

DS5

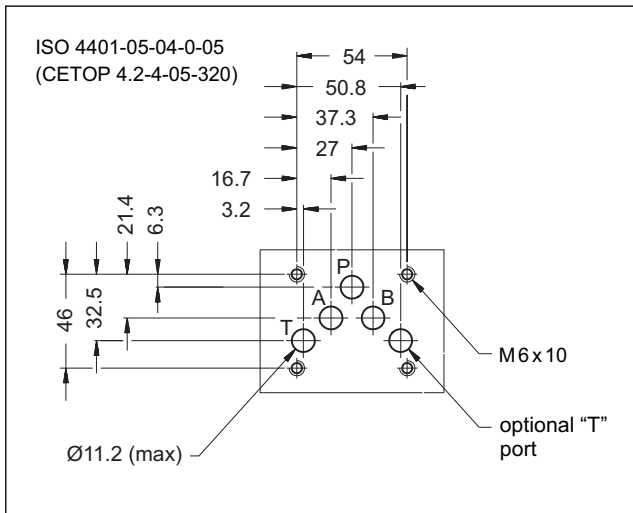
SOLENOID OPERATED DIRECTIONAL CONTROL VALVE

SERIES 12

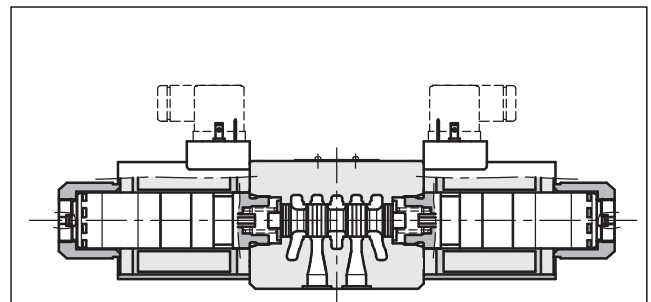
SUBPLATE MOUNTING
ISO 4401-05 (CETOP 05)

p max 320 bar
Q max 150 l/min

MOUNTING INTERFACE



OPERATING PRINCIPLE



- Direct acting, subplate mounting directional control valve, with mounting surface according to ISO 4401 (CETOP RP121H).
- The valve is supplied with 3 or 4 way designs and with several interchangeable spools with different porting arrangements.

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

		DC	AC
Maximum operating pressure	P - A - B ports	320	
	T port - standard version	210	140
	T port - version with Y port (ext.drain)	320	-
Maximum flow rate	l/min	150	120
Pressure drops Δp -Q		see paragraph 4	
Operating limits		see paragraph 6	
Electrical features		see paragraph 7	
Electrical connections		see paragraph 11	
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 class 20/18/15	
Recommended viscosity	cSt	25	
Mass:	single solenoid valve	4,5	3,6
	double solenoid valve	6,1	4,3

- The valve body is made with high strength iron castings provided with wide internal passages in order to minimize the flow pressure drop. Wet armature solenoids with interchangeable coils are used (see paragraph 7).
- The valve is available with DC or AC solenoids. DC solenoids can also be fed with AC power supply, by using connectors with a built-in rectifier bridge (see paragraph 7.2).
- The DC solenoids DS5 directional valve is available in the following special versions:
 - version with Y external subplate drain port, (see paragraph 14.1).
 - version with soft-shifting (see paragraph 14.4)
 - version with adjustable "soft-shift" device (see paragraph 14.5)

1 - IDENTIFICATION CODE

	D	S	5	-		/	12	-			/		
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Solenoid operated directional control valve

ISO 4401-05 (CETOP 05) size

Spool type (see par. 3)

S* **TA**
SA* **TB**
SB* **RK**

Series: (the overall and mounting dimensions remain unchanged from 10 to 19)

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

DC power supply

D12 = 12 V
D24 = 24 V
D28 = 28 V
D48 = 48 V
D110 = 110 V
D220 = 220 V
D00 = valve without coils (see **NOTE 1**)

AC power supply

A24 = 24 V - 50 Hz.
Not available for S4, SA4, SB4 spools
A48 = 48 V - 50 Hz
A110 = 110 V - 50 Hz / 120 V - 60 Hz
A230 = 230 V - 50 Hz / 240 V - 60 Hz
A00 = valve without coils (see **NOTE 1**)
F110 = 110 V - 60 Hz
F220 = 220 V - 60 Hz

Option: Surface treatment not standard. Omit if not required (see **NOTE 2**)

Manual override: omit for override integrated in the tube (**standard**)
CM = manual override, boot protected (only for DC version)
CK = knob manual override (only for DC version)

Coil electrical connection (see par. 11):
K1 = plug for connector type DIN 43650 (**standard**)
K2 = plug for connector type AMP JUNIOR (available on **D12** and **D24** coils only)
K7 = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S (available on **D12** and **D24** coils only)

NOTE 1: Coils locking ring and related OR are supplied together with valves.

NOTE 2: The valve is supplied with standard surface treatment of phosphating black. On request we can supply these valves with other surface finishes. Add suffix **/W*** at the end of the code.

W2 = mat epoxy painting black RAL 9005 thickness 20 ± 40µ

W4 = Gas nitriding with oxidation process. Black colour.

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.

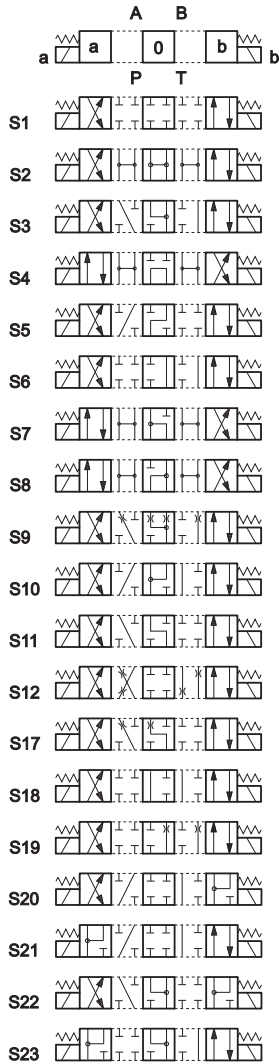
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

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

3 - SPOOL TYPE

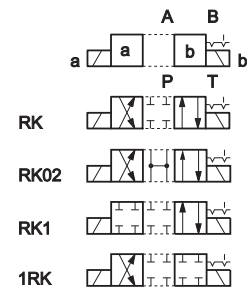
Type S*:

2 solenoids - 3 positions
with spring centering



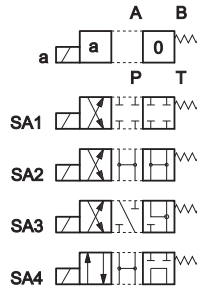
Type RK:

2 solenoids - 2 positions
with mechanical retention



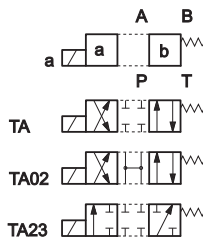
Type SA*:

1 solenoid side A
2 positions (central + external)
with spring centering



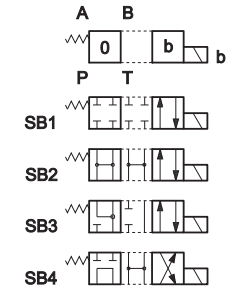
Type TA:

1 solenoid side A
2 external positions
with return spring



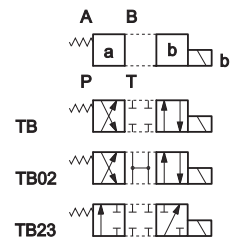
Type SB*:

1 solenoid side B
2 positions (central + external)
with spring centering



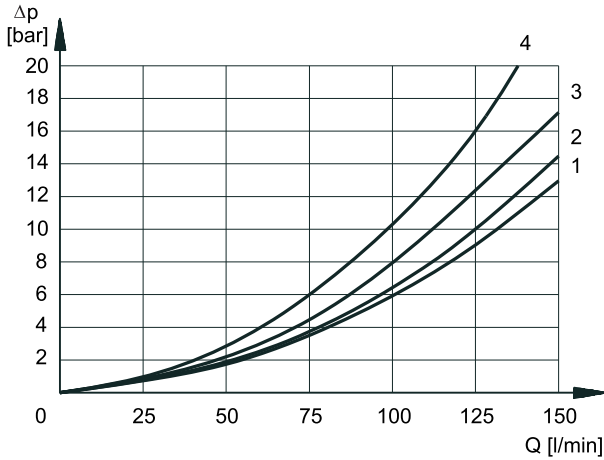
Type TB:

1 solenoid side B
2 external positions
with return spring



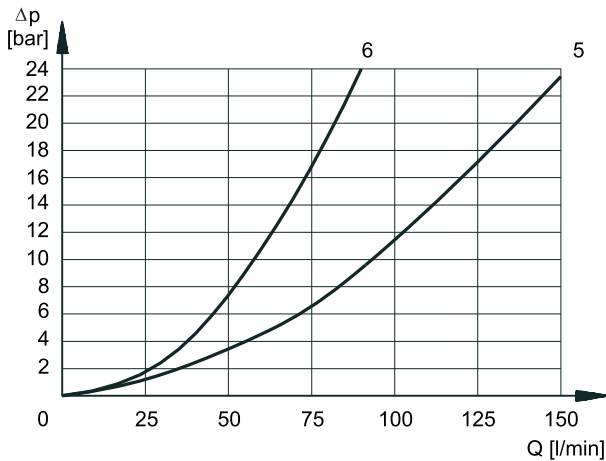
Besides the diagrams shown, which are the most frequently used, other special versions are available: consult our technical department for their identification, feasibility and operating limits.

4 - PRESSURE DROPS Δp -Q (obtained with viscosity 36 cSt at 50 °C)



PRESSURE DROPS WITH VALVE ENERGIZED

SPOOL TYPE	FLOW DIRECTION			
	P-A	P-B	A-T	B-T
	CURVES ON GRAPH			
S1, SA1, SB1	2	2	1	1
S2, SA2, SB2	3	3	1	1
S3, SA3, SB3	3	3	2	2
S4, SA4, SB4	1	1	2	2
S5	2	1	1	1
S6, S11	3	3	2	2
S7, S8	1	1	2	2
S9	3	3	2	2
S10	1	1	1	1
S12	2	2	1	1
S17, S19	2	2	1	1
S18	1	2	1	1
S20, S21				
S22, S23				
TA, TB	3	3	2	2
TA02, TB02	3	3	2	2
TA23, TB23	4	4		
RK	3	3	2	2
RK02	3	3	2	2
RK1, 1RK	3	3	2	2



PRESSURE DROPS WITH VALVE IN DE-ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION				
	P-A	P-B	A-T	B-T	P-T
	CURVES ON GRAPH				
S2, SA2, SB2					5
S3, SA3, SB3			6	6	
S4, SA4, SB4					5
S5		3			
S6				6	
S7					5
S8					5
S10	3	3			
S11			6		
S18	3				
S22					
S23					

5 - SWITCHING TIMES

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

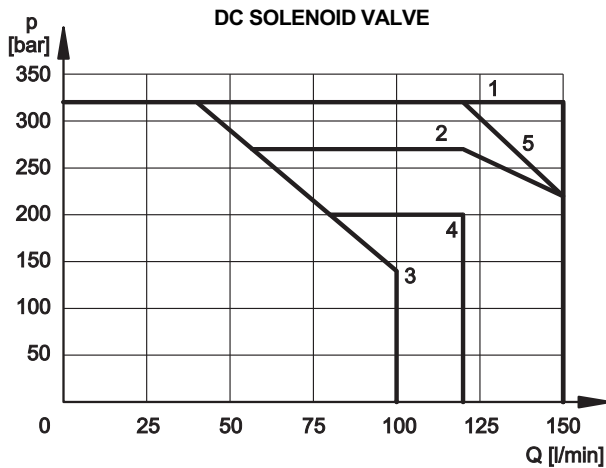
COIL TYPE	TIMES [ms]	
	ENERGIZING	-ENERGIZING
DC	100 + 150 ms	20 + 50 ms
AC	15 + 30 ms	20 + 50 ms

6 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions.

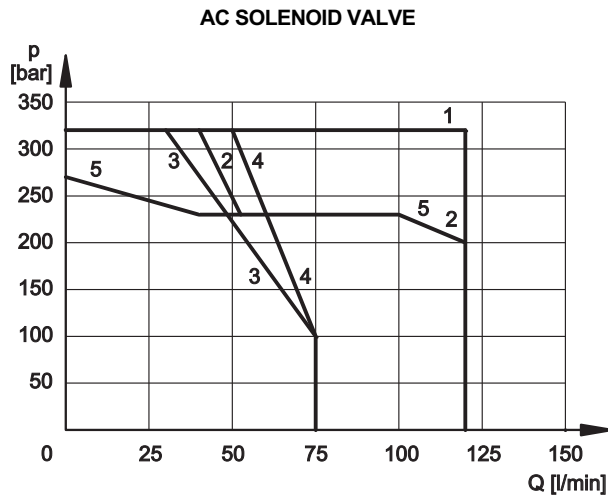
The values have been obtained according to ISO 64003 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage.

The values have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.



SPOOL TYPE	CURVE	
	P-A	P-B
S1, SA1, SB1	1	1
S2, SA2, SB2	1	1
S3, SA3, SB3	2	2
S4, SA4, SB4	3	3
S5	1	1
S6	2	1
S7	3	3
S8	3	3
S9	1	1
S10	1	1
S11	1	2
S12	1	1

SPOOL TYPE	CURVE	
	P-A	P-B
S17	1	4
S18	1	1
S19	4	1
S20		
S21		
S22		
S23		
TA, TB	5	5
TA02, TB02	4	4
TA23, TB23	1	1
RK	1	1
RK02	1	1
RK1, 1RK	1	1



SPOOL TYPE	CURVE	
	P-A	P-B
S1, SA1, SB1	1	1
S2, SA2, SB2	2	2
S3, SA3, SB3	2	2
S4, SA4, SB4	4	4
S5	1	1
S6	2	1
S7	3	3
S8	3	3
S9	2	2
S10	1	1
S11	1	2
S12	1	1

SPOOL TYPE	CURVE	
	P-A	P-B
S17	1	5
S18	1	1
S19	5	1
S20		
S21		
S22		
S23		
TA, TB	1	1
TA02, TB02	5	5
TA23, TB23	1	1
RK	1	1
RK02	1	1
RK1, 1RK	1	1

NOTE:

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.

For flow and pressure performances of soft-shifting configuration (options F) see par. 14.4

Flow and pressure performances of adjustable soft-shifting device configurations (options S) are influenced by the set shifting time.

7 - ELECTRICAL FEATURES

7.1 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, to suit the available space.

Protection from atmospheric agents CEI EN 60529

Plug-in type	IP 65	IP 67	IP 69 K
K1 DIN 43650	x (*)		
K2 AMP JUNIOR	x	x (*)	
K7 DEUTSCH DT04 male	x	x	x (*)

(*) The protection degree is guaranteed only with the connector correctly connected and installed

VOLTAGE SUPPLY FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY	15.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC) (NOTE 1)	In compliance with 2004/108/EC
LOW VOLTAGE	In compliance with 2006/95/EC
CLASS OF PROTECTION: Coil insulation (VDE 0580) Impregnation:	class H class F

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).

7.2 Current and absorbed power for DC solenoid valve

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

The rectified current supply takes place by fitting the valve with an alternating current source (50 or 60 Hz), rectified by means of a bridge built-in to the "D" type connectors (see cat. 49 000).

However, when supplying the valve with rectified current, it is necessary to consider a reduction of the operating limits by 15-20% approx.

Coils for direct current (values ± 5%)

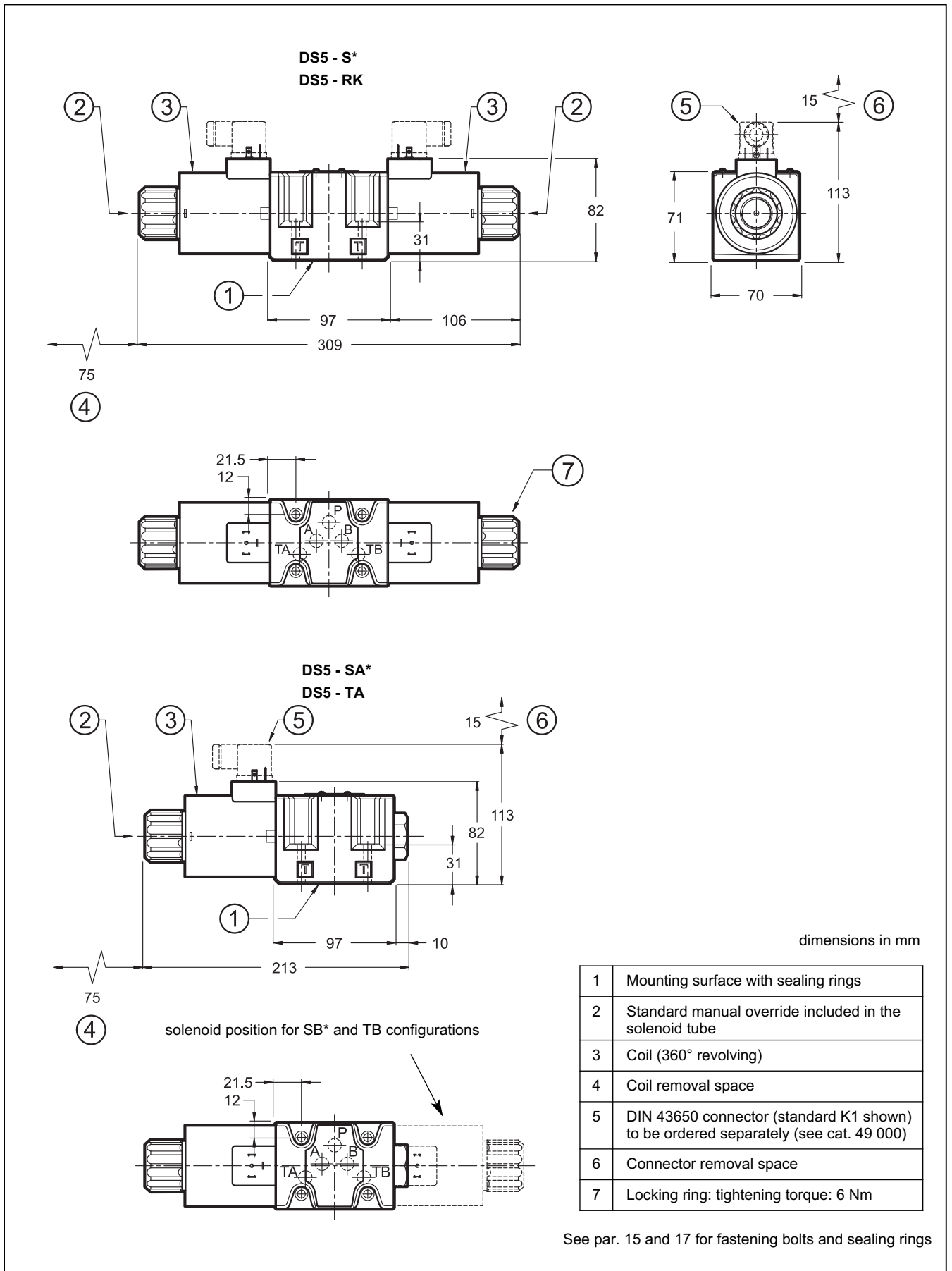
Suffix	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt. [W]	Coil code		
					K1	K2	K7
D12	12	3,2	3,75	45	1903200	1903210	1903220
D24	24	12	2	48	1903201	1903211	1903221
D28	28	16,2	1,72	48	1903202		
D48	48	49	0,98	47	1903203		
D110	110	250	0,44	48	1903204		
D220	220	1050	0,21	47	1903205		

7.3 Current and absorbed power for AC solenoid valve

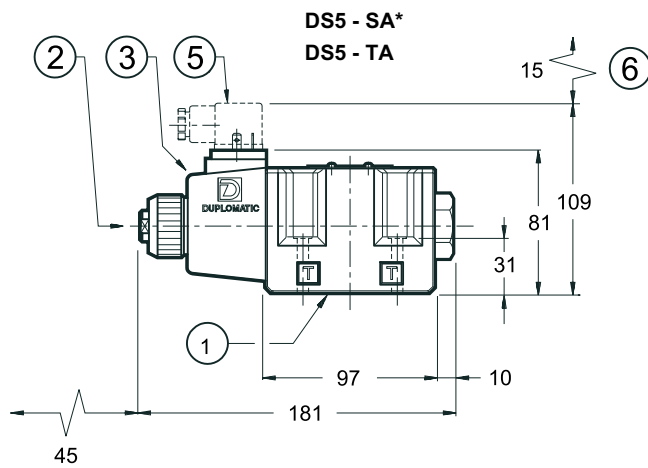
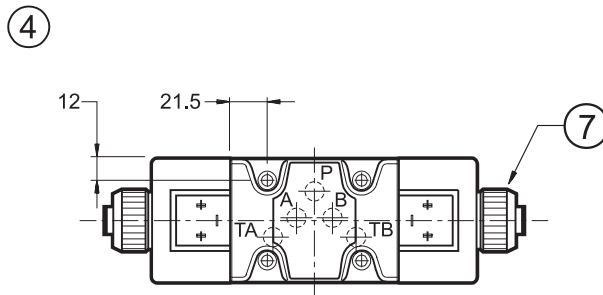
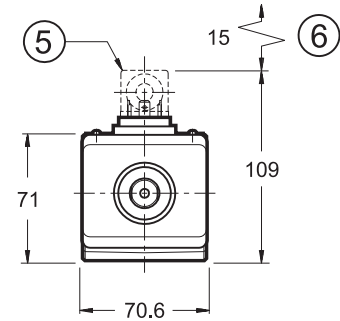
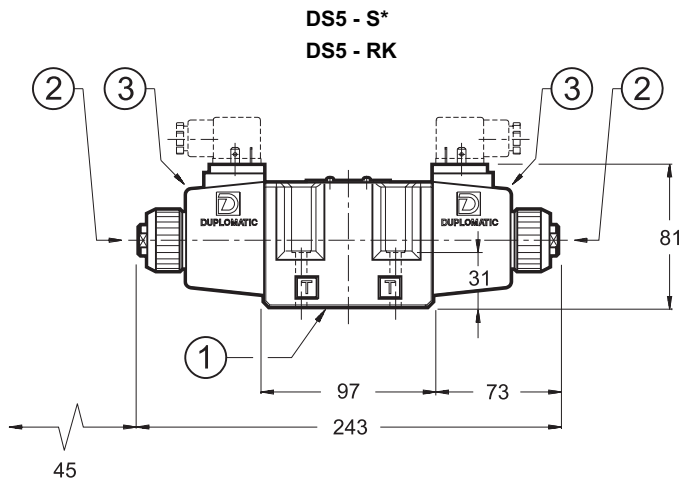
The table shows current and power consumption values at inrush and at holding, relevant to the different coil types for AC current.

Suffix	Nominal voltage [V]	Frequency [Hz]	Resistance at 20°C [ohm]	Current consumption at inrush [A]	Current consumption at holding [A]	Power consumption at inrush [VA]	Power consumption at holding [VA]	Coil code
A24	24	50	0,53	25	3,96	600	95	1902890
A48	48		2,09	12,5	2,3	600	110	1902891
A110	110V-50Hz	50/60	10,9	5,2	0,96	572	105	1902892
	120V-60Hz		10,9	5,2	0,89	572	105	
A230	230V-50Hz		52,7	2,8	0,46	644	105	1902893
	240V-60Hz		52,7	2,8	0,38	644	105	
F110	110	60	8,80	5,2	0,95	572	105	1902894
F220	220		35,2	2,7	0,48	594	105	1902895

8 - OVERALL AND MOUNTING DIMENSIONS FOR DC SOLENOID VALVES

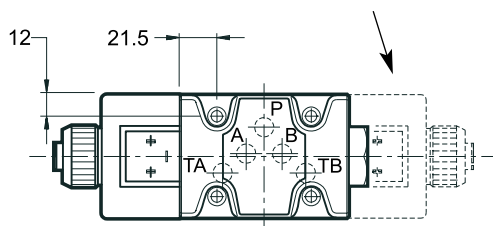


9 - OVERALL AND MOUNTING DIMENSIONS FOR AC SOLENOID VALVES



dimensions in mm

4 solenoid position for SB* and TB configurations

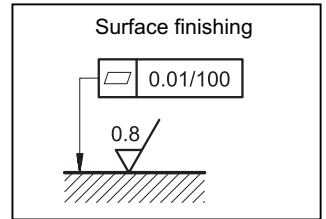


1	Mounting surface with sealing rings
2	Standard manual override included in the solenoid tube
3	Coil (360° revolving)
4	Coil removal space
5	DIN 43650 connector - to be ordered separately (see cat. 49 000)
6	Connector removal space
7	Locking ring: tightening torque: 4.5 - 5 Nm

See par. 16 and 17 for fastening bolts and sealing rings

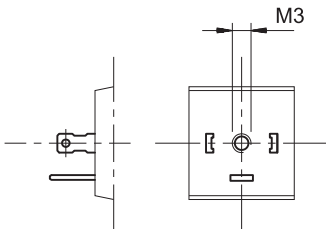
10 - INSTALLATION

Configurations with centering and return springs can be mounted in any position; type RK valves - without springs and with mechanical detent - must be mounted with the longitudinal axis horizontal. Valve fixing is by means of screws or tie rods, with the valve mounted 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 and/or smoothness are not met, fluid leakage between valve and mounting surface can easily occur.

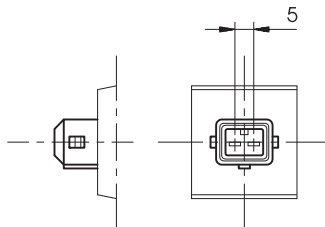


11 - ELECTRIC CONNECTIONS

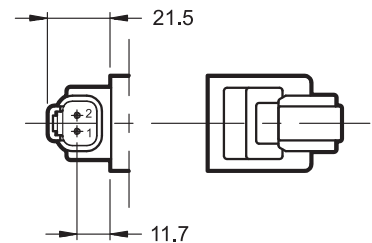
connection for DIN 43650 connector type code **K1 (standard)**



connection for AMP JUNIOR connector type code **K2**



connection for DEUTSCH DT06-2S male connector type code **K7**

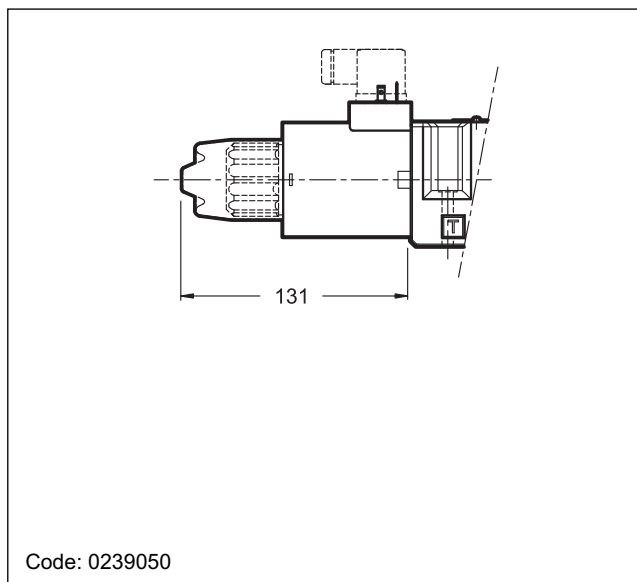


12 - ELECTRIC CONNECTORS

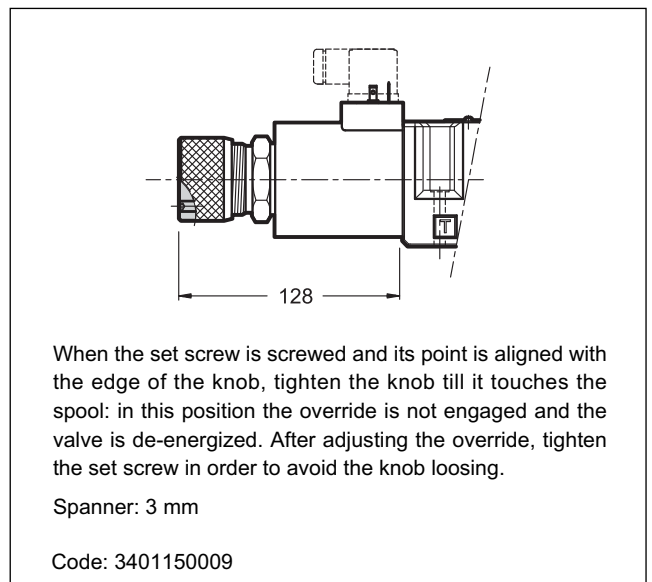
The solenoid operated valves are delivered without connectors. For coils with standard electrical connections K1 type (DIN 43650) the connectors can be ordered separately. For the identification of the connector type to be ordered please see cat. 49 000. For K2 and K7 connection type the related connectors are not available.

13 - MANUAL OVERRIDES FOR DC SOLENOID VALVES

13.1 - CM - Manual override, boot protected



13.2 - CK-DS5/10 Knob manual override



14 - SPECIAL VERSIONS FOR DC SOLENOID VALVE

14.1 - Identification code for external drain version

D	S	5	-	/	12	-	K1	/	Y		
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Solenoid operated directional control valve

ISO 4401-05 (CETOP 05) size

Spool type (see par. 3)

Series n.: _____
(the overall and mounting dimensions remain unchanged from 10 to 19)

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

Coil type _____

D12 = 12 V
D24 = 24 V
D28 = 28 V
D48 = 48 V
D110 = 110 V
D220 = 220 V

NOTE :The valve is supplied with standard surface treatment of phosphating black. On request we can supply these valves with other surface finishes. Add suffix **/W*** at the end of the code.

W2 = mat epoxy painting black RAL 9005
thickness 20 ÷ 40µ

W4 = gas nitriding with oxidation process. Black colour.

Option: Surface treatment not standard. Omit if not required (see **NOTE**)

Manual override: omit for override integrated in the tube (**standard**)
CM = manual override, boot protected
CK = knob manual override

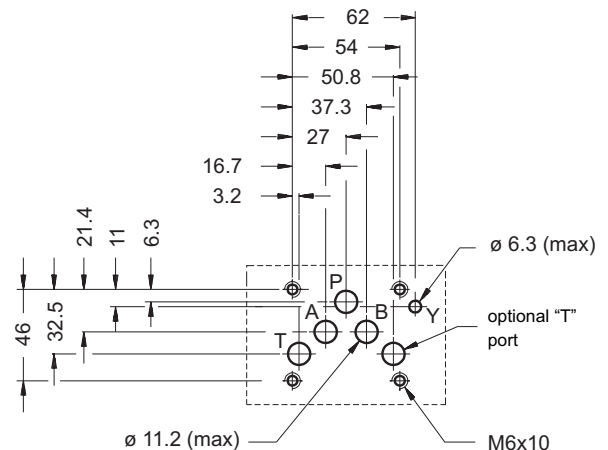
Port for subplate external drain

Coil electrical connection (see par. 11):
K1 = plug for connector type DIN 43650 (**standard**)
K2 = plug for connector type AMP JUNIOR (available on **D12** and **D24** coils only)
K7 = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S (available on **D12** and **D24** coils only)

14.2 - Subplate external drain port (option Y)

This version allows the operation with pressures up to 320 bar on the valve T port.

It is a drain port Y realized on the valve mounting interface in compliance with ISO 4401-05-05-0-05 (CETOP 4.2-4-R05). The Y port is connected with the solenoid chamber: in this way the tubes are not stressed by the pressure operating on the valve T port.



14.3- Identification code for soft-shifting versions

D	S	5	-		/		-		/			
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Solenoid operated directional control valve

ISO 4401-05 (CETOP 05) size

Spool type (see par. 3)

S1	S4	TA
S2	S7	TB
S9	S8	TA02
S12		TB02

Series n.:

12 - for version **S**
13 - for version **F**
 (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:

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

Power supply

D12 = 12 V
D24 = 24 V
D28 = 28 V
D110 = 110 V
D220 = 220 V

Option: Surface treatment not standard. Omit if not required (see **NOTE**)

Manual override: omit for override integrated in the tube (**standard**)
CM = manual override, boot protected
CK = knob manual override

Options:
F = soft-shifting (see par. 14.4)
S = adjustable soft-shifting device (see par 14.5)

Coil electrical connection (see par. 11):
K1 = plug for connector type DIN 43650 (**standard**)
K2 = plug for connector type AMP JUNIOR (available on **D12** and **D24** coils only)
K7 = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S (available on **D12** and **D24** coils only)

NOTE :The valve is supplied with standard surface treatment of phosphating black. On request we can supply these valves with other surface finishes. Add suffix **/W*** at the end of the code.

W2 = mat epoxy painting black RAL 9005
 thickness 20 ÷ 40µ

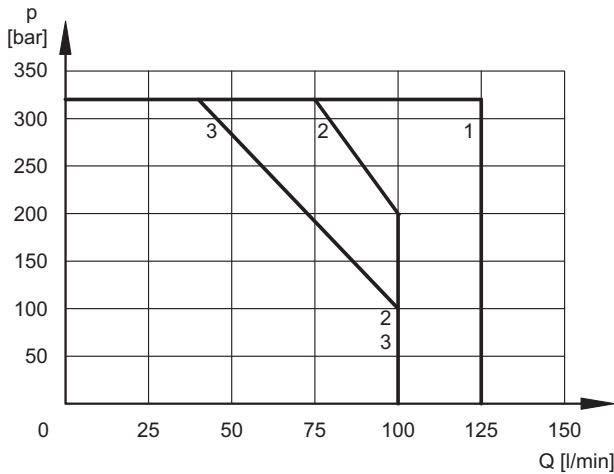
W4 = gas nitriding with oxidation process. Black colour.

14.4 - Fixed restrictor for soft-shifting (option F)

This version enables hydraulic actuators to perform a smooth start and stop by reducing the speed of movement of the valve spool.

The diagram on the side shows the operating limits of the spools available in the soft-shifting version (**NOTE:** for this version, the S9 spool must be used instead of the S3 one). The table on the side shows the switching times. The values indicated are obtained according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

The shifting time and characteristics curves are influenced by the viscosity (and thus by the temperature) of the operating fluid. Moreover, times can vary according to the flow rate and operating pressure values of the valve.



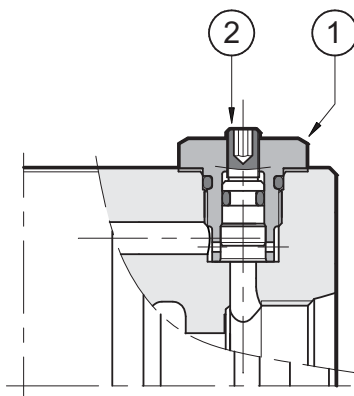
SPOOL TYPE	CURVE		TIMES	
	P-A	P-B	ENERGIZING	DE-ENERGIZING
S1, S12	1	1	300 ÷ 500	300 ÷ 500
S2	2	2	450	200 ÷ 300
S4, S7, S8	3	3	400	400 ÷ 200
S9	1	1	300 ÷ 500	300 ÷ 500
TA, TB	2	2	300 ÷ 400	300 ÷ 400
TA02, TB02	2	2	400	200 ÷ 300

14.5 - Directional solenoid valve with adjustable “soft-shifting” device (option S)

This solenoid valve is supplied with a suitable device, adjustable by the user, which enables the control of the valve spool shifting time.

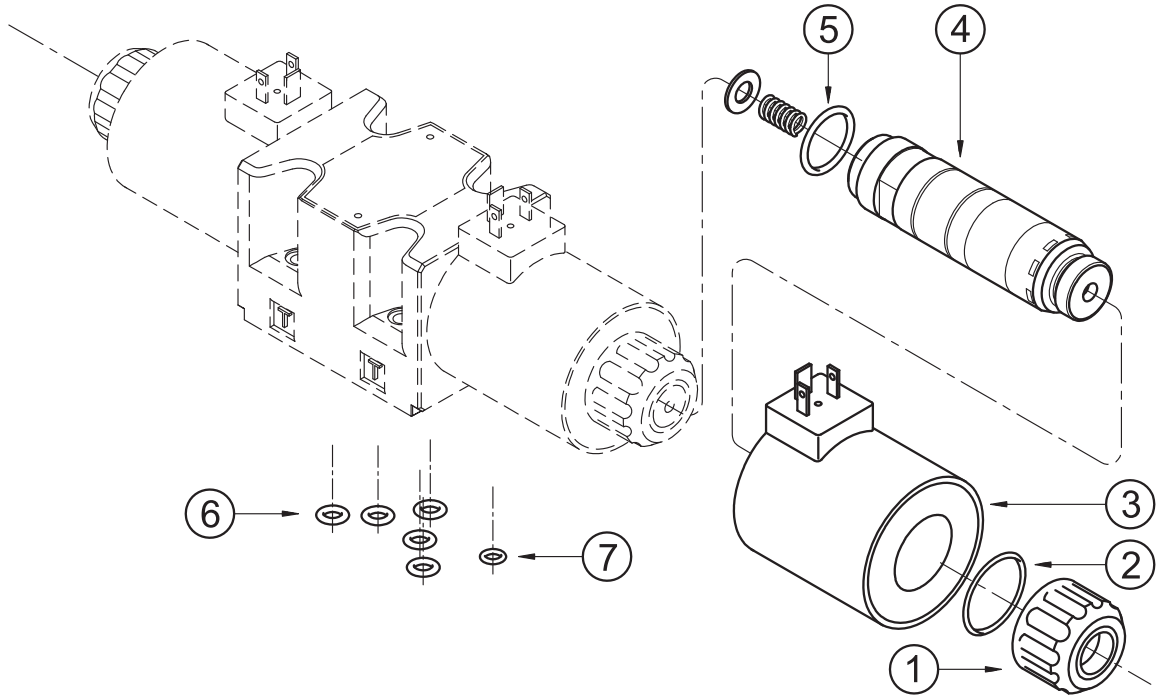
In this way the hydraulic actuators can perform smooth movements, by controlling the valve switching time according to the machine cycle and the inertia of the moving parts.

NOTE: during the first start-up the valve body must be filled with the operating fluid through the tap (1) .



1	Spanner for plug: 17 mm - tightening torque 20 Nm
2	Shifting time adjustment screw countersunk hex spanner 2,5 mm

15 - SPARE PARTS FOR DC SOLENOID VALVE



DC COILS IDENTIFICATION CODE

C 31 - / 21

Supply voltage

D12 = 12 V
D24 = 24 V
D28 = 28 V
D48 = 48 V
D110 = 110 V
D220 = 220 V

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

Coil electrical connection (see par. 11):

K1 = plug for connector type DIN 43650 (**standard**)
K2 = plug for connector type AMP JUNIOR (available on **D12** and **D24** coils only)
K7 = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S (available on **D12** and **D24** coils only)

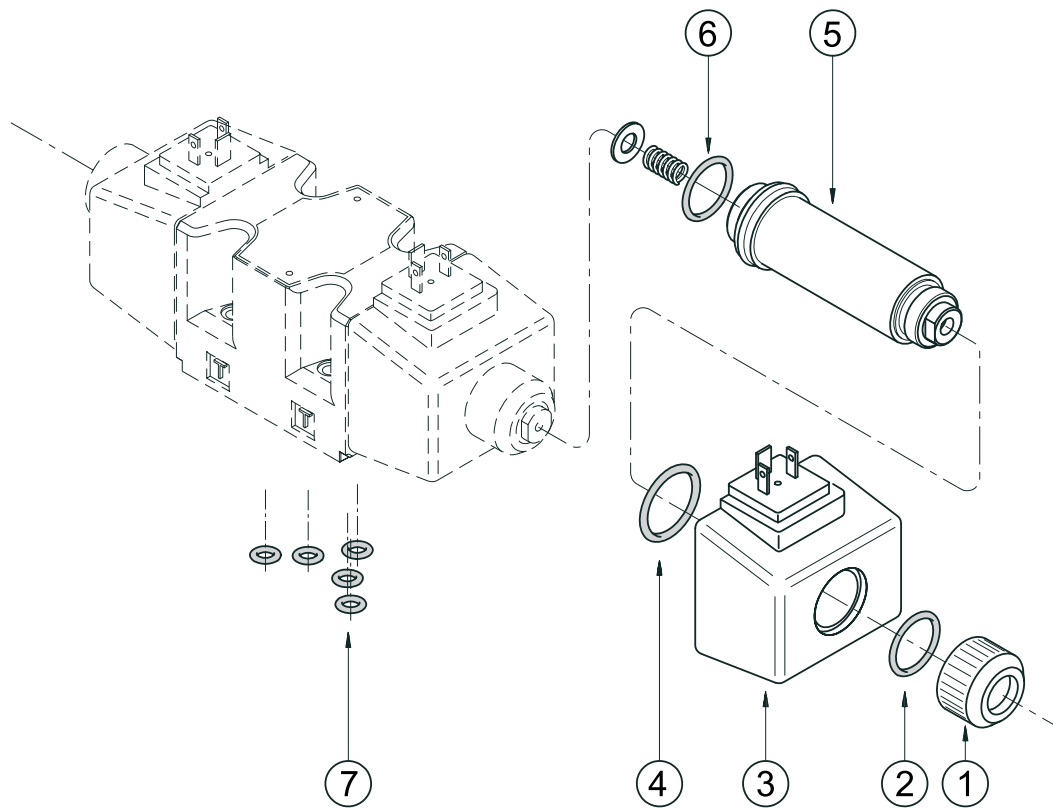
1	Coil locking ring with seal included cod. 0119383 tightening torque: 6 Nm
2	ORM type 0320 - 25 (32x2.5) - 70 Shore
3	Coil (see identification code)
4	Solenoid tube TD31-M27/20N (NBR seals) TD31-M27/20V (FPM seals) NOTE: the solenoid tube is supplied with OR n° 5.
5	OR type 3-912 (23.47x2.95) - 70 Shore
6	N. 5 OR type 2050 (12.42x1.78) - 90 Shore
7	For version with external subplate drain only (Y option): OR type 2037 (9.25x1.78) - 90 Shore

SEALS KIT

The codes here below include O-Rings ref. 2, 5, 6 and 7.

Cod. 1984418 NBR seals
Cod. 1984419 FPM (viton) seals

16 - SPARE PARTS FOR AC SOLENOID VALVE



AC COILS IDENTIFICATION CODE

C 25.4 - K1 / 11

Supply voltage

A24 = 24 V - 50 Hz
A48 = 48 V - 50 Hz
A110 = 110 V - 50 Hz
 120 V - 60 Hz
A230 = 230 V - 50 Hz
 240 V - 60 Hz
F110 = 110 V - 60 Hz
F220 = 220 V - 60 Hz

Series no.:
 (the overall and
 mounting dimensions
 remain unchanged
 from 10 to 19)

plug for connector type
 DIN 43650 (**standard**)

SEALS KIT

The codes here below include O-Rings ref. 2, 4, 6 and 7.

Cod. 1984420 NBR seals
Cod. 1984421 FPM (viton) seals

1	Coil locking ring cod. 0119402 tightening torque: 4.5 - 5 Nm
2	OR type 4100 (24.99x3.53) - 90 Shore
3	Coil (see identification code)
4	OR type 2112 (28.30x1.78) - 90 Shore
5	Solenoid tubes: TA25.4-M27/11N (NBR seals) TA25.4-M27/11V (FPM seals) NOTE: the tube is supplied with OR n° 6.
6	OR type 3-912 (23.47x2.95) - 70 Shore
7	N. 5 OR type 2050 (12.42x1.78) - 90 Shore

17 - FASTENING BOLTS

4 bolts SHC M6x40
 Tightening torque 8 Nm

18 - SUBPLATES (See catalogue 51 000)

Type PMD4-AI4G with rear ports 1/2" BSP

Type PMD4-AL4G with side ports 1/2" BSP



DIPLOMATIC OLEODINAMICA S.p.A.

20015 PARABIAGO (MI) • Via M. Re Depaolini 24
 Tel. +39 0331.895.111
 Fax +39 0331.895.339

www.diplomatic.com • e-mail: sales.exp@diplomatic.com