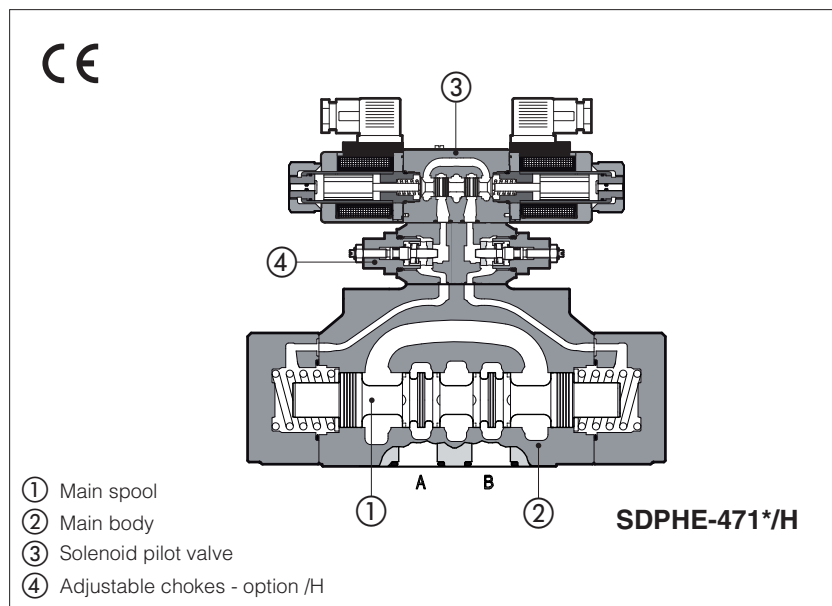


# Solenoid directional valves type SDPHE

piloted, spool type



Spool type, pilot operated directional solenoid valves available in three or four way configurations.

They are operated by a directional valve ③ type SDHE (see technical table SHE015) equipped with threaded solenoids for AC or DC power supply and certified according to North American Standard **cURus**.

Spools ① are fully interchangeable and they are available in a wide range of hydraulic configurations.

The valve body is made by shell-moulding castings ② machined by transfer lines and then cleaned by thermal deburring. Optimized flow paths largely cored with extrawide channels to tank ensures low pressure drops.

Valves can be supplied with following optional devices:

- Option /H, adjustable chokes for the valve's switching times control ④;
- Option /S, main spool stroke adjustment.

Rugged execution suitable for outdoor use.

Mounting surface: **ISO 4401 size 16, 25, 32**

Max flow **up to 300, 700 and 1000 l/min.**

Pressure **up to 350 bar**

## 1 MODEL CODE

|   |          |            |           |          |                |              |           |   |
|---|----------|------------|-----------|----------|----------------|--------------|-----------|---|
| <b>SDPH</b>   | <b>E</b> | <b>- 2</b> | <b>61</b> | <b>1</b> | <b>/ A - X</b> | <b>24 DC</b> | <b>**</b> | <b>/ *</b>  |
| Pilot operated directional control valve  |          |            |           |          |                |              |           |   |
| Solenoid pilot valve:<br><b>E</b> = SDHE for AC and DC supply, high performances with <b>cURus</b> certified solenoids  |          |            |           |          |                |              |           | Seals material, see section ③:<br>- = NBR<br><b>PE</b> = FKM<br><b>BT</b> = HNBR  |
| Valve size: <b>2</b> = 16 <b>4</b> = 25 <b>6</b> = 32   |          |            |           |          |                |              |           | Series number   |
| Valve configuration, see section ②<br><b>61</b> = single solenoid, center plus external position, spring centered<br><b>63</b> = single solenoid, 2 external positions, spring offset<br><b>67</b> = single solenoid, center plus external position, spring offset<br><b>71</b> = double solenoid, 3 positions, spring centered<br><b>75</b> = double solenoid, 2 external positions, with detent |          |            |           |          |                |              |           | Voltage code, see section ⑤   |
| Spool type, see section ②   |          |            |           |          |                |              |           |   |
| <b>Note:</b> SDPHE-* S PIL version without pilot solenoid valve available on request  |          |            |           |          |                |              |           |   |
|   |          |            |           |          |                |              |           | <b>X</b> = without connector<br>See section ⑪ for available connectors, to be ordered separately<br><b>00-AC</b> = AC solenoid valve without coils<br><b>00-DC</b> = DC solenoid valve without coils<br><b>XJ</b> = AMP Junior Timer connector<br><b>XK</b> = Deutsch connector<br><b>XS</b> = Lead Wire connection |
|   |          |            |           |          |                |              |           | Options, see section ④  |

## 2 CONFIGURATIONS and SPOOLS (representation according to ISO 1219-1, for functional scheme, see section ④)

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

### 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 -*70 (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 | 75 years, for further details see technical table P007   |                            |                      |
| Ambient temperature                    | <b>Standard</b> = -30°C ÷ +70°C; <b>/PE</b> option = -20°C ÷ +70°C; <b>/BT</b> option = -40°C ÷ +70°C  |                            |                      |
| Seals, recommended fluid temperature   | NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C<br>FKM seals (/PE option)= -20°C ÷ +80°C<br>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 <a href="http://www.atos.com">www.atos.com</a> or KTF catalog   |                            |                      |
| <b>Hydraulic fluid</b>                 | <b>Suitable seals type</b>   | <b>Classification</b>      | <b>Ref. Standard</b> |
| 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   |                            |                      |
| <b>Operating pressure</b>              | P, A, B, X = <b>350 bar</b><br>T = <b>250 bar</b> for external drain (standard)<br>T with internal drain (option /D) and port Y = <b>210 bar</b> SDPHE (DC); <b>160 bar</b> SDPHE (AC)<br>Minimum pilot pressure = 8 bar |                            |                      |
| Rated flow                             | See diagrams Q/Δp at section 6   |                            |                      |
| <b>Maximum flow</b>                    | SDPHE-2: <b>300 l/min</b> ; SDPHE-4: <b>700 l/min</b> ; SDPHE-6: <b>1000 l/min</b><br>(see rated flow at section 6 and operating limits at section 7)  |                            |                      |

#### 3.1 Coils characteristics

|                                   |  |
|-----------------------------------|--|
| Insulation class                  | <b>H</b> (180°C) for DC coils <b>F</b> (155°C) for AC coils<br>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 | <b>IP 65</b> (with connectors 666, 667 or 669 correctly assembled)   |
| Relative duty factor              | 100%   |
| Supply voltage and frequency      | See electric features 5  |
| Supply voltage tolerance          | ± 10%  |
| Certification                     | <b>cURus</b> North American standard   |

### 4 NOTES

#### 4.1 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).

**/R** = Pilot pressure generator (4 bar on port P) see section 4.2

**/S** = Main spool stroke adjustment.

**/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

#### 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).

**/L1, /L2, /L3** = calibrated restrictors on A and B ports of the pilot valve: **L1** = 0,8mm, **L2** = 1mm, **L3** = 1,25mm

**/L9** = plug with calibrated restrictor in P port of pilot valve - see section 9

Suggested for pilot pressure higher than 210 bar or to limit the hydraulics shocks caused by the fast main spool switching

#### 4.2 Special shaped spools

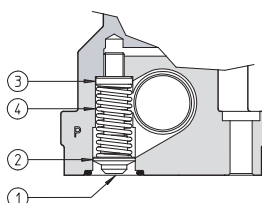
- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.

- spools type **1, 4** are also available as **1/1** and **4/8** that are properly shaped to reduce water-hammer shocks during the switching (to use with option /L\*).

| Shaped spool availability | 0/1 | 3/1 | 1/1 | 4/8 |
|---------------------------|-----|-----|-----|-----|
| SDPHE-2, SDPHE-4          | •   | •   | •   | •   |
| SDPHE-6                   | -   | •   | •   | •   |

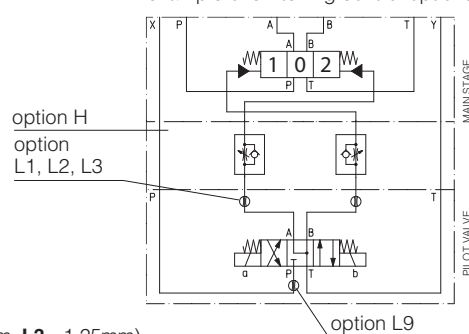
#### 4.3 Pilot pressure generator (option /R)

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, 5, 58**. 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

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



## 5 ELECTRIC FEATURES

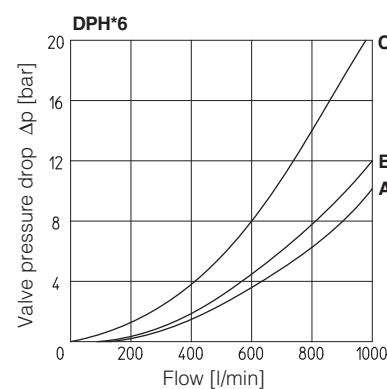
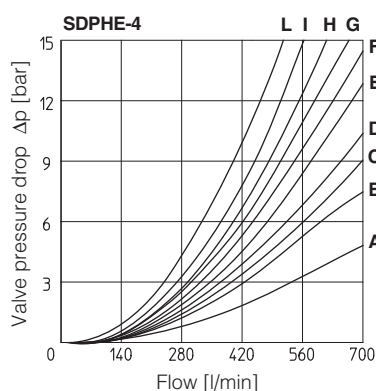
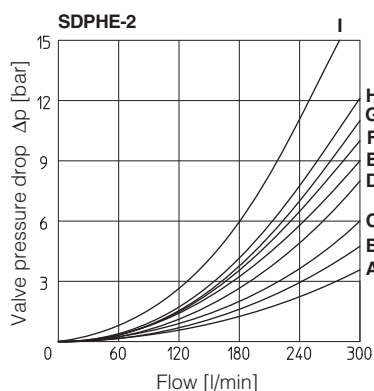
| Valve | External supply<br>nominal voltage<br>± 10% | Voltage<br>code | Type of<br>connector | Power<br>consumption (2) | Code of spare coil |
|-------|---|-----------------|----------------------|--------------------------|--------------------|
| SDPHE | 12 DC                                     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

(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 58 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.

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



| Spool type      | Flow direction |     |     |     |     |
|-----------------|----------------|-----|-----|-----|-----|
|                 | P→A            | P→B | A→T | B→T | P→T |
| 0/2, 1, 3, 6, 7 | A              | A   | D   | A   | -   |
| 1/1, 1/2        | 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   |
| 19              | C              | -   | -   | G   | -   |
| 39              | C              | -   | -   | H   | -   |
| 49              | -              | D   | -   | -   | -   |
| 58              | B              | A   | F   | H   | H   |
| 91              | C              | C   | E   | -   | -   |
| 93              | -              | C   | D   | -   | -   |

| 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, 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   |
| 19             | F              | -   | -   | E   | -   |
| 39             | G              | F   | -   | F   | -   |
| 58             | E              | A   | B   | F   | H   |
| 91             | F              | F   | D   | -   | -   |
| 93             | -              | G   | D   | -   | -   |

| 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   |

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

### SDPHE-2

| Spool            | Inlet pressure [bar] |     |     |     |
|------------------|----------------------|-----|-----|-----|
|                  | 70                   | 140 | 210 | 350 |
| 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 |
| 58, *9, 9*       | 300                  | 300 | 270 | 200 |

### SDPHE-4

| Spool            | Inlet pressure [bar] |     |     |     |
|------------------|----------------------|-----|-----|-----|
|                  | 70                   | 140 | 210 | 350 |
| 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 |
| 58, *9, 9*       | 500                  | 500 | 500 | 450 |

### SDPHE-6

| Spool        | Inlet pressure [bar] |     |     |     |
|--------------|----------------------|-----|-----|-----|
|              | 70                   | 140 | 210 | 350 |
| 1, 3, 6, 7,  | 1000                 | 950 | 850 | 700 |
| 0            | 950                  | 900 | 800 | 650 |
| 1/2, 2, 4, 5 | 850                  | 800 | 700 | 450 |
| 58, 19/91    | 950                  | 850 | 650 | 450 |

## 8 SWITCHING TIMES (average values in m sec)

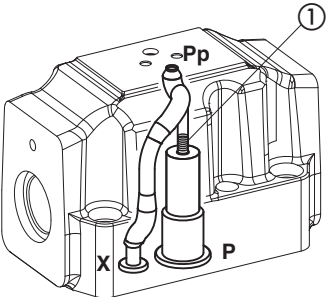
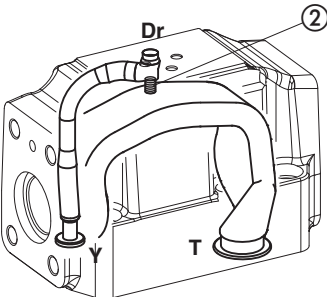
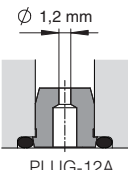
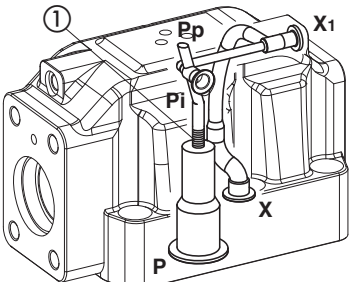
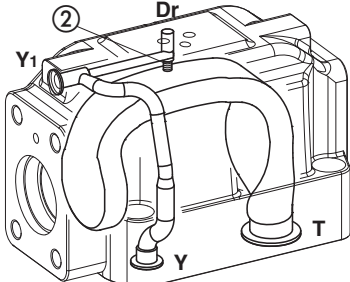
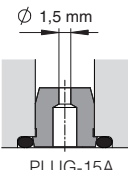
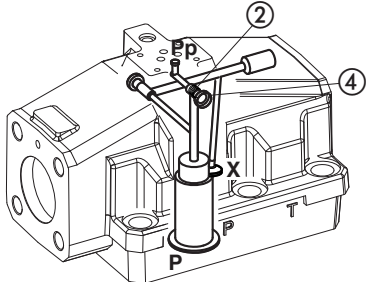
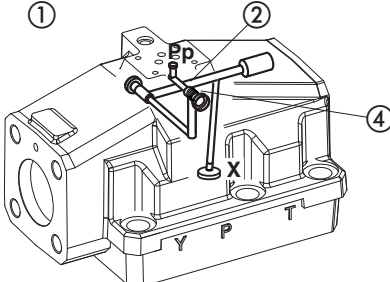
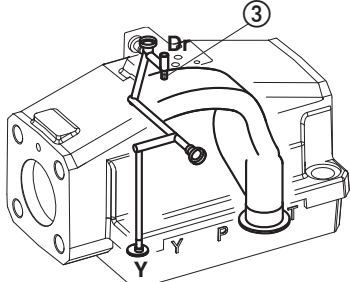
| Valve model | Configuration            |            | Piloting pressure   |                |                     |                |                     |                |
|-------------|--------------------------|------------|---------------------|----------------|---------------------|----------------|---------------------|----------------|
|             |                          |            | 70 bar              |                | 140 bar             |                | 250 bar             |                |
|             |                          |            | Alternating current | Direct current | Alternating current | Direct current | Alternating current | Direct current |
| SDPHE-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                  |                |                     |                |                     |                |
| SDPHE-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                 |                |                     |                |                     |                |
| SDPHE-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.

## 9 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

|   |  |  |  |  |
|---|--|--|--|--|
| <b>SDPHE-2 Pilot channels</b><br>   |  | <b>SDPHE-2 Drain channels</b><br>  |  | <b>Internal piloting:</b> Without blinded plug SP-X300F ①;<br><b>External piloting:</b> Add blinded plug SP-X300F ①;<br><b>Internal drain:</b> Without blinded plug SP-X300F ②;<br><b>External drain:</b> Add blinded plug SP-X300F ②.<br><br><b>Option L9</b><br>This option provides a calibrated restrictor PLUG-H-12A (Ø 1,2 mm) in the P port of the pilot valve<br> |
| <b>SDPHE-4 Pilot channels</b><br>  |  | <b>SDPHE-4 Drain channels</b><br> |  | <b>Internal piloting:</b> Without blinded plug SP-X500F ①;<br><b>External piloting:</b> Add blinded plug SP-X500F ①;<br><b>Internal drain:</b> Without blinded plug SP-X300F ②;<br><b>External drain:</b> Add blinded plug SP-X300F ②.<br><br><b>Option L9</b><br>This option provides a calibrated restrictor PLUG-H-15A (Ø 1,5 mm) in the P port of the pilot valve<br> |
| <b>SDPHE-6 Pilot channels</b><br>  |  | <b>SDPHE-6 Pilot channels</b><br> |  | <b>SDPHE-6 Drain channels</b><br>   |
| <b>Internal piloting:</b><br>plug SP-X325A in pos ②;<br>To reach the orifice ②, remove plug ④ = G 1/8"<br>Note: valve body is different from internal and external piloting |  | <b>External piloting:</b><br>plug SP-X325A in pos ②;   |  | <b>Internal drain:</b><br>Without blinded plug SP-X300F ③;<br><b>External drain:</b><br>Add blinded plug SP-X300F ③.   |

## 10 DIMENSIONS FOR SDPHE-2 [mm]

### SDPHE-2\*

ISO 4401: 2005

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

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

Diameter of ports A, B, P, T:  $\varnothing = 20$  mm;

Diameter of ports X, Y:  $\varnothing = 7$  mm;

Seals: 4 OR 130, 2 OR 2043

**P** = PRESSURE PORT

**A, B** = USE PORT

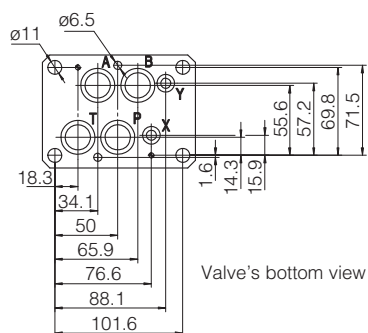
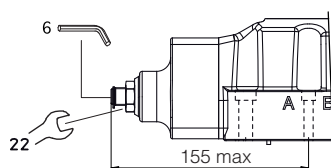
**T** = TANK PORT

**X** = EXTERNAL OIL

PILOT PORT

**Y** = DRAIN PORT

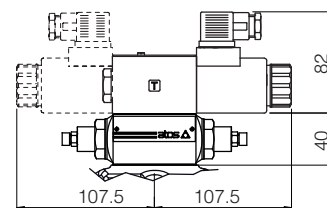
Stroke adjustment  
device for option /S



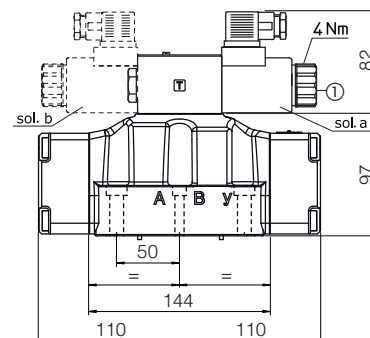
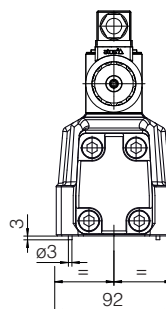
Valve's bottom view

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

### SDPHE-2\*/H



### SDPHE-2\*



Overall dimensions refer to valves with connectors type 666

① Standard manual override PIN

## 11 DIMENSIONS FOR SDPHE-4 [mm]

### SDPHE-4\*

ISO 4401: 2005

Mounting surface: 4401-08-08-0-05

Fastening bolts:

6 socket head screws M12x60 class 12.9

Tightening torque = 125 Nm

Seals: 4 OR 4112; 2 OR 3056

Diameter of ports A, B, P, T:  $\varnothing = 24$  mm;

Diameter of ports X, Y:  $\varnothing = 7$  mm;

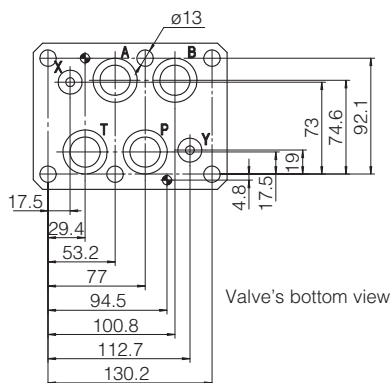
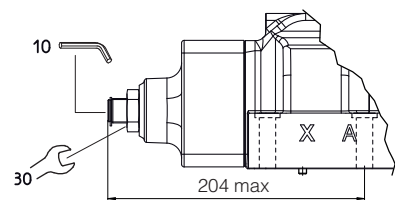
**P** = PRESSURE PORT

**A, B** = USE PORT

**T** = TANK PORT

**X** = EXTERNAL OIL PILOT PORT

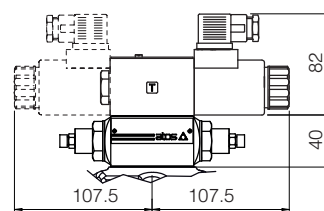
**Y** = DRAIN PORT



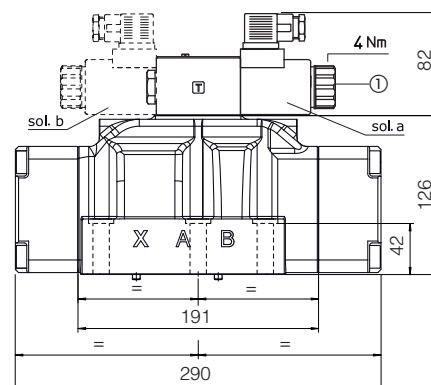
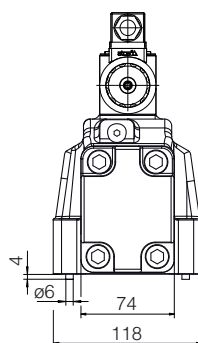
Valve's bottom view

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

### SDPHE-4\*/H



### SDPHE-4\*



Overall dimensions refer to valves with connectors type 666

① Standard manual override PIN

## 12 DIMENSIONS FOR DPH\*-6 [mm]

### SDPHE-6\*

ISO 4401: 2005

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

Fastening bolts:

6 socket head screws M20x80 class 12.9

Tightening torque = 600 Nm

Diameter of ports A, B, P, T:  $\varnothing = 34$  mm;

Diameter of ports X, Y:  $\varnothing = 7$  mm;

Seals: 4 OR 144, 2 OR 3056

**P** = PRESSURE PORT

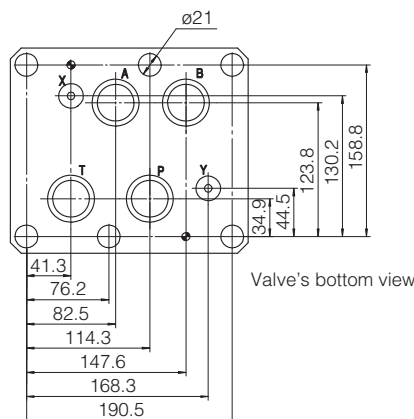
**A, B** = USE PORT

**T** = TANK PORT

**X** = EXTERNAL OIL

PILOT PORT

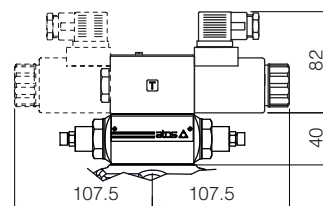
**Y** = DRAIN PORT



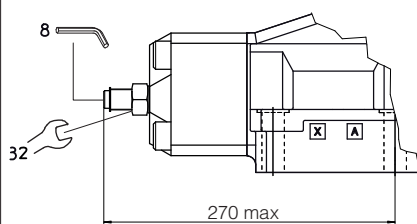
Valve's bottom view

| Mass (Kg) |      |
|-----------|------|
| SDPHE-66  | 43,8 |
| SDPHE-67  | 44,1 |
| Option /S | +3,5 |
| Option H  | +1,0 |

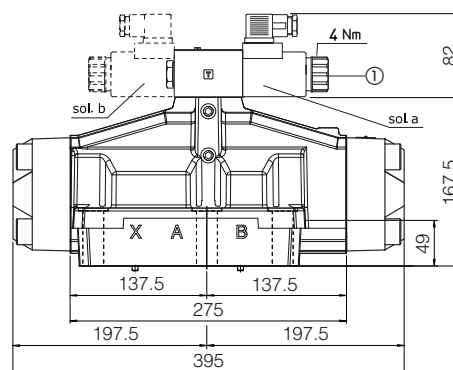
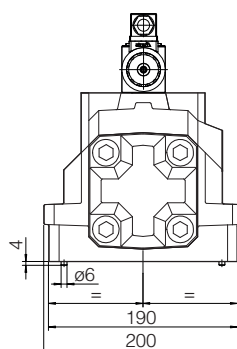
### SDPHE-6\*/H



### Stroke adjustment device for option/S



### SDPHE-6\*



Overall dimensions refer to valves with connectors type 666

① Standard manual override PIN

## 13 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 - the connectors must be ordered separately

| Connector code | Function  |
|----------------|---|
| <b>666</b>     | Connector IP65, suitable for direct connection to electric supply source  |
| <b>667</b>     | As 666 connector IP65 but with built-in signal led, suitable for direct connection to electric supply source          |
| <b>669</b>     | With built-in rectifier bridge for supplying DC coils by alternating current (AC 110V and 230V - I <sub>max</sub> 1A) |