SLOVENSKI STANDARD
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Dostopne hladilnice - Definicije, toplotnoizolacijske lastnosti in preskusne metode - 2. del: Prilagojene hladilnice

Walk-in cold rooms - Definition, thermal insulation performance and test methods - Part 2: Customized cold rooms

Begehbare Kühlräume - Definitionen, Wärmedämmung und Prüfmethoden - Teil 2: Maßgefertigte Bauteile für Kühlräume

Chambres froides - Définition, performance d'isolation thermique et méthodes d'essai - Partie 2 : Chambres froides personnalisées

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Walk-in cold rooms - Definition, thermal insulation performance and test methods - Part 2: Customized cold rooms

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (EN 16855-2:2018) has been prepared by Technical Committee CEN/TC 44 “Commercial and Professional Refrigerating Appliances and Systems, Performance and Energy Consumption”, 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of an identical text or by endorsement, at the latest by June 2019, and conflicting national standards shall be withdrawn at the latest by June 2019.

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Introduction

This document was drafted following 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 was necessary to identify the reference standards for calculation, measurement of insulation properties, 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.

1 Scope

This document provides test or calculation methods to assess thermal insulation performances for customized walk-in cold rooms and components under normal end-use conditions.

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;

— internal side of panels subject to temperatures within the indicative range −40 °C ≤ T ≤ 12 °C;

— external side of panels subject to temperatures within the indicative range −8 °C ≤ T ≤ 30 °C; temperatures below 0 °C, or higher than 20 °C, can be reached if the walk-in cold room is located inside not air-conditioned premises.

NOTE In case the customized walk-in cold room working at positive storage temperature is used as a food processing room or a clean room, the standard is applied.

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.

EN 12086, *Thermal insulating products for building applications - Determination of water vapour transmission properties*

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 12865, *Hygrothermal performance of building components and building elements - Determination of the resistance of external wall systems to driving rain under pulsating air pressure*

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

EN ISO 6946, *Building components and building elements - Thermal resistance and thermal transmittance - Calculation methods (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, *Thermal bridges in building construction - Heat flows and surface temperatures - Detailed calculations (ISO 10211)*

EN ISO 10456, *Building materials and products - Hygrothermal properties -Tabulated design values and procedures for determining declared and design thermal values (ISO 10456)*

EN ISO 12572, *Hygrothermal performance of building materials and products - Determination of water vapour transmission properties - Cup method (ISO 12572)*

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

3 Terms and definitions

For the purposes of this document, 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
walk-in cold room
thermally insulated enclosure made of 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

3.1.1
customized walk- in cold room
walk-in cold room installed by assembling the single components, requiring on-site cutting of the sandwich panels

3.1.2
customized walk-in cold room with floor
walk-in cold room equipped with a thermally insulated floor, above ground level or embedded in the ground; the room has all insulated faces

3.1.3
customized walk-in cold room with pre-insulated floor
walk-in cold room equipped with a thermally insulated floor embedded in the ground, below ground level, covered with a structural layer (i.e.: concrete) usually levelled to the external ground level; the room has all insulated faces

3.1.4
customized walk-in cold room without floor
walk-in cold room without a thermally insulated floor; the room has only insulated walls and ceiling

3.1.5
walk-in cold room component
element that, when assembled together, compose a walk-in cold room; components can be for example: panels, doors, corner flashings, claddings and profiles used for head-to-head panels connection

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, with different type of perimetrical profile

[SOURCE: EN 14509:2013, 3.17]

3.3
perimetrical design
cross section and characteristics of the perimetrical surface of the sandwich panel related to the joint system

Note 1 to entry: A perimetrical design is realized with 3.3.1, 3.3.2 and 3.3.3 or a combination of 3.3.1, 3.3.2 and 3.3.3 or none of them.

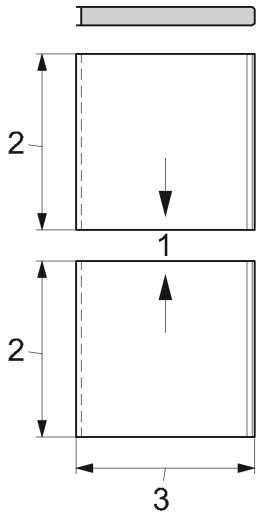
3.3.1
male-female perimetrical design
design solution that allows sealing, structural resistance, thermal insulation, correct alignment at installation

3.3.2
gasket perimetrical design
design solution that allows sealing by embedding into a sandwich panel a sealing material

3.3.3
camlock perimetrical design
design solution that allows sealing, structural resistance, mechanical locking between adjacent sandwich panels

3.3.4
edge of the panel
side of the panel where adjacent panels join together in the same plane along the width

Note 1 to entry: See Figure 1.



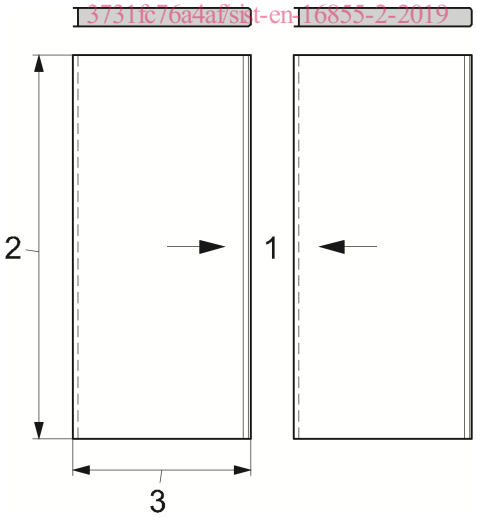
Key

1 edge of panel
2 length
3 width

Figure 1 — Example of the edge of the panel

3.3.5
longitudinal edge of the panel
side of the panel where adjacent panels join together in the same plane along the length

Note 1 to entry: See Figure 2.



Key

1 longitudinal edge of panel
2 length
3 width

Figure 2 — Example of longitudinal edge of the panel

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

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 (cold) 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

3.14
insulating material
thermally insulated product with a declared thermal conductivity lower than 0,06 W/(m•K) at 10 °C

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 between two metal faces

3.20
face, facing
flat, lightly profiled or profiled thin metal sheet firmly bonded to the core

3.21
fixing (fastening) system
system, fastening panels to the supporting system or other components to the panels or components to each other

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, 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
positive storage temperature
PT
any temperature above –5 °C and below 12 °C, for chilled perishable items storage

3.26
negative storage temperature
NT
any temperature below –5 °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))

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

3.35
edge to edge panels connection
system used to connect the heads of adjacent panels that have been previously cut on-site along the width of the panel

3.36
longitudinal edge by longitudinal edge joint
connection between panels that have been previously cut on-site along the length of the panel

3.37
pre-insulated floor
thermally insulated floor embedded in the ground, below ground level, consisting of several layers made of different materials or components

3.38
significant layer
layer of the pre-insulated floor that gives a not negligible contribution to the calculation of the thermal transmittance of the floor

3.39
concrete support below lower vapor barrier
slab made of concrete supporting the customized walk-in cold room, giving a negligible contribution to the calculation of the thermal transmittance of the floor

4 Symbols and abbreviations

U thermal transfer coefficient (W/m²•K)

U_{tot} overall heat transfer coefficient (W/m²•K)

U_j single component heat transfer coefficient (W/m²•K)

W heating power (W)

S mean surface area (m²)

R thermal resistance (m²•K/W)

R_D Declared value of thermal resistance (m²•K/W)

D thickness (m)

λ thermal conductivity coefficient (W/m•K)

h surface heat transfer coefficient (W/m²•K)

l length (m)

Ψ linear thermal transmittance of the joints per metre length of the panel (W/m•K)

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

5 Performance

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 positive storage temperature is T = +5 °C, and for negative storage temperature is T = −18 °C.