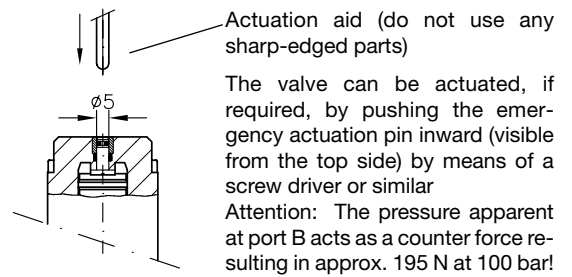
Continuation "Solenoid actuation"

Coding GM and WGM

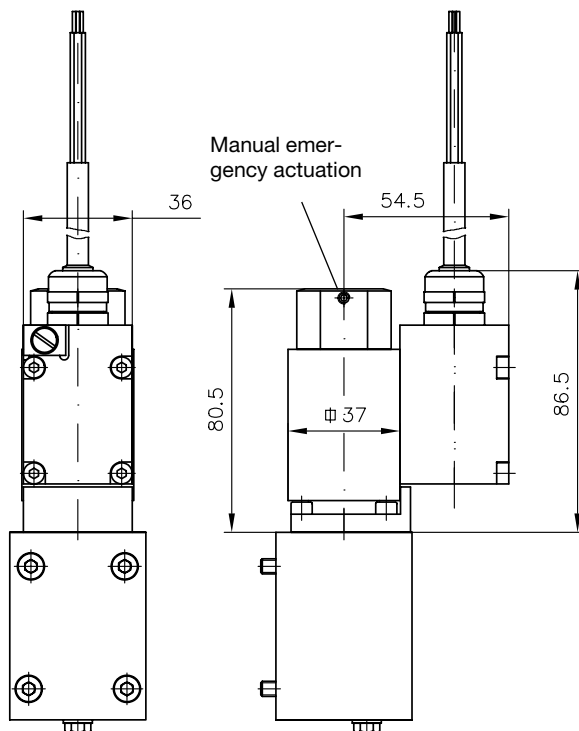
all symbols without W

**Manual emergency actuation**

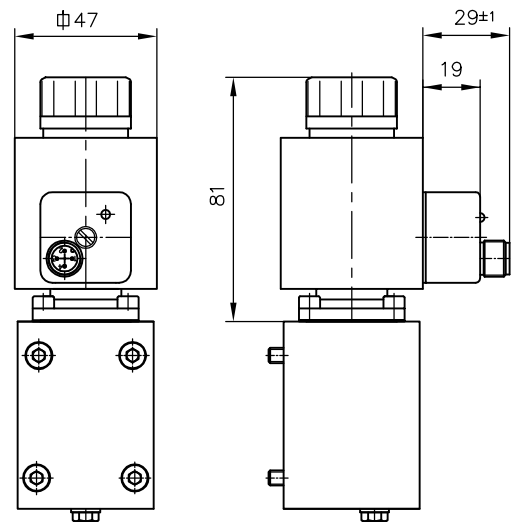
(Applies to all solenoid versions)

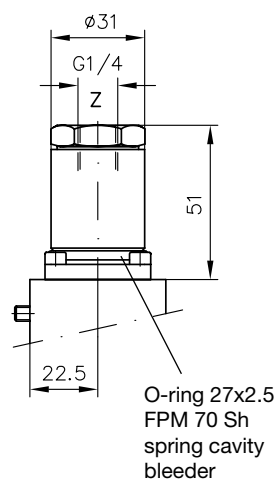
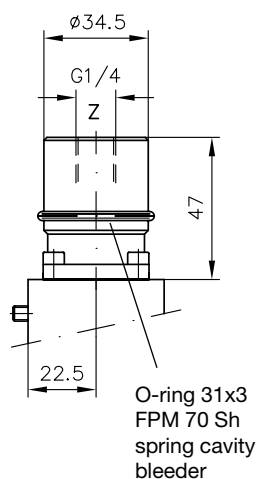
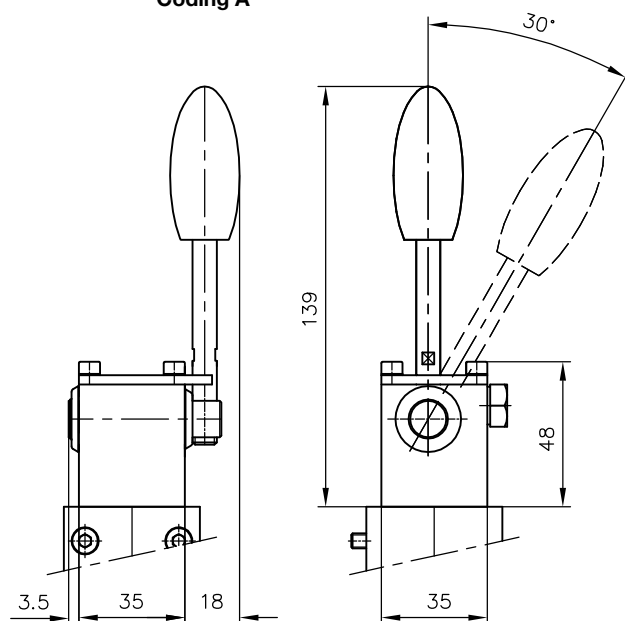
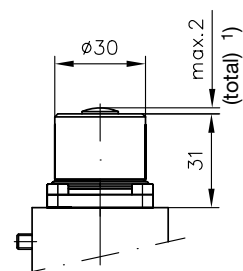
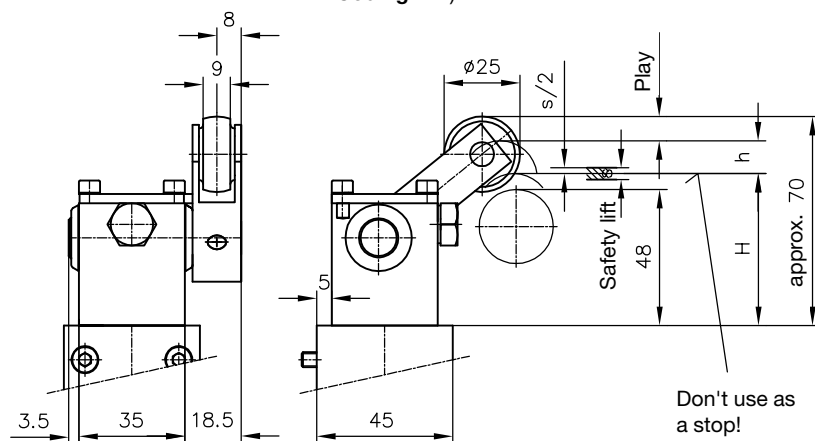
**Coding G 24ex**

all symbols without W

**Coding M 24/8W**

all symbols without W



Hydraulic
Coding H 1/4 ²⁾

Pneumatic ²⁾
Coding P

Manual ²⁾
Coding A

Mechanical ²⁾
Coding T

Coding K ²⁾


Actuation force F at 100 ... 400 bar:

Type NBVP 16 R-T = 80 ... 140 N

NBVP 16 Z-T = 140 ... 190 N

NBVP 16 S-T = 140 ... 190 N

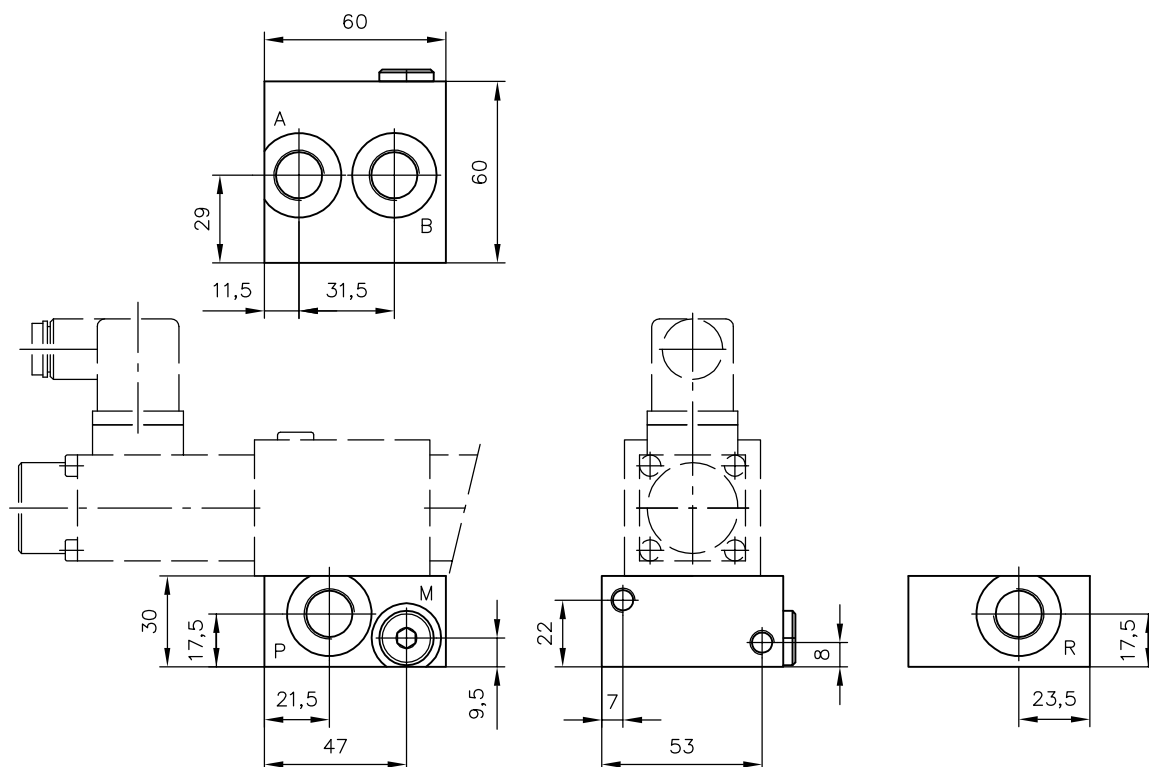
Working stroke (mm) with		NBVP 16 R.-K	NBVP 16 S.-K	NBVP 16 Z.-K
Start of funktion	(H+h)	66	66	66
Functional stroke	h	14	10	14
Switching position range	s	---	±1	±1
Actuation force	N	approx. 26	approx. 22	approx. 35

¹⁾ Distribution: Play 0.5 mm
 Working stroke 1 mm
 Safety lift 0.5 mm

²⁾ Only symbols R, S, Z, Y, J

4.3 Sub-plate for pipe connection

Coding -3/8



Ports conf. DIN ISO 228/1 (BSPP):

P, R, A, B = G 3/8

M = G 1/4 (plugged, no function)

5. Appendix

5.1 Parts No. of the orifices, when ordering spare parts

Coding	Parts No.	Coding	Parts No.
B ...	EUMA-orifice DIN 913	S	ER 14
	M8x8-B 0 (without hole)	S1	ER 14/1
	M8x8-B 0,8 (Ø 0.8)	ABV ...	EBR 14-B 0,7 (Ø 0.7)
	M8x8-B 1,0 (Ø 1.0)	BBV ...	EBR 14-B 1,0 (Ø 1.0)
	M8x8-B 1,2 (Ø 1.2)	ABR ...	EBR 14-B 1,5 (Ø 1.5)
	M8x8-B 1,5 (Ø 1.5)	BBR ...	EBR 14-B 2,0 (Ø 2.0)
	M8x8-B 2,0 (Ø 2.0)		
R	ER 13	AB ...	7966 003 a (Ø 0.7)
		BB ...	7966 003 f (Ø 0.9)
			7966 003 b (Ø 1.0)
			7966 003 c (Ø 1.5)
			7966 003 d (Ø 2.0)
			7966 003 e (Ø 2.5)