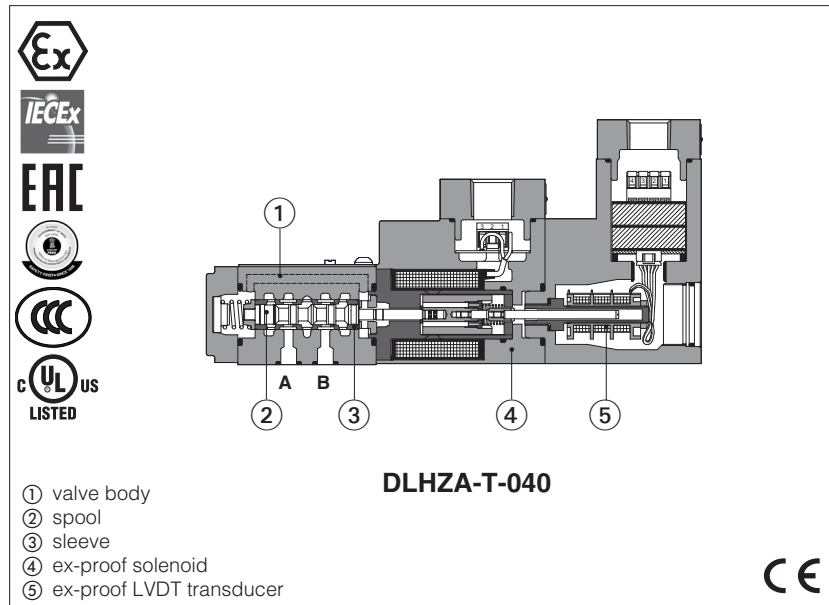


Ex-proof servoproportional directional valves sleeve execution

direct, with LVDT transducer and zero spool overlap - **ATEX, IECEx, EAC, PESO, CCC** or **cULus**



DLHZA-T, DLKZA-T

Ex-proof servoproportional directional valves, direct, sleeve execution, with LVDT position transducer and zero spool overlap for best performances in any position closed loop control.

They are equipped with ex-proof proportional solenoids and LVDT transducer certified for safe operations in hazardous environments with potentially explosive atmosphere.

Certifications:

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

The flameproof enclosure of solenoid and transducer, prevents the propagation of accidental internal sparks or fire to the external environment.

The solenoids are also designed to limit the surface temperature within the classified limits.

DLHZA: Size: **06** - ISO 4401 Max flow: **50 l/min** Max pressure: **350 bar**
DLKZA: Size: **10** - ISO 4401 Max flow: **100 l/min** Max pressure: **315 bar**

1 MODEL CODE

DLHZA	/	*	-	T	-	0	40	-	L	7	3	/	M	/	*	/	*																				
<p>Ex-proof proportional directional valves direct</p> <p>DLHZA = size 06 DLKZA = size 10</p> <p>Certification: Multicertification ATEX, IECEx, EAC, PESO, CCC: - = omit for Group II 2G IID (1) M = Group I (mining) North American Certification: UL = cULus</p> <p>T = with LVDT transducer</p> <p>Valve size ISO 4401: 0 = 06 1 = 10</p> <p>Configuration: Standard</p> <p>40 = </p> <p>with fail safe configuration 1 or 3</p> <p>60 = </p> <p>without fail safe</p> <p>Option /B</p> <p></p> <p>Spool type, regulating characteristics:</p> <p>L = linear V = progressive T = not linear (2)</p> <p>D = differential-linear (2) DT = differential-not linear (2)</p> <p>P-A = Q, B-T = Q/2 P-A = Q, B-T = Q/2 P-B = Q/2, A-T = Q P-B = Q/2, A-T = Q</p> <p>Seals material, see section 6: - = NBR PE = FKM BT = HNBR (3)</p> <p>Series number</p> <p>Options (4): B = solenoid and position transducer at side of port A (5) C = position transducer with current feedback 4÷20 mA Y = external drain</p> <p>Solenoid and transducer threaded connection for cable gland fitting: GK = GK-1/2" - not for cULus (6) M = M20x1,5 - not for cULus NPT = 1/2" NPT</p> <p>Fail safe configuration, see section 12:</p> <p>1 = 3 = </p> <p>Spool size: 0(L) 1(L) 1(V) 3(L) 3(T) 3(V) 5(L,T) 7(L,T,V,D,DT)</p> <table border="1"> <tr> <td>DLHZA</td> <td>=</td> <td>4</td> <td>7</td> <td>8</td> <td>14</td> <td>-</td> <td>20</td> <td>28</td> <td>40</td> </tr> <tr> <td>DLKZA</td> <td>=</td> <td>-</td> <td>-</td> <td>-</td> <td>60</td> <td>60</td> <td>-</td> <td>-</td> <td>100</td> </tr> </table> <p>Nominal flow (l/min) at Δp 70bar P-T</p>																		DLHZA	=	4	7	8	14	-	20	28	40	DLKZA	=	-	-	-	60	60	-	-	100
DLHZA	=	4	7	8	14	-	20	28	40																												
DLKZA	=	-	-	-	60	60	-	-	100																												

- (1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization)
(2) Only for configuration **40** (3) Not for multicertification **M** group I (mining) (4) Possible combined options: /B, /BY, /CY, /BCY
(5) In standard configuration the solenoid and position transducer are at side of port B (6) Approved only for the Italian market

2 ELECTRONIC DRIVERS

Electronic drivers are factory set with max current limitation for ex-proof valves.

Please include in the driver order also the complete code of the connected ex-proof proportional valve.

Drivers model	E-BM-TEB-* /A	E-BM-TES-* /A	Z-BM-TEZ-* /A
Type	digital	digital	digital
Format	DIN-rail panel		
Data sheet	GS230	GS240	GS330

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, $R_a \leq 0,8$ recommended $R_a 0,4$ - flatness ratio 0,01/100
MTTFd values according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	Standard = $-20^{\circ}\text{C} \div +70^{\circ}\text{C}$ /PE option = $-20^{\circ}\text{C} \div +70^{\circ}\text{C}$ /BT option = $-40^{\circ}\text{C} \div +60^{\circ}\text{C}$
Storage temperature range	Standard = $-20^{\circ}\text{C} \div +80^{\circ}\text{C}$ /PE option = $-20^{\circ}\text{C} \div +80^{\circ}\text{C}$ /BT option = $-40^{\circ}\text{C} \div +70^{\circ}\text{C}$
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO9227) > 200h
Compliance	Explosion proof protection, see section 7 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" RoHs Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50°C

Valve model	DLHZA												DLKZA							
Pressure limits [bar]	ports P, A, B = 350; T = 210 (250 with external drain /Y)												ports P, A, B = 315; T = 210 (250 with external drain /Y)							
Spool type	L0	L1	V1	L3	V3	L5	T5	L7	T7	V7	D7	DT7	L3	T3	L7	T7	V7	D7	DT7	
Max flow [l/min]																				
Δp P-T	Δp = 30 bar	2,5	4,5	8	9	13	18		26		26÷13		40		60		60÷33			
	Δp = 70 bar	4	7	12	14	20	28		40		40÷20		60		100		100÷50			
	max permissible flow	5	9	16	18	26	32		50		50÷28		70		100		100÷50			
Δp max P-T [bar]	120	120	120	120	120	100		100		100		90		70		70				
Leakage [cm³/min] at P = 100 bar (1)	<100	<200	<100	<300	<150	<500	<200	<900	<200	<200	<700	<200	<1000	<400	<1500	<400	<400	<1200	<400	
Response time (2) [ms]	≤ 13												≤ 20							
Hysteresis [% of max regulation]	≤ 0,1												≤ 0,1							
Repeatability [% of max regulation]	± 0,1												± 0,1							
Thermal drift	t displacement < 1% at ΔT = 40°C																			

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 2


(1) Referred to spool in neutral position and 50°C oil temperature (2) 0-100% step signal

5 ELECTRICAL CHARACTERISTICS

Max. power	35W
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree with relevant cable gland	Multicertification: IP66/67 to DIN EN60529 UL: raintight enclosure, UL approved
Duty factor	Continuous rating (ED=100%)
Voltage code	standard
Coil resistance R at 20°C	3,2 Ω
Max. solenoid current	2,5 A

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

Seals, recommended fluid temperature	NBR seals (standard) = $-20^{\circ}\text{C} \div +60^{\circ}\text{C}$, with HFC hydraulic fluids = $-20^{\circ}\text{C} \div +50^{\circ}\text{C}$ FKM seals (/PE option) = $-20^{\circ}\text{C} \div +80^{\circ}\text{C}$ HNBR seals (/BT option) = $-40^{\circ}\text{C} \div +60^{\circ}\text{C}$, with HFC hydraulic fluids = $-40^{\circ}\text{C} \div +50^{\circ}\text{C}$		
Recommended viscosity	20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLDP	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water (1)	NBR, HNBR	HFC	

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

(1) **Performance limitations in case of flame resistant fluids with water:**

-max operating pressure = 210 bar -max fluid temperature = 50°C

7 CERTIFICATION DATA

Valve type	DLHZA, DLKZA		DLHZA/M, DLKZA/M	DLHZA/UL, DLKZA/UL	
Certifications	Multicertification Group II ATEX, IECEx, EAC, PESO, CCC		Multicertification Group I ATEX, IECEx	North American cULus	
Solenoid certified code	OZA-T		OZAM-T	OZA-T/EC	
Type examination certificate (1)	ATEX: CESI 02 ATEX 014 IECEX: IECEX CES 10.0010x EAC: RU C - IT.A 38.B.00425/21 PESO: P588812/1 CCC: 2024322307005903		ATEX: CESI 03 ATEX 057x IECEX: IECEX CES 12.0007x	20170324 - E366100	
Method of protection	<ul style="list-style-type: none"> • ATEX Ex II 2G Ex db IIC T4/T3 Gb Ex II 2D Ex tb IIIC T135°C/T200°C Db • IECEX Ex db IIC T4/T3 Gb Ex tb IIIC T135°C/T200°C Db • EAC 1Ex d IIC T4/T3 Gb X Ex tb IIIC T135°C/T200°C Db X • PESO Ex db IIC T4/T3 Gb • CCC Ex d IIC T4/T3 Gb Ex tD A21 IP66/IP67 T135°C/T200°C 		<ul style="list-style-type: none"> • ATEX Ex I M2 Ex db I Mb • IECEX Ex db I Mb 	<ul style="list-style-type: none"> • UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB 	
Temperature class	T4	T3	-	T4	T3
Surface temperature	≤ 135°C	≤ 200°C	≤ 150°C	≤ 135°C	≤ 200°C
Ambient temperature (2)	-40 ÷ +40°C	-40 ÷ +70°C	-20 ÷ +60°C	-40 ÷ +55°C	-40 ÷ +70°C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30 CSA 22.2 n°139	
Cable entrance: threaded connection	GK = GK-1/2" M = M20x1,5 NPT = 1/2" NPT			1/2" NPT	

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

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

In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

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

8 EX PROOF SOLENOIDS AND LVDT TRANSDUCER WIRING

Multicertification

n°8 M4x20
locking torque 4Nm

- ① solenoid cover with threaded connection for cable gland fitting
- ② transducer cover with threaded connection for cable gland fitting
- ③ solenoid terminal board for cables wiring
- ④ transducer terminal board for cables wiring
- ⑤ screw terminal for additional equipotential grounding

Solenoid wiring

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

Position transducer wiring

	1 = Output signal	PCB 4 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)
	2 = Supply -15 V	
	3 = Supply +15 V	
	4 = GND	

cULus certification

n°8 M4x20
locking torque 4Nm

- ① solenoid cover with threaded connection for cable gland fitting
- ② transducer cover with threaded connection for cable gland fitting
- ③ solenoid terminal board for cables wiring
- ④ transducer terminal board for cables wiring

Solenoid wiring

Pay attention to respect the polarity

	1 = Coil +	PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 9 note 1
	2 = GND	
	3 = Coil -	

alternative GND screw terminal vconnected to solenoid housing

Position transducer wiring

	1 = Output signal	PCB 4 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 9 note 1
	2 = Supply -15 V	
	3 = Supply +15 V	
	4 = GND	

9 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 ("BT" Models require a temperature range from -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.

9.1 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 [°C]	
	Group I	Group II	Group I	Group II	Group I	Group II
40°C	-	T4	150°C	135°C	-	90°C
60°C	-	-	150°C	-	110°C	-
70°C	N.A.	T3	N.A.	200°C	N.A.	120°C

cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature
55°C	T4	135°C	100°C
70°C	T3	200°C	100°C

10 CABLE GLANDS - only 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

11 OPTIONS

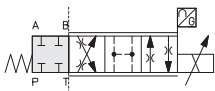
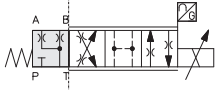
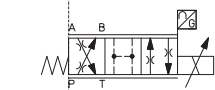
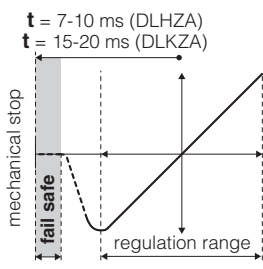
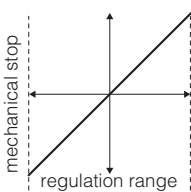
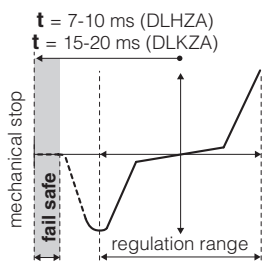
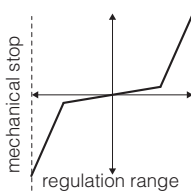
B = Solenoid and position transducer at side of port A of the main stage

C = Position transducer with current feedback 4÷20 mA, suggested in case of long distance between the electronic driver and the proportional valve

Y = External drain, to be selected if the pressure at T port is higher than the max allowed limits

11.1 Possible combined options: /BC, /BY, /CY, /BCY

12 FAIL SAFE POSITION

CONFIGURATION	LINEAR	NOT LINEAR
 <p>fail safe 1</p>  <p>fail safe 3</p>  <p>without fail safe</p>	 <p>t = time required by the valve to switch from central to fail safe position at the power switch-off, with pressure 0 to 100 bar</p> 	 

Fail safe connections		P → A	P → B	A → T	B → T
Leakage [cm ³ /min] at P = 100 bar (1)	Fail safe 1	50	70	70	50
	Fail safe 3	50	70	-	-
Flow [l/min] (2)	Fail safe 3	DLHZA	-	15÷30	10÷20
		DLKZA	-	40÷60	25÷40

(1) Referred to spool in fail safe position and 50°C oil temperature

(2) Referred to spool in fail safe position at Δp = 35 bar per edge

13 DIAGRAMS - based on mineral oil ISO VG 46 at 50°C

13.1 Regulation diagrams

1 = Linear spools L

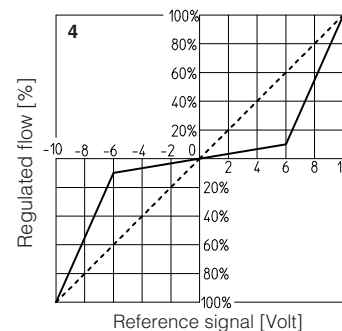
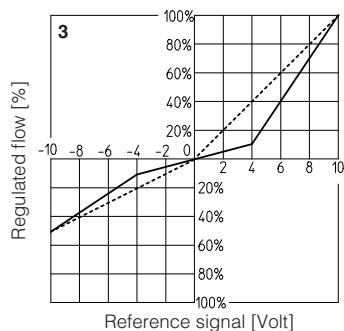
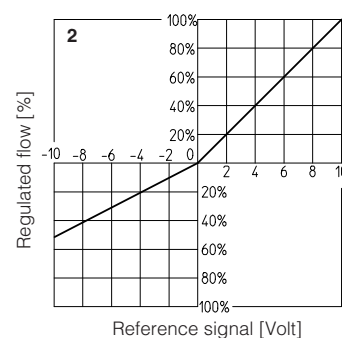
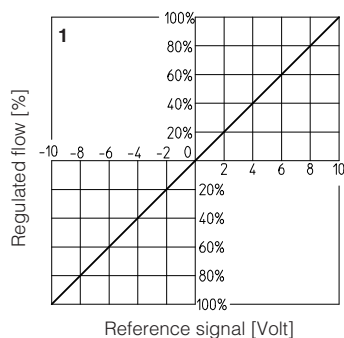
2 = Differential - linear spool D7

3 = Differential non linear spool DT7

4 = Non linear spool, T5 (only for DLHZA)

5 = Non linear spool, T3 (only for DLKZA) and T7

6 = Progressive spool V



T3, T5 and T7 spool types are specific for fine low flow control in the range from 0 to 60% (T5) and 0 to 40% (T3 and T7) of max spool stroke.

The non linear characteristics of the spool is compensated by the electronic driver, so the final valve regulation is resulting linear respect the reference signal (dotted line).

DT7 has the same characteristic of T7 but it is specific for applications with cylinders with area ratio 1:2

Note:

Hydraulic configuration vs. reference signal:

Standard:

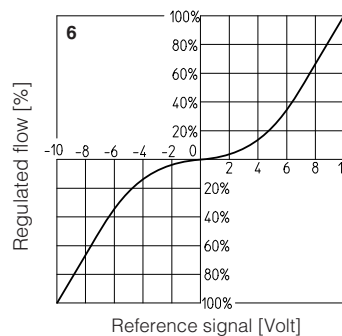
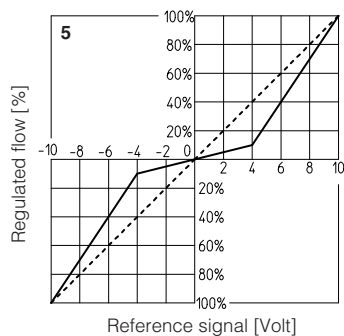
Reference signal $0 \div +10 \text{ V}$ } $P \rightarrow A / B \rightarrow T$
 $12 \div 20 \text{ mA}$

Reference signal $0 \div -10 \text{ V}$ } $P \rightarrow B / A \rightarrow T$
 $12 \div 4 \text{ mA}$

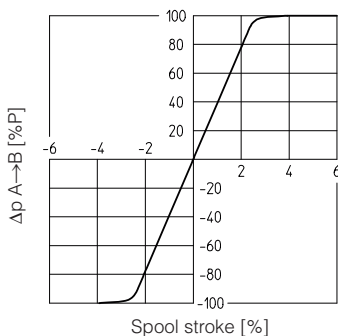
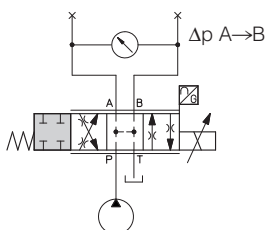
option /B:

Reference signal $0 \div +10 \text{ V}$ } $P \rightarrow B / A \rightarrow T$
 $12 \div 20 \text{ mA}$

Reference signal $0 \div -10 \text{ V}$ } $P \rightarrow A / B \rightarrow T$
 $12 \div 4 \text{ mA}$



13.2 Pressure gain



14 FASTENING BOLTS AND SEALS

	DLHZA	DLKZA
	Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	Seals: 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	Seals: 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

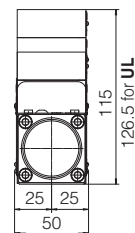
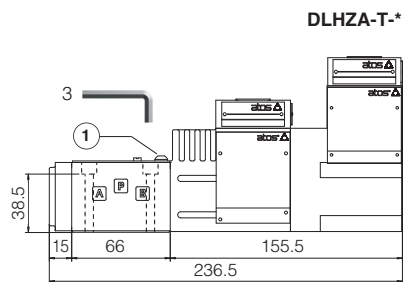
DLHZA

ISO 4401: 2005 (see table P005)

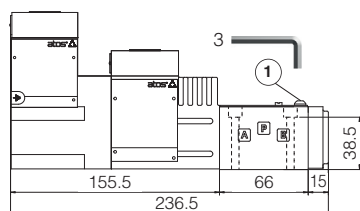
Mounting surface: 4401-03-02-0-05

(for /Y surface: 4401-03-03-0-05 without port X)

Mass [kg]	
DLHZA-T-*	4,0



DLHZA-T-*/B



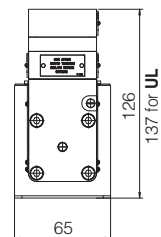
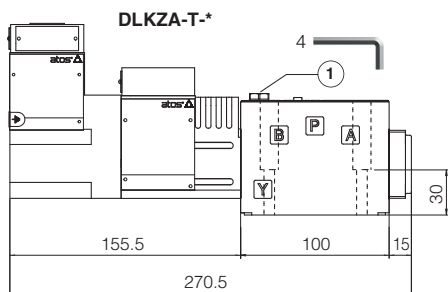
DLKZA

ISO 4401: 2005 (see table P005)

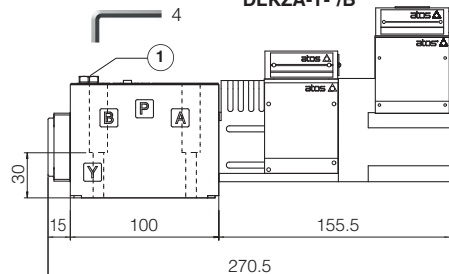
Mounting surface: 4401-05-04-0-05

(for /Y surface: 4401-05-05-0-05 without port X)

Mass [kg]	
DLKZA-T-*	6,1



DLKZA-T-*/B



① = Air bleed off

16 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, CCC, PESO
X030	Summary of Atos ex-proof components certified to cULus
FX900	Operating and maintenance information for ex-proof proportional valves
KX800	Cable glands for ex-proof valves
P005	Mounting surfaces for electrohydraulic valves