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Heat meters - Recommendations for circulation water in industrial and district heating systems and their operation

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Heat meters - Recommendations for circulation water in industrial and district heating systems and their operation

This draft Technical Report is submitted to CEN members for Technical Committee Approval. It has been drawn up by the Technical Committee CEN/TC 176.

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

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European foreword

This document (FprCEN/TR 16911:2015) has been prepared by Technical Committee CEN/TC 176 “Heat meters”, the secretariat of which is held by SIS.

This document is currently submitted to the Technical Committee Approval.

Introduction

This document is based on the German Guideline AGFW FW 510 prepared by the German Heat and Power Association (AGFW) that represents the state of the art but does not have a normative status has been reproduced in this Technical Report with the permission of AGFW.

This Technical Report is an informative document that describes a process that may be applied for the operation of district heating facilities and gives recommendations for the water used in such facilities. The water quality described in this Technical Report can be used also during testing of heat meters.

1 Scope

This Technical Report applies to industrial and district heating supply by means of high-temperature water heating facilities (flow temperature > 100 °C). This also applies to high-temperature water heating facilities (flow temperature ≤ 100 °C) that are directly connected to district heating networks. In this Technical Report, the aforementioned supply variants will, in the following, be referred to as “district heating facilities”.

This document applies without limitations to new facilities. For existing district heating facilities, the application of this Technical Report is recommended in order to prevent faults due to the chemical composition of the circulation water that would affect the facilities' safe operability and availability.

NOTE Informative notes in the form of guidance and recommendations are identified correspondingly and set in italics for better differentiation.

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 1717, *Protection against pollution of potable water in water installations and general requirements of devices to prevent pollution by backflow*

ISO 11466, *Soil quality — Extraction of trace elements soluble in aqua regia*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 General

3.1.1
district heating
heat (regardless of its origin) which is supplied by means of a transfer medium (mostly hot water or steam) commercially on the basis of a supply agreement and from the delivery of which no collateral duties arise with regard to leasing regulations

3.1.2
hot-/warm-water heating plants
hot-/warm-water generating facility in connection with a district heating network

3.1.3
water treatment
measures taken to remove solid particles, water-soluble substances (salts) and gases from the filling-, supplementary- or circulation water

3.1.4
primary network
district heating network in indirect (e. g. heat exchanger) or direct connection with the heat generator

3.1.5
secondary network
district heating network separated from the primary district heating network by a substation with different system parameters

3.1.6
tertiary network
end-user's domestic installation

3.1.7
heat exchanger with intermediary medium
heat exchanger with a safety system for the indirect heating of drinking water and in which the heating side and the drinking water side are separated by two walls; the space between the two walls is filled with a medium

3.1.8
chalk/carbonic acid equilibrium
if calciferous water is heated up, the concentration of bonded calcium hydrogen carbonate decreases with increasing temperature, and the so called "chalk/carbonic acid equilibrium" shifts from the side of the calcium hydrogen carbonate through the escaping carbon dioxide towards the side of the calcium carbonate:

$$Ca\,(HCO_3)_2 \Leftrightarrow CaCO_3 \downarrow + CO_2 \uparrow + H_2O$$

3.1.9
bicarbonate decomposition
after sofenting and in cause of higher temperature, sodium bicarbonate gradually decomposes into at least sodium hydroxid, water and carbon dioxide (at about 55°C, higher pressure)

$$2\ NaHCO_3 \rightarrow Na_2CO_3 + CO_2 \uparrow + H_2O$$

$$Na_2CO_3 + 2H_2O \rightarrow 2\ NaOH + H_2CO_3$$

$$H_2CO_3 \rightarrow CO_2 \uparrow + H_2O$$

3.1.10
boiler scale
conglomerate of low-solubility alkaline earth salts which form at temperatures < 100 °C, mainly CaCO3 and MgCO3

3.1.11
limescale
conglomerate of low-solubility alkaline earth salts, mainly CaCO3, MgCO3, CaSO4 and CaSiO3

Note 1 to entry: They form either by heat conversion of the alkaline earth salts dissolved in the water (carbonate hardness) or by overstepping the point of solubility which is also temperature-dependent. Soluble alkaline earth salts are available as hardness components or neutral salts in drinking water.

3.1.12
heat transfer medium according to Class 4 pursuant to EN 1717
heat transfer medium which contains toxic, very toxic, carcinogenic or radioactive substances

3.1.13
water conditioning
improving certain quality parameters of the circulation water (e.g. increasing the pH value) by means of conditioning chemicals

3.2 Types of water

3.2.1
untreated water
water available upstream from the treatment plant, regardless of a possible previous treatment outside the plant

3.2.2
soft water
oxygenated water that has been treated by ion exchange to remove earth alkali (the process is called softening)

3.2.3
demineralized water
oxygenated water that has been treated to remove the major part of dissociated, water-soluble substances and is characterized by a pH value < 7, a conductance < 20 μS/cm and a silicic acid concentration < 0,5 mg/l

3.2.4
distilled water
deionized water
oxygenated water that has been treated by ion exchange to fully remove all dissociated, water-soluble substances

3.2.5
filling water
conditioned water with which district heating facilities are initially, partly or re-filled

3.2.6
supplementary water
conditioned water with which temperature-related volume differences and losses due to evaporation and leakage are compensated

3.2.7
circulation water
water that flows through the heat generator/heat exchanger, the piping network, heat transfer stations and, if applicable, radiators. The term not only applies to primary networks, but also to water in a secondary network

3.2.8
feedwater
water that is used to feed a steam generator. It consists of supplementary water and condensate water after full treatment and conditioning

Note 1 to entry: Feedwater is considered as salt-free if its cation conductance is < 0,2 μS/cm and the silicic acid concentration is < 0,02 mg/l (not to mistake for distilled water!).

3.2.9
boiler water
water contained in water piping and large-scale water boilers and whose properties differ from those of feedwater due to densification processes during use

3.3 Units

3.3.1 General

Pursuant to the “Units in Metrology Act”, the below-mentioned water-chemical terms and units apply.

3.3.2 Measurands

3.3.2.1
molar amount
concentration of substances contained in the water is stated in mmol/l or in mg/l

3.3.2.2
pH value
index for the acidic, neutral or alkaline reaction of water

Note 1 to entry: At a reference temperature of 25 °C, the pH value scale from 0 to 14 applies. Water is acidic at pH values < 7, neutral at a pH value = 7, and alkaline at pH values > 7.

3.3.2.3
electrical conductivity
the salt concentration is generally determined by measuring the electrical conductivity which includes all dissociated elements of the investigated medium, i.e. bases, acids and salts. In water chemistry, the reference temperature used to measure electrical conductivity is 25 °C, the unit of measurement is μS/cm

3.3.2.4
sum of alkaline earth (hardness)
the former term “hardness” has been replaced by the term “sum of alkaline earth“

Note 1 to entry: The former units for the alkaline earth concentration (°d and mval/l) have been replaced by mmol/l, mol/m^3 and mg/l. The following applies to the conversion of the units:

1 mmol/l = 1 mol/m3 corresponding to 2 mval/l that will give 56 mg CaO/l

Note 2 to entry: Example of calculation for the conversion of the former units:

3,4 mval/l: 2 = 1,7 mmol/l

Note 3 to entry: Contrary to the concentration indications derived from the term “hardness” (°dH), technical expressions such as “water softening” and “softened water” remain in usage.

4 Symbols and abbreviations

4.1 Chemical terms

Al^{3+}	aluminium ion
Ca^{2+}	calcium ion
CaCO3	calcium carbonate
CaSiO3	calcium silicate
CaSO4	calcium sulphate
Cl^{-}	chloride ion
CO_2	carbon dioxide
Cu+ / Cu^{2+}	copper(I) ion / copper(II) ion
EDTA	ethylenediaminetetraacetic acid or ethylenediaminetetraacetate
Fe	iron
Fe 2+ / Fe 3+	iron(II) ion / iron(III) ion
KS4.3	acid capacity up to pH value 4,3
KS8.2	acid capacity up to pH value 8,2
Mg^{2+}	magnesium ion
MgCO3	magnesium carbonate
N_2	nitrogen
NaCl	sodium chloride (common salt)