Intrinsically safe solenoid valves
on/off controls - ATEX or IECEX certification

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, worldwide 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, worldwide recognized safety certification Ex ia (ib) I Mb

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

<table>
<thead>
<tr>
<th>Solenoid code</th>
<th>Group II ATEX OW-18/6</th>
<th>OW-18/H</th>
<th>Group I ATEX (mining) OWM-18/6</th>
<th>OWM-18/H</th>
<th>Group II IECEx OWI-18/6</th>
<th>OWI-18/H</th>
<th>Group I IECEx (mining) OWIM-18/6</th>
<th>OWIM-18/H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal resistance at 20°C</td>
<td>155 Ω</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coil insulation</td>
<td>Class H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection degree</td>
<td>IP65</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>IP67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duty factor</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical connector</td>
<td>DIN 43650 2 pin+GND</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MIL-C-26482 3 pin</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 2 INTRINSICALLY SAFE SOLENOIDS: ELECTRICAL AND TEMPERATURE DATA

<table>
<thead>
<tr>
<th>Method of protection</th>
<th>Ex ia / Ex ib according to EN60079-0: 2006, EN60079-11:2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas group</td>
<td>I and IIC</td>
</tr>
<tr>
<td>Temperature class</td>
<td>T6</td>
</tr>
<tr>
<td>V max</td>
<td>27 V</td>
</tr>
<tr>
<td>I max</td>
<td>130 mA</td>
</tr>
<tr>
<td>P max</td>
<td>0.9 W</td>
</tr>
<tr>
<td>Minimum supply current</td>
<td>65mA, for I.S. barriers see sections 18 to 21</td>
</tr>
<tr>
<td>Surface temperature (ambient temp. +60°C)</td>
<td>≤ 85°C</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>-40 ÷ +60°C (1)</td>
</tr>
</tbody>
</table>

(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.
3.1 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
IC, IIB, IIC = 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 continuously present

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

3.3 GROUP II IECEx
Ex = Equipment for explosive atmospheres
ia = Intrinsically safe execution
IC, IIB, IIC = 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

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
4 MAIN CHARACTERISTICS OF INTRINSICALLY SAFE VALVES

Assembly position
the installation of DHW valves with the axis in vertical position is not recommended.

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
from -20°C to +60°C (standard and /PE seals and water glycol) –40°C to +60°C for /BT option

Fluid
Hydraulic oil as per DIN 51524 ... 535; for other fluids see section 9

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 (p10 ≥ 75 recommended)

Fluid temperature
-20°C +60°C (standard and /PE seals and water glycol) –40°C to +60°C for /BT option

-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 = 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)

(1) Spool type 3H provides larger passages A-B to T in central position than spool type 3, see section 11.3

(2) Option /BT = low temperature -40°C also available on request (not for group I Atex -mining-)

6 HYDRAULIC CONFIGURATIONS OF DHW VALVES

7 CONFIGURATION 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
### 9 HYDRAULIC CONFIGURATIONS OF DLOH VALVES

#### DLOH-WO

- Configuration: 2A, 2C, 3A, 3C
- Flow direction: P→A, P→B (1), A→T, B→T

#### Diagrams

- **DHW**
  - Type: 0, 0/2, 1/2, 1, 3, 3H
  - Ports: P, A, B, T
- **DLOH-WO**
  - Type: 2A, 2C, 3A, 3C
  - Ports: P, A, B, T, T

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

#### DHW

- Flow type: 0, 0/2, 1/2, 1, 3, 3H
- Flow direction: P→A, P→B, A→T, B→T

#### DLOH-WO

- Flow type: 2A, 2C, 3A, 3C
- Flow direction: P→A, P→B, A→T, B→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

- **DHW**
  - Type: 0, 0/2, 1/2, 1, 3, 3H
  - Ports: P, A, B, T
  - Operating pressure: Ports P, A, B = 350 bar, Port T = 160 bar
  - Operating limits (only for DHW-0713H)
    - Max flow = 10 l/min
    - Max pressure = 150 bar
  - Flow capability in central position A-B → T (only for DHW-0713H)
    - Max flow = 25 l/min

#### DLOH-WO

- Type: 2A, 2C, 3A, 3C
- Diagrams: G, F, E
- Operating pressure: Ports P, A, B = 350 bar
- Operating limits (only for DHW-0713H)
  - Max flow = 10 l/min
  - Max pressure = 150 bar
- Flow capability in central position A-B → T (only for DHW-0713H)
  - Max flow = 25 l/min

### 12 INTERNAL LEAKAGES

#### 12.1 DHW internal leakages

- 16 cm³/min with P=100 bar
- 30 cm³/min with P=140 bar

#### 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**

<table>
<thead>
<tr>
<th>Model Code</th>
<th>Pressure Relief Valve, Subplate Mounting, See Tab. C066</th>
<th>Pressure Relief Valve, Threaded Connections, See Tab. C040</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>M</strong></td>
<td><strong>E</strong></td>
<td><strong>EM</strong></td>
</tr>
</tbody>
</table>

**LIDBH =** with solenoid valve and shuttle valve for pilot selection

**LIDEW =** with solenoid valve for pilot selection

**Series number**

**Value size**

- **10 =** size 10 (ISO 6264)
- **20 =** size 20 (ISO 6264)
- **32 =** size 32 (ISO 6264)

**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)
- **/WO =** Intrinsically safe solenoid

**Note:** For the code of the ISO cartridge to use with the above covers see tab. H003, section L51880 and tab. H030, section L51881.

14 HYDRAULIC CHARACTERISTICS

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AGAM-10-WO</strong></td>
<td>4 - 50</td>
<td>4 - 50</td>
<td>200</td>
</tr>
<tr>
<td><strong>AGAM-20-WO</strong></td>
<td>6 - 100</td>
<td>6 - 100</td>
<td>400</td>
</tr>
<tr>
<td><strong>AGAM-32-WO</strong></td>
<td>7 - 210</td>
<td>7 - 210</td>
<td>600</td>
</tr>
</tbody>
</table>

**Valve model**

- **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**

- **50** = 4 - 50 bar
- **100** = 6 - 100 bar
- **210** = 7 - 210 bar
- **350** = 8 - 350 bar

**Max pressure**

- **350**

**Max flow**

- **200**
- **400**
- **600**

**Connector type - see section**

- **/6 =** DIN 43650 (standard)
- **/H =** MIL-C-26482

**Number of the different setting pressure values:**

- **1** = one setting pressure
- **2** = two setting pressure
- **3** = three setting pressure

15 MODEL CODE OF COVERS FOR CARTRIDGE VALVES

**LIDBH =** with solenoid valve and shuttle valve for pilot selection

**LIDEW =** with solenoid valve for pilot selection

**Series number**

**Valve size (ISO 7368)**

- **1** = 16
- **2** = 16
- **3** = 16
- **4** = 16
- **5** = 50
- **6** = 63

**Options:**

- **/BT** = low temperature -40°C also available on request (not for group I Atex - mining)

**Seals material (1):**

- **/E** = external attachments X (G 1/4") and underneath port X supplied plugged (only for sizes 40 to 80)

**Connector type - see section**

- **/6 =** DIN 43650 (standard)
- **/H =** MIL-C-26482

16 HYDRAULIC SYMBOLS

**LIDBH1A-**

**LIDBH2A-**

**LIDBH2C-**

**LIDBH1C-**

**LIDBH4-**

**LIDBH5-**

**LIDBH6-**

**LIDEW1-**

**LIDEW2-**

**LIDEW4-**

**LIDEW5-**

**LIDEW6-**

**Note:** For the code of the ISO cartridge to use with the above covers see tab. H003, section B and tab. H030, section B.

(1) Option **/BT** = low temperature -40°C also available on request (not for group I Atex - mining)
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) $V_{\text{max}}$ and $I_{\text{max}}$ of the solenoid as specified in section L51880 must not be exceeded also in fault conditions;
2) the resistance of the solenoid is $150 \Omega$ 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 18.

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

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

**Y-BXNE 412 00**

Supply voltage
- $E = 110/230$ V Ac
- $2 = 24\div48$ V DC

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.

### TECHNICAL CHARACTERISTICS OF I.S. BARRIER

**Y-BXNE 412**

- N' output channels: 2
- Power supply voltage: $110\div230$ V Ac ±10% (50/60 Hz)
- Power consumption: < 3W
- Output voltage $U_{\text{o}}$: 19.5 V
- Output current $I_{\text{o}}$: 341 mA
- Output power $P_{\text{o}}$: 1.64 W
- Galvanic insulation supply/output: 2500 V Ac / 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

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

**Y-BXNE 412**

- Dimensions: 65 x 40 x 135 mm
- Number of inputs: 3
- Number of outputs: 2
- Power supply: +24 Vdc
- Safety zone
- Hazardous zone
- Solenoid A
- Solenoid B
- Input command Sol. A
- Input command Sol. B
- Manual override pin
- 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

---

17 SOLENOID DIMENSIONS AND WIRING

<table>
<thead>
<tr>
<th>Connector wiring</th>
<th>DIN 43650</th>
<th>MIL-C-26482</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (A)</td>
<td>A</td>
<td>H</td>
</tr>
<tr>
<td>2 (C)</td>
<td>C</td>
<td>O</td>
</tr>
<tr>
<td>3 B GND</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: the connectors are supplied with the valves.
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)

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;

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;

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;
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

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

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