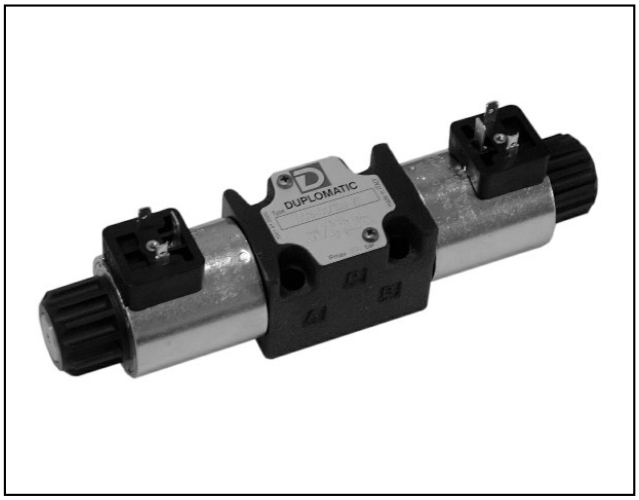
DUPLOMATIC
HYDRAULICS



DS3

SOLENOID OPERATED DIRECTIONAL CONTROL VALVE

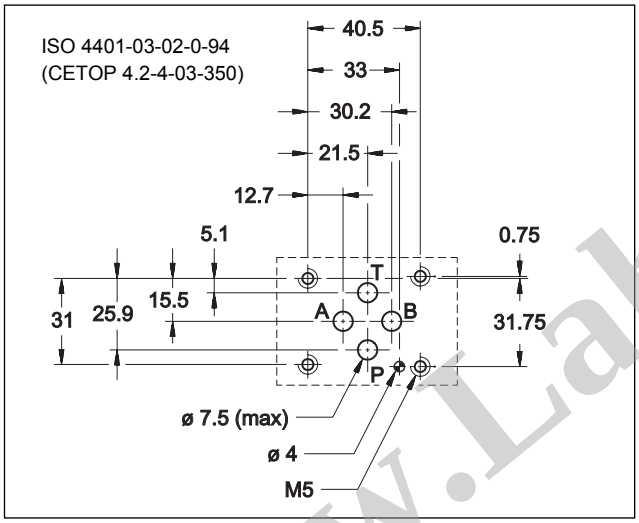
SERIES 10

SUBPLATE MOUNTING
ISO 4401-03 (CETOP 03)

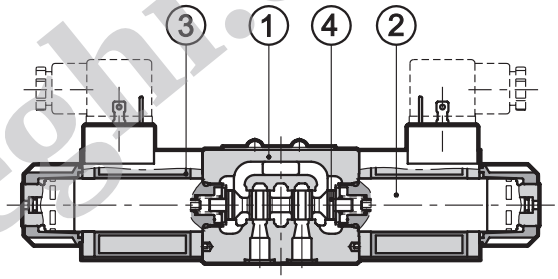
p max **350** bar

Q max **100** l/min

MOUNTING INTERFACE



OPERATING PRINCIPLE



- Direct acting, subplate mounting directional control valve, with mounting surface according to ISO 4401 (CETOP RP121H).

- The valve body ① is made with high strength iron castings provided with wide internal passages in order to minimize the flow pressure drop. Wet armature solenoids ② with interchangeable coils ③ are used (for further information on solenoids see par. 7).

- The valve is supplied with 3 or 4 ways designs, with 2 or 3 positions and with several interchangeable spools ④ with different porting arrangements.

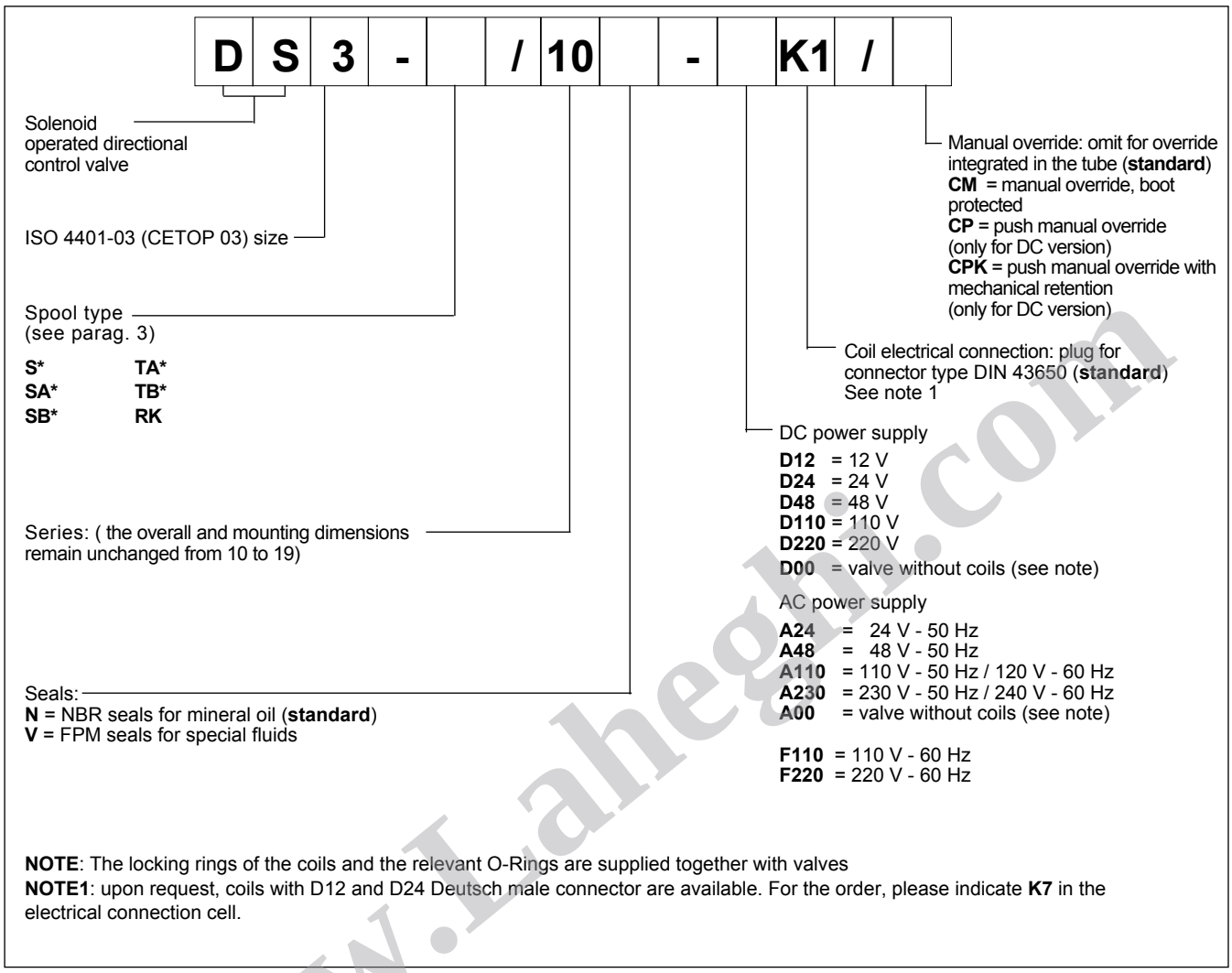
-The valve is available with DC or AC solenoids. DC solenoids can also be fed with AC power supply, by using connectors with a built-in rectifier bridge (see par. 7.2).

- The DC solenoids DS3 directional valve is also available in the following special versions:
  - version with Y external subplate drain port, (see par. 13.2).
  - version with fixed restrictor for soft shifting (see par. 13.3)

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

		CC	CA
Maximum operating pressure Ports P - A - B	bar	350	
Port T standard version	bar	210	160
Port T version with Y port	bar	320	-
Maximum flow rate	l/min	100	90
Pressure drop Δp-Q	see parag. 4		
Operating limits	see parag. 6		
Electrical features	see parag. 7		
Electrical connections	plug for connector DIN 43650		
Ambient temperature range	°C	–20 / +50	
Fluid temperature range	°C	–20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Recommended viscosity	cSt	25	
Fluid contamination degree	according to NAS 1638 class 10		
Mass: single solenoid valve	kg	1,5	1,35
Mass: double solenoid valve	kg	2	1,8

1 - IDENTIFICATION CODE



NOTE: The locking rings of the coils and the relevant O-Rings are supplied together with valves
NOTE1: upon request, coils with D12 and D24 Deutsch male connector are available. For the order, please indicate **K7** in the electrical connection cell.

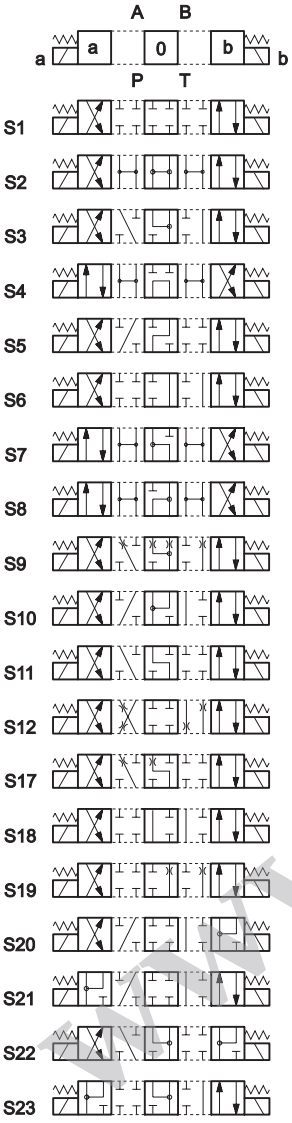
2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HH, HL or HM type, according to ISO 6743-4.
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.

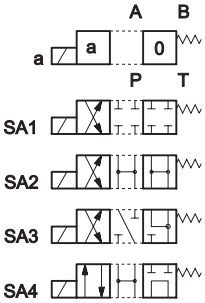
Using fluids at temperatures higher than 70°C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

3 - CONFIGURATIONS

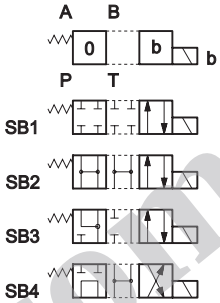
Type **S***:
2 solenoids - 3 positions
with spring centering



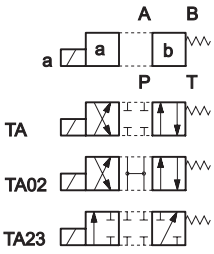
Type **SA***:
1 solenoid side A
2 positions (central + external)
with spring centering



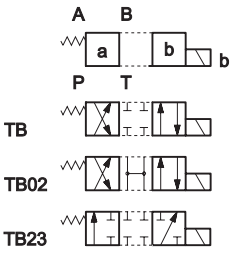
Type **SB***:
1 solenoid side B
2 positions (central + external)
with spring centering



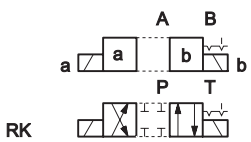
Type **TA**:
1 solenoid side A
2 external positions
with return spring



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

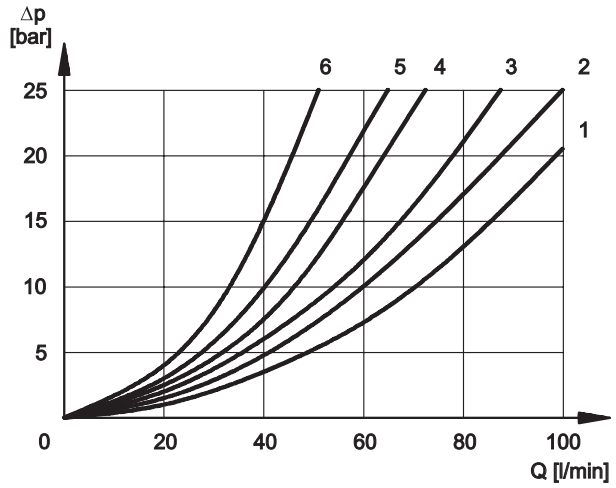


Type **RK**:
2 solenoids - 2 positions
with mechanical retention



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)



For pressure drops between A and B lines of spools S10, S20, S21, S22 and S23, which are used in the regenerative diagram, refer to curve 5.

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	6	6	6	6
S5	2	1	3	3
S6	2	2	3	1
S7, S8	6	6	6	6
S9	2	2	3	3
S10	1	3	1	3
S11	2	2	1	3
S12	2	2	3	3
S17				
S18	1	2	3	3
S19				
S20	1	5	2	
S21	5	1		2
S22	1	5	2	
S23	5	1		2
TA, TB	2	2	2	2
TA02, TB02	2	2	2	2
TA23, TB23	3	3		
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					5
S5		4			
S6				3	
S7, S8					5
S10	3	3			
S11			3		
S17					
S18	4				
S19					
S22			3	3	
S23			3	3	

5 - SWITCHING TIMES

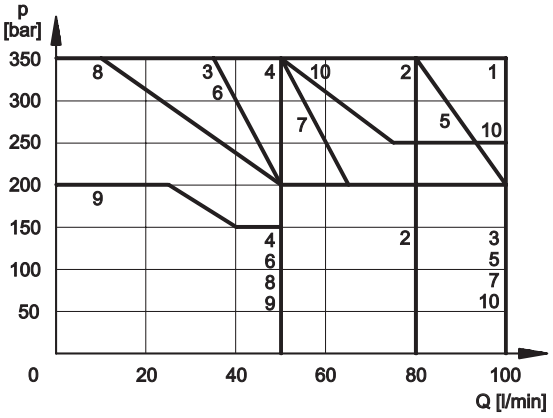
The values indicated are obtained according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

SPOOL TYPE	TIMES	
	ENERGIZING	DE-ENERGIZING
CC	25 ÷ 75 ms	15 ÷ 25 ms
CA	10 ÷ 25 ms	15 ÷ 40 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 value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to NAS 1638 class 7.

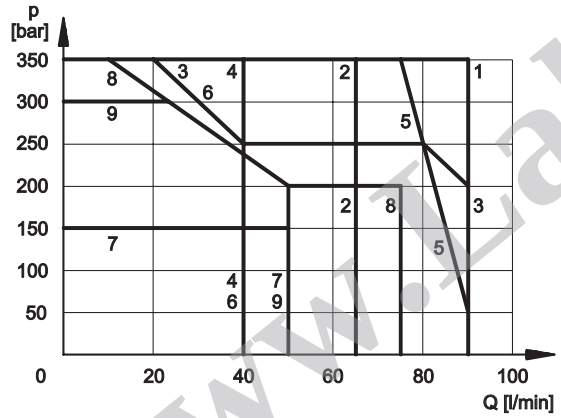
DC SOLENOID VALVE



SPOOL TYPE	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	1	1
S6	6	7
S7	4	4
S8	4	4
S9	10	10
S10	1	1
S11	7	6
S12	1	1

SPOOL TYPE	CURVE	
	P-A	P-B
S17		
S18	1	1
S19		
S20	8*	8
S21	8	8*
S22	9*	8
S23	8	9*
TA, TB	5	5
TA02, TB02	1	1
TA23, TB23	2	2
RK	1	1

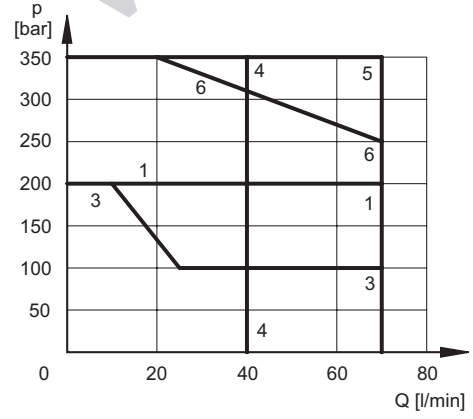
AC SOLENOID VALVE



SPOOL TYPE	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	1	1
S6	3	1
S7	4	4
S8	4	4
S9	1	1
S10	1	1
S11	1	3
S12	1	1

SPOOL TYPE	CURVE	
	P-A	P-B
S17		
S18	1	1
S19		
S20	9*	8
S21	8	9*
S22	7*	6
S23	6	7*
TA, TB	1	1
TA02, TB02	1	1
TA23, TB23	5	5
RK	1	1

AC SOLENOID VALVE with coil A110 fed with 110V - 60 Hz



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

NOTE: The values indicated in the graphs are relevant to the standard solenoid valve. The operating limits can be considerably reduced if a 4-way valve is used with port A or B plugged.
For flow and pressure performances of soft-shifting configuration see par. 13.2.
For DC solenoid valves fed with AC by means of connectors with built-in rectifier bridge, see par. 7.2.

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, and can be rotated 360°, to suit the available space.
Note 1: In order to further reduce the emissions, use of type H connectors is recommended. These prevent voltage peaks on opening of the coil supply electrical circuit (see CAT. 49 000).
Note 2: The IP65 protection degree is guaranteed only with the connector correctly connected and installed.

SUPPLY VOLTAGE FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY	18.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC) **EMISSIONS (note 1)** EN 50081-1 **IMMUNITY** EN 50082-2	in compliance with 89/336 CEE
LOW VOLTAGE	in compliance with 73/23/CEE 96/68/CEE
Class of protection: Atmospheric agents (CEI EN 60529) Coil insulation (VDE 0580) Impregnation: DC valve AC valve	IP 65 **(note 2)** classe H classe F classe H

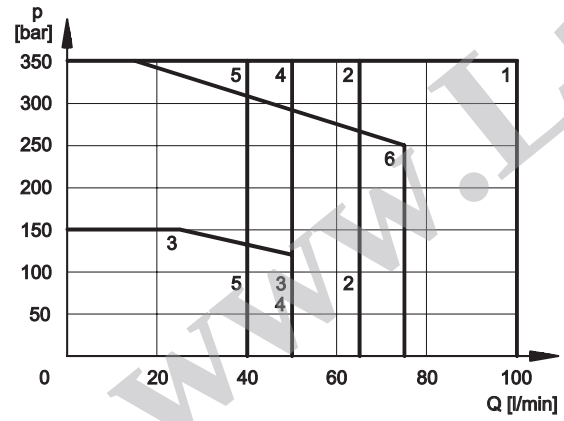
7.2 Current and absorbed power for DC solenoid valve

The table shows current and power consumption values relevant to the different coil types for DC.
The rectified current supply takes place by fitting the valve (with the exception of D12 coil) with an alternating current source (50 or 60 Hz), rectified by means of a bridge built-in to the "D" type connectors (see cat. 49 000), by considering a reduction of the operating limits (see diagram below).

Coils for direct current (values ± 5%)

Suffix	Nominal voltage [V]	Resistance at 20°C [ohm]	Current consumpt. [A]	Power consumpt. [W]	Coil code
D12	12	4,4	2,72	32,6	1902860
D24	24	18,6	1,29	31	1902861
D48	48	78,6	0,61	29,3	1902863
D110	110	423	0,26	28,6	1902864
D220	220	1692	0,13	28,6	1902865

Operating limits for DC solenoid valves fed with AC by means of connectors with built-in rectifier bridge.



SPOOL TYPE	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	6	6
TA, TB	5	5
RK	1	1

7.3 Current and absorbed power for AC solenoid valve

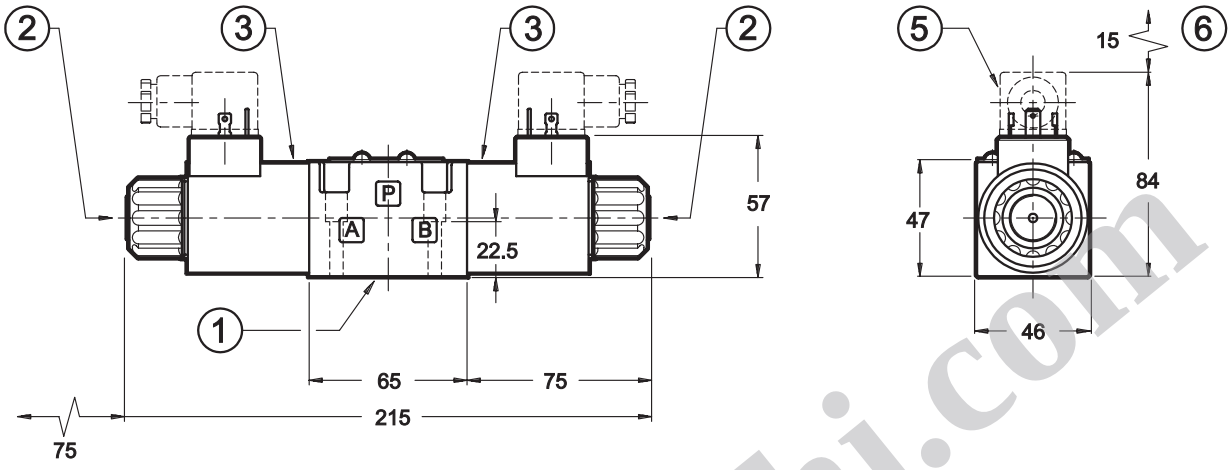
The table shows current and power consumption values at inrush and at holding, relevant to the different coil types for AC current.

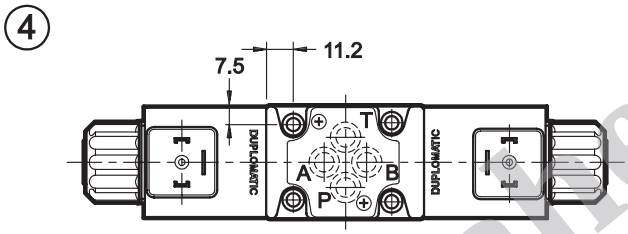
Coils for alternating current (values ± 5%)

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	1,46	8	2	192	48	1902830
A48	48	50	5,84	4,4	1,1	204	51	1902831
A110	110V-50Hz	50/60	32	1,84	0,46	192	48	1902832
	120V-60Hz			1,56	0,39	188	47	
A230	230V-50Hz		140	0,76	0,19	176	44	1902833
	240V-60Hz			0,6	0,15	144	36	
F110	110	60	26	1,6	0,4	176	44	1902834
F220	220		106	0,8	0,2	180	45	1902835

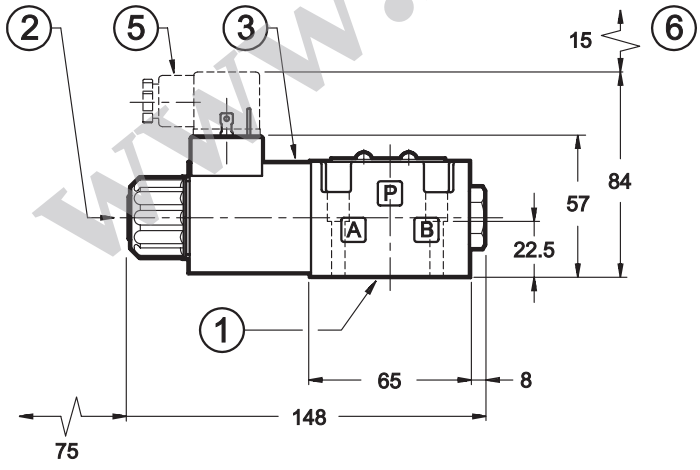
8 - OVERALL AND MOUNTING DIMENSIONS FOR DC SOLENOID VALVES

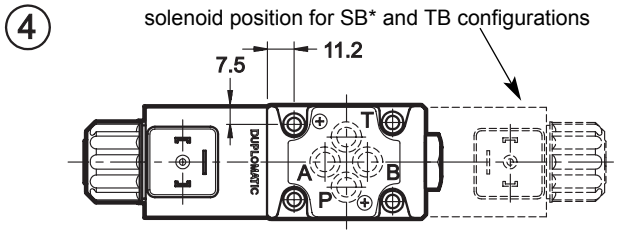
DS3 - S*
DS3 - RK





DS3 - SA*
DS3 - TA





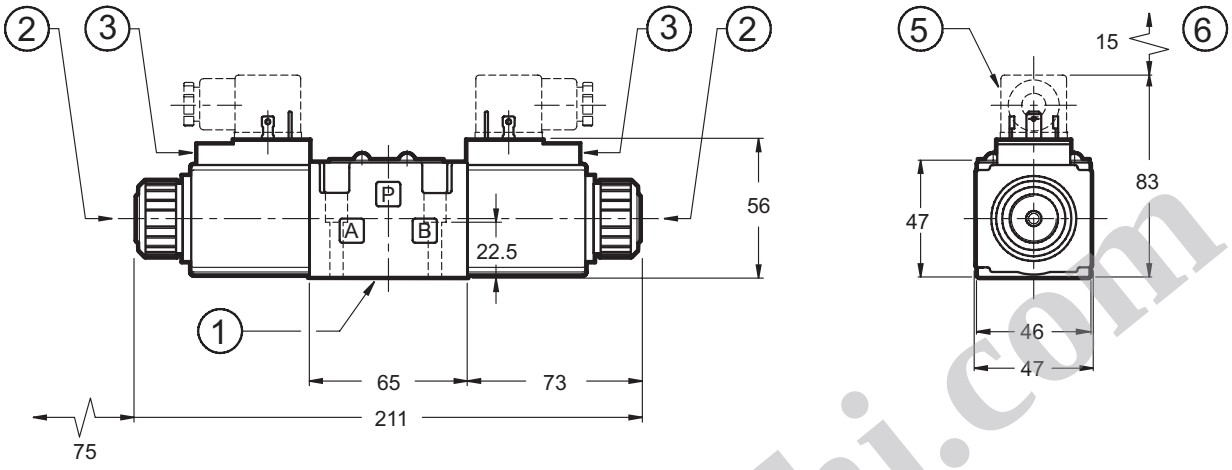
dimensions in mm

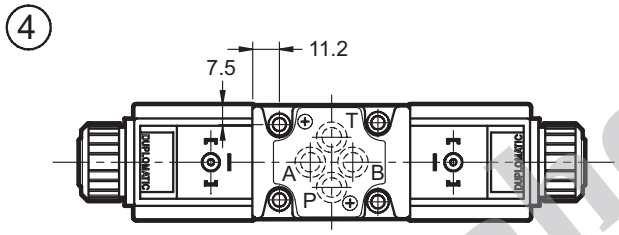
1	Mounting surface with sealing rings
2	Standard manual override included in the solenoid tube
3	Coil (90° revolving)
4	Coil removal space
5	DIN 43650 electrical connector to be ordered separately (see cat. 49 000)
6	Connector removal space

See par. 16 for fastening bolts and sealing rings

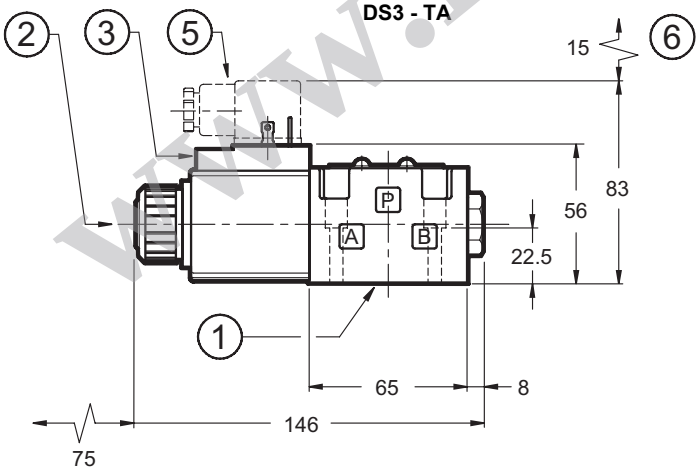
9 - OVERALL AND MOUNTING DIMENSIONS FOR AC SOLENOIDS VALVES

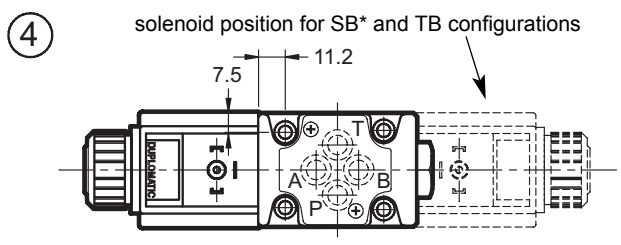
DS3 - S*
DS3 - RK





DS3 - SA*
DS3 - TA





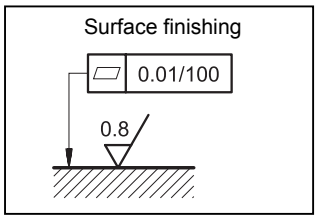
dimensions in mm

1	Mounting surface with sealing rings
2	Standard manual override included in the solenoid tube
3	Coil (90° revolving)
4	Coil removal space
5	DIN 43650 electrical connector to be ordered separately (see cat. 49 000)
6	Connector removal space

See par. 16 for fastening bolts and sealing rings

10 - INSTALLATION

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



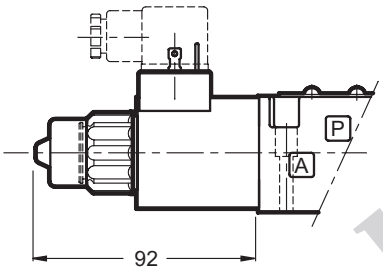
11 - ELECTRIC CONNECTORS

The solenoid operated valves are delivered without the connectors. They must be ordered separately.
For the identification of the connector type to be ordered, please see catalogue 49 000.

12 - MANUAL OVERRIDES

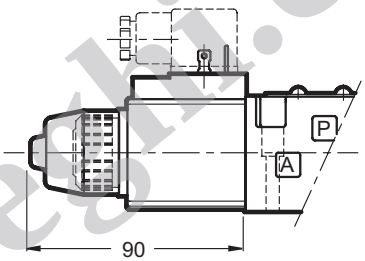
12.1 - CM-DS3/10 Manual override, boot protected

Version for DC solenoid valve



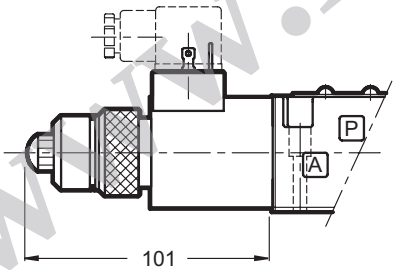
Code: 3401150001

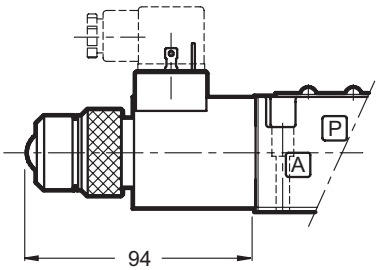
Version for AC solenoid valve



Code: 0119334

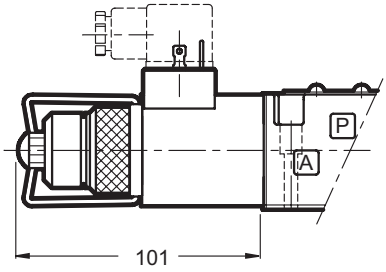
12.2 - CP-DS3/10 Push manual override (only for DC solenoid valve)

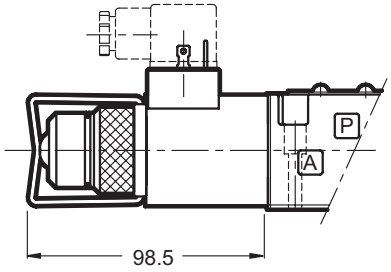




Code: 3401150005

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

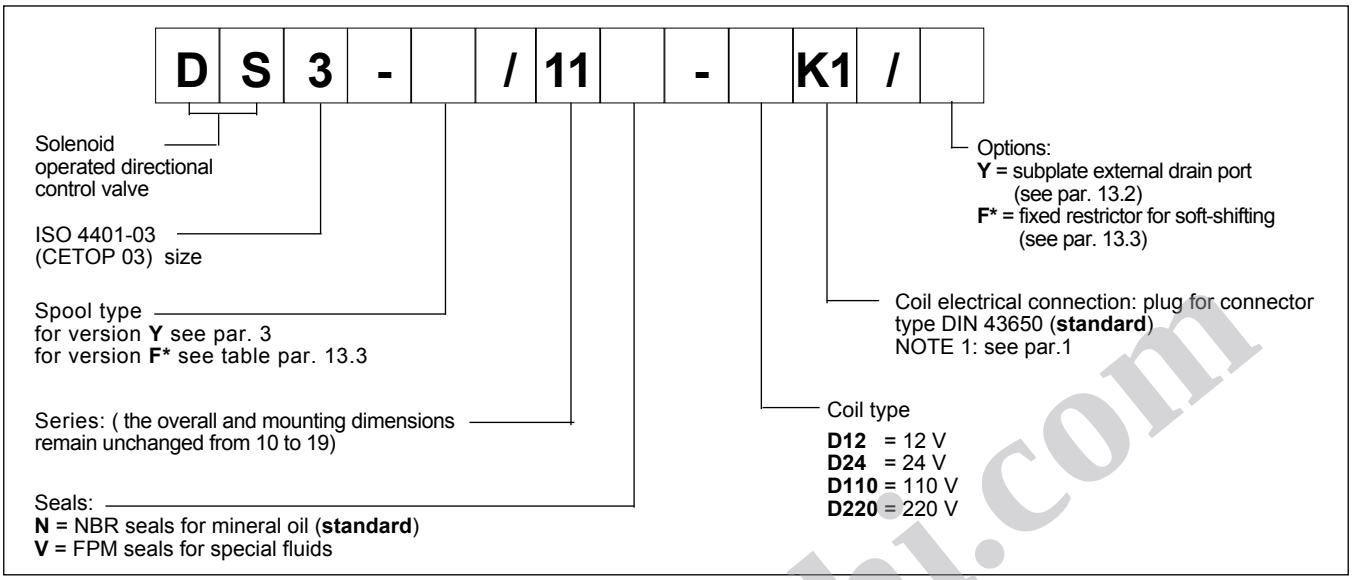




Code: 3401150004

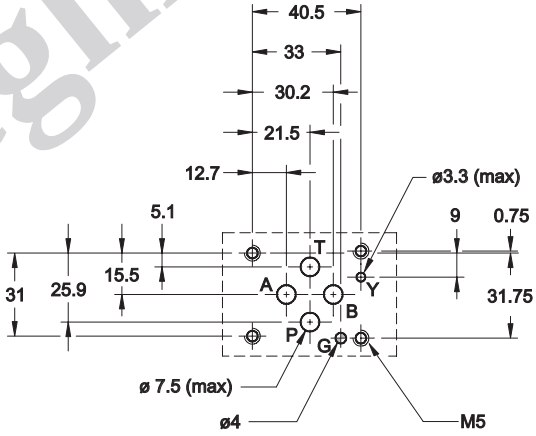
13 - SPECIAL VERSIONS FOR DC SOLENOID VALVE

13.1 - Identification code



13.2 - Subplate external drain port (option /Y)

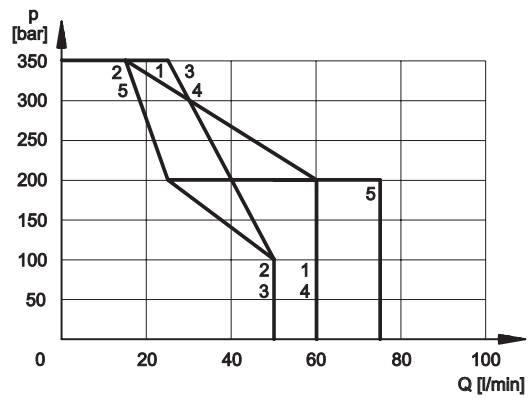
This version allows the operation with pressures up to 320 bar on the valve T port.
It is a drain port Y realized on the valve mounting interface in compliance with ISO 4401-03-03-0-94 standards. The Y port is connected with the solenoid chamber: in this way the tubes are not stressed by the pressure operating on the valve T port.



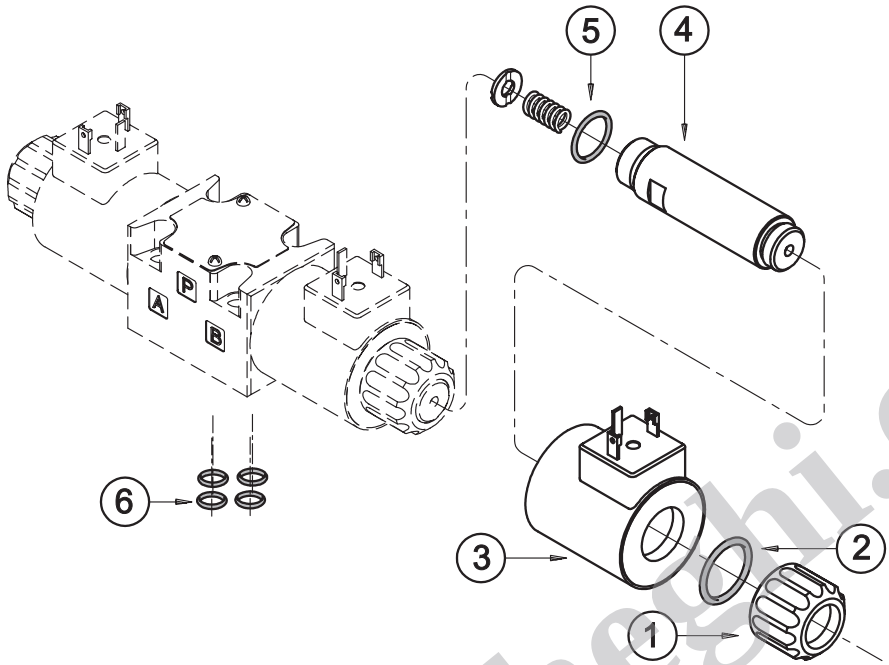
13.3 - Fixed restrictor for soft-shifting (option /F*)

This version enables hydraulic actuators to perform a smooth start and stop by reducing the speed of movement of the valve spool.
The spool speed is reduced by means of restrictors with a calibrated orifice installed in the valve body. These restrictors can't be replaced.
The diagram on the side shows the operating limits of the spools available in the soft-shifting version (Note: for this version, the S9 spool must be used instead of the S3 one).
The table on the side shows the switching times. The values indicated are obtained according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.
The shifting time, with the same calibrated orifice, is influenced by the viscosity (and thus by the temperature) of the operating fluid. Moreover, de-energizing times can vary according to the flow rate and operating pressure values of the valve.
For the correct functioning of the soft-shifting, ensure that the solenoid tubes are always filled with oil. For this purpose, we recommend to install a backpressure valve set at 1 ÷ 2 bar on T line.

SPOOL TYPE	CURVE		RESTRICTOR	TIMES	
	P-A	P-B	TYPE	ENERGIZING	DE-ENERGIZING
S1, S12	1	1	F**08**	150	200 ÷ 400
S2	2	2	F**08**	200	100 ÷ 400
S4, S7, S8	3	3	F**06**	150	200 ÷ 500
S9	4	4	F**08**	150	150 ÷ 400
TA, TB	5	5	F**08**	100 ÷ 400	100 ÷ 900
TA02, TB02	2	2	F**08**	100 ÷ 700	150 ÷ 900



14 - SPARE PARTS FOR DC SOLENOID VALVE



①	Coil locking ring with seal included cod. 0119412
②	O-Ring type ORM-0220-20 - 70 shore
③	Coil (see identification code on the side)
④	Solenoid tube TD22-DS3/10N (NBR seals) TD22-DS3/10V (FPM seals) Note: the solenoid tube is supplied with O-Ring rif. ⑤
⑤	O-Ring type 2062 - 70 shore
⑥	N. 4 O-Ring type 2037 - 90 shore

DC COILS IDENTIFICATION CODE

C	22	-		K1	/	10

Supply voltage

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

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

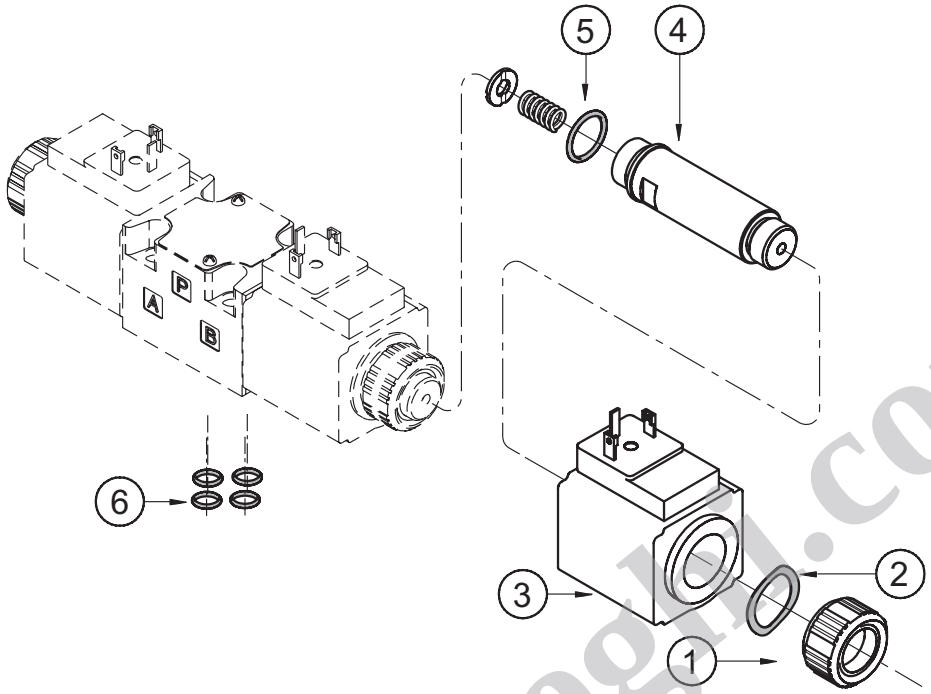
Series no.: (the overall and mounting dimensions remain unchanged from10 to 19)

SEALS KIT

The codes here below include O-Ring rif. ② ⑤ ⑥

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

15 - SPARE PARTS FOR AC SOLENOID VALVE



①	Coil locking ring cod. 0119333
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: the solenoid tube is supplied with O-Ring rif. ⑥
⑤	O-Ring type 2062 - 70 shore
⑥	N. 4 O-Ring type 2037 - 90 shore

SEALS KIT

The codes here below include O-Ring rif. ② ⑤ ⑥

Cod. 1985411 NBR seals
Cod. 1985412 FPM (viton) seals

AC COILS IDENTIFICATION CODE

C	20.6	-		K1	/	10

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 DIN 43650 (**standard**)

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

16 - VALVE FASTENING BOLTS

N. 4 fastening bolts type TCEI M5x30 (12.9 class recommended)
Tightening torque 5 Nm

17 - SUBPLATES (See catalogue 51 000)

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

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