

BS EN 16901:2016



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# Ice-cream freezers — Classification, requirements and test conditions

**National foreword**

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## Ice-cream freezers - Classification, requirements and test conditions

Congélateurs pour crèmes glacées - Classification,  
exigences et conditions d'essai

Speiseeis-Gefriermaschinen - Klassifikation,  
Anforderungen und Prüfbedingungen

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**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**

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## European foreword

This document (EN 16901:2016) 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of an identical text or by endorsement, at the latest by June 2017, and conflicting national standards shall be withdrawn at the latest by June 2017.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive 2009/125/EC.

For relationship with EU Directive, see informative Annex ZA, which is an integral part of this document.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

## 1 Scope

The scope of this European Standard is to define the classification for horizontal closed ice-cream freezer with access of the product from the top 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  $\leq 600$  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, 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 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.

### 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.

### 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**

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, excluding 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

##### **total energy consumption**

##### **TEC**

total amount of energy used by an ice cream freezer

#### 3.4.4

##### **specific energy consumption for ice cream freezers**

##### **SEC**

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**

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

## 4 Symbols

$t_{run}$	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
$\Delta t$	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 <sup>3</sup> (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)

## 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.

#### **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.

### 5.2.5.3 Specific energy consumption

The ice cream freezer specific energy consumption (SEC) as ratio between TEC and equivalent volume (TEC/Veq) shall be stated by the manufacturer. This value shall be used to compare the energy efficiency between different ice cream freezers.

## 6 Tests

### 6.1 General

When the characteristics of an ice-cream freezer are to be verified, all the tests and inspections shall be applied to one and the same ice-cream freezer. These tests and inspections may also be made individually for the study of a particular characteristic.

Table 2 lists the tests and inspections that shall be carried out. Ice-cream freezers shall comply with the requirements specified in this part of the standard using the appropriate test method.

**Table 2 — Test summary**

Tests and inspections	Requirement clause	Test method	Test room
Seal test	5.2.1.3	6.2.1	Outside test room (see 6.2)
Absence of odour and taste (not compulsory)	—	Annex E	
Durability of lid	5.2.1.3	6.2.2	
Temperature	5.1	6.3.6.1	Inside test room (see 6.3)
Water vapour condensation	5.2.3.2	6.3.6.4	
Temperature rise time	-	6.3.6.5	
Energy consumption	5.2.5.2	6.3.6.6	

### 6.2 Tests outside test room

#### 6.2.1 General

The tests which may be carried out outside the test room deal with the inspection of construction characteristics, physical dimensions and the absence of odour and taste.

#### 6.2.2 Seal test for lids

The effectiveness of lids provided to ensure a seal shall be tested as follows (with the ice-cream freezer not running). Insert a strip of paper 50 mm wide, 0,08 mm thick and of a suitable length at any point of the seal. With the lid closed normally on it the strip of paper shall not slide freely.

NOTE 1 Attention is drawn to the fact that some ice cream freezers having lids are fitted with decompression valves which allow air to penetrate for a short period of time so that any drop in pressure created inside the ice cream freezer is compensated. No test is required for such valves.

NOTE 2 The most unfavourable points can be found by inspecting the contact of the seal with the ice cream freezer closed and lighted from the inside.

### 6.2.3 Test on durability of lid

#### 6.2.3.1 General

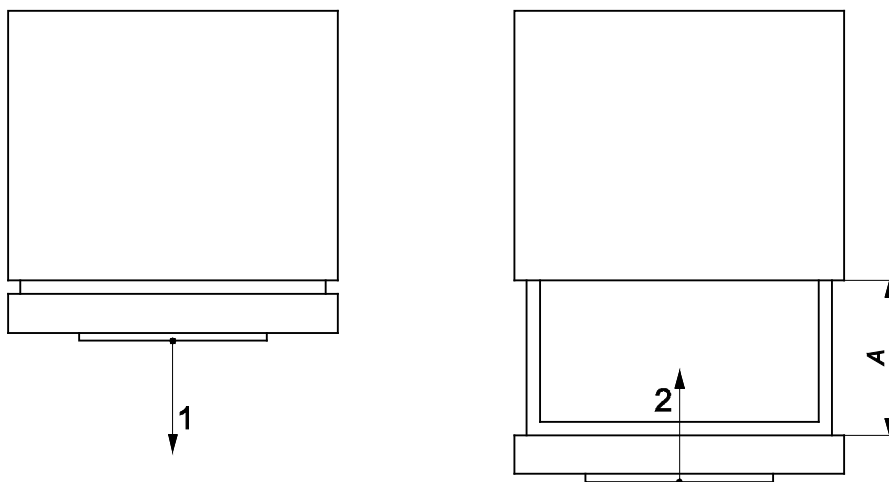
The purpose of these tests, carried out using the following procedures, is to check the durability of the lids. The ambient temperature shall be between +16 °C and +32 °C. The refrigerating appliance shall be switched off.

#### 6.2.3.2 Opening sequence

The lids shall be pulled out to within 15 mm to 20 mm of their fully open position (Figure 1).

#### 6.2.3.3 Closing sequence

The lids shall be closed as in normal use from within 15 mm to 20 mm of their fully closed position (Figure 1).



#### Key

- A opening course
- 1 pull out
- 2 push

**Figure 1 — Durability of lid**

The number of cycles per minute shall be between 5 and 10. Each lid shall withstand 30 000 opening and closing operations without deterioration which could be prejudicial to the air-tightness of the lid sealing. All the lids shall be present on the cabinet when tested.

#### 6.2.4 Linear dimensions, areas and volumes

Measurements shall be made with the ice-cream freezer not in operation but situated in a place where the temperature is maintained between 16 °C and 30 °C. If the ice cream freezer includes jacks or other components for adjustment of height (i.e. castor or wheel), the height defined shall be the minimum height necessary at installation of the ice cream freezer.

When measuring the net volume parts necessary for the proper functioning of the ice cream freezer shall be fitted as intended and the volume representing the space occupied by these parts deducted (see Annex B).



## 6.3 Tests inside test room

### 6.3.1 General

The tests which are carried out inside the test room deal with the measurement of the following characteristics:

- temperature;
- water vapour condensation;
- electrical energy consumption.

General test conditions are defined, which are common for all tests carried out inside the test room. These conditions concern the test room, the test and M-packages, and the measuring instruments.

### 6.3.2 Test room conditions

#### 6.3.2.1 Design, walls, floor and radiant heat

The test room shall be a parallelepiped space in which two of the opposite side walls, referred to as the discharge technical side wall and the return technical side wall, are designed to create an even, horizontal air flow within the test room. By convention, the distance separating these two technical side walls is referred to as the “length” of the test room.

The minimum useful dimensions (length, width, height) of the test room shall be dependent on the overall dimensions (length, depth, height) of the ice cream freezer to be tested.

The ceiling and the two non-technical side walls of the room shall be thermally insulated and shall be equipped with an inner metal skin.

A minimum insulation level equivalent to 60 mm of rigid polyurethane foam ( $\lambda = 0,03 \text{ W/m } ^\circ\text{C}$ ) should be used for the building of a new test room.

The floor shall be made of concrete or of thermally equivalent material and/or shall be sufficiently insulated to ensure that external climatic conditions do not affect the floor temperature.

Lighting shall be installed to maintain  $600 \pm 100 \text{ lx}$  measured at a height of 1 m above the floor level and shall be lit continuously during the test period. The emission spectrum of that lighting device within the infrared field shall not include peaks of a value of more than  $500 \text{ W/5 nm/lm}$ .

The walls, ceilings and any partitions of rooms intended for the testing of ice cream freezer shall be painted in light grey (for example, NCS 2706-G90Y or RAL 7032) with an emissivity between 0,9 and 1 at  $25 \text{ }^\circ\text{C}$ .

#### 6.3.2.2 Thermal and air flow characteristics

An experimental evaluation of the test-room performances shall be carried out at a minimum of once per year

- with test room empty and with lighting switched on,
- in a test room at ambient temperature of  $25 \text{ }^\circ\text{C}$  and 60 % relative humidity,
- measuring the velocity, temperature and relative humidity of the air at different points within two vertical planes parallel to the technical side walls and 600 mm away from the technical side walls, and
- with the climate measuring point located at the geometrical centre of the test room during the evaluation.

These measuring points shall form a two-dimensional grid in which the step is a maximum of 500 mm in the horizontal and vertical directions. The peripheral line of points shall be located at a maximum of 500 mm from the other two side walls, floor and ceiling.

A three-dimensional grid inside the test room shall be investigated when obstacles/irregularities projected into the room of more than 1 m<sup>2</sup> surface area facing the discharge technical side wall exist along the walls.

The mean horizontal air velocity measured during 1 min with a maximal interval of 5 s at each of the points defined above shall lie between 0,1 m/s and 0,2 m/s.

Air temperature measured at each of the points defined above shall not deviate from the rated temperature of the test-room climate class by more than 2 °C.

The test room shall be capable of maintaining values of humidity within ± 5 units of the relative humidity percentage figures of the rated humidity of the test room temperature class at the specified measuring points.

Surface temperature of walls, ceiling and floor shall be measured in proximity to the points which constitute the peripheral line of the grid defined above. These surface temperatures shall remain within a tolerance of ± 2 °C in relation to the air temperature measured at the nearest point of the grid.

### 6.3.2.3 Climate classes

Tests shall be carried out in one of the climate classes according to Table 3.

During the test, the test room shall be capable of maintaining values of temperature and humidity within ± 1 °C of the temperature and ± 5 units of the relative humidity percentage figures at the specified climate measuring point(s) (see 6.3.5.3).

**Table 3 — Test room climate classes**

<b>Test room climate class range</b>	<b>Minimum temperature and relative humidity</b>	<b>Maximum temperature and relative humidity</b>
A	+16 °C, 80 %	30 °C, 55 %
B	+16 °C, 80 %	35 °C, 75 %
C	+16 °C, 80 %	40 °C, 40 %

### 6.3.3 Test packages and life-time

#### 6.3.3.1 General

When tests are carried out, test packages in the form of rigid parallelepipeds shall be used; the size and mass of the test packages, including their packaging, shall be as specified in Table 4.

The tolerances for test packages shall be:

- ± 2 mm for linear dimensions 25 mm to 50 mm,
- ± 4 mm for linear dimensions 100 mm to 200 mm, and
- ± 2 % for mass.

**Table 4 — Dimensions and mass of test packages**

<b>Dimensions [mm]</b>	<b>Mass [g]</b>
50 × 100 × 100	500
50 × 100 × 200	1 000
The following packages may be used as fillers to complete the cabinet loading: 25 × 100 × 200	500

Due to the frequency of use and to the loading pressure, the packages could change in dimensions and weight. Test packages shall be checked annually for conformity with the following life-time tolerances. When a test package is found to exceed one of the following tolerances, it shall be replaced:

- a) Loss of mass: – 5 %.
- b) On the wrapper: visible hole.
- c) Change in linear dimensions:
  - 1) ± 4 mm for dimensions 25 mm and 50 mm;
  - 2) ± 8 mm for dimensions 100 mm and 200 mm.

Each test package shall consist of a filling material and a wrapper.

Filling material containing, per 1 000 g:

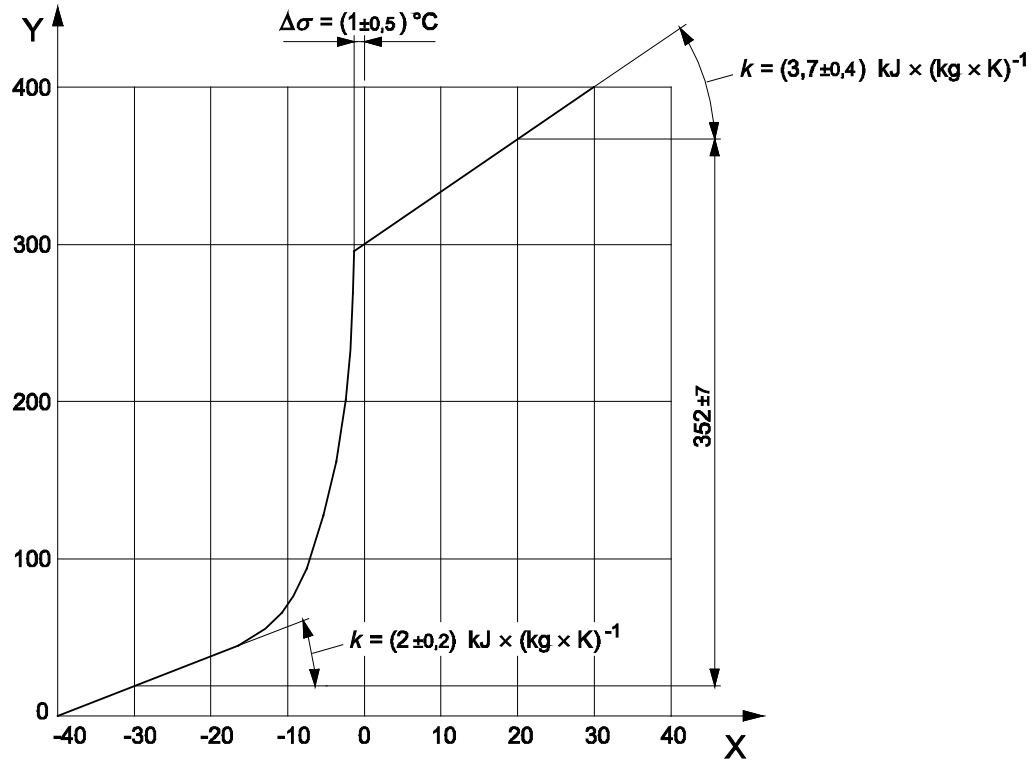
- 230,0 g of oxyethylmethylcellulose,
- 764,2 g of water,
- 5,0 g of sodium chloride, and
- 0,8 g of para-chlorometa-cresol.

The freezing point of this material is –1 °C (its thermal characteristics corresponding to those of lean beef). The enthalpy value of 285 kJ/kg shall correspond to the temperature (–1 ± 0,5) °C (see Figure 2, Tables 5 and 6).

About 4 % of water should be added in order to compensate for evaporation during the preparation of the filling material.

Wrapper: a sheet of transparent colourless plastic or any other suitable material of such nature that exchange of moisture with the ambient medium is negligible being the surface emissivity coefficient equal to or greater than 0,9 at 25 °C. The maximum total thickness shall be 1,0 mm. After filling this sheet shall be sealed.

The correspondence of the packages' material composition with the above mentioned characteristics should be certified by the supplier or by an independent laboratory.



**Key**

- X temperature, °C
- Y specific enthalpy, kJ/kg

**Figure 2 — Thermal characteristics of test packages**

**Table 5 — Temperature and specific enthalpy of test packages**

Temperature [°C]	Specific enthalpy [kJ/kg]
-40	0
-30	19
-25	28
-20	39
-18	43
-16	49
-14	55
-12	63
-10	73
-9	79
-8	85
-7	93
-6	102
-5	114
-4	129
-3	152
-2	194
-1	285
0	297
+10	334
+20	371

**Table 6 — Temperature and increase in specific enthalpy of test packages**

Temperature range °C	Increase in specific enthalpy kJ/kg
- 30 to - 20	20 ± 2
+ 10 to + 20	37 ± 4
- 30 to + 20	352 ± 7

### 6.3.3.2 M-packages and life-time

Some of the 500 g packages (50 mm × 100 mm × 100 mm) specified in Table 4 shall be equipped for temperature measurement, being fitted with temperature sensors inserted in the geometrical centre of the packages in direct contact with the filling material. All precautions shall be taken to minimize extraneous conduction of heat and to avoid any possibility of entrance of the air from the hole in the

wrapper for the passage of the temperature sensor that could create oxidation and loss of weight in the filling material. These packages are called M-packages (see Figure 3).

Due to frequency of use and loading pressure the package could change in dimensions and weight. All M-packages shall be checked annually for conformity with the life time tolerances specified in 6.3.3. The checking results shall be recorded for all M-packages. When an M-package is found to exceed one of the tolerances, it shall be replaced.

Dimensions in millimetres

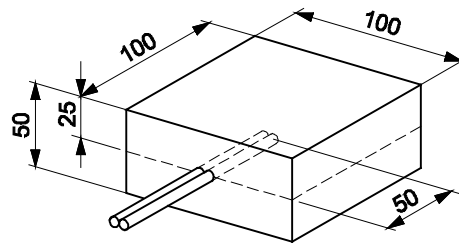


Figure 3 — M-Package

#### 6.3.3.3 Alternative for filling test packages

Alternative filling test packages having the dimensions shown in Table 4 and density of  $(480 \pm 80)$  kg/m<sup>3</sup> can be used, except for rows and columns in transverse sections containing M-packages.

This test package may be a box made of plastic material of any density, and of 1 mm nominal thickness. Cellular or foam material shall not be used. The case shall not incorporate any protrusions that would cause the vertical separation of packages in a stack. Opposite faces shall be substantially parallel, and moulding draft shall be the minimum practicable. Seams or joints shall not result in protrusions sufficient to cause significant air gaps between adjacent packages.

Colour can be important if dark enough to be affected by ambient heat radiation; however, a pastel colour, e.g. light pink, pale blue or green, shall have no significant effect in normal surroundings.

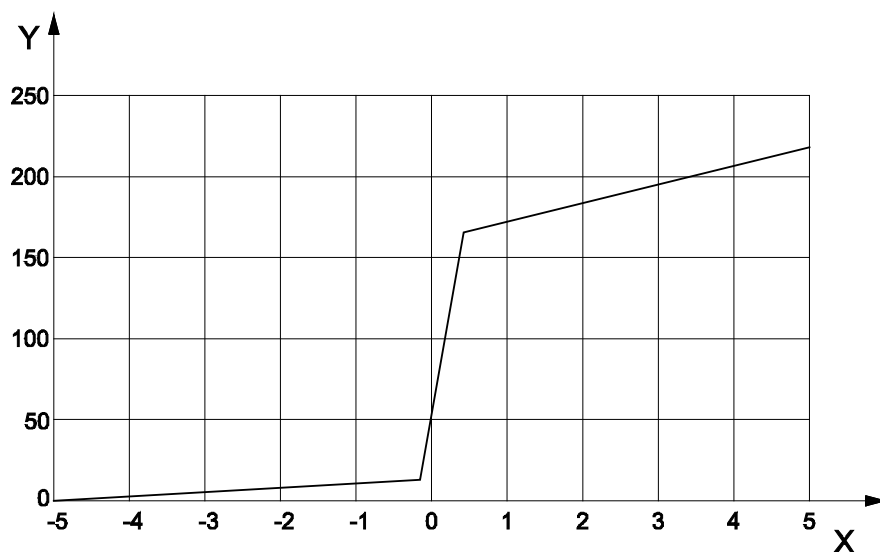
The contents shall be water containing 0,08 % of para-chlorometa-cresol and 0,5 % of sodium chloride, soaked into a porous material such as a natural, plastic or cellulose sponge (see Table 7; Table 8 and Figure 4).

**Table 7 — Temperature and specific enthalpy of filler packages**

<b>Temperature [°C]</b>	<b>Specific enthalpy [kJ/kg]</b>
-5	0
-4	3
-3	4
-2	7
-1	10
0	45
+1	172
+2	183
+3	194
+4	206
+5	218

**Table 8 — Temperature and increase in specific enthalpy of filler packages**

<b>Temperature range [°C]</b>	<b>Increase in specific enthalpy [kJ/kg]</b>
-5 to -1	10
-1 to +1	162
+1 to +5	46
-5 to +5	218



**Key**

X temperature, °C

Y specific enthalpy, kJ/kg

**Figure 4 — Thermal characteristics of filler packages**

**6.3.4 Instruments, measuring equipment and measuring expanded measurement uncertainty**

All measurements shall be carried out with instruments that have been calibrated.

- Temperature measurements shall be made to an expanded measurement uncertainty of  $\pm 0,8$  °C. Climate temperatures shall be measured by sensors, inserted in the centre of tinned solid copper or copper-zinc alloy cylinders having a mass of 25 g and of minimum external area (diameter = height = approximately 12,5 mm).
- Illumination flux per square metre shall be measured to an expanded measurement uncertainty of  $\pm 10$  %.
- Relative humidity shall be measured to an expanded measurement uncertainty of  $\pm 3$  units of the percentage figure.
- Electrical energy consumption shall be measured to an expanded measurement uncertainty of  $\pm 2$  %.
- Time interval measurements shall be made to an expanded measurement uncertainty of  $\pm 1$  % or better. All the temperatures shall be recorded at a maximum interval of 60 s. Air velocity shall be measured using a laboratory-type instrument with an expanded measurement uncertainty of 10 % and with a minimum sensitivity of 0,03 m/s in the range of 0 to 1,5 m/s in horizontal flow at the temperature of the selected ambient class.

**6.3.5 Preparation of test ice cream freezer**

**6.3.5.1 Selection, installation and positioning within the test room**

Each ice cream freezer intended to be tested, unless a prototype, shall be selected from stock or routine production and shall be representative of normal construction and adjustment.

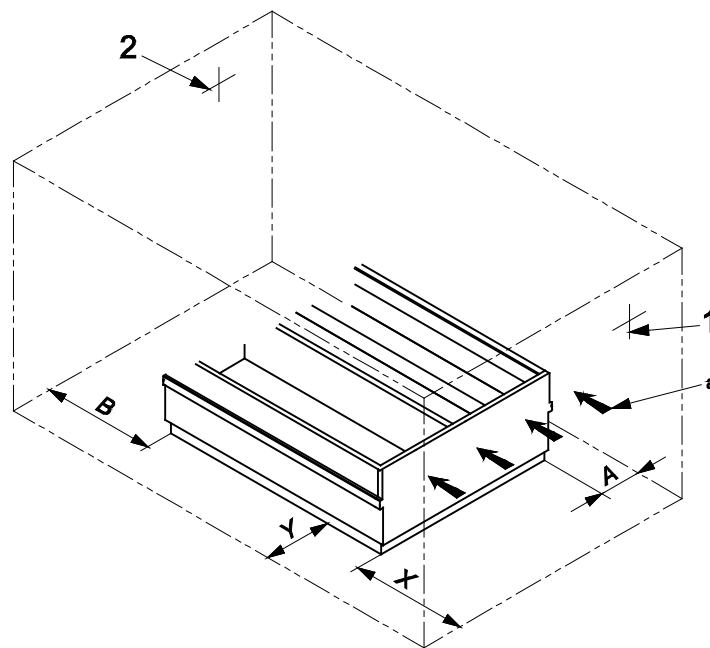


The ice cream freezer, including all components required for normal operation, shall be assembled, set up and sited as it would be installed in service as far as practicable and in accordance with the manufacturer's instructions. All permanently located accessories required for normal use shall be in their respective places.

The ice cream freezer shall be located as follows (see Figure 5):

- $X = 2$  m and  $B \geq 1$  m for all ice cream freezers;
- $Y \geq 0,8$  m for all ice cream freezer
- $A = 0,1$  m

Dimensions in millimetres

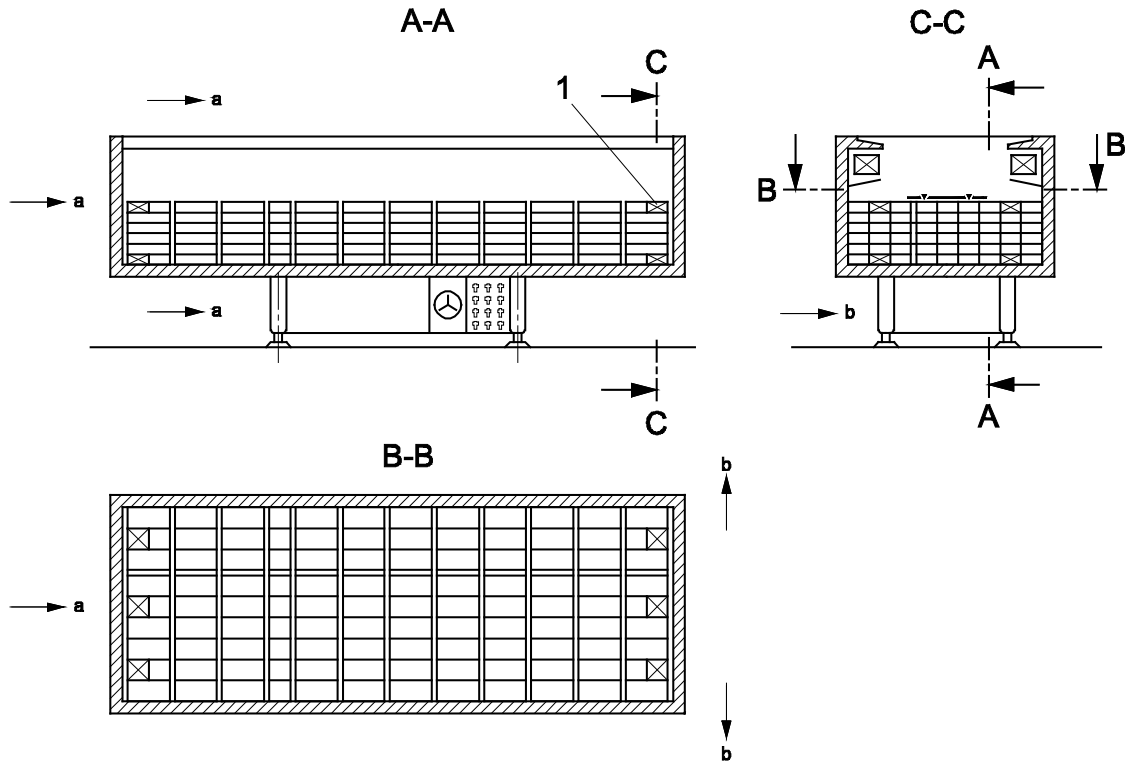


**Key**

- 1 technical side wall — test room air discharge
- 2 technical side wall — test room air return
- a air currents parallel to the plane of the opening (in longitudinal direction).

**Figure 5 — Ice cream location within the test room**

The direction of the warm condenser airflow should be the same as the test room air flow direction and not opposed to it. If this is not possible because of the cabinet's design the condenser airflow should be perpendicular the test room airflow direction (see Figure 6).



**Key**

- 1 M-package
- a air currents parallel to the plane of the opening surface (in longitudinal direction)
- b air flow direction of condensing unit

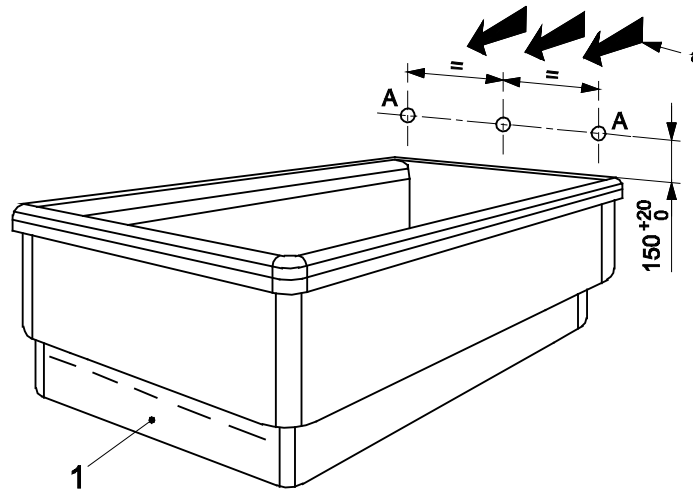
**Figure 6 — Condensing air with test room air flow, or across, but not opposed the test room air flow**

**6.3.5.2 Air movement**

Air movement shall be provided. The air movement, shall be, as far as practicable, parallel to the plane of the cabinet display opening and to the longitudinal axis (see Figure 7). The length of the cabinet is defined as the longest horizontal dimension of the display opening. With the refrigerated display cabinet switched off, the air velocity at the three points along the line shown in Figure 8 shall be  $0,2 \begin{smallmatrix} +0 \\ -0,1 \end{smallmatrix}$  m/s. For ice cream freezers with lids the direction of air flow shall be such that the air movement is parallel to the plane of the cabinet display opening and the air enters the cabinet when the lid(s) is (are) open.

Test room air movement shall be checked during the test in order to be sure that the test room is running correctly. The method of checking is left to the discretion of the testing authority.

Dimensions in millimetres



**Key**

A-A line for the measurement of the air velocity

1 possible location of condensing unit

a air currents parallel to the plane of the opening (in longitudinal direction).

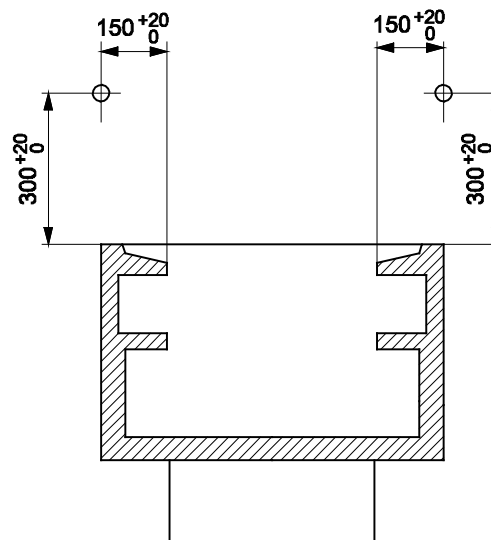
**Figure 7 — Air movement**

**6.3.5.3 Climate measuring point**

The point for measurement of ambient temperature and relative humidity shall be midway along the length of the ice cream freezer and in accordance with Figure 8.

For ice cream freezers, the warm condenser air flow shall be prevented from influencing the temperature at the measuring point by air deflectors or other suitable means (see Figure 8).

Dimensions in millimetres



**Figure 8 — Climate measuring point for ice cream freezer**

### **6.3.5.4 Loading the ice cream freezer**

#### **6.3.5.4.1 General**

The ice cream freezer shall be loaded with test packages and M-packages (see 3.5.1) up to the load limit, as illustrated in Figure 9 and Figure 10. These packages shall have been brought previously to a temperature equal to that expected during the test. 1 000 g packages and 500 g packages should be used. To complete the loading, use test packages of the following sizes:

- 25 mm × 100 mm × 200 mm;

The test packages shall be arranged so as to form an even level.

A clearance of 25 mm ± 5 mm shall be left between package rows and adjacent to the internal end walls of the ice cream freezer.

It is permitted to use partitions with a thickness of approximately 25 mm to position the packages on condition that they have minimal effect on normal airflow and minimal thermal conduction.

Lengthways rows shall be 200 mm, any remaining spaces shall be filled with test packages to obtain one or two adjustment rows of which the width can measure from 100 mm up to 300 mm.

Depth-wise, any remaining spaces of less than 25 mm wide shall be filled with wooden vertical dividers, placed approximately midway along the space between two M-packages.

Metallic grids (non conductive material) can be used to support the test package loading on M-package rows and the adjacent ones.

#### **6.3.5.4.2 Loading heights**

The loading height of the refrigerated shelves shall be equal to the height defined by the load limit, with a tolerance of ± 25 mm (see Figure 9 and Figure 10).

#### **6.3.5.4.3 M-package locations**

The M-packages shall be placed at the position shown in Figure 9 and Figure 10.

#### **6.3.5.4.4 Longitudinal section**

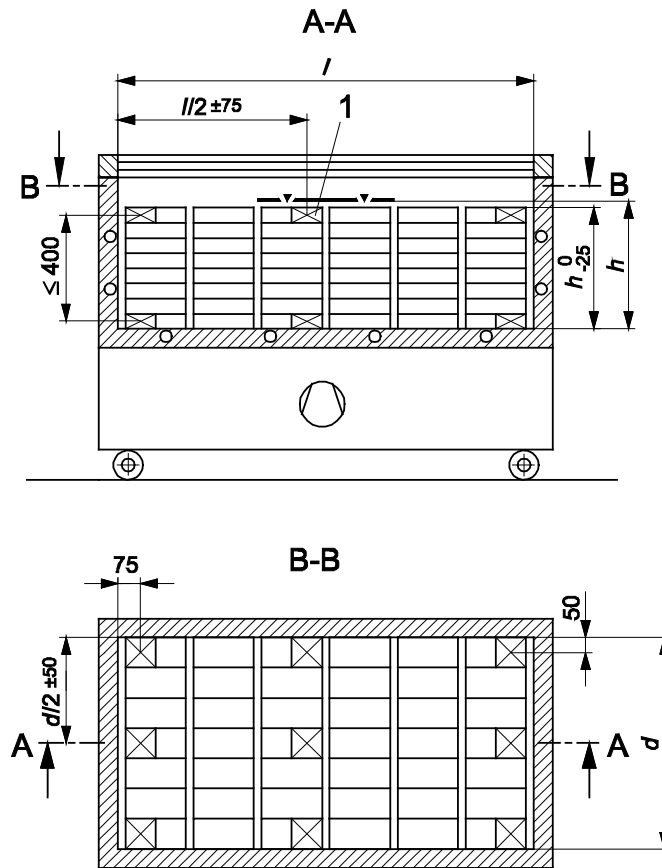
For ice cream freezer lengths of less than or equal to 700 mm, M-packages shall be located into two transverse sections of the loading such that the M-package axis is situated at 75 mm from each ice cream freezer end wall.

For ice cream freezer lengths of more than 700 mm, a third transverse section shall be placed midway along the ice cream freezer length, with a tolerance of 75 mm. When the ice cream freezer includes at its central area any mechanical structure, M-packages of this third transverse section and located against the back panel shall be shifted towards the test room air discharge side by 325 mm.

#### **6.3.5.4.5 Cross-section**

For refrigerated base deck depths of less than or equal to 550 mm, M-packages shall be located into two longitudinal sections, such that the M-package axis is situated at 50 mm from the back wall and 50 mm from the front wall (see in Figure 9 and Figure 10).

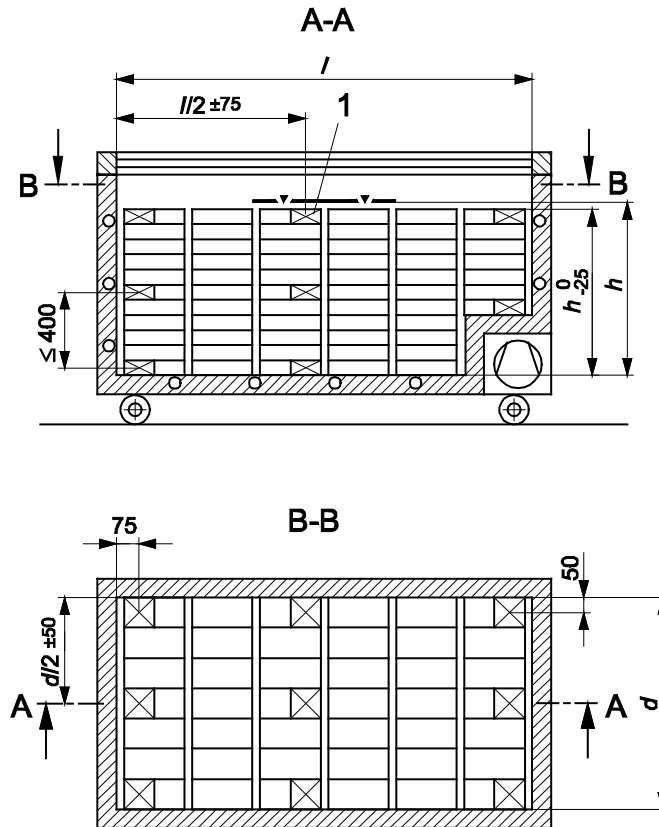
Dimensions in millimetres



**Key**

- 1 M-package
- d depth of base deck
- h height at load limit
- l length of the ice cream freezer

**Figure 9 — Glass lid ice cream freezer with flat base deck with and without tubes laid at the base**



**Key**

- 1 M-package
- d depth of base deck
- h height at load limit
- l length of the ice cream freezer

**Figure 10 — Glass lid ice cream freezer with stepped base deck with and without tubes laid at the base**

**6.3.5.5 Running in**

When an ice cream freezer is tested, the operating conditions shall comply with those stated by the ice cream freezer manufacturer.

Adjustable automatic controllers shall be set in such a way that the required M-package temperature class of the ice cream freezer is reached. Where the controller is not adjustable, the ice cream freezer shall be tested as delivered.

The manufacturer's recommended routine of defrosting shall be followed. Before tests are started, the ice cream freezer shall be switched on and allowed to run when empty for at least 12 h at the specified climate class and without erratic functioning of the refrigerating system, controls or defrosting operations. Otherwise, the running-in period shall be continued accordingly.

After the running-in period the ice cream freezer shall be filled with test packages and M-packages according to 6.3.5.4.5 for the tests.

After loading, the ice cream freezer shall be operated until stable conditions have been reached (see 6.3.5.6) and during the test period (see 6.3.5.7). The test room shall be maintained at the desired climate class as specified in 6.3.2.3 while the temperatures of the M-packages are recorded.

### 6.3.5.6 Stable conditions

An ice cream freezer is considered to operate under stable conditions if, during a period of 24 h, the temperature of each M-package agrees within  $\pm 0,5$  °C at the corresponding points on the temperature curve.

Stable conditions shall be determined prior to the doors opening sequence and, if the ice cream freezer is fitted with lighting, the lights shall be continuously left switched on during the stable period. Night covers shall not be in place during the stable running period.

### 6.3.5.7 Test period

The test period shall be not less than 24 h for all ice cream freezers, under stable condition.

### 6.3.5.8 Lighting and night-covers

Prior to the tests being carried out, the ice cream freezer shall have been operated for 24 h under stable operating conditions as defined in 6.3.5.6.

Ice cream freezers shall undergo the tests reported in Figure 11.

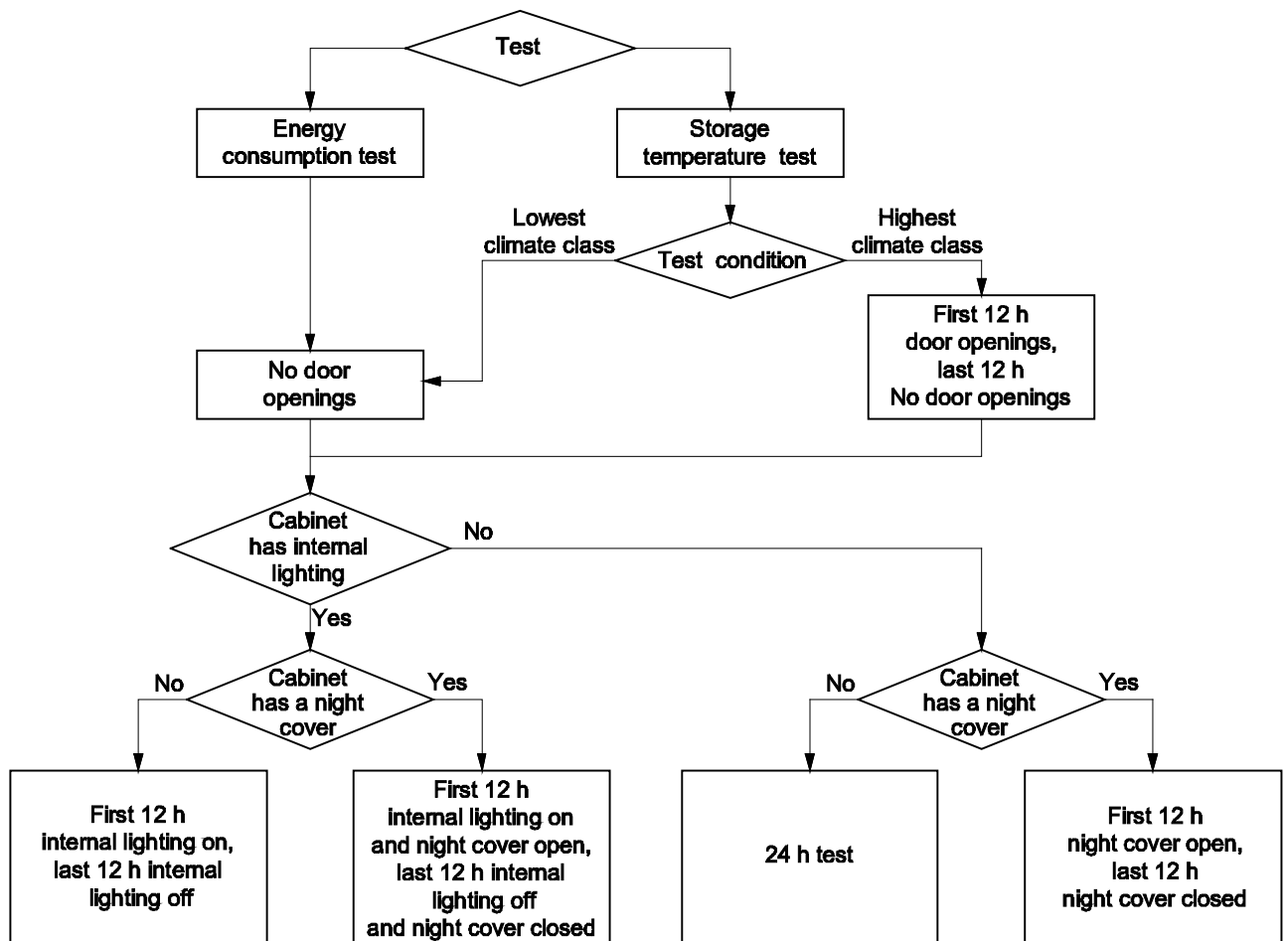


Figure 11 — Tests on ice cream freezers with lights or without lights

### 6.3.5.9 Test on several ice cream freezers in the same test room

If more than one ice cream freezer in the same room is being tested, appropriate arrangements, such as the use of partitions, shall be made in order to ensure that the conditions surrounding each ice cream freezer are in accordance with the test requirements specified in 6.3.5.1 and 6.3.5.2.

### 6.3.6 Test on ice cream freezers

#### 6.3.6.1 Temperature test

##### 6.3.6.1.1 General

Two temperature tests are carried out to check performance of the ice cream freezer under the minimum and maximum operating conditions tests a) and b) in 6.3.6.1.2.

A third test is carried out to measure the total energy consumption (TEC) in 6.3.6.2.

##### 6.3.6.1.2 Test conditions

The following test conditions shall be applied:

- a) Temperature test for checking the minimum storage temperatures of the ice cream freezer:
  - + 16 °C for class A; 80 % relative humidity;
  - + 16 °C for class B; 80 % relative humidity;
  - + 16 °C for class C; 80 % relative humidity;
- b) Temperature test for checking the maximum storage temperatures for of the ice cream freezer:
  - + 30 °C for class A; 55 % relative humidity;
  - + 35 °C for class B; 75 % relative humidity;
  - + 40 °C for class C; 40 % relative humidity;

NOTE For a rated range of climate classes, tests shall be performed at the extreme ambient temperatures of the range of rated classes.

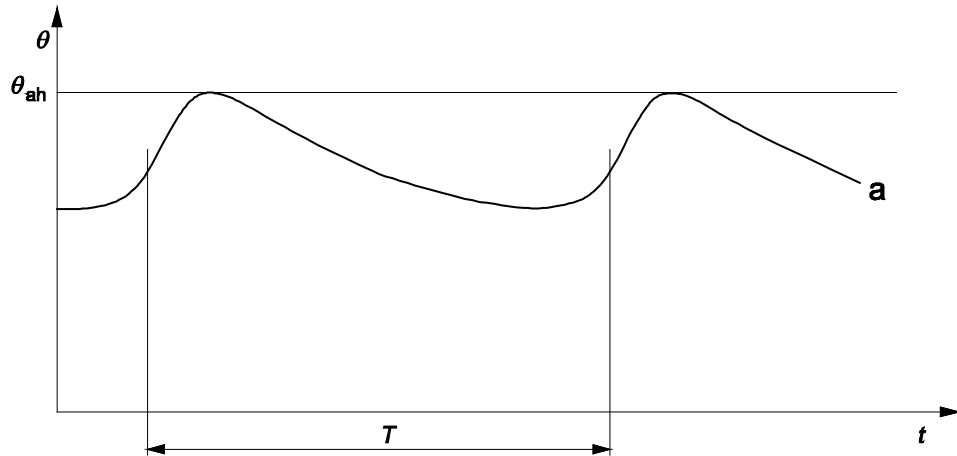
EXAMPLE For an ice cream freezer rated from A to C, tests are performed at + 16 °C and at + 40 °C.

- c) Temperature test for the measure of the total energy consumption:
  - + 30 °C –55 % RH for classes A, B, C.

##### 6.3.6.1.3 Temperature curves of M-packages

For each temperature test at the test condition described in 6.3.6.1.2 from the recorded temperatures of all M-packages, curves shall be plotted in function of time, related to the temperature of the warmest M-package (i.e. the one with the highest peak temperature  $\theta_{ah}$ ) (see curve a in Figure 12). All other M-package temperatures shall be available for reference if required.





**Key**

- θ temperature
- θ<sub>ah</sub> highest temperature of warmest M-package
- t time
- T test period
- a temperature curve a of warmest M-package

**Figure 12 — Relevant temperature curve of M-packages**

**6.3.6.1.4 Calculation of average mean temperature**

The average instant temperature at measuring sample  $n$  of all M-packages,  $\theta_{cn}$  (curve c in Figure 13), is expressed by the following formula:

$$\theta_{cn} = \frac{1}{K_{maxc}} \times \sum_{k=1}^{K_{maxc}} (\theta_k)_n \quad (2)$$

where

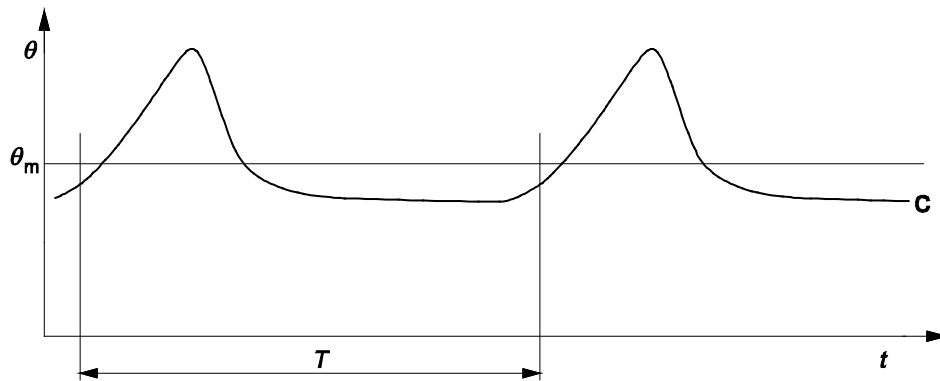
- $n$  is the time index for the instant measuring sample
- $k$  is the index for the individual M-package
- $K_{maxc}$  is the number of all M-packages
- $(\theta_k)_n$  is the instant measured temperature of M-package  $k$  at measuring sample  $n$

From these average instant temperatures the arithmetic mean temperatures of all M-packages  $\theta_{mc}$  for the test period shall be calculated as follows:

$$\theta_{mc} = \frac{1}{N_{max}} \times \sum_{n=1}^{N_{max}} \theta_{cn} \quad (3)$$

where  $N_{max}$  is the number of measuring samples taken during the test period.

The formula is valid only for constant time intervals during the test period.



**Key**

- θ temperature
- θ<sub>m</sub> average mean temperature
- t time
- T test period
- c curve c of arithmetic mean temperature of all M-packages

**Figure 13 — Arithmetic mean temperature of M-packages**

**6.3.6.2 Lid opening sequence**

The maximum temperature storage test shall include a lid opening sequence as follows. This test shall be carried out, regardless of the number of lids.

Prior to the start of the 12-h lid opening period, each lid shall be opened once for 3 min. Where an ice cream freezer is provided with more than one lid, each lid shall be opened once for 3 min consecutively.

Each lid shall then be opened six times per hour for the remaining 12 h period. Where more than one lid pertains to the ice cream freezer under test, the sequence in which the lids are opened shall be staggered, i.e. in the case of two lids: lid 1 at 0 min, lid 2 at 5 min, lid 1 at 10 min, lid 2 at 15 min, etc.

Sliding glass lids shall be opened beyond 80 % of the maximum area which can be opened.

Each lid opening shall be opened for a total of 6 s. During this opening period, lids shall be kept open beyond the minimum required opening, i.e. for 4 s.

Within the test period, the lids shall be opened cyclically for 12 h within 24 h. The 12 h cycle of lid opening shall start at the beginning of the test period.

**6.3.6.3 Power supply**

The tolerance on power supply shall be ± 2 % for voltage and ± 1 % for frequency in relation to the nominal values given on the marking plate or otherwise stated.

**6.3.6.4 Water vapour condensation test**

The ice cream freezers shall be located and loaded in accordance with 6.3.5.1 and 6.3.5.4.5, operated in accordance with the manufacturer's instructions at the conditions appropriate to the test room climate class for which it is intended (see Table 3), and then operated for the test period according to 6.5.5.7, during which measurements shall be recorded. Lighting and night-covers, if any, shall be manipulated according to 6.3.5.8. The test may be carried out during the temperature tests as conditions described in 6.3.6.1.2 c).

If anti-condensation heaters are provided which can be switched on and off by the user they shall not be switched on. If, however, running water appears externally when the ice cream freezer is subjected to

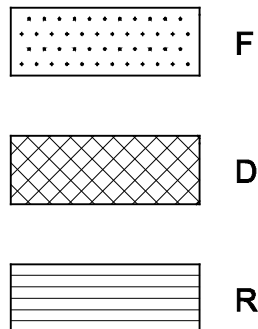
the water vapour condensation test, the test shall be repeated with the anti-condensation heaters switched on.

Before starting the test period, all external surfaces of the ice cream freezer shall be carefully wiped dry with a clean cloth. If the ice cream freezer is fitted with automatic defrosting equipment this test period shall be selected during the period when condensation is most likely to occur.

The ice cream freezer shall be considered satisfactory if the test report shows that during the test period there is no evidence of condensed water vapour having been in direct contact with, or having dripped on to, any test packages and — depending on the method used to detect water vapour condensation — provided the following results have been obtained:

- 1) all ice cream freezer surfaces, whether adjacent or otherwise, remain free of moisture by the provision of insulation, ventilation or heating to maintain a temperature above dew point of 20,0 °C (corresponding to 30 °C and 55 % RH);
- 2) internal surfaces, wherever practical, remain free of moisture collection or ice;
- 3) mirrors that can periodically mist during defrost clear by evaporation on the return to the refrigeration cycle.

During the test period, external surface areas exhibiting fog, droplets or running water shall be outlined and designated with the letters F, D and R respectively. A coded sketch shall be made showing the maximum area and degree of condensation appearing during the test on all surfaces; the code shown in Figure 14 shall be used.



**Key**

- F fog/mist
- D droplets
- R running water

**Figure 14 — Condensation code**

**6.3.6.5 Temperature rise time test for C1 ice-cream freezers**

The ice cream freezer shall be tested at stable conditions, loaded and installed according to Clause 6.3.5 without night covers in place and shall be located inside the test room at 30°C and 55 % RH. After the operation of the refrigerating system has been interrupted, the time elapsed from the condition  $\alpha$  to the condition  $\beta$  shall be measured and declared by the manufacturer (see Table 9).

**Table 9 — Temperature rise time conditions for C1**

Test room condition	Condition $\alpha$ warmest M-package temperature [°C]	Condition $\beta$ warmest M-package temperature [°C]
30 °C – 55 % RH for class A,B, C	-18,0	- 9,0

### 6.3.6.6 Electrical energy consumption test

#### 6.3.6.6.1 Test conditions

The ice-cream freezer shall be located and loaded in accordance with 6.3.5.1 and 6.3.5.4.5, operated in accordance with the manufacturer's instructions at the test room ambient temperature of 30 °C at 55 % RH (6.3.6.1.2 c), and then operated for the test period according to 6.3.5.7, without the lid opening sequence, during which measurements shall be recorded. Night-covers and/or lighting, if any, shall be manipulated according to 6.3.5.8.

#### 6.3.6.6.2 Energy consumption measurement

The measured total energy consumption (TEC), reported in kWh/24h (the number of decimal places shall be 3), shall include the condensing unit energy consumption, the compressor switching on/off frequency and the relative running time (ratio of running time to overall duration of a measurement cycle excluding defrost time), with all fitted electrical power-using components switched on.

#### 6.3.6.6.3 Calculation of TEC

The total daily energy consumption expressed in kWh/24h is calculated directly during the performance test using the instruments as defined above. The number of decimal places to express the TEC shall be 3.

#### 6.3.6.6.4 Calculation of specific energy consumption (SEC)

The value of SEC, representing the specific energy consumption for an ice cream freezer, is calculated from the following equation :

$$SEC = TEC / V_{eq} \text{ [kWh/24h.m}^3\text{]}$$

## 7 Test report

For each test carried out, general information and specific test results shall be given as follows:

### 7.1 Tests outside test room

- The lids seal according to the test specified in 6.2.1;
- The lids have the durability according to the test specified in 6.2.2;
- Linear dimensions, areas and volumes according to the test specified in 6.2.3 and information according to Table 10.

**Table 10 — Linear dimensions, areas and volumes**

Description	Symbol	Unit	Number of decimal places
External dimensions at installation	D, H, W	mm	2
Footprint		m <sup>2</sup>	2
Total display area	TDA	m <sup>2</sup>	2
Net volume		l	3
		m <sup>3</sup>	3
Gross volume		l	3
		m <sup>3</sup>	3

- absence of odour and taste (if applicable) according to the method described in Annex E.

## 7.2 Tests inside test room

- General test conditions shall be in accordance with 6.3.1 and Table 11.

**Table 11 — Conditions for tests inside test room**

Clause n°	Description
6.3.4	Statement that the test room, all loading packages and materials and the instrumentation used are in accordance with 6.3.1, specifying if alternative for filling test packages described in 6.3.3.2 are used
6.3.2.3	Test room climate class for which the ice cream freezer is intended and in which the test has been made

- Ice cream freezer preparation shall be in accordance with Table 12.

**Table 12 — Ice cream freezer preparation for tests inside test room**

Clause n°	Description	Symbol	Unit	Number of decimal places
6.3.5.1	The ice cream freezer location within the test room using the Figure 9 presentation	<i>X, B, Y, A</i>	mm	0
6.3.5.4	Number of the figure according to which the ice cream freezers was loaded			--
6.3.5.5	The method of temperature control, setting parameters and sensor locations			--
6.3.5.8	Whether the test was made with or without night-covers and/or light			--
6.3.6.3	The international number of the refrigerant (see ISO 817)			---

- Temperature test shall be in accordance with 6.3.6.1 and Table 13.

**Table 13 — Temperature test for tests inside test room**

Clause n°	Description	Symbol	Unit	Number of decimal places
6.3.6.1.2	For ice cream freezers fitted with night-covers and/or lights, if the results are for the maximum temperature test of 6.3.5.8 or for both tests (two sets of results shall be provided for the latter case)			
6.3.6.1.3	The time/temperature curves of the warmest M-packages and the extreme values $\theta_{ah}$ and the resulting ice cream freezer classification (see Table 1 and Figure 11)	$\theta_{ah}$	°C	1
6.3.6.1.4	The average mean temperatures of all M-packages (see also Figure 12)		°C	1
6.3.6.1.3	For temperature display systems, the sensor location and the maximum values displayed under stable operating conditions		°C	1
6.3.6.5	Time elapsed from the condition $\alpha$ to the condition $\beta$		hr	2

— Water vapour condensation test shall be in accordance with 6.3.6.4. and Table 14.

**Table 14 — Water vapour condensation test**

Clause n°	Description	Symbol	Unit
6.3.6.1.2	For ice cream freezers fitted with night-covers and/or lights, if the results are for the “first” or the “second” test of 6.3.5.8 or for both tests (two sets of results shall be provided for the latter case)		
6.3.6.4	Whether any manual switch provided for anti-condensation heaters was switched off		
6.3.6.4	The duration of the period of observation		h
	Coded sketches as defined in Figure 13		

— Electrical energy consumption test shall be in accordance with 6.3.6.6 and Table 15.

**Table 15 — Electrical energy consumption test**

Clause n°	Description	Symbol	Unit	Number of decimal places
6.3.6.6	total electrical energy consumption	<i>TEC</i>	kWh/24 h	2
	Compressor switching on/off frequency			
	Relative running time			

— Specific energy consumption calculation shall be in accordance with 6.3.6.6.4 and Table 16.

Table 16 — Specific energy consumption

Clause n°	Description	Symbol	Unit	Number of decimal places
6.3.6.6.4	Ratio between TEC and equivalent volume		kWh/24h m <sup>3</sup>	2

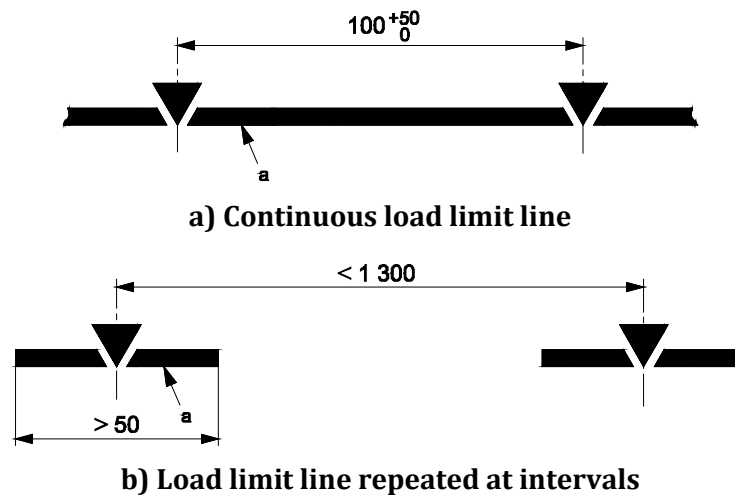
## 8 Marking

### 8.1 Load limit

Every ice cream freezer shall be clearly and permanently marked with one or several load limit line(s) [see Figure 15 b)], on the inside face, as shown in Figure 16, to denote the load limit. Where it is not possible to exceed the load limit, no marking is required.

The load limit line shall be continuous [see Figure 15 a)], or repeated at intervals [Figure 15 b)] to ensure that it cannot be overlooked. Individual markings shall be at least 50 mm long and shall contain at least one equilateral triangle with side dimension,  $d_1$ , included within 5,5 mm and 15 mm (see Figure 16).

Dimensions in millimetres



#### Key

a This denotes the load limit

Figure 15 — Load limit markings

Dimensions in millimetres

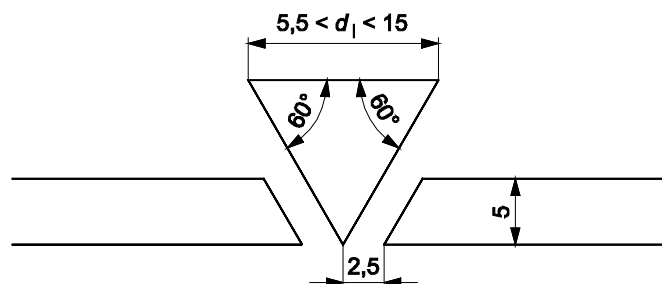
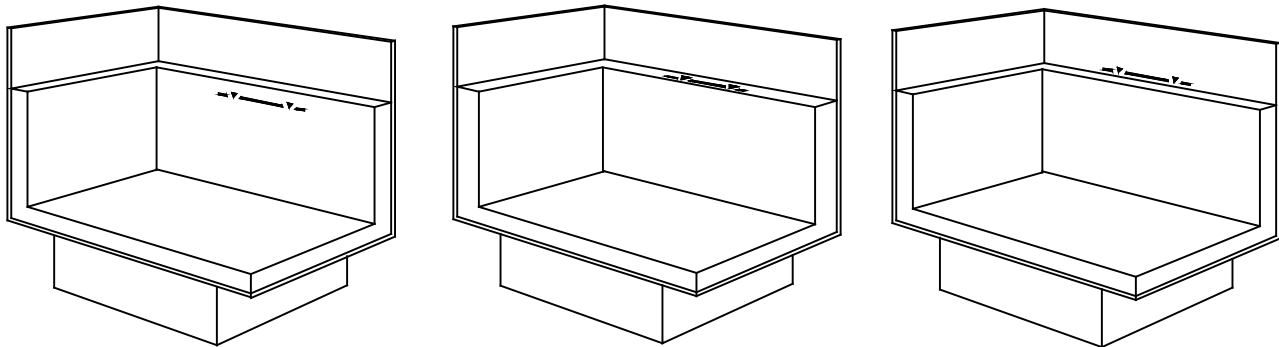


Figure 16 — Dimensions of load limit line

Where a load limit line cannot be marked on the inside face because of ice cream freezer design, an outline sketch showing the load limit shall be fixed in a visible position and in the manufacturer's instruction handbook (see Figure 17).



**Figure 17 — Different positions for the load limit**

## 8.2 Marking plate

Each ice cream freezer shall have the following information marked in a permanent and legible manner in locations where it is readily accessible:

- a) the reference to this Standard;
- b) ice-cream freezer;
- c) the manufacturer's name or trademark or both (not necessarily the same name as that of the condensing unit);
- d) model and serial number of the ice cream freezer, integral condensing unit(s), etc., or sufficient information to provide adequate identification for replacement of parts or necessary servicing;
- e) a description of the ice cream freezer's internal fittings;
- f) all information relating to the power supply for which the ice cream freezer is designed;
- g) the international number of refrigerant(s) (see ISO 817) used and its (their) mass, in grams;
- h) marking in accordance with ISO 5149-2;
- i) the M-package temperature class;
- j) the test room climate class;
- k) for ice cream freezer classified as S it shall be indicated: ambient temperature, ambient humidity, product temperature range; e.g.: S (27 °C/58 %/-15°C ÷ -5°C)

## 8.3 Information to be supplied by the manufacturer

The following information shall be provided by the manufacturer for each ice cream freezer model.

- a) Overall external dimensions at installation.
- b) Overall external dimensions in service (see 6.3.5.1)



- c) For each indicated M-package class (see 5.1):
- 1) net volume and equivalent volume (see Annex B);
  - 2) the maximum load, in kilograms, permitted in the baskets or on the base deck for the various methods of arranging them in the ice cream freezer;
  - 3) for ice cream freezers fitted with night-covers and/or lights,
    - i) the electrical energy consumption, in kilowatt hours per 24 h, measured in accordance with the test described in 6.3.6.6,
    - ii) the specific energy consumption SEC; in kilowatt hours per 24 h per m<sup>3</sup> of equivalent volume.
- d) For each test room climate class in which the ice cream freezer operates, the manufacturer shall furnish the following temperature display information, according to the measured results in the test (see 6.3.5):
- location of the temperature sensor;
  - maximum values displayed by the instrument or measured at the sensor location in stable operating conditions;
  - maximum value displayed by the instrument or measured at the sensor location at the warmest moment during or just after the defrosting period;
  - conditions where the display of temperature may be interrupted (for example during defrosting).

**Annex A**  
(informative)

**Ice-cream freezer families**

The ice cream freezer families are described in Table A.1.

**Table A.1 — Ice cream freezer families**

<b>Ice cream freezer family</b>	<b>Symbol</b>
Closed transparent lid	ICFT
Closed solid lid	ICFS

**Annex B**  
(normative)

**Net volume calculation**

The net volume ( $V_n$ ) shall be calculated as the sum of the individual volumes obtained within the load limit lines, excluding any basket(s).

Each of the individual volumes shall be expressed in litres, to two decimal places. The net volume shall be rounded to the nearest decimal place.

## Annex C (normative)

### Equivalent volume calculation

The calculation of the equivalent volume is related to the specific compartment. This volume is “normalised” to an equivalent volume, for the different compartment classification temperatures which can occur.

For ice cream freezers the following equation applies to calculate the equivalent volume:

$$V_{eq} = NV * \frac{12 - T_c}{30} * C_c \quad (C.1)$$

where

net volume ( $NV$ ) defined as in Annex B.

$T_c$  is the warmest M-package temperature in the ice cream freezer (see Table 1):

- 1)  $-18,0$  °C for C1
- 2)  $-7,0$  °C for C2
- 3) For special class (S)  $T_c$  is the warmest M-package temperature declared by the manufacturer.

$C_c$  is the climate class factor:

- 1.00 for CC\_A for ICFT (Annex A)
- 1.1 for CC\_B for-ICFT (Annex A)
- 1.2 for CC\_C for ICFT (Annex A)
- 1.00 for CC\_A for ICFS (Annex A)
- 1.04 for CC\_B for-ICFS (Annex A)
- 1.10 for CC\_C for ICFS (Annex A)

## Annex D (normative)

### TDA calculation

#### D.1 General

The TDA is determined by the sum of vertical and horizontal projected areas from visible foodstuff, in square metres.

#### D.2 Calculation of TDA

The total display area shall be calculated as follows:

$$TDA = (H_g \times L_{gh}) + (V_g \times L_{gv}) \quad (D.1)$$

where

$H$  is the horizontal projection, in metres;

$V$  is the vertical projection, in metres;

$L$  is the cabinet length without end walls, in metres;

$o$  is the open surface;

$g$  is the glazing surface;

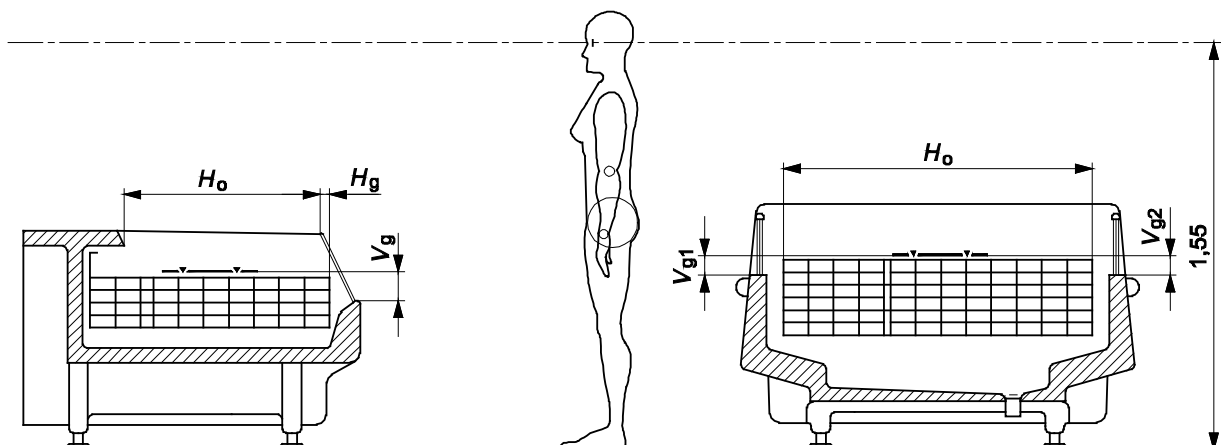
$h$  is the horizontal;

$v$  is the vertical;

For cabinets with glazing on two or more sides of the cabinet, the TDA shall be calculated for the total glazed area.

Following figures illustrate the calculation for the most common cabinets.

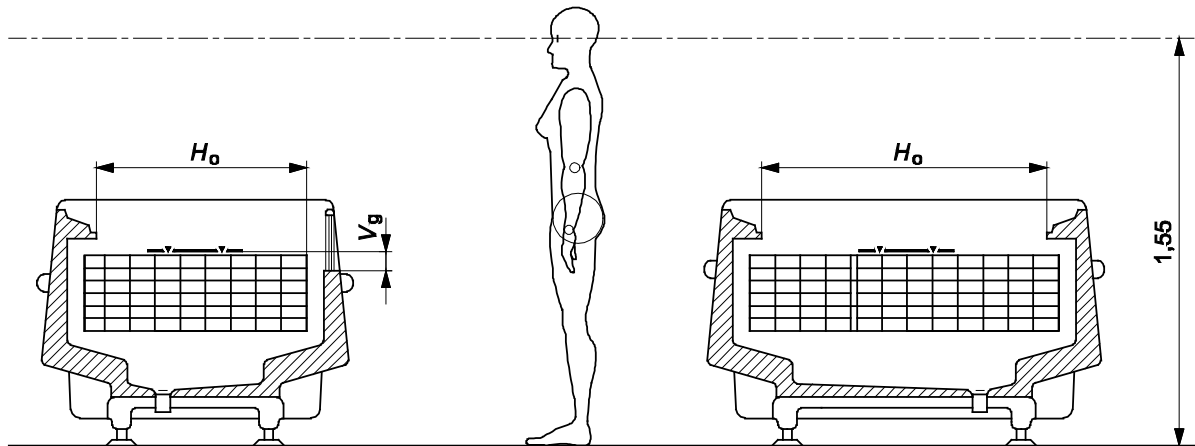
Dimensions in metres



	$L_{oh} = 2,500$	$H_o = 0,770$		$L_{oh} = 2,500$	$H_o = 1,176$
$T_{gh} = 90\%$	$L_{gh} = 2,500$	$H_g = 0,012$	$T_{gh} = 100\%$	$L_{gh} = 2,500$	$H_g = 0$
	$L_{ov} = 2,500$	$V_o = 0$		$L_{ov} = 2,500$	$V_o = 0$
$T_{gv} = 90\%$	$L_{gv} = 2,500$	$V_g = 0,090$	$T_{gv1} = 81\%$	$L_{gv1} = 2,400$	$V_{g1} = 0,058$
			$T_{gv2} = 81\%$	$L_{gv2} = 2,400$	$V_{g2} = 0,058$
$TDA = (H_o \times L_{oh}) + (H_g \times T_{gh} \times L_{gh}) + (V_o \times L_{ov}) + (V_g \times T_{gv} \times L_{gv})$			$TDA = (H_o \times L_{oh}) + (H_g \times T_{gh} \times L_{gh}) + (V_o \times L_{ov}) + (V_{g1} \times T_{gv1} \times L_{gv1}) + (V_{g2} \times T_{gv2} \times L_{gv2})$		
+ 2,155			+ 3,16		
			+ 6		

Figure D.1 — Horizontal, open, wall-site and island cabinets

Dimensions in metres



	$L_{oh} = 2,500$	$H_o = 0,800$		$L_{oh} = 2,500$	$H_o = 1,084$
$T_{gh} = 100 \%$	$L_{gh} = 2,500$	$H_g = 0$	$T_{gh} = 100 \%$	$L_{gh} = 2,500$	$H_g = 0$
	$L_{ov} = 2,500$	$V_o = 0$		$L_{ov} = 2,500$	$V_o = 0$
$T_{gv} = 73 \%$	$L_{gv} = 2,400$	$V_g = 0,058$	$T_{gv} = 100 \%$	$L_{gv} = 2,500$	$V_g = 0$
$TDA = \frac{(H_o \times L_{oh}) + (H_g \times T_{gh} \times L_{gh})}{(V_o \times L_{ov}) + (V_g \times T_{gv} \times L_{gv})} + 2,10$			$TDA = \frac{(H_o \times L_{oh}) + (H_g \times T_{gh} \times L_{gh})}{(V_o \times L_{ov}) + (V_g \times T_{gv} \times L_{gv})} + 2,71$		
			0		

Figure D.2 — Horizontal, open, island cabinets

## **Annex E** (informative)

### **Test for absence of odour and taste**

#### **E.1 Preparation and testing**

##### **E.1.1 Ambient temperature**

The ambient temperature shall be between +16 °C and +30 °C.

##### **E.1.2 Cleaning**

The ice cream freezer shall be cleaned prior to the test in accordance with the manufacturer's instructions and afterwards with pure water.

##### **E.1.3 Thermostat setting**

The ice cream freezer shall be operated for 48 h, with the thermostat and other control devices set in accordance with the manufacturer's instructions which will give the required temperature according to the relevant classification.

##### **E.1.4 Samples**

The analytical samples and check samples respectively for each ice cream freezer or compartment are:

- 100 ml potable water;
- a slice of fresh unsalted butter of 75 mm × 35 mm × 5 mm.

From each of the above, six samples at least are necessary to serve as analytical samples and six at least to serve as control samples.

The analytical samples shall be placed in Petri dishes and the control samples in glass containers, the latter being hermetically sealed.

Prior to the test, all Petri dishes and containers which are used for the test shall be cleaned with fuming nitric acid and subsequently washed with distilled water until a complete absence of odour is obtained.

The analytical samples of water and butter shall be placed uncovered into the ice cream or compartment. The control samples in the hermetically sealed glass containers shall be placed close to the analytical samples.

##### **E.1.5 Test period**

The analytical samples and the control samples shall be left in the operating ice cream with the door(s), if any, closed and at the specified temperature conditions for 48 h. After 48 h, the analytical samples shall be covered.

The analytical samples and check samples shall be removed and warmed to approximately 20 °C.



## **E.2 Examination of samples**

### **E.2.1 Conditions**

Examination shall be made about 2 h after removal of the samples from the ice cream and shall be carried out by at least three examiners familiar with the test method. Each examiner shall receive:

- two analytical samples of water,
- two control samples of water,
- two analytical samples of butter, and
- two control samples of butter.

The identity of the samples shall not be made known to the examiners. The samples of water shall be examined prior to the samples of butter, unless a separate examination by different examiners takes place.

The examiners shall record their remarks independently of each other, in writing.

### **E.2.2 Evaluation**

The evaluation of the analytical samples shall be carried out with reference to the following scale:

- Mark 0: no foreign odour or foreign taste
- Mark 1: slight foreign odour or foreign taste
- Mark 2: definitely perceptible foreign odour or foreign taste
- Mark 3: distinct foreign odour or foreign taste

When the mean value of the individual results during each evaluation for odour and taste exceed Mark 1, the test shall be repeated. The following provisions shall be made for this second test:

- defrosting of the evaporator;
- cleaning of the ice cream freezer or freezer compartments;
- operation of the empty ice cream for one week;
- repetition of defrosting of the evaporator;
- temperature adjustment for the second test for absence of odour and taste.

## **Annex F** (normative)

### **Performance and energy rating of ice cream freezers**

#### **F.1 Scope**

The scope of this annex is to establish data requirements for standard ratings of ice cream. It is intended for the guidance of the industry, including manufacturers, engineers, installers, contractors and users. The values reported using this annex allow comparison of specific energy consumption (SEC) of different models of ice cream freezers within the same product family, at the same product temperature classification, at standard rating conditions.

#### **F.2 Standard rating conditions for ice cream freezers**

Standard rating conditions are defined as follows:

- 1) Test: in compliance with this Standard,
- 2) Climate class: 30°C 55 % RH,
- 3) Supply voltage and frequency: what is reported in the ice cream freezer name plate.

#### **F.3 Specific energy consumption (SEC) for ice cream freezers**

The data required to calculate the specific energy consumption values (SEC) at standard rating conditions for ice cream freezers from measured data or from calculated data when, alternate electrical components are applied are the following are defined as follows:

SEC value: TEC/Equivalent volume

The net volume value is calculated for each ice cream freezer family following indication of Annex B of this standard.

TEC is calculated according to 6.3.6.6.3.

## Annex ZA (informative)

### Relationship between this European Standard and the ecodesign requirements of Commission Draft Ecodesign Regulation DG ENER LOT12 aimed to be covered

This European Standard has been prepared under a Commission’s standardization request “M/495” to provide one voluntary means of conforming to the ecodesign requirements of Commission Draft Ecodesign Regulation DG ENER LOT12 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for refrigerated commercial display cabinets.

Once this standard is cited in the Official Journal of the European Union under that Regulation, compliance with the normative clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding ecodesign requirements of that Regulation and associated EFTA regulations.

**Table ZA.1 — Correspondence between this European Standard and Commission Draft Ecodesign Regulation DG ENER LOT12 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for refrigerated commercial display cabinets and Commission’s standardization request ‘M/495’**

Ecodesign Requirements of Draft Ecodesign Regulation DG ENER LOT12	Clause(s)/subclause(s) of this EN	Remarks/Notes
Net storage volume	3.3.6	Requested by the Commission
Equivalent volume	3.3.8	Factor to be used for determination of the energy efficiency index, because of the different temperature classifications in this standard

**WARNING 1** — Presumption of conformity stays valid only as long as a reference to this European Standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

**WARNING 2** — Other Union legislation may be applicable to the products falling within the scope of this standard.

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- [2] EN 614-1, *Safety of machinery — Ergonomic design principles — Part 1: Terminology and general principles*
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- [5] EN ISO 23953-2, *Refrigerated display cabinets - Part 2: Classification, requirements and test conditions (ISO 23953-2)*
- [6] EN 62552, *Household refrigerating appliances - Characteristics and test methods (IEC 62552)*



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