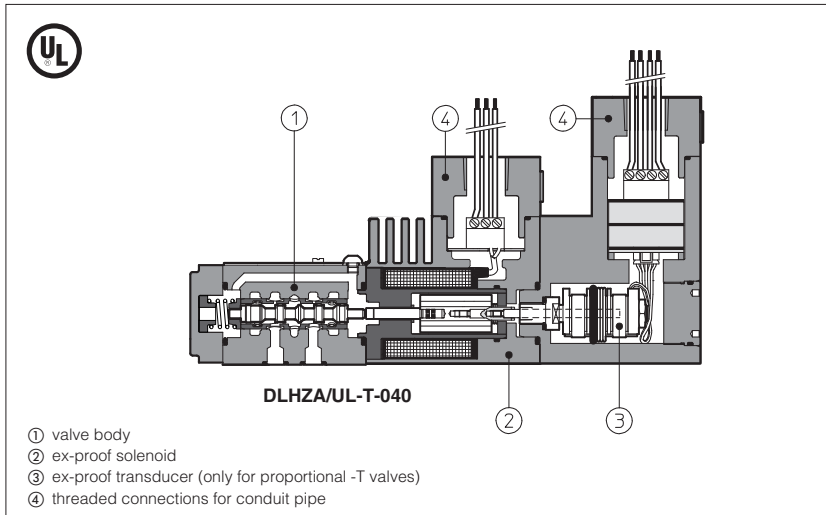


Explosion-proof solenoid valves

on/off and proportional controls - C UL US certification



Explosion-proof on/off and proportional solenoids certified C UL US according to UL 1002 and CSA 22.2 n°139-1982 Standard, Class I, Groups C&D (Groups IIA & IIB to NEC 505-7).

The solenoid case is designed to contain the possible explosion which could be caused by the presence of the gas mixture inside the housing, thus avoiding dangerous propagation in the external environment.

DHA and DLOH valves are conform to **SIL 3** safety level (TÜV approved).

They are also designed to limit the external temperature according to the certified class to avoid the self ignition of the explosive mixture present in the environment.

These solenoids are applied to hydraulic valves for application in explosion-hazardous environments.

1 EXPLOSION PROOF SOLENOIDS: MAIN DATA

SOLENOID TYPE	PROPORTIONAL		ON-OFF
	without transducer	with transducer	
Solenoid code	OZAUL-A	OZAUL-T	OAUL
Voltage code	V _{dc} ±10% 12 DC, 24 DC	12 DC	12DC, 24DC, 110DC, 125DC, 220DC 12AC, 24AC, 110AC, 230AC (1)
Power consumption	35W		12W
Coil insulation	Class H		
Protection degree	IP 67 According to IEC 144 when correctly coupled with the relevant conduit pipe		
Duty factor	100%		
Mechanical construction	Flame proof housing classified, according to UL 1002 and CSA 22.2 n°139-1982, class I, groups C&D (Groups IIA & IIB to NEC 505-7)		
Cable entrance and electrical wiring	Connection 1/2" NPT (ANSI B2.1) for conduit pipe The valves are supplied with 1,07 m (42 inches) cable length factory wired - cable size AWG 16		

(1) For alternating current supply a rectifier bridge is provided built-in the solenoid

2 EXPLOSION PROOF SOLENOIDS: TEMPERATURE DATA

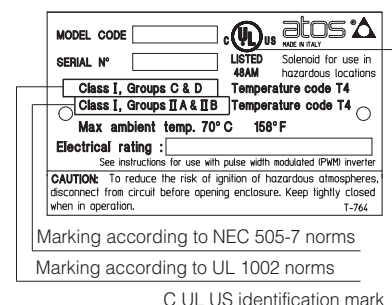
SOLENOID TYPE	PROPORTIONAL	ON/OFF
Method of protection	Ex d	
Temperature class with +70°C ambient temp.	T4	Not applicable
Surface temperature	≤135 °C	≤ 85 °C
Ambient temperature	-40 ÷ +70 °C	

3 CERTIFICATIONS

In the following is resumed the valves marking according to UL 1002 and CSA 22.2 n° 139-1982 certification

- Class I** = Equipment for famable gas and vapours
- Division 1** = Possibility of explosive atmosphere during normal functioning
- Groups C&D** = Gas group (according to UL 1002)
- Groups IIA&IIB** = Gas group (according to NEC 505-7)
- T4** = Temperature class of solenoid surface referred to +70°C ambient temperature

3.1 EXAMPLE OF NAMEPLATE MARKING



4 MODEL CODE OF SPOOL TYPE ON-OFF DIRECTIONAL SOLENOID VALVES

<p>DHA = spool type - direct DPHA = spool type - piloted</p> <p>UL = C UL US certification</p> <p>Valve size (ISO 4401) for DHA 0 = 06 for DPHA 1 = 10 2 = 16 4 = 25 6 = 32</p> <p>Valve configuration, DHA see section 5 and DPHA see section 6</p> <p>Spool type, DHA see section 5 and DPHA see section 6</p> <p>Solenoid threaded connection: NPT = 1/2" NPT ANSI B2.1 (tapered)</p>	<p>/ UL - 0 63 1/2 / NPT / *</p>	<p>24DC</p>	<p>**</p>	<p style="text-align: right;">/*</p> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> Seals material: omit for NBR (mineral oil & water glycol) PE = FPM Low temperature execution: BT = low temperature -40°C </div> <p>Series number</p> <p>Voltage code - see section 1</p> <p>Options: A = solenoid at side of port B (for single solenoid valves) O = horizontal cable entrance MV = vertical hand lever (1) WP = prolonged manual override protected by metallic cap</p> <p>Only for DPHA: /D = Internal drain /E = External pilot pressure /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). /L9 = (only for DPHA-2 and DPHA-4) plug with calibrated restrictor on port P of pilot valve /S = Main spool stroke adjustment (only for DPHA-2, -3)</p>
---	---	--------------------	------------------	--

(1) Option **/MV** available only for DHA, configuration 61, 63, 71 and spool type 0, 0/2, 1, 1P, 1/2, 1/2P, 3, 3P, 4, 7

5 CONFIGURATIONS and SPOOLS

<p>Configurations</p>	<p>Spoils</p>	<p>Configurations</p>	<p>Spoils</p>
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6 CONFIGURATIONS and SPOOLS

<p>Configurations</p>	<p>Spoils</p>	<p>Configurations</p>	<p>Spoils</p>
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NOTES:

- 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, 2, 3, 4, 5, 58, 6, 7, 8, 19, 91**

7 MODEL CODE OF POPPET TYPE, LEAK FREE, DIRECTIONAL SOLENOID VALVES

DLO H - 2 A / NPT - AO/UL / * 24DC ** /*

Directional control valve poppet type, size 06

H = max flow 12 l/min
K = max flow 30 l/min

2 = two way (only for DLOH)
3 = three way

Valve configuration, see section 8
A = open in rest position
C = closed in rest position

Solenoid threaded connection:
NPT = 1/2" NPT ANSI B2.1 (tapered)

(1) Option **/BT** = low temperature -40°C also available on request

Seals material (1):
omit for NBR (mineral oil & water glycol)
PE = FPM

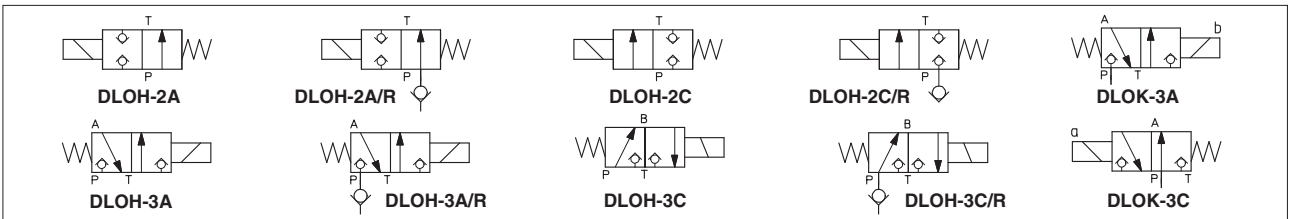
Series number

Voltage code - see section 11

Options:
O = horizontal cable entrance
R = with check valve on port P (only for DLOH)
WP = prolonged manual override protected by metallic cap

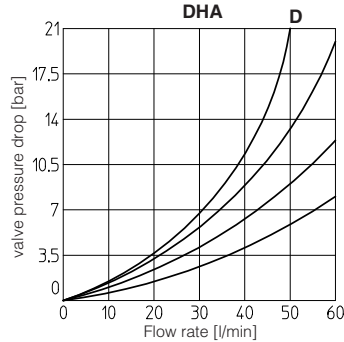
AO/UL = C UL US certification

8 CONFIGURATION OF DLOH/AO/* AND DLOK/AO/*



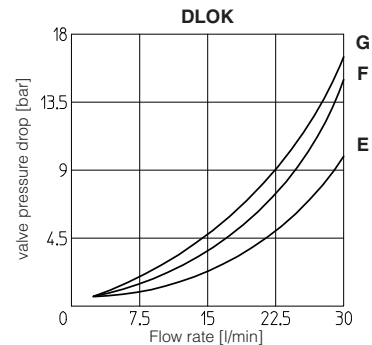
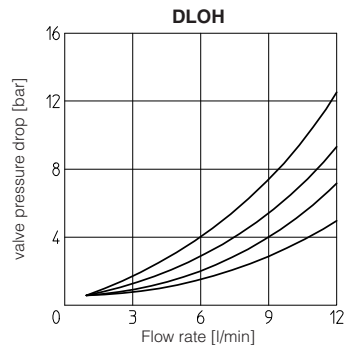
9 Q/Δp DIAGRAMS OF ON/OFF DIRECTIONAL CONTROLS (based on mineral oil ISO VG 46 at 50°C)

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



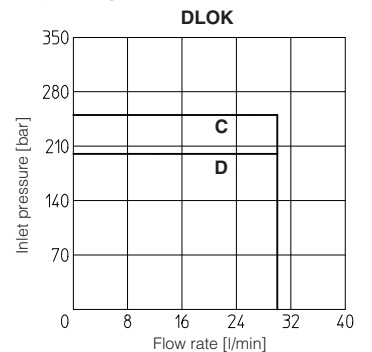
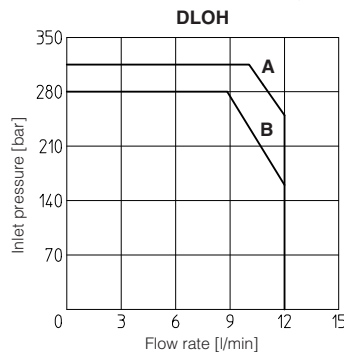
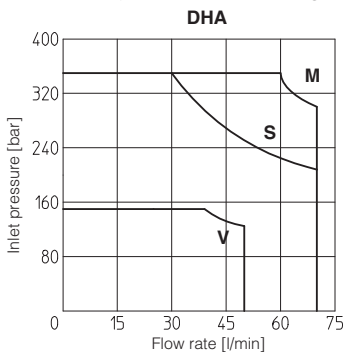
INTERNAL LEAKAGE of DLOH and DLOK less than 5 drops/min (0,36 cm³/min) at max pressure.

Flow direction \ Valve type	P → A (1) (P → B)		A → T (B → T)	
	DLOH-2A	DLOH-2C	DLOH-3A	DLOH-3C
DLOH-2A	B	-		
DLOH-2C	C	-		
DLOH-3A	D	C		
DLOH-3C	C	A		
DLOK-3A	G	F		
DLOK-3C	F	E		



10 OPERATING LIMITS OF ON/OFF DIRECTIONAL CONTROLS (based on mineral oil ISO VG 46 at 50°C)

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



M = Spools 0, 1, 8; **V** = Spools 4, 5.
S = Spools 0/2, 1/2, 3, 6, 7;

A = DLOH-3A;
B = DLOH-2A, DLOH-3C.

C = DLOK-3A;
D = DLOK-3C.

10.1 Max pressure in port T = 210 bar

11 MODEL CODE OF PRESSURE RELIEF VALVES

AGAM - 20 / 2 0 /210/100/100 / NPT - AO/UL / * 24 DC ** /*

AGAM = pressure relief valve: subplate mounting, see tab. C066
ARAM = pressure relief valve: threaded connections, see tab. C045

Valve size for AGAM: **10** (ISO 6264) **20** = G 3/4" **32** (ISO 6264)
 for ARAM: **20** = G 3/4" **32** = G 1 1/4"

Number of the different setting pressure values:
1 = one setting pressure
2 = two setting pressure
3 = three setting pressure

Valve configuration
0 = venting with de-energized solenoid
1 = venting with energized solenoid
2 = without venting

Max regulated pressure of first (second / third) setting see section 12

Seals material (1):
 omit for NBR (mineral oil & water glycol)
PE = FPM

Series number

Voltage Code, see section 11

Options:
E = external pilot
O = horizontal cable entrance
V = regulating handwheel
WP = prolonged manual override protected by metallic cap
Y = external drain

AO/UL = C UL US certification

Solenoid threaded connection:
NPT = 1/2" NPT ANSI B2.1 (tapered)

(1) Option **/BT** = low temperature -40°C also available on request

12 HYDRAULIC CHARACTERISTICS

Valve model	Size 10	Size 20	Size 32
Setting		50; 100; 210; 350	
Max pressure port P [bar]		350	
Pressure range [bar]		4÷50; 6÷100; 7÷210; 8÷350	
Max flow AGAM [l/min]	200	400	600
Max flow ARAM [l/min]	-	350	500

13 MODEL CODE OF COVERS FOR CARTRIDGE VALVES

LIDEW - 1 / NPT - AO/UL - * 24DC ** /*

Cover type:
LIDBH* = with solenoid valve and shuttle valve for pilot selection
LIDEW* = with solenoid valve for pilot selection
 * = valve configuration (see H030 section 2)

Size (ISO 7368)
1 = 16; **4** = 40; **8** = 80 (only for LIDEW);
2 = 25; **5** = 50;
3 = 32; **6** = 63;

Solenoid threaded connection:
NPT = 1/2" NPT ANSI B2.1 (tapered)

Certification type
AO/UL = C UL US certification

Optional different provision or setting of the calibrated plugs in the pilot channels see table H030 sect. 6

Seals material (1):
 omit for NBR (mineral oil & water glycol)
PE = FPM

Series number

Voltage code - see section 11

Options:
B = cartridge piloted via port "B" of solenoid pilot valve
E = external attachments X (1/4" GAS) and underneath port X supplied plugged (only for sizes 40..80)
O = horizontal cable entrance
WP = prolonged manual override protected by metallic cap

Note: for the code of the ISO cartridge to use with the above covers see tab. H003, section 2 and tab. H030, section 3.

(1) Option **/BT** = low temperature -40°C also available on request

14 HYDRAULIC SYMBOLS

15 MODEL CODE OF PROPORTIONAL DIRECTIONAL VALVES

DHZA /UL - T - 0 7 1 - L 5 / NPT / * / * / ** / *

DHZA = size 06
DKZA = size 10
DPZA = size 10
 = size 16
 = size 25

UL = C UL US certification

A = without integral position transducer
T = with integral position transducer (not for DPZA)

Valve size (ISO 4401)
 DHZA DKZA DPZA
0= size 06 **1**= size 10 **1**= size 10
2= size 16 **4**= size 25
6= size 32

Configuration, DHZA and DKZA see section 16, DPZA see section 17
5 = external plus central position, spring centered
7 = 3 position, spring centered

Spool overlapping in central position, DHZA and DKZA see section 16, DPZA see section 17
1 = P, A, B, T positive overlapping
3 = P positive overlapping; A, B, T, negative

Spool type
L = linear; **S** = progressive; **D** = as **S**, but with P-A = Q, P-B = Q/2

(1) Option **/BT** = low temperature -40°C also available on request
 (2) Option **/MV** Available only for DHZA configuration 51, 53, 71, spool type S3, S5, D3, D5, L3, L5

Seals material (1):
 omit for NBR (mineral oil & water glycol)
PE = FPM

Series number

Omit for standard coil 12 Vdc:
24 = with 24 VDC coils (only A version)

Options:
B = solenoid at side of port A (only for single solenoid valves)
C = position transducer with current feedback 4=20 mA (only for -T)
D = internal drain (only for DPZA)
E = external pilot (only for DPZA)
G = pressure reducing valve for piloting (only for DPZA)
MV = vertical hand lever (2)
O = horizontal cable entrance (only for -A)
WP = prolonged manual override protected by metallic cap (only for -A)
Y = external drain (only for DHZA and DKZA)

Solenoid threaded connection:
NPT = 1/2" NPT ANSI B2.1 (tapered)

Spool size: DHZA and DKZA see section 16, DPZA see section 17

16 HYDRAULIC CHARACTERISTICS of DHZA and DKZA (based on mineral oil ISO VG 46 at 50 °C)

Hydraulic symbols *71, *71/B *73, *73/B *51 *53 *51/B *53/B

Valve model	DHZA-A DHZA-T				DKZA-A DKZA-T			
Spool overlapping	1, 3		1, 3		1, 3		1, 3	
Spool type and size	L14		L1		S3, L3, D3		S5, L5, D5	
Pressure limits [bar]	ports P, A, B = 350; T = 160 (250 with external drain /Y)							
Δp max P-T [bar]	70				50			
Max flow [l/min]	70				40			
at Δp = 10 bar (P-T)	1	4,5	8	17	28	45	60	
at Δp = 30 bar (P-T)	2	8	14	30	50	80	105	
max permissible flow	3	12	21	45	60	90	120	
Response time (1) [ms]	< 30 (A) < 15 (T)		< 30 (A) < 15 (T)		< 40 (A) < 20 (T)		< 40 (A) < 20 (T)	
Hysteresis [%]	≤ 5% (A) ≤ 0,2% (T)		≤ 5% (A) ≤ 0,2% (T)		≤ 5% (A) ≤ 0,2% (T)		≤ 5% (A) ≤ 0,2% (T)	
Repeatability	± 1% (A) ± 0,1% (T)		± 1% (A) ± 0,1% (T)		± 1% (A) ± 0,1% (T)		± 1% (A) ± 0,1% (T)	

(1) Response times at step signal (0%→100%) are measured from 10% to 90% of step value and are strictly referred to the valve regulation.

17 HYDRAULIC CHARACTERISTICS OF DPZA (based on mineral oil ISO VG 46 at 50 °C)

Hydraulic symbols *71, *71/B *73 *51 *53 *51/B *53/B

Valve model	DPZA-1			DPZA-2					DPZA-3			DPZA-6			
Spool type and size (1)	L5	S5	D5	S3	D3	L5	S5	D5	L5	S5	D5	L5	S5	D5	
Pressure limits [bar]	Ports P, A, B, X = 350; T = 250; Y = 0														
Max flow [l/min]	600														
at Δp = 10 bar	100	100	100:60	130	130:80	200	180	180:130	390	360	360:220	600	600	600:370	
at Δp = 30 bar	160	160	160:100	225	225:135	340	310	310:225	680	620	620:380	1030	1030	1030:640	
max permissible flow	180	180	180:110	550	550:300	760	640	640:(460)	1450	1350	1350:820	1600	1600	1600:100	
Response time (2) [ms]	< 80			< 100					< 120						
Hysteresis [%]	≤ 5%			≤ 5%					≤ 5%						
Repeatability	± 1%			± 1%					± 1%						

(1) Additional spools and configurations for -T execution, see table F172.

(2) Response times at step signal (0%→100%) are measured from 10% to 90% of step value and are strictly referred to the valve regulation.

ELECTRONIC DRIVERS TO BE USED WITH EX-PROOF PROPORTIONAL VALVES

- Atos driver for proportional valves type -A (without transducer): **E-ME-AC**, see tab. G035
- Atos driver for proportional valves type -T (with transducer): **E-ME-T**, see tab. G140

18 MODEL CODE OF SERVOPROPORTIONAL VALVES

DLHZA / UL - T - 0 4 0 - L 7 3 / NPT / * ** /*

DLHZA = size 06
DLKZA = size 10

UL = C UL US certification

T = with integral position transducer

Valve size (ISO 4401)
0 = size 06 (DLHZA)
1 = size 10 (DLKZA)

Configuration, see section 19
4 = spring offset with fail safe
6 = spring offset

Spool overlapping in central position, see section 19
0 = P, A, B, T zero overlapping

Spool type
L = linear; **T** = not linear;

Seals material (1):
omit for NBR (mineral oil & water glycol)
PE = FPM

Series number

Options:
B = solenoid at side of port A
C = position transducer with current feedback 4÷20 mA
Y = external drain

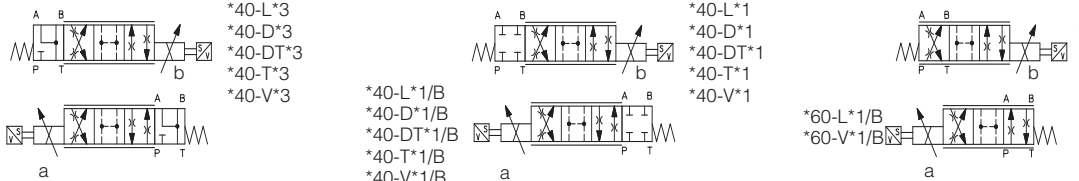
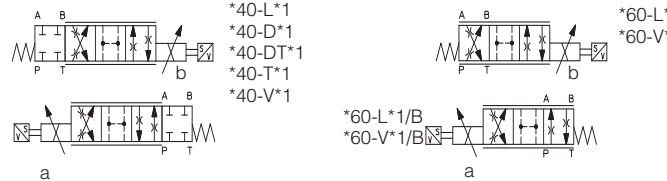
Solenoid threaded connection:
NPT = 1/2" NPT ANSI B2.1 (tapered)

Fail safe configuration:
1 = A, B, P, T with positive overlapping **3** = P, positive overlapping; A, B, T negative

Spool size: see section 19

(1) Option **/BT** = low temperature -40°C also available on request

19 HYDRAULIC CHARACTERISTICS (based on mineral oil ISO VG 46 at 50 °C)

Hydraulic symbols																		
Valve model	DLHZA-T*										DLKZA-T*							
Pressure limits [bar]	ports P, A, B = 350; T = 160 (250 with external drain /Y)										ports P, A, B = 315; T = 160 (250 with external drain /Y)							
Δp max P-T	70										60							
Spool	L0	L1	V1	L3	V3	L5	T5	L7	T7	V7	D7	DT7	L3	L7	T7	V7	D7	DT7
Max flow at Δp = 30 bar	2,5	4,5	5	9	13	18				26	26÷13		40		65		65÷33	
max permissible flow	4	7	8	14	20	28				40	40÷20		55		80		80÷40	
Leakage [cm³/min] at P = 100 bar (1)	<100	<200	<100	<300	<150	<500	<200	<900	<200	<200	<700	<200	<1000	<1500	<400	<400	<1200	<400
Response time [ms]	≤ 10										≤ 15							
Hysteresis [%]	≤ 0,1%										≤ 0,1%							
Thermal drift	zero point displacement < 1% at ΔT = 40°C																	

(1) Referred to spool in center position and 50°C oil temperature.

20 MODEL CODE OF PRESSURE COMPENSATED PROPORTIONAL FLOW CONTROL VALVES

QVHZA / UL - T - 06 / 12 / NPT / * / * ** /*

QVHZA = size 06
QVKZA = size 10

UL = C UL US certification

A = without position transducer
T = with integral position transducer

Valve size (ISO 4401)
QVHZA: **06** QVKZA: **10**

Max regulated flow:
QVHZA QVKZA
3 = 3,5 l/min; **36** = 36 l/min; **65** = 65 l/min
12 = 12 l/min; **45** = 45 l/min; **90** = 90 l/min
18 = 18 l/min;

Seals material (1):
omit for NBR (mineral oil & water glycol)
PE = FPM

Series number



Omit for standard coil 12 Vdc:
24 = with 24 VDC coils (only A version)

Options:
C = current feedback signal 4÷20 mA (only for -T versions)
D = quick venting
O = horizontal cable entrance (only for -A versions)
WP = prolonged manual override protected by metallic cap (only for valves without transducer)

Solenoid threaded connection:
NPT = 1/2" NPT ANSI B2.1 (tapered)

(1) Option **/BT** = low temperature -40°C also available on request

21 HYDRAULIC CHARACTERISTICS (based on mineral oil ISO VG 46 at 50 °C)

Hydraulic symbols	 <p>QVHZA-A QVKZA-A</p>	 <p>QVHZA-T QVKZA-T</p>														
Note: In three-way versions port P is open. In two-way versions port P must be plugged. Port T must always be plugged.																
Valve model	QVHZA-A					QVHZA-T					QVKZA-A		QVKZA-T			
Valve size	06					06					10		10			
Max pressure ports P, A, B	210															
Max regulated flow [l/min]	3,5	12	18	36	45	3,5	12	18	35	45	65	90	65	90		
Min regulated flow (1) [cm³/min]	15	20	30	50	60	15	20	30	50	60	85	100	85	100		
Regulating Δp [bar]	4 - 6		10 - 12			15	4 - 6		10 - 12			15	6 - 8	10 - 12	6 - 8	10 - 12
Max flow on port A [l/min]	40		35	50	55	50					60	70	100	70	100	

Above performance data refer to valves coupled with Atos electronic drivers.

(1) Values are referred to 3-way configuration. In the 2-way configuration, the values of min regulated flow are higher

22 MODEL CODE OF PROPORTIONAL PRESSURE RELIEF AND COMPENSATOR VALVES

RZMA / UL - A - 010 / 250 / NPT / * / * ** / *

Pressure relief:
RZMA = subplate size 06
HZMA = modular size 06
AGMZA = subplate size 10, 20, 32
LIMZA = cartridge (1)
 Pressure compensator:
LICZA = cartridge (1)

UL = C UL US certification

A = without integral pressure transducer

Valve size:
 see section 23 for size code

Max regulated pressure:
 see section 23

(1) For the code of the ISO cartridge to use with LIMZA and LICZA, see tab. F300 section 2.
 (2) Option **/BT** = low temperature -40°C also available on request

Seals material (2):
 omit for NBR (mineral oil & water glycol)
PE = FPM

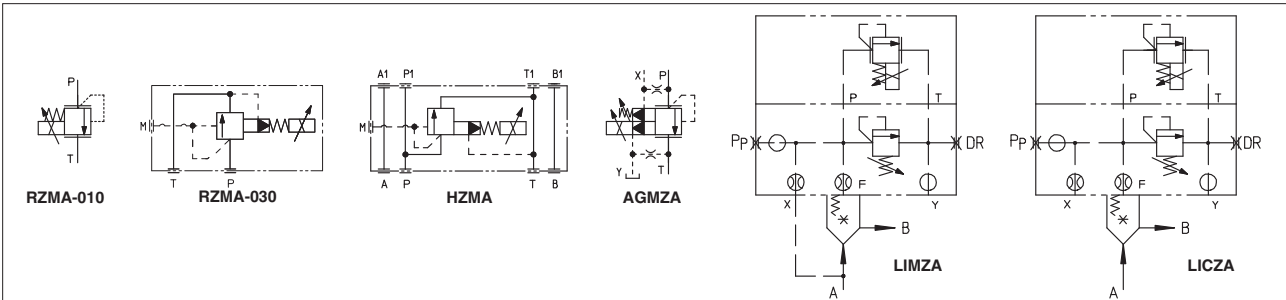
Series number

Omit for standard coil 12 Vdc:
24 = with 24 VDC coils (only A version)

Options:
E = external pilot (only for AGMZA)
O = horizontal cable entrance
P = with integral mechanical pressure limiter (only for L1*ZA)
Y = external drain (only for AGMZA)

Solenoid threaded connection:
NPT = 1/2" NPT ANSI B2.1 (tapered)

23 HYDRAULIC CHARACTERISTICS



Valve model	RZMA			HZMA			AGMZA			LIMZA						LICZA				
Size code	010	030	030	10	20	32	1	2	3	4	5	6	8	1	2	3	4	5		
Valve size	06			10	20	32	16	25	32	40	50	63	80	16	25	32	40	50		
Max regulated pressure [bar]							80;			180;			250							
Max pressure at port P, A, B, X [bar]							315													
Max pressure at port T, Y [bar]							210													
Max flow [l/min]	4	40	40	200	400	600	200	400	750	1000	2000	3000	4500	200	400	750	1000	2000		

24 MODEL CODE OF PROPORTIONAL PRESSURE REDUCING VALVES

RZGA / UL - A - 010 / 250 / NPT / * / * ** / *

Pressure reducing:
RZGA = subplate size 06
HZGA = modular size 06
KZGA = modular size 10
AGRCZA = subplate size 10, 20
LIRZA = cartridge

UL = C UL US certification

A = without integral transducer

Valve size:
 see section 23 for size code

Max regulated pressure:
 see section 23

Note: for the code of the ISO cartridge to use with LIRZA, see tab. F300 section 2.
 (1) Option **/BT** = low temperature -40°C also available on request

Seals material (1):
 omit for NBR (mineral oil & water glycol)
PE = FPM

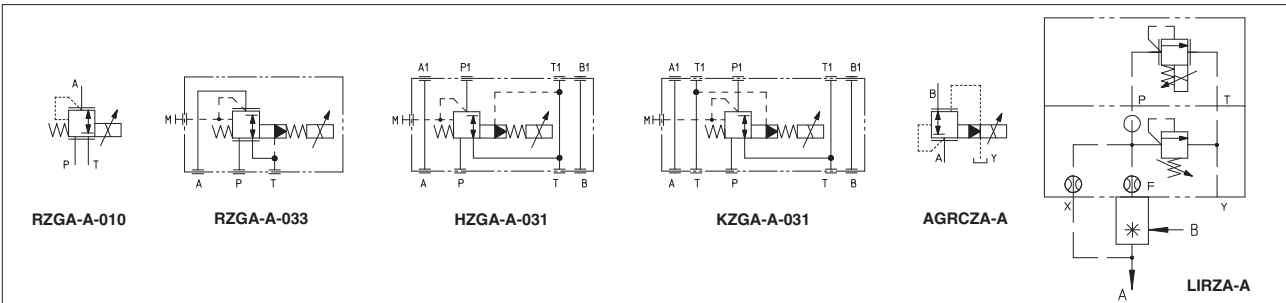
Series number

Omit for standard coil 12 Vdc:
24 = with 24 Vdc coils (only A version)

Options:
O = horizontal cable entrance (1)
P = with integral mechanical pressure limiter (only for AGRCZA and LIRZA)
R = with check valve (only for AGRCZA)

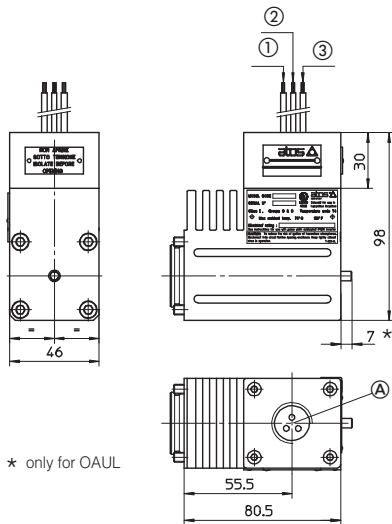
Solenoid threaded connection:
NPT = 1/2" NPT ANSI B2.1 (tapered)

25 HYDRAULIC CHARACTERISTICS



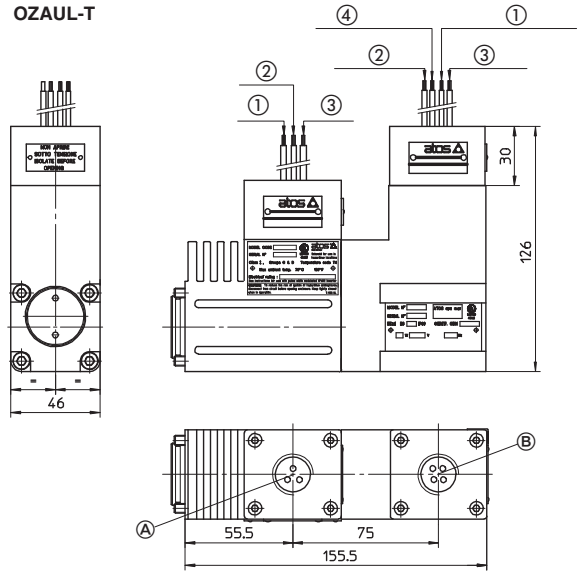
Valve model	RZGA		HZGA	KZGA	AGRCZA		LIRZA			
Size code	010	033	031	031	10	20	1	2	3	4
Valve size	06			10	10	20	16	25	32	40
Max regulated pressure [bar]	32; 100; 210				80;		180;		250	
Min regulated pressure [bar]	0.8	1	1	1	1	1	7	7	7	7
Max pressure at port P [bar]	315									
Max pressure at port T [bar]	210									
Max flow [l/min]	12	40	40	100	160	300	160	300	550	800

**OAUL
OZAUL-A**

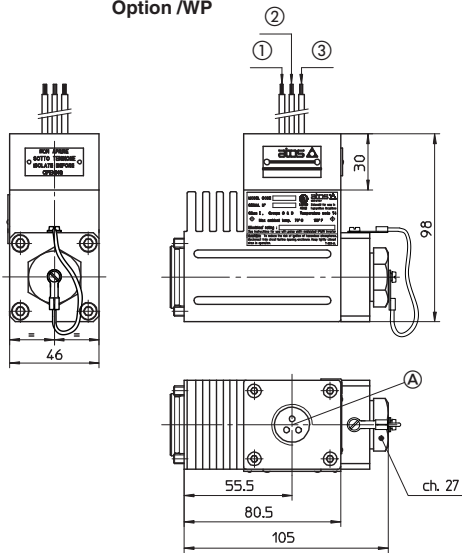


* only for OAUL

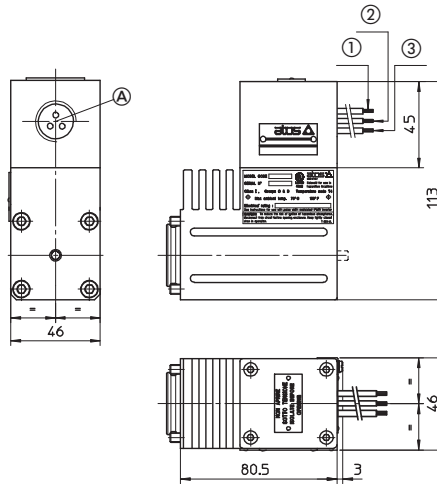
OZAUL-T



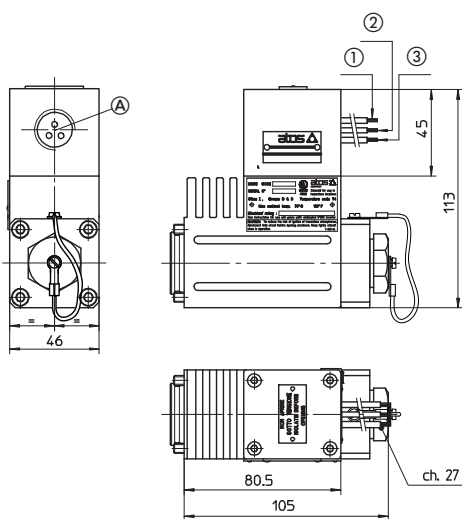
Option /WP



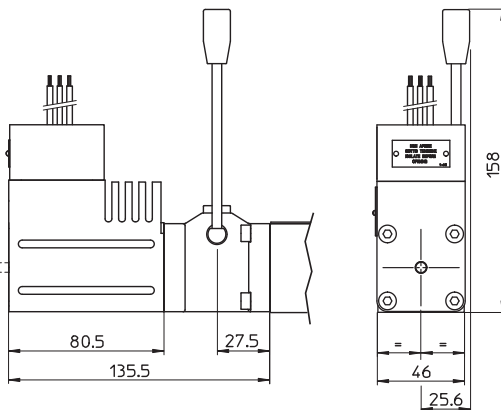
Option /O



Option /OWP



Option /MV



(A) Solenoid wiring (connection 1/2" NPT)

OAUL-*AC

- ① white = Coil (neutral)
- ② green = GND
- ③ black = Coil

OAUL-*DC

- ① red = +
- ② green = GND
- ③ black = -

OZAUL

- ① red = Coil
- ② green = GND
- ③ black = Coil

(B) Position transducer wiring (connection 1/2" NPT)

- ① white = Output signal
- ② black = Supply -15 V
- ③ red = Supply +15 V
- ④ yellow = GND

The valves are supplied with 1 m (42 inches) cable length, factory wired - cable size AWG 16