BS EN 1434-6:2015

BSI Standards Publication

Heat meters

Part 6: Installation, commissioning, operational monitoring and maintenance

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National foreword

This British Standard is the UK implementation of EN 1434-6:2015. It supersedes BS EN 1434-6:2007 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee CPI/30, Measurement of fluid flow in closed conduits.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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European foreword

This document (EN 1434-6:2015) has been prepared by Technical Committee CEN/TC 176 "Heat meters", the secretariat of which is held by SIS.

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of an identical text or by endorsement, at the latest by May 2016, and conflicting national standards shall be withdrawn at the latest by May 2016.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 1434-6:2007.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive.

For relationship with EU Directive, see informative Annex ZA, which is an integral part of this document.

EN 1434, *Heat meters* consists of the following parts:

— *Part 1: General requirements*

— *Part 2: Constructional requirements*

— *Part 3: Data exchange and interfaces*[1)]

— *Part 4: Pattern approval tests*

— *Part 5: Initial verification tests*

— *Part 6: Installation, commissioning, operational monitoring and maintenance*

In comparison to EN 1434-6:2007, the following changes have been made:

— special cases for combined cooling and heating meters are added;

— additional functionalities for smart metering applications are added;

— installation requirements added for heat meters which are located next to cables like data communication cables and mains supply cables;

— installation requirement changed for 4-wire connections;

— cooling meters are added.

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,

1) EN 1434-3 is maintained by CEN/TC 294.

Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies commissioning, operational monitoring and maintenance and applies to heat meters. Heat meters are instruments intended for measuring the energy 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.

This standard covers meters for closed systems only, where the differential pressure over the thermal load is limited.

2 Normative references

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

EN 1434-1:2015, *Heat meters — Part 1: General requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1434-1:2015 and the following apply.

3.1
heating system
heating installation of the dwelling or premises, including the exchange circuit, the heat meter, the associated fittings and the electrical equipment

Note 1 to entry: The heating system typically commences and finishes at the two connections to the heat mains.

3.2
heat mains
heat suppliers distribution pipes to which the consumer's installation is connected

3.3
inlet and outlet limbs
pipes connecting the heating system to the heat mains

3.4
primary circuit
circuit hydraulically connected to the heat mains

3.5
secondary circuit
circuit hydraulically separated from the primary circuit

3.6
competent authority
persons or organizations charged with the responsibility for the heat meter and/or its installation

4 Requirements

4.1 Design requirements

4.1.1 When designing the heating system, the heat meter manufacturer meter specification and installation instructions shall be followed.

For DN 40 and smaller, it is possible to use short direct sensors. To achieve good temperature sensitivity, direct sensors should be installed without temperature pockets. Temperature pockets should only be used when required for safety reasons.

4.1.2 To avoid unnecessary systematic error the temperature sensors shall be placed directly before and after the thermal load. If the differential pressure between the sensors is too high this systematic error might be too large.

For typical systematic negative error as a function of differential pressure and temperature difference, see Table 1.

Table 1 — Typical systematic negative error as a function of differential pressure and temperature difference

Diff in bar	**Temperature difference in K**							
	3	**5**	**10**	**20**	**30**	**40**	**50**	**60**
0,5	0,2	0,2	0,1	0,1	0,1	0	0	0
1	*0,5*	*0,4*	0,3	0,2	0,1	0,1	0,1	0,1
2	*0,9*	*0,7*	*0,5*	0,3	0,2	0,2	0,1	0,1
3	*1,4*	*1,1*	*0,8*	*0,5*	0,3	0,2	0,2	0,2
4	*1,8*	*1,5*	*1,0*	*0,6*	*0,4*	0,3	0,3	0,2
5	*2,3*	*1,9*	*1,3*	*0,8*	*0,5*	*0,4*	0,3	0,3
6	*2,7*	*2,2*	*1,5*	*0,9*	*0,6*	*0,5*	*0,4*	0,3
7	*3,2*	*2,6*	*1,9*	*1,1*	*0,7*	*0,6*	*0,5*	*0,4*
8	*3,6*	*3,0*	*2,0*	*1,2*	*0,9*	*0,7*	*0,5*	*0,4*
9	*4,1*	*3,3*	*2,3*	*1,4*	*1,0*	*0,7*	*0,6*	*0,5*
10	*4,5*	*4,0*	*2,5*	*1,5*	*1,1*	*0,8*	*0,7*	*0,5*

The values are shown as fraction of the maximum permissible error for the calculator. The values below the marked line are higher than 1/3rd of the maximum permissible error for the heat calculator. If the resulting error is higher than 1/3rd of the maximum permissible error, it is recommended to change the installation to have smaller differential pressure.

NOTE In cases where flows from two different loads with different temperatures (e.g. for space heating and domestic warm water) are merged together just before the temperature sensor, the optimum position for the sensor is after the flow sensor.

4.1.3 For bifunctional meters for change-over systems between heating and cooling additional requirements are necessary to ensure the correct switching over function between the heating and cooling register. These requirements are:

— the lowest operating temperature in the inlet pipe at heating conditions shall be at least 3 °C higher than any specified optional switching over temperature θ_{hc},

— the highest operating temperature in the inlet pipe at cooling conditions shall be at least 3 °C lower than any specified optional switching over temperature θ_{hc},

— the minimum temperature difference in heating and cooling application shall be more than 3 K.

NOTE The above mentioned temperature range of at least 3 °C covers the maximum accepted uncertainty in absolute temperature and the cable resistance.

A temperature sensor with smaller tolerances than 2 °C for measuring absolute temperature is recommended.

4.2 Installation requirements

The heat meter shall be installed in accordance with the manufacturer's instructions.

Before installation, the circuit into which the flow sensor is to be installed shall be thoroughly flushed to remove debris. The strainer, where fitted, shall be cleaned.

The heat meter shall be protected from the risk of damage by shock and vibration induced by the surround-ings at the place of installation.

The heat meter shall not be subjected to undue stresses caused by pipes and fittings.

The pipe lines of the heating system up and downstream of the heat meter shall be adequately anchored.

Heat meters designed to operate from an AC mains supply shall be wired in accordance with wiring regulations applicable.

The AC mains power supply shall be secured against accidental interruption. However, circuit protection shall be incorporated according to the state of the art, to safely disconnect the device when electrical problems occur.

Measurement signal leads shall not be laid directly alongside other leads such as mains supply cables, low voltage supply cables and data communication cables and shall be independently supported. The separation between those groups shall not be less than 50 mm. Unless the calculator under installation was type tested according to the latest version of EN 1434-4, it is recommended to install cables and calculators with a distance of at least 60 cm to strong electromagnetic fields, e.g. frequency controlled pumps and similar high energy mains cables.

Mains and external signal cables longer than 10 m shall in areas where lightning is frequent be protected with an external lightning surge protection at the cable entrance to the building.

Each signal lead between temperature sensors and calculator shall be one continuous length without joints except 4-wire connection solutions which are approved.

Signal circuits between parts of a heat meter shall be so installed as to deter unauthorized interference and disconnection.

Precautions shall be taken to prevent damage to the heat meter by unfavourable hydraulic conditions (cavitation, surging, water hammer).

When the installation of the heat and cooling meters is complete, it shall be inspected and approved by representatives of the competent authority in accordance with established procedures and the inspection shall be documented.

Installation shall be done according to national legislation on legal metrology.

4.3 Heat meter commissioning

4.3.1 General

The responsibility for the carrying out of each of the inspection phases is not necessarily restricted to one person or one authority depending on the national legislation on legal metrology, but however arranged, the following points shall be addressed and responsibilities defined.

4.3.2 Certification check

Before commissioning commences it shall be ascertained firstly, that the correct heat meter has been installed by comparing the heat meter manufacturer's type and size designation against the system specification. Secondly, it shall be checked that the heat meter, if a complete instrument, bears the correct pattern approval mark and, if a combined instrument, that each of the meters sub-assemblies bear the pattern approval marks stipulated in the pattern approval document for the heat meter installed.

4.3.3 Installation check

At least the following points shall be checked:

— Is the flow sensor mounted in the correct position and with the correct flow direction?

— Does the temperature sensor fit correctly into the pocket (pockets shorter than 140 mm shall be marked "EN 1434" or dimensions checked)?

— Are the temperature sensors correctly installed?

— Is the heat meter installed at a safe distance from sources of electromagnetic interference (switchgear, electric motors, fluorescent lights)?

— Where called for, has the heat meter been correctly earthed?

— The specified protection class (IP) has to be ensured: Is every cable diameter within the minimum and maximum diameter as specified by the manufacturer?

— Are the gaskets dedicated to the application (e.g. temperature range, pressure, durability, medium)?

— Are the accessories correctly installed according to the installation instructions of the manufacturer and operator?

— Is the heat meter seen to be functioning when the heating system starts operating?

4.3.4 Heat meter security

At the completion of commissioning, the heat meter's protective devices shall be sealed by representatives of the competent authority. For any further adjustment of the meter or for replacement of sub-assemblies, batteries, etc., it will thus be necessary to break one or more seals.

If a seal has to be broken then the renewal shall be conducted in conformity with the national legislation of legal metrology

Annex A
(informative)

Heat meter installation

A.1 General

This annex gives recommendations for the installation of heat meters into the heating system of which they form a component.

It includes reference to the quality of the heat conveying liquid and contains recommendations of direct concern to the distributor of heat, the building owner and the final consumer.

A.2 Criteria for the selection of a heat meter

The type, size, accuracy and environmental class of a heat meter is determined according to the operating and environmental conditions of the installation, taking into account in particular the following:

a) pressure of the heat conveying liquid;

b) physical and chemical characteristics of the heat conveying liquid;

c) acceptable pressure loss across the heat meter;

d) accuracy requirements;

e) temperature ranges in inlet and outlet limbs to the heating system and the system temperature difference;

f) expected maximum and minimum flow rate of the heat conveying liquid;

g) required thermal power of the heating system;

h) nature of the flow rate through the heat meter, whether constant, variable or intermittent;

i) requirements concerning the electrical supply to the heat meter;

j) special requirements of the space around the heat meter for ease of reading, security installation and servicing of the meter;

k) requirements for connections, i.e. flanges, fittings and meter dimensions.

A.3 Quality of the heat conveying liquid

A.3.1 General

Heat meters in general are constructed to withstand variations in the chemical constituents and the acidity or alkalinity of the heat conveying liquid. However, the presence of solids in suspension and their deposition onto the surfaces of the passages of the heat meter or their effect on the moving parts of a mechanical flow sensor causes degradation of the performance with time.

Solids may be present as products of corrosion from the materials of which the heating system and the supply mains are constructed. They may also be created, in the case of hot water systems, within the circuit by the action of heat on the chemicals contained in the water.

A.3.2 Primary water quality

The quality of the water in primary circuits is in general high and closely controlled because of its boiler origin. Hence heat meters in primary circuits tend to function in a satisfactory environment. Water quality should be according to CEN/TR 16911.

A.3.3 Secondary water quality

Heat meters functioning in secondary circuits, experience shows, are more prone to problems arising from the water quality. Water quality should be according to CEN/TR 16911.

When purchasing or specifying heat meters the owner of the meter should consult with the meter manufacturer to determine any particular water requirements.

A.4 Heat meter flow circuit design

Circuit design should be arranged/ modified to ensure efficiency of meter operation and should take account of individual installation requirements.

Typical circuit design layouts are indicated in Figures A.1 to A.7.

To avoid deterioration of the metrological performance of the heat meter, any pressure controlling device should not be placed between the temperature sensors.

It is also recommended that arrangements are made to permit in-situ checking of heat meters, for example, a double set of temperature measuring points.

Thermal comfort in smaller dwellings will normally require the use of automatic control devices if optimum energy performance of the installation is to be obtained.

The inlet and outlet temperature sensors and the flow sensors are installed in the same circuit. Where possible, the pipes should have identical dimensions and similar velocity profiles. The two temperature sensors should be mounted in an identical manner.

For temperature measurement, long probes and/or direct sensors are given preference.

Evaluating small circuits therefore could involve consideration of the following aspects:

— heat consumption above the upper limit of flow rate q_s;

— heat consumption below the lower limit of flow rate q_i;

— dynamic stability considerations.

As a general rule heat meters are specified and tested under steady state conditions within the maximum and minimum limits specified by the manufacturer.

When setting up requirements for small circuits the foregoing effects should be considered from a technical and economic viewpoint according to the prescriptions of the manufacturer and of the type examination certificate.

To minimize problems arising from these phenomena the following actions can be taken:

— installation of flow and temperature limiters when q_s may be exceeded;

— employment of heat meters with a large measuring range (1:100) when very low flow rates are expected;

— employment of heat meters with a high sampling rate when the heat consumption fluctuates.

In the case of heat meters operated by battery, the life time of the battery should be considered.

A.5 Additional recommendations for cooling application

Install flow sensor at high temperature line to reduce condensation, and to improve meter performance, due to temperature dependence.

— As cooling meters very often operate with a very low temperature difference, maximum care should be taken at temperature sensor selection and installation. Symmetrical installation and insulation of the sensors are very important factors.

— Balanced adjustment of temperature measurement, inside the calculator of a hybrid instrument, at the specific heat conveying liquid temperature, will improve performance.

To avoid the accumulation of condensation, install pockets with opening downwards.

A.6 Examples for the installation of heat and cooling meters

The following key applies to the Figures A.2 to A.7 (see Figure A 1):

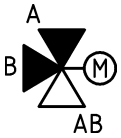
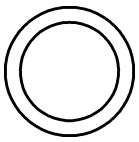
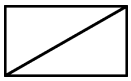
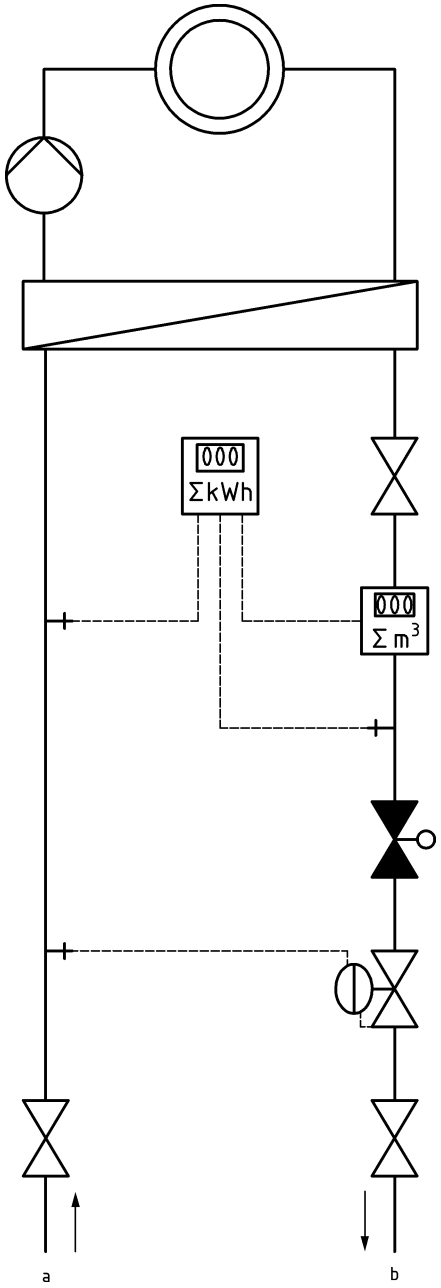
	Calculator		Three-way mixing valve
	Flow sensor		Isolation valve
	Temperature sensor		Differential pressure regulating valve
	Wrong position for temperature sensor		Consumer (e.g. radiators)
	Pump		Heat exchanger
	Non-return flap		Cold water inlet
	Regulating valve		Hot tap water outlet
	Two-ways regulating valve		

Figure A.1 — Definition of Symbols



NOTE The differential pressure regulating valve is only installed if the pressure level at this station is too high.

Figure A.2 — Typical installation of a heat meter in a district heating network - Installation in circuit with variable flow and permanent positive temperature difference

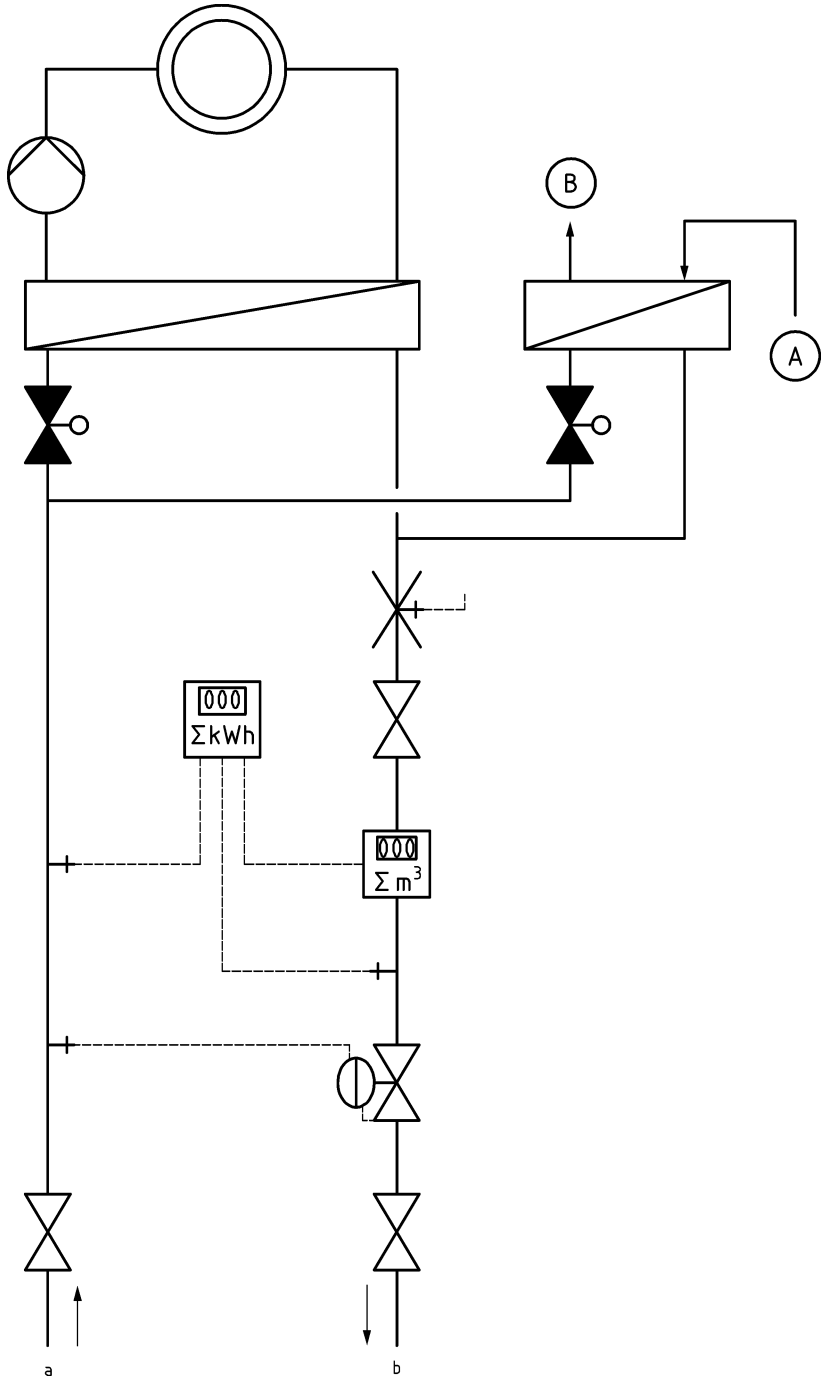


Figure A.3 — Typical installation of a heat meter in a district heating network - A substation with parallel heat exchangers for space heating and domestic hot water

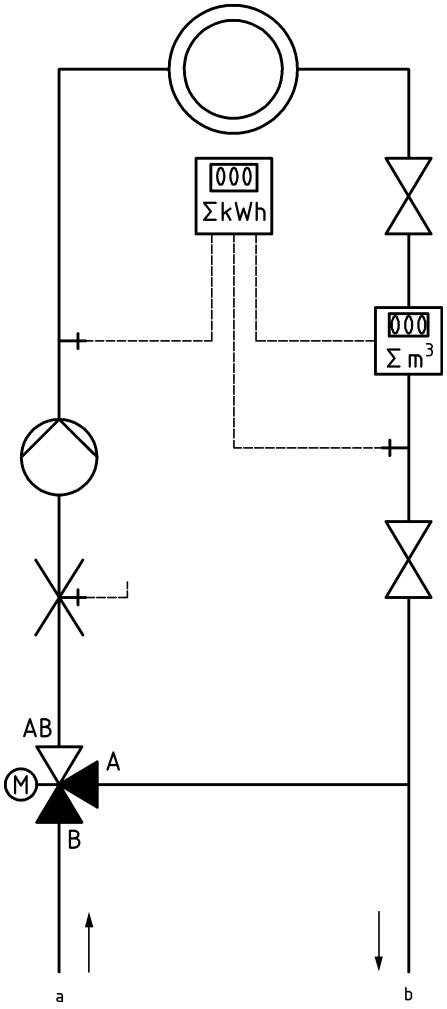
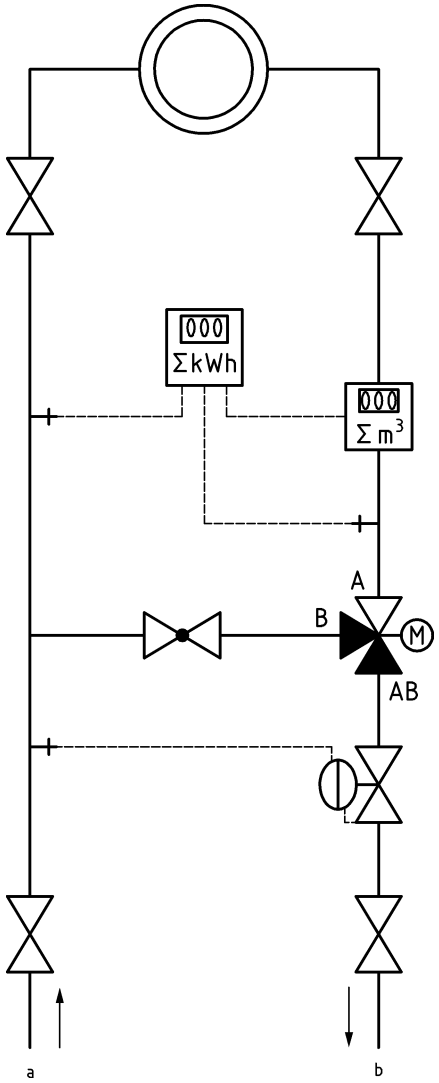


Figure A.4 — Typical installation of a heat meter in a local distribution network - Installation in circuit with nearly constant flow



NOTE The differential pressure regulating valve is only installed if the pressure level at this station is too high.

Figure A.5 — Typical installation of a heat meter in a local distribution network - Installation in circuit with variable flow

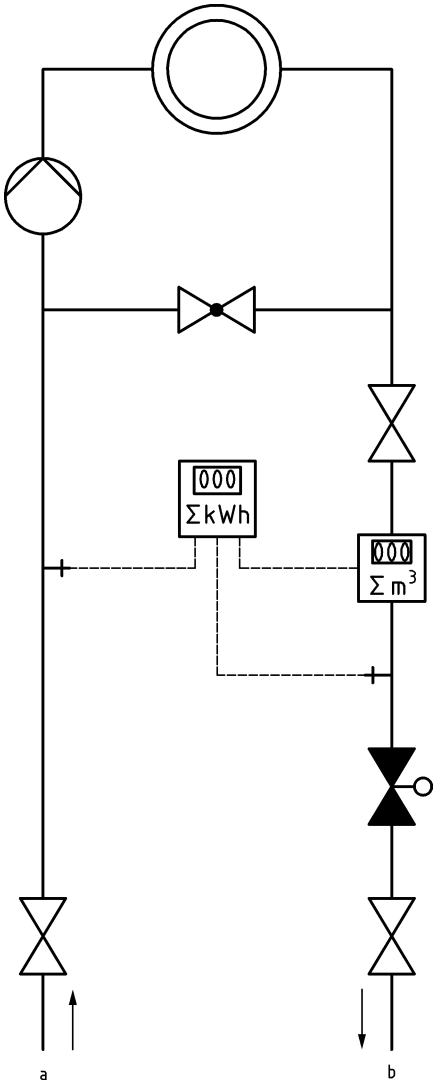


Figure A.6 — Typical installation of a cooling meter in a local distribution network - Installation in circuit with variable flow

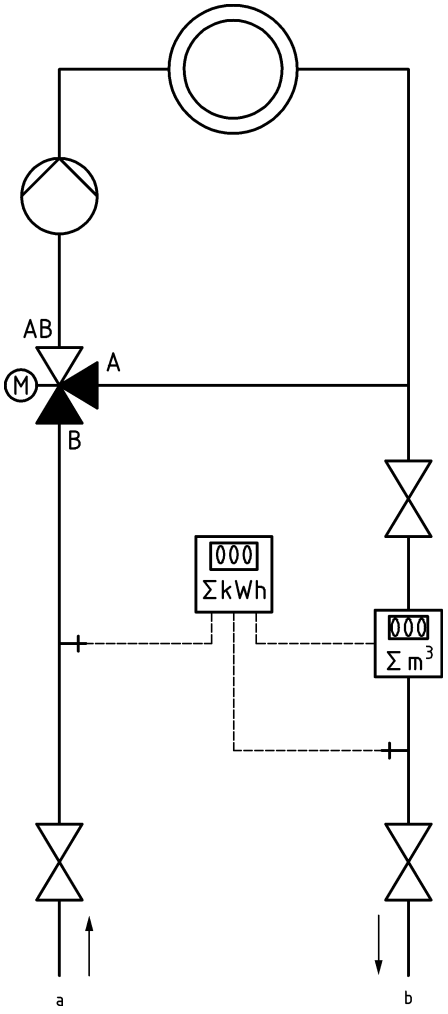
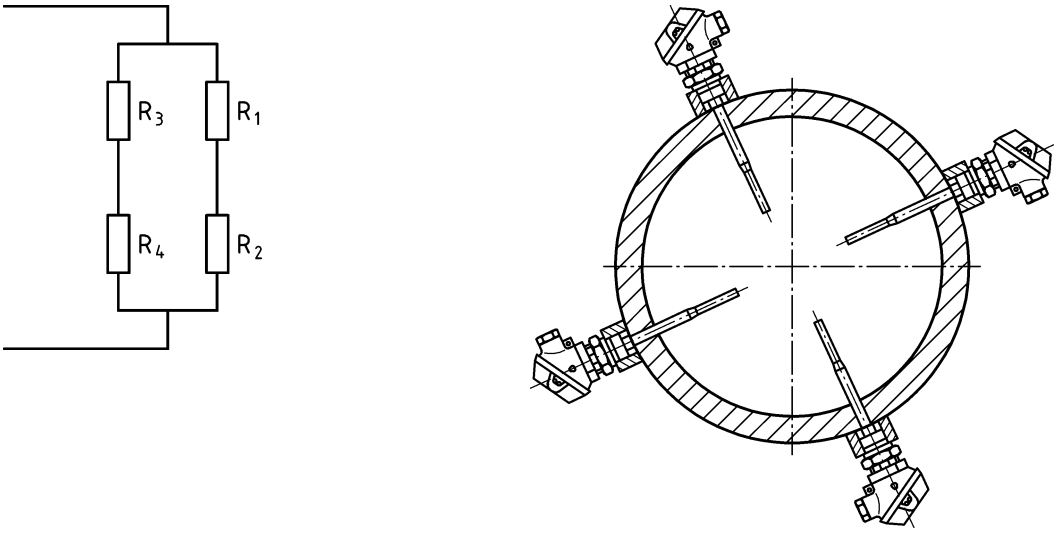


Figure A.7 — Typical installation of a cooling meter in a local distribution network - Installation only in a circuit with variable flow

A.7 Additional recommendations for large pipes > DN 250

In large heating installations that might operate with a low flow rate, the laminar flow profile will cause temperature gradients over the pipe diameter. Measuring the temperature the traditionally way, with one pair of temperature sensors, one sensor in each pipe, could therefore cause measurement errors.

A way to reduce the error is to install four temperature sensors in each pipe, with the measuring points spread over the pipe area to catch the stratification, and thereby have a temperature measurement which is closer to the average temperature in the pipes. See Figure A.8.



a) **b)**

Figure A.8 — Quadrant installation of four temperature sensors

When connecting these sensors in series/parallel the origin characteristics of each sensor (e.g. Pt100, Pt500) will remain.

The use of four separate sensor pairs is acceptable regarding the overall MPE.

Special care shall be taken during selection of the sensor lengths, making the electrical installation and sealing.

Annex B
(informative)

Heat meter operational monitoring and maintenance

B.1 Introduction

This annex includes recommendations for the operational monitoring and maintenance of new and replacement heat meters. It refers to heat meter life, describes monitoring procedures and includes a recommended maintenance check list. These recommendations are of direct concern to the distributor of heat, the building owner and the final consumer.

B.2 Heat meter service life

The competent authority may specify the length of time or a procedure for determining the length of time for which the conformity assessment document/initial verification certificate of the heat meter is valid. At the end of this period the heat meter would normally be replaced. Any heat meter operational, or maintenance check, should commence by checking that where an operational life has been stipulated, this has not been exceeded.

B.3 Heat meter monitoring procedures

In the operation and management of metered heating installations, it is important to monitor the efficiency of the heat meter operation. This involves inspection visits to each meter and the institution of monitoring procedures within the organization to check that the indication of consumption is what might be expected for that meter.

Without recalibrating the heat meter in-situ, or removing it and recalibrating it in the laboratory, the object of monitoring, as distinct from inspection, is to be able to form an educated opinion as to whether the meter's indications are correct. This may result from knowledge of the heat meter's duty, past history, the season's weather etc.

Routines have to be developed to achieve an acceptable balance between the cost of monitoring and inspection and the economic consequences of defective meters.

By comparing the climatic data for previous years and the past heat consumption recorded for a particular meter with the climatic data for the present heating season, it is possible to arrive at an estimated consumption for that heat meter, or to identify abnormalities in its reading.

For obvious reasons, it is desirable to read heat meters at frequent intervals. For large heat meters, it is recommended that heat meters should be read at least four times a year.

B.4 Maintenance check list

The Service and Repair Manual recommendations should be followed, including as a minimum, the following list (see also Figure B.1).

— Check that the security seals are intact and undamaged.

— Check that the meter is functioning.

— Check that the local indication of consumption agrees with the remote indication of consumption and that the security wiring and codes are operational.

— Check that the heat meter's isolating valves are fully open, that they can be closed and that they are not leaking.

— Check for signs of leaks from the meter, associated fittings and connections.

— Check for water penetration at the meter site leading to water dripping onto or flooding the meter.

— Check that all meter cables are firmly connected and that the cables are undamaged and unaffected by ambient heat or other action.

— Check earth continuity, where applicable.

— Check that the heat meter support brackets, clamps etc. are properly fitted, functional and in good order.

— Check and, if required, clean or replace filter elements.

— Check that the ambient temperature is within the range specified for the meter.

— Record the heat meter reading.

B.5 Replacement of failed heat meters

The reason for failure of a heat meter should be investigated at the installation site since defects may not be recognized once the heat meter has been removed.

Check the following points:

— Are there signs of illegal tampering with the meter?

— Are seals broken?

— Has the heat meter been installed correctly, according to the manufacturer´s instructions, etc.?

The replacement of a failed meter by a new or reconditioned unit is governed by exactly the same procedures as those governing new installations as given in Annexes A and B.

INSTALLATION ADDRESS:

VISUAL CONTROL:		
SEALINGS	INTACT	
	BROKEN	
TEMPERATURE SENSORS	PROPER PLACED	
	DISMANTLED	
ELECTRICAL CONNECTIONS	INTACT	
	DISCONNECTED	
	BATTERY FAILURE	
FILTER	CLEAN	
	DIRTY	
	CHOKED	
SIGNS OF PHYSICAL DAMAGE		

DATE OF OPERATION:		
	OLD HEAT METER	NEW HEAT METER
SERIAL NUMBER		
HOUR COUNTER		
m^3-COUNTER		
kWh-COUNTER		
CUSTOMERS SIGNATURE:		
OPERATORS SIGNATURE:		

INSTRUCTION: IMMEDIATELY AFTER DISMANTLING, THE FLOW METER SHALL BE PLUGGED AND CAREFULLY PLACED IN THE TRANSPORT BOX.
THE HEAT METER MAY NOT BE DISASSEMBLED, CLEANED OR SUBJECTED TO PHYSICAL OVERLOAD OR FROST.
THE HEAT METER AND PRESENT REPORT SHALL BE DELIVERED TO THE CALIBRATION LABORATORY ON DAY OF OPERATION.

Figure B.1 — Maintenance report (example)

Annex C
(informative)

Suggested gauge for checking the dimensions of installed temperature sensor pockets

In 4.3.3 (Installation check) it is prescribed that for sensors shorter than 140 mm it is important to check that the dimensions of the temperature sensor pockets is correct for the intended temperature sensors.

The marking "EN 1434" proves that the critical internal diameter is correct for a sensor according to this European Standard. If this marking is missing the tool specified below can be used to verify the correct internal diameter (see Figure C.1).

1) One end of the tool shall fit fully down into bottom of the pocket.

2) The other end of the tool is not allowed to fit into the pocket.

Dimensions in millimetres

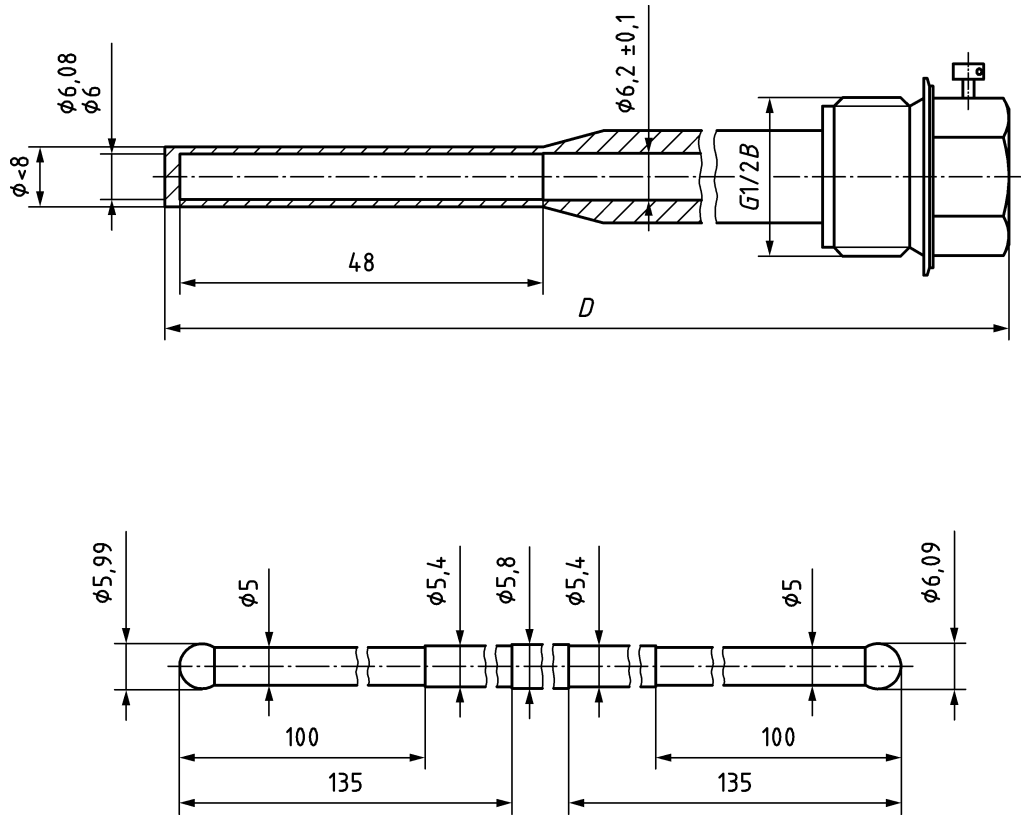


Figure C.1 — Suggested dimensions of gauge shown together with a pocket

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 2004/22/EC, MID

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 2004/22/EC, MID.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and Directive2004/22/EC, MID

Clause(s)/sub-clause(s) of this EN	**Essential Requirements (ERs) of Directive 2004/22/EC, MID**	**Qualifying remarks/Notes**
	Annex I, Essential Requirements, Definitions:	
Scope	Measurand	In scope of standard defined.

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Bibliography

[1] EN 1434-4, *Heat meters — Part 4: Pattern approval tests*

[2] CEN/TR 16911, *Heat meters — Recommendations for circulation water in industrial and district heating systems and their operation*

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