

Household refrigerating appliances — Characteristics and test methods

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National foreword

This British Standard is the UK implementation of EN ISO 15502:2005. It is identical with ISO 15502:2005, incorporating corrigendum February 2007. It supersedes BS EN 28187:1992, BS EN ISO 5155:1996, BS EN ISO 7371:1996 and BS EN ISO 8561:1996 which will be withdrawn in June 2008.

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

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Foreword

This document (EN ISO 15502:2005) has been prepared by Technical Committee ISO/TC 86 "Refrigeration and air-conditioning" in collaboration with Technical Committee CEN/TC 44 "Household refrigerating appliances and commercial refrigeration equipment", the secretariat of which is held by UNI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2008, and conflicting national standards shall be withdrawn at the latest by June 2008.

This document supersedes EN 28187:1991, EN ISO 5155:1995, EN ISO 7371:1995 and EN ISO 8561:1995.

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Endorsement notice

The text of ISO 15502:2005 has been approved by CEN as EN ISO 15502:2005 without any modifications.

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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.

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ISO 15502 was prepared by Technical Committee ISO/TC 86, *Refrigeration and air-conditioning*, Subcommittee SC 5, *Testing and rating of household refrigeration appliances*.

This first edition cancels and replaces ISO 5155:1995, ISO 7371:1995, ISO 8187:1991 and ISO 8561:1995, of which it constitutes a technical revision. It also incorporates the amendments ISO 7371:1995/Amd.1:1997, ISO 8187:1991/Amd.1:1997 and ISO 8561:1995/Amd.1:1997.

Household refrigerating appliances — Characteristics and test methods

1 Scope

This International Standard specifies the essential characteristics of household refrigerating appliances, factory-assembled and cooled by internal natural convection or forced air circulation, and establishes test methods for checking the characteristics. These are type tests, and because of this, when verification of the performance of a refrigerating appliance of a given type in relation to this International Standard is necessary, it is preferable, wherever practicable, that all the tests specified be applied to a single unit. The tests can also be made individually for the study of a particular characteristic.

NOTE For the safety requirements applicable to household refrigerating appliances, see IEC 60335-2-24, for noise requirements applicable to household refrigerators and freezers, see ISO 8960, and for additional safety requirements applicable to the refrigerating systems of household refrigerating appliances, see in ISO 5149.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 534, *Paper and board — Determination of thickness, density and specific volume*

ISO 817, *Refrigerants — Designation system*

ISO 8960, *Refrigerators, frozen-food storage cabinets and food freezers for household and similar use — Measurement of emission of airborne acoustical noise*

AC1 IEC 60335-2-24:2006, *Household and similar electrical appliances — Safety — Part 2-24: Particular requirements for refrigerating appliances, ice-cream appliances and ice-makers* AC1

3 Terms, definitions and symbols

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

3.1

refrigerating appliance

factory-assembled insulated cabinet with one or more compartments and of suitable volume and equipment for household use, cooled by natural convection or a frost-free system whereby the cooling is obtained by one or more energy-consuming means

NOTE From the point of view of installation, there are various types of household refrigerating appliance (free-standing, wall-mounted, built-in, etc.).

AC1 Footnote deleted AC1

3.1.1

compression-type refrigerating appliance

refrigerating appliance in which refrigeration is effected by means of a motor-driven compressor

3.1.2

absorption-type refrigerating appliance

refrigerating appliance in which refrigeration is effected by an absorption process using heat as energy source

3.1.3

refrigerator

refrigerating appliance intended for the preservation of food, one of whose compartments is suitable for the storage of fresh food

3.1.3.1

frost-free refrigerator

refrigerator in which all compartments are automatically defrosted with automatic disposal of the defrosted water and at least one compartment is cooled by a frost-free system and at least one is a "frozen-food storage" compartment

NOTE A single-compartment refrigerator using a frost-free system cannot be called a frost-free refrigerator.

3.1.4

refrigerator-freezer

refrigerating appliance having at least one compartment suitable for the storage of fresh food (the fresh-food storage compartment) and at least one other (the food freezer compartment) suitable for the freezing of fresh food and the storage of frozen food under three-star storage conditions

3.1.4.1

frost-free refrigerator-freezer

refrigerator-freezer in which all compartments are automatically defrosted with automatic disposal of the defrosted water and at least one compartment is cooled by a frost-free system

3.1.5

frozen-food storage cabinet

refrigerating appliance having one or more compartments suitable for the storage of frozen food

3.1.5.1

frost-free frozen-food storage cabinet

frozen-food storage cabinet in which all compartments are automatically defrosted with automatic disposal of the defrosted water and which is cooled by a frost-free system

3.1.6

food freezer

refrigerating appliance having one or more compartments suitable for freezing foodstuffs from ambient temperature down to a temperature of $-18\text{ }^{\circ}\text{C}$ and which is also suitable for the storage of frozen food under three-star storage conditions

NOTE In certain instances, two-star sections and/or compartments are permitted within the compartment or cabinet (see 7.2.8).

3.1.6.1

frost-free food freezer

food freezer in which all compartments are automatically defrosted with automatic disposal of the defrosted water and at least one compartment is cooled by a frost-free system

3.1.7

built-in appliance

fixed refrigerating appliance intended to be installed in a cabinet, in a prepared recess in a wall or similar location

3.2**frost-free system**

system automatically operated to prevent the permanent formation of frost, in which cooling is provided by forced air circulation, the evaporator or evaporators are defrosted by an automatic defrost system and the water from defrosting is disposed of automatically

3.3 Compartments and sections**3.3.1****fresh-food storage compartment**

compartment intended for the storage of unfrozen food, which may itself be divided into sub-compartments

NOTE The storage temperatures can be maintained according to Clause 6.

3.3.2**cellar compartment**

compartment intended for the storage of particular foods or beverages at a temperature warmer than that of the fresh-food storage compartment

NOTE The storage temperatures can be maintained according to Clause 6.

3.3.3**chill compartment**

compartment intended specifically for the storage of highly perishable foodstuffs whose volume is capable of containing at least 2 M packages

NOTE The storage temperatures can be maintained according to Clause 6.

3.3.4**ice-making compartment**

low-temperature compartment intended specifically for the freezing and storage of ice

3.3.5**frozen-food storage compartment**

low-temperature compartment intended specifically for the storage of frozen food

NOTE Frozen-food storage compartments are classified according to temperature, see 3.3.5.1 to 3.3.5.5.

3.3.5.1**one-star compartment**

frozen-food storage compartment in which the temperature is not warmer than – 6 °C

3.3.5.2**two-star compartment**

frozen-food storage compartment in which the temperature is not warmer than – 12 °C

3.3.5.3**three-star compartment**

frozen-food storage compartment in which the temperature is not warmer than – 18 °C

3.3.5.4**food freezer compartment****four-star compartment**

compartment suitable for freezing foodstuffs from ambient temperature down to – 18 °C, and which is also suitable for the storage of frozen food under three-star storage conditions

NOTE Two-star sections and/or compartments are permitted within the compartment or cabinet (see 7.2.8).

3.3.5.5

two-star section

part of a food freezer compartment or cabinet, or three-star compartment or cabinet, which is not self-contained (i.e. does not have its own individual access door or lid) and in which the temperature is not warmer than -12°C

3.4

rated

stated as a value (e.g. a volume) by the manufacturer

3.5 Physical aspects and dimensions

3.5.1

top-opening type

refrigerating appliance in which the compartment(s) are accessible from the top

3.5.2

upright type

refrigerating appliance in which the compartment(s) are accessible from the front

3.5.3

overall dimensions

space — height, width and depth — with doors or lids closed taken up by the refrigerating appliance

3.5.4

overall space required in use

total space — height, width and depth — with doors or lids open necessary for the refrigerating appliance for normal use

3.5.5

gross volume

volume within the inside liner of the refrigerating appliance, or of a compartment with an external door, without internal fittings and with the doors or lids closed

3.5.6

storage volume

part of the gross volume of any compartment that remains after deduction of the volume of components and spaces recognized as unusable for the storage of food

NOTE See 7.2.

3.5.7

shelf

horizontal surface (shelves, partitions, etc.) on which food can be placed

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

3.5.8

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

NOTE See 7.3.

3.5.9

load limit

surface enveloping a frozen-food storage volume

3.5.10**load-limit line**

permanent mark indicating limit of three-star frozen-food storage volume

3.5.11**storage plan**

arrangement of test packages within a refrigerating appliance

3.6 Definitions relating to performance characteristics**3.6.1****energy consumption**

energy consumed by a refrigerating appliance calculated over a period of 24 h when tested according to this International Standard

3.6.2**fresh-food storage temperature**

t_{ma}

mean temperature of the fresh-food storage compartment

3.6.3**frozen-food storage temperature**

t^* , t^{**} , t^{***}

maximum temperature of any M package during the test period

NOTE 1 The superscript attached to the symbol t corresponds to the one-star, two-star or three-star temperature.

NOTE 2 See 8.8.3.

3.6.4**cellar compartment storage temperature**

t_{cma}

mean temperature of the cellar compartment

3.6.5**chill compartment storage temperature**

t_{cc}

instantaneous storage temperature of the chill compartment

3.6.6**freezing capacity**

amount of food expressed in kilograms that can be frozen to a temperature of $-18\text{ }^{\circ}\text{C}$ in 24 h when tested in accordance with Clause 17 of this International Standard

3.6.7**ice-making capacity**

quantity of ice the refrigerating appliance is capable of producing within 24 h in an automatic icemaker, and/or the time necessary for the freezing of the water in the ice tray(s) supplied with the refrigerating appliance

3.6.8**automatic defrost**

defrosting where no action is necessary by the user to initiate the removal of frost accumulation or to restore normal operation, and the disposal of the defrost water is automatic

3.6.9

semi-automatic defrost

defrosting where an action is necessary by the user to initiate the removal of frost accumulation and normal operation is restored automatically, the defrost water being removed manually or removed and disposed of automatically

3.6.10

semi-automatic defrost

defrosting where no action is necessary by the user to initiate the removal of frost accumulation nor to restore normal operation, but the removal of the defrost water is manual

3.6.11

manual defrost

defrosting where an action is necessary by the user to initiate the removal of frost accumulation and where restoration to normal operation requires a further action by the user, the defrost water being removed manually or removed and disposed of automatically

3.6.12

automatic disposal of defrost water

removal and evaporation of the defrost water which does not require any action by the user

3.6.13

manual removal of defrost water

collection and removal of defrost water that requires actions by the user

3.6.14

adaptive defrost

form of automatic defrosting system where energy consumed in defrosting is reduced by an automatic process whereby the time intervals between successive defrosts are determined by an operating condition variable (or variables) other than, or in addition to, elapsed time or compressor run time.

3.6.15

test package

food simulant used as load when testing frozen food compartments and chill compartments and during freezing capacity testing in all compartments of refrigerator-freezers

3.6.16

M-package

test package fitted with a temperature sensor at its geometric centre

3.6.17

operating cycle

⟨frost-free systems⟩ period commencing at the initiation of an automatic defrosting cycle and terminating at the moment of initiation of the next automatic defrosting cycle

3.6.18

operating cycle

⟨systems designed to operate continuously⟩ period of 24 h under stable operating conditions

3.6.19

operating cycle

⟨other refrigerating appliances⟩ period between two successive stops of the refrigerating system, or part of the system, under stable operating conditions

3.6.20

automatic defrosting cycle

period between the moment when the means of defrosting the evaporator(s) is switched on and the moment when the refrigeration process is re-established

3.6.21**stable operating conditions**

conditions in which a refrigerating appliance's mean temperatures and energy consumption are stable

3.6.22**ambient temperature**

measured temperature in the space surrounding the refrigerating appliance under test

3.6.23**temperature rise time**

time period needed to raise the temperature of food in the frozen food compartment from -18 °C to -9 °C after the operation of the refrigerated system has been interrupted

3.7 Definitions relating to refrigerating system**3.7.1****refrigerant**

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

3.7.2**condenser**

heat exchanger in which vaporized refrigerant is liquefied by rejecting heat to an external cooling medium

3.7.3**evaporator**

heat exchanger in which the liquid refrigerant is vaporized by absorbing heat from the medium to be refrigerated

3.7.4**temperature control device**

device which automatically regulates the operation of a refrigerating system according to the temperature of an evaporator or of a compartment or cabinet

3.8 Symbols

T_i, T_{ci} temperature measurement points

t_i instantaneous temperature value (fresh food compartment)

t_{ci} instantaneous temperature value (cellar compartment)

t_{cc} instantaneous temperature value (chill compartment)

t_{im} integrated time average of t_i

t_{cim} integrated time average of t_{ci}

t_a instantaneous arithmetic average of t_1, t_2, t_3

t_{ca} instantaneous arithmetic average of t_{c1}, t_{c2}, t_{c3}

t_{ma} arithmetic average of t_{1m}, t_{2m}, t_{3m}

t_{cma} arithmetic average of $t_{c1m}, t_{c2m}, t_{c3m}$

i subscript representing 1, 2 or 3

4 Classification

4.1 Refrigerating appliances conforming to this International Standard are classified into four climate classes or into a range of classes, see Table 1. The range of ambient temperatures in which the appliances are intended to be used, and for which the required storage temperatures are to be met (see Clause 6), shall be as specified in Table 1.

Table 1 — Climate classes

Class	Symbol	Ambient temperature range °C
Extended temperate	SN	+ 10 to + 32
Temperate	N	+ 16 to + 32
Subtropical	ST	+ 16 to + 38
Tropical	T	+ 16 to + 43

4.2 Refrigerator-freezers conforming to this International Standard are classified into the following two types:

- a) refrigerator-freezer type I — having a single, user-adjustable temperature control device for regulating the temperatures of the fresh-food storage compartment and of the food freezer compartments;
- b) refrigerator-freezer type II — having user-adjustable means for the separate regulation of the temperatures of the fresh-food storage compartment and of the food freezer compartments.

NOTE Where there is another kind of compartment, there can be additional means of regulating that compartment's temperature.

5 Materials, design and manufacture

5.1 General

Refrigerating appliances 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, which shall be recorded in the final test report (see Clause 19).

5.2 Materials and finishes

Materials used inside refrigerating appliances shall not transmit odours or taste to food. A test procedure for guidance is given in Annex C.

Materials used inside refrigerating appliances 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 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 air-tightness

The thermal insulation of the refrigerating appliances shall be efficient. 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 refrigerating appliance 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. Compliance is checked by the test specified in Clause 9.

5.4 Doors, lids, drawers and fittings

External doors, lids and drawers of refrigerating appliances shall withstand opening and closing without deterioration which could be prejudicial to their air-tightness. Fittings shall be capable of maintaining their proper function. Compliance is checked by the test specified in Clause 11.

It shall be possible to open an external door, lid or drawer on a refrigerating appliance from the inside. Compliance is checked by the test given in Clause 10.

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 shall be easily removable.

5.6 Collection and disposal of defrost water

5.6.1 For refrigerating appliances with automatic disposal of defrost water, means shall be provided for collecting completely the defrost water either in a removable internal drip tray, or in an external receptacle wherein the defrost water is evaporated, or by other means. For frost-free refrigerating appliances or compartments, defrost water shall only be collected into external receptacles.

The drip tray or other defrost water receptacle should have adequate volume and, additionally, external drip trays should have adequate evaporating means.

The volume of drip trays of evaporators which are semi-automatically or manually defrosted shall be at least equal to the volume for the related evaporator(s), calculated by multiplying by 1 mm their total surface area on which ice can form.

Any drainage system shall be designed to ensure its proper function. It shall be easily accessible for the clearing of any blockage, and shall be designed so as to prevent any undue ingress of air into the food storage compartment(s).

5.6.2 For refrigerating appliances with manual removal of defrost water, means or instructions shall be provided to enable the collection of defrost water in such a way as to prevent water from flooding the floor beneath the refrigerating appliance and/or damaging foodstuffs that may remain in the refrigerating appliance during defrosting.

The volume of drip trays of evaporators with semi-automatic or manual defrost shall be at least equal to the volume for the related evaporator(s), calculated by multiplying by 1 mm their total surface area on which ice can form.

Any drainage system shall be designed to ensure its proper function. It shall be easily accessible for the clearing of any blockage, and shall be designed so as to prevent any undue ingress of air into the food storage compartment(s).

5.7 Refrigerating system

5.7.1 The mechanical operation of the refrigerating appliance should not give rise to undue noise or vibration.

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

5.7.3 The evaporator should be so designed or protected so that it will not suffer any damage during the normal use of the refrigerating 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 alternating frosting and defrosting.

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

5.7.5 Pipes and connections to moving or resiliently mounted parts should be arranged so as not to generate noise, nor to touch or 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.

5.7.6 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 refrigeration appliance and its surroundings.

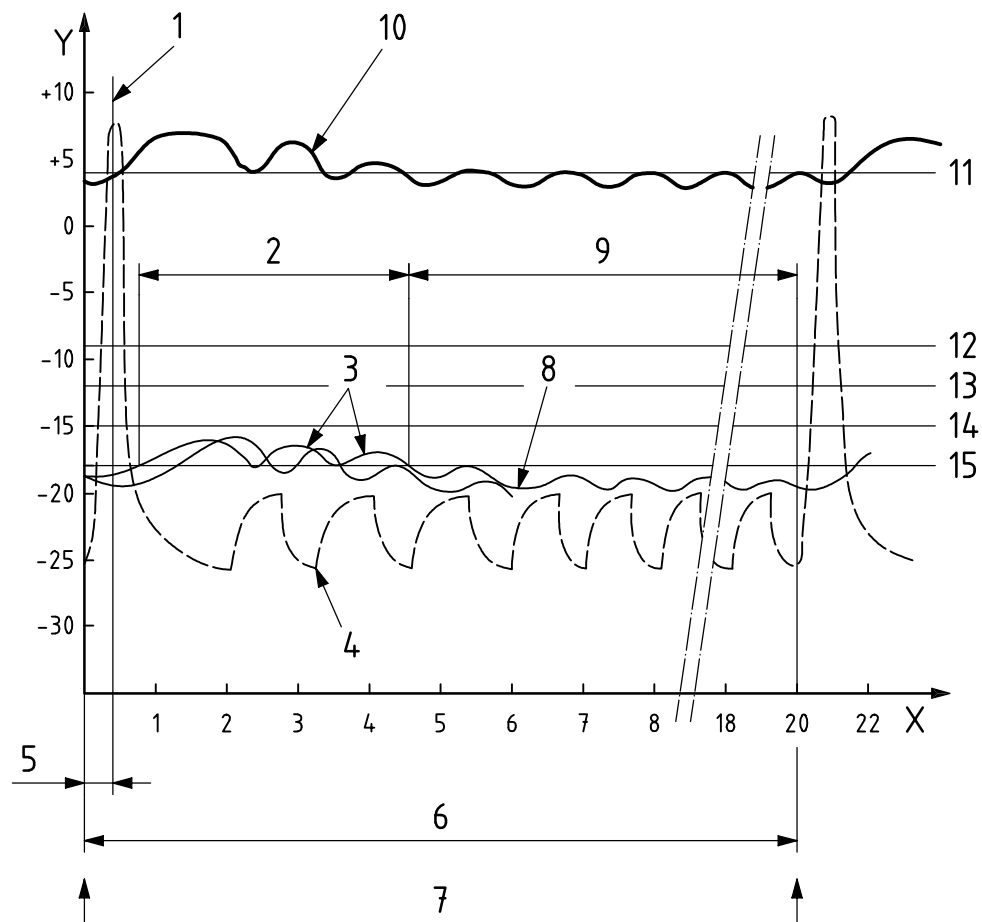
6 Storage temperatures

Under the conditions specified in Clause 13, the refrigerating appliance shall be capable of maintaining, simultaneously, the required storage temperatures in the different compartments and the permitted temperature deviations (during the defrost cycle) as given in Table 2 for the different types of refrigerating appliances and for the appropriate climate classes.

NOTE Table 5 gives the storage temperature applicable to the water condensation test specified in Clause 14, the energy consumption test given in Clause 15 and the temperature rise test according to Clause 16.

Table 2 — Storage temperatures

°C						
Fresh-food storage compartment		Food freezer and three-star compartment/cabinet	Two-star compartment/section	One-star compartment	Cellar compartment	Chill compartment
t_{1m}, t_{2m}, t_{3m}	t_{ma}	t^{***}	t^{**}	t^*	t_{cm}	t_{cc}
$0 \leq t_{1m}, t_{2m}, t_{3m} \leq 8$	$\leq +4$	$\leq -18^a$	$\leq -12^a$	≤ -6	$+8 \leq t_{cm} \leq +14$	$-2 \leq t_{cc} \leq +3$
^a As a result of a defrost cycle, the storage temperatures of frost free and/or adaptive defrost refrigerating appliances are permitted to rise by no more than 3 K during a period not greater than 4 hours or 20 % of the duration of the operating cycle, whichever is the shorter. An example of an operating cycle for a frost-free refrigerator-freezer is given in Figure 1.						



Key

- X time, h
- Y temperature, °C
- 1 start of the refrigerating process
- 2 period of 20 % of the operating cycle of max. 4 h when elevated temperatures are allowed for M-packages in the freezer compartment
- 3 instantaneous temperatures of different M-packages
- 4 temperature of evaporator
- 5 automatic defrosting cycle
- 6 operating cycle
- 7 moments when the means of defrosting is switched on
- 8 instantaneous temperature of the warmest M-package
- 9 period under which the conditions in Table 2 should apply, with the exception of footnote a)
- 10 t_a
- 11 t_{ma}
- 12 $t^{**} + 3 \text{ K}$
- 13 t^{**}
- 14 $t^{***} + 3 \text{ K}$
- 15 t^{***}

Figure 1 — Example of operating cycle for frost-free refrigerator-freezer

7 Determination of linear dimensions, volumes and areas

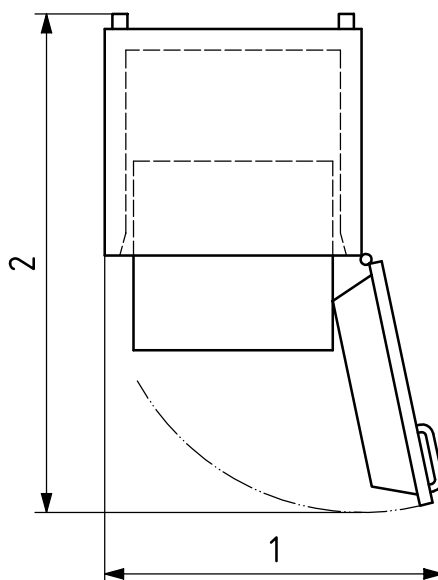
7.1 Determination of linear dimensions

Linear dimensions shall be measured to the nearest millimetre.

The measurements shall be carried out on the refrigerating appliance as delivered and not operating. If there is a cellar compartment, the volume of which is adjustable, measurements shall be made with this compartment adjusted to both its minimum and maximum volumes.

The overall dimensions shall be measured as the height, width and depth of the rectangular parallelepiped, whose base is horizontal, within which the refrigerating appliance is inscribed to include the complete appliance except for the handle — the protrusion of which, if any, is to be specified separately.

The overall space required in use shall be measured as the height, width and depth, including the handle, increased by the space necessary for free circulation of the cooling air when the refrigerating appliance is in service, plus the space necessary to allow opening of the means of access to that minimum angle permitting removal of all removable parts such as containers and shelves, including a drip tray that has to be removed and any water that has to be emptied manually (see Figure 2).



Key

- 1 width
- 2 depth with open door

Figure 2 — Overall space required in use (upright type)

7.2 Determination of volumes

7.2.1 General

Calculated volumes shall be expressed to the nearest whole number of cubic decimetres or of litres

7.2.2 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, temperature control devices 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 an example, see Figure 22 a), b), c), d).

7.2.3 Determination of the total storage volume

The total storage volume 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 7.2.2.

7.2.4 Storage volume of fresh-food storage, chill and cellar compartments

The storage volume of the fresh-food storage, chill and cellar compartments shall be the gross volume of the compartment minus

- the volume of the evaporator space,
- the volume of any housings (such as those for interior lights, temperature-control devices and other devices),
- the volume of shelves, partitions, retainers and other accessories whose wall thickness is greater than 13 mm according to 7.2.9.1, and
- the space between the inner door protrusion and the inner liner of the fresh-food storage compartment, chill and cellar compartment, unless it is intended for the storage of food.

Where the volumes of the cellar compartment and fresh-food storage compartment are adjustable relative to one another by the user, the storage volumes of these compartments shall be determined with the cellar compartment adjusted to its minimum and maximum volumes.

7.2.5 Volume of evaporator space

7.2.5.1 Volume

The volume of the evaporator space shall be the product of the depth, width and height.

7.2.5.2 Depth

The depth of the evaporator space shall be the mean horizontal distance between the front and rear surfaces of the enclosed space of the cabinet, measured at the level of the evaporator, unless there is a space provided in front of the evaporator for food storage.

Where a storage space is located in front of the evaporator, the depth of the evaporator space shall be taken as the mean horizontal distance from the inner surface of the rear of the enclosed space of the cabinet to the foremost part of the evaporator, or of the evaporator door if fitted.

7.2.5.3 Width

The width of the evaporator space shall be the overall horizontal width of the evaporator itself (neglecting suction headers near the top of the evaporator) or, if side ribs are used, the overall width including the ribs.

If there is less than 70 mm horizontal distance between the evaporator or the ribs and an inside wall of the enclosed space of the cabinet, such space shall be considered as part of the evaporator space.

7.2.5.4 Height

The height of the evaporator space shall be the mean vertical distance between the lower limit of the evaporator and the upper partition of the food storage compartment.

If the free space between the upper surface or top of the evaporator and the upper partition of the food storage compartment exceeds 40 mm, it shall be added to the storage volume of the fresh-food storage compartment.

The evaporator height shall include any internal drip tray and/or drip collector, except in the case when the storage height of the drip tray is greater than 40 mm and a definite manual operation is also needed to initiate defrosting.

7.2.6 Storage volume of ice-making compartments

The storage volume of the ice-making compartments shall be the sum of the volumes of all the compartments of this type in the refrigerating appliance.

The volumes of these compartments shall be determined in a similar manner to that specified in 7.2.3 and 7.2.4, as appropriate.

7.2.7 Storage volume of food freezer compartments/cabinets and frozen-food storage compartments/cabinets

For the determination of the storage volume, the total volume which is unsuitable for storage shall be determined and then deducted from the gross volume determined according to 7.2.2.

The total volume to be deducted shall comprise the following (for examples, see Figure 24):

- 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 refrigerating 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 13.3.2.2) 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 satisfactory performance of the refrigerating system;
- f) the volume of all removable parts which are stated by the manufacturer as necessary for the proper functioning of the refrigerating appliance, except shelves and partitions whose thickness is not greater than 13 mm (see 7.2.9.1);
- g) the volume rendered unusable by the use of removable parts (e.g. baskets, shelves) necessary for obtaining satisfactory thermal and mechanical characteristics (see also 8.6.4);
- h) any volume where the vertical clearance is less than 52 mm;
- i) any volume where it is impossible to place an M-package of nominal dimensions in any position;
- j) the storage volume of any two-star section(s).

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 refrigerating 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.

7.2.8 Two-star sections and/or compartments in food freezer compartments/cabinets and in three-star compartments/cabinets

Two-star sections and/or compartments are permitted both in the door and in the remaining storage volume when all the following conditions are met:

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

7.2.9 Volumes of shelves and partitions (for examples, see Figure 25)

7.2.9.1 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 apexes of the corrugations or pipes, unless the distance between adjacent corrugations or pipes is greater than 100 mm.

7.2.9.2 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.

7.2.9.3 Fractional shelves and partitions

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.

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.

7.3 Determination of storage shelf area

7.3.1 General

The area shall be expressed in square decimetres or square metres.

7.3.2 Determination of shelf area

7.3.2.1 Full shelf composed of 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 18 a)].

Depth: mean distance measured parallel to the surface of the shelf (or of the bottom of the refrigerating 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 18 b)]. When the door of an upright-type refrigerating appliance is provided with shelves, this distance shall be determined by analogy [see Figure 18 c) and d)].

7.3.2.2 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, but taking into account Figure 18 e).

7.3.2.3 Cut-away shelves

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

7.3.2.4 Juxtaposed shelves

In the case of juxtaposed shelves, the depth shall be determined in accordance with Figure 18 d).

7.3.2.5 Door shelves

The area shall be the product of the width and depth. These two dimensions shall be determined by analogy with 7.3.2.1, 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 18 c)].

7.3.2.6 Baskets and containers

The area shall be the product of the two mean horizontal dimensions [see Figure 19 a)].

7.3.2.7 Particular cases

7.3.2.7.1 General

The bottom of the enclosed space of the compartment 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.

7.3.2.7.2 Fresh-food storage compartment, and chill and cellar compartments

Any part of a full shelf, basket or the bottom of a compartment having less than 100 mm vertical clearance above, when all the shelves and baskets 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 19 b].

7.3.2.7.3 Food freezer compartment/cabinet and low-temperature compartment/cabinet

Any part of a full shelf, basket or the bottom of a food freezer compartment, or cabinet, or frozen-food storage compartment or cabinet, 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 19 b)].

In the case of an ice-making compartment, the minimum vertical clearance shall not be less than 40 mm.

7.3.3 Drip tray

Whenever the space occupied by the drip trays is included in the storage volume, the part of the shelf supporting the drip tray or the bottom of the drip tray shall be considered as part of the storage shelf area, provided that a definite manual operation is needed to initiate defrosting.

7.3.4 Suspended containers

7.3.4.1 Fresh-food storage compartment, chill and cellar compartment

The area of the interior surface of the bottom of a suspended container and the area of the shelf immediately below shall not both be counted, unless the vertical clearance between this shelf and the exterior surface of the bottom of the container is at least 100 mm.

Nevertheless, in the case of one container — and one only — this minimum clearance may be reduced to 80 mm to the extent where this possibility has not been applied for the shelves.

If the minimum vertical clearance within a suspended container, as measured between the interior surface of the bottom and the cover, or to the shelf immediately above, is less than 40 mm, the bottom area of the container shall not be added.

7.3.4.2 Food freezer compartment/cabinet and low-temperature compartment/cabinet

For a food freezer compartment or cabinet, or frozen-food storage compartment or cabinet, the dimension of the minimum vertical clearances specified in 7.3.4.1 shall be 52 mm in all cases.

For an ice-making compartment, the minimum vertical clearance dimension shall be 40 mm in all cases.

8 General test conditions

8.1 General

The order of carrying out the tests need not necessarily follow the sequence of the clauses. 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 subclause concerning the test.

The manufacturer's storage plans shall be used, provided that they are in accordance with 13.3.

Tolerances on linear dimensions shall be $\pm 5\%$ unless otherwise stated.

8.2 Ambient temperatures

The ambient temperature is measured at two points, T_{a1} and T_{a2} , located at the vertical and horizontal centreline of the sides of the refrigerating appliance and at a distance of 350 mm from the refrigerating appliance (see Figure 3).

It is the arithmetical average of the time-integrated temperatures that is measured and which is the value used for the tests.

Ambient temperatures are measured using copper or brass cylinders (see 8.7) at each of the two measurement points.

Ambient temperature sensors shall be shielded from any sources or sinks of radiant heat in the test room, including conditioning equipment, external windows or other appliances under test.

Ambient temperatures shall be kept constant within $\pm 0,5\text{ K}$ both during the periods required for obtaining stable operating conditions and during the tests.

The vertical ambient temperature gradient from the platform specified in 8.4 to a height of 2 m shall not exceed 1 K/m measured at the same vertical axis as for the ambient temperature measurement.

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

a) For checking the storage temperatures:

+ 10 °C and + 32 °C	for class SN refrigerating appliances;
+ 16 °C and + 32 °C	for class N refrigerating appliances;
+ 16 °C and + 38 °C	for class ST refrigerating appliances;
+ 16 °C and + 43 °C	for class T refrigerating appliances;

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

EXAMPLE For refrigerating appliances rated from SN to T, tests are performed at + 10 °C and at + 43 °C.

b) For checking the energy consumption, temperature rise time, freezing capacity and ice-making capacity of all refrigerating appliances, as applicable:

+ 25 °C	for class SN, class N and class ST refrigerating appliances;
+ 32 °C	for class T refrigerating appliances.

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

8.3 Humidity

Unless otherwise specified, relative humidity shall not exceed 75 % .

8.4 Installation of refrigerating appliances

Each refrigerating appliance shall be placed on a wooden solid-top platform²⁾ painted dull black and open for free air circulation under the platform. The bottom of the platform shall not be less than 0,05 m above the test room floor and shall extend at least 0,3 m beyond all sides of the refrigerating appliance, except at the rear where it shall extend to the vertical partition.

The air temperature shall be measured using copper or brass cylinders (see 8.7) 20 to 30 mm below the bottom of the platform. The value shall be at ambient temperature $\pm 1,0$ K. The measurement point shall be on the vertical axis through the geometrical centre of the refrigerating appliance.

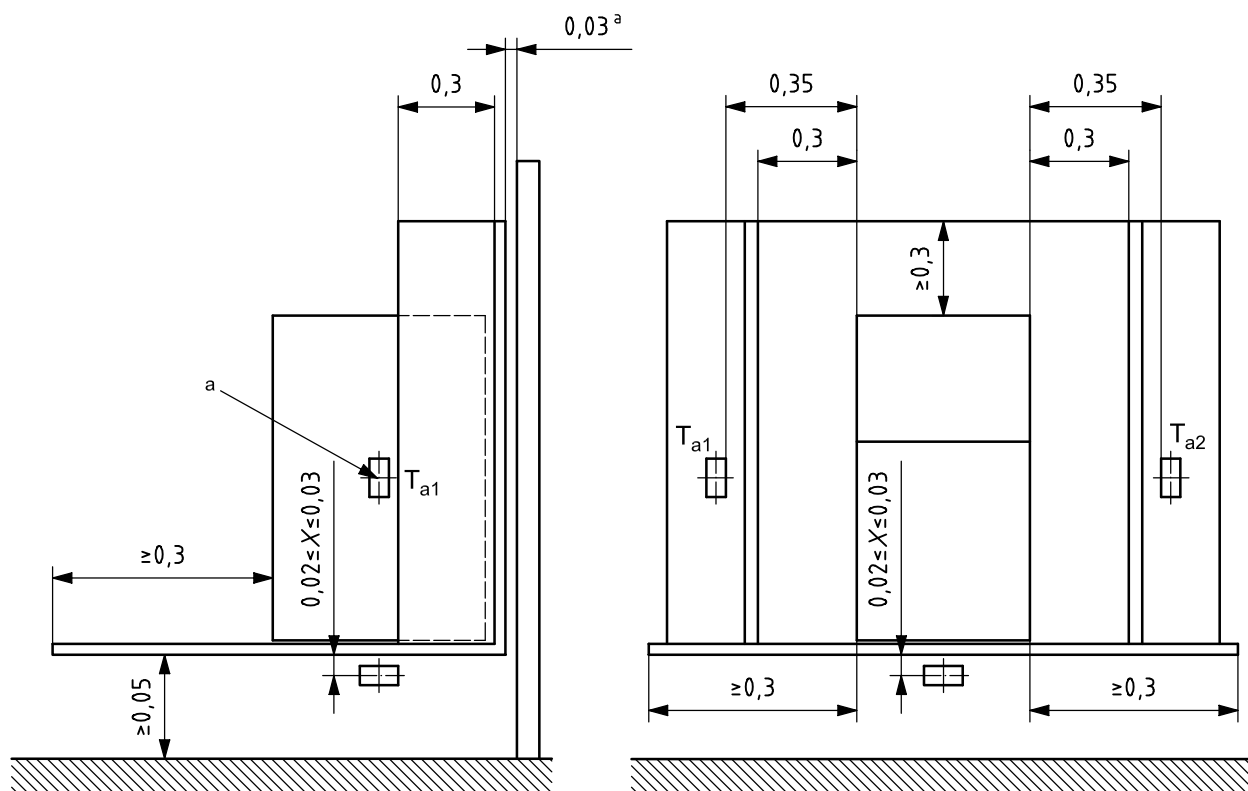
The temperature measurement is performed before the refrigerating appliance is started.

Circulation of air around the refrigerating appliance shall be restricted by surrounding the refrigerating appliance with three vertical partitions made of wood, 16 to 30 mm thick, painted dull black and arranged as follows.

- a) One of the partitions shall be placed parallel to the rear of the refrigerating appliance: for free-standing appliances, against the stops; for built-in appliances, at the distance specified by the manufacturer in connection with the required overall space. At the rear of this partition there shall be a sufficient air gap to the room wall (≥ 30 mm) to minimize the influence of adjacent structures.
- b) 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.
- c) The whole partition structure shall have the form and dimensions shown in Figure 3.

2) A suspended floor under which a temperature reading can be taken meeting the other specifications of a platform is to be regarded as a platform.

Dimensions in metres



Air velocity measurement $< 0,25$ m/s at centre of all accessible appliance walls (also top), 0.3 m distance.

^a Distance to wall of test room $> 0,03$ m.

Figure 3 — Partition to restrict air circulation and ambient temperatures sensor position

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 refrigerating appliance.

The refrigerating appliance shall be so placed or shielded as to prevent direct radiation to or from the space cooling or heating equipment or windows in the test room, and shall be placed far enough away from all other objects in the test room to ensure that the air surrounding the refrigerating appliance is at ambient temperature.

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

NOTE The back wall may have a different temperature than the test room when placed in contact with the test room walls. This is due to radiation and conduction of the condenser of the refrigerating appliance and to the surface temperature of the test room wall, which in its turn depends on the surrounding of the test wall.

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

Refrigerating appliances intended to be built-in shall be built in according to the manufacturer's instructions and Annex D.

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

8.5 Test packages

8.5.1 Dimensions and tolerances

The test packages used in the tests shall be in the form of rectangular parallelepipeds. Their size, prior to freezing, and their mass, packaging included, shall be in accordance with Table 3.

Table 3 — Test package dimensions and mass

Dimensions mm	Tolerance mm	Mass g	Tolerance %
25 × 50 × 100	± 2,0	125	± 2
50 × 50 × 100	for dimensions 25 and 50	250	
50 × 100 × 100	± 3,0	500	
25 × 100 × 200	for dimensions 100 and 200	500	
50 × 100 × 200		1 000	

Test packages shall be checked regularly and shall not present visible holes or cracks on the wrapper.

When any package is found to exceed a tolerance according to Table 3, it shall be replaced by a new package.

8.5.2 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 water;
- 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).

b) 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;
- 0,6 g of 6-chloro-*m*-cresol.

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

For the measurement of chill compartments, only test package b), with a freezing point of – 5 °C, shall be used.

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