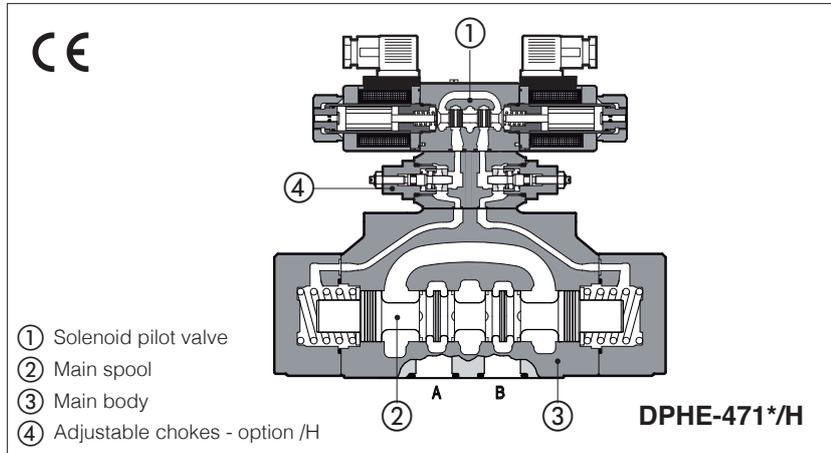


Solenoid directional valves type DPHE

piloted, spool type



- ① Solenoid pilot valve
- ② Main spool
- ③ Main body
- ④ Adjustable chokes - option /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 DHE (see tech. table E015) equipped with high performance solenoids for AC or DC power supply, certified according to North American standard **cURus**.

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**

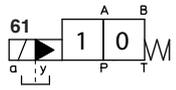
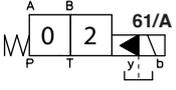
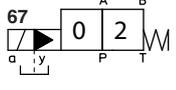
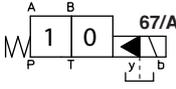
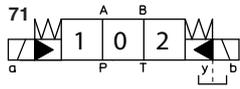
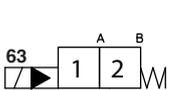
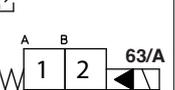
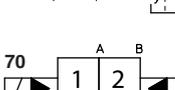
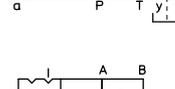
Max flow: **160, 300, 700, 1000 l/min.**

Max pressure: **350 bar**

1 MODEL CODE

DPH	E	-	2	61	1	/	A	-	X	24 DC	*	/	*
Piloted directional valve													
Solenoid pilot valve: E = DHE for AC and DC supply, high performances with cURus certified solenoids													
Valve size: 1 = 10 2 = 16 4 = 25 6 = 32													
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													
Voltage code, see section 6											Seals material, see section 14: - = NBR PE = FKM BT = HNBR		
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											Options, see note 1 at section 7		
Spool type, see section 2.													

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

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

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, for further details see technical table P007
Ambient temperature range	Standard = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Storage temperature range	Standard = -30°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°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	DPHE-1: 160 l/min ; DPHE-2: 300 l/min ; DPHE-4: 700 l/min ; DPHE-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 occurring 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

Valve code	External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption (2)	Code of spare coil DHE
DPHE	12 DC	12 DC	666 or 667	30 W	COE-12DC
	14 DC	14 DC			COE-14DC
	24 DC	24 DC			COE-24DC
	28 DC	28 DC			COE-28DC
	48 DC	48 DC			COE-48DC
	110 DC	110 DC			COE-110DC
	125 DC	125 DC			COE-125DC
	220 DC	220 DC		COE-220DC	
	24/50 AC	24/50/60 AC		58 VA (3)	COE-24/50/60AC (1)
	48/50 AC	48/50/60 AC			COE-48/50/60AC (1)
	110/50 AC	110/50/60 AC			COE-110/50/60AC (1)
	230/50 AC	230/50/60 AC			COE-230/50/60AC (1)
	115/50 AC	115/60 AC			COE-115/60AC
	230/50 AC	230/60 AC		80 VA (3)	COE-230/60AC
	110/50 AC - 120/60 AC	110 RC	669	30 W	COE-110RC
	230/50 AC - 230/60 AC	230 RC			COE-230RC

(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 52 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.

7 OPTIONS

7.1 Options

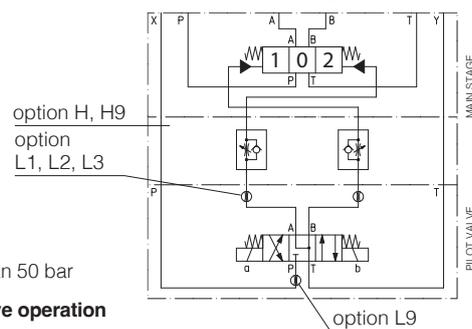
- /A** = Solenoid mounted at side of port A of main body (only for single solenoid valves).
In standard version, solenoid is mounted at side of port B.
- /D** = Internal drain (standard configuration is external drain)
- /E** = External pilot pressure (standard configuration is internal pilot pressure).
- /FV** = With proximity switch for spool position monitoring: see tab. EY030.
- /R** = Pilot pressure generator (not for DPHE-1, see section 8)
- /S** = Main spool stroke adjustment (not for DPHE-1).
- /W/P** = 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

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
- /L9** = (only for DPHE-2 and DPHE-4) plug with calibrated restrictor in P port of pilot valve - see section 12
Suggested for pilot pressure higher than 210 bar or to limit the hydraulics shocks caused by the fast main spool switching

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



7.2 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, 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								
DPHE-1	•	•		•				
DPHE-2, DPHE-4	•	•	•	•	•	•	•	•
DPHE-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]			
	DPHE-1	DPHE-2	DPHE-4	DPHE-6
61*	14	8	8	10
63*	8	8	8	8
67*	8	8	8	8
70*	8	8	8	8
71*	14	10	10	10
75*	8	8	8	8

OPTION /R

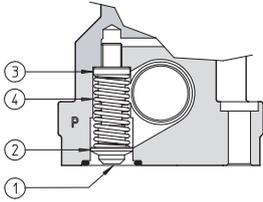
The **/R** device is available for valves **DPHE-2, -4, -6** with **internal piloting** and for **all types of spools**.

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:

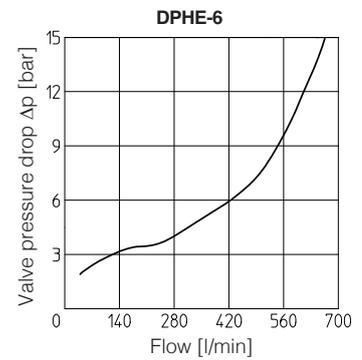
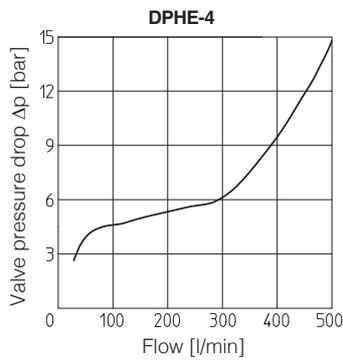
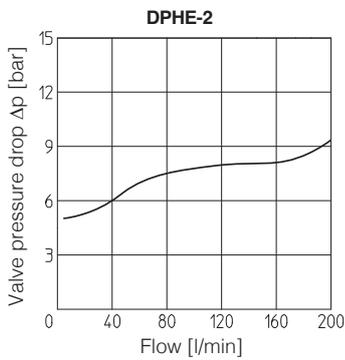
DPHE-2: **5 l/min** DPHE-4: **35 l/min** DPHE-6: **75 l/min**



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

Ordering code of spare pilot pressure generator

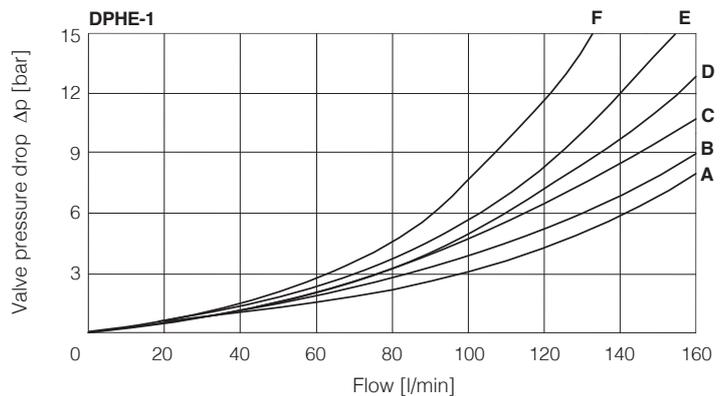
R/DP	-	*
Pilot pressure generator		Size: 2 for DPHE-2 4 for DPHE-4 6 for DPHE-6



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

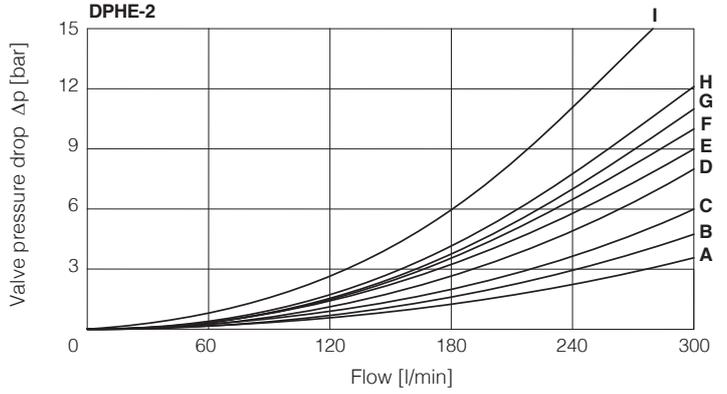
DPHE-1

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, 5/8	A	E	C	C	F



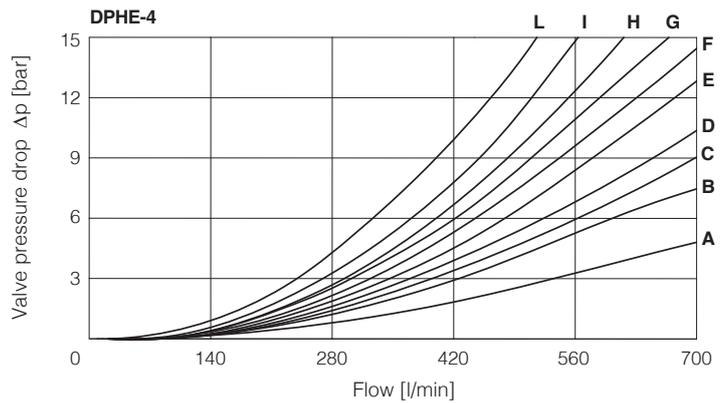
DPHE-2

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	-	-	-	-



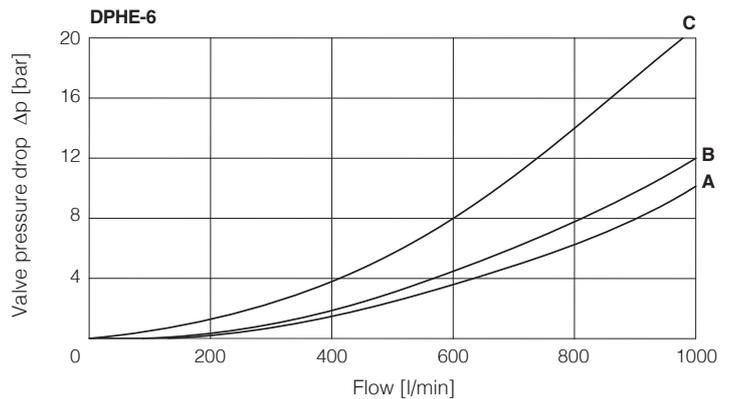
DPHE-4

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	-	-



DPHE-6

Spool type	Flow direction				
	P→A	P→B	A→T	B→T	P→T
0	A	A	B	B	B
1	A	A	A	B	-
3	A	-	A	B	-
4	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

DPHE-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

DPHE-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

DPHE-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

DPHE-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)

Valve model	Configuration		Piloting pressure					
			70 bar		140 bar		250 bar	
			Alternating current	Direct current	Alternating current	Direct current	Alternating current	Direct current
DPHE-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					
DPHE-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					
DPHE-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					
DPHE-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:

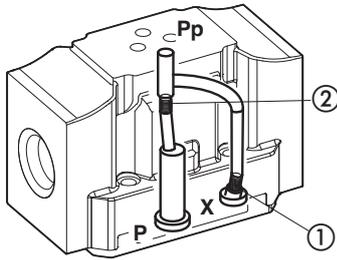
- 1) For configuration 75, times of switching ON and switching OFF are the same: this value is equal to time of switch ON of configuration 63.
- 2) TEST CONDITIONS
 - Nominal voltage supply DC (direct) and AC (alternating) with connector type SP-666. The use of other connectors can affect the switching 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

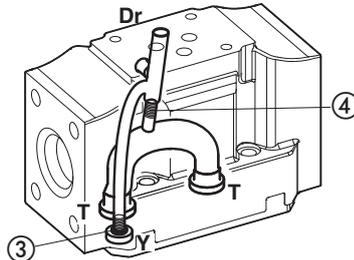
Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below. To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270. Standard valves configuration provides internal pilot and external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

DPHE-1

Pilot channels



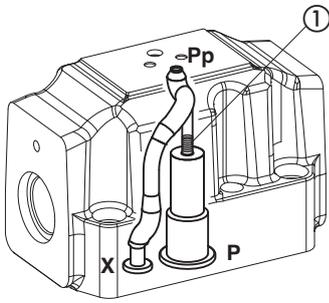
Drain channels



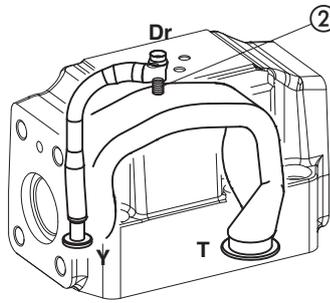
- Internal piloting:** blinded plug SP-X300F ① in X;
- plug SP-X310F ② in Pp;
- External piloting:** blinded plug SP-X300F ② in Pp;
- plug SP-X310F ① in X;
- Internal drain:** blinded plug SP-X300F ③ in Y;
- External drain:** blinded plug SP-X300F ④ in Dr.

DPHE-2

Pilot channels



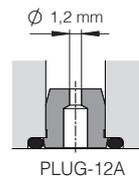
Drain channels



- 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.

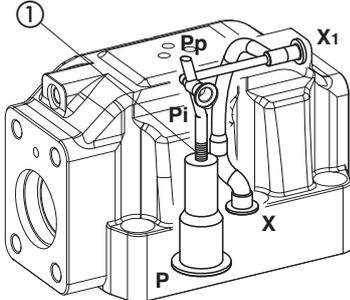
Option L9

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

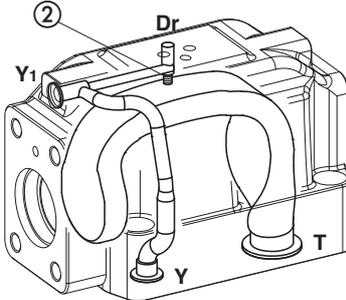


DPHE-4

Pilot channels



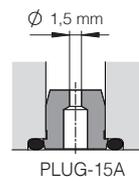
Drain channels



- 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.

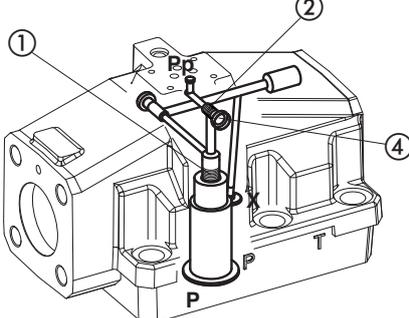
Option L9

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

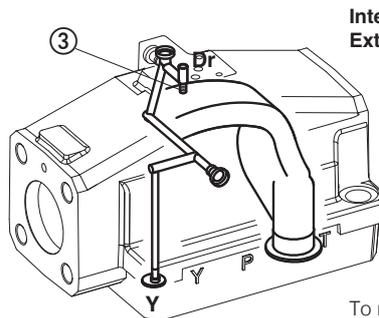


DPHE-6

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

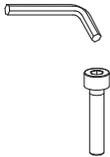
669 = with built-in rectifier bridge for supplying DC coils by alternate current (AC 110V and 230V - I_{max} 1A)

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, recommended 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 HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15 ÷ 100 mm ² /s - max allowed range 2,8 ÷ 500 mm ² /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	

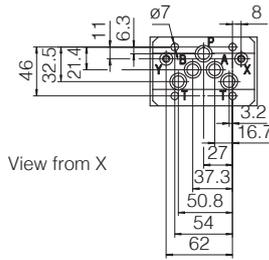
15 FASTENING BOLTS AND SEALS

	<p>DPHE-1</p> <p>Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm</p>	<p>DPHE-2</p> <p>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</p>	<p>DPHE-4</p> <p>Fastening bolts: 6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm</p>	<p>DPHE-6</p> <p>Fastening bolts: 6 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm</p>
	<p>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)</p>	<p>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)</p>	<p>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)</p>	<p>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)</p>

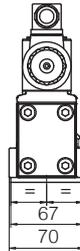
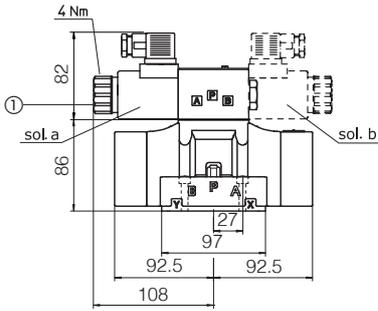
DPHE-1*

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

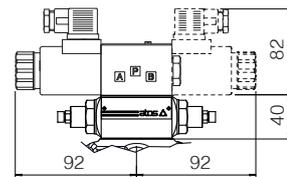
- P = PRESSURE PORT
- A, B = USE PORT
- T = TANK PORT
- X = EXTERNAL OIL PILOT PORT
- Y = DRAIN PORT



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



DPHE-1*/H /H9

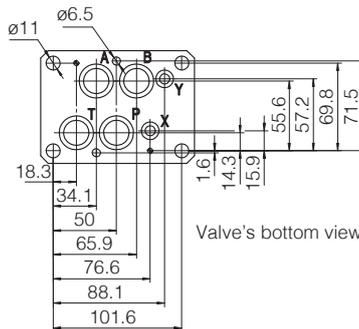


① Standard manual override PIN
 Overall dimensions refer to valves **DC** voltage, with connectors type 666

DPHE-2*

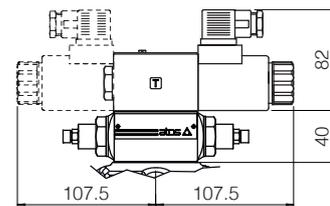
ISO 4401: 2005
 Mounting surface: 4401-07-07-0-05

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

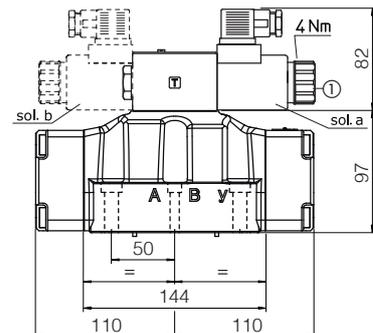
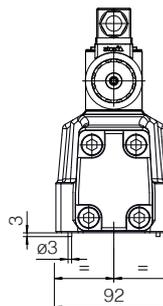
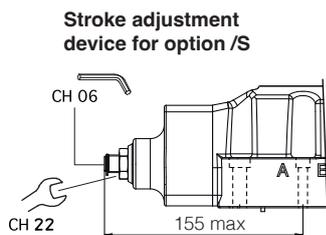


Mass (Kg)	
DPHE-26	9,9
DPHE-27	10,3
Option /S	+1,0
Option H, H9	+1,0

DPHE-2*/H /H9



DPHE-2*



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

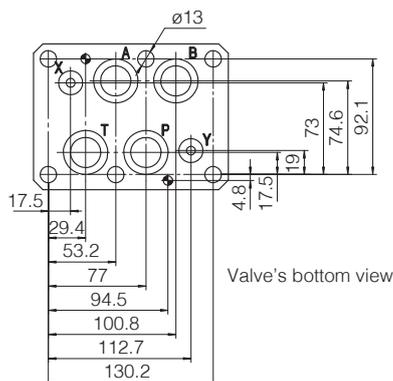
DPHE-4*

ISO 4401: 2005

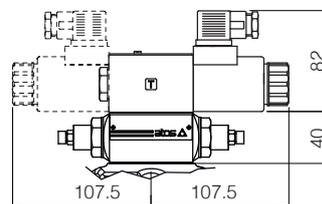
Mounting surface: 4401-08-08-0-05 (see table P005)

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

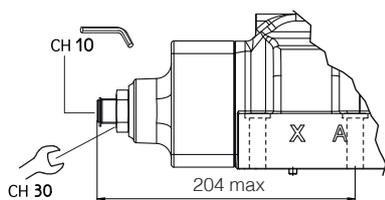
Mass (Kg)	
DPHE-46	17,4
DPHE-47	17,8
Option /S	+1,5
Option H, H9	+1,0



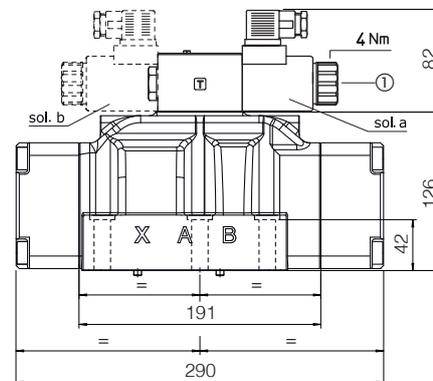
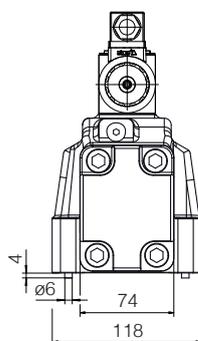
DPHE-4*/H /H9



Stroke adjustment device for option /S



DPHE-4*



① Standard manual override PIN

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

DPHE-6*

ISO 4401: 2005

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

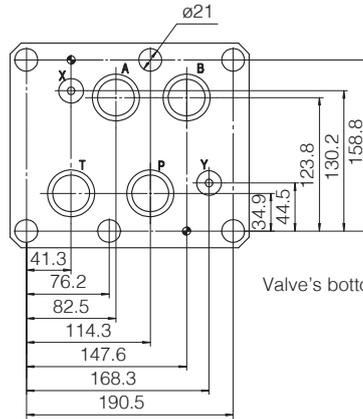
P = PRESSURE PORT

A, B = USE PORT

T = TANK PORT

X = EXTERNAL OIL PILOT PORT

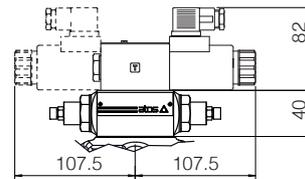
Y = DRAIN PORT



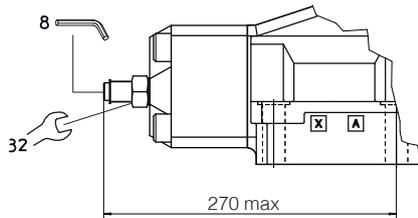
Valve's bottom view

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

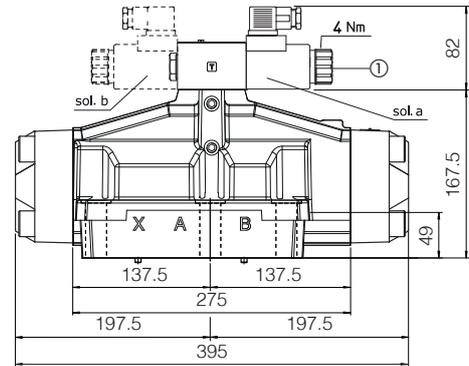
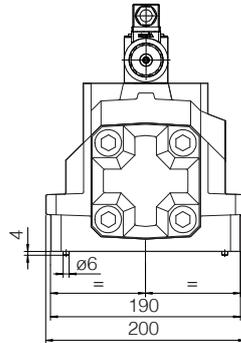
DPHE-6*/H/H9



Stroke adjustment device for option/S



DPHE-6*



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	
DPHE-1	BA-428	Ports A, B, P, T, X, Y underneath;	G 3/4"	G 1/4"	36,5	21,5	5,6
DPHE-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
DPHE-2	BA-418	Ports A, B, P, T, X, Y underneath;	G 3/4"	G 1/4"	36,5	21,5	3,5
DPHE-2	BA-518	Ports A, B, P, T, X, Y underneath;	G 1"	G 1/4"	46	21,5	8
DPHE-2	BA-519	Ports P, T, X, Y underneath; ports A, B on lateral side	G 1"	G 1/4"	46	21,5	8
DPHE-4	BA-508	Ports A, B, P, T, X, Y underneath;	G 1"	G 1/4"	46	21,5	7
DPHE-4	BA-509	Ports P, T, X, Y underneath; ports A, B on lateral	G 1"	G 1/4"	46	21,5	12,5
DPHE-6	BA-708	Ports A, B, P, T, X, Y underneath;	G 1 1/2"	G 1/4"	63,5	21,5	17