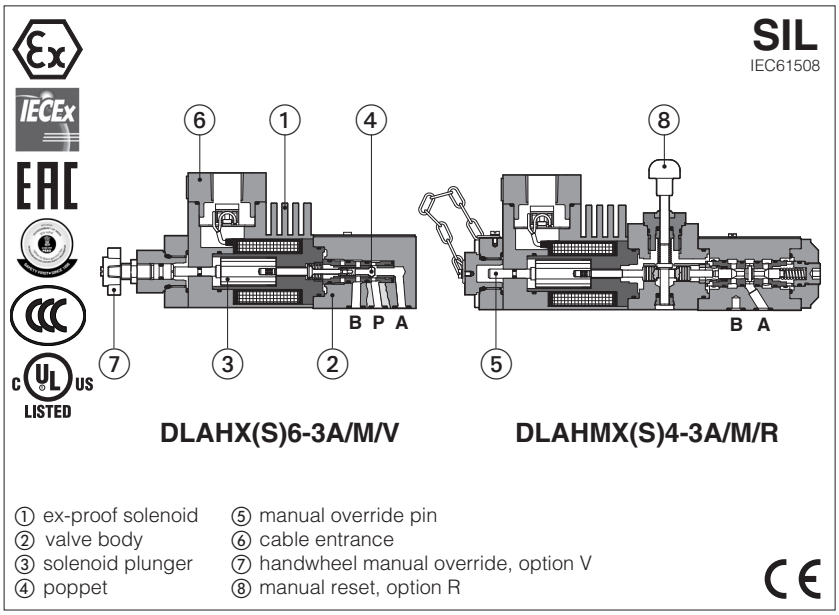
Stainless steel ex-proof solenoid directional valves

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

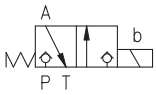
(1) See section 6 for materials specification.
(2) **6** and **4** versions differ only for the coil power, see power consumption at section 5 and operating limits at section 15.
(3) The "X" valves in full stainless steel execution are factory tested by Atos with mineral oil or pure water in order to 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

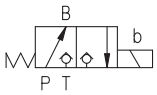
Valve execution		Multicertification		cULus		Max flow (l/min)	Max pressure (bar)
X	XS	Tclass	Power	Tclass	Power		
DLAHX4	**DLAHXS4**	T4, T3	25W	T3	33W	12	350
DLAHX6	**DLAHXS6**	T6, T4	8W	T6, T5	12W	10	315, 350
DLAHMX4	**DLAHMXS4**	T4, T3	25W	T3	33W	25, 30	315
-	**DLAHMXS6**	T6, T4	8W	T6, T5	12W	25	250

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

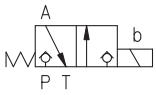
DLAHX(S)-3A



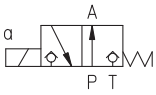
DLAHX(S)-3C



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 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" SIL to IEC 61508: 2010, see section 9 (only for DLAHX and DLAHXS) RoHs Directive 2011/65/EU as last update by 2015/65/EU 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 FKM seals (/PE option) = -20°C ÷ +80°C 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 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 DLAHMX4, DLAHMXS4		DLAHX6, DLAHXS6 - , DLAHMXS6		DLAHX4**/UL**, DLAHXS4**/UL** DLAHMX4**/UL**, DLAHMXS4**/UL**	DLAHX6**/UL**, DLAHXS6**/UL** - , DLAHMXS6**/UL**	
Certifications	Multicertification **ATEX IECEx EAC PESO CCC**				North American **cULus**		
Solenoid certified code	**OAKX/WP** **OAKXS/WP**		**OAX/WP** **OAXS/WP**		**OAKX/EC/WP** **OAKXS/EC/WP**	**OAX/EC/WP** **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** DLAHMX4 **/BBT**		DLAHX6 **/BBT**	
Certifications	Multicertification **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 **ATEX IECEx EAC PESO CCC**	North American **cULus**
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P391133/1 CCC: 2020322307003240	20170324 - E366100
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T6/T4/T3 Gb Ex II 2D Ex tb IIIC T85°C/T200°C Db • IECEx Ex db IIC T6/T4/T3 Gb Ex tb IIIC T85°C/T200°C Db • PESO Ex II 2G Exd IIC T6/T4/T3 Gb • CCC Ex d IIC T6/T4/T3 Gb Ex tD A21 IP66/IP67 T85°C/T135°C/T200°C	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB
Applicable standards	EN 60079-0 IEC 60079-0 EN 60079-1 IEC 60079-1 EN 60079-31 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30-1986 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**

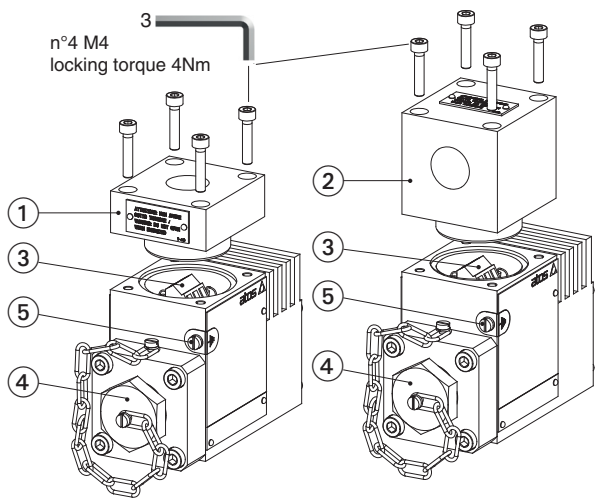
9 SIL compliance with IEC 61508: 2010 - only DLAHX and DLAHXS

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



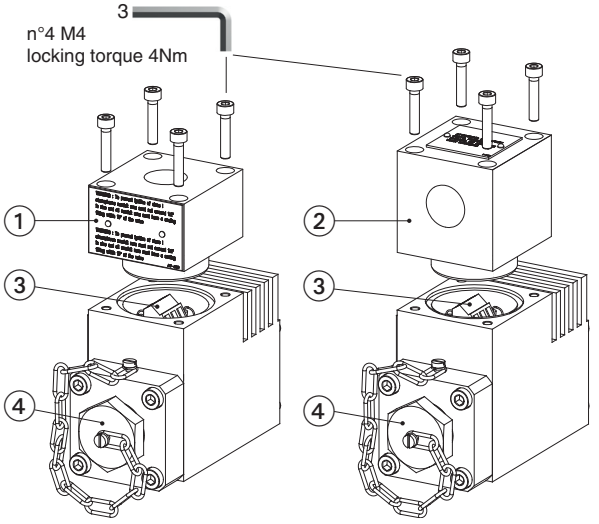
Standard version **Option /O**

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

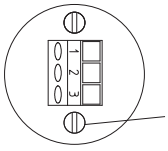
PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

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

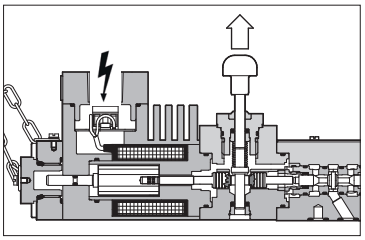
O = horizontal cable entrance , to be selected in case of limited verical space

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

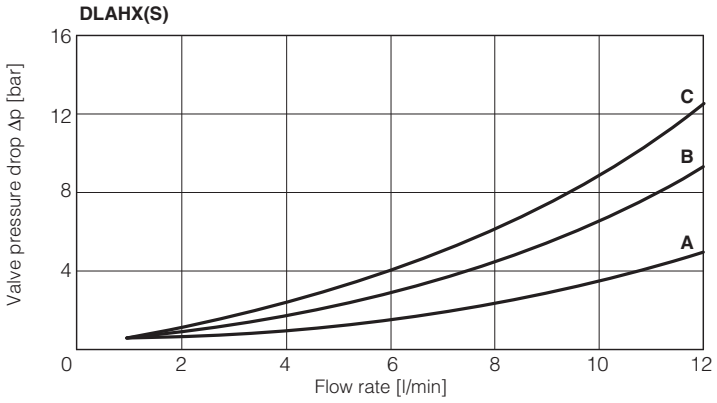


13.1 Possible combined options

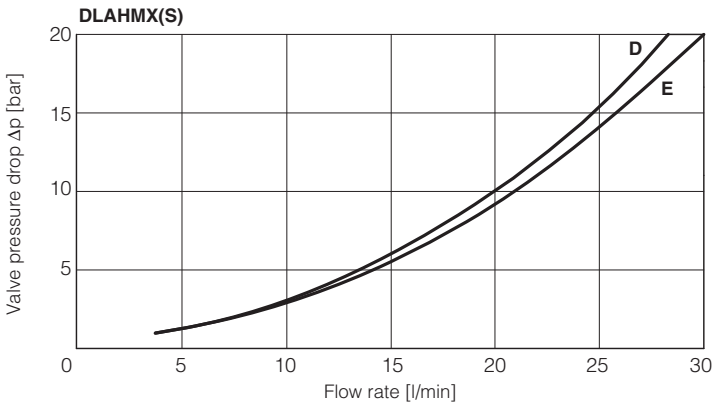
OR, OV

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



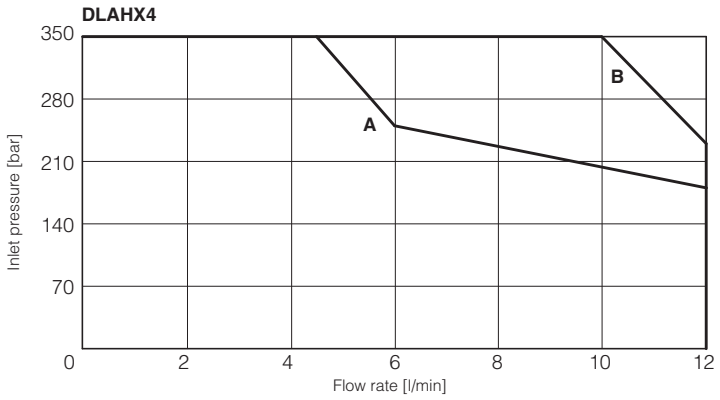
Valve type	Curve	Flow direction
DLAHMX(S)-3A	E	P-A, P-B
	D	A-T, B-T
DLAHMX(S)-3C	E	P-A, P-B
	D	A-T, B-T



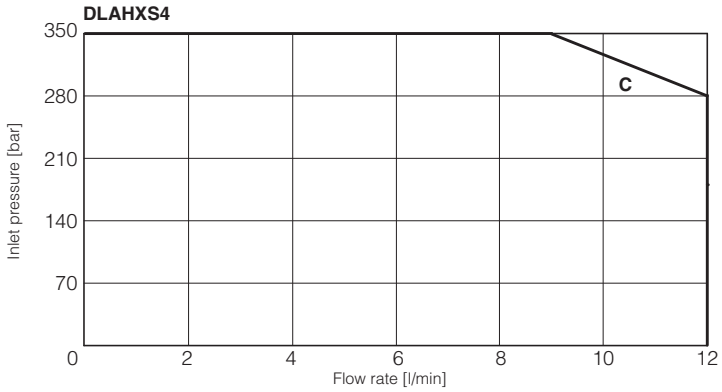
15 **OPERATING LIMITS** (based on mineral oil ISO VG 46 at 50°C)

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

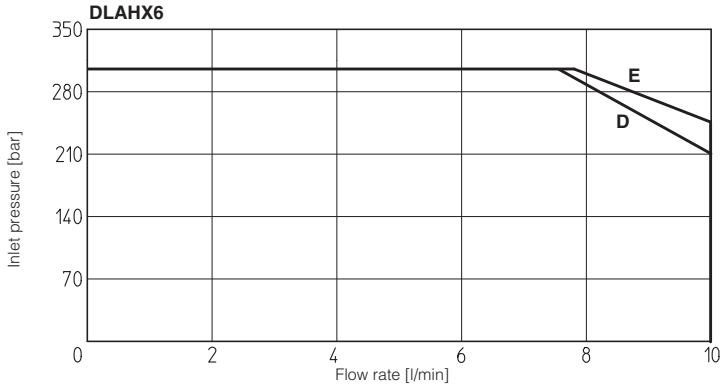
Valve type	Curve	Configuration
DLAHX4	A	3C
	B	3A



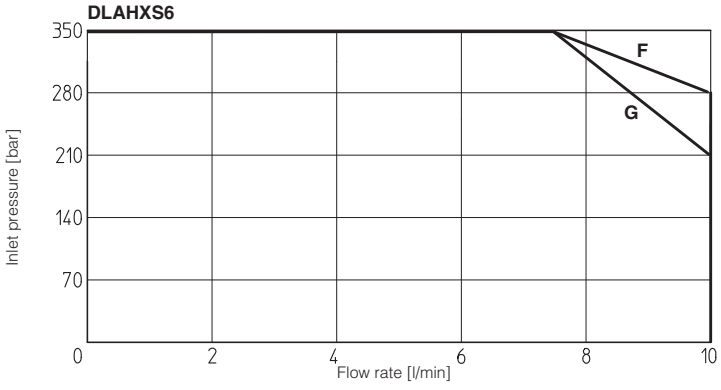
Valve type	Curve	Configuration
DLAHXS4	C	3A , 3C



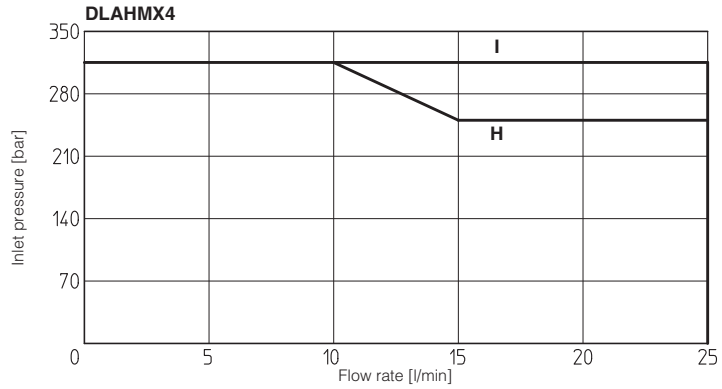
Valve type	Curve	Configuration
DLAHX6	D	3A
	E	3C



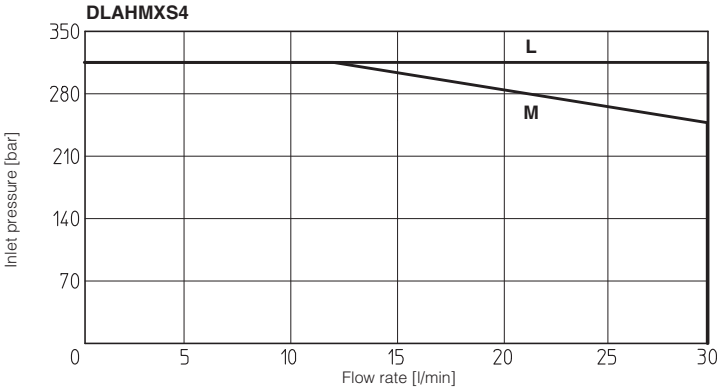
Valve type	Curve	Configuration
DLAHXS6	F	3A
	G	3C



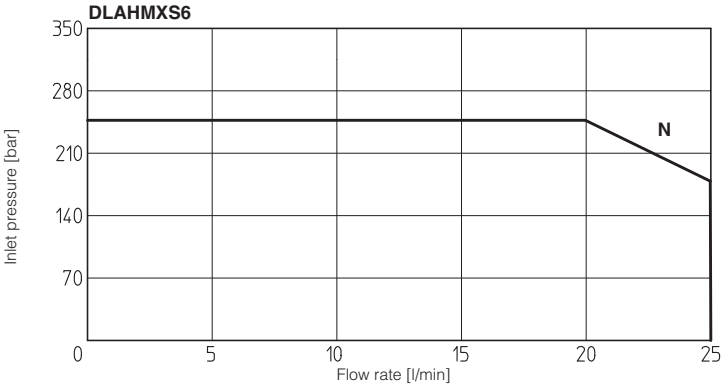
Valve type	Curve	Configuration
DLAHMX4	H	3C
	I	3A



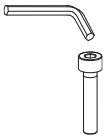
Valve type	Curve	Configuration
DLAHMXS4	L	3A
	M	3C



Valve type	Curve	Configuration
DLAHMXS6	N	3A , 3C



16 FASTENING BOLTS AND SEALS



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

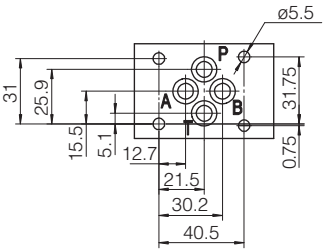
Seals:
4 OR 108;
Diameter of ports P, A, B, T: Ø 7,5 mm (max)

17 INSTALLATION DIMENSIONS [mm]

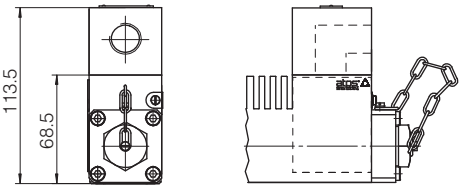
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05

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

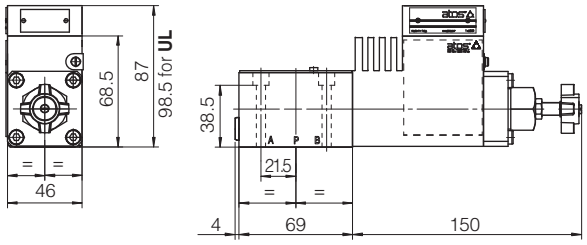


horizontal cable entrance option **/O**

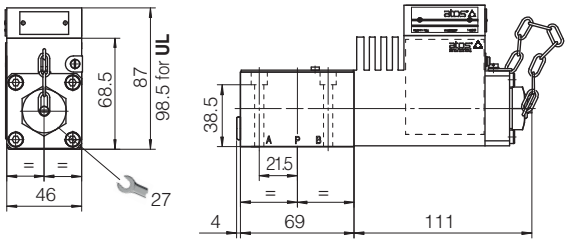


P = PRESSURE PORT
A = USE PORT (not used for -3C version)
B = USE PORT (not used for -3A version)
T = TANK PORT

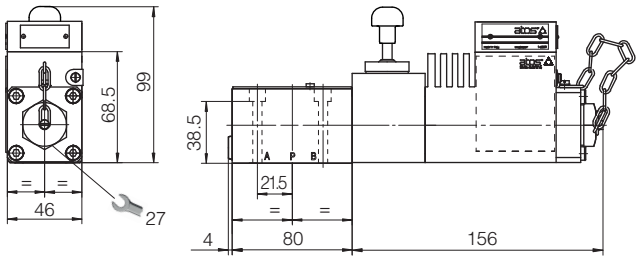
DLAHX(S)*-3A/M/V



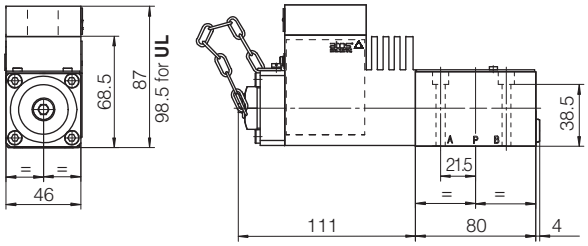
DLAHX(S)*-3C/M



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