International Standard

ISO 19424

Refrigerated food lockers — Thermal and energy performance, ratings, environmental test conditions and associated testing methods

Casiers réfrigérés pour aliments — Performance thermique et énergétique, évaluation, conditions d'essai environnementales et méthodes d'essai associées

First edition
2026-09

Reference number
ISO 19424:2026(en)

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword ... **iv**

1 Scope ... **1**

2 Normative references ... **1**

3 Terms, definitions, symbols and abbreviated terms ... **1**
3.1 Terms and definitions ... 1
3.2 Symbols ... 3
3.2.1 General ... 3
3.2.2 Compression-type refrigeration systems ... 4
3.2.3 Indirect refrigeration-type systems ... 4

4 Requirements ... **4**
4.1 General ... 4
4.2 Construction ... 4
4.3 Operating characteristics ... 5
4.3.1 Classification according to temperature storage ... 5
4.3.2 Classification according to environmental condition ... 5

5 Tests ... **5**
5.1 General ... 5
5.2 Tests outside or inside test room ... 6
5.2.1 General ... 6
5.2.2 Seal test for doors ... 6
5.2.3 Linear dimensions, areas ... 6
5.3 Tests inside test room ... 6
5.3.1 General ... 6
5.3.2 Test room conditions ... 7
5.3.3 Preparation of test locker and general test procedures ... 11
5.3.4 Temperature test ... 21
5.3.5 Water vapour condensation test ... 23
5.3.6 Electrical energy consumption test ... 24
5.3.7 Heat extraction rate measurement when condensing unit is remote from locker ... 24

6 Test report ... **34**
6.1 General ... 34
6.2 Tests outside test room ... 35
6.2.1 Seal test of doors ... 35
6.2.2 Linear dimensions, areas and volumes ... 35
6.3 Tests inside test room ... 35
6.3.1 General test conditions ... 35
6.3.2 Locker preparation ... 35
6.3.3 Temperature test ... 36
6.3.4 Water vapour condensation test ... 36
6.3.5 Electrical energy consumption test ... 36
6.3.6 Heat extraction rate measurement when the condensing unit is remote from the locker ... 37

7 Marking ... **38**
7.1 Load limit ... 38
7.2 Marking plate ... 40
7.3 Information to be supplied by the manufacturer ... 40

Annex A (normative) **Net volume calculation** ... **42**

Bibliography ... **43**

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Foreword

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This document was prepared by Technical Committee ISO/TC 86 *Refrigeration and air-conditioning*, Subcommittee SC 7, *Testing and rating of commercial refrigerated display cabinets*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 44, *Commercial and professional refrigerating appliances and systems, performance and energy consumption,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

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Refrigerated food lockers — Thermal and energy performance, ratings, environmental test conditions and associated testing methods

1 Scope

This document specifies requirements for the thermal and energy performance of refrigerated food lockers in given environmental conditions and intended for the temporary cold storage of chilled or frozen pre-ordered or pre-selected foodstuff until the final collection by the consumer.

This document also covers construction characteristics relevant for thermal and energy performance.

This document specifies tests conditions and methods for checking the requirements to be satisfied as well as the classification of refrigerated lockers, their marking and the list of characteristics to be declared by the manufacturer.

This document is not applicable to refrigerated vending machines.

It is also not applicable to:

— commercial beverage coolers covered by ISO 22044;

— ice cream freezers covered by ISO 22043;

— refrigerated display cabinets covered by ISO 23953-1 and ISO 23953-2;

— cabinets intended for storage or cabinets intended for use, e.g. in catering or non-retail refrigerated applications.

This document does not cover health and safety aspects and ergonomic principles.

The document does not cover safe storage temperatures for any specific perishable foodstuff.

The refrigeration system, providing the cooling function, is either fully or partially integrated or completely remote from the refrigerated food locker and connected by interconnecting pipe-work.

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 23953-1, *Refrigerated display cabinets — Part 1: Vocabulary*

ISO 23953-2:2023, *Refrigerated display cabinets — Part 2: Classification, requirements and test conditions*

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 23953-1 and the following apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1.1
refrigerated food locker
locker
commercial appliance with frozen, chilled or high temperature storage temperature zones, intended for the temporary cold storage of pre-ordered or pre-selected foodstuff until the final collection by the consumer

Note 1 to entry: Refrigerated food lockers are foreseen for constant operation and are located inside or outside a building or under a specific weather protection which is not part of the refrigerated food locker.

Note 2 to entry: The refrigeration system, providing the cooling function, is either fully or partially integrated or completely remote from the refrigerated food locker and connected by interconnecting pipe-work.

Note 3 to entry: A refrigerated food locker consists of a single or multiple separated cold storage compartments with frozen, chilled, high temperature or switchable storage temperature zones, see Table 1.

Note 4 to entry: Compartments are thermally insulated and access to the foodstuff is via a locked door or locked opening(s).

Note 5 to entry: The loading of the refrigerated food locker with the foodstuff is executed by professional personnel from the operator either from the front or back and self-served by the consumer from the front.

3.1.2
installation
assembly of compartments, lockers, refrigerating system and all the apparatus necessary for their operation, which can be connected on-site to make a complete system

3.1.3
protected installation
installation specifically designed for outdoor locations and capable of operating under specific range of outdoor conditions, in accordance with the information provided in the manufacturer's instructions

Note 1 to entry: Typically, a protected installation is sheltered by an incomplete enclosure which includes one or more walls and a roof. The roof typically projects on the front side of the installation for a length which guarantees protection from dripping water with a maximum tilt angle of 15 °, see Figure 1.

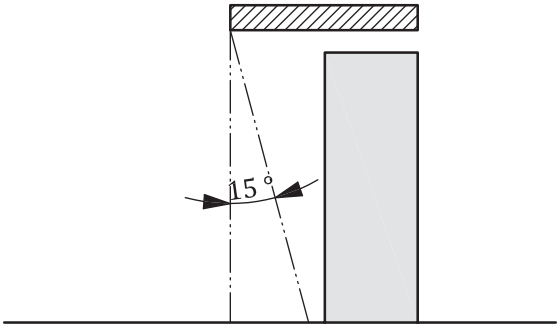


Figure 1 — Protected installation

3.1.4
indoor location
enclosed room or space inside a building, with controlled or uncontrolled environmental conditions

3.1.5
outdoor location
location outside of any building or structure, exposed to the external ambient, with no protection

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3.1.6
net volume
storage volume inside the appliance which can be used for storage of products

Note 1 to entry: Net volume shall be calculated in accordance with Annex A.

3.2 Symbols

3.2.1 General

t_{run} running time, expressed in h

t_{stop} stopping time, expressed in h

t_{deft} defrost time, expressed in h

q_m mass flow rate of liquid refrigerant or secondary refrigerant, expressed in kg/s

Δt time between two consecutive measuring samples, expressed in h

N_{max} number of measuring samples, expressed in 24 h

Φ_{24} heat extraction rate during a whole day, expressed in kW

$\Phi_{24\text{-deft}}$ heat extraction rate during a whole day excepting defrost time, expressed in kW

$E_{CPEC,24\ h}$ pumping electrical energy consumption, expressed in kWh

$E_{DEC,24\ h}$ direct daily electrical energy consumption, expressed in kWh

E_{HREC} heat removal energy consumption, expressed in kWh

E_{LEC} lighting energy consumption, expressed in kWh

$E_{REC,\ 24\ h}$ refrigeration electrical energy consumption, expressed in kWh

$E_{REC\text{-}RC,24\ h}$ refrigeration electrical energy consumption compression-type, expressed in kWh

$E_{REC\text{-}RI,24\ h}$ refrigeration electrical energy consumption indirect, expressed in kWh

E_{SEC} specific daily electrical energy consumption, expressed in kWh/m^2

E_{TEC} total energy consumption, expressed in kWh

t_{rr} relative or percentage running time:

$$t_{rr} = \frac{t_{run}}{t_{run} + t_{stop}} = \frac{t_{run}}{24 - t_{deft}}$$

where

$$t_{run} + t_{stop} + t_{deft} = 24$$

Φ_n instant heat extraction rate, expressed in kW

V_N net volume

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3.2.2 Compression-type refrigeration systems

h_8, h_4 specific enthalpy, expressed in kJ/kg, where state at point 8 corresponds to refrigerant outlet, and state at point 4 to refrigerant inlet, of locker

θ_{mrun} evaporating temperature, calculated as the average of θ_{dew} and θ_{bub} obtained from pressure p8 and averaged over the t_{run} period, expressed in °C

T_{mrun} = θ_{mrun} + 273,15, expressed in K

3.2.3 Indirect refrigeration-type systems

θ_i secondary fluid temperature at locker inlet, expressed in °C

θ_o secondary fluid temperature at locker outlet, expressed in °C

θ secondary fluid median temperature, expressed in °C (θ_i + θ_o)/2

θ_{mrun} arithmetic average of the secondary fluid median temperature (θ) during t_{run}, expressed in °C

q_L instant value of the secondary fluid mass flow during t_{run}, expressed in kg/s

c_i specific heat of secondary fluid, expressed in kJ/(kg · K), at locker inlet

c_o specific heat of the secondary fluid, expressed in kJ/(kg · K), at locker outlet

$p_{irun} - p_{orun}$ pressure drop between inlet and outlet of locker during t_{run}, expressed in kPa

v specific volume of secondary fluid, expressed in m^3/kg
(simplification: v = constant = 0,001 m^3/kg)

4 Requirements

4.1 General

The installation can be indoor or outdoor. In case of outdoor installation, a protected installation shall have the following characteristics:

— avoid direct sun radiation 1 m of shadow;

— protect from rain;

— protect from dust;

— protect from wind;

— protect from snow loading (for the food locker itself) shall be taken into account 20 kg/m^2 for outdoor installation.

4.2 Construction

The locker and its parts shall be constructed for normal conditions of handling, transport and use. The following requirements apply:

a) Interior fittings, including shelves, baskets, rails, etc. and their supports, shall withstand the loads for the intended use.

b) Where sliding shelves, baskets, trays or drawers are fitted they shall retain their shape and ease of movement when fully loaded.

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