



**DIPLOMATIC  
HYDRAULICS**

41 510/104 ED

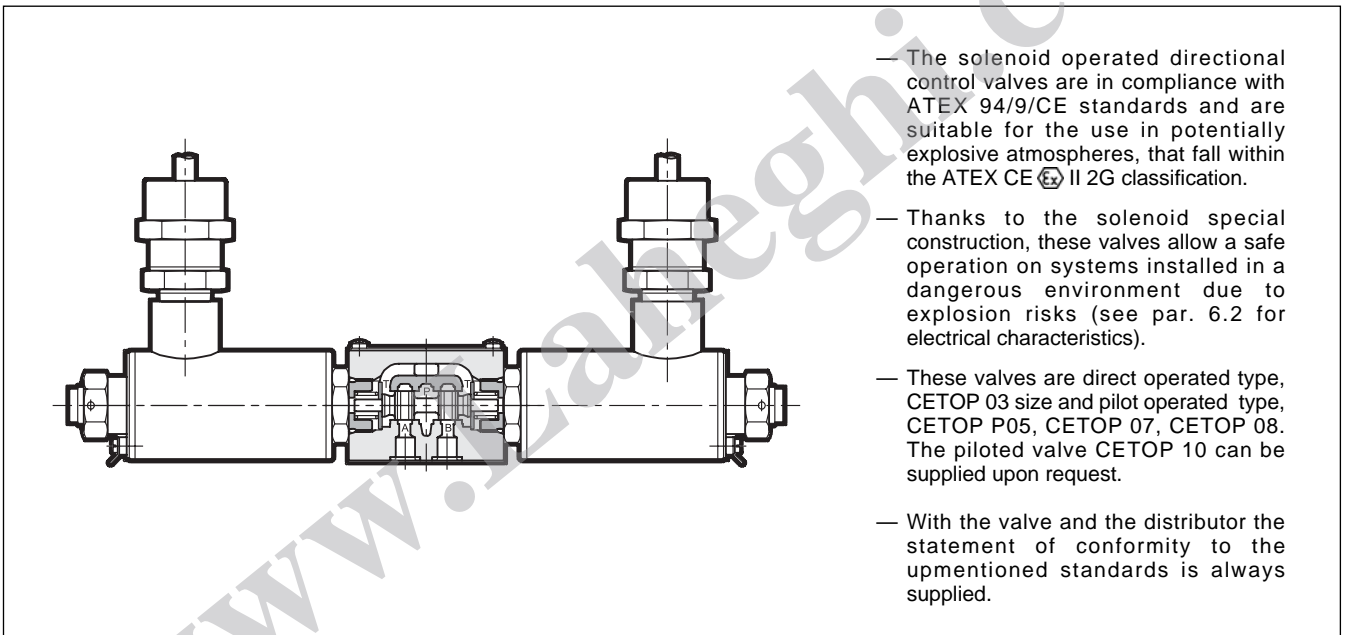


**EXPLOSION-PROOF VERSION  
SOLENOID OPERATED  
DIRECTIONAL CONTROL VALVES  
in compliance with ATEX 94/9/CE  
standards  
SERIES 21**

**MD1K            CETOP 03  
E4P4K           CETOP P05  
E07P4K          CETOP 07  
E5P4K            CETOP 08**

**p** max (see specifications table)

**Q** max (see specifications table)



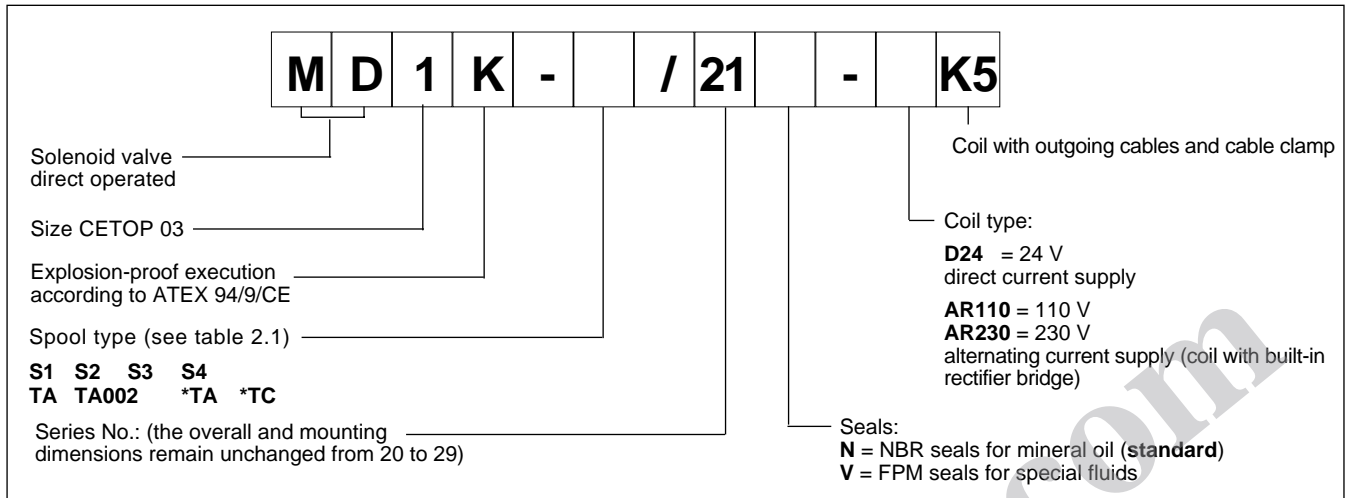
- The solenoid operated directional control valves are in compliance with ATEX 94/9/CE standards and are suitable for the use in potentially explosive atmospheres, that fall within the ATEX CE II 2G classification.
- Thanks to the solenoid special construction, these valves allow a safe operation on systems installed in a dangerous environment due to explosion risks (see par. 6.2 for electrical characteristics).
- These valves are direct operated type, CETOP 03 size and pilot operated type, CETOP P05, CETOP 07, CETOP 08. The piloted valve CETOP 10 can be supplied upon request.
- With the valve and the distributor the statement of conformity to the upmentioned standards is always supplied.

<b>PERFORMANCE RATINGS</b> (with mineral oil of viscosity of 36 cSt at 50°C)		<b>MD1K</b>	<b>E4P4K</b>	<b>E07P4K</b>	<b>E5P4K</b>
Maximum working pressure:	- P A B ports (standard version)	350	320		
	- T port	140	see operating limits par. 4.4		
Maximum flow	l/min	See par. 4.2	150	300	600
Electrical features		See par. 6			
Ambient temperature range	°C	-20 ÷ +50			
Fluid temperature range	°C	-20 ÷ +80			
Fluid viscosity range	cSt	10 ÷ 400			
Recommended viscosity	cSt	25			
Fluid contamination degree		according to NAS 1638 class 10			
Mass:	single solenoid valve	2.5	9.0	9.5	16.0
	double solenoid valve	3.6	10.2	10.7	17.2

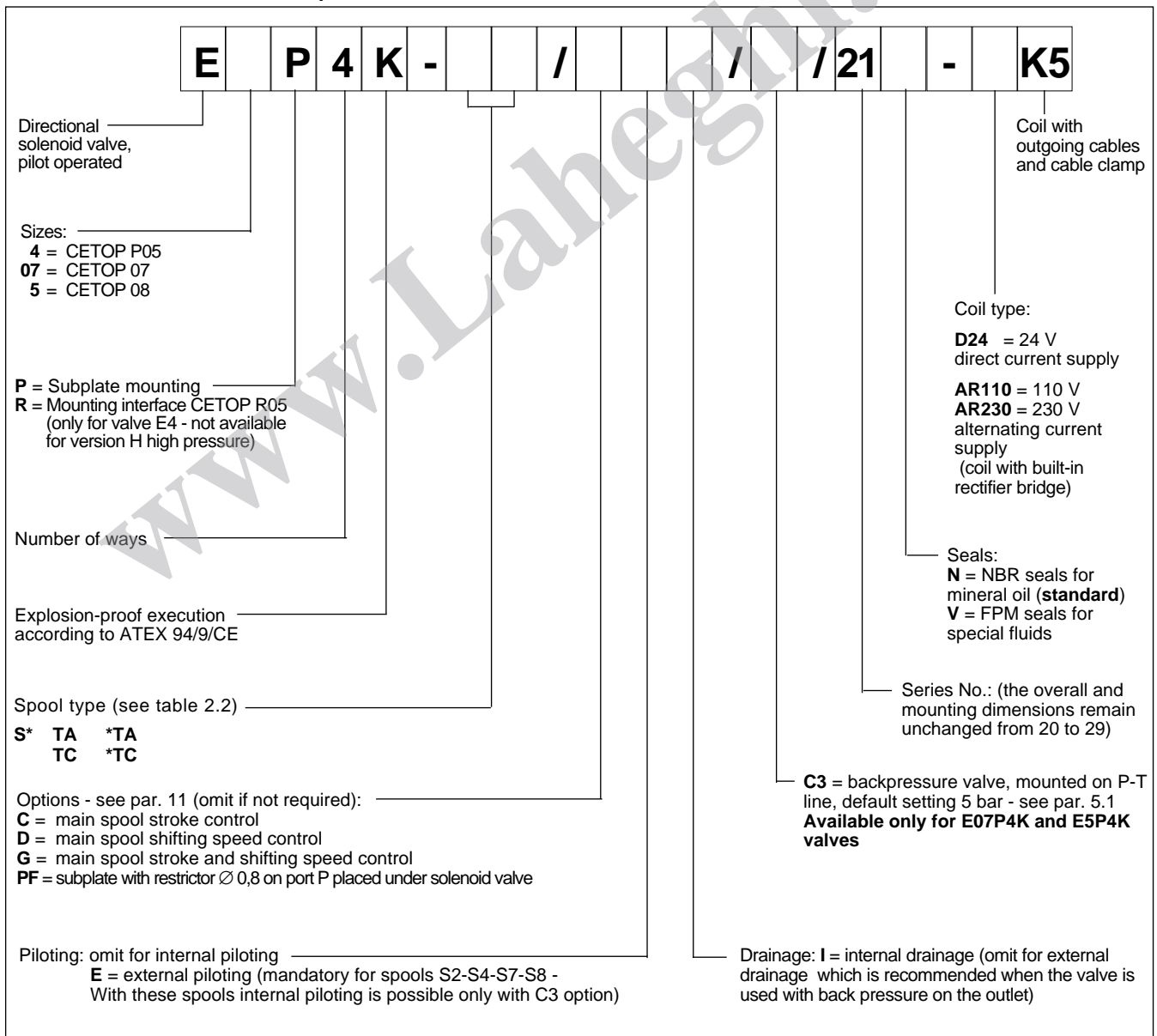


## 1 - IDENTIFICATION CODES

### 1.1 MD1K solenoid valves identification code



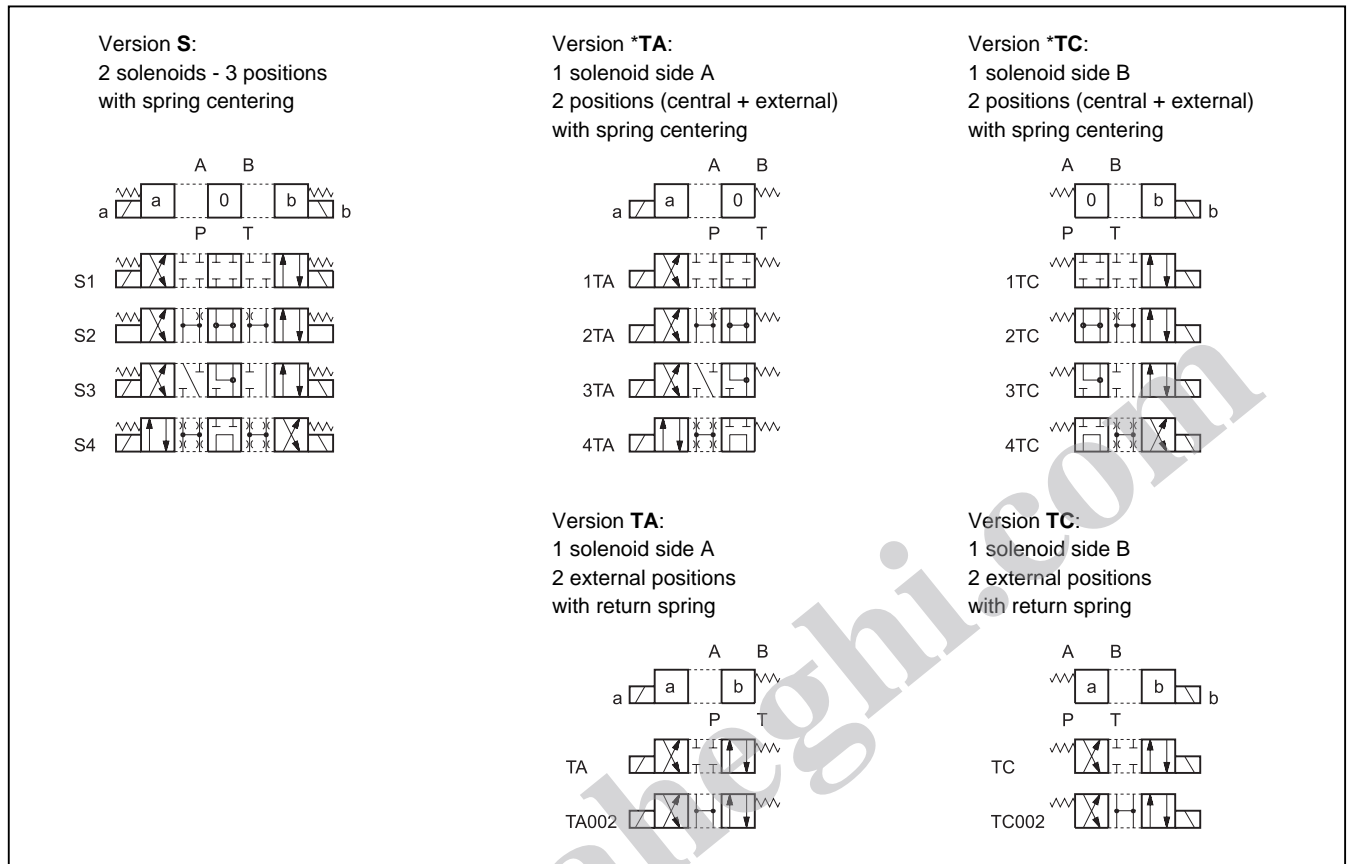
### 1.2 - E4P4K - E07P4K - E5P4K pilot-solenoid valves



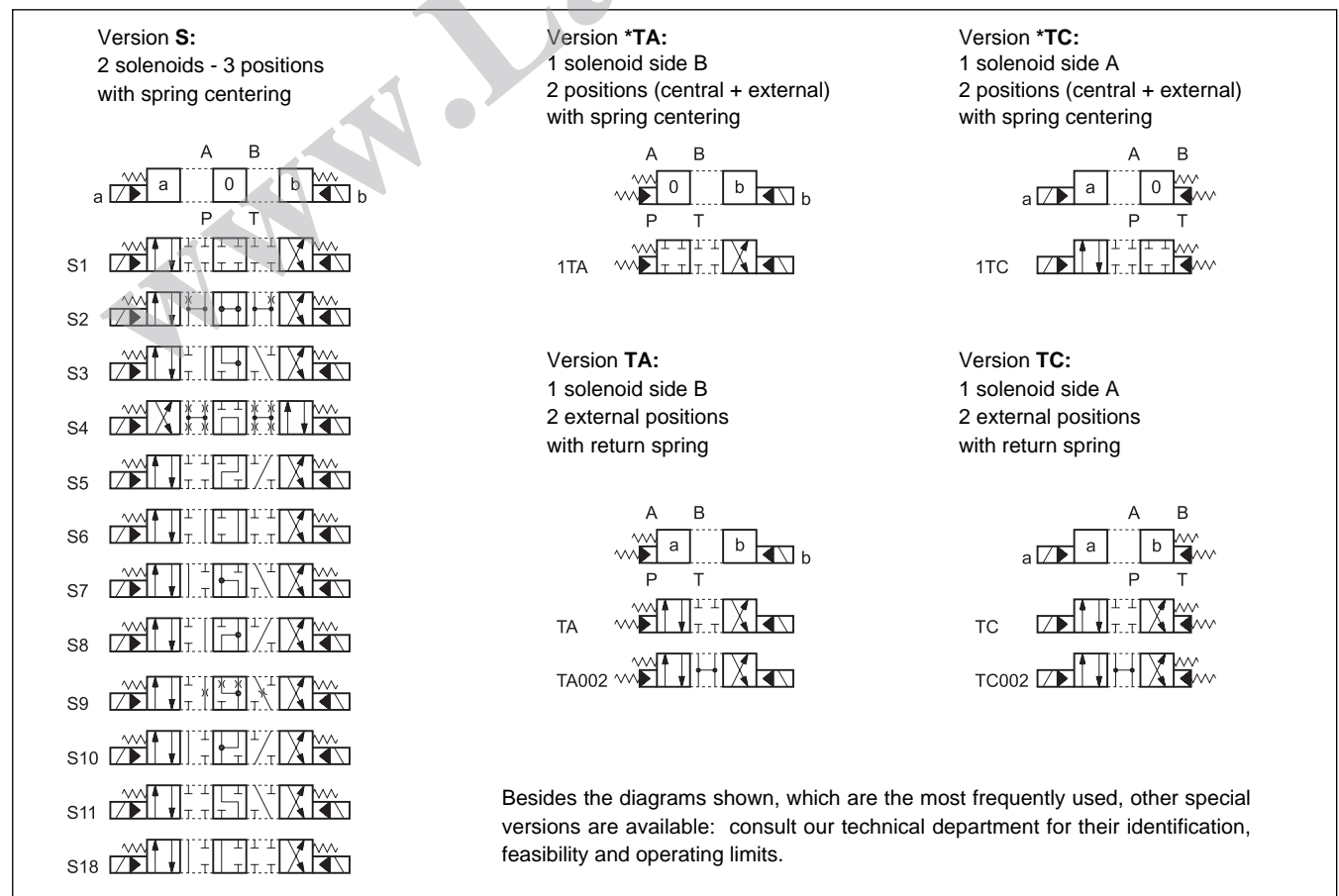


## 2 - CONFIGURATIONS

### 2.1 - Configurations available for MD1K



### 2.2 - Configurations available for E4P4K - E07P4K - E5P4K





### 3 - HYDRAULIC FLUIDS

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

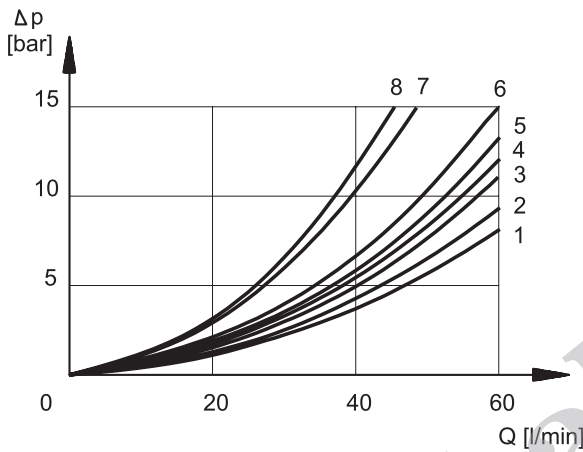
For fluids HFD-R type (phosphate esters) use FPM seals (code V).

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

Using fluids at temperatures higher than 70°C causes a faster degrading of the fluid's characteristics and of the seals. The fluid must be preserved in its physical and chemical characteristics.

### 4 - PERFORMANCE CHARACTERISTICS (values obtained at viscosity 36 cSt at 50°C)

#### 4.1 - Pressure drops $\Delta p$ -Q MD1K



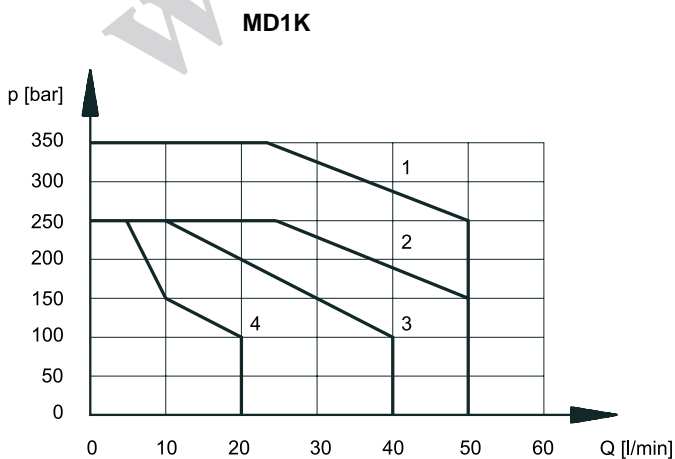
SPOOL	SPOOL POSITION	CONNECTIONS				
		P→A	P→B	A→T	B→T	P→T
CURVES ON GRAPH						
S1, 1TA, 1TC	Energized	5	5	3	3	
S2, 2TA, 2TC	De-energized	2	2	1	1	6*
S3, 3TA, 3TC	De-energized	5	5	7■	7○	
	Energized	5	5	1	1	
S4, 4TA, 4TC	De-energized	8	8	7	7	7
	Energized	8	8	7	7	
TA, TC	De-energized	5	5	4	4	
	Energized	5	5	4	4	

\* A-B blocked    ■ B blocked    ○ A blocked

#### 4.2 - Operating limits for MD1K

The curves define the flow rate operating fields according to the solenoid valve pressure.

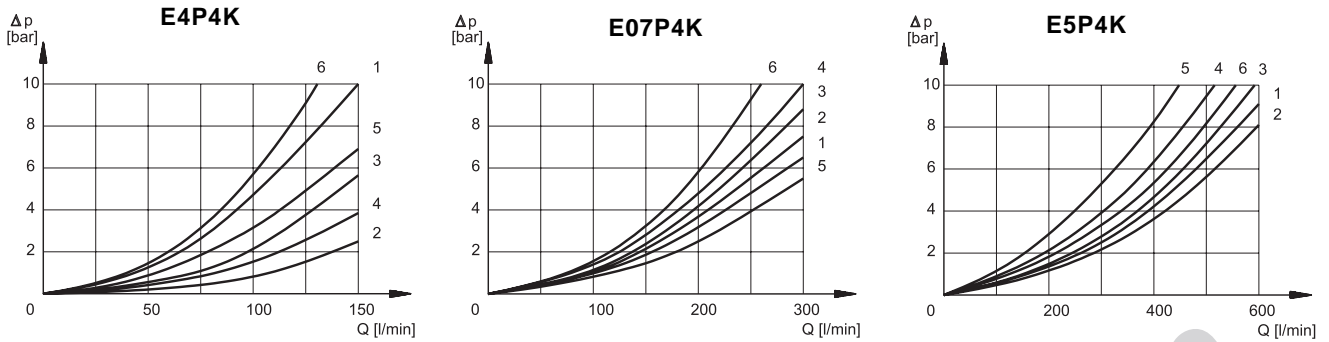
The values have been obtained with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage.



curve	type	curve	type
1	S1, 1TA, 1TC	3	S4, 4TA, 4TC
2	TA, TC	4	S3, 3TA, 3TC
3	S2, 2TA, 2TC		



### 4.3 - Pressure drops $\Delta p$ -Q per E4P4K - E07P4K - E5P4K



SPOOL	SPOOL POSITION	E4P4K				
		CONNECTIONS				
		P → A	P → B	A → T	B → T	P → T
S1	Energized	1	1	2	3	
S2	De-energized Energized	5	5	2	4	6*
S3	De-energized Energized	1	1	1 <sup>●</sup> 2	1 <sup>○</sup> 4	
S4	De-energized Energized	6	6	3	5	6
S5	De-energized Energized	1	5	2	3	
S6	De-energized Energized	1	1	2	4	1
S7	De-energized Energized	6	6	3	5	6 <sup>○</sup>
S8	De-energized Energized	6	6	3	5	6 <sup>●</sup>
S9	Energized	1	1	2	2	
S10	De-energized Energized	1 <sup>●</sup> 5	1 <sup>○</sup> 5	2	3	
S11	De-energized Energized	1	1	1 2	3	
S18	De-energized Energized	5 5	1	2	3	
TA	De-energized Energized	1	1	4	3	

SPOOL	SPOOL POSITION	E07P4K				
		CONNECTIONS				
		P → A	P → B	A → T	B → T	P → T
S1	Energized	1	1	2	3	
S2	De-energized Energized	5	5	1	2	6*
S3	De-energized Energized	1	1	4 <sup>●</sup> 1	4 <sup>○</sup> 2	
S4	De-energized Energized	6	6	3	4	6
S5	De-energized Energized	1	4 5	2	3	
S6	De-energized Energized	1	1	2	4 2	
S7	De-energized Energized	6	6	3	4	6 <sup>○</sup>
S8	De-energized Energized	6	6	4	3	6 <sup>●</sup>
S9	Energized	1	1	2	3	
S10	De-energized Energized	4 <sup>●</sup> 5	4 <sup>○</sup> 5	2	3	
S11	De-energized Energized	1	1	3 1	3	
S18	De-energized Energized	4 5	1	2	3	
TA	De-energized Energized	1	1	2	3	

SPOOL	SPOOL POSITION	E5P4K				
		CONNECTIONS				
		P → A	P → B	A → T	B → T	P → T
S1	Energized	1	1	2	3	
S2	De-energized Energized	2	2	1	2	6*
S3	De-energized Energized	1	1	4 <sup>●</sup> 1	4 <sup>○</sup> 2	
S4	De-energized Energized	6	6	3	4	5
S5	De-energized Energized	1	4 2	2	3	
S6	De-energized Energized	1	1	2	4 2	
S7	De-energized Energized	6	6	3	4	5 <sup>○</sup>
S8	De-energized Energized	6	6	4	3	5 <sup>●</sup>
S9	Energized	1	1	2	3	
S10	De-energized Energized	4 <sup>●</sup> 2	4 <sup>○</sup> 2	2	3	
S11	De-energized Energized	1	1	3 1	3	
S18	De-energized Energized	4 2	1	2	3	
TA	De-energized Energized	1	1	2	3	

\* A-B blocked ● B blocked ○ A blocked

### 4.4 - Operating limits for E4P4K - E07P4K - E5P4K

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

MAXIMUM FLOW RATES [l/min]	E4P4K		E07P4K		E5P4K	
	PRESSURES					
Spool type	210 bar	320 bar	210 bar	320 bar	210 bar	320 bar
S4, S7, S8	120	100	250	200	500	450
All other spools	150	120	300	250	600	500



#### 4.5 Switching times

The values indicated refer to a solenoid valve S1 configuration with  $Q = 25 \text{ l/min}$ ,  $p = 150 \text{ bar}$  and with PA and BT connections. The switch on and off times are obtained at the time a pressure variation occurs on the line.

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 ( $\pm 10\%$ )	ENERGIZING	DE-ENERGIZING
MD1K	100 ms	80 ms

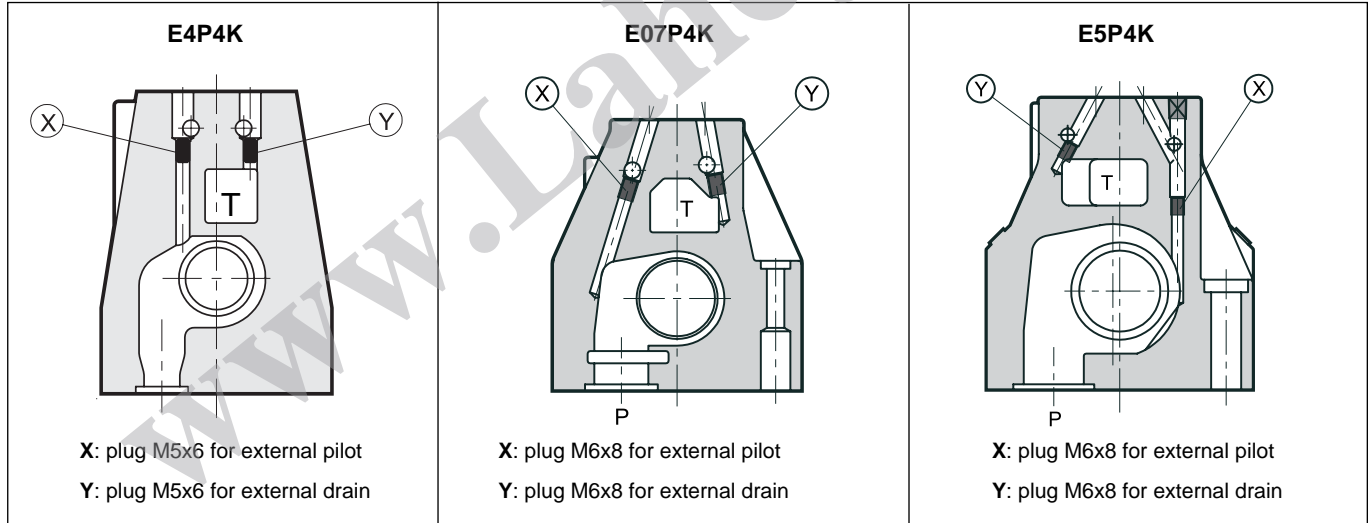
TIMES ( $\pm 10\%$ ) [ms]	ENERGIZING		DE-ENERGIZING	
	2 Pos.	3 Pos.	2 Pos.	3 Pos.
E4P4K	70	60	70	50
E07P4K	70	60	80	50
E5P4K	80	60	90	60

#### 5 - PILOTING AND DRAINAGE

The E\*P4K 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*P4K-**	INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
E*P4K-**/I	INTERNAL PILOT AND EXTERNAL DRAIN	NO	NO
E*P4K-**/E	INTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
E*P4K-**/EI	INTERNAL PILOT AND EXTERNAL DRAIN	YES	NO

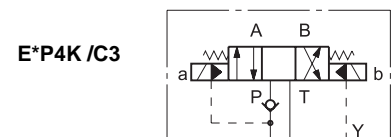


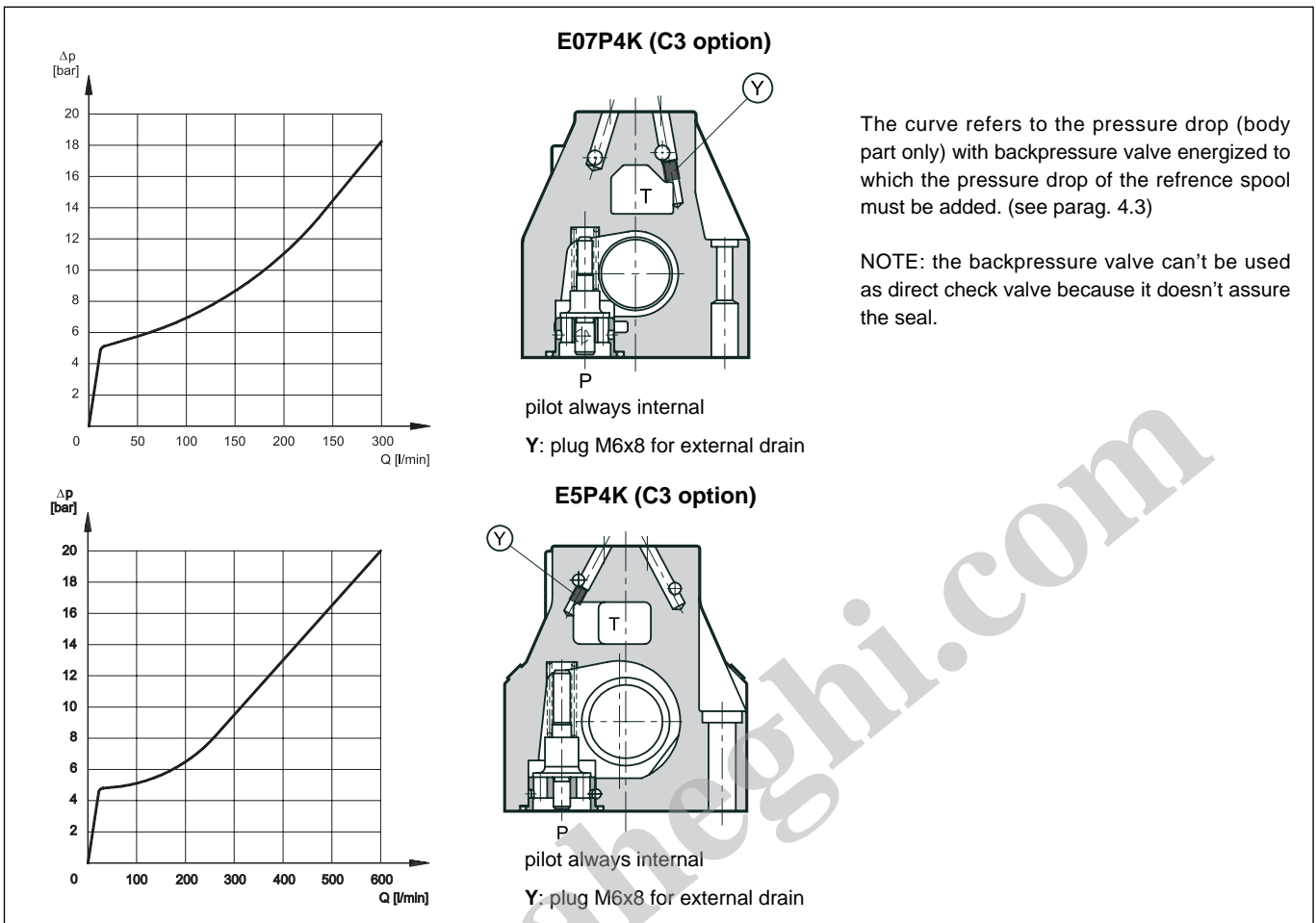
#### 5.1 - Check valve incorporated on line P

(Available only for valves E07P4K - E5P4K)

Valves E07P4K7 and E5P4K are available upon request with check valve incorporated on line P. This is particularly useful to obtain the necessary piloting pressure when the control valve, in the rest position, has line P connected to the T outlet (spools type S2, S4, S7, S8). The cracking pressure is 5 bar. Add **C3** to the identification code for this request (see par. 1.2).

**C3 version is available only with internal pilot.**





## 6 - ELECTRICAL CHARACTERISTICS

### 6.1 Classification

The valves can be used for applications and installations in potentially explosive atmospheres that fall within the ATEX CE II 2G classification.

- Group: II (surface plants)
- Category: 2 (high protection for areas 1 and 2)
- Type of atmosphere: G (explosive atmosphere with gas or vapours)

### 6.2 Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded onto 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 hexagonal threaded nut provided with anti-unlocking safety screw and it can be turned 360° on its axis, depending on the available space.

The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment.

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

The AR coils (for alternating current supply) contain a built-in rectifier bridge.

### 6.3 Current and power consumption

The table shows current and power consumption values relevant to the different coil types, for direct or alternating 50 or 60 Hz current supply. AR coils must be used when the valve is fed with AC power supply and then rectified by means of the rectifier bridge incorporated into the coil.

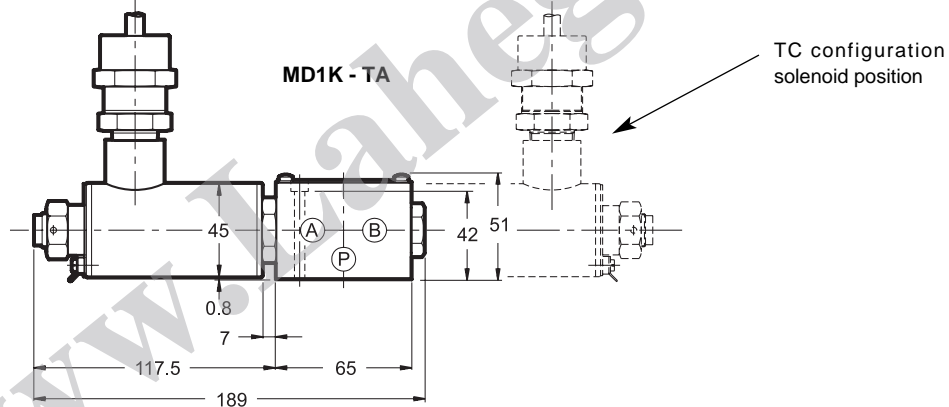
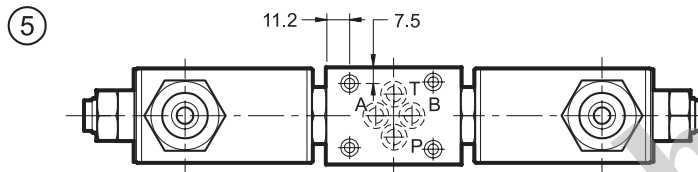
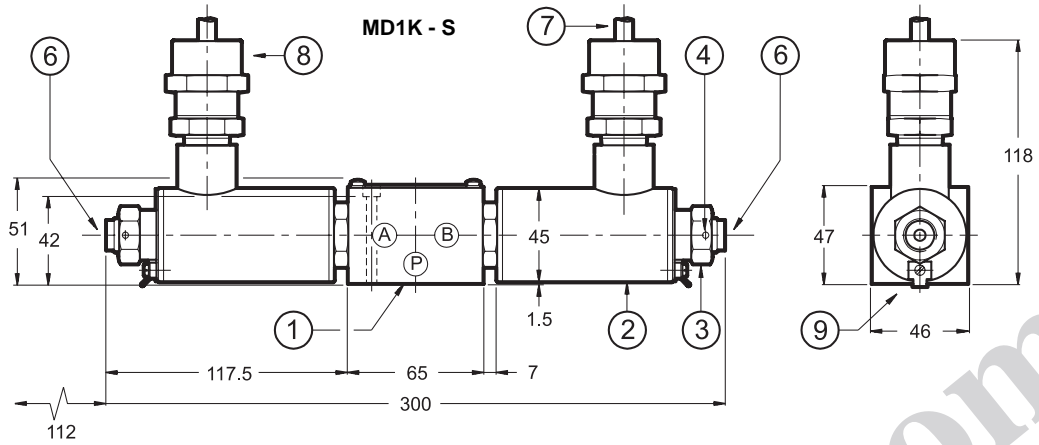
<b>VOLTAGE SUPPLY FLUCTUATION</b>	± 10% Vnom
<b>MAX. SWITCH ON FREQUENCY</b> MD1K E4P4K - E07P4K E5P4K	8.000 ins/hr 6.000 ins/hr 4.000 ins/hr
<b>DUTY CYCLE</b>	100%
<b>EXPLOSION-PROOF VERSION</b>	According to ATEX 94/9/CE
<b>ELECTROMAGNETIC COMPATIBILITY (EMC) EMISSIONS IMMUNITY</b>	According to 89/336 CEE
<b>LOW VOLTAGE</b>	According to 73/23/CEE 96/68/CEE
<b>TEMPERATURE CLASS</b>	T5 (surface temperature ≤ 100°C)
Class of protection according to IEC 144 standards: Atmospheric agents Coil insulation	IP 67 class H

Coil type	Absorbed current A (± 5%)	Power (± 5%)	
		W	VA
D24	0,46	11	
AR110	0,1		11
AR230	0,05		11

Note: AR coils are for alternating current supply either 50 or 60 Hz.



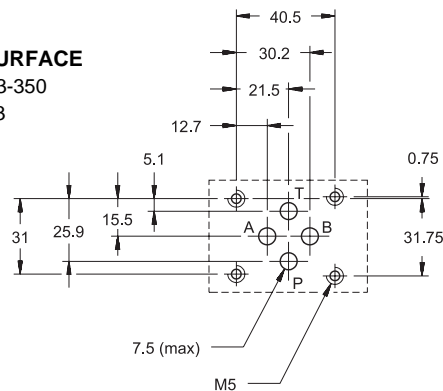
## 7 - OVERALL AND MOUNTING DIMENSIONS MD1K



dimensions in mm

### MOUNTING SURFACE

CETOP 4.2-4-03-350  
ISO/CD 4401-03



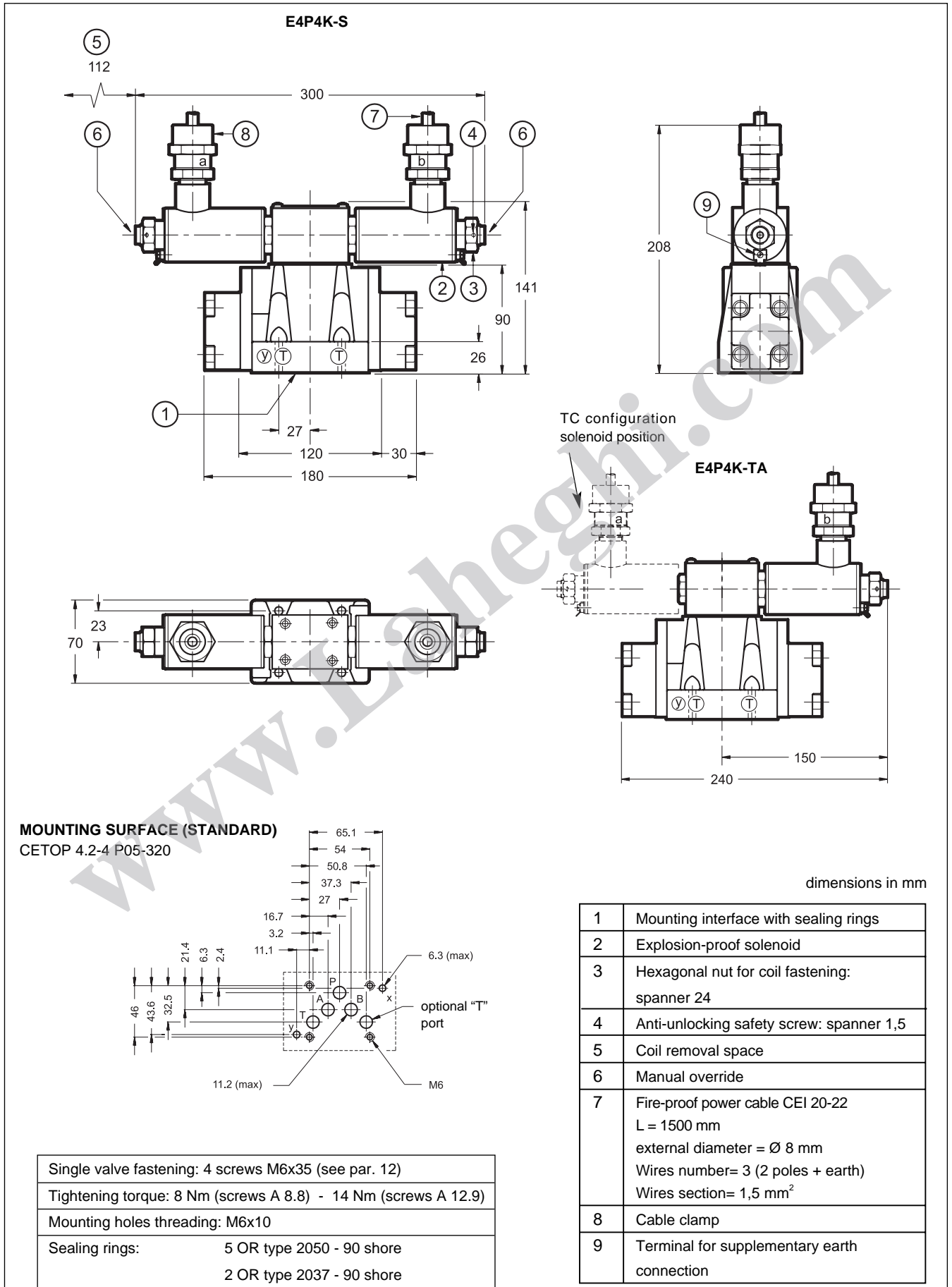
Single valve fastening: 4 screws M5x50
Tightening torque: 5 Nm
Mounting holes threading: M5x10
Sealing rings: 4 OR type 2037 - 90 shore

1	Mounting interface with sealing rings
2	Explosion-proof solenoid
3	Hexagonal nut for coil fastening: spanner 24
4	Anti-unlocking safety screw: spanner 1,5
5	Coil removal space
6	Manual override
7	Fire-proof power cable CEI 20-22 L = 1500 mm external diameter = $\varnothing$ 8 mm Wires number= 3 (2 poles + earth) Wires section= 1,5 mm <sup>2</sup>
8	Cable clamp
9	Terminal for supplementary earth connection



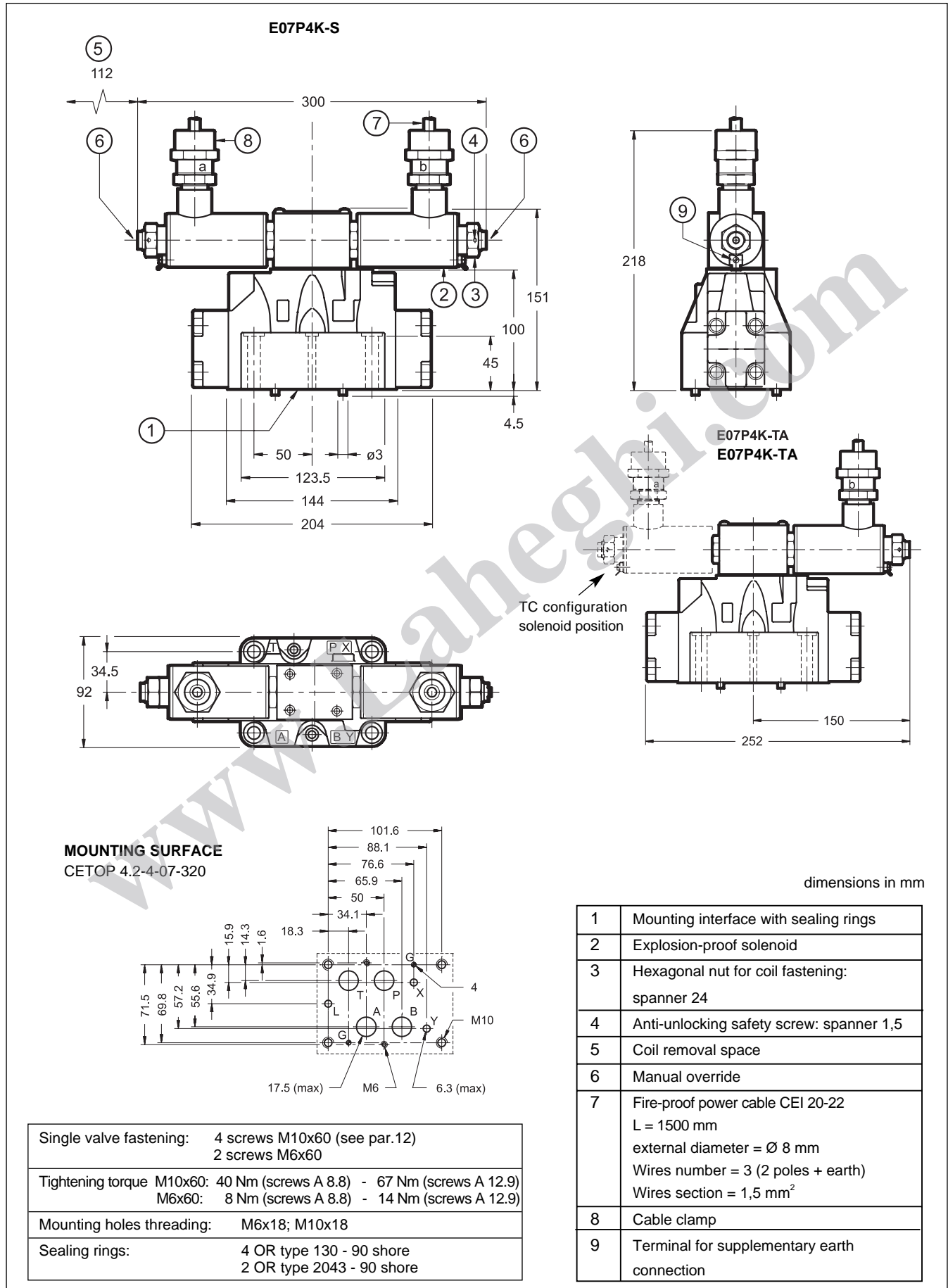


## 8 - OVERALL AND MOUNTING DIMENSIONS E4P4K



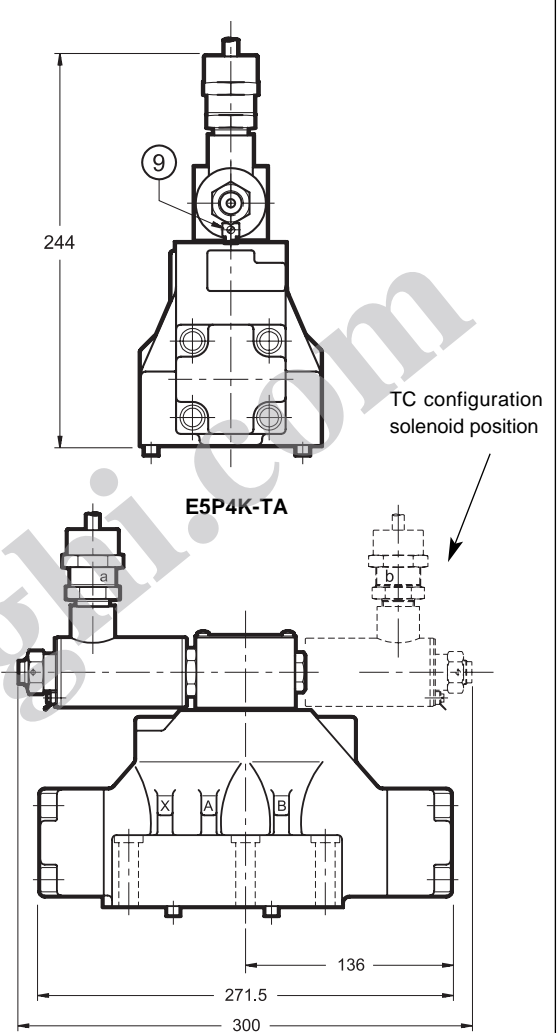
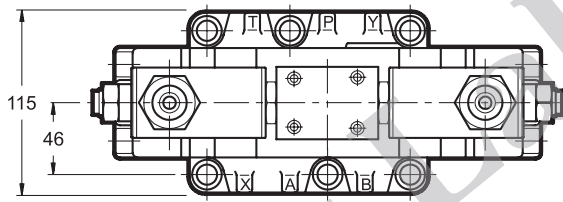
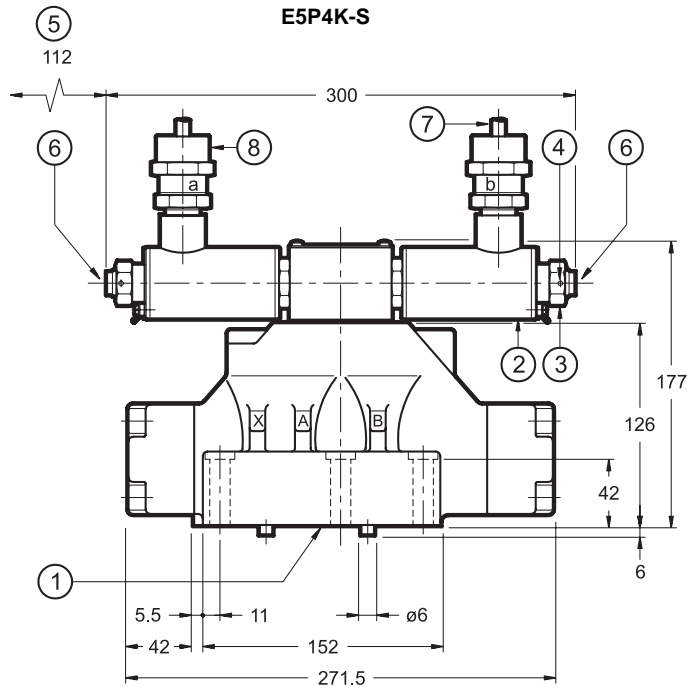


## 9 - OVERALL AND MOUNTING DIMENSIONS E07P4K

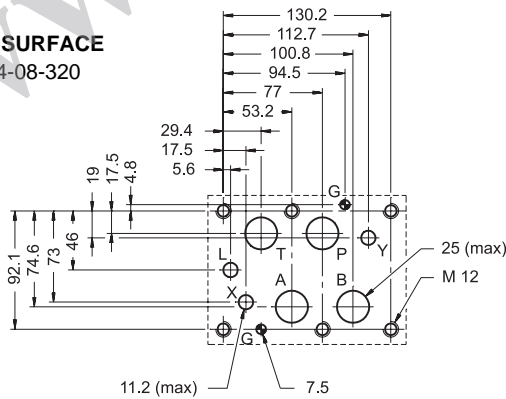




### 10 - OVERALL AND MOUNTING DIMENSIONS E5P4K



#### MOUNTING SURFACE CETOP 4.2-4-08-320



dimensions in mm

Single valve fastening:	6 screws M12x60 (see par. 12)
Tightening torque:	69 Nm (screws A 8.8) - 115 Nm (screws A 12.9)
Mounting holes threading:	M12x20
Sealing rings:	4 OR type 3118 - 90 shore 2 OR type 3081 - 90 shore

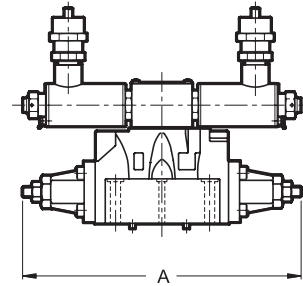
1	Mounting interface with sealing rings
2	Explosion-proof solenoid
3	Hexagonal nut for coil fastening: spanner 24
4	Anti-unlocking safety screw: spanner 1,5
5	Coil removal space
6	Manual override
7	Fire-proof power cable CEI 20-22 L = 1500 mm external diameter = Ø 8 mm Wires number= 3 (2 poles + earth) Wires section= 1,5 mm <sup>2</sup>
8	Cable clamp
9	Terminal for supplementary earth connection



## 11 - CONTROLS

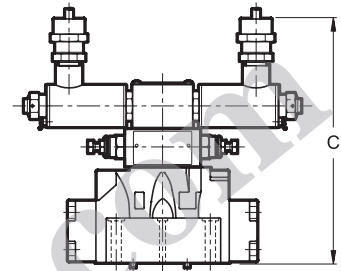
### 11.1 Control of the main spool stroke: C

It is possible to introduce special stroke controls in the heads of the hydropiloted valve so as to vary the maximum spool clearance opening. This solution allows control of the flow rate from the pump to the actuator and from the actuator to the outlet, obtaining a double adjustable control on the actuator. Add the letter **C** to the identification code to request this device (see par. 1.2).



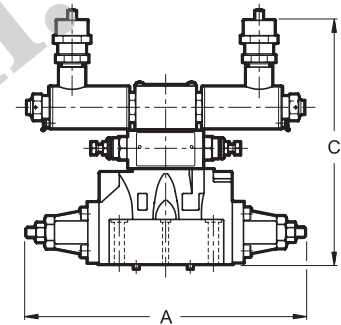
### 11.2 Control of the main spool shifting speed: D

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 changeover smoothness can be varied. Add the letter **D** to the identification code to request this device (see par. 1.2).



### 11.3 Control of the main spool stroke and shifting speed: G

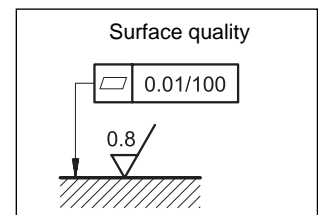
It is possible to have the valve fitted with both the spool stroke device and the piloting flow rate control device. Add the letter **G** to the identification code to request this solution (see par. 1.2).



	E4P4K	E07P4K	E5P4K
A	280	320	415
C	240	250	276

## 12 - INSTALLATION

Configurations with centering and recall springs can be mounted in any position. 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.



## 13 - SUBPLATES (see catalogue 51 000)

	E4P4K	E07P4K	E5P4K
Type with rear ports	PME4-AI5G	PME07-AI6G	
Type with side ports	PME4-AL5G	PME07-AL6G	PME5-AL8G
Threading P, T, A, B, X, Y	3/4" 1/4" BSP	1" BSP 1/4" BSP	1 1/2" BSP 1/4" BSP

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