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Harmonized standards applied: EN 1434-1:2007, EN 1434-2:2007, EN 1434-2:2007/AC:2007, EN 1434-3:2008, EN 1434-4:2007, EN 1434-4:2007/AC:2007, EN 1434-5:2007.
Additionally documents applied:
WELMEC 7.2 – Software guide (Issue 5).

The measuring instrument must correspond with the following specifications:

1 Design of the instrument

1.1 Construction

Heat meter SonoMeter 31 consists of the primary flow sensor and the calculator with type approved pair of temperature sensors with Pt 500 elements.
Flow sensor consists of brass body with built-in ultrasound transducers. The flow sensor connected with the calculator via two screened cables, which length can be from 3 m to 100 m. One cable is used for flow sensors q_p = (0,6...2,5) m³/h.
The flow sensors q_p = (0,6...6) m³/h has intended place for temperature sensor installation.
For flow sensors having relative diameters from DN65 to DN100 body can be made from either brass (cast) or steel (welded construction).
The calculator of the heat meter can be mounted directly on the flow sensor or separately.
Depending on modification, the meter is powered by 3,6 V DC lithium battery either 230 V AC main.

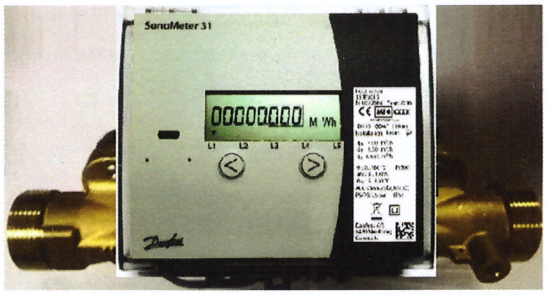

Fig.1.Heat meter SonoMeter 31 (calculator and flow sensor)

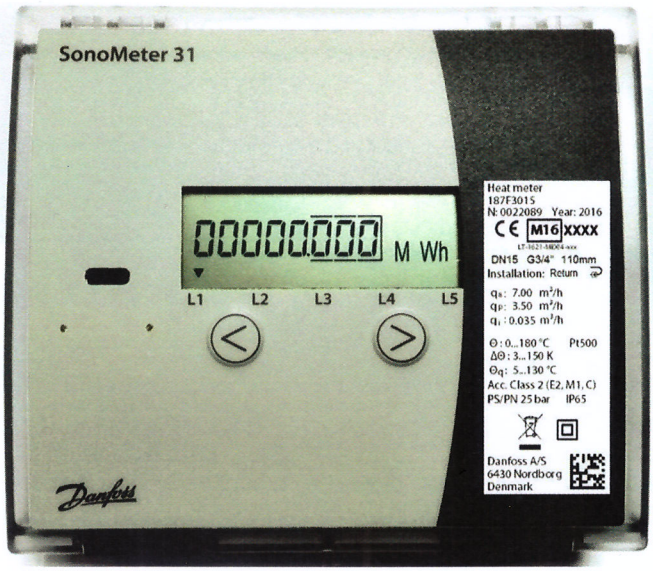

Fig.2. Calculator of the heat meter SonoMeter 31

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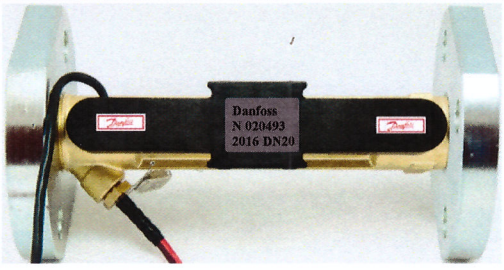
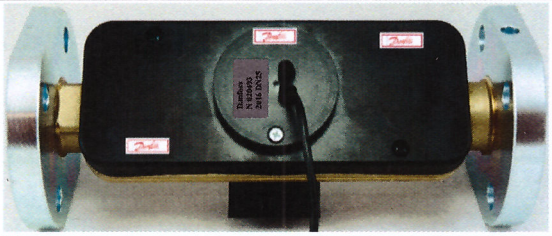
a) Flow sensor of the heat meter SonoMeter 31 q_p = 0,6/1,0/1,5/2,5 m³/h with threaded end connections G ¾ B or G 1 B

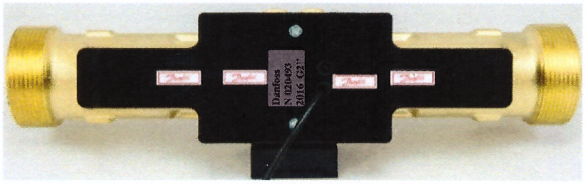


b) Flow sensor of the heat meter SonoMeter 31 q_p = 0,6/1,0/1,5/2,5 m³/h with flanged end connections DN20

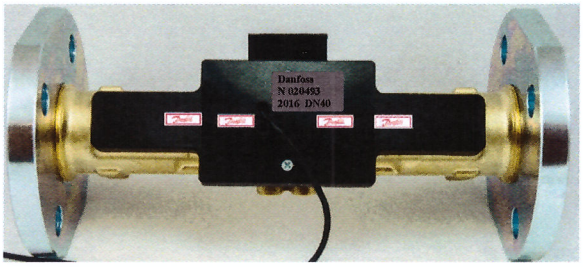
c) Flow sensor of the heat meter SonoMeter 31 q_p = 3,5/6 m³/h with threaded end connections G 1¼ B



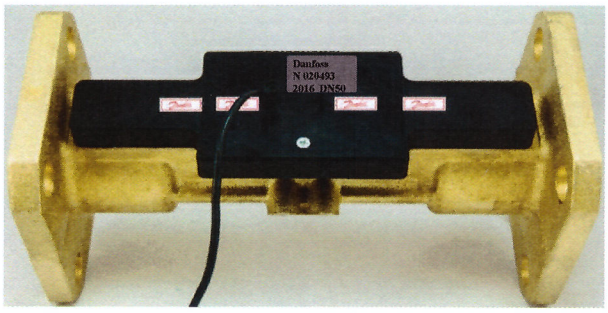
d) Flow sensor of the heat meter SonoMeter 31 q_p = 3,5/6 m³/h with flanged end connections DN25 or DN32



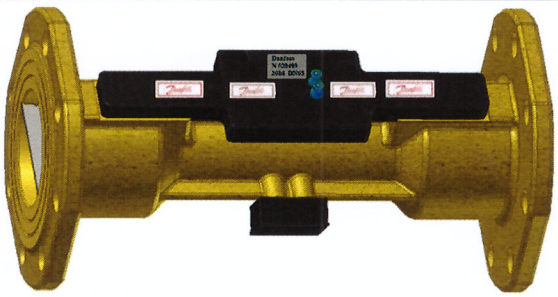
e) Flow sensor of the heat meter SonoMeter 31 q_p = 10 m³/h with threaded end connections G 2 B



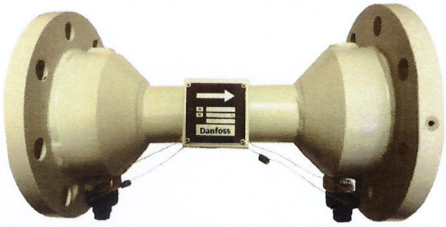
f) Flow sensor of the heat meter SonoMeter 31 q_p = 10 m³/h with flanged end connections DN40



g) Flow sensor of the heat meter SonoMeter 31 q_p = 15 m³/h with flanged end connections DN50



h) Flow sensor of the heat meter SonoMeter 31 q_p = 25/40/60 m³/h with flanged end connections (DN65/DN80/DN100), brass body



i) Flow sensor of the heat meter SonoMeter 31 q_p = 25/40/60 m³/h with flanged end connections (DN65/DN80/DN100), steel body

Fig.3. Flow sensor of the heat meter SonoMeter 31

The user may select (when orders) one of six energy measurement schemes to which requirements of the Directive 2014/32/EU are applied (Table 1), or one of six energy measurement schemes to which requirements of the Directive 2014/32/EU are not applied (Table 2).

Table 1

Measurement scheme application	Conventional designation of the measurement scheme
For closed heating systems. Flow sensor in supply pipe	U1
For closed heating systems. Flow sensor in return pipe	U2
For closed heating systems. Flow sensor in supply pipe. With leakage detection option.	U1F
For closed heating systems. Flow sensor in return pipe. With leakage detection option.	U2F
For closed system for accounting of heating/cooling energy. Flow sensor in supply pipe	U1L*
For closed system for accounting of heating/cooling energy. Flow sensor in return pipe	U2L*

Remark: * - *for these measurements schemes requirements of the Directive 2014/32/EU are applied when the meter is used for accounting of heating energy. It is marked on the meter label.*

1.2 Measurand sensor

The heat meter hardware consists of an ultrasonic flow sensor and heat meter calculator with the connected temperature sensors. The calculator measures the resistance of type approved pair of temperature sensors with Pt 500 elements and converts it to temperature according to formulas of EN 60751. The calculator also measures the volume of the heat-conveying liquid by processing signals received from the ultrasound transducers of the flow sensor.

1.3 Measurand processing

The energy, consumed for heating, is calculated by integrating the temperature difference and the volume of the heat-conveying liquid over time. The temperature difference is calculated from the resistance of the temperature sensors pair connected to the calculator.

1.4 Indication of the measurement results

The accumulated quantity of thermal energy is presented on the LCD display in the MWh. Other units (kWh, Gcal, GJ) can be chosen too.

1.5 Optional equipment and functions subject to MID requirements

None.

1.6 Technical documentation

Ultrasonic energy meter for heating and cooling SonoMeter 31 - Technical description, installation and user instructions: VDSHU103, 12-10-2016.
Test instruction of the heat meter SonoMeter 31, 05-2016.

Other reference documents on which basis this certificate is issued, are stored in a file Nr.LEI-12-MP-052.16.

1.7 Integrated equipment and functions not subject to MID

The energy measurement schemes to which requirements of the Directive 2014/32/EU are not applied, presented in Table 2.

Table 2

Measurement scheme application	Conventional designation of the measurement scheme
For closed heating systems with flow sensor in supply pipe. For open heating system with cold water temperature measurement and with two flow sensors, installed in flow and return pipes	A
For closed heating system with flow sensor in return pipe. For open heating system for accounting energy consumption for heating, with cold water temperature measurement and with two flow sensors, installed in flow and return pipes	A1
For closed heating systems with flow sensor in return pipe. For open heating system for accounting of supplied heat energy, with two flow sensors, installed in return and replenishment pipes	A2
For closed heating systems with flow sensor in return pipe. For open heating system for accounting of supplied heat energy, with two flow sensors, installed in supply and replenishment pipes	A4
For combined heating – hot water preparation systems. Measuring system consist of the two independent heating energy meters. Flow sensor of the first meter is mounted in supply pipe, flow sensor of the second meter is intended for accounting of hot water energy	U1A3
For combined heating – hot water preparation systems. Measuring system consist of the two independent heating energy meters. Flow sensor of the first meter is mounted in return pipe, flow sensor of the second meter is intended for accounting of hot water energy	U2A3

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

- M-Bus module;
- RS232 module;
- RS485 module;
- M-Bus, CL, or RS232 communication module with pulse outputs;
- M-Bus, CL, or RS232 communication module with current outputs;
- MODBUS module;
- MiniBus module;
- 868 MHz RF radio module.

Optical interface according to EN 62056-21 requirements integrated in the meter.
Two pulse inputs with programmable pulse value for additional flow meters.
Programmable relay output.
Four pulse outputs for test signals.

The technical characteristics of the meter inputs /outputs and communication interfaces are presented in section 3 of this appendix.

The meter can be used also for cooling energy measurement under rated operating conditions, listed in section 2.1.

2 Technical data

2.1 Rated operating conditions

2.1.1 Measurand

Heating energy, calculated from the measured volume of water and the measured difference of water temperature in flow and return pipes.

2.1.2 Measurement range

For calculator:

- limits of the temperature — Θ: 0 °C to180 °C;
- limits of temperature differences * — $\Delta\Theta$: 2 K to 150 K or 3 K to 150 K.

Remark: * - *the lower limit of the temperature difference of the meter and connected temperature sensor pair must be the same.*

Technical data of heat meter flow sensor are presented in Table 3:

Table 3

End connections	Flow-rate, m³/h			Overall length, mm
	Permanent q_p	Maximum q_s	Minimum q_i	
G ¾	0,6	1,2	0,006 (0,024)	110
G 1 or DN20	0,6	1,2	0,006 (0,024)	190
G ¾	1,0	2,0	0,01 (0,04)	110
G 1 or DN20	1,0	2,0	0,01 (0,04)	190
G ¾	1,5	3,0	0,006 (0,06)	110; 165
G 1 or DN20	1,5	3,0	0,006 (0,06)	190
G ¾	1,5	3,0	0,015 (0,06)	110; 165
G 1 or DN20	1,5	3,0	0,015 (0,06)	190
G 1	1,5	3,0	0,015 (0,06)	130
G 1	2,5	5,0	0,01 (0,1)	130
G 1 or DN20	2,5	5,0	0,01 (0,1)	190
G 1	2,5	5,0	0,025 (0,1)	130
G 1 or DN20	2,5	5,0	0,025 (0,1)	190
G 1¼ or DN25 or DN32	3,5	7,0	0,035 (0,14)	260
G 1¼ or DN25 or DN32	6,0	12,0	0,024 (0,24)	260
G 1¼ or DN25 or DN32	6,0	12,0	0,06 (0,24)	260
G 2 or DN40	10,0	20,0	0,04 (0,4)	300
G 2 or DN40	10,0	20,0	0,10 (0,4)	300
DN50	15,0	30,0	0,06 (0,6)	270
DN50	15,0	30,0	0,15 (0,6)	270
DN65	25,0	50,0	0,10 (1,0)	300
DN65	25,0	50,0	0,25 (1,0)	300
DN80	40,0	80,0	0,16 (1,6)	350
DN80	40,0	80,0	0,40 (1,6)	350
DN100	60,0	120,0	0,24 (2,4)	350
DN100	60,0	120,0	0,60 (2,4)	350

Remark: *-minimum flow-rate q_i for temperature limits of heat-conveying liquid from 0 °C to 130 °C is indicated in the brackets.*

Temperature limits of heat-conveying liquid are presented in Table 4:

Table 4

Temperature limits of heat-conveying liquid, Θ_q	Temperature limits of heat-conveying liquid, Θ_q, for measurement schemes U1L and U2L
5 °C to 130 °C	5 °C to 130 °C or 0 °C to 130 °C (optional)

2.1.3 Accuracy class

Accuracy class - 2 according to EN 1434-1.

2.1.4 Environmental conditions / Influence quantities

Ambient temperature	:	5 °C to 55 °C;
Humidity level	:	condensing;
Installations	:	indoor;
Mechanical environment	:	class M1;
Electromagnetic environment	:	class E2.

2.1.5 Maximum admissible working pressure

The maximum admissible working pressure/nominal pressure (PS/PN) of heat meter is 16 bar or 25 bar.

2.1.6 Mounting position of the flow sensor of the heat meter

Flow sensor of the heat meter can be mounted either horizontally or vertically.

3 Interfaces and compatibility conditions

Two or three temperature measurement channels for connecting temperature sensors with Pt 500 sensing elements. Connection of the temperature sensors according to the two-wire or four-wire scheme.

Two pulse input with programmable pulse value for additional flow meters. Class of pulse input device –IB or IC according to EN 1434-2. Type of pulses: active or passive. High voltage level of active pulses 2,5 V to 3,7 V, low voltage level - 0 V to 0,7 V.

Integrated optical communication interface according to EN 62056-21 requirements.

Two programmable pulse/frequency outputs (available with plug-in multi module SKU46 and with mains supply). Class of pulse output device – OD according to EN 1434-2.

Two programmable current outputs (available with mains supply and with plug-in multi module SKU45). Current range: 0 mA to 20 mA or 4 mA to 20 mA.

Programmable relay 230 V, 2A output for limiting regulation or alarm function (available with mains supply module SKM37).

Serial interface M-Bus (available with plug-in module SKU46, SKU45 or SKS43), CL (available with plug-in module SKU46 or SKU45), or RS232 (available with plug-in module SKU46, SKU45 or SKS48).

Serial interface RS485 (available with plug-in module RS485 or MODBUS).

Serial interface MiniBus (available with plug-in module MiniBus).

Wireless interface (available with 868 MHz RF module).
Four pulse outputs for test signals. Class of pulse output device – OD according to EN 1434-2, active pulses with amplitude 3,5 V ± 0,3 V, maximum current level – 0,1 mA.

4 Requirements on production, putting into use and utilization

4.1 Requirements on production

At the end of the manufacturing and adjustment process the heat meters shall be tested according to the requirements of the EN 1434-5. Errors of indication shall not exceed the maximum permissible errors, described in Annex VI (MI-004) of Directive 2014/32/EU.
The flow sensor of the heat meter can be tested with cold water (25 ± 5) °C.

4.2 Requirements on putting into use

The heat meter must be installed in accordance with the requirements of technical description listed in section 1.6.
For flow sensors of the heat meter with nominal diameter DN65 to DN100 necessary straight pipelines lengths are: upstream $\geq 5 \times$ DN, downstream $\geq 3 \times$ DN. For flow sensors of other sizes the straight pipelines installation in upstream and downstream the sensor are not necessary.

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

Test instruction of the heat meter SonoMeter 31, 05-2016.

5.2 Special equipment or software

No special requirements identified.

5.3 Identification of hardware and software

Identification of hardware:

- see Fig.1, Fig.2, Fig.3 and Fig. 4 of this appendix.

Identification of software: version number of the firmware is **3.01**. This number on demand can be shown on the display.

5.4 Calibration-adjustment procedure

The tests are carried out according to the test instruction of the heat meter SonoMeter 31 given on pages 11 and 12 of this appendix, in accordance with the requirements of the EN 1434-5.

6 Security measures

6.1 Sealing

The following heat meter calculator sealing is provided:

- manufacturer's adhesive seal-sticker on the fixing bolt of electronic module under protecting cover (Fig. 4 pos. 1) and on the one bolt of cover protecting electronic module, which protect the access to the adjustment activation jumper (Fig. 4, pos. 2);
- the locks of top and bottom parts of the calculator are sealed with one or two hanged seals of heat supplier after installation (Fig. 4, pos. 3).

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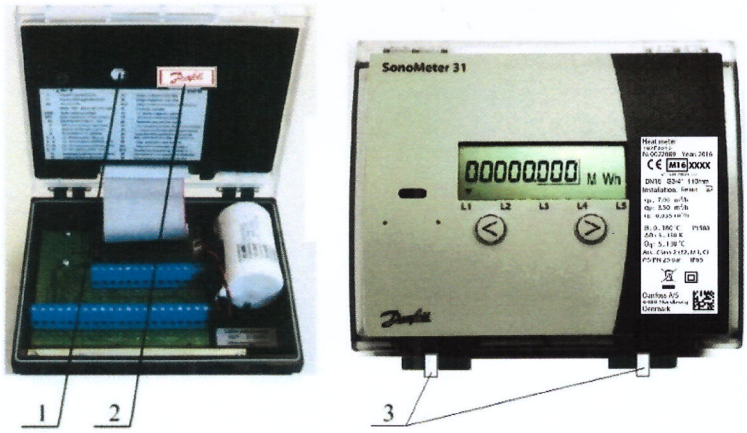


Fig.4. Sealing of the calculator of the heat meter

The following flow sensor sealing is provided:

- manufacturer adhesive seal - sticker on the bolts of the cover (Fig.5, Fig.6, Fig.7);
- two manufacturer's hanged seals on ultrasonic transducers of flow sensor with steel body (Fig. 8).

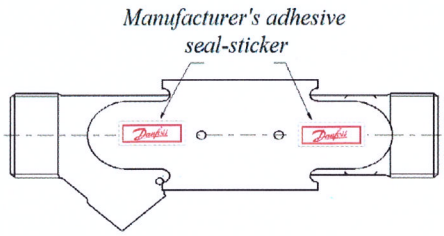


Fig. 5. Sealing of flow sensor
q_p = 0,6/1,0/1,5/2,5 m³/h

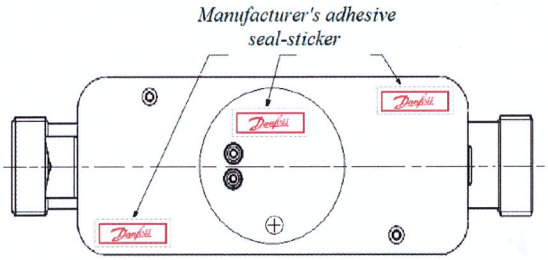


Fig. 6. Sealing of flow sensor
q_p = 3,5/6,0 m³/h

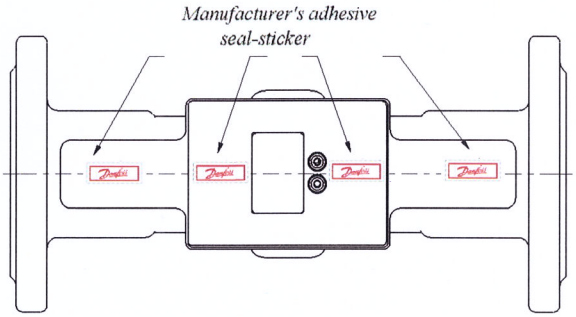


Fig. 7. Sealing of flow sensor
q_p = 10/15/25/40/60 m³/h (brass body)

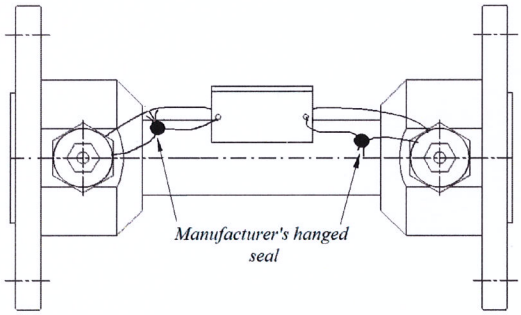


Fig. 8. Sealing of flow sensor
q_p = 25/40/60 m³/h (steel body)

a) Manufacturer's adhesive seal-sticker

b) Manufacturer's hanged seal

Fig.9. Examples of the manufacturer's seals

6.2 Data logger

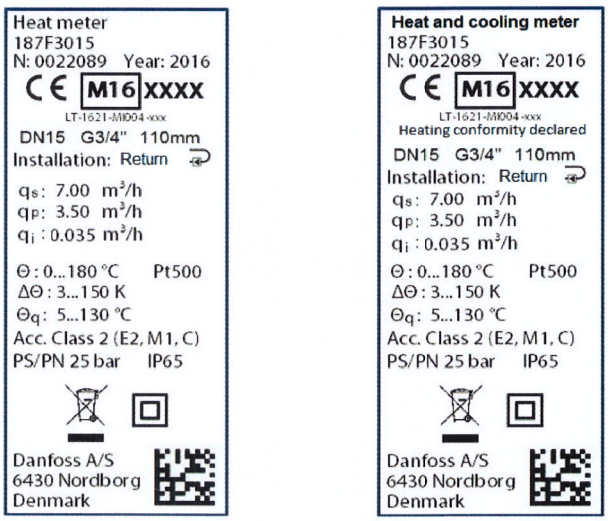
Archive data retention time is at least 12 years.

7 Marking and inscriptions

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

At least the following information shall appear in legible and indelible characters on the heat meter calculator casing and his label:

- EU-type examination certificate number (LT-1621-MI004-023 rev.1);
- manufacturer's mark or name;
- type designation;
- year of manufacture and serial number;
- limits of the temperature;
- limits of temperature differences;
- limits of heat conveying liquid temperature;
- type of temperature sensors (Pt 500);
- limits of flow-rate: maximum q_s, permanent q_p and minimum q_i;
- the maximum admissible working pressure/nominal pressure (PS/PN);
- flow sensor to be installed in the flow (supply) or return;
- accuracy class;
- voltage level for external power supply;
- climatic class;
- electromagnetic class;
- mechanical class;
- additional marking (Heating conformity declared) for meters intended for accounting of heating/cooling energy when measurement scheme U1L or U2L is programmed.



a) For heating energy accounting

b) For heating/cooling energy accounting

Fig. 10. Examples of the calculator marking labels

Additional adhesive label-sticker is on the cover of the flow sensor brass body. On the label is the following information:

- nominal diameter DN or connecting thread of the meter;
- serial number;

- year of manufacture;
- manufacturer's mark or name.

Additional metal label is attached to the flow sensor DN65/DN80/DN100 steel body. On the label is the following information:

- nominal diameter DN;
- serial number;
- year of manufacture;
- manufacturer's mark or name;
- arrow to indicate the direction of the flow.

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

7.2 Conformity marking

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

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

8 List of the drawings attached to the certificate.

Drawings are not added.

9 Certificate history

Issue	Date and reference No.	Description
LT-1621-MI004-023	02-06-2016, No. LEI-12-MP-042.16	Type examination certificate first issued
LT-1621-MI004-023 Revision 1	02-11-2016, No. LEI-12-MP-052.16	1. For measurements schemes U1L and U2L the requirements of the Directive 2014/32/EU are applied when the meter is used for accounting of heating energy. 2. Reduced flow rate range (in Table 3 the minimum flow-rate q_i is presented in the brackets) is valid, when temperature limits of heat-conveying liquid are 0 °C to 130 °C. 3. The meter marking label is changed. New label for meters intended for accounting of heating/cooling energy (measurement schemes U1L and U2L) is applied. 4. Document VDSHU103, issued 03-05-2016, is replaced by document VDSHU103, issued 12-10-2016.

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Test instruction of the heat meter SonoMeter 31

1. Energy errors determination test

1) For evaluation of energy measurement errors two precise resistors are connected for simulating supply and return flow temperatures to the temperature measurement channels T1 and T2 (see connection diagrame Fig. 1p).
2) When the temperature sensor pair is connected to the calculator, the test for calculator and temperature sensor pair is carried out, with the temperature sesors immersed in temperature regulated baths.
3) Flow sensor of the heat meter must be not filled with water or disconnected from the calculator.
4) Short press the SET button 2 times, and there will be "TEST" in the calculator display (TEST mode is activated);
5) Short press button ◀ 1 time, the volume pulse simulation starts and endures of 100 seconds.
6) When the "TEST" stops blinking, sequentially press the button ▶. The measured energy (kWh) and simulated volume (m³) read directly from calculator display. The simulated volume is 10 m³ or 1 m³ (depending on the permanent flow-rate of the heat meter).
7) The measured energy can be read using the 2st test pulse output too (see connection diagrame Fig. 1p).
8) After the test press the SET button to get out from the TEST mode.

2. Volume errors determination test

1) Press the SET button and the editing mode of the meter is activated ("SET" is shown on the display).Press the ▶ button sequentially to get to the configuration window of the temperature Θ5 (parameter 3:/5). With the buttons ◀ and ▶ the temperature approximate to the water temperature in the test bench must be set (with accuracy ± 5 °C) :

2) Short press the SET button 2 times, and there will be "TEST" in the calculator display (TEST mode is activated).
3) The flow sensor measurement errors should be evaluated using hydrodynamic test bench at controls flow rates specified in the section 5.2 of the EN1434-5. The 4st test pulse output should be used (see connection diagrame Fig. 1p).
4) The volume pulse values in TEST mode are presented in Table 1p:

Table 1p

Maximum flow-rate q_s of the heat meter, m³/h	Volume pulse value in TEST mode, litre/pulse	Energy pulse value in TEST mode, Wh/pulse
$q_s < 5$	0,001	0,1
$5 \le q_s \le 50$	0,01	1
$50 \le q_s$	0,1	10

5) The recommended minimum volume pulse quantity and minimum duration of the test for the volume errors determination test is presented in Table 2p.

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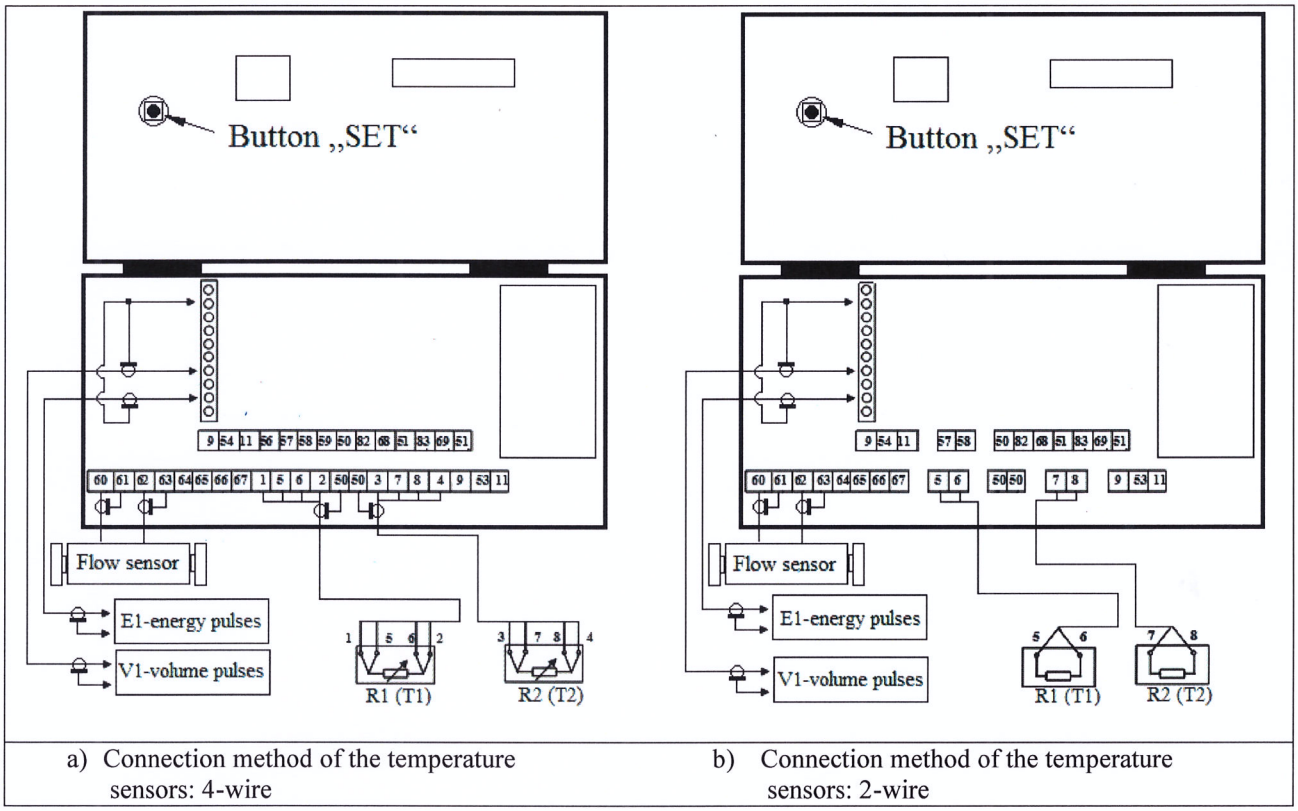
Table 2p

Test flow-rate q, m³/h	Pulse quantity N	Duration of the test T, minutes
$0{,}1\ q_p < q \le q_s$	$N \ge 1000$	$T > 2$
$q_i \le q \le 0{,}1\ q_p$	$N > 500$	$T > 2 + 8\ q_i/q$

6) After the test the previous value of the temperature Θ5 must be set. Press the SET button to get out from the TEST mode.



a) Connection method of the temperature sensors: 4-wire

b) Connection method of the temperature sensors: 2-wire

Fig. 1p. Connection diagrame for the test of the heat meter SonoMeter 31

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