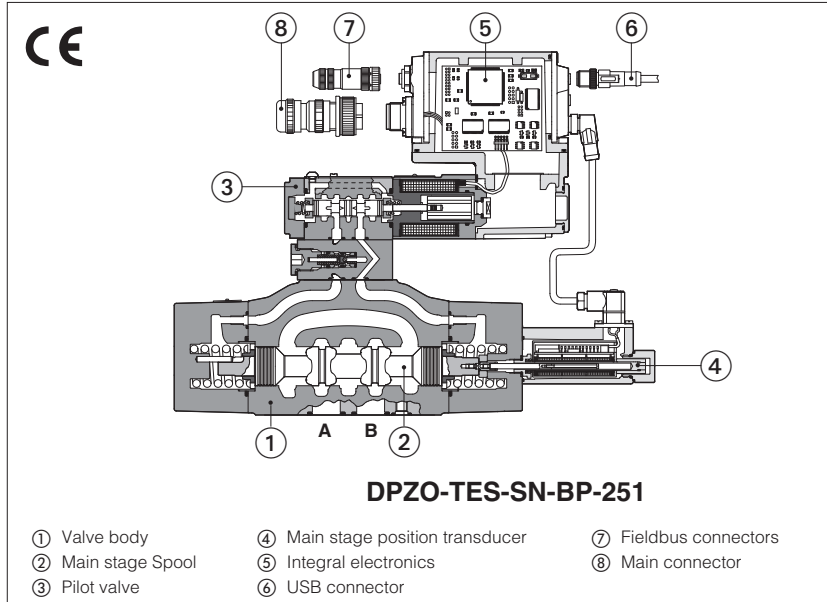


Two stage proportional directional valves

digital, with position transducers and **positive spool overlap**



DPZO-TEB, DPZO-TEs

Two stage digital proportional valves specifically designed for directional and speed controls.

They are equipped with main stage LVDT position transducer and positive spool overlap for best dynamics in directional controls and not compensated flow regulations.

The integral digital electronic driver performs the valve's hydraulic regulation according to the reference signal and assures valve-to-valve interchangeability thanks to the factory presetting.

The valves are available in TEB basic execution with analog reference signals and USB port for software functional parameters setting or in TES full execution which includes also optional fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

Size: **10 to 32**
 Max flow: **180 to 1600 l/min**
 Max pressure: **350 bar**

1 MODEL CODE for STANDARD SPOOLS

DPZO	-	T	-	ES	-	SN	-	NP	-	2	-	71	-	L	/	5	/	*	/	*	/	*
<p>Two stage proportional directional valve</p> <p>T = closed-loop one LVDT transducer</p> <p>Integral digital drivers: EB = basic (1) ES = full</p> <p>Alternated P/Q controls SN = none</p> <p>Fieldbus interfaces USB port always present: NP = Not present (1) BP = PROFIBUS DP BC = CANopen EH = EtherCAT</p> <p>Valve size ISO 4401: 1 = 10 2 = 16 4 = 25 6 = 32</p>																						
<p>Seals material, see sect. 5, 6: - = NBR PE = FKM BT = HNBR</p> <p>Series number</p>																						

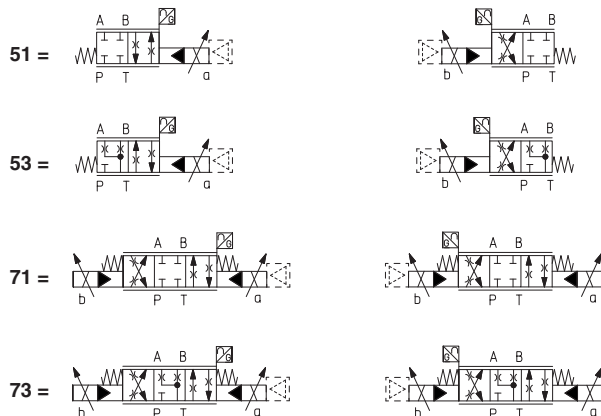
Hydraulic options, see section 9:
B = solenoid, integral electronics and position transducer at side of port A of the main stage
D = internal drain
E = external pilot (through port X)

Electronic options, see sections 11
I = current reference input and monitor 4÷20 mA (omit for standard voltage reference input and monitor ±10 V)
F = fault signal
Q = enable signal
Z = double power supply, enable, fault and monitor signals (12 pin connector) (2)

Configuration:

Standard

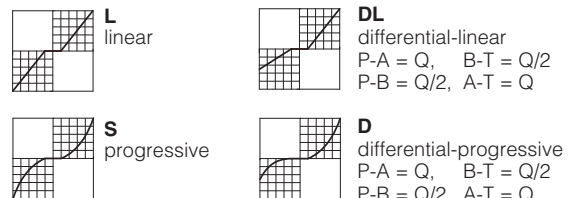
Option /B



Spool size	3 (L,S,D)	5 (L,DL,S,D)	5 (L,S,D)
DPZO-1	-	100	-
DPZO-2	160	250	-
DPZO-4	-	480	-
DPZO-6	-	-	640

Nominal flow (l/min) at Δp 10bar P-T

Spool type - regulating characteristics:



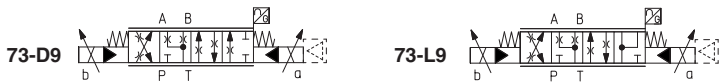
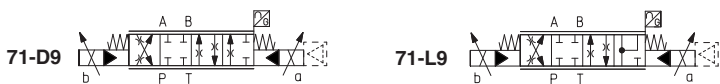
(1) TEB basic execution available only in version **SN-NP**

(2) double power supply only for **TES**

2 MODEL CODE for SPECIAL SPOOLS - refer to section 1 for valve model code and options

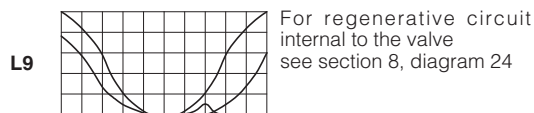
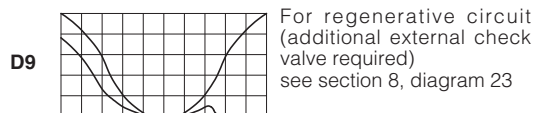
DPZO - **T** **ES** - **SN** - **NP** - **2** **71 - L9** / * / * / *

Configuration, spool type and size:



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

Nominal flow (l/min) at Δp 10bar P-T



3 GENERAL NOTES

DPZO-TEB, TES proportional valves are CE marked according to the applicable Directives (e.g. Immunity/Emission EMC Directive and Low Voltage Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in table F003 and in the installation notes supplied with relevant components. The electrical signals of the valve (e.g. monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

WARNING

To avoid overheating and possible damage of the electronic driver, the valves must be never energized without hydraulic supply to the pilot stage. In case of prolonged pauses of the valve operation during the machine cycle, it is always advisable to disable the driver (option /Q or /Z). A safety fuse 2,5 A installed on 24VDC power supply of each valve is always recommended, see also Power supply note at sections 11

4 FIELDBUS - only for **TES**

Fieldbus allows the direct communication of the proportional valve with machine control unit for digital reference signal, diagnostics and settings of functional parameters. Analog reference signal remain available on the main connector for quick commissioning and maintenance. For detailed information about fieldbus features and specification see tech table **GS510**.

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

Assembly position	Any position			
Subplate surface finishing	Roughness index, Ra 0,4 flatness ratio 0,01/100 (ISO 1101)			
MTTFd valves according to EN ISO 13849	75 years, see technical table P007			
Ambient temperature range	standard execution = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C			
Storage temperature range	Standard execution = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Max. solenoid current	2,6 A			
Max. power	50 Watt			
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	IP66/67			
Tropicalization	Tropical coating on electronics PCB			
Duty factor	Continuous rating (ED=100%)			
EMC, climate and mechanical load	See technical table G004			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT IEC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Valve model	DPZO-*-1	DPZO-*-2	DPZO-*-4	DPZO-*-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	L5, S5, D5
	special D9		D9, L9	D9
Nominal flow (1) [l/min]				
Δp = 10 bar	100	160	250	480
Δp = 30 bar	160	270	430	830
Max permissible flow [l/min]	180	400	550	1000
Piloting pressure [bar]	min. = 25; max = 350 (option /G advisable for pilot pressure > 200 bar)			
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	900/2800
Main stage [l/min]	0,15/0,5	0,2/0,6	0,3/1,0	1,0/3,0
Response time (4) [ms]	< 60	< 75	< 80	< 120
Hysteresis	≤ 0,1 [% of max regulation]			
Repeatability	± 0,1 [% of max regulation]			
Thermal drift	zero point displacement < 1% at ΔT = 40°C			

Notes:

above performance data refer to valves coupled with Atos electronic drivers, see section 8.

(1) for different Δp, see section 9.2 (2) with step reference input signal 0 ÷ 100 % (3) at p = 100/350 bar (4) see detailed diagrams in section 8.3

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

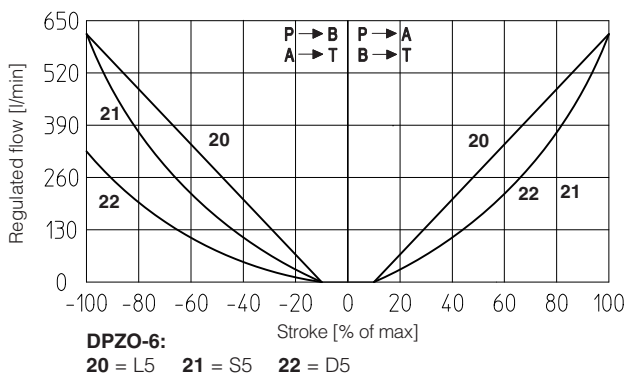
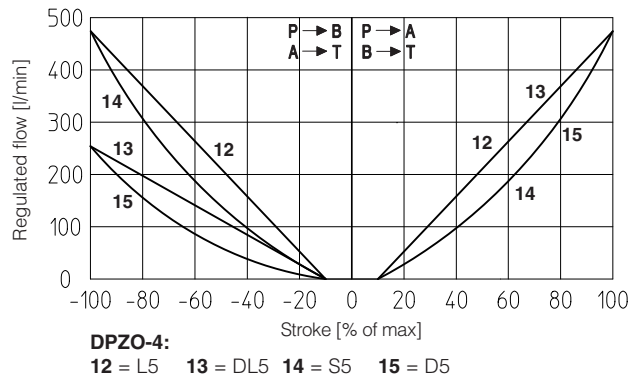
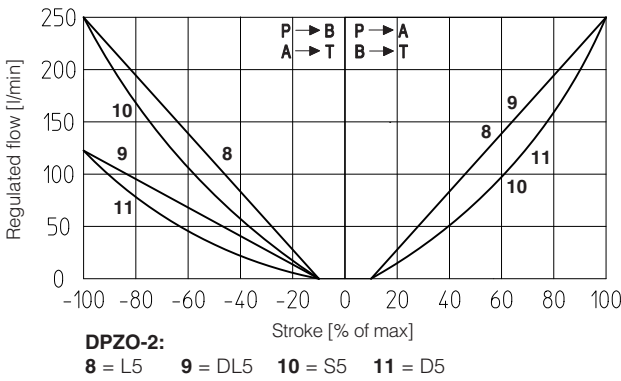
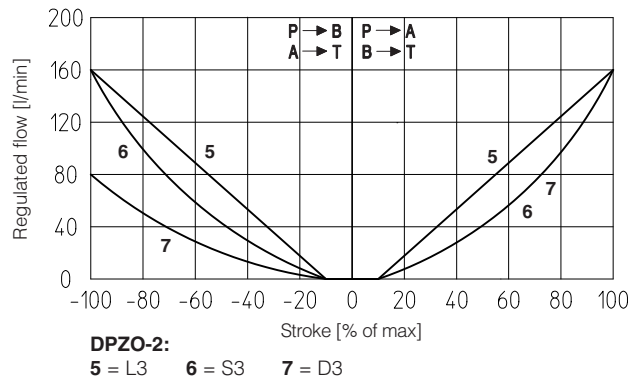
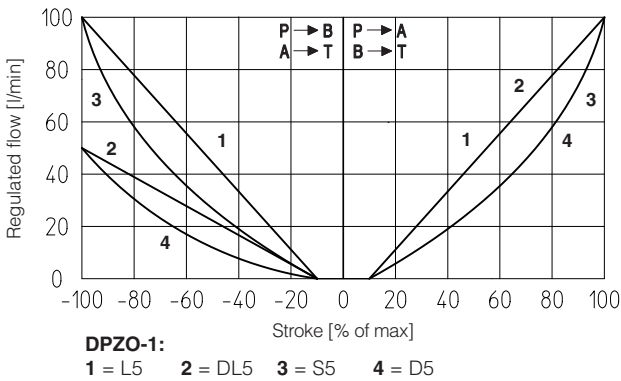
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Fluid contamination class	ISO 4406 class 20/18/15 NAS 1638 class 9, in line filters of 10 µm (β10 ≥75 recommended)		
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	

7 ELECTRONIC DRIVERS - for main and communication connector see sections **13**, **14**

Valve model	TEB	TES
Drivers model	E-RI-TEB-N	E-RI-TES-N
Type	Digital	
Format	Integral to valve	
Data sheet	GS208	GS210

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

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



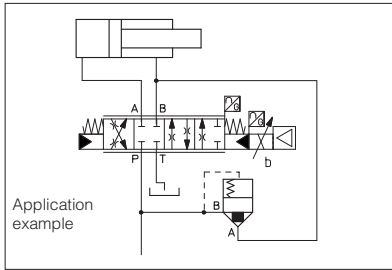
Note:

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

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

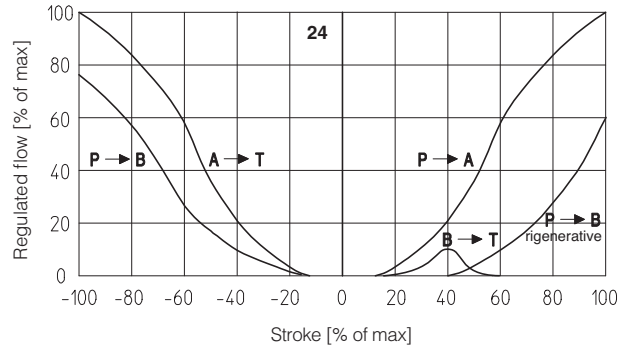
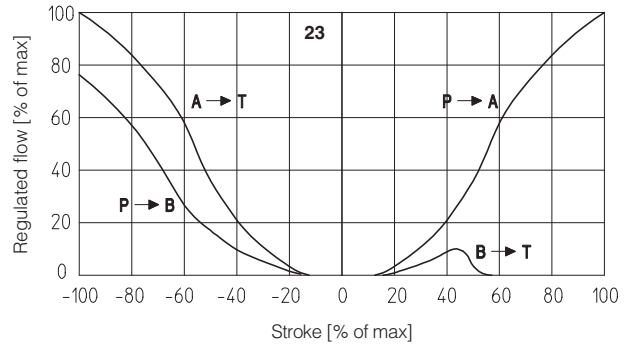
23 = differential - regenerative spool **D9**
(not available for valve size 32 and 35)

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



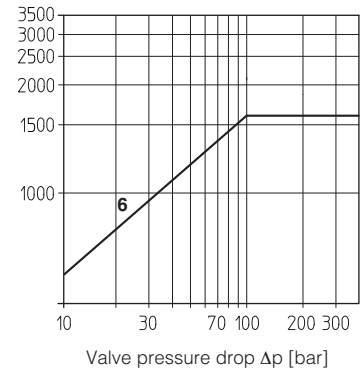
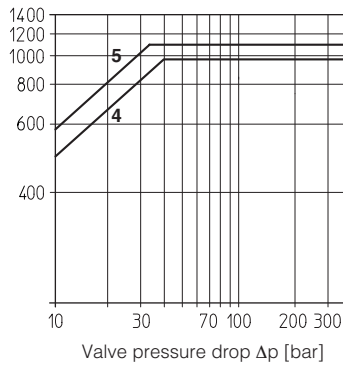
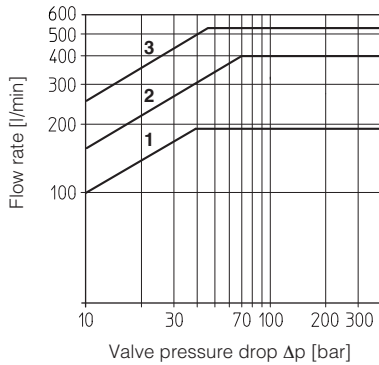
24 = linear - internal regenerative spool **L9**
(available only for valve size 16)

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-4M:

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

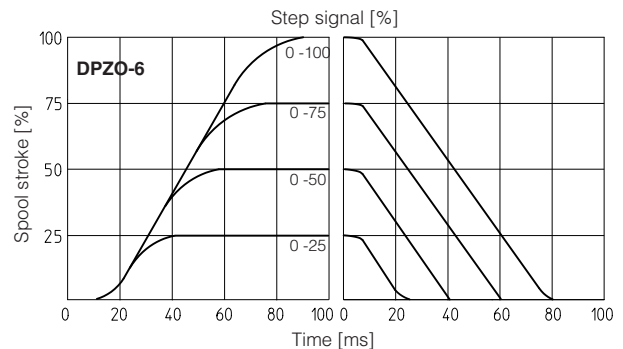
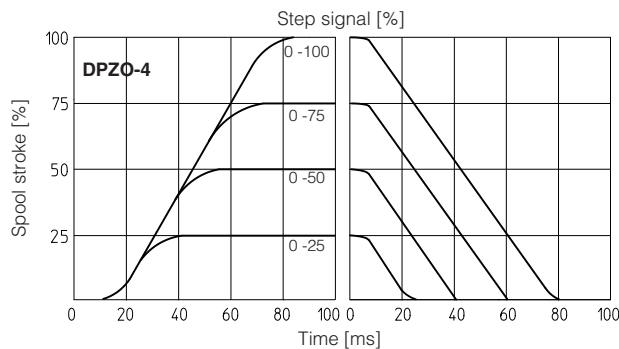
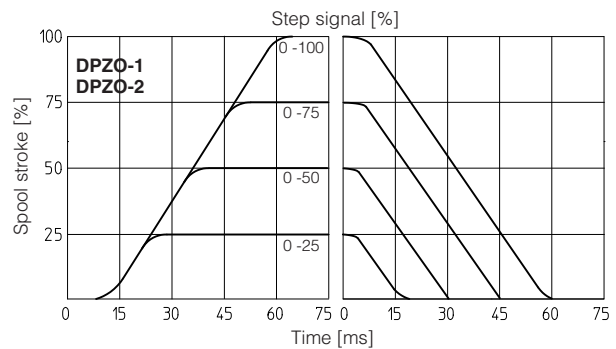
DPZO-6:

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.



9 HYDRAULIC OPTIONS

9.1 Option /B

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

9.2 Pilot and drain configuration

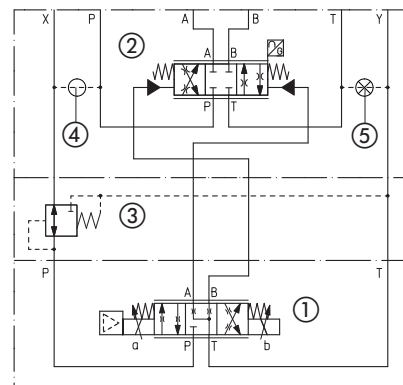
The pilot / drain configuration can be modified as shown in the functional scheme here aside, for detailed view of plugs position, see section 15
The valve's standard configuration provides internal pilot and external drain.

For different pilot / drain configuration select:

Option /E External pilot (through port X)

Option /D Internal drain (through port T)

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 ELECTRONIC OPTIONS

Standard driver execution provides on the 7 pin main connector:

Power supply - 24 VDC must be appropriately stabilized or rectified and filtered; a 2,5 A safety fuse is required in series to each driver power supply Apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers

Reference input signal - analog differential input with ± 10 VDC nominal range (pin D, E), proportional to desired valve spool position

Monitor output signal - analog output signal proportional to the actual valve's spool position with ± 10 VDC nominal range

A minimum time of 300 to 500 ms have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10.1 Option /F

It provides a Fault output signal in place of the Monitor output signal, to indicate fault conditions of the driver (cable interruption of spool transducers or reference signal - for /I option): Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC

10.2 Option /I

It provides 4 \div 20 mA current reference and monitor signals, instead of the standard ± 10 V.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 V or ± 20 mA.

It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

10.3 Option /Q

It provides the possibility to enable or disable the valve functioning without cutting the power supply (the valve functioning is disabled but the driver current output stage is still active). To enable the driver supply a 24 VDC on the enable input signal.

10.4 Option /Z

It provides, on the 12 pin main connector, the following additional features:

Enable Input Signal

To enable the driver, supply 24 VDC on pin 3 referred to pin 2: when the Enable signal is set to zero the valve functioning is disabled (zero current to the solenoid) but the driver current output stage is still active.

Fault Output Signal

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4+20mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24VDC (pin 11 referred to pin 2): Fault status is not affected by the Enable input signal

Power supply for driver's logics and communication - only for TES

Separated power supply for the solenoid (pin 1, 2) and for the digital electronic circuits (pin 9, 10).

Cutting solenoid power supply allows to interrupt the valve functioning but keeping energized the digital electronics thus avoiding fault conditions of the machine fieldbus controller. This condition aids to realize safety systems in compliance with European Norms EN13849-1 (ex EN954-1).

10.5 Possible combined options

/F/, /IQ and /IZ

11 ELECTRONIC CONNECTIONS AND LEDS

11.1 Main connector signal - 7 pin - standard, /F and /Q options (A1)

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	V+			Power supply 24 Vdc	Input - power supply
B	V0			Power supply 0 Vdc	Gnd - power supply
C	AGND		AGND	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 Vdc) or disable (0 Vdc) the valve, referred to V0	Input - on/off signal
D	Q_INPUT+			Flow reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
E	INPUT-			Negative reference input signal for Q_INPUT+	Input - analog signal
F	Q_MONITOR referred to: AGND V0			Flow monitor output signal: ± 10 Vdc / ± 20 mA maximum range Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Output - analog signal Software selectable
			FAULT	Fault (0 Vdc) or normal working (24 Vdc)	Output - on/off signal
G	EARTH			Internally connected to the driver housing	

11.2 Main connector signal - 12 pin - /Z option (A2)

PIN	TEB-SN /Z	TES-SN /Z	TECHNICAL SPECIFICATIONS	NOTES
	V+		Power supply 24 Vdc	Input - power supply
1	V0		Power supply 0 Vdc	Gnd - power supply
2	ENABLE referred to: V0		Enable (24 Vdc) or disable (0 Vdc) the valve	Input - on/off signal
3		VL0		
4	Q_INPUT+		Flow reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
5	INPUT-		Negative reference input signal for Q_INPUT+	Input - analog signal
6	Q_MONITOR referred to: AGND	VL0	Flow monitor output signal: ± 10 Vdc / ± 20 mA maximum range Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
	AGND			
7		NC	Do not connect	Gnd - analog signal
	R_ENABLE		Repeat enable, output repeter signal of enable input, referred to V0	
8		NC	Do not connect	Output - on/off signal
	NC		Do not connect	
9		VL+	Power supply 24 Vdc for driver's logic and communication	Input - power supply
	NC		Do not connect	
10		VL0	Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
	FAULT referred to: V0	VL0	Fault (0 Vdc) or normal working (24 Vdc)	Output - on/off signal
11 PE	EARTH		Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

11.3 Communications connectors (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Supply for external USB Flash Drive
2	ID	USB Flash Drive identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) (C2) BC fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	not used	(C1) - (C2) pass-through connection (2)
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

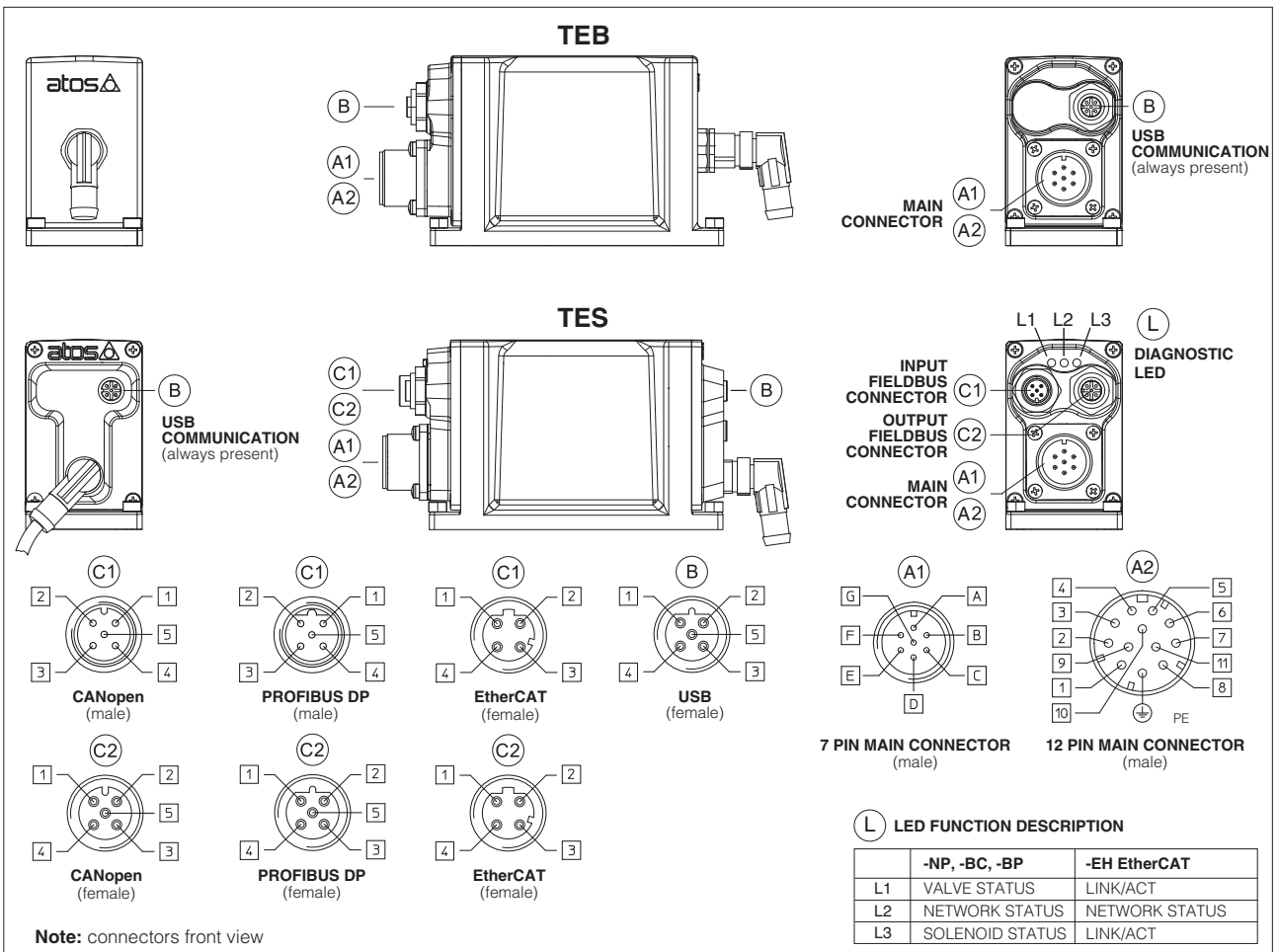
(C1) (C2) BP fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C1) (C2) EH fieldbus execution, connector - M12 - 4 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

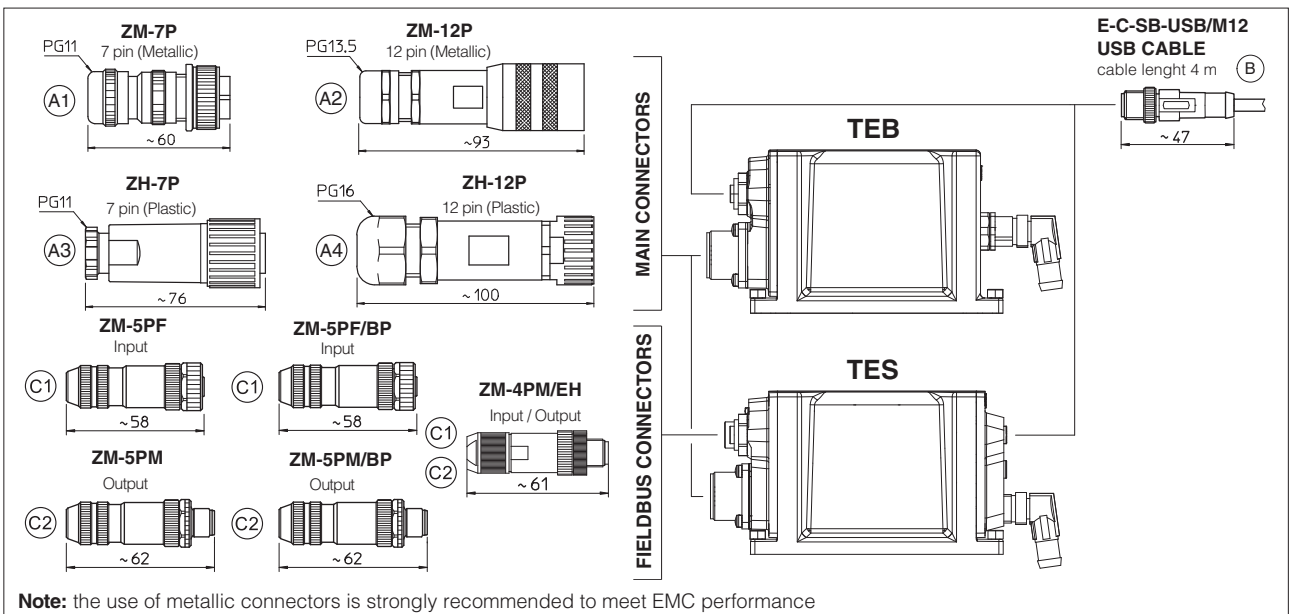
Notes: (1) shield connection on connector's housing is recommended

(2): pin 2 can be fed with external +5V supply of CAN interface

11.4 Connections layout



11 CONNECTORS



13 MODEL CODES OF MAIN CONNECTORS AND COMMUNICATION CONNECTORS - to be ordered separately

VALVE VERSION	TEB TES	TEB /Z TES /Z	CANopen (BC)	PROFIBUS DP (BP)	EtherCat (EH)
CONNECTOR CODE	ZM-7P (A1)	ZM-12P (A2)	ZM-5PF (C1)	ZM-5PF/BP (C1)	ZM-4PM/EH (C1)
	ZH-7P (A3)	ZH-12P (A4)	ZM-5PM (C2)	ZM-5PM/BP (C2)	ZM-4PM/EH (C2)
PROTECTION DEGREE	IP67				
DATA SHEET	GS208, GS210, K500				

only for TES

14 PROGRAMMING TOOLS - see table **GS500**



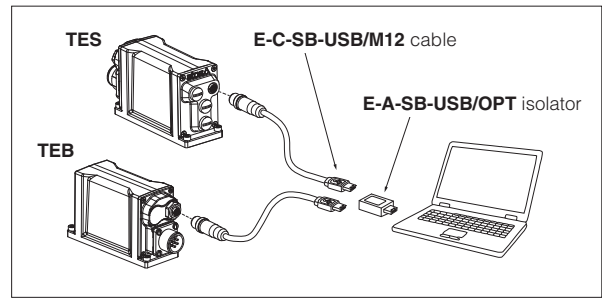
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB communication port to the digital driver. E-SW software is available in different versions according to the driver's fieldbus interface:
 NP (not present) E-SW-PS, BC (CANopen) E-SW-BC, BP (PROFIBUS DP) E-SW-BP and EH (EtherCAT) E-SW-EH.

For fieldbus versions, E-SW software permits valve's parameterization through USB communication port also if the driver is connected to the central machine unit via fieldbus.

WARNING: drivers USB port is not isolated!

Use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection.

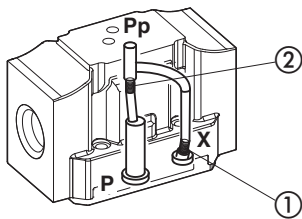
USB connection



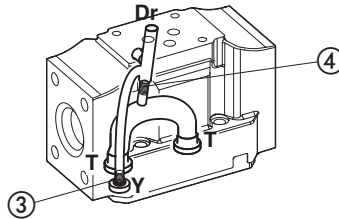
15 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

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

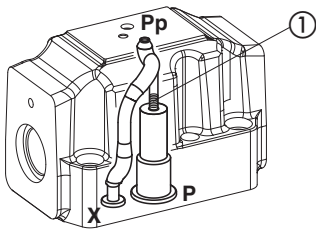


Drain channels

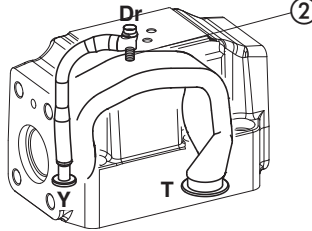


- Internal piloting:** blinded plug SP-X300F ① in X;
- External piloting:** blinded plug SP-X300F ② in Pp;
- Internal drain:** blinded plug SP-X300F ③ in Y;
- External drain:** blinded plug SP-X300F ④ in Dr.

DPZO-2 Pilot channels

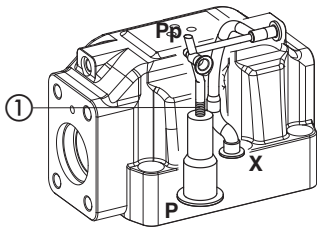


Drain channels

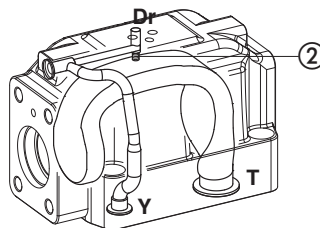


- Internal piloting:** Without blinded plug SP-X300F ①;
- External piloting:** Add blinded plug SP-X300F ①;
- Internal drain:** Without blinded plug SP-X300F ②;
- External drain:** Add blinded plug SP-X300F ②.

DPZO-4 Pilot channels

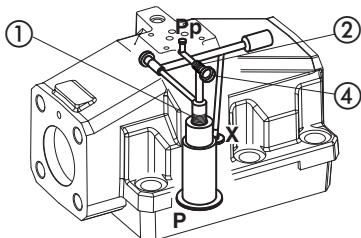


Drain channels

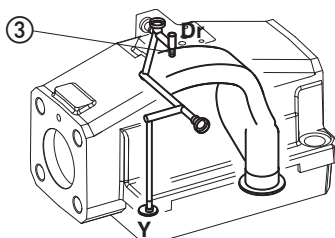


- Internal piloting:** Without blinded plug SP-X500F ①;
- External piloting:** Add blinded plug SP-X500F ①;
- Internal drain:** Without blinded plug SP-X300F ②;
- External drain:** Add blinded plug SP-X300F ②.

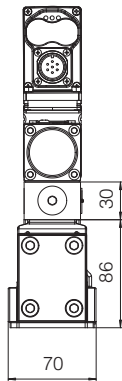
DPZO-6 Pilot channels



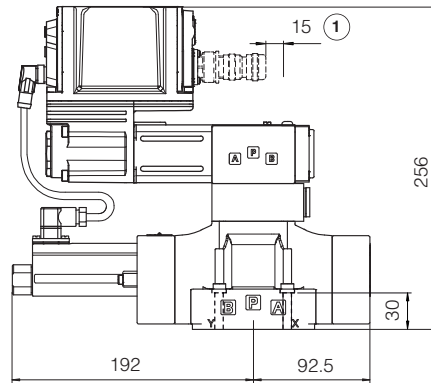
Drain channels



- 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.



DPZO-TEB*-15*
DPZO-TES*-15*



Mass 9 kg

DPZO-TEB*-17*
DPZO-TES*-17*

ISO 4401: 2005

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

(see table P005)

Fastening bolts:

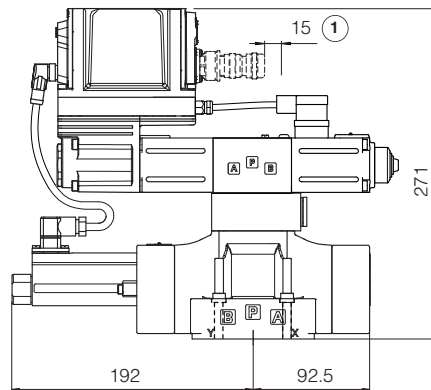
4 socket head screws M6x40 class 12.9

Tightening torque = 15 Nm

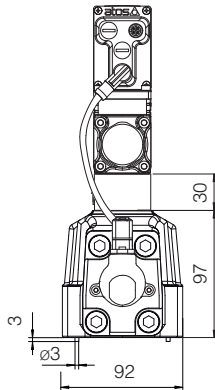
Seals: 5 OR 2050; 2 OR 108

Diameter of ports A, B, P, T: $\varnothing = 11$ mm;

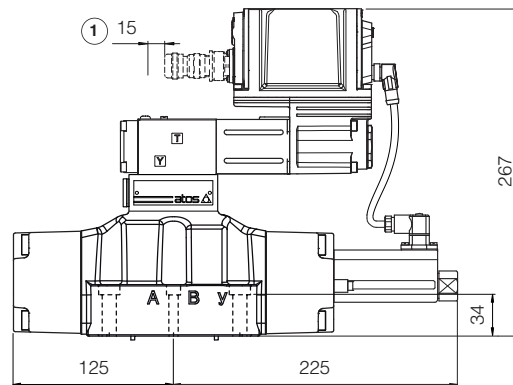
Diameter of ports X, Y: $\varnothing = 5$ mm;



Mass 9,8 kg



DPZO-TEB*-25*
DPZO-TES*-25*



Mass 14 kg

DPZO-TEB*-27*
DPZO-TES*-27*

ISO 4401: 2005

Mounting surface: 4401-07-07-0-05

(see table P005)

Fastening bolts:

4 socket head screws M10x50 class 12.9

Tightening torque = 70 Nm

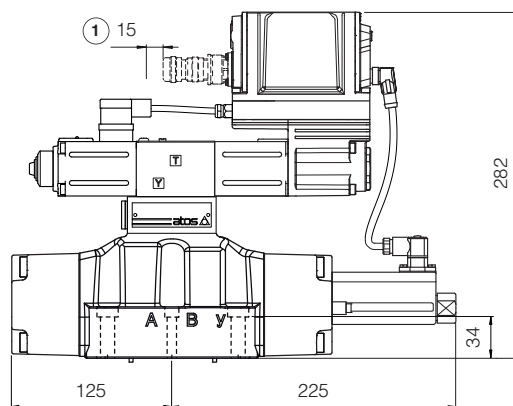
2 socket head screws M6x45 class 12.9

Tightening torque = 15 Nm

Seals: 4 OR 130; 2 OR 2043

Diameter of ports A, B, P, T: $\varnothing = 20$ mm;

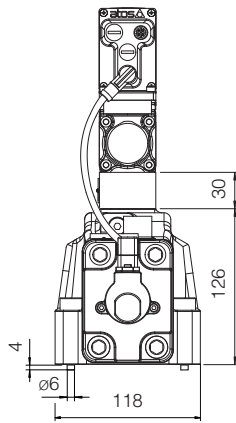
Diameter of ports X, Y: $\varnothing = 7$ mm;



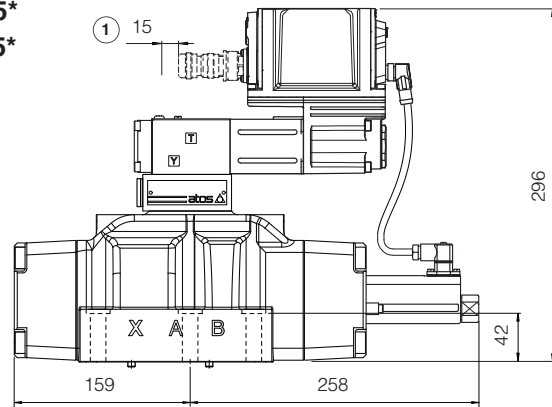
Mass 14,8 kg

① = Space to remove the 7 or 12 pin main connector

For main and communication connectors see section 13, 14



DPZO-TEB*-45*
DPZO-TES*-45*



Mass 18,5 kg

ISO 4401: 2005

Mounting surface: 4401-08-08-0-05

(see table P005)

Fastening bolts:

6 socket head screws M12x60 class 12.9

Tightening torque = 125 Nm

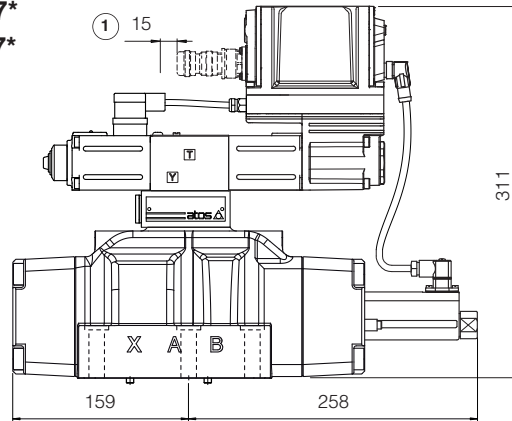
DPZO-4

Seals: 4 OR 4112; 2 OR 3056

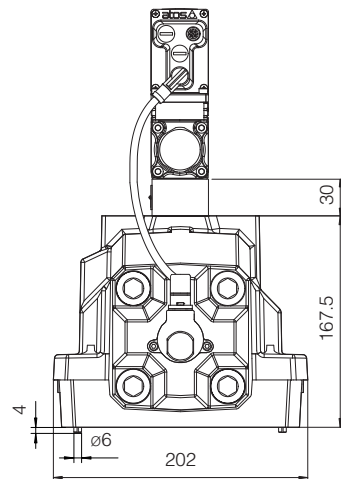
Diameter of ports A, B, P, T: $\varnothing = 24$ mm;

Diameter of ports X, Y: $\varnothing = 7$ mm;

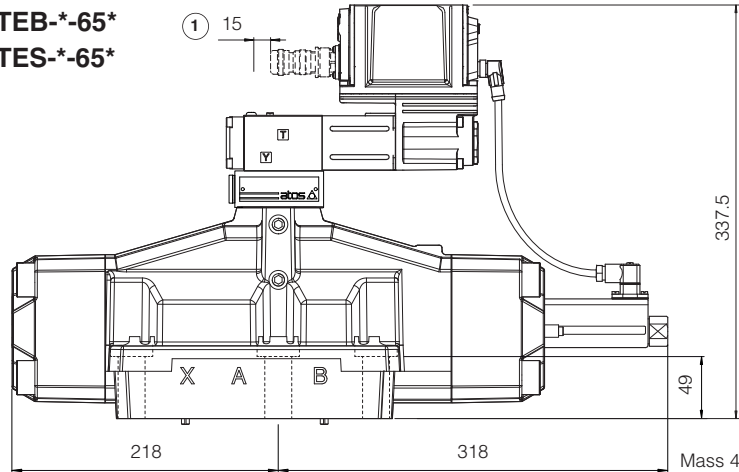
DPZO-TEB*-47*
DPZO-TES*-47*



Mass 19,3 kg



DPZO-TEB*-65*
DPZO-TES*-65*



Mass 42,5 kg

ISO 4401: 2005

Mounting surface: 4401-10-09-0-05

(see table P005)

Fastening bolts:

6 socket head screws M20x90 class 12.9

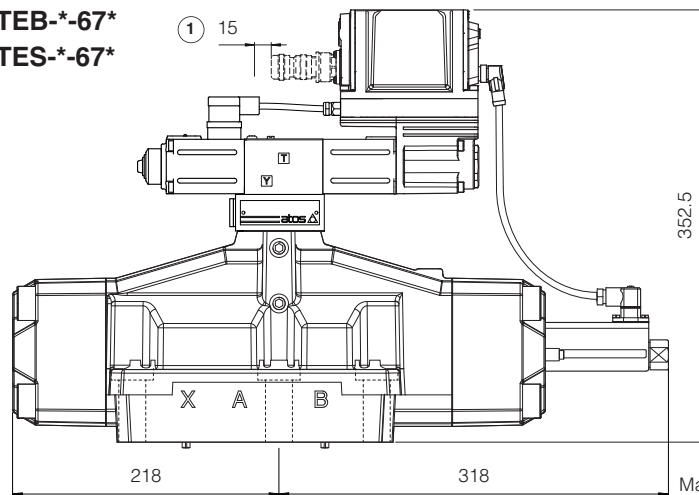
Tightening torque = 600 Nm

Diameter of ports A, B, P, T: $\varnothing = 34$ mm;

Diameter of ports X, Y: $\varnothing = 7$ mm;

Seals: 4 OR 144, 2 OR 3056

DPZO-TEB*-67*
DPZO-TES*-67*



Mass 43,3 kg

① = Space to remove the 7 or 12 pin main connector

For main and communication connectors see section 13, 14