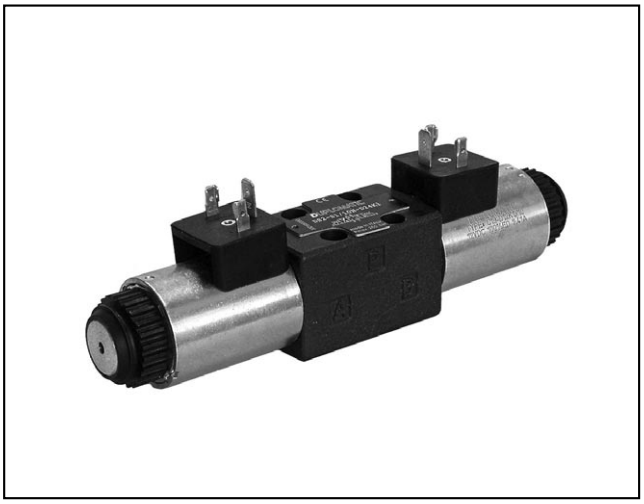


DS2

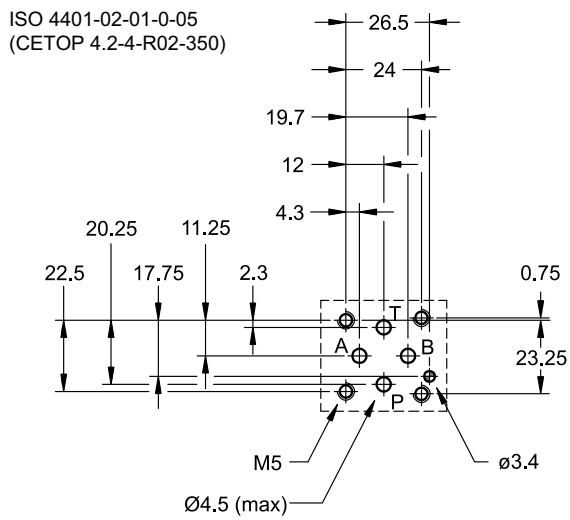
SOLENOID OPERATED DIRECTIONAL CONTROL VALVE

SERIES 10

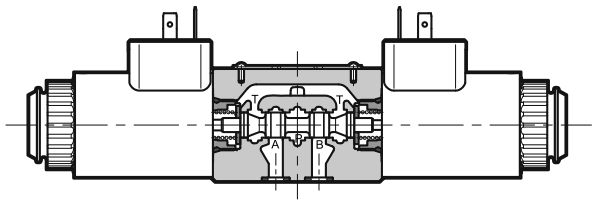
SUBPLATE MOUNTING ISO 4401-02

p max **350** bar
Q max **25** l/min

MOUNTING INTERFACE



OPERATING PRINCIPLE



— Direct acting, subplate mounting directional control valve, with mounting surface according to ISO 4401 standards.

— Compact design with reduced solenoid dimensions, suitable for mini-power packs and mobile and agricultural applications.

— The valve body is made with high strenght cast iron provided with wide internal passages in order to minimize the flow pressure drop. Wet armature solenoids with interchangeable coils are used (for further information on solenoids see paragraph 7).

— The valve is supplied with 4 way designs, with 2 or 3 positions and with several spools with different porting arrangements.

— The valve is available with direct current solenoids.

— The valve is also available with zinc-nickel coating that ensures a salt spray resistance up to 240 hours.

PERFORMANCES

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

Maximum operating pressure: - ports P - A - B - port T	bar	 350 250
Maximum flow rate	l/min	25
Pressure drop Δp-Q	see paragraph 4	
Operating limits	see paragraph 5	
Electrical features	see paragraph 7	
Electrical connections	EN 175301-803 (ex DIN 43650)	
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 double solenoid valve	kg	0.9 1.3

1 - IDENTIFICATION CODE

D	S	2	-		/	10		-		K1	/		

Directional valve, solenoid operated

ISO 4401-02 size

Spool type (see paragraph 2)
S* **TA** **RK**
SA* **TB**
SB*

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

Power supply
D12 = 12 V
D24 = 24 V
D00 = valve without coils (see **NOTE 1**)

Coil electrical connection (see par. 11):
K1 = plug for connector type EN 175301-803 (ex DIN 43650) (**standard**)
K2 = plug for connector type AMP JUNIOR
K7 = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S

Manual override:
Omit for override integrated in the tube (**standard**)
CM = manual override, boot protected
CK1 = turning knob override

Option:
/ W7 = Zinc-nickel surface treatment (see **NOTE 2**)
Omit if not required

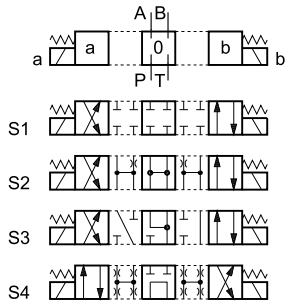
NOTE 2: The standard valve is supplied with surface treatment of phosphating black.

The zinc-nickel finishing on the valve body makes the valve suitable to ensure a salt spray resistance up to **240** hours (test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

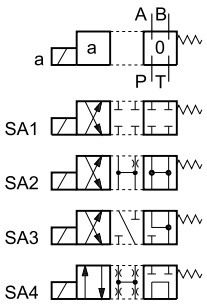
NOTE 1: coils locking ring and related OR are supplied together with valves.

2 - SPOOL TYPE

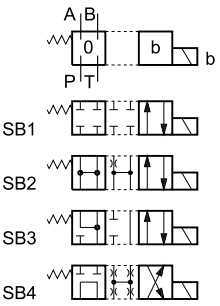
Type **S***:
2 solenoids - 3 positions
with spring centering



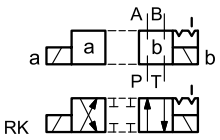
Type **SA***:
1 solenoid side A
2 positions (central + esternal)
with spring centering



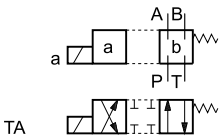
Type **SB***:
1 solenoid side B
2 positions (central + esternal)
with spring centering



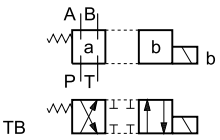
Type **RK**:
2 solenoids - 2 positions
with mechanical retention



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



Type **TB**:
1 solenoid side B
2 external positions
with spring return



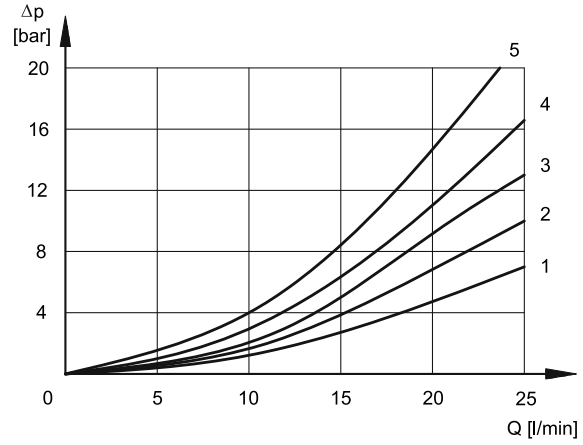
3 - HYDRAULIC FLUIDS

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.

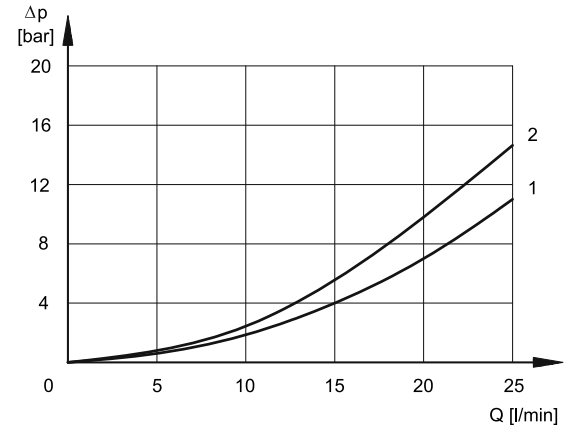
4 - PRESSURE DROPS ΔP-Q

(obtained with viscosity 36 cSt at 50 °C)



ENERGIZED VALVE

SPOOL	FLOW DIRECTIONS			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPHS			
S1, SA1, SB1	1	1	2	2
S2, SA2, SB2	1	1	2	2
S3, SA3, SB3	1	1	1	1
S4, SA4, SB4	4	4	5	5
TA	2	1	2	3
RK	1	1	2	2



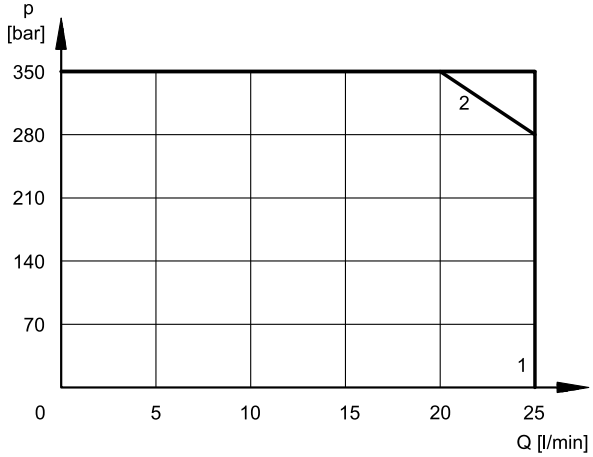
SOLENOID VALVE CENTRAL POSITION

SPOOL	FLOW DIRECTIONS				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPHS				
S2	-	-	-	-	1
S3	-	-	2	2	-
S4	-	-	-	-	2

5 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions. 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 according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage. The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.



SPOOL	CURVE
S1, S2, S3, TA, TB, RK	1
S4	2

6 - SWITCHING TIMES

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

TIMES (±10%) [ms]	
ENERGIZING	DE-ENERGIZING
25 ÷ 75	15 ÷ 25

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 interchangeability of coils of different voltages is allowed within the same type of supply current, alternating or direct.

The coil is fastened to the tube by a threaded ring, and can be rotated 360°, to suit the available space.

SUPPLY VOLTAGE FLUCTUATION	±10% Vnom
MAX SWITCH ON FREQUENCY	10.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC)(NOTE)	In compliance with 2014/30/EU
LOW VOLTAGE	In compliance with 2014/35/EU
CLASS OF PROTECTION: Coil insulation (VDE 0580) Impregnation	 class H class F

Protection from atmospheric agents IEC 60529

The IP protection degree is guaranteed only with both valve and connectors of an equivalent IP degree, correctly connected and installed.

electric connection	electric connection protection	whole valve protection
K1 EN 175301-803 (ex DIN 43650)	IP65	IP65
K2 AMP JUNIOR	IP65/IP67	
K7 DEUTSCH DT04 male	IP65/IP67	

NOTE: 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 power consumption

In direct current energizing, current consumption stays at fairly constant values, essentially determined by Ohm's law: V = R x I

The table shows current and power consumption values related to coil types.

(values ±10 %)

	Resistance at 20°C [Ω]	Current consumption [A]	Power consuption [W]	Coil code		
				K1	**K2**	**K7**
D12	4.98	2.41	28.9	1903560	1903640	1903650
D24	21	1.15	28	1903561	1903641	1903651

8 - ELECTRIC CONNECTORS

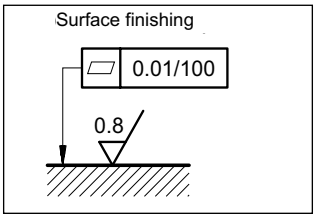
The solenoid valves are not supplied with connector. Connectors type EN 175301-803 (ex DIN 43650) for K1 connections can be ordered separately**.** For the identification of the connector type to be ordered, please see catalogue 49 000.

9 - INSTALLATION

The valves can be mounted in any position.

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

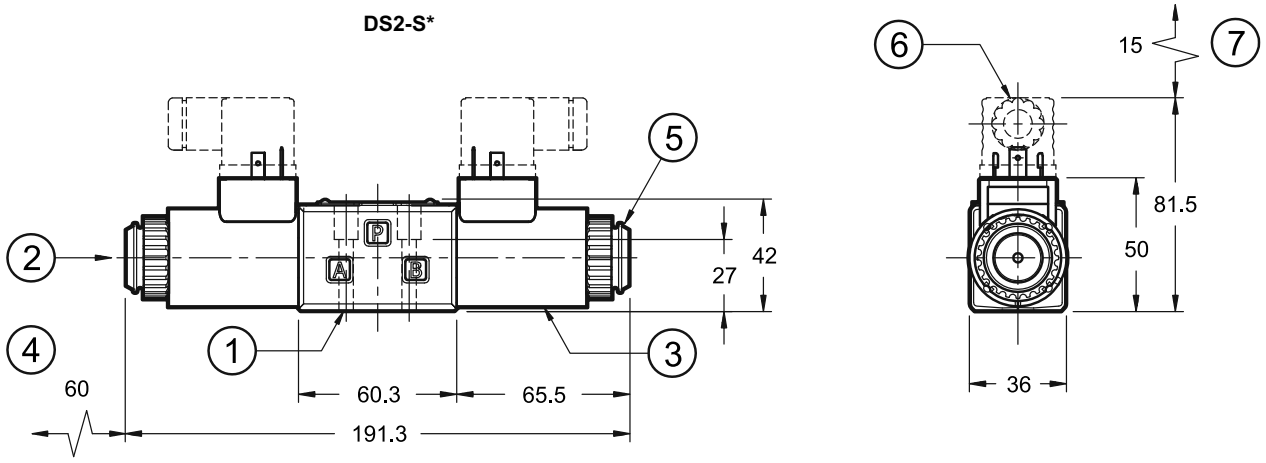
If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.

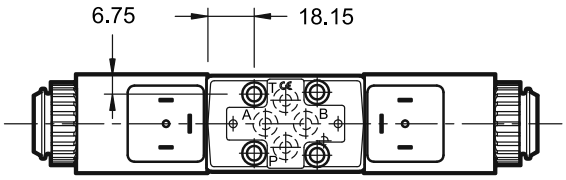


10 - OVERALL MOUNTING AND DIMENSIONS

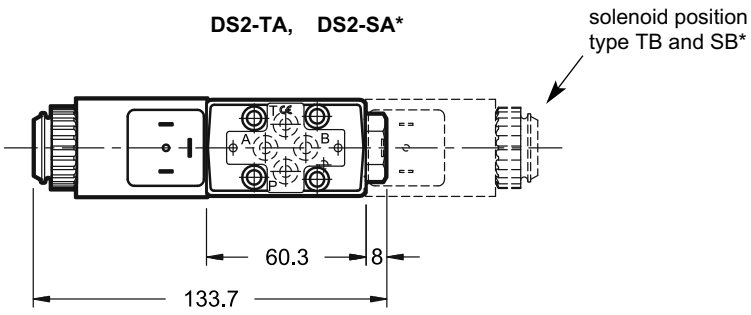
dimensions in mm

DS2-S*





DS2-TA, DS2-SA*



Single valve fastening: 4 SHC screws M5x35 - ISO 4762	
Tightening torque: 5 Nm (bolts A 8.8)	
Threads of mounting holes: M5x10	

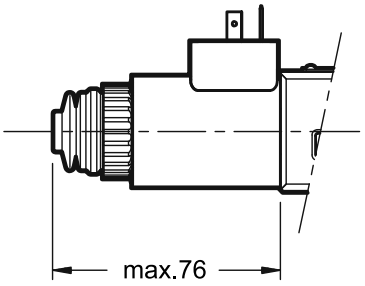
1	Mounting surface with sealing rings: N. 4 OR type 106 (6.75x1.78) - 90 Shore
2	Manual override, integrated in the tube
3	Coil (360° revolving)
4	Coil removal space
5	Locking ring: tightening torque: 5 Nm ± 0,5
6	EN 175301-803 (ex DIN 43650) electrical connector (to be ordered separately - see catalogue 49 000)
7	Connector removal space

11 - MANUAL OVERRIDES

11.1 - CM - boot protected manual override

The boot override can be ordered by entering the code **CM** in the identification code at par. 1, or is available as option to be ordered separately.

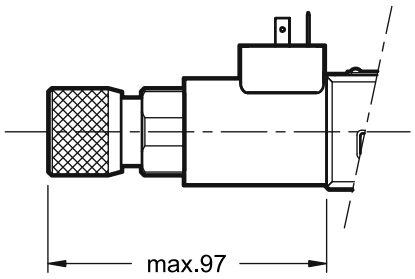
Code: **3404100043**



11.2 - Knob manual override

The knob override can be ordered by entering the code **CK1** in the identification code at par. 1, or is available as option to be ordered separately.

Code: **3404100041**



DUPLOMATIC MOTION SOLUTIONS

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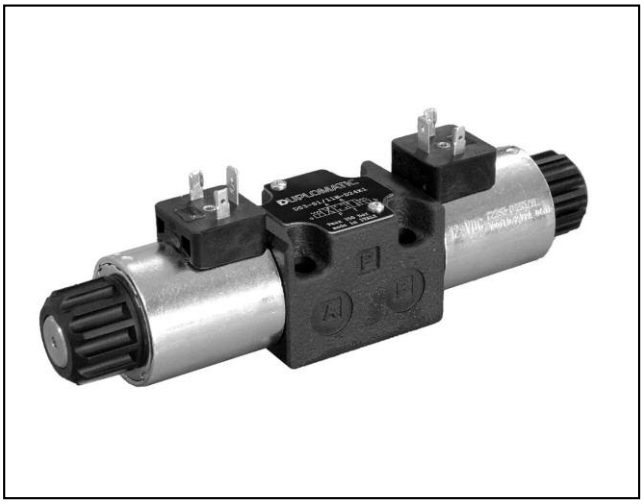
tel. +39 0331.895.111 ▪ www.duplomatic.com ▪ e-mail: sales.exp@duplomatic.com



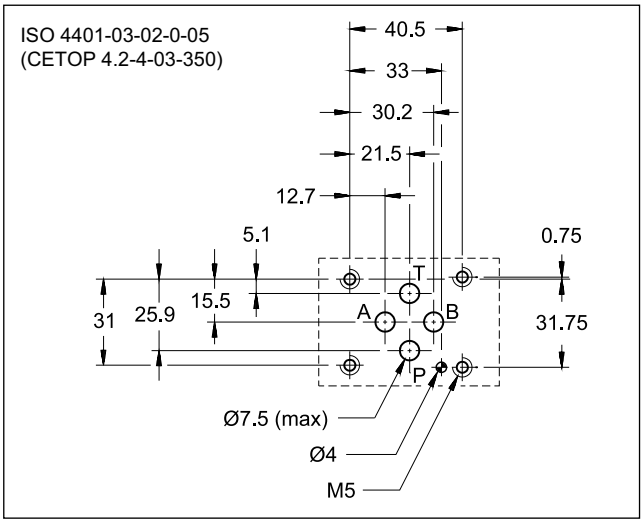
DS3

SOLENOID OPERATED DIRECTIONAL CONTROL VALVE

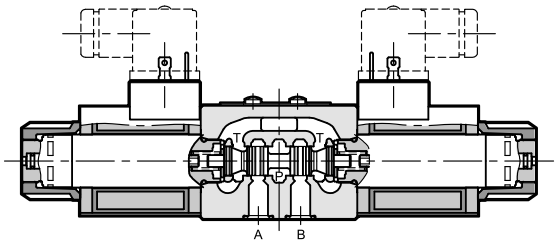
SUBPLATE MOUNTING ISO 4401-03

p max **350** bar
Q max **100** l/min

MOUNTING INTERFACE



OPERATING PRINCIPLE



— Solenoid actuated directional control valve, direct operated with mounting surface according to ISO 4401-03 standards.

— The valve is supplied with 3 or 4 ways design, with 2 or 3 positions with a wide range of spools.

— The valve body is made with high strength iron castings provided with wide internal paths in order to minimize the flow pressure drop. Wet armature solenoids with interchangeable coils are used (for further information on solenoids see par. 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 paragraphs 6.4 and 7.2).

— The DC valve is also available in a soft-shifting version (see par. 14).

— The DC valve is also available with zinc-nickel coating that ensures a salt spray resistance up to 600 hours.

— It is available a version with UL certified 24V DC coils for Canada and United States. (see par. 15).

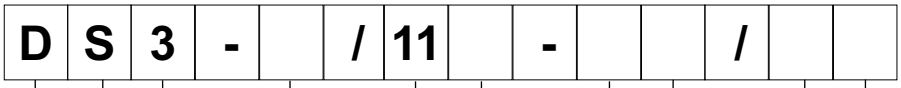
— Alternative to the standard manual override there are lever, push, knob, push and twist, boot and mechanical detent devices.

PERFORMANCES

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

		CC	CA
Maximum operating pressure: - P - A - B ports - T port	bar	350 210	 160
Maximum flowrate	l/min	100	
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 double solenoid valve	kg	1,5 2	1,4 2

1 - IDENTIFICATION CODE



Directional valve, solenoid operated

ISO 4401-03 size

Spool type (see paragraph 3)

S*	**RSA***	**TA**	**RK**
SA*	**RSB***	**TB**	
SB*		**RSA***	
		RSB*	
		TA*	
		TB*	

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
D14 = 14 V
D24 = 24 V
D28 = 28 V
D48 = 48 V
D110 = 110 V
D125 = 125 V
D220 = 220 V

D00 = valve without coils (see **NOTE 1**)

AC power supply

A24 = 24 V - 50 Hz
A48 = 48 V - 50 Hz
A100 = 100 V - 50 Hz / 100 V - 60 Hz
A110 = 110 V - 50 Hz / 120 V - 60 Hz
A230 = 230 V - 50 Hz / 240 V - 60 Hz

A00 = valve without coils (see **NOTE1**)

F110 = 110 V - 60 Hz
F220 = 220 V - 60 Hz

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

Option:
/ W7 = Zinc-nickel surface treatment (see **NOTE 2**)
Not available for AC valves.
Omit if not required

Manual override:
omit for override integrated in the tube (**standard**)

CM = manual override, boot protected

CH = lever manual override (only for DC version). The device is not available for TB, TB* and RSB* spools. RSA* spools: available only for RSA1 and RSA2.

CP = push manual override (only for DC version)

CK1 = turning knob override (only for DC version)

CK2 = push and twist knob override (only for DC version)

CPK = push manual override with mechanical retention (only for DC version)

Coil electrical connection (see par. 11):

K1 = plug for connector type EN 175301-803 (ex 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 2: The standard valve is supplied with surface treatment of phosphating black.

The zinc-nickel finishing on the valve body makes the valve suitable to ensure a salt spray resistance up to **240** hours.
For a salt spray resistance up to **600** hours refer to **paragraph 17**.

(test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

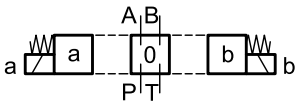
2 - HYDRAULIC FLUIDS

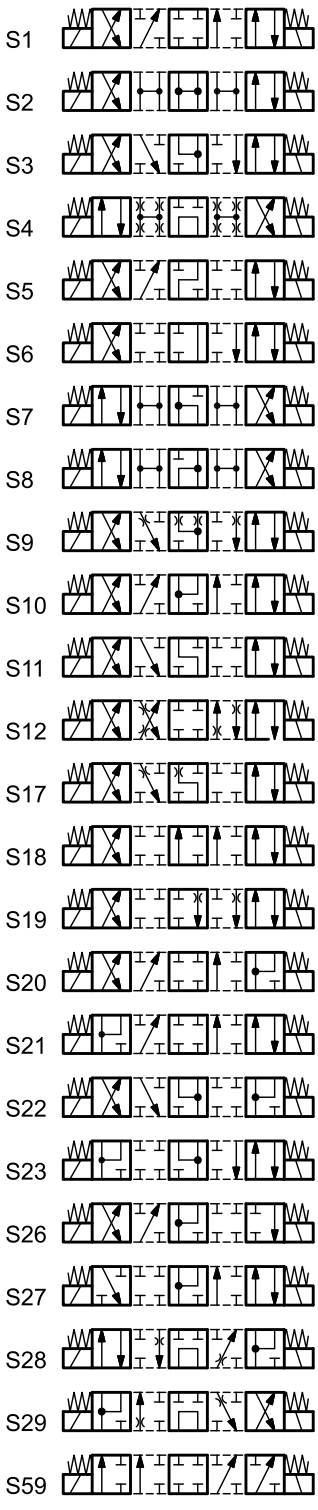
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

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.

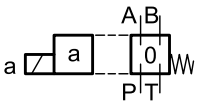
3 - SPOOL TYPE

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

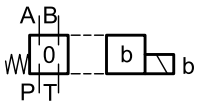




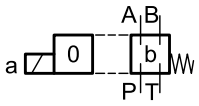
Type **SA***:
1 solenoid side A
2 positions (central + external)
with spring centering



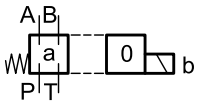
Type **SB***:
1 solenoid side B
2 positions (central + external)
with spring centering

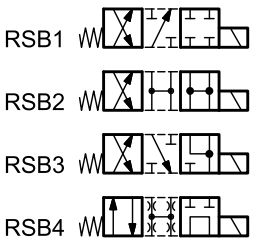


Type **RSA***:
1 solenoid side A
2 positions (external + central)
with return spring



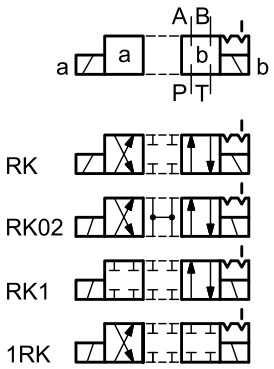
Type **RSB***:
1 solenoid side B
2 positions (external + central)
with return spring



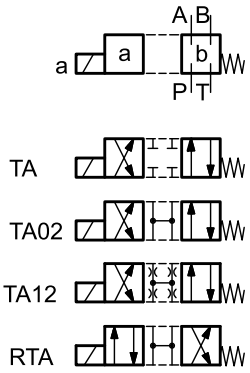


Besides the diagrams shown, which are the most frequently used, other special versions are available: consult our technical department for their identification, feasibility and operating limits.

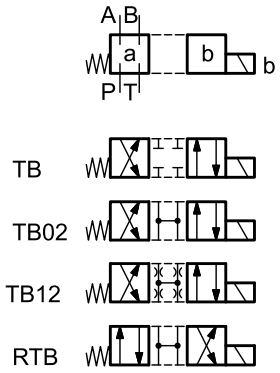
Type **RK**:
2 solenoids - 2 positions
with mechanical retention



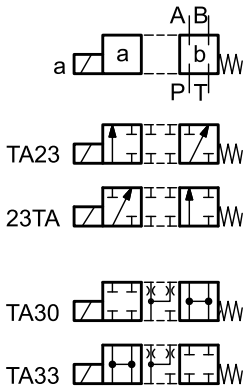
Type **TA**:
1 solenoid side A
2 external positions
with return spring



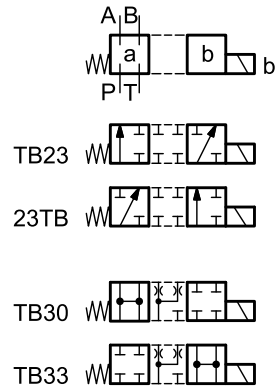
Type **TB**:
1 solenoid side B
2 external positions
with return spring



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



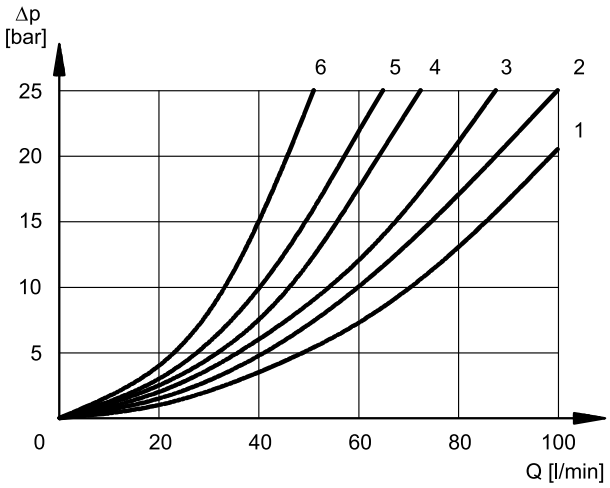
Type **TB***:
1 solenoid side B
2 positions with return spring



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)



ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1, SA1, SB1	2	2	3	3
S2, SA2, SB2	1	1	3	3
S3, SA3, SB3, RSA3, RSB3	3	3	1	1
S4, SA4, SB4, RSA4, RSB4	5	5	5	5
S5	2	1	3	3
S6	2	2	3	1
S7, S8	4	5	5	5
S9	2	2	3	3
S10	1	3	1	3
S11	2	2	1	3
S12, S17, S19	2	2	3	3
S18	1	2	3	3
S20, S22	1	5	2	
S21, S23	5	1		2
S28	6	5	-	6
S29	5	6	6	-
S59	3	3	-	-
TA, TB	3	3	3	3
RTA	2	3	3	2
RTB	3	2	2	3
TA02, TB02	2	2	2	2
TA23, TB23	3	3		
RK, RK02, RK1, 1RK	2	2	2	2

DE-ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S2, SA2, SB2					2
S3, SA3, SB3, RSA3, RSB3			3	3	
S4, SA4, SB4, RSA4, RSB4					3
S5		4			
S6				3	
S7, S8			6	6	3
S10	3	3			
S11			3		
S18	4				
S22, S23			3	3	
S28, S29				6	

5 - SWITCHING TIMES

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

SPOOL TYPE	**TIMES [ms]**	
	ENERGIZING	DE-ENERGIZING
CC	25 ÷ 75	15 ÷ 25
CA	10 ÷ 25	15 ÷ 40

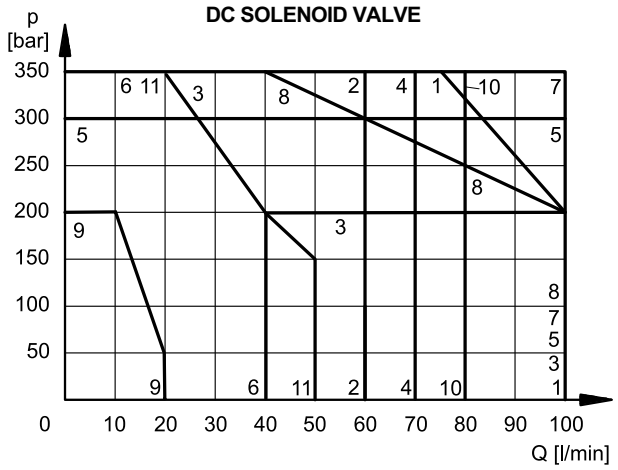
6 - OPERATING LIMITS

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 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage. The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.

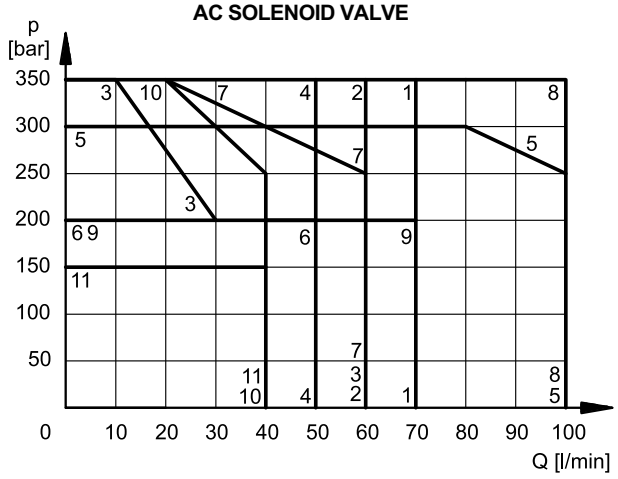
The limits for TA02 and TA spools refer to the 4-way operation. The operating limits of a 4-way valve in 3-way operation or with port A or B plugged or without flow are shown in the chart on the next page. The performance of the DC solenoid powered by AC with rectifier connectors are at par. 6.4. The performances of the soft-shift valve are shown at par. 14.

6.1 - Valves in standard operation

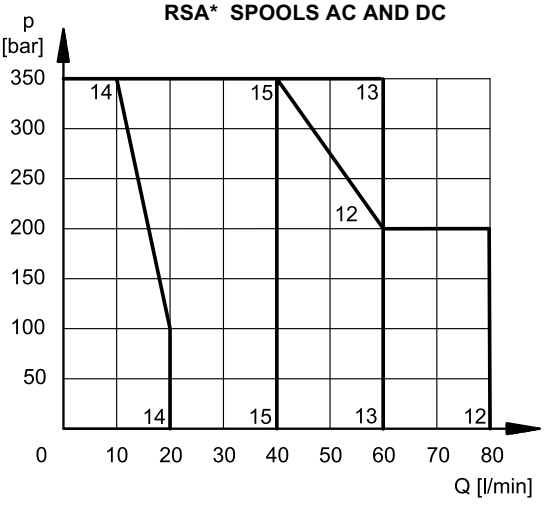
DC SOLENOID VALVE



AC SOLENOID VALVE



RSA* SPOOLS AC AND DC



DC SOLENOID VALVE

SPOOL	CURVE	
	P→A	P→B
S1,SA1,SB1	1	1
S2, SA2, SB2	2	2
S3, SA3, SB3	3	3
S4, SA4, SB4	4	4
S5	5	5
S6	4	6
S7	4	4
S8	4	4
S9	7	7
S10	7	7
S11	4	6
S12	1	1
S17	4	4
S18	5	5
S19	4	4
S20	6*	6
S21	6	6*
S22	6	6
S23	6	6
S28	9*	9*
S29	9*	9*
S59	10	10
TA, TB	7	7
TA02, TB02	8	8
TA23, TB23	2	2
TA 30	1	-
RTA, RTB	11	11
RK	7	7
RK02	8	8
RK1, 1RK	7	7

AC SOLENOID VALVE

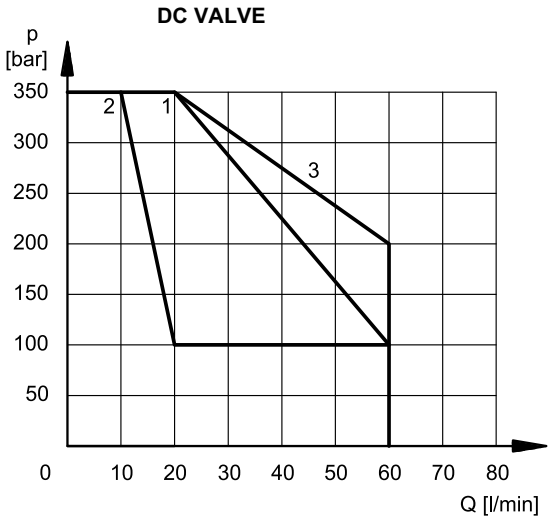
SPOOL	CURVE	
	P→A	P→B
S1,SA1,SB1	1	1
S2, SA2, SB2	2	2
S3, SA3, SB3	3	3
S4, SA4, SB4	2	2
S5	5	5
S6	6	6
S7	4	4
S8	4	4
S9	7	7
S10	8	8
S11	6	6
S12	2	2
S17	7	7
S18	5	5
S19	7	7
S20	10*	10
S21	10	10*
S22	10*	10
S23	10	11*
S28		
S29		
S59		
TA, TB	1	1
TA02, TB02	1	1
TA23, TB23	2	2
TA 30	5	-
RTA, RTB	11	11
RK	8	8
RK02	9	9
RK1, 1RK	8	8

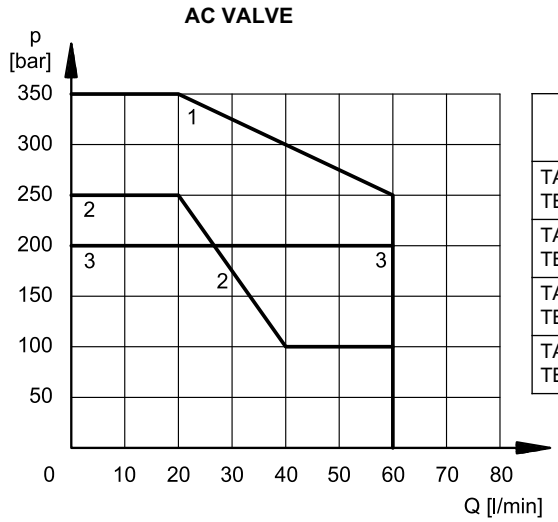
* Performance obtained for a valve with A and B lines connected the one to the piston-side chamber and the other to the rod-side chamber of a double-acting cylinder with area ratio 2:1.

SPOOL	CURVE
RSA1	12
RSA2	13
RSA3	14
RSA4	15

6.2 - 4-way valve in 3-way operation

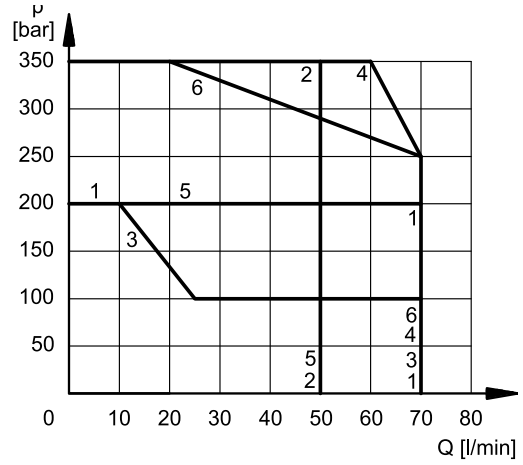
Operating limits of a 4-way valve in 3-way operation or with port A or B plugged or without flow.





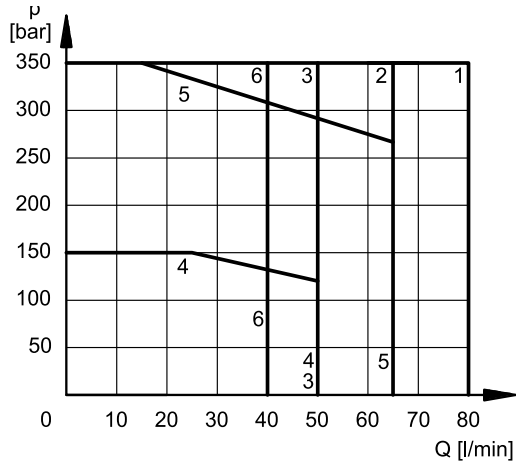
SPOOL	CURVE	
	DC	AC
TA backpr. A TB backpr. B	1	1
TA02 backpr. A TB02 backpr. B	1	1
TA backpr. B TB backpr. A	2	1
TA02 backpr. B TB02 backpr. A	3	3

6.3 - AC solenoid valve with coil A110 fed with 110V - 60 Hz



SPOOL	CURVE	
	P→A	P→B
S1,SA1, SB1	1	1
S2, SA2, SB2	2	2
S3, SA3, SB3	3	3
S4, SA4, SB4	4	4
S9	5	5
TA, TB	2	2
RK	6	6

6.4 - Operating limits for DC solenoid valves fed with AC with rectifier connectors



SPOOL	CURVE	
	P→A	P→B
S1, SA1, SB1	2	2
S2, SA2, SB2	3	3
S3, SA3, SB3	4	4
S4, SA4, SB4	2	2
S9	5	5
TA, TB	6	6
RK	1	1

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 360°, to suit the available space.

Protection from atmospheric agents IEC 60529

The IP protection degree is guaranteed only with both valve and connectors of an equivalent IP degree, correctly connected and installed.

electric connection	electric connection protection	whole valve protection
K1 EN 175301-803 (ex DIN 43650)	IP65	IP65
K2 AMP JUNIOR	IP65/67	
K7 DEUTSCH DT04 male	IP65/67	

SUPPLY VOLTAGE FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY	18.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC) (NOTE)	In compliance with 2014/30/EU
LOW VOLTAGE	In compliance with 2014/35/EU
CLASS OF PROTECTION : Coil insulation (VDE 0580) Impregnation: DC valve AC valve	 class H class F class H

NOTE: In order to further reduce the emissions, with DC supply, 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 of the DC coils.

Using connectors type "D" (see cat. 49 000) with embedded bridge rectifier it is possible to feed DC coils (starting from 48V voltage) with alternating current (50 or 60 Hz), considering a reduction of the operating limits (see diagram at section 6.4).

Coils for direct current (values ± 10%)

	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt [W]	Coil code K1	K2	K7
D12	12	4,4	2,72	32,7	1903080	1903100	1902940
D14	14	7,2	1.93	27	1903086		
D24	24	18,6	1,29	31	1903081	1903101	1902941
D28	28	26	1,11	31	1903082		
D48	48	78,6	0,61	29,5	1903083		
D110	110	423	0,26	28,2	1903464		
D125	125	550	0,23	28,6	1903467		
D220	220	1692	0,13	28,2	1903465		

7.3 - Current and absorbed power for AC solenoid valve

The table shows current and power consumption values at inrush and at holding, for AC coils.

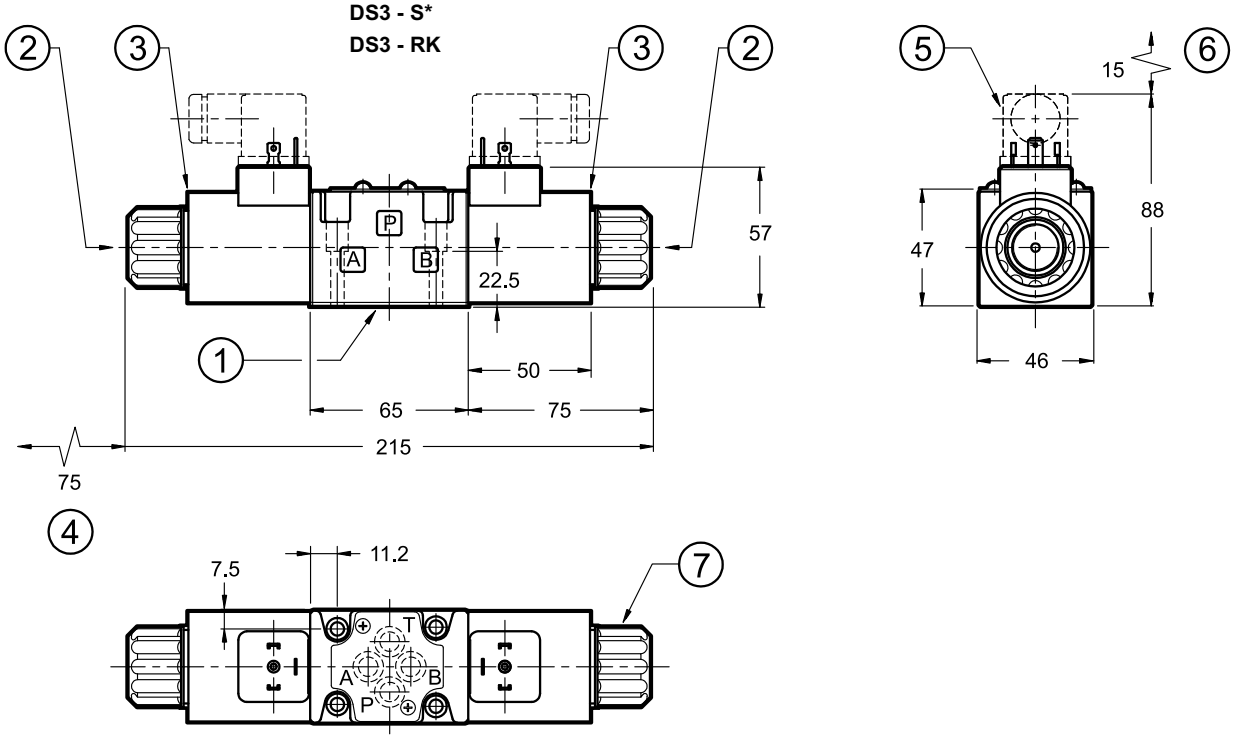
Coils for alternating current (values ± 5%)

Suffix	Nominal Voltage [V]	Freq. [Hz]	Resistance at 20°C [Ω]	Current consumption at inrush [A]	Current consumption at holding [A]	Power consumption at inrush [VA]	Power consumption at holding [VA]	Coil Code K1
A24	24	50	1,69	5,81	1,32	139	32	1902830
A48	48		6,02	3,78	0,86	182	41	1902831
A100	100V-50Hz 100V-60Hz	50/60	23,3	2,11	0,48	211	48	1902836
				1,63	0,37	163	37	
A110	110V-50Hz 120V-60Hz		33	1,76	0,40	194	44	1902832
				1,54	0,35	185	42	
A230	230V-50Hz 240V-60Hz		135	0,92	0,21	213	48	1902833
				0,79	0,18	190	43	
F110	110	60	28,5	1,45	0,33	160	36	1902834
F220	220		103	0,92	0,21	203	46	1902835

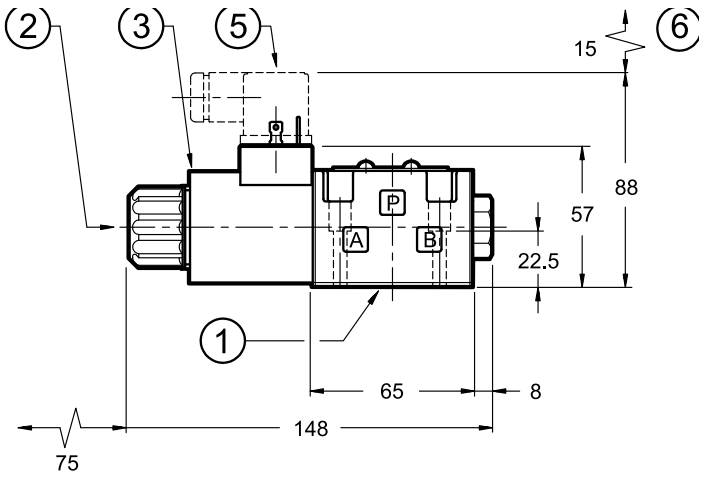
8 - OVERALL AND MOUNTING DIMENSIONS FOR DC SOLENOID VALVES

dimensions in mm

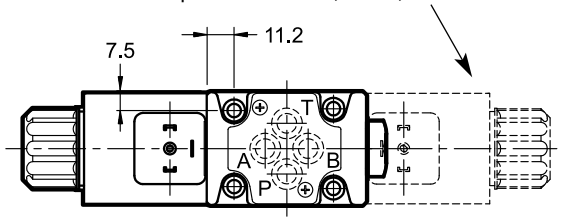
DS3 - S*
DS3 - RK



DS3-SA*, DS3-RSA*
DS3-TA, DS3-TA*



solenoid position for SB* , RSB*, TB and TB* configurations



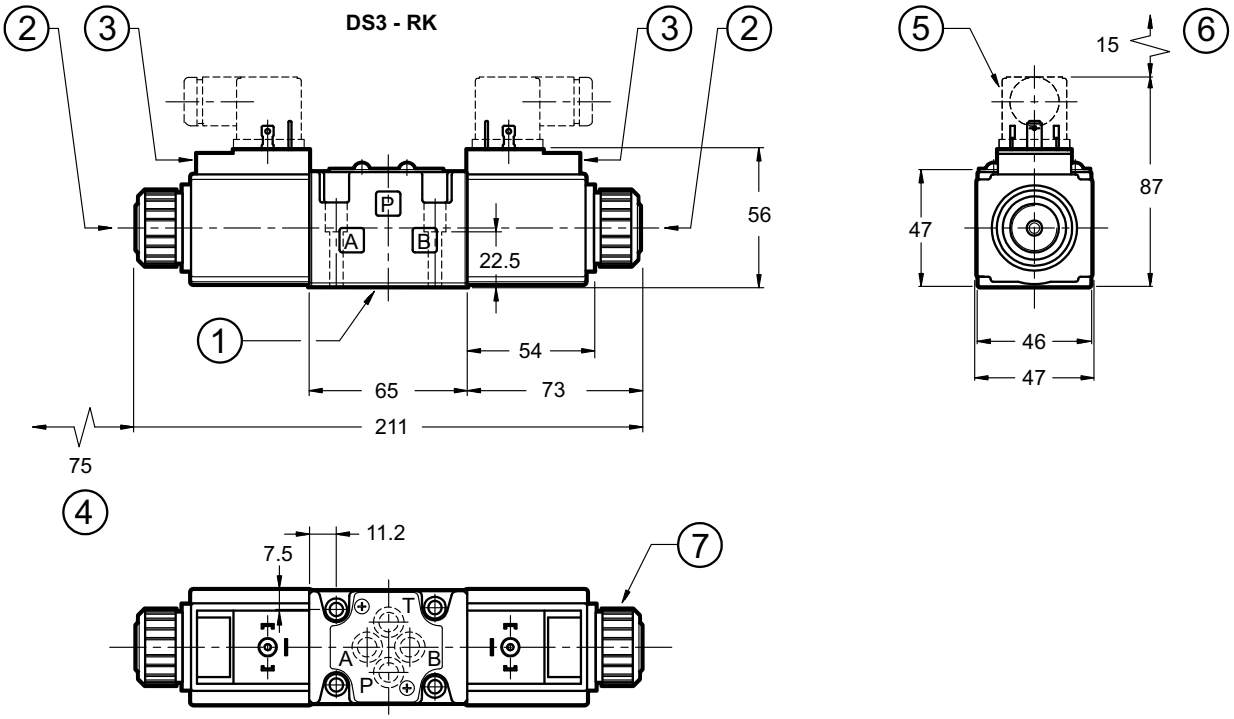
Valve fastening: 4 SHC screws ISO 4762 M5x30
Tightening torque: 5 Nm (A8.8)
Threads of mounting holes: M5x10

1	Mounting surface with sealing rings: 4 OR 2037 (9.25x1.78) - 90 shore
2	Standard manual override included in the solenoid tube
3	Coil (360° revolving)
4	Coil removal space
5	EN 175301-803 (ex DIN 43650) connector To be ordered separately. See cat. 49 000
6	Connector removal space
7	Locking ring: tightening torque 5 ±0.5 Nm

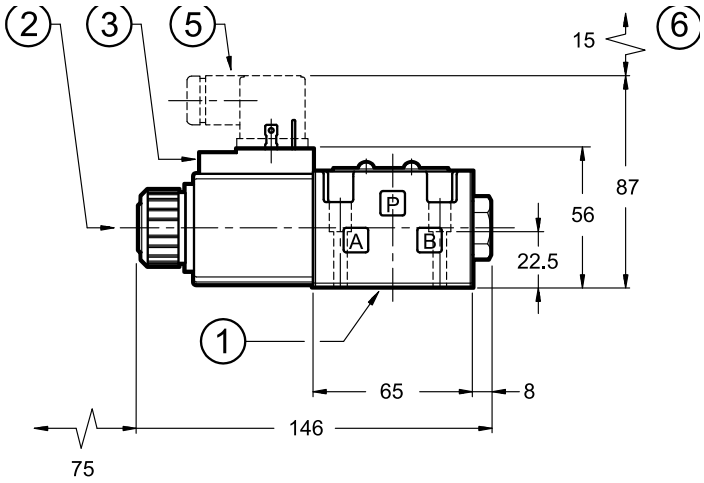
9 - OVERALL AND MOUNTING DIMENSIONS FOR AC SOLENOID VALVES

dimensions in mm

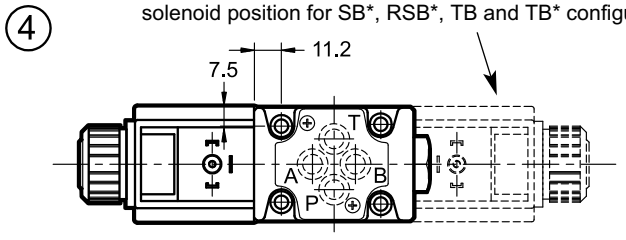
DS3 - S*
DS3 - RK



DS3-SA*, DS3-RSA*
DS3-TA, DS3-TA*



solenoid position for SB*, RSB*, TB and TB* configurations



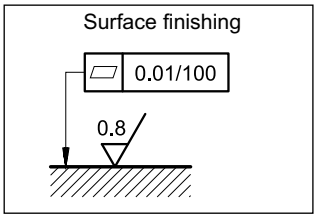
Valve fastening: 4 SHC screws ISO 4762 M5x30
Tightening torque: 5 Nm (A8.8)
Threads of mounting holes: M5x10

1	Mounting surface with sealing rings: 4 OR 2037 (9.25x1.78) - 90 shore
2	Standard manual override included in the solenoid tube
3	Coil (90° revolving)
4	Coil removal space
5	EN 175301-803 (ex DIN 43650) connector To be ordered separately. See cat. 49 000
6	Connector removal space
7	Locking ring: tightening torque 5 ±0.5 Nm

10 - INSTALLATION

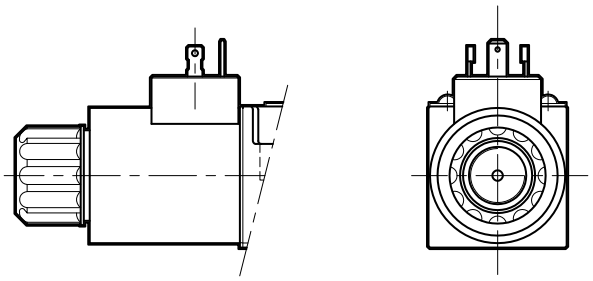
Configurations with centering and return springs can be mounted in any position; type RK valves - without springs and with mechanical detent - must be mounted with the longitudinal axis horizontal.

Valve fixing takes place 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 leakages between valve and mounting surface can easily occur.

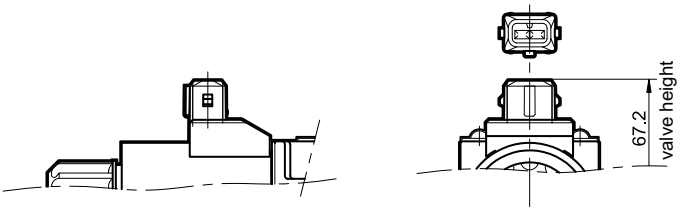


11 - ELECTRIC CONNECTIONS

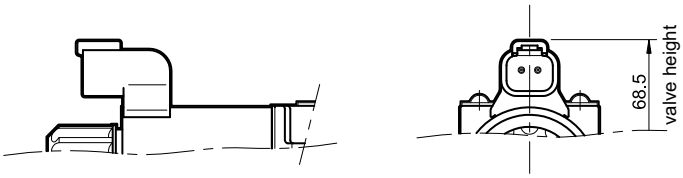
connection for EN 175301-803
(ex DIN 43650) connector
code **K1** (**standard**)
code **WK1** (W7 version only)



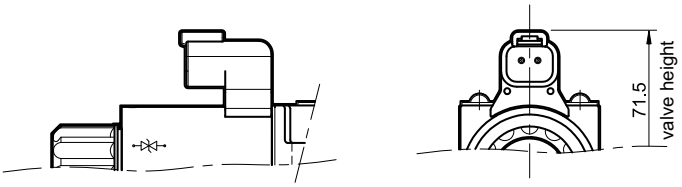
connection for AMP JUNIOR
connector
code **K2**



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



connection for
DEUTSCH DT06-2S male connector
code **WK7** (W7 version only)
code **WK7D** (W7 version only - coil
with diode)



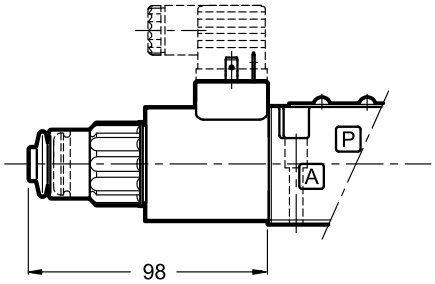
12 - ELECTRIC CONNECTORS

Solenoid operated valves are delivered without connectors. Connectors type EN 175301-803 (ex DIN 43650) for K1 connections can be ordered separately. See catalogue 49 000.

13 - MANUAL OVERRIDES

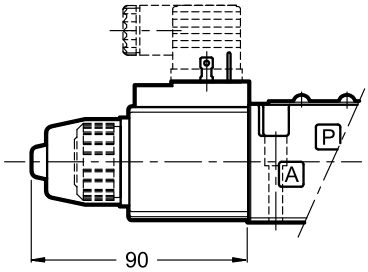
13.1 - Manual override, boot protected

CM-DS3/11 - Version for DC solenoid valve



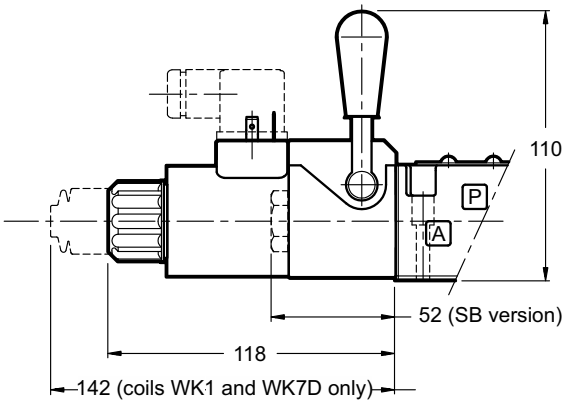
Code: 3401150006

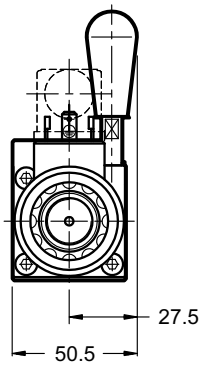
Version for AC solenoid valve



Code: 0269201

13.2 - CH-DS3/11 Lever manual override (only for DC solenoid valve)

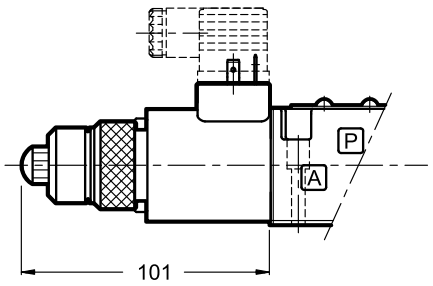




NOTE: The lever device is always located in the A side of the valve.

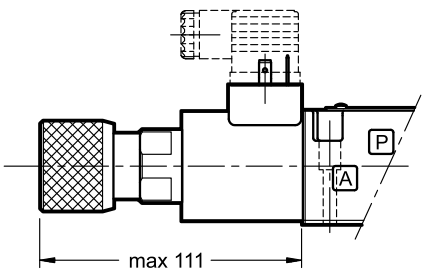
The high resistance to corrosion valves (par. 17) are equipped with a boot for solenoid tube protection.

13.3 - CP-DS3/10 Push manual override (only for DC solenoid valve)



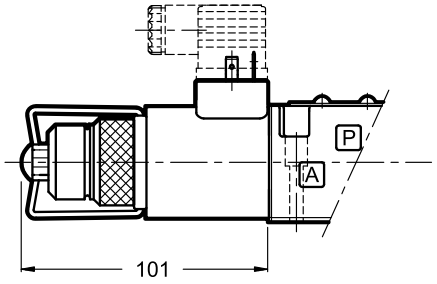
Code: 3401150005

13.4 - CK1-DS3/11 knob manual override, turning (only for DC solenoid valve)



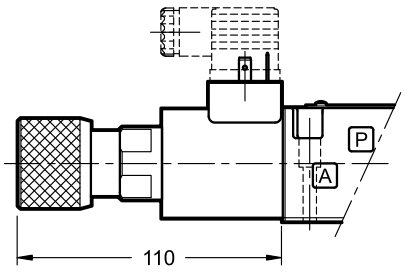
Code: 3401150021

13.5 - CPK-DS3/10 Push manual override with mechanical retention (only for DC solenoid valve)



Code: 3401150004

13.6 - CK2-DS3/10 Push and twist manual override (only for DC solenoid valve)



Code: 3401150018

14 - SOFT-SHIFT VERSION FOR DC VALVE

14.1 - Identification code

D	S	3	-		/	13		-			/	F		

Solenoid operated directional control valve

ISO 4401-03 size

Spool type
The hydraulic symbols of S2F and S4F are identical to those of S2 and S4 spools (p.2)

S1	**TA12**
S2F	**TB12**
S4F	**TA23**
S9	**TB23**
S12	

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
D110 = 110 V
D220 = 220 V

Coil electrical connection (see par. 11):
K1 = plug for connector type EN 175301-803 (ex 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)

Soft-shifting

Manual override (see par.1 and 13)

Option:
/ W7 = see par. 1

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

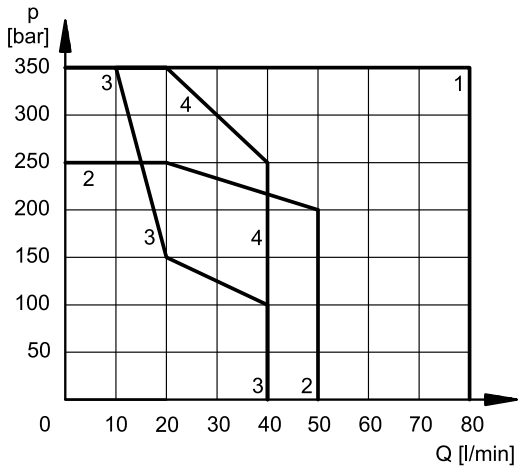
In this version, the S9 spool must be used instead of the S3 type.

The diagram on the side shows the operating limits of the spools available in the soft-shifting version, while the table 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.

For correct operation of the soft-shifting ensure the solenoid tubes are always filled with oil. At this matter, we recommend to install a backpressure valve set at 1 ÷ 2 bar on T line.



SPOOL	CURVE	TIMES [ms]	
		ENERGIZING	DE-ENERGIZING
S1, S12	1	350	200 ÷ 300
S2F	2	400	100 ÷ 250
S4F	4	350	150 ÷ 300
S9	1	400	200 ÷ 300
TA12, TB12	3	180	200 ÷ 300
TA23, TB23		300	200 ÷ 300

15 - VERSION WITH UL CERTIFIED COILS

15.1 - Identification code

D	S	3	-		/	11		-	D24	UL	K1	/	

Solenoid operated directional control valve

ISO 4401-03 size

Spool type
See paragraph 3

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

Power supply DC 24 V

LISK coil, UL certified to United States and Canada. Class 155 (F)

Coil electrical connection for connector type EN 175301-803 (ex DIN 43650)

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

15.2 - UL file number

The UL database website provides informations about the certification, by entering the code MH29222 in the 'UL file number' field.

15.3 - Electrical features

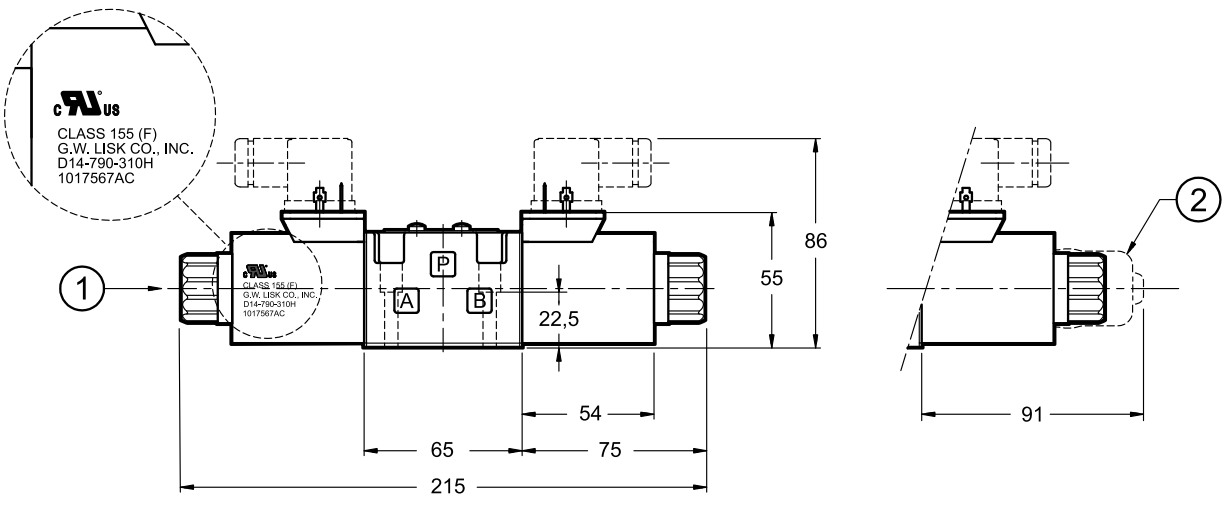
(values ± 10%)

	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt [W]	Coil code
D24ULK1	24	19.2	1.25	30	1903341

NOTE: Valves with UL coils must be ordered complete. **The UL coils are not interchangeable with those of standard valves.**

15.4 - Overall and mounting dimensions

dimensions in mm



Valve fastening: 4 SHC screws ISO 4762 M5x30
Tightening torque: 5 Nm (A8.8)
Threads of mounting holes: M5x10

1	Standard manual override included in the solenoid tube
2	CM version: boot manual ovverride, rubber

16 - VERSION WITH FIXING INTERCHANGEABLE WITH 4WE6*6X REXROTH

16.1 - Identification code

D	S	3	R	-		/	11		-			/		

Directional valve, solenoid operated

ISO 4401-03 size

Fastening screws interchangeable with Rexroth 4WE6*6X valve.

Spool type (see paragraph 3)

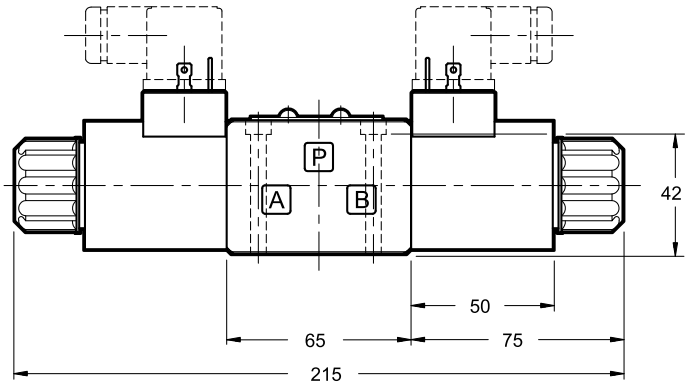
S* **SA*** **SB*** **RSA*** **RSB*** **TA** **TB** **TA*** **TB*** **RK**

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

Complete the indentification code configuration as for in paragraph 1.

16.2 - Overall and mounting dimensions for DC solenoid valves

dimensions in mm

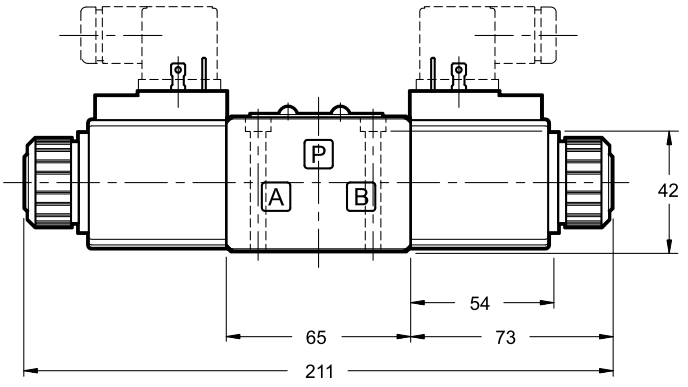


Please refer to the standard valve at paragraph 8 for non-quoted dimensions.

Valve fastening: 4 SHC screws ISO 4762 M5x50
Tightening torque: 5 Nm (A8.8)
Threads of mounting holes: M5x10

16.3 - Overall and mounting dimensions for AC solenoid valves

dimensions in mm

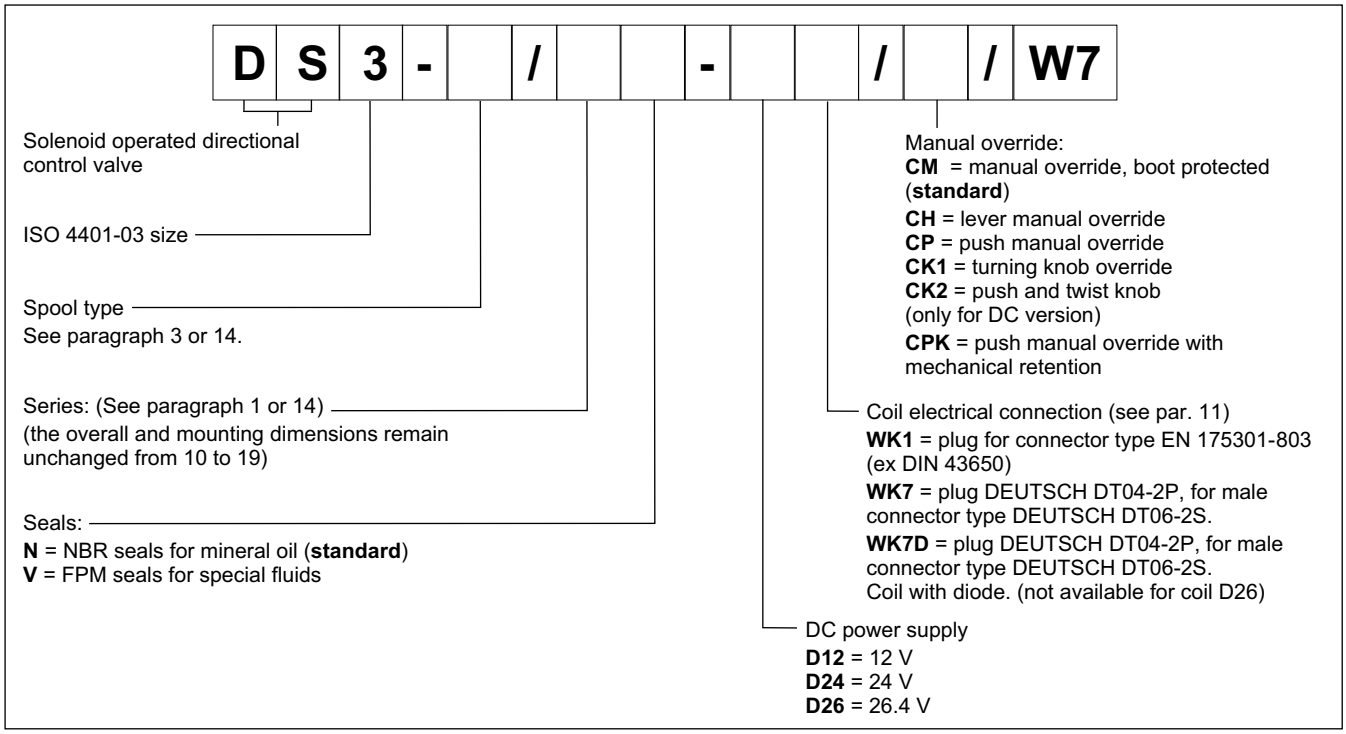


Please refer to the standard valve at paragraph 9 for non-quoted dimensions.

Valve fastening: 4 SHC screws ISO 4762 M5x50
Tightening torque: 5 Nm (A8.8)
Threads of mounting holes: M5x10

17 - HIGH IP AND CORROSION RESISTANCE VERSION

17.1 - Identification code



17.2 - Corrosion resistance

This version features the zinc-nickel coating on all exposed metal parts of the valve, making it resistant to exposure to the salt spray for **600** hours (test performed according to UNI EN ISO 9227 and assessment test performed according to UNI EN ISO 10289).

17.3 - DC coils

The coils feature a zinc-nickel surface treatment.

The WK7D coil includes a suppressor diode of pulses for protection from voltage peaks during switching. During the switching the diode significantly reduces the energy released by the winding, by limiting the voltage to 31.4V in the D12 coil and to 58.9 V in the D24 coil.

(values ±10%)

	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt [W]	Coil code		
					WK1	WK7	WK7D
D12	12	4,4	2,72	32,7	1903590	1903580	1903600
D24	24	18,6	1,29	31	1903591	1903581	1903601
D26	26,4	21,8	1,21	32	1903599	1903589	-

17.4 - Protection from atmospheric agents IEC 60529

The IP protection degree is guaranteed only with both valve and connectors of an equivalent IP degree, correctly connected and installed.

electric connection	electric connection protection	whole valve protection
WK1 EN 175301-803 (ex DIN 43650)	IP66	IP66
WK7 DEUTSCH DT04 male	IP66/IP68/IP69 IP69K*	IP66/IP68/IP69 IP69K*
WK7D DEUTSCH DT04 male	IP66/IP68/IP69 IP69K*	IP66/IP68/IP69 IP69K*

(*) The IP69K protection degree is not taken into account in IEC 60529 but it is included in ISO 20653.

NOTE: As regards the liquid ingress protection (second digit), there are three means of protection.

Codes from 1 to 6 are related to water jets.

Rates 7 and 8 are related to immersion.

Rate 9 is reserved for high pressure and temperature water jets.

This means that IPX6 covers all the lower steps, rate IPX8 covers IPX7 but not IPX6 and lower, instead IPX9 does not cover any of them.

Whether a device meets two types of protection requirements it must be indicated by listing both the tests separated by a slash.

(E.g. a marking of an equipment covered both by temporary immersion and water jets is IP66/IP68).

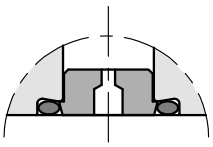
18 - PORT RESTRICTORS

Port restrictors are recommended if flow variations which exceed the valve performance limit during the switching processes occur, or for circuit dampening.

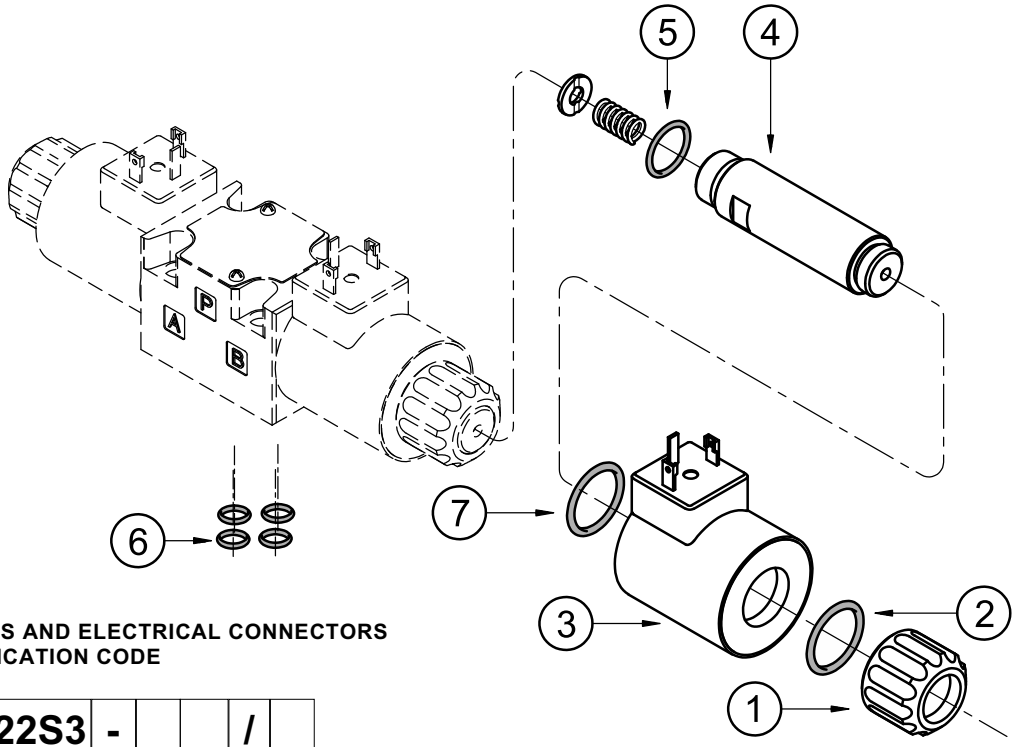
Port restrictor plugs can be ordered separately with the part numbers shown at left.

Ø (mm)	part number
blank	**0144162**
0.6	**0144163**
0.8	**0144033**
1	**0144034**

Ø (mm)	part number
1.2	**0144035**
1.5	**0144036**
1.8	**0144164**
2	**0144165**



19 - SPARE PARTS FOR DC SOLENOID VALVE



DC COILS AND ELECTRICAL CONNECTORS IDENTIFICATION CODE

C	22S3	-			/	

Supply voltage
D12 = 12 V
D14 = 14 V
D24 = 24 V
D26 = 26.4 V
D28 = 28 V
D48 = 48 V
D125 = 125 V
D110 = 110 V
D220 = 220 V

Series no.:
10 = for K7 and WK7
11 = for K1 up to D48 and K2
12 = for K1 D110, D125, D220, WK1 and WK7D

Coil electrical connection (see par. 11):
K1 = plug for connector EN 175301-803 (ex DIN 43650)
for coils **D12**, **D24** and **D26**:
WK1 = plug for connector EN 175301-803 (ex DIN 43650)
WK7 = plug DEUTSCH DT04-2P, for male connector type DEUTSCH DT06-2S.
Only for **D12** and **D24**:
K2 = plug for connector AMP JUNIOR
K7 = plug DEUTSCH DT04-2P, for male connector type DEUTSCH DT06-2S.
WK7D = plug DEUTSCH DT04-2P, for male connector type DEUTSCH DT06-2S.
Coil with diode.

NOTE: You can also order coils using the coil codes in paragraphs 7.2 and 17.3.

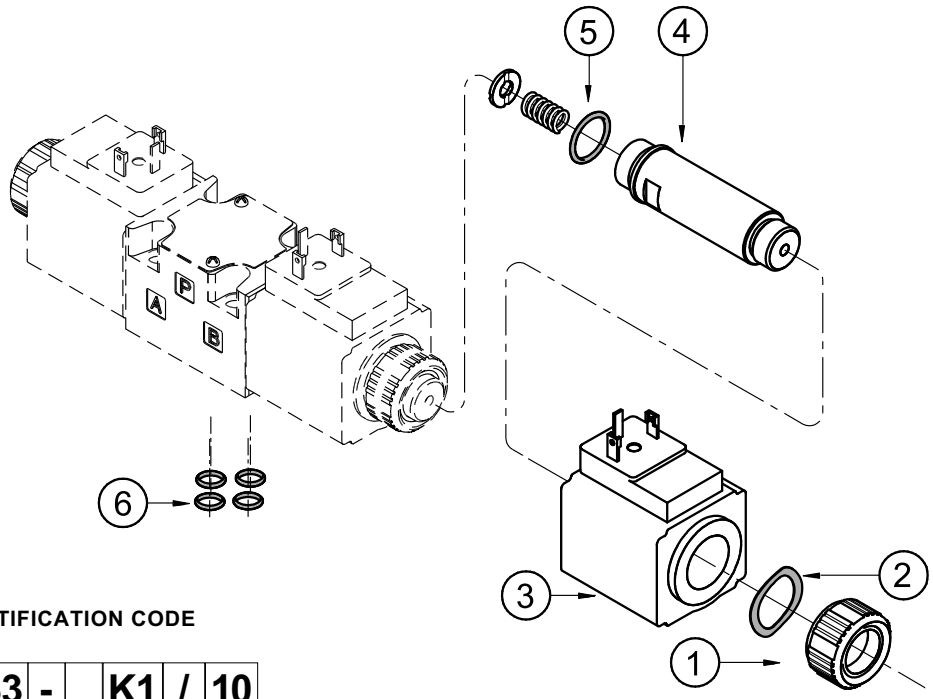
1	Coil locking ring with seal included cod. 0119412 Tightening torque 5 ±0.5 Nm
2	ORM type 0220-20 (22x2) - 70 Shore
3	Coil (see identification code)
4	Solenoid tube for standard version: TD22-DS3/10N (NBR seals) TD22-DS3/10V (FPM seals) Solenoid tube for version with soft-shifting: TD22-DS3F/10N (NBR seals) TD22-DS3F/10V (FPM seals) **NOTE:** OR n°5 included
5	OR type 2062 (15.6x1.78) - 70 Shore
6	4 OR type 2037 (9.25x1.78) - 90 Shore
7	For coils WK* only: ORM-0220-20 - MVQ

SEALS KIT

The codes include the O-Ring n° 2, 5, 6 e 7.

Cod. 1985406 NBR seals
Cod. 1985410 FPM (viton) seals

20 - SPARE PARTS FOR AC SOLENOID VALVE



AC COILS IDENTIFICATION CODE

C	20.6S3	-		K1	/	10

Supply voltage
A24 = 24 V - 50 Hz
A48 = 48 V - 50 Hz
A100 = 100 V - 50 Hz
100 V - 60 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

Plug for connector type
EN 175301-803
(ex DIN 43650)

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

1	Coil locking ring cod. 0119333 Tightening torque 5 ±0.5 Nm
2	Snap ring cod. 0550483
3	Coil (see identification code on the side)
4	Solenoid tube : TA20.6-DS3/10N (NBR seals) TA20.6-DS3/10V (FPM seals) **NOTE**: OR n° 5 included
5	OR type 2062 (15.6x1.78) - 70 Shore
6	N. 4 OR type 2037 (9.25x1.78) - 90 Shore

SEALS KIT
The codes include the OR nr. 5 and 6.

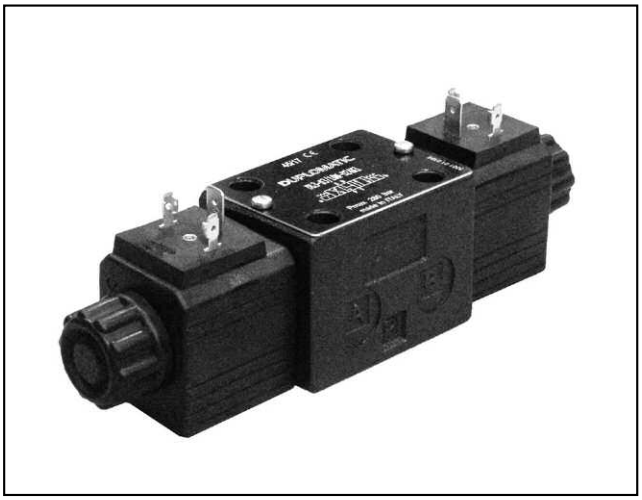
Cod. 1985406 NBR seals
Cod. 1985410 FPM (viton) seals

NOTE: You can also order coils using the coil codes in paragraph 7.3

21 - SUBPLATES
(see catalogue 51 000)

Type PMMD-AI3G with rear ports 3/8” BSP
Type PMMD-AL3G with side ports 3/8” BSP

DUPLOMATIC MOTION SOLUTIONS
DUPLOMATIC MS S.p.A.
via M. Re Depaolini 24 ▪ 20015 PARABIAGO (MI) ▪ ITALY
tel. +39 0331.895.111 ▪ www.duplomatic.com ▪ e-mail: sales.exp@duplomatic.com



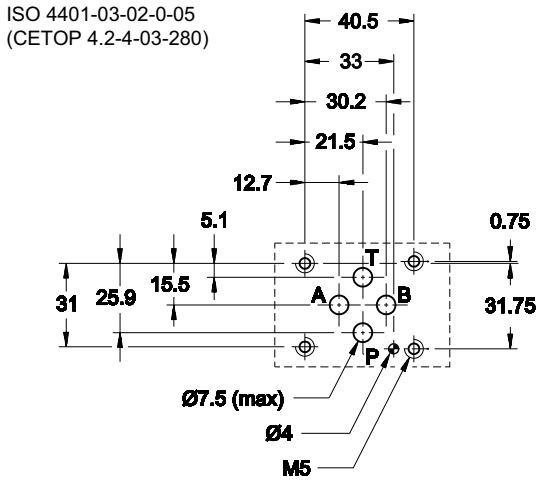
DL3

SOLENOID OPERATED DIRECTIONAL CONTROL VALVE COMPACT VERSION

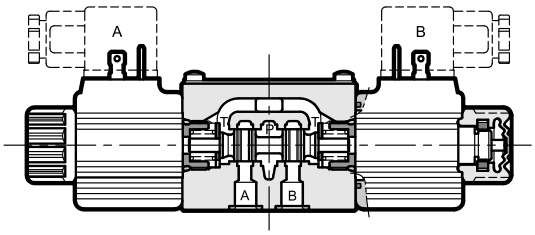
SUBPLATE MOUNTING ISO 4401-03

p max **280** bar
Q max **50** l/min

MOUNTING SURFACE



OPERATING PRINCIPLE



— Direct acting, subplate mounting directional control valve, with mounting surface according to ISO 4401-03 standards.

— Compact design with reduced solenoid dimensions, suitable for mini-power packs and mobile and agricultural applications.

— 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 (for further information on solenoids see paragraph 7).

— The valve is supplied with 3 or 4 way designs and with several interchangeable spools with different porting arrangements.

— The valve is available with DC or AC current solenoids and with several types of electrical connections to cover various installation requirements (see paragraphs 7 and 11).

— The DC valve comes with boot protected manual override which ensures a protection degree IP69K for connections types WK7 and WK8.

— It is available also with zinc-nickel surface treatment, that ensures a salt spray resistance up to 600 hours.

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

		CC	CA
Maximum operating pressure: - ports P - A - B - port T	bar	280 250	160
Maximum flow rate	l/min	50	
Pressure drop Δp-Q	see paragraph 4		
Operating limits	see paragraph 5		
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	
Masse: single solenoid valve double solenoid valve	kg	1,1 1,4	

1 - IDENTIFICATION CODE

D	L	3	-		/			-			/		

Solenoid operated directional control valve

Compact version

ISO 4401-03 size

Spool type (see paragraph 3):

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

Series no.:

10 = for direct current valves
11 = for alternate current valves
(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

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

Manual override (see par. 13)
on **DC** version:
omit for boot manual override integrated in the coil locking ring
CK1 = knob manual override
on **AC** version:
omit for manual override integrated in the tube
CM = manual override boot protected

Coil electrical connection:
(see paragraph 11)
K1 = plug for connector type EN 175301-803 (ex DIN 43650) **(standard)**

For **D12** and **D24** coils only:
K2 = plug for connector type AMP JUNIOR
K4 = outgoing cables
WK7 = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S
WK8 = plug for connector type AMP SUPER SEAL

DC power supply
D12 = 12 V
D24 = 24 V
D28 = 28 V
D48 = 48 V
} direct current

R110 = 110 V
R230 = 230 V
} rectified current

D00 = valve without coils (see **NOTE 1**)

AC power supply
A24 = 24 V - 50 Hz
A110 = 110 V - 50 Hz
A230 = 230 V - 50 Hz
A00 = valve without coils (see **NOTE 1**)

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

NOTE 2:The standard surface treatment is phosphating black.
On request we can supply these valves with zinc-nickel finishing, making the valve suitable to ensure a salt spray resistance up to **600** hours (test operated according to UNI EN ISO 9227 standard and test evaluation operated according to UNI EN ISO 10289 standard)
Add **/W7** at the end of the identification code.

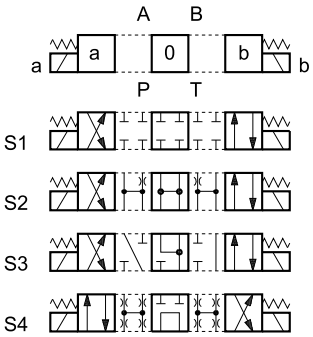
2 - HYDRAULIC FLUIDS

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.

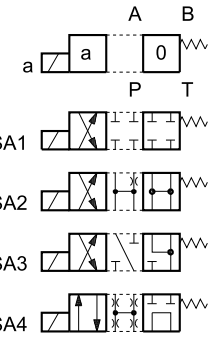
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

3 - SPOOL TYPE

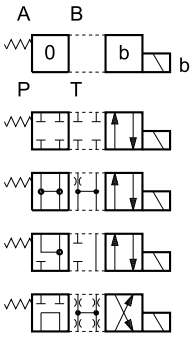
Type **S***:
2 solenoids - 3 positions
with spring centering



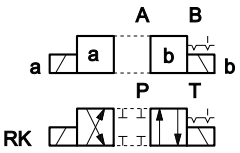
Type **SA***:
1 solenoid side A
2 positions (central + external)
with spring centering



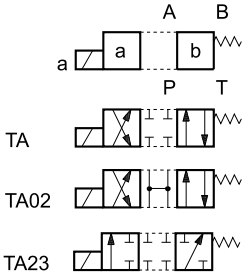
Type **SB***:
1 solenoid side B
2 positions (central + external)
with spring centering



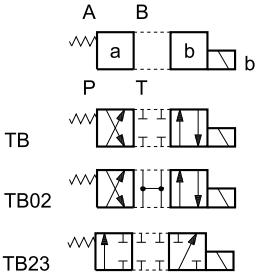
Type **RK**:
2 solenoids - 2 positions
with mechanical retention



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



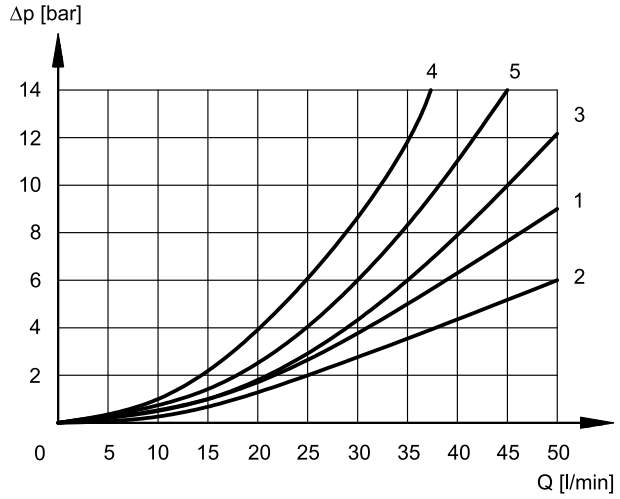
Type **TB**:
1 solenoid side B
2 external positions
with return spring



NOTE: Others spools available on request only.

4 - PRESSURE DROPS ΔP-Q

(obtained with viscosity of 36 cSt at 50 °C)



ENERGIZED VALVE

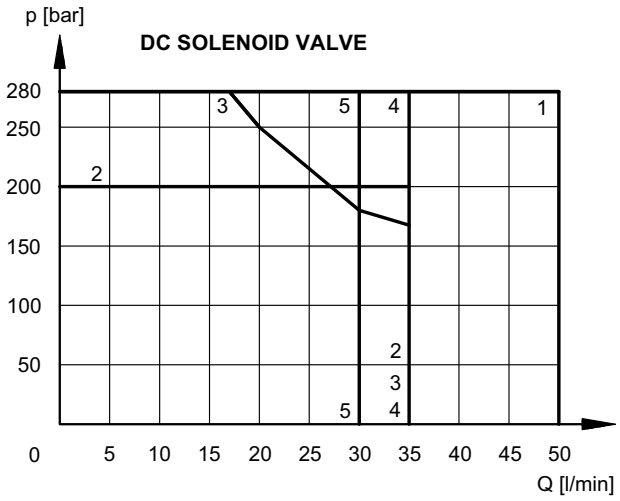
SPOOL	FLOW DIRECTIONS				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPHS				
S1	1	1	1	1	-
S2	1	1	2	2	3
S3	3	3	2	2	-
S4	4	4	4	4	5
RK	1	1	1	1	-
TA	3	3	3	3	-

5 - OPERATING LIMITS

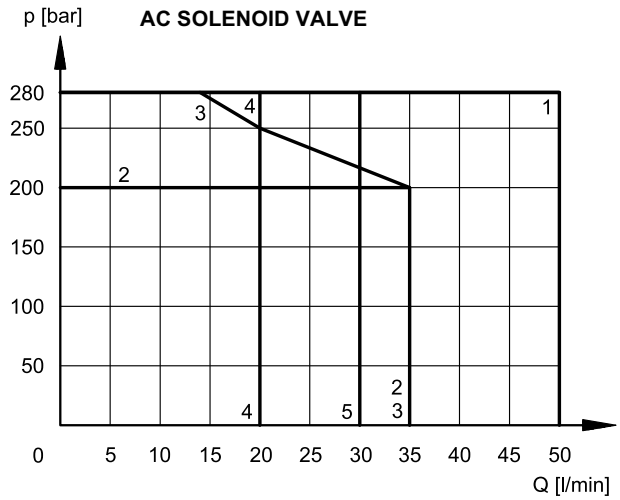
The curves define the flow rate operating fields according to the valve pressure of the different versions. The values indicated in the graphs are relevant to the standard solenoid valve.

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 according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage. The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.



SPOOL	CURVE
S1, TA	1
S2	2
S3	3
S4	4
RK	5



SPOOL	CURVE
S1, TA	1
S2	2
S3	3
S4	4
RK	5

6 - SWITCHING TIMES

The values indicated are obtained with spool S1, according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

SUPPLY	TIMES (±10%) [ms]	
	ENERGIZING	DE-ENERGIZING
DC	25 ÷ 75	15 ÷ 25
AC	10 ÷ 25	15 ÷ 30

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 +/- 90°, to suit the available space.

The interchangeability of coils of different voltages is allowed within the same type of supply current, alternating or direct.

Protection from atmospheric agents IEC 60529

The IP protection degree is intended for the whole valve. It is guaranteed only with both valve and connectors of an equivalent IP grade, correctly connected and installed.

Electric connection	IP65	IP66	IP67	IP68	IP69 IP69K (*)
K1 EN 175301-803	x	x			
K2 AMP JUNIOR	x		x		
K4 outgoing cables	x				
WK7 DEUTSCH DT04 male	x		x	x	x
WK8 AMP SUPER SEAL	x	x	x	x	x

(*) The protection degree IP69K is not taken into account in IEC 60529 but it is included in both ISO 20653.

SUPPLY VOLTAGE FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY	10.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	In compliance with 2014/30/EU
LOW VOLTAGE	In compliance with 2014/35/EU
CLASS OF PROTECTION Coil insulation (VDE 0580) Impregnation	 class H class H

NOTE: In order to further reduce the emissions, with DC supply, 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 - DC valve - Current and power consumption

In direct current energizing, current consumption stays at fairly constant values, essentially determined by Ohm's law: V = R x I

"R" coils have to be used when the valve is fed with AC power supply subsequently rectified by means of rectifier bridge, externally or incorporated in the "D" type connector (see cat. 49 000).

The table shows current and power consumption values for DC and RC coil types.

Coils for direct current (values ±5%)

	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumption [A]	Power consumption [W]	[VA]	Coil code K1	K2	K4	WK7	WK8
D12	12	5,4	2,2	26,5		1902740	1902750	1902770	1903510	1903520
D24	24	20,7	1,16	27,8		1902741	1902751	1902771	1903511	1903521
D28	28	27,5	1,02	28,5		1902744				
D48	48	82	0,58	28		1902745				
R110	110	363	0,25		27,2	1902742				
R230	230	1640	0,11		26,4	1902743				

7.3 - AC valve - Current and power consumption

In alternating current energizing, an initial phase (maximum movement) is seen, during which the solenoid consumes elevated value currents (inrush current); the current values diminish during the plunger stroke until it reaches the minimum values (holding current) when the plunger reaches the stroke end. The table shows the values of absorption at the inrush and at holding.

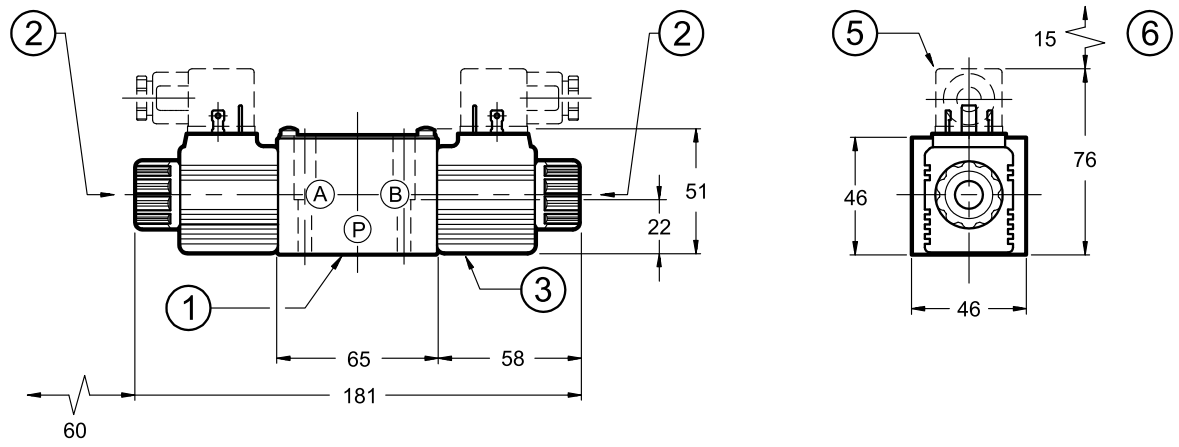
Coils for alternating current (values ±10%)

	Nominal voltage [V]	Freq. [Hz]	Resistance at 20°C [Ω]	Current consumption at inrush [A]	Current consumption at holding [A]	Power consumption at inrush [VA]	Power consumption at holding [VA]	Coil code K1
A24	24	50	2,7	4,5	1,47	109,2	35,3	1903190
A110	110		73,4	1,0	0,31	107,8	34,1	1903192
A230	230		320	0,5	0,16	112,7	36,8	1903193

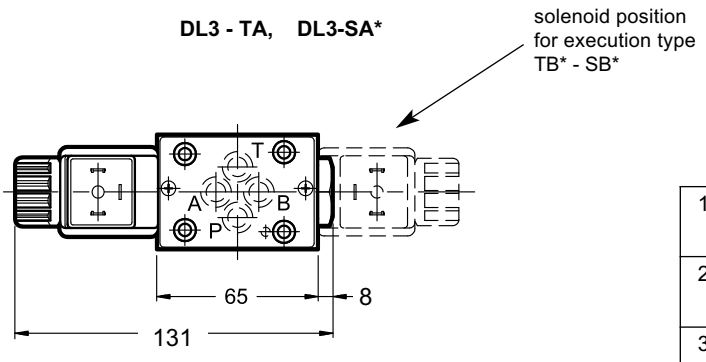
8 - DL3 DC OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

DL3 - S*



DL3 - TA, DL3-SA*

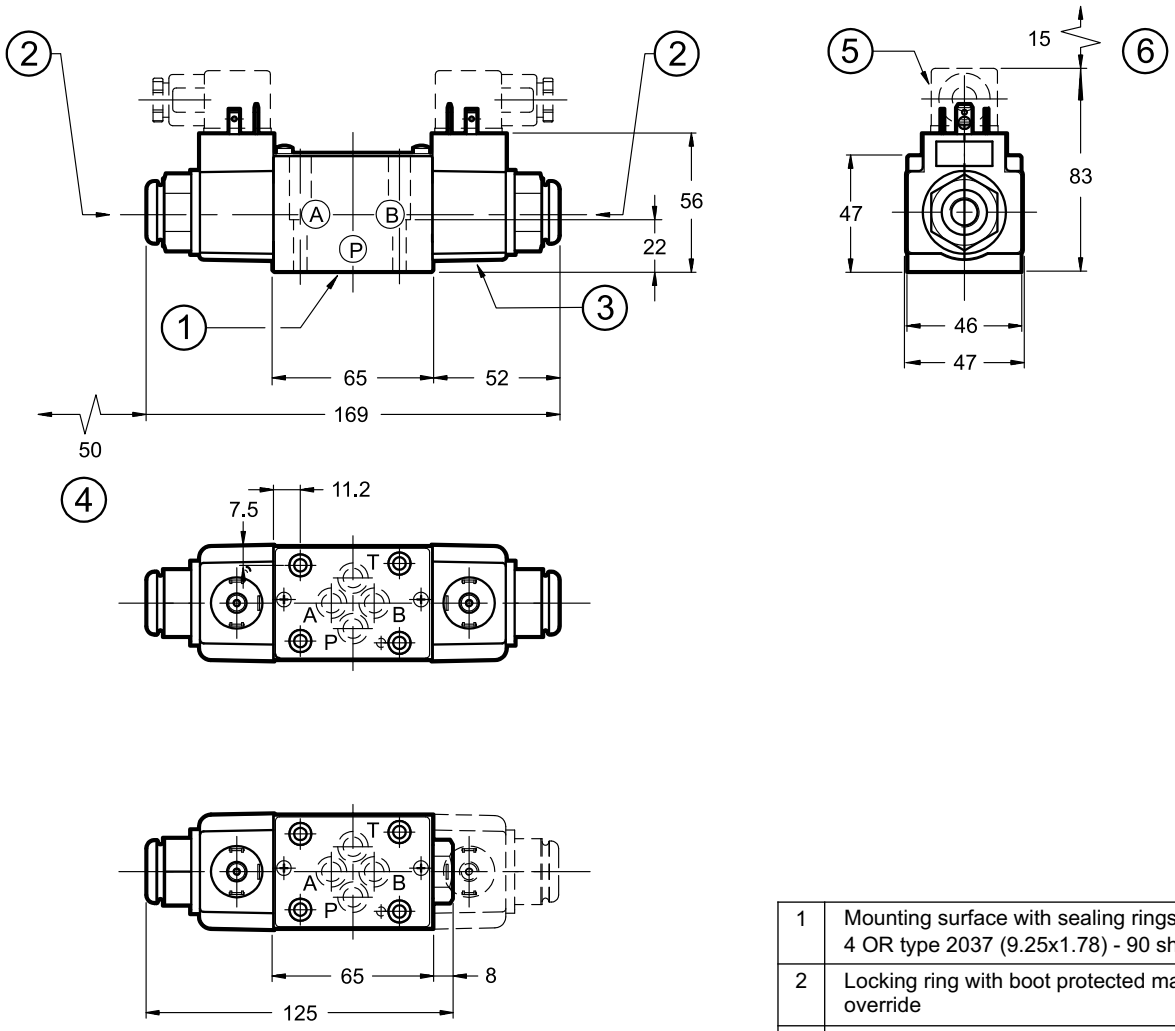


1	Mounting surface with sealing rings: 4 OR type 2037 (9.25x1.78) - 90 shore
2	Locking ring with boot protected manual override
3	Coil (90° revolving)
4	Coil removal space
5	EN 175301-803 (ex DIN 43650) electrical connector (representation with K1 standard connection - see paragraph 11 for other connection types)
6	Connector removal space

Valve fastening: 4 SHC screws ISO 4762 M5x30
Tightening torque: 5 Nm (A8.8)
Threads of mounting holes: M5x10

9 - DL3 AC OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



Valve fastening: 4 SHC screws ISO 4762 M5x30
Tightening torque: 5 Nm (A8.8)
Threads of mounting holes: M5x10

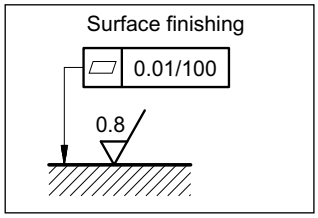
1	Mounting surface with sealing rings: 4 OR type 2037 (9.25x1.78) - 90 shore
2	Locking ring with boot protected manual override
3	Coil
4	Coil removal space
5	EN 175301-803 (ex DIN 43650) electrical connector
6	Connector removal space

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.

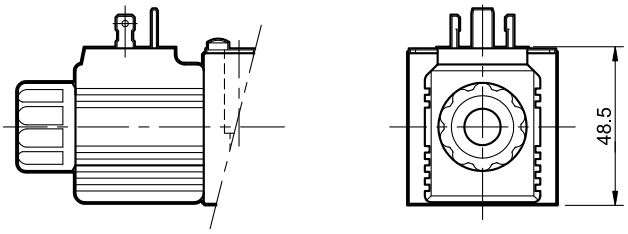
Valve fitting takes place by means of screws or tie rods, fixing the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

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

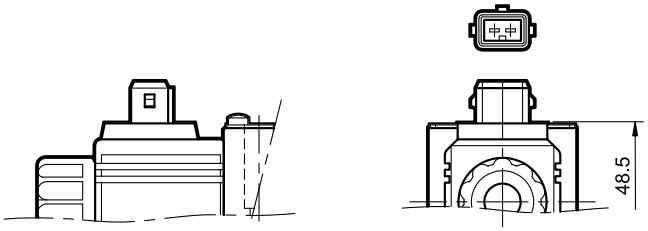


11 - ELECTRIC CONNECTIONS

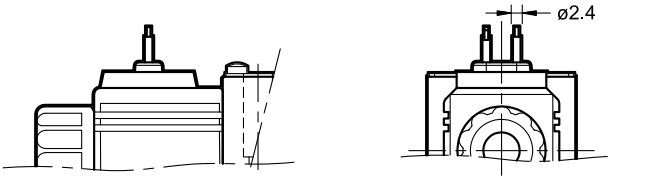
connection for EN 175301-803
(ex DIN 43650) connector
code **K1** (**standard**)



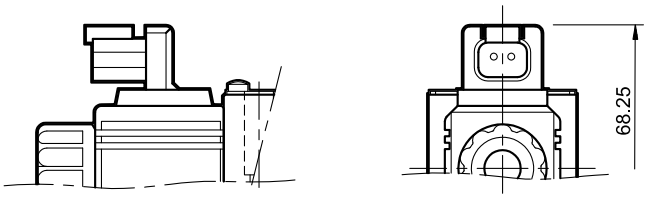
connection for AMP JUNIOR
connector type
code **K2**



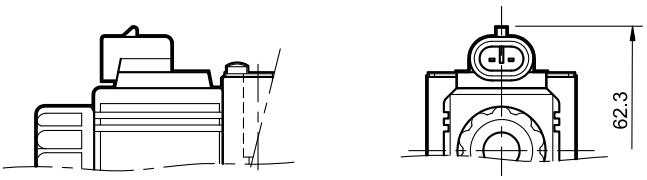
outgoing cable connections
cable length = 1 mt
code **K4**



connection for DEUTSCH DT04-2P
for male connector type DEUTSCH DT06
code **WK7**



connection for AMP SUPER SEAL
(two contacts) connector type
code **WK8**



12 - ELECTRIC CONNECTORS

Solenoid operated valves are delivered without connectors. Connectors type EN 175301-803 (ex DIN 43650) for K1 connections can be ordered separately. See catalogue 49 000. We do not delivery connectors for connections K2, WK7 and WK8.

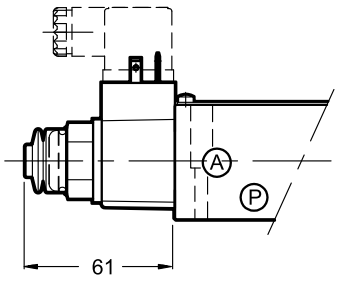
13 - OPTIONAL MANUAL OVERRIDES

13.1 - Boot protected manual override

On the DC version the boot override is integrated in the coil locking ring, as standard.

On the AC version, however, the boot override can be ordered by entering the code **CM** in the identification code at par. 1, or is available as option to be ordered separately.

code **3401210001**.



code **3401210001**

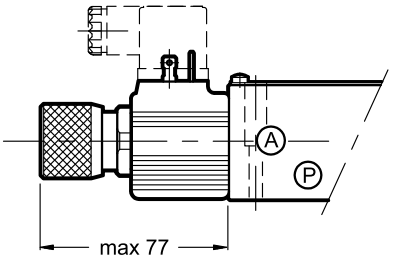
13.2 - Knob manual override

Available only for DC version

Max stroke: 4.5 mm
mm per turn: 1

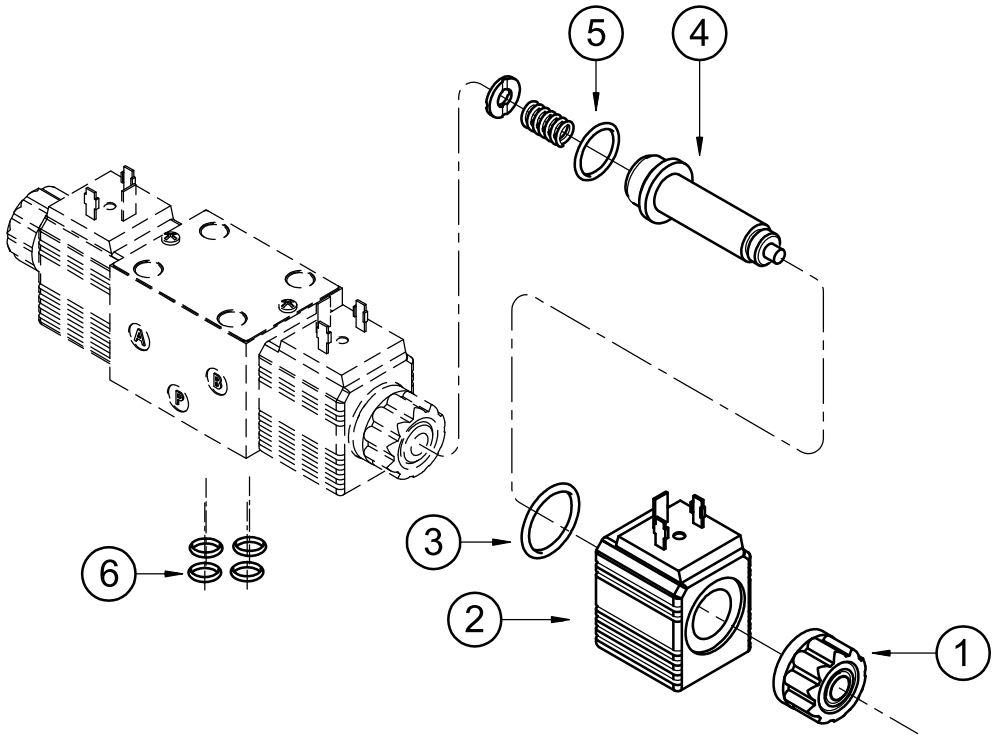
The knob override can be ordered by entering the code **CK1** in the identification code at par. 1, or is available as option to be ordered separately.

code **3404100040.**



code **3404100040**

14 - SPARE PARTS FOR DC SOLENOID VALVE



IDENTIFICATION CODE FOR DC AND RC COILS

C	14	L3	-			/	10

Supply voltage

D12 = 12 V
D24 = 24 V
D28 = 28 V
D48 = 48 V
} direct current

R110 = 110 V
R230 = 230 V
} rectified current

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

Coil electrical connection:
K1 = plug for connector type EN 175301-803 (ex DIN 43650)

D12 and **D24** coils only:

K2 = plug for connector type AMP JUNIOR

K4 = outgoing cables

WK7 =plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S

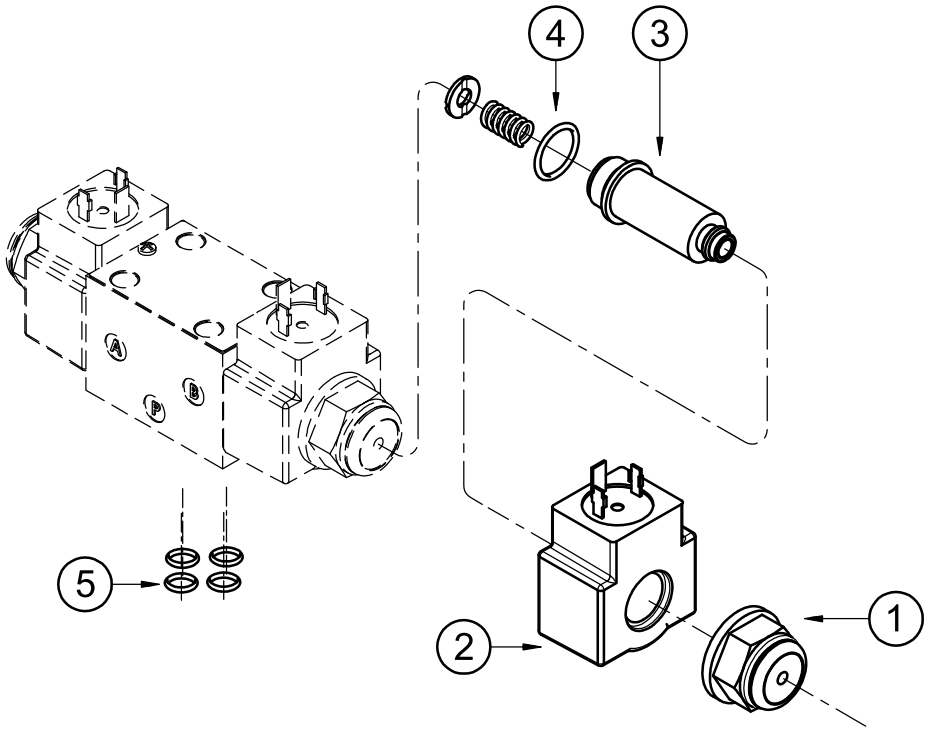
WK8 = plug for connector type AMP SUPER SEAL

1	Coil locking ring - code 0119382 tightening torque: 3 ÷ 3.4 Nm
2	Coil (see identification code)
3	OR type 2112 (28.3x1.78)
4	Solenoid tube: TD14-M18/11N (NBR seals) TD14-M18/11V (FPM seals) (OR n° 5 included)
5	OR type 2062 (15.6x1.78) - 70 Shore
6	N. 4 OR type 2037 (9.25x1.78) - 90 Shore

SEAL KIT

The codes included the OR n° 5 and 6.
Cod. 1984435 NBR seals
Cod. 1984436 FPM seals

15 - SPARE PARTS FOR AC SOLENOID VALVE



IDENTIFICATION CODE FOR AC COILS

C	18	L3	-		K1	/	11

Supply voltage
A24 = 24 V - 50 Hz
A110 = 110 V - 50 Hz
A230 = 230 V - 50 Hz

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

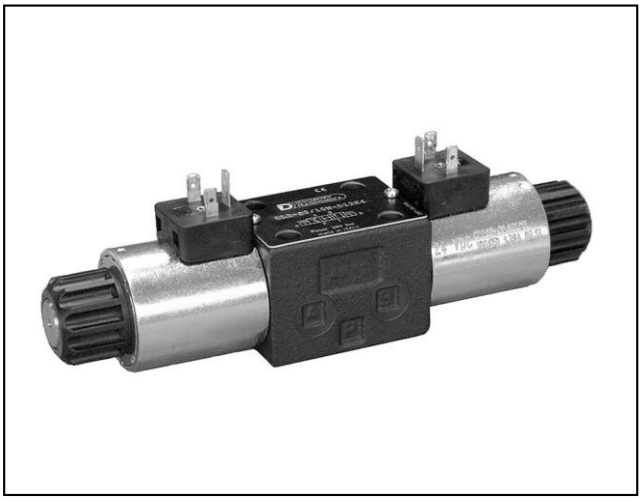
Coil electrical connection:
plug for connector type
EN 175301-803 (ex DIN 43650)

1	Coil locking ring - code. 0119469 tightening torque: 3 ÷ 3.4 Nm
2	Coil (see identification code)
3	Solenoid tube: TA18-M18/11N (NBR seals) TA18-M18/11V (FPM seals) **NOTE**: OR n° 4 included.
4	OR type 2062 (15.6x1.78) - 70 Shore
5	N. 4 OR type 2037 (9.25x1.78) - 90 Shore

SEAL KIT
The codes included the OR n° 4 and 5.
Cod. 1984435 NBR seals
Cod. 1984436 FPM seals

16 - SUBPLATES
(see catalogue 51 000)

Type PMMD-AI3G with rear ports
Type PMMD-AL3G with side ports
P, T, A, B port threading: 3/8” BSP



DL3B

8 WATT SOLENOID OPERATED DIRECTIONAL CONTROL VALVE

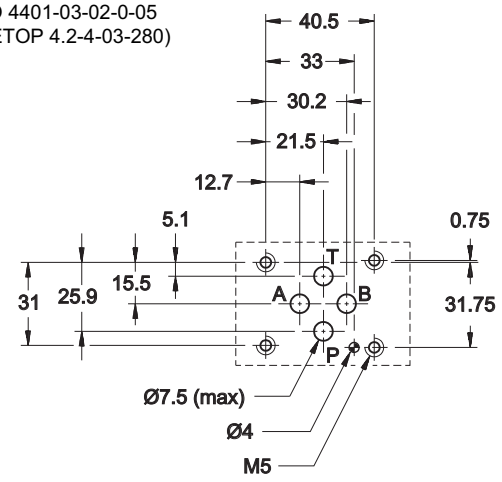
SERIES 10

SUBPLATE MOUNTING ISO 4401-03

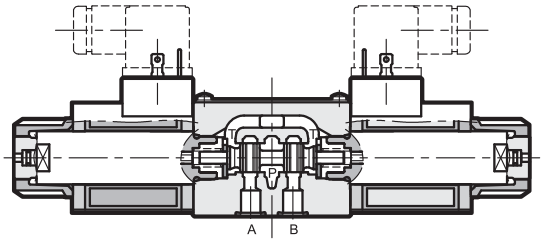
p max **280** bar
Q max **60** l/min

MOUNTING SURFACE

ISO 4401-03-02-0-05
(CETOP 4.2-4-03-280)



OPERATING PRINCIPLE



— 8 watt direct acting, subplate mounting directional control valve, with mounting surface according to ISO 4401-03 standards.

— Compact design with reduced solenoid dimensions, suitable for mini-power packs and mobile and agricultural applications.

— 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 (for further information on solenoids see par. 7).

— The valve is supplied with 4 way designs and with several interchangeable spools with different porting arrangements.

— It is available also with zinc-nickel surface treatment, that ensures a salt spray resistance up to 240 hours.

— The valve is available with DC current solenoids with 24 V power supply.

PERFORMANCES

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

Maximum operating pressure: - ports P - A - B - port T	bar	 280 210
Maximum flow rate	l/min	50
Pressure drop Δp-Q	see paragraph 4	
Operating limits	see paragraph 5	
Electrical features	see paragraph 7	
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 double solenoid valve	kg	1,5 2

1 - IDENTIFICATION CODE

D	L	3	B	-		/	10		-	DL24	K1	

Solenoid operated directional control valve

Compact version

ISO 4401-03 size

Spool type (see paragraph 3):

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

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

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

Coil electrical connection:
plug for connector type EN 175301-803 (ex DIN 43650) (**standard**)

DC power supply 24 V

NOTE: Standard surface treatment is phosphating black.

On request we can supply these valves with zinc-nickel finishing, suitable to ensure a salt spray resistance up to 240 h (test operated according to UNI EN ISO 9227 standard and test evaluation operated according to UNI EN ISO 10289 standard)

Add **/W7** at the end of the code.

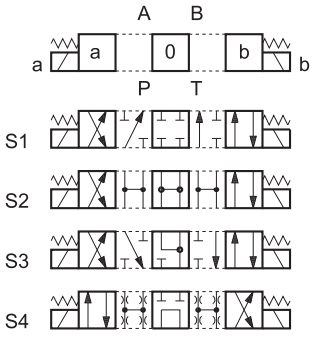
2 - HYDRAULIC FLUIDS

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.

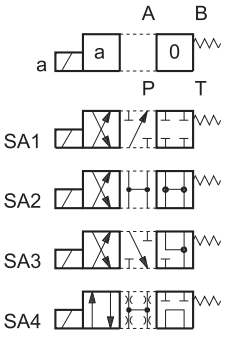
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

3 - SPOOL TYPE

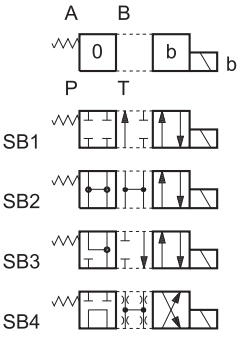
Type **S***:
2 solenoids - 3 positions
with spring centering



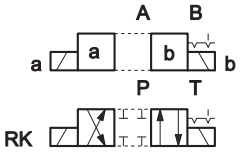
Type **SA***:
1 solenoid side A
2 positions (central + external)
with spring centering



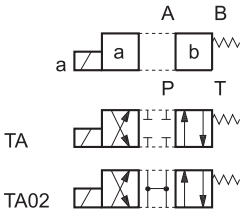
Type **SB***:
1 solenoid side B
2 positions (central + external)
with spring centering



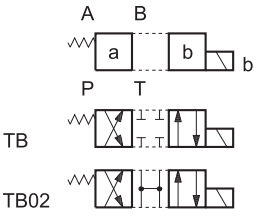
Type **RK**:
2 solenoids - 2 positions
with mechanical retention



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



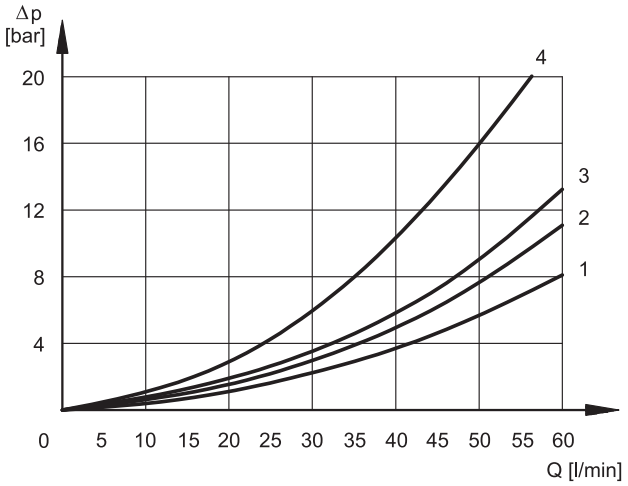
Type **TB**:
1 solenoid side B
2 external positions
with return spring



NOTE: Others spools available on request only.

4 - PRESSURE DROPS ΔP-Q

(obtained with viscosity of 36 cSt at 50 °C)



ENERGIZED VALVE

SPOOL	FLOW DIRECTIONS			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1	2	3	3	2
S2	1	1	1	1
S3	3	3	1	1
S4	4	4	4	4
RK	3	3	3	3
TA, TB	3	3	3	3
TA02, TB02	1	1	1	1

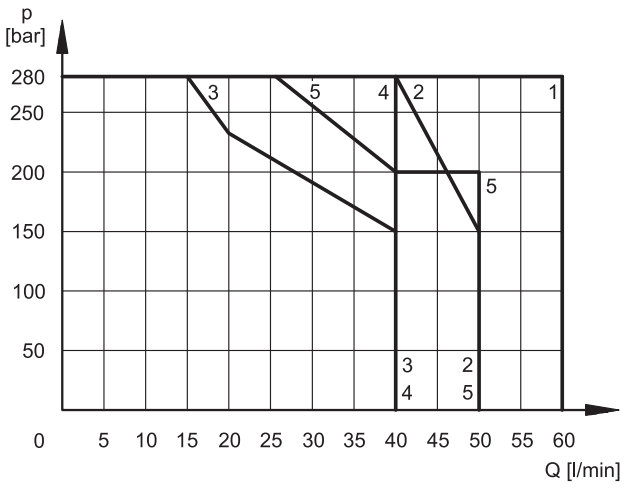
For the pressure drop with a de-energized valve P→T of the spools S2 and S4 refer to the curve 3; for the spool S4 refer to the curve 4.

5 - 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 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage. The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.

The limits for TA02 and TA spools refer to the 4-way operation. The operating limits of a 4-way valve in 3-way operation or with port A or B plugged or without flow are shown in the chart on the next page.



SPOOL	CURVE
S1	1
S2	1
S3	3
S4	4
TA, TB	5
TA02, TB02	2
RK	4

6 - SWITCHING TIMES

The values indicated are obtained with spool S1, according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

TIMES (±10%) [ms]	
ENERGIZING	DE-ENERGIZING
25 ÷ 75	15 ÷ 25

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 360°, to suit the available space.

SUPPLY VOLTAGE FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY	7.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	In compliance with 2014/30/EU
LOW VOLTAGE	In compliance with 2014/35/EU
CLASS OF PROTECTION : Atmospheric agents IEC 60529 Coil insulation (VDE 0580) Impregnation	 IP 65 (**NOTE**) class H class F

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

7.2 - Current and absorbed power for solenoid valve

The table shows current and power consumption values relevant to the 24 VDC coil.

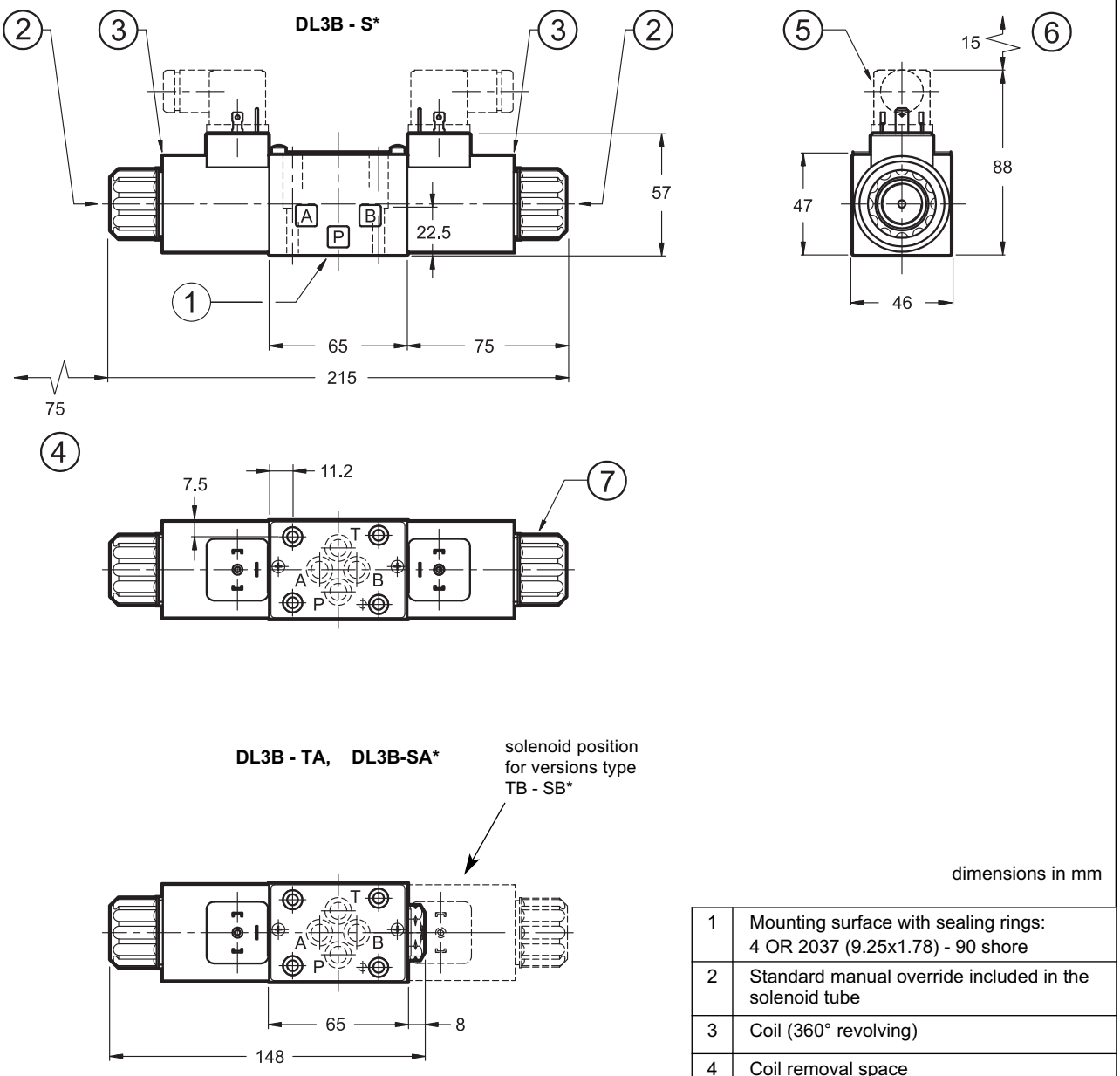
Coil for direct current (values ±10%)

	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt [W]	Coil code
DL24	24	64.6	0.37	8.92	1903291

8 - ELECTRIC CONNECTORS

Solenoid operated are delivered without connectors. Connectors must be ordered separately. See catalogue 49 000.

9 - DL3B OVERALL AND MOUNTING DIMENSIONS



dimensions in mm

Valve fastening: 4 SHC screws ISO 4762 M5x30	
Tightening torque: 5 Nm (A8.8)	
Threads of mounting holes: M5x10	

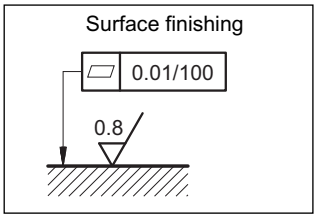
1	Mounting surface with sealing rings: 4 OR 2037 (9.25x1.78) - 90 shore
2	Standard manual override included in the solenoid tube
3	Coil (360° revolving)
4	Coil removal space
5	EN 175301-803 (ex DIN 43650) connector to be ordered separately (see cat. 49 000)
6	Connector removal space
7	Locking ring: tightening torque 5 ±0.5 Nm

10 - INSTALLATION

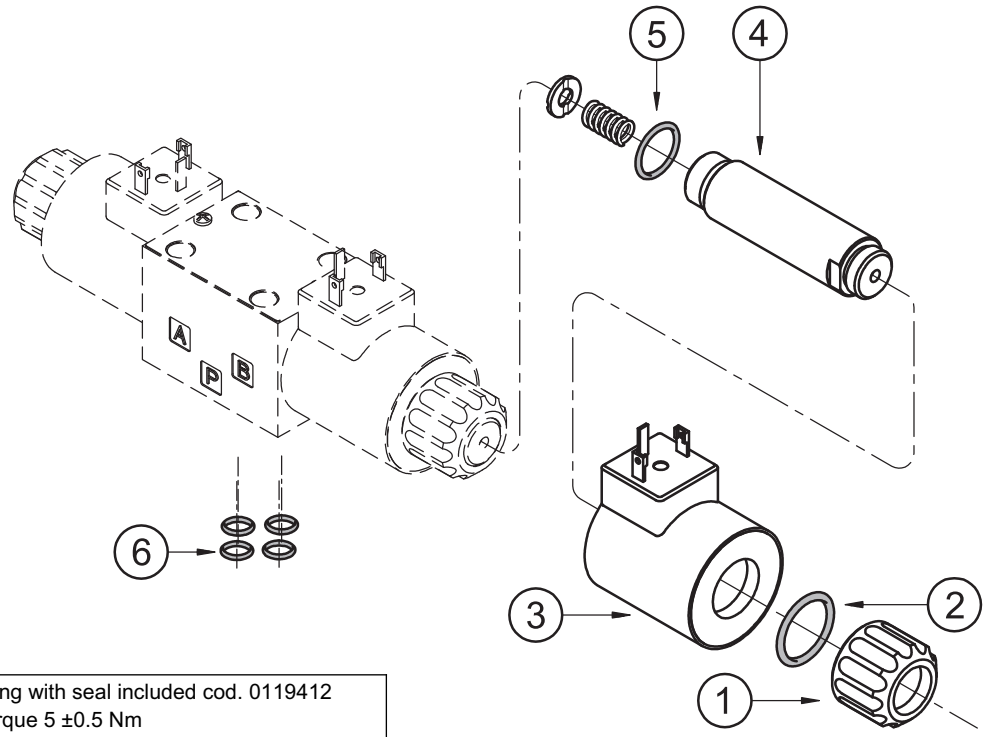
Configurations with centering and return springs can be mounted in any position; type RK valves - without springs and with mechanical detent - must be mounted with the longitudinal axis horizontal.

Valve fitting takes place by means of screws or tie rods, fixing 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.



11 - SPARE PARTS FOR SOLENOID VALVE



1	Coil locking ring with seal included cod. 0119412 Tightening torque 5 ±0.5 Nm
2	ORM type 0220-20 (22x2) - 70 Shore
3	Coil C22L3B-DL24K1/11
4	Solenoid tube for standard version: TD22-DL3B/10N (NBR seals) TD22-DL3B/10V (FPM seals) **NOTE:** OR n°5 included
5	OR type 2062 (15.6x1.78) - 70 Shore
6	N. 4 OR type 2037 (9.25x1.78) - 90 Shore

SEALS KIT

The codes include the O-Ring n° 2, 5 and 6.

Cod. 1985406 NBR seals
Cod. 1985410 FPM (viton) seals

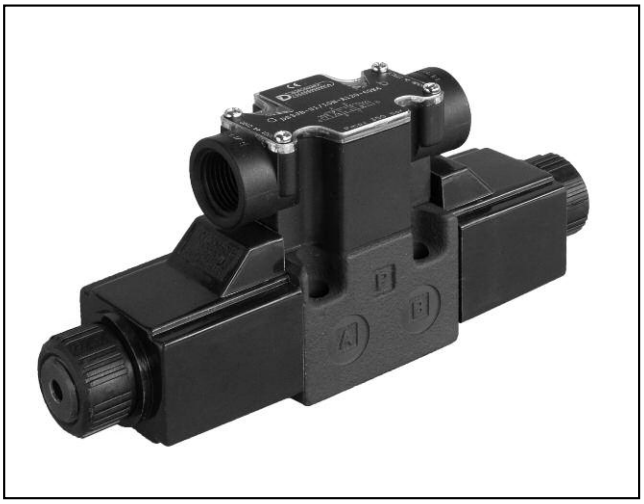
12 - SUBPLATES

(see catalogue 51 000)

Type PMMD-AI3G with rear ports 3/8” BSP
Type PMMD-AL3G with side ports 3/8” BSP

DUPLOMATIC MOTION SOLUTIONS

DUPLOMATIC MS S.p.A.
via M. Re Depaolini 24 ▪ 20015 PARABIAGO (MI) ▪ ITALY
tel. +39 0331.895.111 ▪ www.duplomatic.com ▪ e-mail: sales.exp@duplomatic.com



DS3JB

SOLENOID OPERATED DIRECTIONAL CONTROL VALVE

AC
SERIES 10

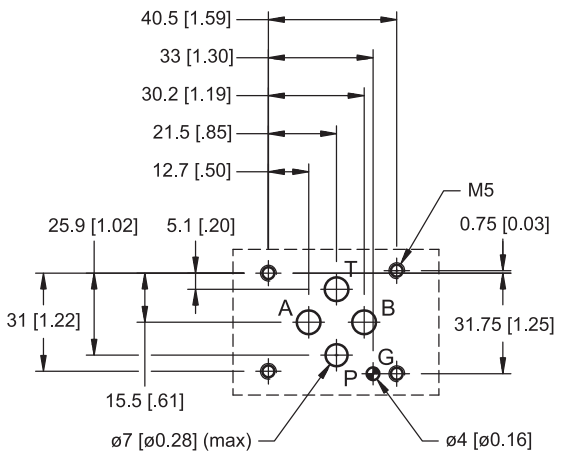
SUBPLATE MOUNTING
NFPA D03 (ISO 4401-03)

p max **5000** psi (350 bar)
Q max **20** GPM (76 l/min)

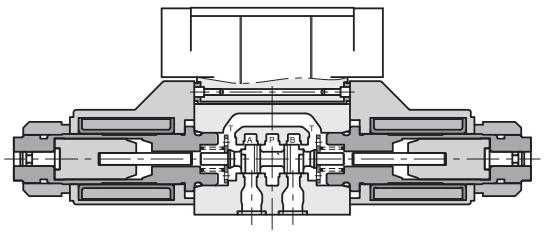
MOUNTING SURFACE

ISO 4401-03-02-0-05
NFPA D03

dimensions in mm [inch]



OPERATING PRINCIPLE



— Direct acting, subplate mounting directional control valve, with mounting surface according to NFPA D03 standards.

— The valve is supplied with 3 or 4 ports designs, with 2 or 3 positions with a wide range of spools.

— 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 (for further information on solenoids see par. 7).

— The valve is equipped with junction box to be wired.

— The valve is available with AC solenoids.

— A boot protected manual override is available for applications in tropical climate.

PERFORMANCES

(obtained with mineral oil with viscosity of 170 SUS at 50°C)

Maximum operating pressure: - P - A - B ports - T port	psi	 5000 2300
Maximum flowrate	GPM	20
Electrical connection	junction box	
Ambient temperature range	°F	-4 / +122
Fluid temperature range	°F	-24 / +176
Fluid viscosity range	SUS	60 ÷ 1900
Fluid contamination degree	according to ISO 4406:1999 class 20/18/15	
Recommended viscosity	SUS	120
Mass: single solenoid valve dual solenoid valve	lbs	3.15 4.15

1 - IDENTIFICATION CODE

D	S	3	JB	-		/	10		-		K6	/	

Solenoid operated directional control valve

NFPA D03 (ISO 4401-03) size

Junction box

Spool type (see paragraph 2)

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

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

AC coil type
A120-60 = 110/120 V - 60 Hz
A240-60 = 220/240 V - 60 Hz

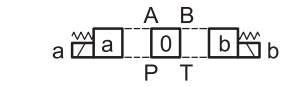
Coil electrical connection:
K6 = 2 pins for junction box

Manual override:
Omit for override integrated in the tube (**standard**)
CM = boot protected

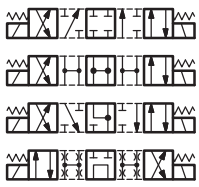
2 - SPOOL TYPE

Other spools are available on request.

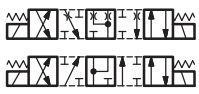
Type **S***:
2 solenoids - 3 positions
with spring centering



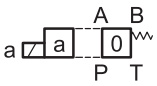
S1
S2
S3
S4



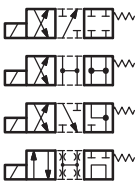
S9
S10



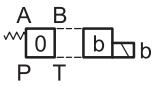
Type **SA***:
1 solenoid side A
2 positions (central + external)
with spring centering



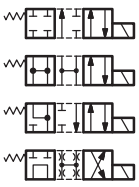
SA1
SA2
SA3
SA4



Type **SB***:
1 solenoid side B
2 positions (central + external)
with spring centering



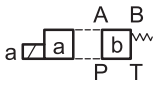
SB1
SB2
SB3
SB4



Type **RK**:
2 solenoids - 2 positions
with mechanical retention

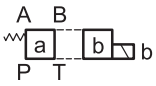
RK

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

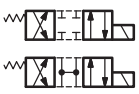


TA
TA02

Type **TB**:
1 solenoid side B
2 external positions
with return spring



TB
TB02



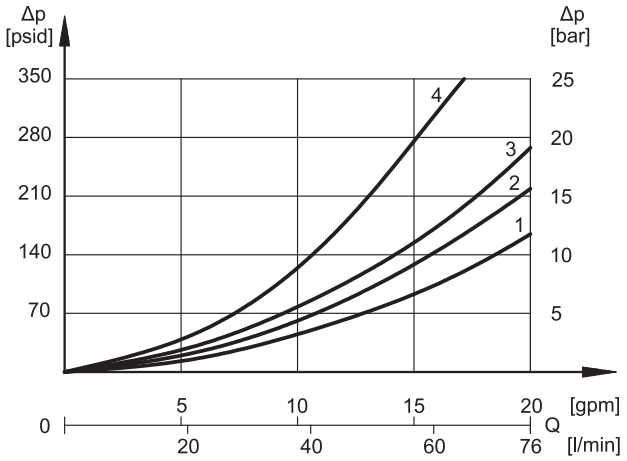
3 - HYDRAULIC FLUIDS

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 176 °F causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

4 - PRESSURE DROPS Δp-Q

(obtained with viscosity 170 SUS at 122 °F)



When spool S10 is used for regenerative circuits, pressure drops between A and B lines are described by curve 4 .

PRESSURE DROPS WITH VALVE IN ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1, SA1, SB1	2	2	3	3
S2, SA2, SB2	1	1	3	3
S3, SA3, SB3	3	3	1	1
S4, SA4, SB4	4	4	4	4
S9	2	2	3	3
S10	1	3	1	3
TA, TB	3	3	3	3
TA02, TB02	2	2	2	2
RK	2	2	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					2
S3, SA3, SB3			3	3	
S4, SA4, SB4					3
S10	3	3			

5 - SWITCHING TIMES

The values indicated are obtained according to ISO 6403 standard. They refer to an S1 solenoid valve for Q = 10 GPM, p = 2,000 psi working with mineral oil at a temperature of 122 °F, a viscosity of 170 SUS and with PA and BT connections.

The energizing times are obtained at the time the spool switches over. The de-energizing times are measured at the time pressure variation occurs on the line.

	ENERGIZING	DE-ENERGIZING
TIMES (±10%) [ms]	10 ÷ 25	15 ÷ 40

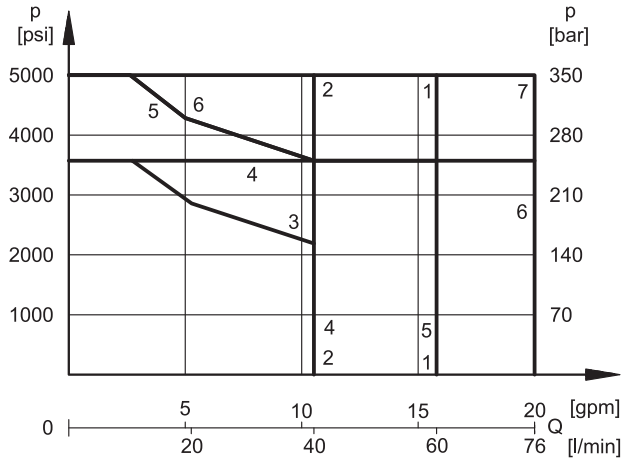
6 - OPERATING LIMITS

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

The values have been obtained according to ISO 6403 standard, with mineral oil, viscosity 170 SUS, temperature 122 °F and filtration according to ISO 4406:1999 class 18/16/13, with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage.

The limits for TA02 and TA spools refer to the 4-port operation. The operating limits can be considerably reduced if a 4-port valve is used as 3-port valve with port A or B plugged or without flow.

Valves fed at 110 V / 60 Hz may have slightly lower performance limits than those showed in the diagram.



SPOOL	CURVE	
	P→A	P→B
S1,SA1,SB1	1	1
S2, SA2, SB2	2	2
S3, SA3, SB3	3	3
S4, SA4, SB4	1	1
S9	4	4
S10	1	1
TA, TB	5	5
TA02, TB02	6	6
RK	7	7

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 nut.

The interchangeability of coils of different voltages is allowed.

SUPPLY VOLTAGE FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY	10.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	In compliance with 2014/30/EU
LOW VOLTAGE	In compliance with 2014/35/EU
CLASS OF PROTECTION : Class of protection IEC 60529 Coil insulation (VDE 0580) Impregnation:	 IP65 class H class H

7.2 Current and absorbed power

The table shows current and power consumption values at inrush and at holding. In alternating current energizing, an initial phase (maximum movement) is seen, during which the solenoid consumes elevated value currents (inrush current); the current values diminish during the plunger stroke until it reaches the minimum values (holding current) when the plunger reaches the stroke end.

Coils (values ± 10%)

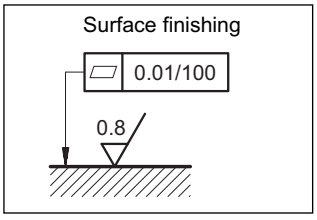
Suffix	Nominal Voltage [V]	Frequency [Hz]	Resistance at 20°C [Ohm]	Current consumption at inrush [A]	Current consumption at holding [A]	Power consumption at inrush [VA]	Power consumption at holding [VA]	Coil Code
C20.6-A120-60K6/10	110	60	27.5	1.8	0.36	198	39.6	1902820
	120			2	0.43	240	51.6	
C20.6-A240-60K6/10	220		110	0.86	0.17	189.2	37.4	1902821
	240			0.98	0.2	235.2	48	

8 - INSTALLATION

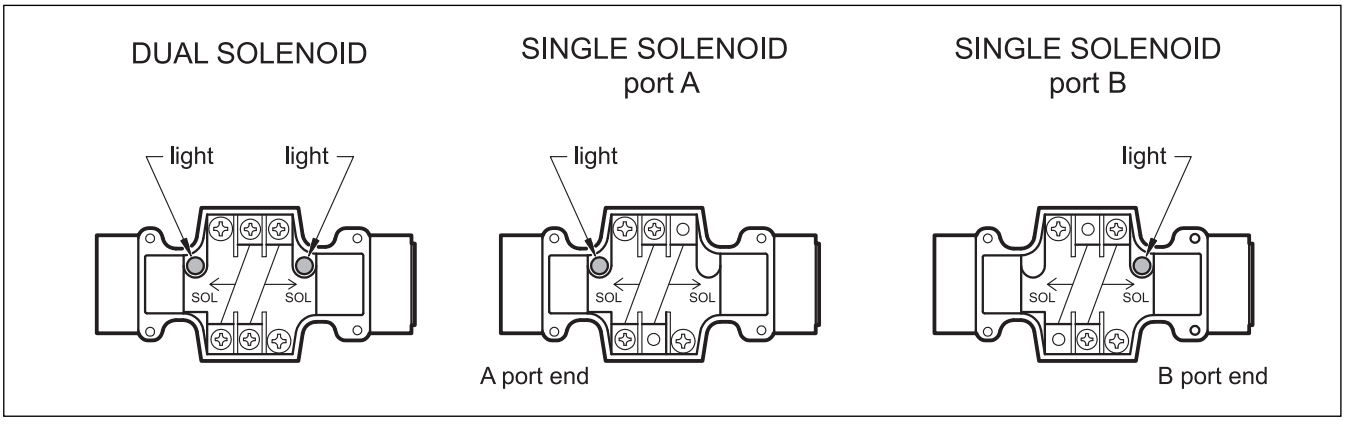
Configurations with centering and return springs can be mounted in any position; type RK valves - without springs and with mechanical detent - must be mounted with the longitudinal axis horizontal.

Valve fixing takes place 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 leakages between valve and mounting surface can easily occur.

For use in tropicat climate, we recommend the use of boot (CM option, see secton 11) to protect the manual override.



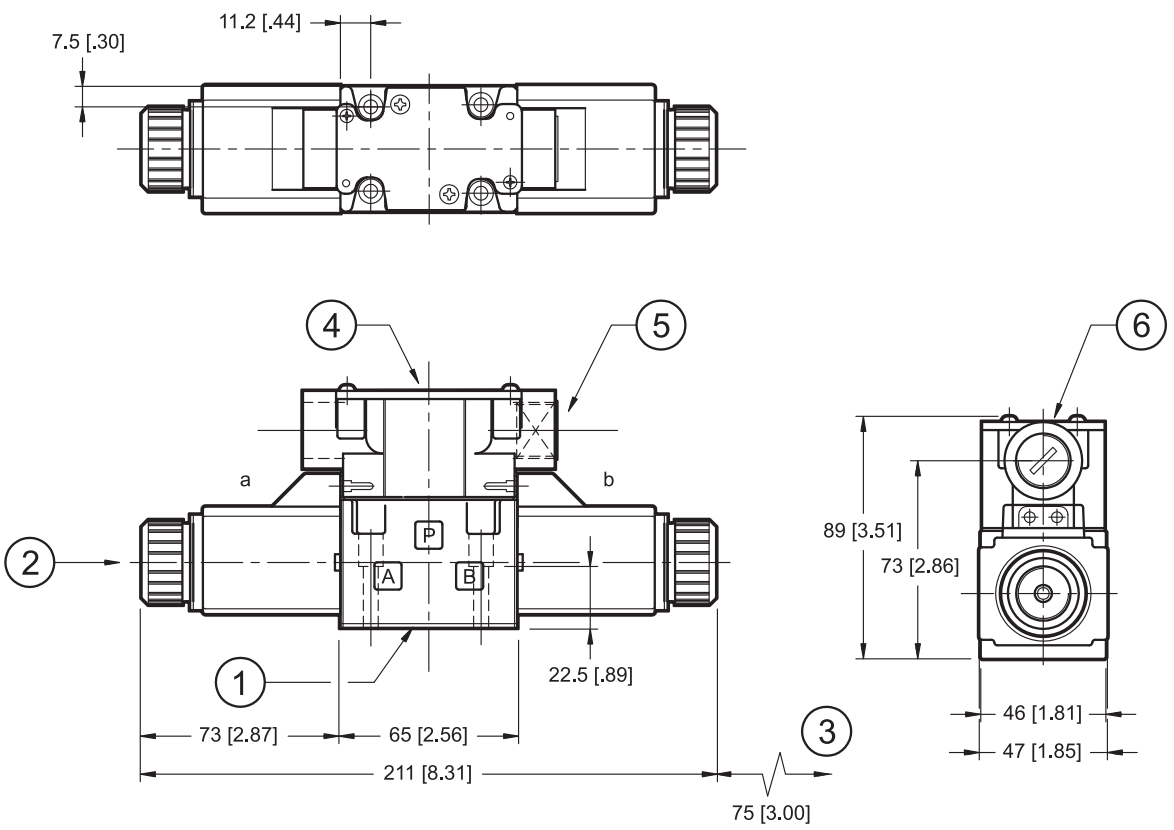
9 - JUNCTION BOX



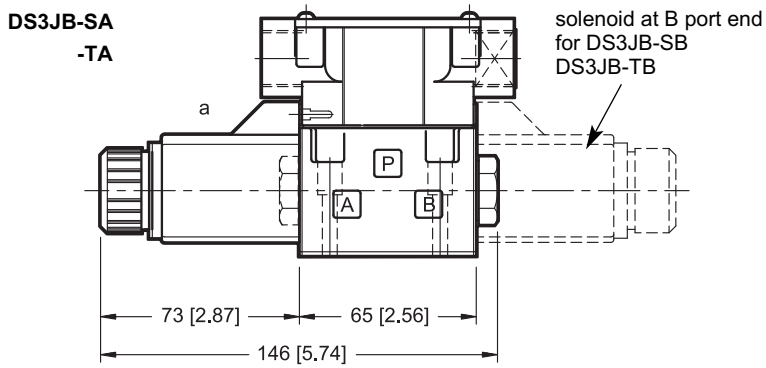
10 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm [inch]

DS3JB - S*
DS3JB - RK

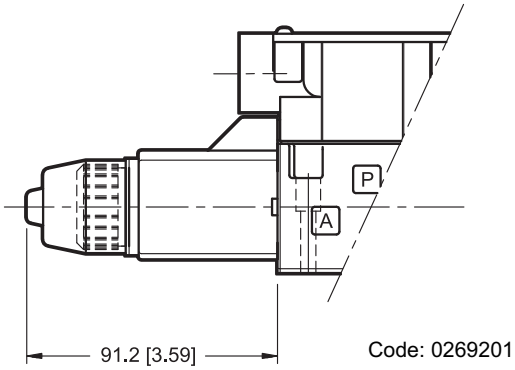


DS3JB-SA
-TA

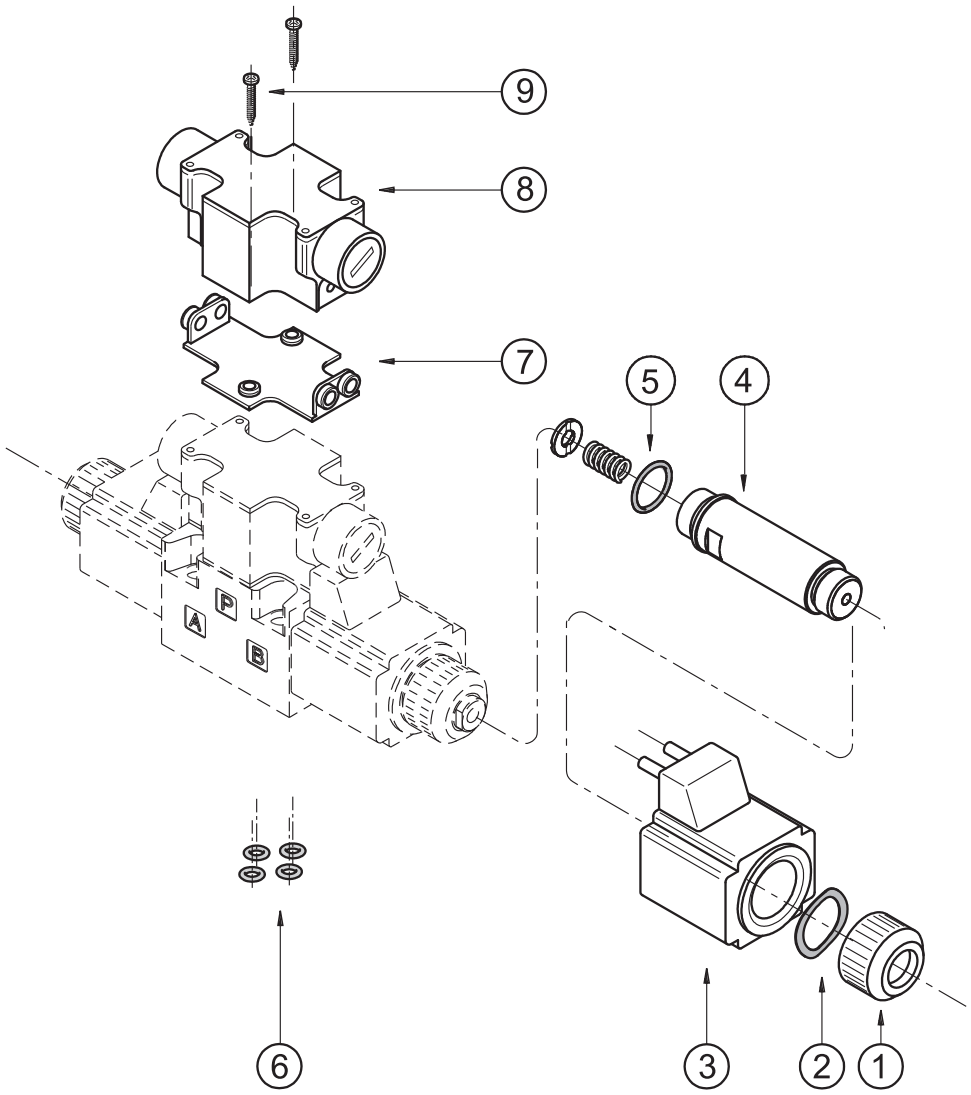


1	Mounting surface with sealing rings: 4 pcs. AS568-012 90 Shore A
2	Standard manual override included in the solenoid tube
3	Coil
4	Junction box
5	Port 1/2" NPT plugged
6	Port for cable gland 1/2" NPT
7	Locking ring tightening torque 4-5 lbf-ft

11 - CM MANUAL OVERRIDE



12 - SPARE PARTS



COILS IDENTIFICATION CODE

C	20.6	-		K6	/	10

Supply voltage
A120-60 = 110/120 V - 60 Hz
A240-60 = 220/240 V - 60 Hz

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

Coil electrical connection:
2 pins for junction box

SEALS KIT

The codes include the O-Ring nr. 5 and 6.

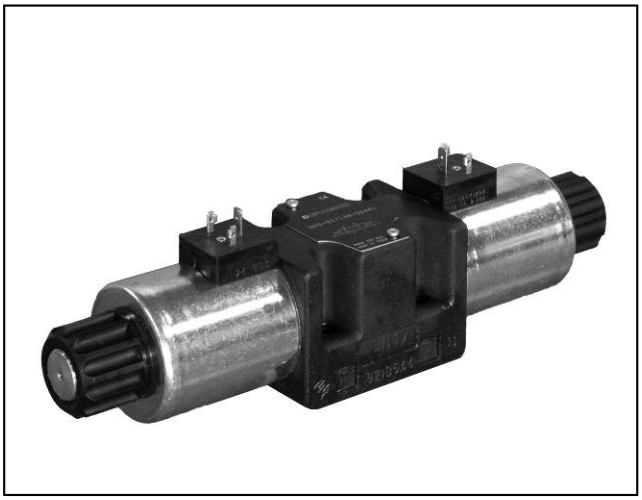
Cod. **1985406** NBR seals
Cod. **1985410** FPM (viton) seals

1	Coil locking ring cod. 0119333 Tightening torque 5 ±0.5 Nm
2	Spring washer code 0550483
3	Coil (see identification code at side)
4	Solenoid tube : TA20.6-DS3/10N (NBR seals) TA20.6-DS3/10V (FPM seals) **NOTE**: OR n° 5 included
5	AS568-016 70 Shore A
6	4 pcs. AS568-012 90 Shore A
7	Seal for junction box code 0119407
8	Junction box
9	2 pcs. Phillips screws M3x25

13 - FASTENING BOLTS

4 SHC M5x30 - ISO 4762 (or 10-24 UNC - 2Bx1.25)

Tightening torque 4-5 lbs.ft



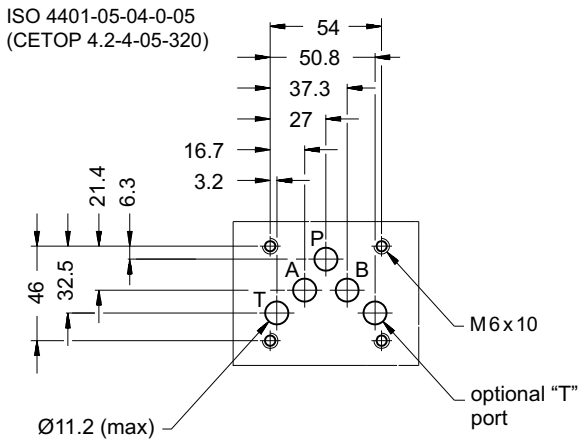
DS5

SOLENOID OPERATED DIRECTIONAL CONTROL VALVE

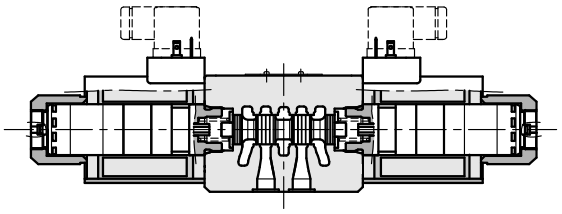
SUBPLATE MOUNTING ISO 4401-05

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.

— The valve is designed for 3 or 4 way and with several interchangeable spools, with different porting arrangements.

— 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 DS5 direct current version is available in the following special versions:

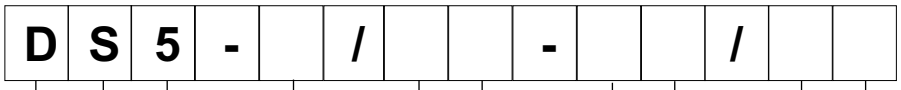
- with Y external subplate drain port, (see par. 13.1 and 13.2).
- with soft-shifting (see par. 13.3 and 13.4)
- with adjustable "soft-shift" device (see paragraph 13.5)

PERFORMANCES

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

		DC	AC
Maximum operating pressure P - A - B ports T port - standard version T port - version with Y port (ext.drain)	bar	320 210 320	 140 -
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 double solenoid valve	kg	4.5 6.1	3.6 4.3

1 - IDENTIFICATION CODE



Solenoid operated directional control valve

ISO 4401-05 size

Spool type (see par. 3)

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

Series:
(the overall and mounting dimensions remain unchanged from 10 to 19)
14 = for DC valves type D*K1 and D12K7
DC valves without coils D00
12 = for AC valves
DC valves D24K7

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

DC power supply
D12 = 12 V
D24 = 24 V
D26 = 26.4 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, S7 and S8 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

Coil electrical connection (see par. 11):
K1 = plug for connector type EN 175301-803 (ex DIN 43650) (**standard**)
Only for **D12** and **D24**:
K7 = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S

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)
CK2 = push and twist knob override (only for DC version)

Option: Surface treatment not standard.
Not available for AC valves.
Omit if not required.
(see **NOTE 2**)

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

NOTE 2:The standard surface treatment is phosphating black.

On request we can supply these valves with zinc-nickel finishing, making the valve suitable to ensure a salt spray resistance up to 240 hours (test operated according to UNI EN ISO 9227 standard and test evaluation operated according to UNI EN ISO 10289 standard)

Add **/W7** at the end of the identification code.

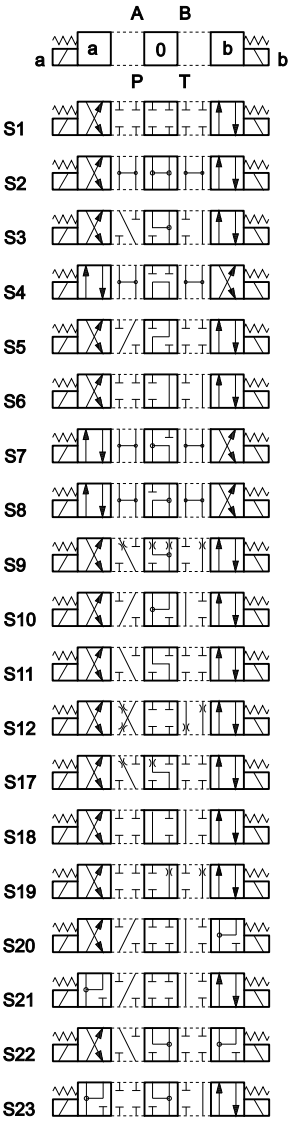
2 - HYDRAULIC FLUIDS

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.

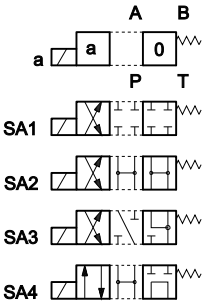
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

3 - SPOOL TYPE

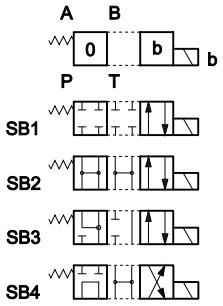
Type **S***:
2 solenoids - 3 positions
with spring centering



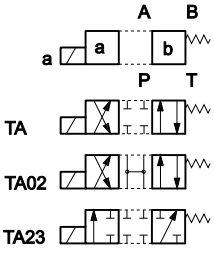
Type **SA***:
1 solenoid side A
2 positions (central + external)
with spring centering



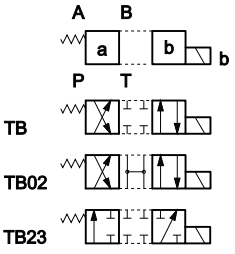
Type **SB***:
1 solenoid side B
2 positions (central + external)
with spring centering



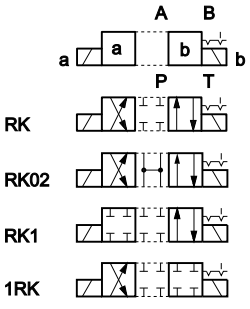
Type **TA**:
1 solenoid side A
2 external positions
with return spring



Type **TB**:
1 solenoid side B
2 external positions
with return spring



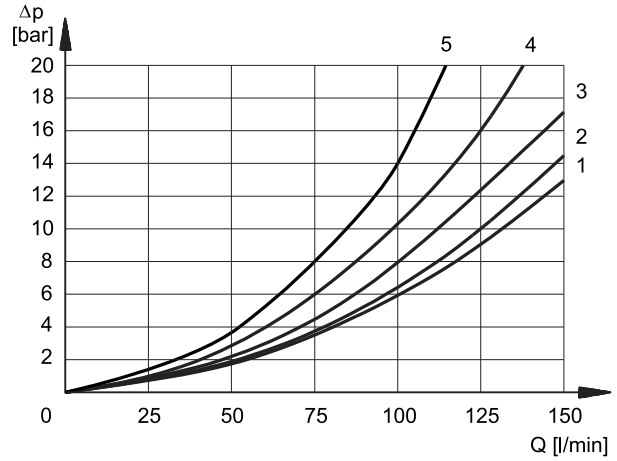
Type **RK**:
2 solenoids - 2 positions
with mechanical retention



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

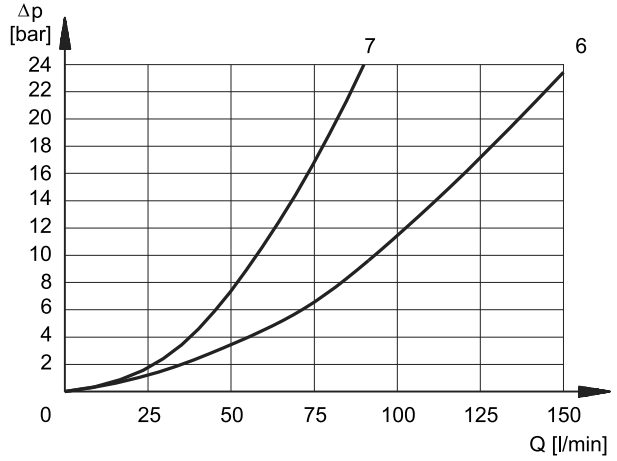
(obtained with viscosity 36 cSt at 50 °C)



ENERGIZED POSITION

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	3	3
S12	2	2	1	1
S17, S19	2	2	1	1
S18	1	2	1	1
S20, S22	2	4	4	-
S21, S23	4	2	-	4
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

For pressure drops between A and B lines of S10, S20, S21, S22 spools which are used in the regenerative diagram, refer to curve 5.



DE-ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION				
	P-A	P-B	A-T	B-T	P-T
	CURVES ON GRAPH				
S2, SA2, SB2					6
S3, SA3, SB3			7	7	
S4, SA4, SB4					6
S5		3			
S6				7	
S7					6
S8					6
S10	3	3			
S11			7		
S18	3				
S22			7	7	

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 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage.

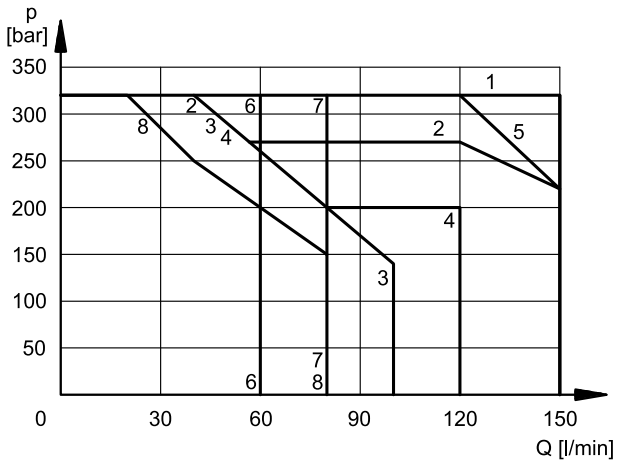
The values have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13 and are relevant to the standard solenoid valve.

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. 13.4.

Flow and pressure performances of adjustable soft-shifting device configurations (options S, par. 13.5) are influenced by the set shifting time.

DC SOLENOID VALVE

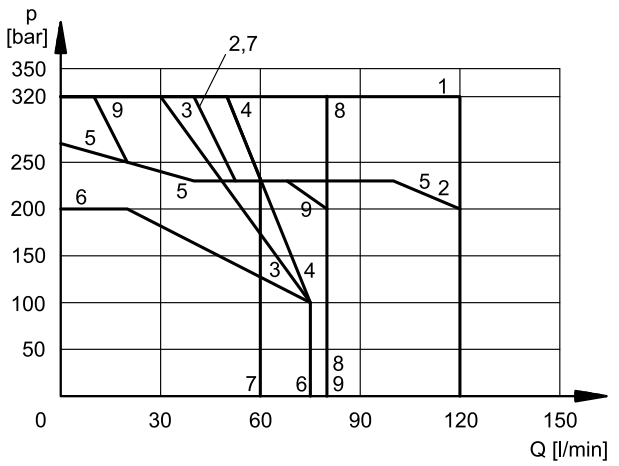


SPOOL	CURVE	
	P→A	P→B
S1, SA1, SB1	1	1
S2, SA2, SB2	1	1
S3, SA3, SB3	2	2
S4, SA4, SB4	3	3
S5	1	1
S6	2	1
S7	3	3
S8	3	3
S9	1	1
S10	3	3
S11	1	2
S12	1	1

SPOOL	CURVE	
	P→A	P→B
S17	1	4
S18	1	1
S19	4	1
S20	8*	7
S21	7	8*
S22	6*	6
S23	6	6*
TA, TB	5	5
TA02, TB02	4	4
TA23, TB23	1	1
RK	1	1
RK02	1	1
RK1, 1RK	1	1

* Performance obtained for a valve with A and B lines connected the one to the piston-side chamber and the other to the rod-side chamber of a double-acting cylinder with area ratio 2:1.

26AC SOLENOID VALVE



SPOOL	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	CURVE	
	P→A	P→B
S17	1	5
S18	1	1
S19	5	1
S20	9*	8
S21	8	9
S22	7	7
S23	7	7
TA, TB	1	1
TA02, TB02	5	5
TA23, TB23	1	1
RK	1	1
RK02	1	1
RK1, 1RK	1	1

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 IEC 60529

he IP protection degree is guaranteed only with both valve and connectors of an equivalent IP degree, correctly connected and installed.

connection type	electric connection protection	whole valve protection
K1 EN 175301-803	IP65	IP65
K7 DEUTSCH DT04 male	IP65/IP67/IP69 IP69K (*)	

(*) The IP69K protection degree is not taken into account in IEC 60529 but it is included in ISO 20653.

VOLTAGE SUPPLY FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY	15.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC) (**NOTE 1**)	In compliance with 2014/30/EU
LOW VOLTAGE	In compliance with 2014/35/EU
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 catalogue 49 000).

7.2 - Current and absorbed power for DC solenoid valve

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

Using connectors type "D" (see cat. 49 000) with embedded bridge rectifier it is possible to feed DC coils (starting from 110V voltage) with alternating current (50 or 60 Hz).

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	Coil code K7
D12	12	3	4	48	1903550	1903620
D24	24	12	2	48	1903551	1903221
D26	26.4	14.5	1.82	48	1903559	
D110	110	250	0.44	48	1903554	
D220	220	1010	0.22	48	1903555	

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.

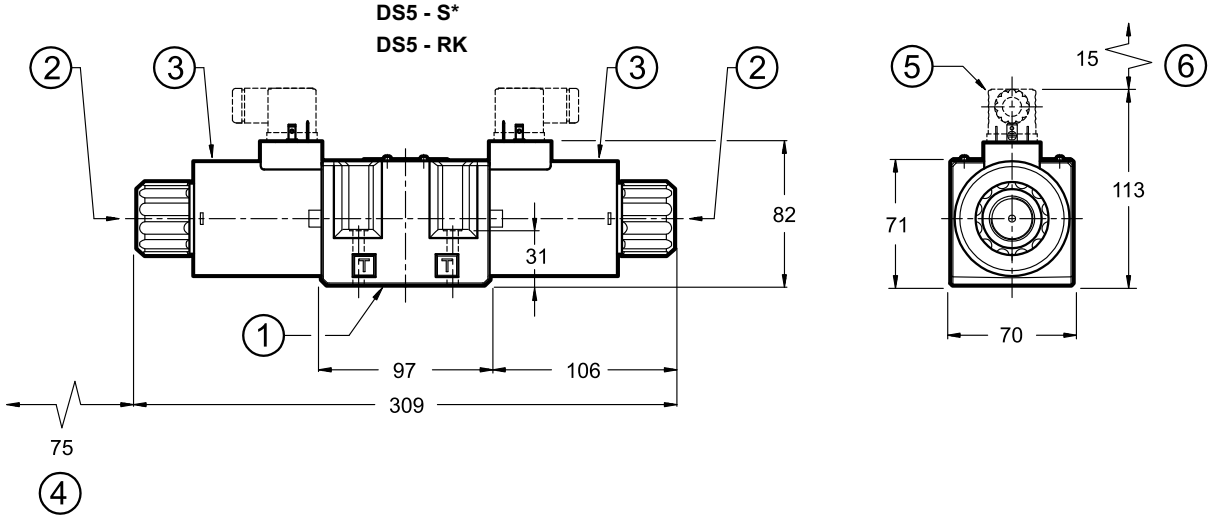
Coils for alternating current (values ± 5%)

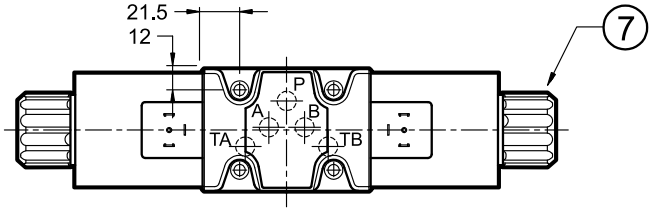
Suffix	Nominal voltage [V]	Frequency [Hz]	Resistance at 20°C [ohm]	Current consumption at inrush [A]	Current consumption at holding [A]	Power consumption at inrush [VA]	Power consumption at holding [VA]	Coil code
A24	24	50	0.53	25	3.96	600	95	1902890
A48	48		2.09	12.5	2.3	600	110	1902891
A110	110V-50Hz	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

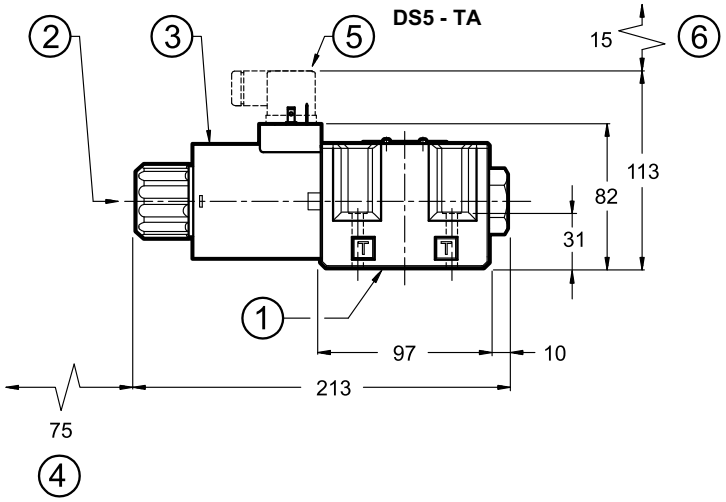
dimensions in mm

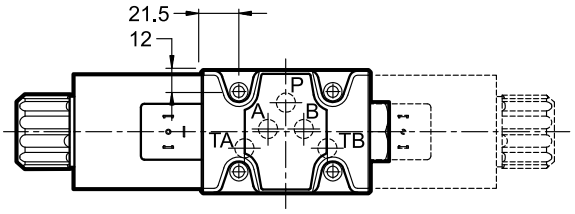
DS5 - S*
DS5 - RK





DS5 - SA*
DS5 - TA



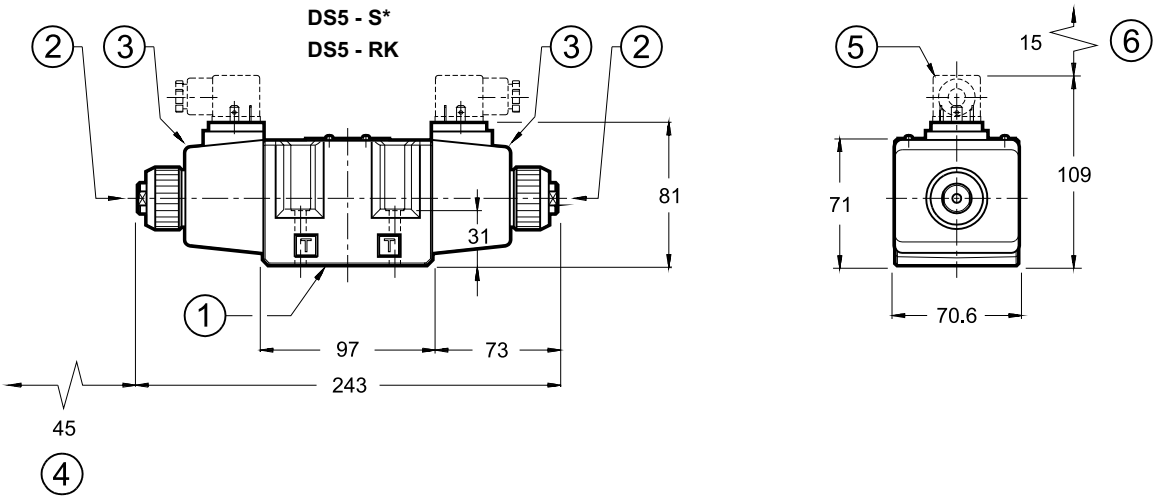


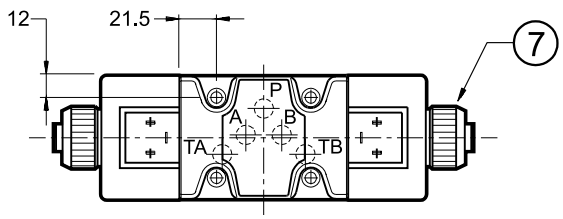
Valve fastening: 4 SHC screws ISO 4762 M6x40
Tightening torque: 8 Nm (screws A8.8)
Threads of mounting holes: M6x10

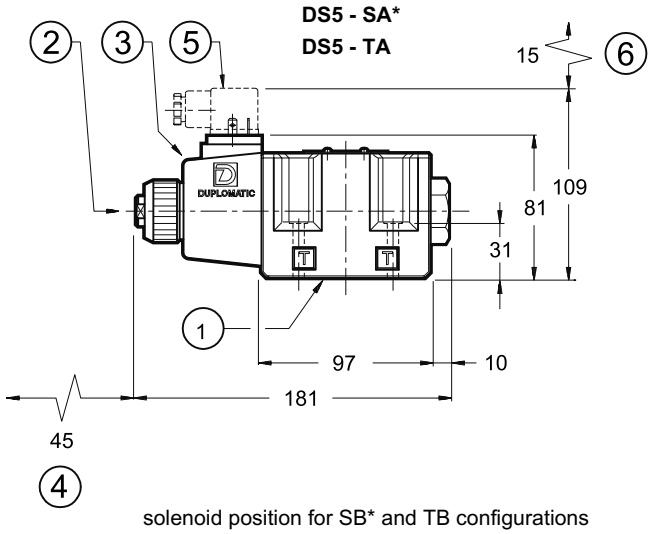
1	Mounting surface with sealing rings: 5 OR type 2050 (12.42x1.78) - 90 Shore Additional for Y version only: 1 OR 2037 (9.25x1.78) - 90 shore
2	Standard manual override included in the solenoid tube
3	Coil (360° revolving)
4	Coil removal space
5	EN 175301-803 (ex DIN 43650) connector (standard K1 shown) to be ordered separately (see cat. 49 000)
6	Connector removal space
7	Locking ring: tightening torque: 6 Nm

9 - OVERALL AND MOUNTING DIMENSIONS FOR AC SOLENOID VALVES

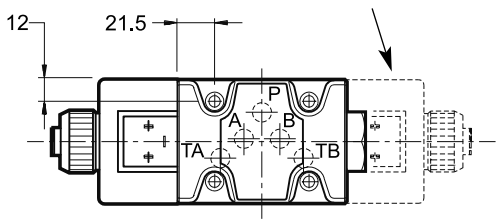
dimensions in mm







solenoid position for SB* and TB configurations



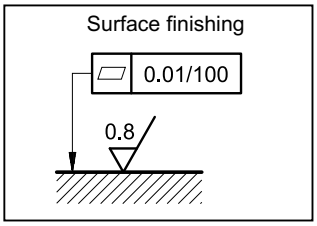
Valve fastening: 4 SHC screws ISO 4762 M6x40
Tightening torque: 8 Nm (screws A8.8)
Threads of mounting holes: M6x10

1	Mounting surface with sealing rings: 5 OR type 2050 (12.42x1.78) - 90 Shore
2	Standard manual override included in the solenoid tube
3	Coil (360° revolving)
4	Coil removal space
5	EN 175301-803 (ex DIN 43650) connector to be ordered separately (see cat. 49 000)
6	Connector removal space
7	Locking ring: tightening torque: 4.5 - 5 Nm

10 - INSTALLATION

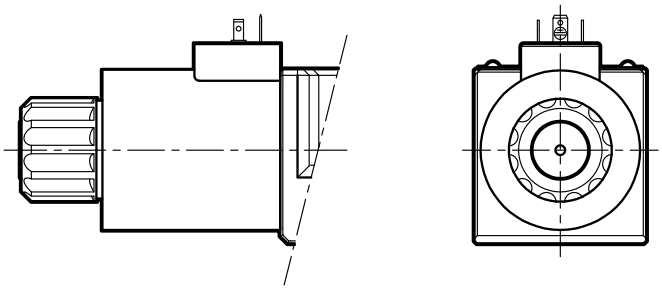
Configurations with centering and return springs can be mounted in any position; type RK valves - without springs and with mechanical detent - must be mounted with the longitudinal axis horizontal. Valve fixing is by means of screws or tie rods, with the valve mounted on a lapped surface, with values 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.

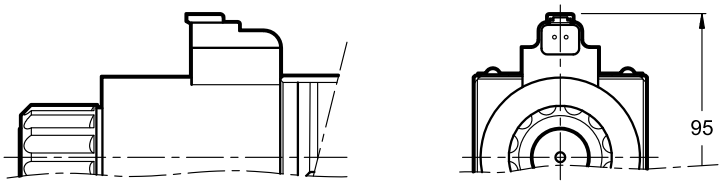


11 - ELECTRIC CONNECTIONS

connection for EN 175301-803 (ex DIN 43650)
connector type
code **K1** (**standard**)



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



12 - ELECTRIC CONNECTORS

Solenoid operated valves are delivered without connectors. Connectors type EN 175301-803 (ex DIN 43650) for K1 connections can be ordered separately. See catalogue 49 000.

13 - SPECIAL VERSIONS FOR DC SOLENOID VALVE

13.1 - Identification code for external drain version

D	S	5	-		/	14		-		K1	/	Y	/		

Solenoid operated directional control valve

ISO 4401-05 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
D26 = 26.4 V
D110 = 110 V
D220 = 220 V

Coil electrical connection (see par. 11):
K1 = plug for connector type EN 175301-803 (ex DIN 43650) (**standard**)
Only for **D12** and **D24**:
K7 = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S

Port for subplate external drain

Manual override:
omit for override integrated in the tube (**standard**)
CM = manual override, boot protected
CK = knob manual override
CK2 = push and twist knob override

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

NOTE :The standard surface treatment is phosphating black.

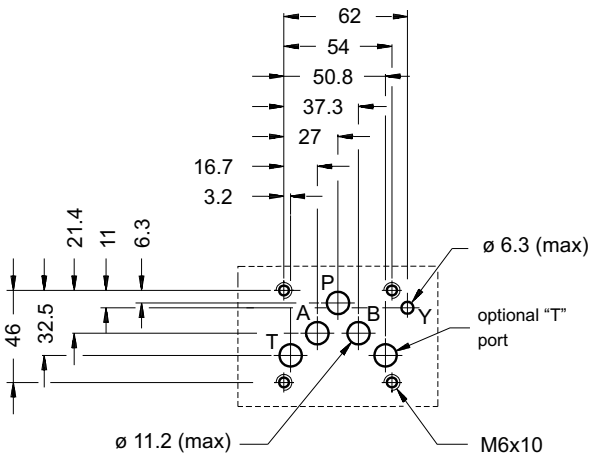
On request we can supply these valves with zinc-nickel finishing, making the valve suitable to ensure a salt spray resistance up to 240 hours (test operated according to UNI EN ISO 9227 standard and test evaluation operated according to UNI EN ISO 10289 standard)

Add **/W7** at the end of the identification code.

13.2 - 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. 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.



13.3 - Identification code for soft-shifting versions

D	S	5	-		/	14		-		K1	/		/	

Solenoid operated directional control valve

ISO 4401-05 size

Spool type (see par. 3)

S1	**S4**	**TA**
S2	**S7**	**TB**
S9	**S8**	**TA02**
S12		**TB02**

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
D26 = 26.4 V
D110 = 110 V
D220 = 220 V

Coil electrical connection (see par. 11):
K1 = plug for connector type EN 175301-803 (ex DIN 43650) (**standard**)
Only for **D12** and **D24**:
K7 = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S

Manual override:
omit for override integrated in the tube (**standard**)
CM = manual override, boot protected
CK = knob manual override
CK2 = push and twist knob override

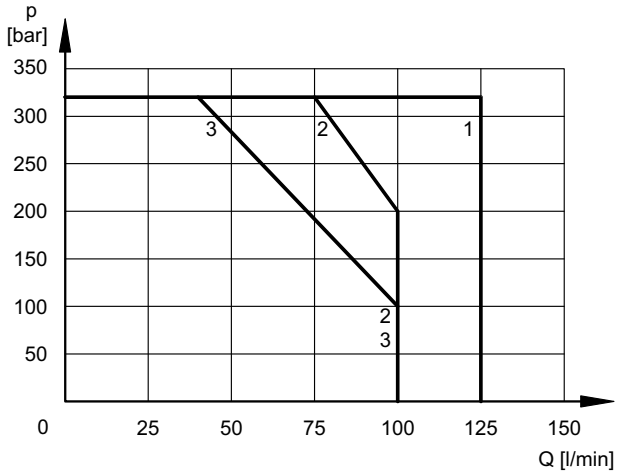
Options:
F = soft-shifting (see par. 13.4)
S = adjustable soft-shifting device (see par 13.5)

13.4 - 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 below shows the operating limits for available spools 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. Indicated values are obtained according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

Both 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.



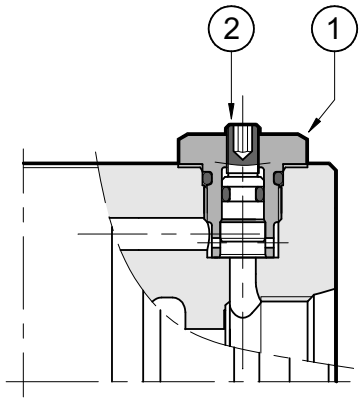
SPOOL TYPE	CURVE		TIMES	
	P-A	P-B	ENERGIZING	DE-ENERGIZING
S1, S12	1	1	300 ÷ 500	300 ÷ 500
S2	2	2	450	200 ÷ 300
S4, S7, S8	3	3	400	400 ÷ 200
S9	1	1	300 ÷ 500	300 ÷ 500
TA, TB	2	2	300 ÷ 400	300 ÷ 400
TA02, TB02	2	2	400	200 ÷ 300

13.5 - 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.

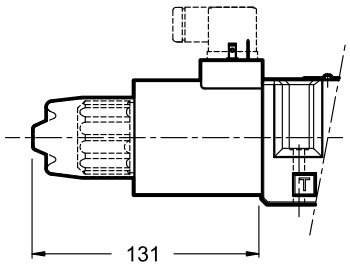
NOTE: during the first start-up the valve body must be filled with the operating fluid through the tap (1) .



1	Spanner for plug: 17 mm - tightening torque 20 Nm
2	Socket hex adjustment screw for shifting time: spanner 2.5 mm

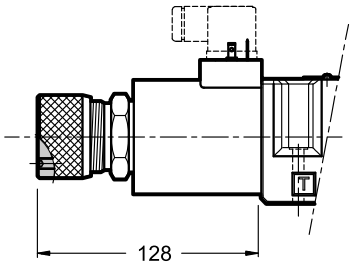
14 - MANUAL OVERRIDES FOR DC SOLENOID VALVES

14.1 - CM - Manual override, boot protected



Code: valves in series 12 = 0239050
valves in series 14 = 0239051

14.2 - CK - Turning knob

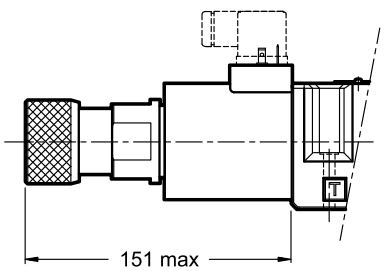


When the set screw is screwed and its point is aligned with the edge of the knob, tighten the knob till it touches the spool: in this position the override is not engaged and the valve is de-energized. After adjusting the override, tighten the set screw in order to avoid the knob loosing.

Spanner: 3 mm

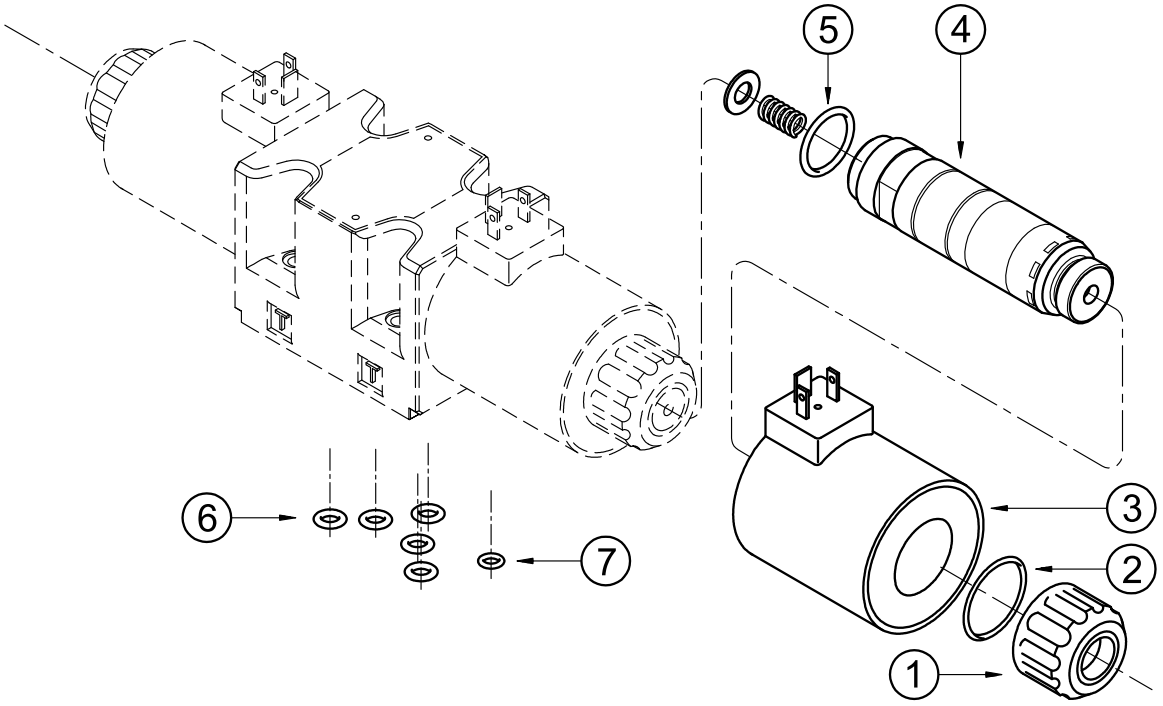
Code: 3803260003

14.3 - CK2 - Push and twist



Code: 3401310001

15 - SPARE PARTS FOR DC SOLENOID VALVE



DC COILS IDENTIFICATION CODE

C	31	-			/	

Supply voltage

D12 = 12 V
D24 = 24 V
D26 = 26.4 V
D110 = 110 V
D220 = 220 V

Series no.:
22 = for K1 and D12K7 coils
21 = for D24K7 coils

Coil electrical connection
K1 = plug for connector type EN 175301-803 (ex DIN 43650) (**standard**)
Only for **D12** and **D24**:
K7 = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S

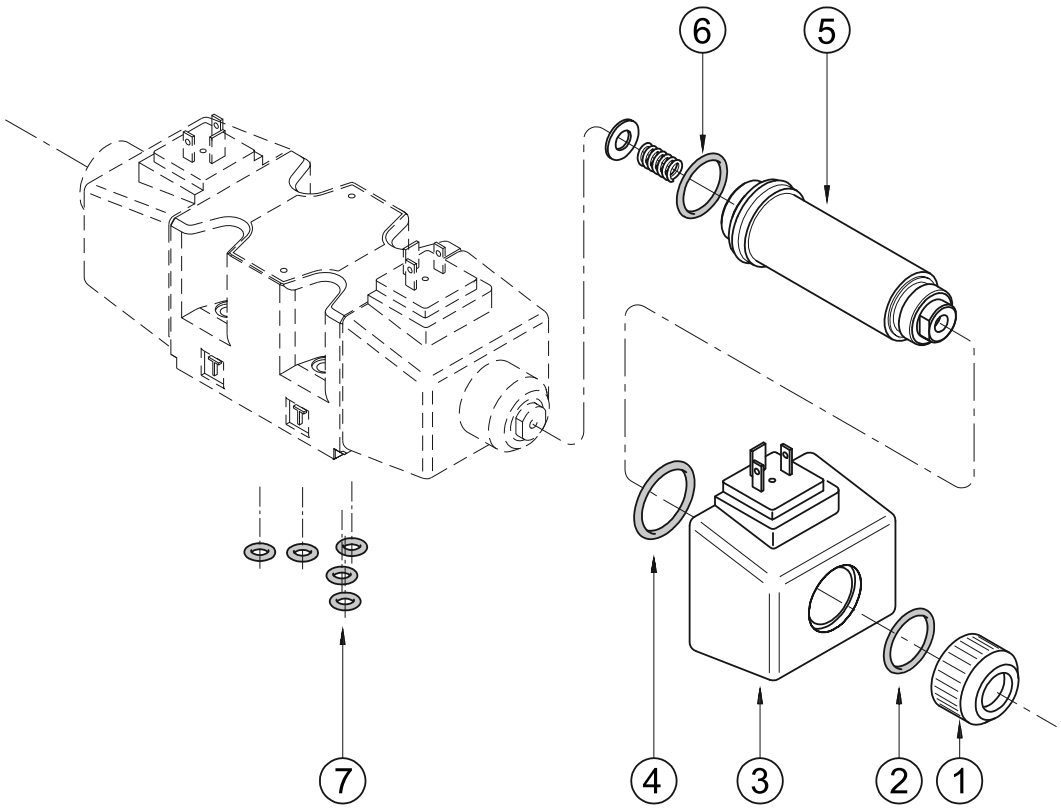
1	Coil locking ring with seal included cod. 0119383 tightening torque: 6 Nm
2	ORM type 0320 - 25 (32x2.5) - 70 Shore
3	Coil (see identification code)
4	Solenoid tube TD31-M27/20N (NBR seals) TD31-M27/20V (FPM seals) **NOTE**: OR n° 5 supplied with.
5	OR type 3-912 (23.47x2.95) - 70 Shore
6	N. 5 OR type 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

Plug for connector type
EN 175301-803
(ex DIN 43650)

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

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) - 70 Shore
3	Coil (see identification code)
4	OR type 2112 (28.30x1.78) - 70 Shore
5	Solenoid tubes: TA25.4-M27/11N (NBR seals) TA25.4-M27/11V (FPM seals) **NOTE**: OR n° 6 supplied with.
6	OR type 3-912 (23.47x2.95) - 70 Shore
7	N. 5 OR type 2050 (12.42x1.78) - 90 Shore

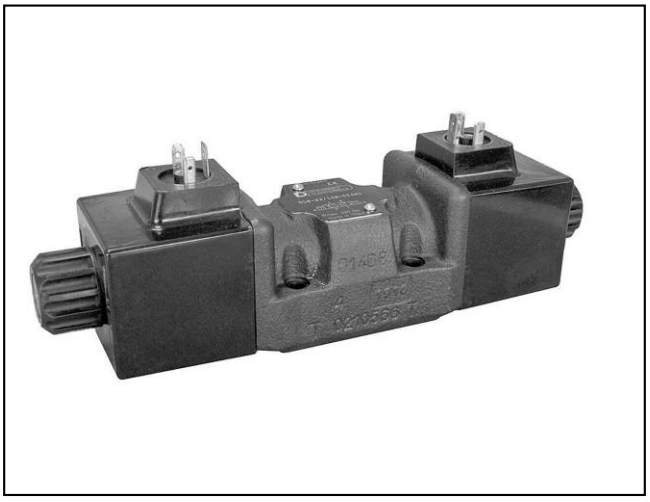
17 - SUBPLATES

(see catalogue 51 000)

Type PMD4-AI4G with rear ports 1/2” BSP
Type PMD4-AL4G with side ports 1/2” BSP

DUPLOMATIC MOTION SOLUTIONS

DUPLOMATIC MS S.p.A.
via M. Re Depaolini 24 ▪ 20015 PARABIAGO (MI) ▪ ITALY
tel. +39 0331.895.111 ▪ www.duplomatic.com ▪ e-mail: sales.exp@duplomatic.com



DL5

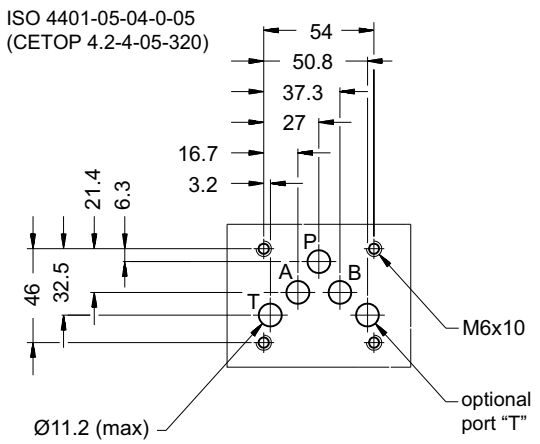
SOLENOID OPERATED DIRECTIONAL CONTROL VALVE COMPACT VERSION

SERIES 10

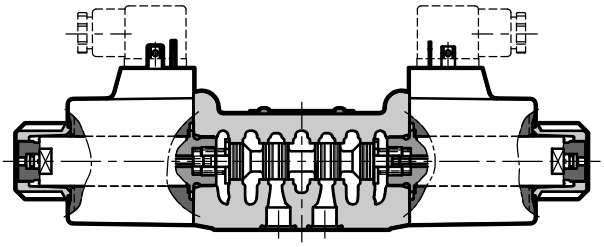
SUBPLATE MOUNTING ISO 4401-05

p max **320** bar
Q max **125** l/min

MOUNTING INTERFACE



OPERATING PRINCIPLE



— Direct acting, subplate mounting directional control valve, with mounting surface according to ISO 4401 standards.

— The valve is suitable for special applications, guaranteed by the reduced solenoid dimensions.

— 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 (for further information on solenoids see paragraph 7).

— The valve is supplied with 3 or 4 way designs and with several interchangeable spools with different porting arrangements.

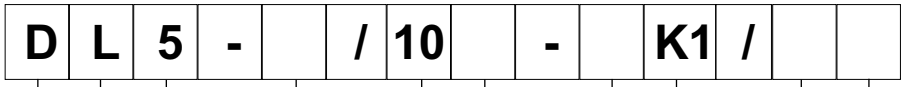
— The valve is available with DC or AC current solenoids.

PERFORMANCES

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

Maximum operating pressure: - ports P - A - B - port T	bar	**CC** 320 210	**CA** 160
Maximum flow rate	l/min	125	100
Pressure drop Δp-Q	see paragraph 4		
Operating limits	see paragraph 5		
Electrical features	see paragraph 7		
Electrical connections	EN 175301-803 (ex DIN 43650)		
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	
Masse: single solenoid valve double solenoid valve	kg	2,8 3,7	

1 - IDENTIFICATION CODE



Solenoid operated directional control valve

Model in compact execution

ISO 4401-05 size

Spool type (see paragraph 3):

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

Series no.: (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

Option:
/ W7 = Zinc-nickel surface treatment.
Omit if not required (see **NOTE 2**)

Manual override - see par. 12
Omit for override integrated in the tube (**standard**)
CM = boot protected.
For DC version only.

Coil electrical connection:
plug for connector type EN 175301-803 (ex DIN 43650) (**standard**)

DC power supply
D12 = 12 V
D24 = 24 V
D00 = valve without coils (see **NOTE 1**)

AC power supply
A24 = 24 V - 50 Hz
A48 = 48 V - 50 Hz
A110 = 110 V - 50 Hz
A230 = 230 V - 50 Hz
A00 = valve without coils (see **NOTE 1**)

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

NOTE 2:The standard valve is supplied with surface treatment of phosphating black.

The zinc-nickel finishing makes the valve suitable to ensure a salt spray resistance up to 240 hours (test operated according to EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

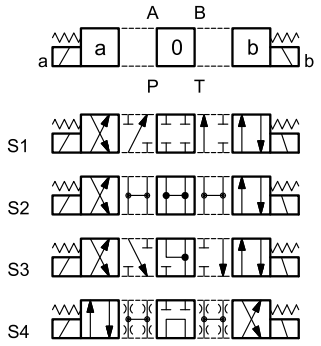
2 - HYDRAULIC FLUIDS

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.

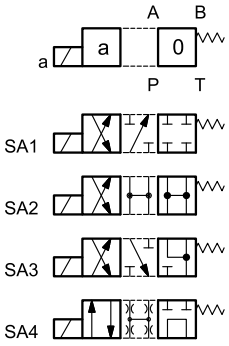
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

3 - SPOOL TYPE

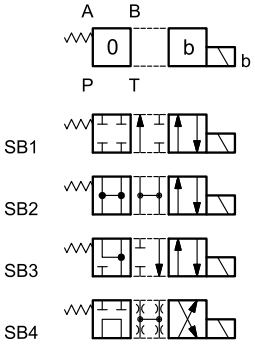
Type **S***:
2 solenoids - 3 positions
with spring centreing



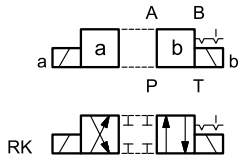
Type **SA***:
1 solenoid side A
2 positions (central + external)
with spring centreing



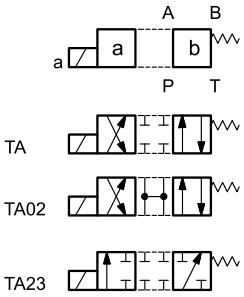
Type **SB***:
1 solenoid side B
2 positions (central + external)
with spring centreing



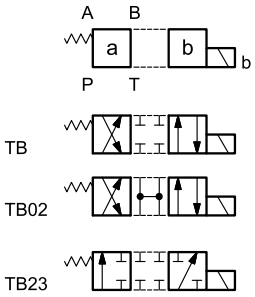
Type **RK**:
2 solenoids - 2 positions
with mechanical retention



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



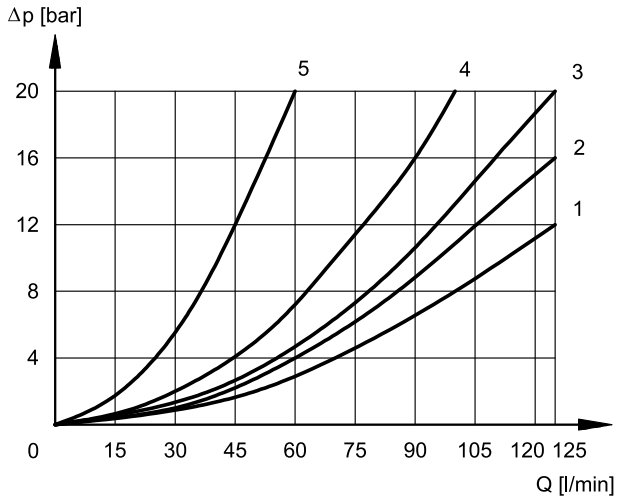
Type **TB**:
1 solenoid side B
2 external positions
with return spring



NOTE: Others spools available on request only.

4 - PRESSURE DROPS Δp-Q

(obtained with viscosity of 36 cSt at 50 °C)



ENERGIZED VALVE

SPOOL	FLOW DIRECTIONS			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPHS			
S1	1	1	2	2
S2	1	1	1	1
S3	1	1	1	1
S4	4	4	4	4
RK	2	2	2	2
TA	2	2	3	3
TA02	2	2	1	1
TA23	3	3	-	-

DE-ENERGIZED VALVE

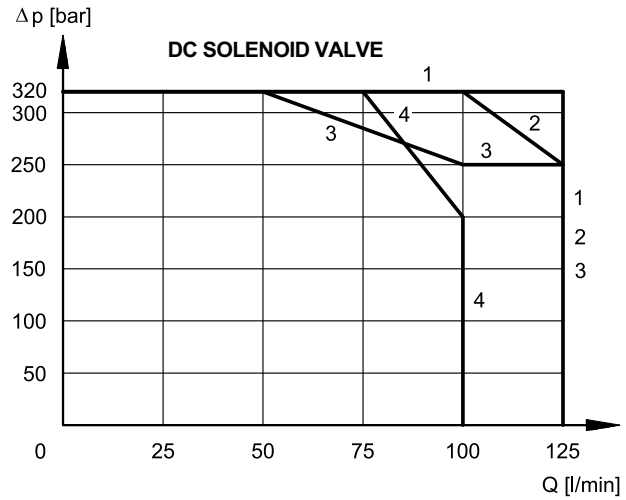
SPOOL	FLOW DIRECTIONS		
	A→T	B→T	P→T
	CURVES ON GRAPHS		
S2	-	-	1
S3	5	5	-
S4	-	-	1

5 - OPERATING LIMITS

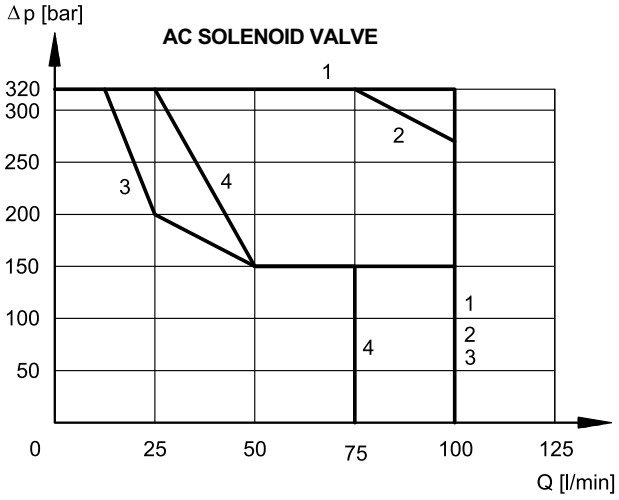
The curves define the flow rate operating fields according to the valve pressure of the different versions.The values indicated in the graphs are relevant to the standard solenoid valve. The operating limits can be considerably reduced if a 4-way valve is used as 3-way valve with port A or B plugged or without flow.

The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage. The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.

5.1 - Standard operating limits



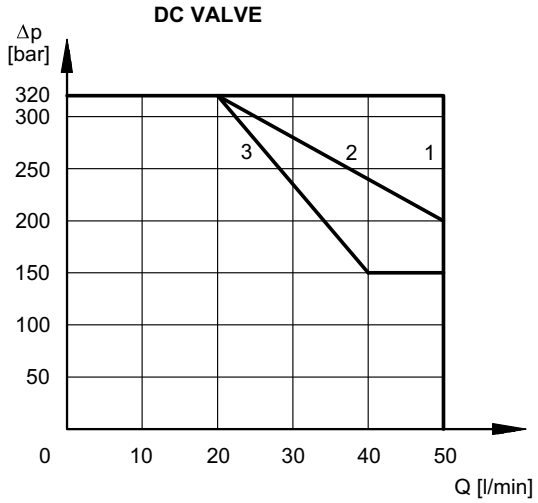
SPOOL	CURVE
S1, S2, RK, TA, TA23	1
S9, TA02	2
S3	3
S4	4

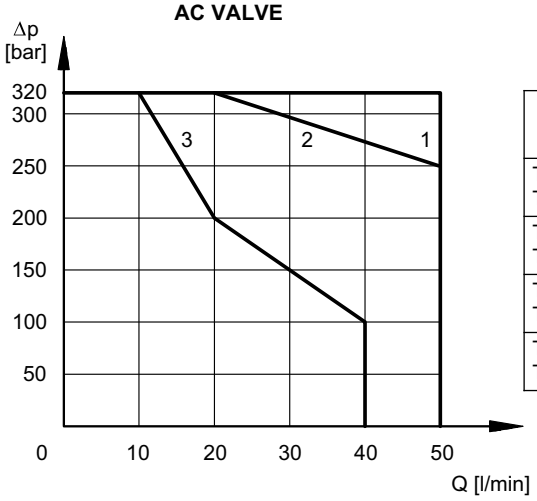


SPOOL	CURVE
S1, RK, TA, TA02, TA23	1
S2	2
S3, S9	3
S4	4

5.2 - 4-way valve in 3-way operation

Operating limits of a 4-way valve in 3-way operation or with port A or B plugged or without flow.





SPOOL	CURVE	
	DC	AC
TA backpr. A TB backpr. B	2	1
TA02 backpr. A TB02 backpr. B	1	1
TA backpr. B TB backpr. A	3	3
TA02 backpr. B TB02 backpr. A	2	2

6 - SWITCHING TIMES

The values indicated are obtained with spool S1, according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

SUPPLY	TIMES (±10%) [ms]	
	ENERGIZING	DE-ENERGIZING
DC	40 ÷ 90	20 ÷ 50
AC	15 ÷ 30	20 ÷ 50

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 +/- 90°, to suit the available space.

The interchangeability of coils of different voltages is allowed within the same type of supply current, alternating or direct.

SUPPLY VOLTAGE FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY	10.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC) - NOTE	In compliance with 2014/30/EU
LOW VOLTAGE	In compliance with 2014/35/EU
CLASS OF PROTECTION Atmospheric agents EN 60529 Coil insulation (VDE 0580) Impregnation:	 IP65 (*) class H class H

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

NOTE: In order to further reduce the emissions, with DC supply, 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 - DC valve - Current and power consumption

In direct current energizing, current consumption stays at fairly constant values, essentially determined by Ohm's law: V = R x I

The table shows current and power consumption values for DC types.

	Resistance at 20°C [Ω] (±5%)	Current consumption [A] (±10%)	Power consumption [W] (±10%)	Coil code K1
C22L5-D12K1	2,9	4,14	50	1903150
C22L5-D24K1	12,3	1,95	47	1903151

7.3 - AC valve - Current and power consumption

In alternating current energizing, an initial phase (maximum movement) is seen, during which the solenoid consumes elevated value currents (inrush current); the current values diminish during the plunger stroke until it reaches the minimum values (holding current) when the plunger reaches the stroke end.

The table shows the values of absorption at the inrush and at holding.

	Freq. [VAC/Hz] (±10%)	Resistance at 20°C [Ω] (±5%)	Current consumption at inrush [A] (±10%)	Current consumption at holding [A] (±5%)	Power consumption at inrush (±10%) [VA]	Power consumption at holding (±10%) [VA]	Coil code K1
C26L5-A24K1	24/50	0,58	15,1	2,84	362,4	68,2	1903160
C26L5-A48K1	48/50	2,34	7,4	1,29	355,2	61,9	1903161
C26L5-A110K1	110/50-120/60	12,3	3,6 - 3,3	0,64 - 0,62	396	70,4 - 74,4	1903162
C26L5-A230K1	230/50-240/60	51,6	1,8 - 1,6	0,31 - 0,28	414 - 384	71,3 - 67,2	1903163

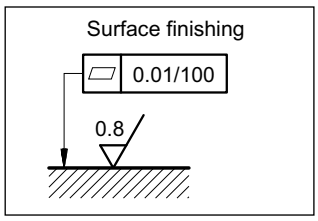
8 - ELECTRIC CONNECTORS

Solenoid operated valves are delivered without connectors. Connectors can be ordered separately. See catalogue 49 000.

9 - INSTALLATION

The configuration with centreing and return springs can be mounted in any position.

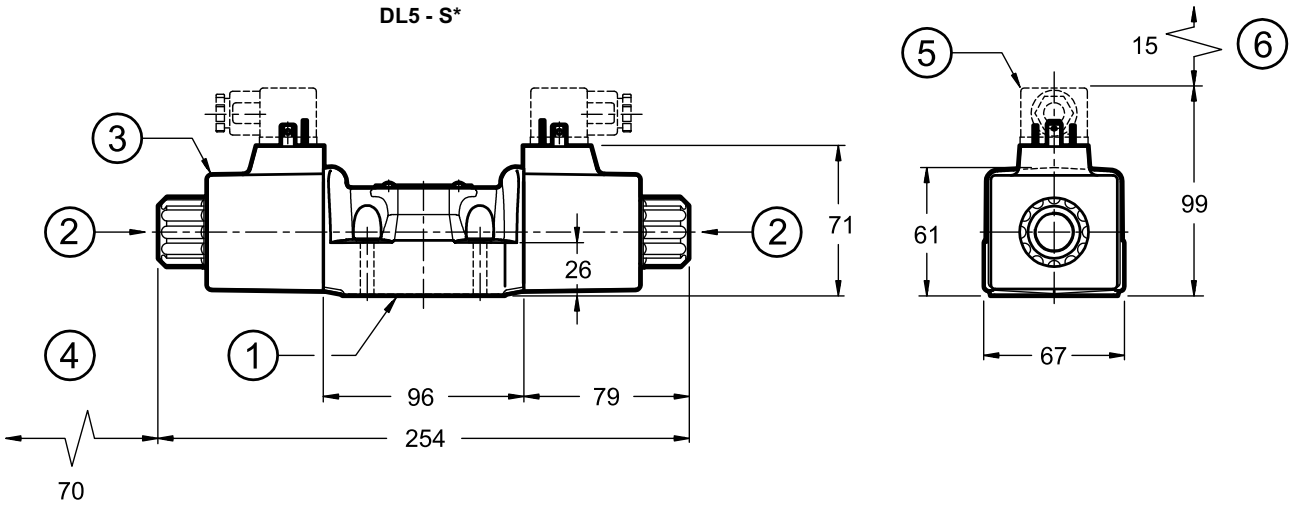
Valve fitting takes place by means of screws or tie rods, fixing the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing. If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.

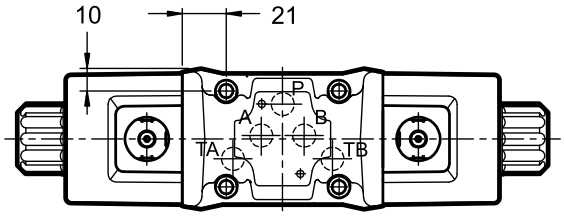


10 - DL5 DC OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

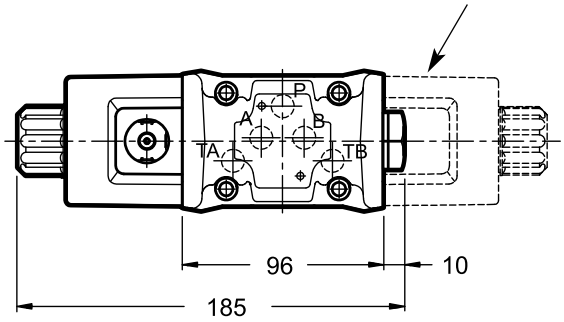
DL5 - S*





DL5 - TA, DL5-SA*

solenoid position for execution type TB* - SB*



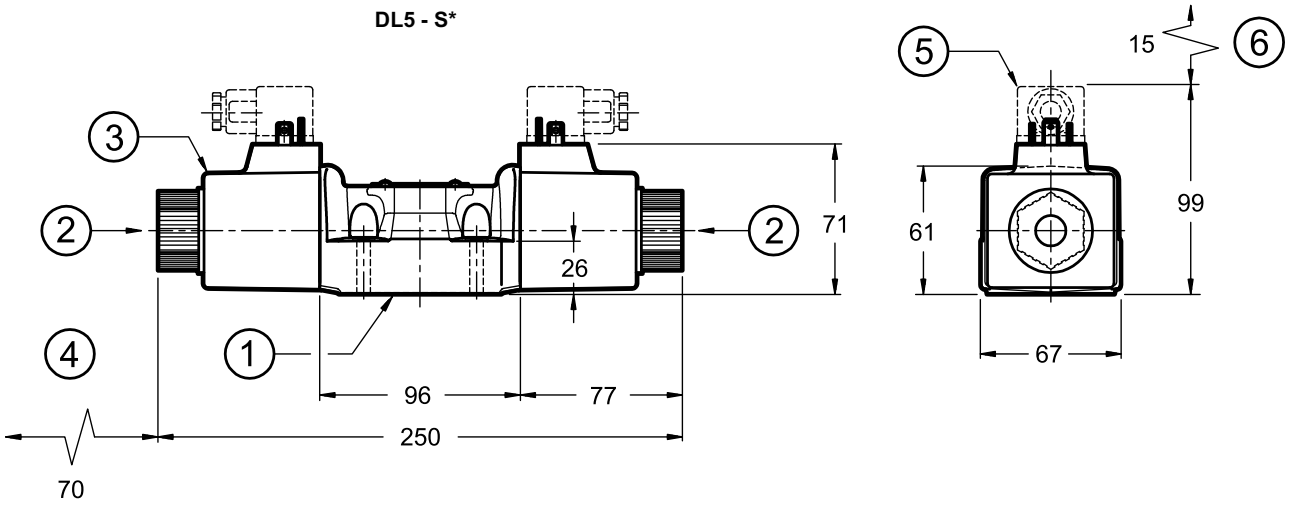
See par. 15 for fastening bolts and sealing rings

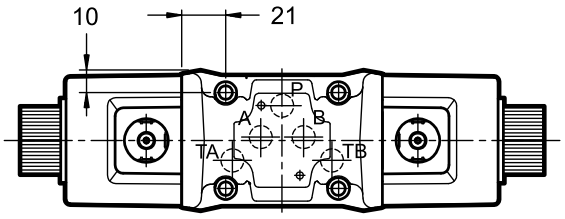
1	Mounting surface with sealing rings
2	Locking ring with standard manual override integrated in the tube
3	Coil
4	Coil removal space
5	EN 175301-803 (ex DIN 43650) electrical connector
6	Connector removal space

11 - DL5 AC OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

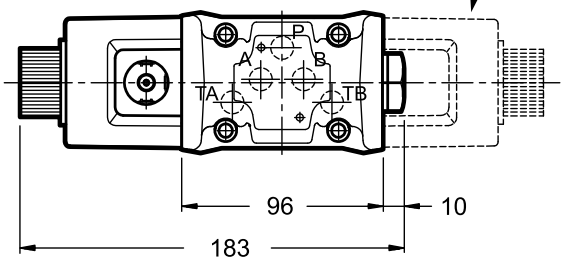
DL5 - S*





solenoid position for execution type TB* - SB*

DL5 - TA*, DL5-SA*



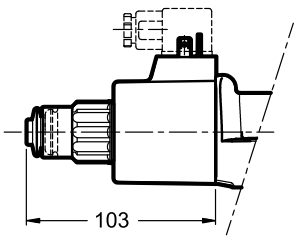
See par. 15 for fastening bolts and sealing rings

1	Mounting surface with sealing rings
2	Locking ring with standard manual override integrated in the tube
3	Coil
4	Coil removal space
5	EN 175301-803 (ex DIN 43650) electrical connector
6	Connector removal space

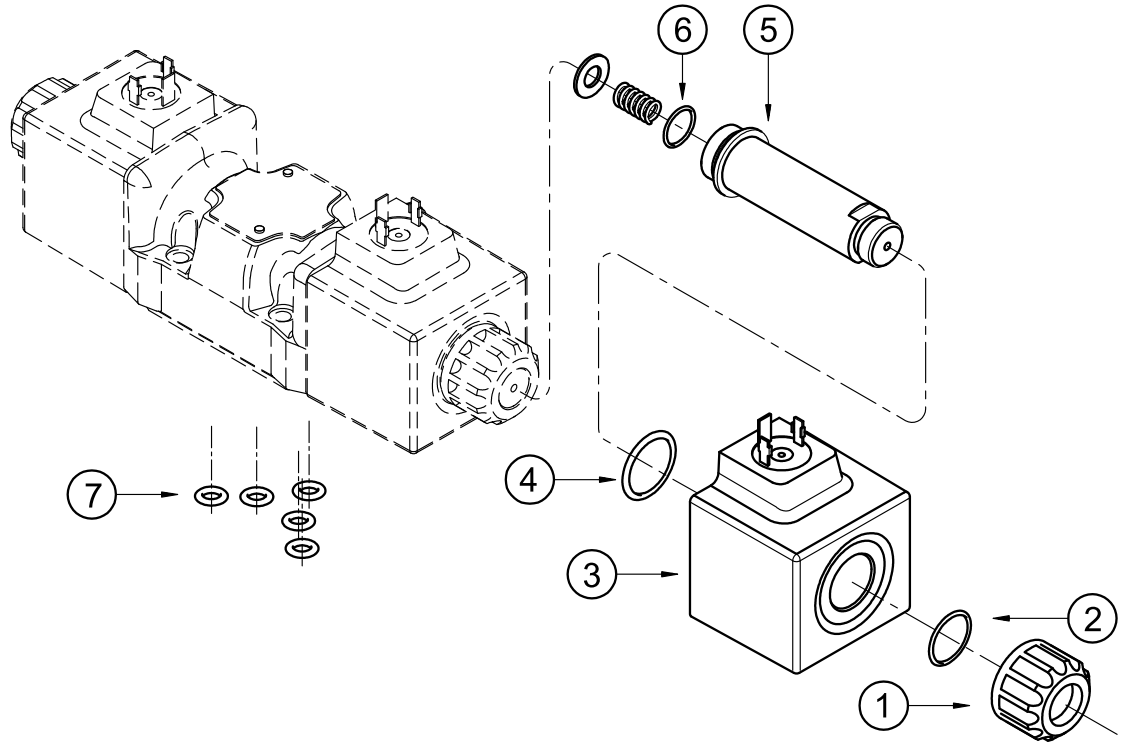
12 - OPTIONAL MANUAL OVERRIDE

12.1 - Boot protected manual override (only for DC solenoid valve)

It can be ordered by entering the code **CM** in the identification code at par. 1, or is available as option to be ordered separately:
code **3401150006**.



13 - SPARE PARTS FOR DC SOLENOID VALVE



IDENTIFICATION CODE FOR DC AND RC COILS

C	22	L5	-		K1	/	10

Supply voltage
D12 = 12 V
D24 = 24 V

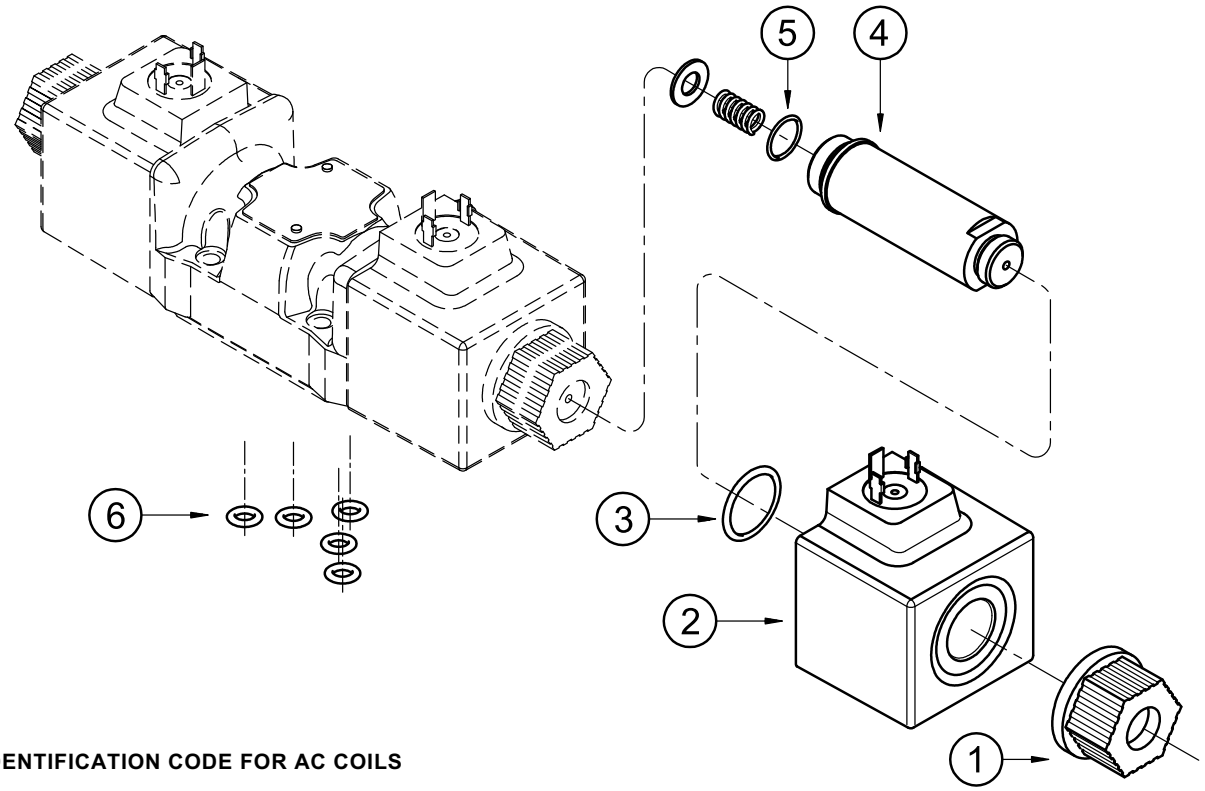
Series no.:
(the overall and mounting dimensions remain unchanged from 10 to 19)

Coil electrical connection:
plug for connector type EN 175301-803 (ex DIN 43650) (**standard**)

1	Coil locking ring - code 0119412
2	ORM-0220-20 - 70 shore
3	Coil (see identification code)
4	ORM-0296-24 (29.6x2.4) - 70 shore
5	Solenoid tube: TD22-DL5/10N (NBR seals) TD22-DL5/10V (FPM seals) (OR n° 6 included)
6	OR type 3.910 (19.18x2.46) - 70 shore
7	N. 5 OR type 2050 (12.42x1.78) - 90 Shore

SEAL KIT
The codes included the OR n° 2, 4, 6 and 7.
Cod. 1985447 NBR seals
Cod. 1985448 FPM seals

14 - SPARE PARTS FOR AC SOLENOID VALVE



IDENTIFICATION CODE FOR AC COILS

C	26	L5	-		K1	/	10

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

Coil electrical connection:
plug for connector type EN 175301-803 (ex DIN 43650) (**standard**)

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

1	Coil locking ring - code. 0119480
2	Coil (see identification code)
3	ORM-0296-24 (29.6x2.4) - 70 shore
4	Solenoid tube: TA26-DL5/10N (NBR seals) TA26-DL5/10V (FPM seals) (OR n° 5 included)
5	OR type 3.910 (19.18x2.46) - 70 shore
6	N. 5 OR type 2050 (12.42x1.78) - 90 Shore

SEAL KIT

The codes included the OR n° 3, 5 and 6.
Cod. 1985449 NBR seals
Cod. 1985450 FPM seals

15 - FASTENING BOLTS AND SEALING RINGS

Single valve fastening: 4 SHC screws ISO 4762 M6x35
Tightening torque: 8 Nm
Sealing rings: N. 5 OR type 2050 (12.42x1.78) - 90 Shore

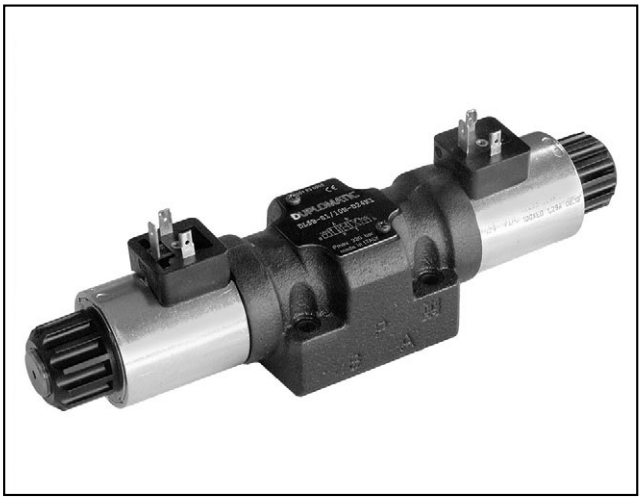
16 - SUBPLATES

(see catalogue 51 000)

Type PMD4-AI4G with rear ports - port threading: 3/4” BSP
Type PMD4-AL4G with side ports - port threading: 1/2” BSP

DUPLOMATIC MOTION SOLUTIONS

DUPLOMATIC MS S.p.A.
via M. Re Depaolini 24 ▪ 20015 PARABIAGO (MI) ▪ ITALY
tel. +39 0331.895.111 ▪ www.duplomatic.com ▪ e-mail: sales.exp@duplomatic.com



DL5B

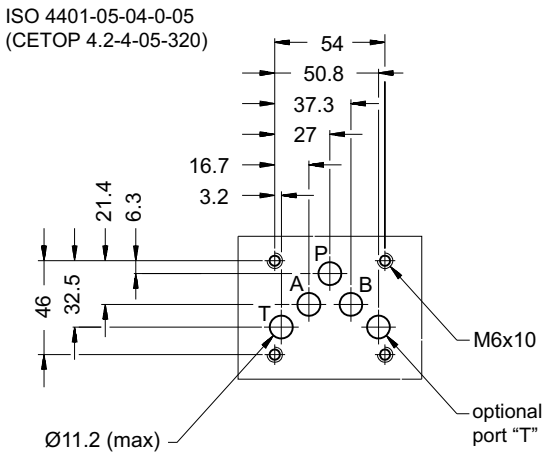
SOLENOID OPERATED DIRECTIONAL VALVE COMPACT VERSION

SERIES 10

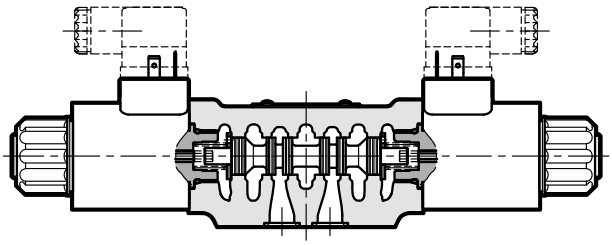
SUBPLATE MOUNTING
ISO 4401-05

p max **320** bar
Q max **125** l/min

MOUNTING SURFACE



OPERATING PRINCIPLE



— Direct acting, subplate mounting directional control valve, with mounting surface according to ISO 4401 standards.

— The valve is suitable for special applications, guaranteed by the reduced solenoid dimensions.

— 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 (for further information on solenoids see paragraph 7).

— The valve is supplied with 3 or 4 way designs, and several types of spools.

— The valve is available with DC current solenoids only.

— The valve is also available with zinc-nickel coating that ensures a salt spray resistance up to 600 hours.

— Alternative to the standard manual override there are push, boot, knob and mechanical detent devices.

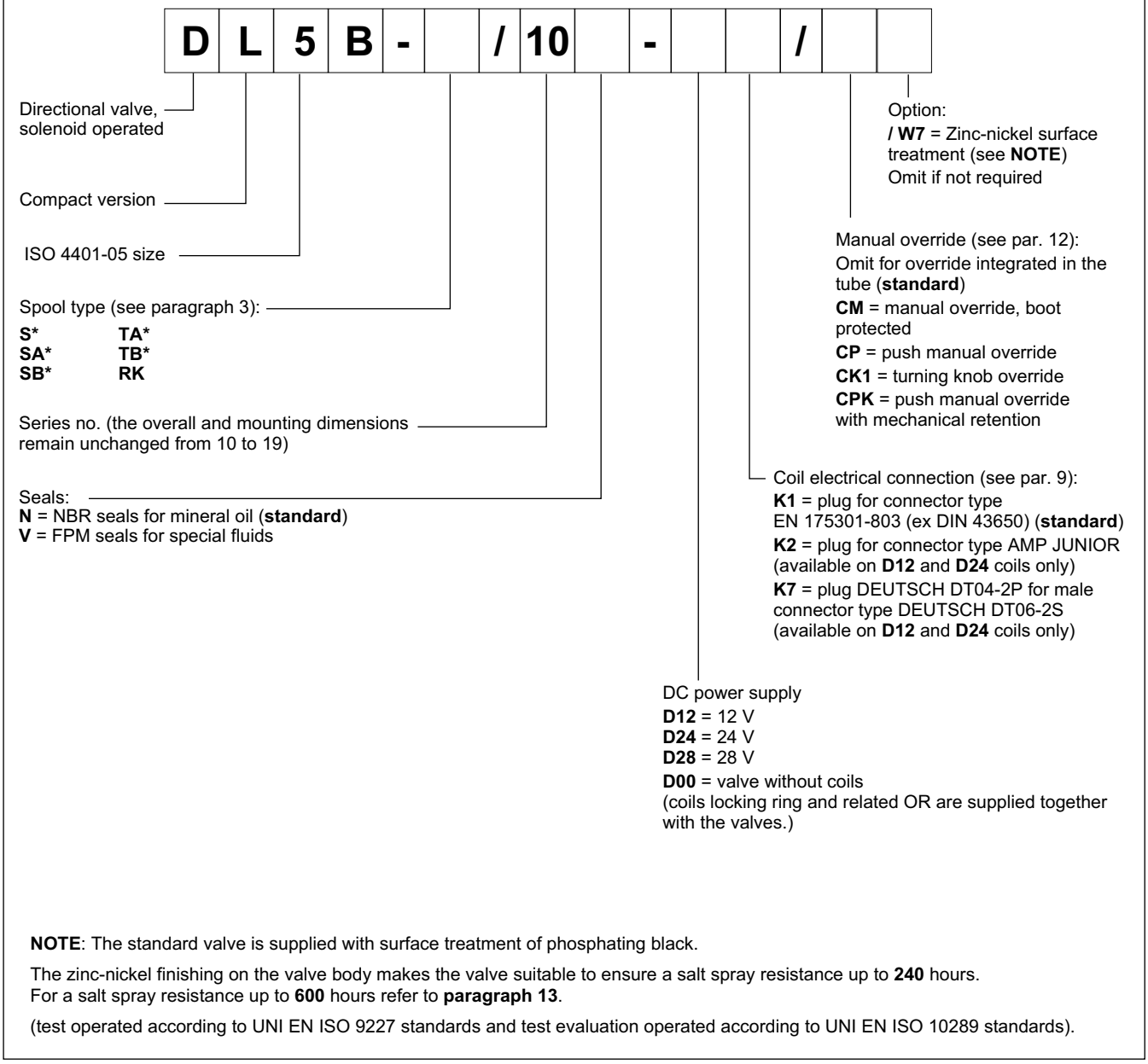
PERFORMANCES

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

Maximum operating pressure: - ports P - A - B - port T	bar	 320 210
Maximum flow rate	l/min	125
Pressure drop Δp-Q	see paragraph 4	
Operating limits	see paragraph 6	
Electrical features	see paragraph 7	
Electrical connections	see paragraph 9	
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
Masse: single solenoid valve double solenoid valve	kg	2,1 2,7

1 - IDENTIFICATION CODE

1.1 - Standard version



NOTE: The standard valve is supplied with surface treatment of phosphating black.

The zinc-nickel finishing on the valve body makes the valve suitable to ensure a salt spray resistance up to **240** hours.
For a salt spray resistance up to **600** hours refer to **paragraph 13**.

(test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

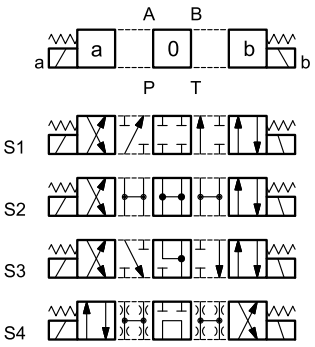
2 - HYDRAULIC FLUIDS

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.

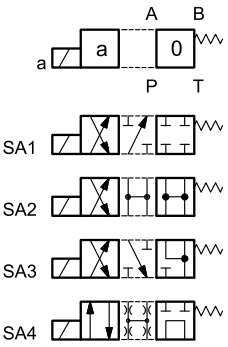
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

3 - SPOOL TYPE

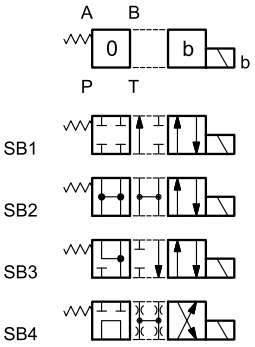
Type **S***:
2 solenoids - 3 positions
with spring centreing



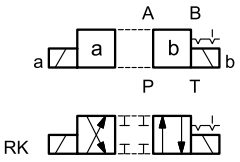
Type **SA***:
1 solenoid side A
2 positions (central + external)
with spring centreing



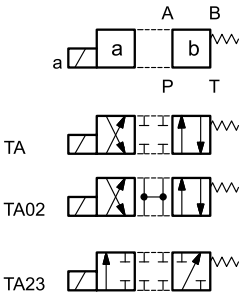
Type **SB***:
1 solenoid side B
2 positions (central + external)
with spring centreing



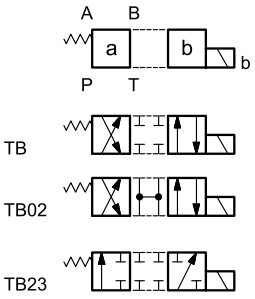
Type **RK**:
2 solenoids - 2 positions
with mechanical retention



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



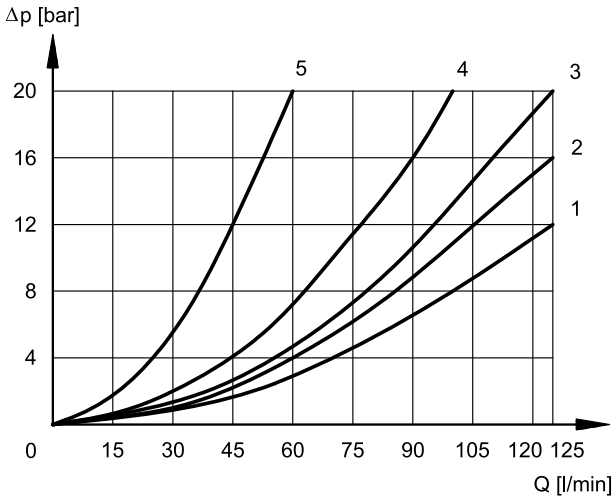
Type **TB**:
1 solenoid side B
2 external positions
with return spring



NOTE: Further spools available on request only.

4 - PRESSURE DROPS Δp-Q

(obtained with viscosity of 36 cSt at 50 °C)



ENERGIZED VALVE

SPOOL	FLOW DIRECTIONS			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPHS			
S1	1	1	2	2
S2	1	1	1	1
S3	1	1	1	1
S4	4	4	4	4
RK	2	2	2	2
TA	2	2	3	3
TA02	2	2	1	1
TA23	3	3	-	-

DE-ENERGIZED VALVE

SPOOL	FLOW DIRECTIONS		
	A→T	B→T	P→T
	CURVES ON GRAPHS		
S2	-	-	1
S3	5	5	-
S4	-	-	1

5 - SWITCHING TIMES

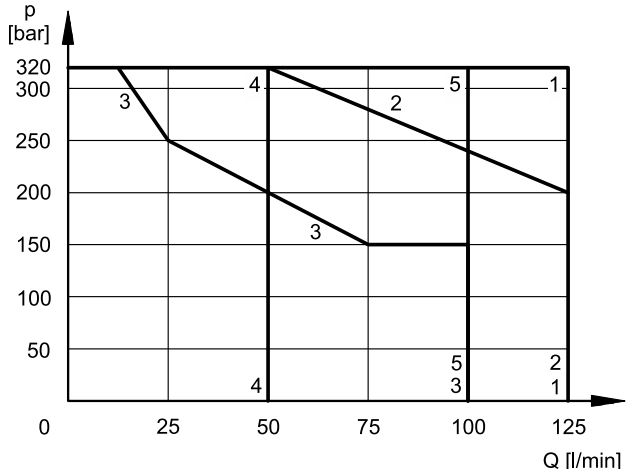
The values indicated are obtained with spool S1, according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

SUPPLY	TIMES (±10%) [ms]	
	ENERGIZING	DE-ENERGIZING
DC	70 ÷ 100	15 ÷ 20

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 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage. The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.

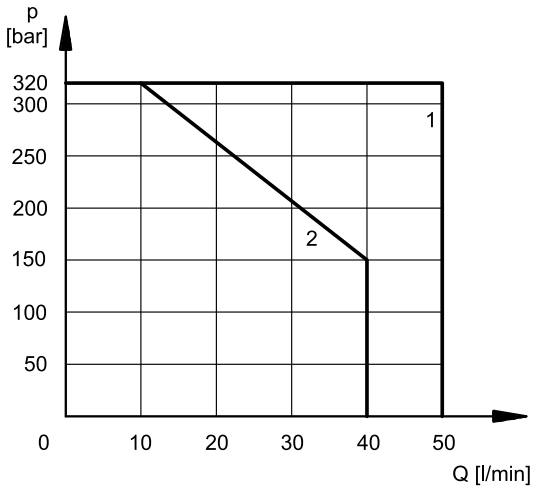
The limits for TA02 and TA spools refer to the 4-way operation. The operating limits of a 4-way valve in 3-way operation or with port A or B plugged or without flow are shown in the chart on the next page.



SPOOL	CURVE
S1, S2, RK	1
TA02	2
S3	3
S4	4
TA, TA23	5

6.1 - 4-way valve in 3-way operation

Operating limits of a 4-way valve in 3-way operation or with port A or B plugged or without flow.



SPOOL	CURVE
TA	1
TA02	2

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. The coils are interchangeable.

Protection from atmospheric agents IEC 60529

The IP protection degree is guaranteed only with both valve and connectors of an equivalent IP degree, correctly connected and installed.

electric connection	electric connection protection	whole valve protection
K1 EN 175301-803 (ex DIN 43650)	IP65	IP65
K2 AMP JUNIOR	IP65/67	
K7 DEUTSCH DT04 male	IP65/67	

SUPPLY VOLTAGE FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY	10.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	In compliance with 2014/30/EU
LOW VOLTAGE (NOTE)	In compliance with 2014/35/EU
CLASS OF PROTECTION Coil insulation (VDE 0580) Impregnation	 class H class F

NOTE: In order to further reduce the emissions, use of type H connectors is recommended, because of they prevent voltage peaks at the opening of the coil supply electrical circuit (see cat. 49 000).

7.2 - Coils current and power consumption

The table below shows the consumption values relating to the various types of coils for direct current power supply.

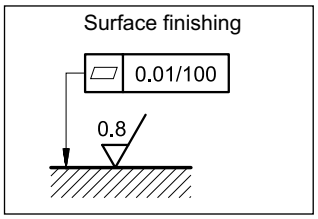
(values ±10%)

	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumption [A]	Power consumption [W]	Coil code K1	Coil code K2	Coil code K7
D12	12	4,4	2,72	32,7	1903080	1903100	1902940
D24	24	18,6	1,29	31	1903081	1903101	1902941
D28	28	26	1,11	31	1903082		-

8 - INSTALLATION

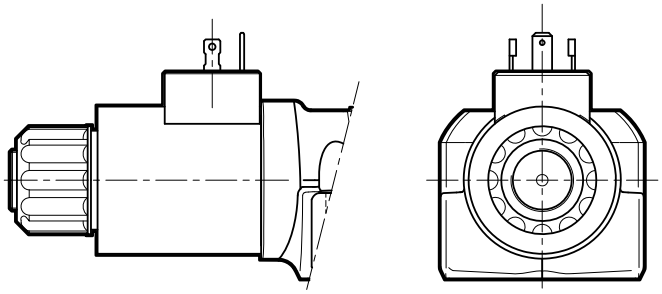
The configuration with centreing and return springs can be mounted in any position.

Valve fitting takes place by means of screws or tie rods, fixing 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.

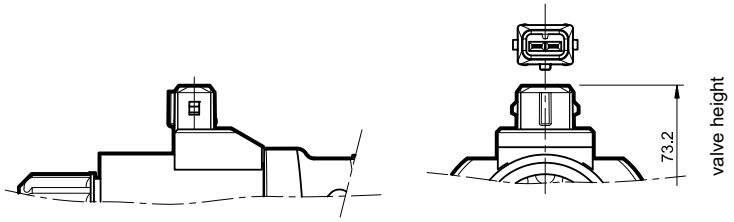


9 - ELECTRIC CONNECTIONS

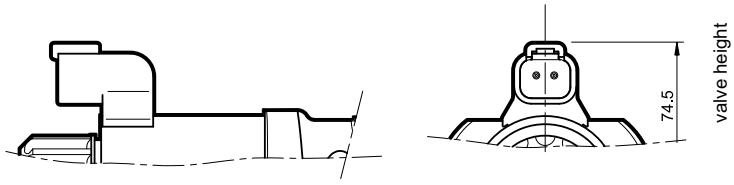
connection for EN 175301-803
(ex DIN 43650) connector
code **K1** (**standard**)
code **WK1** (W7 version only)



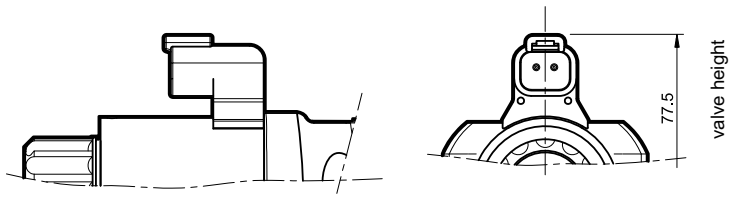
connection for AMP JUNIOR
connector
code **K2**



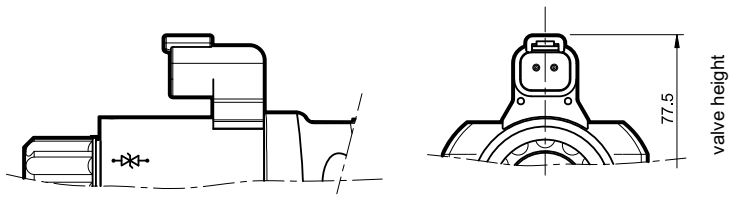
connection for
DEUTSCH DT06-2S male connector
code **K7**



connection for
DEUTSCH DT06-2S male
connector
code **WK7** (W7 version only)



connection for
DEUTSCH DT06-2S male
connector - coil with diode
code **WK7D** (W7 version only)



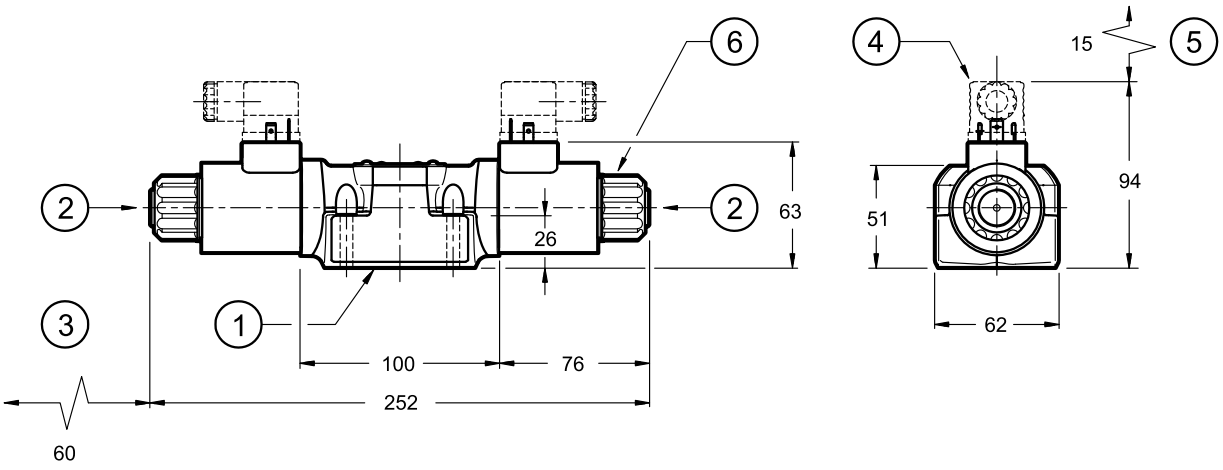
10 - ELECTRIC CONNECTORS

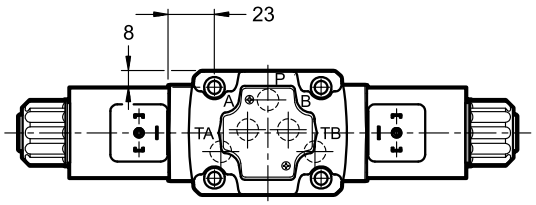
Solenoid operated valves are delivered without connectors. Connectors type EN 175301-803 (ex DIN 43650) for K1 and WK1 connections can be ordered separately. See catalogue 49 000.

11 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

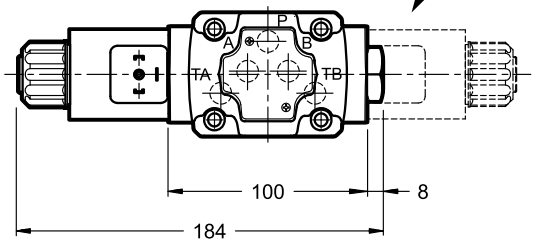
DL5B-S*





DL5B-TA, DL5B-SA*

solenoid position for versions type TB* - SB*

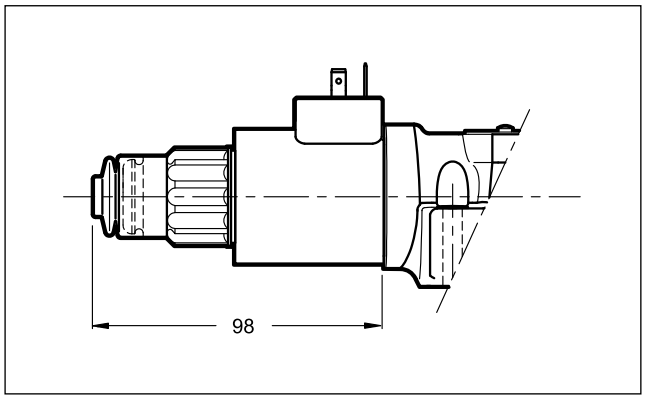


Valve fastening: 4 SHC screws ISO 6742 M6x35
Tightening torque: 8 Nm (A8.8)
Threads of mounting holes: M6x10

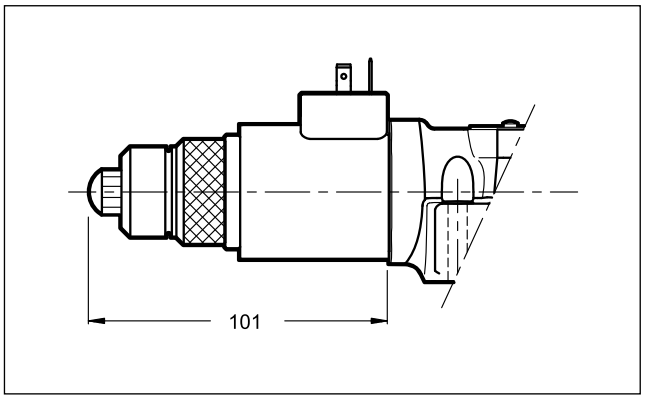
1	Mounting surface with sealing rings: 5 OR type 2050 (12.42x1.78) - 90 Shore
2	Locking ring with standard manual override integrated in the tube
3	Coil removal space
4	EN 175301-803 (ex DIN 43650) electrical connector (representation with K1 standard connection)
5	Connector removal space
6	Locking ring: tightening torque: 5 ± 0.5 Nm

12 - MANUAL OVERRIDES

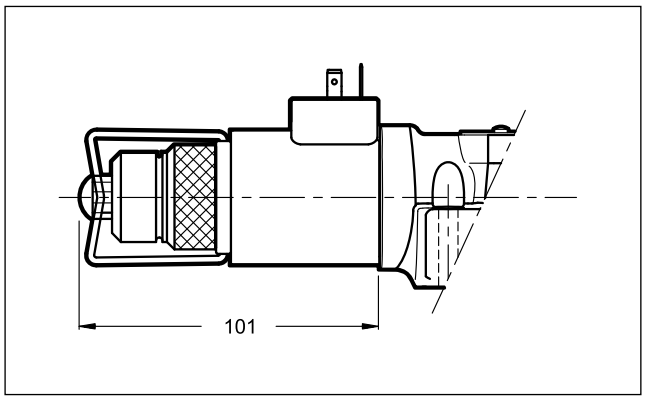
12.1 - CM Manual override, boot protected



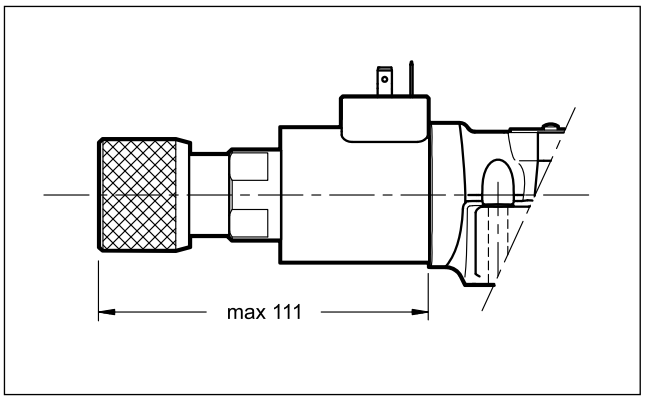
12.2 - CP Push manual override



12.3 - CPK Push manual override with mechanical retention

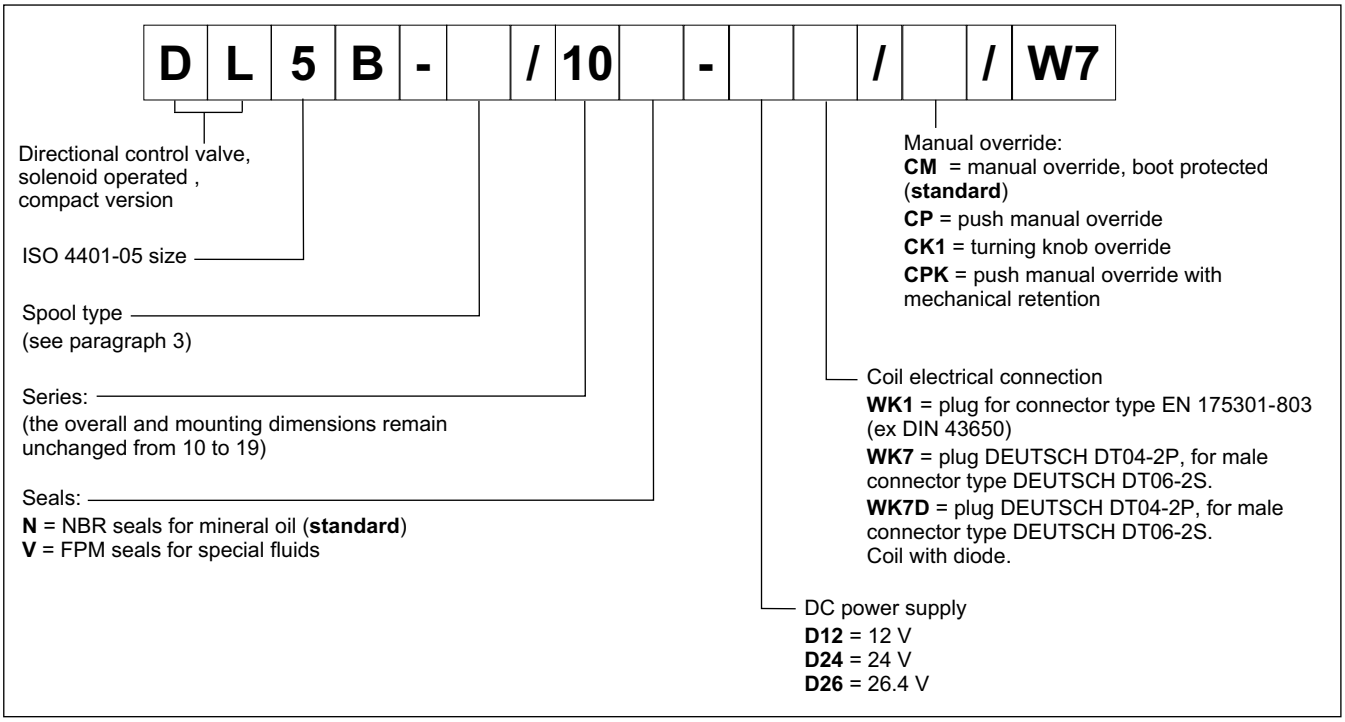


12.4 - CK1 Turning knob override



13 - HIGH IP AND CORROSION RESISTANCE VERSION

13.1 - Identification code



13.2 - Corrosion resistance

This version features the zinc-nickel coating on all exposed metal parts of the valve, making it resistant to exposure to the salt spray for **600** hours (test performed according to UNI EN ISO 9227 and assessment test performed according to UNI EN ISO 10289).

13.3 - DC coils

The coils feature a zinc-nickel surface treatment.

The WK7D coil includes a suppressor diode of pulses for protection from voltage peaks during switching. During the switching the diode significantly reduces the energy released by the winding, by limiting the voltage to 31.4V in the D12 coil and to 58.9 V in the D24 coil.

(values ±10%)

	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt [W]	Coil code		
					WK1	WK7	WK7D
D12	12	4,4	2,72	32,7	1903590	1903580	1903600
D24	24	18,6	1,29	31	1903591	1903581	1903601
D26	26,4	21,8	1,21	32	1903599	1903589	-

13.4 - Protection from atmospheric agents IEC 60529

The IP protection degree is guaranteed only with both valve and connectors of an equivalent IP degree, correctly connected and installed.

electric connection	electric connection protection	whole valve protection
WK1 EN 175301-803 (ex DIN 43650)	IP66	IP66
WK7 DEUTSCH DT04 male	IP66/IP68/IP69 IP69K*	IP66/IP68/IP69 IP69K*
WK7D DEUTSCH DT04 male	IP66/IP68/IP69 IP69K*	IP66/IP68/IP69 IP69K*

(*) The IP69K protection degree is not taken into account in IEC 60529 but it is included in ISO 20653.

NOTE: As regards the liquid ingress protection (second digit), there are three means of protection.

Codes from 1 to 6 are related to water jets.

Rates 7 and 8 are related to immersion.

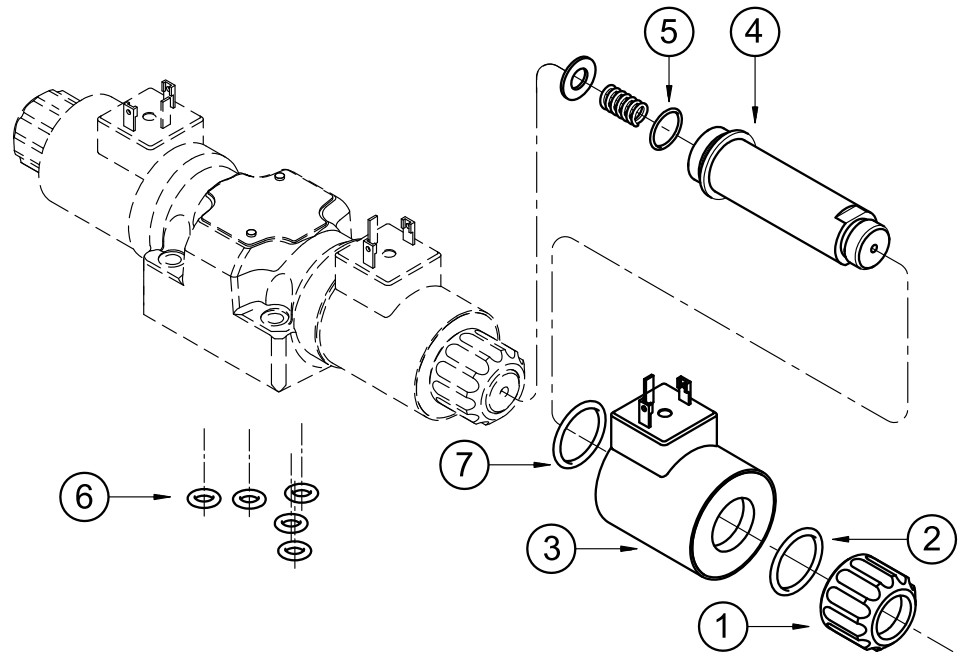
Rate 9 is reserved for high pressure and temperature water jets.

This means that IPX6 covers all the lower steps, rate IPX8 covers IPX7 but not IPX6 and lower, instead IPX9 does not cover any of them.

Whether a device meets two types of protection requirements it must be indicated by listing both the tests separated by a slash.

(E.g. a marking of an equipment covered both by temporary immersion and water jets is IP66/IP68).

14 - SPARE PARTS



IDENTIFICATION CODE FOR DC COILS

C	22	S3	-			/	

Supply voltage
D12 = 12 V
D24 = 24 V
D26 = 26.4 V
D28 = 28 V

Series no.:
10 = for K7 and WK7
11 = for K1, K2 and WK7D
12 = for WK1

Coil electrical connection (see par. 9):
K1 = plug for connector EN 175301-803 (ex DIN 43650)

for coils **D12**, **D24** and **D26**:
WK1 = plug for connector EN 175301-803 (ex DIN 43650)
WK7 = plug DEUTSCH DT04-2P, for male connector type DEUTSCH DT06-2S.

Only for **D12** and **D24**:
K2 = plug for connector AMP JUNIOR
K7 = plug DEUTSCH DT04-2P, for male connector type DEUTSCH DT06-2S.
WK7D = plug DEUTSCH DT04-2P, for male connector type DEUTSCH DT06-2S.
Coil with diode.

1	Coil locking ring - code 0119412 tightening torque: 5 ±0.5 Nm
2	ORM-0220-20 - 70 shore
3	Coil (see identification code)
4	Solenoid tube: TD22-DL5/10N (NBR seals) TD22-DL5/10V (FPM seals) (OR n° 5 included)
5	OR type 3.910 (19.18x2.46) - 70 shore
6	N. 5 OR type 2050 (12.42x1.78) - 90 Shore
7	Only for coil series 12: ORM-0220-20 - MVQ

SEAL KIT

The codes included the OR n° 2, 5, 6 and 7.
Cod. 1985461 NBR seals
Cod. 1985462 FPM seals

NOTE: You can also order coils using the coil codes in paragraphs 7.2 and 13.3.

15 - SUBPLATES

(See catalogue 51 000)

Type PMD4-AI4G with rear ports - threading: 3/4” BSP
Type PMD4-AL4G with side ports - threading: 1/2” BSP

DUPLOMATIC MOTION SOLUTIONS

DUPLOMATIC MS S.p.A.
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MDS5

SOLENOID OPERATED SWITCHING VALVE

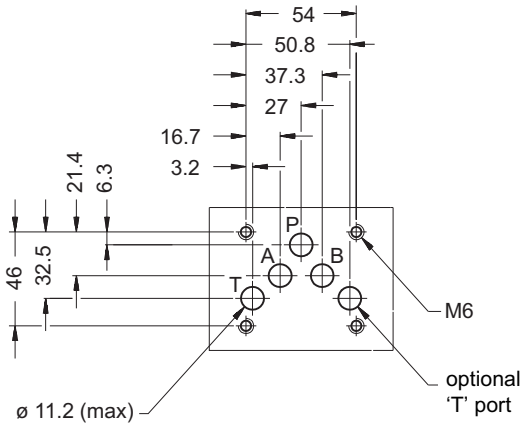
SERIES 10

MODULAR VERSION
ISO 4401-05

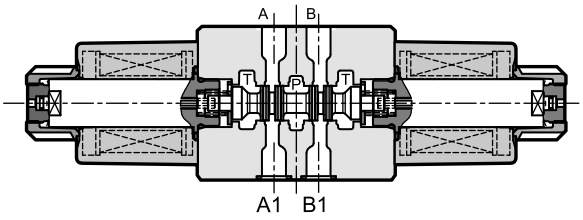
p max **350** bar
Q max **100** l/min

MOUNTING INTERFACE

ISO 4401-05-04-0-05
(CETOP 4.2-4-05-350)



OPERATING PRINCIPLE



— The MDS5 valve is used to switch multiple flow directions, or to select pressure values. Application example here below.

— The flow paths pass right through the entire valve body and due to this particular design, the MDS5 can be assembled with all ISO 4401-05 modular valves.

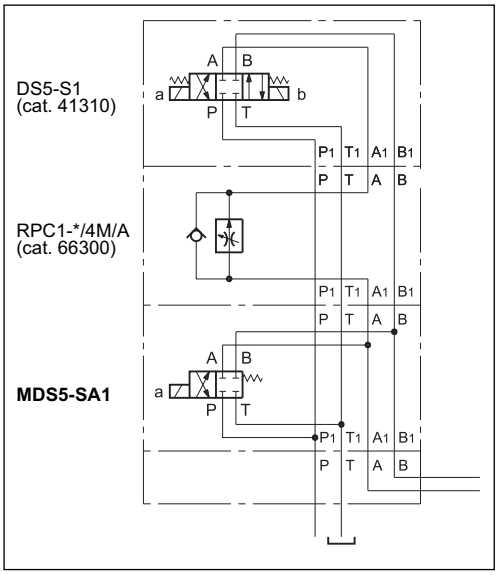
— The special connection of the valve in parallel to the P - T A - B lines of the circuit allows easy construction of different hydraulic configurations, reducing the pressure drops to a minimum.

PERFORMANCES

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

Max operating pressure: P - A - B ports T port (DC version) T port (AC version)	bar	 350 210 160
Maximum flow on P - A - B ports	l/min	100
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: double solenoid single solenoid	kg	4,6 3,7

APPLICATION EXAMPLE



1 - IDENTIFICATION CODE

MDS	5	-		/	10		-		K1	/	

Modular switching valve

Size: ISO 4401-05

Spools (see paragraph 2):
S1 **SA1** **SB1**
TA **TB**

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

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

Option: manual override
Omit for override integrated in the tube (**standard**)
For DC version only:
CM = boot protected.
CK = knob
Details in catalogue 41 330.

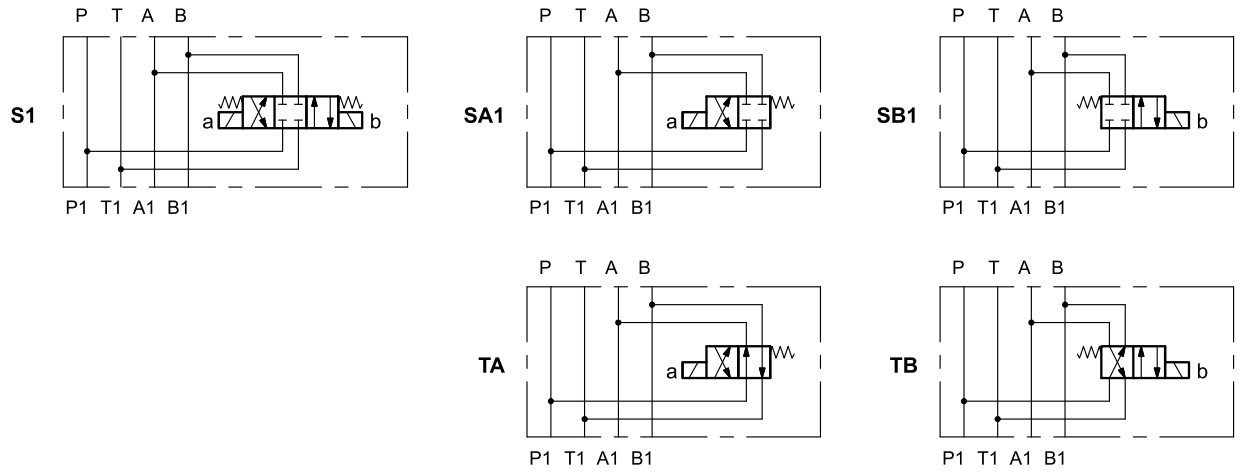
Coil electrical connection
plug for connector type EN 175301-803 (ex DIN 43650)

Power supply:
Details of electrical features are in catalogue 41 330.

DC power supply
D12 = 12 V
D24 = 24 V

AC power supply
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

2 - SPOOLS



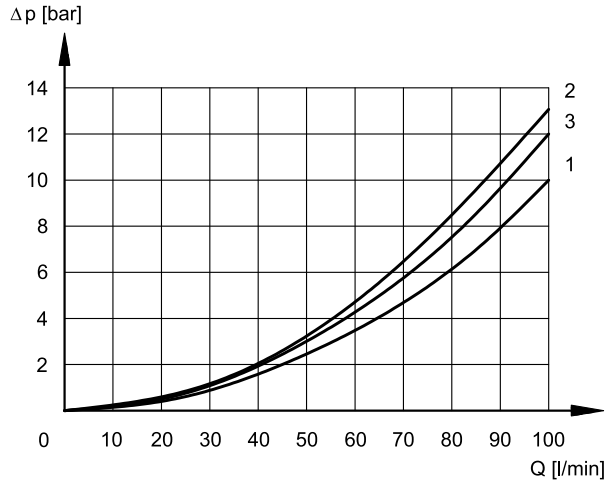
3 - HYDRAULIC FLUIDS

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.

4 - PRESSURE DROPS ΔP-Q

(obtained with viscosity of 36 cSt at 50 °C)



ENERGIZED VALVE

SPOOL	FLOW DIRECTIONS			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPHS			
S1	3	2	1	1

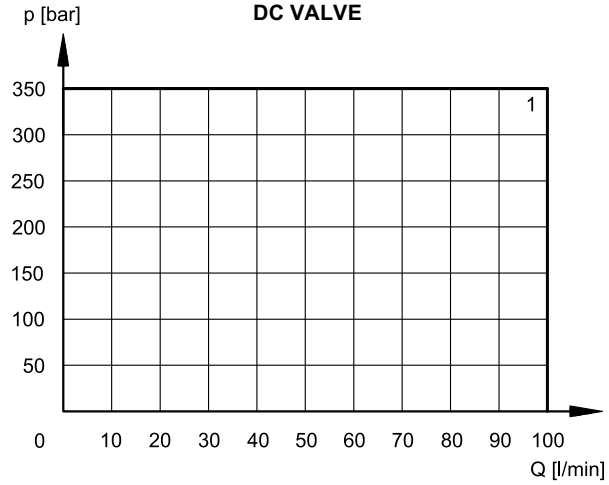
5 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions. 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 according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage. The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.

DC VALVE



SPOOL	CURVE
S1, TA	1

6 - SWITCHING TIMES

The values indicated are obtained with spool S1, according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

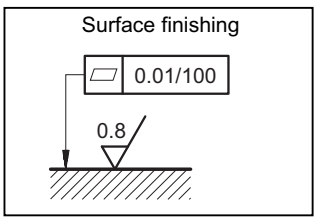
SUPPLY	TIMES (±10%) [ms]	
	ENERGIZING	DE-ENERGIZING
DC	40 ÷ 90	20 ÷ 50
AC	15 ÷ 30	20 ÷ 50

7 - INSTALLATION

The valve can be mounted in any position.

Valve fixing takes place 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.

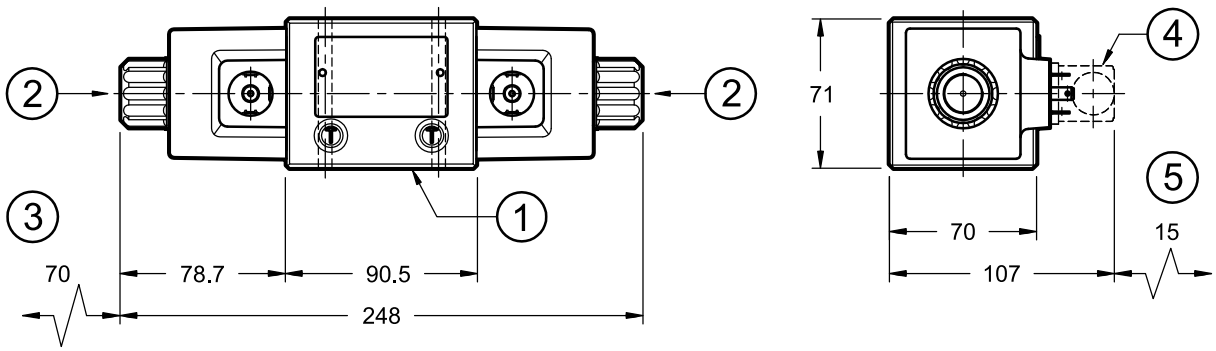
If the minimum values of planarity and/or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.



8 - OVERALL AND MOUNTING DIMENSIONS

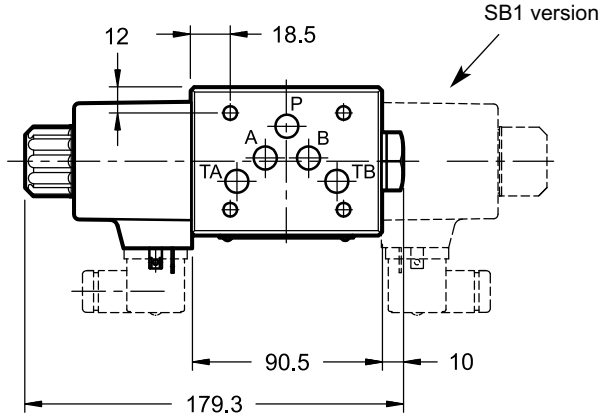
dimensions in mm

MDS5-S1/10*-D*

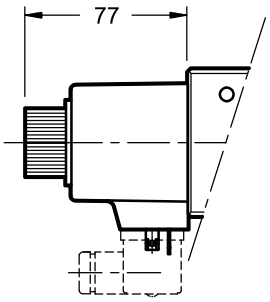


MDS5-TA/10*-D*

solenoid position for TB, SB1 version



MDS5-*/10*-A*



1	Mounting surface with sealing rings: N° 5 OR 2050 (12.42x1.78) - 90 Shore
2	Standard manual override included in the solenoid tube
3	Coil removal space
4	EN 175301-803 (ex DIN 43650) electrical connector to be ordered separately (see cat. 49 000)
5	Connector removal space

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