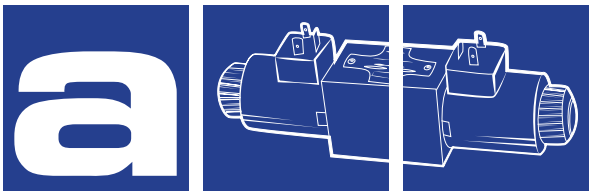


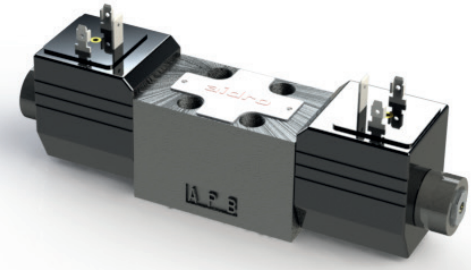
DIRECTIONAL CONTROL VALVES SOLENOID OPERATED

HD2-EI-*

25 l/min - 32 MPa (320 bar)

1 DESCRIPTION

Valves HD2-EI are directional control valve with subplate mounting interface acc. to ISO 4401, DIN 24340 (CETOP 02).
The design of the body is a three chamber casting for production cost saving and low pressure drops.
The valve is available with interchangeable plastic DC solenoids, also for AC power supply using connectors with a built-in rectifier bridge.
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)
HD2	-	EI	-			-		/	10

(1) HD2: 4-way directional control valve CETOP 02

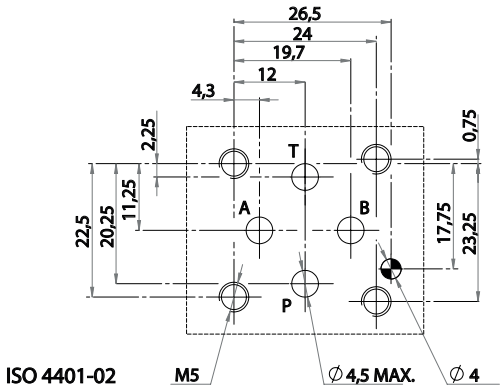
(2) EI: electrically controlled

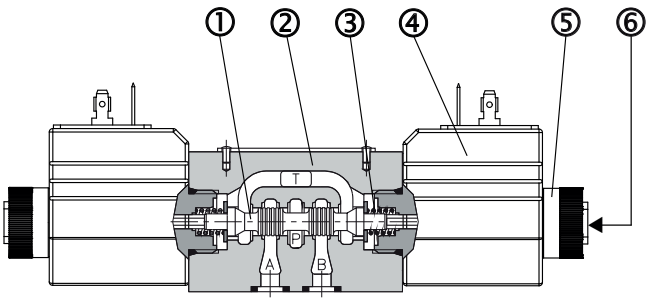
(3) Spool type (see 4)
-number is the main spool type
-letter is solenoid and spring arrangement:
C: 2 solenoids, spool is spring centered (3 position)
LL: 1 solenoid (a), spool is spring offset (2 position, end to end)
ML: 1 solenoid (a), spool is spring offset (2 position, middle to end)

(4) Code reserved for option and variants:
b: only for version LL and ML,solenoid b installed (instead of solenoid a)
ZN: Zinc Nichel surface treatment

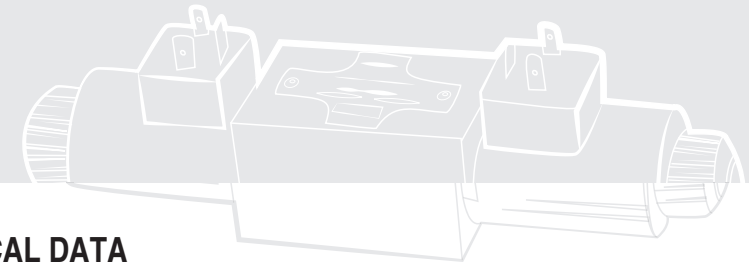
(5) Electric voltage and solenoid coils:
0000: no coils
012C: coils for V12DC
024C: coils for V24DC
110R: coils for V98DC (V110/50 – V115/60 RAC)
220R: coils for V198DC (V220/50 – V230/60 RAC)

(6) Design number (progressive) of the valves





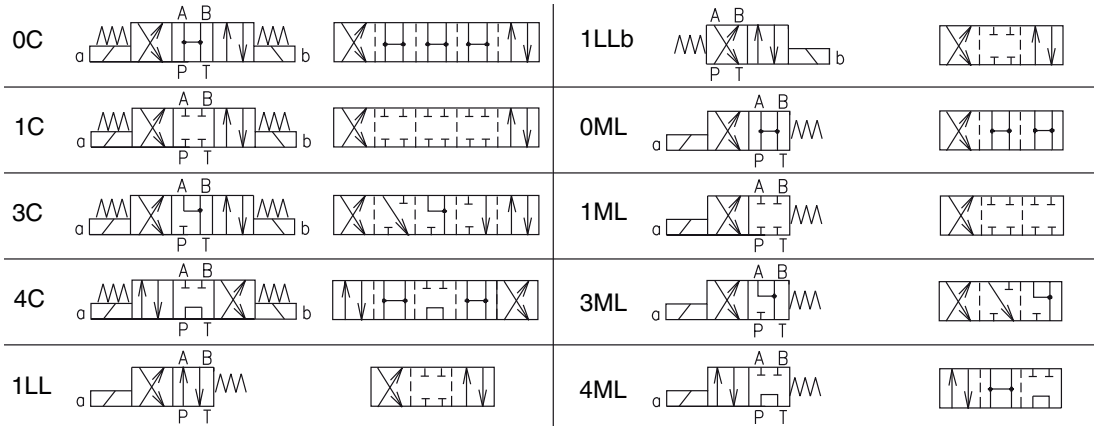
Spools, springs and solenoids combination permit to obtain almost every type of ports (P, A, B, T) connection and sequence. For almost all types of solenoids/springs combination and for all type of spools (with the exception of spool 4), when solenoid “a” is energized, hydraulic connections are P-->B and A-->T; to obtain P-->A and B-->T solenoid “b” must be energized. The hydraulic connections that are obtained in the “central” (neutral) position when solenoids are not energized is the characteristic mark of the spool shape and from it derives its identification number: 0 = P, A, B, T connected 1 = P, A, B, T closed 3 = P closed, A, B, T, connected for other types see 4



3 TECHNICAL DATA

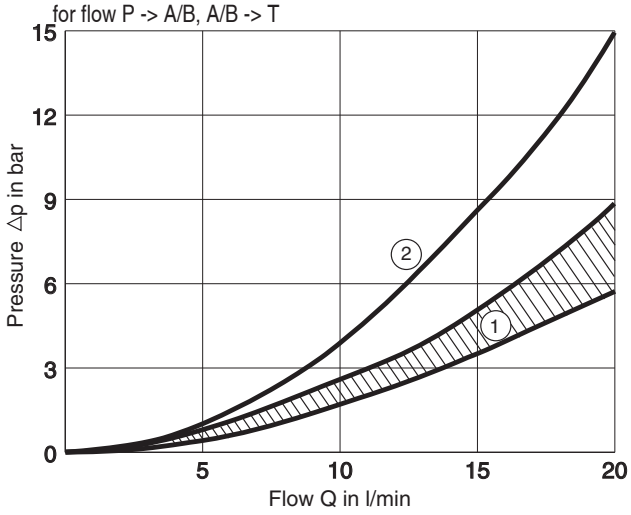
Maximum nominal flow	20 l/min	Electric characteristic:
Maximum rec. flow rate	25 l/min	Valves HD2-EI-* are operated by solenoid that are energized: - directly from a D.C. voltage supply: V 12 DC (012C) V 24 DC (024C) - by the use of connectors that incorporate a full wave bridge rectifier, from A.C. voltage supply: V 110/50, V 115/60 or V115/50 (110R) V 220/50, V 230/60 or V 230/50 (220R) All connectors must conform to ISO 4400 (DIN 43650) and electric circuitery must be able to carry the following rated current values: V 12 DC= 2,4 A V 24 DC= 1,2 A V 110 R= 0,30 A V 220 R= 0,15 A Permissible supply voltage variation: +5% -10%
Maximum nominal pressure (P, A, B)	25 MPa (250 bar)	
Maximum pressure	32 MPa (320 bar)	
Maximum pressure at T port	16 MPa (160 bar)	
Pressure drops	see 5	
Protection to DIN 40050	IP 65	
Duty cycle	100%	
Service life	$\geq 10^7$ cycles	
Installation and dimensions	see 7	
Mass	approx 0,8/1,1kg	

4 SPOOL IDENTIFICATION AND INTERMEDIATE POSITION TRANSITORIES



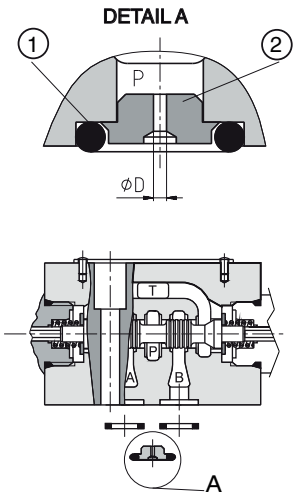
5 TYPICAL DIAGRAMS

Typical Δp-Q curves for valves HD2 -EI-* in standard configuration, with mineral oil at 36 cSt and at 50°C for flow P -> A/B, A/B -> T



①= all spool: P -> A/B and A/B -> T
②= spool 4: P -> A/B and P->T

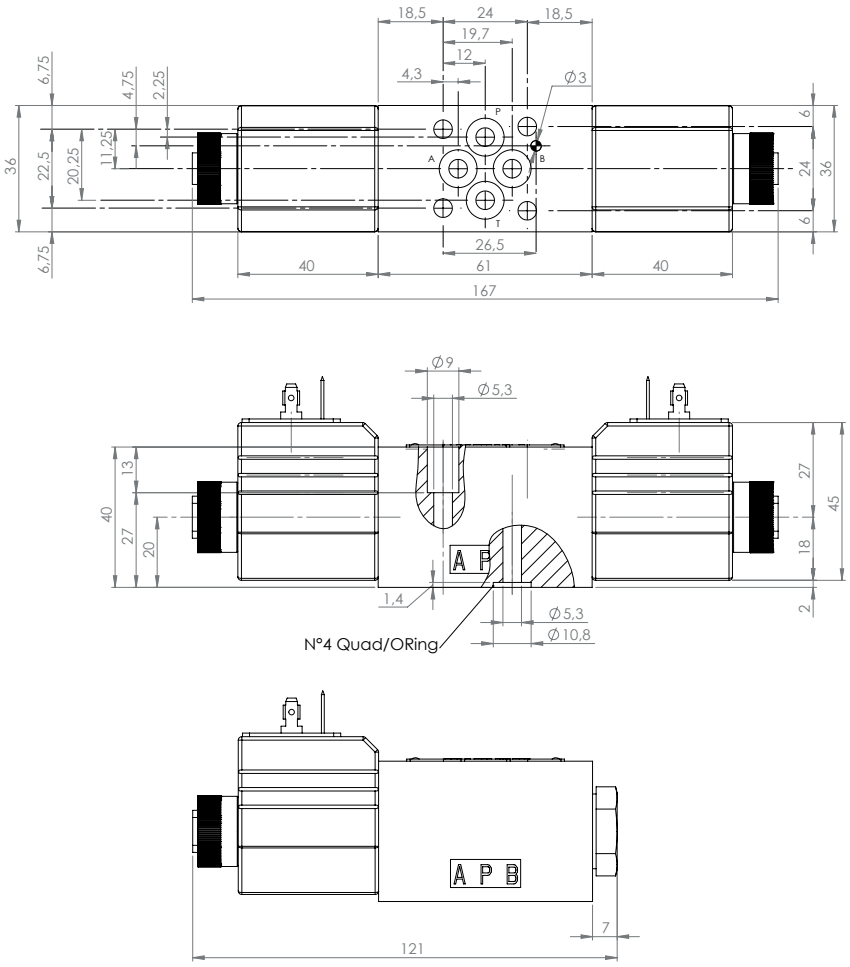
6 OPTIONS



OPTION S CALIBRATED ORIFICE ON P PORT

Option "S" is rappresented by elements ②, suitably shaped to be inserted on P port of the solenoid valve, having a calibrated orifice (of various sizes) able to restrict, at the requested Δp value, the flow rate entering the solenoid valve.
Those elements have the following orifice diameter:
2S - 08 -> D=0,8 mm
2S - 10 -> D=1 mm
2S - 12 -> D=1,2 mm
2S - 15 -> D=1.5 mm
and are kept sealed on the P port of the valve by an OR ① of 7,65x1,78 mm sizes (example OR 107-2031).

7 INSTALLATION DIMENSIONS (mm)

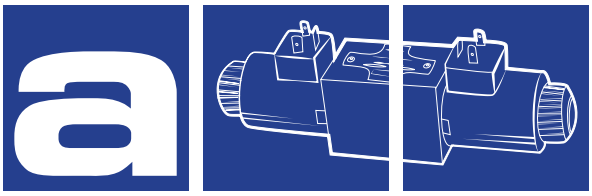


All valves HD2-* conform with ISO and CETOP specifications for mounting surface dimensions and for valves height. When assembled to its mounting plate valve HD2 - * must be fastened with 4 bolts M5x35 (or M5x** according to the number of modules) tightened at 8 Nm torque. Leakage between valve and mounting surface is prevented by the positive compression on their seats of 4 seals of QUAD/O Ring type 7,65x1,68x1,68. 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
- bridge rectifier for AC supply
- voltage surge suppressor, etc.

8 HYDRAULIC FLUIDS

Seals and materials used on standard valves HD2-* are fully compatible with hydraulic fluids of mineral oil base, upgraded with antifoaming and antioxidizing 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.



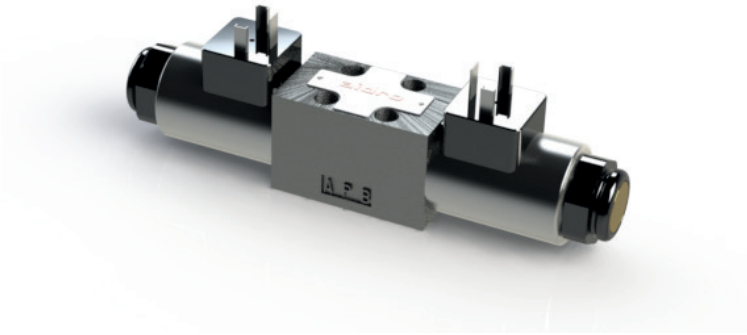
DIRECTIONAL CONTROL VALVES SOLENOID OPERATED

HD2-ES-*

30 l/min - 32 MPa (320 bar)

1 DESCRIPTION

Valves HD2-ES are directional control valve with subplate mounting interface acc. to ISO 4401, DIN 24340 (CETOP 02).
The design of the body is a three chamber casting for production cost saving and low pressure drops.
The valve is available with interchangeable metallic DC solenoids, also for AC power supply using coils with a built-in rectifier bridge.
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)
HD2	-	ES	-			-		/	11

(1) HD2: 4-way directional control valve CETOP 02- Pressure 32 MPa (320 bar)

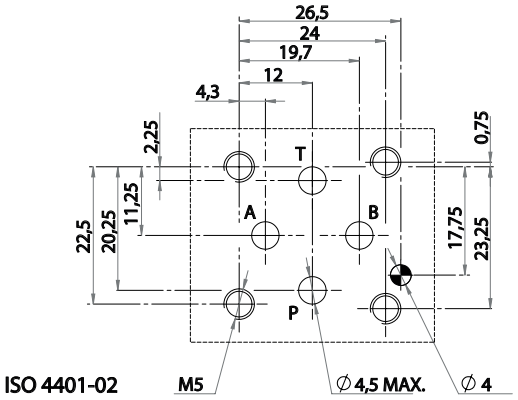
(2) ES: electrically controlled standard

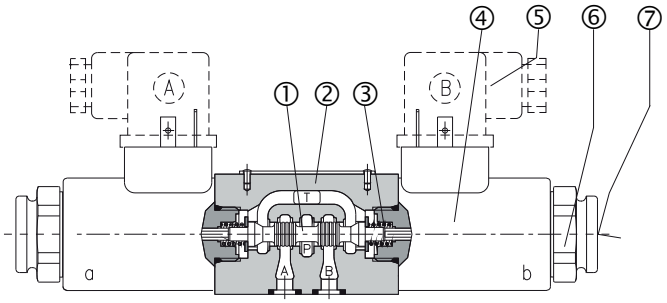
(3) Spool type (see 4)
-number is the main spool type
-letter is solenoid and spring arrangement:
C: 2 solenoids, spool is spring centered (3 position)
N: 2 solenoids, spool is detented (2 position)
LL: 1 solenoid (a), spool is spring offset (2 position, end to end)
ML: 1 solenoid (a), spool is spring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

(4) Code reserved for option and variants:
b: only for version LL, ML, LM solenoid b installed (instead of solenoid a)
K: protuding emergency pins, protected by rubber caps (see 9)
S*: calibrated orifice on P port (see 10)
ZC:zinc plated valve (see 12)
ZN:Zinc nichel plated body (see 12)

(5) Electric voltage and solenoid coils:
0000: no coils
012C: coils for V12DC
024C: coils for V24DC
115A: coils for V110/50 – V115/60 AC
230A: coils for V220/50 – V230/60 AC

(6) Design number (progressive) of the valves





Spools, springs and solenoids combination permit to obtain almost every type of ports (P, A, B, T) connection and sequence. For almost all types of solenoids/springs combination and for all type of spools (with the exception of spool 4), when solenoid “a” is energized, hydraulic connections are P-->B and A-->T; to obtain P-->A and B-->T solenoid “b” must be energized. The hydraulic connections that are obtained in the “central” (neutral) position when solenoids are not energized is the characteristic mark of the spool shape and from it derives its identification number: 0 = P, A, B, T connected 1 = P, A, B, T closed 3 = P closed, A, B, T, connected for other types see 4

3 TECHNICAL DATA

Maximum nominal flow	0,5 dm^3/s (30 l/min)
Maximum rec. flow rate	see 6
Maximum nominal pressure (P, A, B)	32 MPa (320 bar)
Maximum pressure at T port	21 MPa (210 bar)
Pressure drops	see 5
Protection to DIN 40050	IP 65
Duty cycle	100%
Service life	$\geq 10^7$ cycles
Installation and dimensions	see 7
Mass	approx 1,0/1,4 kg

Electric characteristics:

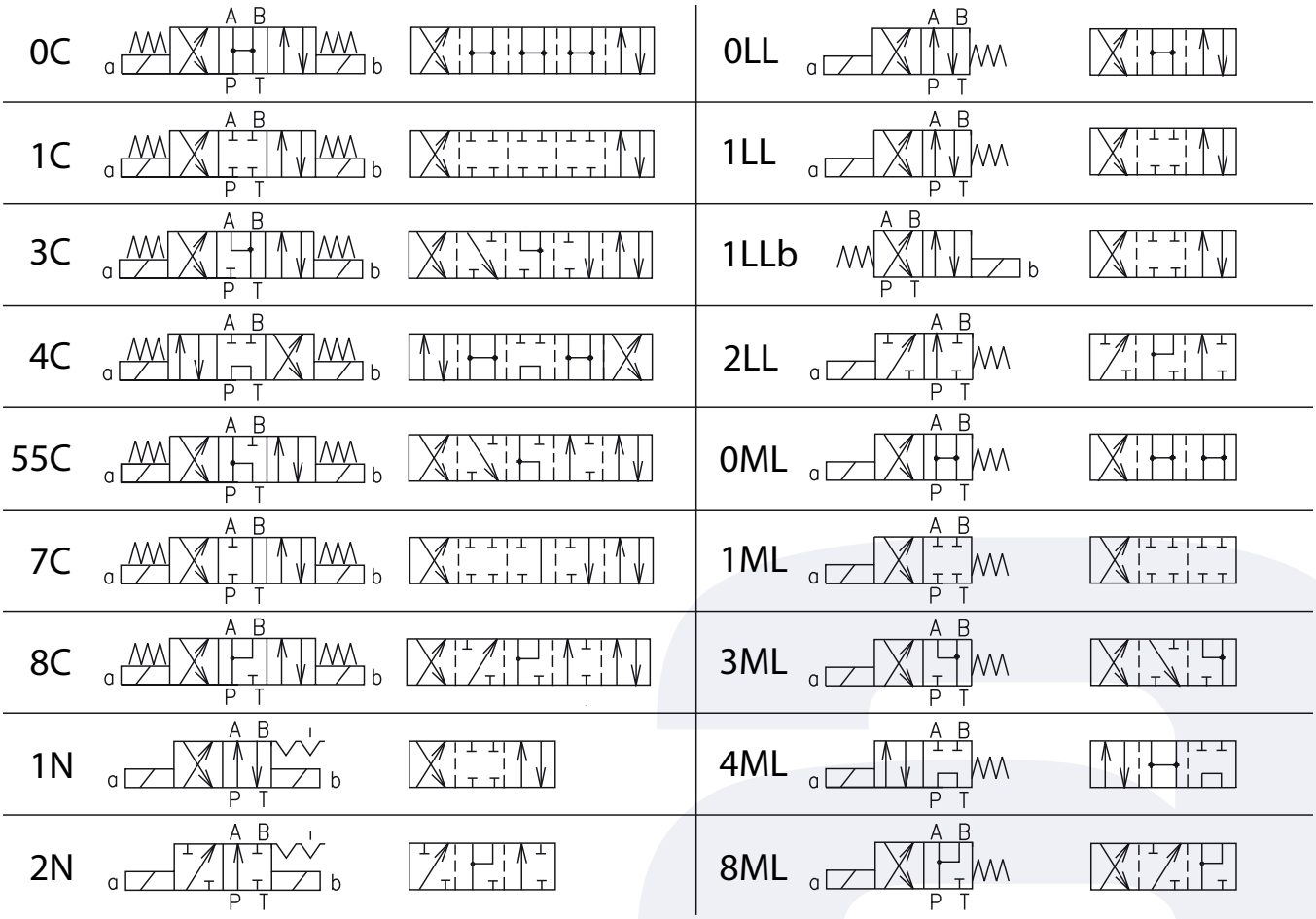
Valves HD2 -ES-* are operated by solenoid that are energized:
- directly from a D.C. voltage supply:
  V 12 DC (012C)
  V 24 DC (024C)
- by the use of coils that incorporate a full wave bridge rectifier, from A.C. voltage supply:
  V 110/50 (V 115/60) =115 A
  V 220/50 (V 230/60) =230 A

All standard valves are to be fitted with connectors conform to ISO 4400 (DIN 43650) and electric circuitery must be able to carry the following rated current values:

V 12 DC = 2,4 A
V 24 DC = 1,2 A
V 110/50 = 0,30 A
V 220/50 = 0,15 A

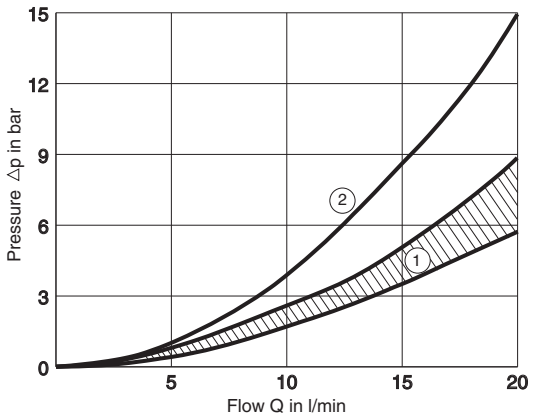
Permissable supply voltage variation: +5% -10%

4 SPOOL IDENTIFICATION AND INTERMEDIATE POSITION TRANSITORIES



5 TYPICAL DIAGRAMS

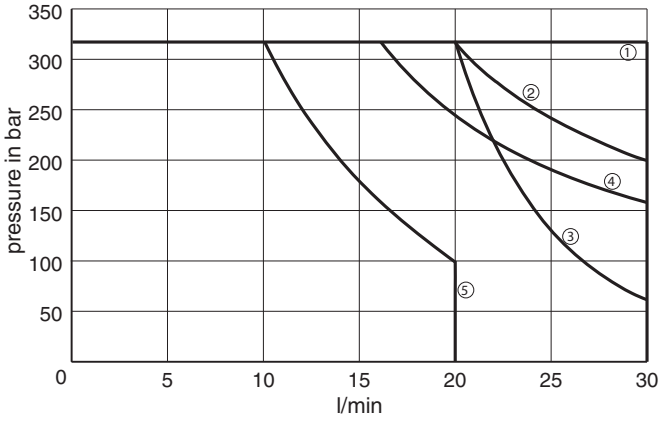
Typical Δp-Q curves for valves HD2-ES-* in standard configuration, with mineral oil at 36 cSt and at 50°C for flow P -> A/B, A/B -> T



①=all spool P -> A/B and A/B -> T ; P -> T spool 4 and 0
②= P -> A/B spool 4 ; A/B -> T spool 4

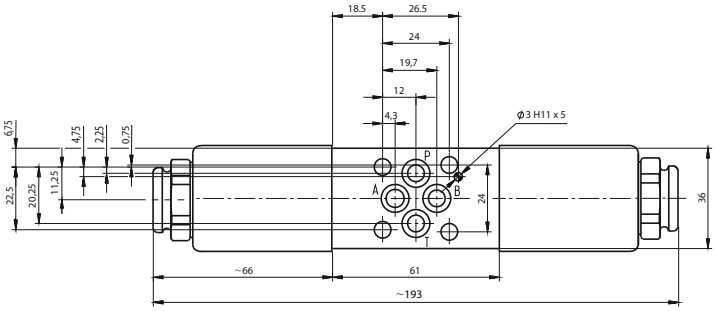
6 HYDRAULIC LIMITS OF USE

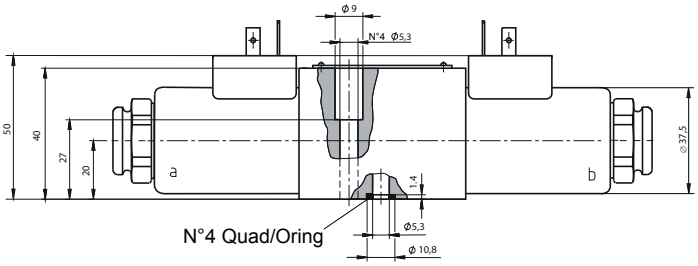
P/Q characteristic limits for safe use of HD2-ES-* solenoid operated valves. Limit curves apply to solenoid valves energized with rated voltage - 5% and flushed with hydraulic fluid with properties according to 8.

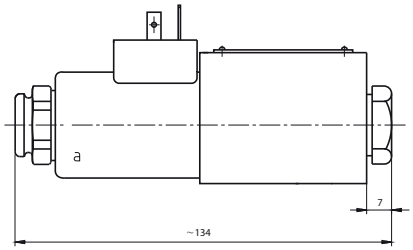


①= HD2 - ES - 0C; - 1C; - 1N; - 3C; - 8C; - 0ML; - 1LL; - 1ML; - 3ML; - 8ML
②= HD2 - ES - 2N; - 7C
③= HD2 - ES - 0LL
④ = HD2 - ES - 4C; - 4ML
⑤ = HD2 - ES - 55C; - 2LL

7 INSTALLATION DIMENSIONS (mm)







All valves HD2-* conform with ISO and CETOP specifications for mounting surface dimensions (see 6) and for valves height. When assembled to its mounting plate valve HD2 - * must be fastened with 4 bolts M5x35 (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/ O Ring type 7,65x1,68x1,68. Solenoid valves can be supplied without electric coils, as HD2 - ES -**-0000 - .
Coils are supplied separately: standard, 3 electric pins coils are BO2-012C, BO2-024C, BO2-115A and BO2-230A.
Connectors to the electric supply is made:
a) On standard solenoid coils 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.

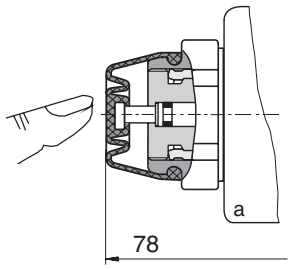
b) On type "AMP" solenoid coils, by connectors conforming to AMP-Timer (see 11)

8 HYDRAULIC FLUIDS

Seals and materials used on standard valves HD2-* are fully compatible with hydraulic fluids of mineral oil base, upgraded with antifoaming and filtered to ISO 4406 class 19/17/14 or better, and used in a raccomended viscosity range from 10 cSt to 60 cSt.

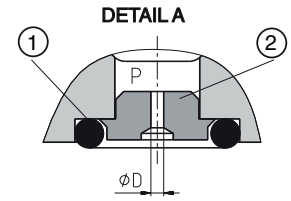
9 VERSION "K": EXTENDED EMERGENCY PIN

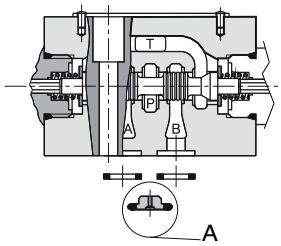
Solenoid valves according to "K" version have extended emergency actuator pins protuding from the solenoid shape, that permit a quick and easy "Hand operation" of the valves, without the need of any tool. The actuator pin and the end of the solenoid are protected by a flexible rubber cap that makes easy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



10 VERSION "S*":CALIBRATED ORIFICE ON P PORT

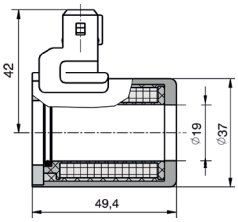
Option "S" is rappresented by elements ② , suitably shaped to be inserted on P port of the solenoid valve, having a calibrated orifice (of various size) able to restrict, at the requested Δp value, the flow rate entering the solenoid valve. Those elements have the following orifice diameter:
2S - 08 D = 0,8 mm
2S - 10 D = 1
2S - 12 D = 1,2 mm
2S - 15 D = 1,5 mm
and are kept sealed on the P port of the valve by an OR ① of 7,65x1,78 mm sizes (example OR 107-2031)



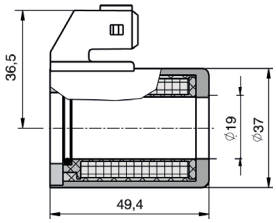


11 VERSION "AMP" and VERSION "Deutsch":

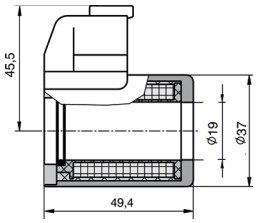
AMP



AMPX (axial)



D (Deutsch)



They are typically used on DC mobile application and they are available for many different coltages voltages:

12 VERSION "ZC" and VERSION "ZN" ZINC PLATED VALVES

Solenoid valves according to "ZC" version are completely zinc plated and protected against every type of corrosion due to saline ambiance or other aggressive chemicals. Zinc thickness are:
on the valve body 10-15 µm
on the solenoid tubes 8-12 µm
on the solenoid coils 8-12 µm

Version ZN (Zinc Nichel) has an higher protection degree which achieve the ISO 9227, 720 h salt spray test requirments

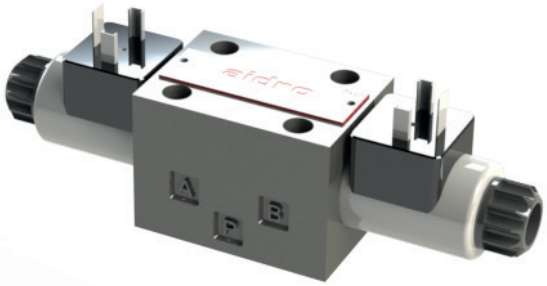
DIRECTIONAL CONTROL VALVES SOLENOID OPERATED

HD33-EF-*

40 l/min - 25 MPa (250 bar)

1 DESCRIPTION

Valves HD33-EF are directional control valve with subplate mounting interface acc. to ISO 4401, DIN 24340 (CETOP 03).
The design of the body is a three chamber casting for production cost saving and low pressure drops. HD33-EF has a low power consumption (18 W) and a compact design.
The valve is available with interchangeable metallic DC solenoids, also for AC power supply using connectors with a built-in rectifier bridge.
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)
HD33	-	EF	-		-		-			/	

(1) HD33: 4-way directional control valve CETOP 03

(2) Electrically controlled

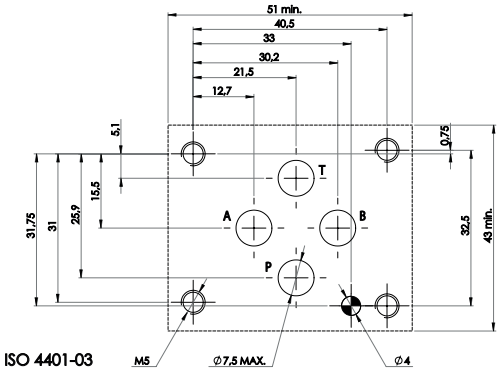
(3) Spool type (see 4):
-number is the main spool type
-letter is the solenoid or spring arrangement:
C : 2 solenoids, spool is spring centered (3 position)
LL : 1 solenoid, spool is spring offset (2 position)
ML : 1 solenoid, spool is spring centered (2 position)

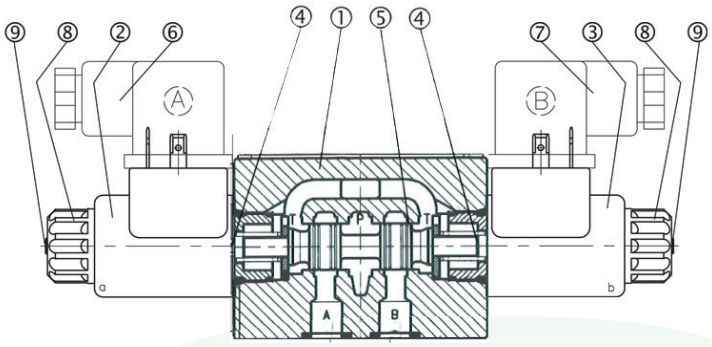
(4) Code reserved for option and variants

(5) Electric voltage and solenoid coils: see 6
0000: no coils
012C: coils for V12DC
024C: coils for V24DC

(6) Coil connection
no designation: DIN 43650-A ISO 4400
AMPX: Amp Junior Timer

(7) Design number (progressive) of the valves



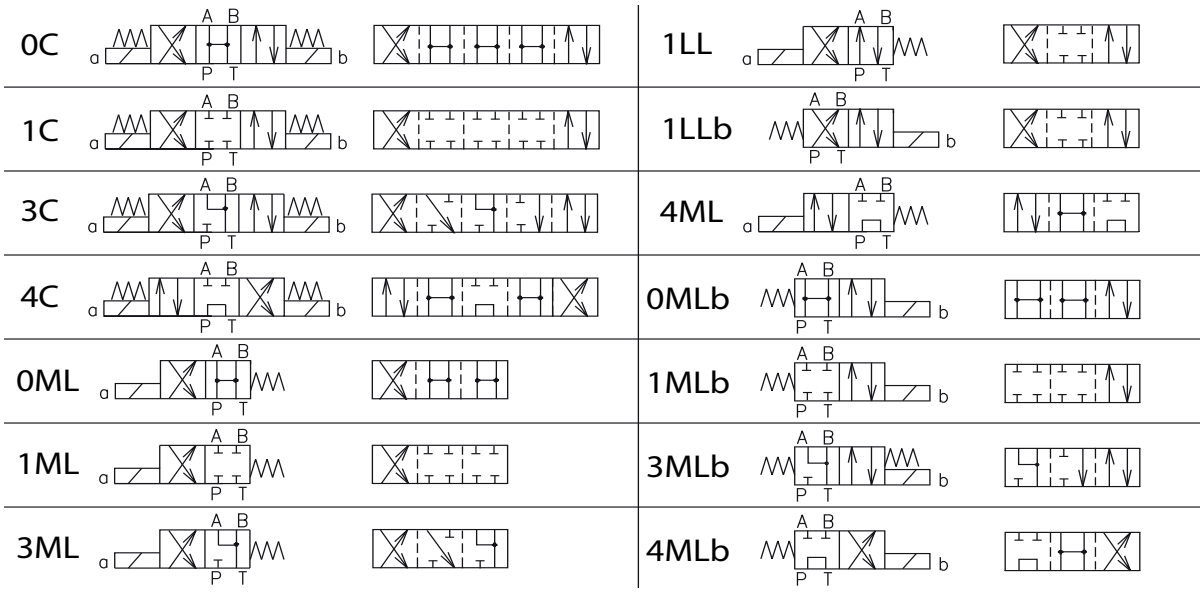


The spool 5 shifts into the valve body 1 subject to the actiong springs 4 and solenoids 9. Spool 5 depending from its shape and its position in the valve body 1, opens and/ or closes passages between P,A,B and T ports, thus controlling the direction of the hydraulic flow.

3 TECHNICAL DATA

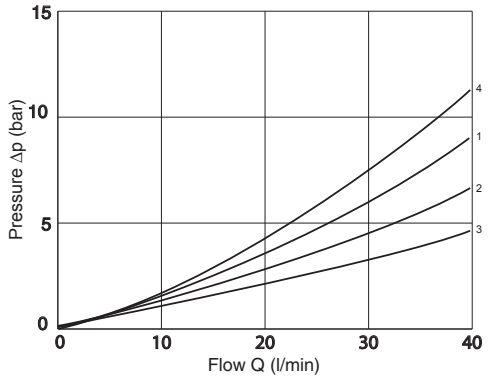
Nominal flow	25 l/min	Electric characteristics:
Maximum rec. flow rate	40 l/min	Valve type HD33-EF-* are operated by solenoid that are energized : directly from a D.C. voltage supply V 12 DC = 012C V 24 DC = 024C 3 pin connectors must conform to ISO 4400 (DIN 43650) Permissible supply voltage variation : ± 10 %
Maximum nominal pressure (P, A, B)	25 MPa (250 bar)	
Maximum pressure at T port	16 MPa (160 bar)	
Pressure drops	see 5	
Protection to DIN 40050	IP 65	
Duty cycle	100%	
Installation and dimensions	see 9	
Mass	1,25/1,10 kg	

4 SPOOL IDENTIFICATION AND INTERMEDIATE POSITION TRANSITORIES

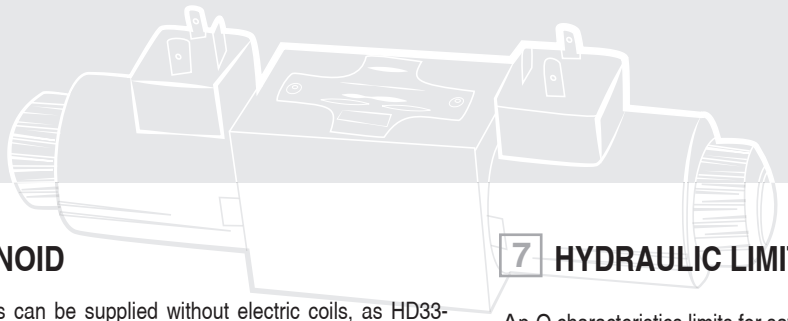


5 TYPICAL DIAGRAMS

Typical Δp-Q curves for valves HD33 -EF-* in standard configuration, with mineral oil at ν=32 mm²/s and T=40°C



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

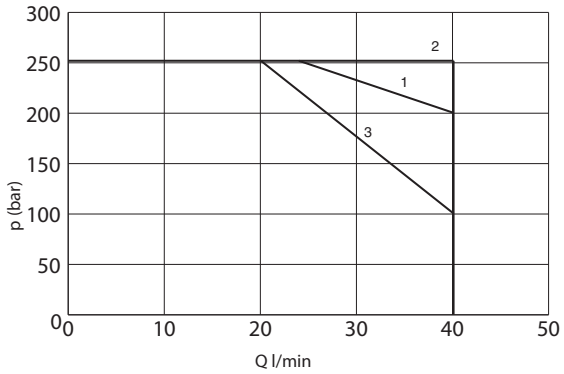


6 SOLENOID

Solenoid valves can be supplied without electric coils, as HD33-EF-****-0000. Coils are supplied separately; standard, 3 electric pins, coils are : - B01-012C - B01-024C. 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 LIMIT OF USE

Δp-Q characteristics limits for safe use of HD33-EF-* solenoid operated valves. Measured at ν = 32mm²/s and T = 40°C

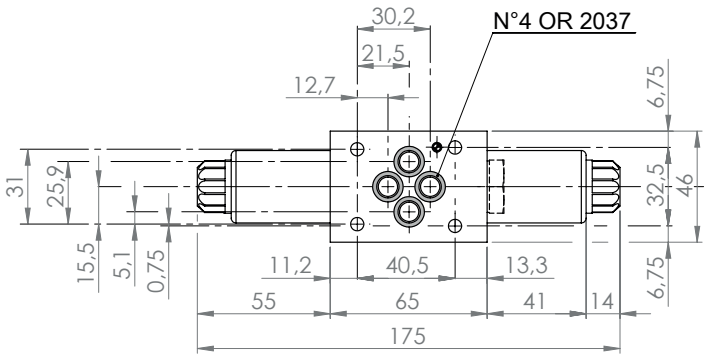


1C	2
4C	3
0C	1
3C	3
1LL	1
3ML	3
4ML	3
1ML	2
0ML	1
1MLb	2
1LLb	1
4MLb	3
0MLb	1
3MLb	3

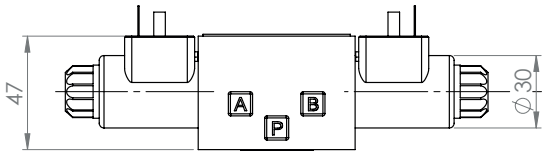
8 HYDRAULIC FLUID

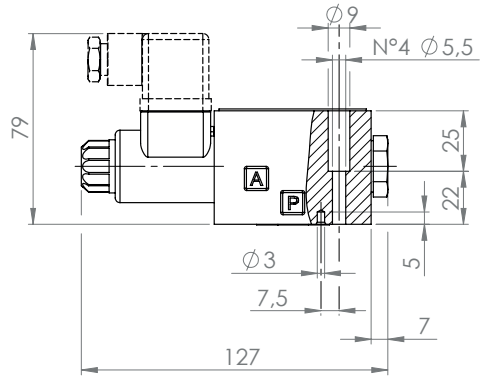
Seals and materials used on standard valves HD3-* are fully compatible with hydraulics fluids of mineral base, upgraded with antifoaming and anti oxidizing agents. The hydraulic fluid must be kept clean and filtered to ISO 4406 class 19/17/14, or better, and used in a recommended viscosity range from 10 cSt to 60 cSt.

9 INSTALLATION DIMENSIONS (mm)



All valves HD33-* conform with ISO and CETOP specifications for mounting surface dimensions and for valves height. When assembled to its mounting plate valve HD33-* 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 O Ring type 9,25x1,78

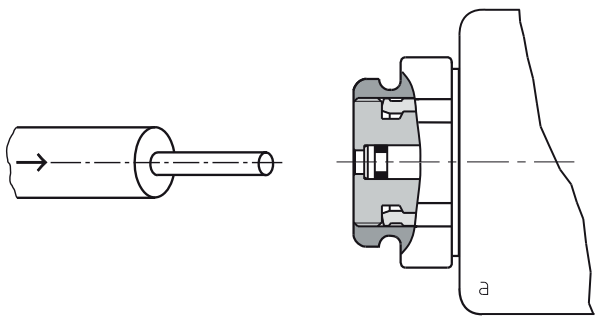




10 MANUAL OVERRIDE

In case of electric cut-offs, the spool can be manually shifted by acting on the emergency pins, located at the end of the solenoids and accessible through the retaining nuts.

Standard model of the manual override

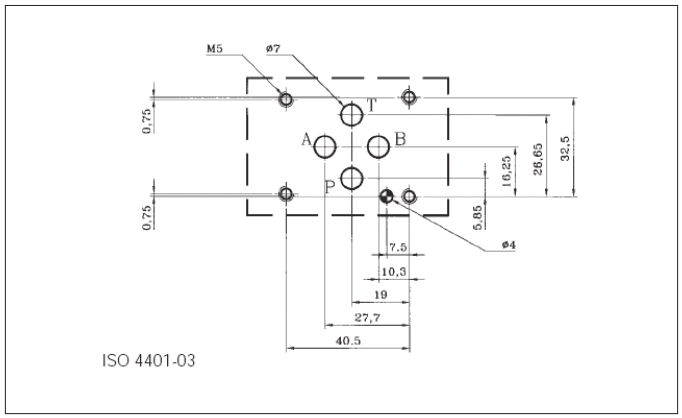


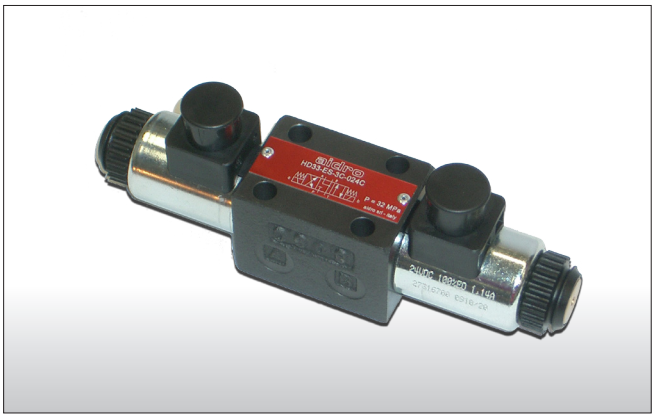
aidro

DIRECTIONAL CONTROL VALVE
SOLENOID OPERATED – CETOP 03
TYPE HD33-ES-*

Qnom = 50 l/min

Pmax = 32 MPa (320 bar)





1 HOW TO READ THE MODEL CODE FOR HD33-ES - Pressure 32 MPa (320 bar)

HD33	-	ES	-	(1)	(C)	-	*	-	(024C)	(-)	/	10
①		②		③	④		⑤		⑥	⑦		⑧

① **HD33** : 4-way directional control valve CETOP 03

② **ES** : electrically controlled

③ **(1)** : spool type (see 5)

④ **(C)** : solenoid(s) and spring(s) arrangements (see 5)

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)

⑤ ***** : Code reserved for options and variants

S-**	:	calibrated orifice on P port, see 14
K	:	water proof caps on emergency pin, see 13

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

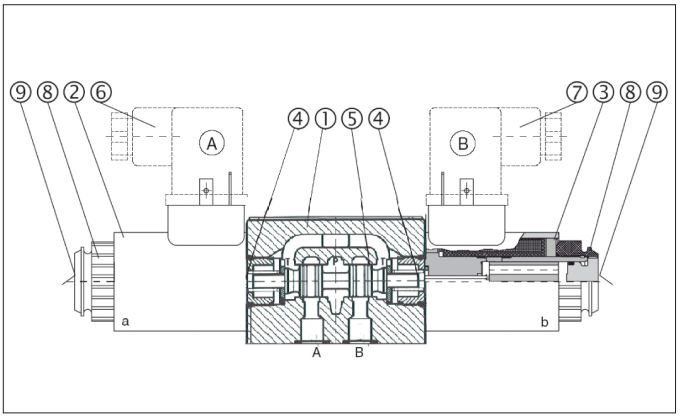
⑦ **-** : Coil connection

-	:	DIN 43650-A ISO 4400
AMP	:	Amp Junior Timer – vertical configuration, see 15
AMPX	:	Amp Junior Timer – axial configuration, see 15
D	:	Deutsch, see 15

⑧ **10** : Design number (progressive) of the valves.

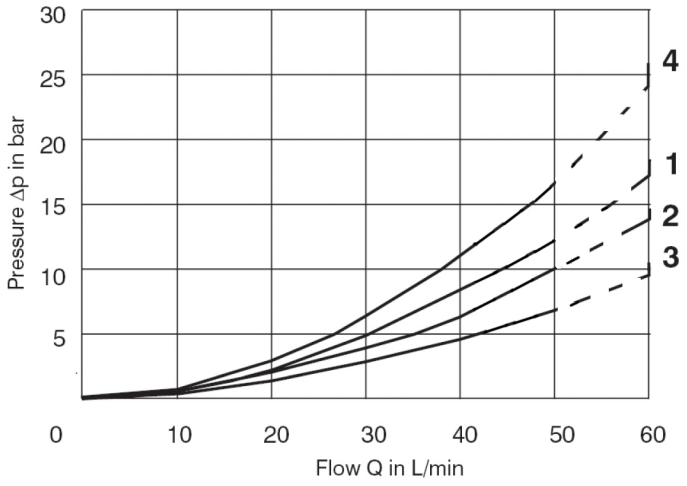
2 DESCRIPTION

The spool ⑤ shifts into the valve body ① subject to the action of springs ④ and solenoids ⑨. Spool ⑤, depending from its shape and its position in the valve body ①, opens and/or closes passages between P, A, B and T ports, thus controlling the direction of the hydraulic flow.



3 TYPICAL DIAGRAMS

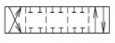
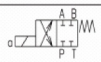
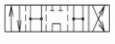
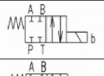
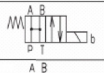
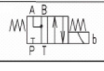
Typical P-Q curves for valves HD33-ES-* in standard configuration, with mineral oil at ν=32 mm²/s and at T=40°C.



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

5 SPOOL IDENTIFICATION AND INTERMEDIATE POSITION TRANSITORIES

Functional Symbols

Designation	Symbol	Interposition	Designation	Symbol	Interposition
1C			1ML		
4C			0ML		
0C			1MLb		
3C			1LLb		
1LL			4MLb		
3ML			0MLb		
4ML			3MLb		

4 TECHNICAL DATA

Nominal flow	50 l/min
Maximum rec. flow rate see 7	60 l/Min
Maximum nominal pressure (P, A, B)	32 MPa (320 bar)
Maximum pressure at T port	21 MPa (210 bar)
Pressure drops	see 3
Electric characteristics	see 6
Protection to DIN 40050	IP 65
Duty cycle	100%
Dimensions	see 9
Installation	see 8
Mass	1,6/1,2 kg

6 ELECTRIC CHARACTERISTICS

Valve type HD33-ES-* are operated by solenoid that are energized :

- directly from a D.C. voltage supply

V 12 DC = 012C
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

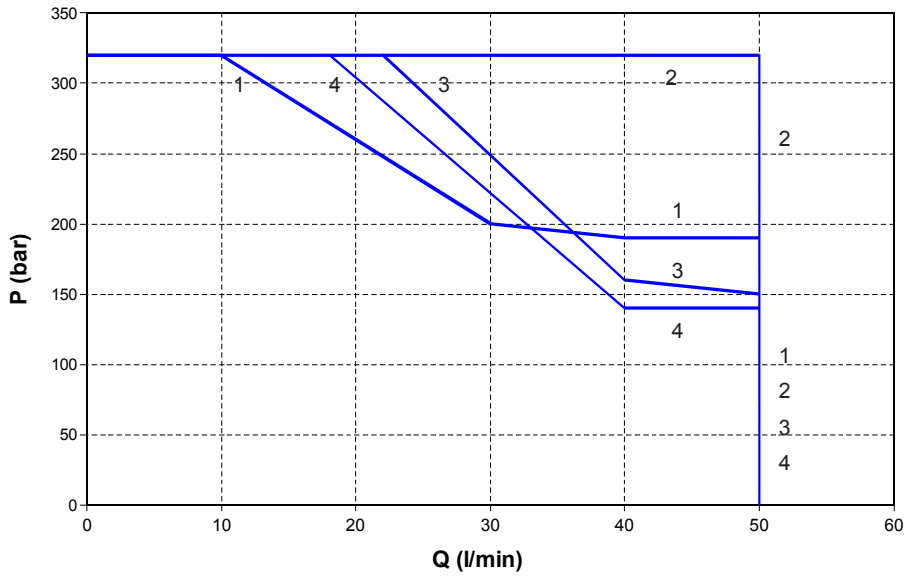
All connectors must conform to ISO 4400 (DIN 43650) and electric circuitry must be able to carry the following rated current values :
V 12 DC = 2,4 A V 115/50 = 0,26 A
V 24 DC = 1,2 A V 230/50 = 0,14 A

Coils with 2 electric pins, conforming with AMP connectors, are only available for DC supply (example of code : B02-012C AMP).

Permissible supply voltage variation : ± 10 %

7 HYDRAULIC LIMITS OF USE

P-Q characteristics limits for safe use of HD33-ES-* solenoid operated valves. Measured at ν = 32 mm²/s and T = 40°C



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

8 INSTALLATION

All valves HD33-* conform with ISO and CETOP specifications for mounting surface dimensions (see 9) and for valves height. When assembled to its mounting plate valve HD33-* must be fastened with 4 bolts M5x30 (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 O Ring type 9,25x1,78.

10 SOLENOID

Solenoid valves can be supplied without electric coils, as HD33-ES-****-0000.
Coils are supplied separately ; standard, 3 electric pins, coils are :
- B02-012C ; B02-024C
- B02-115A ; B02-230A

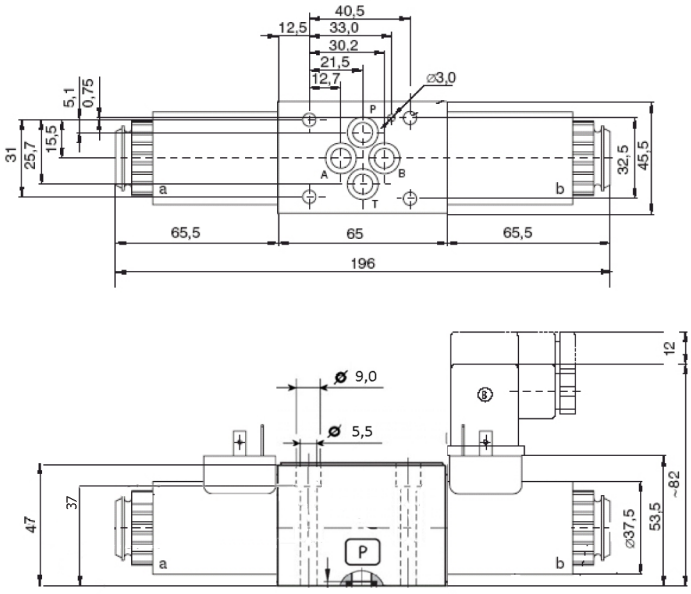
Connections to the electric supply is made by standard 3-PIN connectors, according to ISO 4400 (DIN 43650).
Connectors can be with different cable exit size (PG9, PG11) and beside of the plain connecting function they may incorporate various features like
- Signal led
- Voltage surge suppressor, etc.

11 HYDRAULIC FLUID

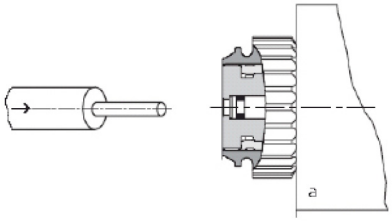
Seals and materials used on standard valves HD33-* are fully compatible with hydraulics fluids of mineral base, upgraded with antifoaming and anti oxidizing agents.
The hydraulic fluid must be kept clean and filtered to ISO 4406 class 19/17/14, or better, and used in a recommended viscosity range from 10 cSt to 60 cSt.

9 INSTALLATION DIMENSIONS

(dimensions are mm)



12 MANUAL OVERRIDE

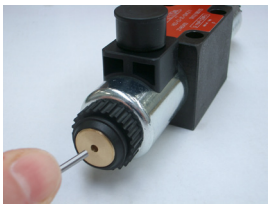


In case of electric cut-offs, the spool can be manually shifted by acting on the emergency pins, located at the end of the solenoids and accessible through the retaining nuts.

Standard model of the manual override

13 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.



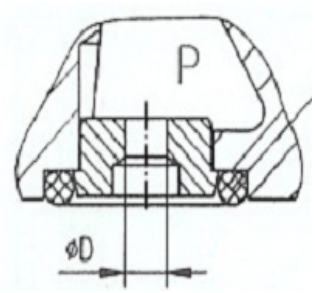
standard manual override

Version "K" Override pin

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

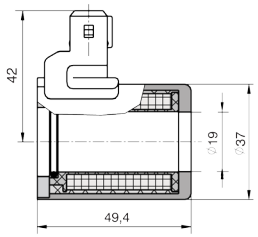
Option “S*” is represented by an element suitably shaped to be inserted on P port of the solenoid valve, having a calibrated orifice (of various sizes) able to restrict, depending on the ΔP value, the flow rate entering the solenoid valve.
Those elements have the following orifice diameters :

- 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

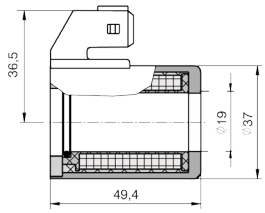


and are kept sealed on the P port of the valve by an OR of 9,25x1,78 mm sizes (example OR 110-2037)

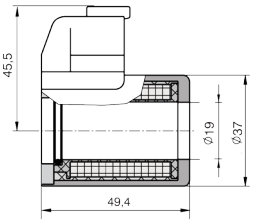
15 SPECIAL COIL CONNECTIONS



AMP =Amp Junior Timer vertical configuration

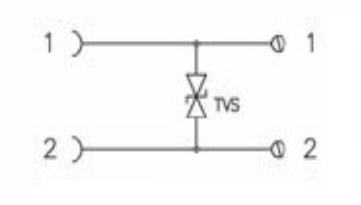


AMPX = Amp Junior Timer axial configuration



D = Deutsch

16 QUENCHING DIODE



On request, 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.

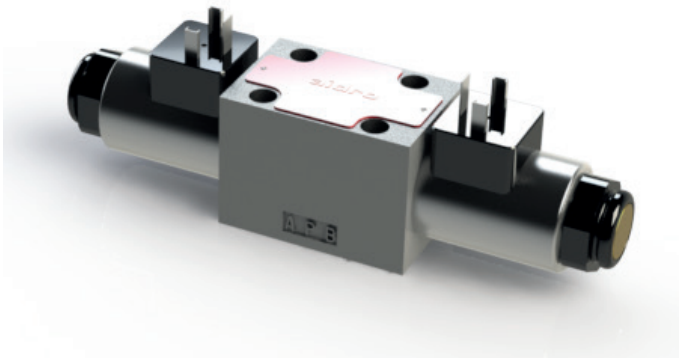
DIRECTIONAL CONTROL VALVES SOLENOID OPERATED

HD3-ES-*-/20

60 l/min - 32 MPa (320 bar)

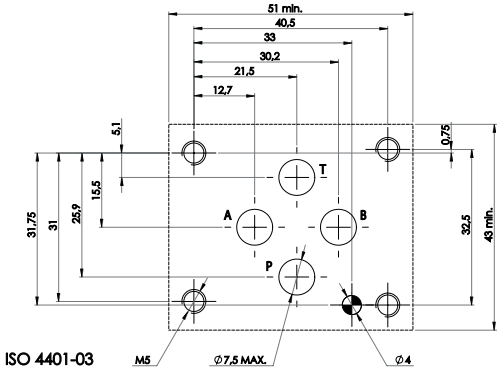
1 DESCRIPTION

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 high qulaity 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	-		-		-			/	20



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

(2) Electrically controlled

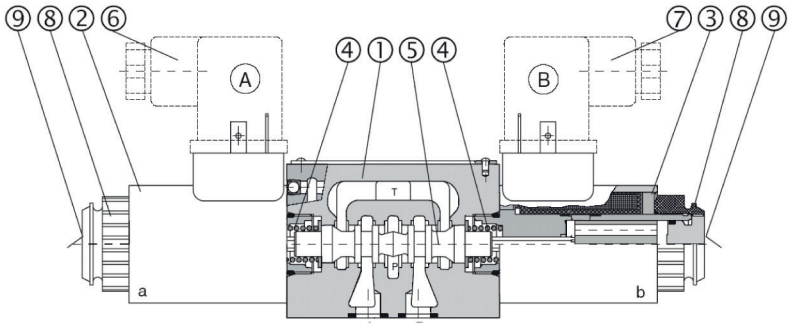
(3) Spool type (see 4):
-number is the main spool type
-letter is the solenoid or spring arrangement:
C : 2 solenoids, spool is spring centered (3 position)
LL : 1 solenoid, spool is spring offset (2 position)
ML : 1 solenoid, spool is spring centered (2 position)

(4) Code reserved for option and variants:
S-**: calibrated orifice on P port, see 11
K : Water proof caps on emergency pin, see 10

(5) Electric voltage and solenoid coils: see 6
0000: no coils
012C: coils for V12DC
024C: coils for V24DC
115A: coils for V110/50- V 115/60AC
230A: coils for V220/50- V 230/60AC

(6) Coil connection
no designation: DIN 43650-A ISO 4400
AMP: Amp Junior Timer- vertical configuration, see 12
AMPX: Amp Junior Timer- axial configuration, see 12
D: Deutsch, see 12

(7) Design number (progressive) of the valves



The spool 5 shifts into the valve body 1 subject to the actiong springs 4 and solenoids 9. Spool 5 depending from its shape and its position in the valve body 1, opens and/ or closes passages between P,A,B and T ports, thus controlling the direction of the hydraulic flow.

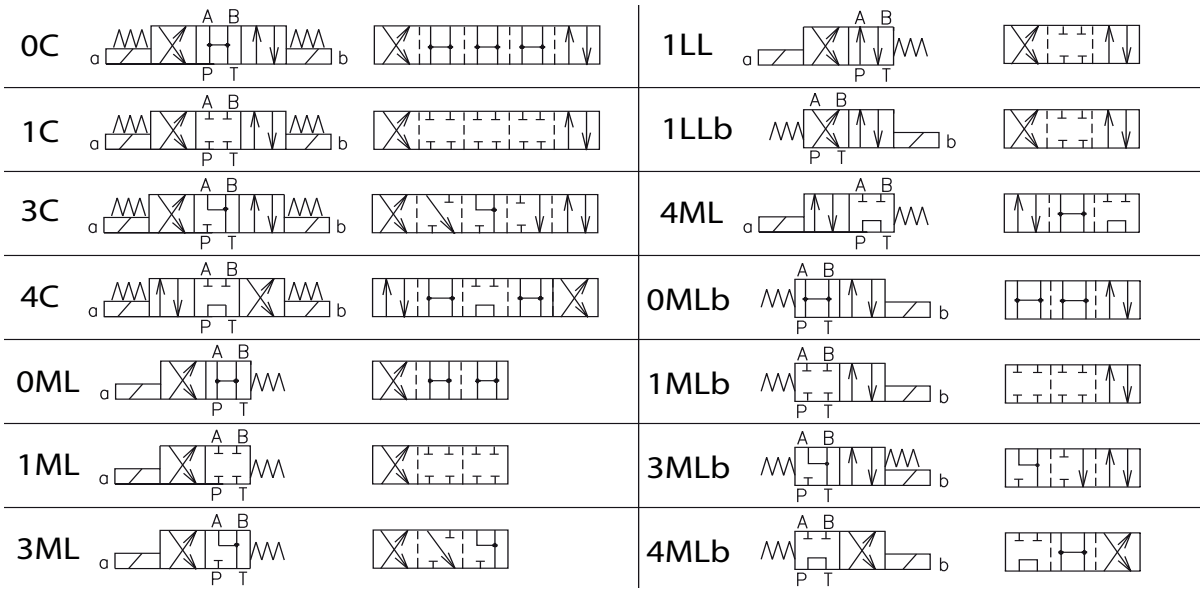
3 TECHNICAL DATA

Nominal flow	50 l/min
Maximum rec. flow rate	60 l/min
Maximum nominal pressure (P, A, B)	32 MPa (320 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 9
Mass	1,6/1,2 kg

Electric characteristics:

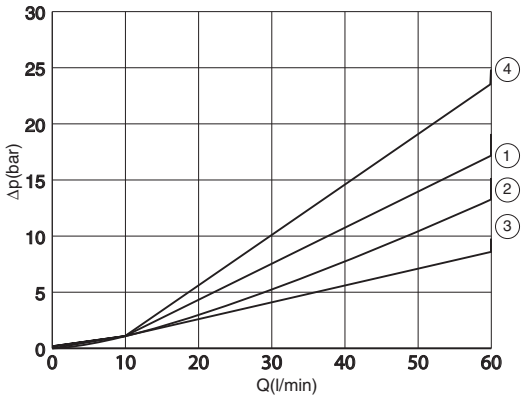
Valve type HD3-ES-* are operated by solenoid that are energized :
Directly from a D.C. voltage supply:
V 12 DC = 012C V 24 DC = 024C
By the use of coils that incorporate a full wave bridge rectifier, from A.C. voltage supply:
V 110/50 - V 115/60 = 115A
V 220/50 - V 230/60 = 230A
Other available voltages 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 = 2,4 A V 115/50 = 0,26 A
V 24 DC = 1,2 A V 230/50 = 0,14 A
Coils with 2 electric pins, conforming with AMP connectors, are only available for DC supply (example of code : B02-012C AMP)).
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 ν=32 mm²/s and T=40°C



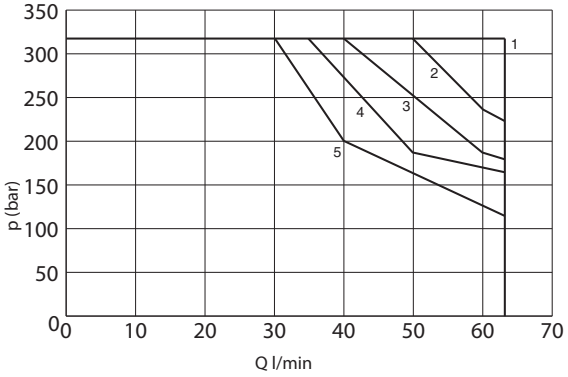
Spool	P-A	P-B	A-T	B-T	P-T
1C	2	2	2	2	
4C	4	4	4	4	2
0C	2	2	3	3	2
3C	2	2	3	3	
1LL	3	3	4	4	
1LLb	3	3	4	4	
1ML		2	2		
4ML	4		4		2
0ML	2		3		2
3ML	2		2		

6 SOLENOID

Solenoid valves can be supplied without electric coils, as HD3-ES-****-0000. Coils are supplied separately; standard, 3 electric pins, coils are : - B02-012C ; B02-024C - B02-115A ; B02-230A 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 LIMIT OF USE

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

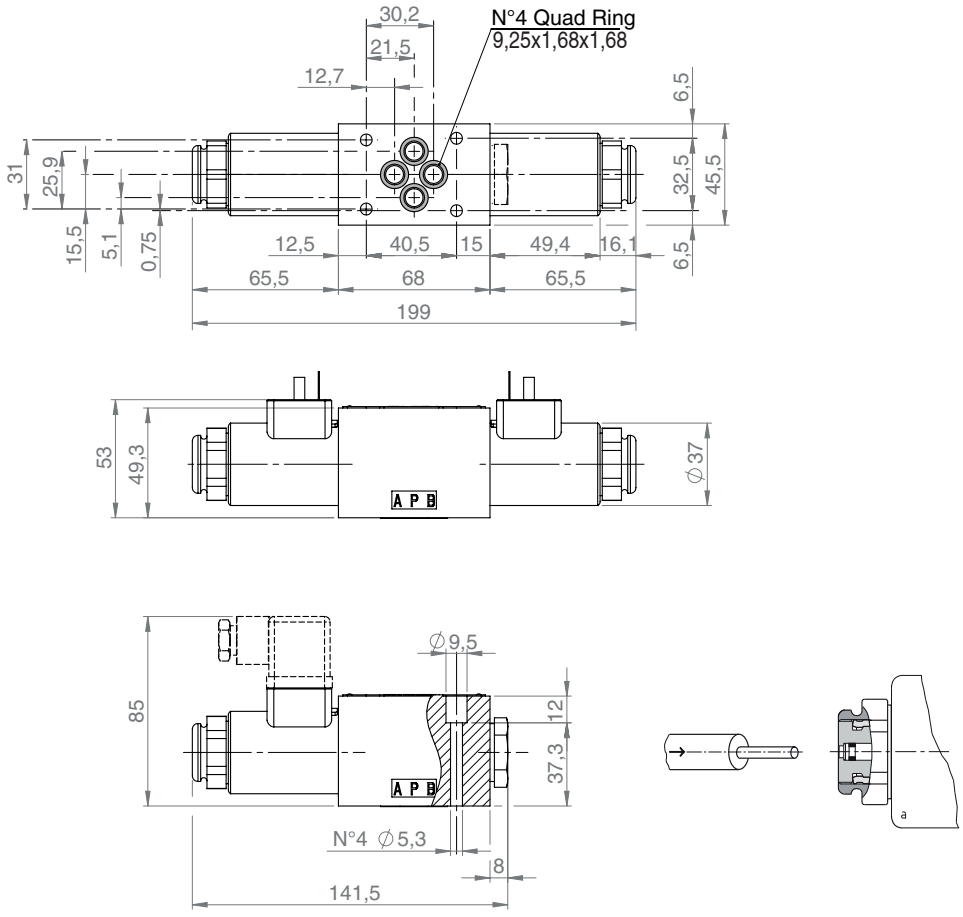


1C	1
4C	5
0C	1
3C	2
1LL	3
3ML	2
4ML	5
1ML	1
0ML	1
1MLb	1
1LLb	1
4MLb	5
0MLb	1
3MLb	2

8 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.

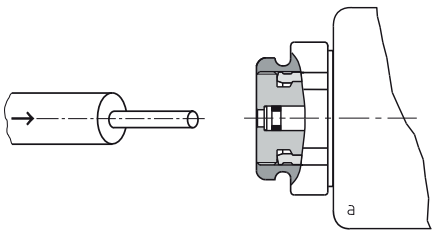
9 INSTALLATION DIMENSIONS (mm)



All valves HD3-* conform with ISO and CETOP specifications for mounting surface dimensions (see 8) 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

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



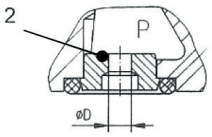
11 VERSION "S*" ; CALIBRATED ORIFICE ON P PORT

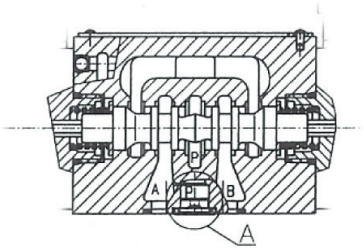
Option "S*" is represented by an element suitably shaped to be inserted on P port of the solenoid valve, having a calibrated orifice (of various sizes) able to restrict, depending on the ΔP value, the flow rate entering the solenoid valve.

Those elements have the following orifice diameters :

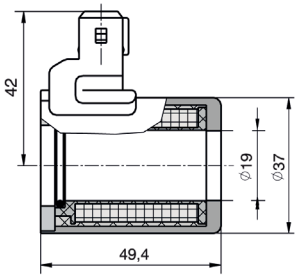
- 3S-00 -> D = 0 mm
- 3S-10 -> D = 1,0 mm
- 3S-15 -> D = 1,5 mm
- 3S-20 -> D = 2,0 mm
- 3S-25 -> D = 2,5 mm

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

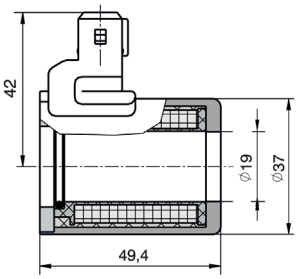




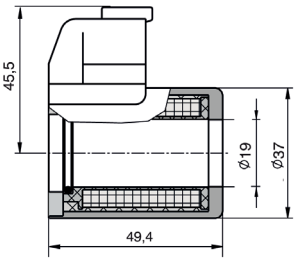
12 SPECIAL COIL CONNECTIONS



AMP =Amp Junior Timer
vertical configuration

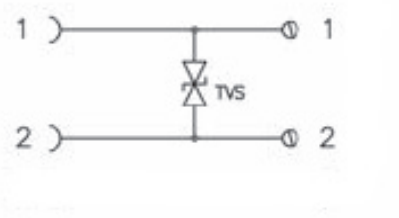


AMP =Amp Junior Timer
axial configuration

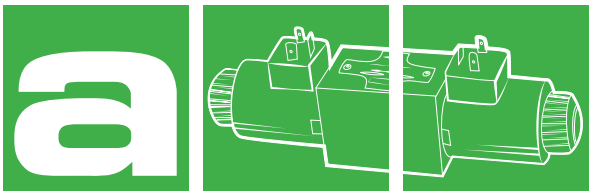


D = Deutsch

13 QUENCHING DIODE



On request, 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



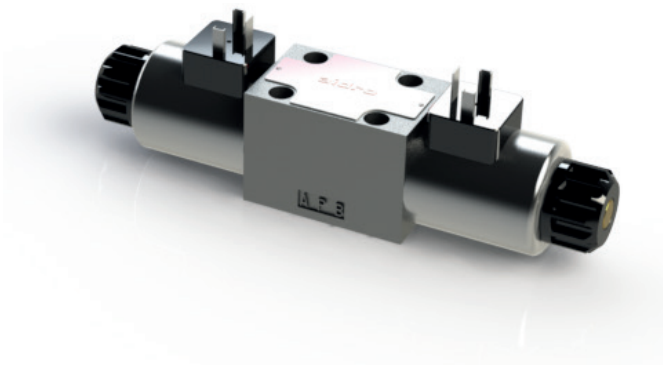
DIRECTIONAL CONTROL VALVES SOLENOID OPERATED

HD3-ES-*/10

80 l/min - 35 MPa (350 bar)

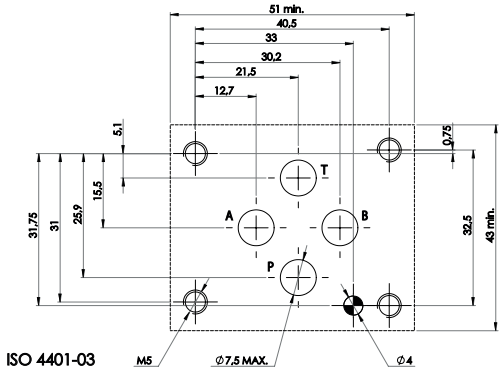
1 DESCRIPTION

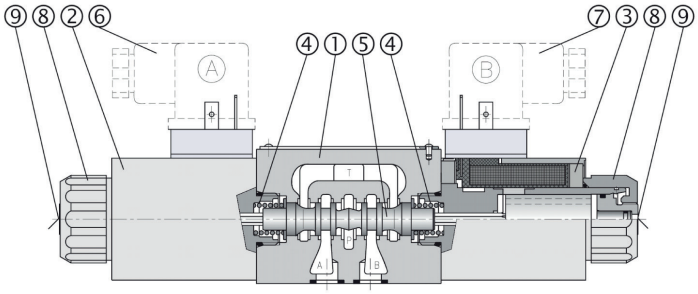
Valves HD3-ES are directional control valve with subplate mounting interface acc. to ISO 4401, DIN 24340 (CETOP 03).
The design of the body is a quality five chamber casting.
The valve is available with interchangeable metallic DC solenoids, also for AC power supply using a built-in rectifier bridge 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)

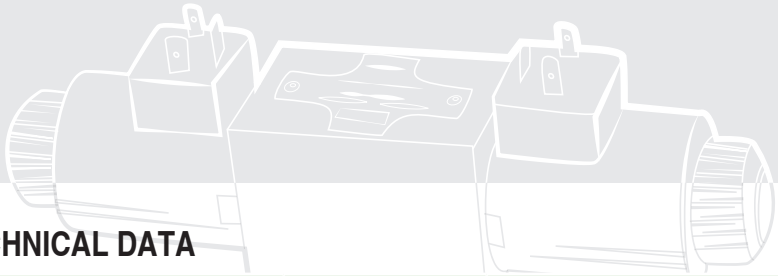
(4) Code reserved for option and variants:
S-**: calibrated orifice on P port, see 11
K : water proof caps on emergency pin, see 10
T : soft shifting device, see 12
Z* : anti corrosion coating (variants), see 14
Sa, Sb: proximity sensors, see 15

(5) Electric voltage and solenoid coils: see 8
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.



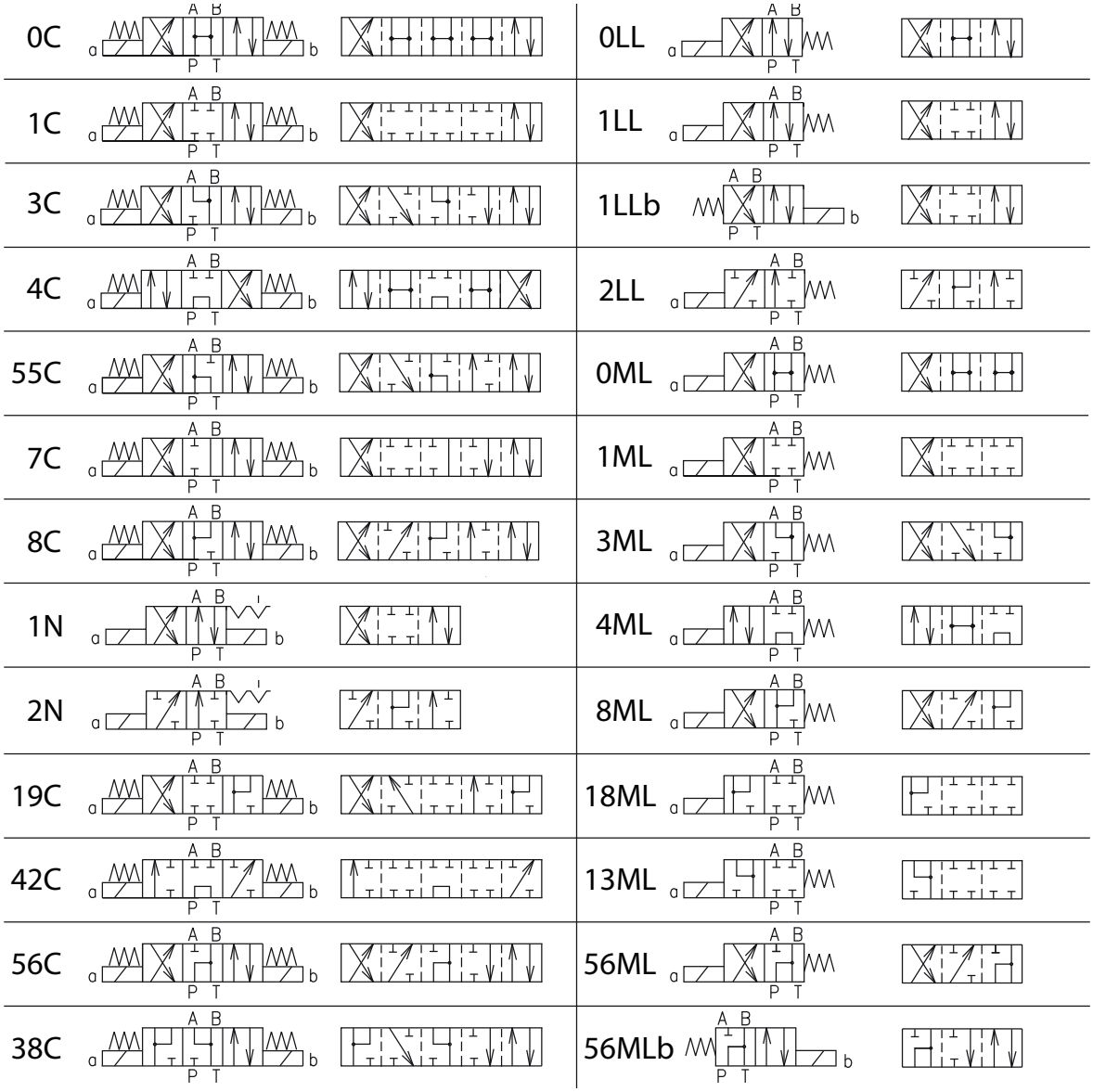
3 TECHNICAL DATA

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:

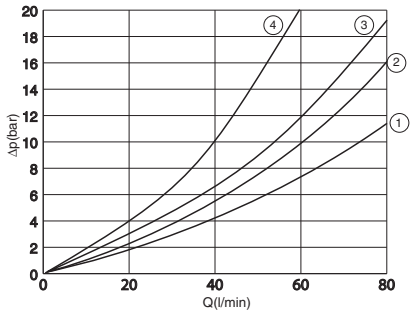
Valve type HD3-ES-* are operated by solenoid that are energized :
Directly from a D.C. voltage supply:
V 12 DC = 012 C V 24 DC = 024C
By the use of coils that incorporate a full wave bridge rectifier, from A.C. voltage supply:
V 110/50 - V 115/60 = 115A
V 220/50 - V 230/60 = 230A
Other available voltages 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



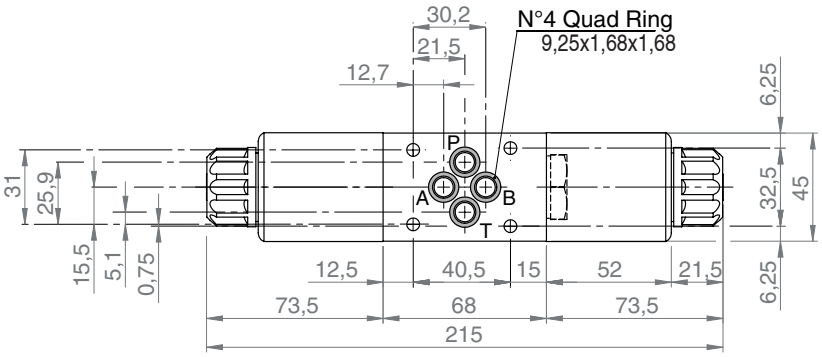
5 TYPICAL DIAGRAMS

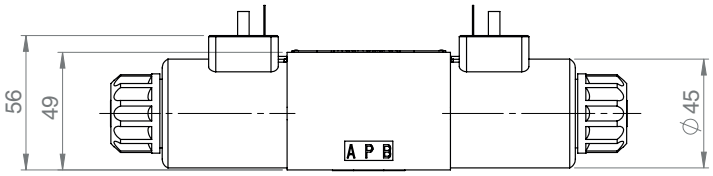
Typical Δp-Q curves for valves HD3 -ES-* in standard configuration, with mineral oil at 32 mm²/s and T=40°C

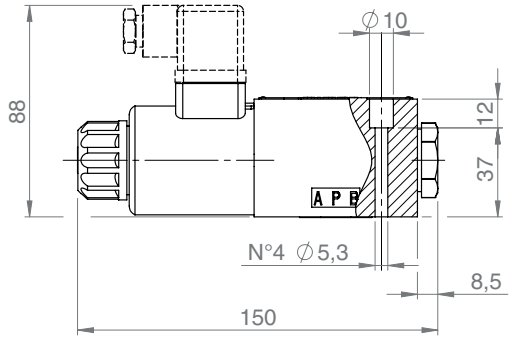


Spool	P-A	P-B	A-T	B-T	P-T
1C	1	1	2	2	
4C	3	3	4	4	1
0C	1	1	2	2	1
3C	1	1	2	2	
1LL	1	1	2	2	
1LLb	1	1	2	2	
1ML		1	2		
4ML	4		4		2
0ML		1	2		1
3ML	1		2		

6 INSTALLATION DIMENSIONS (mm)



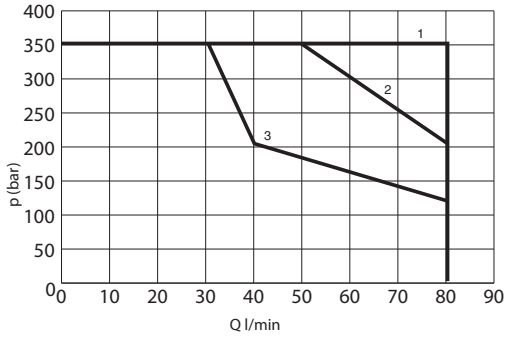




All valves HD3-* conform with ISO and CETOP specifications for mounting surface dimensions (see 9) and for valves height. When assembled to its mounting plate valve HD3-* must be fastened with 4 bolts M5x45 (or M5x** according to the number of modules) tightened at 8 Nm torque. Leakage between valve 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

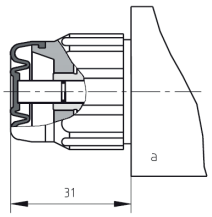
Solenoid valves can be supplied without electric coils, as HD3-ES-****-0000. Coils are supplied separately; standard, 3 electric pins, coils are : - B03.012C ; B03.024C ; B03.115A ; B03.230A Connections to the electric supply is made by standard 3-PIN connectors, according to ISO 4400 (DIN 43650). Connectors 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

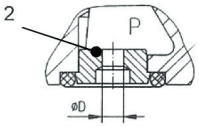
Solenoid valves according to “K” version have extended emergency actuator pins protruding from the solenoid shape, that permit a quick and easy “hand operation” of the valves, without the need of any tool. The actuator pin and the end of the solenoid are protected by a flexible rubber cap that makes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

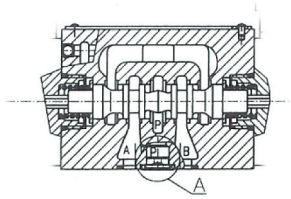


11 VERSION “S*” ; CALIBRATED ORIFICE ON P PORT

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

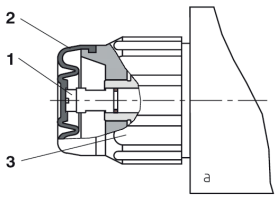




and are kept sealed on the P port of the valve by an OR of 9,25x1,78 mm sizes (example OR 110-2037)

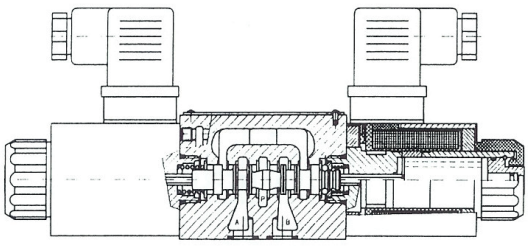
12 VERSION “T”: SOFT SHIFTING

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.



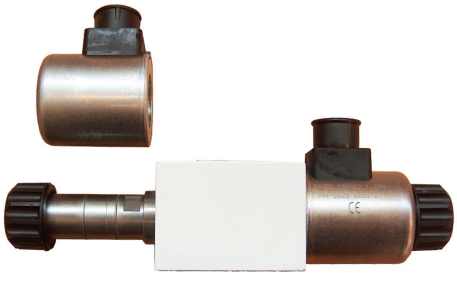
13 VERSION “N”: MECHANICAL DETENT ON SPOOL

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

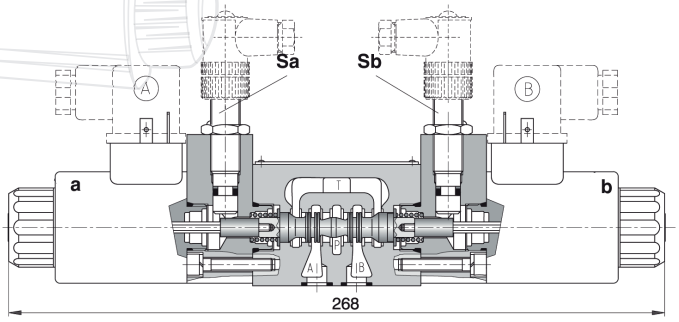
On HD3-ES-* standard valves the body is phosphate coated, the solenoid tubes are not treated and coils mantel and irons are zinc trivalent plated. To increase the resistance to corrosive agents different variants are available :
Example of ZK painted : HD3-ES-3C-ZK-024C/10
ZT: Body, solenoid tubes and 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

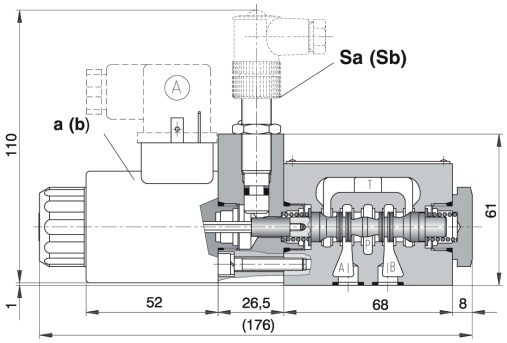


15 VERSION “Sa and Sb”: POSITION SENSOR

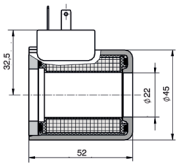
Solenoid valves with spool position sensors are equipped with a proximity sensor able to transform the spool position into an electric signal. It can be used with directional control valves with one or two solenoids. It’s possible to have the two different versions, normally open and normally closed 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

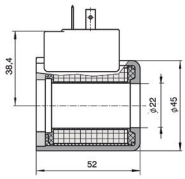




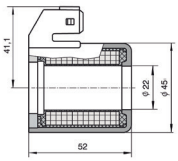
16 SOLENOID COILS types B03-xxxx



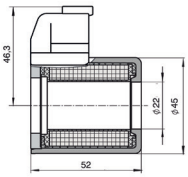
ISO 4400 (DIN 43650)
(standard configuration)
B03-0xxC



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



AMPX = Amp Junior Timerwith
axial configuration
B03-0xxCAMPX

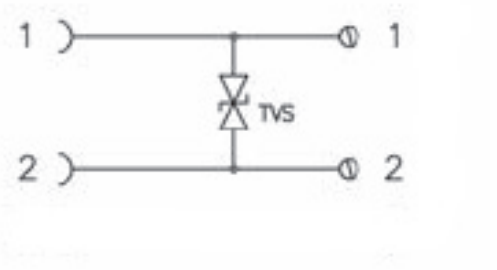


D = Deutsch

B03-0xxD

17 QUENCHING DIODE

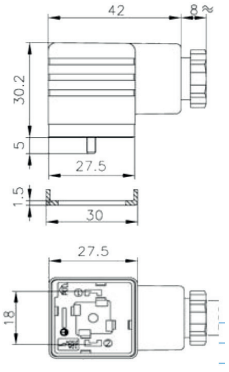
On request, DC coils can be supplied with an integrated bidirectional quenching diode (transil type BZW06-19B) able to provide high overvoltage protection. Their instantaneous response to transient overvoltages makes them particularly suited to protect voltage sensitive devices



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

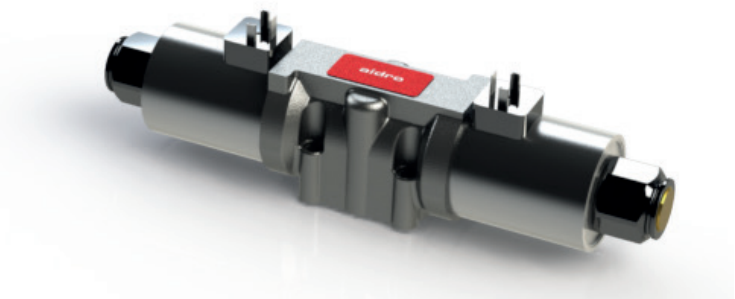
DIRECTIONAL CONTROL VALVES SOLENOID OPERATED

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)

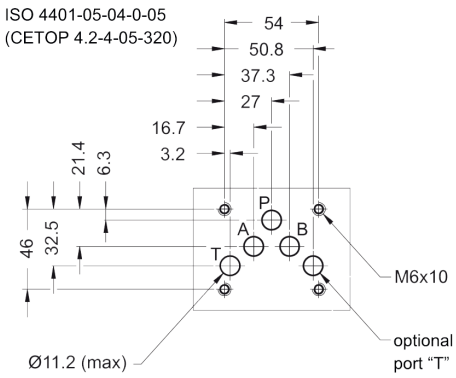
(2) ES : electrically controlled, standard

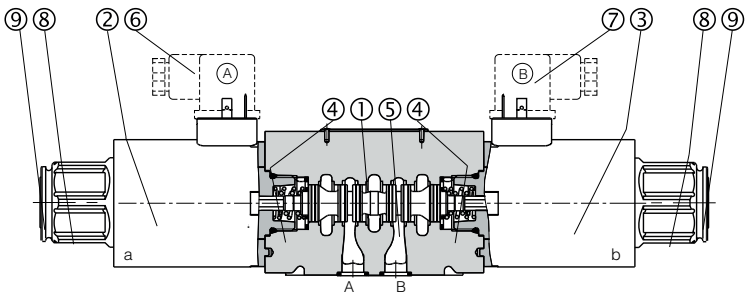
(3) Spool type (see 4)
-number is the main spool type
-letter is the solenoid or spring arrangement:
C : 2 sol. , spool is spring centered (3 position)
N : 2 sol. , spool is detented (2 position)
LL : 1 sol. (a), spool is spring offset (2 pos. , end to end)
ML: 1 sol. (a), spool is spring centered (2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



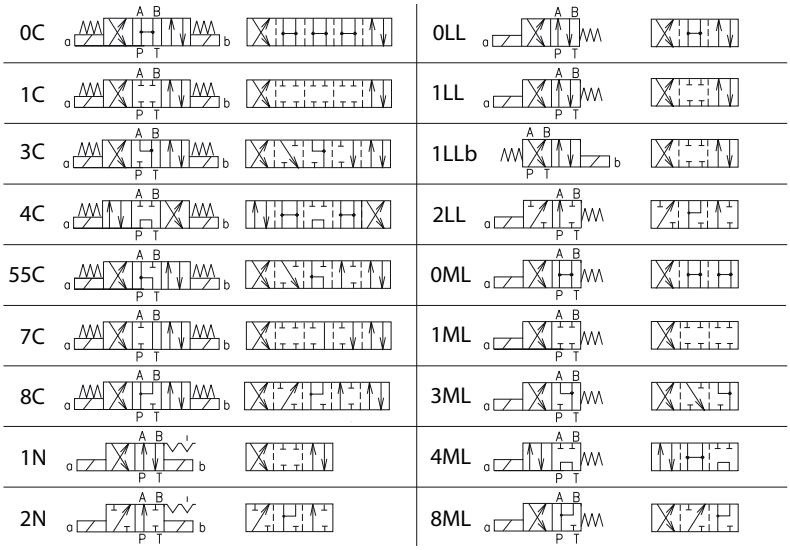


The spool 1 shifts into the valve body 7 subject to the action of springs and solenoids 2 and 3. Spool 1, depending from its shape and its position in the valve body 7, opens and/or closes p assages b etween P , A , B a nd T ports, thus controlling the direction of the ydraulic flow. In case of electric 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

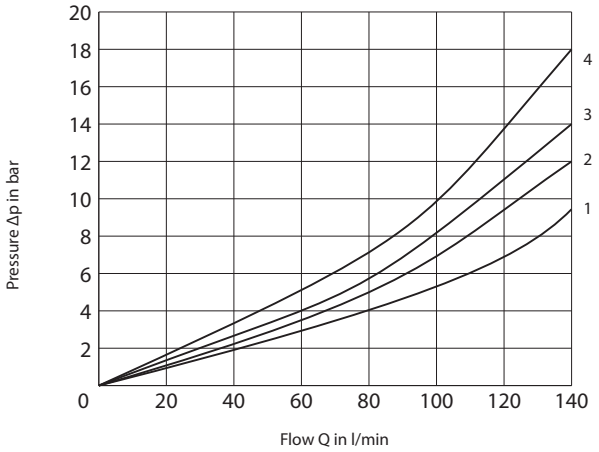
Nominal flow	120 l/min
Max. rec. flow	see 5
Nominal pressure (P, A,B)	32 MPa (320 bar)
Max. rec. Pressure (P, A, B)	35 MPa (350 bar)
Max. rec. Pressure (T port)	21 MPa (210 bar)
Pressure drops	see 6
Protection to DIN 40050	IP 65
Duty cycle	100 %
Service life	> 10^7 cycles
Mass	1 sol. 3,9 kg 2 sol. 5,4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

4 SPOOL IDENTIFICATION AND INTERMEDIATE POSITION TRANSITORIES



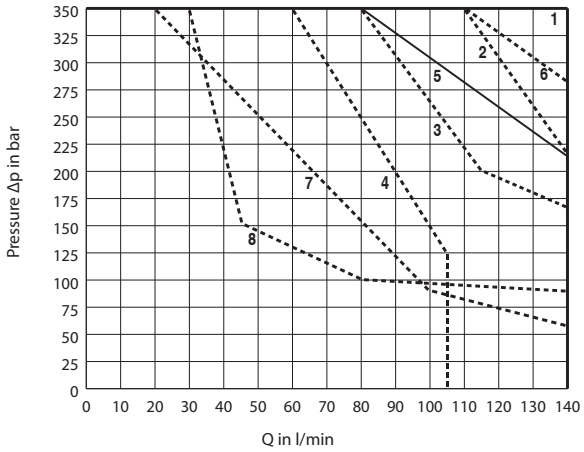
5 TYPICAL DIAGRAMS

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



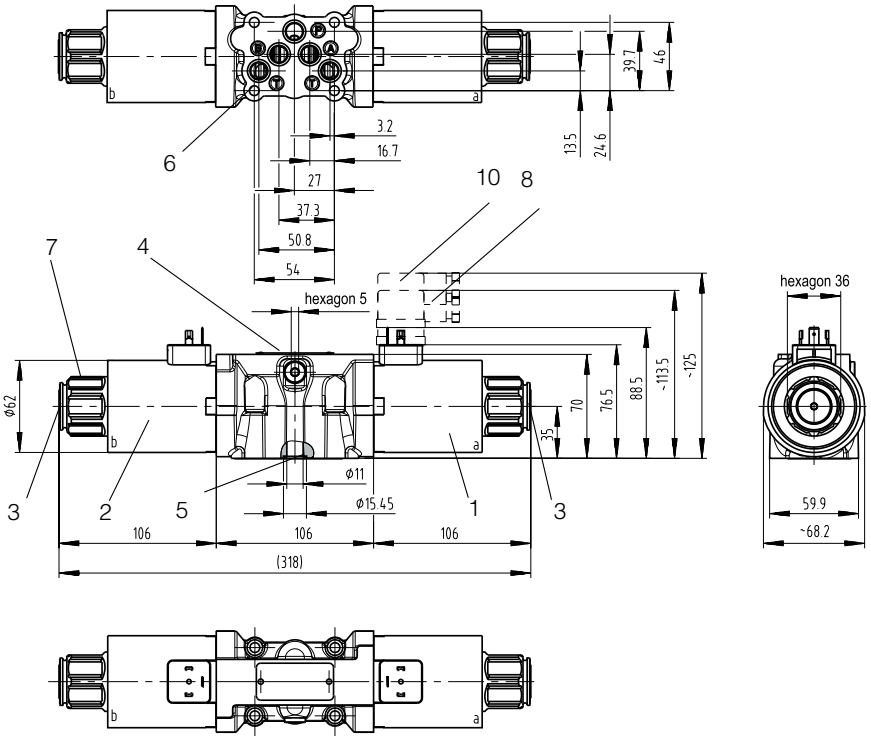
Spool type	P-A	P-B	A-T	B-T	P-T
0C	1	1	2	2	1
1C	1	1	2	2	-
3C	1	1	2	2	-
4C	3	3	4	4	1
55C	1	1	1	2	2
7C	1	1	2	2	-
8C	1	1	2	2	-
1N	1	1	2	3	-
2N	1	1	-	-	-
0LL	1	1	1	3	-
1LL	1	1	2	2	-
1LLb	1	1	2	2	-
2LL	1	1	-	-	-
0ML	-	1	2	-	1
1ML	-	1	2	-	-
3ML	-	1	2	-	-
4ML	3	-	-	4	1
8ML	-	1	2	-	-

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)

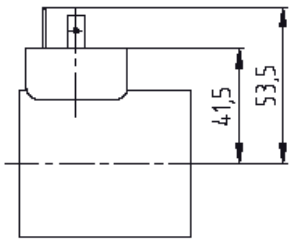


All valves HD5-ES-* conform with ISO and CETOP specifications for mounting surface dimensions and for valves height.
When assembled to its mounting plate, valve HD5-ES-* must be fastened with 4 fixing bolts (socket head screws to ISO 4762) M6 x 40 mm (or M6 x* according to the number of modules) of class 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

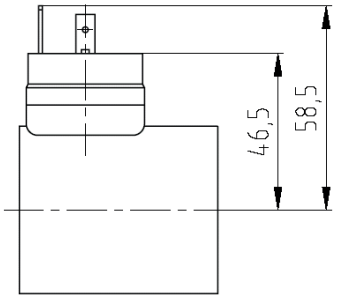


Permissible supply voltage variation : +5% -10%
Special voltages available : V 48 DC, V 106 DC, V 205 DC

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

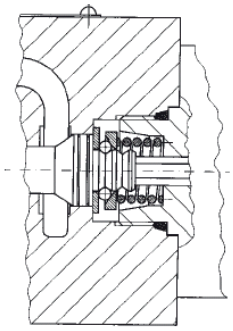
Coils type B05-* for valves HD5-ES-* can be supplied with 2-poles AMP Junior-Timer electric connection. Coils with AMP connection can be supplied separately as B05-***CAMP

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).

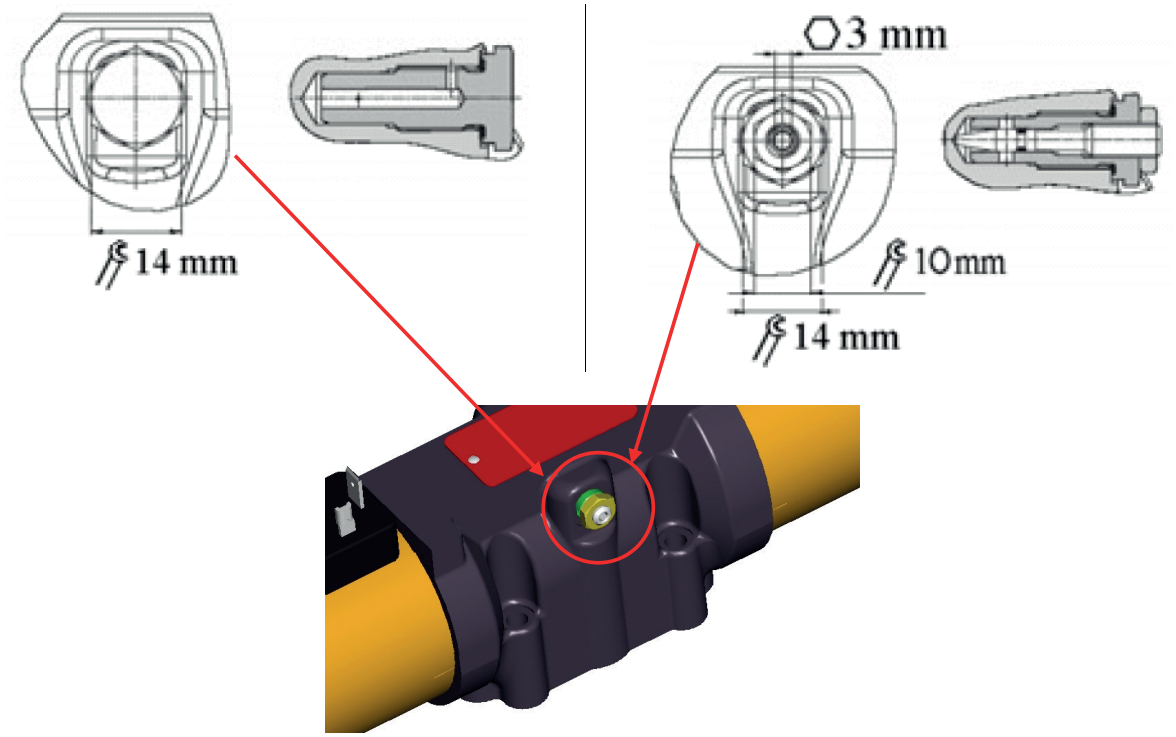


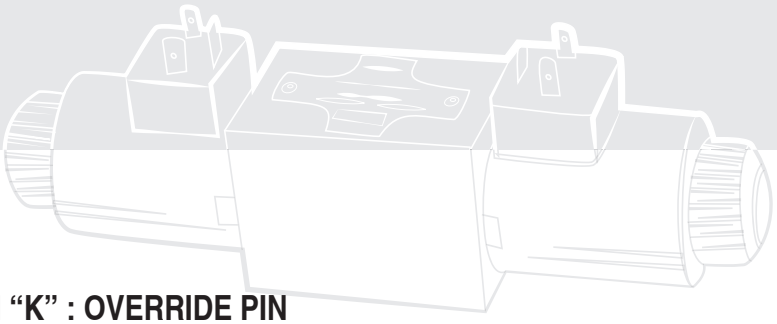
12 VERSION "T": SOFT SHIFTING

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

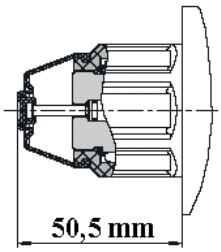
In Version "TR" valves, the fixed orifice is replaced by an adjustable, variable throttle valve that permit a fine and precise adjustment of the spool shifting time. To increase the throttling (and therefore the shifting time) turn clock-wise the adjusting screw (Ch. 3 mm), after having unlocked its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

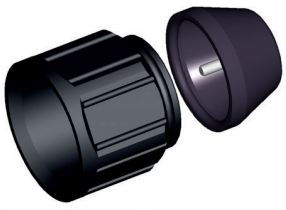




14 VERSION “K” : OVERRIDE PIN

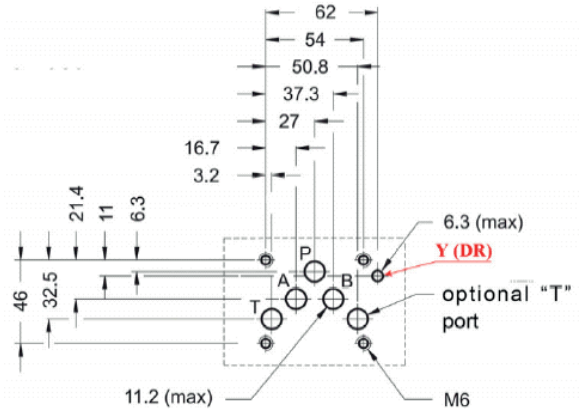
Solenoid valves according to “K” version have override actuators that push on the valve’s override pins and permit a quick and easy “hand operation” of the valves, without the need of any tool. The override actuator is incorporated in a flexible rubber cap that is e asily applicable on the solenoid retaining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



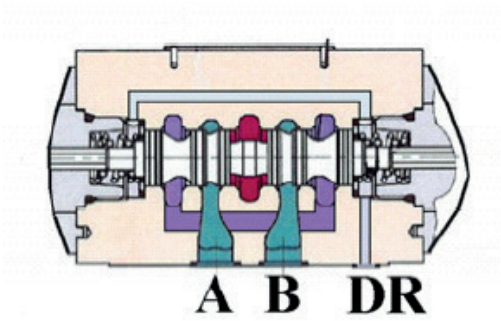


15 VERSION ”DR” : SEPARATE DRAINING OF THE SOLENOID CHAMBER

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



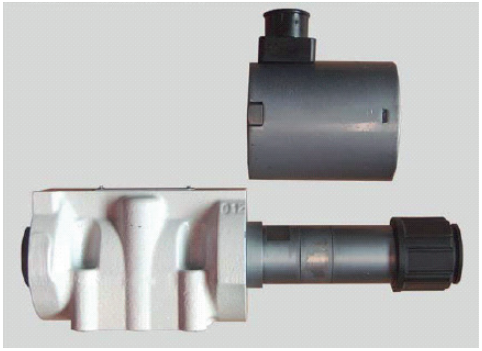
16 ANTICORROSION OPTIONS

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

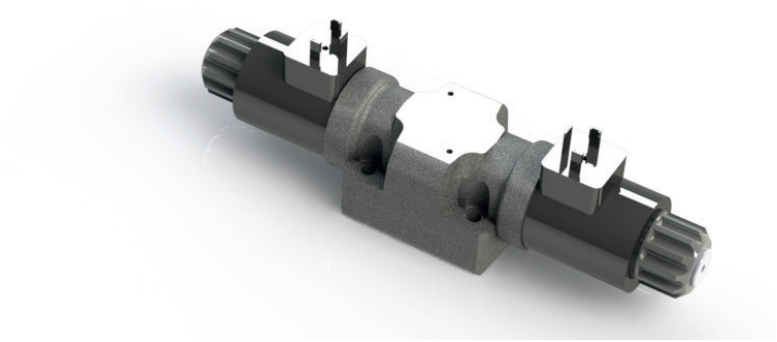
DIRECTIONAL CONTROL VALVES SOLENOID OPERATED

HD5-ED-*

125 l/min 32 MPa (320 bar)

1 DESCRIPTION

Valves HD5-ED are directional control valve with subplate mounting interface acc. to ISO 4401, DIN 24340 (CETOP 05).
The valve is designed for low performance applications when you need a CETOP 5 interface but limited flow rates.
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.



2 ORDERING CODE

(1)		(2)		(3)		(4)		(5)		(6)		(7)
HD5	-	ED	-		-		-		-		/	10

(1) HD5 : 4-way directional control valve CETOP 05

(2) ED : electrically controlled

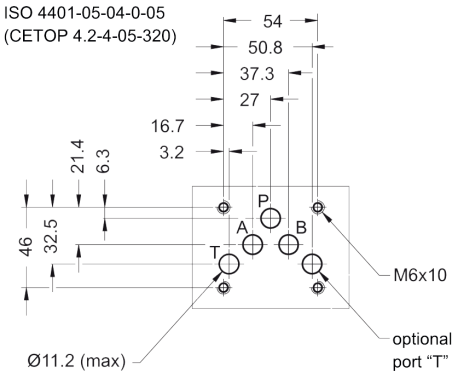
(3) Spool type (see 4)
-number is the main spool type
-letter is the solenoid or spring arrangement:
C : 2 solenoid , spool is spring centered (3 position)
LL : 1 solenoid, spool is spring offset (2 position)
ML: 1 solenoid, spool is spring centered (2 position)

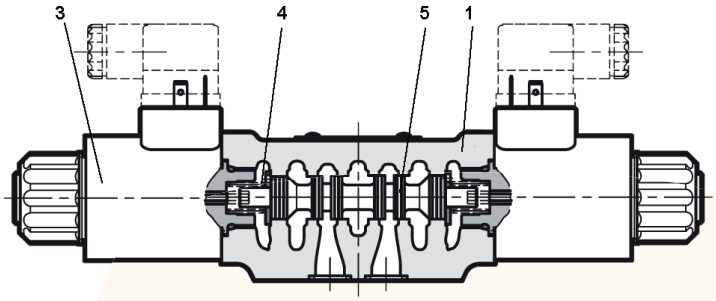
(4) Code reserved for special variants

(5) Electric voltage and solenoid coils:
0000: no coil(s)
012C: coil(s) for 12 V DC
024C: coil(s) for 24 V DC
115A: coil(s) for 110/50 V AC- 115/60 V AC
230A: coil(s) for 220/50 V AC - 230/60 V AC

(6) Coil connection:
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 valve





The spool 5 shifts into the valve body 1 subject to the action of springs 4 and solenoids. Spool 5, depending from its shape and its position in the valve body 1, 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	100 l/min
Maximum rec. flow rate see	125 l/min
Maximum nominal pressure (P,A,B)	32 MPa (320 bar)
Maximum pressure at T port	21 MPa (210 bar)
Pressure drops	see 5
Energizing switching times	70-100 ms
Protection to DIN 40050	IP 65
Duty cycle	100%
Installation and dimensions	see 7
Mass	3,0/2,4 kg

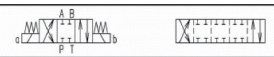
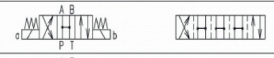
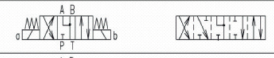
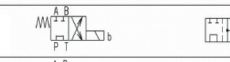
Electric characteristics:

Valve type HD5-ED-* are operated by solenoid that are energized:
- directly from a DC voltage supply
  24 V DC = 024C
  12 V DC = 012C
- by the use of coils that incorporate a full wave rectifier, from AC voltage supply:
  115A110/50 V AC- 115/60 V AC = 115A
  220/50 V AC - 230/60 V AC = 230A

All connectors must conform to ISO 4400 (DIN 43650) and electric circuitery must be able to carry the following rated current values :
  V 12 DC = 2,4 A V 115/50 = 0,26 A
  V 24 DC = 1,2 A V 230/50 = 0,14 A

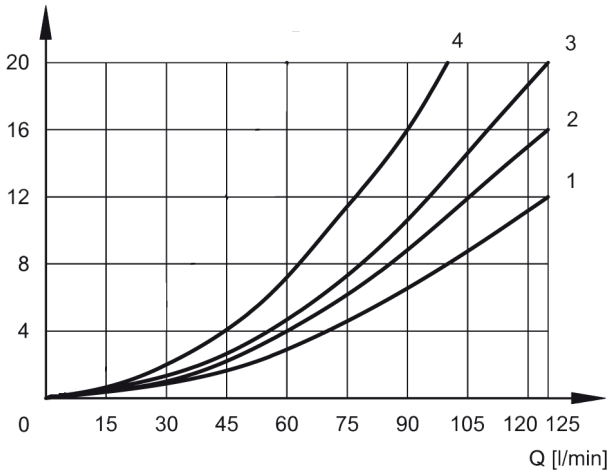
Coils with 2 electric pins, conforming with AMP connectors, are only available for DC supply (example of code : B03-012C AMP).
Permissible supply voltage variation : ± 10 %

4 SPOOL IDENTIFICATION AND INTERMEDIATE POSITION TRANSITORIES

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

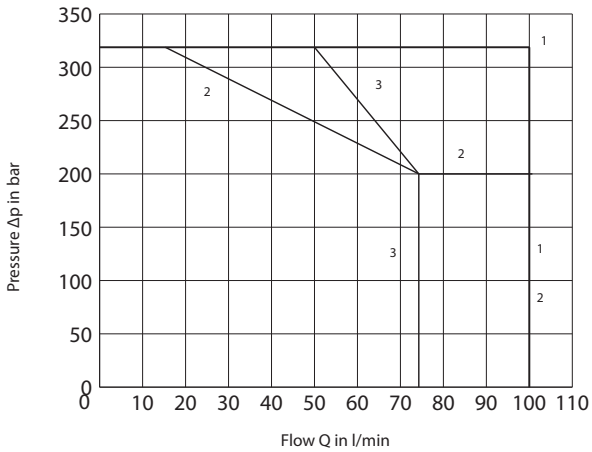
5 TYPICAL DIAGRAMS

Typical P-Q curves for valves HD5-ED-* in standard configuration, with mineral oil at ν=32 mm²/s and at T=40°C.



6 HYDRAULIC LIMIT OF USE

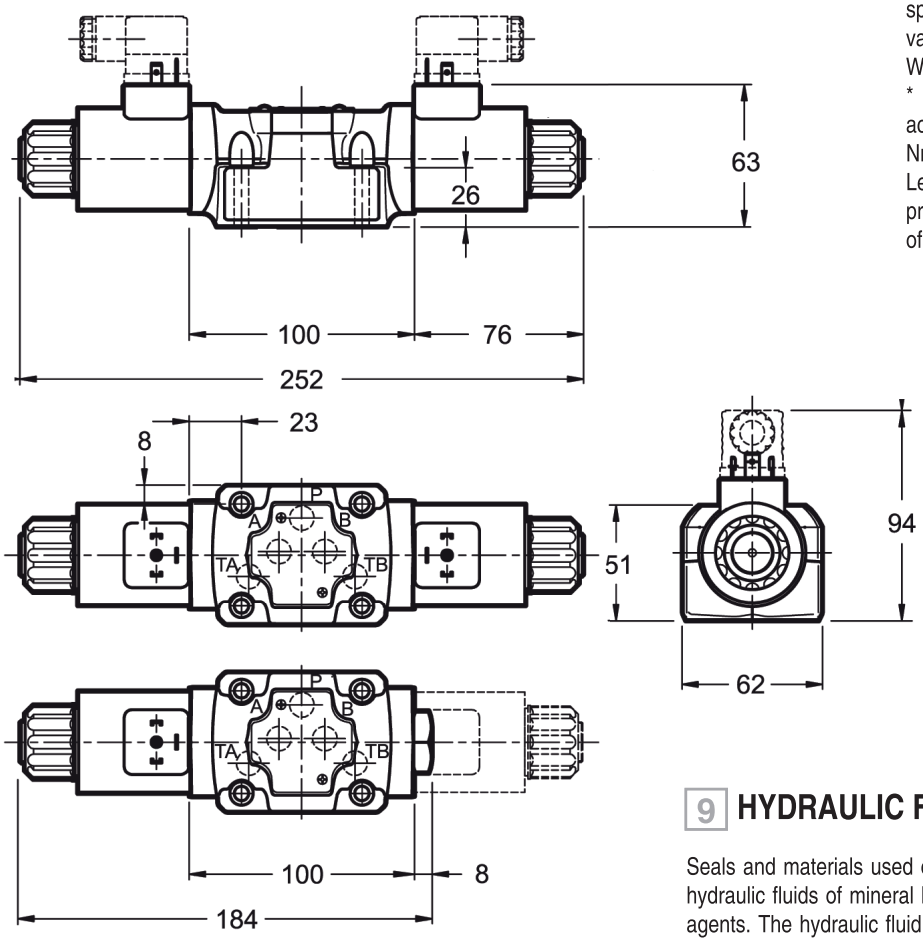
P-Q characteristics limits for safe use of HD5-ED-* solenoid operated valves. Measured at =32 mm²/s and T = 40°C



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

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

7 INSTALLATION DIMENSION (mm)



All valves HD5-* conform with ISO and CETOP specifications for mounting surface dimensions and for valves height.
When assembled to its mounting plate valve HD5-* must be fastened with 4 bolts M6x35 (or M6x** 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 of 5 seals of O Ring type 12,42x1,78 - 90 Shore.

8 SOLENOID

Solenoid valves can be supplied without electric coils, as HD5-ED-****-0000.Coils are ordered separately ; standard, 3 electric pins, coils are :

- B03-024C ; B03-012C
- B03-115A ; B03-230A

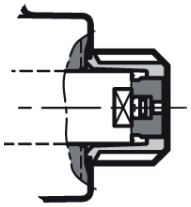
Connections to the electric supply is made by standard 3-PIN connectors, according to ISO 4400 (DIN 43650). Connectors can be with different cable exit size (PG9, PG11) and beside of the plain connecting function they may incorporate various features like

- Signal led
- Voltage surge suppressor, etc.

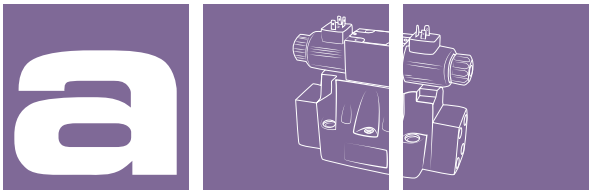
9 HYDRAULIC FLUID

Seals and materials used on standard valves HD5-* are fully compatible with hydraulic 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 MANUAL OVERRIDE



In case of electric cut-offs, the spool can be manually shifted by acting on the emergency pins, located at the end of the solenoids and accessible through the retaining nuts.



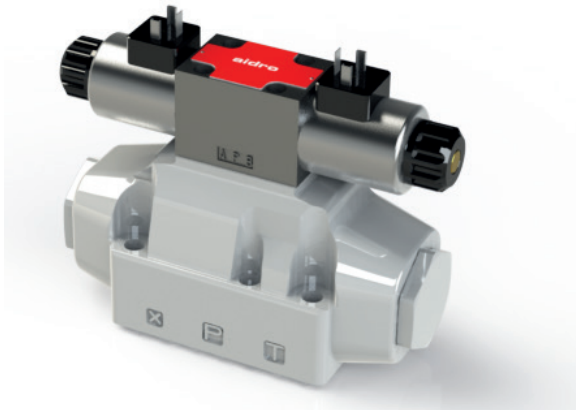
4/2 and 4/3 DIRECTIONAL CONTROL VALVES PILOT OPERATED

HD7-*

350 l/min 32 MPa (320 bar)

1 DESCRIPTION

Valves HD7-ES are directional control valve pilot operated with subplate mounting interface acc. to ISO 4401-07, DIN 24340 (CETOP 07 - NG16).
The body is made with an high quality casting.
The CETOP 3 pilot 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.



2 ORDERING CODE

(1)		(2)		(3)		(4)	(5)		(6)		(7)
HD7	-		-		/			-		/	40

(1) HD7: 4-way directional control valve CETOP 07 - Pressure 32 MPa (320 bar)

(2) Variants:
ES: electrically controlled, standard
HH: hydraulically piloted (main body)

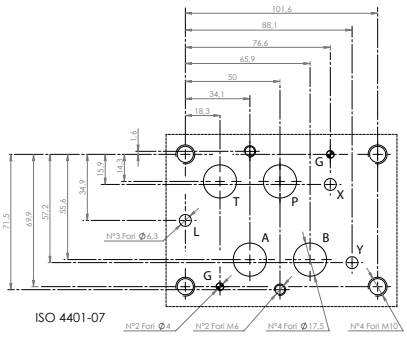
(3) Spool type:
-number is the main spool type
-letter is the solenoid or spring arrangement:
C : 2 solenoids spool is spring centered (3 position)
N : 2 solenoids pilot is detented (2 position)
LL : 1 solenoid (a), spool is spring/hydr. offset (2 position, end to end)
ML : 1 solenoid (a), spool is spring offset (2 position, middle to end)
LM : 1 solenoid (a), spool is spring offset (2 position, end to middle)
b : only for versions LL, MI, LM, see also functional symbols

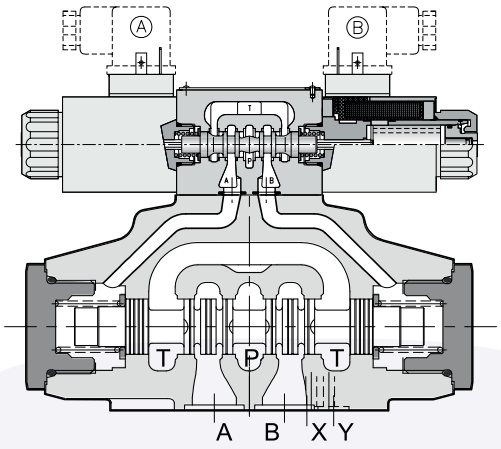
(4) Code reserved for options and variants
C : adjustable limits for main spool stroke
D : double flow control valve to adjust shifting speed
G : adjustable limits and adjustable shifting speed
P : check valve incorporated in P port of the valve

(5) Pilot and drain arrangement
No designation : internal pilot and external drain (standard)
I : internal pilot and internal drain
E : external pilot and external drain

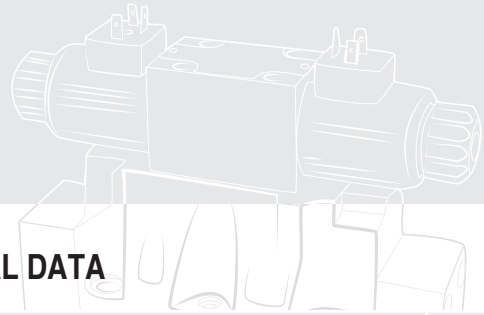
(6) Electric voltage and solenoid coils
0000 : no coils
012C : coils for V12DC
024C : coils for V24DC
115A : coils for V110/50 - V115/60 AC
230A : coils for V220/50 - V230/60 AC
See also electric characteristic

(7) Design number (progressive) of the valves





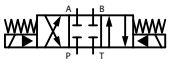
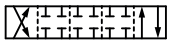
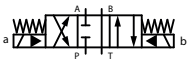
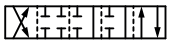
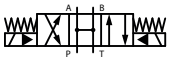
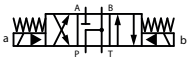
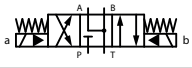
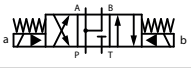
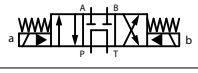
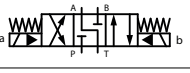
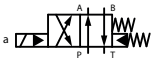
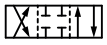
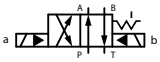
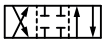
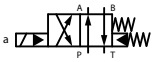
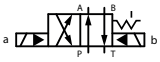
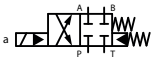
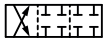
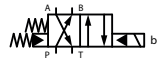
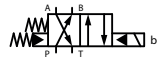
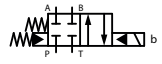
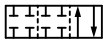
The HD7-ES solenoid operated - hydropiloted valves are consisting of an HD3-ES type solenoid operated directional control valve (see data sheet HD3-ES) that operates a 4-way hydropiloted control valve with a connection surface in accordance with the CETOP standards. They are available in various configurations and spool types. The pilot and the drain connections can be made internal or external by inserting or removing the accordant threaded plugs located in the main directional control valve. A wide range of configurations and different solenoid operated-hydropiloted directional control valve spool positions are available: - 4-way, 3-position directional control valve, with two solenoids; positioning of the spool in center position is obtained with centering springs. - 4-way, 2-position directional control valve with one solenoid; positioning of the spool in center position is determined hydraulically by the pilot valve and mechanically (even without pressure) by the main stage return spring. - 4-way, 2-position directional valve, with two solenoids, with mechanical detent of the shifted pilot spool positions when solenoids are de-energized. The basic surface treatment of the valve housing is phosphate coated and the solenoids are zinc coated.



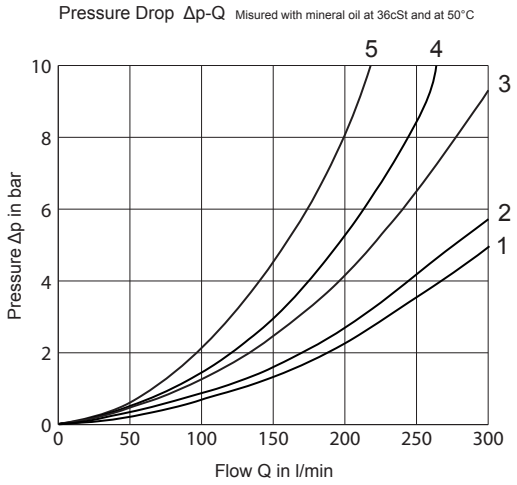
3 TECHNICAL DATA

Max. recommended flow (spring centering)	250 l/min
Max. recommended flow (hydraulic centering and hydraulic off set)	350 l/min
Max pressure at P, A, B ports	320 bar
Max pressure at T port (internal drain)	160 bar
Max pressure at T port (external drain)	250 bar
Pilot pressure minimum	5 bar
Pilot pressure Max. recommended	200 bar
Mass:	
HD7-ES	approx. 9 Kg
HD7-HH	approx. 7,5 Kg

4 SPOOL IDENTIFICATION AND INTERMEDIATE POSITION TRANSITORIES

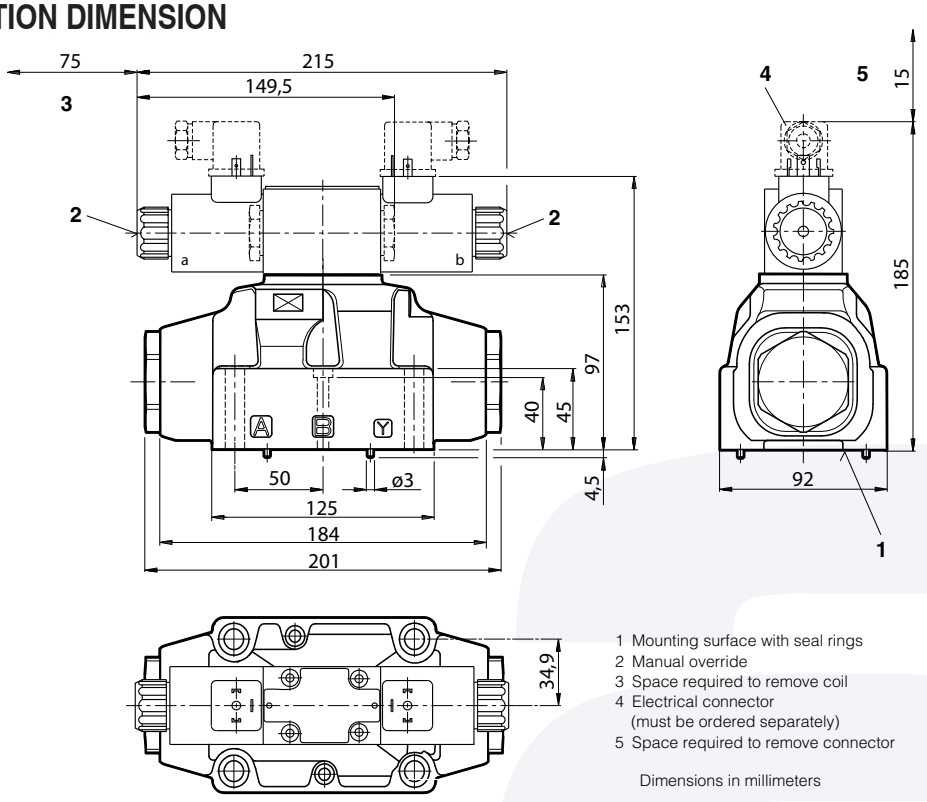
1C			77C		
0C			56C		
3C			8C		
4C			76C		
Two positions with return spring			Two positions with mechanical detent on pilot valve		
1LL			1N		
0LL			0N		
1ML					
1LLb					
0LLb					
1MLb					

5 TYPICAL DIAGRAMS



Spool type	spool position	Connections				
		P-A	P-B	A-T	B-T	P-T
		Curves on graph				
1C	Energized	1	1	2	3	
0C	De-energized Energized	5	5	1	2	6*
3C	De-energized Energized	1	1	4 1	4 2	
4C	De-energized Energized	6	6	3	4	6
67C	De-energized Energized	1	4 5	2	3	
77C	De-energized Energized	1	1	2	4 2	6°
55C	De-energized Energized	6	6	3	4	6
56C	De-energized Energized	6	6	4	3	
3SC	Energized	1	1	2	3	
8C	De-energized Energized	4° 5	4 5	2	3	
76C	De-energized Energized	1	1	3 1	3	
65C	De-energized Energized	4 5	1	2	3	
1LL,OLL,1ML	De-energized Energized	1	1	2	3	
1N,ON	Energized	1	1	2	3	

6 INSTALLATION DIMENSION



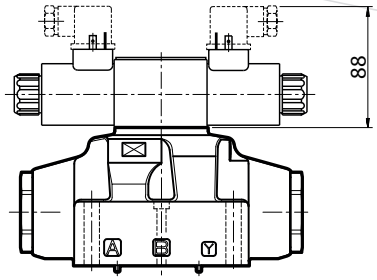
1 Mounting surface with seal rings
2 Manual override
3 Space required to remove coil
4 Electrical connector
(must be ordered separately)
5 Space required to remove connector

Dimensions in millimeters

Single valve fastening:	4 bolts M10 x 60 * * Bolts is not supplied 2 bolts M6 x 60 *
Bolt torque:	M10 x 60: 40 Nm - bolts A 8.8 M6 x 60: 8 Nm - bolts A 8.8
Threads of mounting holes:	M6 x 18; M10 x 18
Seal rings:	4 O-rings type 22.22 x 2.62 (OR 130) 2 O-rings type 10.82 x 1.78 (OR 2043)

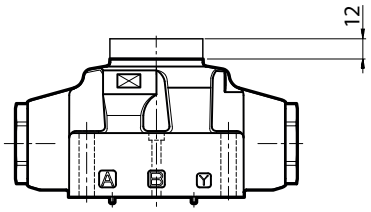
7 TYPE OF COMMAND

Solenoid control: HD7-ES
The valve is supplied with a pilot solenoid valve type HD3-ES.



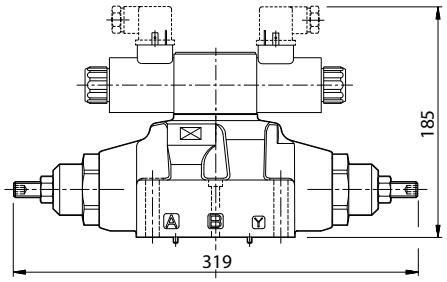
Hydraulic control: HD7-HH
The valve is supplied as main body.

X and Y connections are used for the hydraulic control of the valve.

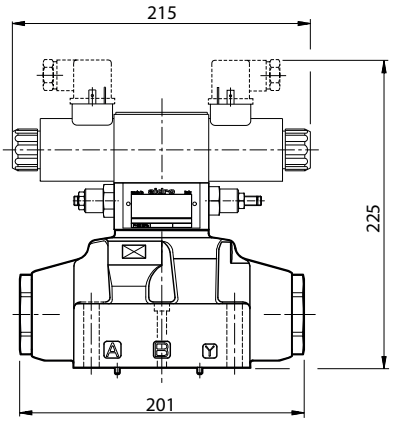


8 CONTROLS

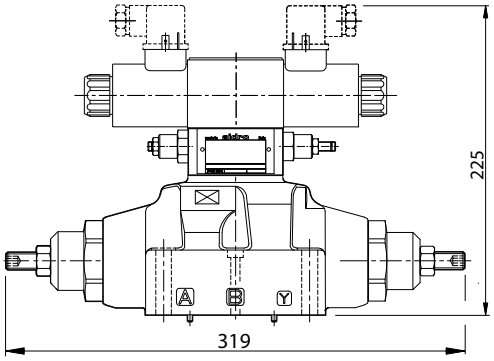
Control of the main spool stroke: C
It is possible to introduce special stroke controls in the heads of the hydropiloted valve so as to vary the maximum spool stroke. This solution allows control of the flow rate from the pump to the actuator and from the actuator to the outlet, obtaining a double adjustable control on the actuator. Add the letter **C** to the identification code to request this device.



Control of the main spool shifting speed: D
By placing a double flow control valve between the pilot solenoid valve and the hydropiloted valve, the piloted flow rate can be controlled and therefore the shifting speed can be varied.
Add the letter **D** to the identification code to request this device.

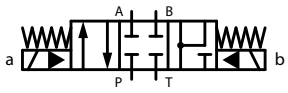


Control of the main spool stroke and shifting speed: G
It is possible to have the valve fitted with both the spool stroke device and the piloting flow rate control device. Add the letter **G** to the identification code to request this solution.

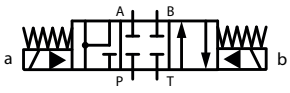


9 SPECIAL CONFIGURATION

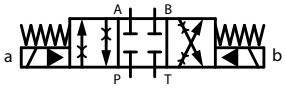
Solenoid valves with special spools
Besides the standard configurations (see pages 2 and 3), we can develop, on request, connection diagrams with special spools for a wide range of applications: consult our technical department for their identification, feasibility and operating limits.



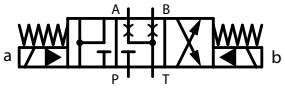
19C



18C

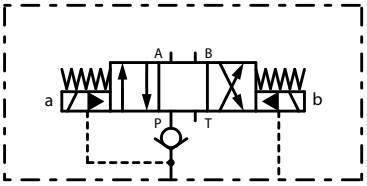


1SC



38C

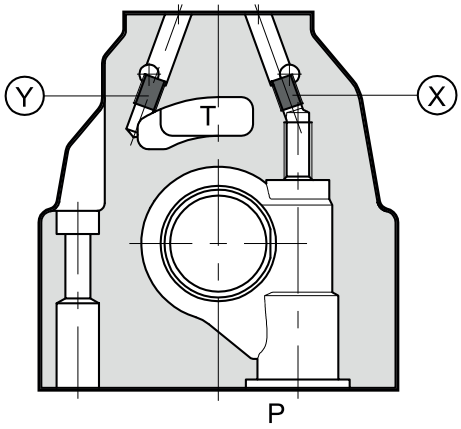
Check valve incorporated on line P: P
Valve HD7 is available upon request with check valve incorporated on line P. This is particulary useful to obtain the necessary piloting pressure when the main control valve, in the rest position, has line P connected to the T outlet. The cracking pressure is 5 bar. Add P to the identification code for this request.



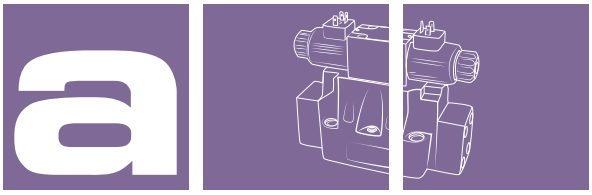
10 PILOT and DRAIN

The HD7 valves are available with pilot and drain, both internal and external. The version with external drain allows for a higher back pressure on the outlet.

Type of valve		Plug assembly	
		X	Y
HD7-ES-**/*	Internal pilot and external drain	NO	YES
HD7-ES-**/*I	Internal pilot and internal drain	NO	NO
HD7-ES-**/*E	External pilot and external drain	YES	YES
HD7-ES-**/*EI	External pilot and internal drain	YES	NO



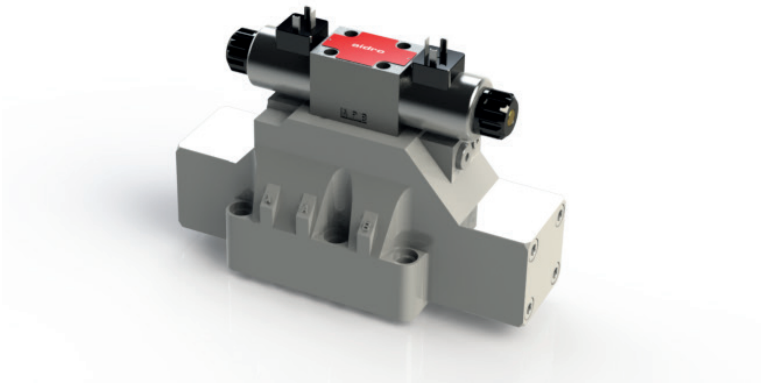
X: plug M6 x 8 for external pilot
Y: plug M6 x 8 for external drain



4/2 and 4/3 WAY DIRECTIONAL CONTROL VALVES PILOT OPERATED
HD8-*
600 l/min 32 MPa (320 bar)

1 DESCRIPTION

Valves HD8-ES are directional control valve pilot operated with subplate mounting interface acc. to ISO 4401-08, DIN 24340 (CETOP 08 - NG25).
The body is made with an high quality casting.
The CETOP 3 pilot 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.



2 ORDERING CODE

(1)		(2)		(3)		(4)	(5)		(6)		(7)
HD8	-		-		/			-		/	40

(1) HD8: 4-way directional control valve CETOP 07 - Pressure 32 MPa (320 bar)

(2) ES : electrically controlled, standard
HH : hydraulically piloted (main body)

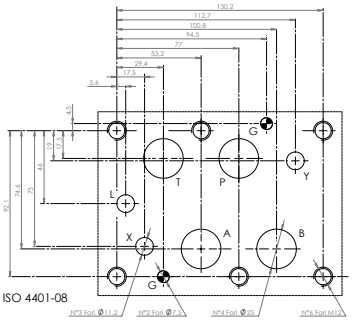
(3)Spool type:
-number is the main spool type
-letter is the solenoid or spring arrangement:
C : 2 solenoids spool is spring centered (3 position)
N : 2 solenoids pilot is detented (2 position)
LL : 1 solenoid (a), spool is spring/hydr. offset (2 position, end to end)
ML : 1 solenoid (a), spool is spring offset (2 position, middle to end)
LM : 1 solenoid (a), spool is spring offset (2 position, end to middle)
b : only for versions LL, MI, LM, see also functional symbols

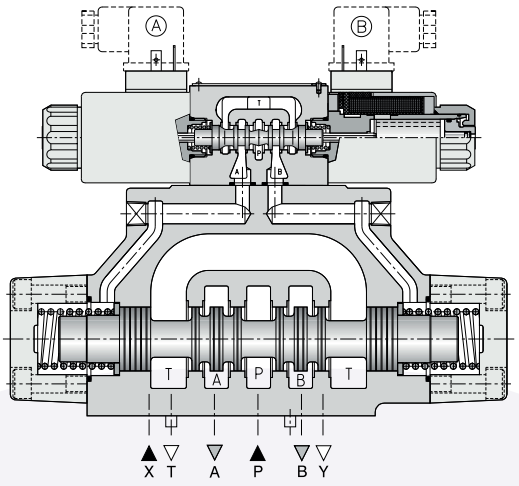
(4) Code reserved for options and variants
C : adjustable limits for main spool stroke
D : double flow control valve to adjust shifting speed
G : adjustable limits and adjustable shifting speed
P : check valve incorporated in P port of the valve

(5) Pilot and drain arrangement
no designation: internal pilot and external drain (standard)
I : internal pilot and internal drain
E : external pilot and external drain

(6) Electric voltage and solenoid coils
0000 : no coils
012C : coils for V12DC
024C : coils for V24DC
115A : coils for V110/50 - V115/60 AC
230A : coils for V220/50 - V230/60 AC
See also electric characteristic

(7) Design number (progressive) of the valves



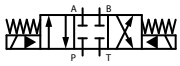
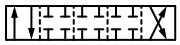
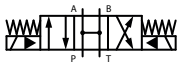
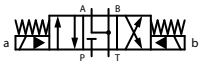
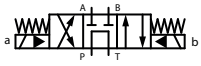
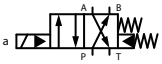
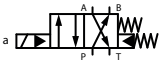
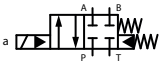
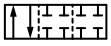
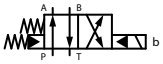
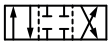
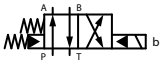
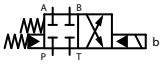
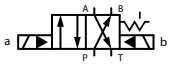
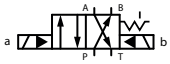


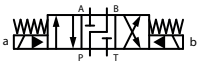
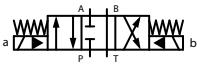
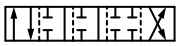
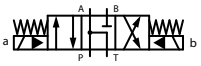
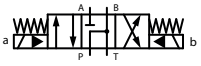
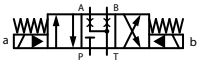
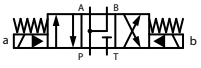
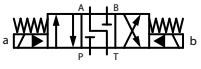
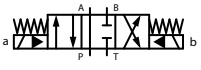
The HD8-ES solenoid operated - hydropiloted valves are consisting of an HD3-ES type solenoid operated directional control valve (see data sheet HD3-ES) that operates a 4-way hydropiloted control valve with a connection surface in accordance with the CETOP standards. They are available in various configurations and spool types. The pilot and the drain connections can be made internal or external by inserting or removing the accordant threaded plugs located in the main directional control valve. A wide range of configurations and different solenoid operated-hydropiloted directional control valve spool positions are available: - 4-way, 3-position directional control valve, with two solenoids; positioning of the spool in center position is obtained with centering springs. - 4-way, 2-position directional control valve with one solenoid; positioning of the spool in center position is determined hydraulically by the pilot valve and mechanically (even without pressure) by the main stage return spring. - 4-way, 2-position directional valve, with two solenoids, with mechanical detent of the shifted pilot spool positions when solenoids are de-energized. The basic surface treatment of the valve housing is phosphate coated and the solenoids are zinc coated.

3 TECHNICAL DATA

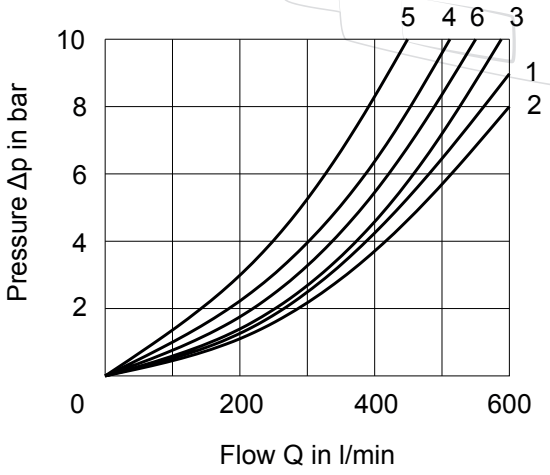
Max. recommended flow (spring centering)	400 l/min
Max. recommended flow (hydraulic centering and hydraulic off set)	600 l/min
Max pressure at P, A, B ports	32 MPa (320 bar)
Max pressure at T port (internal drain)	16 MPa (160 bar)
Max pressure at T port (external drain)	25 MPa (250 bar)
Pilot pressure minimum	0,5 MPa (5 bar)
Pilot pressure Max. recommended	20 MPa (200 bar)
Mass:	
HD8-ES	approx. 15,50 Kg
HD8-HH	approx. 14,00 Kg

4 SPOOL IDENTIFICATION AND INTERMEDIATE POSITION TRANSITORIES

1C		
0C		
3C		
4C		
Two positions with return spring		
1LL		
0LL		
1ML		
1LLb		
0LLb		
1MLb		
Two positions with mechanical detent on pilot valve		
1N		
0N		

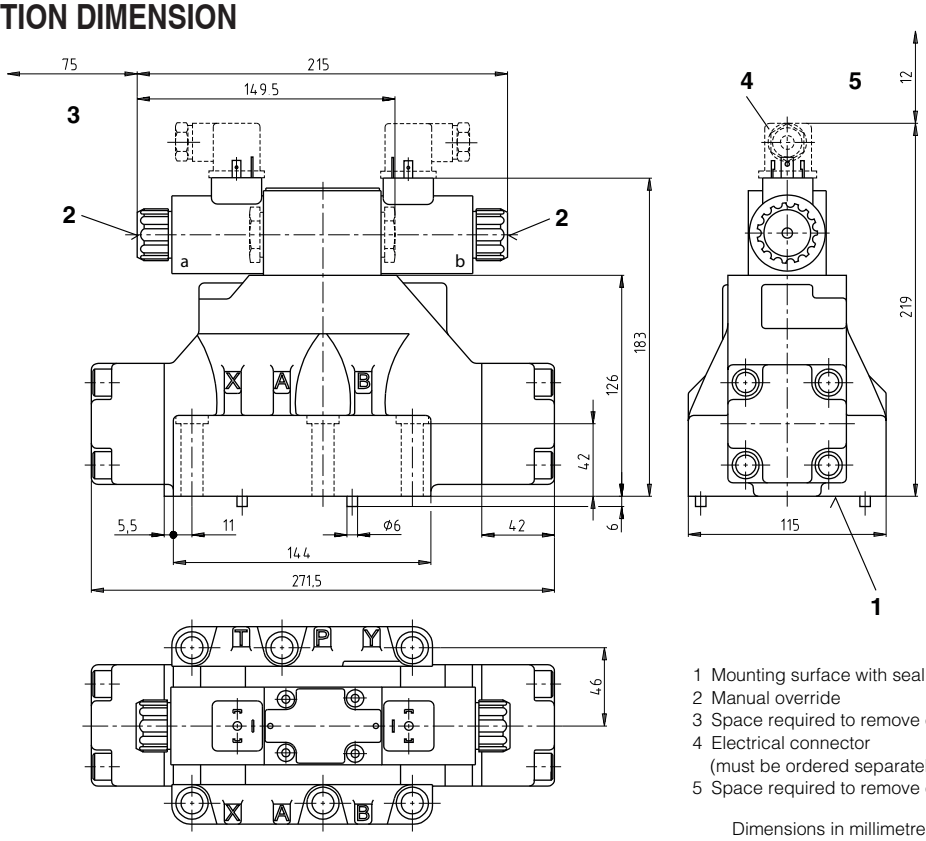
67C		
77C		
55C		
56C		
3SC		
8C		
76C		
65C		

5 TYPICAL DIAGRAMS



Spool type	Spool position	Connections				
		P-A	P-B	A-T	B-T	P-T
		Curves on graph				
1C	Energized	1	1	2	3	
0C	De-energized Energized	2	2	1	2	6*
3C	De-energized Energized	1	1	4° 1	4° 2	
4C	De-energized Energized	6	6	3	4	5
67C	De-energized Energized	1	4 2	2	3	
77C	De-energized Energized	1	1	2	4 2	
55C	De-energized Energized	6	6	3	4	5°
56C	De-energized Energized	6	6	4	3	5°
3SC	Energized	1	1	2	3	
8C	De-energized Energized	4° 2	4° 2	2	3	
76C	De-energized Energized	1	1	3 1	3	
65C	De-energized Energized	4 2	1	2	3	
1LL,OLL, 1ML	De-energized Energized	1	1	2	3	
1N,ON	Energized	1	1	2	3	

6 INSTALLATION DIMENSION



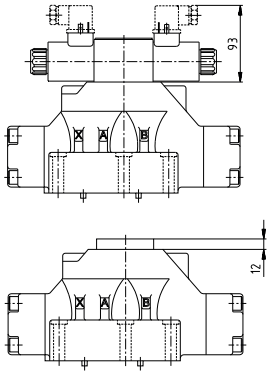
1 Mounting surface with seal rings
2 Manual override
3 Space required to remove coil
4 Electrical connector
(must be ordered separately)
5 Space required to remove connector

Dimensions in millimetres

Single valve fastening:	6 bolts M12 x 60 *
Bolt torque:	69 Nm - bolts A 8.8; 1155 Nm - bolts A 12.9
Threads of mounting holes:	M12 x 20
Seal rings:	4 O-rings type 29.82 x 2.62 2 O-rings type 20.24 x 2.62

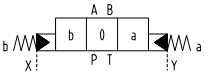
7 TYPE OF COMMAND

Solenoid control: HD8-ES
The valve is supplied with a pilot solenoid valve type HD3-ES.

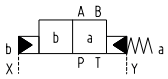


Hydraulic control: HD8-HH
The valve is supplied as main body.

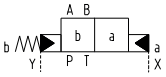
X and Y connections are used for the hydraulic control of the valve.



HD8-HH-*C/E



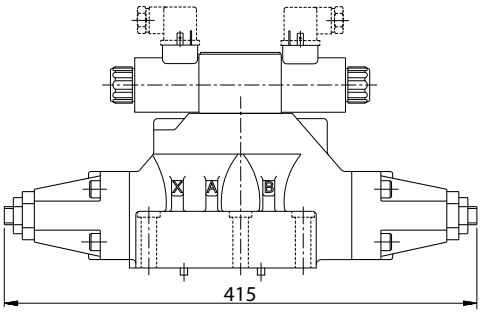
HD8-HH-*LL/E



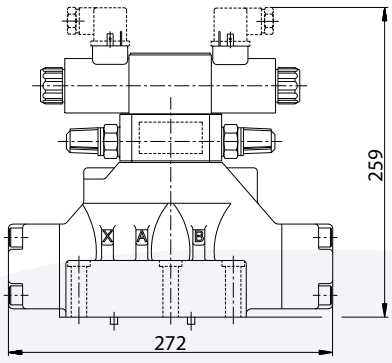
HD8-HH-*LLb/E

8 CONTROLS

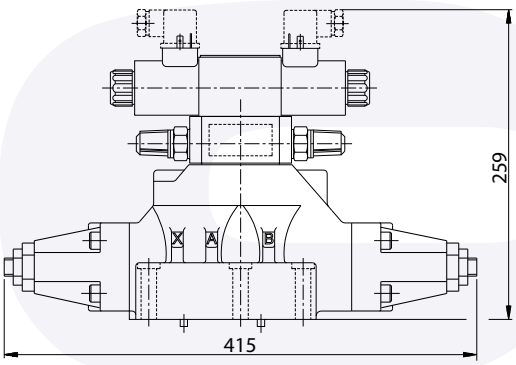
Control of the main spool stroke: C
It is possible to introduce special stroke controls in the heads of the hydropiloted valve so as to vary the maximum spool stroke. This solution allows control of the flow rate from the pump to the actuator and from the actuator to the outlet, obtaining a double adjustable control on the actuator. Add the letter **C** to the identification code to request this device.



Control of the main spool shifting speed: D
By placing a double flow control valve between the pilot solenoid valve and the hydropiloted valve, the piloted flow rate can be controlled and therefore the shifting speed can be varied.
Add the letter **D** to the identification code to request this device.

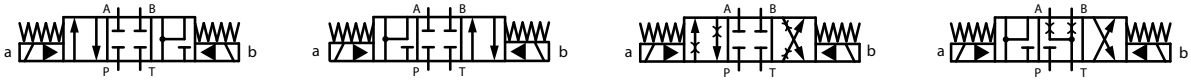


Control of the main spool stroke and shifting speed: G
It is possible to have the valve fitted with both the spool stroke device and the piloting flow rate control device. Add the letter **G** to the identification code to request this solution.



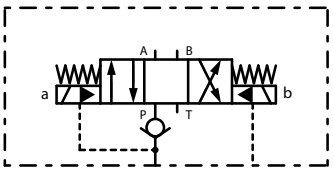
9 SPECIAL CONFIGURATION

Solenoid valves with special spools
Besides the standard configurations (see pages 2 and 3), we can develop, on request, connection diagrams with special spools for a wide range of applications: consult our technical department for their identification, feasibility and operating limits.



19C 18C 1SC 38C

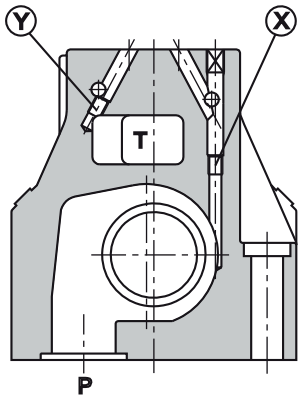
Check valve incorporated on line P: P
Valve HD8 is available upon request with check valve incorporated on line P. This is particulary useful to obtain the necessary piloting pressure when the main control valve, in the rest position, has line P connected to the T outlet. The cracking pressure is 5 bar. Add P to the identification code for this request.



10 PILOT and DRAIN

The HD8 valves are available with pilot and drain, both internal and external. The version with external drain allows for a higher back pressure on the outlet.

Type of valve		Plug assembly	
		X	Y
HD8-ES-**/*	Internal pilot and external drain	NO	YES
HD8-ES-**/*I	Internal pilot and internal drain	NO	NO
HD8-ES-**/*E	External pilot and external drain	YES	YES
HD8-ES-**/*EI	External pilot and internal drain	YES	NO



X: plug 1/16 NPT for external pilot
Y: plug M6 x 8 for external drain