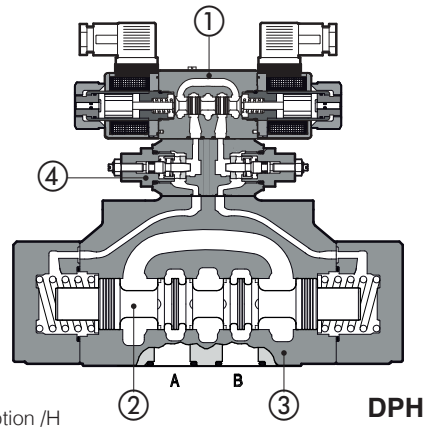
Solenoid directional valves type DPHL

piloted, spool type



① Solenoid pilot valve
② Main spool
③ Main body
④ Adjustable chokes - option /H

DPHL-471*/H

Spool type, pilot operated directional solenoid valves available in 4/3, 4/2, 3/2 way versions.
They are operated by a directional valve ① type DHL (see tech. table E018) equipped with compact solenoids for AC or DC power supply.
Spools ② are fully interchangeable and they are available in a wide range of hydraulic configurations.
The valve body is made by shell-moulding castings ③ with wide internal passages ensuring low pressure drops.

Mounting surface: **ISO 4401 size 10, 16, 25, 32**
Max flow: **160, 300, 700, 1000 l/min**
Max pressure: **350 bar**

1 MODEL CODE

DPH	L	-	2	61	1	/	A	-	X	24 DC	**	/	*

DPH — Piloted directional valve

L — Solenoid pilot valve:
L = DHL compact execution, AC and DC supply

2 — Valve size:
1 = 10 **2** = 16 **4** = 25 **6** = 32

61 — 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
71= double solenoid, 3 positions, spring centered
75= double solenoid, 2 external positions, with detent

1 — Spool type, see section 2

A — Options, see section 7

X
00-AC = AC solenoids without coils
00-DC = DC solenoids without coils
X = without connector
See section 13 for available connectors, to be ordered separately

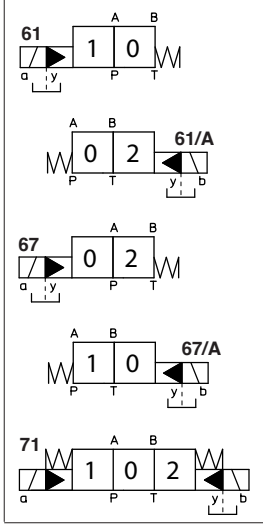
24 DC — Voltage code, see section 6

****** — Series number

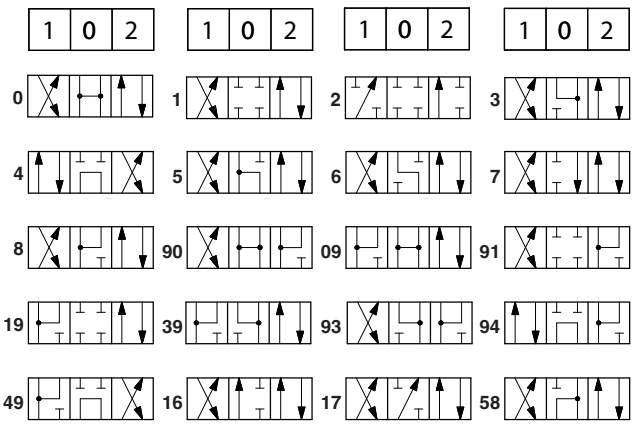
***** — Seals material, see section 15 :
- = NBR
PE = FKM

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

Configurations

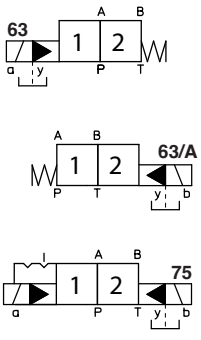


Spools

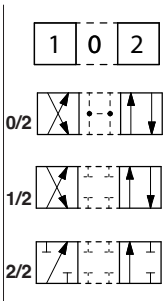


NOTES (see also section 7.1 for special shaped spools):
- For **DPHL-1** are available only spools: **0, 0/2, 1, 1/2, 3, 4, 5, 58, 6, 7**
- For **DPHL-6** are available only spools: **0, 1, 1/2, 2, 3, 4, 5, 58, 6, 7, 8, 19, 91**

Configurations



Spools



3 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C
Storage temperature range	**Standard** = -30°C ÷ +80°C **/PE** option = -20°C ÷ +80°C
Surface protection	Body: zinc coating with black passivation Coil: zinc nickel coating (DC version) plastic incapsulation (AC version)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS

Flow direction	As shown in the symbols of table 2
Operating pressure	Ports P, A, B, X: **350** bar; Ports T, Y **210** bar for DC version; **160** bar for AC version
Rated flow	See Q/Δp diagram at section 9 and operating limits at section 10
Max flow	DPHL-1: **160 l/min;** DPHL-2: **300 l/min;** DPHL-4: **700 l/min;** DPHL-6: **1000 l/min** (see rated flow at section 9 and operating limits at section 10)

5 ELECTRICAL CHARACTERISTICS

Insulation class	**H** (180°C) for DC coils; **F** (155°C) for AC coils 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 to DIN EN 60529	**IP 65** with connectors correctly assembled
Relative duty factor	100%
Supply voltage and frequency	See section 6
Supply voltage tolerance	± 10%

6 COIL VOLTAGE

External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption (2)	Code of spare coil **-X**
12 DC	**12 DC**	666 or 667	29W	COL-12DC
14 DC	**14 DC**			COL-14DC
24 DC	**24 DC**			COL-24DC
28 DC	**28 DC**			COL-28DC
110 DC	**110 DC**			COL-110DC
220 DC	**220 DC**			COL-220DC
110/50 AC (1)	**110/50/60 AC**		58VA (3)	COL-110/50/60AC
115/60 AC	**115/60 AC**			COL-115/60AC
230/50 AC (1)	**230/50/60 AC**			COL-230/50/60AC
230/60 AC	**230/60 AC**			COL-230/60AC
110/50 AC - 120/60 AC	**110 DC**	669	29W	COL-110DC
230/50 AC - 230/60 AC	**220 DC**			COL-220DC

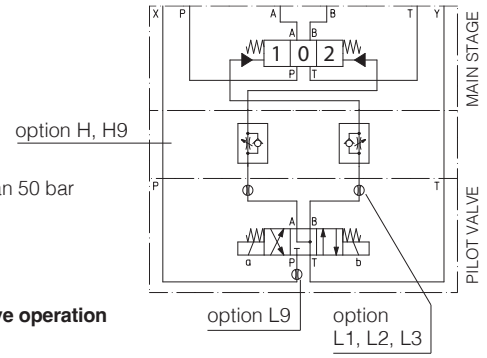
(1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 20÷25% and the power consumption is 55 VA
(2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(3) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.

7 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 (standard configuration is external drain)
/E = External pilot pressure (standard configuration is internal pilot pressure)
/R = Pilot pressure generator (not for DPHL-1 see section 8)
/S = Main spool stroke adjustment (not for DPHL-1)
/WP = Prolonged manual override protected by rubber cap

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

FUNCTIONAL SCHEME (config. 71)
example of switching control options



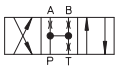
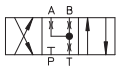
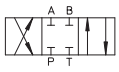
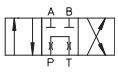
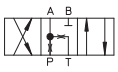
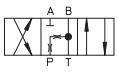
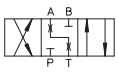
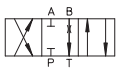
Devices for main spool switching control and to reduce the hydraulic shocks at the valve operation

/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).
/L1, /L2, /L3 = calibrated restrictors on A and B ports of the pilot valve: **L1** =0,8mm, **L2** =1mm, **L3** =1,25mm) - not for DPHL-1.
/L9 = plug with calibrated restictor in P port of pilot valve - see section 12 - only for DPHL-2 and DPHL-4.
Suggested for pilot pressure higher than 210 bar or to limit the hydraulics shocks caused by the fast main spool switching

7.1 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, 58, 6** and **7** are also available as **1/1, 4/8, 5/1, 58/1, 6/1** and **7/1** that are properly shaped to reduce water-hammer shocks during the switching (to use with option /L*).

Shaped spool availability

Shaped spool type	**0/1**	**3/1**	**1/1**	**4/8**	**5/1**	**58/1**	**6/1**	**7/1**
Hydraulic symbol								
DPHL-1	●	●		●				
DPHL-2, DPHL-4	●	●	●	●	●	●	●	●
DPHL-6		●	●	●				

8 PILOTING PRESSURE and OPTION /R

Minimum pilot pressure

To ensure proper operation, a minimum pilot pressure (internal or external) indicated in the following tables, must be maintained.

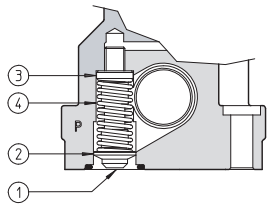
Valve configuration	**Minimum pilot pressure value** [bar]			
	DPHL-1	**DPHL-2**	**DPHL-4**	**DPHL-6**
61*	14	8	8	10
63*	8	8	8	8
67*	8	8	8	8
71*	14	10	10	10
75*	8	8	8	8

OPTION /R

The **/R** device is available for valves **DPHL-2, -4, -6** with **internal piloting** and for **all types of spools.**
It is particularly recommended for spools with a P-T connection in the rest position.
It generates an additional pressure drop on P port which adds to the values indicated in the flow versus pressure diagrams, helping to ensure the minimum piloting values, particularly in case of low flow condition.

Minimum flow rates required for correct operation of the device, are as follows:

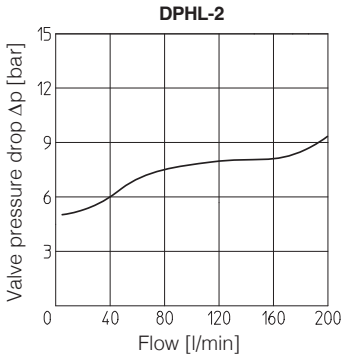
DPHL-2: **5 l/min** DPHL-4: **35 l/min** DPHL-6: **75 l/min**

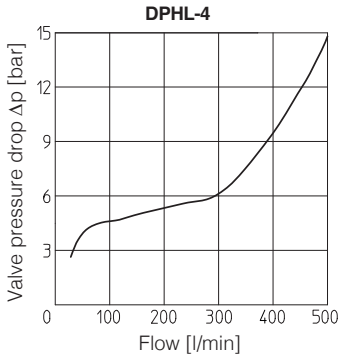


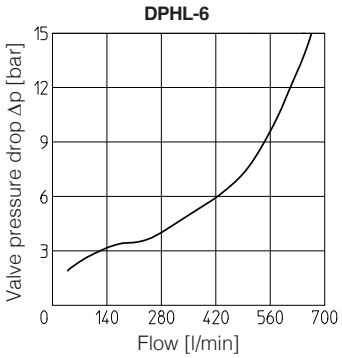
① Flapper-guide
② Flapper
③ Spring stop-washer
④ Spring

Ordering code of spare pilot pressure generator

R/DP	-	*
Pilot pressure generator		Size: **2** for DPHL-2 **4** for DPHL-4 **6** for DPHL-6



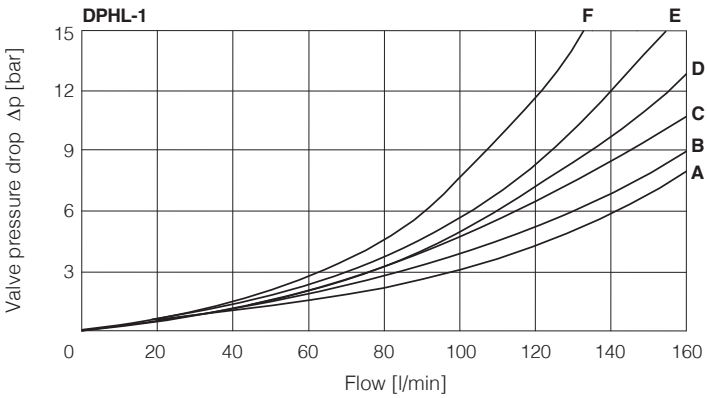




9 FLOW VERSUS PRESSURE DIAGRAMS Based on mineral oil ISO VG 46 at 50°C

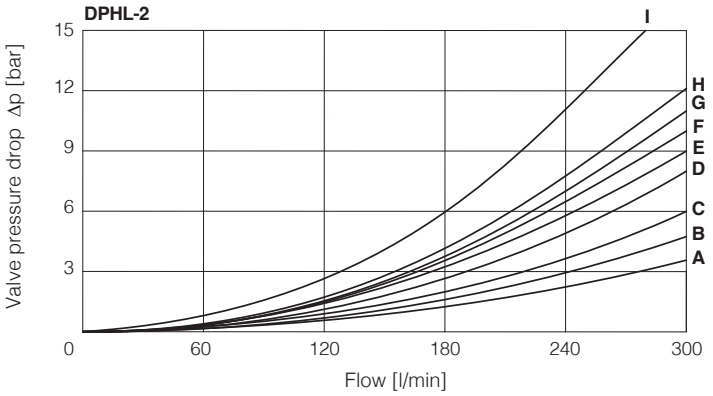
DPHL-1

Spool type	Flow direction				
	P→A	P→B	A→T	B→T	P→T
0/2, 1/2	D	E	D	C	-
0	D	E	C	C	E
1	A	B	D	C	-
3, 6, 7	A	B	C	C	-
4, 4/8	B	C	D	D	-
5, 58	A	E	C	C	F



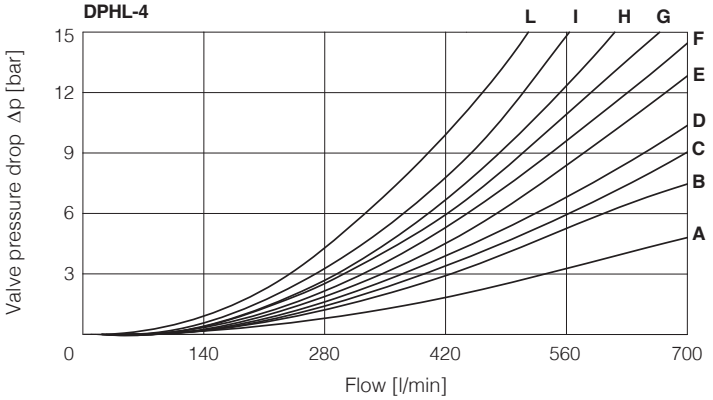
DPHL-2

Spool type	Flow direction				
	P→A	P→B	A→T	B→T	P→T
0/2, 1, 3, 6, 7, 8	A	A	C	D	-
1/1, 1/2, 7/1	B	B	D	E	-
0	A	A	D	E	C
0/1	A	A	D	-	-
2	A	A	-	-	-
2/2	B	B	-	-	-
3/1	A	A	D	D	-
4	C	C	H	I	F
4/8	C	C	G	I	F
5	A	B	F	H	G
5/1	A	B	D	F	-
6/1	B	B	C	E	-
09	A	-	-	G	-
16	A	C	D	F	-
17	C	A	E	F	-
19	C	-	-	G	-
39	C	-	-	H	-
49	-	D	-	-	-
58	B	A	F	H	H
58/1	B	A	D	F	-
90	A	A	E	-	D
91	C	C	E	-	-
93	-	C	D	-	-
94	D	-	-	-	-



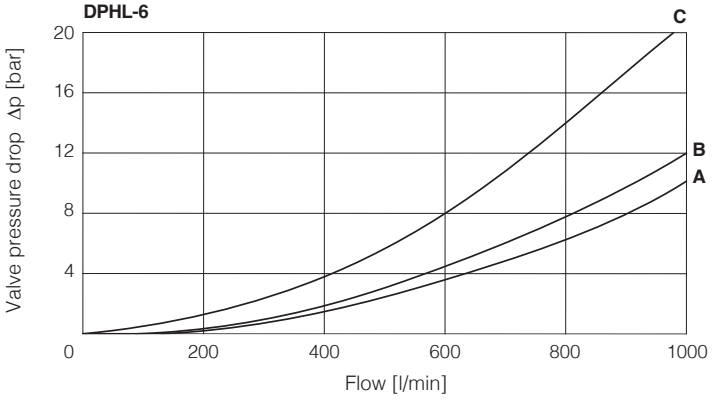
DPHL-4

Spool type	Flow direction				
	P→A	P→B	A→T	B→T	P→T
1	B	B	B	D	-
1/1	D	E	E	F	-
1/2	E	D	B	C	-
0	D	C	D	E	F
0/1, 3/1, 5/1, 6, 7	D	D	D	F	-
0/2	D	D	D	E	-
2	B	B	-	-	-
2/2	E	D	-	-	-
3	B	B	D	F	-
4	C	C	H	L	L
5	A	D	D	D	H
6/1	D	E	D	F	-
7/1	D	E	F	F	-
8	D	D	E	F	-
09	D	-	-	F	F
16	C	D	E	F	-
17	E	D	E	F	-
19	F	-	-	E	-
39	G	F	-	F	-
58	E	A	B	F	H
58/1	E	D	D	F	-
90	D	D	D	-	F
91	F	F	D		
93	-	G	D	-	-



DPHL-6

Spool type	Flow direction				
	P→A	P→B	A→T	B→T	P→T
0, 0/2	A	A	B	B	B
1, 1/2	A	A	A	B	-
3, 6, 7	A	A	A	B	-
4, 5, 58	A	A	C	C	C



10 **OPERATING LIMITS** For a correct valve operation do not exceed the max recommended flow rates (l/min) shown in the below tables

DPHL-1

Spool	**Inlet pressure** [bar]			
	70	**160**	**210**	**350**
	Flow rate [l/min]			
0, 1, 3, 6, 7	160	160	160	145
4, 4/8	160	160	135	100
5, 58	160	160	145	110
0/1, 0/2, 1/2	160	160	145	135

DPHL-2

Spool	**Inlet pressure** [bar]			
	70	**140**	**210**	**350**
	Flow rate [l/min]			
0, 1, 3, 6, 7, 8	300	300	300	300
2, 4, 4/8	300	300	240	140
5	260	220	180	100
0/1, 0/2, 1/2	300	250	210	180
16, 17, 56, *9, 9*	300	300	270	200

DPHL-4

Spool	**Inlet pressure** [bar]			
	70	**140**	**210**	**350**
	Flow rate [l/min]			
1, 6, 7, 8	700	700	700	600
2, 4, 4/8	500	500	450	400
5, 0/1, 0/2, 1/2	600	520	400	300
0, 3	700	700	600	540
16, 17, 58, *9, 9*	500	500	500	450

DPHL-6

Spool	**Inlet pressure** [bar]			
	70	**140**	**210**	**350**
	Flow rate [l/min]			
1, 3, 6, 7, 8	1000	950	850	700
0	950	900	800	650
2, 4, 4/8, 5	850	800	700	450
0/1, 58, 19, 91	950	850	650	450

11 **SWITCHING TIMES** (average values in m sec)

			Piloting pressure 70 bar		140 bar		250 bar	
Valve model	Configuration		Alternating current	Direct current	Alternating current	Direct current	Alternating current	Direct current
DPHL-1	71, 61, 67, 61*/A, 67*/A	Switch ON	35	50	30	45	20	35
		Switch OFF	50					
	63, 63*/A	Switch ON	50	75	40	65	30	50
		Switch OFF	80					
DPHL-2	71, 61, 67, 61*/A, 67*/A	Switch ON	40	55	30	50	20	40
		Switch OFF	60					
	63, 63*/A	Switch ON	55	80	45	70	35	55
		Switch OFF	95					
DPHL-4	71, 61, 67, 61*/A, 67*/A	Switch ON	60	80	45	60	30	45
		Switch OFF	80					
	63, 63*/A	Switch ON	95	115	75	95	50	65
		Switch OFF	130					
DPHL-6	71, 61, 67, 61*/A, 67*/A	Switch ON	70	95	55	70	40	55
		Switch OFF	150					
	63, 63*/A	Switch ON	115	145	95	110	70	90
		Switch OFF	280					

Notes:

1) For configuration 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: ISO VG 46 at 50°C

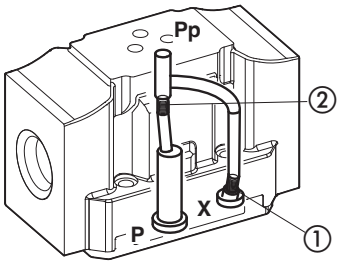
3) The response time is affected by elasticity of the hydraulic circuit, by variation of hydraulic characteristics and temperature.

12 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

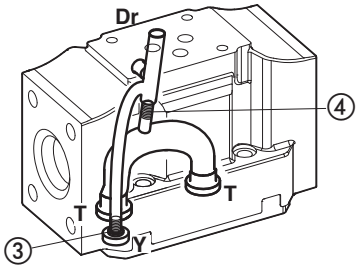
Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain

DPHL-1

Pilot channels



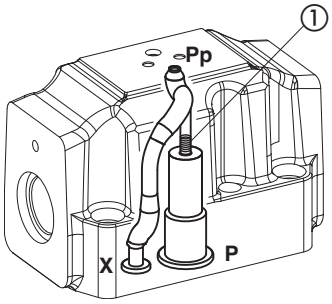
Drain channels



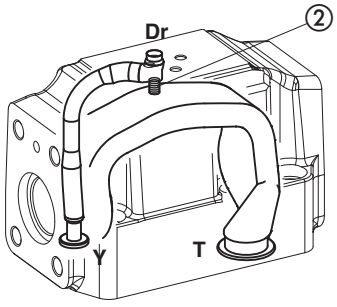
Internal piloting: blinded plug SP-X300F ① in X;
plug SP-X310F ② in Pp;
External piloting: blinded plug SP-X300F ② in Pp;
plug SP-X310F ① in X;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPHL-2

Pilot channels

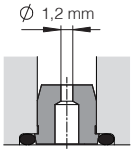


Drain channels



Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

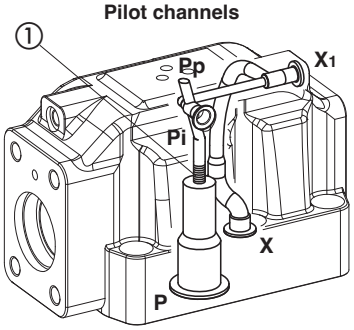
Option L9
This option provides a calibrated restrictor PLUG-H-12A (Ø 1,2 mm) in the P port of the pilot valve



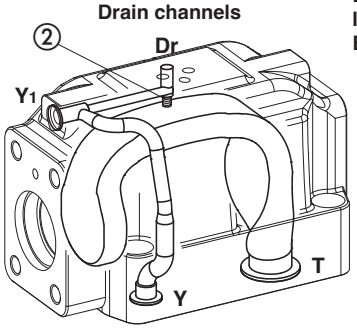
PLUG-12A

DPHL-4

Pilot channels

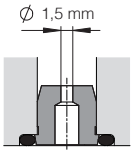


Drain channels



Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

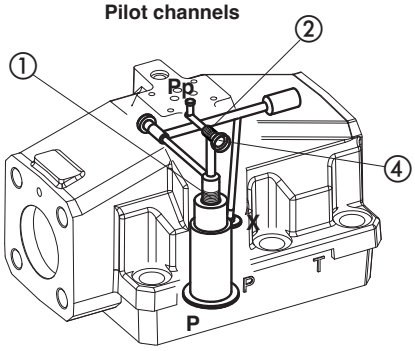
Option L9
This option provides a a calibrated restrictor PLUG-H-15A (Ø 1,5 mm) in the P port of the pilot valve



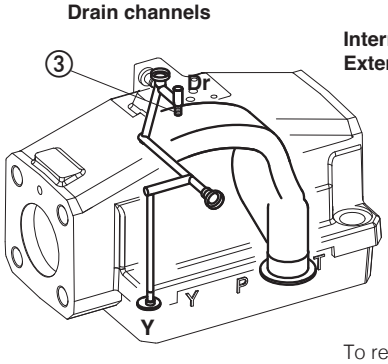
PLUG-15A

DPHL-6

Pilot channels



Drain channels



Internal piloting: Without plug ①;
plug SP-X325A in pos ②;
External piloting: Add DIN-908 M16x1,5 in pos ①;
plug SP-X325A in pos ②;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

To reach the orifice ②, remove plug ④ = G 1/8"

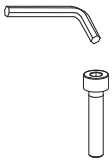
13 **ELECTRIC CONNECTORS ACCORDING TO DIN 43650** (to be ordered separately, see tech table K800)

666 = standard connector IP-65, suitable for direct connection to electric supply source
667 = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC
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

14 **SEALS AND HYDRAULIC FLUID** - for other fluids not included in below table, consult our technical office

Seals, reccomended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°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	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR	HFC	

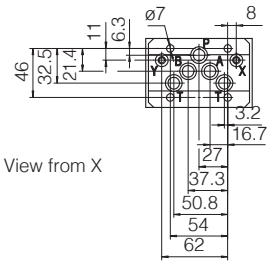
15 **FASTENING BOLTS AND SEALS**

	DPHL-1	**DPHL-2**	**DPHL-4**	**DPHL-6**
	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	**Fastening bolts:** 4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	**Fastening bolts:** 6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	**Fastening bolts:** 6 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm
	**Seals:** 5 OR 2050 Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø 5 mm (max)	**Seals:** 4 OR 130 Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø 7 mm (max)	**Seals:** 4 OR 4112 Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø 7 mm (max)	**Seals:** 4 OR 144 Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø 7 mm (max)

DPHL-1*

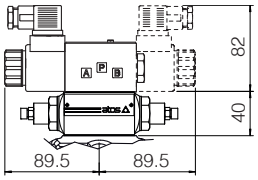
ISO 4401: 2005
Mounting surface: 4401-05-05-0-05

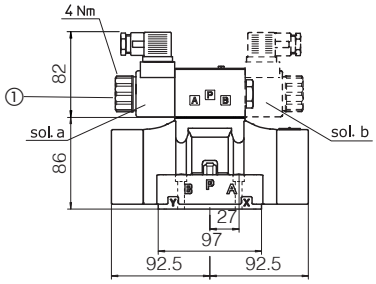
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL OIL PILOT PORT
Y = DRAIN PORT

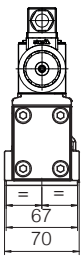


Mass (Kg)	
DPHL-16	6,9
DPHL-17	7,3
Option H, H9	+1,0

DPHL-1*/H /H9





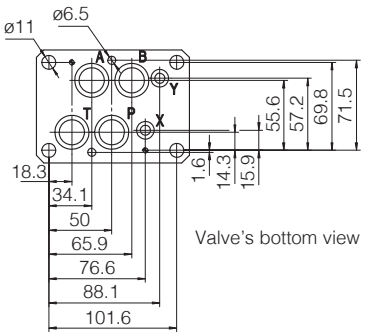


① Standard manual override PIN
Overall dimensions refer to valves **DC** voltage, with connectors type 666

DPHL-2*

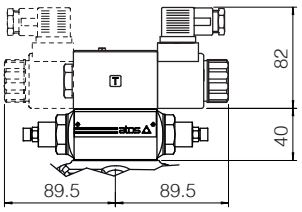
ISO 4401: 2005
Mounting surface: 4401-07-07-0-05

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

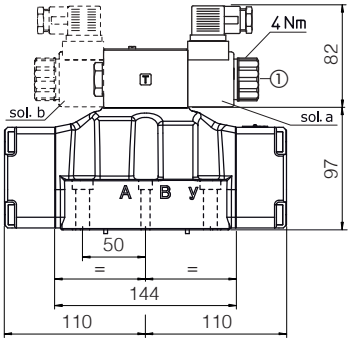


Mass (Kg)	
DPHL-26	9,7
DPHL-27	9,9
Option /S	+1,0
Option H, H9	+1,0

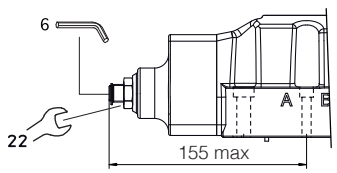
DPHL-2*/H

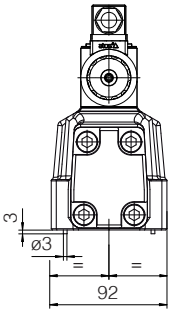


DPHL-2*



Stroke adjustment device for option /S



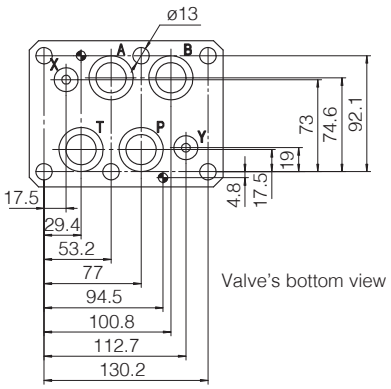


① Standard manual override PIN
Overall dimensions refer to valves **DC** voltage, with connectors type 666

DPHL-4*

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05

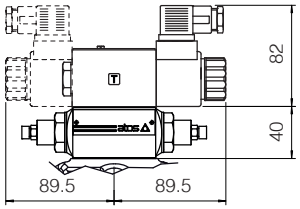
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL OIL PILOT PORT
Y = DRAIN PORT



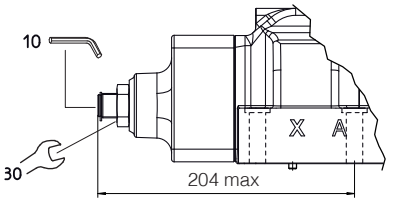
Valve's bottom view

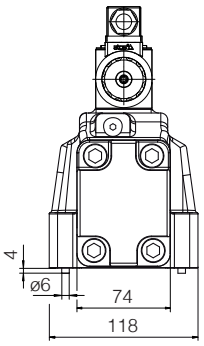
Mass (Kg)	
DPHL-46	17,2
DPHL-47	17,4
Option /S	+1,5
Option H, H9	+1,0

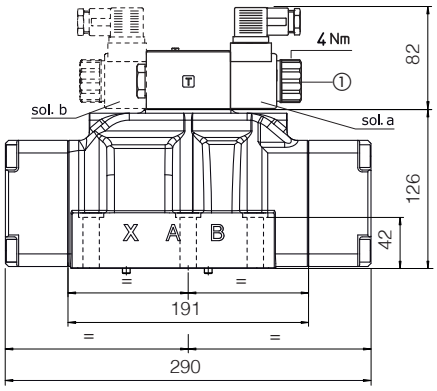
DPHL-4*/H



DPHL-4*







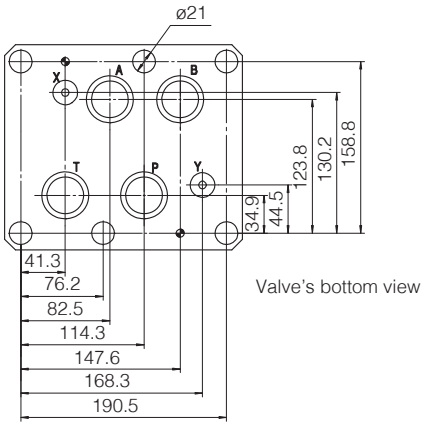
① Standard manual override PIN

Overall dimensions refer to valves **DC** voltage, with connectors type 666

DPHL-6*

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05

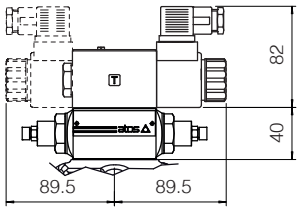
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL OIL PILOT PORT
Y = DRAIN PORT



Valve's bottom view

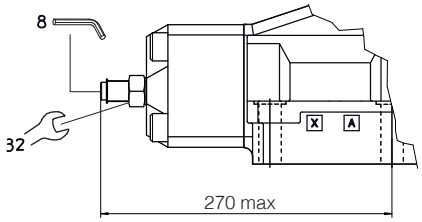
Mass (Kg)	
DPHL-66	44
DPHL-67	44,5
Option /S	+3,5
Option H, H9	+1,0

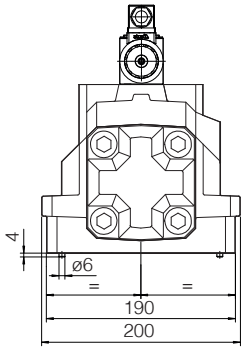
DPHL-6*/H /H9

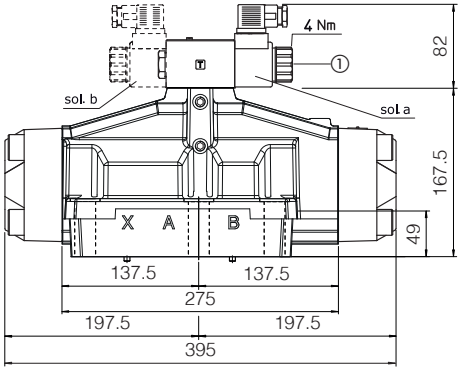


DPHL-6*

Stroke adjustment device for option/S







① Standard manual override PIN

Overall dimensions refer to valves **DC** voltage, with connectors type 666

17 MOUNTING SUBPLATES

Valve	Subplate model	Ports location	Ports		Ø Counterbore [mm]		Mass [Kg]
			A, B, P, T	X, Y	A, B, P, T	X, Y	
DPHL-1	BA-428	Ports A, B, P, T, X, Y underneath;	G 3/4"	G 1/4"	36,5	21,5	5,6
DPHL-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
DPHL-2	BA-418	Ports A, B, P, T, X, Y underneath;	G 3/4"	G 1/4"	36,5	21,5	3,5
DPHL-2	BA-518	Ports A, B, P, T, X, Y underneath;	G 1"	G 1/4"	46	21,5	8
DPHL-2	BA-519	Ports P, T, X, Y underneath; ports A, B on lateral side	G 1"	G 1/4"	46	21,5	8
DPHL-4	BA-508	Ports A, B, P, T, X, Y underneath;	G 1"	G 1/4"	46	21,5	7
DPHL-4	BA-509	Ports P, T, X, Y underneath; ports A, B on lateral	G 1"	G 1/4"	46	21,5	12,5
DPHL-6	BA-708	Ports A, B, P, T, X, Y underneath;	G 1 1/2"	G 1/4"	63,5	21,5	17