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Standards and documents applied:

EN ISO 4064-1:2017;
EN ISO 4064-2:2017;
EN ISO 4064-4:2014;
EN ISO 4064-5:2017.
OIML R 49-1:2013;
OIML R 49-2:2013;
WELMEC 7.2:2015.

The measuring instrument shall meet the following specifications:

1 Design of the instrument

1.1 Construction

Ultrasonic water meter NAUTILUS consists of the primary flow sensor and calculator.

Calculator of the meter is inseparably mounted on the flow sensor (integral construction).

The flow sensor consists of brass body with built-in ultrasonic transducers. The flow sensor, which nominal diameter is from DN65 up to DN100, body may be made either from brass (cast) or steel (welded construction).

The heat meter is powered by 3,6 V DC lithium battery either remote 12 V to 42 V DC or 12 V to 36 V AC power source.



Fig.1. Calculator of the water meter NAUTILUS

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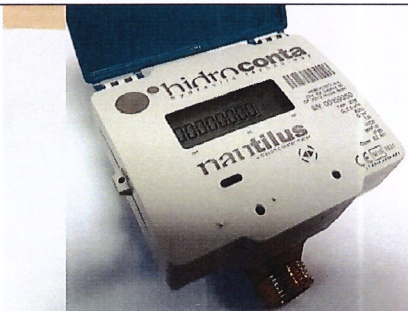
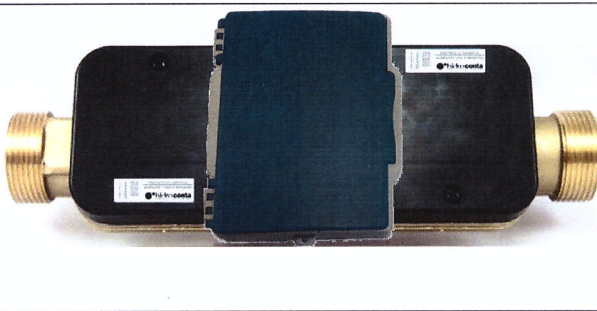
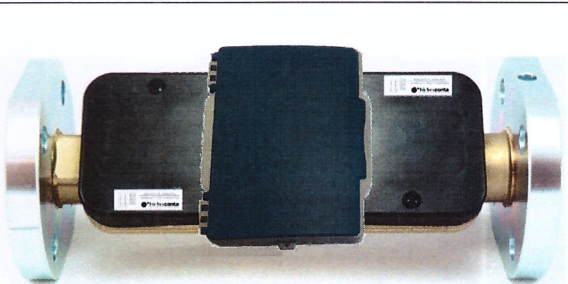
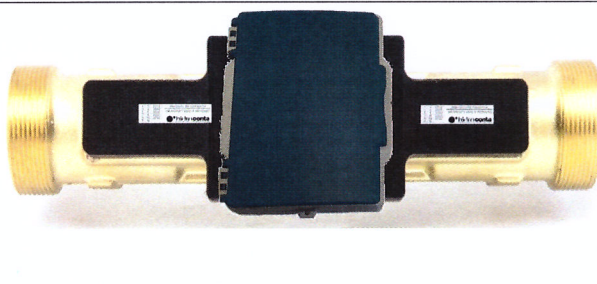
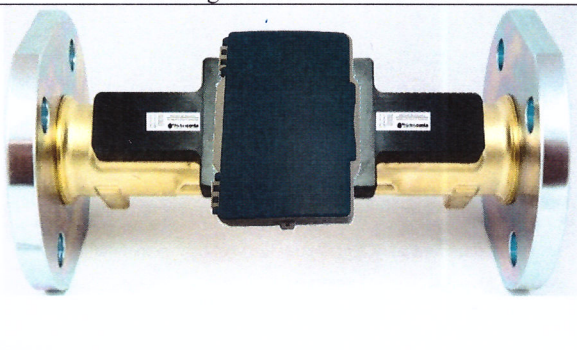
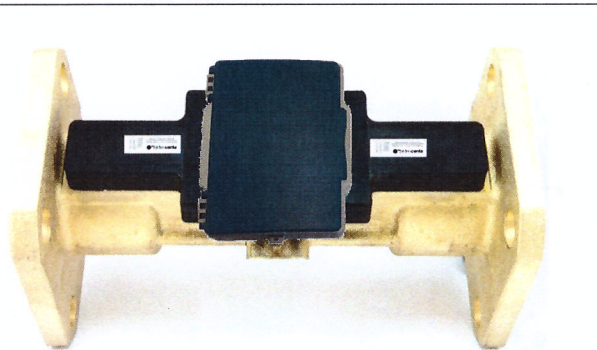
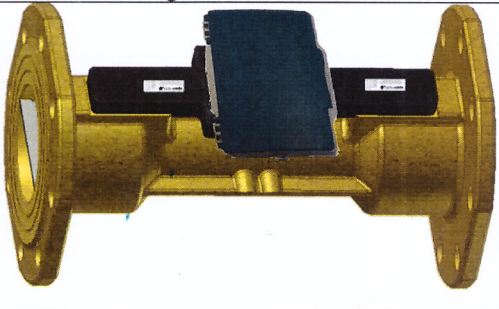
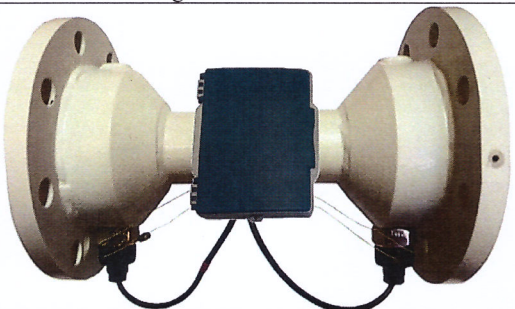
	
a) water meter NAUTILUS with threaded end connections G 3/4 or G 1	b) Water meter NAUTILUS with threaded end connections G 1 1/4
	
c) Water meter NAUTILUS with flanged end connections DN25	d) Water meter NAUTILUS with threaded end connections G 2
	
e) Water meter NAUTILUS with flanged end connections DN40	f) Water meter NAUTILUS with flanged end connections DN50
	
g) Water meter NAUTILUS with flanged end connections (DN65/DN80/DN100), brass body	h) Water meter NAUTILUS with flanged end connections (DN65/DN80/DN100), steel body

Fig.2. Water meter NAUTILUS

1.2 Sensor

Ultrasonic flow sensor.

1.3 Measurement value processing

The calculator calculates the volume of water passing through the flow sensor by integrating the measured flowrate over time.

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1.4 Indication of the measurement results

Measured volume of water is indicated on the 8 columns LCD indicating device.

Indication in operating mode : m³, three digits after decimal point.

Indication in TEST mode : m³, six digits after decimal point.

1.5 Optional equipment and functions subject to MID requirements

None.

1.6 Technical documentation

Ultrasonic water meter NAUTILUS. Technical description: PEF1IP68V04, 20-11-2017.

Other reference documents on which basis this certificate is issued, are stored in a file Nr.LEI-12-MP-082.18.

1.7 Integrated equipment and functions not subject to MID

The optical interface according to requirements of EN 62056-21 is integrated in the meter, intended for data reading via M-Bus protocol, for meter parameters setting and for verification mode (TEST) control. Viewing the parameters on the meter LCD indicating device is controlled by magnet (magnetically operated switch).

Two pulse inputs with programmable pulse value: maximum pulse frequency – 3 Hz, maximum voltage level – 3,6 V.

Two open collector type pulse outputs: maximum current level – 20 mA, maximum voltage level – 25 V.

The meter can be without communication module or equipped with one of the following modules:

- M-Bus module;
- CL module;
- 868 MHz RF radio module;
- MODBUS RS485 module;
- LON module;
- MiniBus module.

Resistance temperature sensor Pt 500 can be connected to the water meter calculator for temperature measurement. Cable length of the sensor – up to 5 m, wiring of sensor - 2-wire. In this case the meter must have an additional temperature measurement function (optional).

The meter body, with end connections from G ¾ to G 1¼ and from DN20 to DN25 has intended place for temperature sensor installation.

2 Technical data

2.1 Rated operating conditions

2.1.1 Measurand

The volume of water passing through the meter, indicated on the LCD indicating device.

2.1.2 Measurement range

The measuring range of the water meter NAUTILUS and other technical characteristics are presented in table 1:



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Table 1

Permanent Q_3	Flowrate, m ³ /h			The ratio R , Q_3/Q_1	End connections	Overall length L , mm	Pressure loss class
	Overload Q_4	Minimum Q_1	Transitional Q_2				
1,6	2,0	0,0064	0,010	250	G ¾	105	ΔP 63/ ΔP 25*
					G ¾	110	ΔP 63/ ΔP 25*
					G ¾	165	ΔP 63/ ΔP 25*
					G 1	105	ΔP 63/ ΔP 25*
					G 1	110	ΔP 63/ ΔP 25*
					G 1	190	ΔP 25
					DN20	190	ΔP 25
2,5	3,125	0,010	0,016	250	G ¾	105	ΔP 63
					G ¾	110	ΔP 63
					G ¾	165	ΔP 63
					G 1	105	ΔP 63
					G 1	110	ΔP 63
					G 1	190	ΔP 25
					DN20	190	ΔP 25
2,5	3,125	0,0063	0,010	400	G ¾	105	ΔP 63
					G ¾	110	ΔP 63
					G ¾	165	ΔP 63
					G 1	105	ΔP 63
					G 1	110	ΔP 63
					G 1	190	ΔP 25
					DN20	190	ΔP 25
4,0	5,0	0,016	0,026	250	G 1	190	ΔP 63/ ΔP 25*
					DN20	190	ΔP 63/ ΔP 25*
					G 1	130	ΔP 63
4,0	5,0	0,010	0,016	400	G 1	130	ΔP 63
					G 1	190	ΔP 63/ ΔP 25*
					DN20	190	ΔP 63/ ΔP 25*
6,3	7,875	0,0252	0,040	250	G 1	190	ΔP 63
					DN20	190	ΔP 63
					G 1¼	260	ΔP 25
					DN25	260	ΔP 25
6,3	7,875	0,016	0,026	400	G 1	190	ΔP 63
					DN20	190	ΔP 63
10,0	12,5	0,04	0,064	250	G 1¼	260	ΔP 63
					DN25	260	ΔP 63
					G 2	300	ΔP 25
					DN40	300	ΔP 25
10,0	12,5	0,025	0,040	400	G 1¼	260	ΔP 63
					DN25	260	ΔP 63
16,0	20,0	0,064	0,100	250	G2	300	ΔP 63
					DN40	300	ΔP 63
					DN50	270	ΔP 25
16,0	20,0	0,040	0,064	400	G 2	300	ΔP 63
					DN40	300	ΔP 63



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Flowrate, m ³ /h				The ratio $R, Q_3/Q_1$	End connections	Overall length $L, \text{ mm}$	Pressure loss class
Permanent Q_3	Overload Q_4	Minimum Q_1	Transitional Q_2				
25,0	31,25	0,100	0,160	250	DN50	270	$\Delta P 63$
					DN65	300	$\Delta P 25$
25,0	31,25	0,063	0,100	400	DN50	270	$\Delta P 63$
40,0	50,0	0,160	0,260	250	DN65	300	$\Delta P 63$
					DN80	300	$\Delta P 25$
					DN80	350	$\Delta P 25$
40,0	50,0	0,100	0,160	400	DN65	300	$\Delta P 63$
63,0	78,75	0,252	0,400	250	DN80	300	$\Delta P 63$
					DN80	350	$\Delta P 63$
					DN100	350	$\Delta P 25$
					DN100	360	$\Delta P 25$
63,0	78,75	0,160	0,260	400	DN80	300	$\Delta P 63$
					DN80	350	$\Delta P 63$
100,0	125,0	0,400	0,640	250	DN100	350	$\Delta P 63$
					DN100	360	$\Delta P 63$
100,0	125,0	0,250	0,400	400	DN100	350	$\Delta P 63$
					DN100	360	$\Delta P 63$

Note: *- depending on the meter tube diameter pressure loss class can be $\Delta P 63$ or $\Delta P 25$.

2.1.3 Meter temperature classes and maximum permissible errors

Meter temperature classes and maximum permissible errors are presented in table 2:

Table 2

Meter temperature class	Water temperature ranges	Maximum permissible errors
T30	between 0,1 °C and 30 °C	$\pm 5 \%$ in flow range $Q_1 \leq Q < Q_2$ $\pm 2 \%$ in flow range $Q_2 \leq Q \leq Q_4$
T30/90	between 30 °C and 90 °C	$\pm 5 \%$ in flow range $Q_1 \leq Q < Q_2$ $\pm 3 \%$ in flow range $Q_2 \leq Q \leq Q_4$
T90	between 0,1 °C and 90 °C	$\pm 5 \%$ in flow range $Q_1 \leq Q < Q_2$ $\pm 2 \%$ in flow range $Q_2 \leq Q \leq Q_4$ (for water temperature between 0,1 °C and 30 °C) $\pm 3 \%$ in flow range $Q_2 \leq Q \leq Q_4$ (for water temperature between 30 °C and 90 °C)

2.1.4 Environmental conditions / Influence quantities

Ambient working temperature : 5 °C to 70 °C;
Humidity level : condensing;
Installations : indoor;
Mechanical environment : class M1;
Electromagnetic environment : class E2;
Degree of protection : IP68.

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2.2 Other operating conditions

2.2.1 Maximum admissible working pressure

The maximum admissible working pressure of water meter is 1,6 MPa (MAP 16) or 2,5 MPa (MAP 25).

2.2.2 Mounting position of the flow sensor of the heat meter

Water meter can be mounted either horizontally, vertically or inclined.

3 Interfaces and compatibility conditions

The communication interfaces of the meter, pulse inputs and outputs are described in section 1.7 of this appendix.

4 Requirements on production, putting into use and utilization

4.1 Requirements on production

At the end of the manufacturing and adjustment process the water meters shall be tested according to the requirements of the EN ISO 4064-2, section 10.1. Errors of water meters shall not exceed the maximum permissible errors, described in Annex III (MI-001) of the Directive 2014/32/EU.

The meters shall be tested within each of the following flowrates:

between Q_1 and $1,1Q_1$;

between Q_2 and $1,1Q_2$;

between $0,9Q_3$ and Q_3 .

For meters class T30: water temperature of tests $20\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$.

For meters class T30/90: water temperature of tests is $50\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$.

For meters class T90: water temperature of tests $20\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$ and $50\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$.

4.2 Requirements on putting into use

The water meter must be installed in accordance with the requirements of technical description listed in section 1.6.

For water meters with nominal diameter DN65 to DN100 necessary straight pipelines lengths are: upstream $\geq 5 \times \text{DN}$, downstream $\geq 3 \times \text{DN}$ (flow profile sensitivity class U5 D3).

For water meters of other sizes the straight pipelines installation in upstream and downstream the meter are not necessary (flow profile sensitivity class U0 D0).

4.3 Requirements for consistent utilization

No special requirements identified.

5 Control of the measuring process after tasks of the instrument in use

5.1 Documentation of the procedure

None.

5.2 Special equipment or software

- optical reading head according to standard EN 62056-21;
- service software **QALCOSONIC HEAT 1 v01r150**.

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5.3 Identification of hardware and software


Identification of hardware:

- see Fig.1 and Fig. 2 of this appendix;
- identification mark on the meter electronics wiring plate is SKU3-v12R8.

Identification of software: version number of the software is **0.08**. This number on demand can be shown on the display.

5.4 Calibration-adjustment procedure

Using an optical head and **QALCOSONIC HEAT 1 v01r150** software the meters verification mode (TEST) is activated. Optical head should be connected to the computer COM interface.

After opening the program startup window („Actual“) computer port number (to which optical head is connected) is entered in the field „Port“. Click button „Open Port“. Briefly place the magnet on the meter calculator (on the area marked with symbol ). The optical head is placed on the meter.

Select menu item „Testing“ and click button „USER Test On/Off“ in the new window. If the operation succeeded, the additional window on the computer display appears with note „Operation done“ and inscription „TEST“ appears on the meter display.

The measuring errors of the meter are determined at three flowrates appointed in section 4.1 of the present appendix. Optical pulse output of the meter is used (Fig. 3), or the meter volume indication can be read directly from meter's LCD (verification scale interval in verification mode – 1 ml).

The volume pulse value in verification mode (TEST) is presented in table 3.

Table 3

Permanent flowrate Q_3 of the meter, m ³ /h	Volume pulse value in verification mode (TEST), litre/pulse
1,6	0,002
2,5	0,004
4	0,005
6,3; 10	0,02
16; 25; 40	0,05
63; 100	0,2

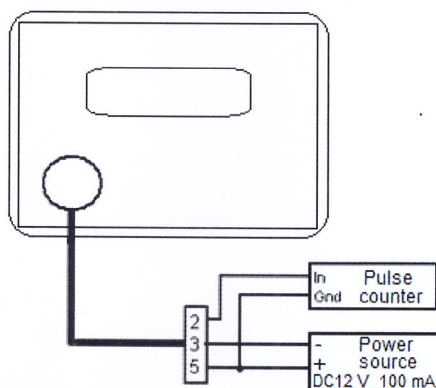


Fig. 3. Connection diagram for the meter errors determination test

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6 Security measures

6.1 Sealing

The following water meter calculator sealing is provided:

- manufacturer's adhesive seal - sticker on the access to the adjustment activation jumper (Fig.4, pos.1) and on the fixer of the cover protecting electronics wiring plate (Fig.4, pos.2);
- after installation the case and cover of the calculator (Fig.4, pos.3) are sealed with two hanged seals of water supplier.

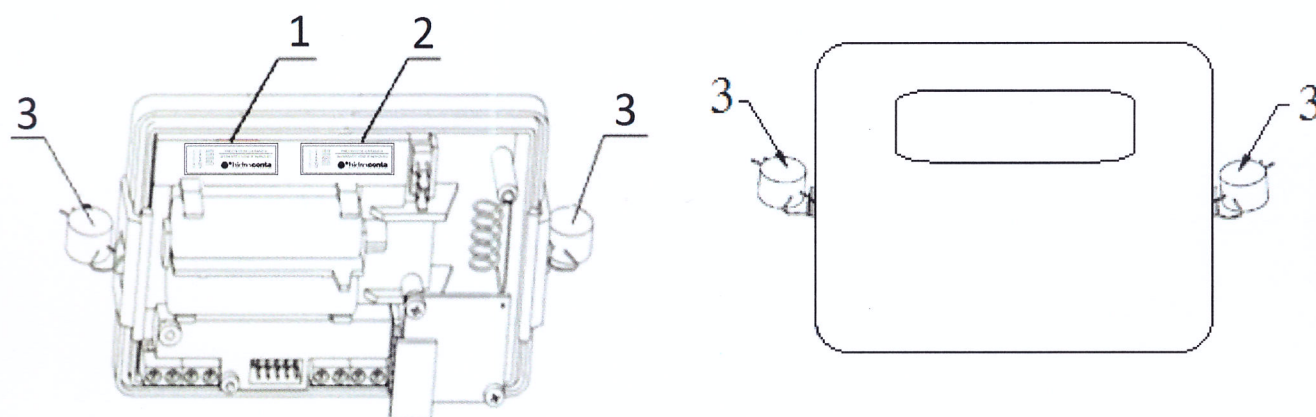


Fig.4: Sealing of the calculator of the water meter NAUTILUS

The following flow sensor sealing is provided:

- manufacturer's adhesive seal - sticker on the bolts of the cover (Fig. 5 a, b, c);
- manufacturer's hanged seals on ultrasonic transducers by steel body (Fig. 5 d);

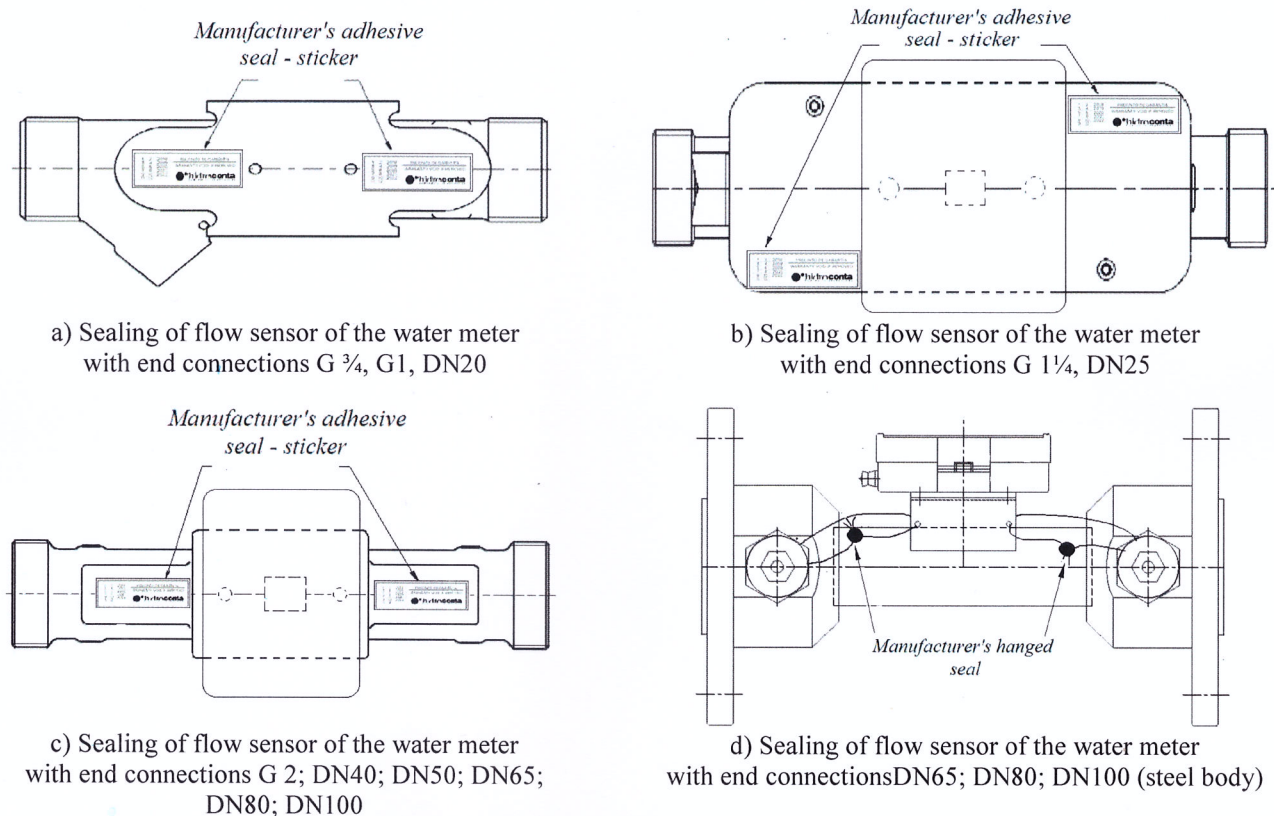


Fig. 5. Sealing of flow sensor of the water meter

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Fig.6. Manufacturer's adhesive seal - sticker

7 Marking and inscriptions

7.1 Information to be borne by and to accompany the measuring instrument

The water meter calculator cover contains the following information:

- EU-type examination certificate number (LT-1621-MI001-036);
- trade mark of the manufacturer;
- manufacturer's address;
- type designation of the meter;
- year of manufacture and serial number;
- unit of measurement: m³ (on LCD display);
- permanent flowrate Q_3 ;
- the ratio Q_3/Q_1 , preceded by „R“;
- the temperature class, where it differs from T30;
- the maximum admissible working pressure;
- pressure loss class, where it differs from ΔP 63;
- the installation sensitivity class of the meter;
- end connections of the flow sensor;
- electromagnetic class;
- mechanical class;
- IP code.

Arrow to indicate the direction of the flow shall appear on flow sensor body.

7.2 Conformity marking

In addition, the label of water meter calculator should contain the following marking:

- „CE” marking;
- supplementary metrology marking, consisting of the capital letter „M” and the last two digits of the year of its affixing, surrounded by a rectangle;
- the number of the notified body that carried out the conformity assessment.

8 List of the drawings attached to the certificate

None.

9 Certificate history

Issue	Date and reference No.	Description
1	2	3
LT-1621-MI001-036	07-12-2018, Nr. LEI-12-MP-082.18	Type examination certificate first issued