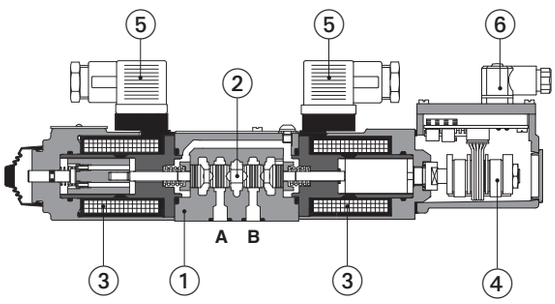
Proportional directional valves **high performance**

direct, with LVDT transducer and positive spool overlap



DHZO-T-071

① Valve body
② Spool
③ Proportional solenoid
④ LVDT transducer
⑤ Solenoid connector
⑥ Transducer connector

DHZO-T, DKZOR-T

Proportional directional valves, direct, with LVDT position transducer and positive spool overlap for best dynamics in directional controls and not compensated flow regulations.

The valves operate in association with digital off-board divers, see section 3.

The LVDT transducer grants very high regulation accuracy and response sensitivity.

With de-energized proportional solenoids, mechanical central position of the spool is performed by centering springs.

Spools regulation characteristics:
L = linear
S = progressive, for fine low flow control
D = differential-progressive, for control of actuators with area ratio 1:2
Q5 and Q6 = for P/Q control

DHZO:	**DKZOR**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **80 l/min**	Max flow: **180 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 MODEL CODE OF STANDARD SPOOLS

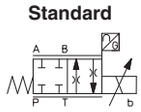
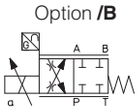
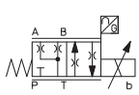
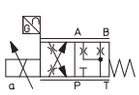
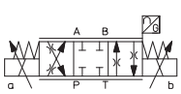
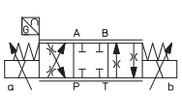
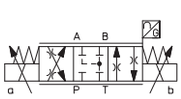
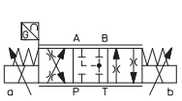
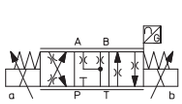
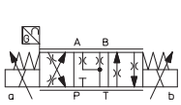
DHZO	-	T	-	0	71	-	L	5	/	*	*	/	*

DHZO = size 06
DKZOR = size 10

T = with LVDT transducer

Valve size ISO 4401:
0 = 06 **1** = 10

Configuration:

	Standard	Option **/B**
51 =		
53 =		
71 =		
72 = (1)		
73 =		

Seals material, see section 7 :
- = NBR
PE = FKM
BT = HNBR

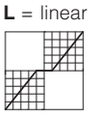
Series number

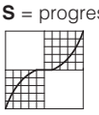
Hydraulic options (2):
B = solenoid and LVDT transducer at side of port A
Y = external drain

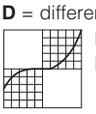
Spool size:	**14** (L)	**1** (L)	**2** (S)	**3** (L,S,D)	**5** (L,S,D)
DHZO =	1	4,5	8	17	28
DKZOR =	-	-	-	45	75

Nominal flow (l/min) at Δp 10bar P-T

Spool type, regulating characteristics **(3)**:

L = linear 

S = progressive 

D = differential-progressive 
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

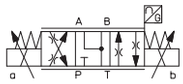
(1) Only for **DKZOR-*-S5** the spool overlapping type 2 provides the same characteristic of type 1, but in central position the internal leakages from P to A and B are drained to tank, avoiding the drift of cylinders with differential areas
(2) Possible combined options: /BY
(3) Spools for P/Q control, see section 2

2 MODEL CODE OF SPOOLS FOR ALTERNATED P/Q CONTROL - for valve model code and options, see section 1

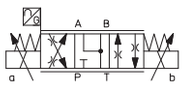
DHZO	-	T	-	0	73 - V9	/	*	*	/	*

Configuration and spool:

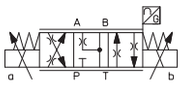
73-Q5



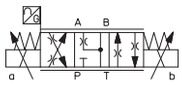
73-Q5/B



73-V9



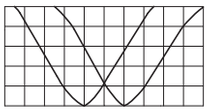
73-V9/B



Spool size:		**Q5**	**V9**
DHZO	=	30	30
DKZOR	=	75	75

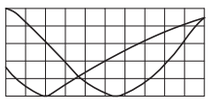
Nominal flow (l/min) at Δp 10 bar P-T

Q5



For alternated P/Q control
see 8.1 - diagram 16

V9



For alternated P/Q control of injection cycle in plastic machinery
see 8.1 - diagram 17

3 OFF-BOARD ELECTRONIC DRIVERS

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

Drivers model	E-BM-TID	E-BM-TEB	E-BM-TES
Type	digital	digital	digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS235	GS230	GS240

4 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

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

Valve model		**DHZO**						**DKZOR**			
Pressure limits [bar]		ports **P**, **A**, **B** = 350; **T** = 210 (250 with external drain /Y) **Y** = 10						ports **P**, **A**, **B** = 315; **T** = 210 (250 with external drain /Y) **Y** = 10			
Configuration		**51, 53, 71, 73**					**73**	**51, 53, 71, 73**		**72**	**73**
Spool type	standard	**L14**	**L1**	**S2**	**L3,S3,D3**	**L5,S5,D5**		**L3,S3,D3**	**L5,S5,D5**	**S5**	
	P/Q						**Q5,V9**				**Q5,V9**
Nominal flow Δp P-T [l/min] **(1)**	Δp= 10 bar	1	4,5	8	18	28	30	45	75	75	75
	Δp= 30 bar	1,7	8	14	30	50	52	80	130	130	130
	Δp= 70 bar	2,6	12	21	45	75	80	120	170	170	170
Max permissible flow **(2)**		4	18	30	50	80	80	130	180	180	180
Leakage [cm³/min]		<30 (at p = 100 bar); <135 (at p = 350 bar)						<80 (at p = 100 bar); <600 (at p = 315 bar)			
Response time **(3)** [ms]		≤ 15						≤ 20			
Hysteresis		≤ 0,2 [% of max regulation]									
Repeatibility		± 0,1 [% of max regulation]									
Thermal drift		zero point displacement < 1% at ΔT = 40°C									

(1) For different Δp, the max flow is in accordance to the diagrams in section 8.2
(2) See detailed diagrams in section 8.3
(3) 0-100% step signal

6 ELECTRICAL CHARACTERISTICS

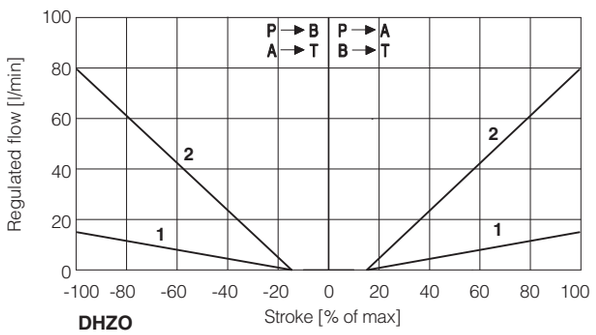
Max power consumption	30 W
Max. solenoid current	**DHZO** = 2,6 A **DKZOR** = 3 A
Coil resistance R at 20°C	**DHZO** = 3 ÷ 3,3 Ω **DKZOR** = 3,8 ÷ 4,1 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

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

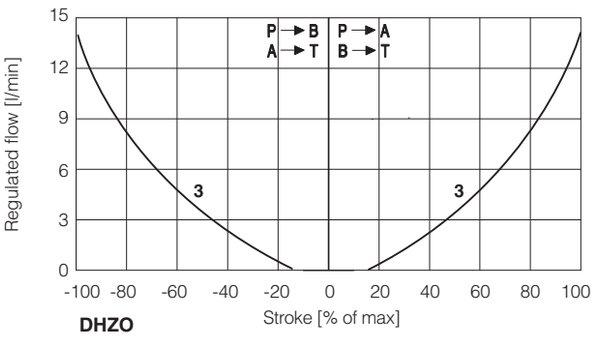
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20÷100 mm²/s - max allowed range 15 ÷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

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

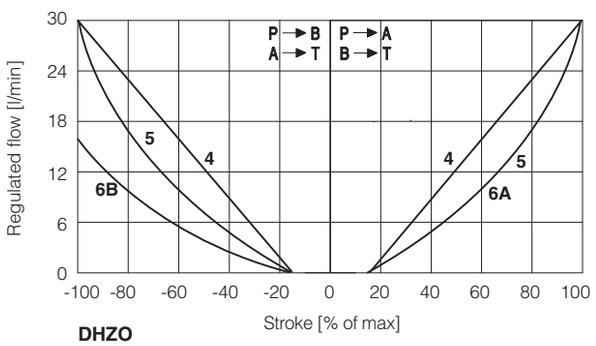
8.1 Regulation diagrams - values measure at Δp 30 bar P-T



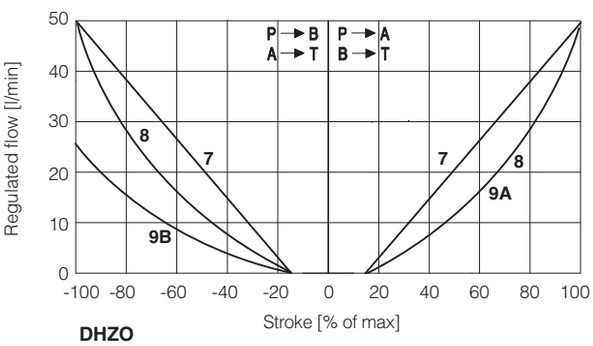
DHZO
1 = L14 **2** = L1



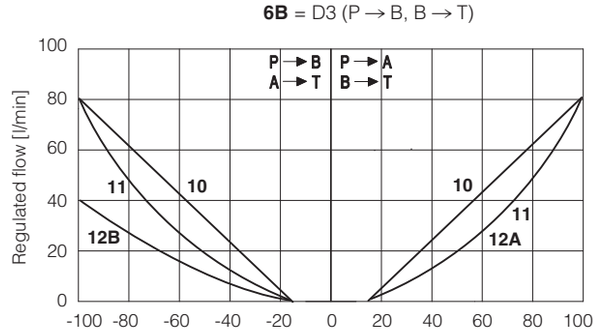
DHZO
3 = S2



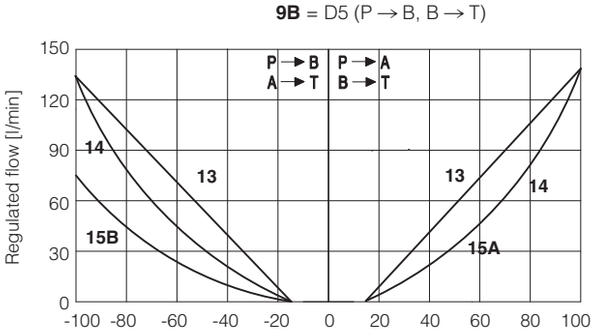
DHZO
4 = L3 **5** = S3 **6A** = D3 (P → A, A → T)
6B = D3 (P → B, B → T)



DHZO
7 = L5 **8** = S5 **9A** = D5 (P → A, A → T)
9B = D5 (P → B, B → T)



DKZOR
10 = L3 **11** = S3 **12A** = D3 (P → A, A → T)
12B = D3 (P → B, B → T)



DKZOR
13 = L5 **14** = S5 **15A** = D5 (P → A, A → T)
15B = D5 (P → B, B → T)

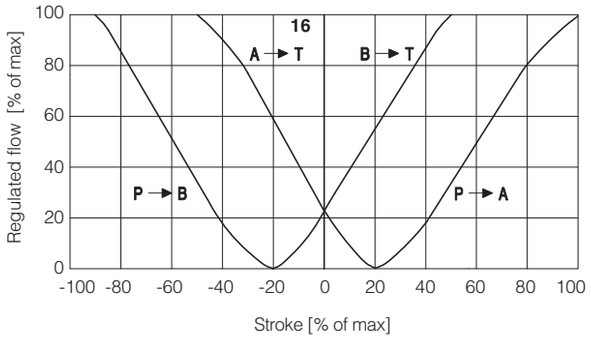
Note:
Hydraulic configuration vs. reference signal for configurations 71, 72 and 73 (standard and option /B)

Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → A / B → T

Reference signal 0 ÷ -10 V / 12 ÷ 4 mA } P → B / A → T

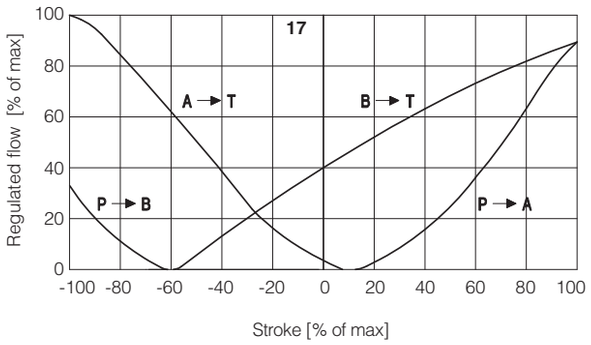
16 = linear spool **Q5**

Q5 spool type is specific for alternate P/Q controls in combination with S* option of digital integral drivers (see tech table **FS500**).
It allows to control the pressure in A port or B port and it provides a safety central position (A-T/B-T) to depressurize the actuator chambers.
The strong meter-in characteristic makes the spool suitable for both pressure control and motion regulations in several applications.



17 = differential - progressive spool **V9**

V9 spool type is specific for alternate P/Q controls in combination with S* option of digital integral drivers (see tech table **FS500**). This spool is specially designed to manage the whole injection cycle in plastic machinery, thanks to the following specific features:
- strong meter-in characteristic to allow the pressure control in A port during the holding pressure (P-A) and the plasticizing (A-T) phases
- safety central position (A-T/B-T) to depressurize the actuator chambers
- large A-T and B-T flow capability, required during the plasticizing phase, to discharge big volumes from high differential injection cylinders with low pressure drops and permitting the contemporary oil suction from tank



8.2 Flow /Δp diagrams

stated at 100% of valve stroke

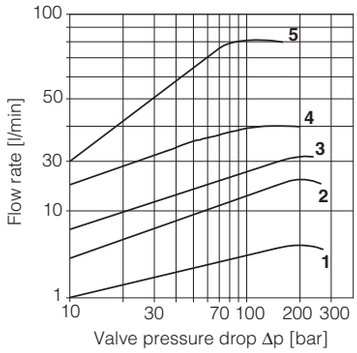
DHZO

1 = spool L14
2 = spool L1
3 = spool S2
4 = spool L3, S3, D3
5 = spool L5, S5, D5, V9

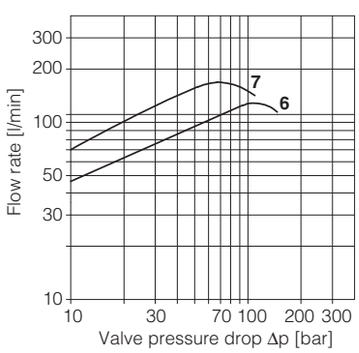
DKZOR

6 = spool S3, L3, D3
7 = spool S5, L5, D5, V9

DHZO



DKZOR



8.3 Operating limits

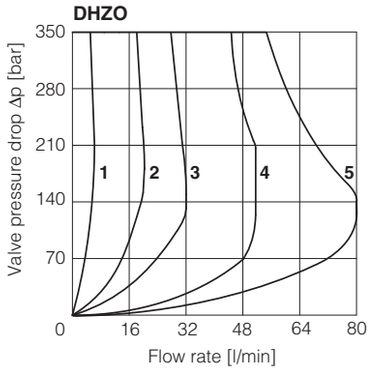
DHZO

1 = spool L14
2 = spool L1
3 = spool S2
4 = spool L3, S3, D3
5 = spool L5, S5, D5, V9

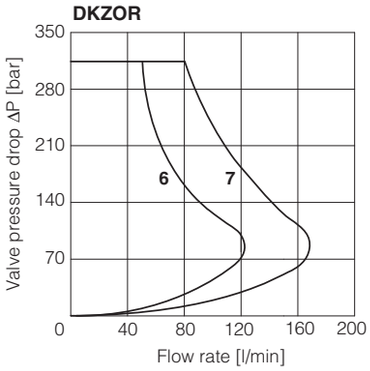
DKZOR

6 = spool S3, L3, D3
7 = spool S5, L5, D5, V9

DHZO

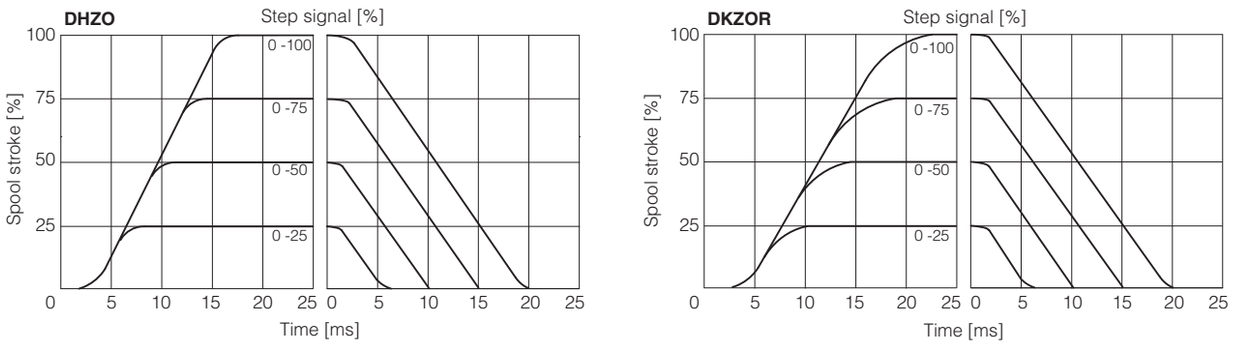


DKZOR



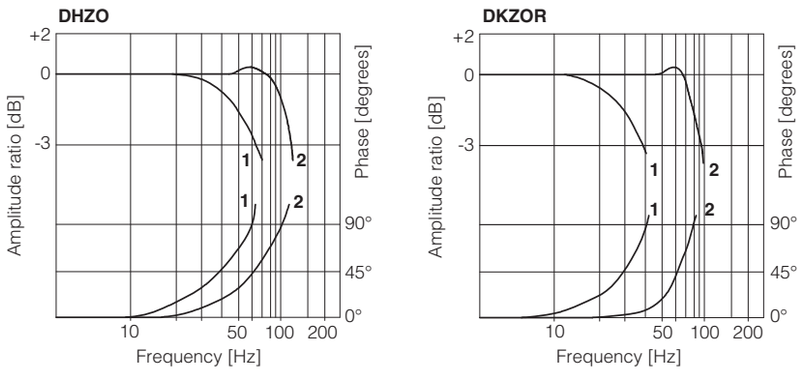
8.4 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values.
For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



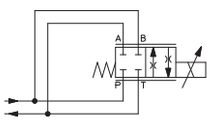
8.5 Bode diagrams

1 = 10% ⟷ 90% nominal stroke
2 = 50% ± 5% nominal stroke



8.6 Operation as throttle valve

Single solenoid valves configuration 51 and 53 can be used as simple throttle valves:
Pmax = 250 bar (option /Y advisable)



Max flow Δp= 15bar [l/min]	SPOOL TYPE				
	L14	**L1**	**S2**	**L3 S3**	**L5 S5**
DHZO	4	16	28	60	100
DKZOR	-	-	-	160	260

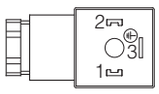
9 HYDRAULIC OPTIONS

B = Solenoid and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 8.1

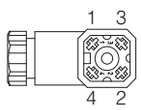
Y = This option is mandatory if the pressure in port T exceeds 210 bar.

10 ELECTRICAL CONNECTION

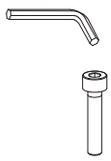
10.1 Solenoid connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

10.2 LVDT transducer connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	**TR**	Output signal	
2	**VT-**	Power supply -15VDC	
3	**VT+**	Power supply +15VDC	
4	**GND**	Ground	

11 FASTENING BOLTS AND SEALS

	DHZO	DKZOR
	**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)

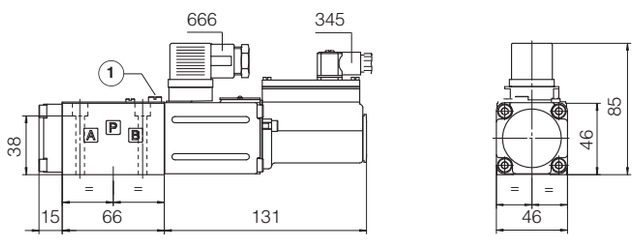
12 INSTALLATION DIMENSIONS [mm]

DHZO-T

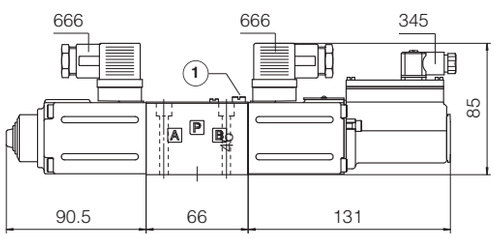
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y surface 4401-03-03-0-05 without X port)

Mass [kg]	
DHZO-T-05	1,9
DHZO-T-07	2,6

DHZO-T-05



DHZO-T-07



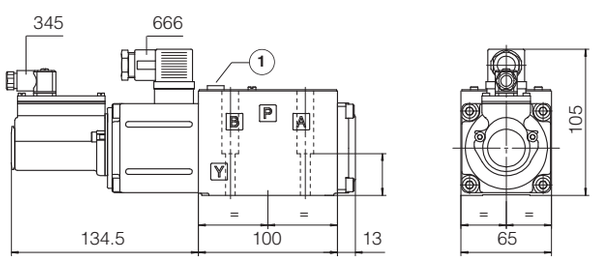
① = Air bleeding  3

DKZOR-T

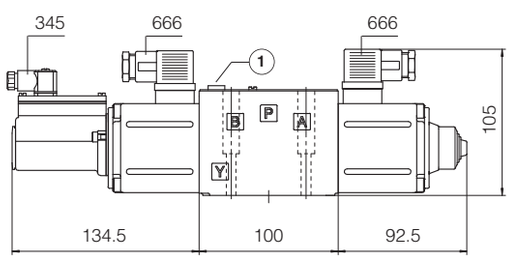
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface 4401-05-05-0-05 without X port)

Mass [kg]	
DKZOR-T-15	3,8
DKZOR-T-17	4,5

DKZOR-T-15



DKZOR-T-17



① = Air bleeding  4  13

Note: for option /B the solenoid and the LVDT transducer are at side of port A

13 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics
FS900	Operating and maintenance information for proportional valves
GS230	E-BM-TEB digital driver
GS235	E-BM-TID digital driver
GS240	E-BM-TES digital driver
GS500	Programming tools
GS510	Fieldbus
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves