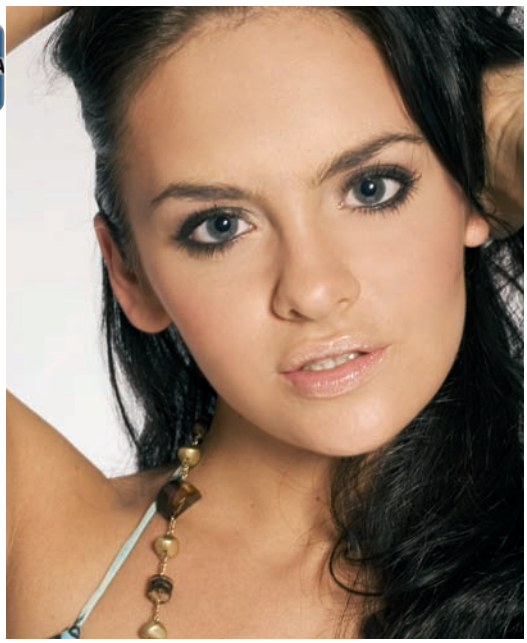
VALVES SOLENOID

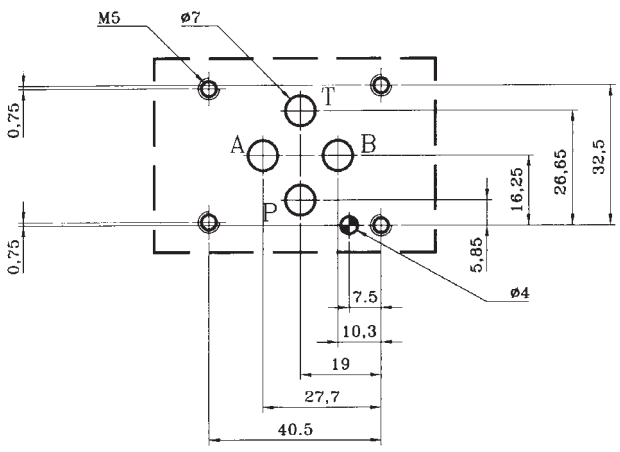
FT3 ES
FT5 ES

TOGNELLAGROUP

TOGNELLA

New generation of solenoid valves devise
with the purpose to meet all the
technical problems about machines tool,
moving and agricultural machines.
The estimated manufacture is with 5
chambers with the tight spool in different points,
so it is possible to: stand better
the hydraulic thrusts, be more steady,
be less exposed to mechanic wear
and tear on the regulating edge, in this way
the hydraulic working turn out much more reliable.
Besides the inside passages arrange
the addressing of the fluid so that
the negative effect of the hydrodynamic force
is reduced at minimum.
The last generation of solenoid has
two main characteristic:
the magnetic part has a big diameter
so that it hasn't a too much high magnetic
flux density;
the supplied solenoids are interchangeable
in the different versions:
12/24/110/115/230 Volt.




M5
ø7
T
A
B
P
0,75
0,75
16,25
26,65
32,5
5,85
ø4
7.5
10,3
19
27,7
40.5

1 HOW TO READ THE MODEL CODE FOR VALVES FT3 - ES - *

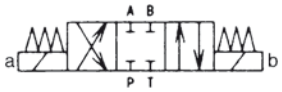
FT3 - ES - (1) (C) - * - (024C) / 10

1 2 3 4 5 6 7

1	FT3	4-way directional control valve Cetop 03 - Pressure 32 Mpa (320 bar)
2	ES	electrically controlled, standard
3	(1)	spool type (see 7)
4	(C)	solenoid(s) and spring(s) arrangement, see also functional symbols 2 C 2 sol., spool is spring centered (3 position) N 2 sol., spool is detented(2 position) see 13 LL 1 sol. (a), spool is spring offset (2 position, end to end) ML 1 sol. (a), spool is spring offset (2 position, middle to end) LM 1 sol. (a), spool is spring offset (2 position, end to middle)
5	*	Code reserved for option and variants b only for version LL, ML, LM sol. b installed (instead of sol. a) T soft shifting device, see 14 S-** calibrated orifice on P port, see 15 K water proof caps on emergency pin, see 16 ZC zinc plated valve, see 17
6	(024C)	Electric voltage and solenoid coils 0000 no coil(s) 012C coil(s) for V12DC 024C coil(s) for V24DC 115A coil(s) for V110/50 - V 115/60 AC 230A coil(s) for V220/50 - V 230/60 AC See also electric characteristics 6
7	Design number (progressive) of the valves	

2 FUNCTIONAL SYMBOLS

1C



1N

1LL

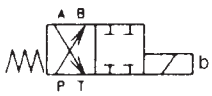
1LLb

1ML

1MLb

1LM

1LMb



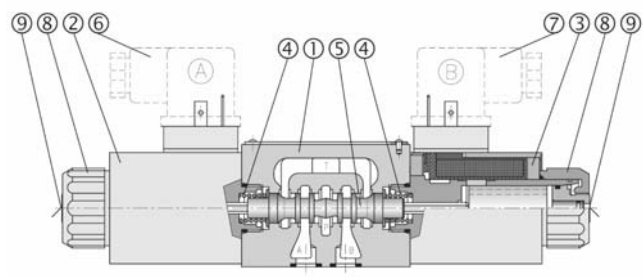
3 DESCRIPTION

DIRECTIONAL CONTROL VALVES SOLENOID OPERATED - CETOP 03 TYPE FT3 - ES - *

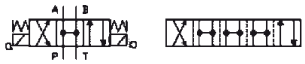
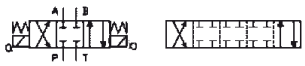
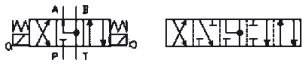
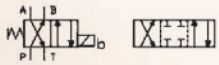
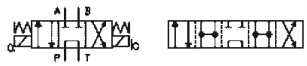
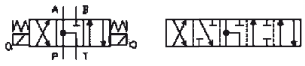
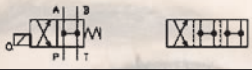
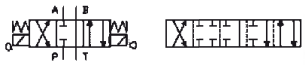
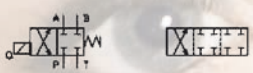
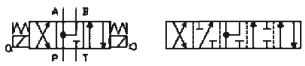
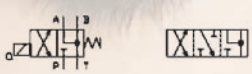
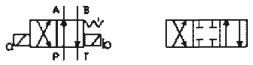
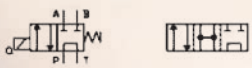
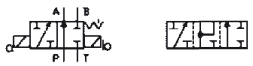
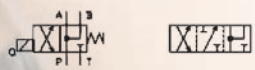
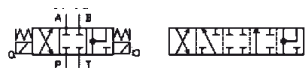
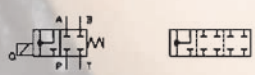
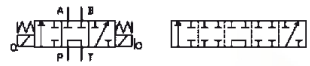
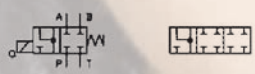
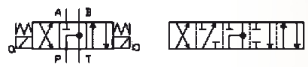
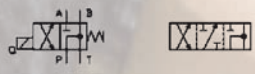
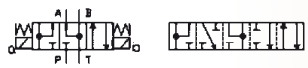
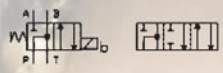
The spool ⑫ shifts in to the valves body ⑪ subject to the action of springs ⑬ and solenoids ① ② .

Spool ⑫ , depending from its shape and its position in the valves body ⑪ , opens and/or closes passages between P, A, B, T ports, thus controlling the direction of the hydraulic flow.

Solenoids ① and ② are energized by electric current flowing-in through connectors ③ and ④ ; in case of electric cut-offs, the spool can be manually shifted by acting on the emergency pins ⑤ , located at the end of the solenoids and accessible through the retaining nuts ⑩ .



4 SPOOL TYPE AND INTERMEDIATE POSITION TRANSITORIES

0C			0LL		
1C			1LL		
3C			1LLb		
4C			2LL		
55C			0ML		
7C			1ML		
8C			3ML		
1N			4ML		
2N			8ML		
19C			18ML		
42C			13ML		
56C			56ML		
38C			56MLb		

5 TECHNICAL DATA

Maximum nominal flow	1dm³/s (60 l/min)
Maximum rec. flow rate	see 9
Maximum nominal pressure (P, A, B)	32 Mpa (320 bar)
Maximum pressure at T port	16 Mpa (160 bar)
Pressure drops	see 4
Electric characteristics	see 6
Protection to DIN 40050	IP 65
Duty cycke	100%
Service life	≥ 107 cycles
Dimensions	see 10
Installation	see 11
Mass	approx. 1,6/2,1 kg

6 INSTALLATION

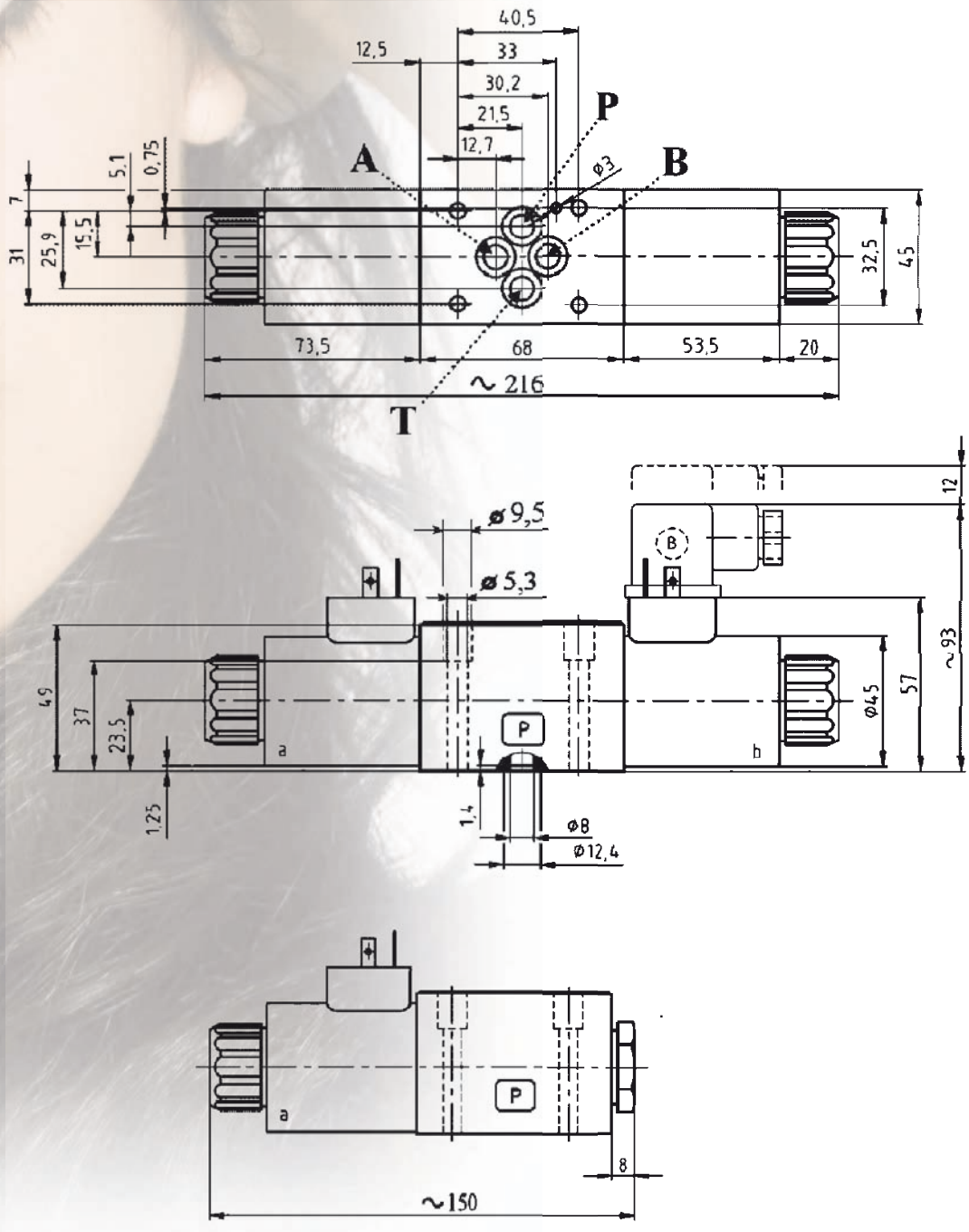
All valves FT3 - * conform ISO and CETOP specifications for mounting surface dimensions (see also front page) and for valves height. When assembled to its mounting plate valve FT3 - * must be fastened with 4 bolts M5 x 45 mm (or M5 x ** according to the number of modules) tightened at 8 Nm torque. Leakage between valve and mounting surface is prevented by the positive compression on their seats of 4 seals of QUAD/O Ring type 9,25x1,68x1,68. Solenoid valves can be supplied without electric coils, as FT3 - ES - ** - 0000 -.
Coils are supplied separately; standard, 3 electric pins, coils are BO3 - 012C, BO3 - 024C, BO3 - 115A and BO3 - 230A.
Connections to the electric supply is made by standard 3-PIN connectors, according to ISO 4400 (DIN 43650).
Connectors can be with different cable exit size (PG9, PG11) and beside of the plain connecting function they may incorporate various features like
- signal led
- voltage surge suppressor, etc.

7 HYDRAULIC FLUIDS

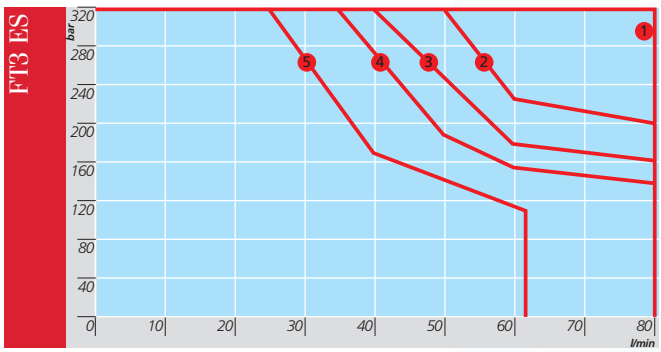
Seals and materials used on standard valves FT3 - * are fully compatible with hydraulics fluids of mineral oil base, upgrade with antifoaming and antioxidant agents.
The hydraulic fluid must be kept clean and filtered to ISO 4406 class 19/17/14, or better, and used in a recommended viscosity range from 10 cSt to 60 cSt.

8 INSTALLATION DIMENSIONS

All dimensions are mm



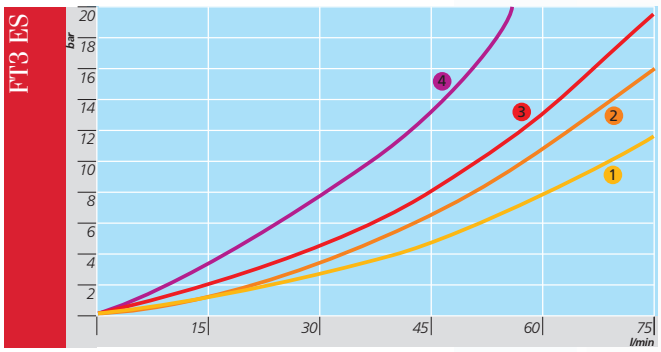
9 HYDRAULIC LIMITS OF USE



P/Q characteristics limits for safe use of FT3 - ES - * solenoid operated valves.
Limit curves apply to sol. valves energized with rated voltage - 5% and flush

1 = FT3 - ES - 0C; - 1C; - 1N; - 1ML; - 8C
2 = FT3 - ES - 3C; - 2
3 = FT3 - ES - 1LL; - 1LLb
4 = FT3 - ES - 0LL
5 = FT3 - ES - 4C

10 TYPICAL DIAGRAMS



Typical Δp-Q curves for valves HD3-ES in standard configuration with mineral oil at υ=32mm²/s and t=40°C.

Spool	P-A	P-B	A-T	B-T	P-T
0C	1	1	2	2	1
0LL	1	1	2	2	-
0ML	-	1	2	-	1
1C	1	1	2	2	-
1LL	1	1	2	2	-
1LLb	1	1	2	2	-
1ML	-	1	2	-	-
1N	1	1	2	2	-
3C	1	1	2	2	-
4C	3	3	4	4	1
8C	1	1	2	2	-

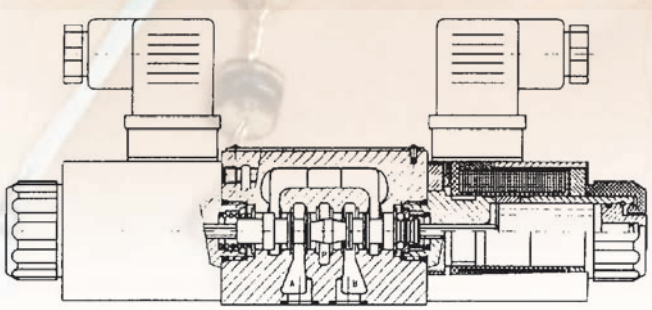
11 SOLENOIDS

Solenoid valves can be supplied without electric coils, as HD3-ES-*-0000.
Coils are supplied separately ; standard, 3 electric pins, coils are :
BO3 - 012 C
BO3 - 024C
BO3 - 115A
BO3 - 230A

Connections to the electric supply is made by standard 3-PIN connectors, according to ISO 4400 (DIN 43650).
Connectors can be with different cable exit size (PG9, PG11) and beside of the plain connecting function they may incorporate various features like :
- Signal led
- Voltage surge suppressor, etc…

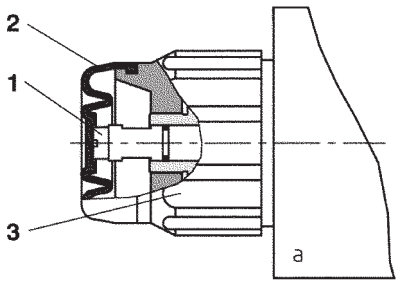
12 VERSION "N": MECHANICAL DETENT ON SPOOL

Solenoid valves with detent typically are 2 position, 2 solenoid, no-spring valve where the spool is kept at the extreme ends of its stroke by a mechanical device. This permits that solenoids are energized by its position regardless of forces due to hydrodinamics or gravitation/inertial effects (vibrations).



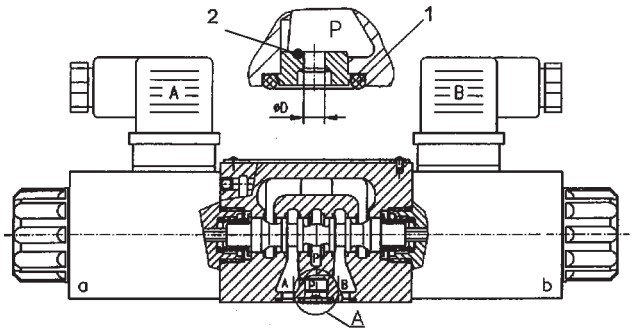
13 VERSION "T": SOFT SHIFTING

Solenoid valves with "soft shifting" devices are 2 or 3 position valves controlled by solenoids Å and Ç which incorporate calibrated orifices in the armature plungers.
The hydraulic controls on the shifting speed of the plunger, and therefore of the spool (129 in the valve's body, permit progressive transitories, thus reducing, thus reducing or eliminating qater hammer effects in the circuit. Typically the shifting time of a "T" version solenoid valve is, when energized, in the order of 300_500 ms (versus 30_50 ms of a standard valve) provided that the armature plunger properly works in the bleeding the air from the solenoid acting on purge's valve Ö, which is protected by cover (15), and by assuring a minimum counter pressure on T line.



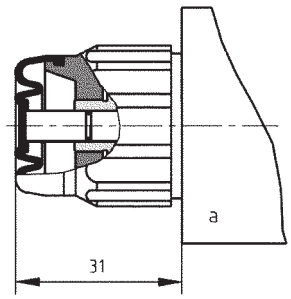
14 VERSION "S": CALIBRATED ORIFICE ON P PORT

Option "S*" is represented by elements ②, suitably shaped to be inserted on p port of the solenoid valve, having a calibrated orifice (of various sizes9 able to restrict, at the requested ΔP value, the flow rate entering the solenoid valve.
Those elements have following orifice diameter:
3S - 10 →D = 1 mm
3S - 20 →D = 2 mm
3 S - 25→D = 2,5 mm
and are kept sealed on the P port of the valve by an OR ① of 9,25x1,78 mm sizes (example OR 110 - 2037).



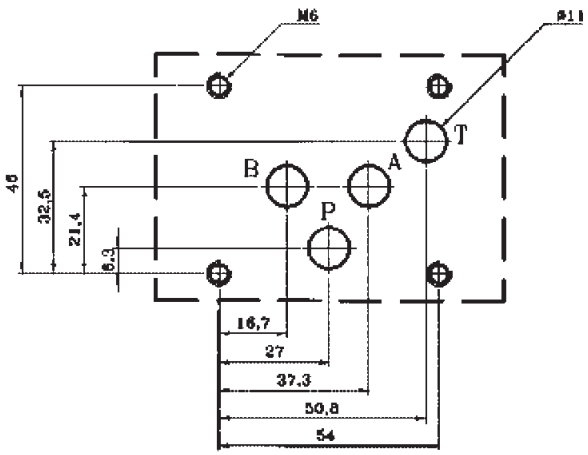
15 VERSION "K": EXTENDED EMERGENCY PIN

Solenoid valves according to "K" version have extended emergency actuator pins protruding from the solenoid shape, that permit a quick and easy "hand operation" of the valves, without the need of any tool. The actuator pin and the end of the solenoid are protected by a flexible rubber cap that makes easy operation and protects from moisture and water splashes.



16 ANTICORROSION OPTIONS

On HD3-ES-* standard valves the body is phosphate coated, the solenoid tubes are
not treated and coils mantel and irons are zinc trivalent plated.
To increase the resistance to corrosive agents different variants are available :
ZT Body, solenoid tubes and coils irons are zinc trivalent plated
ZL Body is coated with special TEMADUR 40 zinc painting
Solenoids have 8-12 µm zinc plating
ZK Body is coated with special TEMADUR 40 zinc painting
Solenoids tube and coils irons are "zinc-nickel" plated


M6
Ø11
T
B
A
P
45
32,5
21,4
6,3
16,7
27
37,3
50,8
54

1 HOW TO READ THE MODEL CODE FOR VALVES FT5 - ES - *

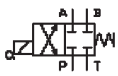
FT5 - ES - (1) (C) - * - (024C) / 20

1 2 3 4 5 6 7

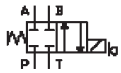
1	FT5	4-way directional control valve Cetop 05 - Pressure 32 Mpa (320 bar)
2	ES	electrically controlled, standard
3	(1)	spool type (see 4)
4	(C)	solenoid(s) and spring(s) arrangement, see also functional symbols 2 C 2 sol., spool is spring centered (3 position) N 2 sol., spool is detented(2 position) LL 1 sol. (a), spool is spring offset (2 position, end to end) ML 1 sol. (a), spool is spring offset (2 position, middle to end) LM 1 sol. (a), spool is spring offset (2 position, end to middle)
5	*	Code reserved for option and variants b only for version LL, ML, LM sol. b installed (instead of a) T* soft shifting device (see 14 and 15) K water proof caps on override pin (see 16) Z* anti corrosion variants (see 17) DR solenoid (s9 chamber draining (see 17)
6	(024C)	Electric voltage and solenoid coils (see 10, 11 and 12)
7	Design number (progressive) of the valves	

2 FUNCTIONAL SYMBOLS

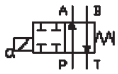
1C 

1ML 

1N 

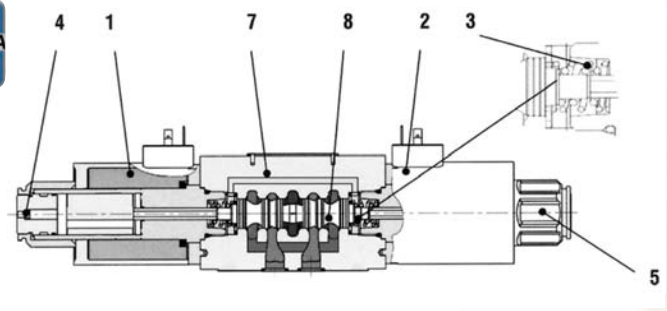
1MLb 

1LL 

1LM 

1LLb 

1LMb 

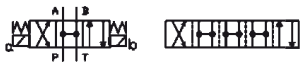
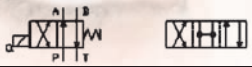
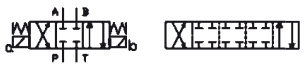
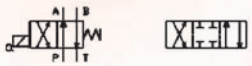
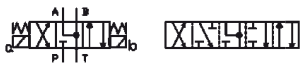
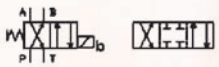
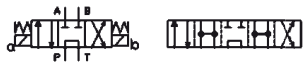
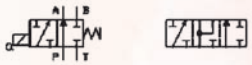
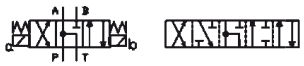
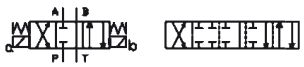
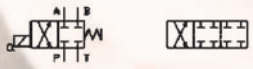
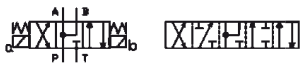
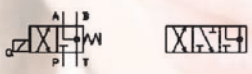
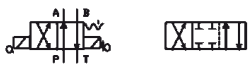
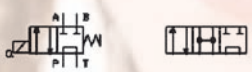
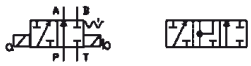
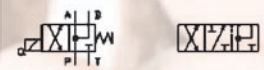


3 DESCRIPTION

DIRECTIONAL CONTROL VALVES SOLENOID OPERATED - CETOP 05 TYPE FT5 - ES - *

The spool ⑧ shifts in to the valves body ⑦ subject to the action of springs ③ and solenoids ①②.
Spool ⑧, depending from its shape and its position in the valves body ⑦, opens and/or closes passages between P, A, B, T ports, thus controlling the direction of the hydraulic flow.
In case of electric cut-offs, the spool can be manually shifted by acting on the override pins ④, located at the end of the solenoids and accessible through the retaining nuts ⑤.

4 SPOOL TYPE AND INTERMEDIATE POSITION TRANSITORIES

0C		0LL	
1C		1LL	
3C		1LLb	
4C		2LL	
55C		0ML	
7C		1ML	
8C		3ML	
1N		4ML	
2N		8ML	

5 TECHNICAL DATA

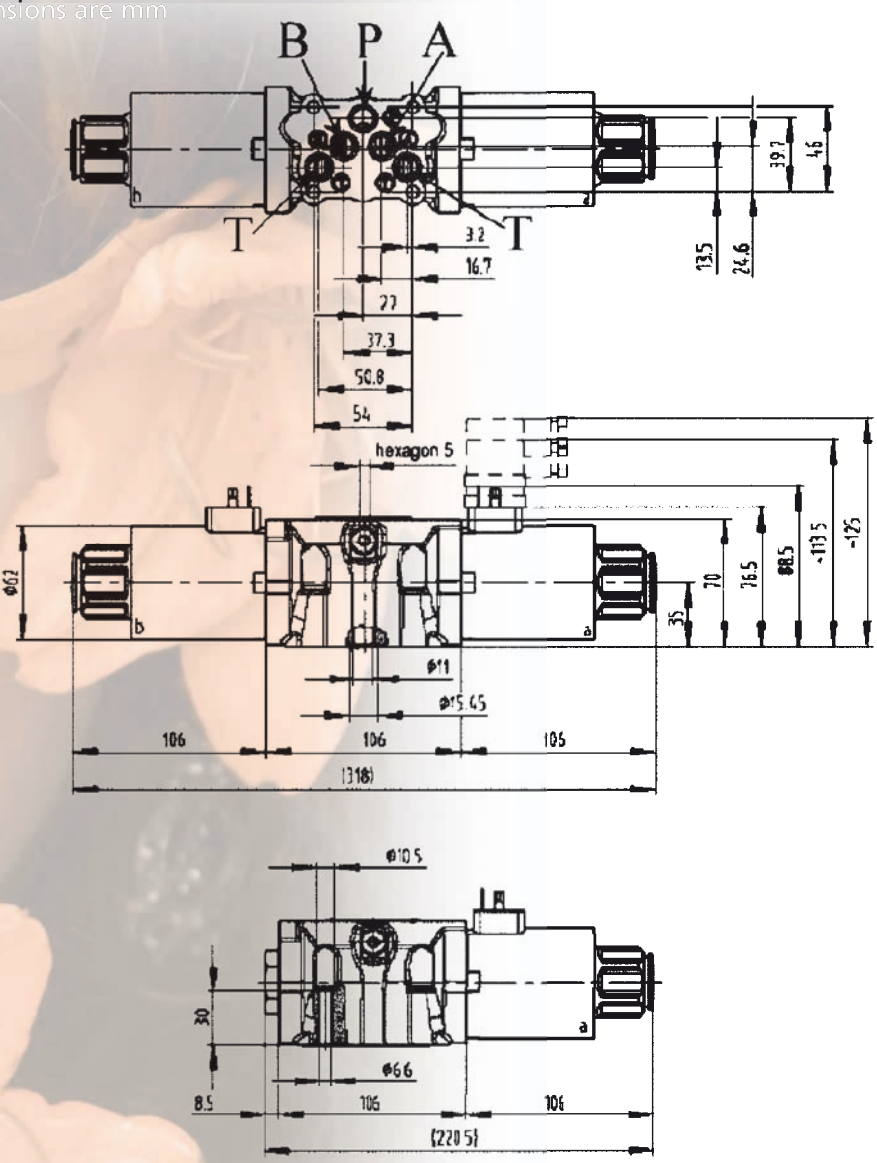
Nominal flow	120 l/min
Maximum rec. flow	see
Nominal pressure (P, A, B)	32 Mpa (320 bar)
Maximum rec. pressure (P, A, B)	35 Mpa (350 bar)
Maximum rec. pressure at T port	21 Mpa (210 bar)
Pressure drops	see
Protection to DIN 40050	IP 65
Duty cycle	100%
Service life	≥ 107 cycles
Mass	1 sol. 3,9 kg 2 sol. 5,4 kg

6 INSTALLATION

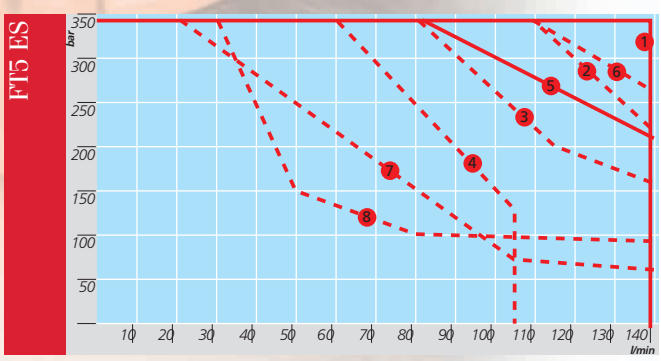
All valves FT5 - ES - * conform with ISO and CETOP specifications for mounting surface dimensions and for valves height.
When assembled to its mounting plate valve FT5 - ES - * must be fastened with 4 bolts M6x40 mm (or M6 x * according to the number of modules) tightened at 12 Nm torque.
Leakage between valve and mounting surface is prevented by the positive compression on their seats o 5 seals of Quad-Ring type 12,42 x 1,68 x 1,68 mm.

7 INSTALLATION DIMENSIONS

All dimensions are mm



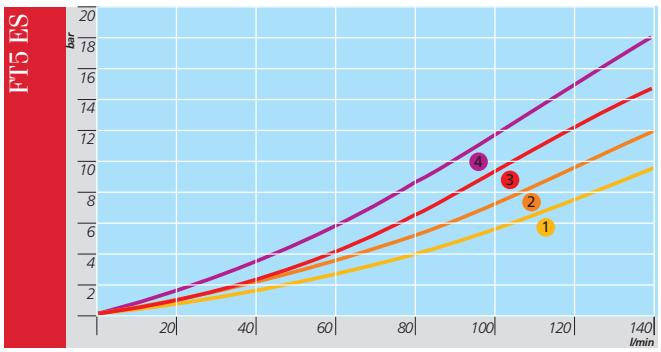
8 HYDRAULIC LIMITS OF USE



p/Q characteristics limits for safe use of FT5 - ES - * solenoid operated valves. Limit curves apply to solenoid valves energized with rated voltage - 5% and flushed with hydraulic fluid with properties according to.

Spool type	Limits
OC	1
1C	
8C	
0ML	
1ML	
8ML	
3C	5
3ML	
4C	3
55C	7
7C	4
1N	6
2N	8
0LL	2
1LL	2
1LLb	2
2LL	8
4ML	3

9 TYPICAL DIAGRAMS



Typical Δp curves for valves FT5 - ES - *, with mineral oil at v = 32 mm²/s and t = 40° C, for flow P→A/B, A/B→T and P→T

Spool type	P-A	P-B	A-T	B-T	P-T
OC	1	1	2	2	1
1C	1	1	2	2	-
3C	1	1	2	2	-
4C	3	3	4	4	1
55C	1	1	1	2	2
7C	1	1	2	2	-
8C	1	1	2	2	-
1N	1	1	2	3	-
2N	1	1	-	-	-
OLL	1	1	1	3	-
1LL	1	1	2	2	-
1LLb	1	1	2	2	-
2LL	1	1	-	-	-
0ML	-	1	2	-	1
1ML	-	1	2	-	-
3ML	-	1	2	-	-
4ML	3	-	-	4	1
8ML	-	1	2	-	-

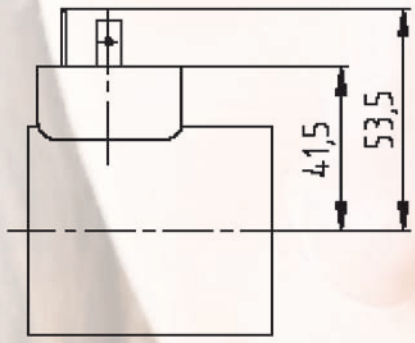
10 SOLENOID COILS, WITH STANDARD ELECTRIC CONNECTION TO ISO 4400/DIN 43650, FOR DC SUPPLY

Standard valves type FT5 - ES - * are operated by solenoid that are energized directly from a D.C. voltage supply. Solenoid valves can be supplied without electric coils as FT5 - ES - * - 0000 and coils can be supplied separately as B05 - ***C

DIRECTLY FROM D.C. SUPPLY

Voltage	*Valve code*	*Coil code*	*Nominal current (A)*
V12 DC	**FT5 - ES - * - * - 012C**	**B05-012C**	3,17
V24 DC	**FT5 - ES - * - * - 024C**	**B05- 024C**	1,73

Permissible supply voltage variation: +5% -10%
Special voltages available: V 48 DC, V 106 DC, V 205 DC



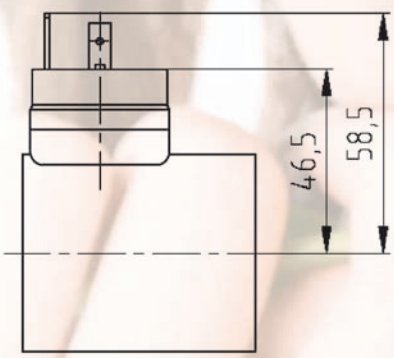
11 SOLENOID COILS, WITH STANDARD ELECTRIC CONNECTION TO ISO 4400/DIN 43650, FOR AC SUPPLY

Valves type FT5 - ES - * can be operated from A.C. supply by the use of coils that incorporate a full wave bridge rectifier. Coils with rectifier can be supplied separately as B05 - ***A.

DIRECTLY D.C. SUPPLY

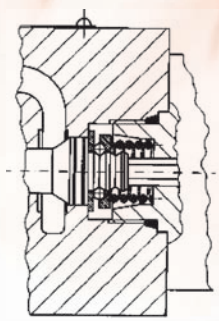
Voltage	*Valve code*	*Coil code*	*Nominal Current (A)*
V115 AC/50(60) Hz	**FT5-ES-*-*-115A**	**B05-115A**	0,40
V230 AC/50(60) Hz	**FT5-ES-*-*-230A**	**B05- 230A**	0,20

Permissible supply voltage variation: +5% -10%



12 VERSION "N": MECHANICAL DETENT ON SPOOL

Solenoids valves with detent typically are 2 positions, 2 solenoid, no-spring valves where the spool is kept at the extreme ands of its stroke by a mechanical device. This permits that solenoids are energized by short time current pulses and the spool remains at its position regardless of forces due to hydrodinamics or gravitational/inertia effects (vibrations).

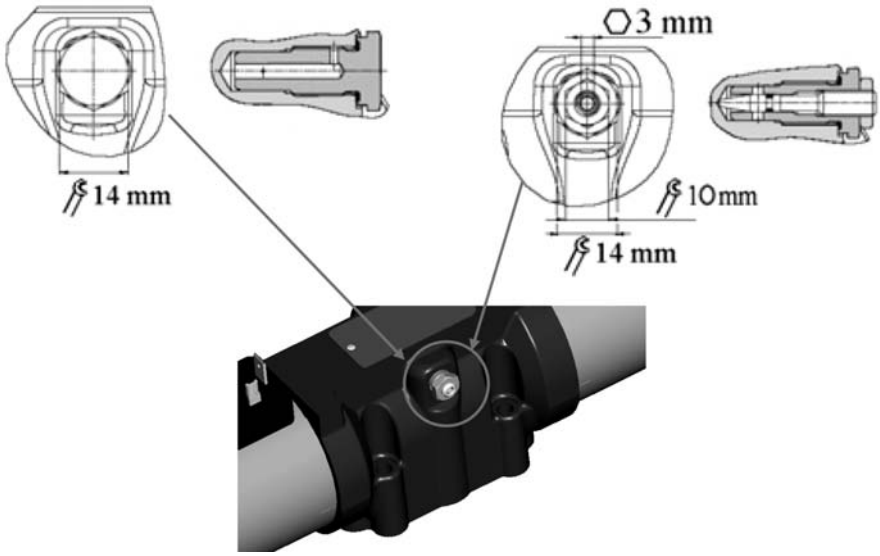


13 VERSION "T": SOFT SHIFTING

Solenoid valves with soft shifting devices are 2 or 3 positions valves, controlled by 2 solenoids, which incorporated a fixed throttling orifice ((0,6) on the channel that connects the extreme hydraulic chambers of the valve.
The throttling effect control the spool shifting time, therefore eliminating unwanted hydraulic shocks.

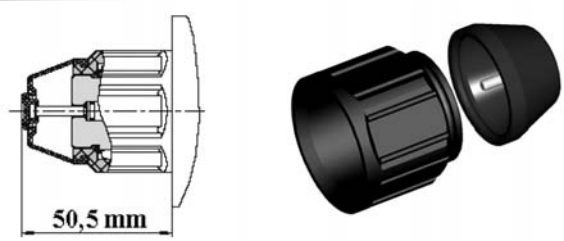
14 VERSION "TR": ADJUSTABLE SOFT SHIFTING

In version "TR" valves, the fixed orifice is replaced by an adjustable, variable throttle valve that permit a fine precise adjustment of the spool shifting time.
To increase the throttling (and therefore the shifting time) turn clock-wise the adjusting screw, after having unlocked its retaining nut.



15 VERSION "K": EXTENDED OVERRIDE PIN

Solenoid valves according to "K" version have extended override actuator pins that permit a quick and easy "hand operation" of the valves, without the need of any tool. The actuator pin and the end of the solenoid are protected by a flexible rubber cap that makes operation and protects from moisture and water splashes.



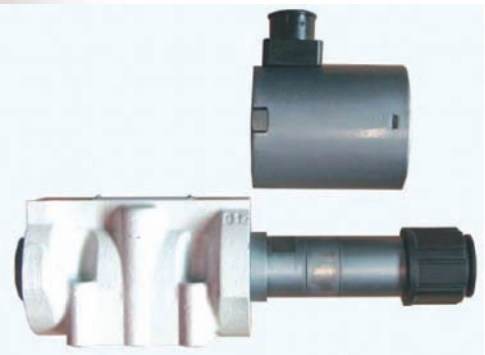
16 ANTICORROSION PROTECTION

On FT5 - ES - * standard valves the body is phosphate coated, the solenoid tubes are treated and coils mantel and irons are zinc trivalent plated.
To increase the resistance to corrosive agents different variants are available:

ZT
- body, solenoid tubes and coils irons are zinc trivalent plated

ZL
- body is coated with special TEMADUR 40 zinc painting
- solenoids have 8-12 µm zinc plating

ZK
- body is coated with special TEMADUR 40 zinc painting
- solenoid tube and coils irons are "zinc-nickel" plated



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