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Household refrigerating appliances — Frozen food storage cabinets and food freezers — Characteristics and test methods

*Appareils de réfrigération à usage ménager — Conservateurs de denrées
congelées et congélateurs — Caractéristiques et méthodes d'essai*



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Foreword

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

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 5155 was prepared by Technical Committee ISO/TC 86, *Refrigeration*, Subcommittee SC 5, *Construction and testing of household refrigerators*.

This second edition cancels and replaces the first edition (ISO 5155:1983), which has been technically revised.

Annexes A and B of this International Standard are for information only.

Household refrigerating appliances — Frozen food storage cabinets and food freezers — Characteristics and test methods

1 Scope

This International Standard specifies the essential characteristics for household frozen food storage cabinets and food freezers which are wholly factory assembled, and lays down the methods of test for the checking of these characteristics.

It does not apply to low-temperature compartments ("one-", "two-" and "three-star" compartments) which are covered in ISO 7371, or freezer compartments incorporated in refrigerators, which are covered in ISO 8187.

It does not include refrigerating performance characteristics and tests, or particular definitions for appliances cooled by internal forced air circulation, which are the subject of ISO 8561.

The tests described in this International Standard are type tests. When it is necessary to verify the performance of a freezer of a given type in relation to this International Standard, all the tests described should in principle be applied to one and the same unit.

These tests can also be made individually for the study of a particular characteristic.

Where no test method is specified, the particular requirement concerned is to be considered as a recommendation.

The electrical and mechanical safety requirements applicable to household frozen food storage cabinets and food freezers are specified in IEC 335-2-24.

Additional safety requirements applicable to mechanical refrigerating systems of household frozen food storage cabinets and food freezers are given in ISO 5149.

The safety requirements applicable to gaseous and liquid fuel heating equipment of absorption-type household refrigerating systems will form the subject of a future International Standard.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 534:1988, *Paper and board — Determination of thickness and apparent bulk density or apparent sheet density*.

ISO 817:—¹⁾, *Refrigerants — Number designation*.

ISO 5149:1993, *Mechanical refrigerating systems used for cooling and heating — Safety requirements*.

IEC 335-2-24:1992, *Safety of household and similar electrical appliances — Part 2: Particular requirements for refrigerators, food freezers and ice-makers*.

1) To be published. (Revision of ISO 817:1974)

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 Appliances

NOTES

1 From the point of view of installation, there are various types of household refrigerator-freezers and their combinations: free-standing, built-in, etc.

2 Definitions 3.1.1 and 3.2.2 are in line with those for a "three star" compartment and food freezer compartment given in ISO 8187.

3.1.1 household frozen food storage cabinet (hereinafter referred to as "three star" cabinet): Insulated cabinet of suitable volume and equipment for household use, cooled by energy-consuming means and having one or more compartments. The storage temperature of the compartments, measured as described in clause 13, is not warmer than $-18\text{ }^{\circ}\text{C}$.

3.1.2 household food freezer (hereinafter referred to as freezer): Insulated cabinet of suitable volume and equipment for household use, cooled by energy-consuming means and having one or more compartments for freezing fresh food. The freezer is suitable for freezing, from $+25\text{ }^{\circ}\text{C}$ to $-18\text{ }^{\circ}\text{C}$ for class SN, N and ST appliances, and from $+32\text{ }^{\circ}\text{C}$ to $-18\text{ }^{\circ}\text{C}$ for class T appliances (see clause 4), a quantity of at least 4,5 kg of test packages per 100 l of its storage volume in 24 h, and in no case less than 2 kg, under the test conditions specified in clause 17, and is also suitable for the storage of frozen food under storage conditions (see 3.1.1).

3.2 "two star" section: Part of a freezer or of a cabinet which is not self-contained (i.e. which does not have its own individual access door or lid), in which the storage temperature (see 3.4.3), measured as described in clause 13, is not warmer than $-12\text{ }^{\circ}\text{C}$. (See also 7.2.4.)

3.3 General definitions

3.3.1 top-opening type: A "three star" cabinet or freezer whose compartment(s) is (are) accessible from the top.

3.3.2 upright type: A "three star" cabinet or freezer whose compartment(s) is (are) accessible from the front.

3.3.3 overall dimensions (doors or lids closed): Measurements of the rectangular parallelepiped,

whose base is horizontal, within which the "three star" cabinet or freezer is inscribed to include the complete appliance except for the handle, the protrusion of which, if any, is to be specified separately.

3.3.4 overall space required in use (doors or lids open): Overall dimensions including the handle, increased by the space necessary for free circulation of the cooling air when the appliance is in service, plus the space necessary to allow opening of the means of access up to that minimum angle permitting removal of all removable parts such as containers and shelves. (See figure 1.)

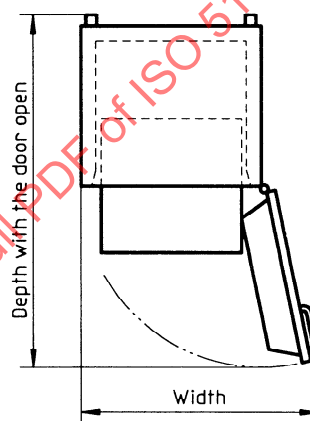


Figure 1 — Overall space required in use (upright type)

3.3.5 Volumes

3.3.5.1 gross volume: The volume within the inside walls of the appliance, or of a compartment with external door, without internal fittings, doors or lids being closed.

3.3.5.2 rated gross volume: Gross volume stated by the manufacturer.

3.3.5.3 total gross volume: Sum of the gross volumes of "three star" cabinets and freezer compartments [including any "two star" section(s)], even if their doors or lids are independent.

3.3.5.4 rated total gross volume: Total gross volume stated by the manufacturer.

3.3.5.5 storage volume: That part of the gross volume of any compartment which remains after deduction of the volume of components and spaces recognized as unusable for the storage of food, de-

terminated by the method given in 7.2, and also after deduction of the volume of any "two star" section.

3.3.5.6 rated storage volume: Storage volume stated by the manufacturer.

3.3.5.7 total storage volume: Sum of the storage volumes of the appliance [including any "two star" section(s)], comprising storage volumes of "three star" cabinets and freezer compartments.

3.3.5.8 rated total storage volume: Total storage volume stated by the manufacturer.

3.3.6 Storage surface

3.3.6.1 shelf: For the purpose of this International Standard, a shelf is any horizontal surface (shelves, partitions, etc.) on which food can be placed.

It may be formed by one component or by components fitted side by side, which may be fixed or removable.

3.3.6.2 storage shelf area: Sum of the horizontal projections of the storage surfaces within the storage volume, including door shelves and the bottom of each compartment, determined in accordance with 7.3.

3.3.6.3 rated storage shelf area: Storage shelf area stated by the manufacturer.

3.3.7 load limit(s): Surface enveloping the "three star" cabinet volume(s).

3.3.8 load limit line(s): Permanent mark(s) indicating the limits of "three star" cabinet volume(s).

3.4 Definitions relating to some performance characteristics

3.4.1 energy consumption: Consumption of a "three star" cabinet and freezer over a period of 24 h, running under stable operating conditions at an ambient temperature of + 25 °C (in the case of class SN, class N and class ST appliances) or + 32 °C (in the case of class T "three star" cabinet and freezer) (see clause 4) and measured under the conditions specified in clause 15.

3.4.2 rated energy consumption: Energy consumption stated by the manufacturer.

3.4.3 frozen food storage temperature, t^{*} , t^{**}** (as appropriate): Maximum temperature of the warmest "M" package of a load placed in storage as specified in 8.5.

3.4.4 freezing capacity (applicable only to freezers): Mass of test packages whose temperature (taken as the instantaneous arithmetical mean temperature of all the "M" packages) can be lowered from the loading temperature of + 25 °C or + 32 °C (see 8.1.1) to - 18 °C in 24 h under the test conditions specified in clause 17. The freezing capacity is expressed in kilograms.

3.4.5 rated freezing capacity (applicable only to freezers): Freezing capacity stated by the manufacturer.

3.4.6 "M" package: A test package in accordance with 8.2, of dimensions 50 mm × 100 mm × 100 mm, fitted with a temperature sensor at its geometric centre.

3.4.7 control cycle: Period between two successive starts, or two successive stops, of a refrigerating system under stable operating conditions.

3.4.8 stable operating conditions: In the case of cyclic operation of a refrigerating system, stable operating conditions are deemed to be reached when, for each of the "M" packages, the temperatures at all corresponding points during successive operating cycles agree within ± 0,5 K and there is no marked trend away from the mean temperature during a period of about 24 h.

In the case of continuous operation of a refrigerating system, stable operating conditions are deemed to be reached when, although there may be a certain variation in temperature, the increase or decrease in the temperature of all the "M" packages does not exceed 0,5 K during a period of 18 h.

3.4.9 percentage running time, R (apparatus with on/off control for the refrigerating source): Under given conditions of ambient temperature and of internal storage temperature, the ratio

$$R = \frac{d}{D} \times 100$$

where

d is the duration of the refrigerating unit operation during a whole number of cycles;

D is the total duration of the cycles.

3.4.10 ambient temperature: Temperature in the space surrounding the appliance under test. It is the arithmetical average of the mean value of temperatures t_{a1} and t_{a2} , measured (see 8.1.1) at two points

located 350 mm from the vertical centreline of the side walls of the appliance at 1 m above the floor line.

3.4.11 temperature rise time: Period between the moment when, under specified test conditions, the temperature of the warmest "M" package in the "three star" cabinet or freezer reaches $-18\text{ }^{\circ}\text{C}$ to the moment when any of the "M" packages (excluding any "two star" sections) first reaches a temperature of $-9\text{ }^{\circ}\text{C}$ when the operation of the refrigerating system is interrupted.

3.5 Definitions relating to the refrigerating system

3.5.1 refrigerant: Fluid used for heat transfer in a refrigerating system, which absorbs heat at a low temperature and a low pressure of the fluid and rejects heat at a higher temperature and a higher pressure of the fluid, usually involving changes of state of the fluid.

3.5.2 cooling device: Device containing the evaporator or in thermal contact with the evaporator; it may be a device with fins or may be suitably shaped for the storage of frozen food or water ice-cubes.

3.6 Definitions relating to compression-type "three star" cabinets or freezers

3.6.1 compression-type "three star" cabinet or freezer: "Three star" cabinet or freezer in which refrigeration is effected by the vaporization at low pressure in a heat exchanger (evaporator) of a liquid refrigerant, the vapour thus formed being restored to the liquid state by mechanical compression to a higher pressure and subsequent cooling in another heat exchanger (condenser).

3.6.2 hermetically sealed motor-driven refrigerating compressor: Motor-compressor in which the compressor and the electric motor (or its moving parts at least) are enclosed in a shell rendered gastight by welding, brazing or other means such that dismantling is not normally possible after assembly. It does not include moving parts outside the shell.

3.6.3 hermetically sealed compressor refrigerating system: Complete system, essentially comprising a hermetically sealed motor-driven compressor, a condenser, a pressure-reducing device, an evaporator, and all other parts containing refrigerant permanently interconnected by the manufacturer by welding, brazing or other means.

3.6.4 refrigerant compressor: Mechanically operated component which withdraws refrigerant vapour

from the evaporator and discharges it at a higher pressure to the condenser.

3.6.5 expansion device: Device in which the pressure of the refrigerant is reduced from that of the condensed liquid to that of the evaporator.

3.6.6 condenser: Heat exchanger in which, after compression, vaporized refrigerant is liquefied by rejecting heat to an external cooling medium.

3.6.7 evaporator: Heat exchanger in which, after expansion, the liquid refrigerant is vaporized by absorbing heat from the medium to be refrigerated.

3.6.8 thermostat: Device which automatically regulates the operation of a refrigerating system according to the temperature of an evaporator or of a compartment.

3.7 Definitions relating to absorption-type "three star" cabinets or freezers

3.7.1 absorption-type "three star" cabinet or freezer: "Three star" cabinet or freezer in which refrigeration is effected by evaporation of a liquid refrigerant in an evaporator, the vapour thus formed being then absorbed by an absorbent medium from which it is subsequently expelled at a higher partial vapour pressure by heating and then liquefied by cooling in a condenser.

3.7.2 absorption refrigerating system: Complete system essentially comprising a boiler, a condenser, an evaporator, an absorber, and all other parts containing refrigerant permanently interconnected by the manufacturer by welding, brazing or other means.

3.7.3 boiler: Heat exchanger in which the absorbed refrigerant is expelled from the absorbent medium by the application of heat.

3.7.4 absorber: Component in which the absorption of the refrigerant by an absorbent medium takes place, the heat emitted in the process being rejected to the environment.

3.7.5 condenser: Heat exchanger in which the vaporized refrigerant, after leaving the boiler, is liquefied by rejecting heat to an external cooling medium.

3.7.6 evaporator: Heat exchanger in which the liquid refrigerant, after a drop in its partial pressure, is vaporized by absorbing heat from the medium to be refrigerated.

4 Classification

With respect to the ability of appliances to operate in extreme ambient temperatures, this International Standard relates to the four climate classes given in table 1.

Table 1 — Climate classes

Values in degrees Celsius

Class	Symbol	Range of ambient temperatures in which the appliances are intended to be used, and for which the required storage temperatures shall be fulfilled (see 6.2.1)
Extended temperature	SN	+ 10 to + 32
Temperate	N	+ 16 to + 32
Subtropical	ST	+ 18 to + 38
Tropical	T	+ 18 to + 43

5 Materials, design and manufacture

5.1 General

"Three star" cabinets and freezers shall be constructed in such a manner as to ensure adequate performance and durability in use. Their performance in use is checked by applying a series of relevant tests.

This clause defines some characteristics which are not tested but to which the attention of the manufacturer is drawn.

5.2 Materials and finishes

Materials used inside "three star" cabinets and freezers shall not contaminate food placed in contact with them nor transmit poisonous substances to food. They shall be resistant to the action of moisture and food acids.

All surface finishes shall, for the purpose intended, be resistant to impact, sufficiently hard, colour-fast, smooth, easily washable, and resistant to damage by moisture and by food acids.

5.3 Thermal insulation and airtightness

The thermal insulation of "three star" cabinets and food freezers should be efficient and permanently

maintained. In particular, the insulating material shall not be subject to shrinkage and shall not allow, under normal working conditions, an excessive accumulation of moisture.

No running water shall appear externally when the "three star" cabinet or freezer is subjected to the water vapour condensation test specified in clause 14.

When the door or lid is closed, there shall be no abnormal ingress of air into the interior.

A strip of paper shall not slide freely when door or lid seals are subjected to the airtightness test specified in clause 9.

5.4 Doors, lids and fittings

Hinges and handles shall be strong and resistant to corrosion.

External doors and lids of "three star" cabinets and freezers shall withstand 10 000 openings and closings without deterioration which may be prejudicial to the airtightness of the "three star" cabinet or freezer when subjected to the durability test of clause 11.

The fastening system shall be such as to enable the door or lid to be easily closed and opened. It shall be efficient and capable of maintaining its proper function.

For "three star" cabinets and freezers having any compartment or section with a volume equal to or greater than 60 l, it shall be possible to open the door or lid of that compartment from the inside with a force not exceeding 70 N when subjected to the test specified in clause 10. The volume of any compartment or section shall be determined when all shelves, partitions and other internal components removable without the aid of a tool have been removed. However, if the door or lid is provided with a mechanical latch which can be locked by a removable key, and the door or lid cannot be closed with the key turned to the locked position, this requirement applies only when the latch is unlocked, provided that the appliance is accompanied by an instruction stating that the key shall be kept out of the reach of children and not kept in the vicinity of the appliance.

5.5 Shelves and containers

Shelves, containers and similar components shall have adequate mechanical strength. Those used for storing food shall withstand the loading test specified in clause 12 without showing such distortion that they could no longer fulfil their intended function. In

particular, sliding or revolving components shall be capable of their full movement when loaded.

Shelves, containers and similar components which are intended to be removable should be easily removable.

5.6 Refrigerating system

5.6.1 The mechanical operation of "three star" cabinets or freezers should not give rise to undue noise or vibration.

5.6.2 The design of the condenser should be such as to reduce to a minimum the accumulation of dust.

5.6.3 The evaporator shall be so designed or protected so that it will not suffer any damage during the normal use of the appliance.

The heat exchange surfaces shall be made of corrosion-resistant material, or shall be finished with a corrosion-proof non-poisonous coating resistant to temperature changes and defrosting.

5.6.4 The means of adjustment of temperature control devices, if intended to be adjusted by the user, should be readily accessible, and their function shall be such as to enable the appliance to meet the requirements of the performance tests.

5.6.5 Pipes and connections to moving or resiliently mounted parts should be arranged so as not to generate noise, not to touch nor to transmit vibrations to other parts, and should be so designed as to prevent failure due to fatigue. All other pipes and connections should be securely anchored. Where necessary, pipes and valves should be properly insulated.

5.6.6 Suitable means should be provided to prevent water condensed on cold parts from affecting the operation of the unit or its controls, or from causing any other damage to the "three star" cabinet or freezer and its surroundings.

6 Required characteristics

6.1 Volumes and areas

6.1.1 Rated gross volume

The measured gross volume shall not be less than the rated gross volume by more than 3 % of the latter or 1 litre, whichever is the greater value.

6.1.2 Rated storage volume

The measured storage volume shall not be less than the rated storage volume by more than 3 % of the latter or 1 litre, whichever is the greater value.

6.1.3 Rated storage shelf area

The measured storage shelf area shall not be less than the rated storage shelf area by more than 3 % of the latter.

6.2 Performance characteristics

6.2.1 Storage temperatures

Under the conditions specified in clause 13, the appliance shall be capable of maintaining, simultaneously, the required storage temperatures as shown in table 2 for the appropriate climate class.

Table 2 — Storage temperatures for all climate classes (see clause 4)

Values in degrees Celsius

Climate class	Test ambient temperature	Freezer and "three star" cabinet t^{***}	"Two star" sections (see 7.2.4) t^{**}
SN	+ 32	≤ -18	≤ -12
N	+ 32		
ST	+ 38		
T	+ 43		

6.2.2 Freezing capacity (applicable only to freezers)

The freezing capacity measured in accordance with clause 17 on the first appliance tested shall not be less than the rated freezing capacity by more than 15 % of the latter.

If the result of the test carried out on the first appliance is less than the declared value minus 15 %, the test shall be carried out on a further three appliances.

The arithmetical mean of the freezing capacity values of these three appliances shall be equal to or greater than the declared value minus 10 %.

The value of the freezing capacity obtained either on the first appliance tested or the arithmetical mean value obtained on a further three appliances shall not be less than 4,5 kg per 100 l of the total storage vol-

ume of the freezer (see 7.2.3) nor less than 2 kg (irrespective of storage volume).

The requirements of 17.1.3 shall be taken into account if appropriate.

6.2.3 Energy consumption

If energy consumption is stated by the manufacturer, the value measured in accordance with clause 15 on the first appliance tested shall not be greater than the rated energy consumption by more than 15 %, of the latter.

If the result of the test carried out on the first appliance is greater than the declared value plus 15 %, the test shall be carried out on a further three appliances.

The arithmetical mean of the energy consumption values of these three appliances shall be equal to or less than the declared value plus 10 %.

6.2.4 Temperature rise time

If the temperature rise time is stated by the manufacturer, the value measured in accordance with clause 16 on the first appliance tested shall not be shorter than the declared value by more than 15 % of the latter.

If the result of the test on the first appliance is less than the declared value minus 15 %, the test shall be carried out on a further three appliances. The arithmetical mean of the periods of temperature rise of these three appliances shall be equal to or greater than the declared value minus 10 %.

7 Determination of linear dimensions, volumes and areas

The measurements are carried out on the appliance as delivered and not operating.

7.1 Determination of linear dimensions

Linear dimensions shall be measured to the nearest millimetre.

7.2 Determination of volumes

Volumes shall be expressed in a whole number of cubic decimetres or of litres.

7.2.1 Determination of gross volume

The gross volume shall be calculated by dividing the total volume into convenient units of volumes of geometric shapes which can easily be measured.

When the gross volume is determined, internal fittings such as shelves, removable partitions, containers, evaporators, thermostats and interior light housings shall be considered as not being in place. However, the gross volume shall take into account the exact shapes of the walls if they contain depressions or projections (for example, see figure 16).

7.2.2 Determination of the total storage volume

The total storage volume of the "three star" cabinet or freezer shall be the sum of the storage volumes of all compartments, including "two star" section(s), as applicable.

For the determination of storage volumes, the total volume of devices and of spaces considered unusable for the storage of food shall be deducted from the gross volume calculated in accordance with 7.2.1 (see 7.2.3).

7.2.3 Storage volume of frozen food storage cabinets and freezers

The storage volume of these appliances shall be the gross volume minus the following (for example, see figure 17):

- a) the volume of spaces situated outside any load limit (natural or marked by the manufacturer);
- b) the volume of spaces provided specifically for making and storing ice, except in the case of appliances fitted with automatic icemakers, when the volume occupied by a removable storage bucket shall be included in the storage volume unless it is specified in the instructions for use that this volume is suitable for the storage of ice only;
- c) the volume of spaces between the front stack(s) of the test package load (see 13.1.2) and the inner vertical surface of the door or any projection from the door where the horizontal distance between the front face of the stack(s) and the inner door surface or projection exceeds 15 mm;
- d) the volume of all fixed components within the load limits;

- e) the volume of spaces which are to be kept free for the good performance of the refrigerating system;
- f) the total volume of the removable parts and of the space rendered unusable by the use of the parts which are stated by the manufacturer as necessary for the proper functioning of the appliance and for meeting all the required characteristics (see clause 6 and 8.3.4) except shelves and partitions whose thickness is not greater than 13 mm (see 7.2.5.1);
- g) the storage volume of any "two star" section(s);
- h) any volume where the vertical clearance is less than 52 mm [see also figure 17 a)];
- i) any volume where it is impossible to place an "M" package of nominal dimensions.

NOTE 3 There is no equivalence between the value of the storage volume determined in accordance with the principles mentioned above and the volume of the packages loaded into the appliance for the storage and freezing tests. The free spaces specified in the test methods could be utilized in normal use and their volume should not be deducted from the gross volume when calculating the storage volume.

7.2.4 "Two star" section(s) in freezers and in "three star" cabinets

"Two star" section(s) is (are) permitted both in the door and in the remaining storage volume when all the following conditions are met:

- a) the "two star" section(s) is (are) marked with the appropriate identification symbol;
- b) the "two star" section(s) is (are) separated from the "three star" volume by a partition, container, or similar construction;
- c) the rated total "two star" storage volume does not exceed 20 % of the storage volume of the cabinet or 30 l, whichever is the smaller value;
- d) the instructions for use give clear guidance regarding the "two star" section(s);
- e) the storage volume of the "two star" section(s) is stated separately and is not included in the storage volume.

7.2.5 Volumes of shelves and partitions (for examples, see figure 18)

7.2.5.1 Thickness

The thickness of a shelf or partition shall be the mean distance between its outer surfaces.

Where the surface of a shelf or partition is corrugated or fitted with external pipe grids, the surface shall be the plane joining the outer apices of the corrugations or pipes, unless the distance between adjacent corrugations or pipes is greater than 100 mm.

7.2.5.2 Full shelves and partitions

The volume of a full shelf or partition shall be the product of its thickness and its depth, width or height, whichever two of these are applicable. The depth, width and height shall be those dimensions of the enclosed space of the cabinet which apply in the plane of the shelf or partition.

7.2.5.3 Fractional shelves and partitions (if applicable)

The volume of a fractional shelf or partition shall be the product of its thickness and its depth, width or height, whichever two of these are applicable.

The depth, width or height shall be the distances from the adjacent surfaces of the enclosed space of the cabinet, and normal to those surfaces, to the further edges of the shelf or partition, or to the evaporator in cases where the fractional shelf or partition touches it.

A horizontal shelf or partition, the edges of which are more than 70 mm from the surfaces of the enclosed space of the cabinet, shall be regarded as a fractional shelf or partition. A vertical partition, the edges of which are more than 100 mm from the surfaces of the enclosed space of the cabinet, shall be regarded as a fractional partition.

7.3 Determination of storage shelf area

The area shall be expressed in square decimetres.

7.3.1 Determination of the area of shelves

7.3.1.1 Full shelves composed of a single part

In the case of a full shelf composed of a single part, the area shall be the product of the width and depth. These two dimensions shall be determined as follows.

- Width: mean distance measured parallel to the surface of the shelf between the inner surfaces of the side walls of the enclosed space of the cabinet, where this dimension does not exceed the actual width of the shelf by more than 20 mm [see figure 12 a)].
- Depth: mean distance measured parallel to the surface of the shelf (or of the bottom of the appliance) between the inner surfaces of the front and rear walls of the enclosed space of the cabinet, where this dimension does not exceed the actual depth of the shelf by more than 20 mm [see figure 12 b)]. When the door of an upright-type appliance is provided with shelves, this distance shall be determined by analogy [see figures 12 c) and 12 d)].

7.3.1.2 Fractional shelves

For the purpose of calculating the area of fractional shelves, the width and depth shall be measured parallel to the surface of the shelves in a similar way to that for full shelves (see 7.3.1.1), but taking into account figure 12 e).

7.3.1.3 Cut-away shelves

When a shelf is cut away, the area of the portion cut out shall be deducted.

7.3.1.4 Juxtaposed shelves

In the case of juxtaposed shelves, the depth shall be determined in accordance with figure 12 d).

7.3.1.5 Door shelves

The area shall be the product of the width and depth. These two dimensions shall be determined by analogy with 7.3.1.1, as follows.

- Width: mean distance between the inner surfaces of the side walls of the door compartment or between the side edges of the retainer bar.
- Depth: mean distance between the surface of the door wall and the vertical plane tangential to the inner front surface of the shelf or retainer bar [see figure 12 c)].

7.3.1.6 Baskets and containers

The area shall be the product of the two mean horizontal dimensions [see figure 13 a)].

7.3.1.7 Particular cases

The bottom of the enclosed space of the cabinet shall be considered as a shelf.

When an inner wall is not vertical, the dimension of the shelf shall be measured at the mid-height between the shelf under consideration and the shelf or horizontal surface immediately above.

Any part of full shelves, baskets or of the bottom of a "three star" cabinet or freezer having less than 52 mm vertical clearance above, when all the shelves and baskets are in position, shall be excluded when calculating the storage area [see figure 13 b)].

For an ice-making compartment, the minimum vertical clearance dimension shall be not less than 40 mm.

8 General test conditions

The order of carrying out the tests need not necessarily follow the sequence of the clauses given in this International Standard.

The results of the tests shall appear in a test report. When necessary, particular information to be noted in this report is mentioned as a special item of the sub-clause concerning the test.

The manufacturer's storage plans shall be used, provided that they are in accordance with this International Standard (see 13.1.2).

8.1 Test room

The appliance shall be set up in a test room as specified in 8.1.3.

8.1.1 Ambient temperature

Tests shall be carried out under the following conditions of ambient temperature.

a) For checking the storage temperatures:

- + 32 °C for class SN and class N appliances;
- + 38 °C for class ST appliances;
- + 43 °C for class T appliances.

NOTE 4 The purpose of this test is to verify the storage temperature limits for the whole ambient temperature range for the relevant class. It is considered that testing at the highest ambient temperature value in the class is sufficient.

- b) For checking the energy consumption, temperature rise time and freezing capacity²⁾:

+ 25 °C for class SN, class N and class ST appliances;

+ 32 °C for class T appliances.

- c) For all other tests, at the temperature stated in the test specifications.

The temperature at each measurement point (see 3.4.10) shall be kept constant within $\pm 0,5$ K of the nominal ambient temperature both during the periods required for obtaining stable operating conditions and during the tests.

The vertical ambient temperature gradient from the platform specified in 8.1.3 to a height of 2 m shall not exceed 2 K/m.

8.1.2 Humidity

Unless otherwise specified, relative humidity shall be kept between 45 % and 75 %.

8.1.3 Installation of appliances

Each appliance shall be placed on a wooden solid-top platform, painted dull black, open for free air circulation under the platform. The top of the platform shall be 0,3 m above the test room floor and shall extend at least 0,3 m, but not more than 0,6 m, beyond all sides of the appliance, except at the rear where it shall extend to the vertical partition.

Circulation of air around the appliance shall be restricted by surrounding the appliance by three vertical partitions, painted dull black, arranged as follows:

- one of the partitions shall be placed parallel to the rear of the appliance, against the stops or at the distance specified by the manufacturer in connection with the required overall space;
- the two other partitions shall be parallel to the sides of the cabinet, and shall be fixed on the platform 0,3 m from the sides of the cabinet; they shall be 0,3 m wide.

The whole partition structure shall have the form and dimensions shown in figure 2.

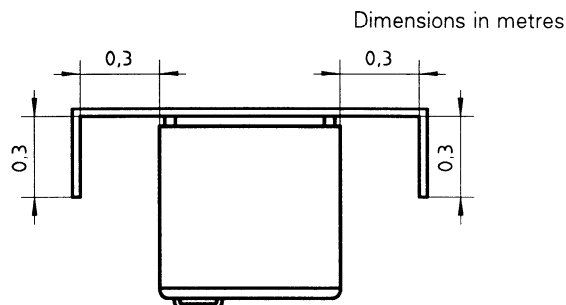


Figure 2 — Partitions to restrict air circulation
(plan view)

The vertical partitions shall present no discontinuity. They shall be of such a height that they extend at least 0,3 m above the top of the appliance.

The appliance shall be so placed or shielded as to prevent direct radiation to or from the space cooling or heating equipment in the test room, and shall be placed far enough away from all other objects in the test room to eliminate any possibility of any point in the space in which it is situated being at a temperature other than ambient.

Air circulation in the test room shall be such that the specified ambient temperatures are obtained within the limits of the specified tolerances. The appliance under test shall be shielded from any air currents of velocity above 0,25 m/s.

The air circulation in the test room shall not interfere with the normal air circulation created by the appliance.

Appliances intended to be built-in shall be built in according to the manufacturer's instructions.

Built-in appliances intended to be combined with appliances other than refrigerating appliances shall be subjected to the tests while they are combined, but with the other appliance not functioning.

8.2 Test packages

When tests are carried out with a loaded appliance, test packages in the form of right parallelepipeds shall be used.

8.2.1 Dimensions and tolerances

Their size, prior to freezing, and their mass, packaging included, shall be as specified in table 3.

2) See annex A for particular conditions.

Table 3 — Dimensions and mass of test packages

Dimensions mm	Mass g
25 × 50 × 100	125
50 × 100 × 100	500
50 × 100 × 200	1 000

Tolerances shall be as follows:

a) on linear dimensions:

± 1,5 mm for dimensions 25 mm and 50 mm

± 3,0 mm for dimensions 100 mm and 200 mm

b) on mass: ± 2 %.

8.2.2 Composition

The packages shall consist of the following.

a) A suitable filling material containing, per 1 000 g:

230 g of oxyethylmethylcellulose

764,2 g of water³⁾

5 g of sodium chloride

0,8 g of 6-chloro-*m*-cresol.

The freezing point of this material is – 1 °C (its thermal characteristics correspond to those of lean beef).

The following alternative composition of test packages with a freezing point near – 5 °C may be used:

232 g of oxyethylmethylcellulose

725 g of water

43 g of sodium chloride

3) The addition of about 4 % of water is recommended in order to compensate for evaporation during the preparation of the filling material.

4) It is advisable to use a laminated sheet, consisting of a layer of high-pressure polyethylene, easily sealable, 120 µm thick, together with an external sheet of polyterephthalate approximately 12,5 µm thick, the two layers being bonded together.

5) Or any other temperature-measuring device giving equivalent precision.

6) See annex A for particular conditions.

0,8 g of 6-chloro-*m*-cresol.

In case of dispute, the first test package composition shall be used as reference test package.

b) A wrapper, consisting of a sheet of plastic⁴⁾ or any other suitable material of such a nature that exchange of moisture with the ambient medium is negligible. After filling, the wrapping sheet shall be sealed.

8.2.3 "M" packages

Some of the 500 g packages (50 mm × 100 mm × 100 mm) are equipped for temperature measurement, being fitted with thermocouples⁵⁾ which are inserted in the geometrical centre of the packages in direct contact with the filling material. All precautions shall be taken to minimize extraneous conduction of heat. These packages are called "M" packages.

8.3 Operating requirements for the appliance

8.3.1 Thermostat setting

The thermostat setting requirements are specified for each test.

When the appliance is fitted with a thermostat which is not designed for adjustment by the user, the appliance shall be tested in the condition as delivered.

8.3.2 Anti-condensation heaters

If an appliance is fitted with an anti-condensation heater which can be switched on and off by the user, this shall be switched on only if it is needed to withstand the water vapour condensation test. If adjustable, it shall be set at maximum heating.

8.3.3 Power supply⁶⁾

8.3.3.1 Electric power supply

The appliance shall be tested at the rated voltage and frequency, or at the mean of the rated voltage range ± 1 %.

8.3.3.2 Power supply other than electric

Appliances other than those for electric power supply shall be tested under supply conditions corresponding to the information on the rating plate.

8.3.3.3 Multiple power supplies

Appliances which are equipped for operation on different power supplies shall be tested for each of the supply conditions indicated on the rating plate (see 8.3.3.1 and 8.3.3.2).

8.3.4 General conditions for the use of baskets, containers and shelves

All shelves, and only those baskets and containers which have been taken into consideration when determining the storage volume, shall be in position.

8.4 Measuring instruments

Temperatures shall be measured with temperature probes, the sensors of which are inserted in "M" packages and, for measuring the ambient temperature, in the centre of tin-covered solid copper or brass cylinders having a mass of 25 g and of minimum external area (diameter = height = about 15,2 mm). The temperatures shall be recorded. Temperature-measuring instruments shall be accurate to within $\pm 0,3$ K.

The relative humidity shall be measured and recorded at a point which is representative. The accuracy of the measuring instruments shall be such that the result, expressed as the dew point, is accurate to within $\pm 0,3$ K.

Watt-hour meters shall be readable to 0,01 kW·h and be accurate to within ± 1 %. The measuring accuracy shall be stated in the test report.

8.5 Measurement of the storage temperature (see also 7.2.4)

The temperatures shall be measured in "M" packages which are distributed throughout the load of test packages specified in the storage plan (see 13.1.2).

The storage temperature (see 3.4.3) is the maximum temperature of the warmest "M" package.

8.6 Measurement of the percentage running time

When an appliance cycles "on/off" when operating under storage conditions at an ambient temperature

of 32 °C, 38 °C or 43 °C, as appropriate for the climate class of the appliance (see clause 13), the running time shall be measured during a test period of at least 24 h, as specified in 8.7. Any suitable device may be used to record the running time of the refrigerating system.

8.6.1 Electrically driven "three star" cabinets and freezers

Use shall be made of a synchronous clock that operates when the refrigerating system is running. When the current relay, inserted in series in the power supply circuit, is energized by the current flowing through it, it applies the voltage to the synchronous clock whose reading is recorded at the beginning and the end of the test. Running time is the difference between the two readings.

Alternatively, either the current or power may be plotted against time from a recording ammeter or wattmeter, and the running and idle periods computed from the graph.

8.6.2 Non-electrically driven "three star" cabinets and freezers

Any suitable device may be used to record the running time of the refrigerating system.

8.7 Test period

The test period shall start at least 24 h after stable operating conditions have been attained.

For appliances with cyclic operation, the test period shall comprise a whole number of control cycles.

9 Testing the airtightness of door or lid seal(s)

The purpose of this test is to ensure that the gasket(s) of the door(s) or lid(s) of the appliance adequately prevent(s) any abnormal ingress of the surrounding air.

9.1 Procedure

The ambient temperature shall be between + 16 °C and + 32 °C. The appliance shall be switched off and shall be in equilibrium with the ambient temperature before carrying out the test.

A strip of paper 50 mm wide and 0,08 mm thick and of suitable length shall be inserted at any point of the seal, and the door or lid shall be closed normally on it.

The verification of the thickness of the paper used shall be in accordance with ISO 534.

The seal shall be assessed by checking that the strip of paper does not slide freely.

The most unfavourable points may be found by inspecting the area around the seal with the appliance closed and illuminated from the inside.

This test shall be carried out both before and after the mechanical durability test (see clause 11).

9.2 Test report

The test report shall indicate whether the tightness of the door or lid seal(s) meets the requirements of the fourth paragraph of 5.3.

10 Testing the opening force of door(s) or lid(s)

The purpose of this test is to check that the door(s) or lid(s) can be opened from the inside.

Compliance shall be checked by inspection and by the following test.

10.1 Procedure

The ambient temperature shall be between + 16 °C and + 32 °C. The appliance shall be switched off and be in equilibrium with the ambient temperature. The door or lid shall be closed for a period of 1 h, after which an "opening" test shall be carried out under the following conditions.

The opening force of 70 N shall be considered as being applied to the inside of the door or lid of the appliance at the midpoint of the edge farthest from the hinge axis in a direction perpendicular to the plane of the door or lid.

The method of measurement shall be one of the following:

- a) by applying the force at a point on the outer surface of the door or lid corresponding to the internal measuring point (for example, with the aid of a suction pad);

- b) if the handle of the door or lid is at the midpoint of the edge farthest from the hinge axis, by applying a force to the handle, the value of the force required to open the door or lid from the inside being determined by proportional calculation from the distances of the handle and of the internal measuring point from the hinge axis.

This test shall be carried out both before and after the mechanical durability test (see clause 11).

10.2 Test report

The test report shall indicate whether the opening force of the door(s) or lid(s) meets the requirements of the fourth paragraph of 5.4.

11 Testing the durability of hinges and handles of door(s) and lid(s)

The purpose of this test is to check the durability of the hinges and handles of door(s) and lid(s).

11.1 External door(s)

11.1.1 Procedure

The ambient temperature shall be between + 16 °C and + 32 °C.

The appliance shall be switched off.

The inner door(s) shall be loaded as specified in 12.1 or 13.1.2.7, as appropriate.

11.1.1.1 Opening sequence (see figure 3)

The movement of the door shall be controlled from an angle of 0° to an angle of opening between 5° and 15°, 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.

11.1.1.2 Closing sequence (see figure 3)

The movement of the door shall be controlled from the angle of opening of 45° to an angle between 40° and 35°, followed by the free movement of the door and its closing as in normal use.

The number of cycles per minute shall be 20 to 25.

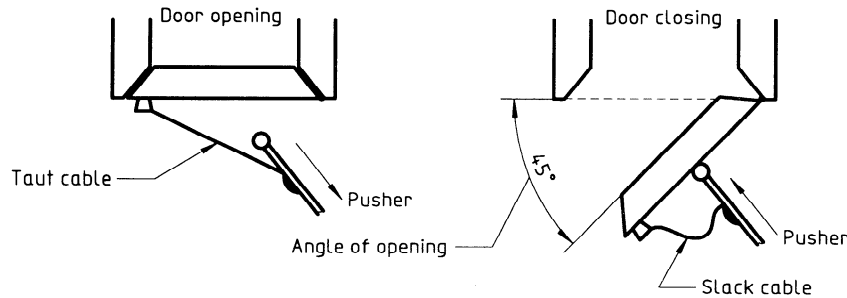


Figure 3 — Example of opening and closing of external door(s)

11.2 Lid(s) and internal door(s)

Test procedure is under consideration.

11.3 Test report

The test report shall indicate whether the hinges and handles meet the requirements of the second paragraph of 5.4, and whether the seals meet the requirements of the fourth paragraph of 5.3.

12 Testing the mechanical strength of shelves and baskets

The purpose of this test is to check the mechanical strength of the components used for storing food (shelves, containers, evaporators).

12.1 Procedure

The ambient temperature shall be between + 16 °C and + 32 °C.

After the storage temperature test (see clause 13), and with the appliance switched off, the behaviour of all loaded shelves, baskets and containers and their supports shall be examined.

All sliding or revolving shelves and containers shall be moved, without modification of their load, to the half-way position, $A/2$, of their permissible course (see figure 4), except that if stops are provided which limit the movement to less than the half-way position the components shall be moved to their stop. They shall be left in this position for 1 h and then returned to their initial position.

If the manufacturer has stated in the instructions for use that some shelves or containers slide out for maintenance or transportation, but must remain in a definite position in normal use, they shall be considered as fixed and the checking shall be carried out in the position as for the storage temperature test.

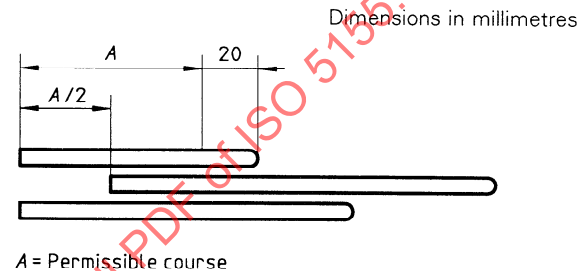


Figure 4 — Test position for sliding components which have no limiting stop

12.2 Test report

The test report shall indicate whether the shelves and containers for storing food meet the requirements of 5.5.

13 Testing the storage temperatures

The purpose of this test is to check compliance with the requirements of 6.2.1 at each of the ambient temperatures (see 8.1.1) for the appropriate climate class.

13.1 Procedure

13.1.1 Preparation of the appliance

The appliance shall be installed in the test room in accordance with 8.1.3. The evaporator(s) shall be defrosted, if necessary, and the internal walls and components of the appliance dried. The means of access (doors or lids) shall be kept closed during the tests.

The appliance shall be set up as in service in accordance with the manufacturer's instructions. All internal fittings supplied with the appliance, including ice trays, shall be put into position (see 8.3.4), except that

the ice trays shall be removed in the case of a freezer or "three star" cabinet having no specific subdivision to accommodate such trays. If the appliance has thermostat(s) and/or other temperature control device(s) which is (are) designed for adjustment by the user, the thermostat(s) and/or device(s) shall be set at the manufacturer's recommended position(s) for normal operation at the appropriate ambient temperature. When the thermostat(s) and/or device(s) is (are) not designed for adjustment by the user, the measurement shall be carried out on the appliance as delivered. The empty appliance shall be operated for at least 24 h to reach equilibrium.

The freezer or "three star" cabinet shall be equipped with test packages and "M" packages in accordance with the following storage plan.

13.1.2 Storage plan

The freezer or "three star" cabinet shall be filled with as many test packages as it can hold, the test packages having previously been brought to a temperature approximately equal to the classification temperature of the compartment or section.

The following conditions shall be met.

13.1.2.1 On each horizontal surface intended for storage, the largest possible number of stacks of test packages having a base of 100 mm × 200 mm shall be made using 1 kg packages (50 mm × 100 mm × 200 mm) laid flat (i.e. with the face having the largest dimensions horizontal).

When an "M" package (500 g and 50 mm × 100 mm × 100 mm) has to be placed in a stack, it shall also be placed flat, side by side with another 500 g package, with the exception of door shelves (see 13.1.2.7).

The loading may, if necessary, be completed by stacks having a base of 100 mm × 100 mm made with 500 g packages laid flat, and then finally by stacks having a base of 50 mm × 100 mm with 125 g packages also laid flat.

Four 125 g packages may be replaced by one 500 g package placed vertically.

13.1.2.2 The height of the stacks shall be such that the vertical clearance between the upper edge of the highest package and the load limit, the shelf or the horizontal surface situated immediately above is not greater than 25 mm, and there is no physical contact between the highest package and that shelf or horizontal surface.

In the case of a top-opening cabinet without load limit line, a vertical clearance greater than 10 mm but less than 35 mm shall be provided between the upper edge of the highest package and the inner surface of the lid.

In order to satisfy these requirements, 125 g packages (25 mm × 50 mm × 100 mm), laid flat, may be used in or immediately above, as appropriate, the middle of any stack.

The number of packages for each stack shall first be determined in accordance with their nominal thickness dimensions, 50 mm and 25 mm. For the actual loading, the packages shall then be chosen in such a way that, taking into account their individual thicknesses, the vertical clearance above each stack is within the above-mentioned limits.

13.1.2.3 Stacks of packages shall be placed in direct contact with the horizontal loading surfaces and vertical surfaces except in the following cases.

a) When the vertical surface is the inner surface of a door, the stacks shall be loaded as follows:

- if there is a marked load limit line, the packages shall be loaded up to that line [see figure 10 a)];

- if there is no load limit line but a natural load limit, the packages shall be loaded up to that limit [see figure 10 b)];

NOTE 5 Internal doors, edges of shelves, baskets or flaps are considered natural load limits.

- if the manufacturer claims the whole volume of the compartment as storage volume, the packages shall be loaded to within 15 mm from the inner vertical surface of the door or any projection from the door; in that case, packages may overhang the front edge of any shelf [see figures 10 c) and 10 d)].

b) When the intersection of a horizontal loading surface and a vertical surface is radiused, the bottom package of any stack shall be placed in direct contact with the horizontal loading surface, and the remainder of the stacks shall project beyond the bottom package so as to be in contact with the vertical surface [see figures 10 e) to 10 h)].

13.1.2.4 If a subdivision is provided specifically for making and storing ice and is not removable without the use of tools, the ice trays shall be filled with water, the contents frozen and placed in position before the compartment is loaded with test packages;

otherwise, the ice trays and the subdivisions shall be removed and the whole compartment loaded with packages.

13.1.2.5 Free air spaces of 15 mm minimum (calculated from the nominal dimensions of the test packages), as far as possible equal, shall be left between adjacent stacks of test packages.

The use of spacers to maintain free air spaces between stacks of test packages is permissible provided that the spacers are of the smallest possible cross-section and of the lowest possible thermal conductivity and are placed in such a way that they do not significantly interfere with normal air circulation.

13.1.2.6 "M" packages shall be placed where the highest temperatures are expected (for examples, see figure 11). These places may be different for the storage temperatures, energy consumption and temperature rise tests.

13.1.2.7 Door shelves, sections and compartments shall also be loaded with as many packages as possible. Packages shall be placed in such a position that the free air spaces between the packages and the inner surface of the door and between the packages and the retainer are equal. In the case of door shelves and compartments, the packages may, if necessary, be placed on end. However, 125 g packages shall only be placed flat. Spacers may be used to maintain the stability of the stacks (see 13.1.2.5).

13.1.3 Measurements

For the appropriate ambient temperature, the thermostat(s) and other controls, if any, shall be adjusted, as necessary, to a position which is likely to give storage temperatures (see 8.5) which comply with 6.2.1, after stable operating conditions (see 3.4.8) have been attained.

13.2 Test report

The test report shall contain at least the following information:

- a) the ambient temperature;
- b) the setting(s) of thermostat(s) and other controls, if any (if designed for adjustment by the user);
- c) a sketch of the loading arrangement in the freezer or "three star" cabinet showing the locations of the "M" packages and the location of the "M" package with the highest maximum temperature in each cabinet and in any "two star" section;

- d) the value(s) of the highest maximum temperature(s).

14 Water vapour condensation test

The purpose of this test is to determine the extent of condensation of water on the external surface of the cabinet under specified ambient conditions.

14.1 Procedure

14.1.1 Ambient temperature

The ambient temperature shall be

+ 25 °C for class SN and N appliances

+ 32 °C for class ST and T appliances

and shall be controlled within the tolerances specified in 8.1.1.

14.1.2 Relative humidity

The relative humidity shall be such that the dew point is

+ 19 °C ± 0,5 K for class SN and N appliances

+ 27 °C ± 0,5 K for class ST and T appliances.

14.1.3 Preparation of the appliance

The setting(s) of the thermostat(s) and other controls (flaps, etc.), if any, the installation and the loading of the appliance shall be the same as for the energy-consumption 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, the requirement of the second paragraph of 5.3 is not fulfilled, the test shall be repeated with the anti-condensation heaters switched on.

14.1.4 Test period

After stable operating conditions have been attained, all external surfaces of the cabinet shall be carefully wiped dry with a clean cloth and the test continued for a period of 24 h.

14.2 Observations

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 14.3).

14.3 Expression of results and test report

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 5 shall be used.

The test report shall also indicate the duration of the period of observation and shall state whether any manual switch provided for anti-condensation heaters was switched on or off.

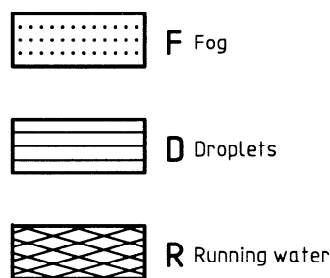


Figure 5 — Condensation code

15 Energy-consumption test

The purpose of this test is to check the energy consumption of appliances under specified test conditions.

NOTE 6 In some countries, a different method of measuring energy consumption is required by law (see annex A).

15.1 Procedure

15.1.1 Ambient temperature⁷⁾

The ambient temperature shall be

+ 25 °C for class SN, N and ST appliances

+ 32 °C for class T appliances

and shall be controlled within the tolerances specified in 8.1.1.

15.1.2 Preparation of the appliance

The appliance shall be installed and loaded as for the storage temperature test (see 8.3 and 13.1).

15.2 Measurements

The energy consumption (electrical, gas or any other) shall be measured during the test period (see 8.7).

In the case of cyclic operation, the initial and final values shall be read immediately after the cut-out of the thermostat.

The measurement of energy consumption shall be carried out under storage conditions with all compartments simultaneously being in operation.

15.2.1 General temperature conditions

The energy consumption is that which is obtained when all the storage temperature conditions (if applicable) in accordance with table 2 are met simultaneously, and which gives the lowest energy consumption.

15.2.2 Determination of the energy consumption

The energy consumption shall be determined either at one of the characteristic temperatures or by interpolation from the results of two tests. When interpolation is used, the temperature obtained from one of the two tests shall be warmer than the characteristic temperature, and the temperature obtained from the other of the two tests shall be colder than the characteristic temperature, within the limits of ± 2 K.

The temperature variation from the above-mentioned characteristic temperature used as the basis for the energy consumption determination shall be within the limits of ± 2 K.

In the case of two tests the results shall be interpolated (for an example, see figure 6).

15.3 Test report

The value of the energy consumption shall be calculated from the measured value for a period of exactly 24 h.

The energy consumption of electrically operated appliances shall be expressed in kilowatt hours per 24 h (kW·h/24 h), to two decimal places.

7) See annex A for particular conditions.

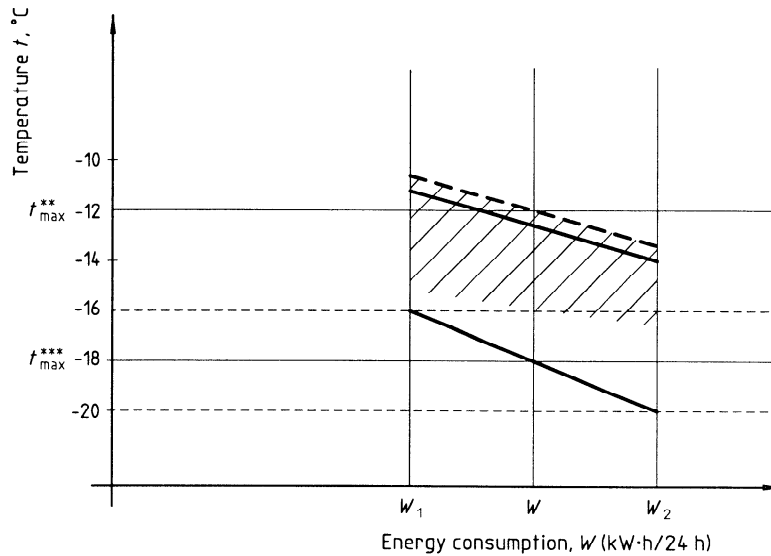


Figure 6 — Example of the determination of energy consumption by interpolation (see 15.2.2)

The report shall mention whether the declared energy consumption, if any, meets the requirements of 6.2.3.

If the energy consumption was determined by interpolation from the results of two tests, the settings shall be those which gave the colder temperatures used for the interpolation.

16 Temperature rise test (if applicable)

The purpose of this test is to check the time for the temperature rise of test packages in freezers and "three star" cabinets under specified test conditions.

16.1 Procedure

16.1.1 Ambient temperature⁷⁾

The ambient temperature shall be

+ 25 °C for class SN, N and ST appliances

+ 32 °C for class T appliances

and shall be controlled within the tolerances specified in 8.1.1.

16.1.2 Preparation of the appliance

The appliance shall be prepared, stabilized and loaded as for the energy-consumption test (see clause 15).

16.1.3 Setting of control devices

Thermostats and other controls (flaps, etc.), if any, shall be set as for the energy-consumption test.

16.2 Test period and measurements

Immediately after the end of a control cycle of the refrigerating system of the appliance, the power supply to the appliance shall be cut off.

The period of time shall be noted from the moment when the temperature of the warmest "M" package (excluding those in the "two star" section) reaches - 18 °C to the moment when any one of the "M" packages first reaches - 9 °C.

16.3 Test report

The test report shall contain the following information:

- the ambient temperature;
- the time for the temperature rise from - 18 °C to - 9 °C;
- whether the declared temperature rise time, if any, meets the requirements of 6.2.4.

17 Freezing test (only for freezers)

The purpose of this test is to check the freezing capacity under specified test conditions.

17.1 Procedure

17.1.1 Ambient temperature

The ambient temperature shall be

+ 25 °C for class SN, N and ST appliances

+ 32 °C for class T appliances

and shall be controlled within the tolerances specified in 8.1.1.

17.1.2 Preparation of the appliance

The appliance shall be installed according to 8.1.3.

The empty appliance should be set up and operated for at least 24 h to reach equilibrium, as for the preparation for the storage temperature test (see 13.1.1).

17.1.3 Loading of the appliance

The freezer shall be loaded with test packages and "M" packages to form a ballast load, the mass of packages used being related to the total storage volume of the appliance [excluding any "two star" section(s)] according to one of the three cases given in table 4.

Table 4 — Mass of test packages

Storage volume of freezer excluding "two star" section(s), V litres	Mass of test packages kg/100 l of V
$V \leq 50$	As many packages as possible consistent with the storage plan (see 13.1.2), but leaving space to accommodate the light load (see 17.1.4.3)
$50 < V \leq 100$	40
$V > 100$	25

If it is not possible to accommodate the light load in the remaining space, the ballast load shall be reduced as necessary to 80 %, 60 % or 40 % of the values specified in table 4.

If the manufacturer's instructions indicate that there is a separate section for freezing food, this section shall be used for the light load only.

In all cases the space left to accommodate the light load shall not exceed the higher value of the two following possibilities:

- 30 % of the total storage volume of the freezer;
- 3 l/kg of light load.

"M" packages shall be uniformly distributed throughout the ballast load, their minimum number being determined by the higher value of the two following possibilities:

- four points;
- one point per 15 kg of load.

Additionally, door shelves and door containers, if any, within the compartment(s) (or cabinet) shall be loaded with two "M" packages, unless there is space for only one package and then one "M" package shall be used.

Any "two star" section within the freezer shall be fully loaded with test packages and "M" packages as for the storage test (see 13.1.2).

The test packages and the "M" packages shall be previously brought to a temperature approximately equal to -18 °C .

The ballast load packages shall be laid flat and distributed uniformly within the freezer, the space for the introduction of the light load (see 17.1.4.3) being left empty. Manufacturer's instructions which are not in conflict with the requirements of this International Standard shall also be taken into account. If the manufacturer has given no instructions, the packages shall be distributed evenly throughout the freezer, with as many packages as possible in direct contact with cooled surfaces, and leaving space for the light load.

The conditions for loading described in the storage plan (see 13.1.2) — with the exception of the total quantity of test packages and the space for the light load — shall be fulfilled.

17.1.4 Operating conditions of the freezer

17.1.4.1 Starting conditions

The loaded appliance is left to run until stable operating conditions are reached. The thermostat setting or the setting of other control devices should be approximately the same as for the energy-consumption test (see clause 15).

After stable operating conditions have been attained, the temperature shall be the following:

- a) the highest maximum temperature of "M" packages in the ballast load of the freezer shall be $\leq -18\text{ }^{\circ}\text{C}$ (but as close as possible to $-18\text{ }^{\circ}\text{C}$);
- b) $t^{**} \leq -12\text{ }^{\circ}\text{C}$ but as close as possible to $-12\text{ }^{\circ}\text{C}$;

In some circumstances it may not be necessary to carry out the stabilization specified here before the stabilization specified in 17.1.4.2.

17.1.4.2 Setting of control devices

Instructions given by the manufacturer shall be taken into account; changes of setting of manually operated controls are not permitted after the introduction of the light load to the end of the freezing process.

17.1.4.2.1 First possibility

The freezer is controlled by a thermostat designed for adjustment by the user and, possibly, with a switch for continuous running.

After stable operating conditions in accordance with 17.1.4.1 have been attained, the freezer shall be set in operation on continuous running or, if this is not possible, the thermostat shall be set for the lowest temperature. The appliance shall be left in operation for 24 h, or in accordance with the manufacturer's instructions if a longer or shorter period is specified. The procedure described in 17.1.4.3 shall then be carried out in accordance with the manufacturer's instructions.

17.1.4.2.2 Second possibility

The freezer is controlled by a thermostat and fitted with a timer which sets the freezer on continuous running and which reverts to thermostatic operation when the set time has elapsed (the timer may be graduated in terms of mass of food to be frozen instead of in terms of duration).

After stable operating conditions in accordance with 17.1.4.1 have been attained, the timer shall be set in operation and the procedure described in 17.1.4.3 shall be carried out in accordance with the manufacturer's instructions.

17.1.4.2.3 Third possibility

If the freezer does not correspond to either of the above two possibilities, the procedure described in 17.1.4.3 shall be carried out in accordance with the manufacturer's instructions after the appliance has

reached stable operating conditions in accordance with 17.1.4.1. Any devices for temperature regulation (thermostats, flaps, etc.) shall be set in accordance with these instructions.

If there are no special instructions, the procedure described in 17.1.4.3 shall be carried out after the appliance has reached stable operating conditions in accordance with the temperature requirements of 17.1.4.1.

17.1.4.3 Freezing of the light load

After the conditions according to 17.1.4.2 have been attained, the light load shall be introduced.

The light load corresponds to the value stated by the manufacturer as that which can be frozen in 24 h and is made up of test packages which have previously been brought to a temperature of $+25\text{ }^{\circ}\text{C} \pm 1\text{ K}$ for class SN, N and ST freezers and to a temperature of $+32\text{ }^{\circ}\text{C} \pm 1\text{ K}$ for class T freezers. If there is a separate section within the freezer, the light load shall be put into this section unless otherwise indicated in the instructions for use.

The light load packages shall be placed flat, and positioned taking into account the manufacturer's instructions and the requirements of the loading plan (see 13.1.2). If no instructions are given, the largest possible number of packages shall be placed in such a way that they will be frozen as rapidly as possible. The use of spacers between adjacent stacks of packages is permitted, but other methods are not permitted.

The light load shall not be placed in physical contact with the ballast load.

"M" packages shall be uniformly distributed throughout this light load; their minimum number shall be determined by the higher value of the two following possibilities:

- a) two points;
- b) one point per 3 kg of load.

The temperatures of the "M" packages in the ballast load and in the light load shall be recorded, together with those of the "M" packages in the other compartment(s), if any (see 17.1.3), until the arithmetic mean of the instantaneous temperatures of all the "M" packages in the light load reaches $-18\text{ }^{\circ}\text{C}$. The time necessary for reaching this temperature shall be noted.

17.1.4.3.1 First possibility

If this temperature is reached in a time between 22 h and 26 h, the mass which would be frozen in 24 h shall be determined from the actual freezing time by proportional calculation.

The test result shall be accepted only if (as applicable according to the type of appliance):

- a) the maximum temperature of any of the "M" packages of the ballast load remains equal to or colder than $-15\text{ }^{\circ}\text{C}$; at the end of the test the maximum temperature of the warmest "M" package of the ballast load shall be equal to or colder than $-18\text{ }^{\circ}\text{C}$;
- b) the maximum temperature of the warmest "M" package in any separate compartment which is not used for ballast in accordance with 17.1.3 remains equal to or colder than $-18\text{ }^{\circ}\text{C}$;
- c) the maximum temperature of the warmest "M" package in any "two star" section remains equal to or colder than $-9\text{ }^{\circ}\text{C}$.

At the end of the test, the maximum temperature of the warmest "M" package in any "two star" section shall be equal to or colder than $-12\text{ }^{\circ}\text{C}$.

17.1.4.3.2 Second possibility

If the actual freezing time is less than 22 h or more than 26 h and/or the conditions of 17.1.4.3.1 a) to c) are not fulfilled, further test(s) shall be carried out, if possible with more favourable setting of control devices (see 17.1.4.2) — but still maintaining the temperature limits in accordance with 17.1.4.1 — on the assumption that better results can be expected.

Otherwise, the test shall be repeated with a different load.

17.1.4.3.3 Third possibility

If the actual freezing time is less than 22 h and the conditions of 17.1.4.3.1 a) to c) are fulfilled, but using a larger light load these conditions cannot be fulfilled, the actual load for which the conditions are met shall be considered (without any proportional calculation) to be the mass which can be frozen in 24 h.

17.2 Test report

The test report shall contain the following information:

- a) the mass, in kilograms, of the ballast load;

- b) the mass, in kilograms, of the light load;
- c) the freezing time, in hours, of the light load;
- d) the freezing capacity, in kilograms, determined during the light load freezing test;
- e) the warmest temperature measured in the "M" packages in the ballast load stored during the light load freezing test together with the warmest temperature measured in the "M" packages in any "three star" cabinet or "two star" section;
- f) the settings of all temperature control devices, including the timer, if any;
- g) the loading plan for the appliance showing the location of the "M" packages and the location of the warmest "M" package(s);
- h) if the freezer is fitted with a device intended to set it in continuous operation when freezing and then to revert to thermostatic operation automatically, the time which elapsed before the freezer reverted to thermostatically controlled operation;
- i) whether the declared freezing capacity meets the requirements of 6.2.2.

18 Final test report

The final test report shall comprise the measurements and test results of the following:

- a) the overall dimensions (see 3.3.3);
- b) the overall space required in use (see 3.3.4);
- c) the total gross volume (see 3.3.5.3 and 7.2.1);
- d) the storage volume(s) (see 3.3.5.5, 7.2.3 and 7.2.4);
- e) the total storage volume (see 3.3.5.7 and 7.2.2);
- f) the storage shelf area (see 3.3.6.2 and 7.3);
- g) airtightness of door(s) or lid(s) (see clause 9);
- h) opening force test of door(s) or lid(s) (see clause 10);
- i) durability test (see clause 11);
- j) mechanical strength test (see clause 12);
- k) storage temperature(s) test (see clause 13);

- l) water vapour condensation test (see clause 14);
- m) energy-consumption test (see clause 15);
- n) temperature rise test, if applicable (see clause 16);
- o) freezing test, if applicable (see clause 17).

19 Designation

Freezers and "three star" cabinets shall be designated according to

- a) the kind (for example single door or double door, freezer, "three star" cabinet, etc.);
- b) the operating principle:
 - compression or absorption, and
 - if absorption, the energy source(s) (electricity, gas or liquid fuel);
- c) the class (extended temperate — SN, temperate — N, subtropical — ST, tropical — T);
- d) the rated total gross volume, either in cubic decimetres or in litres;
- e) the rated total storage volume, either in cubic decimetres or in litres, together with the rated storage volume of the freezer or of the "three star" cabinet and any "two star" sections, as applicable, and the star classification;
- f) the rated freezing capacity, in kilograms, if applicable.

Example of designation

Two-door compressor-type freezer, class N, total gross volume 400 dm³, total storage volume 360 dm³, including 8 dm³ "two star" volume, freezing capacity 20 kg.

20 Marking

20.1 Rating plate

Each appliance shall have, on one or several securely fastened rating plates, the following information marked in a permanent and legible manner, either preferably readily visible in normal use or when the appliance is away from a wall or after the removal, without any tool, of a flap or grille;

- a) the indication "frozen food storage cabinet" or "food freezer";
- b) the trademark or name of the manufacturer or responsible vendor;
- c) the model designation;
- d) the serial number and/or date of manufacture, which may be coded;
- e) the rated gross storage volume, either in cubic decimetres or in litres;
- f) the rated storage volume, either in cubic decimetres or in litres, of the following:
 - the freezer and "three star" cabinet (excluding any "two star" section therein),
 - the "two star" section(s), if any, within the freezer and "three star" cabinet;
- g) the symbol of the class (SN, N, ST or T);
- h) the designation and mass, in grams, of the refrigerant (see ISO 817);
- i) all information relating to the energy source, including those laid down by safety regulations;
- j) the rated freezing capacity, in kilograms (only for freezers).

Items b) to d) (necessary for service) shall be visible when the appliance is in its position for normal use.

The manufacturer is free to show any other information considered desirable.

20.2 Identification of freezers

Freezers shall be identified by a symbol placed on their front, doors or lids, conforming to that shown in figure 7 and defined as follows: a rectangular frame enclosing a large six-pointed star followed by the symbol for a "three star" cabinet.

If the exterior of the appliance is intended to be decorated by the purchaser, and the symbol would then be hidden, the symbol shall be placed on the appropriate compartment inside the appliance.

In the case of a "two star" section in a frozen food storage cabinet or freezer, the standard symbol of two stars shall also appear close to the standard symbol of three/four stars wherever it appears.



Figure 7 — Identification symbol for freezers
(for further details, see figure 14)

The dimensions shall be such that the height of the large star is equal to the height of the curved frame at its midpoint (the long axis of the frame being horizontal).

The symbol shall not make use of more than two colours or exhibit more than two contrasting surface finishes. The colour (or the surface finish) of the large star shall be different from that of the three other stars. (For the purpose of this requirement, white and black are considered as colours.) There shall be no marking or decoration anywhere on the appliance which could be confused with the freezer identification symbol.

20.3 Identification of “three star” cabinets and “two star” sections

“Three star” cabinets (or compartments) shall be identified by a symbol, placed on either front, doors or lids. Six-pointed stars within a frame with curved sides, as shown in figure 8, shall be used for the identification on the cabinet and compartment as specified in 3.1.1 and 3.2.

If the exterior of the appliance is intended to be decorated by the purchaser, and the symbol would then

be hidden, the symbol shall be placed on the appropriate compartment inside the appliance.

The symbol shall not make use of more than two colours or exhibit more than two contrasting surface finishes. (For the purpose of this requirement, white and black are considered as colours.) There shall be no marking or decoration anywhere on the appliance which could be confused with the star identification symbols.

20.4 Load limit line(s)

The load limits of storage volume shall be indicated in a conspicuous and indelible fashion by a load limit line or lines in the form shown in figure 9.

It is recommended that the manufacturer should avoid, as far as possible, the provision of storage spaces outside the load limits and outside any “two star” sections (see 7.2.4).

No load limit line is necessary if, within the gross volume of any cabinet which is suitable for “three star” storage

- no space is acknowledged as being unsuitable for storage (as defined in 3.1.1), or
- the load limits are determined by the particular construction (e.g. baskets, containers, flaps, etc.) or
- the load limits are determined by natural load limits (see figures 10 and 11) and the loading conditions are specially described in the instructions for use.

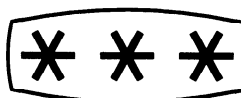
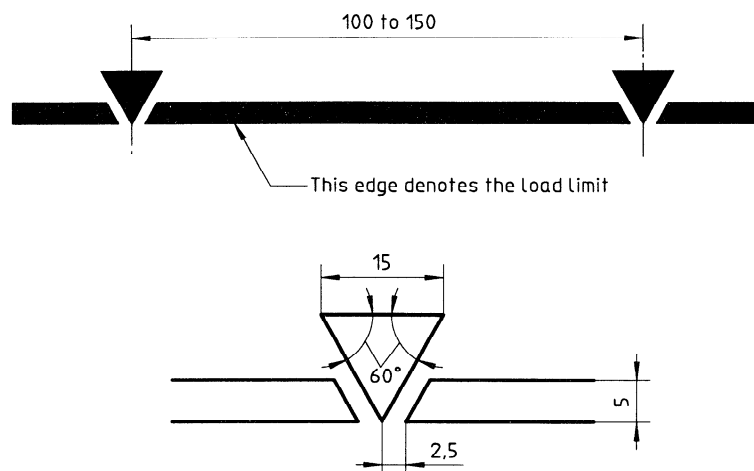


Figure 8 — Identification symbols for “three star” cabinets and “two star” sections
(for further details, see figure 15)

Dimensions in millimetres



NOTE — Dimensions are given for information. They may be reduced while maintaining the same proportions but shall not be less than half the values shown.

Figure 9 — Marking of load limit

21 Technical and advertising literature

Whenever technical and advertising literature is supplied, it should contain the characteristics stated in clause 19 and if, additionally, it contains all or some of the following data, such data shall be in accordance with this International Standard:

- a) the name of manufacturer or responsible vendor;
- b) the model designation;
- c) the range of ambient temperature of the class (SN, N, ST or T) for which the appliance is designed;
- d) the overall space required in use (see 3.3.4), with sketches showing the appliance with the means of access open and closed;
- e) for appliances which are intended to be built-in, the recess dimensions, together with any additional ventilation requirements;
- f) the direction of opening of the door(s), and whether reversible;
- g) the rated energy consumption (see clause 15), with a reference to the ambient temperature at which the value was measured;

- h) the temperature rise time, measured in accordance with clause 16, if applicable;
- i) the rated freezing capacity, measured in accordance with clause 17, if applicable;
- j) the percentage running time, measured in accordance with 8.6;
- k) the rated storage shelf area, measured in accordance with 7.3;
- l) the rated storage volume, measured in accordance with 7.2.

22 Instructions for use and maintenance

Every appliance shall be accompanied on delivery by instructions for its use and maintenance, in the language of the country where it is for sale. These instructions shall include, in particular, information as to

- a) the installation requirements (best location, levelling, connection — if required — for defrost water, connections to energy source);
- b) the overall space required in use (see 3.3.4), with sketches showing the appliance with the means of access open and closed;

- c) for appliances which are intended to be built-in, the recess dimensions together with any additional ventilation requirements;
- d) the operating conditions (starting and stopping procedures);
- e) the instructions for use of the various controls [such as thermostat(s), indicator lights and air circulation];
- f) the limit values of the range of ambient temperature for which the appliance is designed and the fact that the internal temperatures may be affected by such factors as the location of the appliance, ambient temperature and the frequency of door opening; if appropriate, a warning shall be given that the setting of the thermostat or other temperature control devices might have to be varied to allow for these factors;
- g) the care required for best performance, such as:
 - 1) loading the appliance (especially when the storage volume of the freezer or "three star" cabinet is smaller than the corresponding gross volume and when no load limit lines exist),
 - 2) the use of baskets and, where appropriate, a warning on the risk of poor performance when the baskets are not used,
 - 3) the arrangement of food for storage and for freezing, where applicable, including, in particular, advice that food to be frozen shall not be placed in direct contact with food in storage and, if appropriate, that it may be necessary to reduce the quantity to be frozen if freezing every day is anticipated;
- h) the maintenance and cleaning of the appliance;
- i) defrosting;
- j) the fact that effervescent drinks should not be stored in freezers or in "three star" cabinets, and that some products such as water ices should not be consumed too cold;
- k) the need not to exceed the storage time(s) recommended by the food manufacturers for commercially quick frozen food in freezers and "three star" cabinets;
- l) the precautions necessary to prevent an undue rise in temperature of the frozen food while defrosting the appliance, such as wrapping the frozen food in several thicknesses of newspaper;
- m) the fact that a rise of temperature of the frozen food during defrosting may shorten the storage life;
- n) the care required with regard to frozen food in storage in the event of an extended non-running of the appliance (interruption of power supply or failure of the refrigerating system);
- o) the action to be taken when the appliance is switched off and taken out of service temporarily or for an extended period, for example, emptied, defrosted, cleaned and dried, and the door(s) or lid(s) propped ajar;
- p) the necessity that, for doors or lids fitted with locks and keys, the keys should be kept out of the reach of children and not in the vicinity of the appliance, in order to prevent children from being locked inside.

Dimensions in millimetres

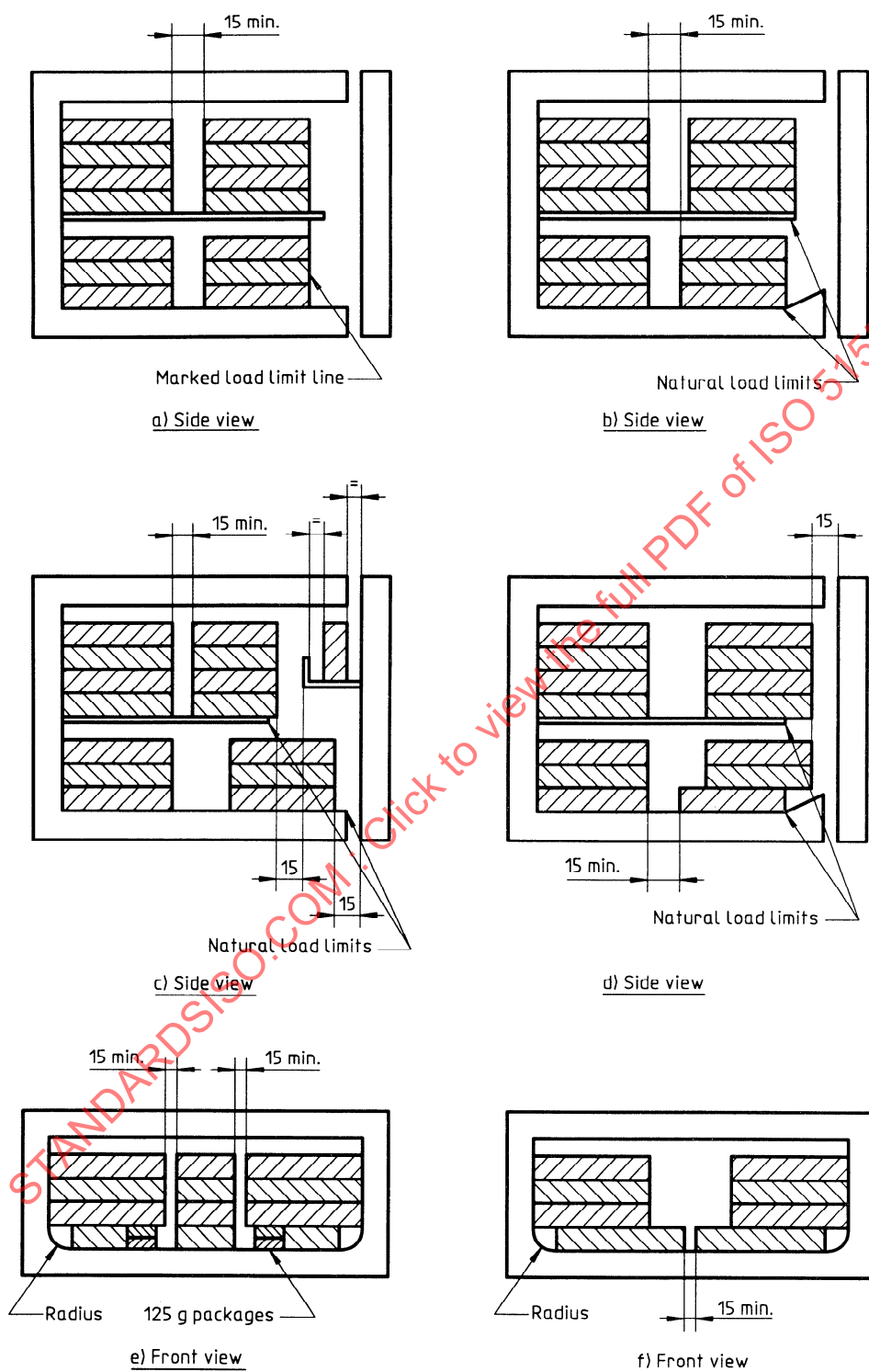
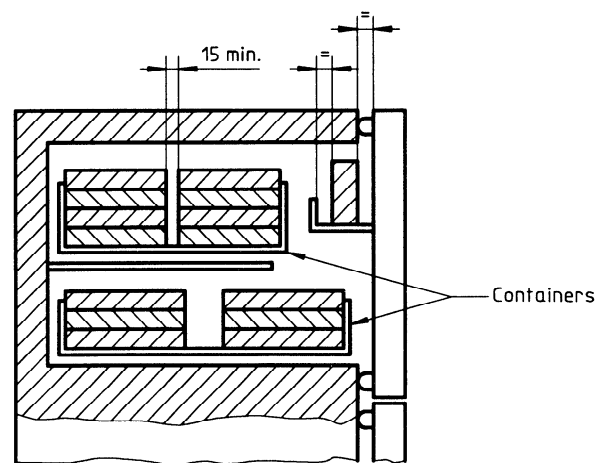
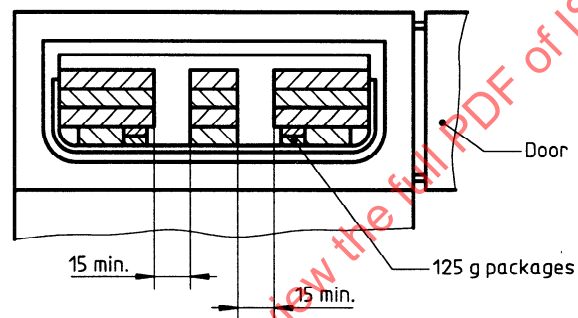


Figure 10 — Examples of storage plan (see 13.1.2)



g) Side view with containers



h) Front view, containers with radiused corners

Figure 10 — Examples of storage plan (see 13.1.2) (concluded)

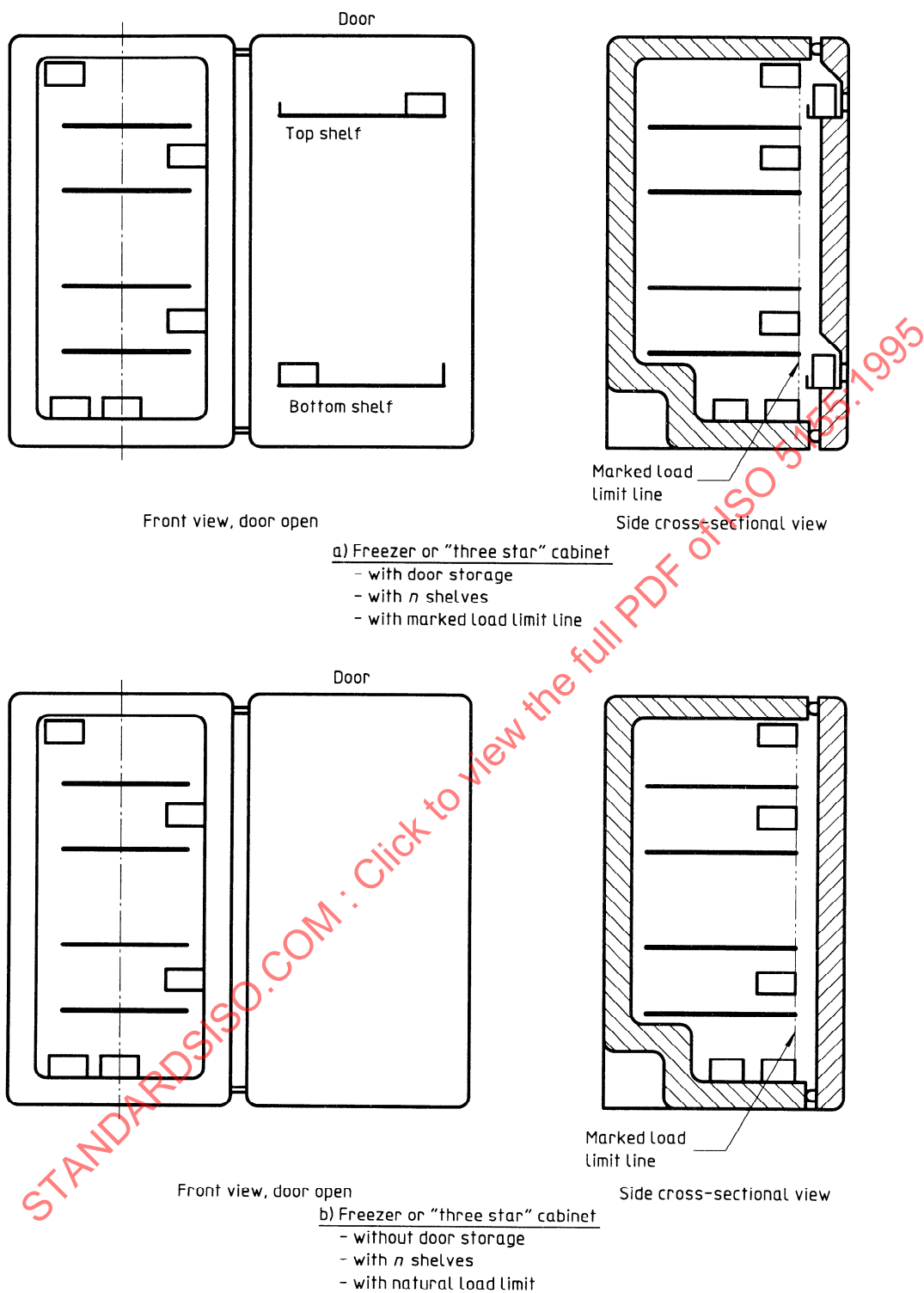


Figure 11 — Examples of positioning of "M" packages

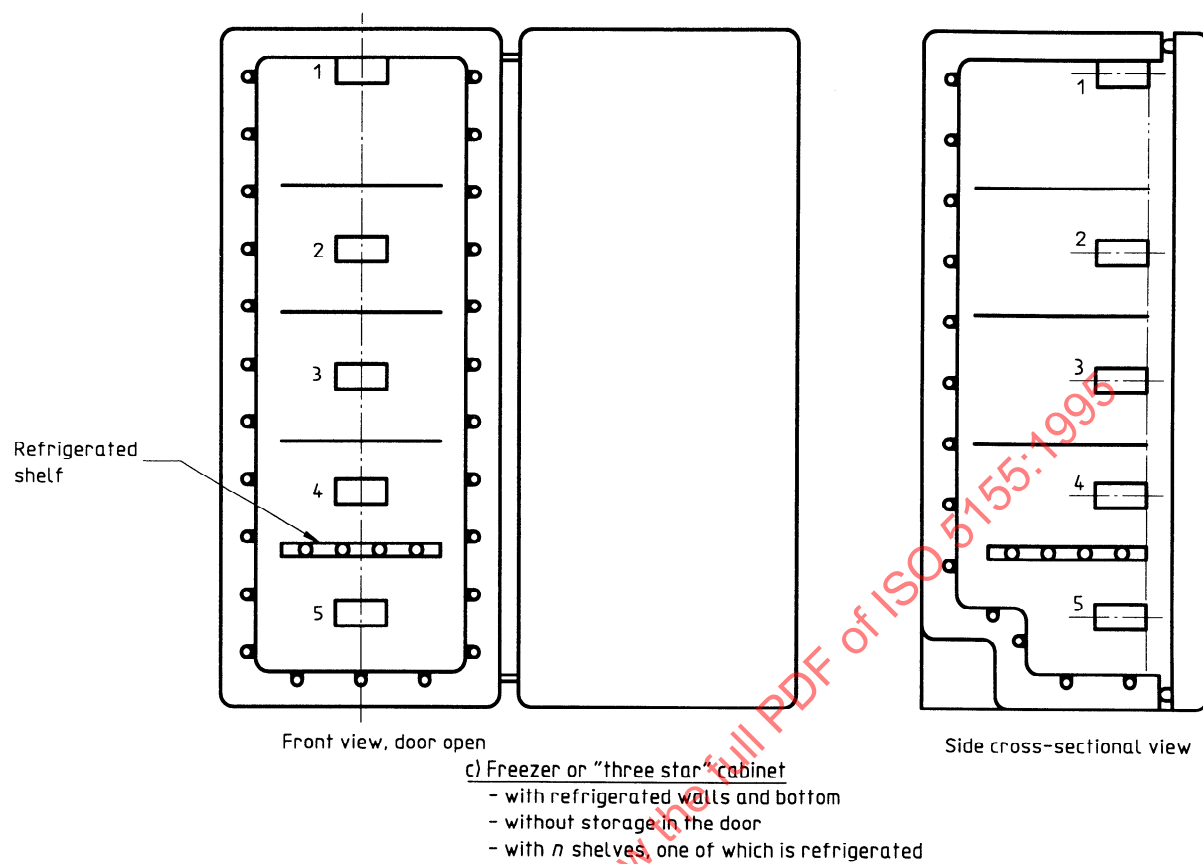
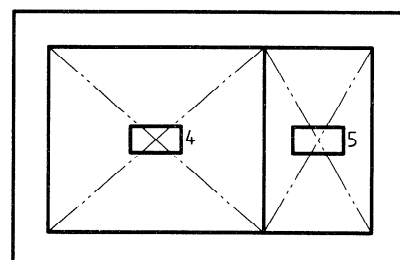
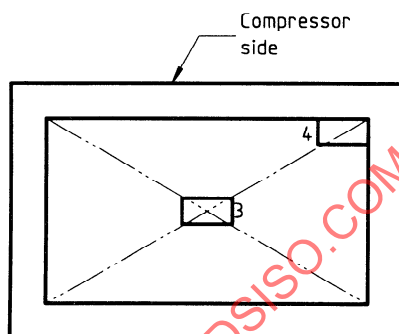
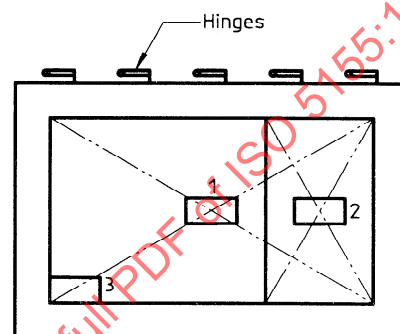
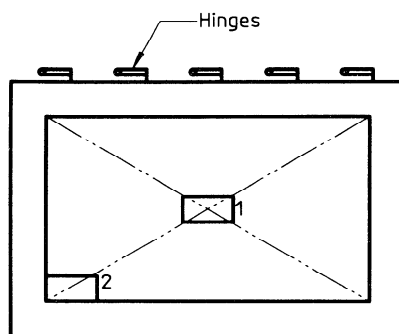
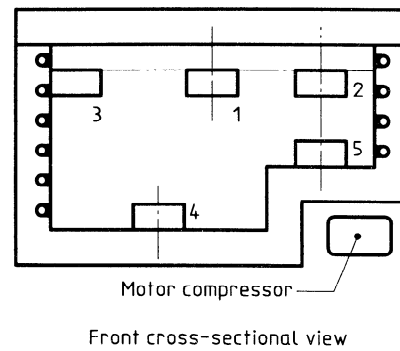
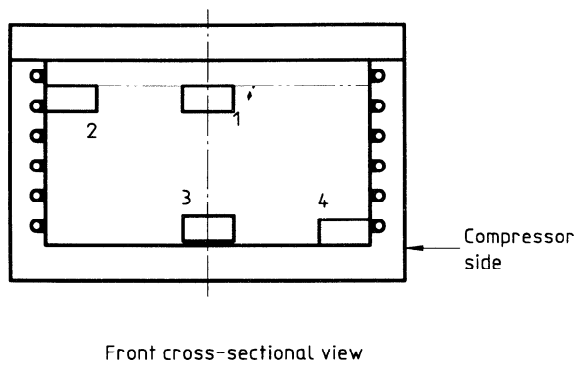


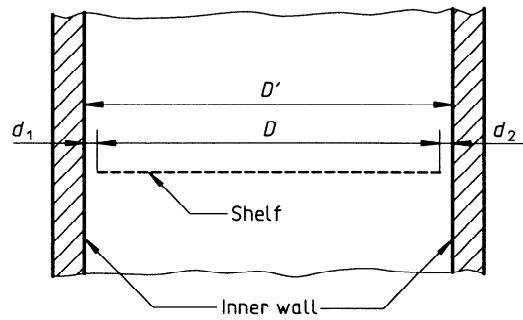
Figure 11 — Examples of positioning of "M" packages (continued)



- d) Top-opening type of appliance
- with refrigerated walls
 - without inner partition

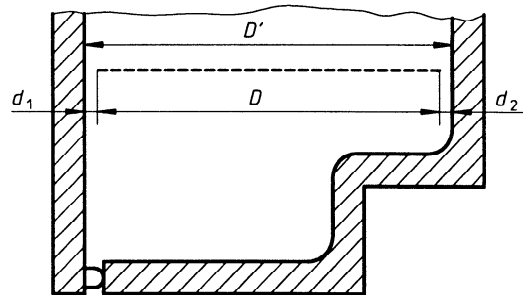
- e) Top-opening type of appliance
- with refrigerated walls
 - with non-refrigerated inner partition

Figure 11 — Examples of positioning of "M" packages (concluded)



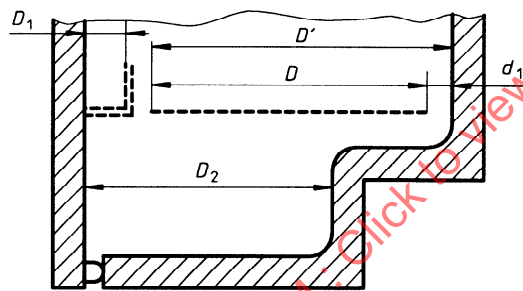
If $d_1 + d_2 \leq 20$ mm:
dimension of the shelf = D'
If $d_1 + d_2 > 20$ mm:
dimension of the shelf = D

a) Determination of width



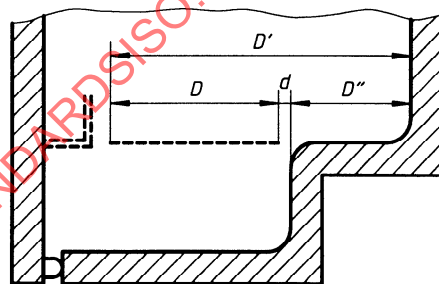
If $d_1 + d_2 \leq 20$ mm:
dimension of the shelf = D'
If $d_1 + d_2 > 20$ mm:
dimension of the shelf = D

b) Determination of depth - Upright-type appliance without storage in the door



If $d_1 \leq 20$ mm:
dimension of the shelf = D'
If $d_1 > 20$ mm:
dimension of the shelf = D
Dimension of the door shelf = D_1
Dimension of the bottom of the appliance = D_2

c) Determination of depth - Upright-type appliance with storage in the door



If $d \leq 20$ mm:
dimension of the shelf = D'
If $d > 20$ mm:
2 shelves of dimensions D and D''

d) Determination of depth - Shelf with juxtaposed parts

Figure 12 — Examples of determination of the dimensions for calculating the area of a shelf (see 7.3.1)