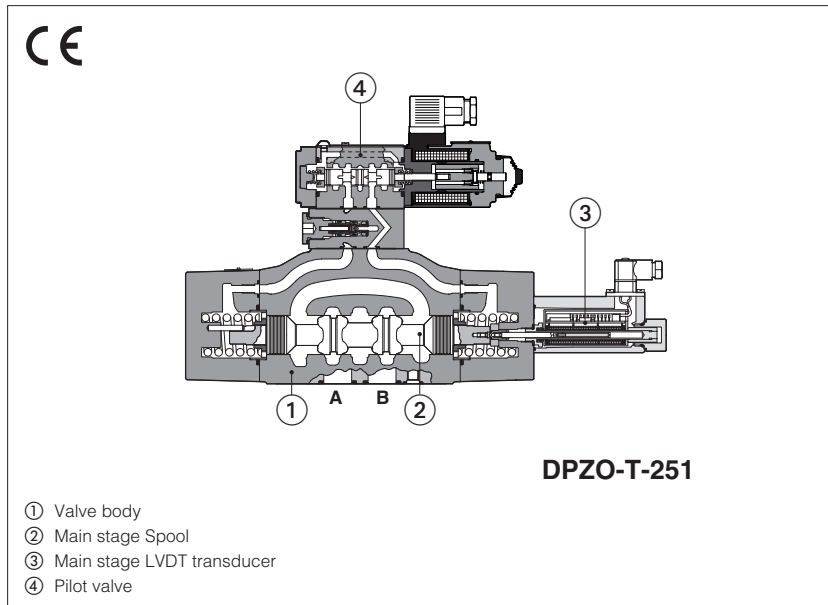


Proportional directional valves

piloted, with LVDT transducer and positive spool overlap



DPZO-T

Proportional directional valves, piloted, with LVDT position transducer (main stage) and positive spool overlap for directional controls and not compensated flow regulations.

The valves operate in association with digital off-board drivers, see section [3].

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 and DL = differential-progressive, for control of actuators with area ratio 1:2

D9 and L9 = for regenerative circuit

Size: 10 ÷ 32 - ISO 4401

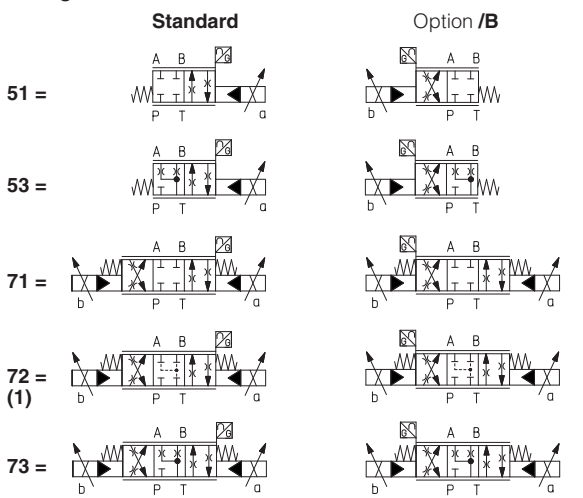
Max flow: 180 ÷ 1600 l/min

Max pressure: 350 bar

1 MODEL CODE OF STANDARD SPOOLS

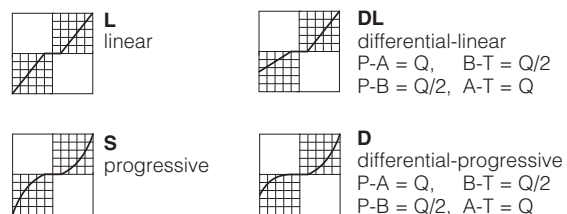
DPZO	-	T	-	2		71	-	L		5	/	*		*	/	*
<p>Proportional directional valve, piloted</p> <p>T = with LVDT transducer</p> <p>Valve size ISO 4401: 1 = 10 2 = 16 4 = 25 6 = 32</p> <p>Seals material, see section [7]: - = NBR PE = FKM BT = HNBR</p> <p>Series number</p> <p>Hydraulic options (3): B = solenoid and LVDT transducer at side of port A of the main stage (side B of pilot valve) D = internal drain E = external pilot pressure</p>																

Configuration:



Spool size:	3	5	5	5
Spool type:	L, S, D	L, DL, S, D	L, S, D	L, S
Configuration:	51,53,71,73	51,53,71,73	51,53,71,73	72
DPZO-1 =	-	100	-	-
DPZO-2 =	160	250	-	250
DPZO-4 =	-	480	-	480
DPZO-6 =	-	-	640	-
Nominal flow (l/min) at Δp 10 bar P-T				

Spool type, regulating characteristics (2):



(1) Only for DPZO sizes 2 and 4 with spools L5 or S5: in central position the leakages P-A and P-B are drained to tank, avoiding the drift of cylinders with differential areas

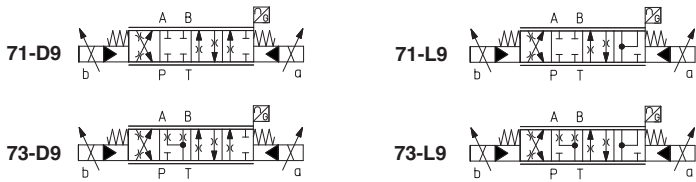
(2) Spools for regenerative circuit, see section [2]

(3) All combination possible

2 MODEL CODE OF SPOOLS FOR REGENERATIVE CIRCUIT - for valve model code and options, see section **1**

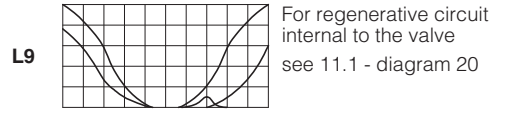
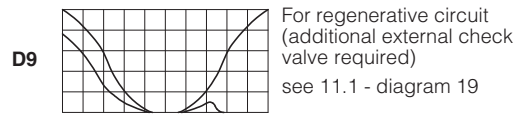
DPZO - **T** - **2** **71 - L9** / * * *

Configuration and spool:



Spool size:	D9	L9
DPZO-1 =	100	-
DPZO-2 =	250	250
DPZO-4 =	480	-

Nominal flow (l/min) at Δp 10bar P-T



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: $R_a \leq 0,8$, recommended $R_a 0,4$ – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	Standard = $-20^\circ\text{C} \div +60^\circ\text{C}$ /PE option = $-20^\circ\text{C} \div +60^\circ\text{C}$ /BT option = $-40^\circ\text{C} \div +60^\circ\text{C}$
Storage 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 = $-40^\circ\text{C} \div +70^\circ\text{C}$
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	DPZO-T-1	DPZO-T-2	DPZO-T-4	DPZO-T-6
Pressure limits [bar]	ports P, A, B, X = 350; T = 250 (10 for option /D); Y = 10;			
Spool type	standard	L5, DL5, S5, D5	L3, S3, D3	L5, DL5, S5, D5
	regenerative	D9		D9, L9
Nominal flow Δp P-T (1) [l/min]	$\Delta p = 10$ bar	100	160	250
	$\Delta p = 30$ bar	160	270	430
	Max permissible flow	180	400	550
				1000
Piloting pressure [bar]	min. = 25; max = 350			
Piloting volume [cm³]	1,4	3,7	9,0	21,6
Piloting flow (2) [l/min]	1,7	3,7	6,8	14,4
Leakage (3)	Pilot [cm³]	100 / 300	100 / 300	200 / 500
	Main stage [l/min]	0,15 / 0,5	0,2 / 0,6	0,3 / 1,0
Response time (4) [ms]	≤ 60	≤ 75	≤ 90	≤ 120
Hysteresis	≤ 1 [% of max regulation]			
Repeatability	$\pm 0,5$ [% of max regulation]			
Thermal drift	zero point displacement < 1% at $\Delta T = 40^\circ\text{C}$			

(1) For different Δp , the max flow is in accordance to the diagrams in section 8.2

(2) With step reference input signal 0 ÷ 100 %

(3) At $p = 100/350$ bar

(4) 0-100% step signal see detailed diagrams in section 8.3

6 ELECTRICAL CHARACTERISTICS

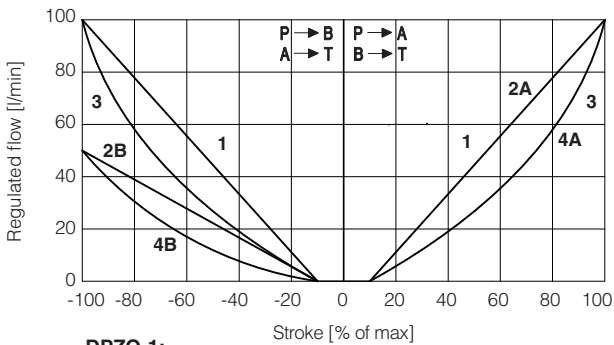
Max power consumption	30 W
Max. solenoid current	2,6 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating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

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

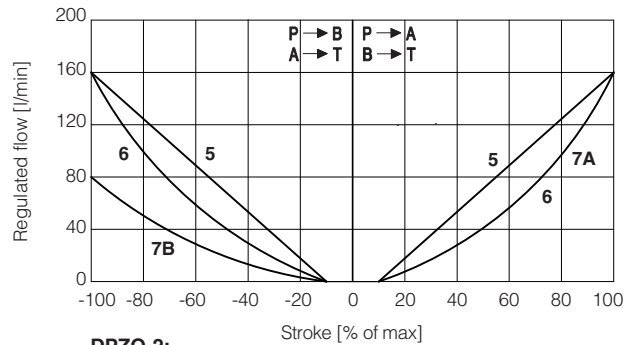
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation longer life	ISO4406 class 18/16/13 NAS1638 class 7 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	

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

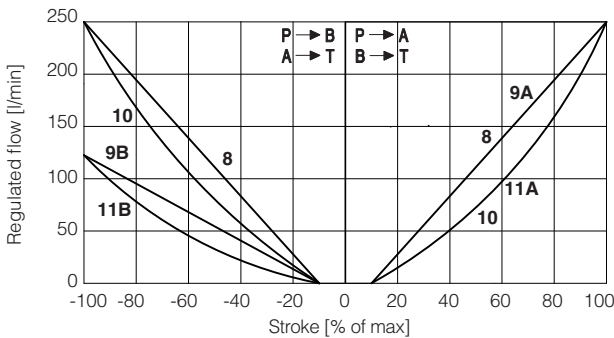
8.1 Regulation diagrams (values measure at p 10 bar P-T)



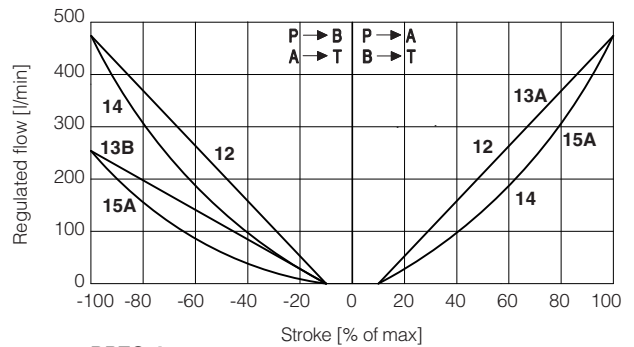
DPZO-1:
1 = L5 **2A** = DL5 (P → A, A → T) **4A** = D5 (P → A, A → T)
3 = S5 **2B** = DL5 (P → B, B → T) **4B** = D5 (P → B, B → T)



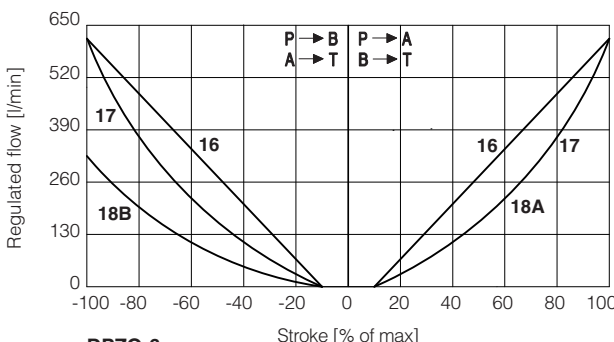
DPZO-2:
5 = L3 **7A** = D3 (P → A, A → T)
6 = S3 **7B** = D3 (P → B, B → T)



DPZO-2:
8 = L5 **9A** = DL5 (P → A, A → T) **11A** = D5 (P → A, A → T)
10 = S5 **9B** = DL5 (P → B, B → T) **11B** = D5 (P → B, B → T)



DPZO-4:
12=L5 **13A**=DL5 (P → A, A → T) **15A**=D5 (P → A, A → T)
14=S5 **13B**=DL5 (P → B, B → T) **15B**=D5 (P → B, B → T)



DPZO-6:
16 = L5 **18A** = D5 (P → A, A → T)
17 = S5 **18B** = D5 (P → B, B → T)

Note:

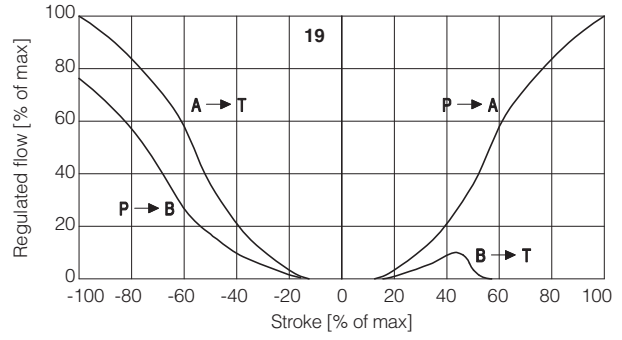
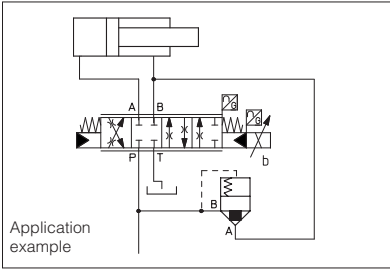
Hydraulic configuration vs. reference signal (standard and option /B)

Reference signal $\left. \begin{matrix} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{matrix} \right\} P \rightarrow A / B \rightarrow T$

Reference signal $\left. \begin{matrix} 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{matrix} \right\} P \rightarrow B / A \rightarrow T$

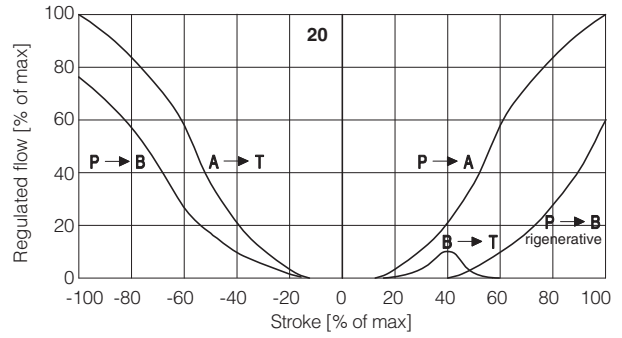
19 = differential - regenerative spool **D9**
(not available for valve size 32)

D9 spool type with a fourth position specific to regenerative circuit, performed by means of an additional external check valve.



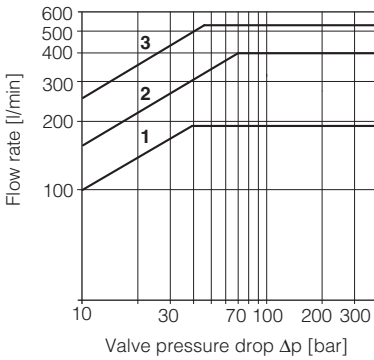
20 = linear - internal regenerative spool **L9**
(available only for valve size 16)

L9 spool type with a fourth position specific to perform a regenerative circuit internal to the valve.



8.2 Operating diagrams

Flow / Δp diagram stated at 100% of spool stroke



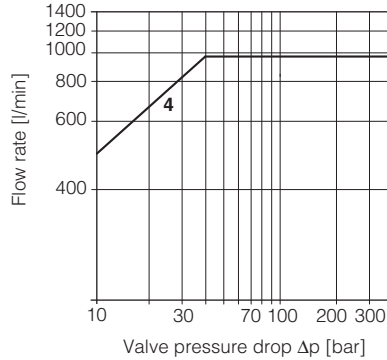
DPZO-1:

1 = spools L5, S5, D5, DL5, D9

DPZO-2:

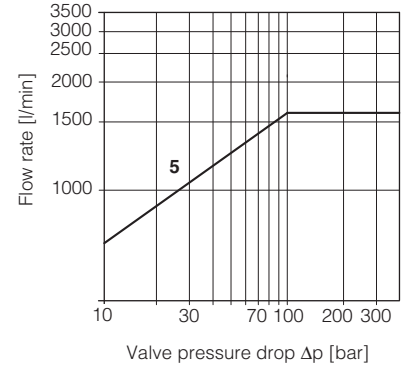
2 = spools L3, S3, D3

3 = spools L5, S5, D5, DL5, D9, L9



DPZO-4:

4 = spools L5, S5, D5, DL5, D9



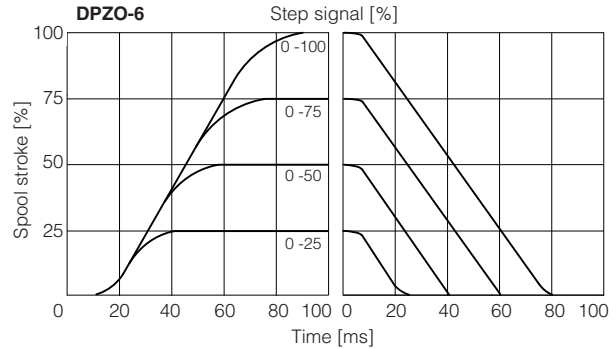
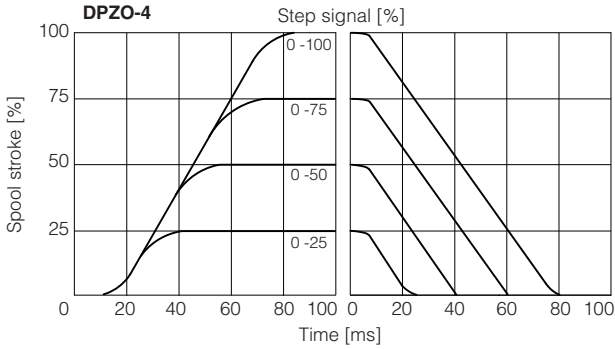
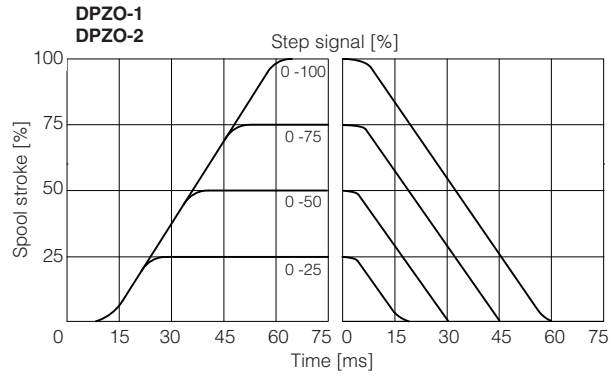
DPZO-6:

6 = L5, S5, D5

8.3 Response time

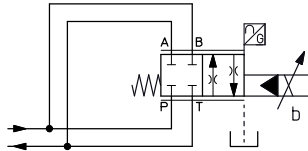
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values.

For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



8.4 Operation as throttle valve

Single solenoid valves (*51) can be used as simple throttle valves:
Pmax = 250 bar



DPZO-*	151-L5	251-L5	451-L5	651-L5
Max flow [l/min]	320	860	1600	2200
$\Delta p = 15$ bar				

9 HYDRAULIC OPTIONS

B = Solenoid and LVDT transducer at side of port A of the main stage (side B of pilot valve). For hydraulic configuration vs reference signal, see 8.1

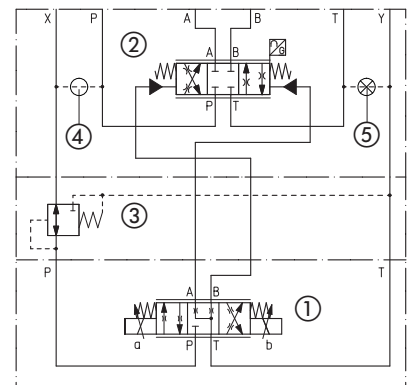
D = Internal drain (through port T).

Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 11
The valve's standard configuration provides internal pilot and external drain.

E = External pilot (through port X).

Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 11
The valve's standard configuration provides internal pilot and external drain.

Functional Scheme - example of configuration 71



- ① Pilot valve
- ② Main stage
- ③ Pressure reducing valve
- ④ Plug to be added for external pilot trough port X
- ⑤ Plug to be removed for internal drain through port T

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 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain

DPZO-1	Pilot channels	Drain channels	<p>Internal piloting: blinded plug SP-X300F ① in X; External piloting: blinded plug SP-X300F ② in Pp; Internal drain: blinded plug SP-X300F ③ in Y; External drain: blinded plug SP-X300F ④ in Dr.</p>
DPZO-2	Pilot channels	Drain channels	<p>Internal piloting: Without blinded plug SP-X300F ①; External piloting: Add blinded plug SP-X300F ①; Internal drain: Without blinded plug SP-X300F ②; External drain: Add blinded plug SP-X300F ②.</p>
DPZO-4	Pilot channels	Drain channels	<p>Internal piloting: Without blinded plug SP-X500F ①; External piloting: Add blinded plug SP-X500F ①; Internal drain: Without blinded plug SP-X300F ②; External drain: Add blinded plug SP-X300F ②.</p>
DPZO-6	Pilot channels	Drain channels	<p>Internal piloting: Without plug ①; External piloting: Add DIN-908 M16x1,5 in pos ①; Internal drain: Without blinded plug SP-X300F ③; External drain: Add blinded plug SP-X300F ③.</p>

12 FASTENING BOLTS AND SEALS

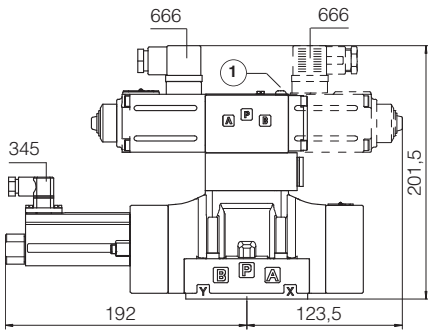
Type	Size	Fastening bolts	Seals
DPZO	1 = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050 Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112 Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	6 = 32	6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm	4 OR 144 Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)

13 INSTALLATION DIMENSIONS [mm]

DPZO-T-1 (dotted line = double solenoid version)

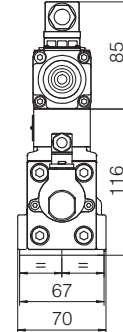
ISO 4401: 2005

Mounting surface: 4401-05-05-0-05 (see table P005)



① = Air bleeding  3

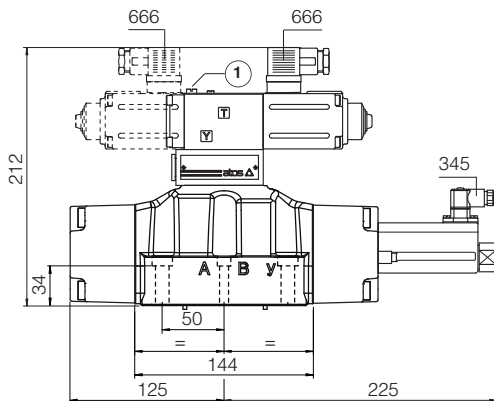
Mass [kg]	
DPZO-T-15	8,5
DPZO-T-17	9,4



DPZO-T-2 (dotted line = double solenoid version)

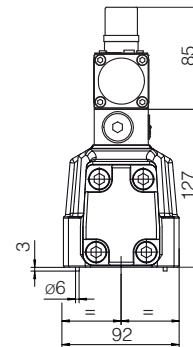
ISO 4401: 2005

Mounting surface: 4401-07-07-0-05 (see table P005)



① = Air bleeding  3

Mass [kg]	
DPZO-T-25	13,5
DPZO-T-27	14,4

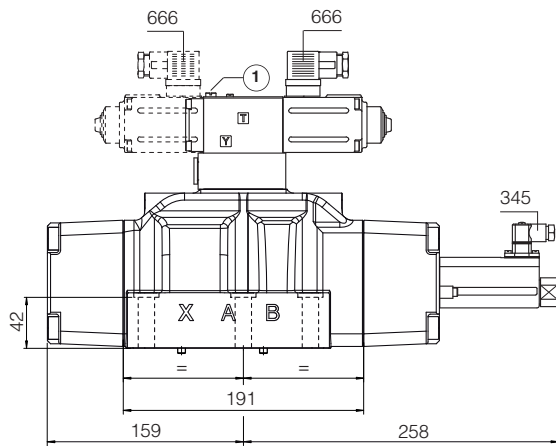


Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid and the LVDT transducer are at side of port A of the main stage

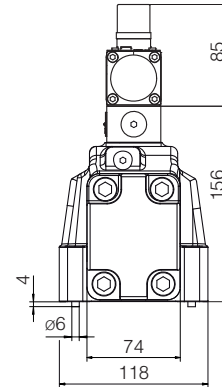
DPZO-T-4 (dotted line = double solenoid version)

ISO 4401: 2005

Mounting surface: 4401-08-08-0-05 (see table P005)



Mass [kg]	
DPZO-T-45	17,6
DPZO-T-47	18,5

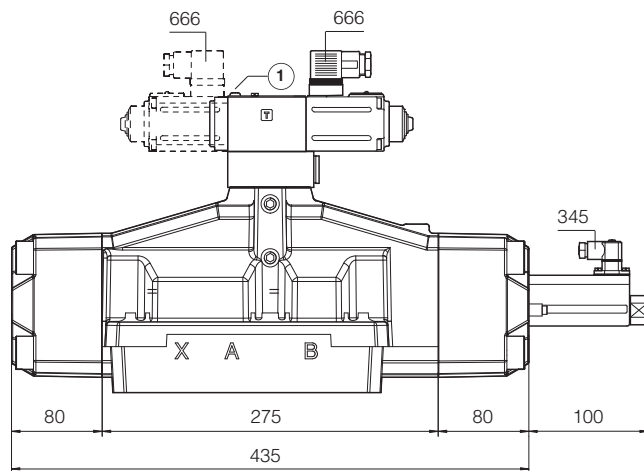


① = Air bleeding 

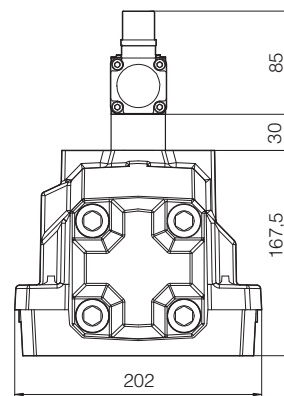
DPZO-T-6 (dotted line = double solenoid version)

ISO 4401: 2005

Mounting surface: 4401-10-09-0-05 (see table P005)



Mass [kg]	
DPZO-T-65	42,3
DPZO-T-67	43,1



① = Air bleeding 

Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid and the LVDT transducer are at side of port A of the main stage

14 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-TEB digital driver

GS500 Programming tools
GS510 Fieldbus
K800 Electric and electronic connectors
P005 Mounting surfaces for electrohydraulic valves