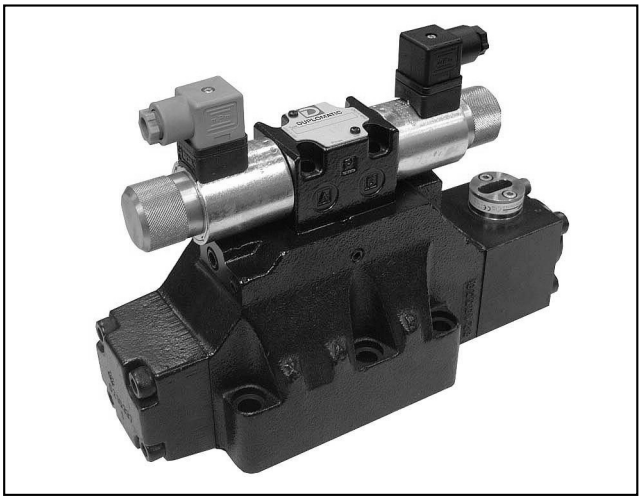
DUPLOMATIC
HYDRAULICS



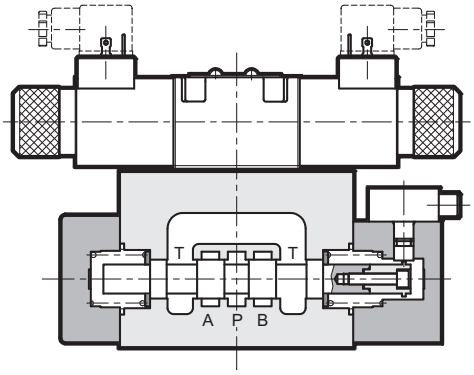
SOLENOID OPERATED DIRECTIONAL CONTROL VALVES WITH MONITORED SPOOLS

DS3M **ISO 4401-03** (CETOP 03)
DS5M **ISO 4401-05** (CETOP 05)
E4P4M **CETOP P05**
E07P4M **ISO 4401-07** (CETOP 07)
E5P4M **ISO 4401-08** (CETOP 08)

p max (see performances table)

Q max (see performances table)

OPERATING PRINCIPLE



— Solenoid operated directional control valves with monitored spools are supplied with an inductive proximity sensor signalling the valve spool position (the case of pilot operated directional control valves the main spool is monitored).

— In particular, the PNP sensor with closed contact signals the position of the spool at rest (de-energized solenoid valve) thus allowing, if connected to an electronic logic, to recognize the state of the directional control valve and to control the combined function (see paragraph 5.3).

— The valves of sizes ISO 4401-03 (CETOP 03) and ISO 4401-05 (CETOP 05) are direct operated while sizes CETOP P05, ISO 4401-07 (CETOP 07) and ISO 4401-08 (CETOP 08) are pilot operated.

— They are supplied with oil bath solenoids and only in direct current versions (see paragraph 5.2 for available voltages).

— As for the type and choice of the available spools see paragraph 1 - Spool types.

A wide range of configurations and different solenoid operated - hydropiloted directional control valve spool positions at rest are available:

– Type S*: 4-way, 3-position directional control valve, with two solenoids; positioning of spool at rest is obtained by centering springs.

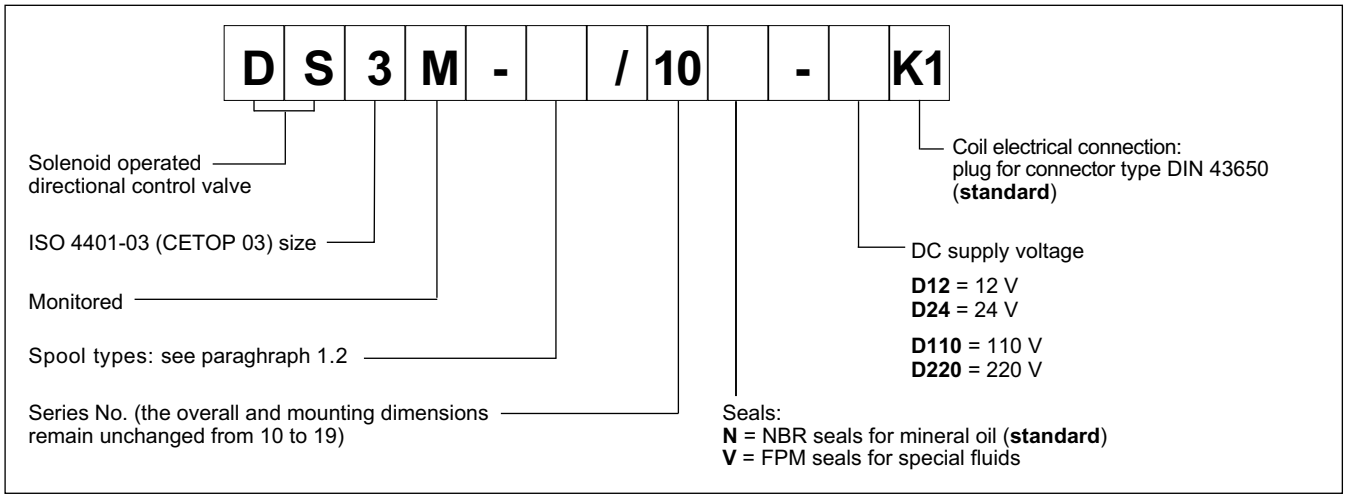
– Type “T*”: 4-way, 2-position directional control valve with one solenoid; for piloted versions positioning of the spool at rest is determined hydraulically by the pilot valve and mechanically (even without pressure) by the main stage return spring.

PERFORMANCES (working with mineral oil of viscosity of 36 cSt at 50°C)

		DS3M	DS5M	E4P4M	E07P4M	E5P4M
Maximum operating pressure: P - A - B ports (**standard**) P - A - B ports (H version) T port	bar	350 - see paragraph 3.2	320 -	320 420 see performance limits at paragraph 3.3		
Maximum flow rate from P to A - B - T	l/min	see performance limits at paragraph 3.3		150	300	600
Ambient temperature range	°C	-20 / +50				
Fluid temperature range	°C	-20 / +80				
Fluid viscosity range	cSt	10 ÷ 400				
Fluid contamination degree		According to ISO 4406:1999 classe 20/18/15				
Recommended viscosity	cSt	25				
Mass: single solenoid valve double solenoid valve	kg	1,7 2,2	3,2 4,8	8,0 8,6	8,5 9,1	15,0 15,6

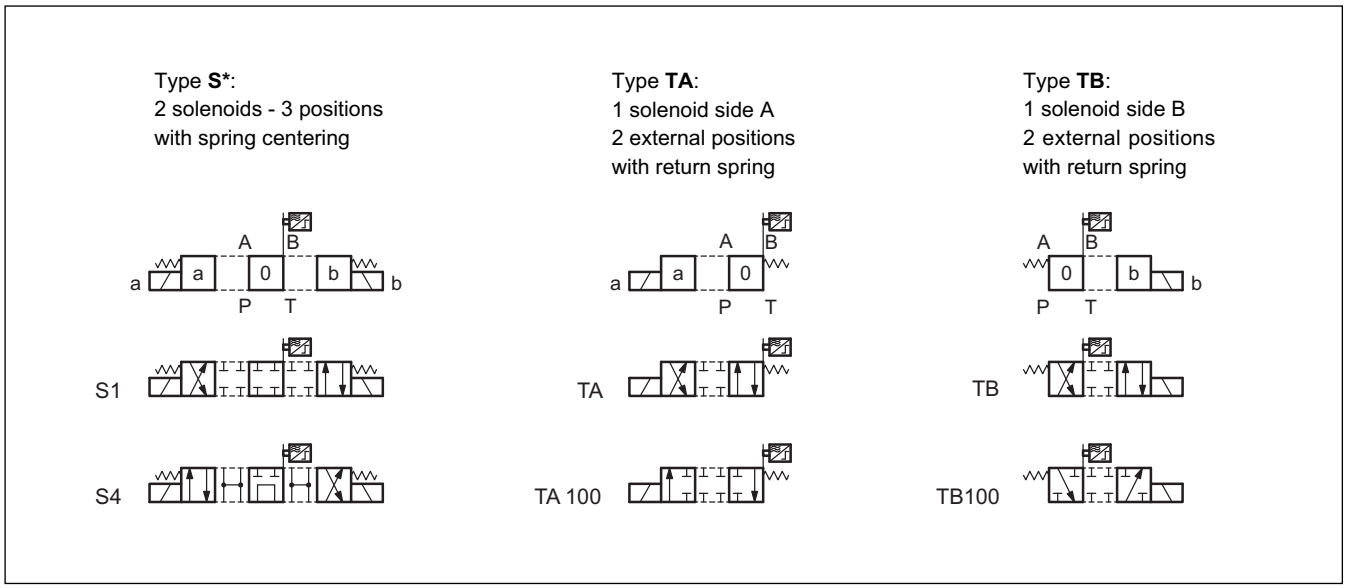
1 - IDENTIFICATION CODE

1.1 Identification code for DS3M solenoid valves

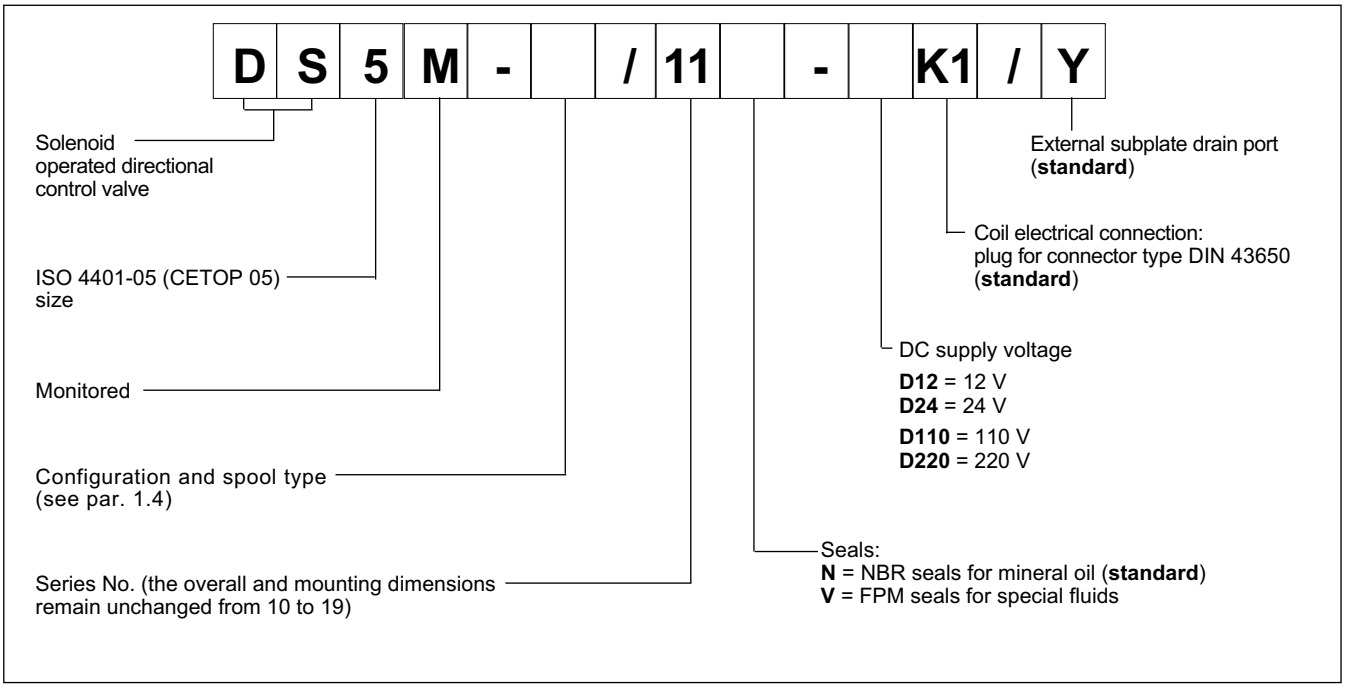


NOTE: In compliance with prEN 693 standards, valves are without manual override.

1.2 - Spool types for DS3M solenoid valves



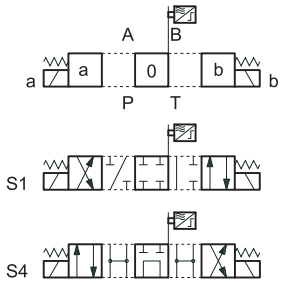
1.3 - Identification code for DS5M solenoid valves



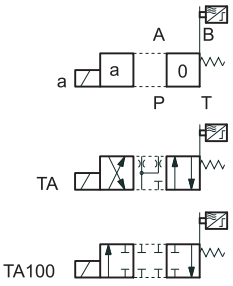
NOTE: In compliance with prEN 693 standards, valves are without manual override

1.4 - Spool type for DS5M solenoid valves

Type **S***:
2 solenoids - 3 positions
with spring centering



Type **TA**:
1 solenoid side A
2 external positions
with return spring



1.5 - Identification code for E4P4M, E07P4M and E5P4M solenoid valves

E | | | **P** | **4** | **M** | **-** | | | **/** | | | | **/** | **20** | | **-** | | **K1**

Pilot-solenoid operated directional control valve

Size:
4 = CETOP P05
07 = ISO 4401-07 (CETOP 07)
5 = ISO 4401-08 (CETOP 08)

H = high pressure version (pmax = 420 bar)
Omit for standard version (pmax = 320 bar)

P = Subplate mounting

R = Mounting interface ISO 4401-05 (CETOP R05) - only for valve E4 (not available for version H high pressure)

Number of ways

Monitored

Spool type: **S* - TA** (see paraghaph 1.6)

Options:
D = main spool shifting speed control (see par. 11.1)
PF = subplate with restrictor Ø0.8 on port P placed under pilot operated solenoid valve (see par. 11.2)

Piloting:
E = external piloting (mandatory for spool S4)
omit for internal piloting

Drainage:
I = internal drainage
omit for external drainage which is recommended when the valve is used with back pressure on the outlet

Series No. (the overall and mounting dimensions remain unchanged from 20 to 29)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

DC power supply
D12 = 12 V
D24 = 24 V
D110 = 110 V
D220 = 220 V

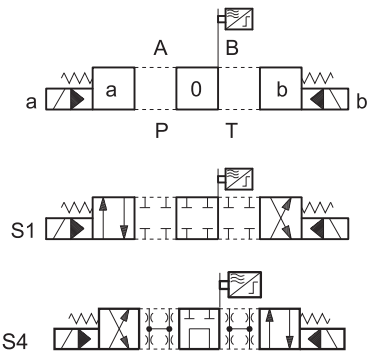
NOTE 1: voltages for alternating current are available on request

Coil electrical connection:
plug for connector type DIN 43650 (**standard**)

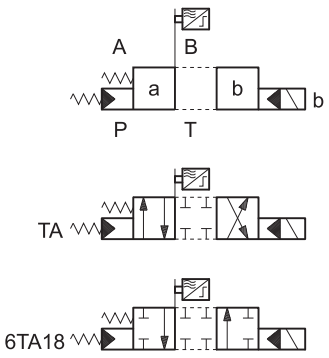
NOTE: In compliance with prEN 693 standards, valves are without manual override

1.6 - Spool type for E4P4M - E07P4M - E5P4M solenoid valves

Type **S***:
2 solenoids - 3 positions
with spring centering



Type **TA**:
1 solenoid side A
2 external positions
with return spring

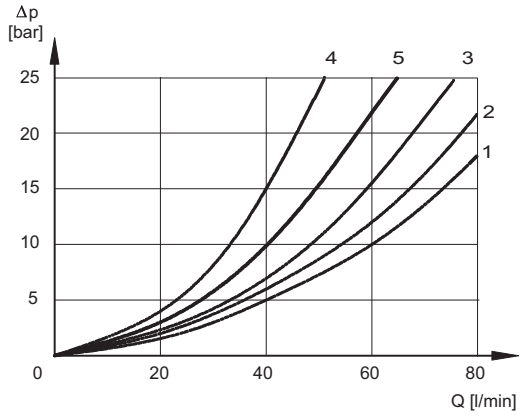


2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N).
For fluids HFDR type (phosphate esters) use FPM seals (code V).
For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

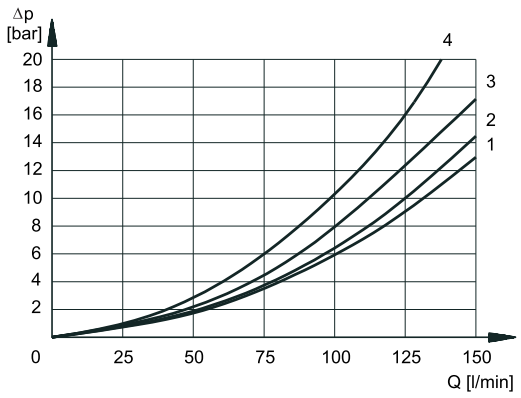
3 - PERFORMANCE CHARACTERISTICS (values obtained with viscosity 36 cSt at 50 °C)

3.1 - Pressure drops Δp-Q



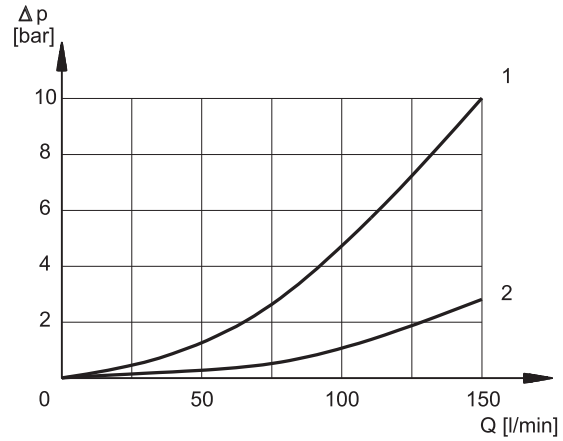
DS3M

SPOOL	SPOOL POSITION	CONNECTIONS				
		P→A	P→B	A→T	B→T	P→T
		CURVES ON GRAPH				
S1	energized	1	1	2	2	-
S4	de-energised energized	4	4	4	4	5
TA	de-energised energized					-
TA100	de-energised energized	3	-	-	3	-
TB	de-energised energized					-
TB100	de-energised energized	-	3	3	-	-



DS5M

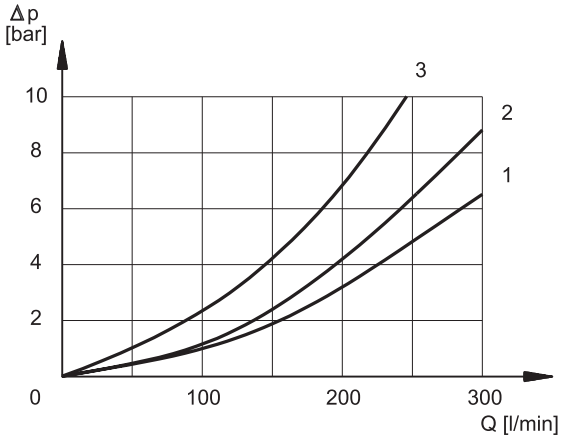
SPOOL	SPOOL POSITION	CONNECTIONS				
		P→A	P→B	A→T	B→T	P→T
		CURVES ON GRAPH				
S1	energized	2	2	1	1	-
S4	de-energised energized	2	2	2	2	4
TA	de-energised energized	3	3	1	1	-
TA100	de-energised energized	2	-	-	2	-



E4P4M

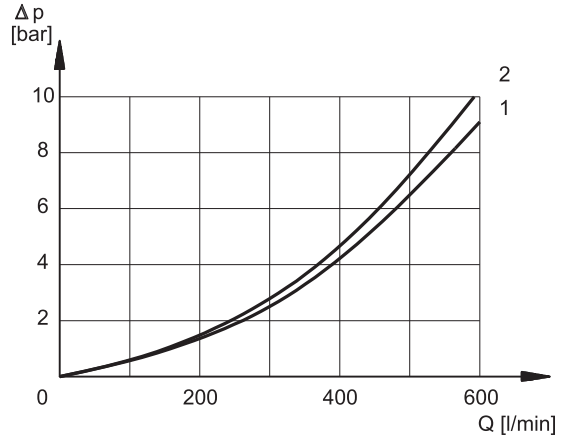
SPOOL	SPOOL POSITION	CONNECTIONS				
		P→A	P→B	A→T	B→T	P→T
		CURVES ON GRAPH				
S1	energized	1	1	2	2	-
S4	de-energised energized					
TA	de-energised energized	1	1	2	2	-
6TA18	de-energised energized	1	-	-	1	-

E07P4M



SPOOL	SPOOL POSITION	CONNECTIONS				
		P→A	P→B	A→T	B→T	P→T
		CURVES ON GRAPH				
S1	eccitato	1	1	2	2	-
S4	diseccitato eccitato					
TA	diseccitato eccitato	1	1	2	2	-
6TA18	diseccitato eccitato	3	-	-	3	-

E5P4M

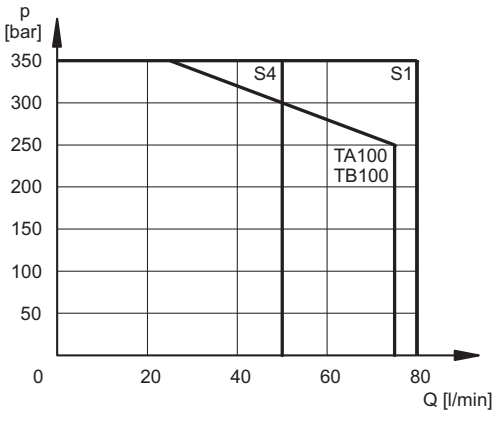


SPOOL	SPOOL POSITION	CONNECTIONS				
		P→A	P→B	A→T	B→T	P→T
		CURVES ON GRAPH				
S1	eccitato	1	1	2	2	-
S4	diseccitato eccitato					
TA	diseccitato eccitato					-
6TA18	diseccitato eccitato					-

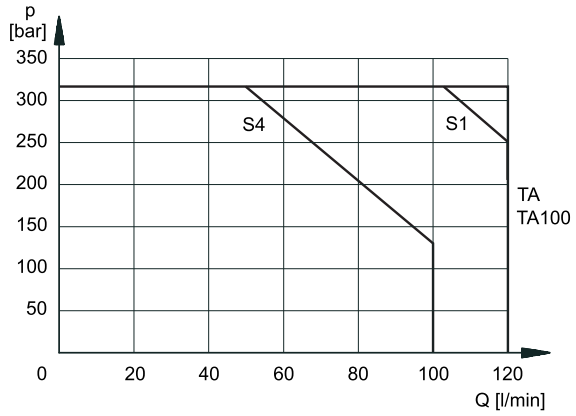
3.2 - Performance limits for DS3M and DS5M solenoid valves

The curves state the flow rate functioning range according to the pressure.
The values are obtained with solenoids at a standard temperature power supplied with a voltage equal to 90% of the rated voltage.

DS3M



MAXIMUM PRESSURE ON LINE T [bar]	
dynamic	50
static	100



DS5M

MAXIMUM PRESSURE ON LINE T [bar]	
standard version with Y port connected	320
version with Y port not connected	50 dynamic 100 static

3.3 - Performance limits for E4P4M - E07P4M - E5P4M solenoid operated directional control valves

PRESSURES [bar]	MIN	MAX
Piloting pressure	5	210*
Pressure on line T with internal drainage	-	140
Pressure on line T with external drainage	-	250

***** For the **H** execution maximum piloting pressure is 280 bar

MAXIMUM FLOW RATES		**E4P4M**		**E07P4M**		**E5P4M**	
		PRESSURES					
Spool type		210 bar	320 bar	210 bar	320 bar	210 bar	320 bar
S4 - 6TA18	[l/min]	120	100	250	200	500	450
S1 - TA	[l/min]	150	120	300	250	600	500

3.4 - Switching times

TIMES [ms]	ENERGIZING	DE-ENERGIZING
DS3M	25 ÷ 75	15 ÷ 25

The indicated values had obtained according to ISO 6403 standards, using mineral oil with viscosity 36 cSt at 50 °C.

TIMES (± 10%) [ms]	ENERGIZING		DE-ENERGIZING	
	2 Pos.	3 Pos.	2 Pos.	3 Pos.
E4P4	70	60	70	50
E07P4M	70	60	80	50
E5P4M	80	60	90	60

The indicated values refer to a solenoid operated directional control valve operating with piloting pressure = 100 bar and with PA and BT connections.
The switch on and off times are obtained at the time a pressure variation occurs on the line.

TIMES (± 10%) [ms]	ENERGIZING	DE-ENERGIZING
DS5M	120	100

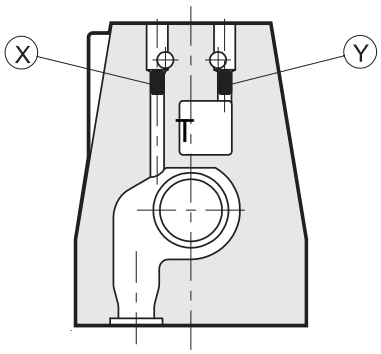
The values indicated refer to a solenoid valve in configuration S1 with Q = 60 l/min, p = 150 bar and with PA and BT connections.
The switch on times are obtained at the time the spool switches over. The switch on and off times are obtained at the time a pressure variation occurs on the line.

4 - PILOTING AND DRAINAGE

The E*P4 valves are available with piloting and drainage, both internal and external.
The version with external drainage allows for a higher back pressure on the outlet.

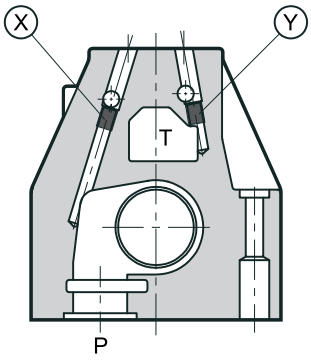
TYPE OF VALVE		Plug assembly	
		X	Y
E*P4M-**	INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
E*P4M-**/**I**	INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
E*P4M-**/**E**	EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
E*P4M-**/**EI**	EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO

X: plug M5x6 for external pilot
Y: plug M5x6 for external drain



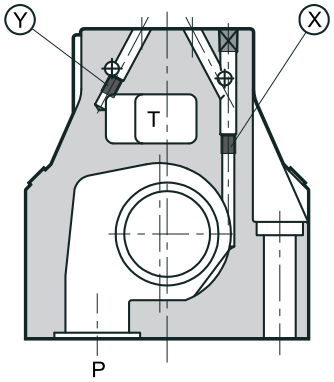
E07P4M

X: plug M6x8 for external pilot
Y: plug M6x8 for external drain



E07P4M

X: plug M6x8 for external pilot
Y: plug M6x8 for external drain



E5P4M

5 - ELECTRICAL FEATURES

5.1 Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

The coil is fastened to the tube by a threaded ring, and can be rotated and locked to suit the available space.

NOTE 1: In order to further reduce the emissions, use of type H connectors is recommended. These prevent voltage peaks on opening of the coil supply electrical circuit (see catalogue 49 000).

NOTE 2: The IP65 protection degree is guaranteed only with the connector correctly connected and installed.

VOLTAGE SUPPLY FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY DS3M - DS5M - E4P4M - E07P4M E5P4M	 5.000 ins/hr 4.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC) emissions (**NOTE 1**) EN 50081-1 immunity EN 50082-2	 In compliance with 89/336 CEE
LOW VOLTAGE	In compliance with 73/23/CEE 96/68/CEE
CLASS OF PROTECTION: Atmospheric agents (CEI EN 60529) Coil insulation (VDE 0580) Impregnation:	 IP 65 (**NOTE 2**) class H class F

5.2 Current and absorbed power

The tables shows current and power consumption values relevant to the different coil types for DC.

DS3M, E4P4M, E07P4M e E5P4M (values ± 5%)

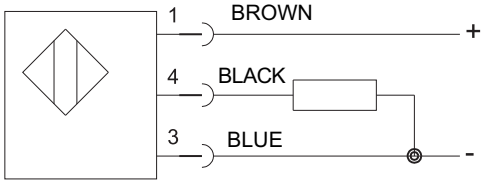
Suffix	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt [W]	Coil code
D12	12	4,4	2,72	32,6	1902860
D24	24	18,6	1,29	31	1902861
D110	110	423	0,26	28,6	1902864
D220	220	1692	0,13	28,6	1902865

DS5M, (values ± 5%)

Suffix	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt [W]	Coil code
D12	12	3 - 3,4	3,81	45,8	1902870
D24	24	12 - 14	1,90	45,3	1902871
D110	110	235 - 270	0,44	48,4	1902872
D220	220	960 - 1110	0,21	47,1	1902873

5.3 Proximity sensor PNP type

CONNECTION SCHEME



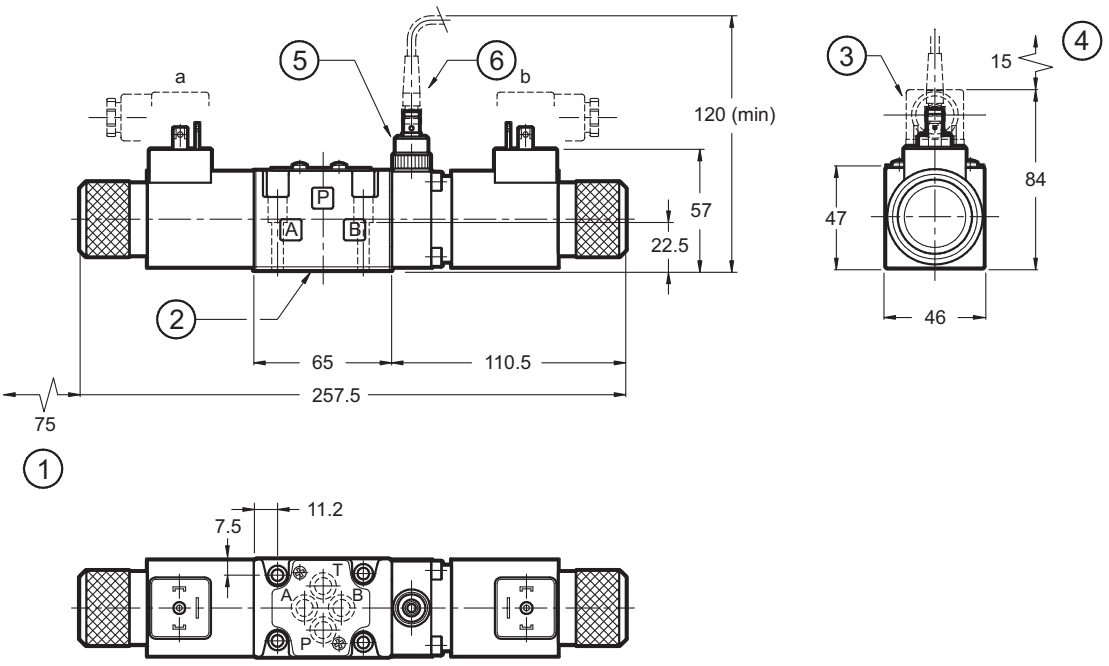
de-energized valve = closed contact = LED on
energized valve = open contact = LED off

		DS3M DS5M	**E4P4M E07P4M E5P4M**
Rated voltage	Vdc	24	
Power supply voltage range	Vdc	10 ÷ 30	
Absorbed current	mA	150	200
Output		normally open contact	
Electric protection		polarity inversion short circuit overvoltage	
Electric connection		with connector	
Max operating pressure	bar	100	350
Operating temperature range	°C	-25 / +70	-25 / +80
Class of protection according to IEC 144 standards (atmospheric agents)		IP67	IP68
Spool position LED (**NOTE**)		YES	NO

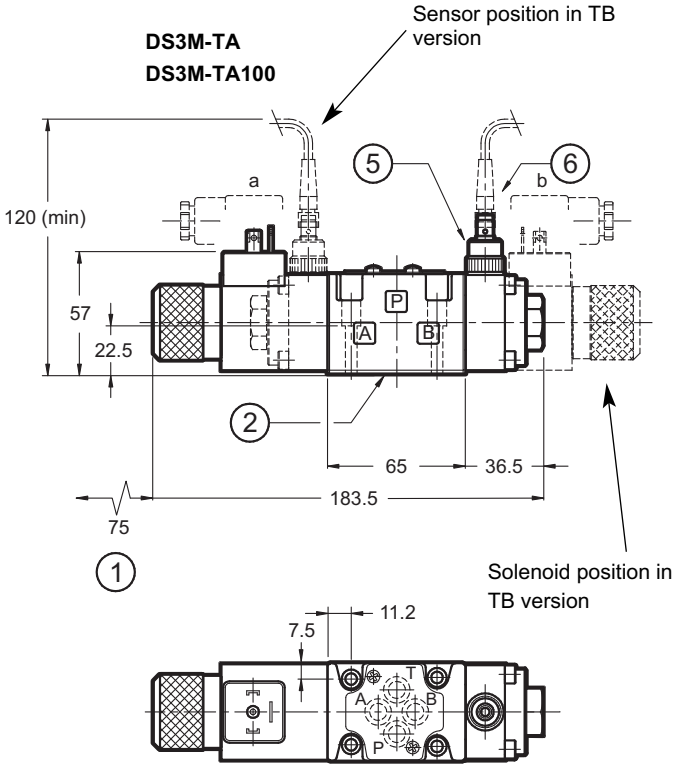
NOTE: On the DS3M and DS5M valves the led is placed straight on the proximity sensor and its light is RED.
On the E4P4M, E07P4M e E5P4M valves the led is placed in the connector and its light is YELLOW.

6 - OVERALL AND MOUNTING DIMENSIONS FOR DS3M SOLENOID VALVES

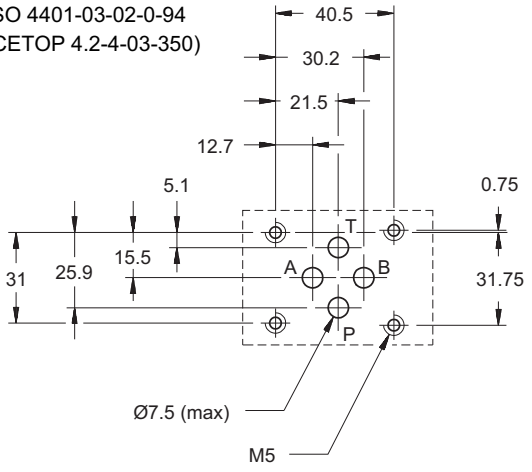
DS3M - S*



DS3M-TA
DS3M-TA100



MOUNTING SURFACE
ISO 4401-03-02-0-94
(CETOP 4.2-4-03-350)



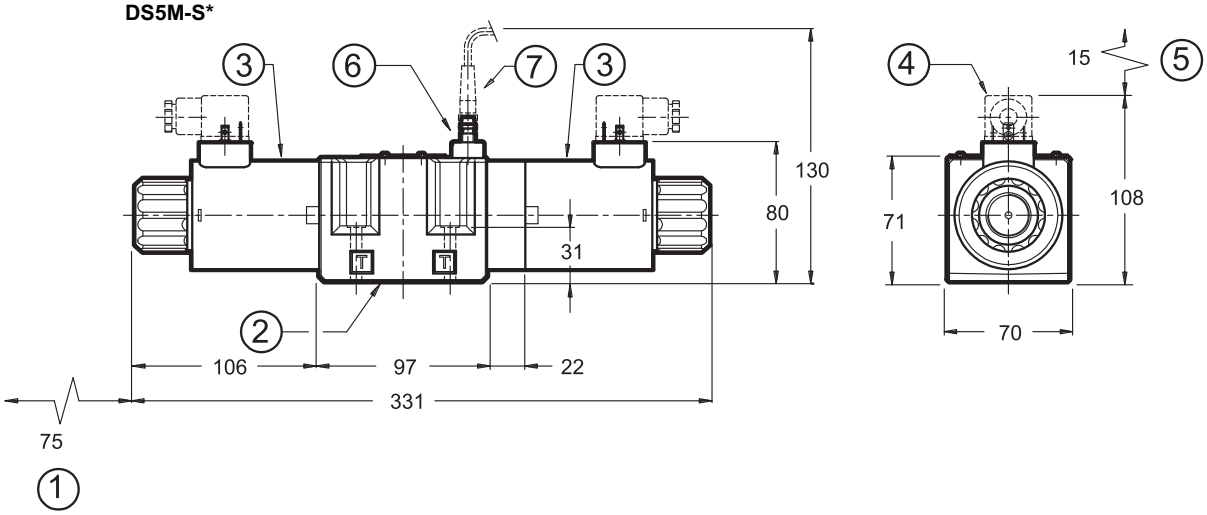
dimensions in mm

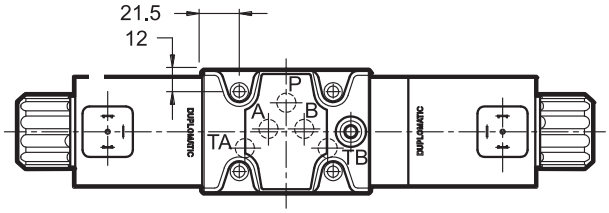
1	Coil removal space
2	Mounting surface with sealing rings
3	Coil electric connector (see paragr. 12.2)
4	Connector removal space
5	Proximity sensor
6	Connector for proximity sensor (see paragr. 12.1)

Fastening of single valve: 4 screws M5x30
Tightening torque: 5 Nm
Threads of mounting holes: M5x10
Sealing rings: 4 OR type 2037 (9.25x1.78) - 90 Shore

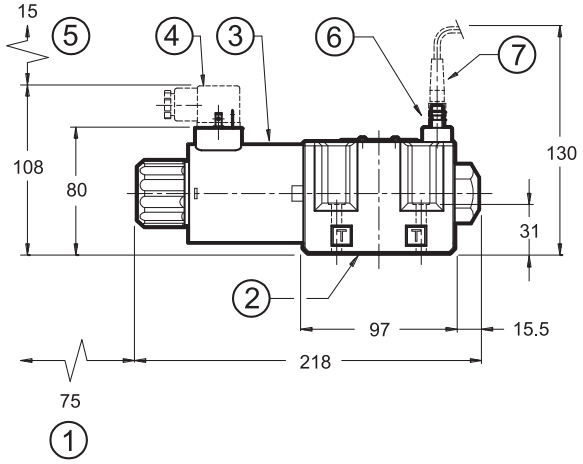
7 -OVERALL AND MOUNTING DIMENSIONS FOR DS5M SOLENOID VALVE

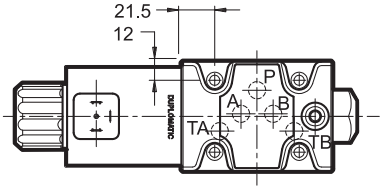
DS5M-S*



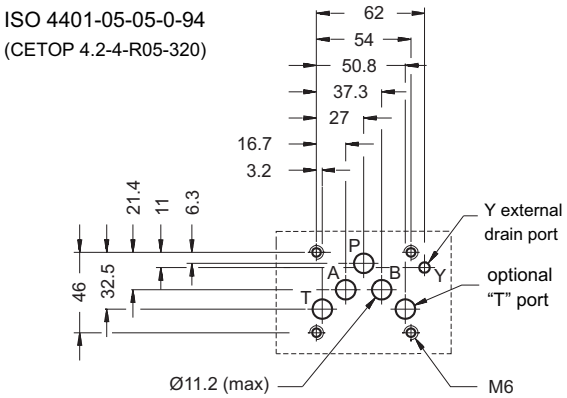


DS5M-TA
DS5M-TA100





MOUNTING SURFACE
ISO 4401-05-05-0-94
(CETOP 4.2-4-R05-320)



dimensions in mm

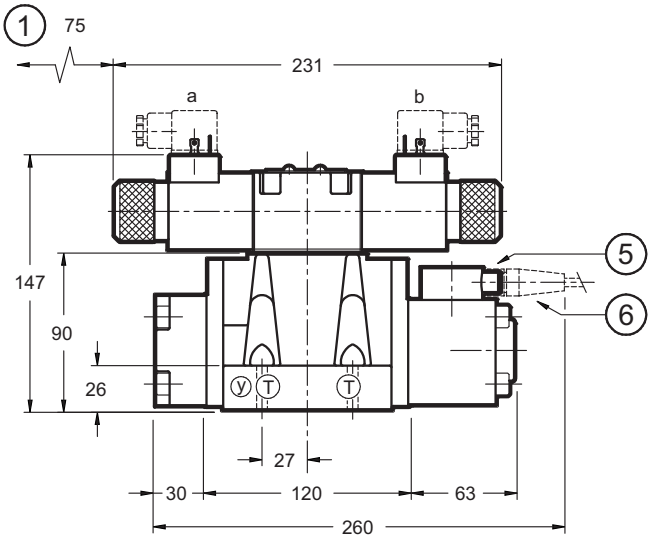
Fastening of single valve: 4 screws M6x40	
Tightening torque: 8 Nm	
Threads of mounting holes: M6x10	
Sealing rings: 5 OR type 2050 (12.42x1.78) - 90 Shore 1 OR type 2037 (9.25x1.78) - 90 Shore	

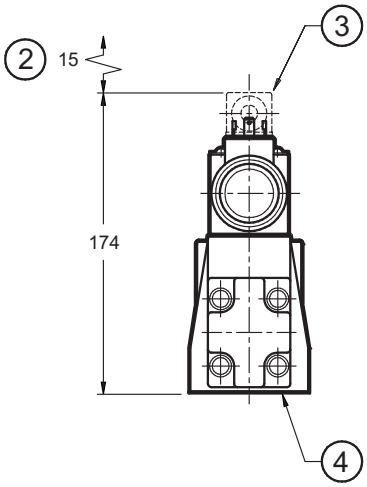
1	Coil removal space
2	Mounting surface with sealing rings
3	Coil (90° orientable)
4	Coil electric connector (see paragraph 12.2)
5	Connector removal space
6	Proximity sensor
7	Connector for proximity sensor (see paragraph 12.1)

8 - E4P4M OVERALL AND MOUNTING DIMENSIONS

E4P4M-S*

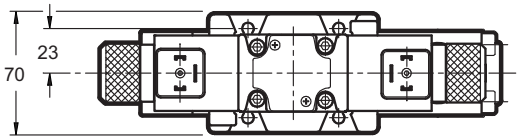
dimensions in mm

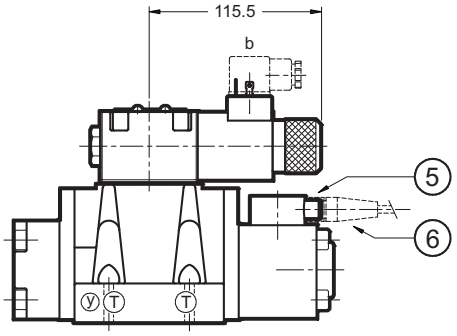




E4P4M-TA
E4P4M-6TA18

for dimensions not shown here see E4P4M-S*

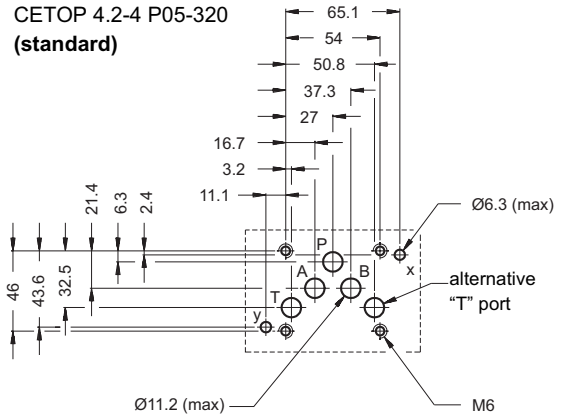




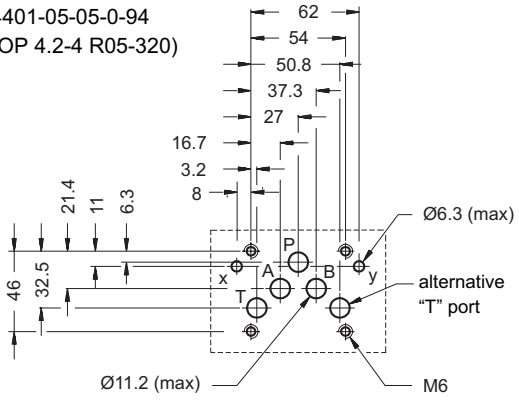
MOUNTING SURFACES

Valves with CETOP R05 mounting interface are available upon request.

CETOP 4.2-4 P05-320
(standard)



ISO 4401-05-05-0-94
(CETOP 4.2-4 R05-320)



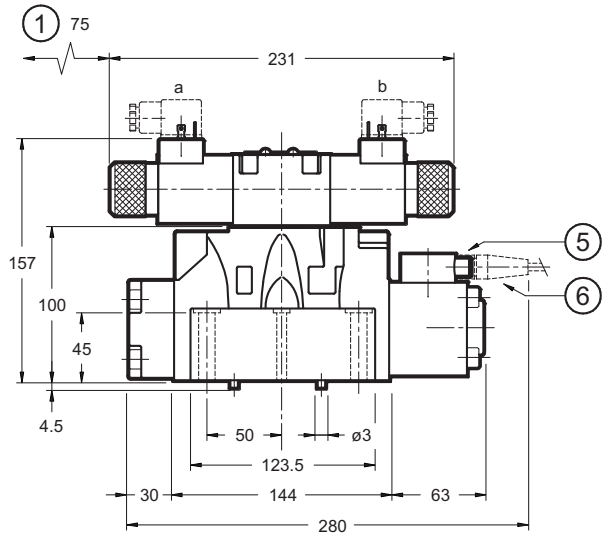
Fastening of single valve: 4 screws M6x35 (**NOTE**)
Tightening torque: 8 Nm (screws A 8.8) - 14 Nm (screws A 12.9)
Threads of mounting holes: M6x10
Sealing rings: 5 OR type 2050 (12.42x1.78) - 90 Shore 2 OR type 2037 (9.25x1.78) - 90 Shore

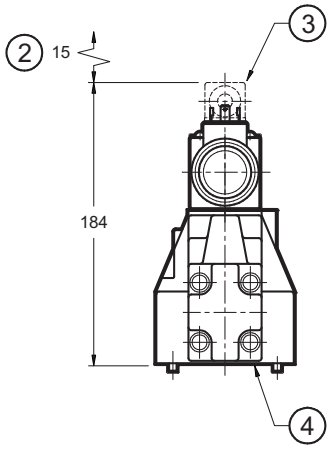
1	Coil removal space
2	Connector removal space
3	Coil electric connector (see paragraph 12.2)
4	Mounting surface with sealing rings
5	Proximity sensor
6	Connector for proximity sensor (see paragraph 12.1)

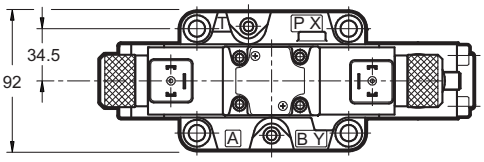
NOTE: Use of class 12.9 fastening screws is recommended for valves in version **H** (high pressure).

9 - E07P4M OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

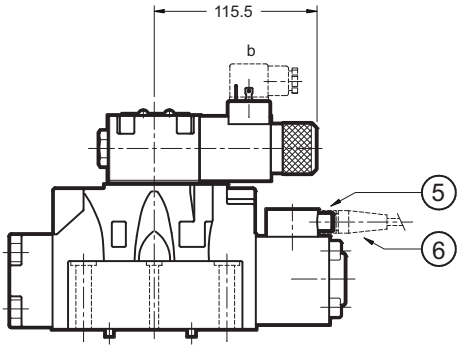




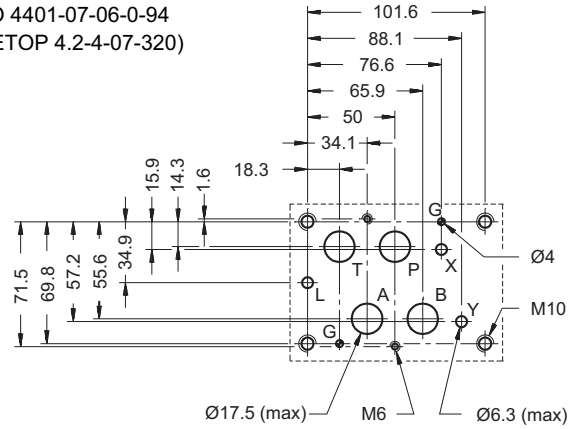


E07P4M-TA
E07P4M-6TA18

for dimensions not shown here see E07P4M-S*



MOUNTING SURFACE
ISO 4401-07-06-0-94
(CETOP 4.2-4-07-320)

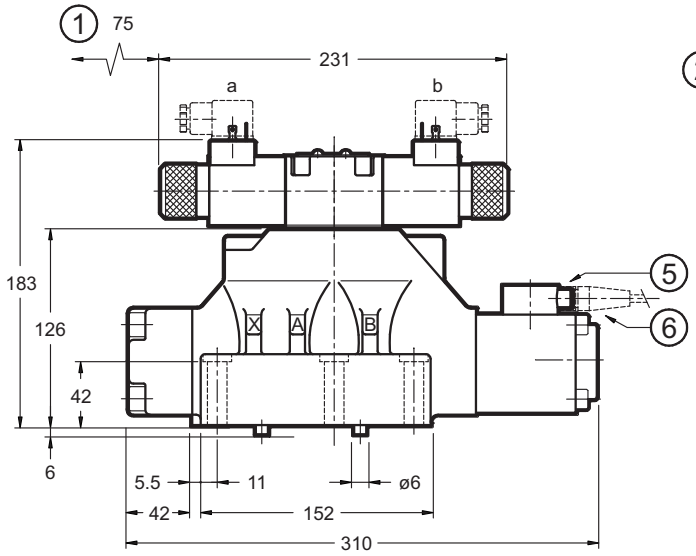


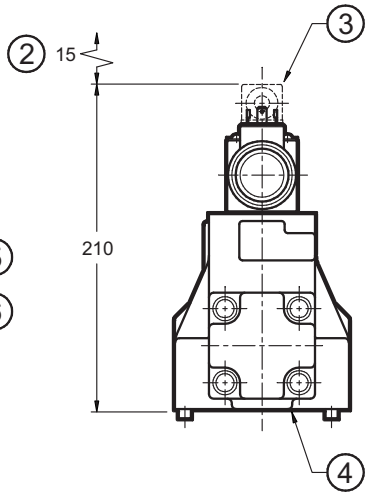
Fastening of single valve: 4 screws M10x60 (**NOTE**) 2 screws M6x60
Tightening torque: M10x60: 40 Nm (screws A 8.8) - 67 Nm (screws A12.9) M6x60: 8 Nm (screws A 8.8) - 14 Nm (screws A12.9)
Threads of mounting holes: M6x18; M10x18
Sealing rings: 4 OR type 130 (22.22X2.62) - 90 Shore 2 OR type 2043 (10.82x1.78) - 90 Shore

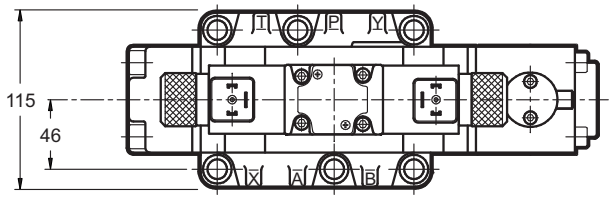
1	Coil removal space
2	Connector removal space
3	Coil electric connector (see paragraph 12.2)
4	Mounting surface with sealing rings
5	Proximity sensor
6	Connector for proximity sensor (see paragraph 12.1)

NOTE: Use of class 12.9 fastening screws is recommended for valves in version **H** (high pressure).

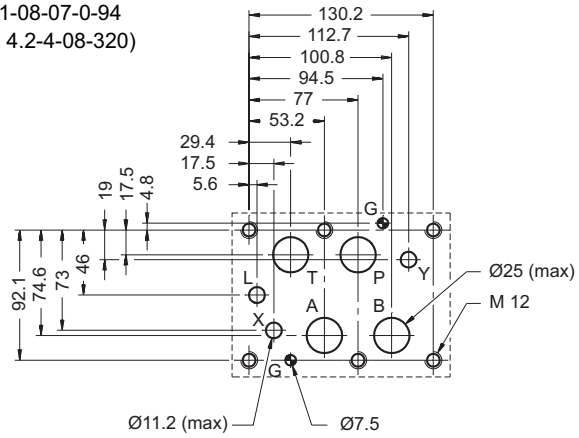
10 - E5P4M OVERALL AND MOUNTING DIMENSIONS







MOUNTING SURFACE
ISO 4401-08-07-0-94
(CETOP 4.2-4-08-320)



dimensions in mm

Fastening of single valve: 6 screws M12x60 (see paragraph 13 Note 5)
Tightening torque: 69 Nm (screws A 8.8) -115 Nm (screws A 12.9)
Threads of mounting holes: M12x20
Sealing rings: 4 OR type 3118 (29.82x2.62) - 90 Shore

1	Coil removal space
2	Connector removal space
3	Coil electric connector (see paragraph 12.1)
4	Mounting surface with sealing rings
5	Proximity sensor
6	Connector for proximity sensor (see paragraph 12.2)

NOTE: Use of class 12.9 fastening screws is recommended for valves in version **H** (high pressure).

11 - OPTIONS

11.1 - Control of the main spool shifting speed

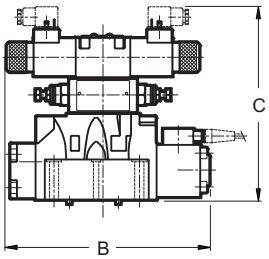
By placing a MERS type double flow control valve between the pilot solenoid valve and the hydropiloted valve, the piloted flow rate can be controlled and therefore the change over smoothness can be varied.

Add the letter **D** to the identification code to request this device (see paragraph 1.5).

13.3 Subplate with throttle on line P

It is possible to introduce a subplate with a restrictor of Ø0,8 on line P between the pilot solenoid valve and the main distributor. The subplate thickness is 10 mm.

Add **PF** to the identification code to request this option (see paragraph 1.5).



dimensions in mm

	E4	E07	E5
B	239	251	310
C	214	224	250

12 - ELECTRIC CONNECTORS

12.1 - Proximity sensor connectors

Connectors for proximity sensors must be ordered separately, by specifying the descriptions here below, depending on the type of valve ordered.

CONNECTOR FOR DS3M AND DS5M
description: ECM3S / M8L / 10

Connector: pre-wired connector M8 - IP68
Cable: with 3 conductors 0.34 mm^2 - length 5 mt - cable material: polyurethane resin (oil resistant)

Without LED. Leds are placed straight on the proximity sensor.

CONNECTOR FOR E4P4M, E07P4M AND E5P4M
description: ECM3S / M12L / 10

Connector: pre-wired connector M12 - IP68
cable: with 3 conductors 0.34 mm^2 - length 5 mt - cable material: polyurethane resin (oil resistant)

LEDS:
GREEN LED: show the presence of power supply voltage to the connector. If the LED is off, the connector is not supplied.
YELLOW LED: show the valve condition:
- valve at rest yellow LED on - green LED on
- switched valve yellow LED off - green LED off

12.1 - Coil connectors

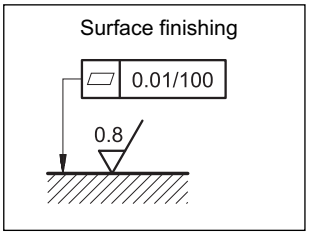
Connectors are never supplied with the solenoid valves, but they must be ordered separately.
For the identification of the connector type to be ordered, please see catalogue 49 000.

13 - INSTALLATION

The valves can be installed in any position without impairing correct operation.

Valve fastening takes place by means of screws or tie rods, laying the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.



14 - SUBPLATES (see catalogue 51 000)

	DS3M	D4M	E4P4M	E07P4M	E5P4M
Type with rear ports	PMMD-AI3G	PMD4-AI4G	PME4-AI5G	PME07-AI6G	
Type with side ports	PMMD-AL3G	PMD4-AL4G	PME4-AL5G	PME07-AL6G	PME5-AL8G
P, T, A, B, port dimensions X, Y port dimensions	3/8" BSP -	1/2" BSP -	3/4" 1/4" BSP	1" BSP 1/4" BSP	1½" BSP 1/4" BSP

DUPLOMATIC HYDRAULICS

DUPLOMATIC OLEODINAMICA SpA
20025 LEGNANO (MI) - P.le Bozzi, 1 / Via Edison
Tel. 0331/472111 - Fax 0331/548328