VALVES RANGE FOR OPEN LOOPS



TECHNICAL CATALOG



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CHECK VALVES

DIRECT	OPERATED	VALVES

Check valve VP-NV (NG 6, 10)

	PILOT OPERATED VALVES
	Check valve NOVE (NG 6 Check valve NOV-6-D (NG 6) Check valve VP-NOV (NG 6,
e	

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POCLAIN HYDRAULICS



Direct operated valves

Pilot operated valves

7 7

11

11

13

15



CHECK VALVE VP-NV

- NG 6, 10
- Up to 350 bar [5 076 PSI]
- Up to 100 L/min [26,4 GPM]
- · Connecting dimensions to ISO 4401.
- For vertical stacking sandwich plate design.
 Free hydraulic fluid flow in one direction.

Operation

Check valves type VP-NV permit the hydraulic fluid flow in one direction, with a tight-off in the opposite direction. Sandwich plate design - for vertical stacking.

These valves consist of a housing (1), poppet (2), and a spring (3). A poppet valve can be fitted into the line P, T, A or B. It serves for shutting off the hydraulic fluid flow in one direction, permitting a free flow in the opposite direction. This is made possible by the poppet (2) which provides positive seating. The hydraulic fluid flow under cracking pressure 0,4 bar [5.8 PSI] causes the poppet to lift, thus freeing the flow. In the opposite direction, the spring (3) pushes the poppet (2) against the seat, shutting the hydraulic fluid flow off.





VP-NV-6, VP-NV-10

Hydraulic symbols



Direct operated valves

Counterbalance valves

Features

Size		6	10
Flow rate	L/min [GPM]	50 [13.2]	100 [26.4]
Flow velocity	m/s	4	ł
Operating pressure	bar [PSI]	350 [5	5 076]
Cracking pressure	bar [PSI]	0,4 [5.8]
Oil temperature range	°C [°F]	-20 to +70 [-4 to +158]
Viscosity range	mm²/s [SUS]	15 to 380 [6	9,5 to 1.760]
Filtration	NAS 1638	8	3
Mass	kg [lb]	0,87 [1.91]	2,77 [6.10]

18/07/2017

Δ P-Q Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].



Dimensions





0

Model code



Direct operated valves



Hydraulic components - Check valves

CHECK VALVE NOV- ... -E

- NG 6, 10
- Up to 350 bar [5 076 PSI]
- Up to 50 L/min [13.2 GPM]
- Threaded connections to ISO 1179 (BSPP/Gas), ISO 11926 (UNF).
- Flow shut-off in one service line.
- Direct in-line mounting.



NOV-6-E; NOV-10-E

Hydraulic symbol

в

Operation

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

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

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

Features

Size		6	10	
Flow rate	L/min [GPM]	35 [9.2	50 [13.2]	
Operating pressure	bar [PSI]	350 [5 076]		
Cracking pressure (B-A)	bar [PSI]	0.5 [7.2]		
Area ratio		1:4		
Oil temperature range	°C [°F]	-20 to +70 [-4 to +158]		
Viscosity range	mm ² /s [SUS]	15 to 380 [69,5 to 1.760]		
Filtration	NAS 1638	8		
Mass	kg [lb]	0,5 [1.10]	0,65 [1.43]	

$\Delta P-Q$ Performance curves

 Δp - Q Performance curves of the flow in direction A \rightarrow B (check valve pilot opened).

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].



Direct operated valves



Dimensions



Size	6	10
L1	90 [3.54]	94 [3.70]
L2	32 [1.26]	34 [1.34]
L3	42 [1.65]	45 [1.77]
L4	28,5 [1.12	30 [1.18]
S	27 [1.06]	30 [1.18]
М	G3/8	G1/2
Z	G1/4	G1/4

Model code



CHECK VALVE NOV-6-D

- NG 6
- Up to 350 bar [5 076 PSI]
- Up to 60 L/min [15.8 GPM]
- Threaded connections to ISO 1179 (BSPP/Gas), ISO 11926 (UNF).
- · Flow shut-off in one service line.
- · Direct in-line mounting.







R

Hydraulic symbol

Operation

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

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

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

Features

Size		6
Flow rate	L/min [GPM]	60 [15.8]
Operating pressure	bar <i>[PSI]</i>	350 [5 076]
Cracking pressure	bar <i>[PSI]</i>	1 [14.5]
Area ratio		1:3,9
Oil temperature range	°C [°F]	-20 to +70 [-4 to +158]
Viscosity range	mm ² /s [SUS]	15 to 380 [69,5 to 1.760]
Filtration	NAS 1638	8
Mass	kg <i>[lb]</i>	1,5 [3.30]

$\Delta P-Q$ Performance curves

 Δp - Q Performance curves of the flow in direction A1, B1 \rightarrow A2, B2 (through check valve) and in direction A2, B2 \rightarrow A1, B1 (check valve pilot opened).

Measured at 50°C [122°F]

and viscosity of 32 mm²/s [148 SUS].



against spring force





Dimensions



Model code



CHECK VALVE VP-NOV

• NG 6, 10

Operation

- Up to 350 bar [5 076 PSI]
- Up to 100 L/min [26,4 GPM]
- Connecting dimensions to ISO 4401.

zero position of the directional valve.

- Flow shut-off in both or one service line.
- For vertical stacking sandwich plate design.Height and width of the valves to ISO 7790 norms.

lines to be automatically shut off and made free, respectively.



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

Hydraulic symbols





Features

Size		6	10
Flow rate	L/min [GPM]	60 [15.8]	100 [26.4]
Operating pressure	bar [PSI]	350 [5	5 076]
Cracking pressure	bar [PSI]	1 <i>[14.5]</i>	0,5 [7.2]
Area ratio		1:3,9	1:3,6
Oil temperature range	°C [°F]	-20 to +70 [-4 to +158]	
Viscosity range	mm ² /s [SUS]	15 to 380 [69	9,5 to 1.760]
Filtration	NAS 1638	8	5
Mass	kg <i>[lb]</i>	1,8 [3.9]	3,5 [7.7]

Pilot operated check valves type VP-NOV enable the hydraulic fluid flow in the service

To assure zero leakage there is necessary to discharge ports A and B towards T in the

Free flow direction is always from the valve side "V" to the subplate side "P". In the opposite direction is the valve blocked for the hydraulic fluid flow. Free flow in port A in

direction P to V is achieved by means of pressure in port B, and vice versa.





Direct operated valves



Dimensions

Size 6







- Nameplate
 4x O-ring 9,25x1,78
 Fixing bores for fixing
- screws M5

Size 10



POCLAIN HYDRAULICS

$\Delta P-Q$ Performance curves

Δp - Q Performance curves of the flow in direction V to P (through check valve) and in direction P to V (check valve pilot opened with $p_x = 80$ bar).

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].





against spring force



Model code





CHECK-Q-METER BZV

• NG 6

- Up to 270 bar [3 916 PSI]
- Up to 60 L/min [15.8 GPM]
- · Hermetically sealing at closed flow path.
- Minimum pressure losses when the medium flows from port A towards port B.
- When the medium flows from port B towards port A the speed of load lowering is controlled with respect to the medium flow rate supplied to the opposite side of the hydraulic motor or cylinder. With operating cylinders the characteristic ratio of surface areas must be taken into account.
- For building into pipe-lines.
- Threaded connections to ISO 9974 (Metric), ISO 1179 (BSPP/Gas), ISO 11926 (UNF).

Operation

The check-Q-meter is used for maintaining constant speed during the lowering of loads by means of hydraulic cylinders or hydromotors in the systems where load changes with time. It prevents uncontrolled falling of load if defects occur in the pipeline between the directional control valve and the check-Q-meter or if there is no pilot pressure. When it is installed in combination with a directional control valve with negative change-over in intermediate positions, it has the function of a holding valve. If the load on hydraulic cylinders or hydromotors does not change the sign, a single check-Q-meter must be used. The check-Q-meter consists of a housing (1), main poppet (2), auxiliary spool (3), pilot poppet (4), spring (5), insert housing (7) and setting screw (8).

Lifting the load:

The hydraulic fluid flows from port A towards port B with minimum pressure losses, the main poppet (2) being lifted. In the case of a pressure drop and an interruption in the hydraulic fluid supply to port A, the main poppet (2) closes, holding the load in position. With the directional control valve in position (a) the hydraulic fluid flows to the annulus side of the hydraulic cylinder, which provokes a certain pilot pressure on the auxiliary spool (3). The check-Q-meter opens and thereby a free hydraulic fluid flow from port B towards port A occurs, when the main poppet (2) leans against the insert housing (7), where as the auxiliary spool (3) still performs a part of the controlled move which depends on the quantity of the hydraulic fluid supplied in a unit of time to the annulus side of the operating cylinder. In the opening direction, also the load pressure works on the circle of the predefined surface. The pilot pressure required for the opening of the check-Q-meter is: safety valve setting - load pressure

Required pilot pressure = -

4.25

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

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







Hydraulic symbols





Mounting example



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

$$p_2 = p_m + p_1 x \phi$$
 $\phi = A1/A2 > 1$

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

Direct operated valves



Features

Size			BZV-6-E	BZV-6-D
Flow rate		L/min [GPM]	60 [15.8]	
Operating pressure	spring 200 bar [2.900 PSI]	bar (PSI)	150 [2	175]
Operating pressure	spring 350 bar [5076 PSI]		270 [3 916]	
Pilot prossuro	spring 200 bar [2.900 PSI]	— bar [PSI] —	4 to 50 [58 to 725]	
Pliot pressure	spring 350 bar [5076 PSI]		6 to 85 [87	to 1.232]
Cracking pressure		bar [PSI]	2,2 [31.9]	
Pilot ratio	R = A2/A1-A2		4,25	
Oil temperature range		°C [°F]	-20 to +70 [-4 to +158]	
Viscosity range		mm ² /s [SUS]	15 to 380 [69,5 to 1.760]	
Filtration		NAS 1638	8	
Mass		kg [lb]	1,5 [3.30]	2,4 [5.29]

Δ P-Q Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].



Dimensions

BZV-6-E-...-C



9. Fixing screw 10. Nameplate





10. Nameplate

Counterbalance valves

Direct operated valves

Pilot operated valves



Model code



CHECK-Q-METER MODULAR VALVE VP-BZV

• NG 6

- Up to 270 bar [3 916 PSI]
- Up to 30 L/min [7.9 GPM]
- Connecting dimensions to ISO 4401.
- Modular plate design for vertical stacking.
- Hight and width of the valve according to ISO 7790.



VP-BZV-6

Hydraulic symbol

Operation

Modular check-Q-meter valve in combination with other stacking elements gives static and dynamic load control by regulating the flow into and out of hydraulic actuators. It prevents load uncontrol run away and allows thermal expansion relief of the hyd aulic fluid. Flow in line B (A) from side P to V is allowed when the required pilot pressure in line A (B) is induced. For stabile valve function the valve must be set (Ps) at least 1.3 - times higher than maximum expected load pressure (PL).

Required pilot pressure (PR)=

Counterbalance valve setting (Ps) - load pressure (PL) Pilot ratio (R)





Features

Size		6 (single valve)	6 (double valve)
Flow rate	L/min [GPM]	30 [7.	9]
Operating pressure	re bar [PSI] 270 [3 916]		916]
Cracking pressure	bar [PSI]	1 [14.5]	
Oil temperature range	°C [°F]	-20 to +70 [-4 to +158]	
Viscosity range	mm ² /s [SUS]	15 to 380 [69,5 to 1.760]	
Filtration	NAS 1638	8	
Mass	kg <i>[lb]</i>	1,3 [2.9]	1,8 [4.00]



$\Delta P-Q$ Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].





- d

Direct operated valves

Pilot operated valves

Model code



Counterbalance valves



PRESSURE CONTROL VALVES



DIRECT OPERATED VALVES

Pressure relief valve VVP (NG 6, 10) Pressure relief valve VVB2-10 (NG 6)



PILOT OPERATED VALVES

Pressure relief valve RT (NG 6, 10) Pressure relief valve VP-RT (NG 6, 10)



Direct operated valves

29

29 33

Pilot operated valves





Direct operated valves

PRESSURE RELIEF VALVE VVP

• NG 6, 10

- Up to 400 bar [5 801 PSI]
- Up to 120 L/min [31.7 GPM]
- · For fitting into a block.
- For independent mounting (when assembled with connection block P-VVP).
- Two pressure setting elements (set screw, rotary knob).





Hydraulic symbol

Operation

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

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

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



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

Features

Size			6	10	
Flow rate		L/min [GPM]	50 [13.2]	120 [31.7]	
Pressure setting range		bar [PSI]	400 [5 801]		
Oil temperature range	ange °C [°F] -30 to +70 [-22 to + 158]				
Viscosity range		mm ² /s [SUS]	2,8 to 380 [12.9 to 1760]		
Filtration		NAS 1638	NAS 1638 8		
Mass	Execution A	ka [lb]	0,4 <i>[0.88]</i>	0,5 [1.10]	
111033	Execution B		0,5 [1.10]	0,6 [1.32]	

Dimensions



	72	94	34	M28x		24,9	15	65	56,5	45	30	19	15	35	6	2540	32		
v vi -0	[2.83]	[3.70]	[1.34]	1,5	60	[0.98]	[0.59]	[2.56]	[2.22]	[1.77]	[1.18]	[0.75]	[0.59]	[1.38]	[0.24]	20119	[1.26]	6	19
\//D 10	68	90	38	M35x	[2.36]	31,9	18,5	80	67,5	52	35	23	18	41	10	3200	36	[0.24]	[0.75]
VVF-10	[2.67]	[3.54]	[1.50]	1,5		[1.25]	[0.73]	[3.15]	[2.66]	[2.05]	[1.38]	[0.90]	[0.71]	[1.61]	[0.39]	52119	[1.42]		

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





$\Delta P-Q$ Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].



Model code



Direct operated valves



Direct operated valves

PRESSURE RELIEF VALVE VVB2-10

• NG 6

Features

- Up to 210 bar [3,045 PSI] Up to 60 L/min [15,8 GPM]

- Direct in-line mounting.
 hreaded connections to ISO 9974 (Metric), ISO 1179 (BSPP/Gas).
- Five different pressure setting elements.







Hydraulic symbol

Size		10				
Operating pressure	bar [PSI]	210 [3 045]				
Flow rate	L/min [GPM]	60 [15.8]				
Pressure setting range	bar [PSI]	120 [1 740]; 160[2 320]; 200 [2 900]				
Oil temperature range	°C [°F]	-10 to +70 [14 to + +158]				
Viscosity range	mm ² /s [SUS]	15 to 380 [69.5 to + 1,760]				
Filtration	ISO 4406-1999	19/17/14				
Mass	kg <i>[lb]</i>	1.85 <i>[4.08]</i>				
Seal type	NBR seals for min	NBR seals for mineral oil HL, HLP, to DIN 51524				



△P-Q Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].





Dimensions





Model code




0000

PRESSURE RELIEF VALVE RT

• NG 4, 6, 10

- Up to 315 bar [4 568 PSI]
- Up to 100 L/min [26.4 GPM]
- For independent fitting into a block.
- Two pressure setting ranges.



RT-4, RT-6, RT-10

RT-6, RT-10

Hydraulic symbol

RT-4



Direct operated valves



Pilot operated pressure relief valves type RT are used for maintaining and limiting the pressure in a hydraulic system.

These valves consist of a housing of cartridge design (1), main spool insert (2) with a spring (3), pilot poppet (4), spring (5) and pressure setting element (6).

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

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



RT-4 Direct operated valves



Features

18/07/17

Size		4	6	10	
Flow rate	L/min <i>[GPM]</i>	4 [1.1]	60 [15.8]	100 <i>[26.4]</i>	
Pressure setting range	bar [PSI]	r [PSI] 315 [4 568]			
Oil temperature range	°C [°F]	-20 to +70 [-4 to + 158]			
Viscosity range	mm ² /s [SUS]	15 to 380 [69.5 to + 1,760]			
Filtration	NAS 1638	8			
Mass	kg <i>[lb]</i>	0,15	[0.33]	0,18 <i>[0.40]</i>	

Pilot operated valves





The value set on the pressure setting element is protected by means of a lead stamp Ø11 and a wire Ø1,1 mm.

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

Size	а	b	С	d	D	L1	L2	L3	L4	L5	L6	М
1.6	96	64	53	6	20,5	36	32	30	26	14	4,8	M20v1
4,0	[3.78]	[2.52]	[2.09]	[0.24]	[0.81]	[1.42]	[1.26]	[1.18]	[1.02]	[0.55]	[0.19]	
10	97	61	50	10,5	24,5	40	36	34	29,7	15	5,2	M24v1
10	[3.82]	[2.40]	[1.97]	[0.41]	[0.96]	[1.57]	[1.42]	[1.34]	[1.17]	[0.59]	[0.20]	1112471

Size 4

$\Delta P-Q$ Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].





Δ P-Q Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].



Model code



Pilot operated valves

Direct operated valves



PRESSURE RELIEF VALVE VP-RT

• NG 6, 10

Operation

- Up to 315 bar [4 568 PSI]
- Up to 100 l/min [26.4 GPM]
- · Connecting dimensions to ISO 4401.
- For vertical stacking sandwich plate design.
 Two pressure setting ranges.



VP-RT-10, VP-RT-6

VP-RT-...DAB

P.T

Hydraulic symbol

B

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

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

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



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









Features

Size		6	10	
Flow rate	L/min [GPM]	50 [13.2]	100 [26.4]	
Pressure setting range	bar [PSI]	3]		
Oil temperature range	°C [°F]	-20 to +70 [-4 to + +158]		
Viscosity range	mm²/s [SUS]	15 to 380 [69.5 to + 1,760]		
Filtration	NAS 1638	8		
Mass	kg <i>[lb]</i>	1,2 <i>[2,64]</i> - 1,7 <i>[3,75]</i> (D)	2,6 [5.73]	



VP-RT-6



13. O-ring, Size 6: 9,25x1,78 Size 10: 12x2. 14. Nameplate

The value set on the pressure setting element is protected by means of a lead stamp Ø11 [0.43 dia.] and a wire Ø1,1 [0.04 dia.].



Required quality of the mating surface

VP-RT-10



Size	L1	L2	L3	L4	L5
VP-RT-6-EA	-	154 <i>[6.06]</i>	-		9 [0.35]
VP-RT-6-EB	-	-	154 [6.06]	90 [3.54]	10 5 [1 50]
VP-RT-6-EP	-	-	154 [0.00]		40,5 [1.59]
VP-RT-6-D	249 [9.80]	-	-	121 <i>[4.76]</i>	40 [1.57]
VP-RT-6-DAB	245 [9.64]	-	-	116,5 <i>[4.59]</i>	38 [1.50]
VP-RT-10-EP	156 <i>[6.14]</i>	-	95,5 [3.76]	20 E [1 12]	-
VP-RT-10-EA	161 [6.34]	-	100 5 [2 06]	20,5 [1.12]	-
VP-RT-10-EB	-	161 [6.34]	100,5 [5.90]	18 [0.71]	-

$\Delta P-Q$ Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].









Model code





EC

Throttle with Check valves

Flow control valves pressure compensated

47

47

0

FLOW CONTROL VALVES



THROTTLE	WITH CHECK	VALVES
----------	------------	--------

Throttle with check valve VP-NDV (NG 6, 10)



FLOW CONTROL VALVES PRESSURE COMPENS	ATED
Flow control valve TVTC (NG 6)	
Flow control valve TVTPB (NG 6, 10)	
Flow control valve TVTPP (NG 6, 10)	
Flow control valve TVTPPO (NG 6)	



FLOW DIVIDERS	67	
Flow divider DTP (NG 6, 10)	67	
		I

Flow dividers



THROTTLE WITH CHECK VALVE VP-NDV

• NG 6, 10

Operation

throttling spool.

- Up to 350 bar [5 076 PSI]
- Up to 100 L/min [26.4 GPM]
- Connecting dimensions to ISO 4401.

the hydraulic fluid in the line A and B.

which are built in a housing.

loss through the check valve.

- For flow control in both service lines.
- For throttling in supply and return lines.
 For vertical stacking sandwich plate design.
 Height and width of the valves to ISO 7790 norms.

Throttle with check valves type VP-NDV are used for throttling the pilot and main flow of

These valves consist of two throttling spools with setting screws and two check valves

In direction V to P (see the hydraulic symbol) flows the hydraulic fluid with low pressure

In direction P to V is the hydraulic fluid flow throttled depending on adjustment of the



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

Hydraulic symbol

Mounting example



Features

Size		6	10	
Flow rate	L/min [GPM]	60 [15.8] 100 [26.4		
Operating pressure	bar [PSI]	350 [5 076]		
Cracking pressure	bar [PSI]	0,4 [5.8]		
Oil temperature range	°C [°F]	-20 to +70 [-4 to +158]		
Viscosity range	mm ² /s [SUS]	15 to 380 [69.5 to 1760]		
Filtration	NAS 1638	8		
Mass	kg [lb]	1,45 [3.20]	3,3 [7.28]	

Flow dividers

Flow control valves pressure compensated

0



Assembly instructions

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

Δ P-Q Performance curves



Model code



Flow control valves pressure compensated

Throttle with Check valves



FLOW CONTROL VALVE TVTC

• NG 6

- Up to 350 bar [5076 PSI]
- Up to 50 L/min [13.21 GPM]
- · Three-way pressure compensator.
- · Operating element: rotary knob.
- Without built in relief valve and non return valve.
- With built in relief valve.

Operation

· With built-in non return valve.

irrespective of the pressure variations.

port or return port to a tank.

works as two-way regulator.

the direction from A to P.

• Threaded connections to ISO 1179 (BSPP/Gas), ISO 11926 (UNF).

valve. The excessive flow rate is discharged over port R to a tank.

3-way compensated flow control valve enables setting of constant fluid flow on port A

The excessive flow rate is discharged to port B and can be used as a secondary working

Whether the pressure in secondary circuit is higher than the regulated pressure the valve

A pressure relief valve in valve type TVTC-..-VV limits the pressure in port A on the set

The non return valve in valve type TVTC -..-NV provides a free flow of the hydraulic fluid in

°C [°F]

kg [lb]

mm²/s [SUS]

TVTC

TVTC-..-NV

TVTC-..-VV

NAS 1638



TVTC-..

R

Hydraulic symbol

TVTC-..

TVTC-..-VV

TVTC-..-NV

-20 to +70 [-4 to +158]

15 to 380 [69.5 to 1760]

8

2 [4.41]

3 [6.61]



Throttle with Check valves

				P		
Features						
Туре		TVTC-12	TVTC-25	TVTC-50		
Flow rate A	L/min [GPM]	1 to 12 [0.26 to 13.17]	1 to 25 [0.26 to 6.60]	1 to 50 [0.26 to 13.21]		
Max. flow rate A	L/min [GPM]	32 [8.45]	65 [1	17.17]		
Operating pressure	bar [PSI]	5 to 350 [72.52 to 5076.32]				
Differential pressure	bar [PSI]	5,5 [79.77]				
Cracking pressure for non return valve	bar [PSI]	0,5 [7.25]				
Flow stability (5 to 350 Bar)	%	±5 (Q)				

Oil temperature range

Viscosity range

Filtration

Mass

ET

0



△P-Q Performance curve for non return valve







Model code



Throttle with Check valves



FLOW CONTROL VALVE TVTP-...-B-...

• NG 6, 10

- Up to 350 bar [5076 PSI]
- Up to 150 L/min [39.63 GPM]
- Three-way pressure compensated.Operating element: rotary knob.
- For independent fitting into a block.
- · For independent mounting (when assembled with connection block P-TVTP).





Operation

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

Hydraulic symbol



Features

Туре		TVTP-25-B	TVTP-60-B	TVTP-90-B	
Rated flow 3	L/min [GPM]	25 [6.60]	60 [15.85]	90 [23.78]	
Flow rate 1 max.	L/min [GPM]	60 [15.85]	90 [23.78]	150 [39.63]	
Operating pressure max.	bar [PSI]	350 [5076]			
Oil temperature range	°C [°F]	-20 to +70 [-4 to +158]			
Viscosity range	mm ² /s [SUS]	15 bis to 380 [69.5 to 1760]			
Filtration	NAS 1638	8			
Mass	kg <i>[lb]</i>	0,6	[1.32]	1 [2.20]	

Flow rate as a function of scale indication

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].



Throttle with Check valves

ET

0

TVTP-...-B-...



Dimensions of cavity



Standard ported body - steel



** used for TVTP-90

Model code



Throttle with Check valves

0



FLOW CONTROL VALVE TVTP-...-P-...

• NG 6, 10

- Up to 210 bar [3046 PSI]
- Up to 150 L/min [39.6 GPM]
- Three-way pressure compensated.Operating element: proportional solenoid.
- · Control electronics: Amplifier P/N: 1659574.
- · For independent fitting into a block.
- For independent mounting (when assembled with connection block P-TVTP).
- Plug-in connector for solenoids to ISO 4400.
 Protection of solenoid IP 54 to EN 60529 / IEC 60529 (IP 65 on request).



TVTP-...-P-...

2

3

Hydraulic symbol

Operation

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

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

_						
Features						
Туре		TVTP-25	TVTP-50	TVTP-90		
Rated flow 3	L/min [GPM]	25 [6.6]	50 [13.2]	90 [23.8]		
Flow rate 1 max.	L/min [GPM]	60 [15.9]	90 [23.8]	150 [39.6]		
Operating pressure max.	bar [PSI]		210 [3 456]			
Hysteresis	%		<5			
Flow constant according to load pressure	%	<±2				
Oil temperature range	°C [°F]	-20 to +70 [-4 to +158]				
Viscosity range	mm²/s [SUS]	15 to 380 [69.5 to 1 761]				
Filtration	NAS 1638	7				
Maga	ka [lb]	1 <i>[</i> 2.2] (TVTP)		1,6 <i>[</i> 3.5] (TVTP)		
WId55	kg [ib]	1,2 <i>[2.6]</i> (TVTPG)		2 [4.4] (TVTPG)		
Power	W	17	7,4	20,8		
Voltage	V	12 and 24 DC				
Rated current at 12 V	А	1,	25	1,79		
Rated current at 24 V	А	0,68 0,81				
Coil resistance at 12 V; 20 °C [68 °F]	Ohm	7,2 4,3				
Coil resistance at 24 V; 20 °C [68 °F]	Ohm	24,6 21				
Rating ED	%	100				

Solenoid current / flow curves

of 32 mm²/s [148 SUS].





_	A mm <i>[Zoll]</i>	B mm <i>[Zoll]</i>	C mm <i>[Zoll]</i>	D mm <i>[Zoll]</i>	E mm <i>[Zoll]</i>	S	Torque into cavity Nm [in.lbf]
TVTP-25-P TVTP-50-P	170 [6,7]	73,5 [2,9]	35 [1,4]	74 [2,9]	210 [8,3]	S32	60-65 [531-575]
TVTP-90-P	198 [7,8]	75 [3,0]	45 [1,8]	84 [3,3]	244 [9,6]	S41	70-75 [619-664]

Dimensions of cavity



Standard ported body - steel



For TVTP-25-P; TVTP-50-P

For TVTP-90-P

50

90



P-1V1P-50	P-1V1P-90
mm <i>[Zoll]</i>	mm [Zoll]
25,1 [0,99]	25 [0,98]
50 [1,97]	65 [2,56]
10 [0,40]	15 <i>[0,59]</i>
80 [3,15]	80 [3,15]
53,2 [2,10]	53,5 [2,11]
100 [3,94]	110 <i>[4,33]</i>
15 <i>[0,59]</i>	17 [0,67]
9 [0,35]	11 <i>[0,43]</i>
8,6 [0,34]	10,6 [0,42]
35 [1,37]	47,5 [1,87]
70 [2,75]	95 [3,74]
20 [0,78]	26 [1,02]
40 [1,57]	52 [2,05]
G 1/2	G 1

Threaded connections to ISO 1179-1.

Throttle with Check valves



Throttle with Check valves

FLOW CONTROL VALVE TVTP-...-PO-...

• NG 6

- Threaded cartridge valve
 Up to 210 bar [3046 PSI]
- Up to 90 L/min [23.8 GPM]
- Maximum regulated flow 60 L/min [15.9 GPM]
- Three-way pressure compensated
- Operating element: proportional solenoid
- Solenoid coil with terminal for connector EN 175301 or Deutsch
- Surface protection: Zn coated DIN 50979 Fe/Zn8/Cn/T2



TVTP-...-PO-...

Operation	Hydraulic symbol
Pressure compensated three-way flow control valves are used to regulate the priority flow in outlet 3 to a maximum adjustable level largely independent of the load and pressure conditions. The surplus flow is diverted to the bypass port 2. The bypass flow may be used for a secondary circuit. Whether port 2 is plugged or the pressure in the secondary circuit is higher than the regulated pressure the valve works as two-way flow control valve.	

Features				
Туре		TVTP-15-PO	TVTP-25-PO	TVTP-50-PO
Rated flow 3	L/min [GPM]	18 <i>[4.76]</i>	27 [7.13]	60 [15.85]
Flow rate 1 max.	L/min [GPM]	60 [15.85]	60 [15.85]	90 [23.78]
Operating pressure max.	bar [PSI]	210 [3 456]		
Hysteresis	%	< ±5		
Flow constant according to load pressure	%	< ±2		
Oil temperature range	°C [°F]	-20 to +70 [-4 to +158]		
Viscosity range	mm ² /s [SUS]	15 to 380 [69.5 to 1 760]		
Filtration	ISO 4406:1999	19/17/14		
Mass	kg <i>[lb]</i>	1 [2.64]		
Electrical				
Power	W	17,4		
Voltage	V	12 and 24 DC		
Rated current at 12 V	A	1,25		
Rated current at 24 V	А	0,68		
Coil resistance at 12 V; 20 °C [68 °F]	Ohm	7,1		
Coil resistance at 24 V; 20 °C [68 °F]	Ohm	26,0		
Recommended PWM dither frequency	Hz	100 - 140		
Duty cycle	%	100		
Protection class to EN 505/ IEC 60529	connector type: ISO 4400) IP65		
	connector type: Deutsch		IP69K	

Solenoid current / flow curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].



Flow control valves pressure compensated





Option V - Terminal Deutsch



Dimensions of cavity



For independent mounting use connection block type P-TVTP-50.

Installation torque is 60 ± 5 Nm.

Model code





FLOW DIVIDER DTP

- NG 6, 10
- Up to 350 bar [5.076 PSI]
- Up to 70 L/min [18,49 GPM]
- Dividing and combining of flow independent of pressure.
- Dividing and combining ratio: 50 %/ 50 %
- · Direct in-line mounting.
- Threaded connections to ISO 9974 (Metric), ISO 1179 (BSPP/Gas), ISO 11926 (UNF).



DTP-10, DTP-6

Hydraulic symbol

Operation

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

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

Division of flow: The fluid flow in the direction from A to B and C

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

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

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





Flow dividers

Features

Туре		DTP-6-20	DTP-6-35	DTP-6-50	DTP-10-70
Min. flow rate	L/min [GPM]	8 [2.11]	12 [3.17]	16 [4.23]	35 [9.25]
Max. flow rate	L/min [GPM]	20 [5.28]	35 [9.25]	50 [13.21]	70 [18.49]
Max. pressure range	bar [PSI]	350 [5 076]			
Dividing	%	50 : 50			
Flow dividing accuracy	%	±5			
Oil temperature range	°C [°F]	-20 to +70 [-4 to +158]			
Viscosity range	mm ² /s [SUS]	15 to 380 [59 to 716]			
Filtration	NAS 1638	8			
Mass	kg <i>[lb]</i>		1,7 [3.75]		2,65 [5.84]

Dimensions

DTP-6



DTP-10





6. Valve cap 7. Two fixing holes for screws ISO 4762 DTP-6 = M6 x 20-10.9 DTP-10 = M6 x 55-10.9 Tightening torque Md = max.15 Nm

8. Nameplate

$\Delta P-Q$ Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].



Model code







Mechanically operated

rated

DIRECTIONAL CONTROL VALVES



V	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) 6/2 way directional valves KV (NG 6, 10)
94.°	



HYDRAULICALLY OPERATED (AUTOMATIC)
4/2 way automatic directional valves PKV (NG 6, 10))
4/2 way automatic directional valves PKVT (NG 6)
4/2, 4/3 way directional valves KV (NG 6, 10)
6/2 way diverter valves KV - High pressure (NG 16)

and a start of a

ELECTRICALLY OPERATED	101	erat
2/2 way directional valves KV (NG 6)	101	do
3/2 way directional valves KVC (NG 4)	105	
3/2 way directional valves KVC (NG 10)	109	
4/2, 4/3 way directional valve KV-5KL (NG 6)	112	au
4/2, 4/3 way directional valve KV-5KO (NG 6)	118	ydr
4/2, 4/3 way directional valve KV-5KO (NG 10)	124	Í
4/2, 4/3 way directional valves type KV (NG 16)	131	
4/2, 4/3 way directional valve KV-3KO (NG 6)	137	
4/2, 4/3 way directional proportional valve KVP (NG 6)	143	
4/2, 4/3 way bankable directional valves KVM (NG 6)	147	
4/2, 4/3 way bankable directional valves KVM (NG 6)	149	
Vertical stacking for KVM valves	155	
Check valve KVM-NOV-6	159	
Throttle with check valve KVM-NDV-6	161	
Pressure relief valve KVM-VV-6	165	
Vertical stacking on valves KVM		
with standard sandwich valves to ISO 4401 (NG 6)	169 🖵	
Auxiliary control lever	171	ed
Inlet plate OB-KVM-6 (NG 6)	173	rat
End plate ZB-KVM-6	179	be
Fixing elements for mounting	181	
6/2 way directional valve KV (NG 6)	183	cal
6/2 way directional valves KV (NG 10)	187	tri
6/2 way directional valves KV (NG 16)	191	
6/2 way directional valves KV-6K (NG 6)	195	
6/2 way directional valves KVH (NG 6)	199	
6/2 way directional valve KVH (NG 8)	202	
6/2 way directional valves KVH (NG 10)	206	
//2 way directional valve KV-//2-6 (NG 6)	210	
//3 way directional valve KV-//3-6 (NG 6)	214	
8/3 way directional valves KV (NG 6)	219	


2/2 way directional valves KVC

• NG 6

- Up to 250 bar [3 625 PSI]
- Up to 35 L/min [9.2 GPM]
- Threaded connections to ISO 9974 (Metric), ISO 1179 (BSPP/Gas)



KVC-2/2-K

Features Size 6 Flow rate L/min [GPM] 35 [9.2] **Operating pressure** bar [PSI] 250 [3 625] 15 to 380 [69.5 to 1 760] Viscosity range mm²/s [SUS] -20 to +70[-4 to 158] Oil temperature range °C [°F] Filtration ISO 4406-1999 19/17/14 Mass kg [lb] 1,2 [2.6] NBR seals for mineral oil HL, HLP, to DIN 51524 Seal type

$\Delta P-Q$ Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].



Hydraulic symbol







Model code





Mechanically operated

2/2 WAY DIRECTIONAL VALVES KVC-NV

• NG 6

- Up to 210 bar [3 045 PSI]
 Up to 40 L/min [10.5 GPM]
 Threaded connections to ISO 9974 (Metric), ISO 1179 (BSPP/Gas)





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

draulic symbol



△P-Q Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].



Electrically operated

Hydraulically operated









Model code



4/2, 4/3 WAY DIRECTIONAL VALVES KV

• NG 6, 10

• Up to 350 bar [5 076 PSI]

POCLAIN HYDRAULICS

- 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.

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).





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

Hydraulic symbols

Spool types





Mechanically operated



Features

Size			6	10
Flow rate		L/min [GPM]	60 [15.8]	100 [26.4]
Operating prossure	P, A, B	bar [PSI]	350 [5 076]
Operating pressure	Т	bar [PSI]	160 [2 320]	
Viscosity range		mm²/s [SUS]	15 to 380 <i>[6</i>	9.5 to 1 760]
Oil temperature range		°C [°F]	-20 to+70	[-4 to 158]
Filtration		NAS 1638		8
Mass		kg <i>[lb]</i>	2,05 [4.52]	5,23 [11.53]
Mounting position			Opt	ional

Dimensions



- 3. Control mechanism on side "a" 4/3 valves
- 4/2 valves, spool types 51A6. 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).

Size 10

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103*[4.06]*

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ca.164[6.46]

83[3.27]

- 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.



△P-Q Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/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	-









6/2 WAY DIRECTIONAL VALVES KV

• NG 6, 10

Operation

valve.

../..-RA).

- 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

direction of the hydraulic medium flow.

There are two types of operation:

• Threaded connections to ISO 9974 (Metric), ISO 1179 (BSPP/Gas).

"a" on ceasing to apply force to the mechanism - type KV-../..-R).

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

1/ With control spool not held in the operating position (the control spool returns to position

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-

P2

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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



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

Hydraulic symbols

Spool types



Mounting example



pa

Electrically operated

18/07/17



Features

Size			6	10
Flow rate		L/min [GPM]	60 [15.8]	120 [31.7]
Operating processo	With YZ	bar [PSI]	350	[5 076]
Operating pressure	Without YZ	bar [PSI]	160	[2 320]
Viscosity range		mm ² /s [SUS]	15 to 380 [69,5 to1 760]
Oil temperature range		°C [°F]	-20 to +7	0 [-4 to158]
Filtration		NAS 1638		8
Mass		kg <i>[lb]</i>	2,4 [5.3]	5,3 [11.7]
Mounting position			On	tional

Mounting position

Optional



Size 6



LA=39,5 [1.55](G3/8, M18x1,5)/37,5 [1.47] (G1/2, M22x1,5) LC=23,5 [0.92] (G3/8, M18x1,5)/25,5[1.00] (G1/2, M22x1,5)

ca.153[6.02]





Housing.
 Control mechanism.
 Valve cap.
 Name plate.

Δ P-Q Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].



Model code



4/2 WAY AUTOMATIC DIRECTIONAL VALVES PKV

• NG 6, 10

Operation

- 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.







Detailed schematics of the valve



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т

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



Features

Size			6	10
Flow rate min/max		L/min [GPM]	1/25 [0.3/6.6]	1/60 [0.3/15.8]
One setting processo	P, A, B	bar [PSI]	To 210) [3 045]
Operating pressure	Т	bar [PSI]	To 40 <i>[580]</i>	
Min. press. req. for autom. change over		bar [PSI]	50	[725]
Change over pressure		bar [PSI]	50 to210 [725 to3 045]
Viscosity range		mm²/s [SUS]	15 to 380 [69.5 to 1 760]
Oil temperature range		°C [°F]	-20 to +7	0 [-4 to158]
Filtration		NAS 1638		8
Mass		kg <i>[lb]</i>	2,6 [5.7]	3,2 [7.0]

Hydraulically operated

Mechanically operated



Size 6



Size 10



bil

Mechanically operated

△P-Q Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].



Model code



Electrically operated



4/2 WAY AUTOMATIC DIRECTIONAL VALVES PKV-...-T

• NG 6

Operation

electrical device.

nut back.

- 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.

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

These valves reverse the movement of an actuator every timethe flow through the valve stops. Preferential starting is $P \rightarrow Band A \rightarrow T$ position. The spool is moved by two springs

andlocked by unbalanced pressure inside valve. When no moreflow is crossing the valve, the spool changes the positioninverting the direction of the actuator. These valves are mostlyused to control the movement compactors or system where it isnot possible to use

The spindle for the PKV-6-T-G valves is used just to set the system pressure limiter. To set

Remove the dome nut and turn the offsetting spindle clockwise until it hits its inner end

5/ Turn the offsetting spindle anticlockwise until it hits its outer end stop then put the dome

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

Offsetting

Dome nut

spindle

Seal

2/ To set the system pressure limiter first block the automatic reversal of the valve.

the maximum pressure you have to block the self-reversing function.

1/ Switch off the pump or reduce pressure to minimum (10 bar max).

Procedure to set a pressure on the system pressure limiter:

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.

the pump.

V

⊽ B

● P T Α





Hydraulic symbol

PKV-6-T



PKV-6-T-G



Detailed schematics of the valve



System pressure limiter

Mechanically operated

18/07/17



Features

Size			6
Flow rate min/max		L/min [GPM]	3/30 [0.8/7.9]
Operating pressure P, A, B		bar [PSI]	50 to 210 [725 to 3 045]
Max. pressure T		bar [PSI]	40 [580]
Viscosity range		mm²/s [SUS]	20 to 200 [92.7 to 926.8]
Oil temperature range		°C [°F]	-20 to +60 [-4 to 140]
Filtration		NAS 1638	8
Maaa	PKV-6-T		1,3 [2.8]
Mass	PKV-6-T-G	— кд [<i>і</i> b]	1,4 [3.1]

Dimensions



1. 4 x fixing screws M5x30 to DIN EN ISO 4762-10.9 must be ordered separately. Required tightening torque Md = 9 Nm [79.65 in.lbf].

2. O-ring 9,25 x 1,78

3. Nameplate



Mechanically operated

△P-Q Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].



Model code





J.

4/2, 4/3 WAY DIRECTIONAL VALVES KV

• NG 6, 10

Operation

the valve body.

valve.

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

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

Ρ

Α

в

т



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

Hydraulic symbols

Spool types





Features

Size			6	10
Flow rate		L/min [GPM]	80 [21.1]	130 [34.3]
Operating processo	Ports A, B, P	bar [PSI]	350 [[5 076]
Operating pressure	Ports X, Y, T	bar [PSI]	210 [3 045]	
Pilot supply pressure min.		bar [PSI]	10	[145]
Viscosity range		mm²/s [SUS]	15 to 380 [6	69.5 to 1 760]
Oil temperature range		°C [°F]	-20 to +70)[-4 to 158]
Filtration		NAS 1638		8
Mass		kg <i>[lb]</i>	1,4 [3.1]	4,0 [8.8]
Mounting position			Opt	ional



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.





$\Delta P-Q$ Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].



•					
1	8	8	6	6	-
2	5	5	4	4	1
6	5	5	9	9	-
51A	5	5	1	1	-



opool	1-0	1-D	A -1	D-1	1 - 1
1	1	1	5	5	-
2	3	3	2	7	8
6	1	1	2	2	-
51A	1	1	3	3	-

Model code





b

6/2 WAY DIVERTER VALVES KV - HIGH PRESSURE

• NG 16

- Up to 450 bar [6 527 PSI]
- Up to 300 L/min [79.25 GPM]
- Hydraulically operated
- Hydraulically operate



KV-6/2-16-H

Hydraulic symbol

6/2 directional valves are normally used for selection between two consumers or two hydraulic circuits which are not operated simultaneously. Control spool is operated by pilot pressure acting on port X. Return of the spool to the initial position is assured by the return spring.



Features

Operation

Max pressure	bar [PSI]	450 [6 527]
Minimal pilot pressure X for spool shift*	bar [PSI]	36 [522]
Max pressure on port X and L	bar [PSI]	210 [3 045]
Max flow range	L/min [GPM]	300 [79.25]
Oil temperature range	°C [°F]	-20 to +70 [-4 to 158]
Viscosity range	mm ² /s [SUS]	15 to 380 [69.5 to 1760]
Fluid contamination	ISO 4406: 1999	19/17/14
Mass	kg [lb]	16,8 [37.04]

* Valid for operation at flow 250 L/min [66.0 GPM] and pressure 450 bar [6 527 PSI]. At lower p-Q load the pilot pressure can be also lower.

Δ P-Q Performance curves

Measured at 50 °C [122 °F] and viscosity 32 mm²/s [148 SUS].





Electrically operated

Hydraulically operated

Mechanically operated









Installation

Mounting position: Indifferent



(*) As per standard DIN 912

N.m [lb.ft]

49 [36]







Mechanically operated

2/2 WAY DIRECTIONAL VALVES KV

• 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).







Hydraulic symbols

Operation

Directly-operated directional seat valves KV are used forthe 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 betweenports A and B. The change-over into the control position b isaccomplished by energizing the solenoid (3), whereby the ball(2) is pushed against the seat (1). The hydraulic fluid on port Ais under pressure.

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

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

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



Mounting example



Hydraulically operated



Features

Hydraulic		
Size		6
Flow rate	L/min [GPM]	30 [7,93]
Operating pressure	bar <i>[PSI]</i>	210 [3045.79]
Oil temperature range	°C [°F]	-20 to +70 [-4 to +158]
Viscosity range	mm²/s [SUS]	15 to 380 [3.24 to 82]
Filtration	NAS 1638	8
Mass	kg <i>[lb]</i>	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 <i>[To</i> +356]
Duty cycle	min ⁻¹	250

* 12V supply voltage - 36W

Dimensions



143 [5.62]

70 [2.76]

G3/8; z=2



$\Delta P-Q$ Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].

Valid for flow direction A to B.



Model code



Connector type

51	
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	М
Deutsch	V





Mechanically operated

3/2 WAY DIRECTIONAL VALVES KVC

• 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).
- Threaded connections to ISO 9974 (Metric), ISO 1179 (BSPP/Gas), ISO 11926 (UNF)



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

Hydraulic symbol

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



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



Electrically operated

Features

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

Electrical		
Supply voltage	V	12, 24
Power	W	29 *
Switch-on time**	ms	50 to 80
Switch-off time**	ms	30 to 55
Switching frequency	1/h	15 000
Ambient temperature	°C [°F]	to50 [122]
Coil temperature	°C [°F]	to 180 [356]
Duty cycle		Continuous

Duty cycle

* 12 V supply voltage - 36 W.

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

$\Delta P-Q$ Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].





Dimensions

KVC-3/2-4-47B

KVC2-3/2-4-47B









Mechanically operated

Hydraulically operated



Electrically operated


Mechanically operated

3/2 WAY DIRECTIONAL VALVES KVC

• NG 10

Operation

- 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

Hydraulic symbol

Mounting example

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.





в в А а Р YZ А а b b т



Features

Hydraulic			
Size			10
Elow rate	Without drainage	I min [CPM]	60 [15.8]
FIOW fale	With drainage		100 [26.4]
Operating pressure	Without drainage	bar (PSI)	250 [3 625]
Operating pressure	With drainage	bai [F31]	350 [5 076]
Oil temperature range		°C [°F]	-20 to +70 [-4 to +158]
Viscosity range		mm ² /s [SUS]	15 to 380 [3.24 to 82]
Mounting position			Optional
Mass	Without drainage	ka [lb]	5,6 [12.34]
	With drainage	—— kg [ib]	7,1 [15.65]
Filtration		NAS 1638	8
Electrical			
Supply voltage		V	12, 24 DC
Power		W	45
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



Dimensions	Without YZ	With YZ
L	201 [7.91]	210 [8.27]
L1	85 [3.34]	94 [3.70]
L2	29,5 [1.16]	31,5 [1.24]
L3	55,5 [2.18]	62,5 [2.46]
L4	42,5 [1.67]	47 [1.85]
L5	19,5 [0.76]	18 <i>[0.71]</i>
L6	46 [1.81]	40 [1.57]
L7	-	79,5 [3.13]
Н	104 [4.09]	105 <i>[4,13]</i>
H1	67 [2.63]	74 [2,91]
H2	73 [2,87]	90 [3,54]
H3	46 [1,81]	66 [2,60]
H4	-	33 [1,30]
H5	50,5 [1,98]	31 [1,22]

3. Solenoid "b" MR-060

5. Emergency manual override 6. Plug-in connector "b" -black 7. Fixing screws:

-without YZ: 2 x M6x60 to ISO 4762-10.9 -with YZ: - 2 x M6x40 to ISO 4762-10.9

8. Nameplate 9. Valve cap



△P-Q Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].



Model code



Mechanically operated



4/2, 4/3 WAY DIRECTIONAL VALVE KV-5KL

- NG 6
- Up to 350 bar [5 076 PSI]
- Up to 80 L/min [21 GPM]
- · Connection diagram and connecting dimensions ISO 4401
- 5-chamber model with good spool guidance
- Optimized flow paths for low losses of pressure
- Low internal leakage
- · Wet pin solenoid with interchangeable coil
- Manual emergency control
- Fulfil EMC (89/336/EEC)
- Packaging in carton box

Operation

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

A valve basically consists of a housing (1), one or two solenoids (2a, 2b), control spool (3) and return spring (4).

In 4/3 way directional valves the centre position of the spool is defined by 4 return springs which hold the spool in the neutral position. The change over to the operating position (a) or (b) is done by energizing the solenoids (2a/ 2b) 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 P, A, B and T. When the solenoid (2a/ 2b) is deenergized, the control spool (3) is returned to neutral position by the return spring (4). In 4/2 way directional valves the centre position of the spool is defined by return spring on the opposite side of the solenoid (2a or 2b).

Change-over of the control spool (3) can be done manually by pressing the pin (6) for emergency manual override in the solenoid core.

Solenoid coil is fastened to the solenoid core (7) by retaining nut (8). Position of the coil (orientation of the connector) is pre-defined by the positioning hole on the valve housing and by the fixation pin (9) on the coil.



KV-4/3-5KL-6

Hydraulic symbols

Spool types









POCLAIN HYDRAULICS



Features

Hydraulic			
Size			6
Flow rate		L/min [GPM]	see ΔP -Q curves
Operating pressure	Ports A, B, P	bar [PSI]	350 [5 076]
	Port T	bar [PSI]	250 [3 625]
Viscosity range		mm²/s [SUS]	15 to 380 [69.5 to 1 760]
Oil temperature range		°C [°F]	-20 to +70[-4 to 158]
Filtration		ISO 4406:1999	19/17/14
Mass	4/2	ka [lb]	1,6 [3.6]
Wid55	4/3	– kg [lb]	2,2 [4.9]
Mounting position			Optional
Electrical			
Supply voltage	Direct	V	12, 24, 48
Supply voltage	Alternating	- v	110, 230
Max. allowable voltage variation			+/- 10 %
Power		W	31
Switch-on time*		ms	200 to 260
Switch-off time*		ms	100 to 120
Switching frequency		1/h	15 000
Ambient temperature		°C [°F]	to 50 [122]
Coil temperature		°C [°F]	to180 [356]
Duty cycle			Continuous
Protection class to EN 50529 / IEC	60529		
	- Connector EN 17 - Connector AMP - Connector Deutso	5301 ch	- IP65 - IP65 - IP69K

[PSI]

319 290 261

87

58 29

80

70

18.5

60

15.9

* Measured on unloaded valve

△P-Q Performance curves

bar 30 -28 -

4 2

0

0

0

10

2.6

20

5.3

30

7.9

pressure

Diff.

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].



Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].



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

40

10.6

50

13.2

Spool	Curve
1	1
2	2
3	3
6	4
51A, 51B	1

5

41A, 41B

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



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. (option D08/D10/D12 in the model code)





Valve assembly- spare parts



- 14. Protection plate
- 15. Nameplate

Detail technical data regarding the solenoids and Model codes for ordering are available in catalogue chapter SOLENOIDS.



Model code



Port T in the valves with spool type 41A and 41B must be used as leakage line when working pressure is over 250 bar [3 625 PSI].







4/2, 4/3 WAY DIRECTIONAL VALVE KV-5KO

• 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).

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.





KV-4/3-5KO-6

Hydraulic symbols

Spool types









POCLAIN HYDRAULICS



Mechanically operated

Features

Hydraulic			
Size			6
Flow rate		L/min [GPM]	see ΔP -Q curves
Operating processo	Ports A, B, P	bar [PSI]	350 [5 076]
Operating pressure	Port T	bar [PSI]	250 [3 625]
Viscosity range		mm ² /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
	4/2	Lev. []]. 1	1,9 [4.2]
MdSS	4/3	— кд [<i>і</i> b]	2,7 [5.9]
Mounting position			Optional
Electrical			
• · ·	Direct		12, 24, 48
Supply voltage	Alternating	V	110, 230
Power		W	29 *
Switch-on time**		ms	50 to 80
Switch-off time**		ms	30 to 55
Switching frequency		1/h	15 000
Ambient temperature		°C [°F]	to 50 [122]
Coil temperature		°C [°F]	to180 [356]
Duty cycle			Continuous

* 12 V supply voltage - 36 W.

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

$\Delta P-Q$ Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].



	Flow path					
Spool	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	2	
6	5	5	9	9	-	
81	5	5	1	1	-	
51A, 51B	5	5	1	1	-	
41A, 41B	7	7	-	-	-	

△P-Q Operating limits

Spool

1

2

3

6

81

51A, 51B

41A, 41B

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].



Curve

1

4

3

3

1

1

2

The operating limits of the valve are determined at a voltage 10% below the nominal rating. The curves refer to application with symetrical flow throw the valve (P-A and B-T). In the case of asymetric 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.

18/07/17





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-important for option with restrictor-type ... "UD"

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 refielled 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.



Mechanically operated

Function drawing



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



Vent screw

Vent screw

(10)

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

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

- Solenoid "a" MR-045
 Solenoid "b" MR-045
 Fixing screws 4 pcs M5 x 30 to ISO 4762 -10.9 must be ordered separately. Required tightening torque Md = 9 Nm
 Plug-in connector "a" grey
 Plug-in connector "b" black
 Emergency manual override
 O-ring 9,25 x 1,78
 Valve cap

- 8. Valve cap
- 9. Nameplate

E

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

≡Β≡

- 10. Constant action restrictor
- Electrically operated

Hydraulically operated

EA=

А



Model code



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

- 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.



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.



KV-4/3-5KO-10

Hydraulic symbol

Spool types









POCLAIN HYDRAULICS



Mechanically operated

Features

Hydraulic			
Size			10
Flow rate		L/min [GPM]	see $\Delta P-Q$ curves
Operating processo	Ports A, B, P	bar [PSI]	350 [5 076]
Operating pressure	Port T	bar [PSI]	250 [3 625]
Viscosity range		mm ² /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	4/2	ka [lb]	6,5 <i>[14.3]</i>
	4/3	—— кд [ю]	7,3 [16.1]
Mounting position			Optional
Electrical			
Cumply voltage	Direct		12, 24, 48
Supply voltage	Alternating	V	10 see ΔP-Q curves 350 [5 076] 250 [3 625] 15 to 380 [69.5 to 1 76] -20 to+70 [-4 to 158] 8 6,5 [14.3] 7,3 [16.1] Optional 110, 230 45 70 to 95 40 to 80 15 000 to 50 [122] to 180 [356] Continuous
Power		W	45
Switch-on time*		ms	70 to 95
Switch-off time*		ms	40 to 80
Switching frequency		1/h	15 000
Ambient temperature		°C [°F]	to 50 [122]
Coil temperature		°C [°F]	to 180 [356]
Duty cycle			Continuous

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

$\Delta P-Q$ Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].



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

△P-Q Operating limits

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS]. [PSI] bar 350 5076 320 4641 4061 280 2 3 5 1-240 3481 Pressure 200 2901 160 2321 6 120 1740 80 1160 580 40 0 20 40 60 80 100 120 l/min [GPM] 15.9 21.1 26.4 31.7 0 5.3 10.6 Flow

Spool	Curve	The operating limits of the valve are
1	1	determined at a voltage 10% below the
2	4	nominal rating. The curves refer to
3	5	 application with symetrical flow throw the valve (P-A and B-T). In the case of
6	3	asymetric flow (e.g. one part not used)
9	6	reduced values may result.
81	1	Note: For values with adjustment of the
51A, 51B	1	switching time reduced values of the
41A, 41B	2	operating limits may result.

Dimensions 122[4.80] 70 ±1 [2.76 ± 0.04] 44 dia. 8 62 KV-4/2-5KO-10 6 [1 6 в Ð With hand operation - add letter G 54[2.13] before spool type in ordering code. <u>24.5</u> [0.96] Max. torque 6 Nm ca. 219[8.62] .Connection diagram and connecting dimensions to ISO 4401. ø 11[0.43 dia.] B ca. 112*[4.41]* 83/3.27] KV-4/3-5KO-10 諁 X 50.5 [1 ø6.6[0.26 dia.] S=27 [1.06] Max. torque 50 Nm 103 [4.06] ca. 108[4.25] ca. 319[12.56] Pg9. 諁 KV-4/2-5KO-10-81 <u>17.5</u> [0.69] S=27[1.06] Max. torque 50 Nm ca. 336.5[13.23] 7 0,01/100mm Rmax4 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.



Installation-important for option with restrictor-type... "UD"

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 refielled 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.



Mechanically operated

Hydraulically operated

Function drawing



18/07/17

Electrically operated



Model code



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









Mechanically operated

4/2, 4/3 WAY DIRECTIONAL VALVES TYPE KV

• 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).

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.

Dischange 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.





KV-4/3-16-

Hydraulic symbols

Spool types













Electrically operated

Features

Flow rate	L/min [GPM]		300 [79.2]	
Operating processo	har (DCI)	Ports A, B, P	350 [5076.3]	
Operating pressure	Dal [PSI]	Port T	250 [3625.9]	
Pilot oil pressure (x-external)	bar <i>[PSI]</i>	50-25	0 [725.2-3625.9]	
Pilot oil pressure (x-internal) Pre-load valve is fitted into P-port of the main valve Without Pre-load valve in the P-port of the main valve		In valve types with internal pilot oil supply (x) t spool types 2, 3, and 4 are possible only when flow in the direction from P towards T achieve flow rate Q = 150 L/min [39.6 GPM], with the control sp the centre position.		
Oil temperature range	°C [°F]	-20 to	9 +70 [-4 to 158]	
Viscosity range	mm²/S	15 to 380		
Required pilot oil volume	cm ³ [cu.in]	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]	
Mass	kg <i>[lb]</i>	4/2 pilot valve	2,2 [4.8]	
		Throttle/check valve	1,45 [3.2]	
		Pressure reducing valve	1,70 [3.7]	
Mounting position		Optional, horiz	contal for spool types 4/2	
Switch-on time Solenoid change-over from the operating to the centre position	(ms)	3 positions valve 2 positions valve	60 85	
Switch-off time Solenoid change-over from the operating to the centre position	(ms)	3 positions valve 2 positions valve	45 50	
Filtration	NAS 1638		8	
Ambient temperature range	°C [°F]	+50 [122]		
Coil temperature range	°C [°F]		+180 [356]	
Power	W	29 (12V si	upply voltage - 36W)	
Voltage	V	12, 2	4, 48, 110, 230	

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

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].

Δ **P-Q Performance curves**

[PSI] bar ķ Diff. pressure 6 - 87 - 29 ►L/min [GPM] **T** 0 Т Flow

Spool type	P-A	P-B	A-T	B-T	P-T
1, R1, 51B, 51A, F51, R51	е	е	е	f	-
2, R2	а	b	С	е	f
3, R3	b	b	С	d	-
4, R4	b	С	С	е	-
5, R5	b	С	С	е	-
6, R6	b	С	d	е	-



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.



Pressure reducing valve

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

Dimensions

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]*.

Throttle check valve

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





Model code



а





Special requirements to be briefly specified



Bal

Mechanically operated

4/2, 4/3 WAY DIRECTIONAL VALVE KV-3KO

• 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.
- Fulfil EMC (89/336/EEC).

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

Hydraulic				
Size			6	
Flow rate		L/min [GPM]	see ΔP -Q curves	
Operating pressure	Ports A, B, P	bar [PSI]	- 250 [3 625]	
	PortT	bar [PSI]		
Viscosity range		mm ² /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 4/2 4/3	4/2	Let. []].]	1,3 [2.9]	
	4/3	kg [lb]	1,8 [3.9]	
Mounting position			Optional	
Electrical				
Supply voltage	Direct	N/	12, 24, 48	
	Alternating	V	110, 230	
Power		W	26	
Switch-on time*		ms	50 to 80	
Switch-off time*		ms	30 to 55	
Switching frequency		1/h	15 000	
Ambient temperature		°C [°F]	to50 [122]	
Coil temperature		°C [°F]	to180 [356]	
Duty cycle			Continuous	

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

$\Delta P-Q$ Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].

△P-Q Operating limits

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].



	Flow path					
Spool	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	-	-	-	



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 lekage line when working pressure is higher than 210 bar [3 045 PSI].







4/2, 4/3 WAY DIRECTIONAL PROPORTIONAL VALVE KVP

• 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).



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			
Size			6
Flow rate		L/min [GPM]	10, 20, 30 [2.6 - 5.2 - 7.9]
Operating pressure	A, B, P	har [PSI]	350 [5 076]
Operating pressure	Т		250 [3 625]
Oil temperature range		°C [°F]	-20 to +70 [-4 to +158]
Viscosity range		mm²/s [SUS]	15 to 380 [3.24 to 82]
Mounting position			Optional
Mass	4/2	ka [lb]	1,65 [3.63]
	4/3	kg [ib]	2,2 [4.85]
Filtration		NAS 1638	7
Proportional			
Hysteresis			5% of max. flow rate
Nominal current	12 DC	<u>^</u>	2
	24 DC	A	1
Electrical			
Supply voltage		V	12, 24 DC
Power		W	36
Ambiant temperature		°C [°F]	to+50 [to +122]
Coil temperature		°C [°F]	to +180 [to +356]
Duty cycle			Continuous

Dimensions


Input signal curves / Flow rate



Power limits transmitted

Measured at 40°C [104°F] and viscosity of 32 mm²/s.



Model code





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 possbility with pressure relief valve, pump unloading valve or flow control valve.
- · Possibility to use standard components for vertical stacking.



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



Parallel (KVM-P) Series (KVM-S) в A А в А B А в Ρ Ρ Ρ P т Т



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

• 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
Size			6	6
Flow rate		L/min [GPM]	40 [10.6]	30 [7.9]
Operating pressure	A, B, P	bor (DSI)	350 [4 568]	250 [3 626]
Operating pressure	Т	— Dai [P31]	250 [3	626]
Oil temperature range		°C [°F]	-20 to +70 [-4 to +158]
Viscosity range		mm ² /s [SUS]	15 to 380 [3.24 to 82]
Mass	4/2	ka [lb]	1,85 [4.08]
Mass	4/3	Kġ [<i>ib</i>]	2,4 [5.29]	
Filtration		NAS 1638	8	
Electrical				
Supply voltage		V	12, 24	1 DC
_			29	9
Power	(12 V DC supply voltage)	VV	36	
Switching frequency		1/h	15 0	000
Ambiant temperature		°C [°F]	to +50 <i>[t</i>	o +122]
Coil temperature		°C [°F]	to +180 [to +356]
Duty cycle			Contin	uous



5

6

8

9

Mmax.50Ncm

Pg 9.

Mmax.6Nm

[1.77 dia. o 45

88 [3.46]

47 [1.85]

23.5

57 [2.24]

Dimensions

25[0.98] Ø Æ \oplus 6 [0.24] 73[2.87] 78[3.07] 87 [3.42] (Manual override - G) 157 [6.18] (KVM-...-4/2) 224 [8.82] / 252 [9.92] (Manual override - G) 55[2.17] (10) 11) ______ [0.91] ф æ \odot

(1)

Mmax. 30 Nm

0

S20 [S0.79]

3

A

1. Solenoid "a" / MR-045-O 2. Solenoid "b" / MR-045-O

2

4

В

7

Р

0

Τ

- 3. Plug-in connector «a» -grey
- 4. Plug-in connector «b» -black
- Emergency manual override
 Manual override with rubber (G)
- 7. O-ring 9,25 x 1,78
- 8. Valve cap (KVM-...-4/2)
- 9. Nameplate

в Ф

- 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



△P-Q Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].

Parallel connection -KVM-P (N1 to N8)





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





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

Spool type	Curve
1	1
2	2
3,6	3

Model code

C'S

K V N Type of connection Series connection Parallel connection	A - □ - 4 / □ -	6 -	
Number of control s Two positions	pool positions		
Three positions	3		
Manual overr	ide option		
Emergency m	anual override	No designation	
Lockable man	ual override	G	
Auxiliary contr	ol lever on valve side A	FA	
Auxiliary contr	ol lever on valve side B	FB	•
Spool type			•
			1
	a∰aAL_B a∰a₽b		3
			6
			1A
	<u> </u>	X)HIH	3A
Parallel connection	a┎ᡔ᠆᠋ᢩᡱ᠋_᠆ᢩᡰᢩᢩᢩᡭᢩᡟᡧ	ELTEX	6A
(KVM-P)		X); III)	51A
			1B
	٥ ٨. ١ ٩	ŒD F (I [‡] ∓)	3B
	₩₽₽		6B
			51B
			81
			2
Series connection (KVM-S)		DHA	2A
	┉ <mark>╔╷┲</mark> ╶ <u></u> ┺╘═┓ь	THE	2B









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.



Hydraulic symbol

1. Bankable directional valve KVM-6

Mounting example

- 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]



• M16x1,5 (ISO 9974-1) • G3/8 (ISO 1179-1) • 9/16-18 UNF-2B (ISO 11926-1)



Hydraulically operated

Electrically operated

Mechanically operated



Directional control valves - Hydraulic components

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



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4

1

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

Hydraulic symbol





۲

30°



Solenoid orientation options

Six different orientation options:











Sealing between stacking elements





8-3

Mechanically operated

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

Size		6
Flow rate	l/min <i>[GPM]</i>	40 [10.5]
Operating pressure	bar <i>[PSI]</i>	350 [5 076]
Cracking pressure	bar <i>[PSI]</i>	1 <i>[14.5]</i>
Area ratio		1:3,9
Oil temperature range	°C [°F]	-20 to +70 [-4 to +158]
Viscosity range	mm²/s [SUS]	15 to 380 [69.5 to 1760]
Filtration	ISO 4406: 1999	19/17/14
Mass	kg [lbs]	1,4 [3.0]





Dimensions



△P-Q Performance curves



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

Features

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



Mounting example

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	mm²/s [SUS]	15 to 380 [69.5 to 1760]
Filtration	ISO 4406: 1999	19/17/14
Mass	ka [lbs]	1.5 [3.3]





Dimensions



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

$\Delta P-Q$ Performance curve



Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].



Model code



Electrically operated





PRESSURE RELIEF VALVE KVM-VV-6

- Up to 350 bar [5 076 PSI]
- Up to 40 I/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 od adjustment of the throttling screw.

Hydraulic symbols









Features

Size		6
Flow rate	l/min [GPM]	40 [10.6]
Pressure setting range	bar [PSI]	15 - 350 <i>[270 - 5 076]</i>
Oil temperature range	°C [°F]	-20 to +70 [-4 to +158]
Viscosity range	mm ² /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 <i>[inch]</i>	L3 mm [inch]	L4 mm <i>[inch]</i>	L5 mm [inch]	Mass kg <i>[lbs]</i>
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 <i>[2.42]</i>
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]

Δ P-Q Performance curves





Mechanically operated

Model code





DD

Hydraulically operated



VERTICAL STACKING ON VALVES KVM WITH STANDARD SANDWICH VALVES TO ISO 4401

• 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
- 2.3Fixing 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)



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

One standard component

Hydraulic symbol



VP-NDV-6 в Mechanically operated

Two standard components



18/07/17

Electrically operated





Model code

18/07/2017

Electrically operated

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

		6	
Ports A, B, P	bar [PSI]	350 [5 076]	
Port T bar [PSI]		250 [3 626]	
	°C [°F]	-20 to +70 [-4 to +158]	
	mm ² /s [SUS]	15 to 380 [69.5 to 1760]	
	ISO 4406: 1999	19/17/14	
ke)	N [lbf]	40 [9.0]	
	kg [lb]	0,9 [1.98]	
	Ports A, B, P Port T	Ports A, B, P bar [PSI] Port T bar [PSI] °C [°F] °C [°F] mm²/s [SUS] ISO 4406: 1999 ke) N [lbf] kg [lb] kg [lb]	

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
- 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



OB-KVM-6-VV35







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	mm²/s [SUS]	15 to 380 [3.24 to 82]			
Filtration	NAS 1638	8			
Mass	kg [lb]	1,25 [2.76]	1,35 [2.98]	2,2 [4.85]	4,5 [9.92]
Flow rate	L/min [GPM]	1		40 [10.6]	
Drees Catting	box (DS/I	/	50-210 [13-55]		
Press Setting	bar [PSI] -	1	100-350 [26-92]		
Adjustments		1	allen key		
Max. pressure	bar [PSI]	1	/	350 [5 076]	210 [3 045]
Supply voltage	V DC	/	1	12, 24	1
Power	W	1	1	17	1
Flow - inlet	L/min [GPM]	/	1	/	max. 50 [max. 13,21]
Flow - priority way	L/min [GPM]	/	1	/	0 - 25 [0 - 6.6]
Flow - bypass	L/min [GPM]	/	1	/	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



Mechanically operated

Dimensions

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



- 1. Pressure relief valve
- 2. Flow control valve - rotary knob -TVTPB
- 3.
- Flow control valve proportional solenoid TVTP Flow control valve proportional solenoid with manual 4. override - TVTPG Threaded connection MP - G1/4 (closed)
- 5.
- 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 Connection dimensions for KVM-6 (see page 12.11.3) 10.

$\Delta P-Q$ Performance curves

Measured at 50°C [122°F] and viscosity of 28 mm²/s [148 SUS].



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









END PLATE ZB-KVM-6





ZB-KVM-6

Model code






FIXING ELEMENTS FOR MOUNTING

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



SET-KVM-6-N3

Description

Screw M8 DIN 939 10.9:

	-	L S
	L mm <i>[in]</i>	Max. number of bankable
N1	80 [3,15]	valves KVM:
N2	127 [4,99]	
N3	174 [6,85]	a) parallel connection (KVM-P) =
N4	221[8,70]	eight valves (max. No).
N5	268 [10,55]	
N6	315 [12,40]	
N7	362 [14,25]	
N8	409 [16,10]	

Model code

<u>SET</u> - <u>KVM</u> - 6	- <mark>-</mark> -
Number of bankable directional valves KVM-6	V
One valves KVM-6	N1
Two valves KVM-6	N2
Three valves KVM-6	N3
Four valves KVM-6	N4
Five valves KVM-6	N5
Six valves KVM-6	N6
Seven valves KVM-6	N7
Eight valves KVM-6	N8



Dimensions

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



 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

Operation

- 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).

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

The KV type directional valves consist of a housing (1), a control spool (2), a solenoid (3)

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

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

P1

P2

YΖ

corresponding flow ways and establishing respective links between the ports

Δ

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

- Protection of solenoid IP 65 to EN 60529 / IEC 60529.
- Fulfil EMC (89/336/EEC).

one basic directional valve.

and a return spring (5).

P1, A, B and P2.

and P2.

(6).





KV-6/2-6-S50

Hydraulic symbol

Spool type



Mounting example



Mechanically operated

Electrically operated

 $^{\mathbf{v}}$ Δ 6 3



18/07/17



Features

Hydraulic			
Size			6
Flow rate		L/min [GPM]	50 [13.2]
Operating pressure	With YZ	bar (PSI)	350 [5 076]
Operating pressure	Without YZ		250 [3 625]
Oil temperature range		°C [°F]	-20 to +70 [-4 to+158]
Viscosity range		mm ² /s [SUS]	15 to 380 [3.24 to 82]
Mounting position			Optional
Mass		kg <i>[lb]</i>	2,5 [5.51]
Filtration		NAS 1638	8
Electrical			
Supply voltage		V	12, 24 DC
Power		W	31
Switching frequency		1/h	15 000
Ambiant temperature		°C [°F]	to +50 [to +122]
Coil temperature		°C [°F]	to +180 [to +356]
Duty cycle			Continuous





△P-Q Performance curve

Measured at 40°C [104°F] and viscosity of 32 mm²/s [148 SUS].





6/2 WAY DIRECTIONAL VALVES KV

- NG 10
- Up to 350 bar /5 076 PS/1
- Up to 120 L/min [31.7 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.







CADB

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).





Mounting example

Hydraulic symbol





Features

Hydraulic			
Size			10
Flow rate		L/min [GPM]	120 [31.7]
Operating prossure	With YZ	— bar [PSI] –	350 [5 076]
Operating pressure	Without YZ		250 [3 625]
Oil temperature range		°C [°F]	-20 to+70 [-4 to +158]
Viscosity range		mm ² /s [SUS]	15 to 380 [3.24 to 82]
Mounting position			Optional
Mass		kg <i>[lb]</i>	5,5 [12.12]
Filtration		NAS 1638	8
Electrica			
Supply voltage		V	12, 24 DC
Power		W	45
Switching frequency		1/h	15000
Ambient temperature		°C [°F]	to+50 [to +122]
Coil temperature		°C [°F]	to+180 [to +356]
Duty cycle			Continuous







△P-Q Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].





6/2 WAY DIRECTIONAL VALVES KV

- 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			
Size			16
Flow rate		L/min [GPM]	250 [66]
Operating pressure		bar [PSI]	15 to 350 [217.56 to 5076.32]
operating pressure	(in port L or in return way)	bar [PSI]	250 [3625.94]
Oil temperature range		°C [°F]	-20 to +70[-4 to 158]
Viscosity range		mm²/s [SUS]	15 to 380 [3.24 to 82]
Mounting position			Optional
Mass		kg <i>[lb]</i>	22 [48.50]
Filtration		NAS 1638	8
Electrical			
Supply voltage		V	12, 24 DC
Demen		W	29
Power	(12 V DC supply voltage)		36
Switching frequency		1/h	15 000
Ambiant temperature		°C [°F]	to +50 [to +122]
Coil temperature		°C [°F]	to +180 [to +356]
Duty cycle			Continuous







△P-Q Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].



Model code





8-3

6/2 WAY DIRECTIONAL VALVES KV-6K

• NG 6

Operation

valve.

- 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).

hydraulic medium flow.



KV-6K/2-6

Hydraulic symbol

Spool type



solenoid (3) with return spring (5). Change-over to the operating position is done by energizing the solenoid (3), whereby the

The KV-6K/2-6 type directional valves consist of a housing (1), a control spool (2), and a

Directional valves type KV-6K/2-6 with direct solenoid operation control the direction of the

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

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).





Mounting example



Hydraulically operated

Mechanically operated



Features

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





Hydraulically operated

△P-Q Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].



Model code



18/07/17

Electrically operated



6/2 WAY DIRECTIONAL VALVES KVH

• NG 6

Operation

valve.

- 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).

hydraulic medium flow.





KVH-6/2-6-S50-N3

Hydraulic symbol



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

Directional valves type KVH with direct solenoid operation control the direction of the

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

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).





Mounting example





Features

Hydraulic			
Size			6
Flow rate		L/min [GPM]	50 [13.21]
Operating pressure	With YZ	— bar [PSI]	315 <i>[4 5</i> 68]
operating pressure	Without YZ		250 [551]
Oil temperature range		°C [°F]	-20 to +70 to +158]
Viscosity range		mm²/s [SUS]	15 to 380 [3.24 to 82]
Mounting position			Optional
Mass		kg <i>[lb]</i>	2,7 <i>[5.95]</i> (N1)
Filtration		NAS 1638	8
Electrical			
Supply voltage		V	12, 24 DC
Bower		10/	29
Fower	(12 V DC supply voltage)	— VV	36
Switching frequency		1/h	15 000
Ambient temperature		°C [°F]	to +50 [to+122]
Coil temperature		°C [°F]	to +180 [to +356]
Duty cycle			Continuous





△P-Q Performance curves

.Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].]



Model code



Mechanically operated



6/2 WAY DIRECTIONAL VALVE KVH

- NG 8
- Up to 350 bar [5 076 PSI]
- Up to 90 L/min [23.8 GPM]
- Threaded connections to ISO 9947 (Metric), ISO 1179 (BSPP/Gas), ISO 11926 (UNF)
- Fulfil EMC (89/336/EEC)
- Plug-in connector for solenoids to ISO 4400/AMP/Deutch
- With internal or external drain release
- · For single use or series assembly of 2 to 6 sections



KVH-6/2-8

Hydraulic symbols

Operation

Directional valves type KVH with direct solenoid operation control the direction of the hydraulic medium flow. They are mostly used as circuit selector valve between two (or more) consumers when we want to control two (or more) consumers by means of one basic directional control valve.

A valve basically consists 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 operating pin (4), thus clearing the corresponding flow ways and establishing respective links between the ports P1-A and P2-B.

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 betweeen ports P1-C and P2-D. The change-over can also be done manually by pressing the pin for emergency manual override on the solenoid core (6).

Solenoid coil is fastened to the core by retaining nut (7). Position of the coil is pre-defined by a pin on the coil (8) and fixation hole on the valve housing.

Wet pin tube of the solenoid core is loaded by working pressure.

When the valve is used at pressure over 250 bar the pressure in the tube must be released by external drain port (9) to tank (option YZ), or internally over the check valves to the lower pressure port - alternatively P1/P2 (option YN).





Mounting example





Features

Hydraulic			
Size			8
Flow rate		L/min [GPM]	90 [24]
Operating prossure	with YN or YZ	bar [PSI]	350 [5 076]
	without drain release	bar [PSI]	250 [3 625]
Viscosity range		mm ² /s [SUS]	15 to 380 [69.5 to 1 760]
Oil temperature range		°C [°F]	-20 to +70 [-4 to +158]
Filtration		ISO 4406:1999	19/17/14
Mass		kg <i>[lb]</i>	3,8 [7.71]
Mounting position			Optional
Electrical			
Supply voltage		V	12 DC, 24 DC
Max. allowable voltage variation			+/- 10 %
Power		W	45
Ambient temperature		°C [°F]	to 50 <i>[122]</i>
Coil temperature		°C [°F]	to 180 [356]
Duty cycle			Continuous

Protection class to EN 50529 / IEC 60529

- Connector AMP - Connector Deutsch

- Connector Deutscr

- IP65 - IP65 - IP69K

 $\Delta P-Q$ Performance curves



Pressure drop curves for flow in one direction, measured on the valves with ports M22x1,5 and spool with negative overlapping.

P-Q Operating limits



Change-over of the spool is assured in the p-Q range below the operating limit curve. However, stability of the spool in position "0" or "b" is assured in the whole p-Q range up to 350 bar and up to 90 l/min [23.8 GPM]. Hydraulically operated

⁻ Connector ISO 4400 - Connector AMP







- 1. Solenoid coil MR-060-O...
- 2. Retaining nut MR-060-M...
- 3. O-ring FI 26x2
- 4. O-ring FI 35x2
- 5. O-ring FI 31x2
- 6. Nameplate



Hydraulically operated







6/2 WAY DIRECTIONAL VALVES KVH

- 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

Hydraulic symbol



Mounting example



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).





POCLAIN HYDRAULICS



Features

Hydraulic			
Size			10
Flow rate		L/min [GPM]	120 [31.70]
Operating processo	With YZ	h an (DC/)	315 [4 568]
Operating pressure	Without YZ	bai [F31]	250 [551]
Oil temperature range		°C [°F]	-20 to +70 [-4 to+158]
Viscosity range		mm ² /s [SUS]	15 to 380 [3.24 to 82]
Mounting position			Optional
Mass		kg <i>[lb]</i>	5,5 [12.12]
Filtration		NAS 1638	8
Electrical			
Supply voltage		V	12, 24 DC
Power		W	45
Switching frequency		1/h	15 000
Ambient temperature		°C [°F]	to +50 [to +122]
Coil temperature		°C [°F]	to +180 [to +356]
Duty cycle			Continuous



Δ P-Q Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].



Model code





ſ



7/2 WAY DIRECTIONAL VALVE KV-7/2-6

• NG 6

- Up to 350 bar [5 076 PSI] Up to 50 L/min [13.2 GPM]
- Threaded connections to ISO 1179-1-N (BSPP/Gas) / ISO 9974 (metric) / ISO 11926 (SAE)

· Protection of solenoid:

- IP 65 to EN 60529 / IEC 60529 ISO and AMP Junior timer connector
- IP 69 to EN 60529 / IEC 60529 Deutsch connector
- Fulfill EMC (89/336/EEC)
- Zinc coated



KV-7/2-6

Hydraulic symbol

Operation

Valves KV-7/2-6 are used as diverter between two hydraulic cylinders which are not operated simultaneously. Two hydraulic cylinders can be controlled by one directional control valve.

Integrated pressure relief valves prevent hydraulic system against pressure peeks on working ports C1 and C2.

The valve is ideal solution for all applications where pressure peeks appear because of mechanical shocks acting on hydraulic cylinder(s).

The oil from pressure relief valves can be released over T port to tank or to accumulator assembled on T port.



Features

Hydraulic			
Size			6
Flow rate		L/min [GPM]	50 [13.2]
Operating pressure	Ports P1, P2, C1, C2, C3, C4	bar [PSI]	350 [5 076]
Operating pressure	port T	bar [PSI]	250 [3 626]
Oil temperature range		°C [°F]	-20 to +70 [-4 to 158]
Viscosity range		mm ² /s [SUS]	15 to 380 [75 to 1 760]
Fluid contamination		ISO 4406:1999	19/17/14
Mass		kg <i>[lb]</i>	3,6 [7.94]
Electrical			
Supply voltage		V	12 DC, 24 DC, 48 DC
Power		W	31
Coil temperature		°C [°F]	to 180 [to 356]
Duty cycle			Continuous



Δ P- Q performance curves

Measured at 50 °C [122 °F] and viscosity 32 mm²/s [148 SUS]



p/Q operating limits

Measured at 50 °C [122 °F] and viscosity 32 mm²/s [148 SUS]

Valve operates stable for all flow directions - spool position 0, a and b at flow up to 100 l/min [26.4 GPM] and pressure up to 350 bar [5 076 PSI].





Model code





Hydraulically operated

Mechanically operated



7/3 WAY DIRECTIONAL VALVE KV-7/3-6

- NG 6
- Up to 350 bar [5 076 PSI]
- Up to 50 L/min [13.2 GPM]
- Threaded connections to ISO 1179-1-N (BSPP/Gas) / ISO 9974 (metric) / ISO 11926 (SAE)

The valve has been designed especially for use on variable V-blade snow plows. Each of

Valve KV-7/3-6 allows to switch between tilting each blade individually (spool pos. "a" and

Hydraulic accumulator absorbs impact energy, and return it back to system through check

Integrated pressure relief valves prevent hydraulic system against pressure peeks on working ports C1 and C2. The oil from pressure relief valves can be released over T port to

- Protection of solenoid:
 - IP 65 to EN 60529 / IEC 60529 ISO and AMP Junior timer connector IP 69 to EN 60529 / IEC 60529 - Deutsch connector

two blades are connected to hydraulic cylinder.

"b") or both simultaneously (spool pos. "0").

tank or to accumulator assembled on T port.

- Fulfill EMC (89/336/EEC)
- Zinc coated surface

Operation



KV-7/3-6-1

Hydraulic symbol



valves.

Features

Hydraulic			
Size			6
Flow rate		L/min [GPM]	50 [13.2]
Operating prossure	Ports P1, P2, C1, C2, C3, C4	bar [PSI]	350 [5 076]
operating pressure	port T	bar [PSI]	250 [3 626]
Oil temperature range		°C [°F]	-20 to +70 [-4 to 158]
Viscosity range		mm²/s [SUS]	15 to 380 [75 to 1 760]
Fluid contamination		ISO 4406:1999	19/17/14
Mass		kg <i>[lb]</i>	3,6 [7.94]
Electrical			
Supply voltage		V	12 DC, 24 DC
Power		W	31
Coil temperature		°C [°F]	to 180 [to 356]
Duty cycle			Continuous



△P- Q Performance curves

Measured at 50 °C [122 °F] and viscosity 32 mm²/s [148 SUS]



p/Q Operating limits

Measured at 50 °C [122 °F] and viscosity 32 mm²/s [148 SUS]

Valve operates stable for all flow directions - spool position 0, a and b at flow up to 100 l/min [26.4 GPM] and pressure up to 350 bar [5 076 PSI].

Dimensions



Hydraulically operated

Electrically operated

18/07/17



Model code




Mechanically operated



Brif

Mechanically operated

8/3 WAY DIRECTIONAL VALVES KV

• NG 6

- Up to 250 bar [3 625 PSI]
- Up to 50 I/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).





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).





Mounting example

Hydraulic symbol





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 ² /s [SUS]	15 to 380 [3.24 to 82]
Mounting position			Optional
Mass		kg <i>[lb]</i>	3,8 [8.38]
Filtration		NAS 1638	8
Electrical			
Supply voltage		V	12, 24 DC
Damas		10/	29
Power	(12 V DC supply voltage)	VV	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





△P-Q Performance curves

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].



Model code







Subplates

225

225

CONNECTING COMPONENTS



SUBPLATES	

Subplates (NG 6, 10, 16)





MANIFOLD BLOCKS

Manifold blocks BP (NG 6, 10)



Manifold blocks





Subplates

SUBPLATES

• NG 6, 10, 16

- Up to 350 bar [5076 PSI]
- Up to 300 I/min [79.3 GPM]
- Connecting dimensions to ISO 4401.
- Threaded connection to ISO 1179 (BSPP/Gas).



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



Subplate type PP-KV-10-G1/2-Ø28L

Surface protection - Phosphated



Manifold blocks



Subplate, type PP-KV-16-G1-Ø41





Subplates

MANIFOLD BLOCKS BP

- NG 6, 10
- Up to 350 bar [5076 PSI]
- .Connecting dimensions to ISO 4401.
- .Threaded connection to ISO 1179-1 (BSPP/Gas).
- .Mounting position unrestricted (valve axis preferably horizontal).
 Because of the large drilling diameters the pressure drop through the manifolds is very low.



BP-6-4-S

Operation

Manifold blocks serve for transmission of hydraulic fluid from source to valves. On the block can be two or up to seven valves (NS 10) or up to eight valves (NS 6) mounted in parallel connection.

Manifold blocks are used for easily realizing of hydraulic circuits without piping between valves and minimal overall dimensions.

Hydraulic symbol





BP-6-...-









Turne	Newsinel size	Ctations	L1	L2	Ports	size	Mass
туре	Nominal Size	Stations	mm [Zoll]	mm [Zoll]	P-T	A-B	kg <i>[lb]</i>
BP-6-1		1	70 [2.75]	54 [2.12]			2,3 [5.07]
BP-6-2		2	120 [4.72]	104 <i>[4.09]</i>			3,9 [8.60]
BP-6-3	-	3	170 [6.69]	154 [6.06]			5,5 [12.12]
BP-6-4	6	4	220 [8.66]	204 [8.03]	G1/2	C3/8	7,2 [15.87]
BP-6-5	0	5	270 [10.63]	254 [10.00]	61/2	63/0	8,8 [19.40]
BP-6-6		6	320 [12.60]	304 [11.97]			10,5 [23.15]
BP-6-7		7	370 [14.56]	354 [13.93]			12,1 [26.67]
BP-6-8		8	420 [16.53]	404 [15.90]			13,7 [30.20]



BP-6-...-S



Type	Nominal sizo	Stations	L1	L2	L3	Ports	size	Mass
туре	Nominal Size	Stations	mm [Zoll]	mm [Zoll]	mm <i>[Zoll]</i>	P-T	A-B	kg <i>[lb]</i>
BP-6-1-S		1	70 [2.75]	54 [2.12]	58 [2.28]			2,3 [5.07]
BP-6-2-S	-	2	120 [4.72]	104 <i>[4.09]</i>	108 <i>[4.25]</i>	G1/2 G3		3,9 [8.60]
BP-6-3-S		3	170 [6.69]	154 [6.06]	158 [6.22]		G3/8	5,5 [12.12]
BP-6-4-S	6	4	220 [8.66]	204 [8.03]	208 [8.19]			7,2 [15.87]
BP-6-5-S		5	270 [10.63]	254 [10.00]	258 [10.15]		03/0	8,8 [19.40]
BP-6-6-S		6	320 [12.60]	304 [11.97]	308 [12.12]			10,5 [23.15]
BP-6-7-S		7	370 [14.56]	354 [13.93]	358 [14.09]			12,1 [26.67]
BP-6-8-S		8	420 [16.53]	404 [15.90]	408 [16.06]			13,7 [30.20]











Turne	Neminal size		L1	L2	Ports size)	Mass
туре	Nominal Size	Stations	mm [Zoll]	mm [Zoll]	Р	A-B	т	kg <i>[lb]</i>
BP-10-1		1	80 [3.15]	56 [2.20]				5,9 [13.00]
BP-10-2	-	2	160 [6.30]	136 [5.35]				11,8 [26.01]
BP-10-3	10	3	240 [9.45]	216 [8.50]	G3/4 G1/2	G1/2		17,7 [39.02]
BP-10-4		4	320 [12.60]	296 [11.65]			G1	23,5 [51.80]
BP-10-5		5	400 [15.74]	376 [14.80]				29,4 [64.81]
BP-10-6		6	480 [18.90]	456 [17.95]				35,3 [77.82]
BP-10-7		7	560 [22.04]	536 [21.10]				41,2 [90.83]





Туро	Nominal sizo	Stations	L1	L2	F	Ports size)	Mass
Type Nomina Size	Stations	mm [Zoll]	mm [Zoll]	Р	A-B	т	kg <i>[lb]</i>	
BP-10-1-S		1	80 [3.15]	56 [2.20]				5,9 [13.00]
BP-10-2-S		2	160 [6.30]	136 [5.35]				11,8 [26.01]
BP-10-3-S		3	240 [9.45]	216 [8.50]				17,7 [39.02]
BP-10-4-S	10	4	320 [12.60]	296 [11.65]	G3/4	G1/2	G1	23,5 [51.80]
BP-10-5-S	-	5	400 [15.74]	376 [14.80]				29,4 [64.81]
BP-10-6-S	-	6	480 [18.90]	456 [17.95]				35,3 [77.82]
BP-10-7-S		7	560 [22.04]	536 [21.10]				41,2 [90.83]

Subplates



Model code





Max. pressure depends on type of used seals.

ELECTRIC AND ELECTRONIC COMPONENTS



PRESSURE SWITCHES		23
Pressure switch TS-4 (NG 4)		235
Stacking sandwich plate VP-T	S-4 (NG 6, 10)	239



SOLENOIDS	241
Direct current solenoids for hydraulics MR	241



Cont	JOYSTICK	245
	Joystick with two switches KRSS	245

Solenoids

Joystick

• Up to 400 bar [5801 PSI]

· Lockable pressure setting.

Minimal dimensions.Four pressure ranges.

Operation

• NG 4

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

• Three mounting methods (horizontal, vertical, built into pipeline).

Operation supervision by means of signal lamp.
Plug-in connector for solenoids to ISO 4400.

• Three pressure setting methods (by means of Allan key, knob, or lockable knob).

PRESSURE SWITCH TS-4

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



TS-4



Circuit diagram

Symbol

Without signal lamp



With signal lamp



Mounting example

One pressure switch



Two pressure switches



h, h1, h2 = Control lamps. c = Relay (contactor). Solenoids

Features

Hydraulic					
Туре		TS-4-70	TS-4-160	TS-4-250	TS-4-400
Size				4	
Min. pressure at pressure rise	bar [PSI]	< 9 [< 131]	< 17 [< 247]	< 20 [< 290]	< 25 [< 363]
Max. pressure at pressure rise	bar [PSI]	70 ±2 [1 015 ±29]	160 ±4 [2 320 ±58]	250 ±6 [3 625 ± 87]	400 ±10 <i>[5 801± 145]</i>
Hysteresis at min. pressure	bar [PSI]	≤ 4 <i>[</i> ? 58]	≤ 8 [? 116]	≤ 10 <i>[</i> ? <i>145]</i>	≤ 13 <i>[</i> ? <i>189]</i>
Hysteresis at max. pressure	bar [PSI]	≤ 8,5 <i>[</i> ? 123]	≤ 15 [? 218]	≤ 20 <i>[</i> ? 290]	≤ 25 <i>[</i> ? 363]
Max. pressure	bar [PSI]	400 [5 801] 500 [7 251]			
Repeating accuracy	%			< ±1	
Shift frequency	min ⁻¹			120	
Oil temperature range	°C [°F]		-20 to +7	70 [-4 to +158]	
Viscosity range	mm²/s [SUS]		15 to 38	30 [3.24 to 82]	
Filtration	NAS 1638			8	
Mass	kg <i>[lb]</i>		0,2 to 0.4	4 [0.44 to 0.88]	

Electrical

Switching capacity		Voltage	V	125; 250
	Alternating current	Ohm load	А	5
		Inductive load	А	5
	Direct	Voltage	V	30; 50; 75; 125; 250
	current	Ohm load	V	5; 2; 1; 0,5; 0,25
		Inductive load	А	5; 2; 1; 0,06; 0,03

Dimensions



- 7. O-ring 5x1,5
- Fixing screws holes, 2 pcs M5x40 to ISO 4762-10.9 Tightening torque Md=9 Nm (not included)
- 9. Fixing the switch to stacking sandwich plate
- 10. Instalation into line
- 11. Fixing the switch to subplate
- 12. Pressure setting by means of Allan key
- 13. Pressure setting by means of knob
- 14. Pressure setting by means of lockable knob
- 15. Screw for protection of the seat pressure



Opening pressure

Measured at 50°C [122°F] and viscosity of 32 mm²/s [148 SUS].



Model code

	TS-4-	· 🖵 - 🖵	- 🖵	- 🖵 -	- 🗶
Pressure setting range	ge				
To 70 bar [1,015 PSI]	-	70			
ToTo 160 bar [2,320 P	SI]	160			
ToTo 250 bar [3,625 P	SIJ	250			
ToTo 400 bar [5,801 P	SI]	400			
Mounting	ethod	•			
Vertical	Guioù	V	-		
Horizontal		Н	-		
Built-in		N	-		
Duit in		, it			
			•		
Pres	sure setting eleme	ent	V		
Allan	key		Α	-	
Knot)		В	_	
Lock	able key		С		
				V	
Plug-	in connector			V	
Witho	ut signal lamp		No	designation	
		12; 24 V		L24	_
With s	signal lamp	48 V		L48	_
		110; 230	V	L230	
	Seals type				
	NBR seals for mine 51524	eral oil HL,HLP	to DIN	No desig	nation
	FPM seals for HET VDMA 24568 and I	G, HEES, HEP SO 15380	PG to	E	
	Special ro	quirements to	he brie	fly specific	d ↓

STACKING SANDWICH PLATE VP-TS-4

• NG 6, 10

• Up to 400 bar [5801 PSI]

VP-TS-4-...

Features

Size		6	10
Flow rate	L/min [GPM]	80 [21.1]	120 [31.7]
Operating pressure	bar <i>[PSI]</i>	400 [5 801]	1
Oil temperature range	°C [°F]	-20 to +70 [-4 to	+158]
Viscosity range	mm ² /s [SUS]	15 to 380 [3.24	to 82]
Filtration	NAS 1638	8	
Mass	kg [lb]	0,9 [1.98]	2,1 [4.63]

Dimensions



Joystick



Model code



DIRECT CURRENT SOLENOIDS FOR HYDRAULICS MR

- · Fast and simple instalation.
- · Reliable functioning in every position.
- · Long life span.
- Solenoid screws into valve block.
- · Removable coil.
- · Corresponding to VDE 0580 recommendations.
- Plug-in connector corresponding to EN 175301-803 standards.
 MR 045 fulfil EMC (89/336/EEC).
- Protection of solenoid: IP 69 for Deutsch connector IP 65 to EN 50529 / IEC 60529 for AMP connector



MR - 060, MR - 045, MR - 045/1

Operation

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

This type of solenoid is used for controlling of directional control valves.

They are activated by passing electric current through the solenoid's coil. For manually operation of the solenoid, there is the emergency switch at the back of the solenoid. Solenoids are of «push-design». When the solenoid is activated the piston pushes the piston rod out of it. The force with which the piston pushes at various points of its stroke (solenoid's movement) is given in the tables. The solenoids are designed for direct current. If a rectifier bridge is added, the alternating current can also be used. They are built for voltages of 12, 24, 48, 110 and 230V. Allowed deviation from the nominal voltage is within -10 to +5%. Their intermittence is 100% at the ambient temperature of 40°C [104°F]. When the ambient temperature is increased the intermittence is correspondingly lowered.

If the buyer so wishes, solenoids have the degree of protection of enclosures IP 65. They are tested to the pressure of 250 bar [3 626 PSI]. Their life span in normal working conditions is 10⁷ operations.



Features

	Strokemm [Zoll]		MR-045 for NG6 5KO	MR-045/1 for NG6 3KO	MR-060 for NG10	
	0 [0]	-	100 [22.5]	90 [20.2]	240 [53.9]	
	1 [0.04]	-	75 [16.9] / 70* [15.7]*	50 [11.2]	130 [29.2]	
	2 [0.08]		60 [13.5] / 50* [11.2]*	35 [7.9]	140 [24 5]	
	3 [0.12]		30 [6.7] / 20* [4.5]*	20 [4.5]	140 [31.5]	
when ED is 100%	4 [0.16]		20 [4.5] / 10* [2.2]*	10 [2.2]	85 [19.1]	
(* 230.)/ AC supply voltage)	5 [0.20]		8 [1.8] / 5* [1.1]*	5 [1.1]	50 [11.2]	
(250 V AC supply voltage) -	6 [0.24]	-	5 [1.1] / 3* [0.7]*	3 [0.7]	35 [7.9]	
	7 [0.28]		-	-	23 [5.2]	
	8 [0.31]		-	-	18 [4.0]	
	9 [0.35]	-	-	-	13 [2.9]	
Power (** 12V supply voltage - 36W)		W	29**	26	45	
Pression		Bar [PSI]	25	60 [3 626]		
Intermittence		%		100		
Mass		kg [lbs]	0,6 [1.32]	0,45 [0.99]	1,6 [3.52]	

Pressure switches



	а	b	D ^{+0,1}	Øe	Øf	g	h	j
MR-045	53 [2.08]	73 [2.87]	17 5 [0 60]	30 [1 18]	45 [1 77]	85 [2 25] / 01* [2 58]*	87 [3.42]	31 [1 34]
MR-045/1	38 [1.49]	58 [2.28]	17,5 [0.09]	50 [1.10]	45[1.77]	00 [0.00] / 91 [0.00]	72 [2.83]	J4 [1.34]
MR-060	72 [2.83]	108 [4.25]	23,9 [0.94]	40 [1.57]	62 [2.44]	103 [4.05] / 109* [4.29]*	122 [4.80]	50 [1.97]

* AC supply voltage

	k	L	Sm	m	n	0	р
MR-045 MR-045/1	30 [1.18]	69 [2.72]	20 [0.78]	67[2.64]	28 [1.10]	35[1.38]	61 [2.40]
MR-060	50 [1.97]	86 [3.38]	27 [1.06]	82[3.23]	40 [1.57]	54 [2.13]	79,5 [3.13]



Pressure switches

Model code (Every part of solenoid has to be ordered separately)



For DC and AC voltage the same core is used.





overvoltage	*
Without overvoltage protection	No designation
With overvoltage protection	Т

Plug-in connector

MR-	к - 🗆 -	무 - 모
Supply voltage	▼ I	└
	Direct voltage	Alternating voltage
12V	12 DC	12 AC
24V	No designation	24AC
48V	48DC	48AC
110 V	110DC	110AC
230V	230DC	230AC*

* To fulfil EMC (89/336/EEC) a capacitor must be built in.

Solenoid with rectifier bridge built in



** not valid for AMP and DEUTSCH

JOYSTICK WITH TWO SWITCHES KRSS

Switching capacity 5 A by 12 V.

Control lever with switches provides control of the valve with direct

by pressing of thumb switches mounted on the control lever.

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

• Fast and simple installation.

Operation

Features

Mounting Material

Switching capacity

Element terminals





KRSS-CO10-B

Mounting example

Solenoids

Dimensions





48

[1.89]

5A by 12 V

Black plastic

Inner thread M10

FASTON A6, 3-0, 8 EN 61210

Model code



Joystick



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