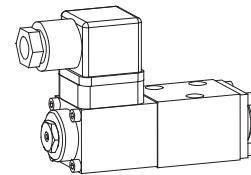


Solenoid operated spool valve

- 4/2-way impulse valve
- 4/3-way with spring centred mid position
- 4/2-way with spring reset
- $Q_{\max} = 15 \text{ l/min}$, $p_{\max} = 350 \text{ bar}$

NG3-Mini®



DESCRIPTION

Spool valve in flange design NG3-Mini. Interface to Wandfluh standard with 4 ports. Solenoid to standard VDE 0580. Direct operated solenoid valve in 5 chamber design. Spool detented or with spring reset. Wet pin type solenoid. Precise spool fit, low leakage, long life time. Threaded ports through additional base plate. Spool made from hardened steel, body from high quality cast steel. Wide range of standard and special voltages. The body made of high grade hydraulic casting for long service life is painted. The cover and the solenoid are zinc coated.

FUNCTION

The solenoid shifts the spool into the corresponding position.

- 4/2-way detented spool valve:
2 solenoids and 2 detented positions. With the solenoids deenergised the spool remains in the last switched position.
- 4/2-way spool valve:
1 solenoid and 2 spool positions, spring offset. With the solenoid deenergised the spool returns to the offset position.
- 4/3-way spool valve:
2 solenoids and 3 spool positions, spring centered. With the solenoids deenergised the spool returns to the center position.

APPLICATION

Solenoid operated spool valves are mainly used for controlling direction of movement and stopping of hydraulic cylinders and motors. Direction of movement depends on the position of spool and its flow symbol. Please pay attention to the performance limits and leakage of the valves. Solenoid operated spool valves are suitable for machine tools and handling systems. Mini-3 valves are used where both, reduced dimensions and weight are important.

CONTENT

GENERAL SPECIFICATIONS.....	1
HYDRAULIC SPECIFICATIONS.....	1
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TYPE LIST/ DESIGNATION OF SYMBOLS.....	2
CHARACTERISTICS.....	2/3
DIMENSIONS.....	3
PARTS LIST	3
ACCESSORIES.....	3

TYPE CODE

Interface	B	M	4	<input type="checkbox"/>	-	<input type="checkbox"/>	#	<input type="checkbox"/>
Medium-solenoid								
Number of control ports								
Description of symbols acc. to table 1.2-26/2								
Standard- nominal voltage U_N :	12 VDC	<input type="checkbox"/>	G12					
	24 VDC	<input type="checkbox"/>	G24					
	110 VAC	<input type="checkbox"/>	R110					
	115 VAC	<input type="checkbox"/>	R115					
	230 VAC	<input type="checkbox"/>	R230					
Design-Index (Subject to change)								

GENERAL SPECIFICATIONS

Description	4/2-, 4/3-spool valve
Nominal size	NG3-Mini to Wandfluh standard
Construction	Direct operated spool valve
Operation	Solenoid
Mounting	Flange 3 fixing holes for socket head cap screws M4x30
Connections	Threaded connection plates Multi-flange subplates Longitudinal stacking system
Ambient temperature	-20...+50°C
Mounting position	any, preferably horizontal
Fastening torque	$M_D = 2,8 \text{ Nm}$ (screw quality 8.8)
Weight: 4/2-way impulse	$m = 0,65 \text{ kg}$
4/3-way	$m = 0,65 \text{ kg}$
4/2-way (1 solenoid)	$m = 0,50 \text{ kg}$

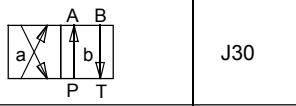
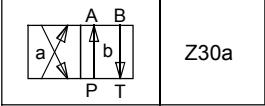
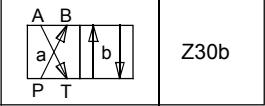
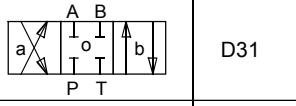
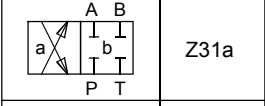
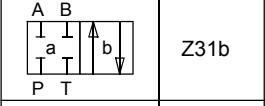
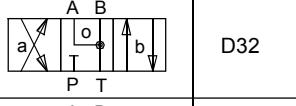
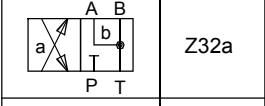
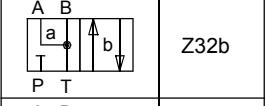
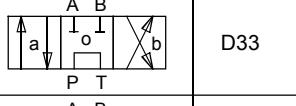
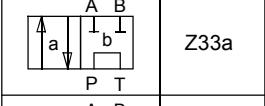
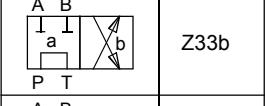
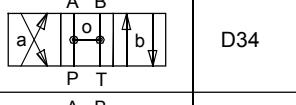
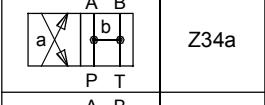
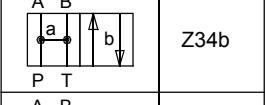
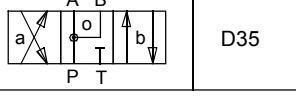
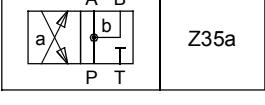
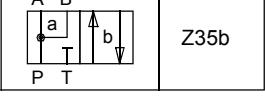
HYDRAULIC SPECIFICATIONS

Fluid	Mineral oil, other fluid on request
Contamination efficiency	ISO 4406:1999, classe 20/18/14 (Required filtration grade $\beta_{10\dots16} \geq 75$) refer to data sheet 1.0-50/2
Viscosity range	12 mm²/s...320 mm²/s
Fluid temperature	-20...+70°C
Working pressure in port P, A, B	$p_{\max} = 350 \text{ bar}$ ($p_T < 20 \text{ bar}$) $p_{\max} = 315 \text{ bar}$ ($p_T > 20 \text{ bar}$)
Tank pressure in port T	$p_{T_{\max}} = 100 \text{ bar}$
Max. volume flow	$Q_{\max} = 15 \text{ l/min}$, see characteristics
Leakage volume flow	see characteristics

ELECTRICAL CONTROL

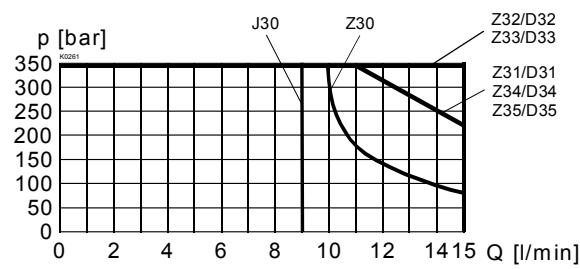
Construction	Solenoid, wet pin push type, pressure tight	Voltage tolerance	±10% of nominal voltage
Standard-nominal voltage	$U_N = 12 \text{ VDC}$ $U_N = 24 \text{ VDC}$ $U_N = 110 \text{ VAC}^*$ $U_N = 115 \text{ VAC}^*$ $U_N = 230 \text{ VAC}^*$ AC = 50 bis 60 Hz * Rectifier integrated in the plug, other nominal voltages and nominal performances on request	Protection class Relative duty factor Switching cycles Operating life Connection/Power supply	IP 65 to EN 60529 100% DF (see data sheet 1.1-430) 15'000/h 10^7 (number of switching cycles, theoretically) Over device plug connection to EN175301-803 (DIN 43650) ISO4400, form A, (2P+E), other connections on request. SIN29V (data sheet 1.1-80)
		Solenoid connection:	

TYPE LIST / DESIGNATION OF SYMBOLS

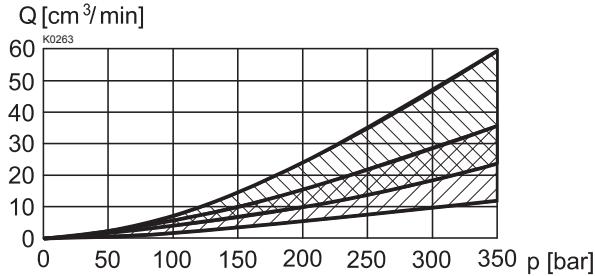
4/2-way valve impulse	4/2-way valve with spring reset operation A-side	Transitional functions operation B-side
		
J30	Z30a	Z30b
4/3-way valve spring centered		
		
D31	Z31a	Z31b
		
D32	Z32a	Z32b
		
D33	Z33a	Z33b
		
D34	Z34a	Z34b
		
D35	Z35a	Z35b

CHARACTERISTICS Oil viscosity $\nu = 30 \text{ mm}^2/\text{s}$

$p = f(Q)$ Performance limits with standard voltage -10%



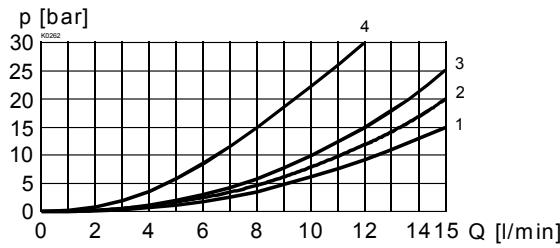
$Q_L = f(p)$ Leakage volume flow characteristics per control edge



Leakage envelope J30/Z30/D31/D32/D34/D35

Leakage envelope D33

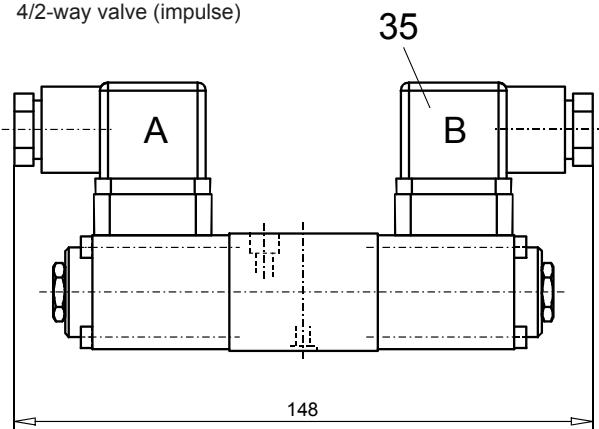
$\Delta p = f(Q)$ Pressure drop volume flow characteristics



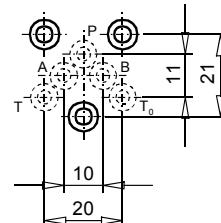
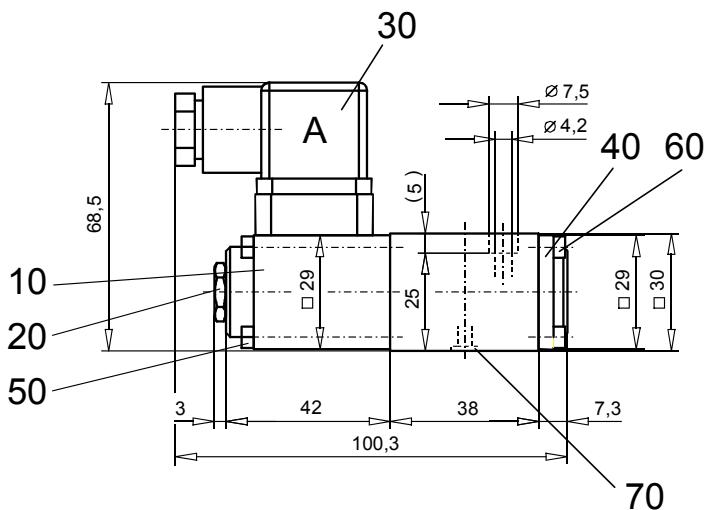
Symbol	Pressure drop Curve no.	Volume flow direction				
		P - A	P - B	P - T	A - T	B - T
Z30/J30		3	3	-	2	2
D31/Z31		3	3	-	2	2
D32/Z32		3	3	-	1	1
D33/Z33		4	4	3	4	4
D34/Z34		4	4	3	1	1
D35/Z35		2	2	-	2	2

DIMENSIONS

4/3-way valve (spring centred)
4/2-way valve (impulse)



4/2-way valve (spring reset)



PARTS LIST

Position	Article	Description
10	260.2 ...	Solenoid SIN29V
20	253.8000	Plug with integr. manual override HB4,5
30	219.2001	Electric plug A (grey)
35	219.2002	Electric plug B (black)
40	56.4200	Cover
50	246.0141	Socket head cap screw M3x40 DIN 912
60	246.0109	Socket head cap screw M3x8 DIN 912
70	160.2045	O-ring ID 4,50x1,50

ACCESSORIES

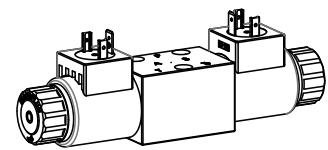
Threaded connecting plates, Multi-flange subplates and Longitudinal stacking system

see Reg. 2.9

Technical explanation see data sheet 1.0-100E

Solenoid operated spool valve

- 4/2-way impulse valve
- 4/3-way with spring centred mid position
- 4/2-way with spring reset
- $Q_{\max} = 30 \text{ l/min}$, $p_{\max} = 350 \text{ bar}$

NG4-Mini®

DESCRIPTION

Spool valve in flange design NG4-Mini. Interface to Wandfluh standard with 4 ports. Solenoid to standard VDE 0580. Direct operated solenoid valve in 5 chamber design. Spool detented or with spring reset. Wet pin type solenoid. Precise spool fit, low leakage, long life time. Spool made from hardened steel. Wide range of standard and special voltages. Two basic versions available (Economy and Medium). The body made of high grade hydraulic casting for long service life is painted. The armature tube and the plug crew are zinc coated. The solenoid coil is nickel-/chromium-coated.

FUNCTION

The solenoid shifts the spool into the corresponding position.

- 4/2-way detented spool valve:
2 solenoids and 2 detented positions. With the solenoids deenergised the spool remains in the last switched position.
- 4/2-way spool valve:
1 solenoid and 2 spool positions, spring offset. With the solenoid deenergised the spool returns to the offset position.
- 4/3-way spool valve:
2 solenoids and 3 spool positions, spring centered. With the solenoids deenergised the spool returns to the center position.

APPLICATION

Solenoid operated spool valves are mainly used for controlling direction of movement and stopping of hydraulic cylinders and motors. Direction of movement depends on the position of spool and its flow symbol. Please pay attention to the performance limits and leakage of the valves. Solenoid operated spool valves are suitable for machine tools and handling systems. Mini-4 valves are used where both, reduced dimensions and weight are important.

TYPE CODE

	W	D	F	A04 -	-	-	-	I	-	-	#	□
Spool valve direct operated												
Economy-slip-on coil	<input checked="" type="checkbox"/>	<input type="checkbox"/>										
Medium-slip-on coil	<input type="checkbox"/>	<input checked="" type="checkbox"/>										
Flange construction												
Mounting interface acc. to Wandfluh standard, NG4-Mini												
Description of symbols acc. to table 1.2-33/2												
Spool specification	Standard											
	Low Leakage	<input type="checkbox"/>	<input checked="" type="checkbox"/>	(only Economy)								
Standard-nominal voltage U_N	12 VDC	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	24 VDC	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	115 VAC	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	230 VAC	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	without solenoid coil	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Slip-on coil												
	Metal housing round with one-sided collar	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Metal housing square with one-sided collar	<input type="checkbox"/>	<input checked="" type="checkbox"/>	V					
Electric connection												
	Connector socket EN 175301 - 803/ISO4400	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Connector socket AMP Junior-Timer	<input type="checkbox"/>	<input checked="" type="checkbox"/>	D					
	Connector Deutsch DT04 - 2P	<input type="checkbox"/>	<input checked="" type="checkbox"/>	G			(only for $U_N \leq 75 \text{ VDC}$)					
Sealing material	NBR											
	FKM (Viton)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	D1								
Manual override	Integrated											
	Push-button	<input type="checkbox"/>	<input checked="" type="checkbox"/>	HF1								
	Spindle	<input type="checkbox"/>	<input checked="" type="checkbox"/>	HS1								
Design-Index (Subject to change)												

* Only available in conjunction with other nominal voltages and connection versions. (See data sheet 1.1-175)

GENERAL SPECIFICATIONS

Description	4/2-, 4/3-spool valve	Ambient temperature	-20...+70 °C (slip-on coil «V»)
Nominal size	NG4-Mini to Wandfluh standard		if > +50 °C, then
Construction	Direct operated spool valve		voltage tolerance 0 / -10%
Operation	Solenoid		-20...+70 °C (slip-on coil «N»)
Mounting	Flange	Mounting position	any, preferably horizontal
	3 fixing holes for	Fastening torque	$M_D = 5,5 \text{ Nm}$ (screw quality 8.8)
Connections	socket head cap screws M5x40		For fixing screws
	Threaded connection plates		$M_D = 5 \text{ Nm}$ for Knurled nut
	Multi-flange subplates		
	Longitudinal stacking system		

ELECTRICAL CONTROL

Construction	Solenoid, wet pin push type, pressure tight
Standard-nominal voltage	$U_N = 12 \text{ VDC}$ $U_N = 24 \text{ VDC}$ $U_N = 115 \text{ VAC}^*$ $U_N = 230 \text{ VAC}^*$ AC = 50 to 60 Hz <small>* Rectifier integrated in the coil, other nominal voltages and nominal performances on request</small>
Voltage tolerance	$\pm 10\%$ of nominal voltage
Protection class to EN 60 529	D: IP 65 J: IP 66 only for $U_N \leq 75 \text{ VDC}$ G: IP 67 and 69K only for $U_N \leq 75 \text{ VDC}$ 100% DF (see data sheet 1.1-430) 15000/h
Relative duty factor	10 ⁷ (number of switching cycles, theoretically)
Switching cycles	Over device plug connection
Operating life	10 ⁷ (number of switching cycles, theoretically)
Connection/Power supply	Over device plug connection
Coil versions:	
Economy: V.E37/19x40	(data sheet 1.1-168)
Medium: V.E37/19x50	(data sheet 1.1-168)

Other electrical specifications see data sheet 1.1-168 (V)
1.1-175 (N)

MANUAL OVERRIDE

- Integrated (-) Actuation pin integrated in the armature tube.
- Push-button (HF1) integrated in the knurled nut.
Actuation by pressing the pin
- Spindle (HS1) integrated in the knurled nut.
Actuation by turning the spindle (infinitely variable valve actuation)

HYDRAULIC SPECIFICATIONS

Fluid	Mineral oil, other fluid on request
Contamination efficiency	ISO 4406:1999, classe 20/18/14 (Required filtration grade $\beta_{10\dots16} \geq 75$) refer to data sheet 1.0-50/2
Viscosity range	12 mm ² /s...320 mm ² /s
Fluid temperature	-20...+70°C
Working pressure in port P, A, B	$p_{max} = 350 \text{ bar}$ ($p_T < 20 \text{ bar}$) $p_{max} = 315 \text{ bar}$ ($p_T > 20 \text{ bar}$)
Tank pressure in port T	$p_{Tmax} = 100 \text{ bar}$
Max. volume flow	$Q_{max} = 30 \text{ l/min}$, see characteristics
Leakage volume flow	see characteristics

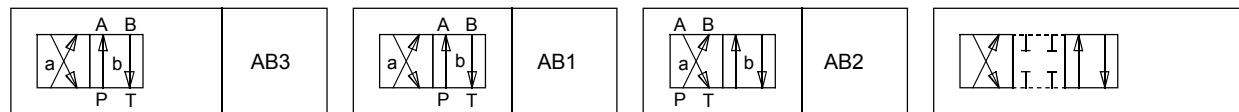
Weight	Economy	Medium
4/2-way impulse	$m = 1,1 \text{ kg}$	$m = 1,25 \text{ kg}$
4/3-way	$m = 1,1 \text{ kg}$	$m = 1,25 \text{ kg}$
4/2-way (1 solenoid)	$m = 0,83 \text{ kg}$	$m = 0,9 \text{ kg}$


NOTE!

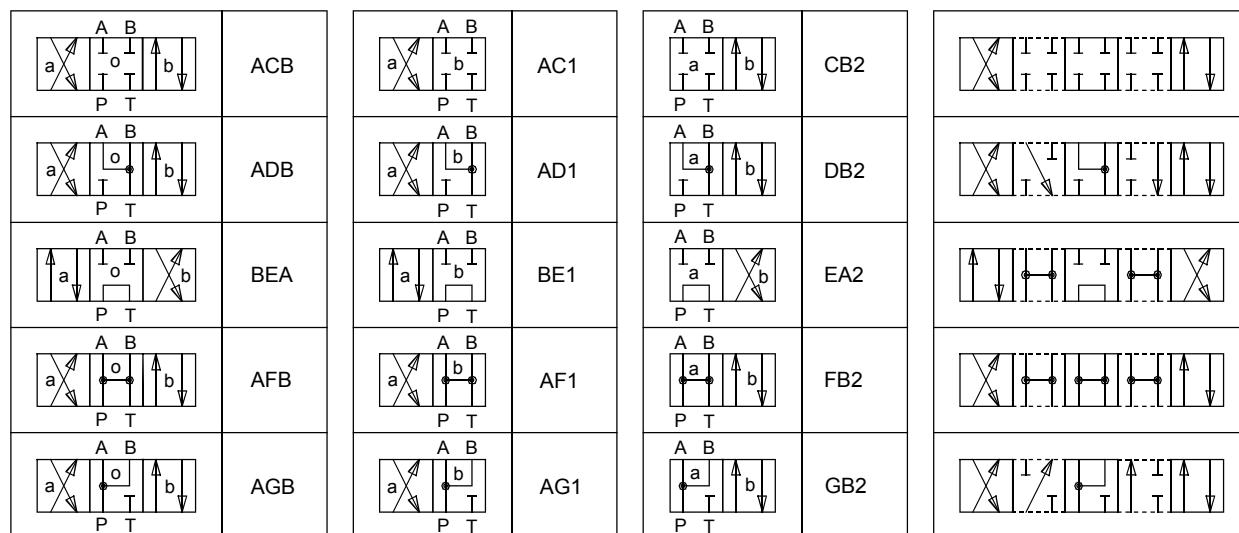
The actuation of the manual override is possible up to a tank pressure of:
40 bar Integrated (-)
40 bar Push-button (HF1)
100 bar Spindle (HS1)

TYPE LIST / DESIGNATION OF SYMBOLS

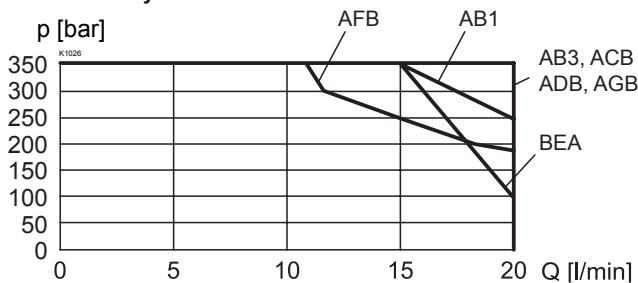
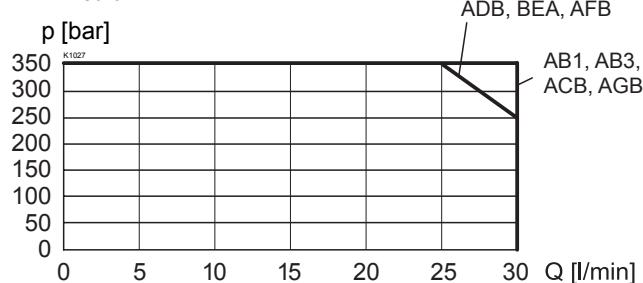
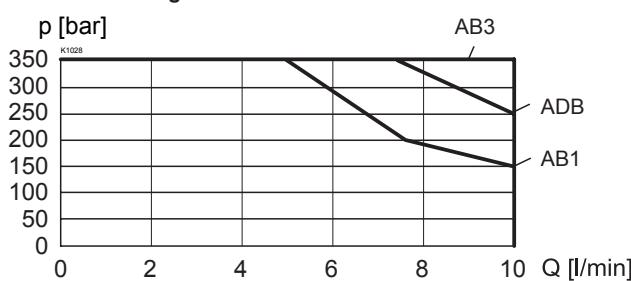
4/2-way valve impulse 4/2-way valve with spring reset operation A-side Transitional functions

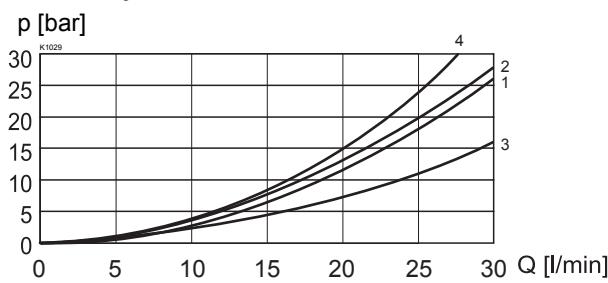


4/3-way valve spring centered

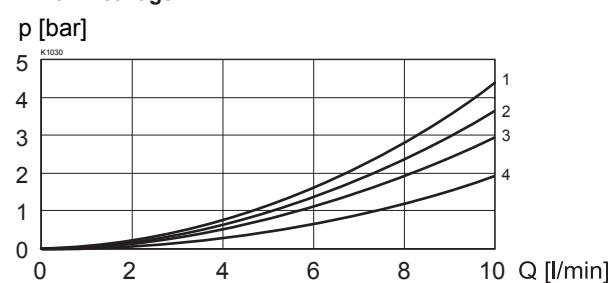


CHARACTERISTICS Oil viscosity $\nu = 30 \text{ mm}^2/\text{s}$
 $p = f(Q)$ Performance limits with standard voltage -10%

Economy

Medium

Low Leakage

 $\Delta p = f(Q)$ Pressure drop volume flow characteristics

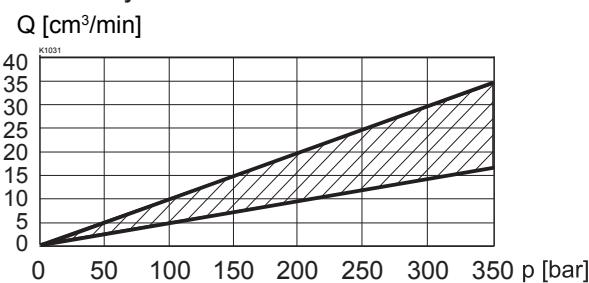
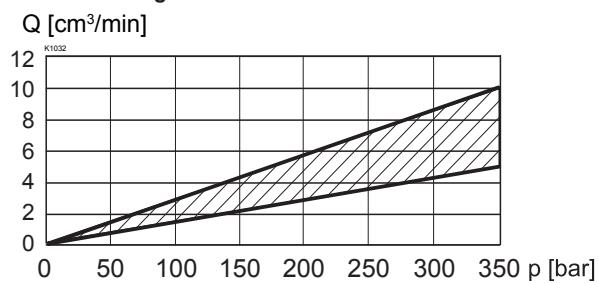
Economy/Medium


Symbol	Pressure drop Curve no.				
	P-A	P-B	P-T	A-T	B-T
AB1	2	2	-	1	1
AB3	2	2	-	1	1
ACB	2	2	-	1	1
ADB	2	2	-	1	1
BEA	1	1	4	1	1
AFB	1	1	3	1	1
AGB	1	1	-	1	1

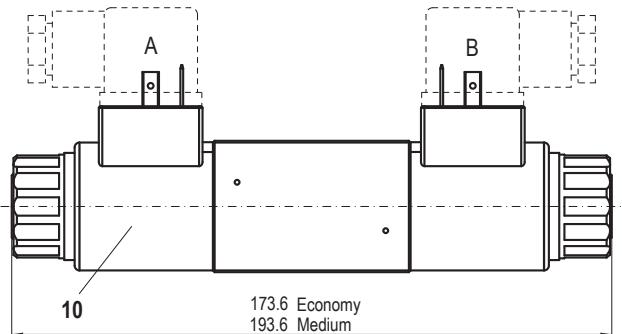
Low Leakage


Symbol	Pressure drop Curve no.				
	P-A	P-B	P-T	A-T	B-T
AB1	1	1	-	1	2
AB3	1	1	-	1	2
ADB	1	1	-	4	3

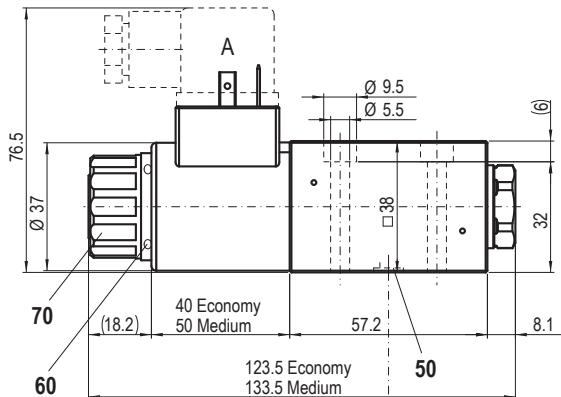
 $Q_L = f(p)$ Leakage volume flow characteristics per control edge

Economy/Medium

Low Leakage


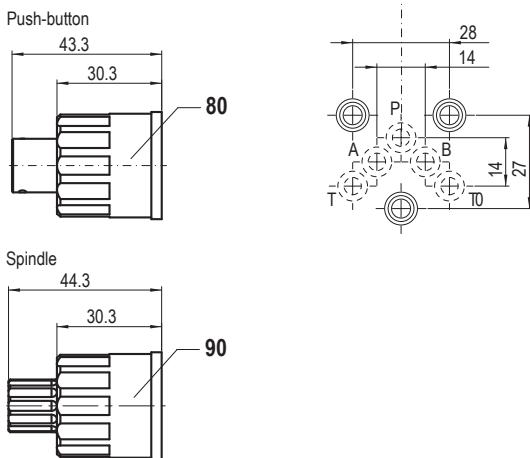
DIMENSIONS

 4/3-way valve (spring centred)
 4/2-way valve (impulse)


4/2-way valve (spring reset)


PARTS LIST

Position	Article	Description
10	206.2...	Economy V.E37/19x40
	206.2...	Medium V.E37/19x50
50	160.2052	O-ring ID 5,28x1,78 (NBR)
	160.6052	O-ring ID 5,28x1,78 (FKM)
60	160.2187	O-ring ID 18,72x2,62 (NBR)
	160.6187	O-ring ID 18,72x2,62 (FKM)
70	154.2700	Knurled nut
80	253.7001	Push-button
90	253.7000	Spindle


ACCESSORIES

Threaded connecting plates, Multi-flange subplates

and Longitudinal stacking system

see Reg. 2.9

Mating connector (A) EN175301-803

article no. 219.2001

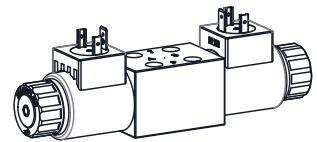
Mating connector (B) EN 175301-803

article no. 219.2002

Technical explanation see data sheet 1.0-100

Solenoid operated spool valve

- 4/2-way impulse valve
- 4/3-way with spring centred mid position
- 4/2-way with spring reset
- $Q_{\max} = 30 \text{ l/min}$, $p_{\max} = 350 \text{ bar}$

NG4
 ISO 4401-02

DESCRIPTION

Spool valve in flange design NG4 to ISO 4401-02 with 4 ports. Solenoid to standard VDE 0580. Direct operated solenoid valve in 5 chamber design. Spool detented or with spring reset. Wet pin type solenoid. Precise spool fit, low leakage, long life time. Spool made from hardened steel. Wide range of standard and special voltages. Two basic versions available (Economy and Medium). The body made of high grade hydraulic casting for long service life is painted. The armature tube and the plug crew are zinc coated. The solenoid coil is nickel-/chromium-coated.

FUNCTION

The solenoid shifts the spool into the corresponding position.

- 4/2-way detented spool valve:
2 solenoids and 2 detented positions. With the solenoids deenergised the spool remains in the last switched position.
- 4/2-way spool valve:
1 solenoid and 2 spool positions, spring offset. With the solenoid deenergised the spool returns to the offset position.
- 4/3-way spool valve:
2 solenoids and 3 spool positions, spring centered. With the solenoids deenergised the spool returns to the center position.

APPLICATION

Solenoid operated spool valves are mainly used for controlling direction of movement and stopping of hydraulic cylinders and motors. Direction of movement depends on the position of spool and its flow symbol. Please pay attention to the performance limits and leakage of the valves. Solenoid operated spool valves are suitable for machine tools and handling systems. 4 valves are used where both, reduced dimensions and weight are important.

TYPE CODE

	W	D	F	B04 -	-	-	-	I	-	-	#	-
Spool valve direct operated												
Economy-slip-on coil	<input checked="" type="checkbox"/>	<input type="checkbox"/>										
Medium-slip-on coil	<input type="checkbox"/>	<input checked="" type="checkbox"/>										
Flange construction												
International standard interface ISO, nominal size 4												
Description of symbols acc. to table 1.2-53/2												
Spool specification	Standard											
	Low Leakage	<input type="checkbox"/>	<input checked="" type="checkbox"/>	(only Economy)								
Standard-nominal voltage U_N	12 VDC	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	24 VDC	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	115 VAC	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	230 VAC	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	without solenoid coil	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Slip-on coil												
	Metal housing round with one-sided collar	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Metal housing square with one-sided collar	<input type="checkbox"/>	<input checked="" type="checkbox"/>	(only Medium)					
Electric connection												
	Connector socket EN 175301 - 803/ISO4400	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Connector socket AMP Junior-Timer	<input type="checkbox"/>	<input checked="" type="checkbox"/>	(only for $U_N \leq 75 \text{ VDC}$)					
	Connector Deutsch DT04 - 2P	<input type="checkbox"/>	<input checked="" type="checkbox"/>	(only for $U_N \leq 75 \text{ VDC}$)								
Sealing material	NBR											
	FKM (Viton)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	D1								
Manual override	Integrated											
	Push-button	<input type="checkbox"/>	<input checked="" type="checkbox"/>	HF1								
	Spindle	<input type="checkbox"/>	<input checked="" type="checkbox"/>	HS1								
Design-Index (Subject to change)												

* Only available in conjunction with other nominal voltages and connection versions. (See data sheet 1.1-175)

GENERAL SPECIFICATIONS

Description	4/2-, 4/3-spool valve	Ambient temperature	-20...+70 °C (slip-on coil «V»)
Nominal size	NG4 to ISO 4401-02		if > +50 °C, then
Construction	Direct operated spool valve		voltage tolerance 0 / -10%
Operation	Solenoid		-20...+70 °C (slip-on coil «N»)
Mounting	Flange	Mounting position	any, preferably horizontal
	4 fixing holes for	Fastening torque	$M_D = 5,5 \text{ Nm}$ (screw quality 8.8)
Connections	socket head cap screws M5x40		For fixing screws
	Threaded connection plates		$M_D = 5 \text{ Nm}$ for Knurled nut
	Multi-flange subplates		
	Longitudinal stacking system		

ELECTRICAL CONTROL

Construction	Solenoid, wet pin push type, pressure tight
Standard-nominal voltage	$U_N = 12 \text{ VDC}$ $U_N = 24 \text{ VDC}$ $U_N = 115 \text{ VAC}^*$ $U_N = 230 \text{ VAC}^*$ AC = 50 to 60 Hz
	* Rectifier integrated in the coil, other nominal voltages and nominal performances on request
Voltage tolerance	$\pm 10\%$ of nominal voltage
Protection class to EN 60 529	D: IP 65 J: IP 66 only for $U_N \leq 75 \text{ VDC}$ G: IP 67 and 69K only for $U_N \leq 75 \text{ VDC}$
Relative duty factor	100% DF (see data sheet 1.1-430)
Switching cycles	15000/h
Operating life	10^7 (number of switching cycles, theoretically)
Connection/Power supply	Over device plug connection
Coil versions:	
Economy: V.E37/19x40	(data sheet 1.1-168)
Medium: V.E37/19x50	(data sheet 1.1-168)

Other electrical specifications see data sheet 1.1-168 (V)
1.1-175 (N)

HYDRAULIC SPECIFICATIONS

Fluid	Mineral oil, other fluid on request
Contamination efficiency	ISO 4406:1999, classe 20/18/14 (Required filtration grade $\beta_{10\dots16} \geq 75$) refer to data sheet 1.0-50/2
Viscosity range	12 mm ² /s...320 mm ² /s
Fluid temperature	-20...+70°C
Working pressure in port P, A, B	$p_{max} = 350 \text{ bar}$
Tank pressure in port T	$p_{Tmax} = 100 \text{ bar}$
Max. volume flow	$Q_{max} = 30 \text{ l/min}$, see characteristics
Leakage volume flow	see characteristics

Weight	Economy	Medium
4/2-way impulse	$m = 1,1 \text{ kg}$	$m = 1,25 \text{ kg}$
4/3-way	$m = 1,1 \text{ kg}$	$m = 1,25 \text{ kg}$
4/2-way (1 solenoid)	$m = 0,83 \text{ kg}$	$m = 0,9 \text{ kg}$

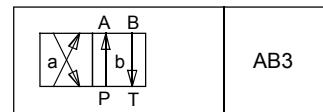
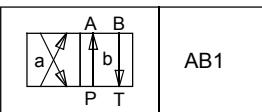
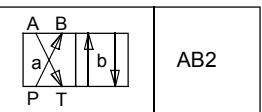
MANUAL OVERRIDE

- Integrated (-) Actuation pin integrated in the armature tube.
- Push-button (HF1) integrated in the knurled nut.
Actuation by pressing the pin
- Spindle (HS1) integrated in the knurled nut.
Actuation by turning the spindle (infinitely variable valve actuation)

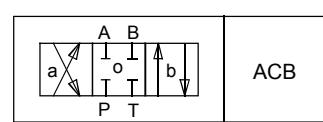
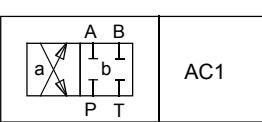
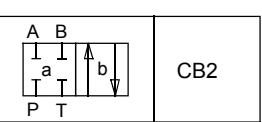
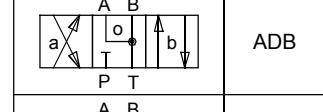
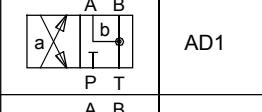
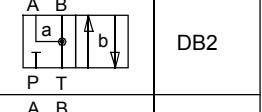
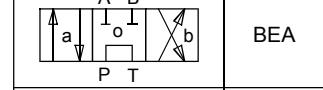
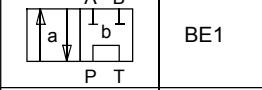
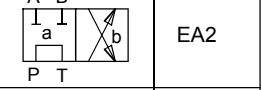
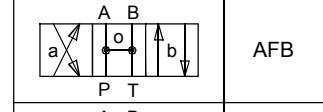
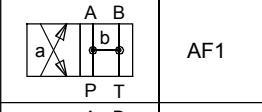
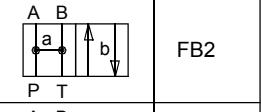
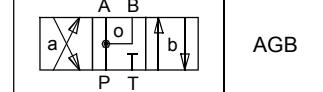
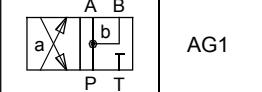
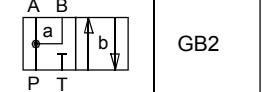

NOTE!

The actuation of the manual override is possible up to a tank pressure of:
40 bar Integrated (-)
40 bar Push-button (HF1)
100 bar Spindle (HS1)

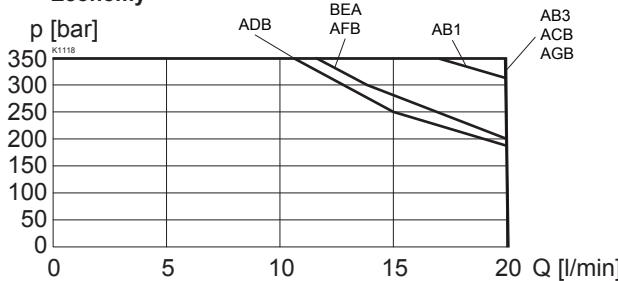
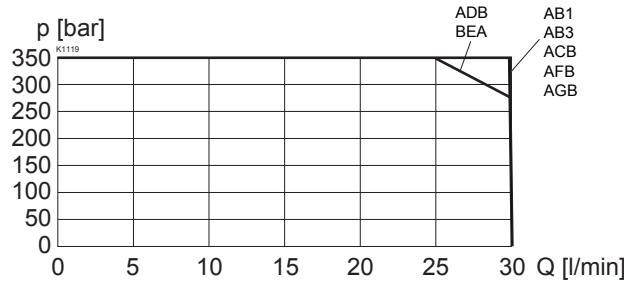
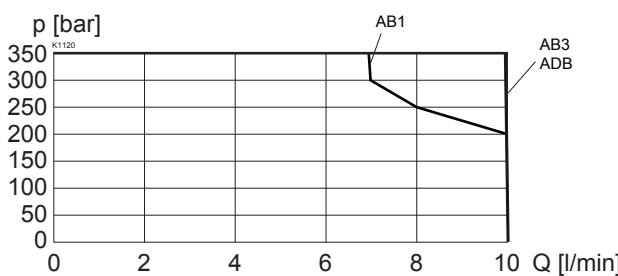
TYPE LIST / DESIGNATION OF SYMBOLS

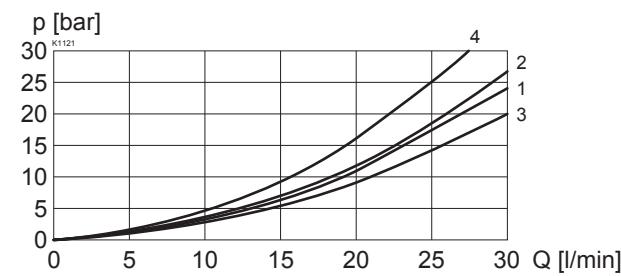
4/2-way valve impulse	4/2-way valve with spring reset operation A-side	Transitional functions
		
AB3	AB1	AB2

4/3-way valve spring centered

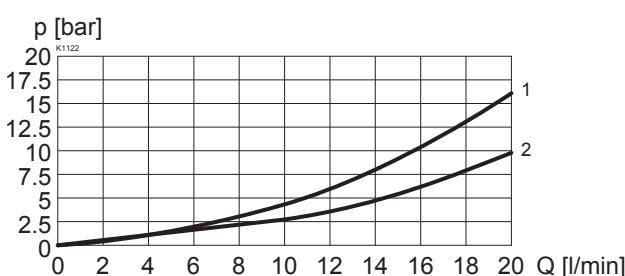
		
ACB	AC1	CB2
		
ADB	AD1	DB2
		
BEA	BE1	EA2
		
AFB	AF1	FB2
		
AGB	AG1	GB2

CHARACTERISTICS Oil viscosity $\nu = 30 \text{ mm}^2/\text{s}$
 $p = f(Q)$ Performance limits with standard voltage -10%

Economy

Medium

Low Leakage

 $\Delta p = f(Q)$ Pressure drop volume flow characteristics

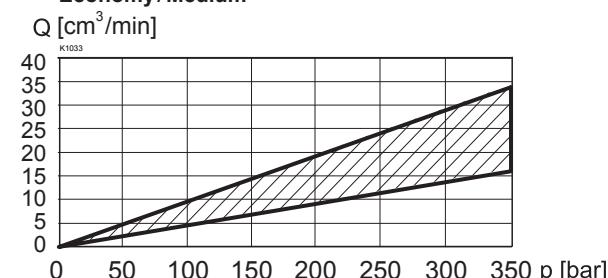
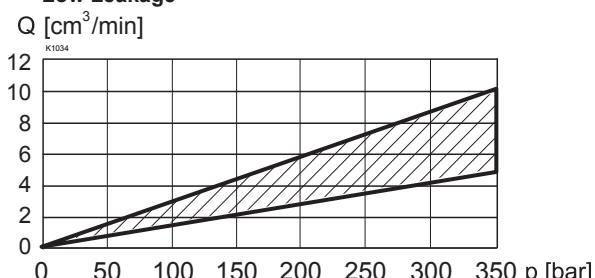
Economy/Medium


Pressure drop Symbol	Curve no.	Volume flow direction				
		P-A	P-B	P-T	A-T	B-T
AB1	2	2	2	-	1	1
AB3	2	2	2	-	1	1
ACB	2	2	2	-	1	1
ADB	2	2	2	-	1	1
BEA	2	2	4	2	2	2
AFB	1	1	3	3	3	3
AGB	3	3	3	-	1	1

Low Leakage


Pressure drop Symbol	Curve no.	Volume flow direction				
		P-A	P-B	P-T	A-T	B-T
AB1	1	1	1	-	1	1
AB3	1	1	1	-	2	2
ADB	1	1	1	-	1	1

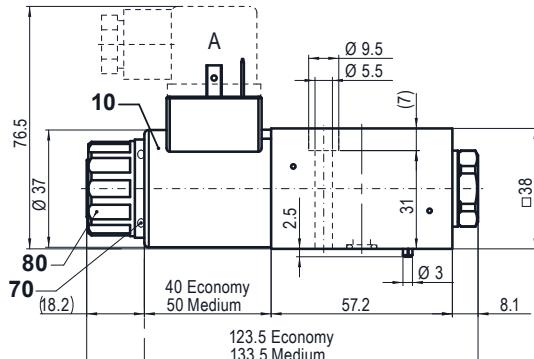
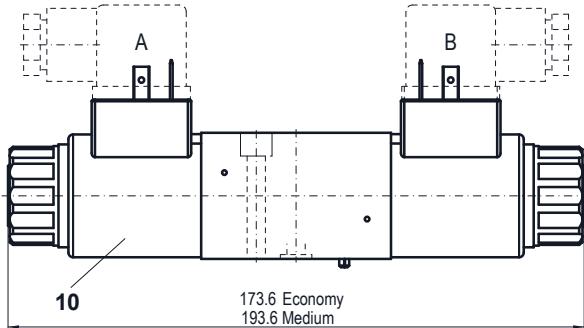
 $Q_L = f(p)$ Leakage volume flow characteristics per control edge

Economy/Medium

Low Leakage


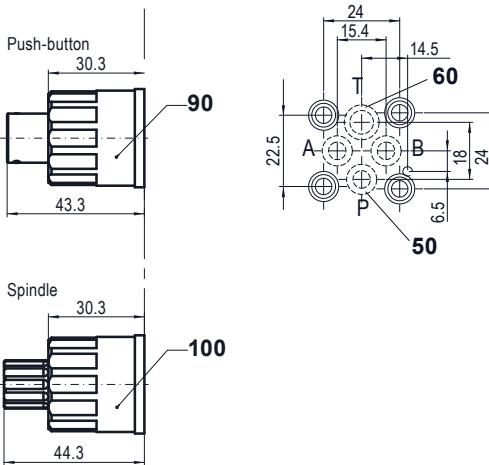
DIMENSIONS

 4/3-way valve (spring centred)
 4/2-way valve (impulse)

4/2-way valve (spring reset)


PARTS LIST

Position	Article	Description
10	206.2...	Economy V.E37/19x40
	206.2...	Medium V.E37/19x50
50	160.2060	O-ring ID 6,07x1,78 (NBR)
	160.6061	O-ring ID 6,07x1,78 (FKM)
60	160.2076	O-ring ID 7,65x1,78 (NBR)
	160.6076	O-ring ID 7,65x1,78 (FKM)
70	160.2187	O-ring ID 18,72x2,62 (NBR)
	160.6187	O-ring ID 18,72x2,62 (FKM)
80	154.2700	Knurled nut
90	253.7001	Push-button
100	253.7000	Spindle


ACCESSORIES

Threaded connecting plates

see Reg. 2.9

Mating connector (A) EN 175301-803

article no. 219.2001

Mating connector (B) EN 175301-803

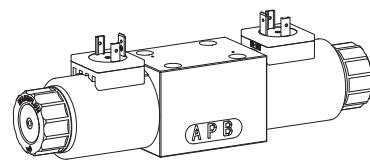
article no. 219.2002

Technical explanation see data sheet 1.0-100

Solenoid operated spool valve

- **4/2-way impulse valve**
- **4/3-way with spring centred mid position**
- **4/2-way with spring reset**
- **$Q_{\max} = 80 \text{ l/min}$, $p_{\max} = 350 \text{ bar}$**

NG6
ISO 4401-03


DESCRIPTION

Spool valve in flange design NG6 to ISO 4401-03/7790 with 4 ports. Solenoid to standard VDE 0580. Direct operated solenoid valve in 5 chamber design. Spool detented or with spring reset. Wet pin type solenoid. Precise spool fit, low leakage, long life time. Spool made from hardened steel. Wide range of standard and special voltages. The body made of high grade hydraulic casting for long service life is painted. The armature tube and the plug crew are zinc coated. The solenoid coil is nickel-/chromium-coated.

FUNCTION

The solenoid shifts the spool into the corresponding position.

- **4/2-way detented spool valve:**
2 solenoids and 2 detented positions. With the solenoids deenergised the spool remains in the last switched position.
- **4/2-way spool valve:**
1 solenoid and 2 spool positions, spring offset. With the solenoid deenergised the spool returns to the offset position.
- **4/3-way spool valve:**
2 solenoids and 3 spool positions, spring centered. With the solenoids deenergised the spool returns to the center position.

APPLICATION

Solenoid operated spool valves are mainly used for controlling direction of movement and stopping of hydraulic cylinders and motors. Direction of movement depends on the position of spool and its flow symbol. Please pay attention to the performance limits and leakage of the valves. Solenoid operated spool valves are suitable for machine tools and handling systems.

TYPE CODE

	W	D	M	F	A06	-	[]	-	[]	/	[]	[]	-	[]	[]	#	[]
Spool valve direct operated																	
Medium-slip-on coil																	
Flange construction																	
International standard interface ISO nominal size 6																	
Description of symbols acc. to table 1.2-59/2																	
Standard-nominal voltage U_N	12 VDC				G12												
	24 VDC				G24												
	115 VAC				R115												
	230 VAC				R230												
	without solenoid coil				X5												
Slip-on coil	Metal housing round		W														
	Metal housing square		M*														
Electric connection	Connector socket EN 175301 - 803/ISO4400			D													
	Connector socket AMP Junior-Timer			J													
	Connector Deutsch DT04 - 2P			G													
Sealing material	NBR																
	FKM (Viton)				D1												
Manual override	Integrated																
	Push-button				HF1												
	Spindle				HS1												
Design-Index (Subject to change)																	

* Only available in conjunction with other nominal voltages and connection versions. (See data sheet 1.1-181)

GENERAL SPECIFICATIONS

Description	4/2-, 4/3-spool valve	Ambient temperature	-20...+70 °C (slip-on coil «W»)
Nominal size	NG6 to ISO 4401-03/7790		if > +50 °C, then
Construction	Direct operated spool valve		voltage tolerance 0 / -10%
Operation	Solenoid		-20...+70 °C (slip-on coil «M»)
Mounting	Flange	Mounting position	any, preferably horizontal
	4 fixing holes for	Fastening torque	$M_D = 5,5 \text{ Nm}$ (screw quality 8.8) for fixing screws
Connections	socket head cap screws M5x50		$M_D = 7 \text{ Nm}$ for knurled nut
	Threaded connection plates		
	Multi-flange subplates		
	Longitudinal stacking system		
Weight			
	4/2-way impulse	m = 2,0 kg	
	4/3-way	m = 2,0 kg	
	4/2-way (1 solenoid)	m = 1,5 kg	

ELECTRICAL CONTROL

Construction	Solenoid, wet pin push type, pressure tight
Standard-nominal voltage	$U_N = 12 \text{ VDC}$ $U_N = 24 \text{ VDC}$ $U_N = 115 \text{ VAC}^*$ $U_N = 230 \text{ VAC}^*$ AC = 50 bis 60 Hz
	* Rectifier integrated in the coil, other nominal voltages and nominal performances on request
Voltage tolerance	$\pm 10\%$ of nominal voltage
Protection class to EN 60 529	D: IP 65 J: IP 66 only for $U_N \leq 75 \text{ VDC}$ G: IP 67 and 69K only for $U_N \leq 75 \text{ VDC}$
Relative duty factor	100% DF (see data sheet 1.1-430)
Switching cycles	15000/h
Operating life	10^7 (number of switching cycles, theoretically)
Connection/Power supply	Over device plug connection
Coil versions:	W.E45/23x50 (data sheet 1.1-182)
Other electrical specifications see data sheet 1.1-182 (W) 1.1-181 (M)	

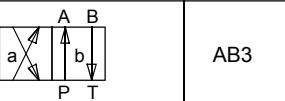
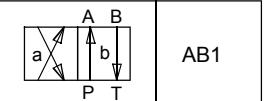
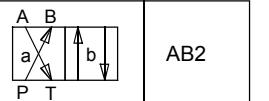
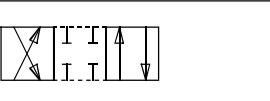
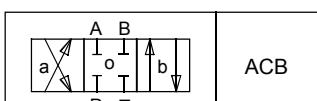
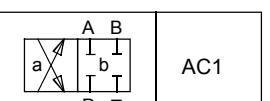
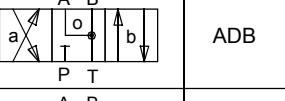
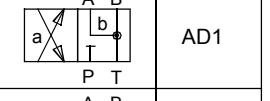
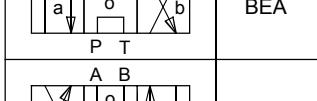
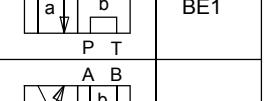
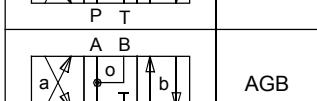
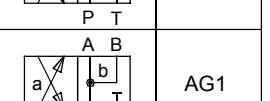
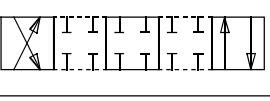
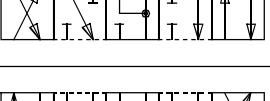
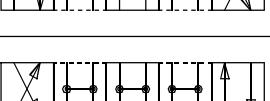
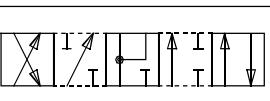
HYDRAULIC SPECIFICATIONS

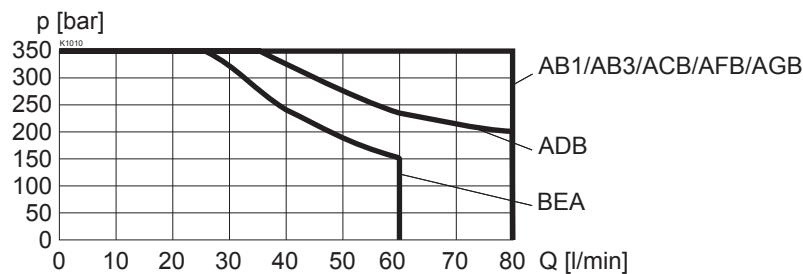
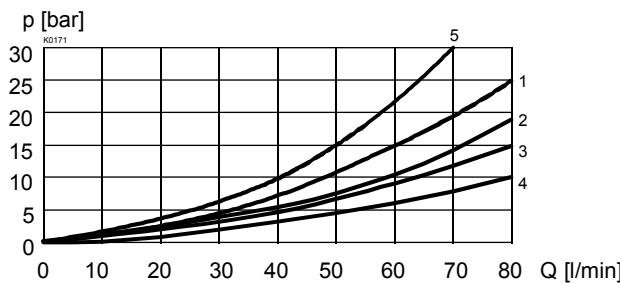
Fluid	Mineral oil, other fluid on request
Contamination efficiency	ISO 4406:1999, classe 20/18/14 (refer to data sheet B10...16≥75) siehe Datenblatt 1.0-50/2
Viscosity range	12 mm ² /s...320 mm ² /s
Fluid temperature	-20...+70°C
Working pressure in port P, A, B	$p_{max} = 350 \text{ bar}$
Tank pressure in port T	$p_{Tmax} = 200 \text{ bar}$
Max. volume flow	$Q_{max} = 80 \text{ l/min}$, see characteristics
Leakage volume flow	see characteristics

MANUAL OVERRIDE

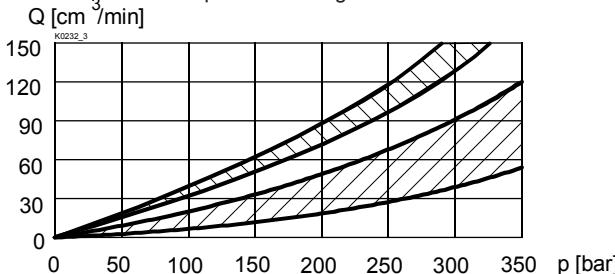
- Integrated (-) Actuation pin integrated in the armature tube.
- Push-button (HF1) integrated in the knurled nut.
Actuation by pressing the pin
- Spindle (HS1) integrated in the knurled nut.
Actuation by turning the spindle (infinitely variable valve actuation)

TYPE LIST / DESIGNATION OF SYMBOLS

4/2-way valve impulse	4/2-way valve with spring reset operation A-side	4/2-way valve with spring reset operation B-side	Transitional functions
	AB3		AB1
	AB2		CB2
	ACB		AC1
	ADB		AD1
	BEA		BE1
	AFB		AF1
	AGB		AG1
			
			
			
			

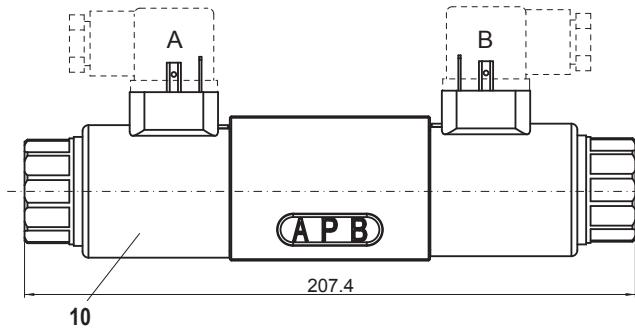
CHARACTERSISTICS Oil viscosity $\nu = 30 \text{ mm}^2/\text{s}$
 $p = f(Q)$ Performance limits with standard voltage -10%

 $\Delta p = f(Q)$ Pressure drop volume flow characteristics


Symbol	Pressure drop Curve no.	Volume flow direction				
		P - A	P - B	P - T	A - T	B - T
AB1/AB2/AB3	2	2	-	1	1	
ACB/AC1/CB2	2	2	-	1	1	
ADB/AD1/DB2	2	2	-	3	3	
BEA/BE1/EA2	2	2	5	2	2	
AFB/AF1/FB2	4	4	-	3	3	
AGB/AG1/GB2	4	4	-	1	1	

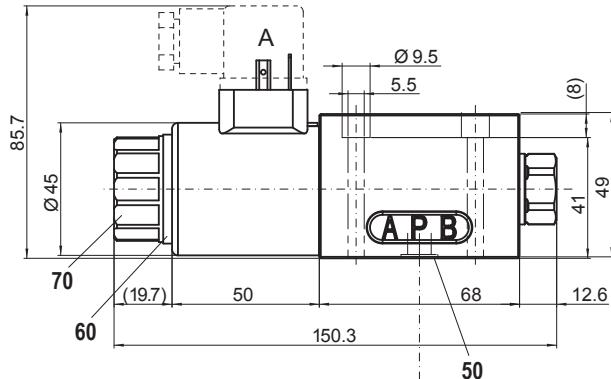
 $Q_L = f(p)$ Leakage volume flow characteristics per control edge


-  Leakage envelope AB3/AB1/ACB/ADB/AFB/AGB
-  Leakage envelope BEA

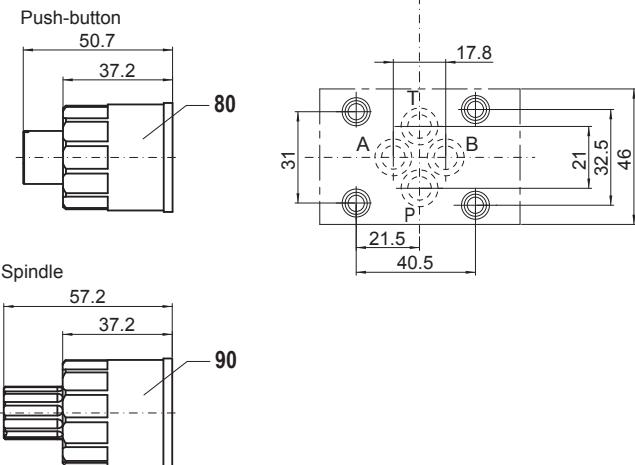
DIMENSIONS

 4/3-way valve (spring centred)
 4/2-way valve (impulse)


4/2-way valve (spring reset)


PARTS LIST

Position	Article	Description
10	206.1...	W.E45/23x50
50	160.2093 160.6092	O-ring ID 9,25x1,78 (NBR) O-ring ID 9,25x1,78 (FKM)
60	160.2222 160.6222	O-ring ID 22,22x2,62 (NBR) O-ring ID 22,22x2,62 (FKM)
70	154.2701	Knurled nut
80	253.7004	Push-button
90	253.7002	Spindle


ACCESSORIES

 Threaded connecting plates, Multi-flange subplates
 and Longitudinal stacking system

see Reg. 2.9

Mating connector (A) EN175301-803

article no. 219.2001

Mating connector (B) EN 175301-803

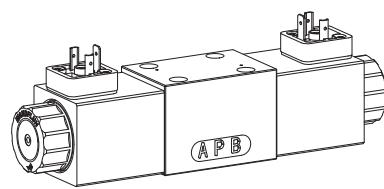
article no. 219.2002

Technical explanation see data sheet 1.0-100

Solenoid operated spool valve

- With 8 Watt spools
- 4/3-way with spring centred mid position
- 4/2-way with spring reset
- $Q_{\max} = 80 \text{ l/min}$, $p_{\max} = 350 \text{ bar}$

NG6
ISO 4401-03


DESCRIPTION

Spool valve in flange design NG6 to ISO 4401-03/7790 with 4 ports. Solenoid to standard VDE 0580. Direct operated solenoid valve in 5 chamber design. Wet pin type solenoid. Precise spool fit, low leakage, long life time. Spool made from hardened steel. Wide range of standard and special voltages. The body made of high grade hydraulic casting for long service life is painted. The armature tube, the solenoid coil and the plug crew are zinc coated.

FUNCTION

The solenoid shifts the spool into the corresponding position.

- 4/2-way spool valve:

1 solenoid and 2 spool positions, spring offset. With the solenoid deenergised the spool returns to the offset position.

- 4/3-way spool valve:

2 solenoids and 3 spool positions, spring centered. With the solenoids deenergised the spool returns to the center position.

APPLICATION

Solenoid operated spool valves are mainly used for controlling direction of movement and stopping of hydraulic cylinders and motors. Direction of movement depends on the position of spool and its flow symbol. Please pay attention to the performance limits and leakage of the valves. Solenoid operated spool valves are suitable for machine tools and handling systems.

TYPE CODE

		W	D	M	F	A06	-	[]	-	[]	/	L8	/	M	[]	-	[]	[]	#	[]
Spool valve direct operated																				
Medium-slip-on coil																				
Flange construction																				
International standard interface ISO nominal size 6																				
Description of symbols acc. to table 1.2-60/2																				
Standard-nominal voltage U_N	12 VDC							G12												
	24 VDC							G24												
	115 VAC							R115												
	230 VAC							R230												
Nominal power P_N	8w Watt																			
Slip-on coil	Metal housing square																			
Electric connection	Connector socket EN 175301 - 803/ISO4400	D																		
	Connector socket AMP Junior-Timer	J																		
	Connector Deutsch DT04 - 2P	G																		
Sealing material	NBR																			
	FKM (Viton)	D1																		
Manual override	Integrated																			
	Push-button							HF1												
	Spindle							HS1												
Design-Index (Subject to change)																				

GENERAL SPECIFICATIONS

Description	4/2-, 4/3-spool valve
Nominal size	NG6 to ISO 4401-03/7790
Construction	Direct operated spool valve
Operation	Solenoid
Mounting	Flange 4 fixing holes for socket head cap screws M5x50
Connections	Threaded connection plates Multi-flange subplates Longitudinal stacking system

Ambient temperature	-20...+70 °C (slip-on coil «W») if > +50 °C, then voltage tolerance 0 / -10%
Mounting position	-20...+70 °C (slip-on coil «M») any, preferably horizontal
Fastening torque	$M_D = 5,5 \text{ Nm}$ (screw quality 8.8) for fixing screws $M_D = 7 \text{ Nm}$ for knurled nut

Weight	
4/3-way	$m = 2,5 \text{ kg}$
4/2-way (1 solenoid)	$m = 1,7 \text{ kg}$

ELECTRICAL CONTROL

Construction	Solenoid, wet pin push type, pressure tight
Standard-nominal voltage	$U_N = 12 \text{ VDC}$ $U_N = 24 \text{ VDC}$ $U_N = 115 \text{ VAC}^*$ $U_N = 230 \text{ VAC}^*$ AC = 50 bis 60 Hz
	* Rectifier integrated in the coil, other nominal voltages and nominal performances on request
Voltage tolerance	$\pm 10\%$ of nominal voltage
Protection class to EN 60 529	D: IP 65 J: IP 66 only for $U_N \leq 75 \text{ VDC}$ G: IP 67 and 69K only for $U_N \leq 75 \text{ VDC}$
Relative duty factor	100% DF (see data sheet 1.1-430)
Switching cycles	15000/h
Operating life	10^7 (number of switching cycles, theoretically)
Connection/Power supply	Over device plug connection

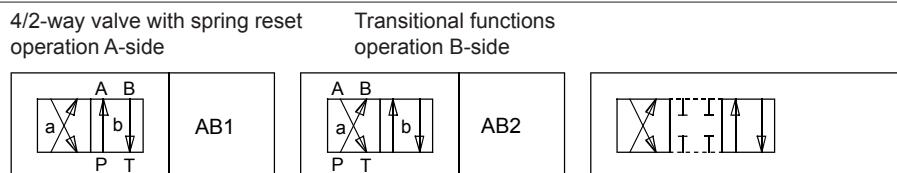
Other electrical specifications see data sheet 1.1-181

HYDRAULIC SPECIFICATIONS

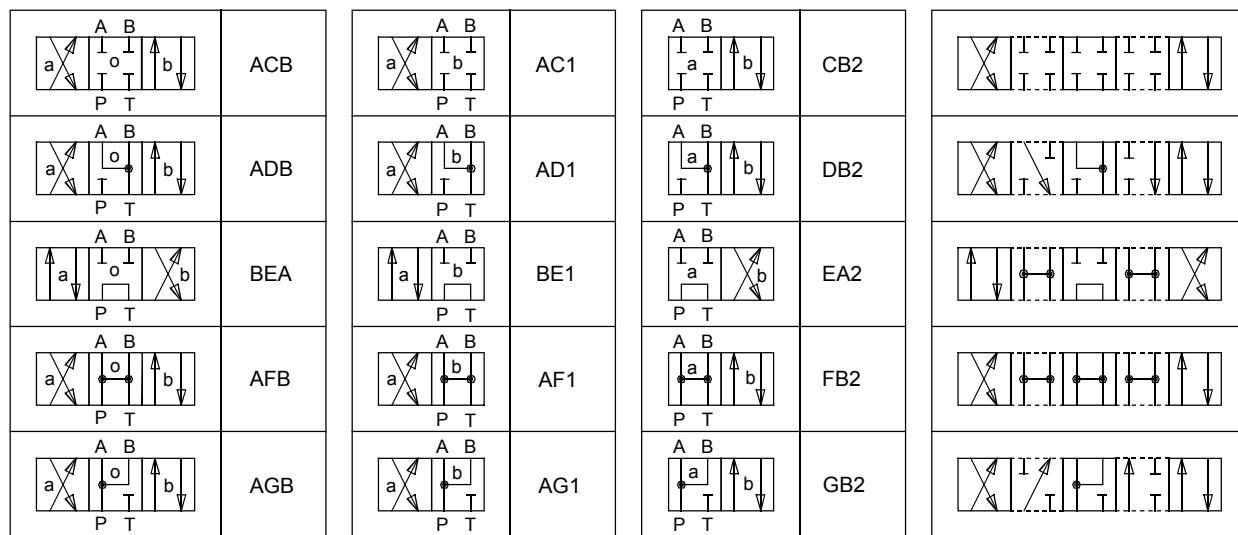
Fluid	Mineral oil, other fluid on request
Contamination efficiency	ISO 4406:1999, classe 20/18/14 (refer to data sheet B10...16≥75) siehe Datenblatt 1.0-50/2
Viscosity range	12 mm ² /s...320 mm ² /s
Fluid temperature	-20...+70°C
Working pressure in port P, A, B	$p_{max} = 350 \text{ bar}$
Tank pressure in port T	$p_{Tmax} = 200 \text{ bar}$
Max. volume flow	$Q_{max} = 80 \text{ l/min}$, see characteristics
Leakage volume flow	see characteristics

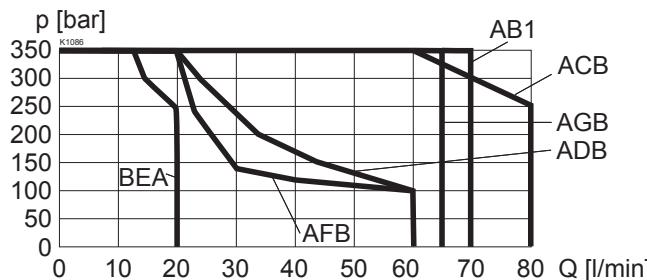
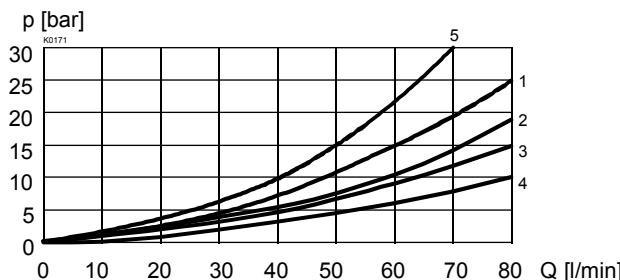
MANUAL OVERRIDE

- Integrated (-) Actuation pin integrated in the armature tube.
- Push-button (HF1) integrated in the knurled nut.
Actuation by pressing the pin
- Spindle (HS1) integrated in the knurled nut.
Actuation by turning the spindle (infinitely variable valve actuation)

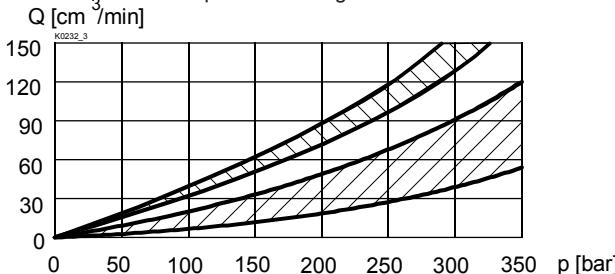
TYPE LIST / DESIGNATION OF SYMBOLS


4/3-way valve spring centered



CHARACTERSISTICS Oil viscosity $\nu = 30 \text{ mm}^2/\text{s}$
 $p = f(Q)$ Performance limits with standard voltage -10%

 $\Delta p = f(Q)$ Pressure drop volume flow characteristics


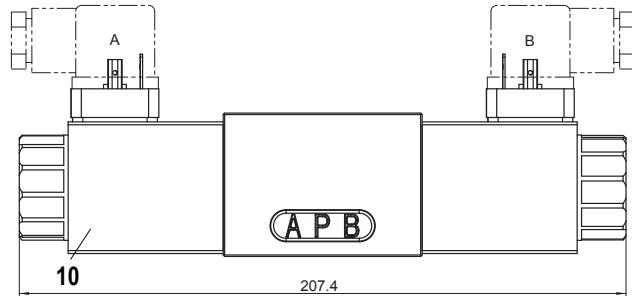
Symbol Pressure drop Curve no.	Volume flow direction				
	P - A	P - B	P - T	A - T	B - T
AB1/AB2	2	2	-	1	1
ACB/AC1/CB2	2	2	-	1	1
ADB/AD1/DB2	2	2	-	3	3
BEA/BE1/EA2	2	2	5	2	2
AFB/AF1/FB2	4	4	-	3	3
AGB/AG1/GB2	4	4	-	1	1

 $Q_L = f(p)$ Leakage volume flow characteristics per control edge

 Leakage envelope AB1/ACB/ADB/AFB/AGB

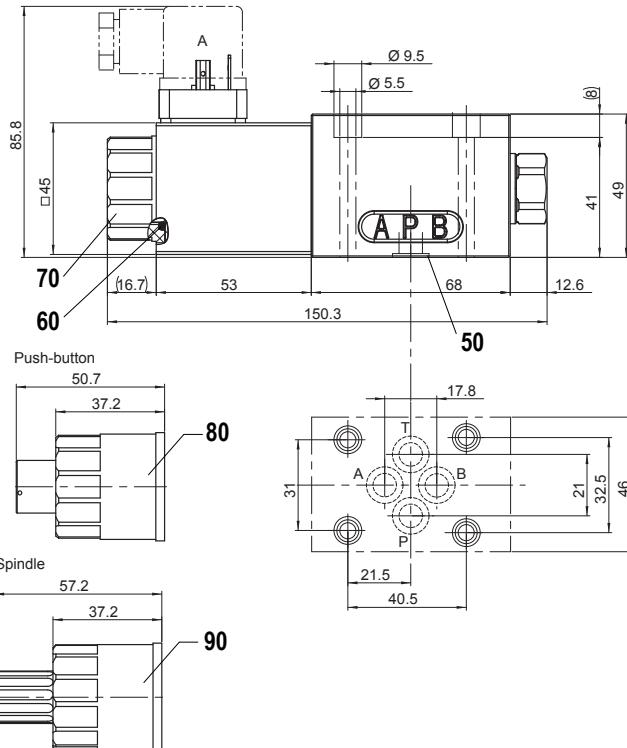
 Leakage envelope BEA

DIMENSIONS

4/3-way valve (spring centred)



4/2-way valve (spring reset)


PARTS LIST

Position	Article	Description
10	206.1...	M.S45/23x50
50	160.2093	O-ring ID 9,25x1,78 (NBR)
	160.6092	O-ring ID 9,25x1,78 (FKM)
60	160.2222	O-ring ID 22,22x2,62 (NBR)
	160.6222	O-ring ID 22,22x2,62 (FKM)
70	154.2701	Knurled nut
80	253.7004	Push-button
90	253.7002	Spindle

ACCESSORIES

 Threaded connecting plates, Multi-flange subplates
 and Longitudinal stacking system

see Reg. 2.9

Mating connector (A) EN175301-803

article no. 219.2001

Mating connector (B) EN 175301-803

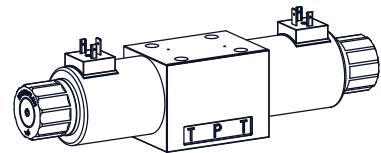
article no. 219.2002

Technical explanation see data sheet 1.0-100

Solenoid operated spool valve

- 4/2-way impulse valve
- 4/3-way with spring centred mid position
- 4/2-way with spring reset
- $Q_{\max} = 160 \text{ l/min}$, $p_{\max} = 350 \text{ bar}$

NG10
 ISO 4401-05


DESCRIPTION

Spool valve in flange design NG10 to ISO 4401-05/7790 with 4 ports. Solenoid to standard VDE 0580. Direct operated solenoid valve in 5 chamber design. Spool detented or with spring reset. Wet pin type solenoid. Precise spool fit, low leakage, long life time. Spool made from hardened steel. Wide range of standard and special voltages. The body made of high grade hydraulic casting for long service life is painted. The armature tube and the plug crew are zinc coated. The solenoid coil is nickel-/chromium-coated.

FUNCTION

The solenoid shifts the spool into the corresponding position.

- 4/2-way detented spool valve:
2 solenoids and 2 detented positions. With the solenoids deenergised the spool remains in the last switched position.
- 4/2-way spool valve:
1 solenoid and 2 spool positions, spring offset. With the solenoid deenergised the spool returns to the offset position.
- 4/3-way spool valve:
2 solenoids and 3 spool positions, spring centered. With the solenoids deenergised the spool returns to the center position.

APPLICATION

Solenoid operated spool valves are mainly used for controlling direction of movement and stopping of hydraulic cylinders and motors. Direction of movement depends on the position of spool and its flow symbol. Please pay attention to the performance limits and leakage of the valves. Solenoid operated spool valves are suitable for machine tools and handling systems.

TYPE CODE

	W	D	M	F	A10	-	□	-	□	/	W	□	-	□	□	#	□
Spool valve direct operated																	
Medium-slip-on coil																	
Flange construction																	
International standard interface ISO nominal size 10																	
Description of symbols acc. to table 1.2-75/2																	
Standard-nominal voltage U_N	12 VDC						G12										
	24 VDC						G24										
	without solenoid coil						X5										
Slip-on coil	Metal housing round				W												
Electric connection	Connector socket EN 175301 - 803/ISO4400					D											
	Connector socket AMP Junior-Timer					J											
	Connector Deutsch DT04 - 2P					G											
Sealing material	NBR																
	FKM (Viton)					D1											
Manual override	Integrated																
	Push-button					HF1											
	Spindle					HS1											
Design-Index (Subject to change)																	

GENERAL SPECIFICATIONS

Description	4/2-, 4/3-spool valve	Ambient temperature	-20...+70 °C
Nominal size	NG10 to ISO 4401-05/7790		if > +50 °C, then
Construction	Direct operated spool valve		voltage tolerance 0 / -10%
Operation	Solenoid		any, preferably horizontal
Mounting	Flange		$M_D = 9,5 \text{ Nm}$ (screw quality 8.8) for fixing screws
	4 fixing holes for		$M_D = 7 \text{ Nm}$ for knurled nut
Connections	socket head cap screws M6x70		
	Threaded connection plates		
	Multi-flange subplates		
	Longitudinal stacking system		

Weight	
4/2-way impulse	$m = 5,9 \text{ kg}$
4/3-way	$m = 5,9 \text{ kg}$
4/2-way (1 solenoid)	$m = 4,4 \text{ kg}$

ELECTRICAL CONTROL

Construction	Solenoid, wet pin push type, pressure tight
Standard-nominal voltage	$U_N = 12$ VDC $U_N = 24$ VDC Other nominal voltages and nominal performances on request
Voltage tolerance	$\pm 10\%$ of nominal voltage
Protection class to EN 60 529	D: IP 65 J: IP 66 only for $U_N \leq 75$ VDC G: IP 67 and 69K only for $U_N \leq 75$ VDC
Relative duty factor	100% DF (see data sheet 1.1-430)
Switching cycles	15000/h
Operating life	10^7 (number of switching cycles, theoretically)
Connection/Power supply	Over device plug connection
Coil versions:	W.E62/31x72 (data sheet 1.1-190)

Other electrical specifications see data sheet 1.1-190

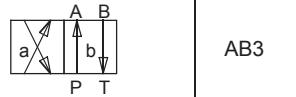
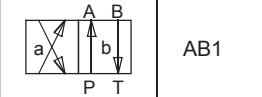
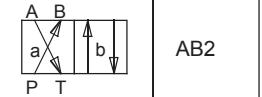
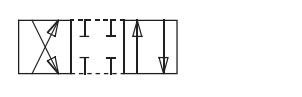
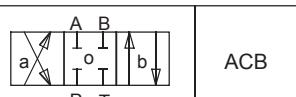
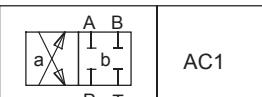
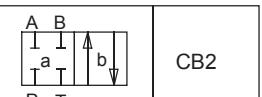
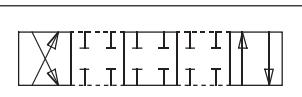
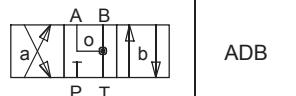
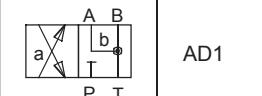
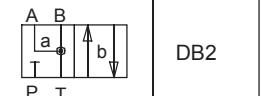
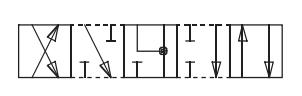
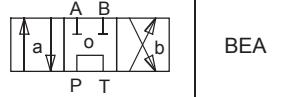
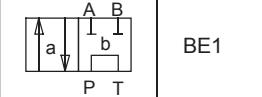
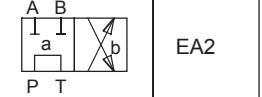
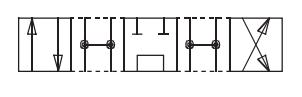
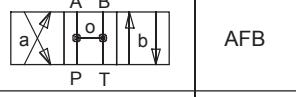
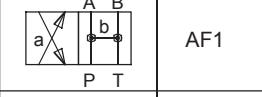
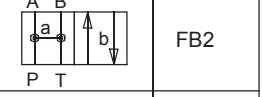
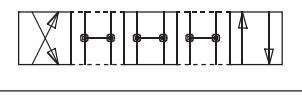
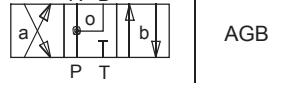
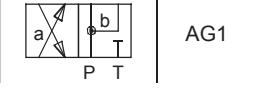
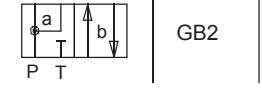
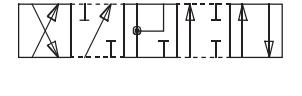
HYDRAULIC SPECIFICATIONS

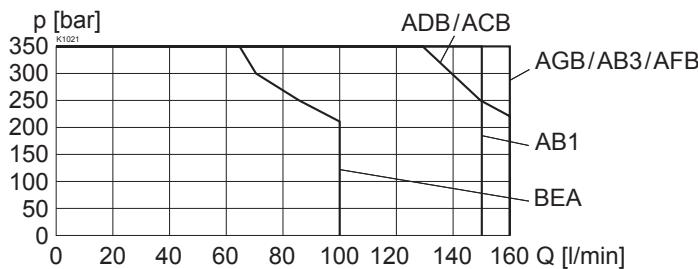
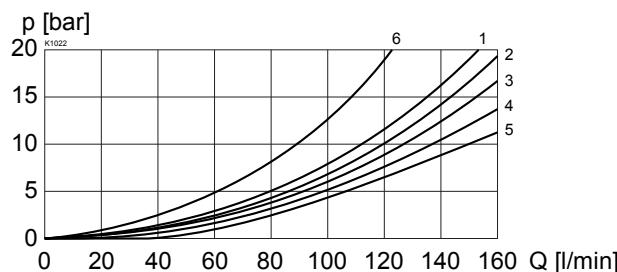
Fluid	Mineral oil, other fluid on request
Contamination efficiency	ISO 4406:1999, classe 20/18/14 (refer to data sheet B10...16≥75) see data sheet 1.0-50/2
Viscosity range	12 mm ² /s...320 mm ² /s
Fluid temperature	-20...+70°C
Working pressure in port P, A, B	$p_{max} = 350$ bar
Tank pressure in port T	$p_{T,max} = 160$ bar
Max. volume flow	$Q_{max} = 160$ l/min, see characteristics
Leakage volume flow	see characteristics

MANUAL OVERRIDE

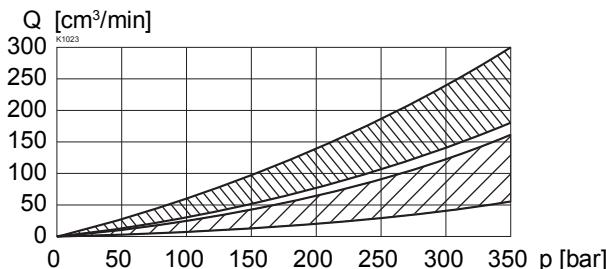
- Integrated (-) Actuation pin integrated in the armature tube.
- Push-button (HF1) integrated in the knurled nut.
Actuation by pressing the pin
- Spindle (HS1) integrated in the knurled nut.
Actuation by turning the spindle (infinitely variable valve actuation)

TYPE LIST / DESIGNATION OF SYMBOLS

4/2-way valve impulse	4/2-way valve with spring reset operation A-side	4/2-way valve with spring reset operation B-side	Transitional functions
			
AB3	AB1	AB2	
4/3-way valve spring centered			
			
ACB	AC1	CB2	
			
ADB	AD1	DB2	
			
BEA	BE1	EA2	
			
AFB	AF1	FB2	
			
AGB	AG1	GB2	

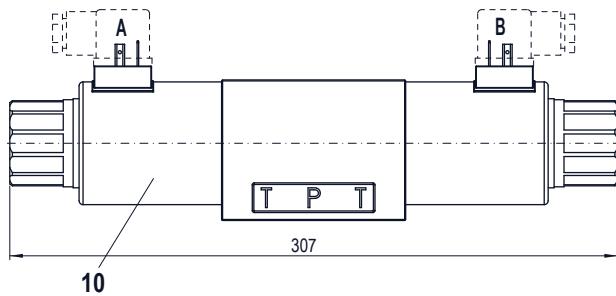
CHARACTERISTICS Oil viscosity $\nu = 30 \text{ mm}^2/\text{s}$
 $p = f(Q)$ Performance limits with standard voltage -10%

 $\Delta p = f(Q)$ Pressure drop volume flow characteristics


Pressure drop Curve no.	Volume flow direction				
	P - A	P - B	P - T	A - T	B - T
AB1	2	2	-	4	4
AB3	2	2	-	4	4
ACB	2	2	-	2	2
ADB	1	1	-	5	5
BEA	3	3	6	4	4
AFB	4	4	5	5	5
AGB	4	4	-	2	2

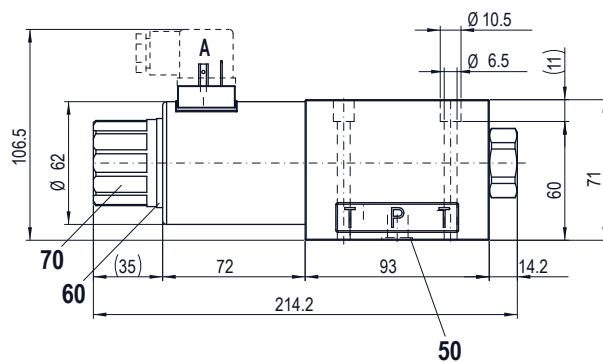
 $Q_L = f(p)$ Leakage volume flow characteristics per control edge


-  Leakage envelope AB3/AB1/ACB/ADB/AFB/AGB
-  Leakage envelope BEA

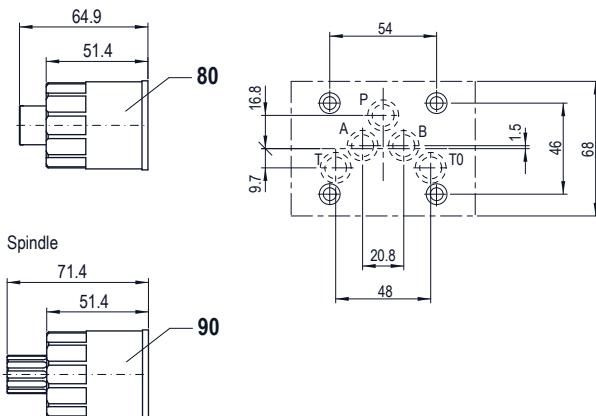
DIMENSIONS

 4/3-way valve (spring centred)
 4/2-way valve (impulse)


4/2-way valve (spring reset)


PARTS LIST

Position	Article	Description
10	206.3...	W.E62/31x72
50	160.2120 160.8124	O-ring ID 12,42x1,78 (NBR) O-ring ID 12,42x1,78 (FKM)
60	160.2282 160.6282	O-ring ID 28,24x2,62 (NBR) O-ring ID 28,24x2,62 (FKM)
70	154.2706	Knurled nut
80	253.7006	Push-button
90	253.7005	Spindle

Push-button

ACCESSORIES

 Threaded connecting plates, Multi-flange subplates
 and Longitudinal stacking system

see Reg. 2.9

Mating connector (A) EN175301-803

article no. 219.2001

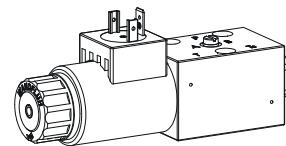
Mating connector (B) EN 175301-803

article no. 219.2002

Technical explanation see data sheet 1.0-100

Solenoid operated spool valve soft switching

- 4/3-way with spring centred mid position
- 4/2-way with spring reset
- $Q_{\max} = 20 \text{ l/min}$, $p_{\max} = 350 \text{ bar}$

NG4-Mini®

DESCRIPTION

Spool valve with soft switching, NG4-Mini flange construction in accordance to Wandfluh-standard with 4 connections. Solenoids to norme VDE 0580. Direct solenoid operated spool valve with a 5 annular chamber body design. The valve's with soft switching characteristic is achieved by means of an optimum combination of removable orifice and piston design. Solenoid wet pin oil immersed armature type. Precision honed spool for low leakage. Low pressure drop due to the body design and spool profiling. Spool is of hardened steel, body is of high grade hydraulic cast iron for long service life. Wide range of standard and special voltages. The body made of high grade hydraulic casting for long service life is painted. The armature tube and the plug crew are zinc coated. The solenoid coil is nickel-/chromium-coated.

TYPE CODE

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Spool valve soft switching	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Medium-slip-on coil	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Flange construction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Mounting interface acc. to Wandfluh standard, NG4-Mini	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Description of symbols acc. to table 1.4-13/2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Standard-nominal voltage U_N	12 VDC	<input type="checkbox"/>	G12													
	24 VDC	<input type="checkbox"/>	G24													
	115 VAC	<input type="checkbox"/>	R115													
	230 VAC	<input type="checkbox"/>	R230													
	without solenoid coil	<input type="checkbox"/>	X5													
Slip-on coil						Metal housing round with one-sided collar	<input type="checkbox"/>	V								
						Metal housing square with one-sided collar	<input type="checkbox"/>	N*								
Electric connection						Connector socket EN 175301 - 803 / ISO4400	<input type="checkbox"/>	D								
						Connector socket AMP Junior-Timer	<input type="checkbox"/>	J	(only for $U_N \leq 75 \text{ VDC}$)							
						Connector Deutsch DT04 - 2P	<input type="checkbox"/>	G	(only for $U_N \leq 75 \text{ VDC}$)							
Sealing material						NBR	<input type="checkbox"/>									
						FKM (Viton)	<input type="checkbox"/>	D1								
Manual override						Integrated	<input type="checkbox"/>									
						Push-button	<input type="checkbox"/>	HF1								
						Spindle	<input type="checkbox"/>	HS1								
Diameter of orifice						$\varnothing 0,3 \text{ mm}$ (Standard)	<input type="checkbox"/>									
Design-Index (Subject to change)																

* Only available in conjunction with other nominal voltages and connection versions. (See data sheet 1.1-175)

GENERAL SPECIFICATIONS

Description	4/2-, 4/3-spool valve	Ambient temperature	-20...+70 °C (slip-on coil «V»)
Nominal size	NG4-Mini to Wandfluh standard		if $> +50^\circ\text{C}$, then
Construction	Direct operated spool valve		voltage tolerance 0 / -10%
Operation	Solenoid		-20...+70 °C (slip-on coil «N»)
Mounting	Flange	Mounting position	any, preferably horizontal
	3 fixing holes for socket head cap screws M5x40	Fastening torque	$M_D = 5,5 \text{ Nm}$ (screw quality 8.8)
Connections	Threaded connection plates Multi-flange subplates Longitudinal stacking system		For fixing screws $M_D = 5 \text{ Nm}$ for Knurled nut

ELECTRICAL CONTROL

Construction	Solenoid, wet pin push type, pressure tight
Standard-nominal voltage	$U_N = 12 \text{ VDC}$ $U_N = 24 \text{ VDC}$ $U_N = 115 \text{ VAC}^*$ $U_N = 230 \text{ VAC}^*$ AC = 50 to 60 Hz * Rectifier integrated in the coil, other nominal voltages and nominal performances on request
Voltage tolerance	$\pm 10\%$ of nominal voltage
Protection class to EN 60 529	D: IP 65 J: IP 66 only for $U_N \leq 75 \text{ VDC}$ G: IP 67 and 69K only for $U_N \leq 75 \text{ VDC}$
Relative duty factor	100% DF (see data sheet 1.1-430)
Switching cycles	15000/h
Operating life	10^7 (number of switching cycles, theoretically)
Connection/Power supply	Over device plug connection
Coil versions:	
Economy: V.E37/19x40	(data sheet 1.1-168)
Medium: V.E37/19x50	(data sheet 1.1-168)
Other electrical specifications see data sheet	1.1-168 (V) 1.1-175 (N)

HYDRAULIC SPECIFICATIONS

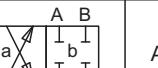
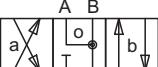
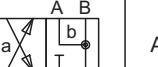
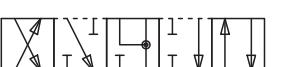
Fluid	Mineral oil, other fluid on request
Contamination efficiency	ISO 4406:1999, classe 18/16/13 (Required filtration grade $\beta_{10\dots16} \geq 75$) refer to data sheet 1.0-50/2
Viscosity range	$12 \text{ mm}^2/\text{s} \dots 320 \text{ mm}^2/\text{s}$
Fluid temperature	-20...+70°C
Working pressure in port P, A, B	$p_{max} = 350 \text{ bar } (p_T < 20 \text{ bar})$ $p_{max} = 315 \text{ bar } (p_T > 20 \text{ bar})$
Tank pressure in port T	$p_{Tmax} = 100 \text{ bar}$
Max. volume flow	$Q_{max} = 20 \text{ l/min}$, see characteristics
Leakage volume flow	see characteristics

Weight	
4/3-way	$m = 1,25 \text{ kg}$
4/2-way (1 solenoid)	$m = 0,9 \text{ kg}$

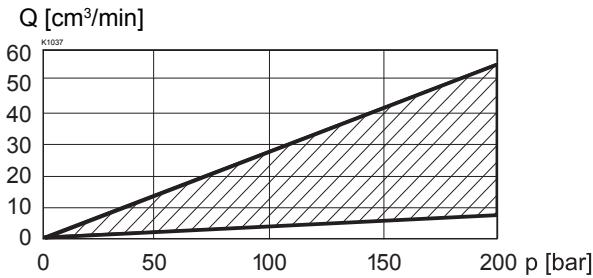
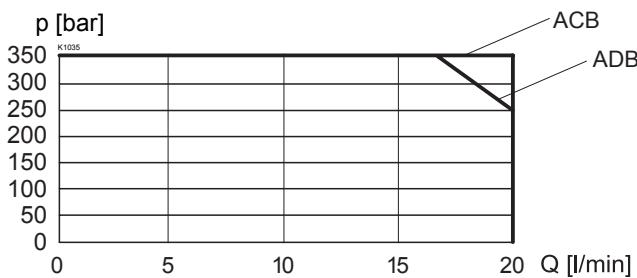
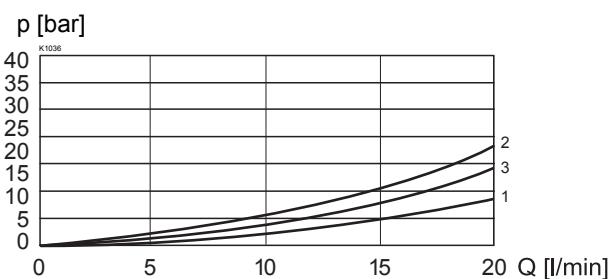
MANUAL OVERRIDE

- Integrated (-) Actuation pin integrated in the armature tube.
- Push-button (HF1) integrated in the knurled nut.
Actuation by pressing the pin
- Spindle (HS1) integrated in the knurled nut.
Actuation by turning the spindle (infinitely variable valve actuation)

TYPE LIST / DESIGNATION OF SYMBOLS

4/3-way valve spring centred	4/2-way valve with spring reset operation A-side	Transitional functions
		
ACB	AC1	CB2
		
ADB	AD1	DB2

CHARACTERISTICS Oil viscosity $\nu = 30 \text{ mm}^2/\text{s}$
 $p = f(Q)$ Performance limits with standard voltage -10%

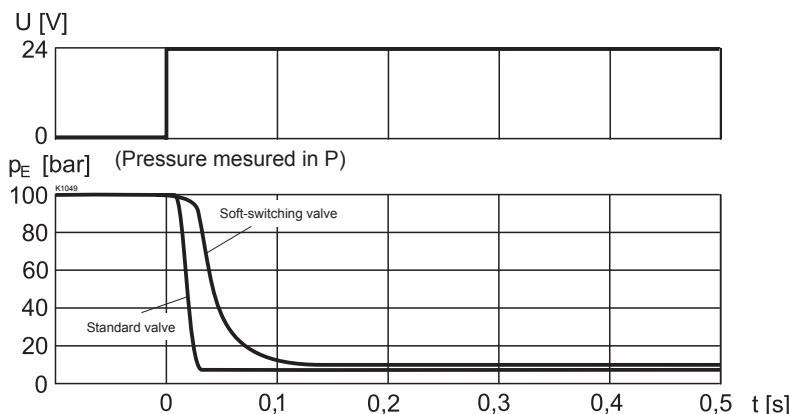
 $Q_L = f(p)$ Leakage volume flow characteristics per control edge

 $\Delta p = f(Q)$ Pressure drop volume flow characteristics


Pressure drop Symbol	Volume flow direction				
	P-A	P-B	P-T	A-T	B-T
ACB	3	3	-	3	3
ADB	2	2	-	1	1

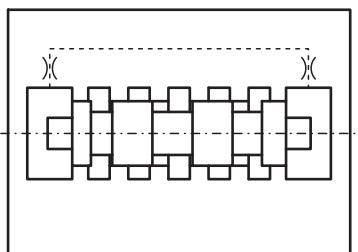
SWITCHING TIMES Influence of soft switching

Measured with WWMFA04-ACB-G24 at $Q = 10 \text{ l/min}$ compared with WDMFA04-ACB-G24

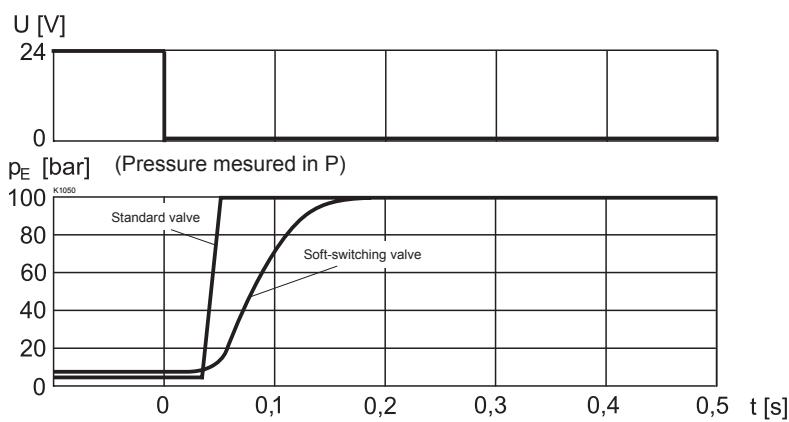
Solenoid energised



Orifices in valve body influence shifting time

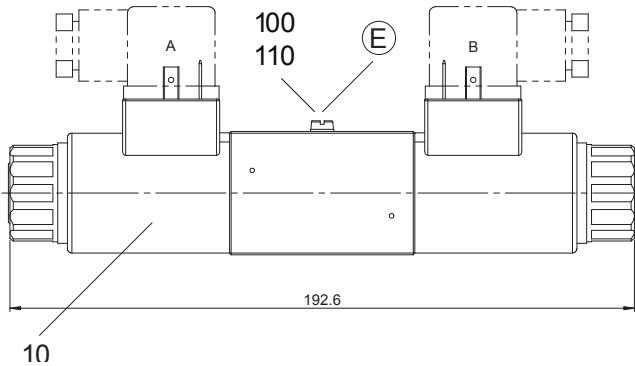


Solenoid deenergised



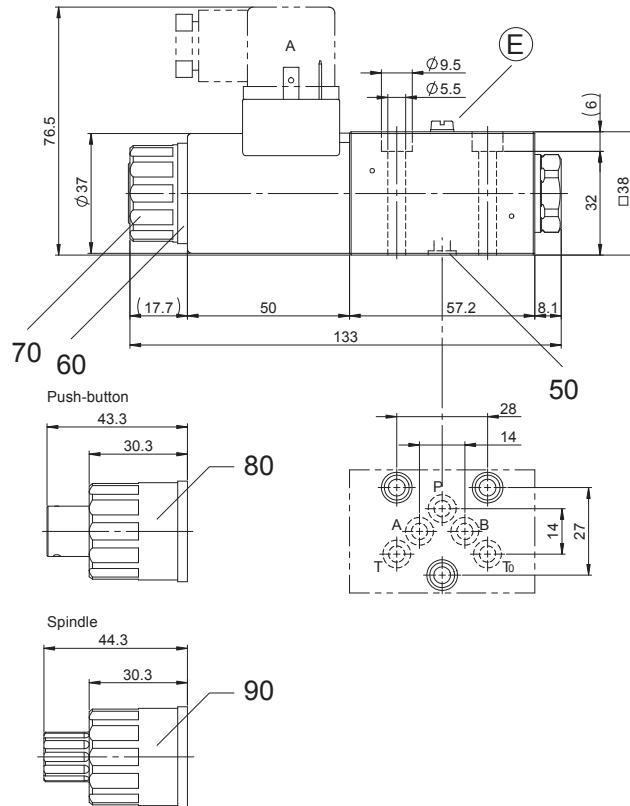
DIMENSIONS

4/3-way valve (spring centred)



E = air bleed screw

4/2-way valve (spring reset)


PARTS LIST

Position	Artikel	Description
10	206.2...	V.E37/19x50
50	160.2052 160.6052	O-ring ID 5,28x1,78 (NBR) O-ring ID 5,28x1,78 (FKM)
60	160.2187 160.6187	O-ring ID 18,72x2,62 (NBR) O-ring ID 18,72x2,62 (FKM)
70	154.2700	Knurled nut
80	253.7001	Push-button
90	253.7000	Spindle
100	246.1007	Socket head cap screw M4x6 DIN84 A
110	049.2040	Bonded seal ID 4,,1x7,2 x1

ACCESSORIES

 Threaded connecting plates, Multi-flange subplates
 and Longitudinal stacking system

see Reg. 2.9

Mating connector (A) EN175301-803

article no. 219.2001

Mating connector (B) EN 175301-803

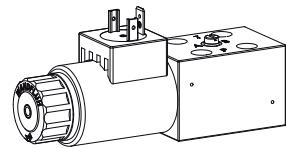
article no. 219.2002

Technical explanation see data sheet 1.0-100

Solenoid operated spool valve with soft switching

- 4/3-way with spring centred mid position
- 4/2-way with spring reset
- $Q_{\max} = 20 \text{ l/min}$, $p_{\max} = 350 \text{ bar}$

NG4[®]
ISO 4401-02


DESCRIPTION

Spool valve with soft switching, NG4 flange construction in accordance to ISO 4401-02 with 4 connections. Solenoids to norme VDE 0580. Direct solenoid operated spool valve with a 5 annular chamber body design. The valve's with soft switching characteristic is achieved by means of an optimum combination of removable orifice and piston design. Solenoid wet pin oil immersed armature type. Precision honed spool for low leakage. Low pressure drop due to the body design and spool profiling. Spool is of hardened steel, body is of high grade hydraulic cast iron for long service life. Wide range of standard voltages. The body made of high grade hydraulic casting for long service life is painted. The armature tube and the plug crew are zinc coated. The solenoid coil is nickel-/chromium-coated.

FUNCTION

The solenoid shifts the spool into the corresponding position.
 • 4/3-way spool valve:
 2 solenoids and 3 spool positions, spring centered. With the solenoids deenergised the spool returns to the center position.
 • 4/2-way spool valve:
 1 solenoid and 2 spool positions, spring offset. With the solenoid deenergised the spool returns to the offset position.

APPLICATION

Normal solenoid spool valves switch very quickly. This can induce shocks in the hydraulic system which can cause mechanical wear and have a negative effect on performance. The soft switching valves slow down and dampen the switching movements. All starting, stopping and oscillating movements are done softly, which benefits the system. Optimum results can be achieved if all ports are connected and the valve is properly bleed of air. Individual settings are available on request.

Important: at the time the valve is taken into service, the valve must be vented under pressure (max. 2 revolutions of screw E).

TYPE CODE

	W	W	M	F	B04 -	[]	- []	/	[]	- []	[]	[]	[]	[]	#	[]
Spool valve soft switching																
Medium-slip-on coil																
Flange construction																
International standard interface ISO, nominal size 4																
Description of symbols acc. to table 1.4-23/2																
Standard-nominal voltage U_N	12 VDC	G12														
	24 VDC	G24														
	115 VAC	R115														
	230 VAC	R230														
without solenoid coil	X5															
Slip-on coil	Metal housing round with one-sided collar	V														
	Metal housing square with one-sided collar	N*														
Electric connection	Connector socket EN 175301 - 803 / ISO4400	D														
	Connector socket AMP Junior-Timer	J	(only for $U_N \leq 75 \text{ VDC}$)													
	Connector Deutsch DT04 - 2P	G	(only for $U_N \leq 75 \text{ VDC}$)													
Sealing material	NBR															
	FKM (Viton)	D1														
Manual override	Integrated															
	Push-button	HF1														
	Spindle	HS1														
Diameter of orifice	$\varnothing 0,3 \text{ mm}$ (Standard)															
Design-Index (Subject to change)																

* Only available in conjunction with other nominal voltages and connection versions. (See data sheet 1.1-175)

GENERAL SPECIFICATIONS

Description	4/2-, 4/3-spool valve	Ambient temperature	-20...+70 °C (slip-on coil «V»)
Nominal size	NG4 to ISO 4401-02		if $> +50^\circ\text{C}$, then
Construction	Direct operated spool valve		voltage tolerance 0 / -10%
Operation	Solenoid		-20...+70 °C (slip-on coil «N»)
Mounting	Flange	Mounting position	any, preferably horizontal
	4 fixing holes for	Fastening torque	$M_D = 5,5 \text{ Nm}$ (screw quality 8.8)
	socket head cap screws M5x40		For fixing screws
Connections	Threaded connection plates		$M_D = 5 \text{ Nm}$ for Knurled nut
	Multi-flange subplates		
	Longitudinal stacking system		

ELECTRICAL CONTROL

Construction	Solenoid, wet pin push type, pressure tight
Standard-nominal voltage	$U_N = 12 \text{ VDC}$ $U_N = 24 \text{ VDC}$ $U_N = 115 \text{ VAC}^*$ $U_N = 230 \text{ VAC}^*$ AC = 50 to 60 Hz <small>* Rectifier integrated in the coil, other nominal voltages and nominal performances on request</small>
Voltage tolerance	$\pm 10\%$ of nominal voltage
Protection class to EN 60 529	Connection version D: IP 65 J: IP 66 only for $U_N \leq 75 \text{ VDC}$ G: IP 67 and 69K only for $U_N \leq 75 \text{ VDC}$
Relative duty factor	100% DF (see data sheet 1.1-430)
Switching cycles	15000/h
Operating life	10^7 (number of switching cycles, theoretically)
Connection/Power supply	Over device plug connection
Coil versions:	
Economy: V.E37/19x40	(data sheet 1.1-168)
Medium: V.E37/19x50	(data sheet 1.1-168)
Other electrical specifications see data sheet	1.1-168 (V) 1.1-175 (N)

HYDRAULIC SPECIFICATIONS

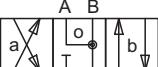
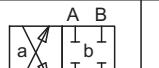
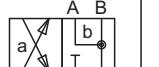
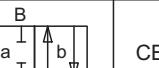
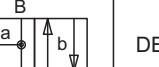
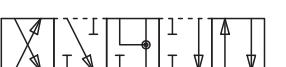
Fluid	Mineral oil, other fluid on request
Contamination efficiency	ISO 4406:1999, classe 18/16/13 (Required filtration grade $\beta_{10\dots16} \geq 75$) refer to data sheet 1.0-50/2
Viscosity range	12 mm ² /s...320 mm ² /s
Fluid temperature	-20...+70°C
Working pressure in port P, A, B	$p_{max} = 350 \text{ bar}$
Tank pressure in port T	$p_{T\max} = 100 \text{ bar}$
Max. volume flow	$Q_{max} = 20 \text{ l/min}$, see characteristics
Leakage volume flow	see characteristics

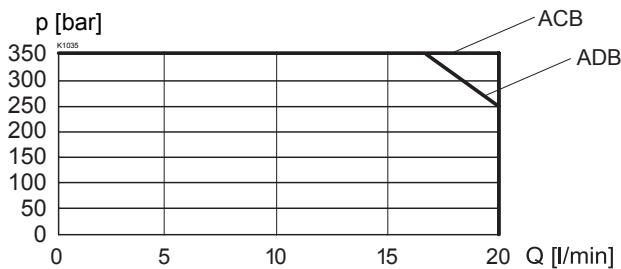
Weight	
4/3-way	$m = 1,25 \text{ kg}$
4/2-way (1 solenoid)	$m = 0,9 \text{ kg}$

MANUAL OVERRIDE

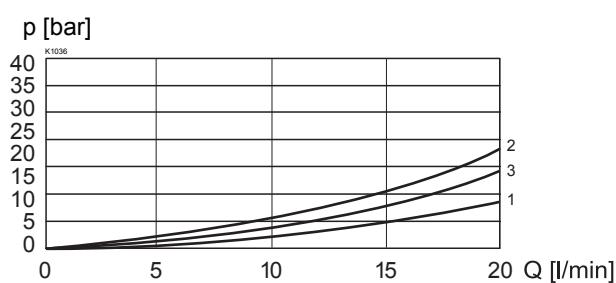
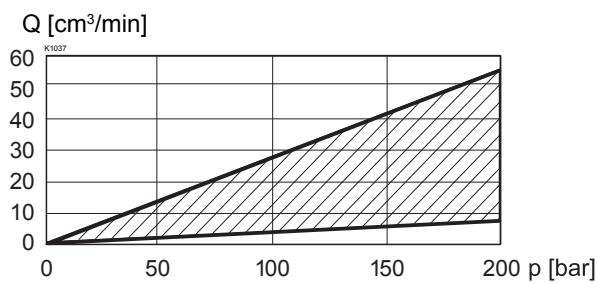
- Integrated (-) Actuation pin integrated in the armature tube.
- Push-button (HF1) integrated in the knurled nut.
Actuation by pressing the pin
- Spindle (HS1) integrated in the knurled nut.
Actuation by turning the spindle (infinitely variable valve actuation)

TYPE LIST / DESIGNATION OF SYMBOLS

4/3-way valve spring centred	4/2-way valve with spring reset operation A-side	operation B-side	Transitional functions
 	 	ACB ADB	 
			 

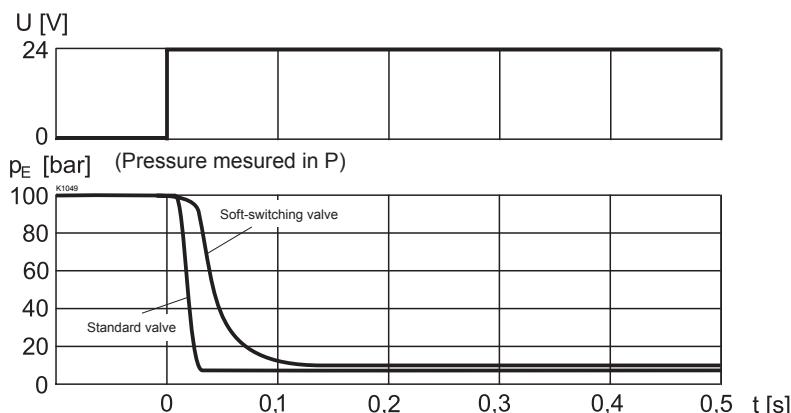
CHARACTERISTICS Oil viscosity $\nu = 30 \text{ mm}^2/\text{s}$
 $p = f(Q)$ Performance limits with standard voltage -10%


Symbol	Pressure drop Curve no.	Volume flow direction				
		P-A	P-B	P-T	A-T	B-T
ACB		3	3	-	3	3
ADB		2	2	-	1	1

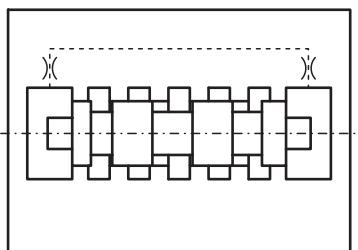
 $\Delta p = f(Q)$ Pressure drop volume flow characteristics

 $Q_L = f(p)$ Leakage volume flow characteristics per control edge

SHIFTING TIMES Influence of soft switching

Measured with WWMFB04-ACB-G24 at $Q = 10 \text{ l/min}$ compared with WDMFB04-ACB-G24

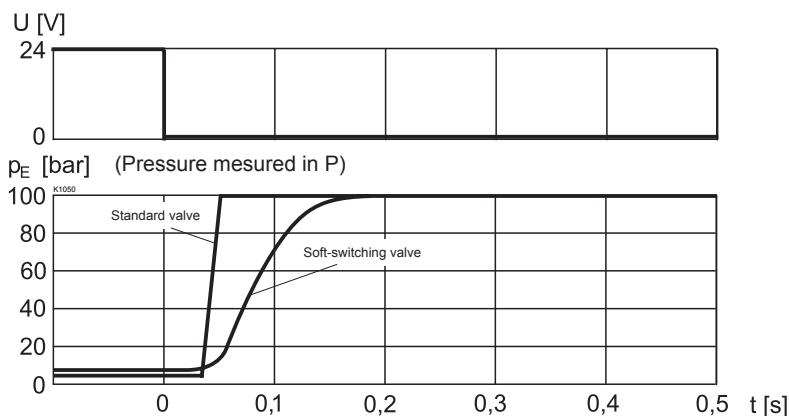
Solenoid energised



Orifices in valve body influence shifting time

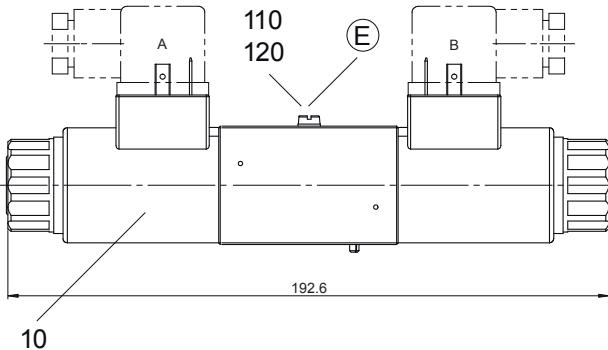


Solenoid deenergised



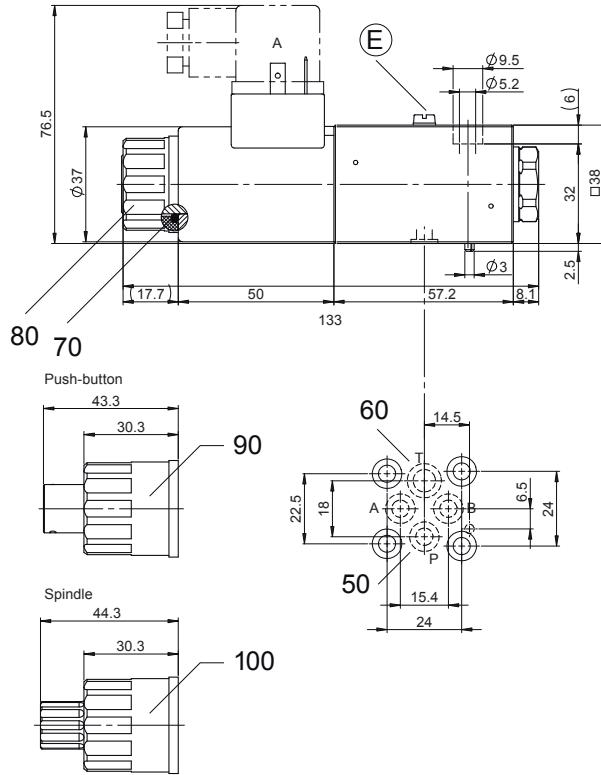
DIMENSIONS

4/3-way valve (spring centred)



E = air bleed screw

4/2-way valve (spring reset)


PARTS LIST

Position	Article	Description
10	206.2...	V.E37/19x50
50	160.2060 160.6061	O-ring ID 6,07x1,78 (NBR) O-ring ID 6,07x1,78 (FKM)
60	160.2076 160.6076	O-ring ID 7,65x1,78 (NBR) O-ring ID 7,65x1,78 (FKM)
70	160.2187 160.6187	O-ring ID 18,72x2,62 (NBR) O-ring ID 18,72x2,62 (FKM)
80	154.2700	Knurled nut
90	253.7001	Push-button
100	253.7000	Spindle
110	246.1007	Socket head cap screw M4x6 DIN84 A
120	049.2040	Bonded seal ID 4,1x7,2 x1

ACCESSORIES

 Threaded connecting plates, Multi-flange subplates
 and Longitudinal stacking system

see Reg. 2.9

Mating connector (A) EN175301-803

article no. 219.2001

Mating connector (B) EN 175301-803

article no. 219.2002

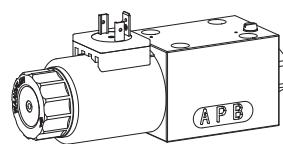
Technical explanation see data sheet 1.0-100

Solenoid operated spool valve soft switching

- 4/3-way with spring centred mid position
- 4/2-way with spring reset
- $Q_{\max} = 60 \text{ l/min}$, $p_{\max} = 350 \text{ bar}$

NG6

ISO 4401-03


DESCRIPTION

Spool valve with soft switching, NG6 flange construction in accordance to ISO 4401-03 with 4 connections. Solenoids to norme VDE 0580. Direct solenoid operated spool valve with a 5 annular chamber body design. The valve's with soft switching characteristic is achieved by means of an optimum combination of removable orifice and piston design. Solenoid wet pin oil immersed armature type. Precision honed spool for low leakage. Low pressure drop due to the body design and spool profiling. Spool is of hardened steel, body is of high grade hydraulic cast iron for long service life. Wide range of standard and special voltages. The body made of high grade hydraulic casting for long service life is painted. The armature tube and the plug crew are zinc coated. The solenoid coil is nickel-/chromium-coated.

FUNCTION

The solenoid shifts the spool into the corresponding position.

- 4/3-way spool valve:
2 solenoids and 3 spool positions, spring centered. With the solenoids deenergised the spool returns to the center position.
- 4/2-way spool valve:
1 solenoid and 2 spool positions, spring offset. With the solenoid deenergised the spool returns to the offset position.

APPLICATION

Normal solenoid spool valves switch very quickly. This can induce shocks in the hydraulic system which can cause mechanical wear and have a negative effect on performance. The soft switching valves slow down and dampen the switching movements. All starting, stopping and oscillating movements are done softly, which benefits the system. Optimum results can be achieved if all ports are connected and the valve is properly bleed of air. Individual settings are available on request.

Important: at the time the valve is taken into service, the valve must be vented under pressure (max. 2 revolutions of screw E).

TYPE CODE

Spool valve soft switching

 W W M F A06 - - / - #

Medium-slip-on coil

Flange construction

International standard interface ISO, nominal size 6

Description of symbols acc. to table 1.4-32/2

Standard-nominal voltage U_N	12 VDC	G12
	24 VDC	G24
	115 VAC	R115
	230 VAC	R230
without solenoid coil		X5

Slip-on coil	Metal housing, round	<input type="checkbox"/> W
	Metal housing, square	<input type="checkbox"/> M*

Electric connection	Connector socket EN 175301 - 803/ISO4400	<input type="checkbox"/> D
	Connector socket AMP Junior-Timer	<input type="checkbox"/> J
	Connector Deutsch DT04 - 2P	<input type="checkbox"/> G (only for $U_N \leq 75 \text{ VDC}$)

Sealing material	NBR	<input type="checkbox"/>
	FKM (Viton)	<input type="checkbox"/> D1

Manual override	Integrated	<input type="checkbox"/>
	Push-button	<input type="checkbox"/> HF1
	Spindle	<input type="checkbox"/> HS1

Diameter of orifice	$\varnothing 0,3 \text{ mm}$ (standard)	<input type="checkbox"/>
	$\varnothing 0,5 \text{ mm}$	<input type="checkbox"/> Q0,5

Design-Index (Subject to change)

* Only available in conjunction with other nominal voltages and connection versions. (See data sheet 1.1-181)

GENERAL SPECIFICATIONS

Description	4/2-, 4/3-spool valve	Ambient temperature	-20...+70 °C (Slip-on coil «W»)
Nominal size	NG6 to ISO 4401-03		if $> +50^\circ\text{C}$, then
Construction	Direct operated spool valve		voltage tolerance 0 / -10 %
Operation	Solenoid		-20...+70 °C (Slip-on coil «M»)
Mounting	Flange, 4 fixing holes for socket head cap screws M5x45	Mounting position	any, preferably horizontal
Connections	Threaded connection plates Multi-flange subplates Longitudinal stacking system	Fastening torque	$M_D = 5,5 \text{ Nm}$ (screw quality 8.8) For fixing screws $M_D = 7 \text{ Nm}$ for Knurled nut
		Weight	
		4/2-way	$m = 2,0 \text{ kg}$
		4/2-way (1 solenoid)	$m = 1,5 \text{ kg}$

ELECTRICAL CONTROL

Construction	Solenoid, wet pin push type, pressure tight
Standard-nominal voltage	$U_N = 12 \text{ VDC}$ $U_N = 24 \text{ VDC}$ $U_N = 115 \text{ VAC}^*$ $U_N = 230 \text{ VAC}^*$ AC = 50 to 60 Hz * Rectifier integrated in the coil, other nominal voltages and nominal performances on request
Voltage tolerance	$\pm 10\%$ of nominal voltage
Protection class to EN 60 529	Connection version D: IP 65 J: IP 66 only for $U_N \leq 75 \text{ VDC}$ G: IP 67 and 69K only for $U_N \leq 75 \text{ VDC}$
Relative duty factor	100% DF (see data sheet 1.1-430)
Switching cycles	Since switching is damped and slow, the switching frequency is of secondary importance.
Operating life	10^7 (number of switching cycles, theoretically)
Connection/Power supply	Over device plug connection
Coil versions:	W.E45/23x50 (data sheet 1.1-182)
Other electrical specifications	see data sheet 1.1-182 (W) 1.1-181 (M)

MANUAL OVERRIDE

- Integrated (-) Actuation pin integrated in the armature tube.
- Push-button (HF1) integrated in the knurled nut.
Actuation by pressing the pin
- Spindle (HS1) integrated in the knurled nut.
Actuation by turning the spindle (infinitely variable valve actuation)

HYDRAULIC SPECIFICATIONS

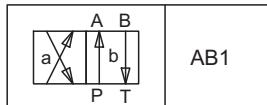
Fluid	Mineral oil, other fluid on request
Contamination efficiency	ISO 4406:1999, classe 20/18/14 (Required filtration grade $\beta_{10\dots16} \geq 75$) refer to data sheet 1.0-50/2
Viscosity range	12 mm ² /s...320 mm ² /s
Fluid temperature	-20...+70°C
Working pressure in port P, A, B	$p_{max} = 350 \text{ bar}$
Tank pressure in port T	$p_{T,max} = 200 \text{ bar}$
Max. volume flow	$Q_{max} = 60 \text{ l/min}$, see characteristics
Leakage volume flow	see characteristics

TYPE LIST / DESIGNATION OF SYMBOLS

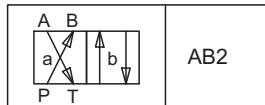
 4/2-way valve with spring reset
operation A-side

operation B-side

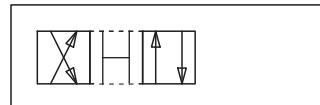
Transitional functions



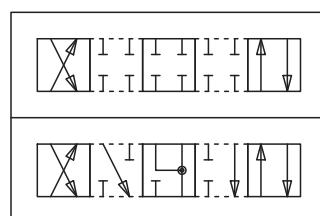
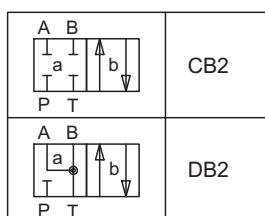
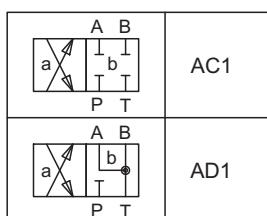
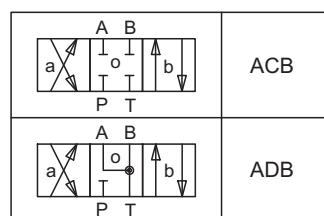
AB1

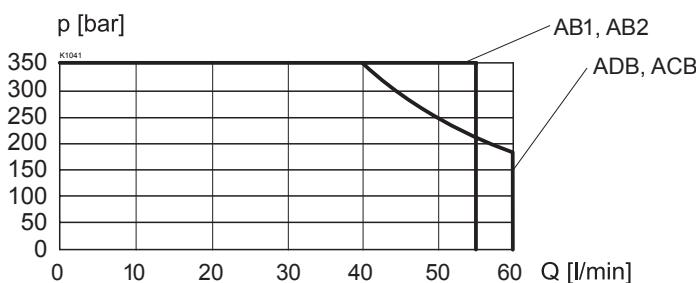


AB2

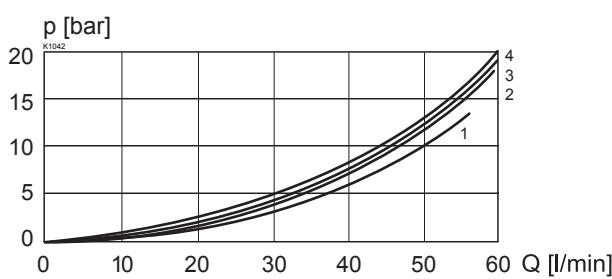
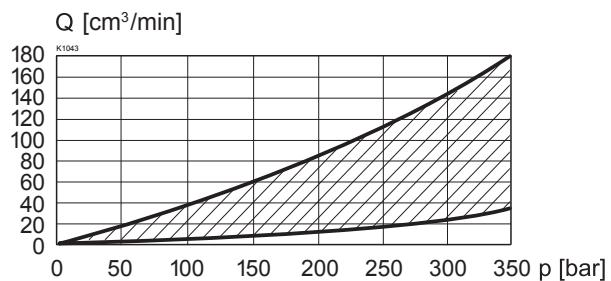


4/3-way valve spring centred



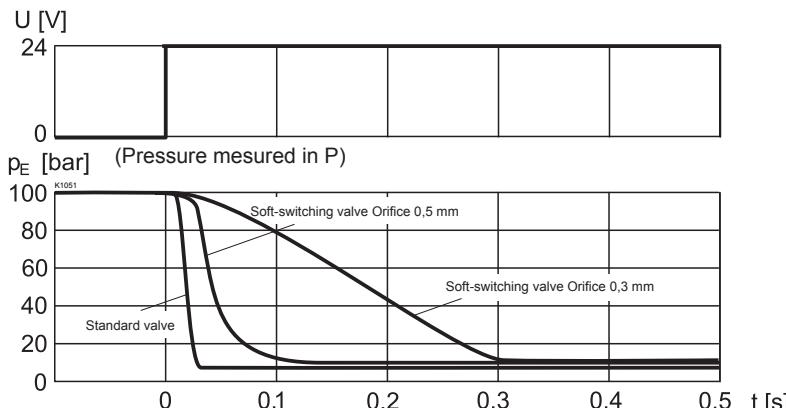
CHARACTERISTICS Oil viscosity $\nu = 30 \text{ mm}^2/\text{s}$
 $p = f(Q)$ Performance limits with standard voltage -10%


Pressure drop Symbol	Curve no	Volume flow direction				
		P-A	P-B	P-T	A-T	B-T
AB1 / AB2	1	1	-	1	1	
ACB	4	4	-	4	4	
ADB	3	3	-	2	2	

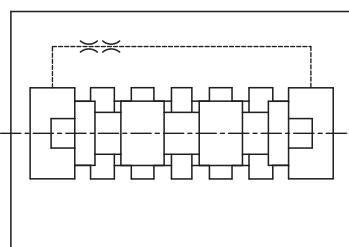
 $\Delta p = f(Q)$ Pressure drop volume flow characteristics

 $Q_L = f(p)$ Leakage volume flow characteristics per control edge

SHIFTING TIMES Influence of soft switching

Measured with WWMFA06-ACB-G24 at $Q = 30 \text{ l/min}$ compared with WDMFA06-ACB-G24

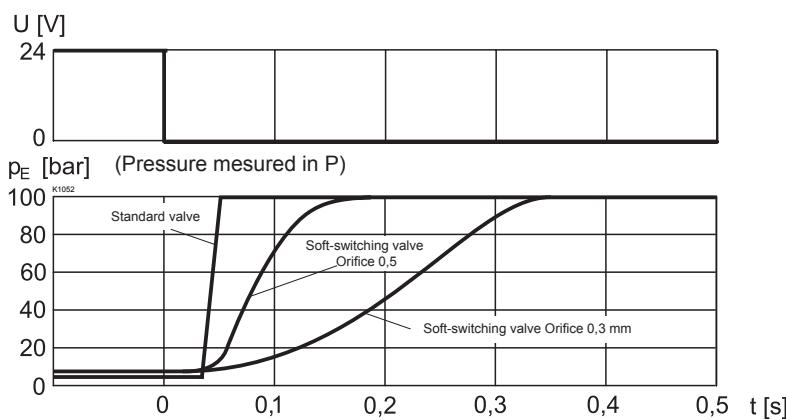
Solenoid energised



Orifices in valve body influence shifting time

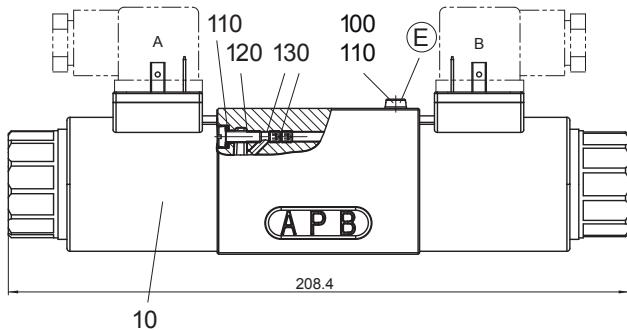


Solenoid deenergised



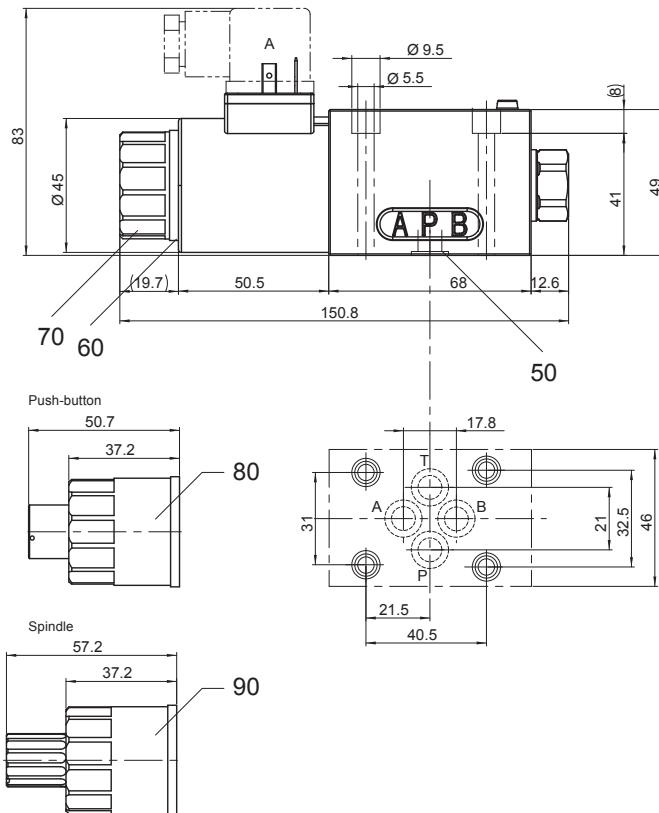
DIMENSIONS

4/3-way valve (spring centred)



E = air bleed screw

4/2-way valve (spring reset)


PARTS LIST

Position	Article	Description
10	206.1...	W.E45/23x50
50	160.2093	O-ring ID 9,25x1,78 (NBR)
	160.6092	O-ring ID 9,25x1,78 (FKM)
60	160.2222	O-ring ID 22,22x2,62 (NBR)
	160.6222	O-ring ID 22,22x2,62 (FKM)
70	154.2701	Knurled nut
80	253.7004	Push-button
90	253.7002	Spindle
100	246.1007	Socket head cap screw M4x6 DIN84 A
110	049.2040	Bonded seal ID 4,1x7,2x1
120	246.1012	Socket head cap screw M4x12 DIN84A
130	118.1029	Orifice M4/0,3x4St
	118.1023	Orifice M4/0,5x4St

ACCESSORIES

 Threaded connecting plates, Multi-flange subplates
 and Longitudinal stacking system

see Reg. 2.9

Mating connector (A) EN175301-803

Article Nr. 219.2001

Mating connector (B) EN 175301-803

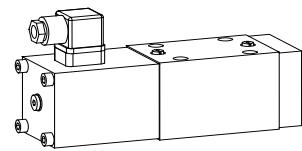
Article Nr. 219.2002

Technical explanation see data sheet 1.0-100

Solenoid operated spool valve with soft switching

- 4/2-way with 2 solenoids
 - 4/3-way with spring centred mid position
 - 4/2-way with spring reset
 - $Q_{\max} = 80 \text{ l/min}$, $p_{\max} = 350 \text{ bar}$

NG10
ISO 4401-05



DESCRIPTION

Spool valve with soft switching, NG10 flange construction in accordance to ISO 4401-05 with 4 connections. Solenoids to norme VDE 0580. Direct solenoid operated spool valve with a 5 annular chamber body design. The valve's with soft switching characteristic is achieved by means of an optimum combination of removable orifice and piston design. Solenoid wet pin oil immersed armature type. Precision honed spool for low leakage. Low pressure drop due to the body design and spool profiling. Spool is of hardened steel, body is of high grade hydraulic cast iron for long service life. Wide range of standard and special voltages in 2 solenoid versions. The body made of high grade hydraulic casting for long service life is painted. The cover and the solenoid are zinc coated.

FUNCTION

- 4/2-way

Two solenoids and 2 switch settings. 100% ED holds the switch setting on the solenoid (no mechanical detente).

- 4/3-way spool valve:

2 solenoids and 3 spool positions, spring centered. With the solenoids deenergised the spool returns to the center position.

- 4/2-way spool valve:

1 solenoid and 2 spool positions, spring offset. With the solenoid deenergised the spool returns to the offset position.

APPLICATION

Normal solenoid spool valves switch very quickly. This can induce shocks in the hydraulic system which can cause mechanical wear and have a negative effect on performance. The soft switching valves slow down and dampen the switching movements. All starting, stopping and oscillating movements are done softly, which benefits the system. Optimum results can be achieved if all ports are connected and the valve is properly bleed of air. Individual settings are available on request.

Important: at the time the valve is taken into service, the valve must be vented under pressure (max. 2 revolutions of screw E).

CONTENT

GENERAL SPECIFICATIONS	1
HYDRAULIC SPECIFICATIONS	1
ELECTRICAL CONTROL.....	2
SOLENOID DESCRIPTION	2
TYPE LIST /	
DESIGNATIONS OF SYMBOLS	2
CHARACTERISTICS.....	3
DIMENSIONS.....	3
SHIFTING TIMES	4
PARTS LIST	4
ACCESSORIES.....	4

TYPE CODE

A	<input type="checkbox"/>	W	4	<input type="checkbox"/>	-	<input type="checkbox"/>	/	<input type="checkbox"/>	#
International mounting interface ISO									
Medium-solenoid	<input checked="" type="checkbox"/>	M							
Super-solenoid	<input type="checkbox"/>	S							
Soft switching									
Number of control ports									
Description of symbols acc. to table 1.4-40/2									
Standard- nominal voltage U_N :		12 VDC	<input type="checkbox"/>	G12	110 VAC	<input type="checkbox"/>	R110		
		24 VDC	<input type="checkbox"/>	G24	115 VAC	<input type="checkbox"/>	R115		
					230 VAC	<input type="checkbox"/>	R230		
Orifice area:		\varnothing 0,5	Standard type no remark						
		\varnothing 0,7	<input type="checkbox"/>	0,7					
		\varnothing 0,9	<input type="checkbox"/>	0,9					
Design-Index (Subject to change)									

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS	
Description	4/2-, 4/3-way spool valve
Nominal size	NG10 to ISO 4401-05
Construction	Direct operated spool valve
Operations	Solenoid
Mounting	Flange 4 fixing holes for socket head cap screw M6 x 65
Connections	Threaded connection plates Multi-flange subplates Longitudinal stacking system
Ambient temperature	-20...+50°C
Mounting position	any, preferably horizontal
Fastening torque	M _D = 9,5 Nm (screw quality 8.8)
Weight:	
4/2-way (2 solenoid)	m = 6,0 kg
4/3-way	m = 6,0 kg
4/2-way (1 solenoid)	m = 4,5 kg

HYDRAULIC SPECIFICATIONS

Fluid	Mineral oil, other fluid on request
Contamination efficiency	ISO 4406:1999, class 18/16/13 (Required filtration grade β 6...10 \geq 75) refer to data sheet 1.0-50/2
Viscosity range	12 mm ² /s...320 mm ² /s
Fluid temperature	-20...+70 °C
Working pressure in port P, A, B	$p_{max} = 350$ bar
Tank pressure in port T	Medium: $p_{max} = 160$ bar Super: $p_{max} = 200$ bar $Q_{max} = 80$ l/min, see characteristics see characteristics
Max. volume flow	
Leakage volume flow	

ELECTRICAL CONTROL

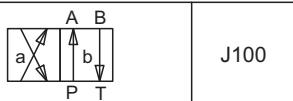
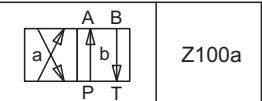
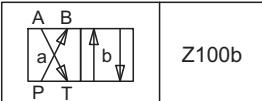
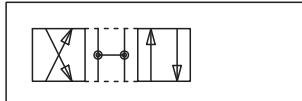
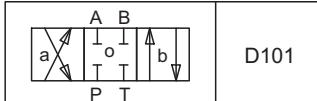
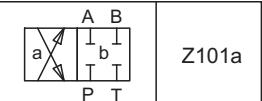
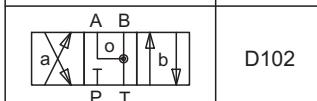
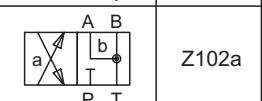
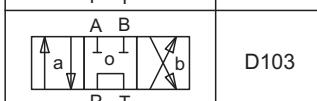
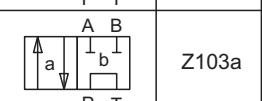
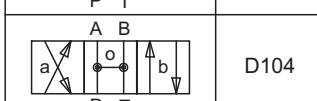
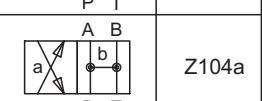
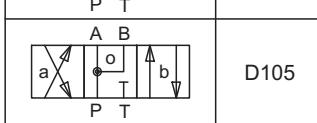
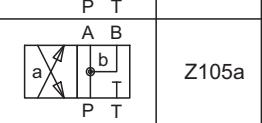
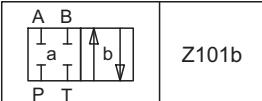
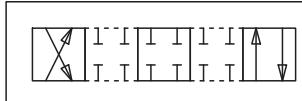
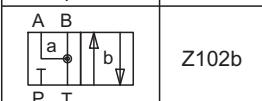
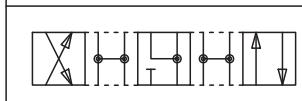
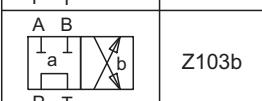
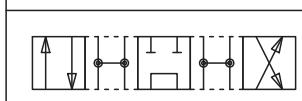
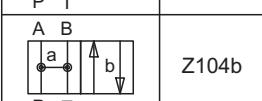
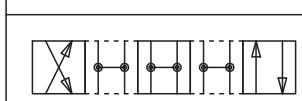
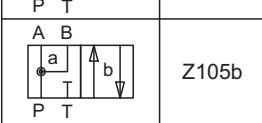
Construction	Solenoid, wet pin push type, pressure tight
Standard-nominal voltage	$U_N = 12 \text{ VDC}, 24 \text{ VDC}$ $U_N = 110 \text{ VAC}^*, 115 \text{ VAC}^*, 230 \text{ VAC}^*$ AC = 50 to 60 Hz * Rectifier integrated in the plug, other nominal voltages and nominal performances on request.
Voltage tolerance	$\pm 10\%$ of nominal voltage
Protection class	IP 65 to EN 60 529
Relative duty factor	100 % DF (see data sheet 1.1-430)
Switching cycles	Since switching is damped and slow, the switching frequency is of secondary importance.
Operating life	10^7 (number of switching cycles, theoretically)
Connection/Power supply	Over device plug connection to ISO 4400/DIN 43 650, (2P+E), other connections on request.

SOLENOID DESCRIPTION

With respect to the selection of the solenoid, the following statements are important:

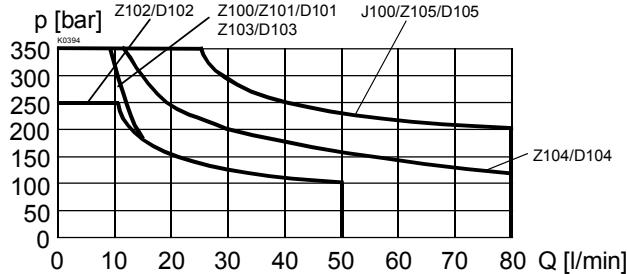
- The solenoid is the most expensive component of the solenoid spool valve.
- For this reason, it is not economical to use the same solenoid for all applications.
- Depending on the application, sales area, and customer, the requirements for solenoid spool valves and solenoids differ very considerably.
- In order to be able to offer the customer an optimum, we can supply our solenoid spool valves NG10 in 2 different versions:
 - Medium SIN60V (data sheet 1.1-145)
 - Super SIS60V (data sheet 1.1-150)

TYPE LIST/DESIGNATION OF SYMBOLS

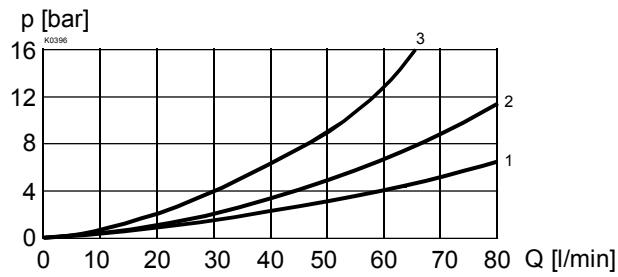
4/2-way valve with 2 solenoids	4/2-way valve with spring reset operation A-side	operation B-side	Transitional functions
	J100		Z100a
		Z100b	
4/3-way valve spring centered			
	D101		Z101a
	D102		Z102a
	D103		Z103a
	D104		Z104a
	D105		Z105a
	Z101b		
	Z102b		Z103b
			Z104b
			Z105b
			

CHARACTERISTICS Oil viscosity $\nu = 30 \text{ mm}^2/\text{s}$

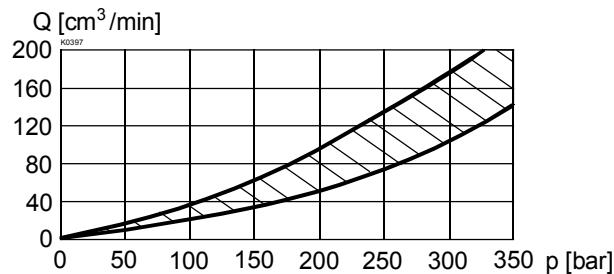
$p = f(Q)$ Performance limits with standard voltage -10 %
Medium



$\Delta p = f(Q)$ Pressure drop volume flow characteristics

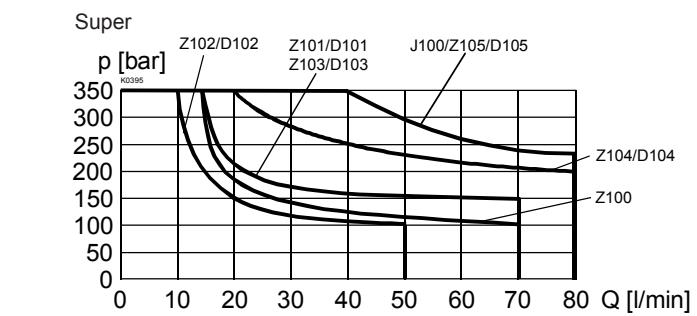
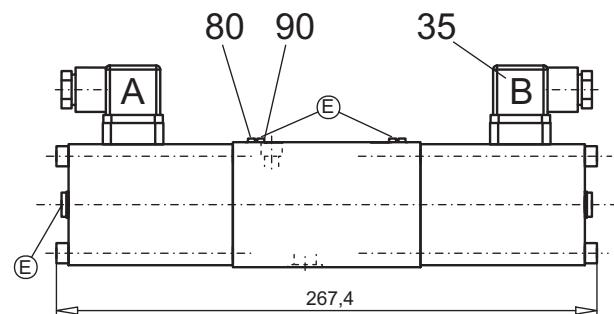


$Q_l = f(p)$ Leakage volume flow characteristics per control edge



DIMENSIONS

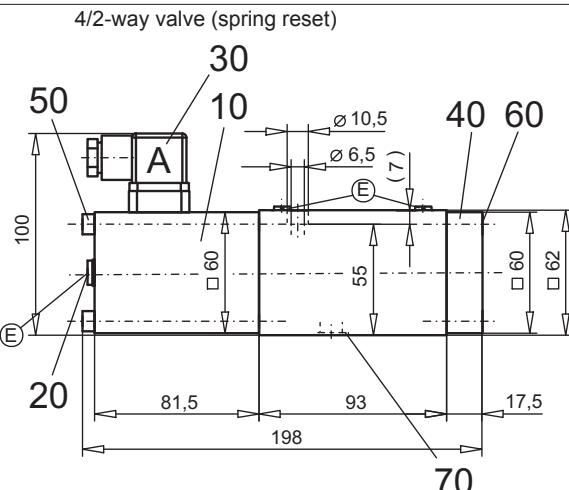
4/3-way valve (spring centered)
4/2-way valve (with 2 solenoids)



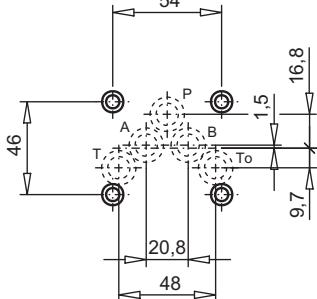
Symbol	Pressure drop curve no.	Volume flow direction				
		P - A	P - B	P - T	A - T	B - T
Z100/J100		2	2	-	2	2
D101/Z101		2	2	-	2	2
D102/Z102		2	2	-	1	1
D103/Z103		3	3	2	3	3
D104/Z104		1	1	-	1	1
D105/Z105		1	1	-	2	2

DIMENSIONS

4/3-way valve (spring centered)
4/2-way valve (with 2 solenoids)



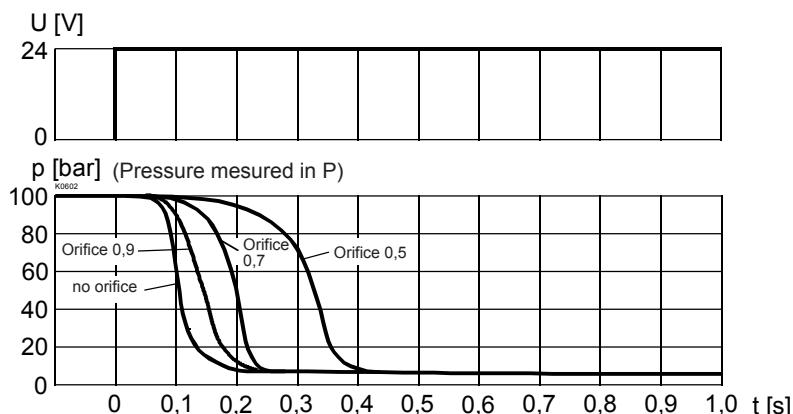
E = air bleed screw



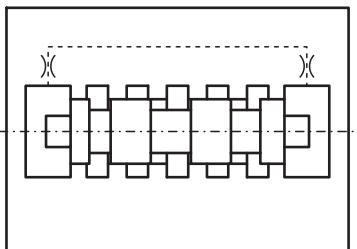
SHIFTING TIMES Influence of orifices on shifting

Mesured with AMW4D61-G24 Flow Q = 7 l/min

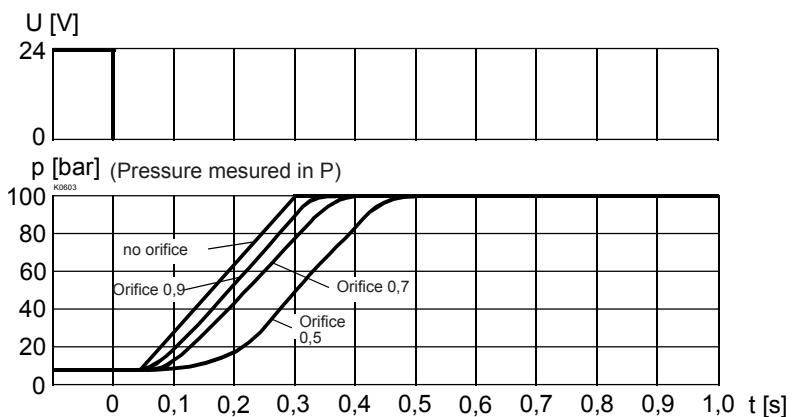
Solenoid energised



Orifices in valve body influence shifting time



Solenoid deenergised


PARTS LIST

Position	Article	Description
10	260.8 ... 260.9 ...	Medium-solenoid SIN60V Super-solenoid SIS60V
20	239.2033	Plug HB0 (incl. seal)
30	219.2001	Plug A (grey)
35	219.2002	Plug B (black)
40	059.2201 059.2203	Cover Medium Cover Super
50	246.3190	Socket head cap screw M6x90 DIN912
60	246.3121	Socket head cap screw M6x20 DIN912
70	160.2140	O-ring ID 14,00x1,78
80	246.2006	Socket head cap screw M5x6 DIN84 A
90	049.2050	Bonded seal ID 5,7x10x1

ACCESSORIES

 Threaded connecting plates, Multi-flange subplates and
Longitudinal stacking system
see Reg. 2.9

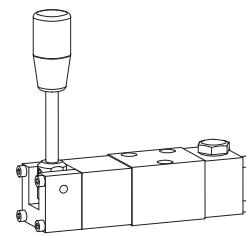
Technical explanation see data sheet 1.0-100

Spool valve

Hand- or roller operated

- 4/2- and 4/3-way detented
- 4/3-way with spring centred mid position
- 4/2-way with spring reset
- $Q_{max} = 8 \text{ l/min}$, $p_{max} = 350 \text{ bar}$

NG3-Mini®



DESCRIPTION

Spool valve NG3-Mini, flange type in accordance to Wandfluh standard with 4 connections, directly operated by hand or roller, in 5 chamber system. The hand lever valve is available with locked spool or with spring reset. The dancing roller valve only has a spring reset facility. Precise spool fit, little leakage, long life. Threaded connection by means of additional connecting plate. Hardened steel spool, the valve body being made from a high quality casting suitable for hydraulic applications. The valve body is painted, the end cover and lever housing are zinc-coated.

FUNCTION

When actuated, the lever or roller displaces the spool to the corresponding switching position.

- 4/2- and 4/3-way manual valves with spring, 1 lever and 2 or 3 switching positions. The spring presses the spool back into the home position.
- 4/2- and 4/3-way manual lever valve with lock, 1 lever and 2 or 3 switching positions. The lock holds the spool in the last position selected.
- 4/2-way dancing roller valve, 1 dancing roller and 2 switching positions. The spring presses the spool back to the starting position.

APPLICATION

Mechanically operated spool valves are mainly used to control the direction of movement and retain hydraulic cylinders and motors. The direction of movement is determined by the position of the valve spool and its symbol. Mechanically operated valves are particularly suitable for use in installations where no control current is available or for applications in areas where there is a risk of explosion (chemical industry, tunnel construction). Mini-3 valves are used where both, reduced dimensions and weight are important.

TYPE CODE

WD	<input type="checkbox"/>	F	A03	-	<input type="checkbox"/>	#	<input type="checkbox"/>
Spool valve direct operated							
Hand lever with spring reset or spring centred		H					
Hand lever dentented		G					
Roller with spring reset		T					
Flange type							
Interface NG3-Mini							
Type charts/Symbols acc. to table on page 1.5-15/2	a-side		1				
	b-side		2				
Design-Index (Subject to change)							

GENERAL SPECIFICATIONS

Description	4/2-, 4/3-way-valve
Nominal size	NG3-Mini to Wandfluh standard
Construction	Direct operated spool valve
Operations	Hand operated (hand lever) or roller
Mounting	Flange
Connections	3 fixing holes for socket head cap screws M4x30 Threaded connection plates Multi-flange plates, Manyfolds Longitudinal stacking system
Ambient temperature	-20...50°C
Mounting position	any, preferable horizontal
Fastening torque	$M_D = 2,8 \text{ Nm}$ (screw quality 8.8)
Weight: Hand lever	$m = 0,62 \text{ kg}$
Roller	$m = 0,55 \text{ kg}$

HYDRAULIC SPECIFICATIONS

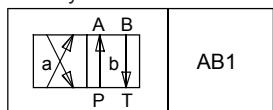
Fluid	Mineral oil, other fluid on request
Contamination efficiency	ISO 4406:1999, class 20/18/14 (Required filtration grade $\beta 10\dots16\geq75$) refer to data sheet 1.0-50/2
Viscosity range	12 mm²/s...320 mm²/s
Fluid temperature	-20...+70°C
Operating pressure in port P, A, B	$p_{max} = 350 \text{ bar}$ ($p_T < 20 \text{ bar}$) $p_{max} = 315 \text{ bar}$ ($p_T > 20 \text{ bar}$)
Tank pressure in port T	$p_{Tmax} = 100 \text{ bar}$
Max. volume flow	$Q_{max} = 8 \text{ l/min}$
Leakage volume flow	see characteristics

CONTROL MECHANICAL

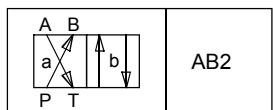
Angle (Hand lever)	$\alpha_b = 13,5^\circ$
Stroke (roller)	$S_b = 1,7 \text{ mm}$
Force: - Hand lever	$F_b = 15 \dots 20 \text{ N}$
- roller	$F_b = 90 \dots 120 \text{ N}$

TYPE LIST / DESIGNATION OF SYMBOLS

4/2-way valve



AB1



AB2

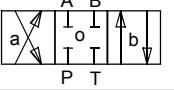
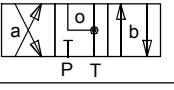
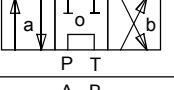
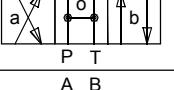
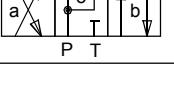
Transitional functions



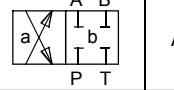
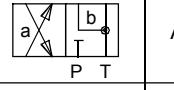
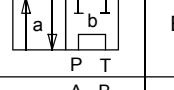
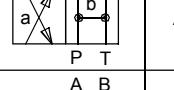
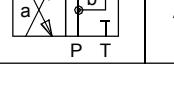
Transitional functions

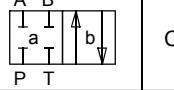
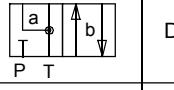
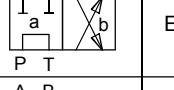
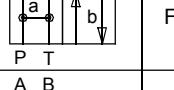
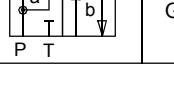
4/3-way valve

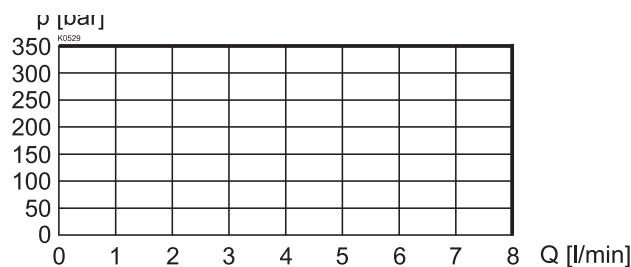
(only by hand lever operation)

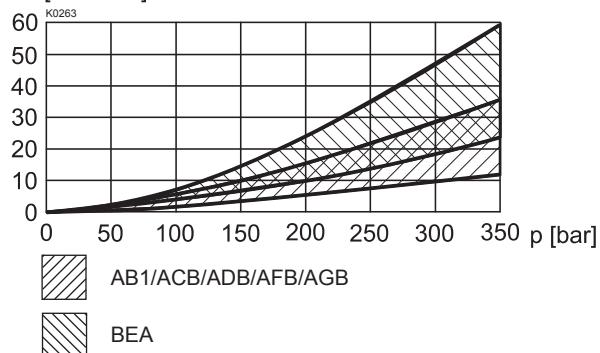
	ACB1 ACB2
	ADB1 ADB2
	BEA1 BEA2
	AFB1 AFB2
	AGB1 AGB2

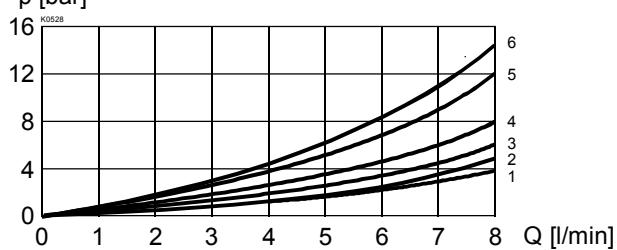
4/2-way valve

	AC1
	AD1
	BE1
	AF1
	AG1

	CB2
	DB2
	EA2
	FB2
	GB2

CHARACTERISTICS Oil viscosity $\nu = 30 \text{ mm}^2/\text{s}$
 $p = f(Q)$ Performance limits

 $Q_L = f(p)$ Leakage volume flow characteristics per control edge

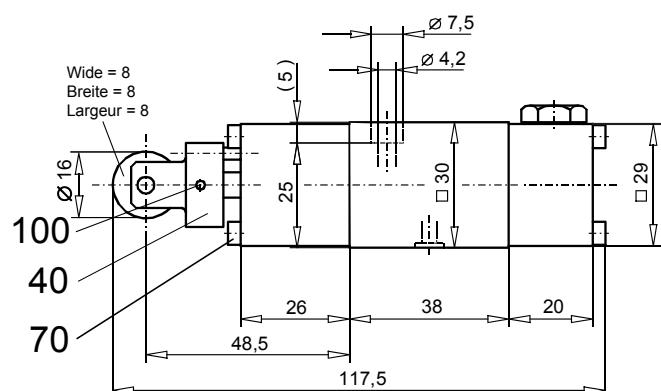
 $Q [\text{cm}^3/\text{min}]$

 $\Delta p = f(Q)$ Pressure drop volume flow characteristics

 $p [\text{bar}]$


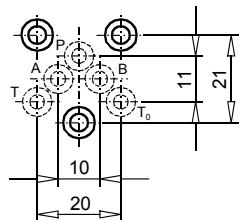
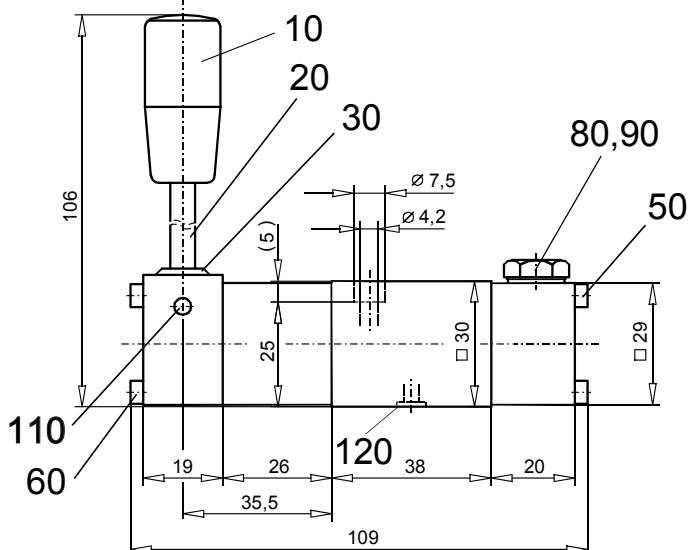
Symbol	Pressure drop curve no.					Volume flow direction				
	P - A	P - B	P - T	A - T	B - T	P - A	P - B	P - T	A - T	B - T
AB1/AB2	4	4	-	3	3					
ACB1/ACB2/AC1/CB2	4	4	-	2	2					
ADB1/ADB2/AD1/DB2	3	3	-	2	2					
BEA1/BEA2/BE1/EA2	6	6	4	5	5					
AFB1/AFB2/AF1/FB2	2	2	1	2	2					
AGB1/AGB2/AG1/GB2	3	3	-	3	3					

DIMENSIONS

Roller



Hand lever


PARTS LIST

Position	Article	Description
10	081.0018	Grip
20	096.2008	Lever
30	034.1106	Bolt
40	253.1100	Mechanical control head BTIII
50	246.0126	Socket head cap screw M3x25 DIN 912
60	246.0151	Socket head cap screw M3x50 DIN 912
70	246.0131	Socket head cap screw M3x30 DIN 912
80	238.1100 239.7104	Plug screw galv. M10x1 DIN 7604A (by spring centred version) Plug screw (by dedented version)
90	049.1100	Cop. seal ring NG10x13,5x1 DIN 7603 (only by dedented version)
100	221.1166	Spring tension pin Ø 2x16 DIN 6325
110	221.1382	Spring tension pin Ø 4x24 DIN 6325
120	160.2045	O-ring ID4,50x1,50

ACCESSORIES

Threaded connection plates, Multi flange plates

register 2.9

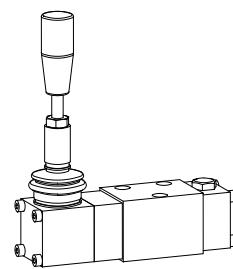
Technical explanation see data sheet 1.0-100

Spool valve

Hand- or roller operated

- 4/2- and 4/3-way detented
- 4/3-way with spring centred mid position
- 4/2-way with spring reset
- $Q_{\max} = 20 \text{ l/min}$, $p_{\max} = 315 \text{ bar}$

NG4-Mini®



DESCRIPTION

Spool valve NG4-Mini, flange type in accordance to Wandfluh standard with 4 connections, directly operated by hand or roller, in 5 chamber system. The hand lever valve is available with locked spool or with spring reset. The dancing roller valve only has a spring reset facility. Precise spool fit, little leakage, long life. Threaded connection by means of additional connecting plate. Hardened steel spool, the valve body being made from a high quality casting suitable for hydraulic applications. The valve body is painted, the end cover and lever housing are phosphatised.

FUNCTION

When actuated, the lever or roller displaces the spool to the corresponding switching position.

- 4/2- and 4/3-way manual valves with spring, 1 lever and 2 or 3 switching positions. The spring presses the spool back into the home position.
- 4/2- and 4/3-way manual lever valve with lock, 1 lever and 2 or 3 switching positions. The lock holds the spool in the last position selected.
- 4/2-way dancing roller valve, 1 dancing roller and 2 switching positions. The spring presses the spool back to the starting position.

APPLICATION

Mechanically operated spool valves are mainly used to control the direction of movement and retain hydraulic cylinders and motors. The direction of movement is determined by the position of the valve spool and its symbol. Mechanically operated valves are particularly suitable for use in installations where no control current is available or for applications in areas where there is a risk of explosion (chemical industry, tunnel construction). Mini-4 valves are used where both, reduced dimensions and weight are important.

TYPE CODE

Interface	B	<input type="checkbox"/>	4	<input type="checkbox"/>	/	<input type="checkbox"/>
Operations:	Hand lever	<input checked="" type="checkbox"/>	Roller	<input type="checkbox"/>		
Number of control ports						
Description of symbols acc. to table 1.5-20/2	side-a	<input checked="" type="checkbox"/>	side-b	<input type="checkbox"/>		
Hand lever with spring reset or spring centred	<input type="checkbox"/>				<input checked="" type="checkbox"/>	
Hand lever dentented	<input type="checkbox"/>				<input type="checkbox"/>	
Roller with spring reset					<input type="checkbox"/>	
Design-Index (Subject to change)						

GENERAL SPECIFICATIONS

Description	4/2-, 4/3-way valve
Nominal size	NG4-Mini to Wandfluh standard
Construction	Direct operated spool valve
Operations	Hand operated (hand lever) or roller
Mounting	Flange 3 fixing holes for socket head cap screws M5x40
Connections	Threaded connection plates Multi-flange plates Longitudinal stacking system
Ambient temperature	-20...50 °C
Mounting position	any, preferable horizontal
Fastening torque	$M_D = 5,5 \text{ Nm}$ (screw quality 8.8)
Weight: Hand lever	$m = 0,87 \text{ kg}$
Roller	$m = 0,85 \text{ kg}$

HYDRAULIC SPECIFICATIONS

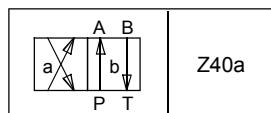
Fluid	Mineral oil, other fluid on request
Contamination efficiency	ISO 4406:1999, class 20/18/14 (Required filtration grade $\beta_{10\dots16} \geq 75$) refer to data sheet 1.0-50/2
Viscosity range	12 mm ² /s...320 mm ² /s
Fluid temperature	-20...+70 °C
Operating pressure	$p_{\max} = 315 \text{ bar}$
in port P, A, B	
Tank pressure	
in port T	
Max. Volume flow	$p_{\max} = 100 \text{ bar}$
Leakage volume flow	$Q_{\max} = 20 \text{ l/min}$ see characteristics see characteristics

CONTROL MECHANICAL

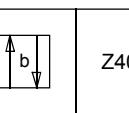
Angle (Hand lever)	$\alpha_b = 5,7^\circ$ / side
Stroke (Roller)	$S_b = 2 \text{ mm}$
Force: Hand lever	$F_b = 15 - 20 \text{ N}$
Roller	$F_b = 90 - 120 \text{ N}$

TYPE LIST / DESIGNATION OF SYMBOLS

4/2-way valve

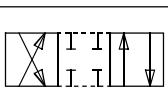


Z40a



Z40b

Transitional functions



4/3-way valve

(only by hand lever operation)

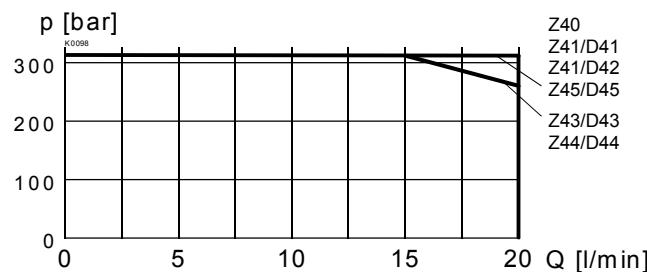
	D41a
	D41b
	D42a
	D42b
	D43a
	D43b
	D44a
	D44b
	D45a
	D45b

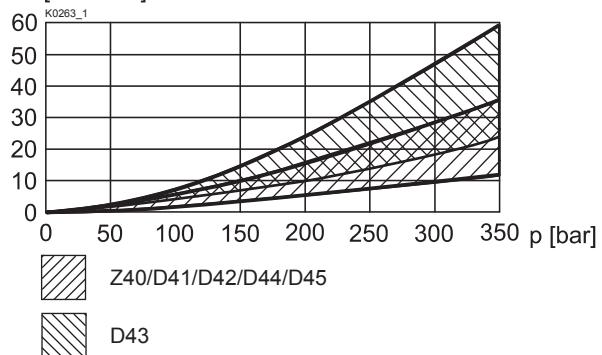
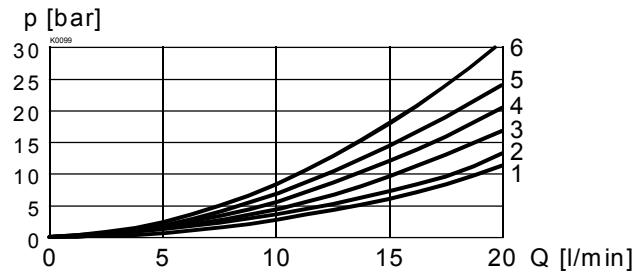
4/2-way valve

	Z41a
	Z42a
	Z43a
	Z44a
	Z45a

	Z41b
	Z42b
	Z43b
	Z44b
	Z45b

Transitional functions

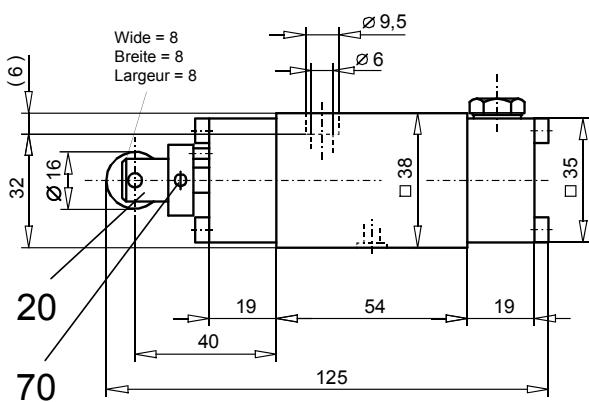
CHARACTERISTICS Oil viscosity $\nu = 30 \text{ mm}^2/\text{s}$
 $p = f(Q)$ Performance limits

 $Q_L = f(p)$ Leakage volume flow characteristics per control edge

 Q [cm³/min]

 $\Delta p = f(Q)$ Pressure drop volume flow characteristics


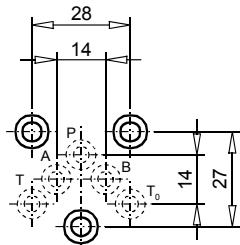
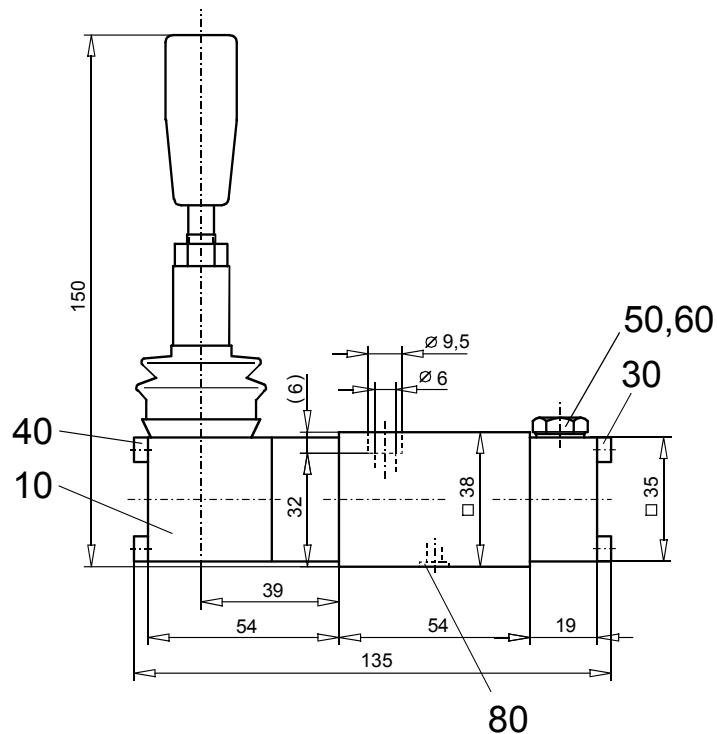
Symbol	Pressure drop curve no.				
	P - A	P - B	P - T	A - T	B - T
Z40	5	5	-	2	2
D41/Z41	5	5	-	2	2
D42/Z42	5	5	-	2	2
D43/Z43	4	4	6	1	1
D44/Z44	4	4	3	1	1
D45/Z45	4	4	-	2	2

DIMENSIONS

Roller



Hand lever


PARTS LIST

Position	Article	Description
10	253.2000	Hand control head BH II
20	253.2100	Mechanical control head BT II
30	246.1125	Socket head cap screw M4 x 25 DIN 912
40	246.1160	Socket head cap screw M4 x 60 DIN 912
50	238.1100 239.1102	Plug screw galv. M10x1 DIN 7604A (by spring centred version) Plug screw (by dedented version)
60	049.1100	Cop. seal ring NG10x13,5x1 DIN 7603 (only by dedented version)
70	221.2272	Spring tension pin Ø3x16 DIN 1481
80	160.2052	O-ring ID5,28x1,78

ACCESSORIES

 Threaded connection plates, Multi-flange plates
and longitudinal stacking system

register 2.9

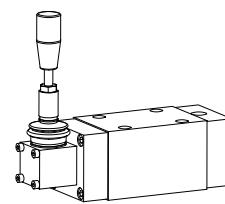
Technical explanation see data sheet 1.0-100

Spool valve

Hand- or roller operated

- 4/2- and 4/3-way detented
- 4/3-way with spring centred mid position
- 4/2-way with spring reset
- $Q_{\max} = 60 \text{ l/min}$, $p_{\max} = 350 \text{ bar}$

NG6
 ISO 4401-03



DESCRIPTION

Spool valve NG6, flange type in accordance to ISO 4401-03 with 4 connections, directly operated by hand or roller, in 5 chamber system.

The hand lever valve is available with locked spool or with spring reset. The dancing roller valve only has a spring reset facility. Precise spool fit, little leakage, long life. Threaded connection by means of additional connecting plate. Hardened steel spool, the valve body being made from a high quality casting suitable for hydraulic applications. The valve body is painted, the end cover and lever housing are phosphatised.

FUNCTION

When actuated, the lever or roller displaces the spool to the corresponding switching position.

- 4/2- and 4/3-way manual valves with spring, 1 lever and 2 or 3 switching positions. The spring presses the spool back into the home position.
- 4/2- and 4/3-way manual lever valve with lock, 1 lever and 2 or 3 switching positions. The lock holds the spool in the last position selected.
- 4/2-way dancing roller valve, 1 dancing roller and 2 switching positions. The spring presses the spool back to the starting position.

APPLICATION

Mechanically operated spool valves are mainly used to control the direction of movement and retain hydraulic cylinders and motors. The direction of movement is determined by the position of the valve spool and its symbol. Mechanically operated valves are particularly suitable for use in installations where no control current is available or for applications in areas where there is a risk of explosion (chemical industry, tunnel construction).

TYPE CODE

Internationale Interface ISO	A <input type="checkbox"/>	4 <input type="checkbox"/>	/ <input type="checkbox"/>	# <input type="checkbox"/>
Operations:	Hand lever <input checked="" type="checkbox"/>	Roller <input type="checkbox"/>		
Number of control ports				
Description of symbols acc. to table 1.5-40/2	side-a <input checked="" type="checkbox"/>	side-b <input type="checkbox"/>		
Hand lever with spring reset or spring centred	<input type="checkbox"/>	<input type="checkbox"/>		
Hand lever dentented	<input type="checkbox"/>			
Roller with spring reset	<input type="checkbox"/>			
Design-Index (Subject to change)				

GENERAL SPECIFICATIONS

Description	4/2-, 4/3-way valve
Nominal size	NG6 to ISO 4401-03
Construction	Direct operated spool valve
Operations	Hand operated (hand lever) or roller
Mounting	Flange
Connections	4 fixing holes for socket head cap screws M5x45 Threaded connection plates Multi-flange plates, Manifolds Longitudinal stacking system
Ambient temperature	-20...50 °C
Mounting position	any, preferable horizontal
Fastening torque	$M_D = 5.5 \text{ Nm}$ (screw quality 8.8)
Weight: Hand lever	$m = 1,55 \text{ kg}$
Roller	$m = 1,50 \text{ kg}$

HYDRAULIC SPECIFICATIONS

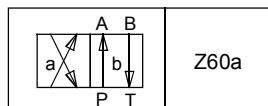
Fluid	Mineral oil, other fluid on request
Contamination efficiency	ISO 4406:1999, class 20/18/14 (Required filtration grade $\beta_{10\dots16} \geq 75$) refer to data sheet 1.0-50/2
Viscosity range	12 mm ² /s...320 mm ² /s
Fluid temperature	-20...+70 °C
Operating pressure in port P, A, B	$p_{\max} = 350 \text{ bar}$
Tank pressure in port T	$p_{\max} = 100 \text{ bar}$
Max. volume flow	$Q_{\max} = 60 \text{ l/min}$
Leakage volume flow	see characteristics

CONTROL MECHANICAL

Angle (Hand lever)	$\alpha_b = 7,7^\circ/\text{side}$
Stroke (roller)	$S_b = 2,7 \text{ mm}$
Force:	
– Hand lever	$F_b = 15 - 20 \text{ N}$
– roller	$F_b = 90 - 120 \text{ N}$

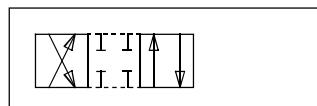
TYPE LIST / DESIGNATION OF SYMBOLS

4/2-way valve



Z60a

Transitional functions



Z60b

4/3-way valve

(only by hand lever operation)

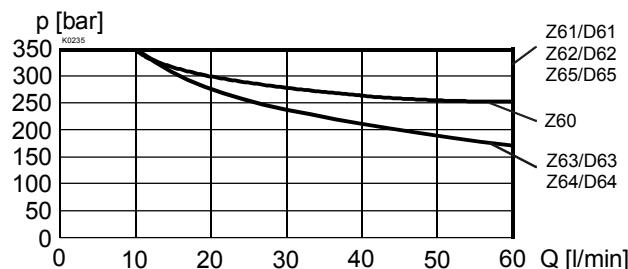
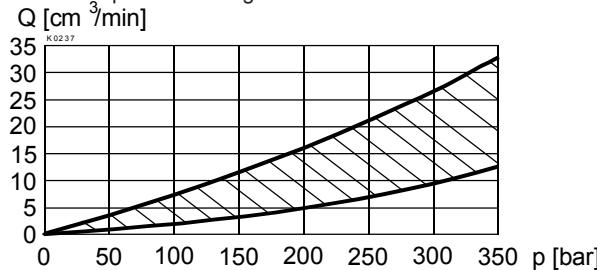
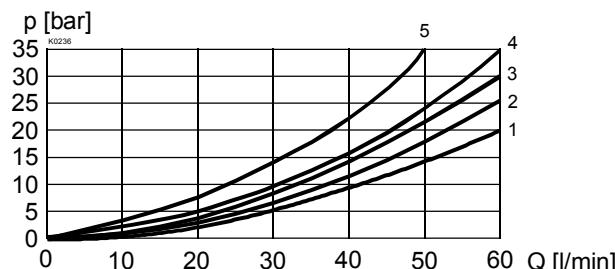
	A B a T P T	D61a
	A B a T P T	D61b
	A B a T P T	D62a
	A B a T P T	D62b
	A B a T P T	D63a
	A B a T P T	D63b
	A B a T P T	D64a
	A B a T P T	D64b
	A B a T P T	D65a
	A B a T P T	D65b

4/2-way valve

	A B a T P T	Z61a
	A B a T P T	Z62a
	A B a T P T	Z63a
	A B a T P T	Z64a
	A B a T P T	Z65a

Transitional functions

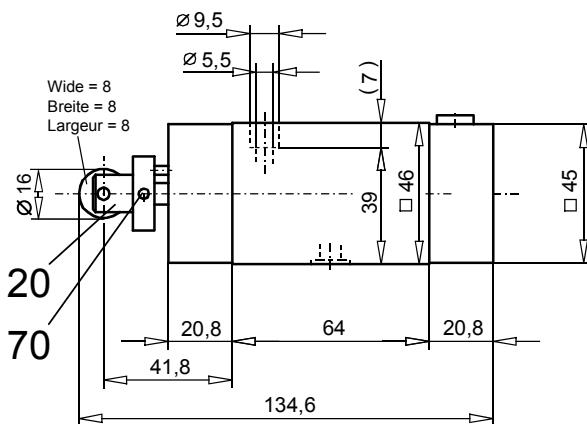
	Z61b
	Z62b
	Z63b
	Z64b
	Z65b

CHARACTERISTICS Oil viscosity $\nu = 30 \text{ mm}^2/\text{s}$
 $p = f(Q)$ Performance limits

 $Q_L = f(p)$ Leakage volume flow characteristics per control edge

 $\Delta p = f(Q)$ Pressure drop volume flow characteristics


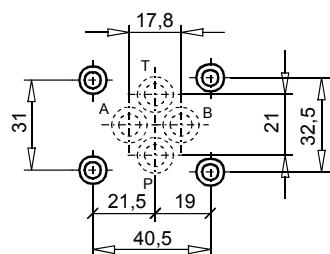
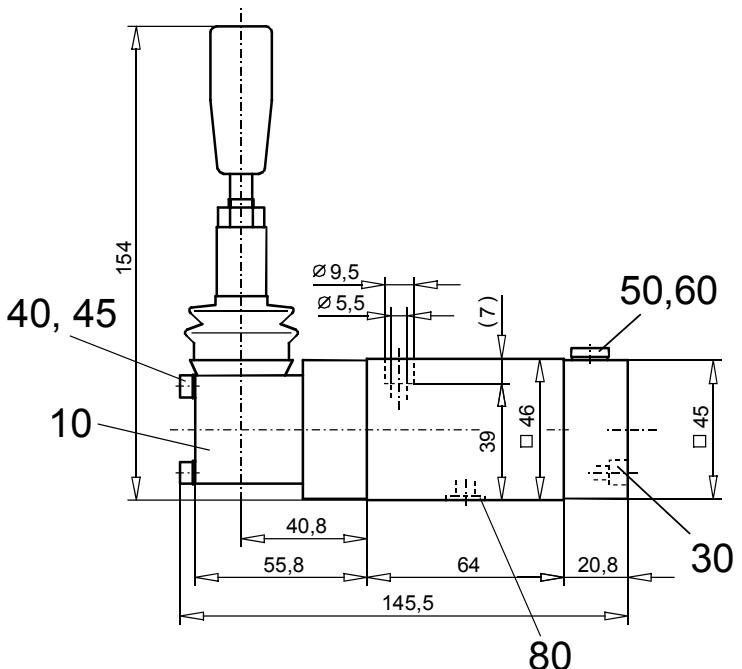
Symbol	Volume flow direction				
	P - A	P - B	P - T	A - T	B - T
Z60	3	3	-	4	4
D61/Z61	2	2	-	4	4
D62/Z62	3	3	-	4	4
D63/Z63	2	2	5	3	3
D64/Z64	1	1	-	3	3
D65/Z65	1	1	-	4	4

DIMENSIONS

Roller



Hand lever



PARTS LIST

Position	Article	Description
10	253.2000	Hand control head BH II
20	253.4100	Mechanical control head AT II
30	246.1120	Socket head cap screw M4x20 DIN 912
40	249.1000	Socket head cap screw M4x63
45	234.5040	Spring washer M4
50	238.0201	Plug screw galv. M8x1 DIN 908 (by spring centred version)
	239.2000	Plug screw (by dedented version)
60	49.1080	Cop. seal ring NG8x11,5x1 DIN 7603 (only by dedented version)
70	221.2272	Spring tension pin Ø 3x16 DIN1 481
80	160.2093	O-ring ID9,25x1,78

ACCESSORIES

Threaded connection plates, Multi-flange plates and longitudinal stacking system

register 2.9

Technical explanation see data sheet 1.0-100

Spool valve

Hand- or roller operated

- 4/2- and 4/3-way detented

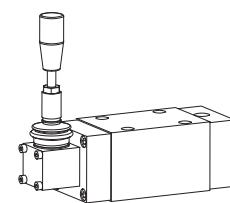
- 4/3-way with spring centred mid position

- 4/2-way with spring reset

- $Q_{\max} = 100 \text{ l/min}$, $p_{\max} = 350 \text{ bar}$

NG10

ISO 4401-05



DESCRIPTION

Spool valve NG10, flange type in accordance with ISO 4401-05 with 4 connections, directly operated by hand or roller, in 5 chamber system. The hand lever valve is available with locked spool or with spring reset. The dancing roller valve only has a spring reset facility. Precise spool fit, little leakage, long life. Threaded connection by means of additional connecting plate. Hardened steel spool, the valve body being made from a high quality casting suitable for hydraulic applications. The valve body is painted, the end cover and lever housing are phosphatised.

FUNCTION

When actuated, the lever or roller displaces the spool to the corresponding switching position.

- 4/2- and 4/3-way manual valves with spring, 1 lever and 2 or 3 switching positions. The spring presses the spool back into the home position.

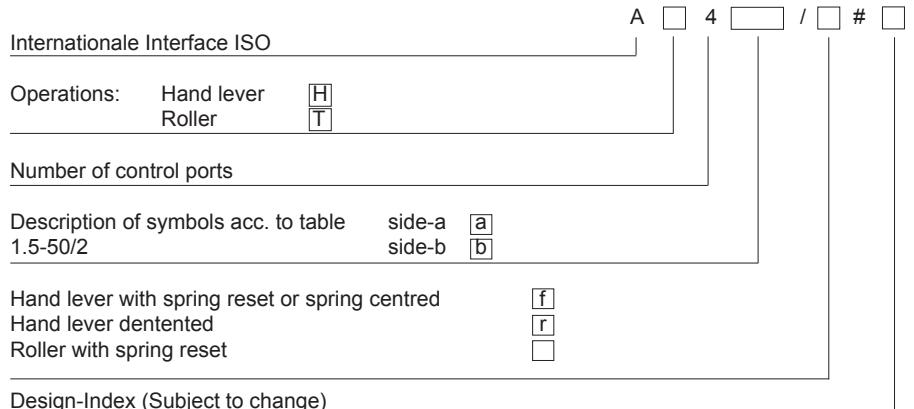
- 4/2- and 4/3-way manual lever valve with lock, 1 lever and 2 or 3 switching positions. The lock holds the spool in the last position selected.

- 4/2-way dancing roller valve, 1 dancing roller and 2 switching positions. The spring presses the spool back to the starting position.

APPLICATION

Mechanically operated spool valves are mainly used to control the direction of movement and retain hydraulic cylinders and motors. The direction of movement is determined by the position of the valve spool and its symbol. Mechanically operated valves are particularly suitable for use in installations where no control current is available or for applications in areas where there is a risk of explosion (chemical industry, tunnel construction).

TYPE CODE



GENERAL SPECIFICATIONS

Description	4/2-, 4/3-way-valve
Nominal size	NG10 to ISO 4401-05
Construction	Direct operated spool valve
Operations	Hand operated (hand lever) or roller
Mounting	Flange 4 fixing holes for socket head cap screws M6 x 65
Connections	Threaded connection plates Multi-flange plates, Manifolds Longitudinal stacking system
Ambient temperature	-20...50°C
Mounting position	any, preferable horizontal
Fastening torque	$M_D = 9.5 \text{ Nm}$ (screw quality 8.8)
Weight:	$m = 3,4 \text{ kg}$

HYDRAULIC SPECIFICATIONS

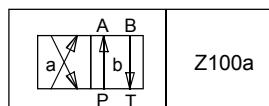
Fluid	Mineral oil, other fluid on request
Contamination efficiency	ISO 4406:1999, class 20/18/14 (Required filtration grade $\beta_{10\dots16} \geq 75$) refer to data sheet 1.0-50/2
Viscosity range	$12 \text{ mm}^2/\text{s} \dots 320 \text{ mm}^2/\text{s}$
Fluid temperature	-20...+70 °C
Operating pressure in port P, A, B	$p_{\max} = 350 \text{ bar}$
Tank pressure in port T	$p_{\max} = 100 \text{ bar}$
Max. volume flow	$Q_{\max} = 100 \text{ l/min}$ (see characteristics) see characteristics
Leakage volume flow	

CONTROL MECHANICAL

Angle (Hand lever)	$\alpha_b = 10.8^\circ/\text{Seite}$
Stroke (roller)	$S_b = 3.8 \text{ mm}$
Forces:	
- Hand lever	$F_b = 16 \dots 30 \text{ N}$
- roller	$F_b = 100 \dots 180 \text{ N}$

TYPE LIST / DESIGNATION OF SYMBOLS

4/2-way valve



Z100a

Transitional functions



Z100b

4/3-way valve

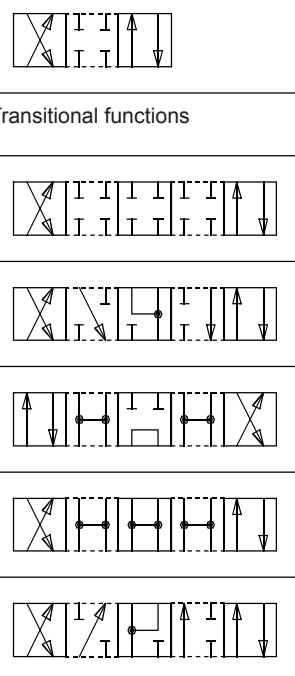
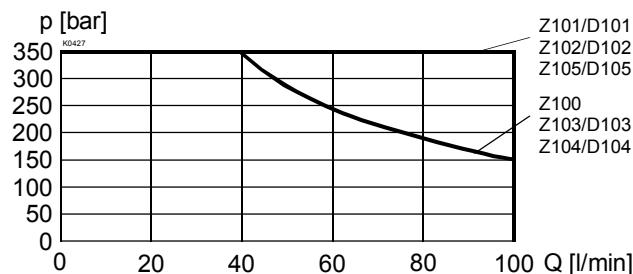
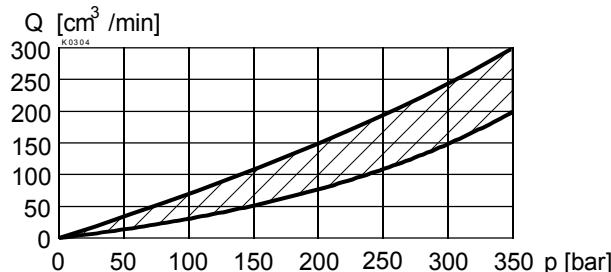
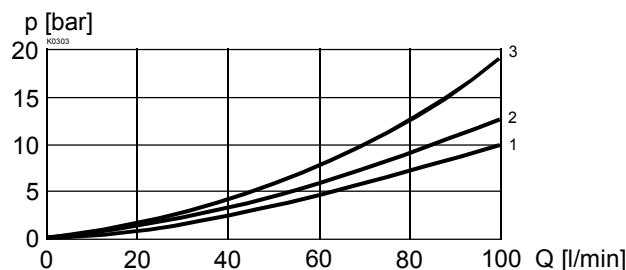
(only by hand lever operation)

	A B a T o T b P T	D101a D101b
	A B a T o T b P T	D102a D102b
	A B a T o T b P T	D103a D103b
	A B a T o T b P T	D104a D104b
	A B a T o T b P T	D105a D105b

4/2-way valve

	A B a T b P T	Z101a
	A B a T b P T	Z102a
	A B a T b P T	Z103a
	A B a T b P T	Z104a
	A B a T b P T	Z105a

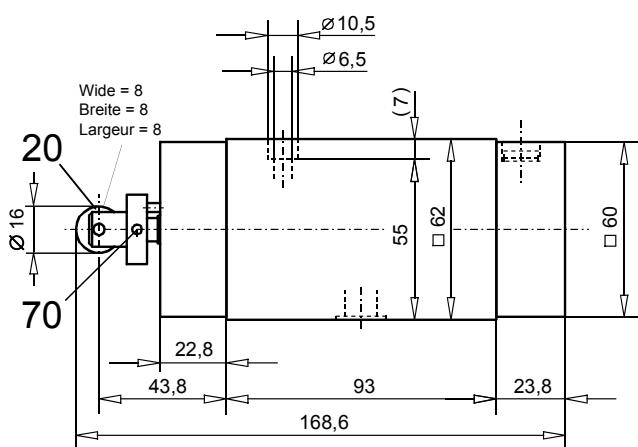
Transitional functions


CHARACTERISTICS Oil viscosity $\nu = 30 \text{ mm}^2/\text{s}$
 $p = f(Q)$ Performance limits

 $Q_L = f(p)$ Leakage volume flow characteristics per control edge

 $\Delta p = f(Q)$ Pressure drop volume flow characteristics


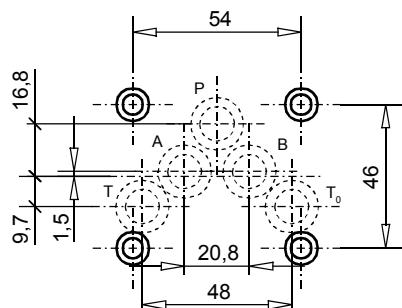
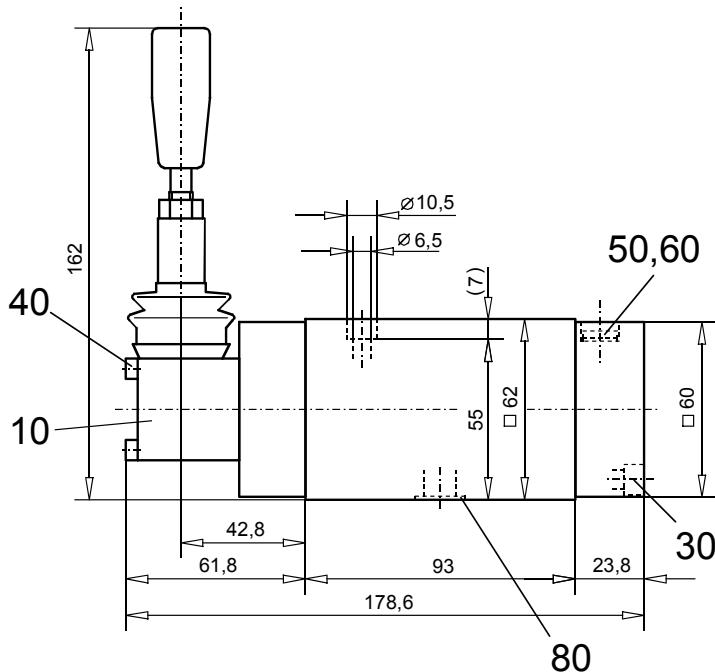
Pressure drop curve no.	Volume flow direction				
	P - A	P - B	P - T	A - T	B - T
Z100/J100	2	2	-	2	2
D101/Z101	2	2	-	2	2
D102/Z102	2	2	-	1	1
D103/Z103	2	2	3	2	2
D104/Z104	1	1	-	1	1
D105/Z105	1	1	-	2	2

DIMENSIONS

Roller



Hand lever


PARTS LIST

Position	Article	Description
10	253.2000	Hand control head BH II
20	253.4100	Mechanical control head AT II
30	246.3125	Socket head cap screw M6x25 DIN 912
40	246.1140	Socket head cap screw M4x40 DIN 912
50	238.0201 239.2000	Plug screw M8x1 DIN 908 (by spring centred version) Plug screw (by dedented version)
60	049.1080	Cop. seal ring NG 8x11,5x1 DIN 7603 (only by dedented version)
70	221.2271	Spring tension pin Ø 3x16 DIN 1481
80	160.2140	O-ring ID14,00x1,78

ACCESSORIES

 Threaded connection plates, Multi-flange plates
and longitudinal stacking system

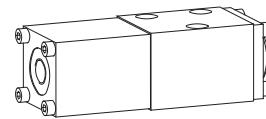
register 2.9

Technical explanation see data sheet 1.0-100

Spool valve pneumatically operated

- 4/2-way impuls version
- 4/3-way with spring centered mid position
- 4/2-way with spring reset
- $Q_{\max} = 8 \text{ l/min}$, $p_{\max} = 350 \text{ bar}$

NG3-Mini®



DESCRIPTION

Spool valve NG3-Mini, flange type in accordance to Wandfluh standard with 4 connections. Directly and pneumatically operated spool valve in a 5 chamber system. Spool blocked or with spring reset. Spool type pneumatic head, precise spool fit, small leakage, long life. Threaded connection by means of additional connecting plate. Spool made from hardened steel, the valve body is made from a high quality casting suitable for hydraulic applications. The valve bodies are painted. The end covers and the pneumatic heads are zinc coated.

FUNCTION

When actuated, the pneumatic head displaces the valve spool to the corresponding switching position.

• 4/2-way impulse spool valve:

2 pneumatic head and 2 locking switch positions. When the pneumatic head is not actuated, the spool is held by the lock in the corresponding switching position.

• 4/3-way spool valve:

2 pneumatic heads and 3 switching position. When the air head is not actuated, the spool is switched back to the centre position via the springs.

• 4/2-way spool valves:

1 pneumatic head and 2 switching positions. When the pneumatic head is not actuated, the spool is switched back to the home position by the spring.

APPLICATION

Pneumatically operated spool valves are mainly used to control the direction of movement and for retaining hydraulic cylinders and motors. The direction of movement is determined by the position of the valve spool and its symbol. Pneumatically operated valves are particularly suitable for use in areas where there is a risk of explosion in the chemical or mining industries and also in industrial installations where compressed air is used. The Mini-3 valves are intended for applications where both the dimensions and weight should be reduced as much as possible or for the pilot control of larger valves.

CONTENTS

GENERAL SPECIFICATIONS.....	1
HYDRAULIC SPECIFICATIONS.....	1
CONTROL PNEUMATIC	1
TYPE CHARTS / SYMBOLS	2
CHARACTERISTICS.....	2
DIMENSIONS.....	3
PARTS LIST	3
ACCESSORIES.....	3

TYPE CODE

WD	L	F	A03	-	<input type="checkbox"/>	#	<input type="checkbox"/>
Spool valve direct operated							
Pneumatically							
Flange construction							
Mounting interface NG3-Mini							
Symbols accord. to table on page 1.6-15/2							
Design-Index (Subject to change)							

GENERAL SPECIFICATIONS

Description	4/2-, 4/3-way valve
Nominal size	NG3-Mini to Wandfluh standard
Construction	Direct operated spool valve
Operations	Pneumatically
Mounting	Flange
Connections	3 fixing holes for socket head cap screws M4x30 Threaded connection plates Multi-flange plates, Manyfolds Longitudinal stacking system
Ambient temperature	-20...50°C
Mounting position	any, preferably horizontal
Fastening torque	$M_D = 2,8 \text{ Nm}$ (screw quality 8.8)
Weight:	
4/2-way Impuls	$m = 0,57 \text{ kg}$
4/3-way	$m = 0,57 \text{ kg}$
4/2-way (1 control head)	$m = 0,42 \text{ kg}$

HYDRAULIC SPECIFICATIONS

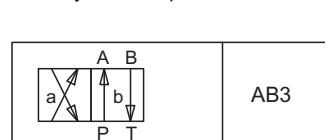
Fluid	Mineral oil, other fluid on request
Contamination efficiency	ISO 4406:1999, class 20/18/14 (Required filtration grade $\beta_{10} \dots 16 \geq 75$) refer to data sheet 1.0-50/2
Viscosity range	$12 \text{ mm}^2/\text{s} \dots 320 \text{ mm}^2/\text{s}$
Fluid temperature	-20...+70°C
Operating pressure in Port P, A, B	$p_{\max} = 350 \text{ bar}$ ($p_T < 20 \text{ bar}$) $p_{\max} = 315 \text{ bar}$ ($p_T > 20 \text{ bar}$)
Tank pressure in tank T	$p_{T\max} = 100 \text{ bar}$
Max. volume flow	$Q_{\max} = 8 \text{ l/min}$, see characteristics
Leakage volume flow	see characteristics

CONTROL PNEUMATIC operated with control head CK III

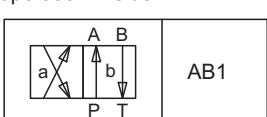
Min. pilot pressure	$p_{st, min} = 2 \text{ bar}$ by $p_T = 20 \text{ bar}$ $p_{st, min} = 5 \text{ bar}$ by $p_T = 100 \text{ bar}$
Control volume	$V_{st} = 2 \text{ cm}^3$

TYPE LIST / DESIGNATION OF SYMBOLS

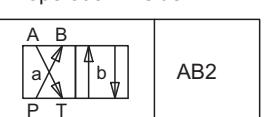
4/2-way valve impulse



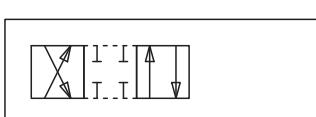
AB3

 4/2-way valve with spring reset
 operation A-side


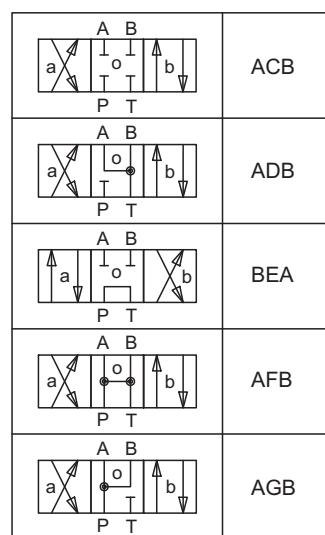
AB1

 Transitional functions
 operation B-side


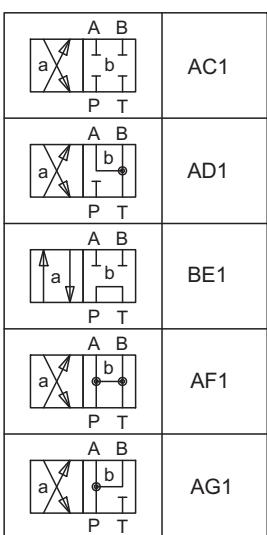
AB2



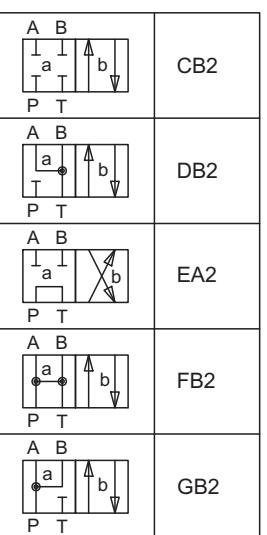
4/3-way valve spring centered



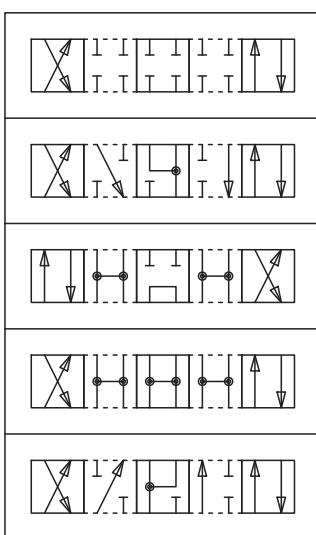
ACB



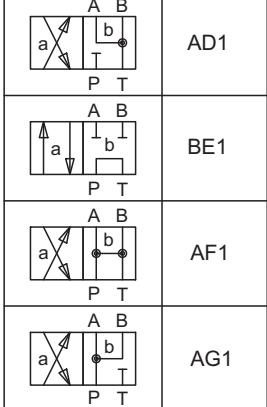
AC1



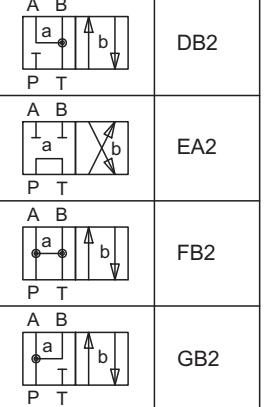
CB2



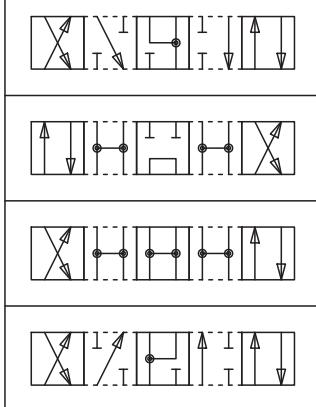
ADB



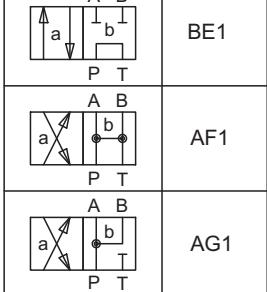
AD1



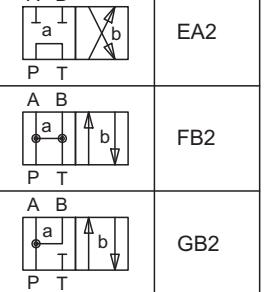
DB2



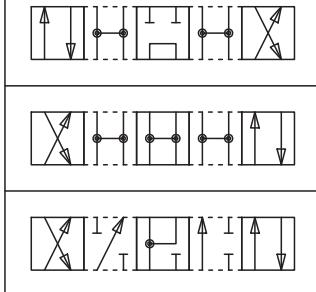
BEA



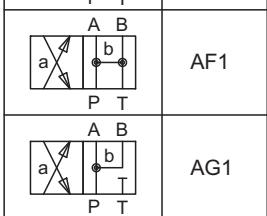
BE1



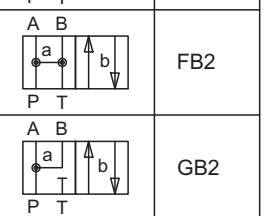
EA2



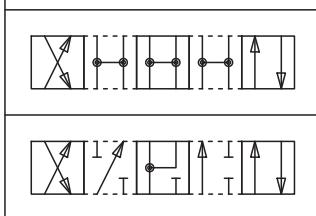
AFB



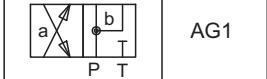
AF1



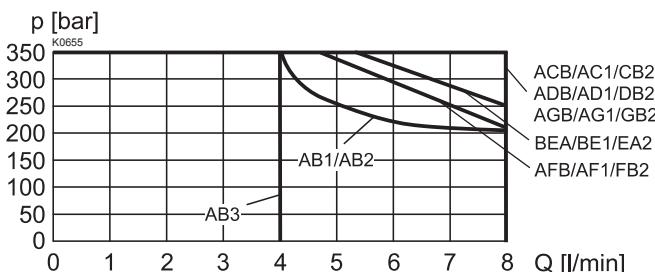
FB2

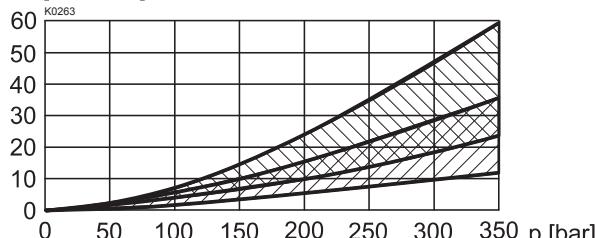


AGB



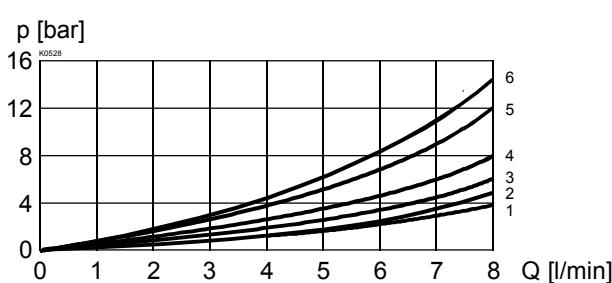
AG1

 CHARACTERISTICS Ölviscosity $\nu = 30 \text{ mm}^2/\text{s}$
 $p = f(Q)$ Performance limits

 $Q_L = f(p)$ Leakage volume flow characteristics per control edge

 $Q [\text{cm}^3/\text{min}]$


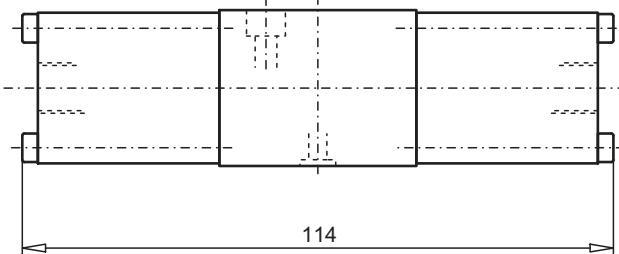
Leakage envelope AB1/ACB/ADB/AFB/AGB

Leakage envelope BEA

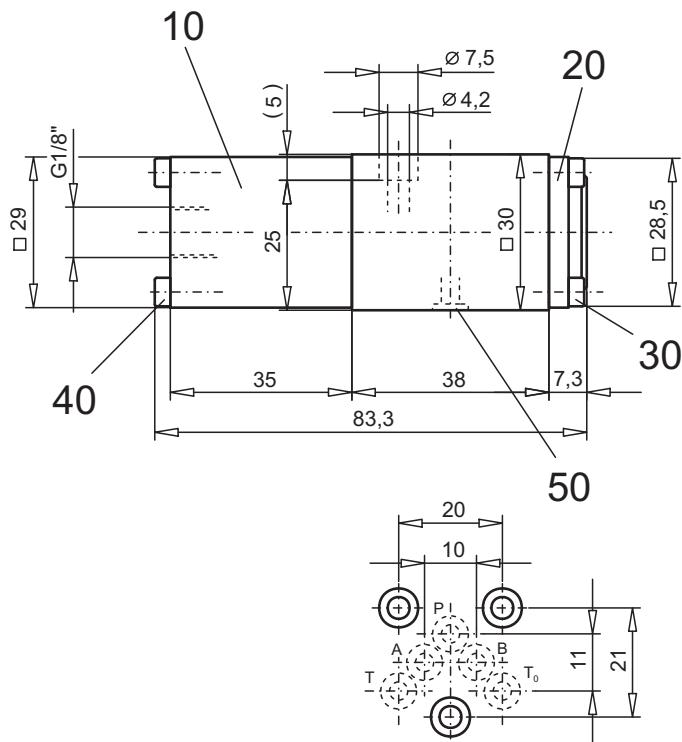
 $\Delta p = f(Q)$ Pressure drop volume flow characteristics


Symbol	Pressure drop Curve no.				
	P - A	P - B	P - T	A - T	B - T
AB1/AB2/AB3	4	4	-	3	3
ACB/AC1/CB2	4	4	-	2	2
ADB/AD1/DB2	3	3	-	2	2
BEA/BE1/EA2	6	6	4	5	5
AFB/AF1/FB2	2	2	1	2	2
AGB/AG1/GB2	3	3	-	3	3

DIMENSIONS

 4/3-way valve (spring centred)
 4/2-way valve (impulse)


4/2-way valve (spring reset)


PARTS LIST

Position	Article	Description
10	254.1000	Control head CKIII
20	056.4200	Cover
30	246.0141	Socket head cap screw M3x40 DIN 912
40	246.0109	Socket head cap screw M3x8 DIN 912
50	160.2045	O-ring ID 4,5x1,5

ACCESSORIES

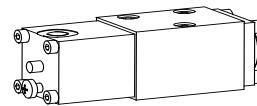
 Threaded connection plates, Multi-flange plates
 and longitudinal stacking system

register 2.9

Technical explanation see data sheet 1.0-100E

Spool valve pneumatically operated

- 4/2-way impuls version detented
- 4/3-way with spring centered mid position
- 4/2-way with spring reset
- $Q_{\max} = 20 \text{ l/min}$, $p_{\max} = 315 \text{ bar}$

NG4-Mini®

DESCRIPTION

Spool valve NG4-Mini, flange type in accordance to Wandfluh standard with 4 connections. Directly and pneumatically operated spool valve in a 5 chamber system. Spool blocked or with spring reset. Spool type pneumatic head, precise spool fit, small leakage, long life. Threaded connection by means of additional connecting plate. Spool made from hardened steel, the valve body is made from a high quality casting suitable for hydraulic applications. The valve bodies are painted. The end covers and the pneumatic heads are zinc coated.

FUNCTION

When actuated, the pneumatic head displaces the valve spool to the corresponding switching position.

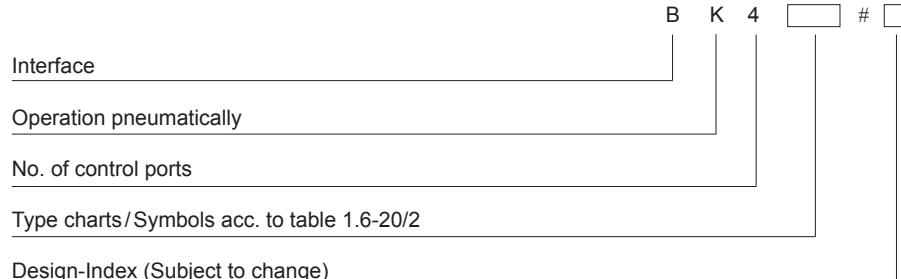
- 4/2-way impulse spool valve:
2 pneumatic head and 2 locking switch positions. When the pneumatic head is not actuated, the spool is held by the lock in the corresponding switching position.
- 4/3-way spool valve:
2 pneumatic heads and 3 switching position. When the air head is not actuated, the spool is switched back to the centre position via the springs.
- 4/2-way spool valves:
1 pneumatic head and 2 switching positions. When the pneumatic head is not actuated, the spool is switched back to the home position by the spring.

APPLICATION

Pneumatically operated spool valves are mainly used to control the direction of movement and for retaining hydraulic cylinders and motors. The direction of movement is determined by the position of the valve spool and its symbol. Pneumatically operated valves are particularly suitable for use in areas where there is a risk of explosion in the chemical or mining industries and also in industrial installations where compressed air is used. The Mini-4 valves are intended for applications where both the dimensions and weight should be reduced as much as possible or for the pilot control of larger valves.

CONTENT

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HYDRAULIC SPECIFICATIONS	1
CONTROL PNEUMATIC	1
TYPE CHARTS/SYMBOLS	2
CHARACTERISTICS.....	2
DIMENSIONS.....	3
PARTS LIST	3
ACCESSORIES.....	3

TYPE CODE

GENERAL SPECIFICATIONS

Description	4/2-, 4/3-way valve
Nominal size	NG4-Mini to Wandfluh standard
Constructions	Direct operated spool valve
Operations	Pneumatically
Mounting	Flange
Connections	3 fixing holes for socket head cap screws M5x40 Threaded connection plates Multi-flange plates Longitudinal stacking system
Ambient temperature	-20...50°C
Mountin position	any, preferably horizontal
Fastening torque	$M_D = 5,5 \text{ Nm}$ (screw quality 8.8)
Weight:	
4/2-way Impuls	$m = 1,04 \text{ kg}$
4/3-way	$m = 1,04 \text{ kg}$
4/2-way (1 control head)	$m = 0,84 \text{ kg}$

HYDRAULIC SPECIFICATIONS

Fluid	Mineral oil, other fluid on request
Contamination efficiency	ISO 4406:1999, class 20/18/14 (Required filtration grade $\beta_{10\dots16} \geq 75$) refer to data sheet 1.0-50/2
Viscosity range	12 mm²/s...320 mm²/s
Fluid temperature	-20...+70 °C
Operating pressure	
in port P, A, B	$p_{\max} = 315 \text{ bar}$
Tank pressure	
in port T	$p_{\max} = 100 \text{ bar}$
Max. Volume flow	$Q_{\max} = 20 \text{ l/min}$, see characteristics
Leakage volume flow	see characteristics

CONTROL PNEUMATIC operated with control head

Min. pilot pressure	$p_{st, \min} = 2,5 \text{ bar}$ at $p_T = 20 \text{ bar}$
	$p_{st, \min} = 5 \text{ bar}$ at $p_T = 100 \text{ bar}$
Control volume	$V_{st} = 2,5 \text{ cm}^3$

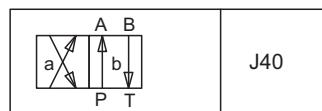
TYPE LIST / DESIGNATION OF SYMBOLS

4/2-way valve impulse

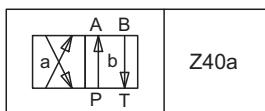
 4/2-way valve with spring reset
 operation A-side

operation B-side

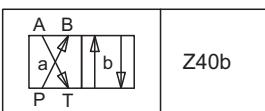
Transitional functions



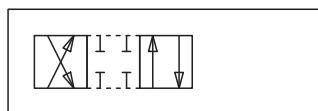
J40



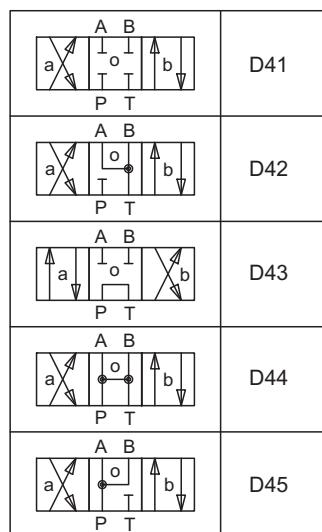
Z40a



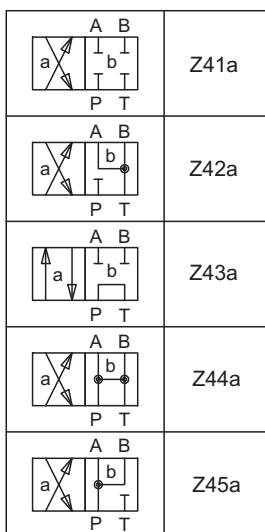
Z40b



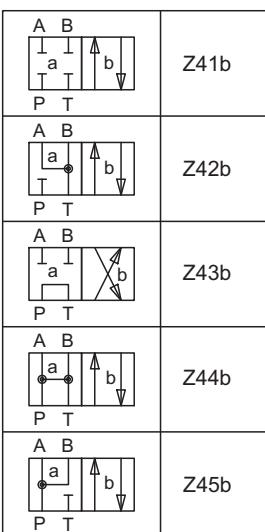
4/3-way valve spring centered



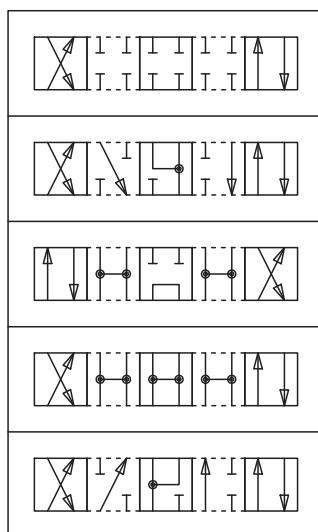
D41



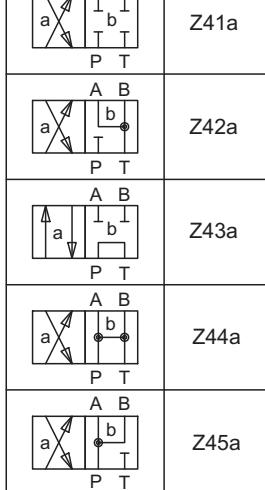
Z41a



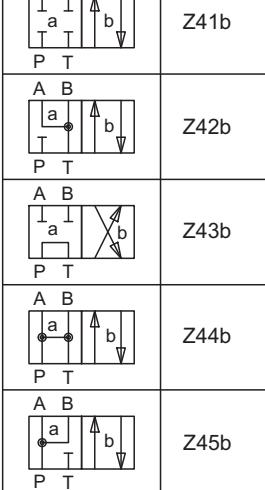
Z41b



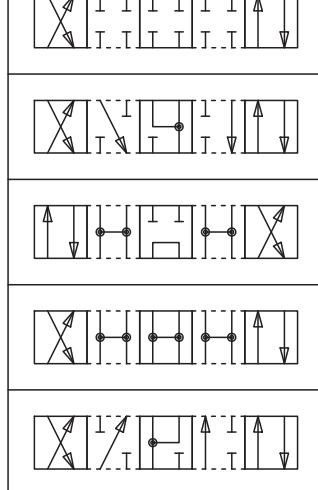
D42



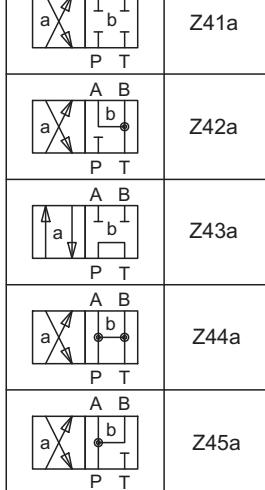
Z42a



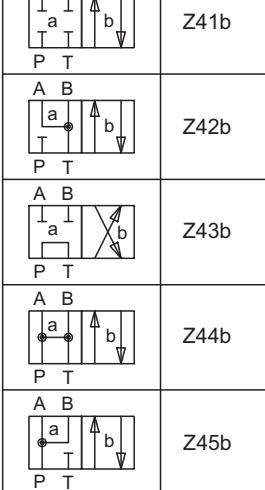
Z42b



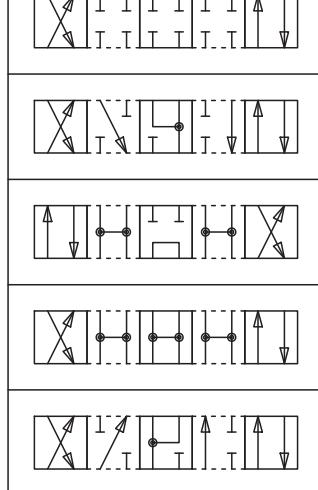
D43



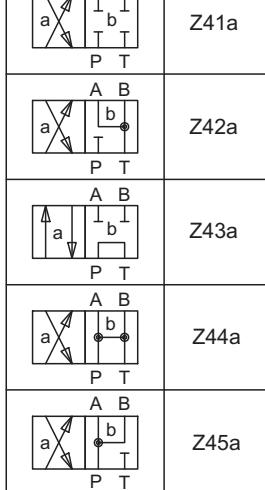
Z43a



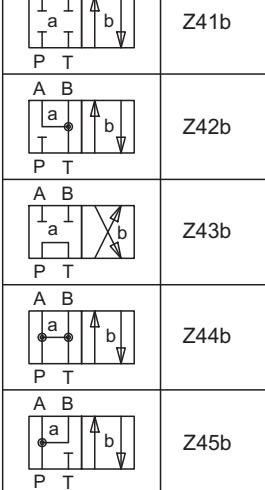
Z43b



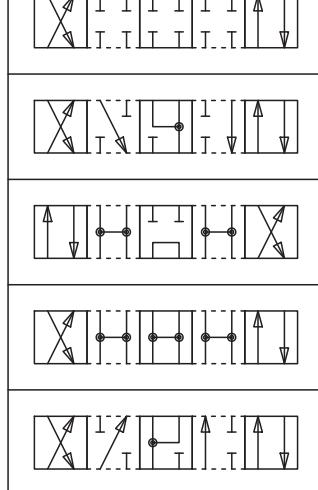
D44



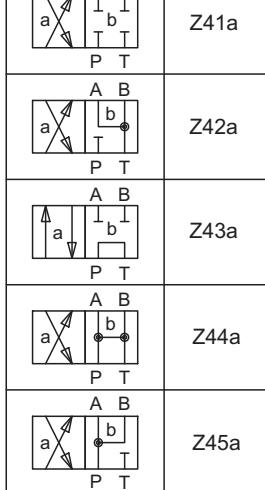
Z44a



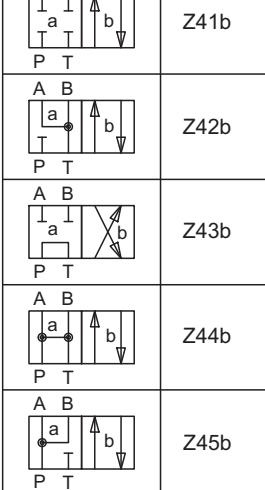
Z44b



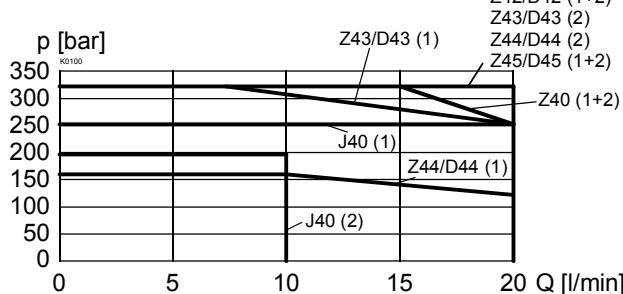
D45



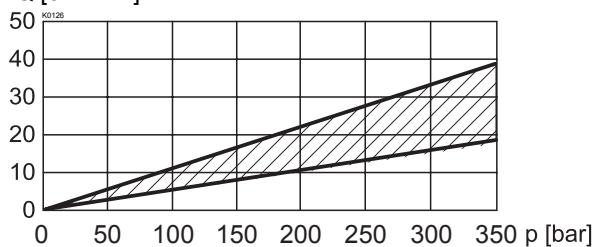
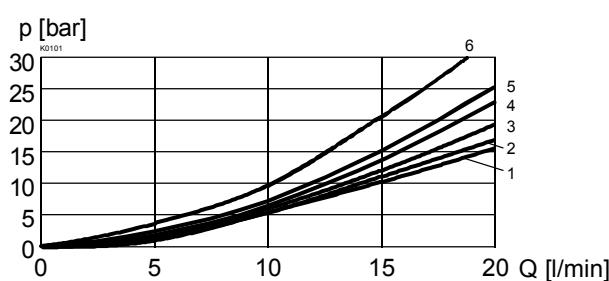
Z45a



Z45b

CHARACTERISTICS Oil viscosity $\nu = 30 \text{ mm}^2/\text{s}$
 $p = f(Q)$ Performance limits

 (1) $p_V = 2,5 \text{ bar}; p_T = 20 \text{ bar}$

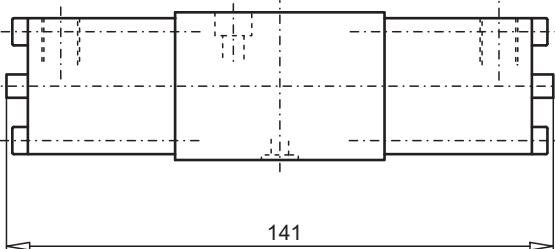
 (2) $p_V = 5 \text{ bar}; p_T = 160 \text{ bar}$
 $Q_L = f(p)$ Leakage volume flow characteristics per control edge

 $Q [\text{cm}^3/\text{min}]$

 $\Delta p = f(Q)$ Pressure drop volume flow characteristics


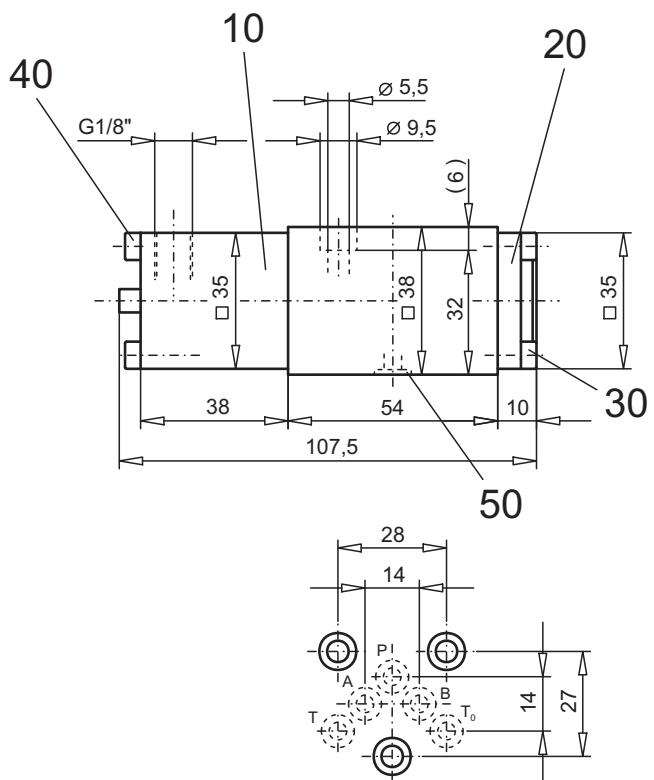
Pressure drop Curve no. Symbol	Volume flow direction				
	P - A	P - B	P - T	A - T	B - T
Z40/J40	5	5	-	2	2
D41/Z41	5	5	-	2	2
D42/Z42	5	5	-	1	1
D43/Z43	4	4	6	2	2
D44/Z44	4	4	3	2	2
D45/Z45	4	4	-	2	2

DIMENSIONS

4/3-way valve (spring centred)
 4/2-way valve (impulse)



4/2-way valve (spring reset)


PARTS LIST

Position	Article	Description
10	254.2000	Control head BKII
20	057.4202	Cover
30	246.1113	Socket head cap screw M4x12 DIN 912
40	246.1146	Socket head cap screw M4x45 DIN 912
50	160.2052	O-ring ID 5,28x1,78

ACCESSORIES

Threaded connection plates, Multi-flange plates
 and longitudinal stacking system

register 2.9

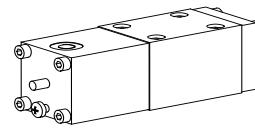
Technical explanation see data sheet 1.0-100

Spool valve pneumatically operated

- 4/2-way impuls version detended
- 4/3-way with spring centered mid position
- 4/2-way with spring reset
- $Q_{\max} = 60 \text{ l/min}$, $p_{\max} = 350 \text{ bar}$

NG6

ISO 4401-03


DESCRIPTION

Spool valve NG6, flange type in accordance to ISO 4401-03 standard with 4 connections. Directly and pneumatically operated spool valve in a 5 chamber system. Spool blocked or with spring reset. Spool type pneumatic head, precise spool fit, small leakage, long life. Threaded connection by means of additional connecting plate. Spool made from hardened steel, the valve body is made from a high quality casting suitable for hydraulic applications. The valve bodies are painted. The end covers and the pneumatic heads are zinc coated.

FUNCTION

When actuated, the pneumatic head displaces the valve spool to the corresponding switching position.

- 4/2-way impulse spool valve:

2 pneumatic head and 2 locking switch positions. When the pneumatic head is not actuated, the spool is held by the lock in the corresponding switching position.

- 4/3-way spool valve:

2 pneumatic heads and 3 switching position. When the air head is not actuated, the spool is switched back to the centre position via the springs.

- 4/2-way spool valves:

1 pneumatic head and 2 switching positions. When the pneumatic head is not actuated, the spool is switched back to the home position by the spring.

APPLICATION

Pneumatically operated spool valves are mainly used to control the direction of movement and for retaining hydraulic cylinders and motors. The direction of movement is determined by the position of the valve spool and its symbol. Pneumatically operated valves are particularly suitable for use in areas where there is a risk of explosion in the chemical or mining industries and also in industrial installations where compressed air is used.

CONTENT

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CONTROL PNEUMATIC	1
TYPE CHARTS/SYMBOLS	2
CHARACTERISTICS.....	2
DIMENSIONS.....	3
PARTS LIST	3
ACCESSORIES.....	3

TYPE CODE

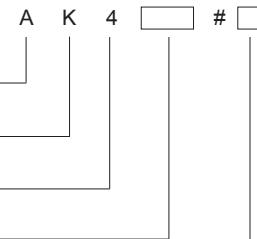
International interface ISO

Operation pneumatically

No. of control ports

Type charts/Symbols acc. to table 1.6-30/2

Design-Index (Subject to change)


GENERAL SPECIFICATIONS

Description	4/2-, 4/3-way valve
Nominal size	NG6 to ISO 4401-03
Constructions	Direct operated spool valve
Operations	Pneumatically
Mounting	Flange
Connections	4 fixing holes for socket head cap screws M5x45 Threaded connection plates Multi-flange plates Longitudinal stacking system
Ambient temperature	-20...50°C
Mountin position	any, preferably horizontal
Fastening torque	$M_D = 5,5 \text{ Nm}$ (screw quality 8.8)
Weight:	
4/2-way impuls	$m = 2,0 \text{ kg}$
4/3-way	$m = 2,0 \text{ kg}$
4/2-way (1 control head)	$m = 1,6 \text{ kg}$

HYDRAULIC SPECIFICATIONS

Fluid	Mineral oil, other fluid on request
Contamination efficiency	ISO 4406:1999, class 20/18/14 (Required filtration grade $\beta_{10...16} \geq 75$) refer to data sheet 1.0-50/2
Viscosity range	12 mm ² /s...320 mm ² /s
Fluid temperature	-20...+70 °C
Operating pressure in port P, A, B	$p_{\max} = 350 \text{ bar}$
Tank pressure in port T	$p_{\max} = 200 \text{ bar}$
Max. Volume flow	$Q_{\max} = 60 \text{ l/min}$, see characteristics
Leakage volume flow	see characteristics

CONTROL PNEUMATIC operated with control head

Min. pilot pressure	$p_{st, \min} = 1,5 \text{ bar}$ at $p_T = 20 \text{ bar}$
	$p_{st, \min} = 5 \text{ bar}$ at $p_T = 200 \text{ bar}$
Control volume	$V_{st} = 6,9 \text{ cm}^3$

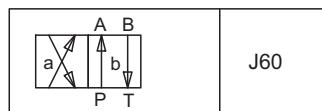
TYPE LIST / DESIGNATION OF SYMBOLS

4/2-way valve impulse

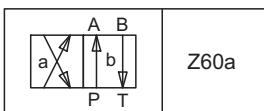
 4/2-way valve with spring reset
 operation A-side

operation B-side

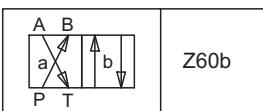
Transitional functions



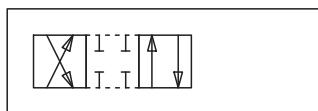
J60



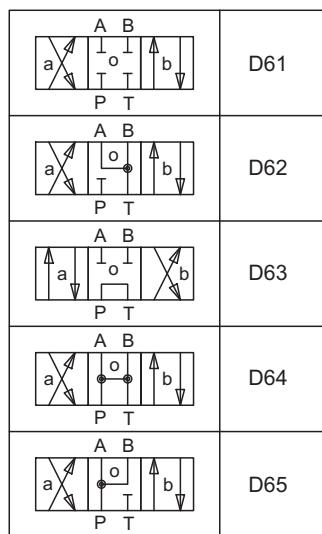
Z60a



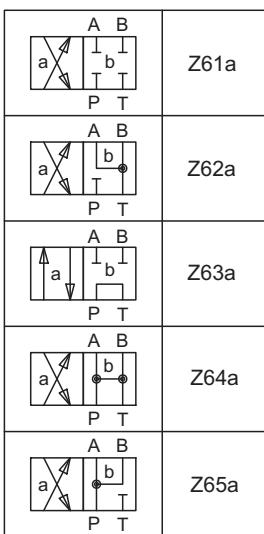
Z60b



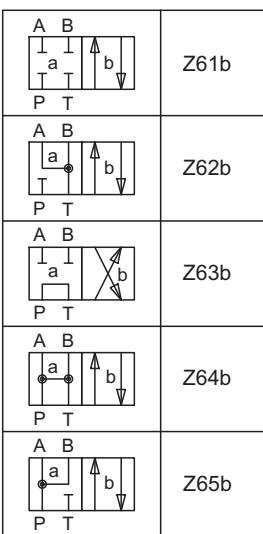
4/3-way valve spring centered



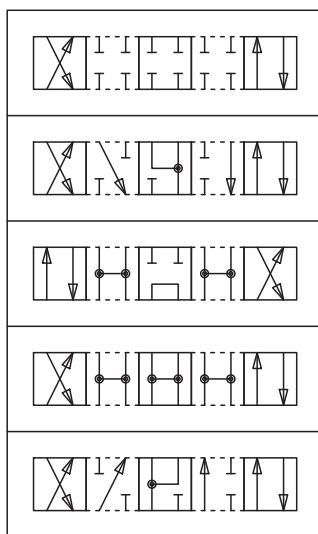
D61



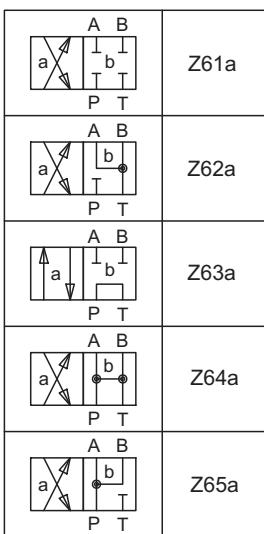
Z61a



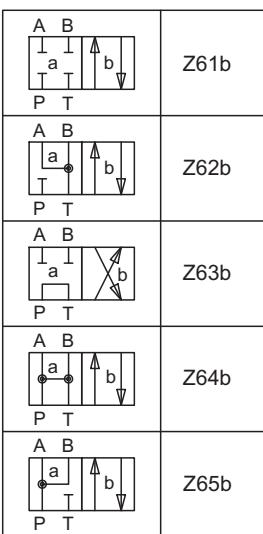
Z61b



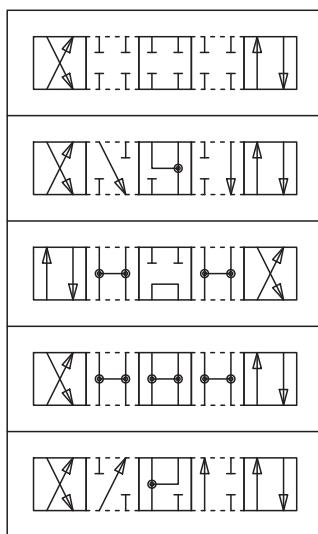
D62



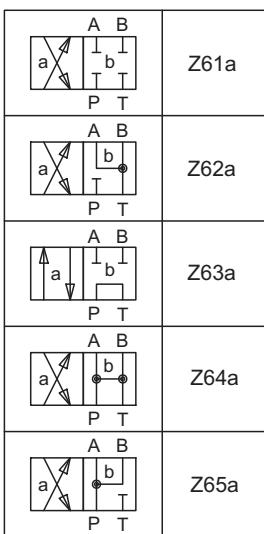
Z62a



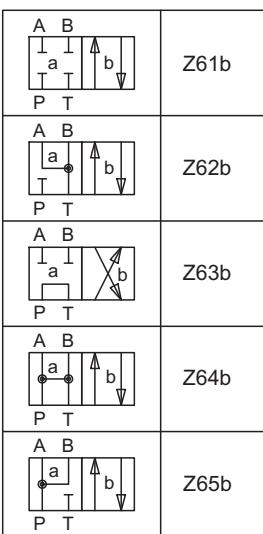
Z62b



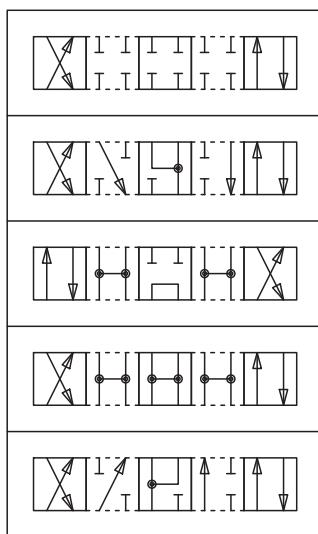
D63



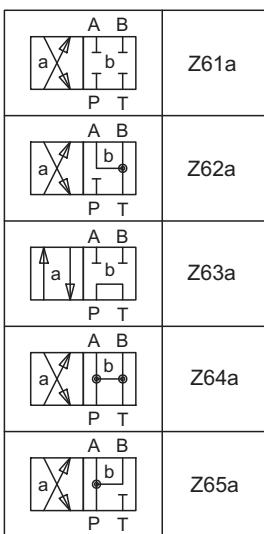
Z63a



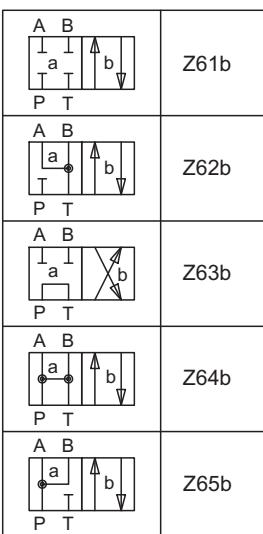
Z63b



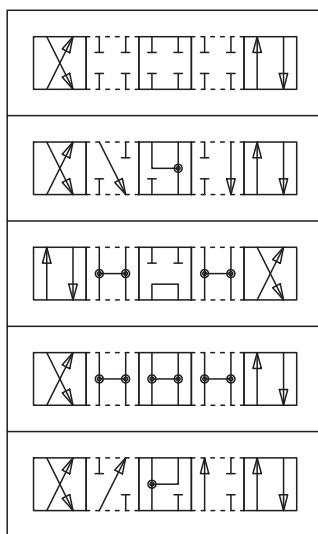
D64



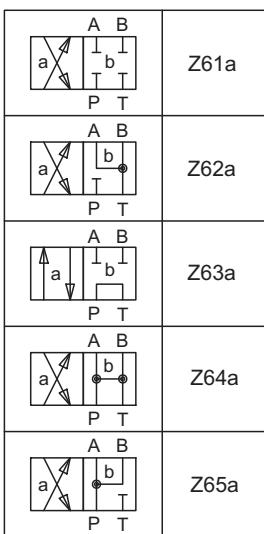
Z64a



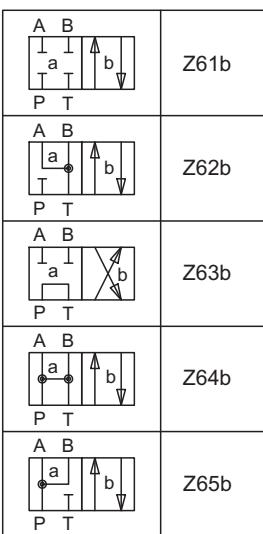
Z64b



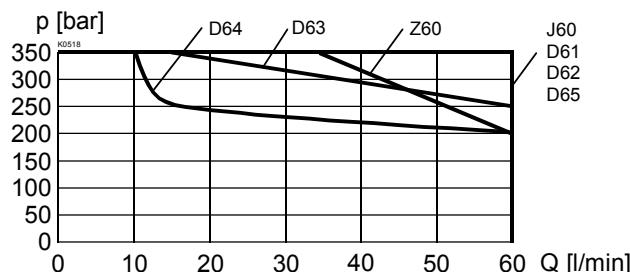
D65

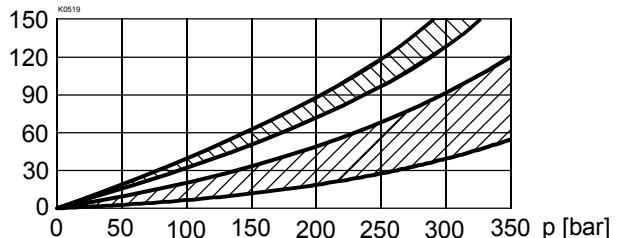


Z65a

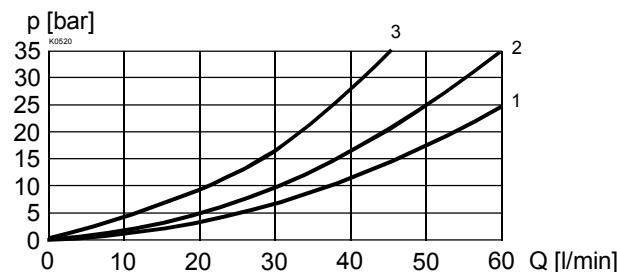


Z65b

CHARACTERISTICS Oil viscosity $\nu = 30 \text{ mm}^2/\text{s}$
 $p = f(Q)$ Performance limits

 $Q_L = f(p)$ Leakage volume flow characteristics per control edge

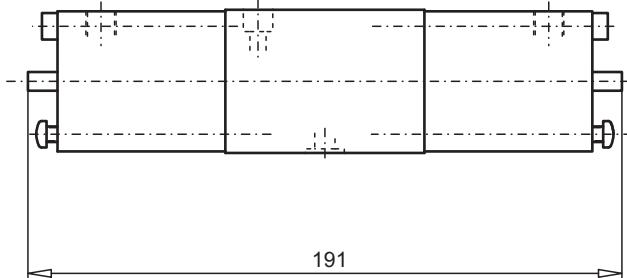
 Q [cm^3/min]


- Leakage envelope J60/Z60/D61/D62/D64/D65
- Leakage envelope D63

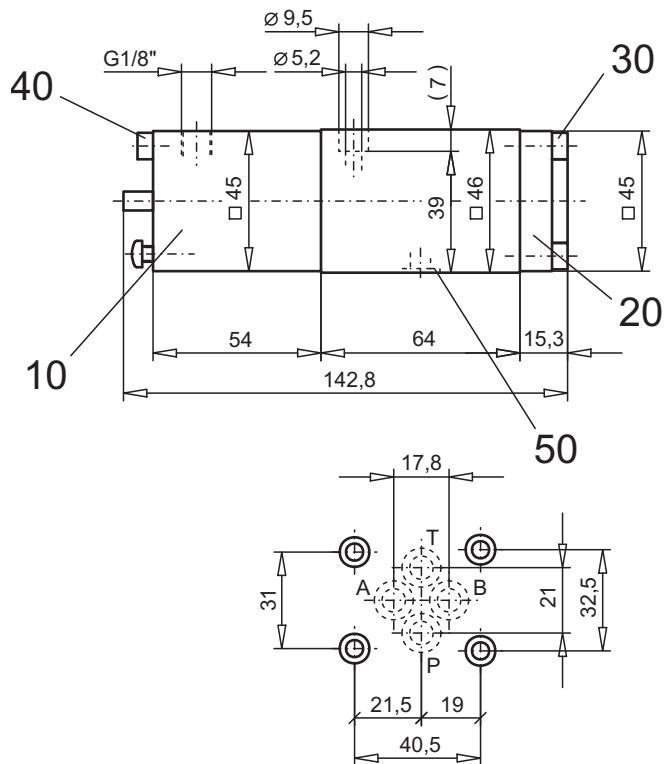
 $\Delta p = f(Q)$ Pressure drop volume flow characteristics


Pressure drop Curve no. Symbol	Volume flow direction				
	P - A	P - B	P - T	A - T	B - T
Z60/J60	2	2	-	2	2
D61/Z61	2	2	-	2	2
D62/Z62	2	2	-	2	2
D63/Z63	2	2	3	2	2
D64/Z64	1	1	-	1	1
D65/Z65	1	1	-	2	2

DIMENSIONS

 4/3-way valve (spring centred)
 4/2-way valve (impulse)


4/2-way valve (spring reset)


PARTS LIST

Position	Article	Description
10	254.4050	Control head CKII
20	058.4211	Cover
30	246.2117	Socket head cap screw M5x16 DIN 912
40	246.2160	Socket head cap screw M5x60 DIN 912
50	160.2093	O-ring ID 9,25x1,78

ACCESSORIES

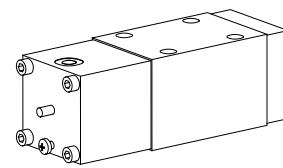
 Threaded connection plates, Multi-flange plates
 and longitudinal stacking system

register 2.9

Technical explanation see data sheet 1.0-100

Spool valve pneumatically operated

- 4/2-way impuls version detended
- 4/3-way with spring centered mid position
- 4/2-way with spring reset
- $Q_{\max} = 80 \text{ l/min}$, $p_{\max} = 350 \text{ bar}$

NG10
 ISO 4401-05

DESCRIPTION

Spool valve NG10, flange type in accordance to ISO 4401-05 standard with 4 connections. Directly and pneumatically operated spool valve in a 5 chamber system. Spool blocked or with spring reset. Spool type pneumatic head, precise spool fit, small leakage, long life. Threaded connection by means of additional connecting plate. Spool made from hardened steel, the valve body is made from a high quality casting suitable for hydraulic applications. The valve bodies are painted. The end covers and the pneumatic heads are zinc coated.

FUNCTION

When actuated, the pneumatic head displaces the valve spool to the corresponding switching position.

- 4/2-way impulse spool valve:
2 pneumatic head and 2 locking switch positions. When the pneumatic head is not actuated, the spool is held by the lock in the corresponding switching position.
- 4/3-way spool valve:
2 pneumatic heads and 3 switching position. When the air head is not actuated, the spool is switched back to the centre position via the springs.
- 4/2-way spool valves:
1 pneumatic head and 2 switching positions. When the pneumatic head is not actuated, the spool is switched back to the home position by the spring.

APPLICATION

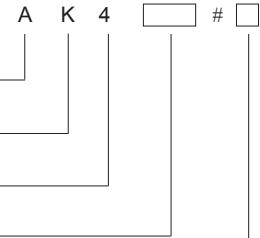
Pneumatically operated spool valves are mainly used to control the direction of movement and for retaining hydraulic cylinders and motors. The direction of movement is determined by the position of the valve spool and its symbol. Pneumatically operated valves are particularly suitable for use in areas where there is a risk of explosion in the chemical or mining industries and also in industrial installations where compressed air is used.

CONTENT

GENERAL SPECIFICATIONS.....	1
HYDRAULIC SPECIFICATIONS	1
CONTROL PNEUMATIC	1
TYPE CHARTS/SYMBOLS	2
CHARACTERISTICS.....	2
DIMENSIONS.....	3
PARTS LIST	3
ACCESSORIES.....	3

TYPE CODE

International interface ISO



Operation pneumatically

No. of control ports

Type charts/Symbols acc. to table 1.6-40/2

Design-Index (Subject to change)

GENERAL SPECIFICATIONS

Description	4/2-, 4/3-way valve
Nominal size	NG10 to ISO 4401-05
Constructions	Direct operated spool valve
Operations	Pneumatically
Mounting	Flange 4 fixing holes for socket head cap screws M6x65
Connections	Threaded connection plates Multi-flange plates Longitudinal stacking system
Ambient temperature	-20...50 °C
Mountin position	any, preferably horizontal
Fastening torque	$M_D = 9,5 \text{ Nm}$ (screw quality 8.8)
Weight:	
4/2-way Impuls	m = 4,8 kg
4/3-way	m = 4,8 kg
4/2-way (1 control head)	m = 3,8 kg

HYDRAULIC SPECIFICATIONS

Fluid	Mineral oil, other fluid on request
Contamination efficiency	ISO 4406:1999, class 20/18/14 (Required filtration grade $\beta_{10...16} \geq 75$) refer to data sheet 1.0-50/2
Viscosity range	12 mm ² /s...320 mm ² /s
Fluid temperature	-20...+70 °C
Operating pressure in port P, A, B	$p_{\max} = 350 \text{ bar}$
Tank pressure in port T	$p_{\max} = 200 \text{ bar}$
Max. Volume flow	$Q_{\max} = 80 \text{ l/min}$, see characteristics
Leakage volume flow	see characteristics

CONTROL PNEUMATIC operated with control head

Min. pilot pressure	$p_{st, \min} = 2,5 \text{ bar}$ at $p_T = 20 \text{ bar}$
	$p_{st, \min} = 5 \text{ bar}$ at $p_T = 200 \text{ bar}$
Control volume	$V_{st} = 10,7 \text{ cm}^3$

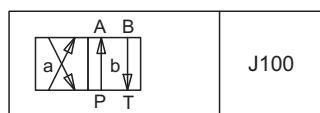
TYPE LIST/DESIGNATION OF SYMBOLS

4/2-way valve impulse

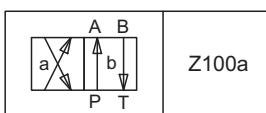
4/2-way valve with spring reset
operation A-side

operation B-side

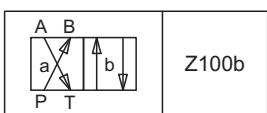
Transitional functions



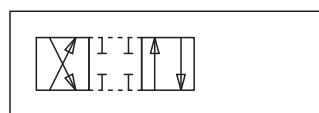
J100



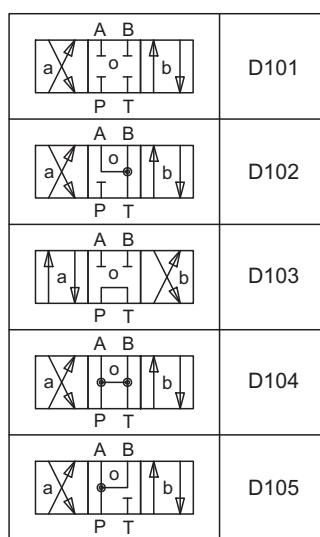
Z100a



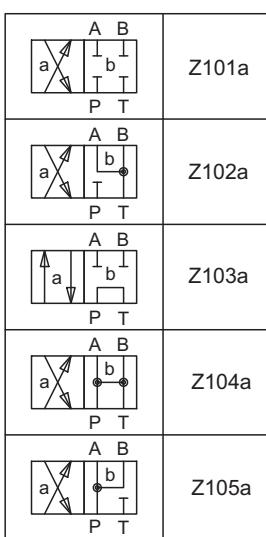
Z100b



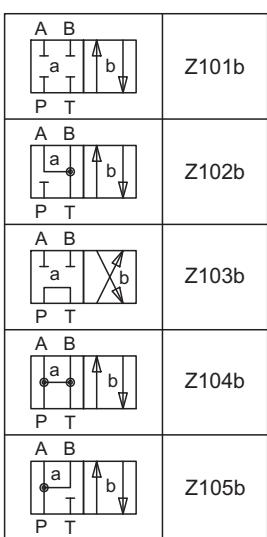
4/3-way valve spring centered



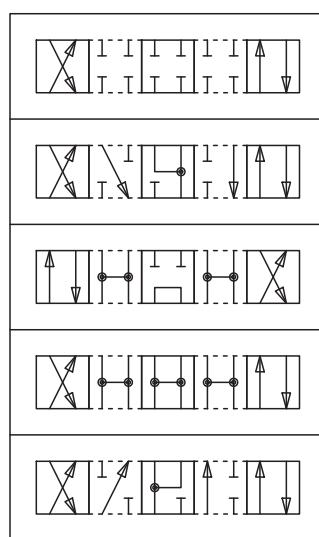
D101



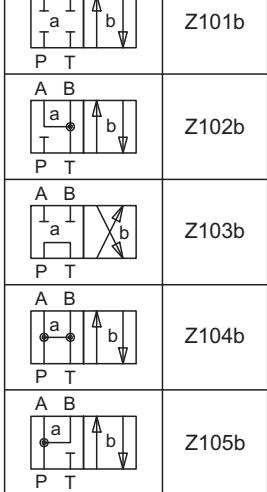
Z101a



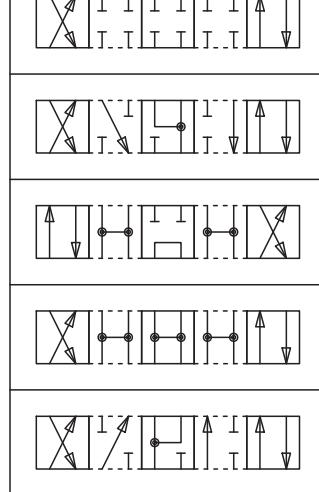
Z101b



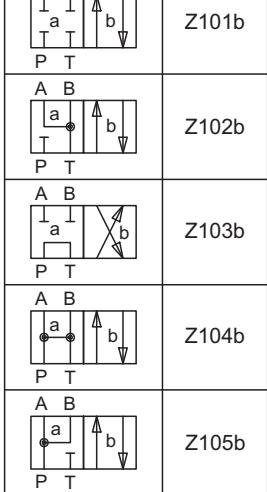
D102



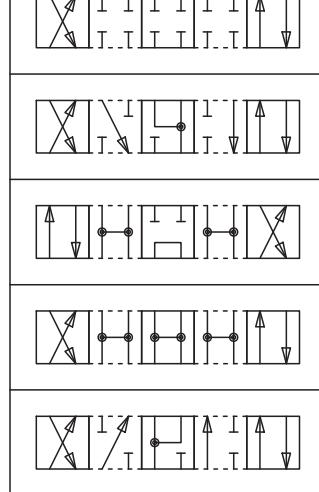
Z102b



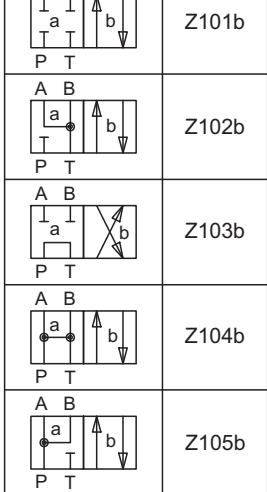
D103



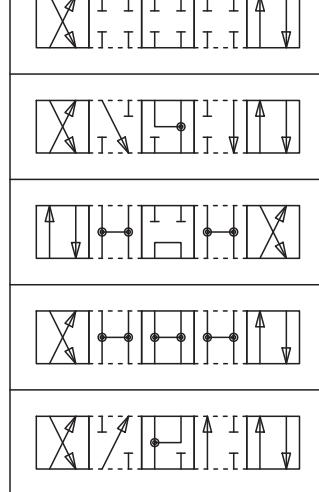
Z103b



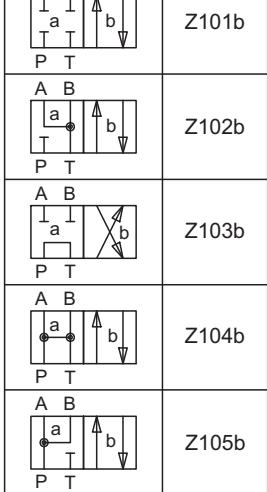
D104



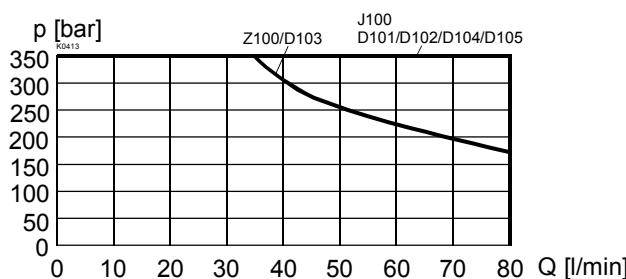
Z104b

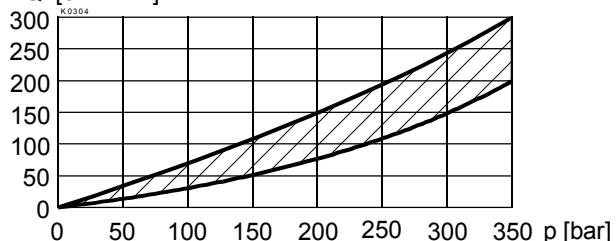
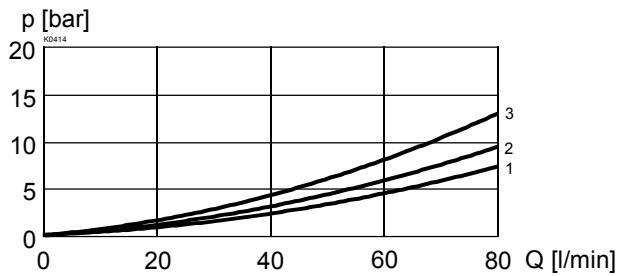


D105



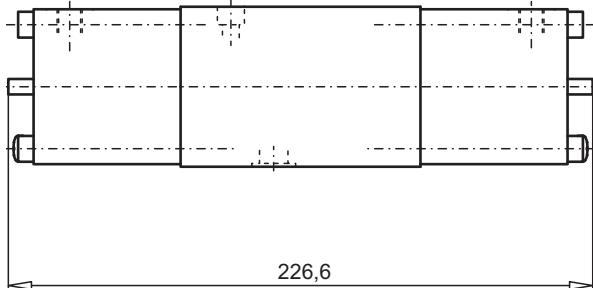
Z105b

CHARACTERISTICS Oilviscosity $\nu = 30 \text{ mm}^2/\text{s}$
 $p = f(Q)$ Performance limits
 $Q_L = f(p)$ Leakage volume flow characteristics per control edge

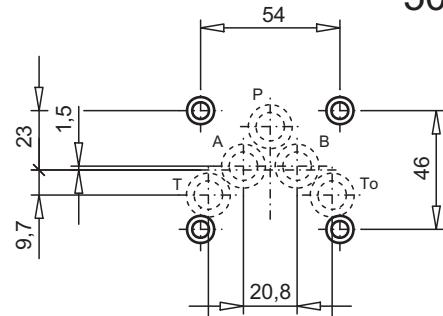
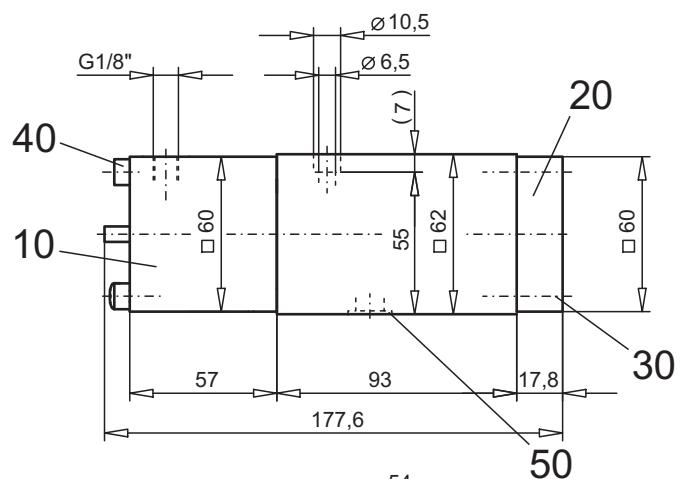
 Q [cm^3/min]
 $\Delta p = f(Q)$ Pressure drop volume flow characteristics

Symbol	Pressure drop Curve no.				
	P-A	P-B	P-T	A-T	B-T
Z100/J100	2	2	-	2	2
D101/Z101	2	2	-	2	2
D102/Z102	2	2	-	1	1
D103/Z103	2	2	3	2	2
D104/Z104	1	1	-	1	1
D105/Z105	1	1	-	2	2

DIMENSIONS

 4/3-way valve (spring centred)
 4/2-way valve (impulse)


4/2-way valve (spring reset)


PARTS LIST

Position	Article	Description
10	254.5000	Control head AKI
20	059.2201	Cover
30	246.3121	Socket head cap screw M6x20 DIN 912
40	246.3166	Socket head cap screw M6x65 DIN 912
50	160.2140	O-ring ID 14,00x1,78

ACCESSORIES

 Threaded connection plates, Multi-flange plates
 and longitudinal stacking system

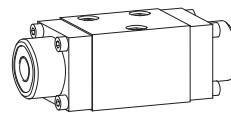
register 2.9

Technical explanation see data sheet 1.0-100

Spool valve hydraulic operation

- 4/2-way impulse valve
- 4/3-way with spring centered mid position
- 4/2-way with spring reset
- $Q_{\max} = 8 \text{ l/min}$, $p_{\max} = 350 \text{ bar}$

NG3-Mini®



DESCRIPTION

Spool valve NG3-Mini, flange type in accordance to Wandfluh standard with 4 connections. Direct hydraulic operation via pilot ports in end covers. 5 chamber system. Spool with spring return or detented. Precise spool fit, low leak, long life. Threaded ports by means of additional connecting plate. Hardened spool. Valve body made of high quality casting. Valve body is painted, the end covers are zinc coated.

FUNCTION

- Pilot pressure shifts spool to end position.
- 4/2-way impulse
 - 2 pilot ports. 2 detented spool positions. Spool held in position by detent unless opposite pilot port is pressurised to shift back.
 - 4/3-way spring centered
 - 2 pilot ports. 3 spool positions. Spool shifted to center position by spring as pilot pressure decays.
 - 4/2-way spring offset
 - 1 pilot port. 1 drain port on spring side, 2 spool positions. Spool shifted to home position by spring as pilot pressure decays.

APPLICATION

Hydraulically operated spool valves are mainly used to control the direction of movement and retain hydraulic cylinders and motors. The direction of movement is determined by the position of the valve spool and its symbol. Hydraulically operated valves are particularly suitable for use in installations where no electric current is available or for applications in areas with a risk of explosion (chemical industry, tunnel construction). Mini-3 valves are used where both, reduced dimensions and weight are important.

CONTENTS

GENERAL SPECIFICATIONS.....	1
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CONTROL HYDRAULIC	1
SPOOL OPTIONS/SYMBOLS.....	2
CHARACTERISTICS.....	2
DIMENSIONS/ SECTIONAL DRAWING	3
PARTS LIST	3
ACCESSOIRES.....	3

TYPE CODE

- WD F F A03 - #
- Spool valve direct operated
 - Hydraulic operation
 - Flange type
 - Interface NG3-Mini
 - Spool options/symbols acc. to table 1.7-15/2
 - Design-Index (Subject to change)

GENERAL SPECIFICATIONS

Description	4/2-, 4/3-way spool valve
Nominal size	NG3-Mini to Wandfluh standard
Construction	Direct operated spool valve
Operations	Hydraulic
Mounting	Flange
Connections	3 fixing holes for socket head cap screws M4x30 Threaded connection plates Multi-flange subplates Longitudinal stacking system
Ambient temperature	-20...+50°C
Mounting position	any, preferably horizontal
Fastening torque	$M_D = 2,8 \text{ Nm}$ (screw quality 8.8)
Weight	$m = 0,4 \text{ kg}$

HYDRAULIC SPECIFICATIONS

Fluid	Mineral oil, other fluid on request
Contamination efficiency	ISO 4406:1999, class 20/18/14 (Required filtration grade $\beta_{10...16} \geq 75$) refer to data sheet 1.0-50/2
Viscosity range	12 mm ² /s...320 mm ² /s
Fluid temperature	-20...+70°C
Operating pressure in ports P, A, B	$p_{\max} = 350 \text{ bar}$ ($p_T < 20 \text{ bar}$) $p_{\max} = 315 \text{ bar}$ ($p_T > 20 \text{ bar}$)
Tank pressure in port T	$p_{T_{\max}} = 90 \text{ bar}$ resp. 10 bar below p_{st}
Max. volume flow	$Q_{\max} = 8 \text{ l/min}$
Leakage volume flow	see characteristics

CONTROL HYDRAULIC

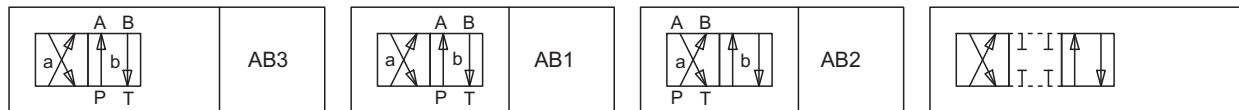
Min. pilot pressure	$p_{st \min} = 10 \text{ bar}$
Max. pilot pressure	$p_{st \max} = 100 \text{ bar}$
Control volume	$V_{st} = 0,08 \text{ cm}^3$

TYPE LIST / DESIGNATION OF SYMBOLS

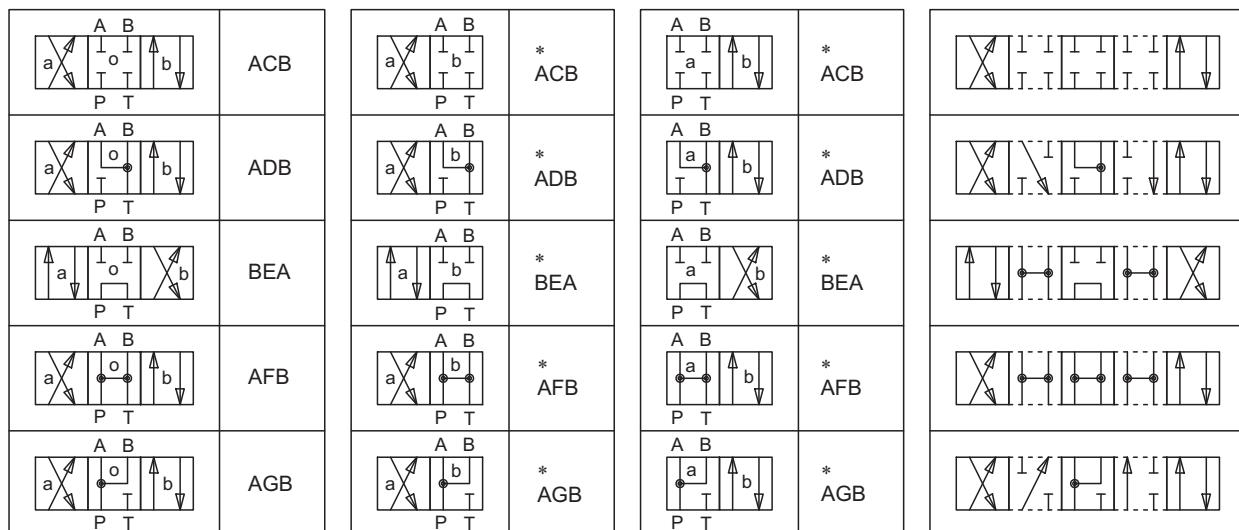
4/2-way valve impulse

4/2-way valve with spring reset

Transitional functions

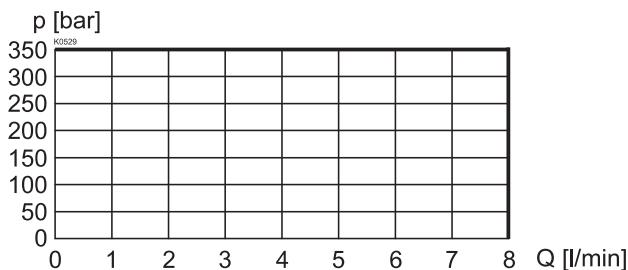


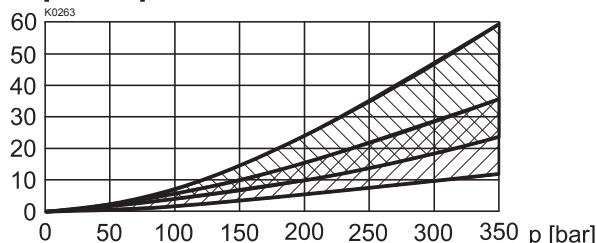
4/3-way valve spring centered or detented



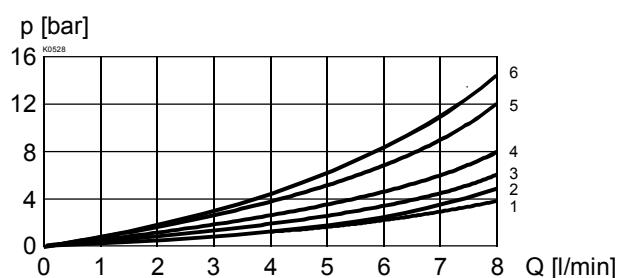
On all 4/2-way valves with spring reset the spring side must be connected to a tank or drain line.

* The 4/2-way valves with spring reset are being delivered as 4/3-way valves.

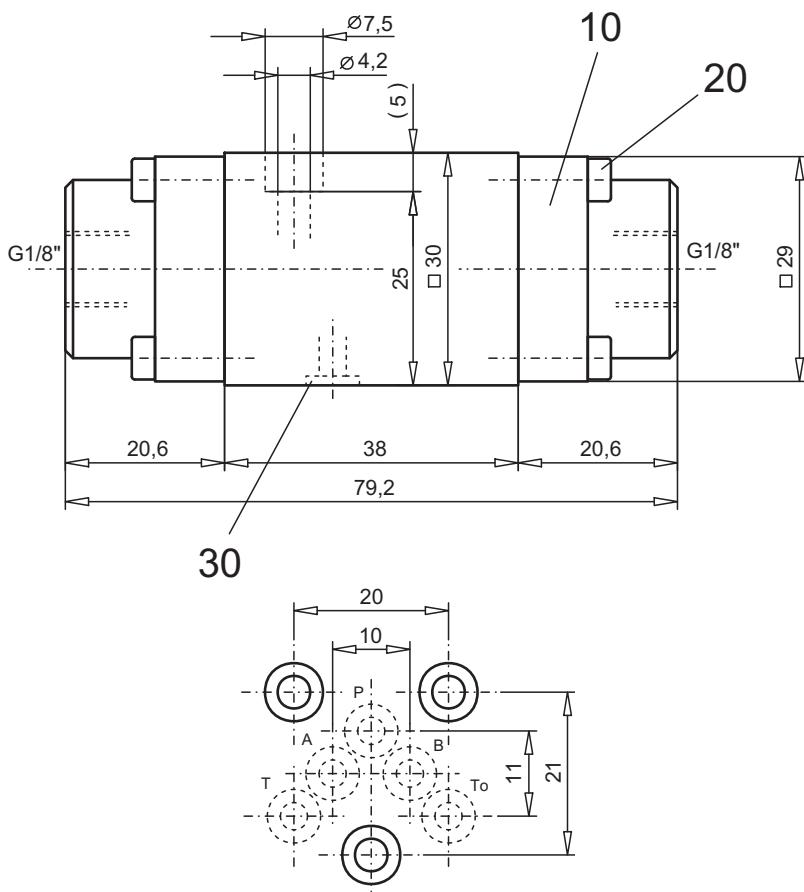
 CHARACTERISTICS Oil viscosity $\nu = 30 \text{ mm}^2/\text{s}$
 $p = f(Q)$ Performance limits

 $Q_L = f(p)$ Leakage volume flow characteristics per control edge

 $Q [\text{cm}^3/\text{min}]$

 Leakage envelope AB1/ACB/ADB/AFB/AGB

 Leakage envelope BEA

 $\Delta p = f(Q)$ Pressure drop volume flow characteristics


Pressure drop curve no. Symbol	Volume flow direction				
	P - A	P - B	P - T	A - T	B - T
AB1/AB2/AB3	4	4	-	3	3
ACB	4	4	-	2	2
ADB	3	3	-	2	2
BEA	6	6	4	5	5
AFB	2	2	1	2	2
AGB	3	3	-	3	3

DIMENSIONS

PARTS LIST

Position	Article	Description
10	056.4701	Cover
20	246.0114	Socket head cap screw M3x14 DIN 912
30	160.2045	O-ring ID 4,5x1,5

ACCESSORIES

Threaded connection plates, Multi-flange plates
and longitudinal stacking system

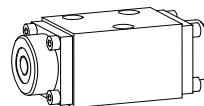
register 2.9

Technical explanation see data sheet 1.0-100E

Spool valve hydraulic operation

- 4/2-way impuls valve
- 4/3-way with spring centered mid position
- 4/2-way with spring reset
- $Q_{\max} = 20 \text{ l/min}$, $p_{\max} = 315 \text{ bar}$

NG4-Mini®



DESCRIPTION

Spool valve NG4-Mini, flange type in accordance to Wandfluh standard with 4 connections. Direct hydraulic operation via pilot ports in end covers. 5 chamber system. Spool with spring return or detented. Precise spool fit, low leak, long life. Threaded ports by means of additional connecting plate. Hardened spool. Valve body made of high quality casting. Valve body is painted, the end covers are zinc coated.

FUNCTION

- Pilot pressure shifts spool to end position.
- 4/2-way impulse
2 pilot ports. 2 detented spool positions. Spool held in position by detent unless opposite pilot port is pressurised to shift back.
- 4/3-way spring centered
2 pilot ports. 3 spool positions. Spool shifted to center position by spring as pilot pressure decays.
- 4/2-way spring offset
1 pilot port. 1 drain port on spring side, 2 spool positions. Spool shifted to home position by spring as pilot pressure decays.

APPLICATION

Hydraulically operated spool valves are mainly used to control the direction of movement and retain hydraulic cylinders and motors. The direction of movement is determined by the position of the valve spool and its symbol. Hydraulically operated valves are particularly suitable for use in installations where no electric current is available or for applications in areas with a risk of explosion (chemical industry, tunnel construction). Mini-4 valves are used where both, reduced dimensions and weight are important.

CONTENT

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TYPE CHARTS/SYMBOLS	2
CHARACTERISTICS.....	2
DIMENSIONS.....	3
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ACCESSORIES.....	3

TYPE CODE

B	P	4	<input type="checkbox"/>	#	<input type="checkbox"/>
Interface					
Hydraulic operation					
No. of control ports					
Type charts/Symbols acc. to table 1.7-20/2					
Design-Index (Subject to change)					

GENERAL SPECIFICATIONS

Description	4/2-, 4/3-way spool valve
Nominal size	NG4-Mini to Wandfluh standard
Construction	Direct operated spool valve
Operations	Hydraulic
Mounting	Flange
Connections	3 fixing holes for socket head cap screws M5x40 Threaded connection plates Multi-flange plates Longitudinal stacking system
Ambient temperature	-20...50 °C
Mounting position	any, preferably horizontal
Fastening torque	$M_D = 5,5 \text{ Nm}$ (screw quality 8.8)
Weight	$m = 0,6 \text{ kg}$

HYDRAULIC SPECIFICATIONS

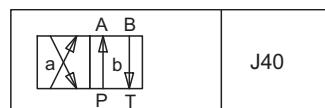
Fluid	Mineral oil, other fluid on request
Contamination efficiency	ISO 4406:1999, class 20/18/14 (Required filtration grade $\beta_{10...16} \geq 75$) refer to data sheet 1.0-50/2
Viscosity range	12 mm²/s...320 mm²/s
Fluid temperature	-20...+70 °C
Operating pressure	$p_{\max} = 315 \text{ bar}$
in port P, A, B	$p_{\max} = 90 \text{ bar}$
Tank pressure	resp. 10 bar below p_{\max}
in port T	$Q_{\max} = 20 \text{ l/min}$, see characteristics see characteristics
Max. Volume flow	
Leakage volume flow	

CONTROL HYDRAULIC

Min. pilot pressure	$p_{st \min} = 10 \text{ bar}$
Max. pilot pressure	$p_{st \max} = 100 \text{ bar}$
Control volume	$V_{st} = 0,16 \text{ cm}^3$

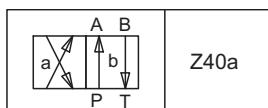
TYPE LIST / DESIGNATION OF SYMBOLS

4/2-way valve impulse



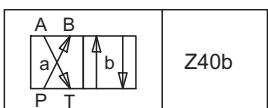
J40

4/2-way valve with spring reset

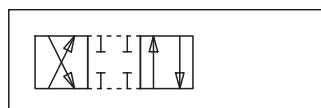


Z40a

Transitional functions



Z40b

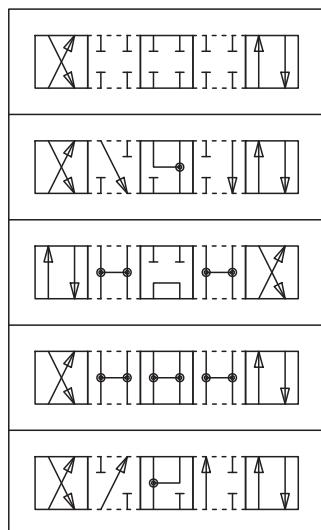


4/3-way valve spring centered or detented

	A B P T	D41
	A B P T	D42
	A B P T	D43
	A B P T	D44
	A B P T	D45

	A B P T	* D41
	A B P T	* D42
	A B P T	* D43
	A B P T	* D44
	A B P T	* D45

	A B P T	* D41
	A B P T	* D42
	A B P T	* D43
	A B P T	* D44
	A B P T	* D45

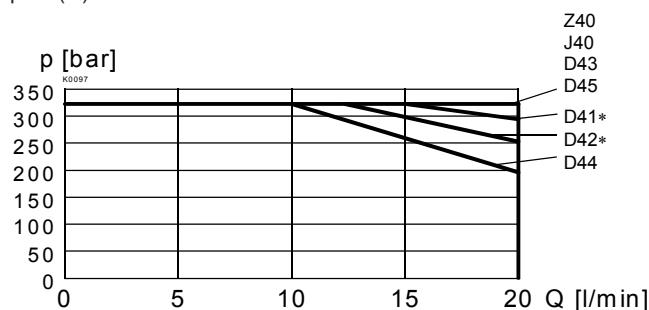
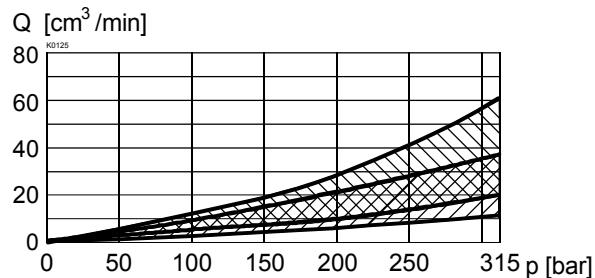


On all 4/2-way valves with spring reset the spring side must be connected to a tank or drain line.

* The 4/2-way valves with spring reset are being delivered as 4/3-way valves.

CHARACTERISTICS Oil viscosity $\nu = 30 \text{ mm}^2/\text{s}$

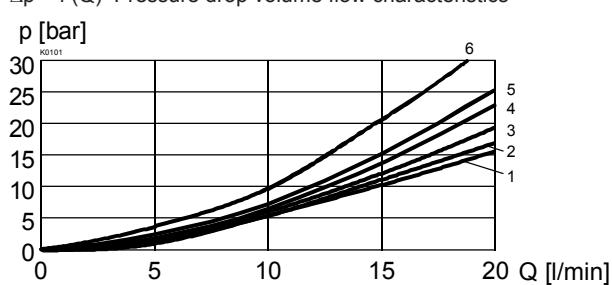
p = f (Q) Performance limits


 Q_L = f (p) Leakage volume flow characteristics per control edge


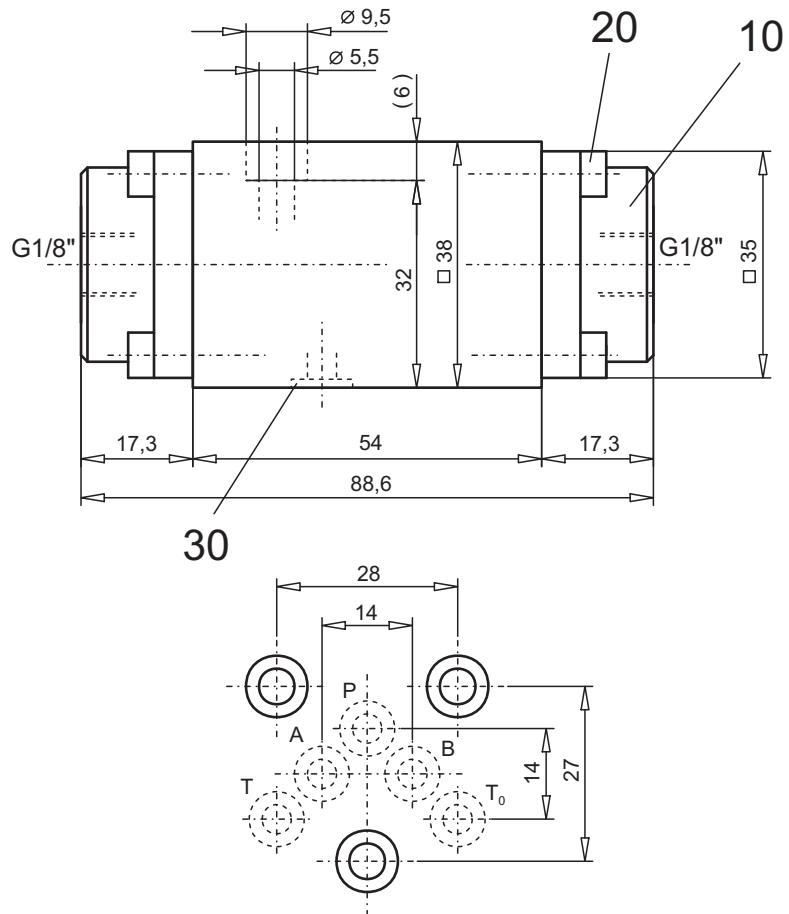
* Performance limit with $p_v = 12 \text{ bar}$: $Q = 20 \text{ l/min}$ and 315 bar

Leakage envelope J40/Z40/D41/D42/D44/D45

Leakage envelope D43

 $\Delta p = f (Q)$ Pressure drop volume flow characteristics


Symbol	Pressure drop curve no.	Volume flow direction				
		P - A	P - B	P - T	A - T	B - T
Z40/J40	5	5	-	2	2	
D41	5	5	-	2	2	
D42	5	5	-	1	1	
D43	4	4	6	2	2	
D44	4	4	3	2	2	
D45	4	4	-	2	2	

DIMENSIONS

PARTS LIST

Position	Article	Description
10	057.4600	Cover
20	246.1113	Socket head cap screw M4x12 DIN 912
30	160.2052	O-ring ID 5,28x1,78

ACCESSORIES

Threaded connection plates, Multi-flange plates
and longitudinal stacking system

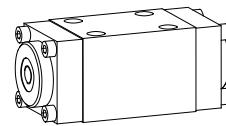
register 2.9

Technical explanation see data sheet 1.0-100

Spool valve hydraulic operation

- 4/2-way impuls valve
- 4/3-way with spring centered mid position
- 4/2-way with spring reset
- $Q_{\max} = 30 \text{ l/min}$, $p_{\max} = 350 \text{ bar}$

NG6
ISO 4401-03



DESCRIPTION

Spool valve NG6, flange type in accordance to ISO 4401-03 with 4 connections. Direct hydraulic operation via pilot ports in end covers. 5 chamber system. Spool with spring return or detented. Precise spool fit, low leak, long life. Threaded ports by means of additional connecting plate. Hardened spool. Valve body made of high quality casting. Valve body painted, end covers zinc coated.

FUNCTION

- Pilot pressure shifts spool to end position.
- 4/2-way impulse
2 pilot ports. 2 detented spool positions. Spool held in position by detent unless opposite pilot port is pressurised to shift back.
- 4/3-way spring centered
2 pilot ports. 3 spool positions. Spool shifted to center position by spring as pilot pressure decays.
- 4/2-way spring offset
1 pilot port. 1 drain port on spring side, 2 spool positions. Spool shifted to home position by spring as pilot pressure decays.

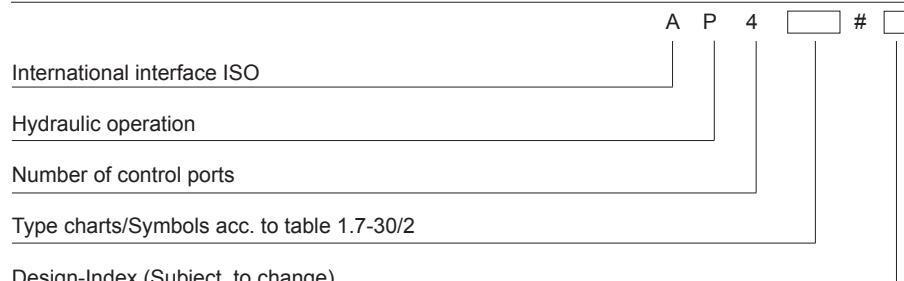
APPLICATION

Hydraulically operated spool valves are mainly used to control the direction of movement and retain hydraulic cylinders and motors. The direction of movement is determined by the position of the valve spool and its symbol. Hydraulically operated valves are particularly suitable for use in installations where no electric current is available or for applications in areas with a risk of explosion (chemical industry, tunnel construction).

CONTENT

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CHARACTERISTICS.....	2
DIMENSIONS.....	3
PARTS LIST	3
ACCESSORIES.....	3

TYPE CODE



GENERAL SPECIFICATIONS

Description	4/2-, 4/3-way spool valve
Nominal size	NG6 to ISO 4401-03
Construction	Direct operated spool valve
Operations	Hydraulic
Mounting	Flange
	4 fixing holes for
Connections	socket head cap screws M5x45
	Threaded connection plates
	Multi-flange plates
	Longitudinal stacking system
Ambient temperature	-20...50 °C
Mounting position	any, preferably horizontal
Fastening torque	M _D = 5.5 Nm (screw quality 8.8)
Weight	m = 1,4 kg

HYDRAULIC SPECIFICATIONS

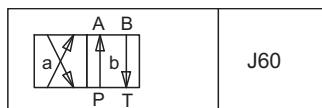
Fluid	Mineral oil, other fluid on request
Contamination efficiency	ISO 4406:1999, class 20/18/14 (Required filtration grade β10...16≥75) refer to data sheet 1.0-50/2
Viscosity range	12 mm ² /s...320 mm ² /s
Fluid temperature	-20...+70 °C
Operating pressure in port P, A, B	$p_{\max} = 350 \text{ bar}$
Tank pressure in port T	$p_{\max} = 150 \text{ bar}$ resp. 10 bar below p_{st}
Max. Volume flow	$Q_{\max} = 30 \text{ l/min}$, see characteristics
Leakage volume flow	see characteristics

CONTROL HYDRAULIC

Min. pilot pressure	$p_{st \min} = 10 \text{ bar}$
Max. pilot pressure	$p_{st \max} = 160 \text{ bar}$
Control volume	$V_{st} = 0,28 \text{ cm}^3$

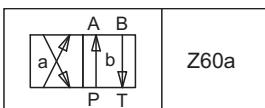
TYPE LIST / DESIGNATION OF SYMBOLS

4/2-way valve impulse



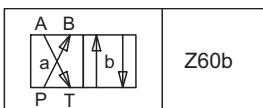
J60

4/2-way valve with spring reset

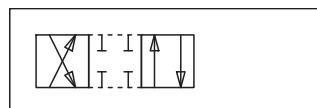


Z60a

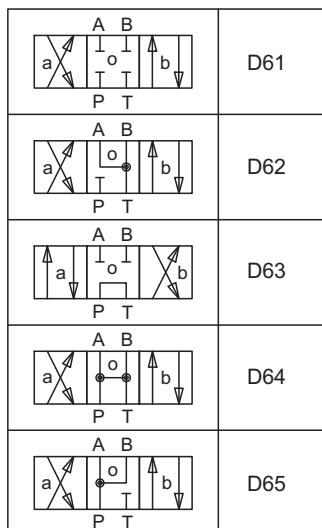
Transitional functions



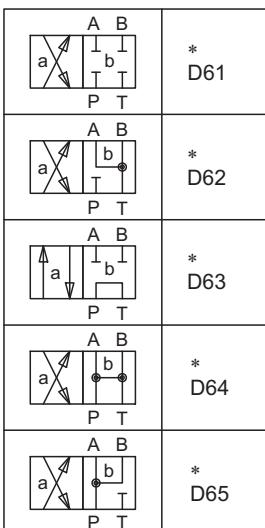
Z60b



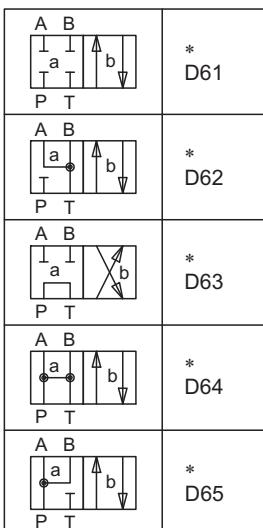
4/3-way valve spring centered or detented



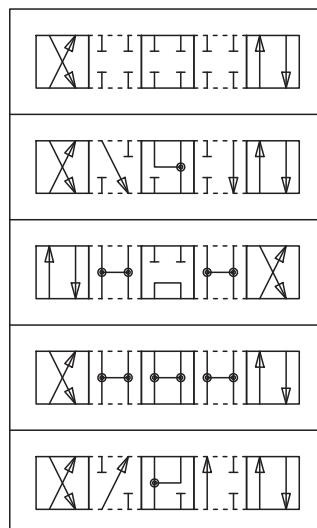
D61



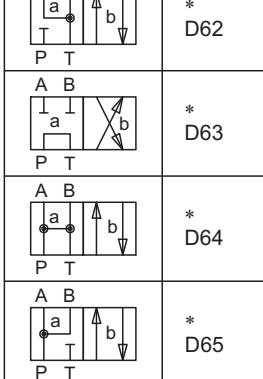
D62



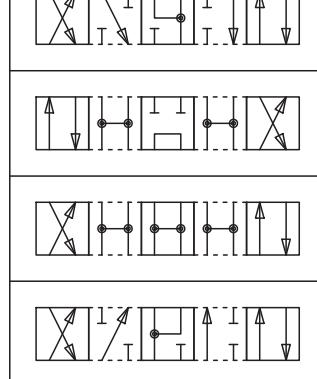
D63



D64

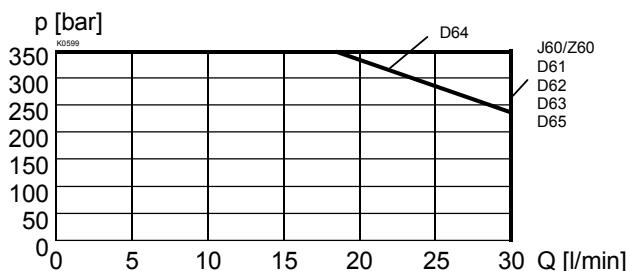


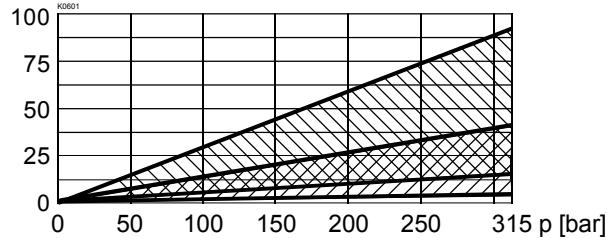
D65



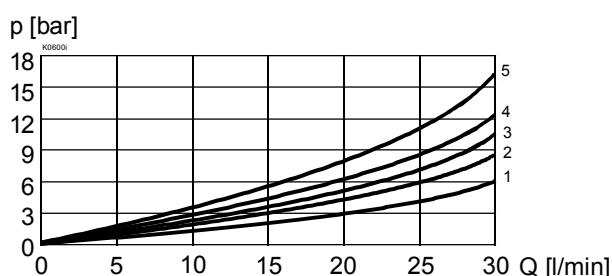
On all 4/2-way valves with spring reset the spring side must be connected to a tank or drain line.

* The 4/2-way valves with spring reset are being delivered as 4/3-way valves.

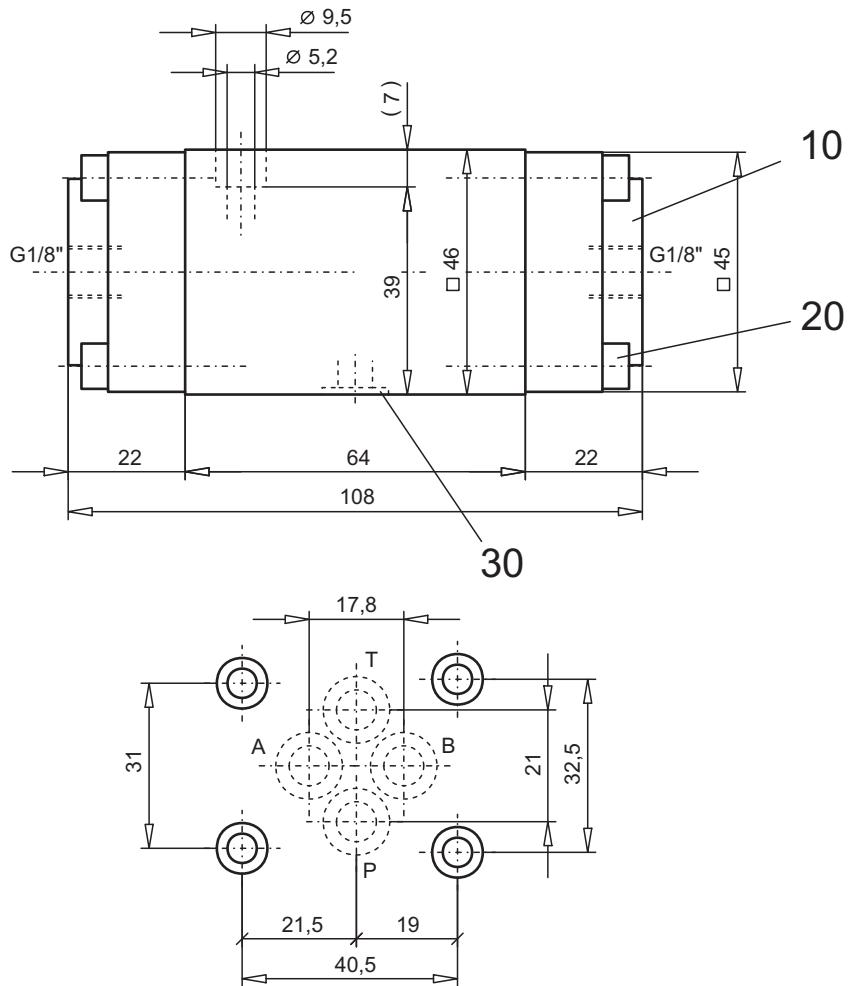
CHARACTERISTICS Oil viscosity $\nu = 30 \text{ mm}^2/\text{s}$
 $p = f(Q)$ Performance limits

 $Q_L = f(p)$ Leakage volume flow characteristics per control edge

 Q [cm^3/min]


Leakage envelope J60/Z60/D61/D62/D64/D65
 Leakage envelope D63

 $\Delta p = f(Q)$ Pressure drop volume flow characteristics


Symbol	Pressure drop curve no.					Volume flow direction				
	P-A	P-B	P-T	A-T	B-T	P-A	P-B	P-T	A-T	B-T
Z60/J60	3	3	-	4	4					
D61/Z61	3	3	-	4	4					
D62/Z62	3	3	-	3	3					
D63/Z63	2	2	5	2	2					
D64/Z64	1	1	1	3	3					
D65/Z65	1	1	-	4	4					

DIMENSIONS

PARTS LIST

Position	Article	Description
10	058.4600	Cover
20	246.2121	Socket head cap screw M5x20 DIN 912
30	160.2093	O-ring ID 9,25x1,78

ACCESSORIES

Threaded connection plates, Multi-flange plates
and longitudinal stacking system

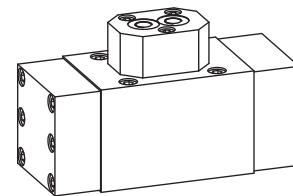
register 2.9

Technical explanation see data sheet 1.0-100

Spool valve hydraulic operation

- 4/2-way Impuls version detented
- 4/3-way with spring centered
- 4/2-way with spring reset
- $Q_{\max} = 100 \text{ l/min}$, $p_{\max} = 350 \text{ bar}$

NG10
ISO 4401-05



DESCRIPTION

Spool valve NG10, flange type in accordance to ISO 4401-05 with 4 connections. Direct hydraulic operation via pilot ports in end covers. 5 chamber system. Spool with spring return or detented. Precise spool fit, low leak, long life. Threaded ports by means of additional connecting plate. Hardened spool. Valve body made of high quality casting. Valve body painted, end covers zinc coated.

FUNCTION

- Pilot pressure shifts spool to end position.
- 4/2-way impulse
 - 2 pilot ports. 2 detented spool positions. Spool held in position by detent unless opposite pilot port is pressurised to shift back.
 - 4/3-way spring centered
 - 2 pilot ports. 3 spool positions. Spool shifted to center position by spring as pilot pressure decays.
 - 4/2-way spring offset
 - 1 pilot port. 1 drain port on spring side, 2 spool positions. Spool shifted to home position by spring as pilot pressure decays.

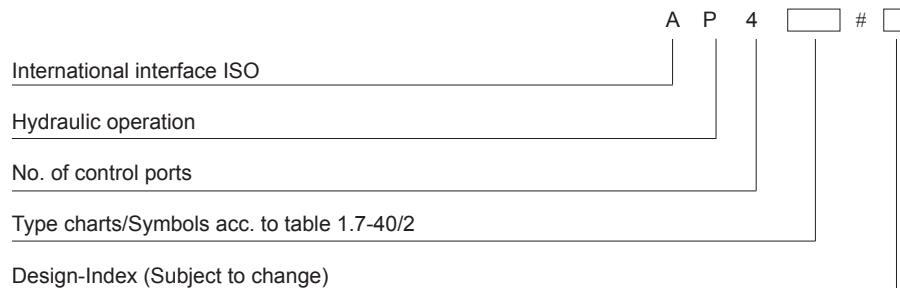
APPLICATION

Hydraulically operated spool valves are mainly used to control the direction of movement and retain hydraulic cylinders and motors. The direction of movement is determined by the position of the valve spool and its symbol. Hydraulically operated valves are particularly suitable for use in installations where no electric current is available or for applications in areas with a risk of explosion (chemical industry, tunnel construction).

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TYPE CODE



GENERAL SPECIFICATIONS

Description	4/2-, 4/3-way spool valve
Nominal size	NG10 to ISO 4401-05
Construction	Direct operated spool valve
Operations	Hydraulic
Mounting	Flange
Connections	4 fixing holes for socket head cap screws M6x65 Threaded connection plates Multi-flange plates Longitudinal stacking system
Ambient temperature	-20...50°C
Mounting position	any, preferably horizontal
Fastening torque	$M_D = 9,5 \text{ Nm}$ (screw quality 8.8)
Weight	$m = 4 \text{ kg}$

HYDRAULIC SPECIFICATIONS

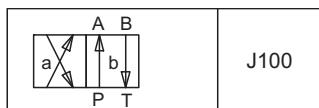
Fluid	Mineral oil, other fluid on request
Contamination efficiency	ISO 4406:1999, class 20/18/14 (Required filtration grade $\beta_{10\dots16} \geq 75$) refer to data sheet 1.0-50/2
Viscosity range	12 mm ² /s...320 mm ² /s
Fluid temperature	-20...+70°C
Operating pressure in port P, A, B	$p_{\max} = 350 \text{ bar}$
Tank pressure in port T	$p_{\max} = 200 \text{ bar}$ resp. 12 bar below p_{\max}
Max. Volume flow	$Q_{\max} = 100 \text{ l/min}$
Leakage volume flow	see characteristics

CONTROL HYDRAULIC

Minimal pilot pressure (for AP4J100)	$p_{st\ min} = 12 \text{ bar}$
Maximal pilot pressure	$p_{st\ max} = 315 \text{ bar}$
Control volume	$V_{st} = 1,25 \text{ cm}^3$
	$p_{st\ min} = 2,5 \text{ bar}$, higher pilot pressure on request

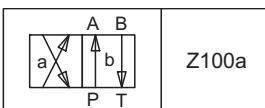
TYPE LIST / DESIGNATION OF SYMBOLS

4/2-way valve impulse



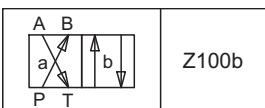
J100

4/2-way valve with spring reset

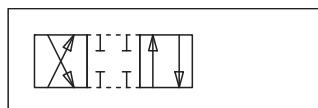


Z100a

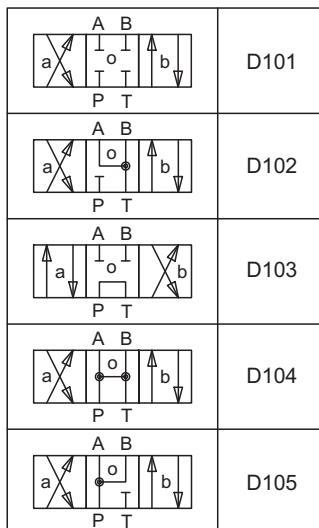
Transitional functions



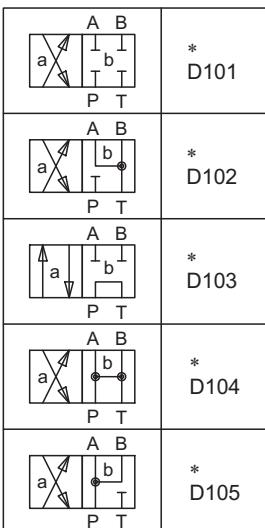
Z100b



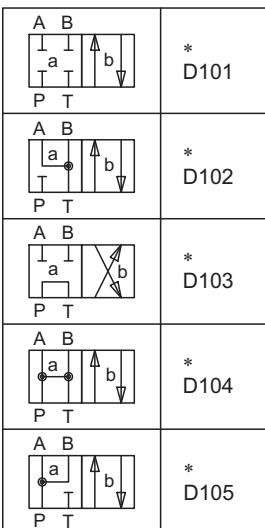
4/3-way valve spring centered or detented



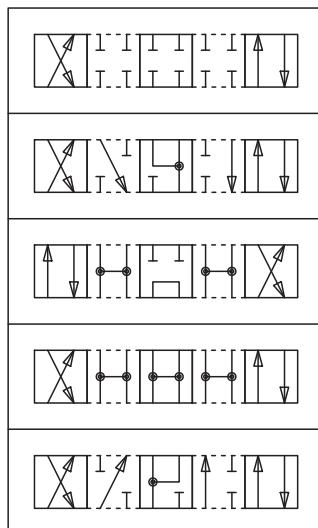
D101



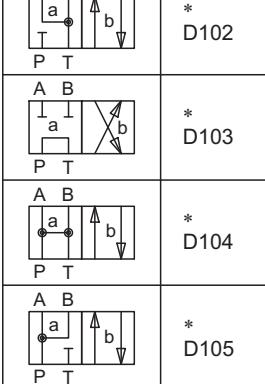
D102



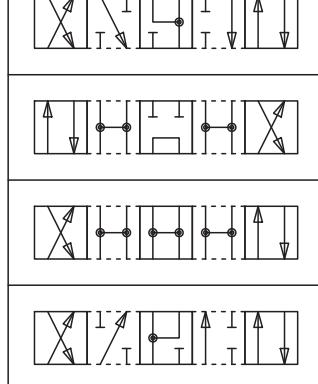
D103



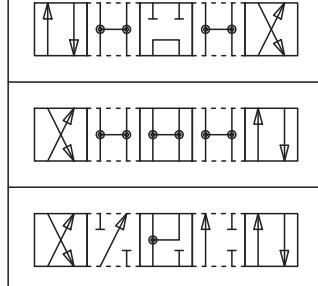
D104



D105



D104

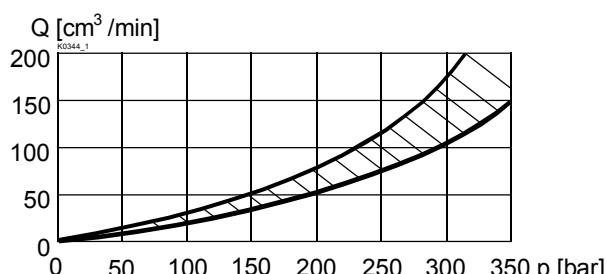
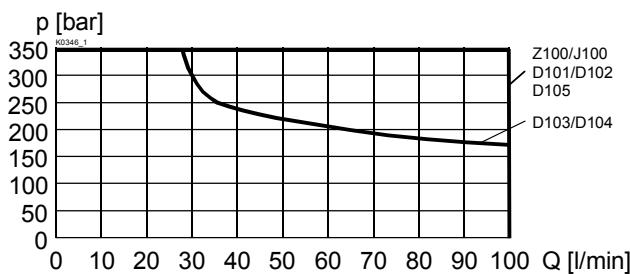
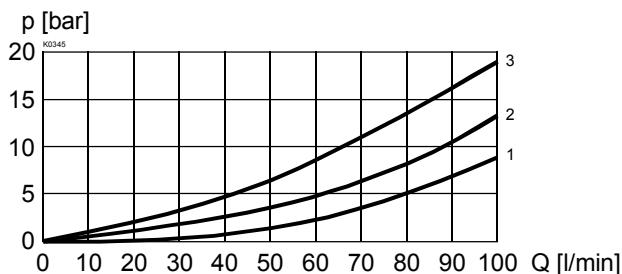


D105

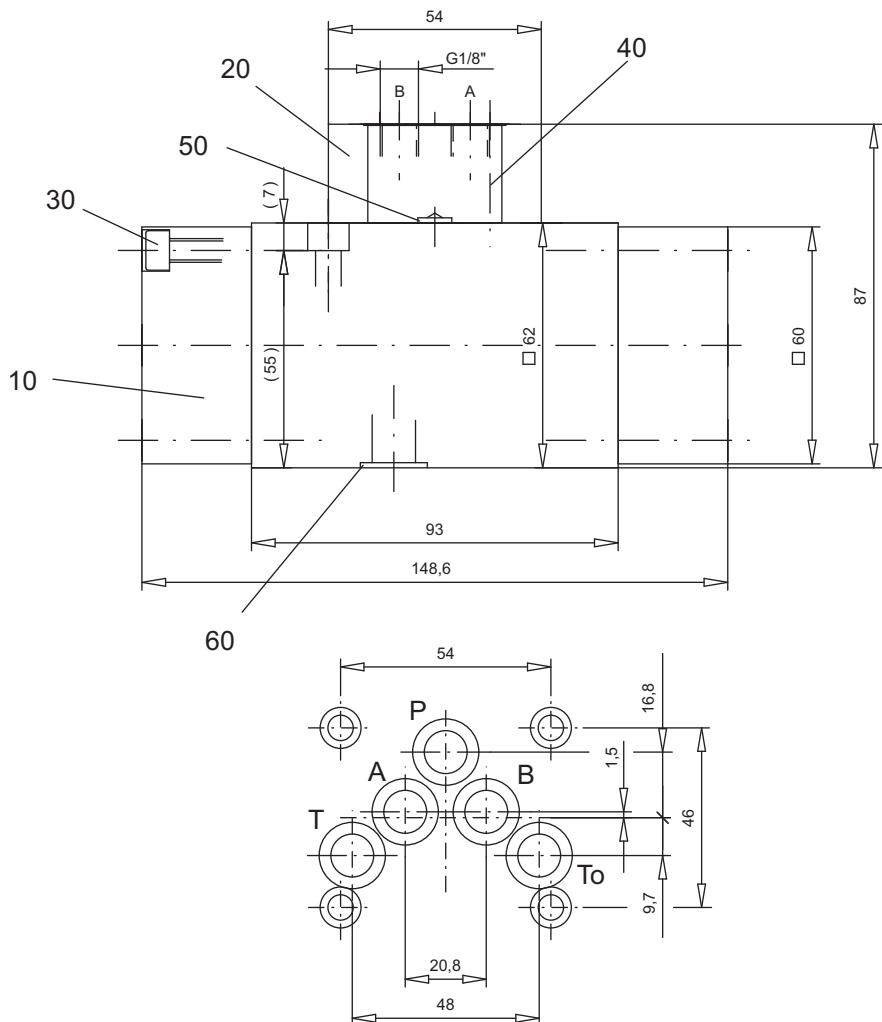
On all 4/2-way valves with spring reset the spring side must be connected to a tank or drain line.

* The 4/2-way valves with spring reset are being delivered as 4/3-way valves.

CHARACTERISTICS Oil viscosity $\nu = 30 \text{ mm}^2/\text{s}$
 $p = f(Q)$ Performance limits

 $Q_L = f(p)$ Leakage volume flow characteristics per control edge

 $\Delta p = f(Q)$ Pressure drop volume flow characteristics


Symbol	Pressure drop curve no.				
	P - A	P - B	P - T	A - T	B - T
Z100/J100	1	1	-	1	2
D101	1	1	-	1	2
D102	1	1	-	1	2
D103	1	1	3	1	2
D104	1	1	-	1	2
D105	1	1	-	1	2

DIMENSIONS

PARTS LIST

Position	Article	Description
10	059.2206	Cover
20	173.1503	Pilot plate NG4-Mini
30	246.3131	Socket head cap screw M6x30 DIN 912
40	246.2126	Socket head cap screw M5x25 DIN 912
50	160.2052	O-ring ID 5,28x1,78
60	160.2140	O-ring ID 14,00x1,78

ACCESSORIES

Threaded connection plates, Multi-flange plates
and longitudinal stacking system

register 2.9

Technical explanation see data sheet 1.0-100

ELECTRICAL CONTROL

Construction	Solenoid, wet pin push type, pressure tight	Voltage tolerance	$\pm 10\%$ of nominal voltage
Standard-nominal voltage	$U_N = 12 \text{ VDC}$ $U_N = 24 \text{ VDC}$ $U_N = 110 \text{ VAC}^*$ $U_N = 115 \text{ VAC}^*$ $U_N = 230 \text{ VAC}^*$ AC = 50 bis 60 Hz	Protection class	IP 65 to EN 60 529
	* Rectifier integrated in the plug, other nominal voltages and nominal performances on request	Relative duty factor	100 % DF (see data sheet 1.1-430)
		Switching cycles	15'000/h
		Operating life	10^7 (number of switching cycles, theoretically)
		Connection/Power supply	Over device plug connection to ISO 4400/DIN 43 650, (2P+E), other connections on request.
		Solenoid version:	SIN35V (data sheet 1.1-105)

MECHANICAL CONTROL

Angle	$\alpha_b = 5,7^\circ/\text{side}$
Force	$F_b = 15-20 \text{ N}$

CONTROL PNEUMATIC operated with control head

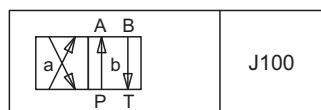
Min. pilot pressure	$p_{st, min} = 2,5 \text{ bar}$ with $p_T = 20 \text{ bar}$
Control volume	$p_{st, min} = 5 \text{ bar}$ with $p_T = 160 \text{ bar}$
	$V_{st} = 2,5 \text{ cm}^3$

TYPE LIST / DESIGNATION OF SYMBOLS

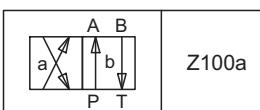
4/2-way valve
with 2 solenoids

4/2-way valve with spring reset
operation A-side
operation B-side

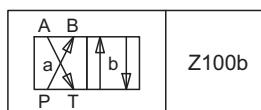
Transitional functions



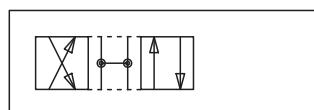
J100



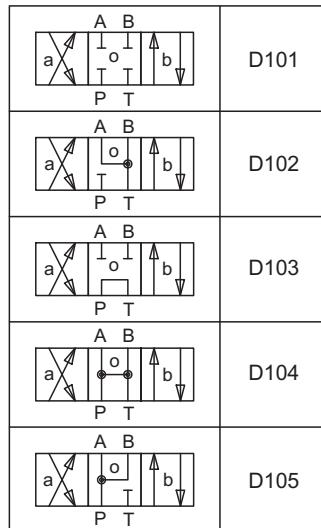
Z100a



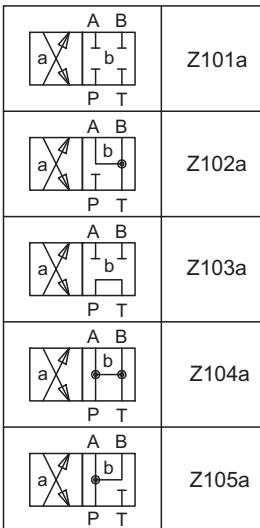
Z100b



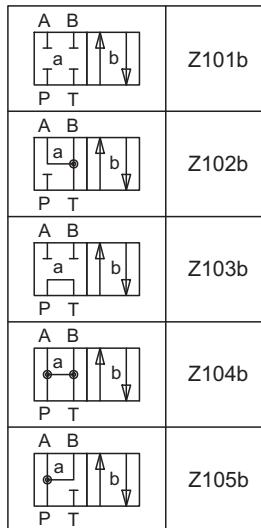
4/3-way valve spring centered



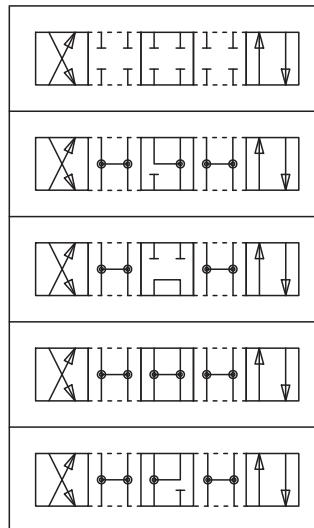
D101



Z101a



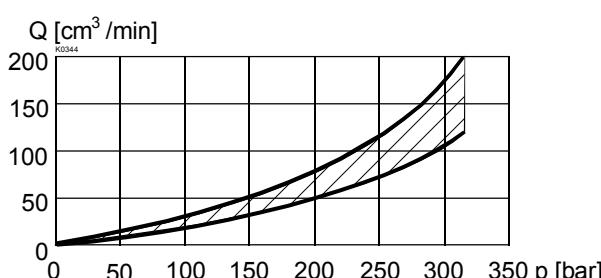
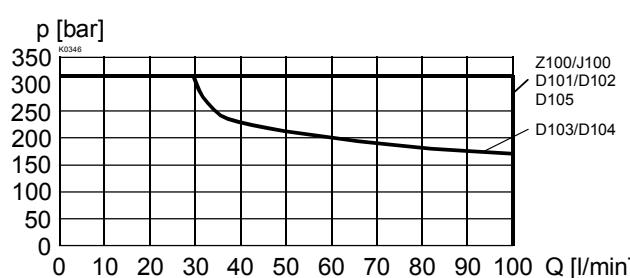
Z101b



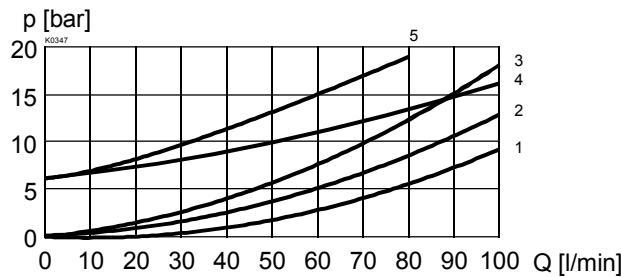
CHARACTERISTICS Oil viscosity $\nu = 30 \text{ mm}^2/\text{s}$

$p = f(Q)$ Performance limits with standard voltage -10%
(Solenoid operated)

$Q_L = f(p)$ Leakage volume flow characteristics per control edge



$\Delta p = f(Q)$ Pressure drop volume flow characteristics



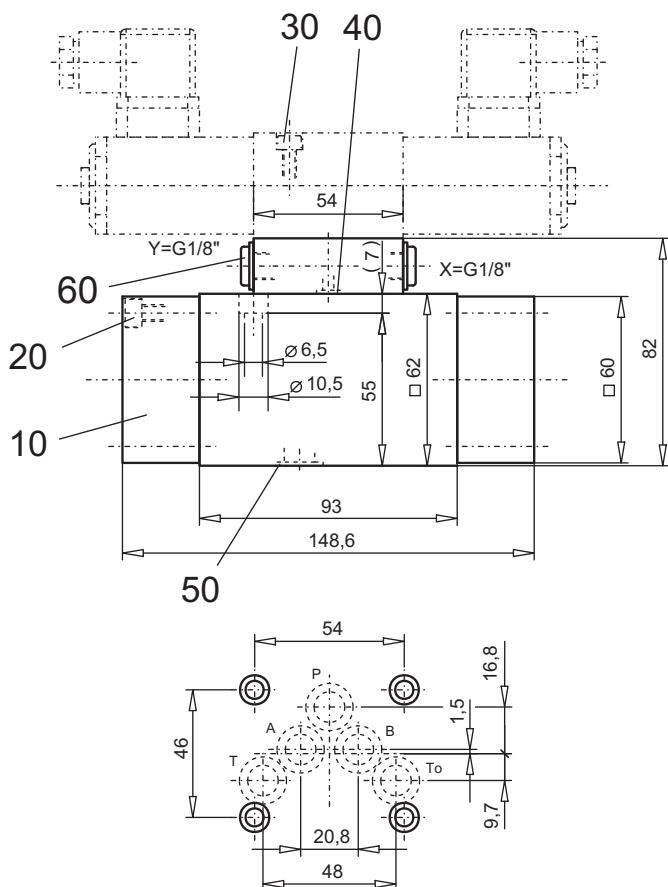
Pilot supply t_i and p_i

Symbol	Pressure drop curve no.				
	P - A	P - B	P - T	A - T	B - T
Z100/J100	1	1	-	1	2
D101/Z101	1	1	-	1	2
D102/Z102	1	1	-	1	2
D103/Z103	4	4	5	1	2
D104/Z104	4	4	-	1	2
D105/Z105	1	1	-	1	2

Pilot supply t_e and p_e

Symbol	Pressure drop curve no.				
	P - A	P - B	P - T	A - T	B - T
Z100/J100	1	1	-	1	2
D101/Z101	1	1	-	1	2
D102/Z102	1	1	-	1	2
D103/Z103	1	1	3	1	2
D104/Z104	1	1	-	1	2
D105/Z105	1	1	-	1	2

DIMENSIONS



Mounting instruction

To screw the main valve body ($M_D = 9,5$ Nm, quality 8.8) to the base plate the pilot valve ($M_D = 5,5$ Nm, quality 8.8) must be taken off.

PARTS LIST

Position	Article	Description
10	059.2206	Cover
20	246.3131	Socket head cap screw M6x30 DIN 912
30	246.2141 246.2160	Socket head cap screw M5x40 DIN 912 for pilot supply t_i Socket head cap screw M5x60 for pilot supply t_e , p_i and p_e
40	160.2052	O-ring ID 5,28x1,78
50	160.2140	O-ring ID 14,00x1,78
60	238.1405	Plug screw G1/8"

ACCESSORIES

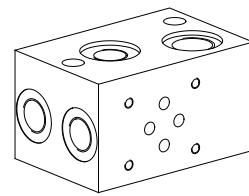
Threaded connecting plates, Multi-flange subplates and Longitudinal stacking system

see Reg. 2.9

Technical explanation see data sheet 1.0-100

Module type manifold blocks

• $p_{\max} = 350$ bar

NG6
ISO 4401-03

DESCRIPTION

Module type manifold blocks with interface NG6 acc. to ISO 4401-03. Using an adapter plate and connecting blocks, combinations with NG3-Mini, NG4-Mini and NG10 are also possible (see also data sheet 2.9-80). The module type manifold blocks are made from steel and are phosphated.

FUNCTION

The module type manifold blocks are available with 3 different basic circuits, namely parallel, serial and pressure reduction circuit.

APPLICATION

This block system can be used as a replacement for expensive special blocks. Existing systems may be extended or reduced by adding as removing modular blocks.

TYPE CODE

	A	LV	6	<input type="checkbox"/>	#	<input type="checkbox"/>
International standard interface ISO						
Module type manifold						
Nominal size 6						
Type list						
Parallel circuit	P					
Serial circuit	S					
Pressure reduction circuit	D					
Design-Index (Subject to change)						

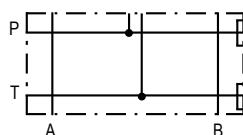
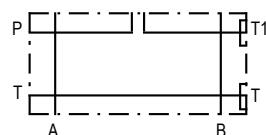
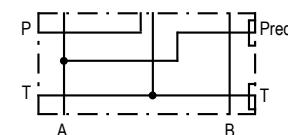
GENERAL SPECIFICATIONS

Description	Parallel-, serial- and pressure reduction circuit
Nominal size	NG6 acc. to ISO 4401-03
Fastening	see data sheet 2.9-124
Connection	Threaded connections P, P _{red} , T1, A, B = G3/8" T = G1/2"
Mounting position	any
Weight:	m = 2,0 kg

HYDRAULIC SPECIFICATIONS

Working pressure	$p_{\max} = 350$ bar
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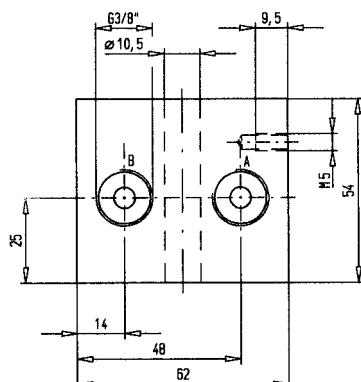
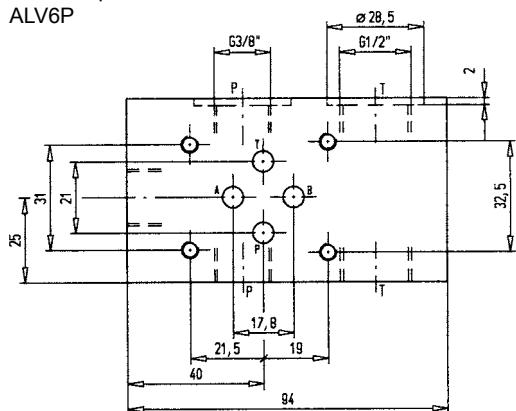
SYMBOLS

Block for parallel circuit
ALV6P

Block for serial circuit
ALV6S

Block for pressure reduction circuit
ALV6D


DIMENSIONS

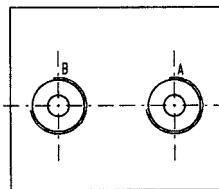
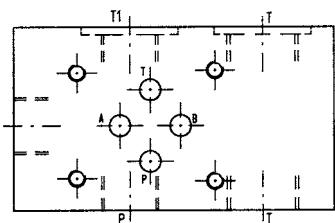
Block for parallel circuit

ALV6P



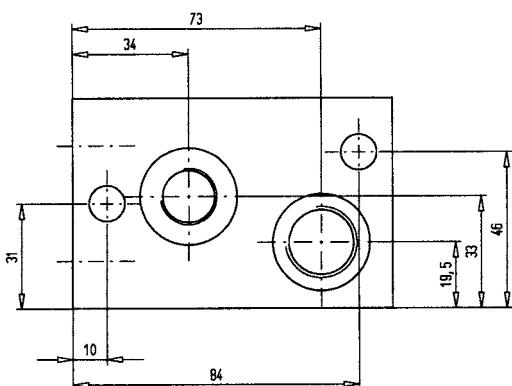
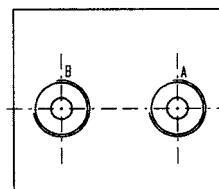
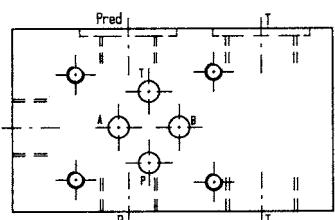
Block for serial circuit

ALV6S



Block for pressure reduction circuit

ALV6D


PARTS LIST

Position	Article	Description
10	160.2238	O-ring ID 23,81x2,62

ACCESSORIES

 Fixing brackets AB61/AB62 and studs
 see data sheet 2.9-124