



SLOVENSKI STANDARD
oSIST prEN 16440-2:2020
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**Metode za preskušanje hladilnih naprav za toplotno izolirana transportna sredstva
- 2. del: Eutektične hladilne naprave**

Testing methodologies for refrigerating devices for insulated means of transport - Part 2:
Eutectic cooling devices

Prüfung von Kühleinrichtungen für wärmegeämmte Transportmittel - Teil 2: Eutektische
Kühleinrichtungen

Méthodes d'essai des dispositifs de réfrigération des moyens de transport isothermes -
Partie 2: Dispositifs de réfrigération eutectiques

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Testing methodologies for refrigerating devices for insulated means of transport - Part 2: Eutectic cooling devices

Méthodes d'essai des dispositifs de réfrigération des moyens de transport isothermes - Partie 2: Dispositifs de réfrigération eutectiques

Prüfung von Kühleinrichtungen für wärmegeämmte Transportmittel - Teil 2: Eutektische Kühleinrichtungen

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 413.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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

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European foreword

This document (prEN 16440-2:2020) has been prepared by Technical Committee CEN/TC 413 “Insulated means of transport for temperature sensitive goods with or without cooling and/or heating device”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

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prEN 16440-2:2020 (E)**1 Scope**

This document applies to eutectic cooling devices which are intended to be used with insulated transport equipment.

The following applications are covered:

- Eutectic cooling devices with or without compressor/condenser unit intended to be installed into insulated means of transport (e.g. lorries, trailers, swap bodies, other transport equipment and wagons). Charging of the eutectic elements from the liquid to the solid phase may be performed either by a compressor/condenser unit mounted onto the vehicle or by a stationary direct or indirect system. The eutectic cooling devices are equipped, if relevant, with necessary components for the charging, transmission, cooling and/or with temperature control devices. The eutectic elements can be fitted with or without fans;
- Eutectic cooling devices with independent eutectic elements are not covered by this document.

This document specifies the testing methodologies.

This document is only applicable for mono-temperature eutectic cooling devices. This document does not provide any safety requirements.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

ISO/IEC Guide 99:2007, *International vocabulary of metrology – Basic and general concepts and associated terms (VIM)*

EN ISO 5801, *Fans - Performance testing using standardized airways (ISO 5801)*

3 Terms and definitions, symbols and uncertainties**3.1 Terms and definitions**

For the purposes of this document, the terms and definitions of ISO/IEC Guide 99:2007 and the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1.1**air volume flow (for eutectic units with fans, only)**

V_A

volume flow delivered by the fan(s) in the eutectic unit

3.1.2**calorimeter box**

thermally insulated room in which the eutectic unit of the eutectic cooling device is placed

Note 1 to entry: With eutectic cooling devices, usually the insulated transport equipment is used as the calorimeter box.

3.1.3**charging time**

t_{ch}

period of time required for the freezing of the eutectic mixture inside the eutectic elements which shall be submitted to the charging conditions defined by the manufacturer

3.1.4**compressor/condenser unit**

part of the eutectic cooling device including compressor, condenser, condenser fans, housing, drives (electric motor, internal combustion motor, hydraulic engine and similar) and the operating panel with the control devices

3.1.5**conditioned test room**

room where the test conditions can be maintained at a constant level and in which the calorimeter box with the eutectic unit is mounted

Note 1 to entry: Eutectic unit is mounted inside the calorimeter box and its compressor condensing unit is mounted outside the calorimeter box, if applicable.

3.1.6**insulated means for transport**

insulated vans, bodyworks for trucks and trailers, swap bodies, any kind of mobile containers and railway wagons

3.1.7**cooling device**

system which lowers and/or maintains temperature

3.1.8**cooling energy efficiency ratio**

EER_c

ratio of the useful cooling energy E_c to the total energy consumption E_T of the eutectic cooling device under rated conditions

3.1.9**energy supply**

devices not forming part of the eutectic cooling device but providing or generating the form of energy required for its operation

Note 1 to entry: This includes electric generators, hydraulic pumps, electric accumulators and fuel cells, among others.

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3.1.10**dependent eutectic cooling device**

system with eutectic unit serving as a cooling device, intended to be installed into an insulated transport equipment with a compressor/condenser unit intended to be installed or not onto the vehicle to charge the eutectic unit

3.1.11**eutectic element**

elements (e.g. tubes, plates, etc.) containing eutectic mixtures intended for cold charging, optionally having evaporation tubes or heat exchangers

3.1.12**eutectic mixture**

liquid mixture of two or more components which at certain ratios inhibit the crystallisation process of one another resulting in a system having a lower melting point than either component

3.1.13**eutectic unit**

part of the eutectic cooling device consisting of one or more eutectic elements with or without forced air circulation and, if applicable, including the required expansion or refrigerant control valve and refrigerant distributor

3.1.14**heat load**
 P_{HL}

Heating power delivered into the calorimeter box by electric heating elements during the determination of the useful cooling capacity P_c

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3.1.15**heat transmission**
 P_{TR}

heat flow through the insulated limiting surfaces of the calorimeter box

3.1.16**heat transmission energy**
 E_{TR}

thermal energy transmitted through the insulated limiting surfaces of the calorimeter box during the determination of the maximum cooling time t_{cmax}

3.1.17**independent eutectic cooling unit**

eutectic elements or eutectic units without any connection to a refrigerant circuit

Note 1 to entry: See Figure 1.

3.1.18**inlet air temperature at the compressor/condenser unit**
 $T_{IN CON}$

mean temperature of different measuring points located at air inlets of the compressor/condenser unit

3.1.19**inlet air temperature at the eutectic unit (for eutectic units with fans, only)**
 $T_{IN CD}$

mean temperature of different measuring points located at air inlets of the eutectic unit

3.1.20**inside temperature of the calorimeter box** T_i

arithmetic mean temperature measured at different locations inside the calorimeter box

3.3.21**load space**

volume inside an insulated transport equipment or a compartment available for loading the goods including any required accessories (i.e. shelves, meat rails, etc.)

3.1.22**maximum cooling time** t_{cmax}

period of time after the charging time starting:

- for direct charging, from the switch off of the compressor/condenser unit;
- for indirect charging, from the switching off of the stationary plant;
- for independent eutectic cooling devices, at the closing of the calorimeter box

stopping when the inside temperature T_i of the calorimeter box exceeds the requested temperature of the class

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3.1.23**operating time (for eutectic units with fans, only)** t_{op}

period of total run time of the eutectic unit fans during the test

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3.1.24**outlet air temperature at the eutectic unit (for eutectic units with fans, only)** $T_{OUT CD}$

mean temperature of different measuring points located on the air outlet of the eutectic unit

3.1.25**rated conditions**

constant values laid down for comparison and certification purposes

3.1.26**temperature of the conditioned test room** T_e

mean temperature of different measurement points located outside the calorimeter box (in the conditioned test room)

3.1.27**total energy consumption** E_T

energy consumption of all components necessary for the operation of the eutectic cooling device under rated conditions, over the total charging time and the maximum cooling time

Note 1 to entry: Example of energy: fuel or electricity.

prEN 16440-2:2020 (E)**3.1.28****total power** P_T

arithmetic mean of the power input of all eutectic cooling device components necessary for the operation during charging and/or cooling under rated conditions, including all means for operation

3.1.29**total thermal transmittance** U

heat flow passing through the insulating limiting surfaces of the calorimeter box per degree temperature difference

3.1.30**useful cooling capacity** P_C

capacity of the eutectic unit available with a defined heat load inside the calorimeter box determined under rated conditions

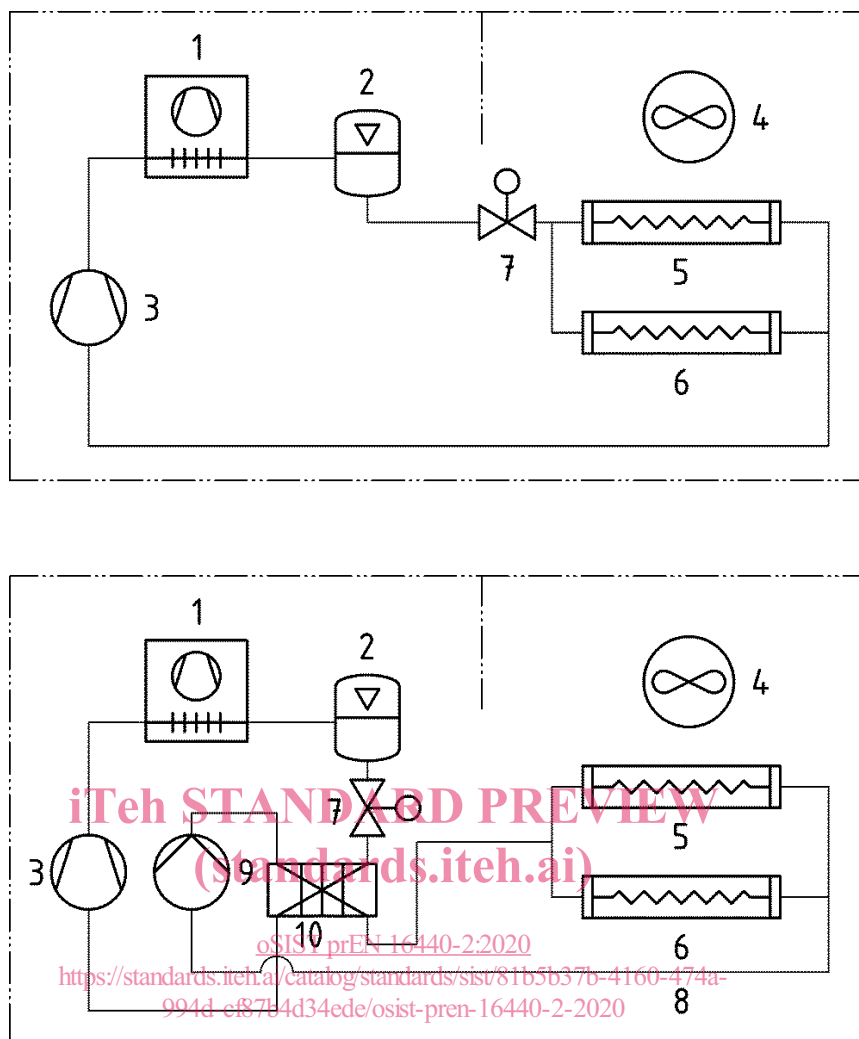
3.1.31**useful cooling energy** E_C

cooling energy stored in the eutectic elements and available over the maximum cooling time at a certain heat load in the calorimeter box under rated conditions

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**Key**

- 1 Condenser
- 2 Compressor/Condenser unit
- 3 Compressor
- 4 Optional fans/optional control devices
- 5 Eutectic element no. 1
- 6 Eutectic element no. 2 (cross section with inside heat exchanger)
- 7 expansion valve
- 8 Secondary Refrigerant
- 9 Pump
- 10 Heat exchanger

Figure 1 — Typical principles for eutectic cooling devices