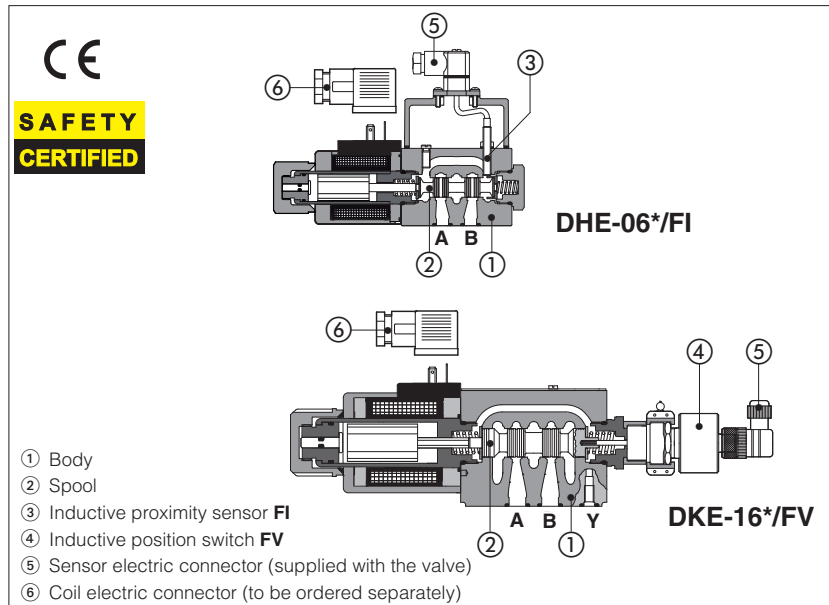


Safety directional valves with spool position monitoring

On-off, direct operated, conforming to Machine Directive 2006/42/EC - certified by



Direct operated safety directional valves with spool position monitoring, **CE** marked and certified by **TÜV** in accordance with safety requirements of Machine Directive 2006/42/EC.

DHE, size 06, high performances, for AC and DC supply with cURus certified solenoids

DKE, size 10, for AC and DC supply with cURus certified solenoids

The valves are equipped with **FI** inductive proximity sensor or **FV** inductive position switch for the spool position monitoring, see section **1** and **1.1** for sensors availability and technical characteristics.

Certification

The **TÜV** certificate can be downloaded from www.atos.com, catalog on line, technical information section.

Mounting surface: **ISO 4401**, size **06** and **10**

Max flow: **DHE 80 l/min**

DKE 150 l/min

Max pressure: **350 bar**

1 RANGE OF VALVE'S MODELS

Valve code	Size	Description	DC solenoids		AC solenoids	
			Sensor type			
			/FI	/FV	/FI	/FV
DHE-06	06	direct operated solenoid valves, on-off, single solenoid	•	•	•	•
DHE-07	06	direct operated solenoid valves, on-off, double solenoid	•	•	•	
DKE-16	10	direct operated solenoid valves, on-off, single solenoid	•	•	•	•
DKE-17	10	direct operated solenoid valves, on-off, double solenoid	•	•	•	

Notes:

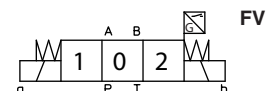
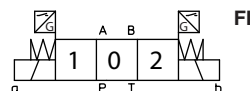
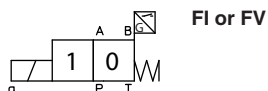
FI = inductive proximity sensor, type NO (normally open) or NC (normally closed)

FV = inductive position switch providing both NO and NC contacts to be wired on the electric connector

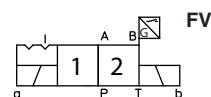
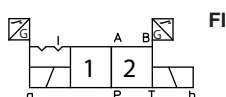
See section **1.1** for sensor's characteristics

1.1 FI sensor & FV switch configurations

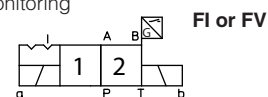
Single solenoid valves size 06 & 10 are provided with n°1 FI sensor or n° 1 FV switch for the spool position monitoring



Double solenoid valves size 06 with detent are provided with n°2 FI sensors or n° 1 FV switch for the spool position monitoring



Double solenoid valves size 10 with detent are provided with n° 1 FI sensor or n° 1 FV switch for the spool position monitoring



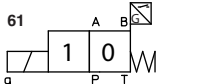
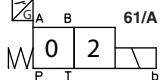
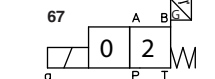
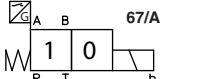
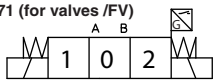
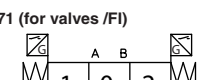
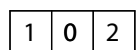
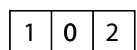
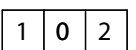
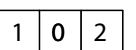
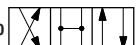
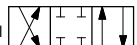
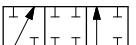
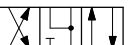
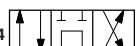
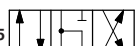
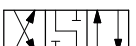
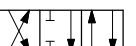
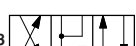
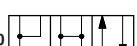
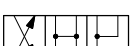
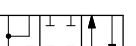
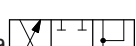

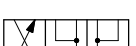
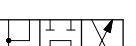

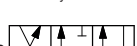
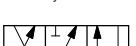
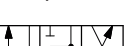
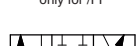
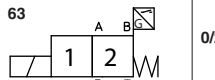
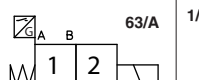
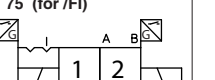
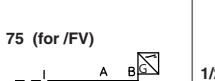
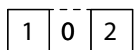





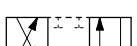
For model code of **DHE** safety valves, see section **2**

For model code of **DKE** safety valves, see section **4**

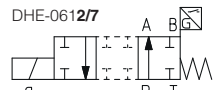
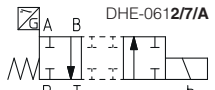
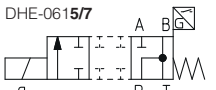
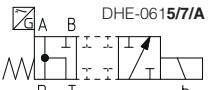
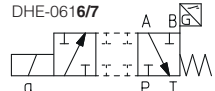
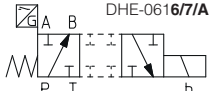
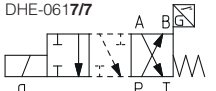
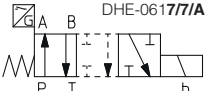
2 MODEL CODE OF DHE

DHE	- 0	63	1/2	/ A	/ FV	* - X	24DC	**	/ *
Directional control valve size 06 DHE = max flow 80 l/min Size ISO 4401 0 = size 06 Valve configuration , see section 3 61 =single solenoid, central plus external position, spring centered 63 =single solenoid, 2 external positions, spring offset 67 =single solenoid, external plus central position, spring offset 71 =double solenoid, 3 positions, spring centered 75 =double solenoid, 2 external positions, with detent Spool type , see section 3 Options , see section 8 (1) the FV inductive position switch provides both NC and NO contacts									
								Series number PE = FKM	Seals material see sect. 6,7 - = NBR PE = FKM
								Voltage code , see section 9	
								X = without connector, see section 10 for available connectors, to be ordered separately	
								Electrical signal - only for FI version (1): /NC = electric contact is closed when the valve is de-energized /NO = electric contact is open when the valve is de-energized	
								Spool position monitor: FI = inductive proximity switch FV = inductive position switch (double contact)	

3 CONFIGURATIONS AND SPOOLS (representation according to ISO 1219-1)

Configurations	Spoils	Configurations	Spoils
61  61/A  67  67/A  71 (for valves /FV)  71 (for valves /FI) 	                         (1) only for DHE-0711/9/FI	63  63/A  75 (for /FI)  75 (for /FV) 	      

3.1 Configuration for spool */7

DHE-0612/7 	DHE-0612/7/A 	DHE-0615/7 	DHE-0615/7/A 
DHE-0616/7 	DHE-0616/7/A 	DHE-0617/7 	DHE-0617/7/A 

3.2 Special shaped spools for DHE

- 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 switching.
- spools type **1**, **1/2**, **3**, **8** are available as **1P**, **1/2P**, **3P**, **8P** to limit valve internal leakages.
- Other types of spools can be supplied on request.

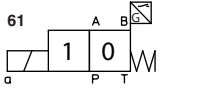
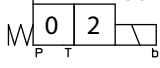
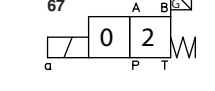
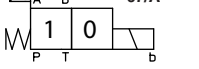
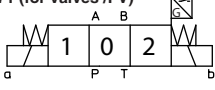
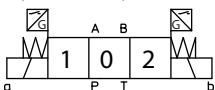
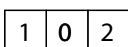
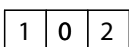
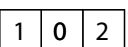
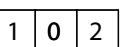
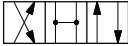
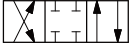


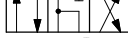





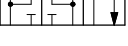
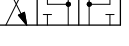
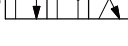

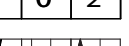


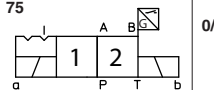
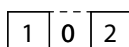
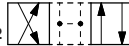
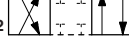
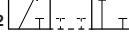
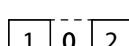


3.3 Standard spool availability for DHE - spools not listed in the table are available for all valves models

Valve type	standard spool						
	09	90	39	93	49	94	1/9
DHE/FI	•	•	•	•	•	•	•
DHE/FV							

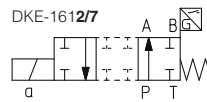
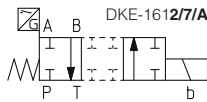
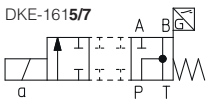
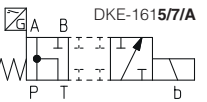
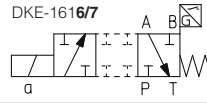
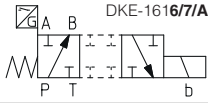
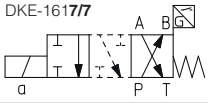
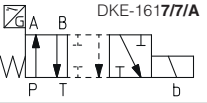
4 MODEL CODE OF DKE

DKE	- 1	63	1/2	/ A	/ FV	* - X	24DC	** / *
Directional control valve size 10								Seals material see sect. 6, 7 - = NBR PE = FKM
Size ISO 4401 1 = size 10								Series number
Valve configuration, see section 5 61 = single solenoid, central plus external position, spring centered 63 = single solenoid, 2 external positions, spring offset 67 = single solenoid, external plus central posi- tion, spring offset 71 = double solenoid, 3 positions, spring centered 75 = double solenoid, 2 external positions, with detent							Voltage code, see section 9	
Spool type, see section 5								
Options, see section 8								
DKE/FI and /FV are always provided with Y drain port (1) the FV inductive position switch provides both NC and NO contacts								
								Electrical signal - only for FI version (1): /NC = electric contact is closed when the valve is de-energized /NO = electric contact is open when the valve is de-energized
								Spool position monitor: FI = inductive proximity switch FV = inductive position switch (double contact)

5 CONFIGURATIONS AND SPOOLS (representation according to ISO 1219-1)

Configurations	Spoils	Configurations	Spoils
<p>61</p>  <p>61/A</p>  <p>67</p>  <p>67/A</p>  <p>71 (for valves /FV)</p>  <p>71 (for valves /FI)</p> 	<p>1 0 2</p>  <p>1 0 2</p>  <p>1 0 2</p>  <p>1 0 2</p>  <p>0</p>  <p>1</p>  <p>3</p>  <p>4</p>  <p>5</p>  <p>6</p>  <p>7</p>  <p>8</p>  <p>91</p>  <p>19</p>  <p>93</p>  <p>39</p>  <p>58</p>  <p>1/9 (1)</p>  <p>1/3 (2)</p>  <p>(1) only for DKE-1711/9/FI (2) only for DKE-*DC, configuration 61 or 61/A</p>	<p>63</p>  <p>63/A</p>  <p>75</p> 	<p>1 0 2</p>  <p>0/2</p>  <p>1/2</p>  <p>2/2</p>  <p>1 0 2</p>  <p>0/2</p>  <p>1/2</p> 

5.1 Configuration for spool */7

DKE-1612/7	DKE-1612/7/A	DKE-1615/7	DKE-1615/7/A
			
DKE-1616/7	DKE-1616/7/A	DKE-1617/7	DKE-1617/7/A
			

5.2 Special shaped spools for DKE

- 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 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.
- other types of spools can be supplied on request.

6 MAIN CHARACTERISTICS

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 Machine Directive 2006/42/EC. -EC type-examination certificate for safety components (1) -ISO 13849 category 1, PLC in high demand mode CE to Low Voltage Directive 2014/35/EU and Machine Directive 2006/42/EC. RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006
Ambient temperature	Standard = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C
Flow direction	As shown in the symbols of table 3 and 5
Surface protection	Zinc coating with black passivation Coil: zinc nickel coating (DC version) plastic incapsulation (AC version)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200h
Operating pressure	DHE P, A, B = 350 bar T = 100 bar (version /FI); 210 bar (DC solenoid - version /FV); 160 bar (AC solenoid - version /FV)
	DKE P, A, B = 350 bar T = (with Y port not connected to tank) 100 bar (version /FI); 210 bar (DC solenoid - version /FV); 120 bar (AC solenoid - version /FV) T = (with Y port drained to tank) 250 bar
Rated flow	see diagrams Q/Δp at section 14
Maximum flow	DHE 80 l/min see section 15
	DKE 150 l/min see section 15

(1) The type-examination certificate can be download from www.atos.com

6.1 Coils characteristics

Insulation class	H (180°C) for DC coils F (155°C) for AC coils Due to the occurring 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 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric features 9
Supply voltage tolerance	± 10%
Certification	cURus North American standard

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

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		
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	HFUD, HFDR	ISO 12922
Flame resistant with water	NBR	HFC	

8 OPTIONS

A = Single solenoid valves: solenoid mounted at side of port B. In standard versions the solenoid is mounted at side of port A.

Double solenoid valves DHE/FV(DC), DKE/FV(DC): FV inductive position switch mounted at side of port A. In standard versions the position switch is mounted at side of port B.

WARNING: the manual operation is not permitted for safety valves, than the valve is provided with solenoid blind rings to prevent the access to the manual override. The manual override protected by rubber cup (option /WP) is not available



WARNING: the inobservance of following prescriptions invalidates the certification and may represent a risk for personnel injury



Safety valves must be installed and commissioned only by qualified personnel

Safety valves must not be disassembled

The inductive proximity FI or the inductive position switch FV can be adjusted only by the valve's manufacturer or Atos authorized service centers

Valve's components cannot be interchanged

The valves must operate without switching shocks and spool vibrations

9.1 COILS FOR DHE VALVES

(1) In case of 60 Hz voltage frequency the performances are reduced by 20~25% and the power consumption is 58 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.

(1) In case of 60 Hz voltage frequency the performances are reduced by 20 ÷ 25% 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.

EY010

11 TECHNICAL CHARACTERISTICS OF INDUCTIVE PROXIMITY AND POSITION SWITCHES

Type of switch	/FI proximity sensor	/FI scheme	/FV position switch	/FV scheme
Supply voltage [V]	10÷30		20÷32	
Ripple max [%]	≤ 20		≤ 10	
Max current [mA]	200		400	
Max peak pressure [bar]	100		400	
Mechanical life	virtually infinite		virtually infinite	
Switch logic	PNP		PNP	
		1 output signal 2 supply +24 Vdc 4 GND	1 supply +24 Vdc 2 output signal	3 GND 4 output signal

12 CONNECTING SCHEMES OF INDUCTIVE PROXIMITY AND POSITION SWITCHES - FI and FV sensor's connector are always supplied with the valve

DHE/FI single solenoid / double solenoid (dotted line)	/FV (all valves) single solenoid	/FV (all valves) double solenoid	DKE/FI single solenoid	DKE/FI double solenoid
Connector type 345 IP65 	Connector type ZBE-06 IP65 	Connector type ZBE-06 IP65 	Connector type 666 IP65 	Connector type 664 IP65
1 = output signal 2 = supply +24 VDC 3 = output signal for double solenoid 4 = GND	1 = supply +24 VDC 2 = output signal NC 3 = GND 4 = output signal NO	1 = supply +24 VDC 2 = output signal sol. b 3 = GND 4 = output signal sol. a	1 = output signal S 2 = supply +24 VDC ⊕ = GND	1 = output signal sol. a 2 = supply +24 VDC 3 = output signal sol. b ⊕ = GND

NOTE: the /FI proximity and /FV position switch are not provided with a protective earth connection

13 STATUS OF OUTPUT SIGNAL

13.1 Signal status for FI versions

Signal status for standard version

	Configuration 61 monitored position "0"	Configuration 63 monitored position "2"	Configuration 67 monitored position "2"	Configuration 71 monitored position "0"	Configuration 75 monitored position "2"
HYDRAULIC CONFIGURATION					
spool position	1 0	1 2	0 2	1 0 2	1 2
sensor signal	ON	ON	ON	ON	ON
OFF	ON	ON	ON	ON	ON
sensor a signal	ON	ON	ON	ON	ON
OFF	ON	ON	ON	ON	ON
sensor b signal	ON	ON	ON	ON	ON
ON	ON	ON	ON	ON	ON
OFF	ON	ON	ON	ON	ON

Diagrams show the behaviour of the output signal for inductive switches type **FI/NO**.

For inductive switches type **FI/NC** option the behaviour is opposite (high level signal instead of low level signal and viceversa)

Signal status for option /A

	Configuration 61/A monitored position "0"	Configuration 63/A monitored position "1"	Configuration 67/A monitored position "1"
HYDRAULIC CONFIGURATION			
spool position	0 2	1 2	1 0
sensor signal	ON	ON	ON
OFF	ON	ON	ON

Diagrams show the behaviour of the output signal for inductive switches type **FI/NO**.

For inductive switches type **FI/NC** option the behaviour is opposite (high level signal instead of low level signal and viceversa)

13.2 Signal status for FV versions

Signal status for standard version

DH - DK	Configuration 61	Configuration 63	Configuration 67	Configuration 71	Configuration 75	
Hydraulic configuration						
spool position	1	0	1	2	0	2
pin 2	ON	OFF	ON	OFF	ON	OFF
pin 4	ON	OFF	ON	OFF	ON	OFF

Note: FV position switch can be electrically wired by the customer as NO or NC and then the status of the output signal will be in accordance to the selected configuration

■ = intermediate spool position corresponding to the hydraulic configuration change

Signal status for option /A

DH - DK		Configuration 61/A		Configuration 63/A		Configuration 67/A		Configuration 71/A		Configuration 75/A	
Hydraulic configuration											
spool position		<div>0</div> <div>2</div>		<div>0</div> <div>2</div>		<div>0</div> <div>2</div>		<div>1</div> <div>0</div> <div>2</div>		<div>1</div> <div>2</div>	
pin 2	ON										
	OFF										
pin 4	ON										
	OFF										

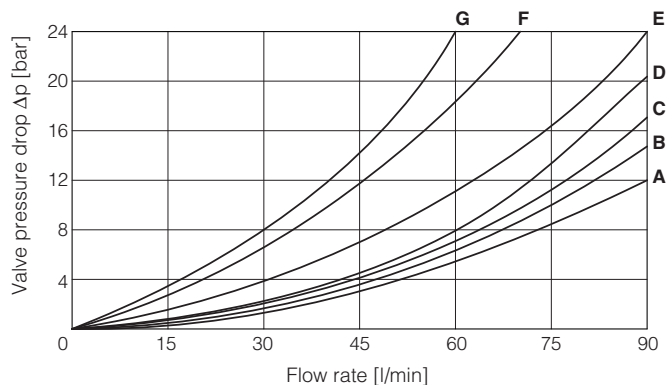
Note: FV position switch can be electrically wired by the customer as NO or NC and then the status of the output signal will be in accordance to the selected configuration

■ = intermediate spool position corresponding to the hydraulic configuration change

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

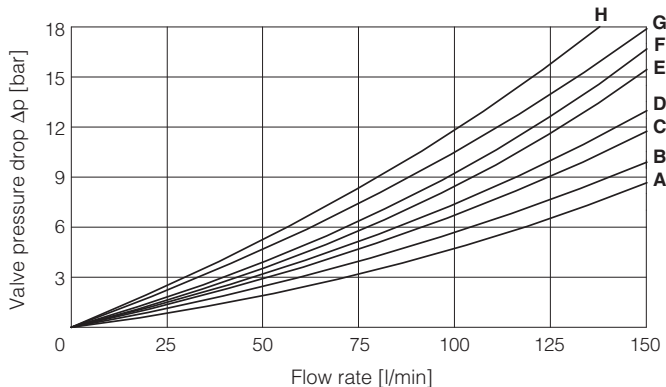
DHE

Flow direction	P→A	P→B	A→T	B→T	P→T
Spool type					
0, 0/1	A	A	C	C	D
1, 1/1, 1/9	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	
39, 93	F	F	G	G	
2/7	E		E		
5/7	D	E		C	F
6/7		D	E		
7/7		F	F	F	



DKE

Flow direction	P→A	P→B	A→T	B→T	P→T	B→A
Spool type						
0, 0/1, 0/2, 2/2	A	A	B	B		
1, 1/1, 1/9, 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	E	E	G	G		H
39, 93	F	F	G	G		H
2/7	G			H		
5/7	D			C	G	
6/7		G	H			
7/7		H	H	H		

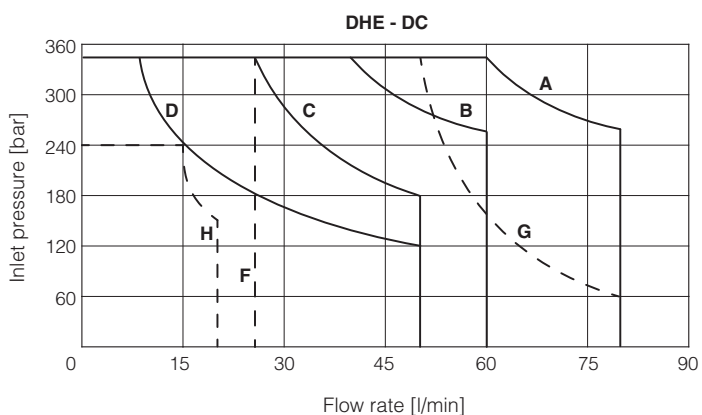
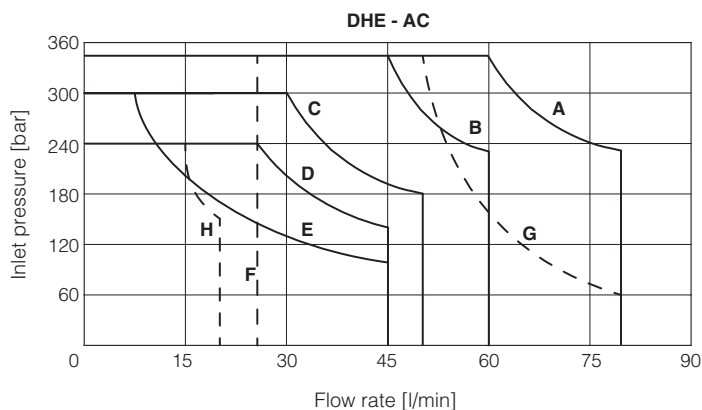


15 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

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.

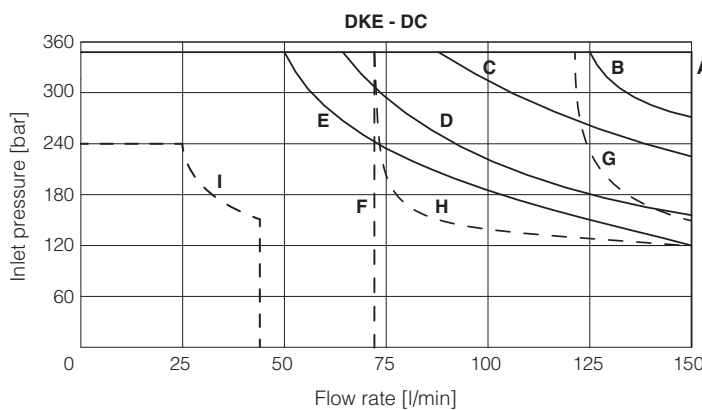
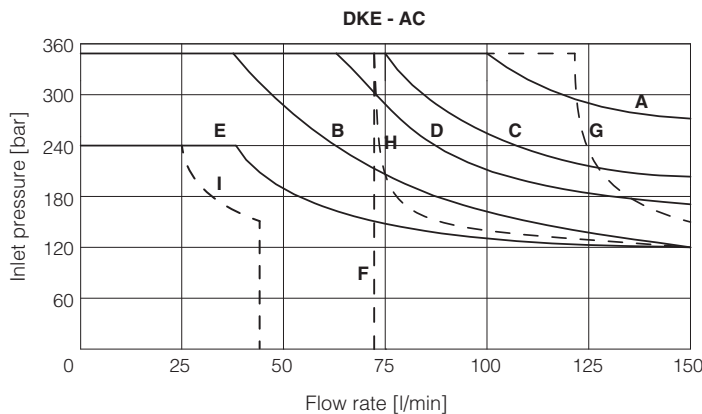
DHE

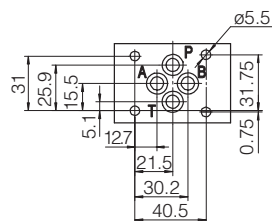
Curve	Spool type	
	AC	DC
A	1, 1/2, 8	0, 0/1, 1, 1/2, 3, 8
B	0, 0/1, 0/2, 1/1, 1/9, 3	0/2, 1/1, 6, 7, 1/9, 19
C	3, 3/1, 6, 7	3/1, 4, 4/8, 5, 5/1, 16, 17, 19, 39, 49, 58, 58/1, 09, 90, 91, 93, 94
D	4, 4/8, 5, 5/1, 16, 17, 19, 39, 58, 58/1, 09, 90, 91, 93, 94	2, 2/2
E	2, 2/2	-
F	2/7, 6/7	2/7, 6/7
G	5/7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



DKE

Curve	Spool type	
	AC	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
F	2/7	2/7
G	5/7	5/7
H	6/7	6/7
I	7/7	7/7





valve's bottom view

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: $\varnothing = 7.5$ mm (max)

P = PRESSURE PORT

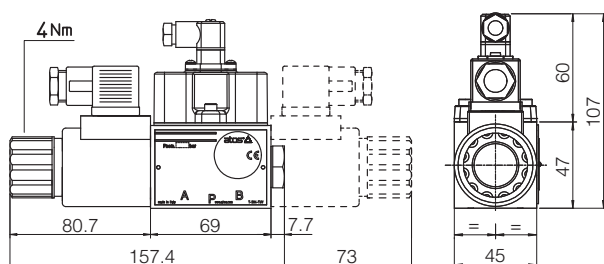
A, B = USE PORT

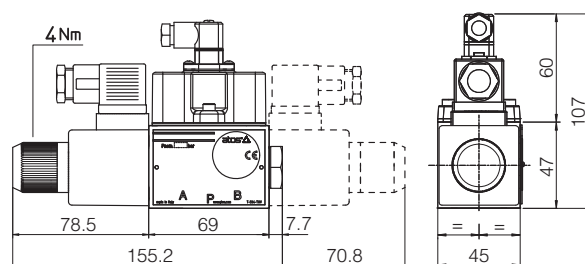
T = TANK PORT

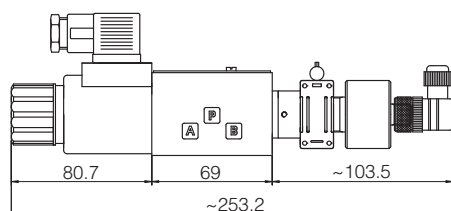
option /A

Single solenoid valves: solenoid mounted at side of port B.

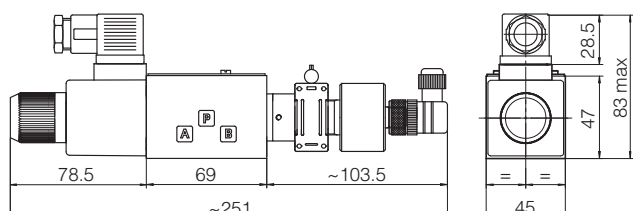
Double solenoid valves DHE/FV(DC): FV inductive position switch mounted at side of port A

DHE-06*/FI (DC)
DHE-07*/FI (DC) dotted line

Mass:
kg 1,85 (one solenoid)
kg 2,1 (two solenoids)

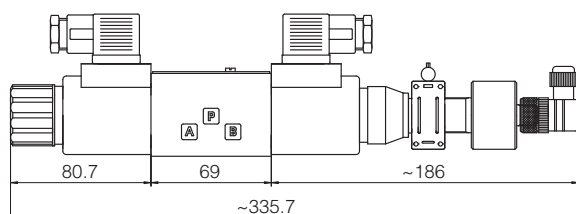
DHE-06*/FI (AC)
DHE-07*/FI (AC) dotted line

Mass:
kg 1,85 (one solenoid)
kg 2,1 (two solenoids)

DHE-06*/FV (DC)


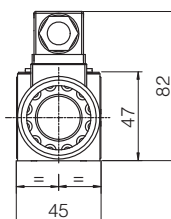
Mass: kg 1,95

DHE-06*/FV (AC)


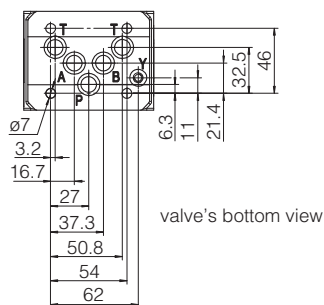
Mass: kg 1,8

DHE-07*/FV (DC)


Mass: kg 2,2



17 DIMENSIONS OF DKE SOLENOID SAFETY VALVES [mm]



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

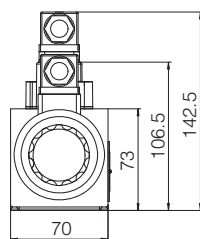
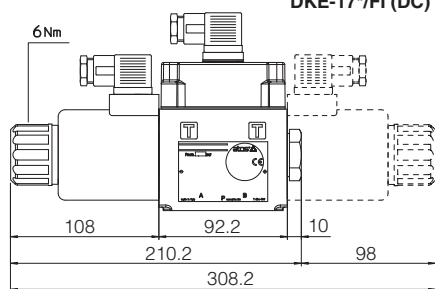
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
Y = DRAIN PORT

option /A

Single solenoid valves: solenoid mounted at side of port B.

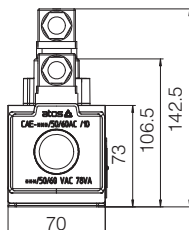
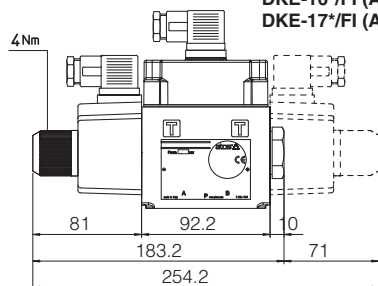
Double solenoid valves DKE/FV(DC):
 FV inductive position switch mounted at side of port A

DKE-16*/FI (DC)
DKE-17*/FI (DC) dotted line



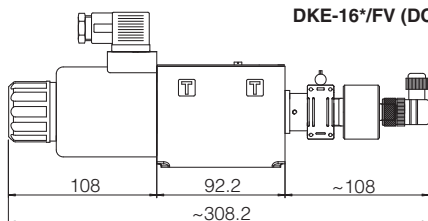
Mass:
 kg 4,4 (one solenoid)
 kg 5,8 (two solenoids)

DKE-16*/FI (AC)
DKE-17*/FI (AC) dotted line



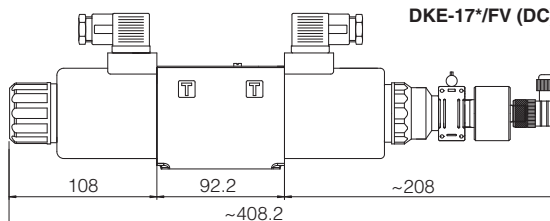
Mass:
 kg 3,7 (one solenoid)
 kg 4,4 (two solenoids)

DKE-16*/FV (DC)



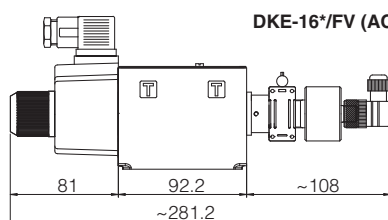
Mass: kg 4,4

DKE-17*/FV (DC)



Mass: kg 5,9

DKE-16*/FV (AC)



Mass: kg 3,8