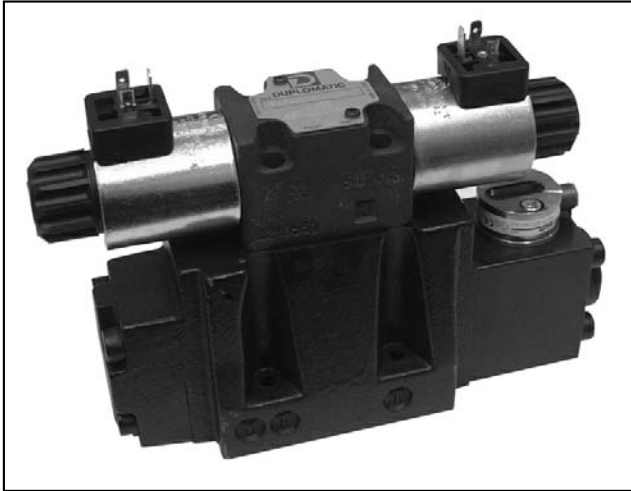




**DIPLOMATIC
HYDRAULICS**

41 500/104 ED

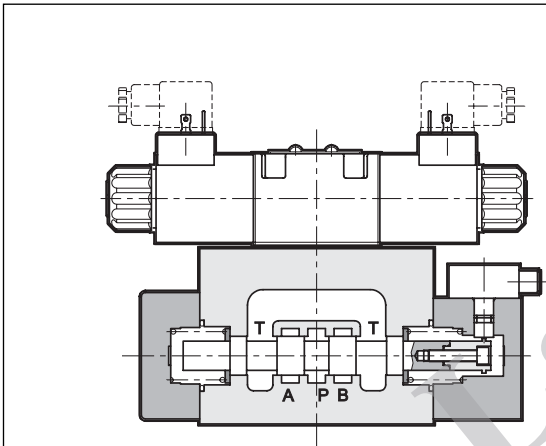


SOLENOID OPERATED DIRECTIONAL CONTROL VALVES WITH MONITORED SPOOLS

MD1M	CETOP 03
DS5M	CETOP 05
E4P4M	CETOP P05
E07P4M	CETOP 07
E5P4M	CETOP 08

p max (see performance ratings table)

Q max (see performance ratings table)



- Solenoid operated directional control valves with monitored spools are supplied with an inductive proximity sensor stating 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 states 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 parag. 5.4).
- The valves of sizes CETOP 03 and CETOP 05 are direct operated while sizes CETOP P05, CETOP 07 and CETOP 08 are pilot operated.
- They are supplied with oil bath solenoids and only in direct current versions (see parag. 5.2 for available voltages).
- As for the type and choice of the available spools see parag. 1 - Configurations.

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

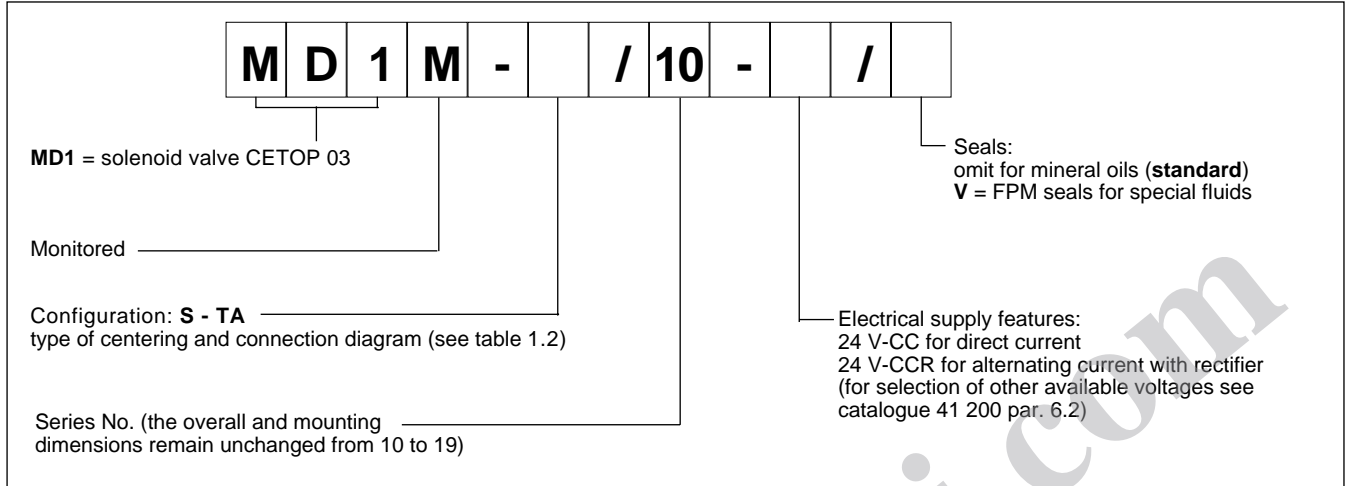
- Type S: 4-way, 3-position directional control valve, with two solenoids; positioning of spool at rest is obtained by centering springs.
- Type "TA": 4-way, 2-position directional control valve with 1 solenoid; for piloted versions positioning of the spool at rest is determined hydraulically by the pilot valve and mechanically (even without pressure) by the main stage return spring.

PERFORMANCE RATINGS (working with mineral oil of viscosity of 36 cSt at 50°C)		MD1M	DS5M	E4P4M	E07P4M	E5P4M	
Maximum operating pressure:	- ports P A B (standard version) (H version)	350	320	320			
	- port T	-	-	420			
		see par. 3.2		see performance limits parag. 3.3			
Maximum flow rate:	- from port P to A-B-T	See performance limits parag. 3.2		150	300	600	
Ambient temperature range	°C	-20 ÷ +50					
Fluid temperature range	°C	-20 ÷ +80					
Fluid viscosity range	cSt	10 ÷ 400					
Recommended viscosity	cSt	25					
Degree of fluid contamination	According to NAS 1638 class 10						
Mass:	Single solenoid valve	kg	1.5	3.2	8.0	8.5	15.0
	Double solenoid valve	kg	2.2	4.8	8.6	9.1	15.6



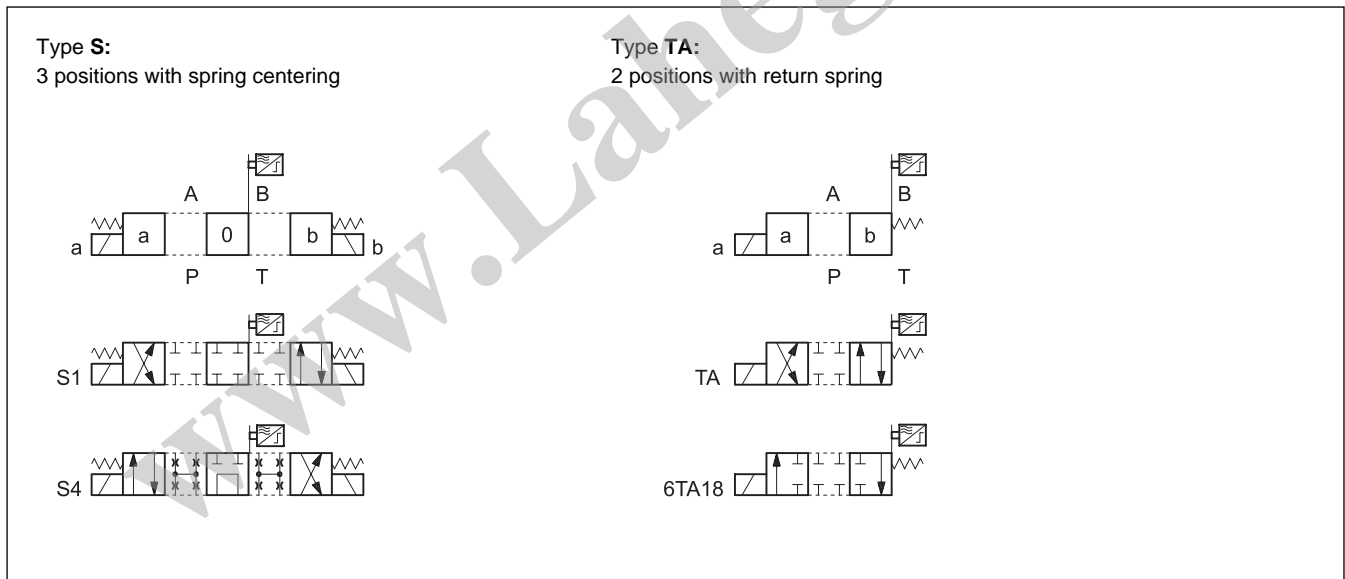
1 - IDENTIFICATION CODE

1.1 IDENTIFICATION CODE FOR MD1M SOLENOID VALVES



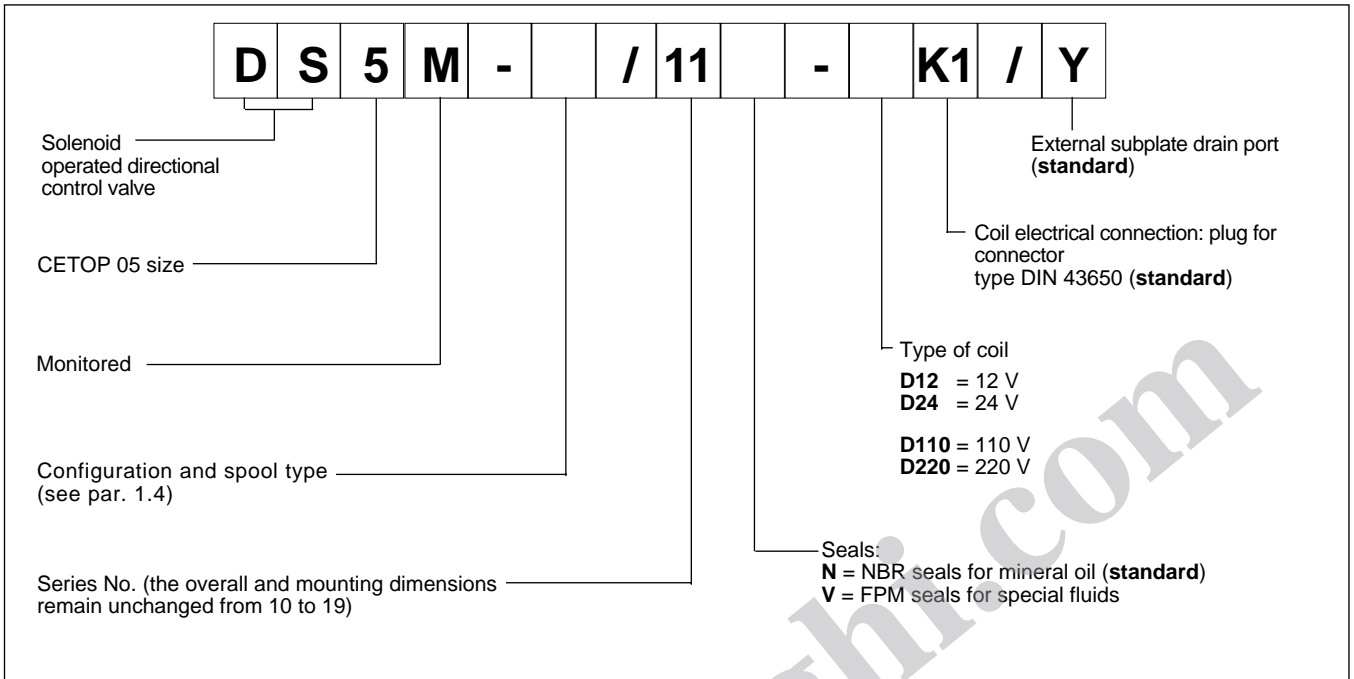
Note: In compliance with prEN 693 standards, valves are without manual override

1.2 - AVAILABLE CONFIGURATIONS FOR MD1M SOLENOID VALVES



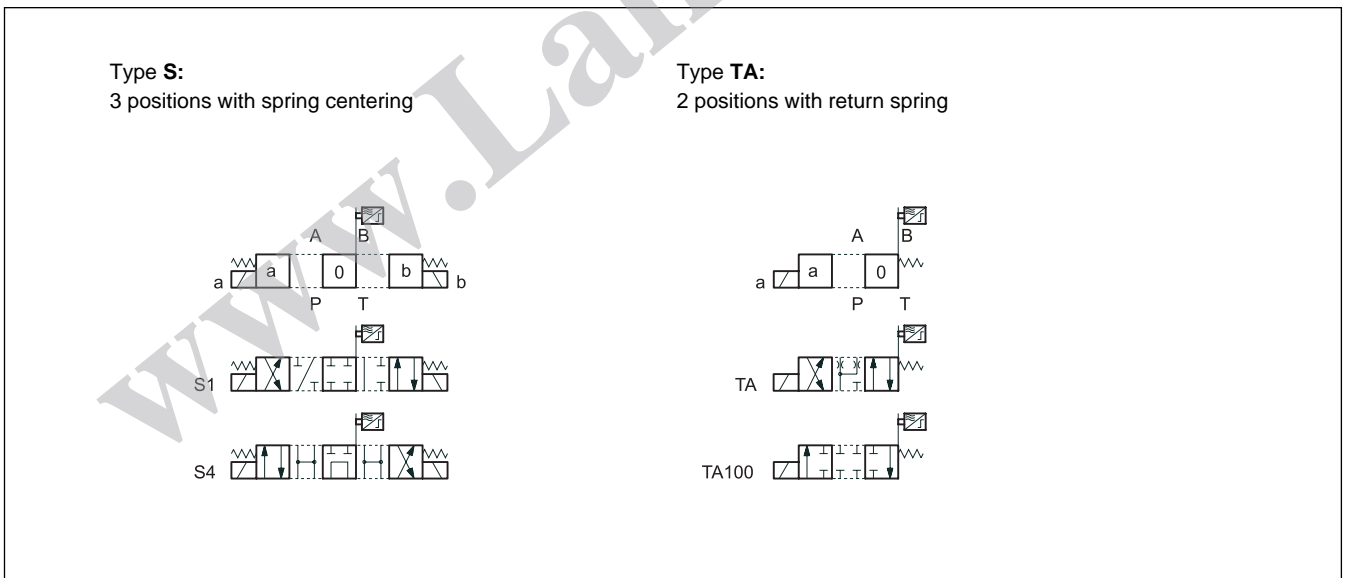


1.3 - IDENTIFICATION CODE FOR DS5M SOLENOID VALVES



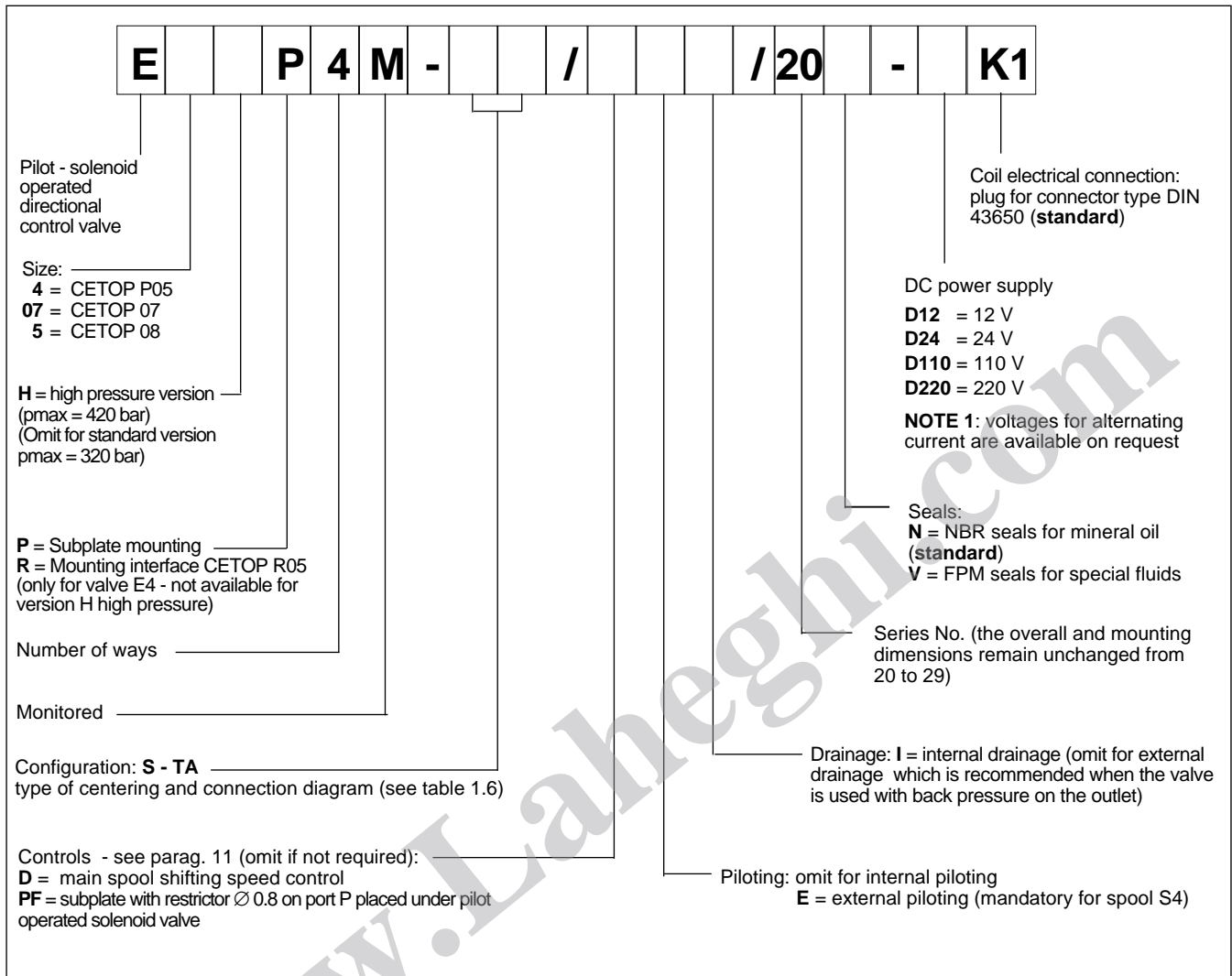
Note: In compliance with prEN 693 standards, valves are without manual override

1.4 - AVAILABLE CONFIGURATIONS FOR DS5M SOLENOID VALVES



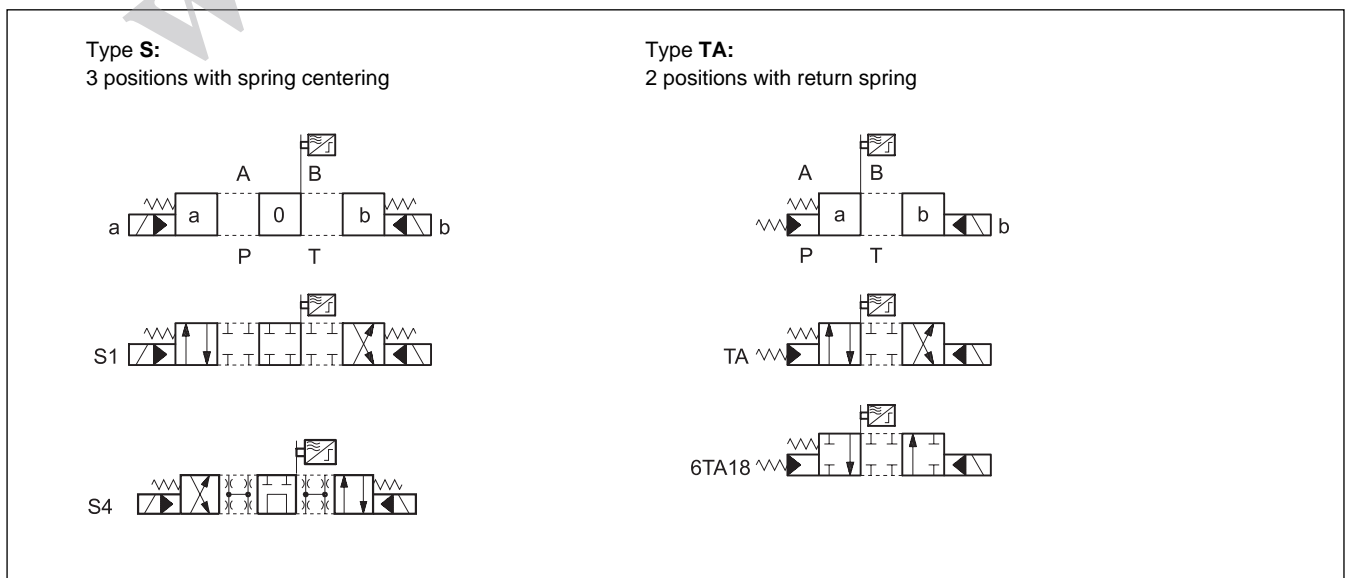


1.5 - IDENTIFICATION CODE FOR E4P4M - E07P4M - E5P4M SOLENOID VALVES



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

1.6 - AVAILABLE CONFIGURATIONS FOR E4P4M - E07P4M - E5P4M SOLENOID VALVES





2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HLP type, according to ISO 6743/3.

For fluids HFD-R type (phosphate esters) use FPM seals (code V).

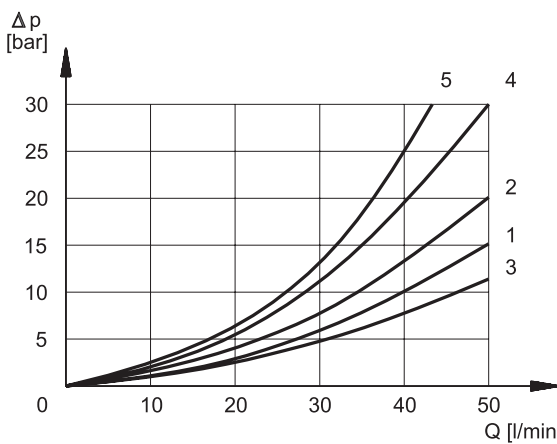
For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 70°C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

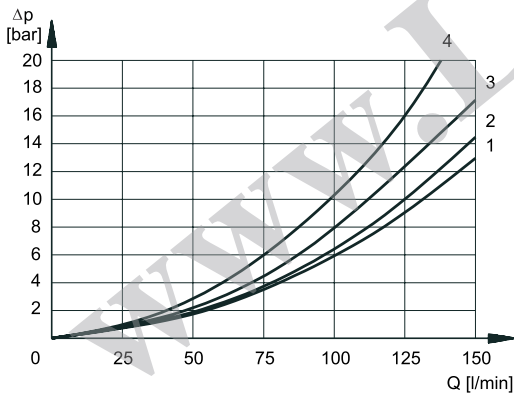
3 - PERFORMANCE CHARACTERISTICS (values obtained with viscosity 36 cSt at 50 °C)

3.1 -PRESSURE DROPS Δp -Q



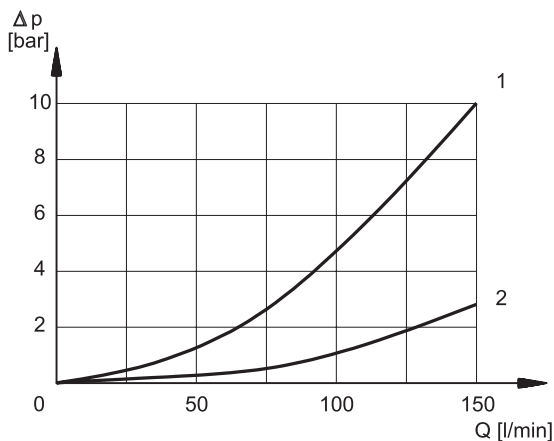
MD1M

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-energized	5	5	4	4	1
TA	De-energized	1	1	2	2	-
6TA18	De-energized	1	-	-	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-energized	2	2	2	2	4
TA	De-energized	3	3	1	1	-
TA100	De-energized	2	-	-	2	-

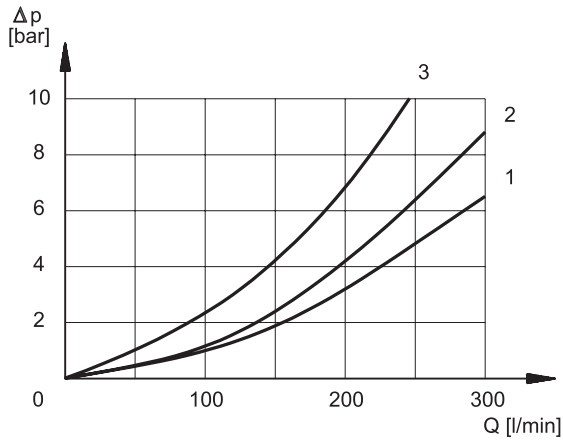


E4P4M

SPOOL	SPOOL POSITION	CONNECTIONS				
		P→A	P→B	A→T	B→T	P→T
CURVES ON GRAPH						
S1	Energized	1	1	2	2	-
TA	De-energized	1	1	2	2	-
6TA18	De-energized	1	-	-	1	-

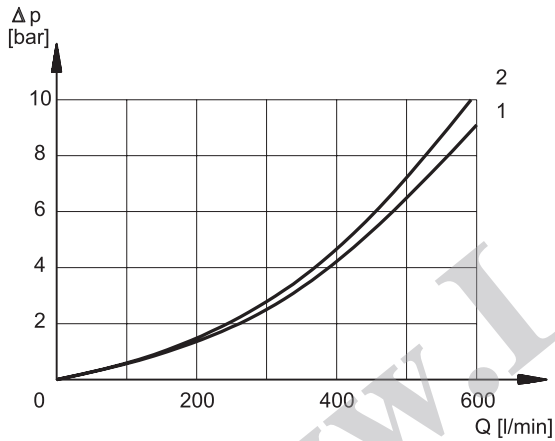


E07P4M



SPOOL	SPOOL POSITION	CONNECTIONS				
		P→A	P→B	A→T	B→T	P→T
CURVES ON GRAPH						
S1	Energized	1	1	2	2	-
TA	De-energized	1	-	-	2	-
	Energized	-	1	2	-	-
6TA18	De-energized	-	-	-	3	-
	Energized	3	-	-	-	-

E5P4M



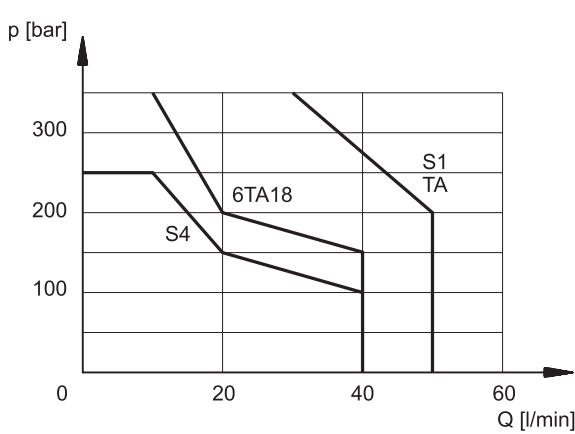
SPOOL	SPOOL POSITION	CONNECTIONS				
		P→A	P→B	A→T	B→T	P→T
CURVES ON GRAPH						
S1	Energized	1	1	2	2	-



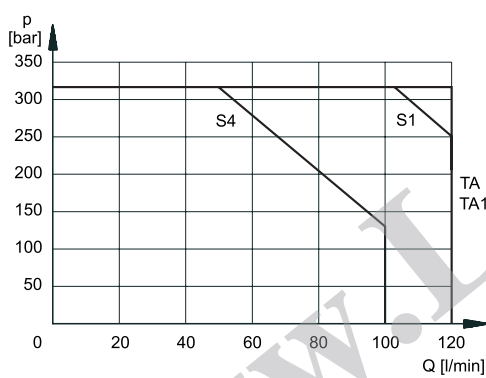
3.2 - PERFORMANCE LIMITS FOR MD1M AND DS5M SOLENOID VALVES

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.



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



MAXIMUM PRESSURE ON LINE T [bar]	
standard version	320
with Y port connected	
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

The values indicated refer to a solenoid valve in configuration S1 with Q = 40 l/min, p = 150 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%)	ENERGIZING	DE-ENERGIZING
MD1M	100 ms	80 ms

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.

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

The values indicated 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	
	2 Pos.	3 Pos.	2 Pos.	3 Pos.
E4P4M	70	60	70	50
E07P4M	70	60	80	50
E5P4M	80	60	90	60

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

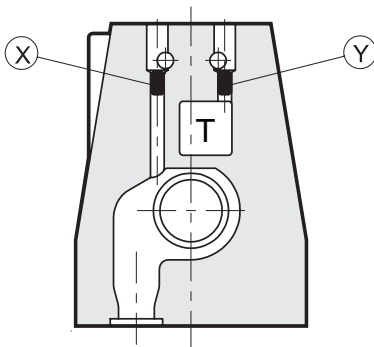
Y: plug M5x6 for external drain

X: plug M6x8 for external pilot

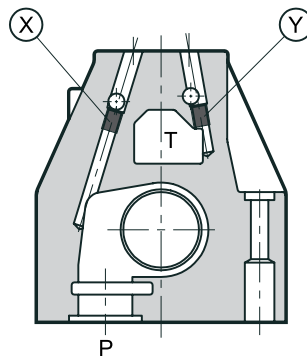
Y: plug M6x8 for external drain

X: plug M6x8 for external pilot

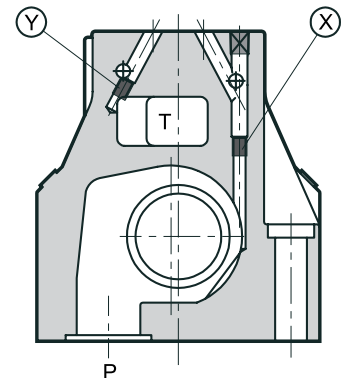
Y: plug M6x8 for external drain



E07P4M



E07P4M



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 360°, 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 CAT. 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 MD1M - DS5M - E4P4M - E07P4M E5P4M	5.000 ins/hr 4.000 ins/hr	
DUTY CYCLE	100%	
ELECTROMAGNETIC COMPATIBILITY (EMC) EMISSIONS (note 1) IMMUNITY	EN 50081-1 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: DC valve AC valve	IP 65 (note 2) class H class F class H	

5.2 Available voltages

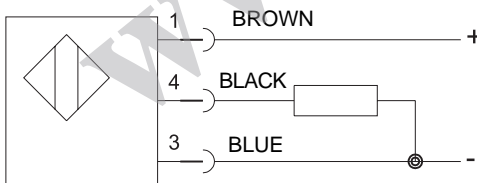
For MD1M see catalogue 41 200 par. 6.

For DS5M see catalogue 41 310 par. 7.

For E4P4M, E07P4M and E5P4M see catalogue 41 150 par. 7.

5.3 Proximity sensor PNP type

Connection scheme



de-energized valve = closed contact

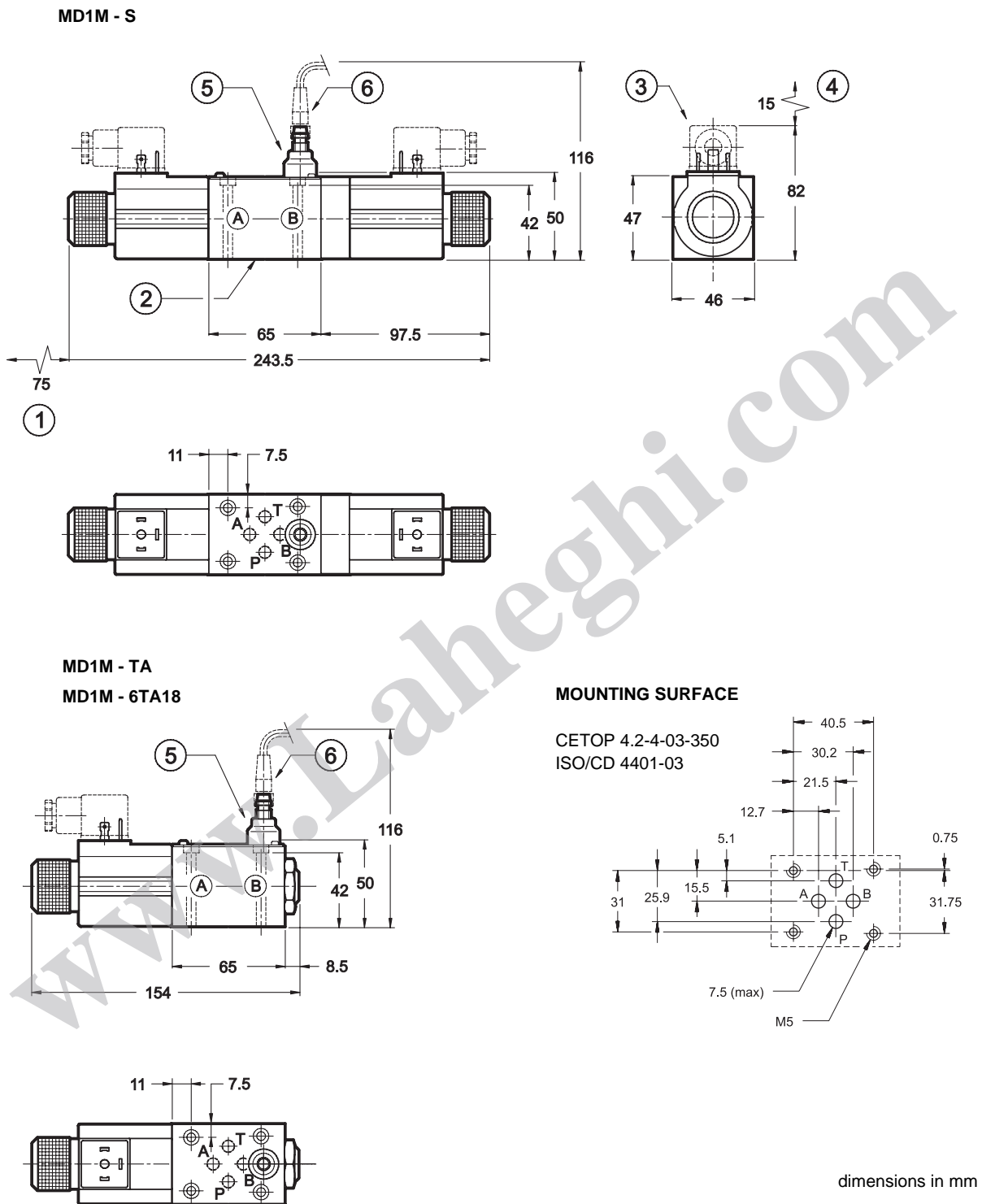
energized valve = open contact

NOTE: For spool position LEDS see parag. 12.2

Sensor applied on a directional control valve type:		MD1M DS5M	E4P4M E07P4M E5P4M
Rated voltage	Vdc	24	24
Power supply voltage range	Vdc	10 ÷ 55	10 ÷ 30
Absorbed current	mA	200	200
Output	normally open contact		
Electric protection	- polarity inversion - short circuit - overvoltage		
Maximum operating pressure	bar	100	350
Electric connection	with connector		
Operating temperature range	°C	-25 ÷ +70	-25 ÷ +80
Class of protection according to IEC 144 standards Atmospheric agents	IP67		IP68
Spool position LEDS	YES		NO (present on connector)



6 - OVERALL AND MOUNTING DIMENSIONS FOR MD1M SOLENOID VALVES

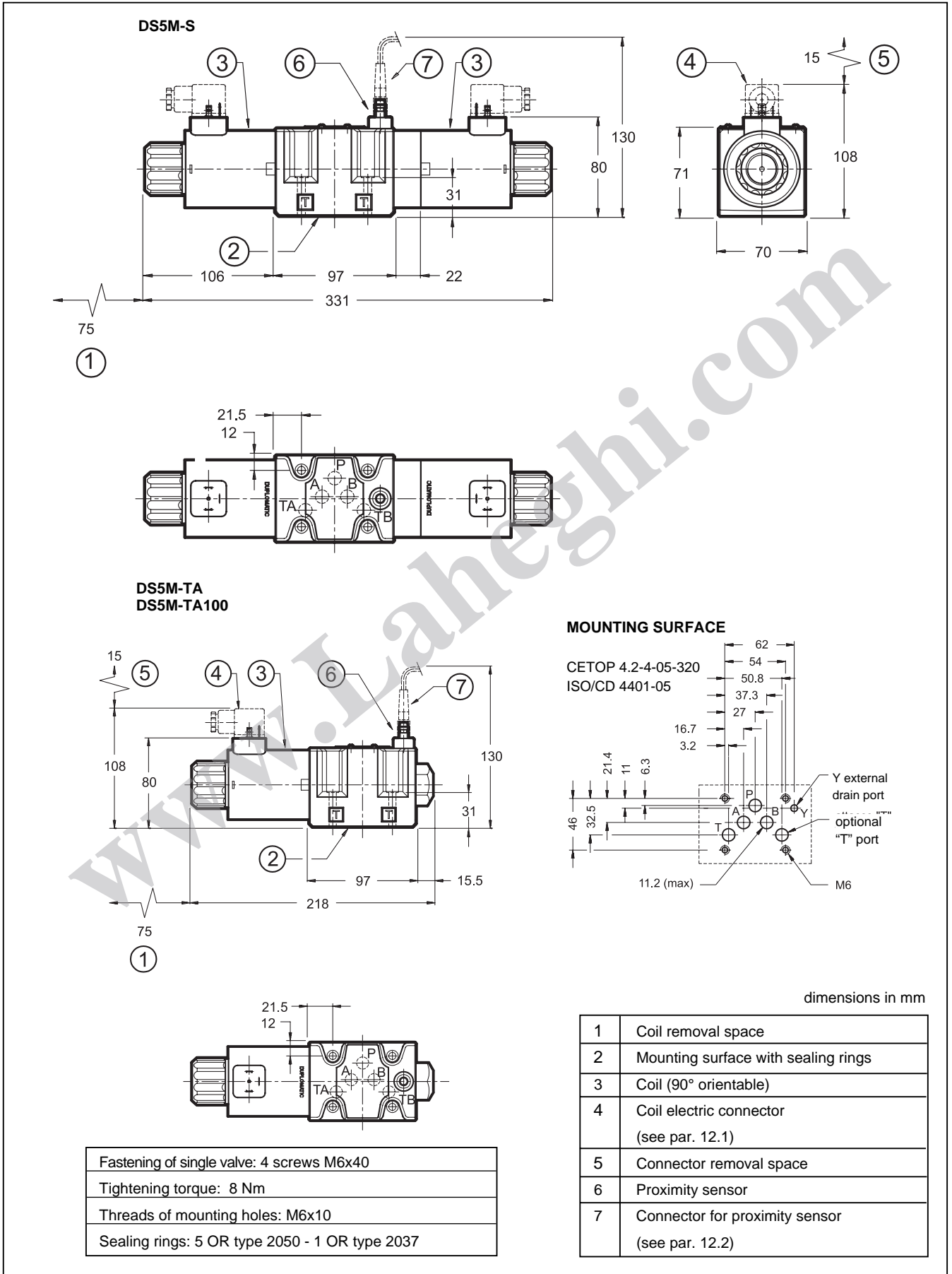


Fastening of single valve: 4 screws M5x50
Tightening torque: 5 Nm
Threads of mounting holes: M5x10
Sealing rings: 4 OR type 2037

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

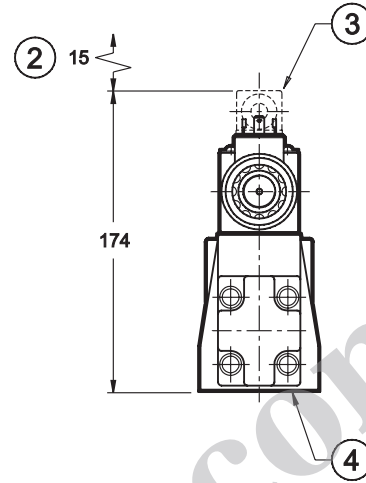
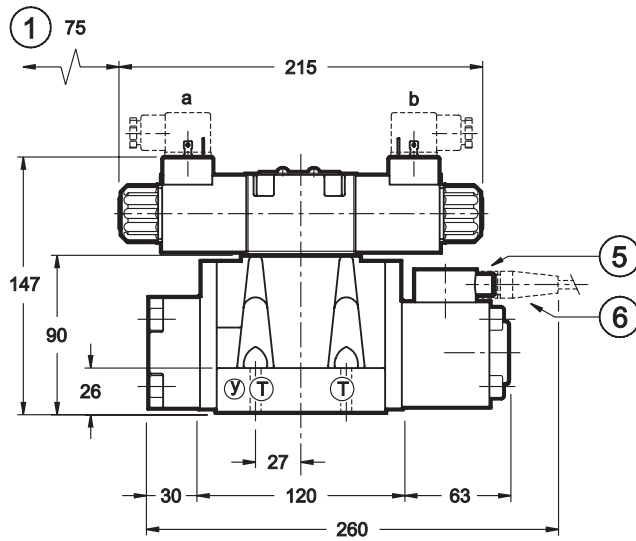


7 - OVERALL AND MOUNTING DIMENSIONS FOR DS5M SOLENOID VALVE

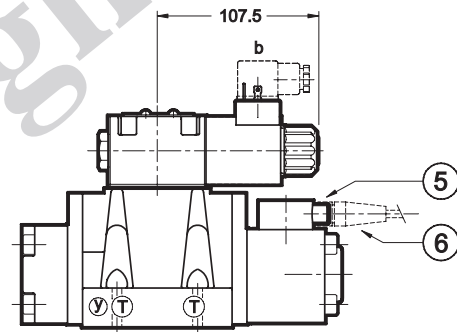
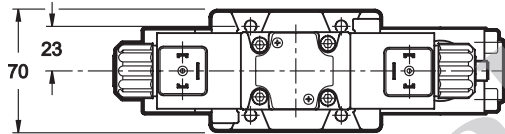




8 - E4P4M OVERALL AND MOUNTING DIMENSIONS

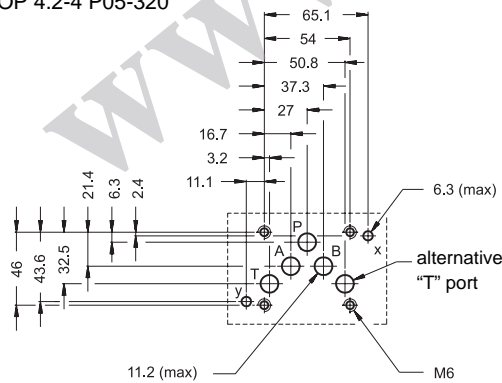


E4P4M-TA
E4P4M-6TA18 (for dimensions not shown here see E4P4M-S)



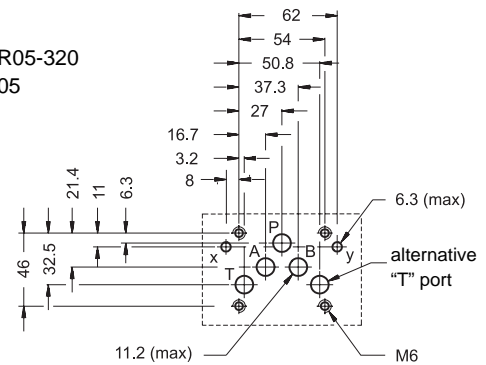
MOUNTING SURFACE(STANDARD)

CETOP 4.2-4 P05-320



Valves with CETOP R05 mounting interface are available upon request.

CETOP 4.2-4 R05-320
ISO/CD 4401-05



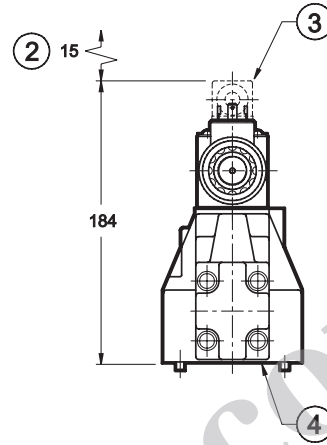
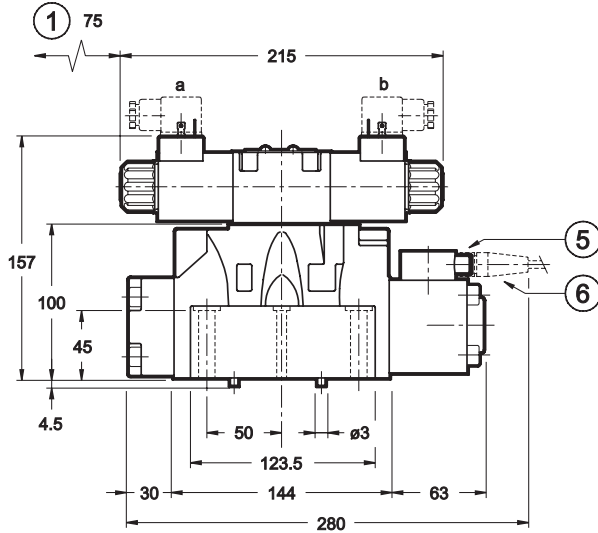
dimensions in mm

Fastening of single valve: 4 screws M6x35 (see parag. 13 - Note 5)
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 2 OR type 2037

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

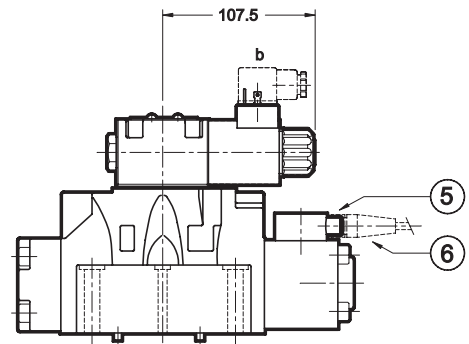
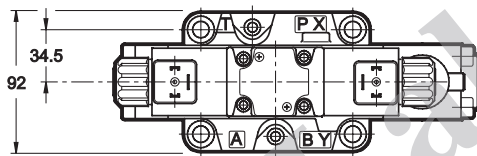


9 - E07P4M OVERALL AND MOUNTING DIMENSIONS



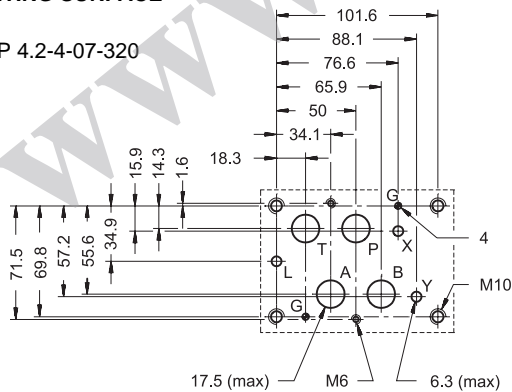
E07P4M-TA
E07P4M-6TA18

(for dimensions not shown here
see E07P4M-S)



MOUNTING SURFACE

CETOP 4.2-4-07-320



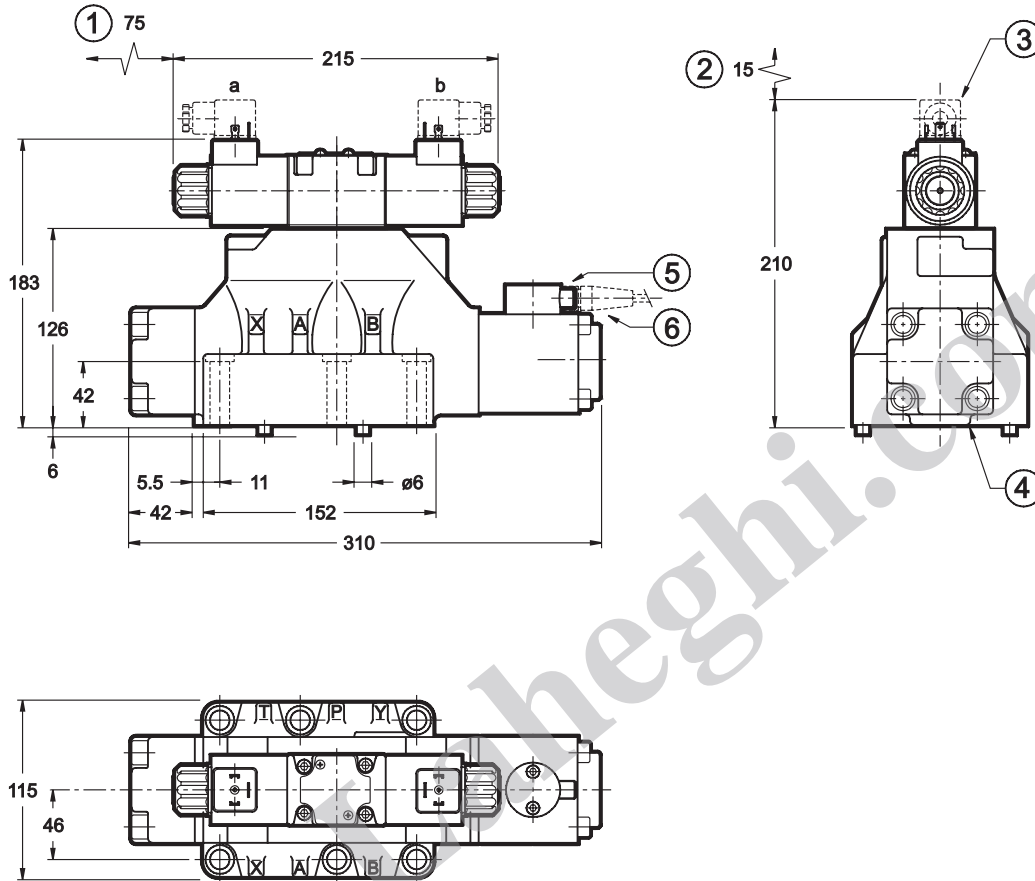
dimensions in mm

Fastening of single valve:	4 screws M10x60 (see parag. 13 Note 5) 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 2 OR type 2043

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

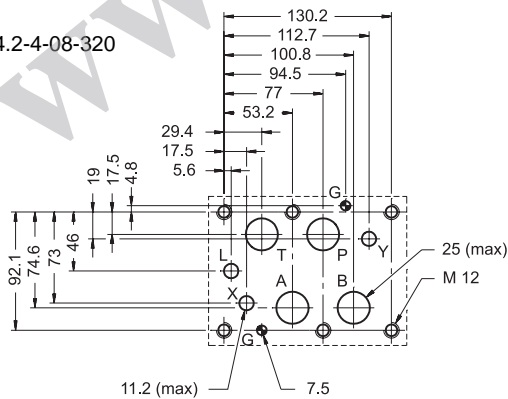


10 - E5P4M OVERALL AND MOUNTING DIMENSIONS



MOUNTING SURFACE

CETOP 4.2-4-08-320



dimensions in mm

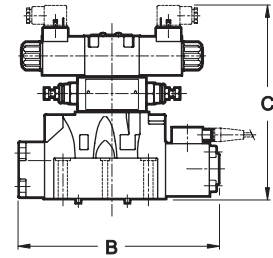
Fastening of single valve: 6 screws M12x60 (see parag. 13 Note 5)
Tightening torque: 69 Nm (screws A 8.8) -115 Nm (screws A 12.9)
Threads of mounting holes: M12x20
Sealing rings: 4 OR type 3118 2 OR type 3081

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



11 - CONTROL OF THE MAIN SPOOL SHIFTING SPEED: D

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 parag. 1.5).



	E4	E5
B	212	272
C	211	247

12 - ELECTRIC CONNECTORS

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.

12.2 - Proximity sensor connectors

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

ECM3S / M8L / 10 - STRAIGHT CONNECTOR FOR MD1M AND DS5M SOLENOID VALVES

90° pre-wired connector M8 - IP67 cable with 3 0.25 mm² conductors
length 5 m. - cable material: polyurethane resin (oil resistant)
Without LEDS

NOTE: The led is on the proximity sensor
- valve at rest: red led ON
- switched valve: red led OFF

ECM3S / M12L / 10 - STRAIGHT CONNECTOR FOR E4P4M - E07P4M - E5P4M SOLENOID OPERATED DIRECTIONAL CONTROL VALVES

90° pre-wired connector M12 - IP68 cable with 3 0.34 mm² conductors
length 5 m. - cable material: polyurethane resin (oil resistant)
LEDS: - valve at rest yellow LED ON - green LED ON
 switched valve yellow LED OFF - green LED ON

NOTE: The green led indicates the presence of power supply voltage to the connector.

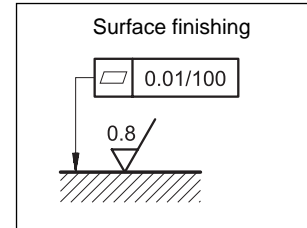
supplied connector: Green led ON
not supplied connector: Green led OFF



13 - INSTALLATION

Note 5: Use of class 12.9 fastening screws is recommended for valves E4, E07, E5 in version H (high pressure).

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)

	MD1M	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	3/8" BSP	1/2" BSP	3/4"	1" BSP	1 1/2" BSP
X, Y port dimensions	-	-	1/4" BSP	1/4" BSP	1/4" BSP

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