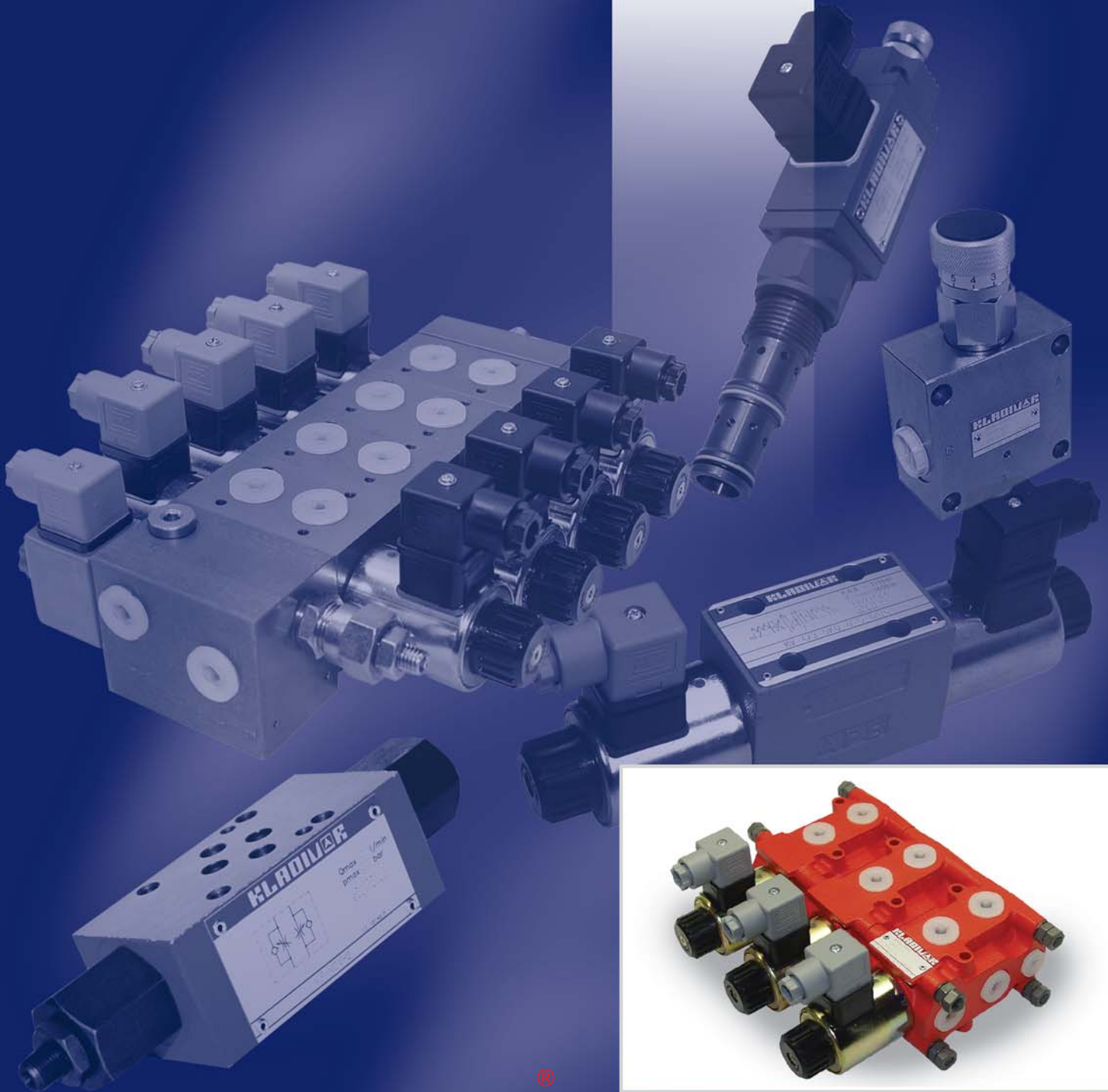


HK12-03-05



**KLADRIVAR**<sup>®</sup>

CATALOGUE  
**HYDRAULICS 12**

## Contents

Description	Type	Size	Page
-------------	------	------	------

### Check valves

Modular check valves	VP-NV	6,10	1.1.1-1.1.2
In line check valves	NV	6,8,10,16	1.3.1-1.3.2
Modular pilot operated check valves	VP-NOV	6,10	1.5.1-1.5.2
In line double acting pilot operated check valves	NOV-4-D	4	1.7.1
In line simple acting pilot operated check valves	NOV-6-E	6	1.9.1
In line double acting pilot operated check valves	NOV-6-D	6	1.11.1
Check-Q-meter	BZV	6	1.15.1-1.15.3

### Directional control valves

Solenoid operated directional control seat valves	KV-2/2	6	3.1.1-3.1.2
Automatic change-over directional control valves	PKV	10	3.3.1-3.3.2
Lever operated directional control valves	KV	6,10	3.5.1-3.5.2
Solenoid operated directional control valves	KV	6	3.11.1-3.11.4
Solenoid operated directional control valves	KV	10	3.13.1-3.13.4
Solenoid operated directional control valves	KV	16	3.15.1-3.15.4
Solenoid operated selector valves	KV-6/2	6	3.21.1-3.21.2
Solenoid operated selector valves	KV-6K/2	6	3.23.1-3.23.2
Solenoid operated selector valves	KVV	6	3.25.1-3.25.2
Solenoid operated selector valves	KV-6/2	10	3.27.1-3.27.2
Solenoid operated selector valves	KVC-3/2	10	3.29.1-3.29.2
Solenoid operated selector valves	KV-6/2	16	3.31.1-3.31.2
Solenoid operated selector valves	KV-8/3	6	3.33.1-3.33.2
Modular solenoid operated selector valves	KVH-6/2	6	3.35.1-3.35.2
Modular solenoid operated selector valves	KVH-6/2	10	3.37.1-3.37.2
Modular solenoid operated directional control valves	KVM	6	3.41.1-3.41.8

### Pressure control valves

Direct operated pressure control valves	VVP	6,10	5.1.1-5.1.2
Pilot operated pressure control valves	RT	6,10	5.3.1-5.3.2
Modular pilot operated pressure control valves	VP-RT	6,10	5.5.1-5.5.2

### Flow control valves

Modular throttle/check valves	VP-NDV	6,10	7.1.1-7.1.2
2-way pressure compensated flow control valves	TVD	6	7.3.1-7.3.2
Flow dividers	DTP	6,10	7.5.1-7.5.2
3-way pressure compensated flow control valves	TVTC	6	7.7.1-7.7.2
3-way pressure compensated flow control valves-cartridge	TVTP-...-B	6,10	7.9.1-7.9.2
3-way pressure compensated proportional flow control valves	TVTP-...-P	6,10	7.11.1-7.11.2

### Electric and electronic components

Pressure switches	TS, VP-TS	4,6,10	11.1.1-11.1.4
Solenoids	MR	∅45, ∅60	11.3.1-11.3.2
Control lever with switches	KRSS		11.5.1
Amplifiers for proportional solenoids	R59		11.7.1

### Connecting components

Subplates	PP-KV	6,10,16	15.1.1-15.1.2
Multi-station manifolds	BP	6,10	15.3.1-15.3.3
Stacking elements	EV, EP, BO	6,10	15.5.1-15.5.8

### Hydraulic power units and systems

Mini hydraulic power packs	MHS		30.1.1-30.1.7
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In case of any indistinctness please contact manufacturer.

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V primeru nejasnosti se posvetujte s proizvajalcem.

Catalogue: Hydraulics 12  
Catalogue No.: HK12 - 03.05  
Design: Tone Pintar  
Photo: Franci Temelj

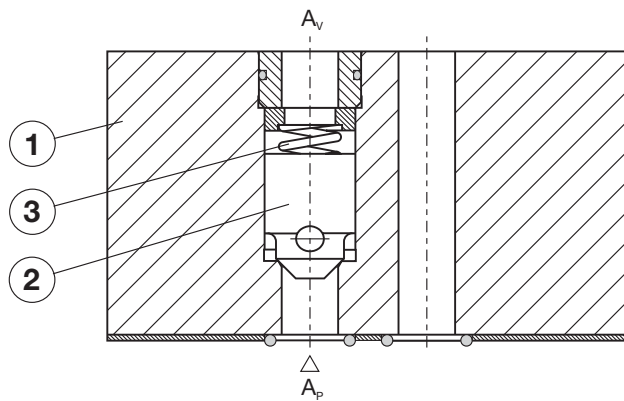
## CHECK VALVE type VP-NV

- NS-6, 10
- to 350 bar
- to 100 l/min
- Connecting dimensions to ISO 4401
- For vertical stacking - sandwich plate design
- Free hydraulic fluid flow in one direction



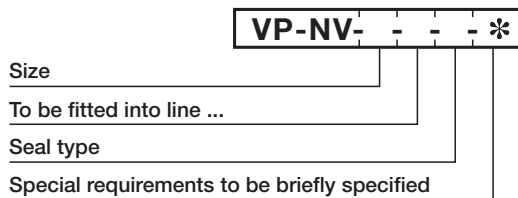
VP-NV-6, VP-NV-10

### Description of operating



Check valves type VP-NV permit the hydraulic fluid flow in one direction, with a tight-off in the opposite direction. Sandwich plate design - for vertical stacking. These valves consist of a housing (1), poppet (2), and a spring (3). A poppet valve can be fitted into the line P, T, A or B. It serves for shutting off the hydraulic fluid flow in one direction, permitting a free flow in the opposite direction. This is made possible by the poppet (2) which provides positive seating. The hydraulic fluid flow under cracking pressure 0,4 bar causes the poppet to lift, thus freeing the flow. In the opposite direction, the spring (3) pushes the poppet (2) against the seat, shutting the hydraulic fluid flow off.

### Ordering code



Size Size 6 = 6  
Size 10 = 10

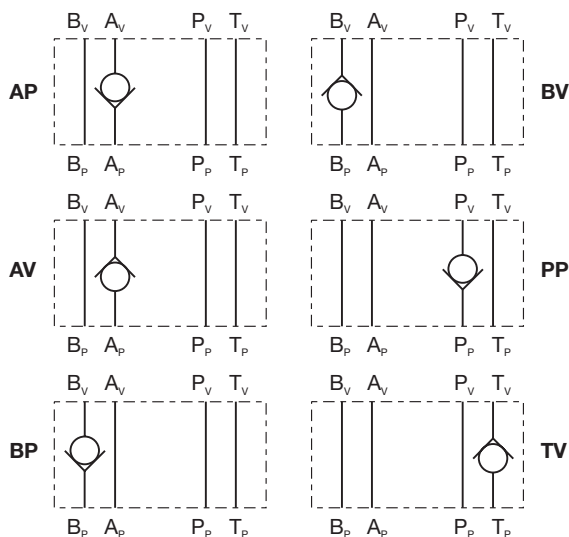
### To be fitted into line ... Flow direction

$A_p-A_v$  = AP       $B_v-B_p$  = BV  
 $A_v-A_p$  = AV       $P_p-P_v$  = PP  
 $B_p-B_v$  = BP       $T_v-T_p$  = TV

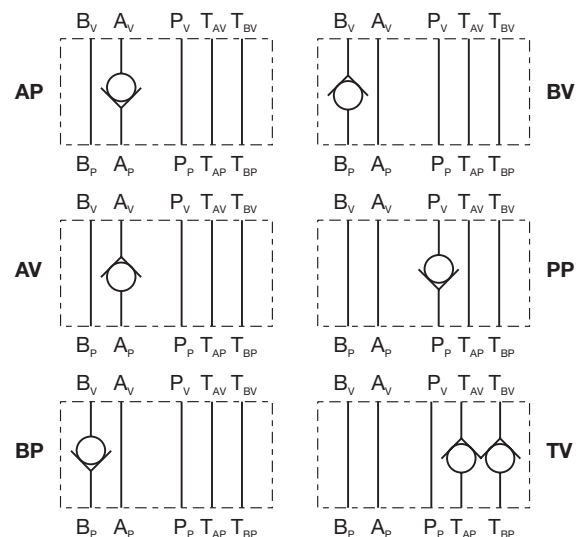
### Seal type

NBR seals for mineral oil HL, HLP, to DIN 51524 = no desig.  
FPM seals for HETG, HEES, HEPG to VDMA 24568 and ISO 15380 = E

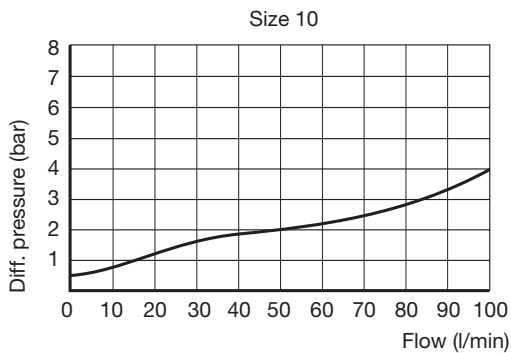
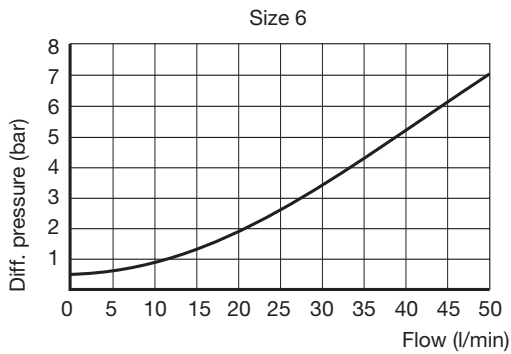
### Symbol - size 6



### Symbol - size 10



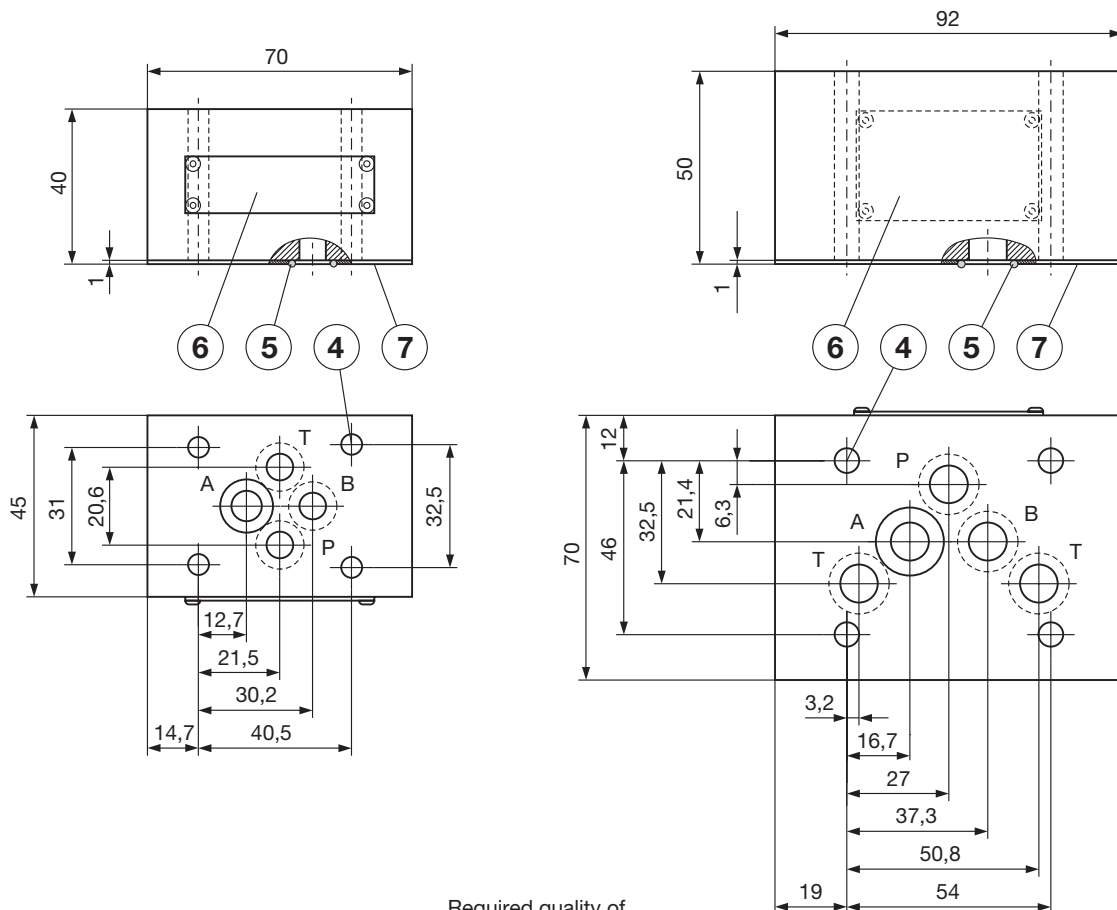
**Δ p - Q Performance curves**  
(measured at  $t = 50\text{ °C}$  and  $\nu = 32\text{ mm}^2/\text{s}$ )



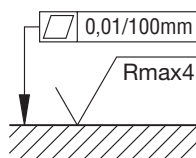
**Technical data**

Size		6	10
Flow rate	l/min	50	100
Flow velocity	m/s	4	4
Operating pressure	bar	350	350
Cracking pressure	bar	0,4	0,4
Oil temperature range	°C	-20 to +70	-20 to +70
Viscosity range	mm <sup>2</sup> /s	15 to 380	15 to 380
Filtration	NAS 1638	8	8
Mass	kg	0,87	2,77

**Dimensions (mm)**



Required quality of the mating surface



- 4. Bores for fixing screws M5
- 5. O-ring 9,25x1,78
- 6. Nameplate
- 7. O-ring plate

- 4. Bores for fixing screws M6
- 5. O-ring 12,42x1,78
- 6. Nameplate
- 7. O-ring plate

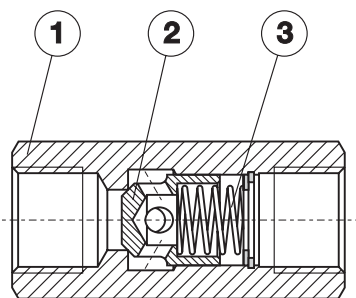
**CHECK VALVE type NV**

- NS-6,8,10,16
- to 350 bar
- to 150 l/min
- Direct in-line mounting
- Free hydraulic fluid flow in one direction



NV-6, 8, 10, 16

**Description of operating**



Check valve type NV permit the hydraulic fluid flow in one direction, with a tight shut-off in the opposite direction.

These valves consist of a housing (1), a poppet (2), and a spring (3).

Both ends of the valve housing are provided with a thread for in-line mounting. The valve is built into pipelines or onto subplates via pipe connection.

**Ordering code**

Nominal Size  
Special requirements to be briefly specified

**NV- -\***

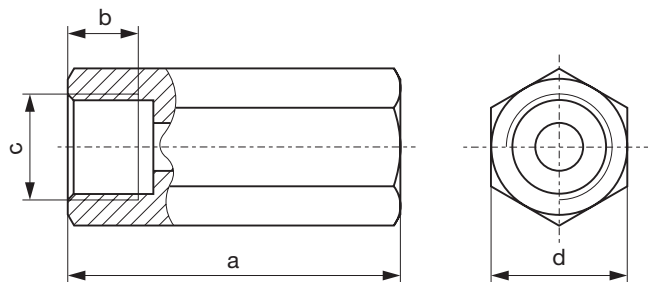
**Nominal size**

NV-6 = **6-G1/4**    NV-10 = **10-G1/2**  
NV-8 = **8-G3/8**    NV-16 = **16-G3/4**

**Symbol**



**Dimensions (mm)**

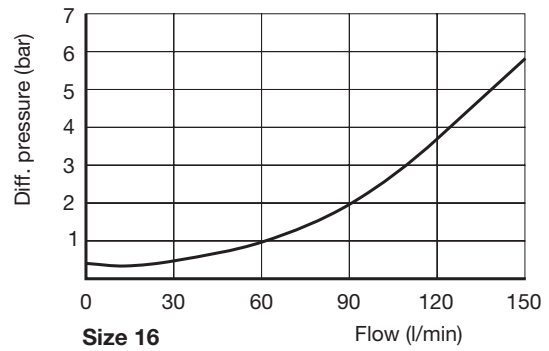
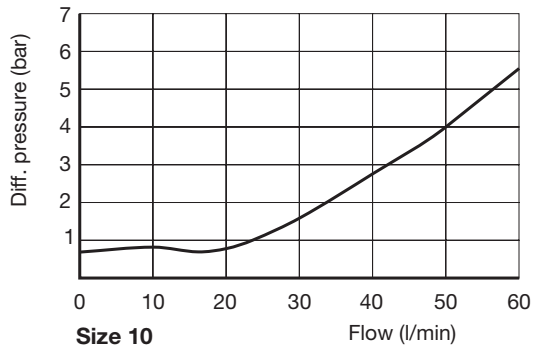
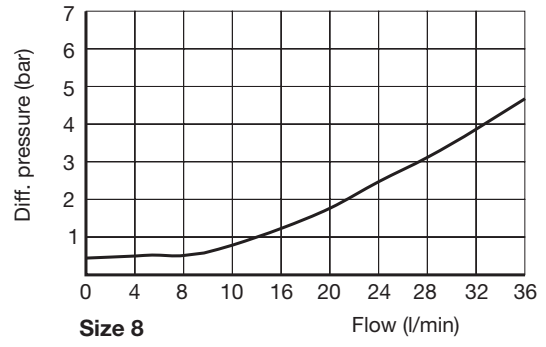
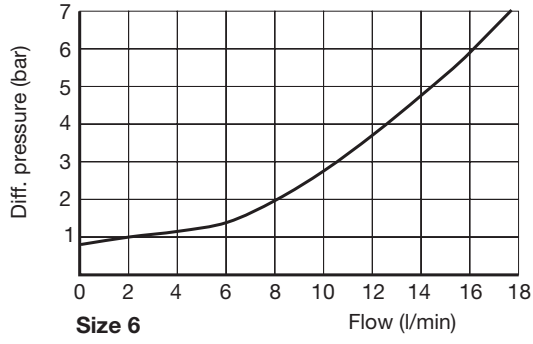


Type	a	b	c	d
NV-6	58	12	G1/4	19
NV-8	58	12	G3/8	24
NV-10	72	14	G1/2	30
NV-16	85	16	G3/4	36

**Technical data**

Size		6	8	10	16
Flow rate	l/min	16	35	60	150
Operating pressure	bar	350	350	350	350
Cracking pressure	See characteristic curves on page 1.3.2				
Oil temperature range		-20 to +70	-20 to +70	-20 to +70	-20 to +70
Viscosity range	°C	15 to 380	15 to 380	15 to 380	15 to 380
Filtration	mm <sup>2</sup> /s	8	8	8	8
Mass	NAS 1638	0,1	0,2	0,3	0,5
Hydraulic fluid	kg Oil HL, HLP, to DIN 51524 and HETG, HEES, HEPG to VDMA 24568 and ISO 15380				

△ p - Q Performance curves (measured at t = 50 °C and  $\nu = 32 \text{ mm}^2/\text{s}$ )



## CHECK VALVE type VP-NOV

- NS-6, 10
- to 350 bar
- to 100 l/min
- Direct operated
- Connecting dimensions to ISO 4401
- Flow shut-off in both or one service line
- For vertical stacking - sandwich plate design
- Height and width of the valves to ISO 7790 norms



VP-NOV-10-..., VP-NOV-6-..

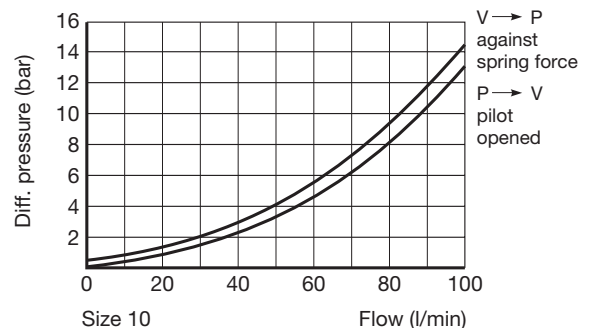
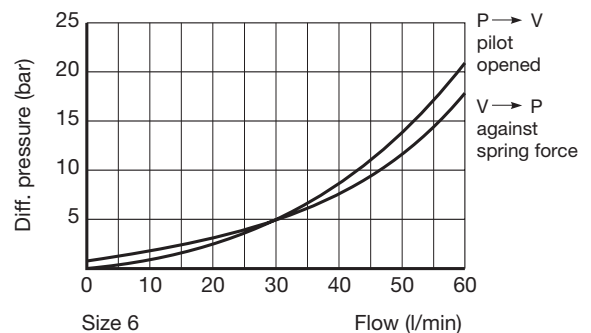
### Description of operating

Pilot operated check valves type VP-NOV enable the hydraulic fluid flow in the service lines to be automatically shut off and made free, respectively.

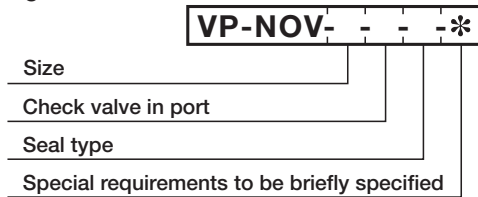
Free flow direction is always from the valve side "V" to the subplate side "P". In the opposite direction is the valve blocked for the hydraulic fluid flow. Free flow in port A in direction P to V is achieved by means of pressure in port B, and vice versa. To assure zero leakage there is necessary to discharge ports A and B towards T in the zero position of the directional valve.

### Performance curves

$\Delta p - Q$  Performance curves of the flow in direction V to P (through check valve) and in direction P to V (check valve pilot opened with  $p_x=80$  bar). Measured at  $t = 50^\circ\text{C}$  and  $\nu = 32 \text{ mm}^2/\text{s}$

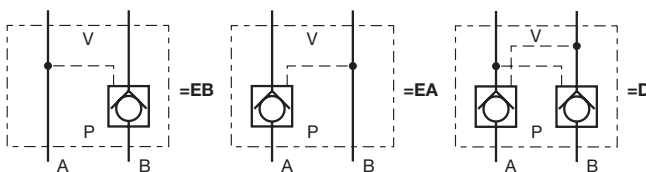


### Ordering code



Size	Seal type	
Size 6 = 6	NBR seals for mineral oil	= no desig.
Size 10 = 10	HL, HLP, to DIN 51524	
	FPM seals for HETG,	= E
	HEES, HEPG to VDMA 24568	
	and ISO 15380	

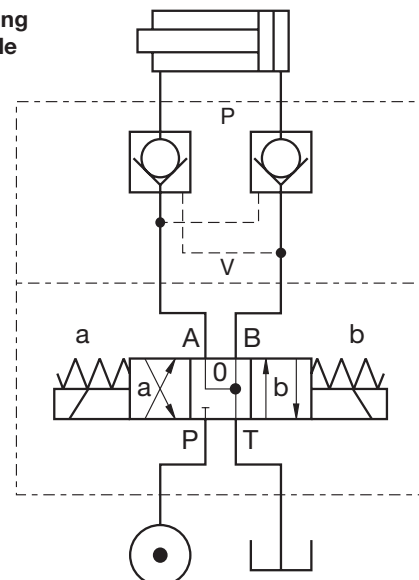
### Check valve in port (symbol)



### Technical data

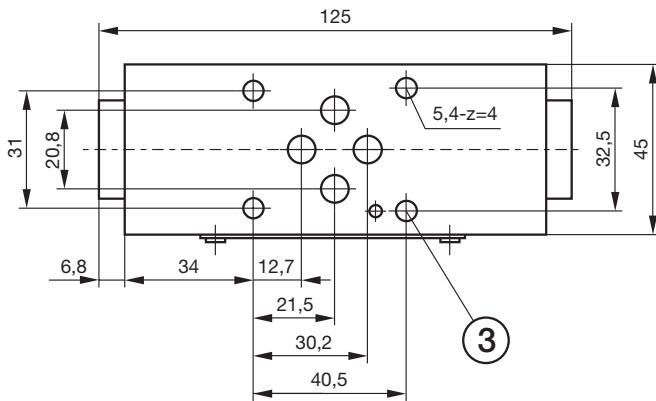
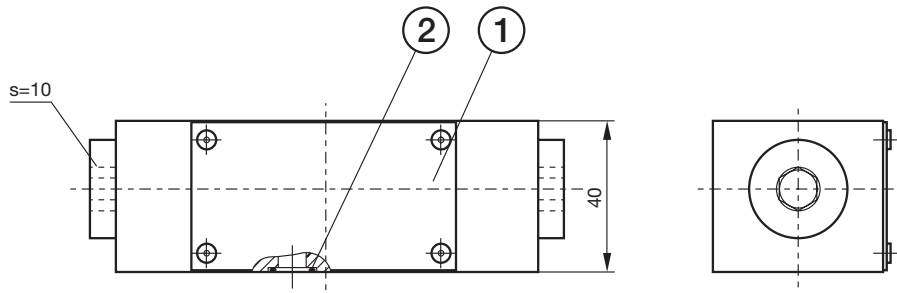
Size		6	10
Flow rate	l/min	60	100
Operating pressure	bar	350	350
Cracking pressure	bar	1	0,5
Area ratio		1:3,9	1:3,6
Oil temperature range	$^\circ\text{C}$	-20 to +70	-20 to +70
Viscosity range	$\text{mm}^2/\text{s}$	15 to 380	15 to 380
Filtration	NAS 1638	8	8
Mass	kg	1,8	3,5

### Mounting example

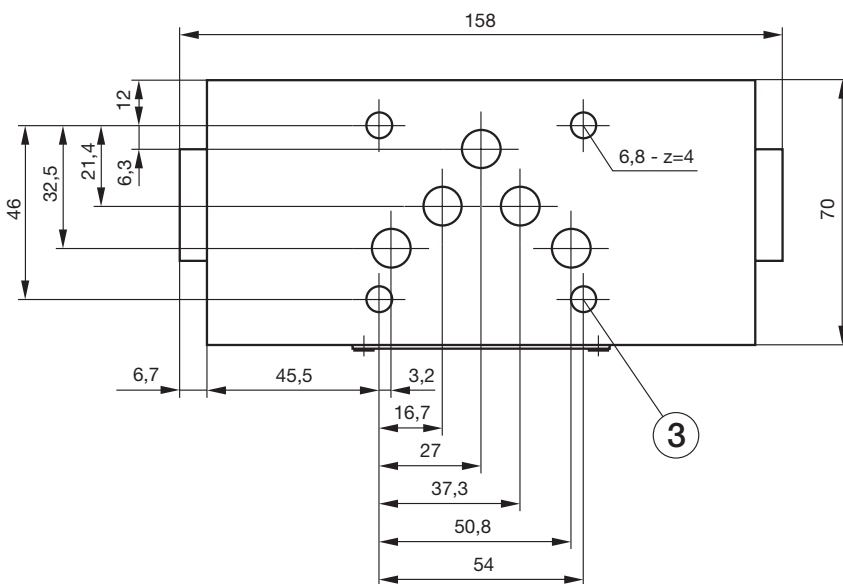
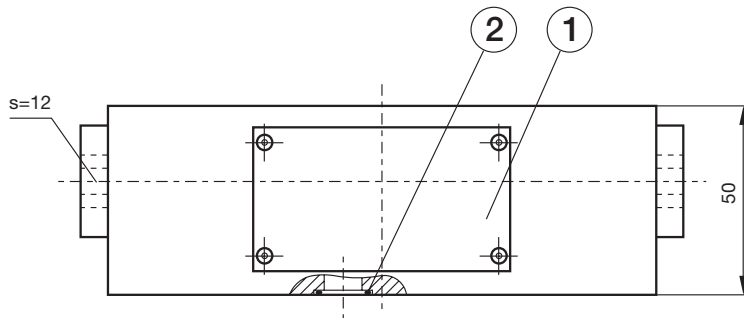




Dimensions (mm)

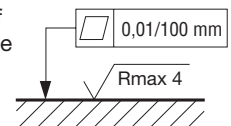


- 1. Nameplate
- 2. O-ring  $\varnothing 9,25 \times 1,78 - 4$  pcs
- 3. Fixing bores for fixing screws M5

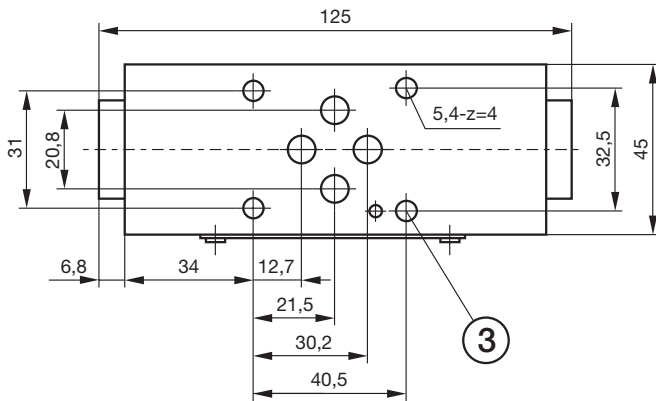
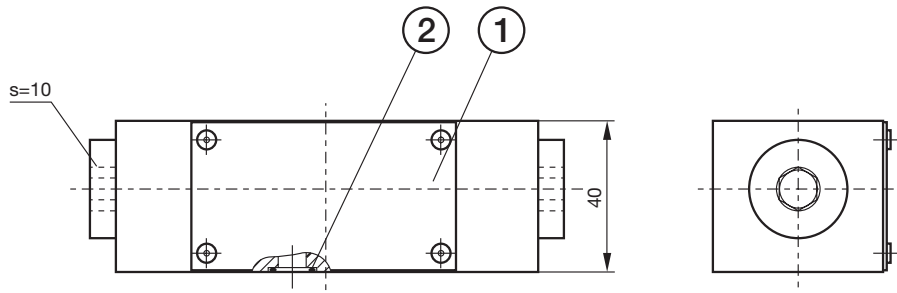


- 1. Nameplate
- 2. O-ring  $\varnothing 12,42 \times 1,78 - 5$  pcs
- 3. Fixing bores for fixing screws M6

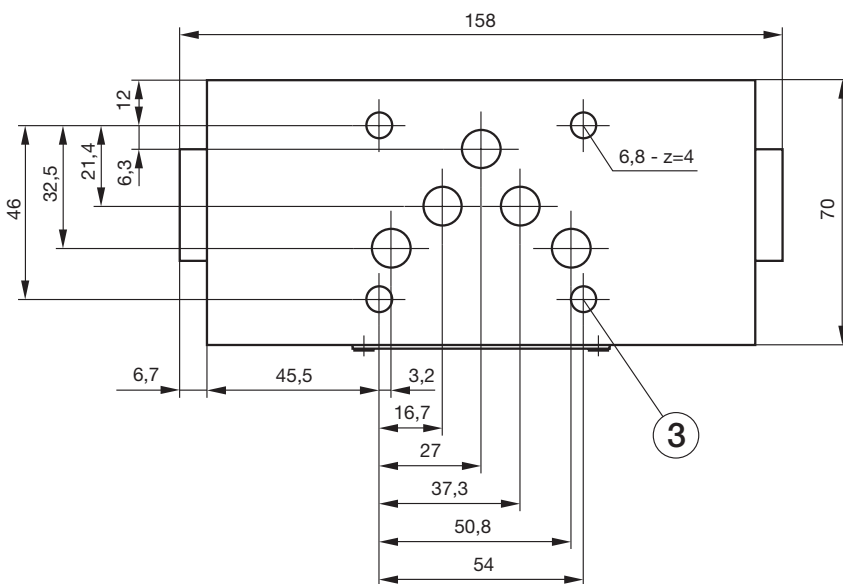
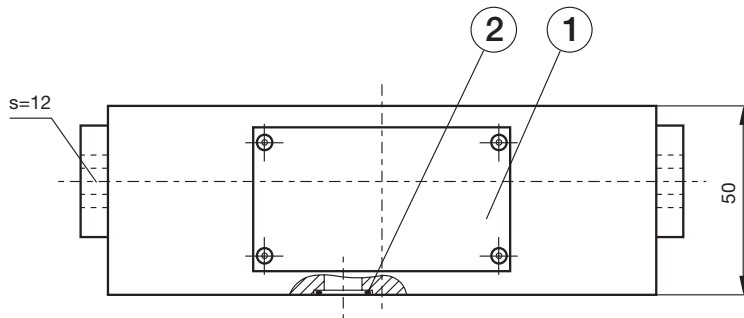
Required quality of the mating surface



Dimensions (mm)

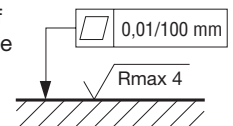


- 1. Nameplate
- 2. O-ring  $\varnothing 9,25 \times 1,78 - 4$  pcs
- 3. Fixing bores for fixing screws M5



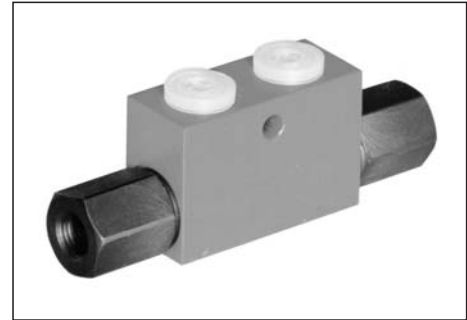
- 1. Nameplate
- 2. O-ring  $\varnothing 12,42 \times 1,78 - 5$  pcs
- 3. Fixing bores for fixing screws M6

Required quality of the mating surface



## CHECK VALVE type NOV

- NS-4
- to 350 bar
- to 30 l/min
- Direct operated
- Threaded connections to ISO 9974, ISO 1179
- Flow shut-off in both service lines
- Direct in-line mounting



NOV-4

### Description of operating

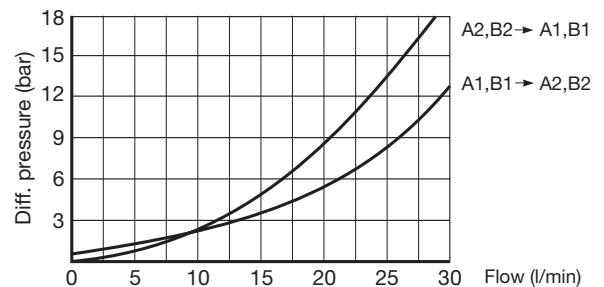
Direct operated check valves type NOV enable the hydraulic fluid flow in the service lines to be automatically shut-off and made free, respectively.

Free flow direction is always from the valve side A1, B1 to side A2, B2. In the opposite direction is the valve blocked for the hydraulic fluid flow. Free flow in port A in direction A2 to A1 is achieved by means of pressure in port B, and vice versa.

To assure zero leakage there is necessary to discharge ports A1 and B1 towards T in the zero position of the directional valve.

### Performance curves

$\Delta p - Q$  Performance curves of the flow in direction A1,B1  $\rightarrow$  A2,B2 (through check valve) and in direction A2,B2  $\rightarrow$  A1,B1 (check valve pilot opened). Measured at  $t = 50\text{ }^{\circ}\text{C}$  and  $\nu = 32\text{ mm}^2/\text{s}$

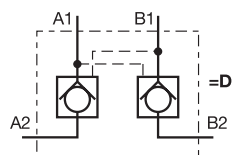


### Ordering code

**NOV-4-D- - -\***

- Check valve in port
- Threaded connections
- Seal type
- Special requirements to be briefly specified

#### Check valve in port (symbol)



#### Threaded connections

M14x1,5 = M  
 G 1/4 = G

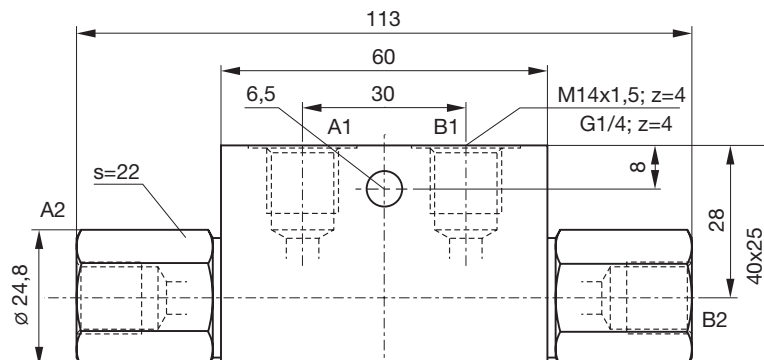
#### Seal type

NBR seals for mineral oil HL, HLP, to DIN 51524 = no desig.  
 FPM seals for HETG, HEES, HEPG to VDMA 24568 and ISO 15380 = E

### Technical data

Size		4
Flow rate	l/min	30
Operating pressure	bar	350
Cracking pressure	bar	1
Area ratio		1:4
Oil temperature range	$^{\circ}\text{C}$	-20 to +70
Viscosity range	$\text{mm}^2/\text{s}$	15 to 380
Filtration	NAS 1638	8
Mass	kg	0,6

### Dimensions (mm)



## CHECK VALVE type NOV

- NS-6
- to 350 bar
- to 35 l/min
- Direct operated
- Threaded connections to ISO 1179
- Flow shut-off in one service line
- Direct in-line mounting



NOV-6

### Description of operating

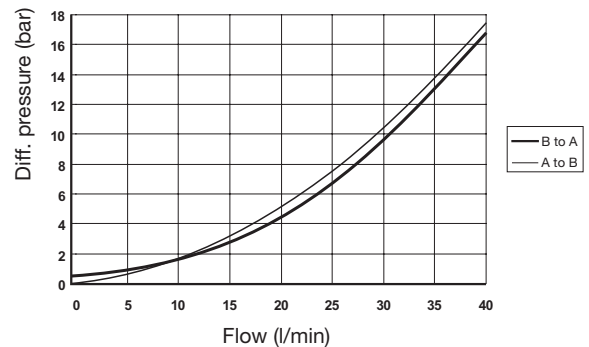
Pilot operated check valves type NOV enable the hydraulic fluid flow in the service lines to be automatically shut-off and made free, respectively.

Free flow direction is from the valve port B to port A. In the opposite direction the valve is blocked for the hydraulic fluid flow. Free flow from port A to port B is achieved by means of pressure in port Z.

To assure zero leakage there is necessary to discharge ports B and Z towards T in the zero position of the directional valve.

### Performance curves

$\Delta p - Q$  Performance curves of the flow in direction B  $\rightarrow$  A (through check valve) and in direction A  $\rightarrow$  B (check valve pilot opened).  
 Measured at  $t = 50\text{ }^{\circ}\text{C}$  and  $\nu = 32\text{ mm}^2/\text{s}$

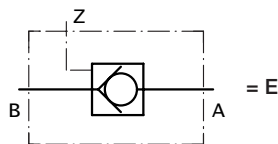


### Ordering code

**NOV-6-E-C- -\***

- Check valve in port
- Threaded connections
- Seal type
- Special requirements to be briefly specified

Check valve  
 in port (symbol)



Threaded connections

Port A, B ...G3/8  
 Port Z ...G1/4 = C

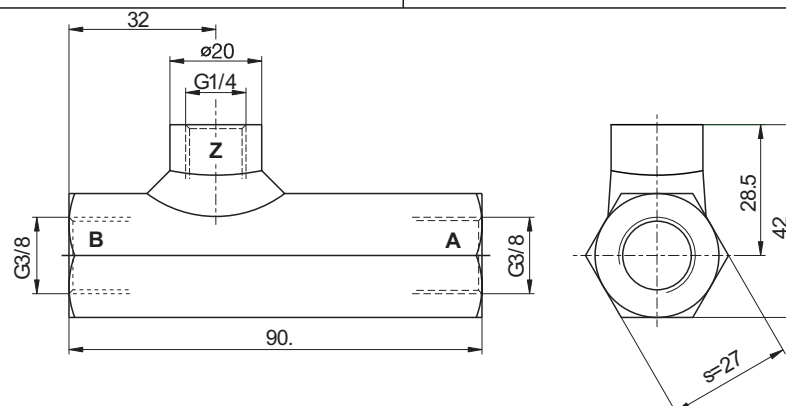
Seal type

NBR seals for mineral oil HL, HLP, to DIN 51524 = no desig.  
 FPM seals for HETG, HEES, HEPG to VDMA 24568 = E  
 and ISO 15380

### Technical data

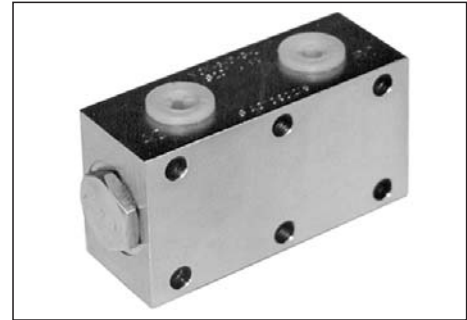
Size		6
Flow rate	l/min	35
Operating pressure	bar	350
Cracking pressure	bar	0,5
Area ratio		1:4
Oil temperature range	$^{\circ}\text{C}$	-20 to +70
Viscosity range	$\text{mm}^2/\text{s}$	15 to 380
Filtration	NAS 1638	8
Mass	kg	0,4

### Dimensions (mm)



**CHECK VALVE type NOV**

- NS-6
- to 350 bar
- to 60 l/min
- Direct operated
- Threaded connections to ISO 1179
- Flow shut-off in both service line
- Direct in-line mounting



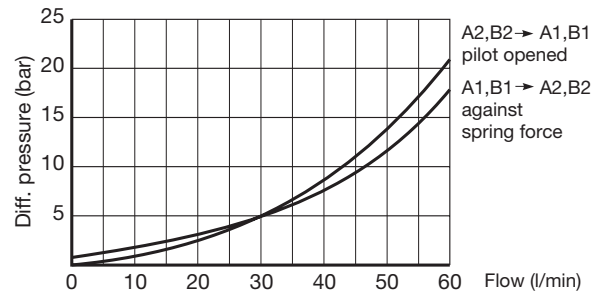
NOV-6

**Description of operating**

Direct operated check valves type NOV enable the hydraulic fluid flow in the service lines to be automatically shut-off and made free, respectively. Free flow direction is always from the valve side A1,B1 to side A2,B2. In the opposite direction is the valve blocked for the hydraulic fluid flow. Free flow in port A in direction A2 to A1 is achieved by means of pressure in port B, and vice versa. To assure zero leakage there is necessary to discharge ports A1 and B1 towards T in the zero position of the directional valve.

**Performance curves**

$\Delta p - Q$  Performance curves of the flow in direction A1,B1  $\rightarrow$  A2,B2 (through check valve) and in direction A2,B2  $\rightarrow$  A1,B1 (check valve pilot opened). Measured at  $t = 50\text{ }^\circ\text{C}$  and  $\nu = 32\text{ mm}^2/\text{s}$



**Ordering code**

**NOV-6-D-G- -\***

- Check valve in port
- Threaded connections
- Seal type
- Special requirements to be briefly specified

**Seal type**

NBR seals for mineral oil HL, HLP, to DIN 51524 = no desig.  
FPM seals for HETG, HEES, HEPG to VDMA 24568 and ISO 15380 = E

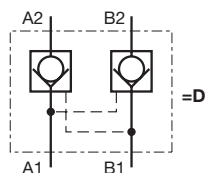
**Threaded connections**

G 3/8 = G

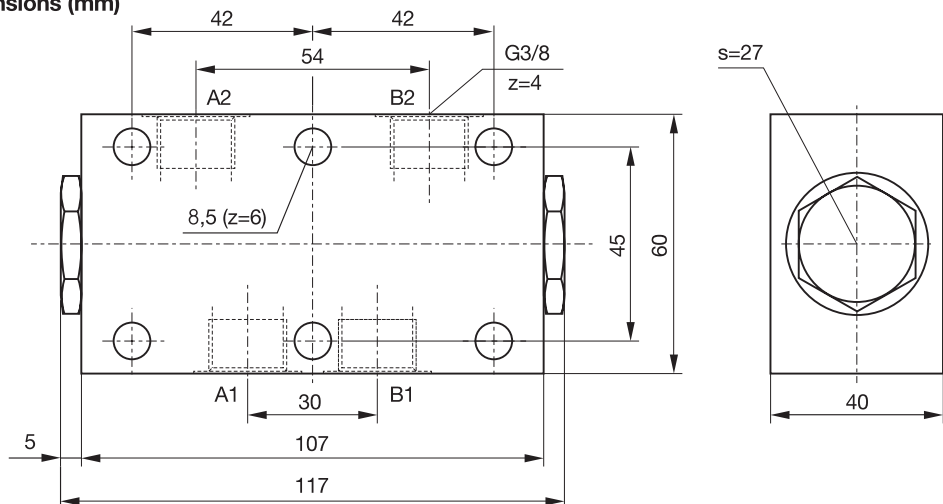
**Technical data**

Size		6
Flow rate	l/min	60
Operating pressure	bar	350
Cracking pressure	bar	1
Area ratio		1:3,9
Oil temperature range	$^\circ\text{C}$	-20 to +70
Viscosity range	$\text{mm}^2/\text{s}$	15 to 380
Filtration	NAS 1638	8
Mass	kg	1,5

**Check valve in port (symbol)**



**Dimensions (mm)**



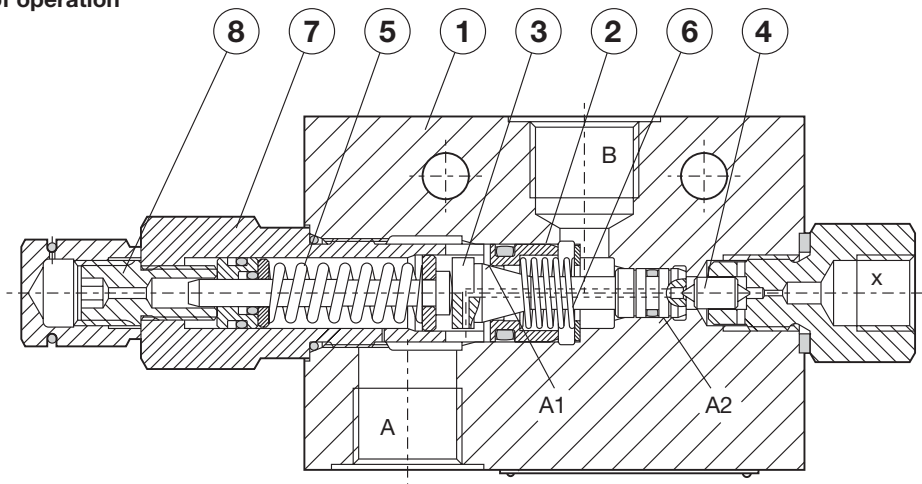
## CHECK-Q-METER type BZV

- NS 6
- to 350 bar
- to 60 l/min
- Direct operated
- Hermetically sealing at closed flow path
- Minimum pressure losses when the medium flows from port A towards port B
- When the medium flows from port B towards port A the speed of load lowering is controlled with respect to the medium flow rate supplied to the opposite side of the hydraulic motor or cylinder. With operating cylinders the characteristic ratio of surface areas must be taken into account
- For building into pipe-lines
- Threaded connections to ISO 9974, ISO 1179



BZV-6-D, BZV-6-E

### Description of operation



The check-Q-meter is used for maintaining constant speed during the lowering of loads by means of hydraulic cylinders or hydromotors in the systems where load changes with time. It prevents uncontrolled falling of load if defects occur in the pipeline between the directional control valve and the check-Q-meter or if there is no pilot pressure. When it is installed in combination with a directional control valve with negative change-over in intermediate positions, it has the function of a holding valve. If the load on hydraulic cylinders or hydromotors does not change the sign, a single check-Q-meter must be used.

The check-Q-meter consists of a housing (1), main poppet (2), auxiliary spool (3), pilot poppet (4), spring (5), insert housing (7) and setting screw (8).

#### Lifting the load

The hydraulic fluid flows from port A towards port B with minimum pressure losses, the main poppet (2) being lifted. In the case of a pressure drop and an interruption in the hydraulic fluid supply to port A, the main poppet (2) closes, holding the load in position.

Lowering the Load (see also the hydraulic circuit diagram with differential cylinder, page 11.4.2). With the directional control valve in position (a) the hydraulic fluid flows to the annulus side of the hydraulic cylinder, which provokes a certain pilot pressure on the auxiliary spool (3). The check-Q-meter opens and thereby a free hydraulic fluid flow from port B towards port A occurs, when the main poppet (2) leans against the insert housing (7), where as the auxiliary spool (3) still performs a part of the controlled move which depends on the quantity of the hydraulic fluid supplied in a unit of time to the annulus side of the operating cylinder. In the opening direction, also the load pressure works on the circle of the predefined surface. The pilot pressure required for the opening of the check-Q-meter is

$$\text{required pilot press.} = \frac{\text{safety valve setting} - \text{load pressure}}{4,25}$$

In case that the hydraulic cylinder piston starts to move faster than permitted by the hydraulic fluid supply, the pilot pressure on the port X drops and the auxiliary spool (3) under the effect of spring (5) moves in the valve closing and shutting-off direction, respectively.

Because of the reduction in flow cross-section the resistances increase, which causes an increase in the pilot pressure and thereby a larger opening of the check-Q-meter. In this manner, the check-Q-meter is continuously balanced during lowering. The spring (5) setting force must be set at least 1.3 -times higher than the maximum force due to the operating pressure (pressure due to load):

$$\text{maximum operating pressure} = \frac{350 \text{ bar}}{1,3} = 270 \text{ bar}$$

### Technical data

Flow rate		l/min	60
Operating pressure	spring 200 bar	bar	150
	spring 350 bar	bar	270
Pilot pressure	spring 200 bar	bar	4 to 50
	spring 350 bar	bar	6 to 85
Cracking pressure		bar	2,2
Pilot ratio	$R=A2/A1-A2$		4,25
Oil temp. range		°C	-20 to +70
Viscosity range		mm <sup>2</sup> /s	15 to 380
Filtration		NAS 1638	8
Mass	BZV-6-E	kg	1,5
	BZV-6-D	kg	2,4

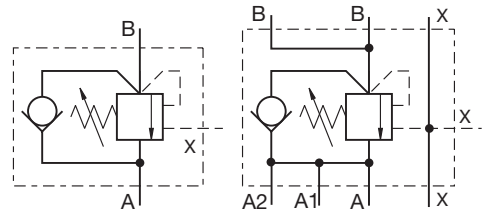
**Ordering code**

**BZV - 6 - - - - \***

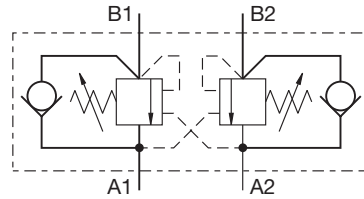
- Symbol type
- Control range
- Mounting method
- Seal type
- Special requirements to be briefly specified

**Symbol type**

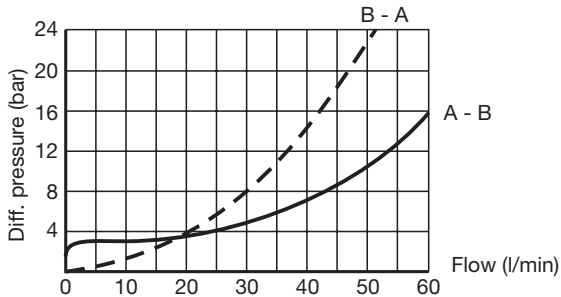
BZV-6-E = E  
single check-Q-meter



BZV-6-D = D  
double check-Q-meter



$\Delta p - Q$  Performance curves  
(measured at  $t = 50^\circ\text{C}$  and  $v = 32 \text{ mm}^2/\text{s}$ )



**Control range**

from 60 to 200 bar = 200  
from 100 to 350 bar = 350

**Mounting method**

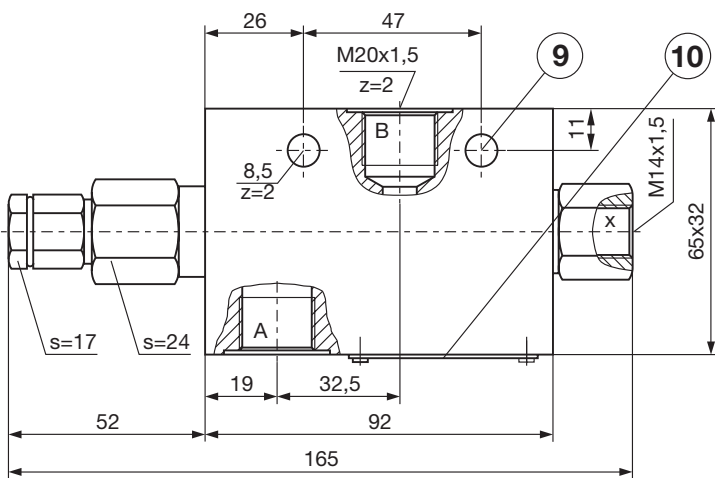
building into pipeline (M20x1,5 / M14x1,5) = C  
building into pipeline (G3/8) = CG  
building direct on hydraulic cilinder = CDG

**Seal type**

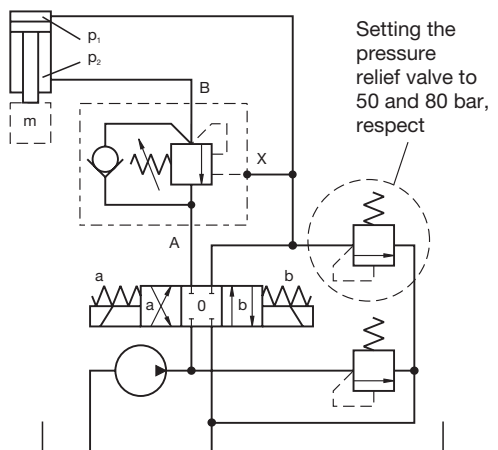
NBR seals for mineral oil HL, HLP, to DIN 51524 = no desig.  
FPM seals for HETG, HEES, HEPG to VDMA 24568 = E  
and ISO 15380

**Dimensions (mm)**

**BZV-6-E-...-C**



**Circuit diagram with hydraulic cylinder**

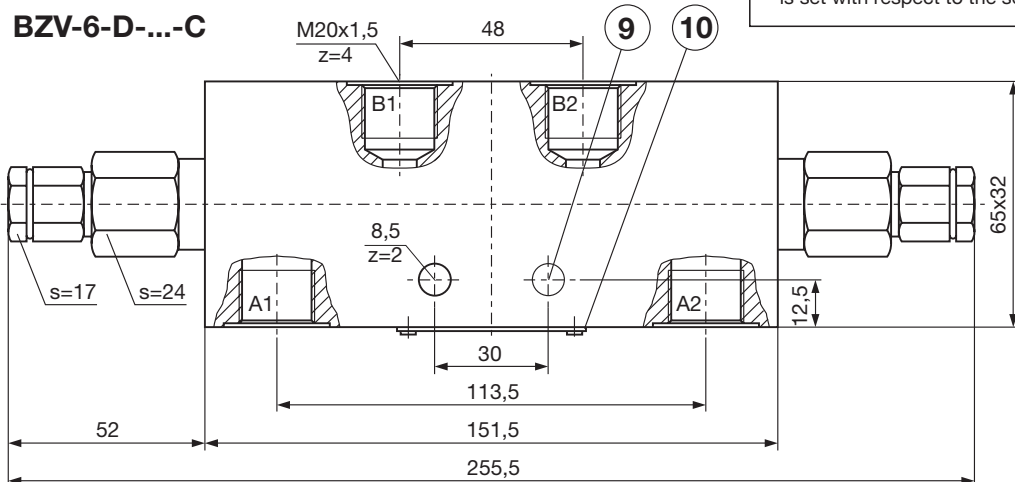


Because of the multiplication of pressure in hydraulic cylinder by the difference of surface areas

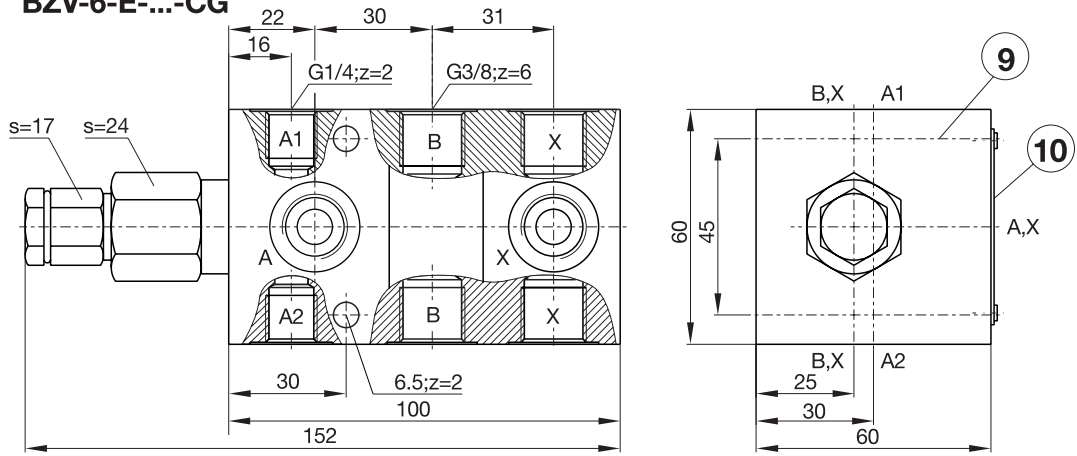
$$p_2 = p_m + p_1 \times \varphi \quad \varphi = \frac{A_1}{A_2} > 1$$

it is recommended to protect the circuit by means of a pressure relief valve, the cracking pressure of which is set with respect to the selected spring (5) in the

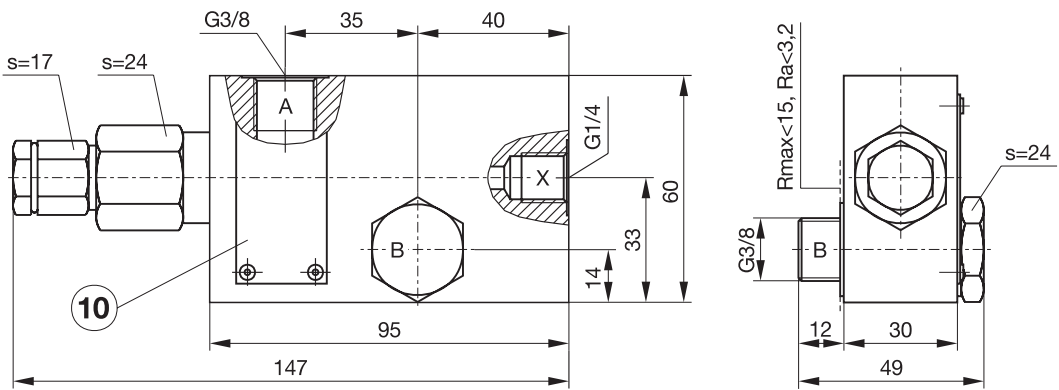
**BZV-6-D-...-C**



**BZV-6-E-...-CG**



**BZV-6-E-...-CDG**



- 9. Fixing screw
- 10. Nameplate



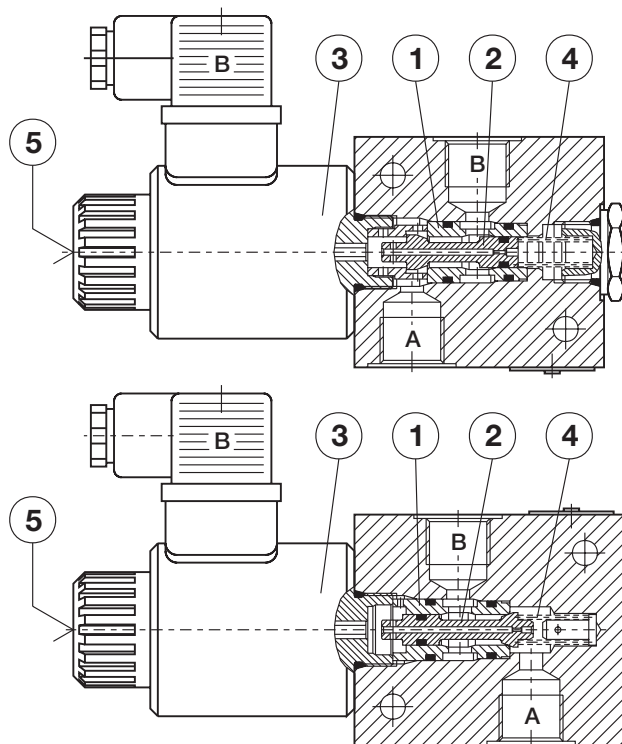
**2/2-WAY DIRECTIONAL VALVES type KV**

- NS-6
- to 210 bar
- to 30 l/min
- Direct in-line mounting
- Threaded connections to ISO 9974, ISO 1179
- Hermetically sealing at closed flow path
- No STICK-SLIP effect even after a prolonged dwell time under pressure
- Direct operating by solenoid
- Plug-in solenoid connector to ISO 4400



KV-2/2-6-S

**Description of operation**



Directly-operated directional seat valves Type KV are used for the control of direction of hydraulic fluid.

**KV-2/2-6-S-A-...**

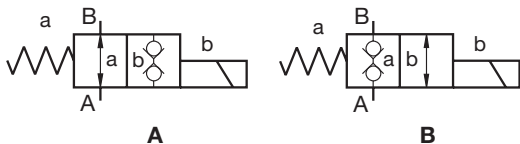
In the start control position a the return spring (4) holds the ball (2) in its open position, thus freeing the flow path between ports A and B. The change-over into the control position b is accomplished by energizing the solenoid (3), whereby the ball (2) is pushed against the seat (1). The hydraulic fluid on port A is under pressure.

**KV-2/2-6-S-B-...**

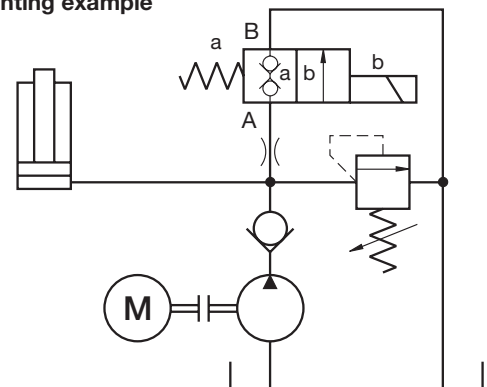
The hydraulic fluid on port A in the start control position a is under pressure. The return spring (4) pushes the ball (2) against its seat (1). The change-over to the control position b is performed by energizing the solenoid (3), thus freeing the flow path between ports A and B.

The change-over can also be done manually by pressing the emergency hand operator (5).

**Symbols (spool type)**



**Mounting example**



**Technical data**

**Hydraulic**

Size		6
Flow rate	l/min	30
Operating pressure	bar	210
Oil temperature range	°C	-20 to +70
Viscosity range	mm <sup>2</sup> /s	15 to 380
Filtration	NAS 1638	8
Mass	kg	2,2

**Electrical**

Supply voltage	V	12, 24, 48, 110, 230 DC or AC
Power	W	29*
Intermittence		continous
Ambient temperature	°C	to +50
Coil temperature	°C	to +180
Duty cycle	min <sup>-1</sup>	250

\*-12 V supply voltage - 36W

**Ordering code**

**KV-2/2-6-S-** - - - - - \*

- Spool type
- Supply voltage
- Protection of solenoid
- Plug-in connector
- Threaded connections
- Seal type
- Special requirements to be briefly specified

**Supply voltage**

direct voltage	24 V = no design.
	12 V = 12 DC
	48 V = 48 DC
	110 V = 110 DC
	220 V = 220 DC
alternating voltage	12 V = 12 AC
	24 V = 24 AC
	48 V = 48 AC
	110 V = 110 AC
	230 V = 230 AC*

Alternating voltage solenoids are fitted with a bridge rectifier.  
 With solenoids of over 48 V an earthing clamp  $\perp$   
 to DIN EN 175301-8003 must be connected.  
 \* To fulfil EMC (89/336/EEC) a capacitor must be built in (see 10.1.1)

**Protection of solenoid**

- protection IP 65 to DIN EN 60529 = no design.
- adverse climatic conditions = Z

**Plug-in connector**

- without signal lamp = no design.
- with signal lamp = L

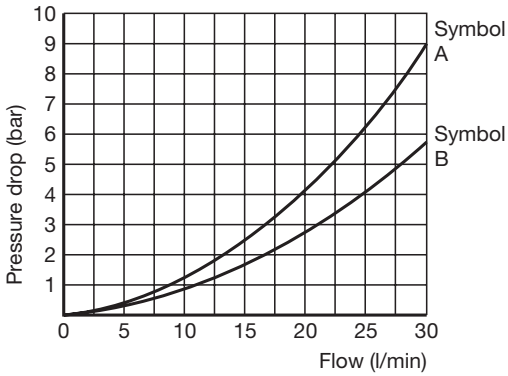
**Threaded connections**

- G 3/8 = no design.

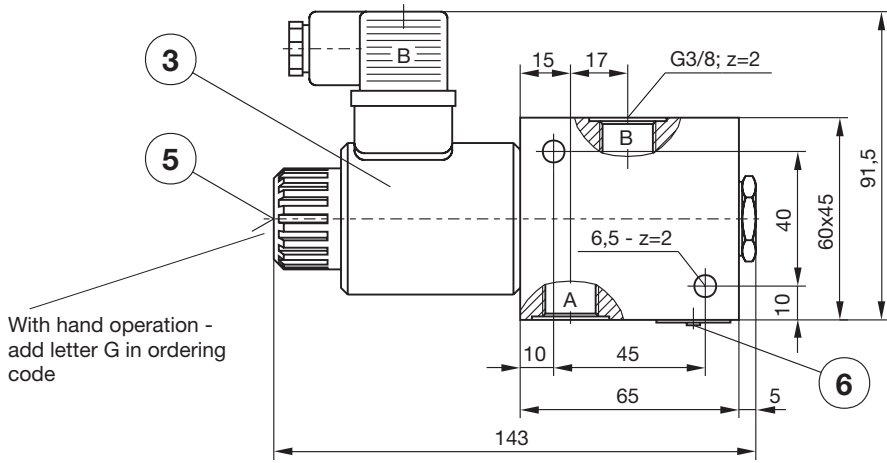
**Seal type**

- NBR seals for mineral oil HL, HLP, to DIN 51524 = no design.
- FPM seals for HETG, HEES, HEPG to VDMA 24568 = E and ISO 15380

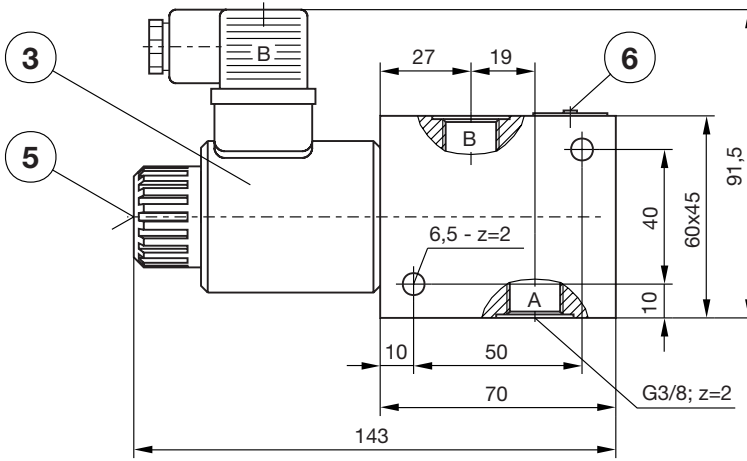
$\Delta p$  - Q Performance curves  
 (measured at  $t = 50^\circ\text{C}$  and  $v = 32 \text{ mm}^2/\text{s}$ )  
 valid for flow direction A to B



**Dimensions (mm)**



**KV-2/2-6-S-A-MR**



**KV-2/2-6-S-B-MR**

- 3. Solenoid "b" MR-045
- 5. Emergency hand operator
- 6. Nameplate

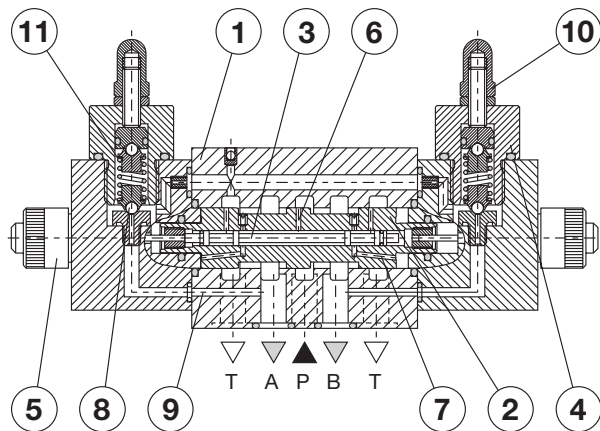
## 4/2-WAY DIRECTIONAL VALVES type PKV

- NS 10
- to 210 bar
- to 60 l/min
- Indirect, hydraulic operation
- Connecting dimensions to ISO 4401
- Provision of pressure setting for change - over
- Automatic change - over from the other operating position
- Connection to subplate type PP-KV-10
- Connection to subplate with pressure relief valve type PP-PKV-10



PKV-10

### Description of operation



Indirectly, hydraulic - operated directional valves type PKV are used to control the hydraulic fluid flow direction by an automatic change - over.

These valves consist of a housing (1), a control spool (2), a change - over piston (3), and two pressure relief valves (4).

When the change - over piston (3) and the control spool (2) are in the neutral position no change - over will occur, and the valve must be shifted to the appropriate position using the emergency hand operator (5). In this way the hydraulic fluid flow through the bores (6) and (7) to the front side of control spool (2), changing - over from the position P - B to the position P - A. The control spool (2) rests in this position until the pressure in the line "A" increases to the value set on the pressure relief valve (4). The pressure rise occurs the operating cylinder reaches the extreme position. At this moment the pilot poppet (8) will lift, freeing the flow of the hydraulic fluid from the channel (9) via the pressure relief valve (4) to the change - over piston (3). The flow shifts the piston to the right and corresponding flow ways are freed, allowing the control spool to change - over to the position P - B. From here on the process is automatic. The pressure setpoint valve for the valves change - over is adjusted on the pressure setting element (10) by which the spring (11) can be set.

### Ordering code

**PKV - 10 - -\***

#### Seal type

Special requirements to be briefly specified

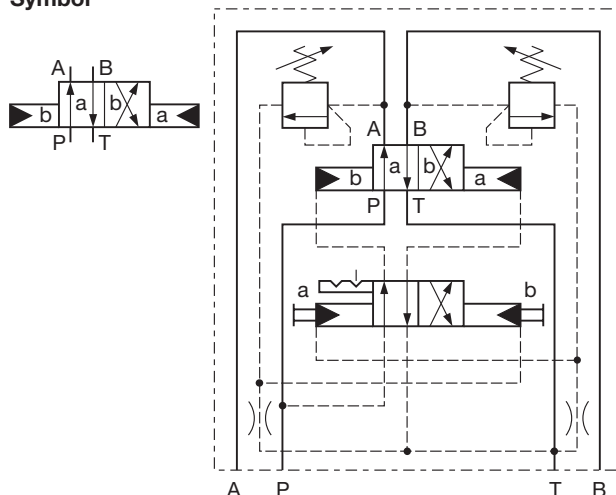
#### Seal type

NBR seals for mineral oil HL, HLP, to DIN 51524 = no desig.  
 FPM seals for HETG, HEES, HEPG to VDMA 24568 and ISO 15380 = E

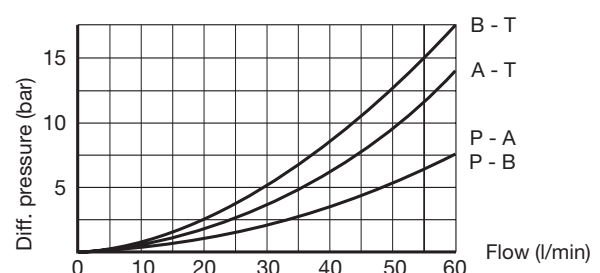
### Technical data

Size		10
Flow rate	l/min	60
Operating pressure P,A,B	bar	to 210
T	bar	to 160
Min. press. req. for autom. change over	bar	20
Minimum flow rate	l/min	0,8
Change over pressure	bar	20 to 200
Viscosity range	mm <sup>2</sup> /s	15 to 380
Oil temperature range	°C	-20 to +70
Mass	kg	3,2
Filtration	NAS 1638	8

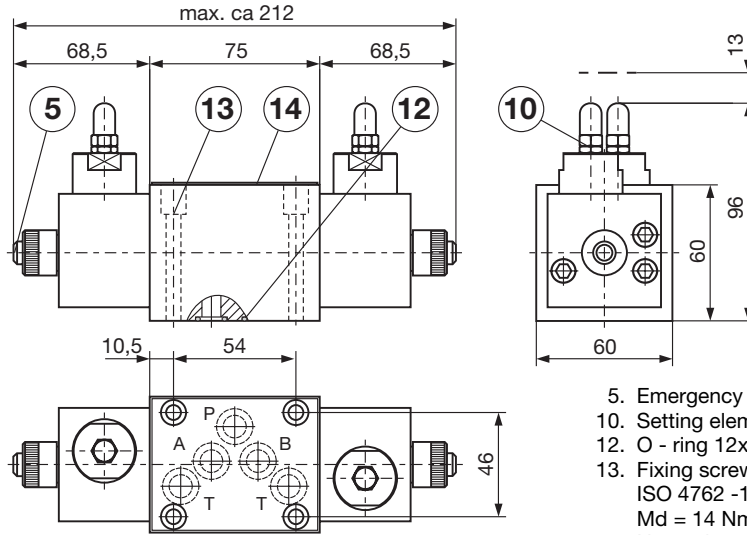
### Symbol



### Δ p - Q Performance curves (measured at t = 50 °C and ν = 32 mm<sup>2</sup>/s)

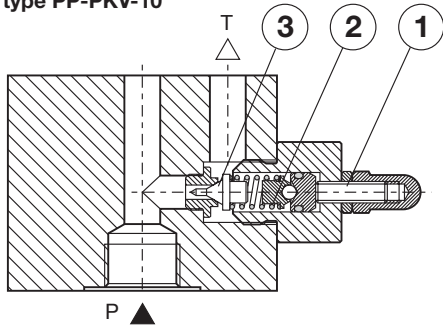


**Dimensions (mm)**



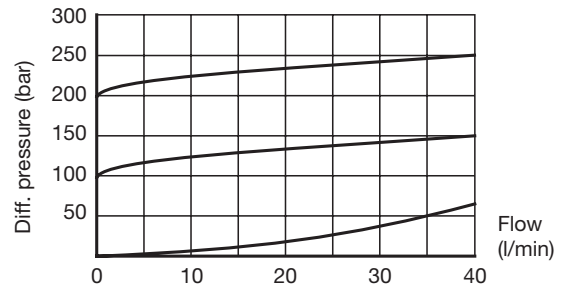
- 5. Emergency hand operator
- 10. Setting elements with protective cap
- 12. O - ring 12x2
- 13. Fixing screws: 4 pcs M6x55 to DIN EN ISO 4762 -10.9 - tightening torque Md = 14 Nm
- 14. Nameplate

**Subplate type PP-PKV-10**

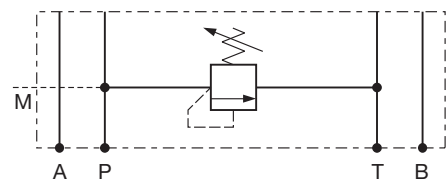


Subplate type PP-PKV-10 is used for fitting the directional valve type PKV-10 into hydraulic system where additional maintaining of maximum pressure is required. The subplate consist of a housing and a pressure relief valve. The latter includes a pilot poppet (1), a spring (2), and a setting element (3). The pressure valve is adjusted by setting element (3) which is used for spring setting (2).

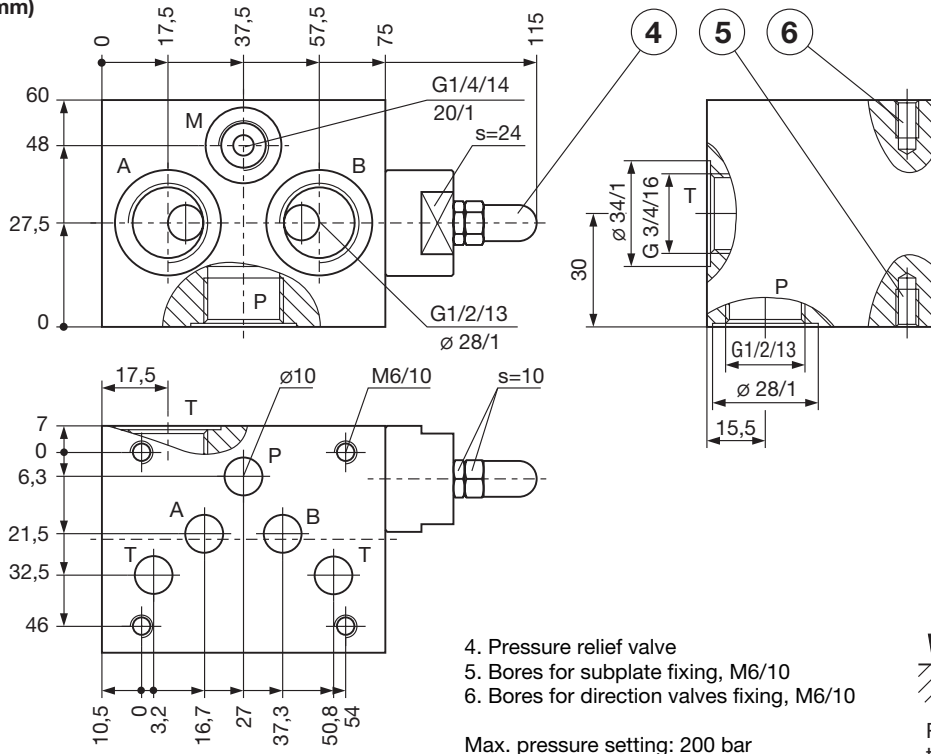
$\Delta p - Q$  Performance curves (measured at  $t = 50\text{ }^{\circ}\text{C}$  and  $\nu = 32\text{ mm}^2/\text{s}$ )



**Symbol**

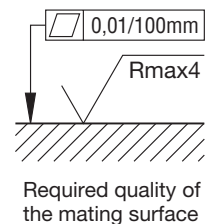


**Dimensions (mm)**



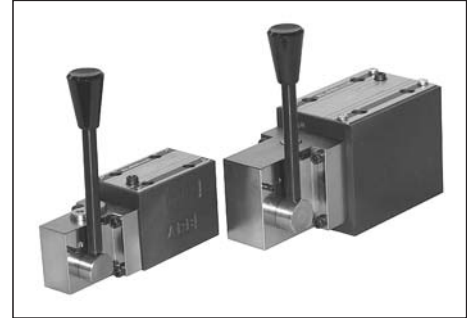
- 4. Pressure relief valve
- 5. Bores for subplate fixing, M6/10
- 6. Bores for direction valves fixing, M6/10

Max. pressure setting: 200 bar



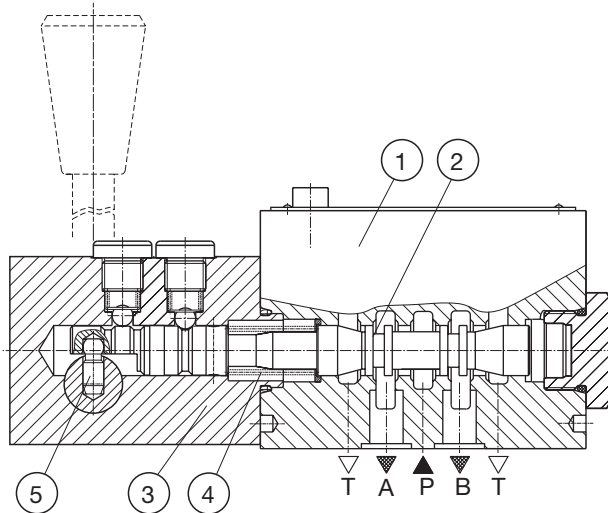
**4/2, 4/3-WAY DIRECTIONAL VALVES**

- NS 6, 10
- to 350 bar
- to 60 l/min, to 100 l/min
- Direct mechanical operation (by means of a lever)
- Connecting dimensions to ISO 4401



KV-4/3-5KO-6-R, KV-4/3-5KO-10-R

**Description of operation**



Directional valves type KV with direct mechanical operation by means of a lever control the direction of the hydraulic fluid medium flow.

These directional valves consist of a housing (1), control spool (2), control mechanism (3), and return spring (4). In 4/3-way directional valves the centre position of the control spool is the neutral position. The change-over to one of the operating positions "a" or "b" is done by moving the operating pin lever (5) in such a manner that its acts on the control spool (2) so as to clear corresponding flow ways and establish relevant links between ports, A, B, P, and T.

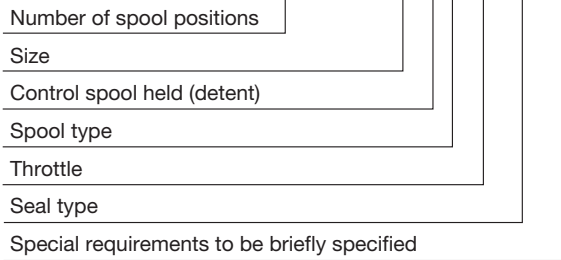
On ceasing to apply force to the control mechanism (3), the return spring (4) push the control spool into the neutral position.

There are two types of operation:

- with control spool not held in the operating position (the control spool returns to neutral position on ceasing to apply force to the control mechanism - type KV-.../...-R)
- with control spool held (detent) in the operating position (the control spool remains in the operating position on ceasing to apply force to the control mechanism lever - type KV-.../...-RA).

**Ordering code**

**KV-4 / -5KO - - - - \***



**Number of control spool position**

- two positions = 2
- three positions = 3

**Size**

- size 6 = 6
- size 10 = 10

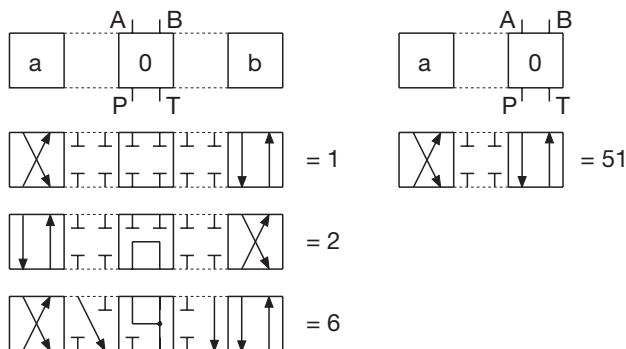
**Throttle**

- without throttle in "P" line ..... = **no desig.**
- throttle 0,8 mm dia ..... = **D08**
- throttle 1,0 mm dia ..... = **D10**
- throttle 1,2 mm dia ..... = **D12**

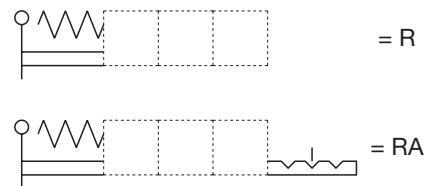
**Seal type**

NBR seals for mineral oil HL, HLP to DIN 51524 = **no desig.**  
 FPM seals for HETG, HEES, HEPG to VDMA 24568 = **E**  
 and ISO 15380

**Spool types**



**Control spool held**

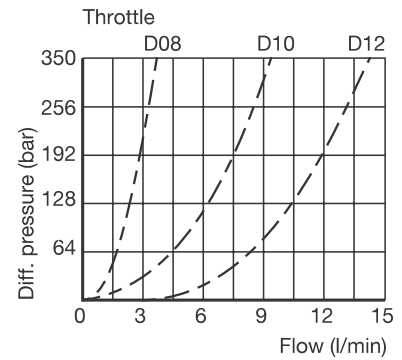
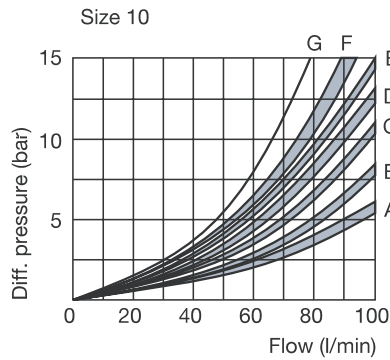
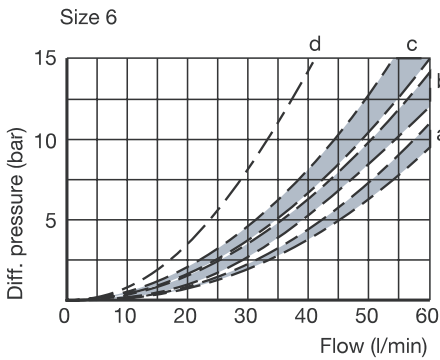


### Technical data

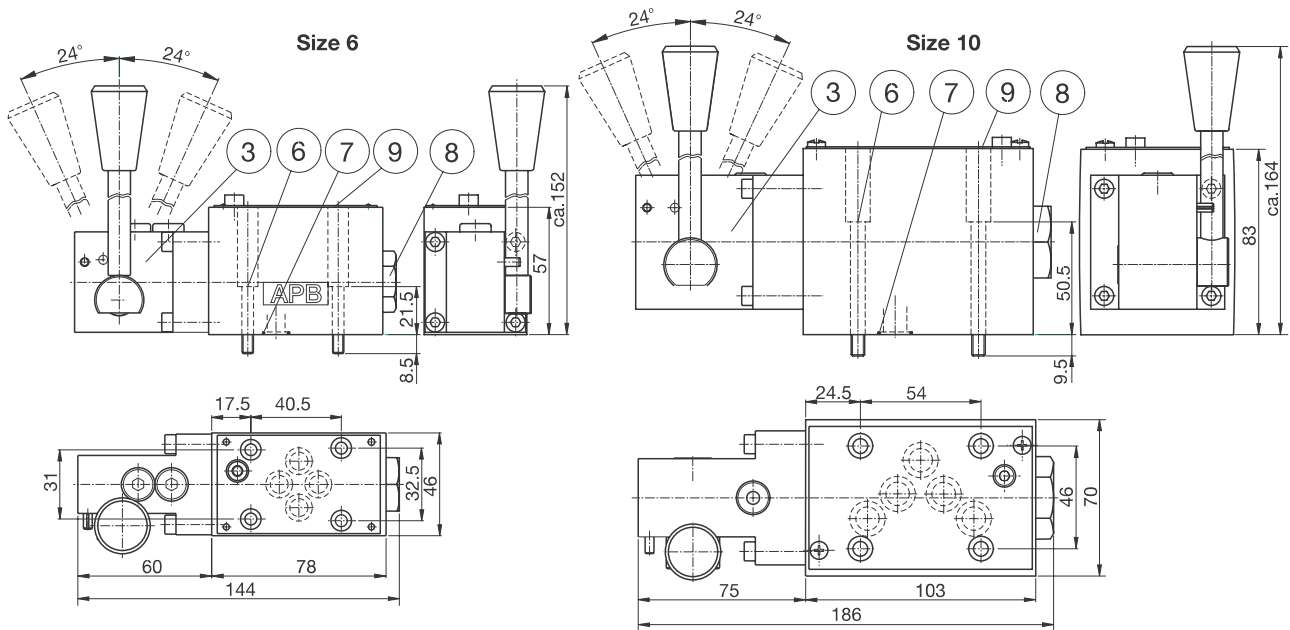
Size		6	10
Flow rate	l/min	60	100
Operating pressure	P, A, B	bar 350	
	T	bar 160	
Filtration	NAS 1638	8	
Fluid temperature range	°C	-20 to +70	
Viscosity range	mm <sup>2</sup> /s	15 to 380	
Mounting position		optional	
Mass	kg	1,35	3.3

Spool	P-A	P-B	A-T	B-T	P-T
1	b,D	b,D	c,B	c,C	-
2	c,B	c,B	c,A	c,A	d,G
3	c,F	c,E	a,B	a,A	-
51A	c,D	b,D	c,C	a,B	-

$\Delta p - Q$  Performance curves (measured at  $t = 50\text{ }^{\circ}\text{C}$  and  $\nu = 32\text{ mm}^2/\text{s}$ )



### Dimensions (mm)

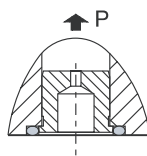


3. Control mechanism on side "a"  
4/3 valves  
4/2 valves, spool types 51A
6. Fixing screws 4 pcs M5 x 30 to DIN EN ISO 4762-10.9 (by special order) Required tightening torque  $M_d = 9\text{ Nm}$
7. O-ring 9.25 x 1.78
8. Valve cap
9. Nameplate

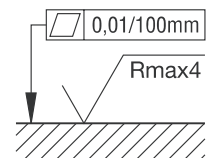
3. Control mechanism on side "a"  
4/3 valves  
4/2 valves, spool types 51A
6. Fixing screws 4 pcs M6 x 60 to DIN EN ISO 4762-10.9 (by special order) Required tightening torque  $M_d = 15\text{ Nm}$
7. O-ring 12,42 x 1,78
8. Valve cap
9. Nameplate

### Cartridge throttle

If flow rates greater than permissible occur during change-over, a cartridge throttle must be fitted into P-line of the directional valve.



Required quality of the mating surface



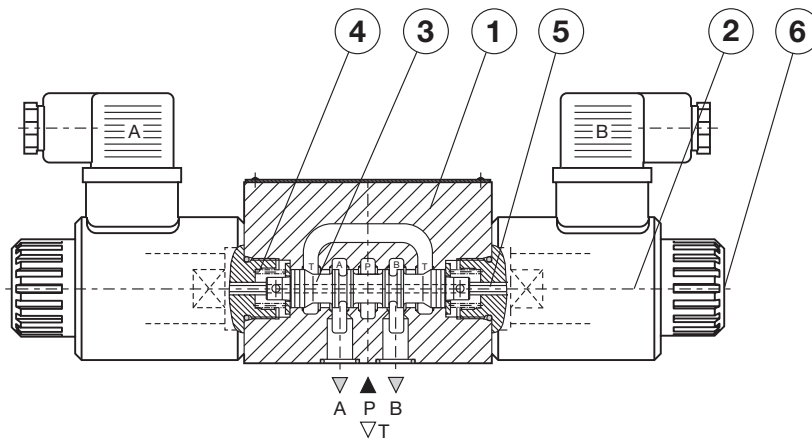
## 4/2 and 4/3 - WAY DIRECTIONAL VALVES type KV

- NS 6
- to 350 bar
- to 75 l/min
- Direct operation by solenoid
- Connection diagram and connecting dimensions to ISO 4401, DIN 24340
- Plug-in connector for solenoids to ISO 4400
- 5-chamber model with good spool guidance
- Optimized flow paths for low losses of pressure
- Adjustment of the switching time
- Wet pin solenoid with interchangeable coil
- Manual emergency control
- Protection of solenoid IP 65 to DIN EN 60529
- Fulfil EMC (89/336/EEC)



KV-4/3-5K0-6

### Description of operation



Directional valves type KV with direct solenoid operation control the direction of the hydraulic medium flow.

These directional valves consist of a housing (1), a control spool (3), and one solenoid (2) with two return springs (4) in 4/2-way directional valves, and two solenoids (2) with two return springs (4) in 4/3-way directional valves. In 4/3-way directional valves the centre position of the control spool is the neutral position. The change-over to the operating position (a) and (b) is done by energising the solenoids (2) "a" and "b" respectively, whereby the solenoid plunger acts on the control spool (3) via the operating pin (5), thus clearing the corresponding flow ways and establishing relevant links between ports A, B, P, and T. For selection of spool types refer to page 3.6.2.

When the solenoid (2) is de-energised, the control spool (3) is returned to its neutral position by the return spring (4). The change-over can be done manually by pressing the emergency hand operator (6).

#### KV-4/2-5KO-6-81

Directional valve with two operating position, two solenoids without springs allows the control spool to be held in the operating position (detent). The control spool remains in the operation position also when the solenoids are de-energised.

### Technical data

Hydraulic

Size	6		
Flow rate	see p-Q curves, page 3.6.3		
Operating pressure ports P,A,B	bar	350	
Operating pressure port T	bar	210	
Oil temperature range	°C	-20 to +70	
Viscosity range	mm <sup>2</sup> /s	15 to 380	
Mounting position	optional		
Mass	4/2	kg	1,9
	4/3	kg	2,7
Filtration	NAS 1638		8

Electrical

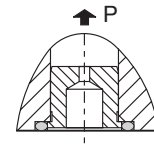
Supply voltage	direct or	V	12, 24, 48
	alternating		110, 230
Power		W	29*
Switch-on time**		ms	50 to 80
Switch-off time**		ms	30 to 55
Switching frequency		1/h	15 000
Ambient temperature		°C	to +50
Coil temperature		°C	to +180
Duty cycle	continuous		
** -The switching-on and off times apply to 24 V DC solenoids			
* -12V supply voltage - 36 W			



## Ordering code

**KV** - / - **5KO** - **6** - - - - - \*

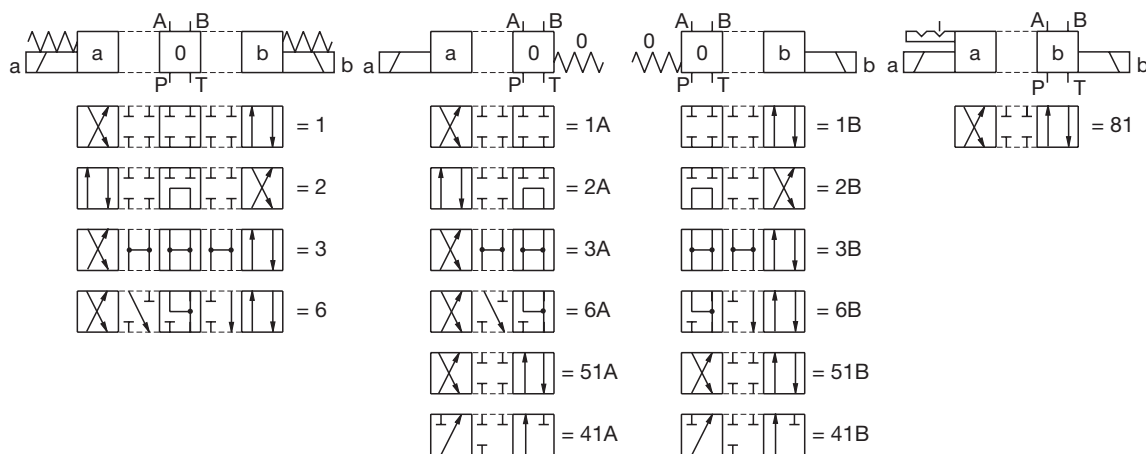
Working ports	
Number of control spool positions	
Spool type	
Supply voltage	
Plug-in connector	
Throttle	
Seal type	
Constant action restrictor	
Special requirements to be briefly specified	



If flow rates greater than permissible occur during change-over, a cartridge throttle must be fitted into P-line of the directional valve.

<b>Working ports</b> 3 working ports = <b>3</b> 4 working ports = <b>4</b>	<b>Plug-in connector</b> without signal lamp = <b>no design</b> with signal lamp = <b>L</b>
<b>Number of control spool positions</b> two positions = <b>2</b> three positions = <b>3</b>	<b>Throttle</b> without throttle in "P" line = <b>no design.</b> throttle 0,8 mm dia = <b>D08</b> throttle 1,0 mm dia = <b>D10</b> throttle 1,2 mm dia = <b>D12</b>
<b>Supply voltage</b> direct voltage 24 V = <b>no design.</b> 12 V = <b>12 DC</b> 48 V = <b>48 DC</b> 110 V = <b>110 DC</b> 230 V = <b>230 DC</b> alternating voltage 12 V = <b>12 AC</b> 24 V = <b>24 AC</b> 48 V = <b>48 AC</b> 110 V = <b>110 AC</b> 230 V = <b>230 AC</b> - Alternating voltage solenoids are fitted with a bridge rectifier. - With solenoids of over 48 V an earthing clamp ( $\perp$ ) to ISO 4400 must be connected. * To fulfil EMC (89/336/EEC) a capacitor must be built in (see 10.2.2)	<b>Seal type</b> NBR seals for mineral oil HL, HLP, to DIN 51524 = <b>no design.</b> FPM seals for HETG, HEES, HEPG to VDMA 24568 = <b>E</b> and ISO 15380
	<b>Constant action restrictor</b> Without restrictor = <b>no design.</b> Restrictor 0,3 dia. = <b>UD</b>

## Spool types



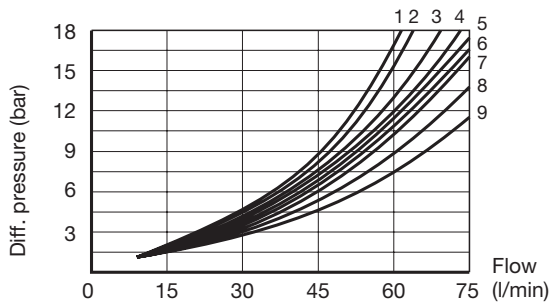
- Port T in the valves with spool type 41A and 41B to be used as leakage line.

Important note:

Valves with adjustment of the switching time - a constant or short - time static oil pressure of at least  $\geq 4$  bar must prevail at connection T of the directional control valve to maintain the pressure in the spring chambers.

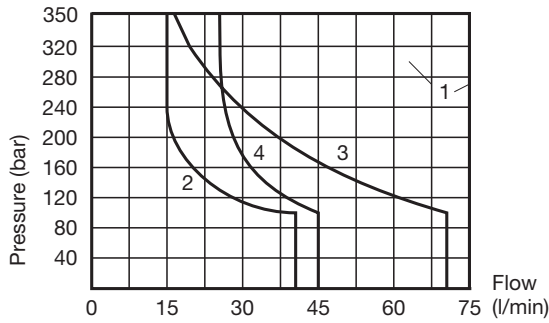


$\Delta p$  - Q Performance curves (measured at  $t = 50\text{ }^\circ\text{C}$  and  $v = 28\text{ mm}^2/\text{s}$ )



Spool type	Flow path				
	P-A	P-B	A-T	B-T	P-T
1	8	8	6	6	-
2	5	5	4	4	1
3	8	8	7	7	-
6	5	5	9	9	-
81	5	5	1	1	-
51A, 51B	5	5	1	1	-
41A, 41B	7	7	-	-	-

p - Q Operating limits (measured at  $t = 50\text{ }^\circ\text{C}$  and  $v = 28\text{ mm}^2/\text{s}$ )

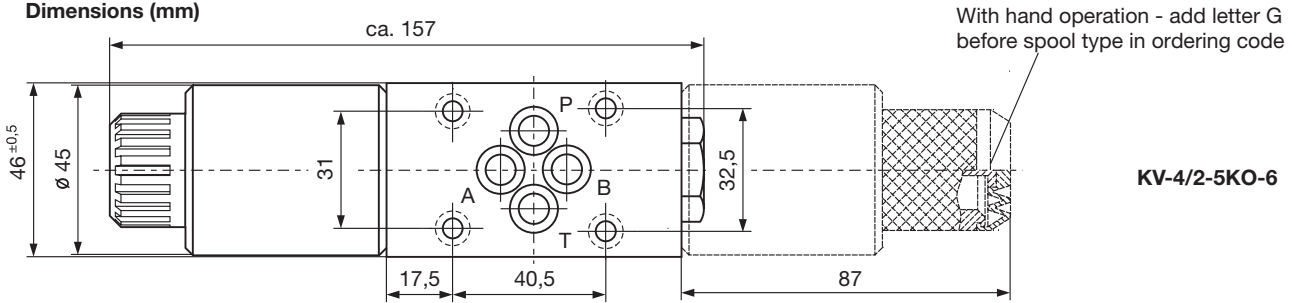


Spool type	Curve
1	1
2	4
3	3
6	3
81	1
51A, 51B	1
41A, 41B	2

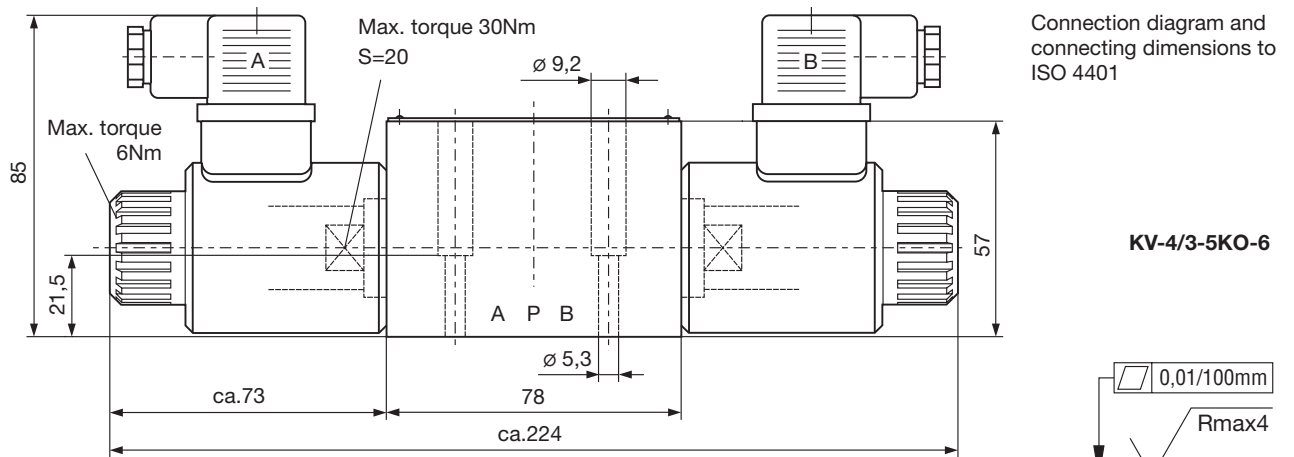
The operating limits of the valve are determined at a voltage 10% below the nominal rating. The curves refer to application with symmetrical flow through the valve (P-A and B-T). In the case of asymmetric flow (e.g. one part not used) reduced values may result.

Note: For valves with adjustment of the switching time reduced values of the operating limits may result.

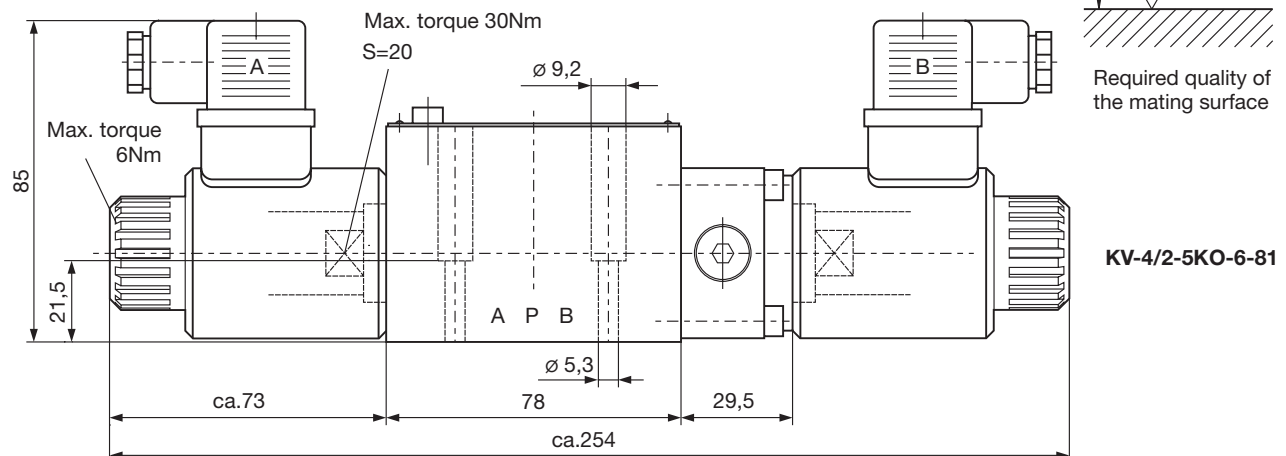
Dimensions (mm)



**KV-4/2-5KO-6**

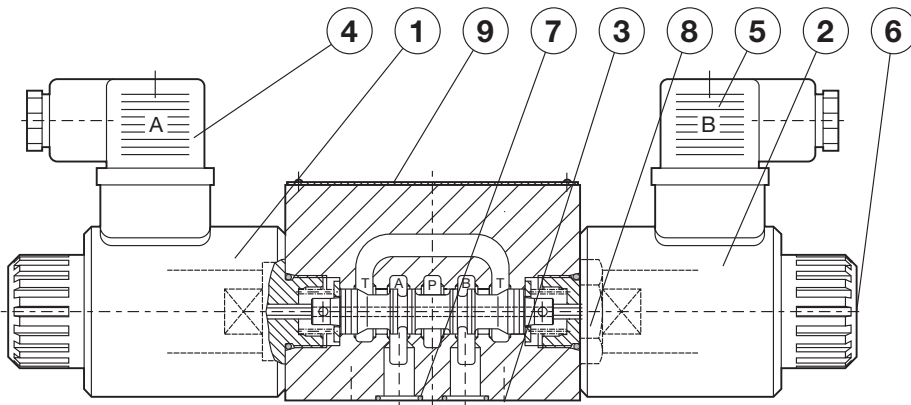


**KV-4/3-5KO-6**



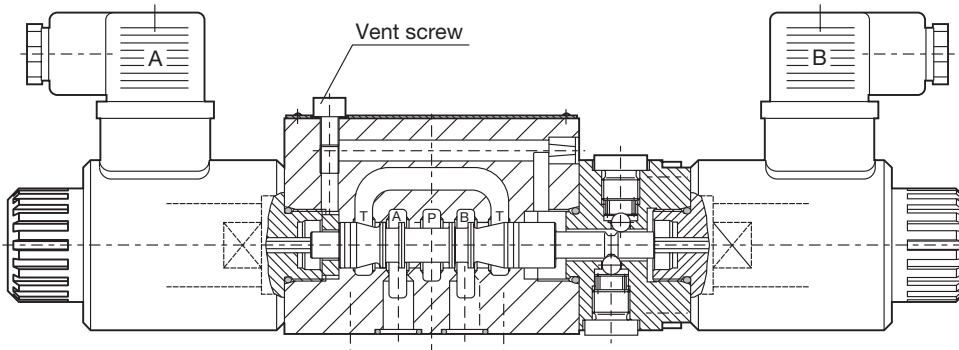
**KV-4/2-5KO-6-81**

Function drawing

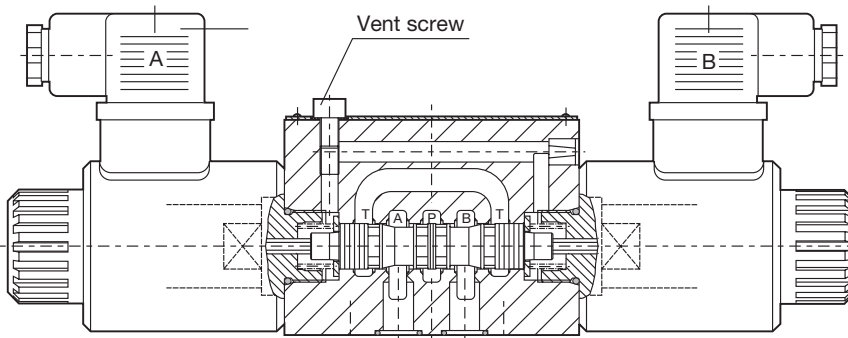


**KV-4/3-5KO-6**  
**(KV-4/2-5KO-6)**

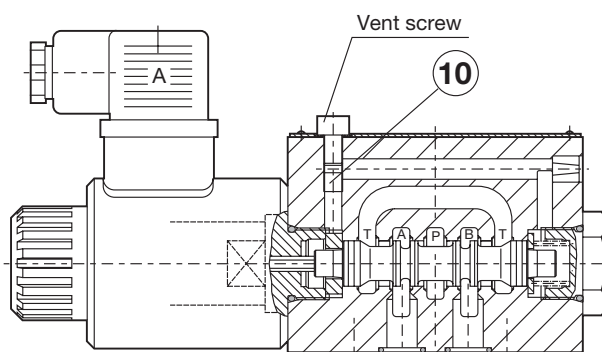
- 1 Solenoid "a" - MR-045
- 2 Solenoid "b" - MR-045
- 3 Fixing screws 4 pcs M5 x 30 to DIN EN ISO 4762 -10.9 must be ordered separately Required tightening torque Md = 9 Nm
- 4 Plug-in connector "a" - grey
- 5 Plug-in connector "b" - black
- 6 Emergency hand operator
- 7 O-ring 9,25 x 1,78
- 8 Valve cap
- 9 Nameplate
- 10 Constant action restrictor



**KV-4/2-5KO-6-81**



**KV-4/3-5KO-6-2**



**KV-4/2-5KO-6-UD**

Installation

The directional control valve must be installed horizontally (Nameplate on top). If this is not the case, the valve must be removed for venting. Unscrew the vent screw. Move the spool alternately to the switching positions a and b until no more bubbles appear at the screw hole. The oil must be visible at the screw hole. Missing oil should be refilled with an oilcan, drop by drop. Screw in the vent screw.

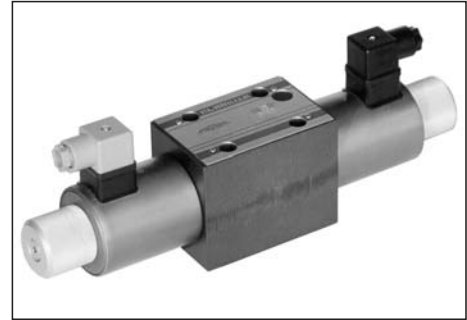
A constant or short time static oil pressure of at least > 4 bar must prevail at connection T of the directional control valve to maintain the oil pressure in the spring chambers. If this is not the case, the preloaded oil volume of the restricted valve would leak into the T channel through the leakage section of the control spool shoulders.

The dampening constancy also depends on the constancy of the oil viscosity.

For this reason the dampening effect should always be adjusted with the system at operational temperature.

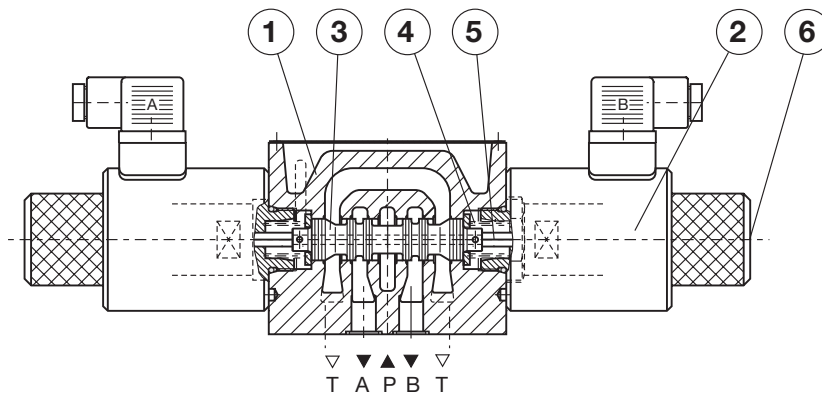
## 4/2 and 4/3 - WAY DIRECTIONAL VALVES type KV

- NS 10
- to 350 bar
- to 120 l/min
- Direct operation by solenoid
- Connection diagram and connecting dimensions to ISO 4401, DIN 24340
- Plug-in connector for solenoids to ISO 4400
- 5-chamber model with good spool guidance
- Optimized flow paths for low losses of pressure
- Adjustment of the switching time
- Wet pin solenoid with interchangeable coil
- Manual emergency control
- Protection of solenoid IP 65 to DIN EN 60529



KV-4/3-5KO-10

### Description of operation



Directional valves type KV with direct solenoid operation control the direction of the hydraulic medium flow.

These directional valves consist of a housing (1), a control spool (3), and one solenoid (2) with two return springs (4) in 4/2-way directional valves, and two solenoids (2) with two return springs (4) in 4/3-way directional valves. In 4/3-way directional valves the centre position of the control spool is the neutral position. The change-over to the operating position (a) and (b) is done by energising the solenoids (2) "a" and "b" respectively, whereby the solenoid plunger acts on the control spool (3) via the operating pin (5), thus clearing the corresponding flow ways and establishing relevant links between ports A, B, P, and T. For selection of spool types refer to page 3.8.2.

When the solenoid (2) is de-energised, the control spool (3) is returned to its neutral position by the return spring (4). The change-over can be done manually by pressing the emergency hand operator (6).

#### KV-4/2-5KO-10-81

Directional valve with two operating position, two solenoids without springs allows the control spool to be held in the operating position (detent). The control spool remains in the operation position also when the solenoids are de-energised.

### Technical data

		Hydraulic	
Size		10	
Flow rate		see p-Q curves, page 3.8.3	
Operating pressure ports P,A,B	bar	350	
Operating pressure port T	bar	210	
Oil temperature range	°C	-20 to +70	
Viscosity range	mm <sup>2</sup> /s	15 to 380	
Mounting position		optional	
Mass	4/2	kg	6,5
	4/3	kg	7,3
Filtration	NAS 1638		8

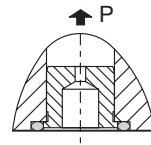
### Electrical

Supply voltage	direct or alternating	V	12, 24, 48 110, 230
Power		W	45
Switch-on time		ms	70 to 95
Switch-off time		ms	40 to 80
Switching frequency		1/h	15 000
Ambient temperature		°C	to +50
Coil temperature		°C	to +180
Duty cycle			continuous
The switching-on and off times apply to 24 V DC solenoids			

### Ordering code

**KV - / -5KO-10- - - - - \***

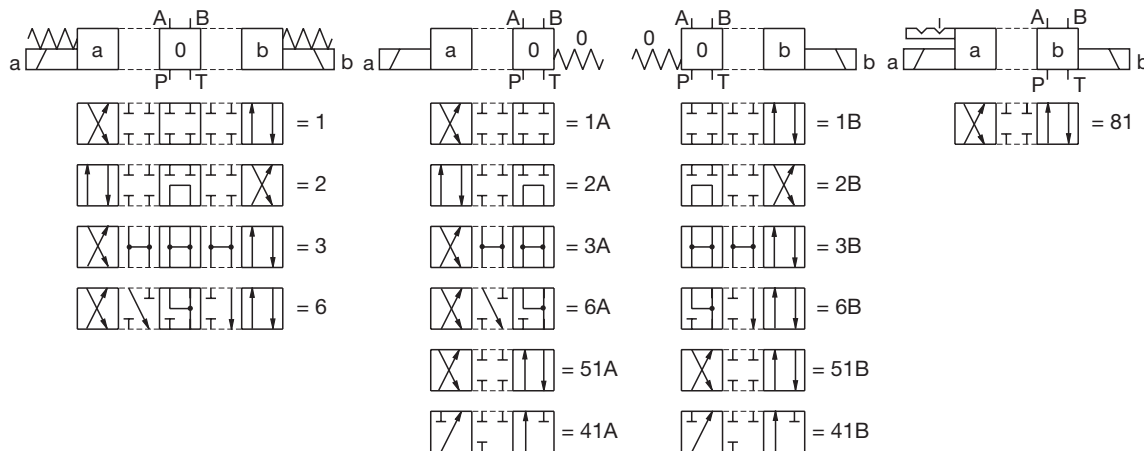
Working ports	
Number of control spool positions	
Spool type	
Supply voltage	
Plug-in connector	
Throttle	
Seal type	
Constant action restrictor	
Special requirements to be briefly specified	



If flow rates greater than permissible occur during change-over, a cartridge throttle must be fitted into P-line of the directional valve.

<b>Working ports</b> 3 working ports = <b>3</b> 4 working ports = <b>4</b>	<b>Plug-in connector</b> without signal lamp = <b>no design</b> with signal lamp = <b>L</b>
<b>Number of control spool positions</b> two positions = <b>2</b> three positions = <b>3</b>	<b>Throttle</b> without throttle in "P" line = <b>no design.</b> throttle 0,8 mm dia = <b>D08</b> throttle 1,0 mm dia = <b>D10</b> throttle 1,2 mm dia = <b>D12</b>
<b>Supply voltage</b> direct voltage                      alternating voltage 24 V = <b>no design.</b> 12 V = <b>12 AC</b> 12 V = <b>12 DC</b> 24 V = <b>24 AC</b> 48 V = <b>48 DC</b> 48 V = <b>48 AC</b> 110 V = <b>110 DC</b> 110 V = <b>110 AC</b> 230 V = <b>230 DC</b> 230 V = <b>230 AC</b>  - Alternating voltage solenoids are fitted with a bridge rectifier. - With solenoids of over 48 V an earthing clamp (⊥) to ISO 4400 must be connected. * To fulfil EMC (89/336/EEC) a capacitor must be built in (see 10.2.2)	<b>Seal type</b> NBR seals for mineral oil HL, HLP, to DIN 51524 = <b>no design.</b> FPM seals for HETG, HEES, HEPG to VDMA 24568 = <b>E</b> and ISO 15380  <b>Constant action restrictor</b> Without restrictor = <b>no design.</b> Restrictor 0,5 dia. = <b>UD</b>

### Spool types

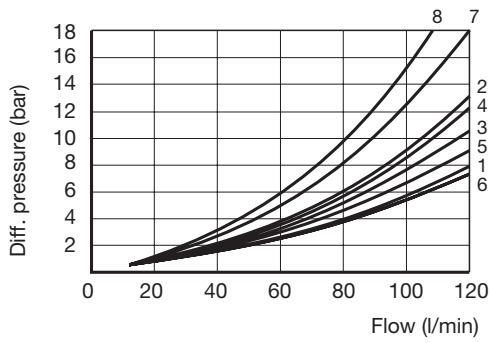


- Port T in the valves with spool type 41A and 41B to be used as leakage line.

Important note:

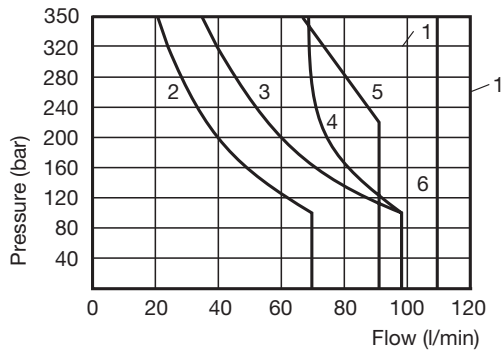
Valves with adjustment of the switching time - a constant or short - time static oil pressure of at least  $\geq 4$  bar must prevail at connection T of the directional control valve to maintain the pressure in the spring chambers.

$\Delta p$  - Q Performance curves (measured at  $t = 50\text{ }^\circ\text{C}$  and  $\nu = 28\text{ mm}^2/\text{s}$ )



Spool type	Flow path				
	P-A	P-B	A-T	B-T	P-T
1	1	1	5	5	-
2	3	3	2	7	8
3	6	6	3	4	-
6	1	1	2	2	-
9	6	6	2	2	-
81	1	1	3	3	-
51A, 51B	1	1	3	3	-
41A, 41B	6	6	-	-	-

p - Q Operating limits (measured at  $t = 50\text{ }^\circ\text{C}$  and  $\nu = 28\text{ mm}^2/\text{s}$ )

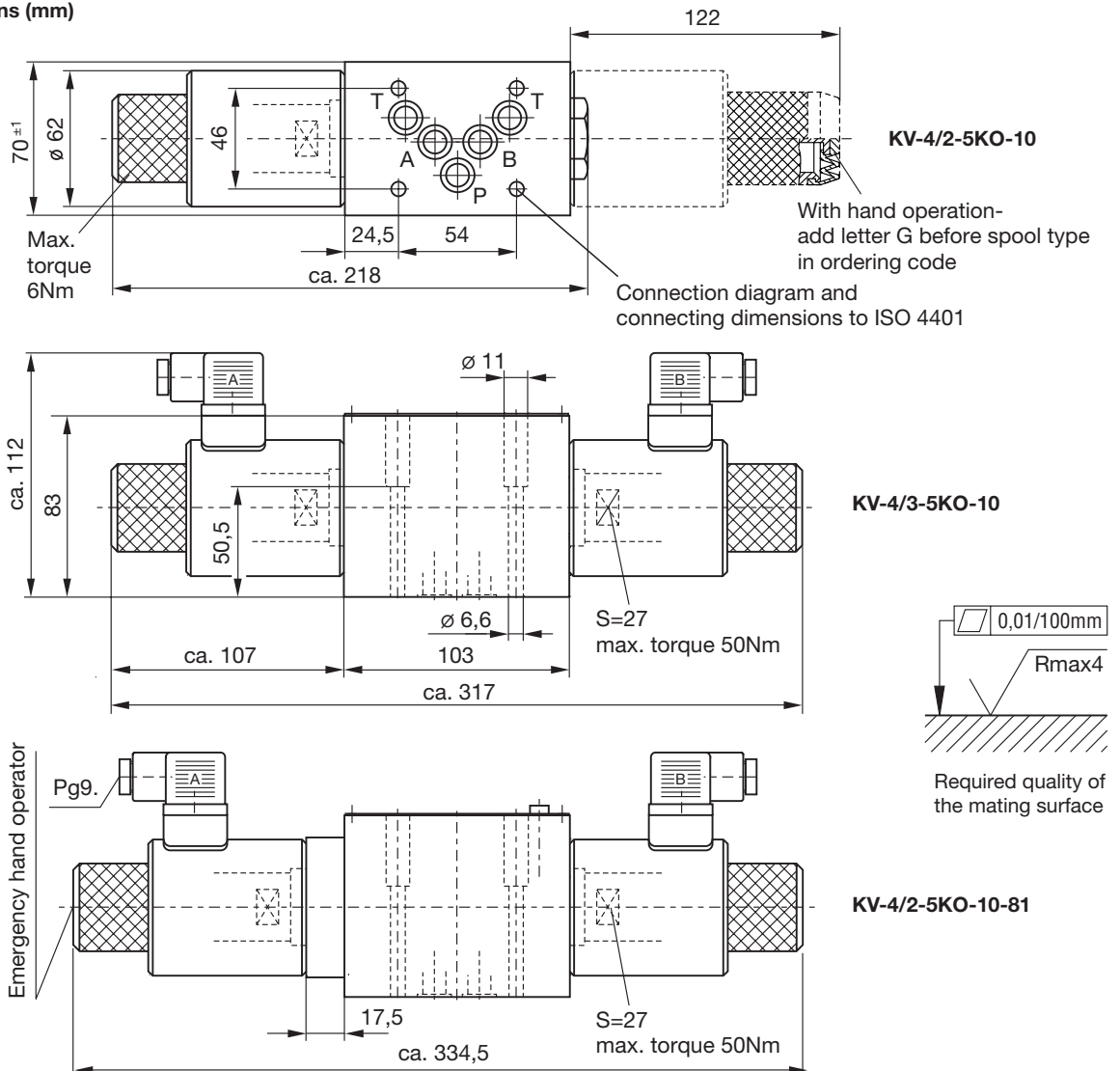


Spool type	Curve
1	1
2	4
3	5
6	3
9	6
81	1
51A, 51B	1
41A, 41B	2

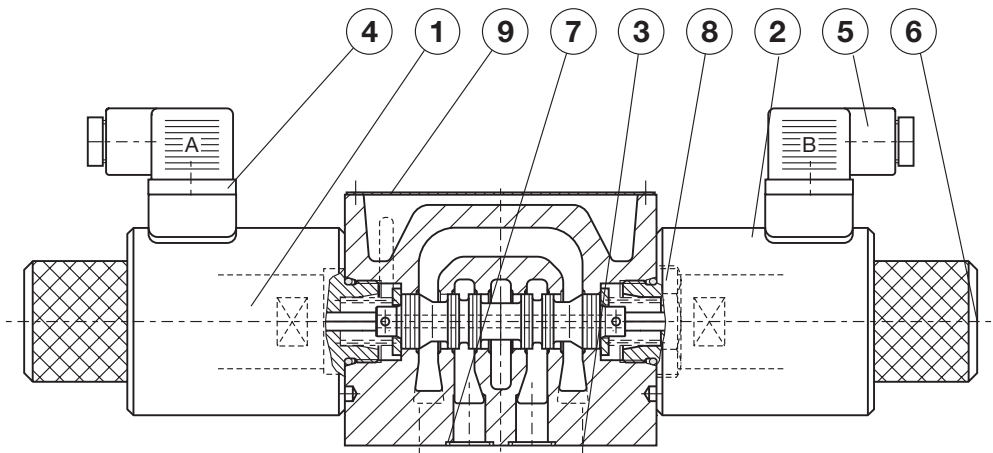
The operating limits of the valve are determined at a voltage 10% below the nominal rating. The curves refer to application with symmetrical flow through the valve (P-A and B-T). In the case of asymmetric flow (e.g. one part not used) reduced values may result.

Note: For valves with adjustment of the switching time reduced values of the operating limits may result.

Dimensions (mm)



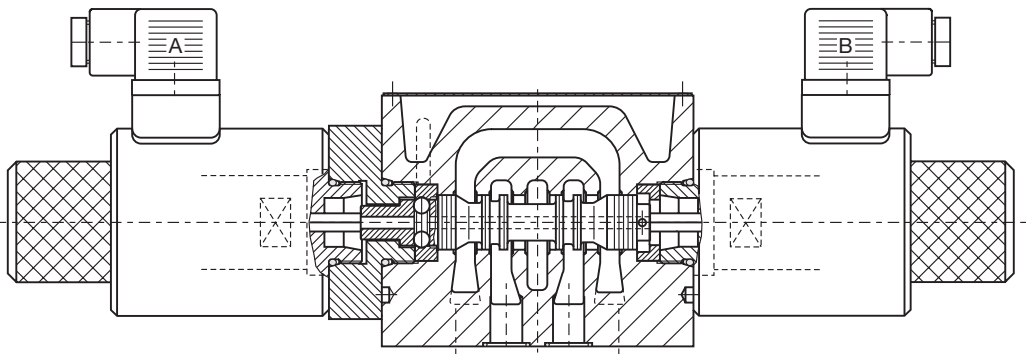
Function drawing



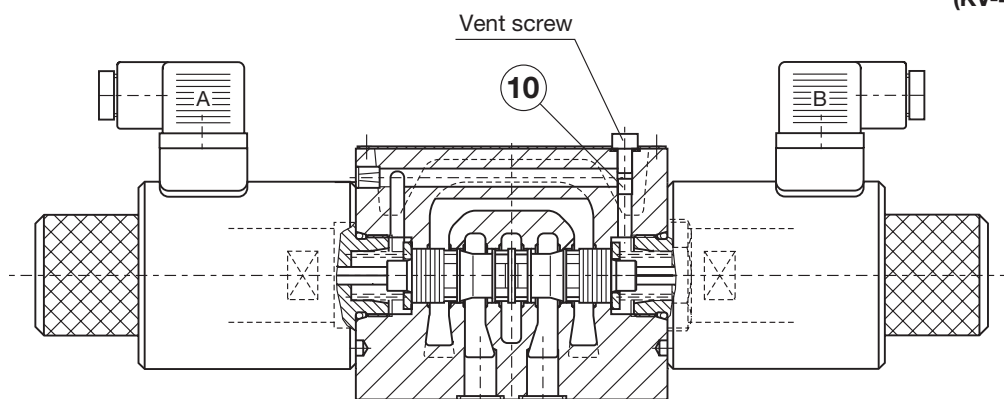
**KV-4/3-5KO-10**  
**(KV-4/2-5KO-10)**

- |   |                                 |
|---|---------------------------------|
| 1 Solenoid "a" - MR-060   | 4 Plug-in connector "a" - grey  |
| 2 Solenoid "b" - MR-060   | 5 Plug-in connector "b" - black |
| 3 Fixing screws 4 pcs M6 x 60<br>to DIN EN ISO 4762 -10.9<br>must be ordered separately<br>Required tightening torque<br>Md = 15 Nm | 6 Emergency hand operator       |
|   | 7 O-ring 12,42 x 1,87           |
|   | 8 Valve cap                     |
|   | 9 Nameplate                     |
|   | 10 Constant action restrictor   |

**KV-4/2-5KO-10-81**



**KV-4/3-5KO-10-2-UD**  
**(KV-4/2-5KO-10-2-UD)**



Installation

The directional control valve must be installed horizontally (Nameplate on top). If this is not the case, the valve must be removed for venting. Unscrew the vent screw. Move the spool alternately to the switching positions a and b until no more bubbles appear at the screw hole. The oil must be visible at the screw hole. Missing oil should be refilled with an oilcan, drop by drop. Screw in the vent screw.

A constant or short time static oil pressure of at least > 4 bar must prevail at connection T of the directional control valve to maintain the oil pressure in the spring chambers. If this is not the case, the preloaded oil volume of the restricted valve would leak into the T channel through the leakage section of the control spool shoulders.

The dampening constancy also depends on the constancy of the oil viscosity.

For this reason the dampening effect should always be adjusted with the system at operational temperature.

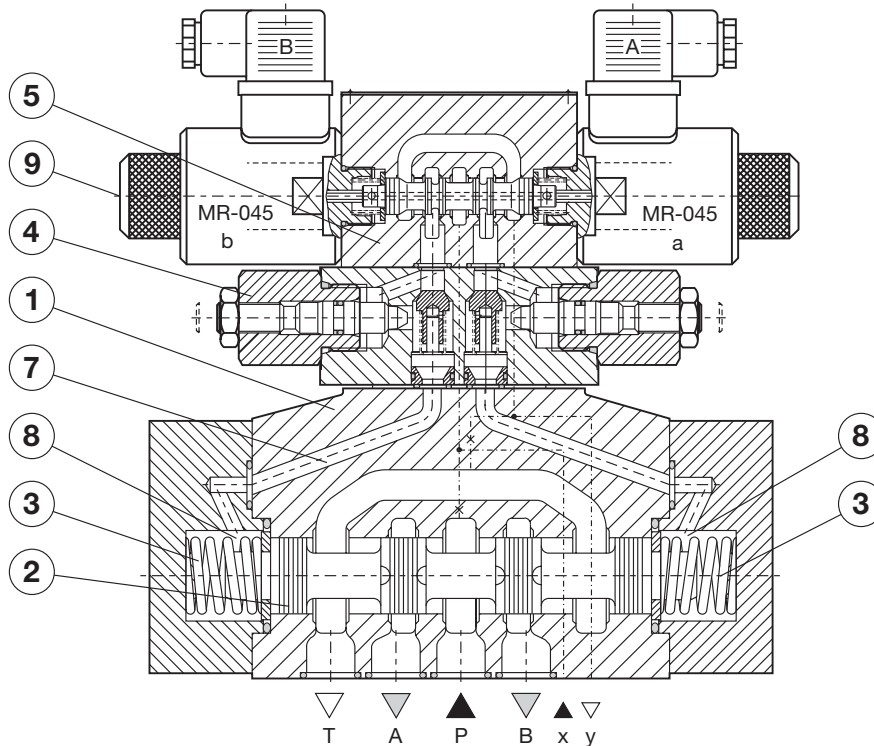
**4/2, 4/3 -WAY DIRECTIONAL VALVES type KV**

- NS-16
- to 350 bar
- to 300 l/min
- Indirect, solenoid, and mechanical (by lever) operation
- Connection diagram and connecting dimensions to ISO 4401
- Plug-in solenoid connector to ISO 4400
- Protection of solenoid IP 65 to DIN EN 60529
- Fulfil EMC (89/336/EEC)



KV-4/3-16..

**Description of operation**



Directional valves type KV with indirect, solenoid-hydraulic operation control the hydraulic fluid flow direction.

These valves consist of the main valve (1), a control spool (2), two return springs (3) in 4/3-way valves and none in 4/2-way valves, a double throttle check/valve (4) and a pilot valve (5).

The pilot valve (5) is connected with the pressure chambers (8) via the pilot line (7). Feeding of the pilot valve oil is either or external (via the port "x"). Change-over of the control spool to one of the operating position is activated by the introduction of oil via the pilot valve (5) into one of the pressure chambers (8). A pressure rise in chambers provokes the movement of the control spool (2). Suitable links between ports A,B,P,T according to spool types are established as set forth in the table.

When the solenoid of the pilot valve (5) are de-energised a link between the pressure chamber (8) and the return line "y" for the pilot oil discharge is established. A pressure drop in the chamber actuates the main valve return spring (3) which automatically return the control spool to the neutral position.

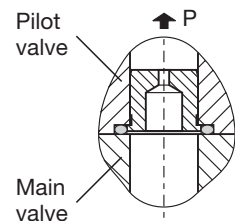
Discharge of the return pilot oil from the pressure chambers is either internal or external (via the port "y").

Manual change-over of the main valve is also possible by pressing the emergency hand operator (9).

Indirect directional valves can also be provided with a manual pilot valve. These valves are manually operated by moving the operating lever.

**Throttle**

If the pilot oil supply rate (x) is greater than permissible a cartridge throttle shall be fitted into the P line of the directional valve.



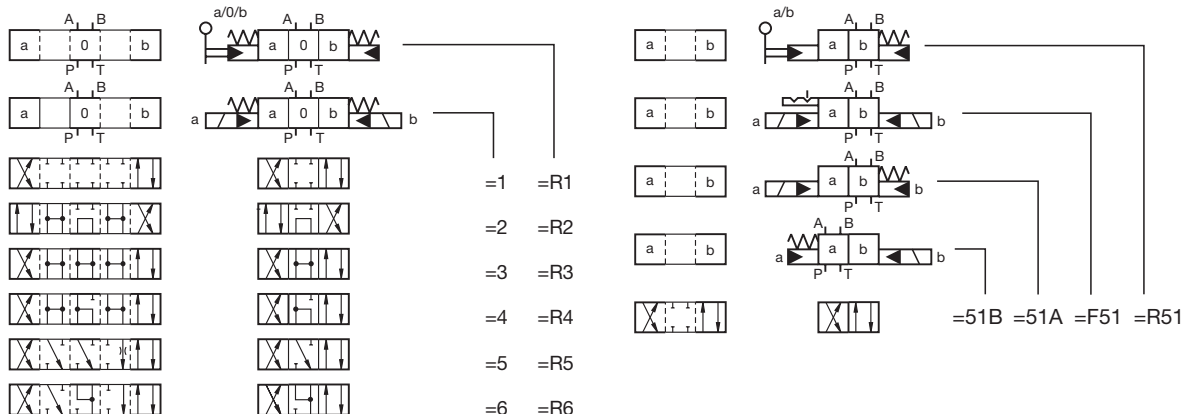
**Ordering code**

**KV - 4 / - 16 - - - - - \***

- Number of control spool positions
- Spool type
- Pilot oil supply and discharge
- Supply voltage
- Plug in connector
- Pilot oil control with a double throttle valve
- Pilot oil control with pressure reducing valve
- Pre-load valve
- Throttle
- Seal type
- Special requirements to be briefly specified

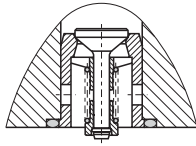
<p><b>Number of control spool position</b></p> <p>two positions = <b>2</b> three positions = <b>3</b></p>	<p><b>Plug-in connector</b></p> <p>without signal lamp = <b>no design</b> with signal lamp = <b>L</b></p>												
<p><b>Pilot oil supply and discharge</b></p> <p>external x,y = <b>Z</b> internal x,y = <b>N</b> internal x, external y = <b>XN</b> internal y, external x = <b>YN</b></p> <p>for supply and discharge with spool types 2 and 3, refer to the table of technical data</p>	<p><b>Pilot oil control with a double throttle valve</b></p> <p>without a double throttle valve = <b>no desig.</b> with a double throttle valve = <b>H</b></p> <p><b>Pilot oil control with pressure reducing valve</b></p> <p>without pressure reducing valve = <b>no desig.</b> with pressure reducing valve = <b>RT</b></p>												
<p><b>Supply voltage</b></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">direct voltage</td> <td style="width: 50%;">alternating voltage</td> </tr> <tr> <td>24 V = <b>no desig.</b></td> <td>12 V = <b>12 AC</b></td> </tr> <tr> <td>12 V = <b>12 DC</b></td> <td>24 V = <b>24 AC</b></td> </tr> <tr> <td>48 V = <b>48 DC</b></td> <td>48 V = <b>48 AC</b></td> </tr> <tr> <td>110 V = <b>110 DC</b></td> <td>110 V = <b>110 AC</b></td> </tr> <tr> <td>230 V = <b>230 DC</b></td> <td>230 V = <b>230 AC *</b></td> </tr> </table> <p>- Alternating voltage solenoids are fitted with a bridge rectifier. - With solenoids of over 48 V an earthing clamp (⊥) to DIN EN 175301-8003 must be connected. * To fulfil EMC (89/336/EEC) a capacitor must be built in (see 10.2.2)</p>	direct voltage	alternating voltage	24 V = <b>no desig.</b>	12 V = <b>12 AC</b>	12 V = <b>12 DC</b>	24 V = <b>24 AC</b>	48 V = <b>48 DC</b>	48 V = <b>48 AC</b>	110 V = <b>110 DC</b>	110 V = <b>110 AC</b>	230 V = <b>230 DC</b>	230 V = <b>230 AC *</b>	<p><b>Pre-load valve</b></p> <p>without pre-load valve = <b>no desig.</b> with pre-load valve = <b>V</b></p> <p><b>Throttle</b></p> <p>without throttle in "P" line = <b>no desig.</b> throttle 0,8 mm dia = <b>D08</b> throttle 1,0 mm dia = <b>D10</b> throttle 1,2 mm dia = <b>D12</b></p> <p><b>Seal type</b></p> <p>NBR seals for mineral oil HL, HLP, to DIN 51524 = <b>no desig.</b> FPM seals for HETG, HEES, HEPG to VDMA 24568 and ISO 15380 = <b>E</b></p>
direct voltage	alternating voltage												
24 V = <b>no desig.</b>	12 V = <b>12 AC</b>												
12 V = <b>12 DC</b>	24 V = <b>24 AC</b>												
48 V = <b>48 DC</b>	48 V = <b>48 AC</b>												
110 V = <b>110 DC</b>	110 V = <b>110 AC</b>												
230 V = <b>230 DC</b>	230 V = <b>230 AC *</b>												

**Spool types**





**Pre-load valve**



In valves with a low pressure bypass and internal pilot oil feed, minimum pilot pressure is obtained by installing a pre-load valve in the P-port of the main valve. The cracking pressure is approx. 4,5 bar.

**Symbol**

○ ... connection in line

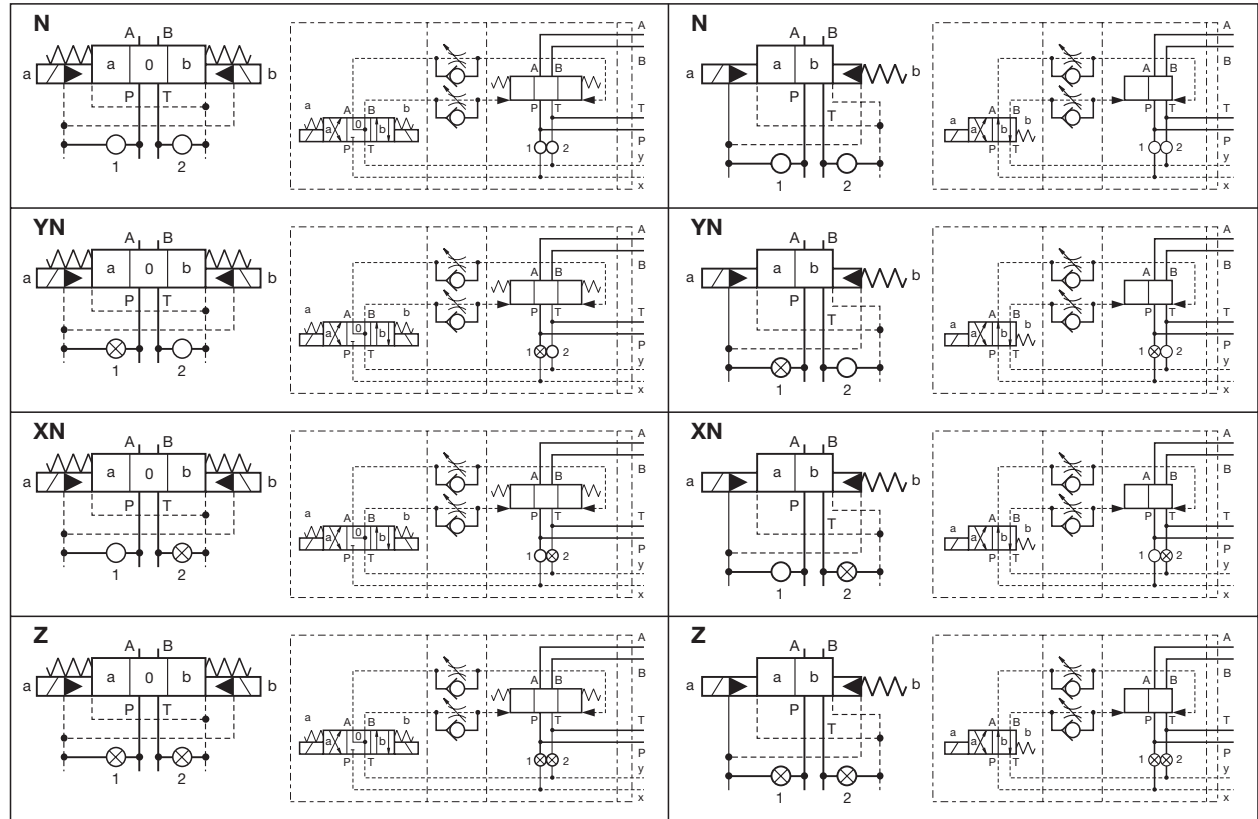
⊗ ... no connection in line

Simplified symbol

Elaborated symbol

Simplified symbol

Elaborated symbol



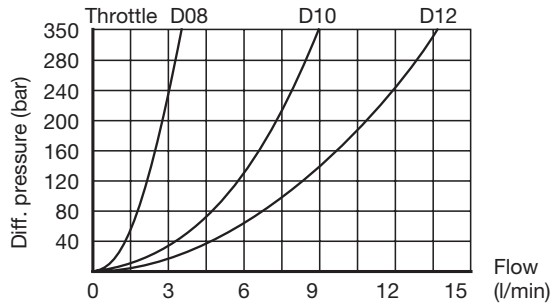
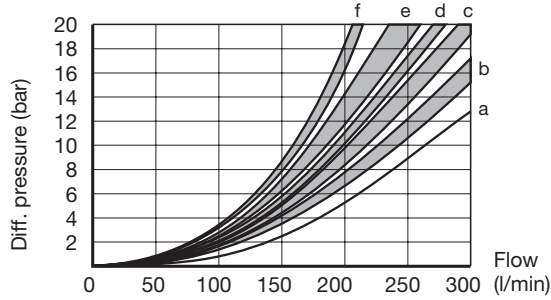
**Technical data**

Flow rate		l/min	300
Operating pressure	ports P, A, B port T	bar bar	350 210
Pilot oil pressure (x-external)		bar	50-250
Pilot oil pressure (x-internal) Pre-load valve is fitted into P-port of the main valve Without Pre-load valve in the P-port of the main valve	In valve types with internal pilot oil supply (x) the spool types 2, 3, and 4 are possible only when the oil flow in the direction from P towards T achieves the flow rate Q = 150 l/min, with the control spool in the centre position.		
Fluid temperature range		°C	-20 to +70
Viscosity range		mm <sup>2</sup> /s	15 to 380
Required pilot oil volume	two-position valve three-position valve	cm <sup>3</sup>	7,8 3,9
Mass	main valve 4/3 pilot valve 4/2 pilot valve throttle/check valve pressure reducing valve	kg	8 2,50 2,20 1,45 1,70
Mounting position	optional, horizontal for spool types 4/2		
Switch-on time	three-position valve	ms	60
Solenoid change-over from the centre to the operating position	two-position valve	ms	85
Switch-off time	three-position valve	ms	45
Solenoid change-over from the operating to the centre position	two-position valve	ms	50
Filtration		NAS 1638	8
Ambient temperature range		°C	to +150
Coil temperature range		°C	to +180
Power		W	29*
Voltage		V	≈12,24,48,110,230

The switch-on and switch-off times apply to 24 V DC solenoids.

\* - 12 V supply voltage - 36 W

$\Delta p$  - Q Performance curves (measured at  $t = 50^\circ\text{C}$  and  $\nu = 32\text{ mm}^2/\text{s}$ )



Spool types	P-A	P-B	A-T	B-T	P-T
1,R1,51B,51A,F51,R51	e	e	e	f	-
2,R2	a	b	c	e	f
3,R3	b	b	c	d	-
4,R4	b	c	c	e	-
5,R5	b	c	c	e	-
6,R6	b	c	d	e	-

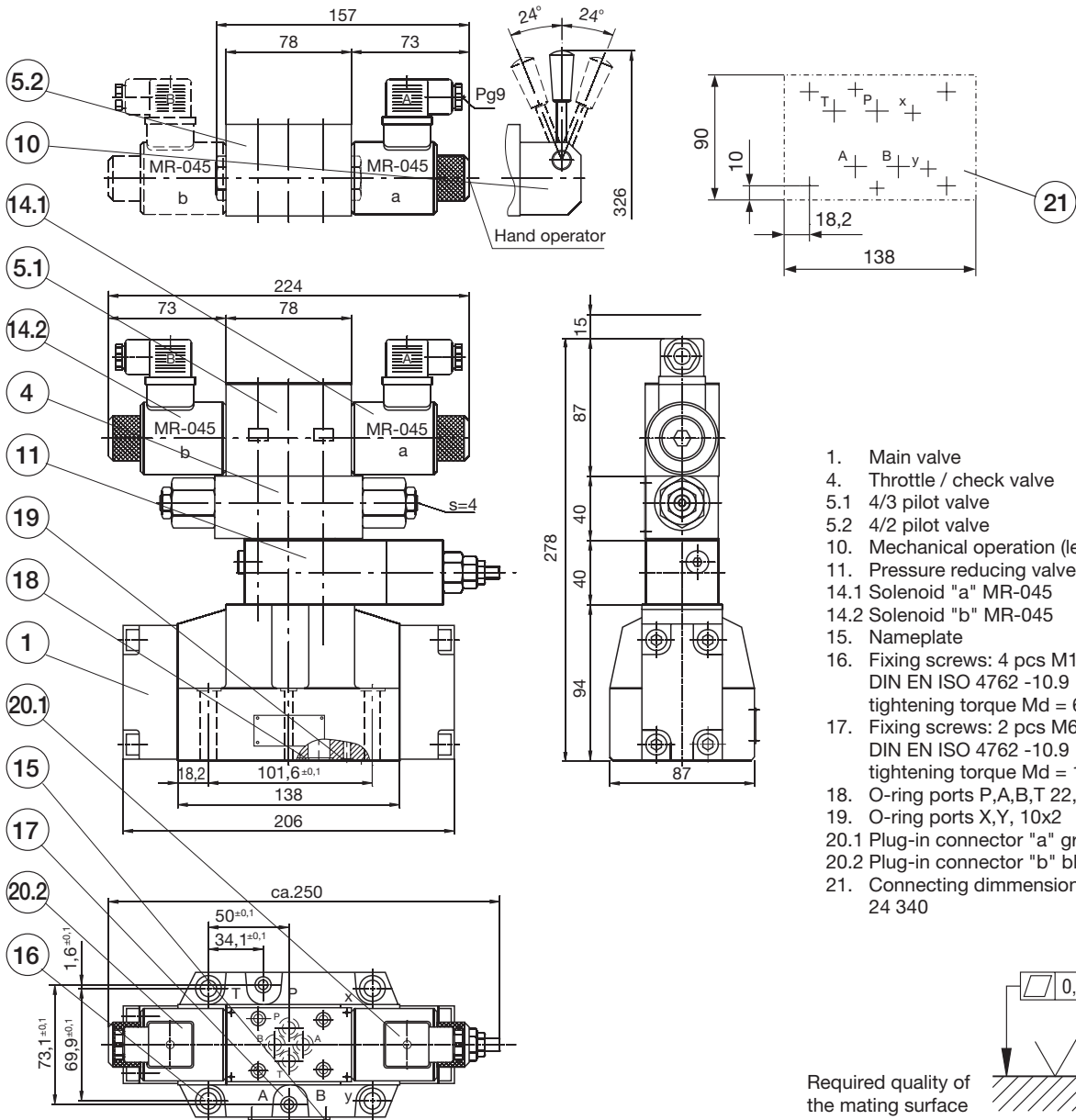
**Throttle check valve**

The throttle/check valve used for setting the supply flow rate of the pilot oil to the pressure chambers. Simultaneously, the change-over speed of the main control spool is adjusted. In this way a smoother change-over, without hydraulic shocks is provided.

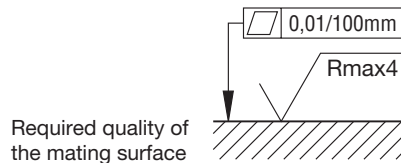
**Pressure reducing valve**

The pressure reducing valve used when the pilot oil "X" pressure exceeds the permissible limit  $p = 250\text{ bar}$ .

**Dimensions (mm)**



1. Main valve
4. Throttle / check valve
- 5.1 4/3 pilot valve
- 5.2 4/2 pilot valve
10. Mechanical operation (lever)
11. Pressure reducing valve
- 14.1 Solenoid "a" MR-045
- 14.2 Solenoid "b" MR-045
15. Nameplate
16. Fixing screws: 4 pcs M10x60 to DIN EN ISO 4762 -10.9  
tightening torque  $M_d = 64\text{ Nm}$
17. Fixing screws: 2 pcs M6x55 to DIN EN ISO 4762 -10.9  
tightening torque  $M_d = 14\text{ Nm}$
18. O-ring ports P,A,B,T 22,22 x 2,62
19. O-ring ports X,Y, 10x2
- 20.1 Plug-in connector "a" grey
- 20.2 Plug-in connector "b" black
21. Connecting dimensions to DIN 24 340



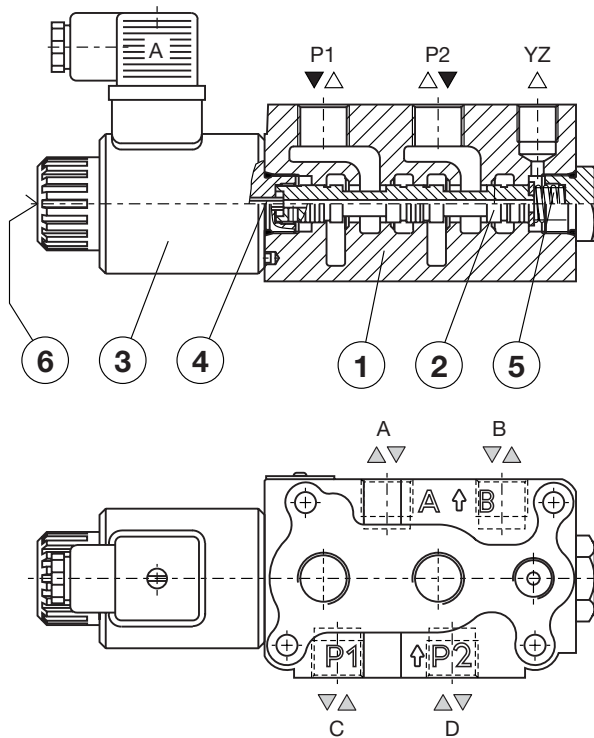
**6/2-WAY DIRECTIONAL VALVES type KV**

- NS 6
- to 350 bar
- to 50 l/min
- Direct operation by solenoid
- Plug-in connector for solenoids to ISO 4400
- Threaded connections to ISO 9974, ISO 1179
- Protection of solenoid IP 65 to DIN EN 60529
- Fulfil EMC (89/336/EEC)



KV-6/2-6-S50

**Description of operation**



Directional valves type KV with direct solenoid operation control the direction of the hydraulic medium flow. They are mostly used as link between two consumers and the basic directional valve, when we want to control both consumers alternately by means of one basic directional valve.

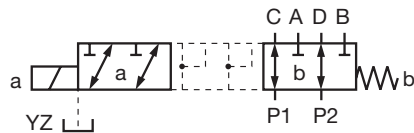
The KV type directional valves consist of a housing (1), a control spool (2), a solenoid (3) and a return spring (5).

Change-over to the operating position is done by energising the solenoid (3), whereby the solenoid plunger acts on the control spool (2) via the operating pin (4), thus clearing the corresponding flow ways and establishing respective links between the ports P1, A, B and P2.

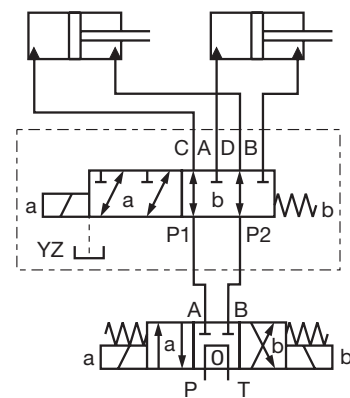
When the solenoid (3) is de-energised, the control spool (2) is returned to its neutral position by the return spring (5), thus establishing again the links between ports P1, C, D and P2.

The change-over can also be done manually by pressing the emergency hand operator (6).

**Symbol**



**Mounting example**



**Technical data**

		Hydraulic	
Size		6	
Flow rate		l/min	50
Operating pressure	with YZ	bar	350
	without YZ	bar	210
Oil temperature range		°C	-20 to +70
Viscosity range		mm <sup>2</sup> /s	15 to 380
Mounting position	optional		
Mass		kg	2.5
Filtration	NAS 1638		8

**Electrical**

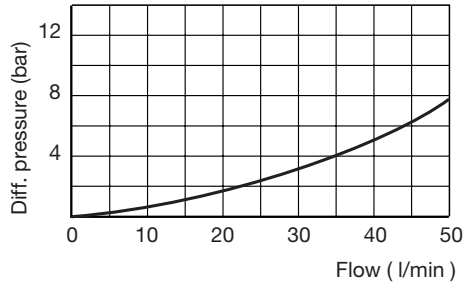
Supply voltage	V	12, 24 DC
Power	W	29
(12 V DC supply voltage)	W	36
Switching frequency	1/h	15000
Ambient temperature	°C	to +50
Coil temperature	°C	to +180
Duty cycle	continuous	

**Ordering code**

**KV-6/2-6 - S50 \***

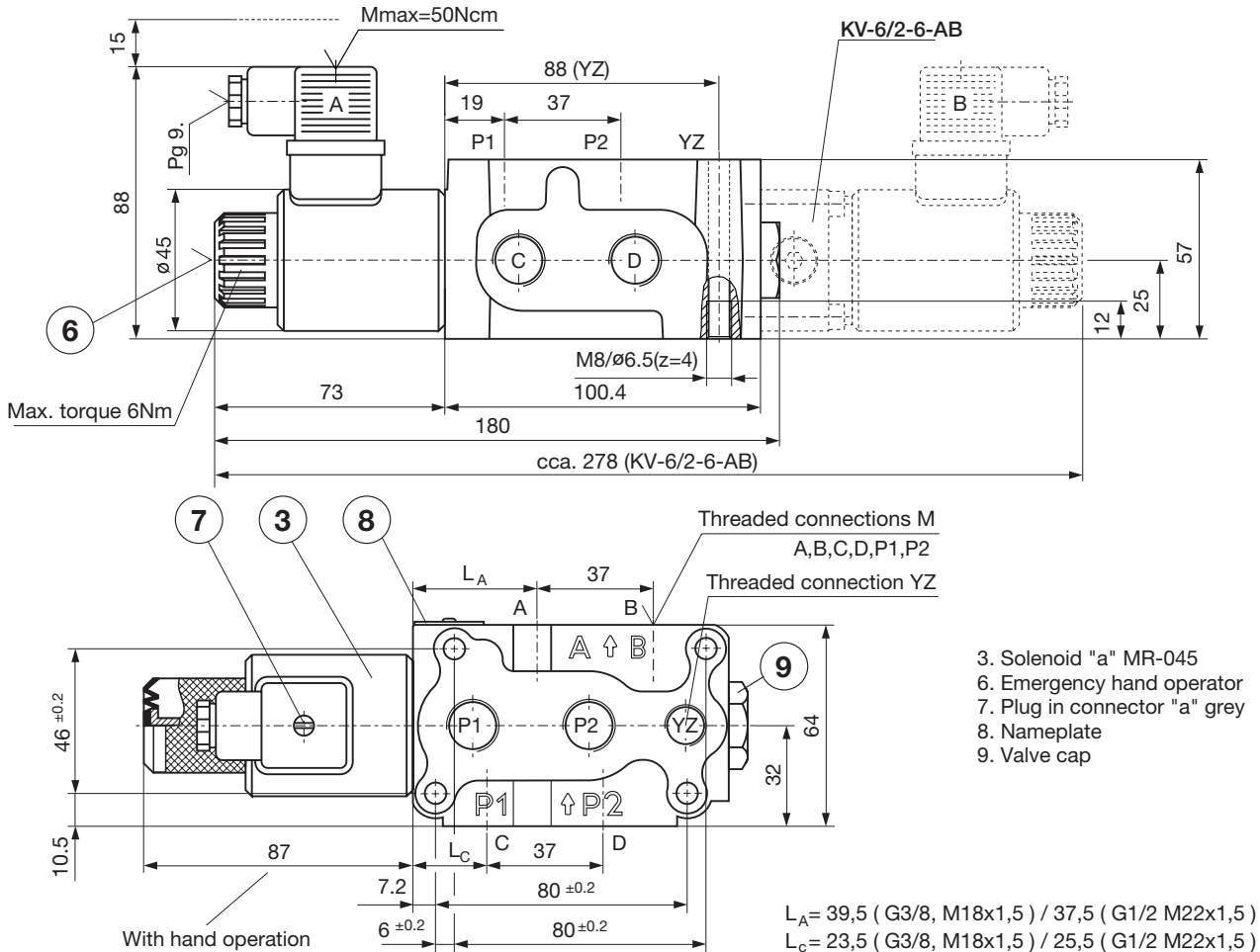
Symbol	
Overlap	
Hand operator	
Supply voltage	
Threaded connections	
Drainage	
Plug-in connector	
Seal type	
Special requirements to be briefly specified	

**Δ p-Q Performance curves**  
(measured at t = 50 °C and ν = 32 mm<sup>2</sup>/s)



<p><b>Symbol</b></p> <p>= no desig.</p> <p>= AB</p>	<p><b>Overlap</b></p> <p>= no desig.</p> <p>= P</p>
<p><b>Hand operator</b></p> <p>without hand operator = no desig.</p> <p>with hand operator = G</p>	<p><b>Supply voltage</b></p> <p>direct voltage 24 V = no desig.</p> <p>direct voltage 12 V = 12 DC</p>
<p><b>Threaded connections M / YZ</b></p> <p>M18x1,5 (YZ=M14x1,5) = no desig.</p> <p>M22x1,5 (YZ=M14x1,5) = M22</p> <p>G3/8 (YZ=G1/4) = 3/8</p> <p>G1/2 (YZ=G1/4) = 1/2</p>	<p><b>Plug-in connector</b></p> <p>without signal lamp = no desig.</p> <p>with signal lamp = L</p> <p><b>Drainage</b></p> <p>without YZ = no desig.</p> <p>with YZ = YZ</p>
<p><b>Seal type</b></p> <p>NBR seals for mineral oil HL, HLP to DIN 51524 = no desig.</p> <p>FPM seals for HETG, HEES, HEPG to VDMA 24568 and ISO15380 = E</p>	

**Dimensions (mm)**



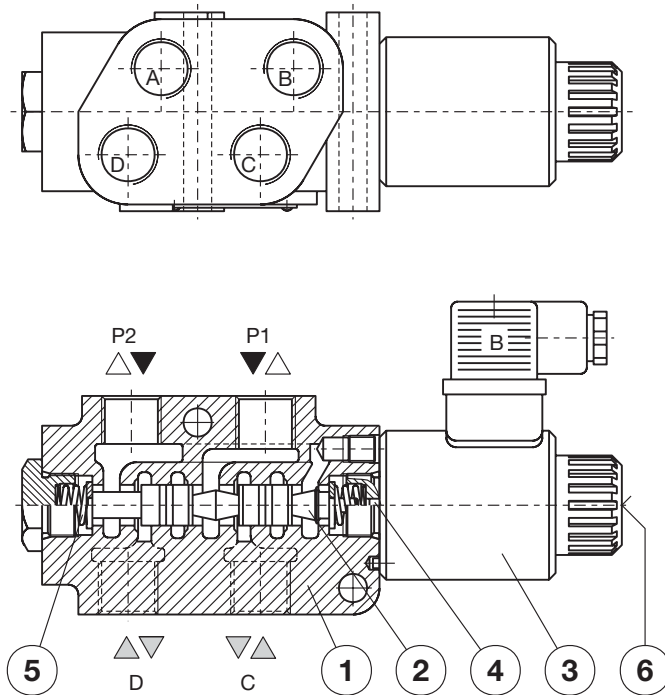
## 6/2-WAY DIRECTIONAL VALVES type KV-6K/2-6

- NS 6
- to 210 bar
- to 50 l/min
- Direct in-line mounting
- Direct operation by solenoid
- Plug-in connector for solenoids to ISO 4400
- Threaded connection to ISO 9974, ISO 1179
- Fulfil EMC (89/336/EEC)



KV-6K/2-6

### Description of operation



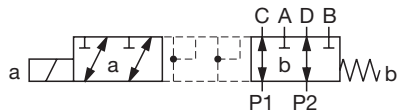
Directional valves type KV-6K/2-6 with direct solenoid operation control the direction of the hydraulic medium flow. They are mostly used as link between two consumers and the basic directional valve, when we want to control both consumers alternately by means of one basic directional valve.

The KV-6K/2-6 type directional valves consist of a housing (1), a control spool (2), and a solenoid (3) with return spring (5). Change-over to the operating position is done by energising the solenoid (3), whereby the solenoid plunger acts on the control spool (2) via the operating pin (4), thus clearing the corresponding flow ways and establishing respective links between the ports P1, A, B and P2.

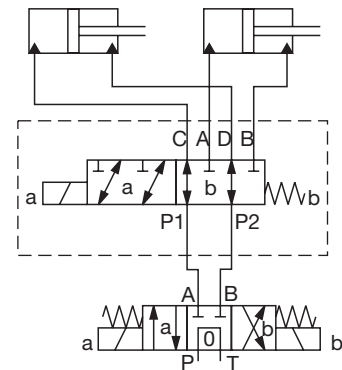
When the solenoid (3) is de-energised, the control spool (2) is returned to its neutral position by the return spring (5), thus establishing again the links between ports P1, C, D and P2.

The change-over can also be done manually by pressing the emergency hand operator (6).

### Symbol



### Mounting example



### Technical data

#### Hydraulic

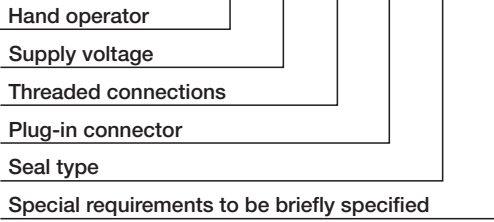
Size		6
Flow rate	L/min	50
Operating pressure	bar	210
Oil temperature range	°C	-20 to +70
Viscosity range	m <sup>2</sup> /s	15 to 380
Mounting position	optional	
Mass	kg	2,5
Filtration	NAS 1638	8

#### Electrical

Supply voltage	V	12, 24 DC
Power	W	29
(12 V DC supply voltage)	W	36
Switching frequency	1/h	15000
Ambient temperature	°C	to +50
Coil temperature	°C	to +180
Duty cycle	continuous	

**Ordering code**

**KV-6K/2-6 - - - - \***



**Hand operator**

without hand operator = no desig.  
with hand operator = G

**Supply voltage**

direct voltage 24 V = no desig.  
direct voltage 12 V = 12 DC

**Threaded connections**

M18x1.5 = no desig.  
G 3/8 = G 3/8

**Plug-in connector**

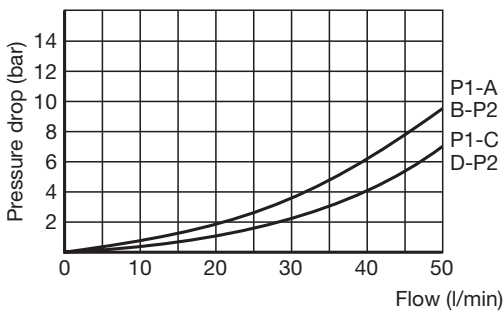
without signal lamp = no desig.  
with signal lamp = L

**Seal type**

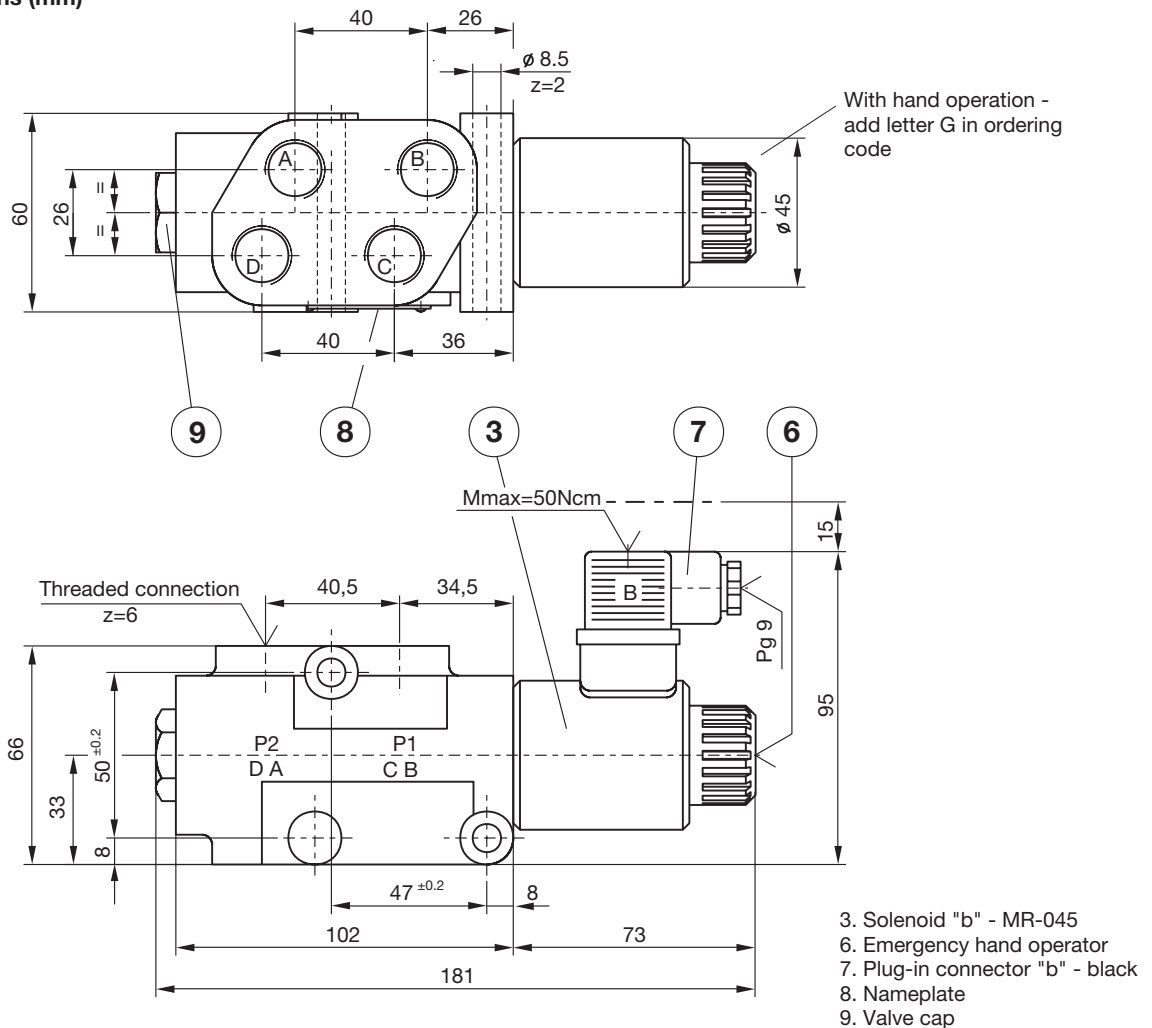
NBR seals for mineral oil HL, HLP, to DIN 51524 = no desig.  
FPM seals for HETG, HEES, HEPG to VDMA 24568 = E  
and ISO 15380

**Δp - Q Performance curves**

(measured at t = 50 °C and ν = 32 mm<sup>2</sup>/s)



**Dimensions (mm)**



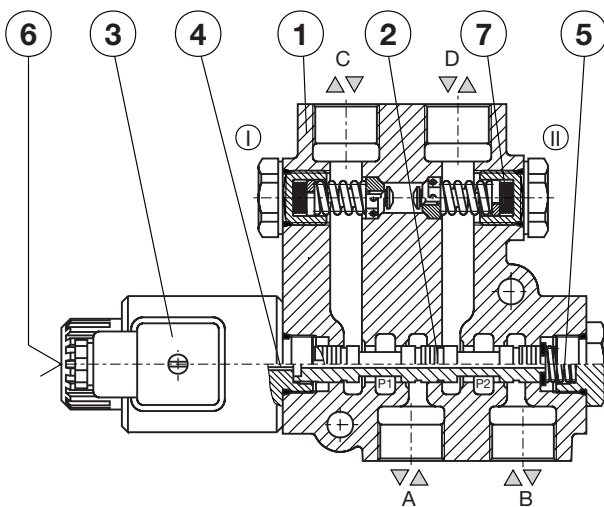
## 6/2-WAY DIRECTIONAL VALVES type KVV

- NS 6
- to 210 bar
- to 50 l/min
- Direct operation by solenoid
- Plug-in connector for solenoids to ISO 4400
- Threaded connection to ISO 9974, ISO 1179
- Fulfil EMC (89/336/EEC)



KVV-A8/2-6

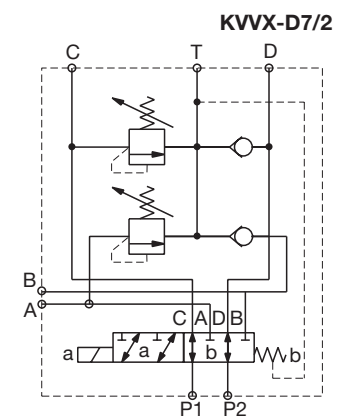
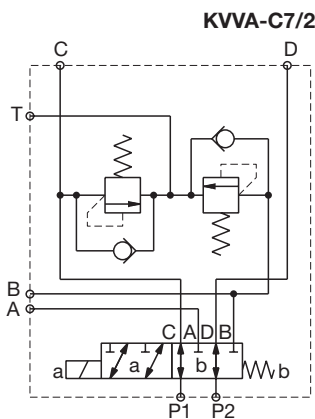
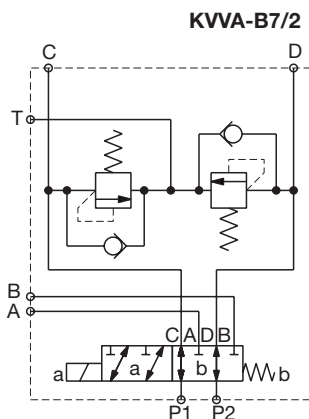
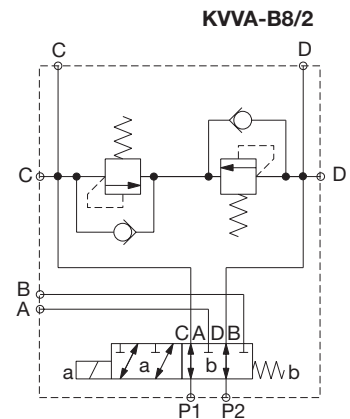
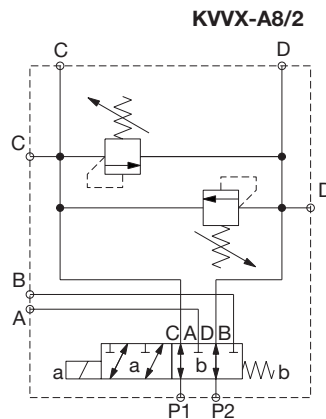
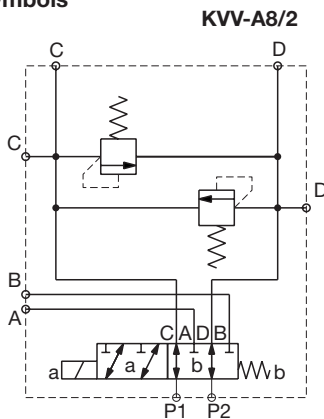
### Description of operation



Direct operated pressure relief valves (7) are used to limit the pressure in working ports. When the pressure exceeds the valve of the spring set the pilot poppet moves off the seat, and frees the flow of the hydraulics fluid. Check valve (type KVVA) possible flow of the hydraulics fluid from T- port to working ports (to prevent cavitation).

Detailed description of operation and technical data - see KV-6/2-6.

### Symbols





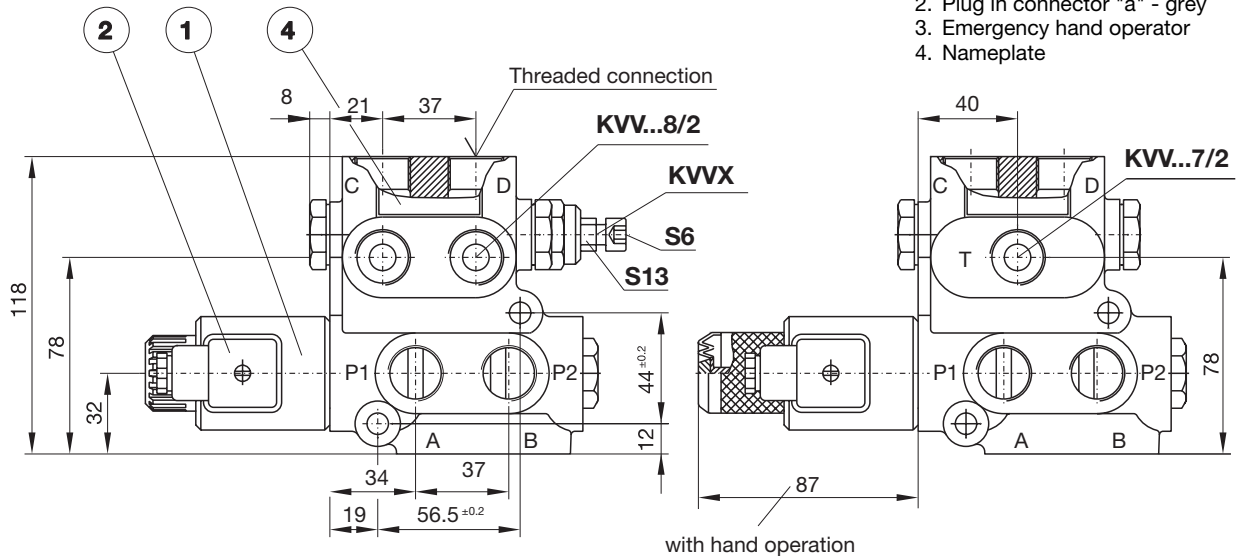
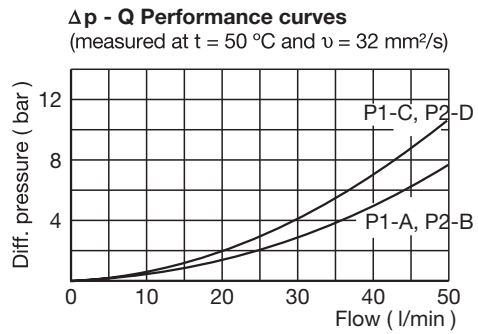
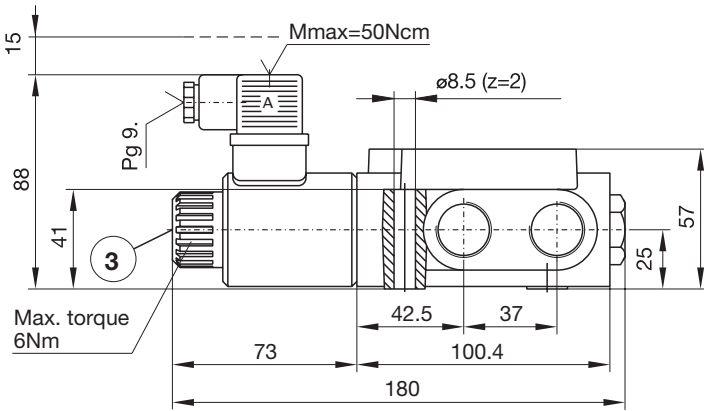
Ordering code

**KVV** - - **6** - - - - - \*

Symbol	
Nominal size	
Pressure setting range	
Overlap	
Hand operator	
Supply voltage	
Threaded connections	
Plug-in connector	
Seal type	
Special requirements to be briefly specified	

<p><b>Pressure setting range ( at 5 l/min )</b></p> <table border="0"> <tr> <td><b>KVV, KVVA</b></td> <td></td> <td><b>KVX</b></td> <td></td> </tr> <tr> <td>100 bar</td> <td>= 10</td> <td>10 - 100 bar</td> <td>= 10</td> </tr> <tr> <td>160 bar</td> <td>= 16</td> <td>50 - 160 bar</td> <td>= 16</td> </tr> <tr> <td>190 bar</td> <td>= 19</td> <td>100 - 190 bar</td> <td>= 19</td> </tr> </table>	<b>KVV, KVVA</b>		<b>KVX</b>		100 bar	= 10	10 - 100 bar	= 10	160 bar	= 16	50 - 160 bar	= 16	190 bar	= 19	100 - 190 bar	= 19	<p><b>Overlap</b></p> <p>= no desig. = P</p>
<b>KVV, KVVA</b>		<b>KVX</b>															
100 bar	= 10	10 - 100 bar	= 10														
160 bar	= 16	50 - 160 bar	= 16														
190 bar	= 19	100 - 190 bar	= 19														
<p><b>Hand operator</b></p> <p>without hand operator = no desig. with hand operator = G</p>	<p><b>Supply voltage</b></p> <p>direct voltage 24 V = no desig. direct voltage 12 V = 12DC</p>																
<p><b>Threaded connections</b></p> <p>M18x1,5 = no desig. M22x1,5 = M22 G3/8 = 3/8 G1/2 = 1/2</p>	<p><b>Plug-in connector</b></p> <p>without signal lamp = no desig. with signal lamp = L</p>																
<p><b>Seal type</b></p> <p>NBR seals for mineral oil HL, HLP = no desig. to DIN 51524 FPM seals for HETG, HEES, HEPG = E to VDMA 24568 and ISO 15380</p>																	

**Dimensions (mm)**  
KVV...A...  
KVV...B..

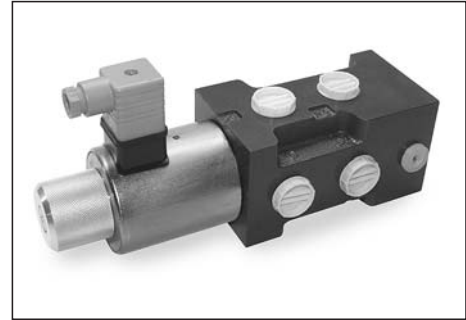


1. Solenoid "a" MR-045
2. Plug in connector "a" - grey
3. Emergency hand operator
4. Nameplate



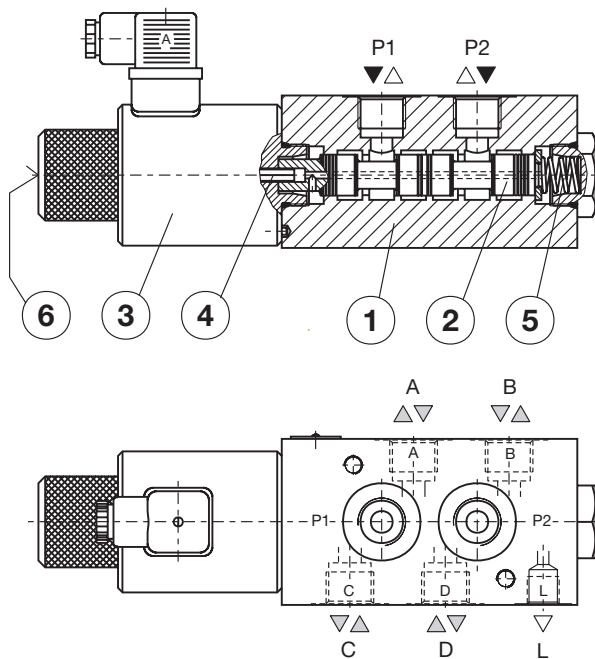
**6/2-WAY DIRECTIONAL VALVES type KV**

- NS 10
- to 350 bar
- to 80 l/min
- Direct operation by solenoid
- Plug-in connector for solenoids to ISO 4400
- Threaded connections to ISO 9974, ISO 1179



KV-6/2-10

**Description of operation**



Directional valves type KV with direct solenoid operation control the direction of the hydraulic medium flow. They are mostly used as link between two consumers and the basic directional valve, when we want to control both consumers alternately by means of one basic directional valve.

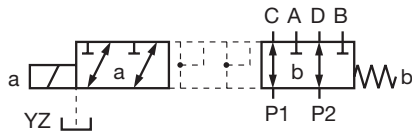
The KV type directional valves consist of a housing (1), a control spool (2), a solenoid (3) and a return spring (5).

Change-over to the operating position is done by energising the solenoid (3), whereby the solenoid plunger acts on the control spool (2) via the operating pin (4), thus clearing the corresponding flow ways and establishing respective links between the ports P1, A, B and P2.

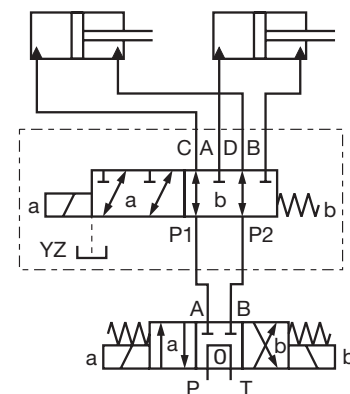
When the solenoid (3) is de-energised, the control spool (2) is returned to its neutral position by the return spring (5), thus establishing again the links between ports P1, C, D and P2.

The change-over can also be done manually by pressing the emergency hand operator (6).

**Symbol**



**Mounting example**



**Technical data**

		Hydraulic	
Size			10
Flow rate		l/min	80
Operating pressure	with YZ	bar	350
	without YZ	bar	210
Oil temperature range		°C	-20 to +70
Viscosity range		mm <sup>2</sup> /s	15 to 380
Mounting position	optional		
Mass		kg	5,5
Filtration	NAS 1638		8

**Electrical**

Supply voltage	V	12, 24 DC
Power	W	45
Switching frequency	1/h	15000
Ambient temperature	°C	to +50
Coil temperature	°C	to +180
Duty cycle	continous	

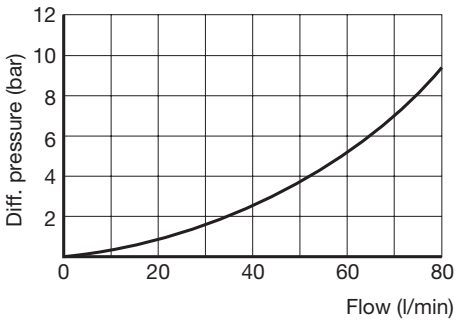
**Ordering code**

**KV-6/2-10 - - - - - \***

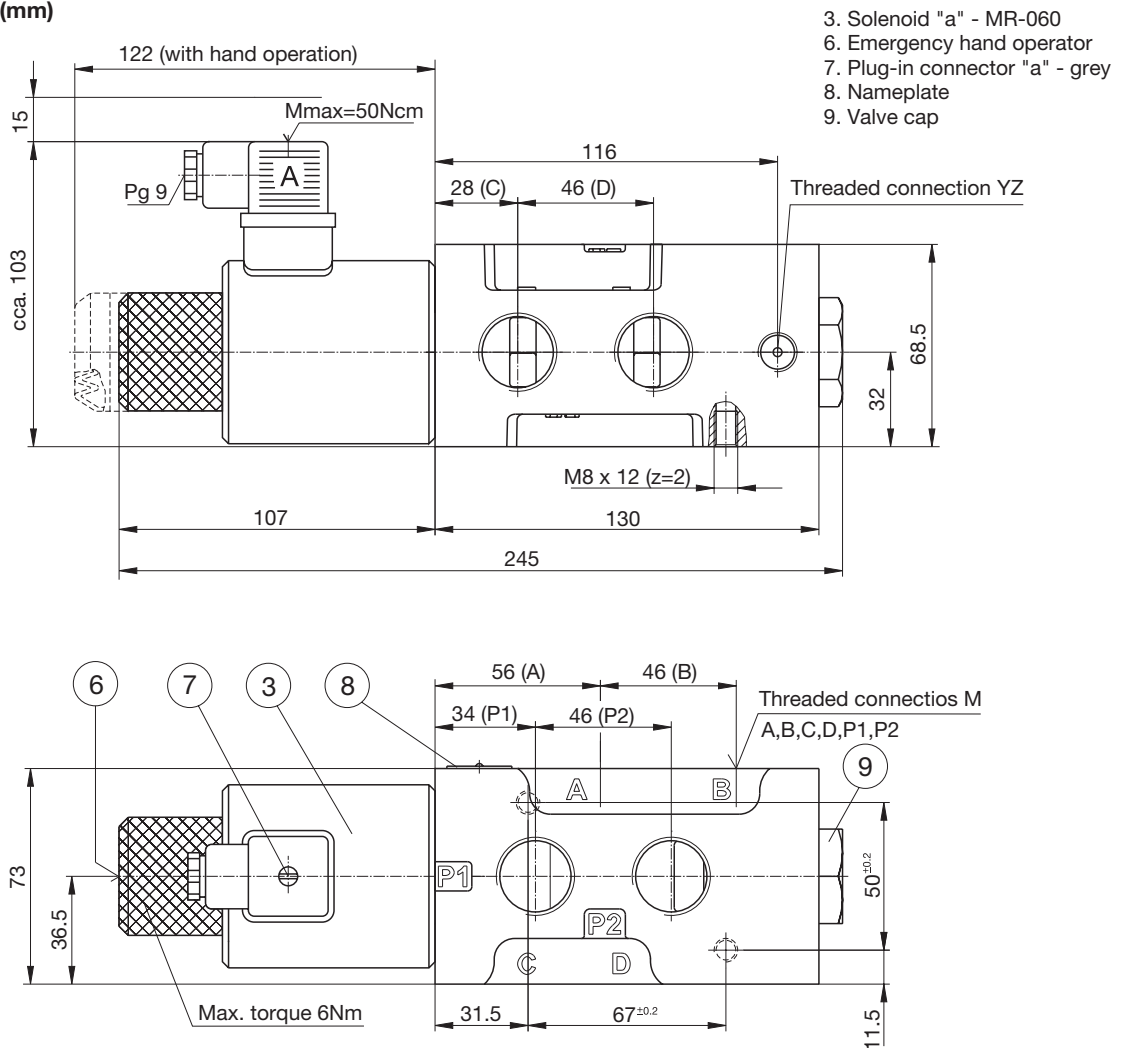
Hand operator	
Supply voltage	
Threaded connections	
Drainage	
Plug-in connector	
Seal type	
Special requirements to be briefly specified	

<b>Hand operator</b>	
without hand operator	= no desig.
with hand operator	= G
<b>Supply voltage</b>	
direct voltage 24 V	= no desig.
direct voltage 12 V	= 12DC
<b>Threaded connections M / YZ</b>	
M 22x1,5 (YZ=14x1,5)	= M22
M 27x2 (YZ=14x1,5)	= M27
G 1/2 (YZ=G1/4)	= 1/2
G 3/4 (YZ=G1/4)	= 3/4
<b>Drainage</b>	
without YZ	= no desig.
with YZ	= YZ
<b>Plug-in connector</b>	
without signal lamp	= no desig.
with signal lamp	= L
<b>Seal type</b>	
NBR seals for mineral oil HL, HLP, to DIN 51524	= no desig.
FPM seals for HETG, HEES, HEPG to VDMA 24568	= E
and ISO 15380	

**Δp - Q Performance curves**  
(measured at t = 50 °C and ν = 32 mm<sup>2</sup>/s)



**Dimensions (mm)**



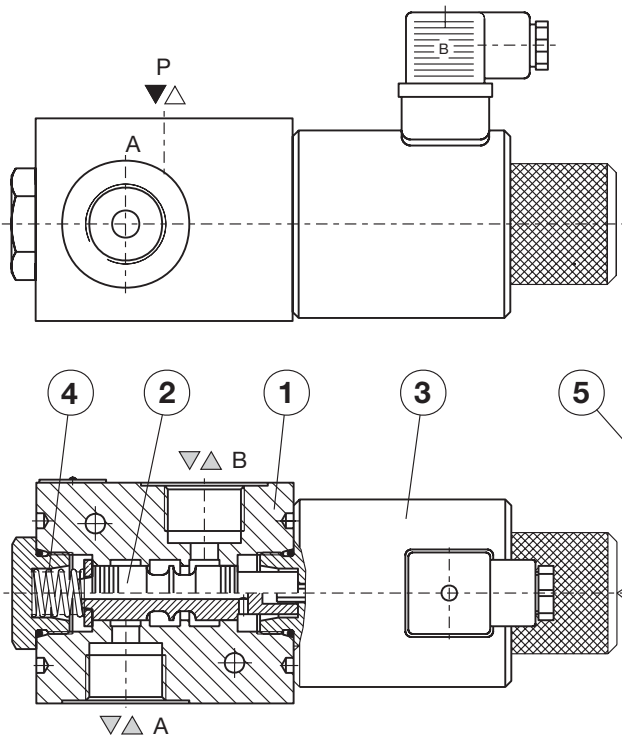
**3/2-WAY DIRECTIONAL VALVE Type KVC-3/2-10-...**

- NS 10
- to 210 bar
- to 60 l/min
- Direct operation by solenoid
- Direct in-line mounting
- Plug-in connector for solenoids to ISO 4400
- Threaded connections to ISO 9974, ISO 1179



KVC-3/2-10

**Description of operation**



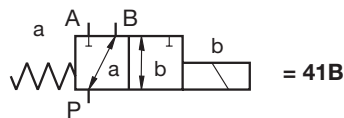
Directional valves type KVC-3/2-10 with direct solenoid operation are used to control the direction of hydraulic fluid flow. Type KVC-3/2-10 is a reduced version of type KV-6/2. It is used for alternate control of two one-pipe working units (e.g. Plunger) with common, main directional valve.

These valves consist of a housing (1), control spool (2), solenoid (3) and two return springs (4).

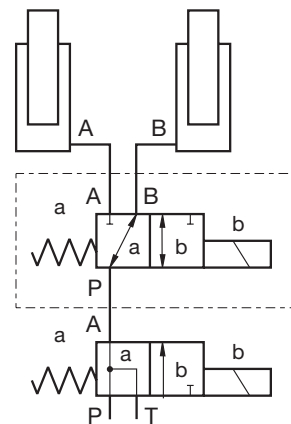
The basic control position is a, in which the return spring holds the control spool (2) in its start position. The change-over to the position b is performed by energizing the solenoid (3), whereas the solenoid plunger pushes the slide into the new position. Consequently, the path from P to B is closed, and the path from P to A is freed. By interrupting the electric control signal of the solenoid, the spool returns to its neutral position a due to the action of the return spring (4).

The change-over can also be done manually by pressing the emergency hand operator (5).

**Symbol (spool type)**



**Mounting example**



**Technical data**

		Hydraulic
Size		10
Flow rate	l/min	60
Operating pressure	bar	210
Oil temperature range	°C	-20 to +70
Viscosity range	mm <sup>2</sup> /s	15 to 380
Mounting position	optional	
Mass	kg	3,75
Filtration	NAS 1638	8

**Electrical**

Supply voltage	V	12, 24
Power	W	45
Switching frequency	1/h	15000
Ambient temperature	°C	to +50
Coil temperature	°C	to +180
Intermittence	100%	

**Ordering code**

**KVC-3/2-10** - - - - - \*

- Spool type
- Supply voltage
- Threaded connections
- Plug-in connector
- Seal type
- Special requirements to be briefly specified

**Supply voltage**

direct voltage 24 V = no design.  
 direct voltage 12 V = 12 DC

**Threaded connections**

M18x1,5 = no design  
 M22x1,5 = M22  
 M20x1,5 = M20  
 G3/8 = G3/8  
 G1/2 = G1/2

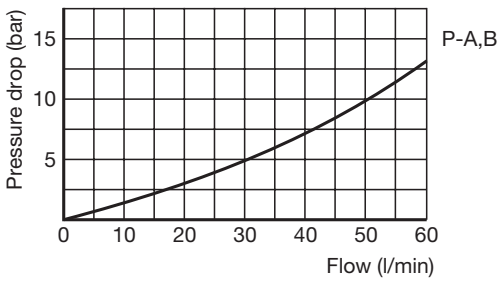
**Plug-in connector**

without signal lamp = no desig.  
 with signal lamp = L

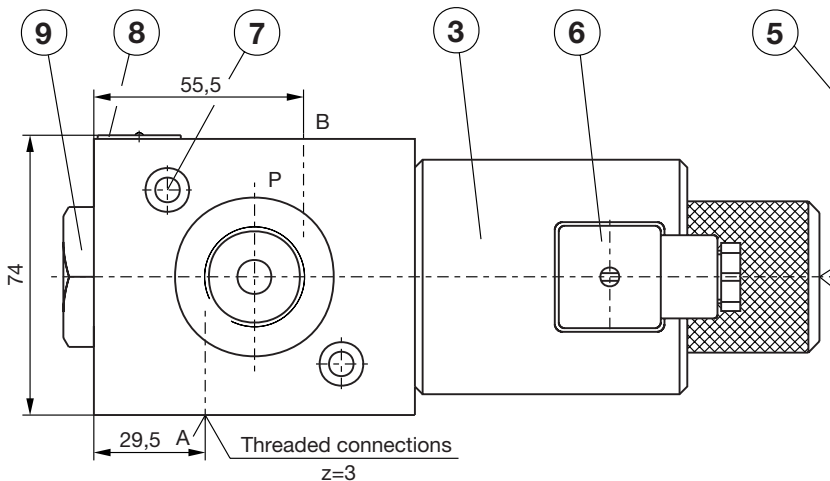
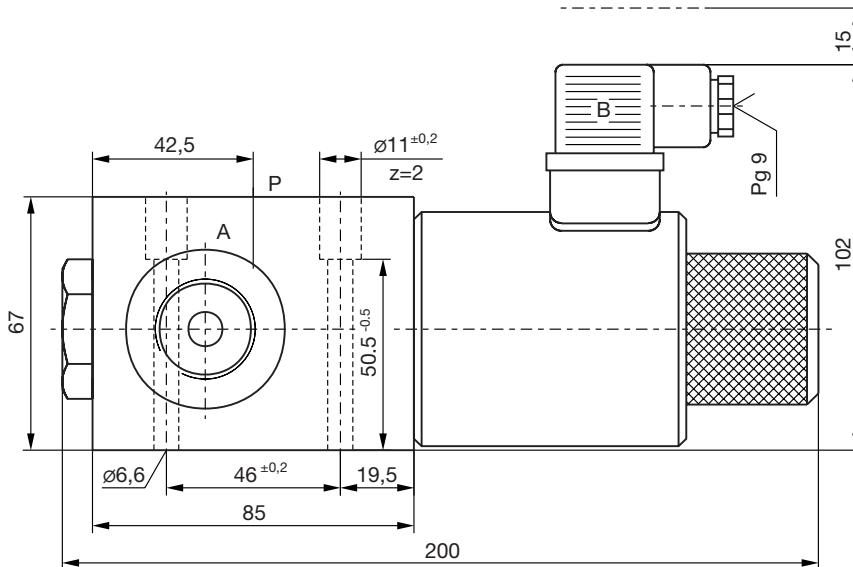
**Seal type**

NBR seals for mineral oil HL, HLP to DIN 51524 = no desig.  
 FPM seals for HETG, HEES, HEPG to VDMA 24568 = E  
 and ISO 15380

**Δp - Q Performance curves**  
 (measured at t = 50 °C and  $\nu = 32 \text{ mm}^2/\text{s}$ )



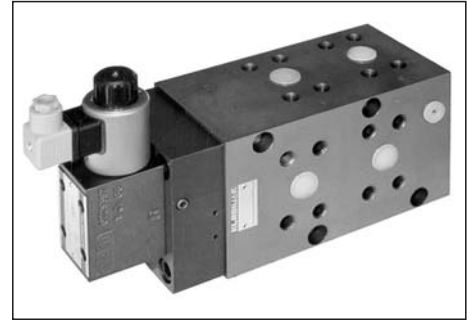
**Dimensions (mm)**



- 3. Solenoid "b" MR-060
- 5. Emergency hand operator
- 6. Plug-in connector "b" -black
- 7. Fixing holes for screws  
DIN EN ISO 4762 (M6x40-10.9)
- 8. Nameplate
- 9. Valve cap

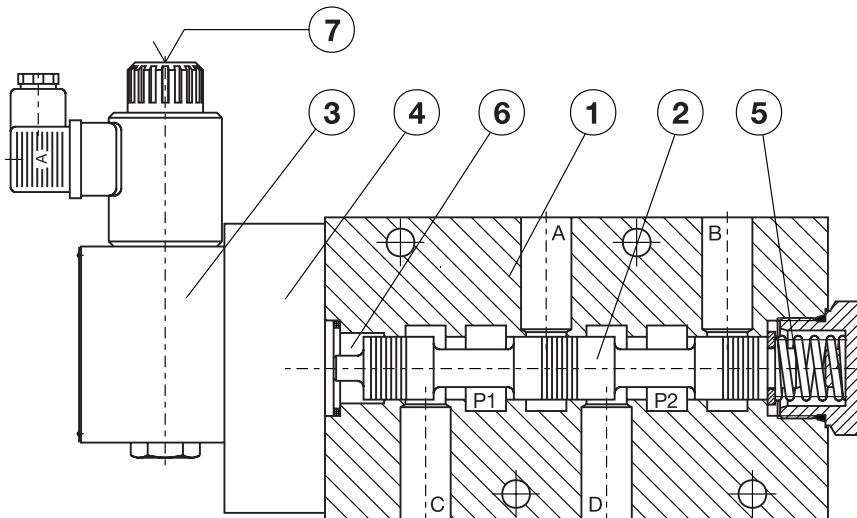
## 6/2-WAY DIRECTIONAL VALVES type KV

- NS 16
- to 350 bar
- to 250 l/min
- Pilot operated
- Tube-in connector for solenoids to ISO 4400
- Tube connection according to DIN 2353
- Fulfil EMC (89/336/EEC)



KV-6/2-16-XN

### Description of operation



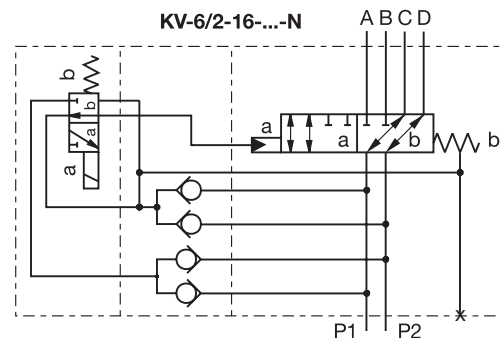
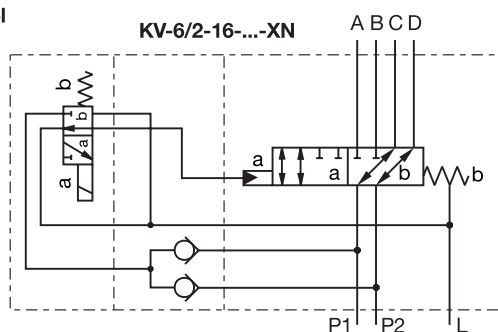
Directional valves type KV-6/2-16 with indirect, solenoid-hydraulics operation control the direction of the hydraulic medium flow. They are mostly used as link between two consumers and the basic directional valve, when we want to control both consumers alternately by means of one basic directional valve.

The KV type directional valves consist of a housing (1), a control spool (2), a pilot valve (3) a sandwich plate (4) and a return spring (5).

Change-over to the operating position is done by energising the solenoid of the pilot valve (3). A pressure rise in the pressure chamber (6), provoke the movement of the control spool (2), thus clearing the corresponding flow ways and establishing respective links between the ports P1, A, B and P2.

When the solenoid of the pilot valve is de-energised, the control spool (2) is returned to its neutral position by the return spring (5), thus establishing again the links between ports P1, C, D and P2. The change-over can also be done manually by pressing the emergency hand operator (7) of the pilot valve.

### Symbol



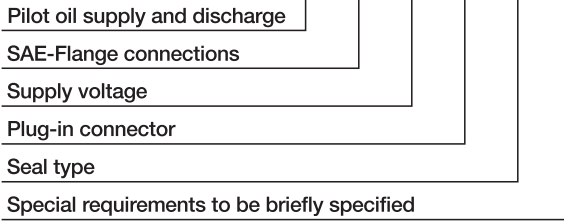
### Technical data

		Hydraulic
Size		16
Flow rate	l/min	250
Operating pressure	bar	350
(in port L or in return way)	bar	160
Oil temperature range	°C	-20 to +70
Viscosity range	mm <sup>2</sup> /s	15 to 380
Mounting position	optional	
Mass	kg	22
Filtration	NAS 1638	8

		Electrical
Supply voltage	V	12, 24 DC
Power	W	29
(12 V DC supply voltage)	W	36
Switching frequency	1/h	15000
Ambient temperature	°C	to +50
Coil temperature	°C	to +180
Duty cycle	continuous	

**Ordering code**

KV -6/2-16 - - - - \*



**Pilot oil supply and discharge**

internal x,y = N  
 internal x, external y (port L) = XN

**SAE-Flange connections**

SAE-Flange connections 3/4 - High pressure series = SAE3/4  
 SAE-Flange connections 1 - High pressure series = SAE1

**Supply voltage**

direct voltage 24 V = no desig.  
 direct voltage 12 V = 12DC

**Plug-in connector**

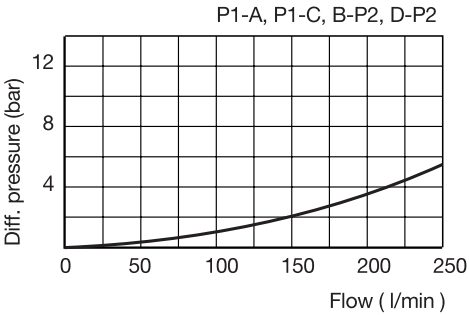
without signal lamp = no desig.  
 with signal lamp = L

**Seal type**

NBR seals for mineral oil HL, HLP, to DIN 51524 = no desig.  
 FPM seals for HETG, HEES, HEPG to VDMA 24568 = E

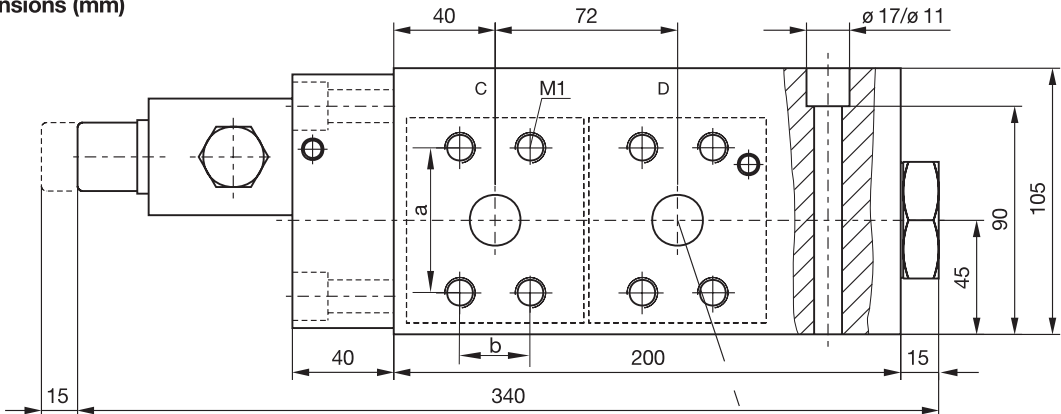
**Δ p-Q Performance curves**

(measured at t = 50 °C and ν = 32 mm<sup>2</sup>/s)



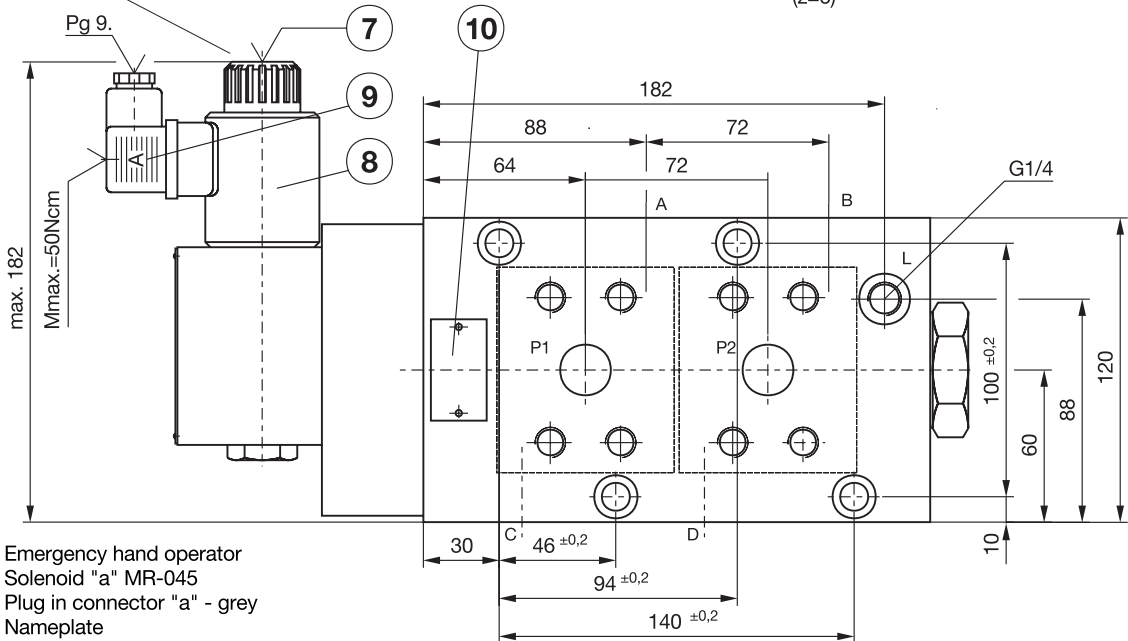
Size	a	b	M1
3/4	50,8	23,8	M10
1	57,2	27,8	M12

**Dimensions (mm)**



With hand operation - add letter G in ordering code

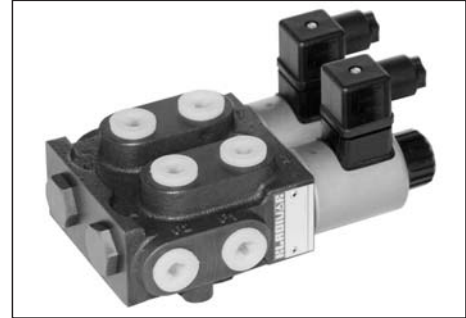
SAE-flange connection - High pressure series (z=6)



- 7. Emergency hand operator
- 8. Solenoid "a" MR-045
- 9. Plug in connector "a" - grey
- 10. Nameplate

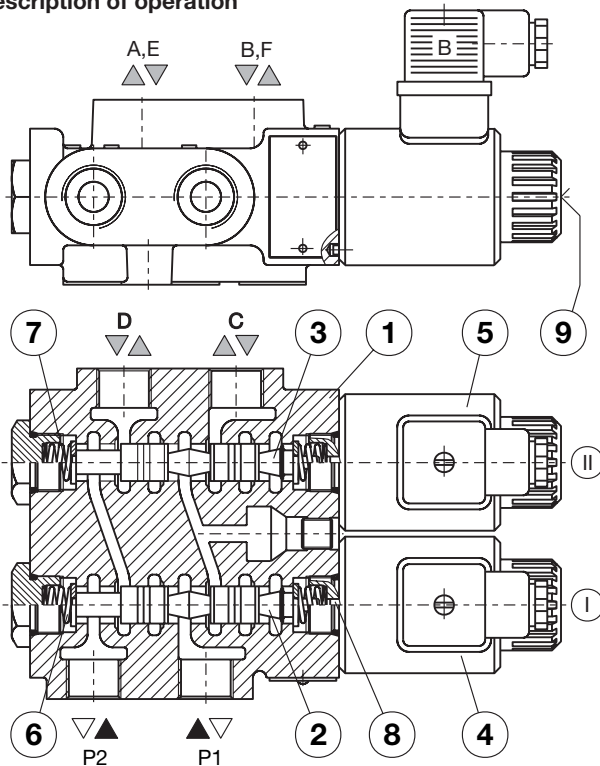
**8/3-WAY DIRECTIONAL VALVES type KV**

- NS 6
- to 210 bar
- to 50 l/min
- Direct operation by solenoid
- Plug-in connector for solenoids to ISO 4400
- Threaded connection to ISO 9974, ISO 1179
- Fulfil EMC (89/336/EEC)



KV-8/3-6

**Description of operation**



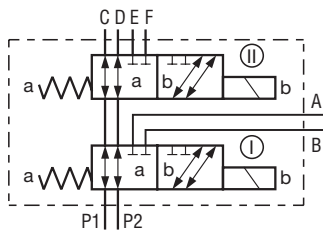
Directional valves type KV with direct solenoid operation control the direction of the hydraulic medium flow. They are mostly used as link between three consumers and the basic directional valve, when we wish to control both consumers alternately by means of one basic directional valve.

The KV type directional valves consist of a housing (1), a control spool (2,3), two solenoids (4,5) with return spring (6,7). Change-over to one of the operating positions is done by combination of operation of solenoids (4,5), whereby the solenoid plunger acts on the control spool (2,3) via the operating pin (8), thus clearing the corresponding flow ways and establishing respective links between the ports P1, A, B, C, D, E, F and P2, as seen forth in the schematic diagram of a mounting example.

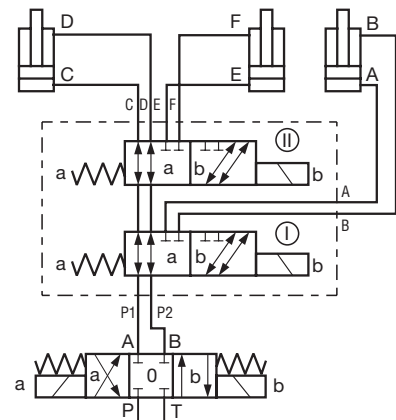
When the solenoid (4,5) is de-energised, the control spool (2,3) is returned to their neutral position by the return spring (6,7).

The change-over can also be done manually by pressing the emergency hand operator (9).

**Symbol**



**Mounting example**



**Technical data**

Size		6
Flow rate	l/min	50
Operating pressure	bar	210
Oil temperature range	°C	-20 to +70
Viscosity range	mm <sup>2</sup> /s	15 to 380
Mounting position	optional	
Mass	kg	3,8
Filtration	NAS 1638	8

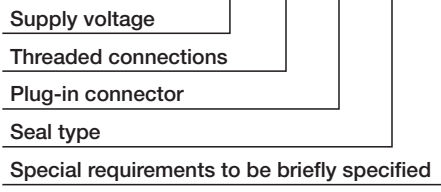
**Hydraulic**

**Electrical**

Supply voltage	V	12, 24 DC
Power	W	29
(12 V DC supply voltage)	W	36
Switching frequency	1/h	15000
Ambient temperature	°C	to +50
Coil temperature	°C	to +180
Duty cycle	continuous	

**Ordering code**

**KV-8/3-6 - - - - \***



**Supply voltage**

direct voltage 24 V = no desig.  
 direct voltage 12 V = 12 DC

**Threaded connections**

M 18x1.5 = no desig.  
 M 22x1,5 = M 22  
 G 3/8 = G 3/8  
 G 1/2 = G 1/2

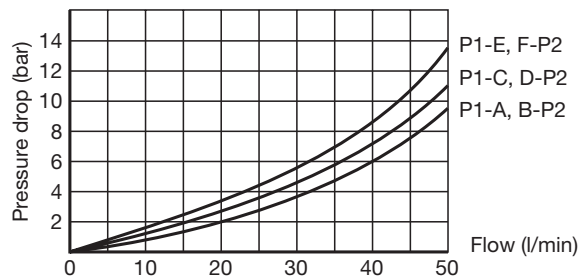
**Plug-in connector**

without signal lamp = no desig.  
 with signal lamp = L

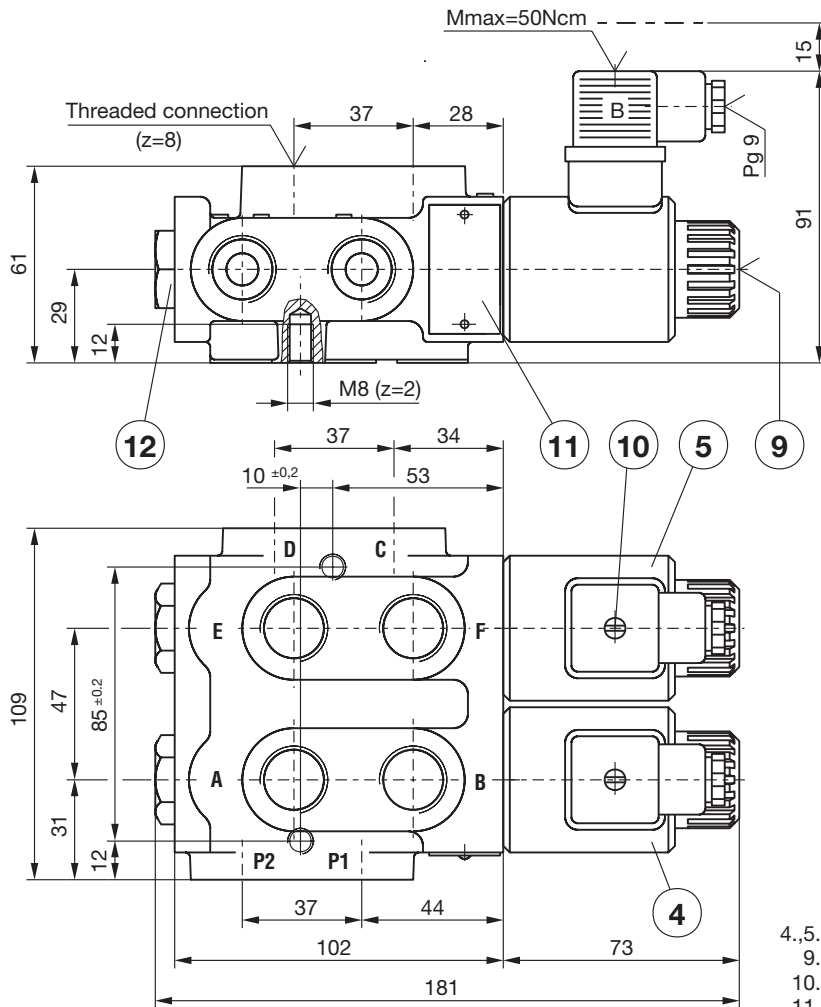
**Seal type**

NBR seals for mineral oil HL, HLP, to DIN 51524 = no desig.  
 FPM seals for HETG, HEES, HEPG to VDMA 24568 = E  
 and ISO 15380

$\Delta p - Q$  Performance curves  
 (measured at  $t = 50\text{ }^\circ\text{C}$  and  $\nu = 32\text{ mm}^2/\text{s}$ )



**Dimensions (mm)**

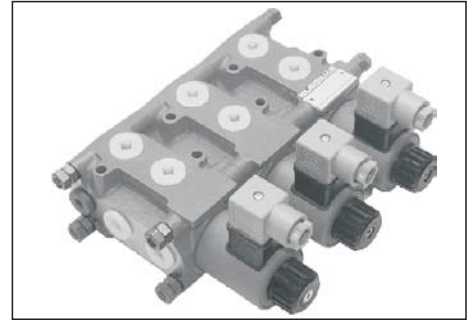


- 4.,5. Solenoids "b" MR-045
- 9. Emergency hand operator
- 10. Plug-in connector "b" - black
- 11. Nameplate
- 12. Valve cap



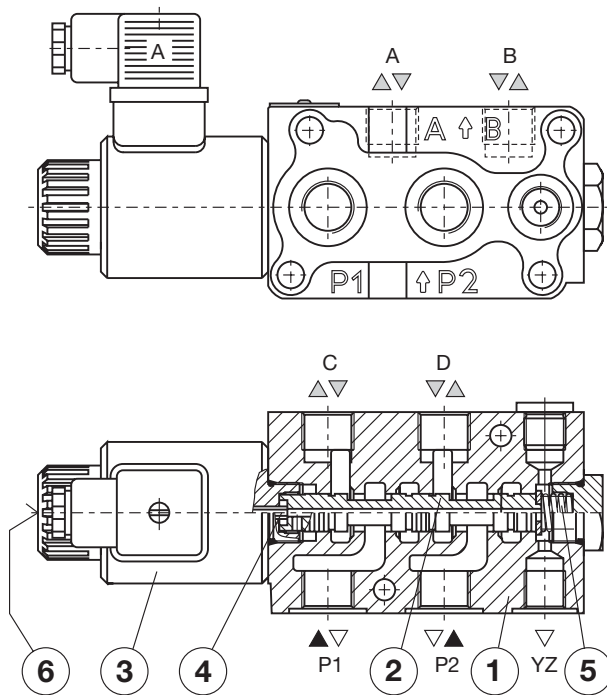
**6/2-WAY DIRECTIONAL VALVES type KVH**

- NS 6
- to 315 bar
- to 50 l/min
- Direct operation by solenoid
- Plug-in connector for solenoids to ISO 4400
- Threaded connection to ISO 9974, ISO 1179
- Fulfil EMC (89/336/CCE)
- For stacking (1-5 units)



**KVH-6/2-6-N3-S50**

**Description of operation**



Directional valves type KVH with direct solenoid operation control the direction of the hydraulic medium flow. They are mostly used as link between two consumers and the basic directional valve, when we want to control both consumers alternately by means of one basic directional valve.

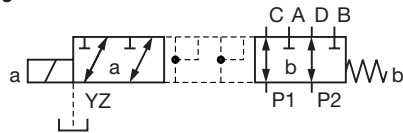
The KVH type directional valves consist of a housing (1), a control spool (2), and a solenoid (3) with return spring (5).

Change-over to the operating position is done by energising the solenoid (3), whereby the solenoid plunger acts on the control spool (2) via the operating pin (4), thus clearing the corresponding flow ways and establishing respective links between the ports P1, A, B and P2.

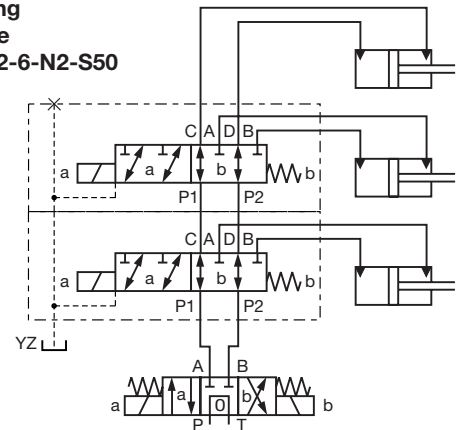
When the solenoid (3) is de-energised, the control spool (2) is returned to its neutral position by the return spring (5), thus establishing again the links between ports P1, C, D and P2.

The change-over can also be done manually by pressing the emergency hand operator (6).

**Symbol**  
**KVH-6/2-6-N1-S50**



**Mounting example**  
**KVH-6/2-6-N2-S50**



**Technical data**

Hydraulic

Size		6
Flow rate	l/min	50
Operating pressure	with YZ	bar 315
	without YZ	bar 210
Oil temperature range	°C	-20 to +70
Viscosity range	mm <sup>2</sup> /s	15 to 380
Mounting position	optional	
Mass	kg	2,7 (N1)
Filtration	NAS 1638	8

Electrical

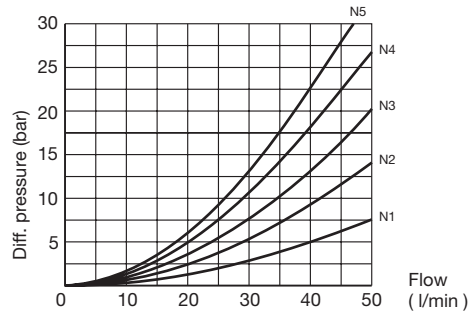
Supply voltage	V	12, 24 DC
Power	W	29
(12 V DC supply voltage)	W	36
Switching frequency	1/h	15000
Ambient temperature	°C	to +50
Coil temperature	°C	to +180
Duty cycle	continuous	

**Ordering code**

**KVH - 6/2 - 6 - - - - - S50 - - \***

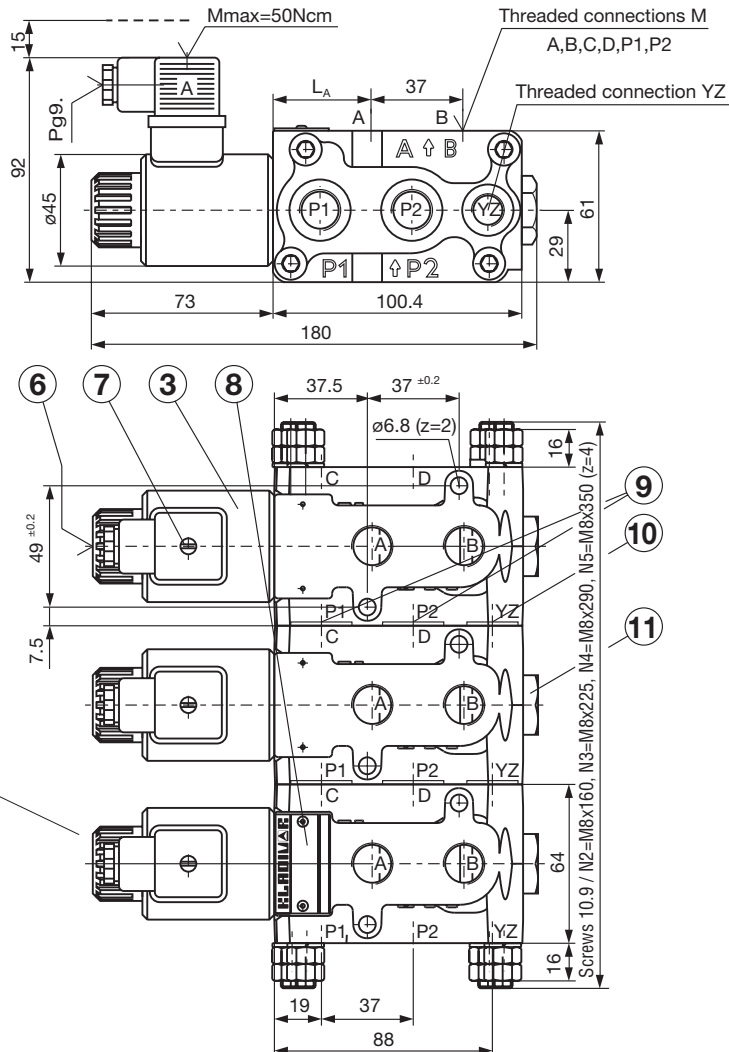
Symbol	
Overlap	
Hand operator	
Supply voltage	
Threaded connections	
Drainage	
Plug-in connector	
Seal type	
Nr. units	
Special requirements to be briefly specified	

**Δp - Q Performance curves**  
(measured at t = 50 °C and v = 32 mm<sup>2</sup>/s)



<p><b>Symbol</b></p> <p>= no desig.</p> <p>= AB</p>	<p><b>Overlap</b></p> <p>= no desig.</p> <p>= P</p>	<p><b>Nr. units</b></p> <p>one units = <b>N1</b></p> <p>two units = <b>N2</b></p> <p>three units = <b>N3</b></p> <p>four units = <b>N4</b></p> <p>five units = <b>N5</b></p>
<p><b>Hand operator</b></p> <p>without hand operator = no desig.</p> <p>with hand operator = <b>G</b></p>	<p><b>Supply voltage</b></p> <p>direct voltage 24 V = no desig.</p> <p>direct voltage 12 V = <b>12 DC</b></p>	
<p><b>Threaded connections M / YZ</b></p> <p>M18x1,5 (YZ=M14x1,5) = no desig.</p> <p>M22x1,5 (YZ=M14x1,5) = <b>M22</b></p> <p>G3/8 (YZ=G1/4) = <b>3/8</b></p> <p>G1/2 (YZ=G1/4) = <b>1/2</b></p>	<p><b>Plug-in connector</b></p> <p>without signal lamp = no desig.</p> <p>with signal lamp = <b>L</b></p> <p><b>Drainage</b></p> <p>without YZ = no desig.</p> <p>with YZ = <b>YZ</b></p>	
<p><b>Seal type</b></p> <p>NBR seals for mineral oil HL, HLP to DIN 51524 = no desig.</p> <p>FPM seals for HETG, HEES, HEPG to VDMA 24568 and ISO 15380 = <b>E</b></p>		

**Dimensions (mm)**  
**KVH-6/2-6-N3-S50**



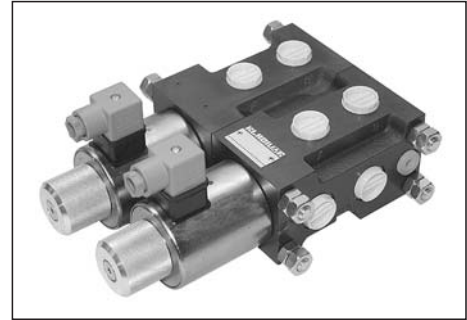
With hand operation - add letter G in ordering code

L<sub>A</sub> = 39,5 ( G3/8, M18x1,5 )  
37,5 ( G1/2, M22x1,5 )

- 3. Solenoid "a" MR-045,
- 6. Emergency hand operator
- 7. Plug-in connector "a" grey
- 8. Nameplate
- 9. O-Ring ; M18x1,5 / G3/8 = ø21x2  
M22x1,5 / G1/2 = ø26x2
- 10. O-Ring ; M14x1,5 / G1/4 = ø17x2
- 11. Valve cap

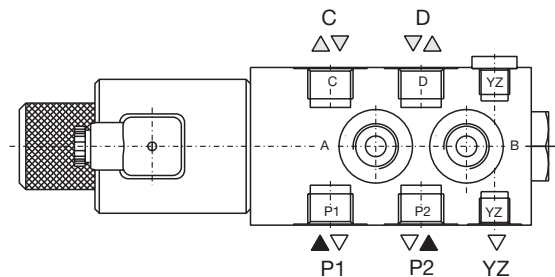
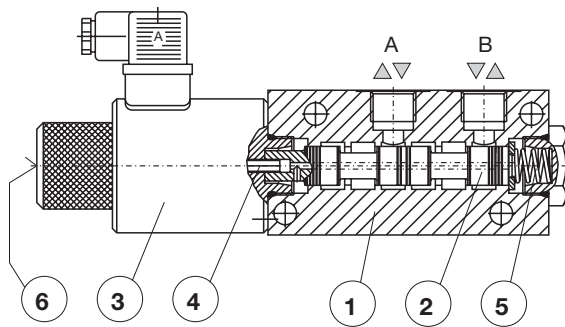
**6/2-WAY DIRECTIONAL VALVES type KVH**

- NS 10
- to 315 bar
- to 80 l/min
- Direct operation by solenoid
- Plug-in connector for solenoids to ISO 4400
- Threaded connection to ISO 9974, ISO 1179



KVH-6/2-10-N2

**Description of operation**



Directional valves type KVH with direct solenoid operation control the direction of the hydraulic medium flow. They are mostly used as link between two consumers and the basic directional valve, when we want to control both consumers alternately by means of one basic directional valve.

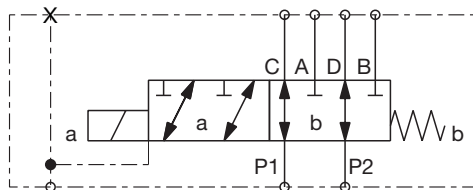
The KVH type directional valves consist of a housing (1), a control spool (2), a solenoid (3) and a return spring (5).

Change-over to the operating position is done by energising the solenoid (3), whereby the solenoid plunger acts on the control spool (2) via the operating pin (4), thus clearing the corresponding flow ways and establishing respective links between the ports P1, A, B and P2.

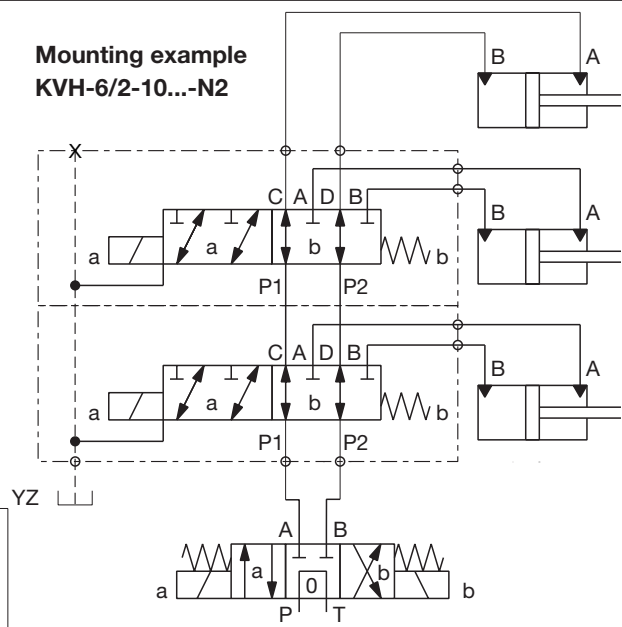
When the solenoid (3) is de-energised, the control spool (2) is returned to its neutral position by the return spring (5), thus establishing again the links between ports P1, C, D and P2.

The change-over can also be done manually by pressing the emergency hand operator (6).

**Symbol**



**Mounting example  
KVH-6/2-10...-N2**



**Tehcnical data**

		Hydraulic	
Size			10
Flow rate		l/min	80
Operating pressure	with YZ	bar	315
	without YZ	bar	210
Oil temperature range		°C	-20 to +70
Viscosity range		mm²/s	15 to 380
Mounting position	optional		
Mass	kg		5,5
Filtration	NAS 1638		8

**Electrical**

Supply voltage	V	12, 24 DC
Power	W	45
Switching frequency	1/h	15000
Ambient temperature	°C	to +50
Coil temperature	°C	to +180
Duty cycle	continious	

**Ordering code**

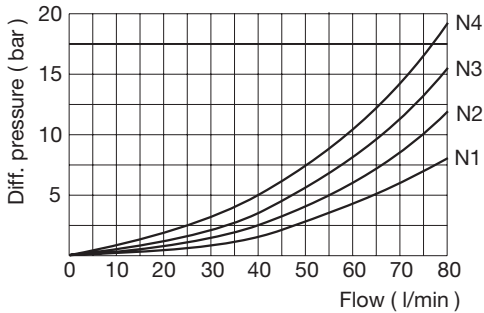
**KVH - 6/2 - 10 - - - - - S40 - - \***

Hand operator	
Supply voltage	
Threaded connections	
Drainage	
Plug-in connector	
Seal type	
Nr. units	
Special requirements to be briefly specified	

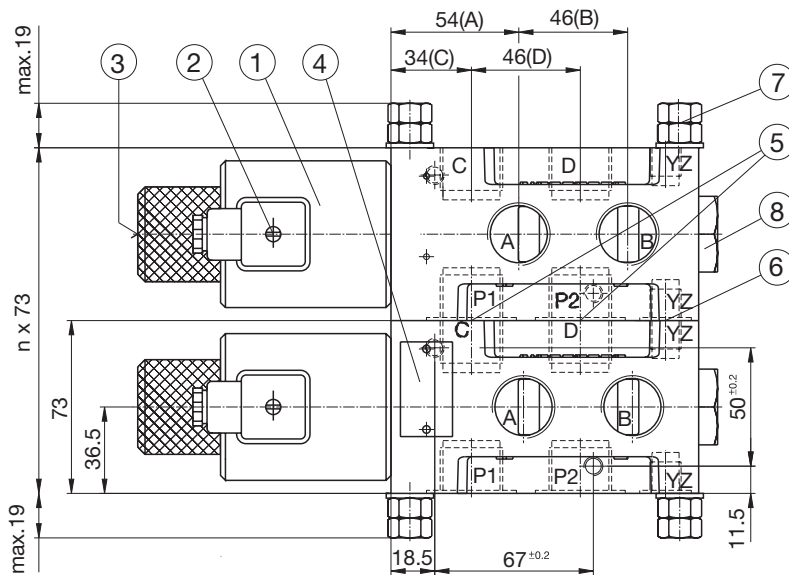
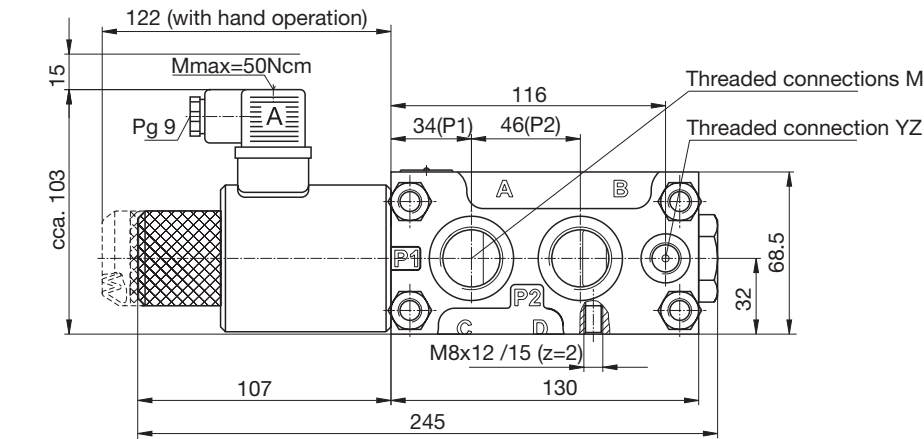
<b>Hand operator</b>	
without hand operator	= no desig.
with hand operator	= G
<b>Supply voltage</b>	
direct voltage 24 V	= no desig.
direct voltage 12 V	= 12DC
<b>Threaded connections M / YZ</b>	
M22x1,5 / M14x1,5	= M22
M27x2 / M14x1,5	= M27
G1/2 / G1/4	= G1/2
G3/4 / G1/4	= G3/4
<b>Drainage</b>	
without YZ	= no desig.
with YZ	= YZ
<b>Plug-in connector</b>	
without signal lamp	= no desig.
with signal lamp	= L
<b>Seal type</b>	
NBR seals for mineral oil HL, HLP to DIN 51524	= no desig.
FPM seals for HETG, HEES, HEPG to VDMA 24568 and ISO 15380	= E
<b>Nr. units</b>	
one unit (n=1)	= N1
two units (n=2)	= N2
three units (n=3)	= N3
four units (n=4)	= N4

**Δp - Q Performance curves**

(measured at t = 50 °C and v = 32 mm<sup>2</sup>/s)



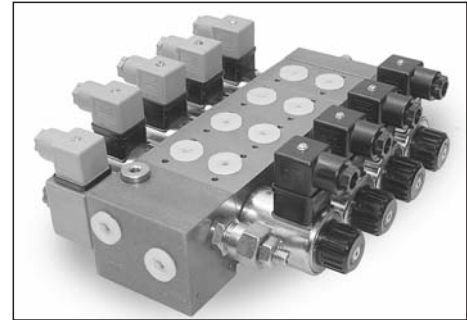
**Dimensions (mm)**



1. Solenoid "a" MR-045
2. Plug-in connector "a" grey
3. Emergency hand operator
4. Nameplate
5. O-Ring; 26x2=KVH-6/2-10-G1/2(M22), 31x2=KVH-6/2-10-G3/4(M27)
6. O-Ring 17x2
7. Screws; M10 - 10.9 (z=4)
8. Valve cap

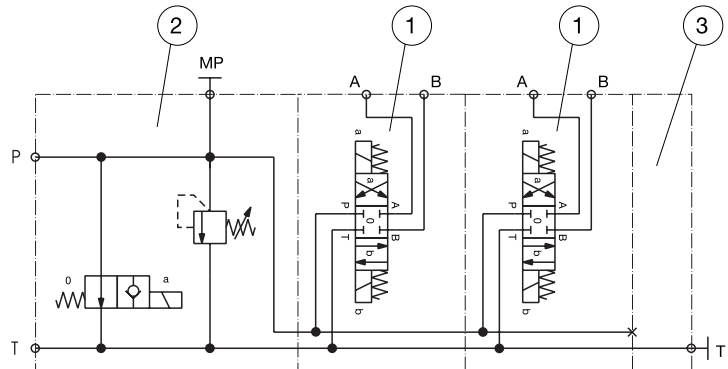
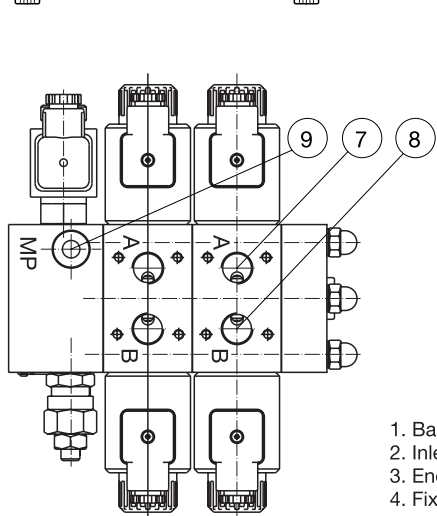
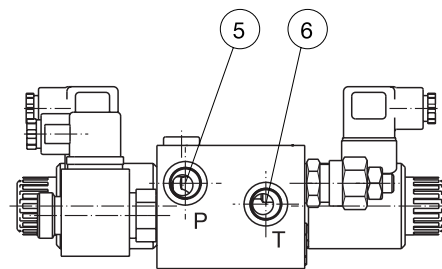
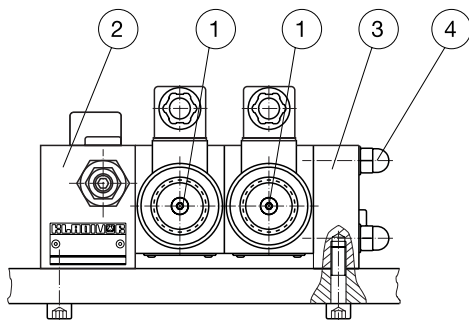
## 4/2 and 4/3 - WAY BANKABLE DIRECTIONAL VALVES type KVM

- NS 6
- to 350 bar
- to 40 l/min
- Threaded connection to ISO 9974, ISO 1179
- Series or parallel connections
- Inlet plate possibility with pressure relief valve, pump unloading valve or flow control valve
- Possibility to use standard components for vertical stacking



KVM - 6 -...- VV - KV - N4

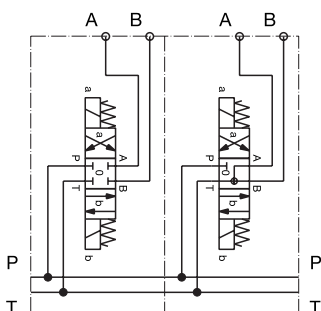
### Basic concept



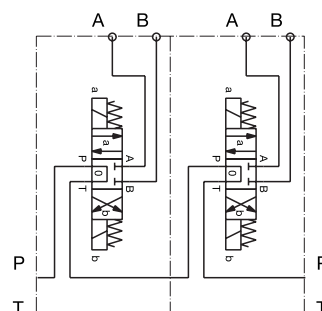
- |   |                                    |
|---|------------------------------------|
| 1. Basic (directional control) valves KVM-6 | 5. Threaded connection P           |
| 2. Inlet plate OB-KVM-6                     | 6. Threaded connection T           |
| 3. End plate ZB-KVM-6                       | 7. Threaded connection A           |
| 4. Fixing elements for mounting SET-KVM-6   | 8. Threaded connection B           |
|   | 9. Threaded connection MP (closed) |

### Type of connection

Parallel (KVM-P)

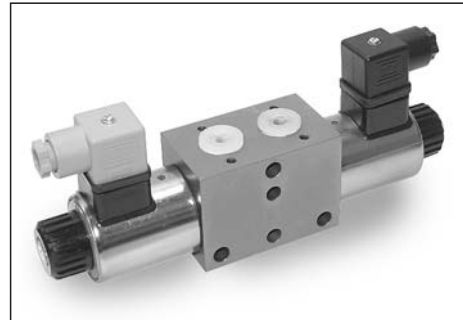


Series (KVM-S)



### 4/2 and 4/3 - WAY BANKABLE DIRECTIONAL VALVES type KVM

- NS 6
- to 350 bar
- to 40 l/min
- Parallel or series connection
- Direct operation by solenoid
- Plug-in connection for solenoids to ISO 4400
- 5-chamber model with good spool guidance
- Wet pin solenoid with interchangeable coil
- Manual emergency control
- Protection of solenoid IP 65 to EN 60529
- Fulfil EMC (89/336/EEC)


**KVM - P - 4/3 - 6 - 1 - 12DC - 3/8**
**Technical data**
**Hydraulic**

			KVM-P	KVM-S
Size			6	6
Flow rate		l/min	40	30
Operating pressure	A, B, P	bar	350	210
	T	bar	210	210
Oil temperature range		°C	-20 to +70	
Viscosity range		mm <sup>2</sup> /s	15 to 380	
Mass	4/2	kg	1,85	
	4/3	kg	2,4	
Filtration		NAS 1638	8	

**Electrical**

Supply voltage	V	12, 24 DC
Power	W	29
(12 V DC supply voltage)	W	36
Switching frequency	1/h	15000
Ambient temperature	°C	to +50
Coil temperature	°C	to +180
Duty cycle	continions	

**Ordering code**

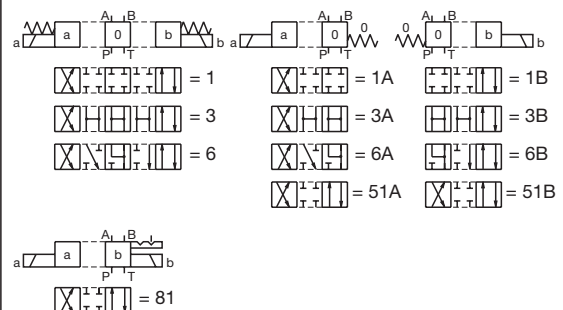
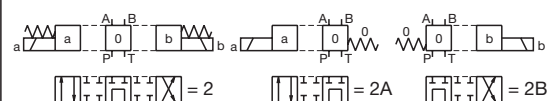
	KVM	-	4/	6	-	-	-	-	*
Type of connection									
Number of control spool positions									
Hand operator									
Spool type									
Supply voltage									
Threaded connections									
Plug-in connector									
Seal type									
Special requirements to be briefly specified									

**Plug-in connector**

without signal lamp = no desig.  
 with signal lamp = L

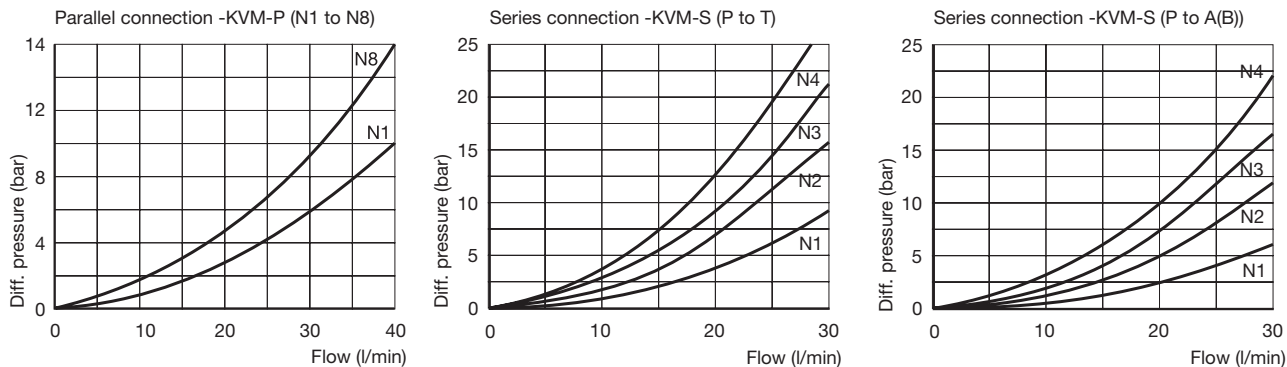
**Seal type**

NBR seals for mineral oil  
 HL, HLP to DIN 51524 = no desig.  
 FMP seals for HETG, HEES,  
 HEPG to VDMA 24568 and ISO 15380 = E

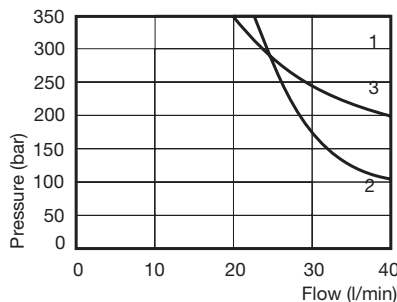
**Spool type - parallel connection (KVM-P)**

**Spool type - series connection (KVM-S)**


<b>Type of connection</b>	
series connection	= S
parallel connection	= P
<b>Number of control spool positions</b>	
two positions	= 2
three positions	= 3
<b>Hand operator</b>	
emergency hand operation	= no design
hand operator with rubber	= G
<b>Supply voltage</b>	
direct voltage 24V	= no design
direct voltage 12V	= 12 DC
<b>Threaded connections</b>	
G3/8 (ISO 1179)	= 3/8
M 18 x 1,5 (ISO 9974)	= no design

**Δp - Q Performance curves (measured at t = 50 °C and v = 28 mm<sup>2</sup>/s)**

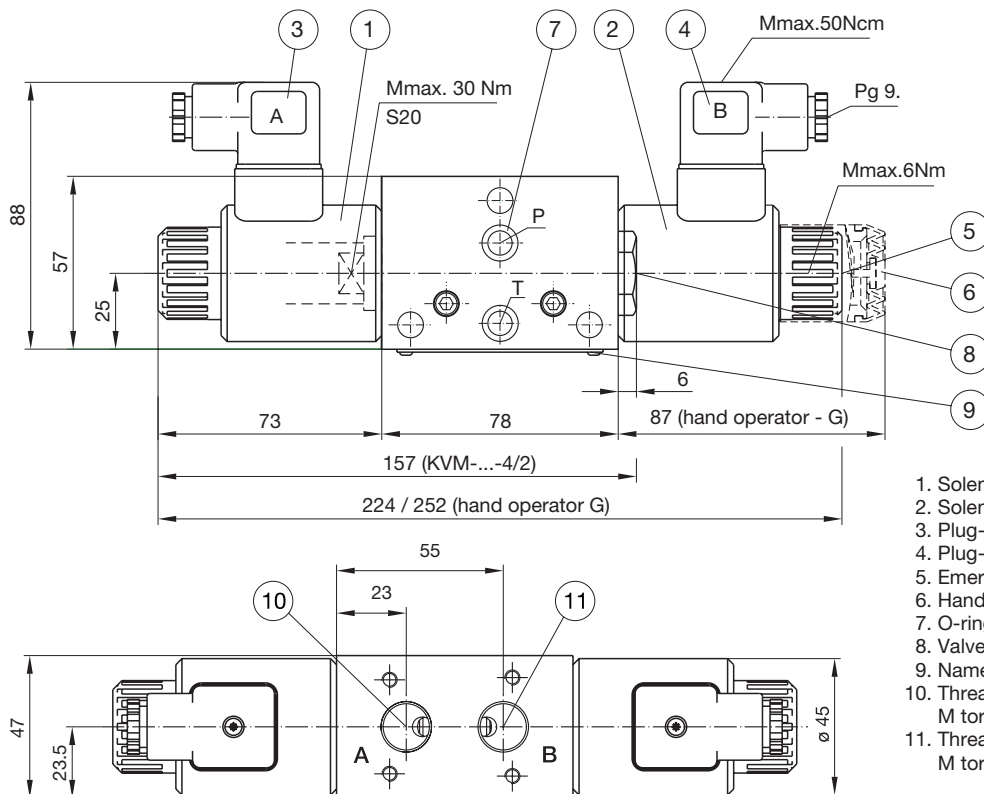


**Δp - Q Performance curves (measured at t = 50 °C and v = 28 mm<sup>2</sup>/s)**



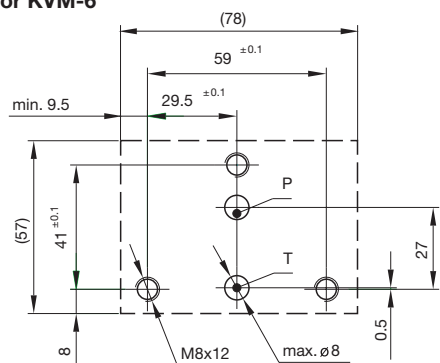
Spool type	Curve
1	1
2	2
3, 6	3

The operating limits of the valve shall be determined at a voltage 10% below the nominal rating. The curves refer to application with symmetrical flow throw the valve (P-A and B-T). In the case of asymmetrical flow (e.g. one part not used) reduced values may result.

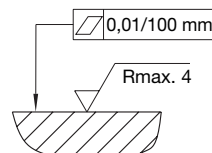


1. Solenoid "a" / MR-045-O
2. Solenoid "b" / MR-045-O
3. Plug-in connector "a" -grey
4. Plug-in connector "b" -black
5. Emergency hand operator
6. Hand operator with rubber (G)
7. O-ring 9,25 x 1,78
8. Valve cap (KVM-...-4/2)
9. Nameplate
10. Threaded connection A-M torque = max. 100 Nm
11. Threaded connection B M torque = max. 100 Nm

**Connection dimensions for KVM-6**



Required quality of the mating surface





## VERTICAL STACKING ON VALVES type KVM

- NS 6
- to 350 bar
- to 40 l/min

- Use standard components for vertical stacking
- Threaded connections to ISO 1179 or ISO 9974
- Possibility of stacking one or two standard components



KVM-P-4/3-5KO-6-and stacking VP-NOV-6

### Ordering code

**STACK - KVM - 6 - - - \***

Number of stacking components

Threaded connections

Seal type

Special requirements to be briefly specified

#### Number of stacking components

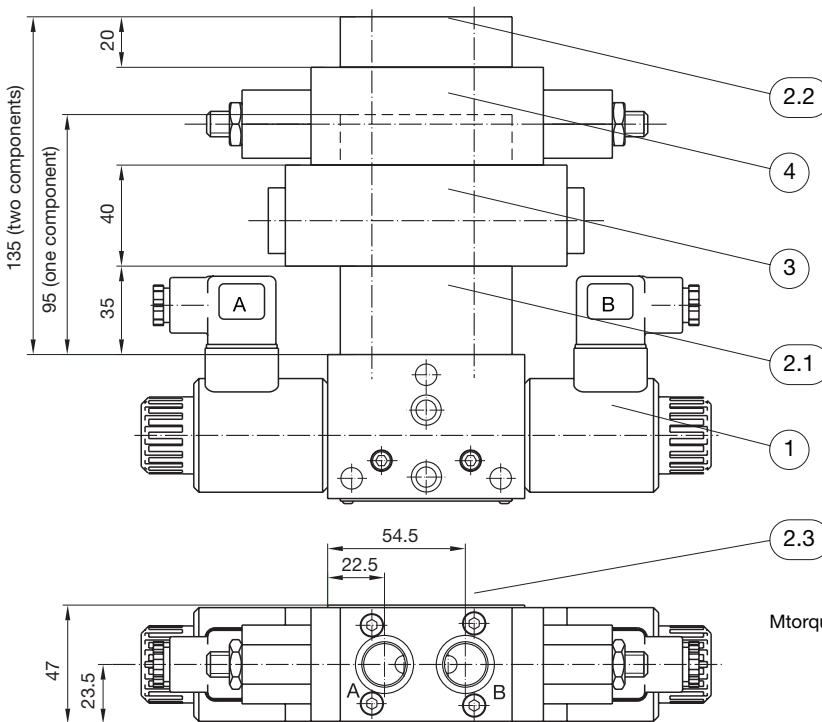
- one standard component = N1
- two standard components = N2

#### Threaded connections

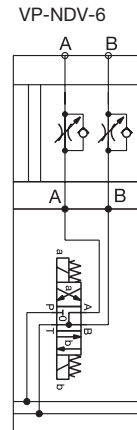
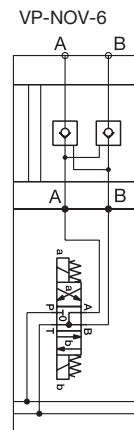
- G3/8 (ISO 1179) = 3/8
- M18 x 1,5 (ISO 9974) = no desig.

#### Seal type

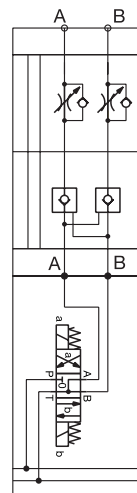
- NBR seals for mineral oil
- HL, HLP to DIN 51524 = no desig.
- FMP seals for HETG, HEES,
- HEPG to VDMA 24568 and ISO 15380 = E



### One standard component



### Two standard components



Mtorque = max. 9 Nm

1. Bankable directional valve KVM-6
2. STACK-KVM-6 consist of:
  - 2.1 Adapter plate and two O-rings 18,77 x 1,78
  - 2.2 End plate and two O-rings 9,25 x 1,78
  - 2.3 Fixing screws M5x100 DIN EN ISO 4762-10.9 (for one stacking component) or M5x140 DIN EN ISO 4762-10.9 (for two stacking components)
3. First stacking component (standard VP-NOV-6 or VP-NDV-6)
4. Second stacking component (standard VP-NDV-6)



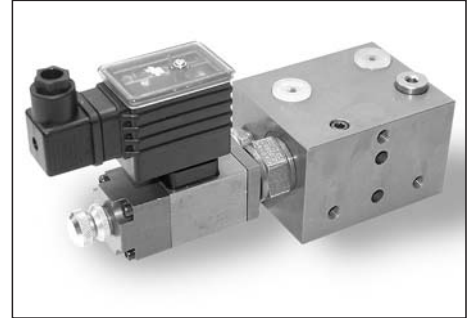
## INLET PLATE type OB-KVM-6

- NS 6
- to 350 bar
- to 40 l/min

- Provide pressure relief valve
- Provide pump unloading valve
- Provide flow control valve
- Threaded connections to ISO 9974, ISO 1179



OB - KVM - 6 - VV20 - KVO



OB - KVM - 6 - VV20 - TVTPG

### Technical data

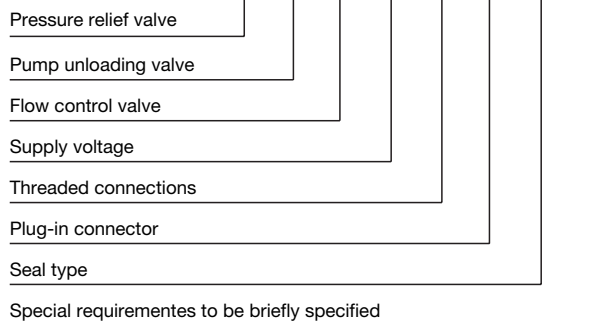
Oil temperature range	°C	-20 to +70
Viscosity range	mm <sup>2</sup> /s	15 to 380
Filtration	NAS 1638	8

Mass	OB-KVM-6	kg	1,25
	OB-KVM-6-VV	kg	1,35
	OB-KVM-VV-KV	kg	2,2
	OB-KVM-VV-TVTP	kg	4,5

Pressure relief valve (VV)			Pump unloading valve (KV)			Flow control valve (TVTP)		
Flow rate	l/min	40	Flow rate	l/min	40	Flow - inlet	l/min	max. 50
Press. setting	bar	50-210	Max. pressure	bar	350	Flow - priority way	l/min	0 - 25
	bar	100-350	Supply voltage	V DC	12, 24	Flow - bypass	l/min	max. 40
Adjustments	socket screw		Power	W	17	Max. pressure	bar	210

### Ordering code

OB - KVM - 6 - - - - - \*

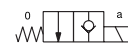


#### Pressure relief valve

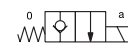
- without pressure relief valve = no desig.
- pressure relief valve - range 50-210 bar = VV20
- pressure relief valve - range 100-350 bar = VV35

#### Pump unloading valve

- without pump unloading valve = no desig.
- pump unloading valve - normally closed = KV0
- .... - with hand operator - knob = KVG0
- pump unloading valve - normally open = KV1
- .... - with hand operator - knob = KVG1



normally open



normally closed

#### Flow control valve

- without flow control valve = no desig.
- Flow control valve - rotary knob - TVTP-25-B = TVTPB
- Flow control valve - prop. solenoid - TVTP-25-P = TVTP
- .... - with hand operator - knob = TVTPG

#### Supply voltage

- direct voltage 24 V = no desig.
- direct voltage 12 V = 12DC

#### Threaded connections

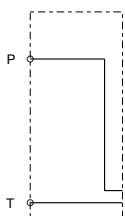
- G3/8 (ISO 1179) = 3/8
- G1/2 (ISO 1179) = 1/2
- M18 x 1,5 (ISO 9974) = no desig.
- M22 x 1,5 (ISO 9974) = M22

#### Plug-in connector

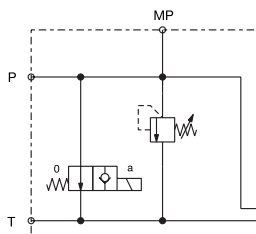
- without signal lamp = no desig.
- with signal lamp = L

#### Seal type

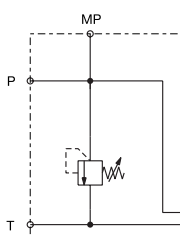
- NBR seals for mineral oil HL, HLP to DIN 51524 = no desig.
- FPM seals for HETG, HEES, HEPG to VDMA 24568 and ISO 15380 = E



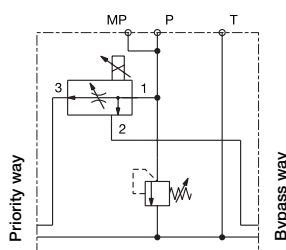
OB-KVM-6



OB-KVM-6-VV20-KV1



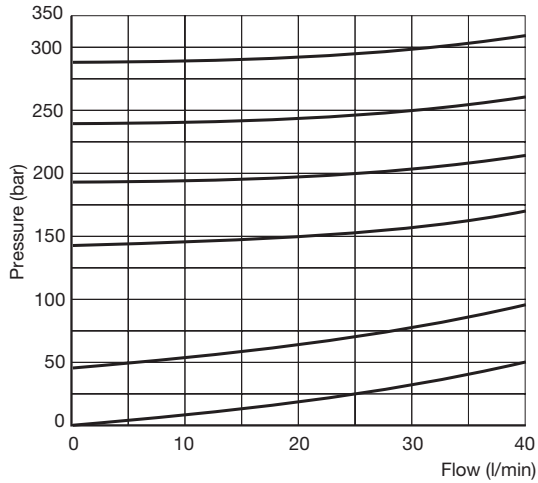
OB-KVM-6-VV35



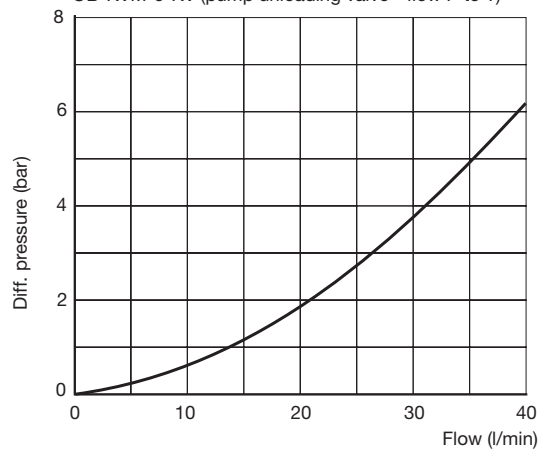
OB-KVM-6-VV20-TVTP

$\Delta p - Q$  Performance curves (measured at  $t = 50\text{ }^{\circ}\text{C}$  and  $v = 28\text{ mm}^2/\text{s}$ )

OB-KVM-6-VV (pressure relief valve - flow P to T)

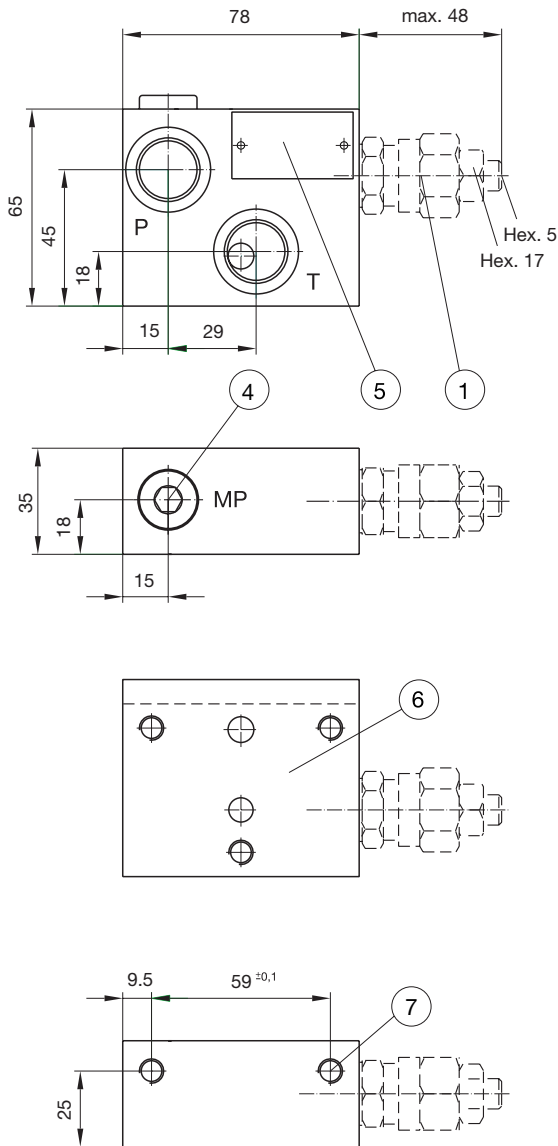


OB-KVM-6-KV (pump unloading valve - flow P to T)

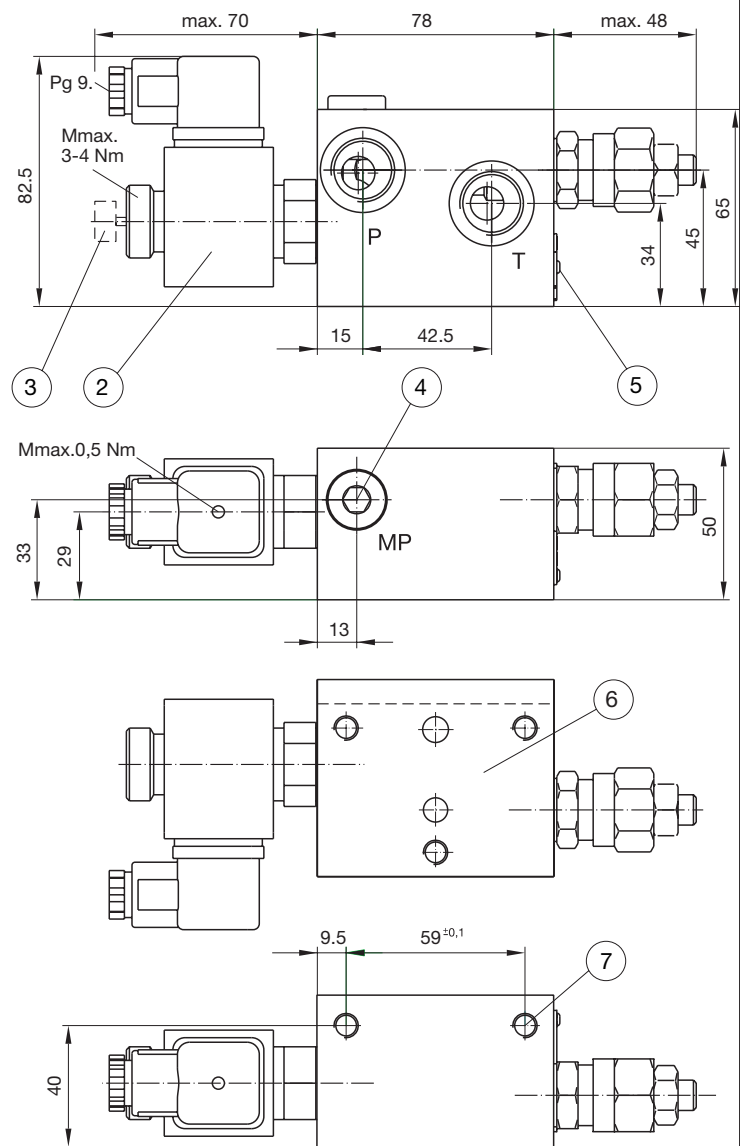


Performance curves for TVTP-25 and TVTP-25-P; see pages 13.3 and 13.4

**OB - KVM - 6**  
**OB - KVM - 6 - VV**



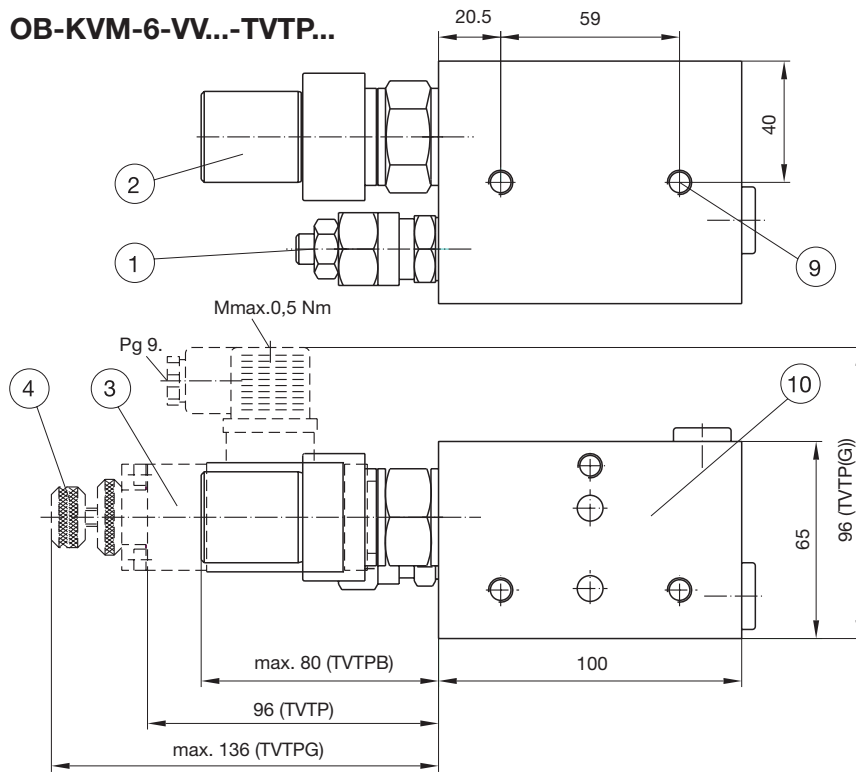
**OB - KVM - 6 - VV ... - KV ...**



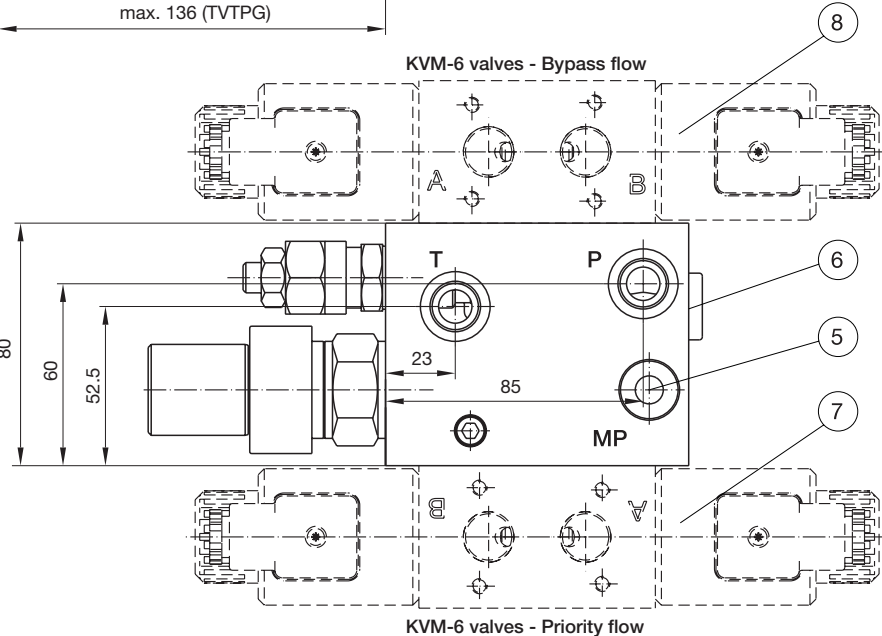
- 1. Pressure relief valve
- 2. Pump unloading valve
- 3. Hand operator with knob
- 4. Threaded connection MP - G1/4 (closed)

- 6. Connection dimensions for KVM-6 (see page 12.11.3)
- 7. Fixing hole (M8 x 12) for mounting assembly

# OB-KVM-6-VV...-TVTP...



1. Pressure relief valve
2. Flow control valve  
- rotary knob - TVTPB
3. Flow control valve  
- proportional solenoid - TVTP
4. Flow control valve  
- proportional solenoid with hand operator - TVTPG
5. Threaded connection MP - G1/4 (closed)
6. Nameplate
7. Bankable directional valves KVM-6 Priority flow
8. Bankable directional valves KVM-6 Bypass flow
9. Fixing hole (M8 x12) for mounting assembly
10. Connection dimensions for KVM-6 (see page 12.11.3)



## END PLATE ZB-KVM-6

Ordering code

Dimensions (mm)

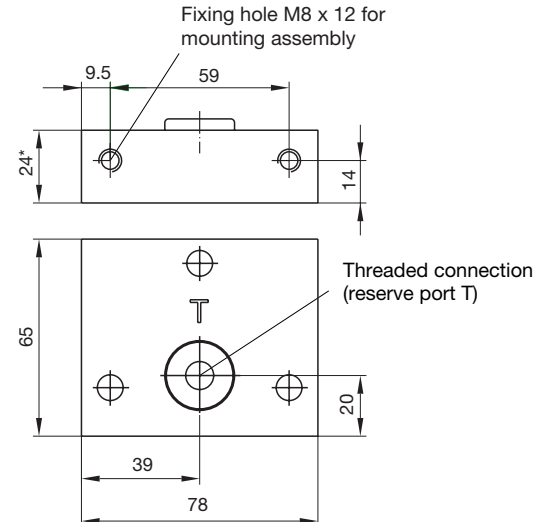
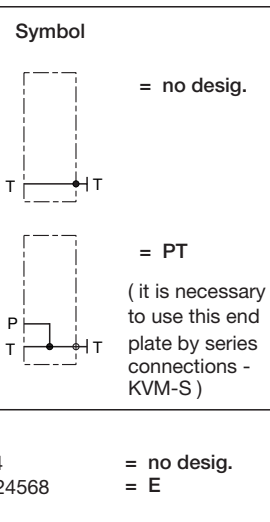
Mass = 0,8 kg

ZB - KVM - 6 - - - - \*

Symbol	
Threaded connections	
Seal type	
Special requir.	to be briefly specified

Threaded connections	
G3/8 (ISO 1179)	= 3/8
G1/2 (ISO 1179)	= 1/2
M18 x 1,5 (ISO 9974)	= no desig.
M22 x 1,5 (ISO 9974)	= M22

Seal type	
NBR seals for mineral oil HL, HLP to DIN 51524	= no desig.
FPM seals for HETG, HEEPS, HEPG to VDMA 24568 and ISO 15380	= E



\* ZB-KVM-6-PT-1/2(M22) = 27

## FIXING ELEMENTS FOR MOUNTING

### Ordering code

**SET - KVM - 6 -**

Number of bankable directional valves

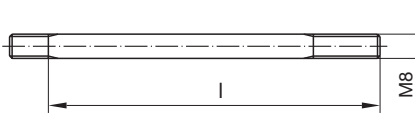
#### Number of bankable directional valves KVM-6

one valve KVM-6	= N1
two valves KVM-6	= N2
three valves KVM-6	= N3
four valves KVM-6	= N4
five valves KVM-6	= N5
six valves KVM-6	= N6
seven valves KVM-6	= N7
eight valves KVM-6	= N8

SET-KVM-6 consists of:

- three nuts M8 DIN 1587
- three washers A8 DIN 6798-J
- three screws M8 DIN 939 10.9

Screw M8 DIN 939 10.9 :



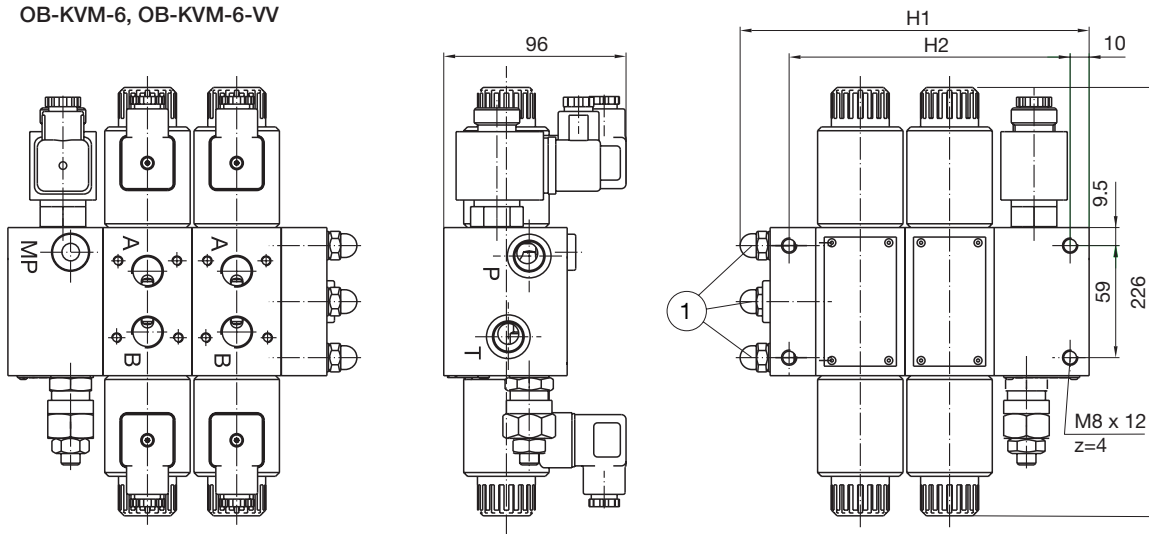
	l (mm)
N1	80
N2	127
N3	174
N4	221
N5	268
N6	315
N7	362
N8	409

Max. number of bankable valves KVM :

- parallel connection (KVM-P) = eight valves ( max. N8 )
- series connection (KVM-S) = four valves ( max. N4 )

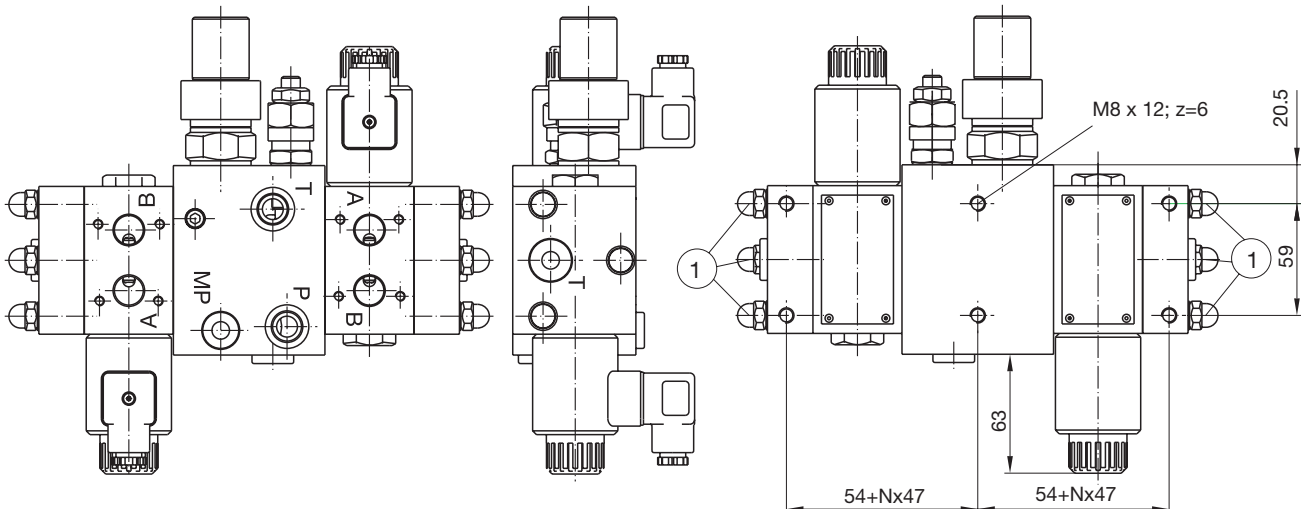
## OVERALL DIMENSIONS

### OB-KVM-6, OB-KVM-6-VV



	H1	H2
OB-KVM-6 or OB-KVM-6-VV...	$75 + N \times 47$ (N = 1 to 8)	$39 + N \times 47$ (N = 1 to 8)
OB-KVM-6-VV...-KV...	$90 + N \times 47$ (N = 1 to 8)	$54 + N \times 47$ (N = 1 to 8)

### OB-KVM-6-VV...-TVTPB...



1. Mtorque / Parallel connection (KVM-P) - max. 20Nm / Series connection (KVM-S) - max. 16 Nm

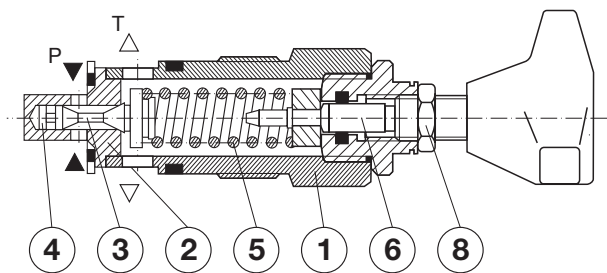
## PRESSURE RELIEF VALVE type VVP

- NS 6, 10
- to 400 bar
- to 120 l/min
- Direct operated
- For fitting into a block
- For independent mounting
- Two pressure setting elements (set screw, rotary knob)



VVP-6, VVP-10

### Description of operation



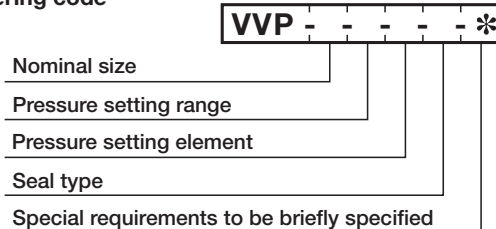
Direct operated pressure relief valves type VVP are used to maintain and limit the pressure in a hydraulic system.

These valves consist of a housing (1), a hardened seat (2), a poppet (3), with a damping spool (4), a spring (5), and a pressure setting element (6).

The P-line of this pressure relief valve is connected with the hydraulic system. The pressure of the hydraulic fluid acts on the front side of the pilot poppet (3), and the force of the spring (5) set by the pressure setting element (6) is applied to the poppet from the opposite side. When the system pressure exceeds the valve of the spring set by the pressure setting element (6) the pilot poppet moves off the seat (2), and frees the flow of the hydraulics fluid in the direction from P towards T.

The damping spool (4) prevents vibrations of the pilot poppet when opening or closing the flow way of the hydraulic flow. Loosening of the pressure setting element is prevented by a counternut (8).

### Ordering code



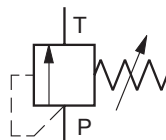
Nominal size	Size 6 = 6
	Size 10 = 10

Pressure setting range	to 50 bar = 50
	to 100 bar = 100
	to 200 bar = 200
	to 315 bar = 315
	to 400 bar = 400

Pressure setting element	set screw with protective cap = A
	rotary knob = B

Seal type	NBR seals for mineral oil HL, HLP, to DIN 51524 = no desig.
	FPM seals for HETG, HEES, HEPG to VDVA 24568 = E
	and ISO 15380

### Symbol

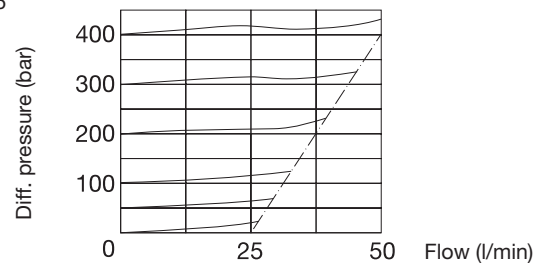


### Technical data

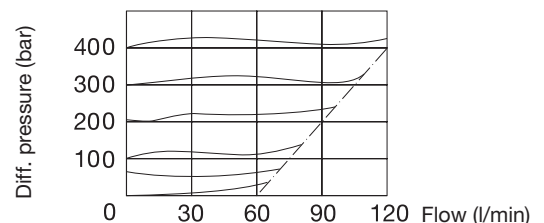
Size		6	10
Flow rate	l/min	50	120
Pressure setting range	bar	to 400	to 400
Oil temperature range	°C	-30 to +70	-30 to +70
Viscosity range	mm <sup>2</sup> /s	2,8 to 380	2,8 to 380
Mass, execution A	kg	0,4	0,5
Mass, execution B	kg	0,5	0,6
Filtration	NAS 1638	8	8

$\Delta p - Q$  Performance curves (measured at  $t = 50\text{ }^{\circ}\text{C}$  and  $\nu = 41\text{ mm}^2/\text{s}$ )

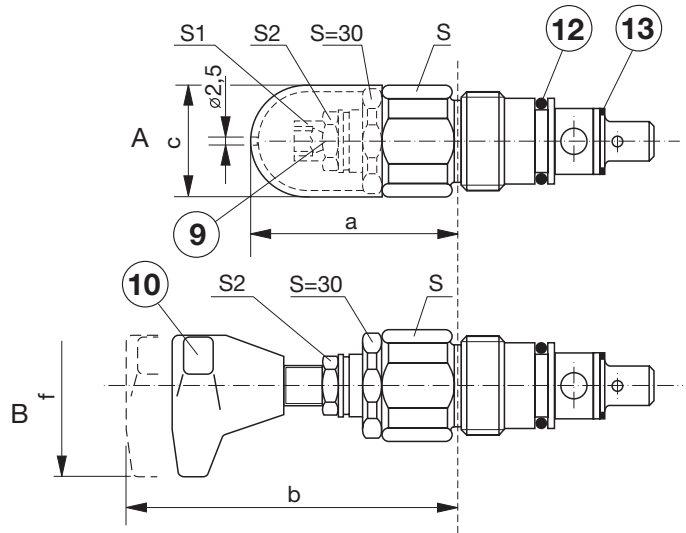
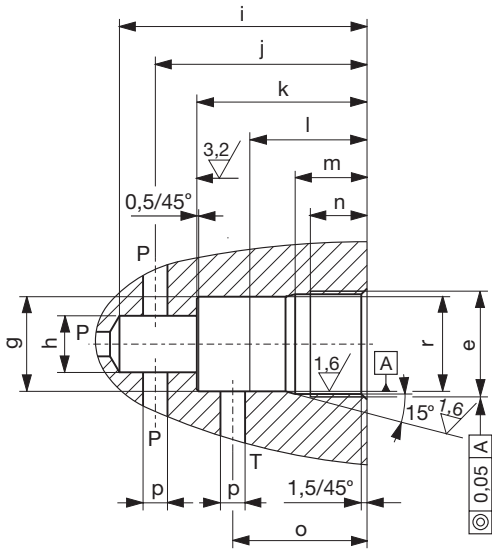
Size 6



Size 10



Dimensions (mm)



- 9. Pressure setting by screw and protective cap
- 10. Pressure setting by rotary knob
- 12. O-ring, nominal size 6, 19,2 x 3
- O-ring, nominal size 10, 26 x 3
- 13. Usit ring, nominal size 6, 17,4 x 24 x 1,5
- Usit ring, nominal size 10, 24,7 x 31 x 2

Tightening torque for fixing: Nominal size 6 Md=80 Nm  
Nominal size 10 Md=140 Nm

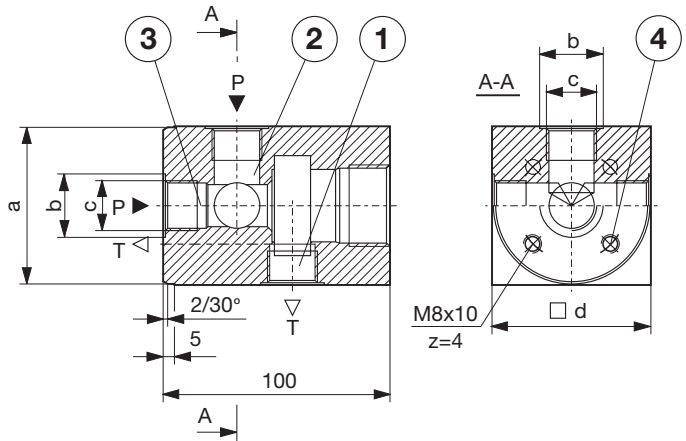
Customer specified setting can be secured by means of a stamp and a wire.

Type	a	b	c	e	f	g	h	i	j	k	l	m	n	o	p	r	s	s1	s2
VVP-6	72	94	∅34	M28x1,5	∅60	∅24,9	∅15	65	56,5 <sup>s5</sup>	45	30	19	15	35	∅6	∅25H9	32	6	19
VVP-10	68	90	∅38	M35x1,5	∅60	∅31,9	∅18,5	80	67,5 <sup>s7</sup>	52	35	23	18	41	∅10	∅32H9	36	6	19

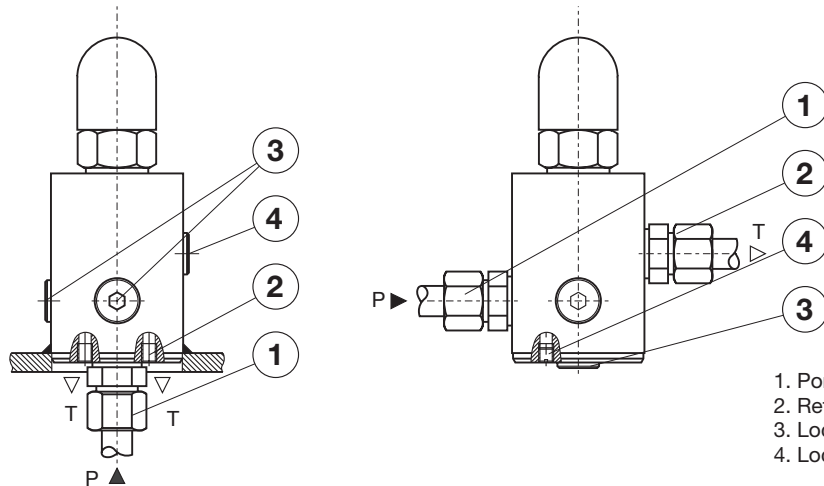
Connecting dimensions / Connection P-VVP-6, P-VVP-10

- 1. Oil discharge when fitted independently
- 2. Oil supply when fitted independently
- 3. Oil supply when fitted on a tank cover
- 4. Oil discharge when fitted on a tank cover

When fitting, the excess ports for oil supply and discharge must be closed by means of suitable screw.



Size	a	b	c	d	mass
6	∅59 d9	∅24 <sup>+0</sup>	M18x1,5	60	2,5 kg
10	∅69 d9	∅28 <sup>+0</sup>	M22x1,5	70	2,9 kg



- 1. Port "P"
- 2. Return line "T"
- 3. Locking screws - P lines
- 4. Locking screws - T line

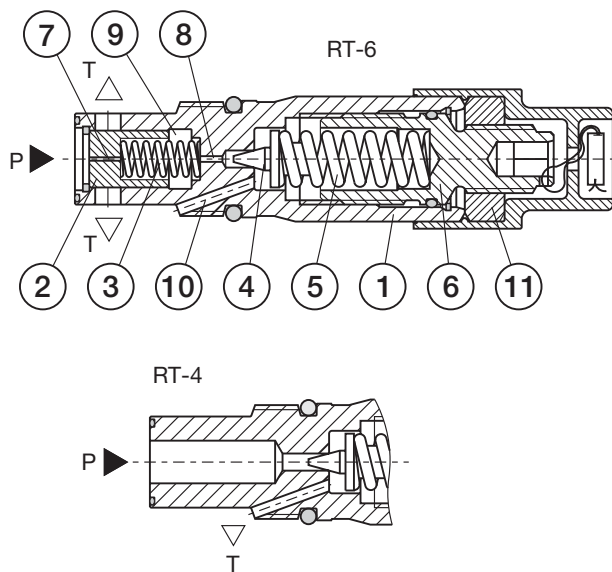
## PRESSURE RELIEF VALVE type RT

- NS 4, 6, 10
- to 350 bar
- to 100 l/min
- Direct operated NS 4
- Pilot operated NS 6, 10
- For independent fitting into a block
- Two pressure setting ranges



RT-4, RT-6, RT-10

### Description of operation

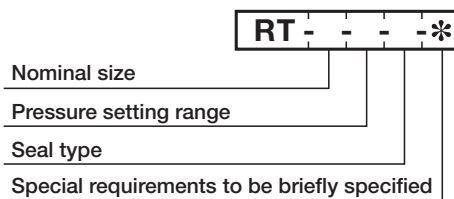


Pilot operated pressure relief valves type RT are used for maintaining and limiting the pressure in a hydraulic system. These valves consist of a housing of cartridge design (1), main spool insert (2) with a spring (3), pilot poppet (4), spring (5) and pressure setting element (6).

The P-line of this pressure relief valve is connected with the hydraulic system. The hydraulic medium pressure acts on the front side of the main spool insert. The bores (7,8) permit the introduction of pilot oil into the pressure chamber (9) and the application of pressure to the opposite side of the main spool insert and the front side of the pilot poppet. The pressure balance in the system and pressure chamber holds this pressure relief valve in closed position till the pressure in system exceeds this value the pilot poppet moves off the valve seat, freeing the pilot oil discharge through the bore (10). A pressure drop in the pressure chamber rises the main spool insert, thus clearing the hydraulic medium flow way in the direction from P towards port T.

Loosening of the pressure setting element (6) is prevented by a counter nut (11).

### Ordering code



#### Nominal size

- Size 4 = 4
- Size 6 = 6
- Size 10 = 10

#### Pressure setting range

- to 100 bar = 100
- to 315 bar = 315

#### Seal type

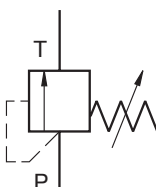
- NBR seals for mineral oil HL, HLP, to DIN 51524 = no desig.
- FPM seals for HETG, HEES, HEPG to VDMA 24568 = E
- and ISO 15380

### Technical data

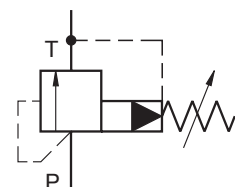
Size		4	6	10
Flow rate	l/min	4	60	100
Pressure setting range	bar	to 315	to 315	to 315
Oil temperature range	°C	-20 to +70	-20 to +70	-20 to +70
Viscosity range	mm <sup>2</sup> /s	15 to 380	15 to 380	15 to 380
Mass	kg	0,15	0,15	0,18
Filtration	NAS 1638	8	8	8

### Symbol

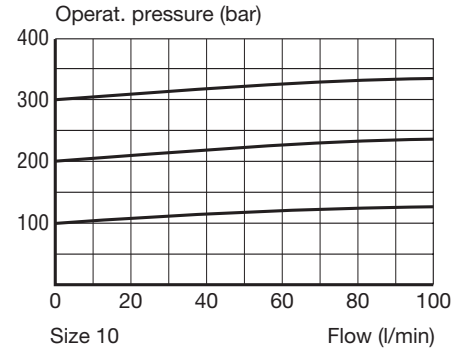
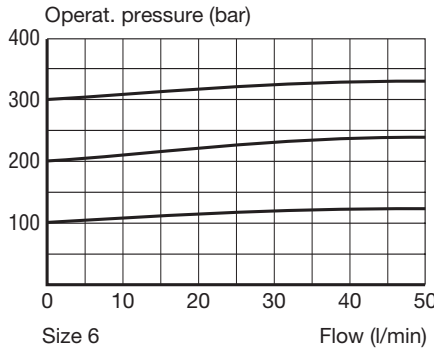
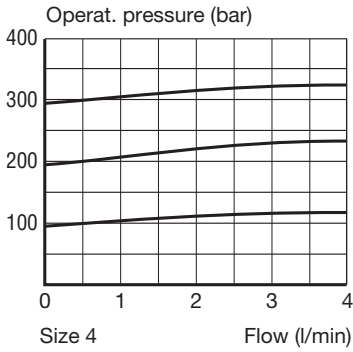
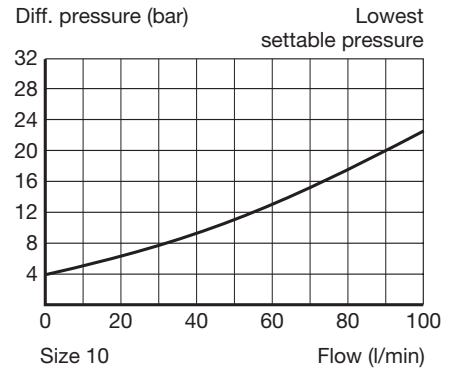
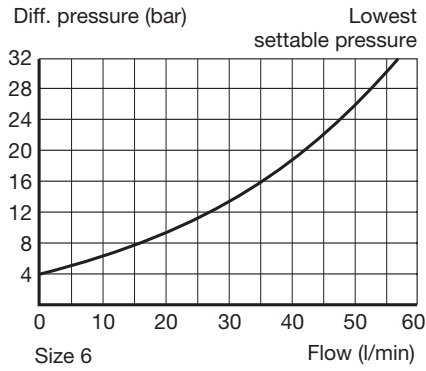
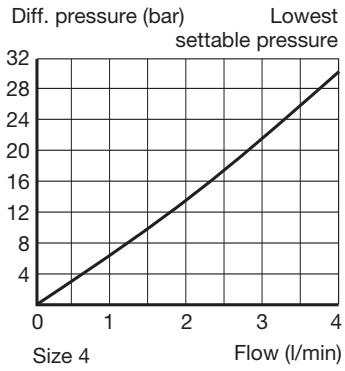
RT-4



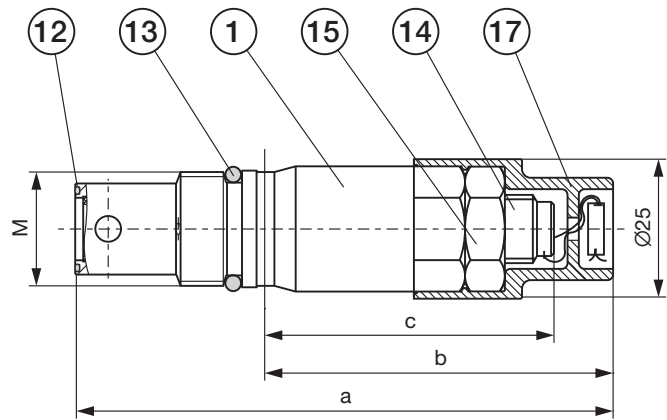
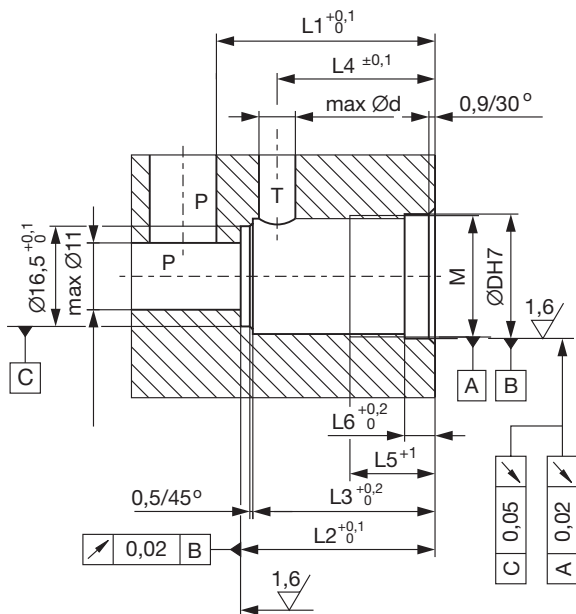
RT-6, RT-10



**△ p - Q Performance curves (measured at t = 50 °C and  $\nu = 32 \text{ mm}^2/\text{s}$ )**



**Dimensions (mm)**



- 1. Housing
- 12. O-ring 13x1
- 13. O-ring, size 4,6 16,3x2,4  
size 10 20x2,5
- 14. Pressure setting element
- 15. Counternut
- 17. PE cover

Tightening torque for fixing  $Md=30 \text{ Nm}$

The value set on the pressure setting element is protected by means of a lead stamp @11 and a wire @1,1 mm.

Note: Ports P and T can be located optionally at any place on the circumference.

Nominal size	a	b	c	d	D	L1	L2	L3	L4	L5	L6	M
size 4,6	96	64	53	6	20,5	36	32	30	26	14	4,8	M20x1
size 10	97	61	50	10,5	24,5	40	36	34	29,7	15	5,2	M24x1



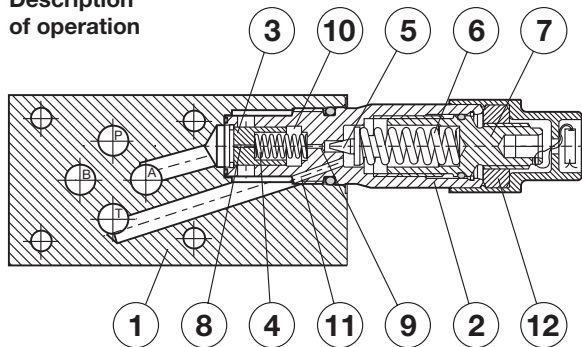
## PRESSURE RELIEF VALVE type VP-RT

- NS 6,10
- to 350 bar
- to 100 l/min
- Pilot operated
- Connecting dimensions to ISO 4401
- For vertical stacking - sandwich plate design
- Two pressure setting ranges



VP-RT-10, VP-RT-6

### Description of operation



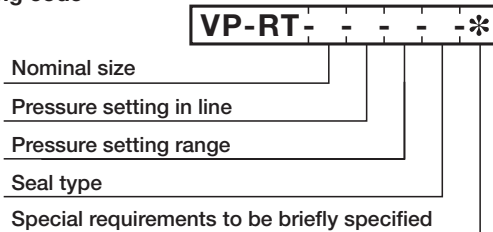
Pilot operated pressure relief valves type VP-RT of sandwich plate design, for vertical stacking, are used for maintaining and limiting the maximum pressure in a hydraulic system.

These valves consist of a stack plate (1), pressure relief valve housing (2), main spool insert (3) with a spring (4), pilot poppet (5), spring (6) and pressure setting element (7). The P-line of this pressure relief valve is connected with the hydraulic system. The hydraulic medium pressure acts on the front side of the main spool insert (3). The bores (8,9) permit the introduction of pilot oil into the pressure chamber (10) and the application of pressure to the opposite side of the main spool insert.

This pressure relief valve remains in closed position till the system pressure exceeds the valve set at the spring (6). A pressure rise in the system above the value set by the pressure setting element (7), provokes the movement of the pilot poppet (5) of the seat, freeing the pilot oil discharge through the bores (9) and (11). A pressure drop in the pressure chamber (10) rises the main spool insert (3), thus clearing the hydraulic medium flow in the direction from port P towards port T.

Loosening of the pressure setting element is prevented by a counter nut (12).

### Ordering code



#### Nominal size

Size 6 = 6  
 Size 10 = 10

### Pressure setting in line

setting in line A = EA  
 setting in line B = EB  
 setting in line P = EP  
 setting in line A and B (for size 6 only) = D

### Pressure setting range

to 100 bar = 100  
 to 315 bar = 315

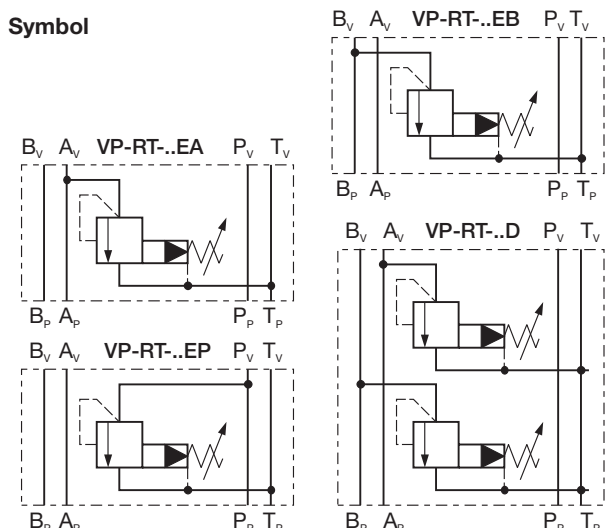
### Seal type

NBR seals for mineral oil HL, HLP, to DIN 51524 = no design.  
 FPM seals for HETG, HEES, HEPG to VDMA 24568 = E  
 and ISO 15380

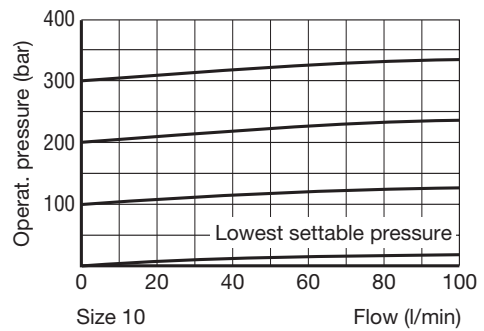
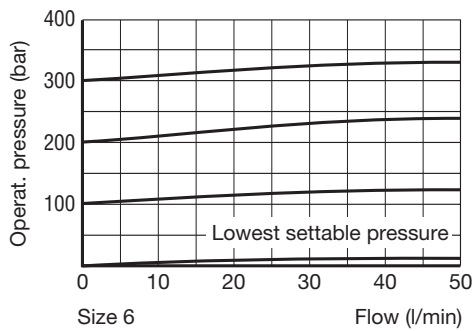
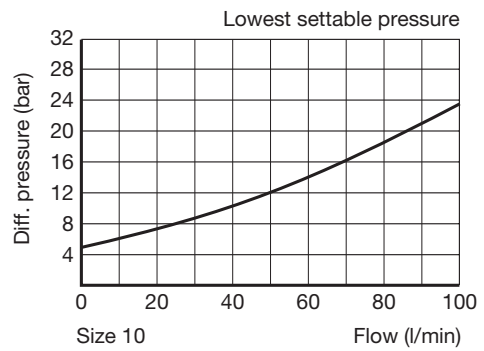
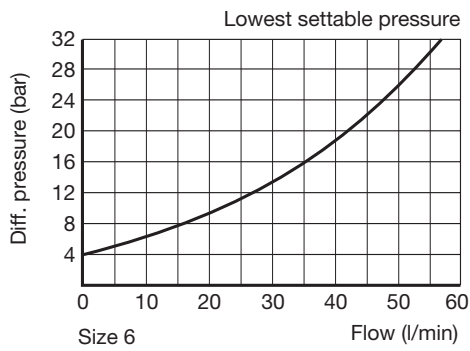
### Technical data

Size		6	10
Flow rate	l/min	50	100
Pressure setting range	bar	to 315	to 315
Oil temperature range	°C	-20 to +70	-20 bis +70
Viscosity range	mm <sup>2</sup> /s	15 to 380	15 to 380
Mass	kg	1,2-1,7(D)	2,6
Filtration	NAS 1638	8	8

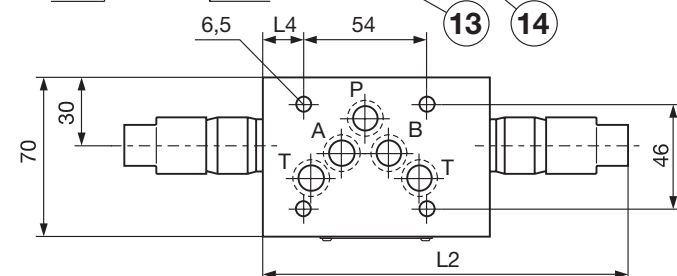
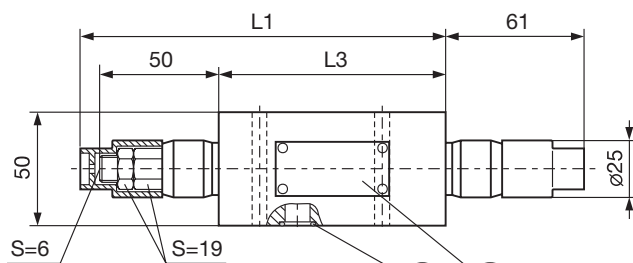
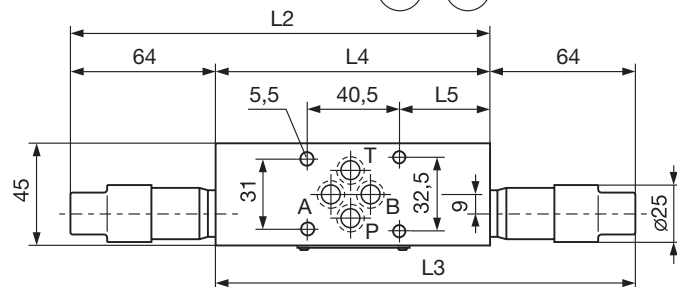
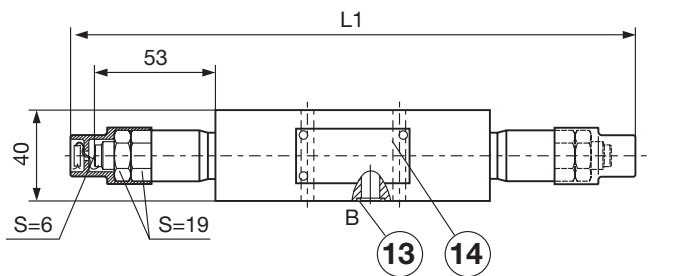
### Symbol



△ p - Q Performance curves (measured at t = 50 °C and  $\nu = 32 \text{ mm}^2/\text{s}$ )



Dimensions (mm)



	VP-RT-6-EA	VP-RT-6-EB	VP-RT-6-EP	VP-RT-6-D
L1	-	-	-	249
L2	154	-	-	-
L3	-	154	154	-
L4	90	90	90	121
L5	9	40,5	40,5	40

13. O-ring 9,25 x 1,78  
14. Nameplate

The value set on the pressure setting element is protected by means of a lead stamp  $\varnothing 11$  and a wire  $\varnothing 1,1 \text{ mm}$ .

Required quality of the mating surface

	VP-RT-10-EP	VP-RT-10-EA	VP-RT-10-EB
L1	156	161	-
L2	-	-	161
L3	95,5	100,5	100,5
L4	28,5	28,5	18

13. O-ring 12x2  
14. Nameplate

The value set on the pressure setting element is protected by means of a lead stamp  $\varnothing 11$  and a wire  $\varnothing 1,1 \text{ mm}$ .

## THROTTLE/CHECK VALVE type VP-NDV

- NS-6, 10
- to 350 bar
- to 100 l/min
- Connecting dimensions to ISO 4401
- For flow control in both service lines
- For throttling in supply - and return lines
- For vertical stacking - sandwich plate design
- Height and width of the valves to ISO 7790 norms



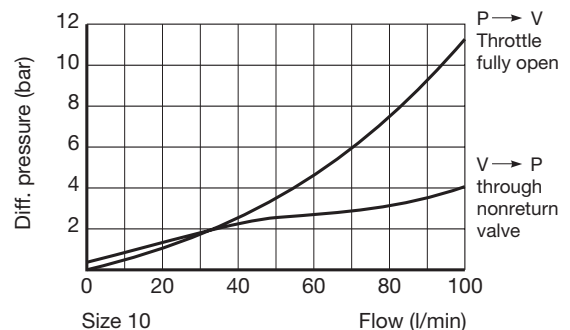
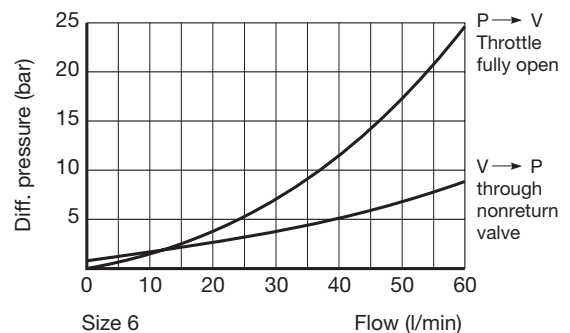
VP-NDV-10-..., VP-NDV-6-...

### Description of operating

Throttle/check valves type VP-NDV are used for throttling the pilot and main flow of the hydraulic fluid in the line A and B. These valves consist of two throttling spools with setting screws and two check valves which are built in a housing. In direction V to P (see the hydraulic symbol) flows the hydraulic fluid with low pressure loss through the check valve. In direction P to V is the hydraulic fluid flow throttled depending on adjustment of the throttling spool.

### Performance curves

$\Delta p - Q$  Performance curves of the flow in direction V to P (through the nonreturn valve with throttle closed) and in direction P to V (throttle in fully open position). Measured at  $t = 50\text{ }^\circ\text{C}$  and  $\nu = 32\text{ mm}^2/\text{s}$



### Ordering code

**VP-NDV-** - - \*

- Size
- Seal type
- Special requirements to be briefly specified

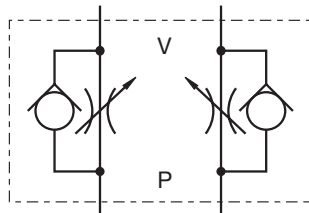
#### Size

Size 6 = 6  
 Size 10 = 10

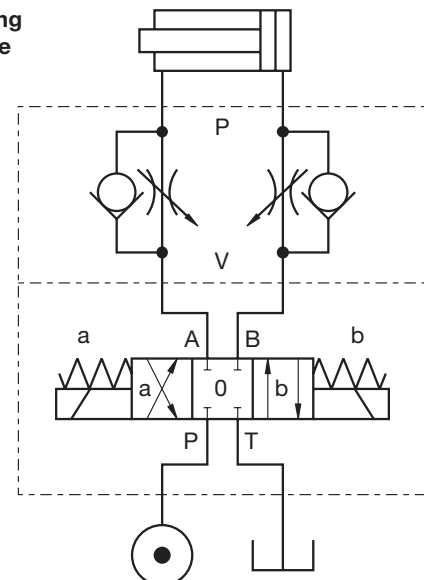
#### Seal type

NBR seals for mineral oil HL, HLP, to DIN 51524 = no desig.  
 FPM seals for HETG, HEES, HEPG to VDMA 24568 = E  
 and ISO 15380

### Symbol



### Mounting example



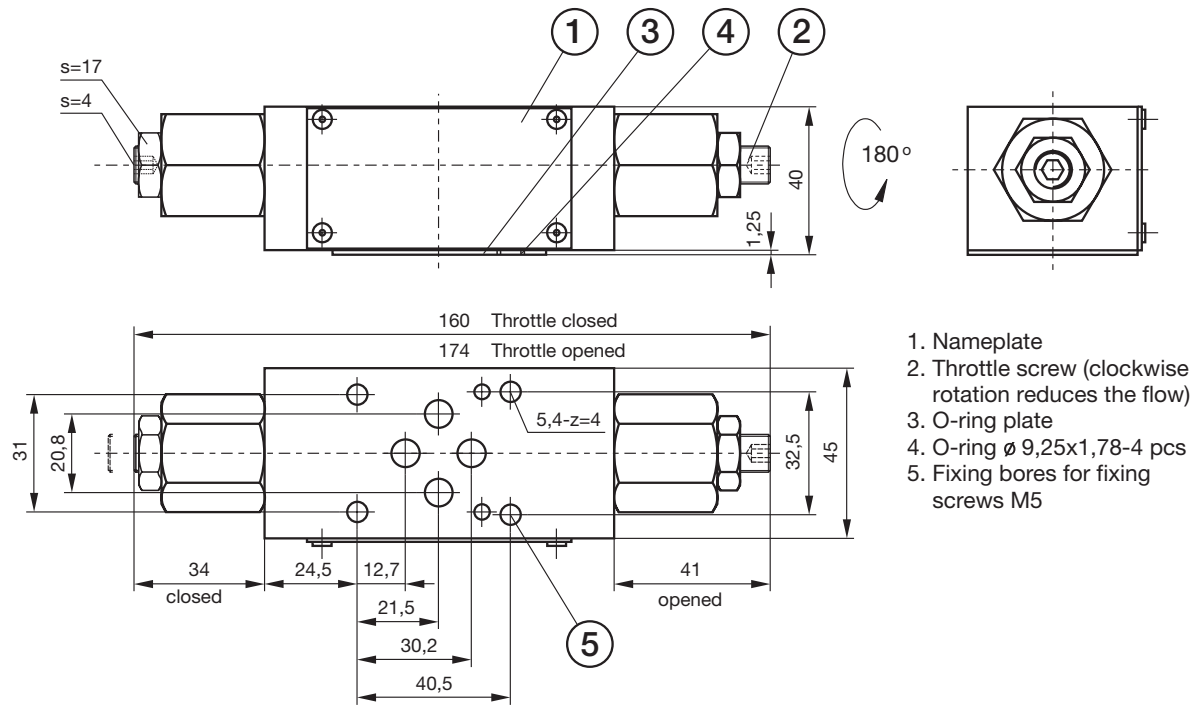
### Technical data

Size		6	10
Flow rate	l/min	60	100
Operating pressure	bar	350	350
Cracking pressure	bar	0,4	0,4
Oil temperature range	$^\circ\text{C}$	-20 to +70	-20 to +70
Viscosity range	$\text{mm}^2/\text{s}$	15 to 380	15 to 380
Filtration	NAS 1638	8	8
Mass	kg	1,45	3,3

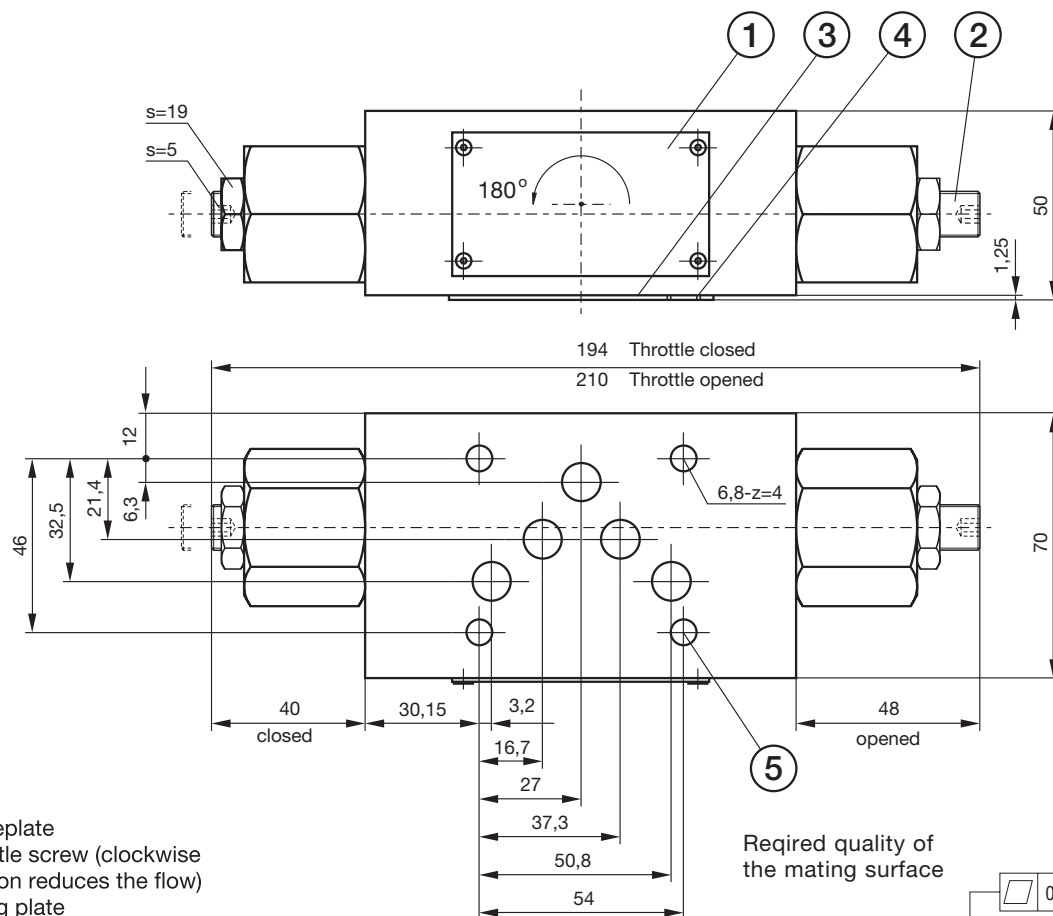
## Assembly instructions

Throttle/check valves type VP-NDV are designed for vertical stacking. With these valves there can be throttling of the hydraulic fluid flow in return line or supply line achieved. Direction of throttling can be selected by turning the installation position of the valve i.e. valves size 6 turning 180° around the longitudinal axis; valves size 10 turning 180° around the lateral axis (see drawing below). The O-ring plate is always mounted on the subplate side.

## Dimensions (mm)

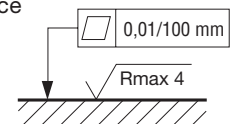


1. Nameplate
2. Throttle screw (clockwise rotation reduces the flow)
3. O-ring plate
4. O-ring  $\varnothing 9,25 \times 1,78$ -4 pcs
5. Fixing bores for fixing screws M5



1. Nameplate
2. Throttle screw (clockwise rotation reduces the flow)
3. O-ring plate
4. O-ring  $\varnothing 12,42 \times 1,78$ -5 pcs
5. Fixing bores for fixing screws M6

Required quality of the mating surface



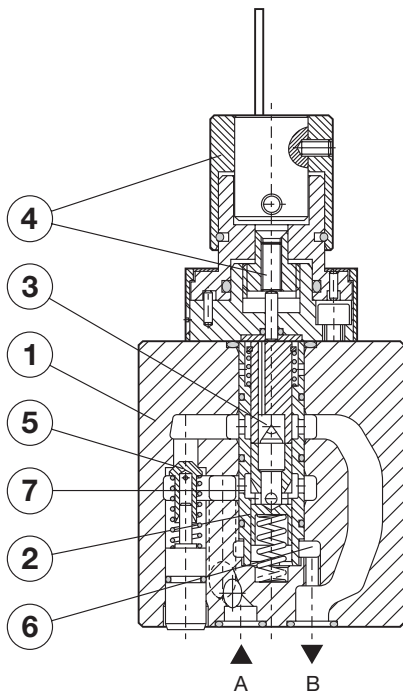
**FLOW CONTROL VALVE type TVD**

- NS 6
- to 350 bar
- to 16 l/min
- Two - way pressure compensated
- Connecting dimensions to ISO 4401
- Operating elements: rotary knob / roller
- With built - in non-return valve
- Without built - in non-return valve



TVD-6

**Description of operation**



Flow control valves type TVD are used to set the flow of the hydraulic fluid. The flow depends neither on inlet nor on outlet pressures, which means that the flow setpoint valve remains constant also with a change of the pressure drop.

These valves consist of a housing (1), a pressure compensator (2), an orifice (3), a setting element (4), and a non-return valve (5).

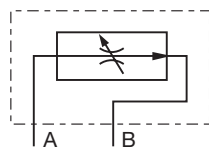
The hydraulic fluid flow is adjusted by a setting element (4) which moves the orifice (3) to the corresponding open position. The flow of the fluid is throttled in the direction from A to B. Maintaining of the constant flow towards the user is provided by the pressure compensator (2). The fluid flows through the bore (6) under the pressure compensator, acting on it by the pressure of the line B. From the opposite side, the pressure compensator is acted upon by the pressure which is before the orifice (3). The pressure compensator shifts the working position. A pressure built - up in the line B provokes the movement of the pressure compensator to the increased open position. This enlarges the gap between the bores (7), the orifice (3) and the user. On the contrary, the pressure compensator shifts to the closed position if there is a pressure rise in the line A. The hydraulic fluid flow is constant, and does not depend on the loads on the user.

The non-return valve (5) provides a free flow of the hydraulic fluid in the direction from B to A.

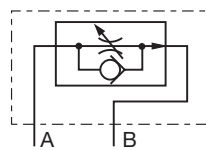
The flow control valve without the non-return valve (5) provides operation of the valve only in the direction of the flow from A to B.

**Symbol**

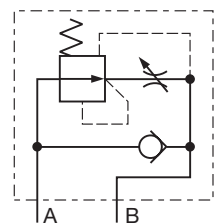
TVD-6



TVD-6-NV



Detailed

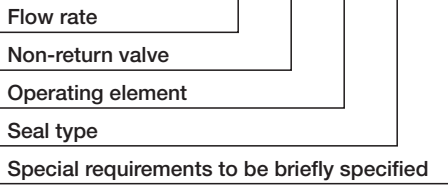


**Tehnickal data**

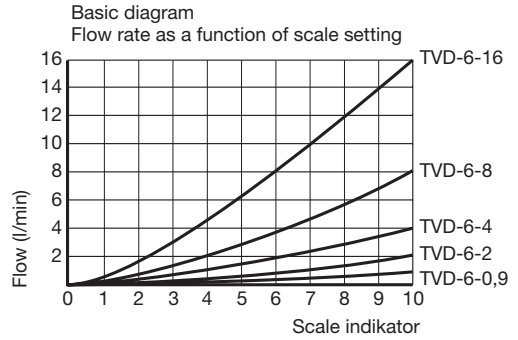
Type		TVD-6-0,9	TVD-6-2	TVD-6-4	TVD-6-8	TVD-6-16
Flow rate	l/min	0,9	2	4	8	16
Min. pressure drop	bar	4	4	10-12	10-14	10-16
Operating pressure	bar	to 100	to 100	to 100	to 350	
Oil temperature range	°C	-20 to +70				
Viscosity range	mm <sup>2</sup> /s	15 to 380				
Mass	kg	1,6				
Filtration	NAS 1638	8				

**Ordering code**

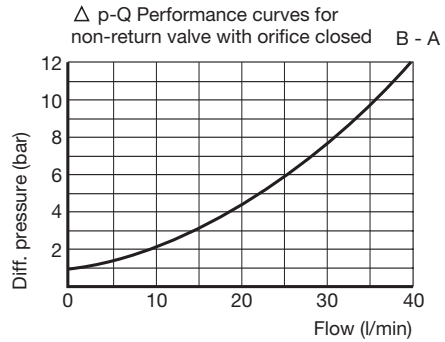
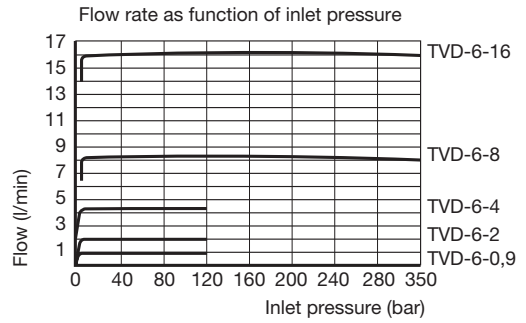
**TVD- 6 - - - - \***



**Δ p - Q Performance curves (measured at t = 50 °C and ν = 32 mm<sup>2</sup>/s)**

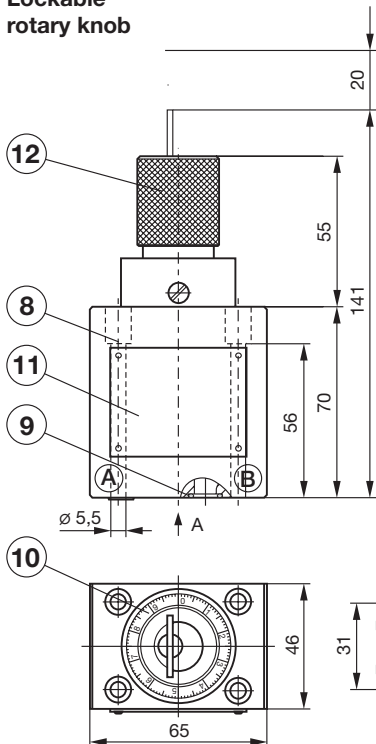


<p><b>Flow rate</b></p> <p>to 0,9 l/min = 09 to 2 l/min = 2 to 4 l/min = 4 to 8 l/min = 8 to 16 l/min = 16</p>
<p><b>Non-return valve</b></p> <p>without nonreturn valve = no design. with nonreturn valve = NV</p>
<p><b>Operating element</b></p> <p>Lockable rotary knob = no design. Rotary knob = R Roller = K</p>
<p><b>Seal type</b></p> <p>NBR seals for mineral oil HL, HLP, to DIN 51524 = no design. FPM seals for HETG, HEES, HEPG to VDMA 24568 = E and ISO 15380</p>

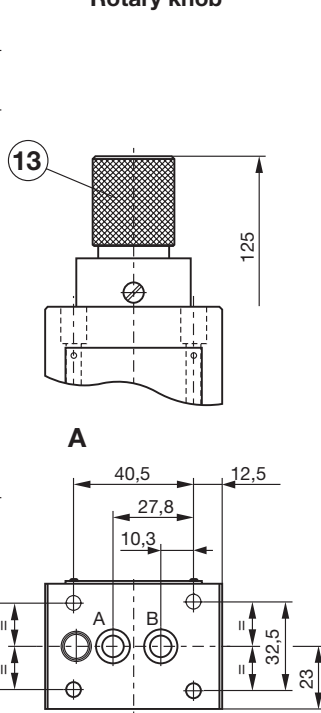


**Dimensions (mm)**

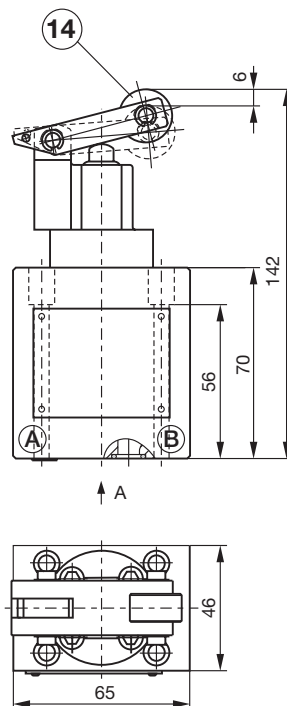
**Lockable rotary knob**



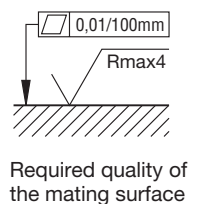
**Rotary knob**



**Roller**



- 8. 4 pcs fixing screws M5 x 65 to DIN EN ISO 4762-10.9 tightening torque Md=9 Nm
- 9. O-ring 9,25 x 1,78
- 10. Scale for setting read - out
- 11. Nameplate
- 12. Lockable rotary knob
- 13. Rotary knob
- 14. Roller



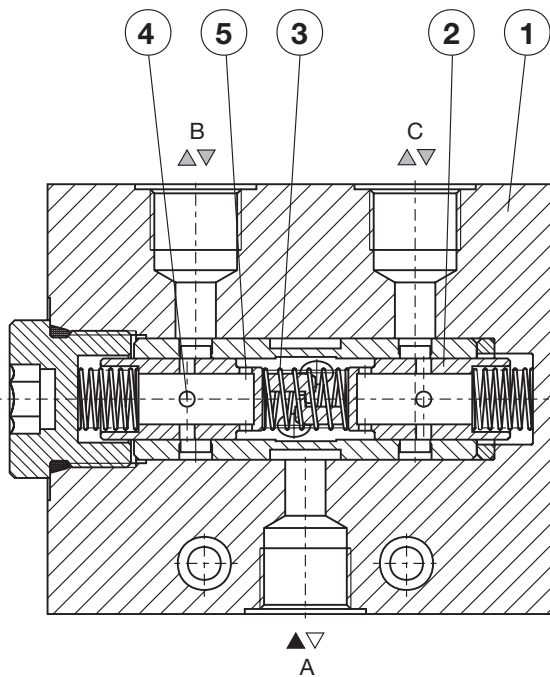
## FLOW DIVIDER Type DTP

- NS 6, 10
- to 350 bar
- to 70 l/min
- Dividing and combining of flow independent of pressure
- Dividing and combining ratio: 50 % : 50 %
- Direct in-line mounting
- Threaded connection to ISO 9974, ISO 1179

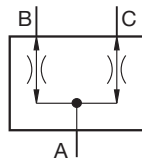


DTP-10, DTP-6

### Description of operation



#### Symbol



The flow divider DTP has two function, dividing and combining of fluid flow. The regulator divides the fluid flow in the direction from A to B and C, and combines flows in the direction from B and C to A. The dividing / combining ratio is 50 % : 50 %, independent of pressure in respective pipeline, B or C.

The regulator consists of a housing (1), two dividing spools (2) and three weak springs (3).

**Division of flow:** The fluid flow in the direction from A to B and C. The flow in chamber A is divided and flows through the orifices (5) with constant cross-section and throttles (4) into chambers B and C. The pressure drop through the orifices (5) depends on the pressure load. The increase of flow towards one of both chambers provokes increased pressure drop through the orifices. The pressure drop generates the pressure force which shifts both spools (2). Consequently, the throttles (4) are reduced, and the pressure drop of fluid through the throttles increases. The spools keep on moving until the pressure drops through the orifices (5) are balanced. Consequently, both fluid flows are balanced, too.

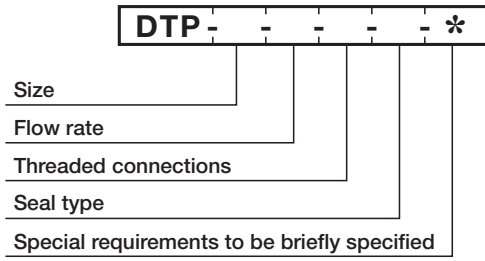
**Combining of flows:** The oil flow in the direction from B and C to A. The operation is identical as at dividing of flow. The divider combines both flows in the ratio 50 % to 50 %.

The principle of operation depends on the pressure drop, which again depends on the fluid flow. For this reason the divider functions properly only within the defined flow range. Limitation of maximal flow - rate of pressure drop, limitation of minimal pressure - dividing and combining accuracy.

### Technical data

		DTP-6-20	DTP-6-35	DTP-6-50	DTP-10-70
Min. flow rate	l/min	8	12	16	35
Max. flow rate	l/min	20	35	50	70
Max. pressure range	bar	350			
Dividing	%	50 : 50			
Flow dividing accuracy	%	±5			
Oil temperature range	°C	-20 to +70			
Viscosity range	mm <sup>2</sup> /s	15 to 380			
Filtration	NAS 1638	8			
Mass	kg	1,7	1,7	1,7	2,65

**Ordering code**



**Size**

Nominal size 6 = 6  
 Nominal size 10 = 10

**Flow rate**

DTP-6 8 - 20 l/min = 20  
 12 - 35 l/min = 35  
 16 - 50 l/min = 50

DTP-10 35 - 70 l/min = 70

**Threaded connections**

DTP-6 M 18x1,5 = no desig.  
 G 3/8 = G 3/8

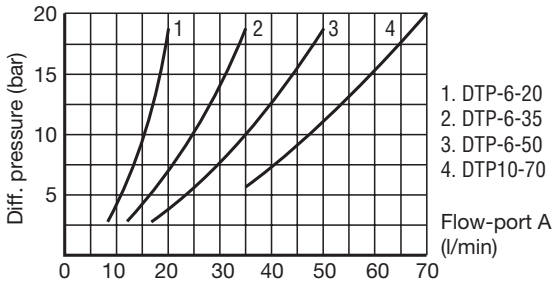
DTP-10 M22x1,5 = M 22  
 G 1/2 = G 1/2

**Seal type**

NBR seals for mineral oil HL, HLP, to DIN 51524 = no desig.  
 FPM seals for HETG, HEES, HEPG to VDMA 24568 = E  
 and ISO 15380

**Δp - Q Performance curves**

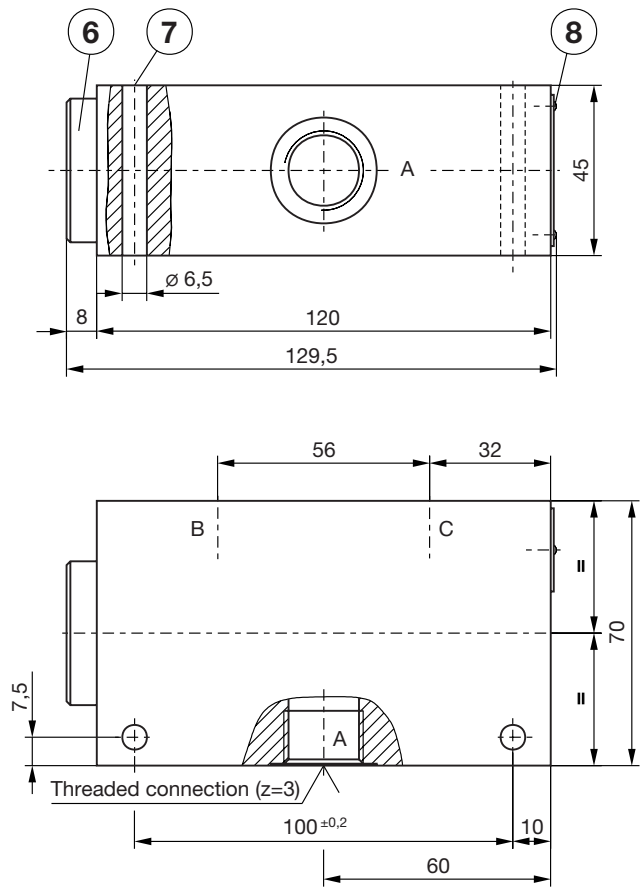
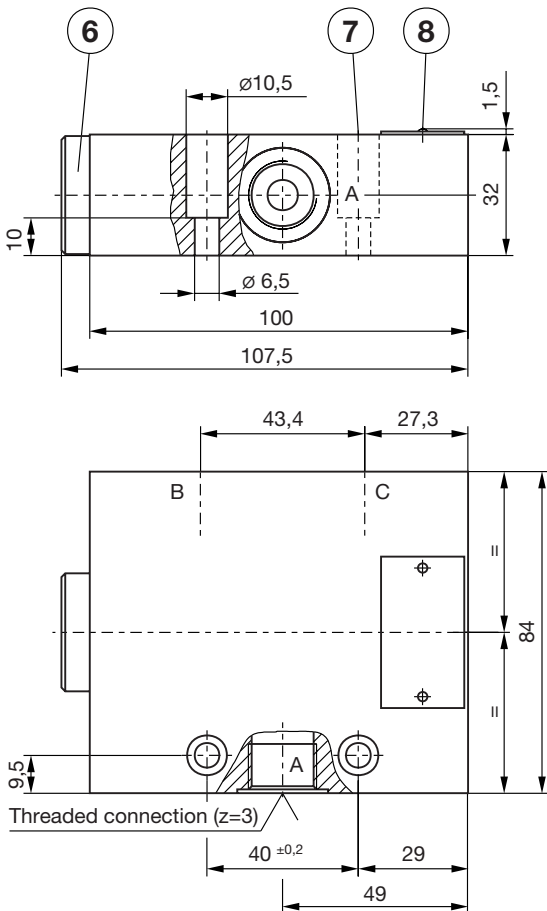
(measured at t = 50 °C and ν = 32 mm<sup>2</sup>/s)



**Dimensions (mm)**

**DTP-6**

**DTP-10**





## FLOW CONTROL VALVE type TVTC

- to 350 bar
- to 50 l/min

- Three-way pressure compensator
- Operating element: rotary knob
- Without built - in relief valve and non return valve
- With built - in relief valve
- With built-in non return valve
- Threaded connection to ISO 9974, ISO 1179



TVTC-..

### Description of operation

3-way compensated flow control valve enables setting of constant fluid flow on port A irrespective of the pressure variations. The excessive flow rate is discharged to port B and can be used as a secondary working port or return port to a tank.

When the port B is used as a secondary working port the pressure must not exceed the pressure on port A.

A pressure relief valve in valve type TVTC-..-VV limits the pressure in port A on the set value. The excessive flow rate is discharged over port R to a tank.

The non return valve in valve type TVTC -..-NV provides a free flow of the hydraulic fluid in the direction from A to P.

### Ordering code

**TVTC** - - - - - \*

Flow rate

Pressure relief valve or non return valve

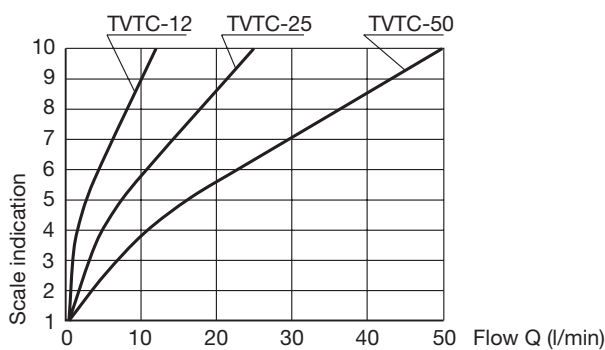
Threaded connection A, B, R

Threaded connection P

Seal type

Special requirements to be briefly specified

### Flow rate as a function of scale indication



### Flow rate

1 to 50 l/min = 50

1 to 25 l/min = 25

1 to 12 l/min = 12

### Pressure relief valve or non return valve

without relief valve = no design

with relief valve 4 to 175 bar = VV17

with relief valve 10 to 350 bar = VV35

with non return valve = NV

### Threaded connections

A, B, R - G1/2 (ø34/1) = 1/2

P - G3/4 (ø36/0,2) = 3/4

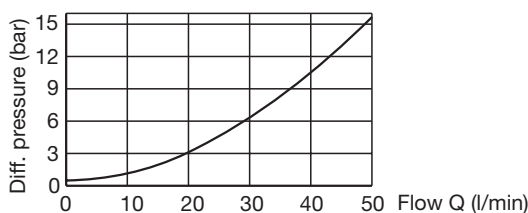
### Seal type

NBR seals for mineral oil HL,HLP to DIN51524 = no design

FPM seals for HETG,HEES,HEPG to VDMA24568 = E

and ISO 15380

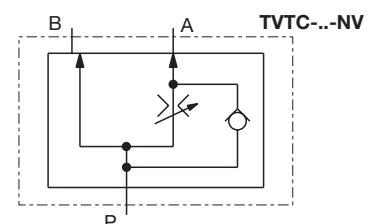
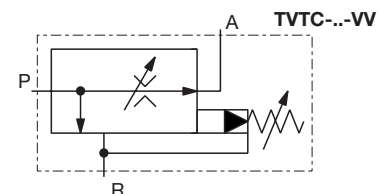
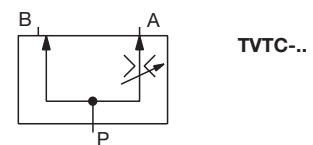
### Δp-Q Performance curve for non return valve



### Technical data

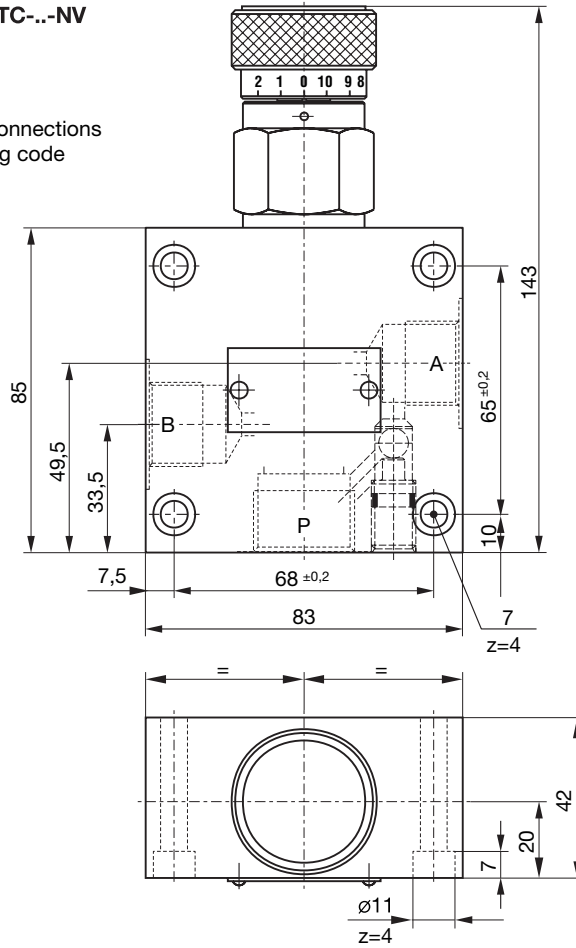
Type		TVTC-12-...	TVTC-25-...	TVTC-50-...
Flow rate A	l/min	1 to 12	1 to 25	1 to 50
Max. flow rate P	l/min	32	65	65
Operating pressure	bar	5 to 350		
Diff. pressure	bar	to 5,5		
Cracking press. for non ret. v.	bar	to 0,5		
Flow stability (5 to 350 bar)	%	±5 (Q)		
Oil temperature range	°C	-20 to +70		
Viscosity range	mm <sup>2</sup> /s	15 to 380		
Filtration	NAS 1638	8		
Mass	kg	2 (TVTC-...; TVTC-...-NV)		3 (TVTC-...-VV)

### Symbol



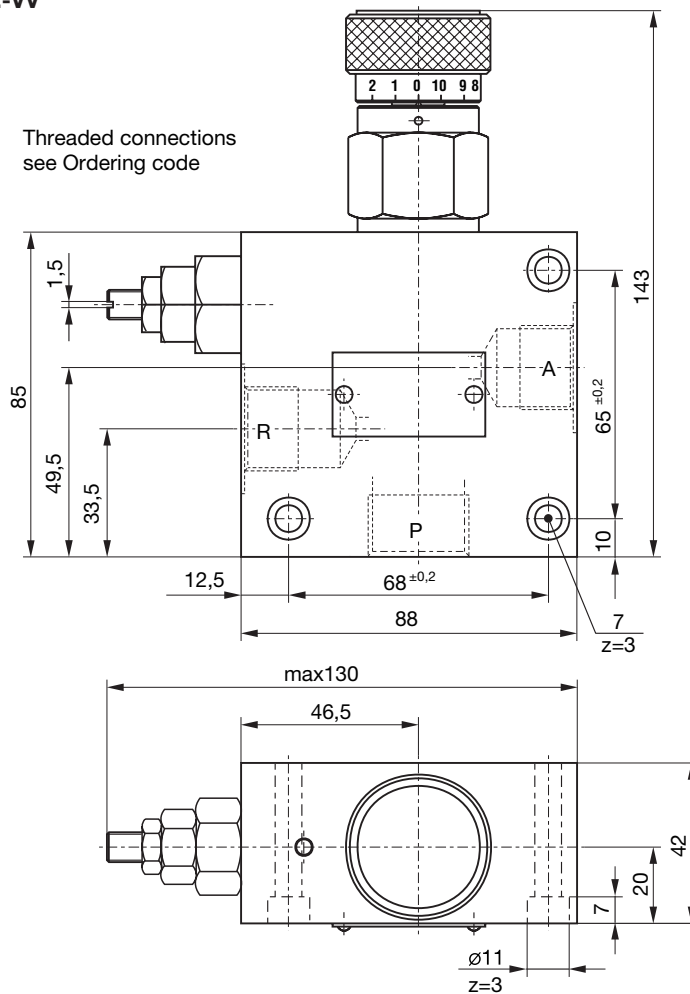
Dimensions (mm) TVTC-...; TVTC-...-NV

Threaded connections  
see Ordering code



Dimensions (mm) TVTC-...-VV

Threaded connections  
see Ordering code



## FLOW CONTROL VALVE type TVTP-...-B-...

- to 350 bar
- to 90 l/min

- Three-way pressure compensated
- Operating element: rotary knob
- For independent fitting into a block

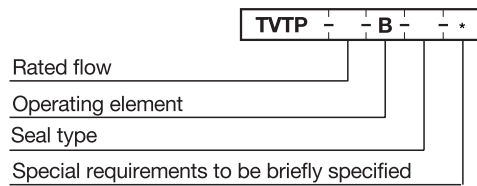


TVTP-...-B-...

### Description of operation

TVTP three-way flow regulators are used to regulate the priority flow in outlet 3 to a maximum adjustable level largely independent of the load and pressure conditions. The surplus flow is diverted to the bypass port 2. The bypass flow may be used for a secondary circuit. Whether the pressure in secondary circuit is higher than the regulated pressure the valve works as two-way regulator.

### Ordering code



#### Rated flow

25 l/min = **25**  
 60 l/min = **60**  
 90 l/min = **90**

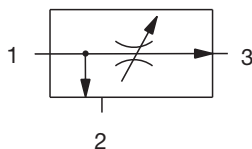
#### Operating element

rotary knob = **B**

#### Seal type

NBR seals for mineral oil HL, HLP to DIN 51524 = **no design**.  
 FPM seals for HETG, HEES, HEPG to VDMA 24568 = **E**  
 and ISO 15380

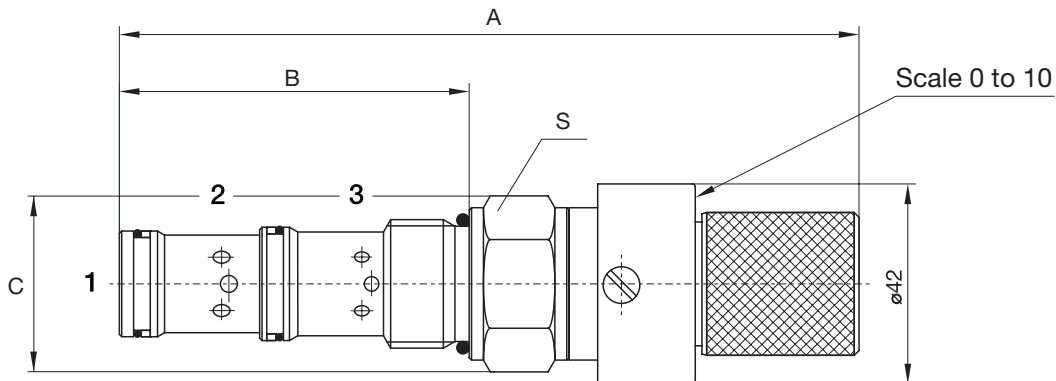
### Symbol:



### Technical data

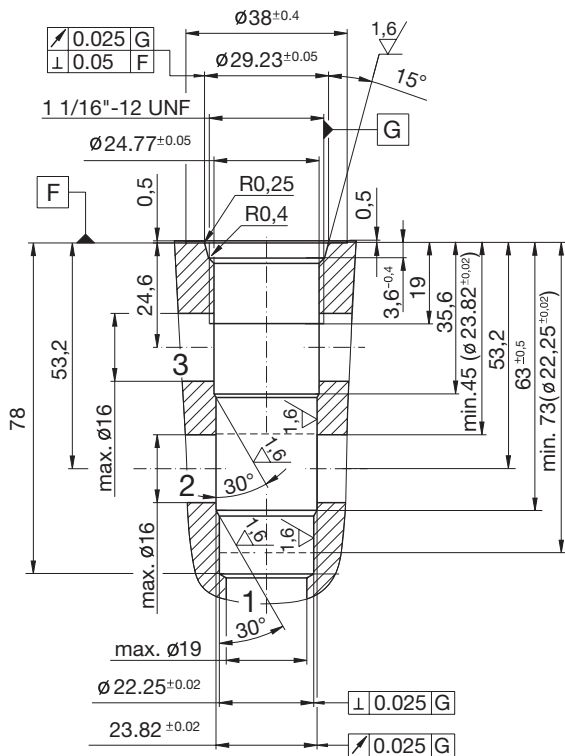
Type		TVTP-25-B	TVTP-60-B	TVTP-90-B
Rated flow 3	l/min	25	60	90
Flow rate 1 max.	l/min	60	90	150
Operating press. max.	bar	350		
Oil temperature range	°C	-20 to +70		
Viscosity range	mm <sup>2</sup> /s	15 to 380		
Filtration	NAS 1638	8		
Mass	kg	0.6		1

Dimensions (mm): TVTP-...-B-...

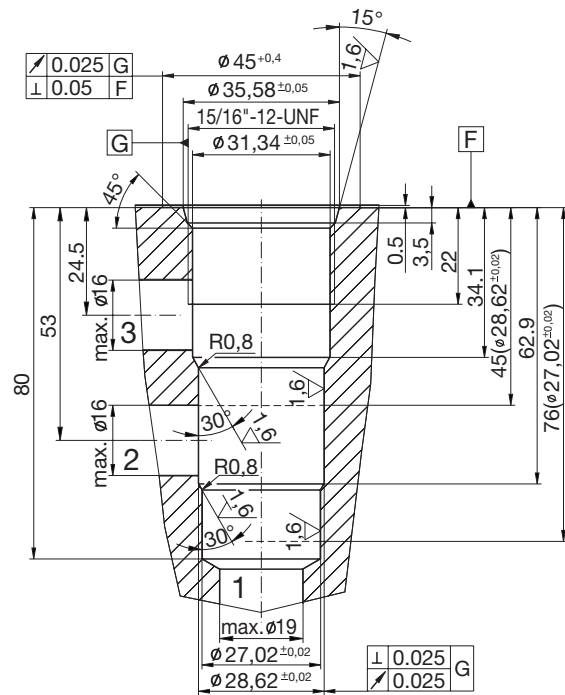


Type	A	B	C	S	Torque into Cavity (Nm)
TVTP-25-P	155	73,5	37	S32	60 - 65
TVTP-50-P	176	75	46	S41	70 - 75

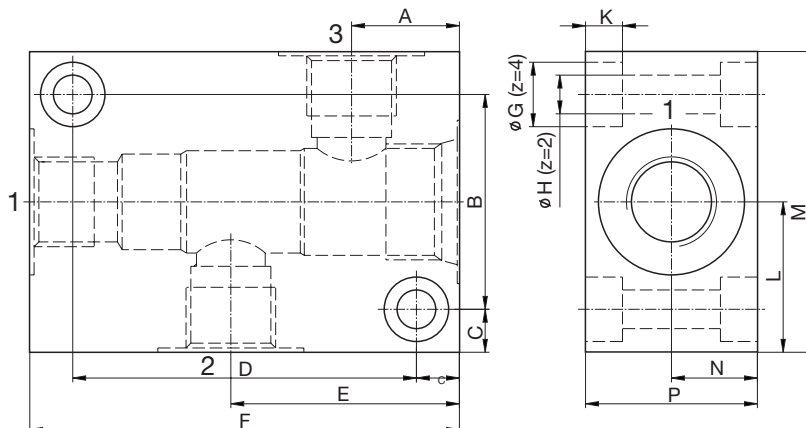
Dimensions of cavity (mm) TVTP-25, TVTP-50



TVTP-90



Standard Ported Body - Steel



Dimensions (mm)

	ORDERING CODE	
	P-TVTP-50	P-TVTP-90
A	25,1	25
B	50	65
C	10	15
D	80	80
E	53,2	53,5
F	100	110
G	15	17
H	9	11
K	8,6	10,6
L	35	47,5
M	70	95
N	20	26
P	40	52
U	G 1/2	G 1

Threaded connections ISO 1179-1.

## FLOW CONTROL VALVE type TVTP-...-P-...

- to 210 bar
- to 50 l/min

- Three-way pressure compensated
- Operating element: proportional solenoid
- Control electronics: Amplifier R59209NP221
- For independent fitting into a block
- Plug-in connector for solenoids to ISO 4400
- Protection of solenoid IP 54 to DIN EN 60529 (IP 65 on request)



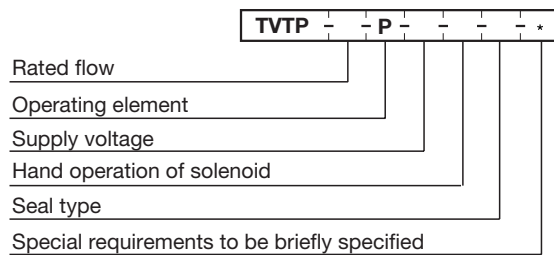
TVTP-...-P-...

### Description of operation

TVTP three-way flow regulators are used to regulate the priority flow in outlet 3 to a maximum adjustable level largely independent of the load and pressure conditions. The surplus flow is diverted to the bypass port 2. The bypass flow may be used for a secondary circuit.

Whether the pressure in secondary circuit is higher than the regulated pressure the valve works as two-way regulator.

### Ordering code



#### Rated flow

25 l/min = **25**  
 50 l/min = **50**  
 90 l/min = **90**

#### Operating element

proportional solenoid = **P**

#### Supply voltage

12V direct voltage = **12DC**  
 24V direct voltage = **24DC**

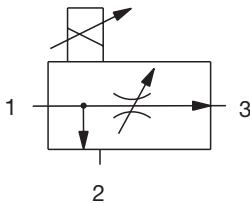
#### Hand operation of solenoid

without hand operation = **no design.**  
 with hand operation = **G**

#### Seal type

NBR seals for mineral oil HL,HLP to DIN 51524 = **no desing.**  
 FPM seals for HETG,HEES,HEPG to VDMA 24568 = **E**  
 and ISO 15380

### Symbol:

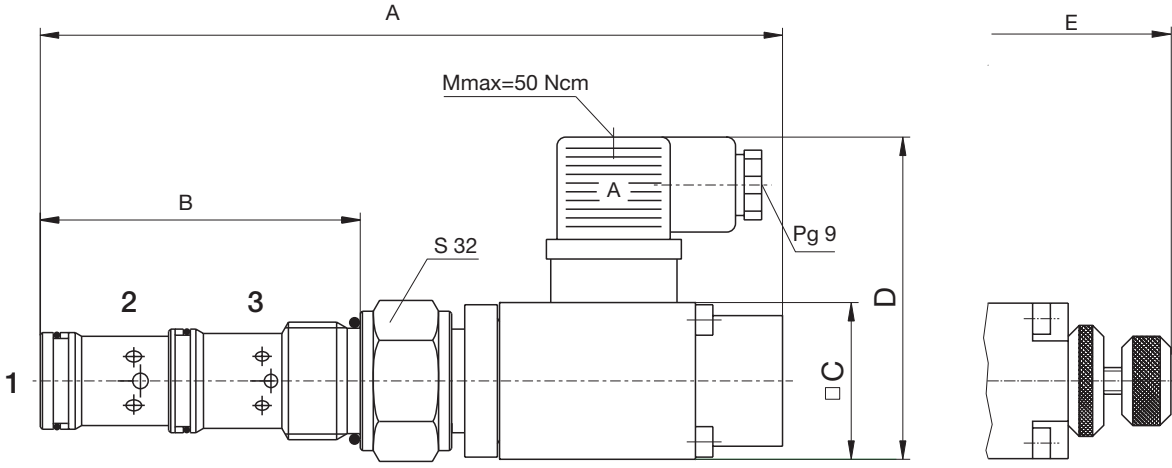


### Technical data

Type		TVTP-25	TVTP-50	TVTP-90	
Rated flow 3	l/min	25	50	90	
Flow rate 1 max.	l/min	60	90	150	
Operating pressure max.	bar	210			
Hysteresis	%	<5			
Oil temperature range	°C	-20 to +70			
Viscosity range	mm <sup>2</sup> /s	15 to 380			
Filtration	NAS 1638	7			
Mass	kg	1 (TVTP-..)		1,6 (TVTP-..)	
		1.2 (TVTP-..G)		2 (TVTP-..G)	
Supply voltage	V	12DC	24DC	12DC	24DC
Limiting power	W	17,4		20,8	
Rated current	A	1,25	0,68	1,79	0,81
Coil resistance at 20 °C	Ohm	7,2	24,6	4,3	21
Rating ED	%	100			

Dimensions (mm): TVTP-...-P..

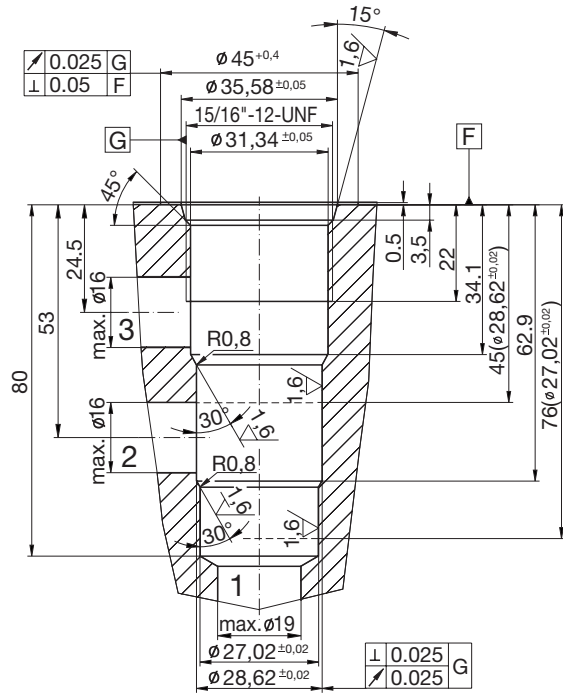
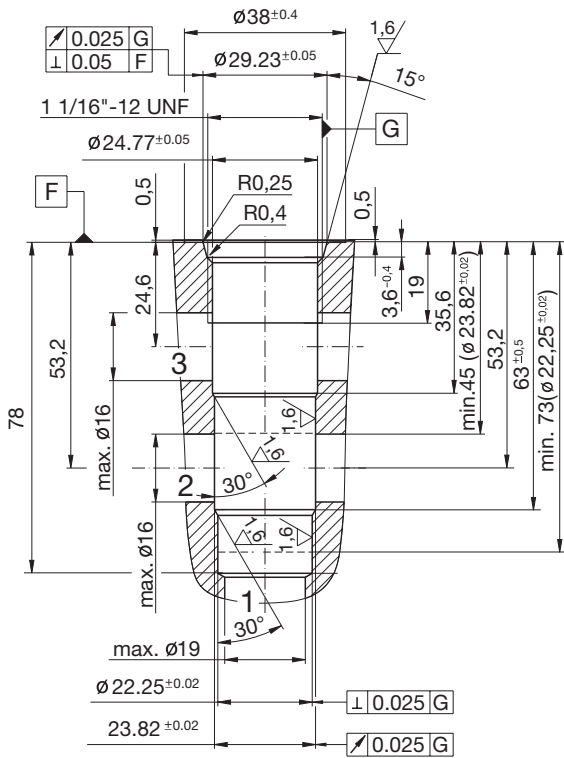
TVTP-...-P...-G



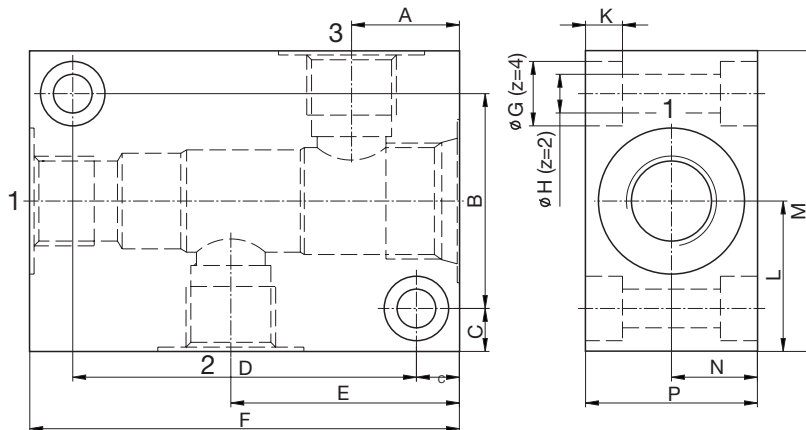
Type	A	B	C	D	E	S	Torque into Cavity (Nm)
TVTP-25-P	170	73,5	35	74	210	S32	60 - 65
TVTP-50-P							
TVTP-90-P	198	75	45	84	244	S41	70 - 75

Dimensions of cavity (mm) TVTP-25, TVTP-50

TVTP-90



Standard Ported Body - Steel



Dimensions (mm)

	ORDERING CODE	
	P-TVTP-50	P-TVTP-90
A	25,1	25
B	50	65
C	10	15
D	80	80
E	53,2	53,5
F	100	110
G	15	17
H	9	11
K	8,6	10,6
L	35	47,5
M	70	95
N	20	26
P	40	52
U	G 1/2	G 1

Threaded connections ISO 1179-1.

## PRESSURE SWITCH type TS

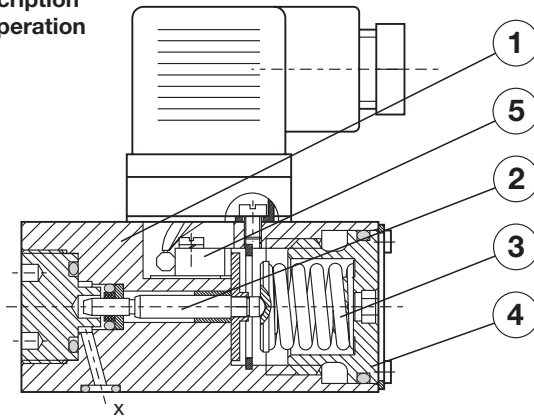
- NS 4
- to 400 bar

- Minimal dimensions
- Four pressure ranges
- Three mounting methods (horizontal, vertical, built into pipeline)
- Three pressure setting methods (by means of Allan key, knob, or lockable knob)
- Lockable pressure setting
- Operation supervision by means of signal lamp
- Plug-in connector for solenoids to ISO 4400



TS-4, VP-TS-4

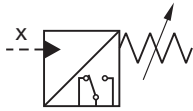
### Description of operation



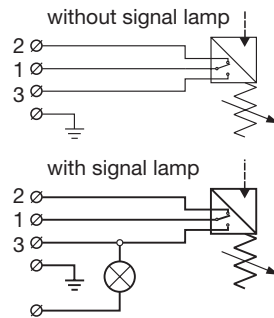
Pressure switches type TS are used for switching electric circuits on and off, respectively, depending on the flow rate in the hydraulic system. These switches can be mounted as control or monitoring elements. When the pressure switch is used as monitoring element, the operation of hydraulic systems can be supervised by means of light or sound signals.

The TS type pressure switch consists of a housing (1), a piston (2), a spring (3), a setting knob (4) and a microswitch (5). Pressure acts on the piston (2), pushing it against the spring (3). When the piston force exceeds the preset tension of the spring, the microswitch (5) turns the electric power on, or respectively, off. The tension and thereby the switching - on and off pressure rates can be preset by means of the setting knob (4).

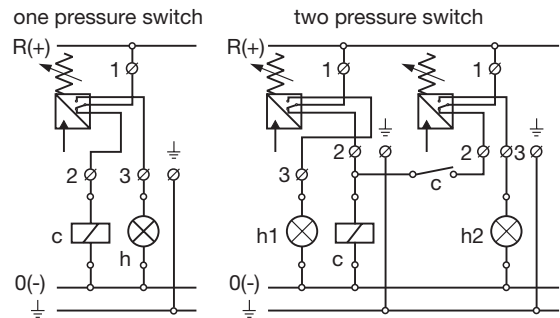
### Symbol



### Circuit diagram



### Mounting example



h, h1, h2 - control lamps  
 c - relay (contactor)

### Technical data

Type		Hydraulic			
		TS-4-70	TS-4-160	TS-4-250	TS-4-400
Size		4			
Min. pressure at pressure rise	bar	< 9	< 17	< 20	< 25
Max. pressure at pressure rise	bar	70±2	160±4	250±6	400±10
Hysteresis at max. pressure	bar	≤ 8,5	≤ 15	≤ 20	≤ 25
Hysteresis at min. pressure	bar	≤ 4	≤ 8	≤ 10	≤ 13
Max. pressure	bar	400	400	500	500
Repeating accuracy	%	< ±1			
Shift frequency	min <sup>-1</sup>	to 120			
Oil temperature range	°C	-20 to +70			
Viscosity range	mm <sup>2</sup> /s	15 to 380			
Mass	kg	0,2 to 0,4			
Filtration	NAS 1638	8			

### Electrical

Switching capacity					
Alternating current			Direct current		
Voltage	Ohm load	Inductive load	Voltage	Ohm load	Inductive load
V	A	A	V	A	A
			to 15	10	10
			30	7	5
			50	2	2
			75	1	1
125	7	5	125	0,5	0,06
250	7	5	250	0,2	0,03

**Ordering code**

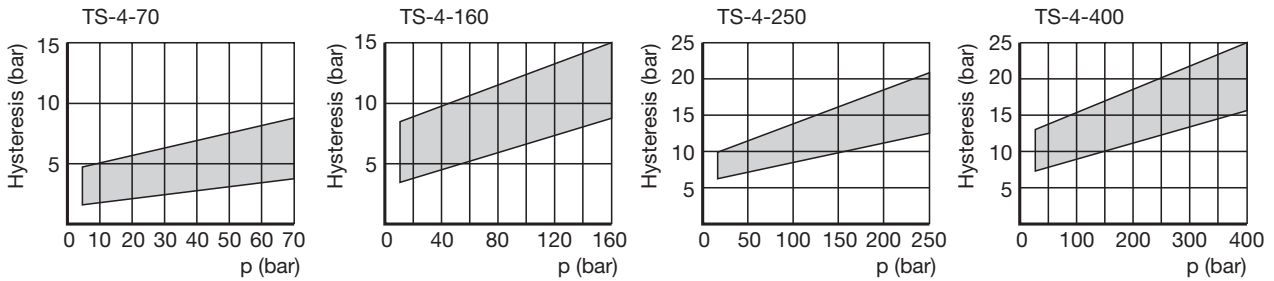
**TS-4- - - - - \***

- Pressure setting range
- Mounting method
- Pressure setting element
- Plug-in connector
- Seal type
- Special requirements to be briefly specified

<p><b>Pressure setting range</b></p> <p>to 70 bar = 70                  to 160 bar = 160                  to 250 bar = 250                  to 400 bar = 400</p>	<p><b>Mounting method</b></p> <p>vertical = V                  horizontal = H                  built-in = N</p>
<p><b>Pressure setting element</b></p> <p>Allan key = A                  Knob = B                  Lockable key = C</p>	
<p><b>Plug-in connector</b></p> <p>without signal lamp = no design.                  with signal lamp: 12, 24 V = L24                  48 V = L48                  110, 230 V = L230</p>	
<p><b>Seal type</b></p> <p>NBR seals for mineral oil HL, HLP, to DIN 51524 = no design.                  FPM seals for HETG, HEES, HEPG to VDMA 24568 = E                  and ISO 15380</p>	

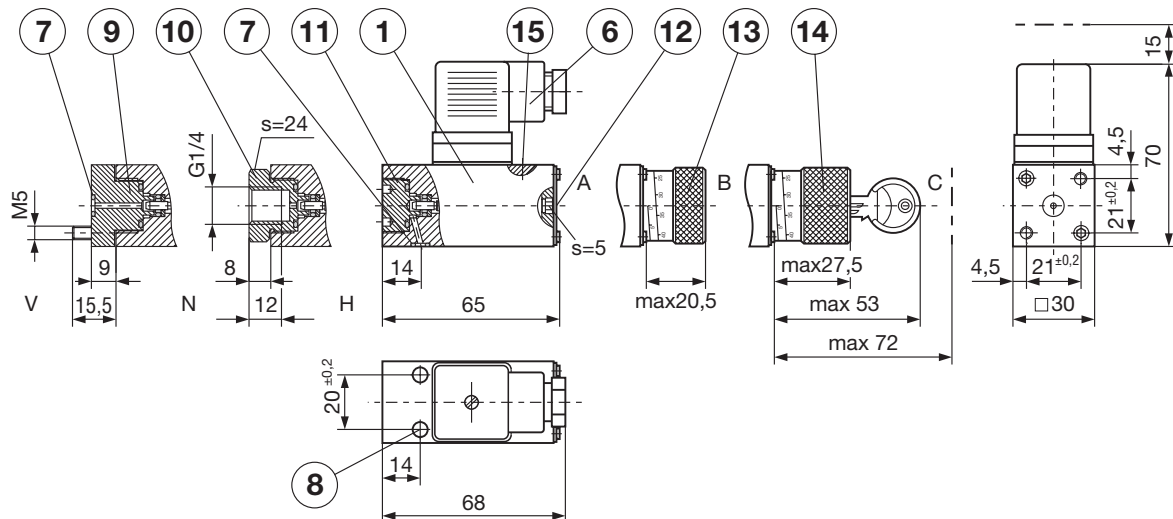
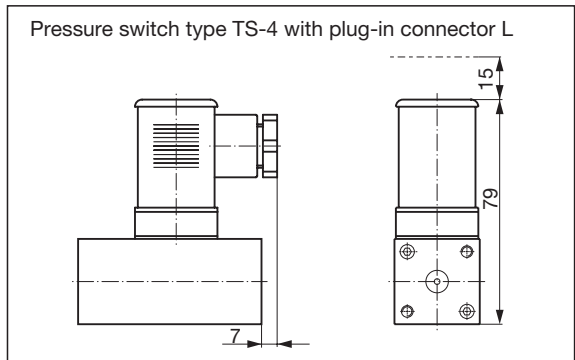
**Note:**  
 The signal lamp is adapted to AC and DC voltage. With DC voltage, the polarity must be observed.

**Hysteresis** (measured at  $t = 50\text{ }^{\circ}\text{C}$  and  $v = 32\text{ mm}^2/\text{s}$ )



**Dimensions (mm)**

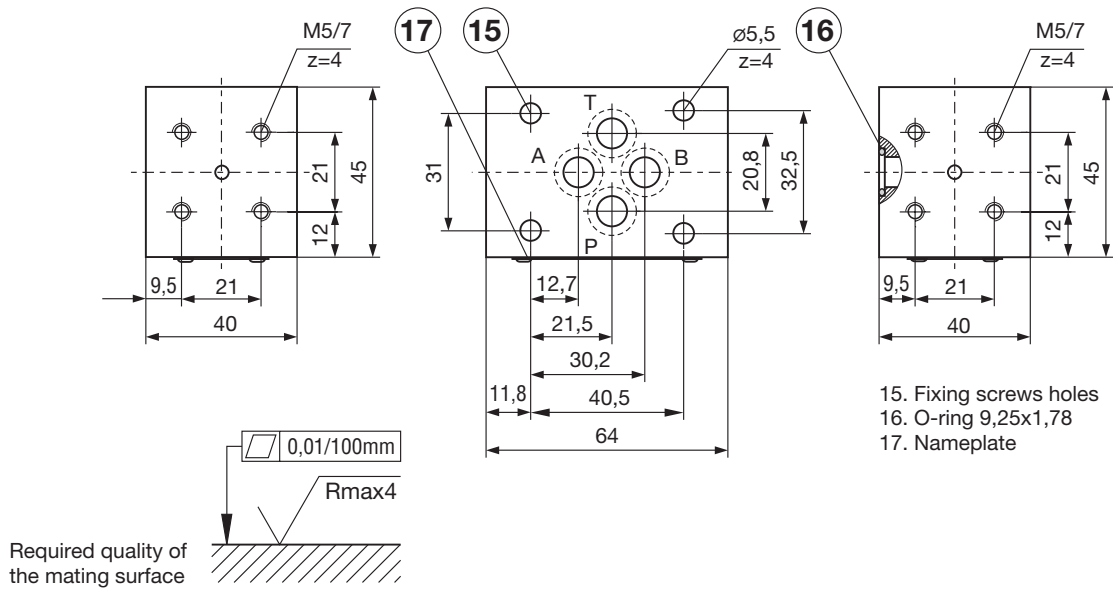
1. Pressure switch body
6. Plug-in connector
7. O-ring 5x1,5
8. Fixing screws holes, 2 pcs M5x40 to DIN EN ISO 4762-10.9  
Tightening torque  $M_d=9\text{ Nm}$  (not included)
9. Fixing the switch to stacking sandwich plate
10. Installation into line
11. Fixing the switch to subplate
12. Pressure setting by means of Allan key
13. Pressure setting by means of knob
14. Pressure setting by means of lockable knob
15. Screw for protection of the seat pressure





**STACKING SANDWICH PLATE type VP-TS-4-6**

Dimensions (mm)


**Ordering code**
**VP-TS-4-6- - - \***

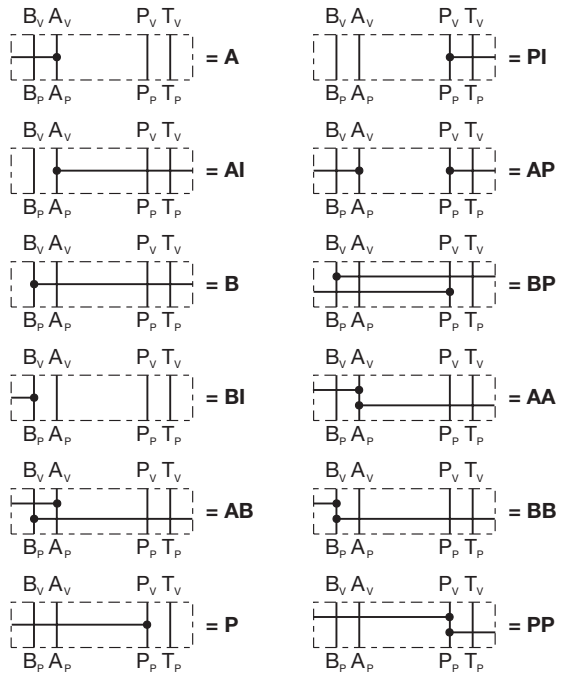
Symbol

Seal type

Special requirements to be briefly specified

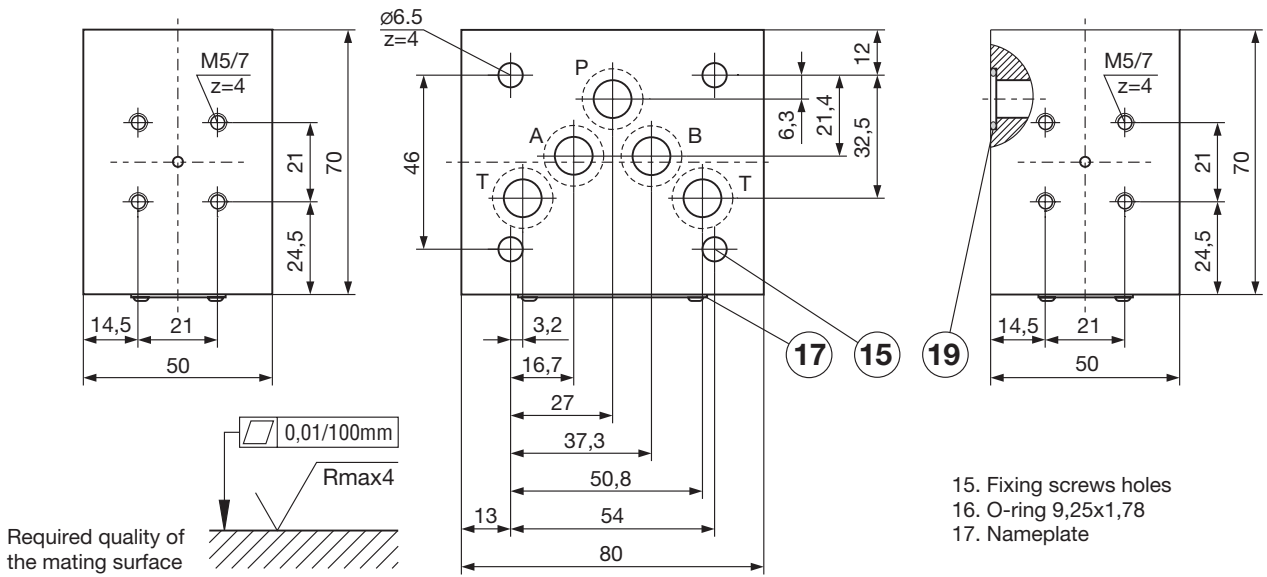
**Seal type**

 NBR seals for mineral oil HL, HLP, to DIN 51524 = no design.  
 FPM seals for HETG, HEES, HEPG to VDMA 24568 = E  
 and ISO 15380

**Symbol**

**Technical data**

Size		6
Flow	l/min	80
Pressure	bar	400
Oil temperature range	°C	-20 to +70
Viscosity range	mm <sup>2</sup> /s	15 to 380
Mass	kg	0,9
Filtration	NAS 1638	8

# STACKING SANDWICH PLATE type VP-TS-4-10



## Ordering code

**VP-TS-4-10- - - \***

Symbol

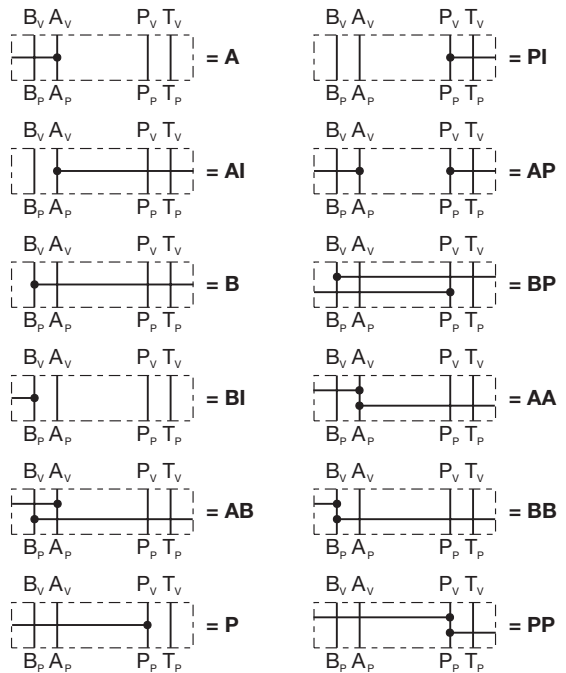
Seal type

Special requirements to be briefly specified

### Seal type

NBR seals for mineral oil HL, HLP, to DIN 51524 = no design.  
FPM seals for HETG, HEES, HEPG to VDMA 24568 = E  
and ISO 15380

## Symbol



## Technical data

Size		10
Flow	l/min	120
Pressure	bar	400
Oil temperature range	°C	-20 to +70
Viscosity range	mm <sup>2</sup> /s	15 to 380
Mass	kg	2,1
Filtration	NAS 1638	8

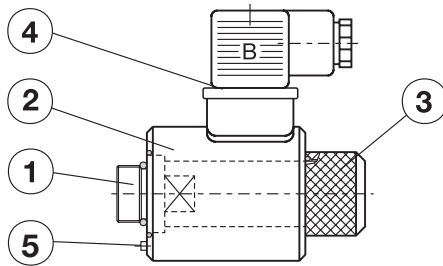
**DIRECT CURRENT SOLENOIDS FOR HYDRAULICS type MR**

- Fast and simple installation
- Reliable functioning in every position
- Long life span
- Solenoid screws into valve block
- Removable coil
- Corresponding to VDE 0580 recommendations
- Plug-in connector corresponding to EN 175301-8003 standards
- MR - 045 fulfil EMC (89/336/EEC)



MR-060, MR-045

**Description of operation**



A piston that can move freely lengthwise, is placed in an oil-tight core (1). A coil (2) protected by housing surrounds the core. The plug-in connector (4) is fixed to the housing. The coil is fixed on the core by retaining nut (3) and protected against rotation with a pin (5).

This type of solenoid is used for controlling of directional control valves. They are activated by passing electric current through the solenoid's coil. For manually operation of the solenoid, there is the emergency switch at the back of the solenoid. Solenoids are of "push-design". When the solenoid is activated the piston pushes the piston rod out of it. The force with which the piston pushes at various points of its stroke (solenoid's movement) is given in the tables. The solenoids are designed for direct current. If a rectifier bridge is added, the alternating current can also be used. They are built for voltages of 12, 24, 48, 110 and 230V. Allowed deviation from the nominal voltage is within -10 to + 5%. Their intermittence is 100% at the ambient temperature of 40°C. When the ambient temperature is increased the intermittence is correspondingly lowered. If the buyer so wishes, solenoid for different voltages and intermittence can be delivered. Solenoids have the degree of protection of enclosures IP 65 (IEC). They are tested to the pressure of 210 bar. Their life span in normal working conditions is 10<sup>7</sup> operations.

**Ordering code**

**1. Core:**

**MR - \* - J**  
Size

Note: - For DC and AC voltage the same core is used.

**2. Coil:**

**MR - \* - O - \***  
Size  
Supply voltage

**3. Retaining nut:**

**MR - \* - M - \***  
Size  
Hand operation of solenoid

**4. Plug-in connector:**

**MR - K - \* - \* - \***  
Supply voltage  
Colour-signal lamp  
Cable gland

**Example: MR-045-J, MR-045-O-12DC, MR-045-M, MR-K-24AC-L**

**Note:** - Every part of the solenoid (position 1-4) has to be ordered separately.

**Size**

- ø 45 mm = 045
- ø 62 mm = 060

**Supply voltage**

direct voltage		alternating voltage	
24 V	= no design.	12 V	= 12 AC
12 V	= 12 DC	24 V	= 24 AC
48 V	= 48 DC	48 V	= 48 AC
110 V	= 110 DC	110 V	= 110 AC
230 V	= 230 DC	230 V	= 230 AC *

**Hand operation of solenoid**

- without hand operation = no design
- with hand operation = G

**Colour-signal lamp**

- grey - without signal lamp = A
- black - without signal lamp = B
- transparent - with signal lamp = L

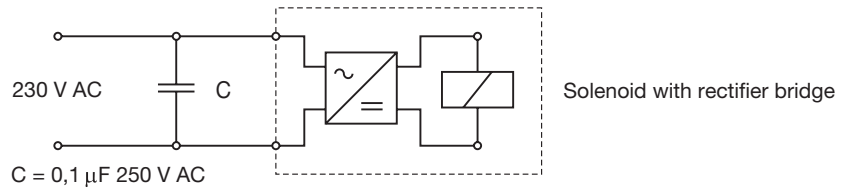
**Cable gland**

- Pg 9 = no design
- Pg 11 = 11

\* see Note (next page)

**Note:**

\* To fulfil EMC (89/336/EEC) a capacitor must be built in when using the solenoid with supply voltage 230 V, AC

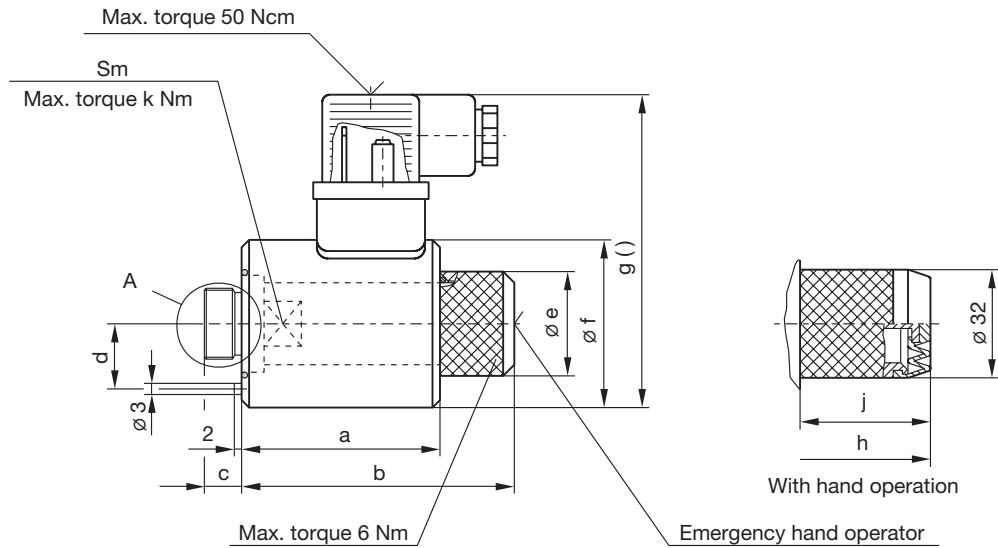


**Technical data**

Type of solenoid	Force F at 90% Un, and working temperature when ED is 100%										Power P	Pressure	Intermittence	Mass
	Stroke													
	0 mm	1 mm	2 mm	3 mm	4 mm	5,5 mm	6 mm	7 mm	8 mm	9 mm				
	N	N	N	N	N	N	N	N	N	N	W	bar	%	kg
MR-045	100	75 (70)	60 (50)	30 (20)	20 (10)	8 (5)	5 (3)				29*	210	100	0,6
MR-060	240	130	140	140	85	50	35	23	18	13	45	210	100	1,6

\* - 12 V supply voltage - 36 W      ( ) - 230 V AC supply voltage

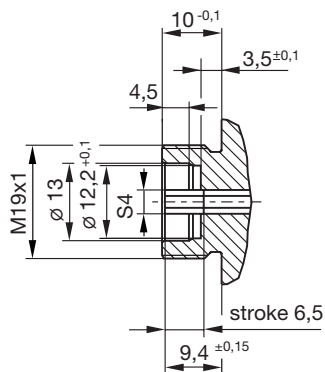
**Dimensions (mm)**



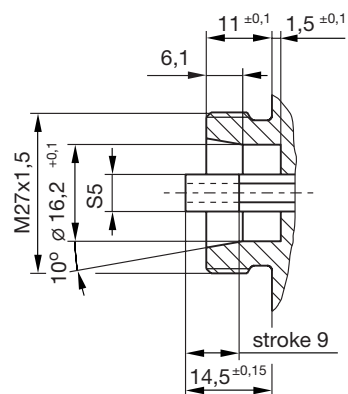
	a	b	c <sup>±0,1</sup>	d <sup>+0,1</sup>	∅e	∅f	g ( )	h	j	k	Sm
MR-045	53	73	10	17,5	30	45	85 (91)	87	34	30	20
MR-060	72	107	11	23,9	40	62	103 (109)	122	50	50	27

( ) - AC supply voltage

**A MR-045**



**A MR-060**



**CONTROL LEVER WITH SWITCHES, typ KRSS**

- Switching capacity 5 A by 12 V
- Fast and simple installation



KRSS-CO10-B

**Description of operation:**

Control lever with switches provides control of the valve with direct mechanical operation and optional control of valves with direct solenoid operation. The lever is usually mounted on the operating pin lever of the valve with direct mechanical operation. The optional thumb switches mounted on the control lever have to be connected with power supply and solenoids on solenoid valves. The valve with direct mechanical operation is activated by deflection of the control lever. The solenoid valves are activated by pressing of thumb switches mounted on the control lever.

**Technical data:**

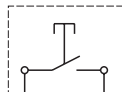
Material	Black plastics
Mounting	Inner thread M10
Switching capacity	5A by 12 V
El. terminals	FASTON A6,3-0,8 EN 61210

**Ordering code:**

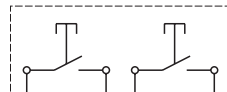
**KRSS - CO10 -**

Typ of lever \_\_\_\_\_  
Combinations of switches \_\_\_\_\_

**Combinations of switches:**

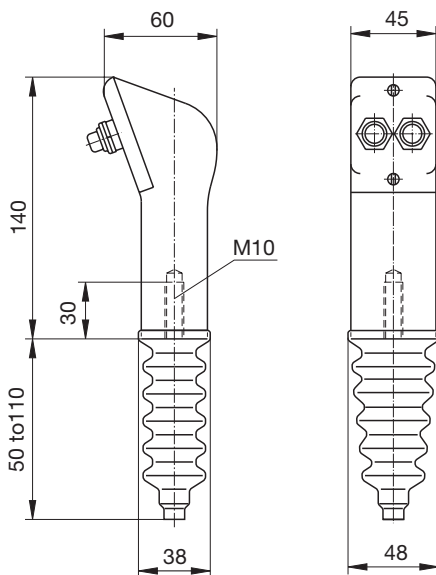


= A

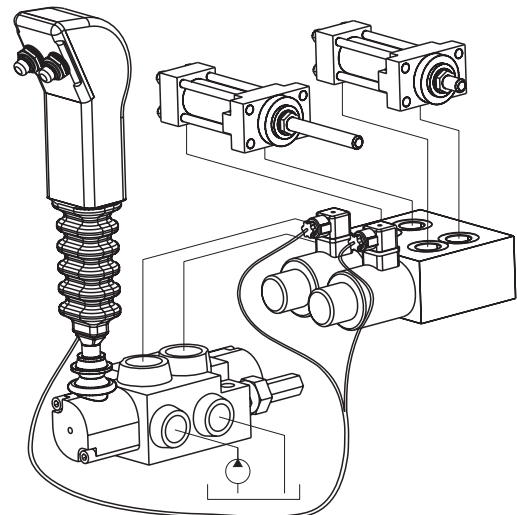


= B

**Dimensions (mm):**



**Mounting example:**



## AMPLIFIER FOR SUPPLY OF THE PROPORTIONAL SOLENOID type R59209NP221

- Plug-in connector for solenoids to ISO 4400

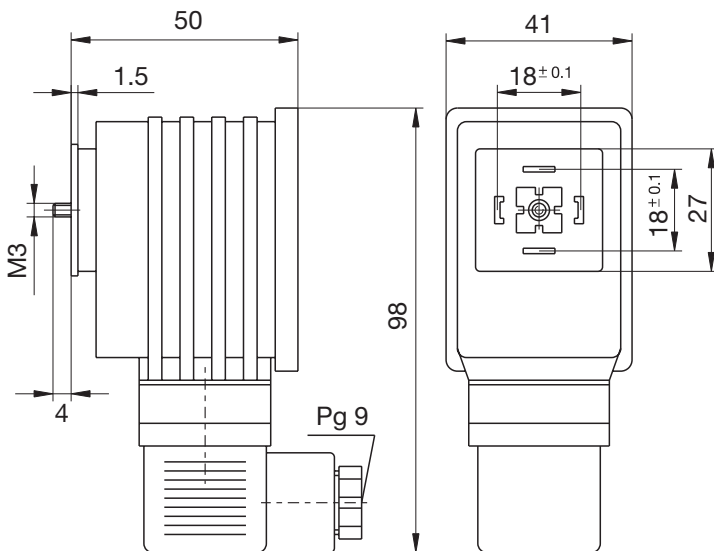


R59209NP221

### Description of operation

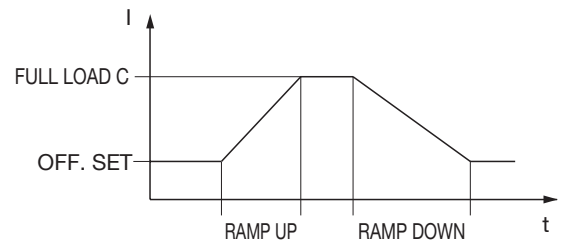
These switch mode units provide stepless control for proportional valves. Start current (OFF.SET) and full load current (FLC) can be individually preset. The current in the solenoid is substantially independent of changes in solenoid resistance and supply voltage variation. The inherent Dither, due to switch-mode operation helps to overcome friction effects in the solenoid. Ramp controls are fitted to give up to 10 seconds for the current in the solenoid to built up to its full load value, or to return to the offset point.

### Dimensions (mm):

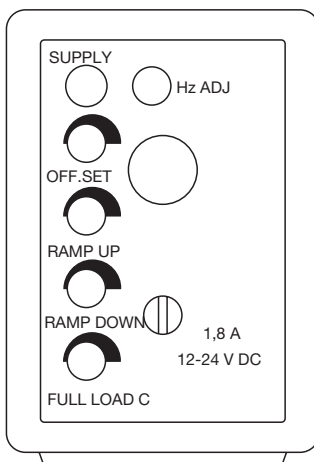


### Technical data

Switching frequency	Hz	100...500	
Two reg. ramp up and ramp down	sec	0...10	
Operating temperature range	°C	-5...+80	
Storage temperature range	°C	-45...+100	
Power supply voltage	V DC	9...30	
Control signal	V DC	0...10	
Full load current	mA	1800	
Offset range	12 V	mA	0...900
	24 V		0...600



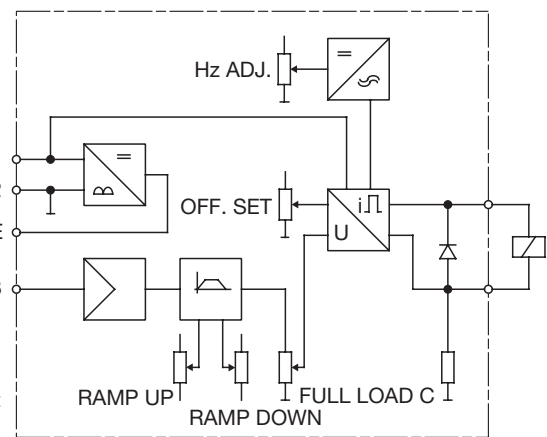
### Connection and adjustment elements



Connection of external potentiometer

5 to 10 kOhm

PIN 1 = +V supply input  
 PIN 2 = 0V supply input  
 PIN 3 = Control signal input  
 PIN E = Ref. voltage output



**SUBPLATES**

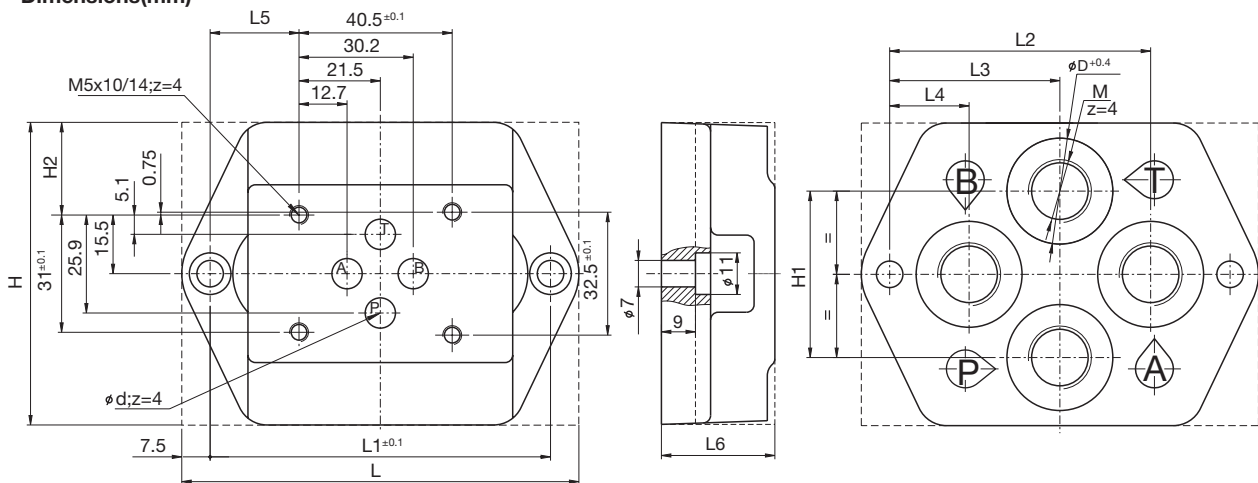
- NS 6, 10, 16
- to 350 bar
- to 300 l/min

- Connecting dimensions to ISO 4401
- Threaded connection to ISO 1179



PP-KV-6, PP-KV-10, PP-KV-16

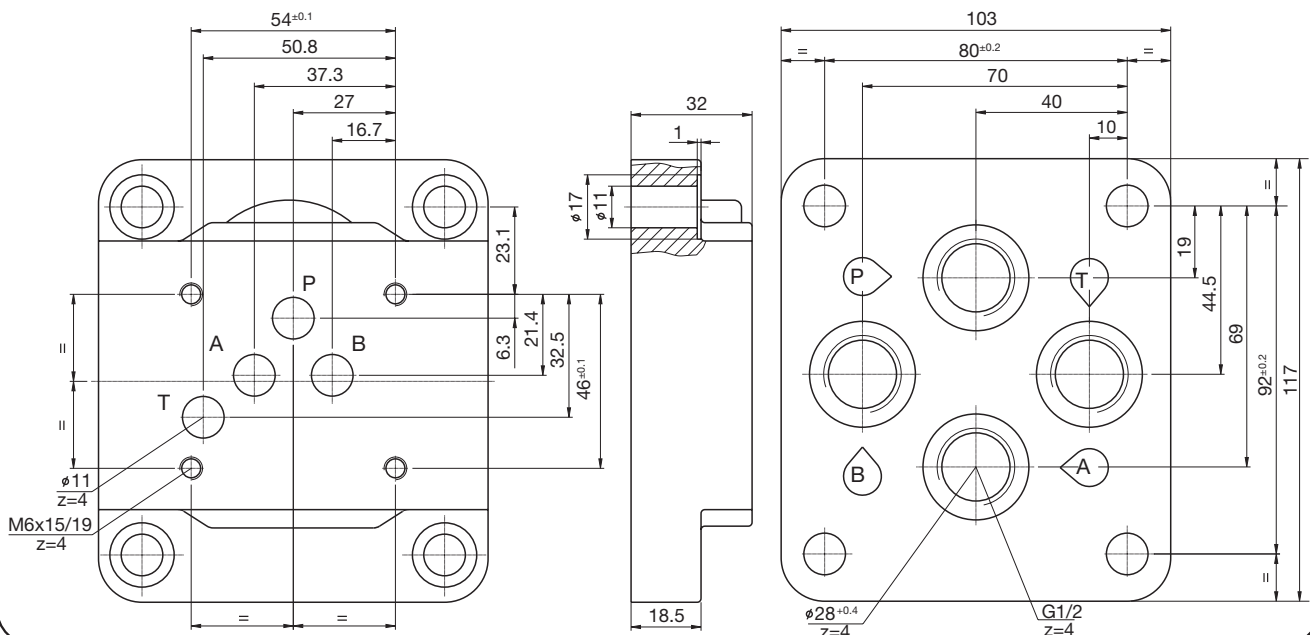
**Subplate, type PP-KV-6-...**  
**Dimensions(mm)**



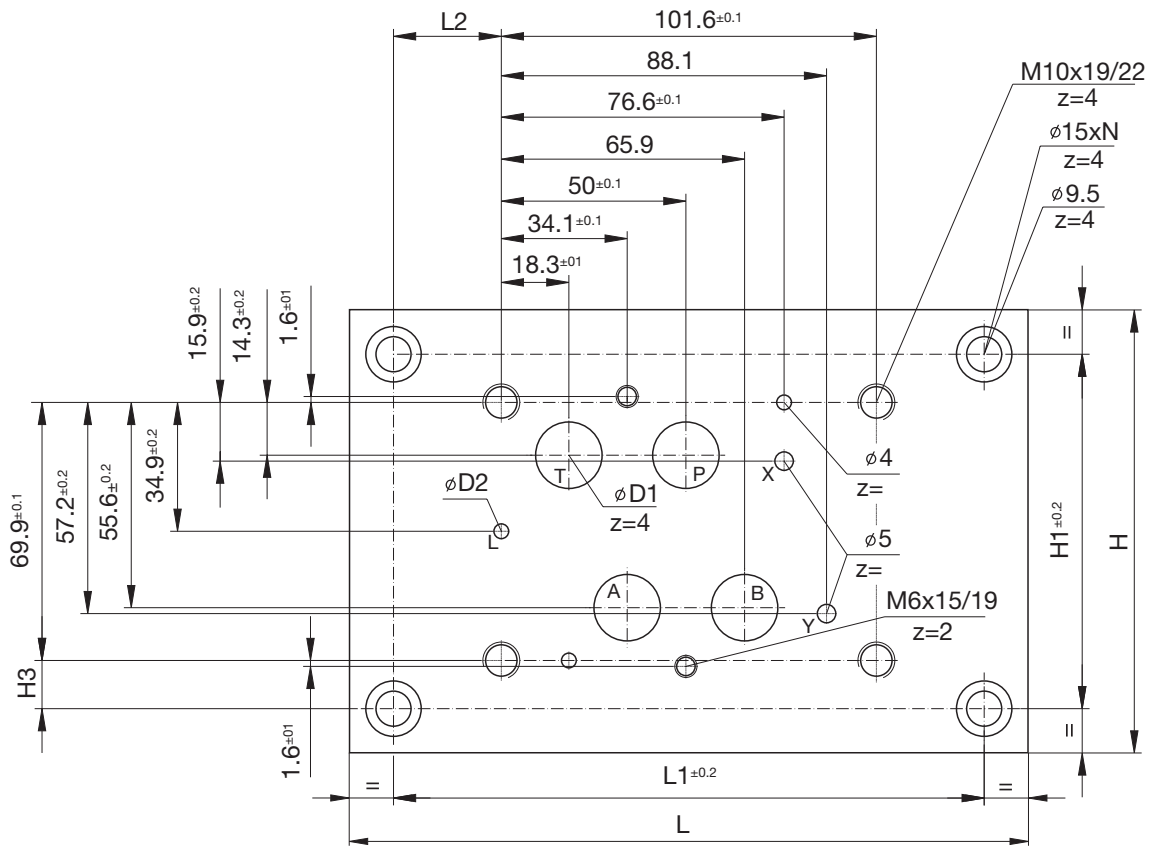
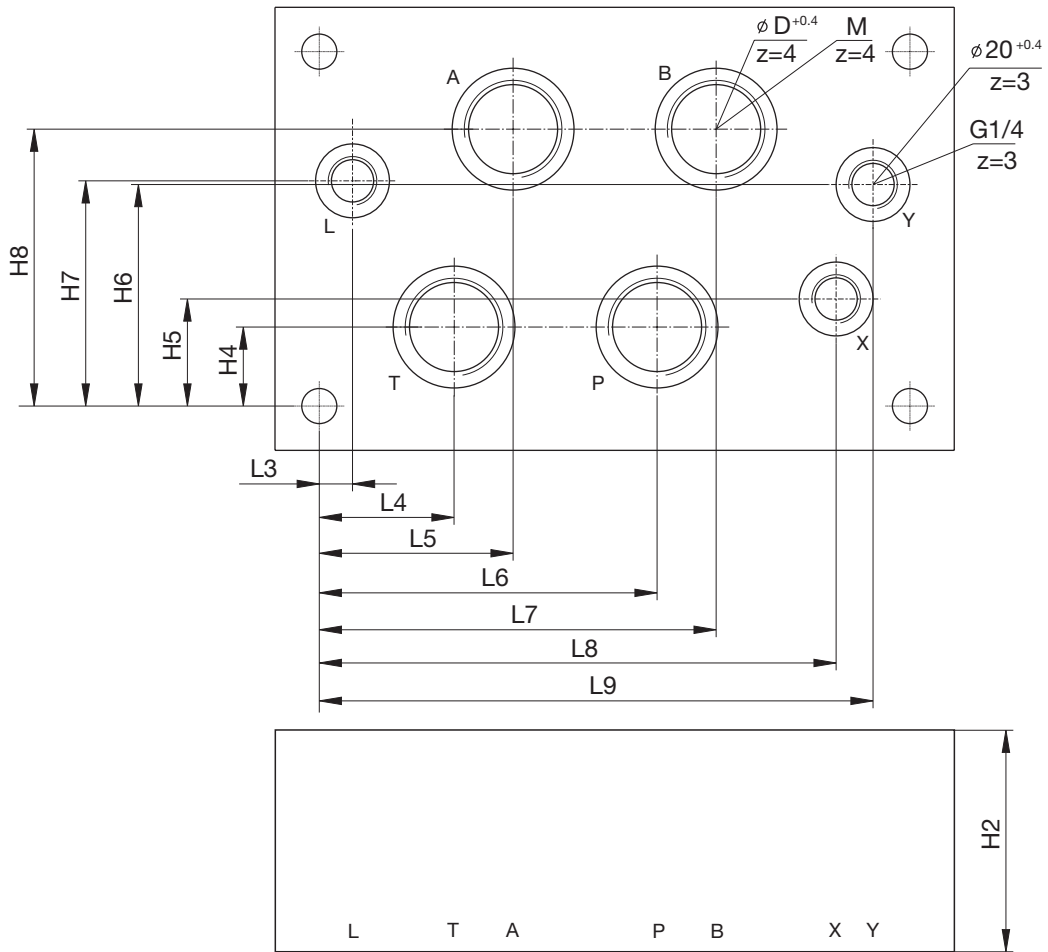
Type	M	D <sup>+0.4</sup>	d	L	L1	L2	L3	L4	L5	L6	H	H1	H2	Surface protection
PP-KV-6-2-G3/8-φ28-L (fromcast)	G3/8	28	8	105	90	69	45	21	23.5	30	80	44	24.5	Phosphated
PP-KV-6-2-G3/8-φ28-L-ZN (fromcast)	G3/8	28	8	105	90	69	45	21	23.5	30	80	44	24.5	Zinc-plated
PP-KV-6-2-G1/2-φ28-L (fromcast)	G1/2	28	8	105	90	69	45	21	23.5	30	80	44	24.5	Phosphated
PP-KV-6-2-G1/2-φ34	G1/2	34	7.5	125	110	82.5	55	27.5	33.5	32	100	58	34.5	Phosphated
PP-KV-6-2-G1/4-φ22	G1/4	22	6	95	80	58	40	22	18.5	30	60	34	14.5	Zinc-plated

**Subplate, type PP-KV-10-G1/2-φ28-L**  
**Dimensions(mm)**

Surface protection-Phosphated



**Subplate, type PP-KV-16**  
**Dimensions (mm)**



Type	M	D	D1	D2	N	L	L1	L2	L3	L4	L5	L6	L7	L8	L9	H	H1	H2	H3	H4	H5	H6	H7	H8	Surface protection
PP-KV-16-G3/4- $\phi 33$	G3/4	33	18	4	20	160	140	19.2	12.2	36.2	50.2	79.2	93.2	113.2	128.2	92	69.9	32	0	14.3	15.9	51.9	39.9	55.6	Phosphated
PP-KV-16-G1- $\phi 41$	G1	41	20	5	48	184	160	30	9	36.5	52.5	91.5	107.5	140	150	120	96	60	13	21.4	29	60	61	75	Phosphated



## MANIFOLD BLOCKS type BP

- NS 6, 10
- to 350 bar

- Connecting dimensions to DIN 24340, ISO 4401
- Port type; BSPP: ISO 1179-1
- Mounting position unrestricted (valve axis preferably horizontal)
- Because of the large drilling diameters the pressure drop through the manifolds is very low.

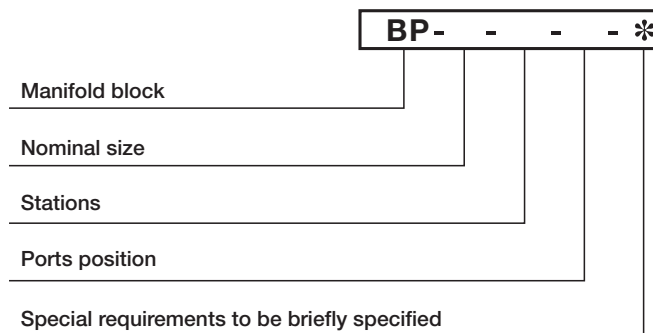


BP-6-4-S

### Description

Manifold blocks serve for transmission of hydraulic fluid from source to valves. On the block can be two or up to seven valves (NS 10) or up to eight valves (NS 6) mounted in parallel connection. Manifold blocks are used for easily realizing of hydraulic circuits without piping between valves and minimal overall dimensions.

### Ordering code



#### Nominal size

Size 6 (CETOP 3) = 6  
 A + B = G3/8; spotface  $\varnothing$  28/1  
 P + T = G1/2; spotface  $\varnothing$  34/1

Size 10 (CETOP 5) = 10  
 A + B = G1/2; spotface  $\varnothing$  34/1  
 P = G3/4; spotface  $\varnothing$  42/1  
 T = G1 ; spotface  $\varnothing$  47/1

#### Stations

1 station = 1	5 station = 5
2 stations = 2	6 stations = 6
3 stations = 3	7 stations = 7
4 stations = 4	8 stations = 8

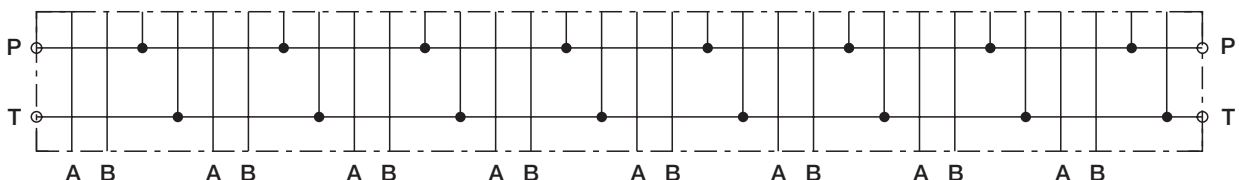
\* for NS 10 up to 7 stations

#### Ports position

Rear = no desig.  
 Side = S

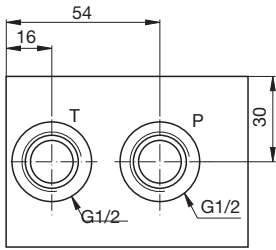
**Note:** Max. pressure depend on type of used seals.

### Symbol

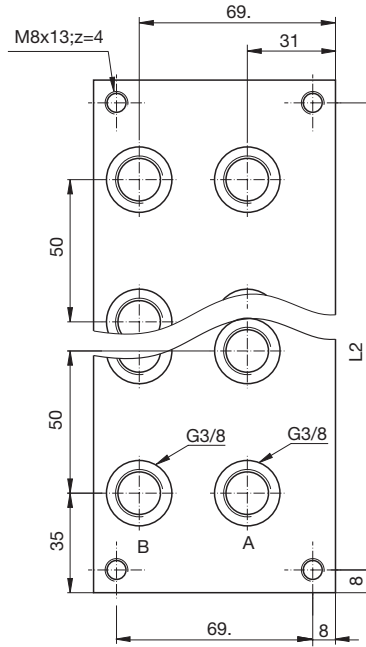
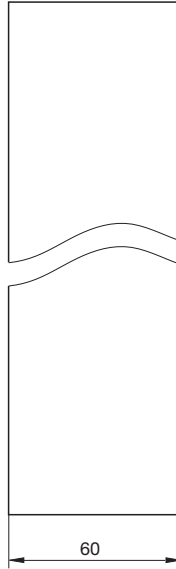
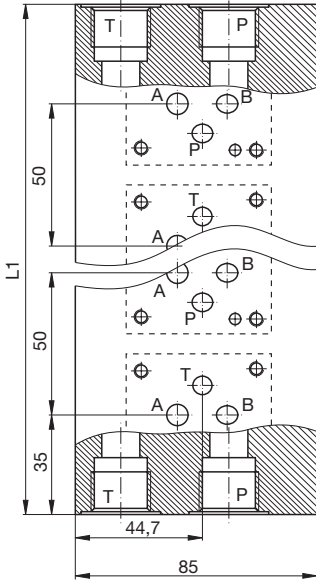


Dimensions (mm)

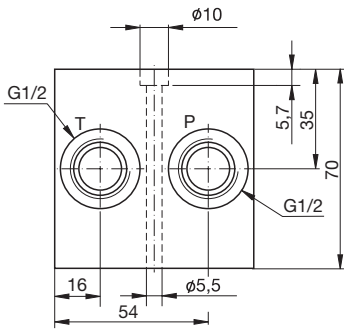
BP-6-....-



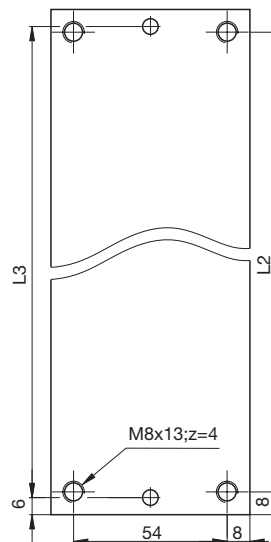
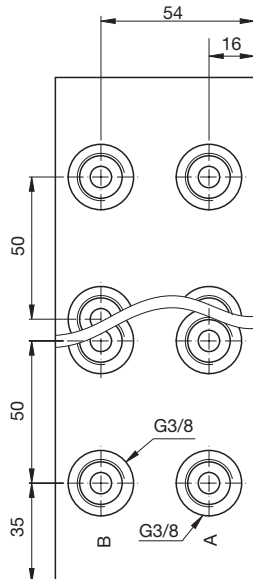
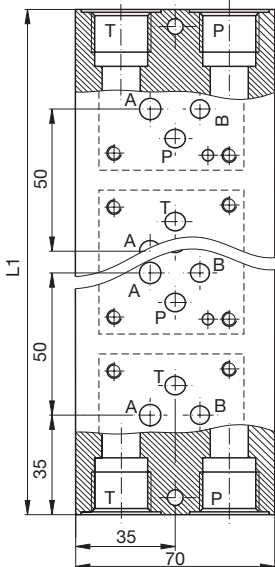
Code	Nominal size	Stations	L1 (mm)	L2 (mm)	Ports size		Mass (kg)
					P, T	A, B	
BP-6-1	6	1	70	54	G1/2	G3/8	2,3
BP-6-2	6	2	120	104	G1/2	G3/8	3,9
BP-6-3	6	3	170	154	G1/2	G3/8	5,5
BP-6-4	6	4	220	204	G1/2	G3/8	7,2
BP-6-5	6	5	270	254	G1/2	G3/8	8,8
BP-6-6	6	6	320	304	G1/2	G3/8	10,5
BP-6-7	6	7	370	354	G1/2	G3/8	12,1
BP-6-8	6	8	420	404	G1/2	G3/8	13,7



BP-6-....-S

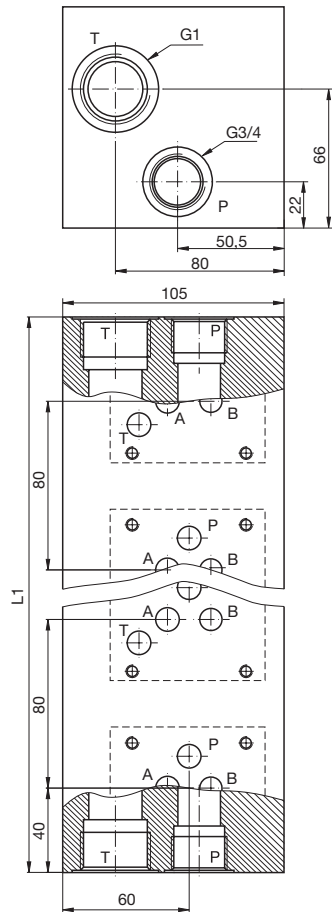


Code	Nominal size	Stations	L1 (mm)	L2 (mm)	L3 (mm)	Ports size		Mass (kg)
						P, T	A, B	
BP-6-1-S	6	1	70	54	58	G1/2	G3/8	2,3
BP-6-2-S	6	2	120	104	108	G1/2	G3/8	3,9
BP-6-3-S	6	3	170	154	158	G1/2	G3/8	5,5
BP-6-4-S	6	4	220	204	208	G1/2	G3/8	7,2
BP-6-5-S	6	5	270	254	258	G1/2	G3/8	8,8
BP-6-6-S	6	6	320	304	308	G1/2	G3/8	10,5
BP-6-7-S	6	7	370	354	358	G1/2	G3/8	12,1
BP-6-8-S	6	8	420	404	408	G1/2	G3/8	13,7

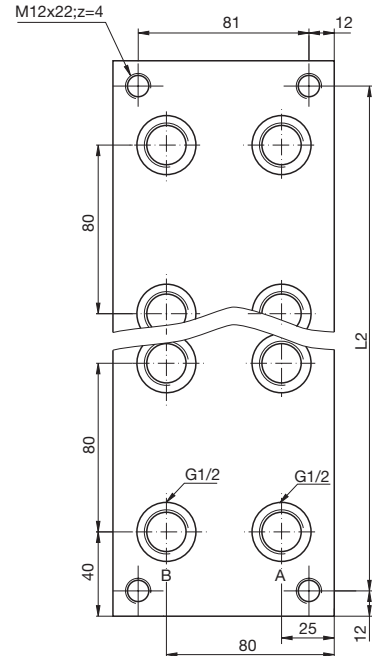
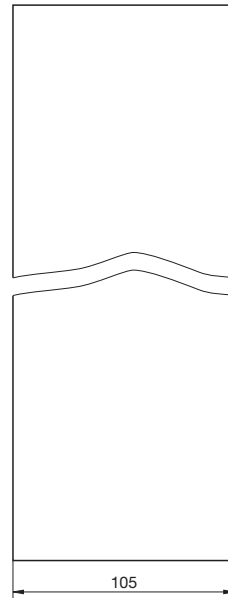


**Dimensions (mm)**

**BP-10-....-....**

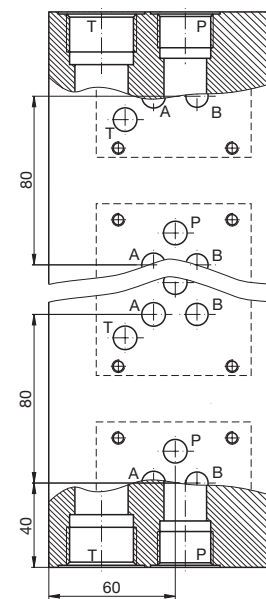
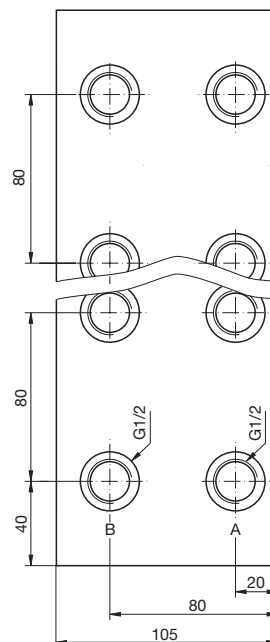
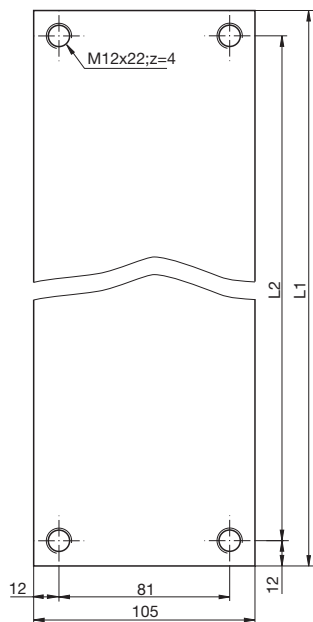
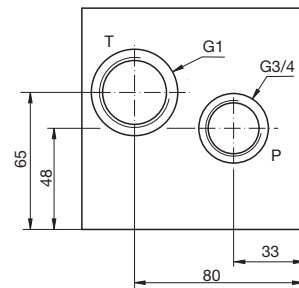


Code	Nominal size	Stations	L1 (mm)	L2 (mm)	Ports size			Mass (kg)
					P	A, B	T	
BP-10-1	10	1	80	56	G3/4	G1/2	G1	5,9
BP-10-2	10	2	160	136	G3/4	G1/2	G1	11,8
BP-10-3	10	3	240	216	G3/4	G1/2	G1	17,7
BP-10-4	10	4	320	296	G3/4	G1/2	G1	23,5
BP-10-5	10	5	400	376	G3/4	G1/2	G1	29,4
BP-10-6	10	6	480	456	G3/4	G1/2	G1	35,3
BP-10-7	10	7	560	536	G3/4	G1/2	G1	41,2



**BP-10-....-S**

Code	Nominal size	Stations	L1 (mm)	L2 (mm)	Ports size			Mass (kg)
					P	A, B	T	
BP-10-1	10	1	80	56	G3/4	G1/2	G1	5,9
BP-10-2	10	2	160	136	G3/4	G1/2	G1	11,8
BP-10-3	10	3	240	216	G3/4	G1/2	G1	17,7
BP-10-4	10	4	320	296	G3/4	G1/2	G1	23,5
BP-10-5	10	5	400	376	G3/4	G1/2	G1	29,4
BP-10-6	10	6	480	456	G3/4	G1/2	G1	35,3
BP-10-7	10	7	560	536	G3/4	G1/2	G1	41,2

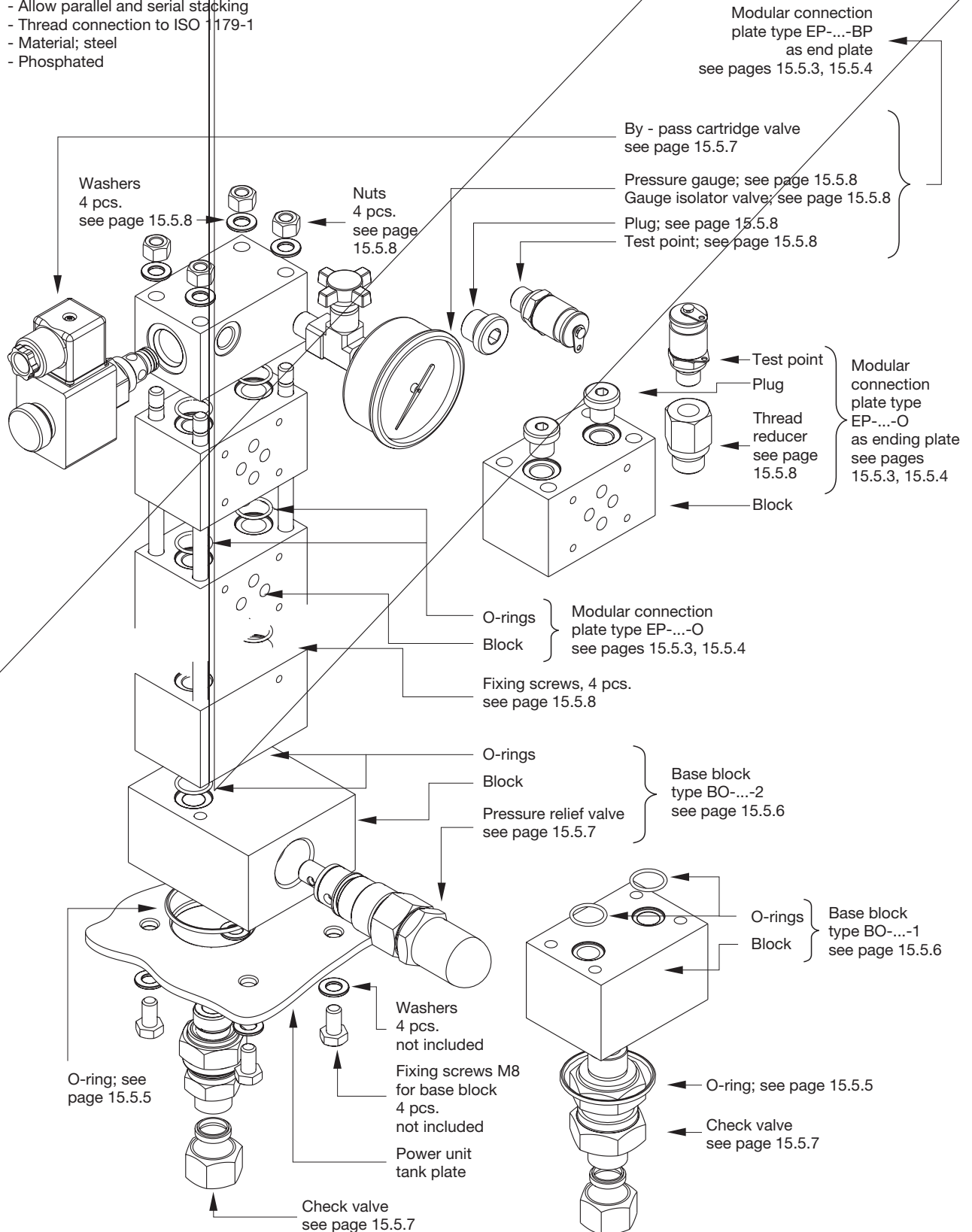


## STACKING ELEMENTS type EV

- NS 6,10
- to 350 bar
- Compact design
- With or without by-pass valve
- With or without pressure relief valve
- Up to eight valve connections
- Allow parallel and serial stacking
- Thread connection to ISO 1179-1
- Material; steel
- Phosphated

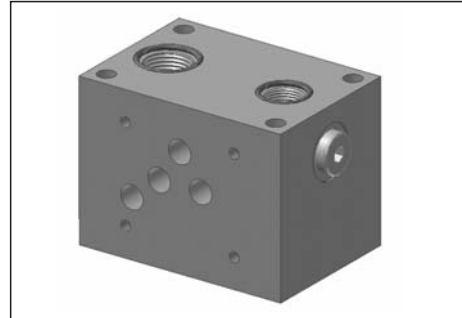
### Technical data

Required filtration	NAS 1638	8
Oil temperature range	°C	-20 to +70
Viscosity range	mm <sup>2</sup> /s	15 to 380
Seal type		NBR



## MODULAR CONNECTION PLATES type EP

- NS 6, 10
- to 350 bar
- Connecting dimensions to ISO 4401, DIN 24340
- Mounting position unrestricted



EP - 10 - O

### Description

Modular connection plates are used for transmission of hydraulic fluid from its source to hydraulic valves. By using modular connection plates it is simple to realize complete hydraulic circuit and piping is restricted to the connections to the loads only.

### Ordering code



- Modular connection plate
- Nominal size
- Symbol
- By-pass valve type (only for BP symbol)
- Supply voltage (only for BP symbol)
- Special requirements to be briefly specified

### Nominal size

- NS 6 = 6  
 A+B = G3/8 ;spotface  $\varnothing$ 28  
 M = G1/4 ;spotface  $\varnothing$ 20
- NS 10 = 10  
 A+B = G1/2 ;spotface  $\varnothing$ 34  
 M = G3/8 ;spotface  $\varnothing$ 23

### By - pass valve type

- Normally open valve = O
- Normally close valve = C
- Without by-pass valve = N

### Supply voltage

- 24V DC = 24DC  
 230V AC = 230AC

### Symbol

Symbol; **O** Basic modular connection plate

Weight [kg]:	
EP-6-O	1,3
EP-10-O	3,8

Symbol; **SC** Modular plate for serial connection

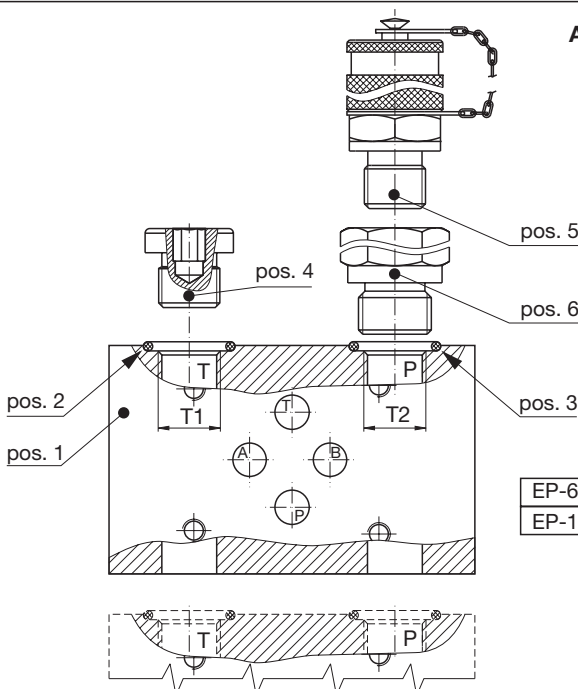
Weight [kg]:	
EP-6-SC	1,4
EP-10-SC	3,8

Symbol; **BP** Ending modular plate with by-pass valve

Weight [kg]:	
EP-6-BP	1,1
EP-10-BP	2,5

**Note:** Weight without by-pass valve

### Assembly set for modular plates O and SC



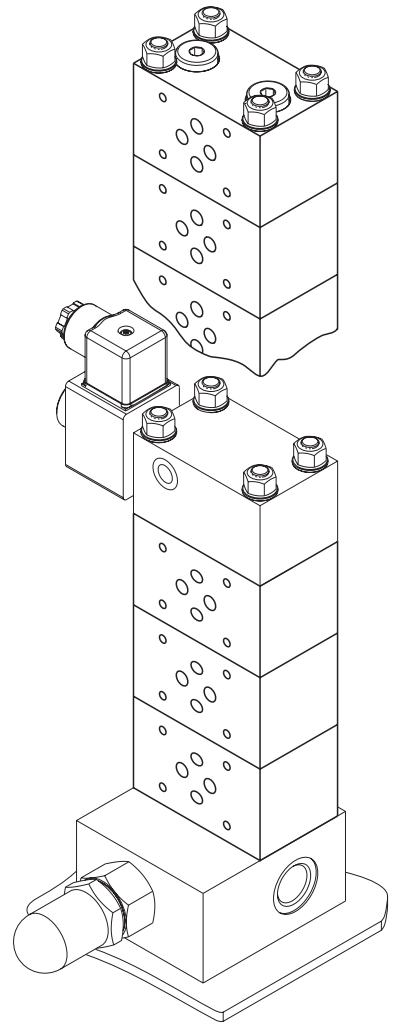
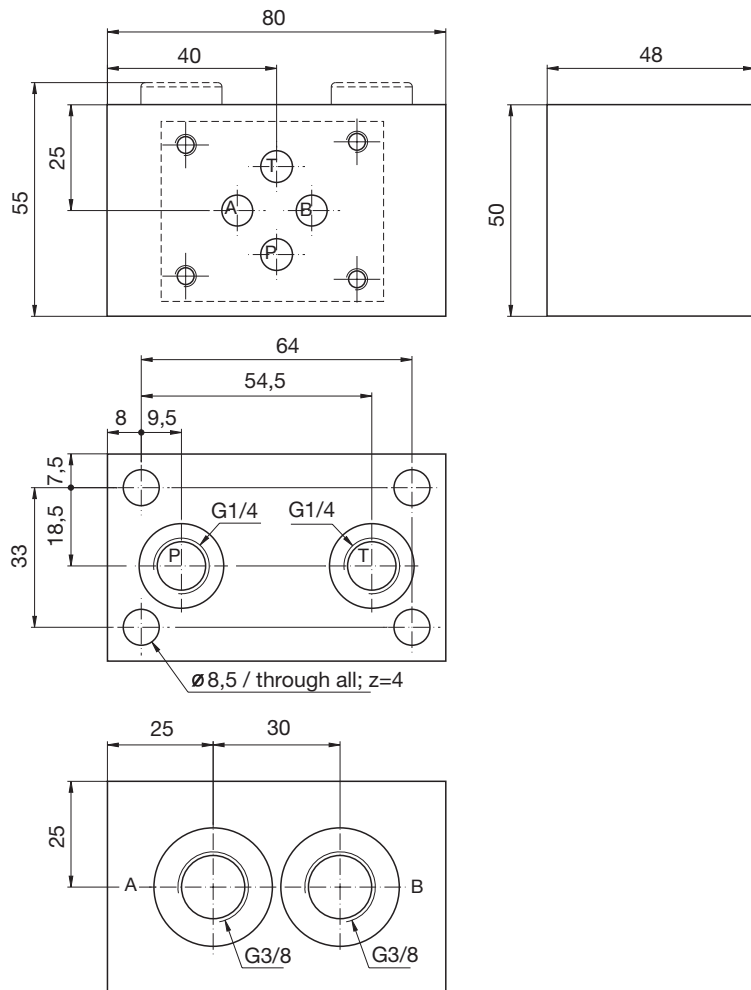
pos. 1	T1	T2	pos. 2	pos. 3
EP-6-O	G1/4	G1/4	O-ring $\varnothing$ 17,17x1,78	O-ring $\varnothing$ 17,17x1,78
EP-6-SC	G1/4	G1/4	O-ring $\varnothing$ 17,17x1,78	O-ring $\varnothing$ 17,17x1,78
EP-10-O	G1/2	G3/8	O-ring $\varnothing$ 23,47x2,62	O-ring $\varnothing$ 18,72x2,62
EP-10-SC	G1/2	G3/8	O-ring $\varnothing$ 23,47x2,62	O-ring $\varnothing$ 18,72x2,62

### When using EP...-O as end plate

	pos. 4	pos. 5	pos. 6
EP-6-O	Plug G1/4*	Test point G1/4*	Without
EP-10-O	Plug G1/2*	Test point G1/4*	Thread reducer G3/8 $\rightarrow$ G1/4* (T2) Thread reducer G1/2 $\rightarrow$ G1/4* (T1)

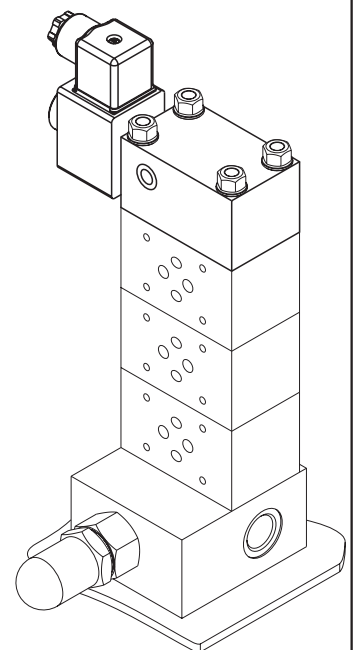
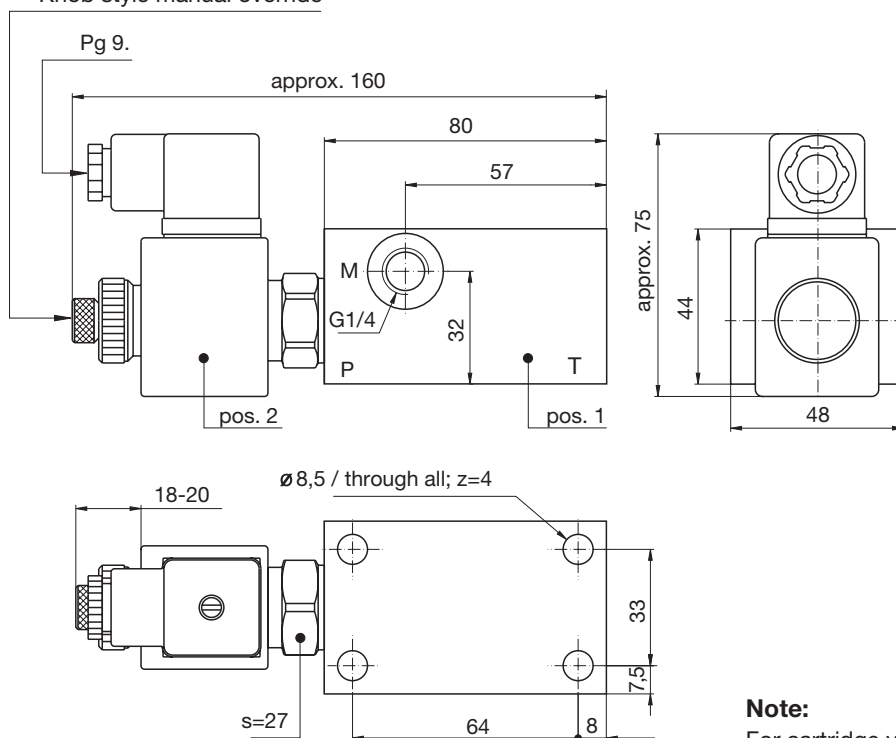
**Note:**  
 \* Not included! See page 15.5.8

**Dimensions [mm] for EP-6-O and EP-6-SC**



**Dimensions [mm] for EP-6-BP**

Knob style manual override

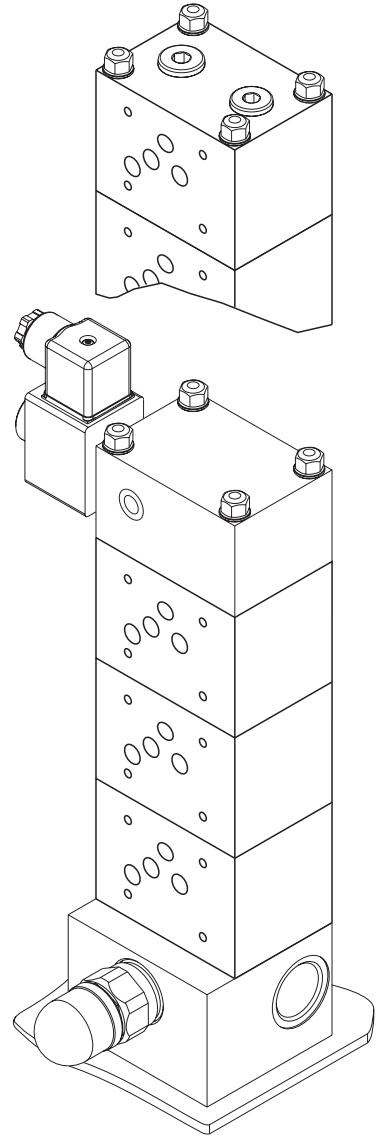
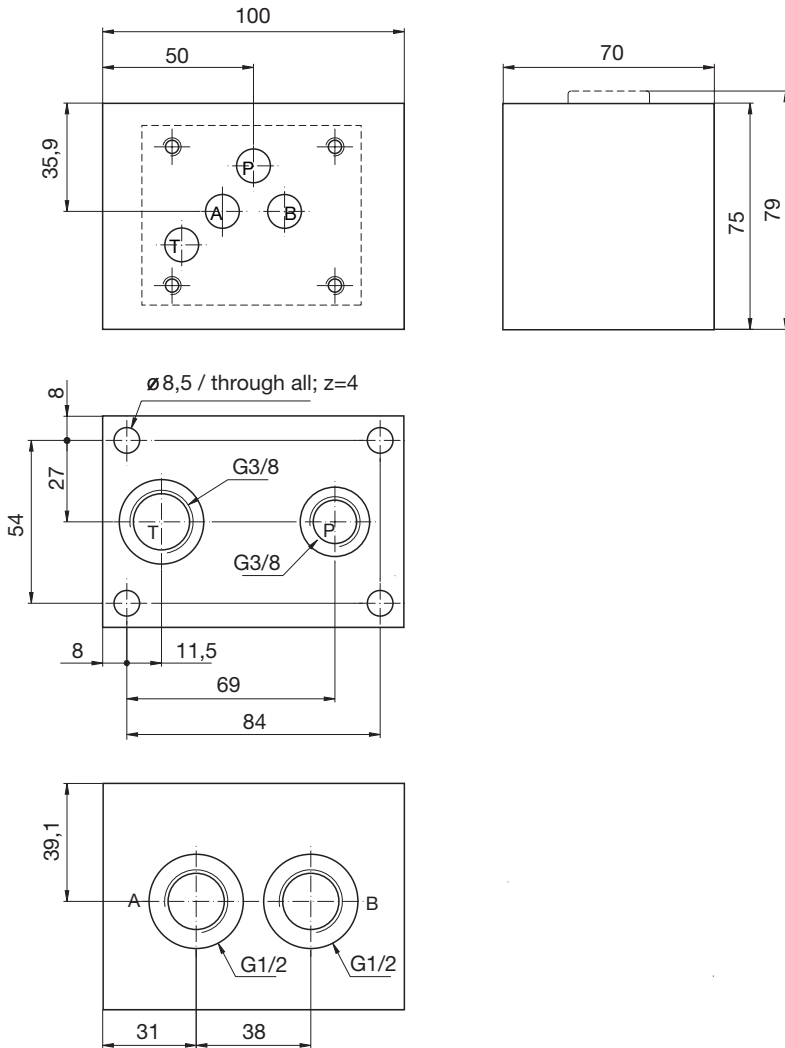


pos. 1;	EP-6-BP
pos. 2;	By - pass valve

**Note:**

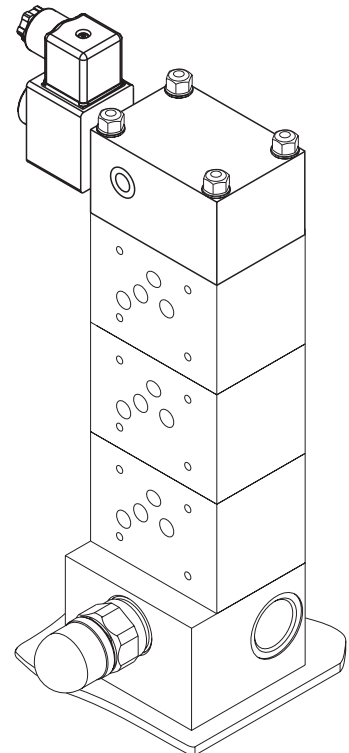
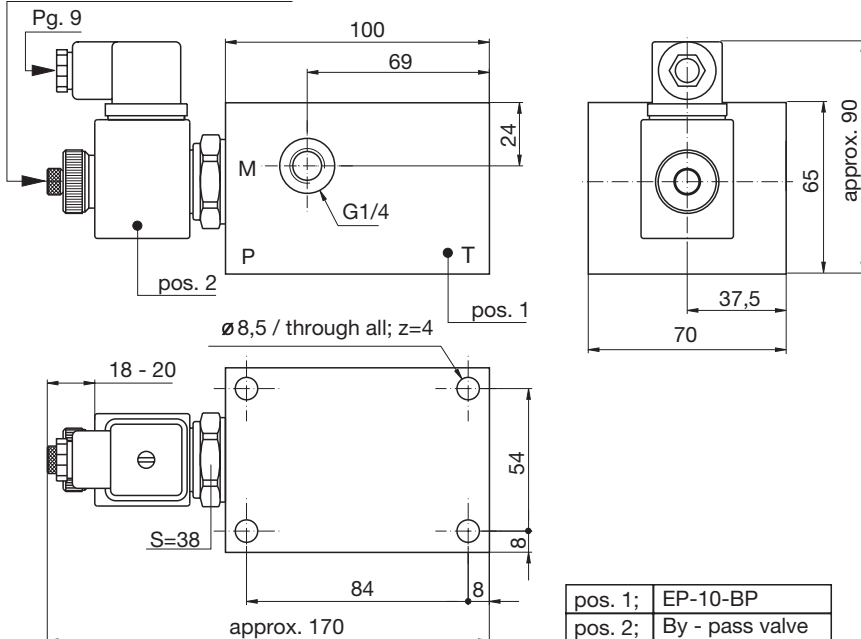
For cartridge valve details see page 15.5.7

**Dimensions [mm] for EP-10-O and EP-10-SC**



**Dimensions [mm] for EP-10-BP**

Knob style manual override

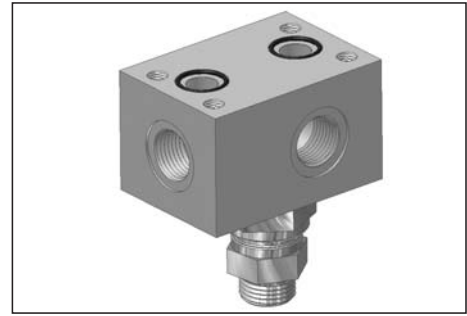


**Note:**

For cartridge valve details see page 15.5.7

## BASE BLOCK type BO

- NS 6, 10
- to 350 bar
- Base block for modular connection plates type EP
- Very low pressure drop due to advanced design and large drilling diameters



BO - 6 - 1

### Description

Base blocks are used for transmission of hydraulic fluid from its source to modular connection plates. Their design allows many different combinations and mounting positions. Two inlet ports allow bottom and side connection. Pressure relief valve is included as protection of the system from overpressure and check valve is used to protect the oil flow back to its source.

### Ordering code



- Base block
- Nominal size
- Symbol
- Check valve
- Pressure relief valve (only for BO-...-2-...)
- Pressure relief valve setting range
- Special requirements to be briefly specified

### Nominal size

- NS 6 = 6  
P + T = G1/2 ; spotface  $\varnothing 34$
- NS 10 = 10  
P + T = G1 ; spotface  $\varnothing 47$

### Pressure relief valve setting range

- to 400 bar = 400
- to 200 bar = 200
- to 100 bar = 100

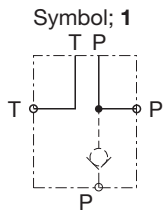
### Check valve

- Without check valve = no desig.
- With check valve = NV

### Important note:

When setting maximal system pressure do not exceed maximum operating pressure 350 bar!

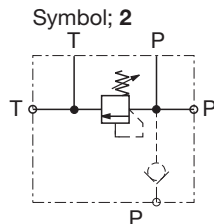
### Symbol



Base block without pressure relief valve

Weight [kg]:

BO-6-1	1,5
BO-10-1	3,2

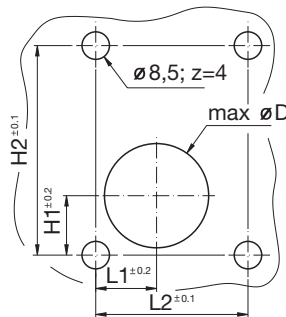


Base block with pressure relief valve

Weight [kg]:

BO-6-2	2,3
BO-10-2	3,8

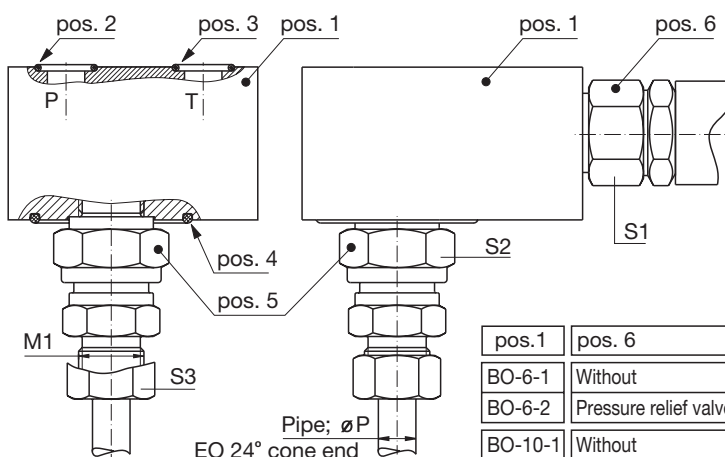
### Plate cut out



### Dimensions [mm]

	BO-6-1	BO-6-2	BO-10-1	BO-10-2
H1	25	22,5	27	27
H2	64	74	84	84
L1	20	25	27	27
L2	40	64	54	74
øD	44	44	58	58

### Assembly set for base blocks BO-...-1 and BO-...-2



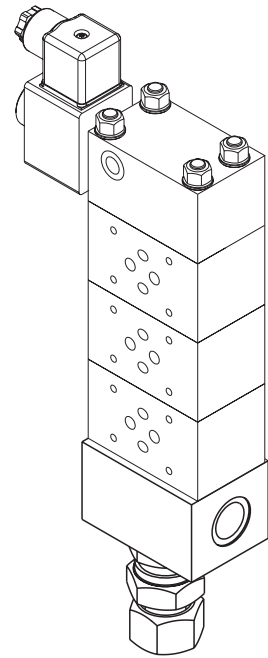
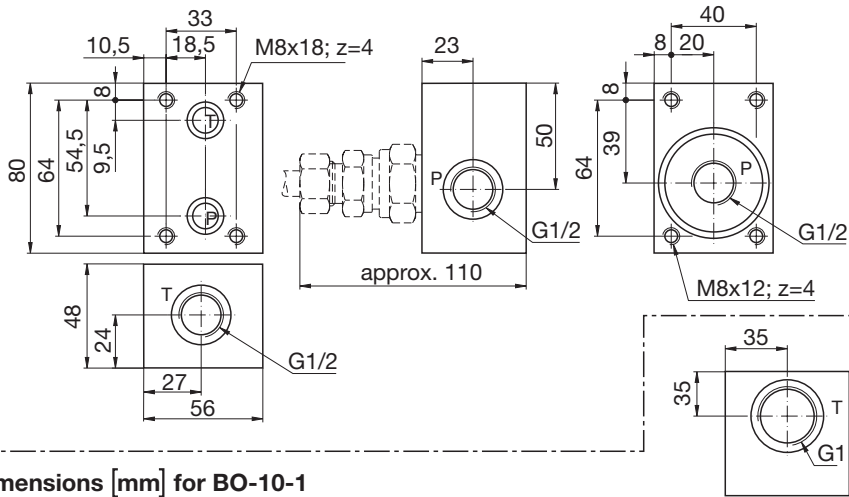
pos. 1	pos. 2	pos. 3
BO-6-1		
BO-6-2	O-ring $\varnothing 17,17 \times 1,78$	O-ring $\varnothing 17,17 \times 1,78$
BO-10-1		
BO-10-2	O-ring $\varnothing 18,72 \times 2,62$	O-ring $\varnothing 23,47 \times 2,62$
pos. 1	pos. 4	pos. 5
BO-6-1	O-ring $\varnothing 48 \times 2,5$	Check valve for NS 6 stacking
BO-6-2		
BO-10-1	O-ring $\varnothing 62 \times 2$	Check valve for NS 10 stacking
BO-10-2		

pos. 1	pos. 6	S1 [mm]	S2 [mm]	S3 [mm]	øP [mm]	M1 [mm]
BO-6-1	Without	Without	36	32	15	M22x1,5
BO-6-2	Pressure relief valve VVP-6	32				
BO-10-1	Without	Without	50	46	25	M36x2
BO-10-2	Pressure relief valve VVP-10	36				

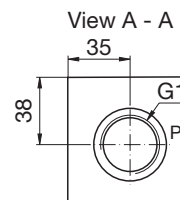
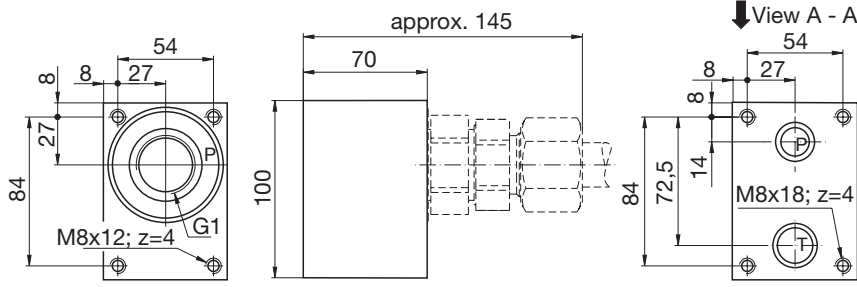
Functional nut and cutting ring are included in delivery!



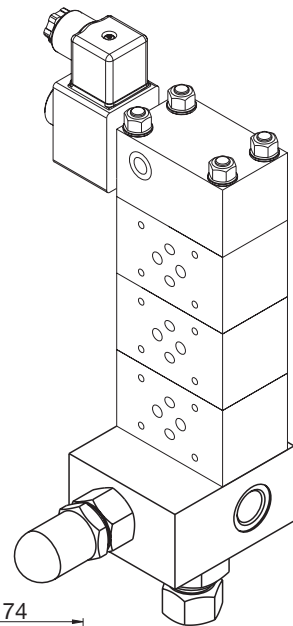
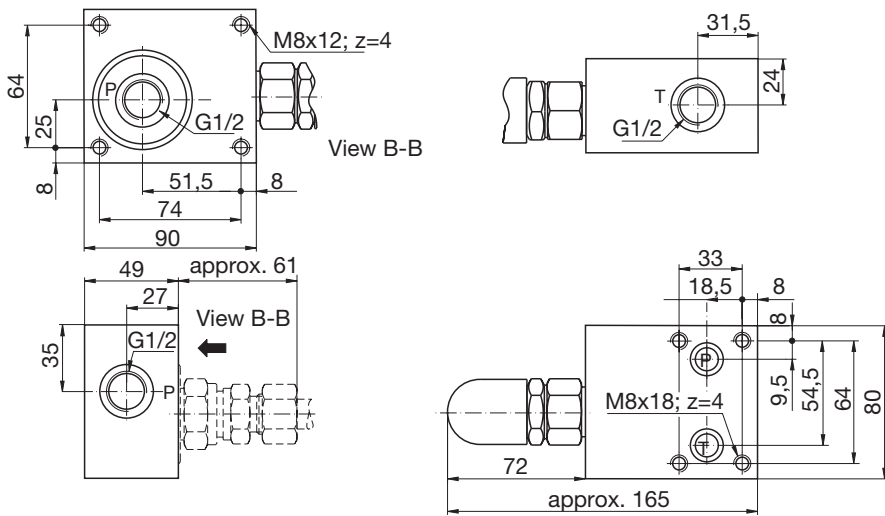
**Dimensions [mm] for BO-6-1**



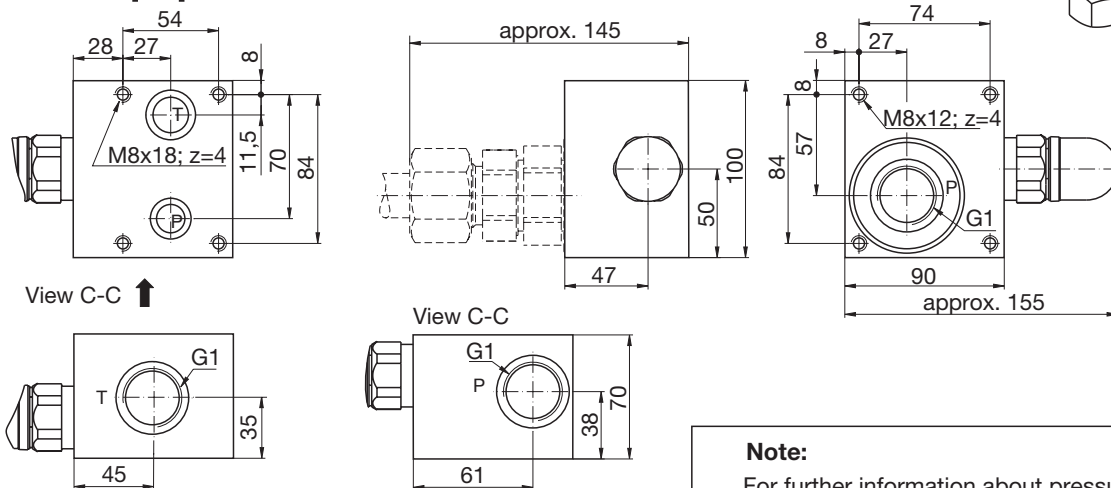
**Dimensions [mm] for BO-10-1**



**Dimensions [mm] for BO-6-2**



**Dimensions [mm] for BO-10-2**



**Note:**

For further information about pressure relief and check valves see page 15.5.7

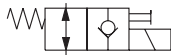
## INCLUDED COMPONENTS in EV stacking elements

### By - pass valves

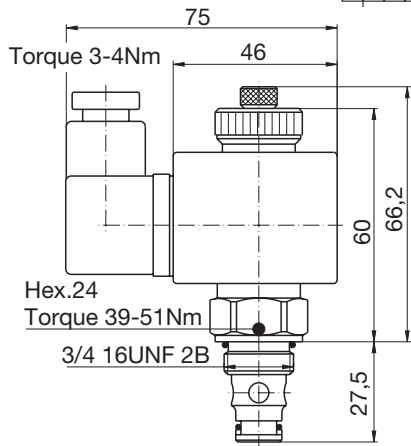
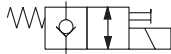
for NS 6 stacking

Maximum pressure: 350 bar  
 Rated flow: 30 l/min  
 Weight: 0,13 kg

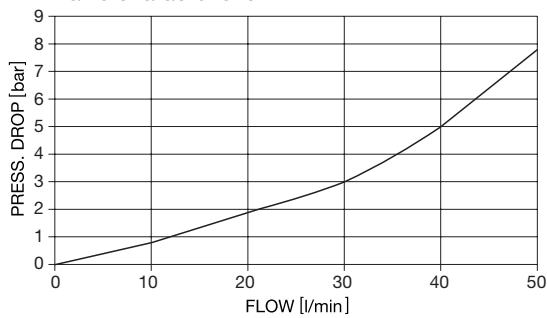
Normally open valve



Normally closed valve



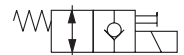
Valve characteristic



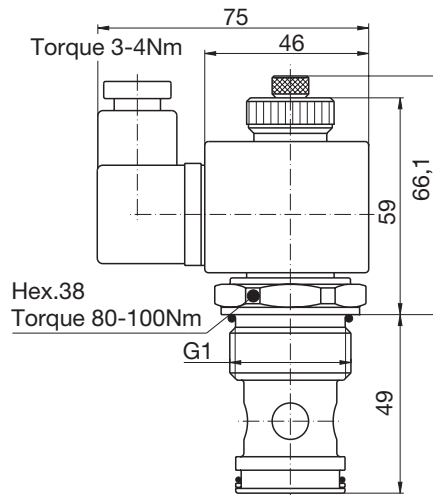
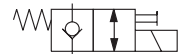
for NS 10 stacking

Maximum pressure: 350 bar  
 Rated flow: 150 l/min  
 Weight: 0,35 kg

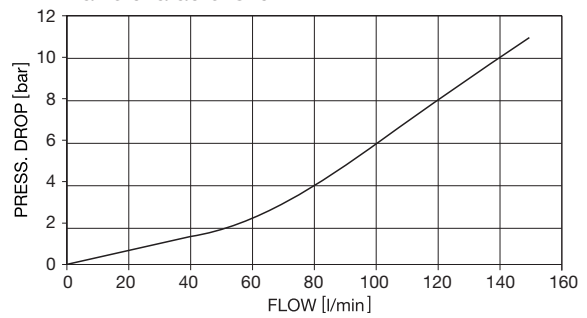
Normally open valve



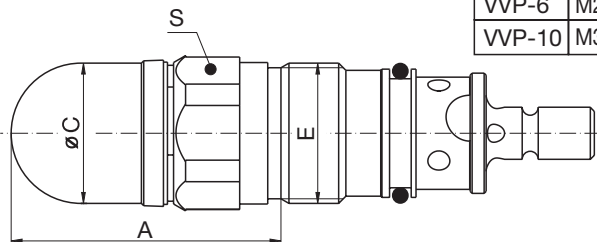
Normally closed valve



Valve characteristic

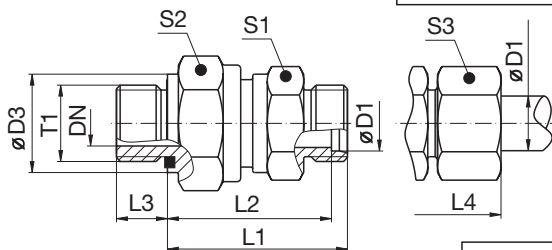


### Pressure relief valves



	E	A [mm]	C [mm]	S [mm]	Weight [kg]	Tight. torque [Nm]
VVP-6	M28x1,5	72	34	32	0,5	80
VVP-10	M35x1,5	68	38	36	0,6	140

### Check valves



	D1 [mm]	T1	DN [mm]	L1 [mm]	L2 [mm]	L3 [mm]	L4 [mm]
for NS 6 stacking	15	G1/2	11,5	49,5	42,5	14	57,5
for NS 10 stacking	25	G1	19	66,5	54,5	18	78,5

Maximum pressure: 400 bar  
 Cracking pressure: 1 bar

Functional nut and cutting ring are included in delivery.

	S1 [mm]	S2 [mm]	S3 [mm]	Weight [kg]	Tight. torque [Nm]
for NS 6 stacking	27	32	27	0,186	85
for NS 10 stacking	46	50	46	0,647	260

### Note:

For further information about included components contact Kladivar d.d.

## ADDITIONAL COMPONENTS for EV stacking (not included in EV stacking elements)

### Fixing screws

Ordering code

**SET - EV**

Nominal size

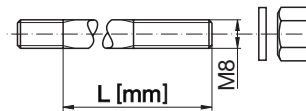
Number of elements

### Nominal size

NS 6 = 6

NS 10 = 10

Number of elements	Screw length L [mm]	
	NS 6	NS 10
1	65	90
2	115	165
3	165	240
4	215	315
5	265	390
6	315	465
7	365	540
8	415	615



SET - EV consist of:

Screw: M8 DIN 835 10.9 4 pcs.  
Spring washer: A8 DIN 6798J 4 pcs.  
Nut: M8 DIN 6330 4 pcs.

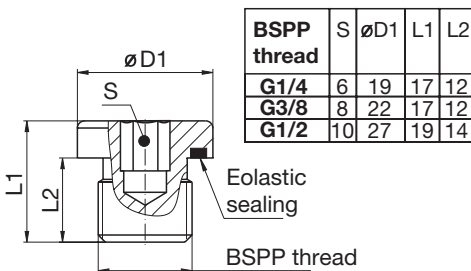
### Plugs, test points, thread reducers

Blanking plugs for ports

**VIJAK VSTI**

Blanking plug

BSPP thread



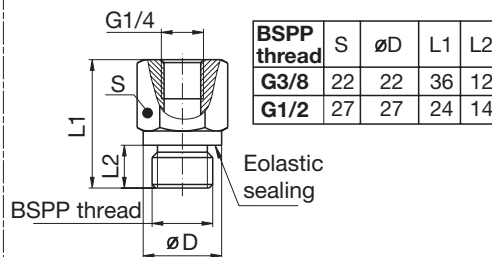
Thread reducers

**PRIKL RI** **1/4**

Thread reducers

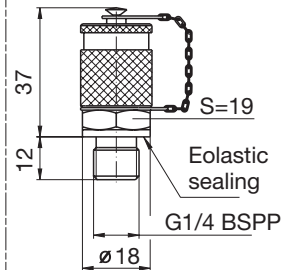
Male stud BSPP thread

Female thread BSPP G1/4



Test point with thread connection M16x2

**PRIKL MER**  
**EMA3/1/4**



### Pressure gauges

- Bourdon tube pressure gauge, size 63 mm
- Liquid filling and forged brass case
- Accuracy class according to EN 837;  $\pm 1,6\%$
- Threaded connection; G1/4 BSPP

Ordering code

**MAN. 01. 10.3** **63** **1/4G**

Pressure gauge

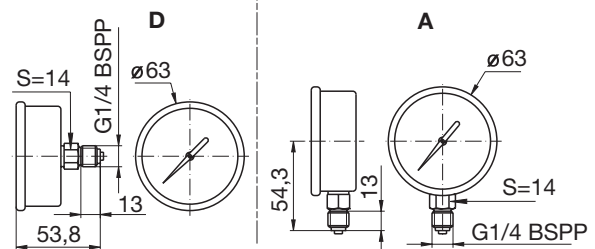
Pressure gauge case type

Pressure gauge nominal size

Pressure range

Threaded connection

### Pressure gauge case type



### Pressure range

0 to 60 bar	=	0 - 60
0 to 100 bar	=	0 - 100
0 to 160 bar	=	0 - 160
0 to 250 bar	=	0 - 250
0 to 400 bar	=	0 - 400

### Gauge isolator valves

- Used to protect pressure gauge
- Suitable for pressure up to 400 bar

Ordering code

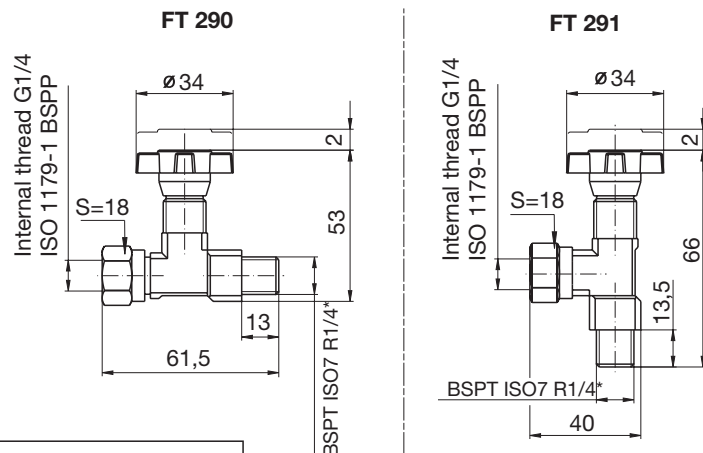
**PIPA MAN.**

Gauge isolator valve

Gauge isolator valve type

\* .... Tightness can only be achieved by liquid or plastic sealing aids.

### Gauge isolator valve type



### Note:

For further information about additional components contact Kladivar d.d.

**MINI HYDRAULIC POWER PACKS, type MHS**

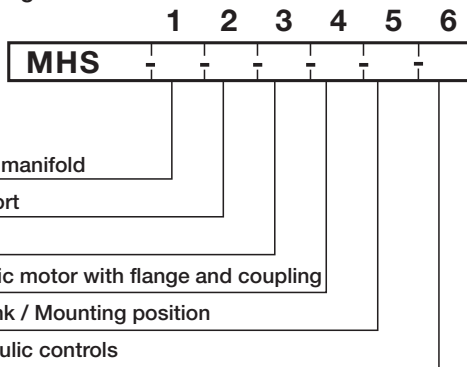
Compact modular design allows wide spectrum of different applications with minimal power pack dimensions. Mini hydraulic power packs are assembled from standard components that are kept on stock. Therefore quick delivery and competitive price is assured.

Most often applications are: tippers, loading truck sides, work tables, lifting scaffolding, elevators, presses, small industrial machines, etc.

Main components are: basic manifold with relief valve and check valve, electric motor, pump with suction strainer, tank and hydraulic controls in five different designs.

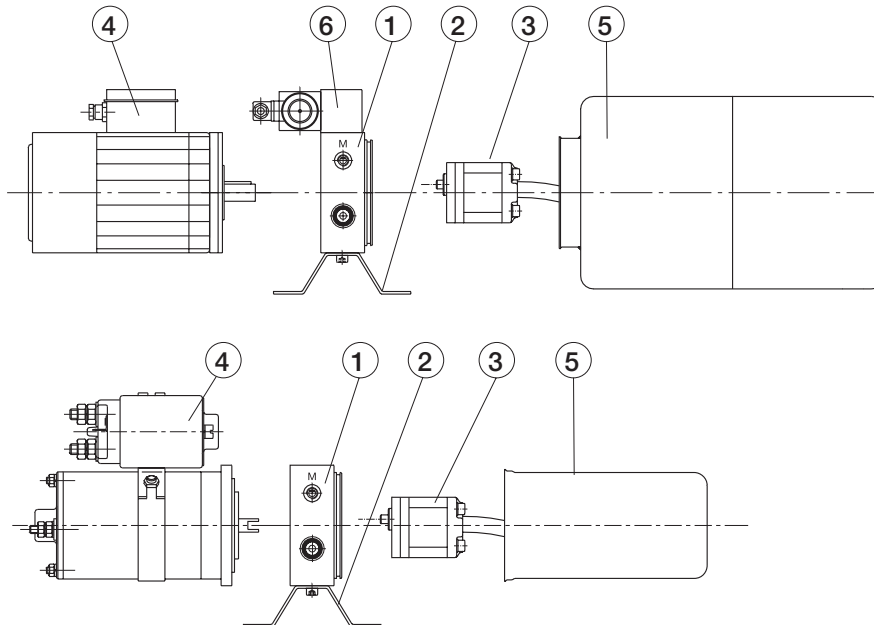


**Ordering code**

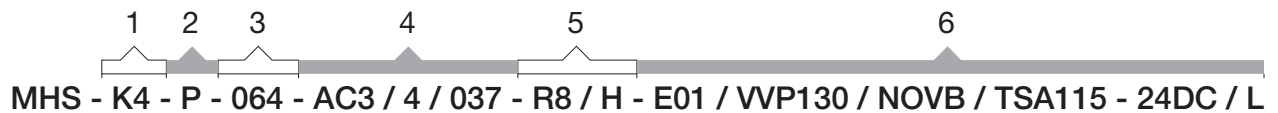


**Technical data**

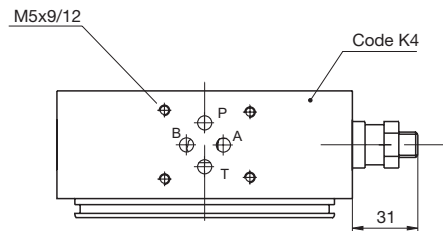
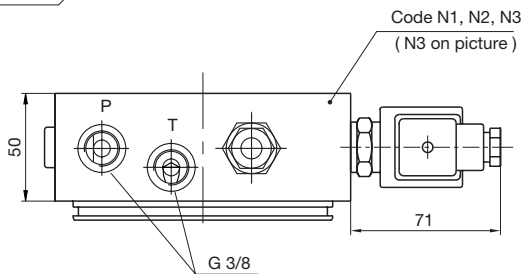
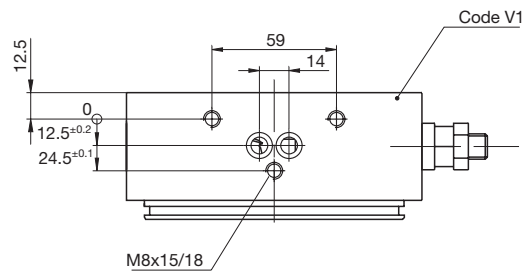
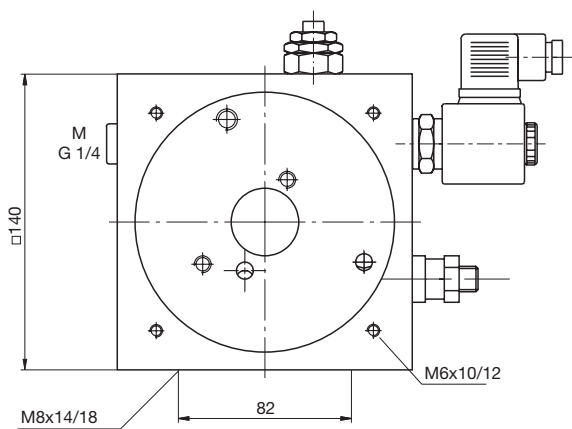
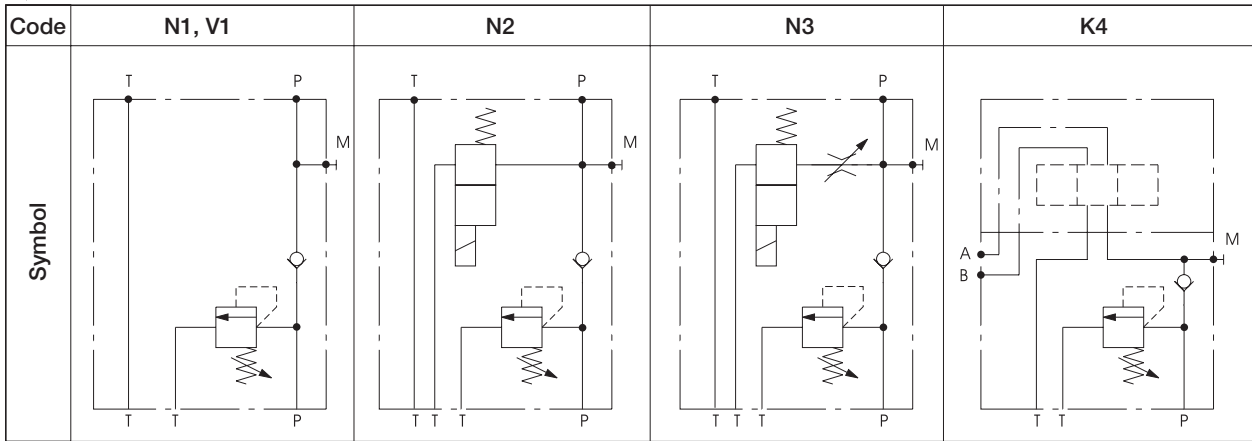
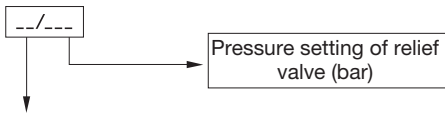
Mounting position	horizontal, vertical
Fixing	thread 2xM8 or support
Threaded connections	G 3/8
Pump type	gear pump
Pump displacement	0,16 - 7,9 ccm/rev
Working pressure	see page 30.1.2 (3. PUMP)
Fluid type	mineral oil HL or HLP (DIN 51524); quick degradable oil HETG, HESS or HEPG (VDMA 24568 and ISO 15380)
Electric motor	AC or DC
Supply voltage	12V DC, 24 DC, 230V AC, 230/400V AC
Motor power	AC to 3kW, DC to 2kW



**Order specification example:**



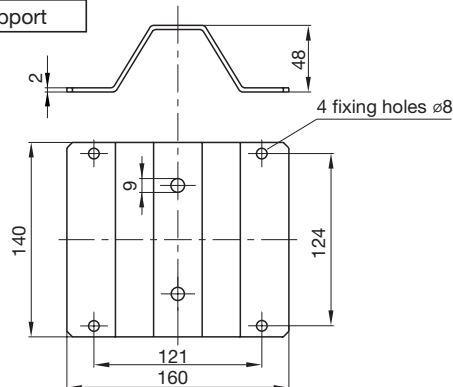
## 1. BASIC MANIFOLD



## 2. SUPPORT



Code	Note
P	Support as on drawing
N	Without support



## 3. PUMP

Note: - Built in 125 µm filter  
- Left rotation pump



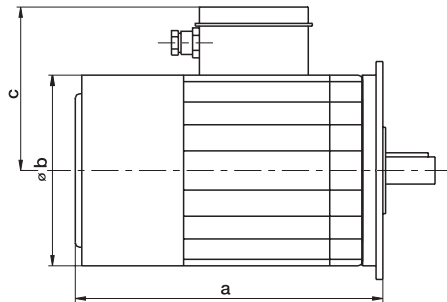
Code	Displacement cm <sup>3</sup>	Max. operating press. (bar)	Max. speed (rpm)
016	0,16	260	9000
024	0,24	260	9000
045	0,45	280	9000
056	0,56	280	9000
075	0,75	280	9000
092	0,92	280	6000
126	1,26	280	6000
148	1,48	280	6000
228	2,28	210	5000
250	2,50	275	4000
330	3,30	275	4000
360	3,60	250	4000
430	4,30	210	3500
480	4,80	160	3000
580	5,80	160	3000
620	6,20	150	3000
790	7,90	120	2500

#### 4. ELECTRIC MOTOR WITH FLANGE AND COUPLING

##### AC motors

---/---/---

Code	No. of phases	Code	min <sup>-1</sup>
AC3	3	4	1500
AC1	1	2	3000

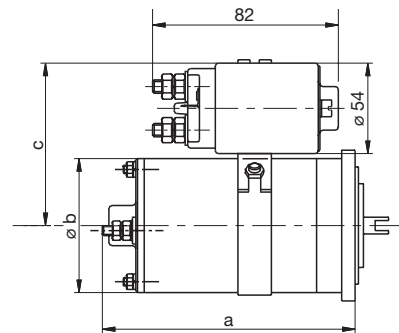


Code = P (kW)				Size (IEC)	Dimensions		
AC 3/4	AC 3/2	AC 1/4	AC 1/2		a	b	c
/	0,18	/	/	63	204	125	95
0,18	0,25	/	/	71	233	148	115
0,25	0,37	0,18	0,25				
0,37	0,55	0,25	0,37	80	249	170	126
0,55	0,75	0,37	0,55				
0,75	1,1	0,55	0,75	90	262	185	142
1,1	1,5	0,75	1,1				
1,5	2,2	1,1	1,5	100	316	210	155
2,2	3	1,5	2,2				
3	/	/	/				

##### Note:

- \* AC motors - 50 Hz; 230/400V - three phases; 230V - one phase.
- \* Starting torque of single phase motors is approx. 50% lower than nominal torque.
- \* Dimension a includes special flange for fixing electric motor to basic manifold.

Code = X; Power to be selected by supplier.



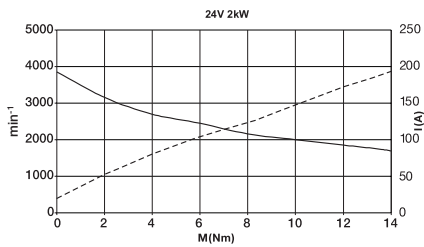
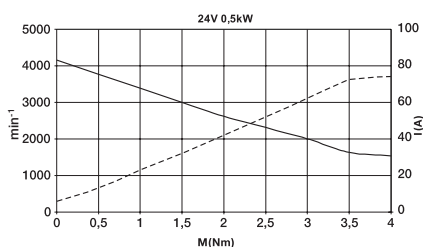
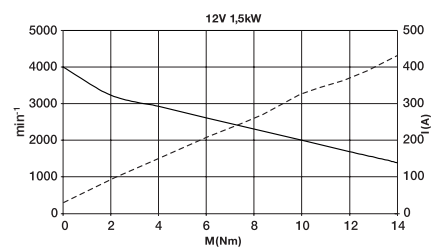
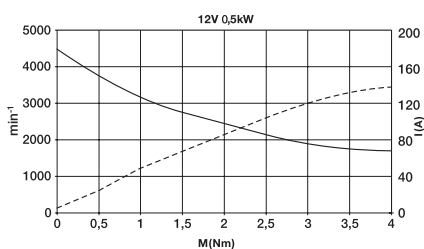
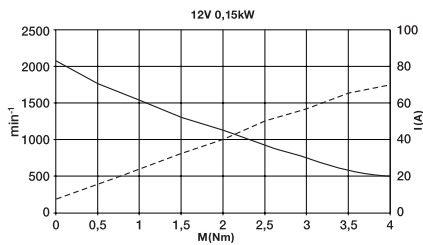
##### DC motors

---/---/---

Code	U(V)	Code	Relay
DC12	12	R	with
DC24	24	N	without

Code = P (kW)		Dimensions		
DC12	DC24	a	b	c
0,15		158	80	102
0,5	0,5			
1,5	2	188	112	118

##### Technical data



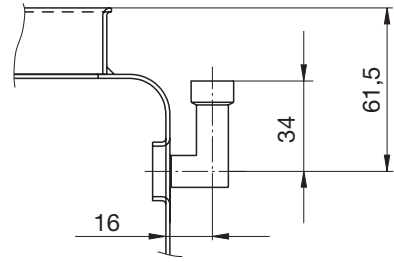
min<sup>-1</sup> ———  
I(A) - - - - -

### 5. OIL TANK / MOUNTING POSITION

---/---

Code	Mount. position
H	Horizontal
V	Vertical

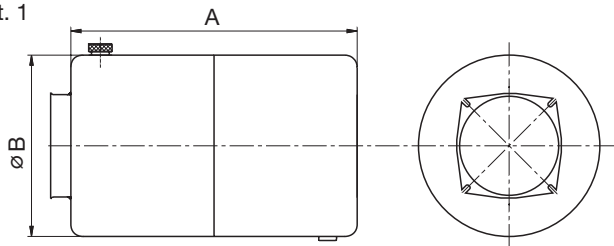
**Note:** Vertical mounting position is not available for R1.5, R2.5, and RC type.



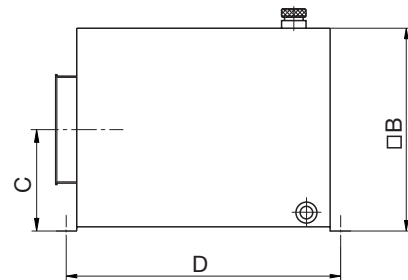
Tank inlet for vertical position.

Code	Vol. (l)	A	B	C	D	E	Pict.
R1,5	1,5	150	130	/	/	/	1
R2,5	2,5	235		/	/	/	1
R5	5	295	174	/	/	/	1
R8	8	419		/	/	/	1
R10	10	262	224	/	/	/	1
R12	12	380		/	/	/	1
RV10	10	280	200	100	305	160	2
RV16	16	300	240	110	325	180	2
RC6	6	280	200	206	210	130	3
RC10	10	340	247	250	250	170	3
RC16	16	368	290	275	270	192	3
RC25	25	490	340	317	326	176	3

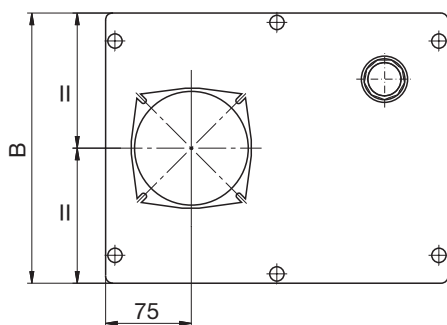
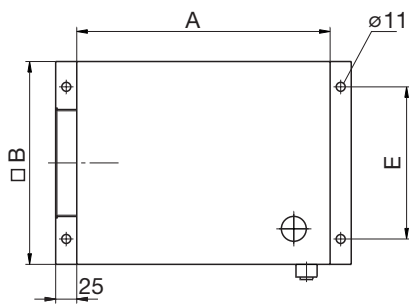
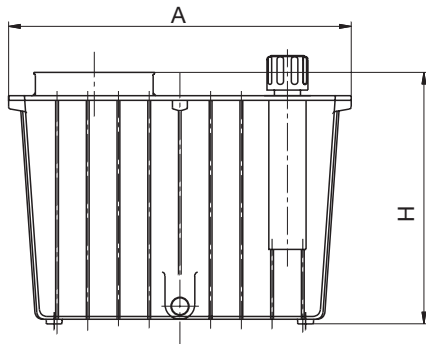
Pict. 1



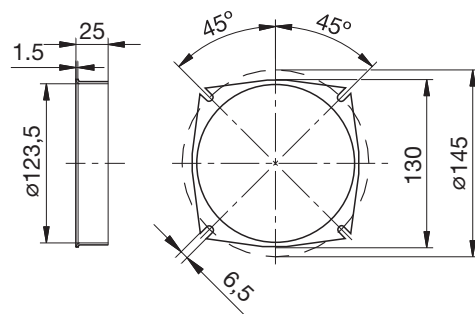
Pict. 2



Pict. 3

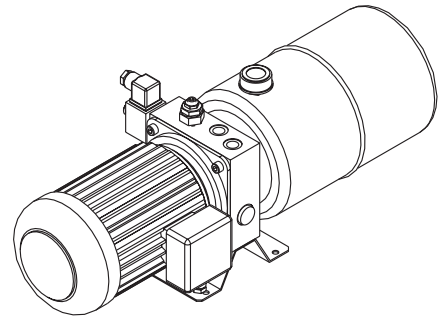
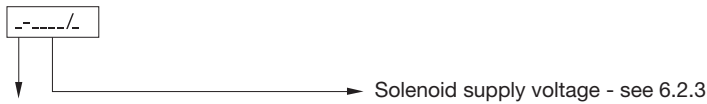


Flange

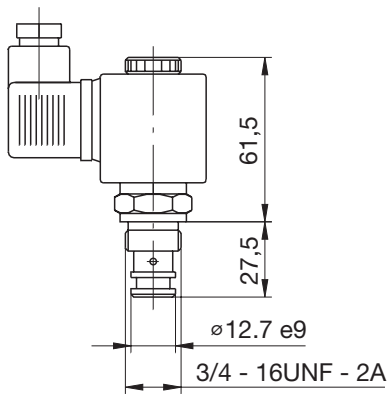


## 6. HYDRAULIC CONTROLS

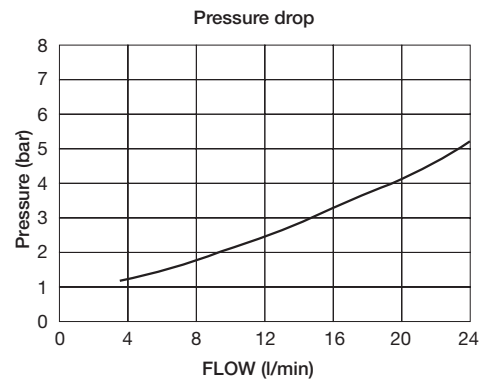
### 6.1 HYDRAULIC CONTROLS FOR BASIC MANIFOLDS N2 AND N3



Code	Symbol	Code	Symbol
A		B	
C		D	



Max. operating pressure 350 bar  
flow rate 30 l/min



## 6.2 HYDRAULIC CONTROLS FOR BASIC MANIFOLDS K4 AND V1

### 6.2.1 DIRECTIONAL CONTROL VALVES

----/ Add. components - Solenoid supply voltage

Code	Symbol	Code	Symbol
E51A		R51A	
E02A		R02A	
E01		R01	
E02		R02	
E03		R03	
E06		R06	

Code	Symbol
BVA	
BVB	

Note: BVA and BVB are by-pass valves for basic manifold V1.



## 6.2.2 ADDITIONAL COMPONENTS

Directional control valve /----- - Solenoid supply voltage ( see 6.2.3 )

Note: X, Y = pressure setting of component (bar); all components are optional

Other components							
Check valve		Throttle / check valve		Pressure relief valve		Pressure switch	
Code	Symbol Description	Code	Symbol Description	Code	Symbol Description	Code	Connected to
NOVD	 VP-NOV-6-D	NDV	 VP-NDV-6-P	VWPx	 VP-RT-6-EP	One switch	
						TSAx	A
						TSBx	B
NOVA	 VP-NOV-6-AE	NDV	 VP-NDV-6-P	VVAx	 VP-RT-6-AE	Two switches	
						TSAxBy	A, B
						TSAxPy	A, P
NOVB	 VP-NOV-6-EB	NDV	 VP-NDV-6-P	VVBx	 VP-RT-6-EB	TSBxPy	B, P
						TSxAy	A, A
						TSPxPy	P, P
						Symbol	
				VVAxBy	 VP-RT-6-D		

Note:  
All other technical details of components are presented in Kladivar's catalogue "Hydraulics".

## 6.2.3 SOLENOID SUPPLY VOLTAGE

Directional control valve / Add. components - -----/

Code	Supply voltage
12DC	12V DC
24DC	24V DC
110AC	110V AC
230AC	230V AC

Code	Signal lamp
L	with
N	without

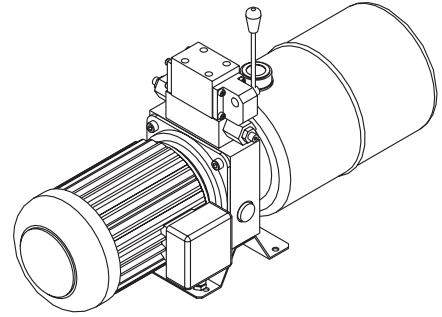
Note:  
Plug-in connectors are enclosed.

### BASIC MANIFOLD K4

Vertical stacking of one directional control valve with additional componets.

#### Ordering code

Directional control valve (1.1) / Additional components (1.2/1.3...) - Solenoid supply voltage.



#### Example for K4

1	1.1	E01	1.2	VVP130	1.3	NOVB	1.4	TSA115	1.5	
Pos.	Directional control valve		Additional components							

#### Ordering example:

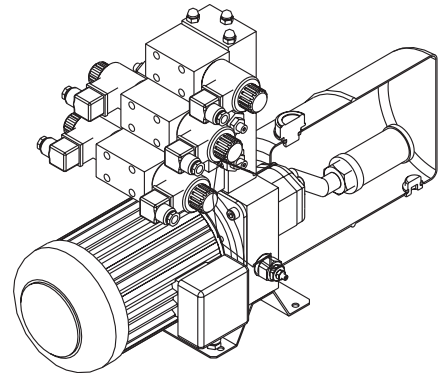
E01 / VVP130 / NOVB / TSA115 / ... - 24DC / L

### BASIC MANIFOLD V1

Horizontal and vertical stacking up to four directional control valves with additional components.

#### Ordering code

Directional control valve (1.1) / Additional components (1.2/1.3...) -  
Directional control valve (2.1) / Additional components (2.2/2.3...) -  
Solenoid supply voltage.



#### Example for V1

4	4.1	...	4.2	...	4.3	...	4.4	...	4.5	...
3	3.1	...	3.2	...	3.3	...	3.4	...	3.5	...
1	2.1	E03	2.2	VVP130	2.3	NOVB	2.4	...	2.5	...
1	1.1	E01	1.2	VVP130	1.3	NOVB	1.4	TSA115	1.5	...
Pos.	Directional control valve		Additional components							

Note: First row (pos. 1) is nearest to the basic manifold.

#### Ordering example:

E01 / VVP130 / NOVB / TSA115 / ... - E03 / VVP130 / NOVB / ...-... / ... / ... / ... -24DC / N

### 7. Other requirements

Other requirements should be described in writing, hydraulic circuit or drawing.

KLADIVAR



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