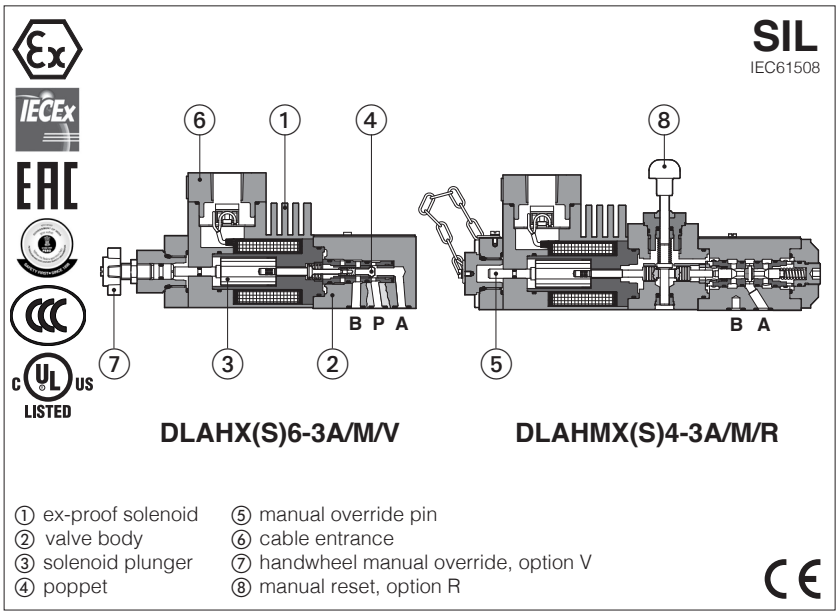
# Stainless steel ex-proof solenoid directional valves

on-off, direct, poppet type leak free - **ATEX, IECEx, EAC, PESO, CCC** or **cULus**




**DLAHX, DLAHXS, DLAHMX, DLAHMXS**

Ex-proof, poppet type, directional solenoid valves made in two different stainless steel executions for corrosive environments and fluids.

- **X** full stainless steel for external and internal parts, to withstand extreme and corrosive environmental conditions, and to ensure full compatibility also with water base and special fluids.
- **XS** stainless steel only for external parts to withstand extreme and corrosive environmental conditions.

Ex-proof stainless steel solenoids are provided with **ATEX, IECEx, EAC, PESO, CCC Multicertification** or **cULus** North American certification, see sect. 8.

DLAHX and DLAHXS are **SIL** compliance with IEC 61508 (TÜV certified)

| **DLAHX(S)**: | **DLAHMX(S)**: |
|---|---|
| Size: **06** - ISO 4401 | Size: **06** - ISO 4401 |
| 3/2 way | 3/2 way |
| Max flow: **12 l/min** | Max flow: **30 l/min** |
| Max pressure: **350 bar** | Max pressure: **315 bar** |

## 1 MODEL CODE

| DLAH | X | 6 | / | * | - | 3 | A | / | M | / | V | 24DC | * | / | * | / | * |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

**DLAH** Ex-proof solenoid directional valve, leak free
**DLAH** = max flow 12 l/min
**DLAHM** = max fow 30 l/min

Stainless steel executions **(1)**:
**X** = full stainless steel
**XS** = stainless steel only external parts

**Solenoid power and Temperature class,** see also certification data in section 8 **(2)**:
Multicertification
**4** = 25W, class **T4/T3**
**6** = 8W, class **T6/T4**
cULus
**4** = 33W, class **T3**
**6** = 12W, class **T6/T5**

**Certification type**:
**-** = omit for **Multicertification** (Group II)
**UL** = cULus certification

**3** = three way

**Valve configuration** - see section 2:
**A** = A to T in rest position
**C** = P to A in rest position - P to B for DLAHX(S)

**Solenoid threaded connection** for cable gland fitting:
**M** = M20x1,5 for **Multicertification**
**NPT** = 1/2" NPT for **/UL**

**Options** - see section 13 for possible combined options:
**O** = horizontal cable entrance
**R** = solenoid manual reset (not combinable with **V**)
**V** = handweel manual override (not combinable with **R**)

**Voltage code** - see section 5

Series number

**Seals material,** see section 6:
**-** = NBR low temp. -40°C
**PE** = FKM
**BBT** = FVMQ fluorosilicon -60°C **(4)**

**Test fluid**, only for X execution **(3)**:
**H** = mineral oil
**W** = pure water

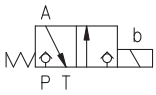
**(1)** See section 6 for materials specification.
**(2)** **6** and **4** versions differ only for the coil power, see power consumption at section 5 and operating limits at section 15.
**(3)** The "X" valves in full stainless steel execution are factory tested by Atos with mineral oil or pure water in order to avoid the contamination of the end user system. At the end of each valve model code must be specified the type of fluid to be used in the valve's testing: "**H**" for hydraulic oil or "**W**" for pure water.
**(4)** Only for Multicertified valves in full stainless steel "**X**" execution (not available for valves with UL certification)

### 1.1 Summary of available models

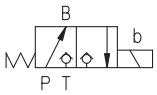
| Valve execution | | Multicertification | | cULus | | Max flow (l/min) | Max pressure (bar) |
|---|---|---|---|---|---|---|---|
| X | XS | Tclass | Power | Tclass | Power | | |
| **DLAHX4** | **DLAHXS4** | T4, T3 | 25W | T3 | 33W | 12 | 350 |
| **DLAHX6** | **DLAHXS6** | T6, T4 | 8W | T6, T5 | 12W | 10 | 315, 350 |
| **DLAHMX4** | **DLAHMXS4** | T4, T3 | 25W | T3 | 33W | 25, 30 | 315 |
| **-** | **DLAHMXS6** | T6, T4 | 8W | T6, T5 | 12W | 25 | 250 |

## 2 CONFIGURATIONS AND HYDRAULIC SYMBOLS (representation according to ISO 1219-1)

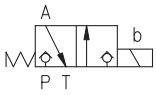
**DLAHX(S)-3A**



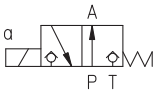

**DLAHX(S)-3C**




**DLAHMX(S)-3A**




**DLAHMX(S)-3C**




## 3 GENERAL CHARACTERISTICS

| | |
|---|---|
| Assembly position / location | Any position |
| Subplate surface finishing | Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101) |
| MTTFd values according to EN ISO 13849 | 150 years, for further details see technical table P007 |
| Ambient temperature | **Standard** = -40°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BBT** option = -60°C ÷ +70°C |
| Storage temperature range | **Standard** = -40°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BBT** option = -60°C ÷ +80°C |
| Compliance | Explosion proof protection, see section 8<br>-Flame proof enclosure "Ex d"<br>-Dust ignition protection by enclosure "Ex t"<br>SIL to IEC 61508: 2010, see section 9 (only for DLAHX and DLAHXS)<br>RoHs Directive 2011/65/EU as last update by 2015/863/EU<br>REACH Regulation (EC) n°1907/2006 |

## 4 HYDRAULIC CHARACTERISTICS

| Valve type | | **DLAHX4 DLAHXS4** | **DLAHX6** | **DLAHXS6** | **DLAHMX4** | **DLAHMXS4** | **DLAHMXS6** |
|---|---|---|---|---|---|---|---|
| Valve size | | 06 | 06 | | 06 | | 06 |
| Max operating pressure: | ports P, A, B [bar] | 350 | 315 | 350 | 315 | | 250 |
| | port T [bar] | 110 | | | | | |
| Rated flow | | see diagrams Q/Δp at section 14 | | | | | |
| Max flow **(1)** | [l/min] | 12 | 10 | | 25 | 30 | 25 |
| Internal leakage | [cm³/min] | less than 5 drops/min (0,36 cm³/min) at max pressure | | | | | |

**(1)** see diagram at section 15

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

## 5 ELECTRICAL CHARACTERISTICS

| Valve type | | **DLAHX4 DLAHXS4 DLAHMX4 DLAHMXS4** | **DLAHX6 DLAHXS6 DLAHMXS6** | **DLAHX4/UL DLAHXS4/UL DLAHMX4/UL DLAHMXS4/UL** | **DLAHX6/UL DLAHXS6/UL DLAHMXS6/UL** |
|---|---|---|---|---|---|
| Voltage code **(1)** | VDC ±10% | **12DC, 24DC, 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 | | 25W | 8W | 33W | 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 MATERIALS SPECIFICATION

| **Valve code** | **Solenoid housing** | **Valve body** | **Internal parts** | **Spring** | **Seals** | | |
|---|---|---|---|---|---|---|---|
| | | | | | **std** | **/PE** | **/BBT** |
| **DLAHX** | AISI 630 | AISI 316L | AISI 316L, 420B, 440C, 430F | AISI 302 | NBR 70 Sh low temp | FKM (viton) | FMVQ (fluorosilicon) |
| **DLAHXS** | AISI 630 | AISI 316L | Carbon steel | AISI 302 | NBR 70 Sh low temp | FKM (viton) | - |
| **DLAHMX** | AISI 630 | AISI 316L | AISI 316L, 420B, 440C, 430F | AISI 302 | NBR 70 Sh low temp | FKM (viton) | FMVQ (fluorosilicon) |
| **DLAHMXS** | AISI 630 | AISI 316L | Carbon steel | AISI 302 | NBR 70 Sh low temp | FKM (viton) | - |

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

| | | | |
|---|---|---|---|
| Seals, recommended fluid temperature **(1)** | NBR seals (standard) = -40°C ÷ +60°C<br>FKM seals (/PE option) = -20°C ÷ +80°C<br>FVMQ seals (/BBT option) = -60°C ÷ +60°C | | |
| Recommended viscosity | 15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s | | |
| Max fluid contamination level | 15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s<br>min = 0,9 mm²/s for X full stainless steel execution with pure water | | |
| **Hydraulic fluid** | **Suitable seals type** | **Classification** | **Ref. Standard** |
| Mineral oils | NBR low temp., FKM, FVMQ | HL, HLP, HLPD, HVLP, HVLPD | DIN 51524 |
| Flame resistant without water | FKM, FVMQ | HFDU, HFDR | ISO 12922 |
| Flame resistant with water **(2)** | NBR low temp. | HFA-E, HFA-S, HFB, HFC | |

**(1)** The operating temperature of the fluid must be compatible with the maximum viscosity range allowed for the valve

**(2) Performance limitations in case of flame resistant fluids with water:**
-max operating pressure = 210 bar -max fluid temperature = 50°C

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

## 8 CERTIFICATION DATA

### 8.1 Certification data for ambient temperature range -40 ÷ +70°C

| Valve type | DLAHX4, DLAHXS4<br>DLAHMX4, DLAHMXS4 | | DLAHX6, DLAHXS6<br>- , DLAHMXS6 | | DLAHX4**/UL**, DLAHXS4**/UL**<br>DLAHMX4**/UL**, DLAHMXS4**/UL** | DLAHX6**/UL**, DLAHXS6**/UL**<br>- , DLAHMXS6**/UL** | |
|---|---|---|---|---|---|---|---|
| Certifications | Multicertification<br>**ATEX IECEx EAC PESO CCC** | | | | North American<br>**cULus** | | |
| Solenoid certified code | **OAKX/WP<br>OAKXS/WP** | | **OAX/WP<br>OAXS/WP** | | **OAKX/EC/WP<br>OAKXS/EC/WP** | **OAX/EC/WP<br>OAXS/EC/WP** | |
| Temperature class | **T4** | **T3** | **T6** | **T4** | **T3** | **T6** | **T5** |
| Surface temperature | ≤ 135°C | ≤ 200°C | ≤ 85°C | ≤ 135°C | ≤ 200°C | ≤ 85°C | ≤ 100°C |
| Ambient temperature | -40 ÷ +45°C | -40 ÷ +70°C | -40 ÷ +45°C | -40 ÷ +70°C | -40 ÷ +70°C | -40 ÷ +55°C | -40 ÷ +70°C |

### 8.2 Certification data for ambient temperature range -60 ÷ +70°C (valves with option /BBT)

| Valve type | DLAHX4 **/BBT**<br>DLAHMX4 **/BBT** | | DLAHX6 **/BBT** | |
|---|---|---|---|---|
| Certifications | Multicertification<br>**ATEX IECEx EAC PESO CCC** | | | |
| Solenoid certified code | **OABKX/WP** | | **OABX/WP** | |
| Temperature class | **T4** | **T3** | **T6** | **T4** |
| Surface temperature | ≤ 135°C | ≤ 200°C | ≤ 85°C | ≤ 135°C |
| Ambient temperature | -60 ÷ +45°C | -60 ÷ +70°C | -60 ÷ +45°C | -60 ÷ +70°C |

### 8.3 Certificates and applicable standards

| Certifications | Multicertification Group II<br>**ATEX IECEx EAC PESO CCC** | North American<br>**cULus** |
|---|---|---|
| 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: P391133/1<br>CCC: 2020322307003240 | 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 II 2G Exd 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 | • UL 1203<br>Class I, Div.I, Groups C & D<br>Class I, Zone I, Groups IIA & IIB |
| Applicable standards | EN 60079-0 IEC 60079-0<br>EN 60079-1 IEC 60079-1<br>EN 60079-31 IEC 60079-31 | UL 1203 and UL429,<br>CSA 22.2 n°30-1986<br>CSA 22.2 n°139-13 |
| Cable entrance: | M20x1,5 | 1/2” NPT ANSI/ASME B46.1 |

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

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

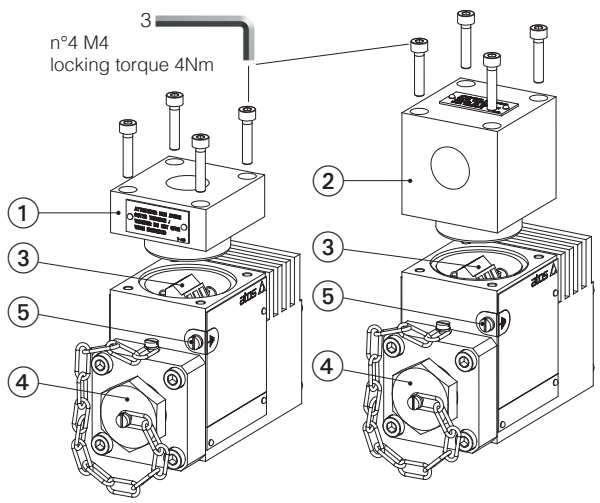
## 9 SIL compliance with IEC 61508: 2010 - only DLAHX and DLAHXS

DLAHX and DLAHXS meet 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)

## 10 EX PROOF SOLENOIDS WIRING

**Multicertification**



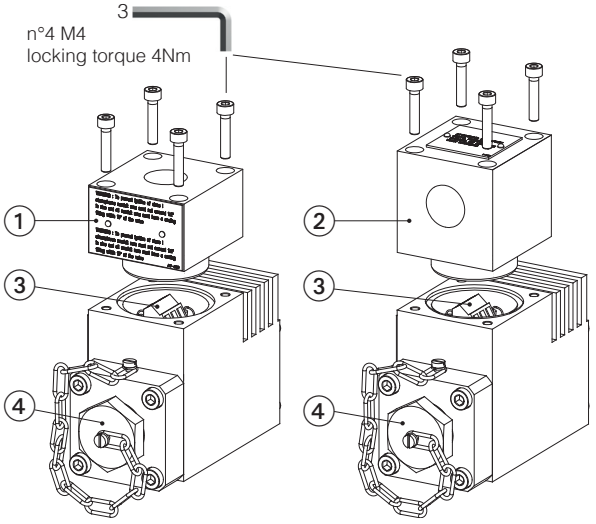

**Standard version** **Option /O**

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 protected by cap
⑤ screw terminal for additional equipotential grounding

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

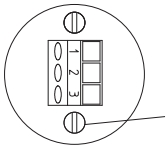
PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

**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 protected by cap



⚠ **Pay attention to respect the polarity**

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

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 11 note 1

alternative GND screw terminal connected to solenoid housing

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

**Multicertification**

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

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

**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 -40°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.

### 11.1 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**

| Solenoid code | Max ambient temperature [°C] | Temperature class | Max surface temperature [°C] | Min cable temperature |
|---|---|---|---|---|
| **OA(B)X OA(B)XS** | 45°C | T6 | 85°C | not prescribed |
| | 70°C | T4 | 135°C | 90°C |
| **OA(B)KX OA(B)KXS** | 45°C | T4 | 85°C | 100°C |
| | 50°C | T3 | 200°C | 100°C |
| | 60°C | T3 | 200°C | 120°C |
| | 70°C | T3 | 200°C | 130°C |

**cULus certification**

| Solenoid code | Max ambient temperature [°C] | Temperature class | Max surface temperature [°C] | Min cable temperature |
|---|---|---|---|---|
| **OAX/EC OAXS/EC** | 55°C | T6 | 85°C | 100°C |
| | 70°C | T5 | 100°C | 100°C |
| **OAKX/EC OAKXS/EC** | 55°C | T3 | 200°C | 115°C |
| | 70°C | T3 | 200°C | 140°C |

## 12 CABLE GLANDS - only **Multicertification**

Cable glands with threaded connections 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

## 13 OPTIONS

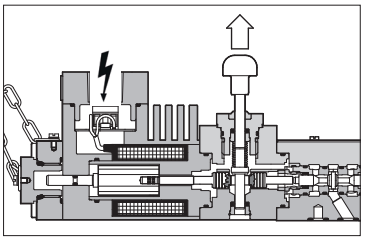
**O** = horizontal cable entrance , to be selected in case of limited verical space

**R** = the R device operates as a security (not combinable with /V).
When the valve is electrically energized, the manual reset knob must be manually lifted at the same time in order to permit the poppet to move from the rest position to the switched position.
The return of the valve to the rest position does not require lifting the manual reset knob.

**V** = with handweel manual override (not combinable with /R)

**Option /R**

Lift to permit the valve switching

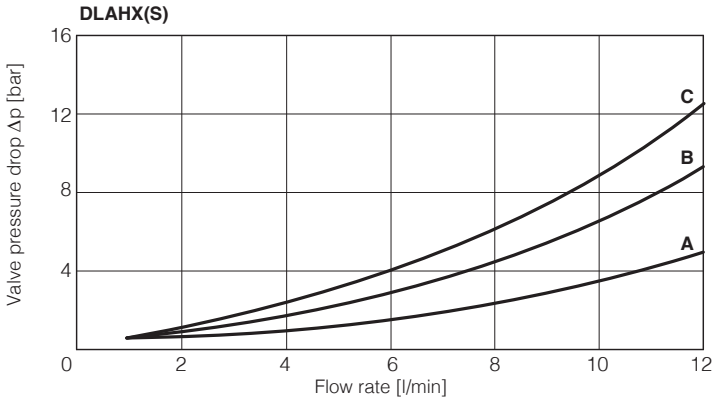


### 13.1 Possible combined options

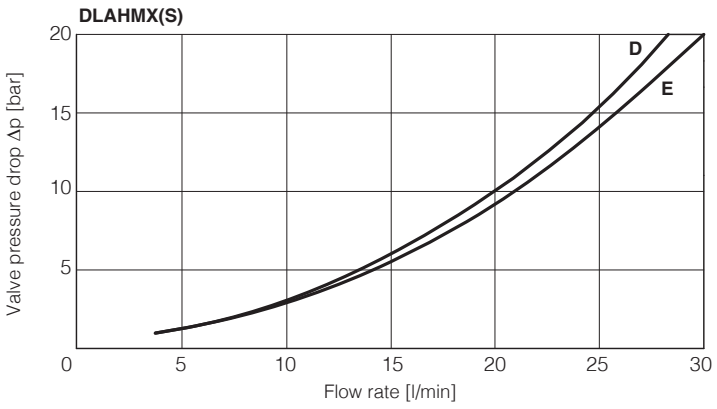
OR, OV

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

| Valve type | Curve | Flow direction |
|---|---|---|
| DLAHX(S)-3A | C | P-A, P-B |
| | B | A-T, B-T |
| DLAHX(S)-3C | B | P-A, P-B |
| | A | A-T, B-T |



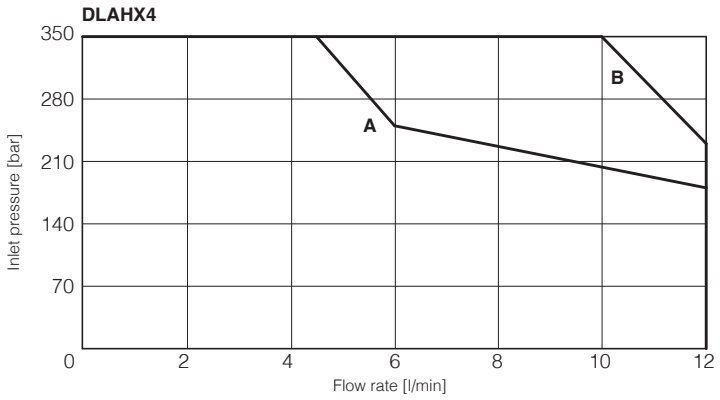

| Valve type | Curve | Flow direction |
|---|---|---|
| DLAHMX(S)-3A | E | P-A, P-B |
| | D | A-T, B-T |
| DLAHMX(S)-3C | E | P-A, P-B |
| | D | A-T, B-T |



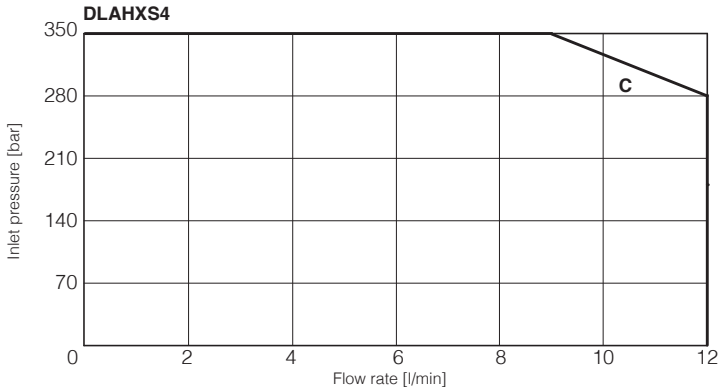
**15** **OPERATING LIMITS** (based on mineral oil ISO VG 46 at 50°C)

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

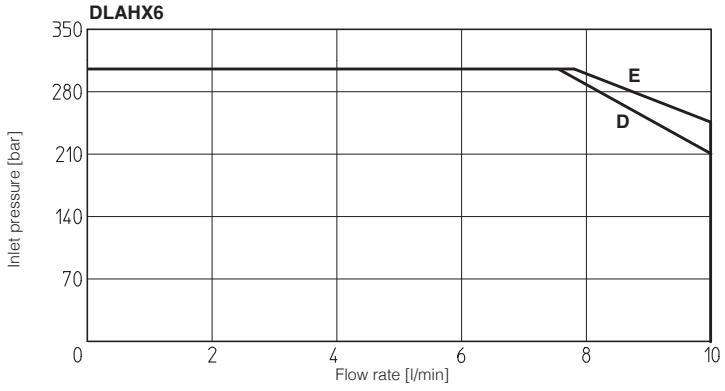
| Valve type | Curve | Configuration |
|---|---|---|
| DLAHX4 | A | 3C |
| | B | 3A |



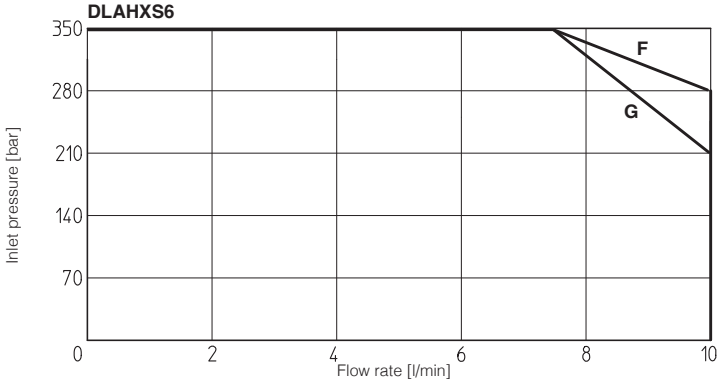

| Valve type | Curve | Configuration |
|---|---|---|
| DLAHXS4 | C | 3A , 3C |




| Valve type | Curve | Configuration |
|---|---|---|
| DLAHX6 | D | 3A |
| | E | 3C |

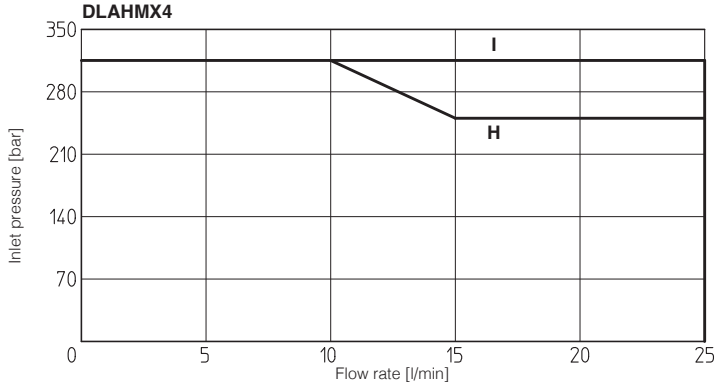



| Valve type | Curve | Configuration |
|---|---|---|
| DLAHXS6 | F | 3A |
| | G | 3C |



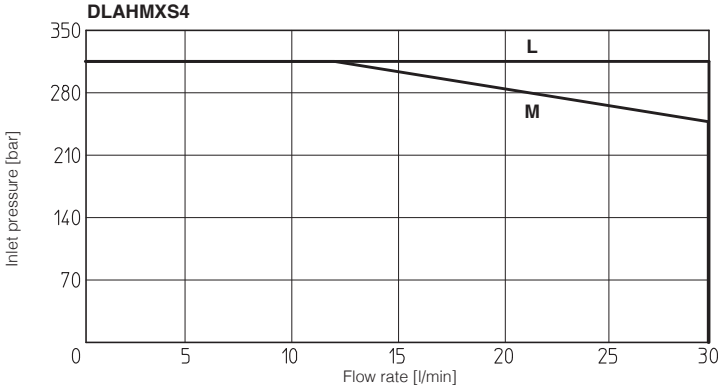
| Valve type | Curve | Configuration |
|---|---|---|
| DLAHMX4 | H | 3C |
| | I | 3A |

**DLAHMX4**



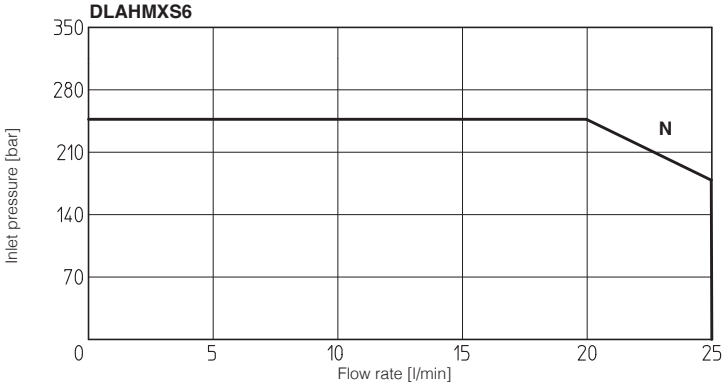

| Valve type | Curve | Configuration |
|---|---|---|
| DLAHMXS4 | L | 3A |
| | M | 3C |

**DLAHMXS4**

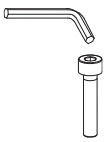



| Valve type | Curve | Configuration |
|---|---|---|
| DLAHMXS6 | N | 3A , 3C |

**DLAHMXS6**



## 16 FASTENING BOLTS AND SEALS



**Fastening bolts:**
4 socket head screws M5x50-A4-70
Tightening torque = 5,5 Nm

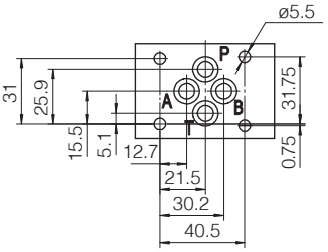
**Seals:**
4 OR 108;
Diameter of ports P, A, B, T: Ø 7,5 mm (max)

## 17 INSTALLATION DIMENSIONS [mm]

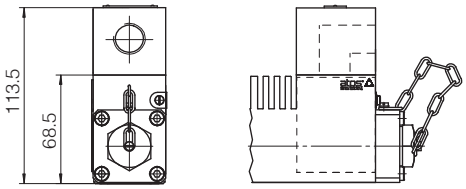
**ISO 4401: 2005**
**Mounting surface: 4401-03-02-0-05**

| Mass [kg] | |
|---|---|
| DLAHX(S)*-3A/M/V | 3 |
| DLAHX(S)*-3C/M | 2,9 |
| DLAHMX(S)*-3A/M/R | 3,8 |
| DLAHMX(S)*-3C/M | 2,9 |
| Option /O | +0,35 |

valve's bottom view

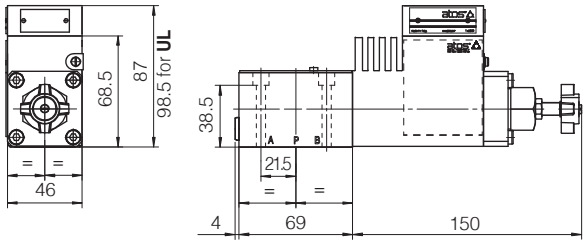



horizontal cable entrance option **/O**

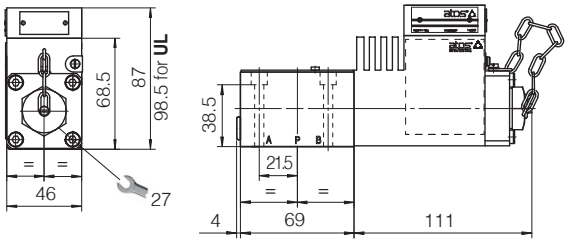



**P** = PRESSURE PORT
**A** = USE PORT (not used for -3C version)
**B** = USE PORT (not used for -3A version)
**T** = TANK PORT

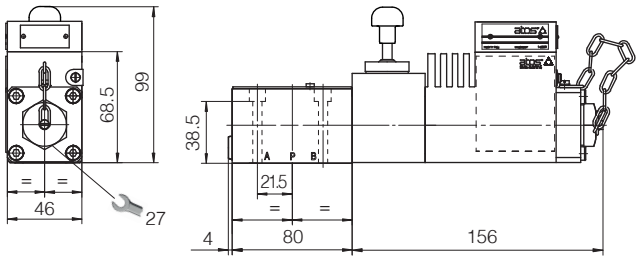
**DLAHX(S)*-3A/M/V**



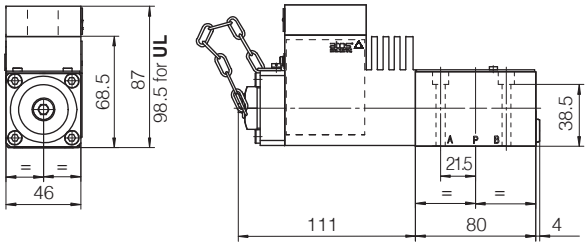

**DLAHX(S)*-3C/M**




**DLAHMX(S)*-3A/M/R**




**DLAHMX(S)*-3C/M**




## 18 RELATED DOCUMENTATION

| | | | |
|---|---|---|---|
| **W010** | Basics for electrohydraulics in corrosive environments | **X010** | Basics for electrohydraulics in hazardous environments |
| **W020** | Summary of Atos stainless steel components | **KX800** | Cable glands for ex-proof valves |
| **EW900** | Operating and maintenance information for stainless steel on-off valves | **P005** | Mounting surfaces for electrohydraulic valves |