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Standards and documents applied:
EN 1434-1:2015+A1:2018;
EN 1434-2:2015+A1:2018;
EN 1434-4:2015+A1:2018;
EN 1434-5:2015+A1:2019;
WELMEC 7.2:2015.

The measuring instrument must correspond with the following specifications:

1 Design of the instrument

1.1 Construction

Thermal energy meter NE consists of the primary flow sensor and the calculator with type approved pair of temperature sensors with Pt 500 elements.
Flow sensor consists of housing with built-in ultrasound transducers.
For flow sensors q_p = (0,6 – 2,5) m³/h body is made from brass (cast), with two ultrasound transducers, the sensor connected with the calculator via one screened cable (Fig. 2, a, b).
For flow sensors q_p = (3,5 – 15) m³/h body is made from brass (cast), with two ultrasound transducers, the sensor connected with the calculator via two screened cables (Fig. 2, c, d, e, f, g).
For flow sensors q_p = (25 – 60) m³/h body can be made from either brass (cast) or steel (welded construction), with two ultrasound transducers, the sensor connected with the calculator via two screened cables (Fig. 2, h, i).
For flow sensors q_p = (60 – 950) m³/h body is made from steel (welded construction), with four ultrasound transducers, the sensor connected with the calculator via four screened cables (Fig. 2, j).
The length of the cables connecting flow sensor to the calculator can be from 3 m to 50 m.
The flow sensors q_p = (0,6 – 6) m³/h has intended place for temperature sensor installation.
The calculator 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 mains.

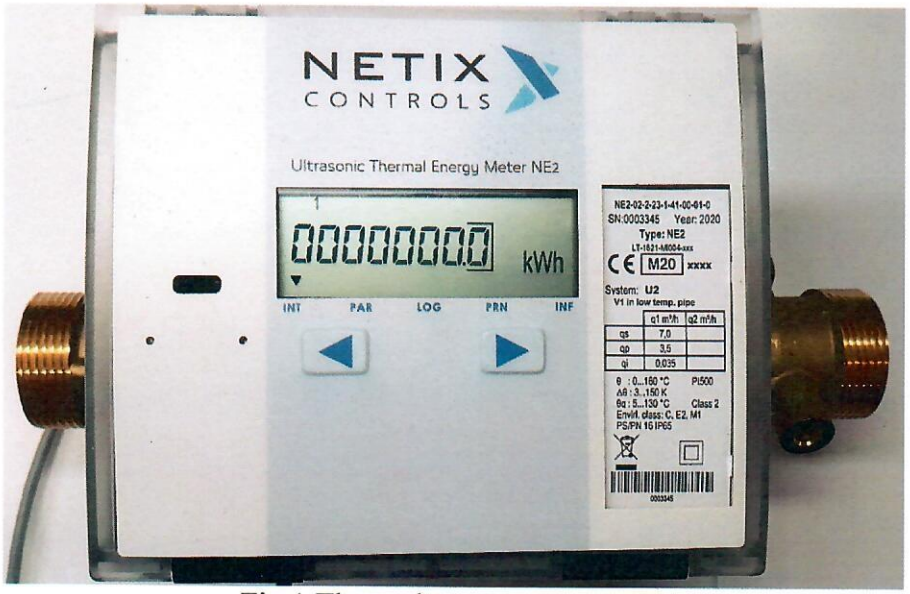

Fig.1.Thermal energy meter NE2

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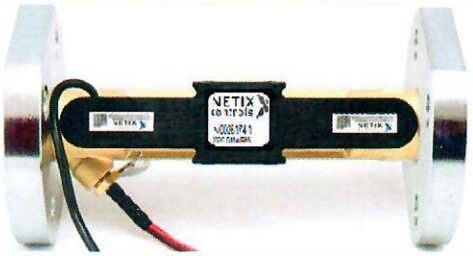
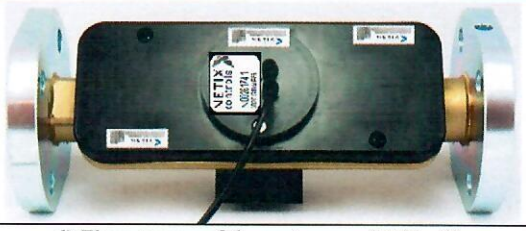
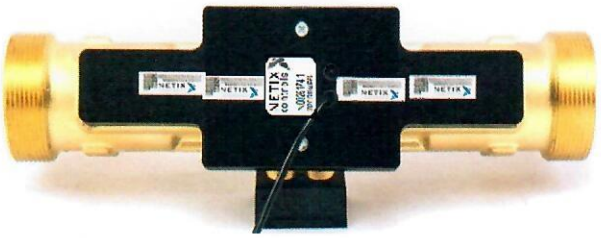
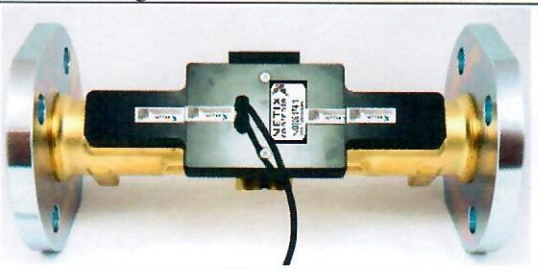
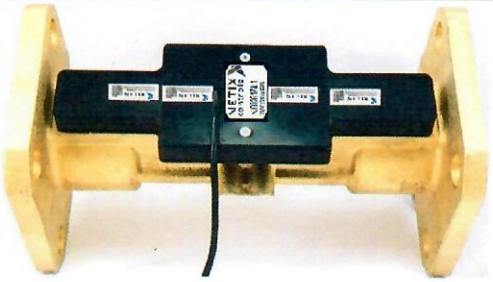
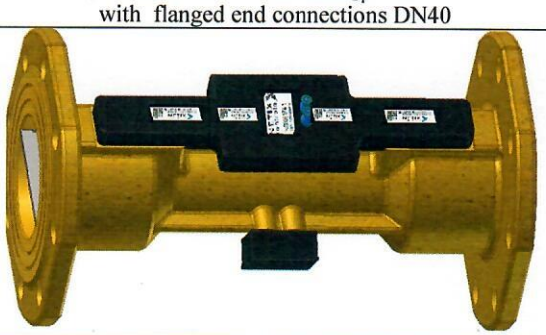
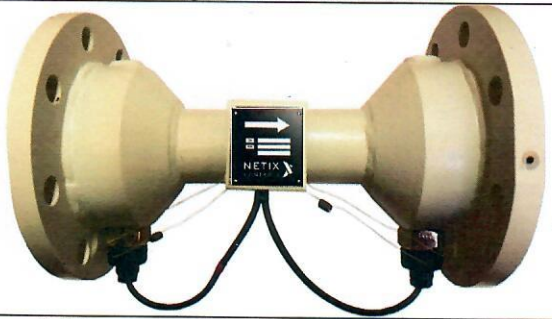
	
a) Flow sensor of the meter q_p = 0,6/1,0/1,5/2,5 m³/h with threaded end connections G ¾ or G 1	b) Flow sensor of the meter q_p = 0,6/1,0/1,5/2,5 m³/h with flanged end connections DN20
	
c) Flow sensor of the meter q_p = 3,5/6 m³/h with threaded end connections G 1¼	d) Flow sensor of the meter q_p = 3,5/6 m³/h with flanged end connections DN25 or DN32
	
e) Flow sensor of the meter q_p = 10 m³/h with threaded end connections G 2	f) Flow sensor of the meter q_p = 10 m³/h with flanged end connections DN40
	
g) Flow sensor of the meter q_p = 15 m³/h with flanged end connections DN50	h) Flow sensor of the meter q_p = 25/40/60 m³/h with flanged end connections (DN65/DN80/DN100), brass body
	
i) Flow sensor of the meter 2 q_p = 25/40/60 m³/h with flanged end connections (DN65/DN80/DN100), steel body	j) Flow sensor of the meter q_p = 60/100/150/250/400/560/750/950 m³/h with flanged end connections (DN100/DN125/DN150/DN200/DN250/DN300/DN400), steel body, with four ultrasound transducers

Fig.2. Flow sensor of the thermal energy meter NE2

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Structure of type number of the thermal energy meter NE2

NE2 – □□ – □ – □□ – □ – □□ – □□ – □□ – □□ – □

Type

Measurement scheme:

Designation	Code	Designation	Code	Designation	Code
U1	01	U1L	06	A2	12
U2	02	U2L	07	A4	14
U1F	04	A	08	U1A3	16
U2F	05	A1	10	U2A3	17

Ratio of the flow rates q_v/q_i:	Code
100 (25)*	2
250	4

Temperature sensors connection scheme, temperature difference measurement range:

	Code		Code
two-wire scheme, 2 K to 150 K	22	two-wire scheme, 3 K to 150 K	23
four-wire scheme, 2 K to 150 K	42	four-wire scheme, 3 K to 150 K	43

Power supply:	Code
Internal battery 3,6 V DC	1
Mains power supply 230 V AC	2

Data code of flow sensor of 1st measurement channel:
Codes are presented in user guide, Table 1.2

Data code of flow sensor of 2st measurement channel:
Code s are presented in user guide, Table 1.2

Connection cable length of flow sensors, m:

Length	Code	Length	Code	Length	Code	Length	Code
3 m	01	10 m	03	20 m	05	50 m	07
5 m	02	15 m	04	40 m	06		

Connection cable length of temperature sensors, m:

Length	Code	Length	Code	Length	Code	Length	Code	Length	Code
3 m	01	10 m	03	20 m	05	60 m	07	100 m	09
5 m	02	15 m	04	40 m	06	80 m	08	None	00

The communication interface:

Type	Code	Type	Code
None	0	M-Bus/RS232/CL, with pulse outputs	5
M-Bus	1	MODBUS	6
RS232	2	MiniBus	7
RS485	3	RF 868 MHz RF module	8
M-Bus/RS232/CL, with current outputs	4	BACnet	9

Note: * - the ratio of the flow rates for temperature limits of heat-conveying liquid from 0 °C to 130 °C is indicated in the brackets (applied for measurement schemes U1L and U2L only).

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 inlet pipe	U1
For closed heating systems. Flow sensor in outlet pipe	U2
For closed heating systems. Flow sensor in inlet pipe. With leakage detection option.	U1F
For closed heating systems. Flow sensor in outlet pipe. With leakage detection option.	U2F
For closed system for accounting of heating/cooling energy. Flow sensor in inlet pipe	U1L*
For closed system for accounting of heating/cooling energy. Flow sensor in outlet pipe	U2L*

Note: * - 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 Sensor

Thermal energy meter hardware consists of an ultrasonic flow sensor and heat meter calculator. 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 thermal energy meter NE2. User guide, 01-2020.
Test instruction of the thermal energy meter NE2, 02-2020.
Other reference documents on which basis this certificate is issued, are stored in a file Nr.LEI-12-MP-099.20.

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

The 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;
- BACnet module.

The 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 inlet and outlet pipes.

2.1.2 Measurement range

For calculator:

- limits of the temperature — Θ: 0 °C to 180 °C;
- limits of temperature differences * — $\Delta\Theta$: 2 K** to 150 K or 3 K to 150 K.

Notes:

1. * - the lower limit of the temperature difference of the meter and connected temperature sensor pair must be the same.
2. ** - for meters with the lower limit of the temperature difference 2 K, the requirements of the Directive 2014/32/EU are not applied.

Technical data of thermal energy 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	12	0,024 (0,24)	260
G 1¼ or DN25 or DN32	6	12	0,06 (0,24)	260
G 2 or DN40	10	20	0,04 (0,4)	300
G 2 or DN40	10	20	0,10 (0,4)	300
DN50	15	30	0,06 (0,6)	270
DN50	15	30	0,15 (0,6)	270
DN65	25	50	0,10 (1,0)	300
DN65	25	50	0,25 (1,0)	300
DN80	40	80	0,16 (1,6)	300; 350
DN80	40	80	0,40 (1,6)	350

End connections	Flow-rate, m³/h			Overall length, mm
	Permanent q_p	Maximum q_s	Minimum q_i	
DN100	60	120	0,24 (2,4)	350
DN100	60	120	0,60 (2,4)	350; 360
DN100*	60	120	0,24 (2,4)	350
DN125*	100	200	1,0 (4)	350
DN125*	100	200	0,4 (4)	350
DN150*	150	300	1,5 (6,25)	500
DN150*	150	300	0,6 (6,25)	500
DN200*	250	500	2,5 (10,4)	500
DN200*	250	500	1,0 (10,4)	500
DN250*	400	1120	4,0 (16)	600
DN250*	400	1120	1,6 (16)	600
DN300*	560	1560	5,6 (22,5)	500
DN300*	560	1560	2,24 (22,5)	500
DN350*	750	2100	7,5 (31,25)	550
DN350*	750	2100	3,0 (31,25)	550
DN400*	950	2660	9,5 (40)	600
DN400*	950	2660	3,8 (40)	600

Notes:

1. * -Flow sensors with four ultrasound transducers.
2. 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 meter is 16 bar or 25 bar.

2.1.6 Mounting position of the flow sensor

Flow sensor of the 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).

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

Four configurable 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 thermal energy 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 thermal energy meter must be installed in accordance with the requirements of user guide listed in section 1.6.

For flow sensors of the heat meter with nominal diameter DN15 to DN50 the straight pipelines installation in upstream and downstream the sensor are not necessary.

For flow sensors of the heat meter with nominal diameter DN65 to DN400 necessary straight pipelines lengths, depending on the fitting type: upstream – from 5 × DN to 20 × DN, downstream ≥ 3 × DN (see user guide in section 1.6 of this appendix).

4.3 Requirements for consistent utilization

No special requirements identified.

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

5.1 Documentation of the procedure
Test instruction of the thermal energy meter NE2, 02-2020.

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 software 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 thermal energy meter NE2 given on pages 13 to 15 of this appendix, in accordance with the requirements of the EN 1434-5.

6 Security measures

6.1 Sealing
The following meter calculator sealing is provided:
- the manufacturer's adhesive seal-sticker on the fixing bolt of electronic module under protecting cover (Fig. 3 pos. 1) and on the one bolt of cover protecting electronic module, which protect the access to the adjustment activation jumper (Fig. 3, 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. 3, pos. 3).

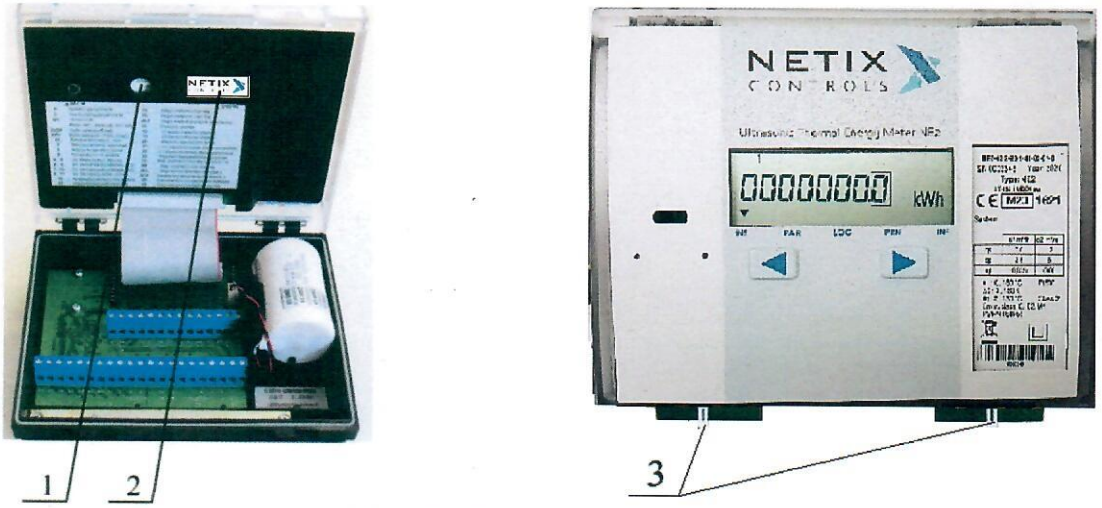

Fig.3. Sealing of the calculator of the thermal energy meter

The following flow sensor sealing is provided:
- manufacturer adhesive seal - sticker on the bolts of the cover with brass body of the flow sensor (Fig.4, a, b, c);

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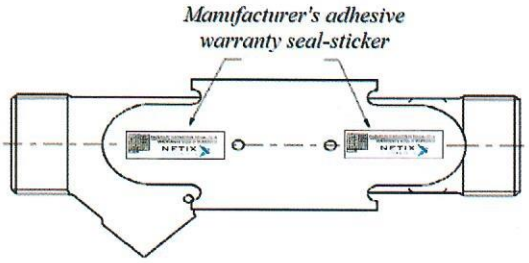
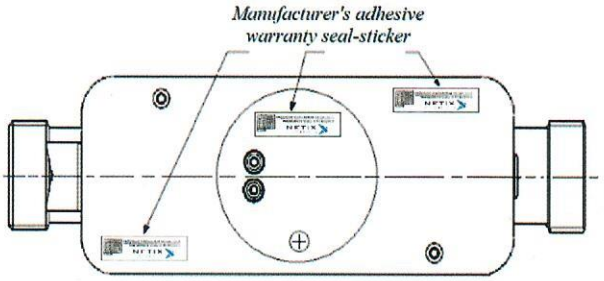
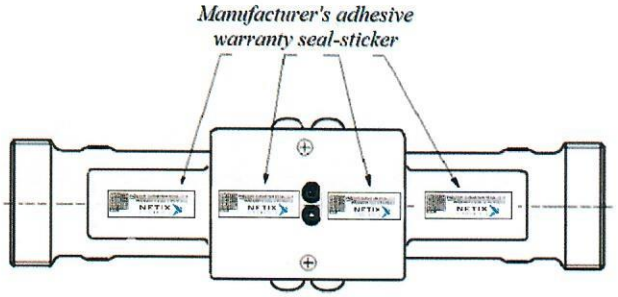
- two manufacturer's hanged seals on ultrasonic transducers of flow sensor with steel body and two ultrasound transducers (Fig. 4, d);
- four manufacturer's hanged seals on ultrasonic transducers of flow sensor with steel body and four ultrasound transducers (Fig. 4, e).



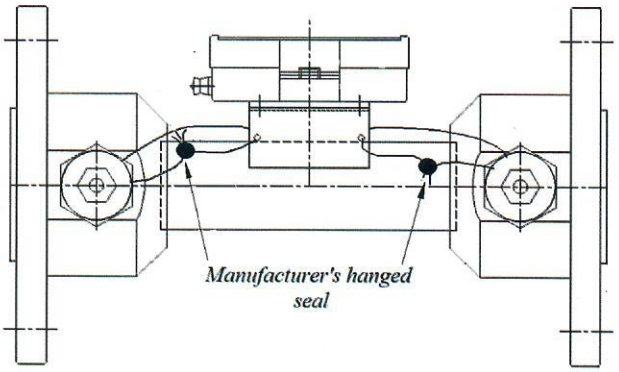
a) Sealing of flow sensor
q_p = 0,6/1,0/1,5/2,5 m³/h



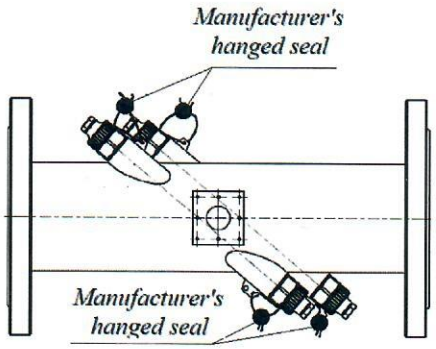
b) Sealing of flow sensor
q_p = 3,5/6,0 m³/h



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



d) Sealing of flow sensor
q_p = 25/40/60 m³/h
(steel body, with two ultrasound transducers)



e) Sealing of flow sensor q_p = 60/100/150/250/400/560/750/950 m³/h
(steel body, with four ultrasound transducers)

Fig.4. Sealing of the flow sensor

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a) Manufacturer's adhesive seal-sticker

b) Manufacturer's adhesive warranty seal-sticker

c) Manufacturer's hanged seal

Fig. 5. Manufacturer's protective seals

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 thermal energy meter calculator casing and his label:

- EU-type examination certificate number;
- manufacturer's mark or name;
- type designation and type number;
- 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 inlet or outlet;
- accuracy class;
- voltage level for external power supply;
- climatic class;
- electromagnetic class;
- mechanical class;
- programmed measurement scheme (see Table 1 and Table 2);
- additional marking (Heating conformity declared) for the measurement schemes U1L and U2L.

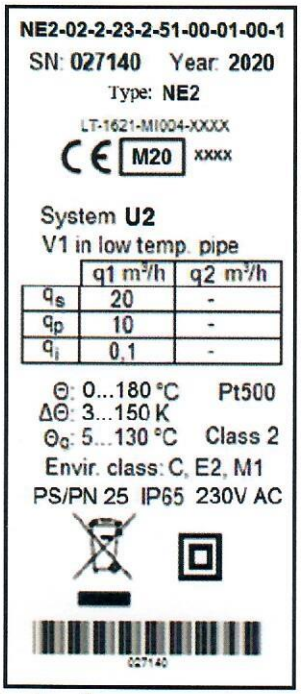
Additional adhesive label-sticker is on the cover of the flow sensor brass body. On the label is the following information:

- nominal diameter DN or connecting thread of the meter;
- serial number;
- year of manufacture;
- manufacturer's mark or name.

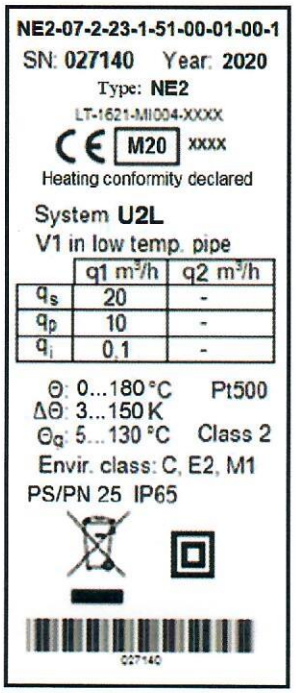
Additional metal label is attached to the flow sensor DN65 – DN400 steel body. On the label is the following information:

- 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.



a) For heating energy accounting



b) For heating/cooling energy accounting

Fig. 6. Examples of the calculator marking labels

7.2 Conformity marking

In addition, the label of 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
1	2	3
LT-1621-MI004-043	04-03-2020, No. LEI-12-MP-099.20	Type examination certificate first issued

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Test instruction of the thermal energy meter NE2

1. Energy errors determination test

1) For evaluation of energy measurement errors two precise resistors are connected for simulating inlet and outlet flow temperatures to the temperature measurement channels T1 and T2 (see connection diagram Fig. 1p, Fig. 2p, Fig. 3p);
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 sensors immersed in temperature regulated baths;
3) Flow sensor of the thermal energy 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 diagram Fig. 1p, Fig. 2p, Fig. 3p);
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);
9) The flow sensor measurement errors should be evaluated using hydrodynamic test bench at controls flow rates specified in the section 6.2 of the EN 1434-5. The 4st test pulse output should be used (see connection diagram Fig. 1p, Fig. 2p, Fig. 3p);
3) The volume pulse values in TEST mode are presented in Table 1p:

Table 1p

Maximum flow-rate q_s of the 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

4) 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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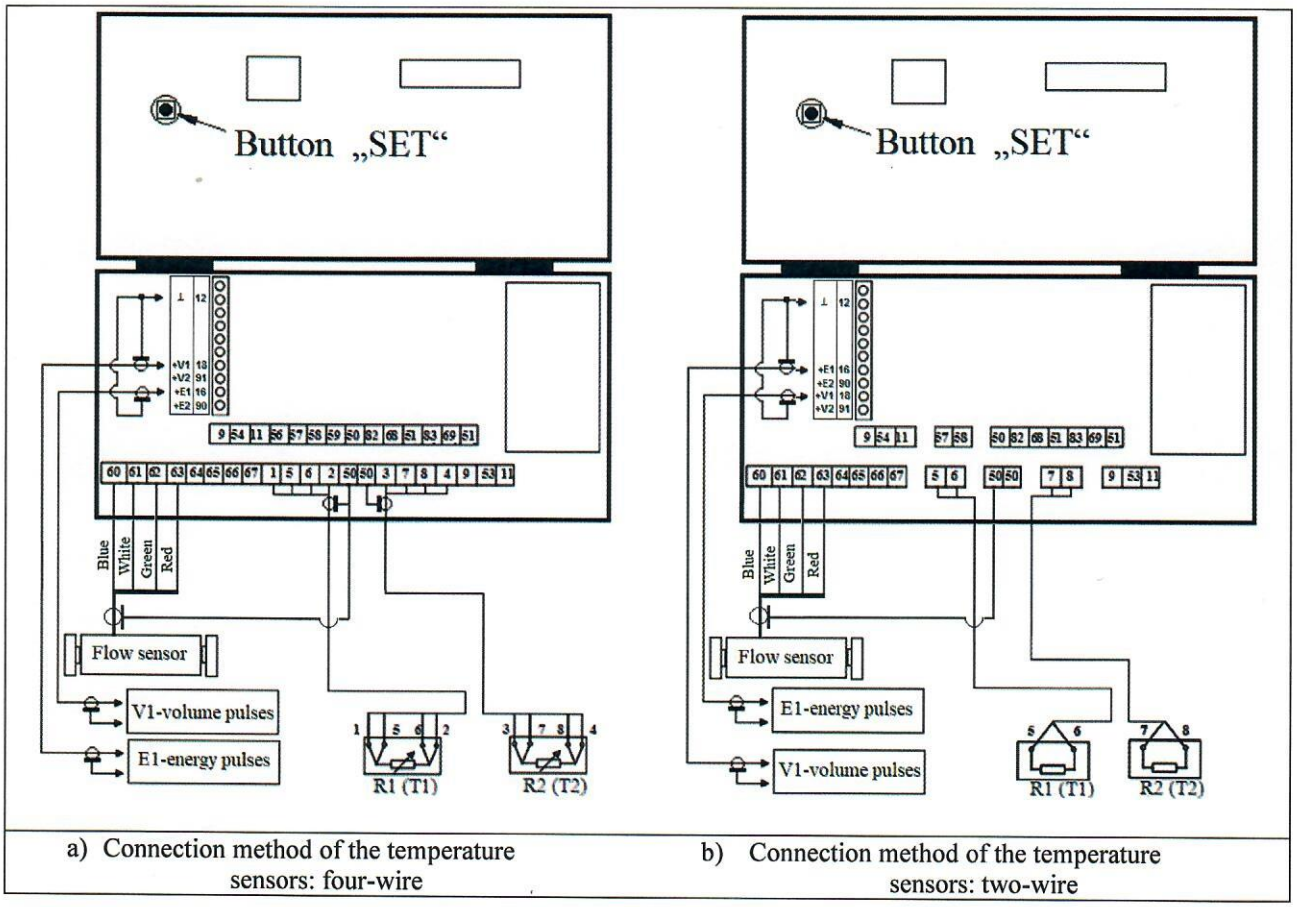
Table 2p

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

5) 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: four-wire

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

Fig. 1p. Connection diagram for the test of the thermal energy meter NE2, q_p = (0,6 – 2,5) m³/h

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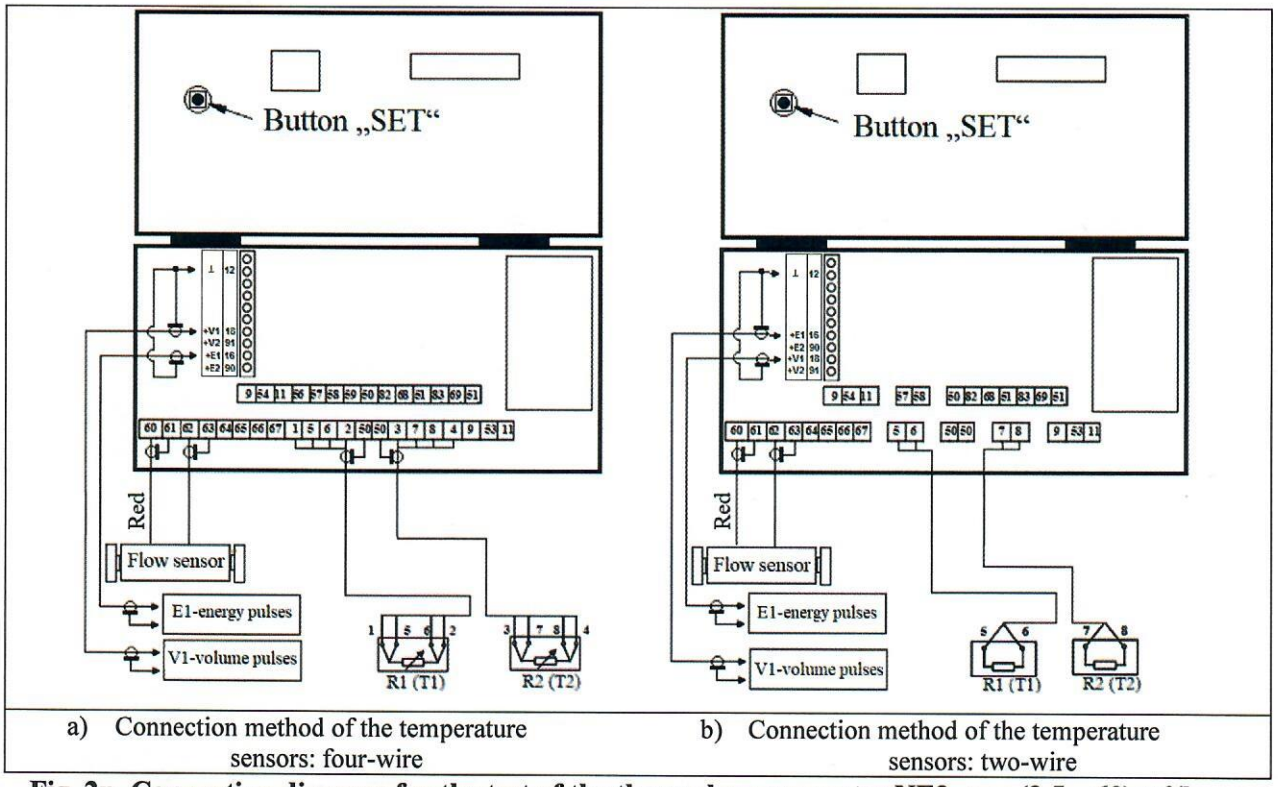
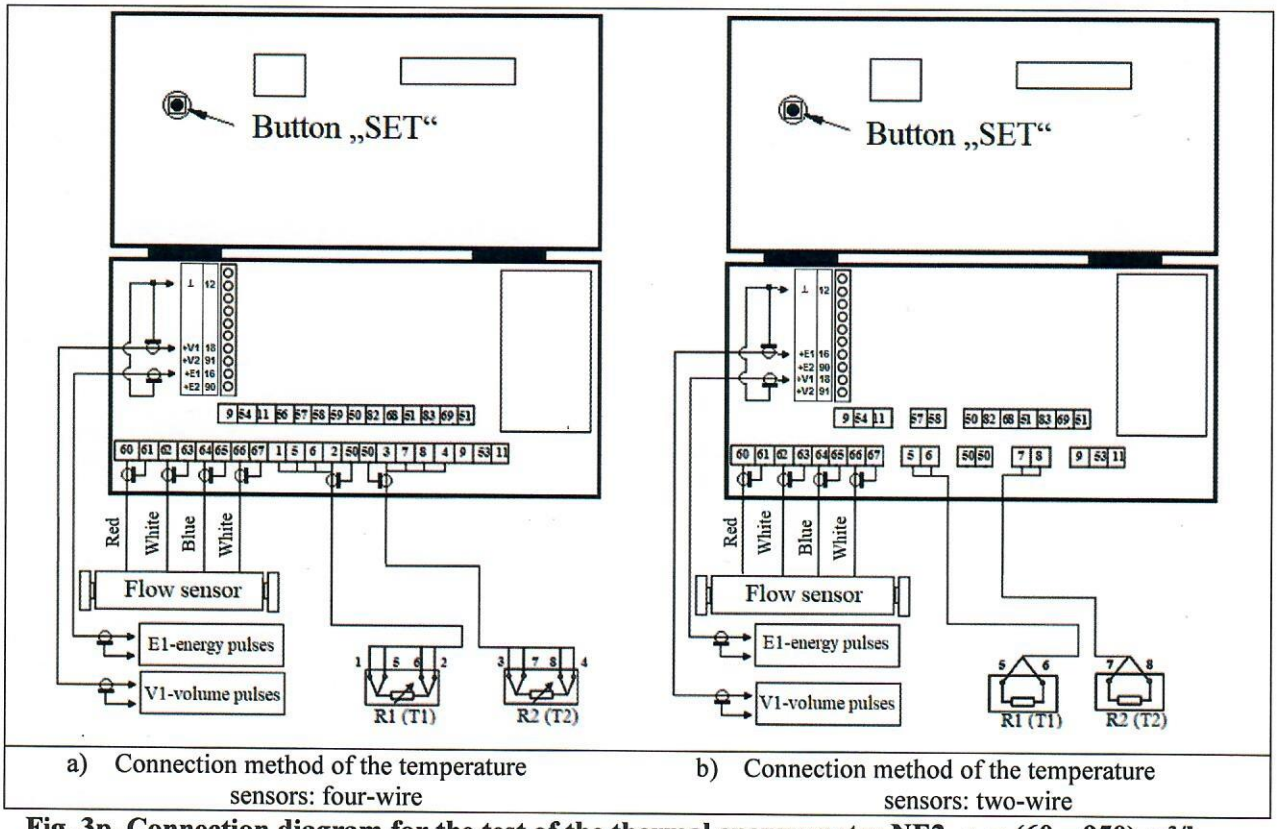


a) Connection method of the temperature sensors: four-wire

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

Fig. 2p. Connection diagram for the test of the thermal energy meter NE2, q_p = (3,5 – 60) m³/h



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

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

Fig. 3p. Connection diagram for the test of the thermal energy meter NE2, q_p = (60 – 950) m³/h (flow sensor with four ultrasound transducers)

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