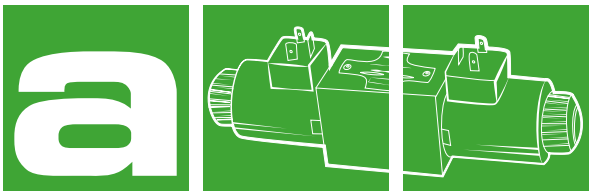


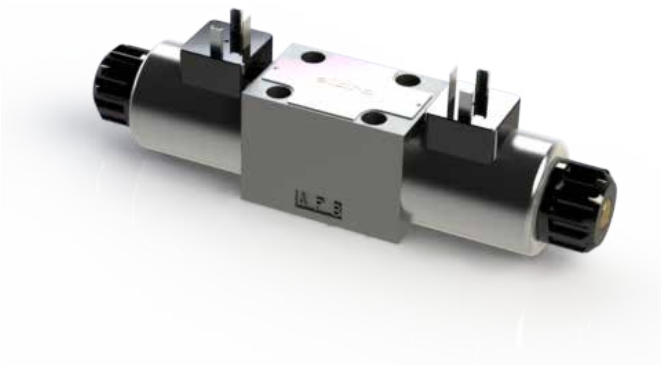
DIRECTIONAL CONTROL VALVES SOLENOID OPERATED

HD3-ES-*/10

80 l/min - 35 MPa (350 bar)

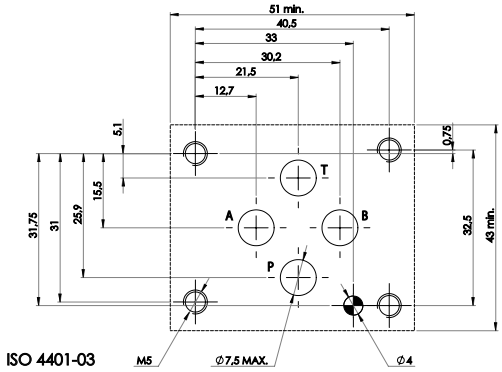
1 DESCRIPTION

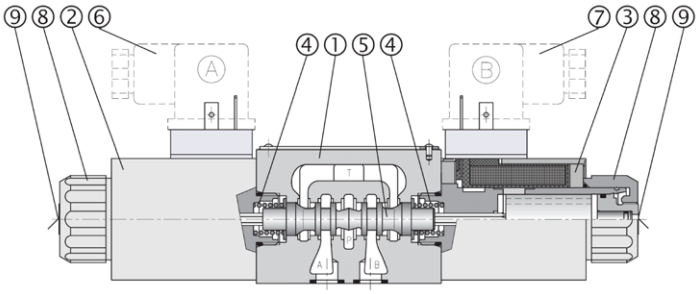
Valves HD3-ES are directional control valve with subplate mounting interface acc. to ISO 4401, DIN 24340 (CETOP 03).
The design of the body is a quality five chamber casting.
The valve is available with interchangeable metallic DC solenoids, also for AC power supply using a built-in rectifier bridge inside the coil.
In the standard version, the valve housing is phosphated for 240 h salt spray protection acc. to ISO 9227 . Enhanced surface protection for mobile sector available (ISO 9227, 520 h salt spray).



2 ORDERING CODE

(1)		(2)		(3)		(4)		(5)	(6)		(7)
HD3	-	ES	-		-		-			/	10





(1) HD3: 4-way directional control valve CETOP 03

(2) ES: Electrically controlled

(3) Spool type (see 4):
-number is the main spool type
-letter is the solenoid or spring arrangement:
C : 2 solenoids, spool is spring centered (3 position)
LL : 1 solenoid, spool is spring offset (2 position)
ML : 1 solenoid, spool is spring centered (2 position)
N : 2 solenoids, spool is detented see 13 (2 position)

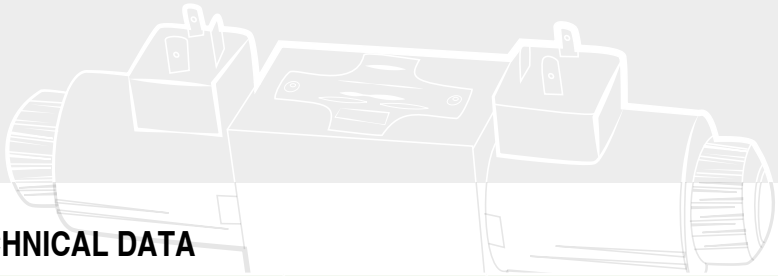
(4) Code reserved for option and variants:
S-**: calibrated orifice on P port, see 11
K : water proof caps on emergency pin, see 10
T : soft shifting device, see 12
Z* : anti corrosion coating (variants), see 14
Sa, Sb: proximity sensors, see 15

(5) Electric voltage and solenoid coils:
0000: no coils
012C: coils for V12DC
024C: coils for V24DC
048C: coils for V48DC
024A: coils for V24/50AC
115A: coils for V110/50- V 115/60AC
230A: coils for V220/50- V 230/60AC

(6) Coil connection (see 16):
no designation: DIN 43650-A ISO 4400
AMP: Amp Junior Timer- vertical configuration
AMPX: Amp Junior Timer- axial configuration
D: Deutsch

(7) Design number (progressive) of the valves

The spool 5 shifts into the valve body 1 subject to the action of springs 4 and solenoids 2. Spool 5, depending from its shape and its position in the valve body, opens and/ or closes passages between P, A, B and T ports, thus controlling the direction of the hydraulic flow.



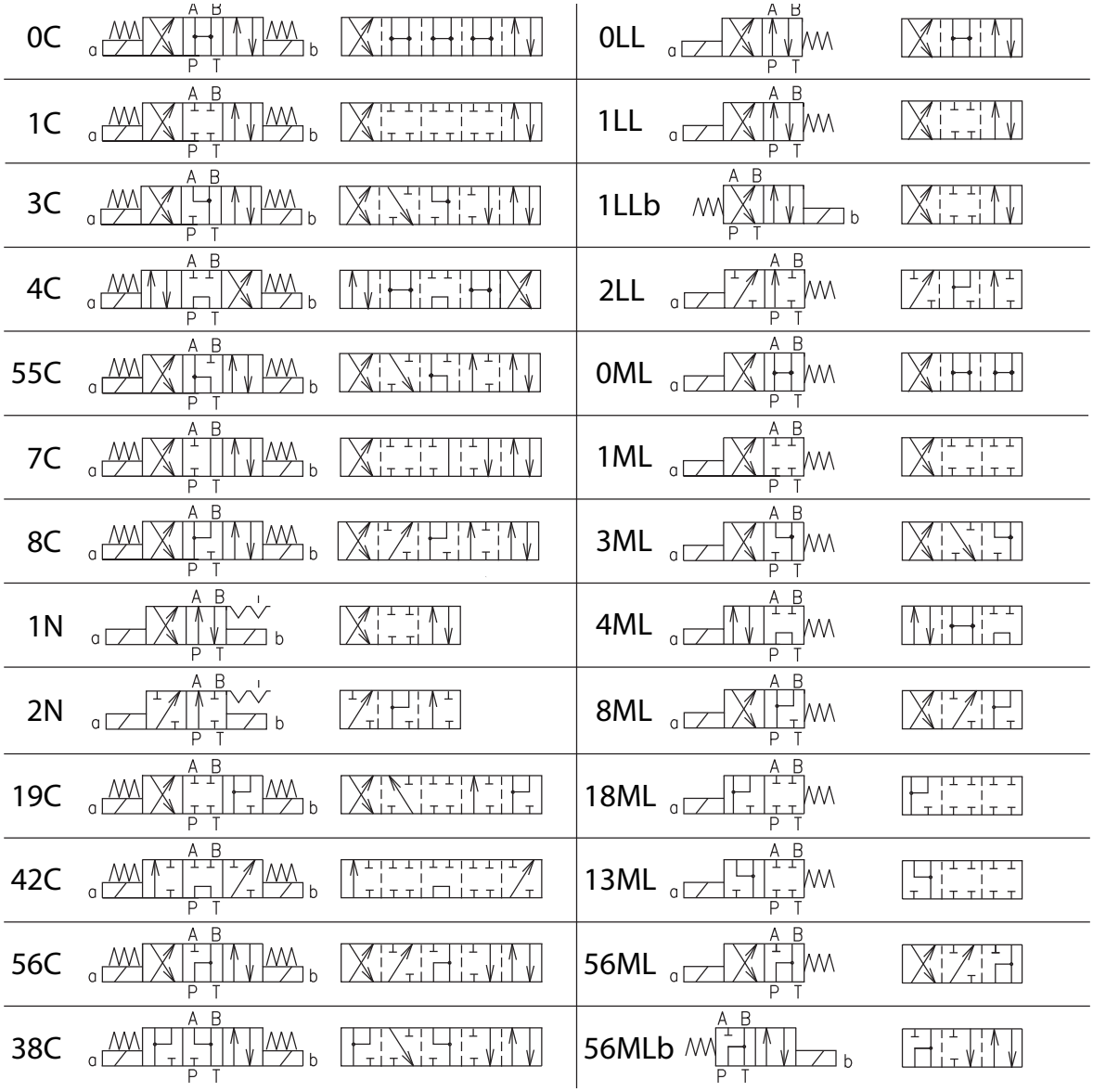
3 TECHNICAL DATA

Nominal flow	60 l/min
Maximum rec. flow rate	80 l/min
Maximum nominal pressure (P, A, B)	35 MPa (350 bar)
Maximum pressure at T port	21 MPa (210 bar)
Pressure drops	see 5
Protection to DIN 40050	IP 65
Duty cycle	100%
Installation and dimensions	see 6
Mass	2,1/1,6 kg

Electric characteristics:

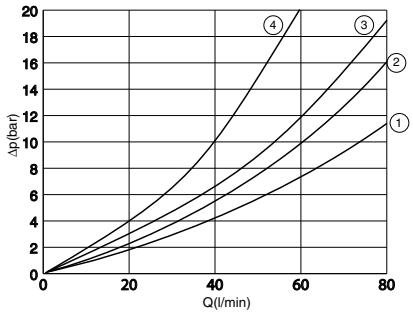
Valve type HD3-ES-* are operated by solenoid that are energized :
Directly from a D.C. voltage supply:
V 12 DC = 012 C V 24 DC = 024C
By the use of coils that incorporate a full wave bridge rectifier, from A.C. voltage supply:
V 110/50 - V 115/60 = 115A
V 220/50 - V 230/60 = 230A
Other available voltages are : 014C ; 048C ; 060C ; 102C ; 205C ; and V24/50 = 024A
All connectors must conform to ISO 4400 (DIN 43650) and electric circuitry must be able to carry the following rated current values :
V 12 DC = 2,4A V 115/50 = 0,26A
V 24 DC = 1,2A V 230/50 = 0,14A
Coils with 2 electric pins, conforming with AMP connectors or Deutsch connectors, are only available for DC supply (example of code: B03.012C AMPX or B03.012C D).
Permissible supply voltage variation : ± 10 %

4 SPOOL IDENTIFICATION AND INTERMEDIATE POSITION TRANSITORIES



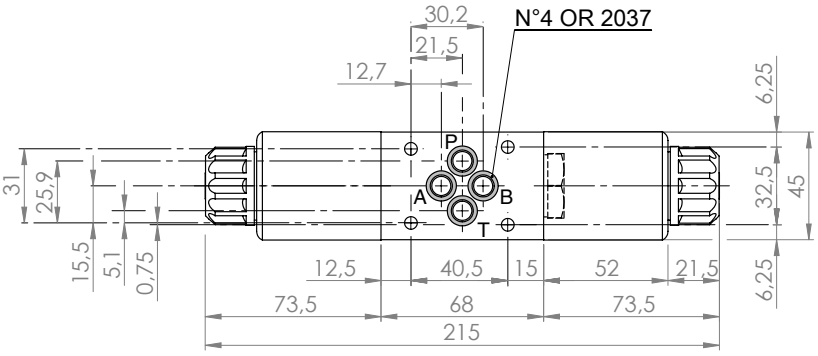
5 TYPICAL DIAGRAMS

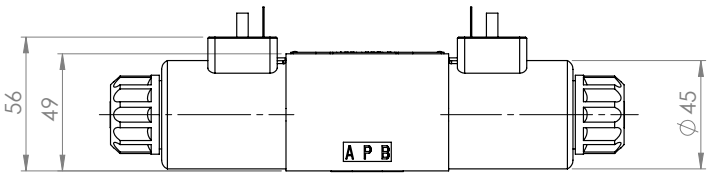
Typical Δp-Q curves for valves HD3 -ES-* in standard configuration, with mineral oil at 32 mm²/s and T=40°C

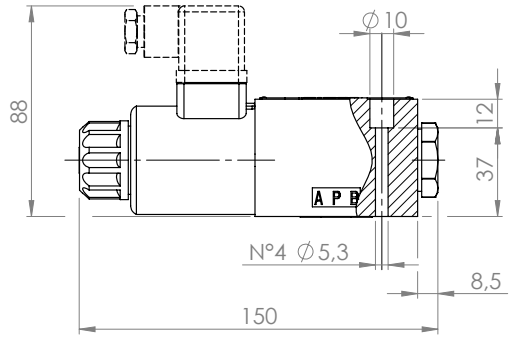


Spool	P-A	P-B	A-T	B-T	P-T
1C	1	1	2	2	
4C	3	3	4	4	1
0C	1	1	2	2	1
3C	1	1	2	2	
1LL	1	1	2	2	
1LLb	1	1	2	2	
1ML		1	2		
4ML	4		4		2
0ML		1	2		1
3ML	1		2		

6 INSTALLATION DIMENSIONS (mm)



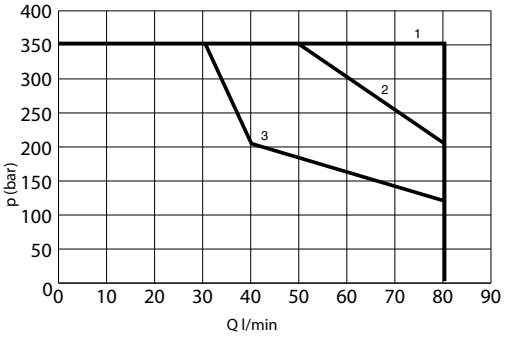




All valves HD3-* conform with ISO and CETOP specifications for mounting surface dimensions (see 9) and for valves height. When assembled to its mounting plate valve HD3-* must be fastened with 4 bolts M5x45 (or M5x** according to the number of modules) tightened at 8 Nm torque. Leakage between valve and mounting surface is prevented by the positive compression on their seats of 4 seals of Quad Ring type 9,25x1,68x1,68.

7 HYDRAULIC LIMIT OF USE

Δp-Q characteristics limits for safe of HD3-ES-* solenoid operated valves. Measured at ν = 32mm²/s and T = 40°C



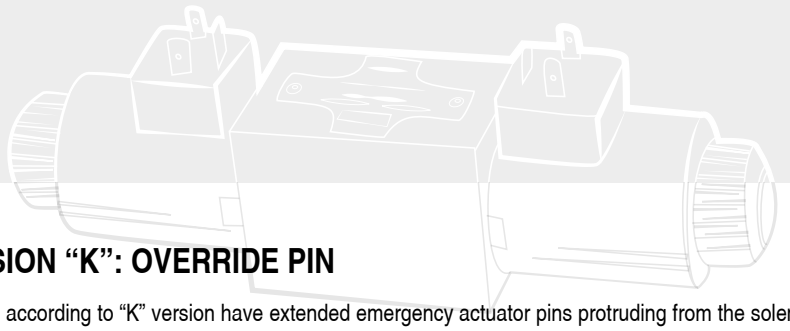
1C	1
4C	3
0C	2
3C	2
1LL	1
3ML	2
4ML	3
1ML	1
0ML	2
1MLb	1
1LLb	1
4MLb	3
0MLb	2
3MLb	2

8 SOLENOID

Solenoid valves can be supplied without electric coils, as HD3-ES-****-0000. Coils are supplied separately; standard, 3 electric pins, coils are : - B03.012C ; B03.024C ; B03.115A ; B03.230A 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. (see 18)

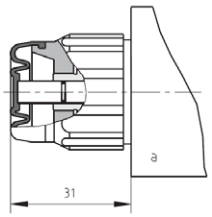
9 HYDRAULIC FLUID

Seals and materials used on standard valves HD3-* are fully compatible with hydraulics fluids of mineral base, upgraded with antifoaming and anti oxidizing 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.



10 VERSION “K”: OVERRIDE 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

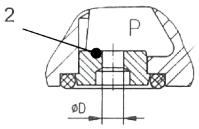


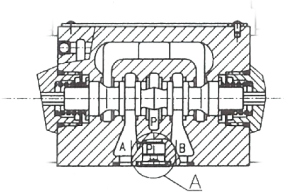
11 VERSION “S*” ; CALIBRATED ORIFICE ON P PORT

Option “S*” is represented by an element suitably shaped to be inserted on P port of the solenoid valve, having a calibrated orifice (of various sizes) able to restrict, depending on the ΔP value, the flow rate entering the solenoid valve.

Those elements have the following orifice diameters :

- 3S-00 -> D = 0 mm
- 3S-10 -> D = 1,0 mm
- 3S-15 -> D = 1,5 mm
- 3S-20 -> D = 2,0 mm
- 3S-25 -> D = 2,5 mm

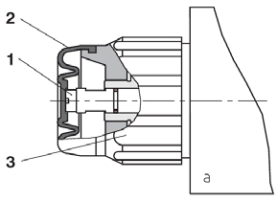




and are kept sealed on the P port of the valve by an OR of 9,25x1,78 mm sizes (example OR 110-2037)

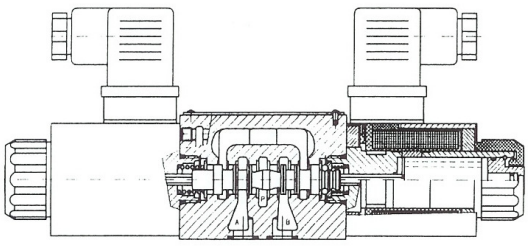
12 VERSION “T”: SOFT SHIFTING

Solenoid valves with “soft shifting” devices are 2 or 3 positions valves controlled by solenoids which incorporate calibrated orifices in the armature plungers. The hydraulic controls on the shifting speed of the plunger, and therefore of the spool in the valve’s body, permit progressive transitories, thus reducing or eliminating water 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 hydraulic fluid. The appropriate conditions are given by assuring a minimum counter pressure on T line and by bleeding the air from the solenoid acting on purge’s valve 1, which is accessible after removing the rubber boot 2 from the solenoid retaining nut 3.



13 VERSION “N”: MECHANICAL DETENT ON SPOOL

Solenoids valves with detent typically are 2 position, 2 solenoid, no-spring valves where the spool is kept at the extreme ends 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 hydrodynamics or gravitational/ inertial effects (vibrations).



14 VERSION “Z”: ANTICORROSION OPTION

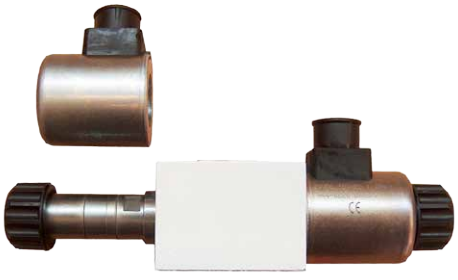
On HD3-ES-* standard valves the body is phosphate coated, the solenoid tubes are not treated and coils mantel and irons are zinc trivalent plated. To increase the resistance to corrosive agents different variants are available :

Example of ZK painted : HD3-ES-3C-ZK-024C/10

ZT: Body, solenoid tubes and coils irons are zinc trivalent plated

ZL: Body is coated with special TEMADUR 20 zinc painting
Solenoids have 8-12 µm zinc plating

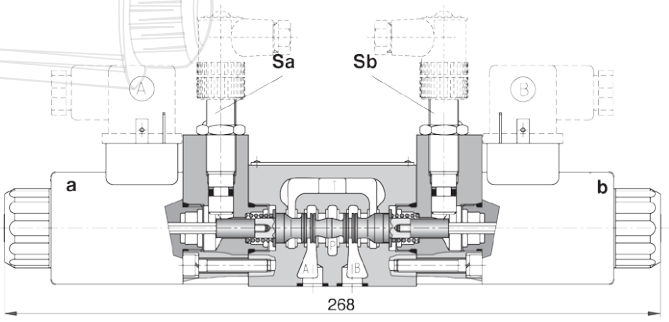
ZK: Body is coated with special TEMADUR 20 zinc painting
Solenoids tube and coils irons are “zinc-nickel” plated

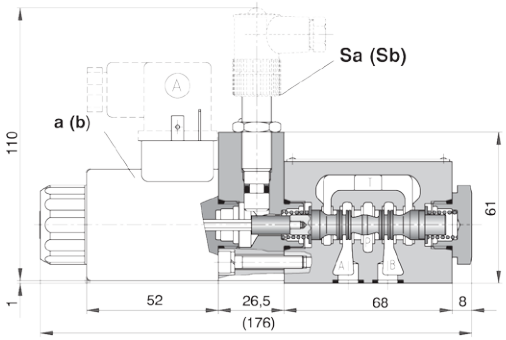


15 VERSION “Sa and Sb”: POSITION SENSOR

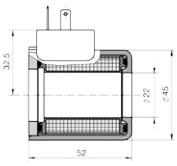
Solenoid valves with spool position sensors are equipped with a proximity sensor able to transform the spool position into an electric signal. It can be used with directional control valves with one or two solenoids. It’s possible to have the two different versions, normally open and normally closed sensor. This option is mandatory in “safe” application, where an electric signal of positive valves spool (displacement) position is needed

Technical data of the Sensor	
Supply Voltage	24 V DC
Supply voltage range	10..30 V DC
Rated current	200 mA
Protection	IP67
Max. operating Pressure	50 bar (standard) - 210 bar (optional)
Indication	yellow led

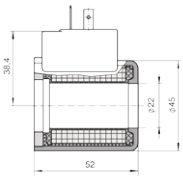




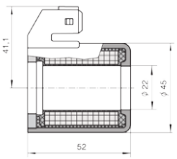
16 SOLENOID COILS types B03-xxxx



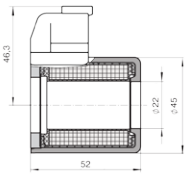
ISO 4400 (DIN 43650)
(standard configuration)
B03-0xxC



115A/230A = ISO 4400 (DIN 43650)
with integrated rectifier
B03-xxxA



AMPX = Amp Junior Timerwith
axial configuration
B03-0xxCAMPX

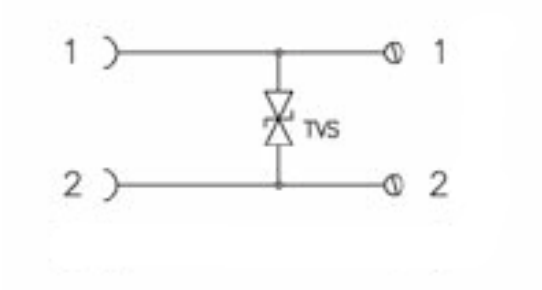


D = Deutsch

B03-0xxD

17 QUENCHING DIODE

On request, DC coils can be supplied with an integrated bidirectional quenching diode (transil type BZW06-19B) able to provide high overvoltage protection. Their instantaneous response to transient overvoltages makes them particularly suited to protect voltage sensitive devices

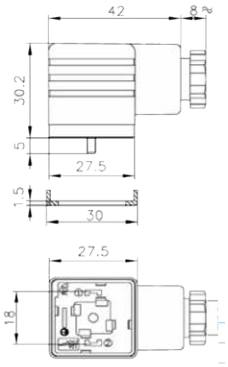


18 CONNECTORS FOR ISO 4400 (DIN 43650) series KA132

Connectors are available for coils with ISO 4400 (DIN 43650) connection. Most common configuration are: Standard, simple, 3 pin connectors:

KA132000B9 = black with PG9
KA132000B1 = black with PG11
KA132000A1 = grey with PG11
KA132L34T9 = transparent with led indication
KA132T54T9 = transparent with led indication and diode transil for protection against overvoltages

For more details and models see aidro table KA-132



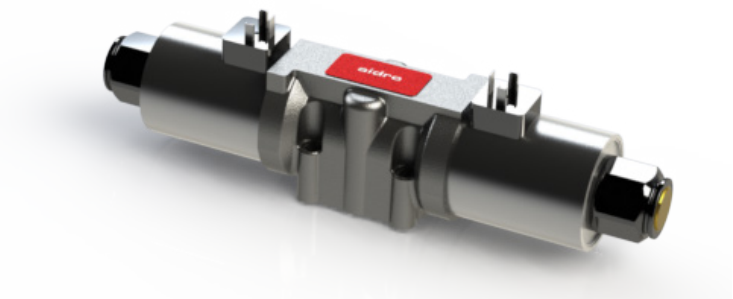
DIRECTIONAL CONTROL VALVES SOLENOID OPERATED

HD5-ES-*

120 l/min 35 MPa (350 bar)

1 DESCRIPTION

Valves HD5-ES are directional control valve with subplate mounting interface acc. to ISO 4401, DIN 24340 (CETOP 05).
The design of the body is a quality five chamber casting.
The valve is available with interchangeable metallic DC solenoids, also for AC power supply using a built-in rectifier bridge inside the coil.
In the standard version, the valve housing is phosphated for 240 h salt spray protection acc. to ISO 9227 . Enhanced surface protection for mobile sector available (ISO 9227, 520 h salt spray).



2 ORDERING CODE

(1)		(2)		(3)		(4)		(5)		(6)
HD5	-	ES	-		-		-		/	20

(1) HD5 : 4-way directional control valve CETOP 05 – Pressure 32 MPa (320 bar)

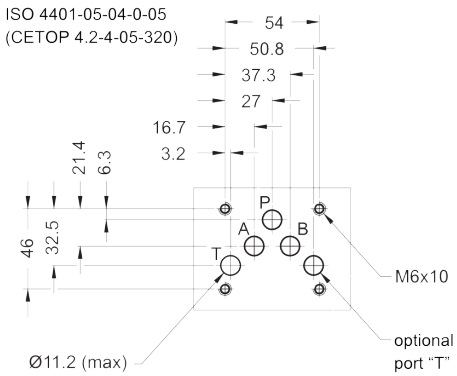
(2) ES : electrically controlled, standard

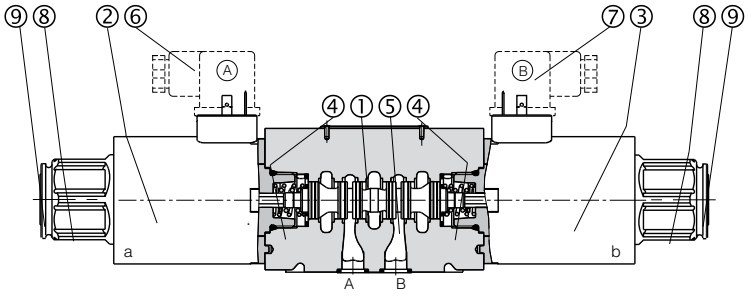
(3) Spool type (see 4)
-number is the main spool type
-letter is the solenoid or spring arrangement:
C : 2 sol. , spool is spring centered (3 position)
N : 2 sol. , spool is detented (2 position)
LL : 1 sol. (a), spool is spring offset (2 pos. , end to end)
ML: 1 sol. (a), spool is spring centered (2 pos. , middle to end)
LM: 1 sol. (a), spool is spring offset (2 pos. , end to middle)

(4) Code reserved for special variants:
b: only for version LL, ML, LM, solenoid b installed (instead of a)
T* : soft shifting device (see 12 and 13)
K : water proof caps on override pin (see 14)
Z* : anti-corrosion variants (see 16)
DR: solenoid(s) chamber draining (see 15)

(5) Electric voltage and solenoid coils (see 8, 9, 10)

(6) 20: design number (progressive) of the valve



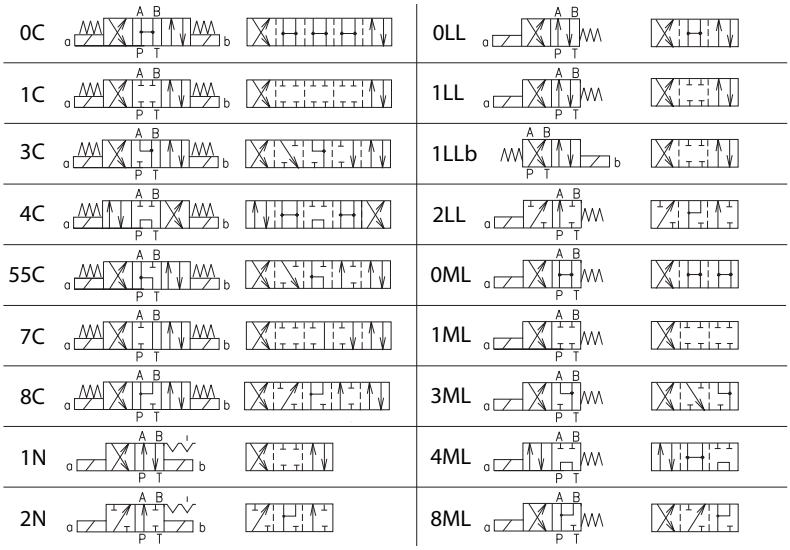


The spool 1 shifts into the valve body 7 subject to the action of springs and solenoids 2 and 3. Spool 1, depending from its shape and its position in the valve body 7, opens and/or closes p assages b etween P , A , B a nd T ports, thus controlling the direction of the ydraulic flow. In case of electric cut-offs the spool can be manually shifted by acting on the override pins 9, located at the end of the solenoids and accessible through the retaining nuts.

3 TECHNICAL DATA

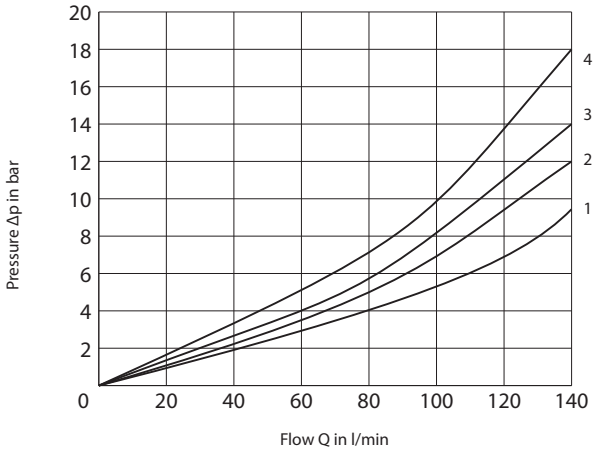
Nominal flow	120 l/min
Max. rec. flow	see 5
Nominal pressure (P, A,B)	32 MPa (320 bar)
Max. rec. Pressure (P, A, B)	35 MPa (350 bar)
Max. rec. Pressure (T port)	21 MPa (210 bar)
Pressure drops	see 6
Protection to DIN 40050	IP 65
Duty cycle	100 %
Service life	> 10^7 cycles
Mass	1 sol. 3,9 kg 2 sol. 5,4 kg

4 SPOOL IDENTIFICATION AND INTERMEDIATE POSITION TRANSITORIES



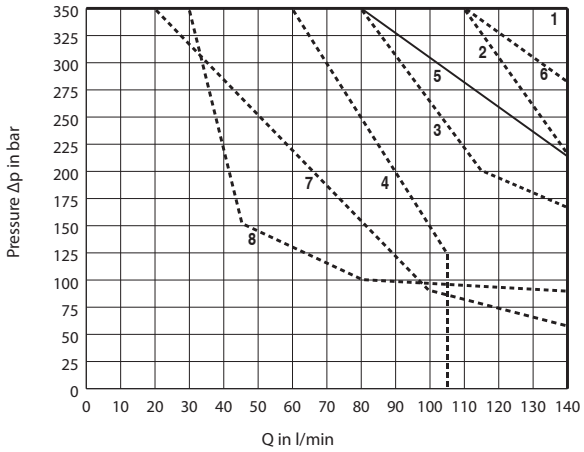
5 TYPICAL DIAGRAMS

Typical Δp curves for valves HD5-ES-*, with mineral oil at ν= 32 mm²/s and t = 40°C, for flow P -> A/B, A/B -> T and P -> T



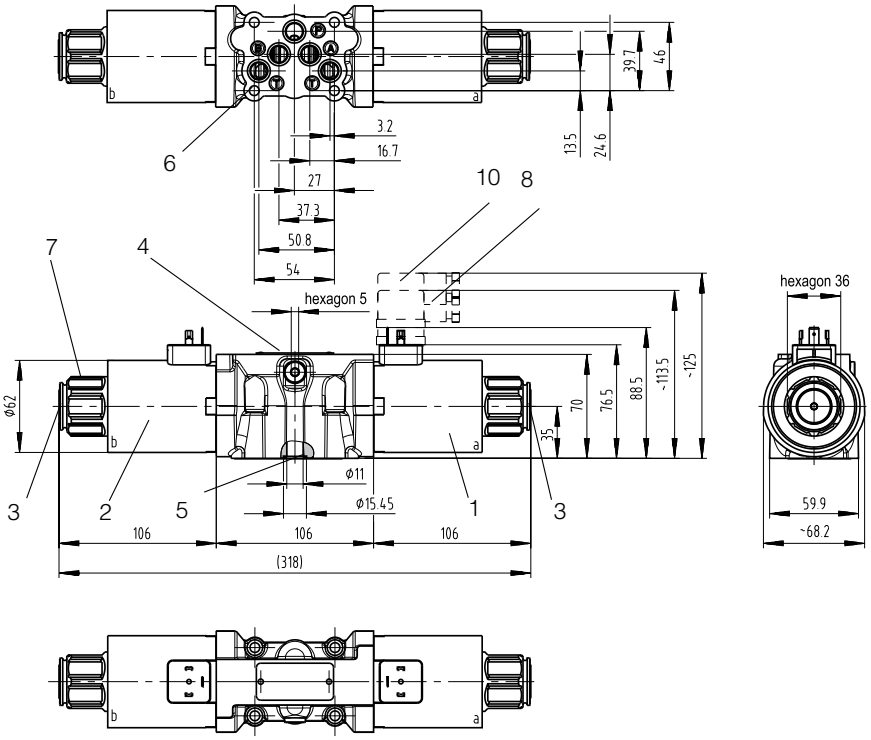
Spool type	P-A	P-B	A-T	B-T	P-T
0C	1	1	2	2	1
1C	1	1	2	2	-
3C	1	1	2	2	-
4C	3	3	4	4	1
55C	1	1	1	2	2
7C	1	1	2	2	-
8C	1	1	2	2	-
1N	1	1	2	3	-
2N	1	1	-	-	-
0LL	1	1	1	3	-
1LL	1	1	2	2	-
1LLb	1	1	2	2	-
2LL	1	1	-	-	-
0ML	-	1	2	-	1
1ML	-	1	2	-	-
3ML	-	1	2	-	-
4ML	3	-	-	4	1
8ML	-	1	2	-	-

6 HYDRAULIC LIMIT OF USE



Spool type	Limit
0C	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

7 INSTALLATION DIMENSION (mm)

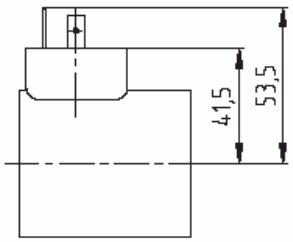


All valves HD5-ES-* conform with ISO and CETOP specifications for mounting surface dimensions and for valves height.
When assembled to its mounting plate, valve HD5-ES-* must be fastened with 4 fixing bolts (socket head screws to ISO 4762) M6 x 40 mm (or M6 x* according to the number of modules) of class 12,9 (ISO898) tightened at 12 Nm torque.
Leakage between valve and mounting surface is prevented by the positive compression on their seats of 5 seals of Quad-Ring type 12,42 x 1,68 x 1,68 mm.

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

Standard valves type HD5-ES-* are operated by solenoid that are energized directly from a D.C. voltage supply. Solenoid valves can be supplied without electric coils as HD5-ES-*-0000 and coils can be supplied separately as B05-***C.

Directly from D.C. supply			
Voltage	Valve Code	Coil Code	Nominal Current (A)
V 12 DC	HD5-ES-*-*-012C	B05-012C	3,17
V 24 DC	HD5-ES-*-*-024C	B05-024C	1,73

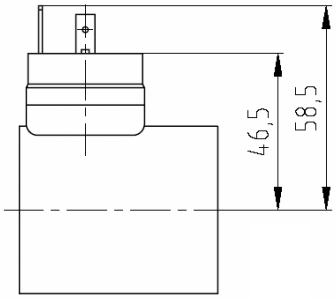


Permissible supply voltage variation : +5% -10%
Special voltages available : V 48 DC, V 106 DC, V 205 DC

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

Valves type HD5-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 from A.C. supply			
Voltage	Valve Code	Coil Code	Nominal Current (A)
V 115 AC / 50 (60) Hz	HD5-ES-*-*-115A	B05-115A	0,40
V 230 AC / 50 (60) Hz	HD5-ES-*-*-230A	B05-230A	0,20



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

10 OPTIONAL ELECTRIC CONNECTION

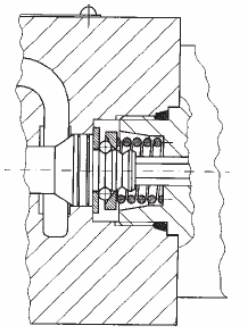
Coils type B05-* for valves HD5-ES-* can be supplied with 2-poles AMP Junior-Timer electric connection. Coils with AMP connection can be supplied separately as B05-***CAMP

AMP electric connection			
Voltage	Valve Code	Coil Code	Nominal Current (A)
V 12 DC	HD5-ES-*-*-012 CAMP	B05-012CAMP	3,17
V 24 DC	HD5-ES-*-*-024 CAMP	B05-024CAMP	1,73

Other optional electric connection are available :
- Flying Leads
- Flying Leads (250 mm) with Deutsch connection (DT04-2P)

11 VERSION "N" : MECHANICAL DETENT ON SPOOL

Solenoids valves with detent typically are 2 position, 2 solenoid, no-spring valves where the spool is kept at the extreme ends of its stroke b y 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/inertial effects (vibrations).

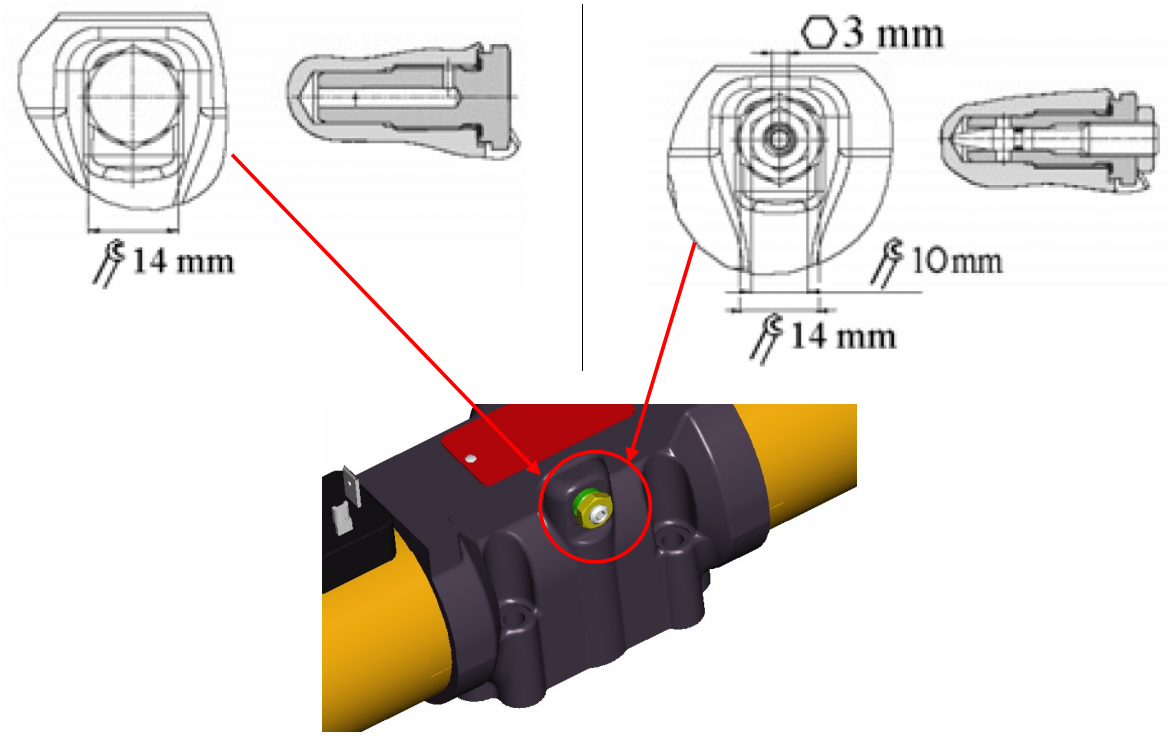


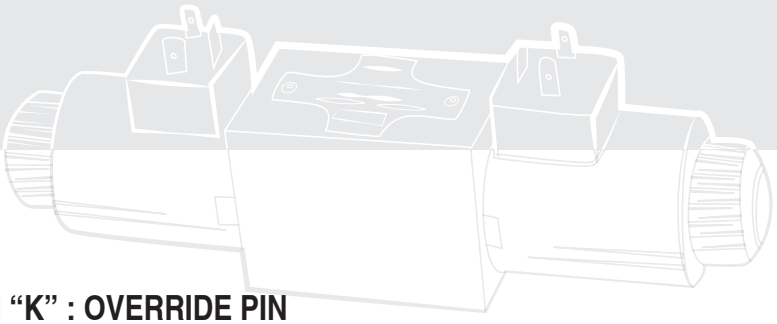
12 VERSION "T": SOFT SHIFTING

Solenoid valves with soft shifting devices are 2 or 3 position valves which incorporated a fixed throttling orifice (Ø 0,6 mm) on the channel that connects the extreme hydraulic chambers of the valve. The throttling effect controls the spool shifting time, thus limiting unwanted hydraulic shocks.

13 VERSION "TR": ADJUSTABLE SOFT SHIFTING

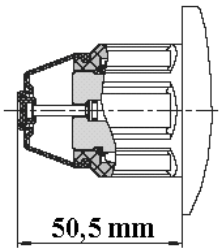
In Version "TR" valves, the fixed orifice is replaced by an adjustable, variable throttle valve that permit a fine and precise adjustment of the spool shifting time. To increase the throttling (and therefore the shifting time) turn clock-wise the adjusting screw (Ch. 3 mm), after having unlocked its retaining nut (Ch. 10 mm).

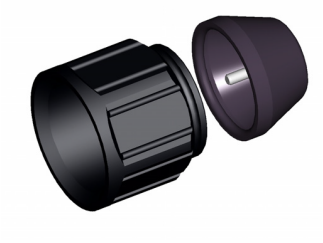




14 VERSION “K” : OVERRIDE PIN

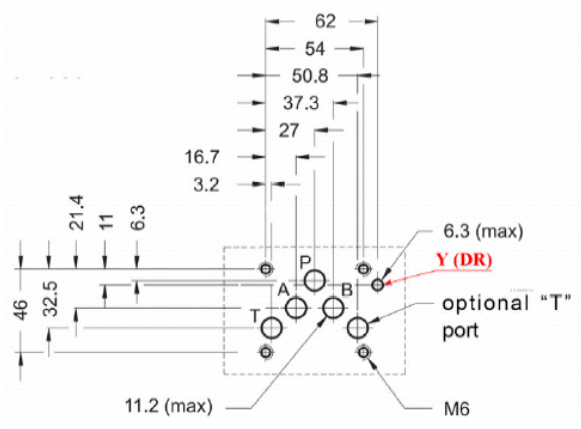
Solenoid valves according to “K” version have override actuators that push on the valve’s override pins and permit a quick and easy “hand operation” of the valves, without the need of any tool. The override actuator is incorporated in a flexible rubber cap that is e asily applicable on the solenoid retaining nuts and that protects from moisture and water splashes.



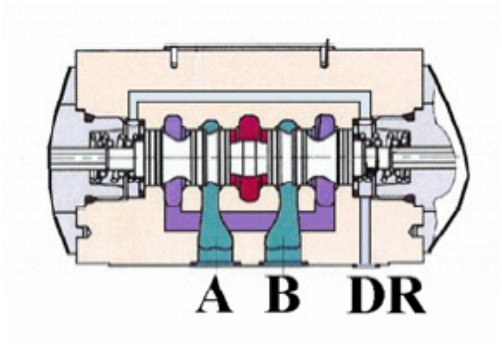


15 VERSION ”DR” : SEPARATE DRAINING OF THE SOLENOID CHAMBER

Solenoid valves according to “DR” version present a draining line of the chambers of the solenoids. This version should be adopted in presence of high counterpressure on T line that exceed the permissible recommended maximum pressure for T ports of the valve (210 bar). Position of additional draining port DR is conform with ISO 4401-05 interface and correspond to the Y port.



Dimensioni in mm



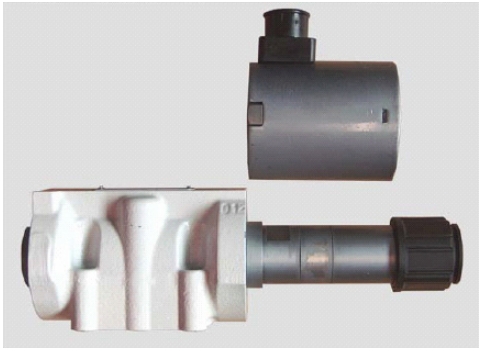
16 ANTICORROSION OPTIONS

On HD5-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



Example of ZK painted valve : HD5-ES-1LLb-ZK-024C/20