SLOVENSKI STANDARD
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Toplotni števci - 4. del: Preskušanje za odobritev tipa

Heat meters - Part 4: Pattern approval tests

Wärmezähler - Teil 4: Prüfungen für die Bauartzulassung

Compteurs d'énergie thermique - Partie 4: Essais en vue de l'approbation de modele

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English version

Heat meters - Part 4: Pattern approval tests

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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CONTENTS

Foreword

This draft European Standard has been prepared by Technical Committee CEN/TC 176 "Heat meters", the secretariat of which is held by DS.

The other parts are:

Part 1 - General requirements

Part 2 - Constructional requirements

Part 3 - Data exchange and interfaces

Part 5 - Initial verification tests

Part 6 - Heat meter installation, commissioning, operational monitoring and maintenance

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 1997, and conflicting national standards shall be withdrawn at the latest by August 1997.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard applies to heat meters, that is to instruments intended for measuring the heat which, in a heat-exchange circuit, is absorbed or given up by a liquid called the heat-conveying liquid. The meter indicates heat quantity in legal units.

Electrical safety requirements are not covered by this standard.

Meters with surface mounted temperature sensors are not yet included in this standard.

Part 4 specifies pattern approval tests.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 1434-1:1997	Heat Meters - Part 1: General requirements
ENV 50140	Electromagnetic compability - Basic immunitity standard -Radiated radio-frequency electromagnetic field immunity test
EN 55022	Limits and methods of measurements of radio disturbance characteristics of information technology equipment. (CISPR 22:1993)
EN 60068-2-1	Environmental testing; Part 2: Tests; test A: Cold (IEC 68-2-1:1990).

EN 60068-2-2	Basic environmental testing procedures - Part 2: Tests - Tests B: Dry heat (IEC 68-2-2:1974)
EN 61000-4-2	Electromagnetic Compatibility (EMC) - Part 4: Testing and measuring techniques - Section 2: Electrostatic discharge immunity test - Basic EMC Publication
EN 61000-4-4	Electromagnetic Compatibility (EMC) - Part 4: Testing and measuring techniques - Section 4: Electrical fast transient/burst immunity test - Basic EMC Publication.
EN 61000-4-3	Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques; section 3: Radiated, radio-frequency, electromagnetic field immunity test (IEC 1000-4-3:1995, modified)
EN 61000-4-11	Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 11: Voltage dips, short interruption and voltage variations immunity tests (IEC 1000-4-11:1994)
IEC 68-2-30	Environmental testing - Part 2: Tests; test Db and guidance: Damp Heat, cyclic (12 + 12 hour cycle).
EN 60751:1995	Industrial platinum resistance thermometer sensors (IEC 751:1983).
ISO 4064-3:1983	Measurement of water flow in closed conduits - Meters for cold potable water - Part 3: Test methods and equipment.

3 General

The procedure shall ascertain that the pattern conforms to the metrological requirements of this Standard. In addition to the checking of the documentation (clause 7) and the comparison of the pattern with the metrological requirements of this standard, the tests in clause 6 shall be performed.

4 Requirements

Under normal operating conditions, the error of heat meters or their sub-assemblies shall not exceed the maximum permissible error, MPE specified in EN 1434-1.
When heat meters or their sub-assemblies are exposed to disturbances, significant faults shall not occur.

5 Specification of operating conditions

5.1 Rated operating conditions

The rated operating conditions are those given in table 1.

Table 1: Rated operating conditions

Environmental class	A	B	C
Ambient temperature - °C	+ 5 to + 55	- 25 to +55	+ 5 to + 55
Relative humidity - %	< 93		

Mains supply voltage - V	230^{+10}_{-15} %
Mains frequency	f_{nom} ± 2 %
Battery voltage	The voltage of a battery in service under normal conditions

5.2 Reference conditions

Range of ambient temperature: +15 °C to +35 °C
Range of relative humidity: 25 % to 75 %
Range of ambient air pressure: 86 kPa to 106 kPa

The actual temperature and relative humidity within the specified range shall not vary by more than ± 2,5 K and ± 5 percentage points respectively during the period of one measurement.

The reference conditions for a sub-assembly shall be the conditions under which it would operate if it was a part of a combined heat meter.

5.3 Reference values for the measurand, RVM

5.3.1 Reference values for the measurand, RVM, for $q_p \leq 3{,}5$ m³/h

Range of temperature difference: (40 ± 2) K

or $\Delta\Theta_{max}\ ^{0}_{-2}$ K if $\Delta\Theta_{max}$ is less than 40 K

Range of flow-rate: (0,7 to 0,75) q_p in m^3/h

Return temperature: (50 ± 5)°C

or the upper limit of the return temperature, if it is less than 50 °C

The conditions mentioned above are reference values for a complete heat meter. Reference values for sub-assemblies are the relevant parts of the above mentioned conditions.

5.3.2 Reference values for the measurand, RVM, for $q_p > 3{,}5$ m³/h

Flow-rate simulation for the flow sensor electronics is allowed, but testing with water is always preferred and carried out in accordance with 5.3.1.

If flow-rate simulation is used, the following RVM values apply:

Range of temperature differences: (40 ± 2) K

or $\Delta\Theta_{max}\ ^{0}_{-2}$ K if $\Delta\Theta_{max}$ is less than 40 K

Water temperature in flow sensor: (50 ± 5)°C or ambient

Range of flow-rate: (0,7 to 0,75) q_p in m^3/h

The power supply to and the signal wires from the flow sensor shall be connected.

The flow sensor including flow sensor electronics shall be operated at zero flow rate (without low flow cut off device).

6 Tests and measurements

6.1 General

Unless otherwise stated in the test specification, the test requirements apply irrespective of the heat meter's environmental class. See clause 10 of EN 1434-1:1997.

All measurements shall be carried out under the installation conditions (e.g. straight sections of piping upstream and downstream of the meter) stipulated by the supplier for his type of meter. For all tests the heat conveying liquid shall be water, unless otherwise specified.

If a temperature sensor can be installed in the flow sensor, this shall be done during the performance tests of the flow sensor. Where a filter or strainer is an integral part of the flow sensor, it shall be included in all the tests.

If the error determined lies outside the MPE, the test shall be repeated twice unless otherwise stated. The test is then declared satisfactory if both

- the arithmetic mean of the result of the three tests

and

- at least two of the test results are within or at the MPE.

Depending on the flow sensor size the tests and measurements to be carried out are described below:

The tests in 6.4 and 6.16 shall be done on all sizes.

The test in 6.8 shall be carried out only for those sizes of a type for which the highest wear is expected.

The tests in 6.17 shall be carried out for all sizes. For DN>200 it shall be carried out at Θ_{min}.

For each meter model the following tests shall be carried out on one size only: 6.5, 6.6, 6.7, 6.9, 6.10, 6.11, 6.12, 6.13, 6.14, 6.15 and 6.18.

6.2 Test programme

Samples of a heat meter, or its sub-assemblies, submitted for pattern approval, shall be subject to tests to verify their conformity with clause 4. Unless otherwise stated, the tests shall be carried out at reference conditions and the samples shall be exposed to the influence factors or disturbances specified for the respective tests, as stated in table 2.

The test sequence and the number of items used, shall be either as described in table 2 or as agreed between the supplier and the testing laboratory (assuming 3 samples, numbered by the testing laboratory).

Only one influence quantity shall be applied at a time.

If the meter under test (complete, combined or sub-assemblies) has test outputs for quantity of water, temperature difference and/or energy, these outputs can be used to test such parameters.

6.3 Uncertainty of test equipment

Standards, instruments and methods used in pattern approval tests shall suit the purpose, be traceable to more precise standards and be part of a reliable calibration programme.

The uncertainties associated with these standards, methods and measuring instruments shall always be known. They shall either:

a) not exceed 1/5 of the maximum permissible errors of the heat meter or the sub-assemblies

or

b) be subtracted from the maximum permissible errors of the heat meter or the sub-assemblies to obtain a new MPE.

The use of a) is recommended.

b) may only be used when $\Delta\Theta \leq 3$ K.

Table 2: Test programme for heat meters and their sub-assemblies.

Test	Sub-clause	Exposure	Temperature sensor pair	Flow sensor	Calculating device	Complete meter	Sample no.
		INFLUENCE FACTORS					
MPE	6.4	Performance test	X	X	X	X	2
MPE	6.5	Dry heat		X(a)	X	X	2
MPE	6.6	Cold		X(a)	X	X	2
MPE	6.7	Static deviations in supply voltage		X(a)	X	X	2
		DISTURBANCES					
NSFa	6.8	Durability	X	X		X	2
NSFd	6.9	Damp heat, cyclic		X(a)	X	X	1
NSFd	6.10	Short time reduction in supply voltage		X(a)	X	X	3
NSFa	6.11	Electrical transients		X(a)(b)	X(b)	X	3
NSFd	6.12	Electromagnetic field		X(a)(b)	X(b)	X	3
NSFa	6.13	Electrostatic discharge		X(a)	X	X	3
NSFd	6.14	Static magnetic field		X	X	X	3
NSFd	6.15	Electromagnetic field at mains frequency		X(a)	X	X	3
NSFa	6.16	Internal pressure		X		X	1
	6.17	Pressure loss		X		X	1
	6.18	Electromagnetic emission		X(a)	X(b)	X	3

MPE - maximum permissible error according to clause 9 of EN 1434-1:1997
NSFd - No significant fault shall occur during the test
NSFa - No significant fault shall occur after the test
X - Test to be performed
a - Only for flow sensors with electronic devices
b - This test shall be done with connected cables

6.4 Performance test

The initial intrinsic error shall be determined at least at the conditions stated in 6.4.1, 6.4.2, 6.4.3 and 6.4.4

6.4.1 Flow sensor

All performance tests shall be carried out three times.

6.4.1.1 General

Flow rates:

q_1 $^{0}_{-10}$ %, q_2 ± 5%, q_3 ± 5%, q_4 ± 5% and q_5 $^{+10}_{0}$ %

where

$q_1 = q_s$ and $q_5 = q_i$, $q_1/q_2 = q_2/q_3 = q_3/q_4 = q_4/q_5 = K$

where

$$K = \sqrt[4]{\frac{q_s}{q_i}}$$

The point nearest to 0,7 q_p to 0,75 q_p shall be changed to be within 0,7 q_p to 0,75 q_p in order to obtain one point within RVM conditions.

Water temperatures:

a) Θ_{min} to (Θ_{min} + 5)°C (but not less than 10 °C)
b) (50 ± 5)°C
c) (85 ± 5)°C.

The water temperature at the heat meter shall not vary by more than 2 K during a measurement.

For flow sensors larger than DN250 the test may be carried out only at the one temperature a), if the following conditions are satisfied:

- The test results for smaller flow sensors of the same model are inside MPE for all water temperatures.

- Documentary evidence is given that technological similarity exists between the models tested and the larger sizes applied for.

6.4.1.2 Electromagnetic type flow sensors shall be tested with water having an electrical conductivity higher than 200 µS/cm.

If the supplier has stated a lower permitted conductivity, tests shall also be performed at that conductivity at the flow rates q_1 and q_5, and at the water temperature a). The conductivity shall be noted in the type test report.

If the electronic part of the flow sensor is separated from the sensor head, the type and the maximum length of the connecting cable to the electrodes shall be stated by the supplier, be used for the above mentioned low conductivity test and noted in the type test report.

6.4.1.3 For fast response meters the transient behaviour of the flow sensors of size $q_p \leq 2{,}5$ m³/h shall be investigated by measuring the total quantity of water delivered in 10 to 15 cycles, consisting of a 10 s period at a flow rate of q_s and a 30 s period at zero flow rate.

The total quantity of water measured shall be twice the quantity used for the test at q_s in 6.4.1.1.

The duration of start and stop shall be (1 ± 0,2)s.

The water temperature shall be as a) in 6.4.1.1

The error shall not exceed the MPE.

For a complete or combined meter, the water temperature specified above is the return temperature. The temperature difference shall be the maximum obtainable, but shall not exceed 42 K.

6.4.2 Calculator

The calculator shall be tested at the following simulated temperatures:

Temperature	Temperature difference
a) $\Theta_{return} = (\Theta_{min}\ ^{+5}_{0})$°C	$\Delta\Theta_{min}$, 5, 20, $\Delta\Theta_{RVM}$ in K
b) $\Theta_{return} = (\Theta_{RVM} \pm 5)$°C	$\Delta\Theta_{min}$, 5, 20, $\Delta\Theta_{RVM}$, $\Delta\theta_{max}$ in K
c) $\Theta_{flow} = (\Theta_{max}\ ^{0}_{-5})$°C	20, $\Delta\Theta_{RVM}$, $\Delta\Theta_{max}$ in K

The maximum temperature for these tests shall not exceed Θ_{max}

Tolerances:

For all temperature differences: ±20%,

except for $\Delta\Theta_{min}$: $^{+20}_{0}$ % and $\Delta\Theta_{max}$: $^{0}_{-20}$ %.

For all test points, the simulated flow rate shall not create a signal exceeding the maximum signal acceptable by the calculator.

6.4.3 Temperature sensors

6.4.3.1 Minimum immersion depth

The value of the specified minimum immersion depth (See 4.16 of EN 1434-1:1997) shall be verified.

6.4.3.2 Thermal response time

The temperature sensors shall be tested according to 4.3.3.3 of EN 60751:1995 (pockets shall be excluded). The response time shall not exceed the supplier's specification.