



Ta slovenski standard je istoveten z: EN 16855-1:2017

en,fr,de

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 16855-1

January 2017

ICS 97.130.20

English Version

Walk-in cold rooms - Definition, thermal insulation performance and test methods - Part 1: Prefabricated cold room kits

Chambres froides - Définition, performances
d'isolation thermique et méthodes d'essai - Partie 1 :
Kits de chambres froides préfabriquées

Begehbare Kühlräume - Begriffe, Wärmedämmleistung
und Prüfverfahren - Teil 1: Fertigbauteile für
Kühlräume

This European Standard was approved by CEN on 26 September 2016.

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EN 16855-1:2017 (E)**European foreword**

This document (EN 16855-1:2017) has been prepared by Technical Committee CEN/TC 44 “Commercial and Professional Refrigerating Appliances and Systems”, the secretariat of which is held by UNI.

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of an identical text or by endorsement, at the latest by July 2017, and conflicting national standards shall be withdrawn at the latest by July 2017.

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Introduction

The drafting of this European Standard was driven by the necessity to compare the systems placed on the market on the base of the minimum thermal insulation requirements and to establish the average level of energy consumption for a future minimum energy performance standard definition, with reference to the EU policy on increasing energy efficiency of energy related products (Directive 2009/125/EC) in the frame of the EU “20-20-20” targets. It also aims to identify the reference standards for calculation, measurement of insulation properties, to identify the best practice rules for elimination of thermal bridges, assembly techniques and provisions to be taken in order to ensure the best level of insulation and power consumption.

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1 Scope

This European Standard applies to prefabricated walk-in cold room kits and components. It provides test or calculation methods to assess thermal insulation performances under normal end-use conditions.

Performance characteristics of walk-in cold rooms are to be assessed in terms of thermal insulating properties, in order to give a basis on which assessing energy consumption related properties of walk-in cold rooms, and of their components.

Performance characteristics are to be assessed for every single component of the walk-in cold room, and for the assembled walk-in cold room as a whole.

The normal end-use conditions of a walk-in cold room are considered to be:

- installation inside an existing building;
- not exposed to external weather conditions.

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 12667:2001, *Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Products of high and medium thermal resistance*

EN 12939, *Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Thick products of high and medium thermal resistance*

EN 13162, *Thermal insulation products for buildings - Factory made mineral wool (MW) products - Specification*

EN 13163, *Thermal insulation products for buildings - Factory made expanded polystyrene (EPS) products - Specification*

EN 13164, *Thermal insulation products for buildings - Factory made extruded polystyrene foam (XPS) products - Specification*

EN 13165, *Thermal insulation products for buildings - Factory made rigid polyurethane foam (PU) products - Specification*

EN 13166, *Thermal insulation products for buildings - Factory made phenolic foam (PF) products - Specification*

EN 13167, *Thermal insulation products for buildings - Factory made cellular glass (CG) products - Specification*

EN 14509:2013, *Self-supporting double skin metal faced insulating panels - Factory made products - Specifications*

EN ISO 6946, *Building components and building elements - Thermal resistance and thermal transmittance - Calculation method (ISO 6946)*

EN ISO 10077-1, *Thermal performance of windows, doors and shutters - Calculation of thermal transmittance - Part 1: General (ISO 10077-1)*

EN ISO 10077-2, *Thermal performance of windows, doors and shutters - Calculation of thermal transmittance - Part 2: Numerical method for frames (ISO 10077-2)*

EN ISO 10211:2007, *Thermal bridges in building construction - Heat flows and surface temperatures - Detailed calculations (ISO 10211)*

EN ISO 14683, *Thermal bridges in building construction - Linear thermal transmittance - Simplified methods and default values (ISO 14683)*

ISO 4590, *Rigid cellular plastics — Determination of the volume percentage of open cells and of closed cells*

3 Terms and definitions

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

3.1

walk-in cold room

thermally insulated enclosure kit made of prefabricated sandwich panels intended for the storage of chilled and/or frozen perishable items, accessible via at least one door, and which is large enough to let somebody walk in it

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3.1.1

prefabricated walk-in cold room kits

walk-in cold room kits delivered to installation sites ready for assembly without any rework of the sandwich panel

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3.1.2

pre-assembled walk-in cold room

walk-in cold room shipped to the customer already assembled, for which no on-site assembly is required

3.1.3

prefabricated walk-in cold room with floor

walk-in cold room having six insulated walls and equipped with a thermally insulated floor

3.1.4

prefabricated walk-in cold room without floor

walk-in cold room having five insulated walls and without a thermally insulated floor

3.1.5

walk-in cold room components

elements that, when assembled together, compose a walk-in cold room

Note 1 to entry: Components can be for example: panels, doors, corners.

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3.2

sandwich panel

building product consisting of two metal faces positioned on either side of a core that is a thermally insulating material, which is firmly bonded to both faces so that the three components act compositely when under load

[SOURCE: EN 14509:2013, definition 3.17]

3.3

perimetrical profile

cross section and characteristics of the perimetrical surface of the sandwich panel related to the joint system, realized with a male-female perimetrical profile, gasket perimetrical profile and camlock perimetrical profile or a combination of them or none of them

3.3.1

male-female perimetrical profile

design solution that allows sealing, structural resistance, thermal insulation, correct alignment at installation

3.3.2

gasket perimetrical profile

design solution that allows sealing by embedding into a sandwich panel a sealing material

3.3.3

camlock perimetrical profile

design solution that allows sealing, structural resistance, mechanical locking between adjacent sandwich panels

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3.4

overall heat transfer coefficient

measure of the global insulating thermal performance of a walk-in cold room envelope, assembled with doors and all ancillaries, in terms of heat flux per unit area per degree difference in temperature

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3.5

mean surface area

S

surface area calculated by the geometric mean between the outside surface area and the inside surface area

3.6

surface heat transfer coefficient

heat flux per unit area per degree difference in temperature

3.7

surface thermal resistance

ratio between temperature difference and heat flux through the surface

3.8

air curtain

technical equipment, producing a controlled stream of air aimed across an opening to create an air seal, that separates different environments, while allowing flow of traffic and unobstructed vision through the opening

3.9**strip curtain**

provision, made of strips, preventing sudden heat gains, when opening doors

3.10 Types of door**3.10.1****hinged door**

door whose actuation takes place by means of rotation of the door leaf around the axis of rotation of the hinges

3.10.2**sliding door**

door whose actuation takes place by means of sliding of the door leaf parallel to the wall

3.10.3**swing door**

hinged door whose door leaf can rotate in both directions

3.10.4**roll shutter**

door whose actuation takes place by means of rolling and unrolling of the flexible door leaf

3.11**mechanical closing device**

mechanical device that helps self-closing of the door, and avoids door leaf to remain ajar, used to reduce energy losses and keep internal temperature

3.12**door switch device**

switch to control evaporator fan motors, internal lighting, alarm and other device improving energy saving

3.13**thermal bridge**

part of the walk-in cold room where the otherwise uniform thermal resistance is significantly changed by a material and/or geometrical discontinuity

3.13.1**linear thermal bridge**

thermal bridge with a uniform cross-section along one of the three orthogonal axes

[SOURCE: EN ISO 10211:2007, definition 3.1.2]

3.13.2**punctual thermal bridge**

localized thermal bridge whose influence can be represented by a punctual thermal transmittance

[SOURCE: adapted from EN ISO 10211:2007, definition 3.1.3]

3.14**insulating material**

thermally insulated product with a declared thermal conductivity lower than 0,06 W/(mK) at 10°C

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3.15

ageing

worsening of the thermal properties of an insulating material or structure along time

3.16

linear thermal transmittance

heat flow rate in the steady state divided by length and by the temperature difference between the environments on either side of a thermal bridge

3.17

punctual thermal transmittance

heat flow rate in the steady state divided by the temperature difference between the environments on either side of a thermal bridge (W/K)

3.18

walk-in cold room ceiling

covering of the walk-in cold room

3.19

core

layer of material, having thermal insulating properties, which is bonded or injected between two metal faces

3.20

**face
facing**

lightly profiled or profiled thin metal sheet firmly bonded to the core

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3.21

fixing (fastening) system

system fastening panels to the supporting system or other components to the panels or components to each other

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3.22

joint

interface between two panels where the meeting edges have been designed to allow the panels to join together in the same plane

[SOURCE: EN 14509:2013, definition 3.13]

3.23

junction

connection between adjacent panels and corners

Note 1 to entry: For example wall to wall, wall to ceiling, wall to floor.

3.24

storage temperature

target storage temperature which is intended to be maintained within the operating walk-in cold room

3.25

medium storage temperature**MT**

any temperature above -5°C , for chilled perishable items storage

3.26**low storage temperature****LT**

any temperature below $-5\text{ }^{\circ}\text{C}$, for frozen perishable items storage

3.27**gross storage volume**

internal dimensions of the cold room, measured from floor to ceiling and from left to right (total height x total width x total length in cubic meters (m^3))

Note 1 to entry: When measuring in meters, the precision for measurements is to be of two decimals; tolerance shall be of $\pm 0,5\text{ cm}$.

3.28**thermal conductivity**

property of a material to conduct heat

3.29**thermal insulation**

property of a material of reducing transfer of thermal energy through its thickness

3.30**supporting profile**

system not structural part of the building, used to permanently support ceiling panels (when necessary), cooling systems, and other equipment of the walk in cold room

3.31**significant figure**

digit that carry meaning contributing to the number precision, considering that leading zeros and trailing zeros placeholders merely indicating the scale are not significant

3.32**product sample**

part of the sandwich panel or door leaf obtained by cutting in the central part of the same product, including any facings and core material

3.33**test specimen**

slice of core material to be tested, taken from the middle thickness at an equal distance from the product sample edges

3.34**group of walk-in cold room components**

walk-in cold room components of similar chemical and physical characteristics, produced on the same production line

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4 Symbols and abbreviations

U_{tot}	overall heat transfer coefficient ($\text{W}/\text{m}^2\text{K}$)
U_j	single component heat transfer coefficient ($\text{W}/\text{m}^2\text{K}$)
W	heating power (W)
S	surface (m^2)
R	thermal resistance ($\text{m}^2\text{K}/\text{W}$)
D	thickness (m)
λ	thermal conductivity coefficient (W/mK)
h	surface heat transfer coefficient ($\text{W}/\text{m}^2\text{K}$)
l	length (m)
Ψ	linear thermal transmittance of the joints per metre length of the panel (W/mK)
X	punctual thermal bridges transmittance (W/K)

Subscripts

n	nominal
i	internal
e	external
c	core
f	facing
s	surface
f	fluid (air)
w	wall
a	air
j	generic index

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5 Performances**5.1 General**

Performance characteristics of walk-in cold rooms shall be assessed in terms of thermal insulating properties, in order to give a basis on which assessing energy consumption related properties of walk-in cold rooms, and of their components.

Performance characteristics shall be assessed for every single component of the walk-in cold room and for the assembled walk-in cold room as a whole.

For the calculations or tests, the reference point for walk-in cold rooms working at medium storage temperature is $T = +5\text{ }^{\circ}\text{C}$, and for low storage temperature is $T = -18\text{ }^{\circ}\text{C}$.

5.2 Thermal insulation performances

Thermal insulation performances of walk-in cold room kits are assessed by considering the relevant characteristic of every single component of a walk-in cold room, which shall be assessed by test and/or by calculations. Components of walk-in cold rooms can be identified as follows:

- 1) wall and ceiling panels;
- 2) floor panels;
- 3) door(s);
- 4) window(s);
- 5) fixing systems and junctions;
- 6) supporting profiles.

For comparison walk-in cold rooms with and without thermally insulated floor will be considered.

Air infiltration through the open door will be considered in terms of devices to avoid or limit the ingress of ambient air, from the environment outside the walk-in cold room. A classification of the used device will be proposed, in order to evaluate the contribution to the improvement of walk-in cold room performance characteristics in terms of energy consumption.

5.3 Other performances

5.3.1 Air permeability

Considering a useful life of the cold room of 10 years, taking into account the extremely low air permeability of the metal facings, air permeability of the panels is considered to have negligible effects on the behaviour of the room. Consequently, no assessment is required.

5.3.2 Water vapour permeability

The content of 5.3.1 is also valid for water vapour permeability.

6 Methods to assess thermal insulation performances of prefabricated walk-in cold room components

6.1 General

The assessment of energy consumption related characteristics of single components of a walk-in cold room will be performed considering the following aspects:

- 1) thermal conductivity of modular panels core;
- 2) thermal transmittance of wall and ceiling panels;
- 3) thermal transmittance of floor panels;
- 4) thermal transmittance of doors;
- 5) thermal transmittance of windows;
- 6) thermal transmittance of corners;
- 7) influence of the supporting profiles.