



**SLOVENSKI STANDARD**  
**SIST EN 1434-4:2007**

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**Toplotni števcí - 4. del: Preskusi 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

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

Wärmezähler - Teil 4: Prüfungen für die Bauartzulassung

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

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## Foreword

This document (EN 1434-4:2007) has been prepared by Technical Committee CEN/TC 176 "Heat meters", the secretariat of which is held by DS.

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of an identical text or by endorsement, at the latest by August 2007, and conflicting national standards shall be withdrawn at the latest by August 2007.

This document supersedes EN 1434-4:1997.

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 - Installation, commissioning, operational monitoring and maintenance

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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## 1 Scope

This European Standard specifies pattern approval tests and applies to heat meters, that is to instruments intended for measuring the heat which, in a heat-exchange circuit, is absorbed (cooling) or given up (heating) by a liquid called the heat-conveying liquid. The heat meter indicates the quantity of heat in legal units.

Electrical safety requirements are not covered by this European Standard.

Pressure safety requirements are not covered by this European Standard.

Surface mounted temperature sensors are not covered by this European Standard.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ENV 13005, *Guide to the expression of uncertainty in measurement*

EN 1434-1:2007, *Heat meters — Part 1: General requirements*

EN 14154-3:2005, *Water meters — Part 3: Test methods and equipment*

EN 55022, *Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement (CISPR 22:2005, modified)*

EN 60068-2-1, *Environmental testing — Part 2: Tests — Test A: Cold (IEC 60068-2-1:1990)*

EN 60068-2-2, *Basic environmental testing procedures — Part 2-2: Tests — Tests B: Dry heat (IEC 60068-2-2:1974 + IEC 60068-2-2A:1976)*

EN 60068-2-30, *Environmental testing — Part 2-30: Tests — Test Db: Damp heat, cyclic (12 h + 12 h cycle) (IEC 60068-2-30:2005)*

EN 60751:1995, *Industrial platinum resistance thermometer sensors (IEC 60751:1983 + A1:1986)*

EN 61000-4-2, *Electromagnetic compatibility (EMC) — Part 4: Testing and measurement techniques — Section 2: Electrostatic discharge immunity test — Basic EMC publication (IEC 61000-4-2:1995)*

EN 61000-4-3, *Electromagnetic compatibility (EMC) — Part 4-3: Testing and measurement techniques — Radiated, radio-frequency, electromagnetic field immunity test (IEC 61000-4-3:2006)*

EN 61000-4-4, *Electromagnetic compatibility (EMC) — Part 4-4: Testing and measurement techniques — Electrical fast transient/burst immunity test (IEC 61000-4-4:2004)*

EN 61000-4-5, *Electromagnetic compatibility (EMC) — Part 4: Testing and measurement techniques — Section 5: Surge immunity test (IEC 61000-4-5:1995)*

EN 61000-4-6:1996, *Electromagnetic compatibility (EMC) — Part 4-6: Testing and measurement techniques — Section 6: Immunity to conducted disturbances, induced by radio-frequency fields (IEC 61000-4-6:1996)*

EN 61000-4-8, *Electromagnetic compatibility (EMC) — Part 4: Testing and measurement techniques — Section 8: Power frequency magnetic field immunity test — Basic EMC publication (IEC 61000-4-8:1993)*

EN 61000-4-11, *Electromagnetic compatibility (EMC) — Part 4-11: Testing and measuring techniques — Voltage dips, short interruption and voltage variations immunity tests (IEC 61000-4-1:2004)*

ISO 4064-3:2005, *Measurement of water flow in fully charged closed conduits — Meters for cold potable water and hot water — Part 3: Test methods and equipment*

### 3 General

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

It is recommended to use a checklist as in Annex B to report in a standardised way the result of the comparison between the pattern under approval with the essential requirements of this European Standard.

### 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

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#### 5.1 Rated operating conditions

The rated operating conditions are those given in Table 1.

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**Table 1 — Rated operating conditions**

Environmental class	A	B	C
Ambient temperature in °C	+ 5 to + 55	-25 to +55	+5 to +55
Relative humidity in %	< 93		
Mains supply voltage in V	195 V to 253 V		
Mains frequency	$f_{nom} \pm 2 \%$		
Battery voltage	The voltage of a battery in service under normal conditions		
Remote AC supply voltage	12 V to 36 V		
Remote DC supply voltage	12 V to 42 V		
Local external DC supply voltage	as specified by supplier		

#### 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



Basic mounting orientation

The actual temperature and relative humidity within the specified range shall not vary by more than  $\pm 2,5$  K and  $\pm 5$  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 General

For heating/cooling meters the RVM shall be based on the values for the heating range.

#### 5.3.2 Reference values for the measurand, RVM, for $q_p \leq 3,5$ m<sup>3</sup>/h

**Table 2 — Reference values for heating and cooling**

	Heating applications	Cooling applications
Range of temperature difference	(40 ± 2) K or $\Delta\theta_{\max-2}^0$ K if $\Delta\theta_{\max}$ is less than 40 K	(10 ± 2) K
Range of flow-rate:	(0,7 to 0,75) $q_p$ in m <sup>3</sup> /h	(0,7 to 0,75) $q_p$ in m <sup>3</sup> /h
Return temperature:	(50 ± 5) °C or the upper limit of the return temperature, if it is less than 50 °C	(50 ± 5) °C or the upper limit of the temperature range, if it is less than 50 °C

The conditions, mentioned in Table 2, are reference values for a complete heat meter. Reference values for sub-assemblies are the relevant parts of the conditions mentioned in Table 2.

#### 5.3.3 Reference values for the measurand, RVM, for $q_p > 3,5$ m<sup>3</sup>/h

Flow-rate simulation for the flow sensor electronics is allowed, but testing with water is always preferred and carried out in accordance with 5.3.2.

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

Range of temperature differences:

For heating applications: (40 ± 2) K

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

For cooling applications: (10 ± 2) K

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The temperature of the liquid in the flow sensor shall be kept at  $(50 \pm 5)$  °C or at ambient temperature

Range of flow-rate:  $(0,7 \text{ to } 0,75) q_p$

The power and signal wires 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 1434-1:2007.

All measurements shall be carried out under the installation conditions stipulated by the supplier for his type of meter (e.g. straight sections of piping upstream and downstream of the meter). For all tests the heat conveying liquid shall be water, unless otherwise specified. If so, the performance test shall be carried out with the specified liquid and the type approval certificate shall include the specification of the liquid to be used for initial verification.

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:

For each meter model the test in 6.4, 6.18 and 6.19 can be carried out on a limited number of sizes according to an evaluation by the testing laboratory. This evaluation shall be included in the type testing report.

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

For dimensions  $> \text{DN } 200$ , 6.19 shall be carried out at  $\theta_{min}$ .

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, 6.16, 6.17, 6.20 and 6.21.

### 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 3.

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 four 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.

Table 3 — Test programme for heat meters and their sub-assemblies.

Test	Sub-clause	Exposure	Temperature sensor pair	Flow sensor	Calculating device	Complete meter	Sample no.
		<b>INFLUENCE FACTORS</b>					
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
		<b>DISTURBANCES</b>					
NSFa	6.8	Durability	X	X		X	4
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
NSFd	6.13	Electromagnetic field - digital radio equipm.		X(a)(b)	X(b)	X	3
NSFd	6.14	Radio frequency, amplitude modulated		X(a)(b)	X(b)	X	3
NSFa	6.15	Electrostatic discharge		X(a)	X	X	3
NSFd	6.16	Static magnetic field		X	X	X	3
NSFd	6.17	Electromagnetic field at mains frequency		X(a)	X	X	3
NSFa	6.18	Internal pressure		X		X	1
	6.19	Pressure loss		X		X	1
	6.20	Electromagnetic emission		X(a)	X(b)	X	3
	6.21	24 hrs interruption in supply voltage			X	X	3
NSFd	6.22	Flow disturbances		X		X	1
<p>MPE - Maximum permissible error according to Clause 9 of EN 1434-1:2007  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</p>							

For heating/cooling meters the tests in 6.4 shall cover both functions, the tests in 6.6 and 6.9 shall be carried out using the cooling function, but all other tests shall be carried out using the heating function. (For RMV values see 5.3.)

**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 be calculated according to ENV 13005 with a coverage factor of 2 corresponding to a coverage probability of 95 %.

The expanded uncertainties 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,

or otherwise specified in the test description of this standard.

The use of a) is recommended - b) may only be used when  $\Delta\theta \leq 3$  K.

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**6.4 Performance tests**

**6.4.1 General**

The initial intrinsic error shall be determined at least at the conditions stated in 6.4.2, 6.4.3, 6.4.4 and 6.4.5.

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**6.4.2 Flow sensor**

**6.4.2.1 General**

All performance tests shall be carried out three times.

For a meter model with more than one specified mounting orientation, the performance testing shall be performed in the orientation, where the higher influences are expected.

**6.4.2.2 Flow rates**

Flow rates:

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

where

$q_1 = q_5$  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 test flow rate 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.

**Table 4 — Water temperatures**

	Applications		
	Heating	Cooling	
Type of flow sensor	All	Mechanical with $q_p/q_i \leq 10$ Static with $q_p/q_i \leq 25$	Mechanical with $q_p/q_i > 10$ Static with $q_p/q_i > 25$
a	$\theta_{min}$ to $(\theta_{min} + 5) ^\circ\text{C}$ (but not less than $10 ^\circ\text{C}$ )	$(15 \pm 5) ^\circ\text{C}$	$(15 \pm 5) ^\circ\text{C}$
b	$(50 \pm 5) ^\circ\text{C}$		$(5 \pm 1) ^\circ\text{C}$
c	$(85 \pm 5) ^\circ\text{C}$		

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

For flow sensors larger than DN250, testing at water temperature a) only, is considered sufficient 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.

**6.4.2.3** Electromagnetic type flow sensors shall be tested with water having an electrical conductivity higher than  $200 \mu\text{S/cm}$ .

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

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 certificate.

**6.4.2.4** For fast response meters the transient behaviour of the flow sensors of size  $q_p \leq 2,5 \text{ m}^3/\text{h}$  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 6.4.2.2.

The duration of start and stop shall be  $(1 \pm 0,2) \text{ s}$ .

The water temperature shall be as a) in 6.4.2.2.

The error shall not exceed the MPE.

For a complete or combined meter, the water temperature specified above is the return temperature. The