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Ice-cream freezers - Classification, requirements and test conditions (ISO/DIS 22043:2019)

Speiseeis-Gefriermaschinen - Klassifikation, Anforderungen und Prüfbedingungen (ISO/DIS 22043:2019)

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Ice-cream freezers — Classification, requirements and test conditions

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

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*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Ice-cream freezers — Classification, requirements and test conditions

1 Scope

The scope of this Standard is to define the classification for horizontal closed ice-cream freezer with access of the product from the top via transparent or solid lid(s) and to specify their requirements and test methods.

These appliances are different to supermarket segment freezers, as they work with static air cooling, with a skin evaporator (no evaporator fan) and are used specifically for the storage and display of pre-packed ice-cream. This standard is only applicable to integral type refrigeration systems. This standard is not applicable to remote and secondary system type cabinets. Ice-cream freezers within this standard should have a net volume ≤ 600 l and only for transparent lid ice cream freezers they should have a net volume/TDA $\geq 0,35$ m.

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 60335-1, *Household and similar electrical appliances — Safety — Part 1: General requirements (IEC 60335-1)*

EN 60335-2-89, *Household and similar electrical appliances — Safety — Part 2-89: Particular requirements for commercial refrigerating appliances with an incorporated or remote refrigerant condensing unit or compressor (IEC 60335-2-89)*

ISO 817, *Refrigerants — Designation and safety classification*

ISO 5149-2, *Refrigerating systems and heat pumps — Safety and environmental requirements — Part 2: Design, construction, testing, marking and documentation*

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 General

3.1.1

ice cream freezer

horizontal closed refrigerated cabinets intended to store and/or display and sell pre-packed ice cream where access by the consumer to the pre-packed ice cream is gained by opening a lid (solid or transparent) from the top

Note 1 to entry: See [Annex A](#) for the designation of the ice cream freezer family.

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3.2 Parts of ice-cream freezers

3.2.1

condensing unit

combination of one or more compressors, condensers and liquid receivers (when required) and the regularly furnished accessories

3.2.2

night cover

top cover permanently integrated into the ice-cream freezer used to reduce the heat ingress (e.g. by infrared radiation or convection) during the period when there are no sales

3.3 Physical aspects and dimensions

3.3.1

depth

horizontal distance between the front and the rear of the ice cream freezer

3.3.2

width

horizontal distance between the two external sides of the ice cream freezer

3.3.3

height

vertical distance from the bottom to the top of the ice cream freezer

3.3.4

load limit

boundary surface consisting of a plane or several planes within which all M-packages can be maintained within the limits for the M-packages temperature class declared

3.3.5

load limit line

permanently marked boundary line denoting the edge of the load limit surface

3.3.6

net volume V_N

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

Note 1 to entry: For the calculation method see [Annex B](#).

3.3.7

gross volume

volume within the inside walls of the ice-cream freezer or compartment, including internal fittings and the lid when closed

3.3.8

equivalent volume

reference volume corrected for compartment temperature classification

3.3.9

total display area (TDA)

total visible foodstuffs area, including visible area through the glazing, defined by the sum of horizontal and vertical projected surface areas of the net volume

Note 1 to entry: For the calculation method see [Annex D](#).

3.3.10

shelf area

area defined by the external dimensions of the shelf or internal dimensions of the base of the cabinet or basket

3.3.11

footprint

surface occupied by the ice-cream freezer

3.4 Definitions relating to performance characteristics

3.4.1

normal conditions of use

operating conditions which exist when the ice cream freezer, including all permanently located accessories, has been set up and situated in accordance with the recommendations of the manufacturer and is in service

Note 1 to entry: The effects of actions by non-technical personnel for the purposes of loading, unloading, cleaning, defrosting, the manipulation of accessible controls and of any removable accessories etc., according to the manufacturer's instructions are within this definition. The effects of actions resulting from interventions by technical personnel for the purposes of maintenance or repair are outside this definition.

3.4.2

defrost

removal of frost, snow and ice from an ice-cream freezer

3.4.3

TEC (total energy consumption)

total amount of energy used by an ice cream freezer

3.4.4

SEC (specific energy consumption for ice cream freezers)

index of the efficiency of the ice cream freezer, expressed as the ratio of TEC divided by equivalent volume (TEC/Equivalent volume)

3.4.5

product temperature

one of the classifications defined in [Table 1](#) of this standard, establishing the performance level of the ice cream freezer

3.5 Definitions related to test environment

3.5.1

M-package

test package fitted with a temperature measuring device

3.5.2

climate class

classification of the test room climate according to the dry bulb temperature and relative humidity

3.5.3

M-package temperature class

classification of M-package temperature according to the temperatures of the warmest M-packages during the temperature test

3.5.4

ice cream freezers classification

designation given by the combination of climate class and M-package temperature class

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4 Symbols and abbreviated terms

t_{run}	running time — time during which the compressor is running within the 24 h test period
t_{stop}	stopping time — time during which the compressor is not running within the 24 h test period and excluding defrost time
Δt	time between two consecutive measurement samples
N_{max}	number of measuring samples in the 24 h test period
TEC	total energy consumption in kilowatt hours per 24 h period
SEC	specific energy consumption for ice cream freezers expressed in kilowatt hours per 24 h per m ³ (TEC/Equivalent volume);
t_{rr}	relative or percentage running time:

$$t_{rr} = \frac{t_{run}}{t_{run} + t_{stop}} \quad (1)$$

where

$$t_{run} + t_{stop} = 24 \text{ h}$$

t_{90} time in which 90 % of a sudden temperature change of 20 °C is indicated, the measurement medium being moderately agitated air (velocity 1 m/s)

V_N Net volume

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5 Classification and requirements

5.1 Classification

The classification of the ice cream freezers is done according to temperature. The performance of ice cream freezers shall comply with one of the classifications defined in [Table 1](#). The performance shall be verified in accordance with the conditions and test methods specified in [Annex F](#).

Table 1 — Classification according to temperature

Class	Warmest M-package temperature colder or equal to in all tests except lid opening test [°C]	Warmest M-package maximum temperature rise allowed [K]
C1	-18,0	2,0
C2	-7,0	2,0
S	Special classification	2,0

5.2 Requirements

5.2.1 Construction

5.2.1.1 Strength and rigidity

The ice-cream freezer and its parts shall be constructed with adequate strength and rigidity for normal conditions of handling, transport and use and attention shall be given to the following:

- a) interior fittings shall be sufficiently strong for the duty required;
- b) where sliding shelves, baskets or trays are fitted they shall retain their shape and ease of movement when fully loaded;
- c) any fitments which are provided with stops to prevent accidental removal shall be self-supporting when fully loaded and withdrawn to the limit of the stops.

5.2.1.2 Pipes and connections

Pipes and connections to moving or resiliently mounted parts shall be arranged so as not to foul or transmit harmful vibrations to other parts. All other pipes and connections shall be securely anchored and have sufficient free length and/or vibration eliminators to prevent failure due to fatigue. Where necessary, pipes and valves shall be adequately thermally insulated.

5.2.1.3 Lids

Lids shall be condensate-free at the climate class specified by the manufacturer.

When any lids provided to ensure an air seal to the refrigerated space are closed, there shall be no undue leakage of ambient air into the interior (see 6.2.1). The lids shall not open of their own accord.

The gasket shall be made from a material whose characteristics are compatible with the operating conditions (especially temperatures). If the fastening device is mechanical, a stop or other means shall be provided to prevent the gasket from being excessively deformed.

5.2.1.4 Joints and seams

All construction joints and seams within the net volume shall prevent the accumulation of potentially contaminating substances. All construction joints and seams within the net volume shall permit the easy removal of any deposits of potentially contaminating substances.

5.2.2 Materials

5.2.2.1 General

The materials shall be durable and shall not favour the development of mould or emit odours. Under normal conditions of use, materials in contact with foodstuffs shall be resistant to moisture and shall neither be toxic nor contaminate them.

5.2.2.2 Corrosion resistance

Metal parts, used in the construction of cabinets, shall have resistance to corrosion appropriate to their location and function.

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5.2.2.3 Thermal insulation

The thermal insulation shall be efficient and permanently fixed. In particular, the insulating material shall not be subject to shrinkage and shall not allow under normal working conditions an accumulation of moisture.

Suitable means shall be used to prevent deterioration of the thermal insulation by the ingress of moisture.

Where the insulation space is vented to the inside, it shall be ensured that particles of the insulation material cannot escape into the foodstuff display compartment.

For fibrous insulation materials, it shall not be possible to insert a rigid probe of 1 mm diameter through any aperture which allows access to the insulating material, the probe being applied with negligible force.

5.2.3 Refrigerating system

5.2.3.1 Design and construction

The design and construction of all parts of the refrigerating system subject to internal pressure shall take into account the maximum working pressure to which they are subjected when the ice cream freezer is in operation or at rest. The maximum ambient temperature during transit shall be taken into account. All refrigerant containing components shall be in accordance with ISO 5149-2.

5.2.3.2 Condensation

There shall be suitable means to prevent water condensing on cold surfaces of the ice cream freezer and its parts and from harmfully affecting the operation of the refrigerating system or its controls.

5.2.3.3 System protection

For ice-cream freezers, the refrigerating system shall suffer no damage if any lid in the cooler is left open while the ice cream freezer is operating in an ambient temperature corresponding to the climate class (see [Table 1](#)) for which the cooler is intended. When the lid is kept open under normal operating conditions (for example, during product loading) or is left open accidentally, any automatic motor overload protective device may come into operation.

5.2.3.4 Refrigerant

When deciding on the refrigerant for the system, attention shall be given to the possible hazards associated with the use of certain refrigerants and heat-transfer media due to their toxicity, flammability etc. Guidance on this point is available in ISO 5149-2.

5.2.4 Electrical components

5.2.4.1 General

Electrical components shall be in accordance with EN 60335-2-89 and EN 60335-1.

5.2.4.2 Temperature display

The ice-cream freezer shall incorporate a temperature display instrument showing the air temperature in the refrigerated display ice cream freezer, at the load line, to provide an indication of the operation and functioning of the refrigerating equipment and information on its operating state.

NOTE As a rule, measured air temperature is not identical with pre packed ice cream temperature in an ice cream freezer.

5.2.4.3 Temperature-measuring instrument

Suitable temperature-measuring instruments shall be used, i.e. those that fulfill the following requirements:

- the unit symbol (°C) shall be inscribed or displayed on the temperature-measuring instrument;
- the range of measurement shall be at least from –40 °C to + 40 °C;
- the scale division or smallest numerical increment shall be less than or equal to 1 °C;
- the maximum errors shall be 2 K over the total measuring range;
- the time constant t_{90} of the sensor shall be equal to or less than 20 min.

When temperature-measuring instruments are employed in ice-cream freezers:

one temperature-measuring instrument shall be employed for each ice-cream freezer with its own refrigerating circuit.

5.2.4.4 Temperature sensor location

The temperature sensor location shall be readily accessible to enable on site testing for the correct indication of temperature and replacement of the temperature measuring instrument on site in service.

NOTE 1 The temperature sensor of a thermometer is considered to be “readily accessible” if it is reached directly for examination. It is necessary to remove access panel(s) to carry out replacement.

NOTE 2 The positioning of the temperature sensor in a guide tube is also considered to be “readily accessible” if the sensor is introduced into and removed from the guide tube without a tool.

Wherever possible, the mounting method shall not supply heat to, or withdraw heat from the temperature sensor. The temperature sensor shall be protected against heat radiation from the external ambient.

NOTE 3 For electronic controllers, it is possible to display a calculated temperature.

NOTE 4 For recording and display of temperatures, one or two temperature sensors are used. The temperature sensor is the same as those used for controlling the refrigeration. An alarm is activated in case of error. This option is not in accordance with the requirements of EN 12830.

NOTE 5 It is the responsibility of the supplier and user to ensure that the location of the temperature sensor complies with national regulation on temperature control of foodstuffs.

5.2.5 Operating characteristics

5.2.5.1 Water vapour condensation

The performance of ice-cream freezer shall not be impaired by water vapour condensation. The amount of water vapour condensation shall be verified according to the conditions and test methods specified in [6.3.6.4](#).

5.2.5.2 Energy consumption

The energy consumption shall be stated by the manufacturer. The total energy consumption (TEC) shall be measured and calculated according to the conditions and the test methods specified in [6.3.6.6.3](#).