



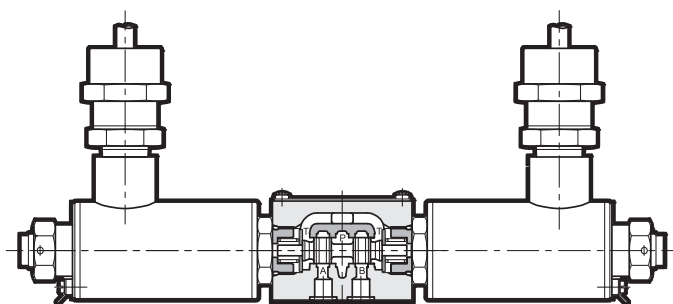
EXPLOSION-PROOF VERSION SOLENOID OPERATED DIRECTIONAL CONTROL VALVES in compliance with ATEX 94/9/CE SERIES 21

MD1K **ISO 4401-03 (CETOP 03)**
E4P4K **CETOP P05**
E07P4K **ISO 4401-07 (CETOP 07)**
E5P4K **ISO 4401-08 (CETOP 08)**

p max (see table of performances)

Q max (see table of performances)

OPERATING PRINCIPLE



- 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 either the ATEX II 2GD for gas or for dust classification. See par. 6.2 for electrical characteristics.
- These valves are direct operated type, ISO 4401-03 (CETOP 03) size and pilot operated type, CETOP P05, ISO 4401-07 (CETOP 07), ISO 4401-08 (CETOP 08). The piloted valve ISO 4401-10 (CETOP 10) can be supplied upon request.
- With the valve and the distributor the statement of conformity to the upmentioned standards is always supplied.

TYPE EXAMINATION CERTIFICATE NUMBER: **CEC 10/2003 - AET 619**

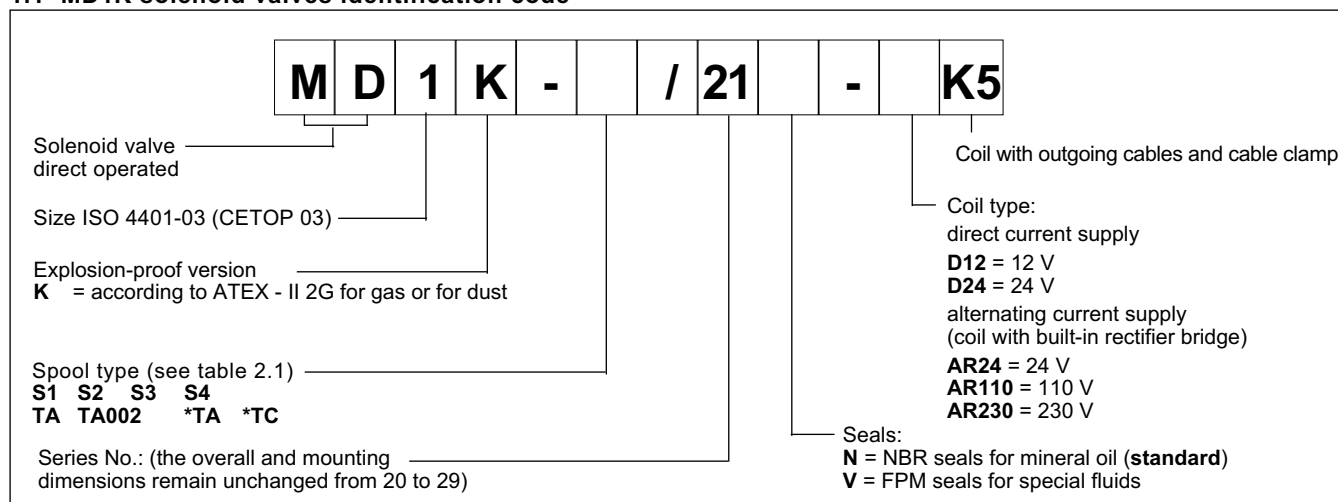
PERFORMANCES (with mineral oil of viscosity of 36 cSt at 50°C)

		MD1K	E4P4K	E07P4K	E5P4K
Maximum operating pressure:					
P - A - B ports (standard)	bar	350	320		
T port		140	see operating limits at paragraph 4.4		
Maximum flow	l/min	see par. 4.2	150	300	600
Electrical feature		see paragraph 6			
Ambient temperature range	°C	-20 / +40			
Fluid temperature range	°C	-20 / +60			
Fluid viscosity range	cSt	10 ÷ 400			
Fluid contamination degree		According to ISO 4406:1999 class 20/18/15			
Recommended viscosity	cSt	25			
Mass: single solenoid valve	kg	2,5	9	9,5	16
double solenoid valve		3,6	10,2	10,7	17,2

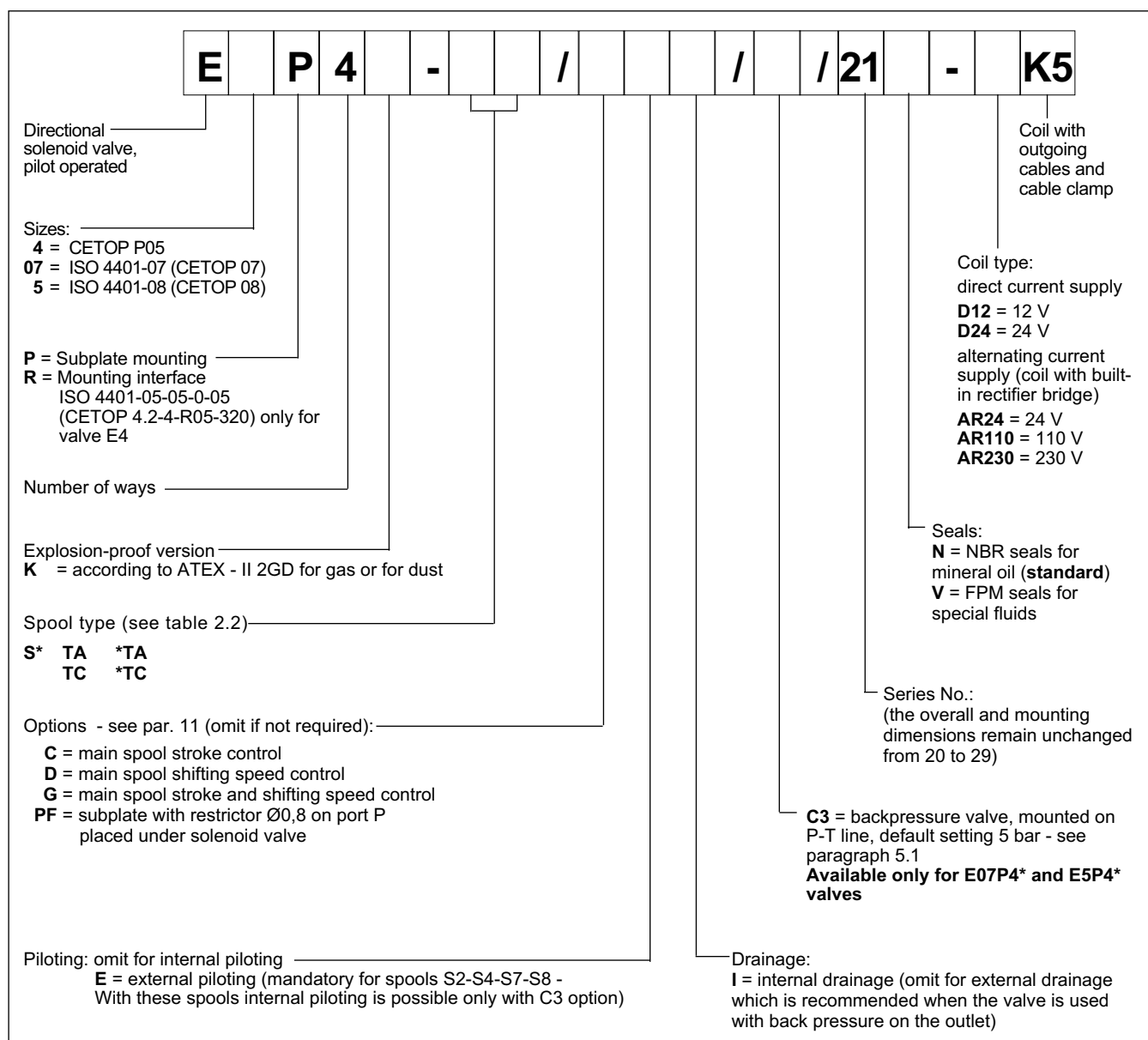


1 - IDENTIFICATION CODES

1.1 MD1K solenoid valves identification code



1.2 - E4P4K, E07P4K, E5P4K pilot-solenoid valves



2 - SPOOL TYPES

2.1 - Spool types available for MD1K

Version S: 2 solenoids - 3 positions with spring centering S1 S2 S3 S4	Version *TA: 1 solenoid side A 2 positions (central + external) with spring centering 1TA 2TA 3TA 4TA	Version *TC: 1 solenoid side B 2 positions (central + external) with spring centering 1TC 2TC 3TC 4TC
Type RK: 2 solenoids - 2 positions with mechanical retention RK	Version TA: 1 solenoid side A 2 external positions with return spring TA TA002	Version TC: 1 solenoid side B 2 external positions with return spring TC TC002

2.2 - Spool types available for E4P4K, E07P4K, E5P4K

Version S: 2 solenoids - 3 positions with spring centering S1 S2 S3 S4 S5 S6 S7 S8 S9 S10 S11 S18	Version *TA: 1 solenoid side B 2 positions (central + external) with spring centering 1TA	Version *TC: 1 solenoid side A 2 positions (central + external) with spring centering 1TC
	Version TA: 1 solenoid side B 2 external positions with return spring TA TA002	Version TC: 1 solenoid side A 2 external positions with return spring TC TC002
	Type RK: 2 solenoids - 2 positions with mechanical retention RK	Besides the diagrams shown, which are the most frequently used, other special versions are available: consult our technical department for their identification, feasibility and operating limits.

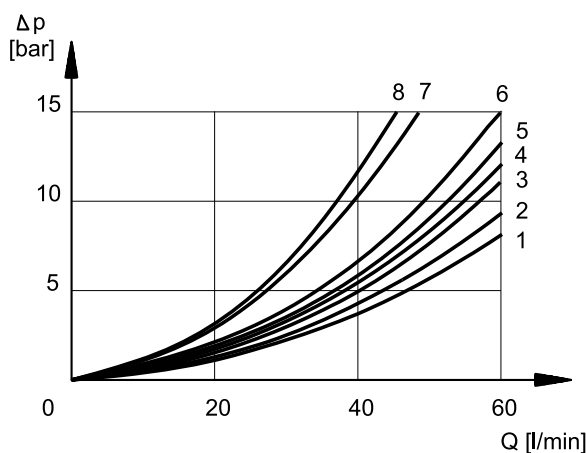


3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid 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.

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

4.1 - Pressure drops Δp -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°	
S4, 4TA, 4TC	de-energized	8	8	7	7	7
TA, TC, RK	energized	5	5	4	4	

* A-B locked

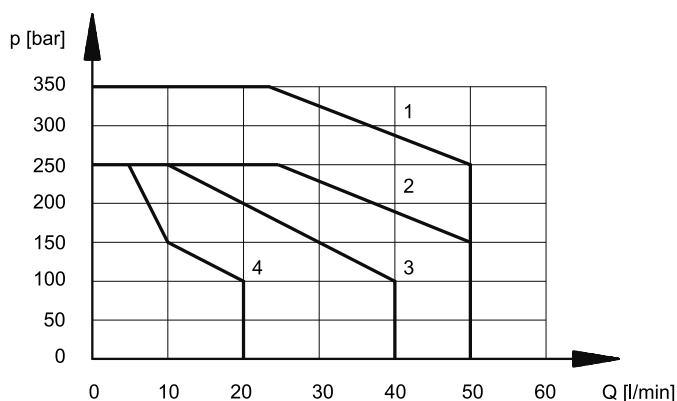
°B locked

°A locked

4.2 - Operating limits for MD1K

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

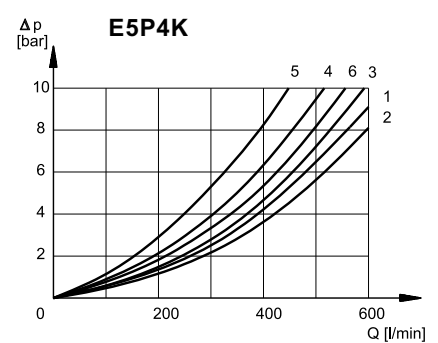
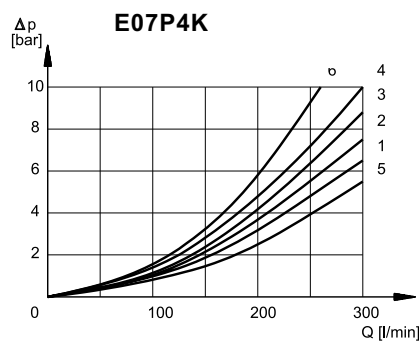
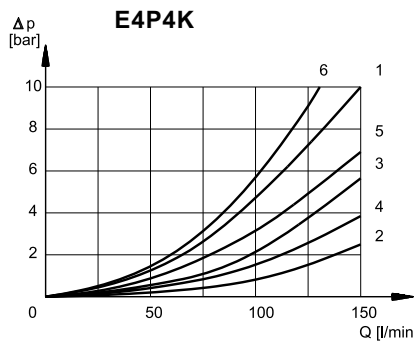
The values indicated in the graphs are relevant to the standard solenoid valve. The operating limits can be considerably reduced if a 4-way valve is used as 3-way valve with port A or B plugged or without flow. The values have been obtained with viscosity 36 cSt, temperature 50°C, filtration 25 µm and with solenoids at rated temperature, supplied with voltage equal to 90% of the nominal voltage.



CURVE	SPOOL TYPE
1	S1, RK, 1TA, 1TC
2	TA, TC
3	S2, 2TA, 2TC
3	S4, 4TA, 4TC
4	S3, 3TA, 3TC



4.3 - Pressure drops Δp -Q for E4P4K, E07P4K, E5P4K



E4P4K

SPOOL	SPOOL POSITION	CONNECTIONS				
		P→A	P→B	A→T	B→T	P→T
		CURVES ON GRAPH				
S1	Energized	1	1	2	3	
S2	De-energized					6*
	Energized	5	5	2	4	
S3	De-energized			1●	1○	
	Energized	1	1	2	4	
S4	De-energized					6
	Energized	6	6	3	5	
S5	De-energized		1			
	Energized	1	5	2	3	
S6	De-energized				1	
	Energized	1	1	2	4	
S7	De-energized					6○
	Energized	6	6	3	5	
S8	De-energized					6●
	Energized	6	6	3	5	
S9	Energized	1	1	2	2	
S10	De-energized	1●	1○			
	Energized	5	5	2	3	
S11	De-energized			1		
	Energized	1	1	2	3	
S18	De-energized	5				
	Energized	5	1	2	3	
TA	De-energized	1			3	
	Energized		1	4		
RK	Energized	1	1	4	3	

E07P4K

CONNECTIONS				
P→A	P→B	A→T	B→T	P→T
CURVES ON GRAPH				
1	1	2	3	
				6*
5	5	1	2	
		4●	4○	
1	1	1	2	
6	6	3	4	6
	4			
1	5	2	3	
			4	
1	1	2	2	
				6○
6	6	3	4	
				6●
6	6	4	3	
1	1	2	3	
4●	4○			
5	5	2	3	
		3		
1	1	1	3	
4				
5	1	2	3	
1			3	
	1	2		
1	1	2	3	

E5P4K

CONNECTIONS				
P→A	P→B	A→T	B→T	P→T
CURVES ON GRAPH				
1	1	2	3	
				6*
2	2	1	2	
		4●	4○	
1	1	1	2	
6	6	3	4	5
	4			
1	2	2	3	
			4	
1	1	2	2	
				5○
6	6	3	4	
				5●
6	6	4	3	
1	1	2	3	
4●	4○			
2	2	2	3	
		3		
1	1	1	3	
4				
2	1	2	3	
1			3	
	1	2		
1	1	2	3	

* A-B locked ●B locked ○A locked



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	
Spool type	PRESSURES					
	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.

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

The values indicated refer to a solenoid operated directional control valve operating with piloting pressure = 100 bar and with PA and BT connections.

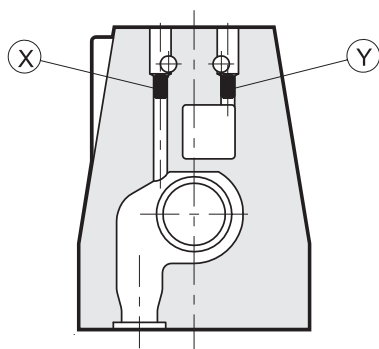
The switch on and off times are obtained at the time a pressure variation occurs on the line.

TIMES ($\pm 10\%$) [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

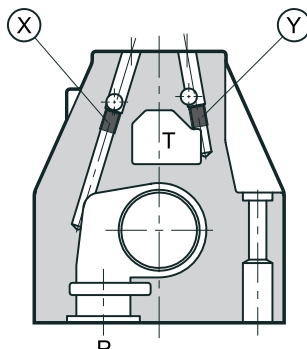
The E*P4K valves are available with piloting and drainage, both internal and external. The version with external drainage allows for a higher back pressure on the outlet.

E4P4K



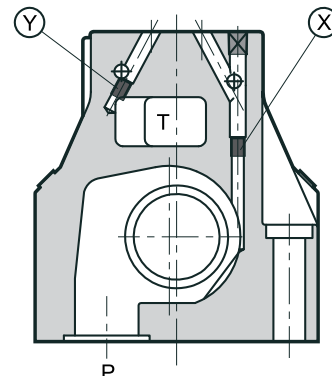
X: plug M5x6 for external pilot
Y: plug M5x6 for external drain

E07P4K



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

E5P4K



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

TYPE OF VALVE		Plug assembly	
		X	Y
E*P4*-**	INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
E*P4*-**/I	INTERNAL PILOT AND EXTERNAL DRAIN	NO	NO
E*P4*-**/E	INTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
E*P4*-**/EI	INTERNAL PILOT AND EXTERNAL DRAIN	YES	NO

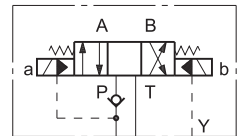
5.1 - Check valve incorporated on line P

(Available only for valves E07P4* - E5P4*)

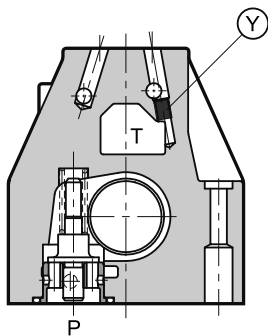
Valves E07P4* and E5P4* are available upon request with check valve incorporated on line P. This is particularly useful to obtain the necessary piloting pressure when the control valve, in the rest position, has line P connected to the T outlet (spools type S2, S4, S7, S8). The cracking pressure is 5 bar.. Add C3 to the identification code for this request (see paragraph 1.2).

C3 version is available only with internal pilot.

E*P4* /C3

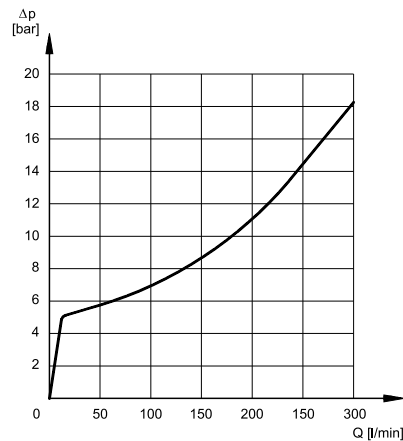


E07P4* (C3 option)

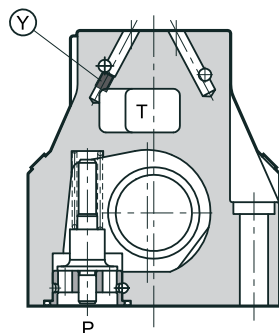


pilot always internal

Y: plug M6x8 for external drain

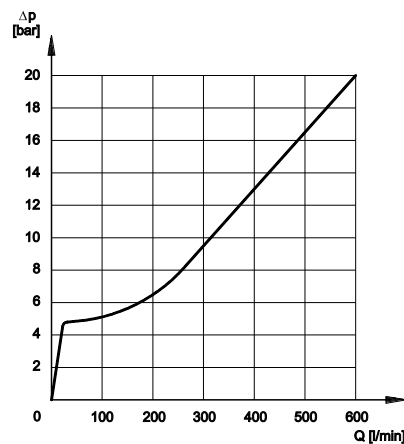


E5P4* (C3 option)



pilot always internal

Y: plug M6x8 for external drain



The curve refers to the pressure drop (body part only) with backpressure valve energized to which the pressure drop of the reference spool must be added. (see paragraph 4.3)

NOTE: the backpressure valve can't be used as direct check valve because it doesn't assure the seal.



6 - ELECTRICAL CHARACTERISTICS

6.1 Classification

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

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

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 an 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.

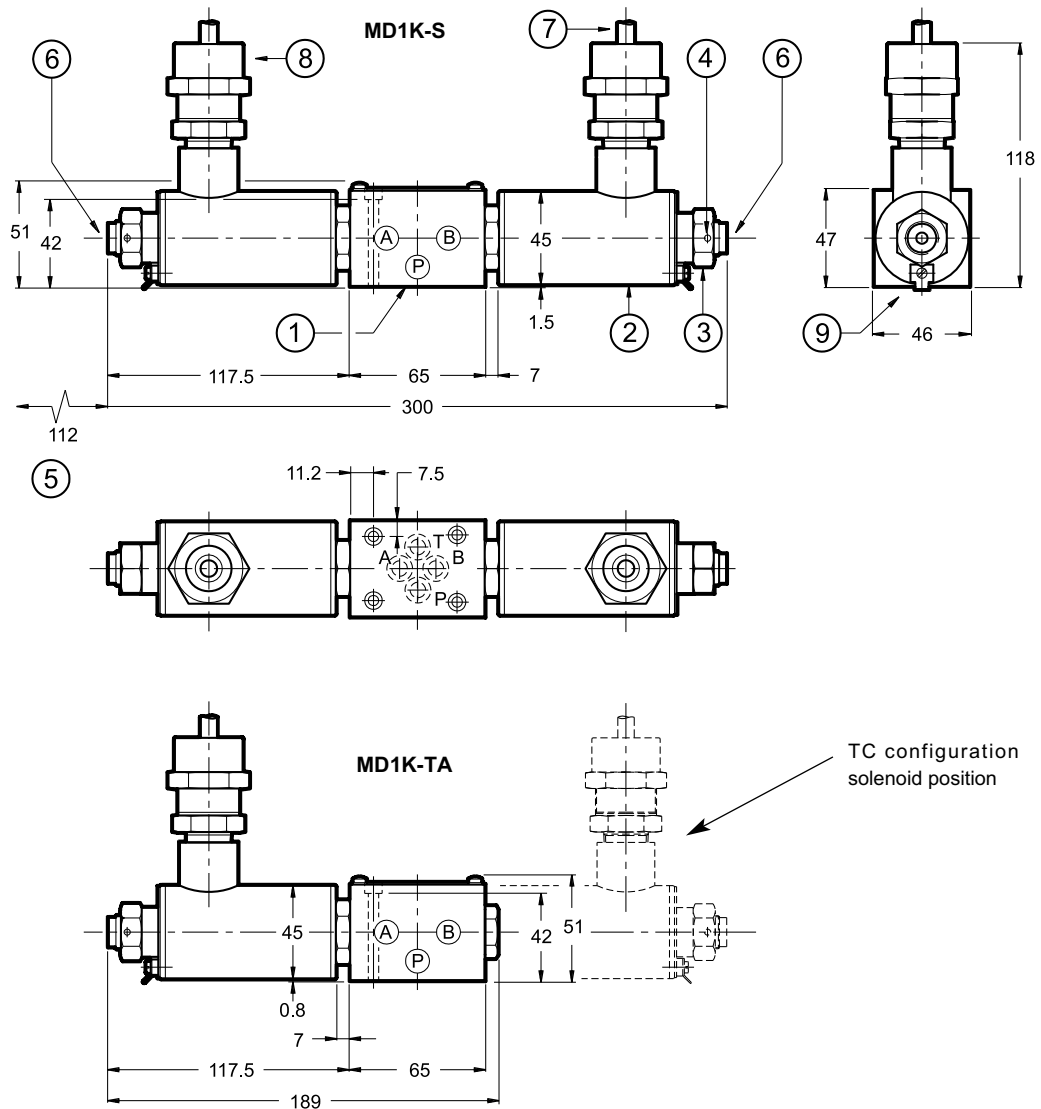
VOLTAGE SUPPLY FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY MD1K E4P4K, E07P4K E5P4K	8.000 ins/hr 6.000 ins/hr 4.000 ins/hr
DUTY CYCLE	100%
EXPLOSION-PROOF VERSION	According to ATEX 94/9/CE
ELECTROMAGNETIC COMPATIBILITY (EMC) (NOTE 1)	According to 2004/108/CE
LOW VOLTAGE	According to 2006/95/CE
TEMPERATURE CLASS	T5 (surface temperature ≤ 100°C)
CLASS OF PROTECTION: Atmospheric agents (CEI EN 60529) Coil insulation	IP 67 class H

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.

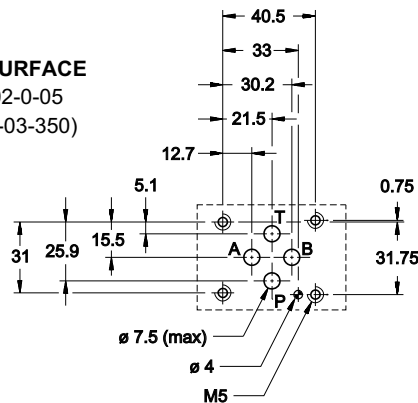
Coil Type	Absorbed current A (± 5%)	Power (± 5%)	
		W	VA
D12	0,92	11	
D24	0,46	11	
AR24	0,46		11
AR110	0,1		11
AR230	0,05		11

7 - OVERALL AND MOUNTING DIMENSIONS MD1K



dimensions in mm

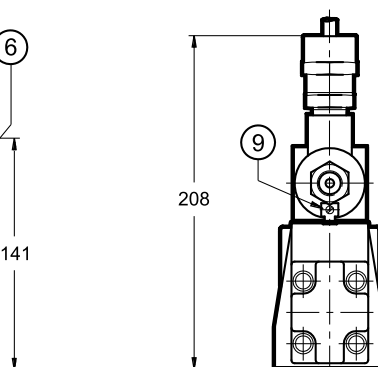
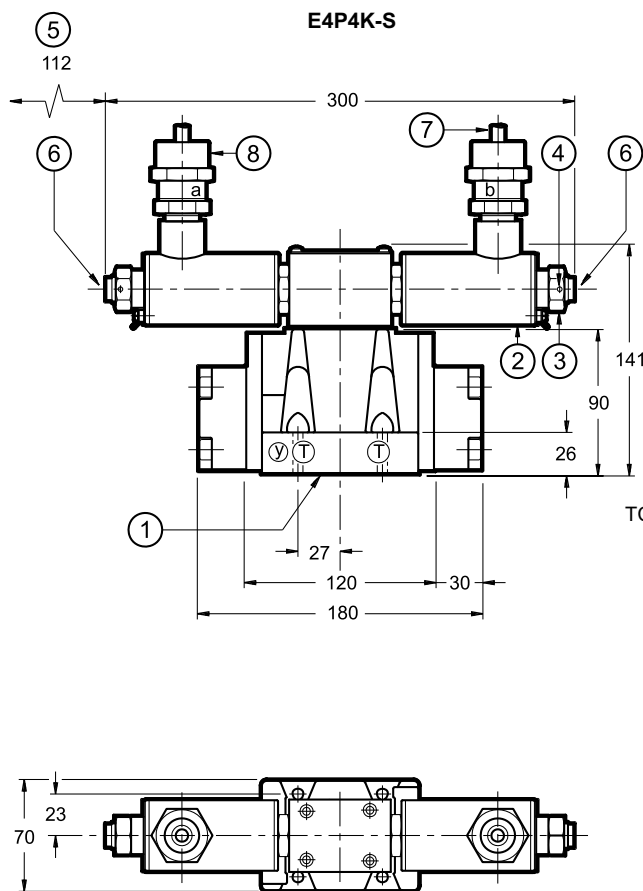
MOUNTING SURFACE ISO 4401-03-02-0-05 (CETOP 4.2-4-03-350)



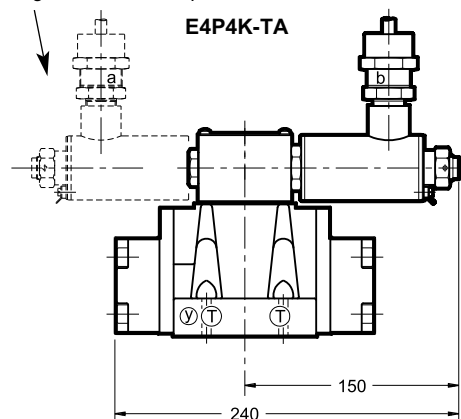
Single valve fastening: 4 bolts M5x50 (recommended class 12.9)
Tightening torque: 5 Nm (bolts 8.8) - 8 Nm (bolts 12.9)
Mounting holes threading: M5x10
Sealing rings: 4 OR type 2037 (9.25x1.78) - 90 Shore

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 = Ø8 mm Wires number= 3 (2 poles + earth) Wires section= 1,5 mm ²
8	Cable clamp
9	Terminal for supplementary earth connection

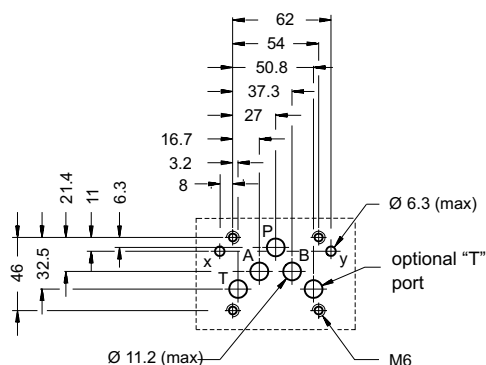
8 - OVERALL AND MOUNTING DIMENSIONS E4P4K



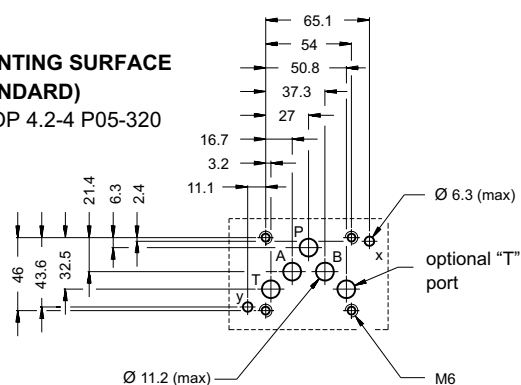
TC configuration solenoid position



Valves with mounting surface according to ISO 4401-05-05-0-05 (CETOP 4.2-4-R05-320) standards, are available upon request. See par. 1 for the identification code.



MOUNTING SURFACE (STANDARD)
CETOP 4.2-4 P05-320

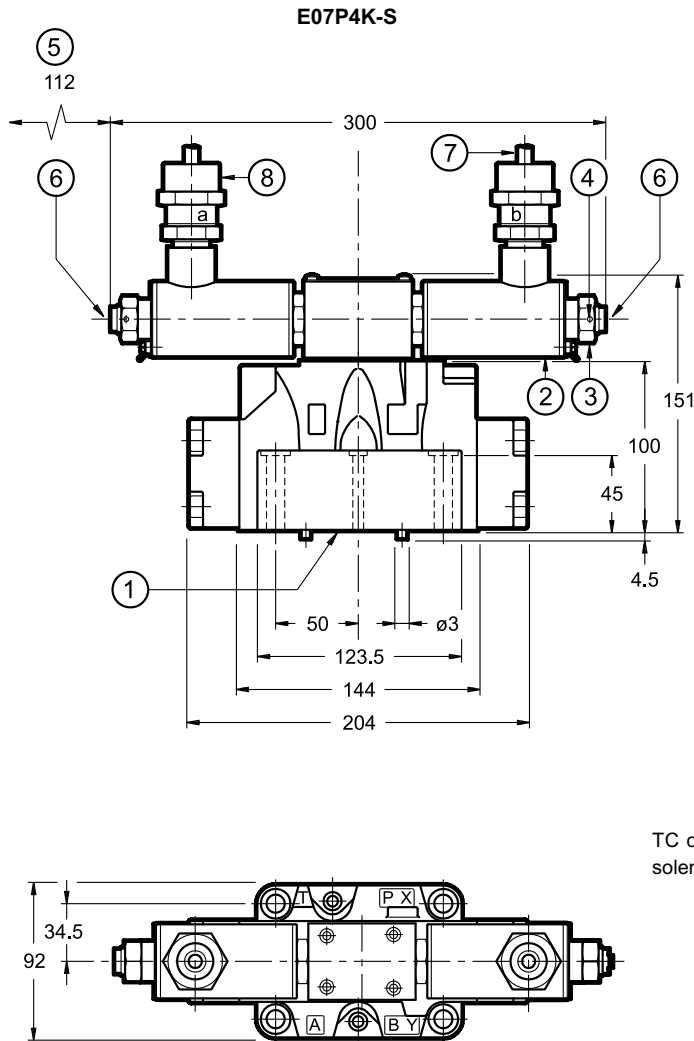


dimensions in mm

Single valve fastening: 4 bolts M6x35 (recommended class 12.9)
Tightening torque: 8 Nm (bolts 8.8) - 14 Nm (bolts 12.9)
Mounting holes threading: M6x10
Sealing rings: 5 OR type 2050 (12.42x1.78) - 90 Shore 2 OR type 2037 (9.25 x 1.78) - 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 ²
8	Cable clamp
9	Terminal for supplementary earth connection

9 - OVERALL AND MOUNTING DIMENSIONS E07P4K - E07P4KD



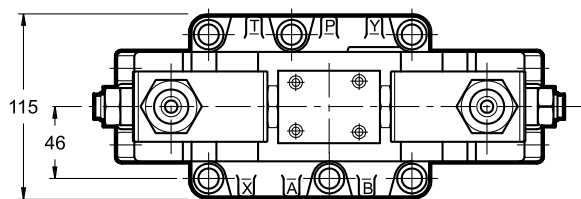
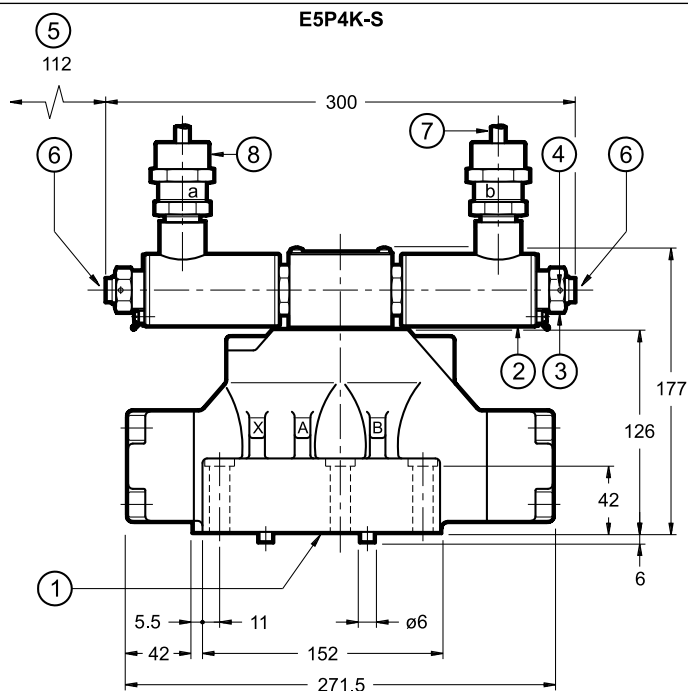
MOUNTING SURFACE
ISO 4401-07-07-0-05
(CETOP 4.2-4-07-320)

dimensions in mm

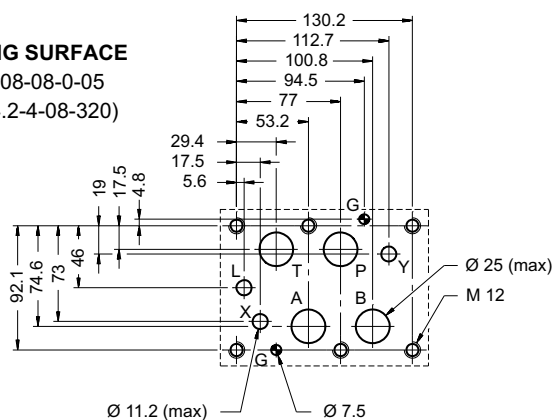
Single valve fastening:	4 bolts M10x60 (recommended class 12.9) 2 bolts M6x60 (recommended class 12.9)
Tightening torque	M10x60: 40 Nm (bolts 8.8) - 67 Nm (bolts 12.9) M6x60: 8 Nm (bolts 8.8) - 14 Nm (bolts 12.9)
Mounting holes threading:	M6x18; M10x18
Sealing rings:	4 OR type 130 (22.22x2.62) - 90 Shore 2 OR type 2043 (10.82x1.78) - 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 ²
8	Cable clamp
9	Terminal for supplementary earth connection

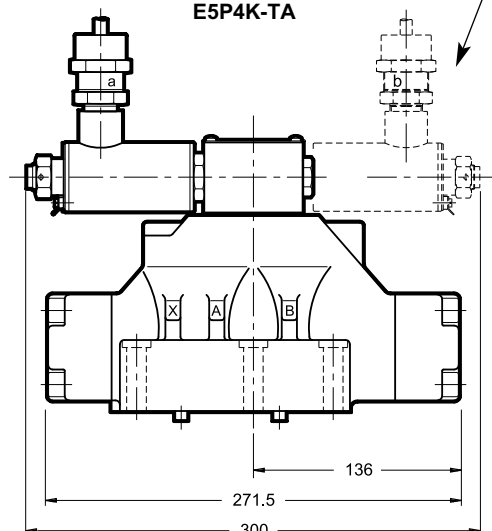
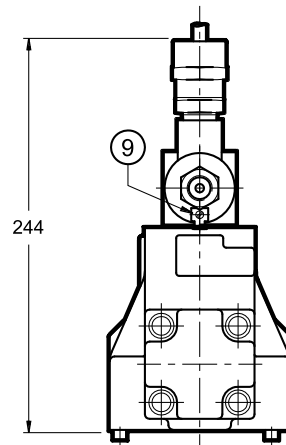
10 - OVERALL AND MOUNTING DIMENSIONS E5P4K



MOUNTING SURFACE ISO 4401-08-08-0-05 (CETOP 4.2-4-08-320)



Single valve fastening:	6 bolts M12x60 (recommended class 12.9)
Tightening torque:	69 Nm (bolts 8.8) - 115 Nm (bolts 12.9)
Mounting holes threading:	M12x20
Sealing rings:	4 OR type 3118 (29.82x2.62) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore



dimensions in mm

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 ²
8	Cable clamp
9	Terminal for supplementary earth connection



11 - OPTIONS

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 paragraph 1).

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 paragraph 1).

11.3 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.

Add **PF** to the identification code to request this option (see paragraph 1).

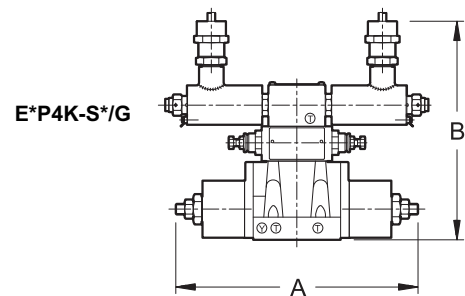
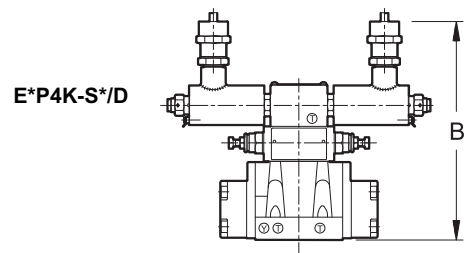
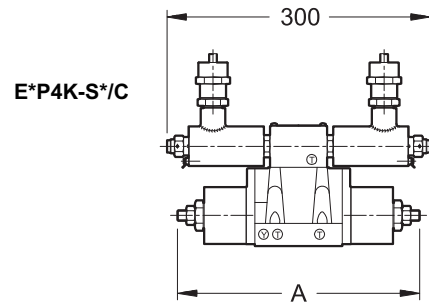
11.4 Control of the main spool stroke and shifting speed: G

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 paragraph 1).

	E4*	E07*	E5*
A	280	301	401,5
B	250	258	284

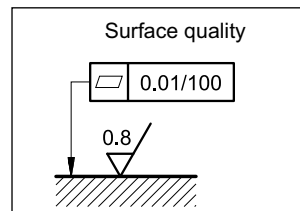
dimensions in mm





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	1½" BSP 1/4" BSP



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