Bundesamt
für Eich- und
Vermessungswesen

Physikalisch-technischer Prüfdienst (PTP)

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T23-1857

Baueinheiten-Zertifikat Nr. NB23-0170 PC

Parts Certificate No. NB23-0170 PC

ausgestellt von *issued by*	Bundesamt für Eich- und Vermessungswesen (BEV) *Federal Office for Metrology and Surveying (BEV)*
gemäß *according to*	WELMEC Dokument 8.8 sowie Welmec Guide 7.2 und OIML R117 *WELMEC-Guide 8.8 as well as Welmec Guide 7.2 and OIML R117*
ausgestellt für *issued to*	Anton Paar GmbH Anton- Paar- Straße 20 8054 Graz Österreich /Austria
für *for*	Coriolis Massedurchflussmesser *Coriolis Massflow Meter*
Typ *type*	L-Cor 8000 Serie L-Cor 8000 series
Softwareversion *software version*	Siehe Punkt 3.1 *See point 3.1*
Gültig bis *valid until*	30. Jänner 2034 *January 30th, 2034*

Die Hauptmerkmale und Auflagen sind in der Anlage enthalten, die 11 Seiten umfasst.
Description, technical data, requirements and security measures are included in the Annex. (11 pages)

Elektronische Amtssignatur Official Electronic Signature		
Signaturwert / Signature Value	VI27gCvfDL7i8aEG5K0iIUZvEuuLtKrUwe6sPjJ2u3gYJYpeMlnUsjqa87nWXugzt3UOZ5RV8kK3ut9Kdr4n XQyIF1786TKsIzEdvSHpMpe38RhTmSUoeCRgYlO/Kx13XarK0Imr8YZykVyoUuO6XLCVnSmftAm4/hpHgL4I KApHiL3h8ElFNy5ceNkvN2UPy7spJEtP1kljx6/Drdn5IcMvW57yuJOn5I4WtvmUOb7oVAmbv1rWFNmFngKs fUiQAiRGA+bHNa19OxN6quC5mzEHJa4JvrZdAfp0qC3UXMZtbAZuPvI3aR9TY6oRIBSUti1H5FjSco8Amnx+ 2KLVBw==	
REPUBLIK ÖSTERREICH BUNDESAMT FÜR EICH- UND VERMESSUNGSWESEN @ AMTSSIGNATUR	Unterzeichner / Signatory	Physikalisch-technischer Prüfdienst des BEV
	Datum und Zeit / Date and Time	2024-01-31T11:18:13+01:00
	Zertifikat-Aussteller / Certificate Issuer	CN=a-sign-corporate-07,OU=a-sign-corporate-07,O=A-Trust Ges. f. Sicherheitssysteme im elektr. Datenverkehr GmbH,C=AT
	Serien-Nr. / Serial No.	11743158
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Freigabe erfolgte durch BITTNER-ROHRHOFER Karin, MILOTA Petra

Annex to Parts Certifcate No. NB23-0170 PC

1. Design and Function

Coriolis mass-flowmeter type L-Cor 8000 intended to be used as a part of a measuring system. The meter is capable of bi-directional flow and mass-flow measurement for liquids other than water.

It operates on the principle of Coriolis force.

The measurement sensor unit (see fig. 1a and 1b) consists of a housing in which a pair of U-shaped flow tubes fixed at both ends is excited by an electromagnetic oscillator to maintain oscillation at resonant frequency. A twist of these flow tubes takes place in proportion to the mass flowrate of the process fluid, which is sensed by the right-hand and left-hand electromagnetic pickoffs. The time shift between the two signals is representative for the mass flow rate.

A standard DC transmitter (calculator/indicating device of the sensor unit)[1] then sends its output as a mass flow signal. From the resonant frequency of the measurement tubes, the density of the liquid flowing through the sensor is determined. From the measured mass Q_M and density ρ, the volume Q_V of the liquid flowing through the sensor is calculated according to the calculation specification:

$$Q_V = Q_M/\rho \qquad \text{(Equ.1)}$$

The transmitter unit is equipped integrally or separately from/in the sensor unit (see fig.1a, b). It has a large size display with self-check screen, self-diagnosis features (e.g. cable disconnection check, temperature monitoring, pipeline vibration check, etc.) and field reconfiguration capability.

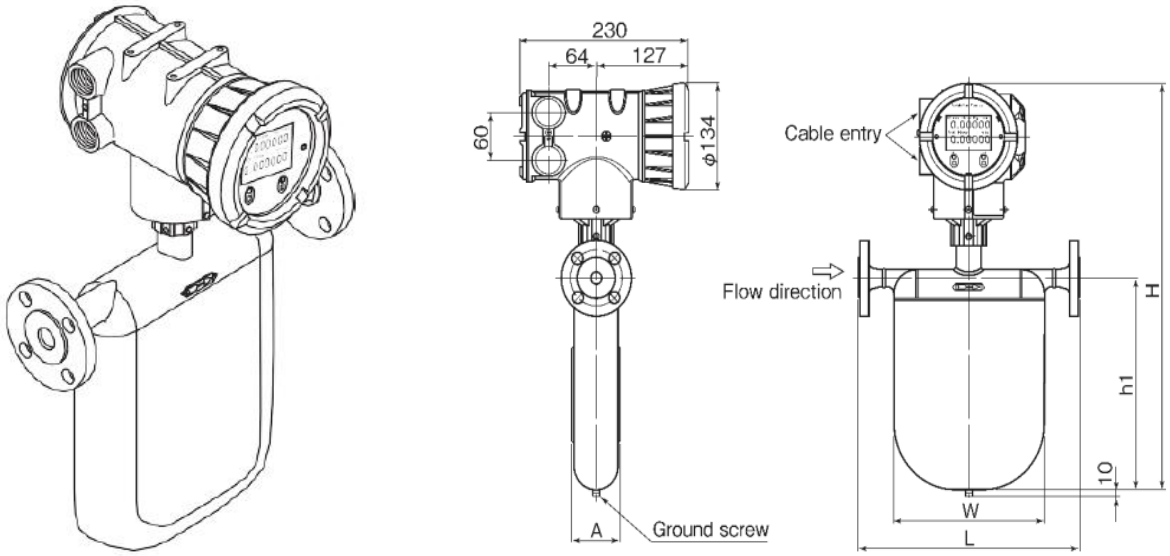


Fig. 1a: Schematic views with outline dimensions of a L-Cor 8000 integrally mounted model (for example). The design depends on the diameter in- and outlet.

[1] *Remark: Not in the sense of an Electronic Calculating and Indicating Device (ECID) for the legally relevant calculation of amount and price and data storage.*

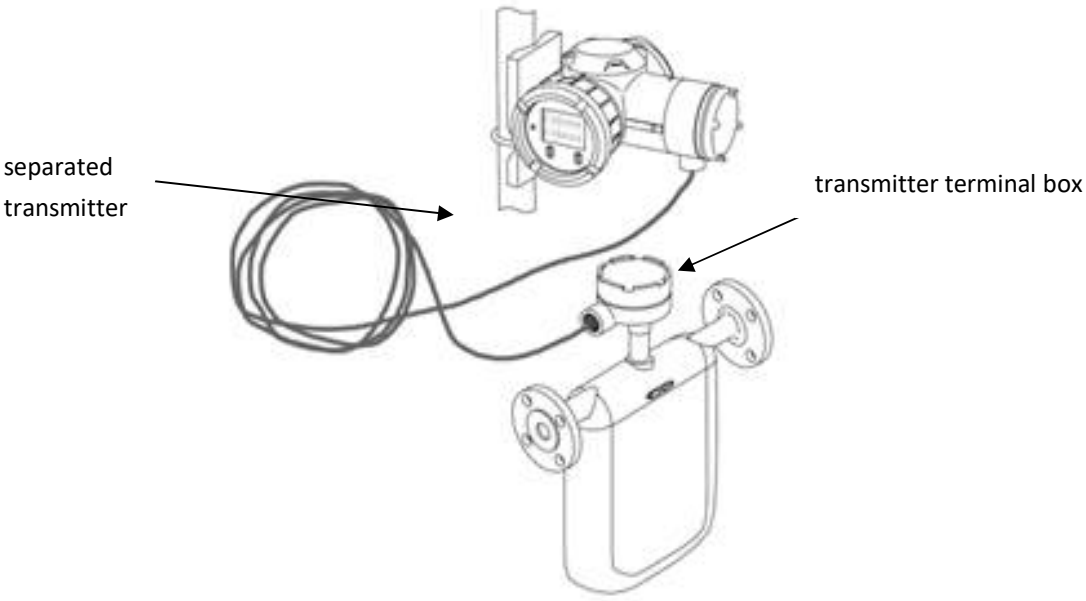
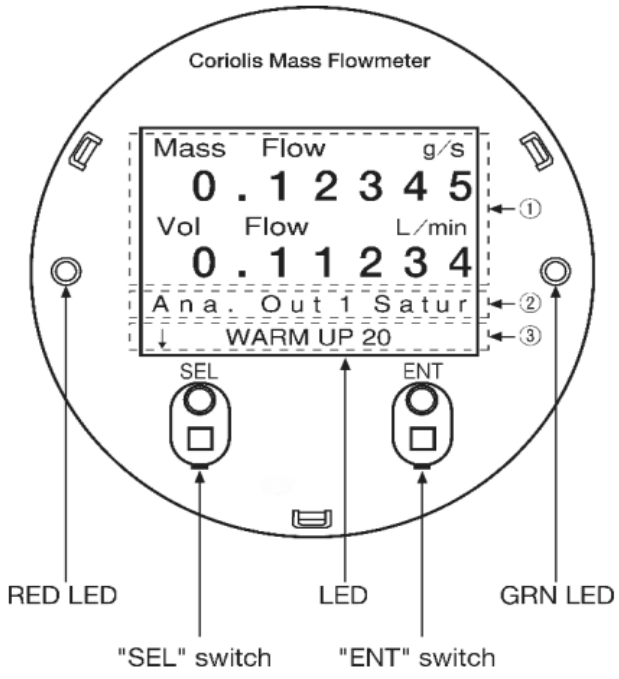


Fig. 1b: Schematic view of a L-Cor 8000 separately mounted model.

The LCD-indicating device (see fig. 2) with touch panel through front glass (infrared optical sensor) is capable of indicating several quantities. For legally relevant purposes ("Weights and Measures, W&M" purposes) is allowed: mass and volume.



Further, indication of density[2], temperature, (via PT100, class B) incorporated functions (e.g. zero-point adjustment, parameter settings, error logging, …) and status of the flowmeter via LCD backlights.

The detection of gaseous inclusions in the liquid is done with the adjustment of a gas multiphase alarm.

The mass flowmeter is compliant with various communications standards (see points 3.1.2 and 5).

Temperature conversion is done via standardized methods (see point 3.1.4).

Fig. 2: Example for the LCD- indicating device of the L-Cor 8000 series

[2] *Remark: Density measurements for legally relevant purposes are subjected to country specific regulations. Testing of density outputs for W&M related purposes are out of scope of this Parts Certificate.*

1.1 Measurand processing

The essential parts of the CRC-secured data transmission are shown in fig.3:

The signals from the pickup coils are read by an AD-converter and formatted by a Field Programmable Gate Array (FPGA) for further processing.

The digital signal processor DSP1 is responsible for exciting the vibration system, for phased measurement and temperature measurement.

The calculation processing is done by the second processor, DSP 2, which calculates the current density and mass flow using the exciting frequency, phase shift, temperature and an adjustment factor.

The main CPU monitors the system and provides the measurements data for I/O CPU and display. The custody transfer software includes the determination of mass, density, volume and corrects temperature effects on the senor´s measurements tubes.

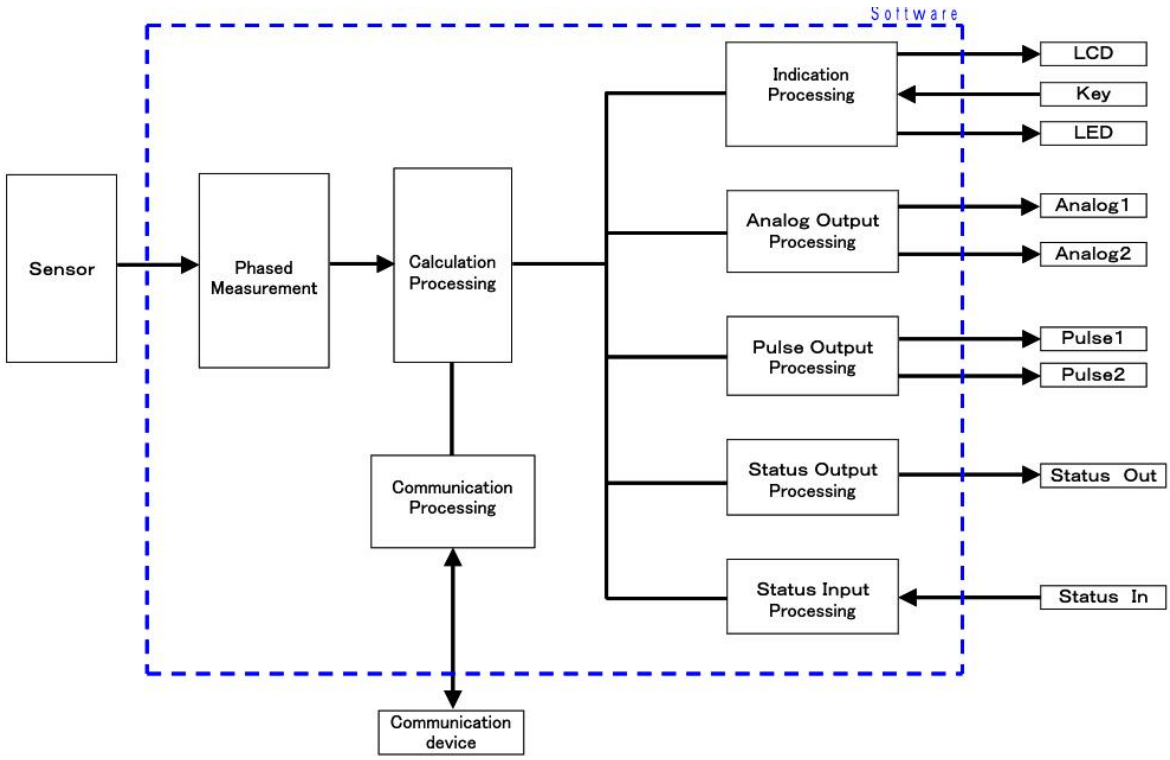


Fig. 3: Signal-processing of the sensor output

2. Type

L-Cor 8000 series with a standard transmitter type PA0K.

3. Technical Data

3.1 Operating conditions

3.1.1 Overview of the L-Cor 8000 series:

Table 1: Operating conditions of the series

Model (product code)	**AU015**	**AU25**	**AU040 AU050**	**AU80**	**AU100 AU150**	**AU15H AU200**	**AU20H AU250**
Nominal size: Diameter inlet-/outlet (mm)	15	25	50	80	100	150	200
Q_{min} (kg/min) For accuracy class 0.3	3	9	32,5	100	285	583	1167
Q_{min} (kg/min) For accuracy class 0.5	1,5	4,5	16,25	50	142,5	292	583
Q_{max} (kg/min) For accuracy class 0.3 and 0.5	120	360	1300	4000	11400	23333	46667
Density ρ (kg/m^3)	300- 2000						
Viscosity η (mPa*s)	$\leq$ 10000						
Minimum measured quantity, *MMQ* (kg)	5	10	50	100	500	1000	1000
Temperature range liquid (°C)	- 200°C to +200 °C						
Temperature range ambient (°C)	- 40 °C to +55 °C						
Maximum pressure, P_{max} (kPa)	Flange rating dependent						
Humidity environment class	H3						
Mechanical environment class	M3						
Electromagnetic environment class	E2						
Flow direction	Bidirectional						
Pulse outputs	Mass Flow Volume Flow						

3.1.2 Transmitter

Type: PA0K

Table 2: General specifications

Item	Description
Power source:	20 to 30 VDC
Transmitter construction:	integrally- or separately mounted
Transmission length: *Remark: only for separately mounted transmitter*	max. 200 m
Ambient temperature:	- 40 °C to + 55 °C
Display:	LCD display (128 x 64 dots), 2 Backlights, 2 infrared optical sensors
Communication interfaces:	– ModBus – PROFIBUS PA – (Foundation) FieldBus – Hart
Outputs (sensor side) *Remark: When Fieldbus, PROFIBUS PA is selected as communication interfaces, all input and output signals will be turned off.*	2 analog, 4-20 mA (e.g. density transmission) 2 pulse output 1 status output 1 error output
Input/ Output Custody transfer	Double pulse mode: 90° or 180° (phase-shift is selectable)

3.1.3 Software- Versions

Table 3: Legally relevant versions

Designation	Version number	Checksum
Main CPU: LCor	03.17	580c
I/O CPU: LCor	01.13	d741
DSP 1: LCor	01.01.00.03	b584
DSP 2: LCor	03.01.00.04	3eac
LCD CPU: LCor	03.10	eed7

3.1.4 Temperature Conversion (optional)

For the conversion of the temperature the following standards are applied:

- ISO 91, Petroleum and related products - Temperature and pressure volume correction factors (petroleum measurement tables) and standard reference conditions;
- ASTM D1250, Standard Guide for use of the Petroleum Measurement Tables.

3.1.5 Parameter Settings (Custody transfer)

The following functions shall be disabled in write protect mode:

- LCD display switches
- L-Cor configuration software communication
- Analog Trim Function
- Reset Function
- Process Variables- Setting Change
- Pulse Output Function- Setting Change
- Analog Output Function- Setting Change
- Status Output - Setting Change
- Status Input Function- Setting Change
- High/Low Alarm Function- Setting Change
- Gas Mixed Flow Alarm Function- Setting Change

Generally, for other legally relevant purposes:

- Parameter settings, other than those mentioned above, for legally relevant functions (e.g. temperature conversion) shall be disabled in write protect mode

3.1.6 Associated measuring instrument

If the density measurement is done in the sense of an associated measuring instrument according to Directive 2014/32/EU, Annex VII, table 4, the maximum permissible error (MPE) of the density measurement for measuring systems of accuracy classes 0.3 or 0.5 is: $\pm$ 1 kg/m^3

3.2 Technical documentations

All technical documentations and evaluation reports for the issue of this Parts Certificate are documented in the documentation folder NB23-0170, appertaining to this Parts Certificate.

The results of this Parts Certificate are reported in the test report (type evaluation) T23-1857, PTP/BEV, Vienna, January 2024.

4. Optional equipment

4.1 Legally relevant equipment:

The L-Cor 8000 series may be connected to any peripheral device (e.g. flow computer, conversion device, etc.) that has been issued with a parts certificate by a Notified Body responsible for Annex II, Module B under the Directive 2014/32/EU and bears the CE-marking of conformity to the relevant directives.

4.2 Non-legally relevant equipment:

Peripheral equipment may be connected under the conditions that it bears at least the CE marking for conformity to the EMC Directive and that it is not capable of transmitting any data or instructions into the measuring system, other than for checking for correct data transmission.

4.3 Printer:

If the measuring system, in which the flowmeter is used, is equipped with a ticket printing device that is subject to legal control, this printing device shall comply with the relevant applicable printer-requirements as stated in OIML R 117-1, 2019.

5. Interfaces und compatibility conditions

The L-Cor 8000 series shall only be connected to devices with a transmission (communication) protocol compatible with the interface types mentioned in point 3.1.2, table 2.

6. Requirements on production, putting into use and utilisation

In general, the manufacturer- specific instructions for the essential components of the sensor unit and the communication interfaces shall always be taken in to account in order to ensure precise measurements under legal control.

6.1. Requirements on production

In general, all components of the sensor unit have to fulfil the requirements of conformity to the relevant directives.

If the flow meter is applied in a measuring system: the flowmeter shall be constructed in accordance with the description and documentations belonging to this Parts Certificate.

6.2. Requirements on putting into use

A special density calibration prior to installation in field or in the field on the liquid to be measured shall be done. In particular, if the density measurements will be done in the sense of an associated measuring instrument (see point 3.1.6);
Mandatory parameter settings shall be highly secured in a way so that only authorised persons have access to legally relevant parameters;
Manufacturer- specific instructions regarding the installation (physical orientation, safety, wiring, etc.) of the flowmeter shall always be taken in to account;

6.3. Requirements on utilisation

- The L-Cor 8000 series shall only be used under the rated operating conditions mentioned in point 3.1;
- The minimum measured quantity shall be in form $1x10^n$, $2x10^n$ or $5x10^n$;
- The volume indication/ output can only be applied for legally relevant purposes, if: special density calibration prior to installation in field or in the field on the liquid to be measured was done;
- If an ECID (flowcomputer) is connected to the flowmeter, the display may be blinded with respect to mass/ volume indication in order to avoid multiple indication of a legally relevant result;
- Manufacturer- specific instructions regarding the utilisation and operation of the flowmeter shall always be taken in to account.

7. Control of the instrument in use

According to this Parts Certificate and, if the L-Cor 8000 series is a part of a measuring device for liquids other than water, control in accordiance with the EU-type examination certificate (TEC)[3] issued for that device.

If the sensor unit is used in bi-directional directions, both flow directions shall be proved during the initial verification.

Software: Control of the version numbers in the Service Software Menu according to table 3,
Control whether parameter settings are in the write protect mode after setting of the write-protect-switch.

Hardware: Control of the name-plate;
For separately mounted transmitters: control of the assigned flowmeter components and cable length. The assignment shall be proven by their serial numbers.

8. Security measures

All sealings shall be done in an appropriate way (sticker or wire with seal).

- Write-protect-switch: positioned on the CPU board as shown in fig. 4

[3] Issued by a Notified Body responsible for Annex II, Module B and G under the Directive 2014/32/EU

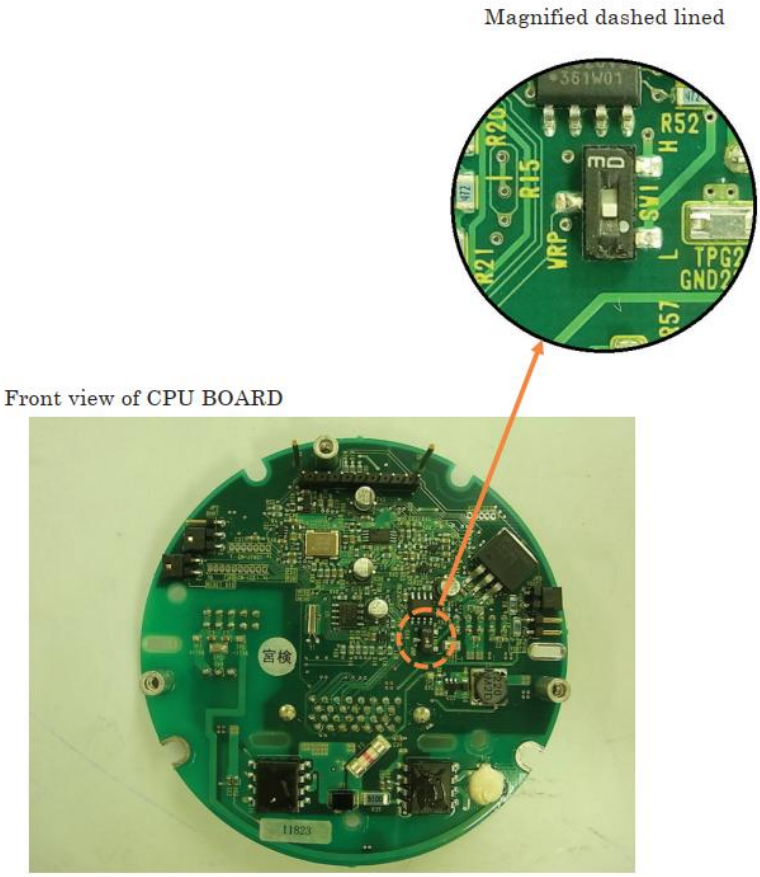


Fig. 4: Front-view of the CPU-board with write-protect-switch, which is accessed by removing the transmitter front lid and the LCD board

The setting of the write-protect-switch is done via SW1 (see fig.4, circled dashed line) on the CPU-board, which is accessed by removing the transmitter front lid and LCD board.

The operating settings are according to table 4:

SW1 (WRP) setting	Description
L	Parameter write enable
H	Parameter write disable

After the meter is set to write protect mode, the message “Write protect” or “Write protected” is displayed on the LCD screen.

- Front lid of the transmitter with a wire and seal to prevent unauthorised access (see fig.5);
- For integrally mounted transmitter: sealing of the transmitter terminal with the sensor to prevent unauthorised separation of these components (see fig 6);

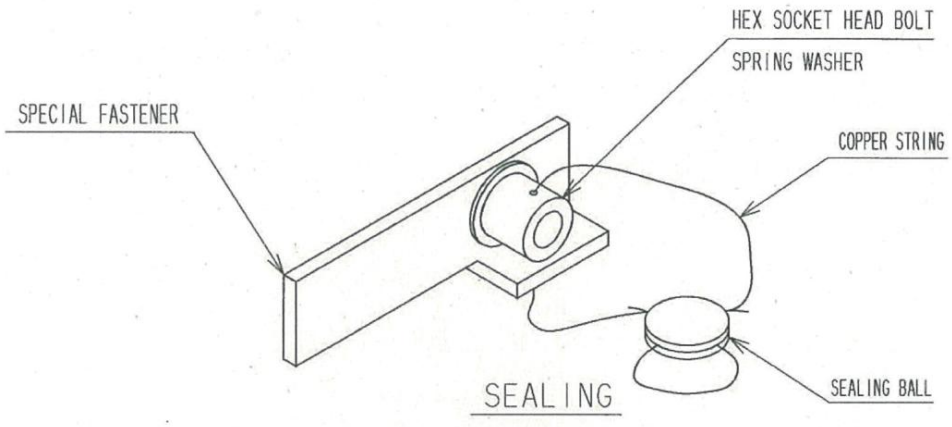


Fig. 5.: Sealing of the front lid

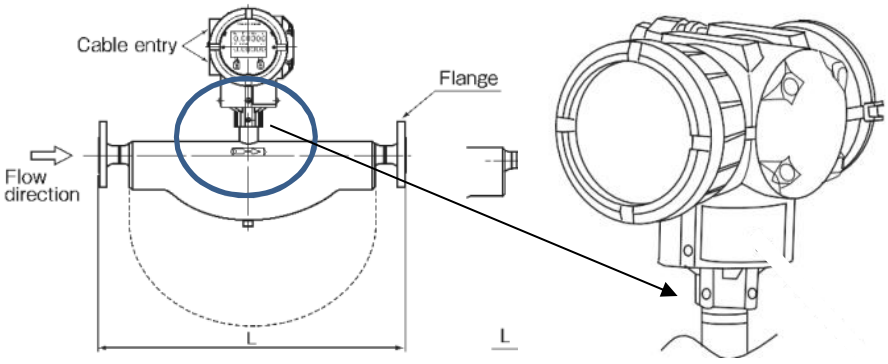


Fig.6: Sealing of integrally mounted transmitter

– For separately mounted transmitter: sealing of the deposited transmitter to prevent unauthorised removal (see fig. 7)

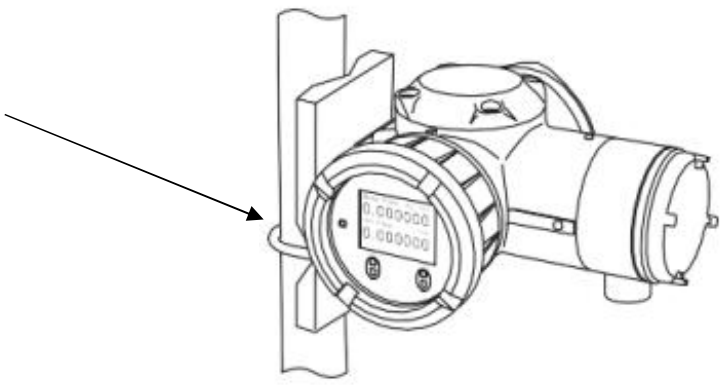


Fig. 7: Sealing of the separately mounted transmitter

9. Labelling and inscriptions

The instrument shall bear a name-plate, clearly visible, indestructible and easy of access as follows:

- The number of this Parts Certificate
- The sensor unit designation, model- and transmitter type
- Name and/or trademark of the manufacturer
- Serial number sensor, serial number transmitter
- Year of manufacture of the senor unit
- Operating conditions according to point 3.1, table 1