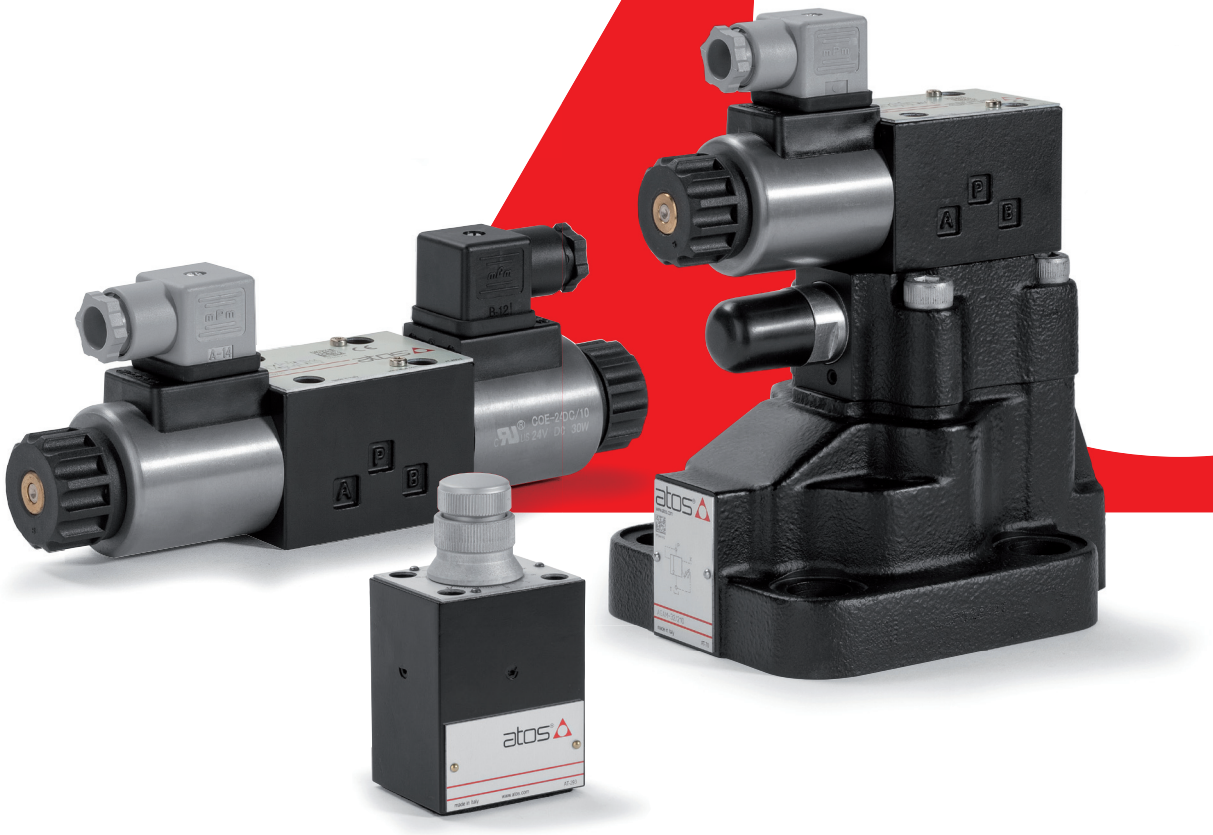
Гидрораспределители, клапаны ATOS

Технические характеристики



Алматы (7273)495-231
Ангарск (3955)60-70-56
Архангельск (8182)63-90-72
Астрахань (8512)99-46-04
Барнаул (3852)73-04-60
Белгород (4722)40-23-64
Благовещенск (4162)22-76-07
Брянск (4832)59-03-52
Владивосток (423)249-28-31
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Владимир (4922)49-43-18
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Киров (8332)68-02-04
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Омск (3812)21-46-40
Орел (4862)44-53-42
Оренбург (3532)37-68-04
Пенза (8412)22-31-16
Петрозаводск (8142)55-98-37
Псков (8112)59-10-37
Пермь (342)205-81-47
Ростов-на-Дону (863)308-18-15
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Сочи (862)225-72-31
Ставрополь (8652)20-65-13
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INDEX

ON-OFF VALVES

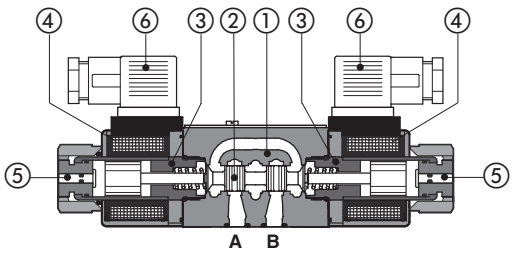
		Size	Qmax [l/min]	Table	Pag
CHECK VALVES					
DB, DR	direct, screw-in cartridge	G1/4" ÷ G1/2	95	C400	631
ADR	direct, in line	G1/4" ÷ G1 1/4"	500	C406	633
ADRL	piloted, in line	G3/8" ÷ G1 1/4"	300	C450	635
AGRL	piloted, subplate	10 ÷ 32	160 ÷ 500		
SAFETY VALVES					
directionals, machine directive 2006/42/EC					
DHI/FV, DHE/FV, DKE/FV DHI/FI, DHE/FI, DKE/FI	direct, spool type, subplate, AC or DC solenoids	06 ÷ 10	60 ÷ 150	EY010	639
HF/FV	direct, spool type, modular, AC or DC solenoids	06	60	EY050	649
JO-DL/FV	piloted, poppet type, leak free screw-in cartridge, DC solenoids	UNF 3/4" ÷ 1 5/16"	40 ÷ 300	EY105	653
DPHI/FV, DPHE/FV	piloted, spool type, subplate, AC or DC solenoids	10 ÷ 25	160 ÷ 700	EY030	657
LIFI, LIDA/FV, LIDAS/FV	piloted, poppet type, ISO cartridge, optional AC or DC solenoids	16 ÷ 50	120 ÷ 1800	EY120	667
pressure relief, PED 2014/68/UE					
CART M/PED CART ARE/PED	direct, screw-in cartridge	G1/2" ÷ M35	2,5 ÷ 150	CY010	675
ARE/PED	direct, in line	G3/8" ÷ G1/2"	60 ÷ 100	CY020	679
ARAM/PED	piloted, in line, optional AC or DC solenoids	G3/4" ÷ G1 1/4"	350 ÷ 500	CY045	683
AGAM/PED	piloted, subplate, optional AC or DC solenoids	10 ÷ 32	200 ÷ 600	CY066	689
MODULAR VALVES					
directionals					
HF	direct, spool type, modular, AC or DC solenoids	06	60	D050	695
pressure					
HMP, HM, KM	relief, direct or piloted, poppet type	06 ÷ 10	35 ÷ 120	D120	699
HS, KS	sequence, direct or piloted, spool type	06 ÷ 10	40 ÷ 80	D130	703
HG, KG, JPG	reducing, direct or piloted, spool type, 3 or 2 way	06 ÷ 25	50 ÷ 300	D140	705
HC, KC, JPC	compensator, direct or piloted, spool type, 2 way	06 ÷ 16	50 ÷ 200	D150	709
flow					
DHQ	direct, pressure compensated, by-pass solenoid valve	06	36	D170	711
HQ, KQ, JPQ	throttle, reverse free flow	06 ÷ 25	80 ÷ 300	D160	713
check					
HR, KR, JPR	direct or piloted	06 ÷ 25	60 ÷ 300	D180	717

NEXT

ISO CARTRIDGES		Size	Qmax [l/min]	Table	Pag
SC LI	2 way, slip-in	16 ÷ 100	270 ÷ 9000	H003	721
directionals					
LIDEW, LIDBH	functional covers, optional AC or DC solenoids	16 ÷ 100	270 ÷ 9000	H030	725
LIDAS, LIDASH	2 way, active piloting, optional AC or DC solenoids	16 ÷ 50	240 ÷ 2100	H050	731
pressure					
LIMM	relief, functional covers, optional AC or DC solenoids	16 ÷ 80	180 ÷ 4900		
LIRA	reducing, functional covers	16 ÷ 40	140 ÷ 750	H010	735
LIC	compensator, functional covers	16 ÷ 80	180 ÷ 4900		
flow					
LIDD	functional covers, throttle with stroke limiter	16 ÷ 63	270 ÷ 4000	H020	741
check					
LIDA	normally closed, functional covers	16 ÷ 100	270 ÷ 9000		
LIDO	normally open, functional covers	16 ÷ 50	160 ÷ 1800	H040	745
LIDB	normally closed, functional covers, shuttle valve	16 ÷ 63	270 ÷ 4000		
LIDR	normally closed, functional covers, check valve	16 ÷ 63	270 ÷ 4000		

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.

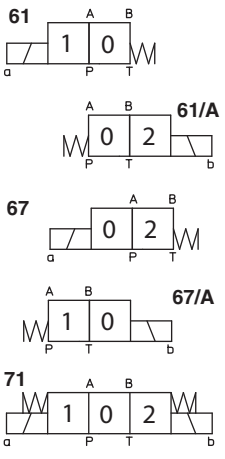
Mounting surface: **ISO 4401 size 06**
Max flow: **60 l/min**
Max pressure: **350 bar**

1 MODEL CODE

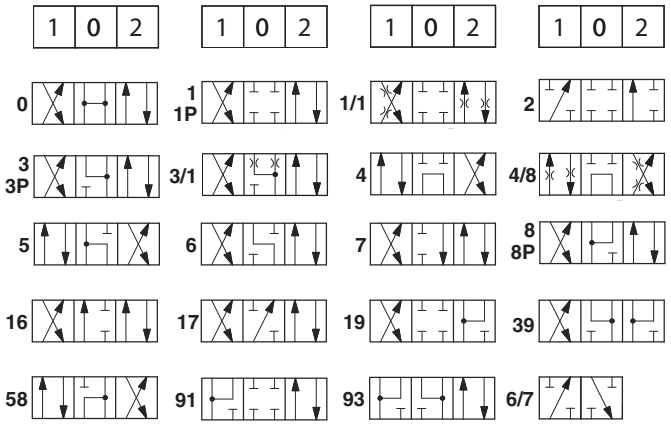
DHL - 0	61	1	/	A	-	X	24 DC	*	/	*
Solenoid directional valves size 06	Valve configuration, see section 2 **61** = single solenoid, center plus external position, spring centered **63** = single solenoid, 2 external positions, spring offset **67** = single solenoid, center plus external position, spring 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)

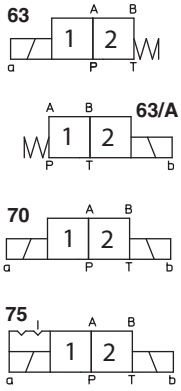
Configurations



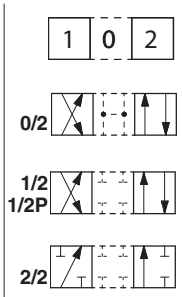
Spools



Configurations



Spools



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

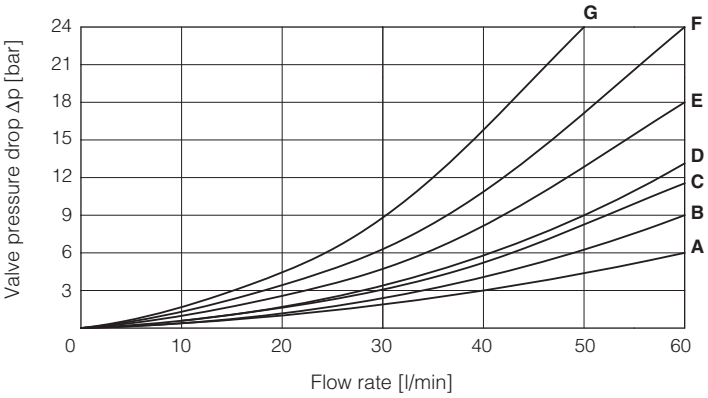
WP = prolonged manual override protected by rubber cap.

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	

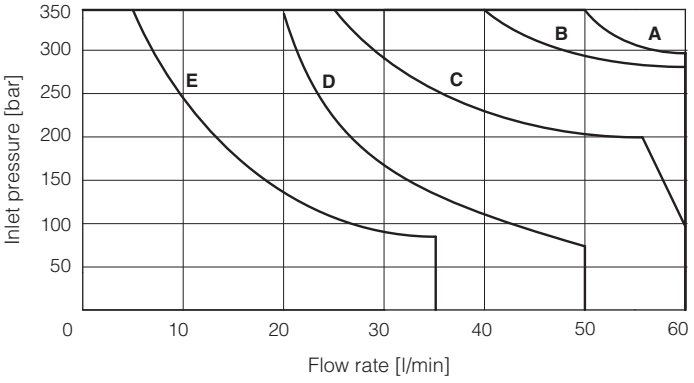


9 **OPERATING LIMITS** based on mineral oil ISO VG 46 at 50°C

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.

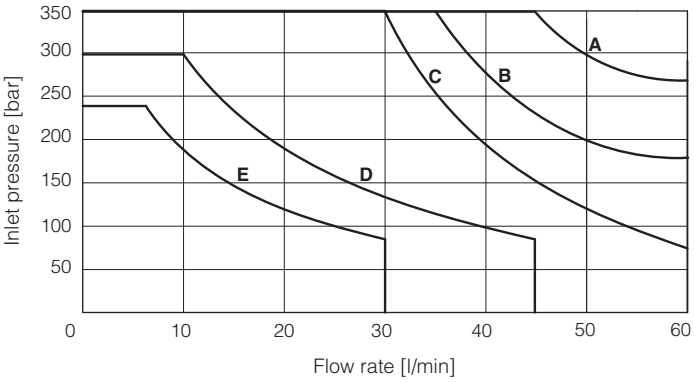
Curve	DC version, spool type:
A	0, 0/2, 1/2, 1/2P, 8, 8P
B	1, 1P, 1/1
C	3, 3P, 3/1, 6, 7
D	4, 4/8, 16, 17, 5, 19, 39, 58, 91, 93
E	2, 2/2, 6/7

DHL - DC



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

DHL - AC



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**

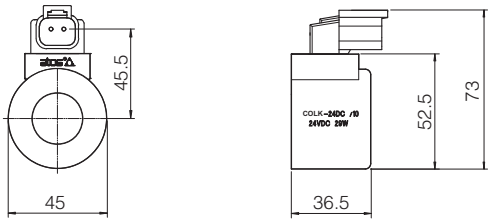
Valve	AC (cycles/h)	DC (cycles/h)
DHL + 666 / 667	7200	15000

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 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	

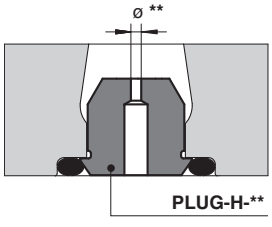
15 PLUG-IN RESTRICTOR (to be ordered separately)

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



PLUG-H-**

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)

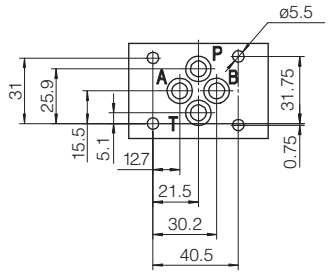
17 DIMENSIONS [mm]

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

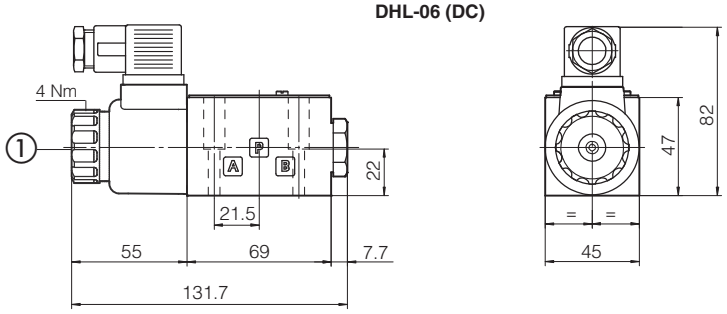
Mass (Kg)		
	DC	AC
DHL-06	1,3	1,2
DHL-07	1,6	1,4

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

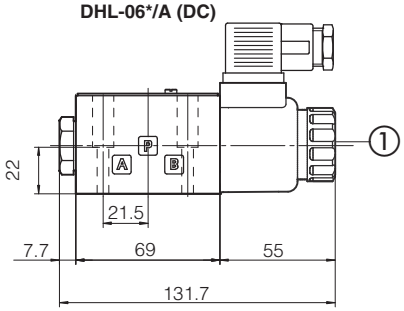
Valve's bottom view



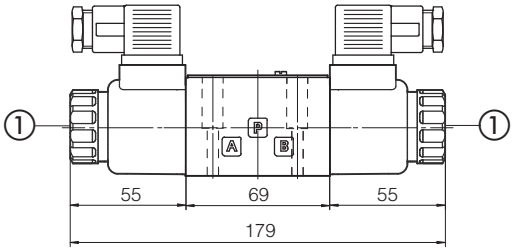
DHL-06 (DC)



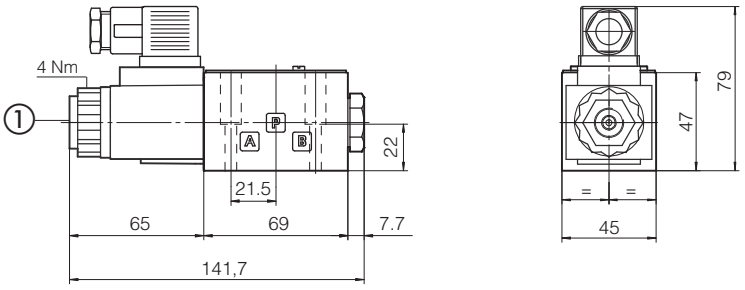
DHL-06*/A (DC)



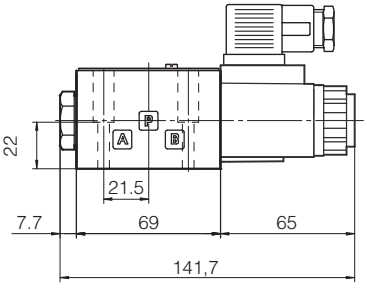
DHL-07 (DC)



DHL-06 (AC)



DHL-06*/A (AC)



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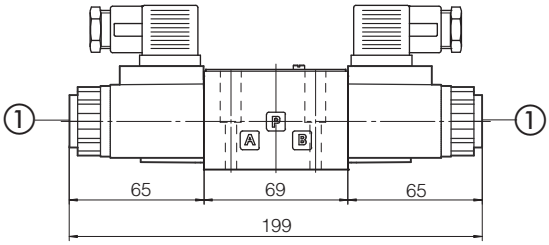
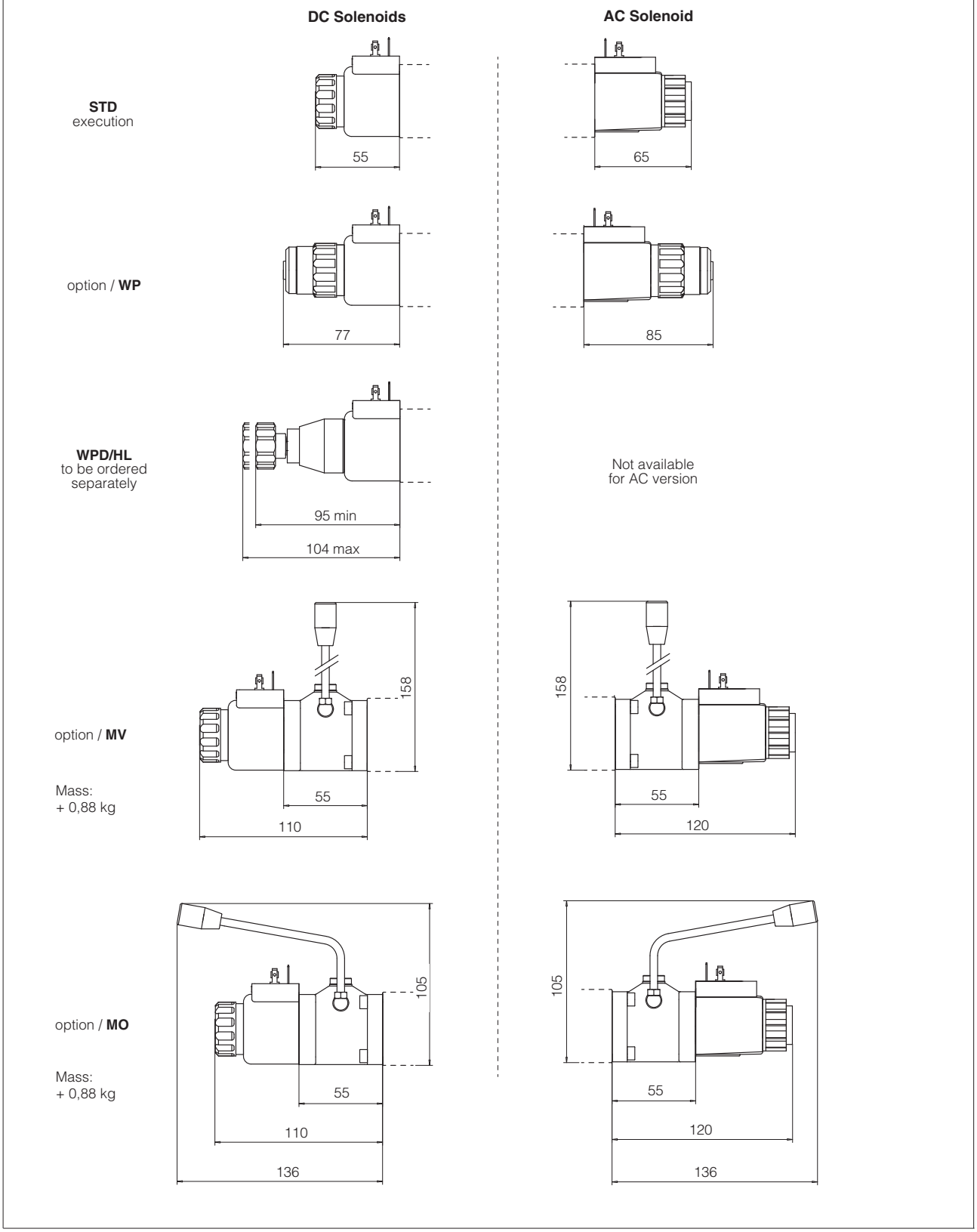


(1) Standard manual override PIN

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

18 MANUAL OVERRIDE

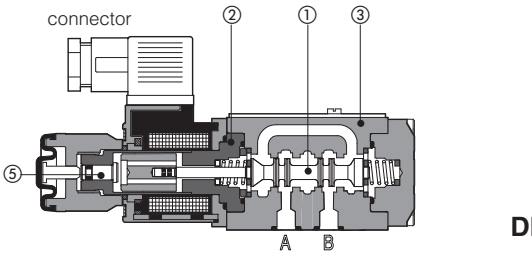


19 RELATED DOCUMENTATION

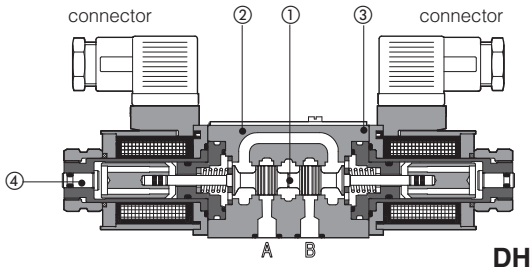
E001	Basics for solenoid directional valves
K150	Handwheels for hydraulic controls
K280	Single and modular subplates
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves
E900	Operating and maintenance information

Solenoid directional valves type DHI

direct, spool type



DHI-063*/WP



DHI-071*

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	*	/	*

DHI - 0: Directional control valves size 06

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
- **77** = double solenoid, center plus external position, without springs

1: Spool type, see section 2

A: Options, see note 1 at section 4

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

24 DC: Voltage code, see section 5
- **00** = valve without coils
- **X** = without connector

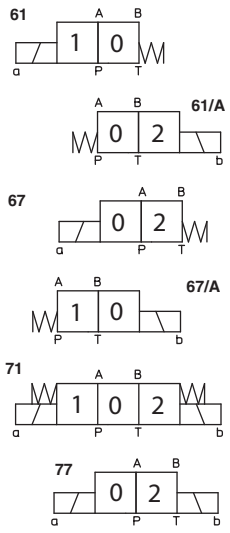
See section 13 for available connectors, to be ordered separately
Coils with special connectors, see section 10
- **XJ** = AMP Junior Timer connector
- **XK** = Deutsch connector
- **XS** = Lead Wire connection

*****: Series number

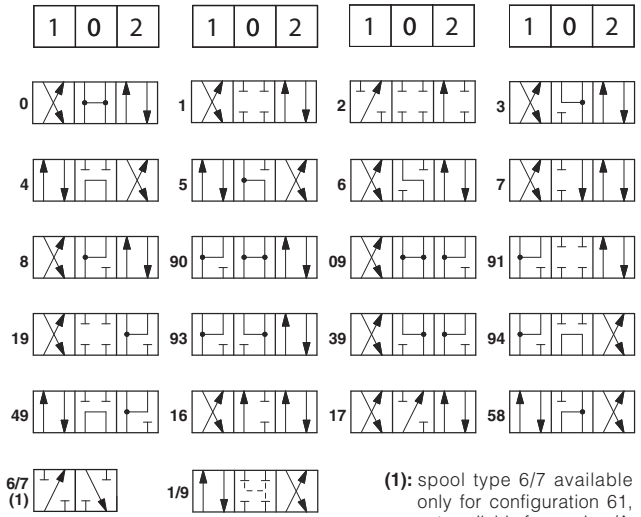
*****: Seals material, see section 3:
- **-** = NBR
- **PE** = FKM
- **BT** = HNBR

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

Configurations

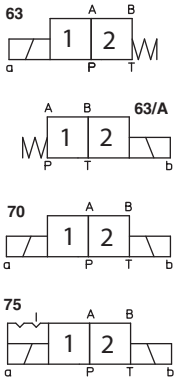


Spools

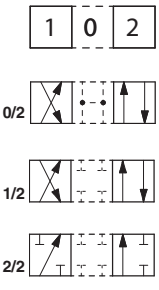


(1): spool type 6/7 available only for configuration 61, not available for version /A

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 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

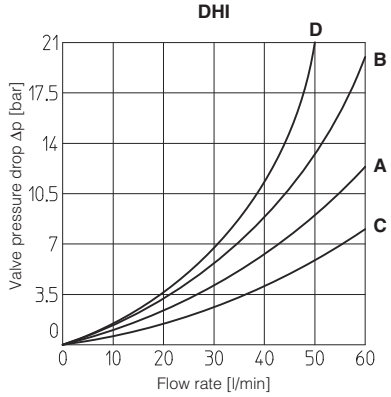
External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption (2)	Code of spare coil DHI	Colour of coil label
6 DC	**6 DC**	666 or 667	33 W	COU-6DC/ 80	brown
9 DC	**9 DC**			COU-9DC /80	light blue
12 DC	**12 DC**			COU-12DC /80	green
14 DC	**14 DC**			COU-14DC /80	brown
18 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	

DHI



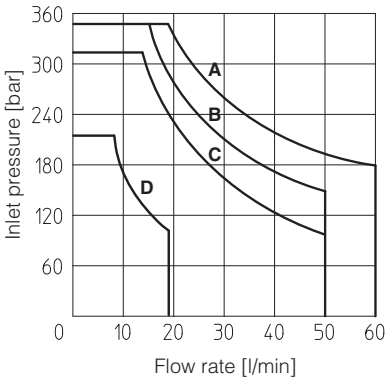
7 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

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

DHI



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.

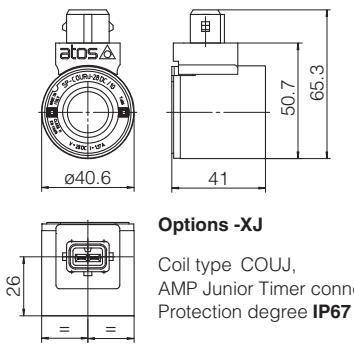
The elasticity of the hydraulic circuit and the variations of the hydraulic characteristics and temperature affect the response time.

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

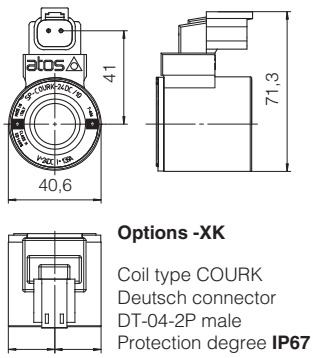
AMP Junior timer connector



Options -XJ

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

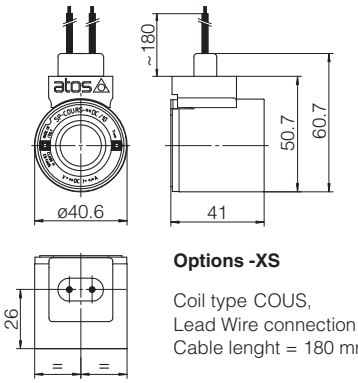
Deutsch connector DT-04-2P



Options -XK

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

Lead Wire connection



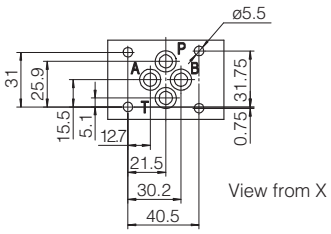
Options -XS

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]

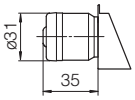
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Fastening bolts:
4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108
Ports P,A,B,T: Ø = 7.5 mm (max).



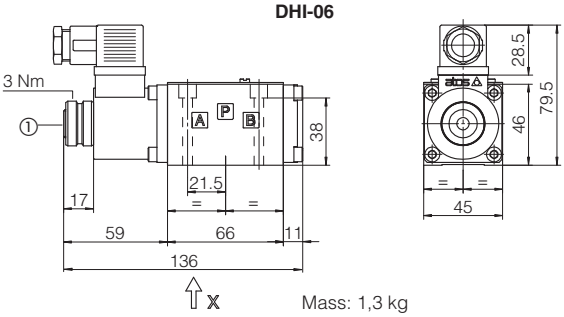
View from X

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

OPTION /WP

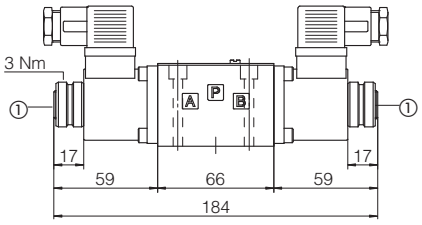


DHI-06



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

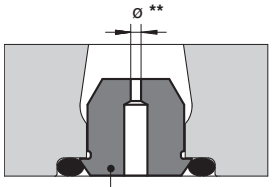
12 PLUG-IN RESTRICTOR (to be ordered separately)

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



PLUG-H-**

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

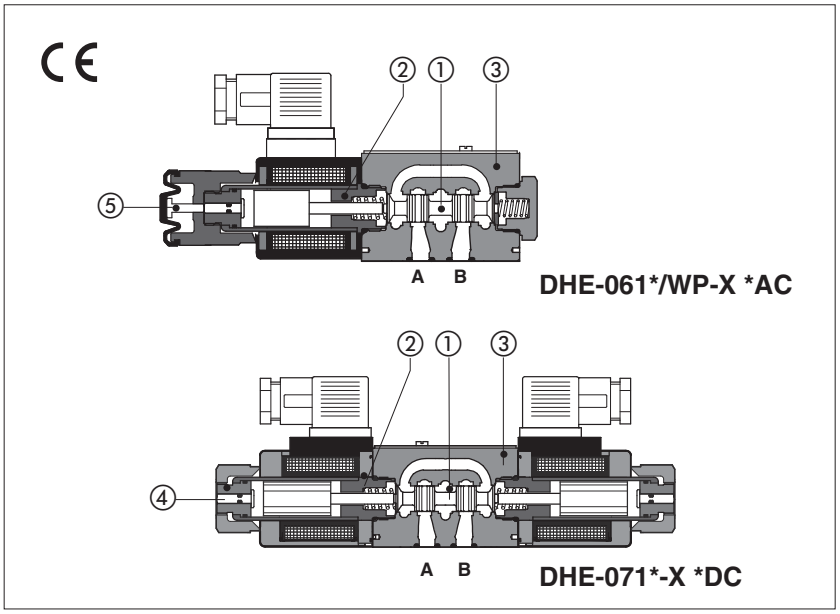
14 MOUNTING SUBPLATES

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	*	/	*

DHE - 0: Directional control valves size 06

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
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

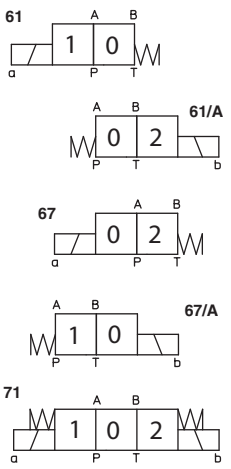
24 DC: Voltage code, see section 5

*****: Series number

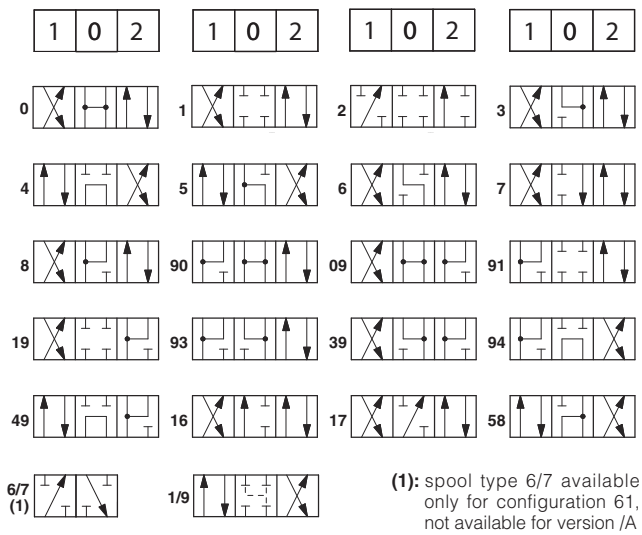
*****: Seals material, see section 3:
- = NBR
PE = FKM
BT = HNBR

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

Configurations

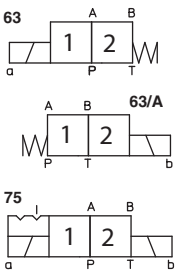


Spools

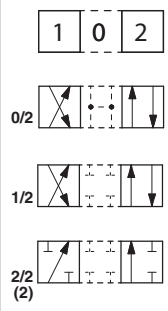


(1): spool type 6/7 available only for configuration 61, not available for version /A

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 mm^2/s - max allowed range 2.8 ÷ 500 mm^2/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at 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

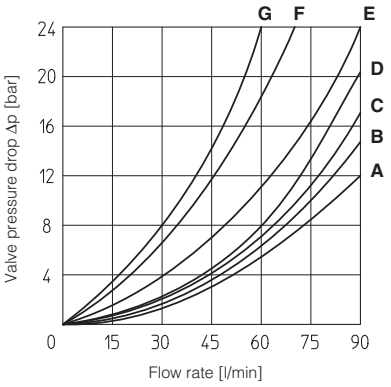
External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption (2)	Code of spare coil DHE
12 DC	**12 DC**	666 or 667	30 W	COE-12DC
14 DC	**14 DC**			COE-14DC
24 DC	**24 DC**			COE-24DC
28 DC	**28 DC**			COE-28DC
48 DC	**48 DC**			COE-48DC
110 DC	**110 DC**			COE-110DC
125 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

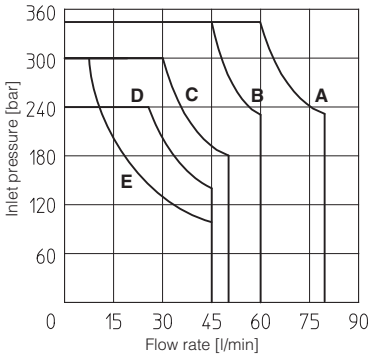


7 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

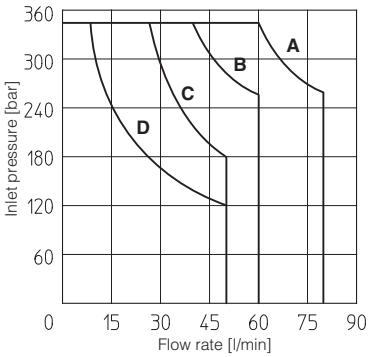
The diagrams have been obtained with warm solenoids and power supply at lowest value (V_{nom} - 10%). The curves refer to application with symmetrical flow through the valve (i.e. P→A and B→T). In case of asymmetric flow and if the valves have the devices for controlling the switching times the operating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

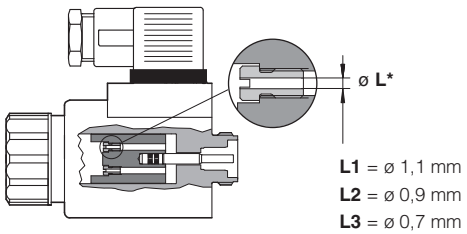
The elasticity of the hydraulic circuit and the variations of the hydraulic characteristics and temperature affect the response time.

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.



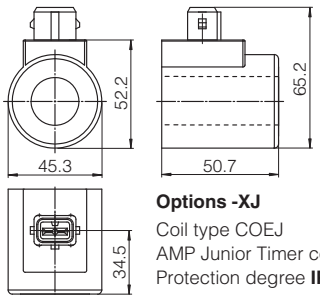
L1 = ø 1,1 mm
L2 = ø 0,9 mm
L3 = ø 0,7 mm

10 SWITCHING FREQUENCY

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

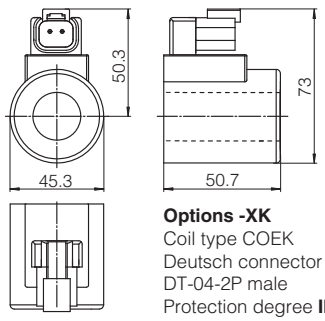
11 COIL WITH SPECIAL CONNECTORS only for voltage supply 12, 14, 24, 28 VDC

AMP Junior timer connector



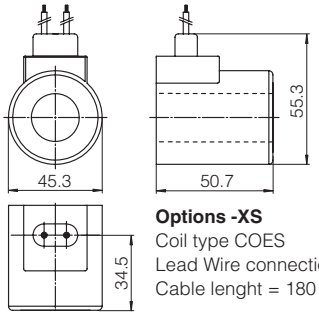
Options -XJ
Coil type COEJ
AMP Junior Timer connector
Protection degree **IP67**

Deutsch connector DT-04-2P



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

Lead Wire connection

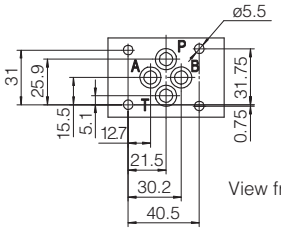


Options -XS
Coil type COES
Lead Wire connection
Cable lenght = 180 mm

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

12 DIMENSIONS [mm]

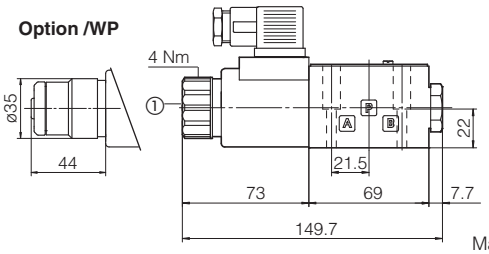
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Fastening bolts: 4 socket head screws:
M5x30 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108
Ports P,A,B,T: Ø = 7.5 mm (max)



View from X

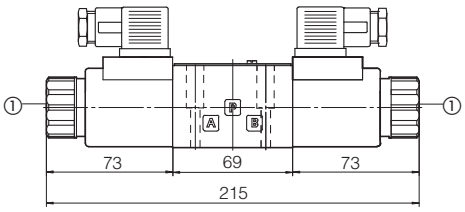
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT

DHE-06(DC)



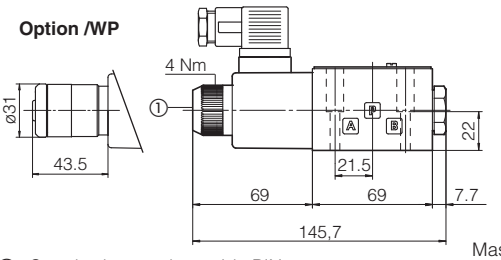
Mass: 1,5 kg

DHE-07(DC)



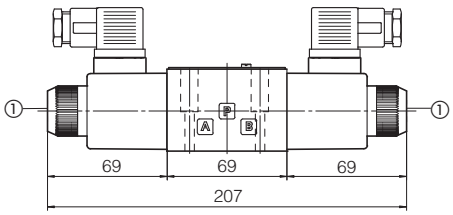
Mass: 2 kg

DHE-06(AC)



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

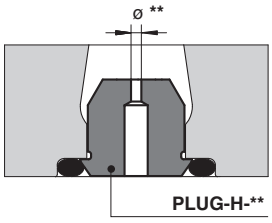
13 PLUG-IN RESTRICTOR (to be ordered separately)

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

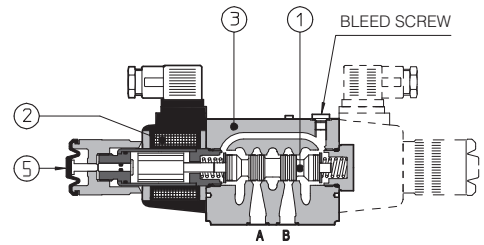
15 MOUNTING SUBPLATES

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

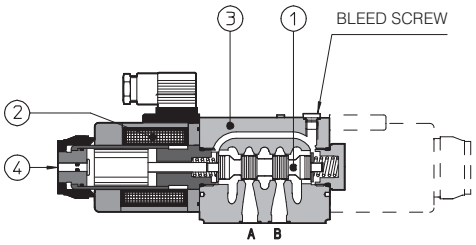
The subplates are supplied with 4 fastening bolts M5x50. Also available are multi-station subplates and modular subplates. For further details see table K280.

Solenoid directional valves type DKE

direct, spool type



DKE-161*/WP-X *AC (3 CHAMBERS BODY)



DKE-17*-X *DC (5 CHAMBERS BODY)

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

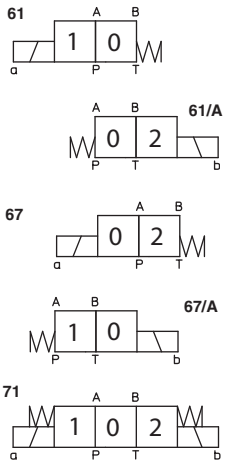
24 DC
Voltage code, see section 5

*****
Series number

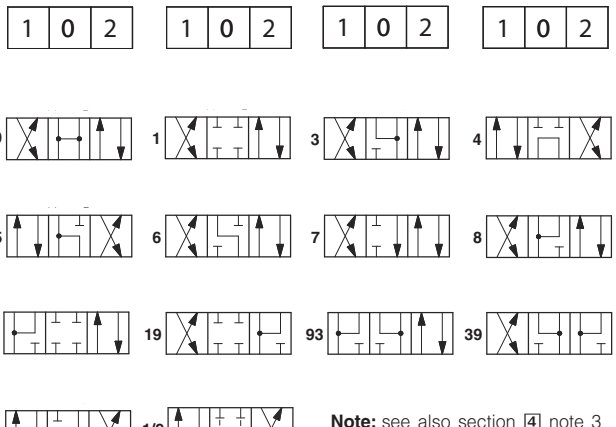
*****
Seals material, see section 4:
- = NBR
PE = FKM
BT = HNBR

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

Configurations

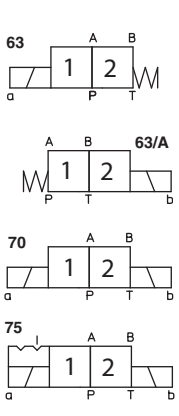


Spools

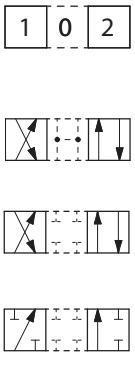


Note: see also section 4 note 3 for special shaped spools

Configurations



Spools



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 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

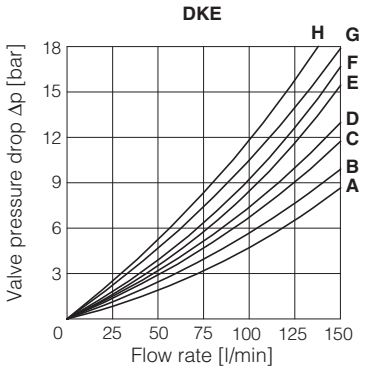
(1) In case of 60 Hz voltage frequency the performances are reduced by 10÷15% and the power consumption is 90 VA

(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.

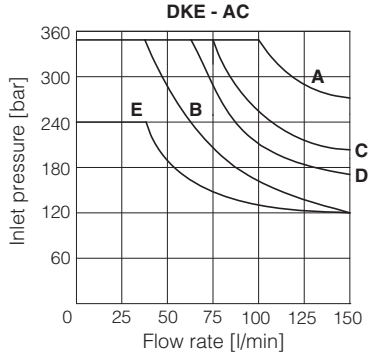
6 Q/ΔP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

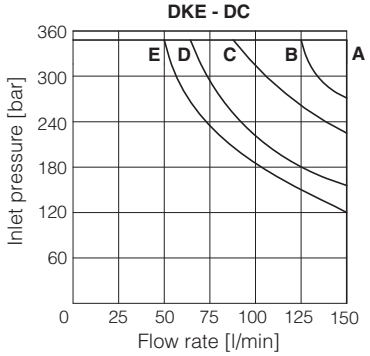
Flow direction / Spool type	P→A	P→B	A→T	B→T	P→T	B→A
0, 0/1, 0/2, 2/2	A	A	B	B		
1, 1/1, 6, 8	A	A	D	C		
3, 3/1, 7	A	A	C	D		
4	B	B	B	B	F	
5, 58	A	B	C	C	G	
1/2	B	C	C	B		
19, 91	F	F	G	G		H
1/9, 39, 93	F	F	G	G		H

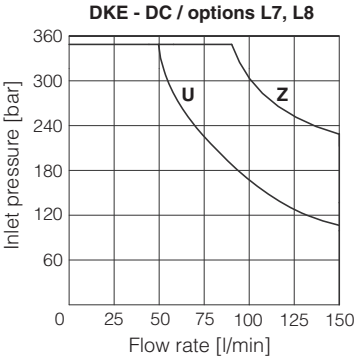


7 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

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

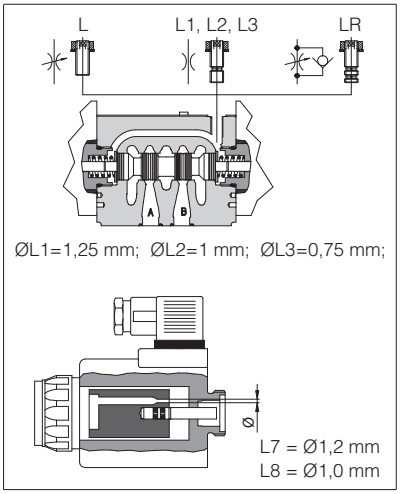
Valve	AC (cycles/h)	DC (cycles/h)
DKE + 666 / 667	7200	15000

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.

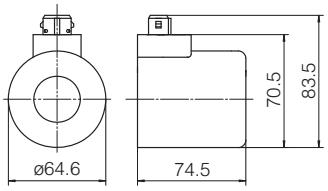
- **L**: controls and regulates the switching time in both moving directions of the spool: regulation is carried out by screwing/unscrewing the element itself (regulating choke);
- **L1/L2/L3**: controls the switching time in both moving directions of the spool by means of fixed calibrated restrictor (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.

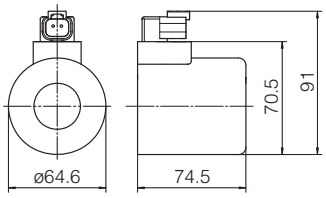


11 COILS TYPE CAE WITH SPECIAL CONNECTORS (only for 12DC, 14DC, 24DC and 28DC)

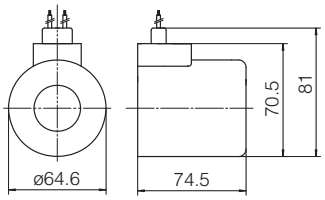
Options -XJ
Coil type CAEJ
AMP Junior Timer connector
Protection degree IP67



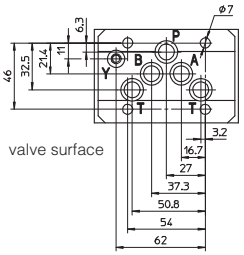
Options -XK
Coil type CAEK
Deutsch connector, DT-04-2P male
Protection degree IP67



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



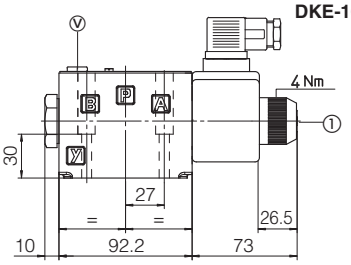
12 INSTALLATION DIMENSIONS [mm]

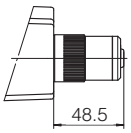


ISO 4401: 2005
Mounting surface according to 4401-05-05-0-05
(without X port, Y port optional)
Fastening bolts:
4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Seals: 5 OR 2050 and 1 OR 108
Ports P,A,B,T: Ø = 11.5 mm (max)
Ports Y: Ø = 5 mm

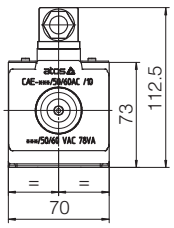
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
Y = DRAIN PORT (only for option /Y)
For the max pressures on ports, see section 3

DKE-16*-AC



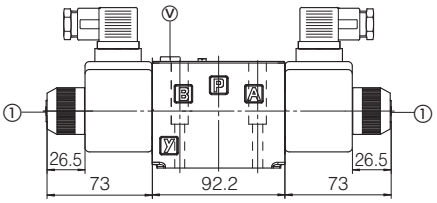


Option /WP



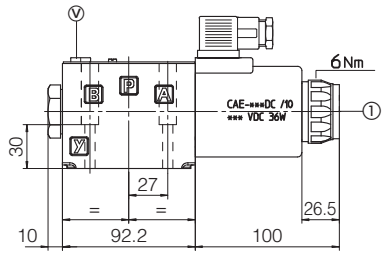
Mass: 3,9 kg

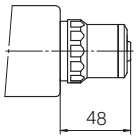
DKE-17*-AC



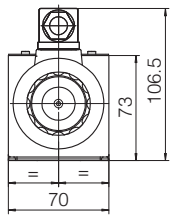
Mass: 4,7 kg

DKE-16*-DC



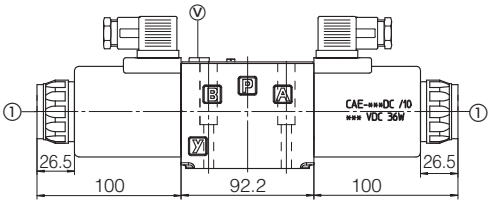


Option /WP



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)

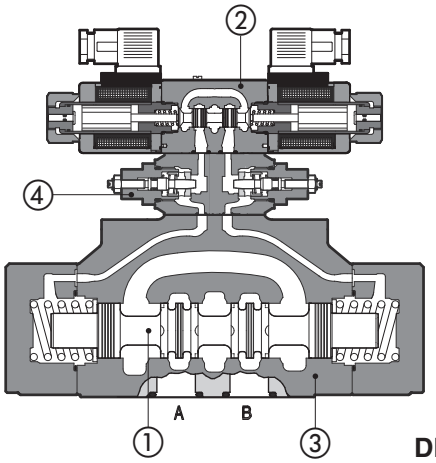
14 MOUNTING SUBPLATES

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.

Solenoid directional valves type DPHI and DPHE

piloted, spool type



DPHE-471*/H

Spool type, two stage directional valves with solenoids certified according to North American standard **cURus**, available in two different executions:

- DPHI for AC and DC supply, solenoid pilot ② type DHI, see tech. table E010
- DPHE high performances, for AC and DC supply, solenoid pilot ② type DHE see tech. table E015

Single and double solenoids versions are available in two or three position configurations and with a wide range of interchangeable spools ①, see section 2.
Standard coils protection **IP65**.
The valve body is made by shell-moulding casting ③ with wide internal passages.
The valves can be supplied with optional devices, see section 4 for available options.

Mounting surface: **ISO 4401, size 10, 16, 25 and 32**
Max flow: **160, 300, 700, 1000 l/min.**
Max pressure: **350 bar**

1 MODEL CODE

DPH	E	-	2	61	1	/	A	-	X	24 DC	*	/	*

DPH — Two stage directional control valve

E — Solenoid pilot valve:
I = DHI for AC and DC supply with **cURus** certified solenoids
E = DHE for AC and DC supply, high performances with **cURus** certified solenoids

2 — Valve size:
1 = 10 **2** = 16 **4** = 25 **6** = 32

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 — **X** = without connector
See section 14 for available connectors, to be ordered separately
00 = solenoid valve without coils (for DPHI)
00-AC = AC solenoid valve without coils (for DPHE)
00-DC = DC solenoid valve without coils (for DPHE)

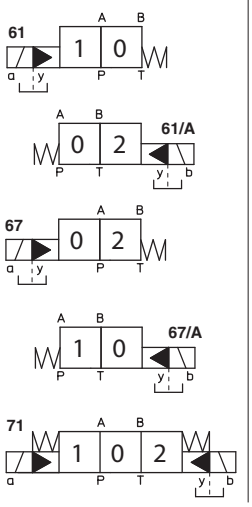
24 DC — Voltage code, see section 5

***** — Series number

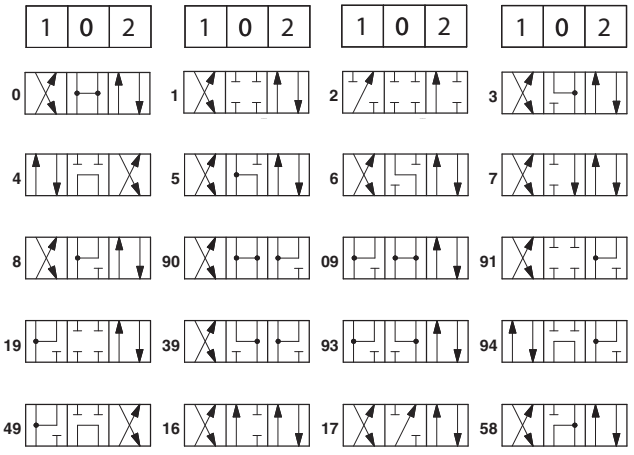
***** — Seals material, see section 3:
- = NBR
PE = FKM
BT = HNBR

2 CONFIGURATIONS and SPOOLS (representation according to ISO 1219-1, for functional scheme, see section 4)

Configurations

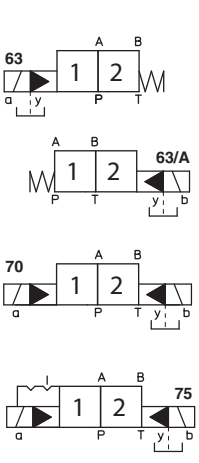


Spools

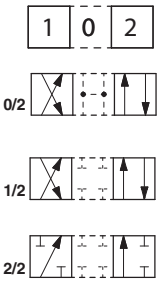


NOTES (see also section 4,2 for special shaped spools):
- For **DP*-1** are available only spools: **0, 0/2, 1, 1/2, 3, 4, 5, 58, 6, 7**
- For **DP*-6** are available only spools: **0, 1, 1/2, 2, 3, 4, 5, 58, 6, 7, 8, 19, 91**

Configurations



Spools



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

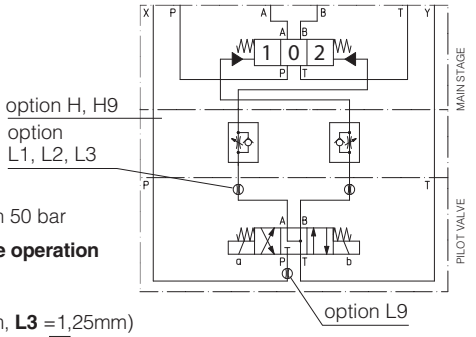
Assembly position / location	Any position for all valves except for type -*70 (without springs) that must be installed with horizontal axis if operated by impulses.		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	75 years, 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		
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 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	P, A, B, X = **350 bar** (for pilot pressure see also option /L9 at section 4) T = **250 bar** for external drain (standard) T and Y with internal drain (option /D) = **120 bar** DPHI; **210 bar** DPHE (DC); **160 bar** DPHE (AC) Ports Y and L (if required): 0 bar Minimum pilot pressure for correct operation is 8 bar		
Rated flow	See diagrams Q/Δp at section 6		
Maximum flow	DPH*-1: **160 l/min;** DPH*-2: **300 l/min;** DPH*-4: **700 l/min;** DPH*-6: **1000 l/min** (see rated flow at section 6 and operating limits at section 7)		

3.1 Coils characteristics

Insulation class	**H** (180°C) for DC coils (all versions) and AC coils (only DPHI) **F** (155°C) for AC coils (only DPHE) 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 or E-SD 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

FUNCTIONAL SCHEME (config. 71)
example of switching control options



4.1 Options

/A = Solenoid mounted at side of port A of main body (only for single solenoid valves).
In standard version, solenoid is mounted at side of port B.
/D = Internal drain (standard configuration is external drain)
/E = External pilot pressure (standard configuration is internal pilot pressure).
/FV = With proximity switch for spool position monitoring: see tab. E110.
/R = Pilot pressure generator (4 bar on port P - not for DPH*-1, see section 9.
/S = Main spool stroke adjustment (not for DPH*-1).
/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

Devices for main spool switching control and to reduce the hydraulic shocks at the valve operation
/H = Adjustable chokes (meter-out to the pilot chambers of the main valve).
/H9 = Adjustable chokes (meter-in to the pilot chambers of the main valve).
/L1, /L2, /L3 = calibrated restrictors on A and B ports of the pilot valve: **L1** =0,8mm, **L2** =1mm, **L3** =1,25mm)
/L9 = (only for DP-2 and DP-4) plug with calibrated restictor in P port of pilot valve - see section 10
Suggested for pilot pressure higher than 210 bar or to limit the hydraulics shocks caused by the fast main spool switching

4.2 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, 58, 6** and **7** are also available as **1/1, 4/8, 5/1, 58/1, 6/1** and **7/1** that are properly shaped to reduce water-hammer shocks during the switching (to use with option /L*).

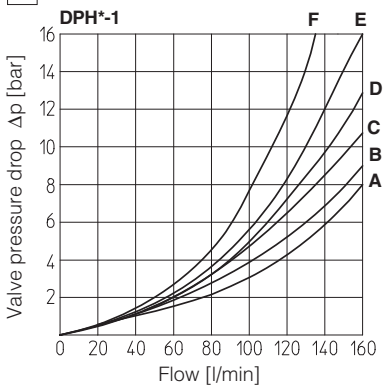
Shaped spool availability	0/1	3/1	1/1	4/8	5/1	58/1	6/1	7/1
DPH*-1	•	•		•				
DPH*-2, DPH*-4	•	•	•	•	•	•	•	•
DPH*-6		•	•	•				

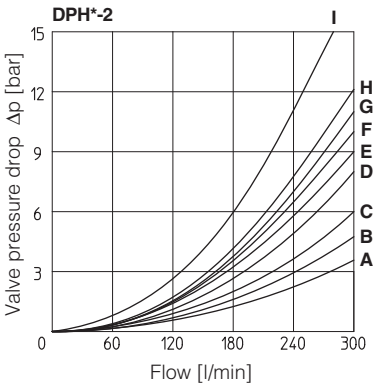
5 ELECTRIC FEATURES

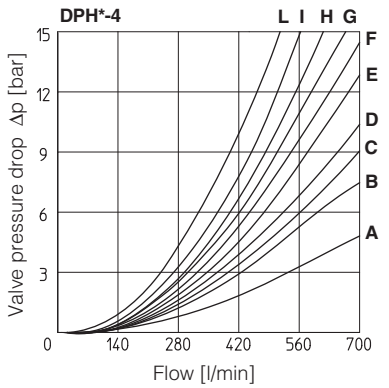
Valve	External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption **(3)** DHI	Power consumption **(3)** DHE	Code of spare coil DPHI	Colour of coil label DPHI	Code of spare coil DPHE
DPHI DPHE	6 DC	**6 DC** (4)	666 or 667	33 W	30 W	COU-6DC	brown	-
	12 DC	**12 DC**				COU-12DC	green	COE-12DC
	14 DC	**14 DC**				COU-14DC	brown	COE-14DC
	24 DC	**24 DC**				COU-24DC	red	COE-24DC
	28 DC	**28 DC**				COU-28DC	silver	COE-28DC
	48 DC	**48 DC**				COU-48DC	silver	COE-48DC
	110 DC	**110 DC**				COU-110DC	gold	COE-110DC
	125 DC	**125 DC**				COU-125DC	blue	COE-125DC
	220 DC	**220 DC**				COU-220DC	black	COE-220DC
	24/50 AC	**24/50/60 AC** (4)		60 VA	-	COI-24/50/60AC (1)	pink	-
	24/60 AC							
	48/50 AC	**48/50/60 AC** (4)				COI-48/50/60AC (1)	white	-
	48/60 AC							
	110/50 AC	**110/50/60 AC**			58 VA	COI-110/50/60AC (1)	yellow	COE-110/50/60AC
	115/60 AC (5)	**115/60 AC**		-	80 VA	-		COE-115/60AC
	120/60 AC (4)	**120/60 AC**		60 VA	-	COI-120/60AC	white	-
	230/50 AC	**230/50/60 AC**			58 VA	COI-230/50/60AC (1)	light blue	COE-230/50/60AC
	230/60 AC	**230/60 AC**			80 VA	COI-230/60AC	silver	COE-230/60AC
	110/50 AC 120/60 AC	**110RC**	669	33 W	30 W	COU-110RC	gold	COE-110RC
	230/50 AC 230/60 AC	**230RC**				COU-230RC	blue	COE-230RC

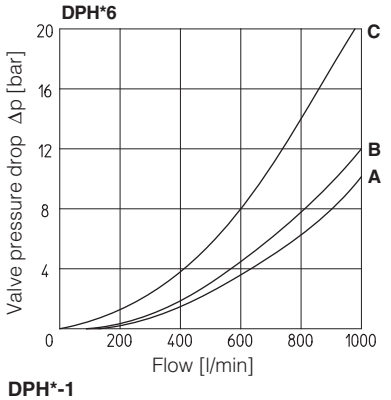
(1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10÷15% and the power consumption is 55 VA (DPHI) and 58 VA (DPHE)
(2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(3) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.
(4) Only for DPHI
(5) Only for DPHE

6 FLOW VERSUS PRESSURE DIAGRAMS Based on mineral oil ISO VG 46 at 50°C









DPH*-1

Spool type \ Flow direction	P→A	P→B	A→T	B→T	P→T
0/2, 1/2	D	E	D	C	-
0	D	E	C	C	E
1	A	B	D	C	-
3, 6, 7	A	B	C	C	-
4, 4/8	B	C	D	D	-
5, 58	A	E	C	C	F

DPH*-6

Spool type \ Flow direction	P→A	P→B	A→T	B→T	P→T
0	A	A	B	B	B
1	A	A	A	B	-
3	A	-	A	B	-
4	A	A	C	C	C

DPH*-2

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

DPH*-4

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

7 OPERATING LIMITS

For a correct valve operation do not exceed the max recommended flow rates (l/min) shown in the below tables

DPH*-1

Spool	Inlet pressure [bar]			
	70	160	210	350
	Flow rate [l/min]			
0, 1, 3, 6, 7	160	160	160	145
4, 4/8	160	160	135	100
5, 58	160	160	145	110
0/1, 0/2, 1/2	160	160	145	135

DPH*-2

Spool	Inlet pressure [bar]			
	70	140	210	350
	Flow rate [l/min]			
0, 1, 3, 6, 7, 8	300	300	300	300
2, 4, 4/8	300	300	240	140
5	260	220	180	100
0/1, 0/2, 1/2	300	250	210	180
16, 17, 56, *9, 9*	300	300	270	200

DPH*-4

Spool	Inlet pressure [bar]			
	70	140	210	350
	Flow rate [l/min]			
1, 6, 7, 8	700	700	700	600
2, 4, 4/8	500	500	450	400
5, 0/1, 0/2, 1/2	600	520	400	300
0, 3	700	700	600	540
16, 17, 58, *9, 9*	500	500	500	450

DPH*6

Spool	Inlet pressure [bar]			
	70	140	210	350
	Flow rate [l/min]			
1, 3, 6, 7, 8	1000	950	850	700
0	950	900	800	650
2, 4, 4/8, 5	850	800	700	450
0/1, 58, 19, 91	950	850	650	450

8 SWITCHING TIMES (average values in m sec)

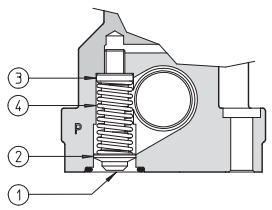
Valve model	Configuration		Piloting pressure 70 bar		140 bar		250 bar	
			Alternating current	Direct current	Alternating current	Direct current	Alternating current	Direct current
DPH*-1	71, 61, 67, 61*/A, 67*/A	Switch ON	35	50	30	45	20	35
		Switch OFF	50					
	63, 63*/A	Switch ON	50	75	40	65	30	50
		Switch OFF	80					
DPH*-2	71, 61, 67, 61*/A, 67*/A	Switch ON	40	55	30	50	20	40
		Switch OFF	60					
	63, 63*/A	Switch ON	55	80	45	70	35	55
		Switch OFF	95					
DPH*-4	71, 61, 67, 61*/A, 67*/A	Switch ON	60	80	45	60	30	45
		Switch OFF	80					
	63, 63*/A	Switch ON	95	115	75	95	50	65
		Switch OFF	130					
DPH*-6	71, 61, 67, 61*/A, 67*/A	Switch ON	70	95	55	70	40	55
		Switch OFF	150					
	63, 63*/A	Switch ON	115	145	95	110	70	90
		Switch OFF	280					

Notes:
1) For configuration 75, times of switching ON and switching OFF are the same: this value is equal to time of switch ON of configuration 63.
2) TEST CONDITIONS
- Nominal voltage supply DC (direct) and AC (alternating) with connector type SP-666. The use of other connectors can affect the switching time;
- 2 bar of counter pressure on port T;
- mineral oil: ISO VG 46 at 50°C

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

9 PILOT PRESSURE GENERATOR (OPTION /R)

The device **/R** generates an additional pressure drop, in order to ensure the minimum pilot pressure, for correct operation of the valves with internal pilot and fitted with spools type **0, 0/1, 4, 4/8, 5, 58, 09, 90, 94, 49.** The device **/R** has to be fitted when the pressure drop in the valve, verified on flow versus pressure diagrams, is lower than the minimum pilot pressure value.

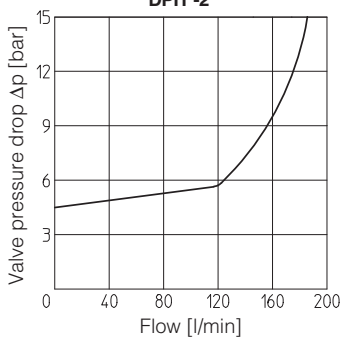


① Flapper-guide
② Flapper
③ Spring stop-washer
④ Spring

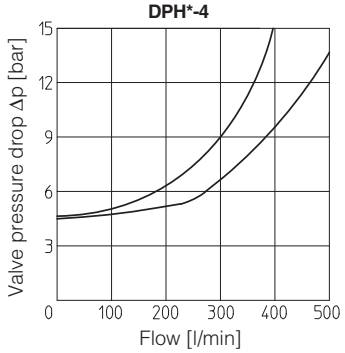
Ordering code of spare pilot pressure generator

R/DP	-	*
Pilot pressure generator		Size: **2** for DP-2 **4** for DP-4 **6** for DP-6

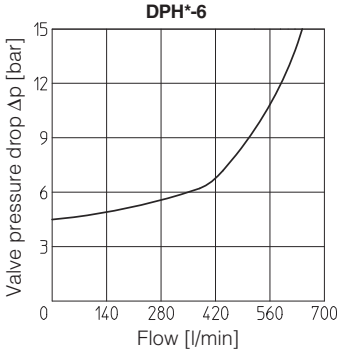
DPH*-2



DPH*-4



DPH*-6

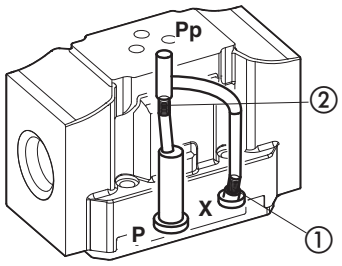


10 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

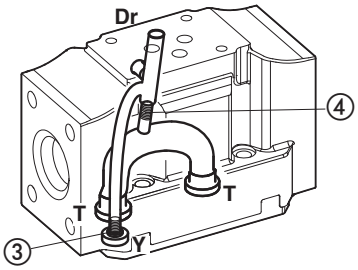
Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain

DPH*-1

Pilot channels



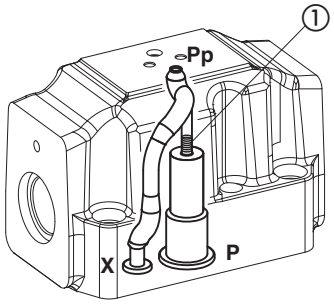
Drain channels



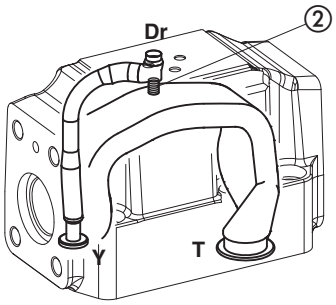
Internal piloting: blinded plug SP-X300F ① in X;
plug SP-X310F ② in Pp;
External piloting: blinded plug SP-X300F ② in Pp;
plug SP-X310F ① in X;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPH*-2

Pilot channels

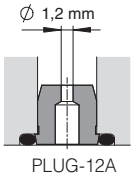


Drain channels



Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

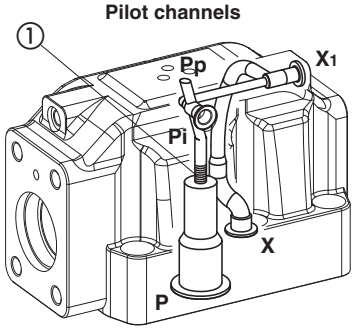
Option L9
This option provides a calibrated restrictor PLUG-H-12A (Ø 1,2 mm) in the P port of the pilot valve



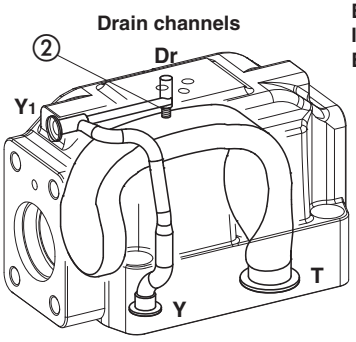
PLUG-12A

DPH*-4

Pilot channels

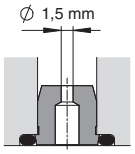


Drain channels



Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

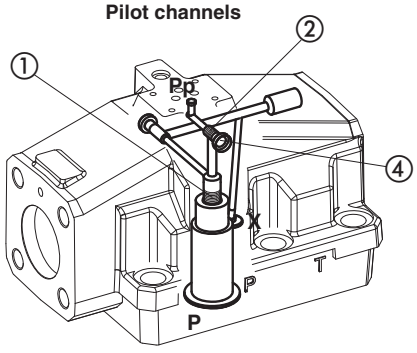
Option L9
This option provides a a calibrated restrictor PLUG-H-15A (Ø 1,5 mm) in the P port of the pilot valve



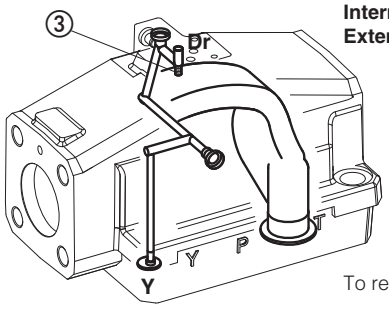
PLUG-15A

DPH*-6

Pilot channels



Drain channels



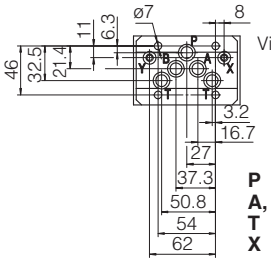
Internal piloting: Without plug ①;
plug SP-X325A in pos ②;
External piloting: Add DIN-908 M16x1,5 in pos ①;
plug SP-X325A in pos ②;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

To reach the orifice ②, remove plug ④ = G 1/8”

11 DIMENSIONS FOR DPH*-1 AND DPH*-2 [mm]

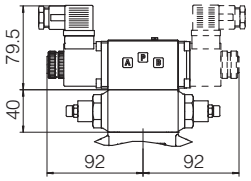
DPH*-1*

ISO 4401: 2005
Mounting surface: 4401-05-05-0-05
Fastening bolts:
4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Diameter of ports A,B, P, T: Ø = 11 mm;
Diameter of ports X, Y: Ø = 5 mm;
Seals: 5 OR 2050, 2 OR 108

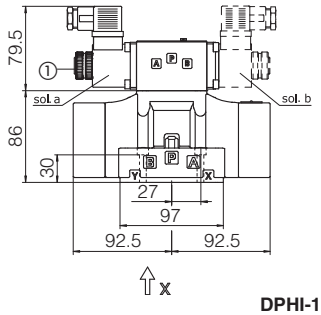


P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL OIL PILOT PORT
Y = DRAIN PORT

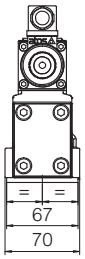
DPHI-1*/H /H9

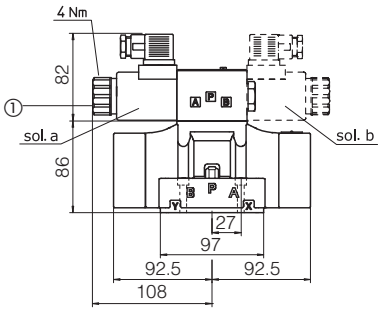


Mass (Kg)	
DPHI-16	6,8
DPHI-17	7,1
DPHE-16	6,9
DPHE-17	7,3
Option H, H9	+1,0



DPHI-1*



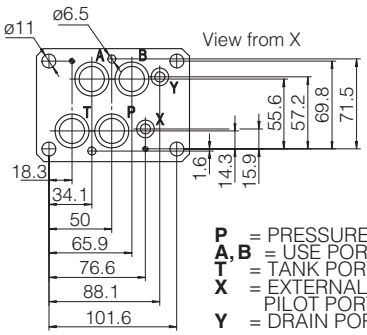


DPHE-1*

① Standard manual override PIN

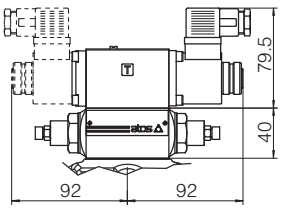
DPH*-2*

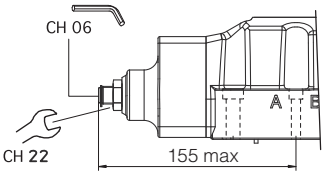
ISO 4401: 2005
Mounting surface: 4401-07-07-0-05
Fastening bolts:
4 socket head screws M10x50 class 12.9
Tightening torque = 70 Nm
2 socket head screws M6x45 class 12.9
Tightening torque = 15 Nm
Diameter of ports A, B, P, T: Ø = 20 mm;
Diameter of ports X, Y: Ø = 7 mm;
Seals: 4 OR 130, 2 OR 2043



P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL OIL PILOT PORT
Y = DRAIN PORT

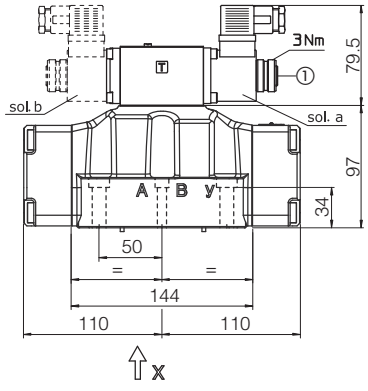
DPHI-2*/H /H9



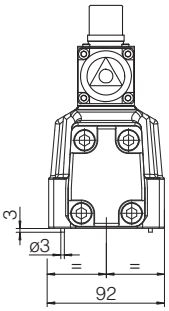


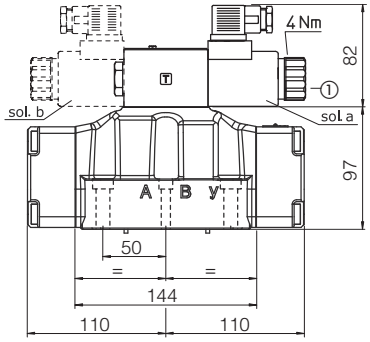
Stroke adjustment device for option /S

Mass (Kg)	
DPHI-26	9,8
DPHI-27	10,1
DPHE-26	9,9
DPHE-27	10,3
Option /S	+1,0
Option H, H9	+1,0



DPHI-2*





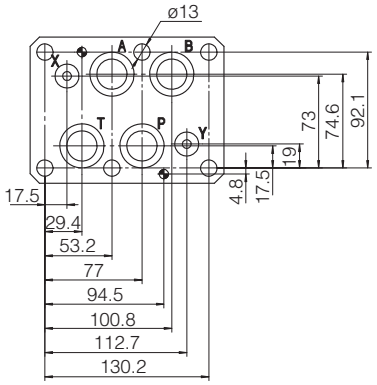
DPHE-2*

① Standard manual override PIN

Overall dimensions refer to valves with connectors type 666

DPH*-4*

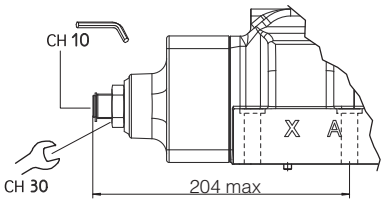
ISO 4401: 2005
Mounting surface: 4401-08-08-0-05 (see table P005)
Fastening bolts:
6 socket head screws M12x60 class 12.9
Tightening torque = 125 Nm
Seals: 4 OR 4112; 2 OR 3056
Diameter of ports A, B, P, T: Ø = 24 mm;
Diameter of ports X, Y: Ø = 7 mm;



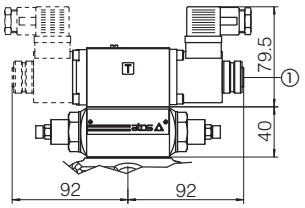
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL OIL PILOT PORT
Y = DRAIN PORT
For the max pressures on ports, see section

Mass (Kg)	
DPHI-46	17,3
DPHI-47	17,6
DPHE-46	17,4
DPHE-47	17,8
Option /S	+1,5
Option H, H9	+1,0

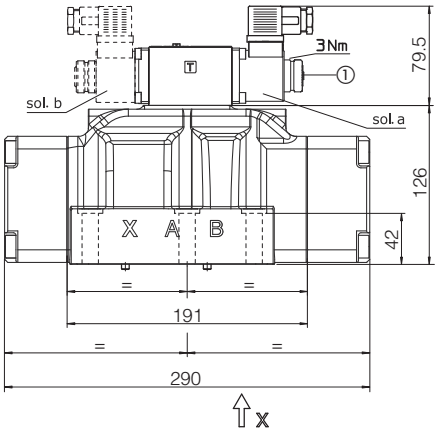
DPHI-4*
Stroke adjustment device for option /S

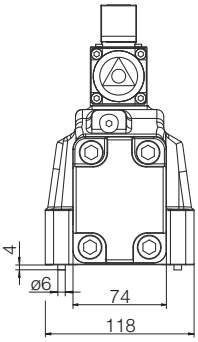


DPHI-4*/H /H9

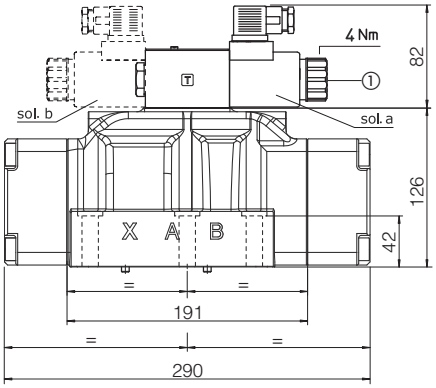


DPHI-4*





DPHE-4*



① Standard manual override PIN

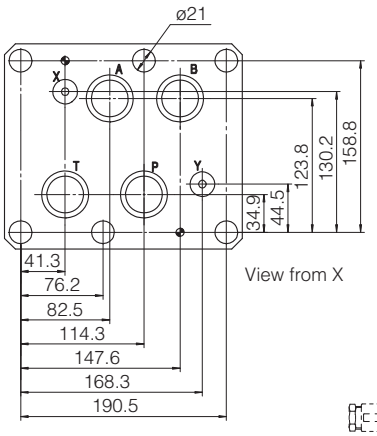
Overall dimensions refer to valves with connectors type 666

13 DIMENSIONS FOR DPH*-6 [mm]

DPH*-6*

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05

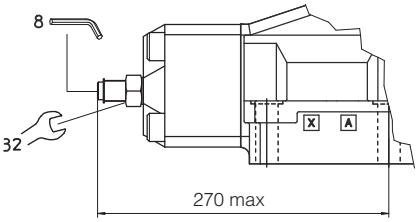
Fastening bolts:
6 socket head screws M20x80 class 12.9
Tightening torque = 600 Nm
Diameter of ports A, B, P, T: Ø = 34 mm;
Diameter of ports X, Y: Ø = 7 mm;
Seals: 4 OR 144, 2 OR 3056



View from X

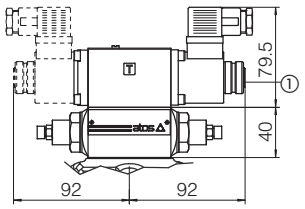
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL OIL PILOT PORT
Y = DRAIN PORT

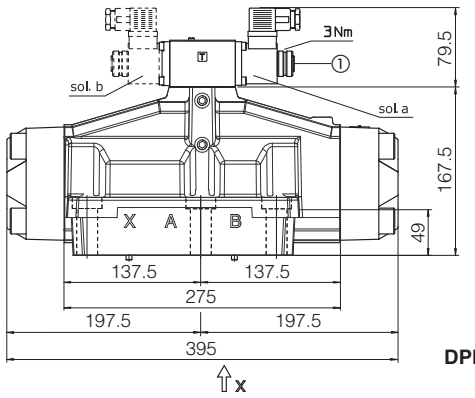
Stroke adjustment device for option/S



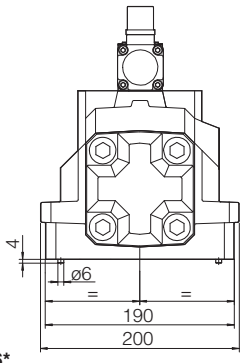
Mass (Kg)	
DPHI-66	43,8
DPHI-67	44,1
DPHE-66	44
DPHE-67	44,5
Option /S	+3,5
Option H, H9	+1,0

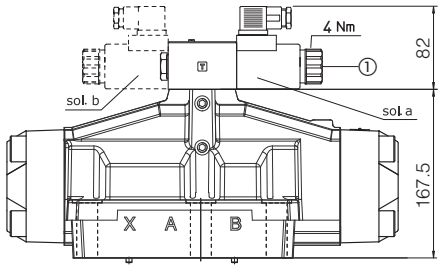
DPHI-6*/H /H9





DPHI-6*





DPHE-6*

① Standard manual override PIN

Overall dimensions refer to valves with connectors type 666

14 ELECTRONIC CONNECTORS ACCORDING TO DIN 43650 - the connectors must be ordered separately

Connector code	Function
666	Connector IP65, suitable for direct connection to electric supply source
667	As 666 connector IP65 but with built-in signal led, suitable for direct connection to electric supply source
669	With built-in rectifier bridge for supplying DC coils by alternating current (AC 110V and 230V - Imax 1A)

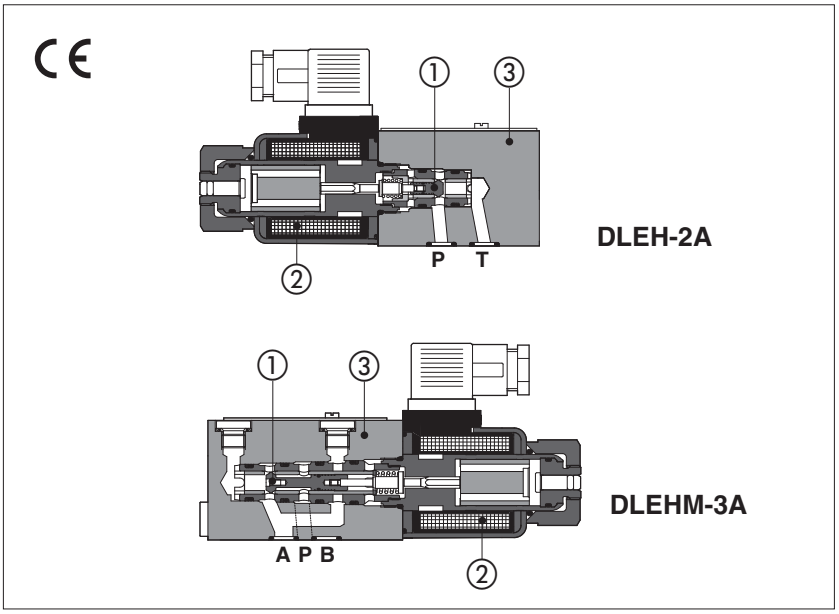
For other available connectors, see tab. E010, E015 and K500

15 MOUNTING SUBPLATES FOR DPH*-1, DPH*-2, DPH*-4 AND DPH*-6

Valve	Subplate model	Ports location	Ports		Ø Counterbore [mm]		Mass [Kg]
			A, B, P, T	X, Y	A, B, P, T	X, Y	
DPH*-1	BA-428	Ports A, B, P, T, X, Y underneath;	G 3/4"	G 1/4"	36,5	21,5	5,6
DPH*-1	BA-434	Ports P, T, X, Y underneath; ports A, B on lateral side	G 3/4"	G 1/4"	36,5	21,5	5,5
DPH*-2	BA-418	Ports A, B, P, T, X, Y underneath;	G 3/4"	G 1/4"	36,5	21,5	3,5
DPH*-2	BA-518	Ports A, B, P, T, X, Y underneath;	G 1"	G 1/4"	46	21,5	8
DPH*-2	BA-519	Ports P, T, X, Y underneath; ports A, B on lateral side	G 1"	G 1/4"	46	21,5	8
DPH*-4	BA-508	Ports A, B, P, T, X, Y underneath;	G 1"	G 1/4"	46	21,5	7
DPH*-4	BA-509	Ports P, T, X, Y underneath; ports A, B on lateral	G 1"	G 1/4"	46	21,5	12,5
DPH*-6	BA-708	Ports A, B, P, T, X, Y underneath;	G 11/2"	G 1/4"	63,5	21,5	17

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

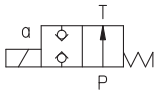
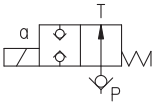
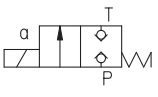
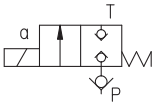
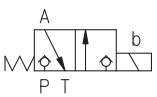
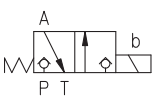
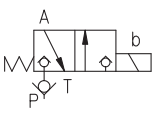
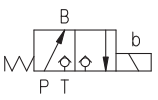
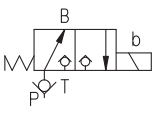
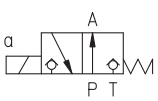
00-DC = DC solenoids without coils
X = without connector
See section 5 for available connectors, to be ordered separately

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 mm^2/s - max allowed range 2.8 ÷ 500 mm^2/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at 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 cm^3/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)

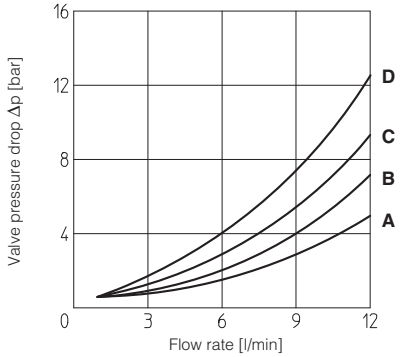
6 ELECTRIC FEATURES

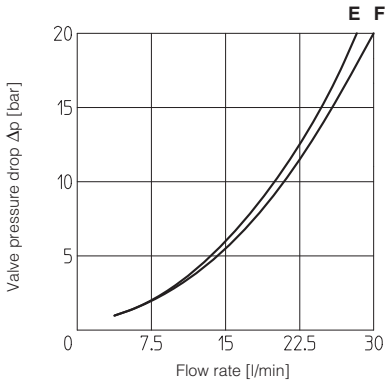
External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption	Code of spare coil
12 DC	**12 DC**	666 or 667	30 W	COE-12DC
14 DC	**14 DC**			COE-14DC
24 DC	**24 DC**			COE-24DC
28 DC	**28 DC**			COE-28DC
48 DC	**48 DC**			COE-48DC
110 DC	**110 DC**			COE-110DC
125 DC	**125 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

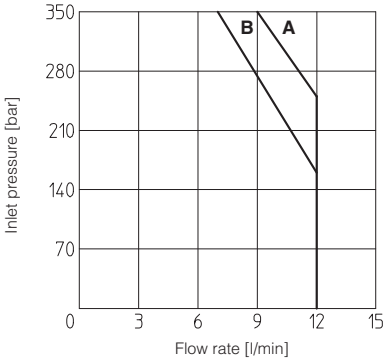
The diagram has been obtained with warm solenoids and power supply at lowest value (Vnom - 10%).

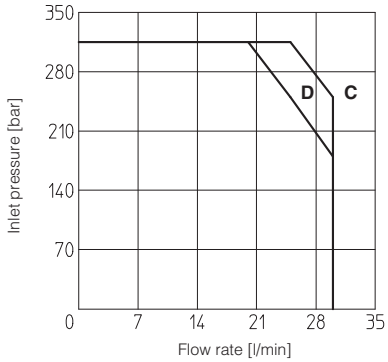
A = DLEH-3A, DLEH-2C

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

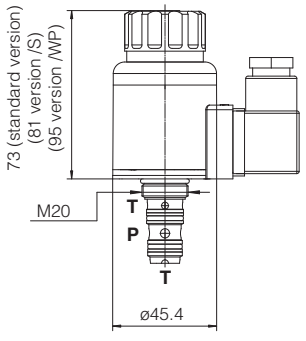
TEST CONDITIONS:

- 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

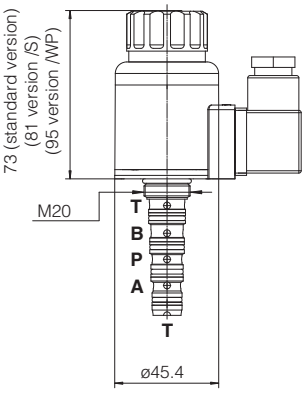
The response time is affected by elasticity of the hydraulic circuit, by variation of hydraulic characteristics and temperature

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

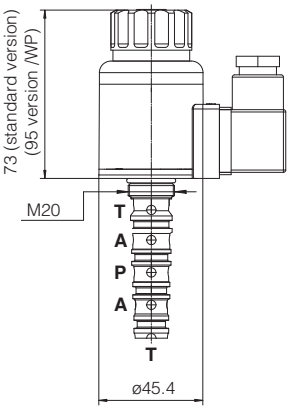
CART LEH-2A
CART LEH-2C



CART LEH-3A
CART LEH-3C

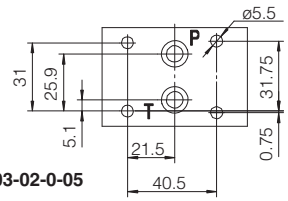


CART LEHM-3A
CART LEHM-3C



11 DIMENSIONS [mm]

DLEH-2*
DLEH-2*/R

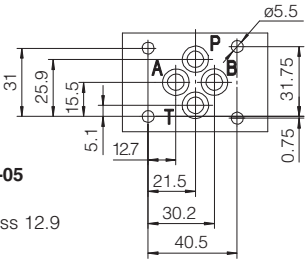


ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
without A and B ports

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

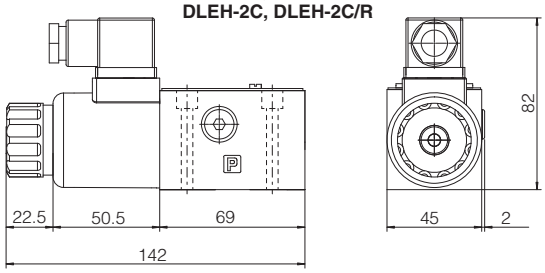


ISO 4401: 2005
Mounting surface: 4401-03-02-0-05

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)

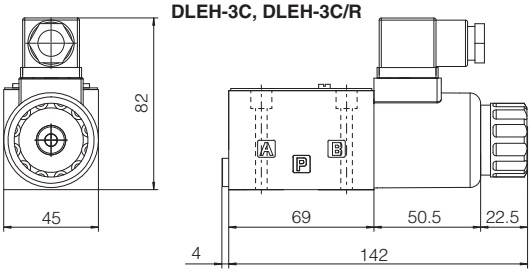
P = PRESSURE PORT
A = USE PORT (not used for DLEH and LEH -3C versions)
B = USE PORT (not used for DLEH and LEH -3A versions)
(not used for DLEHM and LEHM)
T = TANK PORT
For the max pressures on ports, see section 3

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



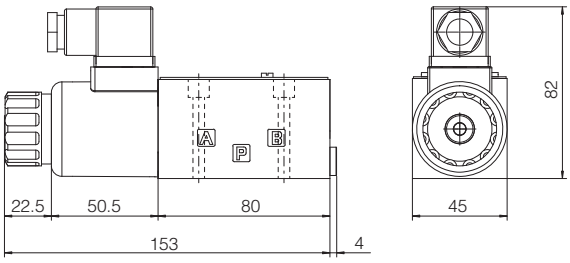
Mass: 1,5 Kg

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



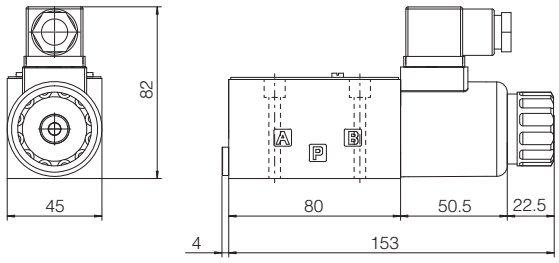
Mass: 1,5 Kg

DLEHM-3C



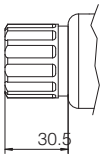
Mass: 1,7 Kg

DLEHM-3A

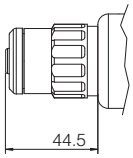


Mass: 1,7 Kg

Option /S



Option /WP



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

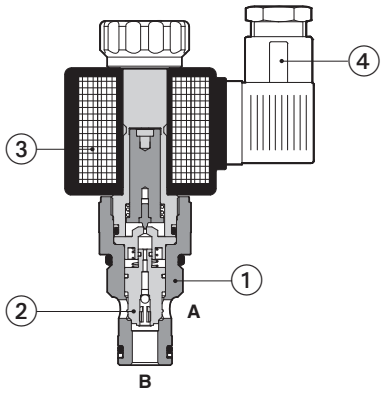
Overall dimensions refer to valves with connectors type 666

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

Solenoid cartridge valves

screw-in, 2-way, poppet type, leak free



① cartridge body
② poppet
③ coil
④ coil connector (to be ordered separately)

JO-DL-4-2-X 24DC

JO-DL

Leak free, poppet type solenoid cartridges in screw-in execution normally used to cut off the hydraulic power supply line. They are available in normally closed NC, or normally open NO configurations.

Max flow: **300 l/min**
Max pressure: **350 bar**

1 MODEL CODE

JO	-	D	L	-	4	-	2	/	NC	-	X	24 DC	**	/	*

Cartridge valve screw-in type UNF

D = Directional control

L = Poppet type

Size:
4 = 3/4”-16UNF-2A
6 = 7/8”-14UNF-2A
10 = 1 5/16”-12UNF-2A

2 = Two-way

Version:
NC = normally closed in rest position
NO = normally open in rest position

X = Without connector, see section 5 for available connector

Voltage code:
12DC = 12 VDC
24DC = 24 VDC

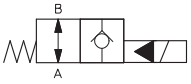
Series number

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

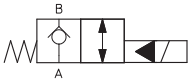
2 HYDRAULIC SYMBOL

Hydraulic symbols

/NO



/NC



3 GENERAL CHARACTERISTICS

Installation position	Any position
Cavity	JO-DL-4 = SAE-08-2N; JO-DL-6 = SAE-10-2N; JO-DL-10 = SAE-16-2N
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Ambient temperature	**Standard** execution = -30°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
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

Model			**JO-DL-4-2/NC**	**JO-DL-4-2/NO**	**JO-DL-6-2/NC**	**JO-DL-6-2/NO**	**JO-DL-10-2/NC**	**JO-DL-10-2/NO**
Operating pressure		[bar]	Ports A and B **350**					
Max flow		[l/min]	40		75		300	
Response time:	energizing	[ms]	35	50	30	50	35	150
	de-energizing	[ms]	50	35	60	35	70	35
Internal leakage			less than 5 drops/min (≤ 0,36 cm³/min) max at 350 bar					

5 ELECTRIC CHARACTERISTICS

Relative duty factor	100%	
Supply voltage	See model code at section 1	
Supply voltage tolerance	±10%	
Max power	19 Watt	
Power connector	666 (plastic - black); 3 pins, cable clamp PG11, cable max ø 11 mm	**to be ordered separately**
Connectors features	DIN 43650 - ISO 4400; IP65 (DIN 40050); VDE 0110C	

6 INSTALLATION NOTES

1) The assembling of cartridges inside manifolds must be done tightening the valve exagonal ring (for tightening torque, see section 10). Excessive values can cause anomalous deformation and poppet sticking.

2) The CE certification is valid only with shielded electric cables and connector. Consult also tab. P004.

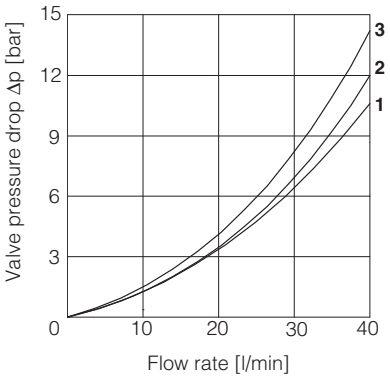
7 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult Atos Technical Office

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 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	ISO 4406 class 20/18/15 NAS 1638 class 9, see also filter section 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	

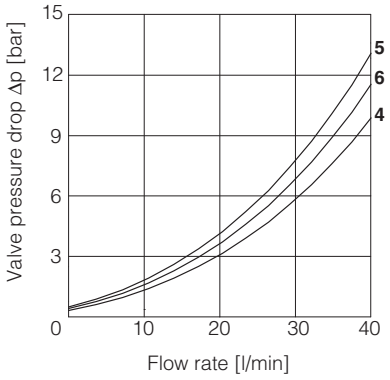
8 **DIAGRAMS** based on mineral oil ISO VG 46 at 50°C

9.1 JO-DL-4

Valve pressure drop - NO version
1= A → B de-energized
2= B → A de-energized
3= B → A energized

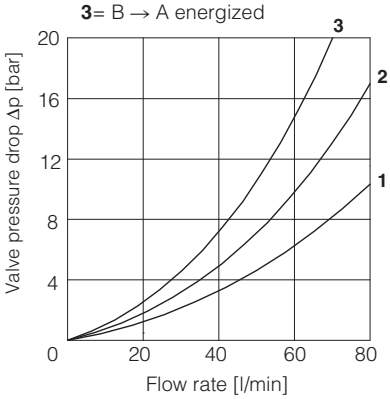


Valve pressure drop - NC version
4= A → B energized
5= B → A de-energized
6= B → A energized

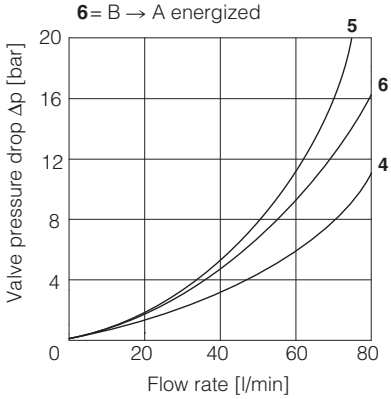


9.2 JO-DL-6

Valve pressure drop - NO version
1= A → B de-energized
2= B → A de-energized
3= B → A energized

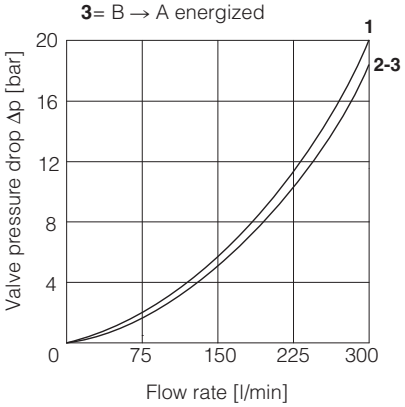


Valve pressure drop - NC version
4= A → B energized
5= B → A de-energized
6= B → A energized

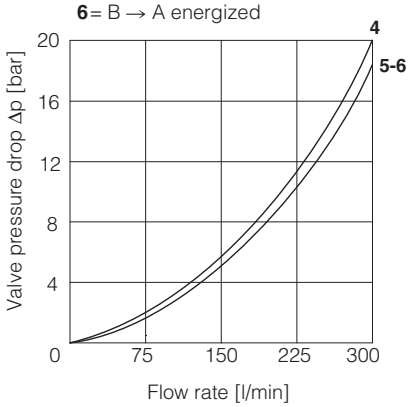


9.3 JO-DL-10

Valve pressure drop - NO version
1= A → B de-energized
2= B → A de-energized
3= B → A energized



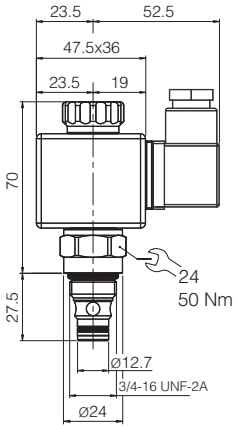
Valve pressure drop - NC version
4= A → B energized
5= B → A de-energized
6= B → A energized



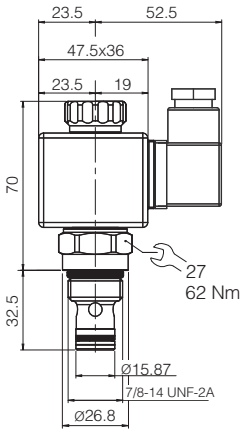
9 INSTALLATION DIMENSIONS [mm]

Version /NO and /NC

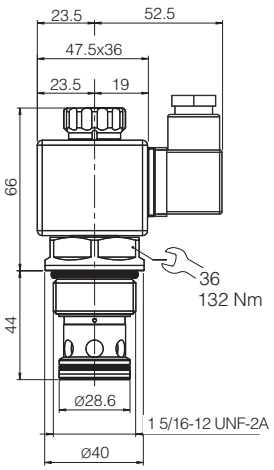
JO-DL-4-2/N*
Mass 0.35 Kg



JO-DL-6-2/N*
Mass 0.35 Kg

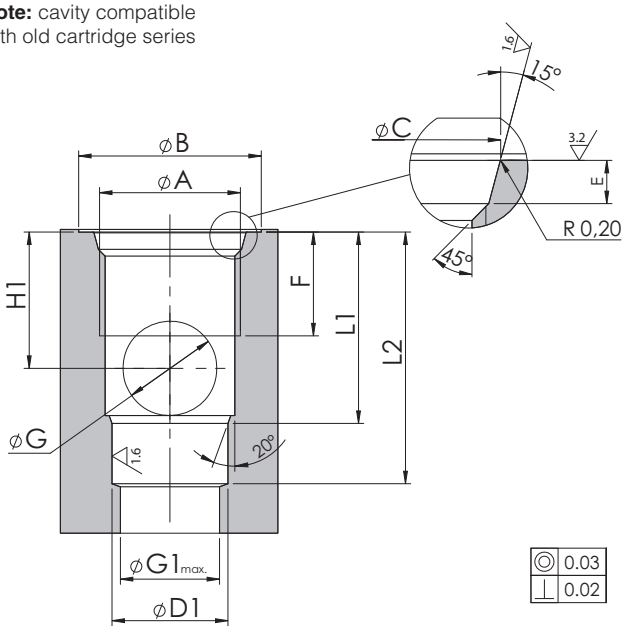


JO-DL-10-2/N*
Mass 0.4 Kg



10 CAVITY DIMENSIONS

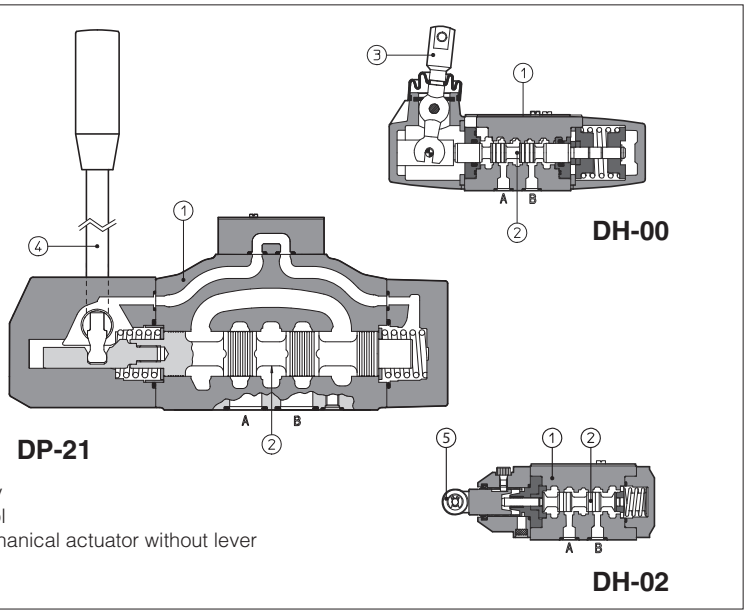
Note: cavity compatible with old cartridge series



	SAE-08-2N	SAE-10-2N	SAE-16-2N
A	3/4-16 UNF	7/8-14 UNF	1 5/16-12 UNF
B	26	30	42
C	20.6 $^{+0,1}_{0}$	23.9 $^{+0,1}_{0}$	35.5 $^{+0,1}_{0}$
D1	12.7 $^{+0,05}_{0}$	15.87 $^{+0,05}_{0}$	28.60 $^{+0,05}_{0}$
E	2.6 $^{+0,3}_{0}$	2.6 $^{+0,3}_{0}$	3.3 $^{+0,3}_{0}$
F	13	15	20
G	9	12	19
G1	12	15	24
H1	14	18	25
L1	20.5	25.5	36
L2	29	34.5	49

Hand & mechanical directional valves

ISO 4401 sizes 06, 10, 16 and 25



① body
② spool
③ mechanical actuator without lever
④ lever
⑤ cam

Hand & mechanical operated directional valves are spool type, three or four way, two or three position valves, available with following actuator types:
- mechanical actuator: general purpose execution for connection to customer device for the valve's remote operation
- hand-lever
- cam (only for DH and DK).

Valve sizes and max flow:

DH-0 = size 06, flow up to 50 l/min
DK-10 (11) = size 10, flow up to 100 l/min
DK-12 = size 10, flow up to 140 l/min
DP-2 = size 16, flow up to 300 l/min
DP-4 = size 25, flow up to 700 l/min

Max pressure:
350 bar for DH-0, DP-2, DP-4
315 bar for DK-1*

1 MODEL CODE

DH-0	1	1	3	/	C	/	A	**	/	*

Directional control valve, size:
DH-0 = 06
DK-1 = 10
DP-2 = 16
DP-4 = 25

Type of actuator:
0 = mechanical, without lever
1 = hand-lever
2 = cam (only for DH-0 and DK-1)

Valve configuration, **see sections** 2 and 3
0 = free, without springs
1 = spring centered, without detent
2 = retun to internal position
3 = return to external position
4 = 3 position, with detent
5 = 2 external positions, with detent
6 = centre plus external positions, with detent
7 = return to external position from the centre position
8 = return to the centre position from the external position

Spool type, see section 3

Only for DH-01 hand-lever valves:
/C = short hand - lever and reducend actuation force

Options:
/A = actuator device mounted on side of port B
Lever position to be specified for DH-00, DH-01 and DK-00, DK-01 with configuration 6, 7, 8, see section 3 for hydraulic connections:
/I = in rest position the lever is inclined towards the valve body
/E = in rest position the lever is inclined in opposite side
Only for DK-1:
/Y = external drain

Series number

Seals material:
- = NBR
PE = FKM

2 RANGE OF VALVE'S MODELS

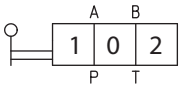
VALVE TYPE	SIZE	VALVE CONFIGURATION								
		0	1	2	3	4	5	6	7	8
DH-00	06	●	●	●	●	●	●	●	●	●
DH-01		●	●	●	●	●	●	●	●	●
DH-02					●				●	●
DK-10	10	●	●	●	●	●	●	●	●	●
DK-11		●	●	●	●	●	●	●	●	●
DK-12					●				●	●
DP-20	16		●		●	●	●			
DP-21			●		●	●	●			
DP-40	25		●		●	●	●			
DP-41			●		●	●	●			

3 **CONFIGURATIONS and SPOOLS** - for intermediate passages, see tab. E001

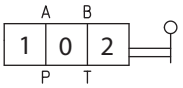
DH-00*, DH-01* and DK-10*, DK-11* - mechanical and hand lever actuator

Configurations

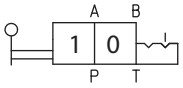
DH-000* DK-100* **DH-010* DK-110***



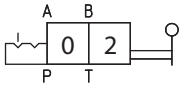
DH-000*/A DK-100*/A **DH-010*/A DK-110*/A**



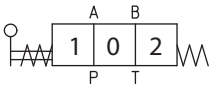
DH-006*/E DK-106*/E **DH-016*/E DK-116*/E**



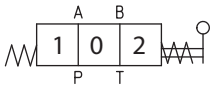
DH-006*/EA DK-106*/EA **DH-016*/EA DK-116*/EA**



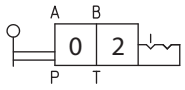
DH-001* DK-101* **DH-011* DK-111***



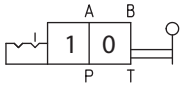
DH-001*/A DK-101*/A **DH-011*/A DK-111*/A**



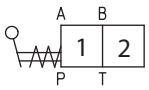
DH-006*/I DK-106*/I **DH-016*/I DK-116*/I**



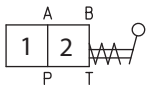
DH-006*/IA DK-106*/IA **DH-016*/IA DK-116*/IA**



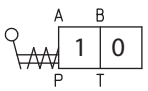
DH-002* DK-102* **DH-012* DK-112***



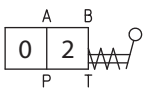
DH-002*/A DK-102*/A **DH-012*/A DK-112*/A**



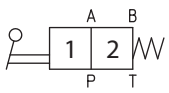
DH-007*/E DK-107*/E **DH-017*/E DK-117*/E**



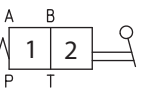
DH-007*/EA DK-107*/EA **DH-017*/EA DK-117*/EA**



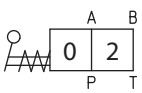
DH-003* DK-103* **DH-013* DK-113***



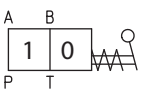
DH-003*/A DK-103*/A **DH-013*/A DK-113*/A**



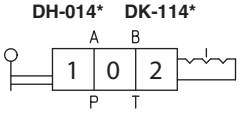
DH-007*/I DK-107*/I **DH-017*/I DK-117*/I**



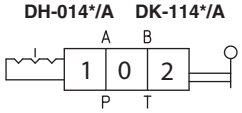
DH-007*/IA DK-107*/IA **DH-017*/IA DK-117*/IA**



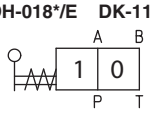
DH-004* DK-104* **DH-014* DK-114***



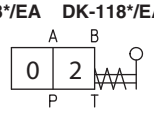
DH-004*/A DK-104*/A **DH-014*/A DK-114*/A**



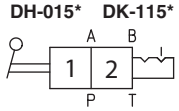
DH-008*/E DK-108*/E **DH-018*/E DK-118*/E**



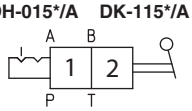
DH-008*/EA DK-108*/EA **DH-018*/EA DK-118*/EA**



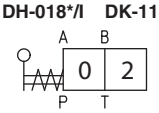
DH-005* DK-105* **DH-015* DK-115***



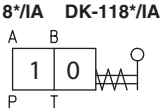
DH-005*/A DK-105*/A **DH-015*/A DK-115*/A**



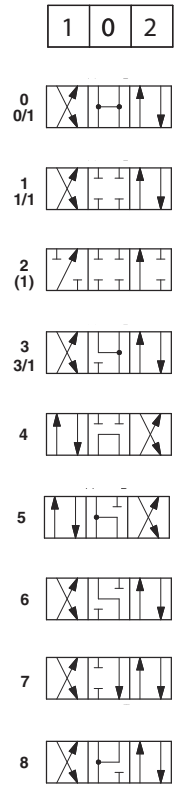
DH-008*/I DK-108*/I **DH-018*/I DK-118*/I**



DH-008*/IA DK-108*/IA **DH-018*/IA DK-118*/IA**



Spools

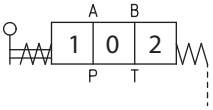


(1) Spool type 2 available only for DH

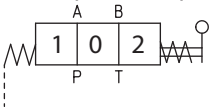
DP-20*, DP-21*, DP-40*, DP-41* - hand lever actuator

Configurations

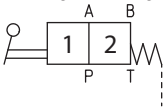
DP-201* DP-401* **DP-211* DP-411***



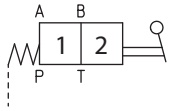
DP-201*/A DP-401*/A **DP-211*/A DP-411*/A**



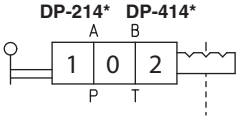
DP-203* DP-403* **DP-213* DP-413***



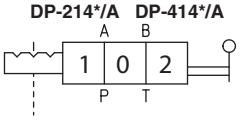
DP-203*/A DP-403*/A **DP-213*/A DP-413*/A**



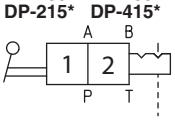
DP-204* DP-404* **DP-214* DP-414***



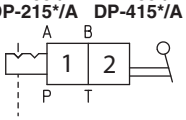
DP-204*/A DP-404*/A **DP-214*/A DP-414*/A**



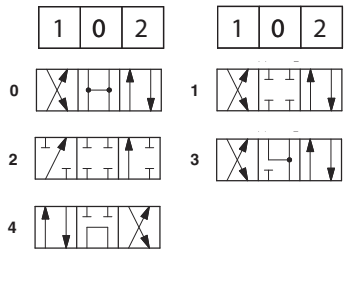
DP-205* DP-405* **DP-215* DP-415***



DP-205*/A DP-405*/A **DP-215*/A DP-415*/A**



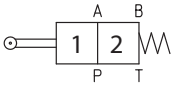
Spools



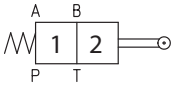
DH-02*, DK-12* - cam actuator

Configurations

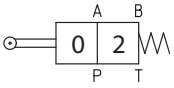
DH-023* DK-123*



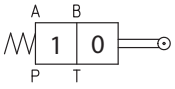
DH-023*/A DK-123*/A



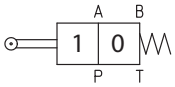
DH-027* DK-127*



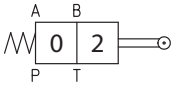
DH-027*/A DK-127*/A



DH-028* DK-128*



DH-028*/A DK-128*/A



Spools

(1) Spool type 2 available only for DH

NOTE

- Spools type 0/2, 1/2, 2/2 are only used for valves type DH-023*/2 and DK 123*/2;

4 GENERAL CHARACTERISTICS

Assembly position		Any position except for configurtion 7 (without spring) that must be installed with horizontal axis
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
Flow direction		As shown in the symbols of tables 3
Compliance		RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Operating pressure	**DH**	P, A, B = **350 bar** T = **160 bar**
	DK	P, A, B = **315 bar** T = **160 bar**
	DP	P, A, B, X = **350 bar** T = **250 bar** for external drain (standard); Ports Y = 0 bar
Maximum flow	**DH**	**50 l/min**
	DK-10, DK-11	**100 l/min**
	DK-12	**140 l/min**
	DP-2	**300 l/min**
	DP-4	**700 l/min**

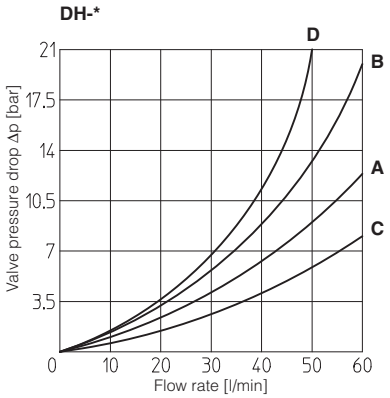
5 SEALS AND HYDRAULIC FLUIDS - For other fluids not included in above table, consult our technical office

Seals, recommended fluid temperature	NBR seals = (standard) -30°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 15 ÷ 380 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at 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	

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

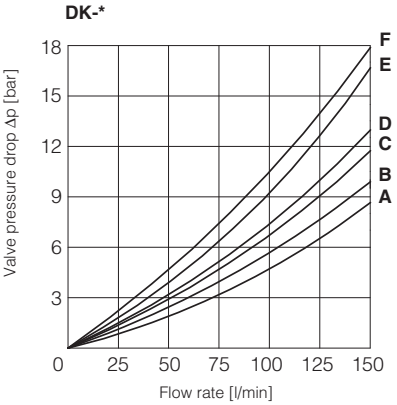
DH-*

Flow direction / Spool type	P→A	P→B	A→T	B→T	P→T
0, 0/1, 0/2	C	C	C	C	
1, 1/1, 1/2	A	A	A	A	
2, 2/2, 3, 3/1	A	A	C	C	
4, 5	D	D	D	D	A
6, 7	A	A	C	A	
8	C	C	B	B	



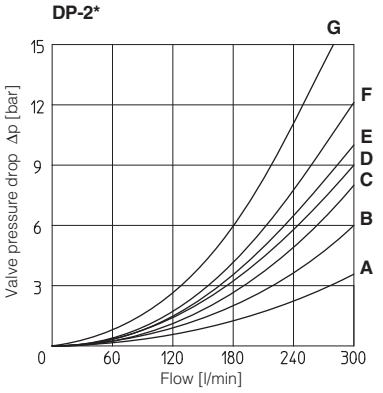
DK-*

Flow direction / Spool type	P→A	P→B	A→T	B→T	P→T
0, 0/1, 0/2	A	A	B	B	
1, 1/1, 1/2, 6, 8	A	A	D	C	
3, 3/1, 7	A	A	C	D	
4	B	B	B	B	E
5	A	B	C	C	F



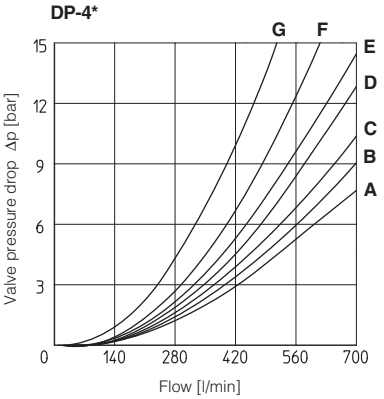
DP-2*

Spool type / Flow direction	P→A	P→B	A→T	B→T	P→T
1, 3	A	A	C	A	-
0	A	A	C	D	B
2	A	A	-	-	-
4	B	B	F	G	E



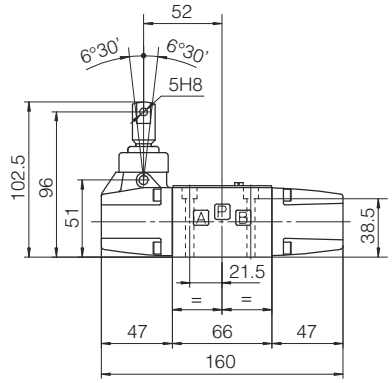
DP-4*

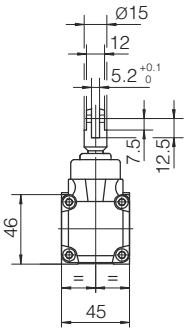
Spool type / Flow direction	P→A	P→B	A→T	B→T	P→T
1	A	A	A	C	-
0	C	B	C	D	E
2	A	A	-	-	-
3	A	A	C	E	-
4	B	B	F	G	G



7 DIMENSIONS OF HAND & MECHANICAL OPERATED VALVES ISO 4401 SIZE 06 [mm]

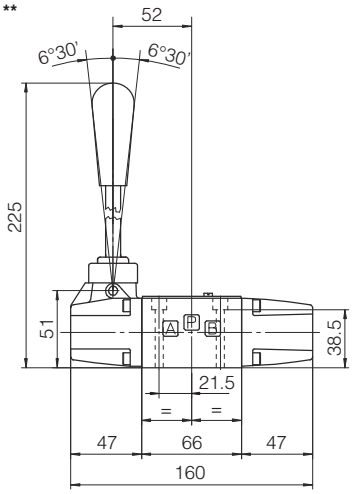
DH-00**

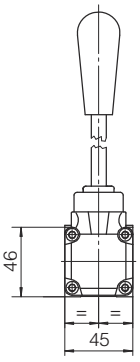




Mass: 1,2 Kg

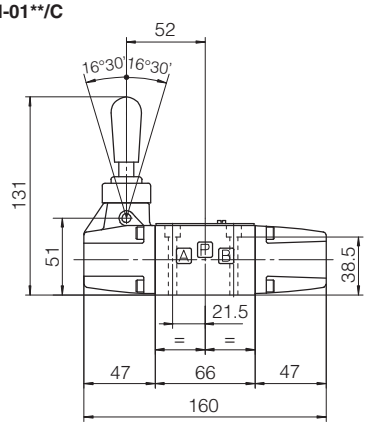
DH-01**

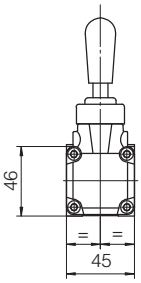




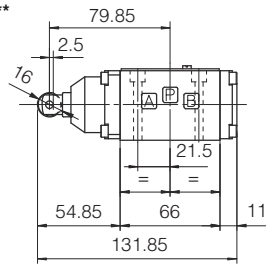
Mass: 1,6 Kg

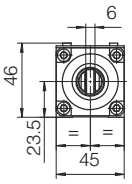
DH-01/C**





DH-02**





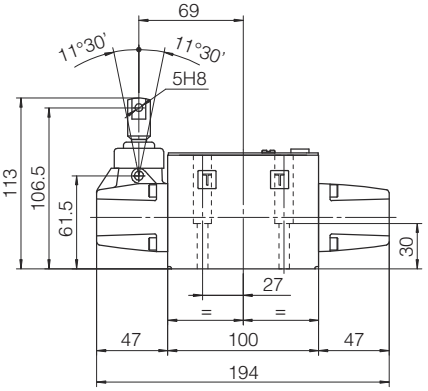
Mass: 1,2 Kg

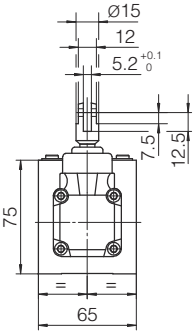
Working stroke: 2,5 mm; extra-stroke: 0,5 mm max.

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
Fastening bolts: 4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm
Diameter of ports A, B, P, T: Ø = 7,5 mm (max)
Seals: 4 OR 108

8 DIMENSIONS OF HAND & MECHANICAL OPERATED VALVES ISO 4401 SIZE 10 [mm]

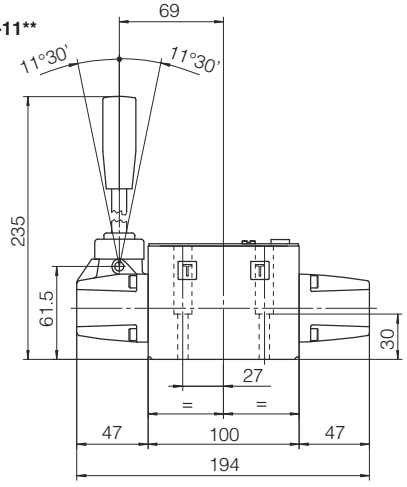
DK-10**

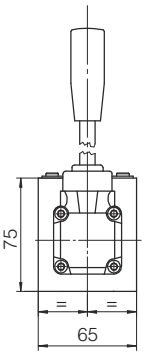




Mass: 2,5 Kg

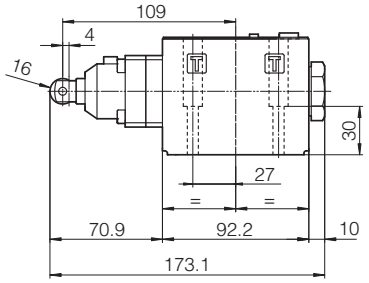
DK-11**

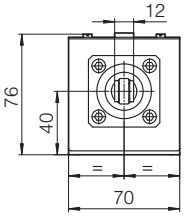




Mass: 2,8 Kg

DK-12**





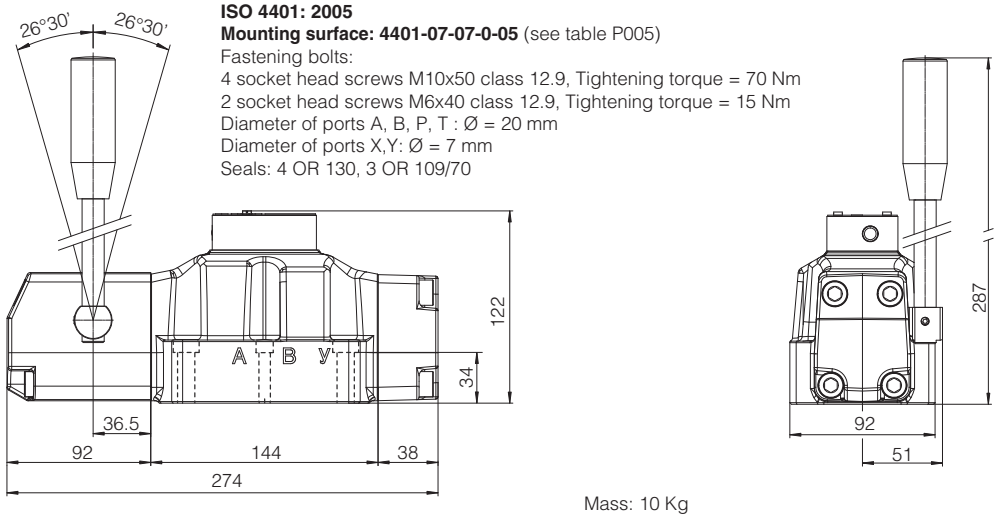
Mass: 2,5 Kg

Working stroke: 4 mm; extra-stroke: 0,5 mm max.

ISO 4401: 2005
Mounting surface: 4401-05-05-0-05 (see table P005)
(Without X port, Y port optional)
Fastening bolts: 4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Diameter of ports A, B, P, T: Ø = 11,2 mm (max)
Seals: 5 OR 2050

9 DIMENSIONS OF HAND & MECHANICAL OPERATED VALVES ISO 4401 SIZE 16 [mm]

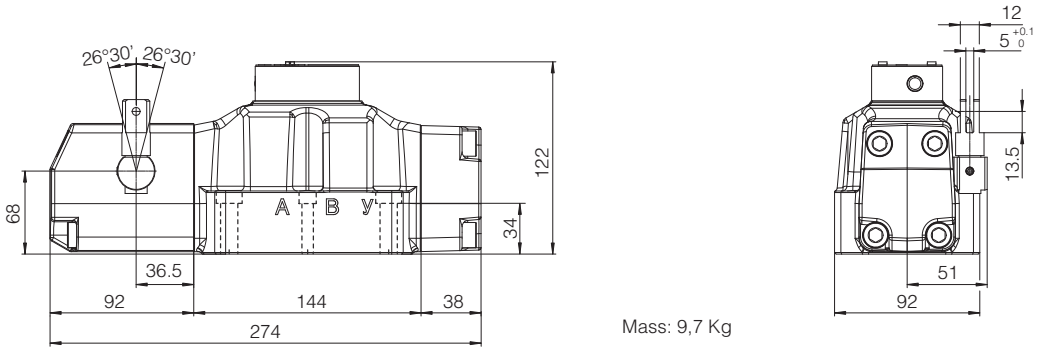
DP-21



ISO 4401: 2005
Mounting surface: 4401-07-07-0-05 (see table P005)
Fastening bolts:
4 socket head screws M10x50 class 12.9, Tightening torque = 70 Nm
2 socket head screws M6x40 class 12.9, Tightening torque = 15 Nm
Diameter of ports A, B, P, T : Ø = 20 mm
Diameter of ports X,Y: Ø = 7 mm
Seals: 4 OR 130, 3 OR 109/70

Mass: 10 Kg

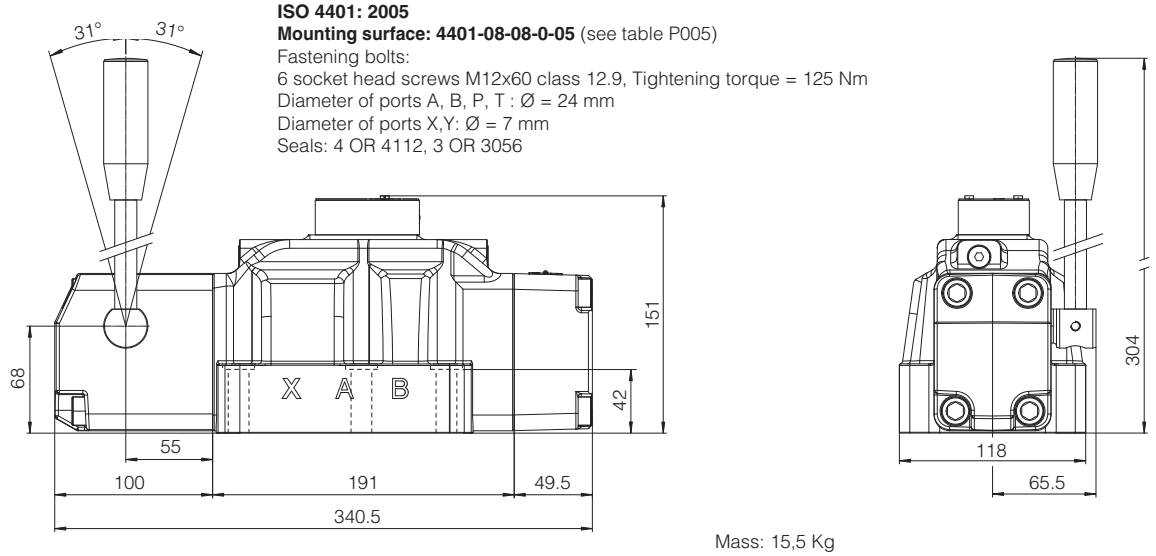
DP-20



Mass: 9,7 Kg

10 DIMENSIONS OF HAND & MECHANICAL OPERATED VALVES ISO 4401 SIZE 25 [mm]

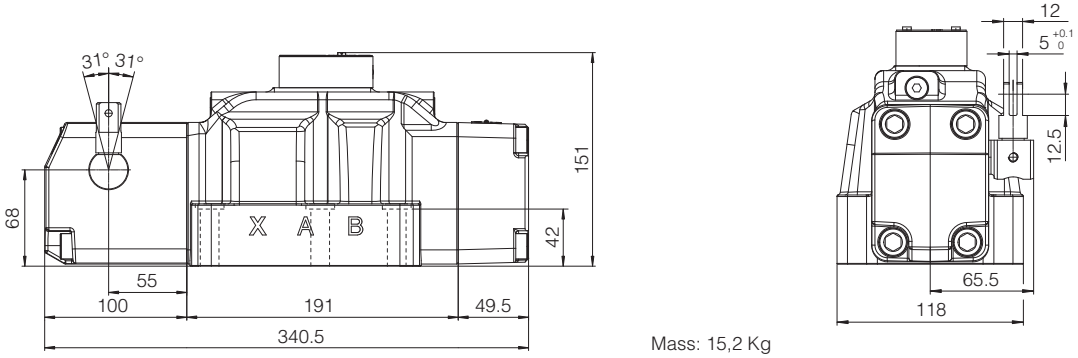
DP-41



ISO 4401: 2005
Mounting surface: 4401-08-08-0-05 (see table P005)
Fastening bolts:
6 socket head screws M12x60 class 12.9, Tightening torque = 125 Nm
Diameter of ports A, B, P, T : Ø = 24 mm
Diameter of ports X,Y: Ø = 7 mm
Seals: 4 OR 4112, 3 OR 3056

Mass: 15,5 Kg

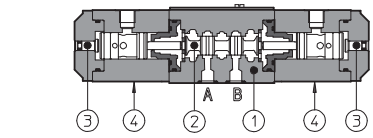
DP-40



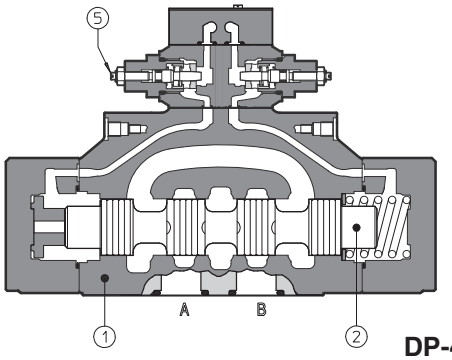
Mass: 15,2 Kg

Hydraulic operated directional valves

ISO 4401 size 06, 10, 16, 25 and 32



DH-0511



DP-4411/H

① Main body
② Spool
③ Manual override
④ Hydraulic actuator
⑤ Adjustable chokes (option /H)

Hydraulic operated directional valves are spool type, three or four way, two or three position, designed to operate in oil hydraulic systems.
Available with single or double hydraulic actuator.

Valve sizes and max flow:

DH-0 = size 06, flow up to 50 l/min
DK-1 = size 10, flow up to 160 l/min
DP-1 = size 10, flow up to 160 l/min
DP-2 = size 16, flow up to 300 l/min
DP-4 = size 25, flow up to 700 l/min
DP-6 = size 32, flow up to 1000 l/min

Max pressure:
350 bar for DH-0, DP-1, DP-2, DP-4, DP-6
315 bar for DK-1

1 MODEL CODE

DH-0	4	1	3	/	A	**	/	*

DH-0

Directional control valve, size:
DH-0 = 06
DK-1 = 10
DP-1 = 10
DP-2 = 16
DP-4 = 25
DP-6 = 32

4

Type of actuator:
4 = single actuator
5 = double actuator

1

Valve configuration, see section 5
0 = free, without springs
1 = spring centered, without detent
3 = spring offset external position
5 = 2 external positions, with detent (only for DH and DK)
7 = center and external positions

3

Spool type, see section 4

A

Options:
only for DH-04 and DK-14, see section 4:
/A = actuator device mounted on side of port B
only for DP:
/H = adjustable chokes for controlling the main spool shifting time (meter-out to the pilot chambers of the main valve)
/H9= adjustable chokes for controlling the main spool shifting time (meter-in to the pilot chambers of the main valve)
/R = with check valve on port P (not available for DP-1*)
/S = main spool stroke adjustment (not available for DP-1*)

******

Series number

*****

Seals material, see section 3:
- = NBR
PE = FKM
BT = HNBR (only for DP)

2 HYDRAULIC CHARACTERISTICS

Valve model		DH-0	DK-1	DP-1	DP-2	DP-4	DP-6
Max recommended flow	[l/min]	50	160	160	300	700	1000
Max pressure on port P, A, B	[bar]	350	315	350			
Max pressure on port T (also X, Y for DP)	[bar]	see note **(1)**		250			
Minimum pilot pressure	[bar]	3 (min) 5 (suggested)		4			
Max recommended pressure on piloting line	[bar]	70		250			

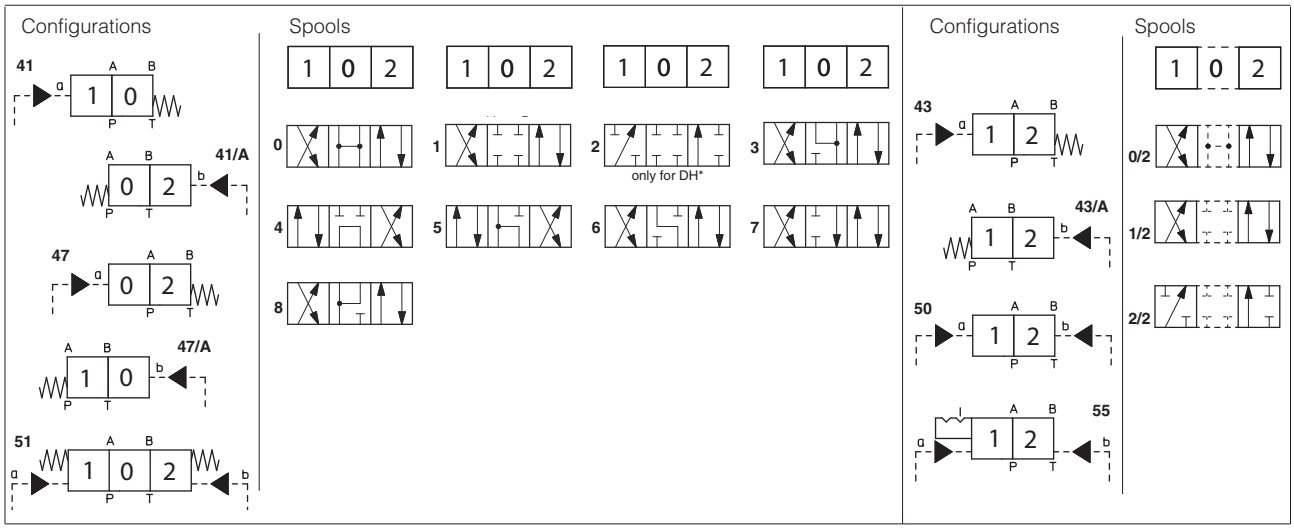
(1) The max pressure on port T has to be not over 50% of pilot pressure

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

Assembly position / location	any position except for valves type DH-050, DK-150, DP-*50 (without springs) that must be installed with their longitudinal axis horizontal
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	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Ambient temperature range	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 KTF catalog

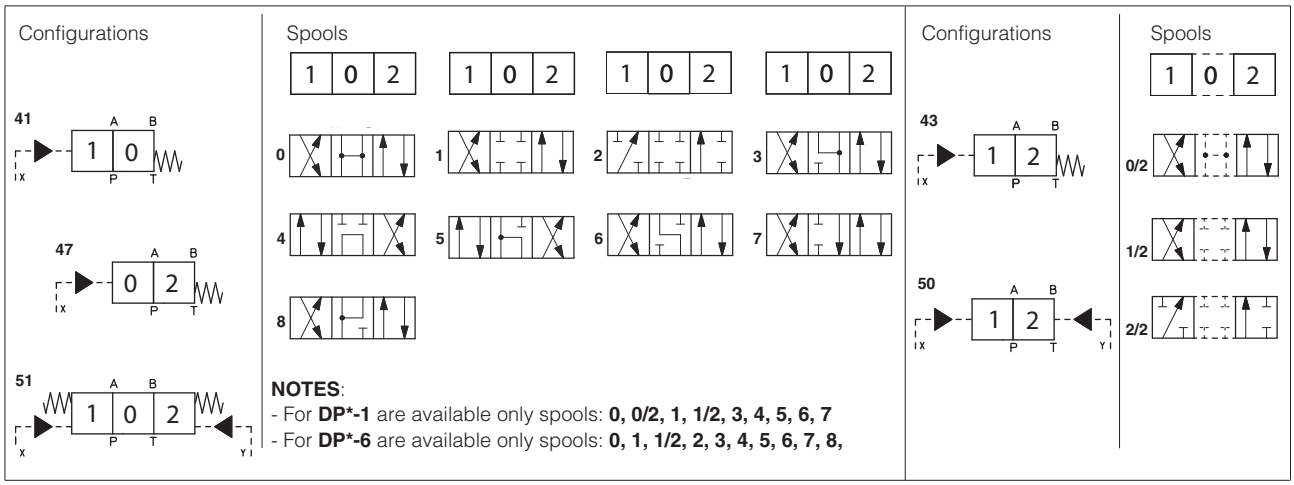
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

4 CONFIGURATIONS and SPOOLS valves type DH-*, DK-*



NOTES
- 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** and **5** are also available as **1/1, 4/8** (only for DH), and **5/1.** 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** (only for DH-0) to limit valve internal leakages.

5 CONFIGURATIONS and SPOOLS valves type DP-*



NOTES:
- For **DP*-1** are available only spools: **0, 0/2, 1, 1/2, 3, 4, 5, 6, 7**
- For **DP*-6** are available only spools: **0, 1, 1/2, 2, 3, 4, 5, 6, 7, 8,**

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** and **5** are also available as **1/1, 4/8** and **5/1** are properly shaped to reduce water-hammer shocks during the switching.

6 Q/Δp DIAGRAMS

DH-0	See note and diagrams on table E010 relating the DH* valve from which DH-0* are derivated
DK-1	See note and diagrams on table E025 relating the DKE valve from which DK-1* are derivated
DP-1	See note and diagrams on table E085 relating the DPH*-1 valve from which DP-1* are derivated
DP-2	See note and diagrams on table E085 relating the DPH*-2 valve from which DP-2* are derivated
DP-4	See note and diagrams on table E085 relating the DPH*-4 valve from which DP-4* are derivated
DP-6	See note and diagrams on table E085 relating the DPH*-6 valve from which DP-6* are derivated

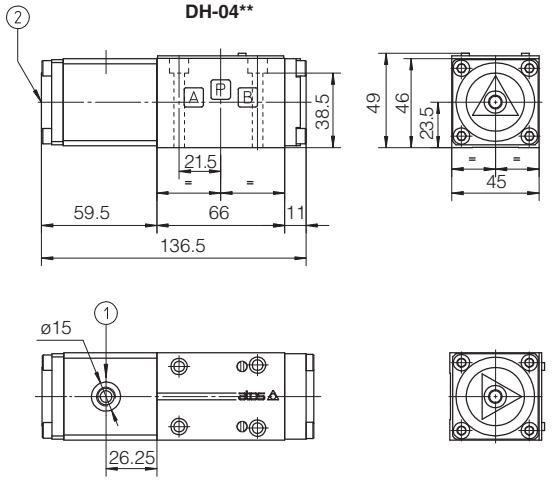
7 DIMENSIONS OF HYDRAULIC OPERATED VALVES ISO 4401 size 06 and 10 [mm]

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
Fastening bolts: 4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm
Diameter of ports A, B, P, T: Ø = 7,5 mm (max)
Seals: 4 OR 108

① Pilot pressure port G1/8”
② Manual override

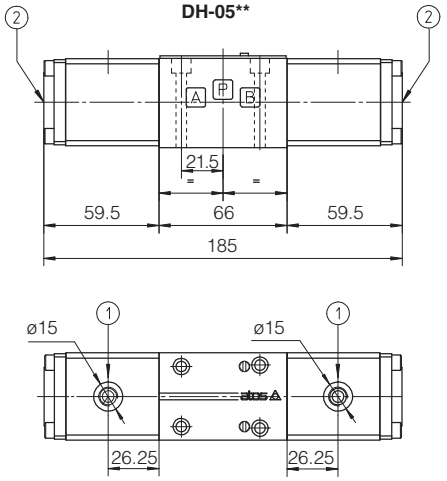
Mounting subplates: see tab. E010

DH-04**



Mass: 1,2 Kg

DH-05**



Mass: 1,6 Kg

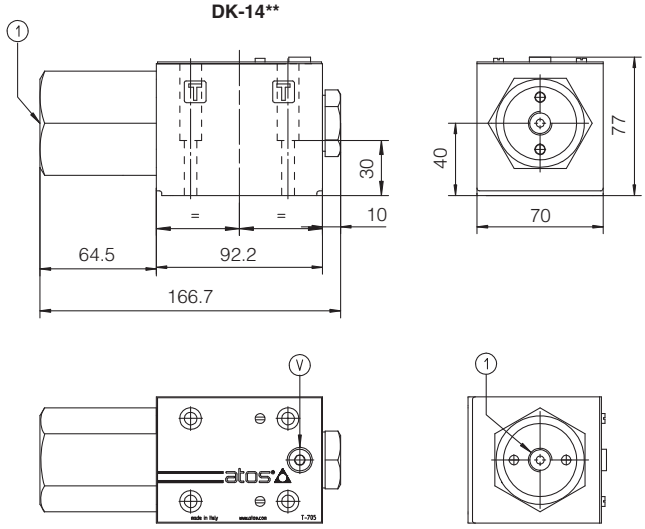
ISO 4401: 2005
Mounting surface: 4401-05-05-0-05 (see table P005)
(without X port)
Fastening bolts: 4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Diameter of ports A, B, P, T: Ø = 11,2 mm (max)
Diameter of port Y: Ø = 5 mm
Seals: 5 OR 2050, 1 OR 108

① Pilot pressure port G1/4”
Ⓥ Air bleed

Mounting subplates: see tab. E025 (only version /Y)

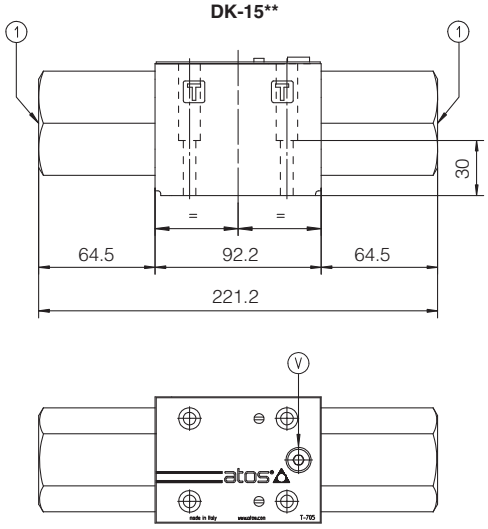
Note: Line Y must be always present and no counter pressure are allowed on this line.

DK-14**



Mass: 3,4 Kg

DK-15**

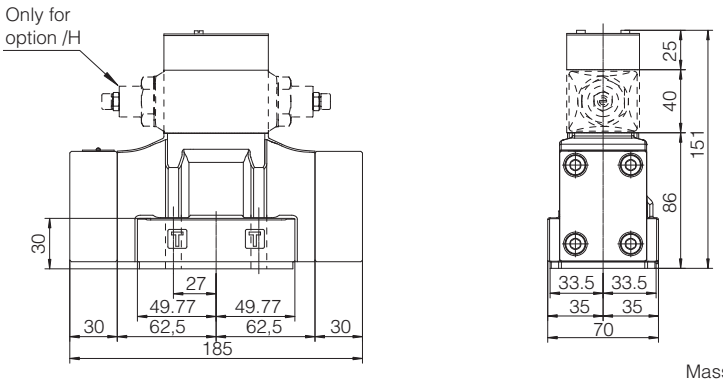


Mass: 4,2 Kg

8 DIMENSIONS OF HYDRAULIC OPERATED VALVES ISO 4401 size 16, 25 and 32 [mm]

DP-1

ISO 4401: 2005
Mounting surface: 4401-05-05-0-05
(see table P005)
Fastening bolts:
4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Diameter of ports A, B, P, T : Ø = 11
Diameter of ports X,Y: Ø = 5 mm
Seals: 5 OR 2050, 2 OR 108

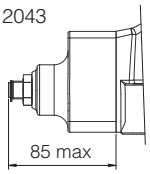


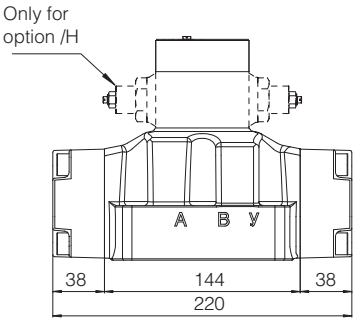
Mass: 7,1 Kg

DP-2

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05
Fastening bolts:
4 socket head screws M10x50 class 12.9
Tightening torque = 70 Nm
2 socket head screws M6x45 class 12.9
Tightening torque = 15 Nm
Diameter of ports A, B, P, T: Ø = 20
Diameter of ports X,Y: Ø = 7 mm
Diameter of port L: Ø = 5 mm
Seals: 4 OR 130, 2 OR 2043

Stroke adjustment device for option /S



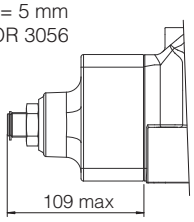


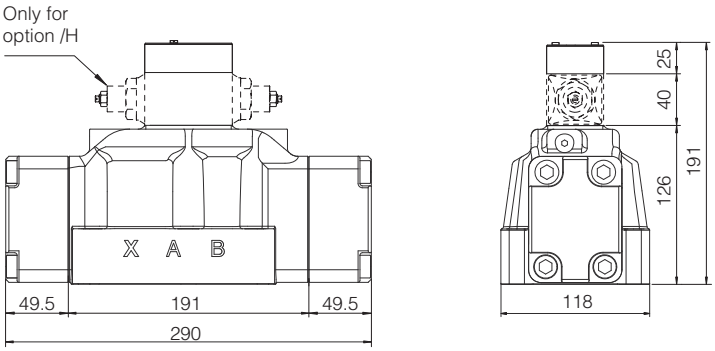
Mass: 10 Kg

DP-4

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05
Fastening bolts:
6 socket head screws M12x60 class 12.9
Tightening torque = 125 Nm
Diameter of ports A, B, P, T : Ø = 24
Diameter of ports X,Y: Ø = 7 mm
Diameter of port L: Ø = 5 mm
Seals: 4 OR 4112, 2 OR 3056

Stroke adjustment device for option /S



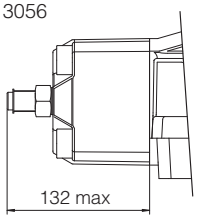


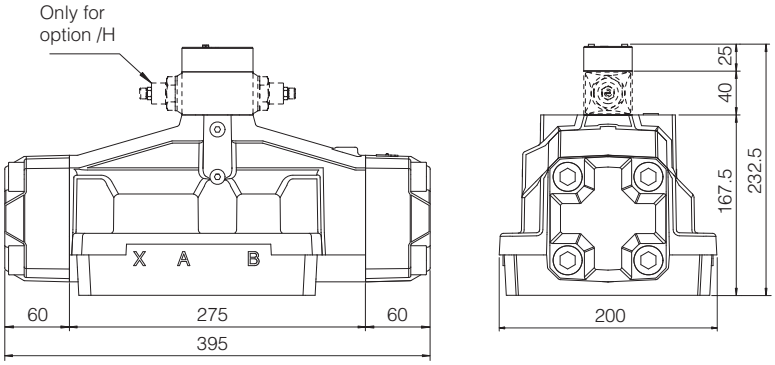
Mass: 16,5 Kg

DP-6

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05
(port L optional)
Fastening bolts:
6 socket head screws M20x80 class 12.9
Tightening torque = 600 Nm
Diameter of ports A, B, P, T : Ø = 34 mm
Diameter of ports X,Y: Ø = 7 mm
Diameter of port L: Ø = 5 mm
Seals: 4 OR 144, 2 OR 3056

Stroke adjustment device for option /S



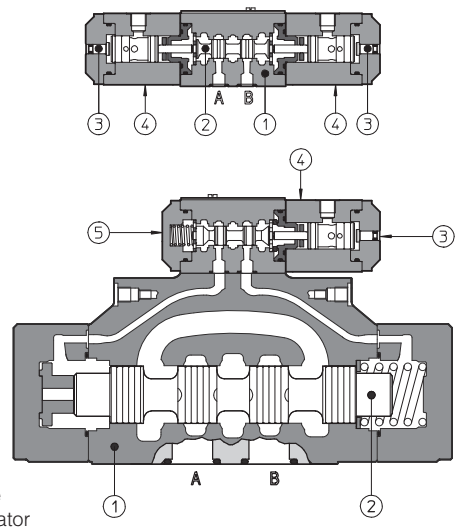


Mass: 38 Kg

Mounting subplates: see tab. K280

Pneumatic operated directional valves

ISO 4401 sizes 06, 10, 16, 25 and 32



DH-09*

DPH-48*

① Main body
② Spool
③ Manual override
④ Pneumatic actuator
⑤ Pilot valve

Pneumatic operated directional valves are spool type ②, three or four way, two or three position, designed to operate in oil hydraulic systems.
Available with single or double pneumatic actuator ④ with manual override.

Valve sizes and max flow:

DH-0 = size 06, flow up to 50 l/min
DK-1 = size 10, flow up to 160 l/min
DPH-2 = size 16, flow up to 300 l/min
DPH-4 = size 25, flow up to 700 l/min
DPH-6 = size 32, flow up to 1000 l/min

Max pressure:
350 bar for DH-0, DPH-2, DPH-4, DPH-6
315 bar for DK-1

1 MODEL CODE

DH-0	8	1	3	/	A	**	/	*

DH-0
Directional control valve, size:
DH-0 = 06
DK-1 = 10
DPH-2 = 16
DPH-4 = 25
DPH-6 = 32

8
Type of actuator:
8 = single actuator
9 = double actuator

1
Valve configuration, see sections 4 and 5
0 = free, without springs
1 = spring centered, without detent
3 = spring offset external position
5 = 2 external positions, with detent
7 = center and external positions

3
Spool type, see sections 4 and 5

A
Options:
only for valve with single actuator:
/A = Actuator device mounted on side of port B (for DH and DK). Actuator device mounted on side of port A of main body (for DPH)
only for DPH:
/D = internal drain
/E = external pressure
/H = adjustable chokes for controlling the main spool shifting time (meter-out to the pilot chambers of the main valve)
/H9= adjustable chokes for controlling the main spool shifting time (meter-in to the pilot chambers of the main valve)
/R = pilot pressure generator on port P at 4 bar
/S = main spool stroke adjustment

******
Series number

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

2 HYDRAULIC CHARACTERISTICS

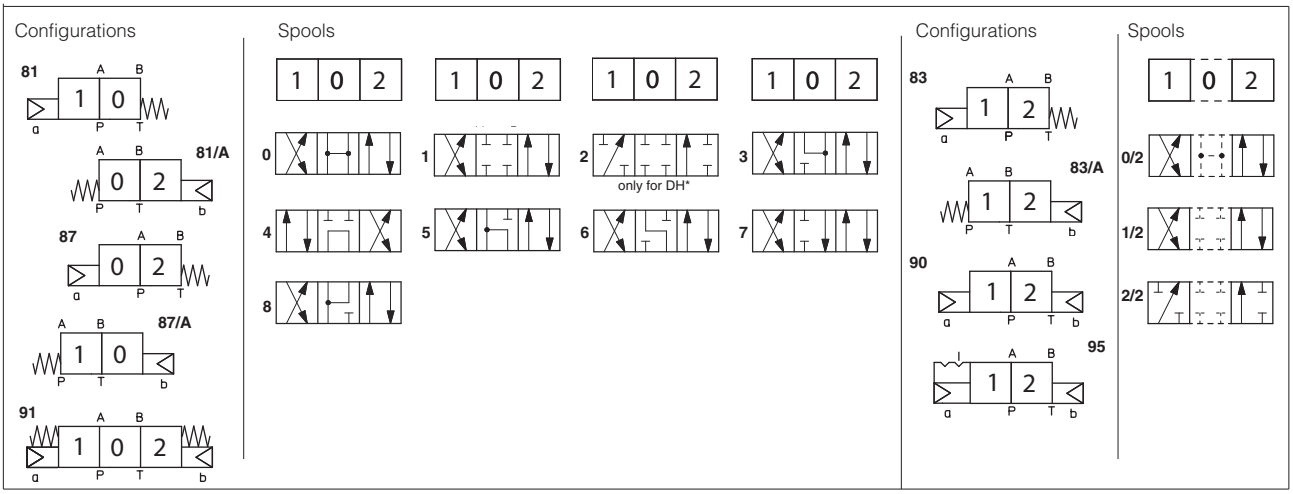
Valve model		DH-0	DK-1	DPH-2	DPH-4	DPH-6
Max recommended flow	[l/min]	50	160	300	700	1000
Max pressure on port P, A, B (also X for DP)	[bar]	350	315	350		
Max pressure on port T	[bar]		210	250		
Max pressure on port L and Y	[bar]	–		null pressure		
Recommended oil pressure on piloting line	[bar]	–		Min = 4 Max = 250 The device **/R** generates an additional pressure drop, in order to ensure the minimum pilot pressure, for correct operation of the valves with internal pilot and fitted with spools type **0, 0/1, 4, 4/8, 5.** The device **/R** has to be fitted when the pressure drop in the valve, verified on flow versus pressure diagrams, is lower than the minimum pilot pressure value.		
Recommended pneumatic pressure **(1)**	[bar]	Min = 2 Max = 12				

(1) filtered and lubricated air

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

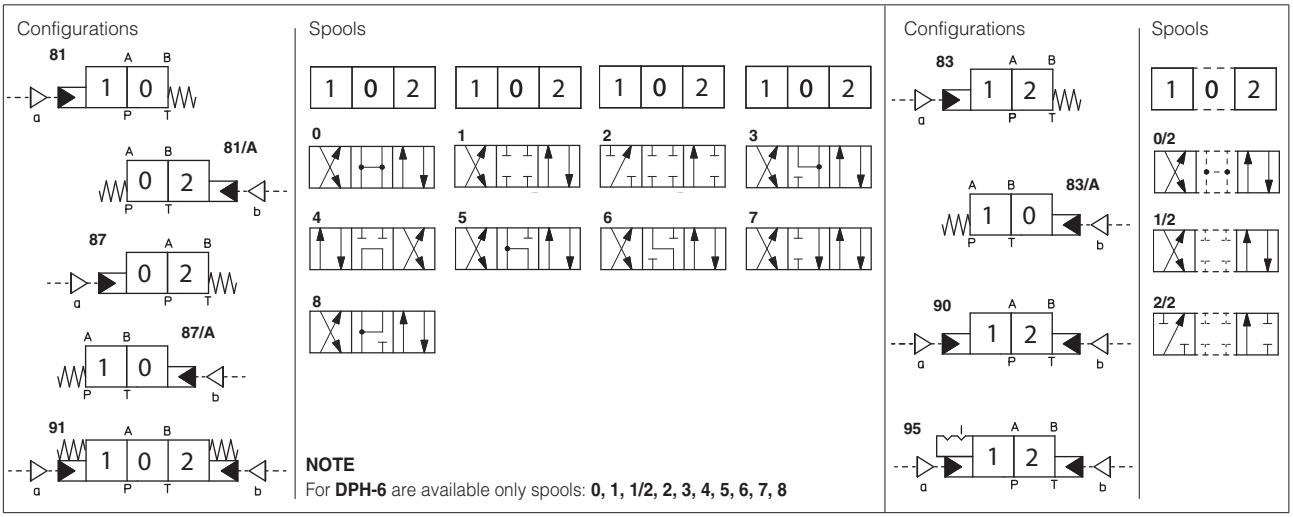
Assembly position / location	Any position for all valves except for type -*90 (without springs) that must be installed with horizontal axis if operated by impulses.		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
Compliance	RoHS Directive 2011/65/EU as last 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;		
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 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	

4 CONFIGURATIONS and SPOOLS of valves type DH-*, DK-*



NOTES
- 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** and **5** are also available as **1/1, 4/8** (only for DH-0) and **5/1.** 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** (only for DH-0) to limit valve internal leakages.

5 CONFIGURATIONS and SPOOLS of valves type DPH-*



NOTE
For **DPH-6** are available only spools: **0, 1, 1/2, 2, 3, 4, 5, 6, 7, 8**

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,** and **5** are also available as **1/1, 4/8** and **5/1** are properly shaped to reduce water-hammer shocks during the switching.

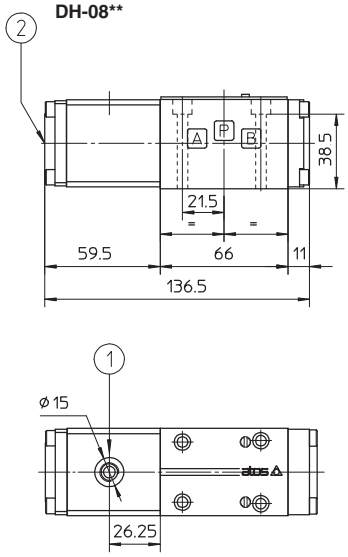
6 Q/Δp DIAGRAMS

DH-0	See note and diagrams on table E010 relating the DH* valve from which DH-0* are derivated
DK-1	See note and diagrams on table E025 relating the DKE valve from which DK-1* are derivated
DPH-2	See note and diagrams on table E085 relating the DPH*-2 valve from which DP-2* are derivated
DPH-4	See note and diagrams on table E085 relating the DPH*-4 valve from which DP-4* are derivated
DPH-6	See note and diagrams on table E085 relating the DPH*-6 valve from which DP-6* are derivated

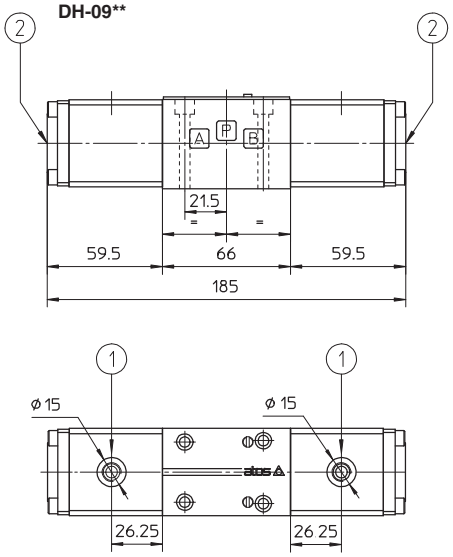
7 INSTALLATION DIMENSIONS of VALVES type DH and DK [mm]

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Fastening bolts: 4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm
Diameter of ports A, B, P, T: Ø = 7,5 mm (max)
Seals: 4 OR 108

DH-08**



DH-09**



Mass: 1,2 Kg

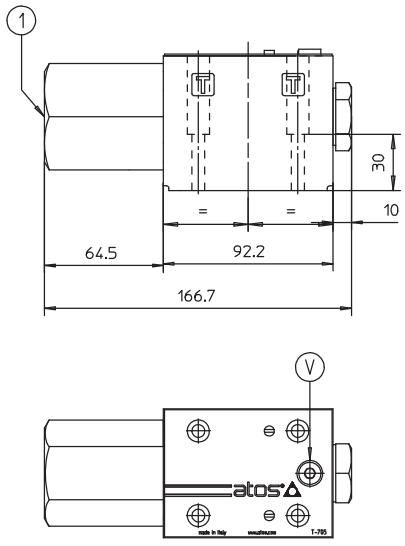
Mass: 1,6 Kg

① Pilot pressure port G1/8”
② Manual override

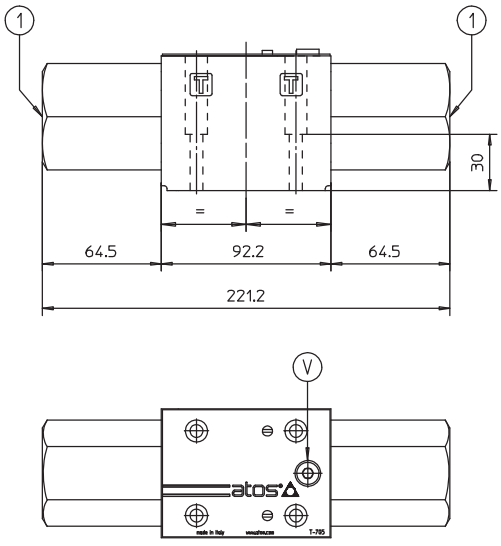
Mounting subplates: see tab. E010

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05
Fastening bolts: 4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Diameter of ports A, B, P, T: Ø = 11,2 mm (max)
Seals: 5 OR 2050

DK-18**



DK-19**



Mass: 3,4 Kg

Mass: 4,2 Kg

① Pilot pressure port G1/4”
Ⓥ Air bleed

Mounting subplates: see tab. E025

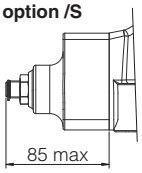
8 INSTALLATION DIMENSIONS of VALVES type DP [mm]

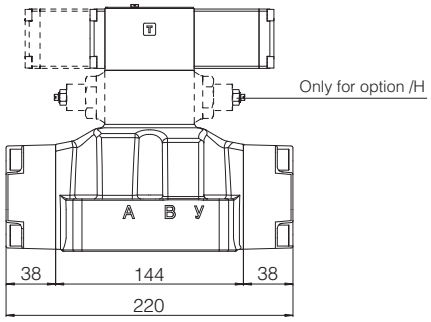
DPH-2

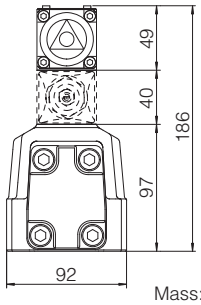
ISO 4401: 2005
Mounting surface: 4401-07-07-0-05

Fastening bolts:
4 socket head screws M10x50 class 12.9
Tightening torque = 70 Nm
2 socket head screws M6x45 class 12.9
Tightening torque = 15 Nm
Diameter of ports A, B, P, T : Ø = 20
Diameter of ports X,Y: Ø = 7 mm
Seals: 4 OR 130, 2 OR 2043

Stroke adjustment device for option /S







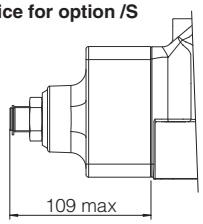
Mass: 11,5 Kg

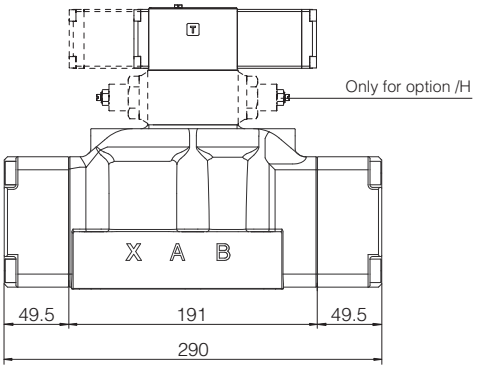
DPH-4

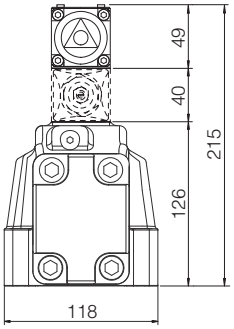
ISO 4401: 2005
Mounting surface: 4401-08-08-0-05

Fastening bolts:
6 socket head screws M12x60 class 12.9
Tightening torque = 125 Nm
Diameter of ports A, B, P, T: Ø = 24
Diameter of ports X,Y: Ø = 7 mm
Seals: 4 OR 4112, 2 OR 3056

Stroke adjustment device for option /S







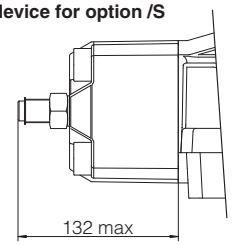
Mass: 18 Kg

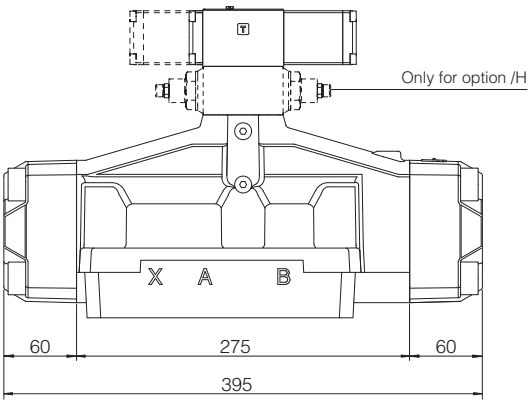
DPH-6

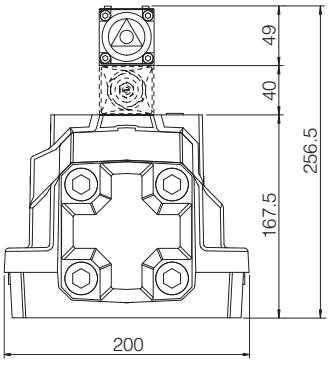
ISO 4401: 2005
Mounting surface: 4401-10-09-0-05

Fastening bolts:
6 socket head screws M20x80 class 12.9
Tightening torque = 600 Nm
Diameter of ports A, B, P, T: Ø = 34 mm
Diameter of ports X,Y: Ø = 7 mm
Seals: 4 OR 144, 2 OR 3056

Stroke adjustment device for option /S



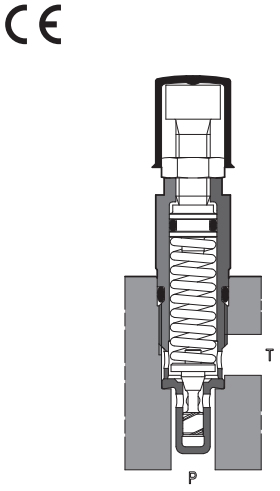




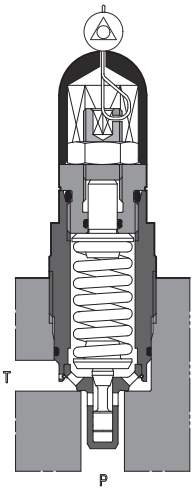
Mass: 39,5 Kg

Cartridge pressure relief valves type CART

screw-in mounting, direct operated



CART M-5/***



CART M-6/*/RS**

CART are screw-in, direct operated pressure relief valves.
They are used to limit the max pressure in the hydraulic systems or to protect part of the circuit from overpressure.
They are available in six sizes for different flow and pressure ranges.

The cartridge execution is specifically designed to reduce the dimension of blocks and manifolds, without penalizing the functional characteristics.

Option **RS**, conforms to the Machine Directive (2006/42/CE), with factory preset and lead sealed regulation.
The factory pressure setting required by the costumer corresponds to the valve's cracking pressure.

Max flow: **150 l/min**
Max pressure: up to **420 bar**

1 MODEL CODE

CART	M-6	/	420	/	RS	/	*	**	/	*

CART — Screw-in relief cartridges

M-6 — Size:
M-3 = G1/2 **(1)**
M-4 = M14x1
M-5 = M20x1,5
M-6 = M33x1,5 **(1)**
ARE-15 = M32x1,5
ARE-20 = M35x1,5 **(1)**

420 — Max pressure:
see section 3

RS — Options:
see section 5 for options availability and combination:
R = leak free execution **(2)**
RS = leak free execution plus lead sealed regulation conforming to 2006/42/CE

Manual override only for standard and /R option **(3)**:
V = regulating handwheel
VF = regulating knob
VS = regulating knob with safety locking

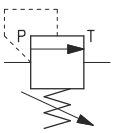
***** — Only for RS option:
280 = factory pressure setting to be defined by the customer
min step: 1 bar - min pressure setting: 25 bar
(example 280 = 280 bar)

****** — Series number

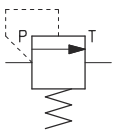
***** — Seals material, see section 4:
- = NBR
PE = FKM
BT = HNBR

For **PED** version see technical table CY010
(1) Available also in stainless steel execution, see technical table CW010
(2) Standard execution of CART M-4 and CART ARE-20 provides the leak free feature, then the /R is always present in the valve model code, with the exception in case of RS options
(3) For handwheel and knob features, see sections 7, 8. For their availability see section 5

2 HYDRAULIC SYMBOLS



CART
CART **/R



CART **/RS

3 HYDRAULIC CHARACTERISTICS

Valve model		CART M-3	CART M-4	CART M-5	CART M-6	CART ARE-15	CART ARE-20
Max pressure setting [bar]	**STANDARD**	50 100 210 350 420	100 210 350 420	50 100 210 250 350	50 100 210 350 500	15 50 75 150 250 350 420	50 100 210 315 400
	R				50 100 210 350 500	15 50 75 150 250 420	
	RS		220 270 350		220 270 330 350	150 190 230	
Pressure range [bar]	**STANDARD (1)**	4÷50 6÷100 7÷210 8÷350 15÷420	6÷100 7÷210 8÷350 15÷420	2÷50 3÷100 5÷210 7÷250 8÷350	2÷50 3÷100 8÷210 15÷350 15÷500	2÷15 3÷50 4÷75 8÷150 8÷250 8÷350 15÷420	3÷50 5÷100 6÷210 8÷315 10÷400
	R (1)				2÷50 3÷100 10÷210 15÷350 15÷500	2÷15 3÷50 4÷75 8÷150 8÷250 15÷420	
	RS (1)		210÷260 260÷300 300÷370		200÷250 250÷290 290÷350 310÷370	130÷170 170÷210 210÷250	
Max pressure on port T [bar]		50	50	50	50	50	50
Max flow [l/min]	**STANDARD**	2,5	15	35	40	75	120
	RS	2,5	15	50	60	100	150

(1) The values correspond to the min and max regulation of the valve's craking pressure

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

Assembly position	Any position		
Compliance	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	ISO 4406 class 20/18/15 NAS 1638 class 9, see also filter section 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	

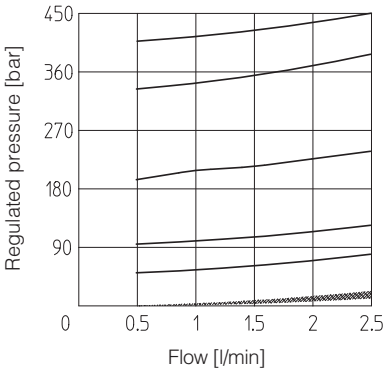
5 OPTIONS AVAILABILITY

Valve model		CART M-3	CART M-4	CART M-5	CART M-6	CART ARE-15	CART ARE-20
Option	**/R**		STANDARD		●	●	STANDARD
	/RS		●		●	●	
	/V	●			●	●	●
	/VF				●	●	
	/VS				●	●	
Combinated option **(1)**	**/RV**				●	●	●
	/RVF				●	●	
	/RVS				●	●	

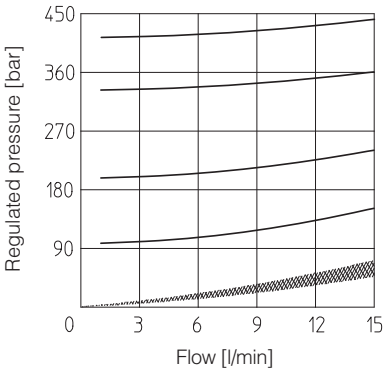
(1) RV = leak free and regulating handwheel
RVF = leak free and regulating knob
RVS = leak free and regulating knob with safety lock

6 REGULATED PRESSURE VERSUS FLOW DIAGRAMS (based on mineral oil ISO VG 46 at 50°C)

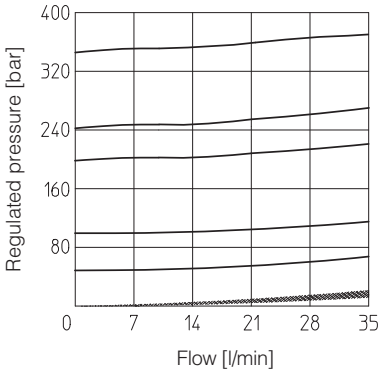
CART M-3



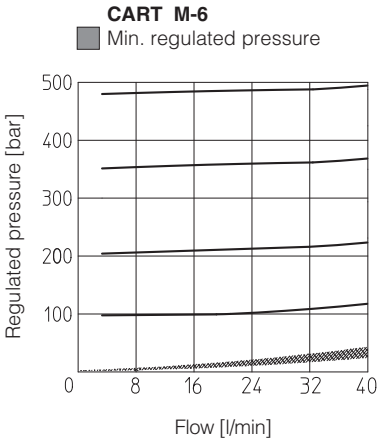
CART M-4 **/R



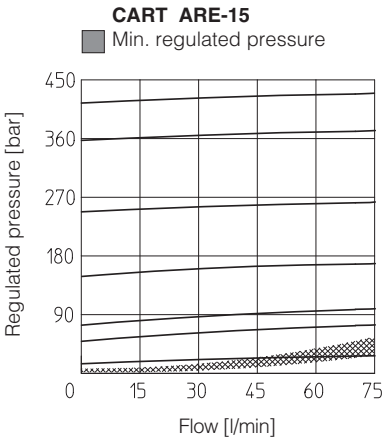
CART M-5



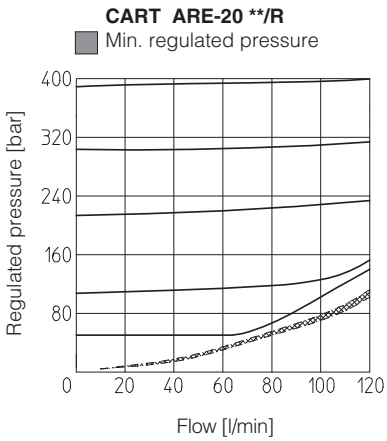
CART M-6



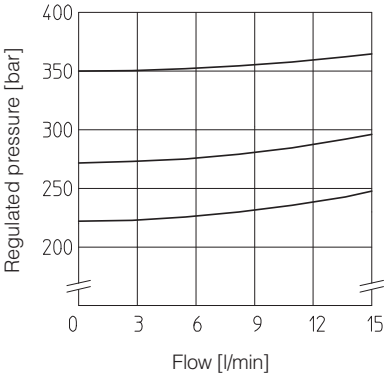
CART ARE-15



CART ARE-20 **/R



CART M-4 **/RS



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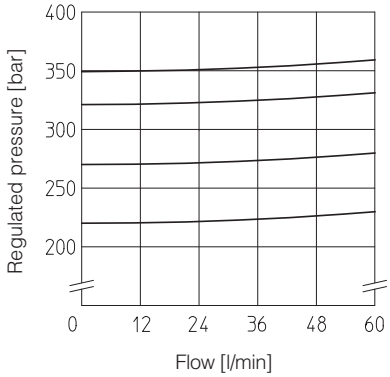
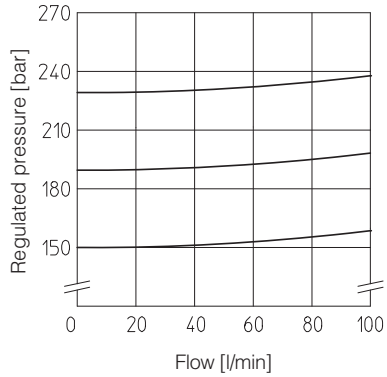
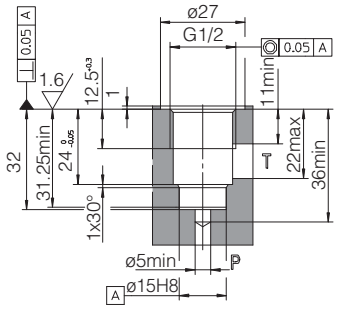


CART ARE-15 **/RS

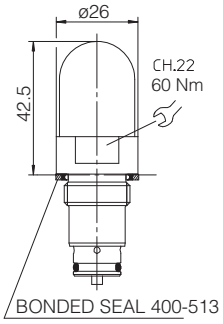


7 CAVITY AND DIMENSIONS FOR CART M-3, M-4 AND M-5 [mm]

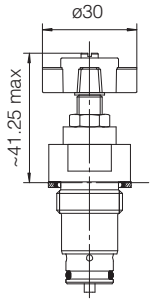
CART M-3



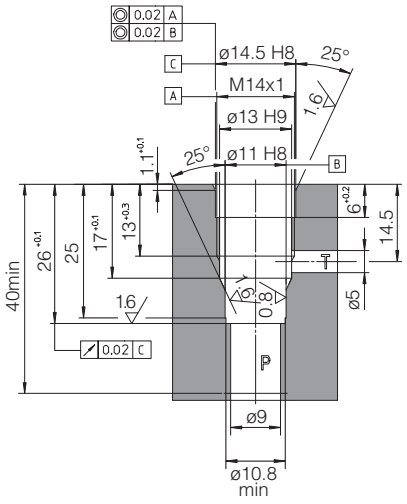
Standard



Option /V

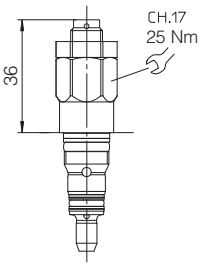


CART M-4

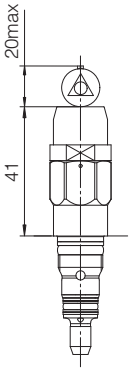


Cavity drawing not in scale
with the cartridge

Standard

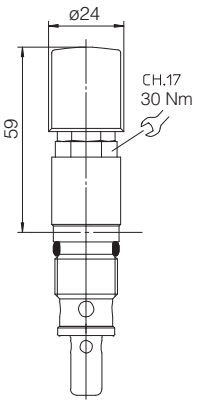


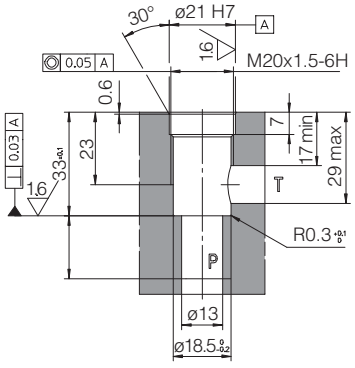
Option /RS



CART M-5

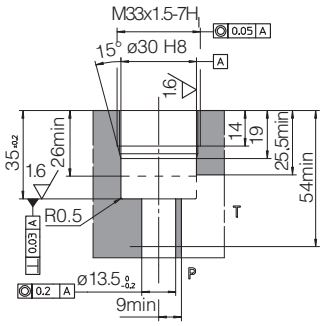
Standard



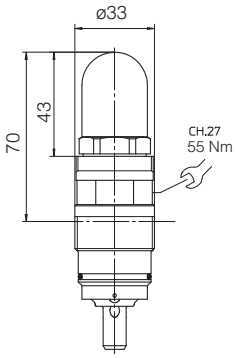


8 CAVITY AND DIMENSIONS FOR CART M-6, CART ARE-15 AND ARE-20 [mm]

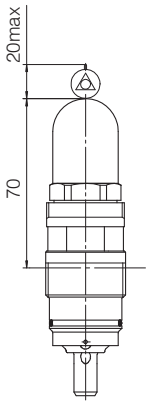
CART M-6



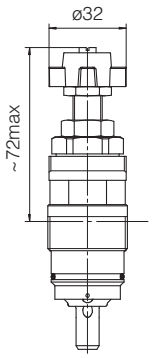
Standard



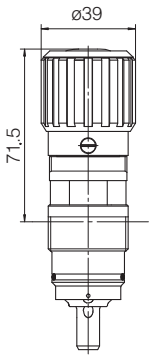
Option /RS



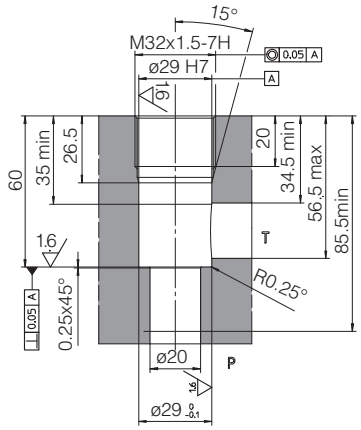
Option /V



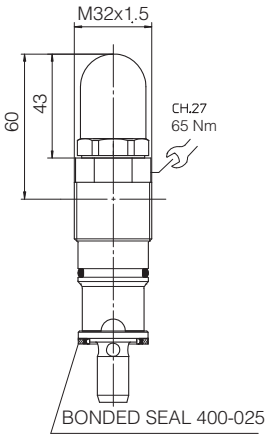
Option /VF /VS



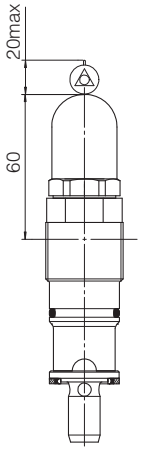
CART ARE-15



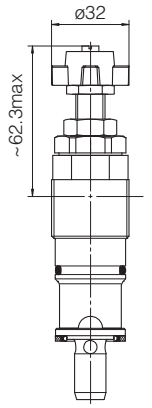
Standard



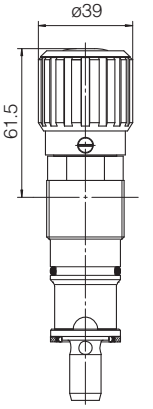
Option /RS



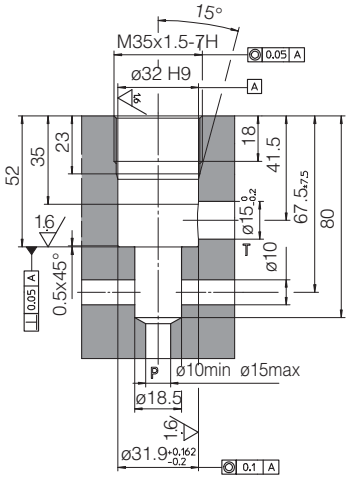
Option /V



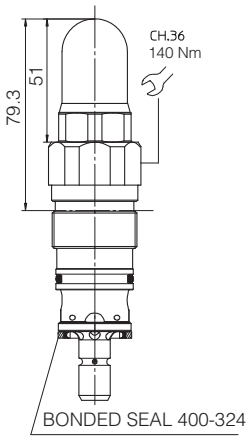
Option /VF /VS



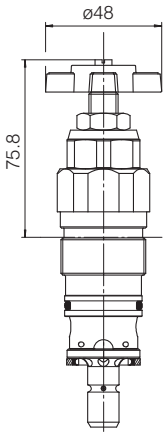
CART ARE-20



Standard

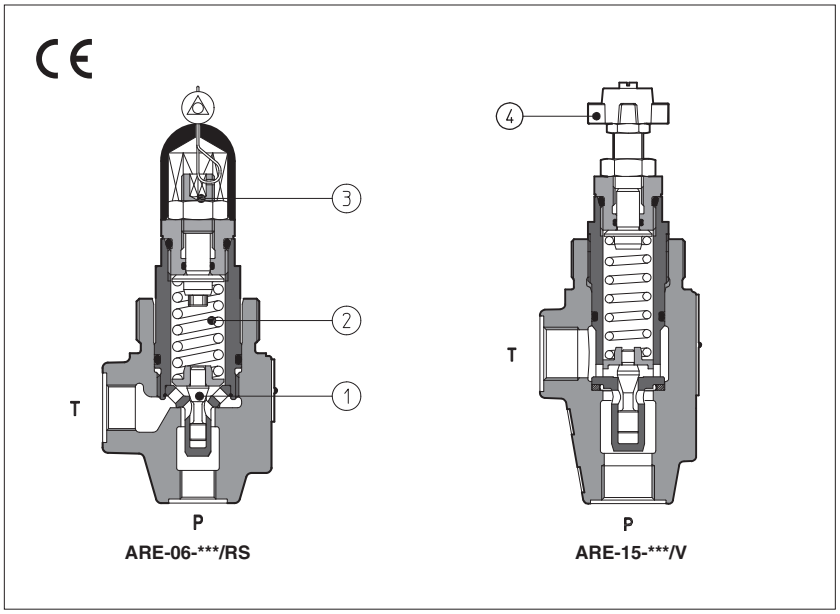


Option /V



Pressure relief valves type ARE

direct operated, in line mounting



ARE-06-*/RS** **ARE-15-***/V**

ARE are poppet type, directed operated pressure relief valves, with threaded ports for in line mounting.

The flow P→T is permitted when pressure force acting on the poppet ① overcomes the force of the spring ②.

Regulation is operated by means of a screw ③ or optionally by means of a handwheel ④ acting on the spring.

Clockwise rotation increases the pressure.

These valves are available in two sizes, with port P=G 1/4" or G 1/2".

Option **RS**, conforms to the Machine Directive (2006/42/CE), with factory preset and lead sealed regulation.
The factory pressure setting required by the costumer corresponds to the valve's cracking pressure.

Max flow: **100 l/min**:
Max pressure: ARE-06 up to **500 bar**
ARE-15 up to **420 bar**

1 MODEL CODE

ARE	-	06	/	350	/	RS	/	*	**	/	*

ARE = pressure relief valve with thread connections
Available also in cartridge execution, see tab. C010

Size:
06 = port P G 1/4"
15 = port P G 1/2"

Max pressure:
see section 3

Options **(2)**:
R = leak free execution **(2)**
RS = leak free execution plus lead sealed regulation conforming to 2006/42/CE

Manual override only for standard and /R option:
V = regulating handwheel
VF = regulating knob
VS = regulating knob with safety locking

Only for RS options:
280 = factory pressure setting to be defined depending to the customer requirement (example 280 = 280 bar)

Series number

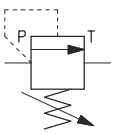
Seals material, see section 4:
- = NBR
PE = FKM
BT = HNBR

For **PED** version see technical table CY020

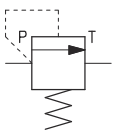
(1) Possible combined options:
RV = reduced leakages and regulating handweel
RVF = reduced leakages and regulating knob
RVS = reduced leakages and regulating knob with safety locking

2 HYDRAULIC SYMBOLS

Hydraulic symbol



ARE-06
ARE-15



ARE-06 **/RS
ARE-15 **/RS

3 HYDRAULIC CHARACTERISTICS

Valve model		ARE-06					ARE-15						
Max pressure setting [bar]	**Standard**	50	100	210	350	500	15	50	75	150	250	350	420
	/R	50	100	210	350	500	15	50	75	150	250		420
	/RS	220	270	330	350				150	190	230		
Pressure range [bar]	**Standard**	2÷50	3÷100	10÷210	15÷350	30÷500	2÷15	3÷50	4÷75	8÷150	8÷250	30÷350	30÷420
	/R (1)	2÷50	3÷100	10÷210	15÷350	30÷500	2÷15	3÷50	4÷75	8÷150	8÷250		30÷420
	/RS (1)	200÷250	250÷290	290÷350	310÷370			130÷170	170÷210	210÷250			
Max pressure port T [bar]		50					50						
Max flow [l/min]	**Standard, /R**	40					75						
	/RS	60					100						

(1) The values correspond to the min and max regulation of the valve's craking pressure

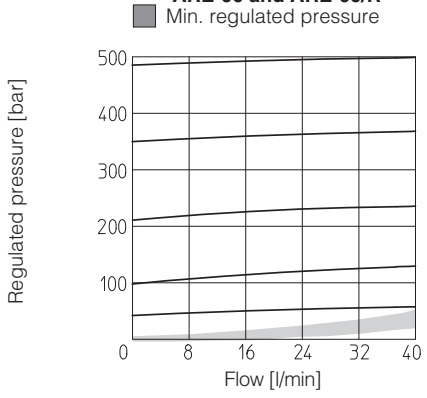
4 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position	Any position
Compliance	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 ÷ +60°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
Fluid contamination class	ISO 4406 class 21/19/16 NAS 1638 class 10, in line filters of 25 μm (β25 ≥75 recommended)

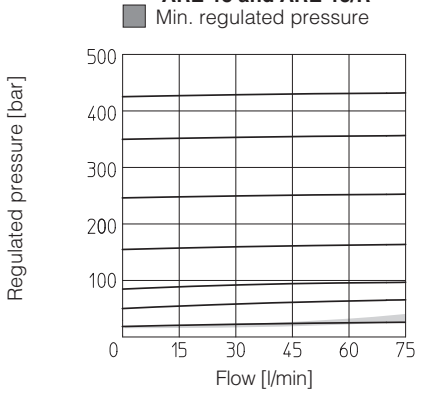
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

5 REGULATED PRESSURE VERSUS FLOW DIAGRAMS (based on mineral oil ISO VG 46 at 50°C)

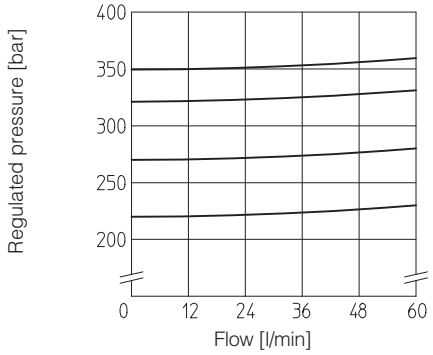
ARE-06 and ARE-06/R



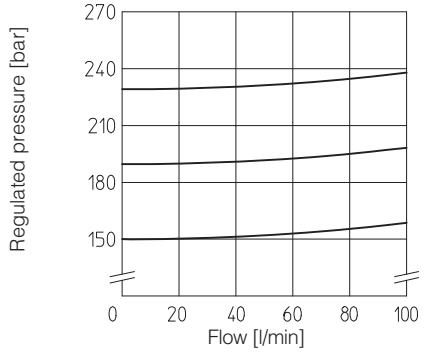
ARE-15 and ARE-15/R



ARE-06 /RS



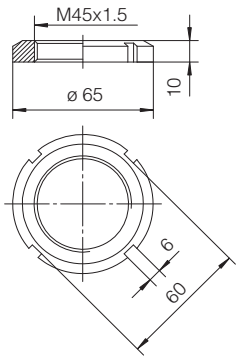
ARE-15 /RS

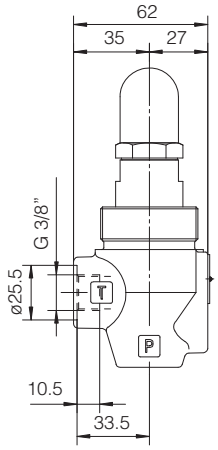


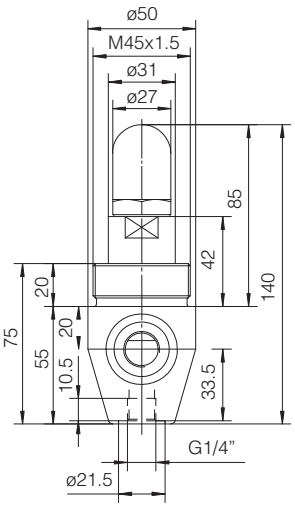
6 DIMENSIONS [mm]

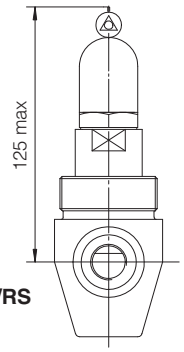
ARE-06

P = INLET PORT G 1/4”
T = OUTLET PORT G 3/8”
Locking ring for fastening the valve.
Model code: SP-6-RE-310030

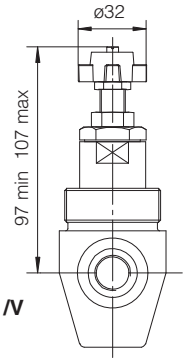




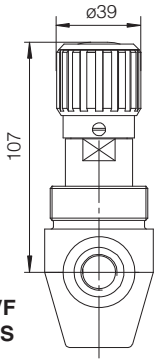




Option /RS



Option /V

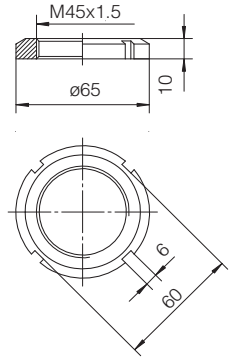


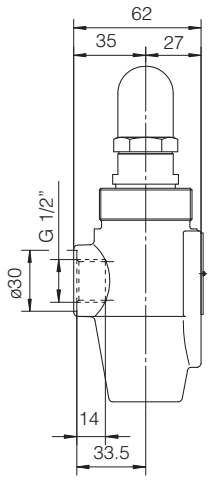
Option /VF /VS

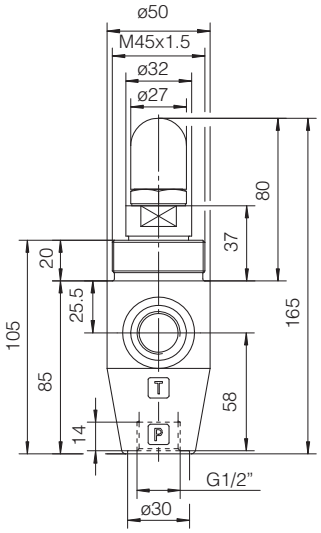
Mass: 1 Kg

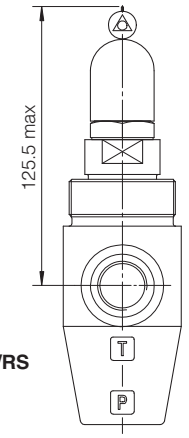
ARE-15

P = INLET PORT G 1/2”
T = OUTLET PORT G 1/2”
Locking ring for fastening the valve.
Model code: SP-6-RE-310030

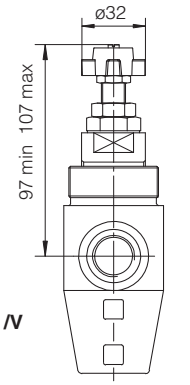




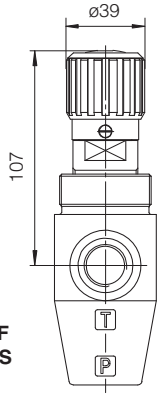




Option /RS



Option /V



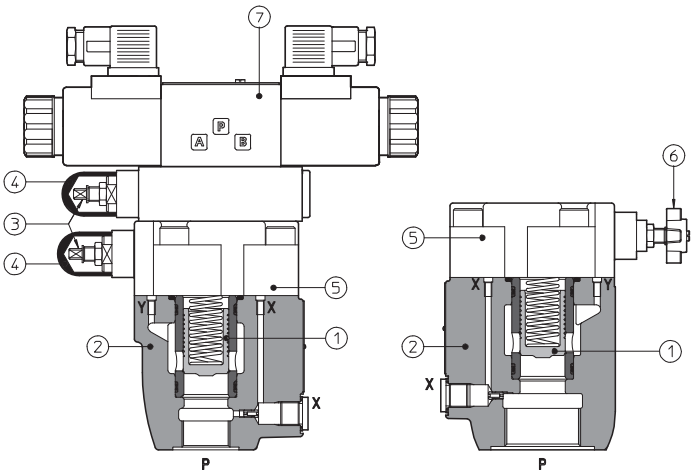
Option /VF /VS

Note:
For handwheel features, see technical table K150.

Mass: 1,3 Kg

Pressure relief valves type ARAM

two stage, in line mounting - G 3/4" and G 1¼" threaded ports



ARAM-20/20...-E **ARAM-32..../V**

ARAM are two stage pressure relief valves with balanced poppet, designed with threaded ports for in-line mounting.

In standard versions the piloting pressure of the poppet ① of the main stage ② is regulated by means of a grub screw ③ protected by cap ④ installed in the cover ⑤.

Optional versions with setting adjustment by handwheel ⑥ instead of the grub screw are available on request.
Clockwise rotation increases the pressure.

ARAM can be equipped with a pilot solenoid valve ⑦ for venting or for different pressure setting, type:

- DHI for AC and DC supply, with **cURus** certified solenoids
- DHE for AC and DC supply, high performances with **cURus** certified solenoids

Threaded ports: **G 3/4", G 1¼"**
Max flow: **350, 500 l/min**
Max pressure up to **350 bar**

1 MODEL CODE

ARAM	-	20	/	20	/	210	/	100/100	/	V	-	I	X	24DC	**	/	*

ARAM = pressure relief valve threated port connections

Size:
20= port P - G 3/4"
32= port P - G 1¼"

Setting pressure and venting option **(1)**:
- = one setting pressure without option
10 = one setting pressure with venting, with de-energized solenoid
11 = one setting pressure with venting, with energized solenoid
20 = two setting pressure with venting, with de-energized solenoid
21 = two setting pressure with venting, with energized solenoid
22 = two setting pressure without venting
32 = three setting pressure without venting

Setting: see section 3 for available setting

Pressure range of second/third setting **(1)**:
50 = 4÷50 bar **100** = 6÷100 bar
210 = 7÷210 bar **350** = 8÷350 bar

Options, see section 5
E V WP Y

Pilot valve **(1)**:
I = DHI for AC and DC supply, with **cURus** certified solenoids
E = DHE for AC and DC supply, high performances with **cURus** certified solenoids

X = without connector **(1):**
See section 6 for available connectors, to be ordered separately
-00 = solenoid valve without coils (for -I)
-00-AC = AC solenoid valve without coils (for -E)
-00-DC = DC solenoid valve without coils (for -E)

Voltage code, see section 7 **(1)**:

Series number

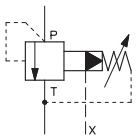
Seals material, see section 4:
- = NBR
PE = FKM
BT = HNBR

For **PED** version see technical table CY045

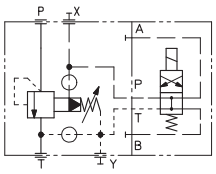
(1) Only for ARAM with solenoid valve for venting and/or for the selection of the setting pressure.

2 HYDRAULIC SYMBOL

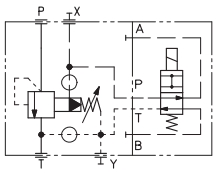
ARAM



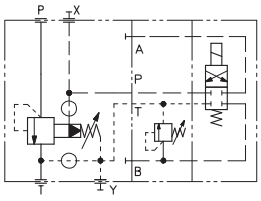
ARAM-/10**

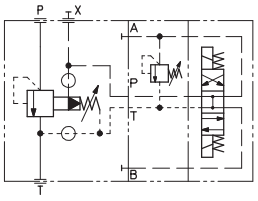


ARAM-/11**

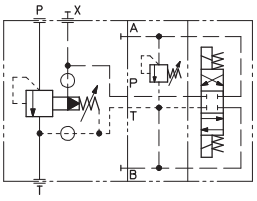


ARAM-/22**

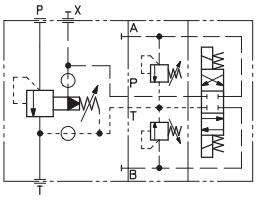




ARAM-/20**



ARAM-/21**



ARAM-/32**

3 HYDRAULIC CHARACTERISTICS

Valve model	**ARAM-20**	**ARAM-32**
Setting [bar]	50; 100; 210; 350	
Pressure range [bar]	4÷50; 6÷100; 7÷210; 8÷350	
Max pressure [bar]	ports P, X = 350 Ports T, Y = 210 (without pilot solenoid valve) For version with pilot solenoid valve, see technical tables E010 and E015	
Max flow [l/min]	350	500

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

Assembly position	Any position		
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		
Fluid contamination class	ISO 4406 class 21/19/16 NAS 1638 class 10, in line filters of 25 µm (β25 ≥75 recommended)		
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	

4.1 Coils characteristics (for ARAM with pilot solenoid valve)

Insulation class	DHI pilot	**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
	DHE pilot	**H** (180°C) for DC coils **F** (155°C) for AC coils	
Protection degree to 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 7	
Supply voltage tolerance		± 10%	
Certification		**cURus** North American standard	

5 OPTIONS

/E = external pilot
/V = regulating handwheel instead of grub screw protected by cap (for handwheel features, see table K150)
/WP = prolunged manual override protected by rubber cap (only for ARAM with pilot solenoid valve)
/Y = external drain (only for ARAM with pilot solenoid valve)

6 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 FOR ARAM WITH SOLENOID VALVE

The connectors must be ordered separately

Code of connector	Function
666	Connector IP-65, suitable for direct connection to electric supply source
667	As 666 connector IP-65 but with built-in signal led, suitable for direct connection to electric supply source

For other available connectors see tab. E010 and K500

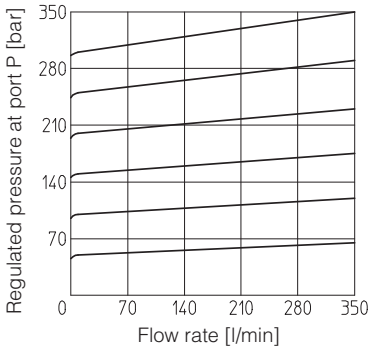
7 ELECTRIC FEATURES FOR AGAM WITH SOLENOID VALVE

Solenoid valve type	External supply nominal voltage ± 10% (1)		**Voltage code**	Type of connector	Power consumption **(3)** DHI	DHE	Code of spare coil DHI	Colour of coil label DHI	Code of spare coil DHE
DHI DHE	DC	12 DC 24 DC 110 DC 220 DC	**12 DC** **24 DC** **110 DC** **220 DC**	666 or 667	33 W	30 W	COU-12DC COU-24DC COU-110DC COU-220DC	green red black black	COE-12DC COE-24DC COE-110DC COE-220DC
	AC	110/50 AC **(2)** 115/60 AC 120/60 AC 230/50 AC **(2)** 230/60 AC	**110/50/60 AC** **115/60 AC (5)** **120/60 AC (6)** **230/50/60 AC** **230/60 AC**	666 or 667	60 VA - 60 VA 60 VA 60 VA	58 VA 80 VA - 58 VA 80 VA	COI-110/50/60AC - COI-120/60AC COI-230/50/60AC COI-230/60AC	yellow - white light blue silver	COE-110/50/60AC COE-115/60AC - COE-230/50/60AC COE-230/60AC

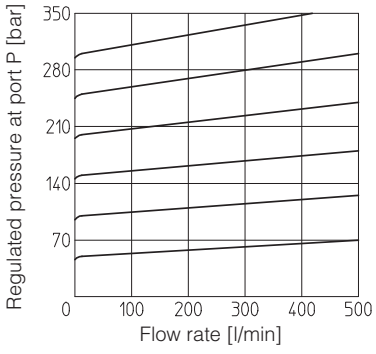
(1) For other supply voltages available on request see technical tables E010, E015.
(2) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷ 15% and the power consumption is 55 VA (DHI) and 58 VA
(3) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(4) When solenoid is energized, the inrush current is approx 3 times the holding current.
(5) Only for DHE
(6) Only for DHI

8 REGULATED PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C

ARAM-20

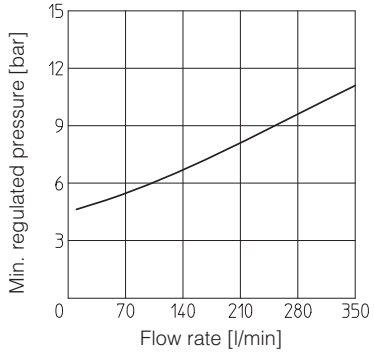


ARAM-32

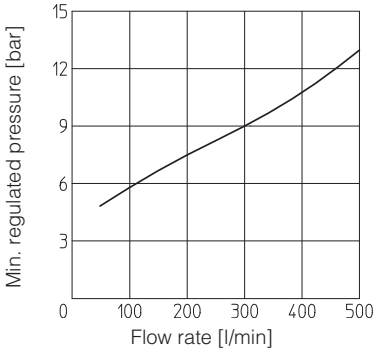


9 MINIMUM PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C

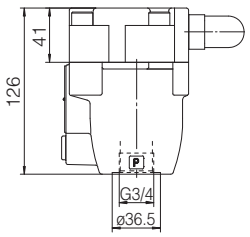
ARAM-20

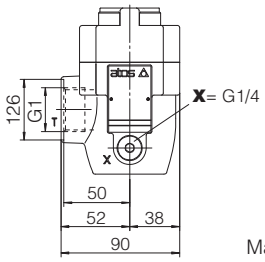


ARAM-32

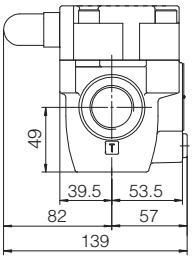


ARAM-20

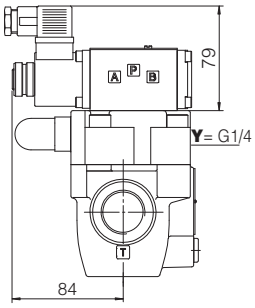




Mass: 3,9 Kg

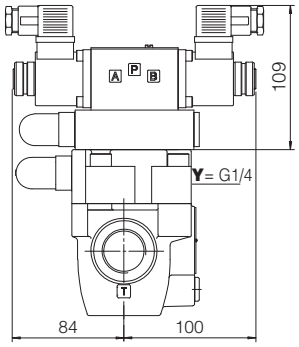


X = port connection for external pilot
Y = port connection for external drain



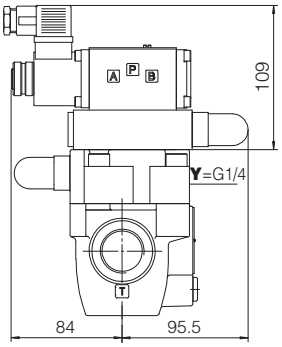
ARAM-20/10/-IX**
ARAM-20/11/-IX**

Mass: 5,4 Kg



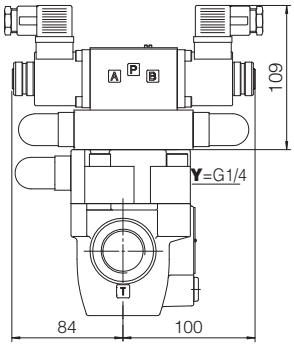
ARAM-20/20/-IX**
ARAM-20/21/-IX**

Mass: 7,1 Kg



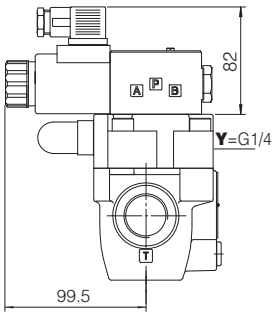
ARAM-20/22/-IX**

Mass: 6,8 Kg



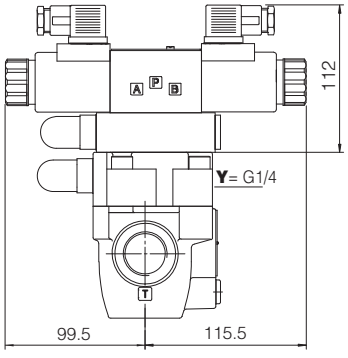
ARAM-20/32/-IX**

Mass: 7,4 Kg



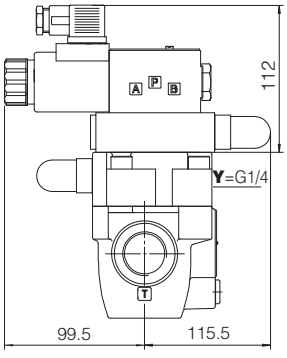
ARAM-20/10/-EX**
ARAM-20/11/-EX**

Mass: 5,7 Kg



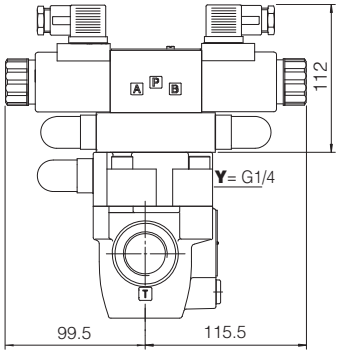
ARAM-20/20/-EX**
ARAM-20/21/-EX**

Mass: 7,7 Kg



ARAM-20/22/-EX**

Mass: 7,2 Kg

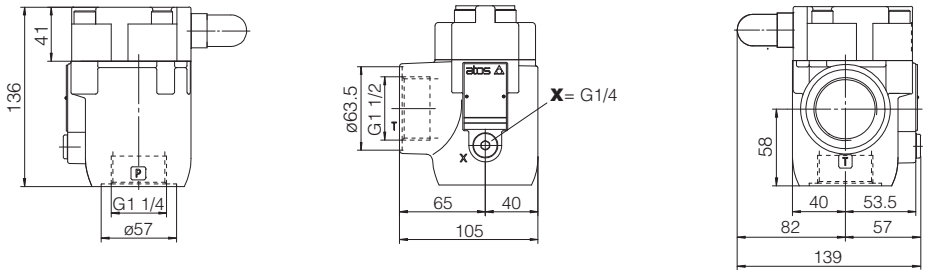


ARAM-20/32/-EX**

Mass: 8 Kg

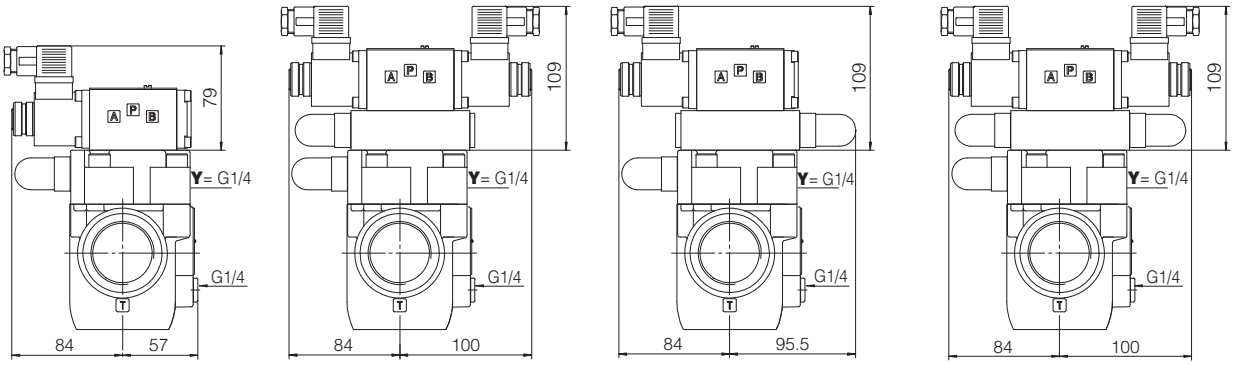
Overall dimensions refer to valves with connectors type 666

ARAM-32



X = port connection for external pilot
Y = port connection for external drain

Mass: 4,7 Kg



ARAM-32/10/-IX**
ARAM-32/11/-IX**

Mass: 6,2 Kg

ARAM-32/20/-IX**
ARAM-32/21/-IX**

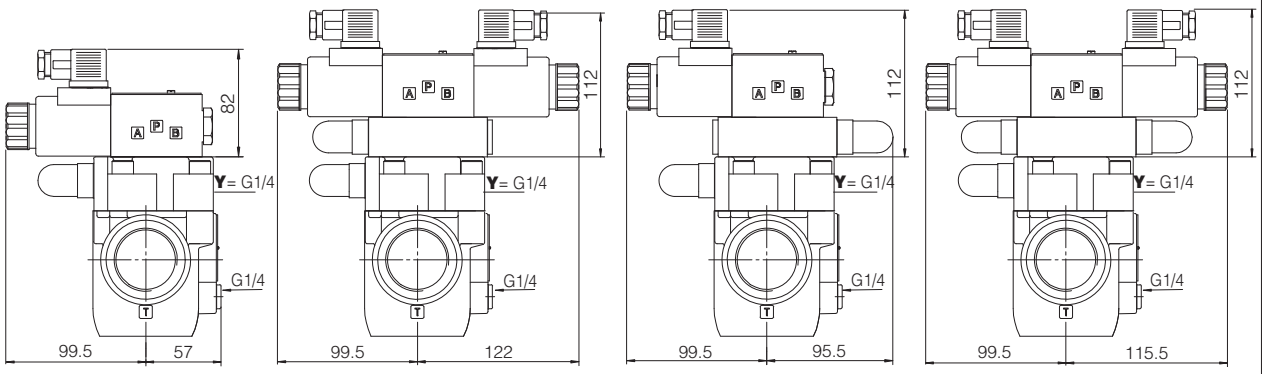
Mass: 7,9 Kg

ARAM-32/22/-IX**

Mass: 7,6 Kg

ARAM-32/32/-IX**

Mass: 8,2 Kg



ARAM-32/10/-EX**
ARAM-32/11/-EX**

Mass: 6,5 Kg

ARAM-32/20/-EX**
ARAM-32/21/-EX**

Mass: 8,5 Kg

ARAM-32/22/-EX**

Mass: 7,9 Kg

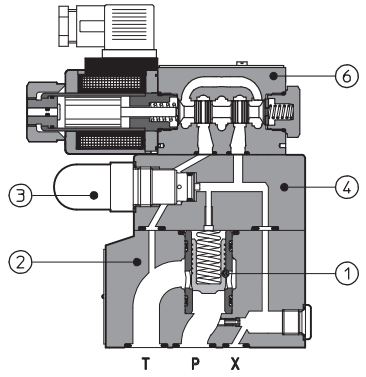
ARAM-32/32/-EX**

Mass: 8,8 Kg

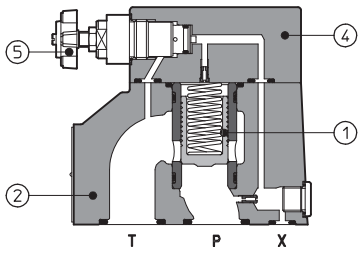
Overall dimensions refer to valves with connectors type 666

Pressure relief valves type AGAM

two stage, subplate mounting - ISO 6264 size 10, 20 and 32



AGAM-10/11...-E



AGAM-20/..../V

AGAM are two stage pressure relief valves with balanced poppet, designed to operate in oil hydraulic systems.

In standard versions the piloting pressure of the poppet ① of the main stage ② is regulated by means of a grub screw protected by cap ③ in the cover ④.

Optional versions with setting adjustment by handwheel ⑤ instead of the grub screw are available on request.

Clockwise rotation increases the pressure.

AGAM can be equipped with a pilot solenoid valve ⑥ for venting or for different pressure setting type:

- DHI for AC and DC supply, with **cURus** certified solenoids
- DHE for AC and DC supply, high performances with **cURus** certified solenoids

Mounting surface: **ISO 6264 size 10, 20** and **32**
Max flow: **200, 400** and **600 l/min**
Max pressure up to **350 bar**

1 MODEL CODE

AGAM	-	20	/	20	/	210	/	100/100	/	V	-	I	X	24DC	**	/	*

AGAM = pressure relief valve subplate mounting

Size:
10 20 32

Setting pressure and venting option:
- = one setting pressure without option
10 = one setting pressure with venting, with de-energized solenoid
11 = one setting pressure with venting, with energized solenoid
20 = two setting pressure with venting, with de-energized solenoid
21 = two setting pressure with venting, with energized solenoid
22 = two setting pressure without venting
32 = three setting pressure without venting

Setting: see section 3 for available setting **(1)**

Pressure range of second/third setting **(1)**:
50 = 4÷50 bar
100 = 6÷100 bar
210 = 7÷210 bar
350 = 8÷350 bar

Options, see section 5
E V WP Y

Pilot valve **(1)**:
I = DHI for AC and DC supply, with **cURus** certified solenoids
E = DHE for AC and DC supply, high performances with **cURus** certified solenoids

X = without connector **(1):**
See section 7 for available connectors, to be ordered separately
-00 = solenoid valve without coils (for -I)
-00-AC = AC solenoid valve without coils (for -E)
-00-DC = DC solenoid valve without coils (for -E)

Voltage code, see section 8 **(1)**:

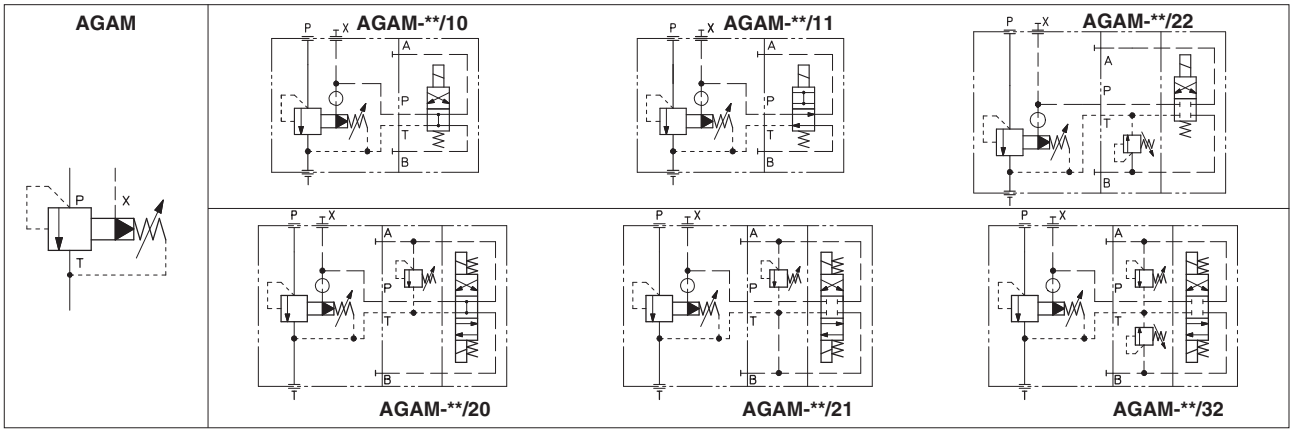
Series number

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

For **PED** version see technical table CY066

(1) Only for AGAM with solenoid valve for venting and/or for the selection of the setting pressure

2 HYDRAULIC SYMBOLS



3 HYDRAULIC CHARACTERISTICS

Valve model	AGAM-10	AGAM-20	AGAM-32
Setting [bar]	50; 100; 210; 350		
Pressure range [bar]	4÷50; 6÷100; 7÷210; 8÷350		
Max pressure [bar]	ports P, X = 350 Ports T, Y = 210 (without pilot solenoid valve) For version with pilot solenoid valve, see technical tables E010 and E015		
Max flow [l/min]	200	400	600

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

Assembly position	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
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 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	

4.1 Coils characteristics (for AGAM with pilot solenoid valve)

Insulation class	DHI pilot	**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
	DHE pilot	**H** (180°C) for DC coils **F** (155°C) for AC coils	
Protection degree to 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 7	
Supply voltage tolerance		± 10%	
Certification		**cURus** North American standard	

5 OPTIONS

/E = external pilot
/V = regulating handwheel instead of grub screw protected by cap (for handwheel features, see table K150)
/WP = prolunged manual override protected by rubber cap (only for AGAM with pilot solenoid valve)

6 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 FOR AGAM WITH SOLENOID VALVE

The connectors must be ordered separately

Code of connector	Function
666	Connector IP-65, suitable for direct connection to electric supply source
667	As 666 connector IP-65 but with built-in signal led, suitable for direct connection to electric supply source

For other available connectors, see tab. E010 and K500

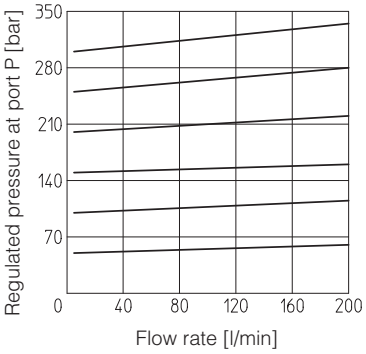
7 ELECTRIC FEATURES FOR AGAM WITH SOLENOID VALVE

Solenoid valve type	External supply nominal voltage ± 10% (1)		**Voltage code**	Type of connector	Power consumption **(3)** DHI	DHE	Code of spare coil DHI	Colour of coil label DHI	Code of spare coil DHE
DHI DHE	DC	12 DC 24 DC 110 DC 220 DC	**12 DC** **24 DC** **110 DC** **220 DC**	666 or 667	33 W	30 W	COU-12DC COU-24DC COU-110DC COU-220DC	green red black black	COE-12DC COE-24DC COE-110DC COE-220DC
	AC	110/50 AC **(2)** 115/60 AC 120/60 AC 230/50 AC **(2)** 230/60 AC	**110/50/60 AC** **115/60 AC (5)** **120/60 AC (6)** **230/50/60 AC** **230/60 AC**	666 or 667	60 VA - 60 VA 60 VA 60 VA	58 VA 80 VA - 58 VA 80 VA	COI-110/50/60AC - COI-120/60AC COI-230/50/60AC COI-230/60AC	yellow - white light blue silver	COE-110/50/60AC COE-115/60AC - COE-230/50/60AC COE-230/60AC

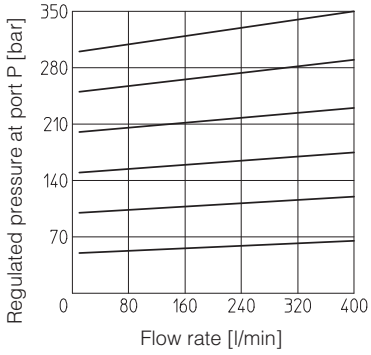
(1) For other supply voltages available on request see technical tables E010, E015.
(2) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷ 15% and the power consumption is 55 VA (DHI) and 58 VA
(3) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(4) When AC solenoid is energized, the inrush current is approx 3 times the holding current.
(5) Only for DHE
(6) Only for DHI

8 REGULATED PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C

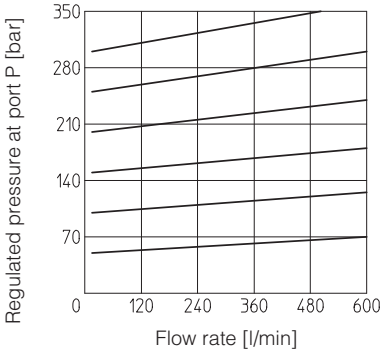
AGAM-10



AGAM-20

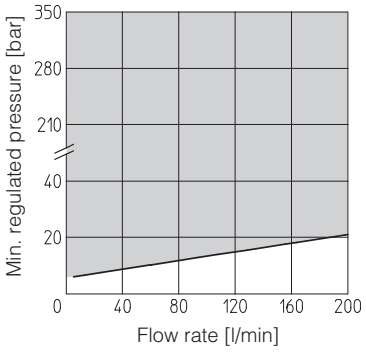


AGAM-32

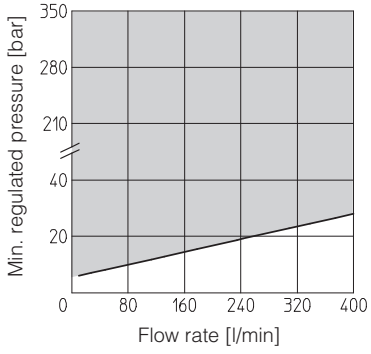


9 PERMISSIBLE RANGE (shared area) based on mineral oil ISO VG 46 at 50°C

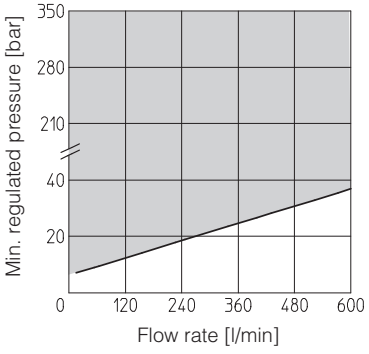
AGAM-10



AGAM-20

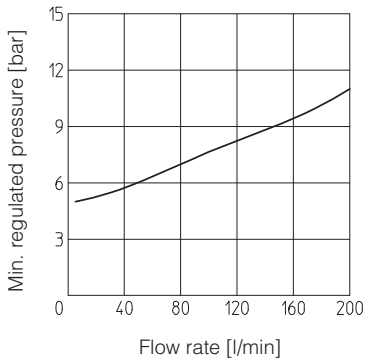


AGAM-32

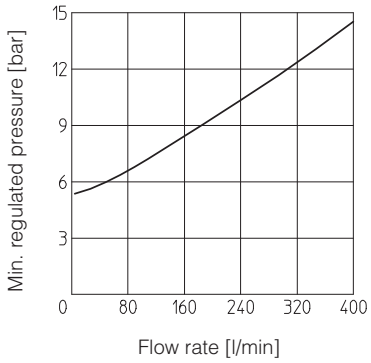


10 MINIMUM PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C

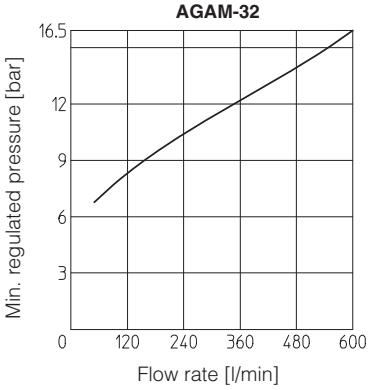
AGAM-10



AGAM-20

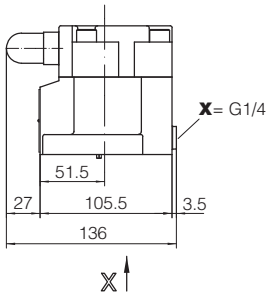


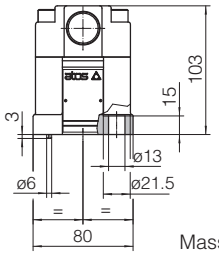
AGAM-32



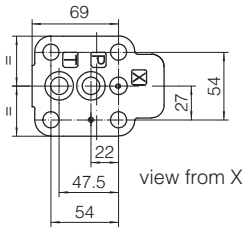
11 DIMENSIONS [mm]

AGAM-10

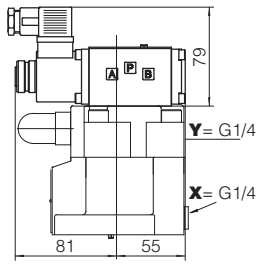




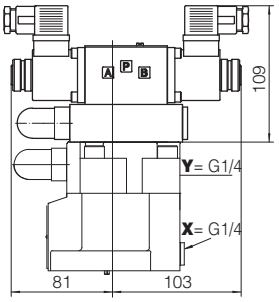
Mass: 3,6 Kg



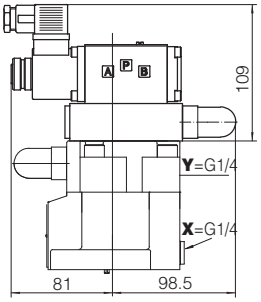
ISO 6264: 2007
Mounting surface: 6264-06-09-1-97
Fastening bolts:
4 socket head screws
M12x35 class 12.9
Tightening torque = 125 Nm
Seals: 2 OR 123; 1 OR 109/70
Ports P, T: Ø = 14,5 mm
Ports X: Ø = 3,2 mm



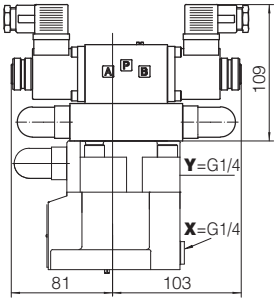
AGAM-10/10/-IX**
AGAM-10/11/-IX**
Mass: 5,1 Kg



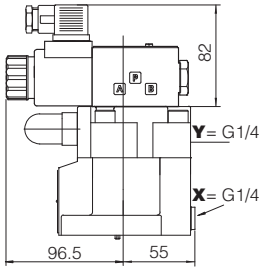
AGAM-10/20/-IX**
AGAM-10/21/-IX**
Mass: 6,2 Kg



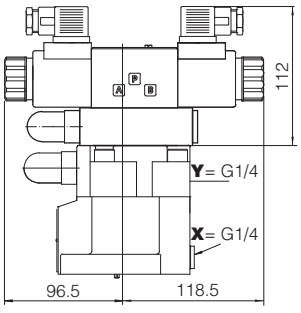
AGAM-10/22/-IX**
Mass: 5,9 Kg



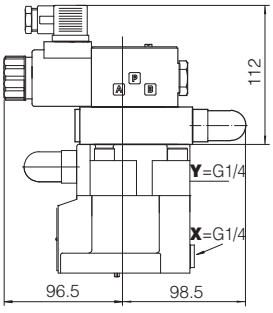
AGAM-10/32/-IX**
Mass: 6,3 Kg



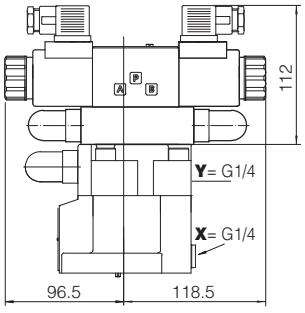
AGAM-10/10/-EX**
AGAM-10/11/-EX**
Mass: 5,1 Kg



AGAM-10/20/-EX**
AGAM-10/21/-EX**
Mass: 6,2 Kg



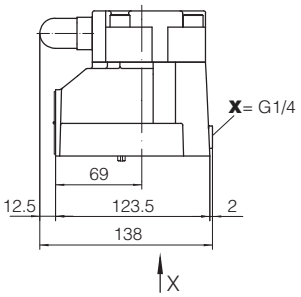
AGAM-10/22/-EX**
Mass: 5,9 Kg

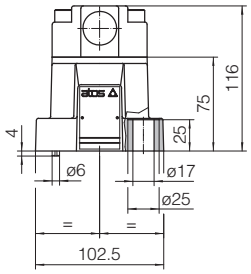


AGAM-10/32/-EX**
Mass: 6,3 Kg

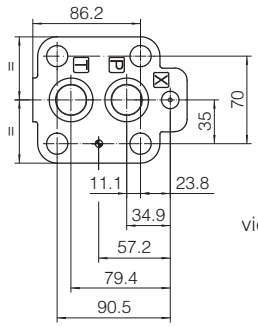
Overall dimensions refer to valves with connectors type 666

AGAM-20



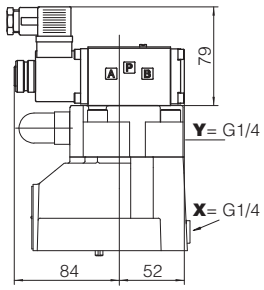


Mass: 4,8Kg



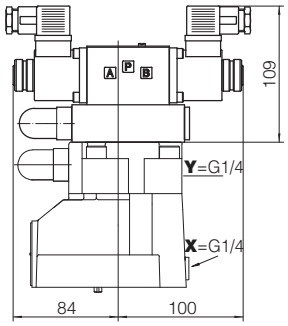
view from X

ISO 6264: 2007
Mounting surface: 6264-08-11-1-97
Fastening bolts:
4 socket head screws M16x50 class 12.9
Tightening torque = 300 Nm
Seals: 2 OR 4112; 1 OR 109/70
Ports P, T: Ø = 24 mm
Ports X: Ø = 3,2 mm



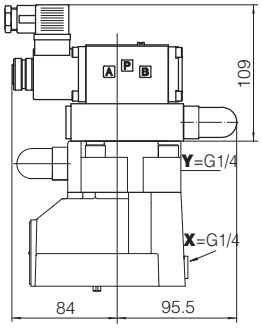
AGAM-20/10/-IX**
AGAM-20/11/-IX**

Mass: 6,3 Kg



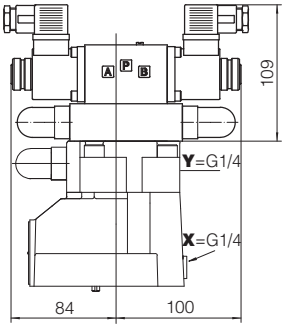
AGAM-20/20/-IX**
AGAM-20/21/-IX**

Mass: 7,4Kg



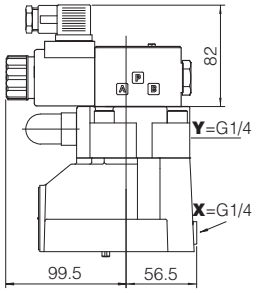
AGAM-20/22/-IX**

Mass: 7,1 Kg



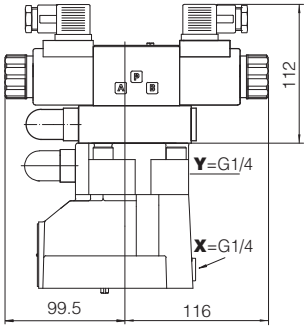
AGAM-20/32/-IX**

Mass: 7,5 Kg



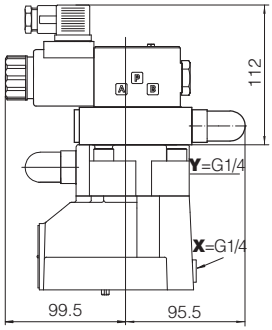
AGAM-20/10/-EX**
AGAM-20/11/-EX**

Mass: 6,3 Kg



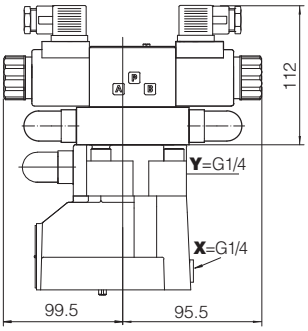
AGAM-20/20/-EX**
AGAM-20/21/-EX**

Mass: 7,4 Kg



AGAM-20/22/-EX**

Mass: 7,1 Kg

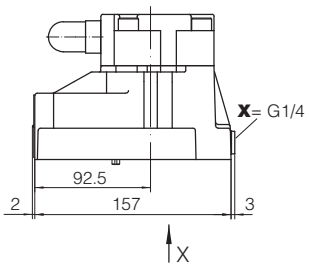


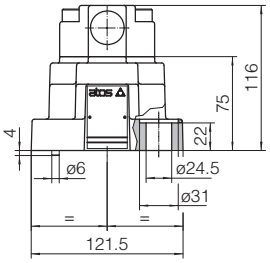
AGAM-20/32/-EX**

Mass: 7,5 Kg

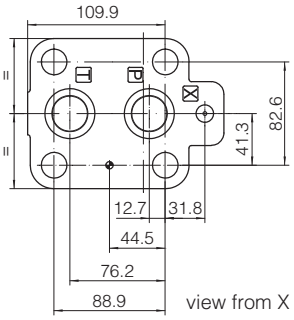
Overall dimensions refer to valves with connectors type 666

AGAM-32



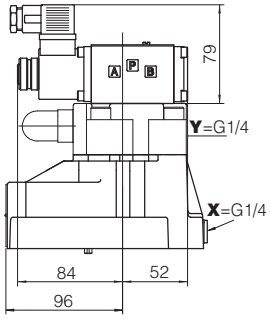


Mass: 6,2 Kg

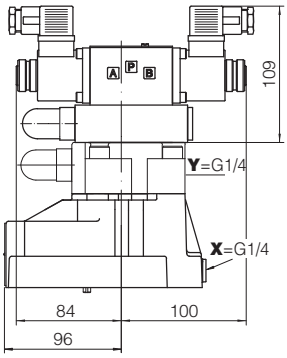


view from X

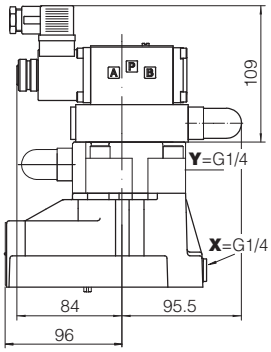
ISO 6264: 2007
Mounting surface: 6264-10-17-1-97 (with M20 fixing holes instead of standard M18)
Fastening bolts:
4 socket head screws
M20x60 class 12.9
Tightening torque = 600 Nm
Seals: 2 OR 4131; 1 OR 109/70
Ports P, T: Ø = 28,5 mm
Ports X: Ø = 3,2 mm



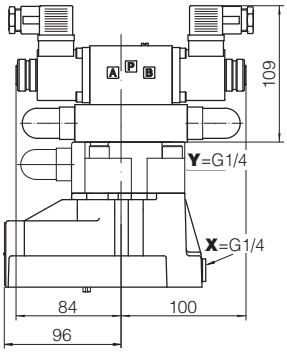
AGAM-32/10/-IX**
AGAM-32/11/-IX**
Mass: 7,7 Kg



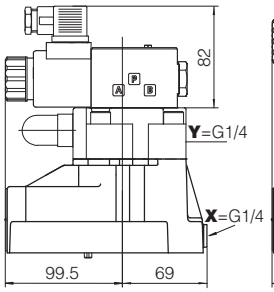
AGAM-32/20/-IX**
AGAM-32/21/-IX**
Mass: 8,8 Kg



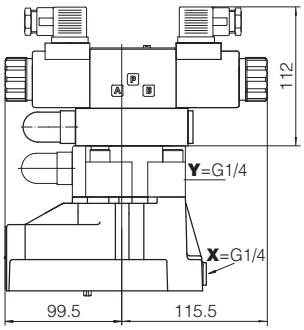
AGAM-32/22/-IX**
Mass: 8,5 Kg



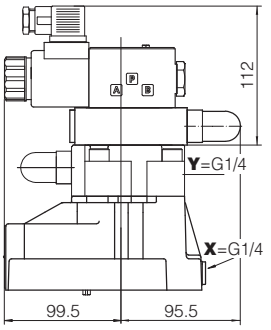
AGAM-32/32/-IX**
Mass: 8,9 Kg



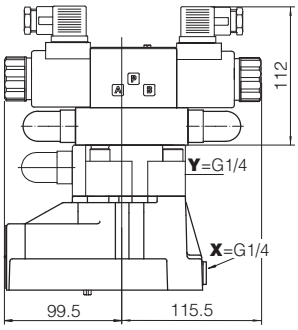
AGAM-32/10/-EX**
AGAM-32/11/-EX**
Mass: 7,7 Kg



AGAM-32/20/-EX**
AGAM-32/21/-EX**
Mass: 8,8 Kg



AGAM-32/22/-EX**
Mass: 8,5 Kg



AGAM-32/32/-EX**
Mass: 8,9 Kg

Overall dimensions refer to valves with connectors type 666

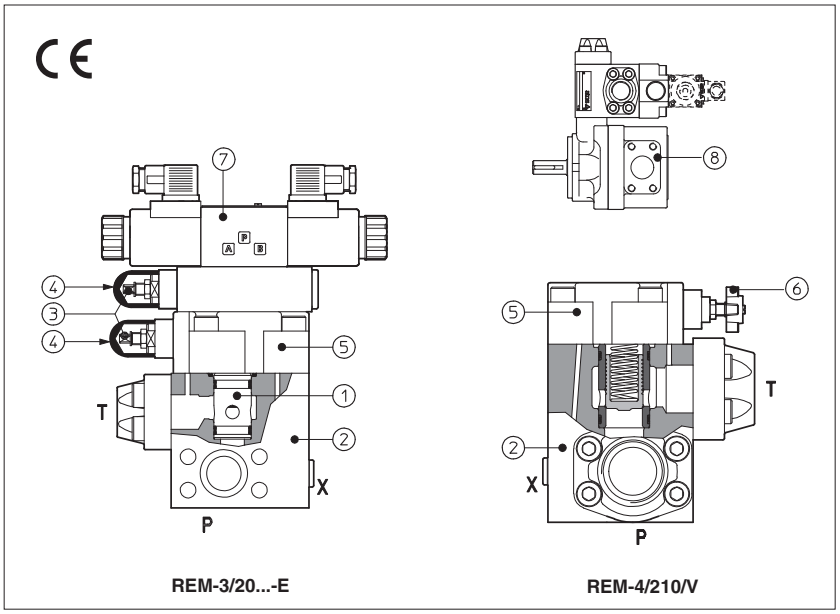
12 MOUNTING SUBPLATES

Valve	Subplate model	Port location	Ports			Ø Counterbore [mm]			Mass [Kg]
			P	T	X	P	T	X	
AGAM-10	BA-306	Ports P, T, X underneath;	G 1/2"	G 3/4"	G 1/4"	30	36,5	21,5	1,5
AGAM-20	BA-406		G 3/4"	G 3/4"	G 1/4"	36,5	36,5	21,5	3,5
	BA-506		G 1"	G 1"	G 1/4"	46	46	21,5	3,5
AGAM-32	BA-706		G 1 1/2"	G 1 1/2"	G 1/4"	63,5	63,5	21,5	6

The subplates are supplied with fastening bolts. For further details see table K280

Pressure relief valves type REM

two stage, flange mounting SAE 3/4", 1", 1¼"



REM-3/20...-E **REM-4/210/V**

REM are two stage pressure relief valves with balanced poppet and SAE flange connection, designed to operate in oil hydraulic systems.

They can be directly mounted with SAE flange attachments on the pumps outlet ports ⑧ and, in particular, on the PFE pumps (see tab. A005, A007).

In standard versions the piloting pressure of the poppet ① of the main stage ② is regulated by means of a grub screw ③ protected by cap ④ in the cover ⑤.

Optional versions with setting adjustment by handwheel ⑥ instead of the grub screw are available on request.

Clockwise rotation increases the pressure.

REM can be equipped with a venting solenoid valve ⑦ type:

- DHI for AC and DC supply, with **cURus** certified solenoids
- DHE for AC and DC supply, high performances, with **cURus** certified solenoids

Mounting surface:
SAE flange connection: **3/4", 1", 1¼"**
Max flow: **200, 400** and **600 l/min** respectively
Pressure up to **350 bar** (depending on models)

1 MODEL CODE

REM	-	4	/	20	210	/	100/100	/	V	-	I	X	24DC	**	/	*

REM = pressure relief valve SAE flange mounting

Size:
3 = SAE 3/4"
4 = SAE 1"
5 = SAE 1¼"

Setting pressure and venting option (1):
- = one setting pressure without option
10 = one setting pressure with venting, with de-energized solenoid
11 = one setting pressure with venting, with energized solenoid
20 = two setting pressure with venting, with de-energized solenoid
21 = two setting pressure with venting, with energized solenoid
22 = two setting pressure without venting
32 = three setting pressure without venting

Pressure range:
50 = 4÷50 bar;
100 = 6÷100 bar;
210 = 7÷210 bar;
350 = 8÷350 bar (only for REM-3)

Pressure range of second/third setting **(1)**:
50 = 4÷50 bar;
100 = 6÷100 bar;
210 = 7÷210 bar;
350 = 8÷350 bar (only for REM-3)

Options **(2)**:
WP = prolonged manual override protected by rubber cap (1)
V = regulating by handwheel instead of a grub screw protected by cap

Pilot valve **(1)**:
-I = DHI for AC and DC supply with **cURus** certified solenoids
-E = DHE for AC and DC supply, high performances with **cURus** certified solenoids

X = without connector **(1):**
See section 7 for available connectors, to be ordered separately
-00 = solenoid valve without coils (for -I)
-00-AC = AC solenoid valve without coils (for -E)
-00-DC = DC solenoid valve without coils (for -E)

Voltage code, see section 7

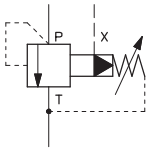
Series number

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

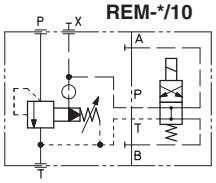
(1) Only for REM with solenoid valve for venting and/or for the selection of the setting pressure
(2) For handwheel features, see technical table K150

2 HYDRAULIC CHARACTERISTICS

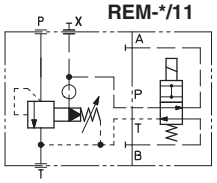
REM



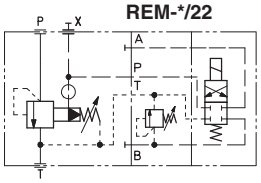
REM-*/10

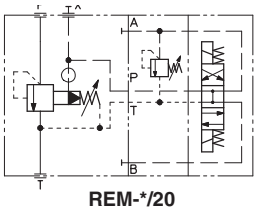


REM-*/11

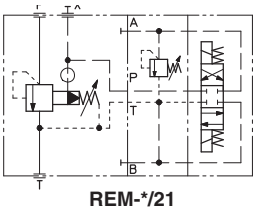


REM-*/22





REM-*/20



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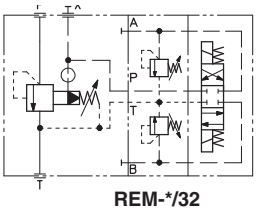


REM-*/32

Valve model		**REM-3**	**REM-4**	**REM-5**
Max flow	[l/min]	200	400	600
Pressure range	[bar]	4-50; 6-100; 7-210; 8-350	4÷50; 6÷100; 7÷210	
Max pressure	[bar]	ports P, X = 350 Port T = 210 (without pilot solenoid valve) For version with pilot solenoid valve, see technical tables E010 and E015		

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

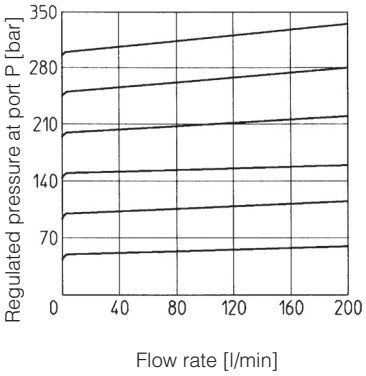
Assembly position	Any position		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -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 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	

3.1 Coils characteristics (for ARAM with pilot solenoid valve)

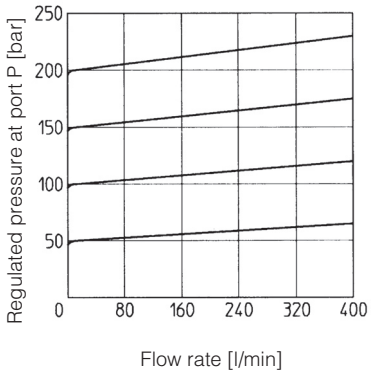
Insulation class	DHI pilot	**H** (180°C)	Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
	DHE pilot	**H** (180°C) for DC coils **F** (155°C) for AC coils	
Protection degree to DIN EN 60529		**IP 65** (with connectors 666, 667, 669 or E-SD correctly assembled)	
Relative duty factor		100%	
Supply voltage and frequency		See electric feature 8	
Supply voltage tolerance		± 10%	
Certification		**cURus** North American standard	

4 REGULATED PRESSURE VERSUS FLOW DIAGRAMS based on fluid viscosity of 25 mm²/s at 40°

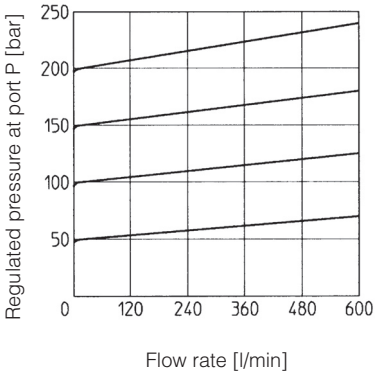
REM-3



REM-4

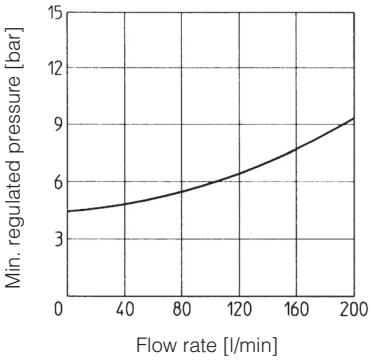


REM-5

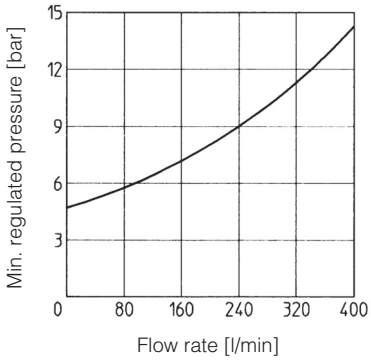


5 MINIMUM PRESSURE VERSUS FLOW DIAGRAMS based on fluid viscosity of 25 mm²/s at 40° C

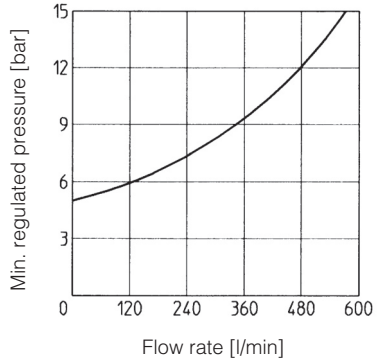
REM-3



REM-4



REM-5



6 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 FOR REM WITH SOLENOID VALVE

The connectors must be ordered separately

Code of connector	Function
666	Connector IP-65, suitable for direct connection to electric supply source
667	As 666 connector IP-65 but with built-in signal led, suitable for direct connection to electric supply source

For other available connectors, see tab. E010 and K500.

7 ELECTRIC FEATURES FOR AGAM WITH SOLENOID VALVE

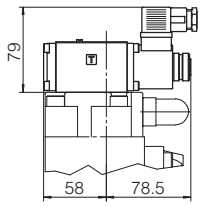
Solenoid valve type	External supply nominal voltage ± 10% (1)		**Voltage code**	Type of connector	Power consumption **(3)** DHI	Power consumption **(3)** DHE	Code of spare coil DHI	Colour of coil label DHI	Code of spare coil DHE
DHI DHE	DC	12 DC 24 DC 110 DC 220 DC	**12 DC** **24 DC** **110 DC** **220 DC**	666 or 667	33 W	30 W	COU-12DC COU-24DC COU-110DC COU-220DC	green red black black	COE-12DC COE-24DC COE-110DC COE-220DC
	AC	110/50 AC **(2)** 115/60 AC 120/60 AC 230/50 AC **(2)** 230/60 AC	**110/50/60 AC** **115/60 AC (5)** **120/60 AC (6)** **230/50/60 AC** **230/60 AC**	666 or 667	60 VA - 60 VA 60 VA 60 VA	58 VA 80 VA - 58 VA 80 VA	COI-110/50/60AC - COI-120/60AC COI-230/50/60AC COI-230/60AC	yellow - white light blue silver	COE-110/50/60AC COE-115/60AC - COE-230/50/60AC COE-230/60AC

(1) For other supply voltages available on request see technical tables E010, E015.
(2) 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 (DHI) and 58 VA
(3) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(4) When solenoid is energized, the inrush current is approx 3 times the holding current.
(5) Only for DHE
(6) Only for DHI

8 DIMENSIONS [mm]

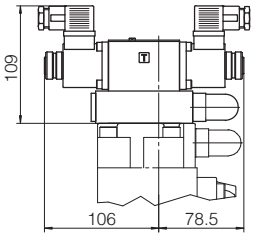
REM-3

REM-3/10/-IX**
REM-3/11/-IX**



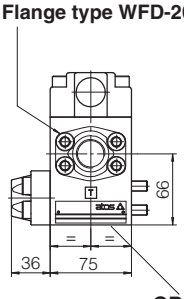
Mass: 8,1 Kg

REM-3/20/-IX**
REM-3/21/-IX**

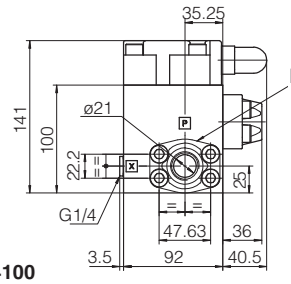


Mass: 9,2 Kg

Flange type WFD-20



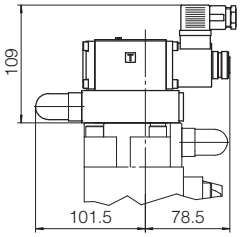
OR-4100



Flange type WFD-20

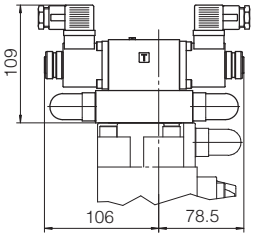
Mass: 6,6 Kg

REM-3/22/-IX**



Mass: 8,9 Kg

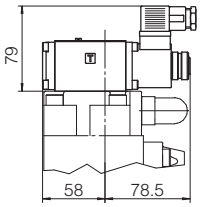
REM-3/32/-IX**



Mass: 9,3 Kg

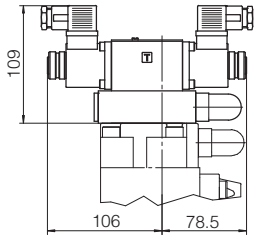
REM-4

REM-4/10/-IX**
REM-4/11/-IX**



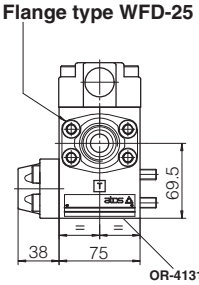
Mass: 8,3 Kg

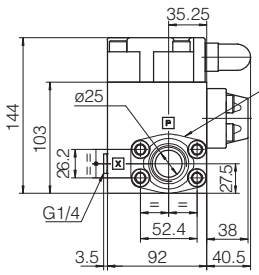
REM-4/20/-IX**
REM-4/21/-IX**



Mass: 9,4 Kg

Flange type WFD-25

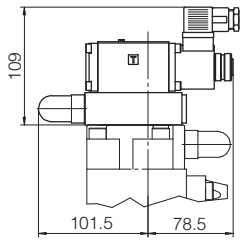




Flange type WFD-25

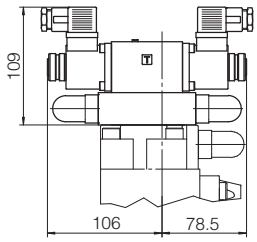
Mass: 6,8 Kg

REM-4/22/-IX**



Mass: 9,1 Kg

REM-4/32/-IX**

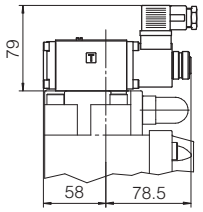


Mass: 9,5 Kg

Overall dimensions refer to valves with connectors type 666.

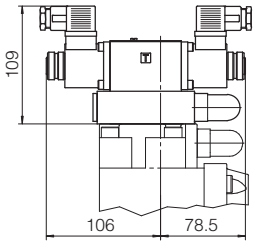
REM-5

REM-5/10/-IX**
REM-5/11/-IX**



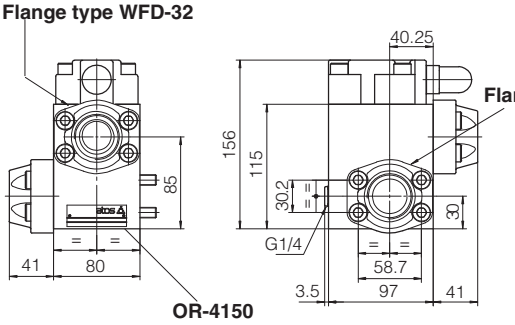
Mass: 9,7 Kg

REM-5/20/-IX**
REM-5/21/-IX**



Mass: 10,8 Kg

Flange type WFD-32

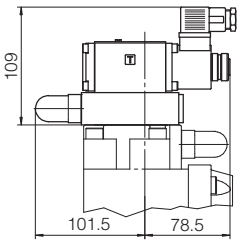


Flange type WFD-32

OR-4150

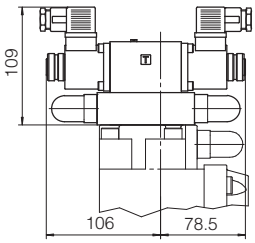
Mass: 8,2 Kg

REM-5/22/-IX**



Mass: 10,5 Kg

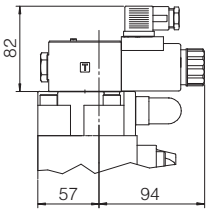
REM-5/32/-IX**



Mass: 10,9 Kg

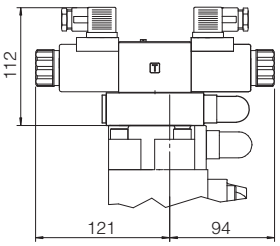
REM-3

REM-3/10/-EX**
REM-3/11/-EX**



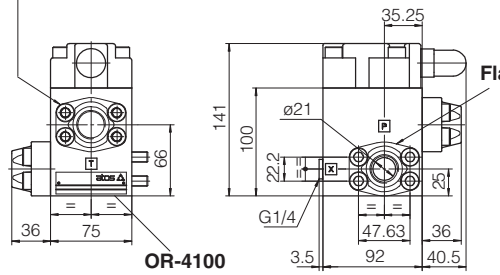
Mass: 8,1 Kg

REM-3/20/-EX**
REM-3/21/-EX**



Mass: 9,2 Kg

Flange type WFD-20

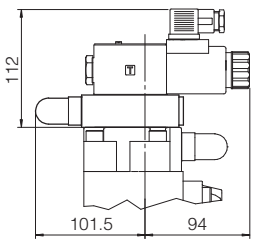


Flange type WFD-20

OR-4100

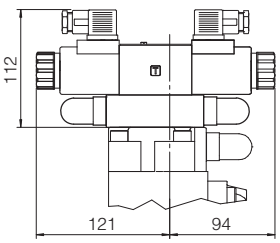
Mass: 6,6 Kg

REM-3/22/-EX**



Mass: 8,9 Kg

REM-3/32/-EX**

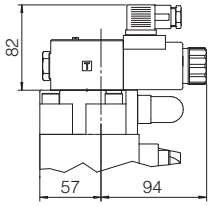


Mass: 9,3 Kg

9 DIMENSIONS [mm]

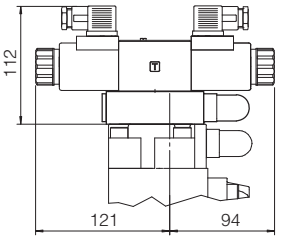
REM-4

REM-4/10/-EX**
REM-4/11/-EX**



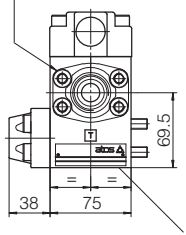
Mass: 8,3 Kg

REM-4/20/-EX**
REM-4/21/-EX**

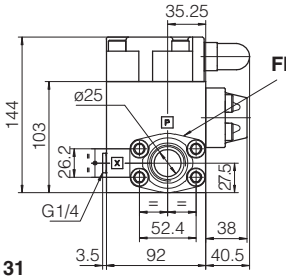


Mass: 9,4 Kg

Flange type WFD-25



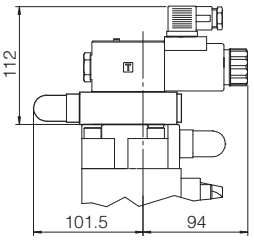
OR-4131



Flange type WFD-25

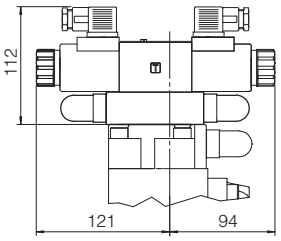
Mass: 6,8 Kg

REM-4/22/-EX**



Mass: 9,1 Kg

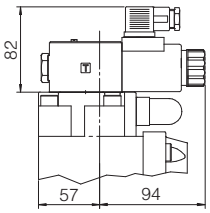
REM-4/32/-EX**



Mass: 9,5 Kg

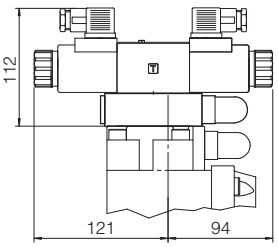
REM-5

REM-5/10/-EX**
REM-5/11/-EX**



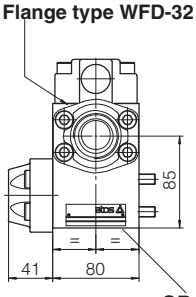
Mass: 9,7 Kg

REM-5/20/-EX**
REM-5/21/-EX**

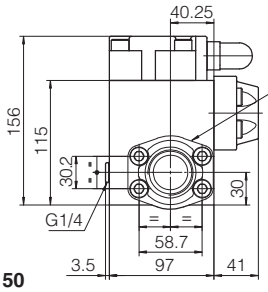


Mass: 10,8 Kg

Flange type WFD-32



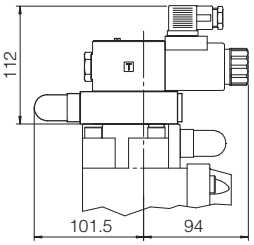
OR-4150



Flange type WFD-32

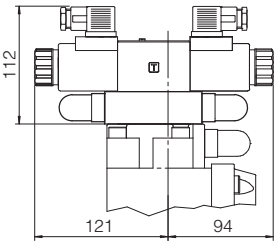
Mass: 8,2 Kg

REM-5/22/-EX**



Mass: 10,5 Kg

REM-5/32/-EX**

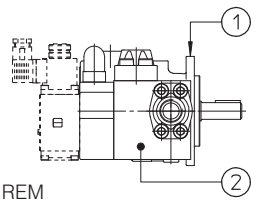


Mass: 10,9 Kg

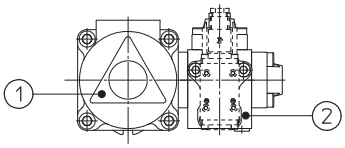
Overall dimensions refer to valves with connectors type 666

10 ASSEMBLY EXAMPLE OF A REM VALVE ON A PFE PUMP

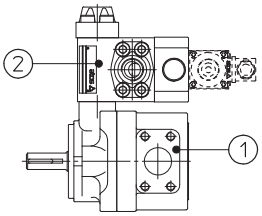
LATERAL VIEW OF PUMP



REAR VIEW OF PUMP



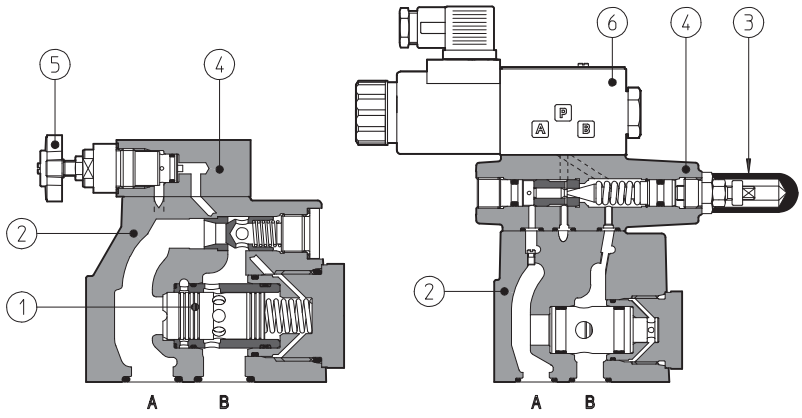
TOP VIEW OF PUMP



① Pump type PFE
② Relief valve type REM

Pressure control valves type AGIR, AGIS, AGIU

two stage, subplate mounting, ISO 5781 sizes 10, 20 and 32



AGIRR-20/*/V** **AGIU-10/11...-E**

Two stage pressure control valves with balanced poppet designed to operate in oil hydraulic systems.
AGIR: pressure reducing;
AGIS: sequence;
AGIU: unloading.

In standard versions the piloting pressure of the poppet ① of the main stage ② is regulated by means of a grub screw protected by cap ③ in the cover ④.
Optional versions with setting adjustment by handwheel ⑤ instead of the grub screw are available on request.
Clockwise rotation increases pressure.

Unloading valves AGIU can be equipped with a venting solenoid valve ⑥ type:
- DHI for AC and DC supply, with **cURus** certified solenoids
- DHE for AC and DC supply, high performances with **cURus** certified solenoids

Mounting surface: **ISO 5781 size 10, 20 and 32**
Max flow:
AGIR = 160, 300, 400 l/min
AGIS = 200, 400, 600 l/min
AGIU = 100, 200, 300 l/min
Pressure up to **350 bar**

1 MODEL CODE

AGIU	*	-	20	/	10	/	210	/	V	-	I	X	24DC	**	/	*

AGIU
Pressure control valves subplate mounting
AGIR = pressure reducing
AGIS = sequence
AGIU = unloading

*
Only for AGIR and AGIS:
R = with check valve
- = without check valve

20
Size: **10** **20** **32**

10
Optional solenoid valve for venting **(1)**
10 = venting with de-energized solenoid
11 = venting with energized solenoid

210
Pressure range:
50 = 4÷50 bar (AGIR*); **100** = 6÷100 bar;
210 = 7÷210 bar; **350** = 8÷350 bar

V
Options **(2)**:
V = regulating handwheel instead of a grub screw protected by cap
VF = regulating knob instead of a grub screw protected by cap (only for AGIS, AGIU)
VS = manual override with safety locking instead of a grub screw protected by cap (only for AGIS, AGIU)
Only for AGIU:
D = internal drain
WP = prolonged manual override protected by rubber cap (1)
- = standard unloading characteristics
5, 6, 7 = other unloading characteristics, see section 5

I
Pilot valve **(1)**:
I = DHI for AC and DC supply, with **cURus** certified solenoids
E = DHE for AC and DC supply, high performances with **cURus** certified solenoids

X
X = without connector **(1):**
See section 7 for available connectors, to be ordered separately
-00 = solenoid valve without coils (for -I)
-00-AC = AC solenoid valve without coils (for -E)
-00-DC = DC solenoid valve without coils (for -E)

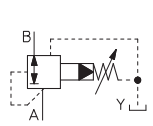
24DC
Voltage code, see section 7 **(1)**

**
Series number

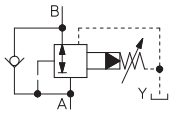
*
Seals material, see section 3:
- = NBR
PE = FKM
BT = HNBR

(1) Only for AGIU with solenoid valve for venting **(2)** For handwheel features, see technical table K150

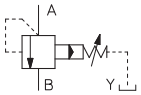
2 HYDRAULIC CHARACTERISTICS



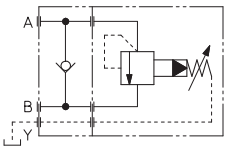
AGIR



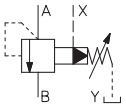
AGIRR



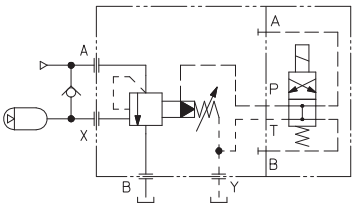
AGIS



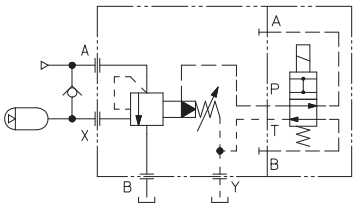
AGISR



AGIU



AGIU-/10**



AGIU-/11**

Valve model		**AGIR-10**	**AGIR-20**	**AGIR-32**	**AGIS-10**	**AGIS-20**	**AGIS-32**	**AGIU-10**	**AGIU-20**	**AGIU-32**
Max flow	[l/min]	160	300	400	200	400	600	100	200	300
Pressure range	[bar]	4÷50 (AGIR*); 6÷100; 7÷210; 8÷350								
Max pressure	[bar]	Ports A, B, X = 350 bar Port Y = 0								

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

Assembly position	Any position
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)
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 KTF catalog

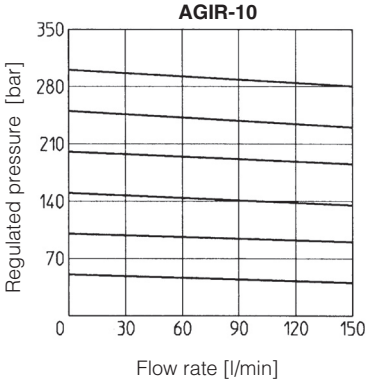
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

3.1 Coils characteristics

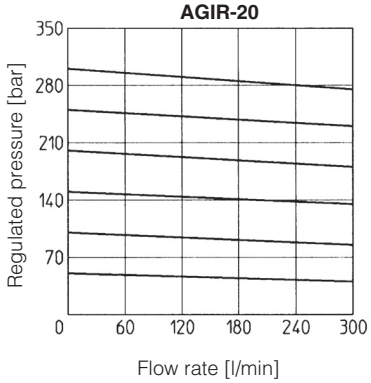
Insulation class	DHI pilot	**H** (180°C)	Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
	DHE pilot	**H** (180°C) for DC coils **F** (155°C) for AC coils	
Protection degree to DIN EN 60529		**IP 65** (with connectors 666, 667, 669 or E-SD correctly assembled)	
Relative duty factor		100%	
Supply voltage and frequency		See electric feature 8	
Supply voltage tolerance		± 10%	
Certification		**cURus** North American standard	

4 REGULATED PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C

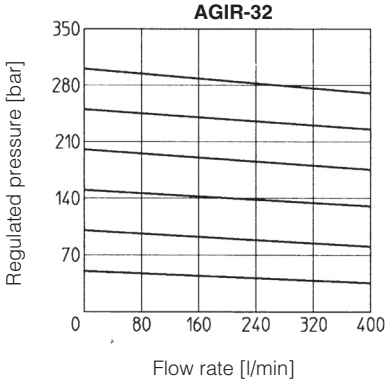
AGIR-10



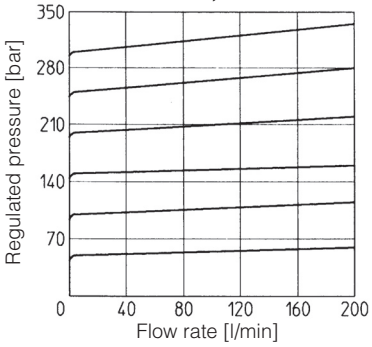
AGIR-20



AGIR-32

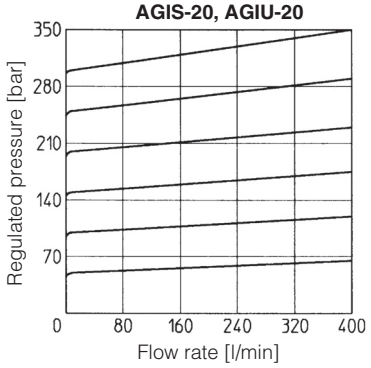


AGIS-10, AGIU-10



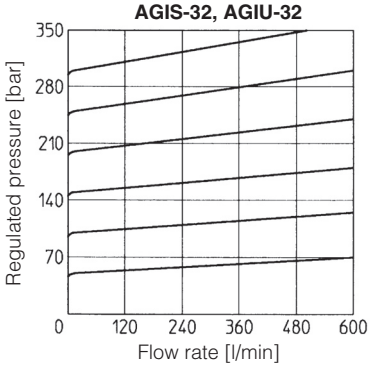
Note: for AGIU-10, the max flow rate is 100 l/min

AGIS-20, AGIU-20



Note: for AGIU-20, the max flow rate is 200 l/min

AGIS-32, AGIU-32



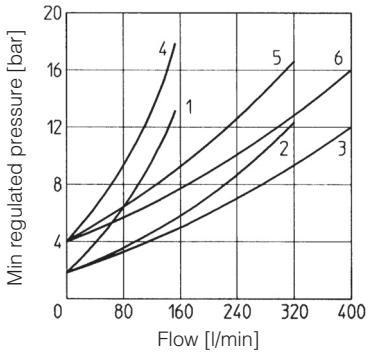
Note: for AGIU-32, the max flow rate is 300 l/min

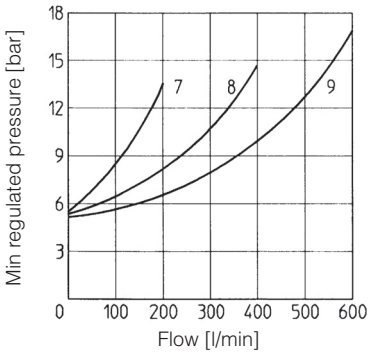
5 OPERATING DIAGRAM

based on mineral oil ISO VG 46 at 50°C

1 = AGIR-10 A → B
2 = AGIR-20 A → B
3 = AGIR-32 A → B
4 = AGIR-10 B → A
5 = AGIR-20 B → A
6 = AGIR-32 B → A

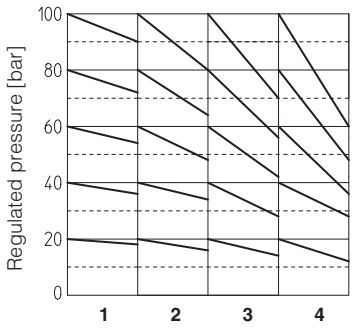
7 = AGIS-10
8 = AGIS-20
9 = AGIS-32

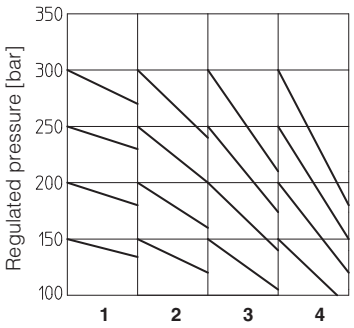




Opening/closing diagram for AGIU

1 = AGIU-**/...(standard) **3** = AGIU-**/.../6
2 = AGIU-**/.../5 **4** = AGIU-**/.../7





NOTES

1)Short pipes with low resistance must be used between the unloading valve and the accumulator;
2)When the resistance is high, the hydraulic pilot signal must be taken as closed as possible to the accumulator;
3)With high pump flow and small valve differential pressure of intervention it is advisable to use the version with external drain;
4)When to use the BA-*25 subplates:
a) in applications with working frequencies >10 Hz use subplates type BA-*25/4 (spring with 4 bar of cracking pressure);
b) in applications with working frequencies <10 Hz use subplates type BA-*25/2 (spring with 2 bar of cracking pressure);

6 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 FOR AGIU WITH SOLENOID VALVE

The connectors must be ordered separately

Code of connector	Function
666	Connector IP-65, suitable for direct connection to electric supply source
667	As 666 connector IP-65 but with built-in signal led, suitable for direct connection to electric supply source

For other available connectors, see tab. E010 and K500

7 ELECTRIC FEATURES FOR AGAM WITH SOLENOID VALVE

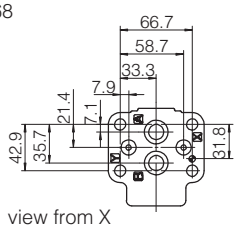
Solenoid valve type	External supply nominal voltage ± 10% (1)		**Voltage code**	Type of connector	Power consumption **(3)** DHI	DHE	Code of spare coil DHI	Colour of coil label DHI	Code of spare coil DHE
DHI DHE	DC	12 DC 24 DC 110 DC 220 DC	**12 DC** **24 DC** **110 DC** **220 DC**	666 or 667	33 W	30 W	COU-12DC COU-24DC COU-110DC COU-220DC	green red black black	COE-12DC COE-24DC COE-110DC COE-220DC
	AC	110/50 AC **(2)** 115/60 AC 120/60 AC 230/50 AC **(2)** 230/60 AC	**110/50/60 AC** **115/60 AC (5)** **120/60 AC (6)** **230/50/60 AC** **230/60 AC**	666 or 667	60 VA - 60 VA 60 VA 60 VA	58 VA 80 VA - 58 VA 80 VA	COI-110/50/60AC - COI-120/60AC COI-230/50/60AC COI-230/60AC	yellow - white light blue silver	COE-110/50/60AC COE-115/60AC - COE-230/50/60AC COE-230/60AC

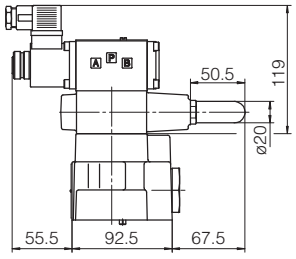
(1) For other supply voltages available on request see technical tables E010, E015.
(2) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷ 15% and the power consumption is 55 VA (DHI) and 58 VA
(3) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(4) When solenoid is energized, the inrush current is approx 3 times the holding current.
(5) Only for DHE
(6) Only for DHI

8 DIMENSIONS [mm]

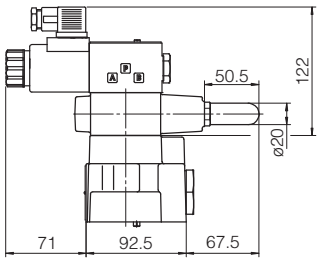
AGIR, AGIS, AGIU size 10

ISO 5781: 2000
Mounting surface: 5781-06-07-0-00
Fastening bolts:
4 socket head screws M10x45 class 12.9
Tightening torque = 70 Nm
Seals: 2 OR 109/70, 2 OR 3068
Ports A, B: Ø = 14 mm
Ports X, Y: Ø = 5 mm

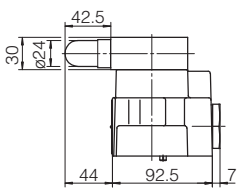


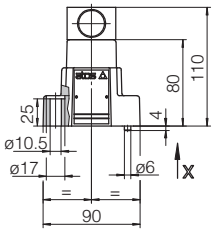


AGIU-10/10/-IX**
Mass = 5,3 Kg

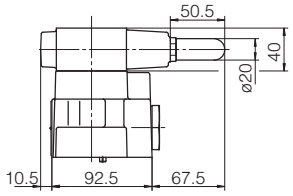


AGIU-10/10/-EX**
Mass = 5,6 Kg

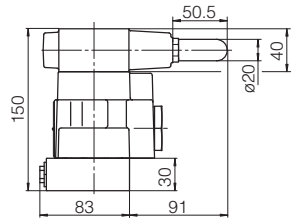




AGIR-10; Mass= 3,3 Kg
AGIRR-10; Mass= 3,5 Kg



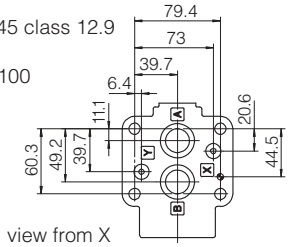
AGIS-10; Mass= 3,8 Kg
AGIU-10; Mass= 3,8 Kg

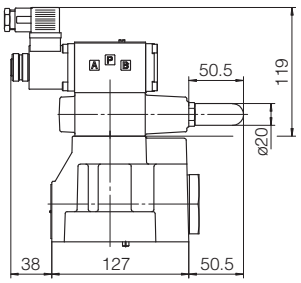


AGISR-10; Mass= 5,3 Kg

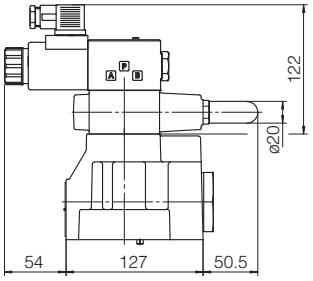
AGIR, AGIS, AGIU size 20

ISO 5781: 2000
Mounting surface: 5781-08-10-0-00
Fastening bolts:
4 socket head screws M10x45 class 12.9
Tightening torque = 70 Nm
Seals: 2 OR 109/70, 2 OR 4100
Ports A, B: Ø = 22 mm
Ports X, Y: Ø = 5 mm

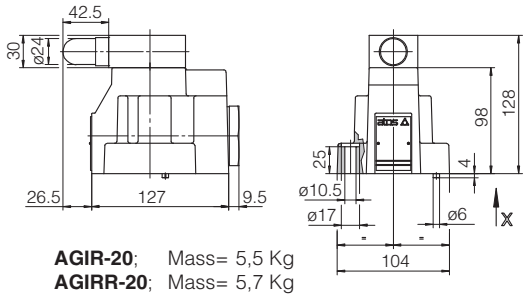




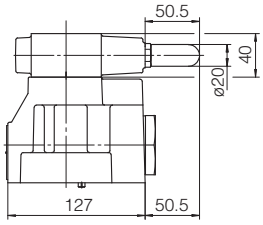
AGIU-20/10/-IX**
Mass = 7,5 Kg



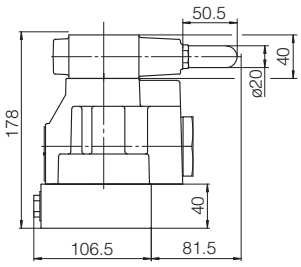
AGIU-20/10/-EX**
Mass = 7,8 Kg



AGIR-20; Mass= 5,5 Kg
AGIRR-20; Mass= 5,7 Kg



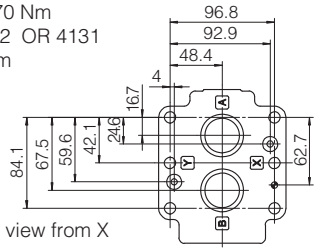
AGIS-20; Mass= 6 Kg
AGIU-20; Mass= 6 Kg

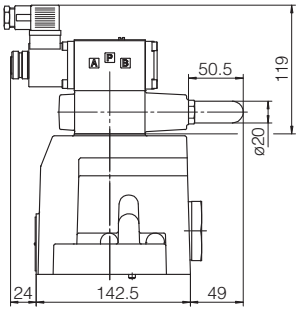


AGISR-20; Mass= 9 Kg

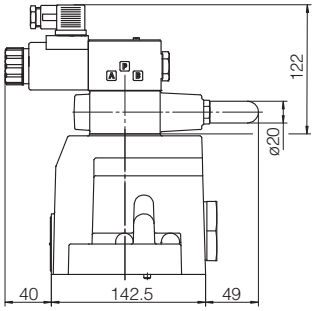
AGIR, AGIS, AGIU size 32

ISO 5781: 2000
Mounting surface: 5781-10-13-0-00
Fastening bolts:
6 socket head screws M10x45 class 12.9
Tightening torque = 70 Nm
Seals: 2 OR 109/70, 2 OR 4131
Ports A, B: Ø = 28 mm
Ports X, Y: Ø = 5 mm

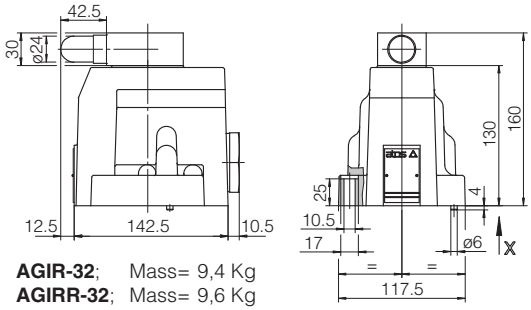




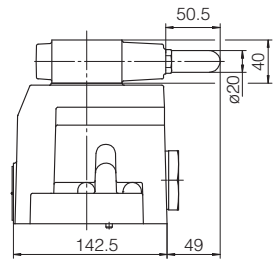
AGIU-32/10/-IX**
Mass = 11,4 Kg



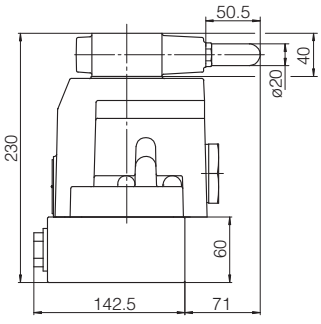
AGIU-32/10/-EX**
Mass = 11,7 Kg



AGIR-32; Mass= 9,4 Kg
AGIRR-32; Mass= 9,6 Kg



AGIS-32; Mass= 9,9 Kg
AGIU-32; Mass= 9,9 Kg



AGISR-32; Mass= 15.5 Kg

Overall dimensions refer to valves with connectors type 666

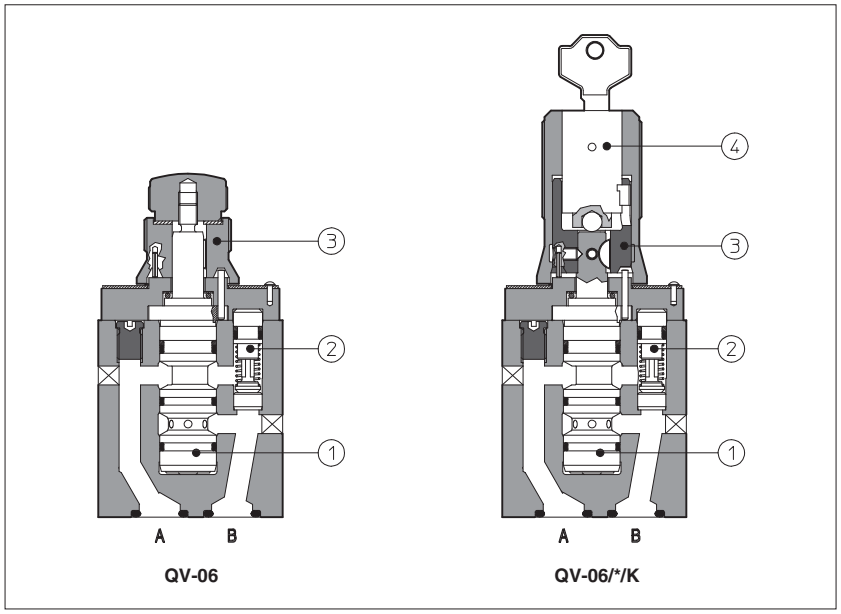
9 MOUNTING SUBPLATES

Valves	Subplate model	Port location	Ports				Ø Counterbore [mm]				Mass [Kg]
			A	B	X-Y	OUT	A	B	X-Y	OUT	
AGI*-10	BA-305	Ports A, B, Y underneath;	G 1/2"	G 1/2"	G 1/4"	-	30	30	21,5	-	1
AGI*-20	BA-505		G 1"	G 1"	G 1/4"	-	46	46	21,5	-	2
AGI*-32	BA-705		G 1 1/2"	G 1 1/2"	G 1/4"	-	63,5	63,5	21,5	-	7,5
AGIU-10	BA-325 (with incorporated check valve)	G 1/2"	G 3/4"	G 1/4"	G 1/2"	30	36,5	21,5	30	5	
AGIU-20	BA-425 (with incorporated check valve)	Ports A, B, Y underneath;	G 1"	G 1"	G 1/4"	G 1"	46	46	21,5	46	6,5
AGIU-32	BA-625 (with incorporated check valve)		G 1 1/2"	G 1 1/2"	G 1/4"	G 1 1/2"	63,5	63,5	21,5	63,5	13

The subplates are supplied with fastening bolts. For further details see table K280

Flow control valves type QV-06

pressure compensated, two way, ISO 4401 size 06



QV are flow control valves with pressure compensator ①: the controlled flow rate is independent of pressure variations.

They are usually supplied with a built-in check valve ② to allow the free flow in the opposite direction.

The flow is regulated by turning a graduate micrometer knob ③. Clockwise rotation increases the flow regulation.
Optional versions with locking key ④ on the adjustment knob are available on request.

ISO 4401 size 06.

Flow up to 1,5; 6; 11; 16; 24 l/min (depending on models).
Pressure up to 250 bar.

Valves designed to operate in hydraulic systems with hydraulic mineral oil or synthetic fluid having similar lubricating characteristics.

1 MODEL CODE

QV	-	06	/	6	/	K	**	/	*

QV: Pressure compensated flow control valve

Size: **06**

Maximum adjustable flow rate:
1 = 1,5 l/min **11** = 11 l/min **24** = 24 l/min
6 = 6 l/min **16** = 16 l/min

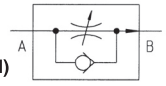
Options:
K = with lock key for the setting knob
V = without by-pass check valve

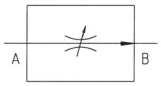
Series number

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

2 HYDRAULIC CHARACTERISTICS

Hydraulic symbols

with check valve (standard) 

without check valve (option /V) 

Valve model	QV-06/1	QV-06/6	QV-06/11	QV-06/16	QV-06/24
Max regulated flow [l/min]	1,5	6	11	16	24
Min regulated flow [cm³/min]	50				
Max flow B→A through check valve [l/min]	24				
Regulating Δp [bar]	3	3	5	6,5	8
Max flow on port A [l/min]	24				
Max pressure [bar]	250				

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

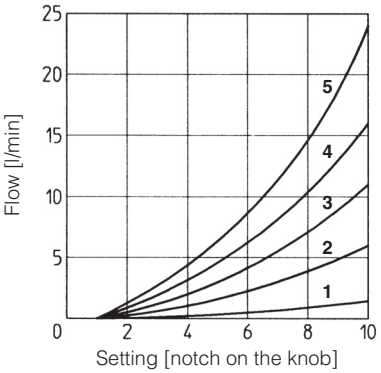
Assembly position	Any position
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Ambient temperature	Standard = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, 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 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	

4 DIAGRAMS based on mineral oil ISO VG 46 at 50°C

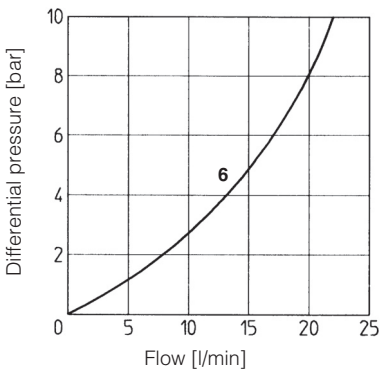
4.1 Regulation diagram

1 = QV-06/1
2 = QV-06/6
3 = QV-06/11
4 = QV-06/16
5 = QV-06/24

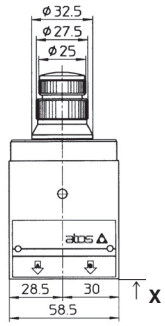


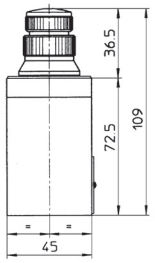
4.2 Q/Δp diagram through the check valve for free flow B→A

6 = QV-06/*

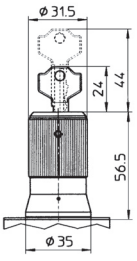


5 DIMENSIONS [mm]

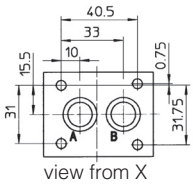




Mass: 1,2 Kg



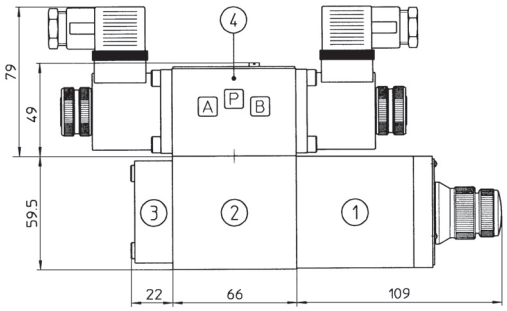
Option /K



view from X

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
(see note 1)
Fastening bolts:
4 socket head screws M5x60 class 12.9
Tightening torque = 8 Nm
Seals: 2 OR 117
Diameter of ports A, B: Ø = 7 mm

ASSEMBLY IN MODULAR STACK
see section 6



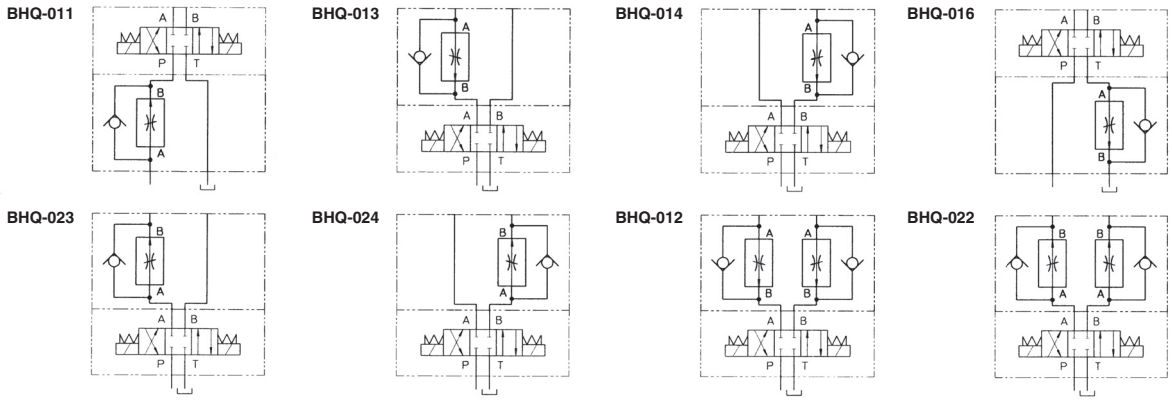
① = Flow control valve type QV-06
Note that the valve(s) is (are) mounted:
- on side port A for BHQ-011, BHQ-013, BHQ-016 and BHQ-023
- on side port B for BHQ-014 and BHQ-024
- on both sides for BHQ-012 and BHQ-022

② = Modular plate type BHQ, see section 6
③ = Closing element. This element can be on side port A or side port B depending on models. It is not present on BHQ-011, BHQ-016, BHQ-012 and BHQ-022
④ = Directional valve type DH* (ISO 4401 size 06)

note 1: the manifold interface has to be provided only of the A and B ports.
The valve cannot be installed on manifolds with ISO 4401-AB-03 interface with P and T ports.

6 MODULAR PLATES TYPE BHQ

The modular plates type BHQ allow the assembling of valves type QV-06 in a modular stack with other components having ISO 4401 size 06 mounting surface. See below for model code and functional sketches; see section 5 for dimensions and example of assembly.



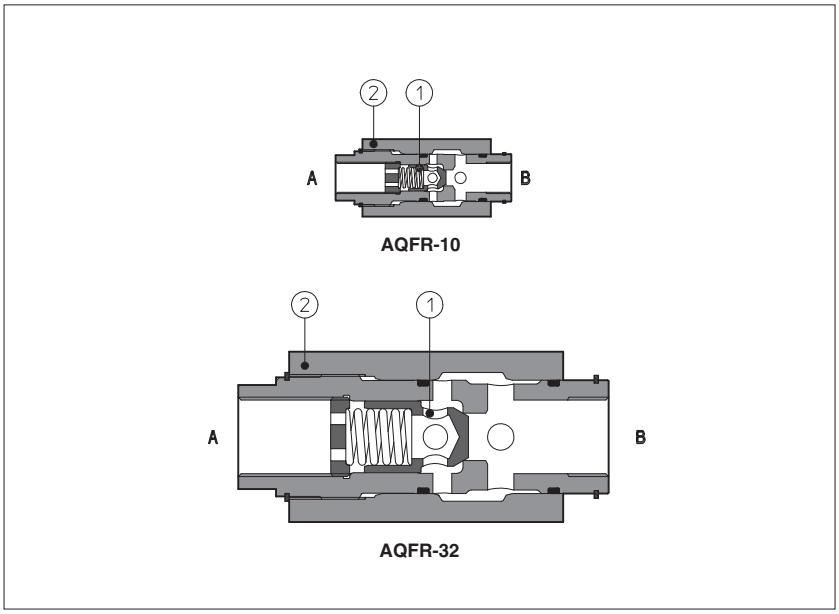
Available also version for phosphate ester (add /PE at the end of the model code).

7 MOUNTING PLATES TYPE BA

Valve	Subplate model	Ports location	Ports A, B, P, T	Ø Counterbore [mm] A, B, P, T	Mass [Kg]
QV-06	BA-202/Q	Ports A, B, P, T underneath;	G 3/8"	–	1,2
	BA-204/Q	Ports P, T underneath; Ports A, B on lateral side	G 3/8"	25,5	1,2
	BA-302/Q	Ports A, B, P, T underneath;	G 1/2"	30	1,8

Flow restrictor valves type AQFR

in-line mounting - from G 3/8" to G 1¼" threaded ports



AQFR are not compensated flow throttling valves with a built-in check valve ① to allow the free flow in the opposite direction.

The flow adjustement is done by turning the external exagon ②. Clockwise rotation increases the throtting (reduced passage). The regulated flow is a function of the pressure drop existing between the inlet and outlet ports.

They are available in five sizes: from 3/8" to 1 ¼" GAS with flow up 30, 50, 80, 160, 250 l/min respectively and pressure up to 400/350 bar (depending on size).

Max pressure: **350 bar**

1 MODEL CODE

AQF	R	-	10	**	/	*

Throtting valve in-line mounting

R = with check valve for free reverse flow

Size and ports dimensions:

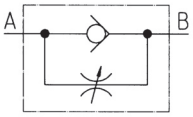
10 = G 3/8" **15** = G 1/2" **20** = G 3/4" **25** = G 1" **32** = G 1 ¼"

Series number

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

2 HYDRAULIC CHARACTERISTICS

Hydraulic symbol



Valve model		AQFR-10	AQFR-15	AQFR-20	AQFR-25	AQFR-32
Max recommended flow	[l/min]	30	50	80	160	250
Max pressure	[bar]	400	350			

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

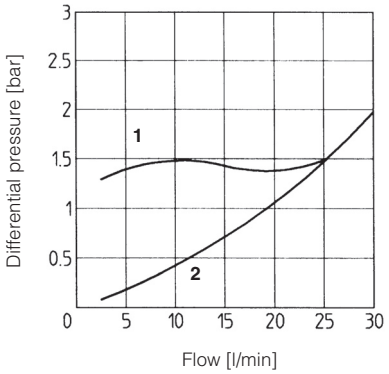
Assembly position	Any position
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Ambient temperature	Standard execution = -30°C ÷ +70°C; /PE option = -20°C ÷ +70°C; /BT option = -40°C ÷ +70°C
Seals, recommended fluid temperature	NBR seals (standard) = -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 KTF catalog

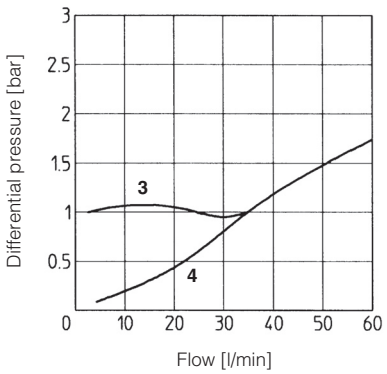
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

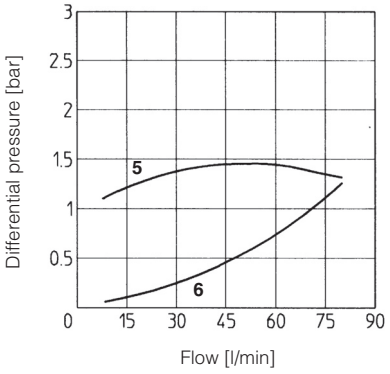
4 DIAGRAMS based on mineral oil ISO VG 46 at 50°C

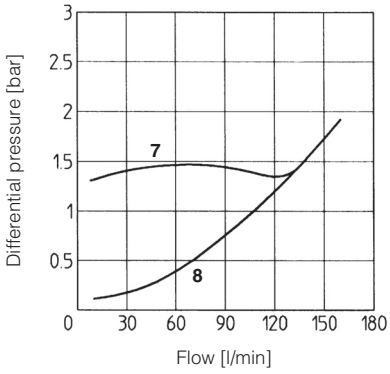
4.1 Q/Δp diagram through the chec valve for free flow B→A with the throttle valve fully open and fully closed

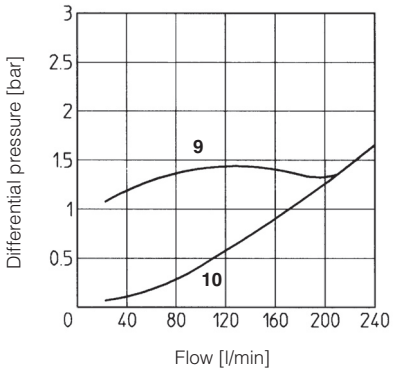
1 = AQFR-10 fully closed
2 = AQFR-10 fully open
3 = AQFR-15 fully closed
4 = AQFR-15 fully open
5 = AQFR-20 fully closed
6 = AQFR-20 fully open
7 = AQFR-25 fully closed
8 = AQFR-25 fully open
9 = AQFR-32 fully closed
10 = AQFR-32 fully open



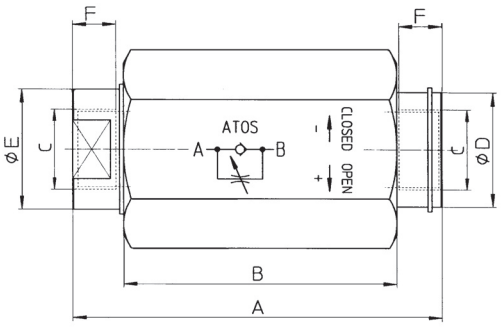


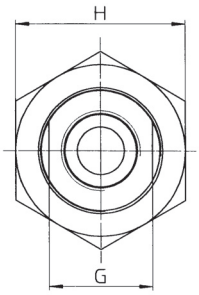






5 DIMENSIONS [mm]

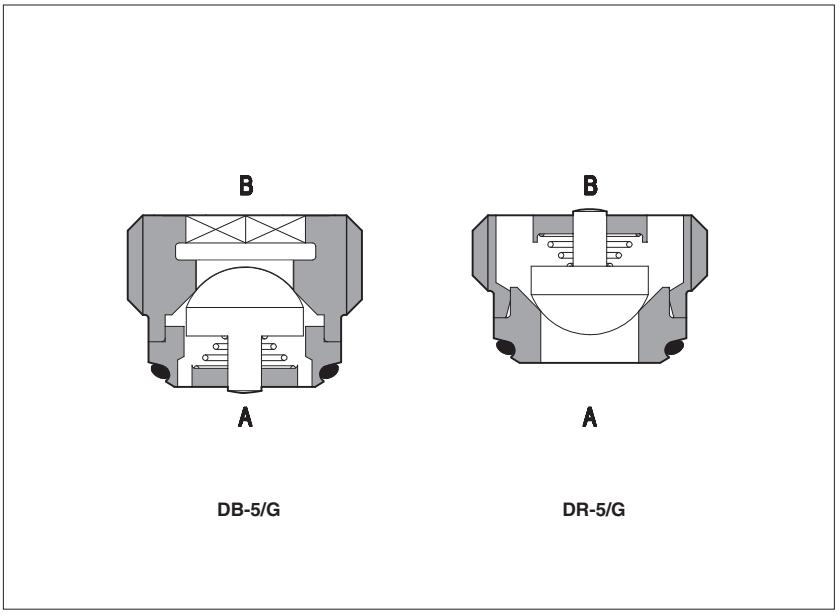




Valve model	A	B	C	ØD	ØE	F	G	H	Mass [Kg]
AQFR-10	93	68	G 3/8"	28	25	13	24	41	0,7
AQFR-15	105	78	G 1/2"	32	30	15	27	46	1
AQFR-20	127	95,5	G 3/4"	36	34	17	32	55	1,6
AQFR-25	153	112	G 1"	48	45	19	42	75	3,5
AQFR-32	196	145	G 1 1/4"	63	60	21	55	90	6,5

Cartridge check valves type DB, DR

screw-in mounting - from G1/4" to G1/2"



DB-5/G **DR-5/G**

DB, **DR** are direct operated check valves for screw-in mounting in cavities from G1/4" to G1/2".
They are specifically designed to reduce the manifold dimensions and simplify the installation.
Cartridge designed to operate in hydraulic systems with hydraulic mineral oil or synthetic fluid having similar lubricating characteristics.

Flow up to **95 l/min**.
Max pressure: **350 bar**

1 MODEL CODE

D	B	-	10	/	G	**	/	*

D: Screw-in check valve

B: **B** = function A → B; **R** = function B → A

10: Size/threated connections: **5** = G 1/4" **10** = G 3/8" **15** = G 1/2"

G: **G** = Gas threading

**: Series number

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

2 HYDRAULIC CHARACTERISTICS

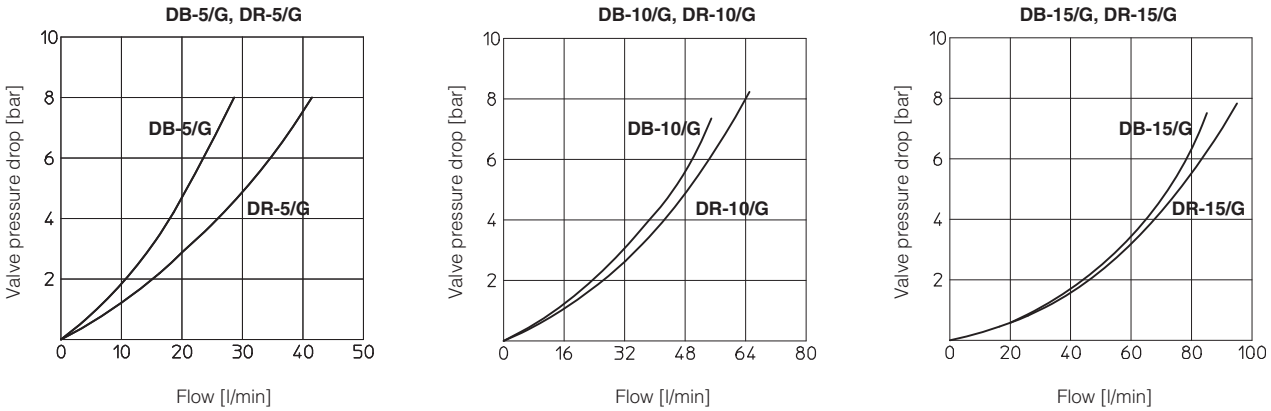
Hydraulic symbol		DB-*/G 			DR-*/G 		
Valve model		**DB-5/G**	**DR-5/G**	**DB-10/G**	**DR-10/G**	**DB-15/G**	**DR-15/G**
Nominal flow (at Δp = 8 bar)	[l/min]	25	35	55	65	85	95
Max pressure	[bar]	350					
Cracking pressure	[bar]	0,3					

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

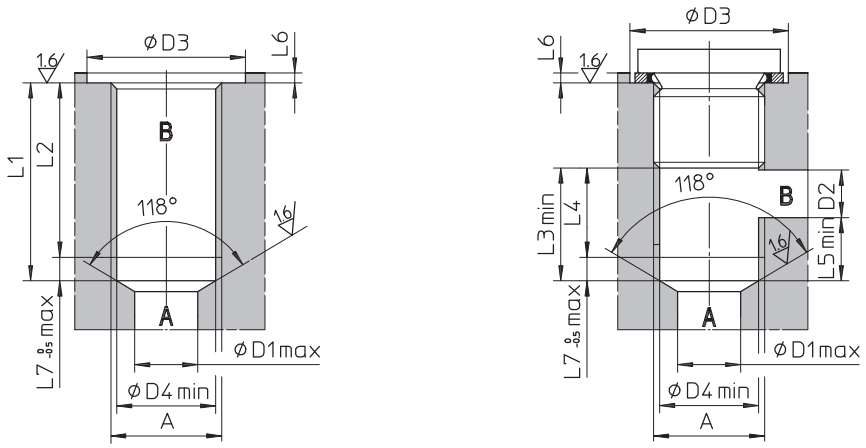
Assembly position	Any position
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Ambient temperature	Standard = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, 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 KTF catalog
Flow direction	As shown in the symbol at section 2
Rated flow	See diagrams Q/Δp at section 4

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	

4 FLOW VERSUS PRESSURE DROP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

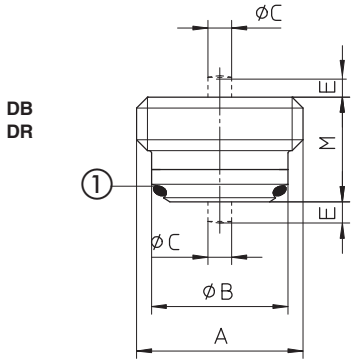


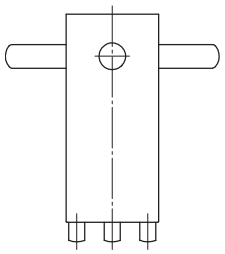
5 RECESS DIMENSIONS [mm]



	A	D1	D2	D3	D4	L1	L2	L3	L4	L5	L6	L7
DB-5/G	G 1/4"	8	6	22	11,6	22	19	14	11	8	1,5	3
DR-5/G												
DB-10/G	G 3/8"	9	8	26	15	24	21	17	14	9	1,5	3
DR-10/G												
DB-15/G	G 1/2"	12	12	30	18,75	28	24,5	22	18,5	10	1,5	3,5
DR-15/G												

6 VALVE DIMENSIONS [mm]





***-DRG-205000**

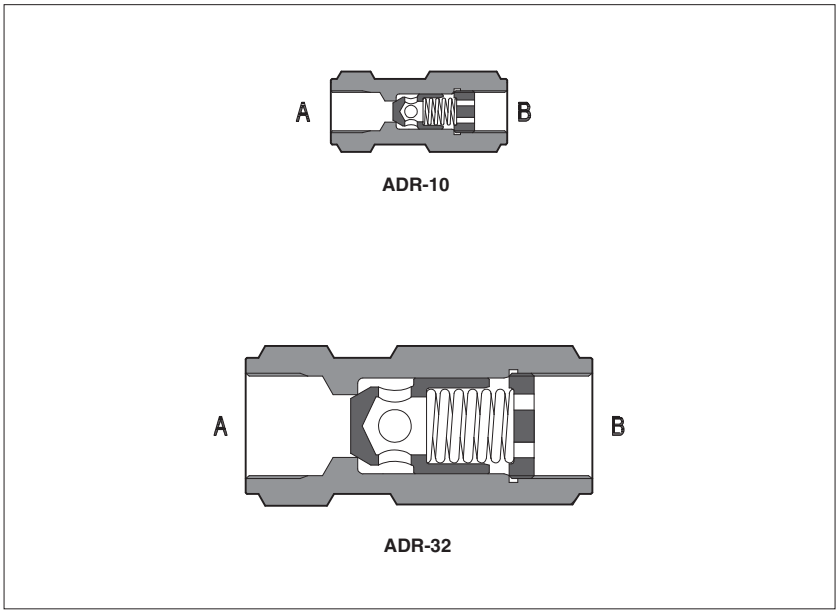
Note: this special key is required for assembling the valve in the cavity

	A	B	C	E	M	①	Mass (Kg)
DB-5/G	G 1/4"	11,5	2,1	1,5	10,3	OR-9x1/70	0,060
DR-5/G			2,4		9		
DB-10/G	G 3/8"	15	2,8	2	11,3	OR-11x1,5/70	0,012
DR-10/G			3,3	2,5	11,4		
DB-15/G	G 1/2"	18,5	3,2	2,5	12,9	OR-14x1,5/70	0,020
DR-15/G			4	2,5	13,6		

	A	KEY	Tightening torque (Nm)
DB-5/G	G 1/4"	CH 7 ⬡	15
DR-5/G		5-DRG-205000	
DB-10/G	G 3/8"	CH 6 ⬡	20
DR-10/G		10-DRG-205000	
DB-15/G	G 1/2"	CH 8 ⬡	40
DR-15/G		15-DRG-205000	

Check valves type ADR

in-line mounting - from G 1/4" to G 1 1/4" threaded ports



ADR are direct operated check valves for in-line mounting available with port size from 1/4" to 1¼" GAS.

Cartridge designed to operate in hydraulic systems with hydraulic mineral oil or synthetic fluid having similar lubricating characteristics.

Flow up to **500 l/min**
Pressure up to **400 bar**

1 MODEL CODE

ADR	-	10	/	4		**
Check valve in-line mounting		Size/threated connections: **06** = G 1/4" **10** = G 3/8" **15** = G 1/2" **20** = G 3/4" **25** = G 1" **32** = G 1 1/4"		Cracking pressure: - = 0,5 bar **/2** = 2 bar **/4** = 4 bar **/8** = 8 bar		Series number

2 HYDRAULIC CHARACTERISTICS

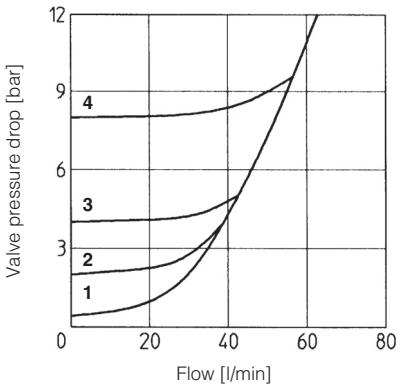
Hydraulic symbol		A B					
Valve model		**ADR-06**	**ADR-10**	**ADR-15**	**ADR-20**	**ADR-25**	**ADR-32**
Max recommended flow	[l/min]	40	80	150	300	360	500
Max pressure	[bar]	400		350			

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

Assembly position	Any position
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Fluid	Hydraulic oil as per DIN 51524 ... 535;
Fluid temperature	≤ 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 KTF catalog
Flow direction	As shown in the symbol at section 2
Rated flow	See diagrams Q/Δp at section 4

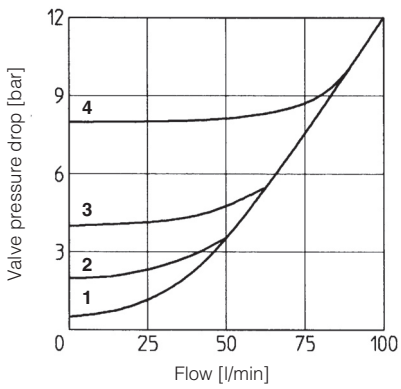
4 FLOW VERSUS PRESSURE DROP DIAGRAMS Based on based on mineral oil ISO VG 46 at 50°C

ADR-06



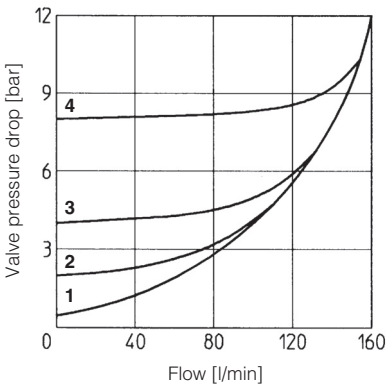
1 = ADR-06
2 = ADR-06/2
3 = ADR-06/4
4 = ADR-06/8

ADR-10



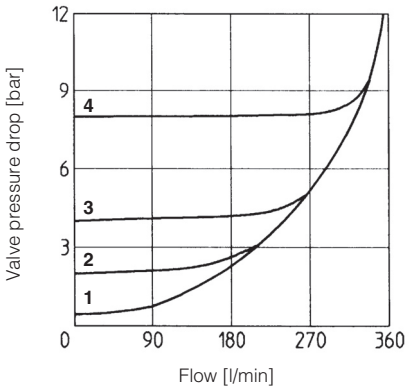
1 = ADR-10
2 = ADR-10/2
3 = ADR-10/4
4 = ADR-10/8

ADR-15



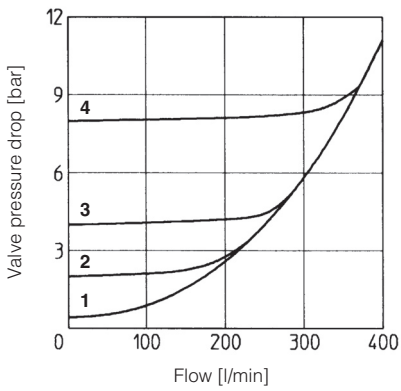
1 = ADR-15
2 = ADR-15/2
3 = ADR-15/4
4 = ADR-15/8

ADR-20



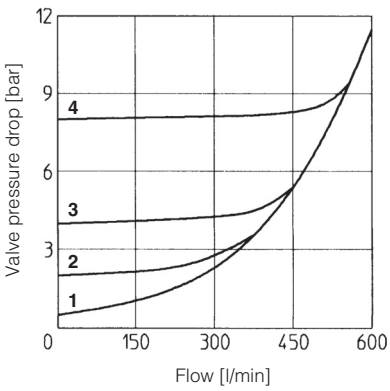
1 = ADR-20
2 = ADR-20/2
3 = ADR-20/4
4 = ADR-20/8

ADR-25



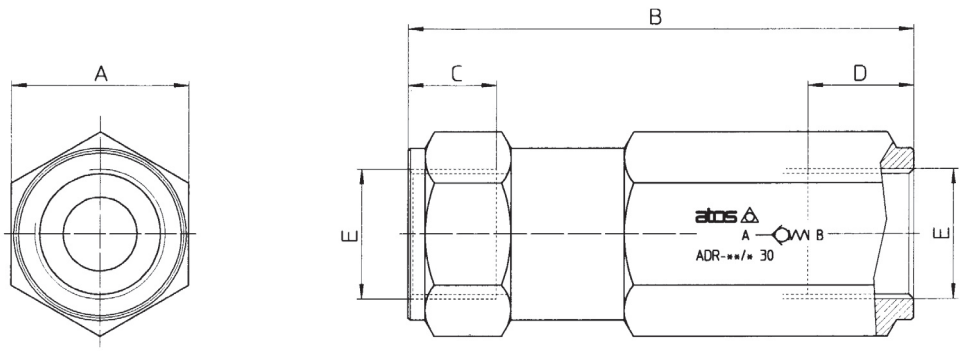
1 = ADR-25
2 = ADR-25/2
3 = ADR-25/4
4 = ADR-25/8

ADR-32



1 = ADR-32
2 = ADR-32/2
3 = ADR-32/4
4 = ADR-32/8

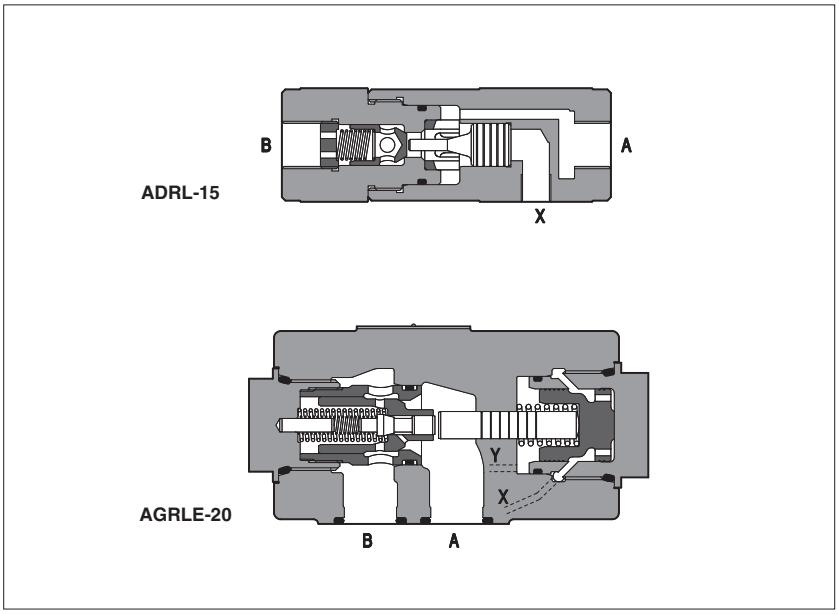
5 DIMENSIONS [mm]



Model	A	B	C	D	E	Mass [kg]
ADR - 06	22	67	12	13	G 1/4"	0,2
ADR - 10	27	70	12	13	G 3/8"	0,4
ADR - 15	32	82,5	14	17	G 1/2"	0,6
ADR - 20	36	102,5	16	21,5	G 3/4"	0,9
ADR - 25	46	120	18	24,5	G 1"	2,1
ADR - 32	55	137,5	20	23	G 1 1/4"	2,5

Pilot operated check valves type ADRL, AGRL, AGRLE

in-line mounting, port size from G 3/8" to G 1 1/4"
subplate mounting, ISO 5781 size 10, 20 and 32



ADRL are pilot operated (port X) check valves for in-line mounting available with port size from 3/8" GAS to 1 1/4" GAS.
Flow up to 300 l/min.
Pressure up to 400 bar.

AGRL and **AGRLE** are pilot operated (port X) check valves for subplate mounting available with mounting surface ISO 5781 size 10, 20 and 32.
Flow up to 500 l/min.
Max pressure: 315 bar.

AGRLE versions have an external drain (port Y) of the pilot chamber to permit a correct use of pilot operated check valve in systems where valve must open in presence of pressure at port A: infact pressure at port A, on regular pilot operated check valves, may affect the check opening by acting against the pilot device.

Valves designed to operate in hydraulic systems with hydraulic mineral oil or synthetic fluid having similar lubricating characteristics.

1 MODEL CODE

AGRL	E	-	10	/	*	**	/	*

ADRL = pilot operated check valve in-line mounting
AGRL = pilot operated check valve subplate mounting

Only for AGRL:
- = without external drain
E = with external drain

Threaded connections for ADRL:
10 = G 3/8"
15 = G 1/2"
20 = G 3/4"
32 = G 1 1/4"

Size for AGRL and AGRLE:
10 **20** **32**

Cracking pressure

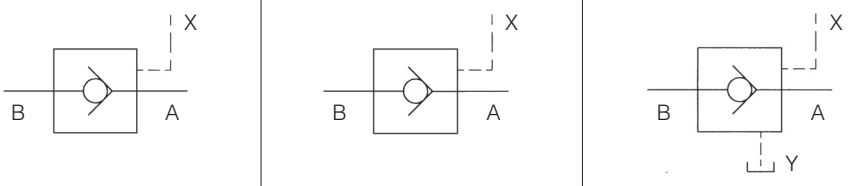
for ADRL	for AGRL
- = 0,5 bar	**-** = 0,5 bar
2 = 2 bar	
4 = 4 bar	
8 = 8 bar	

Series number

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

2 HYDRAULIC CHARACTERISTICS

Hydraulic symbols



Model	ADRL-10	ADRL-15	ADRL-20	ADRL-32	AGRL-10	AGRL-20	AGRL-32	AGRLE-10	AGRLE-20	AGRLE-32
Piloting ratio (1)	2,8	2,7	2,5	2,3	13,6	14,0	14,4	13,6	14,0	14,4
Max recommended flow [l/min]	30	60	100	300	160	300	500	160	300	500
Max pressure [bar]	400	350			315					

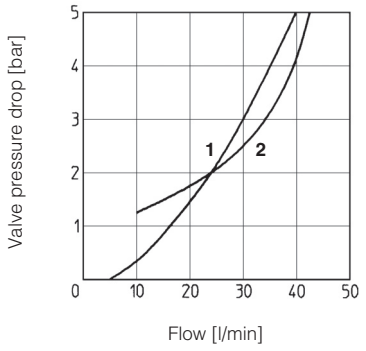
(1) Applying the pilot pressure through the pilot port X, the pilot spool opens the check valve, allowing free flow B→A.
The minimum pilot pressure for correct operation depends on the pilot ratio indicated in the table and on the pressure closing the check. i.e.: the pilot pressure for ADRL-20 is the pressure on the check divided by 2,5. The valves AGRL-* and AGRLE-*, are equipped with a decompression system.

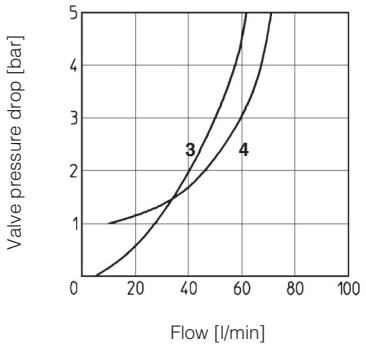
3 **MAIN CHARACTERISTICS, SEALS AND FLUIDS** - for other fluids not included in below table, consult our technical office

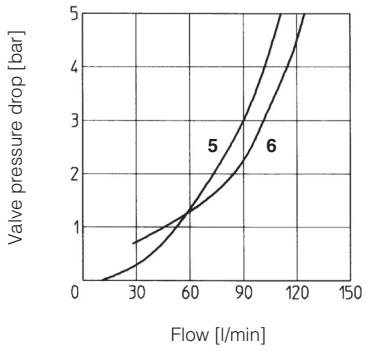
Assembly position	Any position. For AGRLE valves, the drain port Y has to be connected directly to the tank without counter pressure		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -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 KTF catalog		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
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	

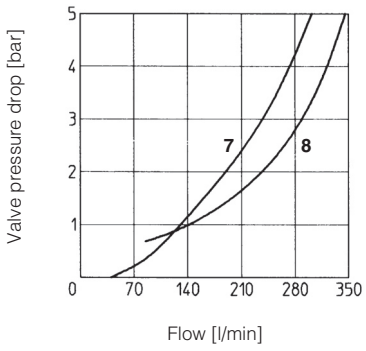
4 **FLOW VERSUS PRESSURE DROP DIAGRAMS FOR ADRL** based on mineral oil ISO VG 46 at 50°C

1 = **ADRL-10** B→A
2 = **ADRL-10** A→B
3 = **ADRL-15** B→A
4 = **ADRL-15** A→B
5 = **ADRL-20** B→A
6 = **ADRL-20** A→B
7 = **ADRL-32** B→A
8 = **ADRL-32** A→B



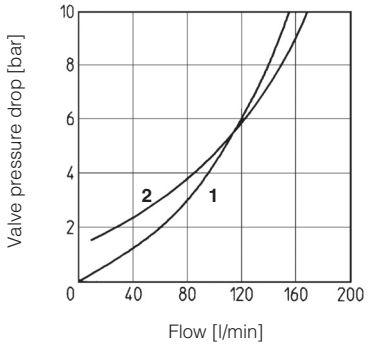


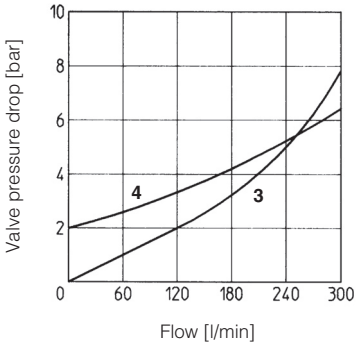


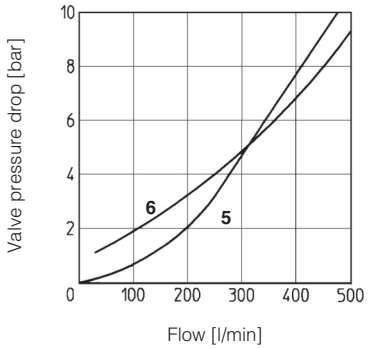


5 FLOW VERSUS PRESSURE DROP DIAGRAMS FOR AGRL AND AGRLE based on mineral oil ISO VG 46 at 50°C

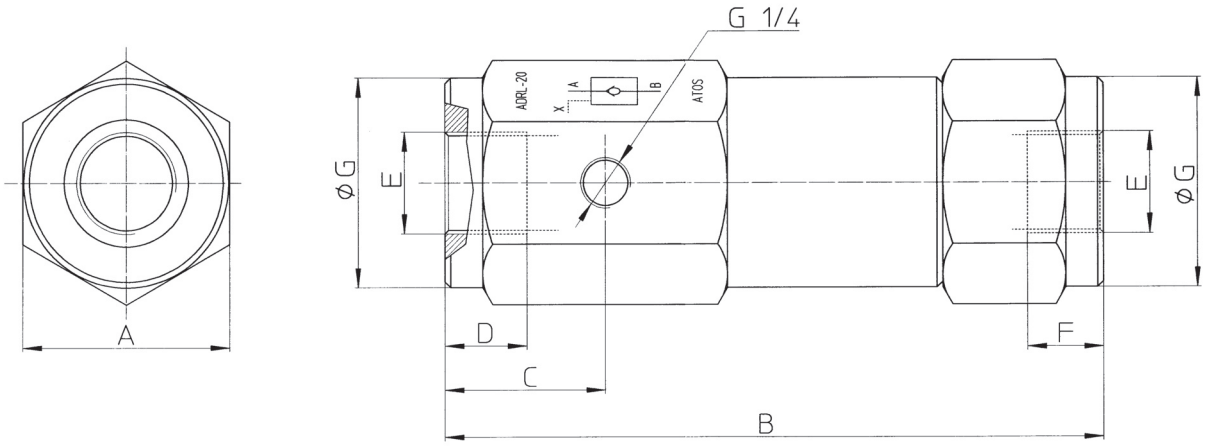
1 = **AGRL-10, AGRLE-10** B→A
2 = **AGRL-10, AGRLE-10** A→B
3 = **AGRL-20, AGRLE-20** B→A
4 = **AGRL-20, AGRLE-20** A→B
5 = **AGRL-32, AGRLE-32** B→A
6 = **AGRL-32, AGRLE-32** A→B







6 DIMENSIONS FOR ADRL VALVES [mm]

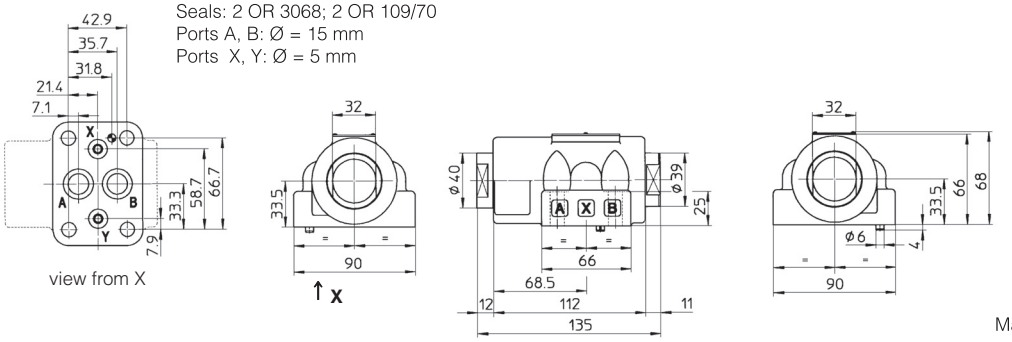


Model	A	B	C	D	E	F	ØG	Mass [Kg]
ADRL-10	41	120	30	14	G 3/8"	12	40	1
ADRL-15	50	145	33	16	G 1/2"	16	49	2
ADRL-20	55	175	42,5	18,5	G 3/4"	19	54,5	2,5
ADRL-32	90	245	53	23,5	G 1 1/4"	25	87,5	7

7 DIMENSIONS FOR AGRL AND AGRLE VALVES [mm]

AGRL-10
AGRLE-10

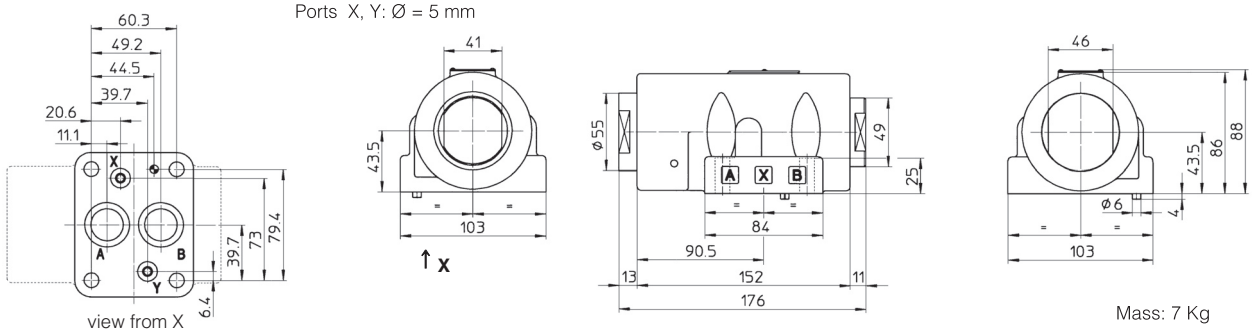
ISO 5781: 2000
Mounting surface: 5781-06-07-0-00
Fastening bolts: 4 socket head screws M10x45 class 12.9
Tightening torque = 70 Nm
Seals: 2 OR 3068; 2 OR 109/70
Ports A, B: Ø = 15 mm
Ports X, Y: Ø = 5 mm



Mass: 4 Kg

AGRL-20
AGRLE-20

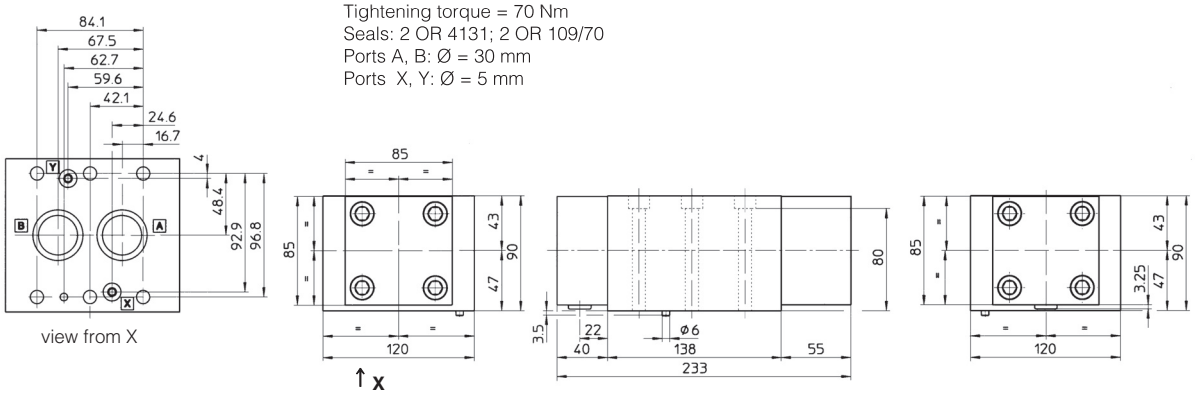
ISO 5781: 2000
Mounting surface: 5781-08-10-0-00
Fastening bolts: 4 socket head screws M10x45 class 12.9
Tightening torque = 70 Nm
Seals: 2 OR 4100; 2 OR 109/70
Ports A, B: Ø = 23 mm
Ports X, Y: Ø = 5 mm



Mass: 7 Kg

AGRL-32
AGRLE-32

ISO 5781: 2000
Mounting surface: 5781-10-13-0-00
Fastening bolts: 6 socket head screws M10x100 class 12.9
Tightening torque = 70 Nm
Seals: 2 OR 4131; 2 OR 109/70
Ports A, B: Ø = 30 mm
Ports X, Y: Ø = 5 mm



Mass: 14,8 Kg

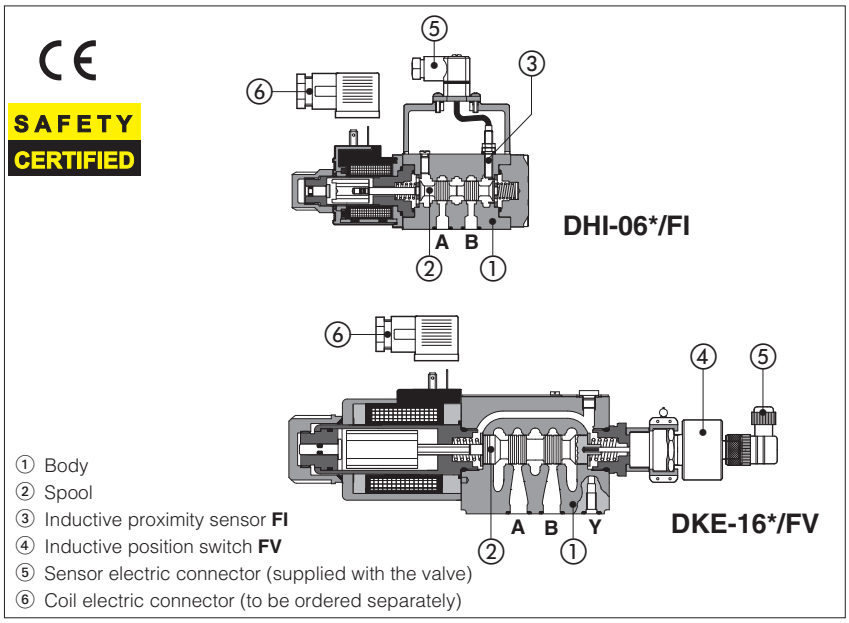
8 MOUNTING SUBPLATES FOR AGRL AND AGRLE VALVES

Valve	Subplate model	Port location	GAS ports				Ø Counterbore [mm]				Mass [kg]
			A	B	X	Y	A	B	X	Y	
AGRL-10, AGRLE-10	BA-305	Ports A, B, X, Y underneath;	1/2"	1/2"	1/4"	1/4"	30	30	21,5	21,5	1
AGRL-20, AGRLE-20	BA-505		1"	1"	1/4"	1/4"	46	46	21,5	21,5	2
AGRL-32, AGRLE-32	BA-705 A		1 1/2"	1 1/2"	1/4"	1/4"	63,5	63,5	21,5	21,5	7,5

The subplates are supplied with fastening bolts. For further details see table K280.

Safety directional valves with spool position monitoring

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



① Body
② Spool
③ Inductive proximity sensor **FI**
④ Inductive position switch **FV**
⑤ Sensor electric connector (supplied with the valve)
⑥ Coil electric connector (to be ordered separately)

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.

DHI, size 06, for AC and DC supply, with cURus certified solenoids

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 [11] for sensors availability and technical characteristics.

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

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

Max flow: **DHI 60 l/min**
DHE 80 l/min
DKE 150 l/min

Max pressure: **350 bar**

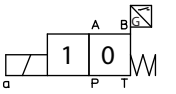
[1] RANGE OF VALVE'S MODELS

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

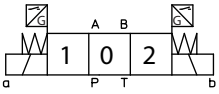
Notes:
FI = inductive proximity sensor, type NO (normally open) or NC (normally closed)
FV = inductive position switch providing both NO and NC contacts to be wired on the electric connector
See section [11] for sensor's characteristics

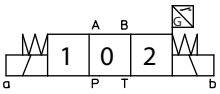
1.1 FI sensor & FV switch configurations

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

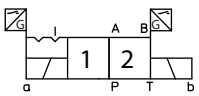


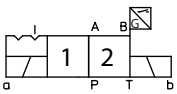
Double solenoid valves size 06 & 10 are provided with n° 2 FI sensors or n° 1 FV switch for the spool position monitoring



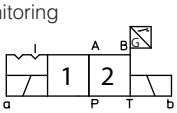


Double solenoid valves size 06 with detent are provided with n°2 FI sensors or n° 1 FV switch for the spool position monitoring





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 DHI and DHE safety valves, see section [2]
For model code of DKE safety valves, see section [4]

2 MODEL CODE OF DHI AND DHE

DHI	-	0	63	1/2	/	A	/	FV	*	-	X	24DC	**	/	*

Directional control valve size 06
DHI = max flow 60 l/min
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

Spool position monitor:
FI = inductive proximity switch
FV = inductive position switch (double contact)

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

X = without connector, see section 10 for available connectors, to be ordered separately

Voltage code, see section 9

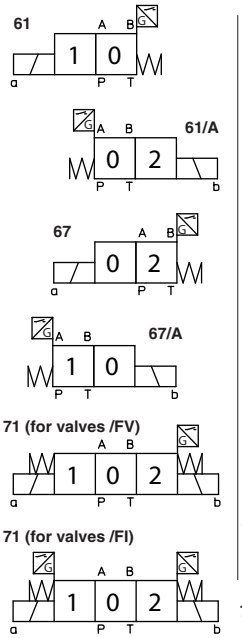
Series number

Seals material see sect. 6,7
- = NBR
PE = FKM

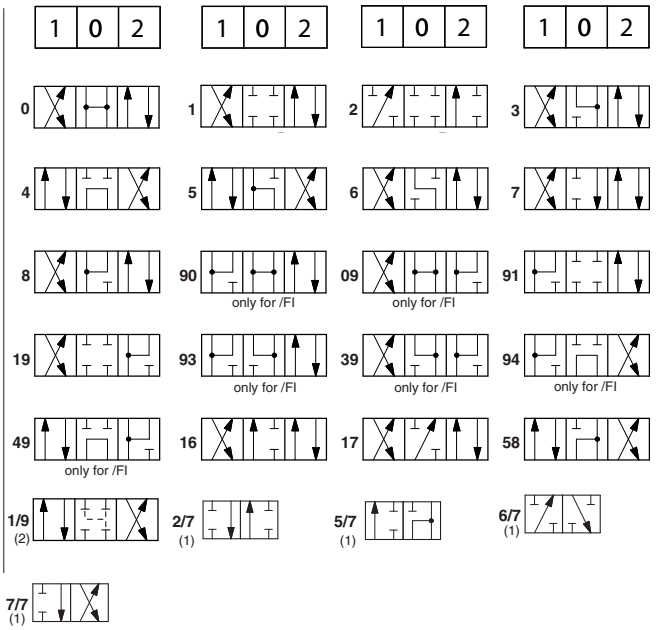
(1) the **FV** inductive position switch provides both NC and NO contacts

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

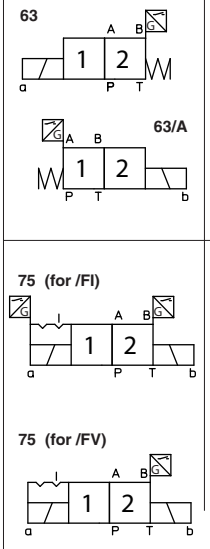
Configurations



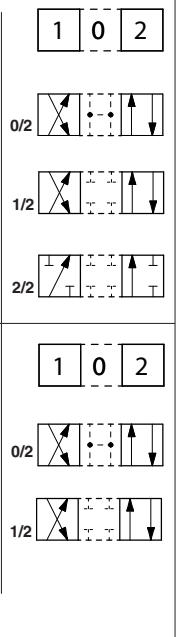
Spools



Configurations



Spools



(1) only for configuration 61, not available for configuration 61/A
(2) only for DHI-0711/9/FI and DHE-0711/9/FI

3.2 Special shaped spools for DHI and 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 swiching.
- 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.

3.1 Standard spool availability for DHI and 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
DHI/FI	•	•	•	•	•	•	•
DHI/FV							
DHE/FI	•	•	•	•	•	•	•
DHE/FV							

4 MODEL CODE OF DKE

DKE	- 1	63	1/2	/ A	/ FV	* - X	24DC	** /	*

Directional control valve size 10

Size ISO 4401
1 = size 10

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 position, spring offset
71 = double solenoid, 3 positions, spring centered
75 = double solenoid, 2 external positions, with detent

Spool type, see section 5

Options, see section 8

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

X = without connector, see section 10 for available connectors, to be ordered separately

Voltage code, see section 9

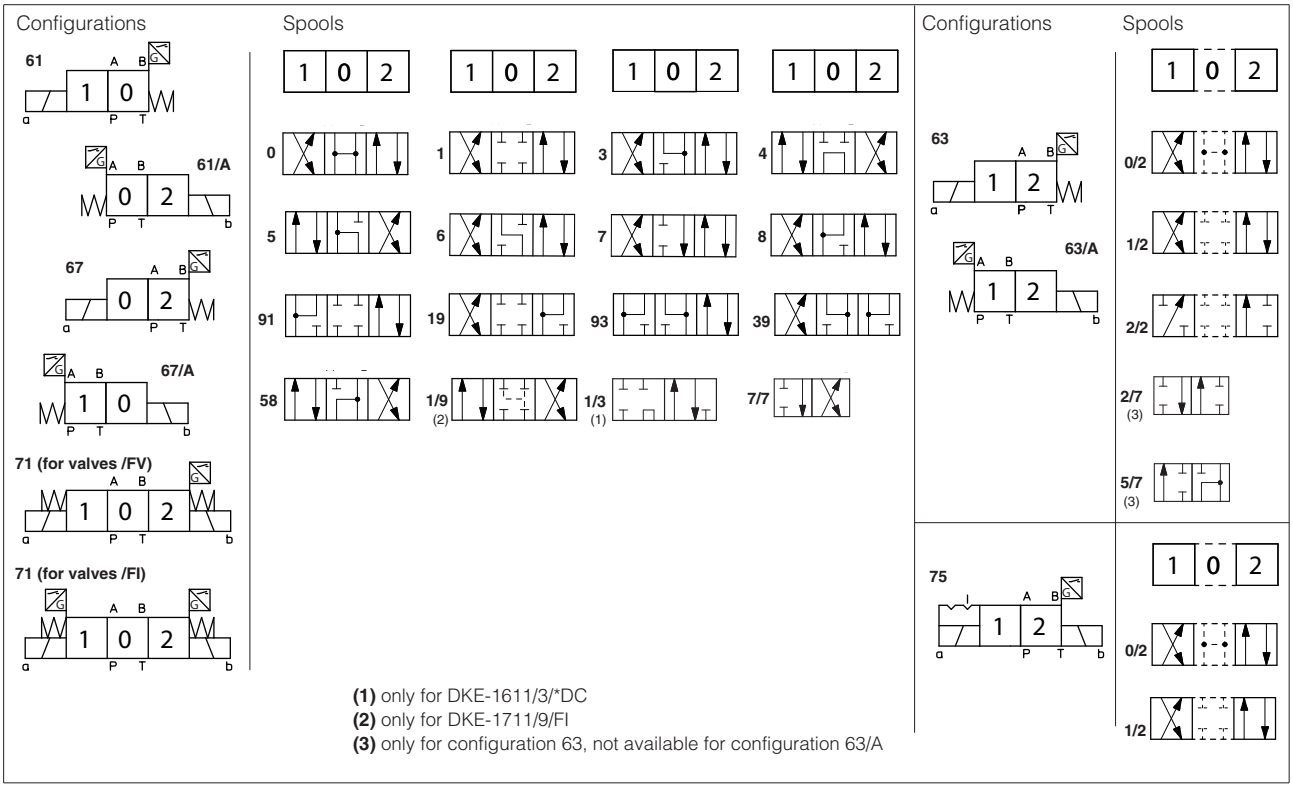
Series number

Seals material see sect. 6,7
- = NBR
PE = FKM

Spool position monitor:
FI = inductive proximity switch
FV = inductive position switch (double contact)

DKE/FI and /FV are always provided with Y drain port
(1) the **FV** inductive position switch provides both NC and NO contacts

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



(1) only for DKE-1611/3/*DC
(2) only for DKE-1711/9/FI
(3) only for configuration 63, not available for configuration 63/A

5.1 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 2015/65/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
Operating pressure	**DHI**	P, A, B = **350 bar** T = **100 bar** (version /FI); **120 bar** (version /FV)
	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	**DHI**	**60 l/min** see section 15
	DHE	**80 l/min** see section 15
	DKE	**150 l/min** see section 15

(1) The type-examination certificate can be download from

6.1 Coils characteristics

Insulation class	**H** (180°C) for DC coils (all versions) and AC coils (only DHI) **F** (155°C) for AC coils (DHE, DKE) 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 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 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	

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 ELECTRIC FEATURES

9.1 COILS FOR DHI AND DHE VALVES

Valve	External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption **(3)**		Code of spare coil		
				DHI	**DHE**	**DHI**	Colour of coil label **DHI**	**DHE**
DHI DHE	6 DC	**6 DC** (4)	666 or 667	33 W	30 W	COU-6DC	brown	-
	12 DC	**12 DC**				COU-12DC	green	COE-12DC
	14 DC	**14 DC**				COU-14DC	brown	COE-14DC
	24 DC	**24 DC**				COU-24DC	red	COE-24DC
	28 DC	**28 DC**				COU-28DC	silver	COE-28DC
	48 DC	**48 DC**				COU-48DC	silver	COE-48DC
	110 DC	**110 DC**				COU-110DC	gold	COE-110DC
	125 DC	**125 DC**				COU-125DC	blue	COE-125DC
	220 DC	**220 DC**				COU-220DC	black	COE-220DC
	24/50 AC	**24/50/60 AC** (4)		60 VA	-	COI-24/50/60AC (1)	pink	-
	24/60 AC							
	48/50 AC	**48/50/60 AC** (4)				COI-48/50/60AC (1)	white	-
	48/60 AC							
	110/50 AC	**110/50/60 AC**			58 VA	COI-110/50/60AC (1)	yellow	COE-110/50/60AC
	115/60 AC (5)	**115/60 AC**		-	80 VA	-		COE-115/60AC
	120/60 AC (4)	**120/60 AC**		60 VA	-	COI-120/60AC	white	-
	230/50 AC	**230/50/60 AC**			58 VA	COI-230/50/60AC (1)	light blue	COE-230/50/60AC
	230/60 AC	**230/60 AC**			80 VA	COI-230/60AC	silver	COE-230/60AC
	110/50 AC	**110RC**	669	33 W	30 W	COU-110RC	gold	COE-110RC
	120/60 AC							
	230/50 AC	**230RC**				COU-230RC	blue	COE-230RC
	230/60 AC							

(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 (DHI) and 58 VA (DHE)
(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. Inrush current values correspond to a power consumption of about 150 VA.
(4) Only for DHI
(5) Only for DHE

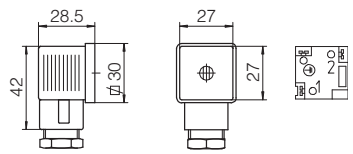
9.2 COILS FOR DKE VALVE

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

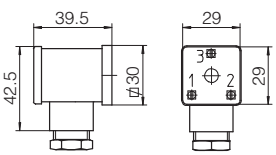
(1) In case of 60 Hz voltage frequency the performances are reduced by 10÷15% and the power consumption is 90 VA
(2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(3) When solenoid is energized, the inrush current is approx 3 times the holding current.

10 COILS ELECTRIC CONNECTORS - according to din 43650 (to be ordered separately)

666, 667 (for AC or DC supply)



669 (for AC supply)



CONNECTOR WIRING

666, 667	**669**
1 = Positive ⊕ 2 = Negative ⊖ ⊕ = Coil ground	1,2= Supply voltage VAC 3 = Coil ground

SUPPLY VOLTAGES

666	**667**	**669**
All voltages	24 AC or DC 110 AC or DC 220 AC or DC	110/50 AC 110/60 AC 230/50 AC 230/60 AC

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

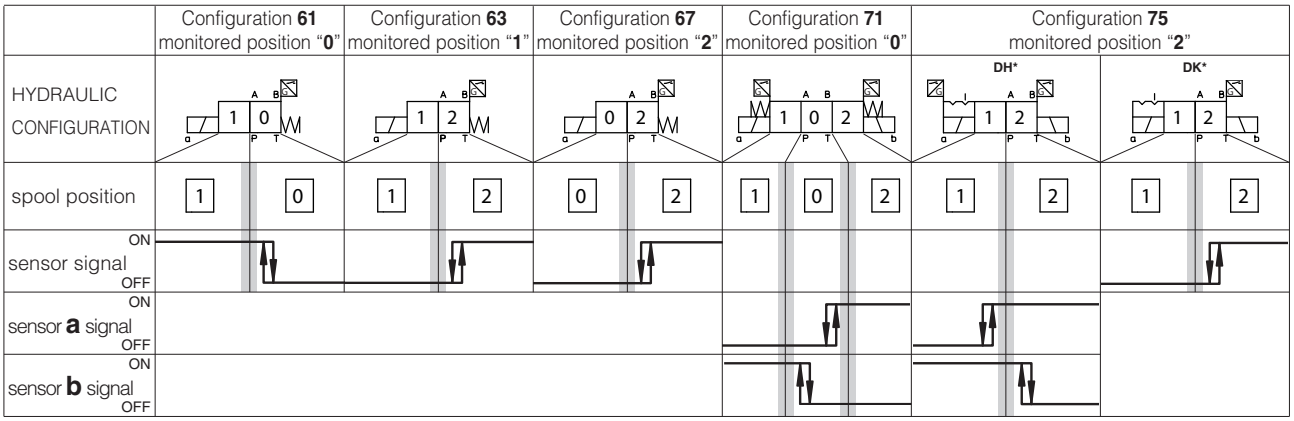
12 CONNECTING SCHEMES OF INDUCTIVE PROXIMITY AND POSITION SWITCHES - FI and FV sensor's connector are always supplied with the valve

DH*/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

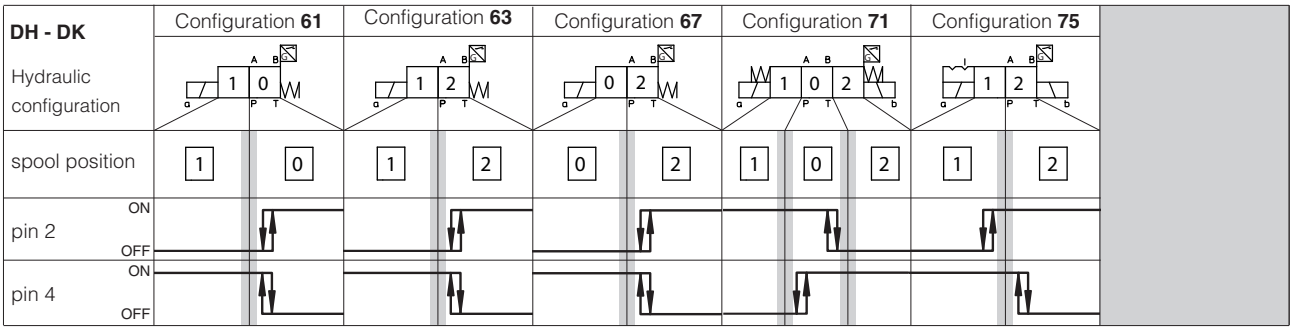
13 STATUS OF OUTPUT SIGNAL

13.1 Signal status for FI versions



Diagrams show the behaviour of the output signal for inductive switches type **FI/NO**.
For inductive switches type **FI/NC** the behaviour is opposite (high level signal instead of low level signal and viceversa)

13.2 Signal status for FV versions



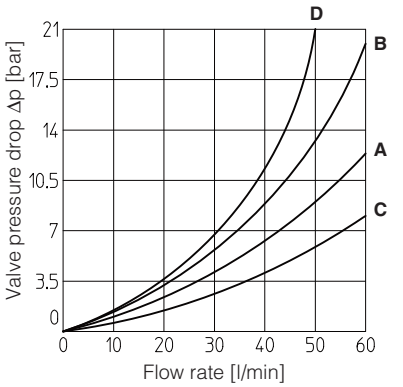
Note: FV position switch can be electrically wired by the customer as NO or NC and then the status of the output signal will be in accordance to the selected configuration

= intermediate spool position corresponding to the hydraulic configuration change

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

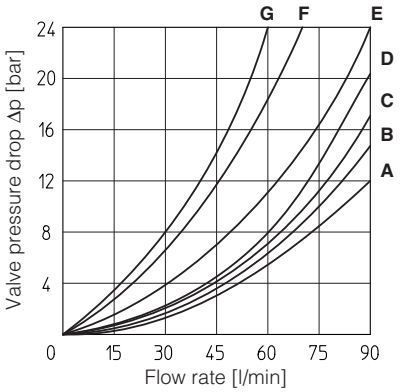
DHI

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, 1/9	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	
09, 19, 90, 91	B	B	A	A	
39, 93	D	D	D	D	



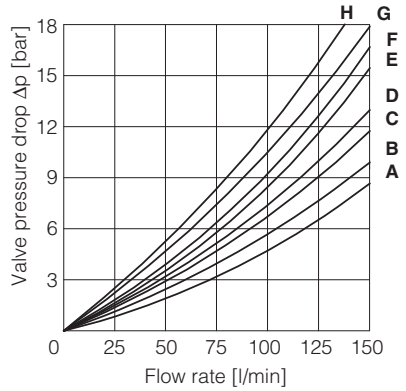
DHE

Flow direction / Spool type	P→A	P→B	A→T	B→T	P→T
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	



DKE

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, 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



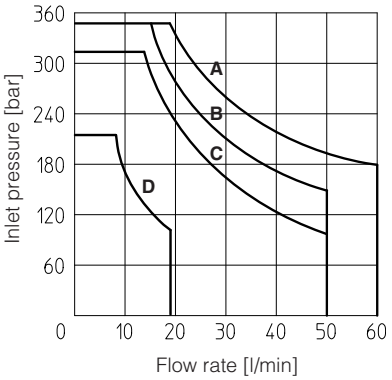
15 **OPERATING LIMITS** based on mineral oil ISO VG 46 at 50°C

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.

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

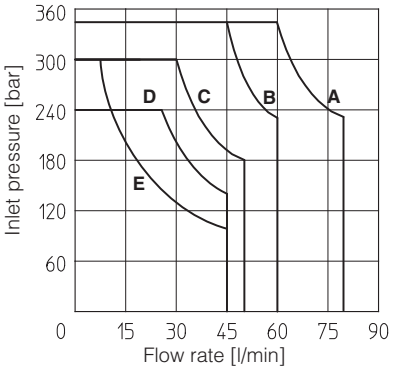
DHI



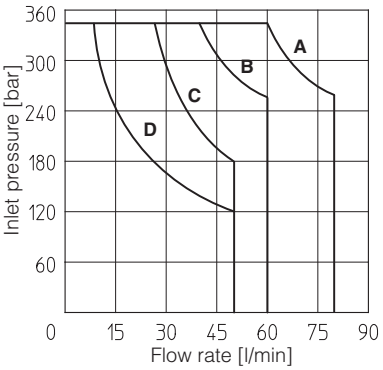
DHE

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	-

DHE - AC



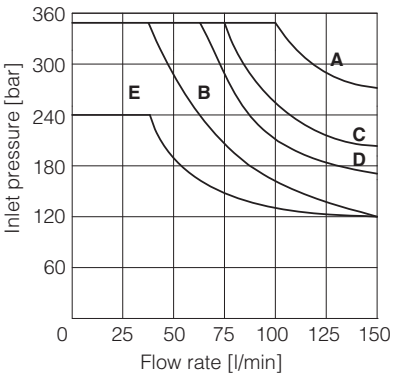
DHE - DC



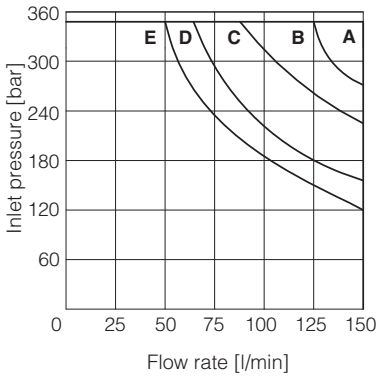
DKE

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

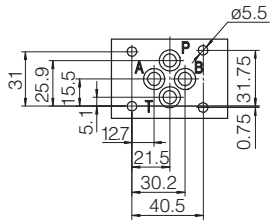
DKE - AC



DKE - DC



16 DIMENSIONS FOR DHI AND DHE SOLENOID SAFETY VALVES [mm]

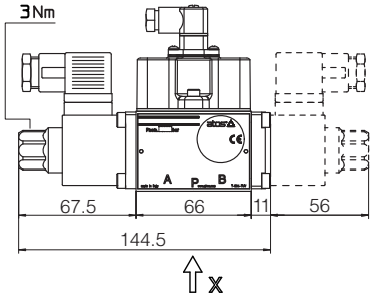


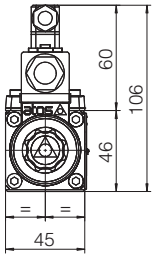
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Fastening bolts:
4 socket head screws: M5x50 class 12.9 (DHI)
M5x30 class 12.9 (DHE)
Tightening torque = 8 Nm
Seals: 4 OR 108
Ports P,A,B,T: Ø = 7.5 mm (max)

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

option /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

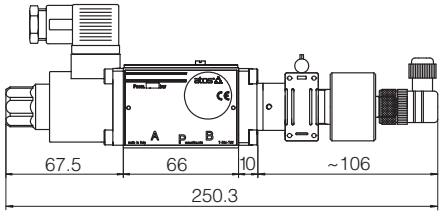
DHI-06*/FI (DC, AC)
DHI-07*/FI (DC, AC) dotted line

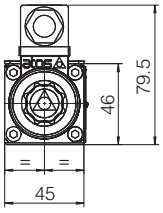




Mass:
kg 1,6 (one solenoid)
kg 1,9 (two solenoids)

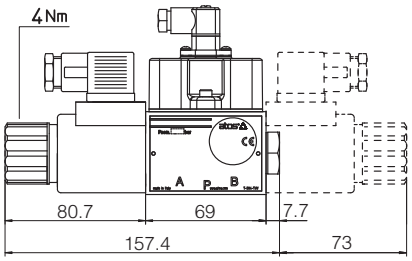
DHI-06*/FV (DC, AC)

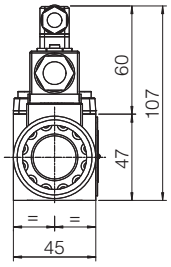




Mass: kg 1,7

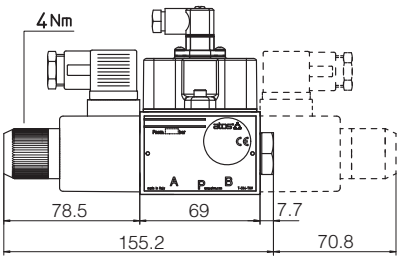
DHE-06*/FI (DC)
DHE-07*/FI (DC) dotted line

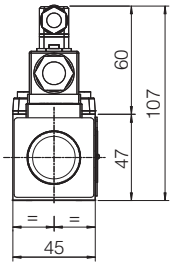




Mass:
kg 1,85 (one solenoid)
kg 2,1 (two solenoids)

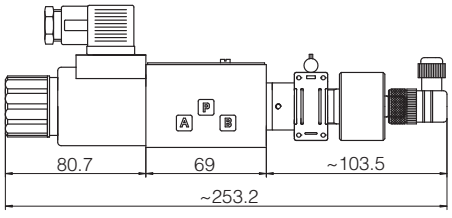
DHE-06*/FI (AC)
DHE-07*/FI (AC) dotted line





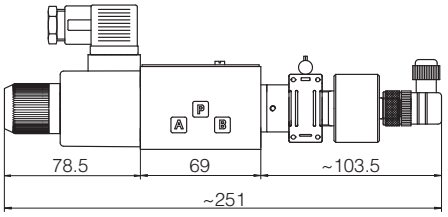
Mass:
kg 1,85 (one solenoid)
kg 2,1 (two solenoids)

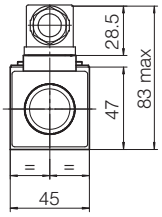
DHE-06*/FV (DC)



Mass: kg 1,95

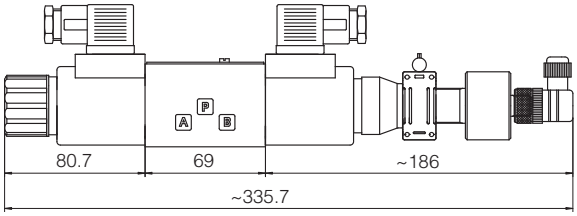
DHE-06*/FV (AC)

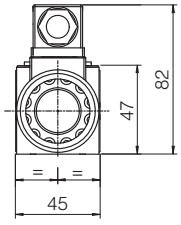




Mass: kg 1,8

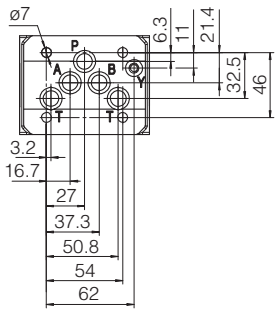
DHE-07*/FV (DC)





Mass: kg 2,2

17 DIMENSIONS OF DKE SOLENOID SAFETY VALVES [mm]

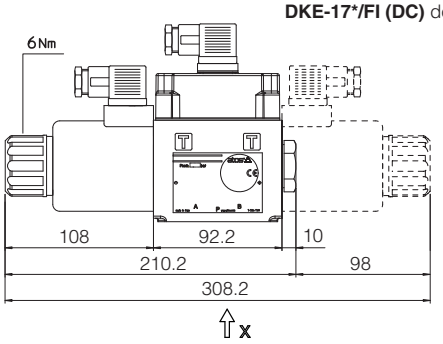


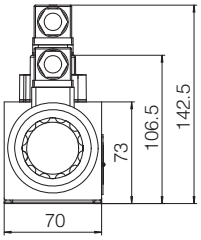
ISO 4401: 2005
Mounting surface:
4401-05-05-0-05
(without port X)
Fastening bolts:
4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Seals: 5 OR 2050. 1 OR 108
Ports P,A,B,T: Ø = 11.5 mm (max)
Ports Y: Ø = 5 mm

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

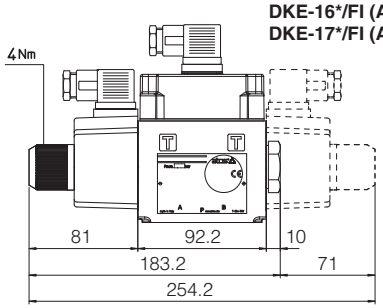
DKE-16*/FI (DC)
DKE-17*/FI (DC) dotted line

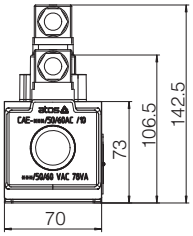




Mass:
kg 4,4 (one solenoid)
kg 5,8 (two solenoids)

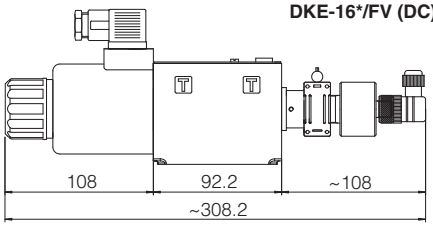
DKE-16*/FI (AC)
DKE-17*/FI (AC) dotted line





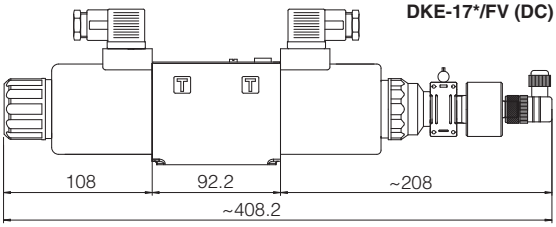
Mass:
kg 3,7 (one solenoid)
kg 4,4 (two solenoids)

DKE-16*/FV (DC)



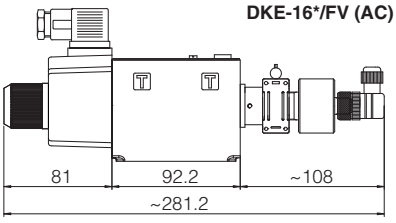
Mass: kg 4,4

DKE-17*/FV (DC)



Mass: kg 5,9

DKE-16*/FV (AC)



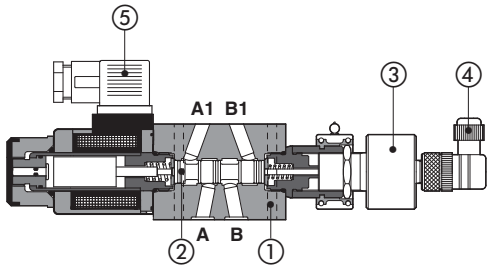
Mass: kg 3,8

Safety modular valves with spool position monitoring

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

CE

SAFETY CERTIFIED



HF-0611/FV

① Body
② Spool
③ Inductive position switch **FV**
④ Sensor electric connector (supplied with the valve)
⑤ Coil electric connector (to be ordered separately)

HF are spool type, direct operated solenoid valves in modular execution, normally used for safety functions to shut-off or to by-pass the hydraulic user lines.
They are provided with **FV** inductive position switch for spool position monitoring, **CE** marked and certified by **TÜV** in accordance with safety requirements of Machine Directive 2006/42/EC.

The modular execution permits to make compact functional circuits, by the stack mounting with other modular valves and solenoid valves size 06.

Applications
Syncro press brakes, vertical presses, plastic injection, ceramic presses.

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

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

1 MODEL CODE

HF-0	61	1	/	A	/	FV	-	E	X	24DC	**	/*

HF-0: Modular directional valve size 06

61: **Valve configuration**, see section 2
61 = single solenoid, central plus external position, spring centered
67 = single solenoid, central plus external position, spring offset

1: **Spool type**: **1**, **3**, **4** see section 2

A: **Options**:
A = solenoid mounted at side of port B
B = orientation of coil and proximity connectors rotated of 180°

FV: **Optional spool position monitor**:
FV = inductive position switch (only for HF-0611, HF-0614, HF-0673)

E: **E** = solenoid OE for AC and DC supply

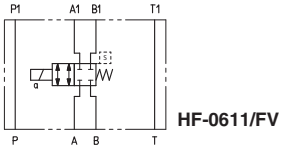
X: **X** = without connector
See section 6 for available connectors, to be ordered separately

24DC: **Voltage code**, see section 7

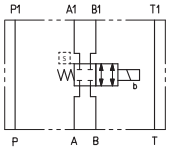
******: Series number

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

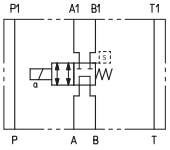
2 CONFIGURATION



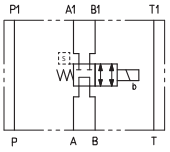
HF-0611/FV



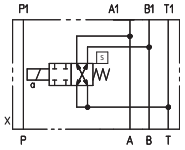
HF-0611/AFV



HF-0614/FV



HF-0614/AFV



HF-0673/FV

3 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 2015/65/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 2
Operating pressure	Ports P,A,B: **350** bar; Port T: **210** bar (DC solenoid); **160** bar (AC solenoid)
Maximum flow	**60 l/min**

(1) The type-examination certificate can be download from

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 mating connectors correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric features 7
Supply voltage tolerance	± 10%
Certification	**cURus** North American standard

4 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 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	

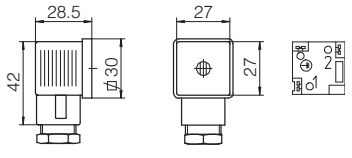
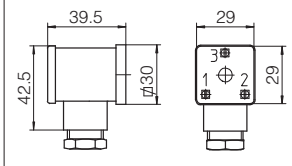
5 OPTIONS

A = Solenoid mounted at side of port B. In standard versions, solenoid is mounted at side of port A.

B = Orientation of coil and proximity connectors rotated of 180°

the manual operation is not permitted for safety valves, than they are provided with solenoid blind rings to prevent the access to the manual override.

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

666, 667 (for AC or DC supply)	**669** (for AC supply)	**CONNECTOR WIRING**	
		**666, 667** 1 = Positive ⊕ 2 = Negative ⊖ ⊕ = Coil ground	**669** 1,2 = Supply voltage VAC 3 = Coil ground
		SUPPLY VOLTAGES	
		666 All voltages	**667** 24 AC or DC 110 AC or DC 220 AC or DC
			669 110/50 AC 110/60 AC 230/50 AC 230/60 AC

Note: for electronic connectors type **E-SD**, see tab. K500

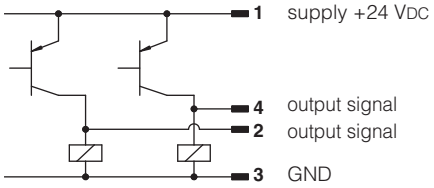
7 ELECTRIC FEATURES

External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption (2)	Code of spare coil
12 DC	**12 DC**	666 or 667	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.

8 TECHNICAL CHARACTERISTICS OF FV INDUCTIVE POSITION SWITCH

Type of switch		contactless inductive position switch with integrated amplifier
Supply voltage	[V]	20÷32
Ripple max	[%]	≤ 10
Max current	[mA]	400
Reaction time	[ms]	15
Max peak pressure	[bar]	400
Mechanical life		virtually infinite
Switch logic		PNP

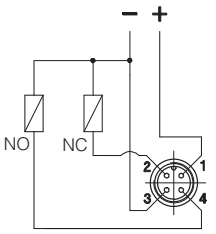


9 CONNECTING SCHEME OF FV INDUCTIVE POSITION SWITCH

single solenoid

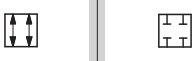
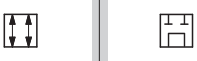
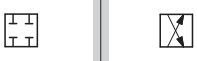
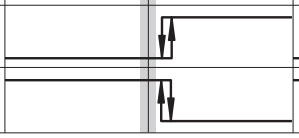
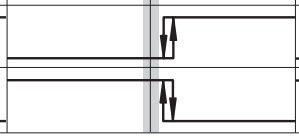
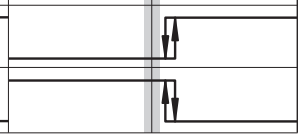
Connector type **ZBE-06**
(supplied with the valve)

1 = supply +24 VDC
2 = output signal NC
3 = GND
4 = output signal NO



Note: the /FV position switch is not provided with a protective earth connection

10 STATUS OF OUTPUT SIGNAL FOR MODULAR VALVES WITH /FV INDUCTIVE POSITION SWITCH

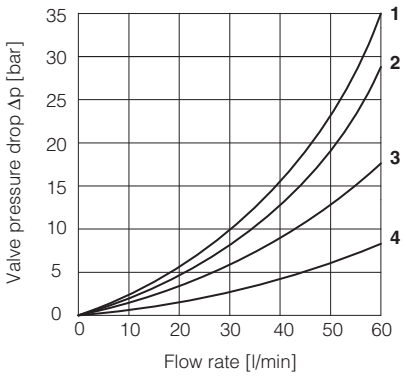
Hydraulic configuration	Configuration **611**	Configuration **614**	Configuration **673**
spool position			
pin 2 ON / OFF			
pin 4 ON / OFF			

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

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

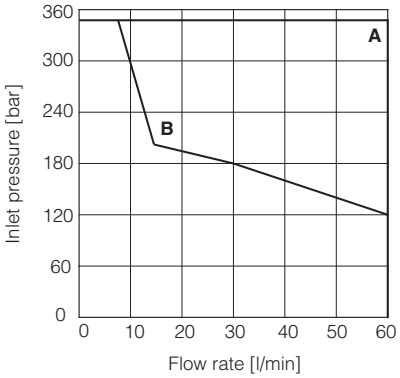
Flow direction / Valve type	A→A1	B→B1	A→B	A1→T	B1→T
HF-0611	1	2			
HF-0614	1	2	3		
HF-0673	3	3		4	4



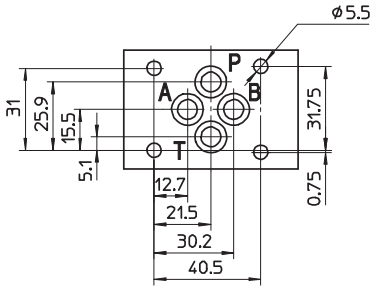
12 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams have been obtained with warm solenoids and power supply at lowest value (V_{nom} - 10%)

Valve type	Curve
HF-0611	**A**
HF-0614, HF-0673	**B**

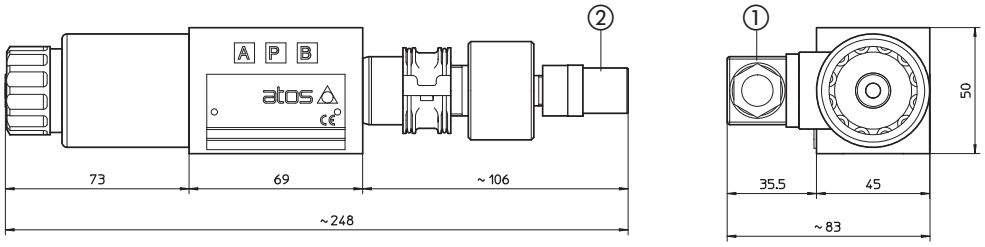


13 DIMENSIONS [mm]



ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Seals: 4 OR 108
Ports P, A, B, T: Ø = 7.5 mm (max).

HF-0611/FV
HF-0614/FV
HF-0673/FV



① = Power supply connector code 666, 667 or 669, to be ordered separately

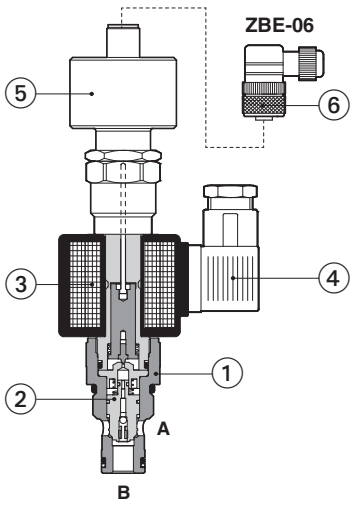
② = Inductive position switch connector code ZBE-06, supplied with the valve

Safety cartridge valves with poppet position monitoring

screw-in, 2-way, poppet type, leak free, conforming to Machine Directive 2006/42/CE - certified by

CE

SAFETY CERTIFIED



1. cartridge body
2. poppet
3. coil
4. coil connectors
5. inductive position switch
6. sensor connector (to be ordered separately)

JO-DL-4-2/FV-X 24DC

JO-DL are leak free, poppet type solenoid cartridges in screw-in execution normally used to cut off the hydraulic power supply line. They are available in normally closed NC configuration.

They are provided with /**FV** inductive position switch (double contact NC/NO) ⑤ wich supplies the output electrical on-off signal indicating the poppet ② position (open/closed), and therefore they can be used as safety valves for emergency conditions.

They are **CE** marked and certified by **TÜV** in accordance with safety requirements of Machine Directive 2006/42/CE.

Certification
The **TÜV** certificate can be downloaded from , catalog on line, tech-nical information section.

Max flow: **300 l/min**
Max pressure: **350 bar**

1 MODEL CODE

JO	-	D	L	-	4	-	2	/	FV	-	X	24 DC	**	/	*

JO — Cartridge valve screw-in type UNF

D = Directional control

L = Poppet type

Size:
4 = 3/4"-16UNF-2A
6 = 7/8"-14UNF-2A
10 = 1 5/16"-12UNF-2A

2 = Two-way

Version:
FV = normally closed in rest position, with inductive position switch (double contact)

X = Without connector, see section 5 for available connector

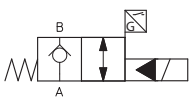
Voltage code:
12DC = 12 VDC
24DC = 24 VDC

****** — Series number

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

2 HYDRAULIC CHARACTERISTICS

Hydraulic symbol



Model			JO-DL-4-2/FV	JO-DL-6-2/FV	JO-DL-10-2/FV
Operating pressure		[bar]	Ports A and B **350**		
Max flow		[l/min]	40	75	300
Response time:	energizing	[ms]	35	30	35
	de-energizing	[ms]	50	60	70
Internal leakage			less than 5 drops/min (≤ 0,36 cm³/min) max at 350 bar		

3 GENERAL CHARACTERISTICS

Installation position	Any position
Cavity	JO-DL-4 = SAE-08-2N; JO-DL-6 = SAE-10-2N; JO-DL-10 = SAE-16-2N
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.
Ambient temperature	**Standard** execution = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C

(1) The type-examination certificate can be download from

4 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult Atos Technical Office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°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		
Fluid contamination class	ISO 4406 class 21/19/16 NAS 1638 class 10, in line filters of 25 μm (β10 ≥75 recommended)		
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	

5 ELECTRIC CHARACTERISTICS

Relative duty factor	100%	
Supply voltage	See model code at section 1	
Supply voltage tolerance	±10%	
Max power	19 Watt	
Power connector	666 (plastic - black); 3 pins, cable clamp PG11, cable max ø 11 mm	**to be ordered separately**
Type of connector for /FV version	Type ZBE-06 (plastic); 4 pins, cable clamp PG9, cable max ø 8 mm	
Connectors features	666: DIN 43650 - ISO 4400; IP65 (DIN 40050); VDE 0110C	
	ZBE-06: M12 - IEC60947-5-2; IP67 (DIN 40050)	

6 INSTALLATION NOTES

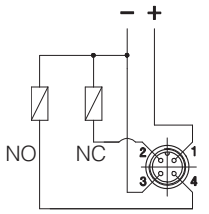
1) The assembling of cartridges inside manifolds must be done tightening the valve exagonal ring (for tightening torque, see section 10).
   Excessive values can cause anomalous deformation and poppet sticking.
   For the /FV versions avoid to tighten through the position sensor.
2) The CE certification is valid only with shielded electric cables and connector. Consult also tab. P004.
   These safety valves must be supplied only and always as one complete component, proximity sensor is factory adjusted.
   The supply of subcomponents invalidates the certification.

7 TECHNICAL CHARACTERISTICS AND CONNECTING SCHEME OF INDUCTIVE POSITION SWITCH /FV

Type of switch		position switch **/FV**
Supply voltage	[V]	20÷32
Ripple max	[%]	≤ 10
Max current	[mA]	400
Max peak pressure	[bar]	400
Mechanical life		virtually infinite
Switch logic		PNP

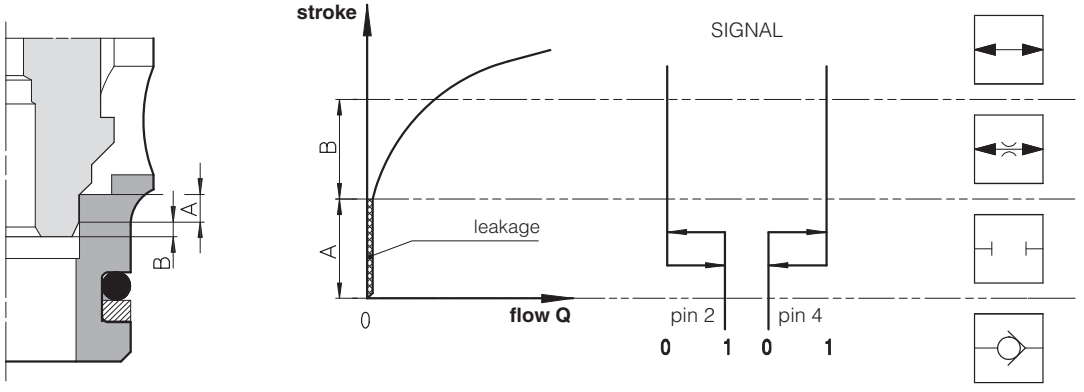
Note: the /FV position switch are not provided with a protective earth connection

Connector type **ZBE-06**



1 = supply +24 VDC
2 = output signal NC
3 = GND
4 = output signal NO

8 SIGNAL STATUS - VERSIONS /FV



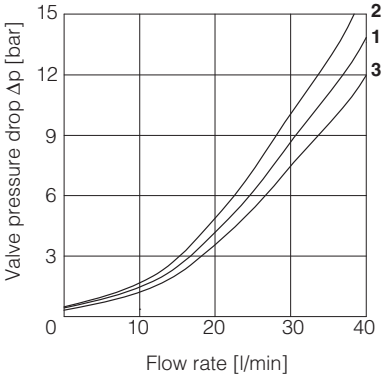
A: overlapping stroke
B: damping stroke

According the criteria of safety specifications, the poppet position signal must change its status inside the overlapping stroke (before the effective valve opening).

9 DIAGRAMS based on mineral oil ISO VG 46 at 50°C

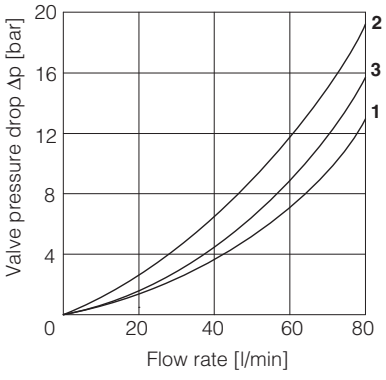
9.1 JO-DL-4

Valve pressure drop - FV version
1= A → B energized
2= B → A de-energized
3= B → A energized



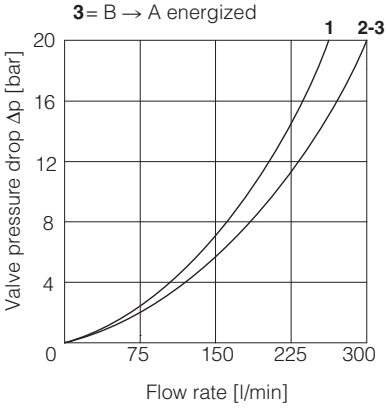
9.2 JO-DL-6

Valve pressure drop - FV version
1= A → B energized
2= B → A de-energized
3= B → A energized



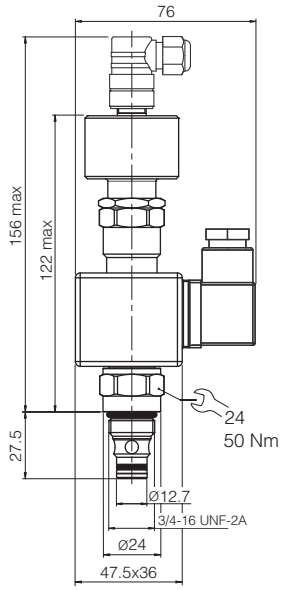
9.3 JO-DL-10

Valve pressure drop - FV version
1= A → B energized
2= B → A de-energized
3= B → A energized

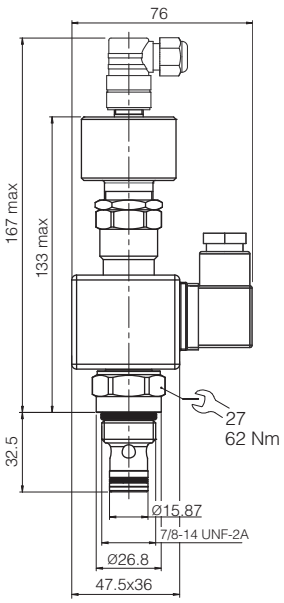


10 DIMENSIONS [mm]

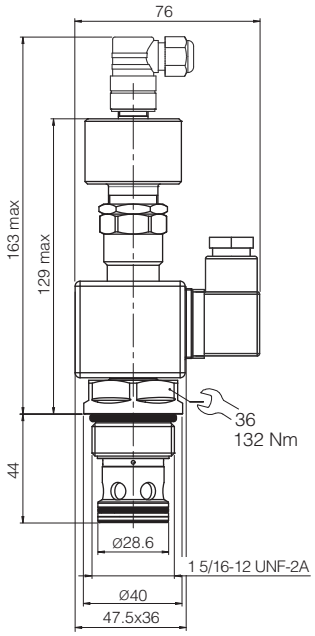
JO-DL-4-2-2/N*/FV
Mass 0.5 Kg



JO-DL-6-2/N*/FV
Mass 0.5 Kg

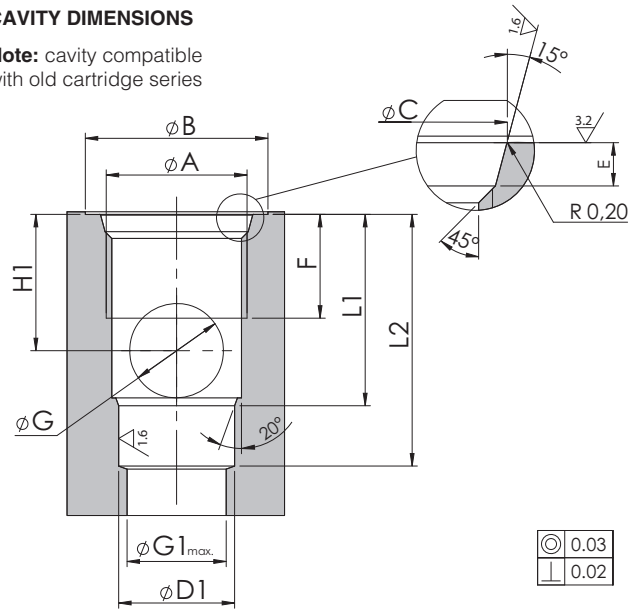


JO-DL-10-2/N*/FV
Mass 0.7 Kg



CAVITY DIMENSIONS

Note: cavity compatible with old cartridge series



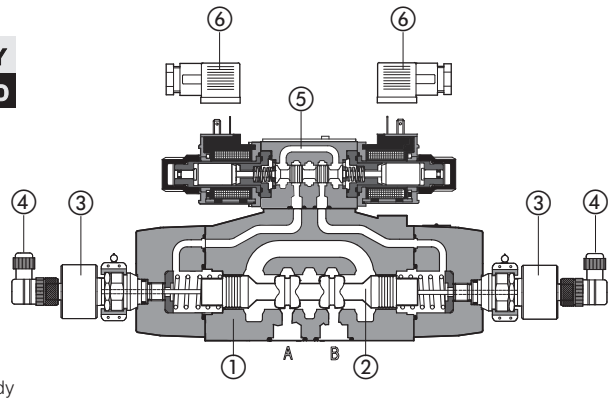
	SAE-08-2N	SAE-10-2N	SAE-16-2N
A	3/4-16 UNF	7/8-14 UNF	1 5/16-12 UNF
B	26	30	42
C	$20.6^{+0,1}_{0}$	$23.9^{+0,1}_{0}$	$35.5^{+0,1}_{0}$
D1	$12.7^{+0,05}_{0}$	$15.87^{+0,05}_{0}$	$28.60^{+0,05}_{0}$
E	$2.6^{+0,3}_{0}$	$2.6^{+0,3}_{0}$	$3.3^{+0,3}_{0}$
F	13	15	20
G	9	12	19
G1	12	15	24
H1	14	18	25
L1	20.5	25.5	36
L2	29	34.5	49

Safety directional valves with spool position monitoring

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

CE

SAFETY CERTIFIED



① Main body
② Main spool
③ Inductive position switch **FV**
④ Sensor electric connector (supplied with the valve)
⑤ Pilot solenoid valve
⑥ Coil electric connector (to be ordered separately)

DPHI-271*/FV

Pilot operated safety directional valves with main spool position monitoring, **CE** marked and certified by **TÜV** in accordance with safety requirements of Machine Directive 2006/42/EC.
Two models are available depending to the pilot valve execution:

DPHI for AC and DC supply, solenoid pilot valve ⑤ type DHI, with cURus certified solenoids, see tech. table E010
DPHE high performances, for AC and DC supply, solenoid pilot valve ⑤ type DHE with cURus certified solenoids, see tech. table E015

The valves are equipped with **FV** inductive position switch for the main spool position monitoring, see section 9 for sensor's technical characteristics.

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

Mounting surface: **ISO 4401, size 10, 16, 25**
Max flow: **160, 300, 700 l/min**
Max pressure: **350 bar**

1 MODEL CODE

DPH	I	-	2	71	1	/	A	/	FV	X	24DC	**	/	*

DPH: Pilot operated directional control valve

Solenoid pilot valve:
I = DHI for AC and DC supply with **cURus** certified solenoids
E = DHE for AC and DC supply, high performances with **cURus** certified solenoids

Valve size, ISO 4401:
1 = 10 **2** = 16 **4** = 25

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

Hydraulic options, see section 5
A, **D**, **E**, **R**
Optional devices for main spool switching control, see section 6
H, **H9**, **L9**

Spool position monitor
FV = inductive position switch (double contact)

X = without connector, see section 8 for available connectors, to be ordered separately

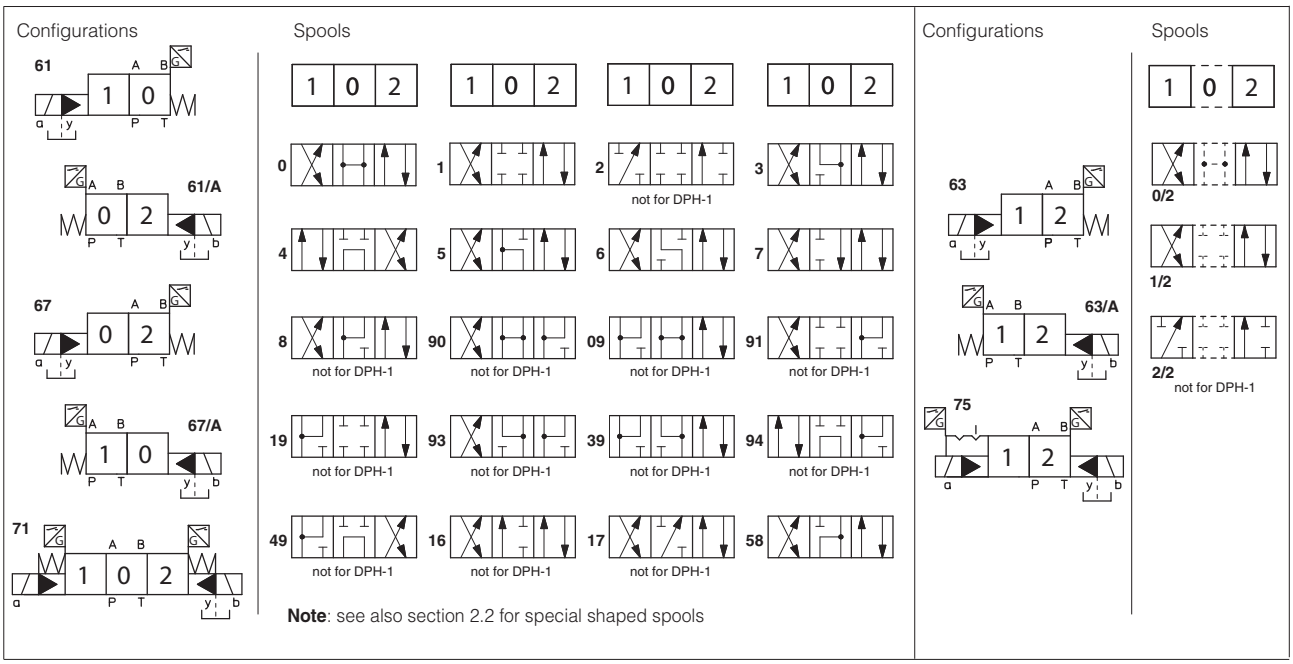
Voltage code, see section 7

Series number

Seals material see sect. 3,4
- = NBR
PE = FKM

Notes:
FV = inductive position switch providing both NO and NC contacts to be wired on the electric connector
The FV inductive position switch is directly connected to the valve main spool
In pilot operated valves only the main spool position is monitored; the pilot solenoid valve is not monitored

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



2.1 Standard spools availability

- DPH*-1 are available only with spools **0, 0/2, 1, 1/2, 3, 4, 5, 58, 6, 7**
- DPH*-2 and DPH*-4 are available with all spools shown in the above table

2.2 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, 58, 6** and **7** are also available as **1/1, 4/8, 5/1, 58/1, 6/1** and **7/1** that are properly shaped to reduce water-hammer shocks during the switching.

2.3 Special spool availability

Valve size	special shaped spool							
	0/1	3/1	1/1	4/8	5/1	58/1	6/1	7/1
DPH*-1	•	•		•				
DPH*-2, DPH*-4	•	•	•	•	•	•	•	•

3 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	75 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 2015/65/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 2
Operating pressure	P, A, B, X = **350 bar** (for pilot pressure see also option /L9 at section 6) T = **250 bar** for external drain (standard) T with internal drain (option /D) = **120 bar** DPHI; **210 bar** DPHE (DC); **160 bar** DPHE (AC) Y = 0 bar Minimum pilot pressure for correct operation is **8 bar**
Maximum flow	DPH*-1: **160 l/min;** DPH*-2: **300 l/min;** DPH*-4: **700 l/min** (see Q/Δp diagrams at section 12 and operating limits at section 13)

(1) The type-examination certificate can be download from

3.1 Coils characteristics

Insulation class	**H** (180°C) for DC coils (all versions) and AC coils (only DPHI) **F** (155°C) for AC coils (only DPHE) 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 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric features [7]
Supply voltage tolerance	± 10%
Certification	**cURus** North American standard

[4] 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 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	

[5] HYDRAULIC OPTIONS

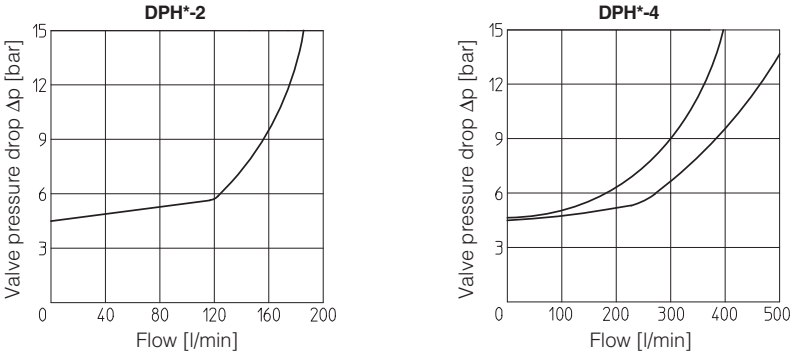
5.1 option /A = Solenoid mounted at side of port A of main body (only for single solenoid valves)
In standard version the solenoid is mounted at side of port B
For sensor position, see sect [16]

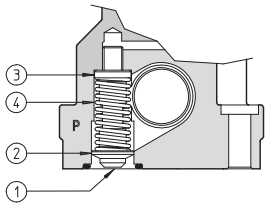
5.2 option /D = Internal drain (standard configuration is external drain)

5.3 option /E = External pilot pressure (standard configuration is internal pilot pressure)

5.4 option /R = Pilot pressure generator (4 bar on port P - not for DPH*-1)
The device **/R** generates an additional pressure drop, in order to ensure the minimum pilot pressure, for correct operation of the valves with internal pilot and fitted with spools type **0, 0/1, 4, 4/8, 5, 58, 09, 90, 94, 49.**
The device **/R** has to be fitted when the pressure drop in the valve, verified on flow versus pressure diagrams, is lower than the minimum pilot pressure value.

Pressure drop through the pilot pressure generator /R





① Flapper-guide ③ Spring stop-washer
② Flapper ④ Spring

Ordering code of spare pilot pressure generator

R/DP	-	*
Pilot pressure generator		Size: **2** for DP-2 **4** for DP-4

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 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

6 DEVICES FOR MAIN SPOOL SWITCHING CONTROL

Following options are suggested to reduce the hydraulic shocks at the valve operation

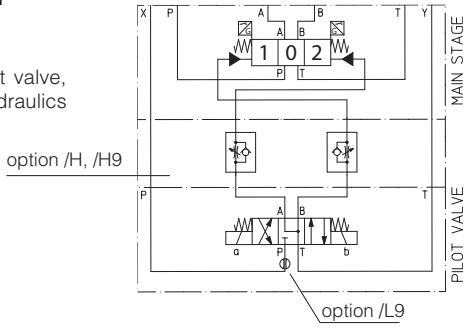
6.1 option /H = Adjustable chokes (meter-out to the pilot chambers of the main valve)

6.2 option /H9 = Adjustable chokes (meter-in to the pilot chambers of the main valve)

6.3 option /L9 = Only for DP-2 and DP-4: plug with calibrated restictor in P port of pilot valve, suggested in case of pilot pressure higher than 210 bar or to limit the hydraulics shocks caused by the fast main spool switching

Plug code:
PLUG-12A ø1,2 mm for DP-2
PLUG-15A ø1,5 mm for DP-4

FUNCTIONAL SCHEME (config. 71)
example of switching control options



7 ELECTRIC FEATURES

Valve	External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption **(3)**		Code of spare coil		
				DPHI	**DPHE**	**DPHI**	Colour of coil label **DPHI**	**DPHE**
DPHI DPHE	6 DC	**6 DC** (4)	666 or 667	33 W	30 W	COU-6DC	brown	-
	12 DC	**12 DC**				COU-12DC	green	COE-12DC
	14 DC	**14 DC**				COU-14DC	brown	COE-14DC
	24 DC	**24 DC**				COU-24DC	red	COE-24DC
	28 DC	**28 DC**				COU-28DC	silver	COE-28DC
	48 DC	**48 DC**				COU-48DC	silver	COE-48DC
	110 DC	**110 DC**				COU-110DC	gold	COE-110DC
	125 DC	**125 DC**				COU-125DC	blue	COE-125DC
	220 DC	**220 DC**				COU-220DC	black	COE-220DC
	24/50 AC	**24/50/60 AC** (4)		60 VA	-	COI-24/50/60AC (1)	pink	-
	24/60 AC							
	48/50 AC	**48/50/60 AC** (4)				COI-48/50/60AC (1)	white	-
	48/60 AC							
	110/50 AC	**110/50/60 AC**			58 VA	COI-110/50/60AC (1)	yellow	COE-110/50/60AC
	115/60 AC (5)	**115/60 AC**		-	80 VA	-		COE-115/60AC
	120/60 AC (4)	**120/60 AC**		60 VA	-	COI-120/60AC	white	-
	230/50 AC	**230/50/60 AC**			58 VA	COI-230/50/60AC (1)	light blue	COE-230/50/60AC
	230/60 AC	**230/60 AC**			80 VA	COI-230/60AC	silver	COE-230/60AC
	110/50 AC	**110RC**	669	33 W	30 W	COU-110RC	gold	COE-110RC
	120/60 AC							
	230/50 AC	**230RC**				COU-230RC	blue	COE-230RC
	230/60 AC							

(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 (DPHI) and 58 VA (DPHE)

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

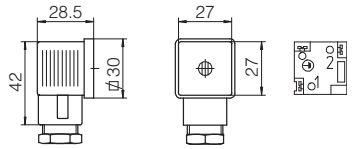
(3) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.

(4) Only for DPHI

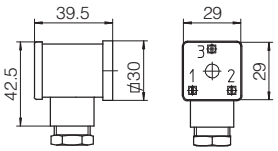
(5) Only for DPHE

8 COILS ELECTRIC CONNECTORS according to din 43650 (to be ordered separately)

666, 667 (for AC or DC supply)



669 (for AC supply)



CONNECTOR WIRING

666, 667
1 = Positive ⊕
2 = Negative ⊖
⏚ = Coil ground

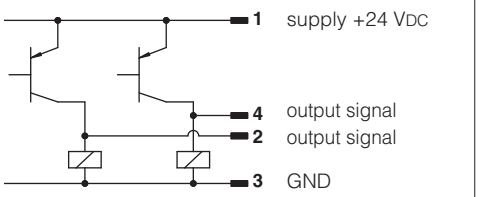
669
1,2= Supply voltage VAC
3 = Coil ground

SUPPLY VOLTAGES

666	**667**	**669**
All voltages	24 AC or DC 110 AC or DC 220 AC or DC	110/50 AC 110/60 AC 230/50 AC 230/60 AC

9 TECHNICAL CHARACTERISTICS OF FV INDUCTIVE POSITION SWITCH

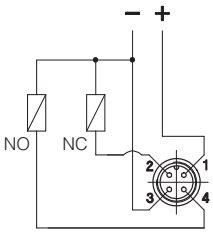
Type of switch		contactless inductive position switch with integrated amplifier
Supply voltage	[V]	20÷32
Ripple max	[%]	≤ 10
Max current	[mA]	400
Reaction time	[ms]	15
Max peak pressure	[bar]	400
Mechanical life		virtually infinite
Switch logic		PNP



10 CONNECTING SCHEME OF FV INDUCTIVE POSITION SWITCH

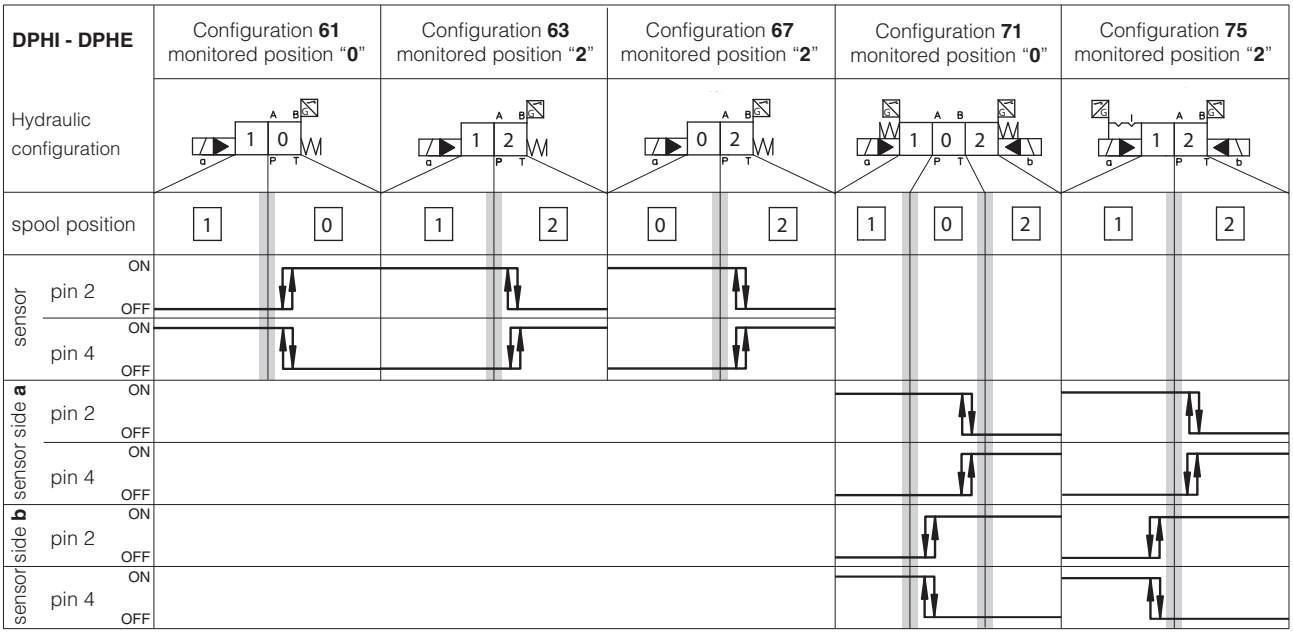
Connector type **ZBE-06** (supplied with the valve)

1 = supply +24 VDC
2 = output signal NC
3 = GND
4 = output signal NO



Note: the /FV position switch is not provided with a protective earth connection

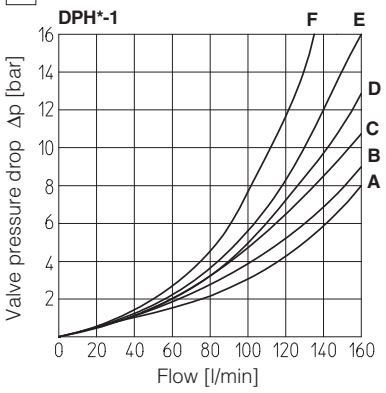
11 STATUS OF OUTPUT SIGNAL

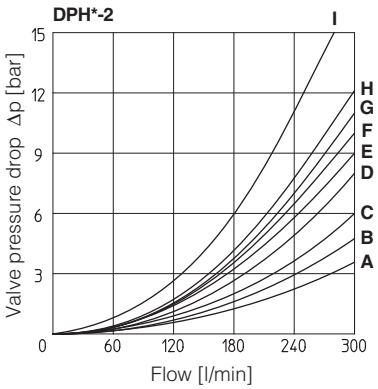


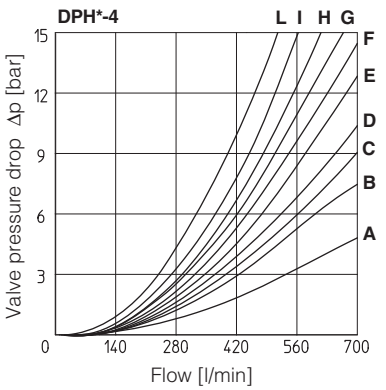
Note:
FV position switch can be electrically wired by the customer as NO or NC and then the status of the output signal will be in accordance to the selected configuration

= intermediate spool position corresponding to the hydraulic configuration change

12 Q/Δp DIAGRAMS based on mineral oil ISO VG 46 at 50°C







DPH*-1

Spool type \ Flow direction	P→A	P→B	A→T	B→T	P→T
0/2, 1/2	D	E	D	C	-
0	D	E	C	C	E
1	A	B	D	C	-
3, 6, 7	A	B	C	C	-
4, 4/8	B	C	D	D	-
5, 58	A	E	C	C	F

DPH*-2

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

DPH*-4

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

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

For a correct valve operation do not exceed the max recommended flow rates (l/min) shown in the below tables

DPH*-1

Spool	Inlet pressure [bar]			
	70	160	210	350
	Flow rate [l/min]			
0, 1, 3, 6, 7	160	160	160	145
4, 4/8	160	160	135	100
5, 58	160	160	145	110
0/1, 0/2, 1/2	160	160	145	135

DPH*-2

Spool	Inlet pressure [bar]			
	70	140	210	350
	Flow rate [l/min]			
0, 1, 3, 6, 7, 8	300	300	300	300
2, 4, 4/8	300	300	240	140
5	260	220	180	100
0/1, 0/2, 1/2	300	250	210	180
16, 17, 56, *9, 9*	300	300	270	200

DPH*-4

Spool	Inlet pressure [bar]			
	70	140	210	350
	Flow rate [l/min]			
1, 6, 7, 8	700	700	700	600
2, 4, 4/8	500	500	450	400
5, 0/1, 0/2, 1/2	600	520	400	300
0, 3	700	700	600	540
16, 17, 58, *9, 9*	500	500	500	450

14 SWITCHING TIMES (average values in m sec)

TEST CONDITIONS:
- Nominal voltage supply DC (direct) and AC (alternating) with connector type SP-666. The use of other connectors can affect the switching time;
- 2 bar of counter pressure on port T;
- mineral oil: ISO VG 46 at 50°C

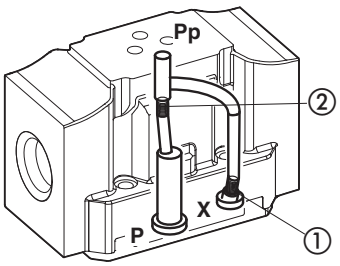
Piloting pressure		70 bar		140 bar		250 bar	
Valve model		Alternating current	Direct current	Alternating current	Direct current	Alternating current	Direct current
DPH*-1	Switch ON	35÷50	50÷75	30÷40	45÷65	20÷30	35÷50
	Switch OFF	50÷80					
DPH*-2	Switch ON	40÷55	55÷80	30÷45	50÷70	20÷35	40÷55
	Switch OFF	60÷95					
DPH*-4	Switch ON	60÷95	80÷115	45÷75	60÷95	30÷50	45÷65
	Switch OFF	80÷130					

15 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

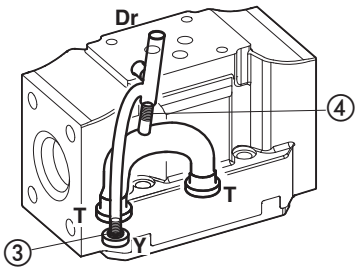
Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain

DPH*-1

Pilot channels



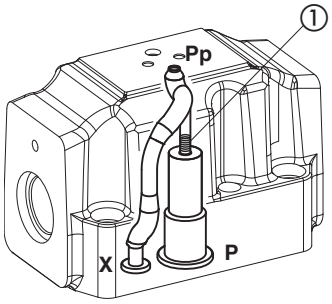
Drain channels



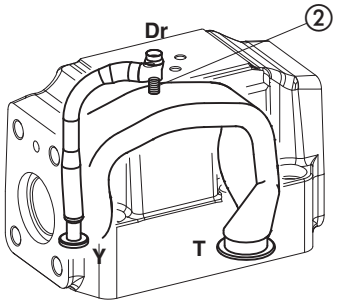
Internal piloting: blinded plug SP-X300F ① in X;
plug SP-X310F ② in Pp;
External piloting: blinded plug SP-X300F ② in Pp;
plug SP-X310F ① in X;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPH*-2

Pilot channels

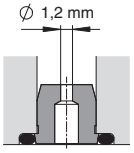


Drain channels



Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

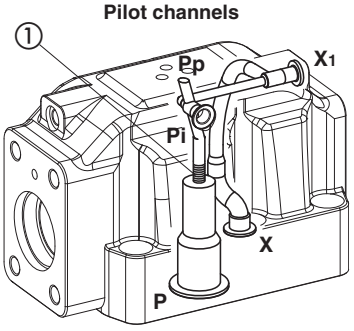
Option L9
This option provides a calibrated restrictor PLUG-H-12A (Ø 1,2 mm) in the P port of the pilot valve



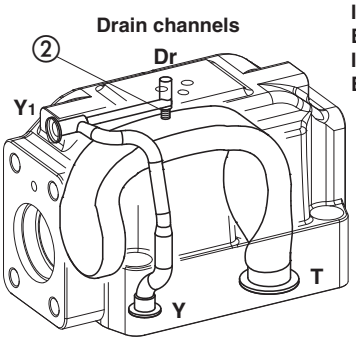
PLUG-12A

DPH*-4

Pilot channels

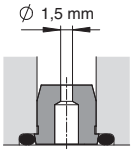


Drain channels



Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

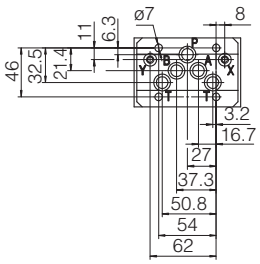
Option L9
This option provides a a calibrated restrictor PLUG-H-15A (Ø 1,5 mm) in the P port of the pilot valve



PLUG-15A

DPH*-1/FV

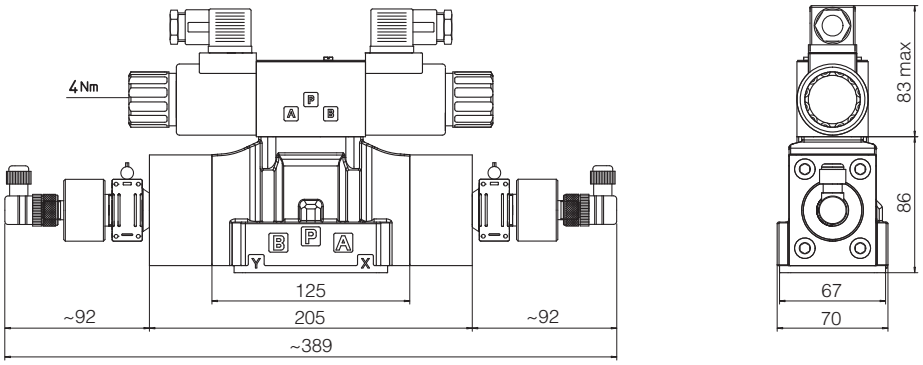
ISO 4401: 2005
Mounting surface:
4401-05-05-0-05
Fastening bolts:
4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Seals: 5 OR 2050, 2 OR 108
Ports P,A,B,T: Ø = 11 mm (max)
Ports X, Y: Ø = 5 mm



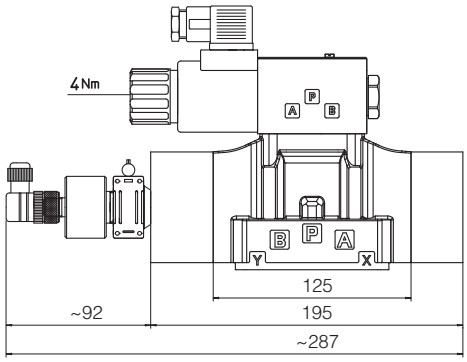
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL OIL PILOT PORT
Y = DRAIN PORT

Mass (Kg)	
DPHI-16	7,1
DPHI-17	7,7
DPHE-16	7,2
DPHE-17	7,9
Option H, H9	+1,0

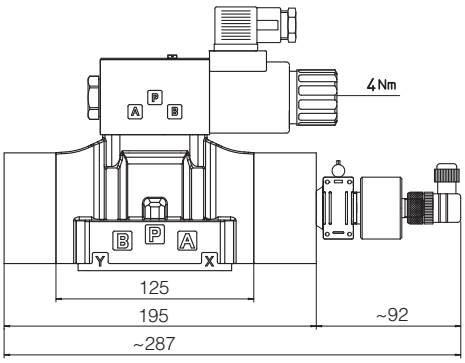
DPH*-171*
DPH*-175*



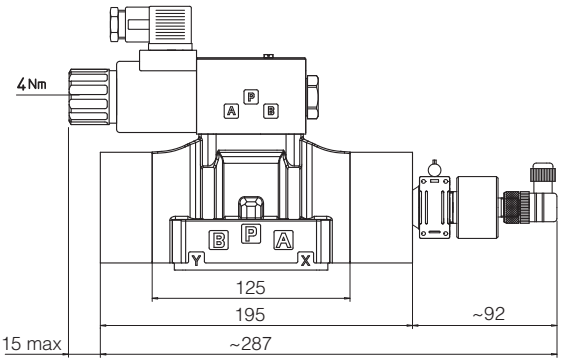
DPH*-161*



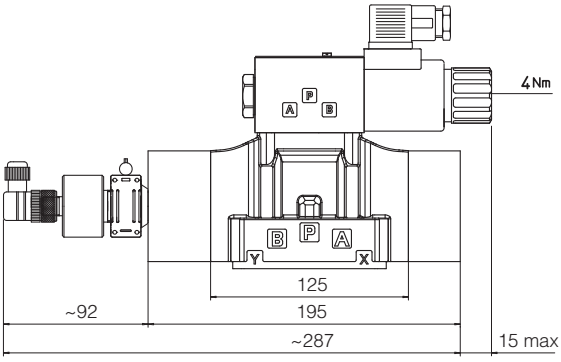
DPH*-161*/A



DPH*-163*
DPH*-167*



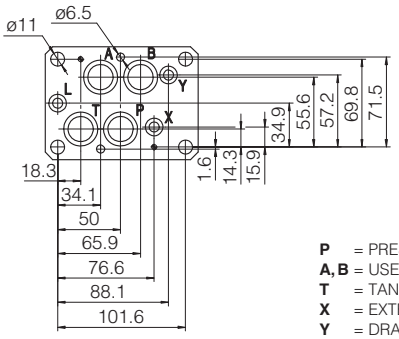
DPH*-163*/A
DPH*-167*/A



DPH*-2*/FV

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05

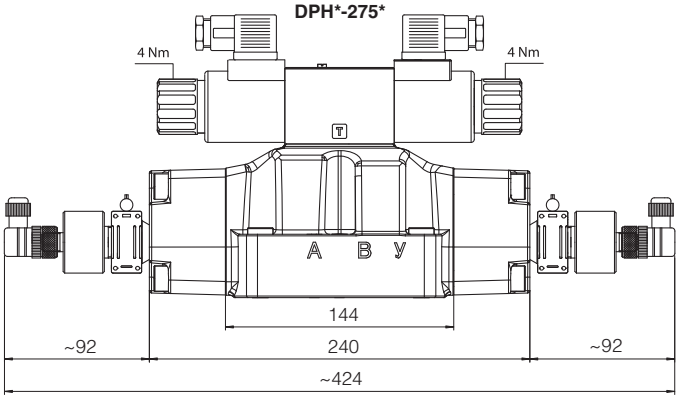
Fastening bolts:
4 socket head screws M10x50 class 12.9
Tightening torque = 70 Nm
2 socket head screws M6x45 class 12.9
Tightening torque = 15 Nm
Diameter of ports A, B, P, T: Ø = 20 mm;
Diameter of ports X, Y: Ø = 7 mm;
Seals: 4 OR 130, 2 OR 2043

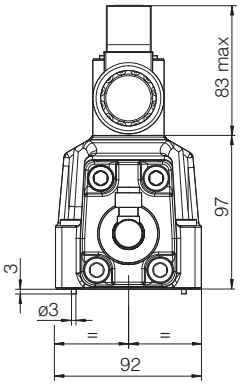


Mass (Kg)	
DPHI-26	10,1
DPHI-27	10,7
DPHE-26	10,2
DPHE-27	10,9
Option H, H9	+1,0

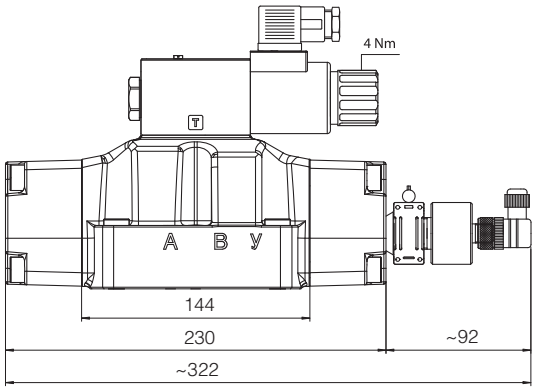
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL OIL PILOT PORT
Y = DRAIN PORT

DPH*-271*
DPH*-275*

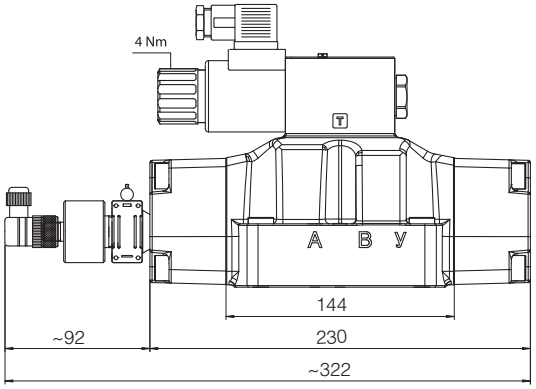




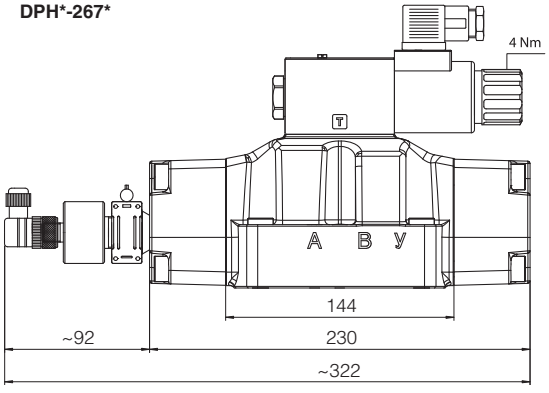
DPH*-261*



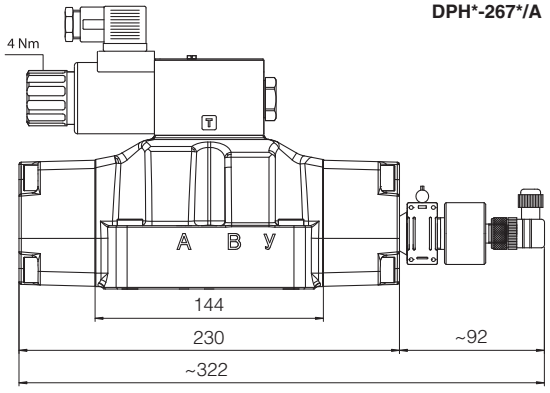
DPH*-261*/A



DPH*-263*
DPH*-267*



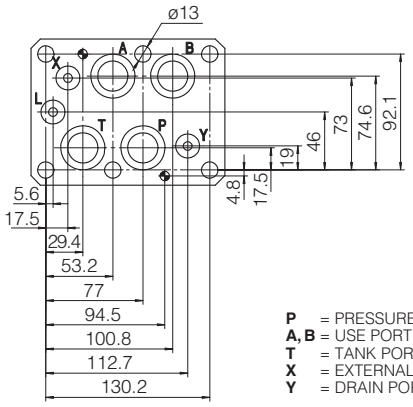
DPH*-263*/A
DPH*-267*/A



DPH*-4*/FV

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05

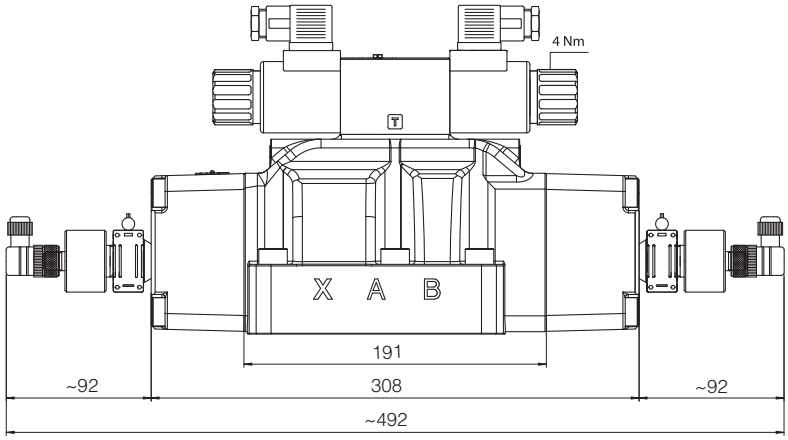
Fastening bolts:
6 socket head screws M12x60 class 12.9
Tightening torque = 125 Nm
Diameter of ports A, B, P, T: Ø = 24 mm;
Diameter of ports X, Y: Ø = 7 mm;
Seals: 4 OR 4112, 2 OR 3056

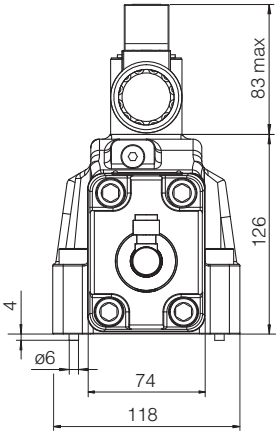


Mass (Kg)	
DPHI-46	17,6
DPHI-47	18,2
DPHE-46	17,7
DPHE-47	18,4
Option H, H9	+1,0

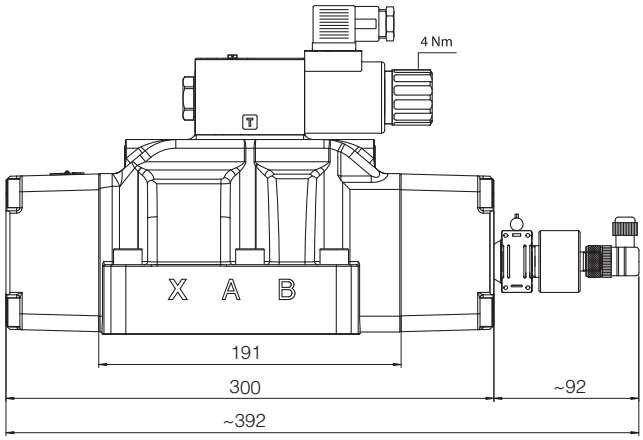
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL OIL PILOT PORT
Y = DRAIN PORT

DPH*-471*
DPH*-475*

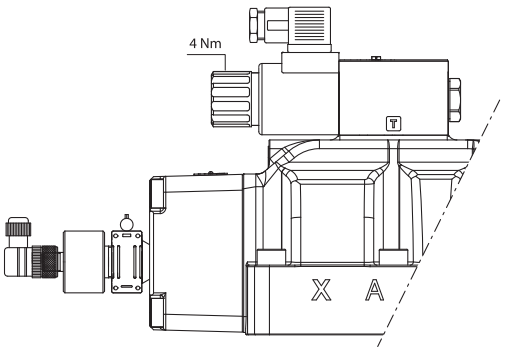




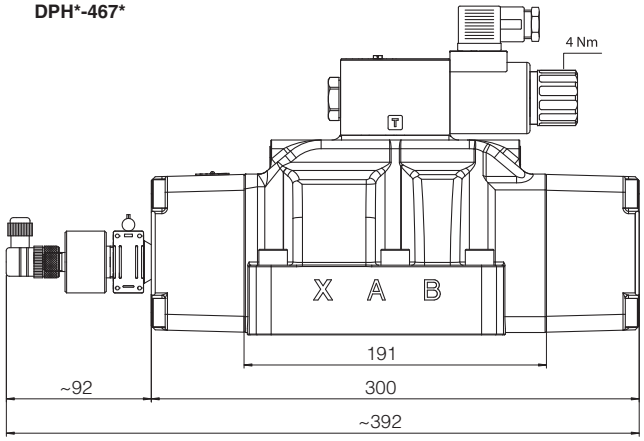
DPH*-461*



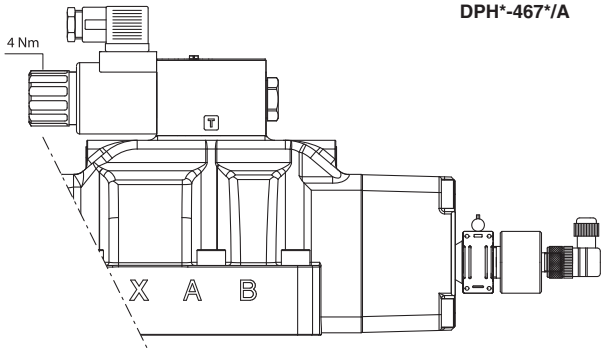
DPH*-461*/A



DPH*-463*
DPH*-467*

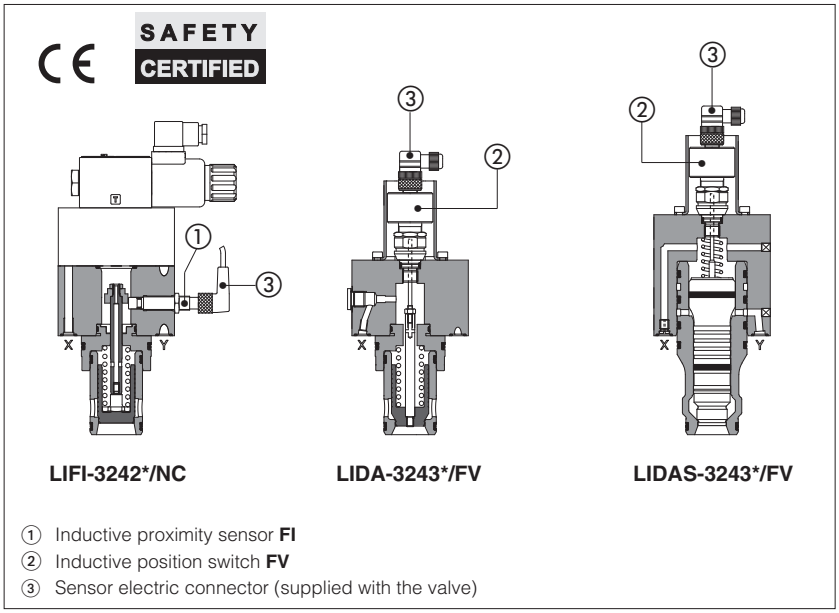


DPH*-463*/A
DPH*-467*/A



Safety cartridge valves with poppet position monitoring

ISO standard, on-off, poppet type, conforming to Machine Directive 2006/42/EC - certified by



① Inductive proximity sensor **FI**
② Inductive position switch **FV**
③ Sensor electric connector (supplied with the valve)

Safety cartridge valves with poppet position monitoring, **CE** marked and certified by **TÜV,** in accordance with safety requirements of Machine Directive 2006/42/EC.

LIFI: intermediate safety element with **FI** inductive proximity sensor, to be coupled with functional covers

LIDA: safety valve with integral cover design and with **FV** inductive position switch, available with optional solenoid pilot valve (LIDAH)

LIDAS: active pilot operated safety valve with **FV** inductive position switch, available with optional solenoid pilot valve (LIDASH), see section 12 for sensors technical characteristics.

These valves are normally used to cut off the hydraulic power line in case of emergency condition, thus avoiding dangerous movements of the machines actuators.

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

Mounting surface & cavity:
ISO 7368 size **16** to **50**
Max flow: **1800 l/min** at Δp = 5 bar
Max pressure: up to **420 bar**

1 RANGE OF VALVE'S MODELS

Valve code	Size	Description	DC solenoids		AC solenoids	
			Sensor type			
			/FI	/FV	/FI	/FV
LIFI	16÷50	intermediate elements with cartridge, to be coupled with a functional cover	•		•	
LIDA(H)	16÷50	cartridges valve		•		•
LIDAS(H)	16÷50	active cartridges valve		•		•

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 12 for sensor's characteristics

2 MODEL CODE OF LIFI INTERMEDIATE SAFETY ELEMENT - to be coupled with covers in section 3

LIF	I	-	25	42	1	/	NC	**	/	*

LIF: Intermediate saferty element and cartridge according to ISO 7368

Poppet position monitor:
I = inductive proximity switch

Size ISO 7368
16; 25; 32; 40; 50
Other dimensions available on request

Type of poppet, see sect. 9 for Q/Δp diagrams
42 = with damping nose, area ratio 1:1,1
43 = with damping nose, area ratio 1:1,6

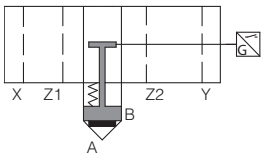
/NC = closed contact with poppet in resting position

Spring cracking pressure:
1 = 0,3 bar for poppet 42; 0,6 bar for poppet 43
2 = 1,5 bar for poppet 42
3 = 3 bar for all poppets
6 = 5,5 bar for all poppets

Series number

***** Seals material:
omit for NBR (mineral oil & water glycol)
PE = FKM

2.1 Hydraulic symbols of LIFI



Note: in LIFI safety valves the cartridge and the intermediate element with poppet position sensor cannot be separated

3 MODEL CODE OF FUNCTIONAL COVERS TO BE COUPLED WITH LIFI SAFETY VALVES

LID	A	-	2	/	*	F	-	I	X	24DC	**	/	*	/	*

Cover according to ISO 7368

Cover type, see section 3.1 for hydraulic configuration:
- **A** = direct pilot
- **B** = with shuttle valve for pilot selection;
- **EW*** = with solenoid valve for pilot selection
- **BH**** = as EW* but with shuttle valve for pilot selection;

Size ISO 7368
1 = 16; **2** = 25; **3** = 32; **4** = 40; **5**= 50;

Options:
- **B** = cartridge piloted via port B of solenoid valve (only for LIDEW* and LIDBH**)
- **E** = with external attachment X (1/4" GAS) and underneath port X plugged
- **F** = prearranged for coupling with LIFI cover

Type of pilot solenoid valve only for LIDBH** and LIDEW*:
- **I** = DHI Pmax **350 bar**
- **E** = DHE Pmax **350 bar**
- **EP** = DHEP Pmax **420 bar**

Only for LIDEW* and LIDBH**:
X = without connector, to be order separately see section 11

Voltage code only for LIDEW* and LIDBH**: see section 10

Series number

Seals material:
omit for NBR (mineral oil & water glycol)
PE = FKM

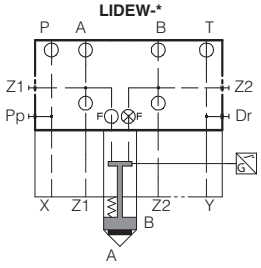
Optional different setting of calibrated plugs in the pilot channels (see tech. tables H030, H040)

For valve type LIDB, LIDEW (in the configuration with external pilot line) Atos can supply leak free poppet type directional pilot valves type DLEH-3*. Consult our technical office for detailed information.

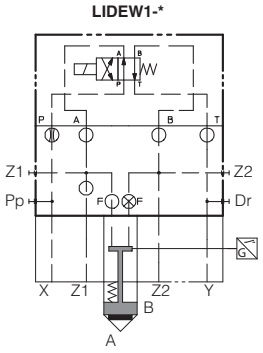
3.1 HYDRAULIC SYMBOLS OF FUNCTIONAL COVERS

the following symbols show the functional covers coupled with intermediate safety element type LIFI

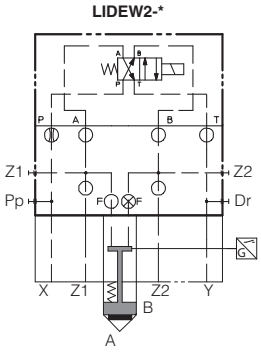
LIDEW-*



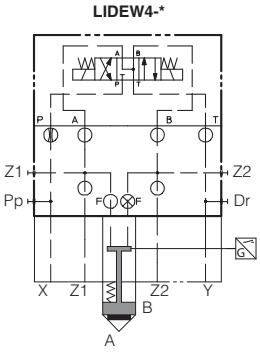
LIDEW1-*



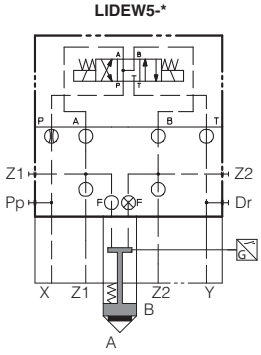
LIDEW2-*



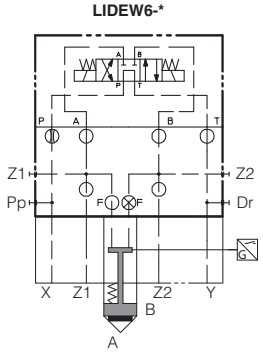
LIDEW4-*



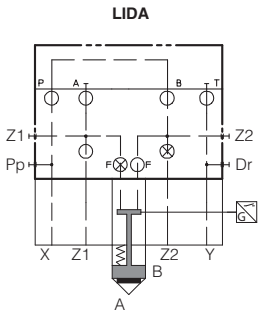
LIDEW5-*



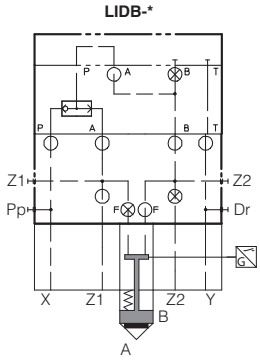
LIDEW6-*



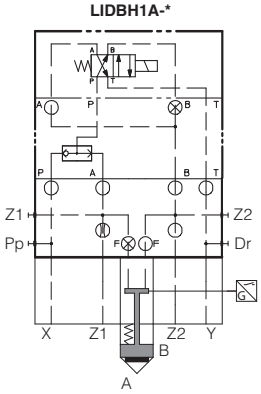
LIDA



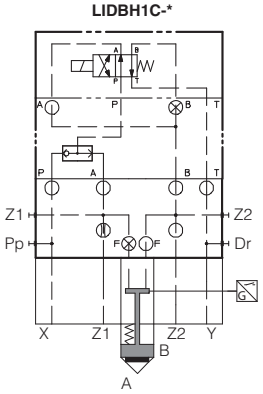
LIDB-*



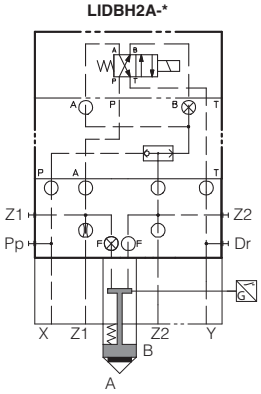
LIDBH1A-*



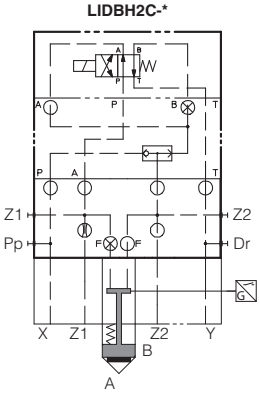
LIDBH1C-*



LIDBH2A-*



LIDBH2C-*



4 MODEL CODE OF LIDA SAFETY VALVES (integral design cover)

LIDA	H	-	25	43	3	/	FV	-	I	X	24DC	**	/	*

Safety cartridge valve according to ISO 7368

optional pilot valve:
- = omit if not required
H = with NG 6 pilot valve

Size ISO 7368:
16; **25**; **32**; **40**; **50**

poppet type:
43 = with damping nose area ratio 1:1,6

spring cracking pressure:
1 = 0,6 bar **3** = 3 bar **6** = 5,5 bar

Poppet position monitor:
FV = inductive position switch (double contact)

Pilot solenoid valve only for LIDAH
I = DHI Pmax **350 bar**
E = DHE Pmax **350 bar**
EP = DHEP Pmax **420 bar**

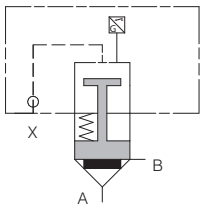
Only for LIDAH
X = without connector, to be order separately see section [11]

Only for LIDAH
Voltage code, see section [10]

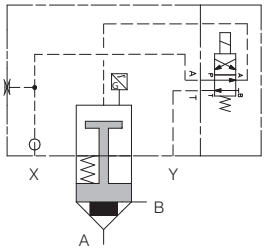
Series number

Seals material: omit for NBR (mineral oil & water glycol)
PE = FKM

4.1 HYDRAULIC SYMBOLS OF LIDA /FV



LIDA-43/FV**



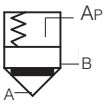
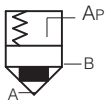
LIDAH-43/FV**

5 MAIN CHARACTERISTICS OF LIFI AND LIDA(H)/FV

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		75 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 2015/65/EU REACH Regulation (EC) n°1907/2006
Ambient temperature		**Standard** = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C
Flow direction		A→B or B→A
Operating pressure	**LIFI**	A, B, X, Z1, Z2 = **420 bar**
	LIDA/FV	A, B, X = **420 bar**;
	LIDAH/FV	A, B, X = LIDAH-I = **350 bar**; LIDAH-E = **350 bar**; LIDAH-EP = **420 bar**
		Y = LIDAH-I = **120 bar**; LIDAH-E, -EP (DC) = **210 bar**; LIDAH-E, -EP (AC) = **160 bar**

(1) The type-examination certificate can be download from

5.1 poppet characteristics of LIFI and LIDA(H)/FV

Poppet type		**42** (only LIFI)	**43**
Functional sketch (Hydraulic symbol)			
Operating pressure		**420 bar**	
Nominal flow at Δp 5bar (l/min) see diagrams Q/Δp at section [15]	Size **16**	140	120
	25	300	280
	32	550	440
	40	1150	860
	50	1800	1370
Area ratio A:Ap		**1:1,1**	**1:2** for size 16, 25 **1:1,6** for size 32, 40,50

6 MODEL CODE OF LIDAS ACTIVE SAFETY PILOT OPERATED VALVES

LIDAS	H	-	40	43	3	/	FV	-	I	X	24DC	**	/	*

Active safety cartridges, according to ISO 7368

Optional pilot valve:
- = without pilot solenoid valve
H = with pilot solenoid valve

Size ISO 7368:
16; **25**; **32**; **40**; **50**

Poppet type:
43 = with damping nose

Spring cracking pressure
3 = 3 bar

Poppet position monitor:
FV = inductive position switch (double contact)

Pilot solenoid valve only for LIDASH
I = DHI Pmax **350 bar**
E = DHE Pmax **350 bar**
EP = DHEP Pmax **420 bar**

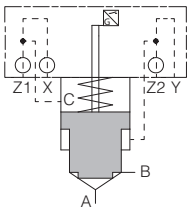
Only for LIDASH
X = without connector, to be order separately see section [11]

Only for LIDASH
voltage code, see section [10]

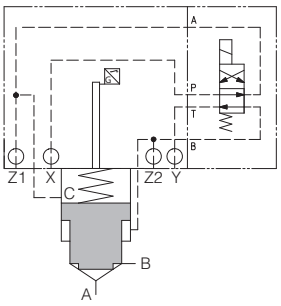
Series number

Seals material:
omit for NBR (mineral oil & water glycol)
PE = FKM

6.1 HYDRAULIC SYMBOLS OF LIDAS



LIDAS/FV



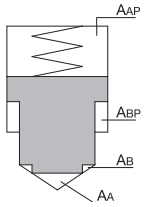
LIDASH-*/FV

7 MAIN CHARACTERISTICS OF LIDAS/FV

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 2015/65/EU REACH Regulation (EC) n°1907/2006				
Ambient temperature		**Standard** = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C				
Flow direction		A→B or B→A				
Operating pressure	**LIDAS/FV**	A, B, X, Z1, Z2 = **420 bar**				
	LIDASH/FV	A, B, X, Z1, Z2 = LIDASH-I **350** bar; LIDASH-E **350** bar; LIDASH-EP **420** bar Y = LIDASH-I **120** bar; LIDASH-E, -EP (DC) = **210** bar; LIDASH-E, -EP (AC) = **160** bar;				
Size		**16**	**25**	**32**	**40**	**50**
Maximum flow at Δp = 5 bar [l/min]		200	360	550	1100	1800
Poppet characteristics [cm²]						
A_A		1,43	3,46	5,30	8,04	13,85
A_B (% of A_A)		58,6	41,7	51,5	56,3	41,7
A_{BP} (% of A_A)		107,0	90,5	85,2	87,9	97,8
A_{AP} (% of A_A)		265,6	232,2	236,7	244,1	239,2
A_A / (A_A + A_B) poppet ratio		0,6				
A_{AP} / (A_A + A_B) piloting ratio		1,6				

(1) The type-examination certificate can be download from

7.1 Poppet areas of LIDAS/FV



Poppet areas

AA = main flow (side A)
AB = main flow (side B)
AAP = piloting area (close)
ABP = piloting area (open)

Thanks to the areas ratio $A_{AP}/(A_A+A_B)$, the valve closing is always ensured with a piloting pressure (X port) equal to the line pressure (A or B line).

8 COILS CHARACTERISTICS

Insulation class	Pilot valve **E**, **EP: H** (180°C) for DC coils **F** (155°C) for AC coils Pilot valve **I: H** (180°C) for DC or 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 10
Supply voltage tolerance	± 10%
Certification	**cURus** North American Standard

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

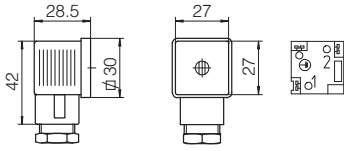
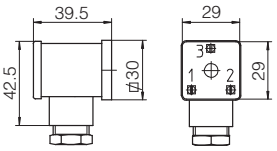
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at 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	

10 ELECTRIC FEATURES - coils for pilot solenoid valves

Valve	External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption **(3)**		Code of spare coil		
				DHI	**DHEP**	**DHI**	Colour of coil label **DHI**	**DHE, DHEP**
DHI DHE DHEP	6 DC	**6 DC** (4)	666 or 667	33 W	30 W	COU-6DC	brown	-
	12 DC	**12 DC**				COU-12DC	green	COE-12DC
	14 DC	**14 DC**				COU-14DC	brown	COE-14DC
	24 DC	**24 DC**				COU-24DC	red	COE-24DC
	28 DC	**28 DC**				COU-28DC	silver	COE-28DC
	48 DC	**48 DC**				COU-48DC	silver	COE-48DC
	110 DC	**110 DC**				COU-110DC	gold	COE-110DC
	125 DC	**125 DC**				COU-125DC	blue	COE-125DC
	220 DC	**220 DC**				COU-220DC	black	COE-220DC
	24/50 AC	**24/50/60 AC** (4)		60 VA	-	COI-24/50/60AC (1)	pink	-
	24/60 AC							
	48/50 AC	**48/50/60 AC** (4)				COI-48/50/60AC (1)	white	-
	48/60 AC							
	110/50 AC	**110/50/60 AC**			58 VA	COI-110/50/60AC (1)	yellow	COE-110/50/60AC
	115/60 AC (5)	**115/60 AC**		-	80 VA	-		COE-115/60AC
	120/60 AC (4)	**120/60 AC**		60 VA	-	COI-120/60AC	white	-
	230/50 AC	**230/50/60 AC**			58 VA	COI-230/50/60AC (1)	light blue	COE-230/50/60AC
	230/60 AC	**230/60 AC**			80 VA	COI-230/60AC	silver	COE-230/60AC
	110/50 AC	**110RC**	669	33 W	30 W	COU-110RC	gold	COE-110RC
	120/60 AC							
	230/50 AC	**230RC**				COU-230RC	blue	COE-230RC
	230/60 AC							

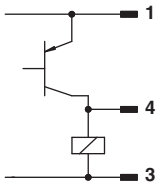
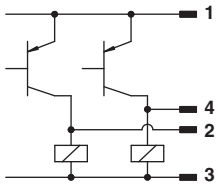
(1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10÷15% and the power consumption is 55 VA (DHI) and 58 VA (DHE and DHEP)
(2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(3) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.
(4) Only for pilot valve DHI
(5) Only for pilot valve DHE and DHEP

11 COILS ELECTRIC CONNECTORS FOR PILOT SOLENOID VALVES according to DIN 43650 (to be ordered separately)

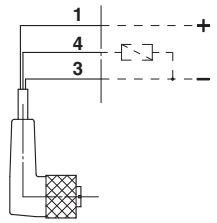
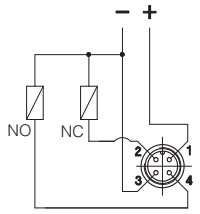
666, 667 (for AC or DC supply)	**669** (for AC supply)	**CONNECTOR WIRING**	
		**666, 667** 1 = Positive ⊕ 2 = Negative ⊖ ⊕ = Coil ground	**669** 1,2= Supply voltage VAC 3 = Coil ground

SUPPLY VOLTAGES		
666	**667**	**669**
All voltages	24 AC or DC 110 AC or DC 220 AC or DC	110/50 AC 110/60 AC 230/50 AC 230/60 AC

12 TECHNICAL CHARACTERISTICS OF INDUCTIVE PROXIMITY AND POSITION SWITCHES

Valve type		**LIFI**	**/FI** scheme	**LIDA*/FV, LIDAS*/FV**	**/FV** scheme
Type of switch		**/FI** proximity sensor		**/FV** position switch	
Supply voltage	[V]	10÷30		20÷32	
Ripple max	[%]	≤ 20		≤ 10	
Max current	[mA]	200		400	
Max peak pressure	[bar]	500		400	
Mechanical life		virtually infinite		virtually infinite	
Switch logic		PNP		PNP	
			1 supply +24 VDC **3** GND **4** output signal		**1** supply +24 VDC **2** output signal **3** GND **4** output signal

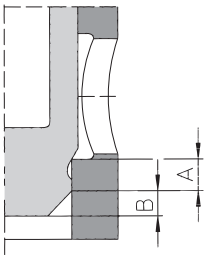
13 CONNECTING SCHEMES OF FI INDUCTIVE PROXIMITY AND FV POSITION SWITCHES

LIFI	**LIDA*/FV, LIDAS*/FV**
Connector type **BKS-B-20-4-03**	Connector type **ZBE-06** IP65
	
1 (brown) = supply +24 VDC 3 (blue) = GND 4 (black) = output signal CABLE LENGHT = 3 m	1 = supply +24 VDC 2 = output signal NC 3 = GND 4 = output signal NO

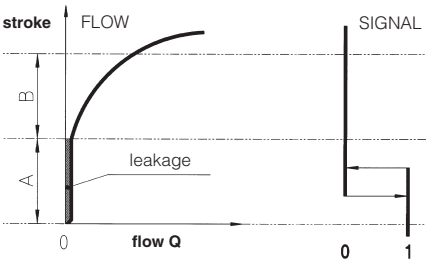
Notes:
- FI and FV sensor's connector are always supplied with the valve
- The /FI and /FV sensors are not provided with a protective earth connection

14 STATUS OF OUTPUT SIGNALS

A: overlapping stroke
B: damping stroke



According the criteria of safety specifications, the poppet position signal must change its status inside the overlapping stroke (before the effective valve opening).

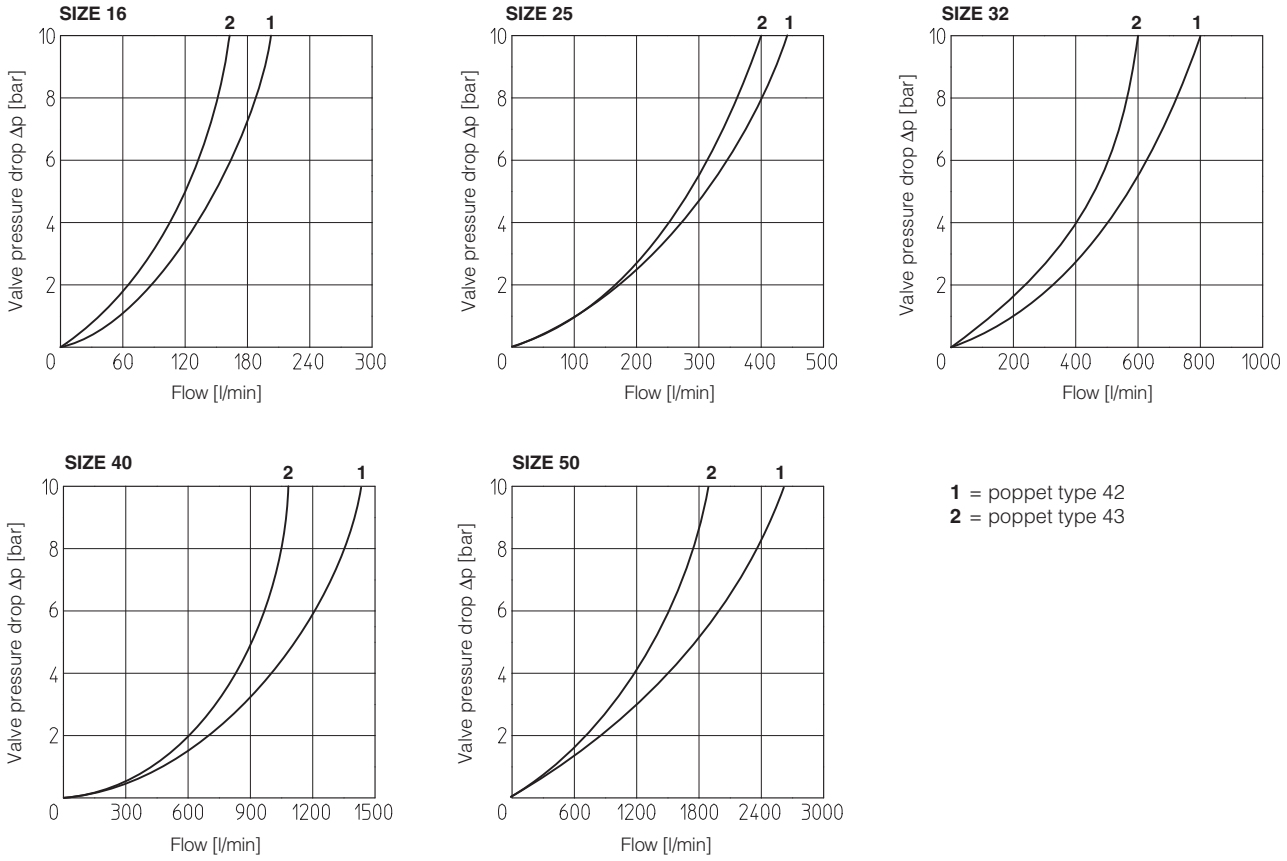


WARNING: the inobservance of following prescriptions invalidates the certification and may represent a risk for personnel injury

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

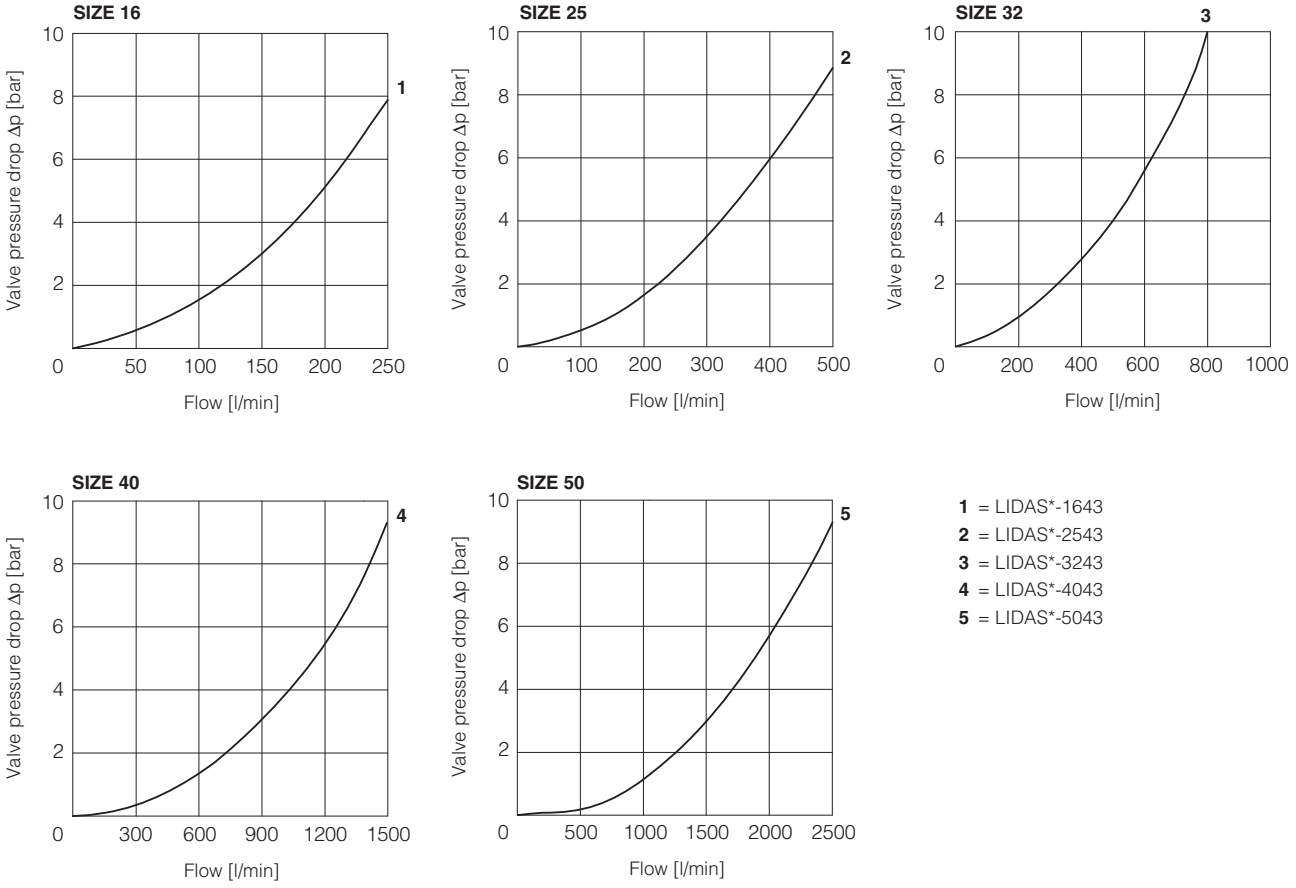
15 Q/Δp DIAGRAMS based on mineral oil ISO VG 46 at 50 °C

15.1 Q/Δp DIAGRAMS of LIFI and LIDA(H)/FV



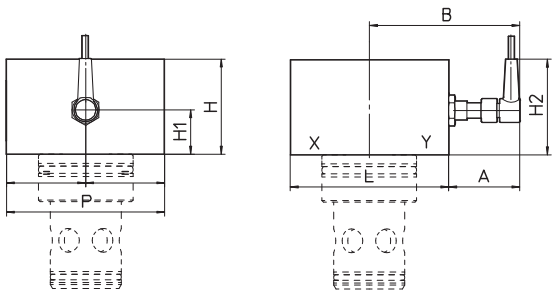
1 = poppet type 42
2 = poppet type 43

15.2 Q/Δp DIAGRAMS OF LIDAS/FV



1 = LIDAS*-1643
2 = LIDAS*-2543
3 = LIDAS*-3243
4 = LIDAS*-4043
5 = LIDAS*-5043

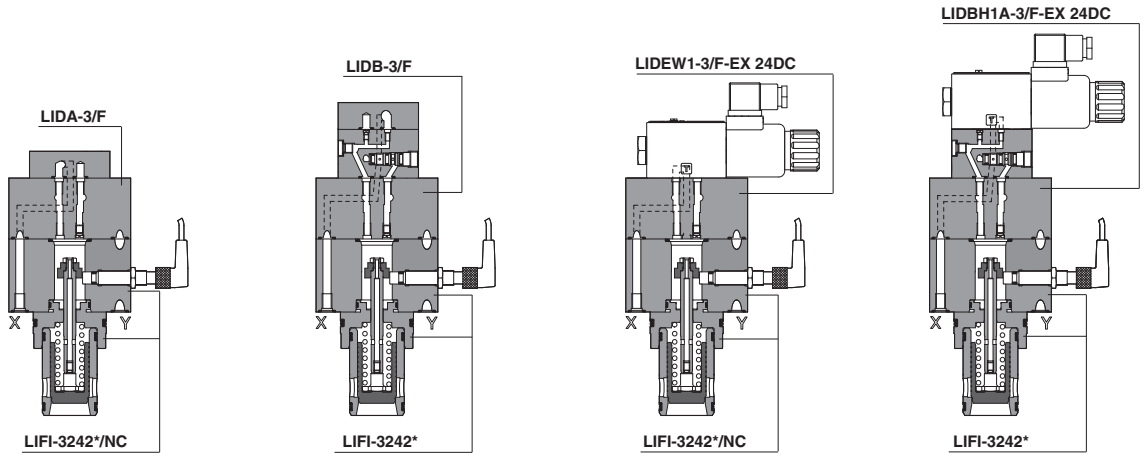
16 DIMENSIONS of LIFI SAFETY COVERS [mm]



	A	B	H	H1	H2	L	P
LIFI-16	54,5	94	50	25	56	72	65
LIFI-25	54,5	97	55	28	59	85	85
LIFI-32	47	97	60	28	59	100	100
LIFI-40	41	103,5	60	30	61	125	125
LIFI-50	44	114	70	30	61	140	140

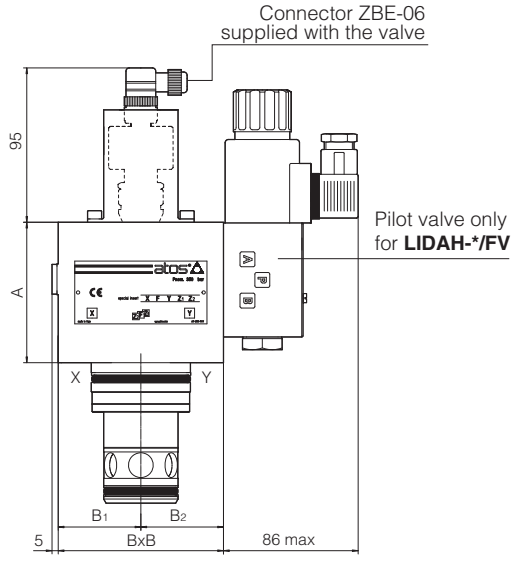
Note: for cover interface and cavity dimensions ISO 7368, see table P006

17 EXAMPLES OF LIFI COUPLED WITH OTHER COVERS (examples in size 32)

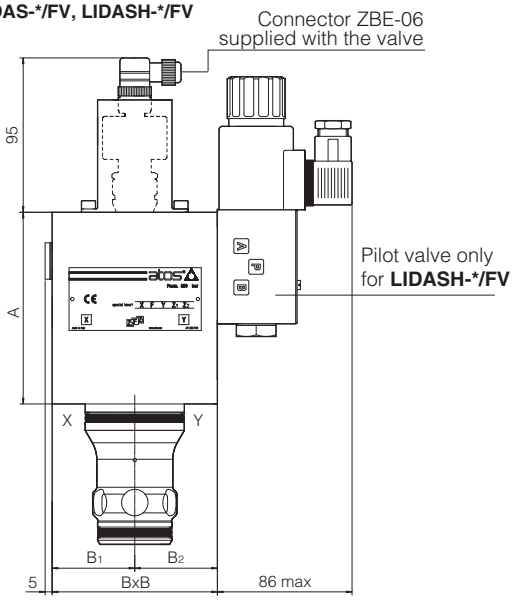


18 INSTALLATION DIMENSIONS of LIDA*/FV and LIDAS*/FV SAFETY CARTRIDGES [mm] (examples in size 32)

LIDA-*/FV, LIDAH-*/FV



LIDAS-*/FV, LIDASH-*/FV

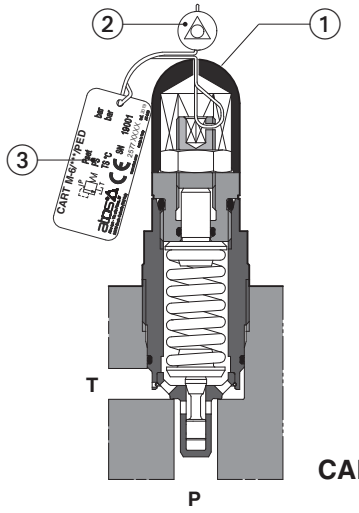


Note: for cover interface and cavity dimensions ISO 7368, see table P006

Size	LIDA				LIDAH				LIDAS				LIDASH				Seal		Fastening bolts			Tightening torque (Nm)
	A	B	B1	B2	A	B	B1	B2	A	B	B1	B2	A	B	B1	B2	LIDA	OTHER	LIDA	LIDAH	LIDAS, LIDASH	
16	50	65x85	40.5	39.5	85	65x80	40.5	39.5	85	65	39.5	39.5	95	65x72	32.5	39.5	1 OR 108	4 OR 108	4 M8x50	4 M8x70	4 M8x80	35
25	50	85	42.5	42.5	85	85	42.5	42.5	102	85	42.5	42.5	115	85	42.5	42.5	1 OR 108	4 OR 108	4 M12x55	4 M12x80	4 M12x95	125
32	65	100	50	50	85	100	50	50	104	100	50	50	116	100	50	50	1 OR 2043	4 OR 2043	4 M16x70	4 M16x70	4 M16x90	300
40	65	125	62.5	62.5	85	125	62.5	62.5	111	125	62.5	62.5	125	125	62.5	62.5	1 OR 3043	4 OR 3043	4 M20x80	4 M20x80	4 M20x70	600
50	65	140	70	70	85	140	70	70	50	140	70	70	135	140	70	70	1 OR 3043	4 OR 3043	4 M20x80	4 M20x80	4 M20x80	600

Safety pressure relief valves

direct, screw-in, conforming to PED Directive 2014/68/EU - certified by DEKRA



CART M-6/420/PED

① plastic cap
② lead sealing
③ nameplate with factory pressure setting

CART /PED

Safety pressure relief valves, certified by DEKRA according to Pressure Equipment Directive 2014/68/EU (PED).

They are designed to operate as safety components, limiting the maximum system pressure or to protect parts of the hydraulic circuit and accumulators from overpressure.

The valves are factory set at the pressure level required by the costumer, see section 6.

The pressure adjustment screw is protected with a lead sealed plastic cap to avoid any tampering.

The screw-in execution is specifically designed to reduce the dimension of blocks and manifolds, without penalizing the functional characteristics.

Size: **G1/2" ÷ M35**
Max flow: **2,5 ÷ 150 l/min**
Max pressure: up to **420 bar**

1 MODEL CODE

CART	M-6	/	420	/	PED	/	280	*	/	*

CART — Safety pressure relief valves, screw-in

Size:
M-3 = G1/2 **(1)**
M-4 = M14x1
M-5 = M20x1,5
M-6 = M33x1,5 **(1)**
ARE-15 = M32x1,5
ARE-20 = M35x1,5 **(1)**

Max pressure (bar):
420 = for CART M-3, M-4, M-6, ARE-15
350 = for CART M-5
400 = for CART ARE-20

PED = EU Type examination to 2014/68/EU - certified by DEKRA

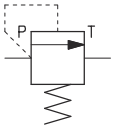
Factory pressure setting (bar):
to be defined by the customer
min step 1 bar (example **280** = 280 bar)
min pressure setting:
25 = for CART-M* and CART ARE-15
30 = for CART ARE-20

Series number

Seals material, see section 5:
- = NBR
PE = FKM
BT = HNBR **(2)**:

(1) Available also in stainless steel execution, see technical table CWY010
(2) BT option is not available for **CART M5/PED** and **CART ARE-20/PED**

2 HYDRAULIC SYMBOL



CART* /PED

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Cavity	See section 9
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Ambient temperature range (not for CART M-5 and ARE-20)	**Standard** = -30°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Ambient temperature range (only for CART M-5 and ARE-20)	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C
Storage temperature range	**Standard** = -30°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200h
Compliance	PED Directive 2014/68/EU - EU type-examination certificate **(1)** RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

(1) The type-examination certificate can be download from

4 HYDRAULIC CHARACTERISTICS

Valve model	**CART M-3**	**CART M-4**	**CART M-5**	**CART M-6**	**CART ARE-15**	**CART ARE-20**
Max pressure [bar] on port P	420	420	350	420	420	400
Factory pressure setting range [bar]	25÷420	25÷420	25÷350	25÷420	25÷420	30÷400
Max pressure on port T [bar] **(1)**	50	50	50	50	50	50
Max flow [l/min] **(2)**	2,5	15	50	60	100	150

(1) The valves should be operated without counterpressure on T line, see note 2 at section 9
(2) Max flow without conterpressure on T line, see diagrams at section 9 for max ammissible flow

5 SEALS AND HYDRAULIC FLUIDS - 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 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	ISO 4406 class 20/18/15 NAS 1638 class 9, see also filter section 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	

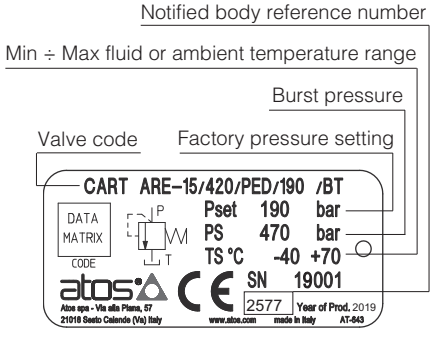
6 FACTORY PRESSURE SETTING

The /PED valves are factory set at the pressure level required by the costumer (min step: 1bar). The factory pressure setting is performed at the flow shown in the following table. The factory pressure setting is marked on the valve nameplate, see section 7

VALVE MODEL	FLOW FOR FACTORY PRESSURE SETTING (l/min)
CART M-3	0.5
CART M-4	0.5
CART M-5	2
CART M-6	2
CART ARE-15	2
CART ARE-20	2

⚠ Any tampering of the lead sealing invalidates the certification

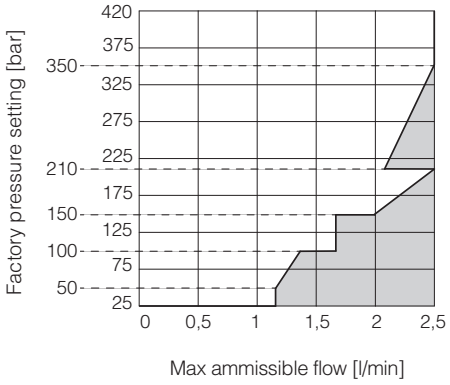
7 NAMEPLATE MARKING



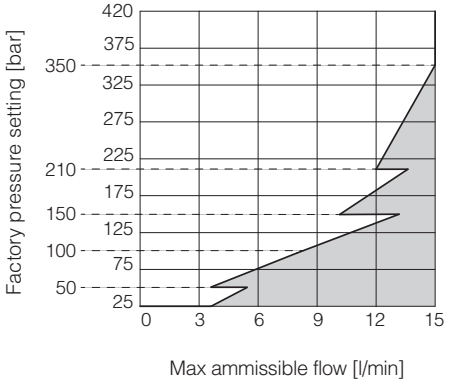
Note: **TS** values are referred to the extreme temperatures, regardless of whether the fluid or the ambient

8 **PERMITTED WORKING RANGE** (based on mineral oil ISO VG 46 at 50°C)

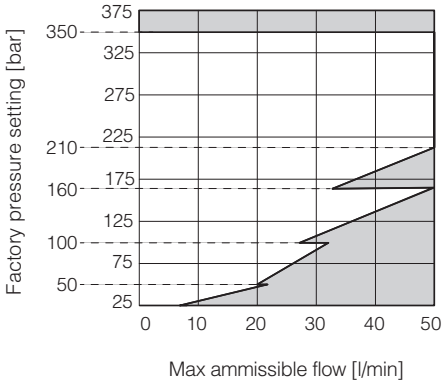
CART M-3 **/PED



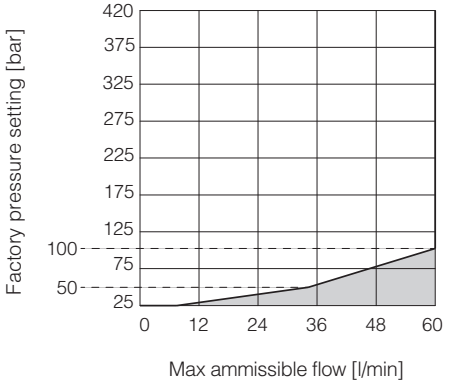
CART M-4 **/PED



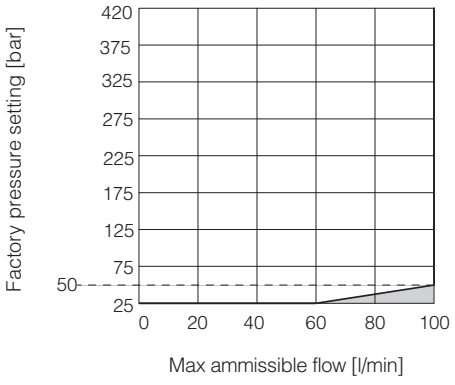
CART M-5 **/PED



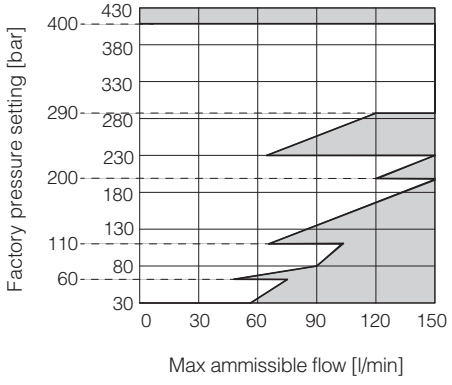
CART M-6 **/PED



CART ARE-15 **/PED



CART ARE-20 **/PED



Notes:

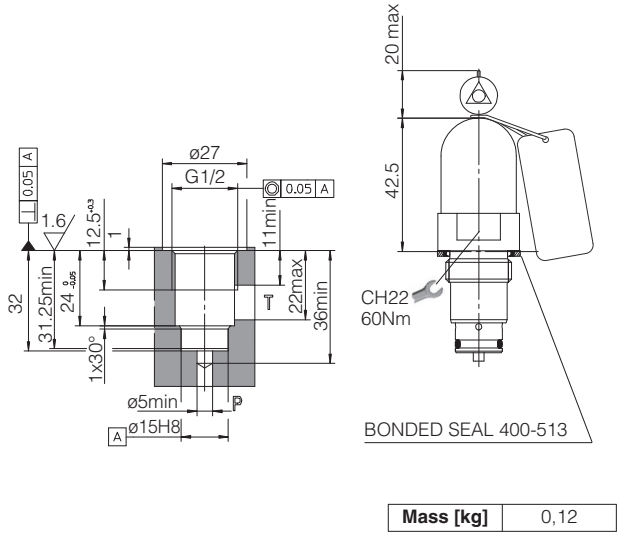
1) The valves can operate only in the white area of the above diagrams.
The max admissible flow values within the white area are those for which the pressure increase remains within **+10% with respect to the factory pressure setting.**
Pressure / flow values located in gray areas cannot be performed.

⚠ Before ordering the valve, check that the maximum admissible flow at the required pressure setting, is greater than the maximum flow rate of the system or the accumulator to be protected.

2) The working range in above diagrams is valid without counterpressure in T line.
The factory pressure setting is increased by the counterpressure valve in T line.
As general rule PED valves should be operated without counter pressure in the T line.
In case of counter pressure in T line, the maximum admissible flow has to be reduced with respect to the values reported in the diagram, so as not to exceed the limit of +10% with respect to the factory pressure setting. Contact Atos technical office for details.

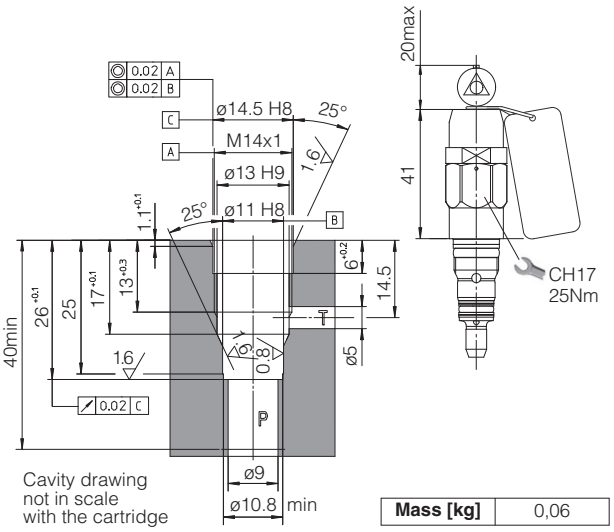
9 CAVITY AND INSTALLATION DIMENSIONS [mm]

CART M-3



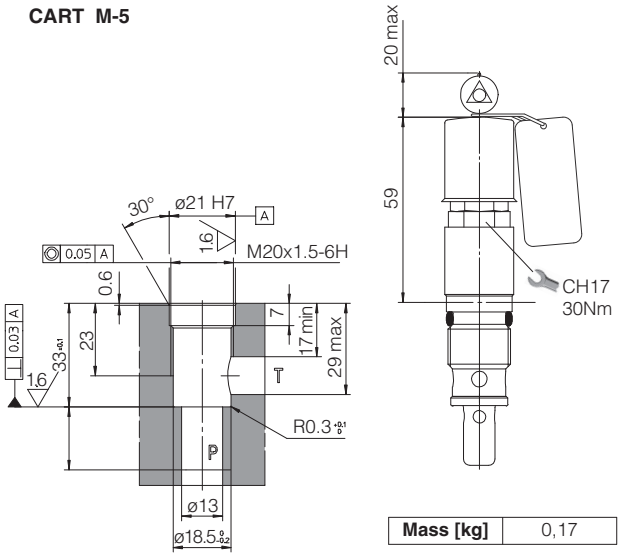
Mass [kg]	0,12

CART M-4



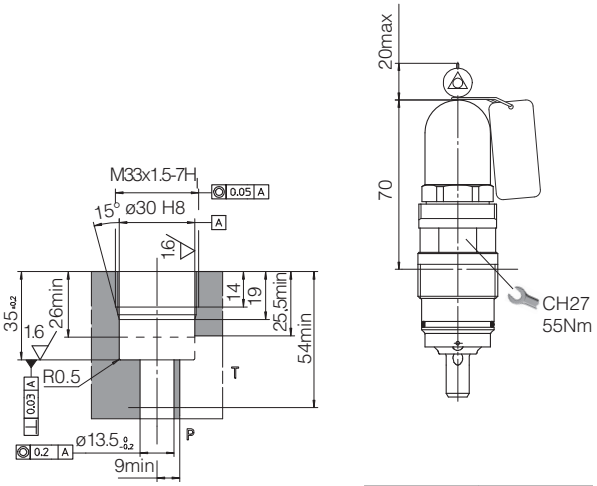
Mass [kg]	0,06

CART M-5



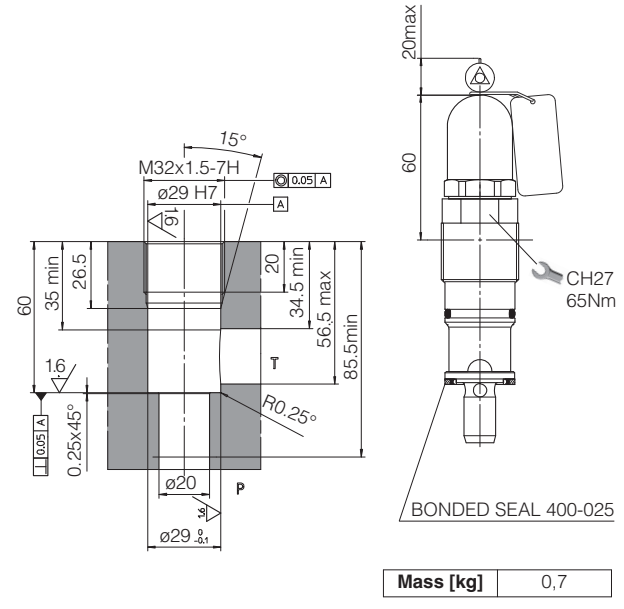
Mass [kg]	0,17

CART M-6



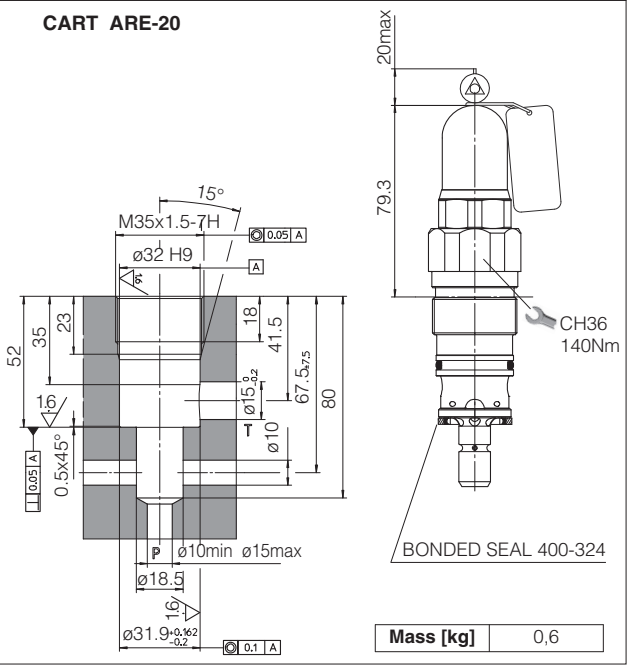
Mass [kg]	0,37

CART ARE-15



Mass [kg]	0,7

CART ARE-20



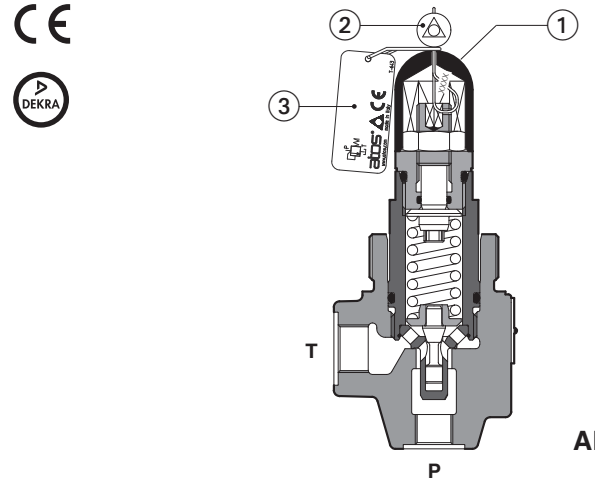
Mass [kg]	0,6

10 RELATED DOCUMENTATION

CY900	Operating and maintenance information for PED certified valves

Safety pressure relief valves

in line, direct, conforming to PED Directive 2014/68/EU - certified by DEKRA



ARE-06/420/PED

① plastic cap
② lead sealing
③ nameplate with factory pressure setting

ARE /PED

Safety pressure relief valves, certified by DEKRA according to Pressure Equipment Directive 2014/68/EU (PED).

They are designed to operate as safety components, limiting the maximum system pressure or to protect parts of the hydraulic circuit and accumulators from overpressure.

The valves are provided with threaded ports for in-line mounting.

The valves are factory set at the pressure level required by the costumer, see section 6.

The pressure adjustment screw is protected with a lead sealed plastic cap to avoid any tampering.

ARE-06: Size: **G 3/8**"
Max flow: **60 l/min**
Max pressure: **420 bar**
ARE-15: Size: **G 1/2**"
Max flow: **100 l/min**
Max pressure: **420 bar**

1 MODEL CODE

ARE	-	06	/	420	/	PED	/	280	*	/	*

Safety pressure relief valves, in-line

Size:
06 = Port P G 3/8"
15 = Port P G 1/2"

Max pressure (bar):
420

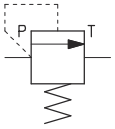
PED = EU Type examination to 2014/68/EU - certified by DEKRA

Factory pressure setting (bar):
to be defined by the customer
min step 1 bar (example **280** = 280 bar)
min pressure setting 25 bar

Series number

Seals material,
see section 5:
- = NBR
PE = FKM
BT = HNBR:

2 HYDRAULIC SYMBOL



ARE-06* /PED

ARE-15* /PED

3 GENERAL CHARACTERISTICS

Assembly position	Any position
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Ambient temperature range	**Standard** = -30°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Storage temperature range	**Standard** = -30°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200h
Compliance	PED Directive 2014/68/EU - EU type-examination certificate **(1)** RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

(1) The type-examination certificate can be download from

4 HYDRAULIC CHARACTERISTICS

Valve model		**ARE-06**	**ARE-15**
Max pressure on port P	[bar]	420	420
Factory pressure setting range	[bar]	25÷420	25÷420
Max pressure on port T **(1)**	[bar]	50	50
Max flow **(2)**	[l/min]	60	100

(1) Ped valves should be operated without counterpressure on T line, see note 2 at section 8
(2) For PED valves see diagrams at section 8

5 SEALS AND HYDRAULIC FLUIDS - 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 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	ISO 4406 class 20/18/15 NAS 1638 class 9, see also filter section 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	

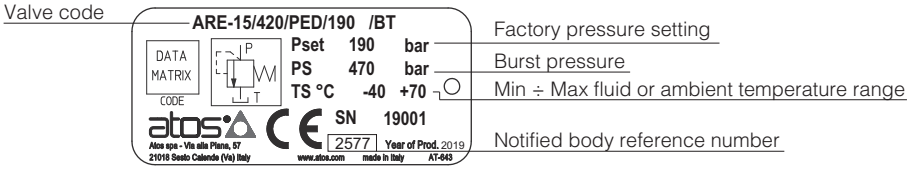
6 FACTORY PRESSURE SETTING

The /PED valves are factory set at the pressure level required by the costumer (min step: 1bar). The factory pressure setting is performed at the flow shown in the following table. The factory pressure setting is marked on the valve nameplate, see section 7

VALVE MODEL	**FLOW FOR FACTORY PRESSURE SETTING (l/min)**
ARE-06	2
ARE-15	2

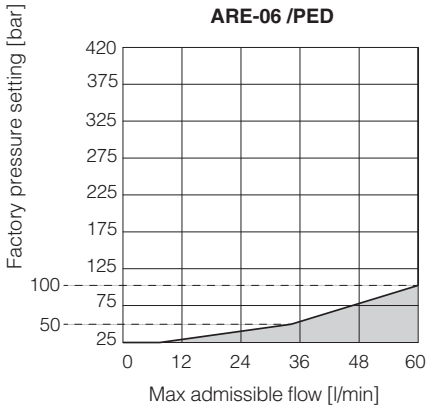
⚠ Any tampering of the lead sealing invalidates the certification

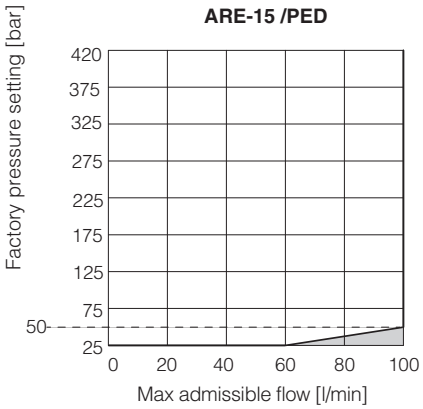
7 NAMEPLATE MARKING



Note: **TS** values are referred to the extreme temperatures, regardless of whether the fluid or the ambient

8 PERMITTED WORKING RANGE (based on mineral oil ISO VG 46 at 50°C)





Notes:

1) The valves can operate only in the white area of the above diagrams.
The max admissible flow values within the white area are those for which the pressure increase remains within **+10% with respect to the factory pressure setting.**
Pressure / flow values located in gray areas cannot be performed.

⚠ Before ordering the valve, check that the maximum admissible flow at the required pressure setting, is greater than the maximum flow rate of the system or the accumulator to be protected.

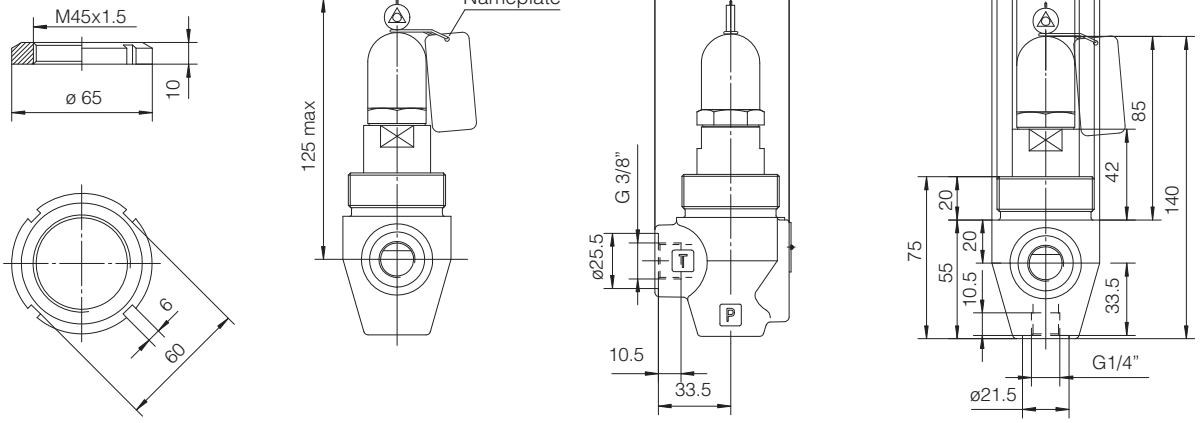
2) The working range in above diagrams is valid without counterpressure in T line.
The factory pressure setting is increased by the counterpressure valve in T line.
As general rule PED valves should be operated without counter pressure in the T line.
In case of counter pressure in T line, the maximum admissible flow has to be reduced with respect to the values reported in the diagram, so as not to exceed the limit of +10% with respect to the factory pressure setting. Contact Atos technical office for details.

9 INSTALLATION DIMENSIONS [mm]

ARE-06

P = INLET PORT G 3/8”
T = OUTLET PORT G 3/8”
Locking ring for fastening the valve.
Model code: SP-6-RE-310030

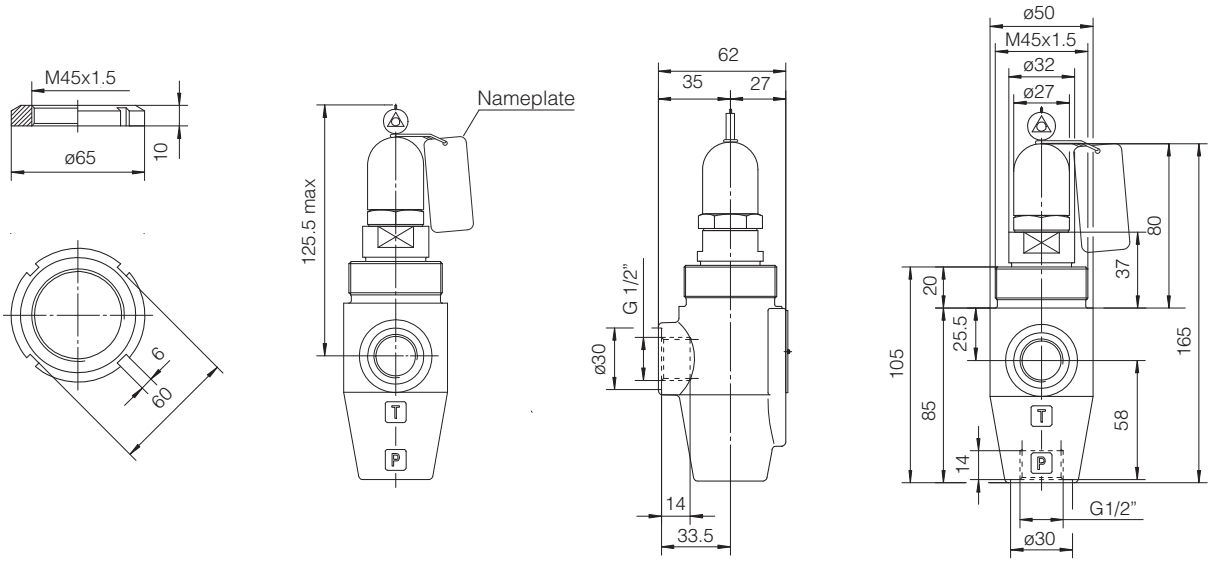
Mass [kg]	
ARE-06	1,0



ARE-15

P = INLET PORT G 1/2”
T = OUTLET PORT G 1/2”
Locking ring for fastening the valve.
Model code: SP-6-RE-310030

Mass [kg]	
ARE-15	1,3

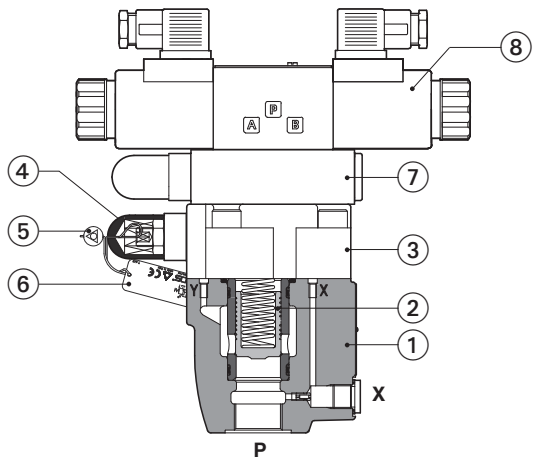


10 RELATED DOCUMENTATION

CY900	Operating and maintenance information for PED certified valves

Safety pressure relief valves

piloted, in-line, conforming to PED Directive 2014/68/EU - certified by DEKRA



① main body
② poppet
③ pilot stage
④ plastic cap
⑤ lead sealing
⑥ nameplate with factory pressure setting
⑦ second /third pressure setting
⑧ pilot solenoid valve for pressure selection

ARAM-20/20/*/PED

ARAM /PED

Safety pressure relief valves, certified by DEKRA according to Pressure Equipment Directive 2014/68/EU (PED).

They are designed to operate as safety components, limiting the maximum system pressure or to protect parts of the hydraulic circuit and accumulators from overpressure.

The valves are factory set at the pressure level required by the costumer, see section [10].

The pressure adjustment screw is protected with a lead sealed plastic cap to avoid any tampering.

ARAM can be equipped with a pilot solenoid valve for venting or for multiple pressure selection.

Size: **G 3/4"** and **G 1 1/4"**
Max flow: **350** and **500 l/min**
Max pressure: **350 bar**

[1] MODEL CODE

ARAM	-	20	/	20	/	350	/	210/100	/	E	/	PED	/	280	-	I	X	24DC	*	/	*

Piloted pressure relief valve, in-line

Valve size ISO 6264:
20 = port P - G 3/4"
32 = port P - G 1 1/4"

Configuration, see section [2] :
- = without pilot solenoid valve
10, 11:
with pilot solenoid valve for venting
20, 21, 22, 32:
with pilot solenoid valve for multiple pressure selection

Max pressure:
350 = 350 bar

Pressure range of second / third setting (1):
50 = 50 bar **100** = 100 bar
210 = 210 bar **350** = 350 bar

Options, see section [9] :
E **WP** **Y**

PED = EU Type examination to 2014/68/EU - certified by DEKRA

Factory pressure setting (bar):
to be defined by the customer min step 1 bar
(example **280** = 280 bar)
min pressure setting 30 bar

Pilot valve (1):
I = DHI for AC and DC supply, with **cURus** certified solenoids
E = DHE for AC and DC supply, high performances with **cURus** certified solenoids

X = without connector **(2)**:
Connectors to be ordered separately: see section [7]
-00 = solenoid valve without coils (for -I)
-00-AC = AC solenoid valve without coils (for -E)
-00-DC = DC solenoid valve without coils (for -E)

Voltage code, see section [6] **(2)**:

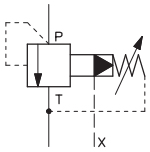
Series number

Seals material, see section [8] :
- = NBR
PE = FKM

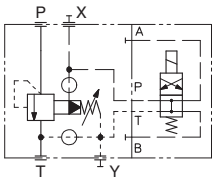
(1) Only for ARAM-* /20, /21, /22, /32
(2) Only for ARAM with pilot solenoid valve

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS

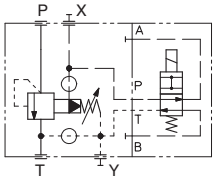
ARAM



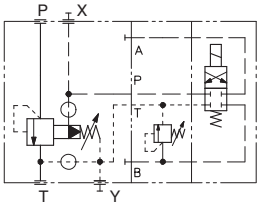
ARAM-/10**
one setting pressure + venting
with de-energized solenoid



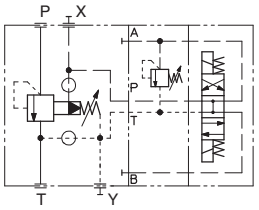
ARAM-/11**
one setting pressure + venting
with energized solenoid



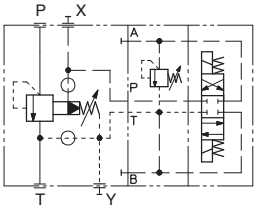
ARAM-/22**
two setting pressure
without venting



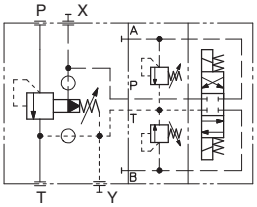
ARAM-/20**
two setting pressure + venting
with de-energized solenoid



ARAM-/21**
two setting pressure + venting
with energized solenoid



ARAM-/32**
three setting pressure
without venting



3 GENERAL CHARACTERISTICS

Assembly position / location	Any position
MTTFd values according to EN ISO 13849	75 years, for further details see technical table P007
Ambient temperature	**Standard** = -20°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	Zinc coating with black passivation -salt spray test (EN ISO9227) > 200h
Compliance	PED Directive 2014/68/EU - EU type-examination certificate **(1)** RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

(1) The type-examination certificate can be download from

4 HYDRAULIC CHARACTERISTICS

Valve model		**ARAM-10**	**ARAM-32**
Max pressure on ports P, X	[bar]	350	
Max pressure on ports T, Y **(1)**	[bar]	210 without pilot solenoid valve 120 with pilot solenoid valve -I 210 with pilot solenoid valve -E with DC solenoid 160 with pilot solenoid valve -E with AC solenoid	
Factory pressure setting range	[bar]	30÷350	
Max flow **(2)**	[l/min]	350	500

(1) The valves should be operated without counterpressure on T line, see note 2 at section 12
(2) Max flow without conterpressure on T line, see diagrams at section 12 for max ammissible flow

5 ELECTRICAL CHARACTERISTICS - for ARAM with pilot solenoid valve

Insulation class	DHI pilot	**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
	DHE pilot	**H** (180°C) for DC coils **F** (155°C) for AC coils	
Protection degree to DIN EN 60529		**IP 65** (with connectors 666, 667, 669 or E-SD correctly assembled)	
Relative duty factor		100%	
Supply voltage and frequency		See coil voltage 6	
Supply voltage tolerance		± 10%	
Certification		**cURus** North American standard	

6 **COIL VOLTAGE** - for ARAM with pilot solenoid valve

External supply nominal voltage ± 10% **(1)**	**Voltage code**	Type of connector	Power consumption **(3)** DHI	DHE	ARAM-*-I Code of spare coil	ARAM-*-I Colour of coil label	ARAM-*-E Code of spare coil
12 DC	**12 DC**	666 or 667	33 W	30 W	COU-12DC	green	COE-12DC
24 DC	**24 DC**				COU-24DC	red	COE-24DC
110 DC	**110 DC**				COU-110DC	black	COE-110DC
220 DC	**220 DC**				COU-220DC	black	COE-220DC
110/50 AC **(2)**	**110/50/60 AC**	666 or 667	60 VA	58 VA	COI-110/50/60AC	yellow	COE-110/50/60AC
115/60 AC	**115/60 AC (4)**		-	80 VA	-	-	COE-115/60AC
120/60 AC	**120/60 AC (5)**		60 VA	-	COI-120/60AC	white	-
230/50 AC **(2)**	**230/50/60 AC**		60 VA	58 VA	COI-230/50/60AC	light blue	COE-230/50/60AC
230/60 AC	**230/60 AC**		60 VA	80 VA	COI-230/60AC	silver	COE-230/60AC

(1) For other supply voltages see technical tables E010, E015
(2) Coil can be supplied also with 60 Hz: in this case the performances are reduced by 10 ÷ 15%
(3) Average values measured at nominal hydraulic condition and ambient temperature 20°C;
When AC solenoid is energized, the inrush current is approx 3 times the holding current
(4) Only for ARAM-*-E
(5) Only for ARAM-*-I

7 **ELECTRIC CONNECTORS ACCORDING TO DIN 43650** - for ARAM with pilot solenoid valve

The connectors must be ordered separately.

Code of connector	Function
666	Connector IP-65, suitable for direct connection to electric supply source
667	As 666 connector IP-65 but with built-in signal led, suitable for direct connection to electric supply source

For other available connectors, see tech table K800

8 **SEALS AND HYDRAULIC FLUIDS** - 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 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	ISO 4406 class 20/18/15 NAS 1638 class 9, see also filter section 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	

9 **OPTIONS**

E = external pilot
WP = prolunged manual override protected by rubber cap - only for ARAM with pilot solenoid valve
Y = external drain - only for ARAM with pilot solenoid valve

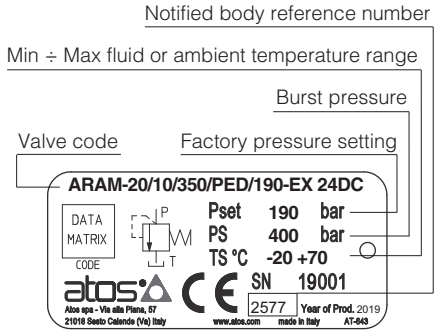
10 FACTORY PRESSURE SETTING

The /PED valves are factory set at the pressure level required by the costumer (min step: 1bar). The factory pressure setting is performed at the flow shown in the following table. The factory pressure setting is marked on the valve nameplate, see section 11 .

VALVE MODEL	FLOW FOR FACTORY PRESSURE SETTING (l/min)
ARAM-10	25
ARAM-20	25

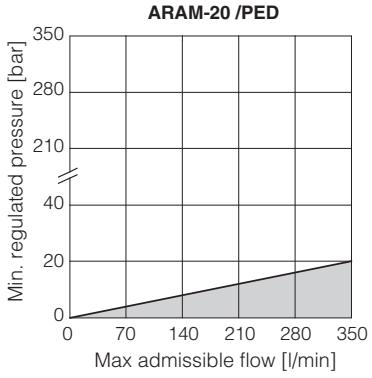
⚠ Any tampering of the lead sealing invalidates the certification

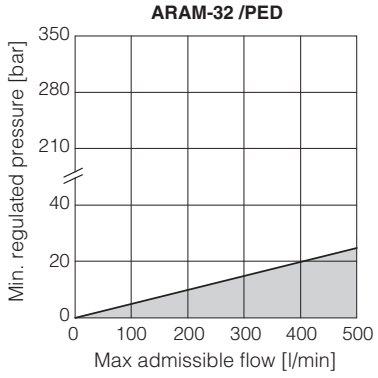
11 NAMEPLATE MARKING



Note: **TS** values are referred to the extreme temperatures, regardless of whether the fluid or the ambient

12 PERMISSIBLE RANGE - based on mineral oil ISO VG 46 at 50°C





Notes:

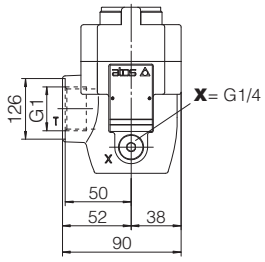
1) The valves can operate only in the white area of the above diagrams.
The max admissible flow values within the white area are those for which the pressure increase remains within **+10% with respect to the factory pressure setting.**
Pressure / flow values located in gray areas cannot be performed.

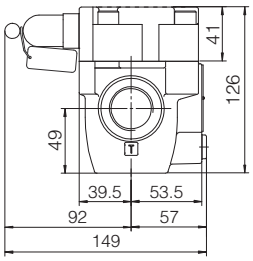
⚠ Before ordering the valve, check that the maximum admissible flow at the required pressure setting, is greater than the maximum flow rate of the system or the accumulator to be protected.

2) The working range in above diagrams is valid without counterpressure in T line.
The factory pressure setting is increased by the counterpressure valve in T line.
As general rule PED valves should be operated without counter pressure in the T line.
In case of counter pressure in T line, the maximum admissible flow has to be reduced with respect to the values reported in the diagram, so as not to exceed the limit of +10% with respect to the factory pressure setting. Contact Atos technical office for details.

13 INSTALLATION DIMENSIONS [mm]

ARAM-20

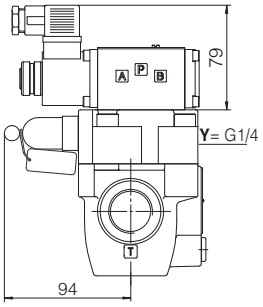




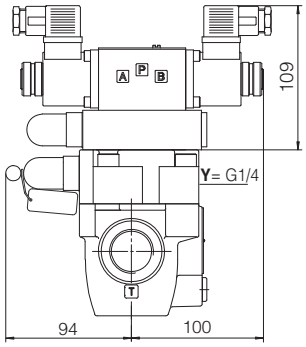
X = port connection for external pilot
Y = port connection for external drain

	Mass [kg]
ARAM-20	3,9

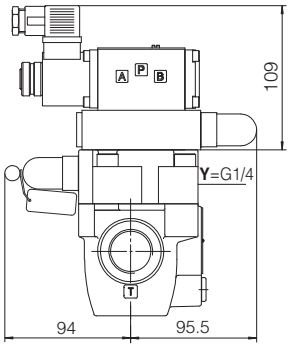
	Mass [kg]	
	with option IX	with option EX
ARAM-20/10	5,4	5,7
ARAM-20/11		
ARAM-20/20	7,1	7,7
ARAM-20/21		
ARAM-20/22	6,8	7,2
ARAM-20/32	7,4	8,0



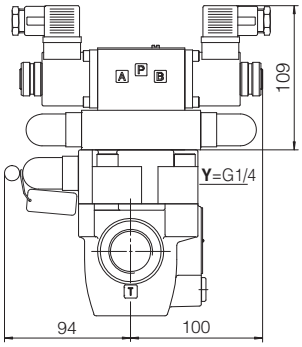
ARAM-20/10/-IX**
ARAM-20/11/-IX**



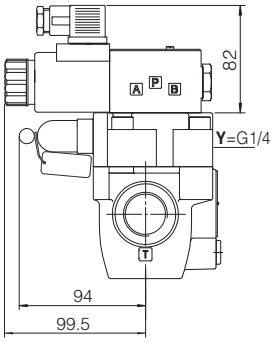
ARAM-20/20/-IX**
ARAM-20/21/-IX**



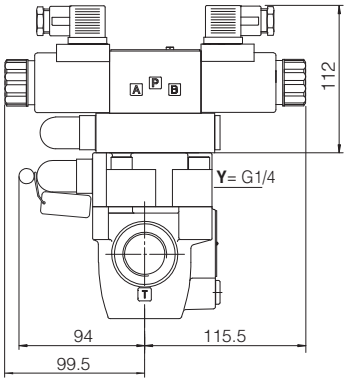
ARAM-20/22/-IX**



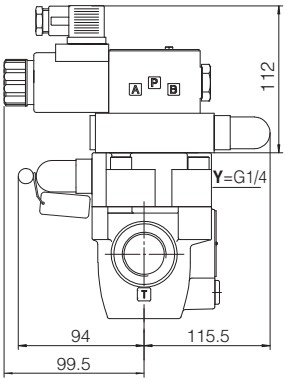
ARAM-20/32/-IX**



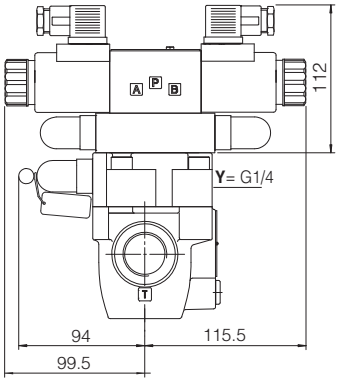
ARAM-20/10/-EX**
ARAM-20/11/-EX**



ARAM-20/20/-EX**
ARAM-20/21/-EX**



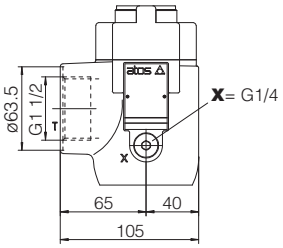
ARAM-20/22/-EX**

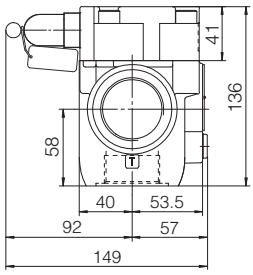


ARAM-20/32/-EX**

Overall dimensions refer to valves with connectors type 666

ARAM-32

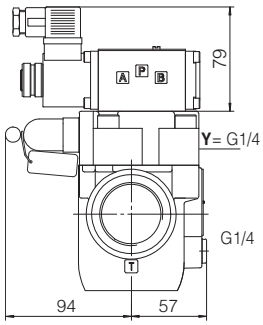




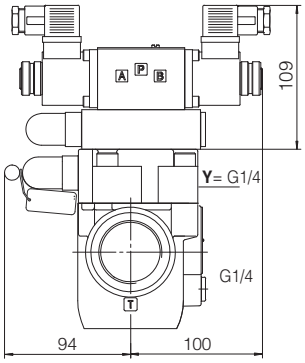
	Mass [kg]
ARAM-32	4,7

	Mass [kg]	
	with option IX	with option EX
ARAM-32/10	6,2	6,5
ARAM-32/11		
ARAM-32/20	7,9	8,5
ARAM-32/21		
ARAM-32/22	7,6	7,9
ARAM-32/32	8,8	8,2

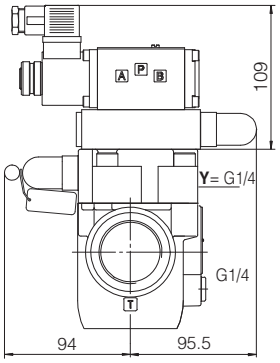
X = port connection for external pilot
Y = port connection for external drain



ARAM-32/10/-IX**
ARAM-32/11/-IX**



ARAM-32/20/-IX**
ARAM-32/21/-IX**



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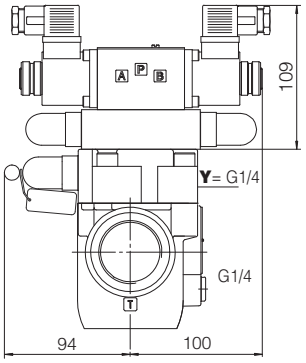
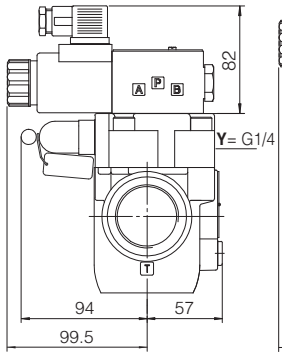
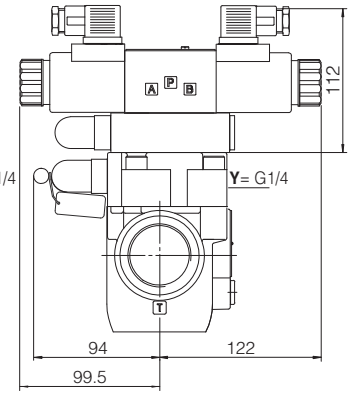


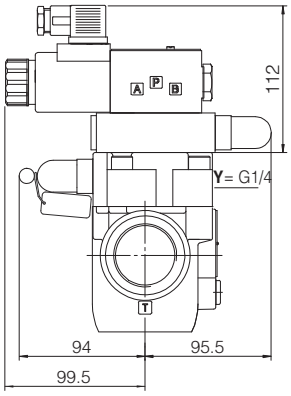
ARAM-32/32/-IX**



ARAM-32/10/-EX**
ARAM-32/11/-EX**



ARAM-32/20/-EX**
ARAM-32/21/-EX**



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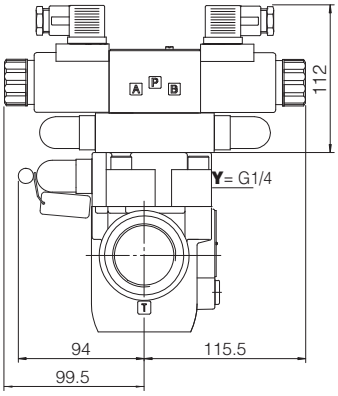


ARAM-32/32/-EX**

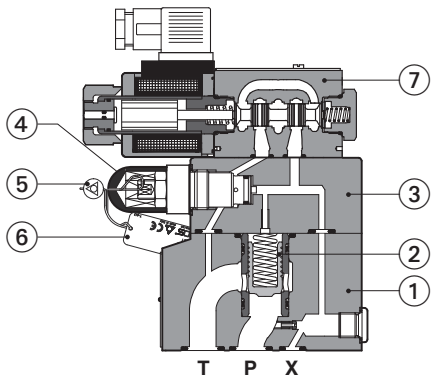
Overall dimensions refer to valves with connectors type 666

14 RELATED DOCUMENTATION

CY900	Operating and maintenance information for PED certified valves

Safety pressure relief valves

piloted, subplate, conforming to PED Directive 2014/68/EU - certified by DEKRA



AGAM-10/11/*/PED

① main body
② poppet
③ pilot stage
④ plastic cap
⑤ lead sealing
⑥ nameplate with factory pressure setting
⑦ pilot solenoid valve for pressure selection

AGAM /PED

Safety pressure relief valves, certified by DEKRA according to Pressure Equipment Directive 2014/68/EU (PED).

They are designed to operate as safety components, limiting the maximum system pressure or to protect parts of the hydraulic circuit and accumulators from overpressure.

The valves are factory set at the pressure level required by the costumer, see section 10.

The pressure adjustment screw is protected with a lead sealed plastic cap to avoid any tampering.

AGAM can be equipped with a pilot solenoid valve for venting or for different pressure selection.

Size: **10, 20** and **32** - ISO 6264
Max flow: **200, 400** and **600 l/min**
Max pressure: **350 bar**

1 MODEL CODE

AGAM	-	20	/	20	/	350	/	210/100	/	E	/	PED	/	280	-	I	X	24DC	*	/	*

Piloted pressure relief valve, subplate

Valve size ISO 6264:
10 20 32

Configuration, see section 2 :
- = without pilot solenoid valve
10, 11:
with pilot solenoid valve for venting
20, 21, 22, 32:
with pilot solenoid valve for multiple pressure selection

Max pressure:
350 = 350 bar

Pressure range of second / third setting (1):
50 = 50 bar **100** = 100 bar
210 = 210 bar **350** = 350 bar

Options, see section 9 :
E WP Y

PED = EU Type examination to 2014/68/EU - certified by DEKRA

Factory pressure setting (bar):
to be defined by the customer min step 1 bar
(example **280** = 280 bar)
min pressure setting 30 bar

Pilot valve (2):
I = DHI for AC and DC supply, with **cURus** certified solenoids
E = DHE for AC and DC supply, high performances with **cURus** certified solenoids

X = without connector **(2)**:
See section 7 for available connectors, to be ordered separately
-00 = solenoid valve without coils (for -I)
-00-AC = AC solenoid valve without coils (for -E)
-00-DC = DC solenoid valve without coils (for -E)

Voltage code, see section 6 **(2)**:

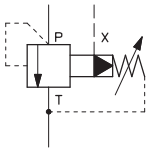
Series number

Seals material, see section 8:
- = NBR
PE = FKM

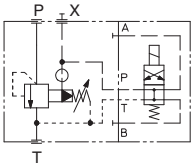
(1) Only for AGAM-* /20, /21, /22, /32
(2) Only for AGAM with pilot solenoid valve

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS

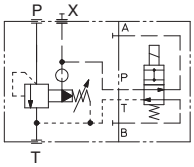
AGAM



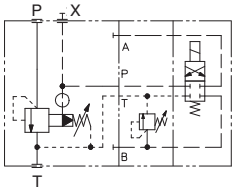
AGAM-/10**
one setting pressure + venting
with de-energized solenoid



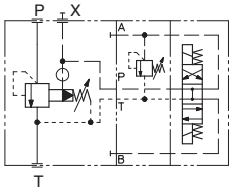
AGAM-/11**
one setting pressure + venting
with energized solenoid



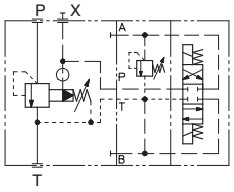
AGAM-/22**
two setting pressure
without venting



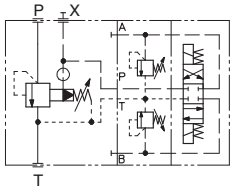
AGAM-/20**
two setting pressure + venting
with de-energized solenoid



AGAM-/21**
two setting pressure + venting
with energized solenoid



AGAM-/32**
three setting pressure
without venting



3 GENERAL CHARACTERISTICS

Assembly position / location	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd values according to EN ISO 13849	75 years, for further details see technical table P007
Ambient temperature	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C
Surface protection	Zinc coating with black passivation -salt spray test (EN ISO9227) > 200h
Compliance	PED Directive 2014/68/EU - EU type-examination certificate **(1)** RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

(1) The type-examination certificate can be download from

4 HYDRAULIC CHARACTERISTICS

Valve model	**AGAM-10**	**AGAM-20**	**AGAM-32**
Max pressure on ports P, X [bar]	350		
Max pressure on ports T, Y **(1)** [bar]	210 without pilot solenoid valve 120 with pilot solenoid valve -I 210 with pilot solenoid valve -E with DC solenoid 160 with pilot solenoid valve -E with AC solenoid		
Factory pressure setting range [bar]	30÷350		
Max flow **(2)** [l/min]	200	400	400

(1) The valves should be operated without counterpressure on T line, see note 2 at section 12
(2) Max flow without conterpressure on T line, see diagrams at section 12 for max ammissible flow

5 ELECTRICAL CHARACTERISTICS - for AGAM with pilot solenoid valve

Insulation class	DHI pilot	**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
	DHE pilot	**H** (180°C) for DC coils **F** (155°C) for AC coils	
Protection degree to DIN EN 60529		**IP 65** (with connectors 666, 667, 669 or E-SD correctly assembled)	
Relative duty factor		100%	
Supply voltage and frequency		See coil voltage 6	
Supply voltage tolerance		± 10%	
Certification		**cURus** North American standard	

6 COIL VOLTAGE - for AGAM with pilot solenoid valve

External supply nominal voltage ± 10% **(1)**	**Voltage code**	Type of connector	Power consumption **(3)** DHI	DHE	AGAM-*-I Code of spare coil	Colour of coil label	AGAM-*-E Code of spare coil
12 DC	**12 DC**	666 or 667	33 W	30 W	COU-12DC	green	COE-12DC
24 DC	**24 DC**				COU-24DC	red	COE-24DC
110 DC	**110 DC**				COU-110DC	black	COE-110DC
220 DC	**220 DC**				COU-220DC	black	COE-220DC
110/50 AC **(2)**	**110/50/60 AC**	666 or 667	60 VA	58 VA	COI-110/50/60AC	yellow	COE-110/50/60AC
115/60 AC	**115/60 AC (4)**		-	80 VA	-	-	COE-115/60AC
120/60 AC	**120/60 AC (5)**		60 VA	-	COI-120/60AC	white	-
230/50 AC **(2)**	**230/50/60 AC**		60 VA	58 VA	COI-230/50/60AC	light blue	COE-230/50/60AC
230/60 AC	**230/60 AC**		60 VA	80 VA	COI-230/60AC	silver	COE-230/60AC

(1) For other supply voltages see technical tables E010, E015
(2) Coil can be supplied also with 60 Hz: in this case the performances are reduced by 10 ÷ 15%
(3) Average values measured at nominal hydraulic condition and ambient temperature 20°C;
When AC solenoid is energized, the inrush current is approx 3 times the holding current
(4) Only for AGAM-*-E
(5) Only for AGAM-*-I

7 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 FOR AGAM WITH SOLENOID VALVE

The connectors must be ordered separately.

Code of connector	Function
666	Connector IP-65, suitable for direct connection to electric supply source
667	As 666 connector IP-65 but with built-in signal led, suitable for direct connection to electric supply source

For other available connectors, see tech table K800

8 SEALS AND HYDRAULIC FLUIDS - 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 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	ISO 4406 class 20/18/15 NAS 1638 class 9, see also filter section 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	

9 OPTIONS

E = external pilot
WP = prolunged manual override protected by rubber cap - only for AGAM with pilot solenoid valve
Y = external drain - only for AGAM with pilot solenoid valve

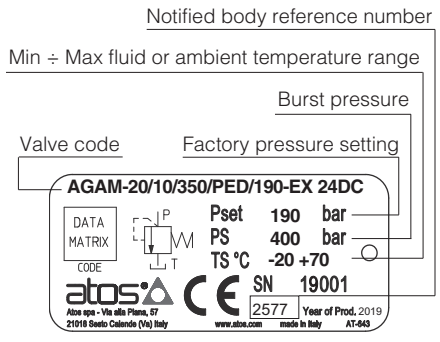
10 FACTORY PRESSURE SETTING

The /PED valves are factory set at the pressure level required by the costumer (min step: 1bar). The factory pressure setting is performed at the flow shown in the following table. The factory pressure setting is marked on the valve nameplate, see section 11 .

VALVE MODEL	FLOW FOR FACTORY PRESSURE SETTING (l/min)
AGAM-10	25
AGAM-20	25
AGAM-32	25

⚠ Any tampering of the lead sealing invalidates the certification

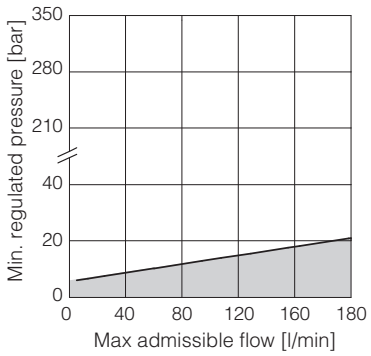
11 NAMEPLATE MARKING



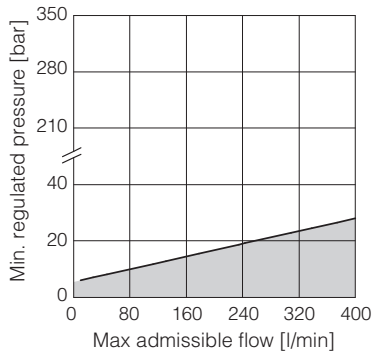
Note: **TS** values are referred to the extreme temperatures, regardless of whether the fluid or the ambient

12 PERMISSIBLE RANGE - based on mineral oil ISO VG 46 at 50°C

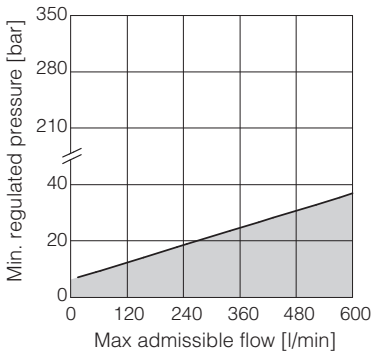
AGAM-10 /PED



AGAM-20 /PED



AGAM-32 /PED



Notes:

1) The valves can operate only in the white area of the above diagrams.
The max admissible flow values within the white area are those for which the pressure increase remains within **+10% with respect to the factory pressure setting.**

Pressure / flow values located in gray areas cannot be performed.

⚠ Before ordering the valve, check that the maximum admissible flow at the required pressure setting, is greater than the maximum flow rate of the system or the accumulator to be protected.

2) The working range in above diagrams is valid without counterpressure in T line.
The factory pressure setting is increased by the counterpressure valve in T line.
As general rule PED valves should be operated without counter pressure in the T line.
In case of counter pressure in T line, the maximum admissible flow has to be reduced with respect to the values reported in the diagram, so as not to exceed the limit of +10% with respect to the factory pressure setting. Contact Atos technical office for details.

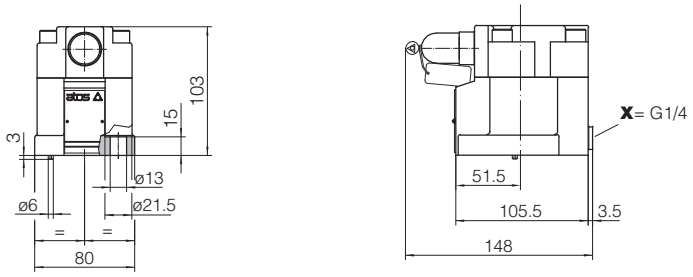
13 INSTALLATION DIMENSIONS [mm]

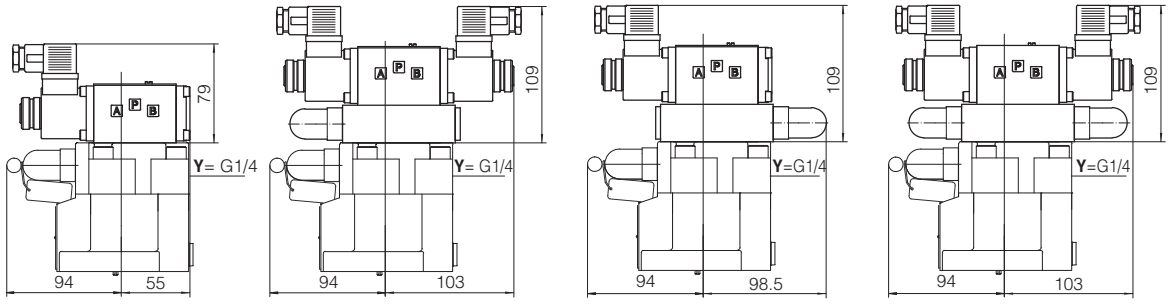
AGAM-10

ISO 6264: 2007 (see table P005)
Mounting surface: 6264-06-09-1-97
Fastening bolts: 4 socket head screws M12x35 class 12.9
Tightening torque = 125 Nm

	Mass [kg]
AGAM-10	3,6

	Mass [kg]	
	with option IX	with option EX
AGAM-10/10	5,1	5,4
AGAM-10/11		
AGAM-10/20	6,2	6,5
AGAM-10/21		
AGAM-10/22	5,9	6,2
AGAM-10/32	6,3	6,9



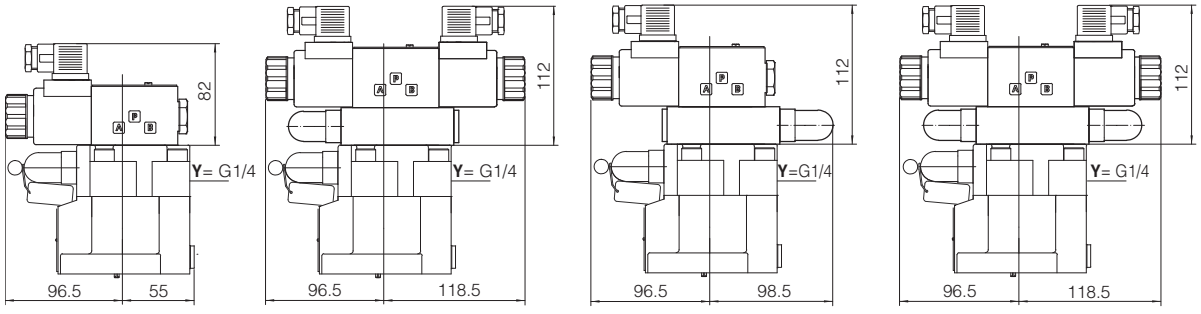


AGAM-10/10/-IX**
AGAM-10/11/-IX**

AGAM-10/20/-IX**
AGAM-10/21/-IX**

AGAM-10/22/-IX**

AGAM-10/32/-IX**



AGAM-10/10/-EX**
AGAM-10/11/-EX**

AGAM-10/20/-EX**
AGAM-10/21/-EX**

AGAM-10/22/-EX**

AGAM-10/32/-EX**

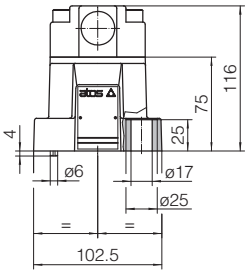
Overall dimensions refer to valves with connectors type 666

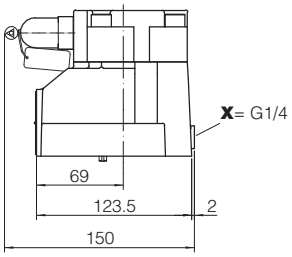
AGAM-20

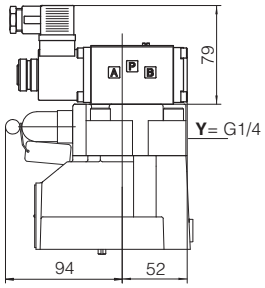
ISO 6264: 2007 (see table P005)
Mounting surface: 6264-08-11-1-97
Fastening bolts:
4 socket head screws M16x50 class 12.9
Tightening torque = 300 Nm

	Mass [kg]
AGAM-20	4,8

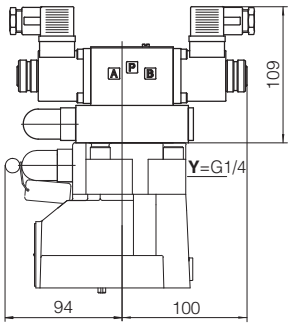
	Mass [kg]	
	with option IX	with option EX
AGAM-20/10	6,3	6,6
AGAM-20/11		
AGAM-20/20	7,4	7,7
AGAM-20/21		
AGAM-20/22	7,1	7,4
AGAM-20/32	7,5	8,1



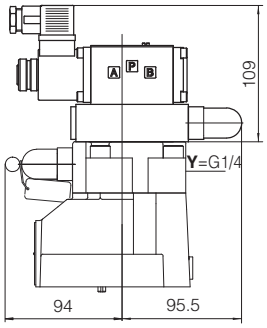




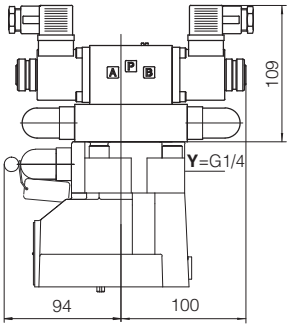
AGAM-20/10/-IX**
AGAM-20/11/-IX**



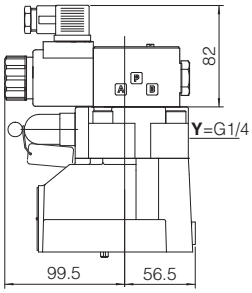
AGAM-20/20/-IX**
AGAM-20/21/-IX**



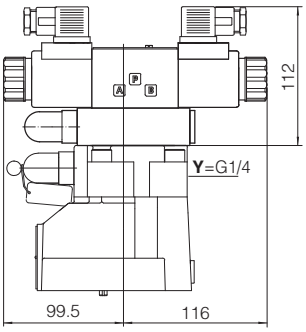
AGAM-20/22/-IX**



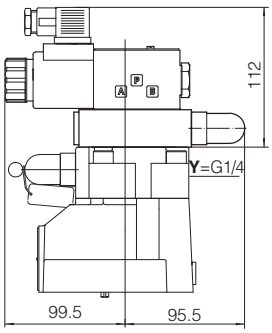
AGAM-20/32/-IX**



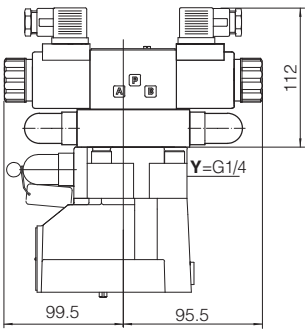
AGAM-20/10/-EX**
AGAM-20/11/-EX**



AGAM-20/20/-EX**
AGAM-20/21/-EX**



AGAM-20/22/-EX**



AGAM-20/32/-EX**

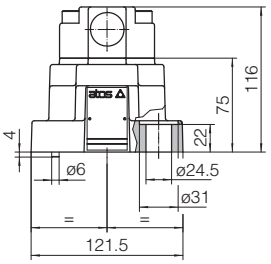
Overall dimensions refer to valves with connectors type 666

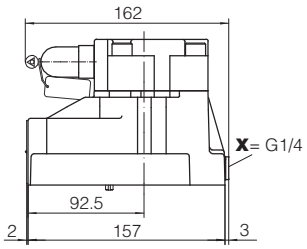
AGAM-32

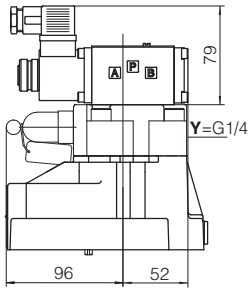
ISO 6264: 2007 (see table P005)
Mounting surface: 6264-10-17-1-97
(with M20 fixing holes instead of standard M18)
Fastening bolts:
4 socket head screws M20x60 class 12.9
Tightening torque = 600 Nm

	Mass [kg]
AGAM-32	6.2

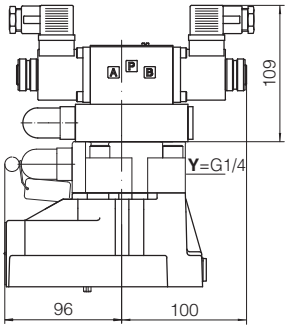
	Mass [kg]	
	with option IX	with option EX
AGAM-32/10	7,7	8
AGAM-32/11		
AGAM-32/20	8,8	8,1
AGAM-32/21		
AGAM-32/22	8,5	8,8
AGAM-32/32	8,9	9,5



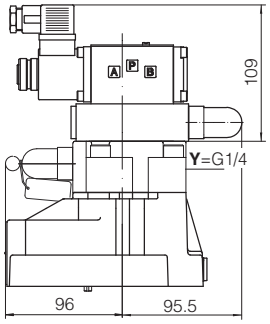




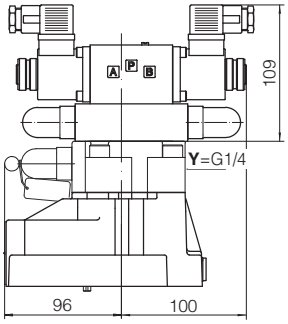
AGAM-32/10/-IX**
AGAM-32/11/-IX**



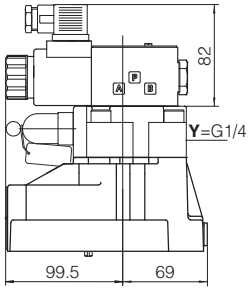
AGAM-32/20/-IX**
AGAM-32/21/-IX**



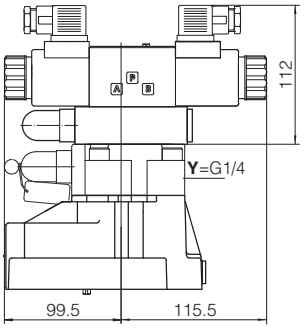
AGAM-32/22/-IX**



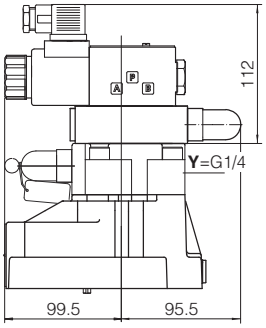
AGAM-32/32/-IX**



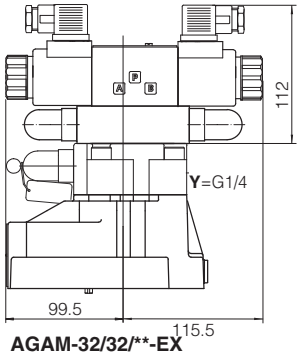
AGAM-32/10/-EX**
AGAM-32/11/-EX**



AGAM-32/20/-EX**
AGAM-32/21/-EX**



AGAM-32/22/-EX**



AGAM-32/32/-EX**

Overall dimensions refer to valves with connectors type 666

14 MOUNTING SUBPLATES - see table K280

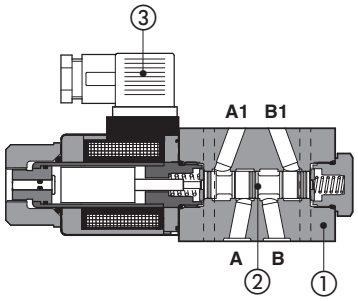
Valve	Subplate model	Port location	Ports			Ø Counterbore [mm]			Mass [Kg]
			P	T	X	P	T	X	
AGAM-10	BA-306	Ports P, T, X underneath;	G 1/2"	G 3/4"	G 1/4"	30	36,5	21,5	1,5
AGAM-20	BA-406		G 3/4"	G 3/4"	G 1/4"	36,5	36,5	21,5	3,5
	BA-506		G 1"	G 1"	G 1/4"	46	46	21,5	3,5
AGAM-32	BA-706		G 1 1/2"	G 1 1/2"	G 1/4"	63,5	63,5	21,5	6

15 RELATED DOCUMENTATION

CY900	Operating and maintenance information for PED certified valves

Solenoid modular valves

direct, modular, spool type



HF-0611

① Body
② Spool
③ Coil electric connector (to be ordered separately)

HF are spool type, direct operated solenoid valves in modular execution, normally used for shut-off or to by-pass the hydraulic user lines.

The modular execution permits to make compact functional circuits, by the stack mounting with other modular valves and solenoid valves size 06.

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

1 MODEL CODE

HF-0	61	1	/	A	-	E	X	24DC	**	/*

Modular directional valve, size 06

Valve configuration, see section 2
61 = single solenoid, central plus external position, spring centered
67 = single solenoid, central plus external position, spring offset

Spool type: **1**, **3**, **4** see section 2

Options:
A = solenoid mounted at side of port B
B = orientation of coil and proximity connectors rotated of 180°
WP = prolunged manual override protected by a rubber cap

00-AC = AC solenoids without coils
00-DC = DC solenoids without coils
E = solenoid OE for AC and DC supply

X = without connector, only for **E** solenoid
See section 6 for available connectors, to be ordered separately

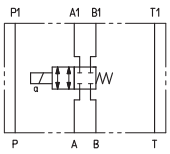
Coils with special connectors
XJ = AMP Junior Timer connector
XK = Deutsch connector
XS = Lead Wire connection

Voltage code, see section 7

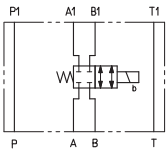
Series number

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

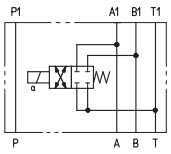
2 CONFIGURATION



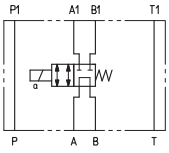
HF-0611



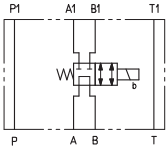
HF-0611/A



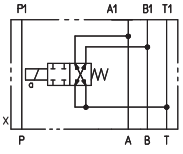
HF-0613



HF-0614



HF-0614/A



HF-0673

3 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 Low Voltage Directive 2014/35/EU and Machine Directive 2006/42/EC. RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Ambient temperature	**Standard** -30°C ÷ +70°C **/PE** option -20°C ÷ +70°C **/BT** option -40°C ÷ +70°C
Flow direction	As shown in the symbols of table 2
Operating pressure	Ports P,A,B: **350** bar; Port T: **210** bar (DC solenoid); **160** bar (AC solenoid)
Maximum flow	**60 l/min**

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 mating connectors correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric features 7
Supply voltage tolerance	± 10%
Certification	**cURus** North American standard

4 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 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 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	

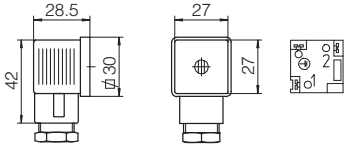
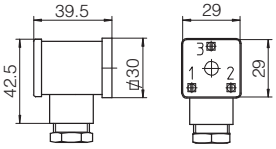
5 OPTIONS

A = Solenoid mounted at side of port B. In standard versions, solenoid is mounted at side of port A.

B = Orientation of coil and proximity connectors rotated of 180°

WP = Prolunged manual override protected by a rubber cap (not for FV)

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

666, 667 (for AC or DC supply)	**669** (for AC supply)	**CONNECTOR WIRING**	
		**666, 667** 1 = Positive ⊕ 2 = Negative ⊖ ⊕ = Coil ground	**669** 1,2 = Supply voltage VAC 3 = Coil ground
		SUPPLY VOLTAGES	
		666 All voltages	**667** 24 AC or DC 110 AC or DC 220 AC or DC
			669 110/50 AC 110/60 AC 230/50 AC 230/60 AC

Note: for electronic connectors type **E-SD**, see tab. K500

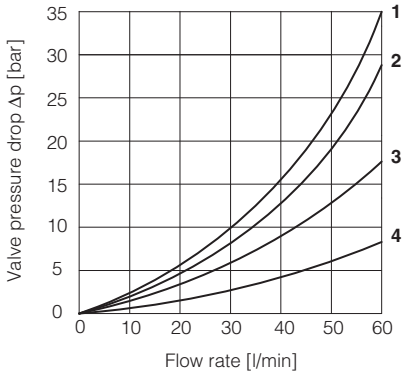
7 ELECTRIC FEATURES

External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption (2)	Code of spare coil
12 DC	**12 DC**	666 or 667	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.

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

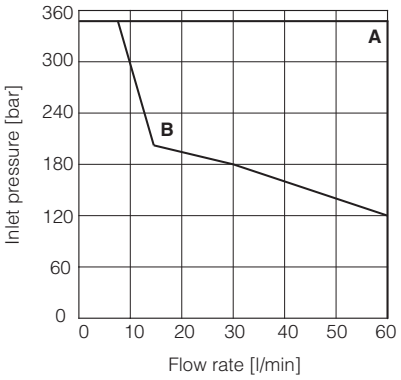
Flow direction / Valve type	**A→A1**	**B→B1**	**A→B**	**A1→T**	**B1→T**
HF-0611	1	2			
HF-0614	1	2	3		
HF-0673	3	3		4	4



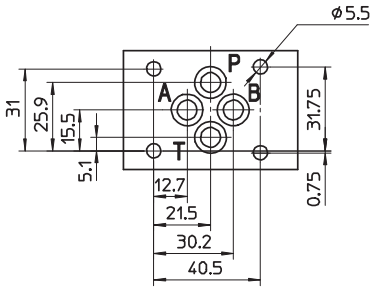
9 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams have been obtained with warm solenoids and power supply at lowest value (V_{nom} - 10%)

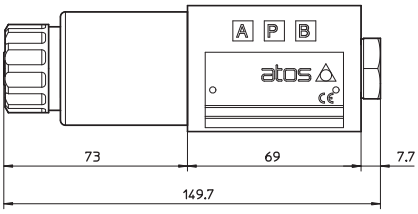
Valve type	Curve
HF-0611	**A**
HF-0614, HF-0673	**B**

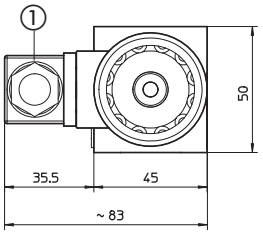


10 DIMENSIONS [mm]



ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Seals: 4 OR 108
Ports P, A, B, T: Ø = 7.5 mm (max).



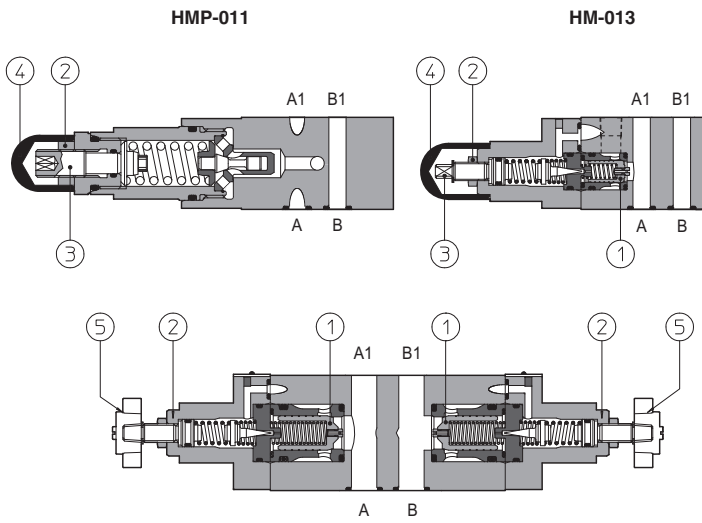


HF-0611
HF-0613
HF-0614
HF-0673

① = Power supply connector code 666, 667 or 669, to be ordered separately

Modular relief valves type HMP, HM, KM

ISO 4401 sizes 06 and 10



HMP are direct operated pressure relief valves.
HM and **KM** are double stage pressure relief valves with balanced poppet ①.

The pressure adjustment is operated by loosening the locking nut ② and turning the screw ③ protected by cap ④. Optional versions with setting adjustment by handwheel ⑤ instead of the screw are available on request.
Clockwise rotation increases the pressure.

Valve size and max flow:

HMP = size 06, max flow: 35 l/min
HM = size 06, max flow: 60 l/min
KM = size 10, max flow: 120 l/min

Mounting surface: **ISO 4401 size 06, 10**
Max pressure: up to **350 bar**

1 MODEL CODE

HM	-	011	/	210	/	V	**	/	*

Modular pressure relief valve size:
HMP = 06
HM = 06
KM = 10

Configuration, see section 2
011 = single on port P, dicharge to port T
012 = double on ports A and B, discharge to port T
013 = single on port A, discharge to port T
014 = single on port B, discharge to port T
015 = double on ports A and B, with the relieved pressure cross-discharged

Pressure range

HMP:	HM and KM:
50 = 2÷ 50 bar	**50** = 4÷ 50 bar
100 = 3÷100 bar	**100** = 5÷100 bar
210 = 10÷210 bar	**210** = 5÷210 bar
350 = 15÷350 bar	**350** = 5÷350 bar

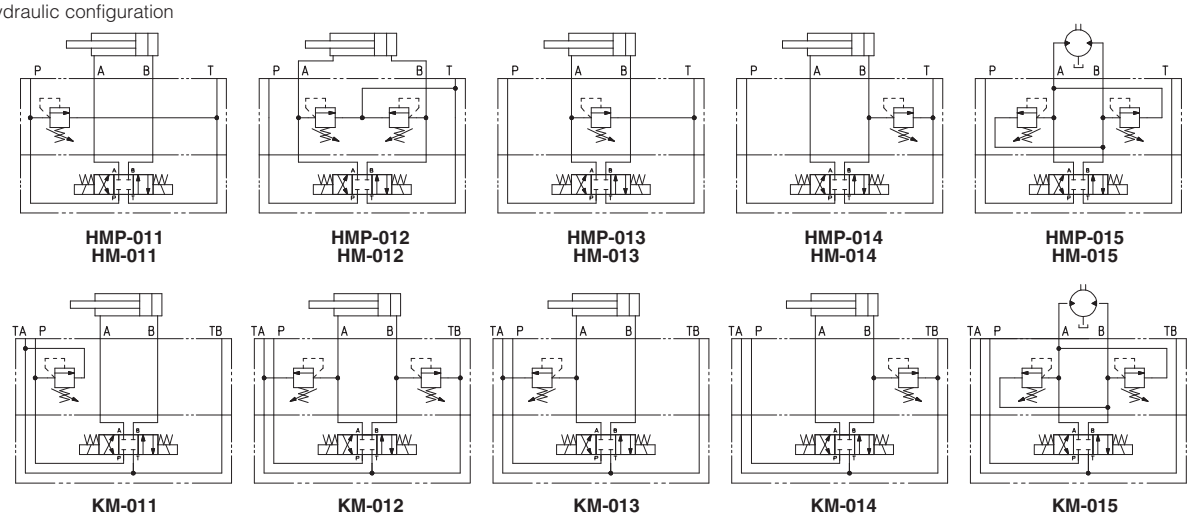
Options:
V = setting adjustment by handwheel instead of a grub screw protected by cap
Only for HMP:
R = reduced leakage for special applications
VF = regulating knob
VS = regulating knob with safety locking

Series number

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

2 HYDRAULIC CHARACTERISTICS

Hydraulic configuration



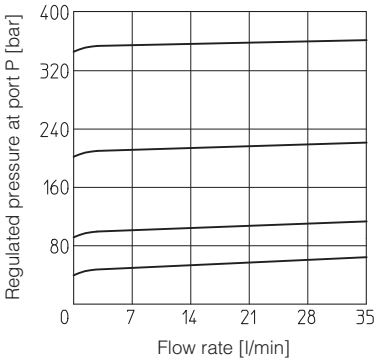
Valve model		HMP	HM	KM
Max flow	[l/min]	35	60	120
Pressure range	[bar]	2÷50; 3÷100; 10÷210; 15÷350	4÷50; 5÷100; 5÷210; 5÷350	

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

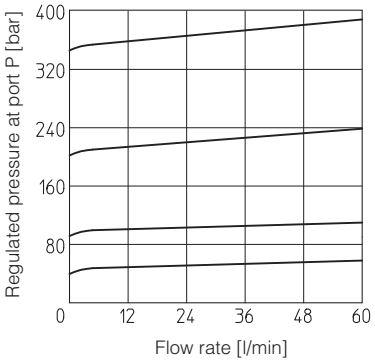
Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH 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 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	

4 REGULATED PRESSURE VERSUS FLOW DIAGRAMS (Based on mineral oil ISO VG 46 at 50°C)

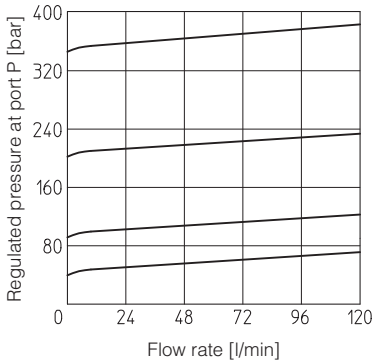
HMP



HM

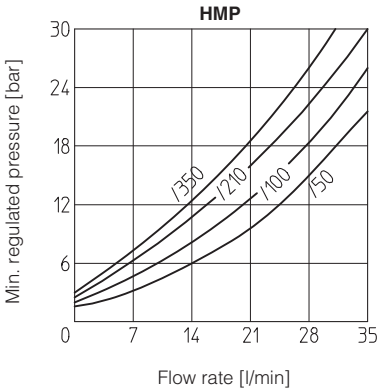


KM

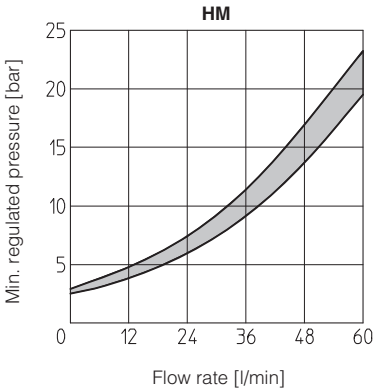


5 MINIMUM PRESSURE VERSUS FLOW DIAGRAMS (Based on fluid viscosity of 25 mm²/s at 40°C)

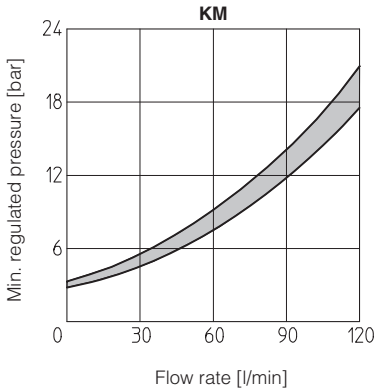
HMP



HM

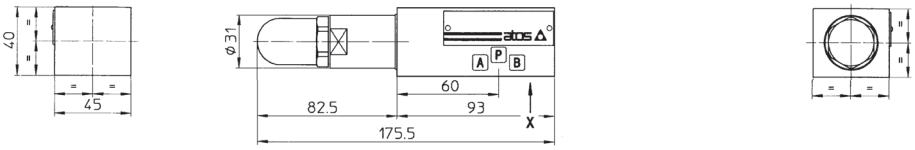


KM



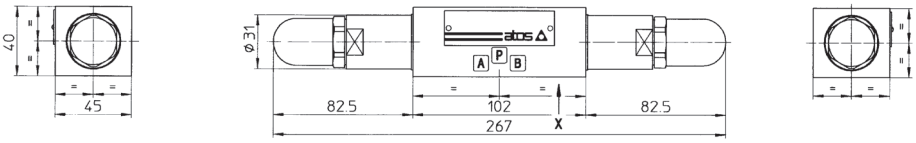
6 INSTALLATION DIMENSIONS OF HMP VALVES [mm]

HMP-011



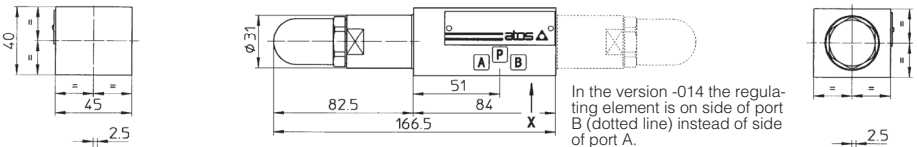
Mass: 1,4 Kg

HMP-012



Mass: 1,7 Kg

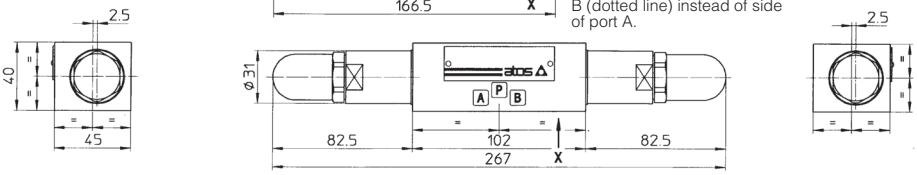
HMP-013
HMP-014



In the version -014 the regulating element is on side of port B (dotted line) instead of side of port A.

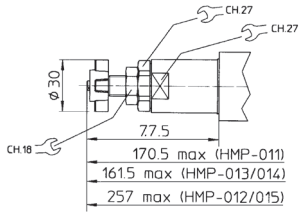
Mass: 1,2 Kg

HMP-015

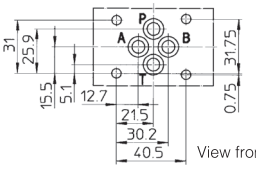


Mass: 1,7 Kg

Adjustment device for option /V

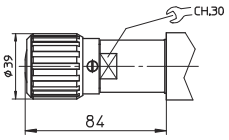


ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Diameter of ports A, B, P, T: Ø = 7,5 mm
Seals: 4 OR 108



View from X

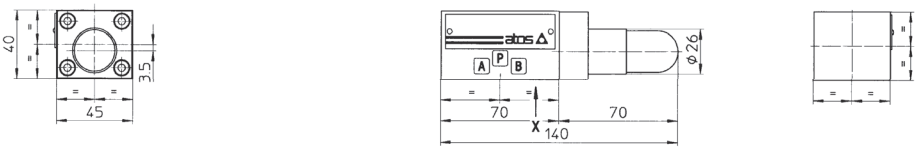
Adjustment device for option /VF and /VS



Fastening bolts: n° 4 socket head screws M5. The lenght depends on number and type of modular elements associated.

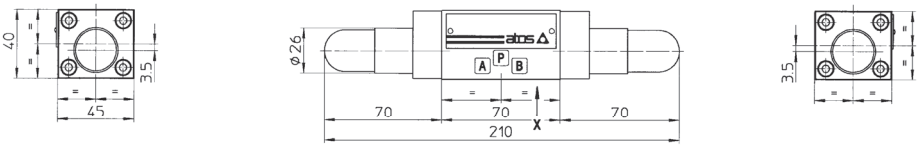
7 INSTALLATION DIMENSIONS OF HM VALVES [mm]

HM-011
HM-014



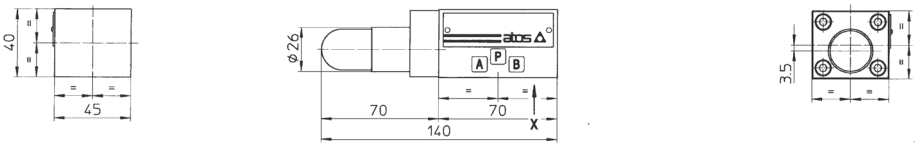
Mass: 1,1 Kg

HM-012
HM-015



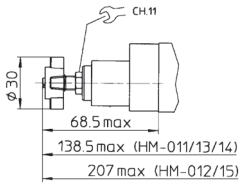
Mass: 1,3 Kg

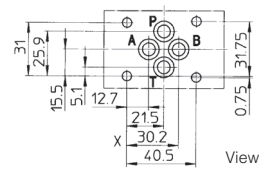
HM-013



Mass: 1,1 Kg

Adjustment device for option /V





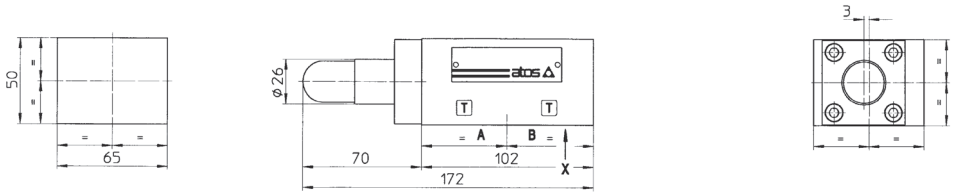
View from X

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Diameter of ports A, B, P, T: Ø = 7,5 mm
Seals: 4 OR 108

Fastening bolts: n° 4 socket head screws M5. The lenght depends on number and type of modular elements associated.

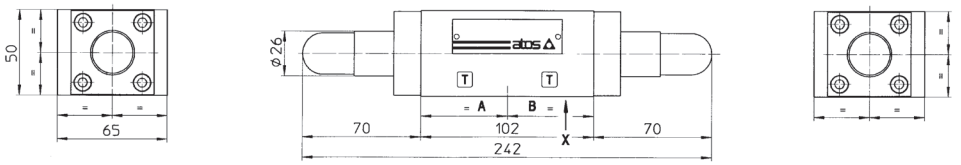
8 INSTALLATION DIMENSIONS OF KM VALVES [mm]

KM-011



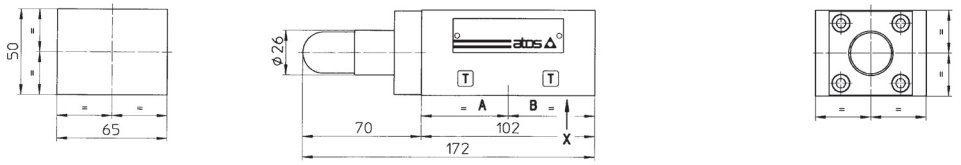
Mass: 2,5 Kg

KM-012



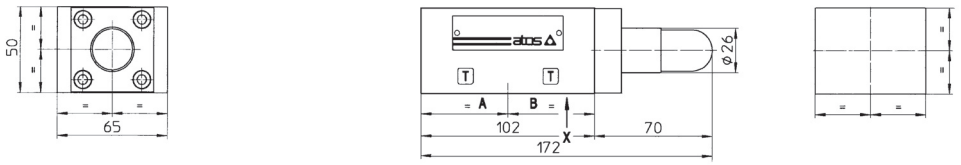
Mass: 2,8 Kg

KM-013



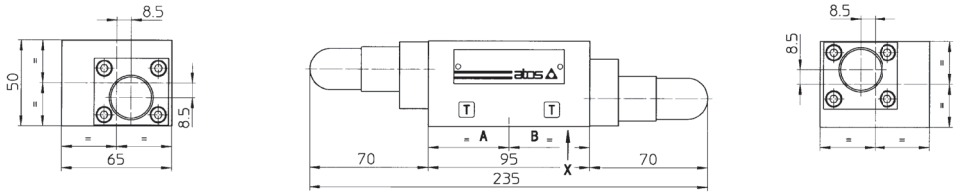
Mass: 2,5 Kg

KM-014



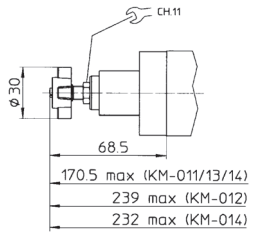
Mass: 2,5 Kg

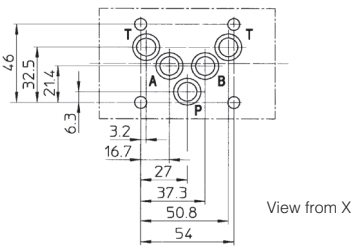
KM-015



Mass: 2,5 Kg

Adjustement device for option /V





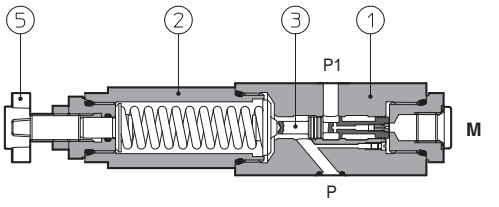
View from X

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05
Diameter of ports A, B, P, T: Ø = 11,2 mm
Seals: 5 OR 2050

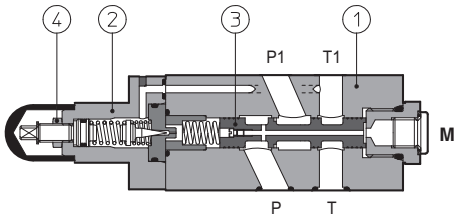
Fastening bolts: n° 4 socket head screws M6. The lenght depends on number and type of modular elements associated.

Modular sequence valves type HS-011 and KS-011

spool type, ISO 4401 size 06 and 10



HS-011/*/V**



KS-011

HS are direct sequence valves, spool type ③.
KS are double stage ① ② sequence valves, spool type ③.

Pressure adjustment is operated by loosening the locking nut ④ and turning the setting screw in the normal model.
Optional versions with a handwheel ⑤ are available on request.
Clockwise rotation increases the pressure.

Valve size and max flow:

HS = size 06, flow up to 40 l/min
KS = size 10, flow up to 80 l/min

Mounting surface: **ISO 4401 size 06, 10**
Max pressure: **350 bar** (HS)
315 bar (KS)

1 MODEL CODE

HS	-	011	/	210	/	V	**	/	*

Modular sequence valve, size:
HS = 06
KS = 10

Configuration, see section 2
011 = single, acting on port P, drain to port T

Pressure range:

for HS:	for KS:
32 = 3 - 32 bar	
100= 20 - 100 bar	**100**= 7 - 100 bar
210= 50 - 210 bar	**210**= 8 - 210 bar

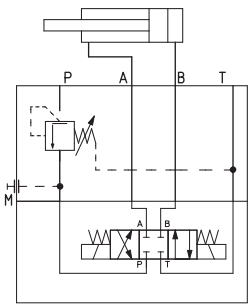
Options:
V = setting adjustment by handwheel instead of a grub screw protected by cap
Only for HS:
VF = regulating knob
VS = regulating knob with safety locking

Series number

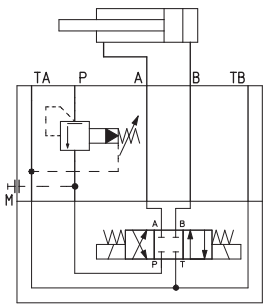
Seals material, see section 3:
- = NBR
PE = FKM
BT = HNBR

2 HYDRAULIC CHARACTERISTICS

Hydraulic configuration



HS-011



KS-011

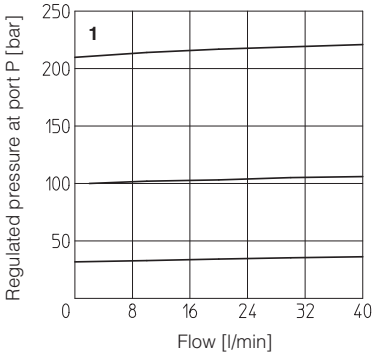
Valve model		HS-011/32	HS-011/100	HS-011/210	KS-011/100	KS-011/210
Max flow	[l/min]	40			80	
Max drain	[cm³/min]	50			50	
Pressure range	[bar]	3 - 32	20 - 100	50 - 210	7 - 100	8 - 210
Max inlet pressure	[bar]	350			315	
Max pressure on port T	[bar]	160			160	

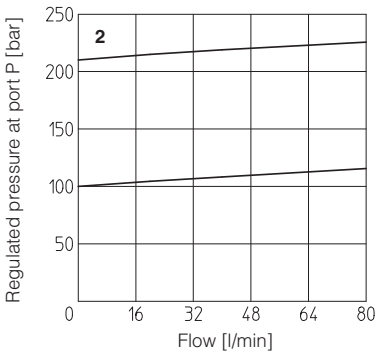
3 MAIN CHARACTERISTICS SEALS and HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	**Standard** = -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 ÷ +60°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 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	

4 REGULATED PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C

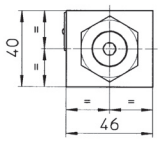
1 = HS
2 = KS

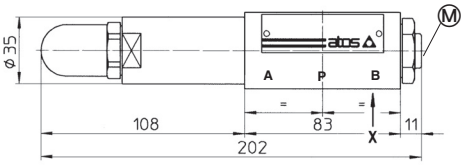


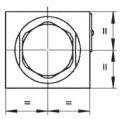


5 INSTALLATION DIMENSIONS [mm]

HS-011

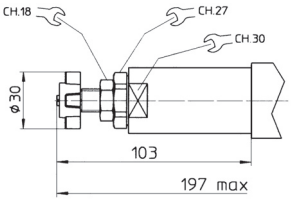




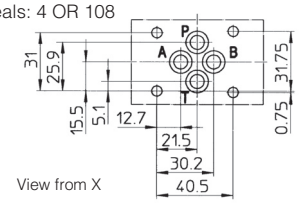


Ⓜ = Pressure gauge port = G 1/4"

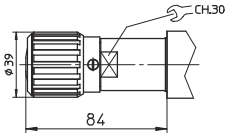
Adjustment device for option/V



ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Diameter of ports A, B, P, T: Ø = 7,5 mm
Seals: 4 OR 108



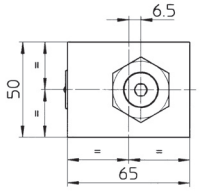
Adjustment device for option /VF and /VS

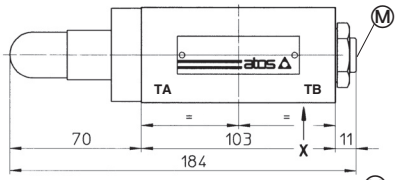


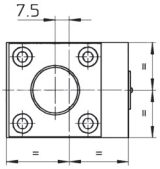
Fastening bolts: n°4 socket head screws M5. The lenght depends on number and type of modular elements associated.

Mass: 2 Kg

KS-011

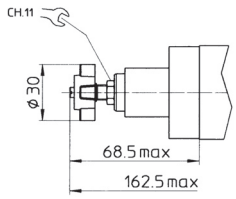


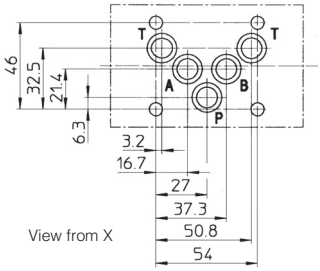




Ⓜ = Pressure gauge port = G 1/4"

Adjustment device for option/V





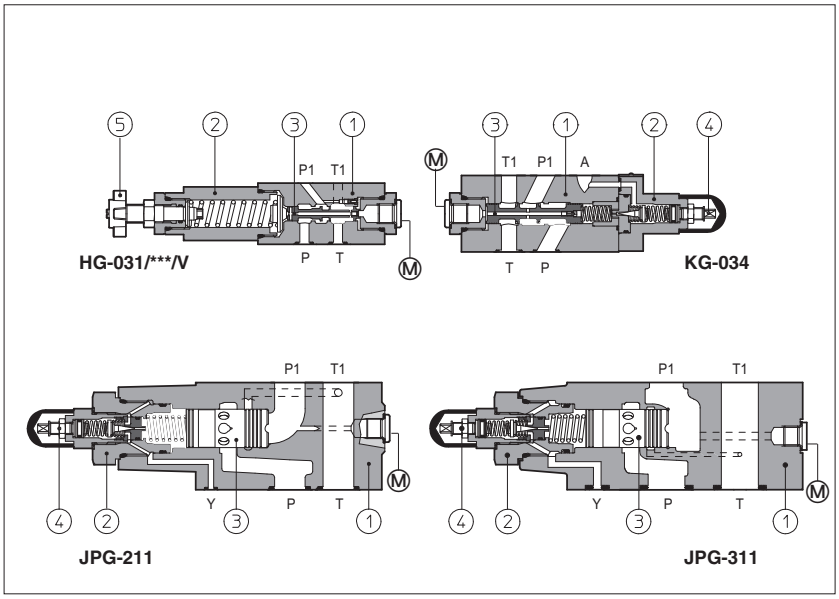
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05
Diameter of ports A, B, P, T: Ø = 11,2 mm
Seals: 5 OR 2050

Fastening bolts: n°4 socket head screws M6. The lenght depends on number and type of modular elements associated.

Mass: 3 Kg

Modular reducing valves type HG, KG, JPG-2 and JPG-3

spool type, ISO 4401 sizes 06, 10, 16 and 25



HG, KG, JPG are pressure reducing valves, spool type ③, designed to operate in oil hydraulic systems.
HG are direct, three way valves;
KG are double stage ① ②, three way valves;
JPG are double stage ① ②, two way valves.
Clockwise rotation increases the pressure.

Valve size and max flow:

HG = size 06 flow up to 50 l/min;
KG = size 10 flow up to 100 l/min;
JPG-2 = size 16 flow up to 250 l/min;
JPG-3 = size 25 flow up to 300 l/min;

Mounting surface:
ISO 4401 size 06, 10, 16 and **25**

Max pressure: **350 bar** for HG
315 bar for KG and JPG

1 MODEL CODE

HG-0	31	/	210	/	V	**	/	*

HG-0: Modular pressure reducing valve, size:
HG-0 = 06 **JPG-2** = 16
KG-0 = 10 **JPG-3** = 25

31: Configuration, see section 2
two way (**only for JPG**):
11 = reduced pressure on P port
three way (**only for HG-0 and KG-0**):
31 = reduced pressure on P port
33 = reduced pressure on A port
34 = reduced pressure on B port

210: Pressure range

HG	KG	JPG
32 = 3 - 32 bar	**100** = 7 - 100 bar	**100** = 6 - 100 bar
50 = 2 - 50 bar	**210** = 8 - 210 bar	**210** = 70 - 210 bar
75 = 10 - 75 bar		
100 = 20 - 100 bar		
210 = 50 - 210 bar		

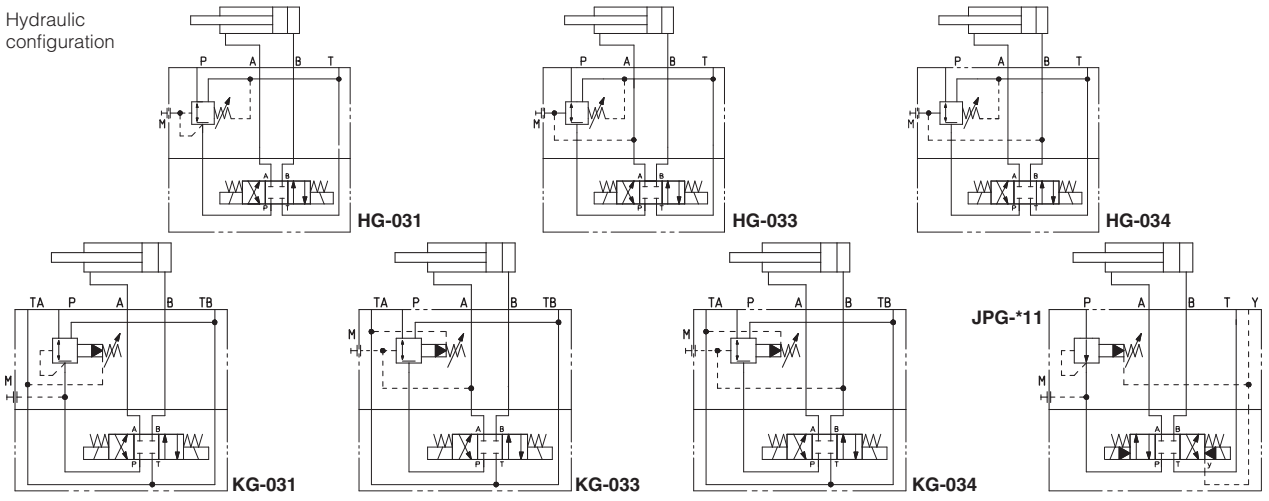
V: Options:
V = setting adjustment by handwheel instead of a grub screw protected by cap
Only for HG:
VF = regulating knob **/VS** = regulating knob with safety locking

******: Series number

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

2 HYDRAULIC CHARACTERISTICS

Hydraulic configuration



Valve model		HG-03*/32	HG-03*/50	HG-03*/75	HG-03*/100	HG-03*/210	KG-03*/100	KG-03*/210	JPG-211/100	JPG-211/210	JPG-311/100	JPG-311/210
Max flow	[l/min]	50					100		250		300	
Pressure range	[bar]	3 ÷ 32	2 ÷ 50	10 ÷ 75	20 ÷ 100	50 ÷ 210	7 ÷ 100	8 ÷ 210	6 ÷ 100	70 ÷ 210	6 ÷ 100	70 ÷ 210
Max inlet pressure	[bar]	350					315		315		315	
Max pressure on port T	[bar]	160					160		160		160	

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		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	**Standard** = -30°C ÷ +80°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°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 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	

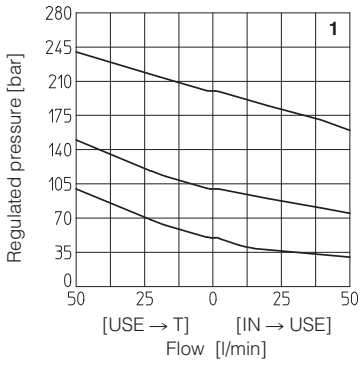
4 DIAGRAMS OF HG-03*

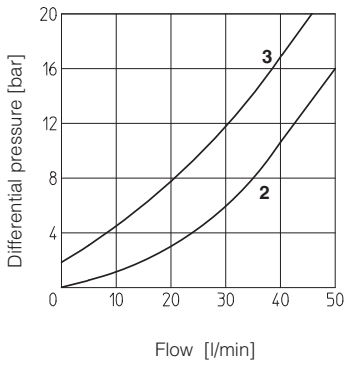
based on mineral oil ISO VG 46 at 50°C

1 = regulated pressure variation versus flow:
- between use port and discharge port
- between inlet port and use port

2 = differential pressure variation versus flow between inlet port and use port

3 = differential pressure variation versus flow between use port and discharge port





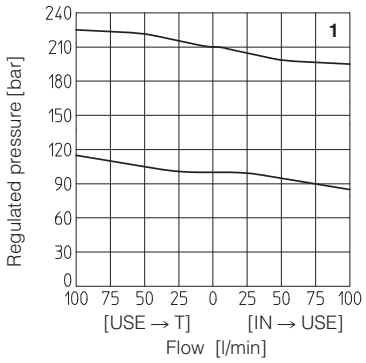
5 DIAGRAMS OF KG-03*

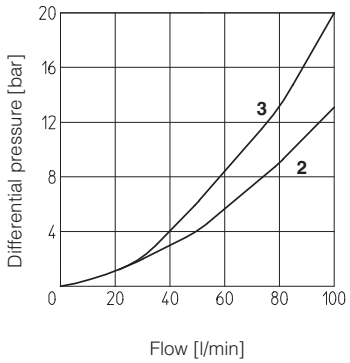
based on mineral oil ISO VG 46 at 50°C

1 = regulated pressure variation versus flow:
- between use port and discharge port
- between inlet port and use port

2 = differential pressure variation versus flow between inlet port and use port

3 = differential pressure variation versus flow between use port and discharge port



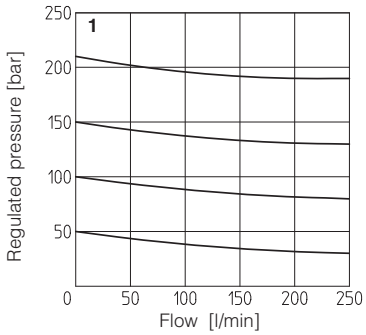


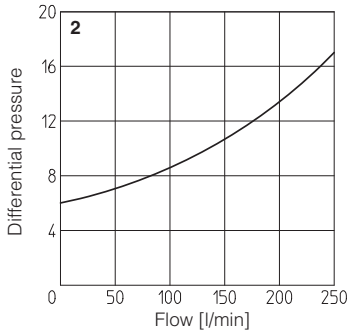
6 DIAGRAMS OF JPG-211

based on mineral oil ISO VG 46 at 50°C

1 = regulated pressure variation versus flow between inlet port and use port

2 = differential pressure variation versus flow between use port and discharge port



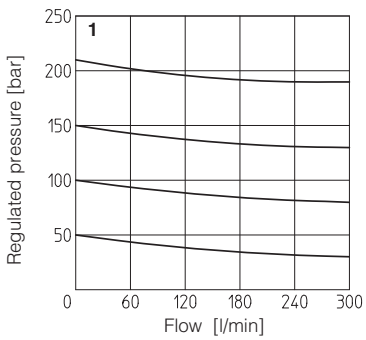


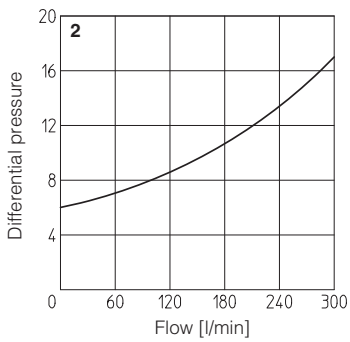
7 DIAGRAMS OF JPG-311

based on mineral oil ISO VG 46 at 50°C

1 = regulated pressure variation versus flow between inlet port and use port

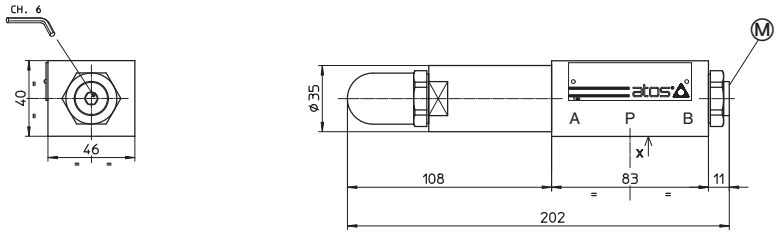
2 = differential pressure variation versus flow between use port and discharge port





8 INSTALLATION DIMENSIONS OF HG-0 VALVES [mm]

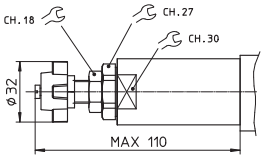
HG-03*



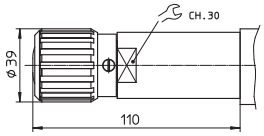
Ⓜ = Pressure gauge port = G 1/4"

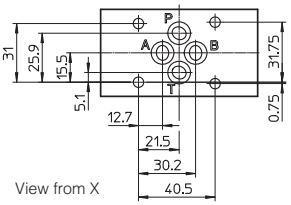
Mass: 2,3 Kg

Adjustment device for option /V



Adjustment device for option /VF and /VS



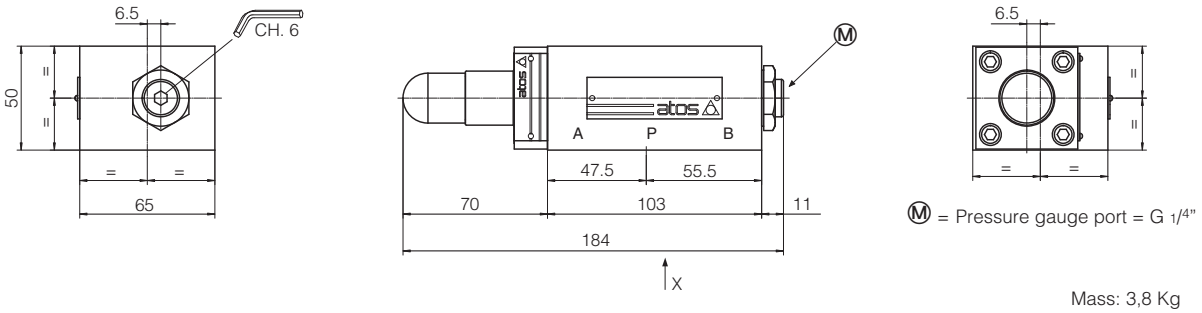


ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Diameter of ports A, B, P, T: Ø = 7,5 mm
Seals: 4 OR 108

Fastening bolts: n° 4 socket head screws M5. The lenght depends on number and type of modular elements associated.

9 INSTALLATION DIMENSIONS OF KG-0 VALVES [mm]

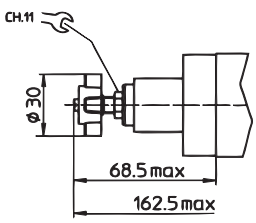
KG-03*

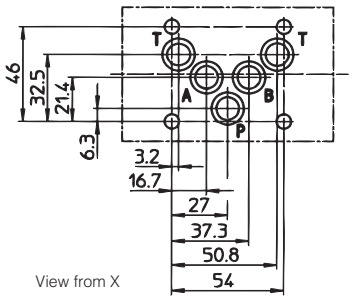


Ⓜ = Pressure gauge port = G 1/4"

Mass: 3,8 Kg

Adjustment device for option /V



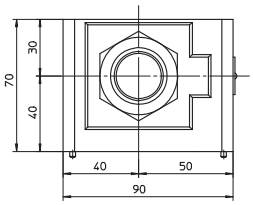


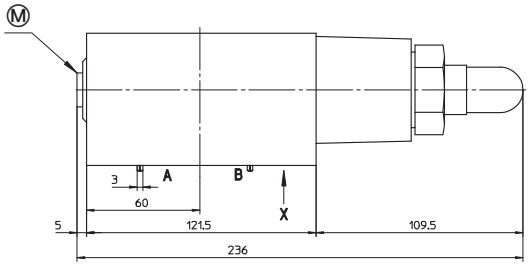
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05
Diameter of ports A, B, P, T: Ø = 11,2 mm
Seals: 5 OR 2050

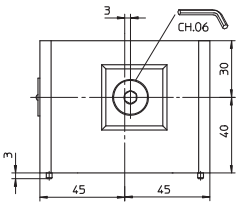
Fastening bolts: n° 4 socket head screws M6. The lenght depends on number and type of modular elements associated.

10 INSTALLATION DIMENSIONS OF JPG-2 VALVES [mm]

JPG-211



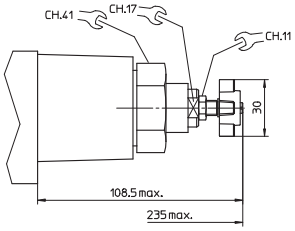


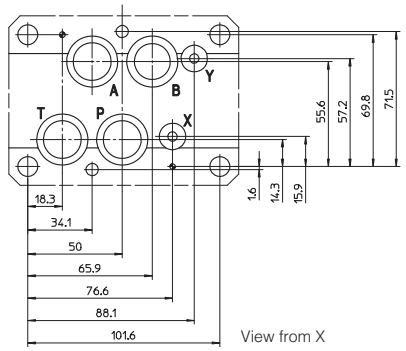


Ⓜ = Pressure gauge port = G 1/4"

Mass: 9 Kg

Adjustment device for option /V



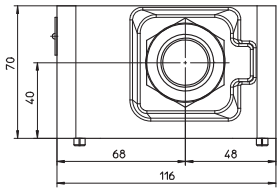


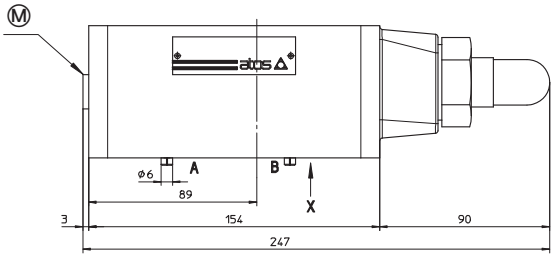
ISO 4401: 2005
Mounting surface: 4401-07-07-0-05
Diameter of ports A, B, P, T: Ø = 20 mm
Diameter of ports X, Y: Ø 7 mm
Seals: 4 OR 130: 2 OR 109

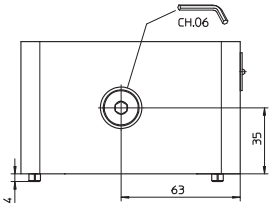
Fastening bolts: n° 4 socket head screws M10 and n° 2 M6. The lenght depends on number and type of modular elements associated.

11 INSTALLATION DIMENSIONS OF JPG-3 VALVES [mm]

JPG-311



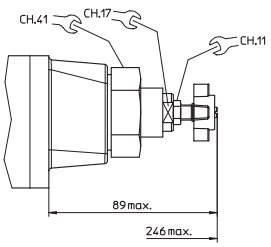


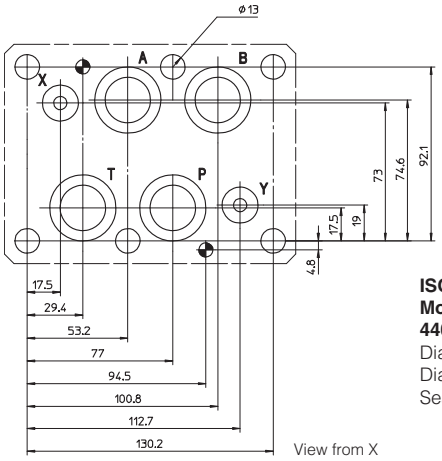


Ⓜ = Pressure gauge port = G 1/4"

Mass: 9 Kg

Adjustment device for option /V



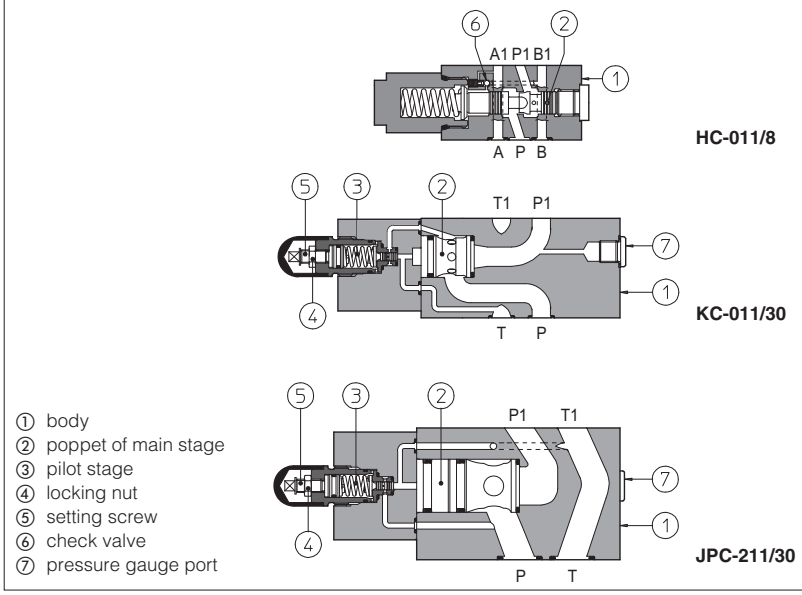


ISO 4401: 2005
Mounting surface:
4401-08-08-0-05 (without port L)
Diameter of ports A, B, P, T: Ø = 24 mm
Diameter of ports X, Y: Ø 7 mm
Seals: 4 OR 130: 2 OR 109

Fastening bolts: n° 6 socket head screws M12. The lenght depends on number and type of modular elements associated.

Modular pressure compensators type HC, KC, and JPC-2

ISO 4401 sizes 06, 10 and 16



① body
② poppet of main stage
③ pilot stage
④ locking nut
⑤ setting screw
⑥ check valve
⑦ pressure gauge port

HC, **KC** and **JPC** are two way pressure compensators for modular assembling with on/off and proportional directional control valves.

They keep a constant differential pressure (Δp) across port P and port A or B in order to maintain a constant flow rate against pressure variations. Automatic piloting selection ⑥ is included.

Fixed Δp is available only for size 06. Adjustment of desired Δp is operated by loosening the locking nut ④ and turning the setting screw ⑤ of pilot device.
Clockwise rotation increases Δp.

HC = size 06, flow up to 50 l/min.
KC = size 10, flow up to 100 l/min.
JPC = size 16, flow up to 200 l/min.

Mounting surface:
ISO 4401 size 06, 10, 16

Max pressure: **350 bar**

1 MODEL CODE

HC-0	-	11	30	/	M	**	/	*

HC-0: Modular pressure compensator, size:
HC-0 = 06
KC-0 = 10
JPC-2 = 16

11: Configuration, see section 2
11 = two way execution with constant Δp beetween P port and user port

30: Adjustable Δp (for all sizes):
30 = 5 - 35 bar

8: Fixed Δp (only for size 06):
8 = 8 bar

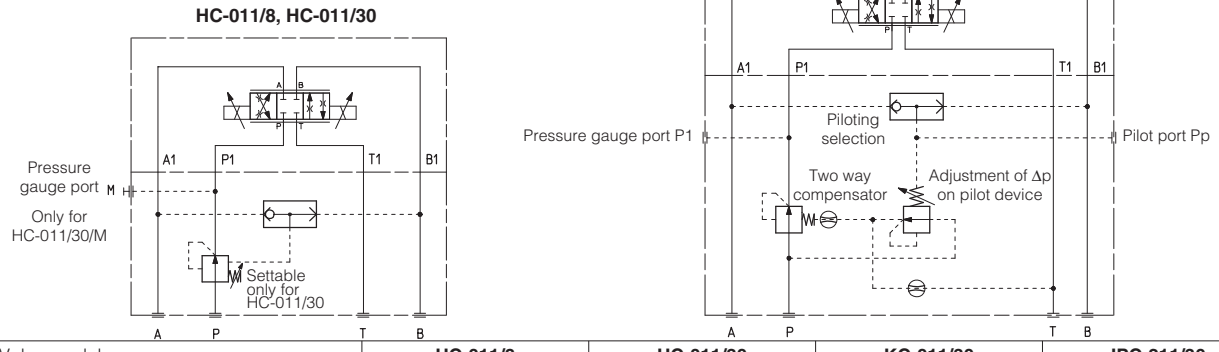
M: Option (only for HC-011/30)
M = fit for manometer port P1

******: Series number

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

2 HYDRAULIC CHARACTERISTICS

Hydraulic configuration



Valve model		HC-011/8	HC-011/30	KC-011/30	JPC-211/30
Max flow	[l/min]	50		100	200
Max inlet pressure	[bar]	350			
Regulating Δp (1)	[bar]	8	5 - 35	5 - 35	

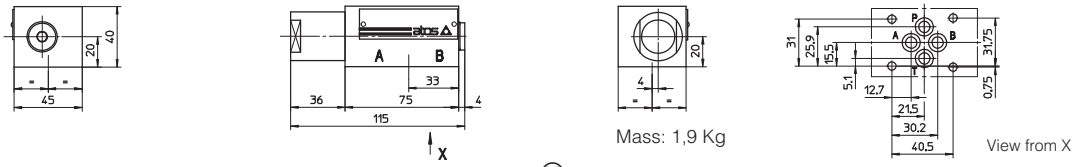
(1) The Δp for single flow path is fixed at 8 bar or is adjustable between 5 and 35 bar; it corresponds to values of total Δp across the valve of 16 bar or between 10 and 70 bar. Threaded plugged ports Pp and P1 are suitable for pressure adjustment or check of Δp value for single flow path (reading difference between Pp and P1 values).

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

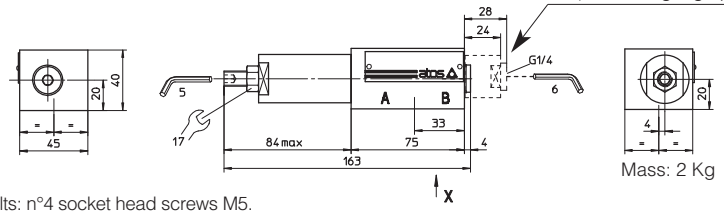
Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	**Standard** = -30°C ÷ +80°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°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 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	

4 INSTALLATION DIMENSIONS [mm]

HC-011/8



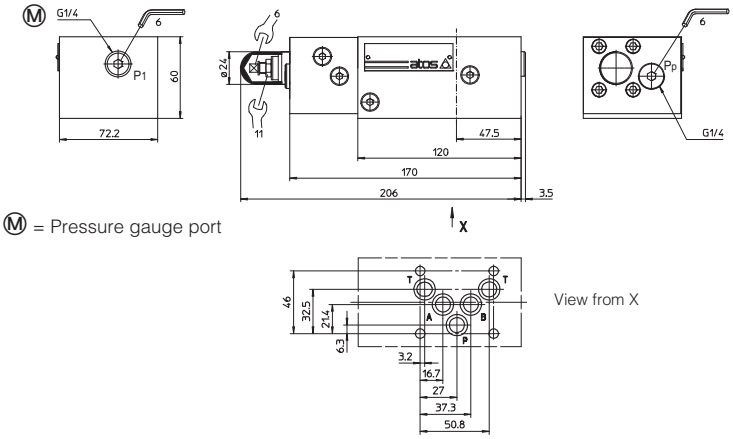
HC-011/30



Fastening bolts: n°4 socket head screws M5.
The lenght depends on number and type of modular elements associated.

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Diameter of ports
A, B, P, T: Ø = 7,5 mm (max)
Seals: 4 OR 108

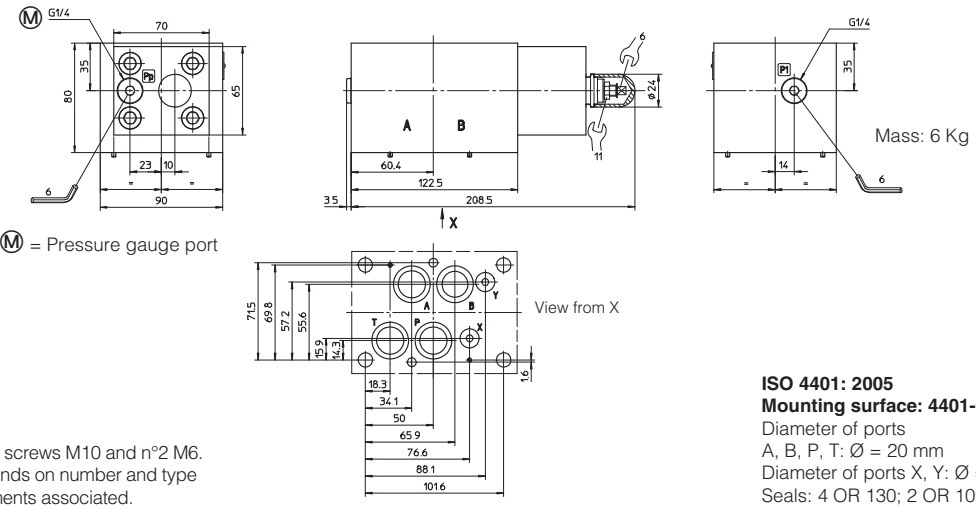
KC



Fastening bolts: n°4 socket head screws M6.
The lenght depends on number and type of modular elements associated.

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05
Diameter of ports
A, B, P, T: Ø = 11,2 mm (max)
Seals: 2 OR 108, 5 OR 2050

JPC

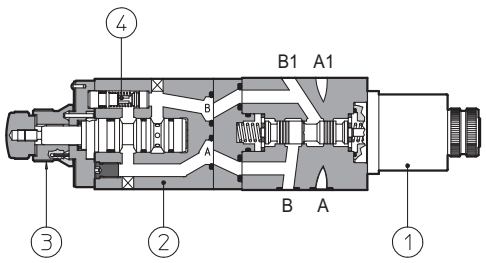


Fastening bolts:
n°4 socket head screws M10 and n°2 M6.
The lenght depends on number and type
of modular elements associated.

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05
Diameter of ports
A, B, P, T: Ø = 20 mm
Diameter of ports X, Y: Ø = 7 mm
Seals: 4 OR 130; 2 OR 109

Modular fast/slow valves type DHQ

compensated flow control and by-pass solenoid valve, ISO 4401 size 06



DHQ-014

DHQ are modular units composed by one by-pass solenoid valve ① and one 2-way pressure compensated flow control valve ② type QV-06 (tab. C210).

The flow control valve is provided with a built-in check valve ④ to allow the free flow in the opposite direction.

The flow adjustment is obtained by turning the graduated micrometer knob ③. Clockwise rotation decreases the throttling (passage reduced).
Optional versions with locking key on the adjustment knob are available on request.

Mounting surface:
ISO 4401 size 06

Max controlled flow: up to 1,5-6-11-16-24 l/min (depending on models);

Free flow up to 36 l/min.

Max pressure: up to **250 bar**

1 MODEL CODE

DHQ-0	13	/	C	/	6	/	K	-	I	X	24DC	**	/	*

DHQ-0: Modular flow control unit, pressure compensated, size: **DHQ-0** = 06

13: Configuration, see section 2
control of flow discharged from the actuator
13 = on port A
14 = on port B
16 = on port T
control of flow entering the actuator:
11 = on port P
23 = on port A
24 = on port B

C = flow controlled when solenoid is de-energized
O = flow controlled when solenoid is energized

6: Maximum adjustable controlled flow:
1 = 1,5 l/min; **6** = 6 l/min; **11** = 11 l/min; **16** = 16 l/min; **24** = 24 l/min
00 = whitout flow control valve

K: Options:
K = with lock key for the setting knob **V** = without by-pass check valve

I: Type of solenoid:
I = solenoid OI for AC and DC supply with **cURus** certification

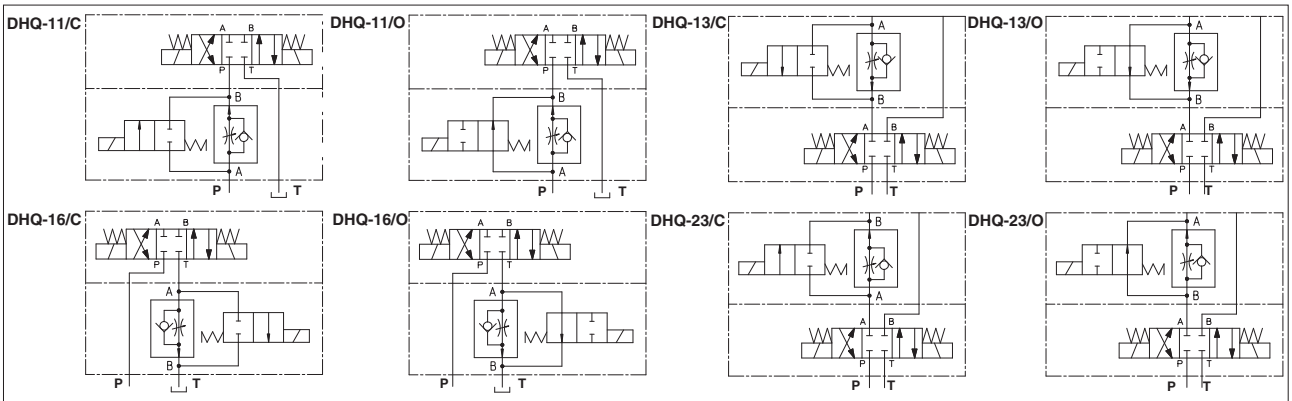
X: **X** = without connector **(1):**
See section 7 for available connectors, to be ordered separately
-00 = solenoid valve without coils

24DC: Supply voltage, see section 4

******: Series number

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

2 HYDRAULIC CHARACTERISTICS



DHQ-014/*, DHQ-024/* are similar to corresponding DHQ-013/*, DHQ-023/* but control the flow through port B of solenoid valve

Valve model		/1	/6	/11	/16	/24
Max regulated flow	[l/min]	1,5	6	11	16	24
Min regulated flow	[cm³/min]	50	50	50	50	50
Regulating Δp	[bar]	3	3	5	6,5	8
Max flow through check valve	[l/min]	24				
Max free flow		36 l/min				
Max flow on port A	[l/min]	24				
Max pressure	[bar]	250				

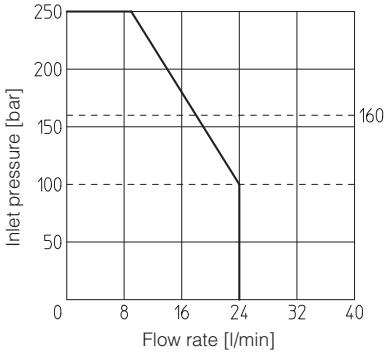
3 MAIN CHARACTERISTICS, SEALS and HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
Compliance	CE to Low Voltage Directive 2014/35/EU and Machine Directive 2006/42/EC. RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	**Standard** = -30°C ÷ +80°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°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 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	

4 ELECTRIC/ELECTRONIC CONNECTORS AND ELECTRIC FEATURES

For electric/electronic connectors (to be ordered separately) and electric features of DHQ units, see tab. E010.

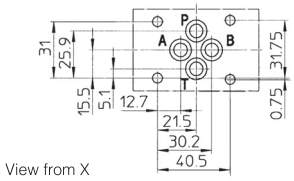
5 OPERATING LIMITS



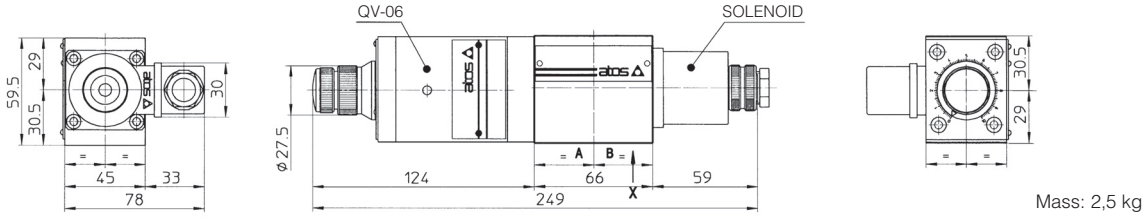
6 INSTALLATION DIMENSIONS [mm]

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Diameter of ports P, A, B, T: Ø = 7,5 mm (max)
Seals: 4 OR 108

Fastening bolts: 4 socket head screws M5.
The lenght depends on number and type
of modular elements associated



View from X



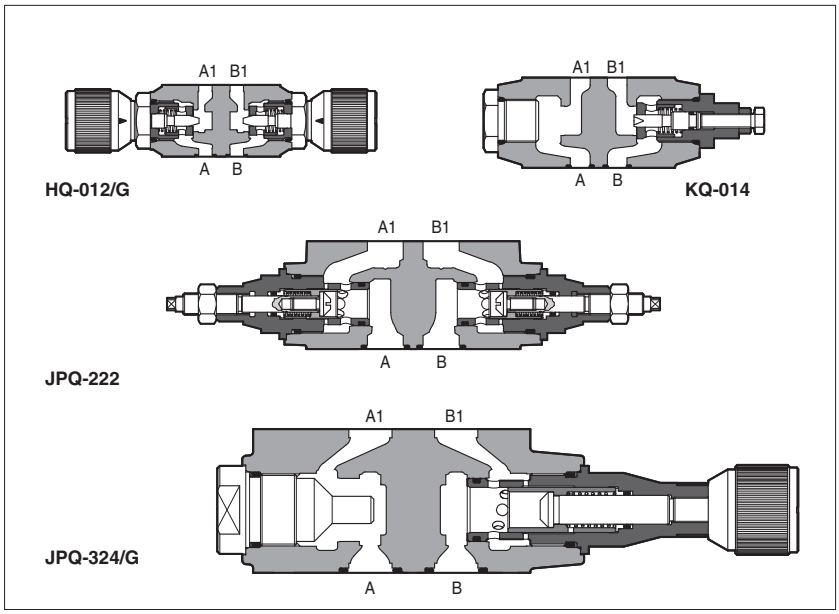
Mass: 2,5 kg

In versions -014 and -024 the position of valve QV-06 and of solenoid are inverted.

Overall dimensions refer to valves with connectors type 666

Modular throttle valves type HQ, KQ, JPQ

flow control, ISO 4401 sizes 06, 10, 16 and 25



HQ, **KQ** and **JPQ** are flow throttling valves, not compensated, and with check valve to allow free flow in the opposite direction.
The flow adjustement is done by turning the setting screw in the normal model.
Optional versions with a graduate micrometer knob are available on request.
Clockwise rotation increases the throttling (passage reduced).

Valve size and max flow:
HQ-0 = size 06, flow up to 25 l/min for /U option, up to 80 l/min for standard
KQ-0 = size 10, flow up to 160 l/min
JPQ-2 = size 16, flow up to 200 l/min
JPQ-3 = size 25, flow up to 300 l/min

Mounting surface:
ISO 4401 size 06, 10, 16 and **25**
Max pressure: **350 bar** (HQ, JPQ)
315 bar (KQ)

1 MODEL CODE

HQ-0	13	/	G	**	/	*

HQ-0
Modular flow control valve, size:
HQ-0 = 06
KQ-0 = 10
JPQ-2 = 16
JPQ-3 = 25

13
Configuration, see section 2
meter OUT control:
12 = double, acting on port A and B
13 = single, acting on port A
14 = single, acting on port B
meter IN control:
22 = double, acting on port A and B
23 = single, acting on port A
24 = single, acting on port B

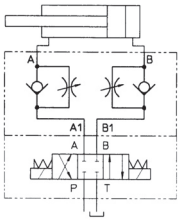
G
Options:
U = better accuracy for reduced flow (only for HQ-0)
G = adjustment by graduated micrometer

******
Series number

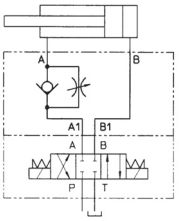
*****
Seals material, see section 3:
- = NBR
PE = FKM
BT = HNBR

2 VALVE CONFIGURATION

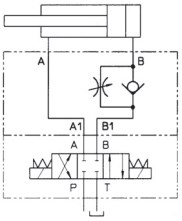
Meter OUT control



HQ-012
KQ-012
JPQ-212
JPQ-312

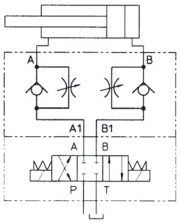


HQ-013
KQ-013
JPQ-213
JPQ-313

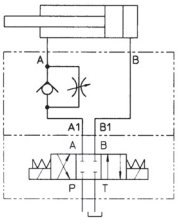


HQ-014
KQ-014
JPQ-214
JPQ-314

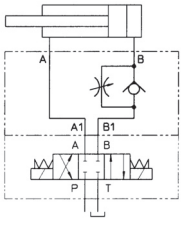
Meter IN control



HQ-022
KQ-022
JPQ-222
JPQ-322



HQ-023
KQ-023
JPQ-223
JPQ-323



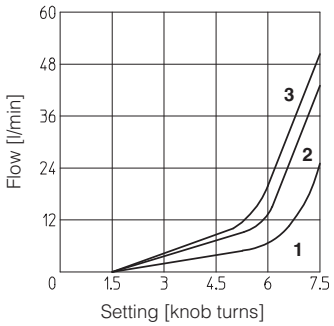
HQ-024
KQ-024
JPQ-224
JPQ-324

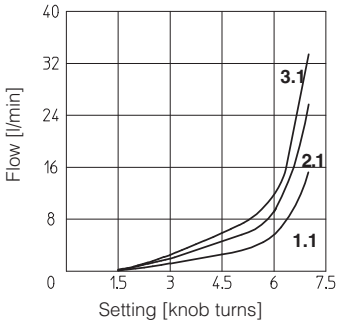
3 MAIN CHARACTERISTICS, SEALS and HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

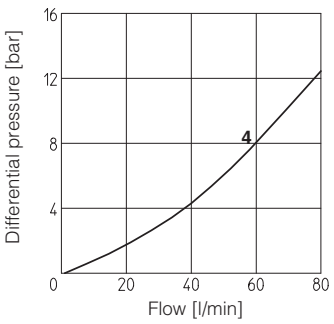
Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH 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 ÷ +60°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 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	

4 DIAGRAMS OF HQ-0 based on mineral oil ISO VG 46 at 50°C

1 = Regulation diagram at Δp 10 bar (1.1 = option /U)
2 = Regulation diagram at Δp 30 bar (2.1 = option /U)
3 = Regulation diagram at Δp 50 bar (3.1 = option /U)
4 = Q/Δp diagram for free flow through the non-return valve

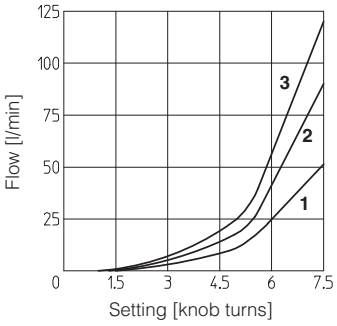


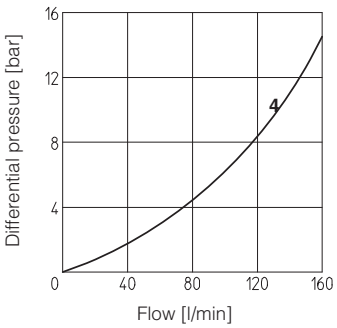




5 DIAGRAMS OF KQ-0 based on mineral oil ISO VG 46 at 50°C

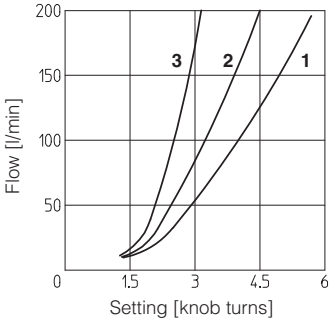
1 = Regulation diagram at Δp 10 bar
2 = Regulation diagram at Δp 30 bar
3 = Regulation diagram at Δp 50 bar
4 = Q/Δp diagram for free flow through the non-return valve

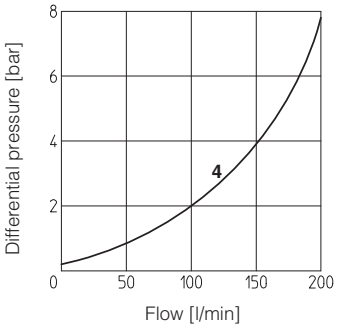




6 DIAGRAMS OF JPQ-2 based on mineral oil ISO VG 46 at 50°C

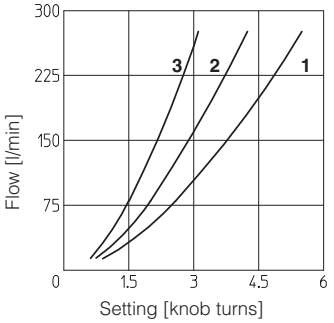
1 = Regulation diagram at Δp 10 bar
2 = Regulation diagram at Δp 30 bar
3 = Regulation diagram at Δp 50 bar
4 = Q/Δp diagram for free flow through the non-return valve

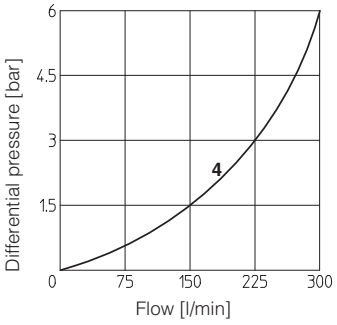




7 DIAGRAMS OF JPQ-3 based on mineral oil ISO VG 46 at 50°C

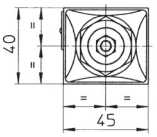
1 = Regulation diagram at Δp 10 bar
2 = Regulation diagram at Δp 30 bar
3 = Regulation diagram at Δp 50 bar
4 = Q/Δp diagram for free flow through the non-return valve

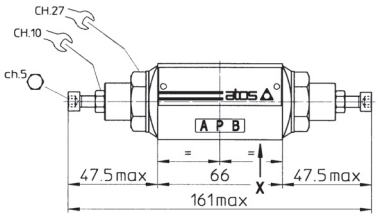




8 INSTALLATION DIMENSIONS OF HQ-0 VALVES [mm]

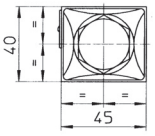
HQ-012
HQ-022

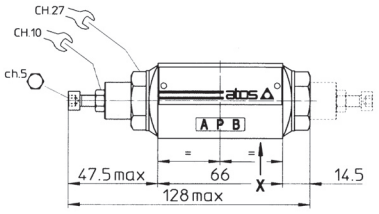




Mass: 1,1 Kg

HQ-013
HQ-014
HQ-023
HQ-024

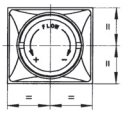


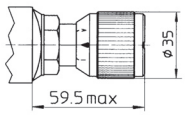


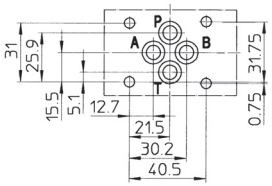
In version -014 and -024 the regulating element is on side of port B (dotted line) instead of side of port A.

Mass: 1,2 Kg

/G OPTION





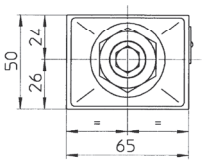


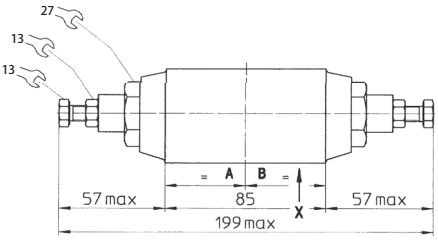
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Diameter of ports A, B, P, T: Ø = 7,5 mm (max)
Seals: 4 OR 108

Fastening bolts: n° 4 socket head screws M5. The lenght depends on number and type of modular elements associated.

9 INSTALLATION DIMENSIONS OF KQ-0 VALVES [mm]

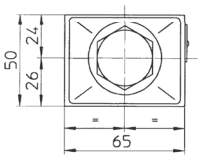
KQ-012
KQ-022

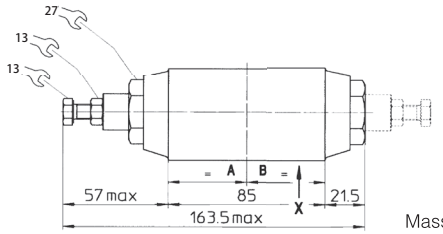




Mass: 2 Kg

KQ-013
KQ-014
KQ-023
KQ-024

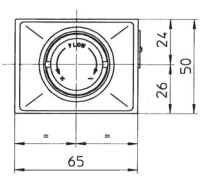


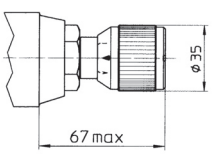


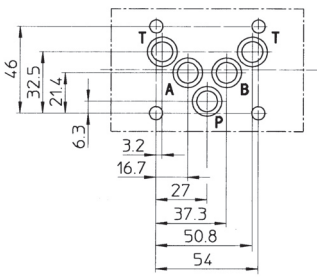
In version -014 and -024 the regulating element is on side of port B (dotted line) instead of side of port A.

Mass: 2,2 Kg

/G OPTION





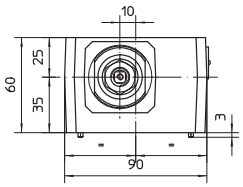


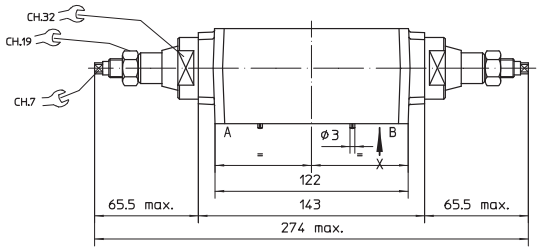
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05
Diameter of ports, A, B, P, T: Ø = 11,2 mm (max)
Seals: 5 OR 2050

Fastening bolts: n° 4 socket head screws M6. The lenght depends on number and type of modular elements associated.

10 INSTALLATION DIMENSIONS OF JPQ-2 VALVES [mm]

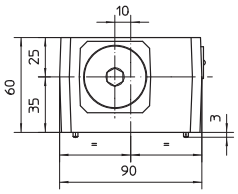
JPQ-212
JPQ-222

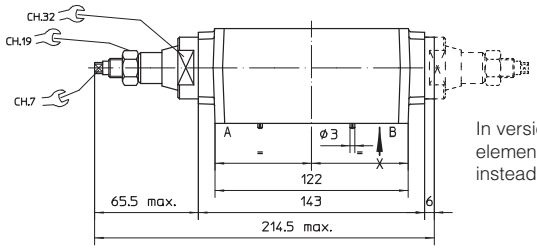




Mass: 4,6 Kg

JPQ-213
JPQ-214
JPQ-223
JPQ-224

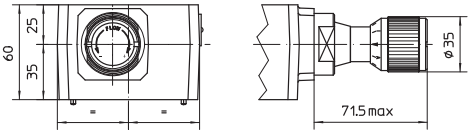


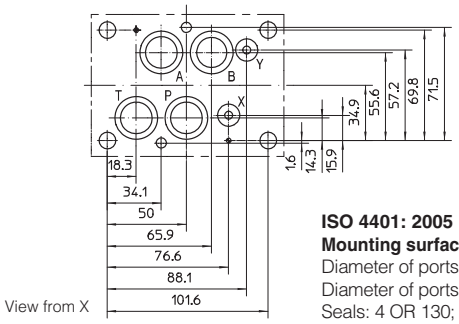


In version -214 and -224 the regulating element is on side of port B (dotted line) instead of side of port A.

Mass: 4,3 Kg

/G OPTION



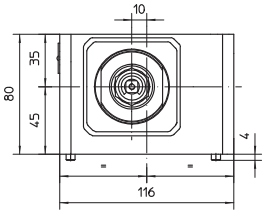


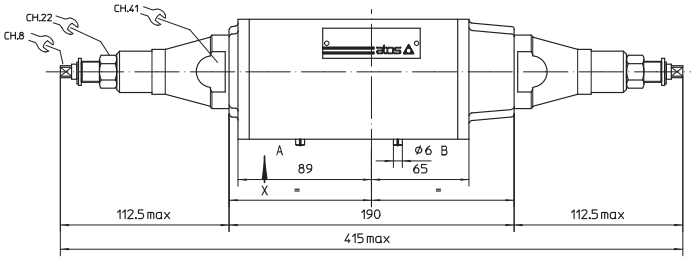
ISO 4401: 2005
Mounting surface: 4401-07-07-0-05
Diameter of ports A, B, P, T: Ø = 20 mm
Diameter of ports X, Y: Ø = 7 mm
Seals: 4 OR 130; 2 OR 109

Fastening bolts: n° 4 socket head screws M10 and n° 2 M6. The lenght depends on number and type of modular elements associated.

11 INSTALLATION DIMENSIONS OF JPQ-3 VALVES [mm]

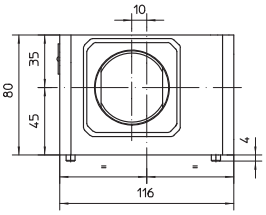
JPQ-312
JPQ-322

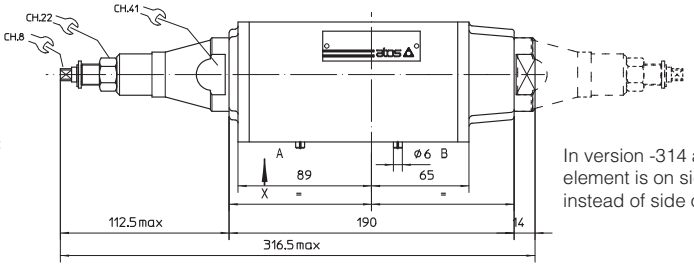




Mass: 10,7 Kg

JPQ-313
JPQ-314
JPQ-323
JPQ-324

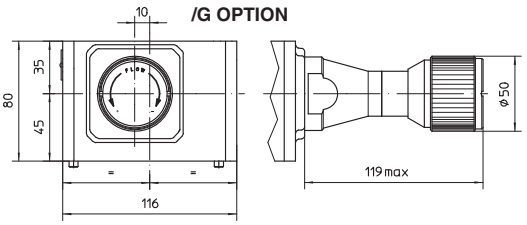


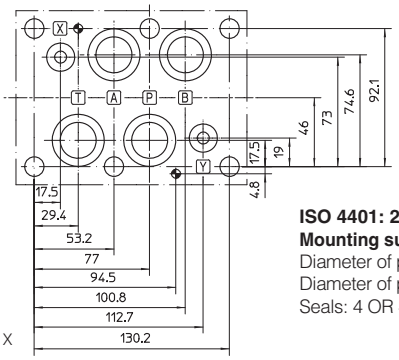


In version -314 and -324 the regulating element is on side of port B (dotted line) instead of side of port A.

Mass: 9,5 Kg

/G OPTION



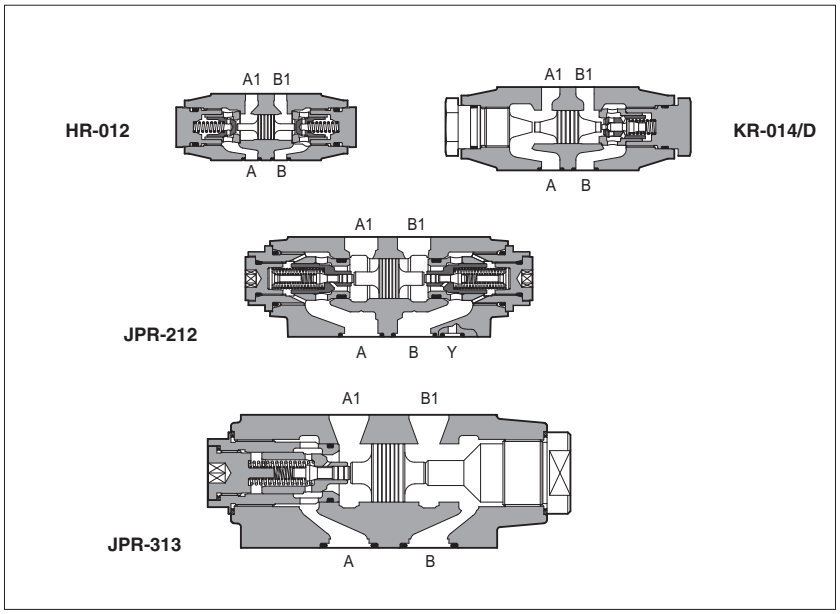


ISO 4401: 2005
Mounting surface: 4401-08-08-0-05
Diameter of ports A, B, P, T: Ø = 24 mm
Diameter of ports X, Y: Ø = 7 mm
Seals: 4 OR 4112; 2 OR 3056

Fastening bolts: n° 6 socket head screws M12. The lenght depends on number and type of modular elements associated.

Modular check valves type HR, KR, JPR

direct or pilot operated, ISO 4401 sizes 06, 10, 16 and 25



HR, KR are check valves available as direct or pilot operated models.
JPR are pilot operated check valves.

Optional versions with decompression are available on request for some models of KR.

HR-0 = size 06: flow up to 60 l/min, pressure up to 350 bar.

KR-0 = size 10: flow up to 120 l/min, pressure up to 315 bar.

JPR-2 = size 16: flow up to 200 l/min, pressure up to 350 bar.

JPR-3 = size 25: flow up to 300 l/min, pressure up to 350 bar.

Valves are designed to operate in hydraulic systems with hydraulic mineral oil or synthetic fluid having similar lubricating characteristics.

1 MODEL CODE

HR-0	12	/	4	/	*	**	/	*

HR-0

Modular check valve, size:
HR-0 = 06 **JPR-2** = 16
KR-0 = 10 **JPR-3** = 25

12

Configuration, see section 2
direct operated (only for HR and KR):
02 = double, acting on port A and B
03 = single, acting on port A
04 = single, acting on port B
11 = single, acting on port P
16 = single, acting on port T

pilot operated:
12 = double, acting on port A and B
13 = single, acting on port A
14 = single, acting on port B

4

Spring cracking pressure:
for HR and KR
– = 0,5 bar (std.) **4** = 4 bar
2 = 2 bar **8** = 8 bar
for JPR
– = 0,5 bar (std)

*****

Options (only for KR-012, -013, -014):
D = with decompression (only with cracking pressure standard = 1 bar)

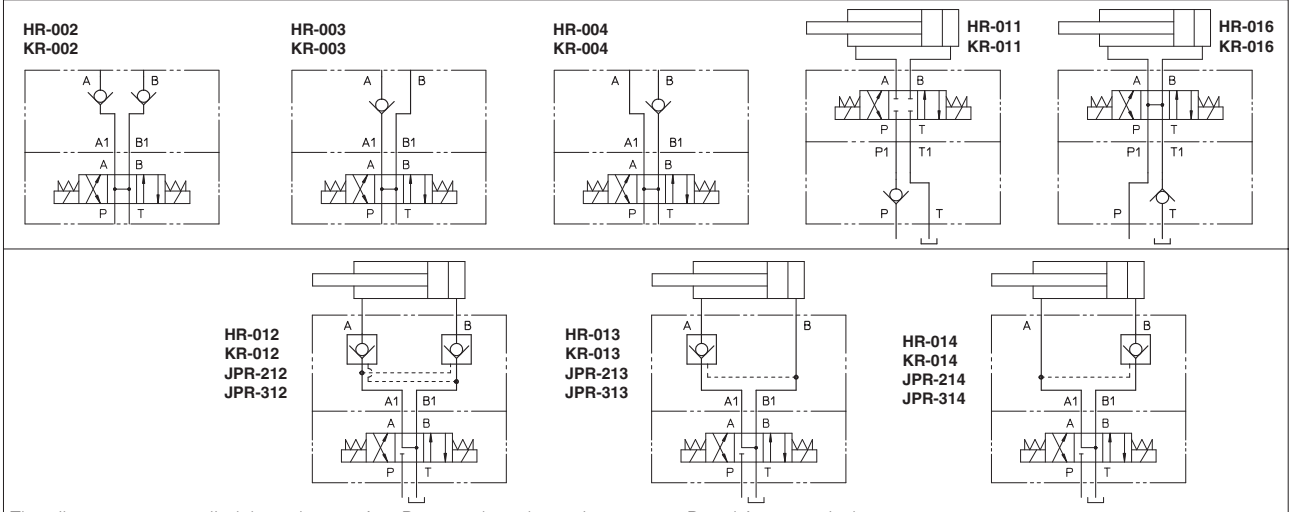
******

Series number

*****

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

2 VALVE CONFIGURATION



The pilote pressure applied through ports A or B opens the valve acting on ports B and A, respectively.
The minimum pilot pressure is a function of the area ratio, see the following table.

VALVE TYPE	AREA RATIO
HR	3,3:1
KR	3,3:1 (standard); 11:1 (option /D decompression system)
JPR-2	13,6:1 (standard version equipped with decompression system)
JPR-3	17:1 (standard version equipped with decompression system)

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		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	**Standard** = -30°C ÷ +80°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°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 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	

4 DIAGRAMS OF HR-0

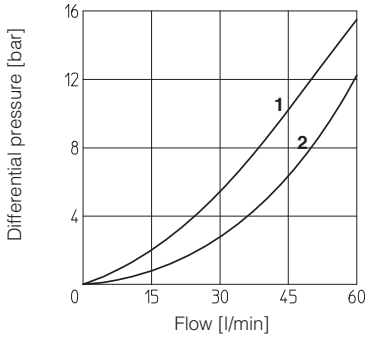
based on mineral oil ISO VG 46 at 50°C

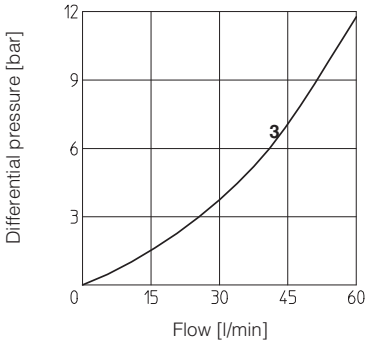
Flow through check valve:

1 = A→A1; B→B1 of HR-012, HR-013, HR-014

2 = A1→A; B1→B of HR-012, HR-013, HR-014

3 = HR-011, HR-016





5 DIAGRAMS OF KR-0

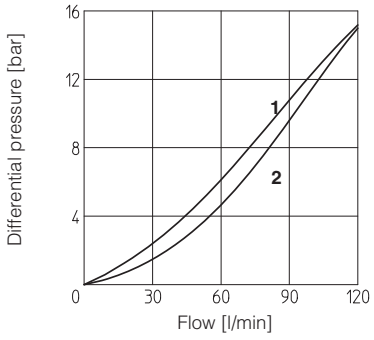
based on mineral oil ISO VG 46 at 50°C

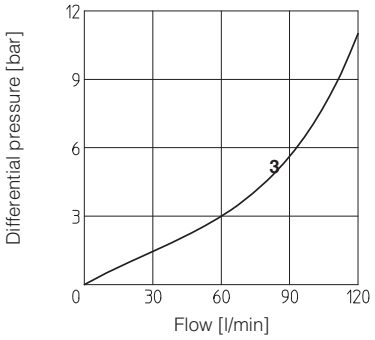
Flow through check valve:

1 = A→A1; B→B1 of KR-012, KR-013, KR-014

2 = A1→A; B1→B of KR-012, KR-013, KR-014

3 = KR-011, KR-016





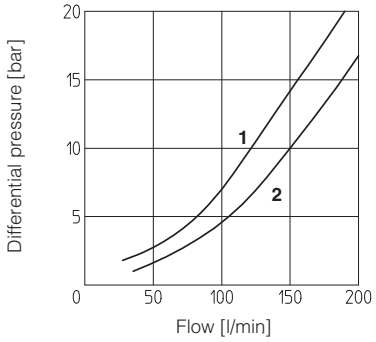
6 DIAGRAMS OF JPR-2

based on mineral oil ISO VG 46 at 50°C

Flow through check valve:

1 = A→A1; B→B1 of JPR-212, JPR-213, JPR-214

2 = A1→A; B1→B of JPR-212, JPR-213, JPR-214



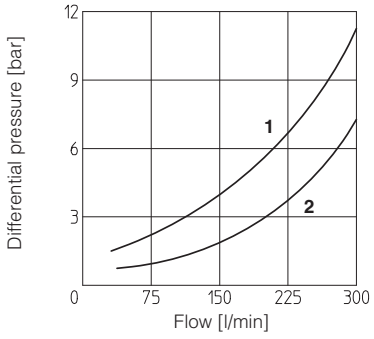
7 DIAGRAMS OF JPR-3

based on mineral oil ISO VG 46 at 50°C

Flow through check valve:

1 = A→A1; B→B1 of JPR-312, JPR-313, JPR-314

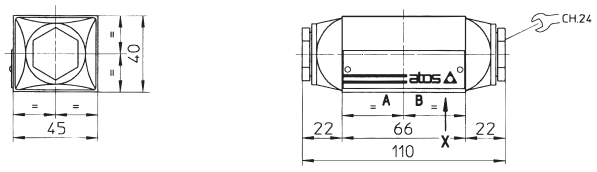
2 = A1→A; B1→B of JPR-312, JPR-313, JPR-314



8 INSTALLATION DIMENSIONS OF HR-0 VALVES [mm]

HR-002
HR-003
HR-004
HR-012
HR-013
HR-014

LATERAL VIEW



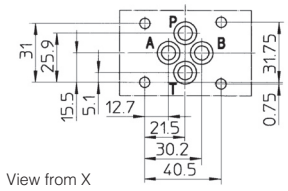
Mass: 1 Kg

HR-011
HR-016

LATERAL VIEW

Mass: 0,7 Kg

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Diameter of ports A, B, P, T: Ø = 7,5 mm (max)
Seals: 4 OR 108



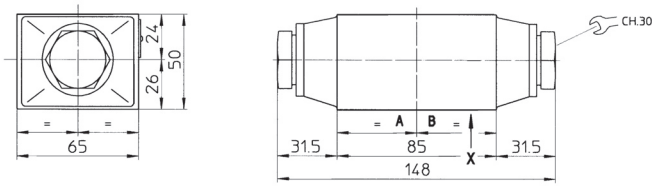
View from X

Fastening bolts: n° 4 socket head screws M5. The lenght depends on number and type of modular elements associated.

9 INSTALLATION DIMENSIONS OF KR-0 VALVES [mm]

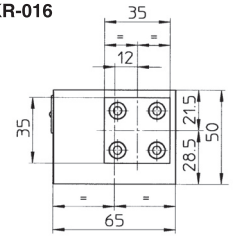
KR-012
KR-002
KR-003
KR-004
KR-013
KR-014

LATERAL VIEW

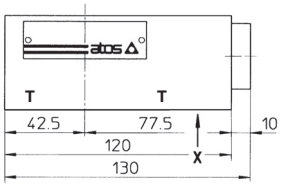


Massa: 2,3 Kg

KR-016



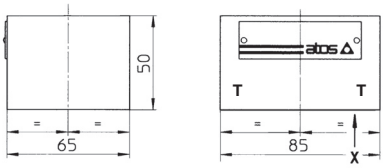
LATERAL VIEW



Mass: 2,5 Kg

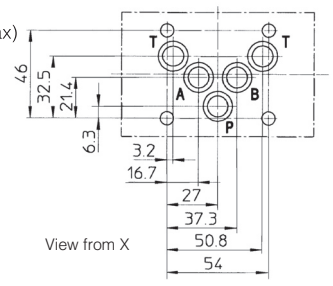
KR-011

LATERAL VIEW



Mass: 1,7 Kg

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05
Diameter of ports, A, B, P, T: Ø = 11,2 mm (max)
Seals: 5 OR 2050



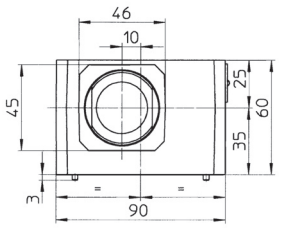
View from X

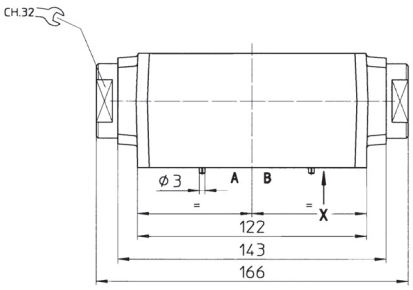
Fastening bolts: n° 4 socket head screws M6. The lenght depends on number and type of modular elements associated.

10 INSTALLATION DIMENSIONS OF JPR-2 VALVES [mm]

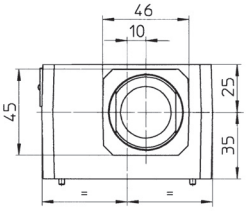
JPR-212
JPR-213
JPR-214

LATERAL VIEW



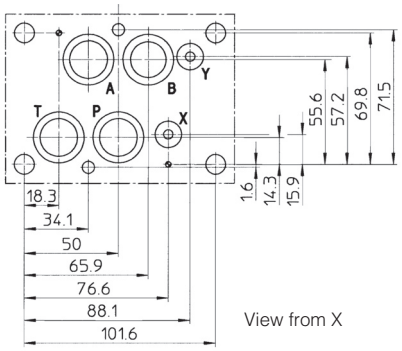


LATERAL VIEW



Mass: 4,4 Kg

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05
Diameter of ports A, B, P, T: Ø = 20 mm
Diameter of ports X, Y: Ø = 7 mm
Seals: 4 OR 130; 2 OR 109



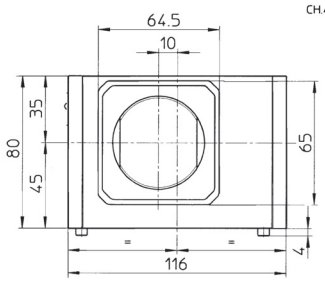
View from X

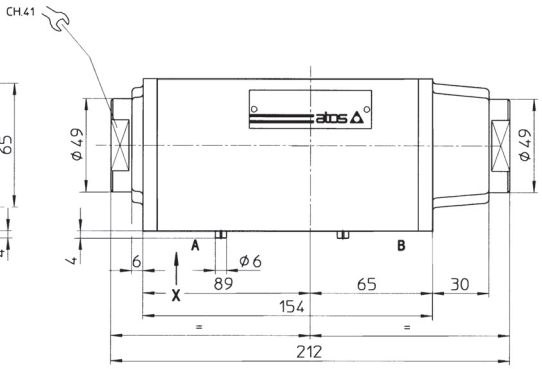
Fastening bolts: n° 4 socket head screws M10 and n° 2 M6. The lenght depends on number and type of modular elements associated.

11 INSTALLATION DIMENSIONS OF JPR-3 VALVES [mm]

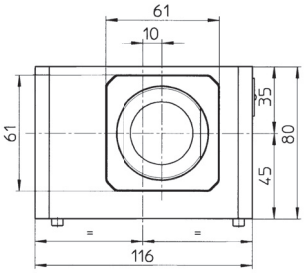
JPR-312
JPR-313
JPR-314

LATERAL VIEW B



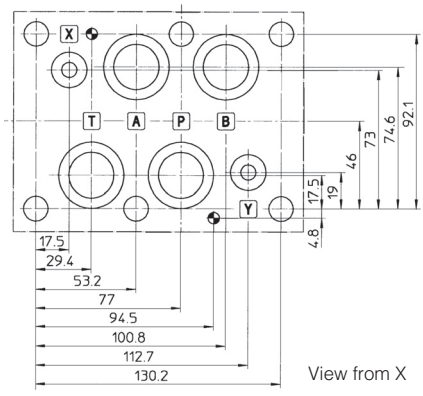


LATERAL VIEW A



Mass: 9,9 Kg

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05
Diameter of ports A, B, P, T: Ø = 24 mm
Diameter of ports X, Y: Ø = 7 mm
Seals: 4 OR 4112; 2 OR 3056

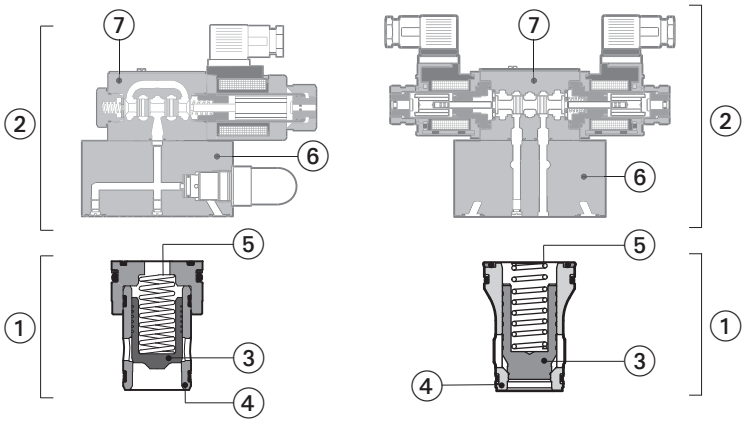


View from X

Fastening bolts: n° 6 socket head screws M12. The lenght depends on number and type of modular elements associated.

ISO cartridges type SC LI

2 way slip-in directional, pressure, flow, check controls



1 Slip-in cartridge type SC LI

2 Functional cover type LI*

2way slip-in cartridges are designed in conformity with ISO 7368 standard cavities for installation in compact manifolds. They are available in several versions to perform directional, pressure, flow and check controls in combination with relevant functional covers.
They permit to control very high flow rates at low pressure drops, reducing the manifold dimensions respect to subplate valves.

The slip-in cartridge ① is made by a poppet ③ sliding into a sleeve ④ and kept in closed position by a spring ⑤ available with different cracking pressure valves.

The functional covers ② are made by a closing element with ISO mounting surface ⑥ provided with internal piloting lines for the cartridge operation. They can be equipped with pilot valves ⑦ and devices performing the specific control (pressure relief, flow metering, directional, check)

Sizes: **16 to 100** ISO 7368

Max flow up to **9000 l/min** at Δp 5 bar

Max pressure **420 bar**

1 MODEL CODE

SC LI	-	16	43	1	*	/	*

Cartridge according to ISO 7368

Size - see section 5
16 25 32 40 50 63 80 100

Type of poppet (1) - see section 5

Spring cracking pressure (1)

Series number

Seals material:
- = NBR
PE = FKM
BT = HNBR

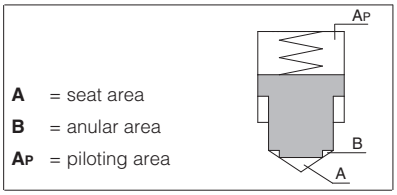
(1) See technical table:

H030 for directional controls
H020 for flow controls
H010 for pressure controls
H040 for check controls

2 MAIN CHARACTERISTCS

Assembly position / location	Any position
Cavity dimensions	ISO 7368, see technical table P006
Compliance	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
Operating pressure	**420 bar**, see technical table of specific valve
Maximum flow	see section 5

3 SC LI CARTRIDGE AREAS



A = seat area
B = anular area
AP = piloting area

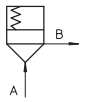
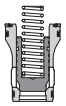
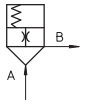
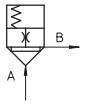
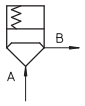
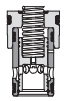
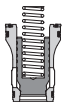
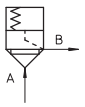
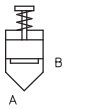
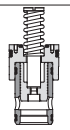
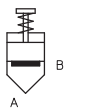
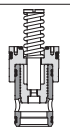
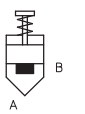
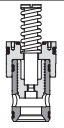
Pressure applied to areas A and B acts to open the poppet.

Pressure applied to area AP plus the spring force act to close the poppet

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

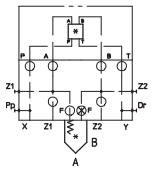
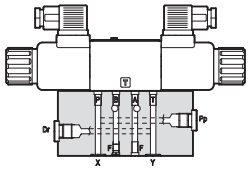
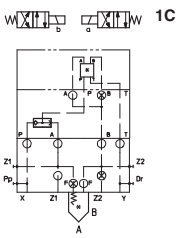
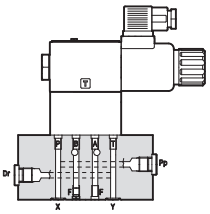
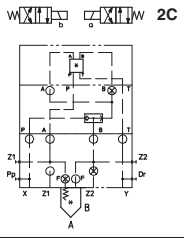
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at 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	

5 TYPE OF POPPET FOR SC LI SLIP-IN CARTRIDGES

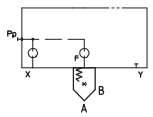
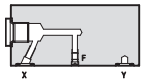
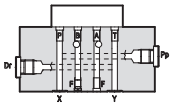
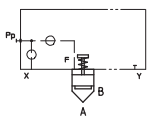
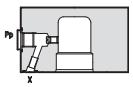
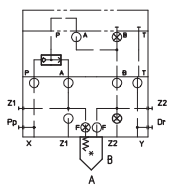
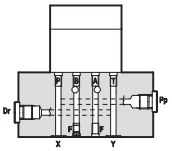
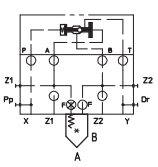
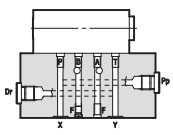
Size / Type	SC LI-16	SC LI-25	SC LI-32	SC LI-40	SC LI-50	SC LI-63	SC LI-80	SC LI-100	Functional sketch (hydraulic symbol)	Typical section	Area ratio	Related functional cover
31	●	●	●	●	●	●	●	–			1 : 1	Poppet type LIMM, LIMHA, LIMHC, LIC, LICM
Qmax [l/min] Δp = 5 bar	180	380	650	1100	2000	3200	5000					
32	●	●	●	●	●	●	●	●			1 : 1,1	Poppet type LIDA, LIDD, LIDB, LIDBH, LIDEW
Qmax [l/min] Δp = 5 bar	270	550	1000	1700	2500	4000	5500	9000				
33	●	●	●	●	●	●	●	●			1 : 1,5	Poppet type LIDA, LIDD, LIDB, LIDBH, LIDEW
Qmax [l/min] Δp = 5 bar	270	550	1000	1700	2500	4000	5500	9000				
34	●	○	○	–	–	–	–	–			1 : 1	Poppet type LIMM, LIMHA, LIMHC
Qmax [l/min] Δp = 5 bar	200											
35	●	●	●	●	●	–	–	–			1 : 1,1	Poppet type LIMM, LIMHA, LIMHC
Qmax [l/min] Δp = 5 bar	200	400	670	1200	2200							
36	●	●	●	●	●	●	●	–			1 : 1	Spool type LIC, LICM
Qmax [l/min] Δp = 5 bar	180	380	650	1100	2000	3200	5000					
37	●	●	●	●	–	–	–	–			1 : 1	Spool type LIRA
Qmax [l/min] Δp = 5 bar	160	270	540	840								
42	●	●	●	●	●	●	●	–			1 : 1,1	Poppet type with dumping nose LIDA, LIDD, LIDB, LIDBH, LIDEW
Qmax [l/min] Δp = 5 bar	240	500	800	1400	2200	3300	4000					
43	●	●	●	●	●	●	●	●			1 : 1,5	Poppet type with dumping nose LIDA, LIDD, LIDB, LIDBH, LIDEW
Qmax [l/min] Δp = 5 bar	240	500	800	1400	2200	3300	4000	6300				
52	●	●	●	●	●	–	–	–			1 : 1,1	Poppet type LIDA
Qmax [l/min] Δp = 5 bar	170	300	450	900	1800							
62	●	●	●	○	●	–	–	–			1 : 1,1	Poppet type LIDO
Qmax [l/min] Δp = 5 bar	170	300	450	900	1800							
63	●	●	●	○	●	–	–	–			1 : 1,1	Poppet type with dumping nose LIDO
Qmax [l/min] Δp = 5 bar	170	300	450	900	1800							
69	–	●	●	●	●	–	–	–			1 : 1,6	
Mass [kg]	0,2	0,5	0,9	1,7	3,0	7,0	13	22				

● normally available from stock
○ on request
– not available

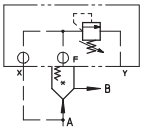
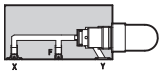
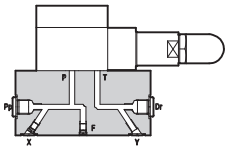
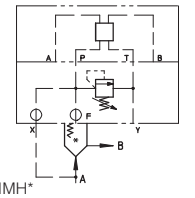
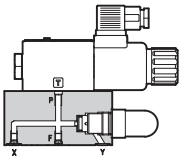
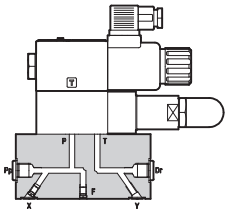
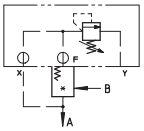
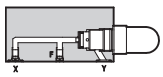
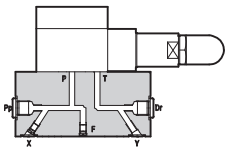
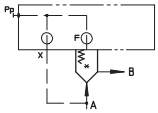
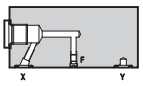
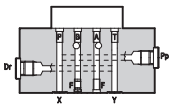
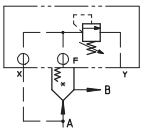
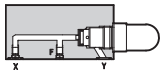
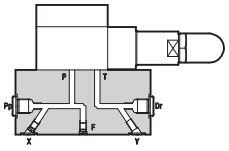
6 FUNCTIONALS COVERS - DIRECTIONAL CONTROL, see table H030

Function and type of control	Size	Hydraulic symbol	Functional cover size 16 ÷ 100	SC LI cartridges
Direct operated directional control valve with solenoid valve for pilot selection **LIDEW***	16 25 32 40 50 63 80 100			SC LI-**32* SC LI-**33* size 16 ... 100 SC LI-**42* size 16 ... 80 SC LI-**43* size 16 ... 100
Direct operated directional control valve with solenoid valve and shuttle valve for pilot selection **LIDBH1A** = open when solenoid is de-energized **LIDBH1C** = closed when solenoid is de-energized	16 25 32 40 50 63 80 100	**1A**  **1C**		SC LI-**32* SC LI-**33* size 16 ... 100 SC LI-**42* size 16 ... 80 SC LI-**43* size 16 ... 100
Direct operated directional control valve with solenoid and shuttle valve for pilot selection **LIDBH2A** = when solenoid is de-energized only connections X→F **LIDBH2C** = when solenoid is de-energized only connections Z1→F	16 25 32 40 50 63 80 100	**2A**  **2C**		SC LI-**32* SC LI-**33* size 16 ... 100 SC LI-**42* size 16 ... 80 SC LI-**43* size 16 ... 100

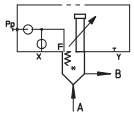
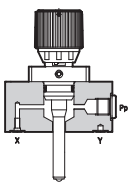
7 FUNCTIONALS COVERS - CHECK FUNCTION, see table H040

Function and type of control	Size	Hydraulic symbol	Functional cover size 16 ÷ 25	Functional cover size 32 ÷ 80	SC LI cartridges
Direct operated check valve normally closed **LIDA**	16 25 32 40 50 63 80				SC LI-**32* SC LI-**33* size 16 ... 80 SC LI-**42* SC LI-**43* size 16 ... 80 SC LI-**52* size 16 ... 50
Direct operated check valve normally open **LIDO**	16 25 32 40 50				SC LI-**62* SC LI-**63* size 16, 25, 32, 50
Direct operated check valve with shuttle valve for pilot selection **LIDB**	16 25 32 40 50 63				SC LI-**32* SC LI-**33* size 16 ... 63 SC LI-**42* SC LI-**43* size 16 ... 63
Direct operated check valve with hydraulically operated pilot check valve **LIDR**	16 25 32 40 50 63		01/20 		SC LI-**32* SC LI-**33* size 16 ... 63 SC LI-**42* SC LI-**43* size 16 ... 63

8 TYPICAL FUNCTIONS OF COVERS - PRESSURE CONTROL, see table H010

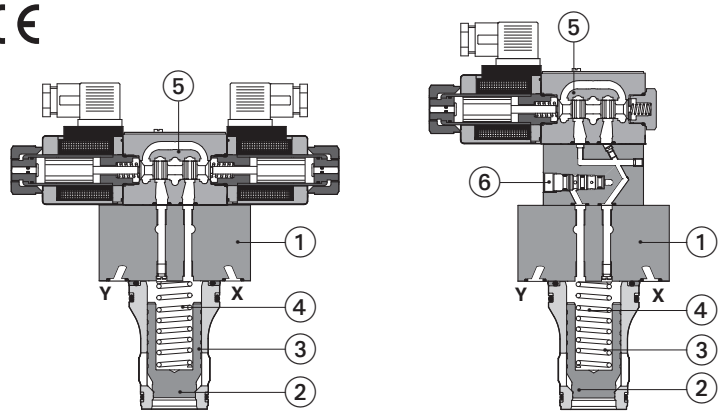
Function and type of control	Size	Hydraulic symbol	Functional cover size 6 ÷ 32	Functional cover size 40 ÷ 80	SC LI cartridges
Pressure relief control with manual setting **LIMM**	16 25 32 40 50 63 80				SC LI-**31* size 16... 80 SC LI-**34* size 16 SC LI-**35* size 16...50
Pressure relief control with solenoid valve for venting **LIMHA** = unloading when solenoid is de-energized **LIMHC** = unloading when solenoid is energized	16 25 32 40 50 63 80	A W W C  LIMH*			SC LI-**31* size 16...80 SC LI-**34* size16 SC LI-**35* size16...50
Pressure reducing control with manual setting. Open in resting position **LIRA**	16 25 32 40				SC LI-**37* size 16...40
Pressure compensator to be coupled with flow control valves **LIC**	16 25 32 40 50 63 80				SC LI-**31* size 16...80 SC LI-**36* size 16...80
Pressure compensator with mechanical max pressure regulation to be coupled with flow control valves. **LICM**	16 25 32 40 50 63 80				SC LI-**31* size 16...80 SC LI-**36* size 16...80

9 FUNCTIONAL COVERS - FLOW CONTROL, see table H020

Function and type of control	Size	Hydraulic symbol	Functional cover size 16 ÷ 63	SC LI cartridges
Flow control with stroke limiter **LIDD**	16 25 32 40 50 63			SC LI-**32* SC LI-**33* size 16...63 SC LI-**42* SC LI-**43* size 16...63

ISO cartridge valves type LIDEW* and LIDBH*

directional control, high flow, **Pmax 420 bar**



LIDEW4-3-E **LIDBH1A-3-E**

① Functional cover
② Poppet
③ Sleeve
④ Spring
⑤ Pilot slenoid valve
⑥ Shuttle valve

Directional control valves in ISO cartridge design, used to intercept or to permit the flow passage according to the selected pilot control. They are made by a functional cover ① and a 2-way **SC LI** slip-in cartridge.

LIDEW: functional cover with or without pilot solenoid valve for cartridge operation, available in different configurations depending to the function to be performed.

LIDBH as LIDEW plus shuttle valve for pilot pressure selection.

The SC LI slip-in cartridge is available with different poppet shape to optimize the control, see section 6.

It is made by a poppet ② sliding into a sleeve ③ and kept in normally closed position by the spring ④ available with different cracking pressure values.

Size: **16** to **100** ISO 7368

Max flow up to **9000** l/min at Δp = 5 bar

Max pressure up to **420 bar**

1 **MODEL CODE OF FUNCTIONAL COVERS** - for model code of slip-in cartridge, see section 5

LI	D	EW	1	-	3	/	*	-	E	X	24DC	**	/	*	*

Cover according to ISO 7368

D = directional function

EW = with or whithout pilot solenoid valve
BH = as EW plus shuttle valve for pilot selection

Cover configuration see section 2
LIDEW: **-** (without pilot valve)
LIDEW: **1**, **2**, **4**, **5**, **6**
LIDBH: **1A**, **1C**, **2A**, **2C**

Size:
1 = 16 **2** = 25 **3** = 32 **4** = 40
5 = 50 **6** = 63 **8** = 80 **10** = 100

Options, see section 3

Pilot solenoid valve (1)
for size 1 to 6: **I** = DHI, **Pmax 350 bar**
E = DHE, **Pmax 350 bar**
EP = DHEP, **Pmax 420 bar**
for size 8 and 10: **E** = DKE, **Pmax 350 bar**
EP = DKEP, **Pmax 420 bar**

X = without connector
See section 9 for available connectors, to be ordered separately
00 = solenoid valve without coils (for **I**)
00-AC = AC solenoid valve without coils (for **E** and **EP**)
00-DC = DC solenoid valve without coils (for **E** and **EP**)

Voltage code see section 8

Series number

Seals material:
- = NBR
PE = FKM
BT = HNBR

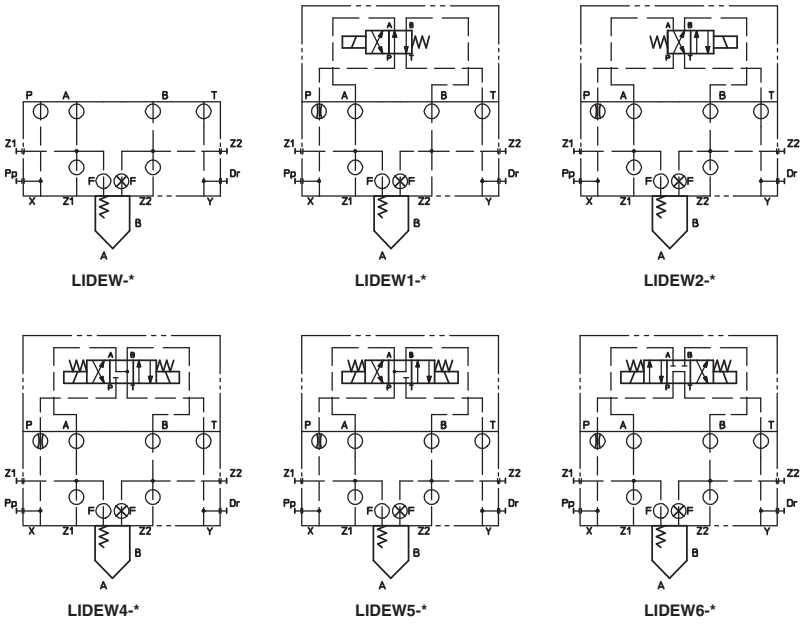
Optional different setting of calibrated plugs in the pilot channels, see sections 3, 4

(1) for solenoid valve's characteristics, see following technical tables:

DHI tech. table E010
DHE tech. table E015
DHEP tech. table TE030
DKE tech. table E025
DKEP tech. table TE030

2 HYDRAULIC SYMBOLS (cover configuration)

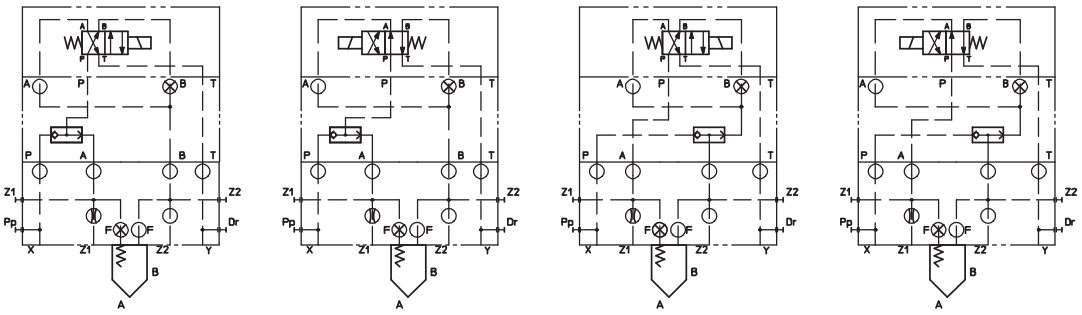
LIDEW



LIDEW-* LIDEW1-* LIDEW2-*

LIDEW4-* LIDEW5-* LIDEW6-*

LIDBH



LIDBH1A-* LIDBH1C-* LIDBH2A-* LIDBH2C-*

3 OPTIONS

For LIDEW*, LIDBH* covers (sizes 40…100):
/E = with external attachments Pp and underneath port X supplied plugged;

For all the models:
/B = cartridge piloted via port "B" of solenoid pilot valve;
/F = prearranged for coupling to an intermediate element with poppet position detector for safety function. See tab. EY120.
/WP = prolonged manual override protected by rubber cap for solenoid pilot valve. See table K150.
*** = Calibrated plugs different from standard ones reported in section 7. The restrictors configuration (if different from the standard) must be indicated at the end of the model code:

LIDEW2	-	1	/*	EX	24DC	**	P	06

P

Channel where the orifice has to be provided:
P = channel X, port P **Z1** = channel Z1
F = channel F **Z2** = channel Z2

06

Size of the throttling hole in teths of millimeters:
05 = 0,5 mm **10** = 1 mm **17** = 1,7 mm
06 = 0,6 mm **12** = 1,2 mm **20** = 2 mm
08 = 0,8 mm **15** = 1,5 mm

4 STANDARD ORIFICES CONFIGURATION

Cover / Port	LIDEW*-1 LIDBH*-1	LIDEW*-2 LIDBH*-2	LIDEW*-3 LIDBH*-3	LIDEW*-4 LIDBH*-4	LIDEW*-5 LIDBH*-5	LIDEW*-6 LIDBH*-6	LIDEW*-8 LIDBH*-8	LIDEW*-10 LIDBH*-10
Z1 (only for LIDBH*-*)	M4 12A	M4 12A	M6 15A	M6 17A	M6 20A	M6 20A	M8 20A	M8 20A
P	M6 12A	M6 12A	M6 15A	M6 17A	M6 20A	M6 20A	M8 20A	M8 25A

M4 ÷ M8 = screw size; **12A ÷ 20A** = calibrated orifices diameter in tenths of mm; **A** = short calibrated hole

5 MODEL CODE OF SLIP-IN CARTRIDGES

SC LI	-	16	43	1	40	/	*

Cartridge according to ISO 7368

Size, the same of relevant cover:

16 25 32 40 50 63 80 100

Type of poppet

32, 33 (size 16 to 100) = without damping nose
42 (size 16 to 80) = as 32 but with damping nose
43 (size 16 to 100) = as 33 but with damping nose

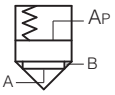
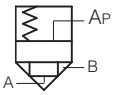
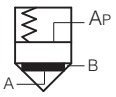
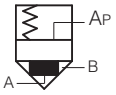
Series number

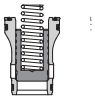
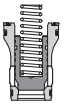
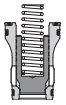
Seals material:
- = NBR
PE = FKM
BT = HNBR

Spring cracking pressure:

1 = 0,3 bar for poppet 32, 42
1 = 0,6 bar for poppet 33, 43
2 = 1,5 bar for poppet 32, 42
3 = 3 bar for all poppets
6 = 5,5 bar for all poppets

6 TYPE OF POPPET

Type of poppet	**32**	**33**	**42**	**43**
Functional sketch (Hydraulic symbol)				

Operating pressure		**420 bar max**			
Nominal flow at Δp 5bar (l/min) see diagrams Q/Δp at section 9	Size **16**	270	270	240	240
	25	550	550	500	500
	32	1000	1000	800	800
	40	1700	1700	1400	1400
	50	2500	2500	2200	2200
	63	4000	4000	3300	3300
	80	5500	5500	4000	4000
	100	9000	9000	-	6300
Typical section					
Area ratio A:Ap		**1:1,1**	**1:1,5**	**1:1,1**	**1:1,5**
Cracking pressure A→B	Spring **1**	0,3 bar	0,6 bar	0,3 bar	0,6 bar
	2	1,5 bar	-	1,5 bar	-
	3	3 bar	2,5 bar	3 bar	2,5 bar
	6	6 bar	6 bar	6 bar	6 bar
Cracking pressure B→A	Spring **1**	3 bar	0,9 bar	3 bar	0,9 bar
	2	12,8 bar	-	12,8 bar	-
	3	32,5 bar	3,8 bar	32,5 bar	3,8 bar
	6	59,4 bar	9 bar	59,4 bar	9 bar

7 MAIN CHARACTERISTCS, 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 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		From A→B or B→A		
Functional cover operating pressure	Pilot valve **I**	Ports A, B, X, Z_1, Z_2: **350** bar	Port Y: **120** bar	
	Pilot valve **E**	Ports A, B, X, Z_1, Z_2: **350** bar	Port Y: **210** bar for DC version; **160** bar for AC version	
	Pilot valve **EP**	Ports A, B, X, Z_1, Z_2: **420** bar	Port Y: **210** bar for DC version; **160** bar for AC version	

7.1 Coils characteristics

Insulation class	Pilot valve **E**, **EP: H** (180°C) for DC coils **F** (155°C) for AC coils Pilot valve **I: H** (180°C) for DC or 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 8
Supply voltage tolerance	± 10%
Certification	**cURus** North American Standard

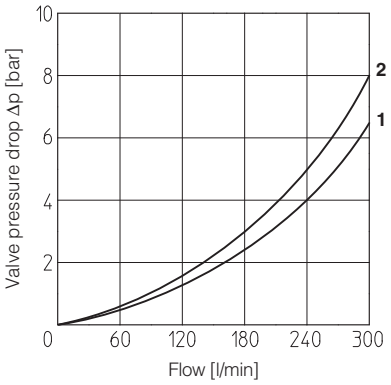
8 ELECTRIC FEATURES

Solenoid valve type	External supply nominal voltage ± 10% (1)		**Voltage code**	Type of connector	Power consumption (3)	Code of spare coil DHI	Colour of coil label DHI	Code of spare coil DHE, DHEP
DHI DHE DHEP	DC	12 DC 24 DC 110 DC 220 DC	**12 DC** **24 DC** **110 DC** **220 DC**	666 or 667	33 W (DHI) 30 W (DHEP)	COU-12DC COU-24DC COU-110DC COU-220DC	green red black black	COE-12DC COE-24DC COE-110DC COE-220DC
	AC	110/50 AC (2) 115/60 AC 120/60 AC 230/50 AC (2) 230/60 AC	**110/50/60 AC** **115/60 AC** (5) **120/60 AC** (6) **230/50/60 AC** **230/60 AC**	666 or 667	60 VA (DHI) 58 VA (DHEP) (4)	COI-110/50/60AC - COI-120/60AC COI-230/50/60AC COI-230/60AC	yellow - white light blue silver	COE-110/50/60AC COE-115/60AC - COE-230/50/60AC COE-230/60AC
DKE DKEP	12 DC 14 DC 24 DC 28 DC 110 DC 220 DC 110/50/60 AC (2) 230/50/60 AC (2) 115/60 AC 230/60 AC 110/50/60 AC 230/50/60 AC		**12 DC** **14 DC** **24 DC** **28 DC** **110 DC** **220 DC** **110/50/60 AC** **230/50/60 AC** **115/60 AC** **230/60 AC** **110 DC** **220DC**	666 or 667	36 W	CAE-12DC CAE-14DC CAE-24DC CAE-28DC CAE-110DC CAE-220DC	-	
					100 VA (7)	CAE-110/50/60AC CAE-120/60AC	-	
					130 VA (7)	CAE-230/50/60AC CAE-230/60AC		
				669	36 W	CAE-110DC CAE-220DC		

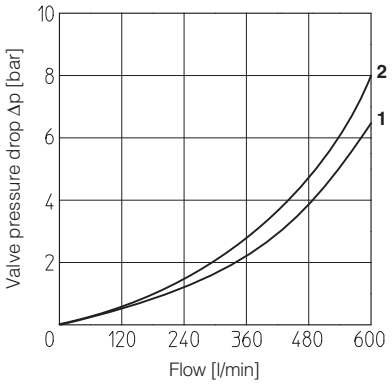
(1) For other supply voltages available on request see technical tables E010, E015, E025, TE030.
(2) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷ 15%. The power consumption is 55 VA (DHI), 58 VA (DHE, DHEP) and 90 VA (DKE, DKEP)
(3) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(4) 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.
(5) Only for DHE, DHEP
(6) Only for DHI
(7) When solenoid is energized, the inrush current is approx 3 times the holding current.

9 **Q/Δp DIAGRAMS** based on mineral oil ISO VG 46 at 50 °C

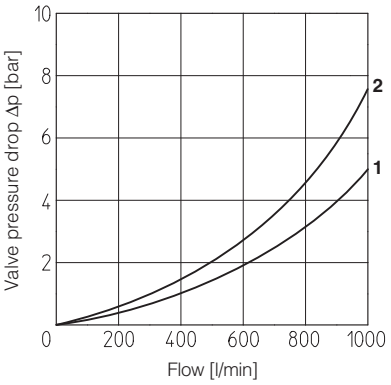
size 16



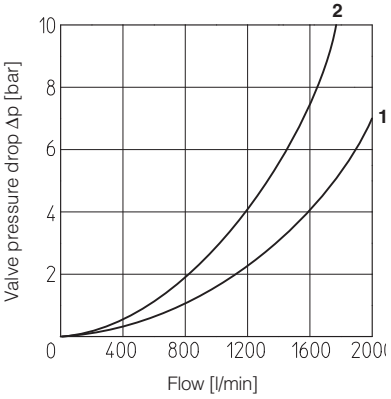
size 25



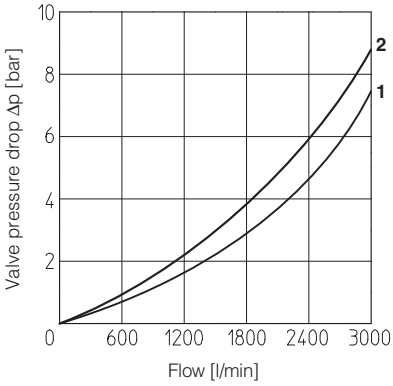
size 32



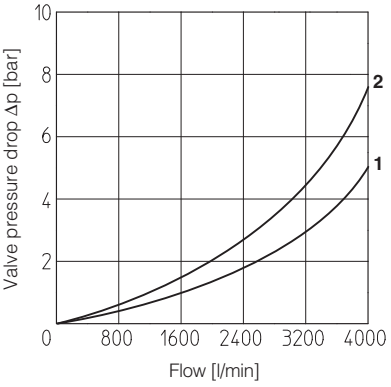
size 40



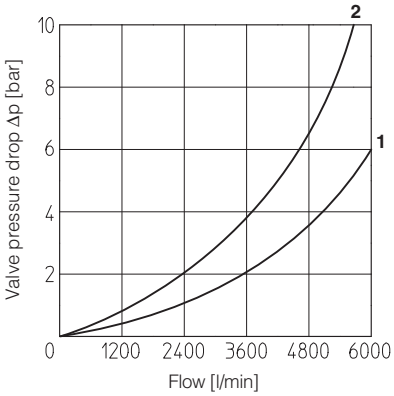
size 50



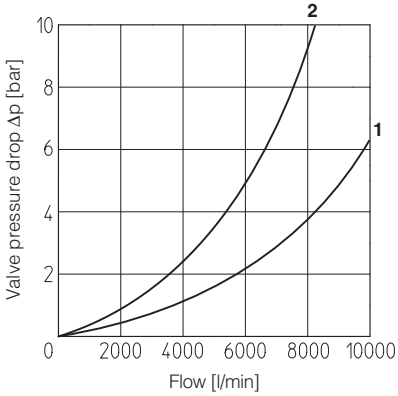
size 63



size 80



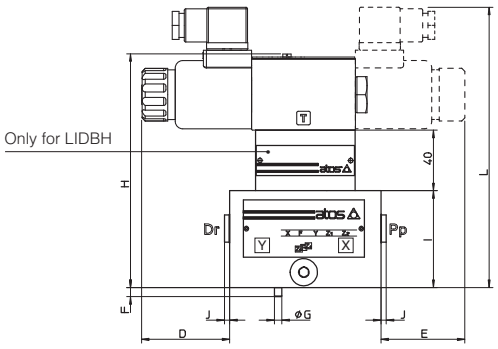
size 100



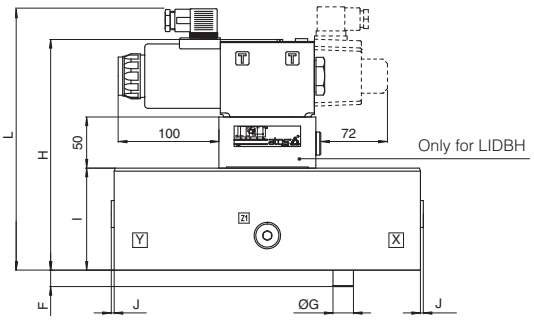
1 = poppet type 32 and 33
2 = poppet type 42 and 43

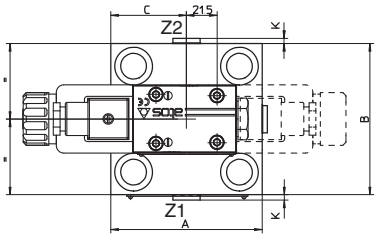
10 COVER DIMENSIONS [mm] - for mounting interface and cavity dimensions see tech. table P006

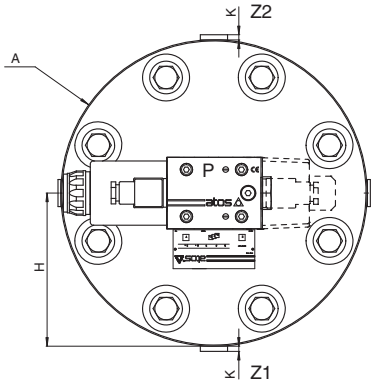
Size 16 ÷ 63
Drawing of size 50
dotted line: example of double solenoid version



Size 80 and 100
dotted line: example of AC solenoid verison







Notes referred to the below table:

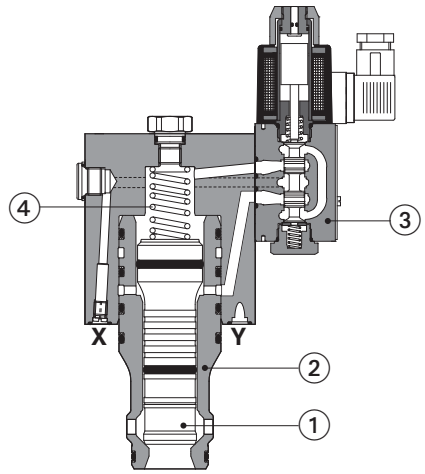
(1) LIDEW1*, LIDBH*A: solenoid at side of port Y of cover;
LIDEW2*, LIDBH*C: solenoid at side of port X of cover;

Size (1)	A	B	C	D max	E max	F	G	H max **LIDEW**	H max **LIDBH**	I	L max	J	K	Ports Pp-Dr	Ports Z_1-Z_2	Seals	Fastening bolts	Tightening torque [Nm]	Mass [Kg]
16	70	65	29	83,5	70,5	4	3	90,5	130,5	40	125	-	-	_	-	4 OR-108	Nr. 4 M8x45	35	2,6 ÷ 3
25	85	85	42,5	69,5	69,5	6	5	90,5	130,5	40	125	-	-	_	-	4 OR-108	Nr. 4 M12x45	125	3 ÷ 3,4
32	100	100	50	62,5	42,5	6	5	100,5	140,5	50	135	-	-	_	-	4 OR-2043	Nr. 4 M16x55	300	3,5 ÷ 4
40	125	125	62,5	49,5	49,5	6	5	110,5	150,5	60	145	3,5	-	G 1/4	-	4 OR-3043	Nr. 4 M20x70	600	6,4 ÷ 6,9
50	140	140	70	42	42	4	6	120,5	160,5	70	155	3,5	3,5	G 1/4	G 1/4	4 OR-3043	Nr. 4 M20x80	600	9,5 ÷ 10
63	180	180	90	22	22	4	6	130,5	170,5	80	165	3,5	3,5	G 3/8	G 3/8	4 OR-3050	Nr. 4 M30x90	2100	17,3÷17,7
80	Ø250	-	125	-	-	6	8	152,5	202,5	80	187	3,5	3,5	G 3/8	G 3/8	4 OR-4075	Nr. 8 M24x90	1000	27,1÷27,7
100	Ø300	-	150	-	-	8	10	182,5	222,5	100	217	3,5	3,5	G 1/2	G 1/2	4 OR-4093	Nr. 8 M30x120	2100	53÷54

Overall dimensions refer to the pilot valves with connectors type 666

On-off active cartridges type LIDAS, 2-way

directional control



① = main poppet
② = cartridge sleeve
③ = solenoid pilot valve (LIDASH-*)
④ = spring

LIDASH-3231-EX

LIDAS are 2-way ISO cartridge valves with active pilot control, normally used to shut-off the hydraulic line.
The particular poppet sealing grants leak-free characteristics.

The poppet ① is hydraulically operated in both directions, ensuring in this way higher reliability and faster response time respect to the conventional spring operated cartridge valves.
The spring ④ ensures the valve closing in absence of pressure in the system.
They are available in different executions:
LIDAS: without pilot solenoid valve
LIDASH: with on-off pilot solenoid valve

Sizes:**16 to 50** ISO 7368
Max flow up to **2100 l/min** with Δp = 5 bar
Max pressure: up to **420 bar**

1 MODEL CODE

LIDAS	H	-	40	43	3	-	E	X	24DC	**	*

LIDAS
On-off active cartridges, according to ISO 7368

H
Pilot solenoid valve
- = without pilot solenoid valve
H = with pilot solenoid valve

40
Size: **16** **25** **32** **40** **50**

43
Poppet type: see section 2
31, **33**
43 (with dumping nose)

3
3 = spring cracking pressure 3 bar

E
Only for LIDASH - Pilot solenoid valve:
I = DHI, **Pmax 350 bar**
E = DHE, **Pmax 350 bar**
EP = DHEP, **Pmax 420 bar**

X
Only for LIDASH
X = without connector
See section 4 for available connectors, to be ordered separately
-00 = solenoid valve without coils (for **I**)
-00-AC = AC solenoid valve without coils (for **E** and **EP**)
-00-DC = DC solenoid valve without coils (for **E** and **EP**)

24DC
Only for LIDASH
Voltage code, see section 6

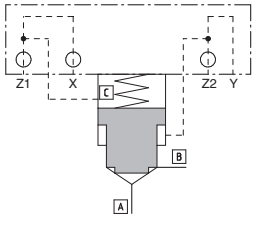
******
Series number

*****
Seals material:
- = NBR
PE = FKM
BT = HNBR

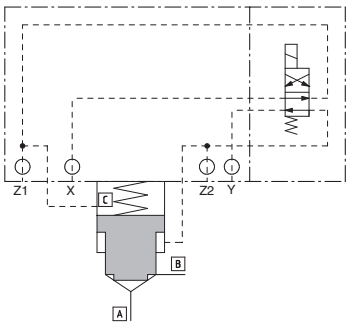
Note: for certified safety version conforming to 2006/42/EC, with inductive position switch (option /FV) see table EY120

2 HYDRAULIC CHARACTERISTICS (based on mineral oil ISO VG 46 at 50 °C)

Hydraulic symbols



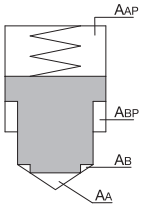
LIDAS



LIDASH

Cartridge areas

AA = main flow (side A)
AB = main flow (side B)
AAP = piloting area (close)
ABP = piloting area (open)



Thanks to the areas ratio AAP/(AA+AB), the valve closing is always ensured with a piloting pressure (X port) equal to the line pressure (A or B line).

3 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUIDS

Assembly position / location			Any position								
Subplate surface finishing			Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)								
MTTFd valves according to EN ISO 13849			LIDAS = 150 years LIDASH = 75 years								
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								
Flow direction			B → A (preferred) or A → B								
Piloting		**LIDAS**	Pressure to **X** = **close** Pressure to **Y** = **open**								
		LIDASH	De-energized = **close** Energized = **open**								
Operating pressure	LIDAS		Ports A, B, X, Z_1, Z_2, Y: **420** bar								
	LIDASH	Pilot valve **I**	Ports A, B, X, Z_1, Z_2: **350** bar Port Y: **120** bar								
		Pilot valve **E**	Ports A, B, X, Z_1, Z_2: **350** bar Port Y: **210** bar for DC version; **160** bar for AC version								
		Pilot valve **EP**	Ports A, B, X, Z_1, Z_2: **420** bar Port Y: **210** bar for DC version; **160** bar for AC version								
Size			**16**		**25**		**32**		**40**		**50**
Maximum flow		Poppet **31**	240		450		700		1400		2100
at Δp = 5 bar [l/min]		Poppet **33**	220		400		600		1300		2000
		Poppet **43**	200		360		550		1100		1800
Poppet characteristics		Poppet type	**31**	**33, 43**	**31**	**33, 43**	**31**	**33, 43**	**31**	**33, 43**	**31**	**33, 43**
A_A [cm²]			2,27	1,43	4,91	3,46	8,04	5,30	12,56	8,04	19,63	13,85
A_B (% of A_A)			0	58,6	0	41,7	0	51,5	0	56,3	0	41,7
A_{BP} (% of A_A)			67,5	107,0	63,8	90,5	56,3	85,2	56,3	87,9	69	97,8
A_{AP} (% of A_A)			167,5	265,6	163,8	232,2	156,3	236,7	156,3	244,1	169	239,2
A_A / (A_A + A_B) poppet ratio			1 for poppet **31** 0,6 for poppet **33, 43**									
A_{AP} / (A_A + A_B) piloting ratio			1,6 for poppet **31** 1,6 for poppet **33, 43**									

3.1 Coils characteristics (only for LIDASH)

Insulation class	Pilot valve **E**, **EP: : H** (180°C) for DC coils **F** (155°C) for AC coils Pilot valve **I: H** (180°C) for DC or 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 6
Supply voltage tolerance	± 10%
Certification	**cURus** North American Standard

4 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 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	

5 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 - the connectors must be ordered separately

Code of connector	Function
666	Connector IP-65, suitable for direct connection to electric supply source
667	As 666 connector IP-65 but with built-in signal led, suitable for direct connection to electric supply source.
669	With built-in rectifier bridge for supplying DC coils by alternating current (AC 110V and 230V - Imax 1A).

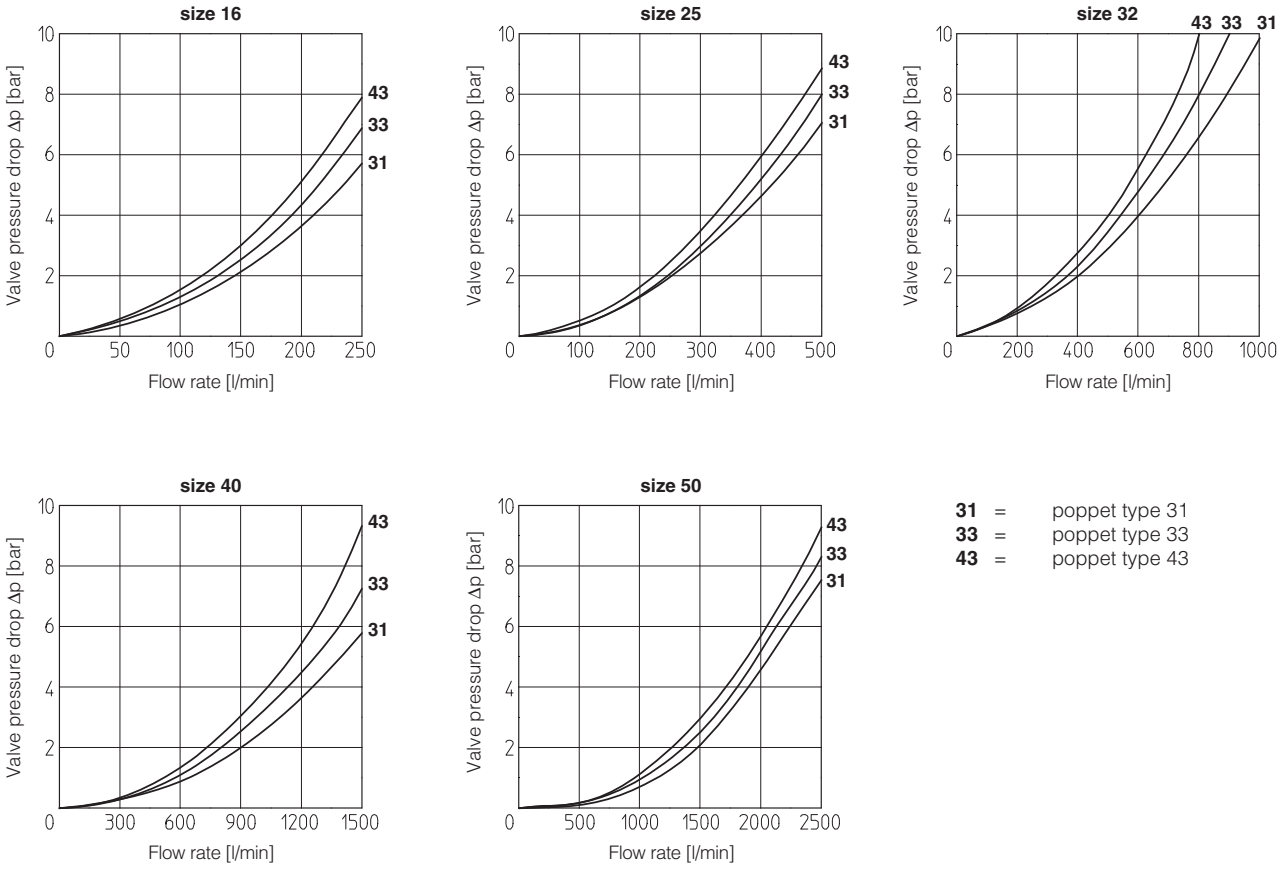
For other available connectors, see tab. K500

6 ELECTRIC FEATURES - coils for pilot solenoid valves

Valve	External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption **(3)**		Code of spare coil		
				DHI	**DHE DHEP**	**DHI**	Colour of coil label **DHI**	**DHE, DHEP**
DHI DHE DHEP	6 DC	**6 DC** (4)	666 or 667	33 W	30 W	COU-6DC	brown	-
	12 DC	**12 DC**				COU-12DC	green	COE-12DC
	14 DC	**14 DC**				COU-14DC	brown	COE-14DC
	24 DC	**24 DC**				COU-24DC	red	COE-24DC
	28 DC	**28 DC**				COU-28DC	silver	COE-28DC
	48 DC	**48 DC**				COU-48DC	silver	COE-48DC
	110 DC	**110 DC**				COU-110DC	gold	COE-110DC
	125 DC	**125 DC**				COU-125DC	blue	COE-125DC
	220 DC	**220 DC**				COU-220DC	black	COE-220DC
	24/50 AC	**24/50/60 AC** (4)		60 VA	-	COI-24/50/60AC (1)	pink	-
	24/60 AC							
	48/50 AC	**48/50/60 AC** (4)				COI-48/50/60AC (1)	white	-
	48/60 AC							
	110/50 AC	**110/50/60 AC**			58 VA	COI-110/50/60AC (1)	yellow	COE-110/50/60AC
	115/60 AC (5)	**115/60 AC**		-	80 VA	-		COE-115/60AC
	120/60 AC (4)	**120/60 AC**		60 VA	-	COI-120/60AC	white	-
	230/50 AC	**230/50/60 AC**			58 VA	COI-230/50/60AC (1)	light blue	COE-230/50/60AC
	230/60 AC	**230/60 AC**			80 VA	COI-230/60AC	silver	COE-230/60AC
	110/50 AC	**110RC**	669	33 W	30 W	COU-110RC	gold	COE-110RC
	120/60 AC							
	230/50 AC	**230RC**				COU-230RC	blue	COE-230RC
	230/60 AC							

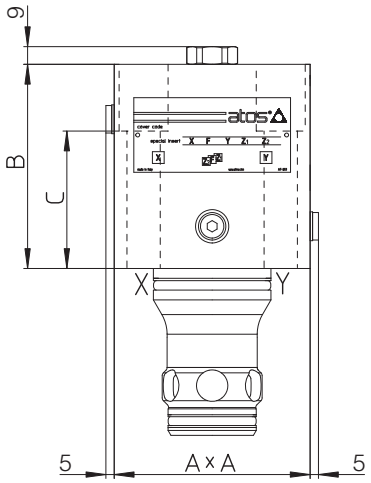
(1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10÷15% and the power consumption is 55 VA (-I) and 58 VA (-E, -EP)
(2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(3) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.
(4) Only for pilot valve DHI
(5) Only for pilot valve DHE, DHEP

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

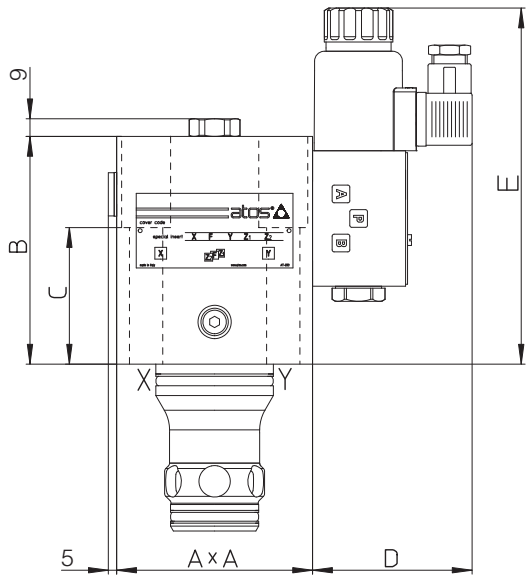


31 = poppet type 31
33 = poppet type 33
43 = poppet type 43

8 INSTALLATION DIMENSIONS [mm]



LIDAS					
Size	A	B	C	Fastening bolts class 12.9	Weight (Kg)
16	65	85	64	N°4 M8x80 35 Nm	2,8
25	85	102	75	N°4 M12x95 125 Nm	5,7
32	100	104	70	N°4 M16x90 300 Nm	7,3
40	125	111	39	N°4 M20x70 600 Nm	14,5
50	140	135	49	N°4 M20x80 600 Nm	120

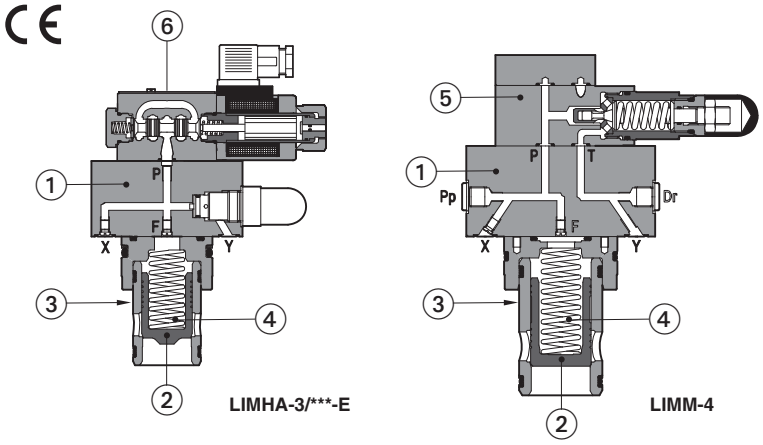


LIDASH								
Size	Pilot valve	A	B	C	D max ①	E max ②	Fastening bolts class 12.9	Weight (Kg)
16	DHI	72x65	95	64	79,5	152	N°4 M8x80 35 Nm	4,3
	DHE(P)				86	167		4,4
25	DHI	85	115	77	79,5	165	N°4 M12x95 125 Nm	7,2
	DHE(P)				86	181		7,3
32	DHI	100	116	70	79,5	176	N°4 M16x90 300 Nm	8,8
	DHE(P)				86	192		8,9
40	DHI	125	125	39	79,5	180	N°4 M20x70 600 Nm	15,5
	DHE(P)				86	196		15,6
50	DHI	140	135	49	79,5	186	N°4 M20x80 600 Nm	20,5
	DHE(P)				86	202		20,6

Note: for mounting interface and cavity dimensions, see tech. table P006

ISO cartridge valves type LIM*, LIRA, LIC*

Pressure controls: relief, reducing, compensator - **Pmax 420 bar**



① Functional cover
② Poppet
③ Sleeve
④ Spring
⑤ Pressure relief pilot valve
⑥ Solenoid pilot valve

Pressure control valves in ISO cartridge design specific for relief, reducing or compensator functions

They are made by a functional cover ① and a 2-way **SC LI** slip-in cartridge.

Depending to the type of control, the cover is equipped with a pilot relief valve ⑤ for the max pressure regulation and a solenoid valve ⑥ for venting.

The SC LI slip-in cartridge is available with different poppet shape to optimize the pressure control, see section 4

It is made by a poppet ② sliding into a sleeve ③ and kept in normally closed position by the spring ④ available with different cracking pressure values.

Size: **16 to 80** ISO 7368
Max flow up to **4900 l/min** at Δp = 5 bar
Max pressure: up to **420 bar**

1 **MODEL CODE OF FUNCTIONAL COVERS** - for model code of slip-in cartridge, see section 5

LI	MHA	-	1	/	210	/	V	-	I	X	24DC	**	/	*	F**

LI: Cover according to ISO 7368

MHA: **Function**:
MM = pressure relief control with manual setting;
MHA = pressure relief control with solenoid valve for venting. Unloading when solenoid is deenergized;
MHC = pressure relief control with solenoid valve for venting. Unloading when solenoid is energized;
RA = pressure reducing control with manual setting. Open in resting position;
C = pressure compensator to be coupled with flow control valves;
CM = pressure compensator with mechanical max pressure regulation to be coupled with flow control valves.

1: **Size**: **1** = 16; **2** = 25; **3** = 32; **4** = 40; **5** = 50; **6** = 63; **8** = 80
LIRA is available only in size 16, 25, 32, 40

210: **Pressure range**:
50 = 6 ÷ 50 bar;
100 = 8 ÷ 100 bar; **350** = 15 ÷ 350 bar;
210 = 10 ÷ 210 bar; **420** = 25 ÷ 420 bar **(1)**

V: **Options**: see section 3

I: **Pilot solenoid valve** only for LIMHA and LIMHC:
I = DHI, **Pmax 350 bar**
E = DHE, **Pmax 350 bar**
EP = DHEP, **Pmax 420 bar (1)**

X: Only for LIMHA and LIMHC
X = without connector
00 = solenoid valve without coils (for -I)
00-AC = AC solenoid valve without coils (for **E** and **EP**)
00-DC = DC solenoid valve without coils (for **E** and **EP**)
See tech. table K500 for available connectors, to be ordered separately

24DC: **Voltage code** only for LIMHA and LIMHC, see section 9

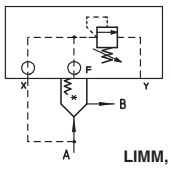
******: Series number

*****: Seals material:
- = NBR
PE = FKM
BT = HNBR

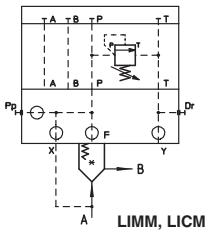
F**: Optional different setting of calibrated plugs in the pilot channels, see section 3, 4

(1) Pressure range 420 bar not available for LIMH*-**I** and LIMH*-**E**; LIMH*-**EP** is available only for pressure range 420 bar

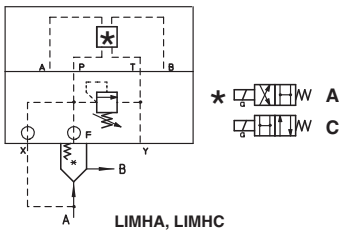
2 HYDRAULIC SYMBOLS



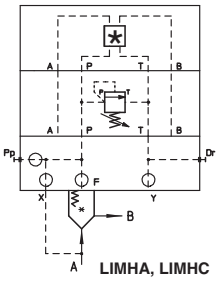
LIMM, LICM
size 16…32



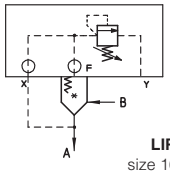
LIMM, LICM
size 40…80



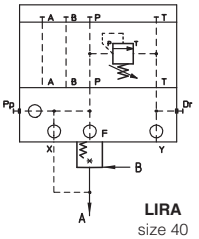
LIMHA, LIMHC
size 16…32



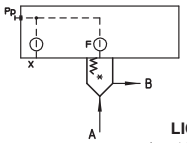
LIMHA, LIMHC
size 40…80



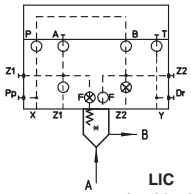
LIRA
size 16…32



LIRA
size 40



LIC
size 16…25



LIC
size 32…80

3 OPTIONS

Only for LIMM (size 16...32):
/P = predisposed for ISO 4401 size 06 mounting surface
Handwheel for pressure control, only for LIMM, LIMH*, LIRA, LICM (see tech. table K150):
/V = regulating handwheel (available for all the sizes)
/VF = regulating knob (available only for sizes 40…80)
/VS = manual override with safety locking (available only for sizes 40…80)
/WP = prolonged manual override protected by rubber cap for pilot solenoid valve

For all the models:
******* = calibrated plugs different from standard one. The restrictors configuration (if different from the standard) must be indicated at the end of the model code:

LIMHA - **1** / **210** - **IX** **24DC** ******

F
Channel where the orifice has to be provided: **X** = channel X **F** = channel F

06
Size of the throttling hole in tenths of millimeters: **05** = 0,5 mm **10** = 1 mm **06** = 0,6 mm **12** = 1,2 mm **08** = 0,8 mm **15** = 1,5 mm

4 STANDARD ORIFICES CONFIGURATION

Port \ Cover	LIM*-1	LIRA-1	LICM-1	LIC-1	LIM*-2	LIRA-2	LICM-2	LIC-2	LIM*-3	LIRA-3	LICM-3	LIC-3	LIM*-4	LIRA-4	LICM-4	LIC-4	LIM*-5	LICM-5	LIC-5	LIM*-6	LICM-6	LIC-6	LIM*-8	LICM-8	LIC-8
X	M4 10A	M4 08A	M4 08A	- -	M4 10A	M4 08A	M4 08A	- -	M6 10A	M6 08A	M6 12A	M6 10A	M6 10A	M6 12A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M8 10A	M8 10A	M8 10A
F	M4 12F	M4 12A	M4 05F	M4 05F	M4 12F	M4 12A	M4 05F	M4 05F	M6 12F	M6 12A	M6 12F	M6 05F	M6 12F	M6 08A	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M8 12F	M8 12F	M8 12F

M4 ÷ M8 = screw size; **10A ÷ 12F** = calibrated orifice diameter in tenths of mm; **A** = short calibrated hole, **F** = long calibrated hole

5 MODEL CODE OF SLIP-IN CARTRIDGES

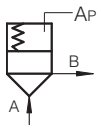
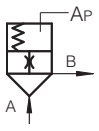
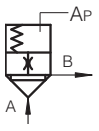
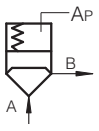
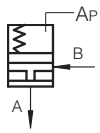
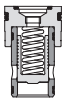
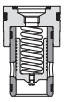
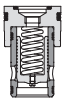
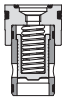
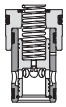
SC LI	-	16	31	2	**	/*
Cartridge according to ISO 7368					Series number	Seals material: **-** = NBR **PE** = FKM **BT** = HNBR

Size, the same of relevant cover:
16 = 16; **32** = 32; **50** = 50; **80** = 80
25 = 25; **40** = 40; **63** = 63;

Type of poppet
31 = (sizes 16…80) = for LIMM, LIMH*, LIC, LICM
34 = (size 16) = for LIMM, LIMH*
35 = (sizes 16…50) = for LIMM, LIMH*
36 = (sizes 16…80) = for LIC, LICM
37 = (sizes 16…40) = for LIRA

Spring cracking pressure:
1 = 0,3 bar for poppet 35;
2 = 1,2 bar for poppet 31, 34, 35;
3 = 3 bar for poppet 31, 34, 35;
4 = 4 bar for poppet 37;
6 = 6 bar for poppet 31, 34, 35, 36;
7 = 7 bar for poppet 37 (not available for size 40);

6 TYPE OF POPPET

Type of poppet		**31**	**34**	**35**	**36**	**37**
Operating pressure		**420 bar**				
Nominal flow at Δp 5bar (l/min) see diagrams Q/Δp at section 8	Size **16**	180	180	180	180	140
	25	370	-	370	370	250
	32	630	-	630	630	500
	40	1100	-	1100	1100	750
	50	1900	-	1900	1900	-
	63	3100	-	-	3100	-
	80	4900	-	-	4900	-
Functional sketch (Hydraulic symbol)						
Typical section						
Area ratio A: AP		**1:1**	**1:1**	**1:1,1**	**1:1**	**1:1**

7 MAIN CHARACTERISTICS SEALS AND HYDRAULIC FLUIDS

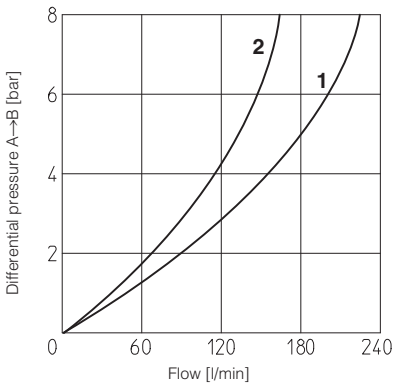
Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Ambient temperature	**Standard** execution = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C		
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		
Fluid contamination class	ISO 4406 class 21/19/16 NAS 1638 class 10, in line filters of 25 μm (β25 ≥75 recommended)		
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		
Functional cover operating pressure all models except **LIMH***	Ports A, B, X: **420** bar;		
LIMH*-I	Ports A, B, X: **350** bar; Port T **120** bar		
LIMH*-E	Ports A, B, X: **350** bar; Port T **210** bar for DC version; **160** bar for AC version		
LIMH*-EP	Ports A, B, X: **420** bar; Port T **210** bar for DC version; **160** bar for AC version		

7.1 Coils characteristics

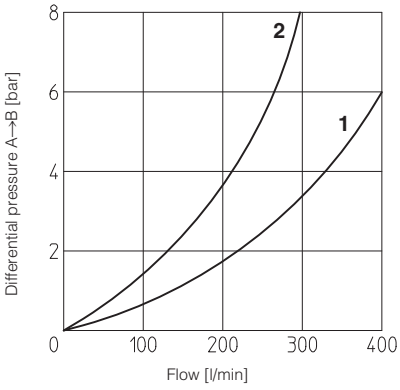
Insulation class	Pilot valve **E**, **EP: H** (180°C) for DC coils **F** (155°C) for AC coils Pilot valve **I: H** (180°C) for DC or AC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	**IP 65** (with connectors 666, 667, 669 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature 9
Supply voltage tolerance	± 10%
Certification	**cURus** North American Standard

8 FLOW /Δp DIAGRAMS based on mineral oil ISO VG 46 at 50 °C

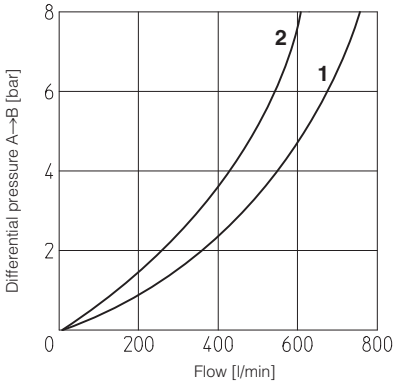
size 16



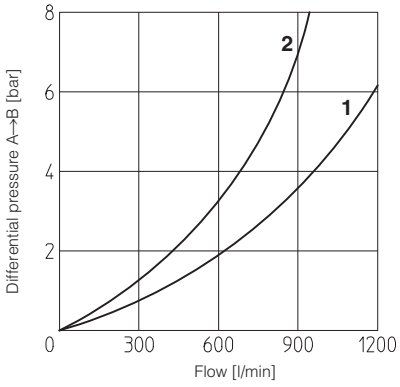
size 25



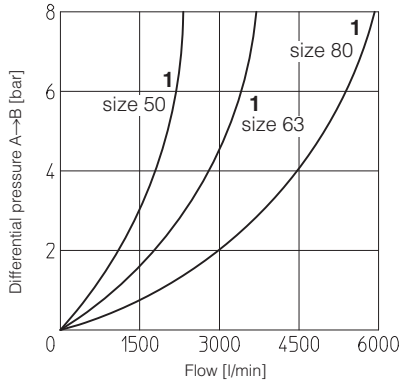
size 32



size 40



size 50, 63, 80



1 = poppet type 31, 34, 35, 36
2 = poppet type 37

Note:

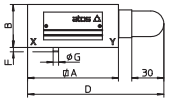
poppet type 34 only for size 16
poppet type 37 for size 16 to 50

9 ELECTRIC FEATURES

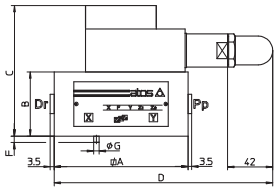
Solenoid valve type	External supply nominal voltage ± 10% (1)		**Voltage code**	Type of connector	Power consumption (3)	Code of spare coil DHI	Colour of coil label DHI	Code of spare coil DHE, DHEP
DHI DHE DHEP	DC	12 DC 24 DC 110 DC 220 DC	**12 DC** **24 DC** **110 DC** **220 DC**	666 or 667	33 W (DHI) 30 W (DHE, DHEP)	COU-12DC COU-24DC COU-110DC COU-220DC	green red black black	COE-12DC COE-24DC COE-110DC COE-220DC
	AC	110/50 AC (2) 115/60 AC 120/60 AC 230/50 AC (2) 230/60 AC	**110/50/60 AC** **115/60 AC** (5) **120/60 AC** (6) **230/50/60 AC** **230/60 AC**	666 or 667	60 VA (DHI) 58 VA (DHE, DHEP) (4)	COI-110/50/60AC - COI-120/60AC COI-230/50/60AC COI-230/60AC	yellow - white light blue silver	COE-110/50/60AC COE-115/60AC - COE-230/50/60AC COE-230/60AC

(1) For other supply voltages available on request see technical tables E010, E015, TE030.
(2) 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 (DHI)
(3) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(4) 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.
(5) Only for DHE, DHEP
(6) Only for DHI

10 COVER DIMENSIONS [mm] - for mounting interface and cavity dimensions see tech. table P006

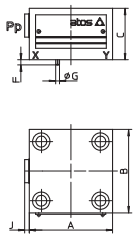


LIMM (size 16…32)
LIRA (size 16…32)
LICM (size 16…32)

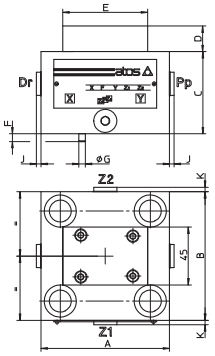


LIMM (size 40…80)
LIRA (size 40)
LICM (size 40…80)

Covers	A	B	C	D	F	G	Port Pp-Dr	Seals	Fastening bolts (2)	Tightening torque [Nm]	Mass [Kg]
LIMM-1 LIRA-1 LICM-1	65	40	-	107,5	4	3	-	2 OR 108	Nr. 4 M8x45	35	1,7
LIMM-2 LIRA-2 LICM-2	85	40	-	127,5	6	5	-	2 OR 108	Nr. 4 M12x45	125	2,2
LIMM-3 LIRA-3 LICM-3	100	50	-	142,5	6	5	-	2 OR 2043	Nr. 4 M16x55	300	3,5
LIMM-4 LIRA-4 LICM-4	125	60	122	195	6	5	G 1/4	2 OR 3043	Nr. 4 M20x70	600	8,9
LIMM-5 LICM-5	140	70	132	202,5	4	6	G 1/4	2 OR 3043	Nr. 4 M20x80	600	12,4
LIMM-6 LICM-6	180	80	142	222,5	4	6	G 3/8	2 OR 3050	Nr. 4 M30x90	2100	21,6
LIMM-8 LICM-8	Ø250	80	172	257,5	6	8	G 3/8	2 OR 4075	Nr. 8 M24x90	1000	30,5

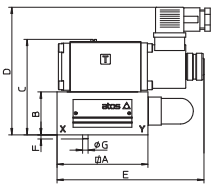


LIC (size 16 ÷ 25)

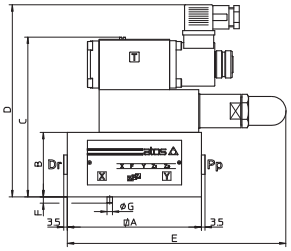


LIC (size 32…80)

Covers	A	B	C	D	E	F	G	K	J	Port Pp-Dr	Port Z_1-Z_2	Seals	Fastening bolts (2)	Tightening torque [Nm]	Mass [Kg]
LIC-1	65	65	40	-	-	4	3	-	3,5	G 1/4	-	2 OR 108	Nr. 4 M8x45	35	1,4
LIC-2	85	85	40	-	-	6	5	-	3,5	G 1/4	-	2 OR 108	Nr. 4 M12x45	125	1,8
LIC-3	100	100	50	20	66	6	5	-	3,5	G 1/4	-	4 OR 2043	Nr. 4 M16x55	300	2,3
LIC-4	125	125	60	20	66	6	5	-	3,5	G 1/4	-	4 OR 3043	Nr. 4 M20x70	600	6,2
LIC-5	140	140	70	20	66	4	6	3,5	3,5	G 1/4	G 1/4	4 OR 3043	Nr. 4 M20x80	600	9,3
LIC-6	180	180	80	20	66	4	6	3,5	3,5	G 3/8	G 3/8	4 OR 3050	Nr. 4 M30x90	2100	17,1
LIC-8	Ø 250	-	80	30	73	6	8	-	3,5	G 3/8	-	4 OR 4075	Nr. 8 M24x90	1000	27



LIMH* (size 16…32)



LIMH* (size 40…80)

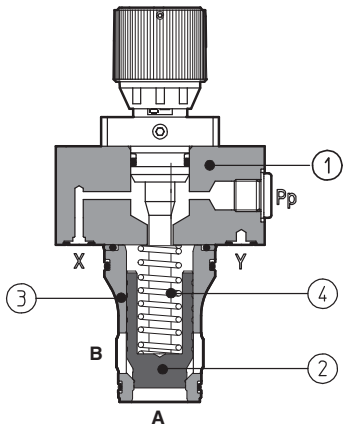
Covers	A	B	C max	D max	E	F	G	Port Pp-Dr	Seals	Fastening bolts (2)	Tightening torque [Nm]	Mass [Kg]
LIMHA-1 LIMHC-1	65 (1)	40	87,5	123,5	124,5	4	3	-	2 OR 108	Nr. 4 M8x45	35	3
LIMHA-2 LIMHC-2	85	40	87,5	123,5	134,5	6	5	-	2 OR 108	Nr. 4 M12x45	125	3,3
LIMHA-3 LIMHC-3	100	50	130,5	153,5	142,5	6	5	-	2 OR 2043	Nr. 4 M16x55	300	5
LIMHA-4 LIMHC-4	125	60	150,5	183,5	195	6	5	G 1/4	2 OR 3043	Nr. 4 M20x70	600	9,2
LIMHA-5 LIMHC-5	140	70	160,5	193,5	202,5	4	6	G 1/4	2 OR 3043	Nr. 4 M20x80	600	13,2
LIMHA-6 LIMHC-6	180	80	170,5	203,5	222,5	4	6	G 3/8	2 OR 3050	Nr. 4 M30x90	2100	22,5
LIMHA-8 LIMHC-8	Ø 250	80	200,5	233,5	257,5	6	8	G 3/8	2 OR 4075	Nr. 8 M24x90	1000	31,3

(1) Cover is not squared: 65x80
(2) Hexagon socket head screw according to DIN 912 class 12.9

Overall dimensions refer to the pilot valves with connectors type 666

ISO cartridge valves type LIDD

Flow control



① Functional cover
② Poppet
③ Sleeve
④ Spring

LIDD-2

LIDD are flow control valves not compensated, in ISO cartridge design, made by a functional "cover" ① and a 2-way SC LI slip-in cartridge.

Covers are provided with regulating screw to adjust the cartridge opening.

The cartridge is made by poppet ② sliding into a sleeve ③. The position of the spool or poppet and then the controlled flow, is manually set on the regulating screw of the cover; the cracking pressure value depends on poppet spring.

Size: **16 to 63** ISO 7368
Max flow up to **4000 l/min** at Δp 5 bar
Max pressure: **LIDD 420 bar**

1 MODEL CODE FOR COVERS - for model code of slip-in cartridge/spool, see section 3, 5

LI	DD	–	1	/	*	**	/*

LI: Cover according to ISO 7368

DD: Flow control valve: **DD** = normally closed with stroke limiter

1: Size for LIDD:
1 = 16 **4** = 40
2 = 25 **5** = 50
3 = 32 **6** = 63

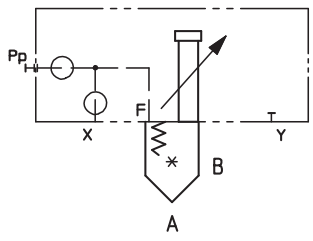
*: Options: see section 6

**: Series number
LIDD = **50** all sizes **(1)**

/*: Seals material:
- = NBR
PE = FKM
BT = HNBR

(1): New series 50 of LIDD cover is highly recommended in combination with new high flow cartridges series 40
The use of old cartridges series 10, 11 and 31 may cause the impossibility to fully close the poppet

2 HYDRAULIC SYMBOLS



3 MODEL CODE OF SLIP-IN CARTRIDGES - for LIDD

SC LI	-	16	43	1	40	/	*

Cartridge according to ISO 7368

Size, the same of relevant cover:
16 25 32 40 50 63

Type of poppet
32, 33 (size 16 to 100) = without damping nose
42 (size 16 to 80) = as 32 but with damping nose
43 (size 16 to 100) = as 33 but with damping nose

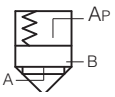
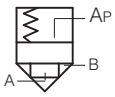
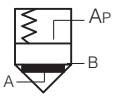
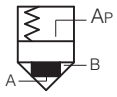
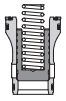
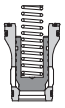
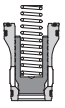
Series number **(1)**
40 = all sizes

Seals material:
- = NBR
PE = FKM
BT = HNBR

Spring cracking pressure:
1 = 0,3 bar for poppet 32, 42
1 = 0,6 bar for poppet 33, 43
2 = 1,5 bar for poppet 32, 42
3 = 3 bar for all poppets
6 = 5,5 bar for all poppets

(1) New series 40 is mechanically interchangeable with standard flow series 31, 11 and 10 - cavity according to ISO 7368
New series 50 of LIDD cover is highly recommended in combination with new cartridges series 40
The use of old cartridges series 10, 11 and 31 may cause the impossibility to fully close the poppet

4 TYPE OF POPPET

Type of poppet		**32**	**33**	**42**	**43**
Functional sketch (Hydraulic symbol)					
Operating pressure		**420 bar max**			
Nominal flow at Δp 5bar (l/min) see diagrams Q/Δp at section 7	Size **16**	270	270	240	240
	25	550	550	500	500
	32	1000	1000	800	800
	40	1700	1700	1400	1400
	50	2500	2500	2200	2200
	63	4000	4000	3300	3300
Typical section					
Area ratio A:Ap		**1:1,1**	**1:1,5**	**1:1,1**	**1:1,5**
Cracking pressure A→B	Spring **1**	0,3 bar	0,6 bar	0,3 bar	0,6 bar
	2	1,5 bar	-	1,5 bar	-
	3	3 bar	2,5 bar	3 bar	2,5 bar
	6	6 bar	6 bar	6 bar	6 bar
Cracking pressure B→A	Spring **1**	3 bar	0,9 bar	3 bar	0,9 bar
	2	12,8 bar	-	12,8 bar	-
	3	32,5 bar	3,8 bar	32,5 bar	3,8 bar
	6	59,4 bar	9 bar	59,4 bar	9 bar

5 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUID

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** execution = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C		
Compliance	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 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	A to B or B to A		
Functional cover operating pressure	ports X, Y: **420** bar		

6 OPTIONS

/E = with external attachments X and underneath port X supplied plugged;

******* = Calibrated plugs different from standard ones. LIDD covers in standard executions are not equipped with restrictors in the pilot channels. When ordering covers equipped with restrictors, it must be indicated at the end of the model code:

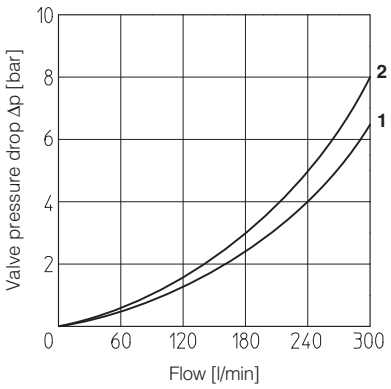
LIDD	-	1	/E	X	06
				Channel where the restrictor has to be provided: **X** = channel X	Size of the throttling hole in tenths of millimeters: **05** = 0,5 mm **10** = 1 mm **06** = 0,6 mm **12** = 1,2 mm **08** = 0,8 mm **15** = 1,5 mm

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

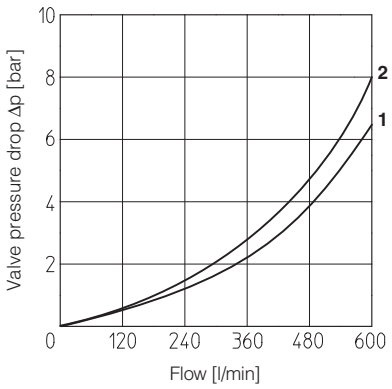
SC LI slip-in cartridges, poppet type 32, 33, 42, 43

1 = poppet type 32 and 33
2 = poppet type 42 and 43

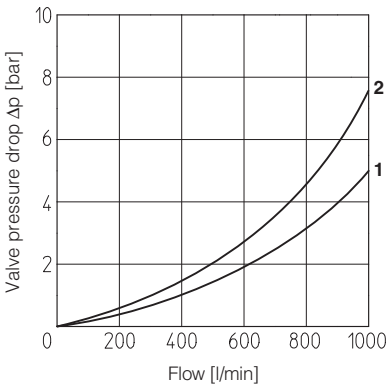
size 16



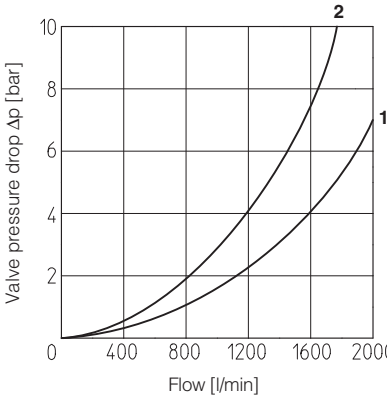
size 25



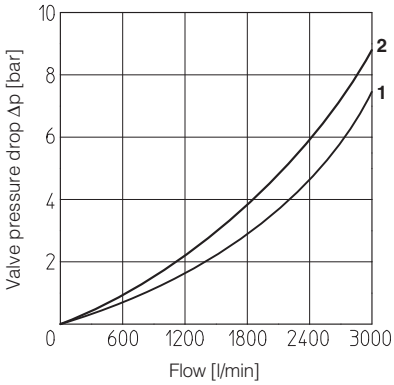
size 32



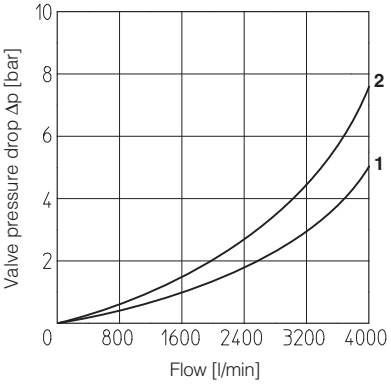
size 40



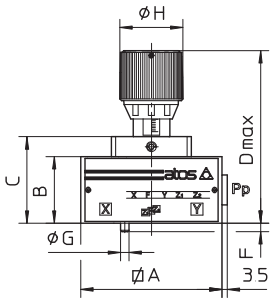
size 50



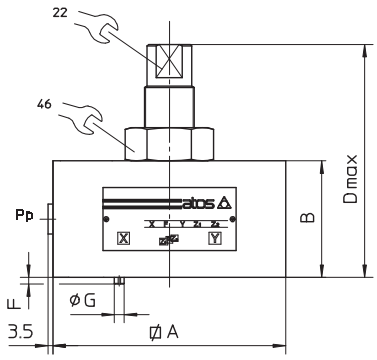
size 63



8 LIDD COVER DIMENSIONS [mm] - for mounting interface and cavity dimensions, see tech. table P006



LIDD (dim. 16...40)



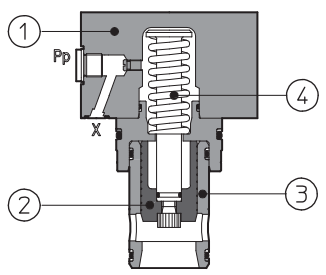
LIDD (size 50 ÷ 63)

Covers	A	B	C	D max	F	G	H	Port Pp	Seals	Fastening bolts (1)	Tightening torque [Nm]	Mass [Kg]
LIDD-1	65	40	52	104	4	3	38	G1/4	2 OR 108	Nr. 4 M8x45	35	2
LIDD-2	85	40	52	104	6	5	38	G1/4	2 OR 108	Nr. 4 M12x45	125	2,4
LIDD-3	100	50	75	156	6	5	50	G1/4	2 OR 2043	Nr. 4 M16x55	300	2,8
LIDD-4	125	60	85	166	6	5	50	G1/4	2 OR 3043	Nr. 4 M20x70	600	6,7
LIDD-5	140	70	-	140	4	6	-	G1/4	2 OR 3043	Nr. 4 M20x80	600	9,8
LIDD-6	180	80	-	151	4	6	-	G3/8	2 OR 3050	Nr. 4 M30x90	2100	17,5

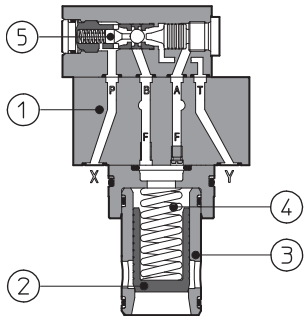
(1) Hexagon socket head screw according to DIN 912 class 12.9

ISO cartridge valves type LID*

Check function, high flow, **Pmax 420 bar**



LIDO-3



LIDR-3

① Functional cover
② Poppet
③ Sleeve
④ Spring
⑤ Pilot operated check valve

Directional control valves in ISO cartridge design, specific for check functions. They are made by a functional cover ① and a 2-way **SC LI** slip-in cartridge.

Covers are available with different check functions:
LIDA, normally closed
LIDO, normally open
LIDB, normally closed with shuttle valve for pilot pressure selection
LIDR, normally closed with pilot operated check valve

The SC LI slip-in cartridge is available with different poppet shape to optimize the check control, see section 6.

It is made by a poppet ② sliding into a sleeve ③ and kept in normally closed position (open position for type 62 and 63) by the spring ④ available with different cracking pressure values.

Size: **16 to 100** ISO 7368
Max flow up to **9000 l/min** at Δp = 5 bar
Max pressure up to **420 bar**

1 MODEL CODE OF FUNCTIONAL COVERS - for model code of slip-in cartridge, see section 5, 7

LI	D	A	-	1	/	*	**	/	**	*

LI: Cover according to ISO 7368

D = directional function

Cover configuration see section 2:
A = normally closed;
O = normally open;
B = with shuttle valve for pilot selection;
R = with hydraulically operated pilot check valve;

Size:
1 = 16; **4** = 40; **8** = 80 (only for LIDA)
2 = 25; **5** = 50; **10** = 100 (only for LIDA)
3 = 32; **6** = 63 (not for LIDO)
LIDO is available only in sizes 16 to 50

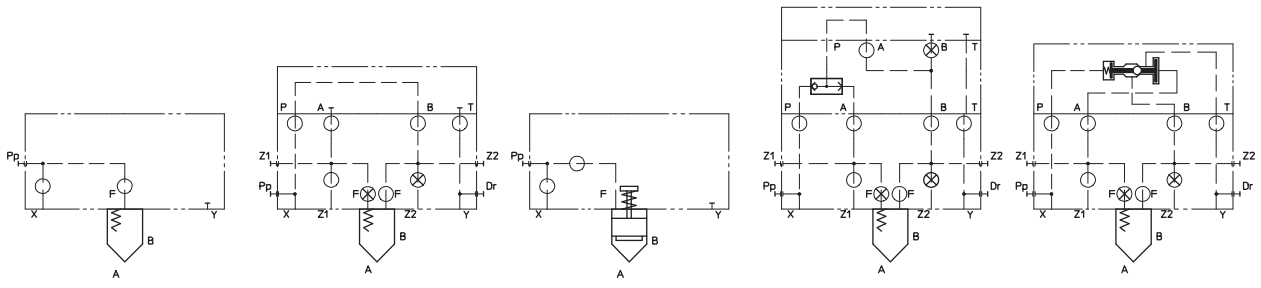
Options: see section 3

Series number

Seals material:
- = NBR
PE = FKM
BT = HNBR

Optional different setting of calibrated plugs in the pilot channels, see section 3, 4

2 HYDRAULIC SYMBOLS (cover configuration)



LIDA size 16…25 | **LIDA** size 32…100 | **LIDO** size 16…50 | **LIDB** size 16…63 | **LIDR** size 16…63

3 OPTIONS

For LIDA (sizes 16 and 25), for LIDO (all sizes) LIDB (sizes 40 ÷ 63), LIDR (sizes 40 ÷ 63):
/E = with external attachments Pp and underneath port X supplied plugged;
For LIDA, LIDB, LIDR:
/F = prearranged for coupling to an intermediate element with position detector for safety valves, see tab. EY120.
For all models:
******* = Calibrated plugs different from standard ones reported in section 4. The restrictors configuration (if different from the standard) it must be indicated at the end of the model code:

LIDB	-	4	/E	**

P
Channel where the restrictor has to be provided: **P** = channel X, port P **Z1** = channel Z1 **F** = channel F **Z2** = channel Z2

06
Size of the throttling hole in tenths of millimiters: **05** = 0,5 mm **10** = 1 mm **17** = 1,7 mm **06** = 0,6 mm **12** = 1,2 mm **20** = 2 mm **08** = 0,8 mm **15** = 1,5 mm

4 STANDARD ORIFICES CONFIGURATION

Port \ Cover	LIDA-1	LIDO-1	LIDB-1	LIDR-1	LIDA-2	LIDO-2	LIDB-2	LIDR-2	LIDA-3	LIDO-3	LIDB-3	LIDR-3	LIDA-4	LIDO-4	LIDB-4	LIDR-4	LIDA-5	LIDO-5	LIDB-5	LIDR-5	LIDA-6	LIDB-6	LIDR-6	LIDA-8	LIDA-10
X	- -	v	- -	- -	- -	M4 10A	- -	- -	- -	M6 12A	- -	- -	- -	M6 15F	- -	- -	- -	M6 15F	- -	- -	- -	- -	- -	- -	- -
P	- -	- -	- -	M6 12A	- -	- -	- -	M6 12A	- -	- -	- -	M6 15A	- -	- -	- -	M6 17A	- -	- -	- -	M6 20A	- -	- -	M6 20A	- -	- -
Z2	- -	- -	- -	M4 100F	- -	- -	- -	M6 300F	- -	- -	- -	M6 300F	- -	- -	- -	M6 300F	- -	- -	- -	M6 300F	- -	- -	M6 300F	- -	- -

M4 ÷ M6 = screw size **10A ÷ 300F** = calibrated orifices diameters in tenths oh mm; **A** = short calibrated hole, **F** = long calibrated hole

5 MODEL CODE OF SLIP-IN CARTRIDGES

SC LI	-	16	43	1	40	/	*

Cartridge according to ISO 7368

Size, the same of relevant cover:
16 25 32 40 50 63 80 100

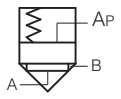
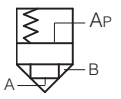
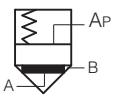
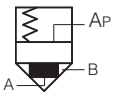
Type of poppet (not for LIDO)
32, 33 (size 16 to 100) = without damping nose
42 (size 16 to 80) = as 32 but with damping nose
43 (size 16 to 100) = as 33 but with damping nose

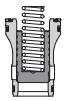
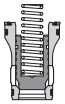
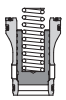
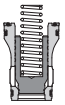
Spring cracking pressure:
1 = 0,3 bar for poppet 32, 42
1 = 0,6 bar for poppet 33, 43
2 = 1,5 bar for poppet 32, 42
3 = 3 bar for all poppets
6 = 5,5 bar for all poppets

Series number

Seals material:
- = NBR
PE = FKM
BT = HNBR

6 TYPE OF POPPET

Type of poppet	**32**	**33**	**42**	**43**
Functional sketch (Hydraulic symbol)				

Operating pressure		**420 bar max**			
Nominal flow at Δp 5bar (l/min) see diagrams Q/Δp at section 10	Size **16**	270	270	240	240
	25	550	550	500	500
	32	1000	1000	800	800
	40	1700	1700	1400	1400
	50	2500	2500	2200	2200
	63	4000	4000	3300	3300
	80	5500	5500	4000	4000
	100	9000	9000	-	6300
Typical section					
Area ratio A:Ap		**1:1,1**	**1:1,5**	**1:1,1**	**1:1,5**
Cracking pressure A→B	Spring **1**	0,3 bar	0,6 bar	0,3 bar	0,6 bar
	2	1,5 bar	-	1,5 bar	-
	3	3 bar	2,5 bar	3 bar	2,5 bar
	6	6 bar	6 bar	6 bar	6 bar
Cracking pressure B→A	Spring **1**	3 bar	0,9 bar	3 bar	0,9 bar
	2	12,8 bar	-	12,8 bar	-
	3	32,5 bar	3,8 bar	32,5 bar	3,8 bar
	6	59,4 bar	9 bar	59,4 bar	9 bar

7 MODEL CODE OF SLIP-IN CARTRIDGES type 52, 62, 63 for LIDA and LIDO

SC LI	-	16	52	1	**	/*

Cartridge according to ISO 7368

Size, the same of relevant cover:
16 **25** **32** **40** **50**

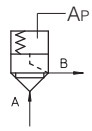
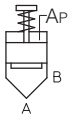
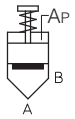
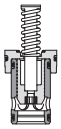
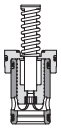
Type of poppet:
52 = normally closed, only for LIDA;
62 = normally open without damping nose, only for LIDO;
63 = normally open with damping nose, only for LIDO

Series number

Seals material:
- = NBR
PE = FKM
BT = HNBR

Spring cracking pressure:
1 = 0,3 bar for poppet 52;
2 = 1,5 bar for poppet 52;
3 = 3 bar for all poppets
6 = 5,5 bar for all poppets

8 TYPICAL FUNCTIONS OF POPPETS

Type of poppet		52	62	63
Operating pressure		**420 bar**		
Nominal flow at Δp 5bar (l/min) see diagrams Q/Δp at section 10	Size **16**	160		
	25	400		
	32	600		
	40	1200		
	50	1800		
Functional sketch (Hydraulic symbol)				
Typical section				
Area ratio A:AP		**1 : 1,1**	**1 : 1,1**	**1 : 1,1**
Cracking pressure A→B (1)	Spring **1**	0,3 bar	-	-
	2	1,5 bar	-	-
	3	3 bar	-	-
	6	6 bar	-	-

(1) Depending on the spring cracking pressure and the area ratio of the poppet

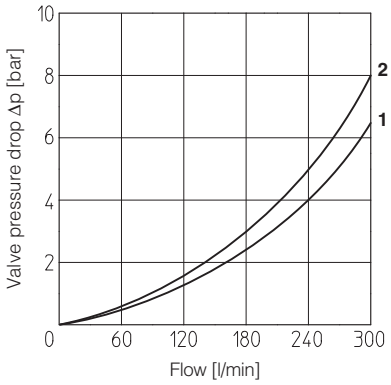
9 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUID

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	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 mm^2/s - max allowed range 2.8 ÷ 500 mm^2/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at 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		
Functional cover operating pressure	Ports P, A, B, X, Z1, Z2: **420** bar		

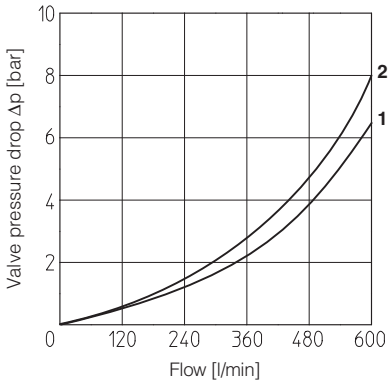
10 **Q/ΔP DIAGRAMS** based on mineral oil ISO VG 46 at 50°C

10.1 SC LI slip-in cartridges, poppet type 32, 33, 42, 43

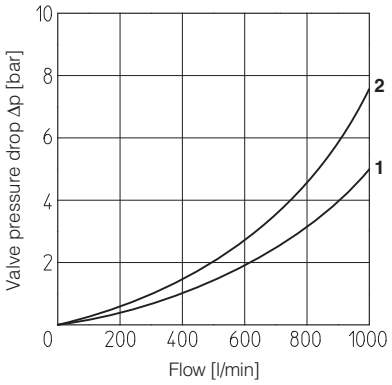
size 16



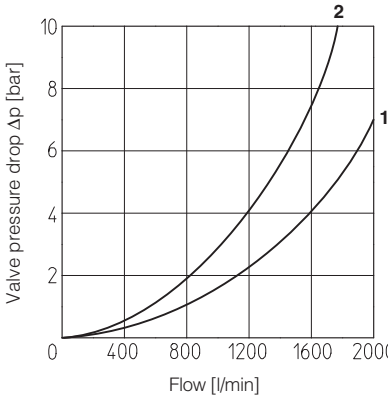
size 25



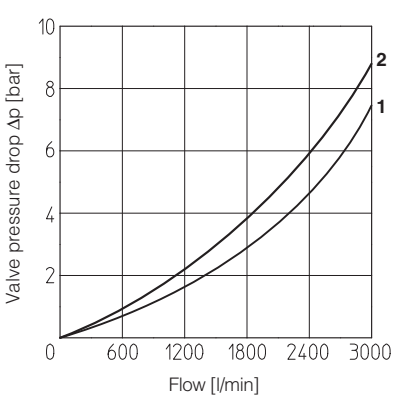
size 32



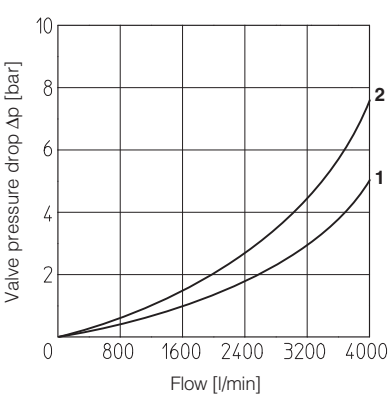
size 40



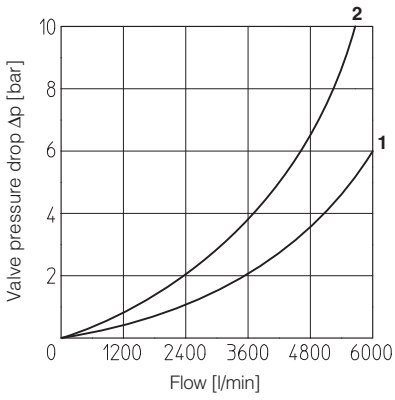
size 50



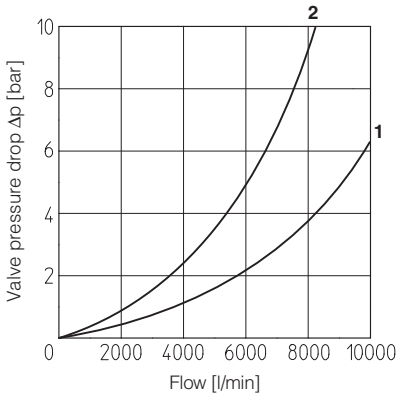
size 63



size 80



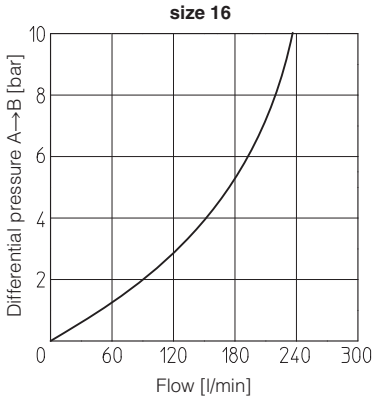
size 100

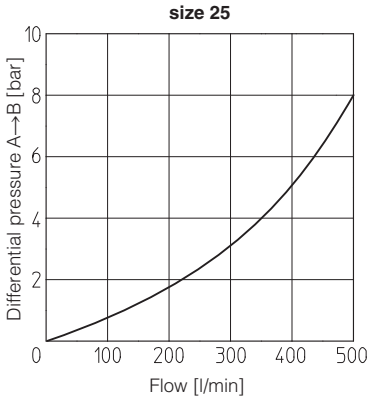


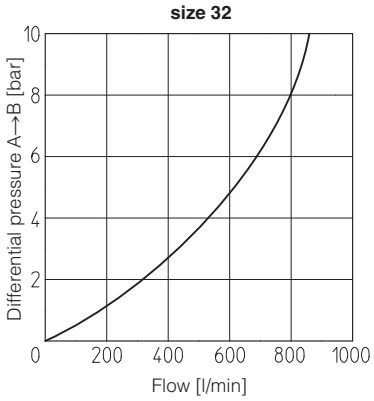
High flow - series 40

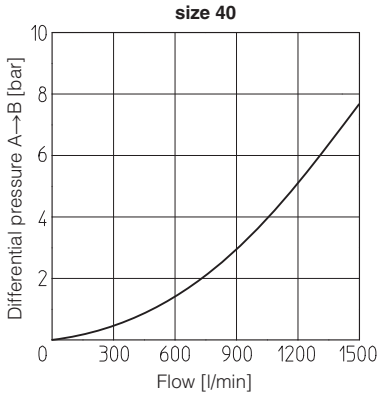
1 = poppet type 32 and 33
2 = poppet type 42 and 43

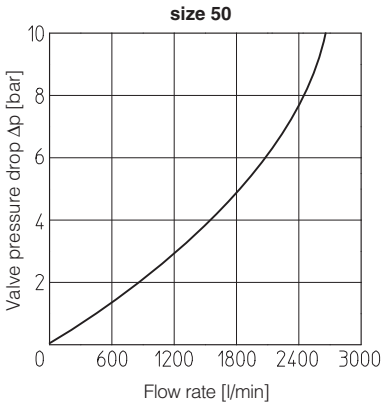
10.2 SC LI slip-in cartridges, poppet type 52, 62, 63





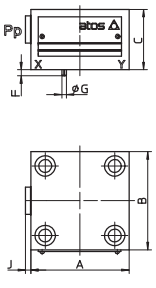




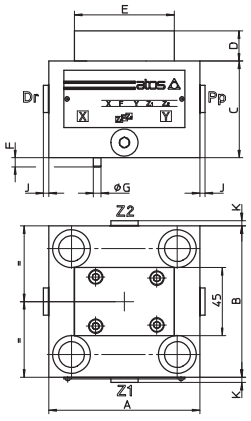


11 COVER DIMENSIONS [mm] - for mounting interface and cavity dimensions, see tech. table P006

LIDA



LIDA (size 16 ÷ 25)
LIDO (size 16…50)

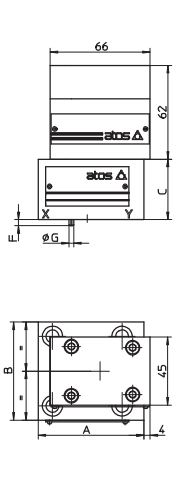


LIDA (size 32…100)
Note: for LIDA-80 and LIDA-100 the cover has round shape

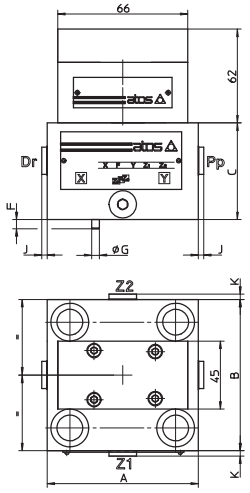
Covers (1)	A	B	C	D	E	F	G	K	J	Port Pp-Dr	Port Z1-Z2	Seals	Fastening bolts (3)	Tightening torque [Nm]	Mass [Kg]
LIDA-1 **LIDO-1**	65	65	40	-	-	4	3	-	3,5	G 1/4	-	2 OR-108 1 OR-108 (2)	Nr. 4 M8x45	35	1,4
LIDA-2 **LIDO-2**	85	85	40	-	-	6	5	-	3,5	G 1/4	-	2 OR-108 1 OR-108 (2)	Nr. 4 M12x45 (4)	125	1,8
LIDA-3 **LIDO-3**	100	100	50 60 (2)	20	66	6	5	-	- 3,5	G 1/4	-	4 OR-2043 1 OR-2043 (2)	Nr. 4 M16x55 (5)	300	2,3
LIDA-4 **LIDO-4**	125	125	60 100	20 -	66 -	6	5	-	3,5 3,5	G 1/4	-	4 OR-3043 1 OR-3043	Nr. 4 M20x70 (6)	600	6,2
LIDA-5 **LIDO-5**	140	140	70 110 (2)	20	66	4	6	3,5	3,5	G 1/4	G 1/4	4 OR-3043 1 OR-3043 (2)	Nr. 4 M20x80 (7)	600	9,3
LIDA-6	180	180	80	20	66	4	6	3,5	3,5	G 3/8	G 3/8	4 OR-3050	Nr. 4 M30x90	2100	17,1
LIDA-8	Ø 250	-	80	30	73	6	8	3,5	3,5	G 3/8	G 3/8	4 OR-4075	Nr. 8 M24x90	1000	27
LIDA-10	Ø 300	-	150	30	73	8	10	3,5	3,5	G 1/2	G 1/2	4 OR-4093	Nr. 8 M30x120	2100	54

(1) For LIDO-2: the external attachment Pp is located at Y port side of the cover;
(2) Only for LIDO;
(3) Hexagon socket head screw according to DIN 912 class 12.9
(4) M12x50 for LIDO-2;
(5) M16x60 for LIDO-3;
(6) M20x100 for LIDO-4;
(7) M20x110 for LIDO-5;

LIDB



LIDB (size 16)

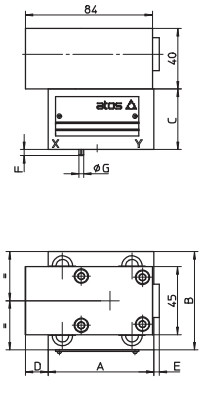


LIDB (size 25…63)

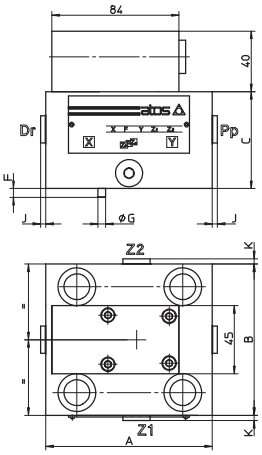
Covers	A	B	C	F	G	J	K	Port Pp-Dr	Port Z1-Z2	Seals	Fastening bolts (2)	Tightening torque [Nm]	Mass [Kg]
LIDB-1	70	65	40	4	3	-	-	-	-	4 OR-108	Nr. 4 M8x45	35	2,2
LIDB-2	85	85	40	6	5	-	-	-	-	4 OR-108	Nr. 4 M12x45	125	2,6
LIDB-3	100	100	50	6	5	-	-	-	-	4 OR-2043	Nr. 4 M16x55	300	3,1
LIDB-4	125	125	60	6	5	3,5	-	G 1/4	-	4 OR-3043	Nr. 4 M20x70	600	7
LIDB-5	140	140	70	4	6	3,5	3,5	G 1/4	G 1/4	4 OR-3043	Nr. 4 M20x80	600	10,1
LIDB-6 (1)	180	180	80	4	6	3,5	3,5	G 3/8	G 3/8	4 OR-3050	Nr. 4 M30x90	2100	17,9

(1) The position of external attachments Pp, Dr, Z1 and Z2 are inverted each others respect to the showed sketch
(2) Hexagon socket head screw according to DIN 912 class 12.9

LIDR



LIDR (size 16…32)



LIDR (size 40…63)

Covers	A	B	C	D	E	F	G	J	K	Port Pp-Dr	Port Z1-Z2	Seals	Fastening bolts (2)	Tightening torque [Nm]	Mass [Kg]
LIDR-1	70	65	40	4	3,5	4	3	-	-	-	-	4 OR-108	Nr. 4 M8x45	35	2,5
LIDR-2	85	85	40	13,5	-	6	5	-	-	-	-	4 OR-108	Nr. 4 M12x45	125	2,9
LIDR-3	100	100	50	6	-	6	5	-	-	-	-	4 OR-2043	Nr. 4 M16x55	300	3,4
LIDR-4	125	125	60	-	-	6	5	3,5	-	G 1/4	-	4 OR-3043	Nr. 4 M20x70	600	7,3
LIDR-5	140	140	70	-	-	4	6	3,5	3,5	G 1/4	G 1/4	4 OR-3043	Nr. 4 M20x80	600	10,4
LIDR-6 (1)	180	180	80	-	-	4	6	3,5	3,5	G 3/8	G 3/8	4 OR-3050	Nr. 4 M30x90	2100	18,3

(1) The position of external attachments Pp, Dr, Z1 and Z2 are inverted each others respect to the showed sketch
(2) Hexagon socket head screw according to DIN 912 class 12.9

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