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Commercial beverage coolers — Classification, requirements and test conditions

Meubles frigorifiques de vente pour boissons — Classification, exigences et conditions d'essai

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Foreword

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

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

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

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

Commercial beverage coolers — Classification, requirements and test conditions

1 Scope

This document specifies the classification for commercial beverage coolers and their requirements and test methods. This document is applicable to integral refrigeration systems.

This document is not applicable to remote and secondary system cabinets.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 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*

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

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

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

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

3.1 Types of commercial beverage coolers

3.1.1
commercial beverage cooler
refrigerated cabinets to sell and/or display pre-packaged beverage products that are non-perishable, designed to chill products loaded at ambient temperature to the defined storage temperature class within a specified time and for which the customer is allowed direct access to the products

Note 1 to entry: In Annex A there is the designation of the commercial beverage cooler family.

Note 2 to entry: The customer is an organization or person that receives a product; customer can be internal or external to the organization.

EXAMPLE Consumer, client, end-user, retailer, beneficiary and purchaser.

3.1.2
vertical commercial beverage cooler
beverage cooler with overall height between 0,5 m and 2,2 m

3.1.3
semi-vertical commercial beverage cooler
vertical beverage cooler for which the overall height does not exceed 1,5 m and having either a vertical or inclined display opening

3.1.4
horizontal commercial beverage cooler
beverage cooler with horizontal display opening on its top and accessible from above

3.1.5
open commercial beverage cooler
horizontal/vertical/semi-vertical beverage cooler where there are not barriers for the access to the displayed products

Note 1 to entry: Do not consider night covers as a barrier for the access to the displayed products.

3.1.6
closed commercial beverage cooler
horizontal/vertical/semi-vertical beverage cooler where access to the displayed product is gained by opening a door or a lid (transparent or solid)

3.2 Parts of commercial beverage coolers

3.2.1
air discharge
opening from which the air curtain emerges

3.2.2
air return
opening at which the air curtain flows back to the evaporator or heat exchanger inside the commercial beverage cooler air ducts

3.2.3
shelf
surface excluding the base deck, on which the goods are displayed

3.2.4
night cover
cover permanently integrated into the commercial open beverage cooler used to reduce the heat ingress (e.g. by infrared radiation or convection)

EXAMPLE Covers can be a night curtain, night blind, night lid.

3.2.5
front
side of the commercial beverage cooler facing the consumer

3.2.6
base deck
lowest display surface of a commercial beverage cooler

3.3 Physical aspects and dimensions

3.3.1
refrigerated shelf area
refrigerated display area where the vertical clearance above any shelf or base deck is greater than or equal to 125 mm, measured perpendicularly above the plane of the shelf or base deck and within the bounds of any load limit

3.3.2
depth
horizontal distance, including rear spacers for air circulation channel, between the front and the rear of the commercial beverage cooler

3.3.3
width
horizontal distance between the two external sides of the commercial beverage cooler

3.3.4
height
vertical distance from the floor to the top of the commercial beverage cooler

Note 1 to entry: If the commercial beverage cooler has adjustable feet, the height defined shall be the minimum and the maximum height necessary at installation of the cooler.

3.3.5
load limit
boundary surface consisting of a plane or several planes within which all M-cans can be maintained within the limits for the M-cans temperature class declared

3.3.6
load limit line
permanently marked boundary line denoting the edge of the load limit surface

3.3.7
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.

3.3.8
gross volume
volume within the inside walls of the commercial beverage cooler or compartment, including internal fittings, doors or lids, if any, with these being closed, and with the load limit being taken into account if the commercial beverage cooler has no door or lid

3.3.9
equivalent volume
V_{eq}
reference volume corrected for compartment classification differences

3.3.10
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.

3.3.11
footprint
surface occupied by the commercial beverage cooler

3.4 Terms and definitions relating to performance characteristics

3.4.1
air curtain
air flow going from the air discharge towards the air return, thereby limiting both heat and mass transfers between the commercial beverage cooler's gross volume and the surrounding environment

3.4.2
normal conditions of use
operating conditions which exist when the commercial beverage cooler, 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 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.

3.4.3
energy management device
EMD
electronic device that automatically controls the refrigeration system and/or other key components of the commercial beverage cooler during the standby mode

EXAMPLE Lights, fans.

3.4.4
standby mode
state in which commercial beverage cooler's lighting, refrigeration and/or other energy-using systems are automatically adjusted such that they consume less energy than they consume in an active mode

Note 1 to entry: In the case of commercial beverage coolers, equipped with an EMD and with night cover built in, or night lid built in, the EMD standby mode is activated manually when the night curtain or night lid is down.

Note 2 to entry: In the case of commercial beverage coolers, equipped only with night cover built- in, or night lid built-in for the energy consumption test refer to 6.3.8.

3.4.5
active mode
state in which the commercial beverage coolers are in the average temperature defined for the product class, also lighting and/or other energy-using systems are on

3.4.6
EMD product average temperature
temperature that allows the commercial beverage cooler, that has been in standby mode for 12 h, to recover the average product temperature defined for each product temperature class in a recovery time less than 4 h

3.4.7
half reload
capability of the beverage cooler to lower all product temperatures within a specified time after half of the products are removed and reloaded with product at ambient temperature

3.4.8
defrosting
removal of frost, snow and ice from a commercial beverage cooler

3.4.9
automatic defrosting
defrosting where no action is necessary by the user to initiate the removal of frost accumulation and to restore normal operation

Note 1 to entry: It includes automatic removal of defrost water.

3.4.10
automatic removal of defrost water
removal and/or evaporation of defrost water that does not require any action by the user

3.4.11
manual removal of defrost water
removal of defrost water that requires an action by the user

3.4.12
specific energy consumption
SEC
index of the efficiency of the *commercial beverage cooler* (3.1.1), expressed as the ratio of TEC divided by *equivalent volume* (3.3.9)

Note 1 to entry: SEC is expressed in kilowatt hours per 24 h per m^3 [kWh/24 h·m^3].

3.5 Terms and definitions related to test environment

3.5.1
M-can
test can used to simulate the product during tests, 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-cans temperature class
classification of test temperature according to temperatures of warmest and coldest M-cans during the temperature test

3.5.4
commercial beverage cooler classification
designation given by the combination of climate class and M-cans temperature class

4 Symbols and abbreviated terms

t_{run}	running time — time during which compressor is running in normal condition within 24 h
t_{stop}	stopping time — time during which compressor is not running (or solenoid valve is close) within 24 h
t_{deft}	defrost time — time during defrost during which compressor is not running (or solenoid valve is closed) or secondary refrigerant is generally not circulating, within 24 h, but not considered as stopping time
t_{pull}	pull down time – time to pull down the temperature of the beverages from the ambient temperature to the defined temperature class
t_{hr}	half reload time – time to recover the beverage cooler temperature after the half reload with product at ambient temperature
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)
Δt	time between two consecutive measuring samples
N_{max}	number of measuring samples in 24 h
n_{deft}	number of defrosts during 24 h
TEC	total energy consumption in kWh per 24 h

SEC specific energy consumption for commercial beverage cooler expressed in kWh/24 h·m^3 (TEC/V_{eq})

t_{rr} relative or percentage running time

θ temperature

θ_m average mean temperature

θ_{ah} highest temperature of warmest M-cans

θ_b lowest temperature of coldest M-cans

V_{eq} equivalent volume

5 Classification and requirements

5.1 Classification according to temperature

The performance of commercial beverage cooler 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 the following clauses.

Table 1 — Classification according to temperature

Class	Highest temperature, θ_{ah}, of warmest M-can colder than or equal to [°C]	Lowest temperature, θ_b, of coldest M-can warmer than or equal to [°C]	Average temperature equal to or less than [°C]
K_1	+7,0	0,0	3,5
K_2	+6,0	−1,0	2,5
K_3	+1,0	−3,5	−1,0
K_4	+9,0	1,0	+5,0
S	Special classification		
NOTE The M-can temperature classes are measured with an expanded measurement uncertainty of ±0,8 °C.			

5.2 Construction

5.2.1 General

5.2.1.1 Strength and rigidity

The commercial beverage cooler 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, including shelves, baskets, rails, etc. and their supports, shall be sufficiently strong for the duty required;

b) where sliding shelves, baskets, trays or drawers 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 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.

5.2.1.3 Condensate drainage

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

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 Wear resistance

Internal and external finishes shall be resistant to wear and capable of being cleaned effectively and hygienically. Finishes shall not crack, chip, flake, rub off or soften under normal conditions of use or during cleaning.

5.2.2.3 Corrosion resistance

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

5.2.3 Thermal insulation

5.2.3.1 Efficiency

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.

5.2.3.2 Vapour barrier

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

5.2.3.3 Containment of insulation material

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.

5.2.4 Refrigerating system

5.2.4.1 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 commercial beverage cooler is in operation or at rest.

For commercial beverage coolers with 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.

5.2.4.2 Condensation

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

5.2.4.3 System protection

For commercial beverage cooler fitted with doors or lids, the refrigerating system shall suffer no damage if any door or lid in the commercial beverage cooler is left open while the commercial beverage cooler is operating in an ambient temperature corresponding to the climate class (see Table 1) for which the commercial beverage cooler is intended.

When the door or 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.

5.2.4.4 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 or secondary refrigerant, due to their toxicity, flammability etc. Guidance on this point is available in ISO 5149-2.

5.2.5 Electrical components

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

6 Tests

6.1 General

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

Table 2 lists the tests and inspections. Commercial beverage cooler shall comply with the requirements specified in this part of standard using the appropriate test method.

Table 2 — Test summary

Tests and inspections	Requirement clause in this document	Test method	Test room
Seal test	—	6.2.2	Outside test room (see 6.2)
Absence of odour and taste (not compulsory)	—	Annex E	
Durability of door and lid			
Temperature	5.1	6.3.11	Inside test room (see 6.3)
Water vapour condensation	5.2.4.2	6.3.12	
Energy consumption		6.3.13	
Half reload recovery		6.3.11.3	

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 doors and lids

The effectiveness of doors or lids provided to ensure a seal shall be tested as follows (with the commercial beverage cooler not running). See Figure 1.

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 door or lid closed normally on it the strip of paper shall not slide freely.

NOTE 1 Attention is drawn to the fact that some commercial beverage coolers having doors provided to ensure an air seal 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 commercial beverage cooler can be 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 commercial beverage cooler closed and lighted from the inside.

6.2.3 Test on durability of door and lid

6.2.3.1 Test condition/preparation

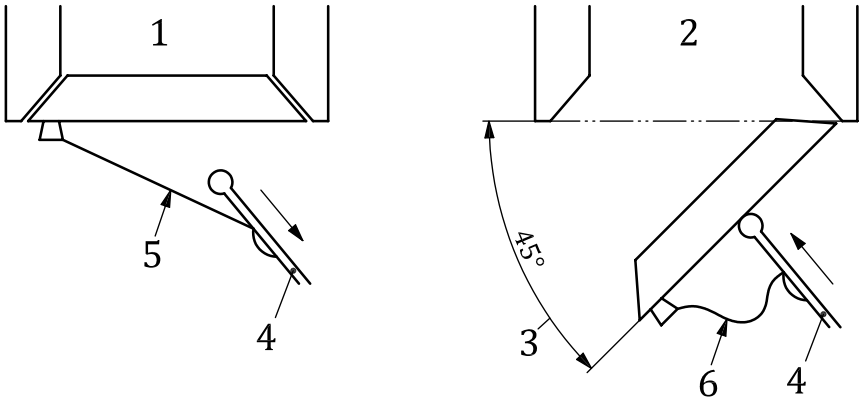
The purpose of these tests, carried out using the following procedures, is to check the durability of the hinges and handles of doors. The ambient temperature shall be between +16 °C and +32 °C. The refrigerating appliance shall be switched off.

6.2.3.2 Opening sequence

The movement of the door shall be controlled from an angle of 0° to an angle of opening between 5° and 45°, followed by a free movement of the door, the controlled movement being approximately sinusoidal. The opening of the door shall take place in the first quarter of the period of the cycle.

6.2.3.3 Closing sequence

The number of cycles per minute shall be 10 to 25. External doors shall withstand 100 000 opening and closing operations without deterioration which could be prejudicial to the airtightness of the door.



Key

1 door opening
2 door closing
3 angle of closing
4 pusher
5 taut cable
6 slack cable

Figure 1 — Durability of lids and doors

6.2.4 Linear dimensions, areas and volumes

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

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

When measuring the net volume parts necessary for the proper functioning of the commercial beverage cooler, including shelves used in the calculation of the refrigerated shelf area, these shall be fitted as intended and the volume representing the space occupied by these parts deducted.

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;

— reload test.

These measurements should be made simultaneously.

In the following, general testing conditions which are common for all tests carried out inside the test room are defined. These conditions concern the test room, the test and M-can, and the measuring instruments.

6.3.2 Test room condition

6.3.2.1 General 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 commercial beverage cooler to be tested and on the location of the display opening of the commercial beverage cooler.

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 lx ± 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/lm.

The walls, ceilings and any partitions of rooms intended for the testing of commercial beverage coolers shall be painted in light grey (e.g. NCS 2706-G90Y or RAL 7032) with an emissivity between 0,9 and 1 at 25 °C.

6.3.2.2 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 at 25 °C and 60 % RH;

— measuring the velocity, temperature and relative humidity (RH) 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 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). The exception to this is test room climate class CC1, for which the tolerance of the relative humidity is instead ±3 units.

Table 3 — Test room climate classes and half reload test

Test room climate class	Dry bulb temperature (°C)	Relative humidity (%)	Max half reload recovery time (see 6.3.11.3) (h)
CC1	25,0	60	≤13,0
CC2	32,2	65	≤16,0
CC3	40,6	75	≤20,0

6.3.2.4 Test room climate measuring point

The point for measurement of ambient temperature and relative humidity shall be midway along the length of the commercial beverage cooler and in accordance with Figures 2 to 5.

For commercial beverage cooler, the warm condenser air flow shall be prevented from influencing the temperature at the measuring point by air deflectors or other suitable means.

Dimensions in millimetres

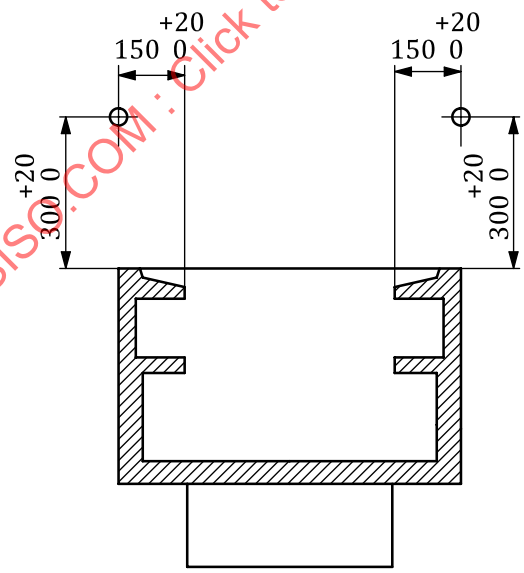


Figure 2 — Climate measuring point for horizontal commercial beverage cooler

Dimensions in millimetres

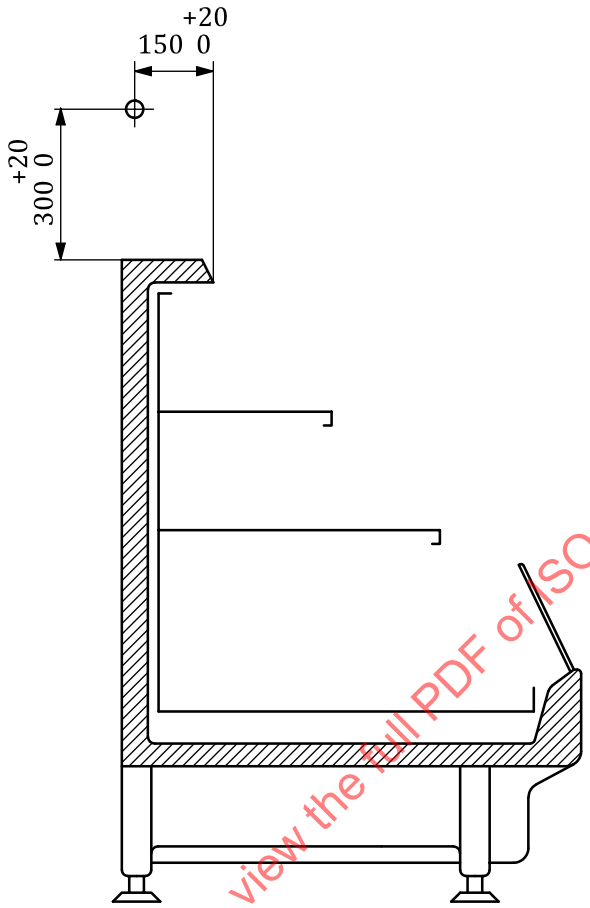


Figure 3 — Climate measuring point for semi vertical commercial beverage cooler

Dimensions in millimetres

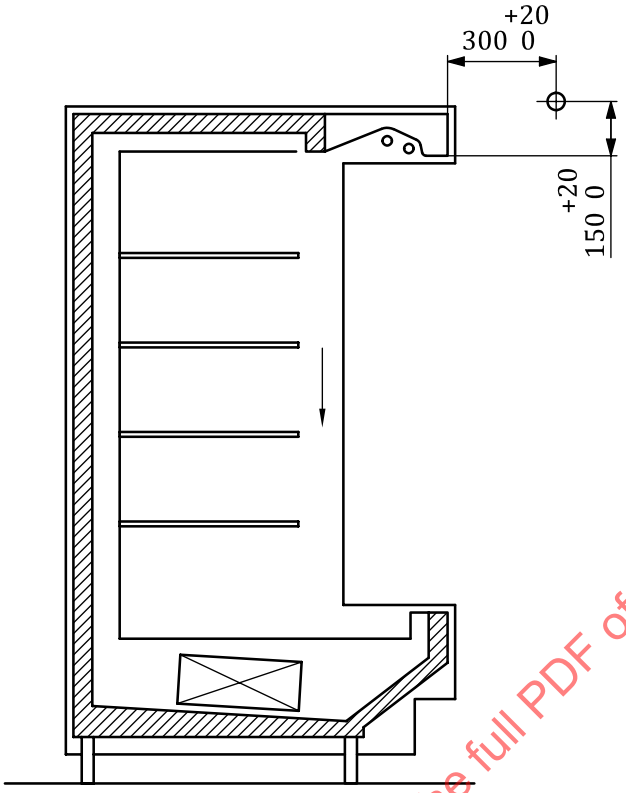


Figure 4 — Climate measuring point for vertical open commercial beverage cooler

Dimensions in millimetres

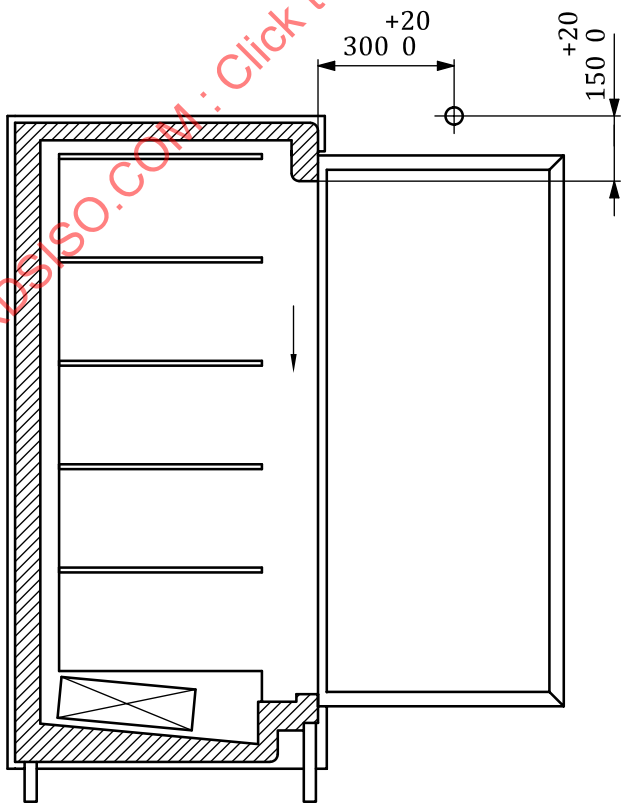


Figure 5 — Climate measuring point for vertical closed commercial beverage cooler

6.3.3 M-can

6.3.3.1 General

M-cans shall be reference cans having height 115 mm and diameter 66 mm and shall be filled with 330 ml of a 33 % Propylene Glycol/ 67 % water mixture (based on weight percentage).

The same dimensions and filling apply to all other cans than M-cans loaded in the commercial beverage cooler under test.

6.3.3.2 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 ±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 ±10 %.

— Relative humidity shall be measured to an expanded measurement uncertainty of ±3 %.

— Electrical energy consumption shall be measured to an expanded measurement uncertainty of ±2 %.

— Time interval measurements shall be made to an expanded measurement uncertainty of ±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 m/s to 1,5 m/s in horizontal flow at the temperature of the selected ambient class.

6.3.4 Preparation of test commercial beverage cooler and general test procedures

6.3.4.1 Commercial beverage cooler selection, installation and positioning within the test room

Each commercial beverage cooler 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 commercial beverage cooler, 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 cabinet shall be located as follows (see Figure 6):

— $X \geq 1,5$ m and B ≥ 0,5 m for vertical closed commercial beverage cooler of length less than 1,6 m and horizontal closed cabinets;

— $X = 2$ m and B ≥ 1 m for all other cabinets;

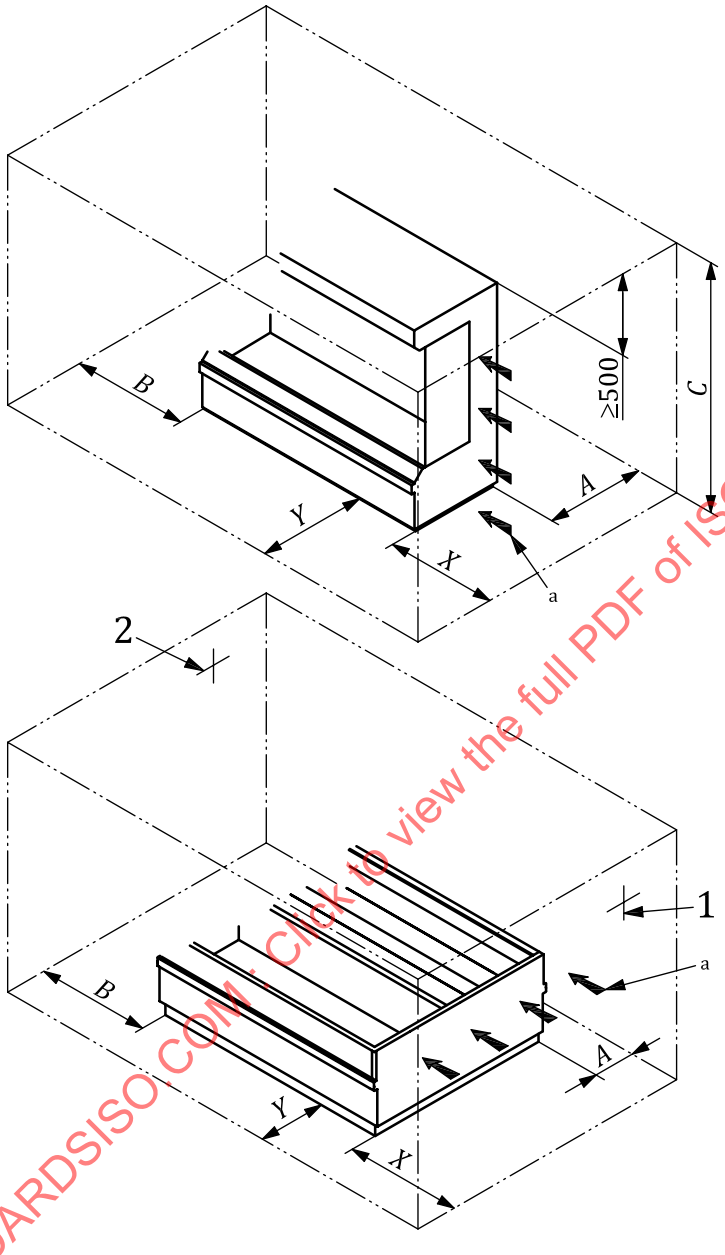
— $Y \geq 1,5$ m for open vertical commercial beverage cooler and combined commercial beverage cooler;

— $Y \geq 0,8$ m for horizontal commercial beverage cooler, vertical cabinets with glass doors and combined cabinets with glass door top;

— $A = 100$ mm;

— $C \geq$ height of cabinet + 0,5 m (for vertical cabinets).

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 6 — Cabinet location within test room

6.3.4.2 Air movement

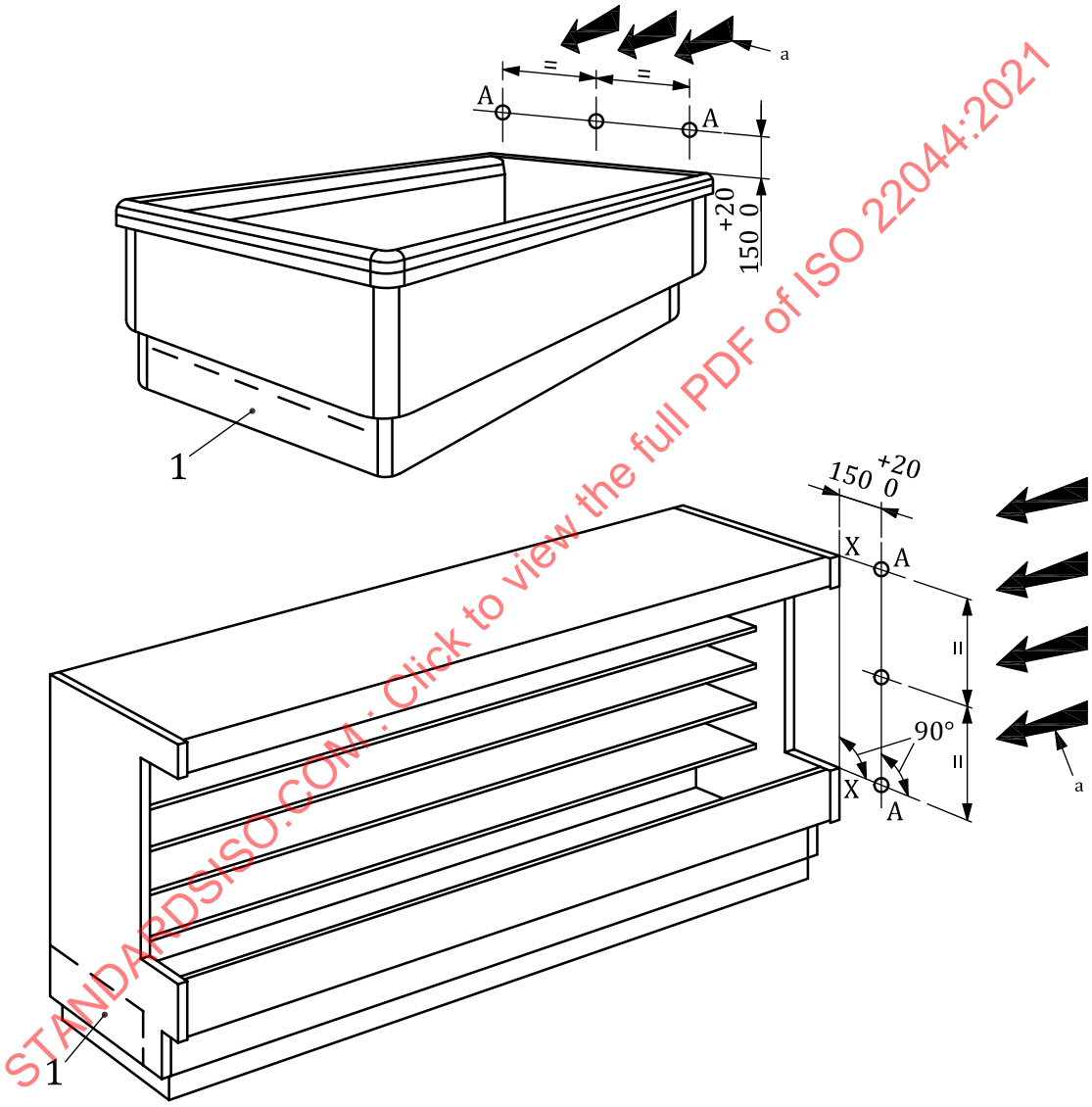
Air movement shall be provided (see Figure 7). The air movement shall be, as far as practicable, parallel to the plane of the cabinet display opening and to the longitudinal axis. The length of the cabinet is defined as the longest horizontal dimension of the display opening. With the refrigerated display cabinet switched off, the air velocity at the three points along the line shown in Figure 7 shall be 0,2 m/s to 0,1 m/s.

For closed commercial beverage coolers 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 door(s) or lid(s) is (are) open.

The majority of the lids shall open in order to allow the air entry into the cabinet; if lids can be indifferently hinged left and right, all shall open in the same direction.

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 testing authority.

Dimensions in millimetres



Key

A-A line for the measurement of the air velocity

X-X reference line joining the end of the upper part and the end of the lower part of the cabinet

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 Loading the commercial beverage cooler

6.3.5.1 General

— The number and placement of the shelves inside the commercial beverage cooler shall be chosen to obtain the maximum load capacity of the unit.

— Install the shelves in the commercial beverage cooler starting with the bottom shelf. Install this shelf on the lowest position available.

— Measure the gap from the top of the M-cans to the lowest portion of the next higher shelf to make sure the shelves are evenly spaced.

— The M-cans shall have a temperature sensor in the geometric centre of the can.

— The M-cans and cans shall be placed at the position shown in Figures 8 to 10.

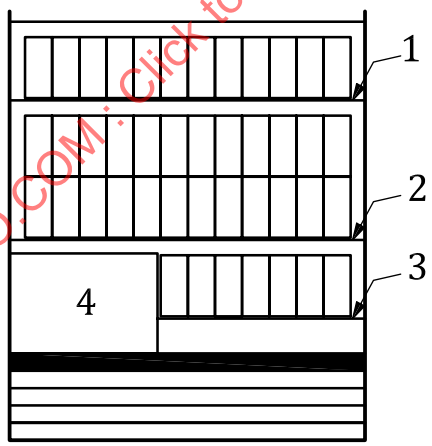
6.3.5.2 M-cans loading

6.3.5.2.1 Vertical closed commercial beverage cooler

A double stack of cans shall be loaded into the commercial beverage cooler in a vertical position and done so without twisting or rotating the cans, see Figure 8. If the top shelf cannot accommodate a double stack due to lack of height, then a single layer of cans shall be loaded.

Place the cans side-by-side on the shelves. Do not stagger or force them into position.

In the event the cooler is designed with some obstruction in the lower part of the cabinet (e.g. compressor housing), position the lower shelves so that the cans next to the obstruction can be placed in an upright position. This may mean positioning a shelf higher than the top of the housing.

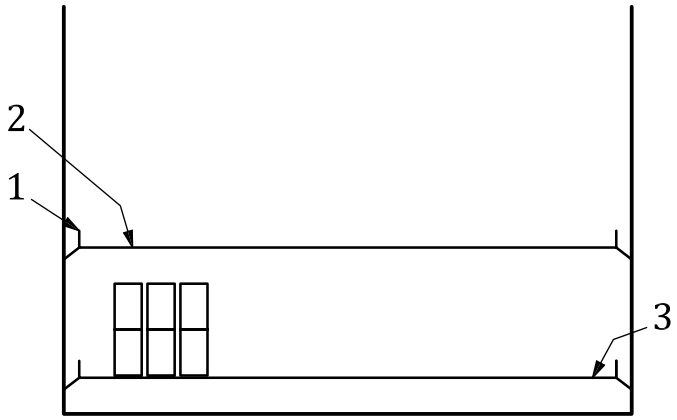


Key

1 top shelf single
2 lowest full shelf
3 compressor well
4 compressor box

Figure 8 — Commercial beverage cooler sectional view

Completely load the shelf, cans shall be aligned in the middle, starting with the bottom shelf or base deck, see Figure 9. Load the cans as far back as the shelving allows. Do not allow cans to overhang the front edges of the shelves. In the width direction of the shelf the maximum number of cans shall be loaded, taking into account load limits.

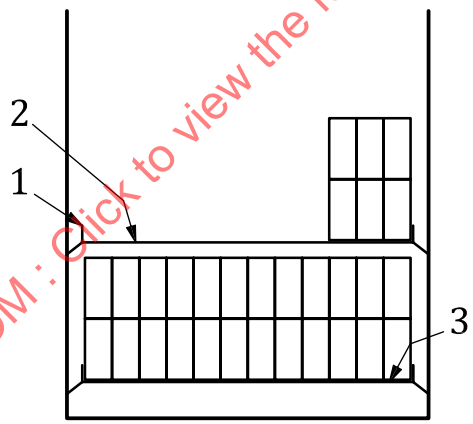


Key

1 side product stop
2 second shelf
3 bottom shelf

Figure 9 — Commercial beverage cooler front view: loading phase 1

Continue loading the commercial beverage cooler repeating the previous steps until the cabinet is fully loaded (see Figure 10).



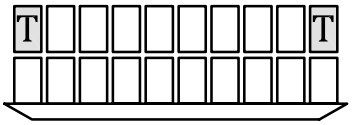
Key

1 side product stop
2 second shelf
3 bottom shelf

Figure 10 — Commercial beverage cooler front view: loading phase 2

6.3.5.2.2 Single door commercial beverage cooler

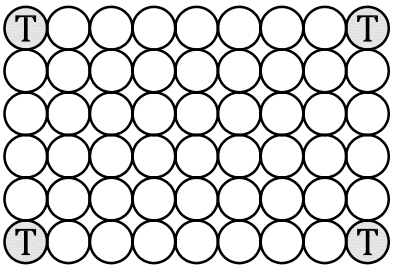
For single door commercial beverage cooler, load each shelf with four test M-cans on the top layer of each shelf (see Figure 11).



Key
T M-can

Figure 11 — Commercial beverage cooler front view glass door merchandiser shelf

Place one test M-can at each corner of the shelf. Refer to Figure 12.

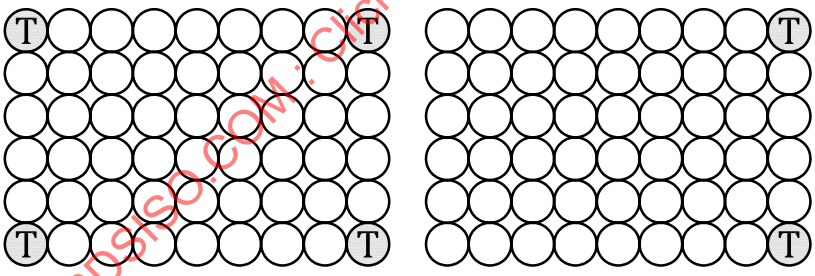


Key
T M-can

Figure 12 — Commercial beverage cooler: single-door merchandiser bottom shelf top view

6.3.5.2.3 Double-door commercial beverage cooler

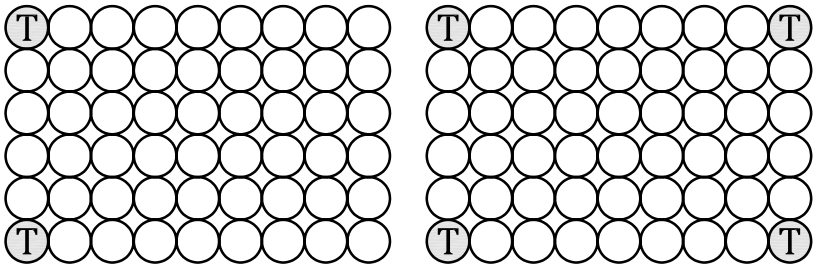
For double-door commercial beverage cooler load each shelf, with six tests M-cans, see Figure 13.



Key
T M-can

Figure 13 — Commercial beverage cooler: double-door merchandiser bottom shelf top view

Load the second shelf from the bottom and alternate the location of the centre test M-cans, see Figure 14.



Key

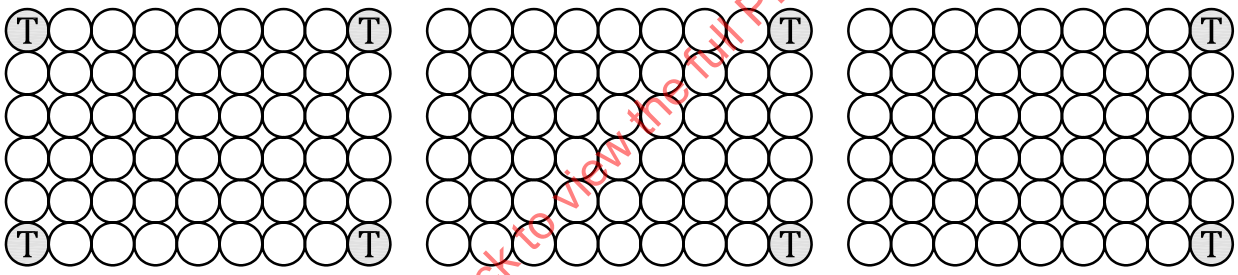
T M-can

Figure 14 — Commercial beverage cooler: double-door merchandiser second and fourth shelves top view

Continue to alternate the location of the centre test M-cans as you load the cabinet from the bottom.

6.3.5.2.4 Triple-door commercial beverage cooler

For triple-door commercial beverage cooler, load each shelf, with eight temperature measurement sensors, see Figure 15.

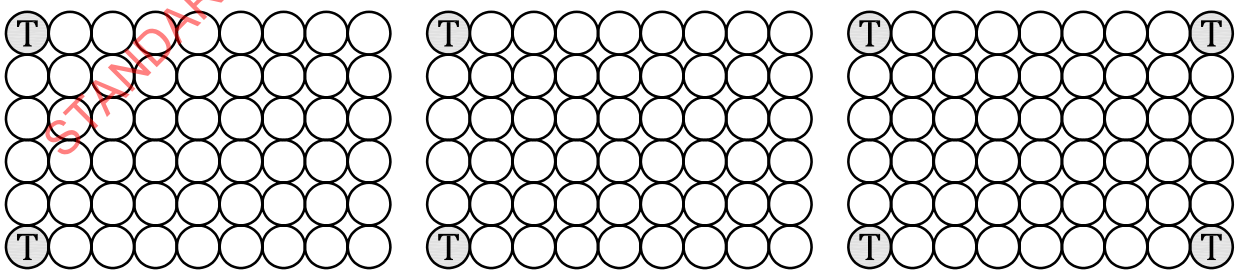


Key

T M-can

Figure 15 — Commercial beverage cooler: triple-door merchandiser bottom shelf top view

Load the second shelf from the bottom and alternate the location of the centre test M-cans. See Figure 16.



Key

T M-can

Figure 16 — Commercial beverage cooler: triple-door merchandiser second and fourth shelves top view

6.3.5.2.5 Horizontal commercial beverage cooler

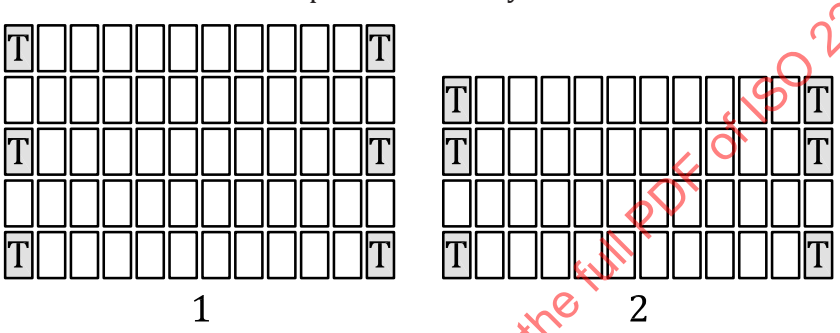
The descriptions and examples on the following pages detail the specific locations and numbers of test M-cans in each layer of a single-door, double-door, or triple-door horizontal commercial beverage cooler.

Load horizontal commercial beverage cooler with six-packs and/or single, product cans. Stack the cans vertically.

Place the cans side-by-side in each layer to fill the commercial beverage cooler. Do not stagger or force the cans into position.

The number and location of the test M-cans depends on the vertical capacity (number of can layers) and the number of commercial beverage cooler doors.

Place the appropriate number of test M-cans in every other layer as you fill the horizontal commercial beverage cooler. Place test M-cans in the top and bottom layers of horizontal coolers. See Figure 17.



Key

T M-can

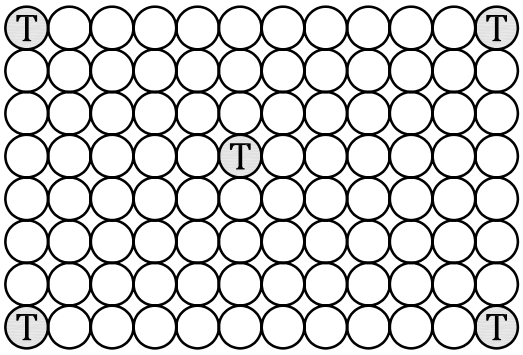
1 single-door horizontal cooler front

2 horizontal cooler front view

Figure 17 — Horizontal commercial beverage cooler: single-door front view

6.3.5.2.6 Single-door horizontal commercial beverage cooler

Place five test M-cans in each appropriate layer of cans in the cooler, see Figure 18.



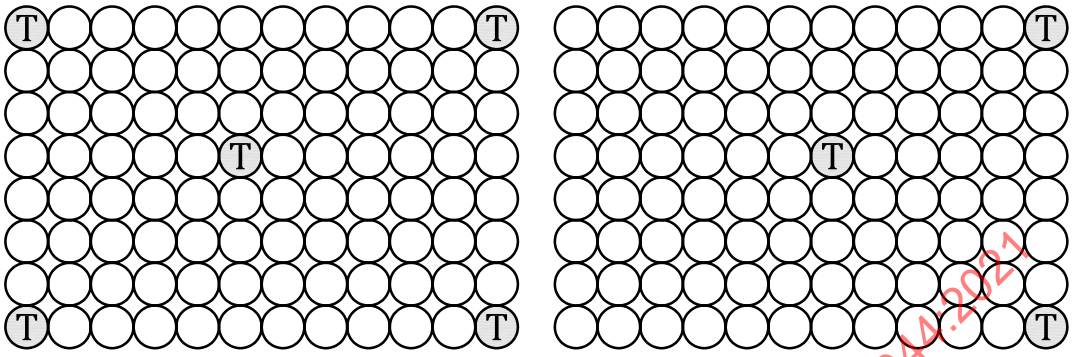
Key

T M-can

Figure 18 — Horizontal commercial beverage cooler top view

6.3.5.2.7 Double-door horizontal commercial beverage cooler

Place eight test M-cans in each appropriate layer of cans in the commercial beverage cooler, see Figure 19.



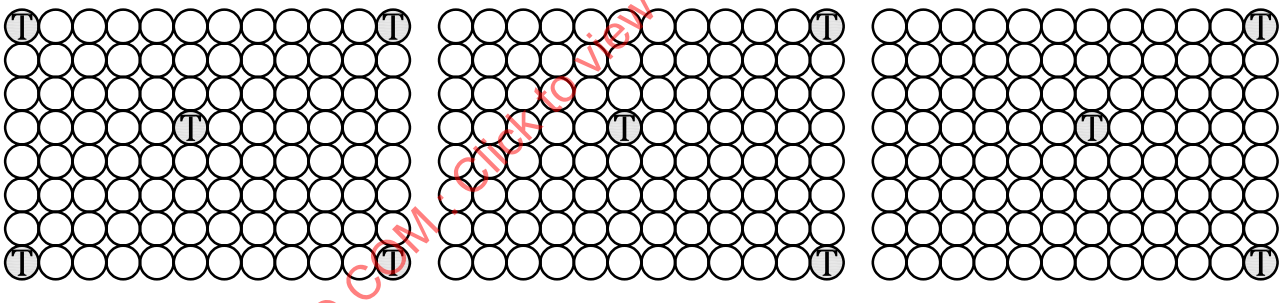
Key

T M-can

Figure 19 — Horizontal commercial beverage cooler double door top view

6.3.5.2.8 Triple-door horizontal commercial beverage cooler

Place eleven test M-cans in each appropriate layer of cans in the commercial beverage cooler. See the following example in Figure 20.

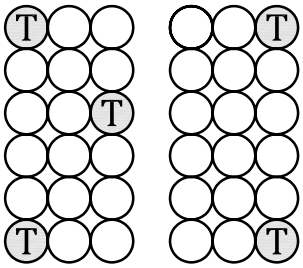


Key

T M-can

Figure 20 — Horizontal commercial beverage cooler triple door top view

Place five test M-cans per layer in multi-door horizontal commercial beverage cooler, which have less than eight M-cans across the width of the entire cooler. See Figure 21.



Key

T M-can

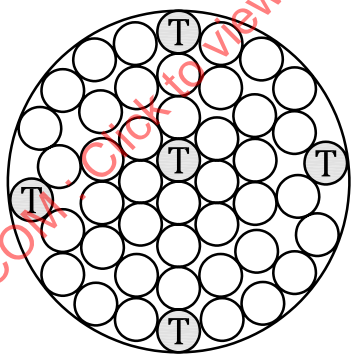
Figure 21 — Horizontal commercial beverage cooler double door, with less than 8 cans across, top view

6.3.5.2.9 Round "Barrel" commercial beverage cooler

Load round "Barrel" commercial beverage cooler with single product cans stacked in the vertical position.

Place the M-cans in a manner which allows each level to be completely loaded with minimal air gaps. The number and location of the test M-cans depends on the vertical capacity, (number of can layers) in the commercial beverage cooler.

Place five test M-cans in each appropriate layer of cans in the commercial beverage cooler (see Figure 22).

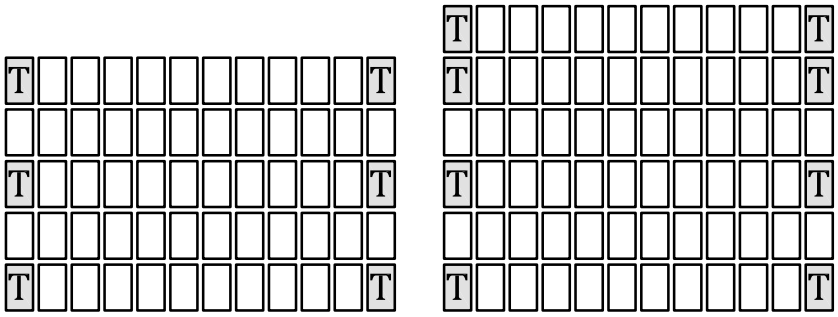


Key

T M-can

Figure 22 — Round barrel commercial beverage cooler top view

Place the appropriate number of test M-cans (based on the vertical capacity), in every other layer as you fill the cooler. Regardless of the number of layers, place test M-cans in the top and bottom layers of all round "Barrel" commercial beverage cooler. See the following illustrations in Figure 23.



Key

T M-can

Figure 23 — Round barrel commercial beverage cooler front view

6.3.5.2.10 Open vertical commercial beverage cooler

Commercial beverage cooler loading and temperature probe placement for open vertical commercial shall meet the loading requirements of vertical closed commercial beverage cooler (see 6.3.5.2.1 to 6.3.5.2.4) according to the following:

— open front coolers having width dimension < 800 mm will meet the single-door merchandiser loading requirements;

— open front coolers having width dimension > 800 mm, but < 1 600 mm will meet the double-door merchandiser loading requirements;

— open front coolers having width dimension > 1 600 mm will meet the triple-door merchandiser loading requirements.

6.3.6 Running in period

When a commercial beverage cooler is tested, the operating conditions shall comply with those stated by the commercial beverage cooler manufacturer.

Adjustable automatic controllers shall be set in such a way that the required M-can temperature class of the commercial beverage cooler is reached. Where the controller is not adjustable, the commercial beverage cooler shall be tested as delivered.

The manufacturer's recommended routine of defrosting shall be followed. Before tests are started, the commercial beverage cooler shall be switched on and allowed to run for at least 2 h at the specified climate class with no M-cans in the commercial beverage cooler and without erratic functioning of the refrigerating system, controls or defrosting operations. Otherwise, the running-in period shall be continued accordingly.

After loading, the cabinet shall be operated until stable conditions have been reached (see 6.3.7) and during the test period (see 6.3.11.2) the test room shall be maintained at the desired climate class as specified in 6.3.2.3, while the temperatures of the M-cans are recorded.

6.3.7 Stable conditions

A commercial beverage cooler is considered to operate under stable conditions if during a period of 24 h, the temperature of each M-can agrees within ±0,5 °C at the corresponding points on the temperature curve.

If the beverage cooler is fitted with lighting and/or night cover or door, stable conditions are to be reached with any lighting on continuously, with any night cover open and with any door(s) closed throughout.

6.3.8 Lighting and night-covers

For beverage coolers without EMD with lighting and night–cover the procedure described in Figure 26 and 27 shall be followed.

6.3.9 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.

6.3.10 Testing several commercial beverage coolers in the same room

If more than one commercial beverage cooler 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 commercial beverage cooler are in accordance with the test requirements specified in Clause 6.

6.3.11 Test with M-cans

6.3.11.1 General

After running in period and once the stable condition has been reached (see 6.3.7) different tests shall be carried out (referring to lighting or night-covers, indications in 6.3.8 shall be followed).

The commercial beverage cooler shall be located and loaded in accordance with 6.3.5 and 6.3.4.1, 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 of 24 h during which measurements shall be recorded.

The first test (described in 6.3.11) is the general temperature test, the second test is the half reload test (6.3.11.3) and the third and last test is the energy consumption test (6.3.11.3.6).

6.3.11.2 Temperature test

6.3.11.2.1 General

Coolers with EMD shall be tested in the active mode status with lighting on and night cover open. This test shall be performed for a duration of 24 h applying the rated climate class.

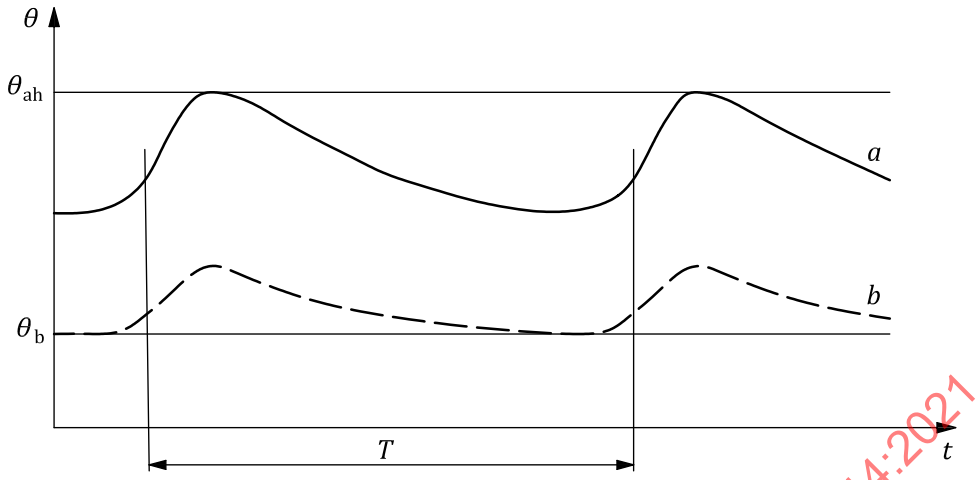
From the recorded temperatures of all M-cans, the following curves shall be plotted as a function of time:

a) the temperature of the warmest M-can (i.e. the one with the highest peak temperature θ_{ah}) (see curve *a* in Figure 24);

b) the temperature of the coldest M-can (i.e. the one with the lowest minimum temperature θ_{b}) (see curve *b* in Figure 24);

c) the arithmetic mean temperature of all M-cans (see curve *d* in Figure 25). All other M-cans temperatures shall be available for reference if required.

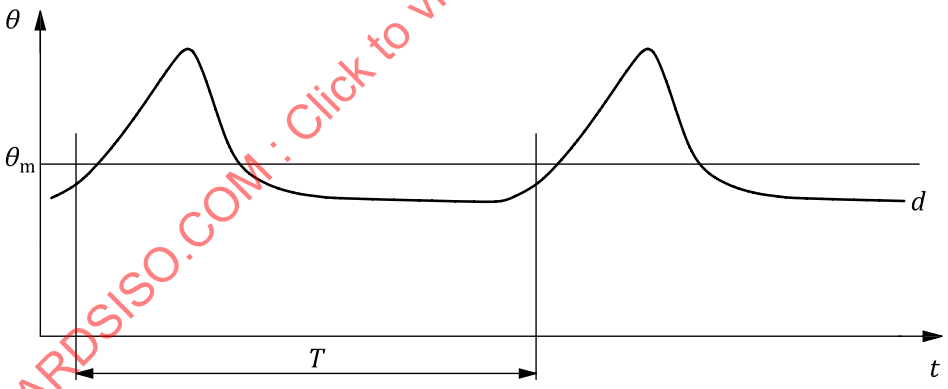
In the case of commercial beverage coolers with multiple temperature classes, curves *a*, *b* and *d* shall be prepared separately for each temperature class.



Key

θ	temperature
θah	highest temperature of warmest M-cans
θb	lowest temperature of coldest M-cans
t	time
T	test period
a	temperature curve a of warmest M-cans
b	temperature curve b of coldest M-cans

Figure 24 — Relevant temperature curves of M-cans



Key

θ	temperature
θ_m	average mean temperature
t	time
T	test period
d	curve d of arithmetic mean temperature of all M-cans

Figure 25 — Arithmetic mean temperature of M-cans (curve *d*)

6.3.11.2.2 Calculation of average mean temperature

The average instant temperature at measuring sample n of all M-cans, θ_{cn} (curve d in Figure 25), is expressed by the following equation:

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

where

n is the time index for the instant measuring sample

k is the index for the individual M-can

K_{maxd} is the number of all M-cans

$(\theta_k)_n$ is the instant measured temperature of M-cans k at measuring sample n

From these average instant temperatures the arithmetic mean temperatures of all M-cans θ_{md} for the test period shall be calculated as follows:

$$\theta_{md} = \frac{1}{N_{max}} \times \sum_{k=1}^{N_{max}} \theta_{dn} \quad (2)$$

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.

6.3.11.3 Half reload recovery test

6.3.11.3.1 Preparation

This test shall be performed at the rated climate class with lighting switched off, if possible and with night covers closed, if present. Coolers with EMD shall be tested with the active mode with lighting off.

Ensure 50 % of all packages cans are removed from the beverage cooler and ensure that the cooler operates in the active mode. If necessary possible EMD functionality may be switches off.

— For vertical and semi-vertical coolers: remove cans from the door back to the vertical centre line of the cooler. The test cans at the vertical and horizontal centre of the cooler is removed with these cans.

— For vertical and semi-vertical coolers with opposing doors, remove cans from both opposing doors toward the vertical centerline of the cooler.

— For horizontal coolers: remove cans from the top down to the midpoint of the cooler. The cans shall meet two stabilization criteria before starting this test:

a) Ambient cans

The to-be-reloaded cans shall stabilize in the ambient condition of the test room.

The temperature of the individual cans cannot deviate more than ±1,0 °C from the nominal ambient temperature and the average temperature of all cans should be within 0,5 °C of the nominal ambient temperature.

b) Cold cans in the cooler

After half of the load has been removed from the cooler, allow the remaining half of cans left in the cooler to stabilize. The cooler shall demonstrate regular compressor cycles.

6.3.11.3.2 Procedure

Open the door or night cover of the cooler and quickly reload the cooler. Place all of the cans in the proper locations as defined in 6.3.5.2.

Follow the door or night cover opening time requirement, as listed in Table 4. If loading is completed before time, door or night cover shall still be kept open until this time is achieved. Large coolers may require two people to reload products within the required frame.

Table 4 — Door or night cover opening time related to the cooler total capacity

Cooler total capacity	Required door/Night cover open time (min)
Greater than 800 cans	14
500 to 800 cans	10
300 to 500 cans	6
Less than 300 cans	4

Immediately following the reload, proceed as follows:

a) for all coolers except open coolers: close the door and let the cooler run undisturbed for 24 h.

b) for open coolers: fully close the night cover (lid, blind, curtain) and let the cooler run undisturbed for 24 h. If the cooler has a light switch, ensure the light is off during this period.

The end time of half reload is defined when the commercial beverage cooler achieves at the same time, all the temperature class specifications.

6.3.11.3.3 Half reload test at CC1

In 13 h or less, for product temperature class K_1 (see 5.1, Table 1), all M-can temperatures shall be reduced to, and then continuously maintained between 0,0 °C and 7,0 °C with an average of all M-cans below 3,5 °C.

In 13 h or less, for product temperature class K_2 (see 5.1, Table 1), all M-can temperatures shall be reduced to, and then continuously maintained between –1,0 °C and 6,0 °C with an average of all M-cans below 2,5 °C.

In 13 h or less, for product temperature class K_3 (see 5.1, Table 1), all M-can temperatures shall be reduced to, and then continuously maintained between –3,5 °C and 1,0 °C with an average of all M-cans below –1,0 °C.

In 13 h or less, for product temperature class K_4 (see 5.1, Table 1), all M-can temperatures shall be reduced to, and then continuously maintained between 1,0 °C and 9,0 °C with an average of all M-cans below 5,0 °C.

In 13 h or less, for product temperature class S (see 5.1, Table 1), all M-can temperatures shall be reduced to, and then continuously maintained between the highest temperature of the warmest M-can and the lowest of the coldest M-can with an average of all M-cans defined by the manufacturer.

Compressor's overload protection shall not be allowed during this test.

6.3.11.3.4 Half reload test at CC2

In 16 h or less, for product temperature class K_1 (see 5.1, Table 1), all M-can temperatures shall be reduced to, and then continuously maintained between 0,0 °C and 7,0 °C with an average of all M-cans below 3,5 °C.

In 16 h or less, for product temperature class K_2 (see 5.1, Table 1), all M-can temperatures shall be reduced to, and then continuously maintained between –1,0 °C and 6,0 °C with an average of all M-cans below 2,5 °C.

In 16 h or less, for product temperature class K_3 (see 5.1, Table 1), all M-can temperatures shall be reduced to, and then continuously maintained between –3,5 °C and 1,0 °C with an average of all M-cans below –1,0 °C.

In 16 h or less, for product temperature class K_4 (see 5.1, Table 1), all M-can temperatures shall be reduced to, and then continuously maintained between 1,0 °C and 9,0 °C with an average of all M-cans below 5,0 °C.

In 16 h or less, for product temperature class S (see 5.1, Table 1), all M-can temperatures shall be reduced to, and then continuously maintained between the highest temperature of the warmest M-can and the lowest of the coldest M-can with an average of all M-cans defined by the manufacturer.

No compressor's overload protection is allowed during this test.

6.3.11.3.5 Half reload test at CC3

In 20 h or less, for product temperature class K_1 (see 5.1, Table 1), all M-can temperatures shall be reduced to, and then continuously maintained between 0,0 °C and 7,0 °C with an average of all M-cans below 3,5 °C.

In 20 h or less, for product temperature class K_2 (see 5.1, Table 1), all M-can temperatures shall be reduced to, and then continuously maintained between –1,0 °C and 6,0 °C with an average of all M-cans below 2,5 °C.

In 20 h or less, for product temperature class K_3 (see 5.1, Table 1), all M-can temperatures shall be reduced to, and then continuously maintained between –3,5 °C and 1,0 °C with an average of all M-cans below –1,0 °C.

In 20 h or less, for product temperature class K_4 (see 5.1, Table 1), all M-can temperatures shall be reduced to, and then continuously maintained between 1,0 °C and 9,0 °C with an average of all M- cans below 5,0 °C.

In 20 h or less, for product temperature class S (see 5.1, Table 1), all M-can temperatures shall be reduced to, and then continuously maintained between the highest temperature of the warmest M-can and the lowest of the coldest M-can with an average of all M-cans defined by the manufacturer.

No compressor's overload protection is allowed during this test.

6.3.11.3.6 Energy consumption test

This test shall be performed at climate class CC1. Figures 26 and 27 present the test procedure for cooling with and without EMD.

For commercial beverage cooler fitted with energy management device (EMD), under stable condition and at test room climate class CC1 (see 6.3.2.3, Table 3), the EMD test shall be performed (see Figure 28).

For a duration of 12 h the commercial beverage cooler (at standby mode) shall maintain the EMD product average temperature. After this 12 h the commercial beverage cooler, in a recovery time less than 4 h, shall be again at the average temperature values described in Table 1.

For the performance and energy rating of commercial beverage coolers see Annex F.

In case the lighting cannot be switched off, the light shall be on during the test.

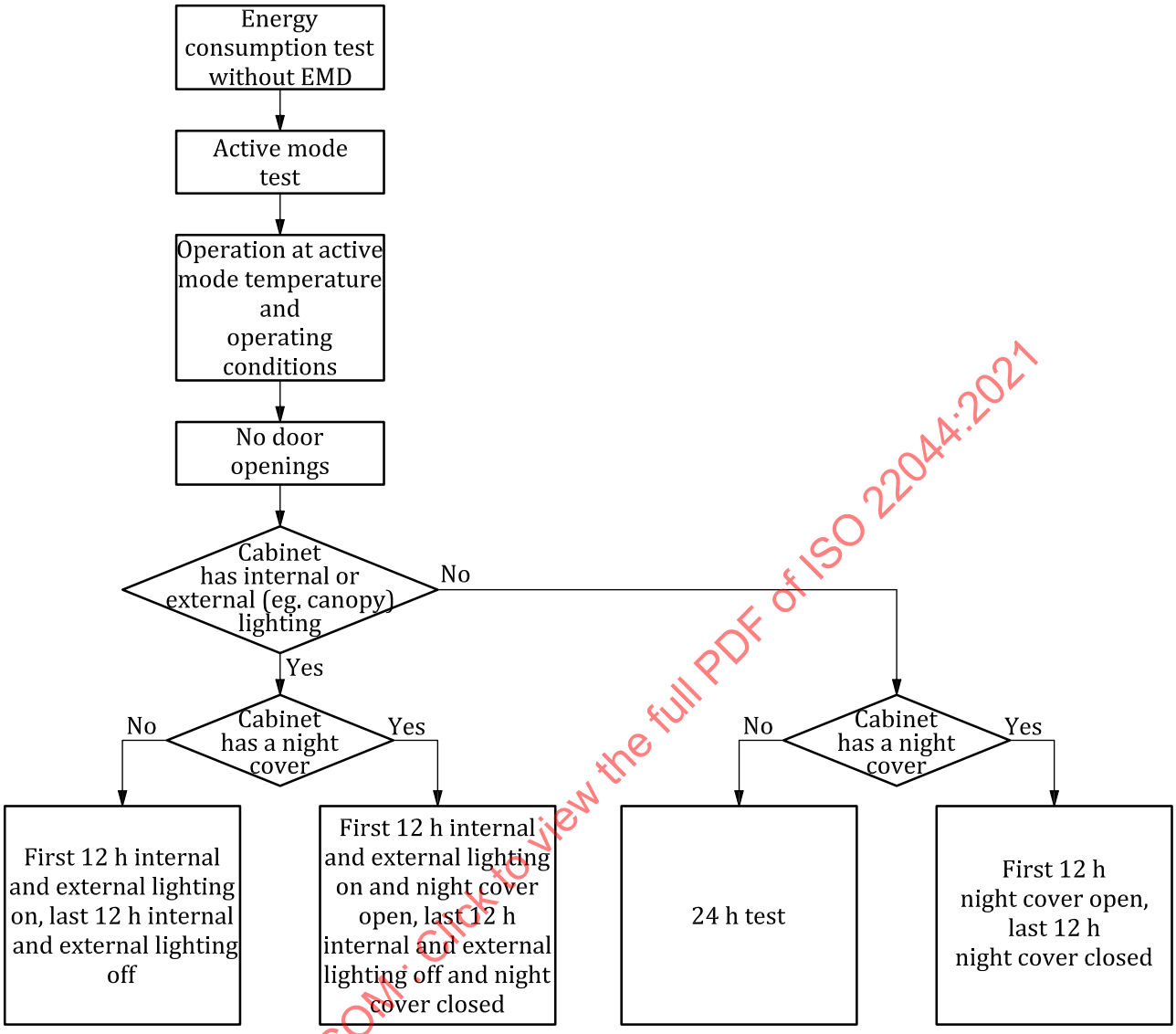


Figure 26 — Beverage coolers without EMD test procedure

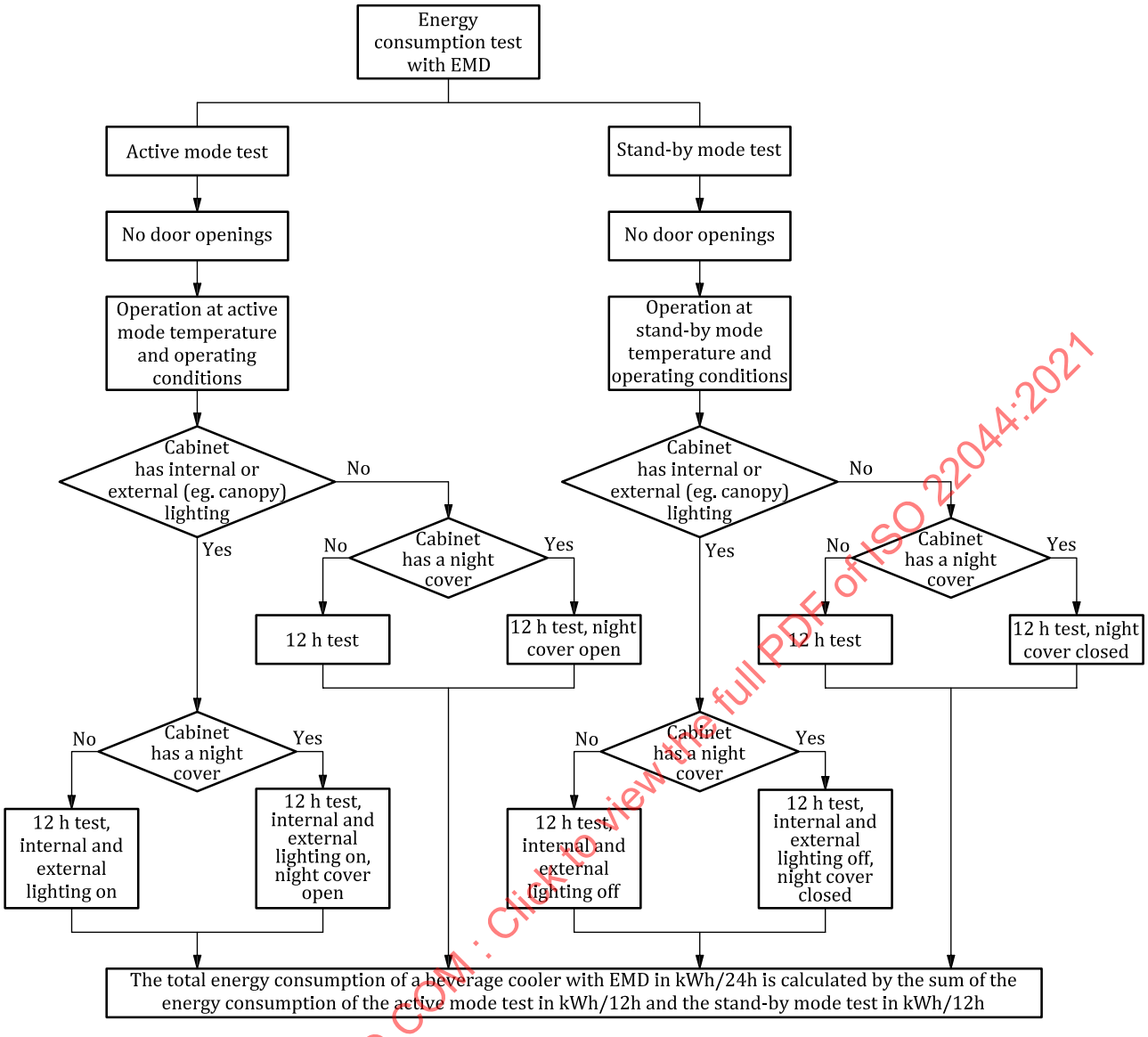
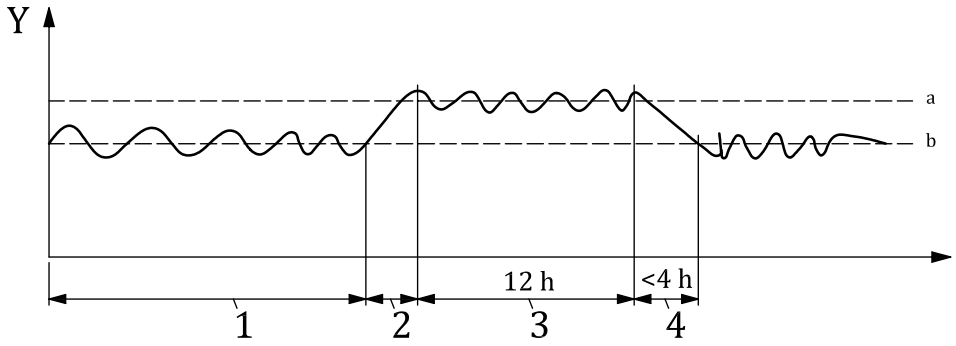


Figure 27 — Commercial beverage cooler fitted with energy management device (EMD) test procedure

Only after this test the manufacturer shall declare the EMD product average temperature (as defined in 3.4.6).



Key

Y T[°C]
1 active mode
2 transition time from active mode and standby mode
3 standby mode
4 recovery time
a EMD average product temperature.
b Average product temperature in active mode.

Figure 28 — EMD test

Just after the transition from the active mode to the standby mode TEC starts to be measured and recorded. TEC shall be measured and recorded during the whole standby mode (12 h).

6.3.12 Water vapour condensation test

6.3.12.1 Test conditions

The commercial beverage cooler shall be located and loaded in accordance with 6.3.4.1 and 6.3.5, 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 1), and then operated for the test period, during which measurements shall be recorded. Lighting and night-covers, if any, shall be manipulated according to 6.3.8. The test may be carried out during the temperature test.

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 commercial beverage cooler 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 commercial beverage cooler shall be carefully wiped dry with a clean cloth. If the commercial beverage cooler is fitted with automatic defrosting equipment this test period shall be selected during the period when condensation is most likely to occur.

6.3.12.2 Test results

The commercial beverage cooler 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 M-cans and — depending on the method used to detect water vapour condensation — provided the following results have been obtained:

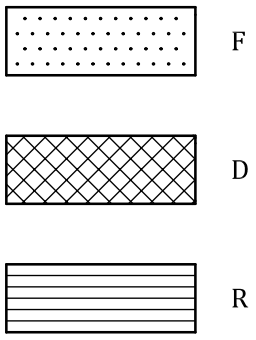
— all commercial beverage cooler surfaces, whether adjacent or otherwise, remain free of moisture by the provision of insulation, ventilation or heating to maintain a temperature above dew point for the climate class specified (Table 1);

— internal surfaces, wherever practical, remain free of moisture collection or ice gather;

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

6.3.12.3 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 (see Figure 29). 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 27 shall be used.



Key

F fog/mist
D droplets
R running

Figure 29 — Condensation code

The measured total energy consumption (TEC), reported in kWh/24 h (the number of decimal places shall be 2), 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),

For commercial beverage coolers without EMD, TEC shall be equal to the TEC measured for active mode temperature test (6.3.11.2) (TEC at active mode).

6.3.13 Calculation of specific energy consumption (SEC)

The value of SEC, representing the specific energy consumption for a commercial beverage cooler, is calculated from the formula:

$$SEC = TEC/V_{eq} \text{ [kWh/24 h·m}^3\text{]} \quad (3)$$

The equivalent volume (V_{eq}) value shall be calculated as specified in Annex C.

6.3.14 Lighting test

A lighting test is described in Annex G.

6.4 Test report

The information identified in Table 5, Table 6 and Table 7 shall be provided in a test report as a minimum. The format of test report can be as required. This listing is not intended to limit the data that may be obtained or reported.

Table 5 — Details of the cabinet under test, test conditions and preparation for test

Description	Determined according to Clause	Symbol	Unit	Number of decimal places
Brand and unique model number of cabinet	7.3			
Type of cabinet / description and configuration (Including for example, family designation from Annex A; open/closed; presence of night cover/ curtain and/or EMD and/or external and internal lighting etc.)	7.3			
Number of glass doors	6.3.4			
Number of solid doors	Table A.1			
The international number of the refrigerant (according to ISO 817)	7.2			
Footprint	3.3.11		m	2
Refrigerated shelf area	3.3.1		m	2
Total display area	Annex D	TDA	m	2
Net volume	Annex B		l	1
			m	4
Gross volume	C.2		l	1
External dimensions at installation (feet or castors to be included in height and set to minimum height if adjustable)	7.3	*D*, *H*, *W*	mm	0
Test room climate class for which the commercial beverage cooler is intended and in which the test has been made (CC1, CC2 etc.)	Table 3			
M-can temperature class in which the test has been made (K_1, K_2 etc.)	Table 1			
Total number of loaded-cans	6.3.5.2			
Statement that the test room, M-cans, instrumentation and test methods used are in accordance with this document, noting any exceptions	6.3.1			
Number of the figure from this document according to which the commercial beverage cooler was loaded, and number of cans loaded for pull-down test	Figure 9 and Figure 10			
The method of temperature control, defrost process, defrost termination, setting parameters	6.3.6			
Whether the test was made with night-covers for the stipulated portion of test	6.3.8			
Whether any lighting was switched on for the stipulated portion of the test	6.3.8			

For the temperature tests, half reload test and EMD test, the following graphs shall be reported:

— Graph 1:

First vertical axis is temperature (°C). Second vertical axis is relative humidity (%). Over the full duration of each test:

— temperature and relative humidity of the environmental room as defined in 6.3.2.4 test room climate measuring point;

— individual temperature of each M-can;

— where applicable the half reload time or EMD recovery time as text and marked in the graph.

— Graph 2:

First vertical axis is temperature (°C). Second vertical axis is electrical current (A). Over the full duration of each test:

— the minimum, average and maximum temperature of the M-cans;

— electrical current (A) showing the compressor cycles;

— where applicable the half reload time or EMD recovery time as text and marked in the graph.

Table 6 — Results of electrical energy consumption test

Clause no.	Description	Symbol	Unit	Number of decimal places
6.3.11.3.6	Total electrical energy consumption according to required formula combining temperature test and EMD test results	TEC	kWh/24 h	2
	Compressor switching on/off frequency			
	Relative running time			
3.4.12	Specific energy consumption (ratio of TEC to equivalent volume)	SEC	kWh/24 h·m3	2

Table 7 — Results of other tests

Clause no.	Description		Unit
6.2.2	Result of seal test of doors and lids	pass/fail	
6.2.3	Result of durability test of doors	pass/fail	
Annex E	Result of test for absence of odour and taste (if applicable)	pass/fail	
6.3.12	Water vapour condensation test	F/D/R/ None	

7 Marking

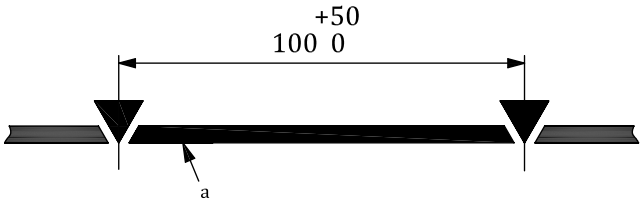
7.1 Load limit

Every commercial beverage cooler shall be clearly and permanently marked with one or several load limit line(s) [see Figure 30 b)], on the inside face, as shown in Figure 31, to denote the load limit. Where it is not possible to exceed the load limit, no marking is required.

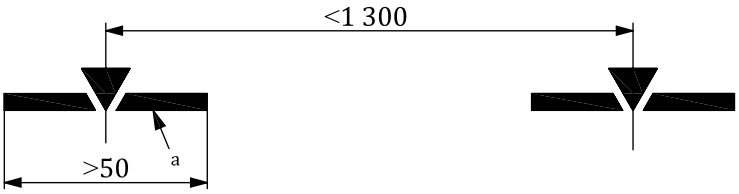
The load limit line shall be continuous [see Figure 30 a)], or repeated at intervals [Figure 30 b)] to ensure that it cannot be overlooked. Individual markings shall be at least 50 mm long and shall contain at least one equilateral triangle with side dimension, d_1, included within 5,5 mm and 15 mm (see Figure 31).

Where a load limit line cannot be marked on the inside face because of commercial beverage cooler design, an outline sketch showing the load limit shall be fixed in a visible position and in the manufacturer's instruction handbook (see Figure 32).

Dimensions in millimetres



a) Continuous load limit line



b) load limit line repeated at intervals

Key

[a] Load limit.

Figure 30 — Load limit markings

Dimensions in millimetres

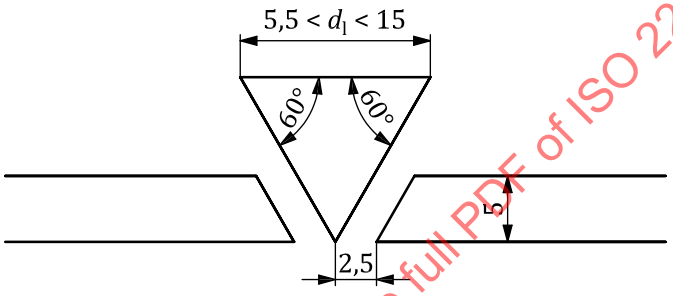


Figure 31 — Dimensions of load limit line

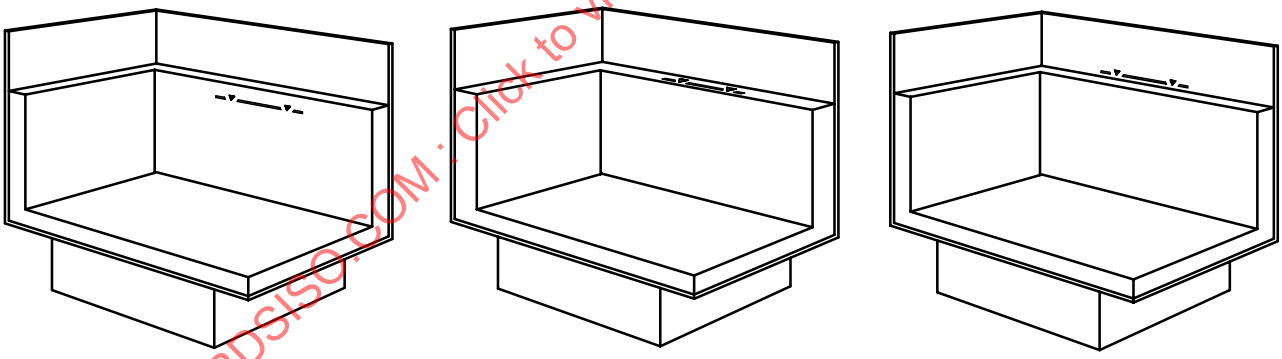


Figure 32 — Different positions for the load limit

7.2 Marking plate

Each commercial beverage cooler shall have the following information marked in a permanent and legible manner in locations where it is readily accessible:

a) reference to this document;

b) commercial beverage cooler;

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 commercial beverage cooler, integral condensing unit(s), etc., or sufficient information to provide adequate identification for replacement of parts or necessary servicing;

e) all information relating to the power supply for which the commercial beverage cooler is designed;

f) for commercial beverage coolers with integral condensing unit, the international number of refrigerant(s) (according to ISO 817) used and its (their) mass;

g) marking in accordance with ISO 5149-2;

h) the M-can temperature class;

i) the test room climate class;

j) for commercial beverage cooler classified as S, it shall be indicated: ambient temperature, ambient humidity, product temperature range, half reload time duration.

EXAMPLE S (27 °C/58 %/0 ÷ 10 °C/18 h)

7.3 Information to be supplied by the manufacturer

The following information shall be provided by the manufacturer for each commercial beverage cooler model:

a) overall external dimensions at installation;

b) overall external dimensions in service including: distance dp between the back of the commercial beverage cooler and the vertical test panel if applicable;

c) for each indicated commercial beverage cooler class (see Table 1):

   1) net volume (see Annex B);

   2) where applicable, the refrigerated shelf area;

   3) the maximum load, in kilograms, permitted on the trays and shelves and in the baskets or on the base deck for the various methods of arranging them in the commercial beverage cooler;

   4) for commercial beverage coolers fitted with night-covers and/or lights, if the results are for the first test (6.3.8) or the second test (6.3.8) or for both tests, in the latter case with two sets of information being provided for

      i) the total energy consumption (TEC), in kilowatt hours per 24 h, measured in accordance with the test described in 6.3.11.3.6;

      ii) the specific energy consumption (SEC); in kilowatt hours per 24 h per m^3 of equivalent volume.

Annex A
(informative)

Commercial beverage cooler family

Table A.1 — Commercial beverage cooler family

Horizontal	Open	BCHO
	Closed transparent lid	BCHT
	Closed solid lid	BCHS
Semi Vertical	Open	BCSO
	Closed transparent door	BCST
	Closed solid door	BCSS
Vertical	Open	BCVO
	Closed transparent door/lid	BCVT
	Closed solid door/lid	BCVS
Combined	Open top - open bottom	BCCO
	Open top - transparent lid bottom	BCCOT
	Open top - solid lid bottom	BCCOS
	Closed transparent door/lid top - open bottom	BCCTO
	Closed solid door/lid top - open bottom	BCCSO
	Closed transparent door/lid top - Closed transparent lid bottom	BCCTT
	Closed transparent door/lid top - Closed solid lid bottom	BCCTS
	Closed solid door/lid top - Closed transparent lid bottom	BCCST
	Closed solid door/lid top - Closed solid lid bottom	BCCST
y = EMD yes n = EMD no		
General classification can be used as follows: BCHO, BCVT, BCCSO. When necessary, the classification can be more precise, for example: BCHOy, BCVTn.		

Annex B
(normative)

Net volume calculation

B.1 General

The net volume (V_n) shall be calculated as the sum of the individual volumes obtained as follows.

B.2 Calculation of net volume

— For shelves: by multiplying each refrigerated shelf area by the distance from the top of the shelf up to 10 mm from the next shelf top surface. For the top shelf the volume shall be obtained multiplying the refrigerated shelf area by the distance up to the load limit.

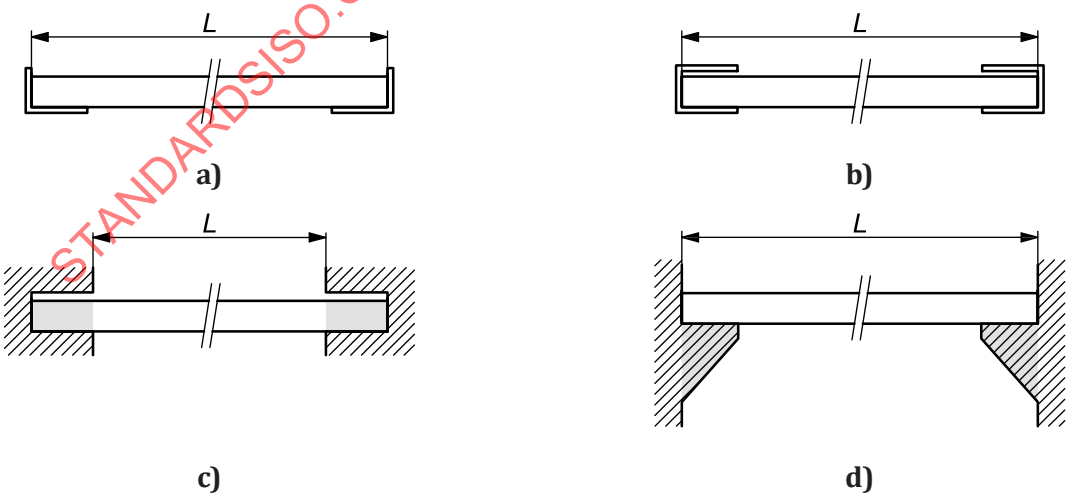
— For horizontal cabinets: by multiplying each bottom basket area by the distance from internal bottom of the basket up to 10 mm from the next top surface. For the top basket the volume shall be obtained multiplying the bottom basket area by the distance up to the load limit.

— For horizontal cabinets without baskets: by multiplying internal floor area by the distance from internal floor up to load line. Each individual volume above a shelf is the vertical projection of the refrigerated shelf area.

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

The net volume shall be calculated by summing-up all individual volumes.

The volume of constructional shelf support protuberances shall be excluded from the volume calculation (see Figure B.1). Compartment(s) of a combined refrigerated cabinet that are not foreseen for storage are not subjected to calculation of net volume.



Key

▭	R
L	width of the shelf

Figure B.1 — Net volume calculation

Annex C
(normative)

Equivalent volume calculation

C.1 General

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

C.2 Calculation of equivalent volume

For beverage coolers Formula (C.1) applies to calculate the equivalent volume:

$$V_{eq} = V_G \times \frac{25 - Tc}{20} \times Cc \quad \text{(C.1)}$$

Tc is the average compartment classification temperature of the compartment being:

— +3,5 °C for K_1 beverage coolers;

— +2,5 °C for K_2 beverage coolers;

— 1,0 °C for K_3 beverage coolers;

— +5,0 °C for K_4 beverage coolers;

— average product temperature defined by the manufacturer for the S class.

Cc is the climate class factor:

— 1,00 for CC1 (25 °C/60 %RH) beverage coolers;

— 1,05 for CC2 (32 °C/65 %RH) beverage coolers;

— 1,10 for CC3 (40 °C/75 %RH) beverage coolers.

C.3 Gross volume measurements

All measured compartment volumes shall be rounded to the nearest 0,1 l. The gross volume (V_G) shall be the sum of these rounded compartment volumes and the declared value for total volume shall be rounded to the nearest whole litres.

The gross volume shall take into account the exact shapes of the walls including all depressions or projections neglecting load lines. When the gross volume is determined, internal fittings such as shelves, baskets, removable partitions, containers and interior light housings shall be considered as not being in place.

The items below shall be considered as being in place (if present) and their volumes deducted:

— the volume of control housings;

— the volume of the evaporator space (which includes any space made inaccessible by the evaporator);

— the volume of air ducts required for proper cooling and operation of the unit;

— space occupied by shelves moulded into the inner door panel.