

EC-Type Examination Certificate

Measuring Instrument Directive

Certificate number: DK-0200-MI004-013

Issued by FORCE Certification A/S, Denmark
EC-notified body number 0200

In accordance with The Danish Safety Technology Authority's statutory order no. 313 of March 30, 2016 which implements the Directive 2014/32/EC of the European Parliament and Council of February 26, 2014 on measuring instruments (MID).

Issued to: **Kamstrup A/S**
Industrivej 28, Stilling
DK-8660 Skanderborg

Type of instrument: Heat Meter

Type designation: MULTICAL[®] 402 (type 402-V/W/T)

Valid until: 2020-04-29

Number of pages: 13, including appendix

Date of issue: 2016-05-19

Version No.: 7
This new version of DK-0200-MI004-013 is issued due to changes to the product.
All previous certificates are withdrawn.

Approved by

Processed by



Lars Poder
Certification Manager



Michael Møller Nielsen
Examiner

The conformity markings may only be affixed to the above type approved equipment. The manufacturer's Declaration of Conformity may only be issued and the notified body identification number may only be affixed on the instrument when the production/product assessment module (D or F) of the directive is fully complied with and controlled by a written inspection agreement with a notified body.
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FORCE Certification references:

TASK no.: 114-33017.04.06.02 and ID no.: DK-0200-MID-00663

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Appendix to

EC-Type Examination Certificate Measuring Instrument Directive

Number: DK-0200-MI004-013

Issued by FORCE Certification A/S, Denmark
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| Version | Issue date | Changes |
|------------------------------|------------|---|
| DK-0200-MI004-013 | 2010-04-29 | Original certificate |
| DK-0200-MI004-013 rev 1-2011 | 2011-05-19 | - |
| DK-0200-MI004-013 rev 1-2012 | 2012-01-10 | <ul style="list-style-type: none"> • Changed main PCB • New software revision • New modules added |
| DK-0200-MI004-013 rev 2-2012 | 2012-05-01 | New section added to description |
| DK-0200-MI004-013 rev 1-2013 | 2013-09-23 | New module added to type number combination |
| DK-0200-MI004-013 rev 1-2014 | 2014-11-12 | <ul style="list-style-type: none"> • New module added to type number combination • New examples of type labels |
| DK-0200-MI004-013 rev 6 | 2015-12-10 | <ul style="list-style-type: none"> • Revision history added • Overview of SW revision and checksum added • Requirements for initial verification clarified • New METERTOOL SW added |
| DK-0200-MI004-013 ver 7 | 2016-05-19 | <ul style="list-style-type: none"> • Language neutral type labels added • Previous versions of this certificate withdrawn |

Applied standards and documents:

EN 1434: 2007

The instruments/measuring systems shall correspond with the following specifications:

Type designation:

MULTICAL[®] 402 (type 402-V/W/T)

Description:

The meter consists of a calculator and a flow sensor, which make out a heat meter together with a type approved Pt 500 or Pt100 temperature sensor pair.

The electrical connection between the calculator and the flow sensor is a 150 cm long cable, and the units can either be physically assembled or mounted separately.

The calculator unit has a display indicating registered thermal energy, and additionally via a pushbutton also accumulated volume, operating hour counter, inlet and outlet temperatures etc.

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The calculator can be retrofitted with various approved plug-in modules, e.g. pulse and radio modules, see page 3. The modules are mounted under the cover plate of the calculator without subsequent reverification.

The volume measurement is made by means of bi directional ultrasonic technique according to the transit time method. Through two ultrasonic transducers sound signals are sent both with and against the flow direction. The flow sensor consists of a meter case made of brass or cast iron, in which the ultrasonic heads are placed. Above the meter case a two-parted plastic cabinet with a rail for possible mounting of the calculator is mounted.

Integrated functions that are not under the Measuring Instruments Directive:

The meter is also type tested as a cooling meter and as a combined Heating/Cooling meter according to EN 1434:2007 and prEN 1434-4:2009, and can therefore be used as so, under the nominal operating temperatures as described in Technical data in this Certificate.

Technical documentation:

Reference no.:

- 114-33017.04.06.02
- 114-33017.04.06.01
- 114-21535.0004.0023
- 113-21029.0004.0005
- 112-23383.0004.0005
- 80.976-267/12
- 80.976-218/11
- 80.976-139/10

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Technical data

| | | | |
|--|---|--|--|
| Legal measuring data | | | |
| According to | | | : EN 1434:2007 (prEN 1434:2009) |
| Instrument type | | | : Complete instrument Combined instrument Parts: Calculator and flow sensor with separate exchangeable temperature sensor pair |
| Accuracy class | | | : 2 and 3 |
| Environment class | | | : E1, M1 |
| Climatic class | | | : 5...55°C, non-condensing, closed location |
| Energy indication | | | : kWh, MWh or GJ |
| Temperature range, calculator | $\theta_{\min} - \theta_{\max}$ | | : 2...160°C 20...110°C |
| Temperature diff. range | $\Delta\theta_{\min} - \Delta\theta_{\max}$ | | : 3...150K 3...90K or 5...90K |
| Temperature sensors | | | : 2 paired Pt 500 or Pt100 sensors, depending on type. Max 10 m unshielded 2-wire cable |
| Flow sensor, position | | | : Inlet or outlet pipe |
| Temperature of medium flow sensor | θ_q | | : 15...130°C, 20...110°C 2...130°C, type 402-T |
| Pressure stage | | | : PN16 and PN25 |
| Nominal volume flow rate | q_p [m ³ /h] | | : 0.6 1.5 2.5 3.5 6 10 15 |
| Pressure loss | Δp [bar] | | : 0.04 0.22 0.03 0.07 0.2 0.06 0.14 |
| Dynamic range | $q_i:q_p$ | | : 1:100, 1:50 and 1:25 |
| | $q_s:q_p$ | | : 2:1 |
| Dynamic range q_p 1.5, 6 and 15 m ³ /h | $q_i:q_p$ | | : 1:250 |
| | $q_s:q_p$ | | : 2:1 |
| Durability specification | | | : Normal flow sensor, typical 5 years and longer. |
| (According to EN 1434) | | | (Long life flow sensor) |
| Installation angle | | | : Horizontally, vertically or at an angle |
| Possibility of build in sensor (M10x1 connection) | | | : G ³ / ₄ and G1 flow parts (threaded) |
| Power supply | | | : 230 VAC, 48...62 Hz : 24 VAC, 48...62 Hz : 3.65 VDC, Lithium battery or D-cell or 2 x AA-Cell |

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Software identification

| Version no. | Checksum for metrological part of the software |
|---------------|--|
| xxxx0201 / B1 | 55297 |
| xxxx0301 / C1 | 58143 |
| xxxx0401 / D1 | 15903 |
| xxxx0501 / E1 | 45240 |

(xxxx is the meter type)

The SW version and checksum can be shown on the display of the meter (display No. 10 and No. 11)

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Type number combination MULTICAL® 402

| | | | | Type | 402- | □ | - | □□ | - | □ | - | □□ | - | □ | - | □ | - | □□ |
|---|---|-------------|---------------------|------|------|---|---|----|---|---|---|----|---|---|---|---|---|----|
| Sensor connections | | | | | | | | | | | | | | | | | | |
| Pt100 | | | | V | | | | | | | | | | | | | | |
| Pt500 | | | | W | | | | | | | | | | | | | | |
| Pt500 | (Flowpart secured against condensation) | | | T | | | | | | | | | | | | | | |
| Modules | | | | | | | | | | | | | | | | | | |
| No module | | | | | | | | 00 | | | | | | | | | | |
| Data + 2 pulse inputs (VA, VB) | | | | | | | | 10 | | | | | | | | | | |
| Data + 2 pulse outputs (CE, CV) | | | | | | | | 11 | | | | | | | | | | |
| M-Bus + 2 pulse inputs (VA, VB) | | | | | | | | 20 | | | | | | | | | | |
| M-Bus + 2 pulse outputs (CE, CV) | | | | | | | | 21 | | | | | | | | | | |
| M-Bus + 2 pulse inputs (VA, VB) , MCIII Data package | | | | | | | | 29 | | | | | | | | | | |
| Wireless M-Bus, 868 MHz, Mode C1 (Ind. Key) | | | | | | | | 30 | | | | | | | | | | |
| Wireless M-Bus, 868 MHz, Mode T1 (Ind. Key) | | | | | | | | 31 | | | | | | | | | | |
| Wireless M-Bus, 868 MHz, Mode T2 (Ind. Key) | | | | | | | | 32 | | | | | | | | | | |
| Wireless M-Bus, 868 MHz, Mode C2 (Ind. Key) | | | | | | | | 33 | | | | | | | | | | |
| Wireless M-Bus, 868 MHz, Mode C1 (No Key) | | | | | | | | 34 | | | | | | | | | | |
| Wireless M-Bus, 868 MHz, Mode C1 (Ind. Key) Alt. Reg. + VA, VB | | | | | | | | 35 | | | | | | | | | | |
| Wireless M-Bus, 868 MHz, Mode C1 (No Key) Alt. Reg. + VA, VB | | | | | | | | 36 | | | | | | | | | | |
| Wireless M-Bus, 868 MHz, Mode T1 (Common Key) | | | | | | | | 37 | | | | | | | | | | |
| Wireless M-Bus, 868 MHz, Mode C1 (Ind. Key) Fixed network | | | | | | | | 38 | | | | | | | | | | |
| Radio, EU, 434 MHz, Int. Ant., NET0 | | | | | | | | 40 | | | | | | | | | | |
| Radio, EU, 434 MHz, Int. Ant., NET1 | | | | | | | | 41 | | | | | | | | | | |
| Radio, EU, 434 MHz, Int.+Ext. Ant., NET0 + 2 pulse inputs (VA, VB) | | | | | | | | 42 | | | | | | | | | | |
| Radio, EU, 434 MHz, Int.+Ext. Ant., NET0 + 2 pulse outputs (CE, CV) | | | | | | | | 43 | | | | | | | | | | |
| Radio, EU, 434 MHz, Int.+Ext. Ant., NET1 + 2 pulse inputs (VA, VB) | | | | | | | | 44 | | | | | | | | | | |
| Radio, EU, 434 MHz, Int.+Ext. Ant., NET1 + 2 pulse outputs (CE, CV) | | | | | | | | 45 | | | | | | | | | | |
| Radio, SE, 444 MHz, Int. Ant., NET0 + 2 pulse inputs (VA, VB) | | | | | | | | 50 | | | | | | | | | | |
| Radio, SE, 444 MHz, Int. Ant., NET1 + 2 pulse inputs (VA, VB) | | | | | | | | 52 | | | | | | | | | | |
| Radio, SE, 444 MHz, Ext. Ant., NET0 + 2 pulse inputs (VA, VB) | | | | | | | | 54 | | | | | | | | | | |
| Radio, SE, 444 MHz, Ext. Ant., NET1 + 2 pulse inputs (VA, VB) | | | | | | | | 56 | | | | | | | | | | |
| Radio, TC, 868 MHz, Int. + Ext. Ant | | | | | | | | 58 | | | | | | | | | | |
| Supply | | | | | | | | | | | | | | | | | | |
| No module | | | | | | | | 0 | | | | | | | | | | |
| Battery, 2 x AA | | | | | | | | 1 | | | | | | | | | | |
| Battery, D-cell | | | | | | | | 2 | | | | | | | | | | |
| 230 VAC supply module | | | | | | | | 7 | | | | | | | | | | |
| 24 VAC supply module | | | | | | | | 8 | | | | | | | | | | |
| Pt500 Sensor set | | | | | | | | | | | | | | | | | | |
| No sensor set | | | | | | | | | | | | | | | | | | 00 |
| Pocket sensor set w/1.5 m cable | | | | | | | | | | | | | | | | | | 0A |
| Pocket sensor set w/3.0 m cable | | | | | | | | | | | | | | | | | | 0B |
| Pocket sensor set w/5.0 m cable | | | | | | | | | | | | | | | | | | 0C |
| Pocket sensor set w/10 m cable | | | | | | | | | | | | | | | | | | 0D |
| Short direct sensor set w/1.5 m cable | | | | | | | | | | | | | | | | | | 0F |
| Short direct sensor set w/5.0 m cable | | | | | | | | | | | | | | | | | | 0G |
| Separate approved sensors | | | | | | | | | | | | | | | | | | XX |
| Flow part | | | | | | | | | | | | | | | | | | |
| q _p [m ³ /h] | Connection | Length [mm] | CCC-default [h-c] | | | | | | | | | | | | | | | |
| 0.6 | G¾B (R½) | 110 | 416 - 416 | | | | | | | | | | | | | | | 1 |
| 0.6 | G1B (R¾) | 130 | 416 - 416 | | | | | | | | | | | | | | | 2 |
| 0.6 | G1B (R¾) | 190 | 416 - 416 | | | | | | | | | | | | | | | 3 |
| 1.5 | G¾B (R½) | 110 | 419 - 407 | | | | | | | | | | | | | | | 4 |
| 1.5 | G¾B (R½) | 165 | 419 - 407 | | | | | | | | | | | | | | | 5 |
| 1.5 | G1B (R¾) | 110 | 419 - 407 | | | | | | | | | | | | | | | 6 |
| 1.5 | G1B (R¾) | 130 | 419 - 407 | | | | | | | | | | | | | | | 7 |
| 1.5 | G1B (R¾) | 165 | 419 - 407 | | | | | | | | | | | | | | | 8 |
| 1.5 | G1B (R¾) | 190 | 419 - 407 | | | | | | | | | | | | | | | 9 |
| 2.5 | G1B (R¾) | 130 | 498 - 498 | | | | | | | | | | | | | | | A |
| 2.5 | G1B (R¾) | 190 | 498 - 498 | | | | | | | | | | | | | | | B |
| 2.5 | DN20 | 190 | 498 - 498 | | | | | | | | | | | | | | | C |
| 3.5 | G5/4B (R1) | 260 | 451 - 436 | | | | | | | | | | | | | | | D |
| 3.5 | DN25 | 260 | 451 - 436 | | | | | | | | | | | | | | | E |
| 6.0 | G5/4B (R1) | 260 | 437 - 438 | | | | | | | | | | | | | | | F |
| 6.0 | DN25 | 260 | 437 - 438 | | | | | | | | | | | | | | | G |
| 10 | G2B (R1½) | 300 | 478 - 483 | | | | | | | | | | | | | | | H |
| 10 | DN40 | 300 | 478 - 483 | | | | | | | | | | | | | | | J |
| 15 | DN50 | 70 | 420 - 485 | | | | | | | | | | | | | | | K |
| Meter type | | | | | | | | | | | | | | | | | | |
| Heat meter | (MID: module B) | | | | | | | | | | | | | | | | | 1 |
| Heat meter | (MID: module B+D) | | | | | | | | | | | | | | | | | 2 |
| Heat meter | (MID: module B+D) | | (E1 & E3 displayed) | | | | | | | | | | | | | | | 3 |
| | | | only 402-T | | | | | | | | | | | | | | | |
| Country code (language on label etc.) | | | | | | | | | | | | | | | | | | XX |

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Verification

Errors: Maximum permissible errors according to Directive 2014/32/EC of the European Parliament and Council of February 26, 2014 on measuring instruments (MID), Annex VI.

Procedure: The test points and verification according to EN 1434-6:2007.

Initial verification tests

As separate units according to 5.2, 5.3, 5.4 (EN 1434-5:2007)

As calculator sensor set according to 5.5 (EN 1434-5:2007)

As complete meter according to 5.7 (EN 1434-5:2007)

Test points

Alternative θ_r in connection with 5.3/7.3 (EN 1434)

| θ_f | θ_r | θ_f | θ_r | θ_f | θ_r |
|------------|------------|------------|------------|------------|------------|
| 43 | 40 | 43 | 40 | 53 | 50 |
| 80 | 60 | 50 | 40 | 70 | 50 |
| 160 | 20 | 160 | 40 | 130 | 20 |

Alternative liquid temperature: 20°C ±5°C

For dynamic ranges $q_i:q_p$ 1:25, 1:50 and 1:100, 1:100 can be used.

Test procedures

The following test functions/units can be used during test:

- Test mode
- Autointegration
- Serial testing
- Externally controlled start-stop
- Pulse Interface

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The heat meter can be verified in one of the following ways

MULTICAL[®] 402 - Test instructions

To be able to carry out test/verification of MULTICAL[®] 402 with minimum time consumption the meter has a test mode.

In order to bring MULTICAL[®] 402 into test mode you disconnect the supply and restart the meter while keeping both display shift buttons pressed. The meter remains in test mode for 9 hours or until the supply is disconnected and the meter restarted. A "P" in the left side of the meter's display shows that the meter is in test mode. In test mode the meter has two extra high-resolution test counters for energy (E') and volume (Q') respectively. The resolution of the extra test counters is 10 [mWh] for energy (E') and 1 [ml] for volume (Q'). Units and resolutions of main counters are not changed.

Display example, high-resolution energy (E')



Display example, high-resolution volume (Q')



Reset of high-resolution registers in test mode:

Keep both display shift buttons pressed for 5-6 seconds – upon which the "OK" symbol switches on in the display and the high-resolution test registers are reset.

For further information on handling various test methods see Technical Description for MULTICAL[®] 402, document 5512-742.

Test of MULTICAL[®] 402 calculator

Test of MULTICAL[®] 402 calculator using autointegration

Dismount the cover of MULTICAL[®] 402.

Pt500 sensors (type 402-W or type 402-T) or Pt100 sensors (type 402-V) according to EN 60 751 are simulated by means of reference resistors. Place the inlet temperature resistor (T1) between terminals 5 and 6 and the outlet temperature resistor (T2) between terminals 7 and 8.

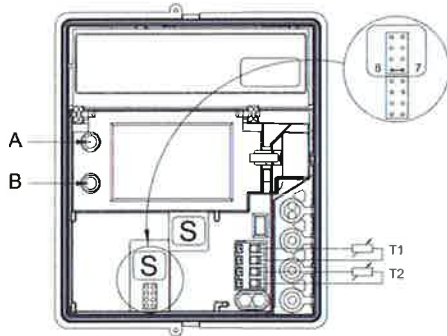
Bring MULTICAL[®] 402 into test mode.

Before starting autointegration pins 7 and 8 of the module connector (under security seal) must be connected - see below sketch. Subsequently, the sub-key is pressed continuously for 5-6 seconds, upon which the "OK" symbol switches on in the display and the integration starts. When autointegration starts the high-resolution registers are reset, whereas the legal main counters continue counting.

The duration of this test is approx. 20 s.

Read the calculated energy from the high-resolution test counter (E').

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NB: Auto integration is only possible if pin 7 and 8 in the connector (under the security seal) are connected.

- S** Security Seal
- A** Main-key (Upper display shift key)
- B** Sub-key (Lower display shift key)

Test of MULTICAL® 402 calculator using PC-based equipment

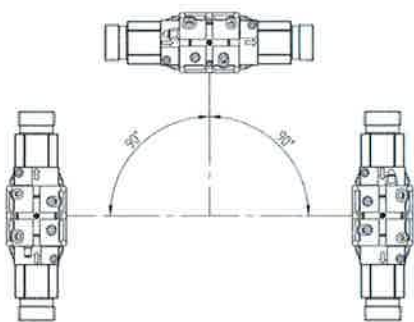
MULTICAL® 402 can be tested by means of the following equipment, which is used together with a standard PC:

- Verification Equipment, type no. 66-99-372 for type 402-W (Type no. 66-99-373 for type 402-T)
- METERTOOL Software, type no. 66-99-712
- METERTOOL HCW software, type no. 66-99-724

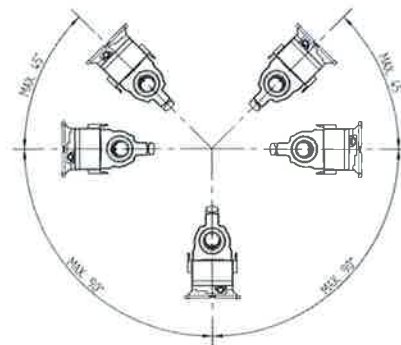
The equipment includes traceably calibrated reference resistors and starts autointegration by means of a serial data command. The test is automatically carried out monitored by the software. For further documentation, please see Technical Description for MULTICAL® 402 document 5512-742.

Test of MULTICAL® 402 flow sensor

Regulations regarding installation angle.



MULTICAL® 402 can be mounted horizontally or vertically.



MULTICAL® 402 can be rotated up to +45° or -90°.

Test of MULTICAL® 402 flow sensor (via display)

- Mount MULTICAL® 402 flow sensor in a test rig
- Dismount the cover of MULTICAL® 402
- Bring MULTICAL® 402 into test mode (See paragraph 1)
- Reset the high-resolution counters, if required (see paragraph 1)
- Connect flow (start)
- Disconnect flow (stop)
- Read the high-resolution test counter for volume (Q') and compare the reading to the actual volume
- Minimum duration from start-up till true flow measurement/start of test is 16 s
- MULTICAL® 402 must not be evacuated (subjected to vacuum).

If temperature sensors/resistors are connected, the high-resolution test register for energy (E') can also be read.

Test of MULTICAL® 402 flow sensor (via volume pulses)

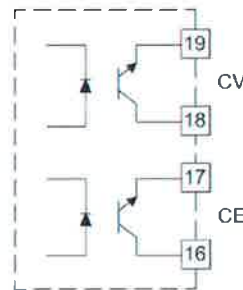
When the meter is in test mode it can emit test pulses (high-resolution energy and volume pulses) with the resolution which appears from the table below.

Test pulses are established via plug-in module 402-0-11 (Data + 2 pulse outputs (CE, CV)).

The pulse outputs are galvanically separated from the meter. (Pulse Interface type 66-99-109 cannot be used for MULTICAL® 402).

Technical data of test pulses via module 402-0-11

| | |
|----------------------|---------------------------------------|
| Energy (CE) | Terminals 16-17 |
| Volume (CV) | Terminals 18-19 |
| Type | Open collector (OB) |
| Pulse duration | 3.9 ms. |
| Max. pulse frequency | 120 Hz |
| External voltage | 5...30 VDC |
| Current | 1...10 mA |
| Residual voltage | $U_{CE} \approx 1 \text{ V}$ at 10 mA |
| Leak current | $I_{CE} \leq 1 \mu\text{A}$ at 25°C |
| Electrical isolation | 2 kV |
| Max. cable length | 5 m |



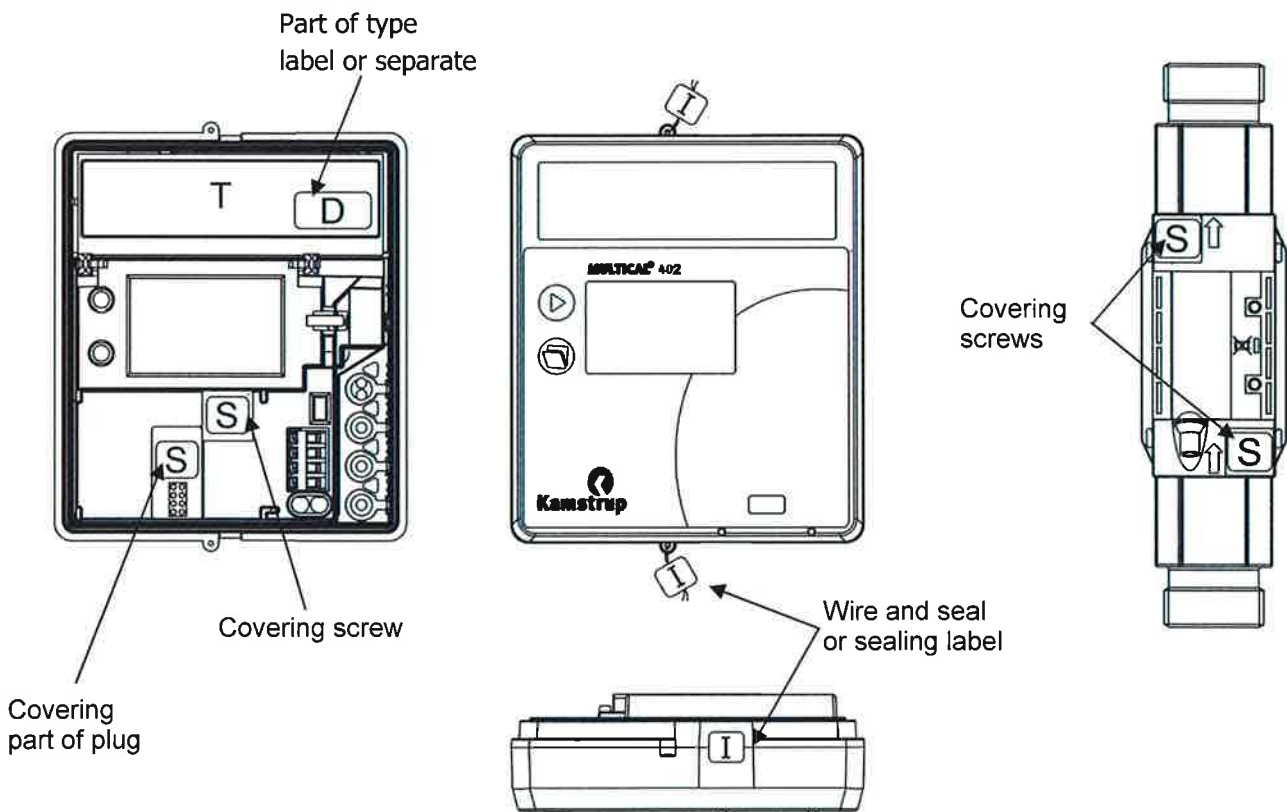
The resolution of the pulse outputs depends on the actual meter size. See below table.

| Meter Size [m³/h] | Energy [Pulses/kWh] | Volume [Pulses/l] | Flow @ 120 Hz [l/h] |
|----------------------|------------------------|----------------------|------------------------|
| qp 0,6 | 1000 | 100 | 4320 |
| qp 1,5 | 1000 | 100 | 4320 |
| qp 2,5 | 1000 | 100 | 4320 |
| qp 3,5 | 500 | 50 | 8640 |
| qp 6,0 | 250 | 25 | 17280 |
| qp 10 | 125 | 12,5 | 34560 |
| qp 15 | 125 | 12,5 | 34560 |

If temperature sensors/resistors are connected, high-resolution energy pulses will also be emitted.

Seals and markings, MULTICAL® 402

- T** Type label (Void label)
- D** Module D/F marking (Part of type label or separate label)
- S** Security seals
- I** Installation seals



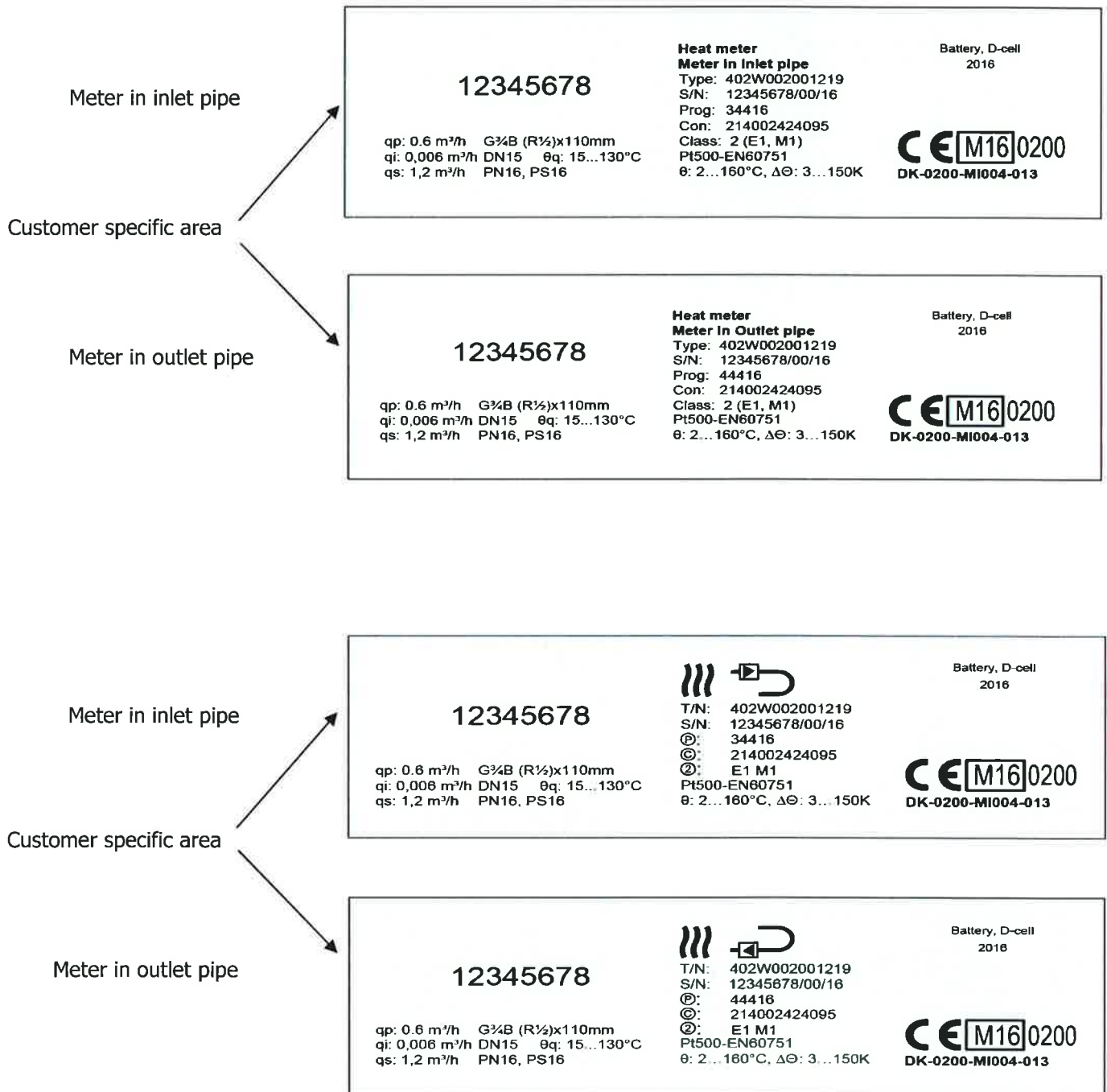
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Markings

System designation
Manufacturer designation or logo
Manufacturer postal address
Certificate number
Mechanical and electromagnetic environment classes
Type, production year and serial number
Temperature limits (θ_{\min} – θ_{\max})
Differential temperature limits ($\Delta\theta_{\min}$ – $\Delta\theta_{\max}$)
Temperature sensor type (Pt100 or Pt500)
Mounting in inlet or outlet pipe
Software version in the display
Voltage level for external power supply
Flow limits (q_i , q_p , q_s)
Limits of temperature flow sensor (θ_q)
Maximum admissible working pressure (PS16 or PS25)
Nominal pressure (PN16 or PN25)
Accuracy class
Arrow to indicate direction of flow.

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Examples of type labels MULTICAL® 402:



Symbols, as an alternative to textual inscriptions, are acceptable if explained in the manual that accompanies the instrument.