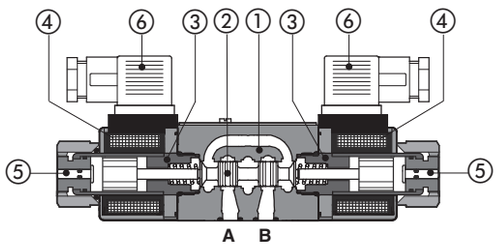
Solenoid directional valves type DHL

direct, spool type, compact execution



DHL-071*-DC

① Valve body
② Spool
③ Solenoid tube
④ Solenoid coil
⑤ Manual override pin
⑥ Electric connector (DIN43650) to be ordered separately

Spool type, 4/3, 4/2, 3/2 way version.
Wet type solenoids made by:
- screwed tube ③, different for AC and DC power supply
- interchangeable coils ④, specific for AC or DC power supply, easily replaceable without tools - see section 6 for available voltages

The valve body ① is 3 chamber type made by shell-moulding casting with wide internal passages ensuring low pressure drops.

Mounting surface: **ISO 4401 size 06**
Max flow: **60 l/min**
Max pressure: **350 bar**

1 MODEL CODE

DHL - 0	61	1	/	A	-	X	24 DC	*	/	*

Solenoid directional valves size 06

Valve configuration, see section 2
61 = single solenoid, center plus external position, spring centered
63 = single solenoid, 2 external positions, spring offset
67 = single solenoid, center plus external position, spring offset
70 = double solenoid, 2 external positions, without springs
71 = double solenoid, 3 positions, spring centered
75 = double solenoid, 2 external positions, with detent

Spool type, see section 2

Options, see section 7

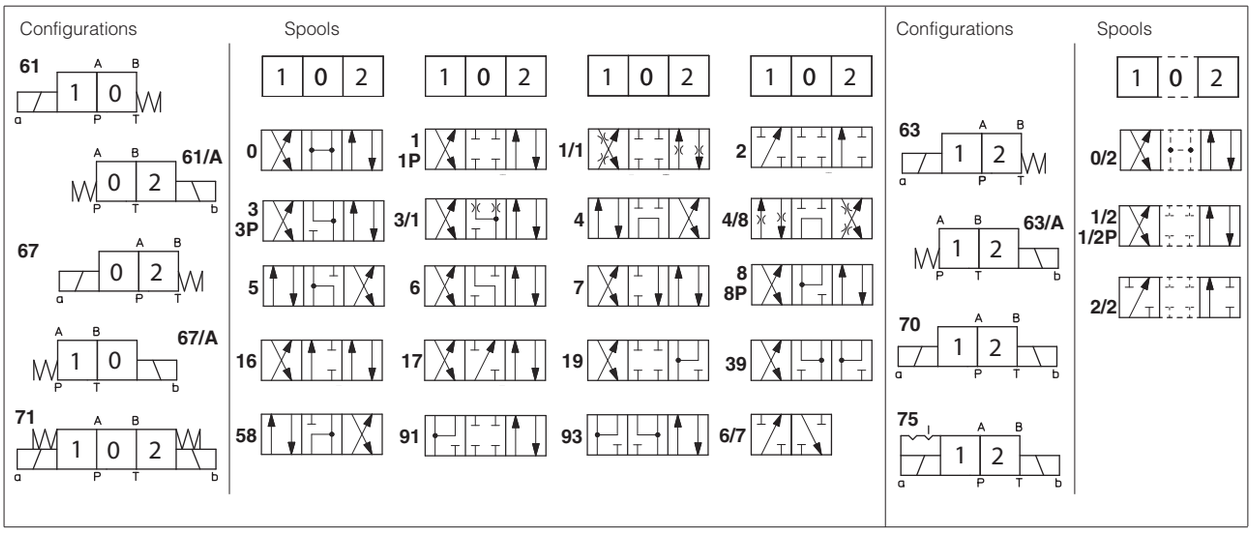
00-AC = AC solenoids without coils
00-DC = DC solenoids without coils
X = without connector
See section 12 for available connectors, to be ordered separately
Coils with special connectors, see section 13
XK = Deutsch connector

Voltage code, see section 6

Series number

Seals material, see section 14:
- = NBR
PE = FKM

2 CONFIGURATIONS and SPOOLS (representation according to ISO 1219-1)



Note: Spool type **6/7** is available only for configuration 61, not available for version /A
Spool type **3/1** has restricted oil passages in central position, from user ports to tank.
Spools type **1/1** and **4/8** are properly shaped to reduce water-hammer shocks during the swiching.
Spools type **1P, 3P, 8P** and **1/2P** reduced the valve internal leakages

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C
Storage temperature range	**Standard** = -30°C ÷ +80°C **/PE** option = -20°C ÷ +80°C
Surface protection	Body: zinc coating with black passivation Coil: zinc nickel coating (DC version) plastic incapsulation (AC version)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS

Operating pressure	Ports P,A,B: **350** bar; Port T **210** bar for DC version; **160** bar for AC version
Max flow	**60 l/min**, see Q/Δp diagram at section 8 and operating limits at section 9

5 ELECTRICAL CHARACTERISTICS

Insulation class	**H** (180°C) for DC coils; **F** (155°C) for AC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	**IP 65** (with connectors 666, 667 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See section 6
Supply voltage tolerance	± 10%

6 COIL VOLTAGE

External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption (2)	Code of spare coil DHL
12 DC	**12 DC**	666 or 667	29W	COL-12DC
14 DC	**14 DC**			COL-14DC
24 DC	**24 DC**			COL-24DC
28 DC	**28 DC**			COL-28DC
110 DC	**110 DC**			COL-110DC
220 DC	**220 DC**			COL-220DC
110/50 AC (1)	**110/50/60 AC**		58VA (3)	COL-110/50/60AC
115/60 AC	**115/60 AC**			COL-115/60AC
230/50 AC (1)	**230/50/60 AC**			COL-230/50/60AC
230/60 AC	**230/60 AC**			COL-230/60AC
110/50 AC - 120/60 AC	**110 DC**	669	29W	COL-110DC
230/50 AC - 230/60 AC	**220 DC**			COL-220DC

(1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10÷15% and the power consumption is 55 VA.

(2) Average values based on tests preformed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(3) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.

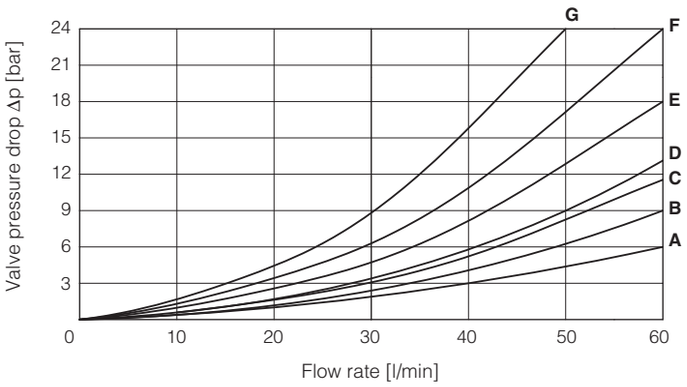
7 OPTIONS

A = Solenoid mounted at side of port B (only for single solenoid valves). In standard versions, solenoid is mounted at side of port A.
MV, MO = auxiliary hand lever positioned vertically (MV) or horizontally (MO). For available configuration and dimensions see section 18
WP = prolonged manual override protected by rubber cap.
WPD/HL = manual override override with detent, to be ordered separatelly, see section 18

⚠ The manual override operation can be possible only if the pressure at T port is lower than 50 bar

8 **Q/ΔP DIAGRAMS** based on mineral oil ISO VG 46 at 50°C

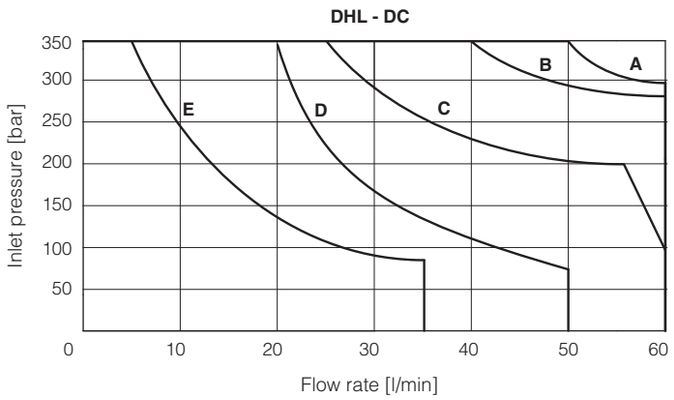
Spool type \ Flow direction	P→A	P→B	A→T	B→T	P→T
0	A	A	C	C	D
1, 1P, 1/1	C	C	C		
3, 3P, 3/1	D	D	A	A	
4, 4/8, 5	F	F	G	C	E
0/2, 1/2, 1/2P	D	D	D	D	
6, 7, 16, 17	D	D	D	D	
8, 8P	A	A	E	E	
2, 6/7	D	D			
2/2	F	F			
19, 91	E	E	D	D	
39, 93	F	F	G	G	



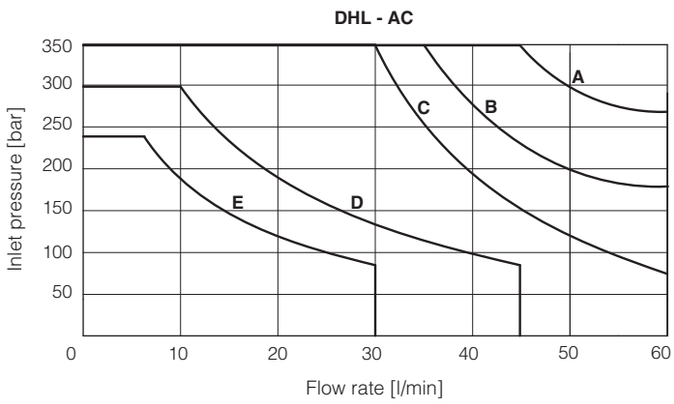
9 **OPERATING LIMITS** based on mineral oil ISO VG 46 at 50°C

The diagrams have been obtained with warm solenoids and power supply at lowest value (V_{nom} - 10%). The curves refer to application with symmetrical flow through the valve (i.e. P→A and B→T). In case of asymmetric flow and if the valves have the devices for controlling the switching times the operating limits must be reduced.

Curve	DC version, spool type:
A	0, 0/2, 1/2, 1/2P, 8, 8P
B	1, 1P, 1/1
C	3, 3P, 3/1, 6, 7
D	4, 4/8, 16, 17, 5, 19, 39, 58, 91, 93
E	2, 2/2, 6/7



Curve	AC version, spool type:
A	0, 0/2, 1/2, 1/2P, 8, 8P
B	1, 1P, 1/1
C	3, 3P, 3/1, 6, 7
D	4, 16, 17, 4/8, 5, 19, 39, 58, 91, 93
E	2, 2/2, 6/7



10 **SWITCHING TIMES** (average values in msec)

Test conditions: - 20 l/min; 150 bar
- nominal voltage
- 2 bar of counter pressure on port T
- mineral oil: ISO VG 46 at 50°C

The elasticity of the hydraulic circuit and the variations of the hydraulic characteristics and temperature affect the response time.

Valve	Switch-on AC	Switch-off AC	Switch-on DC	Switch-off DC
DHL	10 - 25	20 - 40	30 - 50	15 - 25

11 **SWITCHING FREQUENCY**

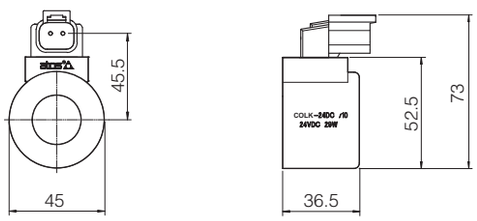
Valve	AC (cycles/h)	DC (cycles/h)
DHL + 666 / 667	7200	15000

12 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately, see tech table K500)

666 = standard connector IP-65, suitable for direct connection to electric supply source
667 = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC
669 = with built-in rectifier bridge for supplying DC coils by alternate current (AC 110V and 230V - Imax 1A)
E-SD = electronic connector which eliminates electric disturbances when solenoid valves are de-energized

13 COILS WITH SPECIAL CONNECTORS only for voltage supply **12, 14, 24, 28** VDC

Deutsch connector DT-04-2P



Options -XK

Coil type COLK, Deutsch connector DT-04-2P male
Protection degree **IP67**

Note: For the electric characteristics refer to standard coils features - see section 6

14 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, reccomended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR	HFC	

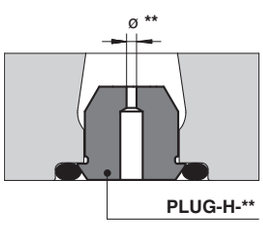
15 PLUG-IN RESTRICTOR (to be ordered separately)

The use of plug-in restrictors in valve's ports P or A or B may be necessary is case of particular conditions as long flexible hoses or the presence of accumulators which could cause at the valve switching instantaneous high flow peaks over the max valve's operating limits.

PLUG-H	-	**	A

08, 10, 12, 15 calibrated orifice diameter in tenths of mm
Example PLUG-H-**12** = orifice diameter **1,2 mm**
Other orifice dimensions are available on request

Short calibrated orifice



16 FASTENING BOLTS AND SEALS

Fastening bolts	Seals
4 socket head screws M5x30 class 12.9 Tightening torque = 8 Nm	4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max)

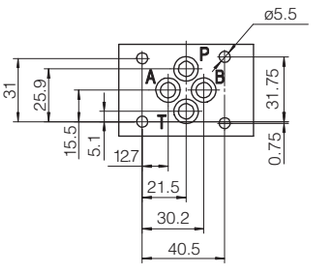
17 DIMENSIONS [mm]

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05

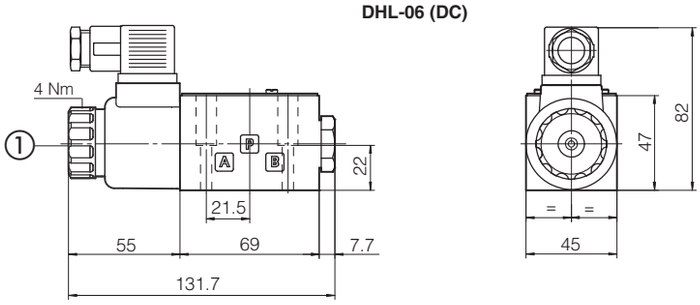
Mass (Kg)		
	DC	AC
DHL-06	1,3	1,2
DHL-07	1,6	1,4

P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT

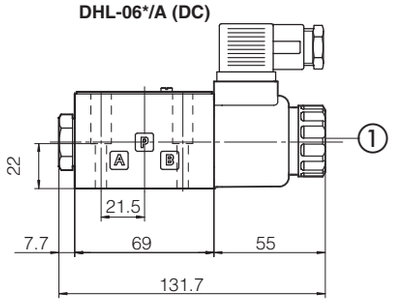
Valve's bottom view



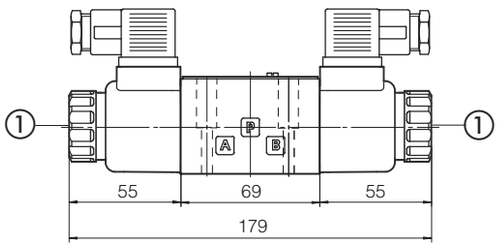
DHL-06 (DC)



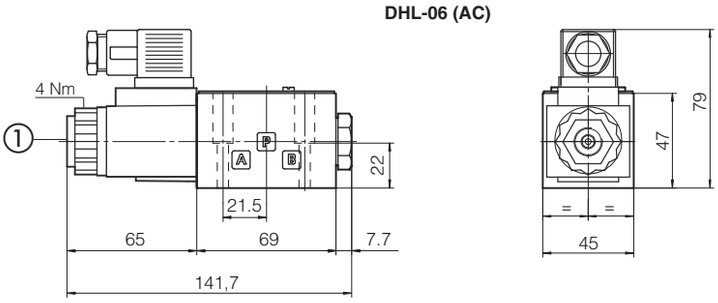
DHL-06*/A (DC)



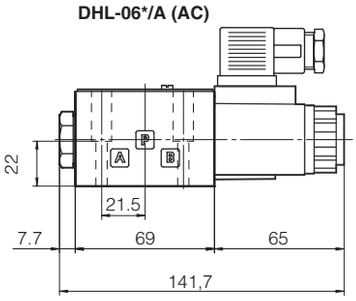
DHL-07 (DC)



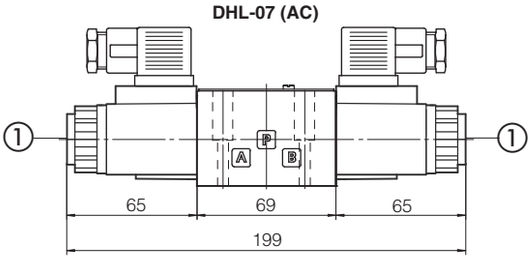
DHL-06 (AC)



DHL-06*/A (AC)



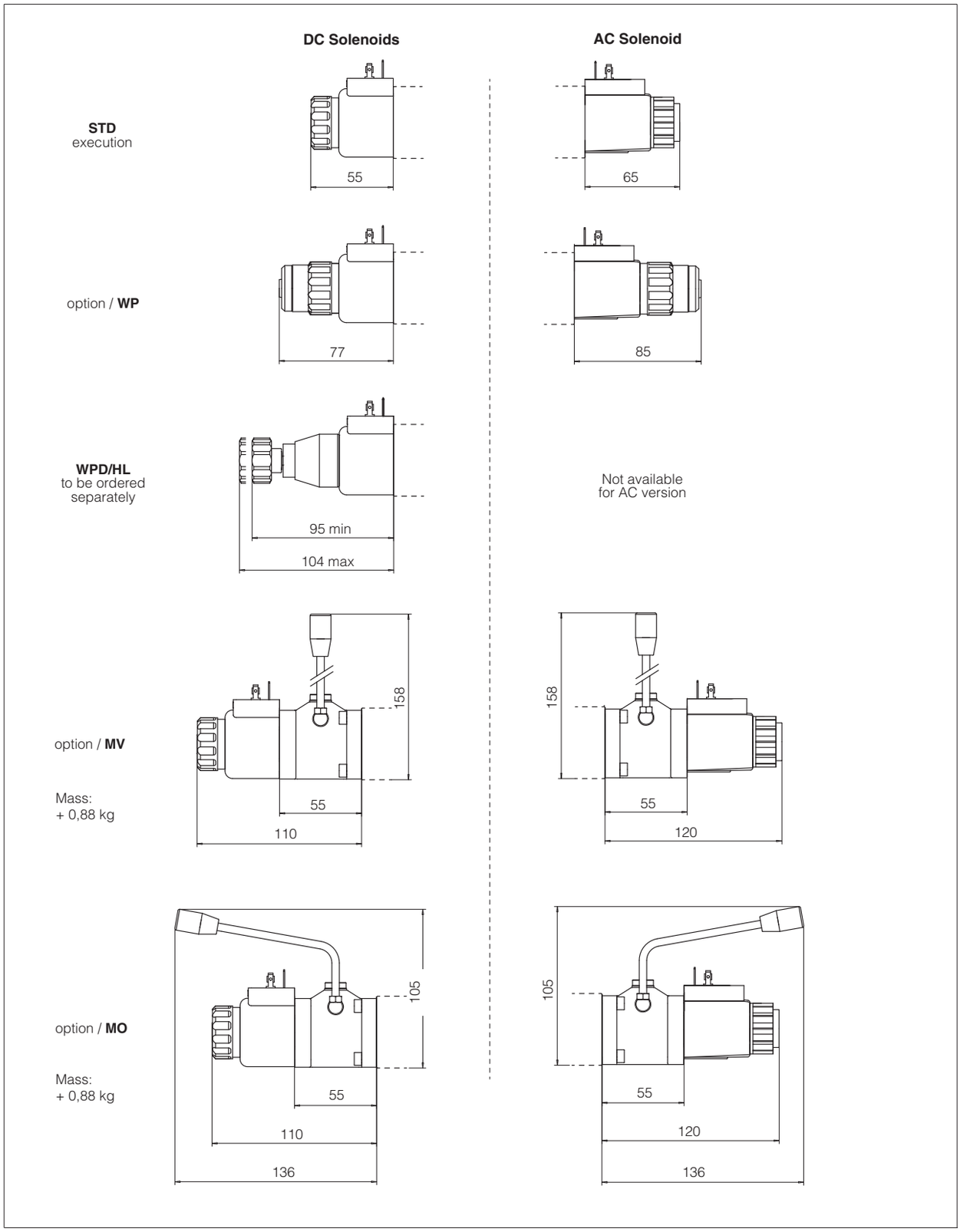
DHL-07 (AC)



① Standard manual override PIN

⚠ The manual override operation can be possible only if the pressure at T ports is lower than 50 bar

18 MANUAL OVERRIDE

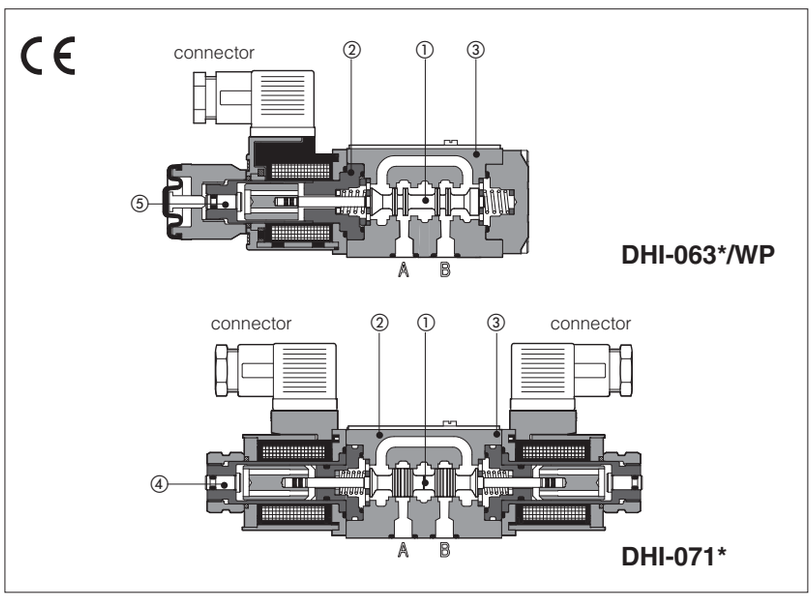


19 RELATED DOCUMENTATION

E001	Basics for solenoid directional valves	**P005**	Mounting surfaces for electrohydraulic valves
K150	Handweels for hydraulic controls	**E900**	Operating and maintenance information
K280	Single and modular subplates		
K800	Electric and electronic connectors		

Solenoid directional valves type DHI

direct, spool type



Spool type, two or three position, direct operated valves with solenoids certified according the North American standard **cURus**.
Solenoids ② are made by:
- wet type flanged tube, same for AC and DC power supply, with integrated manual override pin ④
- interchangeable coils, specific for AC or DC power supply, easily replaceable without tools - see section 5 for available voltages

Standard coils protection **IP65**, optional coils with IP67 AMP Junior Timer, XK Deutsch or Lead Wire connections.
Wide range of interchangeable spools ①, see section 2
The valve body ③ is 3 chamber type made by shell-moulding casting with wide internal passages.

Mounting surface: **ISO 4401 size 06**
Max flow: **60 l/min**
Max pressure: **350 bar**

1 MODEL CODE

DHI - 0	61	1	/	A	-	X	24 DC	*	/	*

Directional control valves size 06

Valve configuration, see section 2
61 = single solenoid, center plus external position, spring centered
63 = single solenoid, 2 external positions, spring offset
67 = single solenoid, center plus external position, spring offset
70 = double solenoid, 2 external positions, without springs
71 = double solenoid, 3 positions, spring centered
75 = double solenoid, 2 external positions, with detent
77 = double solenoid, center plus external position, without springs

Spool type, see section 2

Options, see note 1 at section 4

00 = valve without coils
X = without connector
See section 13 for available connectors, to be ordered separately
Coils with special connectors, see section 10
XJ = AMP Junior Timer connector
XK = Deutsch connector
XS = Lead Wire connection

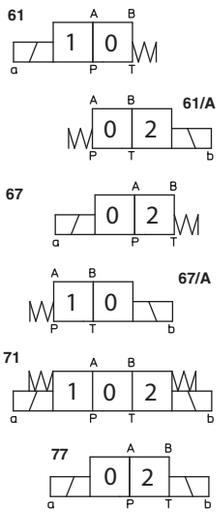
Voltage code, see section 5

Series number

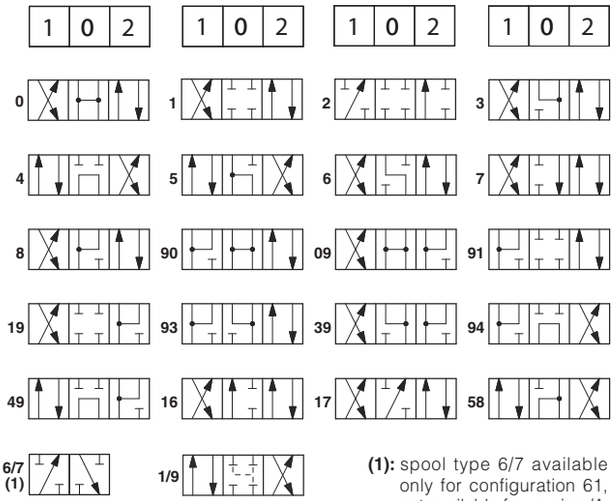
Seals material, see section 3:
- = NBR
PE = FKM
BT = HNBR

2 CONFIGURATIONS and SPOOLS (representation according to ISO 1219-1)

Configurations

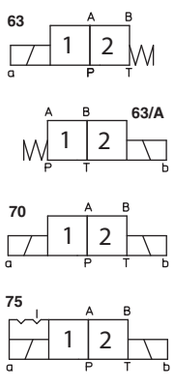


Spools

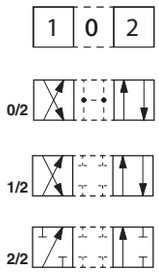


(1): spool type 6/7 available only for configuration 61, not available for version /A

Configurations



Spools



Note: see also section 4, note 3, for special shaped spools

3 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position for all valves except for type - 70 and 77 (without springs) that must be installed with horizontal axis if operated by impulses		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Ambient temperature	**Standard** = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C		
Storage temperature	**Standard** = -30°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +80°C		
Surface protection	Body: zinc coating with black passivation Coil: plastic incapsulation		
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h		
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option)= -20°C ÷ +80°C HNBR seals (/BT option)= -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	
Flow direction	As shown in the symbols of table 2		
Operating pressure	Ports P,A,B: **350** bar; Port T **120** bar		
Rated flow	See diagrams Q/Δp at section 6		
Maximum flow	**60 l/min**, see operating limits at section 7		

3.1 Coils characteristics

Insulation class	**H** (180°C) Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree DIN EN 60529	IP 65 (with connectors 666, 667, 669 or E-SD correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature 6
Supply voltage tolerance	± 10%
Certification	**cURus**

4 NOTES

1 Options

A = Solenoid mounted at side of port B (only for single solenoid valves). In standard versions, solenoid is mounted at side of port A.

WP = prolonged manual override protected by rubber cap - see section 11.

⚠ The manual override operation can be possible only if the pressure at T port is lower than 50 bar.

MV, MO = auxiliary hand lever positioned vertically (MV) or horizontally (MO). For available configuration and dimensions see table E138.

2 Accessories

WPD/H = manual override with detent, to be ordered separately, see tab. K150

3 Special shaped spools

- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spools type **1, 4, 5** and **58** are also available as **1/1, 4/8, 5/1** and **58/1.** They are properly shaped to reduce water-hammer shocks during the swiching.
- spools type **1, 3, 8** and 1/2 are available as **1P, 3P, 8P** and **1/2P** to limit valve internal leakages.
- spool type **1/9** has closed center in rest position but it avoids the pressurization of A and B ports due to the internal leakages.
- Other types of spools can be supplied on request.

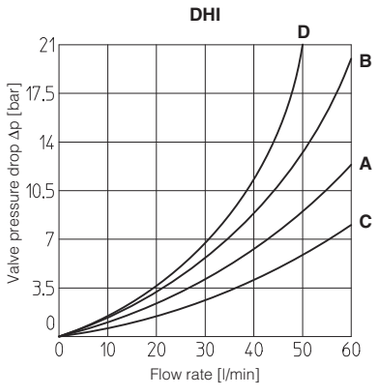
5 ELECTRIC FEATURES

External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption (2)	Code of spare coil DHI	Colour of coil label
6 DC	**6 DC**	666 or 667	33 W	COU-6DC/ 80	brown
9 DC	**9 DC**			COU-9DC /80	light blue
12 DC	**12 DC**			COU-12DC /80	green
14 DC	**14 DC**			COU-14DC /80	brown
18 DC	**18 DC**			COU-18DC /80	blue
24 DC	**24 DC**			COU-24DC /80	red
28 DC	**28 DC**			COU-28DC /80	silver
48 DC	**48 DC**			COU-48DC /80	silver
110 DC	**110 DC**			COU-110DC /80	black
125 DC	**125 DC**			COU-125DC /80	silver
220 DC	**220 DC**			COU-220DC /80	black
24/50 AC 24/60 AC	**24/50/60 AC**		60 VA (3)	COI-24/50/60AC /80 (1)	pink
48/50 AC 48/60 AC	**48/50/60 AC**			COI-48/50/60AC /80 (1)	white
110/50 AC 120/60 AC	**110/50/60 AC** **120/60 AC**			COI-110/50/60AC /80 (1) COI-120/60AC /80	yellow white
230/50 AC 230/60 AC	**230/50/60 AC** **230/60 AC**			COI-230/50/60AC /80 (1) COI-230/60AC /80	light blue silver
110/50 AC 120/60 AC	**110RC**	669	33 W	COU-110RC /80	gold
230/50 AC 230/60 AC	**230RC**			COU-230RC /80	blue

(1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10÷15% and the power consumption is 55 VA
(2) Average values based on tests preformed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(3) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.

6 Q/ΔP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

Flow direction / Spool type	P→A	P→B	A→T	B→T	P→T
0, 0/1	C	C	C	C	
0/2, 1, 1/1, 1/2	A	A	A	A	
2, 3, 3/1	A	A	C	C	
2/2, 4, 4/8, 5, 5/1, 58, 58/1, 94	D	D	D	D	A
6, 7, 16, 17	A	A	C	A	
8	C	C	B	B	
9, 19, 90, 91	B	B	A	A	
1/9, 39, 93	D	D	D	D	

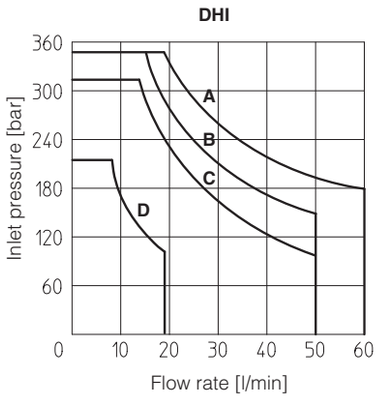


7 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams have been obtained with warm solenoids and power supply at lowest value (V_{nom} - 10%). The curves refer to application with symmetrical flow through the valve (i.e. P→A and B→T). In case of asymmetric flow and if the valves have the devices for controlling the switching times the operating limits must be reduced.

DHI

Curve	Spool type
A	0, 1, 1/2, 8
B	0/1, 0/2, 1/1, 1/9, 3, 3/1
C	4, 4/8, 5, 5/1, 6, 7, 16, 17, 19, 39, 49, 58, 58/1, 09, 90, 91, 93, 94
D	2, 2/2



8 SWITCHING TIMES (average values in msec)

Valve	Switch-on AC	Switch-on DC	Switch-off
DHI + 666 667	30	45	20
DHI + 669	45	—	80
DHI + E-SD	30	45	50

Test conditions:

- 36 l/min; 150 bar
- nominal voltage
- 2 bar of counter pressure on port T
- mineral oil: ISO VG 46 at 50°C.

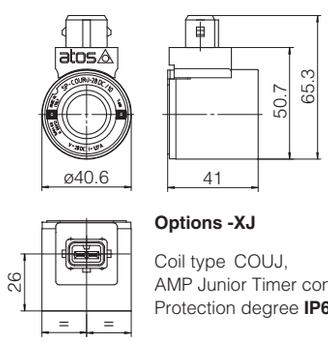
The elasticity of the hydraulic circuit and the variations of the hydraulic characteristics and temperature affect the response time.

9 SWITCHING FREQUENCY

Valve	AC (cycles/h)	DC (cycles/h)
DHI + 666 / 667	7200	15000

10 COILS WITH SPECIAL CONNECTORS only for voltage supply **12, 14, 24, 28** VDC

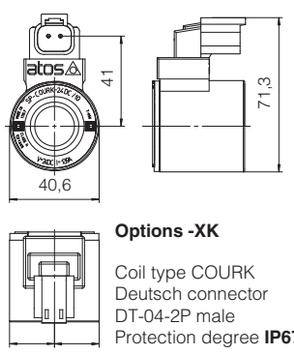
AMP Junior timer connector



Options -XJ

Coil type COUJ,
AMP Junior Timer connector
Protection degree **IP67**

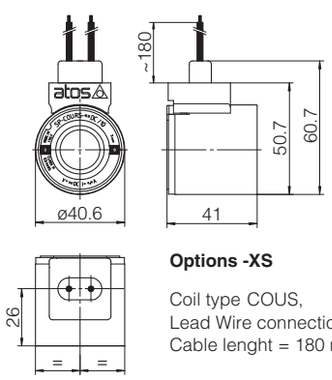
Deutsch connector DT-04-2P



Options -XK

Coil type COURK
Deutsch connector
DT-04-2P male
Protection degree **IP67**

Lead Wire connection



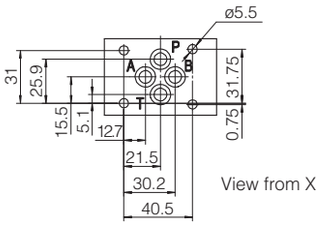
Options -XS

Coil type COUS,
Lead Wire connection
Cable lenght = 180 mm

Note: For the electric characteristics refer to standard coils features - see section 5

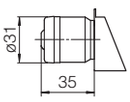
11 DIMENSIONS [mm]

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Fastening bolts:
4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108
Ports P,A,B,T: Ø = 7.5 mm (max).

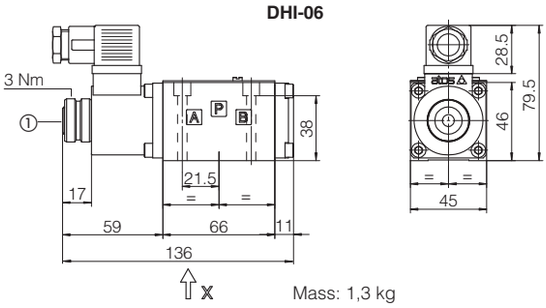


P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT

OPTION /WP

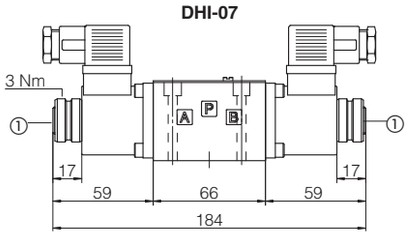


DHI-06



Mass: 1,3 kg

DHI-07



Mass: 1,6 kg

① Standard manual override PIN
⚠ The manual override operation can be possible only if the pressure at T ports is lower than 50 bar

Overall dimensions refer to valves with connectors type 666

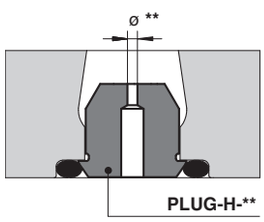
12 PLUG-IN RESTRICTOR (to be ordered separately)

The use of plug-in restrictors in valve's ports P or A or B may be necessary is case of particular conditions as long flexible hoses or the presence of accumulators which could cause at the valve switching instantaneous high flow peaks over the max valve's operating limits.

PLUG-H	-	**	A

08, 10, 12, 15 calibrated orifice diameter in tenths of mm
Example PLUG-H-**12** = orifice diameter **1,2 mm**
Other orifice dimensions are available on request

Short calibrated orifice



13 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately, see tech table K500)

666 = standard connector IP-65, suitable for direct connection to electric supply source
667 = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC
669 = with built-in rectifier bridge for supplying DC coils by alternate current (AC 110V and 230V - Imax 1A)
E-SD = electronic connector which eliminates electric disturbances when solenoid valves are de-energized

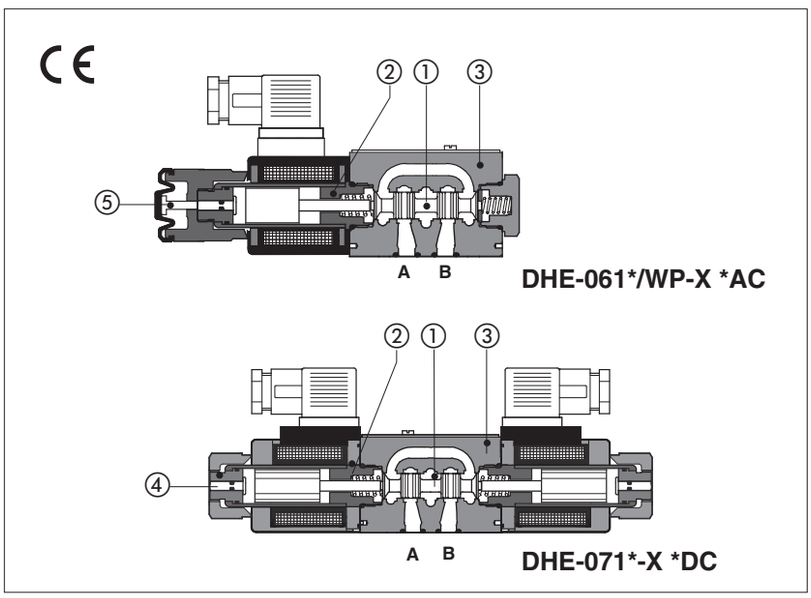
14 MOUNTING SUBPLATES

Model	Ports location	GAS Ports A-B-P-T	Ø Counterbore [mm] A-B-P-T	Mass [kg]
BA-202	Ports A, B, P, T underneath;	3/8"	–	1,2
BA-204	Ports P, T underneath; ports A, B on lateral side	3/8"	25,5	1,8
BA-302	Ports A, B, P, T underneath	1/2"	30	1,8

The subplates are supplied with 4 fastening bolts M5x50. Also available are multi-station subplates and modular subplates. For further details see table K280.

Solenoid directional valves type DHE

direct, spool type, high flow



Spool type, two or three position direct operated valves with high performance threaded solenoids certified according the North American standard **cURus**.

Solenoids ② are made by:

- wet type screwed tube, different for AC and DC power supply, with integrated manual override pin ④
- interchangeable coils, specific for AC or DC power supply, easily replaceable without tools - see section 5 for available voltages

Standard coils protection **IP65** optional coils with IP67 AMP Junior Timer or lead wire connections.

Wide range of interchangeable spools ①, see section 2.

The valve body ③ is 3 chamber type made by shell-moulding casting with wide internal passages.

Mounting surface: **ISO 4401 size 06**
Max flow: **80 l/min**
Max pressure: **350 bar**

1 MODEL CODE

DHE - 0	61	1	/	A	-	X	24 DC	*	/	*

Directional control valves size 06

Valve configuration, see section 2
61 = single solenoid, center plus external position, spring centered
63 = single solenoid, 2 external positions, spring offset
67 = single solenoid, center plus external position, spring offset
71 = double solenoid, 3 positions, spring centered
75 = double solenoid, 2 external positions, with detent

Spool type, see section 2.

Options, see note 1 at section 4.

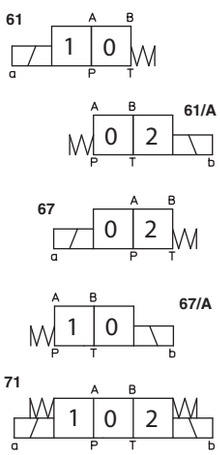
Voltage code, see section 5
00-AC = AC solenoids without coils
00-DC = DC solenoids without coils
X = without connector
See section 14 for available connectors, to be ordered separately
Coils with special connectors, see section 11
XJ = AMP Junior Timer connector
XK = Deutsch connector
XS = Lead Wire connection

Series number

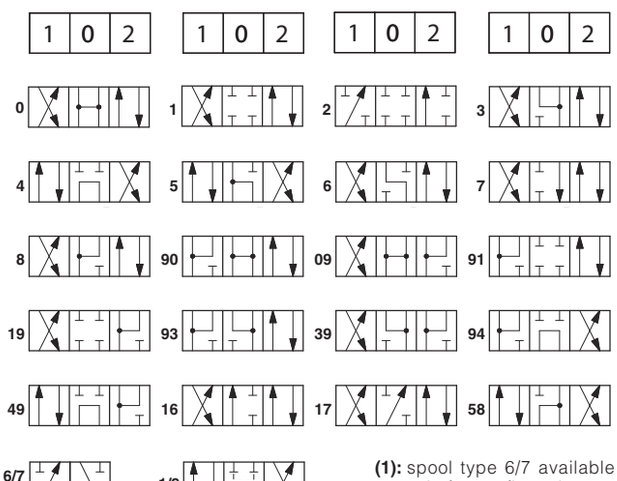
Seals material, see section 3:
- = NBR
PE = FKM
BT = HNBR

2 CONFIGURATIONS and SPOOLS (representation according to ISO 1219-1)

Configurations

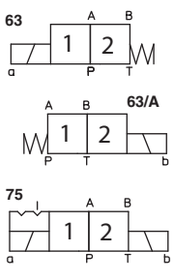


Spools

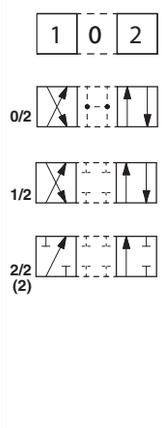


(1): spool type 6/7 available only for configuration 61, not available for version /A

Configurations



Spools



(2): not available for configuration 75

Note: see also section 4, note 3, for special shaped spools

3 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Ambient temperature	**Standard** = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C		
Storage temperature	**Standard** = -30°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +80°C		
Surface protection	Body: zinc coating with black passivation Coil: zinc nickel coating (DC version) plastic incapsulation (AC version)		
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h		
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	
Flow direction	As shown in the symbols of table 2		
Operating pressure	Ports P,A,B: **350** bar; Port T **210** bar for DC version; **160** bar for AC version		
Rated flow	See diagrams Q/Δp at section 6		
Maximum flow	**80 l/min**, see operating limits at section 7		

3.1 Coils characteristics

Insulation class	**H** (180°C) for DC coils **F** (155°C) for AC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	**IP 65** (with connectors 666, 667, 669 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature 5
Supply voltage tolerance	± 10%
Certification	**cURus** North American Standard

4 NOTES

1 Options

A = Solenoid mounted at side of port B (only for single solenoid valves). In standard versions, solenoid is mounted at side of port A.

WP = prolonged manual override protected by rubber cap.

⚠ The manual override operation can be possible only if the pressure at T port is lower than 50 bar - see section 12.

L1, L2, L3 = (only for DHE-DC) device for switching time control, installed in the valve solenoid, see section 9.
For spools 4 and 4/8 only device L3 is available.

FI, FV = with proximity or inductive position switch for monitoring spool position: see tab. E110.

MV, MO = auxiliary hand lever positioned vertically (MV) or horizontally (MO). For available configuration and dimensions see table E138.

2 Accessories

WPD/HE-DC = (only for DHE-DC) manual override with detent, to be ordered separately, see tab. K150

3 Special shaped spools

- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spools type **1, 4**, **5** and **58** are also available as **1/1, 4/8, 5/1** and **58/1.** They are properly shaped to reduce water-hammer shocks during the swiching.
- spools type **1, 1/2, 3, 8** are available as **1P, 1/2P, 3P, 8P** to limit valve internal leakages.
- spool type **1/9** has closed center in rest position but it avoids the pressurization of A and B ports due to the internal leakages.
- Other types of spools can be supplied on request.

5 ELECTRIC FEATURES

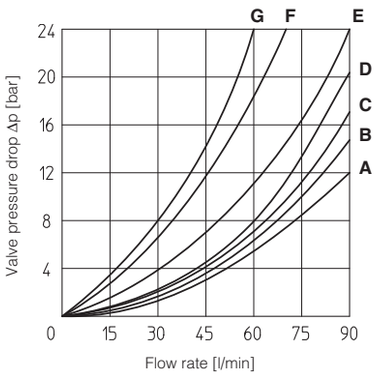
External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption (2)	Code of spare coil DHE
12 DC	**12 DC**	666 or 667	30 W	COE-12DC
14 DC	**14 DC**			COE-14DC
24 DC	**24 DC**			COE-24DC
28 DC	**28 DC**			COE-28DC
48 DC	**48 DC**			COE-48DC
110 DC	**110 DC**			COE-110DC
125 DC	**125 DC**			COE-125DC
220 DC	**220 DC**			COE-220DC
110/50 AC	**110/50/60 AC**		58 VA (3)	COE-110/50/60AC (1)
230/50 AC	**230/50/60 AC**			COE-230/50/60AC (1)
115/60 AC	**115/60 AC**		80 VA (3)	COE-115/60AC
230/60 AC	**230/60 AC**			COE-230/60AC
110/50 AC - 120/60 AC	**110 RC**	669	30 W	COE-110RC
230/50 AC - 230/60 AC	**230 RC**			COE-230RC

(1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷15% and the power consumption is 52 VA.
(2) Average values based on tests preformed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(3) When solenoid is energized, the inrush current is approx 3 times the holding current.

6 Q/ΔP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

Spool type \ Flow direction	P→A	P→B	A→T	B→T	P→T
0, 0/1	A	A	C	C	D
1, 1/1	D	C	C	C	
3, 3/1	D	D	A	A	
4, 4/8, 5, 5/1, 49, 58, 58/1, 94	F	F	G	C	E
1/2, 0/2	D	D	D	D	
6, 7, 16, 17	D	D	D	D	
8	A	A	E	E	
2	D	D			
2/2	F	F			
09, 19, 90, 91	E	E	D	D	
1/9, 39, 93	F	F	G	G	

DHE

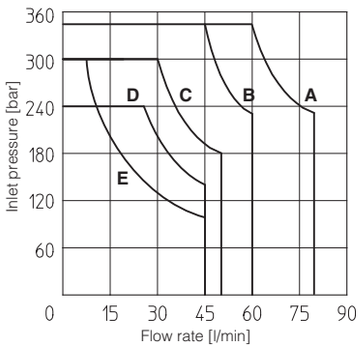


7 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

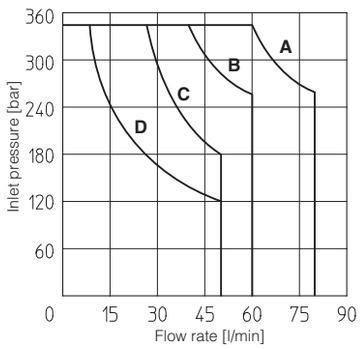
The diagrams have been obtained with warm solenoids and power supply at lowest value (V_{nom} - 10%). The curves refer to application with symmetrical flow through the valve (i.e. P→A and B→T). In case of asymmetric flow and if the valves have the devices for controlling the switching times the operating limits must be reduced.

Curve	Spool type AC	Spool type DC
A	1, 1/2, 8	0, 0/1, 1, 1/2, 3, 8
B	0, 0/1, 0/2, 1/1, 1/9, 3	0/2, 1/1, 6, 7, 1/9, 19
C	3, 3/1, 6, 7	3/1, 4, 4/8, 5, 5/1, 16, 17, 19, 39, 49, 58, 58/1, 09, 90, 91, 93, 94
D	4, 4/8, 5, 5/1, 16, 17, 19, 39, 58, 58/1, 09, 90, 91, 93, 94	2, 2/2
E	2, 2/2	-

DHE - AC



DHE - DC



8 SWITCHING TIMES (average values in msec)

Test conditions: - 36 l/min; 150 bar
- nominal voltage
- 2 bar of counter pressure on port T
- mineral oil: ISO VG 46 at 50°C

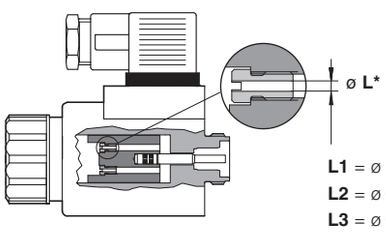
The elasticity of the hydraulic circuit and the variations of the hydraulic characteristics and temperature affect the response time.

Valve	Switch-on AC	Switch-off AC	Switch-on DC	Switch-off DC
DHE	10 - 25	20 - 40	30 - 50	15 - 25
DHE-*/L1	—	—	60	60
DHE-*/L2	—	—	80	80
DHE-*/L3	—	—	150	150

9 DEVICES FOR THE SWITCHING TIME CONTROL

These devices are used to control the valve's switching time (only for DC version) and therefore reduce the hammering shocks in the hydraulic circuit.

Options L1, L2, L3 control the switching time in both moving directions of the valve spool by means of calibrated restrictors installed in the solenoid anchor.



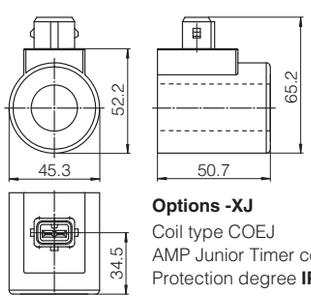
L1 = ø 1,1 mm
L2 = ø 0,9 mm
L3 = ø 0,7 mm

10 SWITCHING FREQUENCY

Valve	AC (cycles/h)	DC (cycles/h)
DHE + 666 / 667	7200	15000

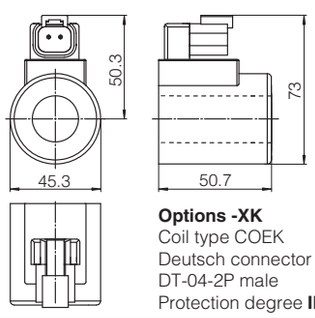
11 COIL WITH SPECIAL CONNECTORS only for voltage supply 12, 14, 24, 28 VDC

AMP Junior timer connector



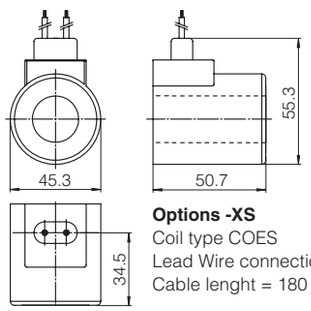
Options -XJ
Coil type COEJ
AMP Junior Timer connector
Protection degree **IP67**

Deutsch connector DT-04-2P



Options -XK
Coil type COEK
Deutsch connector
DT-04-2P male
Protection degree **IP67**

Lead Wire connection

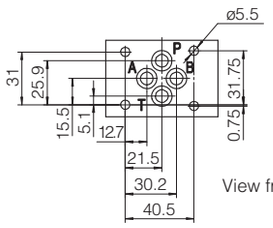


Options -XS
Coil type COES
Lead Wire connection
Cable lenght = 180 mm

Note: for the electric characteristics refer to standard coils features - see section 5

12 DIMENSIONS [mm]

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Fastening bolts: 4 socket head screws:
M5x30 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108
Ports P,A,B,T: Ø = 7.5 mm (max)

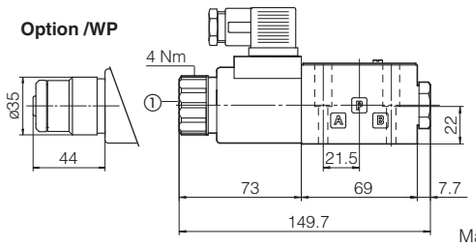


View from X

P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT

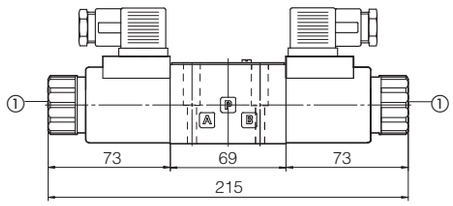
DHE-06(DC)

Option /WP



Mass: 1,5 kg

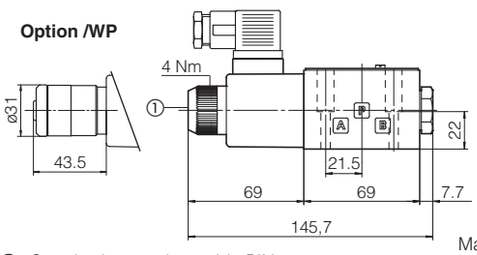
DHE-07(DC)



Mass: 2 kg

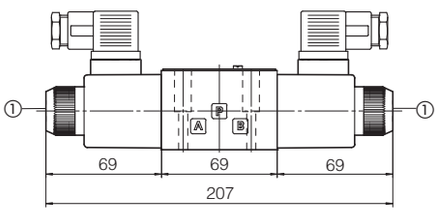
DHE-06(AC)

Option /WP



Mass: 1,4 kg

DHE-07(AC)



Mass: 1,8 kg

① Standard manual override PIN

⚠ The manual override operation can be possible only if the pressure at T ports is lower than 50 bar

Overall dimensions refer to valves with connector 666

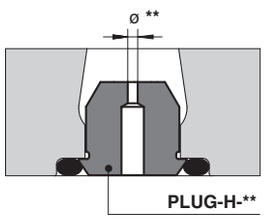
13 PLUG-IN RESTRICTOR (to be ordered separately)

The use of plug-in restrictors in valve's ports P or A or B may be necessary is case of particular conditions as long flexible hoses or the presence of accumulators which could cause at the valve switching instantaneous high flow peaks over the max valve's operating limits.

PLUG-H	-	**	A

08, 10, 12, 15 calibrated orifice diameter in tenths of mm
Example PLUG-H-**12** = orifice diameter **1,2 mm**
Other orifice dimensions are available on request

Short calibrated orifice



PLUG-H-**

14 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately)

666 = standard connector IP-65, suitable for direct connection to electric supply source
667 = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC
669 = with built-in rectifier bridge for supplying DC coils by alternate current (AC 110V and 230V - Imax 1A)
E-SD = electronic connector which eliminates electric disturbances when solenoid valves are de-energized

15 MOUNTING SUBPLATES

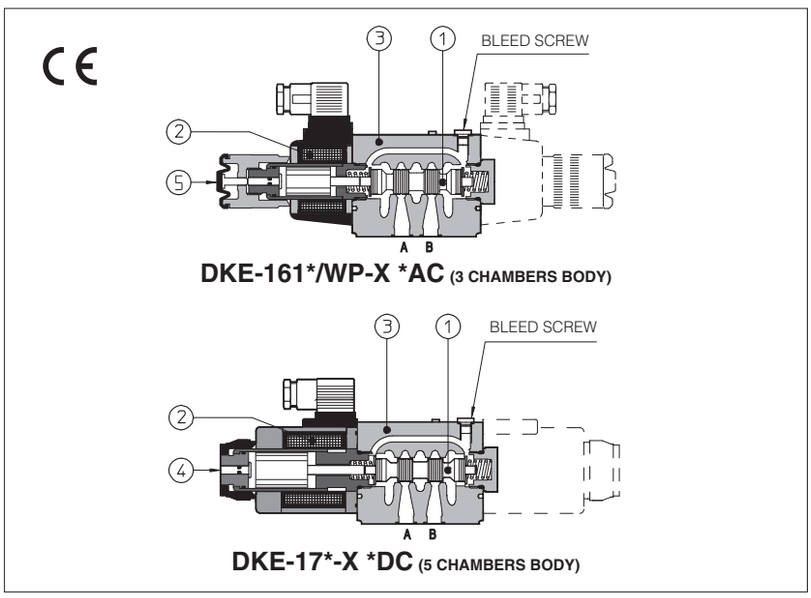
Model	Ports location	GAS Ports A-B-P-T	Ø Counterbore [mm] A-B-P-T	Mass [kg]
BA-202	Ports A, B, P, T underneath;	3/8"	–	1,2
BA-204	Ports P, T underneath; ports A, B on lateral side	3/8"	25,5	1,8
BA-302	Ports A, B, P, T underneath	1/2"	30	1,8

The subplates are supplied with 4 fastening bolts M5x50. Also available are multi-station subplates and modular subplates. For further details see table K280.

Table **E025-9/E**

Solenoid directional valves type DKE

direct, spool type



Spool type, two or three position direct operated valves with threaded solenoids certified according the North American standard **cURus**.

Solenoids ② are made by:

- wet type screwed tube, different for AC and DC power supply, with integrated manual override pin ④
- interchangeable coils, specific for AC or DC power supply, easily replaceable without tools - see section 5 for available voltages

Standard coils protection **IP65**, optional coils with IP67 AMP Junior Timer or lead wire connections.

The valve body ③ is 5 chamber type for all DC versions and for AC safety version /FI and FV

Standard AC version uses 3 chamber type body

Wide range of interchangeable spools ①, see section 2.

The body is made by shell-moulding casting with wide internal passages ensuring low pressure drops

Mounting surface: **ISO 4401 size 10**
Max flow: **150 l/min**
Max pressure: **350 bar**

1 MODEL CODE

DKE - 1	61	1	/	A	-	X	24 DC	*	/	*

DKE - 1: Directional control valves size 10

61: Valve configuration, see section 2
61 = single solenoid, center plus external position, spring centered
63 = single solenoid, 2 external positions, spring offset
67 = single solenoid, center plus external position, spring offset
70 = double solenoid, 2 external positions, without springs
71 = double solenoid, 3 positions, spring centered
75 = double solenoid, 2 external positions, with detent

1: Spool type, see section 2.

A: Options, see note 1 at section 4.

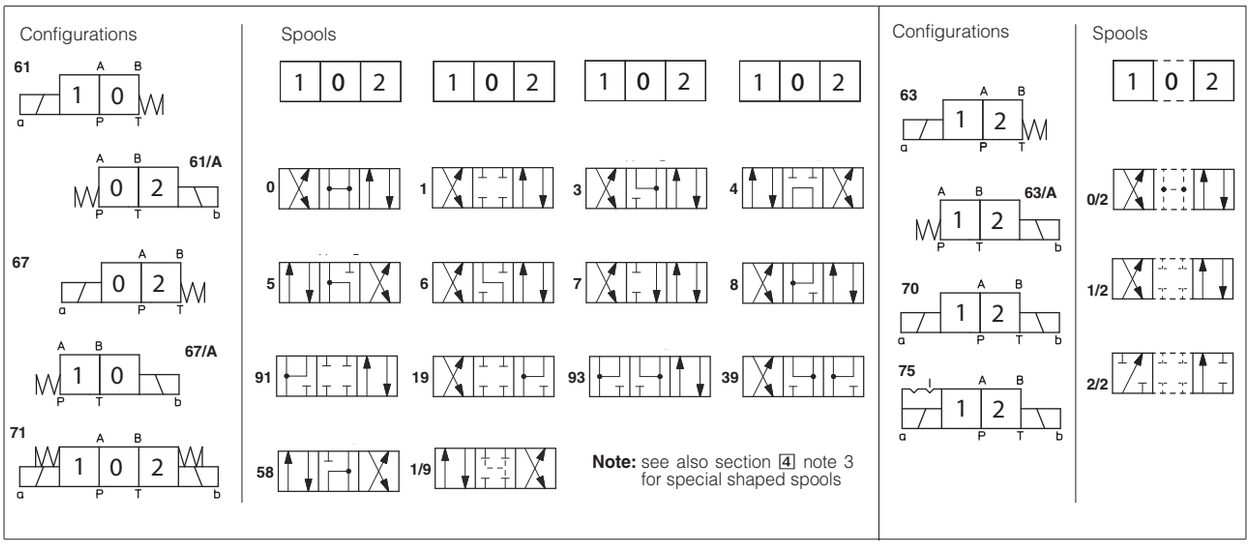
X: **00-AC** = AC solenoids without coils
00-DC = DC solenoids without coils
X = without connector
See section 14 for available connectors, to be ordered separately
Coils with special connectors, see section 11
XJ = AMP Junior Timer connector
XK = Deutsch connector
XS = Lead Wire connection

24 DC: Voltage code, see section 5

*****: Series number

*****: Seals material, see section 4:
- = NBR
PE = FKM
BT = HNBR

2 CONFIGURATIONS and SPOOLS (representation according to ISO 1219-1)



3 MAIN CHARACTERISTCS, SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position for all valves except for type - 170* (without springs) that must be installed with horizontal axis if operated by impulses		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Ambient temperature	**Standard** = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C		
Storage temperature	**Standard** = -30°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +80°C		
Surface protection	Body: zinc coating with black passivation Coil: zinc nickel coating (DC version) plastic incapsulation (AC version)		
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h		
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option)= -20°C ÷ +80°C HNBR seals (/BT option)= -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	
Flow direction	As shown in the symbols of table 2		
Operating pressure	Ports P,A,B: **350** bar; Port T **210** bar for DC version (**250** bar with option /Y); **160** bar for AC version		
Rated flow	See diagrams Q/Δp at section 6		
Maximum flow	**150 l/min**, see operating limits at section 7		

3.1 Coils characteristics

Insulation class	**H** (180°C) for DC coils **F** (155°C) for AC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree DIN EN 60529	**IP 65** (with connectors 666, 667, 669 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature 5
Supply voltage tolerance	± 10%
Certification	**cURus** North American Standard

4 NOTES

1 Options

A = Solenoid mounted at side of port B (only for single solenoid valves). In standard versions, solenoid is mounted at side of port A.
WP = prolonged manual override protected by rubber cap - see section 12.
L, L1, L2, L3, LR, L7, L8 see section 10 = device for switching time control (only for DC solenoids).
L7 and L8 are available only for spool type 0/1, 1/1, 3/1, 4 and 5.
FI, FV = 5 chambers body for DC and AC versions with proximity switch for spool position monitoring: see tab. E110.
Y = external drain, only for DC version, to be selected if the pressure at T port is higher than the max allowed limits.

2 Accessories

WPD/KE-DC = (only for DC supply) manual override with detent, to be ordered separately, see tab. K150

3 Special shaped spools

- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spool type **1** is also available as **1/1**, properly shaped to reduce the water-hammer shocks during the switching.
- spool type **1/9** has closed center in rest position but it avoids the pressurization of A and B ports due to the internal leakages.

5 ELECTRIC FEATURES

External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption (2)	Code of spare coil
12 DC	**12 DC**	666 or 667	36 W	CAE-12DC
14 DC	**14 DC**			CAE-14DC
24 DC	**24 DC**			CAE-24DC
28 DC	**28 DC**			CAE-28DC
110 DC	**110 DC**			CAE-110DC
125 DC	**125 DC**			CAE-125 DC
220 DC	**220 DC**			CAE-220DC
110/50/60 AC	**110/50/60 AC**		100 VA (3)	CAE-110/50/60AC (1)
230/50/60 AC	**230/50/60 AC**			CAE-230/50/60AC (1)
115/60 AC	**115/60 AC**		130 VA (3)	CAE-115/60AC
230/60 AC	**230/60 AC**			CAE-230/60AC
110/50/60 AC	**110 DC**	669	36 W	CAE-110DC
230/50/60 AC	**220 DC**			CAE-220DC

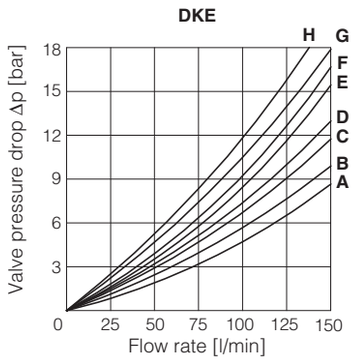
(1) In case of 60 Hz voltage frequency the performances are reduced by 10÷15% and the power consumption is 90 VA

(2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(3) When solenoid is energized, the inrush current is approx 3 times the holding current.

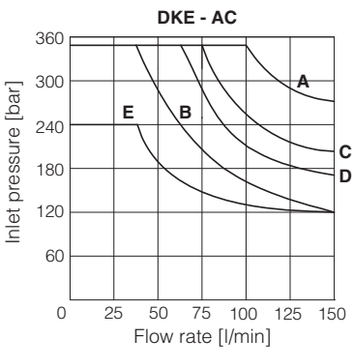
6 Q/ΔP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

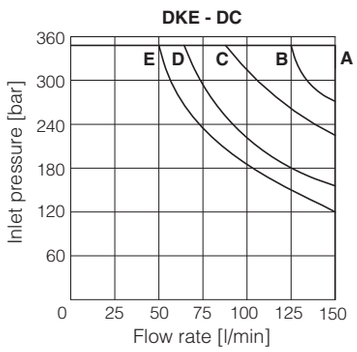
Flow direction / Spool type	P→A	P→B	A→T	B→T	P→T	B→A
0, 0/1, 0/2, 2/2	A	A	B	B		
1, 1/1, 6, 8	A	A	D	C		
3, 3/1, 7	A	A	C	D		
4	B	B	B	B	F	
5, 58	A	B	C	C	G	
1/2	B	C	C	B		
19, 91	F	F	G	G		H
1/9, 39, 93	F	F	G	G		H

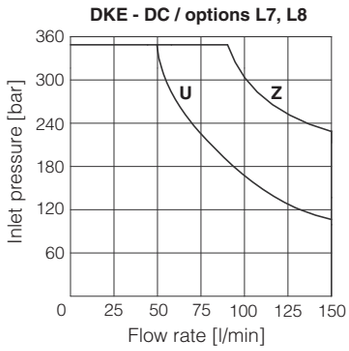


7 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams have been obtained with warm solenoids and power supply at lowest value (V_{nom} - 10%). The curves refer to application with symmetrical flow through the valve (i.e. P→A and B→T). In case of asymmetric flow and if the valves have the devices for controlling the switching times the operating limits must be reduced.







Curve	Spool type AC	Spool type DC
A	0/1	0, 0/1, 1, 1/1, 3, 3/1, 1/2, 0/2, 8
B	4, 5, 19, 91	6, 7
C	0, 1/1, 3, 3/1	19, 91
D	1, 1/2, 0/2	4, 5
E	6, 7, 8, 2/2	2/2
U	-	4, 5
Z	-	0/1, 1/1, 3/1

8 SWITCHING TIMES (average values in msec)

Valve	Switch-on AC	Switch-on DC	Switch-off AC	Switch-off DC
DKE + 666 / 667	40	60	25	35
DKE + 669	60	—	90	—
DKE-*/L*	—	75÷150	—	45÷150
DKE-*/L7 - DKE-*/L8	—	100÷150	—	100÷150

Test conditions:

- 50 l/min; 150 bar
- nominal supply voltage
- 2 bar of back pressure on port T
- mineral oil ISO VG 46 at 50°C

The elasticity of the hydraulic circuit and the variations of the hydraulic characteristics and temperature affect the response time.

9 SWITCHING FREQUENCY

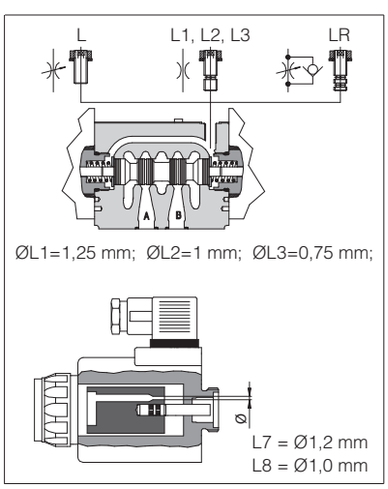
Valve	AC (cycles/h)	DC (cycles/h)
DKE + 666 / 667	7200	15000

10 DEVICES FOR SWITCHING TIME CONTROL

These devices are only available for DC valve version (5 chambers body) and can control the switching time and therefore reduce the coil hammering in the hydraulic circuit. The different types are available shown in the figure.

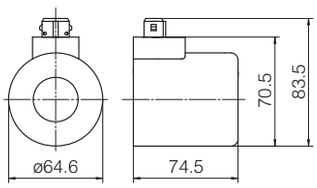
- **L**: controls and regulates the switching time in both moving directions of the spool: regulation is carried out by screwing/unscrewing the element itself (regulating choke);
- **L1/L2/L3**: controls the switching time in both moving directions of the spool by means of fixed calibrated restrictor (gauged flow). The restrictor is positioned in the valve's body ØL1 = 1,25 mm; ØL2 = 1 mm; ØL3 = 0,75 mm;
- **LR**: controls and regulates the switching time in the B→A direction of the spool movement. The device does not control the switching time (standard time) in the opposite direction A→B of the spool movement.
- **L7/L8**: controls the switching time in both moving directions of the spool by means of fixed calibrated restrictor (gauged flow). The restrictor is installed in the solenoid's anchor.

For a correct operation of the switching time control, the passage in which the control device is installed must be completely filled with oil.

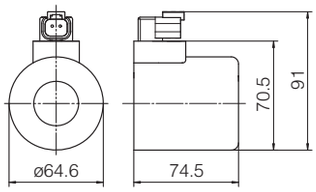


11 COILS TYPE CAE WITH SPECIAL CONNECTORS (only for 12DC, 14DC, 24DC and 28DC)

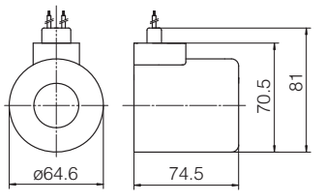
Options -XJ
Coil type CAEJ
AMP Junior Timer connector
Protection degree IP67



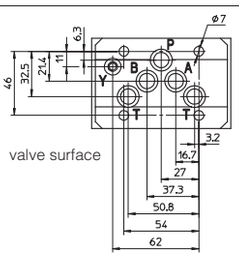
Options -XK
Coil type CAEK
Deutsch connector, DT-04-2P male
Protection degree IP67



Options -XS
Coil type CAES
Lead Wire connection
Cable lenght = 180 mm



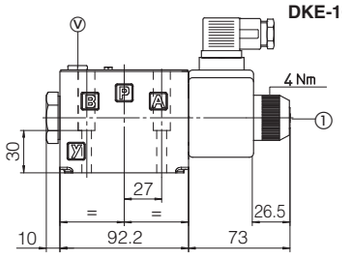
12 INSTALLATION DIMENSIONS [mm]

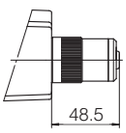


ISO 4401: 2005
Mounting surface according to 4401-05-05-0-05
(without X port, Y port optional)
Fastening bolts:
4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Seals: 5 OR 2050 and 1 OR 108
Ports P,A,B,T: Ø = 11.5 mm (max)
Ports Y: Ø = 5 mm

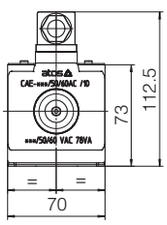
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
Y = DRAIN PORT (only for option /Y)
For the max pressures on ports, see section [3]

DKE-16*-AC



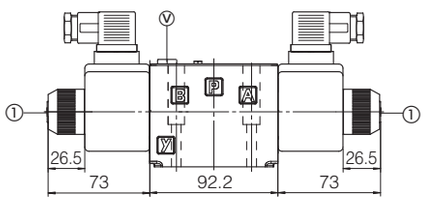


Option /WP



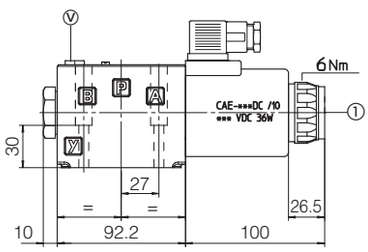
Mass: 3,9 kg

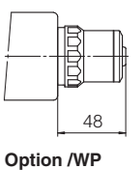
DKE-17*-AC



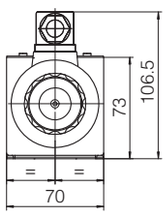
Mass: 4,7 kg

DKE-16*-DC



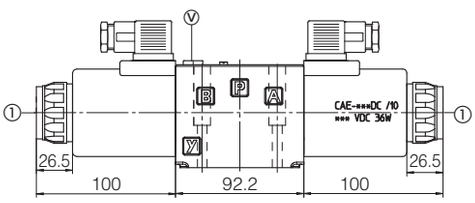


Option /WP



Mass: 4,5 kg

DKE-17*-DC



Mass: 6,1 kg

① Standard manual override PIN. The manual override operation can be possible only if the pressure at T ports is lower than 50 bar
Ⓥ Bleed screw

13 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately, see tech table K500)

666 = standard connector IP-65, suitable for direct connection to electric supply source
667 = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC
669 = with built-in rectifier bridge for supplying DC coils by alternate current (AC 110V and 230V - Imax 1A)

14 MOUNTING SUBPLATES

Model		Ports location	GAS Ports A-B-P-T (X-Y)	Ø Counterbore [mm] A-B-P-T (X-Y)	Mass [kg]
BA-308	(/Y)	Ports A, B, P, T (X, Y) underneath	1/2" (1/4")	30 (21,5)	2,5
BA-428	(/Y)	Ports A, B, P, T (X, Y) underneath	3/4" (1/4")	36,5 (21,5)	5,5
BA-434	(/Y)	Ports P, T, (X, Y) underneath; ports A, B on lateral side	3/4" (1/4")	36,5 (21,5)	8,5

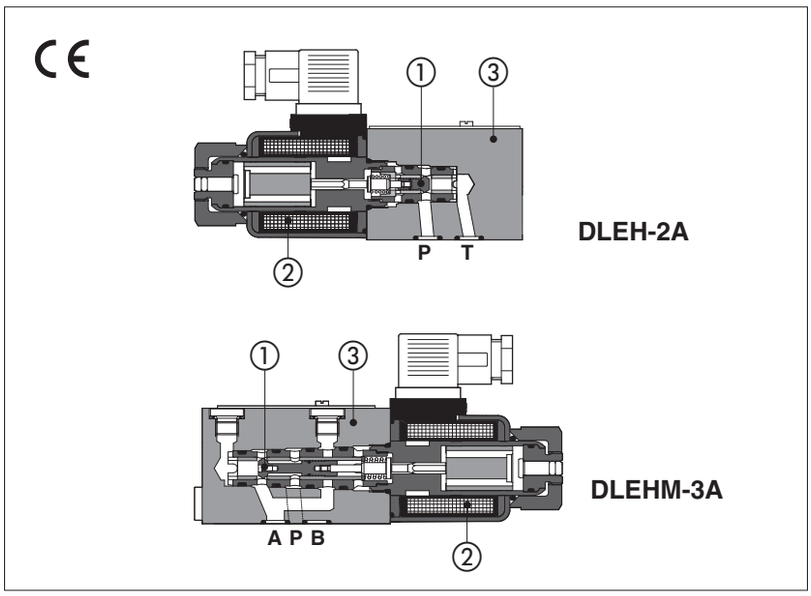
The subplates are supplied with 4 fastening bolts M6x40. Also available are multi-station subplates and modular subplates.
For further details see table K280.

01/20

Table **E045-3/E**

Solenoid directional valves type DLEH and DLEHM

direct, poppet type, leak free



Poppet type ① direct operated valves, designed for applications in oil hydraulic systems with leak free requirements.

Following models are available in a wide range of configurations, see section 2

size 06 subplate version

- **DLEH**: two and three way execution, Qmax 12 l/min
- **DLEHM**: three way execution, Qmax 30 l/min

M20 screw-in cartridge version for easy assembling in hydraulic blocks

- **CART LEH**: two and three way execution, Qmax 12 l/min
- **CART LEHM**: three way execution, Qmax 30 l/min

They are operated by wet type, screwed solenoids ② for DC or RC (rectified) current supply and certified according to the North American standard **cURus**

Standard coils protection **IP65**

Max flow: **12 l/min (DLEH, LEH)**
30 l/min (DLEHM, LEHM)

Max pressure: **350 bar (DLEH, LEH)**
315 bar (DLEHM, LEHM)

1 MODEL CODE

DLEH	-	2	A	/	WP	-	X	24 DC	*	/	*

Directional control valve poppet type:
DLEH = ISO size 06, max flow: 12 l/min
DLEHM = ISO size 06, max flow: 30 l/min
CART LEH = cartridge version max flow12 l/min
CART LEHM = cartridge version max flow 30 l/min

2 = two way (only DLEH and LEH)
3 = three way

Valve configuration, see table 2

Options, see section 4

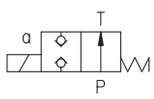
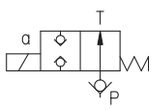
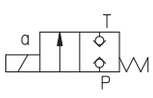
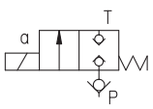
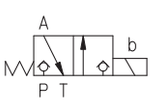
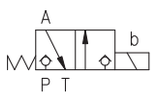
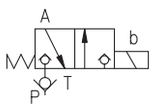
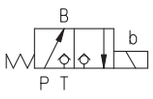
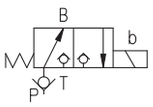
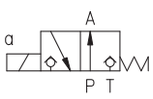
00-DC = DC solenoids without coils
X = without connector
See section 5 for available connectors, to be ordered separately

Voltage code, see section 6

Series number

Seals material, see section 3:
- = NBR
PE = FKM
BT = HNBR

2 VALVE CONFIGURATION

DLEH-2A **CART LEH-2A**	**DLEH-2A/R**	**DLEH-2C** **CART LEH-2C**	**DLEH-2C/R**	**DLEHM-3A** **CART LEHM-3A**
				
DLEH-3A **CART LEH-3A**	**DLEH-3A/R**	**DLEH-3C** **CART LEH-3C**	**DLEH-3C/R**	**DLEHM-3C** **CART LEHM-3C**
				

3 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	
Flow direction	As shown in the symbols of table 2		
Operating pressure	DLEH, LEH: Ports P, A, B **350 bar**; DLEHM, LEHM: Ports P, A **315 bar**; Port T **210** bar;		
Rated flow	See diagrams Q/Δp at section 7		
Max flow	DLEH, LEH: **12 l/min**, DLEHM, LEHM: **30 l/min**, see operating limits at section 8		
Internal leakage	Less than 5 drops/min (≤ 0,36 cm³/min) at max working pressure		

3.1 Coils characteristics

Insulation class	**H** (180°C) for DC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	**IP 65** (with connectors 666, 667, 669 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature 5
Supply voltage tolerance	± 10%
Certification	**cURus** North American Standard

4 NOTES

Options

WP = prolonged manual override protected by rubber cap

⚠ The manual override operation can be possible only if the pressure at T port is lower than 50 bar

R = (only for DLEH) with check valve on P port, see section 2.

S = (only for DLEH and CART LEH) poppet with positive overlapping in the intermediate position to reduce the internal leakage at the valve switching and without manual override pin for safety applications (blind locking ring)

5 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately, see tech table K500)

666 = standard connector IP-65, suitable for direct connection to electric supply source
667 = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC
669 = with built-in rectifier bridge for supplying DC coils by alternate current (AC 110V and 230V - Imax 1A)

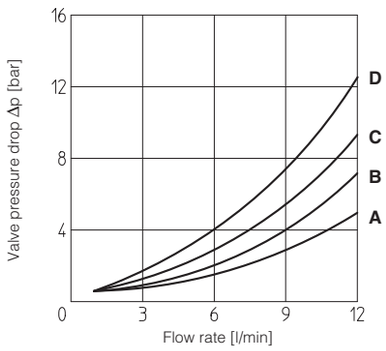
6 ELECTRIC FEATURES

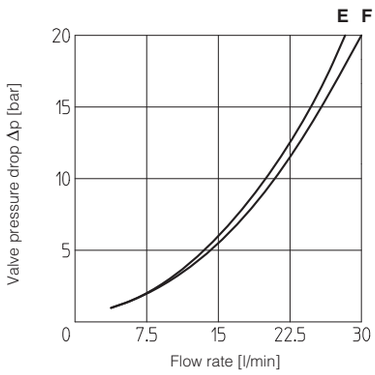
External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption	Code of spare coil
12 DC	**12 DC**	666 or 667	30 W	COE-12DC
14 DC	**14 DC**			COE-14DC
24 DC	**24 DC**			COE-24DC
28 DC	**28 DC**			COE-28DC
48 DC	**48 DC**			COE-48DC
110 DC	**110 DC**			COE-110DC
125 DC	**125 DC**			COE-125DC
220 DC	**220 DC**			COE-220DC
110/50 AC - 120/60 AC	**110 RC**	669		COE-110RC
230/50 AC - 230/60 AC	**230 RC**			COE-230RC

7 Δp/Q DIAGRAM based on mineral oil ISO VG 46 at 50°C

Flow direction / Valve type	P → A (1) (P → B)	A → T (B → T)
DLEH-2A	B	–
DLEH-2C	C	–
DLEH-3A	D	C
DLEH-3C	C	A
DLEHM-3A	F	E
DLEHM-3C	F	E

(1) For two-way valves, pressure drop refers to PØT





8 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

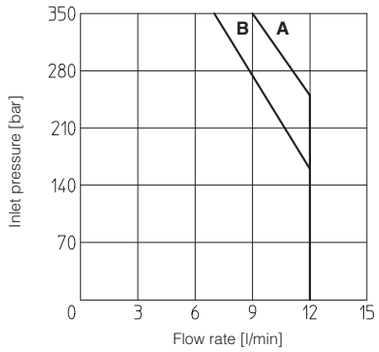
The diagram has been obtained with warm solenoids and power supply at lowest value (Vnom - 10%).

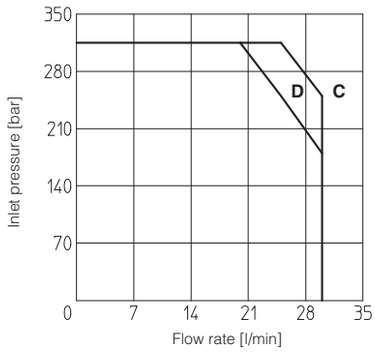
A = DLEH-3A, DLEH-2C

B = DLEH-2A, DLEH-3C

C = DLEHM-3A

D = DLEHM-3C





9 SWITCHING TIMES (average values in msec)

Valve type	Connector	Switch-on AC	Switch-on DC	Switch-off
DLEH(M)-* DC	666, 667	–	45	25
DLEH(M)-* RC	669	30	–	75

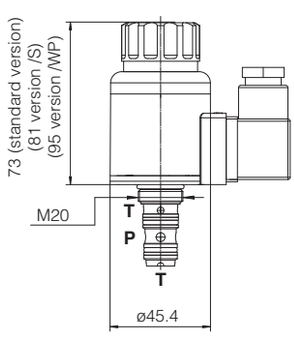
TEST CONDITIONS:

- 8 l/min; 150 bar
- nominal voltage
- 2 bar of counter pressure on port T
- based on mineral oil ISO VG 46 at 50°C

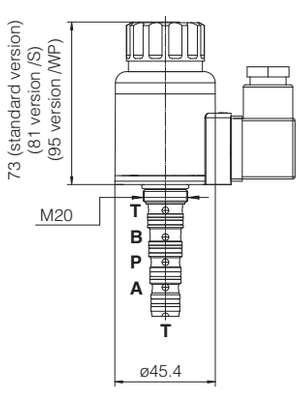
The response time is affected by elasticity of the hydraulic circuit, by variation of hydraulic characteristics and temperature

10 DIMENSIONS OF CARTRIDGE VERSIONS [mm] - for cavity dimensions see table P006

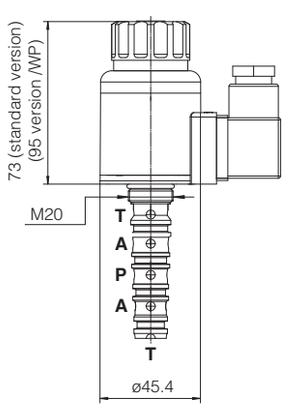
CART LEH-2A
CART LEH-2C



CART LEH-3A
CART LEH-3C

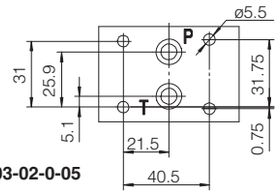


CART LEHM-3A
CART LEHM-3C



11 DIMENSIONS [mm]

DLEH-2*
DLEH-2*/R

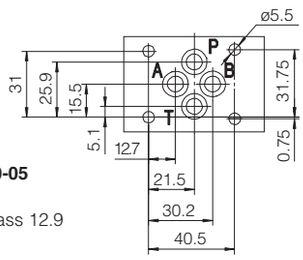


ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
without A and B ports

Fastening bolts:
4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm
Seals: 2 OR 108
Ports P, T: Ø = 7,5 mm (max)

P = PRESSURE PORT
T = USE PORT
For the max pressures on ports, see section 3

DLEH-3*
DLEH-3*/R
DLEHM-3*
DLEHM-3*/R

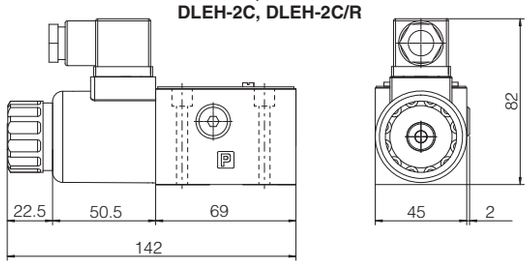


ISO 4401: 2005
Mounting surface: 4401-03-02-0-05

Fastening bolts:
4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108
Ports P, A, B, T: Ø = 7,5 mm (max)

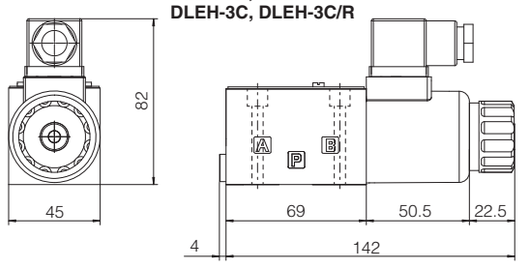
P = PRESSURE PORT
A = USE PORT (not used for DLEH and LEH -3C versions)
B = USE PORT (not used for DLEH and LEH -3A versions)
(not used for DLEHM and LEHM)
T = TANK PORT
For the max pressures on ports, see section 3

DLEH-2A, DLEH-2A/R
DLEH-2C, DLEH-2C/R



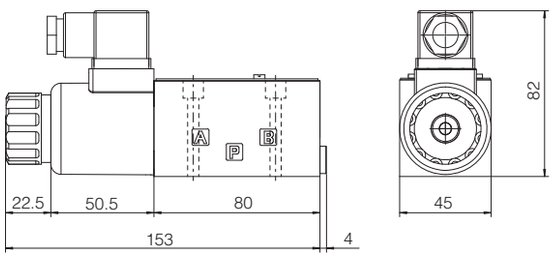
Mass: 1,5 Kg

DLEH-3A, DLEH-3A/R
DLEH-3C, DLEH-3C/R



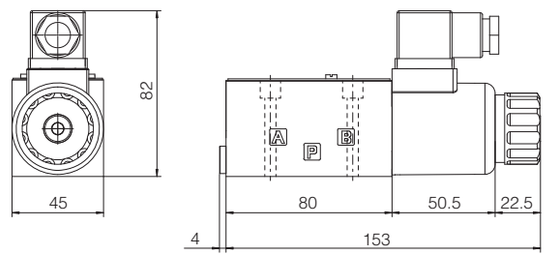
Mass: 1,5 Kg

DLEHM-3C



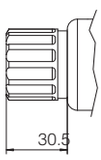
Mass: 1,7 Kg

DLEHM-3A

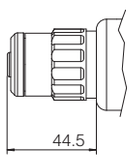


Mass: 1,7 Kg

Option /S



Option /WP



option /S = blind locking ring without manual override
option /WP = prolunged manual override, protected by rubber cap

Overall dimensions refer to valves with connectors type 666

12 MOUNTING SUBPLATES - see table K280

Valve	Subplate model	Ports location	GAS ports A-B-P-T	Ø Counterbore [mm] A-B-P-T	Mass [Kg]
DLEH-* DLEHM-*	BA-202	Ports A, B, P, T underneath;	3/8"	–	1,2
	BA-204	Ports P, T underneath; ports A, B on lateral side	3/8"	25,5	1,8
	BA-302	Ports A, B, P, T underneath;	1/2"	30	1,8