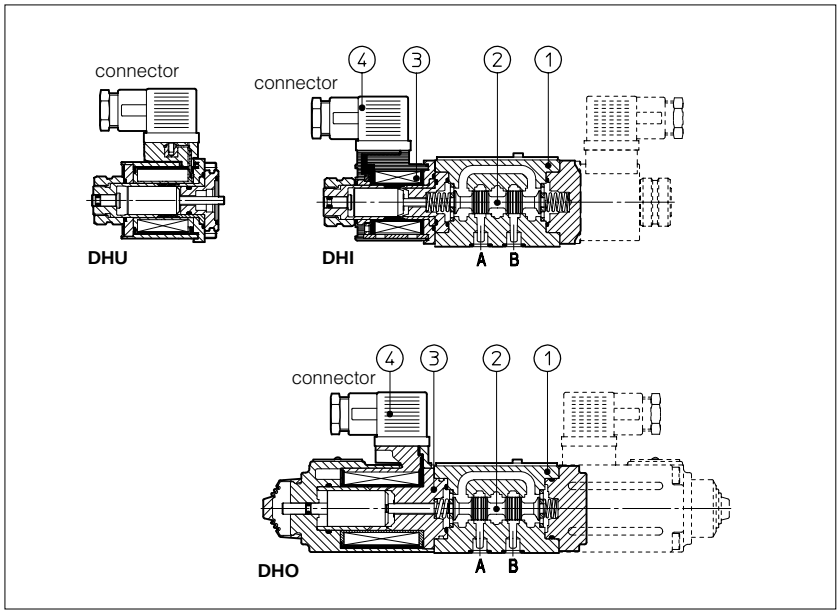
Atos spa
21018 Sesto Calende, Italy - Fax 0331 920005

Solenoid directional valves type DHI, DHU, DHO

direct operated, ISO/Cetop size 03



DHI,DHU and DHO are spool type, three or four way, two or three position direct operated solenoid valves designed to operate in oil hydraulic systems.
They are operated by wet and pressure sealed solenoid ③ with manual override:

- OI solenoid suitable for AC and DC supply;
- OU solenoid for DC supply with improved performance;
- OO solenoid for DC supply with high performance.

Moving parts are protected, lubricated and cushioned in oil.
Shell-moulding casting ① machined by transfer lines and then cleaned by thermal deburring.
Optimized flow paths largely cored with extrawide channels to tank for low pressure drops.
Interchangeable spools ② available in a wide variety of configurations.
DHU and DHO valves can be supplied with optional devices for control of switching times.
Standard electric/electronic connectors ④ able to satisfy the requirements of modern machines for electric interfaces characteristics.
Coils are fully encapsulated (class H).
In DHI and DHU, coils are easily replaceable without aid of tools.
Rugged execution suitable for outdoor use.

Surface mounting ISO/Cetop 03.
Max flow up to 60 l/min for DHI/DHU and up to 80 l/min for DHO.
Max pressure: 350 bar.

1 MODEL CODE

DHI – 0 63 1/2 /A - X 24 DC ** /*

Directional control valves ISO/Cetop 03
DHI-0 = solenoid OI for AC and DC supply
DHU-0 = solenoid OU for DC supply
DHO-0 = solenoid OO for DC supply

Valve configuration, see table 2
61 = single solenoid, center plus external position, spring centered
63 = single solenoid, 2 external positions, spring offset
67 = single solenoid, center plus external position, spring offset
70 = double solenoid, 2 external positions, without spring
71 = double solenoid, 3 positions, spring centered
75 = double solenoid, 2 external positions, with detent (not available for DHO models)
Other configurations are available on request.

Spool type, see table 3.

Options, see note 1 at section 5.

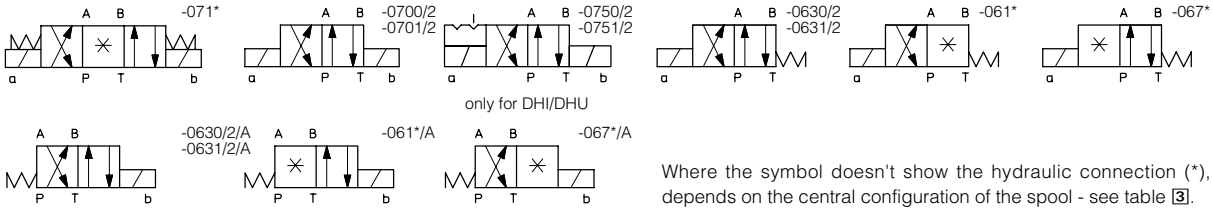
X = without connector
See note 2 at section 5 for available connectors, to be ordered separately

External supply voltage see section 6
00 = valve without coils (only for DHI and DHU).

Design number

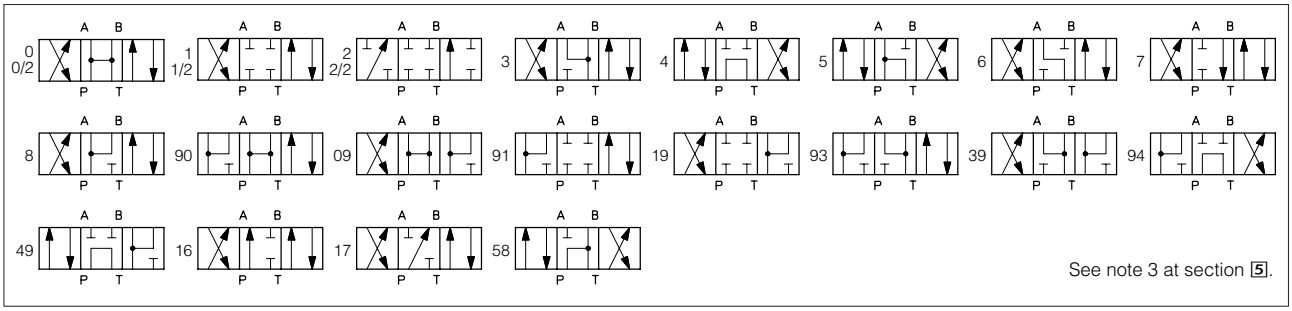
Synthetic fluids
WG =water glycol
PE= phosphate ester

2 CONFIGURATION



Where the symbol doesn't show the hydraulic connection (*), it depends on the central configuration of the spool - see table 3.

3 SPOOLS - for intermediate passages, see tab. E001.



See note 3 at section 5.

4 MAIN CHARACTERISTICS OF DHI, DHU AND DHO DIRECTIONAL VALVES

Assembly position / location	Any position for all valves except for type - 070* (without springs) that must be installed with horizontal axis if operated by impulses
Subplate surface finishing	Roughness index $\sqrt{}^{0,4}$ flatness ratio 0,01/100 (ISO 1101).
Ambient temperature	from -20°C to +70°C.
Fluid	Hydraulic oil as per DIN 51524 .... 535; for other fluids see section 1.
Recommended viscosity	15 ÷ 100 mm²/s at 40°C (ISO VG 15 ÷ 100).
Fluid contamination class	ISO 19/16, achieved with in line filters at 25 μm value to $\beta_{25} \geq 75$ (recommended).
Fluid temperature	T ≤ 80°C if T ≥ 60°C select /PE seals
Flow direction	As shown in the symbols of tables 2 and 3.
Operating pressure	Ports P,A,B: 350 bar; Port T: 120 bar for DHI; 210 bar for DHU and DHO; For versions with proximity switches (/FI/NC and /FI/NO versions) maximum counter pressure allowed on T port is 5 bar
Rated flow	See diagrams Q/Δp at section 7.
Maximum flow	60 l/min for DHI and DHU; 80 l/min for DHO, see operating limits at section 8.
Relative duty factor	100%
Supply voltage and frequency	See model code at section 1.
Supply voltage tolerance	± 10%

5 NOTES

1 Options

A = Solenoid mounted at side of port B (only for single solenoid valves). In standard versions, solenoid is mounted at side of port A.
WP = prolonged manual override protected by rubber cap (standard for DHO models).
L1, L2, L3, = device for controlling switching time (only for DHU and DHO models). Not available for valves with connectors E-SA or E-SE. For spools 4 and 4/8 only device L3 is available.
F * = with proximity switch for monitoring spool position: see tab. E110.

2 Type of electric/electronic connector DIN 43650, to be ordered separately

SP-666 = standard connector IP-65, suitable for direct connection to electric supply source.
SP-667 = as SP-666, but with built-in signal led.
SP-669 = with built-in rectifier bridge for supplying DC coils by alternate current (AC).
E-SA = electronic connector (only for DHI and DHU valves) which improves performances and give faster shifting times for DC solenoid supplied by AC power.
E-SE = electronic connector (only for DHI and DHU valves) which improves performances and reduces power consumption for DC solenoid supplied by DC power.
E-SR = electronic connector which permits switching of solenoid valves by a low power signal (max 20mA).
E-SD = electronic connector which eliminates electric disturbances when solenoid valves are de-energized.
Note: disturbance suppressor devices, similar to E-SD are, standard, built in all E-SA, E-SE, E-SR.

3 Spools

- spools type 0/2, 1/2, 2/2 are only used for two position valves: single solenoid valves, type DH*-063*/2 and double solenoid valves type DH*-070*/2 and DH*-075*/2.
- spools type 0 and 3 are also available as 0/1 and 3/1 that, when in centre position, oil passage from ports to tank are restricted.
- spools type 1,4 and 5 are also available as 1/1, 4/8 and 5/1. They are properly shaped to reduce water-hammer shocks during the swiching.
- spools type 1,3, 8 and 1/2 are available as 1P, 3P, 8P and 1/2P to limit valve leackage.
- Other types of spools can be supplied on request.

6 ELECTRIC FEATURES

Valve	External supply nominal voltage (1) (2)		Type of connector	Power consumption (4)	Code of spare coil (8)	Colour of coil label
DHI and DHU	DIRECT CURRENT	6 DC	SP-666 or SP-667	33 W	SP-COU-6DC/ 80	brown
		12 DC			SP-COU-12DC /80	green
		12 DC			SP-COUR-12DC /10	green
		24 DC			SP-COU-24DC /80	red
		24 DC			SP-COUR-24DC /10	red
		48 DC			SP-COU-48DC /80	silver
		12 DC	E-SE	7 W (5)	SP-COU-6DC /80	brown
		24 DC			SP-COU-12DC /80	green
		24 DC			SP-COUR-12DC /10	green
	ALTERNATE CURRENT	110/50 AC	E-SA	67 VA (6)	SP-COU-24DC /80	red
		120/60 AC		60 VA (6)	SP-COUR-24DC /10	red
		230/50 AC		67 VA (6)	SP-COU-48DC /80	silver
		230/60 AC		60 VA (6)		
		110/50 AC	SP-669	40 VA	SP-COU-110RC /80	gold
		120/60 AC		35 VA	SP-COUR-110RC /10	gold
		230/50 AC		40 VA	SP-COU-230RC /80	blue
		230/60 AC		35 VA	SP-COUR-230RC /10	blue
DHI	ALTERNATE CURRENT	110/50 AC (3)	SP-666 or SP-667	60 VA (7)	SP-COI-110/50/60AC /80	yellow
		120/60 AC			SP-COI-120/60AC /80	white
		230/50 AC (3)			SP-COI-230/50/60AC /80	light blue
		230/60 AC			SP-COI-230/60AC /80	silver
DHO	DIRECT CURRENT	12 DC	SP-666 or SP-667	32 W	–	–
		24 DC			–	–
		110 DC		40 W	–	–
		220 DC			–	–
	ALTERNATE CURRENT	110/50 AC	SP-669	40 VA	–	–
		120/60 AC		35 VA	–	–
		230/50 AC		40 VA	–	–
		230/60 AC		35 VA	–	–

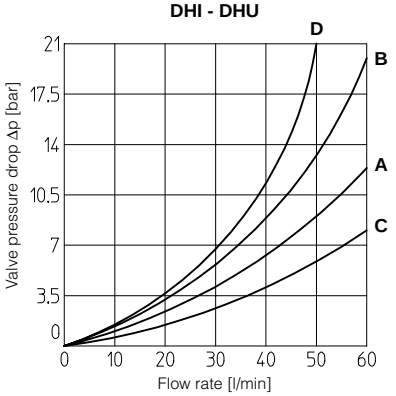
(1) Tolerance on the nominal voltage is ± 10%.
(2) Other supply voltages are available on request: 9 DC (12 DC coil with 50% duty cycle), 28 DC, 110 DC, 125 DC, 220 DC, 24/50/60 AC, 48/50/60 AC.
Supply voltages 14 DC, 28 DC, 110 DC and 220 DC for DHU (and DLOH, DLOK, technical table E041) are available with coil type SP-COUR
(3) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷15% and the power consumption is 55 VA.
(4) Average values based on tests preformed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(5) In a cycle, where solenoid is energized/deenergized in 1 second (1 Hz), the average power consumption is 7 W; for longer cycles, the power consumption is lower.
When solenoid is energized the inrush current is 6 A at 12 VDC and 3 A at 24 VDC corresponding to power consumption peak of 72 W.
These current peaks persist for a period shorter than 100 msec and they must be considered when electric circuit is designed.
(6) When solenoid is energized the inrush current is 4,6A at 110 VAC and 2,3A at 230 VAC; the power consumption peak is 500 VA; these current peaks persist for a period shorter than 40 msec and they must be considered when electric circuit is designed.
(7) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.
(8) Protection class H; Duty cycle: 100%.
Connector protection degree: IP 65.
Coils type SP-COUR-** are available only for DHU

7 Q/ΔP DIAGRAMS

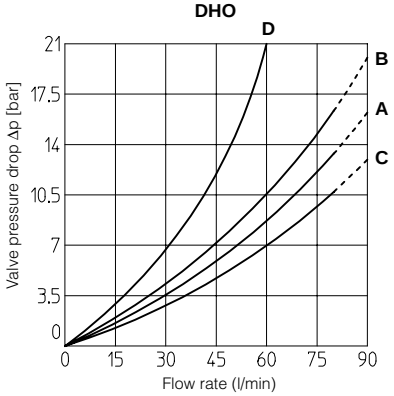
Flow direction / Spool type	P→A	P→B	A→T	B→T	P→T
0	C	C	C	C	
0/2, 1, 1/2	A	A	A	A	
2, 3	A	A	C	C	
2/2, 4, 5, 9*	D	D	D	D	A
6	A	A	C	A	
7	A	A	A	C	
8	C	C	B	B	

Based on fluid viscosity of 43 mm²/s at 40°C.

DHI - DHU



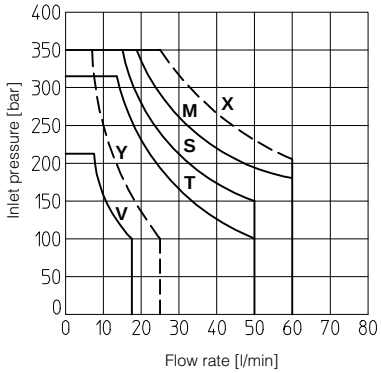
DHO



8 OPERATING LIMITS

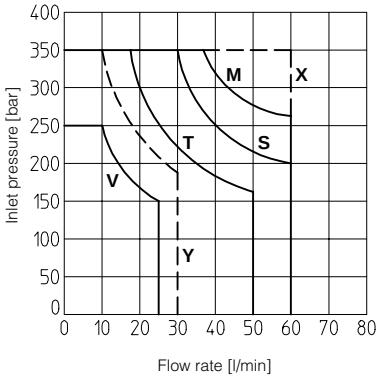
The diagrams have been obtained with warm solenoids and power supply at lowest value (V_{nom} - 10%). The curves refer to application with symmetrical flow through the valve (i.e. P→A and B→T). In case of asymmetric flow and if the valves have the devices for controlling the switching times the operating limits must be reduced.

DHI



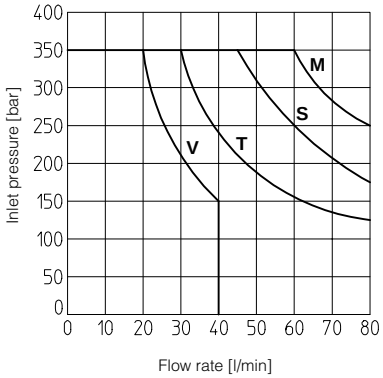
X = Spools 0, 0/2, 1, 1/2, 3, 6, 7, 8, with E-SA or E-SE connectors.
M = Spools 0, 1, 1/2, 8 with electric connectors.
S = Spools 0/2, 3, 6, 7 with electric connectors.
Y = Spools 2, 2/2, *9, 9* with E-SA or E-SE connectors.
V = Spools 2, 2/2, *9, 9* with electric connectors.
T = Spools 4, 5 with electric connectors

DHU



X = Spools 0, 0/2, 1, 1/2, 3, 6, 7, 8 with E-SA or E-SE connector.
M = Spools 0, 1, 1/2, 8 with electric connectors;
S = Spools 0/2, 3, 6, 7 with electric connectors.
Y = Spools 2, 2/2, *9, 9* with E-SA or E-SE connectors.
V = Spools, 2, 2/2, *9, 9* with electric connectors.
T = Spools 4, 5 with electric connectors.

DHO



M = Spools 0, 1, 1/2, 8.
S = Spools 0/2, 3, 6, 7.
V = Spools 2, 2/2, *9, 9*
T = Spools 4, 5.

9 SWITCHING TIMES (average values in msec)

DHI

Valve	Switch-on AC	Switch-on DC	Switch-off
DHI + SP-666 / SP-667	30	45	20
DHI + SP-669	45	—	80
DHI + E-SA	20	—	40
DHI + E-SD / E-SR	30	45	50
DHI + E-SE	—	30	40

DHU

Valve	Switch-on AC	Switch-on DC	Switch-off
DHU + SP-666 / SP-667	—	45	20
DHU + SP-669	45	—	80
DHU + E-SA	20	—	40
DHU + E-SD / E-SR	—	45	50
DHU + E-SE	—	30	40
DHU-*/L1	—	60	60
DHU-*/L2	—	80	80
DHU-*/L3	—	110	150

DHO

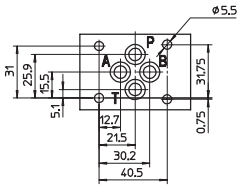
Valve	Switch-on AC	Switch-on DC	Switch-off
DHO + SP-666 / SP-667	—	50	20
DHO + SP-669	50	—	80
DHO + E-SD / E-SR	—	50	50
DHO-*/L1	—	60	60
DHO-*/L2	—	80	80
DHO-*/L3	—	150	150

Test conditions:

- 36 l/min; 150 bar
- nominal voltage
- 2 bar of counter pressure on port T
- mineral oil: 43 mm²/s viscosity at 40°C.

The elasticity of the hydraulic circuit and the variations of the hydraulic characteristics and temperature affect the response time.

10 DIMENSIONS [mm]

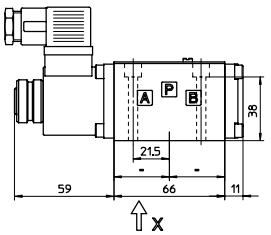


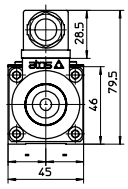
ISO/Cetop 03

Fastening bolts: 4 socket head screws M5x50
Seals: 4 OR 108
Ports P,A,B,T: Ø = 7.5 mm (max).

P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
For the max pressures on ports, see section 4

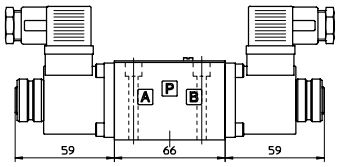
DHI-06





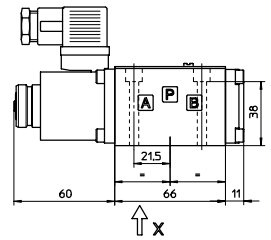
Mass: 1,5 kg

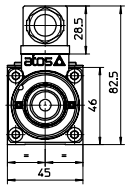
DHI-07



Mass: 1,8 kg

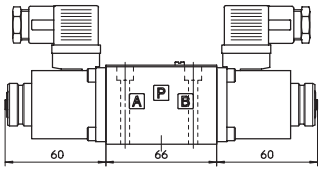
DHU-06





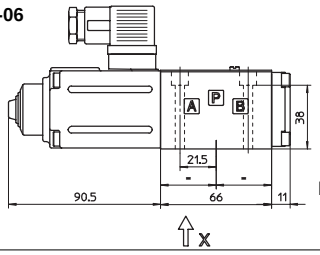
Mass: 1,5 kg

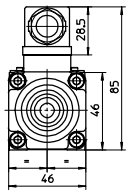
DHU-07



Mass: 1,8 kg

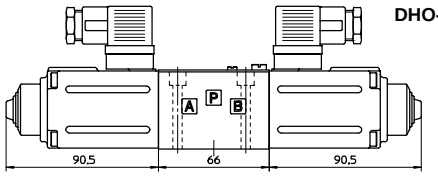
DHO-06





Mass: 1,9 kg

DHO-07

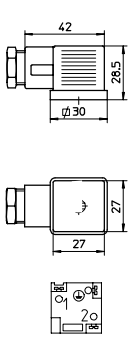


Mass: 2,6 kg

Overall dimensions refer to valves with connectors type SP-666

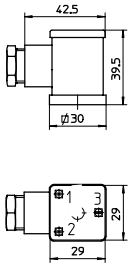
11 ELECTRIC/ELECTRONIC CONNECTORS ACCORDING TO DIN 43650 - The connectors must be ordered separately

SP-666, SP-667
(for AC or DC supply)
E-SD/DC
(for DC supply)



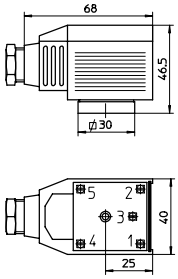
SP-666, SP-667
1 = Positive ⊕
2 = Negative ⊖
⏚ = Coil ground

SP-669
(for AC supply)



SP-669
1,2 = Supply voltage VAC
3 = Coil ground

E-SA (for AC supply)
E-SE (for DC supply)
E-SR/AC (for AC supply)

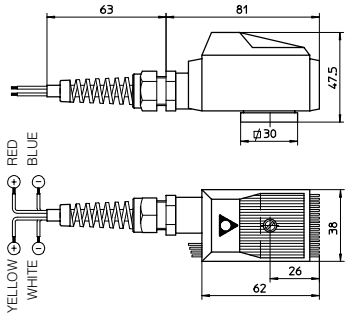


E-SA
1,2 = Supply voltage VAC
3 = Coil ground

E-SE
1 = Positive ⊕
2 = Negative ⊖

E-SR/AC
1,2 = Supply voltage VAC
3 = Coil ground
4 = Negative pilot signal VDC
5 = Positive pilot signal VDC

E-SR/DC (for DC supply)

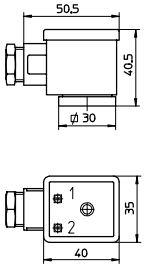


Power supply VDC:
RED = Positive ⊕
BLUE = Ground ⊖

Pilot signal VDC:
YELLOW = Positive ⊕
WHITE = Negative ⊖

Supplied with 5 m long cable.

E-SD/AC
(for AC supply)



1,2 = Supply voltage VAC

12 MOUNTING SUBPLATES

Model	Ports location	GAS Ports A-B-P-T	Ø Counterbore [mm] A-B-P-T	Mass [kg]
BA-202	Ports A, B, P, T underneath;	3/8"	–	1,2
BA-204	Ports P, T underneath; ports A, B on lateral side	3/8"	25,5	1,8
BA-302	Ports A, B, P, T underneath	1/2"	30	1,8

The subplates are supplied with 4 fastening bolts M5x50. Also available are multi-station subplates and modular subplates. For further details see table K280.