

EMATEM - International Summer School

Seeon 17.09.2025 – 18.09.2025

Workitems zur Entwicklung der EN 1434

Review on work items for development of EN 1434

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Zielfunktionen

EN 1434 und begleitende CEN/TR sind Handlungsvorgaben und Hilfen für die Praxis zum Stand von Technik und Erkenntnissen unter Zugrundelegung (meist) harmonisierter Fachgrundnormen nach europäischem Recht

- Ausgaben in offiziellen CEN Sprachen, Übersetzungen unter Verweis auf englischsprachige Ursprungsfassung

Objective

EN 1434 and CEN -Technical Reports accompanied are intended to specify supports for user procedures in field according to state of the art and acknowledges on basis of (usually) harmonized standards, closed to European legislation and issued in official CEN languages with translations referred to the English original

-> Business Operations Support System (BOSS)

<https://boss.cen.eu/developingdeliverables/tr/pages/>

Zusammenhänge Contexts

- Normen- und Richtlinienentwicklungen CEN TC 176 WG 2 - EN 1434 zur Verminderung von Handelsbarrieren, Organisation und Strukturen

Developments in standardization at CEN TC 176 WG 2 for avoidance of trade barriers, EN 1434 developments, organisation and structures

- EMATEM e.V. - Projektanstöße, Sommerschulen und Fachseminare

Motivations on projects, topics on EMATEM Summer Schools, Seminars

- Normative Messgenauigkeitsbestimmung und Messbeständigkeiten für das gesetzliche Messwesen

Normative uncertainty of performance in measurements and durabilities for legal metrology processes

Items in recent version EN 1434:2022



1. Complete clauses 12.4 "Maintenance instructions" and 12.5 "Hints for disposal instructions" of EN 1434-1 by instructions on how to separate different parts of meters before disposal
2. Clarify specifications for "Fast response meters", Annex C of 1434-1 "Define time based and volume based measurement principles.", for EN 1434-4 - description of test procedures (EN 1434-5 - nothing has to be done)
3. Test possibilities for testing complete meters in field: Clause 7a of EN 1434-2 (after the list) - add a requirement to make it possible to dismantle temperature sensors for testing the sensors itself in field, for EN 1434-4 and EN 1434-5 - test methods for complete meters without using of bathes
4. Clause 7.8.2.4 of EN 1434-4: A more than 10 year durability test - check if additional tests are necessary
5. Standardized user interactions and display indications (symbols) including error messages for commissioning of heat and cooling meters as informative annex
6. Clarification of state of the art in measuring energy using liquids other than water (e.g. water/glycol solutions)
7. Clarify if it's possible to make realistic recommendations for conditioning the test water for durability tests, source paper CEN/TC 176/WG 2 N 183
8. New clock wise swirl disturbance body instead of part 4, cl.7.22 - prevent instabilities of disturbance generation
9. Cellular phone disturbances in close proximity to the meter
10. Influences on performances coming by pumps, steps in tubes and conical valves
11. Revision of the CEN report "Installation of heat meters"

https://ematem.org/wp-content/uploads/2022/11/01_Rose_gesetzliches_MW.pdf

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 1434:2022
Thermal energy meters

INTERNATIONAL
RECOMMENDATION

OIML R 75-1
Edition 2002 (E)

INTERNATIONAL
RECOMMENDATION

OIML R 75-2
Edition 2002 (E)

INTERNATIONAL
RECOMMENDATION

OIML R 75-3
Edition 2006 (E)

ICS 17.200.10

English Version

Harmonized Standards and Normative Documents to the Directive 2014/32/EU of the EUROPEAN PARLIAMENT and the COUNCIL

Thermal energy meters - Part 1: General requirements

Compteurs d'énergie thermique - Partie 1:
Prescriptions générales

Wärmezähler - Teil 1: Allgemeine Anforderungen

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

ICS 17.200.20

Will supersede EN 1434-1:2015+A1:2018

English Version

Thermal energy meters - Part 1: General requirements

Compteurs d'énergie thermique - Partie 1:
Prescriptions générales

Thermische Energiemessgeräte - Teil 1: Allgemeine
Anforderungen

The other parts are:

Part 2 - Constructional requirements

Part 3 - Data exchange and interfaces

Part 4 - Pattern approval tests

Part 5 - Initial verification tests

Part 6 - Installation, commissioning, operational monitoring and maintenance



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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels



ORGANISATION INTERNATIONALE
DE MÉTROLOGIE LÉGALE
INTERNATIONAL ORGANIZATION
OF LEGAL METROLOGY



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Work items of WG 2 on upcoming revision of EN 1434 (2026 subsequent)

- Durability tests for flow sensors with more than 10 years for water and heat conveying liquids other than water, to predict durabilities of electric and electronic components of energy meters, medium temperatures for more than 90 °C - covered by product life extension and environmental design, life-time testings
- Fast response measuring, to define energy tests for combined meters and calculators, adaptive modes
- Sensitive measuring of the inconstant heat-coefficients in field, behaviour of water glycol solutions
- Flow profiles in water and water glycol solution networks, e.g. 90 ° bend and double bend out of plane, influences on accuracy caused by disturbed profiles, field situations, CFD simulations and measurements
- Usage of conductive pastes in pockets, stability of thermal contacts between temperature sensors and pockets, handling

Member's work area at CEN/TC 176/WG 2

Subgroups editing the descriptions in parts of standard and Technical Reports

- SG 1: Durability classes for flow sensors of thermal energy meters (head is Mrs. Wagner from AGFW, Germany)
- SG 2: Sensitive measuring for the constants of heat coefficients for liquids other than water (head is Mr. Holoch from BELIMO, Switzerland)
- SG 3: Influence of flow profiles on performance of flow sensors in water and other liquids (head is Mr. Straka from PTB, Germany)
- SG 4: Conductive pastes for temperature sensor's pockets (head is Mr. Holmsten from RISE, Sweden)
- SG 5: Fast response metering for thermal energy meters and sub-assemblies (head is Mr. Baack from PTB, Germany)
- SG 6: Durability of electronic parts and product life extension (head is Mr. Kentved from FORCE, Denmark)
- SG 7: Revision of CEN/TR 13582 "Installation of thermal energy meters - Guidelines for the selection, installation and operation of thermal energy meters" (head is Mr. Holoch from Belimo, Switzerland)
- SG 8: Error-listing and development of EN 1434:2022 by observation of associated reference standards and of German mirror groups regarding to e.g. "Unsymmetrical Installations of Temperature Sensors" (head is Mr. Schmidt as secretary from German DIN in cooperation with Mr. Baack from PTB, Germany)
- [NEW SG 9: Revision of CEN/TR NWIP CEN/TR 16911:2015 "Thermal energy meters - Recommendations for circulation water in industrial and district heating systems and their operation"](#) (head of this new subgroup is Mr. Bolderen from NEN, The Netherlands)

SG 7: Work item finalized

CEN/TC 176

Date: 2024-04

CEN/TR 13582:2024

Secretariat: SIS

**Installation of thermal energy meters — Guidelines for the selection,
installation and operation of thermal energy meters**

**Installation von thermischen Energiemessgeräten — Richtlinien für Auswahl,
Installation und Betrieb von thermischen Energiemessgeräten**

**Compteur d'énergie thermique Installation — Lignes directrices pour la sélection,
l'installation et le fonctionnement des compteurs d'énergie thermique**

CCMC will prepare and attach the official title page.

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EMATEM Fachseminar
 „Planung, Inbetriebnahme und Betrieb von Wärme- und
 Kältezählern nach CEN Technical Report 13582“

Ort

Physikalisch-Technische Bundesanstalt Berlin
 Abbestraße 2-12
 10587 Berlin

Veranstaltungssaal: Kuppelraum Werner-von-Siemens-Bau (4.OG)

<https://ematem.org/einladung-zum-ematem-workshop-cen-tr-13582/>

Siemensbau
 4. Etage



Programm

24. Juni 2025

12:45 – 13:00	Registrierung	Eichhorn
13:00 – 13:10	Begrüßung/Regulatorisches	Rose
13:10 – 13:40	Einführung, Begriffe, Klassen	Baack
13:40 – 13:50	Pause	
13:50 – 14:50	Grundlagen der Dimensionierung, Durchflussbereich, Auswahl einer Durchflusssensorgroße, Volumenstrom-Messverfahren, Dimensionierung nach Anwendungsfällen	Baack/Wien
14:50 – 15:00	Pause	
15:00 – 16:00	Betriebsbedingungen, Einbau, Überprüfung nach Inbetriebnahme, Fehlerbeispiele	Wien
16:00 – 16:10	Pause	
16:10 – 17:00	Andere Flüssigkeiten als Wasser	Holoch
17:15 -	Anlagenführung an der großen Wärmezählerprüfstrecke der PTB Berlin	Leonhardt
ab 19:00	Gemeinsames Abendessen	

25. Juni 2025

09:00 – 10:00	Temperaturmessung, Rechenwerke, Einbau	Bott
10:00 – 10:15	Pause	
10:15 – 10:45	Tauchhülsenproblematik	Bott
10:45 – 11:15	Störeinflüsse Volumenmessung	Eichler
11:15 – 11:30	Pause	
11:30 – 12:00	Elektromagnetische Störeinflüsse	Rose
12:00 – 12:45	Betriebsüberwachung, Kältemessung, Inbetriebnahme nach TR K 9	Baack
12:45 – 13:00	Feedback/Verabschiedung	Baack

Stände der Veröffentlichungen

Status of publications

- Abstimmung im TC 176 zur FprCEN/TR 13582 erfolgte positiv im Juli 2025, Veröffentlichung umgehend erwartet

Voting among TC 176 on FprCEN/TR 13582 approved in July 2025, now publication expected

- zur Veröffentlichung EN 1434:2022 im EU-Amtsblatt (Official Journal) gibt es keine neue Information bzgl. (neu) eingeleitetem EUC – Mandatverfahrens

No more information about the ongoing process of EUC – mandation

EN 1434:2022



CEN/TC 176 "Thermal energy meters"

Secretariat: **SIS**

Secretary: **Beqiri Bledar Mr**

Result of voting

(National Members having abstained are not counted in this vote.)

Approved by National Members

National Members approving: 13

National Members disapproving: 0

Number of Members approving: 100.000 % (requirement ≥ 55 %)

Weighted percentage of Population approving: 100.000 % (requirement ≥ 65 %)

Steps:

finished final template-sessions by HAS-consultant, 13.09.2022 document no. CEN/TC 176 N 614 -> out for harmonization adopted with translations into German and French (done in July 2022)

<https://www.din.de/de/meta/suche/62730!search?query=DIN+EN+1434&submit-btn=Submit>

-> **Publication in 'The Official EUC Journal'** to let free as harmonized standard according to the MID

CEN TC 176 with WG2 did their jobs triggering authorities at the EUC Journal's side ...

Beispiele von Arbeitsabläufen in Arbeitsgruppen und Forschungsvorhaben

Examples of work processes in subgroups and research assignments

- Erhebung und Bewertung von Einflüssen auf Messgenauigkeit und Beständigkeit in Anwendungsfeldern thermischer Energiemessgeräte
Inquiry and assessment of influences on performance and durability in user fields of thermal energy meters
- Prüfung auf Konformität zu den grundlegenden und spezifischen MID-Anforderungen bzgl. Umgebungs- und mechanischer Klassen
Conformity checks onto essential and specific requirements according to MID with its environmental and mechanical classes (application classes A, B, C respectively M1 - M3)
- Detaillierte Erhebung thermodynamischer und Umgebungsbedingungen der Sensorik von Durchflusssensoren und Temperaturfühlern im Kontakt zu Wasser und anderen Wärmeträgerflüssigkeiten
Detailed inquiry on thermodynamics and environmental conditions onto flow and temperature sensors with touch to water and other heat conveying liquids

- Erhebung mechanischer, thermischer und EMV-Einflüsse auf elektrische Kontaktierung und Elektronikkomponenten der Rechenwerke und Schnittstellen
Inquiry on influences by mechanic, thermic and EMC burdens onto electric contact pads and electronic components of calculators and interfaces
- Bewertung praxisbewährter Testverfahren industriellen Umfelds unter Absicherung der Vergleichbarkeit von Messergebnissen
Assessment of technologies tried and tested in industrial sphere with scope to comparability of test results
- Definitionen, Begrifflichkeiten und Konstruktion für Normteile 1 und 2
Definitions, clarification and designs to parts 1 and 2 of standard
- Organisation von Ringvergleichen zu Messunsicherheiten von Notified Bodies, Konformitätsbewertungsstellen und Laboren
Organization of ring comparisons to state the measuring's uncertainties
- Entwicklung wirtschaftlicher, beschleunigter und skalierbarer Tests zur Abschätzung der Messbeständigkeit für Normteil 4
Derivation of economic accelerated durability tests to part 4
- Ableitung von Vorgaben zur Installation und Instandhaltung für Normteil 6
Derivation of requirements for installation and maintenance to part 6

Example to work of SG 1 and SG 6

3.9 types of errors

Thermal energy meters — Part 1: General requirements

Thermische Energiemessgeräte — Teil 1: Allgemeine Anforderungen

Compteurs d'énergie thermique — Partie 1: Prescriptions générales

3.9.1 error of indication

indication of the measuring instrument minus the conventional true value of the measurand

3.9.2 intrinsic error

error of a measuring instrument determined under reference conditions

3.9.3 initial intrinsic error

error of a measuring instrument as determined once prior to performance tests and durability tests

3.9.4 durability error

difference between the intrinsic error after a period of use and the initial intrinsic error

3.9.5 maximum permissible error

MPE
highest values of the error (positive or negative) permitted

Requirements on durability with scope to legal metrology have to be distinguished between requirements on 'life-time' extensions.

In comparison with scales of demands dictated by legal metrology, requirements on 'life-time' are tightened differently.

-> A proper definition of so called '**D1 to D3 classes of life-time**' of meters and subassemblies, influenced by different environmental and conditions by specific chemistries of heat-conveying liquids and by other components (e.g. supplying battery) is under development.

Subgroups – Netzwerkgestaltung

Networking among subgroups by ongoing liasons

- EMATEM e.V. - Projektanstöße, Sommerschulen und Fachseminare
Motivations on projects, topics on EMATEM Summer Schools, Seminars
- Normative Messgenauigkeitsbestimmung und Messbeständigkeiten im gesetzlichen Messwesen, Inputs zur DIN EN 1434 und zu CEN/TR
Normative uncertainty of performance in measurements and durabilities for legal metrology processes by contributions on developments of documents standardized

21st International EMATEM Summer School 2025

Mittwoch 17. September 2025 / Wednesday 17 September 2025

Messwesen, Normung, Prüfprogramme, Konformitätsuntersuchungen Legal Metrology, standardization, test programs, conformity assessments		
ab/from 08:45	Registrierung/ Registration	G. Eichhorn
09:00 – 09:15	Eröffnung, Begrüßung (durch den Vorstand) <i>Welcome / Opening (by the management board)</i>	neu gewählter Vorstand
09:15 – 09:45	Gesetzliches Messwesen, Entwicklungen Technischer Richtlinien und PTB-Anforderungen <i>Legal metrology, developments of technical guidelines and PTB requirements</i>	S. Baack, PTB
09:45 – 10:00	Diskussion / Discussion	
10:00 – 10:15	Workitems zur Entwicklung der EN 1434 <i>Work items for the development of EN 1434</i>	J. Rose, PTB
10:15 – 10:25	Diskussion / Discussion	
10:25 – 10:45	Kaffeepause / coffee break	
10:45 – 11:05	Stand der Überarbeitung der Prüfanweisung GM-P 7.2 <i>State of revision Test Requirements GM-P 7.2</i>	N. Mathies, AGME / Krohne
11:05 – 11:15	Diskussion / Discussion	
11:15 – 11:35	Mathematische Feststellung des Referenzwertes bei Ringvergleichen <i>Methodics of derivation of reference value in ring comparisons</i>	R. Schupp, Heatmeter Consulting- Service
11:35 – 11:45	Diskussion / Discussion	
11:45 – 12:05	Ringvergleich zur spezifischen Wärmekapazität von Wärmeträgerflüssigkeiten <i>Ring comparison for specific heat capacity of conveying liquids</i>	Hans-Peter Ebert (Michael Brütting)
12:05 – 12:15	Diskussion / Discussion	
12:15 – 13:00	Mittagessen / lunch	
13:00 – 13:20	Untersuchung der Unsicherheiten elektronischer Heizkostenverteiler - Ergebnisse, Erkenntnisse und Schlussfolgerungen <i>Investigation of uncertainties of electronic heat cost allocators - results and insights</i>	A. Kähler, TRIOS J. Schmid, HLK Stuttgart GmbH
13:20 – 13:30	Diskussion / Discussion	

SG 2

13:30 – 13:50	Die digitale Immobilie. Effizienzsteigerung durch dual-use von Messdaten <i>The Digital Estate. Increase of efficiency by dual sharing of datas</i>	B. Konopka, Qundis GmbH
13:50 – 14:00	Diskussion / Discussion	
14:00 – 14:20	Projekt MoniGeoFluid: Fortschritte bei der Flüssigkeitsüberwachung für Niedertemperatur-Femwärme- und - Kältenetze <i>Project MoniGeoFluid: Advancements in Fluid Monitoring for Low Temperature District Heating and Cooling Networks</i>	M. Lugmair, FH Salzburg
14:20 – 14:30	Diskussion / Discussion	
14:30 – 14:45	Kaffeepause / coffee break	
14:45 – 15:05	Bewertung des Durchflusstests der EN 1434: Eine vergleichende Studie <i>Evaluating the flow disturbance test in EN 1434: A comparative study</i>	R. Kernebeck, S. Rademacher, WSG Essen K. Hertha- Dunkel, M. Straka, PTB
15:05 – 15:15	Diskussion / Discussion	
15:15 – 15:35	Entwicklung eines Störkörpers für die EN 1434 <i>Development of disturbance generator for EN 1434</i>	K. Hertha- Dunkel, PTB
15:35 – 15:45	Diskussion / Discussion	
15:45 – 16:00	Kaffeepause / coffee break	
16:00 – 16:20	Ergebnisse aus Gutachten bei gerichtlichen Auseinandersetzungen <i>Report of expertises in judicial confrontations</i>	J. Wien, Minol GmbH
16:20 – 16:30	Diskussion / Discussion	
16:30 – 16:50	Messung der Durchflussmenge von Wasser-Monopropylenglykol- Gemischen <i>The Water-Monopropylene Glycol Mixtures Flow Rate Measurement</i>	J. Foltýnek, J. Synáč CMI
16:50 – 17:00	Diskussion / Discussion	
17:45 – 22:00	Abendprogramm / Evening programme <i>Besuch der Brauerei mit Führung und Brotzeit / Visit to the brewery with guided tour and snack</i>	

SG 3

SG 3

SG 2

Donnerstag 18. September 2025 / Thursday 18 September 2025

Messverfahren, Messtechnik, Praxisberichte Measurement method, Measurement technology, Field reports		
09:00 – 09:20	Thermische Energiezähler: Schnelles Prüfverfahren für komplette Zähler und Teilgeräte <i>Thermal Energy Meter: Fast response test method for complete meter and sub-assembly</i>	L. Lanza, Hemina SPA
09:20 – 09:30	Diskussion / Discussion	
09:30 – 09:50	Metrologie schnellansprechender Wärmezeähler - Aktueller Status von Projekt & Prüfstand <i>Metrology of fast-responding thermal energy meters - current state of the project and the testing facility</i>	M. Kühn, PTB
09:50 – 10:00	Diskussion / Discussion	
10:00 – 10:20	Turbinen als Mastermeter in einer Durchflusskalibrieranlage <i>Turbine meter used as master meter in a flow calibration facility</i>	E. Frahm, PTB
10:20 – 10:30	Diskussion / Discussion	
10:30 – 11:00	Kaffeepause / coffee break	
11:00 – 11:20	Test- und Messdatenmanagement gepaarter Temperaturfühler im Kontext der Qualitätssicherung <i>Test and measurement data management of paired temperature probes in the context of quality assurance</i>	P. Hermann, Testo GmbH
11:20 – 11:30	Diskussion / Discussion	
11:30 – 11:50	Thermische Ansprechzeit von Temperaturfühlern - Einfluss der Alterung <i>Thermal response time of temperature sensors – Influence of aging</i>	A. Klewer, Jumo GmbH
11:50 – 12:00	Diskussion / Discussion	
12:00 – 13:00	Mittagessen / lunch	
13:00 – 13:20	Innovative Ansätze zur Verbesserung der Genauigkeit thermischer Energiesmessung durch Simulation und Analyse der Einbaustellen - Aktueller Stand aus dem Forschungsprojekt <i>Innovative Approaches to Improving the Accuracy of Thermal Energy Measurement through Simulation and Analysis of Installation Sites - Current status of the research project</i>	T. Lapp, Jumo GmbH
13:20 – 13:30	Diskussion / Discussion	
13:30 – 13:50	Neues aus der Welt der Temperaturfühler: Teil 1: Neue Erkenntnisse und Ergebnisse aus dem Arbeitskreis Tauchhölse in Bezug zum Auslauf der Duldungsregelung in Deutschland Teil 2: Auswahl der Temperaturfühler für den Einsatz in zusätzlichen Zahlwerken für die Energieakkumulation <i>Combined lecture: News from the world of temperature probes: Part 1: New findings and results from the working group on pockets in relation to the expiry of the tolerance regulation in Germany Part 2: Selection of temperature probes for use in additional meters for energy accumulation</i>	D. Bott, Jumo GmbH
13:50 – 14:00	Diskussion / Discussion	
14:00 – 14:15	Zusammenfassung / Ausblick <i>Summary / Outlook</i>	neuer Vorstand
14:15 – 14:30	Abreise / Departure	

SG 5

SG 5

DIN SpA

DIN SpA

Es werden wieder Simultanübersetzungen englisch / deutsch und deutsch / englisch
angeboten.

Simultaneous translations will be offered in English / German and German / English.

-> inputs by subgroup's lectures

SG 1 “Durability classes for flow sensors of thermal energy meters”

Water Liquid composition

Stress parameter	Wear out mechanism	Effect	Overstress
low pH value	Corrosion in the system	Dissolution of materials, Particles in the system → leading to depositions and turbidity Change of roughness of wall surface → changing of the flow profile	Damage of components of the flow chamber
High pH value		Cu: Dissolution of materials Particles in the system → leading to depositions and turbidity Change of roughness of wall surface → changing of the flow profile	Damage of components of the flow chamber
High El. Conductivity	Corrosion in the system	Hugh amount of ions in the medium → leading to depositions → changed signal amplitude Change of roughness of wall surface → change in flow profile	
Hardness	Coating deposits on transducers and reflectors of the flow chamber	changed signal amplitude; change flow profil in cause of the particles	Mismeasurement
Dissolved oxygen, nitrogen in concentration	Corrosion in the system; Abrasion through mini-gas bubbles	Dissolution of Fe-components in the system → leading to Ironoxid depositions Change of roughness of wall surface → change in flow profile	Mismeasurement Damage of components of the flow chamber
Sulfite (sodium sulfite) And other oxygen scavengers	Corrosion in the system Coating deposits on transducers or reflectors (e.g. Cu or Fe Sulfid)	Dissolution of Fe or Cu-materials, building of FeS or CuS particals, changed signal amplitude	Over dosing of the conditioning reagents leads to damage of Cu-Components

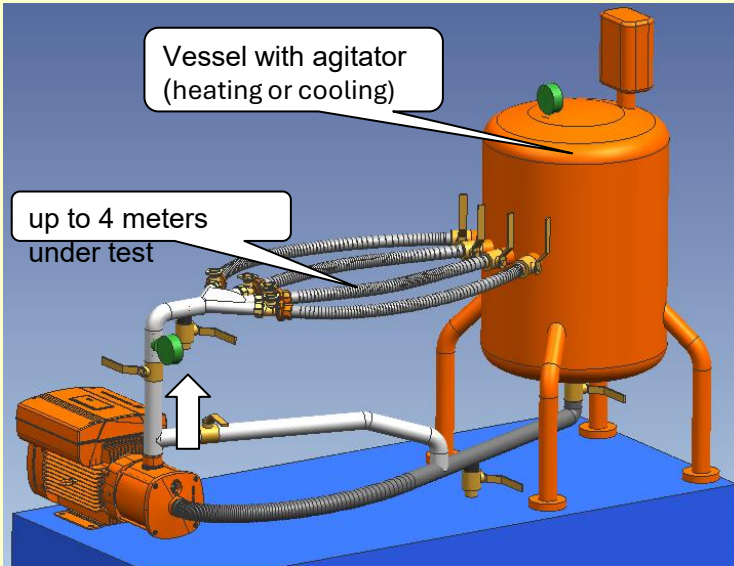
Table 1 Stressing parameters for low-salt mode of operation for district heating systems

[1] Plastic is not attacked by magnetite, but it is deposited if the plastic becomes brittle and then could interfere the measurement.

Material	Ingredients	Dosage	Requirements during the test period for the system, comments
Brass	1) Basic Water is demineralized water = VE-Water 2) Conductivity: round about 4µS/cm 3) Oxygen and Nitrogen 4) pH-value: 8,2 5) Magnetite [1]	To 2) The Conductivity resulting from ammonia dosing To 3) gas open system To 4) Adjust the pH value to 8.2 with ammonia. To 5) The testing fluid has to be treated with magnetite-containing filtered remainders from a district heating network, so that a daily average magnetite concentration of approx. 400 µg/l to 500 µg/l is achieved.	To 3) The hole test bench system is to be operated as a gas-open circuit in order to ensure gas reactions (in particular oxygen). In order to accelerate corrosion reactions the gas (oxygen) access to the system must be ensured in the best possible way. 4) Due to secondary reactions, the dosage must be adjusted and checked daily. 5) Since magnetite does not dissolve in water, the instantaneously value of the magnetite concentration fluctuates and is a function of the flow rate. To prevent the magnetite from settling on the bottom of the storage tank, a circulation pump has to be installed which feeds the test water into the bottom of the storage tank. In addition, for the parameter Magnetite, the last check of the flow sensor must be done 48h after reaching the 0m³/h flow rate, so that a deposit of Magnetite on the flow sensor can be simulated. During the test, due to the high fluctuation of the flow rate, no deposition of magnetite is possible, but the simulation of erosion due to particle flow may take place.
Polymer	Magnetite [1]	The testing fluid has to be treated with magnetite-containing filtered remainders from a district heating network, so that a daily average magnetite concentration of approx. 400 µg/l to 500 µg/l is achieved.	Since magnetite does not dissolve in water, the instantaneously value of the magnetite concentration fluctuates and is a function of the flow rate. To prevent the magnetite from settling on the bottom of the storage tank, a circulation pump has to be installed which feeds the test water into the bottom of the storage tank. In addition, for the parameter Magnetite, the last check of the flow sensor must be done 48h after reaching the 0m³/h flow rate, so that a deposit of Magnetite on the flow sensor can be simulated. During the test, due to the high fluctuation of the flow rate, no deposition of magnetite is possible, but the simulation of erosion due to particle flow may take place.

Table 2 Stressing parameters for salty mode of operation for district heating systems

Material	Ingredients	Dosage	Requirements during the test period for the system, comments
Brass	1) Basic Water is softened drinking water. 2) Conductivity [2]: 1500µS/cm 3) Oxygen and Nitrogen 4) Sodium sulfide (Na₂S) 5) Ammonium sulphate ((NH₄)₂SO₄) 6) pH-value: 8,2 7) Magnetite [1]	1) Soften the drinking water down to 0,2 mmol/l, not less than that value [3] 2) set with Na₂SO₄ 3) gas open system 4) 2 mg/l Sulfid, for example 4,8 mg/l Sodium sulfide 5) 1mg/l Ammonium = 2,5 mg/l Ammonium sulphate 6) Adjust the pH value to 8.2 with sodium bisulphite. 7) The testing fluid is to be treated with magnetite-containing filtered remainders from a district heating network, so that a daily average magnetite concentration of approx. 400 µg/l to 500 µg/l is achieved.	3) The hole test bench system is to be operated as a gas-open circuit in order to ensure oxygen reaction. The oxygen access to the system must be ensured in the best possible way in order to accelerate corrosion reactions. 2, 4, 5, 6) Due to secondary reactions, the dosage must be adjusted and checked daily. 7) Since magnetite does not dissolve in water, the instantaneously value of the magnetite concentration fluctuates and is a function of the flow rate. To prevent the magnetite from settling on the bottom of the storage tank, a circulation pump has to be installed which feeds the test water into the bottom of the storage tank. In addition, for the parameter Magnetite, the last check of the flow sensor must be done 48h after reaching the 0m³/h flow rate, so that a deposit of Magnetite on the flow sensor can be simulated. During the test, due to the high fluctuation of the flow rate, no deposition of magnetite is possible, but the simulation of erosion due to particle flow may take place.
Polymer	2) Magnetite [1]	The testing fluid is to be treated with magnetite-containing filtered remainders from a district heating network, so that a daily average magnetite concentration of approx. 400 µg/l to 500 µg/l is achieved.	Since magnetite does not dissolve in water, the instantaneously value of the magnetite concentration fluctuates and is a function of the flow rate. To prevent the magnetite from settling on the bottom of the storage tank, a circulation pump has to be installed which feeds the test water into the bottom of the storage tank. In addition, for the parameter Magnetite, the last check of the flow sensor must be done 48h after reaching the 0m³/h flow rate, so that a deposit of Magnetite on the flow sensor can be simulated. During the test, due to the high fluctuation of the flow rate, no deposition of magnetite is possible, but the simulation of erosion due to particle flow may take place.



SG 1: Preparing pre - testings with several stressing scenarios, and comparison to meters coming from real field situations

VDI 2035 – values for housing area - not so strong as FW 510 for DH

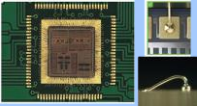
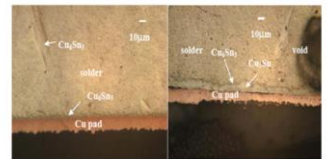
VDI 2035

Füll- und Ergänzungswasser sowie Heizwasser, heizleistungsabhängig			
Gesamtheizleistung in kW	Summe Erdalkalien in mol/m ³ (Gesamthärte in °dH)		
	spezifisches Anlagenvolumen in l/kW Heizleistung ^{a)}		
	≤ 20	> 20 bis ≤ 40	> 40
≤ 50 kW spezifischer Wasserinhalt Wärmeerzeuger ≥ 0,3 t je kW ^{b)}	keine	≤ 3,0 (16,8)	< 0,05 (0,3)
≤ 50 kW spezifischer Wasserinhalt Wärmeerzeuger < 0,3 t je kW ^{b)} (z. B. Umlaufwasserheizer) und Anlagen mit elektrischen Heizelemen- ten	≤ 3,0 (16,8)	≤ 1,5 (8,4)	
> 50 kW bis ≤ 200 kW	≤ 2,0 (11,2)	≤ 1,0 (5,6)	
> 200 kW bis ≤ 600 kW	≤ 1,5 (8,4)	< 0,05 (0,3)	
> 600 kW	< 0,05 (0,3)		
Heizwasser, heizleistungsunabhängig			
Betriebsweise	elektrische Leitfähigkeit in µS/cm		
salzarm	> 10 µS/cm bis ≤ 100 µS/cm		
salzhaltig	> 100 µS/cm bis ≤ 1500 µS/cm		
	Aussehen		
	klar, frei von sedimentierenden Stoffen		
Werkstoffe in der Anlage	pH-Wert		
ohne Aluminiumlegierungen	8,2 bis 10,0		
mit Aluminiumlegierungen	8,2 bis 9,0		

FW 510

	Einheit	salzarm		salzhaltig	Überwachung
Leitfähigkeit 25°C	µS/cm	10 - 30	>30 – 100	100 - 1500	≤ m
Aussehen		klar, frei von suspendierten Stoffen			≤ m
pH-Wert 25°C		9,0-10,0	9,0-10,5	9,0-10,5	≤ m
Sauerstoff	mg/L	< 0,1	< 0,05	< 0,02	≤ m
Summe Erdalkalien (Härte)	mmol/L (°dH)	< 0,02 (< 0,1)	< 0,02 (< 0,1)	< 0,02 (< 0,1)	≤ m

SG 6: “Failure mechanisms in TE meters – Electronics”

Stress parameter	Wear out failure mechanisms (acc. models apply) 	Effect (Wear out failures)	Overstress failure mechanisms (acc. models do not apply) (use outside of specified operation conditions)
Temperature	Diffusion, Evaporation, Thermal ageing (polymers), Relaxation	Bad contacts (+sticking reed contacts), component drift, Kirkendall voiding (bond lifting), dry out of electrolytic capacitors, “weak” displays (bad segments), “gate sinking” and “ohmic contact degradation”, Piezo ceramics (transducer), cable degradation/brittle (e.g. PVC, Silicone etc.), thermal contact paste degrades	Melting, Freezing, Boiling, Explosion, T_g transition (of polymers)
Humidity	Sorption (Adsorption/Absorption), Corrosion, Hydrolysis),	PCB tracks corrode, breaking vias, bad contact, component short circuit, plastic soaking with humidity and expanding, thermal contact paste degrades, cable degradation/brittle (e.g. PVC, Silicone etc.),	Condensation
Vibration	High Cycle Fatigue (HCF)	Broken vias, broken solder joints, broken components (e.g. capacitors),	M1, M2 and M3, “overstress” or specs.?
Thermal cycling	Low Cycle Fatigue (LCF)	Broken vias, broken solder joints, broken components, delamination withing transducer, bad contacts,	xxxx
Voltage	TDDDB (Time Dependent Dielectrical Breakdown)	Relevant?	EOS (Electrical Overstress), Electrostatic discharge
Current	Electromigration	Relevant?	EOS (Electrical Overstress),
Others	Creep, Wear, Ultra Low Cycle Fatigue, Rats, Water (flooding)	Buttons wear, bearing of mech. meter (covered in other group), self-cutting screws in housing (design related),	Impact,
Combined	Fretting corrosion, Migration, Corrosion, TDDDB, Electromigration	Relevant?	SAC solder joint, before and after 1000 h of thermal ageing 
UV light	Photo chemical degradation,	Degradation of housing/cables, ONLY RELEVANT FOR OUTDOOR USE!	

Humidity (cyclic) – "Pump effect" ("cyclic" humidity)

Figures Of Merit (FOM) - Comparison of standardised humidity test methods (24 hours of each test)							
Test method	Sorption*	Condensation	Condensation on Iron cube with side lengths larger than 1 [cm] and (mass, m [grams])	Condensation on ABS plastic cube with side lengths larger than 1 [cm] and (mass, m [grams])	Corrosion Electronics	Corrosion Mechanics	Accumulation**
4.1: IEC 60068-2-78, 30 °C / 85 %RH	2.3	N/A	N/A	N/A	5.9	3.8	N/A
4.1: IEC 60068-2-78, 30 °C / 93 %RH	2.5	N/A	N/A	N/A	7.5	3.9	N/A
4.1: IEC 60068-2-78, 40 °C / 85 %RH	3.9	N/A	N/A	N/A	15.6	7.5	N/A
4.1: IEC 60068-2-78, 40 °C / 93 %RH	4.2	N/A	N/A	N/A	19.9	7.8	N/A
4.2: IEC 60068-2-30 (40 °C upper temp.)	3.1	515	l = 0.6 (m = 2.1)	l = 1.6 (m = 3.7)	12.2	5.2	1.6
4.2: IEC 60068-2-30 (55 °C upper temp.)	5.2	1608	l = 0.3 (m = 0.3)	l = 0.8 (m = 0.5)	38.1	11.7	4.9
4.3: IEC 60068-2-38 (temp./hum. sub-cycle)	6.6	5568	l = 0.4 (m = 0.4)	l = 0.9 (m = 0.8)	70.1	18.9	16.5
4.3: IEC 60068-2-38 (cold. sub-cycle)	6.3	5568	l = 0.4 (m = 0.4)	l = 0.9 (m = 0.8)	69.3	18.5	16.5
4.4: MIL-STD-810F - Method 507.4	6.1	2012	l = 0.4 (m = 0.4)	l = 0.9 (m = 0.7)	52.1	14.7	6.1
4.5: ISO 8092-2 - Section 4.10	4.4	1480	l = 0.06 (m = 0.002)	l = 0.15 (m = 0.003)	37.6	10.0	5.1
4.6: IPC-TM-650 - Method 2.6.3 (Class 3)	8.5	7976	l = 0.8 (m = 3.5)	l = 1.8 (m = 6.2)	86.9	25.6	23.6
4.7: NT ELEC 025 (40 °C upper temp.)	3.4	8757	l = 0.11 (m = 0.01)	l = 0.27 (m = 0.02)	14.8	6.1	28.8
4.7: NT ELEC 025 (55 °C upper temp.)	6.7	22278	l = 0.07 (m = 0.003)	l = 0.18 (m = 0.006)	55.4	16.4	71.7
"Ambient" (20 °C / 65 %RH)	1.0	N/A	N/A	N/A	1.0	1.0	N/A
"Ambient" (25 °C / 60 %RH)	1.2	N/A	N/A	N/A	1.4	0.9	N/A
JESD22-A101-B, 85 °C / 85 %RH	26.9	N/A	N/A	N/A	646.7	170.6	N/A

*NOTE: Also indicator of general "aging" due to the combined effect of temperature and humidity.

**NOTE: Absolute indication of the amount of water vapour [grams] entering enclosure, in 24 hours, per m³ enclosure volume (i.e. due to "humidity pumping").

Which are next steps for WG 2, to handle with Thermal Energy Meters for “Durability with more than 10 years” ?

- 1. Derivation of specific failure rates of electronic components, electric connectors and p-c boards*
- 2. Comparison with International Standards and Recommendations *)*
- 3. Define specific HALT/HASS tests with test chambers into EN 1434-4, cl. 7.8.1*

Highly Accelerated Life Test strategies for safeguarding durability

e.g. *with its tool Highly Accelerated Stress Screening*

**) IEC 61709 Electric components - Reliability - Reference conditions for failure rates and stress models for conversion*

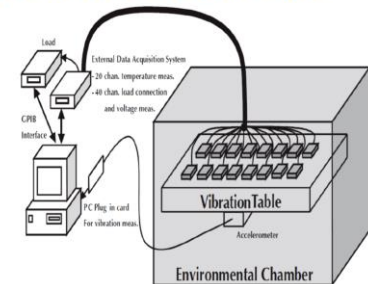
SN 29500 MTBF calculation (Siemens standard)

IEC 61649 Weibull analysis

IEC 62506 METHODS FOR PRODUCT ACCELERATED TESTING

IPC 9592 Requirements for Power Conversion Devices for the Computer and

Telecommunications Industries



Example for work of SG 4

- Usage of conductive pastes in pockets, stability of thermal contacts between temperature sensors and pockets, handling



CEN/TC 176/WG 2 N 926

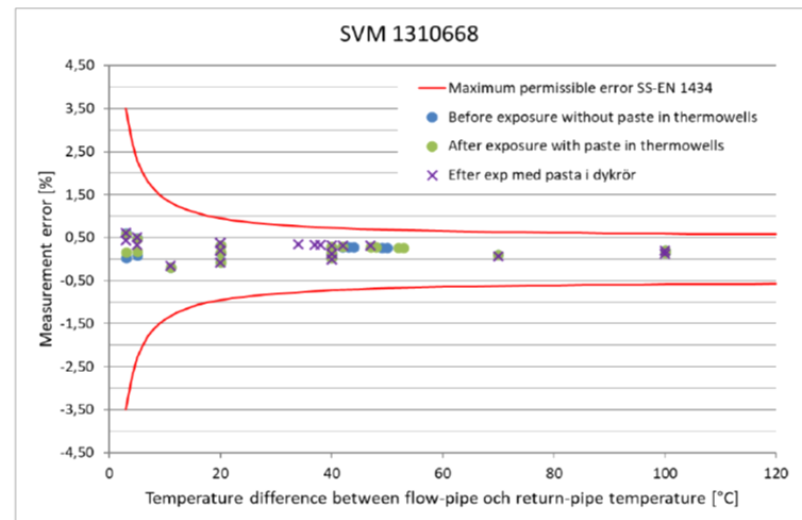
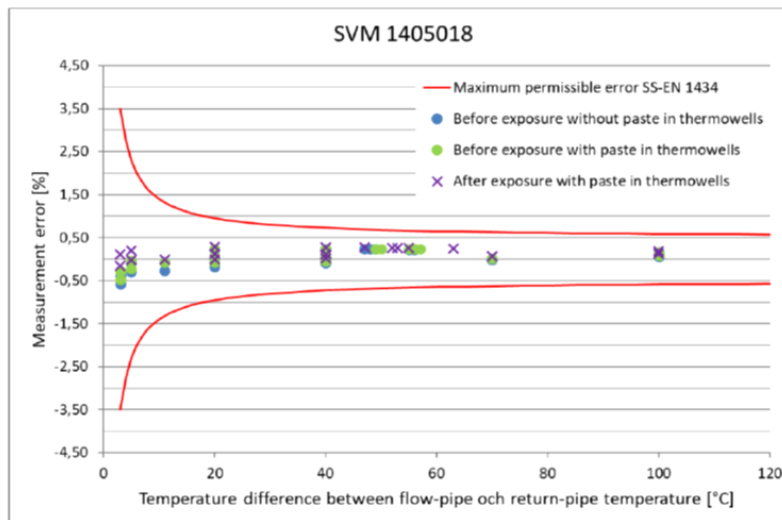
CEN/TC 176/WG 2 "Thermal energy meters - Requirements, test methods and technical editing"
 WG Secretariat: DIN
 Convenor: **Rose Jürgen Mr Dr.**



Presentation - Pockets Pastes WG2 2022-03-23 (Holmsten, Sweden)

Document type	Related content	Document date	Expected action
Project / Other	Meeting: Berlin (Germany) 18 Apr 2023	2023-05-10	INFO

Measurement error (Performance test)



Disassembly - results

- Sensors of brass and mounted with thermal paste no. 1 were stuck in the thermowell
- The thermal paste no.2 was hard
- The 2 sensors mounted with thermal paste no.2 were very hard to remove (the other sensors of the same type mounted with thermal paste no. 1 were easy to remove)



RISE - Research Institutes of Sweden

Conclusions

- The improvements in terms of response time due to the usage of thermal paste mostly persists over time even if the consistency of the paste changes.
- There is a large difference in the consistency for the two different pastes in the project. This is not possible to judge from the specification.
- The same paste reacts differently depending on the sensor type.
- Some combinations of materials in the thermowell / sensor and paste is not suitable.

More knowledge about thermal paste is needed in order to ensure that temperature sensors can be disassembled after a longer exposure

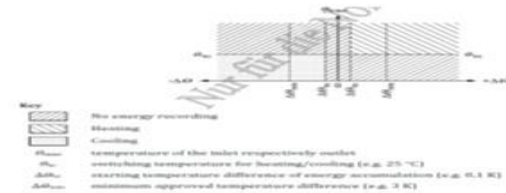
Examples for work of SG 8

- Error - listing table, to clarify EN 1434:2022 as amendment (quotation)

EN 1434-5:2022 (sign error in print version)

With respect to figure 1 in part 1 cl. 3.19.2 to be overworked

Input regarding to part 5 **cl. 6.7 energy-testing**
Complete meter -> **should be changed** (equal to cl. 6.4)



An example for the switching over from heating to cooling register and reversed is given in FprEN 1434-1:2022, Figure 1. It shall be tested that:

- heating energy shall only be recorded at $\Delta\theta > \Delta\theta_{hc}$ and at $\theta_{inlet} > \theta_{hc}$;
- cooling energy shall only be recorded at $\Delta\theta > \Delta\theta_{hc}$ and at $\theta_{inlet} < -\theta_{hc}$.



in cl. 6.7 to be changed as

Additional test for bifunctional meters for change-over systems between heating and cooling:

An example for the switching over from heating to cooling register and reversed is given in FprEN 1434-1:2022, Figure 1.

It shall be tested that:

- heating energy shall only be recorded at $\Delta\theta > \Delta\theta_{hc}$ and at $\theta_{inlet} > \theta_{hc}$.
- cooling energy shall only be recorded at $\Delta\theta < -\Delta\theta_{hc}$ and at $\theta_{inlet} < \theta_{hc}$.

- Error - listing, to clarify EN 1434:2022 as amendment (quotation of examples):

Part 4, Annex D Asymmetric swirl generator

Table D.2 with its columns H and S show wrong numbers of boreholes with their angles.
E.g. for DN 80, the calculation of (H) 8 boreholes times (S) $22\frac{1}{2}^\circ$ is only a half circle (180°).

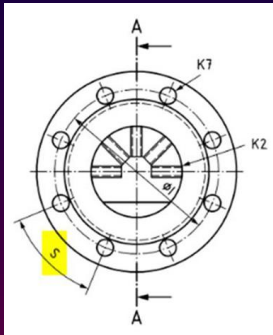


Table D.2 — Dimensions for the wafer type asymmetric swirl generator (see Figure D.2) with general tolerance class m according to ISO 2768

DN	A	B	C	D	E	G	H	I	J	K	N	O	R	S
50	—	104	50	—	—	—	—	125	—	—	1,57 1,52	18	—	45°
65	—	124	65	36	33	21,5	—	—	—	54,28	185	1,57 1,52	18	—
80	—	139	80	—	—	—	—	160	—	—	1,57 1,52	18	—	22 1/2°
100	—	159	100	53	—	33,6	50,8	8	180	1,5	7	83,50	18	—

*to be changed by
CEN/TC176/WG2
document no.
N 948*

In the test description in chapter 7.22 Flow disturbances are prescribed rotations around axis in steps of each 45° resulting in four uniformly distributed testing positions:

Firstly, the ASG shall be orientated with the segmental orifice plate directed upwards (top orientation). Afterwards, the ASG shall be rotated around the pipe axis for three times in the clockwise direction (looking upstream) in steps of each 45° ($\pm 5^\circ$), resulting in four uniformly distributed testing positions.

- ➔ With this, in table D.2 the numbers of flanges (H) have to be doubled and the angles (S) have to be halved with respect to the top orientation for the first borehole of the orifice plate.
- ➔ Additional to this, the elaboration under K 6 'maschine housing $3.2\text{ }\mu\text{m}$ all over' surface is not exact explained for all sections of the swirl generator, so detailed elaborations are necessary (e.g. for the fans).

EMATEM - International Summer School

Seeon 17.09.2025 – 18.09.2025

Workitems zur Entwicklung der EN 1434

Review on work items for development of EN 1434

Dr.-Ing Jürgen Rose

EMATEM e.V.

former CEN TC 176 Convenor WG 2

and Head DIN NA 041-03-05

DAkkS Reviewer

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Thanks to all lecturers and activists !