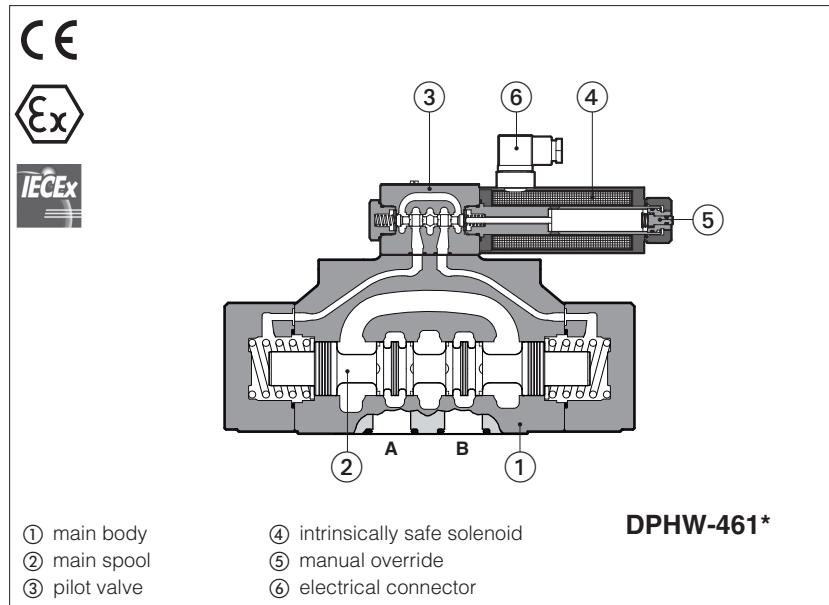


## Intrinsically safe solenoid directional valves

on-off, spool type, piloted - **ATEX** and **IECEX**



### DPHW

On-off spool type, piloted directional valves equipped with intrinsically safe solenoids certified for safe operation in hazardous environment with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX** and **IECEX**:  
for gas group **II 1G** surface plants zone 0, 1, 2
- Multicertification **ATEX** and **IECEX**:  
**I M1** tunnels or mining plants

See section [11](#) for certification data


The valves must be electrically powered through specific "safety barriers" limiting the max current to the solenoid, see section [13](#)

Size: **10, 16** and **25**

Max flow: up to **160, 300** and **700 l/min**

Max pressure: **350 bar**

### 1 MODEL CODE

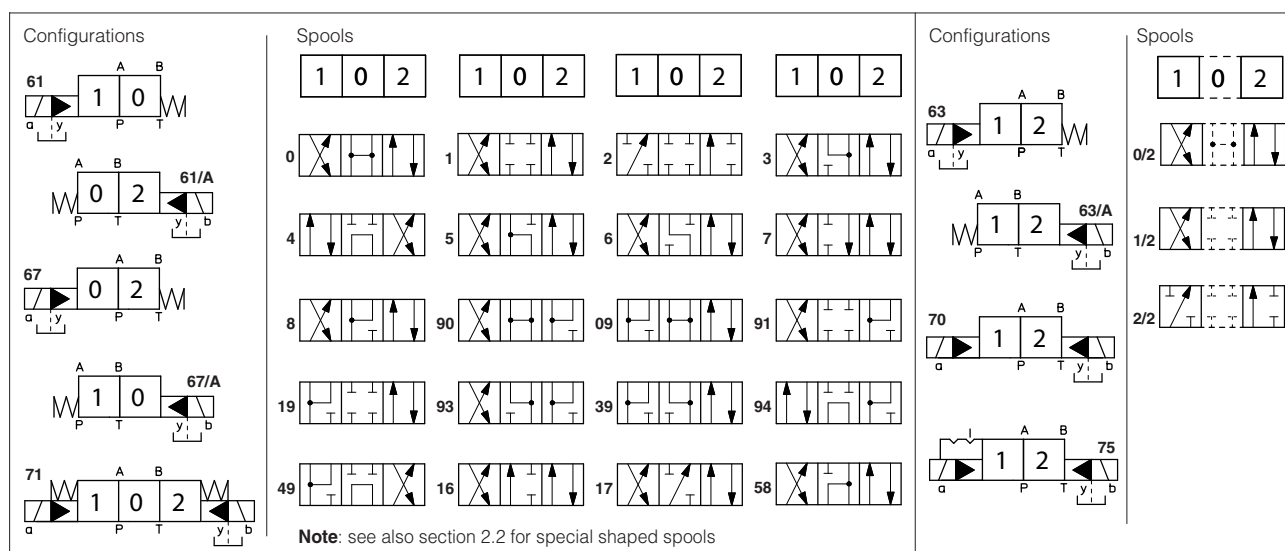
<b>DPHW</b>	/	*	-	<b>2</b>	<b>61</b>	<b>1</b>	/	*	*	/	*
<p>Intrinsically safe directional valve, piloted</p> <p><b>Certification type:</b> - = Omit for Group II 1G <b>M</b> = Group I (mining)</p> <p><b>Valve size (ISO 4401):</b> <b>1</b> = 10    <b>2</b> = 16    <b>4</b> = 25</p> <p><b>Configuration</b>, see section <a href="#">2</a></p> <p><b>Spool type</b>, see section <a href="#">2</a></p>											
<p><b>Seals material</b>, see section <a href="#">8</a> : - = NBR <b>PE</b> = FKM <b>BT</b> = NBR low temp. <b>(1)</b></p> <p>Series number</p> <p><b>Options (2):</b> <b>A</b> = solenoid at side of port B (for single solenoid valves) <b>D</b> = Internal drain <b>E</b> = external pilot pressure <b>H</b> = adjustable chokes (meter-out to the pilot chambers of the main valve) <b>L9</b> = (not for DPHW-1) plug with calibrated restrictor on port P of pilot valve <b>/R</b> = Pilot pressure generator (not for DPHW-1, see section <a href="#">4</a>) <b>WP</b> =  prolonged manual override protected by rubber cap</p>											

**(1)** Not for certification **M** Group I (mining)

**(2)** Possible combined options: all combinations are available

 The pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

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



### 2.1 Standard spoils availability

- DPHW-1 are available only with spoils **0, 0/2, 1, 1/2, 3, 4, 5, 58, 6, 7**
- DPHW-2 and DPHW-4 are available with all spoils shown in the above table

### 2.2 Special shaped spoils

- spoils 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.
- spoils 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.

### 2.3 Special spool availability

Valve size	standard spoils							
	0/1	3/1	1/1	4/8	5/1	58/1	6/1	7/1
DPHW-1	•	•		•				
DPHW-2, DPHW-4	•	•	•	•	•	•	•	•

## 3 DEVICES FOR MAIN SPOOL SWITCHING CONTROL

**Folowing options are suggested to reduce the hydraulic shocks at the valve operation**

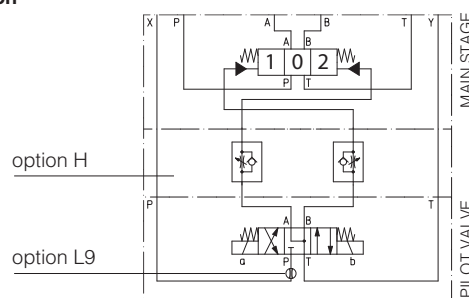
**/H** = Adjustable chokes (meter-out to the pilot chambers of the main valve).

**/L9** (only for DPHW-2 and DPHW-4) plug with calibrated restictor in P port of pilot valve

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



#### 4 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]		
	DPHW-1	DPHW-2	DPHW-4
<b>61*</b>	14	8	8
<b>63*</b>	8	8	8
<b>67*</b>	8	8	8
<b>70*</b>	8	8	8
<b>71*</b>	14	10	10
<b>75*</b>	8	8	8

##### OPTION /R

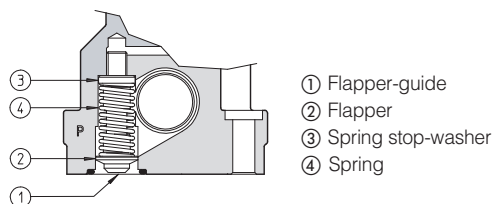
The /R device is available for valves **DPHW-2, DPHW-4** with **internal piloting** and for **all types of spools**.

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.

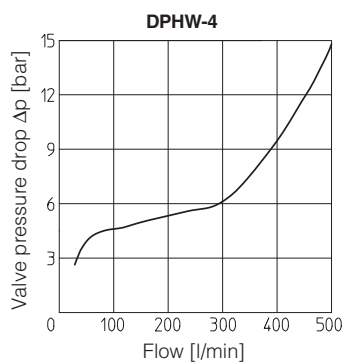
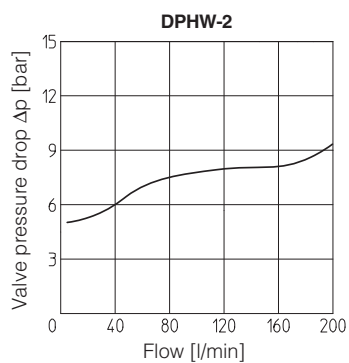
Minimum flow rates required for correct operation of the device, are as follows:

DPHW-2: **5 l/min**     DPHW-4: **35 l/min**



Ordering code of spare pilot pressure generator

<b>R/DP</b>	-	<b>*</b>
Pilot pressure generator		Size: <b>2</b> for DPHW-2 <b>4</b> for DPHW-4



## 5 GENERAL CHARACTERISTICS

Assembly position	Horizontal position only
Subplate surface finishing to ISO 4401	Acceptable roughness index, $R_a \leq 0,8$ recommended $R_a 0,4$ - flatness ratio 0,01/100
MTTFd values according to EN ISO 13849	75 years, for further details see technical table P007
Ambient temperature	<b>Standard</b> = $-30^{\circ}\text{C} \div +60^{\circ}\text{C}$ <b>/PE</b> option = $-20^{\circ}\text{C} \div +60^{\circ}\text{C}$ <b>/BT</b> option = $-40^{\circ}\text{C} \div +60^{\circ}\text{C}$
Storage temperature range	<b>Standard</b> = $-30^{\circ}\text{C} \div +70^{\circ}\text{C}$ <b>/PE</b> option = $-20^{\circ}\text{C} \div +70^{\circ}\text{C}$ <b>/BT</b> option = $-40^{\circ}\text{C} \div +70^{\circ}\text{C}$
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200h
Compliance	Intrinsically safe protection "Ex ia", see section 11 RoHs Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006

## 6 HYDRAULIC CHARACTERISTICS


Operating pressure	P, A, B, X = <b>350 bar</b> T = <b>250 bar</b> with external drain (standard) T and Y = <b>160 bar</b> with internal drain (option /D) Minimum pilot pressure for correct operation is = <b>8 bar</b>
Rated flow	See diagrams Q/ $\Delta p$ at section 9
Maximum flow	DPHW-1: <b>160 l/min</b> ; DPHW-2: <b>300 l/min</b> ; DPHW-4: <b>700 l/min</b> ; see Q/ $\Delta p$ diagrams at section 9 and operating limits at section 10

## 7 ELECTRICAL CHARACTERISTICS - see also section 11

Nominal resistance at 20°C	157 $\Omega$
Coil insulation	Class H
Minimum supply current	70 mA
Protection degree	IP65; IP66/IP67 with mating connector suitable for the protection class
Duty factor	100%
Electrical connector	DIN 43650 2 pin+GND

## 8 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

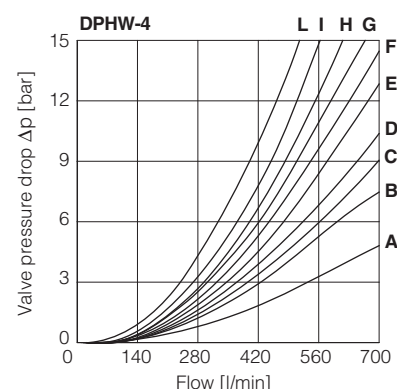
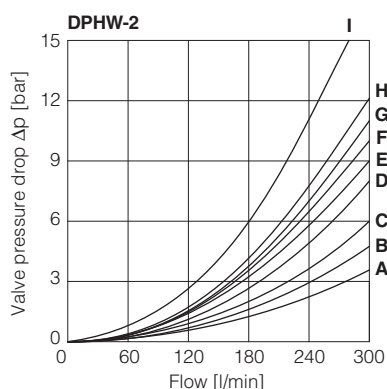
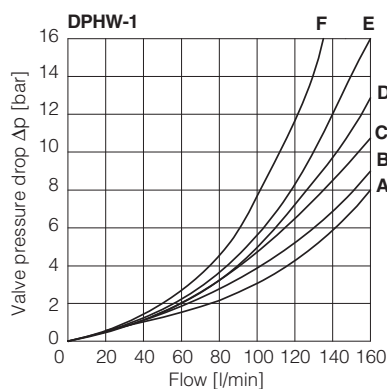
Seals, recommended fluid temperature	NBR seals (standard) = $-20^{\circ}\text{C} \div +60^{\circ}\text{C}$ , with HFC hydraulic fluids = $-20^{\circ}\text{C} \div +50^{\circ}\text{C}$ FKM seals (/PE option) = $-20^{\circ}\text{C} \div +80^{\circ}\text{C}$ NBR low temp. seals (/BT option) = $-40^{\circ}\text{C} \div +60^{\circ}\text{C}$ , with HFC hydraulic fluids = $-40^{\circ}\text{C} \div +50^{\circ}\text{C}$		
Recommended viscosity	15÷100 mm <sup>2</sup> /s - max allowed range 2.8 ÷ 500 mm <sup>2</sup> /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		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDR, HFDR	ISO 12922
Flame resistant with water	NBR, NBR low temp.	HFC	

 The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

### (1) Performance limitations in case of flame resistant fluids with water:

-max operating pressure = 210 bar    -max fluid temperature = 50°C

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



**DPHW-1**

Flow direction					
Spool type	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

**DPHW-2**

Flow direction					
Spool type	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	-	-	-	-

**DPHW-4**

Flow direction					
Spool type	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	-	-

## 10 OPERATING LIMITS

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

**DPHW-1**

Spool type	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

**DPHW-2**

Spool type	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

**DPHW-4**

Spool type	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

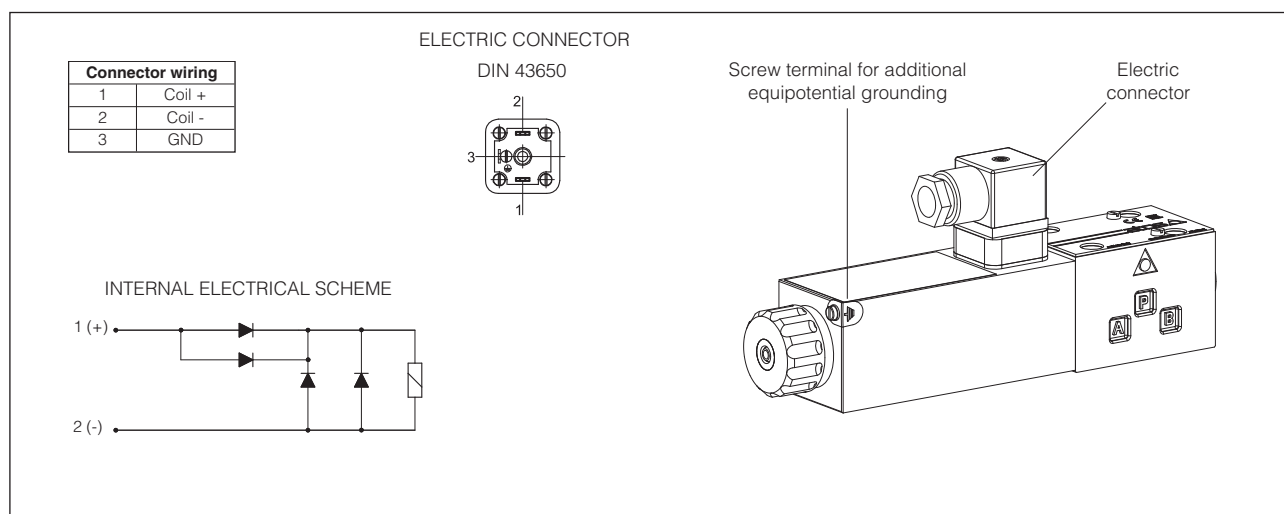
## 11 CERTIFICATION DATA

Valve type	DPHW			DPHW/M
Certification	ATEX, IECEx (Group II)			ATEX, IECEx (Group I)
Solenoid code	COW-150			COW-150/M
Type examination certificate (1)	ATEX: TUV IT 22 ATEX 051X; IECEX: IECEX TPS 22.0057X;			ATEX: TUV IT 22 ATEX 051X IECEX: IECEX TPS 22.0057x
Method of protection	<ul style="list-style-type: none"> <li>• ATEX, Ex II 1G Ex ia IIC T6 Ga Ex II 1G Ex ia IIC T5 Ga</li> <li>• IECEx Ex ia IIC T6 Ga Ex ia IIC T5 Ga</li> </ul>			<ul style="list-style-type: none"> <li>• ATEX, Ex I M1 Ex ia I Ma</li> <li>• IECEx Ex ia I Ma</li> </ul>
Temperature class	T6		T5	-
Electrical characteristics (max values)	Ci , Li	≅ 0	≅ 0	≅ 0
	Ui [V]	30V	30V	30V
	Ii [mA]	800mA	2200mA	2200mA
	Pi [W]	3W	6.82W	6.82W
Ambient temperature	-40 ÷ +60°C		-40 ÷ +60°C	-40 ÷ +60°C
Applicable standards	EN 60079-0 EN 60079-11			IEC 60079-0 IEC 60079-11

(1) The type examiner certificates can be downloaded from [www.atos.com](http://www.atos.com)

**⚠ WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

## 12 EX PROOF SOLENOIDS WIRING



## 13 INTRINSICALLY SAFE BARRIERS - see tech. table **GX010**

Intrinsically safe valves must be powered through safety barriers certified according to Ex-i protection mode, limiting the energy to the solenoid.

To select the proper intrinsically safe barriers following data must be considered:

- 1) V<sub>max</sub> and I<sub>max</sub> of the solenoid as specified in section 11 must not be exceeded also in fault conditions;
- 2) For proper operation, the minimum supply current value must be provided (such as 90mA for coil 108 Ω, with Y-BXNE 412).

The barriers type **Y-BXNE 412** are galvanically isolated electronic devices, complying with European Norms EN60079-0/06, EN60079-11/07 and ATEX certified according to protection mode Ex ia IIC.

The barriers Y-BXNE-412 are double channel type, suitable to operate valves with double or single solenoid. Two single solenoid valves can be connected to the barrier (one to each channel) but they cannot be contemporary operated.

### MODEL CODE OF I.S. BARRIER

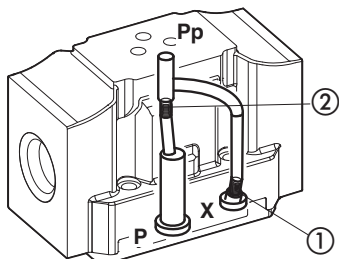
<b>Y-BXNE 412 00</b>	<b>*</b>
Supply voltage <b>E</b> = 110/230 V <sub>AC</sub> <b>2</b> = 24÷48 V <sub>DC</sub>	

## 14 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

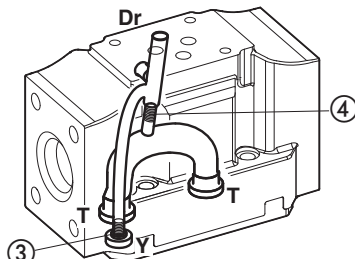
Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.  
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.  
Standard valves configuration provides internal pilot and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

### DPHW-1

#### Pilot channels



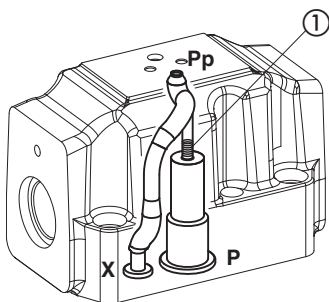
#### Drain channels



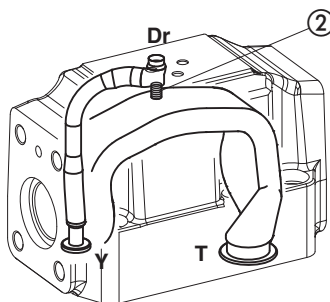
**Internal piloting:** blinded plug SP-X300F ① in X;  
plug SP-X310F ② in Pp;  
**External piloting:** blinded plug SP-X300F ② in Pp;  
plug SP-X310F ① in X;  
**Internal drain:** blinded plug SP-X300F ③ in Y;  
**External drain:** blinded plug SP-X300F ④ in Dr.

### DPHW-2

#### Pilot channels



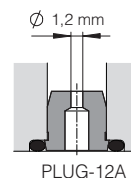
#### Drain channels



**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.

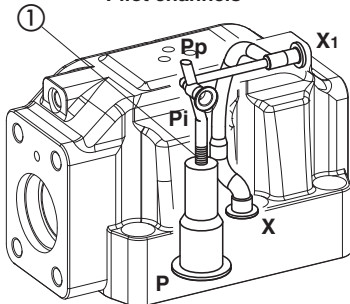
#### Option L9

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

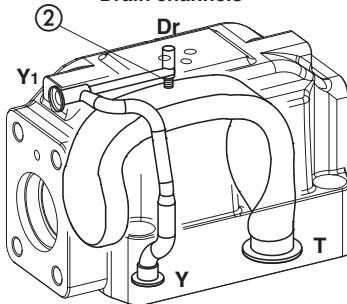


### DPHW-4

#### Pilot channels



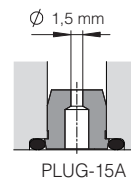
#### Drain channels



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



**DPHW-1\***

ISO 4401: 2005 (see table P005)

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

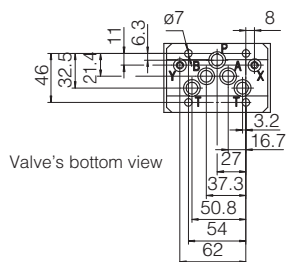
Fastening bolts:

4 socket head screws M6x40 class 12.9

Tightening torque = 15 Nm

Diameter of ports A, B, P, T:  $\varnothing = 11$  mm;Diameter of ports X, Y:  $\varnothing = 5$  mm;

Seals: 5 OR 2050, 2 OR 108

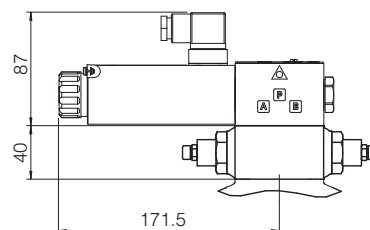
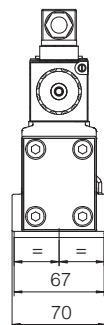
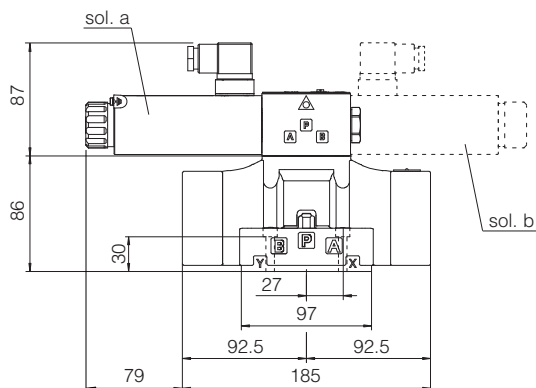


**P** = PRESSURE PORT  
**A, B** = USE PORT  
**T** = TANK PORT  
**X** = EXTERNAL PILOT PORT  
**Y** = DRAIN PORT

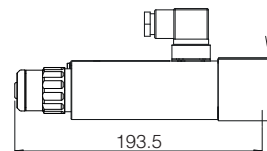
Mass [kg]	
DPHW-16	8,0
DPHW-17	9,5
Option /H	+1,0

**DPHW-16**

DPHW-17 (dotted line)



option /WP

**DPHW-2\***

ISO 4401: 2005 (see table P005)

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

Fastening bolts:

4 socket head screws M10x50 class 12.9

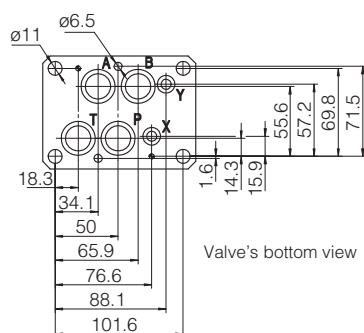
Tightening torque = 70 Nm

2 socket head screws M6x45 class 12.9

Tightening torque = 15 Nm

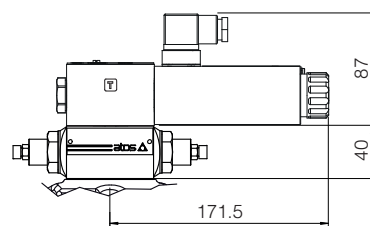
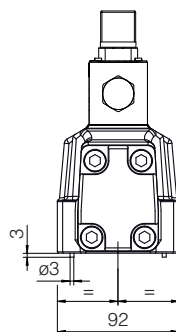
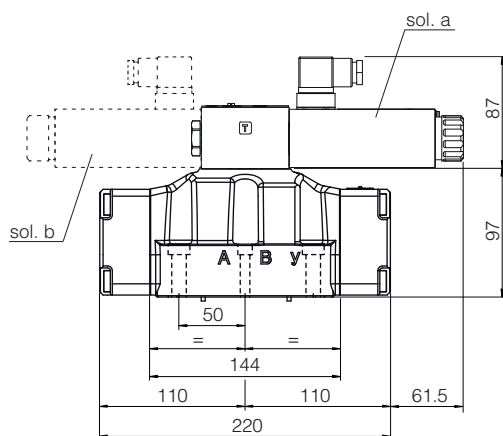
Diameter of ports A, B, P, T:  $\varnothing = 20$  mm;Diameter of ports X, Y:  $\varnothing = 7$  mm;

Seals: 4 OR 130, 2 OR 2043

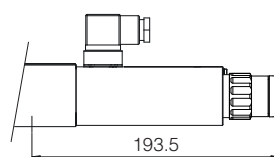


**P** = PRESSURE PORT  
**A, B** = USE PORT  
**T** = TANK PORT  
**X** = EXTERNAL PILOT PORT  
**Y** = DRAIN PORT

Mass [kg]	
DPHW-26	11
DPHW-27	12,5
Option /H	+1,0



option /WP





## DPHW-4\*

ISO 4401: 2005 (see table P005)

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

Fastening bolts:

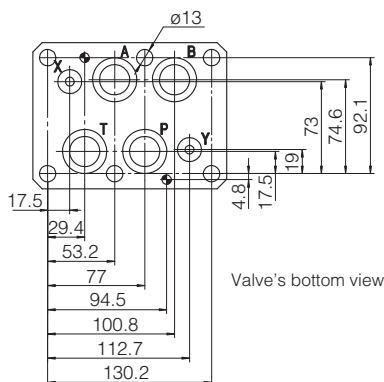
6 socket head screws M12x60 class 12.9

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;



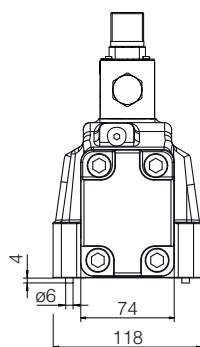
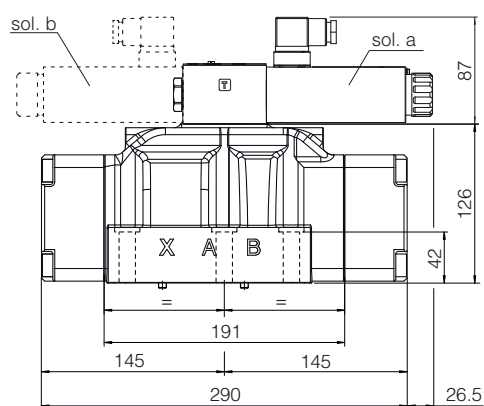
Valve's bottom view

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

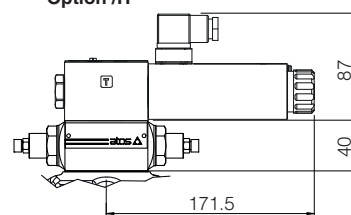
Mass [kg]	
DPHW-46	18,5
DPHW-47	20
Option /H	+1,0

DPHW-46

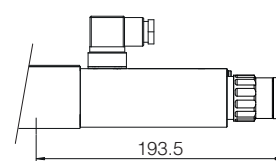
DPHW-47 (dotted line)



Option /H



option /WP



**Note:** the connector type 666 is supplied with the valve

## 16 RELATED DOCUMENTATION

<b>X010</b>	Basics for electrohydraulics in hazardous environments
<b>X050</b>	Summary of Atos intrinsically safe components certified to ATEX and IECEx
<b>EX950</b>	Operating and maintenance information for intrinsically safe valves
<b>P005</b>	Mounting surfaces for electrohydraulic valves