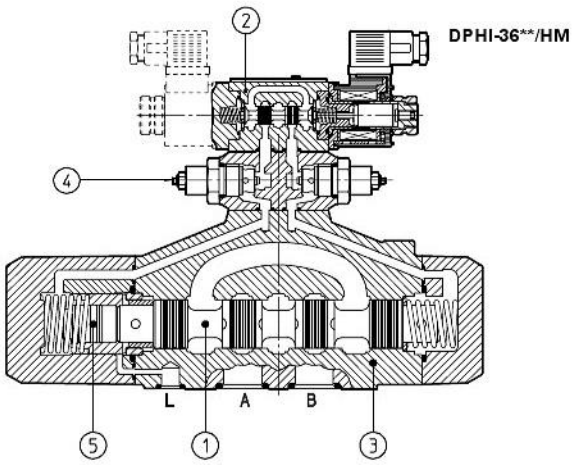
Atos spa
21018 Sesto Calende, Italy - Fax 0331 920005

Solenoid directional valves type DPHI, DPHU, DPHO

two stage, pilot operated, ISO/Cetop size 05, 07, 08 and 10



Dotted line: **DPHI-37**/HM**

DPHI, DPHU and DPHO are spool ① type, two or three position directional piloted solenoid valves designed to operate in oil hydraulic systems.
They are actuated by a direct solenoid valve ②:
- DHI suitable for AC and DC supply;
- DHU suitable for DC supply with improved performances;
- DHO for DC supply, high performances.

Shell-moulding castings ③ machined by transfer lines and then cleaned by thermal deburring. Optimized flow paths largely cored with extrawide channels to tank for low pressure drops.
Valves can be supplied with optional devices for control of switching times ④ and with optional hydraulic centering device of main spool ⑤.
In DPHI and DPHU, coils are easily re- placeable without aid of tools.
Rugged execution suitable for outdoor use.
Mounting interface: ISO/Cetop 05, 07, 08, 10.
Max flow up to 140, 300, 650, 1000 l/min.
Pressure up to 350 bar.

1 MODEL CODE

DPH	I	-	2	71	1	/A	–	X	24DC	**	*

DPH — Piloted directional control valve

Solenoid of pilot valve:
I = solenoid OI for AC and DC supply
U = solenoid OU for DC supply
O = solenoid OO for DC supply

Valve size:
1 = ISO/Cetop 05
2 = ISO/Cetop 07
3 = ISO/Cetop 08
6 = ISO/Cetop 10

Valve configuration, see section [2]:
61 = 1 single solenoid, center plus external position, spring centered
63 = 1 single solenoid, 2 external positions, spring offset
67 = 1 single solenoid, center plus external position, spring offset
70 = 2 double solenoid, 2 external positions, without springs
71 = 2 double solenoid, 3 positions, spring centered
75 = 2 double solenoid, 2 external positions, with detent (not available for DPHO models)
Other configurations are available on request.

Spool type, see section [3]

Options, see note 1 at section [5]

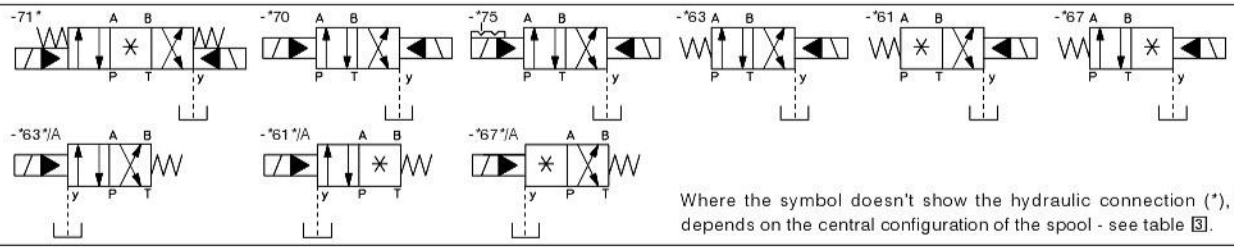
X = without connector
See section [6] for available connectors, to be ordered separately

Supply voltage, see section [7]:
00 = solenoid valve without coils (only for OI and OU solenoids)

Design number

Syntethic fluids:
/WG = water-glycol
/PE = phosphate ester

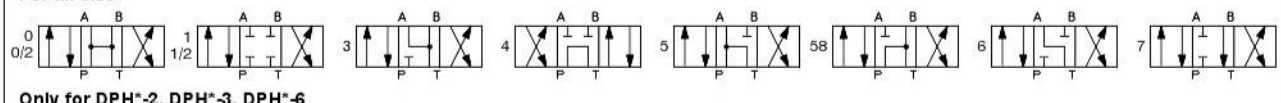
2 CONFIGURATION



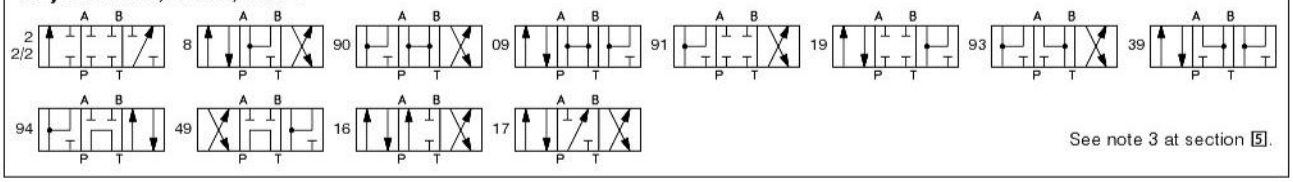
Where the symbol doesn't show the hydraulic connection (*), it depends on the central configuration of the spool - see table [3].

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

For all size



Only for DPH*-2, DPH*-3, DPH*-6



See note 3 at section [5].

4 MAIN CHARACTERISTICS OF SOLENOID DIRECTIONAL VALVES TYPE DPHI, DPHU, DPHO

Installation position	Any position for all valves except for type -*70 (without springs) that must be installed with horizontal axis if operated by impulses.
Subplate surface finishing	Roughness index $\sqrt{\frac{0,1}{}}$; rflatness ratio 0,01/100 (ISO 1101)
Ambient temperature	-20°C to +70°C
Fluid	Hydraulic oil as per DIN 51524...535; for other fluids see section [1]
Recommended viscosity	15 ÷ 100 mm²/sec at 40°C (ISO VG 15 ÷ 100)
Fluid contamination class	ISO 19/16 achieved with in line filters at 25 µm value and $ß_{25} \geq 75$ (recommended)
Fluid temperature	T < 80°C, se T > 60°C scegliere guarnizioni /PE seals
Operating pressure	Ports P, A, B, X: 350 bar; Port T: 250 bar (0 bar for option /D) Ports Y and L (if required): 0 bar Minimum pilot pressure for correct operation is 8 bar (10 bar with hydraulic centering device – option /M)
Maximum flow (see rated flow at section [8] and operating limits at section [9])	DPH*-1: 140 l/min DPH*-2: 300 l/min DPH*-3: 650 l/min DPH*-6: 1000 l/min
Relative duty factor	100%
Supply voltage and frequency	See section [7]

5 NOTES

1 Options

/A = Solenoid mounted at side of port A of main body (only for single solenoid valves). In standard version, solenoid is mounted at side of port B.

/D = Internal drain.

/E = External pilot pressure.

/FC = Microswitch for monitoring spool position (only for DPH*-2, -3, -6).

/FI/NC = Proximity switch (two for double solenoid valves) for monitoring spool position: electric contact is closed when spool is in resting position (only for DPH*-2, -3, -6).

/FI/NO = Proximity switch (two for double solenoid valves) for monitoring spool position: electric contact is open when spool is in resting position (only for DPH*-2, -3, -6).

/H = Adjustable chokes (meter-out to the pilot chambers of the main valve).

/H9 = Adjustable chokes (meter-in to the pilot chambers of the main valve).

/M = (only for three position valves and DPH*-2, -3, -6) = Hydraulic pressure centering: For operation with pressure higher than 250 bar and high rates of flow, the use of hydraulic centering device may be recommended.

/R = Pilot pressure generator (4 bar on port P - only for DPH*-2, -3, -6), see section [11].

/S = Main spool stroke adjustment (only for DPH*-2, -3, -6).

/WP = prolonged manual override protected by rubber cap (standard for DPHO models).

/L1, /L2, /L3 = device for controlling switching time plug (dimension L1, L2, L3) on A and B ports of the pilot valve.

2 Spools

- spools type 0 and 3 are also available as 0/1 and 3/1. With them, when in centre position, oil passage from ports to tank are restricted.
- spools type 1, 4, 5, 6 and 7 are also available as 1/1, 4/8, 5/1, 6/1 and 7/1 (6/1 and 7/1 only for DPH*-2, -3, -6) that are properly shaped to reduce water-hammer shocks during the switching.
- spools type 9, 9*, *9, 16 and 17 are not available for DPH*-6.
- other types of spools can be supplied on request.

6 ELECTRONIC CONNECTORS ACCORDING TO DIN 43650

The connectors must be ordered separately

Code of connector	Function
SP-666	Connector IP-65, suitable for direct connection to electric supply source
SP-667	As SP-666 connector IP-65 but with built-in signal led, suitable for direct connection to electric supply source..
SP-669	With built-in rectifier bridge for supplying DC coils by alternating current (AC). Only for DPHO

For other available connectors, see tab. E010 and K500

7 ELECTRIC FEATURES

Type of solenoid	External supply nominal voltage (1) (2)		Type of connector	Power consumption (4)	Code of spare coil (6)	Colour of coil label
OI OU	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 /80	green
		24 DC			SP-COU-24DC /80	red
		24 DC			SP-COUR-24DC /80	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 /80	green
OI	ALTERNATE CURRENT	110/50 AC (3)	SP-666 or SP-667	60 VA (5)	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
OO	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) For other supply voltages available on request see technical table E010.

(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) 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.

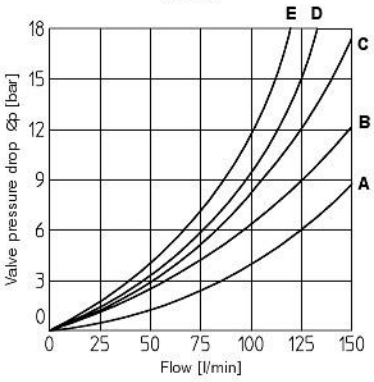
(6) Protection class H; Duty cycle: 100%. Connector protection degree: IP 65. Coils type SP-COUR-** are available only for DPHU

8 FLOW VERSUS PRESSURE DIAGRAMS

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

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

DPH*1



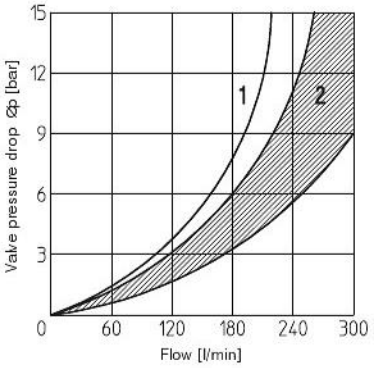
9 OPERATING LIMITS

The max recommended flow rates - l/min - for a correct operation are shown in the tables below for some typical spools and inlet pressure.
For higher values the use of the hydraulic centering device is recommended.

Spool	Inlet pressure			
	70	140	210	350
0, 1, 3, 6, 7	140	140	140	130
4, 4/8	140	140	120	90
5, 5/8	140	140	130	110
0/1, 0/2	140	140	130	120

Flow direction / Spool type	P→A	P→B	A→T	B→T	P→T
4, 4/8	-	-	-	-	1
Other	2	2	2	2	-

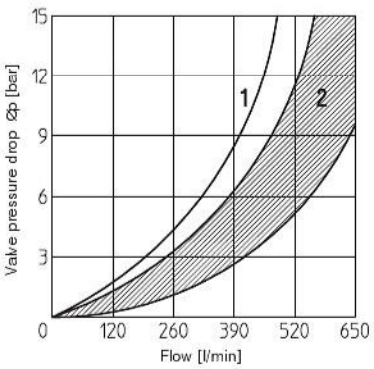
DPH*2



Spool	Inlet pressure			
	70	140	210	350
0,1,3,6,7,8	300	300	300	250
2, 4, 4/8	300	300	240	140
5	260	220	180	100
0/1	300	250	210	180
9, 9	300	300	270	200

Flow direction / Spool type	P→A	P→B	A→T	B→T	P→T
4, 4/8	-	-	-	-	1
Other	2	2	2	2	-

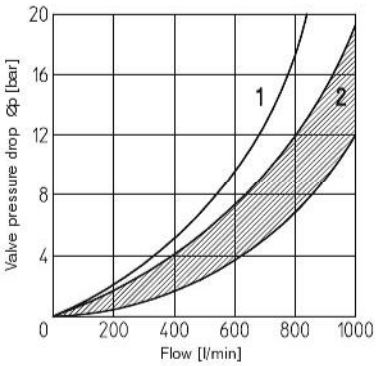
DPH*3



Spool	Inlet pressure			
	70	140	210	350
1, 6, 7, 8	650	650	650	600
2, 4, 4/8	500	500	450	400
5, 0/1	600	520	400	300
0, 3	650	650	600	540
9, 9	500	500	500	450

Flow direction / Spool type	P→A	P→B	A→T	B→T	P→T
4, 4/8	-	-	-	-	1
Other	2	2	2	2	-

DPH*6



Spool	Inlet pressure			
	70	140	210	350
1, 6, 7, 8	1000	950	850	700
0	950	900	800	650
4, 4/8, 5	850	800	700	450
0/1	950	850	650	450

10 SWITCHING TIMES (average values in m sec)

DPH*-1

		Piloting pressure							
		70 bar		140 bar		210 bar		250 bar	
		DPHI	DPHI DPHU DPHO	DPHI	DPHI DPHU DPHO	DPHI	DPHI DPHU DPHO	DPHI	DPHI DPHU DPHO
Configuration		Alternating current	Direct current	Alternating current	Direct current	Alternating current	Direct current	Alternating current	Direct current
71, 61, 67, 61*/A, 67*/A	Switch ON	35	50	30	45	25	40	20	35
	Switch OFF	50							
63, 63*/A	Switch ON	50	75	40	65	35	55	30	50
	Switch OFF	80							

DPH*-2

		Piloting pressure							
		70 bar		140 bar		210 bar		250 bar	
		DPHI	DPHI DPHU DPHO	DPHI	DPHI DPHU DPHO	DPHI	DPHI DPHU DPHO	DPHI	DPHI DPHU DPHO
Configuration		Alternating current	Direct current	Alternating current	Direct current	Alternating current	Direct current	Alternating current	Direct current
71, 61, 67, 61*/A, 67*/A	Switch ON	40	55	30	50	25	45	20	40
	Switch OFF	60							
63, 63*/A	Switch ON	55	80	45	70	40	60	35	55
	Switch OFF	95							

DPH*-3

		Piloting pressure							
		70 bar		140 bar		210 bar		250 bar	
		DPHI	DPHI DPHU DPHO	DPHI	DPHI DPHU DPHO	DPHI	DPHI DPHU DPHO	DPHI	DPHI DPHU DPHO
Configuration		Alternating current	Direct current	Alternating current	Direct current	Alternating current	Direct current	Alternating current	Direct current
71, 61, 67, 61*/A, 67*/A	Switch ON	60	80	45	60	35	50	30	45
	Switch OFF	80							
63, 63*/A	Switch ON	95	115	75	95	65	75	50	65
	Switch OFF	130							

DPH*-6

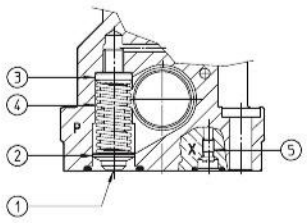
		Piloting pressure							
		70 bar		140 bar		210 bar		250 bar	
		DPHI	DPHI DPHU DPHO	DPHI	DPHI DPHU DPHO	DPHI	DPHI DPHU DPHO	DPHI	DPHI DPHU DPHO
Configuration		Alternating current	Direct current	Alternating current	Direct current	Alternating current	Direct current	Alternating current	Direct current
71, 61, 67, 61*/A, 67*/A	Switch ON	70	95	55	70	45	60	40	55
	Switch OFF	150							
63, 63*/A	Switch ON	115	145	95	110	80	100	70	90
	Switch OFF	280							

Notes:

1) For configuration 70 and 75, times of switching ON and switching OFF are the same: this value is equal to time of switch ON of configuration 63.
2) TEST CONDITIONS
   - Nominal voltage supply DC (direct) and AC (alternating) with connector type SP-666. The use of other connectors can affect the switching time;
   - 2 bar of counter pressure on port T;
   - mineral oil: 43 mm²/sec viscosity at 40°C.
3) The response time is affected by elasticity of the hydraulic circuit, by variation of hydraulic characteristics and temperature.

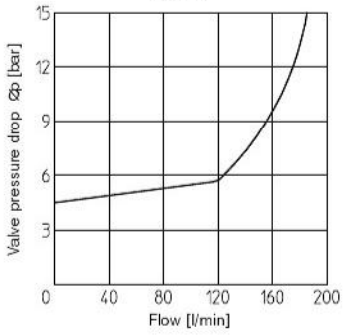
11 PILOT PRESSURE GENERATOR (OPTION /R)

The device /R generates an additional pressure drop, in order to ensure the minimum pilot pressure, for correct operation of the valves with internal pilot and fitted with spools type 0, 0/1, 4, 4/8, and 5. The device /R has to be fitted when the pressure drop in the valve, verified on flow versus pressure diagrams, is lower than the minimum pilot pressure value.

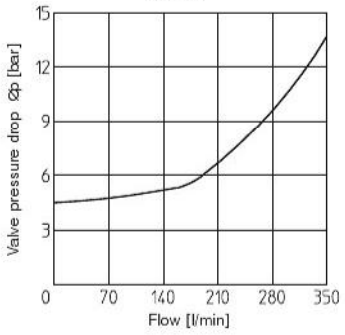


① Flapper-guide
② Flapper
③ Spring stop-washer
④ Spring
for DPH*-2: MO-447
for DPH*-3: MO-472
for DPH*-6: MO-448
⑤ Plug
for DPH*-2: SP-X500
for DPH*-3: SP-X300
for DPH*-6: SP-X300

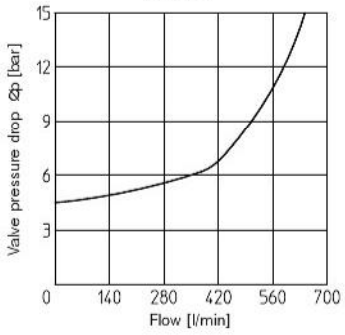
DPH*2



DPH*3



DPH*6

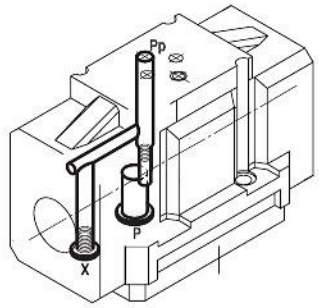


12 ORIFICE LOCATION FOR PILOT/DRAIN CHANNELS

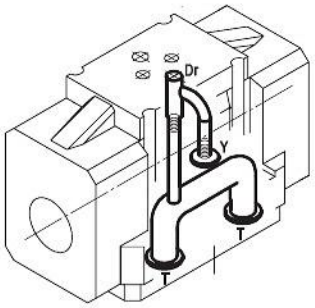
Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration proper plugs must only be interchanged.
Standard valves have internal pilot and external drain

DPH*-1

Pilot channels



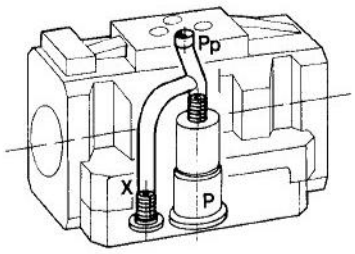
Drain channels



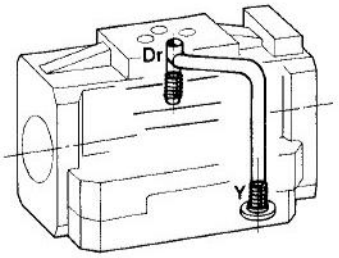
Internal piloting: blinded plug SP-X300 in X; plug SP-X310A in Pp;
External piloting: blinded plug SP-X300 in Pp; plug SP-X310A in X;
Internal drain: blinded plug SP-X300 in Y;
External drain: blinded plug SP-X300 in Dr.

DPH*-2

Pilot channels



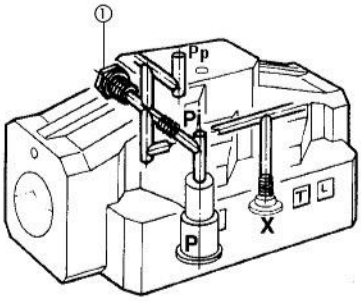
Drain channels



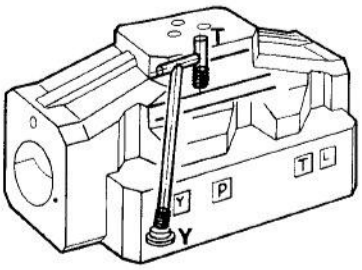
Internal piloting: blinded plug SP-X500 in X; plug SP-X512A in Pp;
External piloting: blinded plug SP-X500 in Pp; plug SP-X512A in X;
Internal drain: blinded plug SP-X300 in Y;
External drain: blinded plug SP-X300 in Dr.

DPH*-3

Pilot channels



Drain channels

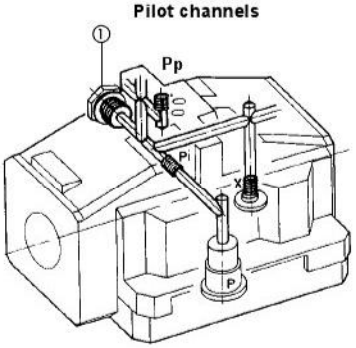


To reach the Pi orifice, remove plug ①

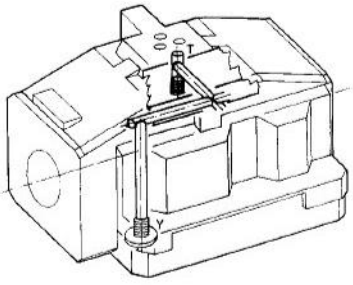
Internal piloting: blinded plug SP-X300 in X; plug SP-X315A in Pp;
External piloting: blinded plug SP-X300 in Pi; plug SP-X315A in X;
Internal drain: blinded plug SP-X300 in Y;
External drain: blinded plug SP-X300 in T.

DPH*-6

Pilot channels



Drain channels



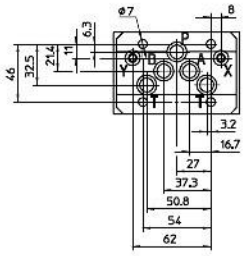
To reach the Pi orifice, remove plug ①

Internal piloting: blinded plug SP-X300 in X; plug SP-X325A in Pp;
External piloting: blinded plug SP-X300 in Pi; plug SP-X325A in X;
Internal drain: blinded plug SP-X300 in Y;
External drain: blinded plug SP-X300 in T.

13 DIMENSIONS FOR DPH*-1 AND DPH*-2 [mm]

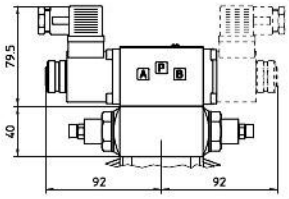
DPH*-1*
ISO/Cetop 05

Fastening bolts:
4 socket head screws CHC M6x40
Diameter of ports A,B, P, T: Ø = 11 mm;
Diameter of ports X, Y: Ø = 5 mm;
Seals: 5 OR 2050
2 OR 108

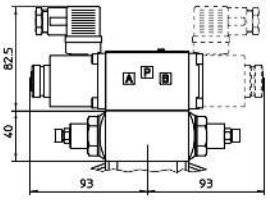


P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL OIL PILOT PORT
Y = DRAIN PORT

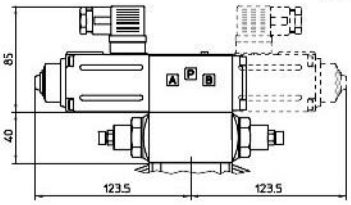
DPHI-1*/H /H9

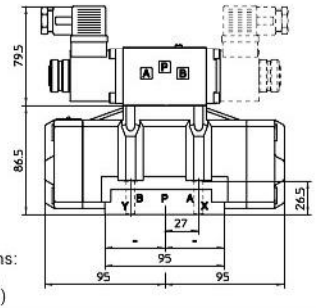


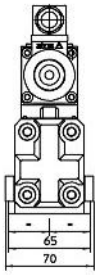
DPHU-1*/H /H9



DPHO-1*/H /H9







DPHI-1*

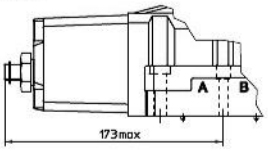
Mass of basic versions:
kg 6,5 (one solenoid)
kg 6,8 (two solenoids)

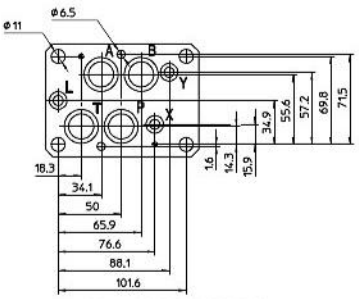
Mass of basic versions:
kg 6,9 (one solenoid)
kg 7,6 (two solenoids)

DPH*-2*
ISO/Cetop 07

Fastening bolts:
4 socket head screws M10x50
2 socket head screws M6x40
Diameter of ports A, B, P, T: Ø = 20 mm;
Diameter of ports X, Y: Ø = 7 mm;
Diameter of ports L: Ø = 5 mm;
Seals: 4 OR 130, 3 OR 109

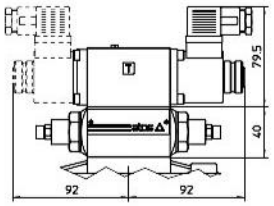
Stroke adjustment device for option/S



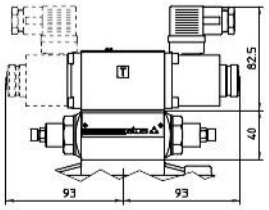


P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL OIL PILOT PORT
Y = DRAIN PORT
L = DRAIN PORT FOR HYDRAULIC CENTERING DEVICE used only for /M versions

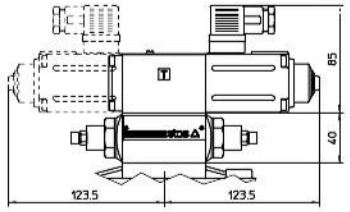
DPHI-2*/H /H9



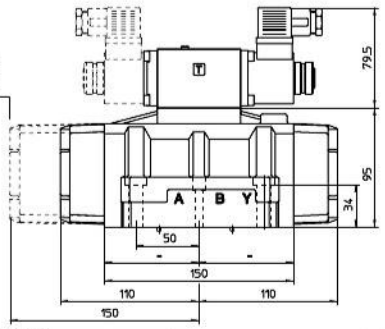
DPHU-2*/H /H9

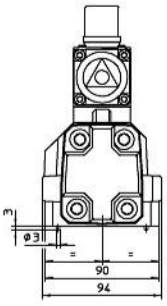


DPHO-2*/H /H9



Only version DPH*-27*/M





DPHI-2*

Mass of basic versions:
kg 9 (one solenoid)
kg 9,3 (two solenoids)

Mass of basic versions:
kg 9,4 (one solenoid)
kg 10,1 (two solenoids)

Overall dimensions refer to valves with connectors type SP-666

14 MOUNTING SUBPLATES FOR DPH*-1 AND DPH*-2

Valve	Subplate model	Ports location	Ports		Ø Counterbore [mm]		Mass [Kg]
			A, B, P, T	X, Y, (L)	A, B, P, T	X, Y, (L)	
DPH*-1	BA-428	Ports A, B, P, T, X, Y underneath;	G 3/4"	G 1/4"	36,5	21,5	5,6
DPH*-1	BA-434	Ports P, T, X, Y underneath; ports A, B on lateral side	G 3/4"	G 1/4"	36,5	21,5	5,5
DPH*-2	BA-418 (/DR)	Ports A, B, P, T, X, Y (L) underneath;	G 3/4"	G 1/4"	36,5	21,5	3,5
DPH*-2	BA-518 (/DR)	Ports A, B, P, T, X, Y (L) underneath;	G 1"	G 1/4"	46	21,5	8
DPH*-2	BA-519 (/DR)	Ports P, T, X, Y (L) underneath; ports A, B on lateral side	G 1"	G 1/4"	46	21,5	8

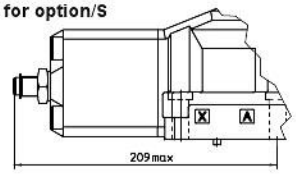
The drain port L (subplates /DR) is required only for valves with hydraulic pressure centering device (option /M)
The subplates are supplied with fastening bolts. For further details see table K280

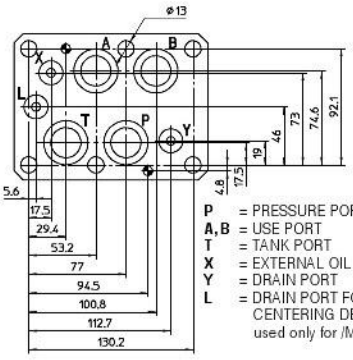
15 DIMENSIONS FOR DPH*-3 AND DPH*-6 [mm]

DPH*-3*
ISO/Cetop 08

Fastening bolts:
6 socket head screws M12x50
Diameter of ports A, B, P, T: Ø = 24 mm;
Diameter of ports X, Y: Ø = 7 mm;
Diameter of port L: Ø = 5 mm;
Seals: 4 OR 4112, 3 OR 3056

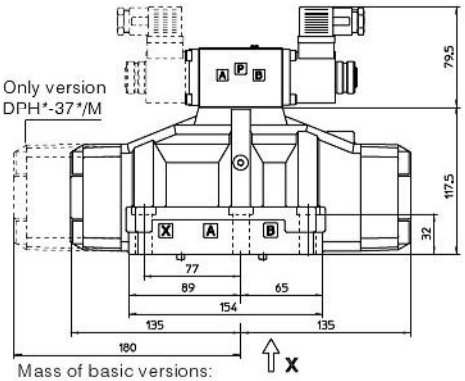
Stroke adjustment device for option/S

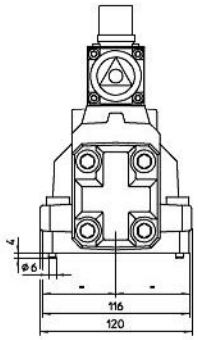




P = PRESSURE PORT
A,B = USE PORT
T = TANK PORT
X = EXTERNAL OIL PILOT PORT
Y = DRAIN PORT
L = DRAIN PORT FOR HYDRAULIC CENTERING DEVICE used only for /M versions

Only version DPH*-37*/M

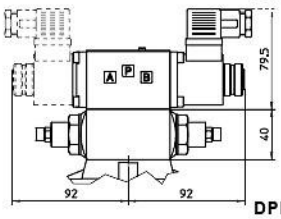




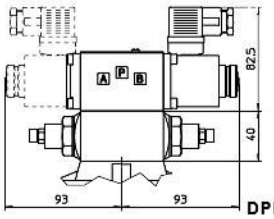
Mass of basic versions:
kg 14 (one solenoid)
kg 14,3 (two solenoids)

DPHI-3*

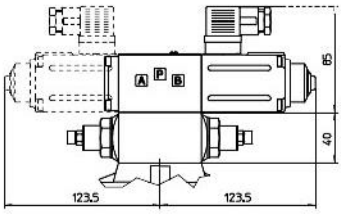
DPHI-3*/H /H9



DPHU-3*/H /H9



DPHO-3*/H /H9

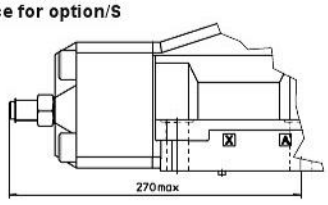


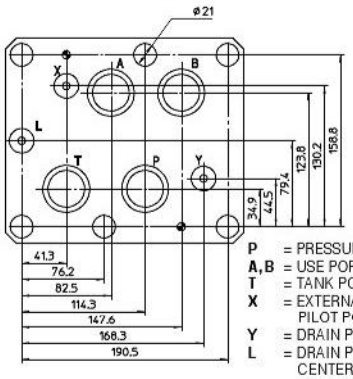
Mass of basic versions:
kg 14,4 (one solenoid)
kg 15,1 (two solenoids)

DPH*-6*
ISO/Cetop 10

Fastening bolts:
6 socket head screws M20x80
Diameter of ports A, B, P, T: Ø = 34 mm;
Diameter of ports X, Y: Ø = 7 mm;
Diameter of ports L: Ø = 5 mm;
Seals: 4 OR 4137, 3 OR 3081

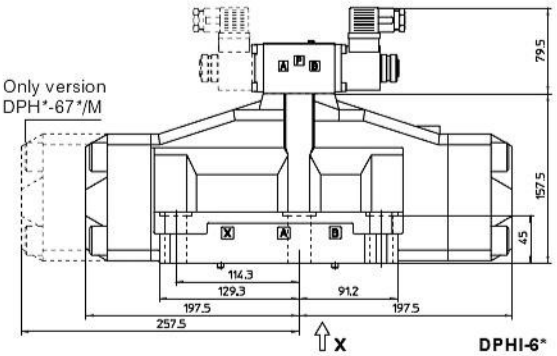
Stroke adjustment device for option/S

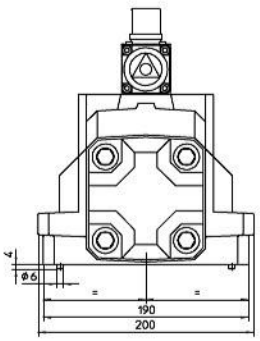




P = PRESSURE PORT
A,B = USE PORT
T = TANK PORT
X = EXTERNAL OIL PILOT PORT
Y = DRAIN PORT
L = DRAIN PORT FOR HYDRAULIC CENTERING DEVICE used only for /M versions

Only version DPH*-67*/M

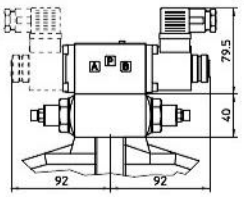




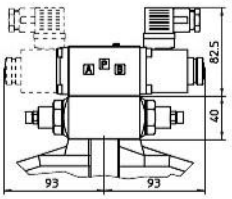
DPHI-6*

Mass of basic versions:
kg 42 (one solenoid)
kg 42,3 (two solenoids)

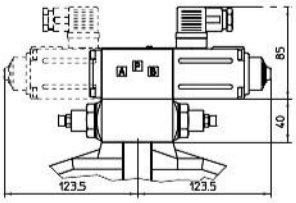
DPHI-6*/H /H9



DPHU-6*/H /H9



DPHO-6*/H /H9



Mass of basic versions:
kg 42,4 (one solenoid)
kg 43,1 (two solenoids)

Overall dimensions refer to valves with connectors type SP-666

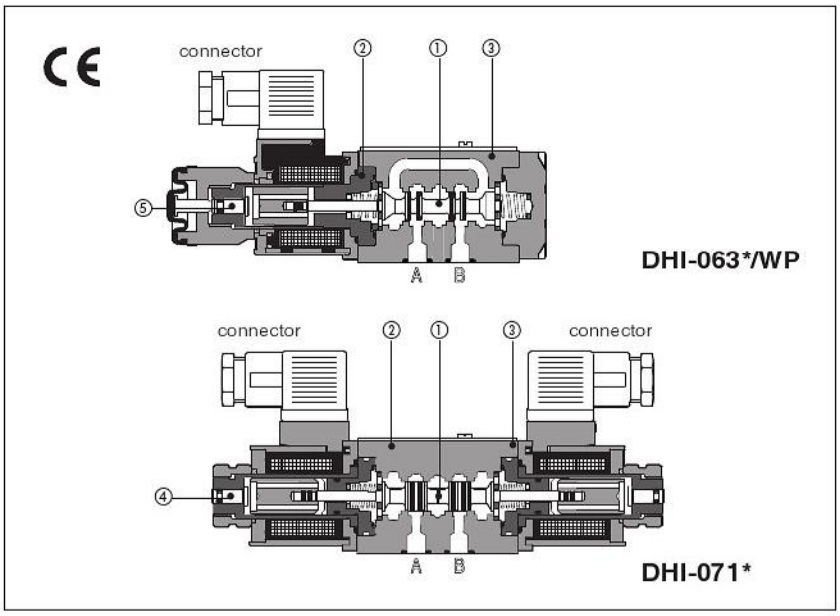
16 MOUNTING SUBPLATES FOR DPH*-3 AND DPH*-6

Valve	Subplate model	Ports location	Ports		Ø Counterbore [mm]		Mass [Kg]
			A, B, P, T	X, Y, (L)	A, B, P, T	X, Y, (L)	
DPH*-3	BA-508 (/DR)	Ports A, B, P, T, X, Y (L) underneath;	G 1"	G 1/4"	46	21,5	7
DPH*-3	BA-509 (/DR)	Ports A, B, P, T, X, Y (L) underneath; ports A, B on lateral	G 1"	G 1/4"	46	21,5	12,5
DPH*-6	BA-708 (/DR)	Ports A, B, P, T, X, Y (L) underneath;	G 1 1/2"	G 1/4"	63,5	21,5	17

The drain port L (subplates /DR) is required only for valves with hydraulic pressure centering device (option /M)
The subplates are supplied with fastening bolts. For further details see table K280

Solenoid directional valves type DHI

direct operated, ISO 4401 size 06



Spool type, two or three position, direct operated valves with solenoids certified according the North American standard **cURus**.

Solenoids ② are made by:

- wet type flanged tube, same for AC and DC power supply, with integrated manual override pin ④
- interchangeable coils, specific for AC or DC power supply, easily replaceable without tools - see section 5 for available voltages

Standard coils protection **IP65**, optional coils with IP67 AMP Junior Timer or lead wire connections.

Wide range of interchangeable spools ①, see section 2

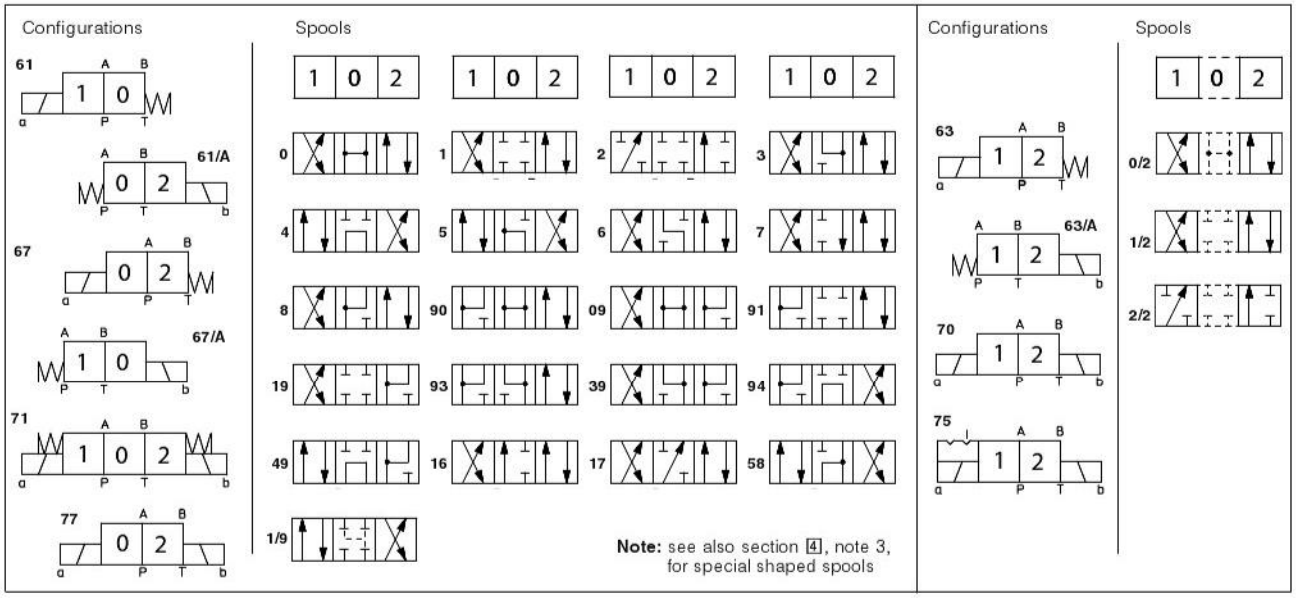
The valve body ③ is 3 chamber type made by shell-moulding casting with wide internal passages.

Mounting surface: **ISO 4401 size 06**
Max flow: **60 l/min**
Max pressure: **350 bar**

1 MODEL CODE

DHI - 0	61	1	/A	-	X	24 DC	**	/*
Directional control valves size 06	Valve configuration, see section 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 springs **71** = double solenoid, 3 positions, spring centered **75** = double solenoid, 2 external positions, with detent **77** = double solenoid, center plus external position, without springs	Spool type, see section 2.	Options, see note 1 at section 4.		**00** = valve without coils **X** = without connector See section 13 for available connectors, to be ordered separately Coils with special connectors, see section 10 **XJ** = AMP Junior Timer connector **XS** = Lead Wire connection	Voltage code, see section 5	Series number	Seals material, see section 3: **-** = NBR **PE** = FKM **BT** = HNBR

2 CONFIGURATIONS and SPOOLS (representation according to ISO 1219-1)



3 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position for all valves except for type - 170* (without springs) that must be installed with horizontal axis if operated by impulses		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Ambient temperature	Standard execution = -30°C ÷ +70°C; /PE option = -20°C ÷ +70°C; /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option)= -20°C ÷ +80°C HNBR seals (/BT option)= -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Fluid contamination class	ISO 4406 class 21/19/16 NAS 1638 class 10, in line filters of 25 μm (β10 ≥75 recommended)		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	
Flow direction	As shown in the symbols of table 2		
Operating pressure	Ports P,A,B: **350** bar; Port T **120** bar		
Rated flow	See diagrams Q/Δp at section 6		
Maximum flow	**60 l/min**, see operating limits at section 7		

3.1 Coils characteristics

Insulation class	**H** (180°C) Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree DIN EN 60529	IP 65 (with connectors 666, 667, 669 or E-SD correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature 6
Supply voltage tolerance	± 10%
Certification	**cURus**

4 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 - see section 11.

⚠ The manual override operation can be possible only if the pressure at T port is lower than 50 bar - see section 11.

WPD/H = manual override with detent, to be ordered separately, see tab. K150
FI, FV = with proximity or inductive position switch for monitoring spool position: see tab. E110.
MV, MO = auxiliary hand lever positioned vertically (MV) or horizontally (MO). For available configuration and dimensions see table E138.

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

666 = standard connector IP-65, suitable for direct connection to electric supply source.
667 = as 666, but with built-in signal led.
669 = with built-in rectifier bridge for supplying DC coils by alternate current (AC 110V and 230V - Imax 1A).
E-SD = electronic connector which eliminates electric disturbances when solenoid valves are de-energized.

3 Special shaped spools

- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spools type **1, 4, 5** and **58** are also available as **1/1, 4/8, 5/1** and **58/1.** 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 internal leakages.
- spool type **1/9** has closed center in rest position but it avoids the pressurization of A and B ports due to the internal leakages.
- Other types of spools can be supplied on request.

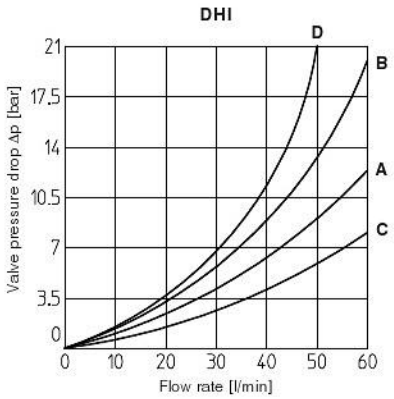
5 ELECTRIC FEATURES

External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption (2)	Code of spare coil DHI	Colour of coil label
6 DC	**6 DC**	666 or 667	33 W	COU-6DC/ 80	brown
9 DC	**9 DC**			COU-9DC /80	light blue
12 DC	**12 DC**			COU-12DC /80	green
14 DC	**14 DC**			COU-14DC /80	brown
18 DC	**18 DC**			COU-18DC /80	blue
24 DC	**24 DC**			COU-24DC /80	red
28 DC	**28 DC**			COU-28DC /80	silver
48 DC	**48 DC**			COU-48DC /80	silver
110 DC	**110 DC**			COU-110DC /80	black
125 DC	**125 DC**			COU-125DC /80	silver
220 DC	**220 DC**			COU-220DC /80	black
24/50 AC 24/60 AC	**24/50/60 AC**		60 VA (3)	COI-24/50/60AC /80 (1)	pink
48/50 AC 48/60 AC	**48/50/60 AC**			COI-48/50/60AC /80 (1)	white
110/50 AC 120/60 AC	**110/50/60 AC** **120/60 AC**			COI-110/50/60AC /80 (1) COI-120/60AC /80	yellow white
230/50 AC 230/60 AC	**230/50/60 AC** **230/60 AC**			COI-230/50/60AC /80 (1) COI-230/60AC /80	light blue silver
110/50 AC 120/60 AC	**110RC**	669	40 VA 35 VA	COU-110RC /80	gold
230/50 AC 230/60 AC	**230RC**		40 VA 35 VA	COU-230RC /80	blue

(1) 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.
(2) Average values based on tests preformed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(3) 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.

6 Q/ΔP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

Flow direction / Spool type	P→A	P→B	A→T	B→T	P→T
0, 0/1	C	C	C	C	
0/2, 1, 1/1, 1/2, 1/9	A	A	A	A	
2, 3, 3/1	A	A	C	C	
2/2, 4, 4/8, 5, 5/1, 58, 58/1, 94	D	D	D	D	A
6, 7, 16, 17	A	A	C	A	
8	C	C	B	B	
9, 19, 90, 91	B	B	A	A	
39, 93	D	D	D	D	

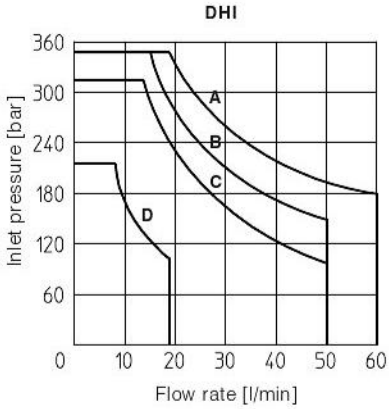


7 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

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

Curve	Spool type
A	0, 1, 1/2, 8
B	0, 0/1, 0/2, 1/1, 1/9, 3, 3/1
C	4, 4/8, 5, 5/1, 6, 7, 16, 17, 19, 39, 49, 58, 58/1, 09, 90, 91, 93, 94
D	2, 2/2



8 SWITCHING TIMES (average values in msec)

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

Test conditions:

- 36 l/min; 150 bar
- nominal voltage
- 2 bar of counter pressure on port T
- mineral oil: ISO VG 46 at 50°C.

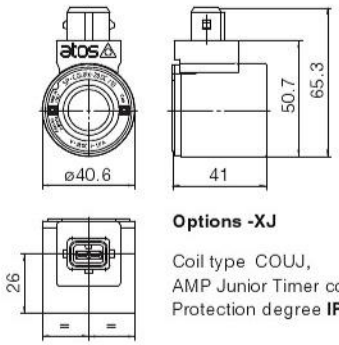
The elasticity of the hydraulic circuit and the variations of the hydraulic characteristics and temperature affect the response time.

9 SWITCHING FREQUENCY

Valve	AC (cycles/h)	DC (cycles/h)
DHE + 666 / 667	7200	15000

10 COILS WITH SPECIAL CONNECTORS only for voltage supply **12, 14, 24, 28** VDC

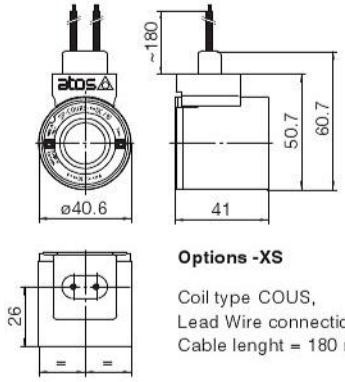
AMP Junior timer connector



Options -XJ

Coil type COUJ,
AMP Junior Timer connector
Protection degree **IP67**

Lead Wire connection



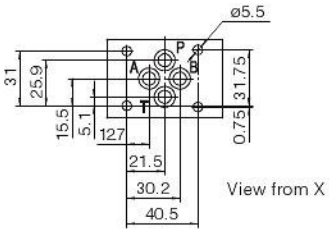
Options -XS

Coil type COUS,
Lead Wire connection
Cable lenght = 180 mm

Note: For the electric characteristics refer to standard coils features - see section 5

11 DIMENSIONS [mm]

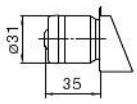
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Fastening bolts:
4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108
Ports P,A,B,T: Ø = 7.5 mm (max).



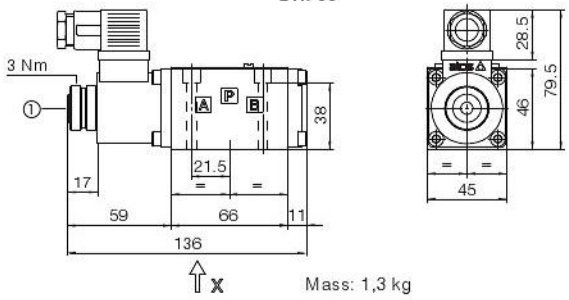
View from X

P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT

OPTION /WP

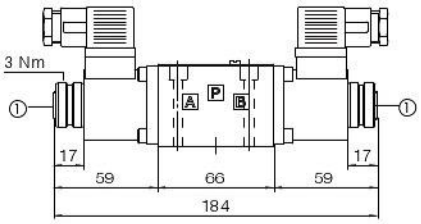


DHI-06



Mass: 1,3 kg

DHI-07



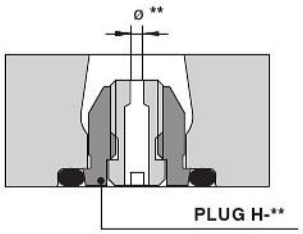
Mass: 1,6 kg

① Standard manual override PIN
⚠ The manual override operation can be possible only if the pressure at T ports is lower than 50 bar

Overall dimensions refer to valves with connectors type 666

12 PLUG-IN RESTRICTOR (to be ordered separately)

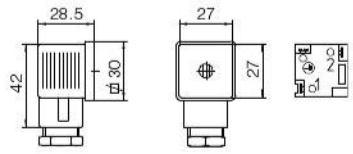
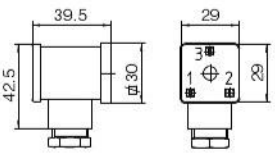
The use of plug-in restrictors in valve's ports P or A or B may be necessary is case of particular conditions as long flexible hoses or the presence of accumulators which could cause at the valve switching instantaneous high flow peaks over the max valve's operating limits.



Ordering code: **PLUG H** - **

08, 10, 12, 15 calibrated orifice diameter in tenths of mm
Example PLUG-H-**12** = orifice diameter **1,2 mm**
Other orifice dimensions are available on request

13 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately)

666, 667 (for AC or DC supply)	**669** (for AC supply)	**CONNECTOR WIRING**	
		**666, 667** 1 = Positive ⊕ 2 = Negative ⊖ ⏚ = Coil ground	**669** 1,2 = Supply voltage VAC 3 = Coil ground

SUPPLY VOLTAGES		
666	**667**	**669**
All voltages	24 AC or DC 110 AC or DC 220 AC or DC	110/50 AC 110/60 AC 230/50 AC 230/60 AC

Note: for electronic connectors type **E-SD**, see tab. K500

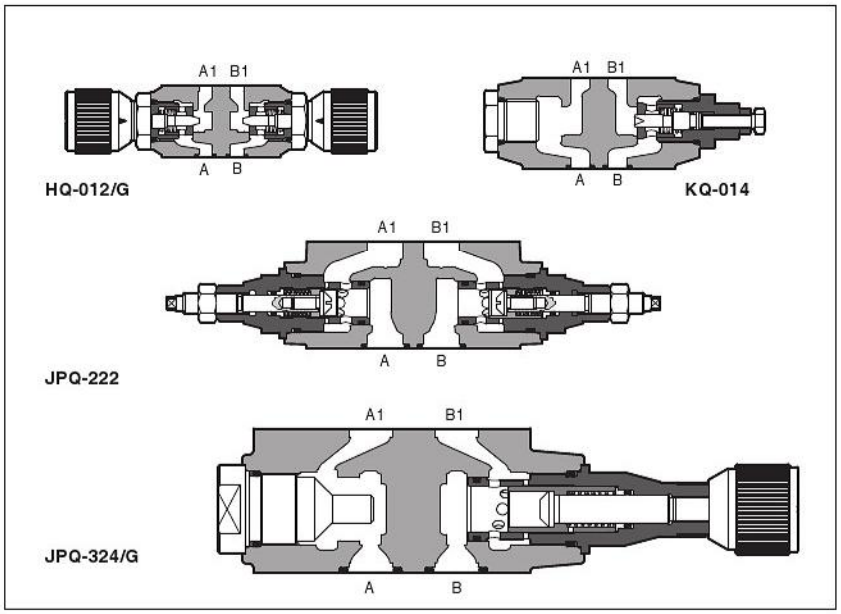
14 MOUNTING SUBPLATES

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.

Modular throttle valves type HQ, KQ, JPQ

flow control, ISO 4401 sizes 06, 10, 16 and 25



HQ, **KQ** and **JPQ** are flow throttling valves, not compensated, and with check valve to allow free flow in the opposite direction.
The flow adjustement is done by turning the setting screw in the normal model.
Optional versions with a graduate micrometer knob are available on request.
Clockwise rotation increases the throttling (passage reduced).

Valve size and max flow:
HQ-0 = size 06, flow up to 25 l/min for /U option, up to 80 l/min for standard
KQ-0 = size 10, flow up to 160 l/min
JPQ-2 = size 16, flow up to 200 l/min
JPQ-3 = size 25, flow up to 300 l/min

Mounting surface:
ISO 4401 size 06, 10, 16 and **25**
Max pressure: **350 bar** (HQ, JPQ)
315 bar (KQ)

1 MODEL CODE

HQ-0	13	/	G	**	/	*

HQ-0
Modular flow control valve, size:
HQ-0 = 06
KQ-0 = 10
JPQ-2 = 16
JPQ-3 = 25

13
Configuration, see section 2
meter OUT control:
12 = double, acting on port A and B
13 = single, acting on port A
14 = single, acting on port B
meter IN control:
22 = double, acting on port A and B
23 = single, acting on port A
24 = single, acting on port B

G
Options:
U = better accuracy for reduced flow (only for HQ-0)
G = adjustment by graduated micrometer

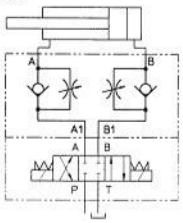
******
Series number

*****
Seals material, see section 3:
- = NBR
PE = FKM
BT = HNBR

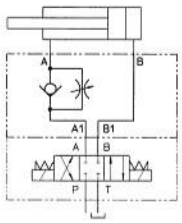
2 VALVE CONFIGURATION

Meter OUT control

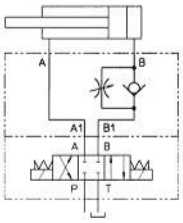
HQ-012
KQ-012
JPQ-212
JPQ-312



HQ-013
KQ-013
JPQ-213
JPQ-313

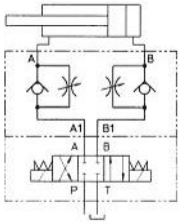


HQ-014
KQ-014
JPQ-214
JPQ-314

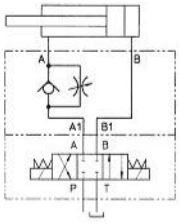


Meter IN control

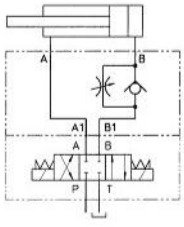
HQ-022
KQ-022
JPQ-222
JPQ-322



HQ-023
KQ-023
JPQ-223
JPQ-323



HQ-024
KQ-024
JPQ-224
JPQ-324

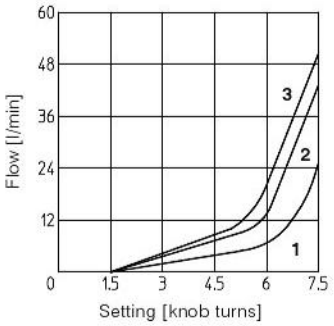


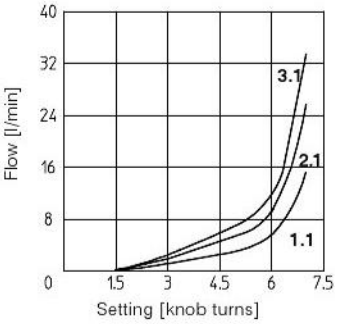
3 MAIN CHARACTERISTICS, SEALS and HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

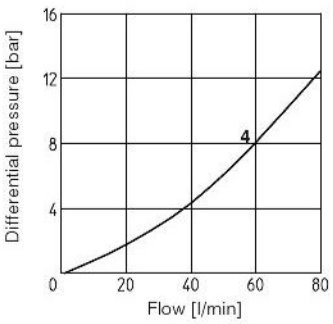
Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option)= -20°C ÷ +80°C HNBR seals (/BT option)= -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

4 DIAGRAMS OF HQ-0 based on mineral oil ISO VG 46 at 50°C

1 = Regulation diagram at Δp 10 bar (1.1 = option /U)
2 = Regulation diagram at Δp 30 bar (2.1 = option /U)
3 = Regulation diagram at Δp 50 bar (3.1 = option /U)
4 = Q/Δp diagram for free flow through the non-return valve

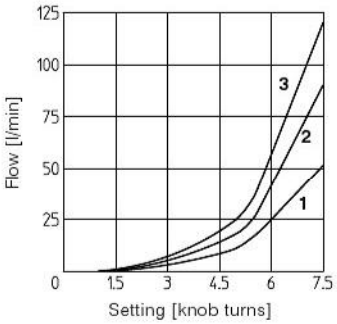


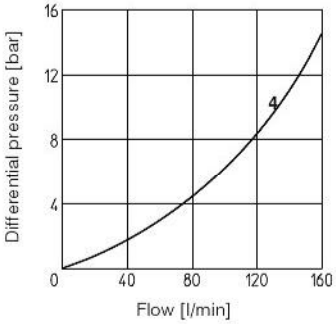




5 DIAGRAMS OF KQ-0 based on mineral oil ISO VG 46 at 50°C

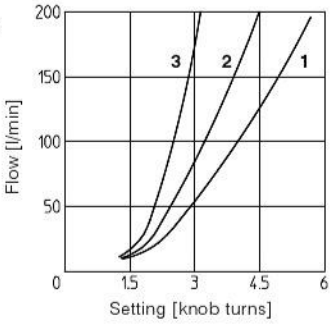
1 = Regulation diagram at Δp 10 bar
2 = Regulation diagram at Δp 30 bar
3 = Regulation diagram at Δp 50 bar
4 = Q/Δp diagram for free flow through the non-return valve

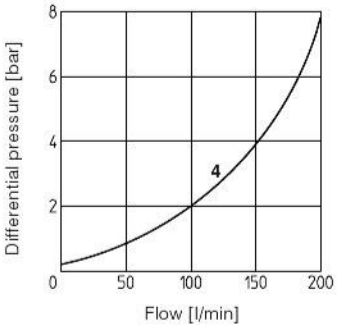




6 DIAGRAMS OF JPQ-2 based on mineral oil ISO VG 46 at 50°C

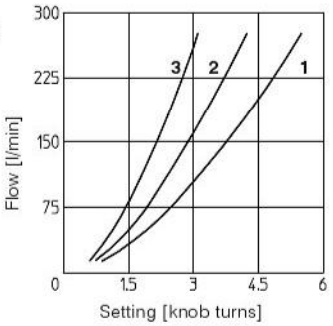
1 = Regulation diagram at Δp 10 bar
2 = Regulation diagram at Δp 30 bar
3 = Regulation diagram at Δp 50 bar
4 = Q/Δp diagram for free flow through the non-return valve

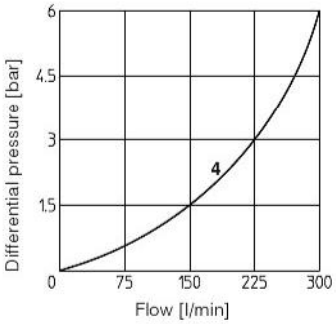




7 DIAGRAMS OF JPQ-3 based on mineral oil ISO VG 46 at 50°C

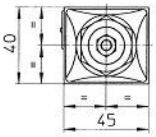
1 = Regulation diagram at Δp 10 bar
2 = Regulation diagram at Δp 30 bar
3 = Regulation diagram at Δp 50 bar
4 = Q/Δp diagram for free flow through the non-return valve

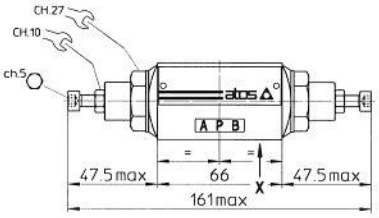




8 INSTALLATION DIMENSIONS OF HQ-0 VALVES [mm]

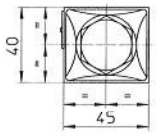
HQ-012
HQ-022

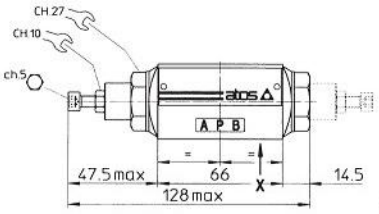




Mass: 1,1 Kg

HQ-013
HQ-014
HQ-023
HQ-024

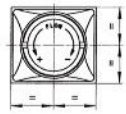


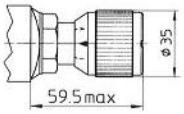


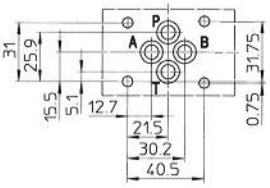
In version -014 and -024 the regulating element is on side of port B (dotted line) instead of side of port A.

Mass: 1,2 Kg

/G OPTION





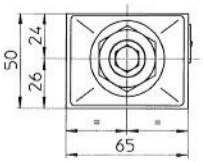


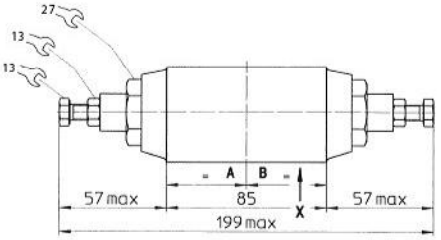
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Diameter of ports A, B, P, T: Ø = 7,5 mm (max)
Seals: 4 OR 108

Fastening bolts: nº 4 socket head screws M5. The lenght depends on number and type of modular elements associated.

9 INSTALLATION DIMENSIONS OF KQ-0 VALVES [mm]

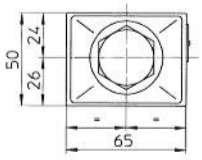
KQ-012
KQ-022

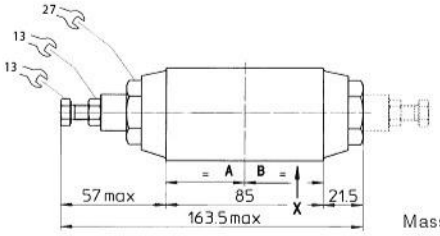




Mass: 2 Kg

KQ-013
KQ-014
KQ-023
KQ-024

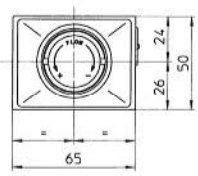


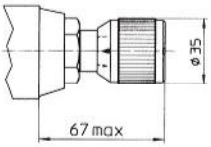


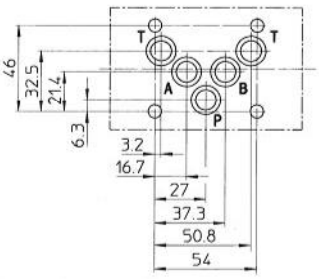
In version -014 and -024 the regulating element is on side of port B (dotted line) instead of side of port A.

Mass: 2,2 Kg

/G OPTION





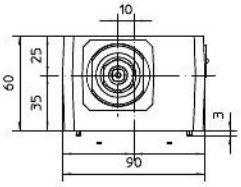


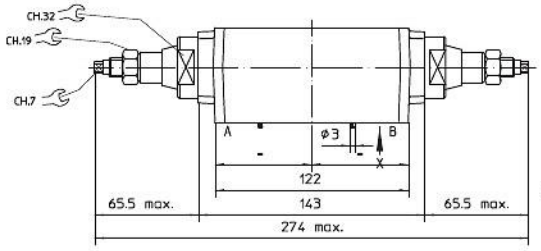
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05
Diameter of ports, A, B, P, T: Ø = 11,2 mm (max)
Seals: 5 OR 2050

Fastening bolts: nº 4 socket head screws M6. The lenght depends on number and type of modular elements associated.

10 INSTALLATION DIMENSIONS OF JPQ-2 VALVES [mm]

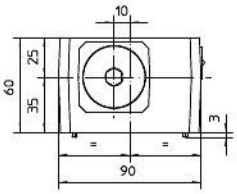
JPQ-212
JPQ-222

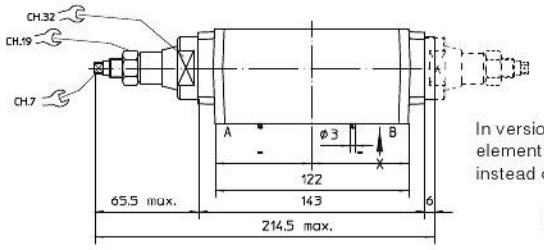




Mass: 4,6 Kg

JPQ-213
JPQ-214
JPQ-223
JPQ-224

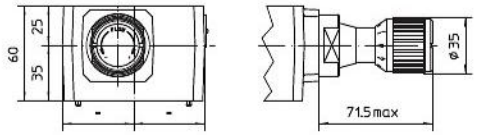


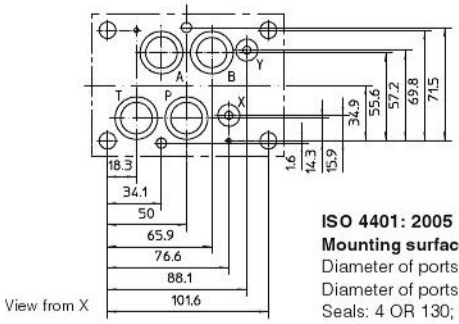


In version -214 and -224 the regulating element is on side of port B (dotted line) instead of side of port A.

Mass: 4,3 Kg

/G OPTION



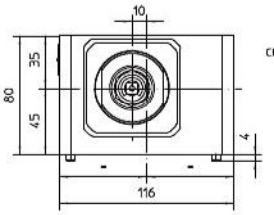


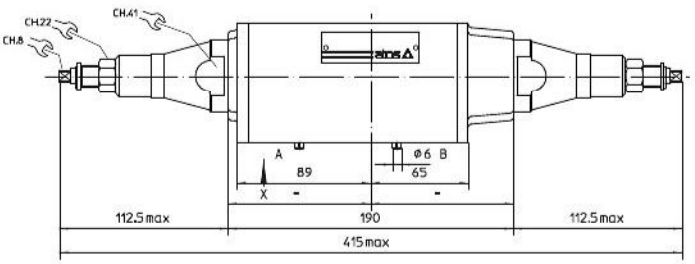
ISO 4401: 2005
Mounting surface: 4401-07-07-0-05
Diameter of ports A, B, P, T: Ø = 20 mm
Diameter of ports X, Y: Ø = 7 mm
Seals: 4 OR 130; 2 OR 109

Fastening bolts: nº 4 socket head screws M10 and nº 2 M6. The lenght depends on number and type of modular elements associated.

11 INSTALLATION DIMENSIONS OF JPQ-3 VALVES [mm]

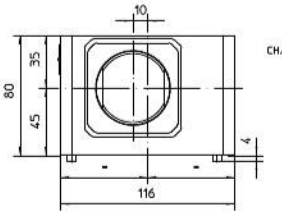
JPQ-312
JPQ-322

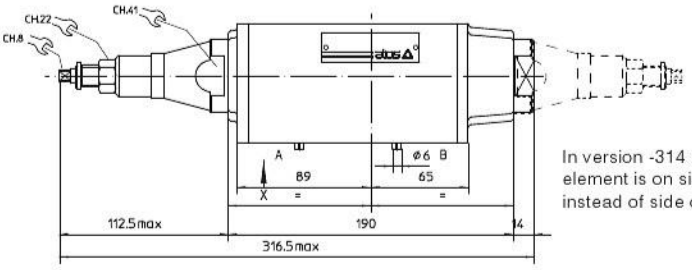




Mass: 10,7 Kg

JPQ-313
JPQ-314
JPQ-323
JPQ-324

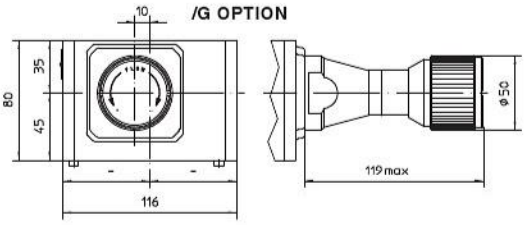


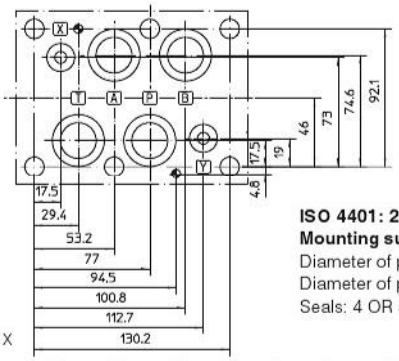


In version -314 and -324 the regulating element is on side of port B (dotted line) instead of side of port A.

Mass: 9,5 Kg

/G OPTION





ISO 4401: 2005
Mounting surface: 4401-08-08-0-05
Diameter of ports A, B, P, T: Ø = 24 mm
Diameter of ports X, Y: Ø = 7 mm
Seals: 4 OR 4112; 2 OR 3056

Fastening bolts: nº 6 socket head screws M12. The lenght depends on number and type of modular elements associated.