

Heat exchangers — Forced circulation air-cooling and air-heating coils — Test procedures for establishing the performance

The European Standard EN 1216:1999, with the incorporation of amendment A1:2002, has the status of a British Standard

ICS 27.060.30

National foreword

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 22, an inside back cover and a back cover.

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This British Standard, having been prepared under the direction of the Engineering Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 May 1999

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ISBN 0 580 30975 4

Amendments issued since publication

Amd. No.	Date	Comments
14280	28 March 2003	See national foreword

Descriptors: heat exchangers, definitions, symbols, performance evaluation, calorific power, measurements, installation, tests, computation

English version

Heat exchangers — Forced circulation air-cooling and air-heating coils — Test procedures for establishing the performance

(includes amendment A1:2002)

Echangeurs thermiques —
Batteries à ailettes à circulation forcée —
Procédures d'essai pour la détermination des
performances
(inclut l'amendement A1:2002)

Wärmeaustauscher —
Luftkühler und Lufterhitzer für erzwungene
Konvektion —
Prüfverfahren zur Leistungsfeststellung
(enthält Änderung A1:2002)

This European Standard was approved by CEN on 28 November 1998. Amendment A1 was approved by CEN on 14 September 2002.

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Comité Européen de Normalisation
Europäisches Komitee für Normung

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Ref. No. EN 1216:1998 + A1:2002 E
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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 110, Heat exchangers, the Secretariat of which is held by BSI.

This European Standard replaces ENV 1216:1993.

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of an identical text or by endorsement, at the latest by June 1999, and conflicting national standards shall be withdrawn at the latest by June 1999.

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

Foreword to amendment A1

This document EN 1216:1998/A1:2002 has been prepared by Technical Committee CEN/TC 110, Heat exchangers, the Secretariat of which is held by BSI.

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 April 2003, and conflicting national standards shall be withdrawn at the latest by April 2003.

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This amendment is introduced to accommodate newly available refrigerants such as R404A, R407C and R410A.

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0 Introduction

This European Standard is one of a series of European Standards dedicated to heat exchangers.

1 Scope

This European Standard applies to forced circulation air-cooling or air-heating coils operating:

- a) with an evaporating or condensing refrigerant;
- b) with a cooling or heating fluid;
- c) without fans.

Operation with steam is not part of the standard.

This standard specifies uniform methods of testing under non-frosting conditions conducted on test samples to test and ascertain the following:

- product identification;
- the capacity;
- air side pressure drop;
- fluid side pressure drop.

at standard conditions, unless otherwise stated by the user.

It is not the purpose of this standard to specify the types of test used for production or field testing.

2 Normative references

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

EN 45001, *General criteria for the operation of testing laboratories*.

3 Definitions

For the purposes of this Standard, the following definitions apply:

3.1

forced-circulation air-cooling or air-heating coil

a tubular heat exchanger, with or without extended surfaces, for use in an air flow, circulated by fans

3.1.1

forced-circulation air-cooling coil

an air-cooling coil through which a cooling fluid is circulated for the purpose of the sensible cooling, or sensible cooling and dehumidification of a forced-circulation air flow, including all components necessary for the distribution and collection of the cooling fluid

3.1.2

forced-circulation air-heating coil

an air-heating coil through which a heating fluid is circulated for the purpose of the sensible heating of a forced-circulation air flow, including all components necessary for the distribution and collection of the heating fluid

3.1.3

cooling fluid

either refrigerant or a liquid used for cooling

3.1.4

heating fluid

either refrigerant or a liquid used for heating

3.1.5

(primary) refrigerant

the working fluid, in a refrigeration system, that absorbs heat by evaporation at a low temperature and rejects it by condensation at a higher temperature. In the following, the term refrigerant is used

3.1.6

liquid

a working fluid circulated through a heating or cooling system which remains liquid during the absorption or rejection of heat

3.2 Coil dimensions

3.2.1

row

a bank of tubes that are located in a plane at right angle to the direction of the air flow

3.2.2

coil inlet area

the internal cross-sectional area of the duct containing the heat exchanger supplied by the manufacturer

3.2.3

total heat transfer surface (air side)

whole external surface of the coil which is exposed to the air flow passing through the coil

3.3 Capacity

3.3.1 Air-cooling capacity

3.3.1.1

sensible (dry) air-cooling capacity

heat flow which is rejected by the air by means of temperature drop

3.3.1.2

latent air-cooling capacity

latent heat flow which is rejected by the condensing water vapour of the air

3.3.1.3

total cooling capacity on air side

sum of the sensible and the latent capacities measured at the same time. It is equal to the enthalpy change of the air across the air cooling coil reduced by the enthalpy flow removed by the condensed water

3.3.1.4

total cooling capacity on fluid side

heat flow absorbed by the cooling fluid, expressed as the product of the mass flow of the cooling fluid and the difference between specific enthalpies at the outlet and inlet connections of the coil

3.3.1.5

enthalpy flow of condensate

difference between the total cooling capacities on air side and on fluid side which is equal to the specific enthalpy of the condensate multiplied by its flow rate

3.3.2 Air-heating capacity

3.3.2.1

heating capacity on air side

heat flow absorbed by the air passing through the coil

3.3.2.2

heating capacity on fluid side

heat flow rejected by the heating fluid, expressed as the product of the mass flow of the heating fluid and the difference between specific enthalpies at the inlet and outlet connections of the coil

A1) 3.4 pressures

NOTE All pressures are average values ascertained over the test duration, and are absolute pressures.

3.4.1**condensing pressure**

the pressure of the refrigerant at the inlet connection of the condenser

3.4.2**evaporating pressure**

the pressure of the refrigerant at the outlet connection of the calorimeter (applicable only to low pressure calorimeter method)

3.5 Temperature

NOTE All temperatures are average values ascertained over the measuring period.

3.5.1 Air temperature**3.5.1.1****air inlet temperature**

average dry bulb or wet bulb temperature of the air at the coil inlet, taking into consideration the local air velocities

3.5.1.2**air outlet temperature**

average dry bulb temperature of the air at the coil outlet, taking into consideration the local air velocities

3.5.2 Liquid temperature**3.5.2.1****liquid inlet temperature**

average temperature of the liquid at the inlet connection of the coil, taking into consideration the local liquid velocities

3.5.2.2**liquid outlet temperature**

average temperature of the liquid at the outlet connection of the coil, taking into consideration the local liquid velocities

3.5.3 Refrigerant temperature**3.5.3.1****evaporating temperature**

dew point temperature of the refrigerant, corresponding to the evaporating pressure

3.5.3.2**condensing temperature**

dew point temperature of the refrigerant corresponding to the condensing pressure

3.5.3.3**superheated vapour temperature**

actual temperature of the refrigerant vapour:

- a) at the air-cooling coil suction outlet connection;
- b) at the air-heating coil inlet connection

3.5.3.4**subcooled refrigerant temperature**

temperature of the liquid refrigerant:

- a) at the inlet of the expansion device (not part of the air-cooling coil);
- b) at the outlet connection of the air-heating coil **A1**

3.5.3.5

bubble point temperature

temperature corresponding to the absolute pressure of the refrigerant at the outlet connection of the condenser

3.6 Temperature difference

3.6.1 Operation with refrigerant

3.6.1.1

inlet temperature difference

absolute value of the difference between the air inlet dry bulb temperature and:

- a) for air-cooling coils the evaporating temperature;
- b) for air-heating coils the condensing temperature

3.6.1.2

superheating

difference between:

- a) for air-cooling coils the superheated vapour temperature and the evaporating temperature;
- b) for air-heating coils the superheated vapour temperature and the condensing temperature

3.6.1.3

subcooling

difference between the bubble point temperature and the subcooled refrigerant temperature:

- a) in the case of an air-cooling coil at the inlet of the expansion device;
- b) in the case of an air-heating coil at the outlet connection of the coil

3.6.2 Operation with liquid

3.6.2.1

inlet temperature difference

absolute value of the difference between air inlet temperature and liquid inlet temperature

3.6.2.2

liquid temperature difference

absolute value of the difference between liquid inlet and outlet temperature

3.6.3

air temperature difference

absolute value of the difference between air inlet and outlet temperature

3.7 high glide

refrigerant where the difference between the condensing and bubble point temperatures at a condensing temperature of 40 °C is greater than 3 K

3.8 Air flow/velocity

3.8.1

air face velocity

air volume flow rate through the coil divided by the coil face area

3.8.2

air mass flux

air mass flow through the coil divided by the coil face area A_1