SLOVENSKI STANDARD
SIST EN 1048:2014

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Nadomešča:
SIST EN 1048:1999

Prenosniki toplote - Zračno hlajeni hladilniki tekočin - Postopki preskušanja za ugotavljanje lastnosti

Heat exchangers - Air cooled liquid coolers ('dry coolers') - Test procedures for establishing performance

Wärmeaustauscher - Luftgekühlte Flüssigkeitskühler ('Trockenkühltürme') - Prüfverfahren zur Leistungsfeststellung

Échangeurs thermiques - Refroidisseurs de liquide à convection forcée ('aéroréfrigérant sec') - Procédures d'essai pour la détermination de la performance

Ta slovenski standard je istoveten z: EN 1048:2014

ICS:

27.060.30	Grelniki vode in prenosniki toplote	Boilers and heat exchangers
27.200	Hladilna tehnologija	Refrigerating technology

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EUROPEAN STANDARD

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English Version

Heat exchangers - Air cooled liquid coolers ('dry coolers') - Test procedures for establishing the performance

Echangeurs thermiques - Refroidisseurs de liquide à convection forcée ('aéroréfrigérant sec') - Procédures d'essai pour la détermination de la performance

Wärmeübertrager - Luftgekühlte Flüssigkeitskühler ('Trockenkühltürme') - Prüfverfahren zur Leistungsfeststellung

This European Standard was approved by CEN on 22 May 2014.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 1048:2014) has been prepared by Technical Committee CEN/TC 110 “Heat exchangers”, the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by February 2015, and conflicting national standards shall be withdrawn at the latest by February 2015.

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 1048:1998.

The main changes with respect to the previous edition are listed below:

a) Clause 3 “Terms and definitions” is modified;

b) The revised standard takes into account the current state of the art.

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, 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.

Introduction

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

1 Scope

This European Standard applies to remote forced convection air cooled liquid coolers, within which no change in the liquid phase occurs.

This European Standard does not apply to liquid coolers, designed primarily for installation within the machinery compartment of packaged products.

Its purpose is to establish uniform methods to test and ascertain the following:

— Product identification;

— Capacity;

— Air flow rate;

— Liquid side pressure drop;

— Energy requirements.

This European Standard does not cover technical safety aspects.

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 ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025)*

3 Terms and definitions

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

3.1
forced convection air cooled liquid cooler: “dry cooler”
self contained system, that cools a single phase liquid by rejecting sensible heat via a heat exchanger to air that is mechanically circulated by integral fan(s)

Note 1 to entry: In the following, “forced convection air cooled liquid cooler” is referred to as “dry cooler”.

3.2
liquid
working fluid circulated through the cooling system, which remains in liquid phase during the absorption and rejection of heat during the test

Note 1 to entry: The liquid can be any fluid which can be defined and that has known physical properties.

3.3
capacity
cooling effect on the liquid passing though the dry cooler

Note 1 to entry: It is defined as the product of the liquid mass flow rate and the difference between the enthalpies at the inlet and outlet connections of the dry cooler.

3.4
temperatures
Note 1 to entry: All temperatures are average values ascertained over the measuring period.

3.4.1
air inlet temperature
average dry bulb temperature of the air at the inlet of the dry cooler, taking into consideration the local air velocities

3.4.2
liquid inlet temperature
average temperature of the liquid at the inlet connection of the dry cooler, taking into consideration the local liquid velocities

3.4.3
liquid outlet temperature
average temperature of the liquid at the outlet connection of the dry cooler, taking into consideration the local liquid velocities

3.5
temperature differences
3.5.1
inlet temperature difference
difference between the liquid inlet temperature and air inlet temperature of the dry cooler

3.5.2
liquid temperature difference
difference between the liquid inlet and liquid outlet temperatures of the dry cooler

3.6
liquid pressure
3.6.1
liquid inlet pressure
static pressure of the liquid at the inlet connection of the dry cooler

3.6.2
liquid outlet pressure
average static pressure of the liquid at the outlet connection of the dry cooler

3.6.3
liquid pressure difference
difference between the liquid inlet pressure and the liquid outlet pressure

3.7
rotational speed of the fans
average rotational speed of all fans

3.8
heat transfer surface (air side)
whole external surface of the coil which is exposed to the air flow passing through the dry cooler

4 Symbols

For the purposes of this document the following apply:

4.1 Letters

Table 1 — Letters

cp_A	Specific heat capacity of the air	kJ/(kg K)
cp_L	Specific heat capacity of the liquid, at the mean temperature within the dry cooler	kJ/(kg K)
n_1	Rotational speed of the fans, measured during the capacity test	min^{-1}
n_2	Rotational speed of the fans, measured during the air volume flow test	min^{-1}
P	Capacity	kW
P_{fan}	Electrical power of the fan(s)	kW
p_{L1}	Liquid inlet pressure	bar
p_{L2}	Liquid outlet pressure	bar
p_{atm}	Atmospheric pressure	hPa
Δp_L	Liquid pressure difference	bar
q_{mL}	Mass flow rate of the liquid	kg/s
q_{vA}	Volumetric flow rate of the air	m^3/s
q_{vL}	Volumetric flow rate of the liquid	m^3/s
ρ_A	Density of the air	kg/m^3
ρ_L	Density of the liquid at temperature t_{L3}	kg/m^3
t_{A1}	Air inlet temperature	°C
t_{L1}	Liquid inlet temperature	°C
t_{L2}	Liquid outlet temperature	°C
t_{L3}	Liquid temperature at flow meter	°C
Δt_1	Inlet temperature difference	K
Δt_L	Liquid temperature difference	K
τ	Test duration	s

4.2 Superscripts

(a/b) refers to the test sequence, $^{(a)}$ above and $^{(b)}$ below the standard conditions.

(st) refers to standard conditions.

5 Standard capacity

5.1 Basis for standard capacity date

5.1.1 The capacity of the dry cooler is dependent on

a) Inlet and liquid temperature difference;

b) Mass flow of air and liquid;

c) Type of liquid and its temperature;

d) Mounting of unit.

The complex relationship that exists between these items and the capacity, means that it is not possible, with sufficient accuracy, to generalize this relationship over widely varying operating condition.

5.1.2 As dry coolers are usually designed to meet specific sets of operating conditions, this standard specifies

a) An acceptable test method which can be applied to any prescribed set of operating conditions;

b) A standard capacity operating condition, which can be used for comparison purposes.

5.2 Standard conditions for dry cooler capacity

Standard capacity shall be based on tests performed on a clean dry cooler under the following operating conditions:

Liquid type	Water
$t_{A1(st)}$	25 °C
$\Delta t_{1(st)}$	15 K
$\Delta t_{L(st)}$	5 K
$p_{atm(st)}$	1013,25 h Pa

The nominal electrical voltage, frequency and phase shall be as specified by the manufacturer.

5.3 Operating conditions for the nominal air flow

The nominal air volume air flow rate refers to an air temperature of + 20 °C and an ambient pressure of 1013,25 hPa.

NOTE The air volume flow is not influenced by the temperature or the atmospheric pressure if the fan speed is constant.

6 Manufacturer's data

To identify the dry cooler and allow its traceability, the manufacturer or supplier shall supply the test house with the following minimum information for every dry cooler:

a) manufacturer's identification;

b) model designation of unit;

c) model designation of fan;

d) rating of the fan motor(s) according to EN 60034-1;

e) standard capacity for the standard conditions in the range of application, stating the liquid used;

f) nominal air flow;

g) nominal fan power;

h) nominal voltage and frequency;

i) total heat transfer surface (air side);

j) fin pitch and thickness;

k) tube outside diameter and internal enhancement;

l) tube pattern;

m) circuiting arrangement;

n) internal volume including headers;

o) installation instructions;

p) maximum permissible operating pressure PS;

q) liquid pressure drop.

7 Measurements

7.1 Uncertainty of measurement

The permissible uncertainty for various parameters is given in Table 2.