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Refrigerated display scooping cabinets for gelato — Classification, requirements and test conditions

bsi.

National foreword

This British Standard is the UK implementation of EN 16838:2016.

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A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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European foreword

This document (EN 16838:2016) 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of an identical text or by endorsement, at the latest by January 2017, and conflicting national standards shall be withdrawn at the latest by January 2017.

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1 Scope

This European Standard specifies requirements for the construction, characteristics and performance of refrigerated display scooping cabinets for gelato used to sale and display artisan and self made gelato, hereafter called “gelato scooping cabinets”. It specifies test conditions and methods for checking that the requirements have been satisfied, as well as classification of the cabinets, their marking and the list of their characteristics to be declared by the manufacturer.

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*

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
gelato scooping cabinets
cabinet cooled by a refrigerating system which enables, to store, to display and to scoop artisan and self made gelato contained in tubs, within prescribed temperature limits

Note 1 to entry: Artisan and self made gelato are hereafter called “gelato”.

3.2
storage section
non-visible part of the gelato scooping cabinet used only to store the product, separated from the display volume and with a different access

3.3
display section
visible part of the gelato scooping cabinet used only to display and to scoop the product

3.4
covers
sliding door or night curtain or swivel panes

3.5
gelato Tub
container intended to store gelato

3.6
net volume
volume containing gelato within the top edge of the tub

3.7
top display area of GelatoTub
area delimited by the external perimeter of a gelato tub open side

3.8
front display area of GelatoTub
area delimited by the external perimeter of a gelato tub front side

3.9
total net volume
net volume of the storage section

3.10
total display area TDA
sum of the top area and the front display area of each visible gelato tubs

4 Symbols and abbreviations

t_{run}	running time — time during which compressor is running (or solenoid valve is open), within 24 h, expressed in hours
t_{stop}	stopping time — time during which compressor is not running (or solenoid valve is closed) within 24 h and excluding defrost time, expressed in hours
t_{deft}	defrost time — time during which compressor is running and hot gas solenoid valve is open (or reverse cycle valve is open)
q_m	mass flow rate of liquid refrigerant in kilograms per second
Δt	time between two consecutive measuring samples, in hours
N_{max}	number of measuring samples in 24 h
n_{deft}	number of defrosts during 24 h
DEC	direct electrical energy consumption, in kilowatt hours per 24 h period
REC_{RC}	refrigeration electrical energy consumption, in kilowatt hours per 24 h period, for remote gelato scooping cabinet for compression-type refrigerating system
TEC	total energy consumption in kilowatt hours per 24 h period
TDA	total display area, in square meters
TEC/TDA	Specific Energy Consumption (SEC) for Gelato scooping cabinet expressed in kilowatt hours per 24 h per square meters
t_{rr}	relative or percentage running time:

$$t_{\text{rr}} = \frac{t_{\text{run}}}{t_{\text{run}} + t_{\text{stop}}} = \frac{t_{\text{run}}}{24 - t_{\text{deft}}} \quad (1)$$

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

Φ_n instant heat extraction rate in kilowatts

h_8, h_4 specific enthalpy in kilojoules per kilogram, where state in Figure 11 corresponds to refrigerant outlet, and state in Figure 12 to refrigerant inlet, of Gelato scooping cabinet

θ_7 refrigerant temperature at evaporator outlet, in degrees Celsius

θ_8 refrigerant temperature at the Gelato scooping cabinet outlet, in degrees Celsius

θ_4 refrigerant temperature at the Gelato scooping cabinet inlet, in degrees Celsius

θ_5 refrigerant temperature at evaporator inlet, in degrees Celsius

p_8 refrigerant pressure at the Gelato scooping cabinet outlet, in Pascals

θ_{mrun} arithmetic average of evaporator-saturated temperature obtained from pressure p_8 by referring to table of saturation properties for refrigerant in use — during t_{run}, in degrees Celsius

θ_{min} arithmetic average of evaporator-saturated temperature obtained from pressure p_8 by referring to table of saturation properties for refrigerant in use — during the last 10 % of all running periods, in degrees Celsius

T_{mrun} = θ_{mrun} + 273,15 in Kelvin

5 Requirements

5.1 Construction

5.1.1 General

5.1.1.1 Strength and rigidity

The Gelato scooping cabinet 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:

1) interior fittings, including shelves, baskets, rails, etc. and their supports, shall be sufficiently strong for the duty required;

2) where sliding shelves, baskets, trays or drawers are fitted they shall retain their shape and ease of movement when fully loaded;

3) 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.

5.1.1.2 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 sufficient free length and/or vibration eliminators shall be provided to prevent failure due to fatigue. Where necessary, pipes and valves shall be adequately thermally insulated.

5.1.1.3 Condensate drainage

Where drains, drip trays or evaporation receptacles are fitted, they shall have ample capacity and shall be easily accessible and cleanable.

Any condensate or defrost water receptacle, or group of receptacles, requiring to be emptied manually shall have a capacity equivalent to at least 48 h of normal operation in the appropriate climate class for which the Gelato scooping cabinet is intended.

5.1.1.4 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.

5.1.2 Materials

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.

5.1.3 Refrigerating system

5.1.3.1 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 Gelato scooping cabinet is in operation or at rest.

For Gelato scooping cabinets with integral condensing unit or components thereof which are charged with refrigerant prior to transportation, the maximum ambient temperature during transit shall be taken into account. All refrigerant containing components shall be in accordance with ISO 5149-2.

5.1.3.2 Condensation

There shall be suitable means to prevent water condensed on cold surfaces of the Gelato scooping cabinet and its parts from harmfully affecting the operation of the refrigerating system or its controls.

5.1.3.3 System protection

For Gelato scooping cabinets fitted with covers, the refrigerating system shall suffer no damage if any cover in the gelato scooping cabinet is left open while the gelato scooping cabinet is operating in an ambient temperature corresponding to the climate class (see Table 4) for which the gelato scooping cabinet is intended.

When the cover 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.

5.1.3.4 Refrigerant

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

5.1.4 Electrical components

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

5.1.5 Temperature display

5.1.5.1 General

The Gelato scooping cabinets shall incorporate a temperature display instrument showing the air temperature in the refrigerated display scooping cabinets to provide an indication of the operation and functioning of refrigerating equipment and information on its operating state.

NOTE As a rule, measured air temperature is not identical with gelato temperature in Gelato scooping cabinets.

5.1.5.2 Temperature-measuring instrument

Suitable temperature-measuring instruments shall be used, i.e. those that fulfil 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 −25 °C to +15 °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.

NOTE The t_{90} time is the 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).

5.1.5.3 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 reachable directly for examination. It ought to be necessary to remove access panel(s) to carry out replacement.

NOTE 2 For Gelato scooping cabinets with natural convection cooling, 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.

The temperature sensor location is defined as part of the temperature test of the Gelato scooping cabinet. During the temperature test air temperatures at the declared sensor location shall be measured and these values noted in the test report.

NOTE 3 It is the responsibility of the supplier and end user to ensure that the temperature measurements complies with national regulation on temperature control of gelato.

5.2 Operating characteristics

5.2.1 Absence of odour and taste

The absence of odour and taste is not compulsory. An optional test method is given in Annex A.

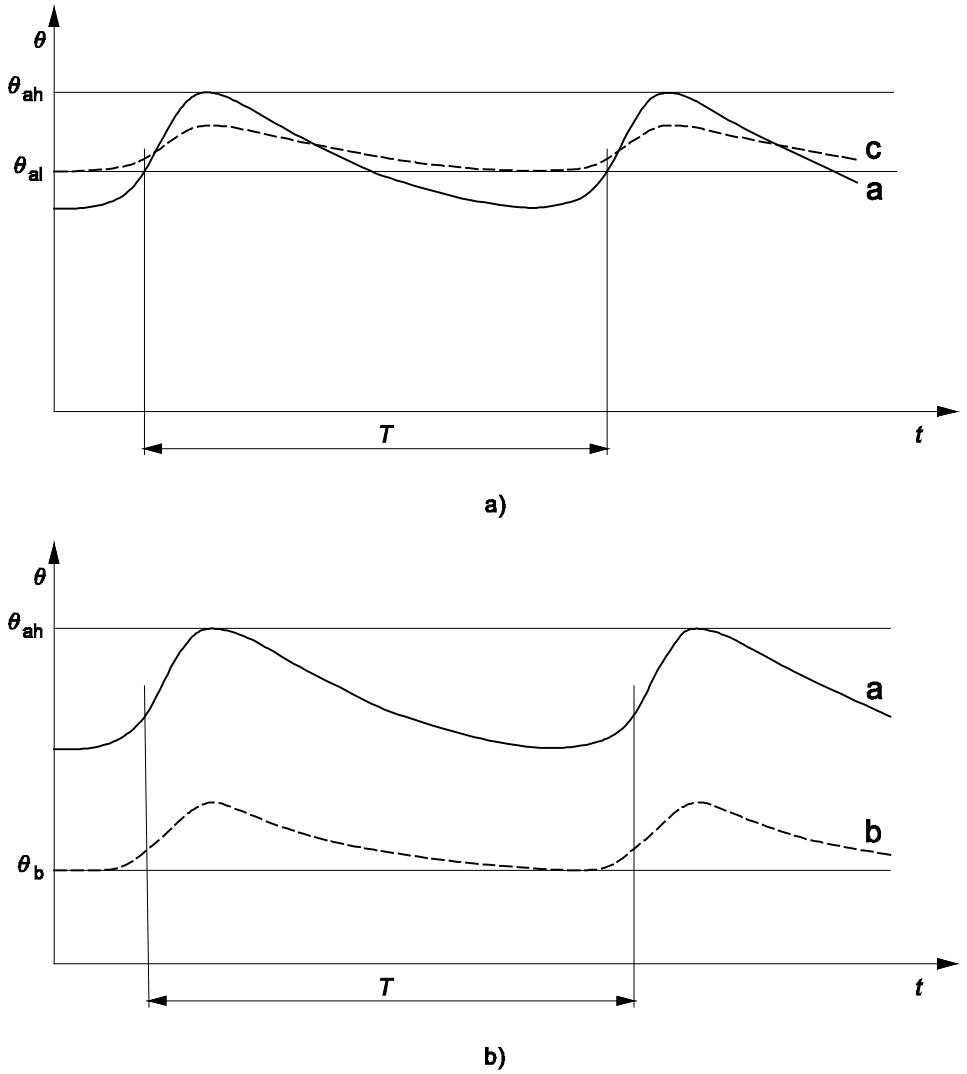
5.2.2 Classification according to temperature

The performance of Gelato scooping cabinet 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 6.3.3.

Table 1 — Temperature classes

Class	**Highest temperature, θ_{ah}, of warmest M-Test gelato tubs colder than or equal to** [a] [b]	**Lowest temperature, θ_b, of coldest M-Test gelato tubs warmer than or equal to** [b]	**Highest minimum temperature, θ_{al}, of all Test tubs colder than or equal to** [a]
	°C		
G1	−10	−14	
G2	−10	−16	
G3	−10	−18	
L1	−15		−18
L2	−12		−18
L3	−12		−15
S	Special classification		

[a, b] See Figure 1.



Key

a) temperature curves of the warmest and of the highest minimum value of M-test gelato tub

b) temperature curves of the warmest and of the coldest M-test gelato tub

a temperature curve a of warmest M-test gelato tub

b temperature curve b of coldest M- test gelato tub

c temperature curve with the highest minimum value of all M-gelato tubs

θ temperature

θ_{ah} highest temperature of warmest M-test gelato tubs

θ_{b} lowest temperature of coldest M-test gelato tubs

θ_{al} highest minimum temperature of all M-gelato tubs

t time

T test period

Figure 1 — Relevant temperature curves of M-Test gelato tubs

5.2.3 Defrosting

The accumulation of ice, frost or snow on surfaces within the refrigerated space, as well as the accumulation of drained defrost water, shall not occur, as it would impair the performance of Gelato scooping cabinets other than those which are intended to be defrosted manually. This shall be verified according to the conditions and test methods specified in 6.3.4.5.

The proposed defrosting procedures (automatic or manual) shall not affect the temperature requirements.

For Gelato scooping cabinets or sections of Gelato scooping cabinets with manual defrosting, the manufacturer shall supply all necessary instructions for the correct operation of the defrosting system.

5.2.4 Water vapour condensation

The performance of Gelato scooping cabinets 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 6.3.5.

5.2.5 Energy consumption

The direct electrical energy consumption (DEC) and, when the condensing unit is remote from the Gelato scooping cabinet, the refrigeration electrical energy consumption (REC) and total energy consumption (TEC) shall be measured and calculated according to the conditions and the test methods specified in 6.3.6 and 6.3.7.

5.2.6 Specific Energy Consumption

Specific Energy Consumption is the rate between TEC and TDA for Gelato scooping Cabinet.

6 Test condition

6.1 General

When the characteristics of a Gelato scooping cabinet are to be verified, all the tests and inspections shall be applied to one and the same Gelato scooping cabinet. These tests and inspections may also be made individually for the study of a particular characteristic.

Table 2 lists the tests and inspections. Gelato scooping cabinets shall comply with the requirements specified in 6.1 using the appropriate test method.

Table 2 — Test summary

Tests and inspections	Requirement clause in this part	Test method	
Physical dimensions		6.2	**Outside test room** (see 6.2)
Temperature	5.2.2	6.3.4	**Inside test room** (see 6.3)
Defrosting	5.2.3	6.3.4	
Energy consumption	5.2.5	6.3.6 and 6.3.7	
Water vapour condensation	5.2.4	6.3.5	

6.2 Tests outside test room

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

Measurements shall be made with the Gelato scooping cabinet not in operation but situated in a place where the temperature is maintained between 16 °C and 30 °C.

For Gelato scooping cabinets having detachable ends, overall dimensions are given with and without ends. If the Gelato scooping cabinet includes jacks or other components for adjustment of height, the height defined shall be the minimum height necessary at installation of the Gelato scooping cabinet.

The total net volume is calculated as sum of the volume of each tub contained in the storage section.

The total display (TDA) area shall be calculated according to the number of top visible gelato tubs multiplied by its top display area plus the number of front visible tubs multiplied by its front display area (see Table 3).

Table 3 — Examples of gelato tubs dimensions

Type	A [mm]	L [mm]	P [mm]	VOLUME [l]	TOP AREA [m^2]	FRONT AREA
GN 1/4	162	265	65	1,9	0,04293	
GN 1/4	162	265	100	2,5	0,04293	
GN 1/4	162	265	150	4,1	0,04293	
GN 1/4	162	265	200	4,9	0,04293	
Gelato Tubs	165	360	80	3,4	0,0594	
Gelato Tubs	165	360	120	5	0,0594	
Gelato Tubs	165	360	150	7	0,0594	
Gelato Tubs	165	360	180	8	0,0594	
Gelato Tubs	250	360	80	5,4	0,09	
Gelato Tubs	250	360	120	8	0,09	
Gelato Tubs	250	360	150	11	0,09	
Gelato Tubs	250	360	180	14	0,09	
Any other geometrical shapes of tubs						

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 and defrosting;

— electrical energy consumption

— water vapour condensation;

— heat extraction rate.

These measurements should be made simultaneously.

6.3.2 Test room — General design, walls, floor and radiant heat

6.3.2.1 General

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 Gelato scooping cabinet to be tested and on the location of the display opening of the Gelato scooping cabinet (see Figure 5).

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 (λ = 0,03 W/m °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 ± 100 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 W/5 nm/1 m.

The walls, ceilings and any partitions of rooms intended for the testing of Gelato scooping cabinets shall have an emissivity between 0,9 and 1 at 25 °C.

6.3.2.2 Test room (empty) — Thermal and air flow characteristics

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

— with test room empty and with lighting switched on,

— in a test-room climate class 3 (see Table 4),

— measuring the velocity, temperature and relative humidity of the air at different points of two vertical planes parallel to the technical side walls and 600 mm away from the technical side walls,

— with the climate measuring point located at the geometrical centre of the test room during this 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^2 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 ± 3 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 Test room climate definition

6.3.2.3.1 Test room climate classes

Tests shall be carried out in one of the climate classes according to Table 4.

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 Figure 2). The exception to this is test-room climate class 3, for which the tolerance of the relative humidity is instead ± 3 units.

Table 4 — Climate classes

Test room climate class	Dry bulb temperature ° C	Relative humidity %	Dew point ° C	Water vapour mass in dry air g/kg
0	20	50	9,3	7,3
1	16	80	12,6	9,1
8	24	55	14,4	10,2
2	22	65	15,2	10,8
3	25	60	16,7	12,0
4	30	55	20,0	14,8
6	27	70	21,1	15,8
5	40	40	23,9	18,8
7	35	75	30,0	27,3
NOTE The water vapour mass in dry air is one of the main points influencing the performance and the energy consumption of the Gelato scooping cabinets. Therefore the order of the climate class in the table is based on the water vapour mass column.				

6.3.2.3.2 Climate measuring point

The point for measurement of ambient temperature and relative humidity shall be locate in the test room airflow 100 mm upstream of the Gelato scooping cabinet (i.e. on the higher supply side of the Gelato scooping cabinet) in line with the work top of the Gelato scooping cabinet at a vertical height of 300 mm (see Figure 2).

For plug-in Gelato scooping cabinets, the warm condenser air flow shall be prevented from influencing the temperature at the measuring point.

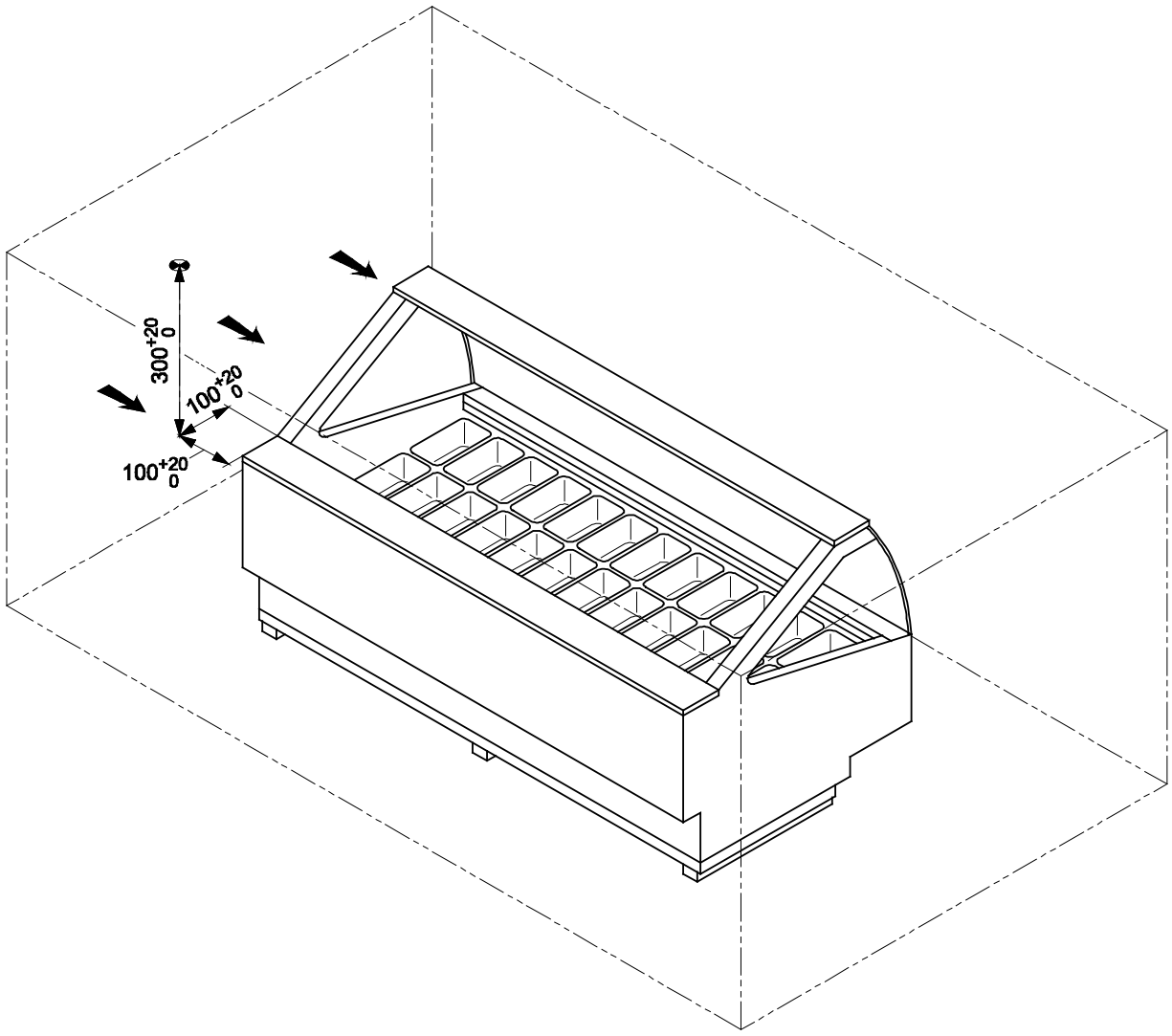


Figure 2 — Climate measuring point for gelato scooping cabinets

6.3.2.3.3 Test gelato tubs

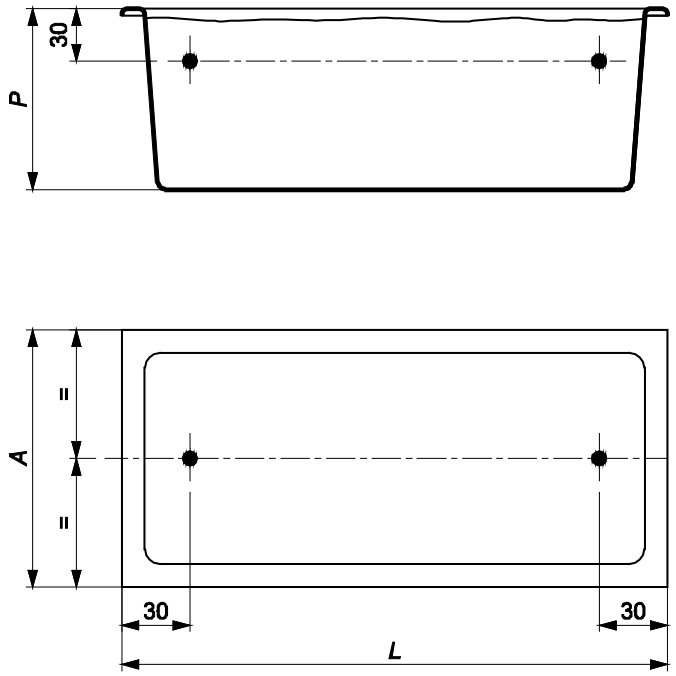
Gelato tubs are filled with the following test mixture up to load limit of the tubs. The reference test mixture contains the ingredients reported in Table 5 per 1000 gr:

Table 5 — Ingredients of the reference test mixture

Ingredients for 1000 g of test mixture	Quantity g
Partly skimmed Milk	700
Saccarose	180
Dextrose	20
Maltodextrin	100

6.3.2.3.4 M-Test gelato tubs

Test gelato tubs with two temperature measuring probes are introduced in the test load as shown in Figure 3.



Key

A tubs width

L tubs length

P tubs height or depth

Figure 3 — Positioning of the measuring probes

6.3.2.3.5 Alternative for filling test tubs

Alternative filling test tubs having the dimensions shown in Table 3 and density of (480 ± 80) kg/m^3 can be used. Cellular or foam material shall not be used.

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.

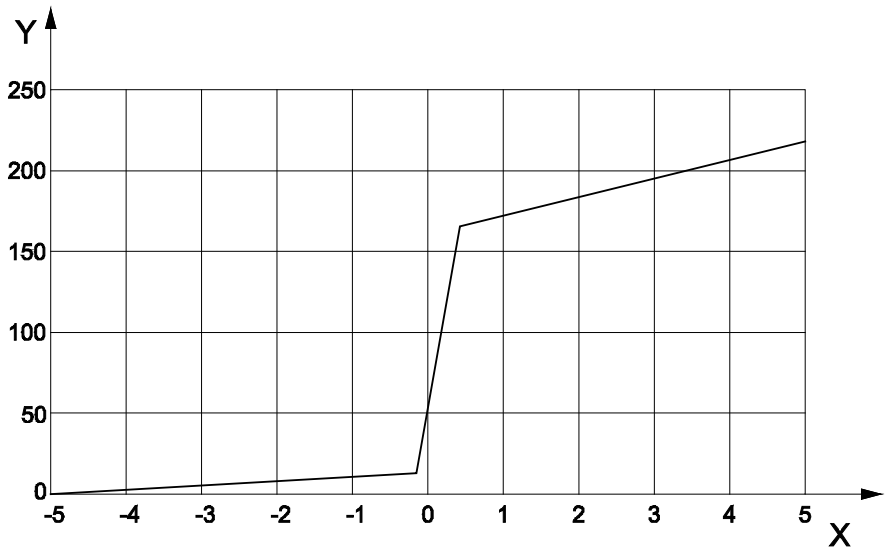
The contents shall be water soaked into a porous material such as a natural, plastics or cellulose sponge.

Table 6 — Temperature and specific enthalpy of filler test gelato tub

Temperature °C	Specific enthalpy kJ/kg
−5	0
−4	3
−3	4
−2	7
−1	10
0	45
+1	172
+2	183
+3	194
+4	206
+5	218

Table 7 — Temperature and increase in specific enthalpy of filler test gelato tubs

Temperature range °C	Increase in specific enthalpy kJ/kg
− 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 test gelato tubs

6.3.2.3.6 Instruments, measuring equipment and measuring accuracy

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

— Temperature measurements shall be made to an accuracy of ± 0,5 °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 accuracy of ± 10 %.

— Pressures shall be measured to an accuracy of ± 1 %.

— Relative humidity shall be measured to an accuracy of ± 3 units of the percentage figure.

— Electrical energy consumption shall be measured to an accuracy of ± 2 % (see 6.3.6).

— Time interval measurements shall be made to an accuracy of ± 1 % or better. All the temperatures are checked at maximum every 60 s.

— The time interval for the measurements of refrigerant mass flow rate, inlet/outlet temperature and inlet and suction pressure shall be 30 s (see 6.3.6.3).

— Air velocity shall be measured using a laboratory-type instrument with an accuracy 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.

— Mass flow rate shall be measured to an accuracy of ± 1 % (see 6.3.7).

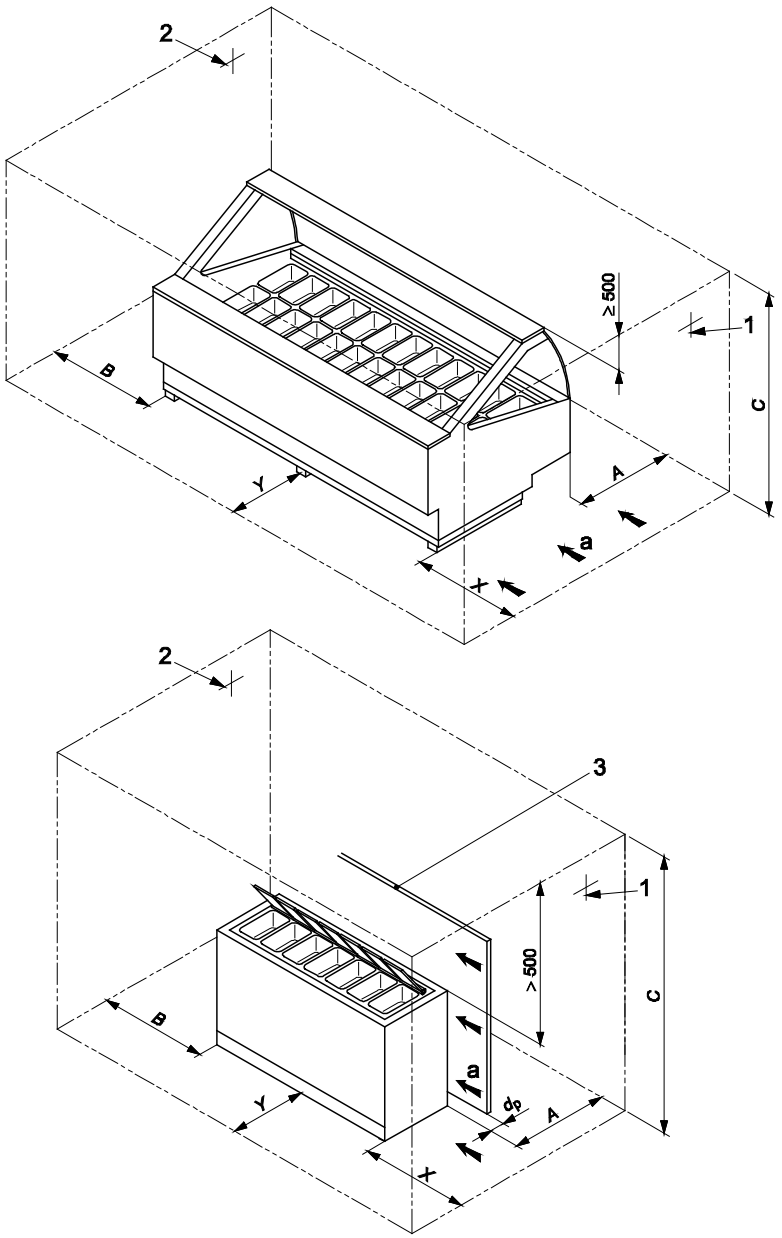
6.3.3 Preparation of test Gelato scooping cabinet and general test procedures

6.3.3.1 Gelato scooping cabinet selection, installation and positioning within the test room

Each Gelato scooping cabinet intended to be tested, unless a prototype, shall be selected from stock or routine production and shall be representative as to construction and adjustment.

The Gelato scooping cabinet, 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 Gelato scooping cabinets shall be located as follows (see Figure 5):



Key

X ≥ 1,0 m

Y ≥ 0,8 m

A ≥ 0,8 m

B ≥ 0,5 m

C ≥ height of Gelato scooping cabinet + 0,5 m

d_p partition distance specified by the manufacturer

1 technical side wall — test room air discharge

2 technical side wall — test room air return

3 vertical partition for wall site Gelato scooping cabinet with same length and height as Gelato scooping cabinet

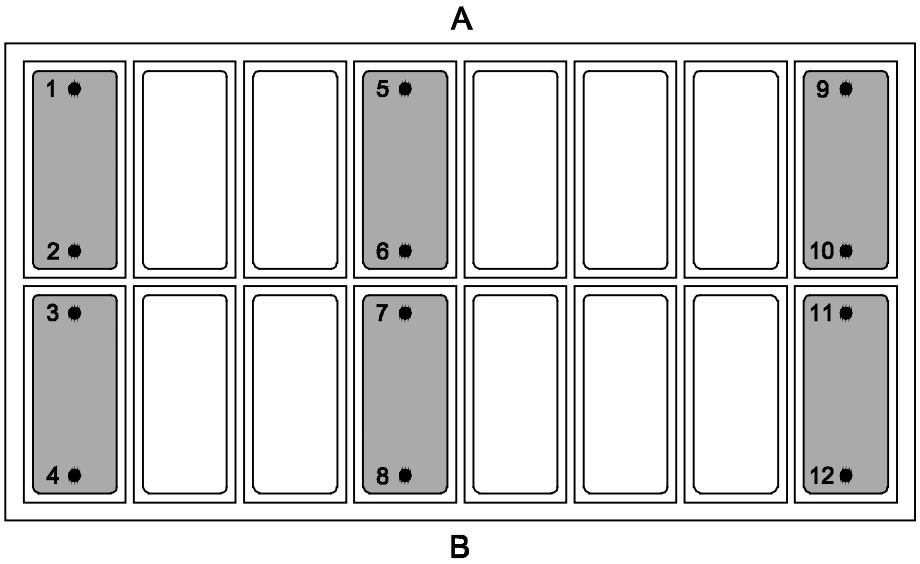
a air currents parallel to the plane of the opening (in longitudinal direction)

Figure 5 — Gelato scooping cabinet position

The Gelato scooping cabinet shall be located within the test room perpendicularly to the two technical side walls in such a way that the distances A or Y measured at the two ends of the Gelato scooping cabinet will be equal with a tolerance of ± 4 mm for each meter of length of the Gelato scooping cabinet.

6.3.3.2 Location of M-test gelato tubs

The Gelato scooping cabinet shall be loaded with test gelato tubs in all positions of display section and storage section. In the display section, the M-test gelato tubs are placed in the positions illustrated in Figure 6.



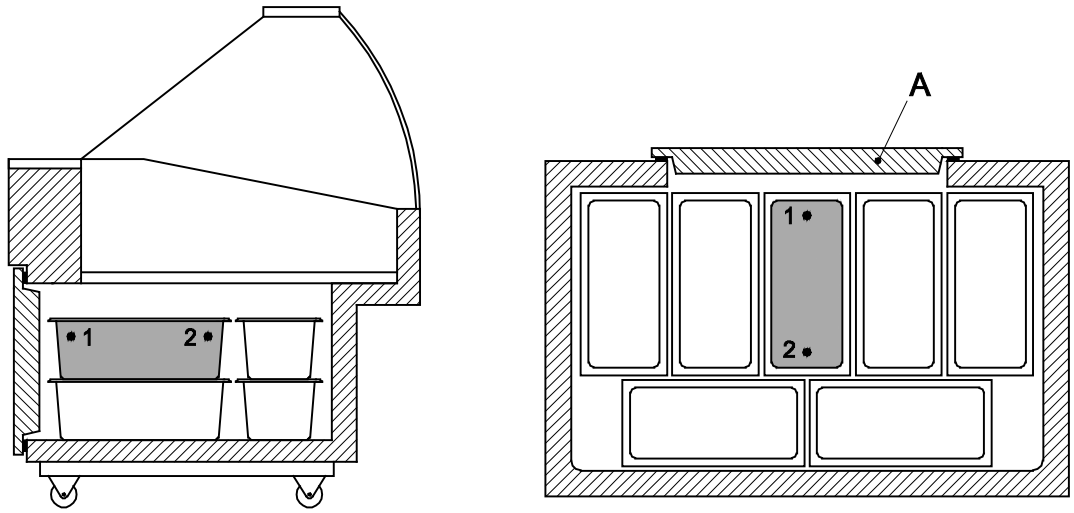
Key

A operator side

B customer side

Figure 6 — Position of M-test gelato tubs in the display section

In the storage section the M-test gelato tub is placed in the centre of the storage close to the door (see Figure 7).



Key

A storage door

Figure 7 — Position of M-test gelato tubs in the storage section

6.3.3.3 Running in

When a Gelato scooping cabinet with a remote condensing unit is tested, the operating conditions shall comply with those stated by the Gelato scooping cabinet manufacturer.

Adjustable automatic controllers shall be set in such a way that the required M- test gelato tubs temperature class of the Gelato scooping cabinet is reached. Where the controller is not adjustable, the Gelato scooping cabinet shall be tested as delivered.

The manufacturer's recommended routine of defrosting shall be followed. Before tests are started, the Gelato scooping cabinet shall be switched on and allowed to run for at least 2 h at the specified climate class with no test gelato tubs in the Gelato scooping cabinet 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 Gelato scooping cabinet shall be filled with test gelato tubs and M- test gelato tubs according to 6.3.3.2.

After loading, the Gelato scooping cabinet shall be operated until stable conditions have been reached (see 6.3.3.4) and during the test period (see 6.3.3.5) the test room shall be maintained at the desired climate class as specified in 6.3.2.3.1, while the temperatures of the M- test gelato tubs are recorded.

6.3.3.4 Stable conditions

The temperatures vary cyclically and the length of the cycle is dependent on the time between two successive defrost periods.

A Gelato scooping cabinet is considered to operate under stable conditions if, during a period of 24 h, the temperature of each M-test gelato tubs agrees within ± 0,5 °C at the corresponding points on the temperature curve. Changes or adjustments to the settings of the test room and to the Gelato scooping cabinet during the stabilization period are not allowed. For gelato scooping cabinet, stable conditions shall be determined prior to the cover opening sequence. (see 6.3.4.2) and, if the Gelato scooping cabinet is fitted with lighting, the lights shall be continuously left switched on.

6.3.3.5 Test period

The test period shall have a duration as follows:

a) not less than 12 h for Gelato scooping cabinets intended to be switched off at night;

b) not less than 24 h for all other Gelato scooping cabinets, under stable conditions.

6.3.3.6 Lighting

If the test Gelato scooping cabinet is fitted with lighting, carry out the tests according to 6.3.4, 6.3.5, 6.3.6 and 6.3.7 as follows:

Gelato scooping cabinet lighting switched on for a period of 12 h (during opening covers sequence) followed by a period of 12 h with Gelato scooping cabinet lighting switched off.

6.3.3.7 Accessories

An additional, separate test shall be conducted if performance-enhancing accessories are fitted, and this shall state in the test report (see Clause 7).

6.3.3.8 Liquid refrigerant inlet condition

The liquid refrigerant temperature at the Gelato scooping cabinet inlet shall not be more than 10 °C above the specified test room temperature. During the test no “flash gas” condition shall occur. This shall be confirmed by observation.

6.3.3.9 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.

6.3.3.10 Testing several Gelato scooping cabinets in the same room

If more than one Gelato scooping cabinet 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 Gelato scooping cabinet are in accordance with the test requirements specified in 6.3.2 to 6.3.3.

6.3.4 Temperature test

6.3.4.1 Test conditions

The Gelato scooping cabinet shall be located and loaded in accordance with 6.3.2 and 6.3.3, operated in accordance with the manufacturer's instructions at the conditions appropriate to the test room climate class for which it is intended (see 6.3.2.3.1), and then operated for the test period defined in 6.3.3.5, during which measurements shall be recorded. Lighting, if any, shall be handled according to 6.3.3.6.

6.3.4.2 Covers opening scheme

Covers opening scheme shall be carried out according to the conditions described in 6.3.3.5 as follows:

a) Opening and closing cycle per 12 h testing period shall be as follows:

   1) each cover shall be opened for 3 min. Where a Gelato scooping cabinet is provided with more than one cover, each cover shall be opened for 3 min consecutively;

   2) keep covers closed for 10 min;

3) for 12 h, each cover is opened six times per hour for 15 s. In case more than one cover pertains to the gelato scooping cabinet to be tested, the sequence in which the covers are opened shall be staggered, i.e. in case of two covers:

   i) cover 1 at the time of 0 min, cover 2 at the time of 5 min,

   ii) cover 1 at the time of 10 min, cover 2 at the time of 15 min, etc.

The covers shall be opened completely.

b) Opening and closing cycle per 24 h testing period shall be as follows:

1) each cover shall be opened for 3 min. Where a Gelato scooping cabinet is provided with more than one cover, each cover shall be opened for 3 min consecutively;

2) keep covers closed for 10 min;

3) for 12 h, each cover is opened six times per hour for 15 s. In case more than one cover pertains to the gelato scooping cabinet to be tested, the sequence in which the covers are opened shall be staggered, i.e. in case of two covers:

   i) cover 1 at the time of 0 min, cover 2 at the time of 5 min,

   ii) cover 1 at the time of 10 min, cover 2 at the time of 15 min, etc.

The covers shall be opened completely.

4) for the remaining time, covers shall be kept closed.

6.3.4.3 Temperature curves of M-test gelato tubs

From the recorded temperatures of all M-test gelato tubs, the following curves shall be plotted as a function of time:

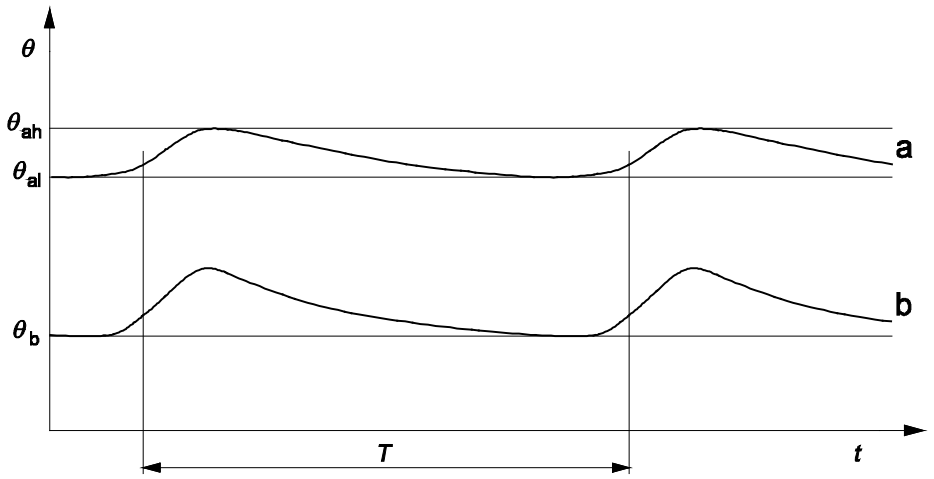
a) the temperature of the warmest M-test gelato tub (the M-test gelato tub with the highest peak temperature) (see Figure 9);

b) the temperature of the coldest M-test gelato tub (the M-test gelato tub with the lowest minimum temperature) (see Figure 9);

c) the arithmetic mean temperature of all M-test gelato tubs (see Figure 9).

All other M-test gelato tub temperatures shall be available for reference if required.

In the case of cabinets with multiple temperature classes, curve a), b) and c) shall be prepared separately for each temperature class.



Key

θ_{ah}	highest temperature of the warmest M-test gelato tub
θ_b	lowest temperature of the coldest M-test gelato tub
θ_{al}	lowest temperature of the warmest M-test gelato tub
a	temperature curve of the warmest M-test gelato tub
b	temperature curve of the coldest M-test gelato tub
θ	temperature
t	time
T	test period

Figure 8 — Warmest M-test gelato tub temperatures (curve a) Coldest M-test gelato tub temperatures (curve b)

6.3.4.4 Calculation of average mean temperature

The average instant temperature at measuring sample n of all M-test gelato tub, θ_{cn} (curve d in Figure 9), is expressed by the following formula:

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

where

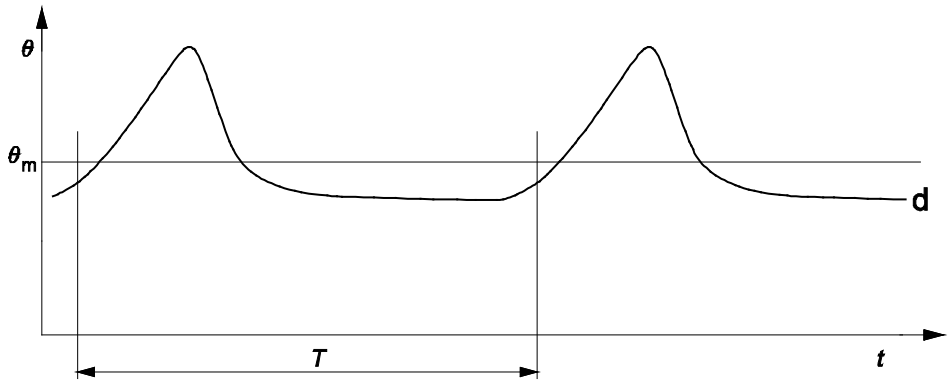
n	is the time index for the instant measuring sample;
k	is the index for the individual M-test gelato tub;
K_{maxc}	is the number of all M-test gelato tubs;
$(\theta_k)_n$	is the instant measured temperature of M-test gelato tubs k at measuring sample n.

From these average instant temperatures the arithmetic mean temperatures of all M-test gelato tubs θ_{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_m average mean temperature

t time

T test period

d curve d of arithmetic mean temperature of all M-test gelato tubs

Figure 9 — Arithmetic mean temperature of M- test gelato tubs (curve d)

The arithmetic mean temperature of M- test gelato tubs curve d shall be plotted together with curves a, b and c and separately for each temperature class in the case of Gelato scooping cabinets with multiple temperature classes.

6.3.4.5 Defrosting

After the temperature test period at the end of the next defrost period — for closed cabinets, a minimum 12 h after the end of the openings — the cabinet shall be switched off and, as necessary, unloaded as quickly as possible. All surfaces, excluding test packages, within the refrigerated space shall be examined for any residual water, ice, frost or snow after dismantling as necessary, accessories and parts.

If water, ice, frost or snow is evident and/or if the temperature test performance level is not being maintained, continue to test for a second test period under the same conditions and with no adjustment to the control device(s).

6.3.5 Water vapour condensation test

6.3.5.1 Test conditions

The Gelato scooping cabinet shall be located and loaded in accordance with 6.3.2 and 6.3.3, 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 6.3.3.5,

during which measurements shall be recorded. Lighting and covers, if any, shall be manipulated according to 6.3.3.6. The test may be carried out during the temperature test.

If anti-condensation heaters are provided, they shall not be switched on. If, however, running water appears externally when the Gelato scooping cabinet 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 Gelato scooping cabinet shall be carefully wiped dry with a clean cloth. If the Gelato scooping cabinet is fitted with automatic defrosting equipment this test period shall be selected during the period when condensation is most likely to occur.

6.3.5.2 Test results

The Gelato scooping cabinet 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 gelato tubs and — depending on the method used to detect water vapour condensation — provided the following results have been obtained:

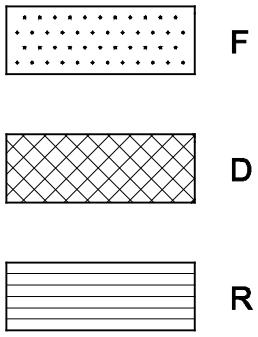
a) all Gelato scooping cabinet surfaces, whether adjacent or otherwise, remain free of moisture by the provision of insulation, ventilation or heating to maintain a temperature above dew point for the climate class specified (Table 3);

b) all surfaces, wherever practical, remain free of moisture collection or ice gather;

c) mirrors that can periodically mist during defrost clear by evaporation on the return to refrigeration cycle.

6.3.5.3 Expression of results

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 10 shall be used.



Key

F fog/mist

D droplets

R running water

Figure 10 — Condensation code

6.3.6 Electrical energy consumption test

6.3.6.1 Test conditions

The Gelato scooping cabinet shall be located and loaded in accordance with 6.3.2 and 6.3.3, 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 4), and then operated for the test period according to 6.3.3.5, during which measurements shall be recorded. Lighting and covers, if any, shall be handled according to 6.3.3.6.

The test shall be carried out during the temperature test.

6.3.6.2 Gelato scooping cabinets fitted with incorporated condensing unit

For Gelato scooping cabinets with an incorporated condensing unit the direct electrical energy consumption (DEC) equals the total energy consumption (TEC), as it includes the condensing unit energy consumption. Refrigeration electrical energy consumption (REC) is not defined for these Gelato scooping cabinets.

Measure the TEC, including the condensing unit energy consumption, reported in kilowatt hours per 24-h period, 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.

6.3.6.3 Gelato scooping Cabinets with remote condensing unit

For Gelato scooping cabinets with a remote condensing unit the DEC does not include the REC.

Measure the DEC of the Gelato scooping cabinet only, with all fitted electrical power-using components switched on.

The DEC recorded for each test shall be the summation of all electrical energy consumed by the Gelato scooping cabinet during the test period, without the control unit.

NOTE If, for technical reasons, it is too difficult to measure separately the component powers, it is possible to use the DEC directly measured.

6.3.7 Heat extraction rate measurement when condensing unit is remote from Gelato scooping cabinet

6.3.7.1 Test conditions

6.3.7.1.1 General

The Gelato scooping cabinet shall be located and loaded in accordance with 6.3.2 and 6.3.3, 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 6.3.3.5, during which measurements shall be recorded. Lighting and covers, if any, shall be manipulated according to 6.3.3.6.

The test shall be carried out during the temperature test.

The refrigeration system shall be connected to the Gelato scooping cabinet as given below.

The refrigerant inlet and outlet temperatures shall be measured using temperature sensors directly inserted into the pipe or inserted into pockets or clamped between the piping and a copper recovery half-sleeve on the inlet and outlet pipe-lines positioned no further than 150 mm from the Gelato scooping cabinet exterior (see Figures 11 a).

Where thermocouples or similar devices are used, the sensor cables shall be arranged such that external influences on the connection cables are eliminated by the use of insulation.

Temperature sensors, connecting wires and pipelines shall be insulated from the outlet of the Gelato scooping cabinet up to at least 150 mm beyond the measuring points.

A flow measuring device (flow meter) shall be installed in the liquid inlet supply line to the Gelato scooping cabinet in order to measure mass flow rate of the liquid refrigerant.

A liquid sight glass shall be installed in the liquid piping downstream and, if necessary, optionally upstream of the flow meter in order to verify the vapour-free state of the refrigerant being supplied to the Gelato scooping Gelato scooping cabinet during the test period.

A temperature sensor shall be installed as stated above within, or at (150 ± 10) mm upstream of, the liquid flow meter, with the piping being insulated at least 150 mm upstream and from the sensor to the inlet of the flow meter.

A measurement of pressure shall be carried out at the Gelato scooping cabinet outlet for compression type systems and both inlet and outlet for indirect type systems at less than 150 mm from the Gelato scooping cabinet.

The heat extraction rate necessary for the Gelato scooping cabinet shall be determined from temperature, pressure and flow rate readings which allow a resultant accuracy of ± 5 %.

6.3.7.1.2 Specific test conditions for Gelato scooping cabinets intended for connection to compression-type refrigerating systems

The refrigeration system remotely located from the Gelato scooping cabinet shall be connected to the Gelato scooping cabinet in accordance with Figure 11 a).

The refrigeration system selected for the test shall be capable of operating as follows:

— with the refrigerant at the saturated evaporating pressure or temperature in service at the Gelato scooping cabinet outlet specified by the manufacturer;

— with the liquid refrigerant vapour free supplied at the Gelato scooping cabinet inlet at a temperature not more than 10 °C above the specified test room temperature, or supplying sub-cooled liquid when specified.

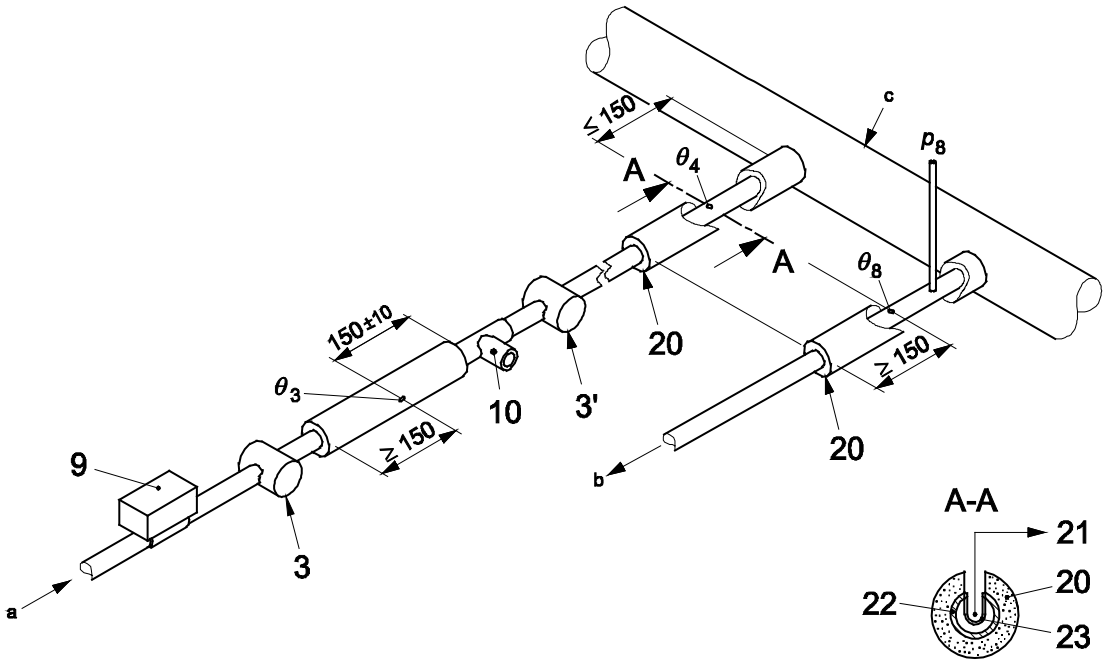
In both conditions, the liquid temperature shall be stated.

6.3.7.2 Determination of heat extraction rate for Gelato scooping Cabinets intended for connection to compression-type refrigerating systems

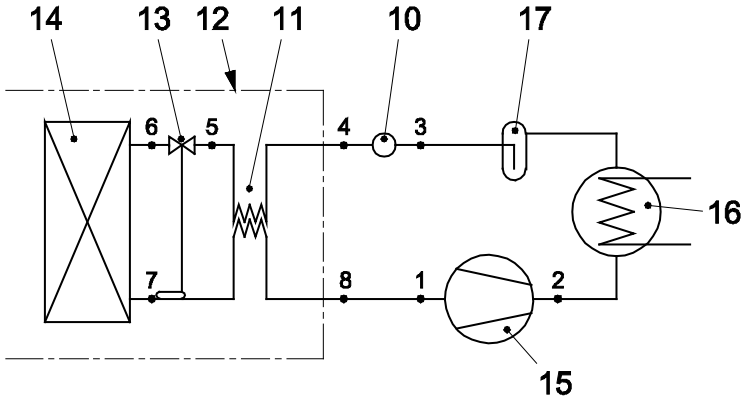
The instant heat extraction rate in kilowatts is defined as

$$\Phi_{\mathrm{n}} = q_{\mathrm{m}} \left(h_8 - h_4 \right) \tag{4}$$

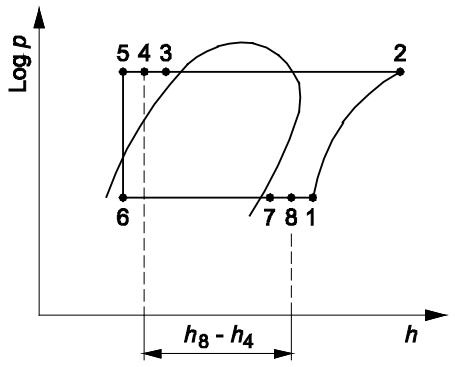
for each individual measuring instant, where *n* indicates the measuring sample (Φ_n = 0 kW during stopping and defrost time); see Figure 11 a).



a) Connection to remote compression-type refrigerating system



b) Connection to remote compression-type refrigerating system



c) Pressure enthalpy diagram showing points referred to in Figure 11 b)

Key

1 compressor inlet

2 compressor outlet

3 sight glass location for subcooled liquid state upstream flow meter

3' sight glass, optional for subcooled liquid state downstream flow meter

4 measurement point at the Gelato scooping cabinet inlet

5 expansion device inlet

6 expansion device outlet and inlet of the evaporator

7 outlet of the evaporator and superheat measurement of the evaporator

8 measurement point at the outlet of the Gelato scooping cabinet

9 inlet valve: open during refrigeration; closed during switch off or defrosting

10 refrigerant mass flow meter

11 fluid vapour heat exchange, if any

12 gelato scooping cabinet

13 expansion device

14 evaporator

15 compressor

16 condenser

17 liquid receiver

20 insulation (to at least 150 mm) from temperature sensor

21 to temperature recorder

22 refrigerant circulation pipe

23 copper thermo-pocket for housing the temperature sensor (shall be filled with glycerine or a similar fluid)

a Liquid supply

b Vapour return

c Pipe connection to Gelato scooping cabinet

Figure 11 — Gelato scooping cabinets intended for connection to compression-type refrigerating systems

6.3.7.3 Procedure

6.3.7.3.1 General

The summation of the instant heat extraction rates Φ_n, in kilowatts, over 24 h gives the following.

a) Total heat extraction, Q_{tot}, in kilowatt hours (see Figures 12):

$$Q_{\text{tot}} = \sum_{n=1}^{n=N_{max}} \Phi_n \times \Delta t \qquad (5)$$

(Φ_n = 0 kW during stopping and defrost time).

b) For continuous running, the steady-state heat extraction, Q_{75}, in kilowatt hours during 75 % of the refrigerating time period excluding the period just after defrost (see Figures 12):

$$Q_{75} = \sum_{i=1}^{i=n_{deft}} \left(\sum_{n=1}^{n=N_{75}} \Phi_n \times \Delta t \right)_i \quad (6)$$

The following shall be given when reporting the heat extraction rate for compression and indirect-type refrigerating systems:

Φ_{run} the heat extraction rate necessary for a single Gelato scooping cabinet installation in laboratory conditions, in kilowatts;

Φ_{run75} for continuous running only, the steady-state heat extraction rate necessary for a single Gelato scooping cabinet installation during 75 % of the refrigerating period, excluding the time just after defrost in laboratory conditions, in kilowatts;

Φ_{24} the heat extraction rate necessary for a Gelato scooping cabinet installation in laboratory conditions, in kilowatts;

$\Phi_{24\text{-deft}}$ a heat extraction rate for calculating the energy consumption of a Gelato scooping cabinet in laboratory conditions, in kilowatts.

6.3.7.3.2 Determination of heat extraction rates

The heat extraction rate necessary for a single Gelato scooping cabinet installation,Φ_{run}, can be calculated by arithmetic averaging of the instant heat extraction rates Φ_{n} during the running time only (t_{run}); see Figures 12:

$$\Phi_{\text{run}} = \frac{Q_{\text{tot}}}{t_{\text{run}}} = \frac{Q_{\text{tot}}}{24 - t_{\text{deft}} - t_{\text{stop}}} \quad (7)$$

The steady-state heat extraction rate necessary for a single Gelato scooping cabinet installation during 75 % of the refrigerating period Φ_{run75} can be calculated by arithmetic averaging of the instant heat extraction rates only during 75 % of the running time, excluding the time just after defrost (t_{run75}).

$$\Phi_{\text{run}75} = \frac{Q_{75}}{0{,}75\ t_{\text{run}}} = \frac{Q_{75}}{0{,}75\left(24 - t_{deft}\right)t_{rr}} \quad (8)$$

The heat extraction rate necessary for a Gelato scooping cabinet installation Φ_{24} can be calculated by arithmetic averaging of the instant heat extraction rates during a whole day, including running, stopping and defrost times (t_{run}, t_{stop} and t_{deft}):

$$\Phi_{24} = \frac{Q_{tot}}{t_{\text{run}} + t_{\text{stop}} + t_{\text{deft}}} = \frac{Q_{\text{tot}}}{24} \quad (9)$$

A heat extraction rate for calculating the energy consumption of a Gelato scooping cabinet $\Phi_{24\text{-deft}}$ can be calculated by arithmetic averaging of the instant heat extraction rates during a whole day excepting defrost time (t_{deft}), e.g. only during running and stopping time (t_{run} and t_{stop}):

$$\Phi_{24-\text{deft}} = \frac{Q_{\text{tot}}}{t_{\text{run}} + t_{\text{stop}}} = \frac{Q_{\text{tot}}}{24 - t_{\text{deft}}} \quad (10)$$

The $\Phi_{24-\text{deft}}$ value shall be used in the REC calculation formula (see 6.3.7.3.3).

6.3.7.3.3 Calculation of REC

The refrigeration electrical energy consumption for a Gelato scooping cabinet intended for a remote compression-type refrigerating system, REC_{RC}, is calculated from the following formula:

$$REC_{RC} = (24 - t_{deft}) \times \Phi_{24-deft} \times \frac{(T_c - T_{mrun})}{(0{,}34 \times T_{mrun})} = Q_{tot} \times \frac{(T_c - T_{mrun})}{(0{,}34 \times T_{mrun})} \quad (11)$$

with a constant condensing temperature of T_c = 308,15 K (35 °C, but calculation in Kelvin).

6.3.7.3.4 Calculation of TEC

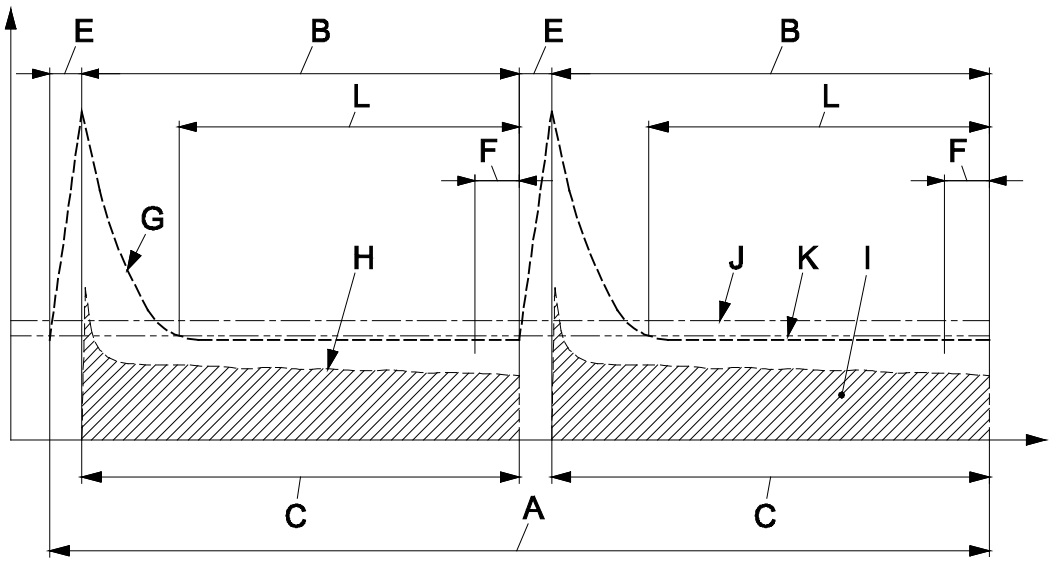
The total daily energy consumption expressed in kWh/24h is calculated from the formula:

$$TEC = DEC + REC \quad (12)$$

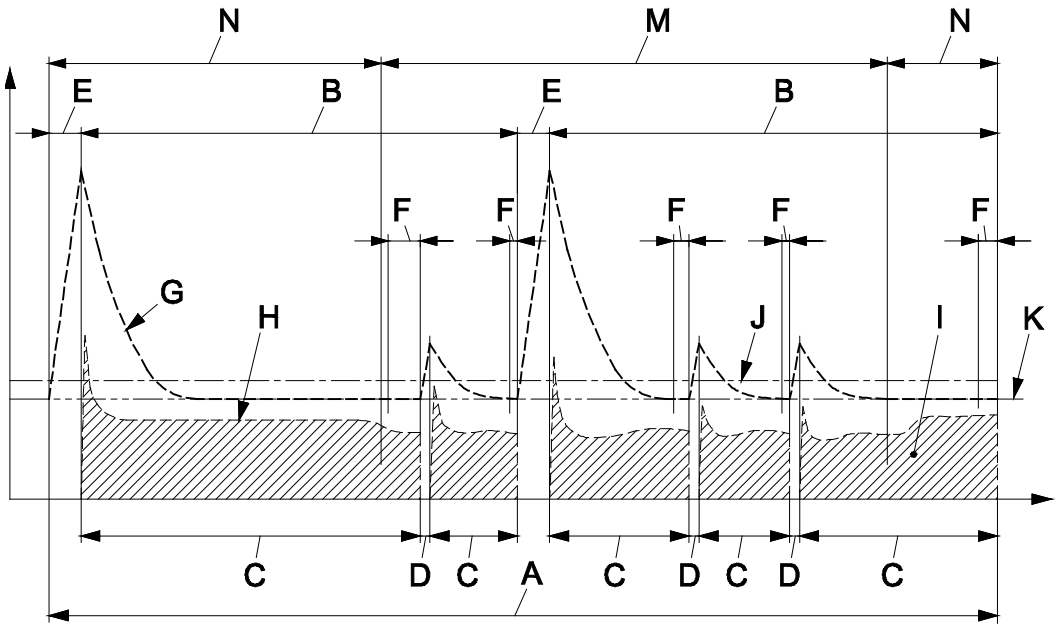
6.3.7.3.5 Calculation of SEC

The value of SEC representing the Specific Energy Consumption for a Gelato scooping cabinet (see Figures 12 and 13) is calculated from the formula:

$$SEC = TEC/TDA \quad (13)$$



a) Constant evaporating pressure, no cycling



b) Constant evaporating pressure, no cycling, and cycling with night covers on

Key

A 24 h (ref.)

B refrigerating period (ref.)

C running time (t_{run})

D off time (t_{stop})

E defrost off period (t_{deft})

F running time for reporting evaporating minimum temperature (t_{run}·10 %)

G evaporating temperature

H instant heat extraction rate (Φ_n)

I total heat extraction (Qtot = area under graph)

J average of evaporator saturated temperature (θ_{mrun})

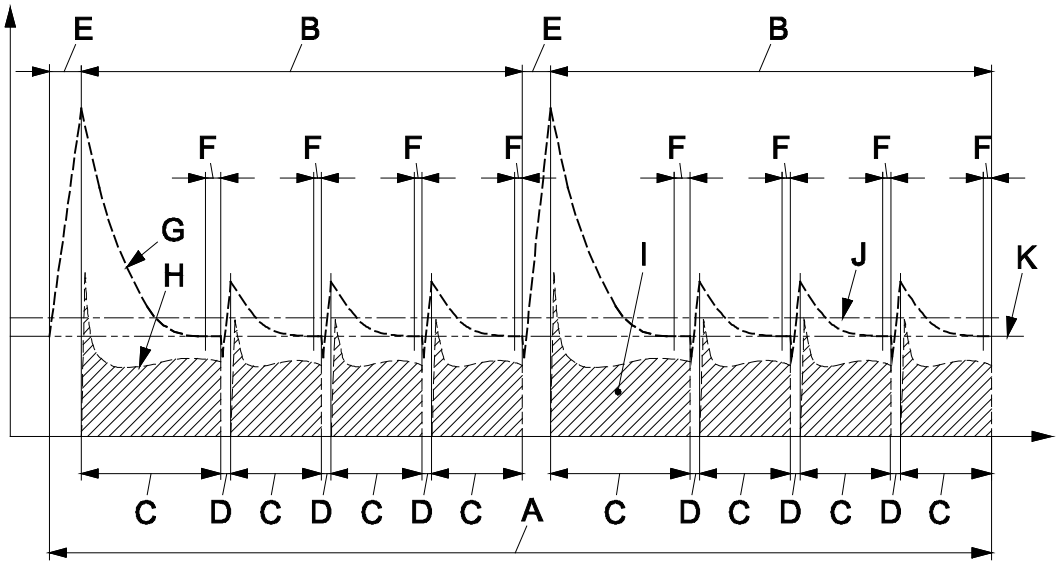
K average of evaporator saturated temperature during last 10 % of running periods (θ_{min})

L 75 % of running time between defrosts (t_{run}·75 %)

M night covers on 12 h

N night covers off 12 h

Figure 12 — Refrigeration cycle — Constant evaporating pressure — No cycling



Key

A 24 h (ref.)

B refrigerating period (ref.)

C running time (t_{run})

D off time (t_{stop})

E defrost off period (t_{deft})

F running time for reporting evaporating minimum temperature (t_{run}·10 %)

G evaporating temperature

H instant heat extraction rate (Φ_n)

I total heat extraction (Qtot = area under graph)

J average of evaporator saturated temperature (θ_{mrun})

K average of evaporator saturated temperature during last 10 % of running periods (θ_{min})

Figure 13 — Refrigeration cycle — Cycling including pump down

7 Test report

7.1 General

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

NOTE For information to be given on the Gelato scooping cabinet, see 8.2.

7.2 Tests outside test room

According to 6.2

See Table 8.

Table 8 — Linear dimensions, areas and volumes

Description	Symbol	Unit	Number of decimal places
Overall external dimensions at installation	L, H, W	mm	0
Total display area	TDA	m^2	2
Net volume for each declared temperature class		l	0
		m^3	3

Test for absence of odour and taste (if applicable)

See Annex A.

7.3 Tests inside test room

7.3.1 General test conditions

According to 6.3.

See Table 9.

Table 9 — Conditions for tests inside test room

Description
Statement that the test room, test gelato tubs, filling material (wood loading), M- test gelato tubs and the instrumentation used are in accordance with 6.3.2 specifying if alternative for filling test of test gelato tubs described in 6.3.2.3.5 are used
Test room climate class for which the Gelato scooping cabinet is intended and in which the test has been made

7.3.2 Cabinet preparation

See Table 10.

Table 10 — Gelato scooping Cabinet preparation for tests inside test room

Description	Symbol	Unit
The Gelato scooping cabinet location within the test room using the Figure 9 presentation	*X, B, Y, A*	mm
For Gelato scooping cabinets intended to be placed against a wall, the location of the vertical partition at the rear of the cabinet	d_p	mm
Number of the figure according to which the Gelato scooping cabinet was loaded		
The method of temperature control, defrost process, defrost termination, setting parameters and sensor locations		
Whether the test was made with or without covers and/or light		
Whether the test was made using alternative filling test test gelato tubs as specify in 6.3.2.3.5		

When the condensing unit is remote from the Gelato scooping cabinet for compression-type refrigerating systems the international number of the refrigerant (see ISO 817)		

7.3.3 Temperature test

According to 6.3.4.

See Table 11.

Table 11 — Temperature test for tests inside test room

Description	Symbol	Unit
For Gelato scooping cabinets fitted with covers and/or lights, if the results are for the "first" or the "second" test of 6.3.3.5 and 6.3.3.6 or for both tests (two sets of results shall be provided for the latter case)		
The time/temperature curves of: — For display section the warmest and the coldest M- test gelato tubs and the extreme values θ_{ah}, θ_b and if necessary θ_{al} and the resulting Gelato scooping cabinet classification (see 5.2.2 Table 1 and Figure 1b) — for storage section (if provided) the warmest M- test gelato tubs and the extreme values θ_{ah} (see 5.2.2 Table 1 and Figure 1a).	θ_{ah} θ_b θ_{al}	°C
The average mean temperatures of all M- test gelato tubs (see also 6.3.4.3 and Figure 9) for display section.		°C
For temperature display systems, the sensor location and the maximum values displayed		
under stable operating conditions		°C
at the warmest moment, during or just after the defrost period		°C
Conditions where the display of temperature may be interrupted (e.g. during defrosting)		
The results from defrost check according to 6.3.4.5		

7.3.4 Water vapour condensation test

According to 6.3.5.

See Table 12.

Table 12 — Water vapour condensation test

Description	Symbol	Unit
For Gelato scooping cabinets fitted with covers and/or lights, state whether the results are for the "first" or the "second" test of 6.3.3.5 and 6.3.3.6 or for both tests. Two sets of results shall be provided in the latter case		
Whether any manual switch provided for anti-condensation heaters was switched off		
The duration of the period of observation		h

Pictures or Coded sketches as defined in 6.3.5.3		

7.3.5 Electrical energy consumption test

According to 6.3.6.

See Table 13.

Table 13 — Electrical energy consumption test

Description	Symbol	Unit
For Gelato scooping cabinets fitted with covers and/or lights, state whether the results are for the "first" or the "second" test of 6.3.3.5 and 6.3.3.6 or for both tests. Two sets of results shall be provided in the latter case		
For Gelato scooping cabinets fitted with integral condensing unit:		
direct electrical energy consumption (= total electrical energy consumption)	DEC (TEC)	kWh/24 h
compressor switching on/off frequency		
relative running time		
For Gelato scooping cabinets with remote condensing unit: direct electrical energy consumption	DEC	kWh/24 h

7.3.6 Heat extraction rate measurement when the condensing unit is remote from the Gelato scooping cabinet

According to 6.3.7.

See Table 14.

Table 14 — Heat extraction rate measurement when the condensing unit is remote from the Gelato scooping cabinet

Description	Symbol	Unit
For Gelato scooping cabinets fitted with night-covers and/or lights, state whether the results are for the "first" or the "second" test of 6.3.3.5 and 6.3.3.6 or for both tests. Two sets of results shall be provided in the latter case		
For compression-type refrigerating systems:		
curves and mean values of the suction pressure, in service, and the refrigerant temperature at the Gelato scooping cabinet outlet	p_8 θ_8	Pa °C
mean value of the saturated evaporator temperature during the running time and during the last 10 % of all running periods	θmrun θmin	°C °C
arithmetic mean suction superheat at the Gelato scooping cabinet outlet		°C
arithmetic mean suction superheat at the evaporator outlet		°C
curve and mean value of the liquid temperature at the Gelato scooping cabinet inlet	θ_4	°C
curve and mean value of the mass flow rate of refrigerant	q_m	kg/s
Heat extraction rates necessary for the Gelato scooping cabinet which result from the foregoing measurements:		
	Φrun	kW
	Φrun75	kW
	Φ_{24}	kW
	Φ24-deft	kW
refrigeration electrical energy consumption	REC	kWh/24 h
total energy consumption	TEC	kWh/24 h
specific energy consumption	SEC	kWh/24 h*m²
for Gelato scooping cabinets where cycling of the system is necessary for operational reasons, the percentage running time	t_{rr}	%

8 Marking

8.1 Marking plate

Each gelato scooping cabinet shall have the following information marked in a permanent and legible manner in locations where it is readily accessible:

a) the manufacturer's name or trademark or both (not necessarily the same name as that of the condensing unit);

b) model and serial number of the Gelato scooping cabinet, integral condensing unit(s), etc., or sufficient information to provide adequate identification for replacement of parts or necessary servicing;

c) a description of the Gelato scooping cabinet's internal fittings;

d) all information relating to the power supply for which the Gelato scooping cabinet is designed;

e) for Gelato scooping cabinets with integral condensing unit, the international number of refrigerant(s) (see ISO 817) used and its (their) mass;

f) for Gelato scooping cabinets having remote condensing units, marking in accordance with ISO 5149-2.

8.2 Information to be supplied by the manufacturer

The following information shall be provided by the manufacturer for each Gelato scooping cabinet model.

a) a description of the Gelato scooping cabinet's internal fittings;

b) overall external dimensions at installation;

c) overall external dimensions in service including: distance d_p between the back of the cabinet and the vertical test panel if applicable (see 6.3.3.1);

d) for each indicated gelato scooping cabinet class (see 5.2.2):

   1) the display opening area;

   2) total display area (see Annex A);

   3) for gelato scooping cabinets fitted with covers and/or lights, if the results are referred to the conditions described in 6.3.3.5 or for both tests, in the latter case with two sets of information being provided for

      i) the electrical energy consumption (DEC), in kilowatt hours per 24 h, measured in accordance with the test described in 6.3.6,

      ii) the specific energy consumption SEC; in kilowatt hours per 24 h per m^2 of total display area,

      iii) if the condensing unit is not fitted in the Gelato scooping cabinet, the information referred to heat extraction rate according to 6.3.7.

NOTE For temperature and climate classes, see 5.2.2 and 6.3.2.3.1.

e) for each temperature class in which the gelato scooping cabinets operate, the manufacturer shall furnish the following temperature display information, according to the measuring results in the test (see 6.3.4):

— 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)

Test for absence of odour and taste

A.1 Preparation and testing

A.1.1 Ambient temperature

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

A.1.2 Cleaning

The Gelato scooping cabinet shall be cleaned prior to the test in accordance with the manufacturer's instructions and afterwards with pure water.

A.1.3 Thermostat setting

The Gelato scooping cabinet 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 (see 5.2.2).

A.1.4 Samples

The analytical samples and check samples respectively for each Gelato scooping cabinet 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 check samples.

The analytical samples shall be placed in Petri dishes and the check 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 Gelato scooping cabinet or compartment. The check samples in the hermetically sealed glass containers shall be placed close to the analytical samples.

A.1.5 Test period

The analytical samples and the check samples shall be left in the operating Gelato scooping cabinet 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.

A.2 Examination of samples

A.2.1 Conditions

Examination shall be made about 2 h after removal of the samples from the Gelato scooping cabinet 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 check samples of water,

— two analytical samples of butter, and

— two check 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.

A.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 Gelato scooping cabinet or compartments;

— operation of the empty Gelato scooping cabinet for one week;

— repetition of defrosting of the evaporator;

— temperature adjustment for the second test for absence of odour and taste.

Annex B
(normative)

Data requirements for performance and energy rating of gelato scooping cabinets

B.1 Scope

The scope of this annex is to establish component data requirements of Gelato scooping cabinets to evaluate the Specific Energy Consumption (SEC) for the following cases:

— additional components that do not affect the Refrigeration electrical energy consumption (REC)

— alternative electrical components that do not affect the Refrigeration electrical energy consumption.

B.2 Terms and definitions

B.2.1

product family

group of Gelato scooping cabinets in accordance with Table B.1

B.2.2

Anti-condensate Energy Consumption (AEC).

energy consumed to remove condensate on the external surface of the gelato scooping cabinet, which includes fan and condensate heater energy expressed in kW•h per day

B.2.3

Defrost Energy Consumption (DFEC)

energy consumed by defrost heaters during defrost period expressed in kW•h per day

B.2.4

Fan Energy Consumption (FEC)

energy consumed by fan motors expressed in kW•h per day

B.2.5

Lighting Energy Consumption (LEC)

energy consumed by lights fitted in the gelato scooping cabinet, expressed in kW•h per day

B.2.6

Condensate Evaporator Pan Energy Consumption (PEC)

energy consumed to evaporate water collected from defrost expressed in kW•h per day

B.2.7

Total Revised Refrigeration Energy Consumption (TECR)

total revised energy consumption obtained from DEC and additional or alternative component energy consumption

Table B.1 — Designation of Gelato scooping cabinet families

Application	Temperature negative	Designation
To be used for	gelato	
Horizontal	Gelato scooping cabinet	GF1
	Gelato scooping cabinet with storage section	GF2
	Gelato pozzetti scooping cabinet	GF3
- G = Gelato - *F* = Frozen - I = Incorporated Condensing unit - R = Remote Condensing unit General classification can be used as follows: GF1, GF2 etc. When necessary, the classification can be more precise. For example RGF1, IGF1		

B.3 Data Requirements for rating of gelato Scooping Cabinets with incorporated condensing unit

B.3.1 General

This section identifies the necessary data required to calculate the Specific Energy Consumption (SEC) at Standard Rating Conditions for gelato scooping cabinet with incorporated condensing unit, from measured data or from calculated data when, alternate or additional electrical components are applied.

The SEC value is expressed by the formula:

$$SEC = TEC/TDA \text{ [kWh/24h*m}^2\text{]} \quad \text{(B.1)}$$

The TEC value is given by the sum of the Total Direct Daily Energy consumption (DEC) expressed by the formula:

$$TEC = DEC \text{ [kWh/24h]} \quad \text{(B.2)}$$

For gelato scooping cabinet with an incorporated condensing unit, the Direct electrical Energy Consumption (DEC) equals the total energy consumption (TEC), as it includes the compressor energy consumption. Refrigeration electrical energy consumption (REC) is not defined for these cabinets.

B.3.2 Evaluation of DEC

For gelato scooping cabinets, DEC value shall be measured with all fitted electrical power-using components switched on.

The DEC recorded for each test shall be the sum of all electrical energy consumed by gelato scooping cabinet during the test period and shall be expressed by the formula:

$$DEC = FEC + LEC + AEC + DFEC + PEC \text{ [kWh/24h]} \quad \text{(B.3)}$$

NOTE If, for technical reasons, it is too difficult to measure separately the component powers, it is possible to use the DEC directly measured.

B.3.3 Evaluation of FEC

The FEC shall be measured data for all fan motors or calculated data using the motor efficiency:

$$FEC = (Pf \cdot tf)/(1000) \quad \text{(B.4)}$$

where:

Pf = (Pfi · n) (measured) or

Pf = (Pfo · n) / (hm) (calculated)

with:

Pf = Power fan, W [W]

tf = Time fans are on in 24 h period, h [h]

n = Number of fan motors

Pfi = Power fan input, W [W]

Pfo = Power fan output found on part nameplate, W [W]

hm = Motor efficiency

B.3.4 Evaluation of LEC

The LEC shall be measured data for all lights or calculated data, using the following formula:

$$LEC = (Pli \cdot tl)/(1000) \quad \text{(B.5)}$$

where:

Pli = Power light input, W [W]

tl = Time lights are on in 24 h period, h [h]

B.3.5 Evaluation of AEC

The AEC shall be measured data for all anti condensate heaters or calculated data, using the following formula:

$$AEC = (Pai \cdot ta)/(1000) \quad \text{(B.6)}$$

where:

Pai = Power anti-condensate heater input, W [W]

ta = Time anti-condensate heaters are on in 24 h period, h [h]

B.3.6 Evaluation of DFEC

The DFEC shall be measured data for all defrost heaters or calculated data, using the following formula:

$$DFEC = (Pd \cdot td)/(1000) \quad \text{(B.7)}$$

where:

Pd = Power defrost heater input, W [W]

td = Time defrost heaters are on in 24 h period, h [h]

B.3.7 Evaluation of PEC

The PEC shall be measured data for all pan heaters or calculated data, using the following formula:

$$PEC = (Pc \cdot tc)/(1000) \quad \text{(B.8)}$$

with:

Pc = Power condensate evaporator pan heaters input, W [W]

tc = Time condensate evaporator pan heaters are on in 24 h period, h [h]

B.3.8 Other Electric Energy Consumption

If there are additional options that decrease or increase the electrical units, they shall be noted under "Other Loads" with an appropriate calculation for energy consumption expressed in kW•h per day.

B.3.9 Alternate Components - Effect on DEC

When removing or replacing an electric component the energy consumption of substituted or alternate components shall be measured or can be calculated using the Formula (B.4), (B.5), (B.6), (B.7), (B.8) and the component's nameplate rating. In this case, the energy usage of the substituted or alternate components shall be used to recalculate the DEC using the Formula (B.3) and changing the value (FEC, LEC, AEC, DFEC, PEC) corresponding to measurement/calculation of the specific component substituted.

When calculating the fan motor energy (FEC) for substituting a fan motor, the airflow rate produced from the assembly shall be equal to the original configuration.

B.4 Data Requirements for rating of gelato Scooping Cabinets with remote condensing unit

B.4.1 General

This section identifies the necessary data required to calculate the Specific Daily Energy Consumption values (SDEC) at Standard Rating Conditions for gelato scooping cabinet with remote condensing unit from measured data or from calculated data when, alternate or additional electrical components are applied.

The SEC value is expressed by the formula:

$$TEC/TDA \text{ [kWh/24h*m}^2\text{]} \quad \text{(B.9)}$$

The TEC value is given by the sum of the Total Direct Daily Energy consumption (DEC) with the Total Daily Refrigeration Energy Consumption (REC) and expressed by the formula:

$$TEC = DEC + REC \text{ [kWh/24h]} \quad \text{(B.10)}$$

The Evaluation of the DEC is given by the same method described for gelato scooping cabinet with internal condensing unit.

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[3] EN 12830, *Temperature recorders for the transport, storage and distribution of chilled, frozen, deep-frozen/quick-frozen food and ice cream - Tests, performance, suitability*

[4] ISO 817, *Refrigerants — Designation and safety classification*

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