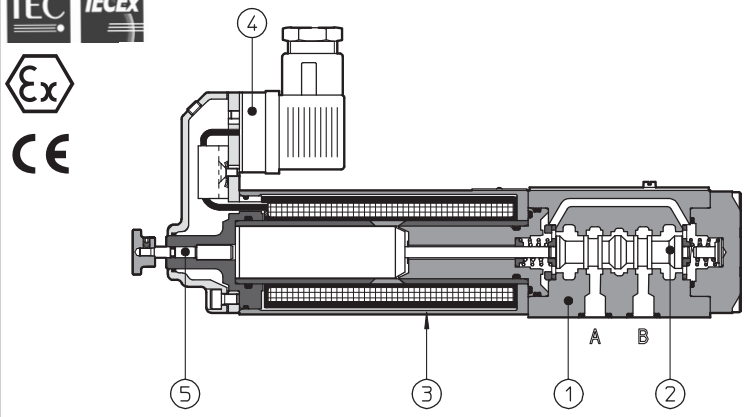
# Intrinsically safe solenoid valves

on/off controls - ATEX or IECEX certification




**DHW-0611/WP/6**

① valve body
② valve spool
③ intrinsically safe solenoid
④ electrical connector
⑤ manual override

On/off valves equipped with intrinsically safe solenoids available with following certifications and protection modes:
**Solenoids group II** for surface plants with gas environment category 1, zone 0, 1 and 2
- ATEX 94/9/CE, Ex II 1 G, Ex ia IIC T6 (IIB T6 or IIA T5)
- IECEx, wordwide recognized safety certification Ex ia IIC T6 (IIB T6, IIA T5) Ga

**Solenoids group I** for surface, tunnels or mining plants
- ATEX 94/9/CE, Ex I M2 Ex ia I
- IECEx, wordwide recognized safety certificationEx ia (ib) I Mb

DHW are **SIL** compliance with IEC 61508 (TÜV certified) - see section 3.5
The "intrinsically safe" protection is based on the principle of limiting the energy of electric circuits in environments with presence of hazardous atmospheres. For this reason the valves must be supplied through specific “safety barriers” limiting the max current to the solenoid. Atos provides galvanically insulated barriers for single and double solenoid valves, see section 18 to 21. The "intrinsically safe" circuit is virtually unable to produce electrical surges or thermic effects able to cause explosion in hazardous environments also in presence of specific break-down situations.

## 1 INTRINSICALLY SAFE SOLENOIDS: MAIN DATA

| | | |
|---|---|---|
| Solenoid code | Group II ATEX | **OW-18/6** |
| | Group I ATEX (mining) | **OWM-18/6** |
| | Group II IECEx | **OWI-18/6** |
| | Group I IECEX (mining) | **OWIM-18/6** |
| Nominal resistance at 20°C | | 150 Ω |
| Coil insulation | | Class H |
| Protection degree | | IP66 |
| Duty factor | | 100% |
| Electrical connector | | DIN 43650 2 pin+GND |

## 2 INTRINSICALLY SAFE SOLENOIDS: ELECTRICAL AND TEMPERATURE DATA

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method of protection | | **Ex ia / Ex ib** according to EN60079-0: 2006, EN60079-11:2007 | | | | | |
| Gas group | | **I** and **IIC** | | | **I** and **IIB** | **I** and **IIA** | **I** |
| Temperature class | | **T6** | | | **T6** | **T5** | **-** |
| Electrical characteristic | V max | 27 V | 19,5 V | 19,11 V | 28 V | 28 V | 12,4 V |
| | I max | 130 mA | 360 mA | 360 mA | 250 mA | 396 mA | 2200 mA |
| | P max | 0,9 W | 1,64 W | 1,72 W | 1,8 W | 2,8 W | 6,82 W |
| Minimum supply current | | ≥ 65mA, for I.S. barriers see section 18 to 21 | | | | | |
| Surface temperature (ambient temp. +60°C) | | ≤ 85°C | | | | ≤ 100°C | 150 °C |
| Ambient temperature | | -40 ÷ +60°C (1) | | | | | -20 ÷ +60°C |

(1) The group II solenoids are Atex certified for minimum temperature -40°C. Select /BT in the valve code for the application with minimum temperature -40°C

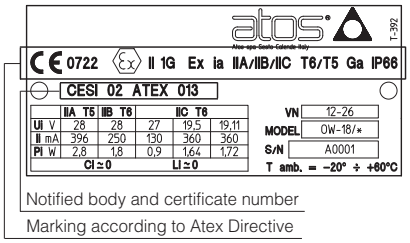
## 3 CERTIFICATIONS

In the following are resumed the valves marking according to the Atex and IECEx Group I and Group II certification:

### 3.1 GROUP II, Atex

**Ex** = Equipment for explosive atmospheres
**II** = Group II for surface plants
**1** = Very high protection (equipment category)
**G** = For gas and vapours
**ia** = Intrinsically safe execution
**IIC, IIB, IIA** = Gas group - applications or surface plants
**T6** / **T5** = Temperature class of the solenoid surface referred to +60°C ambient temperature
**Ga** = Equipment protection level >1000 hrs/y in explosive atmosphere
**IP66** = High protection from dust and water jets
**Zone 0** (1 and 2) = Explosive atmosphere continuosly present

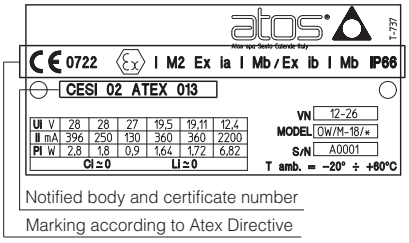
**EXAMPLE OF NAMEPLATE MARKING**




### 3.2 GROUP I Atex (mining)

**Ex** = Equipment for explosive atmospheres
**I** = Group I for mines and surface plants
**M2** = High protection (equipment category)
**Ia, Ib** = Intrinsically safe execution
**I** = Gas group (Methane)
**Mb** = Equipment protection level, high level protection for explosive atmospheres
**IP66** = High protection from dust and water jets

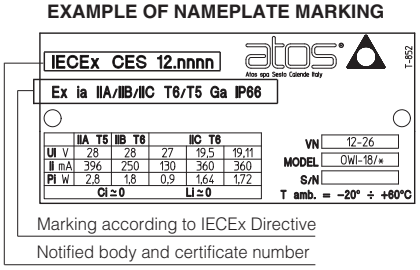
**EXAMPLE OF NAMEPLATE MARKING**




### 3.3 GROUP II IECEx

**Ex** = Equipment for explosive atmospheres
**Ia** = Intrinsically safe execution
**IIC, IIB, IIA** = Gas group - applications or surface plants
**T6, T5** = temperature class of solenoid surface referred to +60°C ambient temperature
**Ga** = Equipment protection level >1000 hrs/y in explosive atmosphere
**IP66** = High protection from dust and water jets

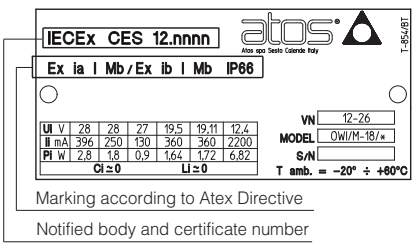
**EXAMPLE OF NAMEPLATE MARKING**




### 3.4 GROUP I IECEx (mining)

**Ex** = Equipment for explosive atmospheres
**Ia (Ib)** = Intrinsically safe execution
**I** = Gas group (Methane)
**Mb** = Equipment protection level, high level protection for explosive atmospheres
**IP66** = High protection from dust and water jets

**EXAMPLE OF NAMEPLATE MARKING**




### 3.5 SIL compliance with IEC 61508: 2010

DHA and DLAH (multicertified for surface and mining) meets the requirements of:
- **SC3** (systematic capability)
- max **SIL 2** (HFT = 0 if the hydraulic system does not provide the redundancy for the specific safety function where the component is applied)
- max **SIL 3** (HFT = 1 if the hydraulic system provides the redundancy for the specific safety function where the component is applied)

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

## 4 MAIN CHARACTERISTICS OF INTRINSICALLY SAFE VALVES

| | |
|---|---|
| Assembly position | the installation of DHW valves with the axis in vertical position is not recommended.<br>If this type of installation is absolutely necessary, please consult our technical office |
| Subplate surface finishing | Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101) |
| Ambient temperature | Standard execution = -30°C ÷ +70°C<br>/PE option = -20°C ÷ +70°C<br>/BT option = -40°C ÷ +70°C |
| Seals, recommended fluid temperature | NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C<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 |
| Fluid | Hydraulic oil as per DIN 51524 .... 535; for other fluids see section 5 |
| Recommended viscosity | 15 ÷ 100 mm²/s at 40°C (ISO VG 15 ÷ 100) max viscosity 400 mm²/s |
| Fluid contamination class | ISO 4406 class 20/18/15 NAS 1638 class 9, in line filters of 10 μm ($\beta_{10} \geq 75$ recommended) |
| Fluid temperature | -20°C +60°C (standard and /PE seals) -40°C to +60°C for /BT option<br>-20°C to +80°C for /PE option |

### 4.1 Corrosion protection characteristics

Valve screws: all screws made in stainless steel class A2

## 5 MODEL CODE OF SPOOL TYPE ON-OFF DIRECTIONAL SOLENOID VALVES

**DH W /* – 0 71 3H / A / 6 ** /***

**DH** = spool type - direct
**DPH** = spool type - piloted

**W** = intrinsically safe solenoid, Atex certified

omit for Atex Group II
**M** = Atex Group I (mining)
**IE** = IECEx Group II
**IEM** = IECEx Group I (mining)

Valve size (ISO 4401):
for DHW: **0** = size 06;
for DPHW: **1** = size 10 **2** = size 16; **4** = size 25

Valve configuration, DHW see section 6 and DPHW see section 7

Spool type, DHW see section 6 and DPHW see section 7
3H = spool type 3H for marine applications (1) Only for DHW-071

Options:
**/A** = solenoid at side of port B
**/WP** = prolunged manual override

Only for DPHW
**/D** = internal drain
**/E** = external pilot pressure
**/H** = adjustable chokes (meter-out to the pilot chambers of the main valve)
**/L9** = (only for DPHA-2 and DPHA-4) plug with calibrated restrictor on port P of pilot valve

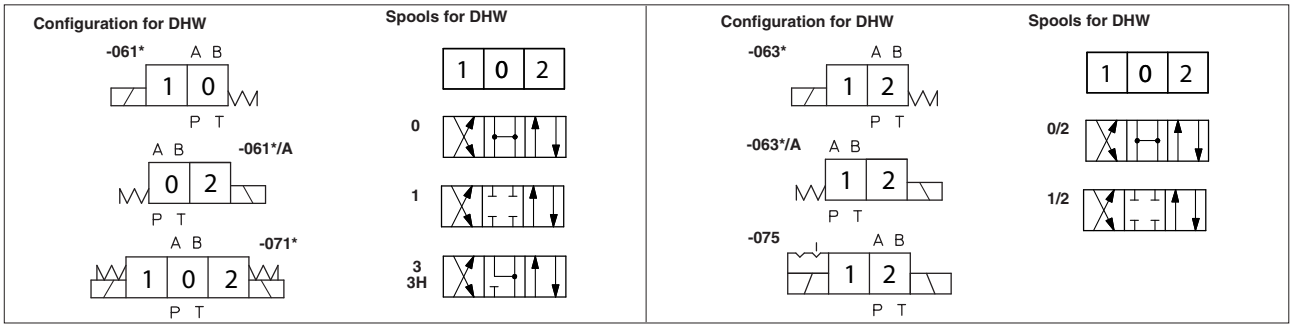
Connector type - see section 17
**/6** = DIN 43650 (standard)

Series number

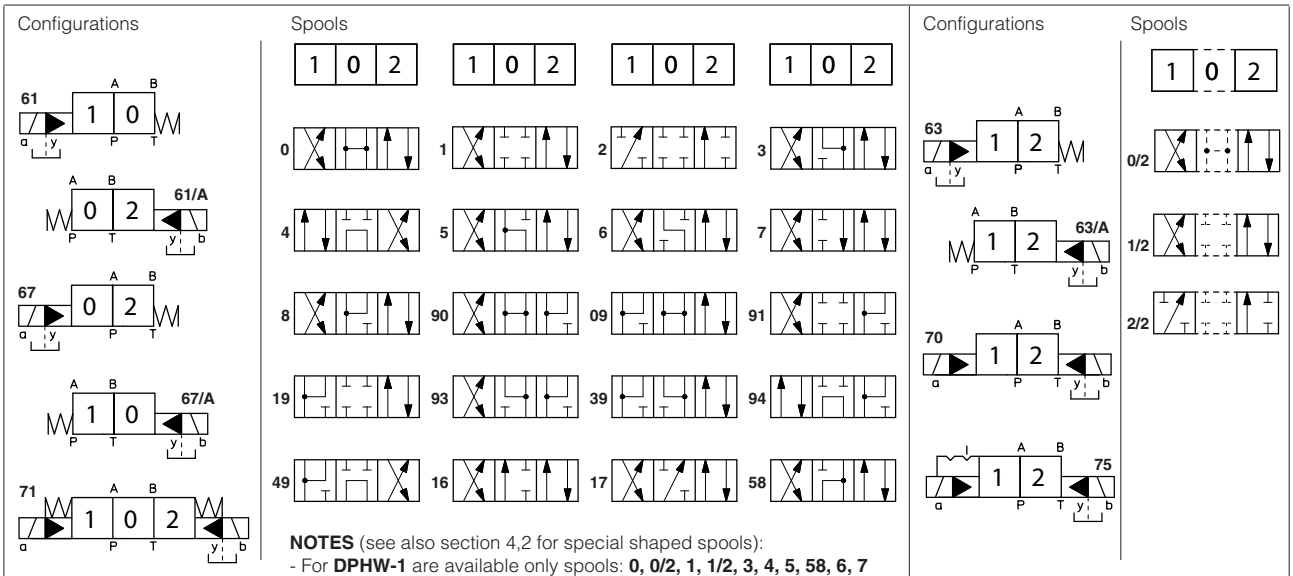
Seals material, see sect.4:
**-** = NBR
**PE** = FKM
**BT** (2)= HNBR

(1) Spool type 3H provides larger passages A-B to T in central position than spool type 3, see section 11.3
(2) Not for group I Atex -mining

## 6 HYDRAULIC CONFIGURATIONS OF DHW VALVES




## 7 CONFIGURATIONS OF DPHW VALVES




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

## 8 MODEL CODE OF POPPET TYPE LEAK FREE ON-OFF DIRECTIONAL SOLENOID VALVES

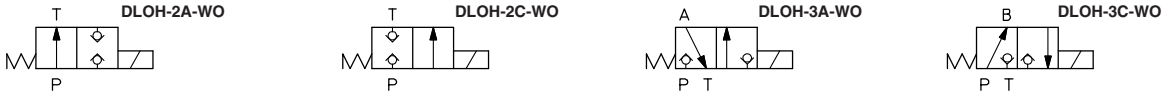
**DLOH /* – 2 A / R – WO / 6 ** /***

- DLOH: directional control valve, poppet type size 06
- /*: omit for Atex Group II; **M** = Atex Group I (mining); **IE** = IECEx Group II; **IEM** = IECEx Group I (mining)
- 2: **2** = 2 way; **3** = 3 way
- A: **A** = open in rest position; **C** = closed in rest position
- R: Options: **/R** = with check valve on port P; **/WP** = prolunged manual override
- WO: **WO** = intrinsically safe solenoid
- 6: Connector type - see section 17; **/6** = DIN 43650 (standard)
- **: Series number
- /*: Seals material, see sect.4: **-** = NBR; **PE** = FKM; **BT** (1)= HNBR

(1) Not for group I Atex -mining

## 9 HYDRAULIC CONFIGURATIONS OF DLOH VALVES

**DLOH*-WO**




## 10 Q/Δp DIAGRAMS based on mineral oil ISO VG 46 at 50°C

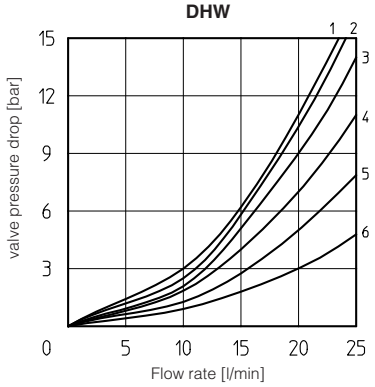
**DHW**

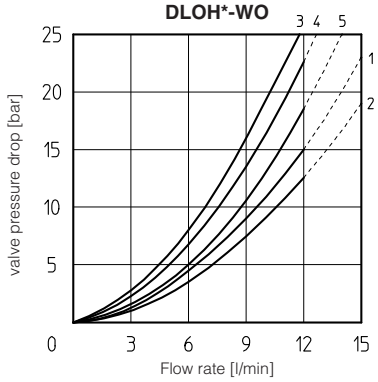
| Flow direction \ spool type | 0 | 0/2 | 1/2 | 1 | 3 | 3H |
|---|---|---|---|---|---|---|
| **P→A / P→B** | 4 | 5 | 5 | 3 | 3 | 3 |
| **A→T / B→T** | 6 | 2 | 1 | 2 | 4 | 5 |

**DLOH*-WO**

| Flow direction \ configuration | 2A | 2C | 3A | 3C |
|---|---|---|---|---|
| **P→A / P→B** (1) | 1 | 2 | 4 | 3 |
| **A→T / B→T** | - | - | 5 | 4 |

(1) For two-way valves pressure drop refers to P→T



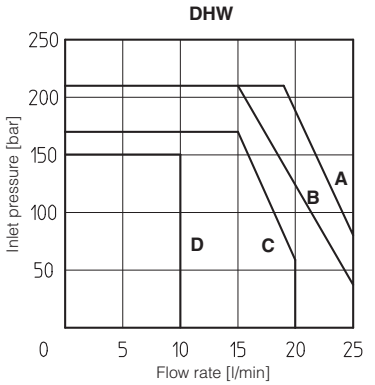



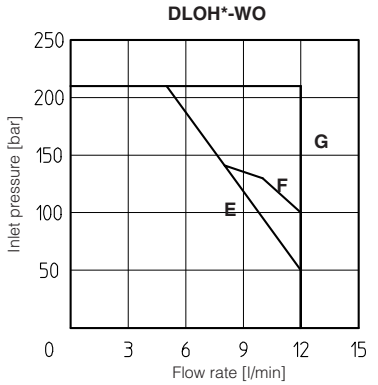

## 11 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams refer to warm solenoids and power supply provided by the Atos barrier type **Y-BXNE-412**. For DHW valves the curves refer to application with symmetrical flow through the valve (i.e. P → A and B → T). In case of asymmetric flow the operating limits must be reduced.

| DHW type | 0 | 0/2 | 1/2 | 1 | 3 | 3H |
|---|---|---|---|---|---|---|
| Diagram | B | B | C | C | A | D |

| DLOH type | 2A | 2C | 3A | 3C |
|---|---|---|---|---|
| Diagram | G | G | F | E |




**11.1 Operating pressure:**
Ports P, A, B = 350 bar Port T = 160 bar

**11.2 Operating limits** (only for **DHW-0713H**)
Max flow = 10 l/1' - Max pressure = 150 bar

**11.3 Flow capability in central position A-B → T** (only for **DHW-0713H**)
Max flow = 25 l/1' with Δp 10,5 bar

## 12 INTERNAL LEAKAGES

**12.1 DHW internal leakages**
18 cm³/min with P=100 bar - fluid viscosity = 43 cSt at 40 °C
30 cm³/min with P=140 bar - fluid viscosity = 22 cSt at 45 °C

**12.2 DLOH-*-WO internal leakages** based on mineral oil ISO VG 46 at 50°C
less than 5 drops/min (0,36 cm³/min) at max pressure.

## 13 MODEL CODE OF PRESSURE CONTROLS

**AGAM /* – 20 / 2 0 / 210 - WO / WP / 6 ** /***

**AGAM** = pressure relief valve, subplate mounting, see tab. C066
**ARAM** = pressure relief valve, threaded connections, see tab. C045

omit for Atex Group II
**M** = Atex Group I (mining)
**IE** = IECEx Group II
**IEM** = IECEx Group I (mining)

Valve size
for AGAM:
**10** = size 10 (ISO 6264);
**20** = size 20 (ISO 6264);
**32** = size 32 (ISO 6264);
for ARAM:
**20** = G 3/4";
**32** = G 1 1/4"

Number of the different setting pressure values:
**1** = one setting pressure
**2** = two setting pressure
**3** = three setting pressure

Valve configuration
**0** = venting with de-energized solenoid
**1** = venting with energized solenoid
**2** = without venting

Pressure range of first/second/third setting:
**50** = 4 - 50 bar
**100** = 6 - 100 bar
**210** = 7 - 210 bar
**350** = 8 - 350 bar

**WO** = Intrinsically safe solenoid

Option:
**/WP** = prolunged manual override

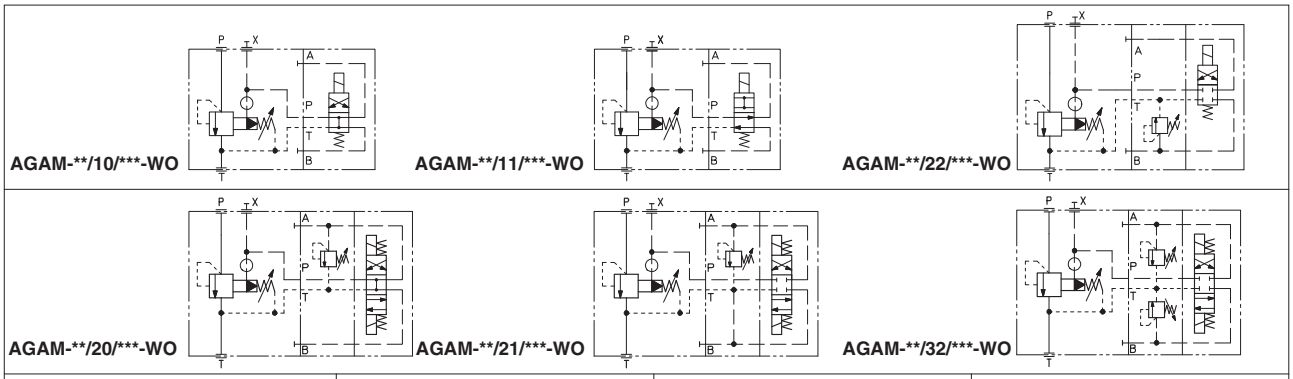
Connector type - see section 17
**/6** = DIN 43650 (standard)

Series number

Seals material, see sect.4:
**-** = NBR
**PE** = FKM
**BT** (1)= HNBR

(1) Not for group I Atex -mining

## 14 HYDRAULIC CHARACTERISTICS




| Valve model | | AGAM-10-WO | AGAM-20-WO | AGAM-32-WO |
|---|---|---|---|---|
| Max pressure | [bar] | 350 | | |
| Setting | | | **50; 100; 210; 350** | |
| Pressure range | [bar] | | 4÷50; 6÷100; 7÷210; 8÷350 | |
| Max flow | [l/min] | 200 | 400 | 600 |

## 15 MODEL CODE OF COVERS FOR CARTRIDGE VALVES

**LIDEW /* 1 – 1 / * - WO / 6 ** /***

Cover type:
**LIDBH** = with solenoid valve and shuttle valve for pilot selection
**LIDEW** = with solenoid valve for pilot selection

omit for Atex Group II
**M** = Atex Group I (mining)
**IE** = IECEx Group II
**IEM** = IECEx Group I (mining)

Valve configuration, see section 16

Valve size (ISO 7368)
for LIDBH*: **1** = 16, **2** = 25, **3** = 32, **4** = 40, **5** = 50
for LIDEW* **1** = 16, **2** = 25, **3** = 32, **4** = 40, **5** = 50, **6** = 63

**WO** = Intrinsically safe solenoid

Options:
**/B** = cartridge piloted via port "B" of solenoid pilot valve
**/E** = external attachments X (G 1/4") and underneath port X supplied plugged (only for sizes 40 to 80)

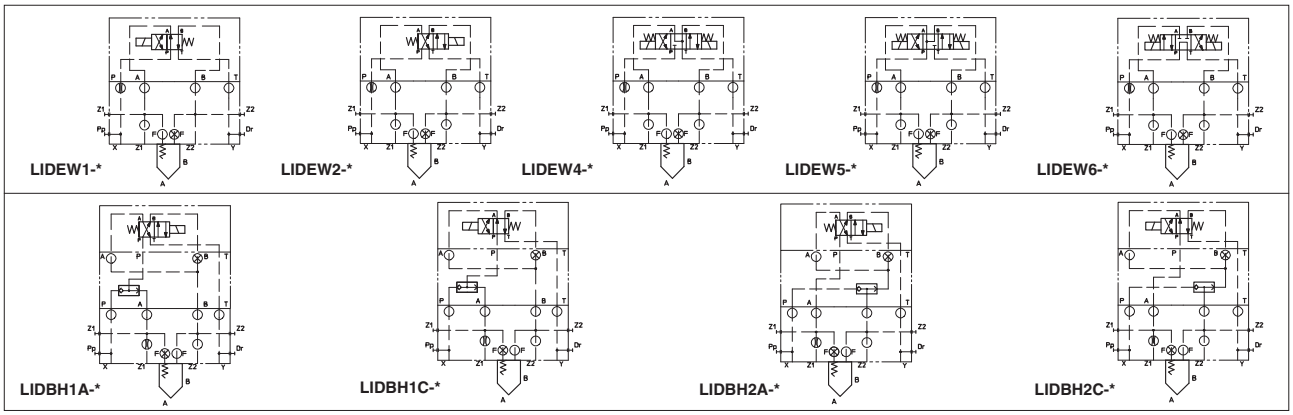
Connector type - see section 17
**/6** = DIN 43650 (standard)

Series number

Seals material, see sect.4:
**-** = NBR
**PE** = FKM
**BT** (1)= HNBR

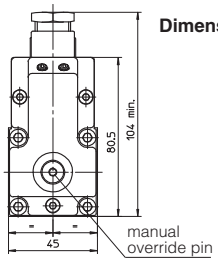
Note: for the code of the ISO cartridge to use with the above covers see tab. H003, section 2 and tab. H030, section 3.
(1) Not for group I Atex -mining

## 16 HYDRAULIC SYMBOLS

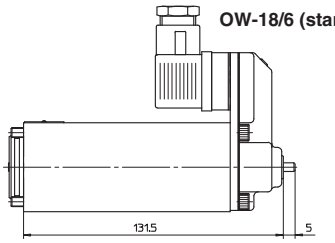


## 17 SOLENOID DIMENSIONS AND WIRING

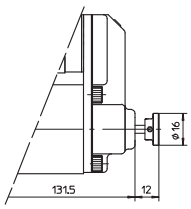
**Dimension [mm]**




**OW-18/6 (standard)**

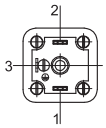



**Option /WP**

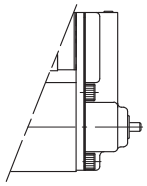


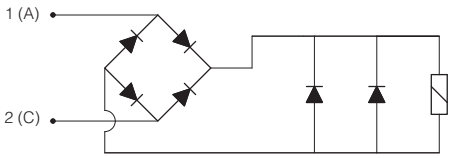

| Connector wiring | | |
|---|---|---|
| /6 | /H | Connections |
| 1 | A | Coil |
| 2 | C | Coil |
| 3 | B | GND |

**DIN 43650**




cover shape for mining version






**note: the connectors are supplied with the valves**

## 18 INTRINSICALLY SAFE BARRIERS

The electric supply to these solenoids must be done through electronic devices situated out of potentially flammable environment (i.e. in safe zone), which limit the electric current to the intrinsically safe solenoid. These electronic devices are normally called “intrinsically safe barriers” approved and certified according to the Ex ia protection mode. To select the proper intrinsically safe barriers following data must be considered:
1) Vmax and Imax of the solenoid as specified in section 2 must not be exceeded also in fault conditions;
2) the resistance of the solenoid is 150 Ω and the current supplied by the barrier, in normal operation condition, must be over the min. limit (65 mA) to ensure the valve correct operation (over 70 mA for max performances).

The barriers type Y-BXNE 412 are galvanically isolated electronic devices, developed according to the European Norms EN60079-0/06, EN60079-11/07 and certified ATEX 94/9/CE, protection mode Ex ia IIC.
These barriers ensure the optimized functioning of the Atos valves up to the max operating limits specified in section 11.
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.

## 19 MODEL CODE OF I.S. BARRIER

### 19.1 I.S. barrier for double solenoid valves

**Y-BXNE 412 00 ***

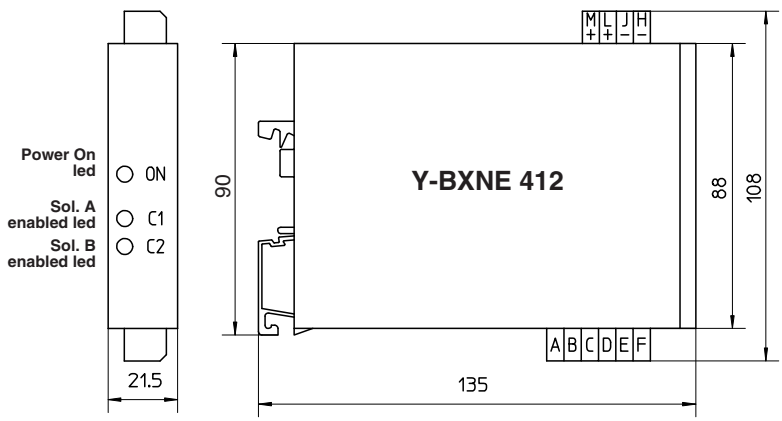
Supply voltage
**E** = 110/230 VAC
**2** = 24÷48 VDC

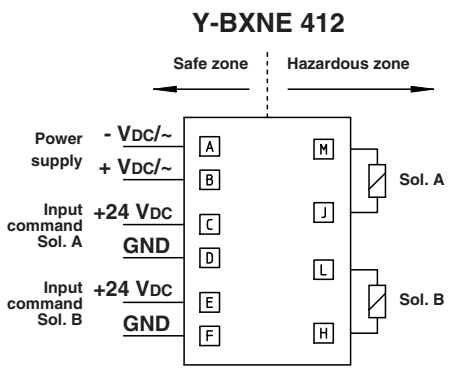
The above barrier can be used both for double or for single solenoid valves.
With one barrier, two single solenoid valves can be operated but not contemporary, see section 18.

## 20 TECHNICAL CHARACTERISTICS OF I.S. BARRIER

| | Y-BXNE 412 |
|---|---|
| N° output channels | 2 |
| Power supply voltage | 110÷230 VAC ±10% (50/60 HZ)<br>21,6 ÷ 53 VDC |
| Power consumption | < 3W |
| Output voltage Uo | 19,5 V |
| Output current Io | 341 mA |
| Output power Po | 1,64 W |
| Galvanic insulation supply/output | 2500 VAC / 50 Hz |
| Storage temperature | -25 °C ÷ +70 °C |
| Working temperature | -10 °C ÷ +60 °C |
| Housing material | ABS case |
| Mounting | on rail EN 50022 |
| Electrical connections | screw terminals |
| Method of protection | Ex ia IIC |
| ATEX classification | Ex II 1 G/D |

## 21 INSTALLATION DIMENSIONS OF I.S. BARRIER [mm]

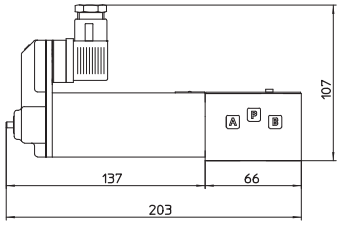


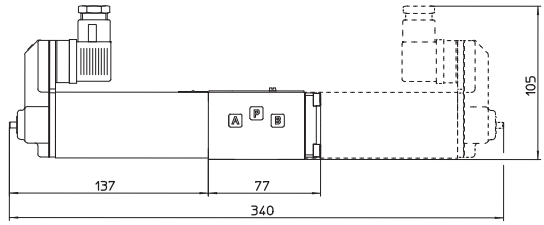
## 22 INSTALLATION DIMENSIONS [mm]

**ISO 4401: 2005**
**Mounting surface: 4401-03-02-0-05** (see table P005)
**(for /Y version, surface 4401-03-03-0-05 without X port)**
Fastening bolts: 4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108; 1 OR 2025
Diameter of ports A, B, P, T: Ø 7,5 mm (max)
Diameter of port Y: Ø = 3,2 mm (only for /Y option)

**DLOH**

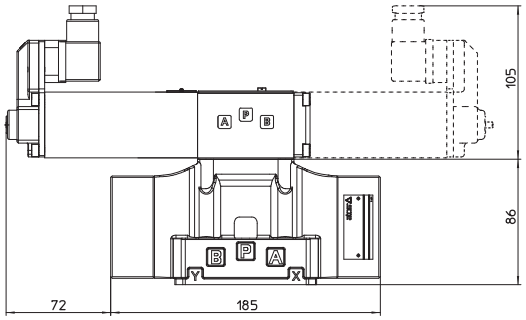



**DHW**



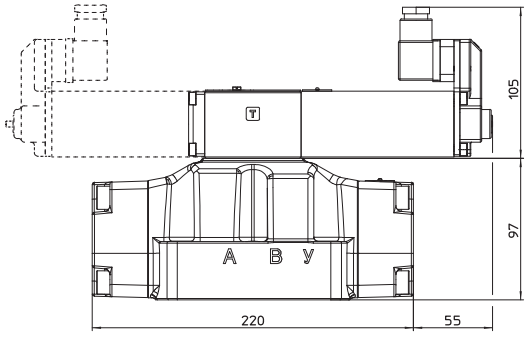

**ISO 4401: 2005**
**Mounting surface: 4401-05-05-0-05** (see table P005)
Fastening bolts: 4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Seals: 5 OR 2050; 2 OR 108
Diameter of ports A, B, P, T: Ø = 11 mm;
Diameter of ports X, Y: Ø = 5 mm;

**DPHW-1**



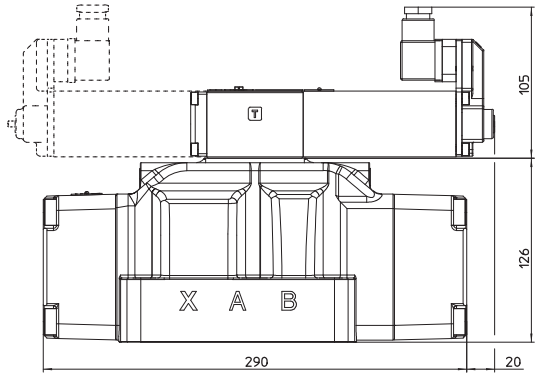

**ISO 4401: 2005**
**Mounting surface: 4401-07-07-0-05** (see table P005)
Fastening bolts:
4 socket head screws M10x50 class 12.9
Tightening torque = 70 Nm
2 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Seals: 4 OR 130; 3 OR 109/70
Diameter of ports A, B, P, T: Ø = 20 mm;
Diameter of ports X, Y: Ø = 7 mm;

**DPHW-2**



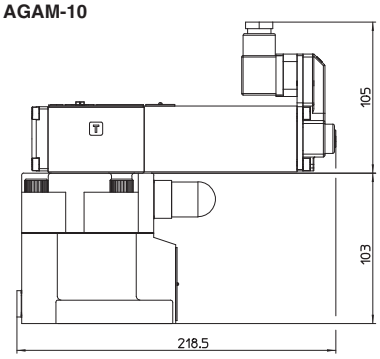

**ISO 4401: 2005**
**Mounting surface: 4401-08-08-0-05** (see table P005)
Fastening bolts:
6 socket head screws M12x60 class 12.9
Tightening torque = 125 Nm
Seals: 4 OR 4112; 2 OR 3056
Diameter of ports A, B, P, T: Ø = 24 mm;
Diameter of ports X, Y: Ø = 7 mm;

**DPHW-4**



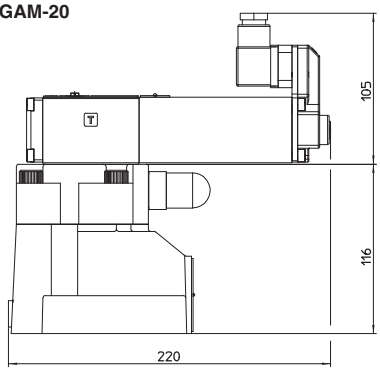
**AGAM-10**

**ISO 6264: 2007**
**Mounting surface: 6264-06-09-1-97**
Fastening bolts:
4 socket head screws M12x35 class 12.9
Tightening torque = 125 Nm
Seals: 2 OR 123; 1 OR 109/70
Ports P, T: Ø = 14,5 mm
Ports X: Ø = 3,2 mm



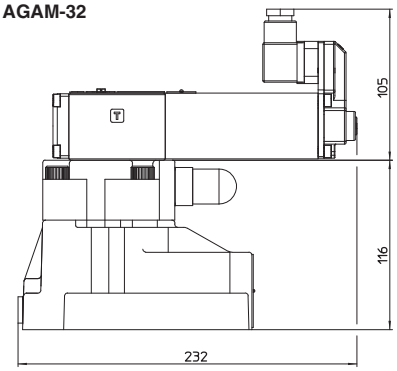

**AGAM-20**

**ISO 6264: 2007**
**Mounting surface: 6264-08-11-1-97**
Fastening bolts:
4 socket head screws M16x50 class 12.9
Tightening torque = 300 Nm
Seals: 2 OR 4112; 1 OR 109/70
Ports P, T: Ø = 24 mm
Ports X: Ø = 3,2 mm

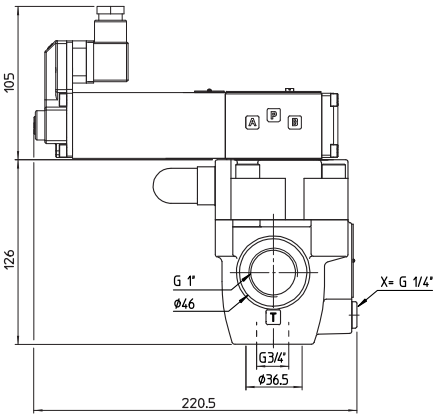



**AGAM-32**

**ISO 6264: 2007**
**Mounting surface: 6264-10-17-1-97**
**(with M20 fixing holes instead of standard M18)**
Fastening bolts:
4 socket head screws M20x60 class 12.9
Tightening torque = 600 Nm
Seals: 2 OR 4131; 1 OR 109/70
Ports P, T: Ø = 28,5 mm
Ports X: Ø = 3,2 mm




**ARAM-20**




**ARAM-32**