

International Standard 5155

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Household frozen food storage cabinets and food freezers — Essential characteristics and test methods

Conservateurs ménagers de denrées congelées et congélateurs ménagers — Caractéristiques essentielles et méthodes d'essai

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Foreword

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Brazil	France	South Africa, Rep. of
Czechoslovakia	Hungary	Spain
Denmark	Israel	Sweden
Egypt, Arab Rep. of	Italy	Switzerland
Finland	Netherlands	

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Canada
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Household frozen food storage cabinets and food freezers — Essential characteristics and test methods

1 Scope and field of application

This International Standard specifies the essential characteristics of household frozen food storage cabinets and household food freezers, and lays down the test methods to check these characteristics.

It applies to factory-assembled appliances whatever their operating principle but not to low-temperature compartments (one-, two- and three-star compartments¹⁾ or freezer compartments incorporated in refrigerators²⁾.

Whenever appropriate testing methods are not specified, the provisions contained in this International Standard should be considered as recommendations.

2 Safety requirements

The safety requirements applicable to the electrical equipment of household refrigerating appliances are covered by IEC Publication 335-2-24.

The safety requirements applicable to refrigerating equipment in general are covered by ISO/R 1662. The parts of ISO/R 1662 which may be applicable to household frozen food storage cabinets and household food freezers are under consideration.

The safety requirements applicable to the heating equipment (gaseous or liquid fuels) of appliances of the absorption type will be covered by a separate International Standard.

3 References

ISO 534, *Paper and board — Determination of the thickness of single sheets (and method of calculation of the apparent density of board)*.

ISO 817, *Organic refrigerants — Number designation*.

ISO/R 824, *Household refrigerators — Part 1 : Performance requirements*.

ISO/R 825, *Household refrigerators — Part 2 : Special low-temperature compartments for the storage of frozen foodstuffs*.

ISO/R 1662, *Refrigerating plants — Safety requirements*.

ISO 3055, *Kitchen equipment — Co-ordinating sizes*.

ISO 5731, *Kitchen equipment — Limit of size*.

ISO 5732, *Kitchen equipment — Sizes of openings for built-in appliances*.

IEC Publication 335-1 (1976), *Safety of household and similar electrical appliances — Part 1 : General requirements*.

IEC Publication 335-2-24 (1976), *Safety of household and similar electrical appliances — Part 2 : Particular requirements for refrigerators and food freezers*.

4 Definitions

4.1 household frozen food storage cabinet : A heat-insulated enclosure having adequate volume and equipment for household use, cooled by an energy-consuming means and having one or more compartments the temperature of which is such that, under the test conditions specified in 8.5, the temperature of products, equal to or below -18°C when they are placed in the appliance, does not rise above this value (-18°C).

4.2 household food freezer : A heat-insulated enclosure having adequate volume and equipment for household use, cooled by an energy-consuming means, having one or more compartments for freezing a quantity of at least 4,5 kg of test-packages per 100 l of storage volume in 24 h under the test conditions for the light load specified in 8.7, and suitable for storage as defined in 4.1.

4.3 General definitions applicable to all appliances

4.3.1 top-opening type of appliance : A frozen food storage cabinet or food freezer the compartment(s) of which is (are) accessible from the top.

1) These compartments are covered by ISO/R 825.

2) Will be the subject of a future International Standard.

4.3.2 upright type of appliance : A frozen food storage cabinet or food freezer the compartment(s) of which is (are) accessible from the front.

4.3.3 overall dimensions (means of access closed) : The measurements of the rectangular parallelepiped, having a horizontal base, within which the appliance fits, including the fittings but not the handle, the protrusion of which, if the case, is to be specified separately.

4.3.4 overall space required in use (means of access open) : The overall dimensions, increased by the space necessary for free circulation of the cooling air when the appliance is in service and the space necessary to allow opening of the means of access to the minimum angle permitting removal of all removable parts (baskets, shelves, etc) (see figure 1).

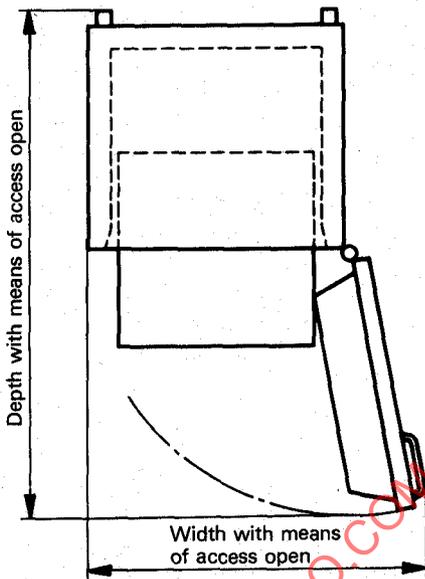


Figure 1 — Overall space required in use

4.3.5 Volumes

4.3.5.1 gross volume of the food compartment(s) : The total volume of the food compartment(s) within the inside walls of the appliance, the means of access being closed and without fittings. However, when cooling is provided by forced air, the gross volume is calculated by subtracting from the total volume, the volume blocked by cold-air ducting, evaporator, fan and other associated accessories.

4.3.5.2 rated gross volume : The gross volume stated by the manufacturer.

4.3.5.3 storage volume : That portion of the gross volume complying with the definition given in 4.3.5.1, minus the volume of components and spaces unusable for food storage (see figure 6).

4.3.5.4 rated storage volume : The storage volume stated by the manufacturer.

4.3.6 Storage surfaces

4.3.6.1 shelf : For the purpose of this International Standard, 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.

4.3.6.2 storage shelf area : The sum of the horizontal projections of each shelf within the storage volume, including door shelves, and of the bottom of the appliance.

4.3.6.3 rated storage shelf area : The storage shelf area stated by the manufacturer.

4.3.7 load limit : The surface enveloping the storage volume.

4.3.8 load-limit line(s) : Permanent mark(s) indicating the limits of the storage volume.

4.3.9 Classification

With regard to the ability of appliances to operate in extreme ambient temperatures, this International Standard distinguishes the two following classes :

Class N (temperate) : appliances intended for use in ambient temperatures not higher than +32 °C.

Class T (tropical) : appliances intended for use in ambient temperatures not higher than +43 °C.

4.4 Definitions relating to some performance characteristics

4.4.1 Frozen food storage cabinets and freezers

4.4.1.1 energy consumption : The consumption by an appliance over a period of 24 h when loaded with simulated frozen food storage test-packages, running under stable operating conditions at an ambient temperature of +25 °C (class N appliances) or +32 °C (class T appliances), the temperature of the stored packages being maintained at or below -18 °C, measured under the conditions specified in 8.8.

4.4.1.2 rated energy consumption : The energy consumption stated by the manufacturer.

4.4.1.3 storage temperature : The maximum temperature of the warmest "M" package of a load placed in storage (see 8.5).

4.4.1.4 temperature rise of the load : The temperature rise of the test-packages which is found under test conditions when the normal operation of the refrigerating system is interrupted.

4.4.2 Food freezers

4.4.2.1 freezing capacity : The mass of test-packages the temperature (i.e. the instantaneous arithmetic mean temperature of all the "M" packages) of which can be lowered from the loading temperature to $-18\text{ }^{\circ}\text{C}$ in 24 h under the test conditions specified in 8.7. The freezing capacity is expressed in kilograms.

4.4.2.2 rated freezing capacity : The freezing capacity stated by the manufacturer.

NOTE — Normally it is impossible to attain the rated freezing capacity day after day. If, therefore, freezing is required day after day, then the quantity to be frozen may have to be reduced. Furthermore, if freezing is carried out without the prior adjustment of the thermostat or operation of the fast-freeze switch (as required in the test specified in 8.7.1), this quantity may have to be similarly reduced.

The user instructions shall draw attention to these points.

4.4.3 automatic defrosting : Defrosting in which the frequency and the duration of the defrost operation and the removal and disposal of the defrost water from the refrigerated space require no intervention by the user.

4.4.4 "M" package : A test-package in accordance with 8.1.2, of dimensions 50 mm \times 100 mm \times 100 mm, fitted with a temperature-measuring probe.

5 Materials, design and manufacture

5.1 General

Household frozen food storage cabinets and food freezers shall be constructed so as to ensure adequate service. Their performance in use is checked by applying the series of tests specified in clause 8.

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

5.2 Materials and finishes

All wall finishes shall be highly resistant to impact, sufficiently hard, colour-fast, smooth, easily washable, and resistant to damage by moisture and to acids present in food.

No materials used inside appliances, in particular for the fittings, shall cause odours. They shall neither contaminate food placed in contact with them nor transmit poisonous substances to food. They shall be resistant to the action of moisture and of acids present in food.

5.3 Thermal insulation and air-tightness

The efficiency of the thermal insulation is tested by applying the water vapour condensation test (see 8.6) and the series of performance tests specified in clause 8.

When the door is closed, there shall be no abnormal ingress of air into the interior. This air-tight condition is checked by apply-

ing the test specified in 8.2; during this test it shall be verified that the strip of paper does not slide freely.

No running water shall appear externally when the appliance is subjected to the water vapour condensation test specified in 8.6.

5.4 Doors and lids

Hinges and handles shall be strong and resistant to corrosion.

5.5 Shelves and baskets

All shelves and baskets, including those which can be removed, shall be sufficiently strong.

When subjected to the test specified in 8.4, the components shall not show such distortion that they could no longer fulfil their intended function (in particular, sliding components shall be capable of their full movement when loaded).

6 Required characteristics

6.1 Dimensional characteristics

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.

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.

6.1.3 Rated storage shelf area

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

6.2 Performance characteristics

6.2.1 Storage temperature (for all appliances)

The appliance shall be capable of maintaining the required storage conditions within the storage volume, i.e. under the conditions specified in 8.5 the maximum temperature of the warmest "M" package shall be maintained at or below $-18\text{ }^{\circ}\text{C}$ during the test.

In addition, during the test specified in 8.6, no running water shall appear.

6.2.2 Rate of temperature rise

Frozen food storage cabinets and freezers shall be designed to limit the rate of temperature rise of the packages if the power supply is interrupted or if the refrigerating system fails. Under

the conditions specified in 8.9, the period between the moment when the temperature of $-18\text{ }^{\circ}\text{C}$ is reached for the first time by any "M" package and that when the temperature of $-9\text{ }^{\circ}\text{C}$ is reached for the first time by any "M" package (the two "M" packages may be different) shall not be shorter than the period stated by the manufacturer.

6.2.3 Freezing capability (for freezers only)

This performance is evaluated by the following series of determinations carried out under the test conditions specified in 8.7.

6.2.3.1 The time necessary to reduce the instantaneous arithmetic mean of the temperatures of the "M" packages in a test load corresponding to 25 kg per 100 l of storage volume from the loading temperature to $-18\text{ }^{\circ}\text{C}$ shall be stated.

6.2.3.2 The value of the freezing capacity measured during the light-load test (mass, in kilograms, of the test load in which the instantaneous arithmetic mean of the temperatures of all the "M" packages can be lowered from the loading temperature to $-18\text{ }^{\circ}\text{C}$ in 24 h under the test conditions specified in 8.7) shall be not less than 4,5 kg per 100 l of storage volume and also shall be not less than 90 % of the rated freezing capacity (to allow for variations in testing).

6.2.3.3 During the determination of the freezing capacity, the maximum temperature reached by any of the previously frozen "M" packages shall be equal to or lower than $-15\text{ }^{\circ}\text{C}$.

6.2.4 Energy consumption

If the energy consumption is stated by the manufacturer, the value measured in accordance with 8.8 shall not exceed the rated energy consumption by more than 10 % of the latter.

6.3 Opening of the door

The doors and lids of frozen food storage cabinets and food freezers shall not be fitted with automatic latching devices which prevent the door or lid from being pushed open from inside.

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

For appliances fitted with lock and key, the instructions for use shall draw the attention of users to the fact that the key for locking the appliance door should be kept out of reach of children and not in the vicinity of the appliance, to prevent children from being locked inside.

For appliances having a volume equal to or greater than 60 l, the door or lid, if it is not locked, shall be capable of being opened from the inside. The force required to open the door or lid, applied from inside the appliance at the mid-point of the edge farthest from the hinge axis in a direction perpendicular to the plane of the door or lid, shall not exceed 70 N.

This requirement is checked by applying the test specified in 8.3.

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 cubic decimetres or litres.

7.2.1 Determination of gross volume

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

When the gross volume is determined, internal fittings are considered as not being in place. However, the gross volume takes into account the exact shapes of the walls if they contain depressions or projections.

If cooling is effected by forced air, any volume which is inaccessible because of air ducts, fans, evaporator and other associated accessories shall also be deducted.

7.2.2 Determination of storage volume (see figure 6)

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

The total volume to be deducted comprises

- a) the volume of spaces situated outside the load limits marked by the manufacturer;
- b) the volume of all fixed components included within the load limits;
- c) the volume of spaces which are to be kept free for correct performance of the refrigerating system;
- d) the volume of all included removable parts which are stated by the manufacturer to be necessary for the proper functioning of the appliance except shelves and partitions whose thickness is not greater than 13 mm;
- e) the volume rendered unusable by the use of removable parts (baskets, shelves, etc.) necessary for obtaining satisfactory thermal and mechanical characteristics;
- f) any volume where it is impossible to place an "M" package.

NOTE — There is no equivalence between the value of the storage volume determined in accordance with the principles 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.

7.3 Determination of storage area

The area shall be expressed in square decimetres.

7.3.1 Determination of the area of a shelf

7.3.1.1 Shelf composed of a single part

In the case of a shelf composed of a single part, the area is the product of the width by the depth. These two dimensions are 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 real width of the shelf by more than 20 mm [see figure 7a)];

depth : mean distance measured parallel to the surface of the shelf 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 7b)]. When the door of an upright-type appliance is provided with shelves, this distance is measured between the rear inner surface of the enclosed space of the cabinet and the vertical plane tangential to the front of the cabinet shelf, provided that any gap between the rear edge of the shelf and the rear wall does not exceed 20 mm [see figure 7c)]. When considering the bottom of an upright-type appliance, the front reference plane is the edge of the enclosed space of the cabinet [see figure 7c)].

7.3.1.2 Shelf with juxtaposed parts

In the case of a shelf with juxtaposed parts, when the distance between two parts does not exceed 20 mm, the dimensions are measured as for a shelf composed of a single part. When the distance is more than 20 mm, the area is measured for each of the parts [see figure 7d)].

7.3.1.3 Specific cases

The bottom of the enclosed space is considered as a shelf.

When an inner wall is not vertical, the dimension of the shelf is measured with reference to the vertical plane cutting this surface as 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 the appliance having less than 100 mm vertical clearance above, when all the shelves are in position, shall be excluded when calculating the storage area. However, it is admissible that for one full shelf or basket the vertical clearance may be reduced to not less than 80 mm (see figure 8).

7.3.2 Determination of the area of door shelves

The shelf area is the product of the width by the depth. These two dimensions are determined by analogy with the specifications in 7.3.1 :

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 front of the shelf or retainer bar [see figure 7c)].

7.3.3 Determination of the area of baskets

The basket area is the product of the two mean horizontal dimensions [see figure 8a)].

The vertical clearance above the inner surface of the bottom of the basket shall not be less than 80 mm [see figure 8b)].

8 Test methods

With a few exceptions, the order of carrying out the tests need not necessarily follow the sequence of the sub-clauses 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.

It is recommended that the test authority should ask the manufacturer for the storage plans and take account of them provided that they are in accordance with this International Standard.

8.1 General test conditions

8.1.1 Test-room

The appliances are set up in a test-room as specified in 8.1.1.1 to 8.1.1.3.

8.1.1.1 Ambient temperature

Tests are carried out under the following conditions of ambient temperature, which is the temperature in the space surrounding the appliance under test, arithmetical mean of the average value of temperatures t_{a1} , t_{a2} , t_{a3} measured at three points located 35 cm from the side walls and front wall of the appliance, on the normals passing through the geometrical centres of the surfaces of these walls.

- a) For checking the storage temperature :
 - + 32 °C for class N appliances;
 - + 43 °C for class T appliances.
- b) For the freezing test and checking the energy consumption and the temperature rise of the load :
 - + 25 °C for class N 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 shall be kept constant within $\pm 0,5$ K both during the periods required for obtaining stable operating conditions and during the tests.

The vertical ambient temperature gradient from the platform specified in 8.1.1.3 to a height of 2 m shall not exceed 2 K/m.

8.1.1.2 Humidity

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

8.1.1.3 Installation of appliances

Each appliance shall be placed on a matt black painted wooden solid-top platform, open for free air circulation under the platform. The top of the platform shall be 0,30 m above the test-room floor and shall extend at least 0,30 m, but not more than 0,60 m, beyond each side of the appliance, except at the rear.

Circulation of air about the appliance shall be restricted by surrounding the appliance by three matt black painted wooden vertical partitions arranged as follows : one of the partitions is 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 are parallel to the sides of the cabinet, and are fixed on the platform 0,30 m from the sides of the cabinet : they are 0,30 m wide. The whole partition structure has the form and dimensions shown in figure 2.

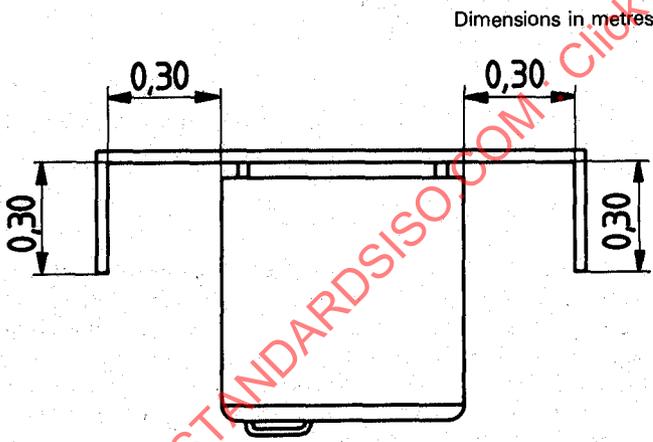


Figure 2 — Partitions to restrict air circulation (plan view)

The vertical partitions shall present no discontinuity. They shall be of such a height that they extend at least 0,30 m above the top of the appliance.

The appliance 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.

The appliance shall be placed to avoid, or shielded against, direct radiation to or from the test room cooling or heating equipment.

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 installed according to the manufacturer's instructions.

Built-in appliances intended to be combined with appliances other than refrigerators shall be tested in combination, but with the other appliance inoperative.

Before the stabilization period preceding the tests, the evaporator shall be defrosted and the interior of the appliance dried, except in the case of appliances fitted with automatic defrosting equipment. The means of access (lids or doors) shall be kept closed during the tests.

8.1.2 Test-packages

When tests are carried out with a loaded appliance, test-packages of rectangular parallelepiped shape shall be used.

8.1.2.1 Sizes and tolerances

The size prior to freezing, and the mass, packaging included, of test-packages shall be as follows :

Size ¹⁾ mm	Mass ²⁾ g
25 × 50 × 100	125
50 × 100 × 100	500
50 × 100 × 200	1 000

- 1) Tolerances on linear dimensions :
 $\pm 1,5$ mm for 25 mm and 50 mm dimensions;
 $\pm 3,0$ mm for 100 mm and 200 mm dimensions
- 2) Tolerance on mass : ± 2 %.

8.1.2.2 Composition

The packages shall consist of

- a) a suitable filling material containing, per 1 000 g :
 - 230 g of oxy-ethyl-methyl cellulose
 - 764,2 g of water¹⁾
 - 5 g of sodium chloride
 - 0,8 g of parachlorometacresol

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

The freezing point of this material is $-1\text{ }^{\circ}\text{C}$ (its thermal characteristics correspond to those of lean beef).

b) a wrapper, consisting of a sheet of plastic¹⁾ or any other suitable material of such a nature that moisture exchange with the ambient medium is negligible.

After filling, the wrapping sheet shall be sealed.

8.1.2.3 "M" packages

Some 500 g packages (50 mm \times 100 mm \times 100 mm) are equipped for temperature measurement, being fitted with thermocouples²⁾ which are inserted in the geometrical centres of the packages. All precautions shall be taken to minimize extraneous conducting of heat. These packages are called "M" packages.

8.1.3 Operating requirements for the appliances

8.1.3.1 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 is tested in the condition in which it is delivered to the user.

8.1.3.2 Anti-condensation heaters

If an appliance is fitted with an anti-condensation heater, this shall be switched on; if adjustable, it shall be set at maximum heating, except for the energy consumption test, when it shall be switched on only if it is needed to withstand the water vapour condensation test.

8.1.3.3 Stable operating conditions

In the case of cyclic operation of the refrigerating system, including any automatic defrost periods, 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 $\pm 0,5\text{ K}$ 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 the 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.

Stable operating conditions are considered to have been maintained during the tests if the temperature fluctuations do not exceed 0,5 K.

1) It is advisable to use a sheet of easily sealed, 120 μm thick high-pressure polyethylene, covered externally with a sheet of approximately 12,5 μm thick polyterephthalate, the two layers being bonded together.

2) Any other temperature-measuring device of equivalent precision may be used.

3) The verification of the thickness of the paper used is made as prescribed in ISO 534.

8.1.3.4 Power supply

8.1.3.4.1 Electric power supply

The appliance shall be tested at the rated voltage and frequency, or at the mean of the rated working range $\pm 1\%$.

8.1.3.4.2 Power supply other than electric

Appliances others than those with electric power supply shall be tested under supply conditions corresponding to the information of the rating plate.

8.1.3.5 General conditions for use of baskets, shelves and trays

Of all the baskets, shelves and trays supplied with the appliance, only those which have been indicated by the manufacturer as being necessary for obtaining satisfactory mechanical and thermal characteristics and for the correct storage of food shall be used during the tests. If the manufacturer gives no indication on this subject, all baskets, shelves and trays shall be in position.

8.1.4 Measuring instruments

The temperatures shall be measured with temperature probes, the sensors of which are inserted either in the test-packages or, for measuring the ambient temperature, in the centre of a tinned solid copper cylinder, 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 $\pm 0,3\text{ K}$.

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 dew point, is accurate within $\pm 0,3\text{ K}$. Watt-hour meters shall be readable to 0,01 kWh and be accurate to within $\pm 1\%$. The measuring accuracy shall be stated in the test report.

8.2 Testing the air-tightness of door or lead seal

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

8.2.1 Procedure

The ambient temperature shall be between $16\text{ }^{\circ}\text{C}$ and $32\text{ }^{\circ}\text{C}$. The appliance shall be operated for at least 24 h under the same condition as specified for the energy consumption test (see 8.8), before carrying out this test.

A strip of paper 50 mm wide, 0,08 mm thick³⁾ and of suitable length shall be inserted at any point of the seal, and the door or lid closed normally on it.

An equilibrium shall then be created between the outside pressure and the interior of the appliance, for example by partially raising the seal of the door or lid.

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

8.2.2 Observations

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

8.3 Testing the opening resistance of door or lid

The purpose of this test is to check that the door or lid is capable of being opened from the inside.

8.3.1 Procedure

The ambient temperature shall be between 16 °C and 32 °C. The appliance shall be switched off and 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 force of 70 N shall be considered as being applied to the inside of the door or lid of the appliance at the mid-point of the edge farthest from the hinge axis in a direction perpendicular to the plane of the door or lid.

8.3.2 Measurement

The method of measurement shall be decided by the laboratory

- a) either 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) or by applying a force to the handle of the door or lid if it is placed at the mid-point of the edge furthest from the hinge axis, the value of the force required being determined by proportional calculation from the distances of the handle and of the internal measuring point from the hinge axis.

8.4 Testing the mechanical strength of shelves and baskets

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

8.4.1 Procedure

After the storage temperature test, or the temperature rise test, the behaviour of all loaded shelves, baskets and their supports shall be examined, and all sliding shelves and baskets shall be moved to the half-way position of their permissible course, without modification of their load 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 baskets 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 carried out only during the storage temperature test.

8.4.2 Test report

Shelves shall be checked during and after the test. Any fractures of shelves or supports, and any distortion which prevents the normal use of a component, shall be noted.

8.5 Testing the storage temperature

8.5.1 Procedure

8.5.1.1 Operating conditions of the appliance

With due regard to the requirements given in 8.1, the empty appliance shall be set to run under the following conditions :

- a) if the thermostat is not designed for adjustment, the appliance shall be tested in the condition as delivered;
- b) if the manufacturer has indicated a temperature control setting, the appliance shall be tested at that setting;
- c) if the manufacturer has indicated a range of settings for normal storage, the thermostat shall be adjusted to the coldest position of this range.

In all other cases, the laboratory shall determine the thermostat setting which is likely to give a temperature of - 18 °C.

8.5.1.2 Storage

After 24 h, the storage volume of the cabinet shall be filled with as many test-packages as it can hold, the test-packages having previously been brought to a temperature of approximately - 18 °C.

The following conditions shall be met :

- a) 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 dimension 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 8.5.1.2 e)].

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 made with 125 g packages also laid flat. Four 125 g packages may be replaced by one 500 g package placed vertically.

- b) 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. If it is

greater than 25 mm, another package shall be introduced, provided that there is no physical contact between the highest package and the shelf or the horizontal surface situated immediately above.

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 the middle layer of any stack, as appropriate.

Unless otherwise indicated by the manufacturer, the stacks of test-packages shall be placed in direct contact with the load limits (represented by the inner walls of the appliance, the sides of baskets, the load lines, etc.).

In the case of an upright cabinet without a vertical load line near the door, the stacks shall be placed so that faces of the packages are in line with the front edges of the shelves.

c) 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 as small as possible a cross-section and of as low as possible a thermal conductivity, and are placed in such a way that they do not interfere significantly with normal air circulation.

d) At least two "M" packages shall be placed in line with each load limit, and additional "M" packages shall be placed where the highest temperatures are expected (see, for example, figures 9 to 15). These places may be different for storage temperature, energy consumption and temperature rise tests.

e) In door compartments, the packages may, if necessary, be placed on end. However, 125 g packages shall only be placed flat and shall not be used as vertical wedges.

8.5.2 Measurements

The temperature of each "M" package shall be recorded.

The loaded appliance shall be left to run until stable operating conditions (as defined in 8.1.3.3) are reached.

If the manufacturer has not indicated a thermostat setting and if the temperature of each "M" package does not always remain at or below $-18\text{ }^{\circ}\text{C}$, the laboratory shall carry out one or more further tests after changing the thermostat setting until the condition is fulfilled.

8.5.3 Test report

The report shall contain at least the following information :

a) thermostat setting (if designed for adjustment by the user);

b) a sketch of the loading arrangement, showing the locations of the "M" packages and the location of the "M" package with the highest maximum temperature;

c) the value of this maximum temperature.

8.6 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.

8.6.1 Procedure

8.6.1.1 Ambient temperature

The ambient temperature shall be :

+25 ± 0,5 °C for class N appliances;

+32 ± 0,5 °C for class T appliances.

8.6.1.2 Relative humidity

The relative humidity shall be such that the dew point is :

+19 ± 0,5 °C for class N appliances;

+27 ± 0,5 °C for class T appliances.

8.6.1.3 Installation of the appliance

The thermostat setting, the positioning and the loading of the appliance shall be the same as for the electrical energy consumption test (see 8.8). If anti-condensation heaters are provided they shall not be switched on. If, however, the requirement of 5.3 is not fulfilled, the test shall be repeated with the anti-condensation heaters switched on.

8.6.1.4 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. If the appliance is fitted with automatic defrosting equipment, this test period shall be selected during the period when condensation is most liable to occur.

8.6.2 Observations

During this period, external surface areas exhibiting fog, droplets or running water shall be outlined and designated with the letters F, D and R respectively.

8.6.3 Expression of results and test report

A coded sketch shall be made showing the area and degree of condensation appearing during the test on all surfaces; the code to be used is shown in figure 3.

The duration of the period of observations shall also be indicated in the test report.

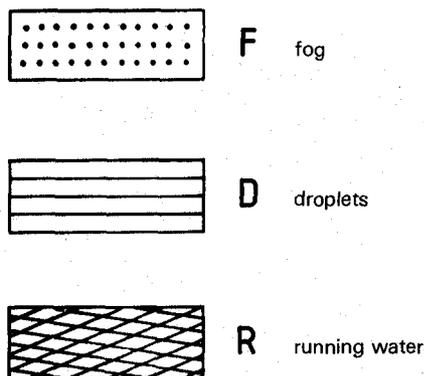


Figure 3 — Condensation code

8.7 Freezing test

8.7.1 Procedure

8.7.1.1 Operating conditions of the appliance

Before the freezing test is begun, and under the test conditions stated in 8.1, the empty appliance shall be cooled to the minimum temperature it can reach when running under stable conditions. Owing to the diversity of equipment and control devices, the three following cases may be distinguished :

- a) The freezer is fitted with a thermostat designed for adjustment by the user and possibly with a switch for continuous running.

The empty appliance shall be set in operation on continuous running or, if this is not possible, with the thermostat set for the lowest temperature. The appliance shall be left in operation until stable operating conditions are reached, and in any case for at least 24 h. The procedure described in 8.7.1.2 shall then be carried out.

- b) The freezer is fitted with a timer which sets the appliance on continuous running when it is released and which causes reversion 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).

The empty appliance shall be set in operation on continuous running and in any case for at least 24 h; the timer being set and re-set as necessary until stable operating conditions are reached. The procedure described in 8.7.1.2 shall then be carried out.

- c) If the freezer does not correspond to either of the above types, it shall be set in operation until stable operating conditions are reached, and in any case for at least 24 h. The procedure described in 8.7.1.2 shall then be carried out.

8.7.1.2 Loading the appliance and measurements

- a) Heavy load

The freezer shall be loaded with test-packages previously brought to the temperature of 25 ± 1 °C for class N ap-

pliances and $+32 \pm 1$ °C for class T appliances. The packages shall be laid flat. They shall be placed in position taking into account the manufacturer's instructions. Their total quantity shall correspond to approximately 25 kg per 100 l of storage volume.

If the manufacturer has given no instructions, all the packages or the largest possible number of them shall be placed in direct contact with cooled surfaces (or in the cooled air stream) in such a way that they are frozen as rapidly as possible. It is necessary to ensure good contact between the packages and the refrigerated surfaces. Spacers can be used but other methods are not permitted.

Temperature-measuring points shall be provided by distributing "M" packages uniformly throughout the load; the number of packages shall be the higher of the two following possibilities :

- 6 packages;
- 1 package per 15 kg of load.

The temperatures of the "M" packages shall be recorded and the time necessary for the arithmetical mean temperature of all the "M" packages to reach -18 °C shall be noted.

- b) Light load

Following the heavy-load freezing operation, the packages shall, if necessary, be regrouped; the freezer shall then be left to run, without changing the thermostat setting, until stable operating conditions are reached (see 8.1.3.3). The light load shall then be introduced. This load shall correspond to the amount stated by the manufacturer as that which can be frozen in 24 h, and shall be made up with test packages previously brought to the temperature of 25 ± 1 °C for class N appliances and 32 ± 1 °C for class T appliances.

If there is a separate freezing compartment, the frozen packages shall be placed in the storage compartment and the light load introduced into the freezing compartment, unless otherwise stated in the instructions for use.

The light load shall not be placed in physical contact with the heavy load. In other respects, the placing of the load shall be carried out following the same principles as for the heavy load.

Temperature-measuring points shall be provided by distributing "M" packages uniformly throughout this light load; the number of packages shall be the higher of the two following possibilities :

- 2 packages;
- 1 package per 3 kg of load.

The temperatures shall be recorded in the previously frozen packages and in the light load packages until the instantaneous arithmetical mean temperature of all the "M" packages of the light load reaches -18 °C. The time necessary for reaching this temperature shall be noted.

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

If the actual freezing time is less than 22 h or greater than 26 h, another test shall be carried out with a new light load. The mass of the second load is the mass likely to be frozen in 24 h determined by proportional calculation from the result of the first test. In this case, the initial light load shall be taken out of the appliance. The latter shall be left running, without modification of the thermostat setting or the switch, but, if relevant, with repeated setting of the timer until stable operating conditions are once more obtained; the second light load shall then be introduced.

The test result shall be accepted only if the maximum temperature of any of the already frozen "M" packages always remains at or below -15°C . Otherwise, the test shall be repeated with a smaller load, so that the maximum temperature of any of the already frozen "M" packages of the heavy load is maintained at or below -15°C and as close as possible to this value. This smaller load is considered to be the mass which can be frozen in 24 h even if the freezing time is less than 22 h.

The experimental result obtained as above is deemed to be correct within a maximum test tolerance of 10 %.

8.7.2 Test report

The test report shall include :

- a) mass of the heavy load (expressed in kilograms);
- b) freezing time of the heavy load (expressed in hours);
- c) mass of the light load (expressed in kilograms);
- d) freezing time of the light load (expressed in hours);
- e) freezing capacity determined during the light load freezing test (expressed in kilograms);
- f) highest temperature in the "M" packages of the heavy load freezing stored during the light load freezing test;
- g) loading plan showing locations of "M" packages and, for the heavy load, the location of the warmest "M" package and the location of the "M" package having the widest fluctuation of temperature, during the light load freezing test;
- h) variations of the instantaneous arithmetical mean temperature of the "M" packages of the heavy load freezing stored during the light load freezing test;

- j) if the freezer is fitted with a device for operating the appliance continuously during the freezing operation and which then reverts to thermostatic operation automatically, the test report shall indicate the time which elapsed before the freezer reverted to thermostatically controlled operation.

8.8 Energy consumption test¹⁾

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

8.8.1 Procedure

8.8.1.1 Ambient temperature

The ambient temperature shall be :

- +25 °C for class N appliances;
- +32 °C for class T appliances.

8.8.1.2 Installation of the appliance and thermostat setting

The appliance shall be set to run with the loading specified in 8.5.1.2, with the ambient temperature specified in 8.8.1.1. If the appliance is equipped with anti-condensation heaters, which are not necessary to withstand the water vapour condensation test, they shall not be switched on. If it is equipped with a thermostat that can be set by the user, it shall be set to give -18°C as the highest temperature of any "M" package, or two tests shall be carried out, one with the highest temperature of any "M" package being colder than -18°C , and one with the highest temperature of any "M" package being warmer than -18°C . A maximum tolerance of $\pm 2\text{ K}$ for the temperature of -18°C is permissible.

After stable operation conditions have been attained in both cases, energy consumption and thermostat setting shall be measured or checked. The energy consumption and thermostat setting for a storage temperature of -18°C shall then be determined by interpolation from the experimental results.

If the thermostat is not designed for adjustment by the user, the appliance shall be tested in the condition as delivered.

8.8.1.3 Measurements

The electrical power consumption shall be measured during a period of about 24 h for each test. For cyclic operation, the initial and final readings of the kilowatt-hour meter shall be taken immediately after the thermostat cuts out.

1) This test is intended for appliances without automatic defrosting. The procedure to be followed for appliances with automatic defrosting is under consideration.

8.8.2 Expression of results and test report

The results shall be expressed in kWh/24 h.

The maximum temperature of the warmest "M" package shall be stated.

8.9 Testing the temperature rise of the load

After the energy consumption test and at the same ambient temperature the thermostat is set to the lower value determined for the energy consumption test. Immediately after the stopping of the refrigerating system the power source shall be cut off. The period of time shall be noted from the moment when the maximum temperature of the warmest "M" package reaches -18°C to the moment when any one of the "M" package first reaches a temperature of -9°C . The time shall be stated in the test report.

9 Test report

The test report shall contain the following information :

- a) storage temperature;
- b) temperature rise of the load;
- c) freezing capacity;
- d) energy consumption;
- e) door opening test;
- f) determination of volumes;
- g) determination of storage shelf area;
- h) air tightness of door or lid seal;
- j) mechanical strength of shelves and baskets;
- k) water vapour condensation.

10 Designation of appliances

Household frozen food storage cabinets and food freezers are designated according to

- a) their kind (whether household frozen food storage cabinet or household food freezer);
- b) their operating principle (compression or absorption) and, as appropriate, the type of refrigerating unit (hermetically sealed, accessible or open), or the kind of energy supply (electricity, gas or liquid fuels);
- c) their class (temperate (N) or tropical (T));
- d) their rated gross volume in cubic decimetres or litres;
- e) their rated storage volume in cubic decimetres or litres;
- f) for freezers : their rated freezing capacity.

Example of designation :

Compressor-type household food freezer, with hermetically sealed unit, class N-gross volume : 400 dm³/storage volume : 375 dm³ — rated freezing capacity : 20 kg.

11 Marking

11.1 Load-limit line(s)

If, within the gross volume, no space is acknowledged as being unsuitable for food storage (as defined in 4.1) no load-limit line is necessary.

In all other cases, the limits of storage volume shall be indicated conspicuously and indelibly by a load line or lines in the form shown in figure 16. If this is not possible, the loading conditions shall be specially described in the instructions for use.

It is recommended that the manufacturer should avoid, as far as possible, the provision of storage spaces outside the load limits.

11.2 Rating plate(s)

Each appliance shall have the following information marked permanently and legibly on one or more securely fastened rating plates which shall be readably visible preferably when the appliance is in normal use or alternatively when it is away from the wall or after the removal, without tools, of a flap or grille :

- a) the indication "frozen food storage cabinet" or "food freezer";
- b) the trade-mark or name of the manufacturer;
- c) the model designation;
- d) the serial number or coded date of manufacture;
- e) the rated gross volume, either in cubic decimetres or litres;
- f) the rated storage volume, either in cubic decimetres or litres;
- g) the symbol of the class, N or T;
- h) the designation and mass of the refrigerant (see ISO 817);
- j) all information relating to the energy source, including those laid down by safety regulations;
- k) for freezers : the rated freezing capacity, expressed in kilograms.

For built-in and under-counter appliances the information under items b) to d) for servicing requirements shall be visible in the normal use condition of the appliance.

The manufacturer is free to show any other information he sees fit.

11.3 Identification of frozen food storage cabinets and food freezers

11.3.1 Identification of frozen food storage cabinets

Frozen food storage cabinets shall be identified by a symbol, placed on the front¹⁾, door or lid, conforming to that shown in figure 4 and defined as follows : three six-pointed stars within a frame with curved sides.



Figure 4 — Symbol for identification of frozen food storage cabinets (for details, see figure 17)

11.3.2 Identification of food freezers

Food freezers shall be identified by a symbol, placed on the front¹⁾, door or lid, conforming to that shown in figure 5 and defined as follows : a rectangular frame enclosing a large six-pointed star followed by the symbol for frozen food storage cabinets (see 11.3.1).

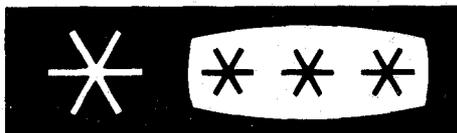


Figure 5 — Symbol for identification of food freezers (for details, see figure 17)

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, nor 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).

12 Technical and advertising literature

Whenever technical and advertising literature is supplied, it may contain the characteristics specified in clause 10; if additionally it contains all or some of the following data, this shall be in accordance with the specifications of this International Standard :

- a) type of appliance (upright or top-opening);
- b) overall space required in use (see 4.3.4), with sketches showing the appliance with the means of access open and closed;

- c) direction of opening the door (for upright appliances);
- d) rated energy consumption measured according to 8.8 (with reference to the ambient temperature at which this value is measured);
- e) lockable door or lid;
- f) other information that the manufacturer considers useful.

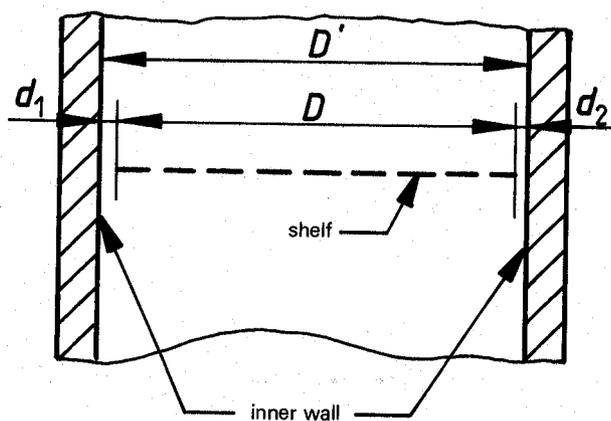
13 Instructions for use and maintenance

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

- a) installation requirements (best location; connection, if required, for defrost water; connection to energy source);
- b) overall space required in use, with sketches showing the appliance open and closed;
- c) operating conditions (starting and stopping procedures);
- d) instructions for use of the various controls (such as thermostat, fast-freeze switch, indicator lights, air circulation and defrosting controls);
- e) care required for best performance, such as : loading the appliance (especially when the storage volume is smaller than the gross volume and when no load-limit lines exist); use of baskets and, where appropriate, a warning on the risk of poor performance when the baskets are not used; also for freezers, arrangement of food for freezing and storage in particular, advice that food to be frozen shall not be placed in direct contact with food in storage, together with guidance regarding reduced loading for day after day freezing;
- f) care required in case of an extended non-running of the appliance (interruption of power supply or failure of the refrigerating system);
- g) maintenance and cleaning of the appliance;
- h) defrosting;
- j) for freezers, the rated freezing capacity;
- k) the necessity that, for appliances with doors or lids fitted with lock and key, the keys should be kept out of reach of children and not in the vicinity of the appliance, in order to prevent children from being locked inside.

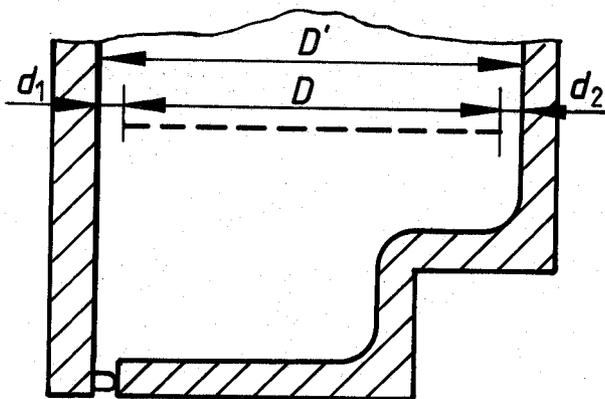
In addition, it is recommended that the manufacturer should draw attention to the fact that effervescent drinks should not be frozen and that some products such as ice-lollies should not be consumed too cold.

1) If the exterior of the cabinet is intended to be decorated by the purchaser the symbol shall be placed inside the appliance.



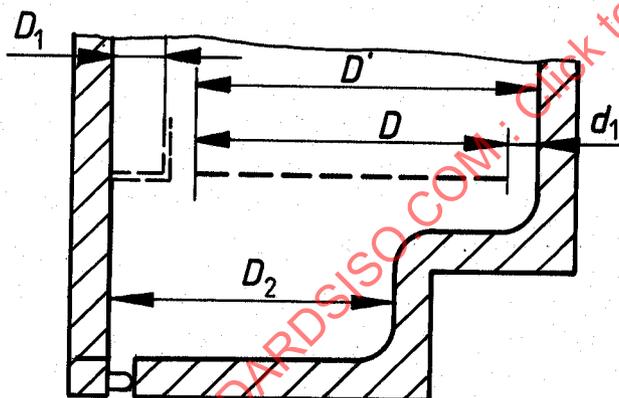
a) Determination of width

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



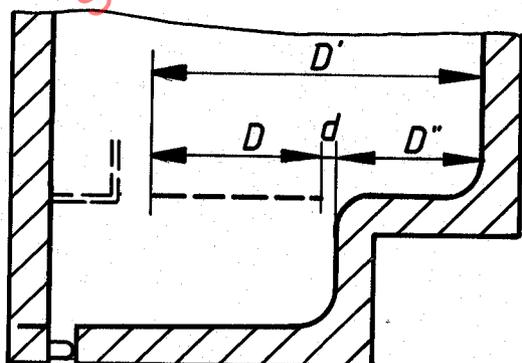
b) Determination of depth of upright appliance without storage in the door

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



c) Determination of depth of upright appliance with storage in the door

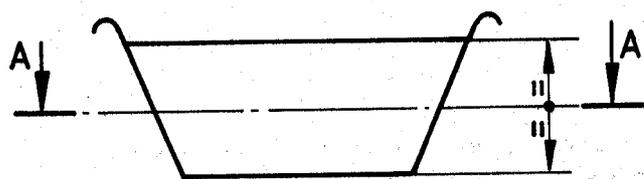
If $d_1 < 20$ mm :
dimension of the shelf = D'
If $d_1 > 20$ mm :
dimension of the shelf = D
Dimension of the shelf of the door = D_1
Dimension of the bottom of the appliance = D_2



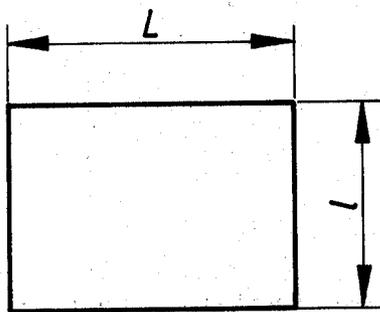
d) Determination of depth of a shelf with juxtaposed parts

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

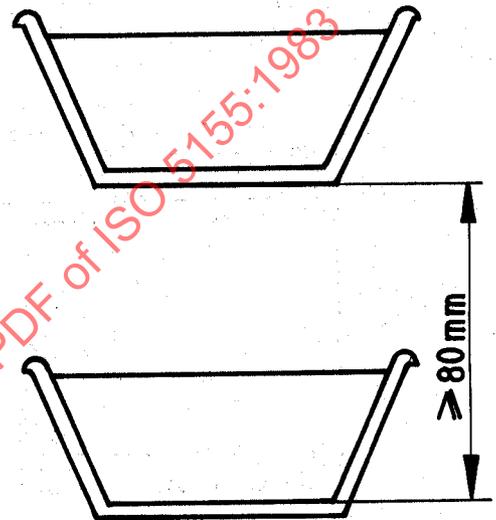
Figure 7 — Examples of determination of the area of a shelf (see 7.3.1)



A-A



Area of a basket
8a



Vertical clearance above a basket
8b

Figure 8 — Example of determination of mean dimensions for calculation of the area of a basket (see 7.3.3)

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NOTE — The locations indicated in figures 9 to 15 are given only by way of example to indicate where the highest temperatures may be expected. If the design of the appliance is different, other locations should be chosen by analogy (see 8.5.1.2).

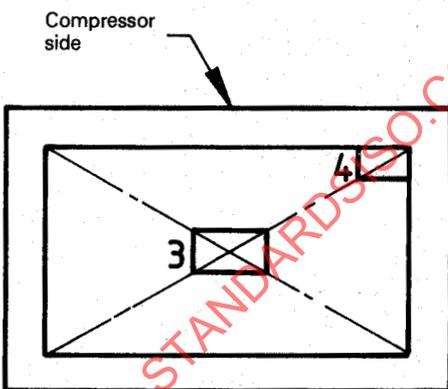
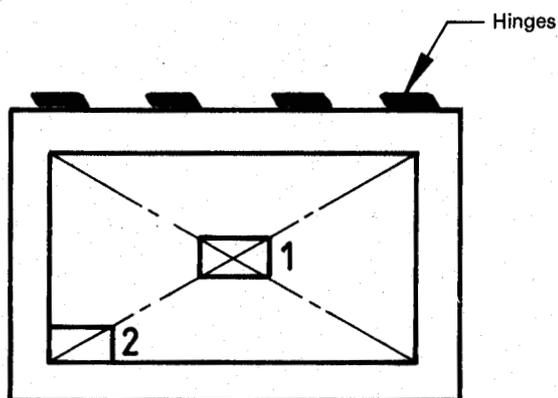
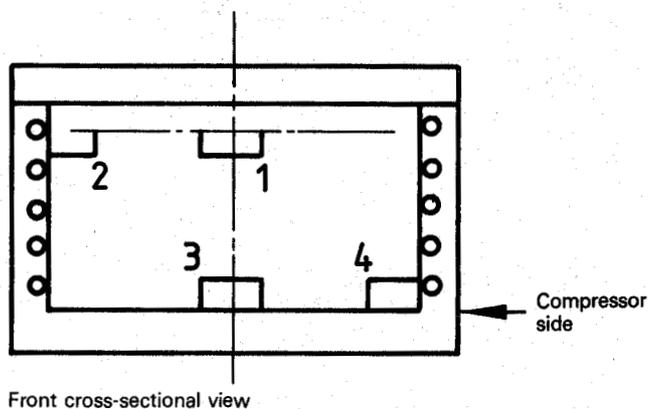


Figure 9 — Example of location of "M" packages in top-opening type appliance

- with refrigerated walls
- without inner partition

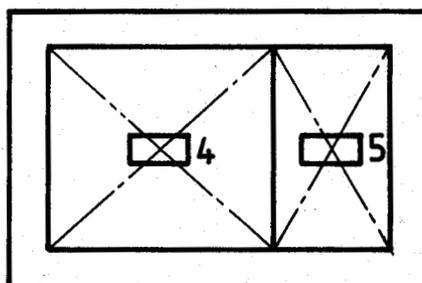
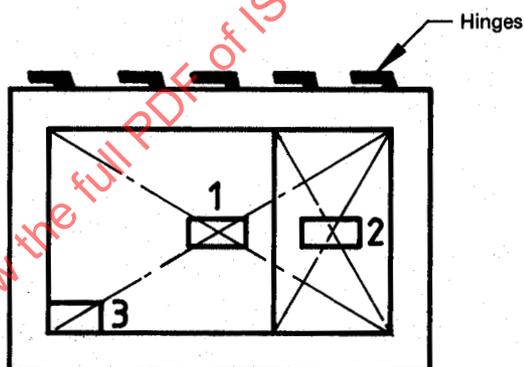
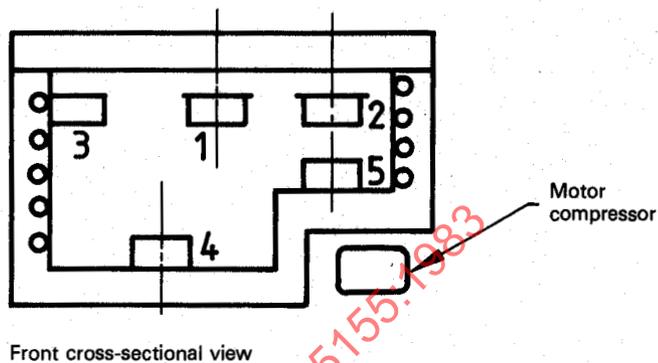


Figure 10 — Example of location of "M" packages in top-opening type appliance

- with refrigerated walls
- with non-refrigerated inner partition

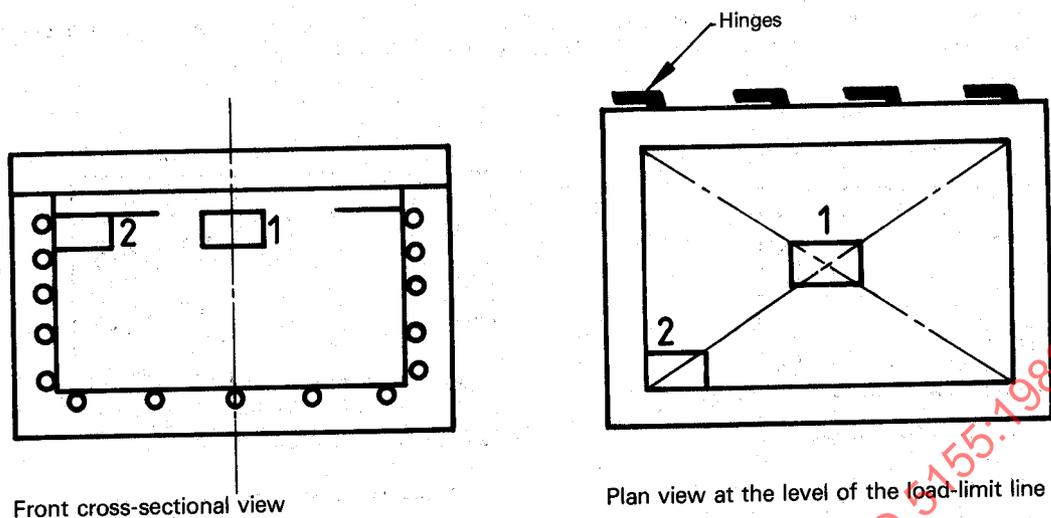


Figure 11 – Example of location of “M” packages in top-opening type appliance

- with refrigerated walls and bottom
- without inner partition

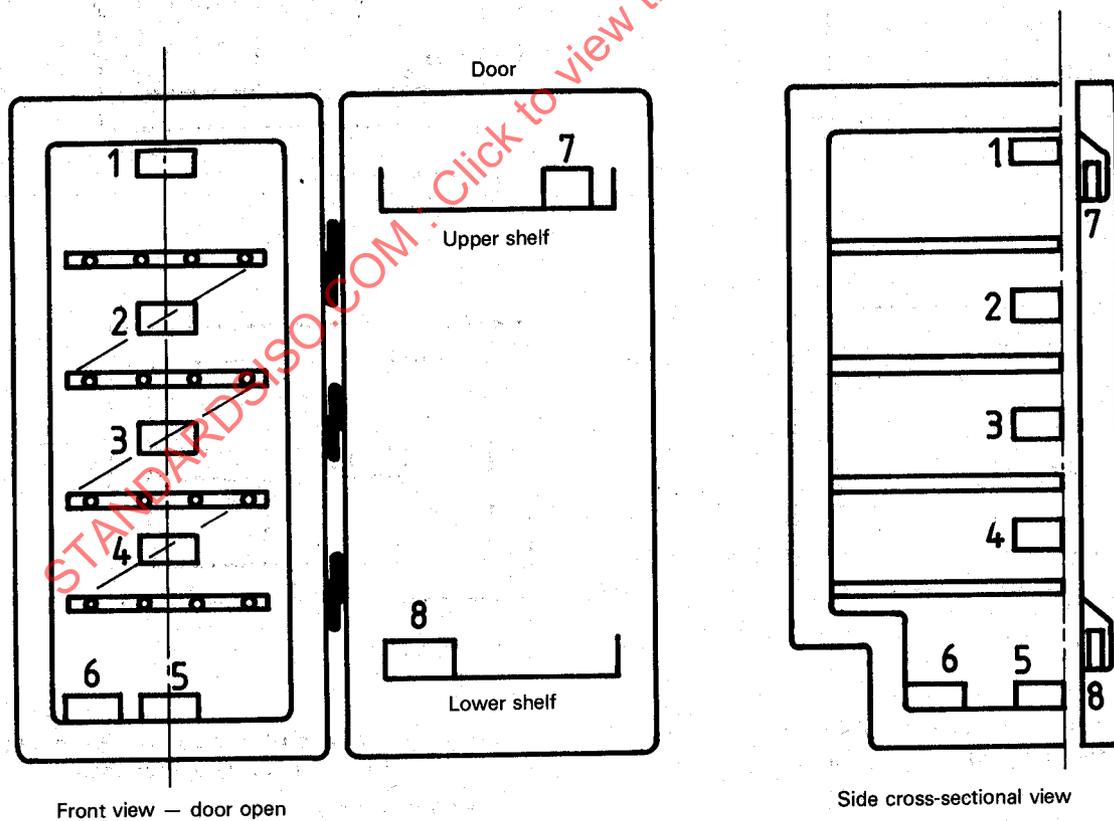


Figure 12 – Example of location of “M” packages in upright-type appliance

- without visible evaporator on the upper part
- with storage in the door
- with n refrigerated shelves