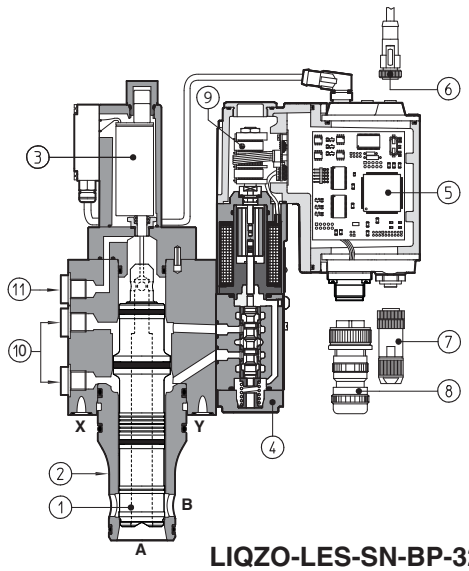
Proportional 2-way cartridges high performance

digital, with two position transducers, ISO 7368 sizes from 16 to 100, rugged design



① Poppet
② Sleeve
③ Main stage position transducer
④ Pilot valve
⑤ Integral electronics
⑥ USB connector
⑦ Fieldbus connectors
⑧ Main connector
⑨ Pilot valve position transducer
⑩ Air bleeding
⑪ Air suction port

LIQZO-LES-SN-BP-322L4

LIQZO-LEB, LIQZP-LEB
LIQZO-LES, LIQZP-LES

High Performance 2-way proportional cartridge valves specifically designed for high speed closed loop controls.
They are equipped with two LVDT position transducers for best dynamics in not compensated flow regulations.
The cartridge execution for blocks installation grants high flow capabilities and minimized pressure drops.
The integral digital electronic driver performs the valve's hydraulic regulation according to the reference signal and assures valve-to-valve interchangeability thanks to the factory presetting.
High performances valves are available in LEB basic execution with analog reference signals and USB port for software functional parameters setting or in LES full execution which includes also optional fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics

LIQZO: sizes from **16** to **40**,
Max flow: **600** to **2500 l/min**
Max pressure: **350 bar**

LIQZP: sizes from **50** to **100**,
Max flow: **4000** to **16.000 l/min**
Max pressure: **420 bar**

1 MODEL CODE

LIQZO	-	L	ES	-	SN	-	NP	-	25	2	L4	/	*	**	/	*

LIQZO - Proportional cartridge
LIQZO = size 16 to 40, Pmax 350 bar
LIQZP = size 50 to 100, Pmax 420 bar

L = closed-loop two LVDT transducers

Integral digital drivers:
EB = basic **(1)**
ES = full

Alternated P/Q controls - see section 3
SN = none

Fieldbus interfaces, USB port always present:
NP = Not present **(1)**
BC = CANopen
BP = PROFIBUS DP
EW= POWERLINK
EH = EtherCAT
EI = EtherNet/IP
EP = PROFINET IRT

Valve size, see section 3

LIQZO =	**16**	**25**	**32**	**40**
l/min	250	500	800	1200
LIQZP =	**50**	**63**	**80**	**100**
l/min	2000	3000	4500	7200

Nominal flow (l/min) at Δp 5 bar

Poppet type - regulating characteristics:
L4 = linear

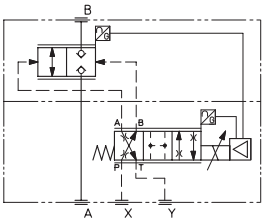
Electronic options, see sections 9
I = current reference input and monitor 4÷20 mA (omit for standard voltage reference input and monitor ±10 V)
F = fault signal
Q = enable signal
Z = double power supply **(2)**, enable, fault and monitor signals (12 pin connector)

Seals material, see sect. 5, 6:
- = NBR
PE = FKM
BT = HNBR

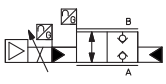
Series number

Configuration: 2 = 2 way

functional symbol



simplified symbol



(1) LEB available only in version **SN-NP** **(2)** Double power supply only for **LES**

2 GENERAL NOTES

LIQZO-LEB, LES and LIQZP-LEB, LES proportional cartridges are **CE** marked according to the applicable Directives (e.g. Immunity/Emission EMC Directive and Low Voltage Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in table F003 and in the installation notes supplied with relevant components.
The electrical signals of the valve (e.g. monitor signals) must not be directly used to activate safety functions, or components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

WARNING
To avoid overheating and possible damage of the electronic driver, the valves must be never energized without hydraulic supply to the pilot stage. In case of prolonged pauses of the valve operation during the machine cycle, it is always advisable to disable the driver (option /Q or /Z)
A safety fuse 2,5 A installed on 24VDC power supply of each valve is always recommended, see also Power supply note at sections 9

WARNING
The loss of the pilot pressure causes the undefined position of the main poppet.
The sudden interruption of the power supply during the valve operation causes the immediate shut-off of the main poppet.
This could cause pressure surges in the hydraulic system or high decelerations which may lead to machine damages.

3 FIELDBUS - only for LES

Fieldbus allows the direct communication of the proportional valve with machine control unit for digital reference signal, diagnostics and settings of functional parameters. Analog reference signal remain available on the main connector for quick commissioning and maintenance. For detailed information about fieldbus features and specification see tech table **GS510**.

4 MAIN CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Assembly position	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, see technical table P007			
Ambient temperature range	**standard** = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C			
Storage temperature range	**standard** = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Max. solenoid current	2,6 A			
Max. power	50 Watt			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66/67 with mating connector			
Tropicalization	Tropical coating on electronics PCB			
Duty factor	Continuous rating (ED=100%)			
EMC, climate and mechanical load	See technical table G004			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK EtherNet/IP, PROFINET IO RT/IRT IEC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Size		**16**	**25**	**32**	**40**	**50**	**63**	**80**	**100**
Max regulated flow [l/min]									
Δp A-B	at Δp = 5 bar	250	500	800	1200	2000	3000	4500	7200
	at Δp = 10 bar	350	700	1100	1700	2800	4250	6350	10200
Max permissible flow		600	1200	1800	2500	4000	6000	10000	16000
Max pressure [bar]	**LIQZO**	Ports A, B = **350** X = 350 Y ≤ 10							
	LIQZP	Ports A, B = **420** X = 350 Y ≤ 10							
Nominal flow of pilot valve at Δp = 70 bar [l/min]		4	8	20	40	40	100	100	100
Leakage of pilot valve at P = 100 bar [l/min]		0,2	0,2	0,3	0,7	0,7	1	1	1
Piloting pressure [bar]		min: 40% of system pressure max 350 recommended 140 ÷ 160							
Piloting volume [cm³]		1,6	2,2	7,0	9,4	17,7	32,5	39,5	49,5
Piloting flow **(1)** [l/min]		4	5,3	14	19	35,5	56	60	60
Response time 0 ÷ 100% step signal **(2)** [ms]		24	25	28	30	30	35	40	50
Hysteresis [% of the max regulation]		≤ 0,1							
Repeatability [% of the max regulation]		± 0,1							
Thermal drift		zero point displacement < 1% at ΔT = 40°C							

Note:
above performance data refer to valves coupled with Atos electronic drivers, see section 6.
(1) with step reference input 0÷100% **(2)** with pilot pressure = 140 bar, see datailed diagrams in section 7.2

5 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 ÷ +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	20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Fluid contamination class	ISO 4406 class 20/18/15 NAS 1638 class 9, in line filters of 10 μm (β10 ≥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	

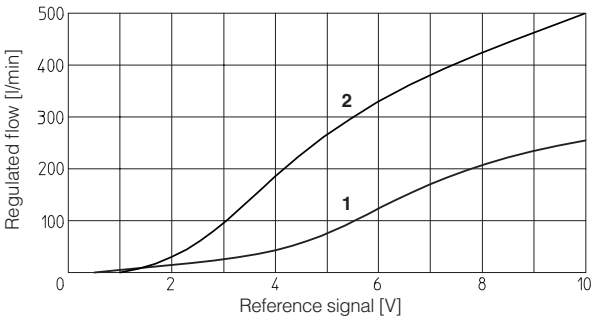
6 ELECTRONIC DRIVERS

Valve model	**LEB**	**LES**
Drivers model	E-RI-LEB-N	E-RI-LES-N
Type	Digital	
Format	Integral to valve	
Data sheet	GS208	GS210

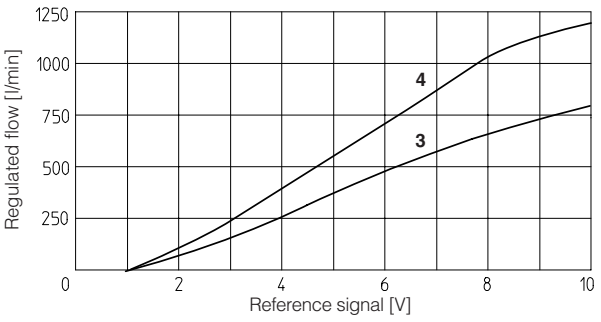
Note: for main and communication connector see sections 11 , 12

7 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

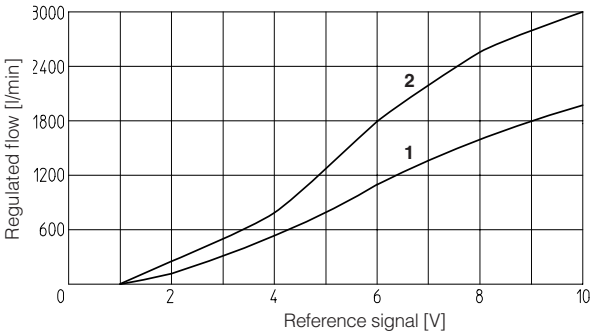
7.1 Regulation diagrams (values measured at Δp 5 bar)



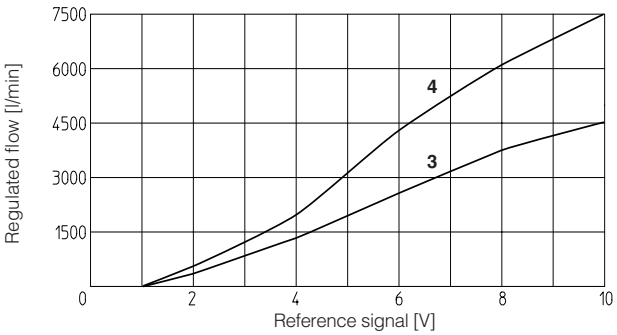
1 = LIQZO-L*-16*
2 = LIQZO-L*-25*



3 = LIQZO-L*-32*
4 = LIQZO-L*-40*



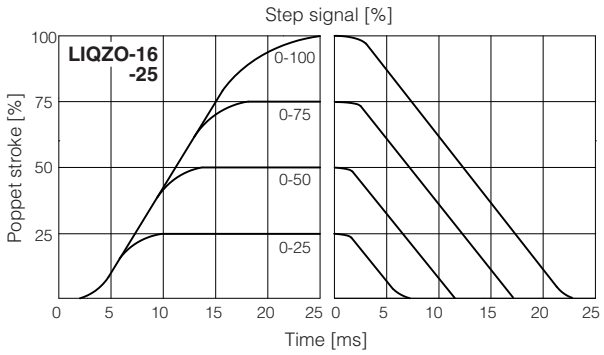
1 = LIQZP-L*-50*
2 = LIQZP-L*-63*

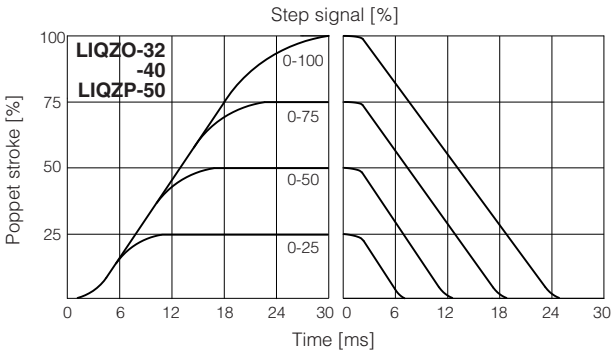


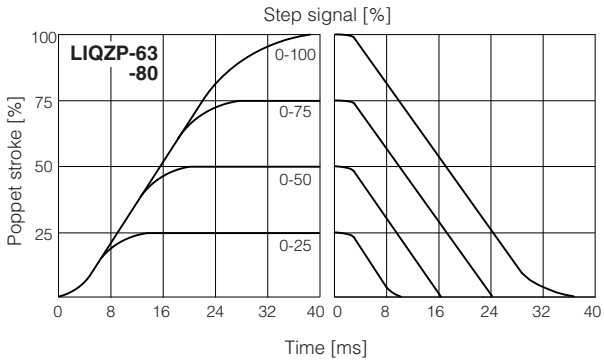
3 = LIQZP-L*-80*
4 = LIQZP-L*-100*

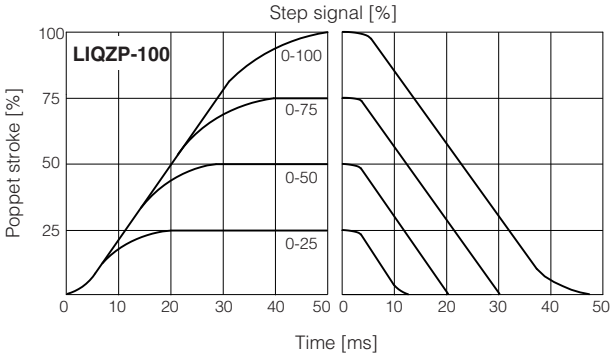
7.2 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.

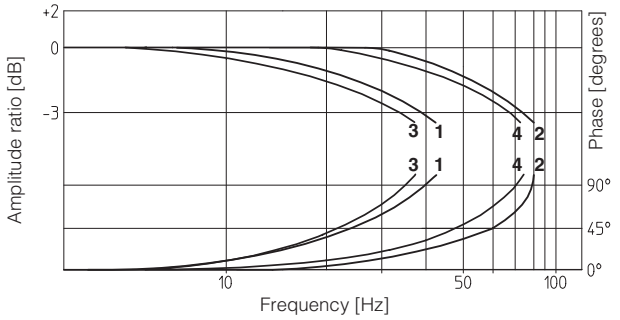




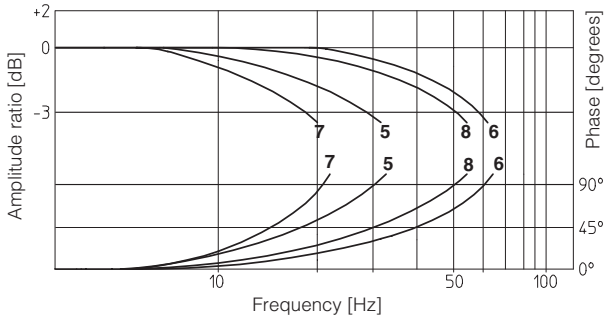




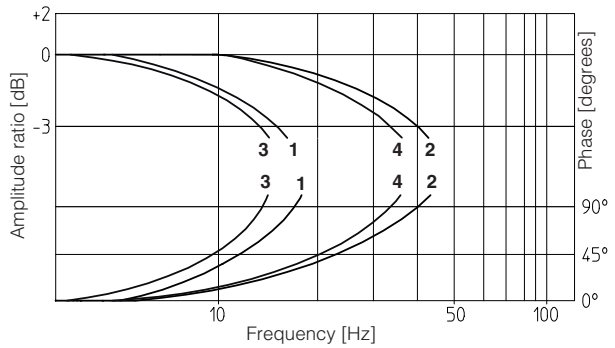
7.3 Bode diagrams - stated at nominal hydraulic conditions



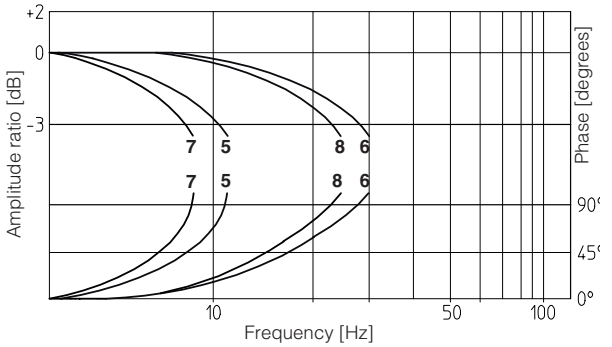
1 = LIQZO-L*-16*: 10% ↔ 90% **3** = LIQZO-L*-25*: 10% ↔ 90%
2 = LIQZO-L*-16*: 50% ± 5% **4** = LIQZO-L*-25*: 50% ± 5%



5 = LIQZO-L*-32*: 10% ↔ 90% **7** = LIQZO-L*-40*: 10% ↔ 90%
6 = LIQZO-L*-32*: 50% ± 5% **8** = LIQZO-L*-40*: 50% ± 5%



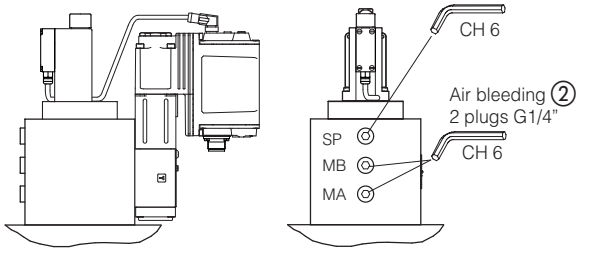
1 = LIQZP-L*-50*: 10% ↔ 90% **3** = LIQZP-L*-63*: 10% ↔ 90%
2 = LIQZP-L*-50*: 50% ± 5% **4** = LIQZP-L*-63*: 50% ± 5%



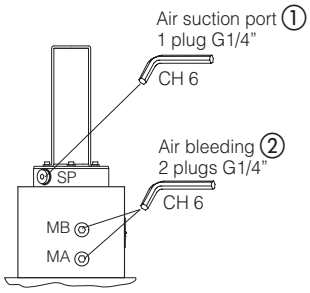
5 = LIQZP-L*-80*: 10% ↔ 90% **7** = LIQZP-L*-100*: 10% ↔ 90%
6 = LIQZP-L*-80*: 50% ± 5% **8** = LIQZP-L*-100*: 50% ± 5%

8 AIR BLEEDING

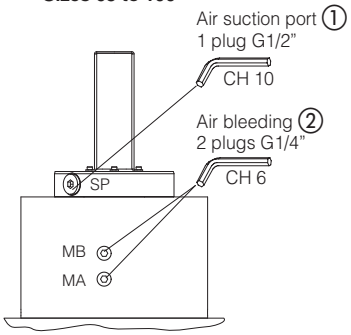
Size 16 to 40



Size 50



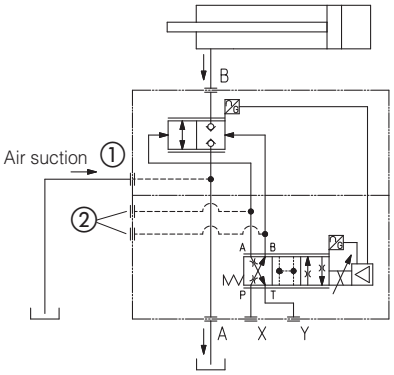
Sizes 63 to 100



① To be used only in case port A is connected to tank and subjected to negative pressure, consult our technical office.

② At the machine commissioning it is advisable to bleed the air from piloting chambers, by loosening the 2 plugs shown in the picture.

Operate the valve for few seconds at low pressure and then lock the plugs.



9 ELECTRONIC OPTIONS

Standard driver execution provides on the 7 pin main connector:

Power supply - 24 VDC must be appropriately stabilized or rectified and filtered; **2,5 A** fuse time lag is required in series to each driver power supply. Apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers

Reference input signal - analog differential input with ±10 VDC nominal range (pin D, E), proportional to desired valve poppet position

Monitor output signal - analog output signal proportional to the actual valve's poppet position with ±10VDC nominal range

Note: a minimum booting time between 400 and 800 ms has be considered from the driver energizing with the 24 VDC power supply before the valve has been ready to operate. During this time the current to the valve coils is switched to zero.

9.1 Option /F

It provides a Fault output signal in place of the Monitor output signal, to indicate fault conditions of the driver (cable interruption of poppet transducers or reference signal - for /I option): Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC

9.2 Option /I

It provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ +10 V.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 V or ±20 mA.

It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

9.3 Option /Q

To enable the driver, supply 24 VDC on pin C referred to pin B: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to maintain active the communication and the other driver functions when the valve has to be disabled. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

9.4 Option /Z

It provides, on the 12 pin main connector, the following additional features:

Enable Input Signal

To enable the driver, supply 24 VDC on pin 3 referred to pin 2: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to maintain active the communication and the other driver functions when the valve has to be disabled. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

Fault Output Signal

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4÷20mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC (pin 11 referred to pin 2): Fault status is not affected by the Enable input signal

Power supply for driver's logics and communication - only for **LES**

Separate power supply (pin 9,10) allow to cut solenoid power supply (pin 1,2) while maintaining active diagnostics, USB and fieldbus communication. A safety fuse is required in series to each driver power supply: 500 mA fast fuse.

9.5 Possible combined options

/FI, /IQ and **/IZ**

10 ELECTRONIC CONNECTIONS AND LEDS

10.1 Main connector signals - 7 pin - standard, **/F** and **/Q** options (A1)

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**			Power supply 24 VDC Rectified and filtered: VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)	Input - power supply
B	**V0**			Power supply 0 VDC	Gnd - power supply
C	**AGND**		**AGND**	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 VDC) or disable (0 VDC) the valve, referred to V0	Input - on/off signal
D	**Q_INPUT+**			Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ +10 V for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**			Negative reference input signal for Q_INPUT+	Input - analog signal
F	**Q_MONITOR** referred to: AGND | V0			Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ +10 V for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
			FAULT	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
G	**EARTH**			Internally connected to the driver housing	

10.2 Main connector signal - 12 pin - **/Z** option (A2)

PIN	LEB-SN /Z	LES-SN /Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**		Power supply 24 VDC Rectified and filtered: VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)	Input - power supply
2	**V0**		Power supply 0 VDC	Gnd - power supply
3	**ENABLE** referred to: V0 | VL0		Enable (24 VDC) or disable (0 VDC) the valve	Input - on/off signal
4	**Q_INPUT+**		Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ +10 V for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**		Negative reference input signal for Q_INPUT+	Input - analog signal
6	**Q_MONITOR** referred to: AGND | VL0		Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ +10 V for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
7	**AGND**		Analog ground	Output - analog signal
		NC	Do not connect	Gnd - analog signal
8	**R_ENABLE**		Repeat enable, output repeter signal of enable input, referred to V0	
		NC	Do not connect	Output - on/off signal
9	**NC**		Do not connect	
		VL+	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**NC**		Do not connect	
		VL0	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT** referred to: V0 | VL0		Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
PE	**EARTH**		Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

10.3 Communications connectors (B) - (C)

(B) **USB connector - M12 - 5 pin** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Supply for external USB Flash Drive
2	**ID**	USB Flash Drive identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) (C2) **BC fieldbus execution, connector - M12 - 5 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**CAN_SHLD**	Shield
2	**not used**	(C1) - (C2) pass-through connection (2)
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

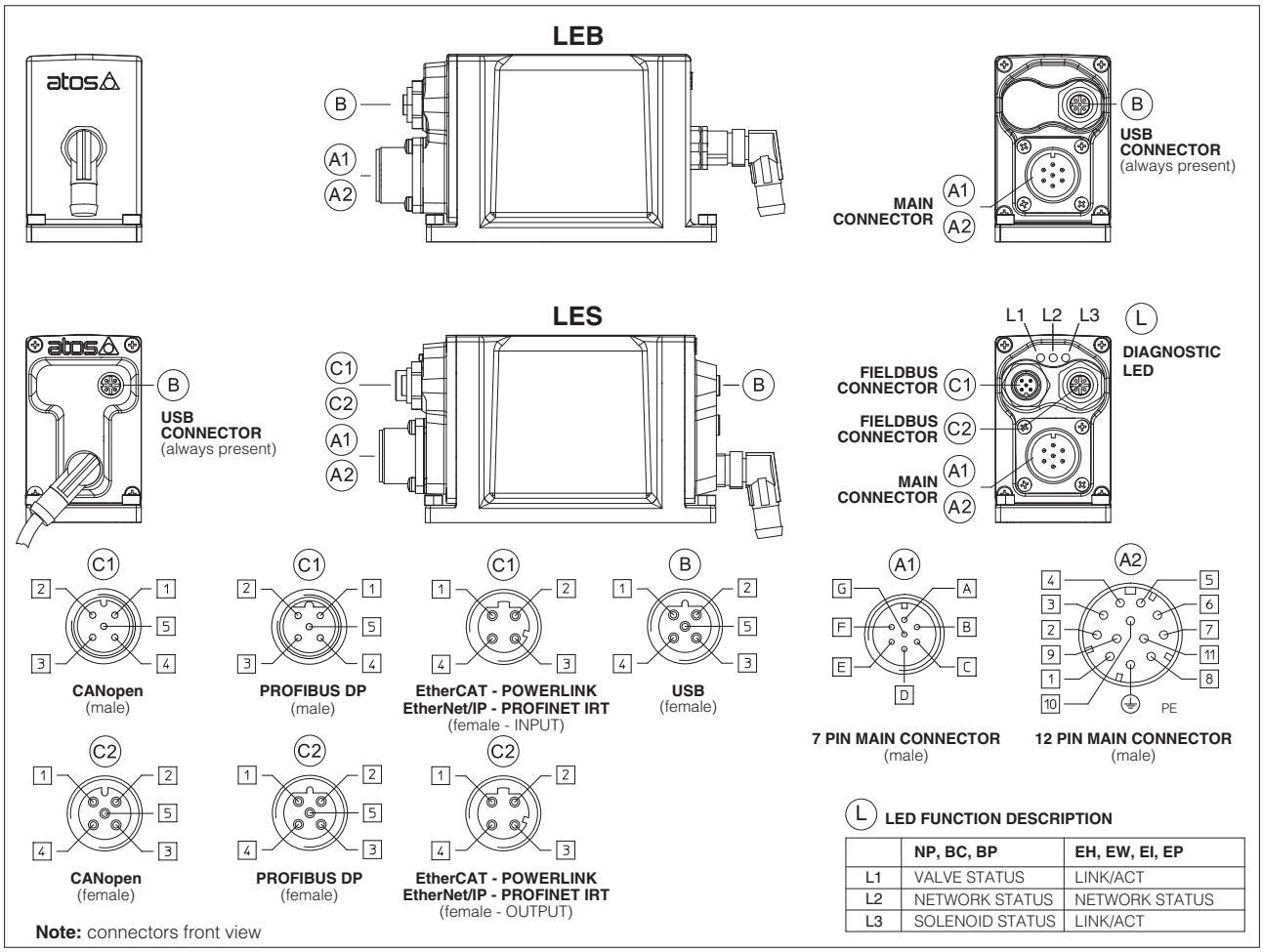
(C1) (C2) **BP fieldbus execution, connector - M12 - 5 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C1) (C2) **EH, EW, EI, EP fieldbus execution,connector - M12 - 4 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

Notes: (1) shield connection on connector's housing is recommended

(2): pin 2 can be fed with external +5V supply of CAN interface

10.5 Connections layout

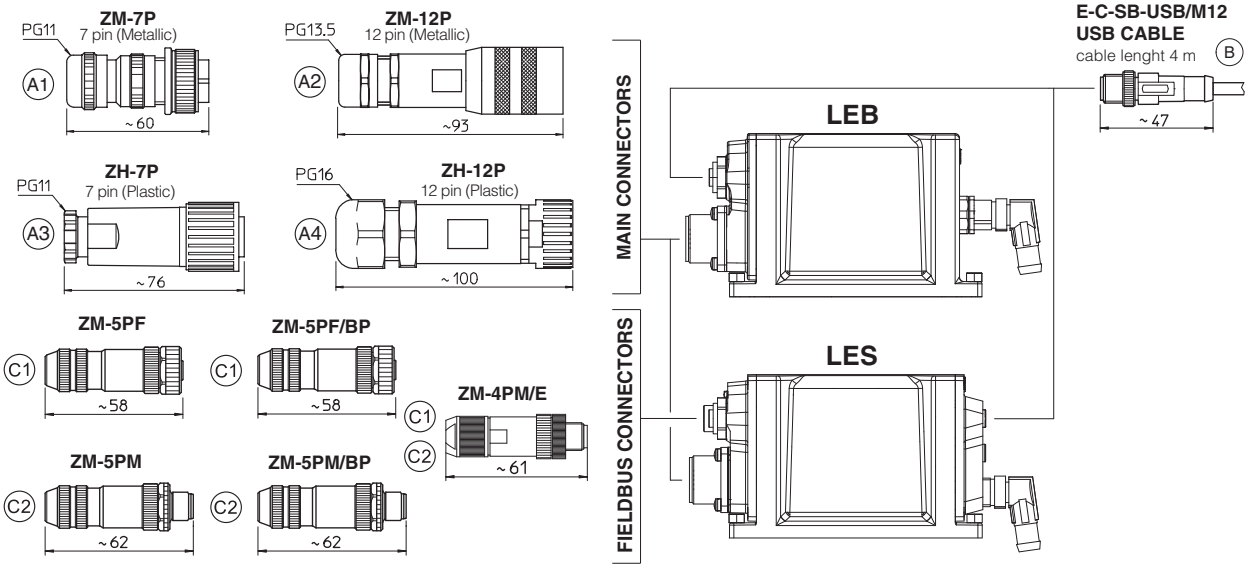


Note: connectors front view

L LED FUNCTION DESCRIPTION

	NP, BC, BP	EH, EW, EI, EP
L1	VALVE STATUS	LINK/ACT
L2	NETWORK STATUS	NETWORK STATUS
L3	SOLENOID STATUS	LINK/ACT

11 CONNECTORS



Note: the use of metallic connectors is strongly recommended to meet EMC performance

12 MODEL CODES OF MAIN CONNECTORS AND COMMUNICATION CONNECTORS - to be ordered separately

VALVE VERSION	LEB LES	LEB /Z LES /Z	BC	BP	EH, EW, EI, EP
CONNECTOR CODE	ZM-7P (A1)	ZM-12P (A2)	ZM-5PF (C1)	ZM-5PF/BP (C1)	ZM-4PM/E (C1)
	ZH-7P (A3)	ZH-12P (A4)	ZM-5PM (C2)	ZM-5PM/BP (C2)	ZM-4PM/E (C2)
PROTECTION DEGREE	IP67				
DATA SHEET	GS208, GS210, K500				

only for **LES**

13 PROGRAMMING TOOLS - see table **GS500**

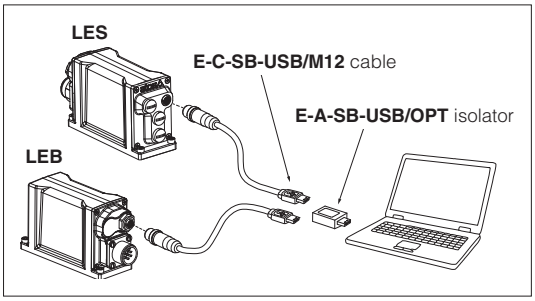
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver. For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options:

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET IRT)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated!
The use of isolator adapter is highly recommended for PC protection (see table **GS500**)

USB connection



14 FASTENING BOLTS and VALVE MASS

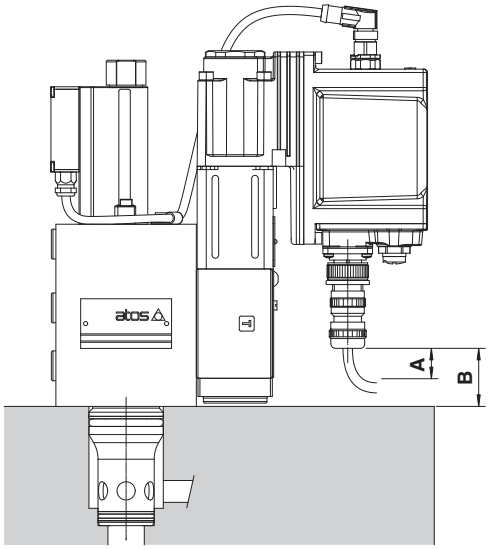
LIQZO			
Size	Fastening bolts class 12.9 **(1)**	Tightening torque	Mass (Kg)
16	N°4 M8x90	35 Nm	5,6
25	N°4 M12x100	125 Nm	8,2
32	N°4 M16x60	300 Nm	10,9
40	N°4 M20x70	600 Nm	16,7

LIQZP			
Size	Fastening bolts class 12.9 **(1)**	Tightening torque	Mass (Kg)
50	N°4 M20x80	600 Nm	23,9
63	N°4 M30x120	2100 Nm	44
80	N°8 M24x80	1000 Nm	71,6
100	N°8 M30x120	2100 Nm	122,5

(1) Fastening bolts supplied with the valve

15 MAIN CONNECTORS INSTALLATION DIMENSIONS

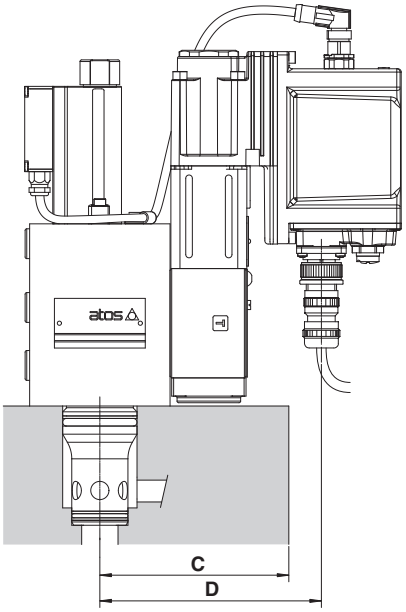
Installation 1 - possible interference between manifold and main connector



A = 15 mm space to remove the 7 or 12 pin main connectors

B = Clearance between main connector to valve's mounting surface. See the below table to verify eventual interferences, depending to the valve size and connector type

Installation 2 - no interference



C = Max manifold dimension to avoid interference with the main connector, see below table

Reference dimension	Main connector code	Valve size							
		16	**25**	**32**	**40**	**50**	**63**	**80**	**100**
B	ZM-7P	32	32	32	32	45	68	68	80
	ZH-7P	**Note 1**	**Note 1**	**Note 1**	**Note 1**	29	52	52	64
	ZM-12P	**Note 1**	**Note 1**	**Note 1**	**Note 1**	**Note 1**	35	35	47
	ZH-12P	**Note 1**	**Note 1**	**Note 1**	**Note 1**	**Note 1**	**Note 1**	**Note 2**	40
C (max)	-	104	114	121	134	141	172	202	229
D	-	124	134	141	154	161	192	222	249

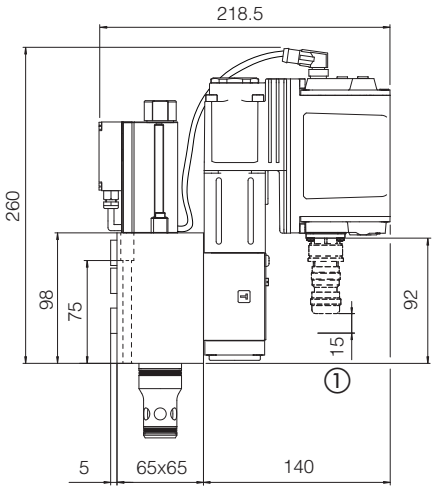
Above dimenions refer to the main connector fully screwed to driver's connector. The space **A** = 15 mm to remove the connector must be considered

Note 1: the connector installation can be performed only if the valve's driver protrudes from the edge of the relevant mounting manifold as rapresented in above "Installation 2"

Note 2: the connector installation may be critic, depending to the cable size and bending radius

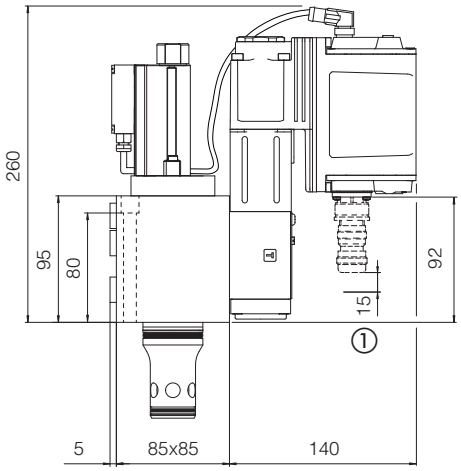
16 INSTALLATION DIMENSIONS [mm]

LIQZO-LEB-162
LIQZO-LES-162



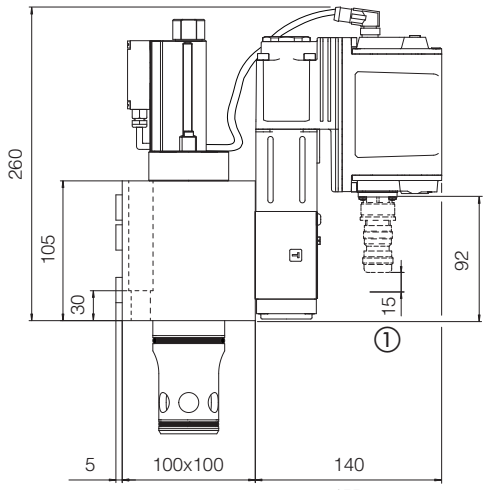
for **EW** - POWERLINK,
EI - EtherNet/IP,
EP- PROFINET IRT

LIQZO-LEB-252
LIQZO-LES-252



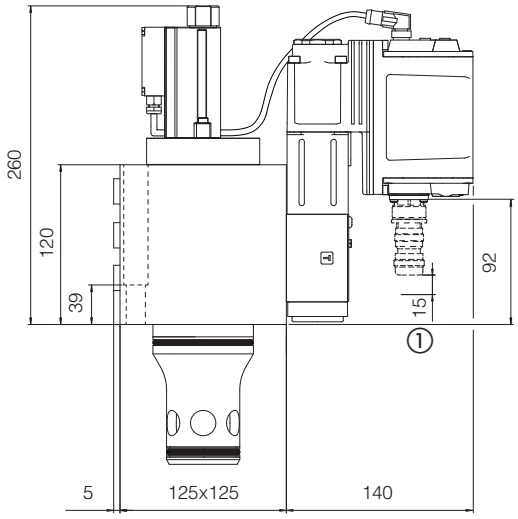
for **EW** - POWERLINK,
EI - EtherNet/IP,
EP- PROFINET IRT

LIQZO-LEB-322
LIQZO-LES-322



for **EW** - POWERLINK,
EI - EtherNet/IP,
EP- PROFINET IRT

LIQZO-LEB-402
LIQZO-LES-402

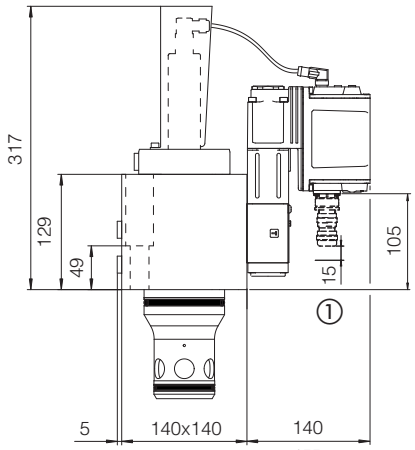


for **EW** - POWERLINK,
EI - EtherNet/IP,
EP- PROFINET IRT

① Space to remove the 7 or 12 pin main connector. For main and communication connectors see section 11, 12

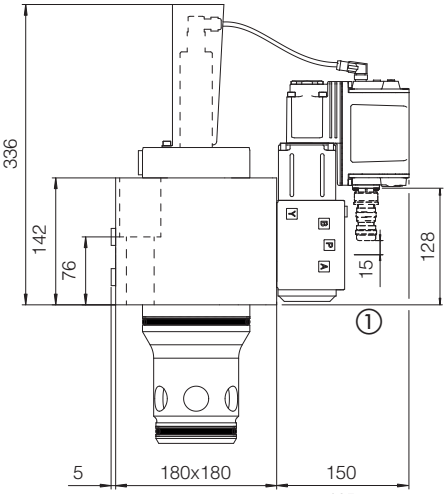
Note: for mounting surface and cavity dimensions, see table P006

LIQZP-LEB-502
LIQZP-LES-502



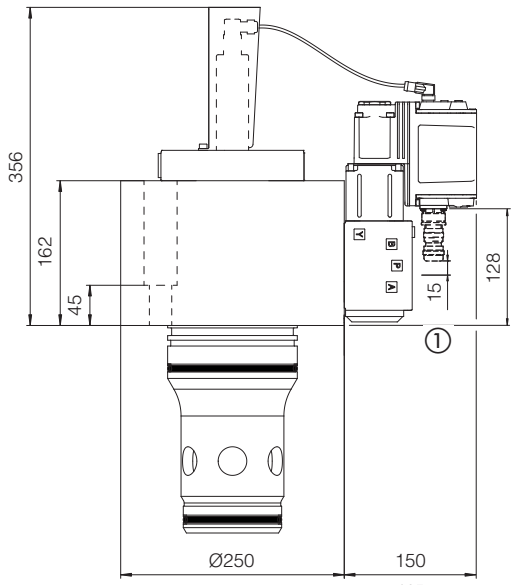
for **EW** - POWERLINK,
EI - EtherNet/IP,
EP- PROFINET IRT

LIQZP-LEB-632
LIQZP-LES-632



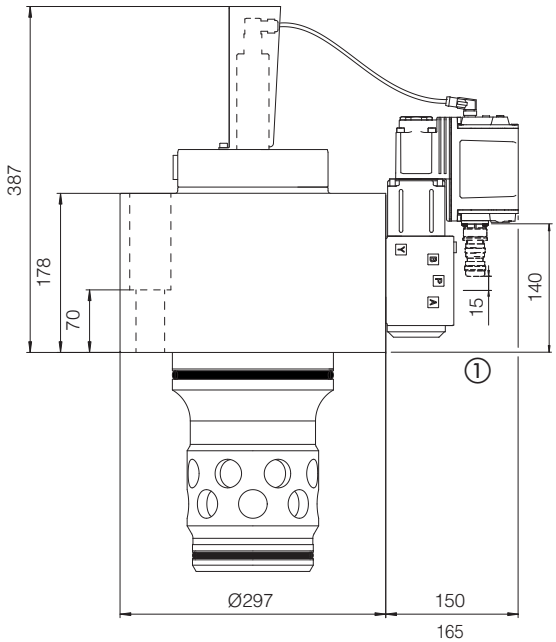
for **EW** - POWERLINK,
EI - EtherNet/IP,
EP- PROFINET IRT

LIQZP-LEB-802
LIQZP-LES-802



for **EW** - POWERLINK,
EI - EtherNet/IP,
EP- PROFINET IRT

LIQZP-LEB-1002
LIQZP-LES-1002



for **EW** - POWERLINK,
EI - EtherNet/IP,
EP- PROFINET IRT

① Space to remove the 7 or 12 pin main connector. For main and communication connectors see section 11, 12

Note: for mounting surface and cavity dimensions, see table P006