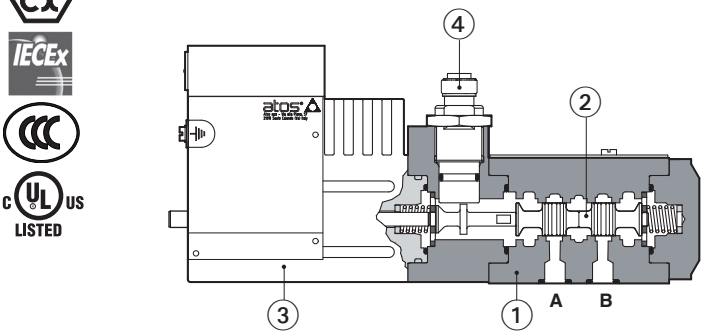
# Ex-proof solenoid valves with spool position monitoring

on/off, direct, with inductive proximity sensor - **ATEX, IECEx, CCC** or **cULus**




**DHA-0631/2/GK/FI/NO 24DC**

① valve body
② spool
③ ex-proof solenoid
④ ex-proof inductive proximity sensor

**DHA /FI**

On-off, spool type directional valves equipped with ex-proof solenoids and proximity sensor for the spool position monitoring, certified for safe operation in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx**, **CCC** for gas group **II 2G** and dust category **II 2D**
- Certification **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas

**Note**: the valve is not certified in conformity to the Machine Directive 2006/42/CE

Size: **06** - ISO 4401
Max flow: **70 l/min**
Max pressure: **350 bar**

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

| DHA | / | * | - | 0 | 63 | 1/2 | - | GK | / | FI | * | / | * | 24DC | /* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

**DHA** = ex-proof spool type valve

**Certification type**:
Multicertification
ATEX, IECEx, CCC:
**-** = omit for Group II 2G / II 2D **(1)**
**M** = Group I M2 (mining)
North American Certification:
**UL** = cULus

Valve size (ISO 4401)
**0** = 06

**Configuration**, see section 2 :

**Spool type**, see section 2 :

**Solenoid threaded connection** for cable gland fitting:
**GK** = GK-1/2" - not for **cULus (2)**
**M** = M20x1,5 - not for **cULus**
**NPT** = 1/2" NPT

**/FI** = inductive proximity sensor

Electrical signal:
**/NO** = electric contact is open when the valve is de-energized

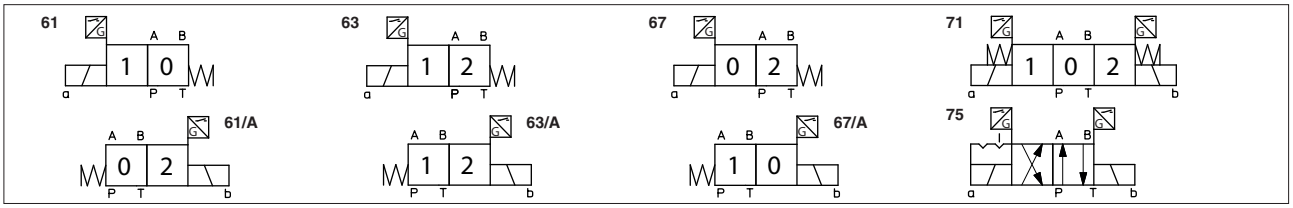
**Options**:
**A** = solenoid at side of port B (for single solenoid valves)
**O** = horizontal cable entrance **(1)**
**WP** = ⚠ manual override protected by metallic cap

**Voltage Code**: see section 5

Seals material
**-** = NBR
**PE** = FKM

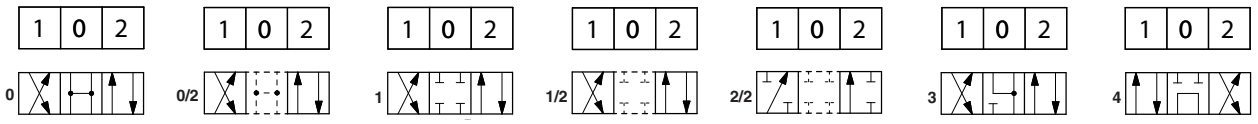
**(1)** Not for multicertification **M** group I (mining) **(2)** Approved only for the Italian market

## 2 CONFIGURATION AND SPOOLS




Configurations **63** is available only for spool type **0/2**, **1/2** and **2/2**; Configurations **61**, **67** and **71** are available only for spools **0**, **1**, **3** and **4**

**Spools**



## 3 GENERAL CHARACTERISTICS

| | |
|---|---|
| Assembly position / location | Any position |
| Subplate surface finishing to ISO 4401 | Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100 |
| MTTFd values according to EN ISO 13849 | 150 years, for further details see technical table P007 |
| Ambient temperature | **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C |
| Storage temperature range | **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C |
| Surface protection | Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200h |
| Compliance | Explosion proof protection, see section 7 for /FI proximity sensor and section 8 for solenoid<br>-Flame proof enclosure "Ex d"<br>-Dust ignition protection by enclosure "Ex t"<br>RoHS Directive 2011/65/EU as last update by 2015/863/EU<br>REACH Regulation (EC) n°1907/2006 |

## 4 HYDRAULIC CHARACTERISTICS

| | |
|---|---|
| Operating pressure | Ports P,A,B: **350** bar;<br>Port T **210** bar |
| Rated flow | See diagrams Q/Δp at section 13 |
| Maximum flow | **70 l/min**, see operating limits at section 14 |

## 5 EX PROOF SOLENOID: ELECTRICAL CHARACTERISTICS

| Valve type | | DHA | DHA/**M** | DHA/**UL** |
|---|---|---|---|---|
| Voltage code **(1)** | VDC ±10% | **12DC, 24DC, 28DC, 48DC, 110DC, 125DC, 220DC** | | **12DC, 24DC, 110DC, 125DC, 220DC** |
| | VAC 50/60 Hz ±10% | **12AC, 24AC, 110AC, 230AC** | | **12AC, 24AC, 110AC, 230AC** |
| Power consumption at 20°C | | 8W | | 12W |
| Coil insulation | | class H | | |
| Protection degree with relevant cable gland | | IP66/67 to DIN EN60529 | | raintight enclosure, UL approved |
| Duty factor | | 100% | | |

**(1)** For alternating current supply a rectifier bridge is provided built-in the solenoid
For power supply frequency 60 Hz, the nominal supply voltage of solenoids 110AC and 230AC must be 115/60 and 240/60 respectively

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

| | | | |
|---|---|---|---|
| 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 | | |
| Recommended viscosity | 15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s | | |
| Fluid contamination class | ISO 4406 class 21/19/16 NAS 1638 class 10, in line filters of 25 μm (β25 ≥75 recommended) | | |
| **Hydraulic fluid** | **Suitable seals type** | **Classification** | **Ref. Standard** |
| Mineral oils | NBR, FKM | HL, HLP, HLPD, HVLP, HVLPD | DIN 51524 |
| Flame resistant without water | FKM | HFDU, HFDR | ISO 12922 |
| Flame resistant with water | NBR | HFC | |

## 7 PROXIMITY SENSOR: GENERAL CHARACTERISTICS AND CERTIFICATION DATA

| **SENSOR TYPE** | | **NJ1,5-18GM-N-D-V1** | |
|---|---|---|---|
| Supply voltage **(1)** | [V] | 8,2 VDC | |
| Current consumption | [mA] | ≥ 3 mA (de-energized) | ≤ 1 mA (energized) |
| Protection degree | | IP66/IP67 according to IEC 60529 | |
| Max pressure | [bar] | 350 | |
| Ambient temperature | | -25 ÷ +85 °C | |
| Type examination certificate | | • ATEX PTB 00 ATEX 2048 X<br>• IECEx IECEx PTB 11.0037X<br>• CCC 2020322315002255<br>• cULus UL-US-2019259-0 / UL-CA-2015551-0 | |
| Method of protection | | • ATEX Ex ia IIC T6...T1 Ga; Ex ia IIC T6...T1 Gb; II 1 D Ex ia IIIC T200 135°C Da<br>• IECEx Ex ia IIC T6...T1 Ga; Ex ia IIC T6...T1 Gb; Ex ia I Mb; Ex ia IIIC T200 135°C Da<br>• CCC Ex ia IIC T1~T6 Ga; Ex ia IIC T1~T6 Gb; Ex ia IIC T1~T6 Gc; Ex iaD 20 T135; Ex ibD 21 T135<br>• cULus Class2 or LV/LC | |

**(1)** For application in explosive environments, the inductive proximity sensor must be electrically supplied by means of a galvanic insulated power amplifier (safety barrier) for intrinsically safe circuits, classified for Zone 1 and 2

## 8 SOLENOID CERTIFICATION DATA

| Valve type | DHA | | DHA/**M** | DHA/**UL** | |
|---|---|---|---|---|---|
| Certifications | Multicertification Group II<br>**ATEX, IECEx, EAC, PESO, CCC** | | Multicertification Group I<br>**ATEX, IECEx** | North American cULus<br>**cULus** | |
| Solenoid certified code | **OA** | | **OA/M** | **OA/EC** | |
| Type examination certificate **(1)** | ATEX: CESI 02 ATEX 014<br>IECEx: IECEx CES 10.0010x<br>EAC: RU C - IT.AЖ38.B.00425/21<br>PESO: P468212/2<br>CCC: 2020322307003240 | | ATEX: CESI 03 ATEX 057x<br>IECEx: IECEx CES 12.0007x | 20170324 - E366100 | |
| Method of protection | • ATEX<br>Ex II 2G Ex db IIC T6/T4/T3 Gb<br>Ex II 2D Ex tb IIIC T85°C/T200°C Db<br>• IECEx<br>Ex db IIC T6/T4/T3 Gb<br>Ex tb IIIC T85°C/T200°C Db<br>• EAC<br>1Ex d IIC T6/T4/T3 Gb X<br>Ex tb IIIC T85°C/T200°C Db X<br>• PESO<br>Ex db IIC T6/T4/T3 Gb<br>• CCC<br>Ex d IIC T6/T4/T3 Gb<br>Ex tD A21 IP66/IP67<br>T85°C/T135°C/T200°C | | • ATEX<br>Ex I M2 Ex db I Mb<br>• IECEx<br>Ex db I Mb | • UL 1203<br>Class I, Div.I, Groups C & D<br>Class I, Zone I, Groups IIA & IIB | |
| Temperature class | **T6** | **T4** | **-** | **T6** | **T5** |
| Surface temperature | ≤ 85 °C | ≤ 135 °C | ≤ 150 °C | ≤ 85 °C | ≤ 100 °C |
| Ambient temperature **(2)** | -40 ÷ +45 °C | -40 ÷ +70 °C | -20 ÷ +70 °C | -40 ÷ +55 °C | -40 ÷ +70 °C |
| Applicable standards | EN 60079-0<br>EN 60079-1<br>EN 60079-31 | | IEC 60079-0<br>IEC 60079-1<br>IEC 60079-31 | UL 1203 and UL429,<br>CSA 22.2 n°30-1986<br>CSA 22.2 n°139-13 | |
| Cable entrance: threaded connection vertical (standard) or horizontal (option /O) | **GK** = GK-1/2"<br>**M** = M20x1,5<br>**NPT** = 1/2" NPT | | | 1/2" NPT ANSI/ASME B46.1 | |

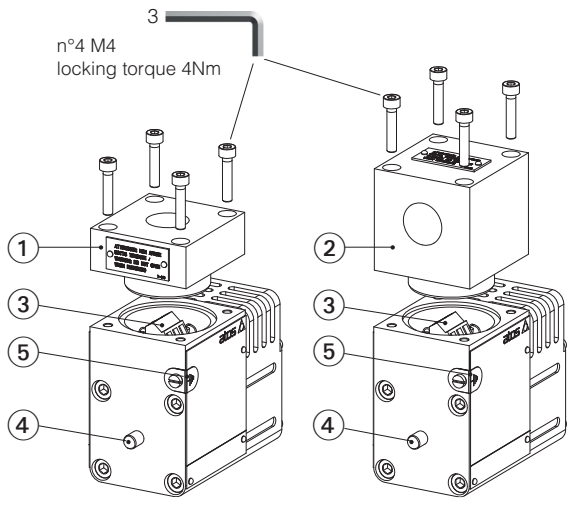
**(1)** The type examinator certificates can be downloaded from www.atos.com

**(2)** The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C

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

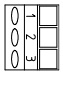
## 9 EX PROOF SOLENOIDS WIRING

**Multicertification**




**Standard version** **Option /O**

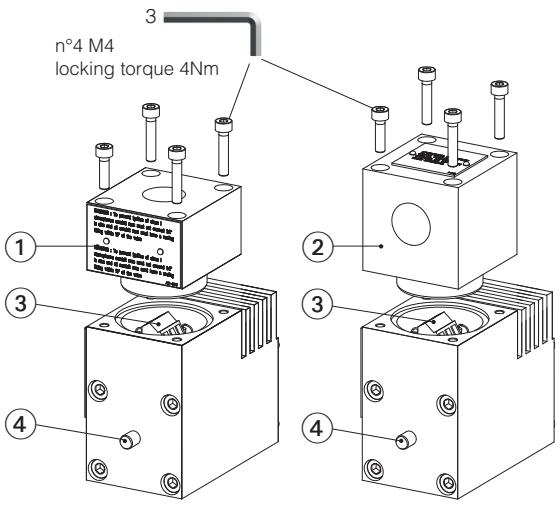
① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override
⑤ screw terminal for additional equipotential grounding




**1** = Coil
**2** = GND
**3** = Coil

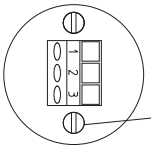
PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

**cULus certification**




**Standard version** **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override




⚠ **Pay attention to coil polarity**

**1** = Coil **+**
**2** = GND
**3** = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 10 note 1

alternative GND screw terminal connected to solenoid housing

**10 CABLE SPECIFICATION AND TEMPERATURE** - Power supply and grounding cables have to comply with following characteristics:

**Multicertification Group I and Group II**

**Power supply:** section of coil connection wires = 2,5 mm²

**Grounding:** section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

**cULus certification:**

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm² (14 AWG) having a suitable service temperature range of at least -25°C to +110°C

**Note 1:** For Class I wiring the 3C 1,5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

### 10.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

**Multicertification**

| Max ambient temperature [°C] | Temperature class | | Max surface temperature [°C] | | Min cable temperature |
|---|---|---|---|---|---|
| | Group I | Group II | Group I | Group II | |
| 45 °C | - | T6 | 150 °C | 85 °C | not prescribed |
| 70 °C | - | T4 | 150 °C | 135 °C | ≥90 °C |

**cULus certification**

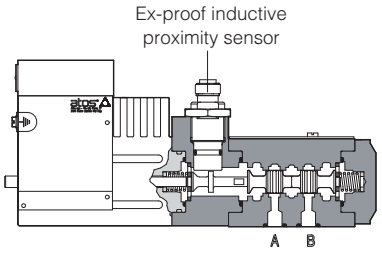
| Max ambient temperature [°C] | Temperature class | Max surface temperature [°C] | Min cable temperature |
|---|---|---|---|
| 55 °C | T6 | ≤85 °C | ≥100 °C |
| 70 °C | T5 | ≤100 °C | ≥100 °C |

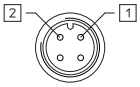
**11 CABLE GLANDS only for Multicertification**

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

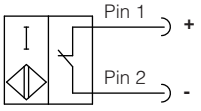
**Note**: a Loctite sealant type 545, should be used on the cable gland entry threads

**12 PROXIMITY SENSOR CONNECTION**



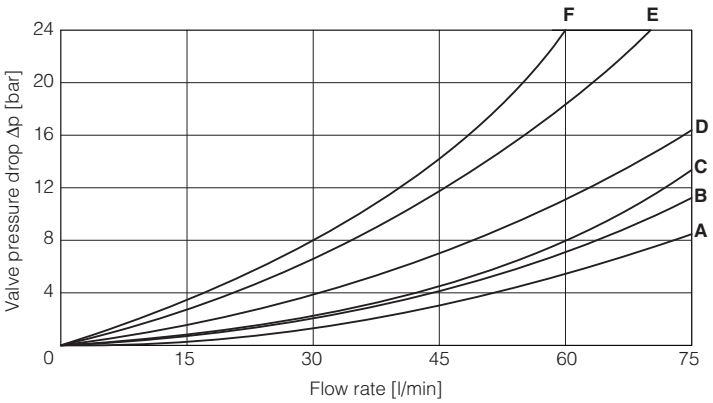

**CONNECTION**
TYPE: 4 pin male
STANDARD: M12 coding A




Pin 3 = do not connect
Pin 4 = do not connect

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

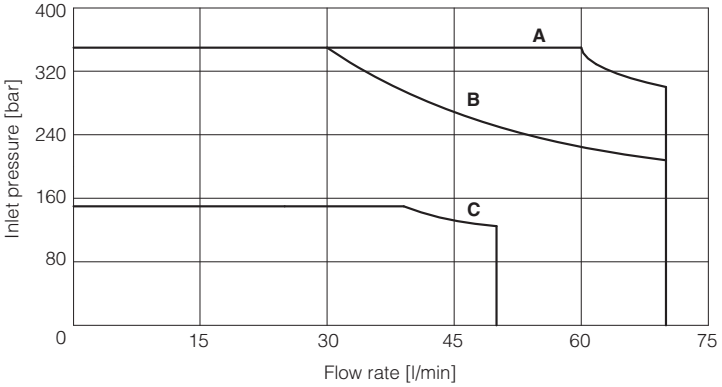
| Flow direction / Spool type | P→A | P→B | A→T | B→T | P→T |
|---|---|---|---|---|---|
| 0 | A | A | B | B | C |
| 1 | C | B | B | B | |
| 3 | C | C | A | A | |
| 4 | E | E | F | B | D |
| 1/2, 0/2 | C | C | C | C | |
| 2/2 | E | E | | | |



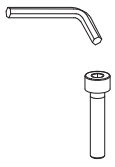

## 14 OPERATING LIMITS (based on mineral oil ISO VG 46 at 50°C)

The diagram have been obtained with warm solenoids and power supply at lowest value ($V_{nom}$-10%).
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.

| Spool type | diagram |
|---|---|
| 0, 1 | **A** |
| 0/2, 1/2, 3 | **B** |
| 2/2, 4 | **C** |




## 15 FASTENING BOLTS AND SEALS



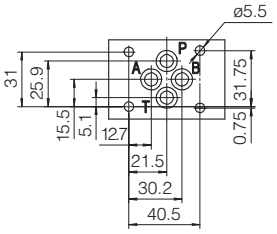
**Fastening bolts:**
4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm

**Seals:**
4 OR 108
Diameter of ports A, B, P, T: Ø 7,5 mm (max)

## 16 INSTALLATION DIMENSIONS

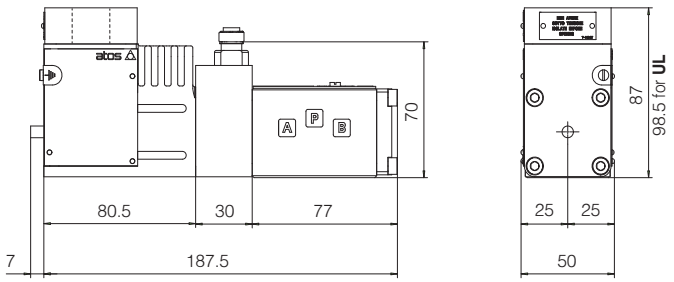
**ISO 4401: 2005** (see table P005)
**Mounting surface: 4401-03-02-0-05**

Valve's bottom view

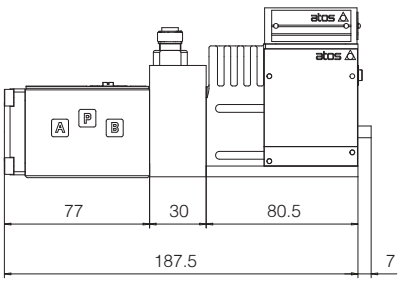



**P** = PRESSURE PORT
**A, B** = USE PORT
**T** = TANK PORT

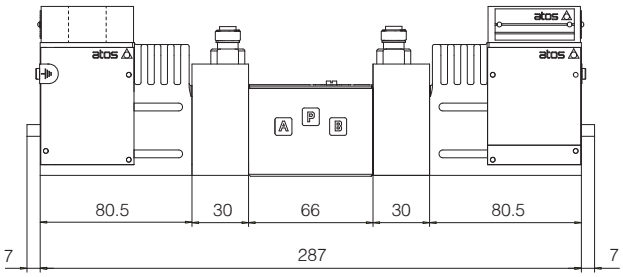
**22*104 DHA-06***




**22*104 DHA-06*/A**

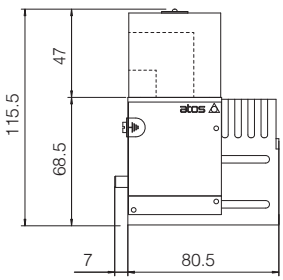



**22*104 DHA-07***

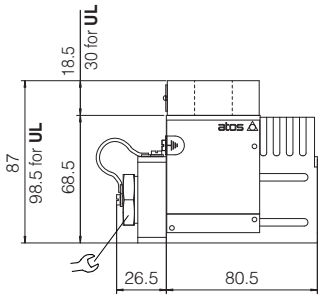



| Mass [kg] | |
|---|---|
| 22*104 DHA-06 | 3,15 |
| 22*104 DHA-07 | 5,3 |
| Option /O | +0,35 |
| Option /WP | +0,25 |

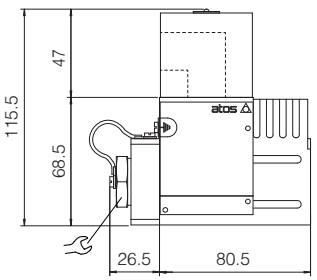
**option /O**




**option /WP**




**option /OWP**




## 17 RELATED DOCUMENTATION

| | | | |
|---|---|---|---|
| **X010** | Basics for electrohydraulics in hazardous environments | **EX900** | Operating and maintenance information for ex-proof on-off valves |
| **X020** | Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, CCC, PESO | **KX800** | Cable glands for ex-proof valves |
| **X030** | Summary of Atos ex-proof components certified to cULus | **P005** | Mounting surfaces for electrohydraulic valves |