



# DIRECTIONAL CONTROL VALVES



## PKV. VALVES.

### DIRECTIONAL CONTROL VALVES



#### MECHANICALLY OPERATED

2/2 way directional valves KVC (NG 6)  
2/2 way directional valves KVC-NV (NG 6)  
4/2, 4/3 way directional valves KV (NG 6, 10)

5

5

7

9

Mechanically operated



#### HYDRAULICALLY OPERATED (AUTOMATIC)

4/2 way automatic directional valves PKV (NG 6, 10)  
4/2 way automatic directional valves PKV-...-T (NG 6)  
4/2, 4/3 way directional valves KV (NG 6, 10)

17

17

21

25

Hydraulically operated



#### ELECTRICALLY OPERATED

2/2 way directional valves KV (NG 6) 29  
3/2 way directional valves KVC (NG 4) 33  
3/2 way directional valves KVC (NG 10) 37  
4/2, 4/3 way directional valve KV-5KO (NG 6) 40  
4/2, 4/3 way directional valve KV-5KO (NG 10) 46  
4/2, 4/3 way directional valves type KV (NS 16) 53  
4/2, 4/3 way directional valve KV-3KO (NG 6) 59  
4/2, 4/3 way directional proportional valve KVP (NG 6) 65  
4/2, 4/3 way bankable directional valves KVM (NG 6) 69  
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Vertical stacking for KVM valves 77  
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Vertical stacking on valves KVM with standard sandwich valves to ISO 4401 (NG 6) 91  
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Inlet plate OB-KVM-6 (NG 6) 95  
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Fixing elements for mounting 103  
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6/2 way directional valves KV (NG 10) 109  
6/2 way directional valves KV (NG 16) 113  
6/2 way directional valves KV-6K (NG 6) 117  
6/2 way directional valves KVH (NG 6) 121  
6/2 way directional valves KVH (NG 10) 125  
6/3 Way directional valves KV (NG 4) 129  
8/3 way directional valves KV (NG 6) 131

29

29

33

37

40

46

53

59

65

69

71

77

81

83

87

91

93

95

101

103

105

109

113

117

121

125

129

131

Electrically operated





## 2/2 WAY DIRECTIONAL VALVES KVC (NG 6)

- NG 6
- Up to 250 bar [3 625 PSI]
- Up to 35 L/min [9.2 GPM]

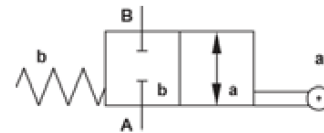


KVC-2/2-K

### Features

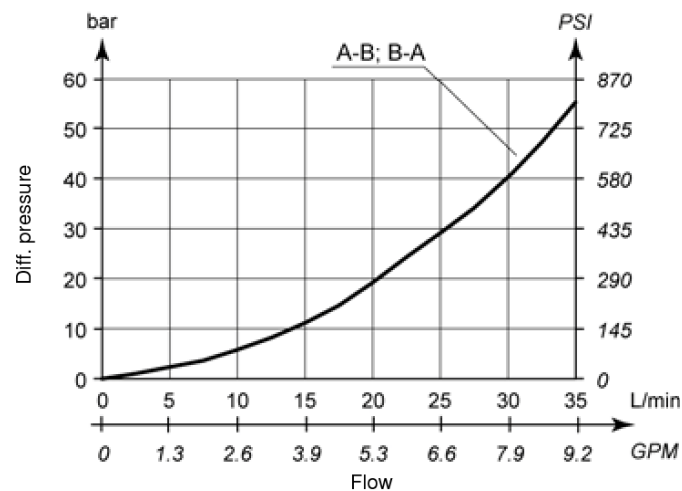
<b>Size</b>		<b>6</b>
<b>Flow rate</b>	L/min [GPM]	35 [9.2]
<b>Operating pressure</b>	bar [PSI]	250 [3 625]
<b>Viscosity range</b>	mm <sup>2</sup> /s [SUS]	15 to 380 [69.5 to 1 760]
<b>Oil temperature range</b>	°C [°F]	-20 to +70 [-4 to 158]
<b>Filtration</b>	ISO 4406-1999	19/17/14
<b>Mass</b>	kg [lb]	1,2 [2.6]
<b>Seal type</b>	NBR seals for mineral oil HL, HLP, to DIN 51524	

### Hydraulic symbol



### ΔP-Q Performance curves

Measured at 50 °C [122 °F] and viscosity of 32 mm<sup>2</sup>/s [148 SUS].





## 2/2 WAY DIRECTIONAL VALVES KVC-NV (NG 6)

- NG 6
- Up to 210 bar [3 045 PSI]
- Up to 40 L/min [10.5 GPM]



KVC-2/2-NV-T

### Features

<b>Size</b>		<b>6</b>
<b>Flow rate</b>	L/min [GPM]	40 [10.5]
<b>Operating pressure</b>	bar [PSI]	210 [3 045]
<b>Viscosity range</b>	mm <sup>2</sup> /s [SUS]	15 to 380 [69.5 to 1 760]
<b>Oil temperature range</b>	°C [°F]	-20 to +70[-4 to 158]
<b>Filtration</b>	ISO 4406-1999	19/17/14
<b>Mass</b>	kg [lb]	1,2 [2.6]
<b>Seal type</b>	NBR seals for mineral oil HL, HLP, to DIN 51524	

### Hydraulic symbol

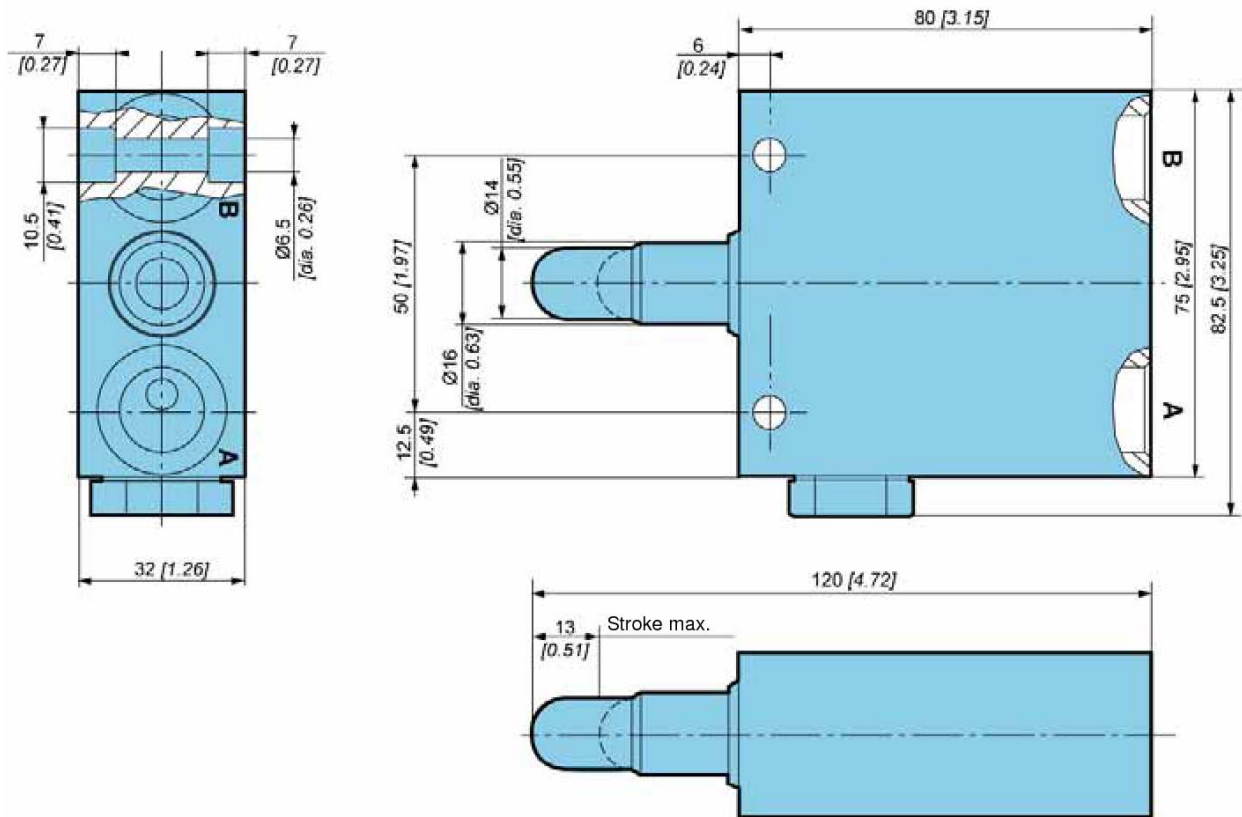


### ΔP-Q Performance curves

Measured at 50 °C [122 °F] and viscosity of 32 mm<sup>2</sup>/s [148 SUS].



## Dimensions



## Model code

K V C - 2 / 2 - N V - T -  - \*

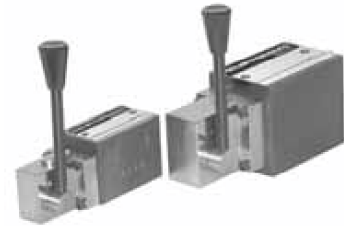
### Threaded connections

M18x1,5	No designation
G3/8	3/8

Special requirements to be briefly specified

## 4/2, 4/3 WAY DIRECTIONAL VALVES KV (NG6, 10)

- NG 6, 10
- Up to 350 bar [5 076 PSI]
- Up to 60 L/min [15.8 GPM] for NG 6
- Up to 100 L/min [26.4 GPM] for NG 10
- Connecting dimensions to ISO 4401.



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

### Operation

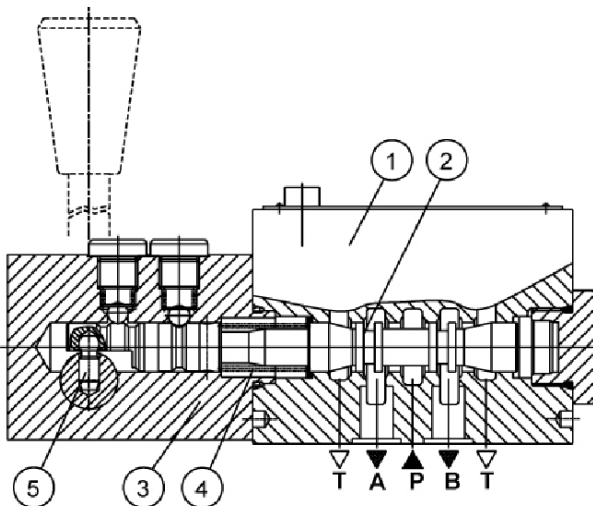
Directional valves type KV with direct mechanical operation by means of a lever control the direction of the hydraulic fluid medium flow.

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.

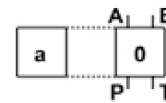
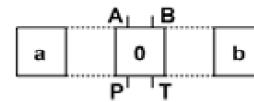
### There are two types of operation:

- 1/ 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).
- 2/ 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).



### Hydraulic symbols

Spool types



## Features

Size		6	10
Flow rate	L/min [GPM]	60 [15.8]	100 [26.4]
Operating pressure	P, A, B	bar [PSI]	
	T	bar [PSI]	
Viscosity range	mm <sup>2</sup> /s [SUS]	15 to 380 [69.5 to 1 760]	
Oil temperature range	°C [°F]	-20 to +70 [-4 to 158]	
Filtration	NAS 1638	8	
Mass	kg [lb]	2,05 [4.52]	5,23 [11.53]
Mounting position		Optional	

## Dimensions



3. Control mechanism on side "a"  
4/3 valves
- 4/2 valves, spool types 51A
6. Fixing screws 4 pcs M5x30 to ISO 4762-10.9  
(by special order).  
Required tightening torque Md = 9 Nm.
7. O-ring 9.25x1.78
8. Valve cap.
9. Nameplate.

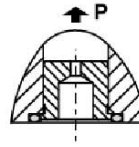
3. Control mechanism on side "a"  
4/3 valves
- 4/2 valves, spool types 51A
6. Fixing screws 4 pcs M6x60 to ISO 4762-10.9  
(by special order).  
Required tightening torque Md = 15 Nm.
7. O-ring 12.42x1.78
8. Valve cap.
9. Nameplate.

Required quality of the mating surface.



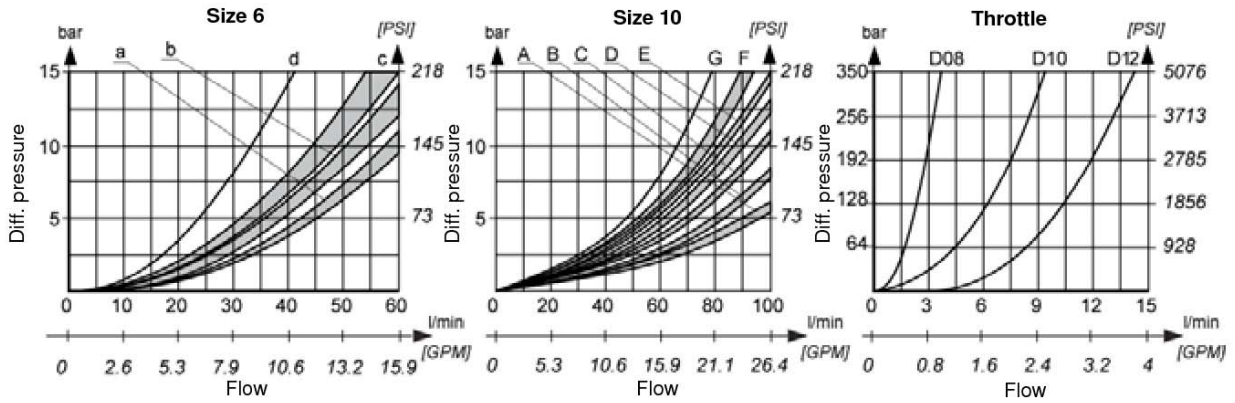
**Cartridge throttle**

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



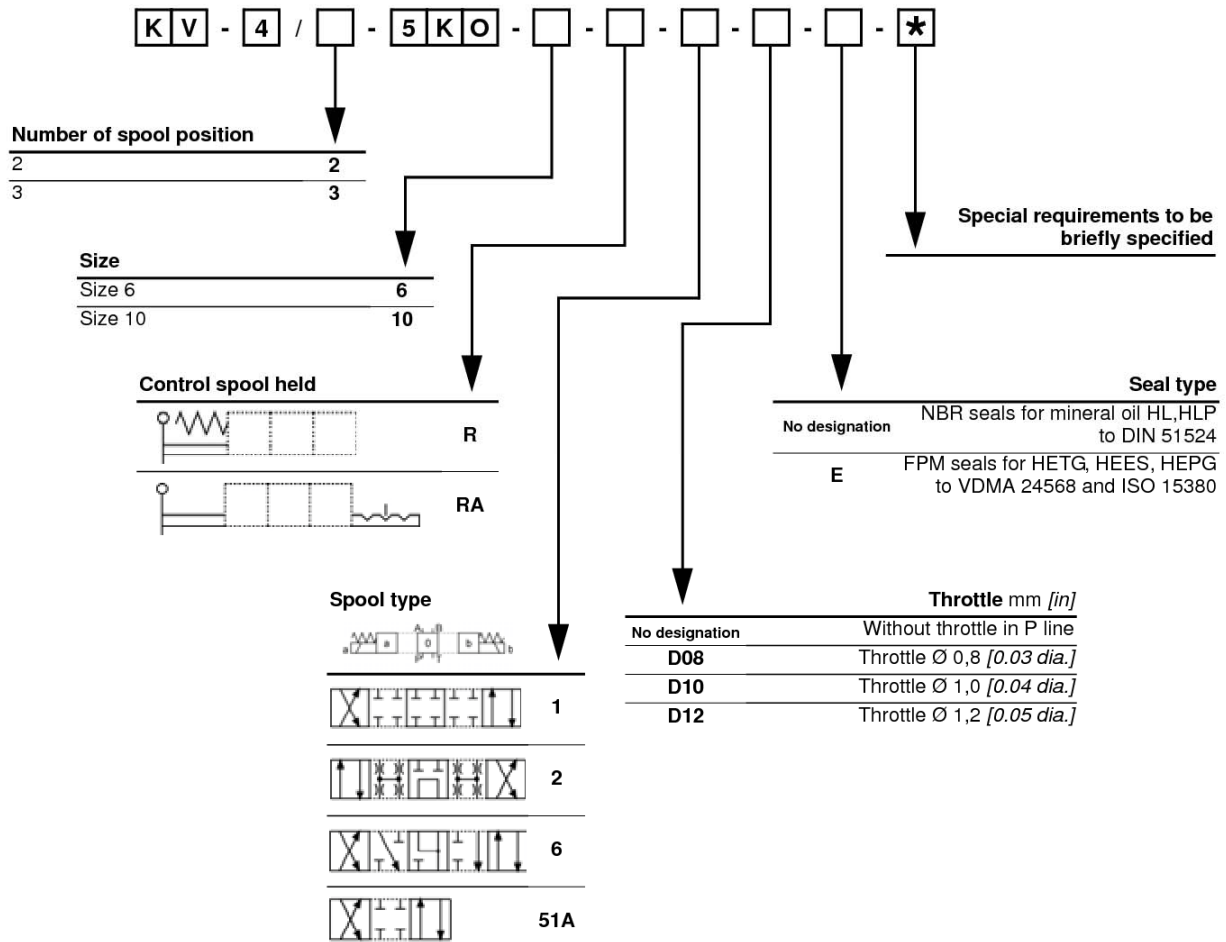
**ΔP-Q Performance curves**

Measured at 50°C [122°F] and viscosity of 32 mm<sup>2</sup>/s [148 SUS].



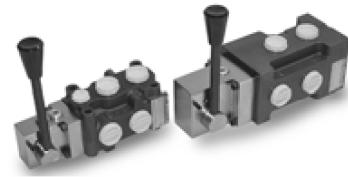
Spool	P-A	P-B	A-T	B-T	P-T
1	b,D	b,D	c,B	c,C	-
2	c,B	c,B	c,A	c,A	d,G
6	b,E	b,E	a,B	a,B	-
51A	c,D	b,D	c,C	a,B	-

**Model code**



## 6/2 WAY DIRECTIONAL VALVES KV

- NG 6, 10
- Up to 350 bar [5 076 PSI]
- Up to 60 L/min [15.8 GPM] for NG 6
- Up to 120 L/min [31.7 GPM] for NG 10
- Threaded connections to ISO 9974 (Metric), ISO 1179 (BSPP/Gas).



KV-6/2-6-R..., KV-6/2-10-R...

### Operation

Directional valves type KV with direct mechanical operation by means of a lever 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.

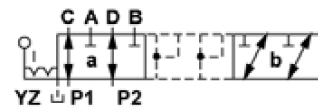
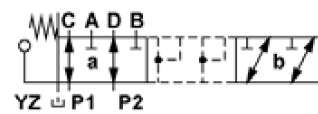
There are two types of operation:

1/ With control spool not held in the operating position (the control spool returns to position "a" on ceasing to apply force to the mechanism - type KV-...-R).

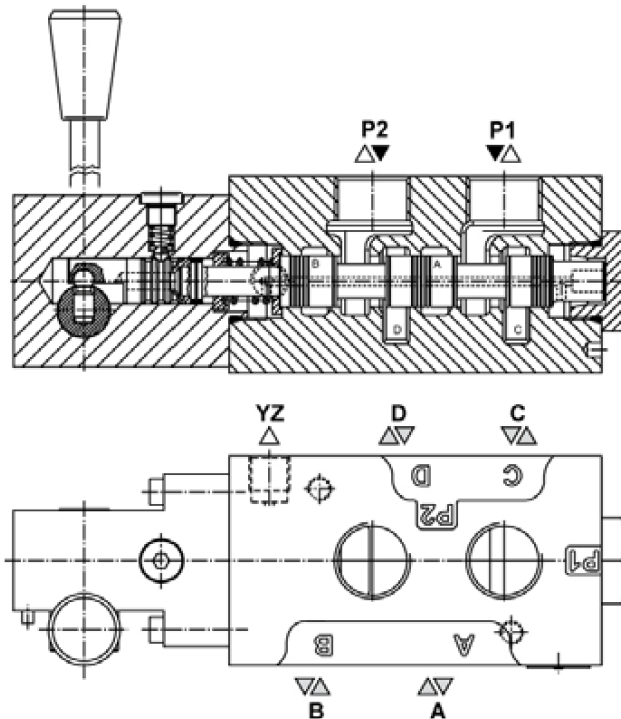
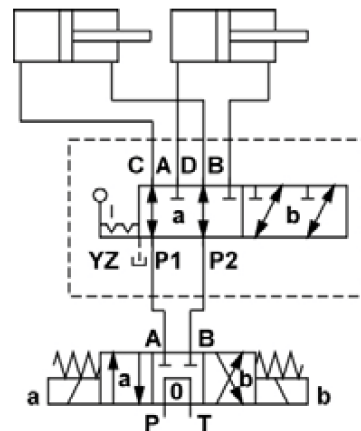
2/ With control spool held (detent) in the operating position (the control spool remains in the operating position on ceasing to apply force to the control mechanism lever - type KV-...-RA).

### Hydraulic symbols

Spool types



### Mounting example

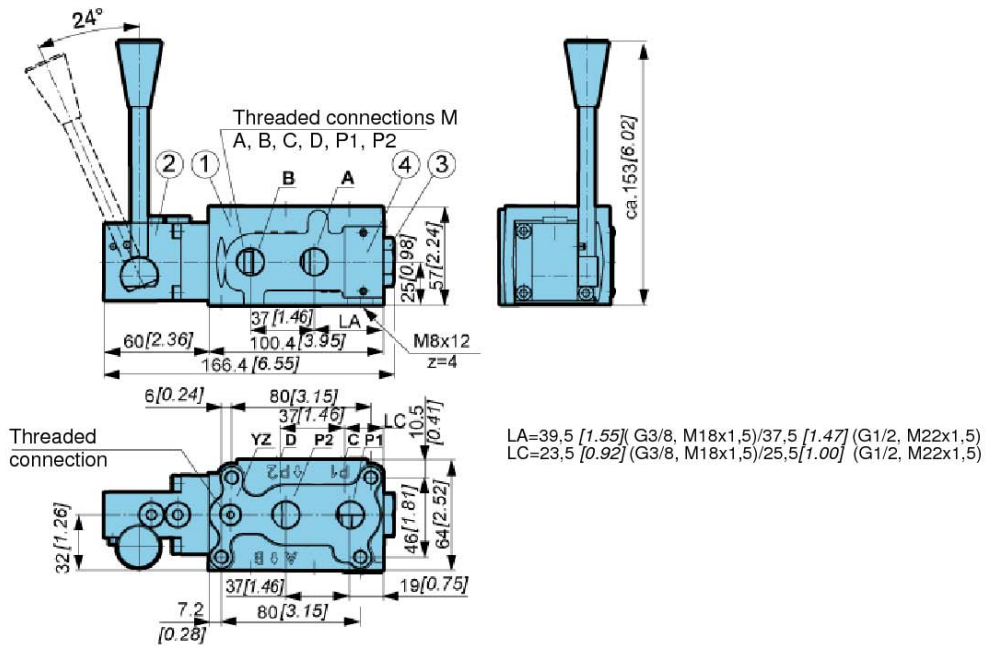


## Features

Size		6	10
<b>Flow rate</b>	L/min [GPM]	60 [15.8]	120 [31.7]
<b>Operating pressure</b>	With YZ	bar [PSI] 350 [5 076]	
	Without YZ	bar [PSI] 160 [2 320]	
<b>Viscosity range</b>	mm <sup>2</sup> /s [SUS]	15 to 380 [69,5 to 1 760]	
<b>Oil temperature range</b>	°C [°F]	-20 to +70 [-4 to 158]	
<b>Filtration</b>	NAS 1638	8	
<b>Mass</b>	kg [lb]	2,4 [5.3]	5,3 [11.7]
<b>Mounting position</b>		Optional	

Dimensions

Size 6



Size 10

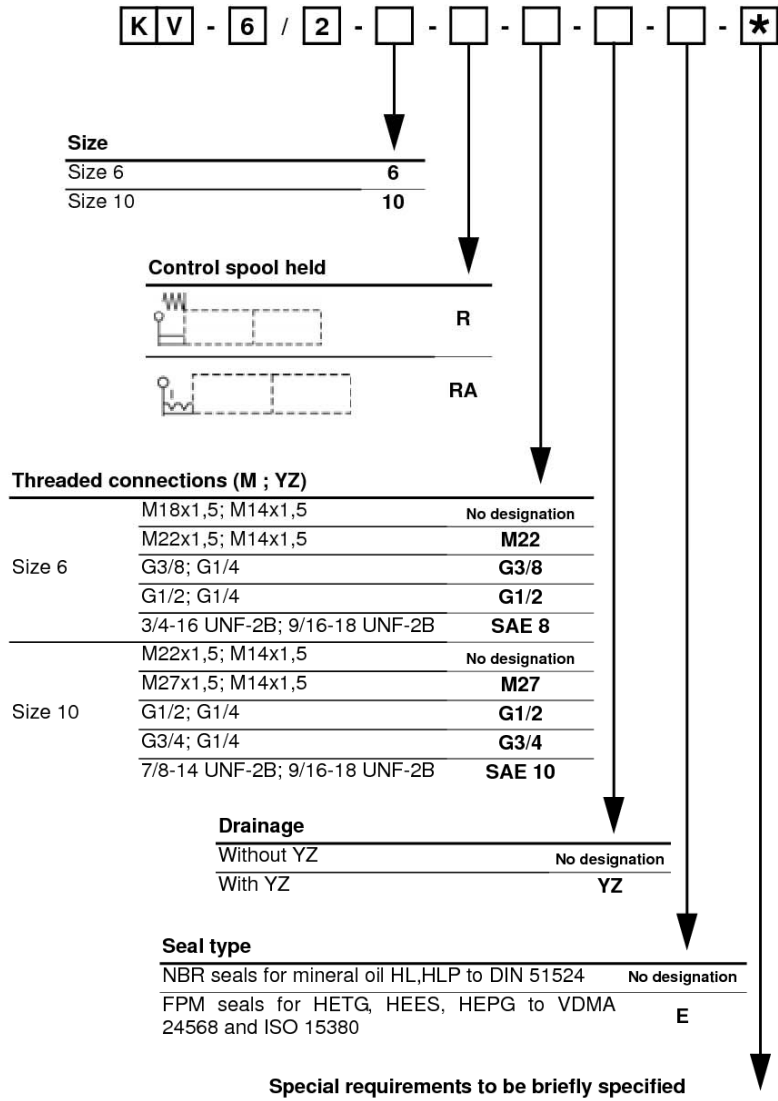


**ΔP-Q Performance curves**

Measured at 50°C [122°F] and viscosity of 32 mm<sup>2</sup>/s [148 SUS].



**Model code**



## 4/2 WAY AUTOMATIC DIRECTIONAL VALVES PKV (NG 6, 10)

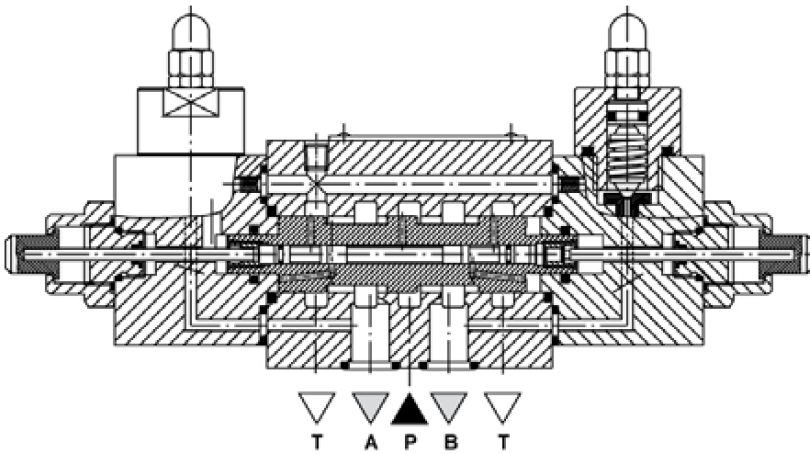
- NG 6, 10
- Up to 210 bar [3 045 PSI]
- Up to 60 L/min [15.8 GPM]
- Indirect hydraulic operation.
- Connecting dimensions to ISO 4401.
- Provision of pressure setting for change - over.
- Automatic change - over from the other operating position.



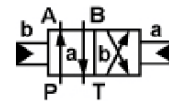
PKV-6, PKV-10

### Operation

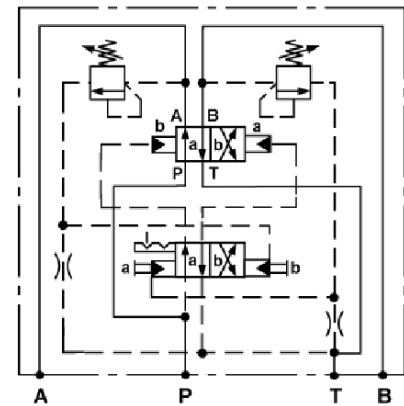
Indirectly, hydraulic - operated directional valves type PKV are used to control the hydraulic fluid flow direction by an automatic change - over.



### Hydraulic symbol



### Mounting example

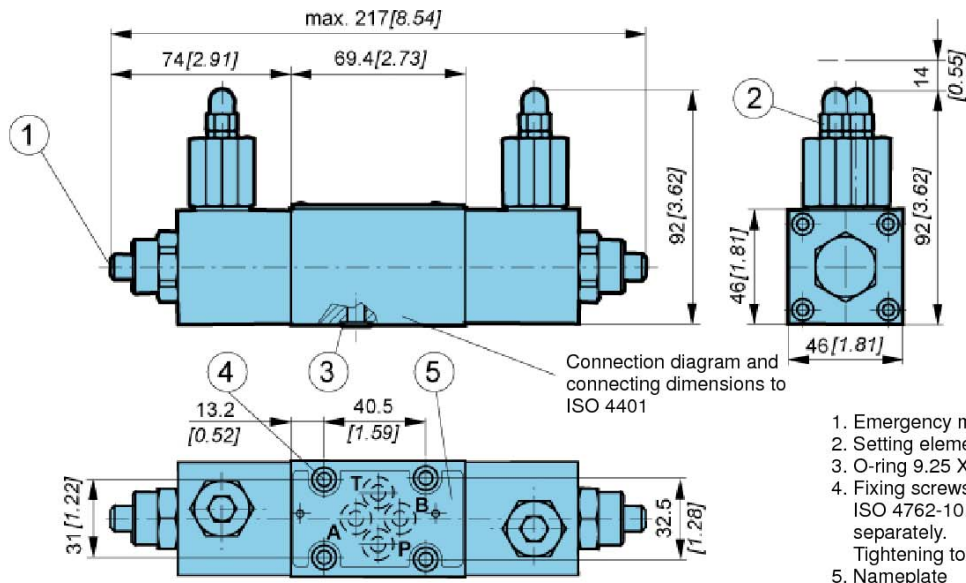


### Features

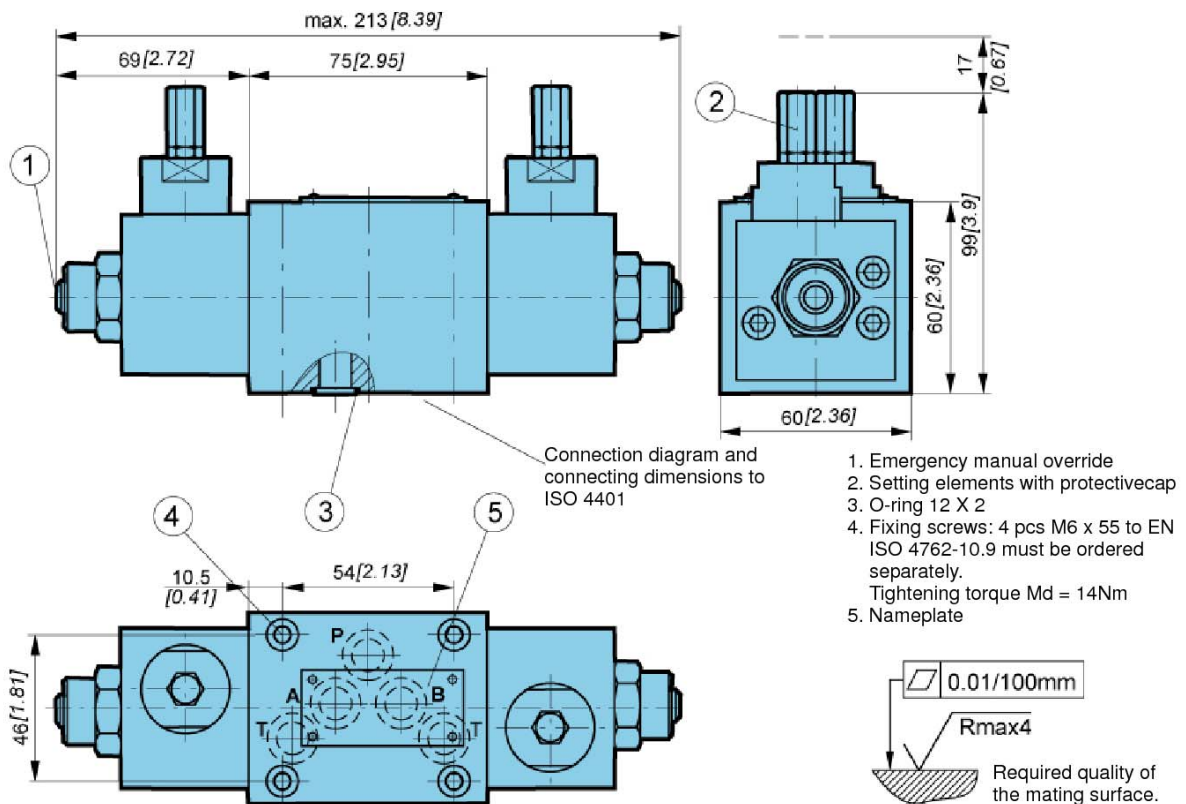
Size		6	10
Flow rate min/max	L/min [GPM]	1/25 [0.3/6.6]	1/60 [0.3/15.8]
Operating pressure	P, A, B	bar [PSI] To 210 [3 045]	
	T	bar [PSI] To 40 [580]	
Min. press. req. for autom. change over	bar [PSI]	50 [725]	
Change over pressure	bar [PSI]	50 to 210 [725 to 3 045]	
Viscosity range	mm <sup>2</sup> /s [SUS]	15 to 380 [69.5 to 1 760]	
Oil temperature range	°C [°F]	-20 to +70 [-4 to 158]	
Filtration	NAS 1638	8	
Mass	kg [lb]	2,6 [5.7]	3,2 [7.0]

**Dimensions**

**Size 6**



**Size 10**

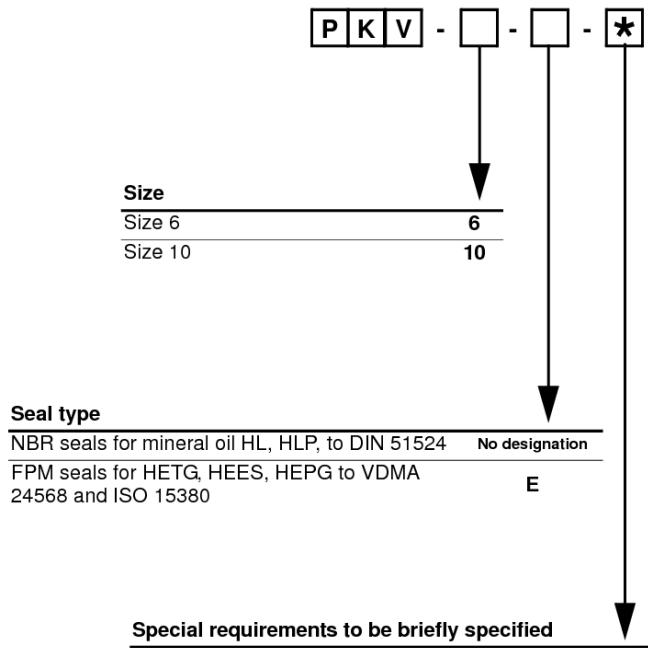


**ΔP-Q Performance curves**

Measured at 50°C [122 °F] and viscosity of 32 mm<sup>2</sup>/s [148 SUS].



**Model code**





## 4/2 WAY AUTOMATIC DIRECTIONAL VALVES PKV-...-T (NG 6)

- NG 6
- Up to 210 bar [3 045 PSI]
- Up to 30 L /min [7.9 GPM]
- Connecting dimensions to ISO 4401.
- Automatic, load - independent reversal.
- Predefined actuator direction at start - up.



PKV-6-T, PKV-6-T-G

### Operation

These valves reverse the movement of an actuator every time the flow through the valve stops. Preferential starting is P → B and A → T position. The spool is moved by two springs and locked by unbalanced pressure inside valve. When no more flow is crossing the valve, the spool changes the position inverting the direction of the actuator. These valves are mostly used to control the movement compactors or system where it is not possible to use electrical device.

### About the spindle for the PKV-6-T-G valves:

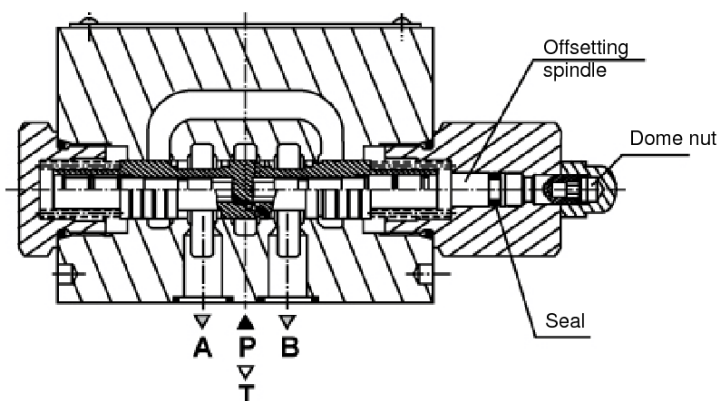
The spindle for the PKV-6-T-G valves is used just to set the system pressure limiter. To set the maximum pressure you have to block the self-reversing function.

### Procedure to set a pressure on the system pressure limiter:

- 1/ Switch off the pump or reduce pressure to minimum (10 bar max).
- 2/ To set the system pressure limiter first block the automatic reversal of the valve. Remove the dome nut and turn the offsetting spindle clockwise until it hits its inner end spool. The spool is now clamped P to B and A to T.
- 3/ Start the pump and set the required pressure.
- 4/ After that stop again the pump.
- 5/ Turn the offsetting spindle anticlockwise until it hits its outer end stop then put the dome nut back.

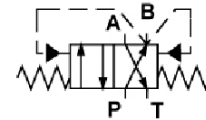


**Never turn the offsetting spindle when the valve is pressurized over 10 bar [145 PSI]. This can cause seal damage. If necessary switch off the pump.**

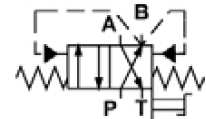


### Hydraulic symbol

#### PKV-6-T



#### PKV-6-T-G



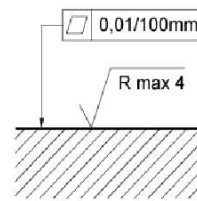
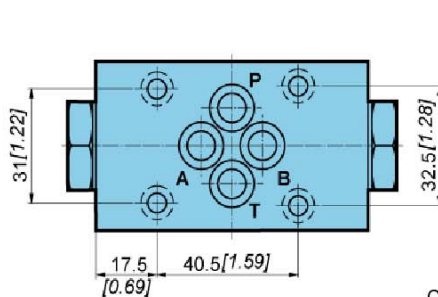
### Mounting example



## Features

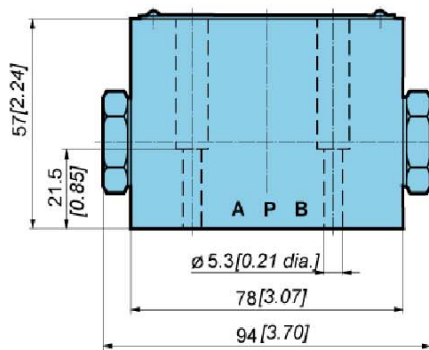
<b>Size</b>	<b>6</b>	
<b>Flow rate min/max</b>	L/min [GPM]	3/30 [0.8/7.9]
<b>Operating pressure P, A, B</b>	bar [PSI]	50 to 210 [725 to 3 045]
<b>Max. pressure T</b>	bar [PSI]	40 [580]
<b>Viscosity range</b>	mm <sup>2</sup> /s [SUS]	20 to 200 [92.7 to 926.8]
<b>Oil temperature range</b>	°C [°F]	-20 to +60 [-4 to 140]
<b>Filtration</b>	NAS 1638	8
<b>Mass</b>	PKV-6-T	1,3 [2.8]
	PKV-6-T-G	1,4 [3.1]

## Dimensions

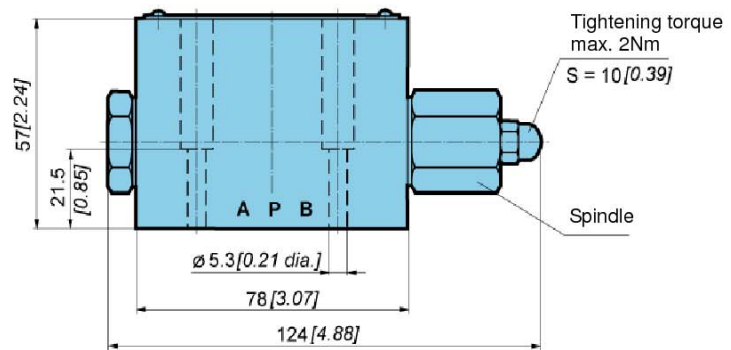


Required quality of the mating surface.

Connection diagram and connecting dimensions to ISO 4401.



PKV-6-T



PKV-6-T-G

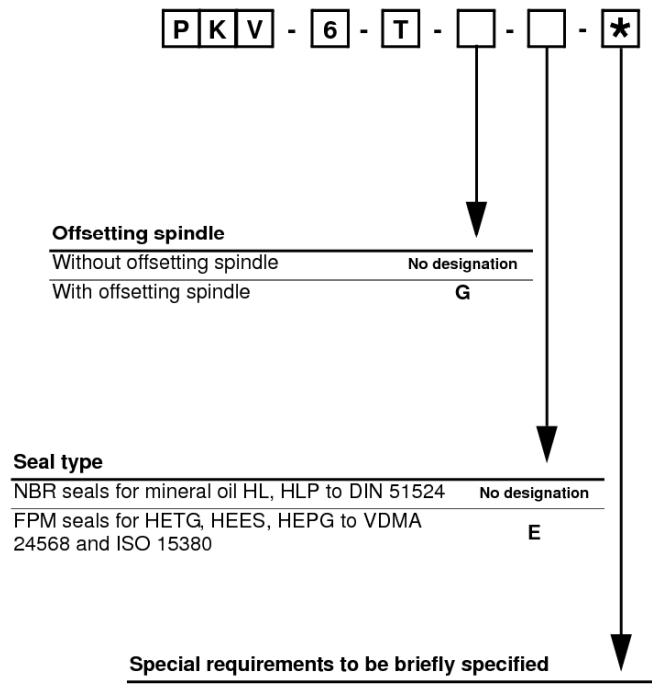
4 x fixing screws M5x30 to DIN EN ISO 4762-10.9 must be ordered separately.  
Required tightening torque  $M_d = 9 \text{ Nm}$  [79.65 in.lbf].

**ΔP-Q Performance curves**

Measured at 50°C [122°F] and viscosity of 32 mm<sup>2</sup>/s [148 SUS].



**Model code**





## 4/2, 4/3 WAY DIRECTIONAL VALVES KV (NG 6, 10)

- NG 6, 10
- Up to 350 bar [5 076 PSI]
- Up to 80 L/min [21.1 GPM]
- Up to 130 L/min [34.3 GPM]
- Direct hydraulic operation.
- Connecting dimensions to ISO 4401.
- Threaded connections to ISO 1179.

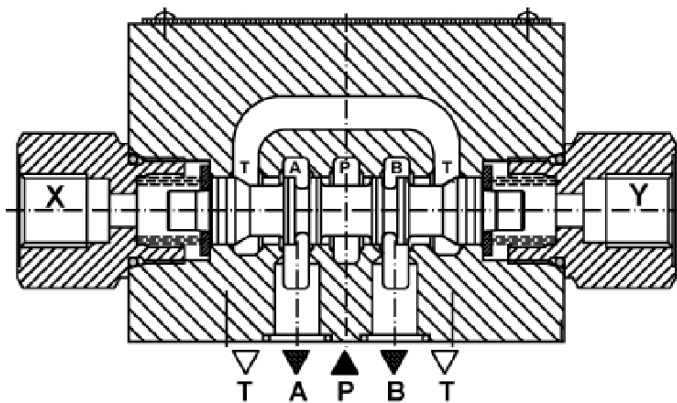


KV-4/3-5KO-6-H, KV-4/3-5KO-10-H

### Operation

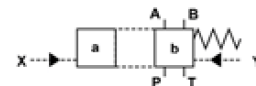
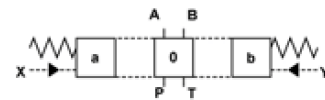
The KV-...-H is a hydraulically controlled 4/3 or 4/2 way directional control valve. The valve is operated by the pilots ports X and Y via the connection of an external pilot pipe direct on the valve body.

The minimum pilot pressure must be ensured for all operating conditions of the directional valve.



### Hydraulic symbols

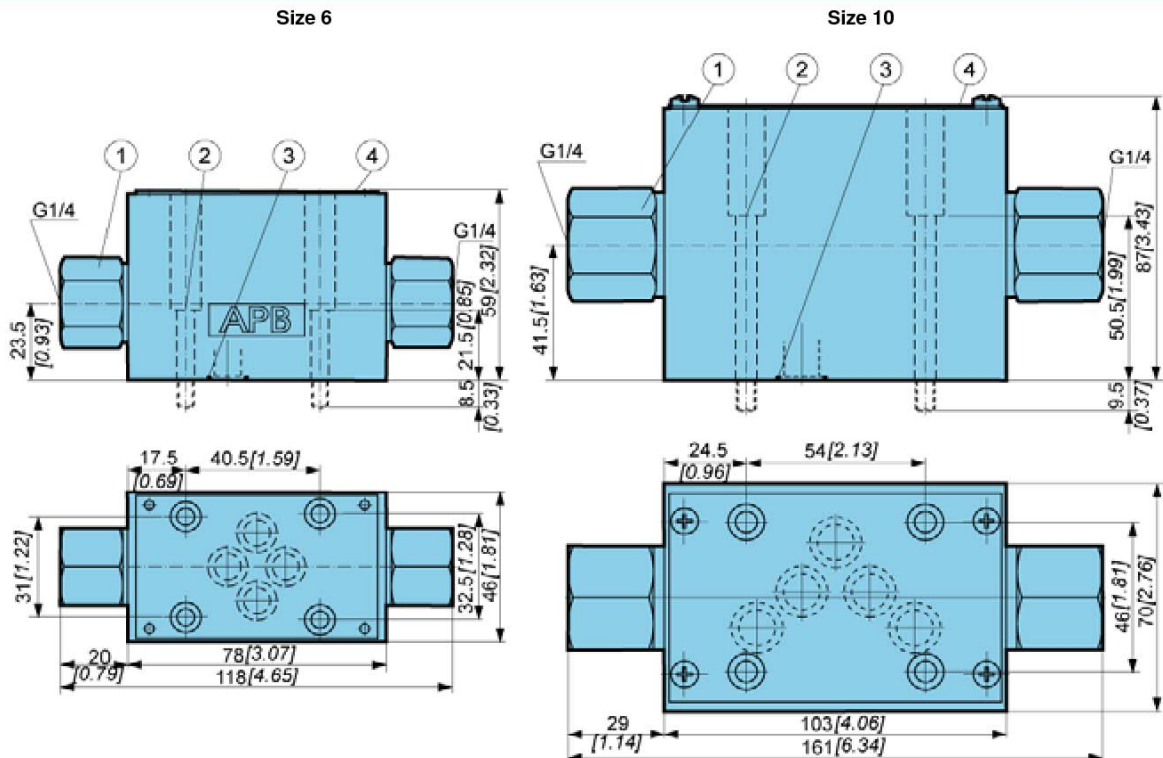
Spool types



### Features

Size		6	10
Flow rate	L/min [GPM]	80 [21.1]	130 [34.3]
Operating pressure	Ports A, B, P	bar [PSI]	350 [5 076]
	Ports X, Y, T	bar [PSI]	210 [3 045]
Pilot supply pressure min.	bar [PSI]	10 [145]	
Viscosity range	mm <sup>2</sup> /s [SUS]	15 to 380 [69.5 to 1 760]	
Oil temperature range	°C [°F]	-20 to +70 [-4 to 158]	
Filtration	NAS 1638		8
Mass	kg [lb]	1,4 [3.1]	4,0 [8.8]
Mounting position			Optional

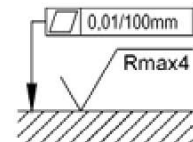
## Dimensions



1. Threaded connection X (Y) - G1/4
2. Fixing screws 4 pcs M5x30 to ISO 4762-10.9 (by special order) Required tightening torque  $M_d = 9\text{Nm}$
3. O-ring 9.25 x 1.78
4. Nameplate.

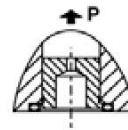
1. Threaded connection X (Y) - G1/4
2. Fixing screws 4 pcs M6x60 to ISO 4762-10.9 (by special order) Required tightening torque  $M_d = 15\text{Nm}$
3. O-ring 12.42 x 1.78
4. Nameplate.

Required quality of the mating surface.



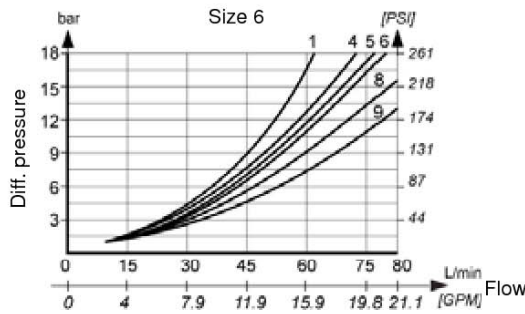
## Cartridge throttle

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

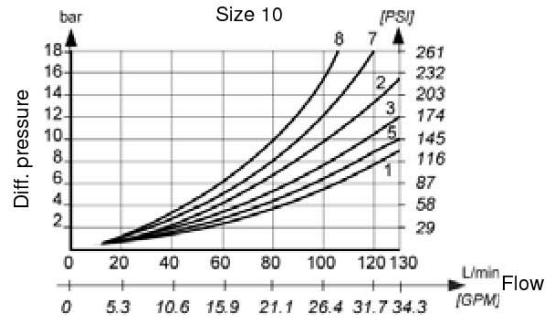


**ΔP-Q Performance curves**

Measured at 50°C [122°F] and viscosity of 32 mm<sup>2</sup>/s [148 SUS].

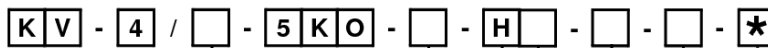


Spool	P-A	P-B	A-T	B-T	P-T
1	8	8	6	6	-
2	5	5	4	4	1
6	5	5	9	9	-
51A	5	5	1	1	-



Spool	P-A	P-B	A-T	B-T	P-T
1	1	1	5	5	-
2	3	3	2	7	8
6	1	1	2	2	-
51A	1	1	3	3	-

**Model code**



**Number of control spool position**

Two positions	2
Three positions	3

**Size**

Size 6	6
Size 10	10

Hydraulically operated

**Spool types**



Special requirements to be briefly specified

**Seal type**

No designation NBR seals for mineral oil  
HL, HLP to DIN 51524

E FPM seals for HETG, HEES,  
HEPG to VDMA 24568 and  
ISO 15380

**Throttle mm [in]**

No designation	Without throttle in P line
<b>D08</b>	Throttle Ø 0,8 [0.03 dia.]
<b>D10</b>	Throttle Ø 1,0 [0.04 dia.]
<b>D12</b>	Throttle Ø 1,2 [0.05 dia.]



## 2/2 WAY DIRECTIONAL VALVES KV (NG 6)

- NG 6
- Up to 210 bar [3045 PSI]
- Up to 30 L/min [7.9 GPM]
- Direct in-line mounting.
- Threaded connections to ISO 1179 (BSPP/Gas), ISO 11926 (UNF).
- Hermetically sealing at closed flow path.
- No STICK-SLIP effect even after a prolonged dwell time under pressure.
- Plug-in solenoid connector to ISO 4400.
- Protection of solenoid IP65 to EN 60529 / IEC 60529.
- Fulfil EMC (89/336/EEC).



KV-2/2-6-S-..

### Operation

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

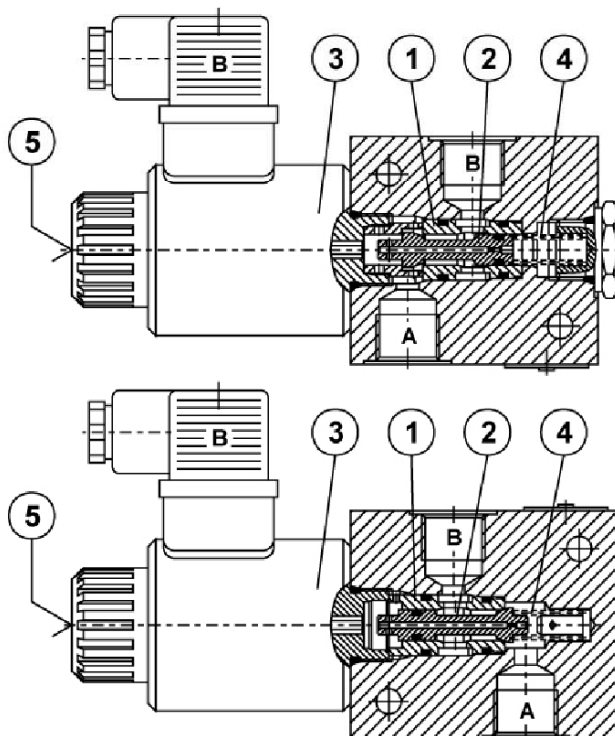
#### KV-2/2-6-S-A-...

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.

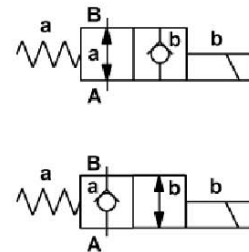
#### KV-2/2-6-S-B-...

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.

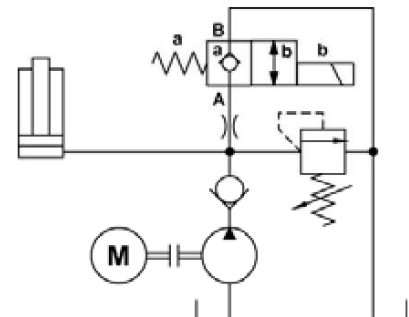
The change-over can also be done manually by pressing the emergency manual override (5).



### Hydraulic symbols



### Mounting example



## Features

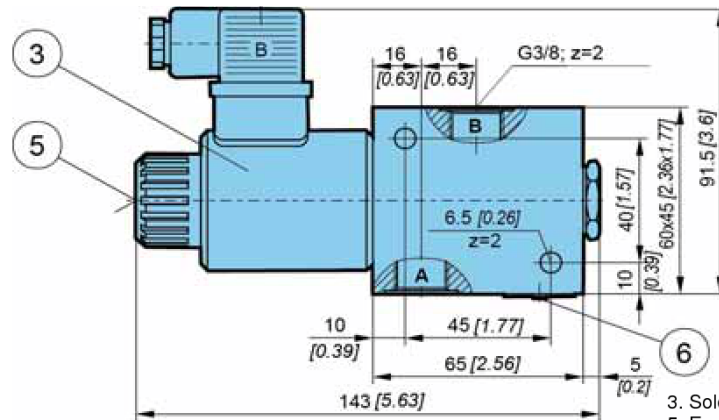
Hydraulic		
Size		6
Flow rate	L/min [GPM]	30 [7,93]
Operating pressure	bar [PSI]	210 [3045,79]
Oil temperature range	°C [°F]	-20 to +70 [-4 to +158]
Viscosity range	mm <sup>2</sup> /s [SUS]	15 to 380 [3.24 to 82]
Filtration	NAS 1638	8
Mass	kg [lb]	2,2 [4,85]

Electrical		
Supply voltage	V	12, 24, 48, 110, 230 DC or AC
Power	W	29 *
Intermittence		continuous
Ambient temperature	°C [°F]	To +50 [To +122]
Coil temperature	°C [°F]	To +180 [To +356]
Duty cycle	min <sup>-1</sup>	250

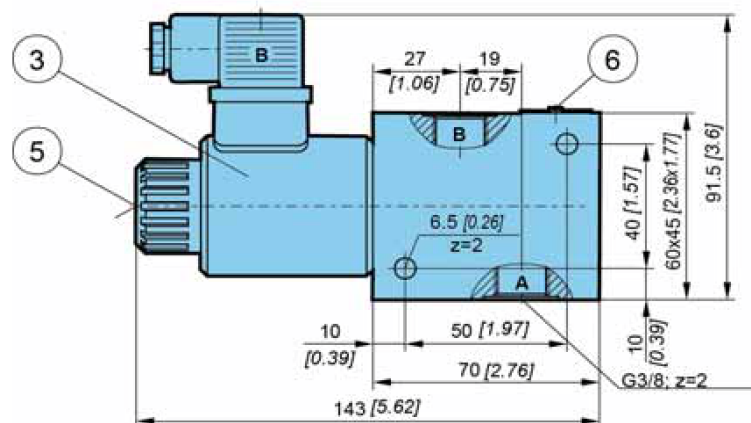
\* 12V supply voltage - 36W

## Dimensions

KV-2/2-6-S-A-



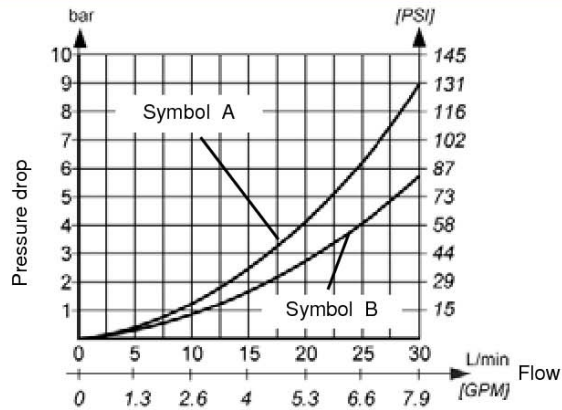
KV-2/2-6-S-B-



**ΔP-Q Performance curves**

Measured at 50°C [122°F] and viscosity of 32 mm<sup>2</sup>/s [148 SUS].

Valid for flow direction A to B.



**Model code**

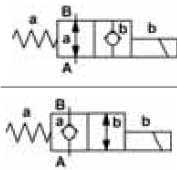


**Manual override option**

Emergency manual override	No designation
Manual override with rubber cover	G
Lockable manual override	C

Special requirements to be briefly specified

**Spool type**



A

B

**Seal type**

No designation	NBR seals for mineral oil HL, HLP, to DIN 51524
E	FPM seals for HETG, HEES, HEPG to VDMA 24568 and ISO 15380

**Supply voltage**

	Direct voltage	Alternating voltage
12 V	12 DC	12 AC
24 V	No designation	24 AC
48 V	48 DC	48 AC
110 V	110 DC	110 AC
220 V	220 DC	-
230 V	-	230 AC*

- 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.

**Threaded connections**

No designation	G 3/8
SAE 8	3/4-16 UNF-2B

**Overvoltage protection**

No designation	overvoltage protection
T	With overvoltage protection

**Connector type**

EN 175301-803 without signal lamp	No designation
EN 175301-803 with signal lamp	L
EN 175301-803 without connector	K
AMP junior timer without connector	M
Deutsch	V



## 3/2 WAY DIRECTIONAL VALVES KVC (NG 4)

- NG 4
- Up to 160 bar [2 320 PSI]
- Up to 16 L/min [4.2 GPM]
- Plug-in connector for solenoids to ISO 4400.
- Optimized flow paths for low losses of pressure.
- Wet pin solenoid with interchangeable coil.
- Manual emergency control.
- Protection of solenoid IP 65 to EN 60529 / IEC 60529.
- Fulfil EMC (89/336/EEC).



KVC2-3/2-4-47B, KVC-3/2-4-47B

### Features

#### Hydraulic

<b>Size</b>	<b>4</b>	
<b>Flow rate</b>	L/min [GPM]	16 [4.2]
<b>Operating pressure</b>	bar [PSI]	160 [2 320]
<b>Viscosity range</b>	mm <sup>2</sup> /s [SUS]	15 to 380 [69.5 to 1760]
<b>Oil temperature range</b>	°C [°F]	-20 to +70 [-4 to 158]
<b>Filtration</b>	ISO 4406-1999	19/17/14
<b>Mass</b>	KVC-3/2-4	1,6 [3.5]
	KVC2-3/2-4	3,5 [7.7]

#### Electrical

<b>Supply voltage</b>	V	12, 24
<b>Power</b>	W	29 *
<b>Switch-on time**</b>	ms	50 to 80
<b>Switch-off time**</b>	ms	30 to 55
<b>Switching frequency</b>	1/h	15 000
<b>Ambient temperature</b>	°C [°F]	to 50 [122]
<b>Coil temperature</b>	°C [°F]	to 180 [356]
<b>Duty cycle</b>	Continuous	

\* 12 V supply voltage - 36 W.

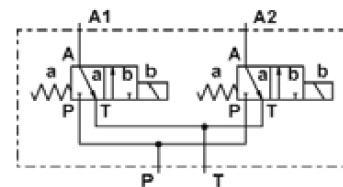
\*\* The switching-on and off times apply to 24 V DC solenoids

### Hydraulic symbol

Single: KVC-3/2-4-47B

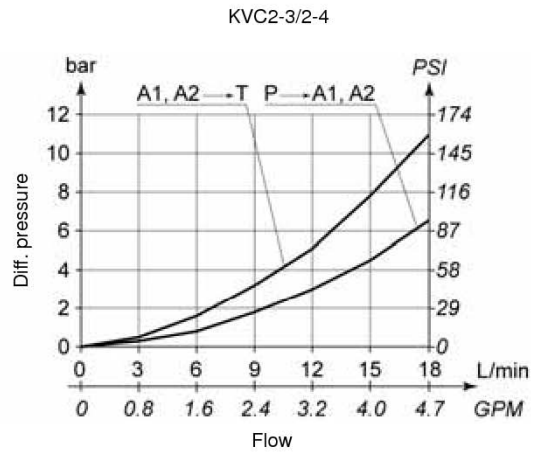
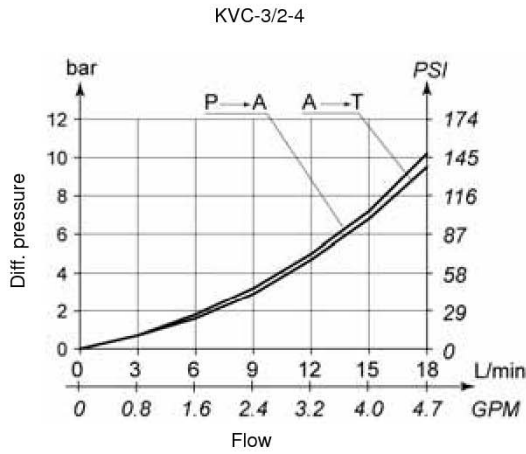


Double: KVC2-3/2-4-47B

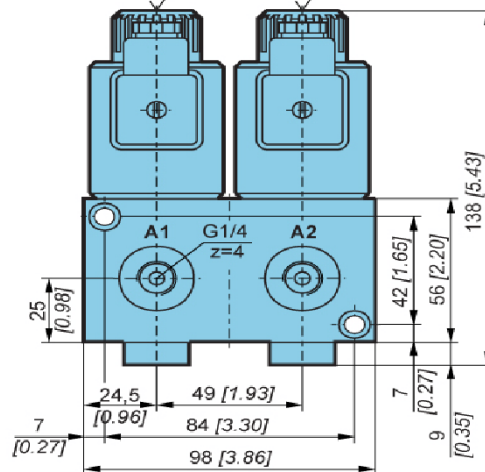
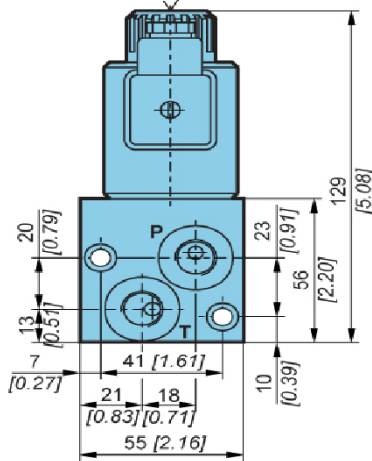
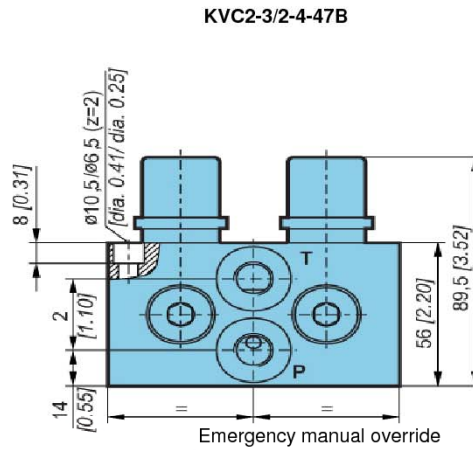
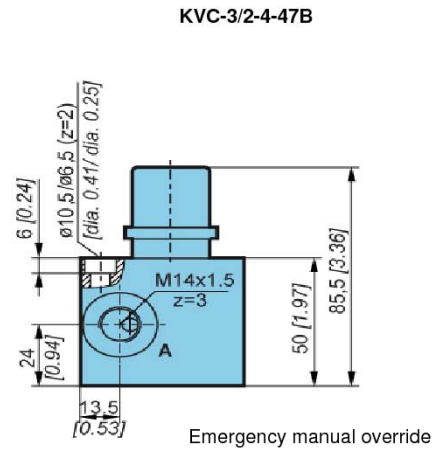


**ΔP-Q Performance curves**

Measured at 50°C [122°F] and viscosity of 32 mm<sup>2</sup>/s [148 SUS].



**Dimensions**



**Model code**





## 3/2 WAY DIRECTIONAL VALVES KVC (NG 10)

- NG 10
- Up to 350 bar [5 076 PSI]
- Up to 100 L/min [26.4 GPM]
- Direct in-line mounting.
- Plug-in connector for solenoids to ISO 4400.
- Threaded connections to ISO 9974 (Metric), ISO 1179 (BSPP/Gas), ISO 11926 (UNF).
- Protection of solenoid IP65 to EN 50529 / IEC 60529.



KVC-3/2-10

### Operation

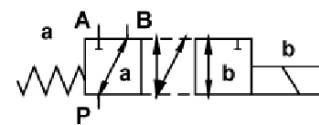
Directional valves type KVC-3/2-10 with direct solenoid operation are used to control the direction of hydraulic fluid flow.

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.

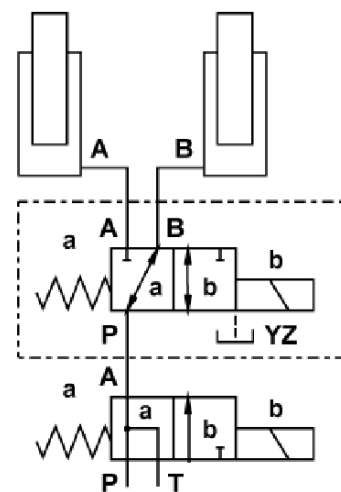
It is also very proper as bypass valve.

The change-over can also be done manually by pressing the emergency manual override.

### Hydraulic symbol



### Mounting example





**ΔP-Q Performance curves**

Measured at 50°C [122°F] and viscosity of 32 mm<sup>2</sup>/s [148 SUS].



**Model code**

**K V C** - **3** / **2** - **10** - **41B** - **□** - **□** - **□** - **□** - **□** - **□** - **\***

**Manual override option**

Emergency manual override	No designation
Manual override with rubber cover	G
Lockable manual override	C

Special requirements to be briefly specified

**Spool type**



41B

**Seal type**

No designation	NBR seals for mineral oil HL, HLP to DIN 51524
E	FPM seals for HETG, HEES, HEPG to VDMA 24568 and ISO 15380

**Supply voltage**

Direct voltage 24V	No designation
Direct voltage 12V	12 DC

**Drainage**

No designation		Without YZ
YZ		With YZ

**Connector type**

175301-803 without signal lamp	No designation
EN 175301-803 with signal lamp	L
EN 175301-803 without connector	K
AMP Junior timer without connector	M
Deutsch	V

**Threaded connections A,B,P ; YZ**

No designation	M18x1,5 ; -
M22	M22x1,5 ; -
M20	M20x1,5 ; -
3/8	G3/8 ; -
1/2	G1/2 ; -
3/4	G3/4 ; -
3/4	G3/4 ; G1/4
SAE 12	1 1/16-12 UNF-2B ; 9/16-18 UNF-2B

**Overvoltage**

Without overvoltage protection	No designation
With overvoltage protection	T

## 4/2, 4/3 WAY DIRECTIONAL VALVE KV-5KO (NG 6)

- NG 6
- Up to 350 bar [5 076 PSI]
- Up to 75 L/min [19.8 GPM]

- Connection diagram and connecting dimensions to ISO 4401.
- 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 EN 60529 / IEC 60529.
- Fulfil EMC (89/336/EEC).



KV-4/3-5KO-6

### 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 energizing 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.

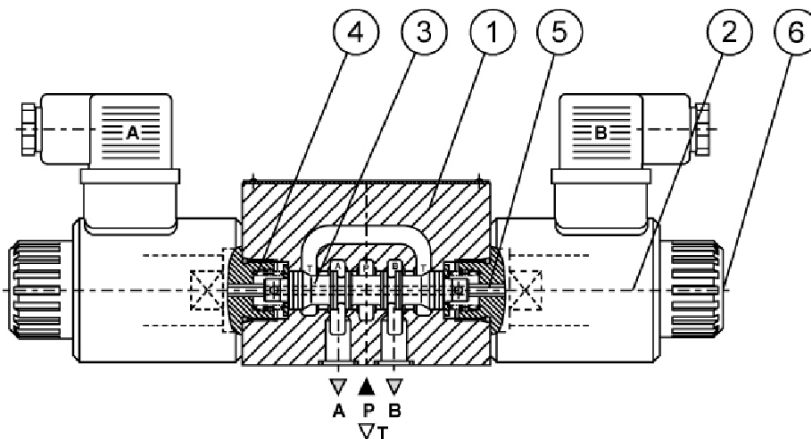
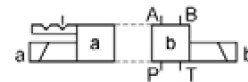
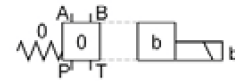
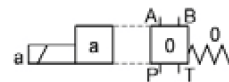
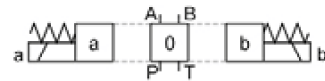
When the solenoid (2) is de-energized, the control spool (3) is returned to its neutral position by the return spring (4). The change-over can be done manually by pressing the emergency manual override (6).

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

Directional valve with two operating position, two solenoids without springs allow 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-energized.

### Hydraulic symbols

Spool types



**Features**

**Hydraulic**

<b>Size</b>			<b>6</b>
<b>Flow rate</b>	L/min [GPM]		see ΔP-Q curves
<b>Operating pressure</b>	Ports A, B, P	bar [PSI]	350 [5 076]
	Port T	bar [PSI]	250 [3 625]
<b>Viscosity range</b>	mm <sup>2</sup> /s [SUS]		15 to 380 [69.5 to 1 760]
<b>Oil temperature range</b>	°C [°F]		-20 to +70 [-4 to 158]
<b>Filtration</b>	NAS 1638		8
<b>Mass</b>	4/2	kg [lb]	1,9 [4.2]
	4/3		2,7 [5.9]
<b>Mounting position</b>	Optional		

**Electrical**

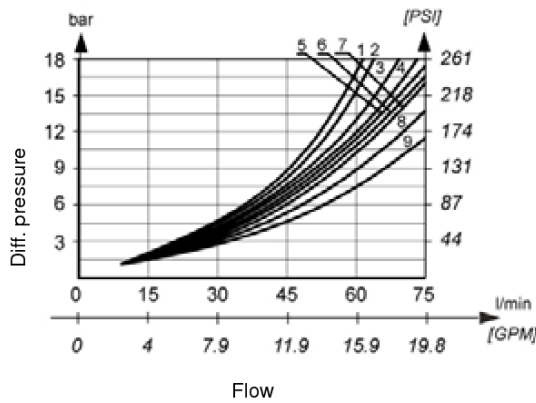
<b>Supply voltage</b>	Direct	V	12, 24, 48
	Alternating		110, 230
<b>Power</b>	W		29 *
<b>Switch-on time**</b>	ms		50 to 80
<b>Switch-off time**</b>	ms		30 to 55
<b>Switching frequency</b>	1/h		15 000
<b>Ambient temperature</b>	°C [°F]		to 50 [122]
<b>Coil temperature</b>	°C [°F]		to 180 [356]
<b>Duty cycle</b>	Continuous		

\* 12 V supply voltage - 36 W.

\*\* The switching-on and off times apply to 24 V DC solenoids.

**ΔP-Q Performance curves**

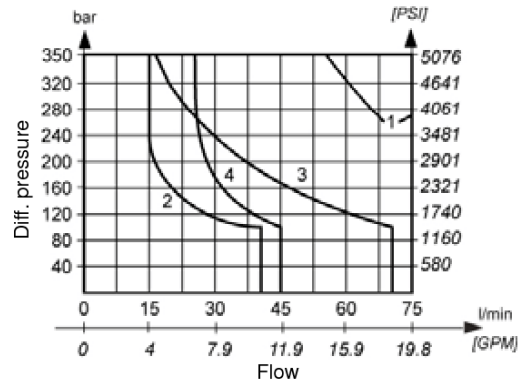
Measured at 50 °C [122 °F] and viscosity of 32 mm<sup>2</sup>/s [148 SUS].



Spool	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	-	-	-

**ΔP-Q Operating limits**

Measured at 50 °C [122 °F] and viscosity of 32 mm<sup>2</sup>/s [148 SUS].



Spool	Kurve
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.

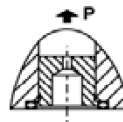
Note: For valves with adjustment of the switching time reduced values of the operating limits may result.

## Dimensions



## 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.



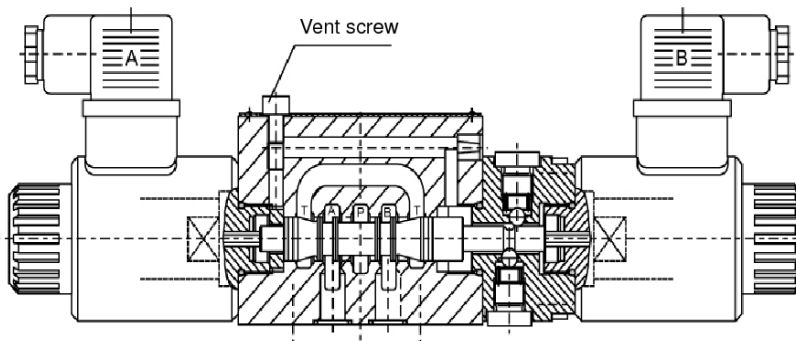
## Installation

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.

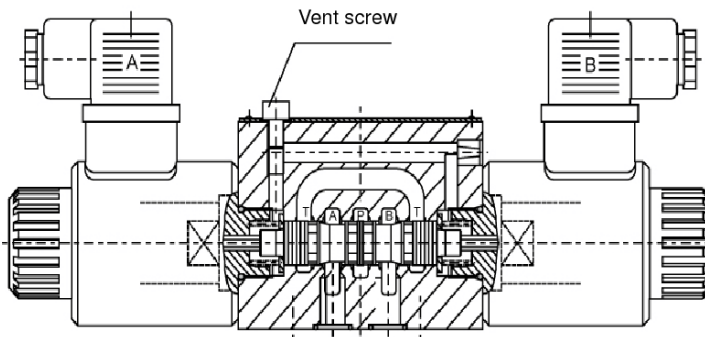
## Function drawing



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



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



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



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

1. Solenoid "a" - MR-045
2. Solenoid "b" - MR-045
3. Fixing screws 4 pcs M5 x 30 to ISO 4762  
-10.9 must be ordered separately.  
Required tightening torque  $M_d = 9 \text{ Nm}$
4. Plug-in connector "a" - grey
5. Plug-in connector "b" - black
6. Emergency manual override
7. O-ring 9,25 x 1,78
8. Valve cap
9. Nameplate
10. Constant action restrictor

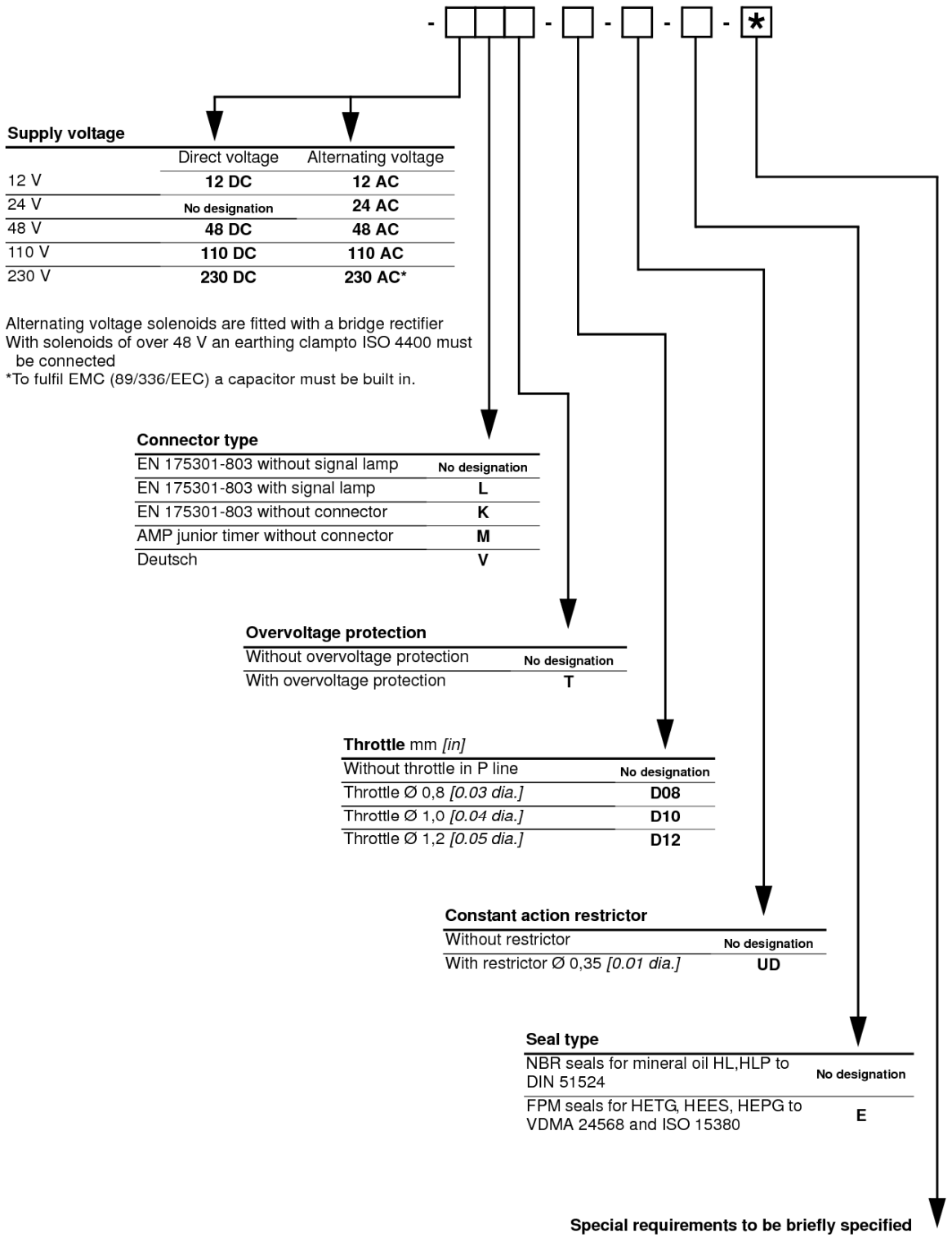
**Model code**



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

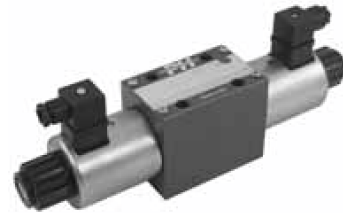


Valves with adjustment of the switching time - a constant or short - time static oil pressure of at least  $\geq 4$  bar [58 PSI] must prevail at connection T of the directional control valve to maintain the pressure in the spring chambers.



## 4/2, 4/3 WAY DIRECTIONAL VALVE KV-5KO (NG 10)

- NG 10
- Up to 350 bar [5 076 PSI].
- Up to 120 L/min [31.7 GPM].
- Connection diagram and connecting dimensions to ISO 4401.
- 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 EN 60529 / IEC 60529.



**KV-4/3-5KO-10**

### 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 energizing 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.

When the solenoid (2) is de-energized, 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 manual override (6).

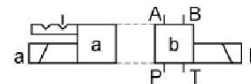
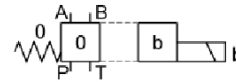
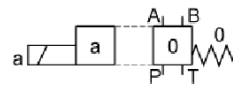
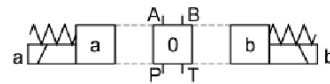
### KV-4/2-5KO-10-81

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.



### Hydraulic symbol

Spool types



**Features**

**Hydraulic**

<b>Size</b>	<b>10</b>		
<b>Flow rate</b>		L/min [GPM]	see ΔP-Q curves
<b>Operating pressure</b>	Ports A, B, P	bar [PSI]	350 [5 076]
	Port T	bar [PSI]	250 [3 625]
<b>Viscosity range</b>		mm <sup>2</sup> /s [SUS]	15 to 380 [69.5 to 1 760]
<b>Oil temperature range</b>		°C [°F]	-20 to +70 [-4 to 158]
<b>Filtration</b>		NAS 1638	8
<b>Mass</b>	4/2	kg [lb]	6,5 [14.3]
	4/3		7,3 [16.1]
<b>Mounting position</b>	Optiona		

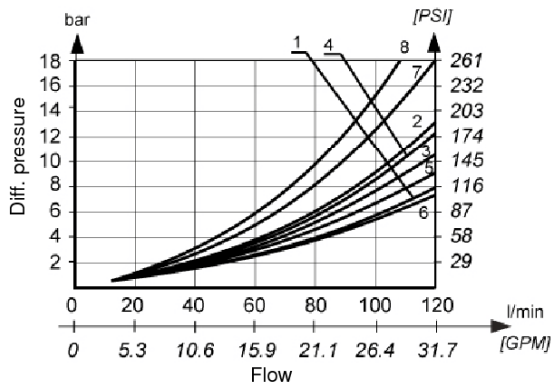
**Electrical**

<b>Supply voltage</b>	Direct	V	12, 24, 48
	Alternating		110, 230
<b>Power</b>		W	45
<b>Switch-on time*</b>		ms	70 to 95
<b>Switch-off time*</b>		ms	40 to 80
<b>Switching frequency</b>		1/h	15 000
<b>Ambient temperature</b>		°C [°F]	to 50 [122]
<b>Coil temperature</b>		°C [°F]	to 180 [356]
<b>Duty cycle</b>	Continuous		

\* The switching-on and off times apply to 24 V DC solenoids.

**ΔP-Q Performance curves**

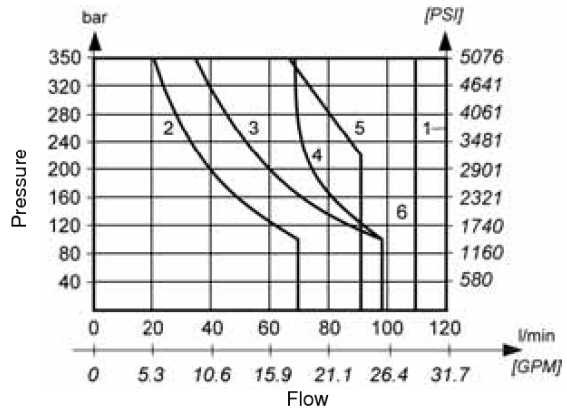
Measured at 50 °C [122 °F] and viscosity of 32 mm<sup>2</sup>/s [148 SUS].



Spool	Flow path			
	P-A	P-B	A-T	B-T
1	1	1	5	5
2	3	3	2	7
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	-	-

**ΔP-Q Operating limits**

Measured at 50 °C [122 °F] and viscosity of 32 mm<sup>2</sup>/s [148 SUS].



Spool	curve	
1	1	The operating limits of the valve are 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 asymmetric flow (e.g. one part not used) reduced values may result.
2	4	
3	5	
6	3	
9	6	
81	1	
51A, 51B	1	Note: For valves with adjustment of the switching time reduced values of the operating limits may result.
41A, 41B	2	

**Dimensions**



**Cartridge throttle**

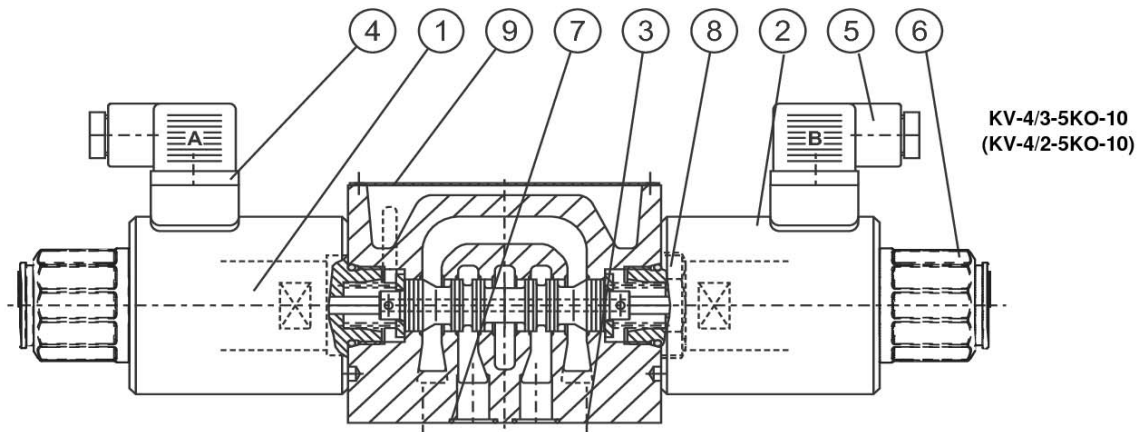
If flow rates greater than permissible occur during change-over, a cartridge throttle must be fitted into P-line of the directional valve.



**Installation**

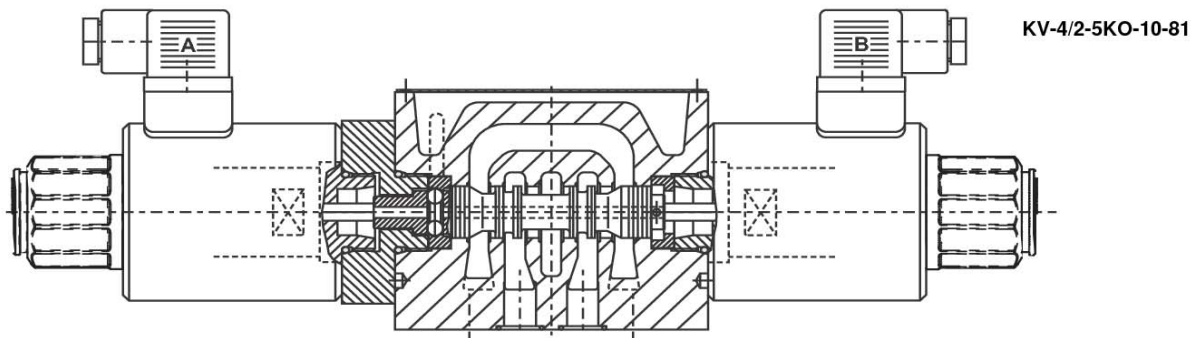
The directional control valve must be installed horizontally (Nameplate on top). If this is not the case, the valve must be removed for venting. Unscrew the vent screw. Move the spool alternately to the switching positions a and b until no more bubbles appear at the screw hole. The oil must be visible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

## Function drawing

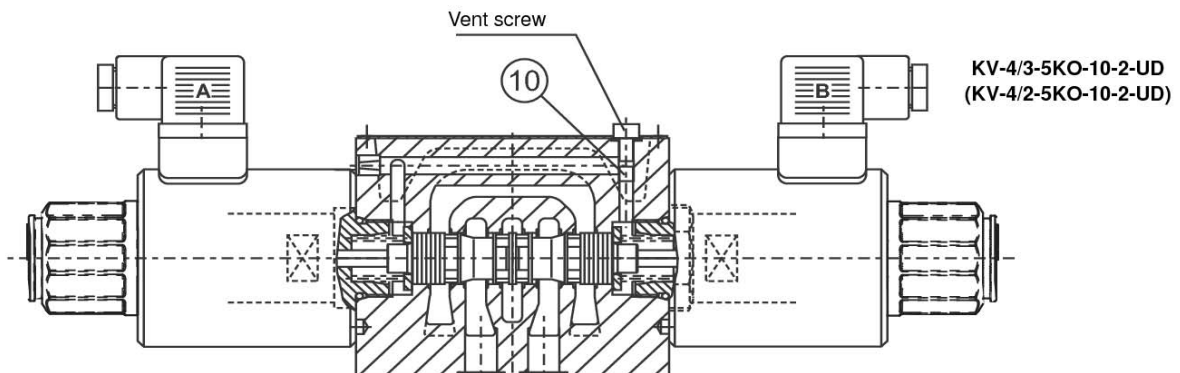


KV-4/3-5KO-10  
(KV-4/2-5KO-10)

- |  |                                  |
|--|----------------------------------|
| 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 to ISO<br>4762 -10.9 must be ordered separately.<br>Required tightening torque Md = 15 Nm | 6. Emergency manual override     |
|  | 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)

**Model code**

**K V** -  /  - **5 K O** - **10** -

**Working ports**

Three working ports	<b>3</b>
Four working ports	<b>4</b>

**Number of control spool position**

Two positions	<b>2</b>
Three positions	<b>3</b>

**Manual override option**

Emergency manual override	<b>No designation</b>
Manual override with rubber cover	<b>G</b>
Lockable manual override	<b>C</b>

**Spool types**

	<b>1</b>		<b>1A</b>		<b>1B</b>		<b>81</b>
	<b>2</b>		<b>2A</b>		<b>2B</b>		
	<b>3</b>		<b>3A</b>		<b>3B</b>		
	<b>6</b>		<b>6A</b>		<b>6B</b>		
			<b>51A</b>		<b>51B</b>		
			<b>41A</b>		<b>41B</b>		

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



Valves with adjustment of the switching time - a constant or short - time static oil pressure of at least > 4 bar [58 PSI] must prevail at connection T of the directional control valve to maintain the pressure in the spring chambers.





## 4/2, 4/3 WAY DIRECTIONAL VALVES TYPE KV (NS 16)

- NG 16
- To 350 bar [5 076 PSI]
- To 300 L/min [79 GPM]
- 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 EN 60529 / IEC 60529.
- Fulfil EMC (89/336/EEC).



KV-4/3-16-

### 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).

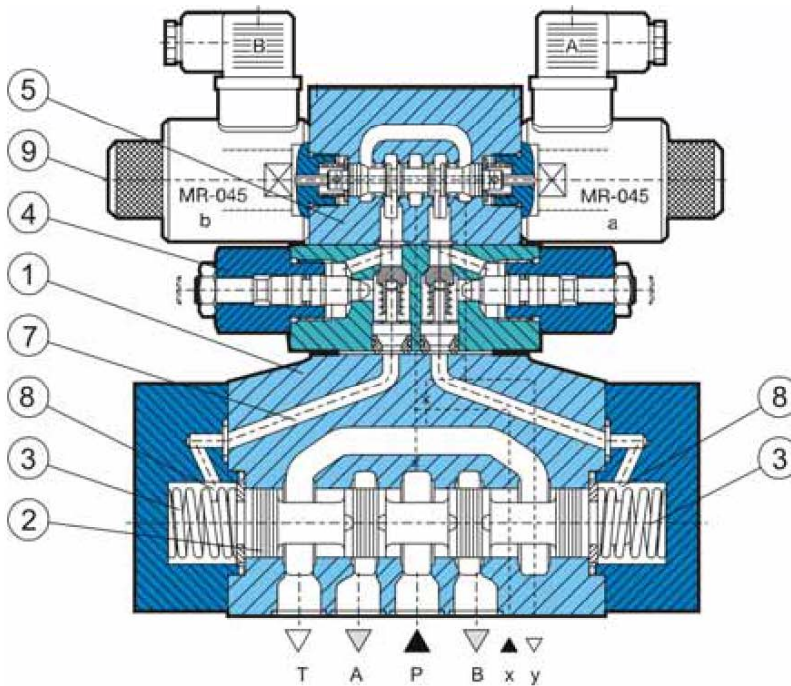
The pilot valve (5) is connected with the pressure chambers (8) via the pilot line (7). Feeding of the pilot valve oil is either or external (via the port "x"). Change-over of the control spool to one of the operating position is activated by the introduction of oil via the pilot valve (5) into one of 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-energized 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").

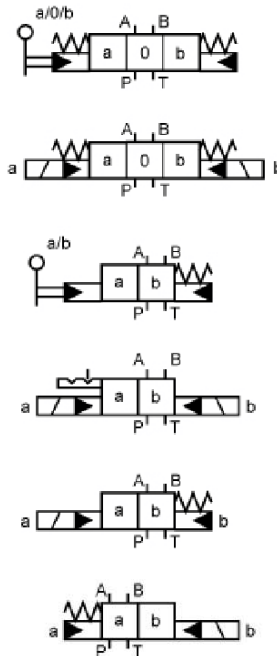
Manual change-over of the main valve is also possible by pressing the emergency manual override (9).

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



### Hydraulic symbols

Spool types



**Features**

<b>Flow rate</b>	<i>l/min [GPM]</i>	300 [79.2]	
<b>Operating pressure</b>	<i>bar [PSI]</i>	Ports A, B, P	350 [5076.3]
		Port T	250 [3625.9]
<b>Pilot oil pressure (x-external)</b>	<i>bar [PSI]</i>	50-250 [725.2-3625.9]	
<b>Pilot oil pressure (x-internal)</b> <b>Pre-load valve is fitted into P-port of the main valve</b> <b>Without Pre-load valve in the P-port of the main valve</b>		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 [39.6 GPM], with the control spool in the centre position.	
<b>Oil temperature range</b>	<i>°C [°F]</i>	-20 to +70 [-4 to 158]	
<b>Viscosity range</b>	<i>mm<sup>2</sup>/S</i>	15 to 380	
<b>Required pilot oil volume</b>	<i>cm<sup>3</sup> [cu.in]</i>	2 positions valve	7,8 [0.47]
		3 positions valve	3,9 [0.24]
		Main valve	8 [17.6]
		4/3 pilot valve	2,5 [5.5]
		4/2 pilot valve	2,2 [4.8]
<b>Mass</b>	<i>Kg [lb]</i>	Throttle/check valve	1,45 [3.2]
		Pressure reducing valve	1,70 [3.7]
<b>Mounting position</b>		Optional, horizontal for spool types 4/2	
<b>Switch-on time</b> <b>Solenoid change-over from the operating to the centre position</b>	(ms)	3 positions valve	60
		2 positions valve	85
<b>Switch-off time</b> <b>Solenoid change-over from the operating to the centre position</b>	(ms)	3 positions valve	45
		2 positions valve	50
<b>Filtration</b>	NAS 1638	8	
<b>Ambient temperature range</b>	<i>°C [°F]</i>	+50 [122]	
<b>Coil temperature range</b>	<i>°C [°F]</i>	+180 [356]	
<b>Power</b>	W	29 (12V supply voltage - 36W)	
<b>Voltage</b>	V	12, 24, 48, 110, 230	

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

**ΔP-Q Performance curves**

Measured at 50°C [122°F] and viscosity of 32 mm<sup>2</sup>/s [148 SUS].



Spool type	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	-

See Model Code for spool type choice.

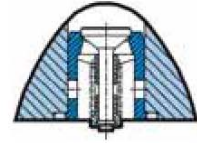
**Cartridge throttle**

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.



**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 to 6 bar [65 to 87 PSI].



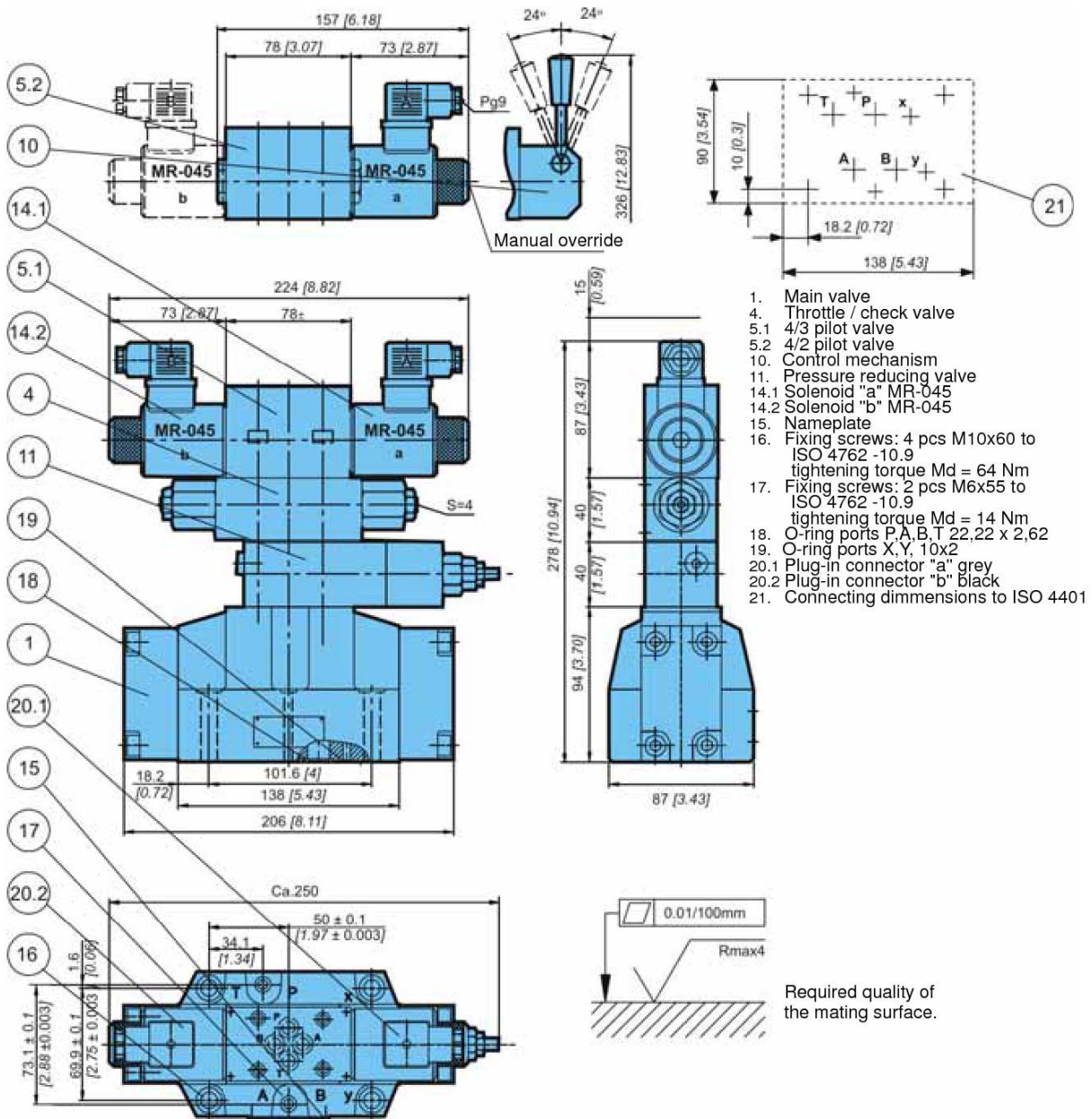
**Pressure reducing valve**

The pressure reducing valve used when the pilot oil "X" pressure exceeds the permissible limit  $p = 250 \text{ bar}$  [3 626 PSI].

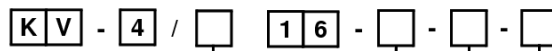
**Throttle check valve**

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.

**Dimensions**



**Model code**



**Number of control spool positions**

Two positions	2
Three positions	3

**Manual override option**

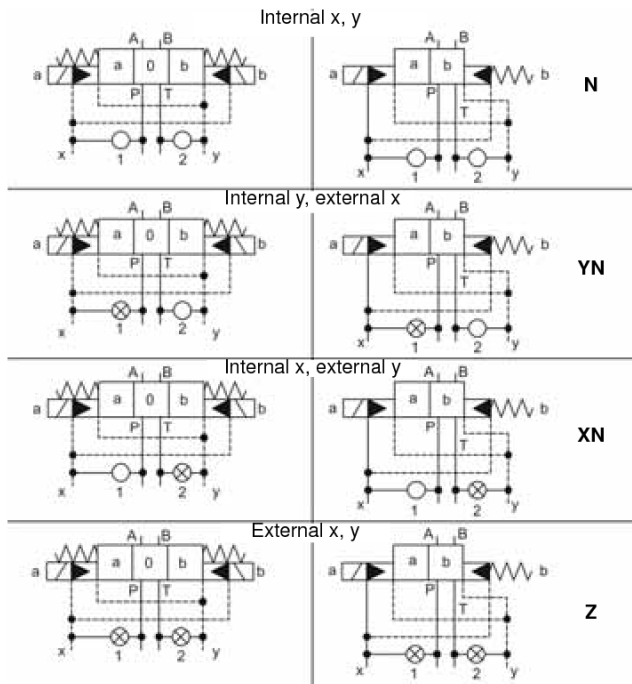
Emergency manual override	No designation
Manual override with rubber cover	G
Lockable manual override	C

**Spool types**

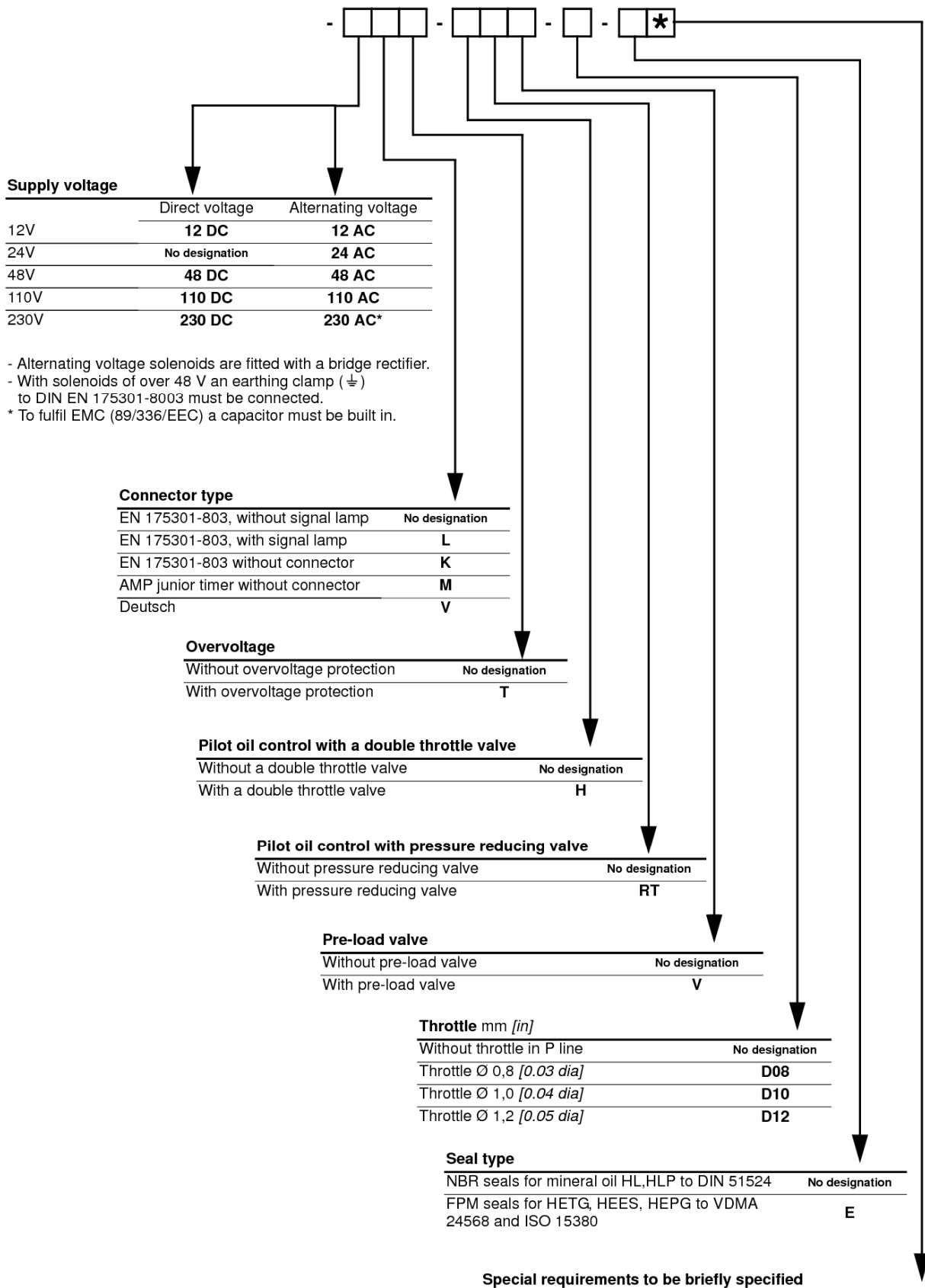
	1
	2
	3
	4
	5
	6
	R1
	R2
	R3
	R4
	R5
	R6
	R51
	F51
	51A
	51B

**Pilot oil supply and discharge**

Three positions      Two positions



For supply and discharge with spool type 2 and 3, refer to the features table.





## 4/2, 4/3 WAY DIRECTIONAL VALVE KV-3KO (NG 6)

- NG 6
- Up to 250 bar [3 625 PSI]
- Up to 40 L/min [10,6 GPM]
- Connection diagram and connecting dimensions to ISO 4401.
- Different types of plug-in connectors.
- 3-chamber model.
- Optimized flow paths for low losses of pressure.
- Wet pin solenoid with interchangeable coil.
- Manual emergency control.
- Protection of solenoid IP 65 to EN 60529 / IEC 60529.
- Fulfill EMC (89/336/EEC).



KV-4/3-3KO-6

### Operation

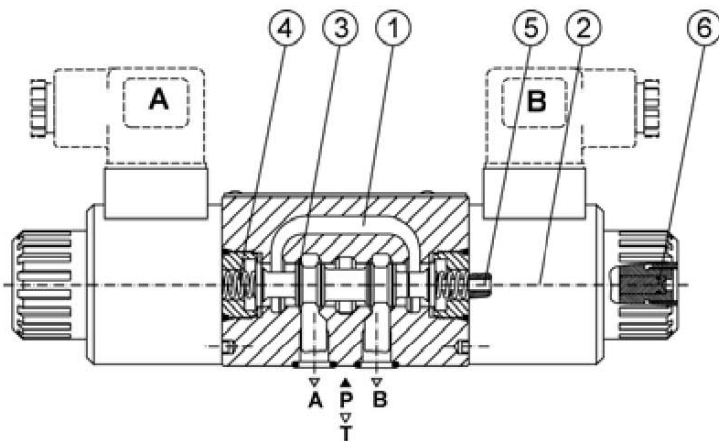
Directional valves type KV-3KO with direct solenoid operation control the direction of the hydraulic medium flow.

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 energizing 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.

When the solenoid (2) is de-energized, 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 manual override (6).

### Hydraulic symbols

Spool types



**Features**

<b>Hydraulic</b>			
<b>Size</b>	<b>6</b>		
<b>Flow rate</b>		L/min [GPM]	see ΔP-Q curves
<b>Operating pressure</b>	Ports A, B, P	bar [PSI]	250 [3 625]
	Port T	bar [PSI]	
<b>Viscosity range</b>		mm <sup>2</sup> /s [SUS]	15 to 380 [69.5 to 1 760]
<b>Oil temperature range</b>		°C [°F]	-20 to +70[-4 to 158]
<b>Filtration</b>		NAS 1638	8
<b>Mass</b>	4/2	kg [lb]	1,3 [2.9]
	4/3		1,8 [3.9]
<b>Mounting position</b>	Optional		

<b>Electrical</b>			
<b>Supply voltage</b>	Direct	V	12, 24, 48
	Alternating		110, 230
<b>Power</b>		W	26
<b>Switch-on time*</b>		ms	50 to 80
<b>Switch-off time*</b>		ms	30 to 55
<b>Switching frequency</b>		1/h	15 000
<b>Ambient temperature</b>		°C [°F]	to 50 [122]
<b>Coil temperature</b>		°C [°F]	to 180 [356]
<b>Duty cycle</b>	Continuous		

\* The switching-on and off times apply to 24 V DC solenoids.

**ΔP-Q Performance curves**

Measured at 50°C [122°F] and viscosity of 32 mm<sup>2</sup>/s [148 SUS].



Spool	Flow path				
	P-A	P-B	A-T	B-T	P-T
1	1	1	2	2	-
2	3	3	3	3	5
3	1	1	4	4	-
6	1	1	1	1	-
51A, 51B	1	1	3	3	-
41A, 41B	3	3	-	-	-

**ΔP-Q Operating limits**

Measured at 50°C [122°F] and viscosity of 32 mm<sup>2</sup>/s [148 SUS].

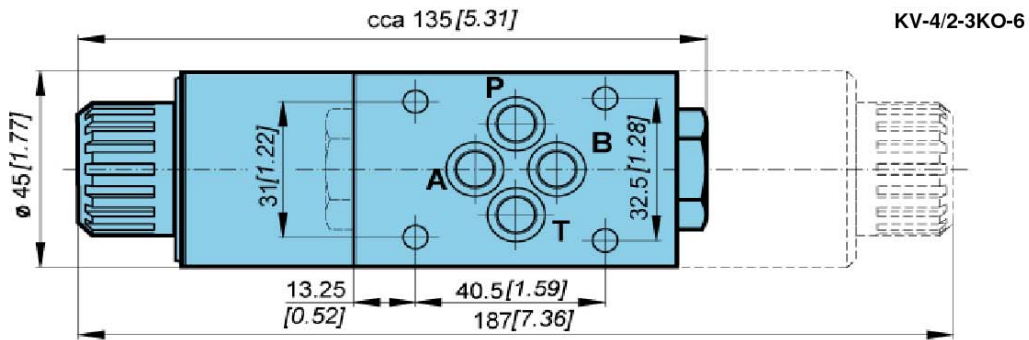


Spool	curve
1	1
2	2
3	3
6	4
51A, 51B	1
41A, 41B	5



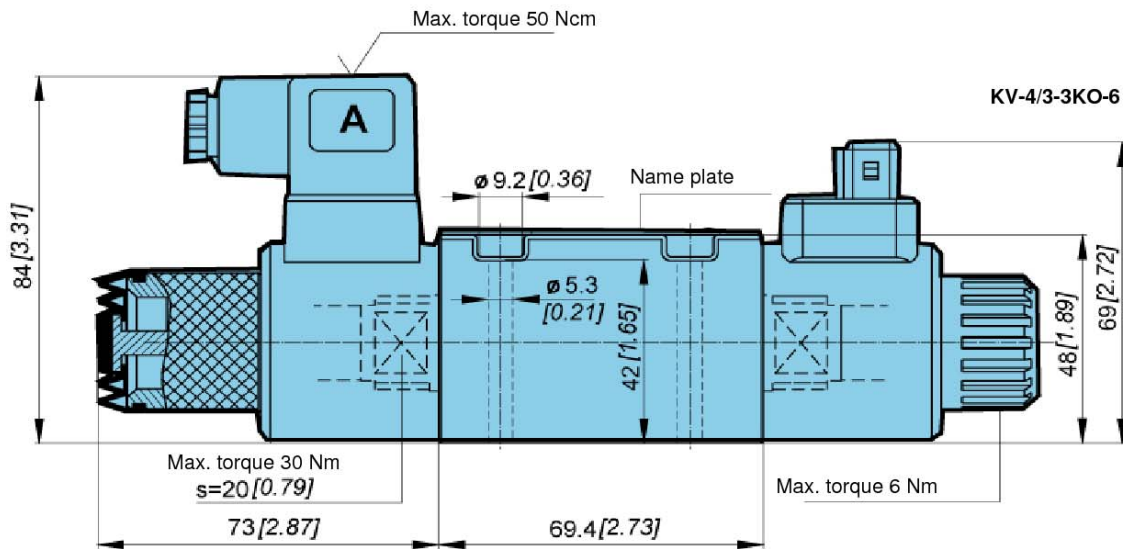
**Dimensions**

Connection diagram and connecting dimensions to ISO 4401.



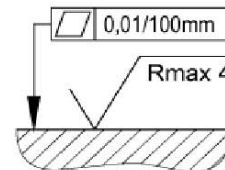
Option: Plug-in connector to ISO 4400

Option: AMP JUNIOR connector



4 x Fixing screws M5x50 to ISO 4762- 10.9 must be ordered separately.  
Required tightening torque Md= 7Nm.

Required quality of the mating surface.

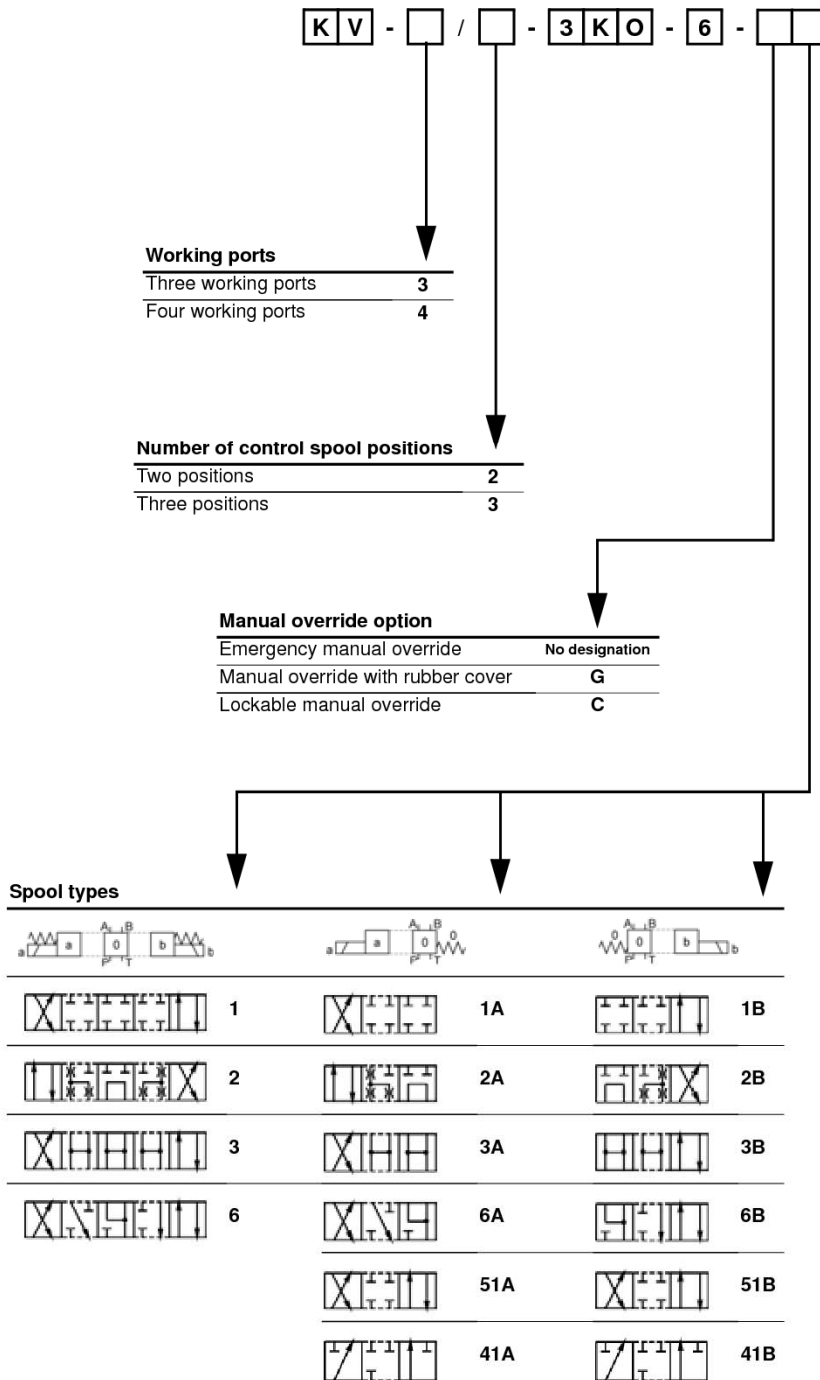


**Cartridge throttle**

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



**Model code**



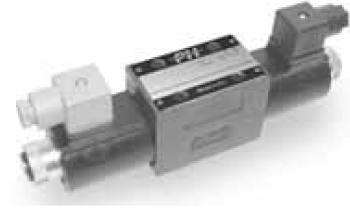
Port T in the valves with spool type 41A and 41B to be used as leakage line when working pressure is higher than 210 bar [3 045 PSI].





## 4/2, 4/3 WAY DIRECTIONAL PROPORTIONAL VALVE KVP (NG 6)

- NG 6
- Up to 350 bar [5 076 PSI]
- Up to 30 L/min [7.9 GPM]
- Plug-in connector for solenoids to ISO 4400. Connection diagram and connection dimensions to ISO 4401.
- 5 chamber models with good spool guidance. Optional control electronics: Amplifier P/N: 1659574.
- Protection of solenoid IP 65 to EN 60529 / IEC 60529.
- Fulfil EMC (89/336/EEC).



KVP-4/3-5KO-6

### Operation

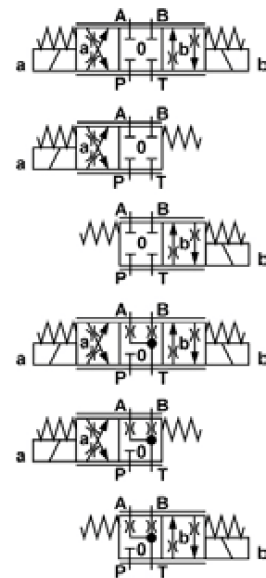
The KVP directional control valve is a proportional valve providing variable flow rates. This valve is used with control electronics. Typical applications are soft switching via adjustable ramps for the reduction of hydraulic and mechanical shocks, and electrically adjustable flow rates - speeds for automating machine functions.

This directional valves consist of a housing (1), a control spool (2), one or two proportional solenoids (3) and two return springs (4). The change-over can be done manually by pressing the emergency manual override (5).



### Hydraulic symbols

Spool type



**Features**

**Hydraulic**

<b>Size</b>			<b>6</b>
<b>Flow rate</b>	L/min [GPM]		10, 20, 30 [2.6 - 5.2 - 7.9]
<b>Operating pressure</b>	A, B, P	bar [PSI]	350 [5 076]
	T		250 [3 625]
<b>Oil temperature range</b>	°C [°F]		-20 to +70 [-4 to +158]
<b>Viscosity range</b>	mm <sup>2</sup> /s [SUS]		15 to 380 [3.24to82]
<b>Mounting position</b>	Optional		
<b>Mass</b>	4/2	kg [lb]	1,65 [3.63]
	4/3		2,2 [4.85]
<b>Filtration</b>	NAS 1638		7

**Proportional**

<b>Hysteresis</b>	5% of max. flow rate		
<b>Nominal current</b>	12 DC	A	2
	24 DC		1

**Electrical**

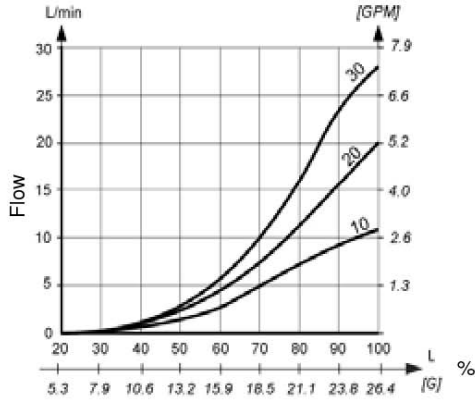
<b>Supply voltage</b>	V		12, 24 DC
<b>Power</b>	W		36
<b>Ambiant temperature</b>	°C [°F]		to+50 [to +122]
<b>Coil temperature</b>	°C [°F]		to +180 [to +356]
<b>Duty cycle</b>	Continuous		

**Dimensions**



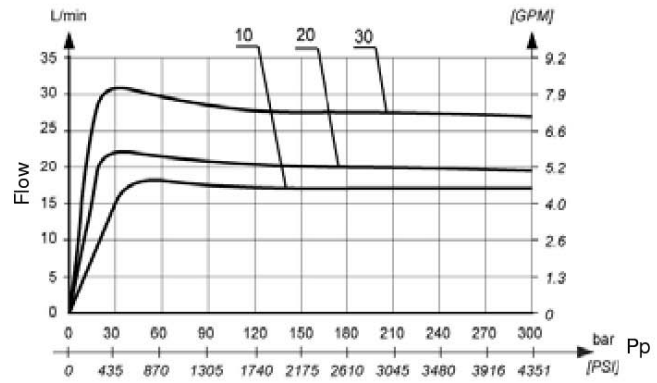
**Input signal curves / Flow rate**

Measured at 40°C [104 °F] and viscosity of 32 mm<sup>2</sup>/s.  
 $\Delta P=5$  bar [72.5PSI] P-A or P-B



**Power limits transmitted**

Measured at 40°C [104 °F] and viscosity of 32 mm<sup>2</sup>/s.



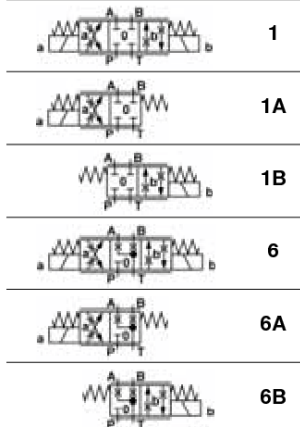
**Model code**

**K V P - 4 / - 5 K O - 6 - - - - \***

**Number of spool positions**

Two positions	2
Three positions	3

**Spool types**



**Regulated flow rate**

( $\Delta P=5$  bar [72.1 PSI] / P-A or P-B)

0-10 L/min [0-2.6 GPM]	10
0-20 L/min [0-5.2 GPM]	20
0-30 L/min [0-7.9 GPM]	30

**Supply voltage**

Direct voltage 24V	No designation
Direct voltage 12V	12 DC

**Special requirements to be briefly specified**

**Seal type**

No designation	NBR seals for mineral oil HL, HLP, to DIN 51524
E	FPM seals for HETG, HEES, HEPG to VDMA 24568 and ISO 15380

**Connector type**

No designation	EN 175301-803 without signal lamp
L	EN 175301-803 with signal lamp
K	EN 175301-803 without connector
V	Deutsch



## 4/2, 4/3 WAY BANKABLE DIRECTIONAL VALVES KVM

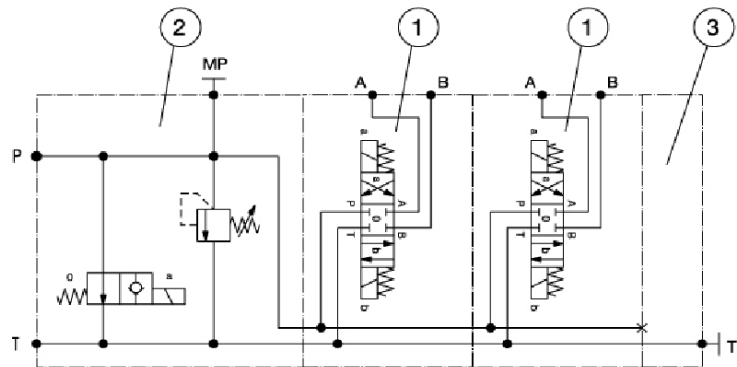
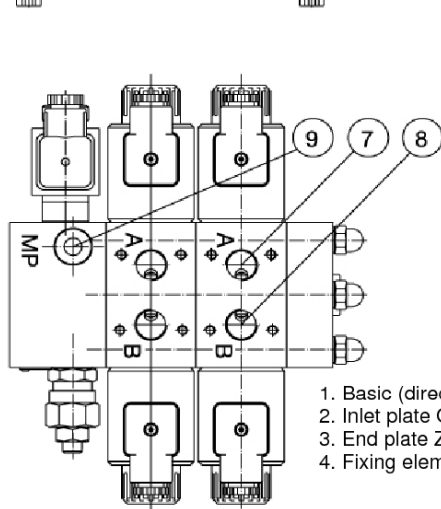
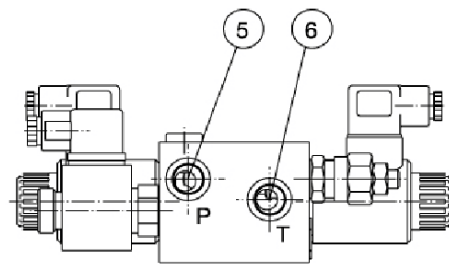
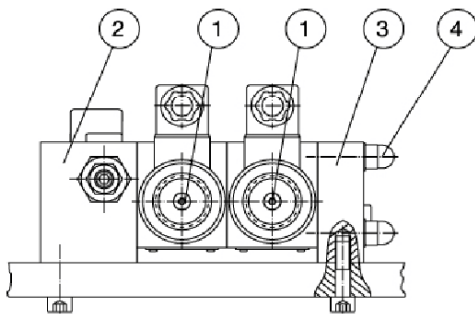
- NG 6
- Up to 350 bar [5 076PSI]
- Up to 40 L/min [10.6 GPM]

- Threaded connection to ISO 9974 (Metric), ISO1179 (BSPP/Gas).
- 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
2. Inlet plate OB-KVM-6
3. End plate ZB-KVM-6
4. Fixing elements for mounting SET-KVM-6

5. Threaded connection P
6. Threaded connection T
7. Threaded connection A
8. Threaded connection B
9. Threaded connection MP (closed)

### Type of connection





## 4/2, 4/3 WAY BANKABLE DIRECTIONAL VALVES KVM (NG 6)

- NG 6
- Up to 350 bar [5 076 PSI]
- Up to 40 L/min [10.6 GPM]
- Parallel or series connection.
- 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 / IEC 60529.
- Fulfil EMC (89/336/EEC).
- Threaded connections to ISO 9974 (Metric), ISO 1179 (BSPP/Gas), ISO 11926 (UNF).



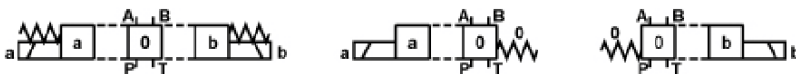
**KVM-P-4/3-6-1-1-12DC-3/8**

### Hydraulic symbol

#### Spool types - Parallel connection (KVM-P)



#### Spool types - Series connection (KVM-S)



### Features

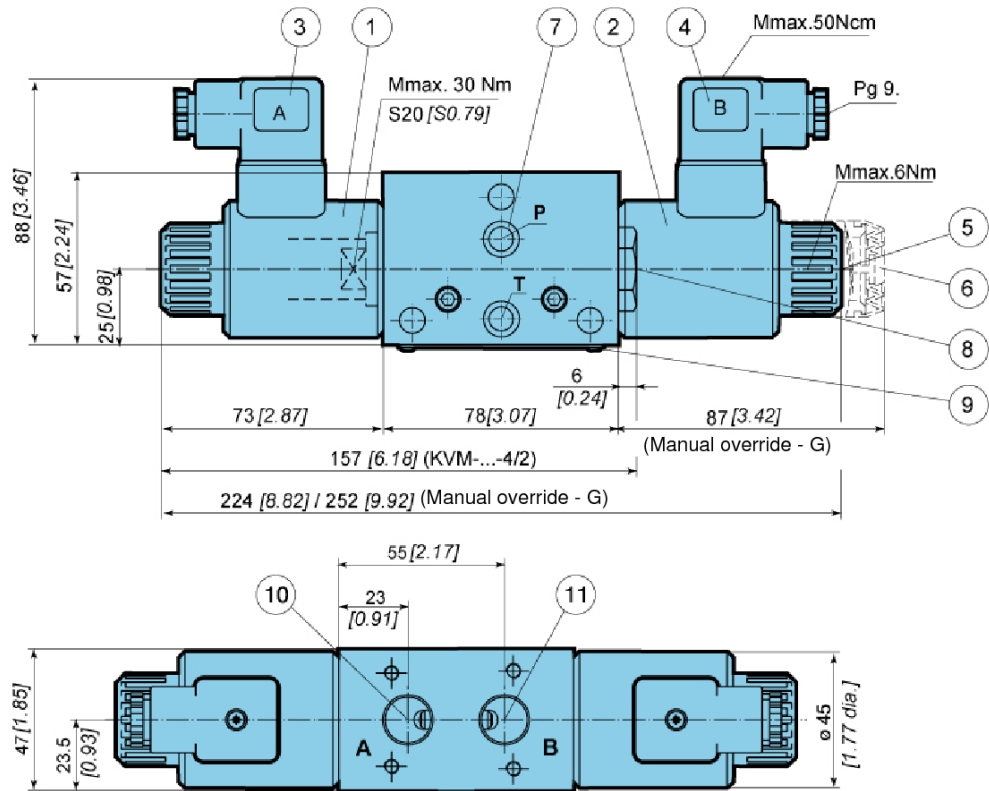
#### Hydraulic

		KVM-P	KVM-S
<b>Size</b>		6	6
<b>Flow rate</b>	L/min [GPM]	40 [10.6]	30 [7.9]
<b>Operating pressure</b>	A, B, P T bar [PSI]	350 [4 568]	250 [3 626]
<b>Oil temperature range</b>	°C [°F]	-20 to +70 [-4 to +158]	
<b>Viscosity range</b>	mm <sup>2</sup> /s [SUS]	15 to 380 [3.24 to 82]	
<b>Mass</b>	4/2 4/3 kg [lb]	1,85 [4.08]	
<b>Filtration</b>	NAS 1638	8	

#### Electrical

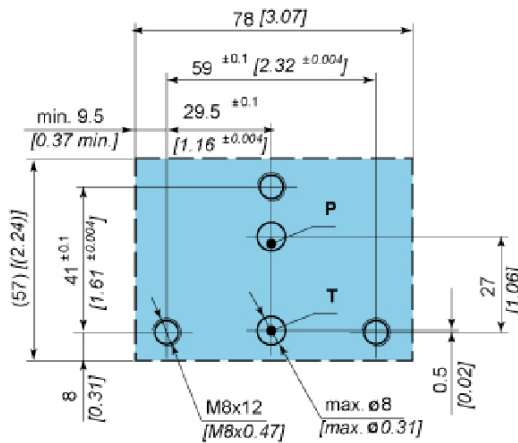
<b>Supply voltage</b>	V	12, 24 DC
<b>Power</b>	W	29
	(12 V DC supply voltage)	36
<b>Switching frequency</b>	1/h	15 000
<b>Ambient temperature</b>	°C [°F]	to +50 [to +122]
<b>Coil temperature</b>	°C [°F]	to +180 [to +356]
<b>Duty cycle</b>		Continuous

**Dimensions**

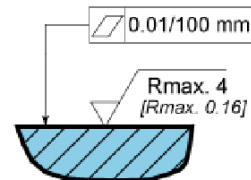


- 1. Solenoid "a" / MR-045-O
- 2. Solenoid "b" / MR-045-O
- 3. Plug-in connector «a» -grey
- 4. Plug-in connector «b» -black
- 5. Emergency manual override
- 6. Manual override with rubber (G)
- 7. O-ring 9,25 x 1,78
- 8. Valve cap (KVM-...-4/2)
- 9. Nameplate
- 10. Threaded connection A-M torque = max.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

**Connection dimensions for KVM-6**



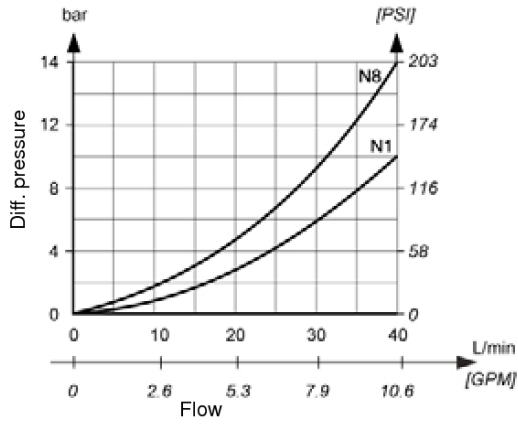
Required quality of the mating surface



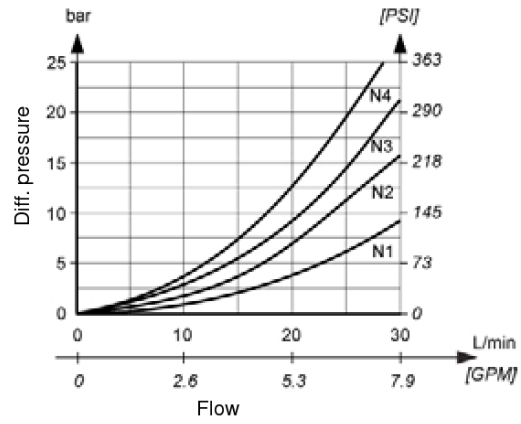
**ΔP-Q Performance curves**

Measured at 50 °C [122 °F] and viscosity of 32 mm<sup>2</sup>/s [148 SUS].

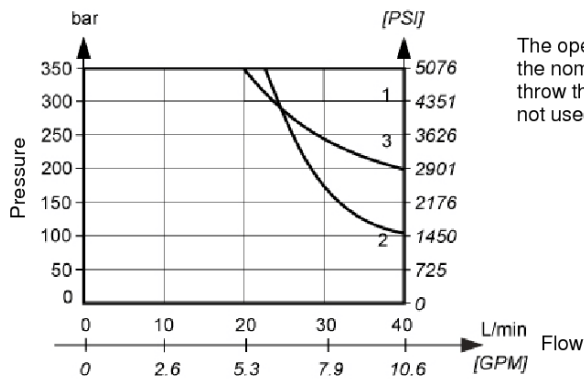
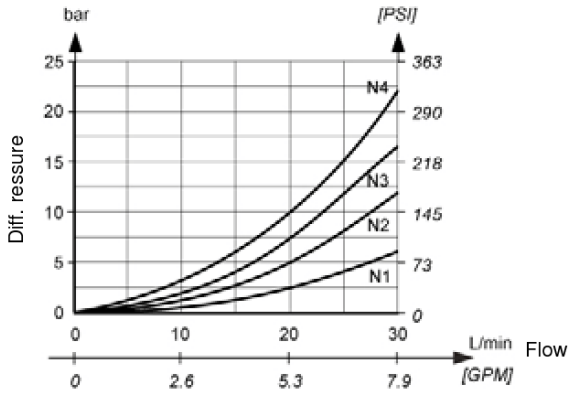
Parallel connection -KVM-P (N1 to N8)



.Series connection -KVM-S (P to T).



Series connection -KVM-S (P to A(B)).

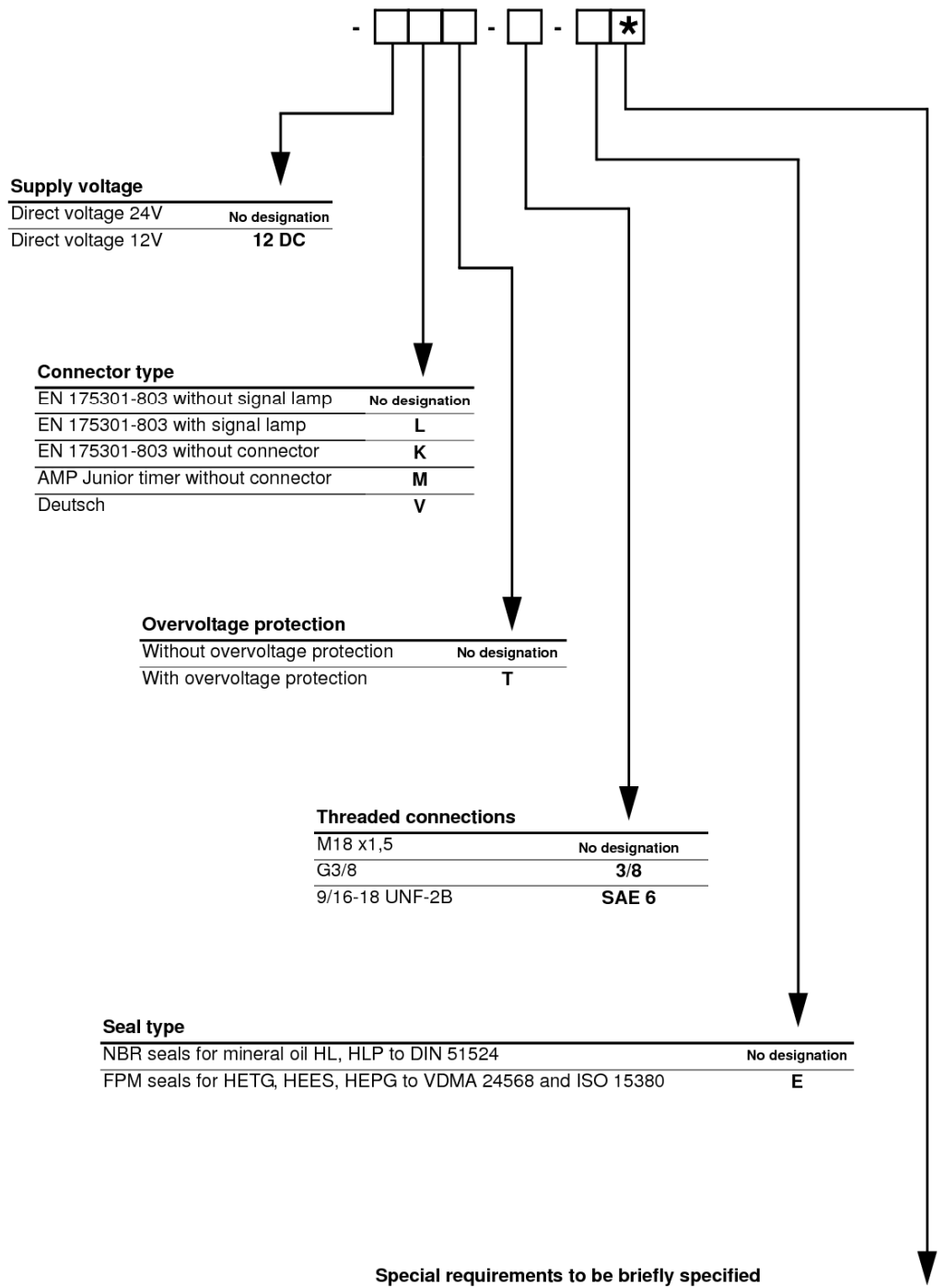


The operating limits of the valve shall be determined at a voltage 10% below the nominal rating. The curves refer to application with symmetrical flow through the valve (P-A and B-T). In the case of asymmetrical flow (e.g. one part not used) reduced values may result.

Spool type	Curve
1	1
2	2
3,6	3

**Model code**

<b>K V M</b> - <span style="border: 1px solid black; padding: 2px;">  </span> - <b>4</b> / <span style="border: 1px solid black; padding: 2px;">  </span> - <b>6</b> - <span style="border: 1px solid black; padding: 2px;">  </span> <span style="border: 1px solid black; padding: 2px;">  </span>		
<b>Type of connection</b>		
Series connection	<b>S</b>	
Parallel connection	<b>P</b>	
<b>Number of control spool positions</b>		
Two positions	<b>2</b>	
Three positions	<b>3</b>	
<b>Manual override option</b>		
Emergency manual override	No designation	
Manual override with rubber	<b>G</b>	
Lockable manual override	<b>C</b>	
<b>Spool type</b>		
		<b>1</b>
		<b>3</b>
		<b>6</b>
		<b>1A</b>
		<b>3A</b>
		<b>6A</b>
		<b>51A</b>
		<b>1B</b>
		<b>3B</b>
		<b>6B</b>
		<b>51B</b>
		<b>81</b>
		<b>2</b>
		<b>2A</b>
		<b>2B</b>
<b>Parallel connection (KVM-P)</b>		
<b>Series connection (KVM-S)</b>		





## VERTICAL STACKING FOR KVM VALVES

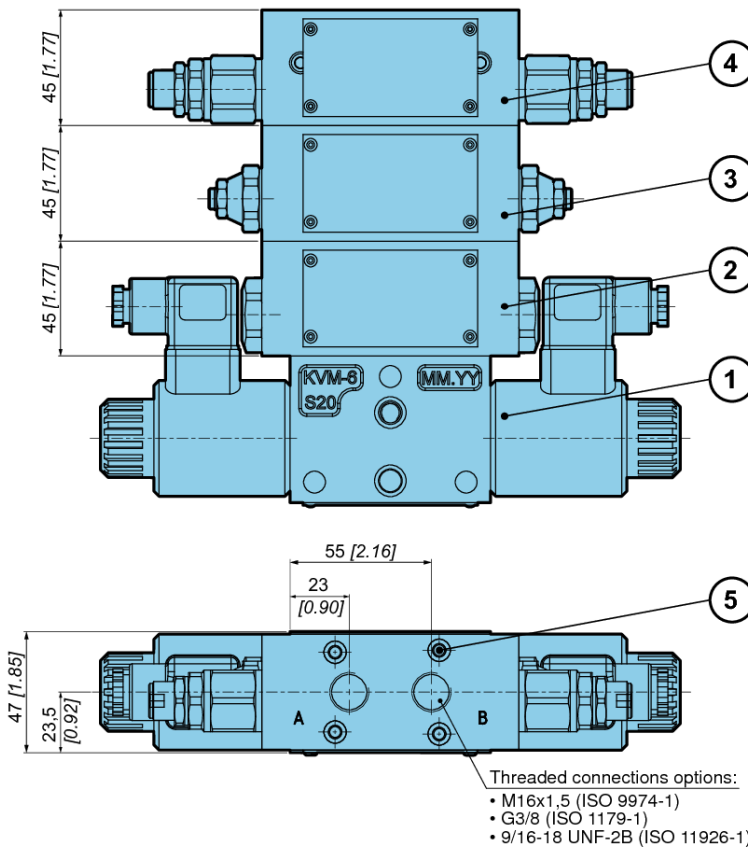
- NG 6
- Up to 350 bar [5076 PSI]
- Up to 40 l/min [10.56 GPM]
- Threaded connections to ISO 9974, ISO 1179 or ISO 11926.
- Possibility of stacking one, two or three vertical stacking components.



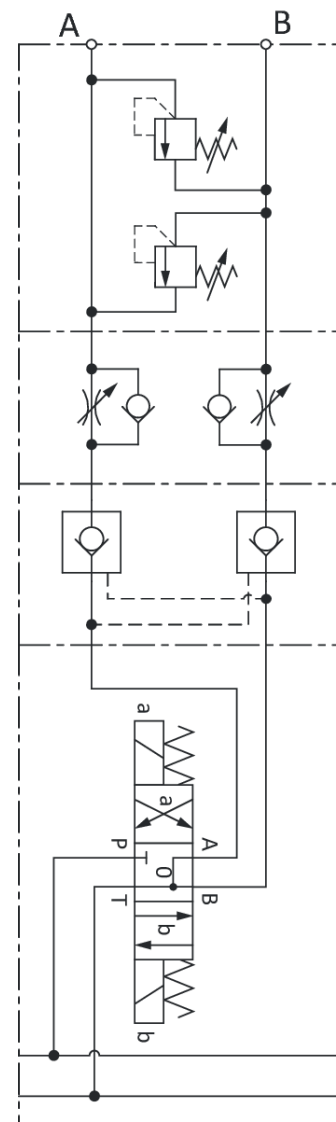
### Mounting example

1. Bankable directional valve KVM-6
2. First stacking component (KVM-NOV-6)
3. Second stacking component (KVM-NDV-6)
4. Third stacking component (KVM-VV-6)
5. Mounting screws for vertical stacking components:
  - M5x55, ISO 4762-10.9 (for one stacking component) - ordering code: 1114573
  - M5x95, ISO 4762-10.9 (for two stacking components) - ordering code: 1253603
  - M5x135, ISO 4762-10.9 (for three stacking components) - ordering code: 1668356

Mounting screws tightening torque: max. 9 Nm [79.6 in.lbf]

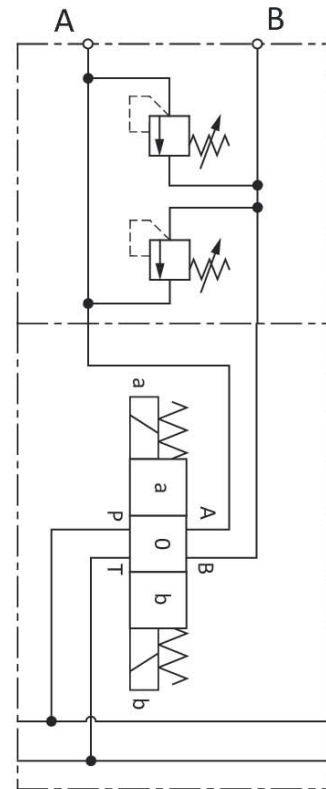
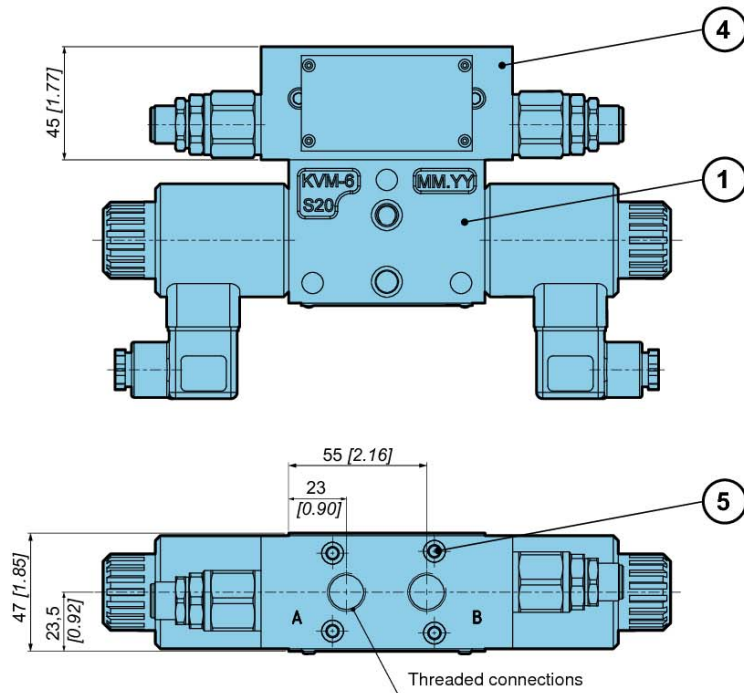


### Hydraulic symbol



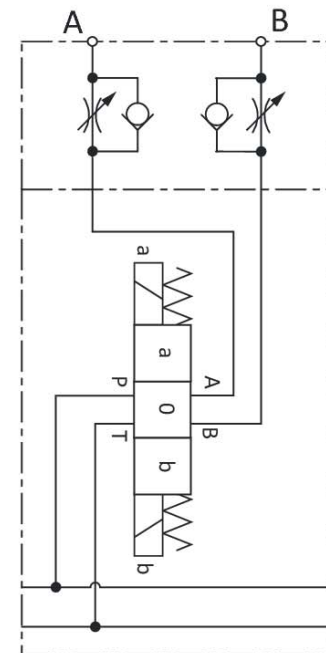
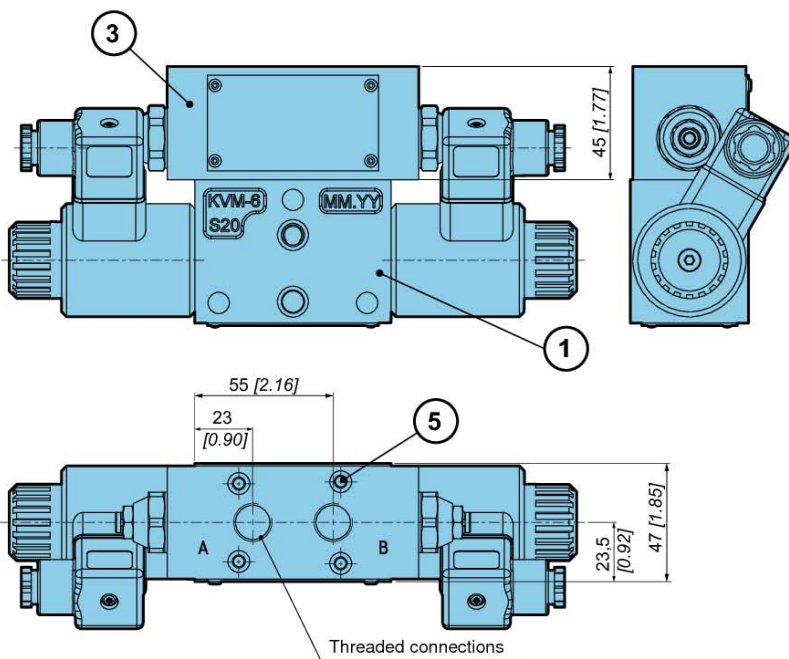
**Directional valve KVM and KVM-VV-6 relief valve mounting example**

**Hydraulic symbol**



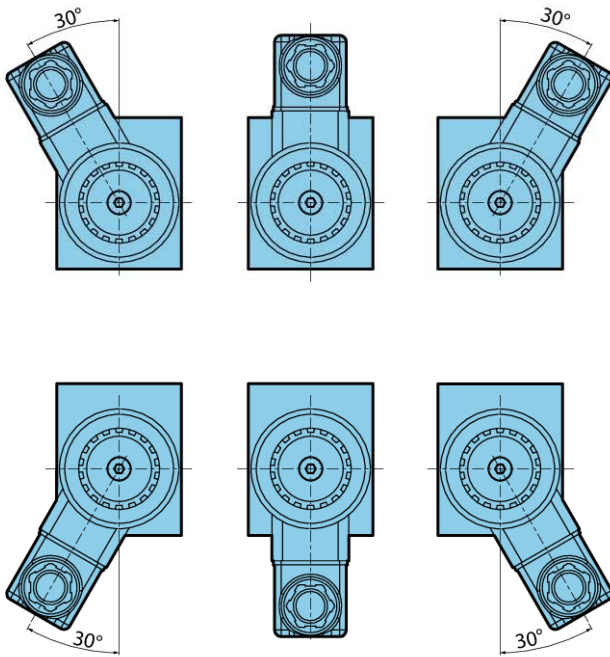
**Directional valve KVM and KVM-NDV-6 throttle valve mounting example**

**Hydraulic symbol**



### Solenoid orientation options

Six different orientation options:



### Sealing between stacking elements





## CHECK VALVE KVM-NOV-6

- Up to 350 bar [5 076 PSI]
- Up to 40 l/min [10,6 GPM]
- Flow shut-off in both or one service line.
- For vertical stacking on KVM directional valves.



### Operation

Pilot operated check valves type KVM-NOV-6 enables 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 to the ports side. In the opposite direction is the valve blocked for the hydraulic fluid flow. Free flow in port A in direction from ports to valve side 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 port T in the zero position of the directional valve.

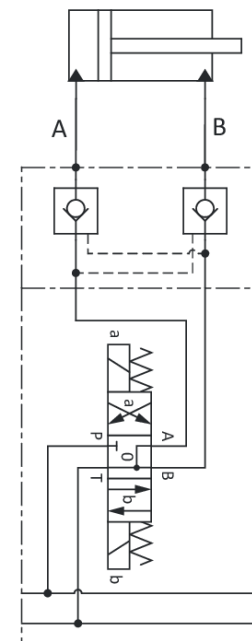
### Hydraulic symbols



### Features

<b>Size</b>		<b>6</b>
<b>Flow rate</b>	l/min [GPM]	40 [10.5]
<b>Operating pressure</b>	bar [PSI]	350 [5 076]
<b>Cracking pressure</b>	bar [PSI]	1 [14.5]
<b>Area ratio</b>		1:3,9
<b>Oil temperature range</b>	°C [°F]	-20 to +70 [-4 to +158]
<b>Viscosity range</b>	mm <sup>2</sup> /s [SUS]	15 to 380 [69.5 to 1760]
<b>Filtration</b>	ISO 4406: 1999	19/17/14
<b>Mass</b>	kg [lbs]	1,4 [3.0]

### Mounting example



**Dimensions**

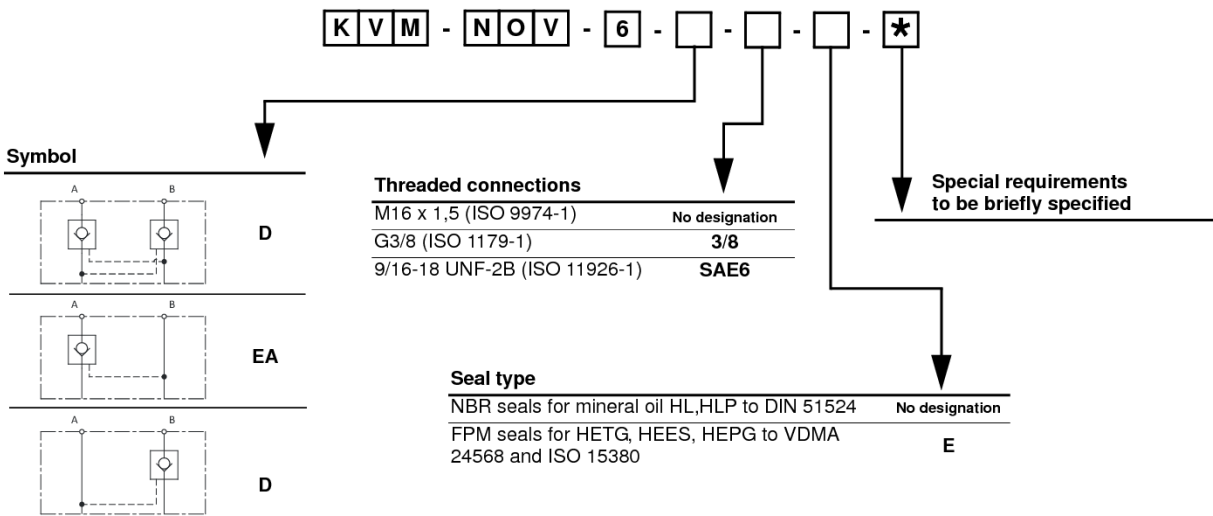


**ΔP-Q Performance curves**

Measured at 50C [122F] and viscosity of 32 mm<sup>2</sup>/s [148 SUS].



**Model code**



## THROTTLE WITH CHECK VALVE KVM-NDV-6

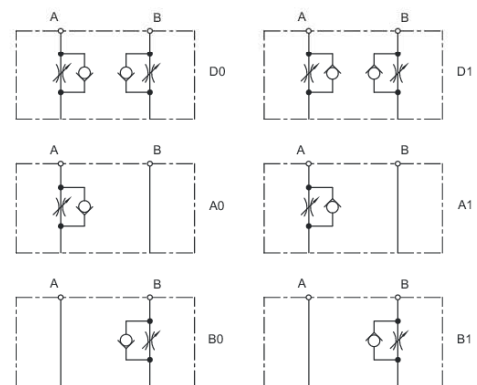
- Up to 350 bar [5 076 PSI]
- Up to 40 l/min [10.6 GPM]
- Flow control in both or one service line.
- For flow throttling in supply and/or return lines.
- For vertical stacking on KVM directional valves.



### Operation

Throttle with check valves type KVM-NDV-6 are used for throttling flow of the hydraulic fluid in lines A and/or B. The KVM-NDV-6 valves are allowing free flow in one direction through check valve and throttled flow in reversed direction. Hydraulic fluid flow is throttled depending od adjustment of the throttling screw.

### Hydraulic symbols



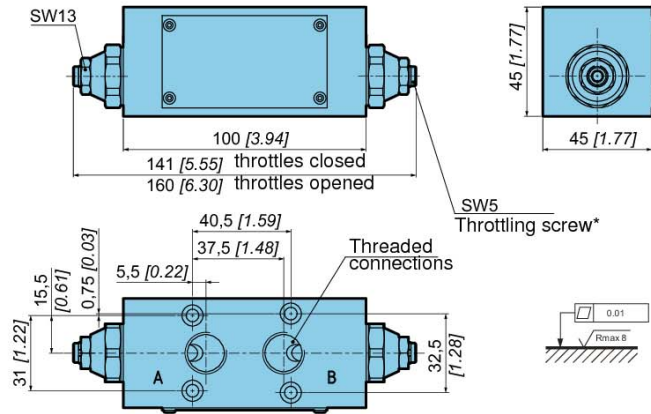
### Features

Size	6	
Flow rate	l/min [GPM]	40 [10.6]
Operating pressure	bar [PSI]	350 [5 076]
Cracking pressure	bar [PSI]	0,5 [7.2]
Oil temperature range	°C [°F]	-20 to +70 [-4 to +158]
Viscosity range	mm <sup>2</sup> /s [SUS]	15 to 380 [69.5 to 1760]
Filtration	ISO 4406: 1999	19/17/14
Mass	kg [lbs]	1,5 [3.3]

### Mounting example



**Dimensions**



\* Clockwise rotation reduces the hydraulic fluid flow. It is recommended that the valve is set at zero pressure in setting line.

**ΔP-Q Performance curve**

Measured at 50C [122F]  
and viscosity of 32 mm<sup>2</sup>/s [148 SUS].



**Model code**

**K V M** - **N D V** - **6** -   -   -   - \*

**Symbol**



**Threaded connections**

M16 x 1,5 (ISO 9974-1)	No designation
G3/8 (ISO 1179-1)	3/8
9/16-18 UNF-2B (ISO 11926-1)	SAE6

Special requirements to be briefly specified

**Seal type**

NBR seals for mineral oil HL,HLP to DIN 51524	No designation
FPM seals for HETG, HEES, HEPG to VDMA 24568 and ISO 15380	E



## PRESSURE RELIEF VALVE KVM-VV-6

- Up to 350 bar [5 076 PSI]
- Up to 40 l/min [10.6 GPM]
- Direct operated.
- For vertical stacking on KVM directional valves.
- Multiple pressure setting ranges.
- Various hydraulic symbols.



### Operation

Throttle with check valves type KVM-NDV-6 are used for throttling flow of the hydraulic fluid in lines A and/or B. The KVM-NDV-6 valves are allowing free flow in one direction through check valve and throttled flow in reversed direction. Hydraulic fluid flow is throttled depending on adjustment of the throttling screw.

### Hydraulic symbols



### Features

Size	<b>6</b>	
Flow rate	l/min [GPM]	40 [10.6]
Pressure setting range	bar [PSI]	15 - 350 [270 - 5 076]
Oil temperature range	°C [°F]	-20 to +70 [-4 to +158]
Viscosity range	mm <sup>2</sup> /s [SUS]	15 to 380 [69.5 to 1760]
Filtration	ISO 4406: 1999	19/17/14
Mass	kg [lbs]	1,1 - 1,8 [2.4 - 4.0]

**Dimensions**

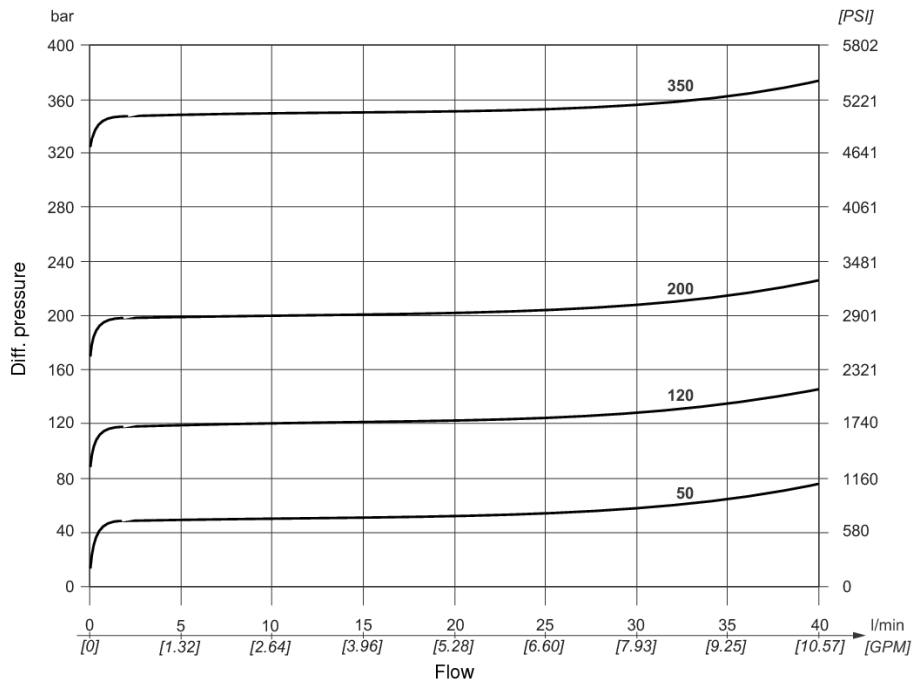


\* Clockwise rotation increases pressure rise at the inlet port of pressure relief valve.

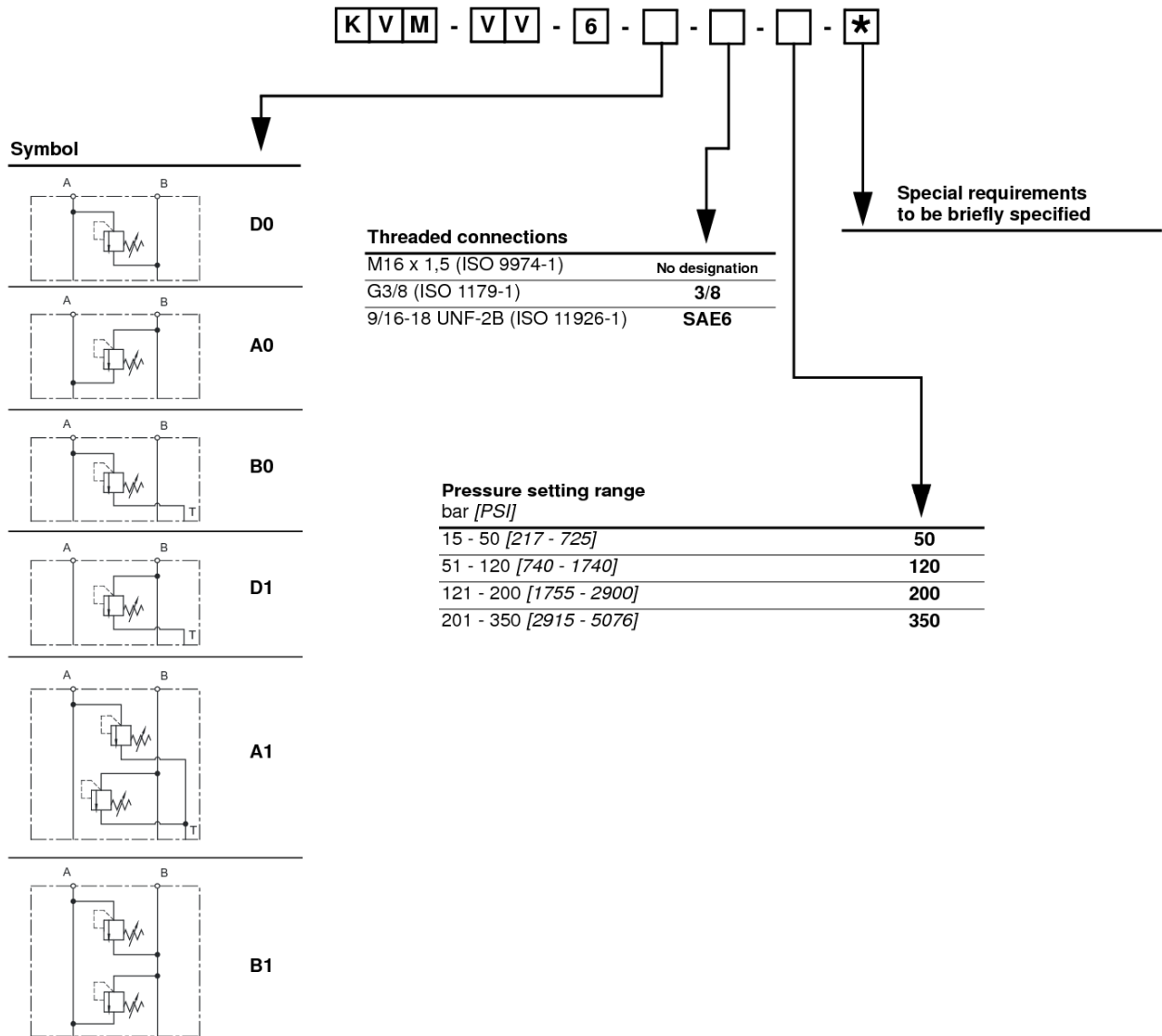
Option	L1 mm [inch]	L2 mm [inch]	L3 mm [inch]	L4 mm [inch]	L5 mm [inch]	Mass kg [lbs]
KVM-VV-6-AB	109 [4.29]	70 [2.76]	0	39 [1.53]	13,5 [0.53]	1,1 [2.42]
KVM-VV-6-BA	109 [4.29]	70 [2.76]	39 [1.53]	0	13,5 [0.53]	1,1 [2.42]
KVM-VV-6-AT	144 [5.67]	100 [3.94]	44 [1.73]	0	29 [1.14]	1,6 [3.53]
KVM-VV-6-BT	121,5 [4.78]	80 [3.15]	0	41,5 [1.63]	8,5 [0.33]	1,3 [2.87]
KVM-VV-6-DT	188 [7.40]	100 [3.94]	44 [1.73]	44 [1.73]	28,5 [1.12]	1,8 [3.97]
KVM-VV-6-DD	188 [7.40]	100 [3.94]	44 [1.73]	44 [1.73]	28,5 [1.12]	1,8 [3.97]

**ΔP-Q Performance curves**

Measured at 50C [122F]  
and viscosity of 32 mm<sup>2</sup>/s [148 SUS].



**Model code**





## VERTICAL STACKING ON VALVES KVM WITH STANDARD SANDWICH VALVES TO ISO 4401 (NG 6)

- NG 6
- Up to 350 bar [5076 PSI]
- Up to 40l/min [10.57 GPM]
- Use standard components for vertical stacking.
- Threaded connections to ISO 9974 or ISO 1179.
- Possibility of stacking one or two standard components.



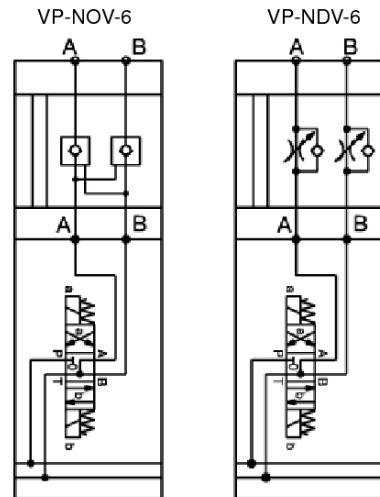
### KVM-P-4/3-5KO-6 and VP-NOV-6 for stacking

#### Description

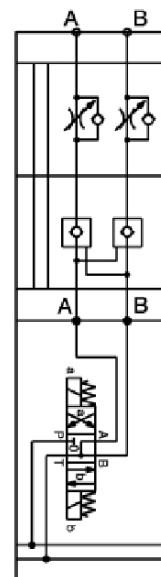
1. Bankable directional valve KVM-6
2. STACK-KVM-6 consist of:
  - 2.1 Adapter plate and two O-rings 18,77 x 1,78
  - 2.2 End plate and two O-rings 9,25 x 1,78
  - 2.3 Fixing screws M5x100 ISO 4762-10.9 (for one stacking component) or M5x140 ISO 4762-10.9 (for two stacking components)
3. First stacking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

#### Hydraulic symbol

One standard component



Two standard components



Mtorque = max. 9Nm [79.6 in.lbf]

**Model code**

**S T A C K** - **K V M** - **6** -  -  -  -

**Number of stacking components**

One standard component	<b>N1</b>
Two standard components	<b>N2</b>

**Threaded connections**

G3/8 (ISO 1179)	<b>3/8</b>
M18 x 1,5 (ISO 9974)	<b>No designation</b>

**Seal type**

NBR seals for mineral oil HL, HLP to DIN 51524	<b>No designation</b>
FPM seals for HETG, HEES, HEPG to VDMA 24568 and ISO 15380	<b>E</b>

**Special requirements to be briefly specified**

## AUXILIARY CONTROL LEVER

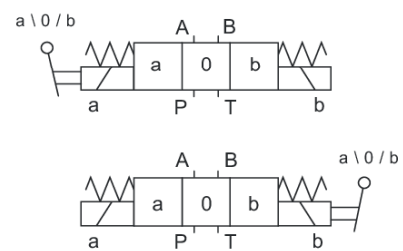
- Compatible with KV-5KO-6, KVM-6 and KVP-5KO-6 directional valves
- Without impact on valve's performance.
- Up to 250 bar [3 625 PSI] on T port.



### Description

The optional auxiliary control lever module offers solenoid or manual operation of directional valves. Control lever provides mechanical connection with main control spool without significant impact on valve's performance. Auxiliary control lever module is mounted between the valve housing and solenoid. During solenoid operation, hand lever remains in neutral position. Modular and robust design of auxiliary control lever enables installation on A or B side of various types of directional valves and operating pressure range up to 250 bar [3 625 PSI] on T port.

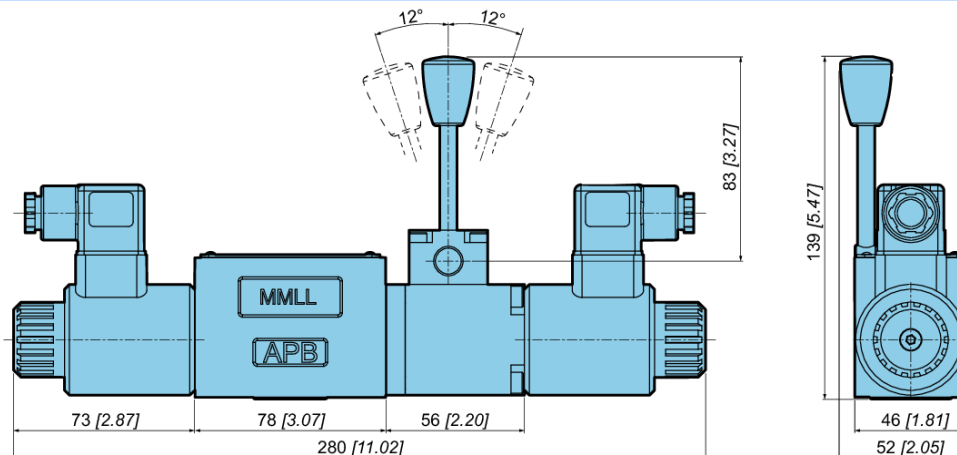
### Hydraulic symbols



### Features

Size	6		
Operating pressure	Ports A, B, P	bar [PSI]	350 [5 076]
	Port T	bar [PSI]	250 [3 626]
Oil temperature range		°C [°F]	-20 to +70 [-4 to +158]
Viscosity range		mm <sup>2</sup> /s [SUS]	15 to 380 [69.5 to 1760]
Filtration	ISO 4406: 1999		19/17/14
Lever actuating force (end stroke)		N [lbf]	40 [9.0]
Mass (ACL module)		kg [lbs]	0,9 [1.98]

### Dimensions



## Model code

The auxiliary control lever on valves KV-5KO-6 and KVM-6 is defined by the designation in the manual override option field.



The auxiliary control lever on valves KVP-6 is defined by the designation FA or FB in the special requirements field.

## INLET PLATE OB-KVM-6 (NG 6)

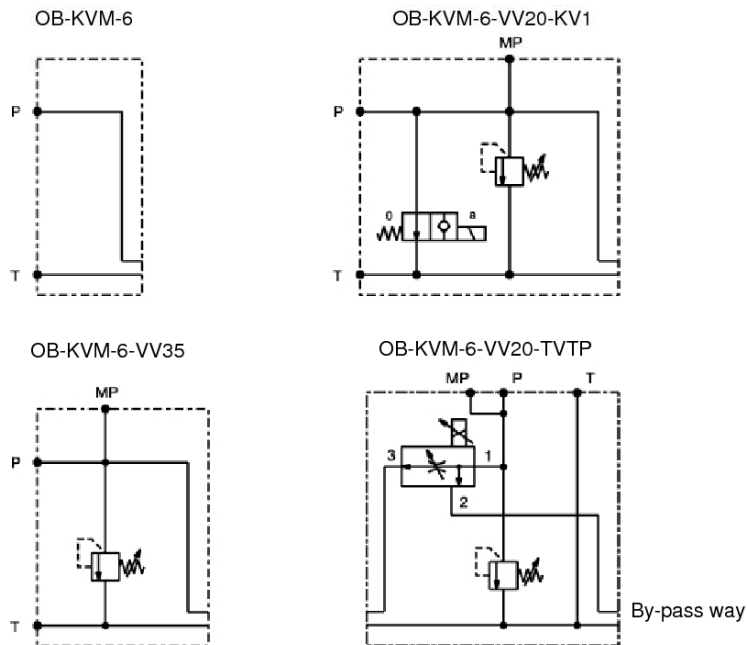
- NG 6
- Up to 350 Bar [5076 PSI]
- Up to 40 L/min [10,6 GPM]
- Provide pressure relief valve.
- Provide pump unloading valve.
- Provide flow control valve.
- Threaded connections to ISO 9974 (Metric), ISO 1179 (BSPP/Gas), ISO 11926 (UNF).



OB-KVM-6-VV20-KVO

OB-KVM-6-VV20-TVTPG

### Hydraulic symbol

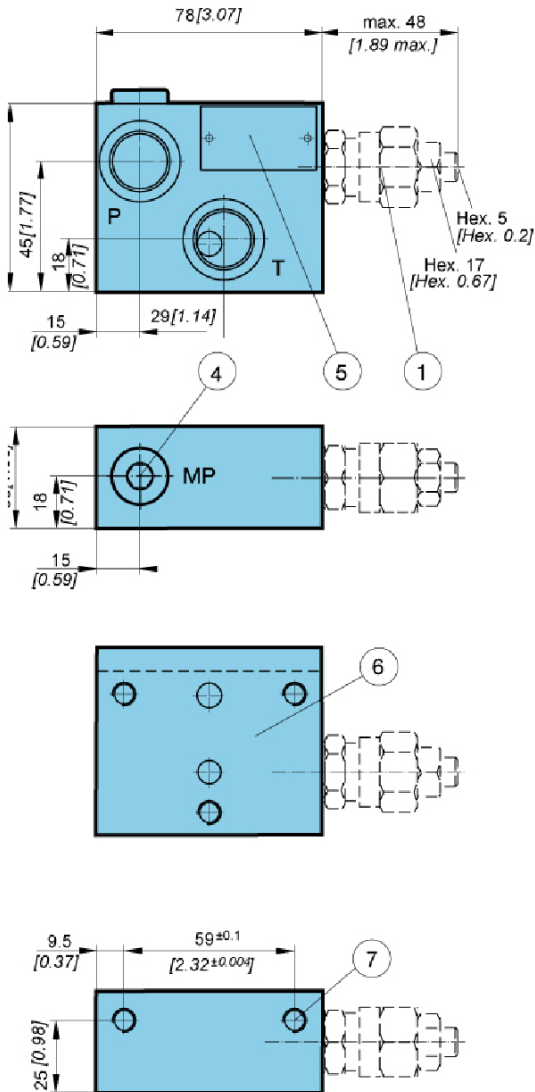


### Features

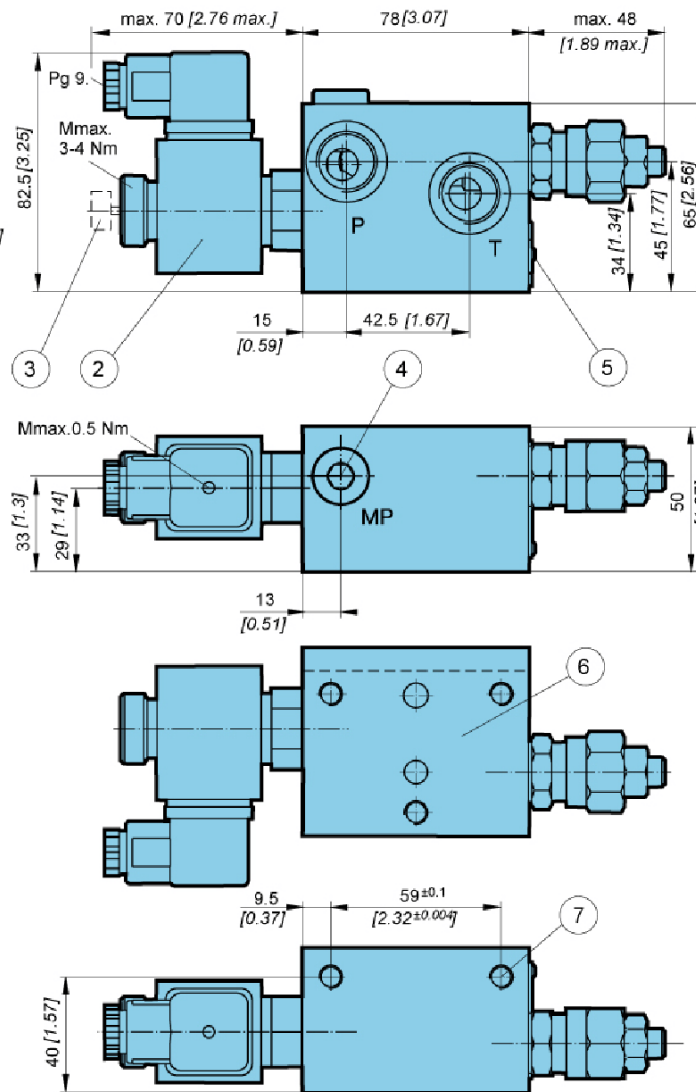
		OB-KVM-6	OB-KVM-6-VV	OB-KVM-VV-KV	OB-KVM-VV-TVTP
Oil temperature range	°C [°F]			-20 to +70 [-4 to +158]	
Viscosity range	mm <sup>2</sup> /s [SUS]			15 to 380 [3.24 to 82]	
Filtration	NAS 1638			8	
Mass	kg [lbs]	1,25 [2.76]	1,35 [2.98]	2,2 [4.85]	4,5 [9.92]
Flow rate	l/min [GPM]	/	/	40 [10.6]	
Press Setting	bar [PSI]	/	/	50-210 [13-55]	
Adjustments		/	/	100-350 [26-92]	
Max. pressure	bar [PSI]	/	/	350 [5 076]	210 [3 045]
Supply voltage	V DC	/	/	12, 24	/
Power	W	/	/	17	/
Flow - inlet	l/min [GPM]	/	/	/	max. 50 [max. 13,21]
Flow - priority way	l/min [GPM]	/	/	/	0 - 25 [0 - 6.6]
Flow - bypass	l/min [GPM]	/	/	/	max. 40 [max. 10,6]

## Dimensions

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



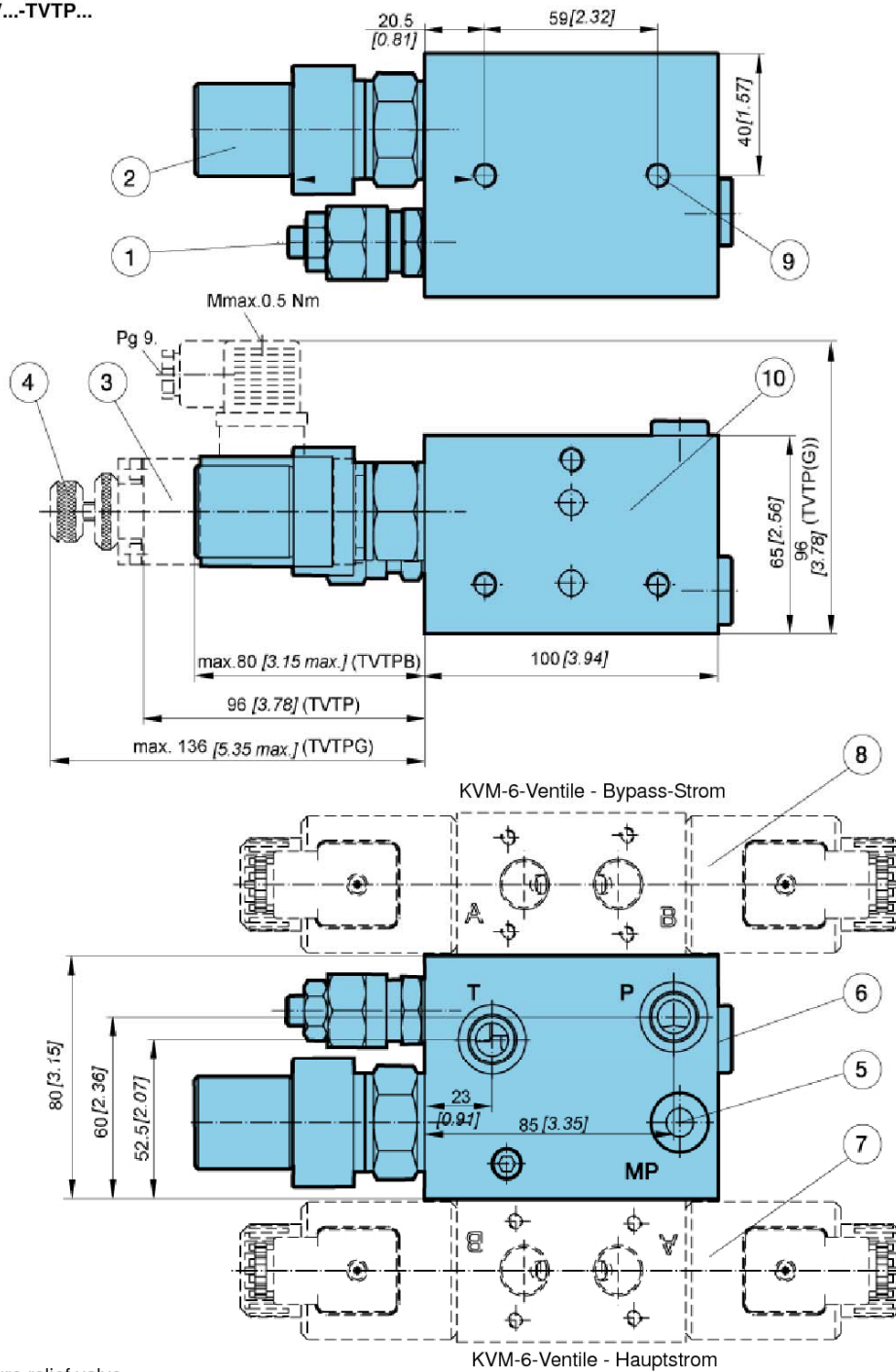
**OB-KVM-6-VV...-KV...**



1. Pressure relief valve
2. Pump unloading valve
3. Manual override with knob
4. Threaded connection MP - G1/4 (closed)
6. Connection dimensions for KVM-6
7. Fixing hole (M8 X 12) for mounting assembly

## Dimensions

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



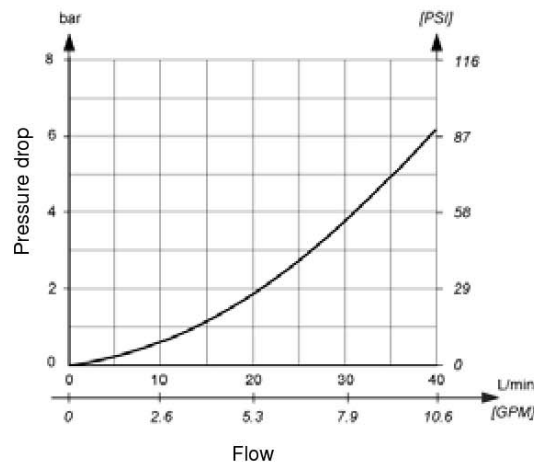
1. Pressure relief valve
2. Flow control valve - rotary knob -TVTPB
3. Flow control valve - proportional solenoid - TVTP
4. Flow control valve - proportional solenoid with manual override - TVTPG
5. Threaded connection MP - G1/4 (closed)
6. Nameplate
7. Bankable directional valves KVM-6 Priority flow
8. Bankable directional valves KVM-6 Bypass flow
9. Fixing hole (M8 x 12) for mounting assembly
10. Connection dimensions for KVM-6 (see page 12.11.3)

**ΔP-Q Performance curves**

Measured at 50°C [122°F] and viscosity of 28 mm<sup>2</sup>/s [148 SUS].

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

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

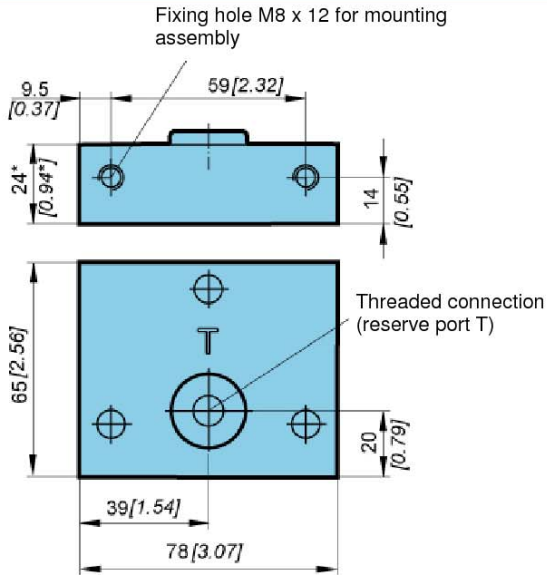






## END PLATE ZB-KVM-6

### Dimensions



**ZB-KVM-6**

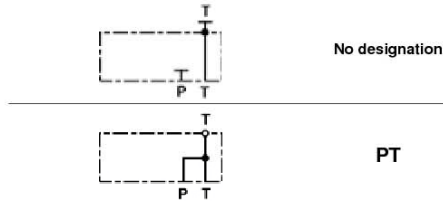
\* ZB-KVM-6-PT-1/2(M22) = 27

Mass = 0,8 kg

### Model code

Z
B
 - 
 K
V
M
 - 
 6
 - 
  
 - 
  
 - 
  
 - 
 \*

**Symbol**



((It is necessary to use this end plate by series connections KVM-S))

**Threaded connections**

M18 x 1,5 (ISO 9974)	No designation
M22 x 1,5 (ISO 9974)	<b>M22</b>
G1/2 (ISO 1179)	<b>1/2</b>
G3/8 (ISO 1179)	<b>3/8</b>
3/4-16 UNF-2B	<b>3/4-16UNF</b>

**Seal type**

NBR seals for mineral oil HL, HLP to DIN 51524	No designation
FPM seals for HETG, HEES, HEPG to VDMA 24568 and ISO 15380	<b>E</b>

**Special requirements to be briefly specified**



## FIXING ELEMENTS FOR MOUNTING

- SET-KVM-6 consists of:
  - Nuts: 3 x M8 DIN 1587
  - Washers: 3 x A8 DIN 6798-J
  - Screws: 3 x M8 DIN 939 10.9



SET-KVM-6-N3

### Description

Screw M8 DIN 939 10.9:



	L mm [in]
<b>N1</b>	80 [3,15]
<b>N2</b>	127 [4,99]
<b>N3</b>	174 [6,85]
<b>N4</b>	221 [8,70]
<b>N5</b>	268 [10,55]
<b>N6</b>	315 [12,40]
<b>N7</b>	362 [14,25]
<b>N8</b>	409 [16,10]

**:Max. number of bankable valves KVM:**

a) parallel connection (KVM-P) = eight valves (max. N8).

### Model code

SET - KVM - 6 - □

Number of bankable directional valves KVM-6

One valves KVM-6	<b>N1</b>
Two valves KVM-6	<b>N2</b>
Three valves KVM-6	<b>N3</b>
Four valves KVM-6	<b>N4</b>
Five valves KVM-6	<b>N5</b>
Six valves KVM-6	<b>N6</b>
Seven valves KVM-6	<b>N7</b>
Eight valves KVM-6	<b>N8</b>

**Dimensions**

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



	H1	H2
OB-KVM-6 or OB-KVM-6-VV...	75+Nx47 (N = 1 to 8)	39+Nx47 (N = 1 to 8)
OB-KVM-6-VV...-KV...	90+Nx47 (N = 1 to 8)	54+Nx47 (N = 1 to 8)

**OB-KVM-6-VV...-TVTPB...**



1. [141 in.lbf]Mtorque / Parallel connection (KVM-P) - max. 20Nm [177 in.lbf] / Series connection (KVM-S) - max. 16 Nm

## 6/2 WAY DIRECTIONAL VALVE KV (NG 6)

- NG 6
- Up to 350 bar [5 076 PSI]
- Up to 50 L/min [13.2 GPM]
- Plug-in connector for solenoids to ISO 4400.
- Threaded connections to ISO 9974 (Metric), ISO 1179 (BSPP/Gas), ISO 11926 (UNF).
- Protection of solenoid IP 65 to EN 60529 / IEC 60529.
- Fulfil EMC (89/336/EEC).



KV-6/2-6-S50

### 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).

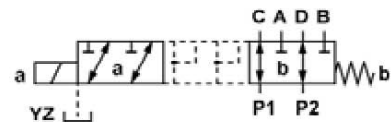
Change-over to the operating position is done by energizing the solenoid (3), whereby the solenoid plunger acts on the control spool (2) via the operating pin (4), thus clearing the corresponding flow ways and establishing respective links between the ports P1, A, B and P2.

When the solenoid (3) is de-energized, 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.

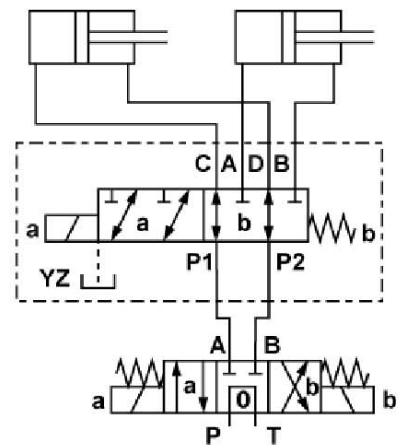
The change-over can also be done manually by pressing the emergency manual override (6).

### Hydraulic symbol

Spool type



### Mounting example



**Features**

**Hydraulic**

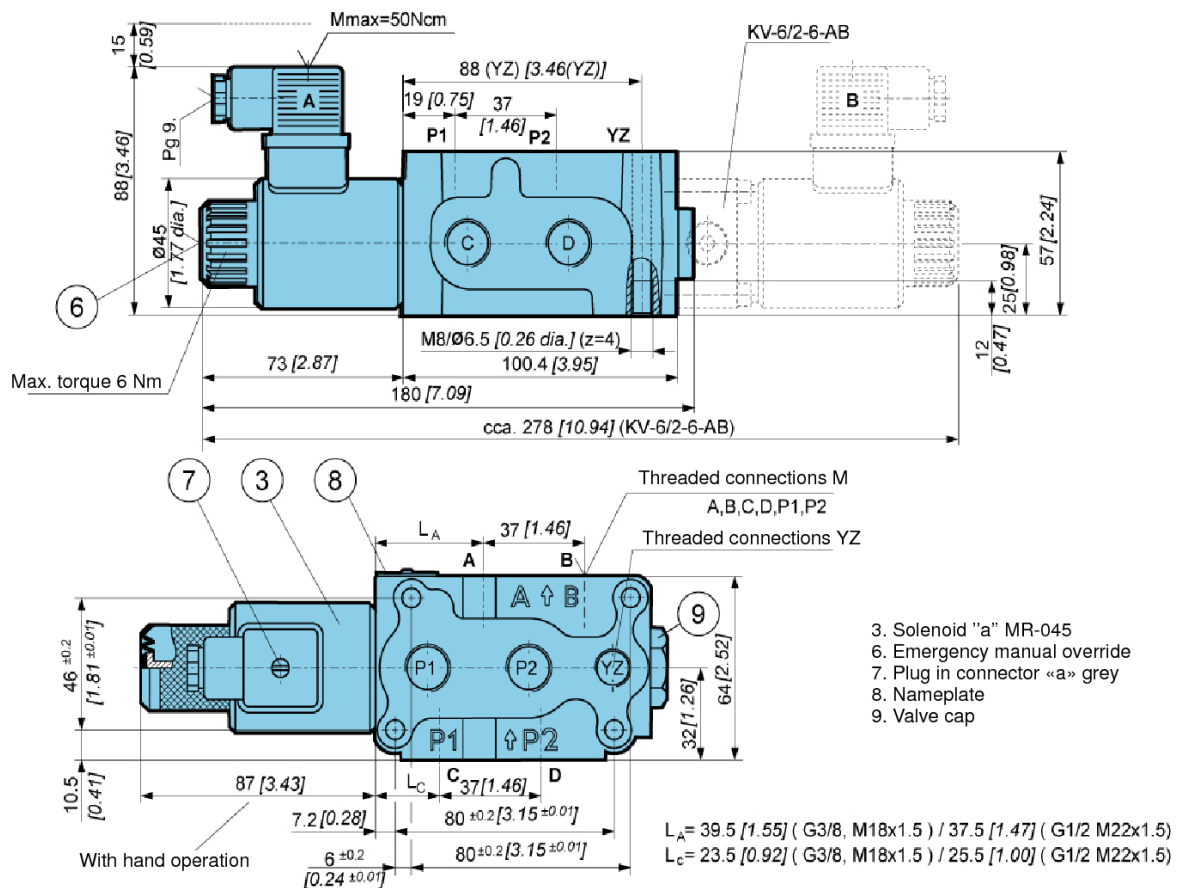
<b>Size</b>			<b>6</b>
<b>Flow rate</b>	L/min [GPM]		50 [13.2]
<b>Operating pressure</b>	With YZ	bar [PSI]	350 [5 076]
	Without YZ		250 [3 625]
<b>Oil temperature range</b>	°C [°F]		-20 to +70 [-4 to +158]
<b>Viscosity range</b>	mm <sup>2</sup> /s [SUS]		15 to 380 [3.24 to 82]
<b>Mounting position</b>	Optional		
<b>Mass</b>	kg [lb]		2,5 [5.51]
<b>Filtration</b>	NAS 1638		8

**Electrical**

<b>Supply voltage</b>	V	12, 24 DC
<b>Power</b>	W	29 *
<b>Switching frequency</b>	1/h	15 000
<b>Ambiant temperature</b>	°C [°F]	to +50 [to +122]
<b>Coil temperature</b>	°C [°F]	to +180 [to +356]
<b>Duty cycle</b>	Continuous	

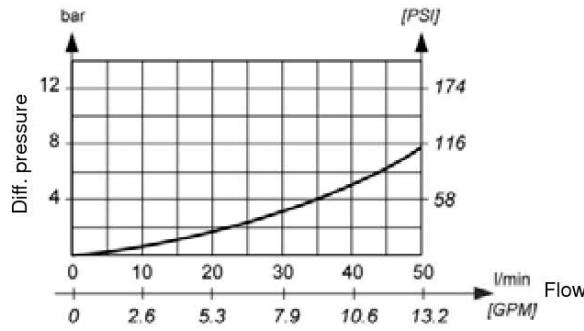
\* 12 V supply voltage - 36 W.

**Dimensions**



**Δp-Q Performance curve**

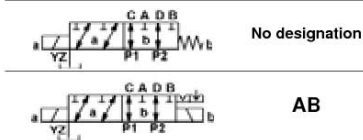
Measured at 40 °C [104 °F] and viscosity of 32 mm<sup>2</sup>/s [148 SUS].



**Model code**

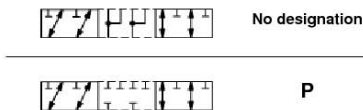
**K V - 6 / 2 - 6 - [ ] - [ ] - [ ] - [ ] - [ ] - [ ] - [ ] - [ ] - S 5 0 - \***

**Spool type**



**Special requirements to be briefly specified**

**Overlap**



**Seal type**  
 No designation: NBR seals for mineral oil HL, HLP to DIN 51524  
 E: FPM seals for HETG, HEES, HEPG to VDMA 24568 and ISO 15380

**Manual override option**

Emergency manual override: No designation  
 Manual override with rubber cover: G  
 Lockable manual override: C

**Drainage**  
 No designation: Without YZ  
 YZ: With YZ

**Supply voltage**

Direct voltage 24V: No designation  
 Direct voltage 12V: 12 DC

**Connector type**

EN 175301-803 without signal lamp: No designation  
 EN 175301-803 with signal lamp: L  
 EN 175301-803 without connector: K  
 AMP Junior timer without connector: M  
 Deutsch: V

**Threaded connections M ; YZ**  
 No designation: M18x1,5 ; M14x1,5  
 M22: M22x1,5 ; M14x1,5  
 3/8: G3/8 ; G1/4  
 1/2: G1/2 ; G1/4  
 SAE 8: 3/4-16 UNF-2B; 9/16-18 UNF-2B

**Overvoltage protection**

Without protection: No designation  
 With protection: T



## 6/2 WAY DIRECTIONAL VALVES KV (NG 10)

- NG 10
- Up to 350 bar [5 076 PSI]
- Up to 120 L/min [31.7 GPM]
- Plug-in connector for solenoids to ISO 4400.
- Threaded connections to ISO 9974 (Metric), ISO 1179 (BSP/Gas), ISO 11926 (UNF).
- Protection of solenoid IP65 to EN 50529 / IEC 60529.



KV-6/2-10

### Operation

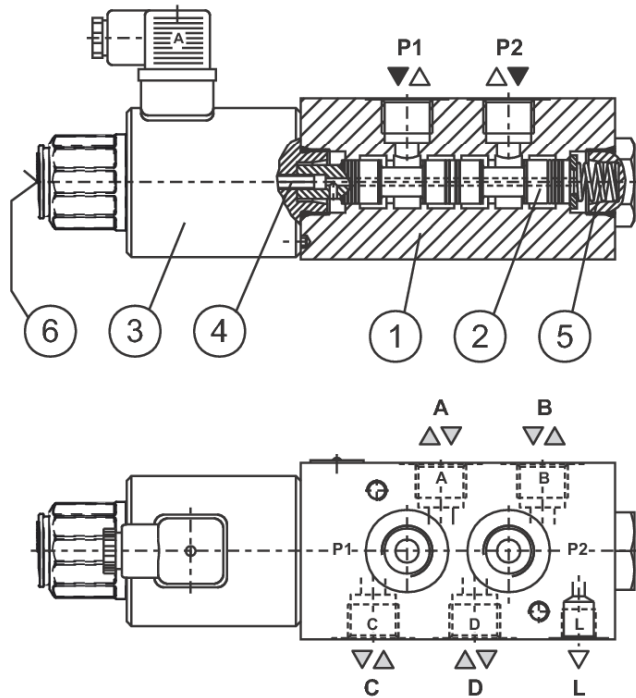
Directional valves type KV with direct solenoid operation control the direction of the hydraulic medium flow. They are mostly used as link between two consumers and the basic directional valve, when we want to control both consumers alternately by means of one basic directional valve.

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

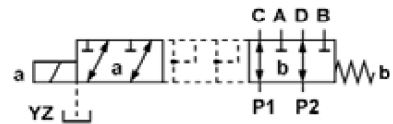
Change-over to the operating position is done by energizing the solenoid (3), whereby the solenoid plunger acts on the control spool (2) via the operating pin (4), thus clearing the corresponding flow ways and establishing respective links between the ports P1, A,B and P2.

When the solenoid (3) is de-energized, 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.

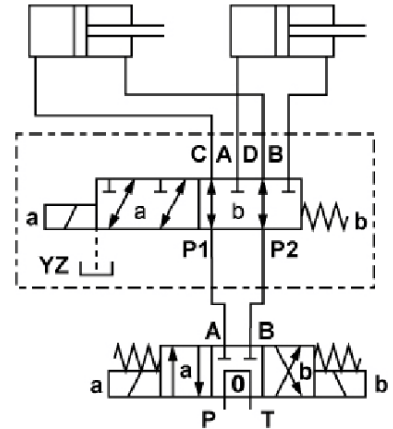
The change-over can also be done manually by pressing the emergency manual override (6).



### Hydraulic symbol



### Mounting example



## Features

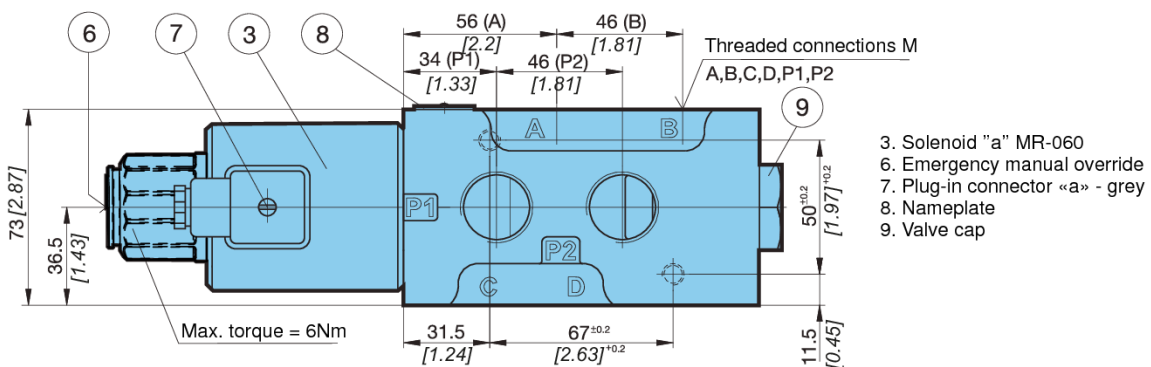
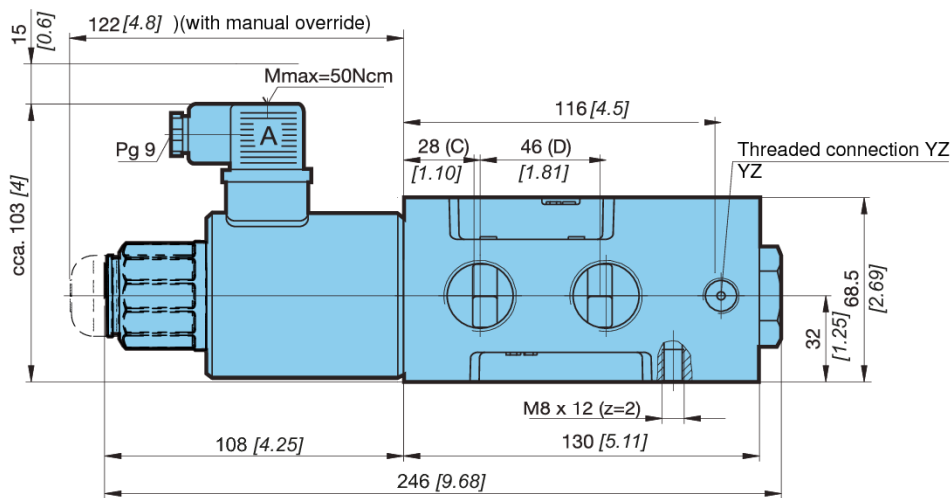
### Hydraulic

<b>Size</b>	<b>10</b>	
<b>Flow rate</b>	L/min [GPM]	120 [31.7]
<b>Operating pressure</b>	With YZ	350 [5 076]
	Without YZ	250 [3 625]
<b>Oil temperature range</b>	°C [°F]	-20 to +70 [-4 to +158]
<b>Viscosity range</b>	mm <sup>2</sup> /s [SUS]	15 to 380 [3.24 to 82]
<b>Mounting position</b>	Optional	
<b>Mass</b>	kg [lb]	5,5 [12.12]
<b>Filtration</b>	NAS 1638	8

### Electrica

<b>Supply voltage</b>	V	12, 24 DC
<b>Power</b>	W	45
<b>Switching frequency</b>	1/h	15000
<b>Ambient temperature</b>	°C [°F]	to +50 [to +122]
<b>Coil temperature</b>	°C [°F]	to +180 [to +356]
<b>Duty cycle</b>	Continuous	

## Dimensions







## 6/2 WAY DIRECTIONAL VALVES KV (NG 16)

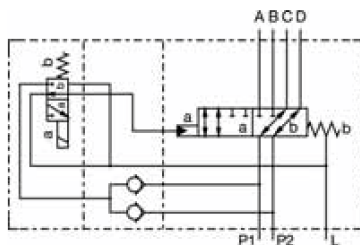
- NG 16
- Up to 350 bar [5 076 PSI]
- Up to 250 L/min [66.04 GPM]
- Plug-in connector for solenoids to ISO 4400.
- Threaded connections to ISO 1179 (BSPP/Gas), ISO 11926 (UNF).
- Flange ports to ISO 6162-2.
- Fulfil EMC (89 / 336 / EEC).
- Protection of solenoid IP 65 to EN 60529 / IEC 60529.



KV-6/2-16-XN

### Hydraulic symbol

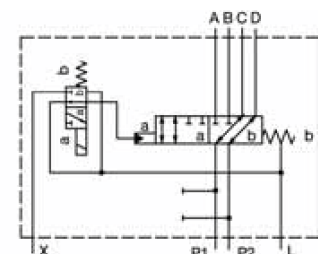
KV-6/2-16-...-XN



KV-6/2-16-...-N



KV-6/2-16-...-Z



### Features

#### Hydraulic

<b>Size</b>		<b>16</b>
<b>Flow rate</b>	L/min [GPM]	250 [66]
<b>Operating pressure</b>	bar [PSI]	15 to 350 [217.56 to 5076.32]
(in port L or in return way)	bar [PSI]	250 [3625.94]
<b>Oil temperature range</b>	°C [°F]	-20 to +70 [-4 to 158]
<b>Viscosity range</b>	mm <sup>2</sup> /s [SUS]	15 to 380 [3.24 to 82]
<b>Mounting position</b>		Optional
<b>Mass</b>	kg [lb]	22 [48.50]
<b>Filtration</b>	NAS 1638	8

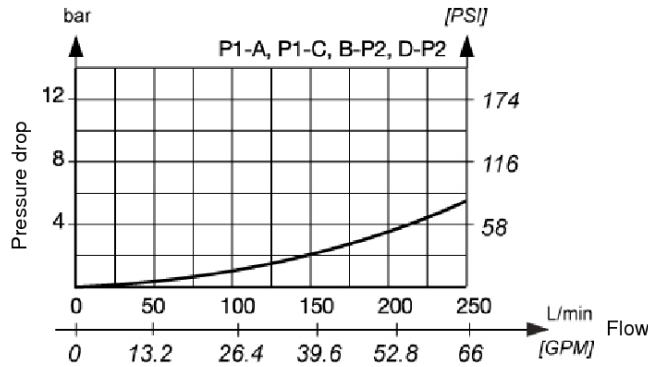
#### Electrical

<b>Supply voltage</b>	V	12, 24 DC
<b>Power</b>	W	29
(12 V DC supply voltage)		36
<b>Switching frequency</b>	1/h	15 000
<b>Ambient temperature</b>	°C [°F]	to +50 [to +122]
<b>Coil temperature</b>	°C [°F]	to +180 [to +356]
<b>Duty cycle</b>		Continuous

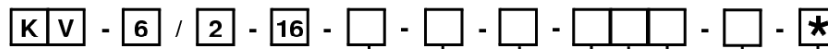


**ΔP-Q Performance curves**

Measured at 50°C [122°F] and viscosity of 32 mm<sup>2</sup>/s [148 SUS].



**Model code**



**Pilot oil supply and discharge**

Internal x, y	N
Internal, external y (port L)	XN
external, external	Z

**Threaded connections M ; L**

G1 ; G1/4	G1/G1/4
1 5/16-12 UNF-2B ; 9/16-18 UNF-2B	SAE 16
SAE-Flange connections 3/4 - high pressure series	SAE3/4
SAE-Flange connections 1 - high pressure series	SAE1

**Manual override option**

Emergency manual override	No designation
Manual override with rubber cover	G
Lockable manual override	C

**supply voltage**

direct voltage 24 V	No designation
direct voltage 12 V	12 DC

**Connector type**

EN 175301-803 without signal lamp	No designation
EN 175301-803 with signal lamp	L
G1/2 (YZ=G1/4) without connector	K
AMP junior timer without connector	M
Deutsch	V

**Overvoltage protection**

without overvoltage protection	No designation
with overvoltage protection	T

**Seal type**

NBR seals for mineral oil HL, HLP to DIN 51524	No designation
FPM seals for HETG, HEES, HEPG to VDMA 24568 and ISO 15380	E

**Special requirements to be briefly specified**



## 6/2 WAY DIRECTIONAL VALVES KV-6K (NG 6)

- NG 6
- Up to 250 bar [3 625 PSI]
- Up to 50 L/min [13.2 GPM]
- Direct in-line mounting.
- Plug-in connector for solenoids to ISO 4400.
- Threaded connections to ISO 9974 (Metric), ISO 1179 (BSPP/Gas), ISO 11926 (UNF).
- Protection of solenoid IP65 to EN 60529 / IEC 60529.
- Fulfil EMC (89/336/EEC).



KV-6K/2-6

### 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 energizing 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-energized, 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.

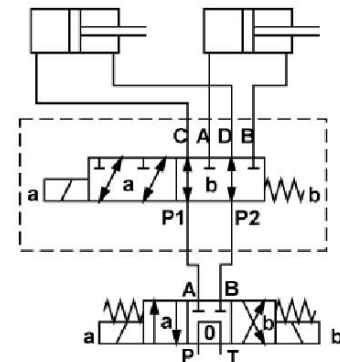
The change-over can also be done manually by pressing the emergency manual override (6).

### Hydraulic symbol

Spool type



### Mounting example



**Features**

Hydraulic		
Size		6
Flow rate	L/min [GPM]	50 [13.2]
Operating pressure	bar [PSI]	250 [3 625]
Oil temperature range	°C [°F]	-20 to +70 [-4 to +158]
Viscosity range	mm <sup>2</sup> /s [SUS]	15 to 380 [3,24 to 82]
Mounting position		Optional
Mass	kg [lb]	2,5 [5.51]
Filtration	NAS 1638	8

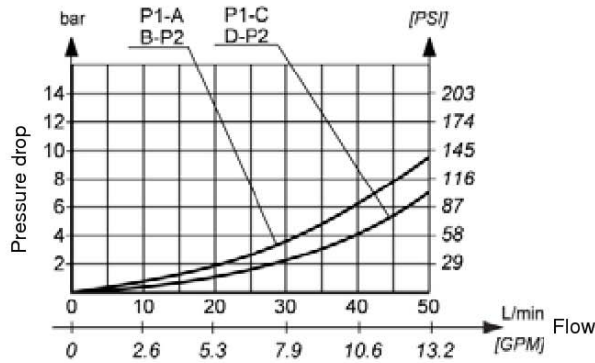
Electrical		
Supply voltage	V	12, 24 DC
Power	W	29
(12 V DC supply voltage)	W	36
Switching frequency	1/h	15000
Ambient temperature	°C [°F]	to +50 [to +122]
Coil temperature	°C [°F]	to +180 [to +356]
Duty cycle		Continuous

**Dimensions**

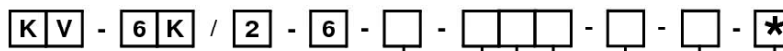


**ΔP-Q Performance curves**

Measured at 50°C [122 °F] and viscosity of 32 mm<sup>2</sup>/s [148 SUS].



**Model code**



**Manual override option**

Emergency manual override	No designation
Manual override with rubber cover	G
Lockable manual override	C

**Supply voltage**

Direct voltage 24V	No designation
VDirect voltage 12V	12 DC

**Connector type**

EN 175301-803 without signal lamp	No designation
EN 175301-803 with signal lamp	L
EN 175301-803 without connector	K
AMP Junior timer without connector	M
Deutsch	V

**Overvoltage**

Without overvoltage protection	No designation
With overvoltage protection	T

**Threaded connections**

M18x1,5	No designation
G 3/8	G3/8
9/16-18 UNF-2B	SAE 6

**Seal type**

NBR seals for mineral oil HL, HLP to DIN 51524	No designation
FPM seals for HETG, HEES, HEPG to VDMA 24568 and ISO 15380	E

Special requirements to be briefly specified



## 6/2 WAY DIRECTIONAL VALVES KVH (NG 6)

- NG 6
- Up to 315 bar [4 568 PSI]
- Up to 50 L/min [13.2 GPM]
- Plug-in connector for solenoids to ISO 4400.
- Threaded connections to ISO 9974 (Metric), ISO 1179 (BSPP/Gas), ISO 11926 (UNF).
- Protection of solenoid IP65 to EN 50529 / IEC 60529.
- Fulfil EMC (89/336/EEC).
- For stacking (1-5 units).



KVH-6/2-6-S50-N3

### 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 energizing 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-energized, 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 manual override (6).



### Hydraulic symbol



### Mounting example



**Features**

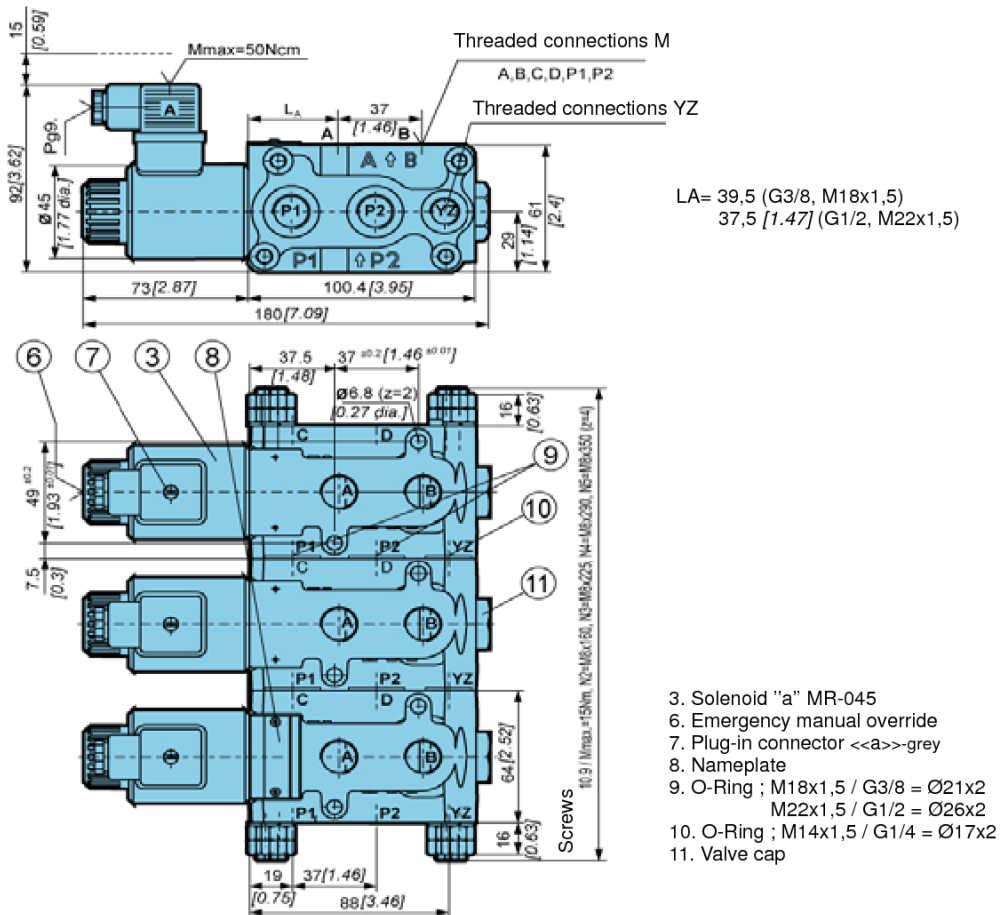
**Hydraulic**

<b>Size</b>			<b>6</b>
<b>Flow rate</b>	L/min [GPM]		50 [13.21]
<b>Operating pressure</b>	With YZ	bar [PSI]	315 [4 568]
	Without YZ		250 [551]
<b>Oil temperature range</b>	°C [°F]		-20 to +70 to +158]
<b>Viscosity range</b>	mm <sup>2</sup> /s [SUS]		15 to 380 [3.24 to 82]
<b>Mounting position</b>			Optional
<b>Mass</b>	kg [lb]		2,7 [5.95] (N1)
<b>Filtration</b>	NAS 1638		8

**Electrical**

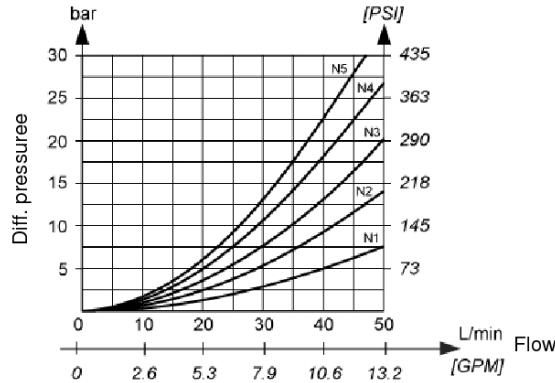
<b>Supply voltage</b>	V	12, 24 DC
<b>Power</b>	W	29
	(12 V DC supply voltage)	36
<b>Switching frequency</b>	1/h	15 000
<b>Ambient temperature</b>	°C [°F]	to +50 [to+122]
<b>Coil temperature</b>	°C [°F]	to +180 [to +356]
<b>Duty cycle</b>	Continuous	

**Dimensions**



**ΔP-Q Performance curves**

.Measured at 50°C [122 °F] and viscosity of 32 mm<sup>2</sup>/s [148 SUS].]



**Model code**

**K V H - 6 / 2 - 6 - [ ] - [ ] - [ ] - [ ] - [ ] - [ ] - S 5 0 - [ ] - [ ] - \***

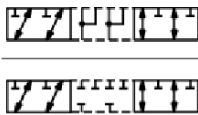
**symbol**



No designation

AB

**Overlap**



No designation

P

**Manual override option**

Emergency manual override	No designation
Manual override with rubber cover	G
Lockable manual override	C

**Supply voltage**

Direct voltage 24V	No designation
Direct voltage 12V	12 DC

**Connector type**

EN 175301-803 without signal lamp	No designation
EN 175301-803 with signal lamp	L
EN 175301-803 without connector	K
AMP Junior timer without connector	M
Deutsch	V

**Overvoltage protection**

Without overvoltage protection	No designation
With overvoltage protection	T

**Special requirements to be briefly specified**

**Number of units**

N1	One
N2	Two
N3	Three
N4	Four
N5	Five

**Seal type**

No designation	NBR seals for mineral oil HL, HLP to DIN 51524
E	FPM seals for HETG, HEES, HEPG to VDMA 24568 and ISO 15380

**Drainage**

No designation	Without YZ
YZ	With YZ

**Threaded connections M ; YZ**

No designation	M18x1,5; M14x1,5
M22	M22x1,5; M14x1,5
3/8	G3/8; G1/4
1/2	G1/2; G1/4
SAE 8	3/4-16 UNF-2b; 9/16-18 UNF-2B



## 6/2 WAY DIRECTIONAL VALVES KVH (NG 10)

- NG 10
- Up to 315 bar [4 568 PSI]
- Up to 120 L/min [31.70 GPM]
- Plug-in connector for solenoids to ISO 4400.
- Threaded connections to ISO 9974 (Metric), ISO 1179 (BSPP/Gas), ISO 11926 (UNF).
- Protection of solenoid IP 65 to EN 50529 / IEC 60529.



KVH-6/2-10-N2

### 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 energizing 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.

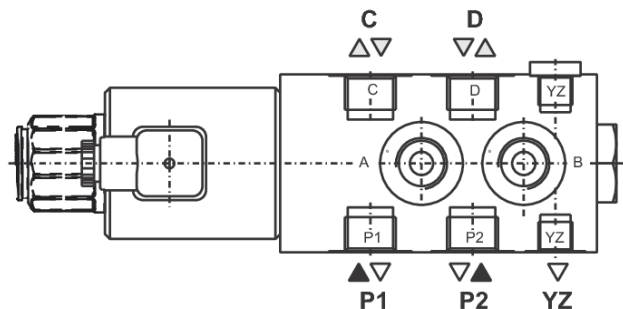
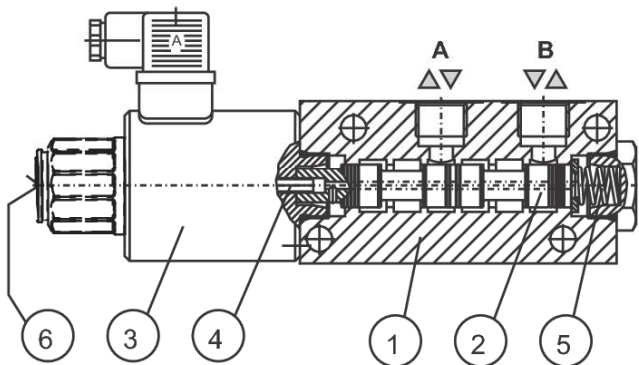
When the solenoid (3) is de-energized, the control spool (2) is returned to its neutral position by the return spring (5), thus establishing again the links between ports P1, C, D and P2.

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

### Hydraulic symbol



### Mounting example



## Features

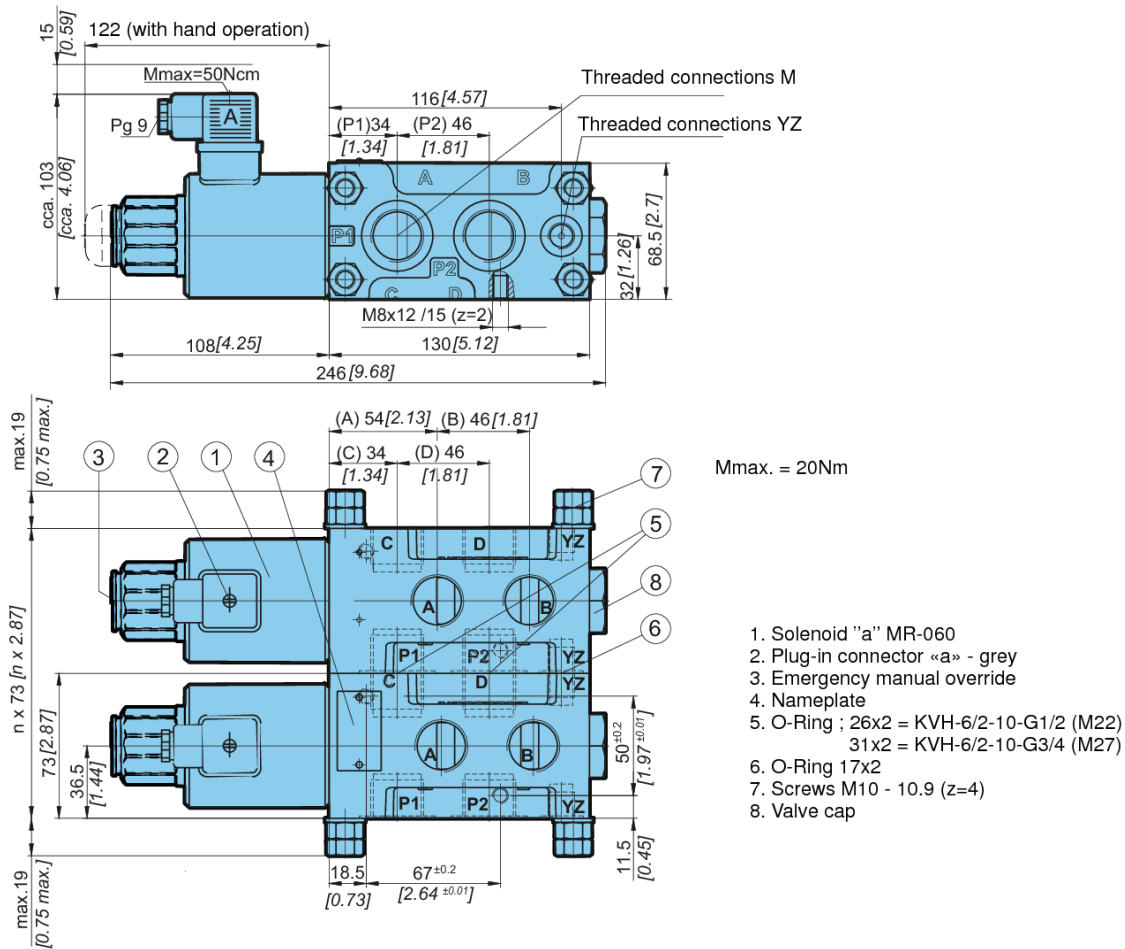
### Hydraulic

<b>Size</b>	<b>10</b>	
<b>Flow rate</b>	L/min [GPM]	120 [31.70]
<b>Operating pressure</b>	With YZ	315 [4 568]
	Without YZ	250 [551]
<b>Oil temperature range</b>	°C [°F]	-20 to +70 [-4 to +158]
<b>Viscosity range</b>	mm <sup>2</sup> /s [SUS]	15 to 380 [3.24 to 82]
<b>Mounting position</b>	Optional	
<b>Mass</b>	kg [lb]	5,5 [12.12]
<b>Filtration</b>	NAS 1638	8

### Electrical

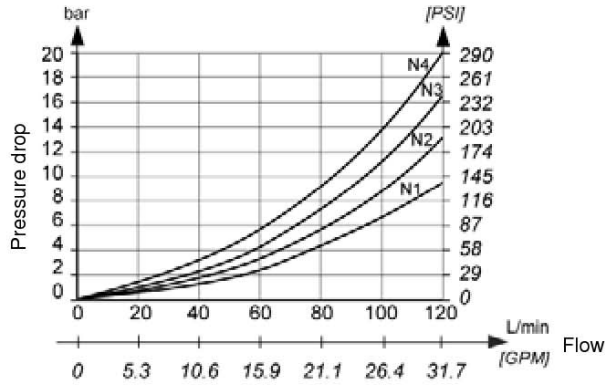
<b>Supply voltage</b>	V	12, 24 DC
<b>Power</b>	W	45
<b>Switching frequency</b>	1/h	15 000
<b>Ambient temperature</b>	°C [°F]	to +50 [to +122]
<b>Coil temperature</b>	°C [°F]	to +180 [to +356]
<b>Duty cycle</b>	Continuous	

## Dimensions



**ΔP-Q Performance curves**

Measured at 50°C [122 °F] and viscosity of 32 mm<sup>2</sup>/s [148 SUS].



**Model code**

**K V H** - **6** / **2** - **10** - **□** - **□** - **□** - **□** - **S 4 0** - **□** - **□** - **\***

**Manual override option**

Emergency manual override	No designation
Manual override with rubber cover	G
Lockable manual override	C

**Supply voltage**

Direct voltage 24V	No designation
Direct voltage 12V	12 DC

**Connector type**

EN 175301-803 without signal lamp	No designation
EN 175301-803 with signal lamp	L
175301-803 without connector	K
AMP Junior timer without connector	M
Deutsch	V

**Overvoltage protection**

Without overvoltage protection	No designation
With overvoltage protection	T

**Threaded connections M; YZ**

M22x1,5; M14x1,5	M22
M27x2; M14x1,5	M27
G1/2; G1/4	G1/2
G3/4; G1/4	G3/4
7/8-14 UNF-2B; 9/16-18 UNF-2B	SAE 10

**Drainage**

Without YZ	No designation
With YZ	YZ

**Seal type**

NBR seals for mineral oil HL, HLP to DIN 51524	No designation
FPM seals for HETG, HEES, HEPG to VDMA 24568 and ISO 15380	E

Special requirements to be briefly specified

**Number of units**

N1	One
N2	Two
N3	Three
N4	Four
N5	Five



## 6/3 WAY DIRECTIONAL VALVES KV (NG 4)

- NG 4
- Up to 210 bar [3045 PSI]
- Up to 7 l/min [1.8 GPM]
- Plug-in connector for solenoids to ISO 4400.
- Threaded connections to ISO 9974 (Metric), ISO 1179 (BSPP/Gas).
- Manual emergency control.
- Fulfill EMC (89/336/EEC).



KV-6K/3-4

### Features

#### Hydraulic

<b>Size</b>		<b>4</b>
<b>Flow rate</b>	L/min [GPM]	7 [1.8]
<b>Operating pressure</b>	bar [PSI]	210 [3 045]
<b>Viscosity range</b>	mm <sup>2</sup> /s [SUS]	15 to 380 [69.5 to 1 760]
<b>Oil temperature range</b>	°C [°F]	-20 to +70 [-4 to 158]
<b>Filtration</b>	ISO 4406-1999	19/17/14
<b>Mass</b>	kg [lb]	1,6 [3.5]
<b>Seal type</b>		NBR seals for mineral oil HL, HLP, to DIN 51524

#### Electrical

<b>Supply voltage</b>	V	12, 24
<b>Power</b>	W	25
<b>Switching frequency</b>	1/h	15 000
<b>Ambient temperature</b>	°C [°F]	to 50 [122]
<b>Coil temperature</b>	°C [°F]	to 180 [356]
<b>Duty cycle</b>		Continuous

### Hydraulic symbol



### ΔP-Q Performance curves

Measured at 50 °C [122 °F] and viscosity of 32 mm<sup>2</sup>/s [148 SUS].





## 8/3 WAY DIRECTIONAL VALVES KV (NG 6)

- NG 6
- Up to 250 bar [3 625 PSI]
- Up to 50 l/min [13.2 GPM]
- Plug-in connector for solenoids to ISO 4400.
- Threaded connections to ISO 9974 (Metric), ISO 1179 (BSPP/Gas), ISO 11926 (UNF).
- Protection of solenoid IP65 to EN 50529 / IEC 60529.
- Fulfil EMC (89/336/EEC).



KV-8/3-6

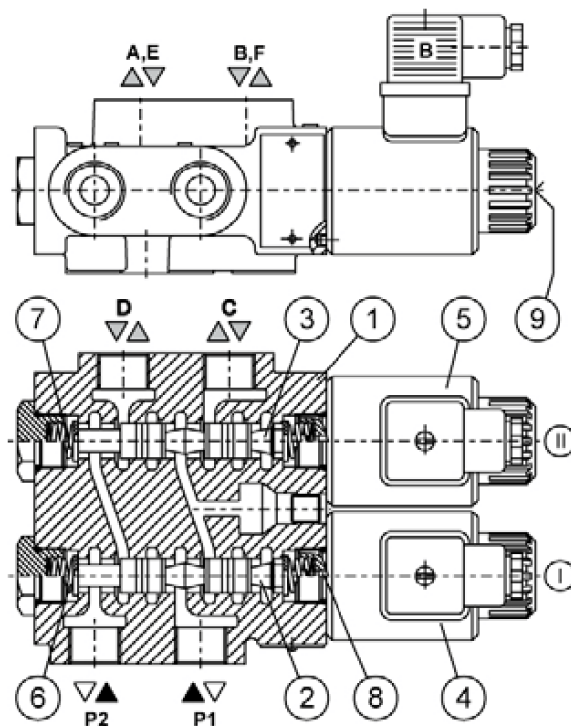
### Operation

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.

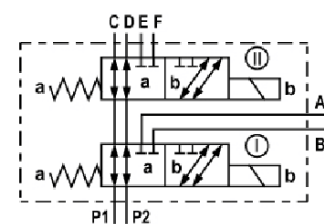
The KV type directional valves consist of a housing (1), a control spool (2,3), two solenoids (4,5) with return spring (6,7). Change-over to one of the operating positions is done by combination of operation of solenoids (4,5), whereby the solenoid plunger acts on the control spool (2,3) via the operating 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-energized, the control spool (2,3) is returned to their neutral position by the return spring (6,7).

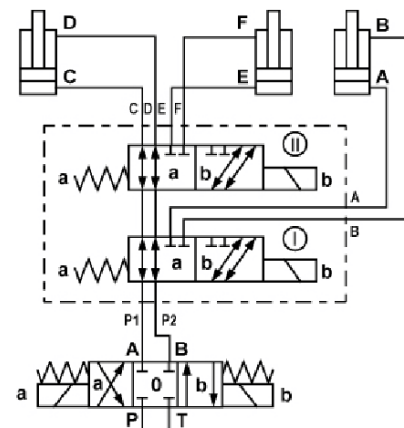
The change-over can also be done manually by pressing the emergency manual override (9).



### Hydraulic symbol



### Mounting example



**Features**

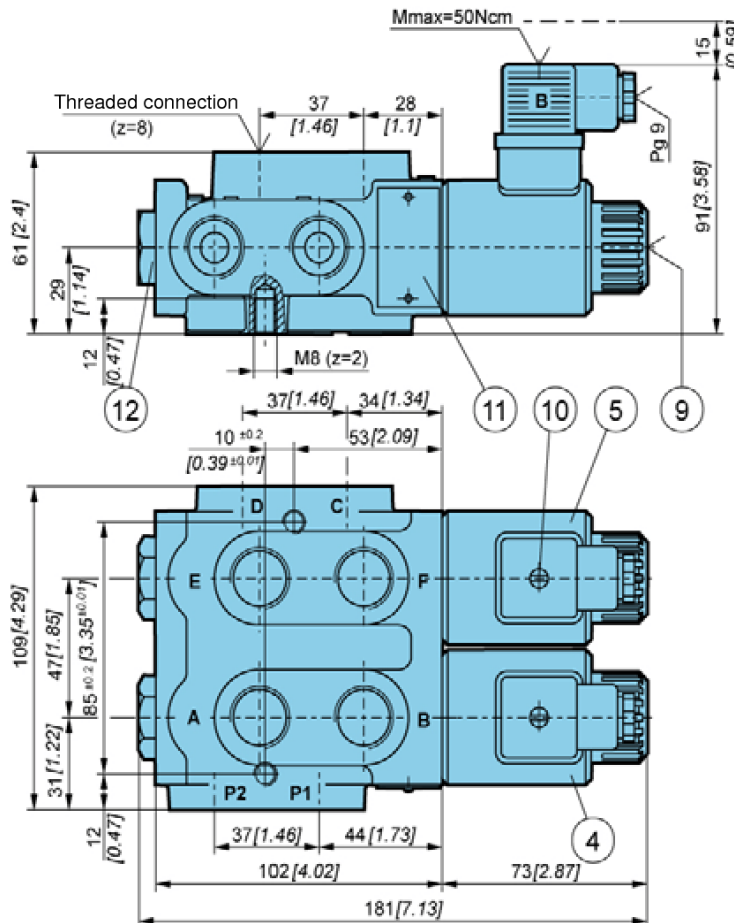
**Hydraulic**

Size	6	
Flow rate	L/min [GPM]	50 [13.21]
Operating pressure	bar [PSI]	250 [3 625]
Oil temperature range	°C [°F]	-20 to +70 [-4 to +158]
Viscosity range	mm <sup>2</sup> /s [SUS]	15 to 380 [3.24 to 82]
Mounting position	Optional	
Mass	kg [lb]	3,8 [8.38]
Filtration	NAS 1638	8

**Electrical**

Supply voltage	V	12, 24 DC
Power (12 V DC supply voltage)	W	29
		36
Switching frequency	1/h	15000
Ambient temperature	°C [°F]	to +50 [to +122]
Coil temperature	°C [°F]	to +180 [to +356]
Duty cycle	Continuous	

**Dimensions**



- 4.5. Solenoid "b" MR-045
- 9. Emergency manual override
- 10. Plug-in connector «b» - black
- 11. Nameplate
- 12. Valve cap

