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**Household refrigerating appliances—
Characteristics and test methods**

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by The Japan Electrical Manufacturers' Association (JEMA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS C 9801:1999** is replaced with this Standard.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

Household refrigerating appliances— Characteristics and test methods

Introduction This Japanese Industrial Standard has been prepared based on the first edition of **ISO 8561** *Household frost-free refrigerating appliances—Refrigerators, refrigerator-freezers, frozen food storage cabinets and food freezers cooled by internal forced air circulation—Characteristics and test methods* published in 1995 and Amendment 1 (1997) with some modifications of the technical contents. The contents of Amendment 1 have been edited and integrated into the text of this Standard, and also, some contents of other refrigerator-related standards (**ISO 5155**, **ISO 7371**, **ISO 8187**, and **ISO/DIS 15502**) are cited in this Standard.

The portions given sidelines or dotted underlines in this Standard are the matters in which the contents of the original International Standard have been modified. A list of modifications with the explanations is given in Annex JA.

1 Scope This Standard specifies the essential characteristics for refrigerators and refrigerator-freezers of household refrigerating appliances, which are wholly factory assembled, and lays down the methods of test for the checking of these performances.

The tests described in this Standard are type tests. When it is necessary to verify the performance of a refrigerating appliance of a given type in relation to this Standard, all the tests described should in principle be applied to one and the same unit. These tests can also be made individually for the study of a particular characteristic.

The electrical and mechanical safety requirements applicable to household refrigerating appliances are specified in **JIS C 9335-2-24**.

This Standard does not apply to household refrigerating appliances operating on energy sources other than electricity, nor to those of electronic cooling system (Peltier cooling).

Additional safety requirements applicable to the refrigerating systems of household refrigerating appliances are given in **ISO 5149**.

NOTE 1 Although this Standard specifies the essential characteristics for refrigerators and refrigerator-freezers of household refrigerating appliances and lays down the methods of test for the checking of these performances, it is not, by itself, intended to be used for assessment of conformity.

NOTE 2 The International Standard corresponding to this Standard is as follows.

ISO 8561 : 1995 *Household frost-free refrigerating appliances—Refrigerators, refrigerator-freezers, frozen food storage cabinets and food freezers cooled by internal forced air circulation—Characteristics and test methods* and **ISO 8561 : 1995/Amendment 1 : 1997** (MOD)

The symbol, (MOD), as given in **ISO/IEC Guide 21**, indicates that the original International Standard has been modified.

2 Normative references The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. If the indication of the year is given to the referred standard, only the edition of indicated year constitutes the provision of this Standard but the revision and amendment made thereafter do not apply. The normative references without the indication of the year apply only to the most recent editions (including amendments).

JIS C 9335-2-24:2005 *Household and similar electrical appliances—Safety—Part 2-24: Particular requirements for refrigerating appliances, ice-cream appliances and ice-makers*

NOTE : Corresponding International Standard **IEC 60335-2-24:2002** *Household and similar electrical appliances—Safety—Part 2-24: Particular requirements for refrigerating appliances, ice-cream appliances and ice-makers* (MOD)

JIS P 8118 *Paper and board—Determination of thickness and density*

NOTE : Corresponding International Standard **ISO 534:1988** *Paper and board—Determination of thickness and apparent bulk density or apparent sheet density* (MOD)

JIS Z 8401 *Guide to the rounding of numbers*

NOTE : Corresponding International Standard **ISO 31-0:1992** *Quantities and units—Part 0: General principles* (MOD)

ISO 817 *Refrigerant—Designation system*

3 Terms, definitions and symbols For the purposes of this Standard, the following definitions apply.

3.1 household refrigerating appliance (hereinafter referred to as “appliances”)¹⁾ insulated cabinet of suitable volume and equipment for household use, cooled by natural convection system or by frost-free system (see **3.1.5**)

It has multiple compartments and is cooled by one or more energy consuming means.

Note ¹⁾ From the point of view of installation, there are various types of household refrigerating appliances: freestanding, wall-mounted, built-in, etc.

3.1.1 household refrigerator (hereinafter referred to as “refrigerator”) a refrigerating appliance having one or more compartments intended for the preservation of food, at least one of which is a compartment suitable for the storage of fresh food

3.1.1.1 household frost-free refrigerator (hereinafter referred to as “frost-free refrigerator”) a refrigerator with an automatic defrost system in which water from defrosting of all compartments is disposed of automatically and of which at least one compartment is frost-free

3.1.2 household refrigerator-freezer (hereinafter referred to as “refrigerator-freezer”) a refrigerating appliance of which at least one compartment (fresh food storage compartment) is suitable for storing fresh food and another compartment is

suitable for freezing fresh food and for storing frozen food under “three star” conditions

3.1.2.1 household frost-free refrigerator-freezer (hereinafter referred to as “frost-free refrigerator-freezer”) a refrigerator-freezer (see **3.1.2**) with an automatic defrost system in which water from defrosting of all compartments is disposed of automatically and of which at least one compartment is frost-free

3.1.2.1.1 household refrigerator-freezer type I (hereinafter referred to as “refrigerator-freezer type I”) a refrigerator-freezer having a single temperature control device for regulating the temperatures of the fresh food storage and food freezer compartments

3.1.2.1.2 household refrigerator-freezer type II (hereinafter referred to as “refrigerator-freezer type II”) a refrigerator-freezer having the means for separate regulation of the temperatures of the fresh food storage and food freezer compartments

3.1.3 household frozen food storage cabinet (hereinafter referred to as “frozen food storage cabinet”) frost-free appliance having one or more compartments which is (are) suitable for the storage of frozen food under “three star” storage conditions (see **3.2.5.4**)

3.1.3.1 household frost-free frozen food storage cabinet (hereinafter referred to as “frost-free frozen food storage cabinet”) a frozen food storage cabinet (see **3.1.3**) with an automatic defrost system in which water from defrosting of all compartments is disposed of automatically and of which at least one compartment is frost-free

3.1.4 household food freezer (hereinafter referred to as “food freezer”) frost-free appliance having one or more compartments suitable for freezing, from +25 °C to -18 °C, a quantity of at least 4.5 kg of test packages per 100 L of its storage volume in 24 h, and in no case less than 2.0 kg, under the test conditions specified in clause 17, 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 appliance.

3.1.5 frost-free system system in which cooling is provided by forced air circulation and the evaporator(s) is (are) defrosted by an automatic defrost system

Characteristics of the “frost-free” system are:

- a) the system is automatically operated to prevent the permanent formation of frost on all refrigerated surfaces;
- b) no accumulation of ice or frost forms on the stored food;
- c) storage temperatures in the fresh food compartment, the frozen food storage and/or freezer compartment and the cellar compartment (if any) are maintained within the limits specified in this Standard;
- d) the water from defrosting is disposed of automatically.

3.1.6 natural convection system a method for cooling which is obtained by natural convection of cold air

3.2 Compartments and sections

3.2.1 fresh food storage compartment compartment intended for the storage of unfrozen food, which may be itself divided into sub-compartments, and in which the temperatures can be maintained in accordance with **6.2.1**

- a) **specific fresh food storage compartment** a compartment for storing specific food such as vegetables, fruit, fish, meat for exclusive use in a fresh food storage compartment of which the storage temperature (see **3.4.2.1**) measured in accordance with clause **13** is +10 °C or less when the setting of the temperature control unit is at the lowest
- b) **specific low-temperature compartment** a compartment for storing at a low temperature specific food such as fish, meat in a specific fresh food storage compartment of which the storage temperature (see **3.4.2.1**) measured in accordance with clause **13** is +2 °C or less when the setting of the temperature control unit is at the lowest

3.2.2 cellar compartment compartment intended for the storage of particular foods or beverages at a temperature warmer than that of the fresh food storage compartment, and in which the temperatures can be maintained in accordance with **6.2.1**

3.2.3 chill compartment compartment intended specifically for the storage of highly perishable foodstuffs in which the temperatures can be maintained between -3 °C and +3 °C, and the volume of which is capable of accommodating at least 2 “M” packages (see **13.1.2.1**)

3.2.4 ice-making compartment compartment intended specifically for the freezing at storage of water ice-cubes

3.2.5 frozen food storage compartments compartments intended specifically for the storage of frozen food.

They are classified according to their temperature, as follows:

3.2.5.1 “one star” compartment compartment in which the storage temperature (see **3.4.2.2**), measured as described in clause **13**, is not warmer than -6 °C

3.2.5.2 “two star” compartment compartment in which the storage temperature (see **3.4.2.2**), measured as described in clause **13**, is not warmer than -12 °C

3.2.5.3 “two star” section part of a food freezer compartment (or cabinet) or of a “three star” compartment (or cabinet) which is not self-contained (i.e. which does not have its own individual access door or lid), in which the storage temperature (see **3.4.2.2**), measured as described in clause **13**, is not warmer than -12 °C (see **7.2.6**)

3.2.5.4 “three star” compartment compartment in which the storage temperature (see 3.4.2.2), measured as described in clause 13, is not warmer than -18°C

3.2.6 food freezer compartment compartment suitable for freezing from $+25^{\circ}\text{C}$ to -18°C , a quantity of at least 4.5 kg of test packages per 100 L of its storage volume in 24 h, and in no case less than 2.0 kg, under the test conditions specified in clause 17, and which is also suitable for the storage of frozen food under “three star” storage conditions (see 3.2.5.4)

NOTE : In certain instances, “two star” sections and/or compartments are permitted within the compartment (or cabinet).

3.3 General definitions

3.3.1 top-opening type appliance in which the compartment(s) is (are) accessible from the top

3.3.2 upright type appliance in which the compartment(s) is (are) accessible from the front

3.3.3 overall dimensions (doors or lids closed) measurements of the rectangular parallelepiped, whose base is horizontal, within which the appliance is inscribed to include the complete appliance except for the handle, the protrusion of which, if any, is to be specified separately

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

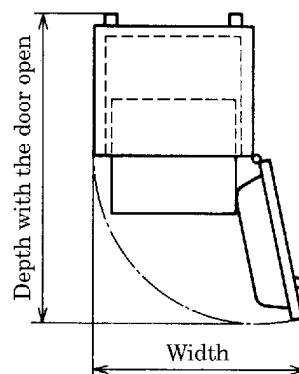


Figure 1 Overall space required in use (upright type)

3.3.5 Volumes

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

3.3.5.2 rated gross volume gross volume stated by the manufacturer

3.3.5.3 total gross volume sum of the gross volumes of the fresh food storage compartment(s), low-temperature compartment(s), food freezer compartment [including any “two star” section(s), and/or compartment(s) contained therein], and cellar compartment(s), as applicable, even if their doors or lids are independent

3.3.5.4 rated total gross volume total gross volume stated by the manufacturer

3.3.5.5 storage volume that part of the gross volume of any compartment which remains after deduction of the volume of components and spaces recognized as unusable for the storage of food, determined by the method given in 7.2

3.3.5.6 rated storage volume storage volume stated by the manufacturer

3.3.5.7 total storage volume sum of the storage volumes of the appliance, comprising the storage volumes of the fresh food storage compartment(s), low-temperature compartment(s), food freezer compartment [including any “two star” section(s) and/or compartment(s) contained therein], chill compartment(s) and cellar compartment(s), as applicable

3.3.5.8 rated total storage volume total storage volume stated by the manufacturer

3.3.5.9 rated volume volume determined in accordance with 7.2.8

3.3.5.10 total rated volume sum of rated volumes

3.3.6 Storage shelf surface

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

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

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

3.3.6.3 rated storage shelf area storage shelf area stated by the manufacturer

3.3.7 load limit(s) surface enveloping the frozen food storage volume(s)

3.3.8 load limit line(s) permanent mark(s) indicating the limits of “three star” frozen food storage volume(s)

3.3.9 metal a tinned cylinder of copper or brass with $25 \text{ g} \pm 1.25 \text{ g}$ in mass and the minimum surface area (diameter and height are about 15.2 mm, respectively)

3.3.10 load limit line in fresh food storage compartment limit line which can load fresh food

3.4 Definitions relating to some performance characteristics

3.4.1 energy consumption (yearly energy consumption stated by the manufacturer) consumption of an appliance over a period of one year measured under the conditions specified in clause 15

3.4.2 Storage temperatures

3.4.2.1 fresh food storage temperature (t_m) arithmetical average of the integral averages, t_{1m} , t_{2m} and t_{3m} of the instantaneous temperatures t_1 , t_2 and t_3 measured with metals placed at given points of the fresh food storage compartment as specified in 8.5

In the freezing test in clause 17, an arithmetical average of the integral averages, t_{1m} , t_{2m} and t_{3m} of the instantaneous temperatures t_1 , t_2 and t_3 measured in “M” packages (see 3.4.5).

3.4.2.2 frozen food storage temperature (t^{***} , t^{**} , t^*)

3.4.2.2.1 frozen food storage temperature the maximum temperature of the warmest “M” package of a load placed in storage as specified in 8.5.3

3.4.2.2.2 frozen food storage temperature: in the case of the energy-consumption test of frost-free frozen food storage cabinet and frost-free refrigerator-freezer in the case of the energy-consumption test of the frost-free frozen food storage cabinet and frost-free refrigerator-freezer, the integral average of all the instantaneous temperatures t_F measured during the energy-consumption test by attaching metals to a position of T_F in figure 15c and figure 15d

3.4.2.3 cellar compartment temperature (t_{cm}) arithmetical average of the integral averages, t_{c1m} , t_{c2m} and t_{c3m} of the instantaneous temperatures t_{c1} , t_{c2} and t_{c3} (see figures 15a and 15b) measured using metals placed at given points in the cellar compartment as specified in 8.5

3.4.2.4 chill compartment temperatures (t_{cc}) maximum and minimum instantaneous temperatures of any “M” package of a load in storage as specified in 8.5

3.4.3 freezing capacity mass of test packages whose temperature (taken as the instantaneous arithmetical mean temperature of all the “M” packages) can be lowered from the loading temperature of +25 °C (see 3.1.4 or 3.2.6) to -18 °C in 24 h under the test conditions specified in clause 17

The freezing capacity is expressed in kilograms.

3.4.3.1 rated freezing capacity freezing capacity stated by the manufacturer

3.4.4 Defrosting The defrosting method is separately specified for a fresh food storage compartment, a food freezer compartment, an ice-making compartment, a frozen food storage compartment and a chill compartment.

3.4.4.1 automatically defrosted an evaporator is automatically defrosted where no action is necessary by the user to initiate the removal of frost accumulation nor to restore normal operation, and where the disposal of the defrost water is automatic

3.4.4.2 semi-automatically defrosted an evaporator where action is necessary by the user to initiate the removal of frost accumulation, normal operation is automatically restored, and the removal of the defrost water is manual or the removal and disposal of the defrost water are automatic

An evaporator where no action is necessary by the user to initiate the removal of frost accumulation nor to restore normal operation, and the removal of the defrost water is manual.

3.4.4.3 manually defrosted an evaporator where action is necessary by the user to initiate the removal of frost accumulation or to restore normal operation, and the removal of the defrost water is manual or the removal and disposal of the defrost water are automatic

3.4.4.4 automatic disposal of defrost water disposal of defrost water is automatic where the removal and the evaporation of the defrost water does not require any action by the user

3.4.5 “M” package a test package in accordance with 8.2, fitted with a temperature sensor at its geometric centre

3.4.6 Cycles

3.4.6.1 control cycle the period between the initiation and the next initiation or the termination and the next termination of a refrigerating system or a part of the system under the stable operating condition

3.4.6.2 operating cycle that period which commences at the initiation of a defrosting cycle and terminates at the moment of initiation of the next defrosting cycle

3.4.6.3 defrosting cycle the 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

3.4.7 stable operating conditions the condition that in the case where a refrigerating system or a part of the system performs the cycle operation including some automatically defrosted periods, during a series of control cycles, the change of “M” package at all measurement points, or the change of the mean temperatures (t_{ma} , t_{cma} , t_{Fa}) of metals for a refrigerator and a refrigerator-freezer is 0.5 K or less per 24 h

In the case where a refrigerating system or a part of the system performs the continuous operation, when the change of all “M” packages or the change of the mean temperatures of metals for a refrigerator and a refrigerator-freezer is within ± 0.5 K per 18 h, the condition is taken as reaching the stable operating condition.

3.4.8 percentage running time (for refrigerators, refrigerator-freezers, frozen food storage cabinets and food freezers)

Percentage running time: R (apparatus with on/off control for the refrigerating source)

Under given conditions of ambient temperature and of internal storage temperature, the ratio is calculated as follows:

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

where

d is the duration of the refrigerating system operation during an operating cycle;

D is the duration of the operating cycle (see **3.4.6.1**).

Refrigerators with two independent cooling systems have two percentage running times, for example, one for the fresh food storage compartment and the other for the frozen food storage compartment.

3.4.8.1 percentage running time (for refrigerators, refrigerator-freezers, frozen food storage cabinets and food freezers of the frost free system)

Percentage running time: R' (apparatus with on/off control for the refrigerating source)

Under given conditions of ambient temperature and of internal storage temperature, the ratio is calculated as follows:

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

where

d' is the duration of the refrigeration system operation during an operating cycle (see **3.4.6.2**);

D' is the total duration of the operating cycle minus the duration of the defrosting cycle (see **3.4.6.3**), even if defrosting occurs by a hot-gas system.

When calculating the percentage running time for an appliance in accordance with this Standard, the duration of the defrosting cycle must be taken into account, R' has been introduced in order to have a clear distinction between this and the percentage running time R of conventional appliances.

For appliances with a hot-gas defrosting system, the time required for hot-gas defrosting shall not be included in the running time of the refrigerating unit.

3.4.9 ice-making capacity quantity of ice the appliance is capable of producing within 24 h, or the time necessary for the freezing of the water in the ice tray(s) supplied with the appliance

3.4.10 ambient temperature temperature in the space surrounding the appliance under test

It is the arithmetical average of the mean value of temperatures T_{a1} and T_{a2} , measured using metals at two points located 350 mm from the vertical centreline of the side walls of the appliance.

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

3.5 Refrigerating system

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

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

3.6 Compression-type appliances

3.6.1 compression-type appliance appliance in which refrigeration is effected by the vaporization at low pressure in a heat exchanger (evaporator) of a liquid refrigerant, the vapour thus formed being restored to the liquid state by mechanical compression to a higher pressure and subsequent cooling in another heat exchanger (condenser)

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

It does not include moving parts outside the shell.

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

3.6.4 refrigerant compressor mechanically operated component which withdraws refrigerant vapour from the evaporator and discharges it at a higher pressure to the condenser

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

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

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

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

3.6.9 fan device which provides cooling by means of a forced air stream to a condenser and/or to one or more compartments of the appliance

3.6.10 defrost timer device which controls the initiation, duration and time lapse between defrost cycles

3.6.11 demand defrost system of defrost control in which the initiation of the defrost cycle is controlled by the rate of accumulation of frost on the evaporator surfaces

3.6.12 defrost heater device which provides heat to the frost formed on the evaporator in order to facilitate the melting and removal of the ice

3.7 Absorption-type refrigerator

3.7.1 absorption-type refrigerator a refrigerator of a type in which refrigerant evaporates in an evaporator, and the generated gas is absorbed by an absorbent, then continuously emitted from the absorbent with higher partial pressure by overheating, liquefied in a condenser and again led into the evaporator

3.7.2 absorption refrigerating system complete system, essentially comprising a hermetically sealed boiler, a condenser, an evaporator, an absorber, and all other parts containing refrigerant permanently incorporated by the manufacturer by welding, brazing or other means

3.7.3 boiler heat exchanger which generates refrigerant from an absorbent medium by applying heat

3.7.4 absorber component which absorbs refrigerant by a medium, which emits heat around in the process absorbed

3.7.5 condenser heat exchanger in which the vaporized refrigerant passing through a boiler is liquefied by ejecting heat to an external cooling medium

3.7.6 evaporator heat exchanger in which the liquid refrigerant of which pressure is reduced is vaporized by absorbing heat from the refrigerated medium

3.8 Symbols

- t_F : Instantaneous temperature value (food freezer compartment and frozen food storage compartment)
- t_i : Instantaneous temperature value (fresh food storage compartment)
- t_{ci} : Instantaneous temperature value (cellar compartment)
- t_{cc} : Instantaneous temperature value (chill compartment)
- t_{im} : Integral mean value of t_i
- t_{cim} : Integral mean value of t_{ci}
- t^{***}, t^{**}, t^* : Integral mean value of t_F (in the case of the energy-consumption test of a frost-free system), or the maximum temperature of the warmest “M” package
- t_{Fa} : Arithmetic mean value of t_F
- t_a : Arithmetic mean value of t_1, t_2 , and t_3
- t_{ca} : Arithmetic mean value of t_{c1}, t_{c2} , and t_{c3}
- t_{ma} : Arithmetic mean value of t_{1m}, t_{2m} , and t_{3m}
- t_{cma} : Arithmetic mean value of t_{c1m}, t_{c2m} , and t_{c3m}

where

$i = 1, 2 \text{ or } 3$

4 Classification Not specified.

NOTE : The four climate classes specified in the corresponding International Standard are deleted in this Standard because it is specified within the limit of climatic conditions of Japan.

5 Materials, design and manufacture

5.1 General 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.

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

5.2 Materials and finishes Materials used inside appliances shall not transmit odours or taste to food. When testing in accordance with clause 19, the mean value of the individual results during each evaluation for odour and taste shall not exceed mark 1.

Materials used inside 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, for the purpose intended, be resistant to impact, sufficiently hard, colour-fast, smooth, easily washable, and resistant to damage by moisture and by food acids.

5.3 Thermal insulation and airtightness The thermal insulation of the appliance should be efficient and permanently maintained. In particular, the insulating material shall not be subject to shrinkage and shall not allow, under normal working conditions, an excessive accumulation of moisture.

No running water shall appear externally when the 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.

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

5.4 Doors, lids and fittings Hinges and handles shall be strong and resistant to corrosion.

External doors and lids of fresh food storage compartments, chill compartments and cellar compartments shall withstand 100 000 openings and closings without deterioration which may be prejudicial to the airtightness of the appliance when subjected to the durability test of clause 11. However, the multi-door type which has two or more doors may withstand 100 000 openings and closings in total, taking as 30 000 openings and closings per one door for refrigerator doors and 15 000 openings and closings per one door for frozen food storage compartment doors.

In the case of frozen food storage cabinets, food freezers and appliances with the food freezer compartment and the frozen food storage compartment, if any, having a separate access door or lid, the hinges and handles of the door or lid of that compartment (or cabinet) shall withstand 10 000 openings and closings.

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

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

5.5 Shelves and containers Shelves, containers and similar components shall have adequate mechanical strength. Those used for storing food shall withstand the loading test specified in clause 12 without showing such distortion that they could no longer fulfil their intended function. In particular, sliding or revolving components shall be capable of their full movement when loaded.

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

5.6 Disposal of defrost water

NOTE : This subclause shall apply to a fresh food storage compartment, a cellar compartment, a chill compartment and a frost-free refrigerator, a refrigerator-freezer, a frozen food storage cabinet and a food freezer.

A means shall be provided for completely collecting the defrost water in a removable internal drip tray or an external receptacle wherein the defrost water is evaporated.

The drip tray or other defrost water receptacle should have adequate volume. If it is an external receptacle, it should have adequate evaporating means.

The drip tray for the semi-automatic or automatic evaporator (either internal or external) shall have a volume not less than the total area of the external and internal surfaces of the relevant evaporator, multiplied by 1 mm.

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

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

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

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

5.7.6 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 appliance and its surroundings.

6 Required characteristics

6.1 Volumes and areas

6.1.1 Rated gross volume The measured gross volume shall not be less than the rated gross volume (indicated value) by more than 3 % of the latter or 1 L, whichever is the greater value.

6.1.2 Rated storage volume The measured storage volume shall not be less than the rated storage volume (indicated value) by more than 3 % of the latter or 1 L, whichever is the greater value.

6.1.3 Rated storage shelf area The measured storage shelf area, including that of any cellar and chill compartments, shall not be less than the rated storage shelf area (indicated value) by more than 3 % of the latter.

6.2 Performance characteristics

6.2.1 Storage temperatures Under the conditions specified in clause 13, the appliance shall be capable of maintaining, simultaneously, the required storage temperatures in the different compartments as shown in table 1 and for the frost-free system appliances, the limit temperatures during defrosting cycle given in table 2.

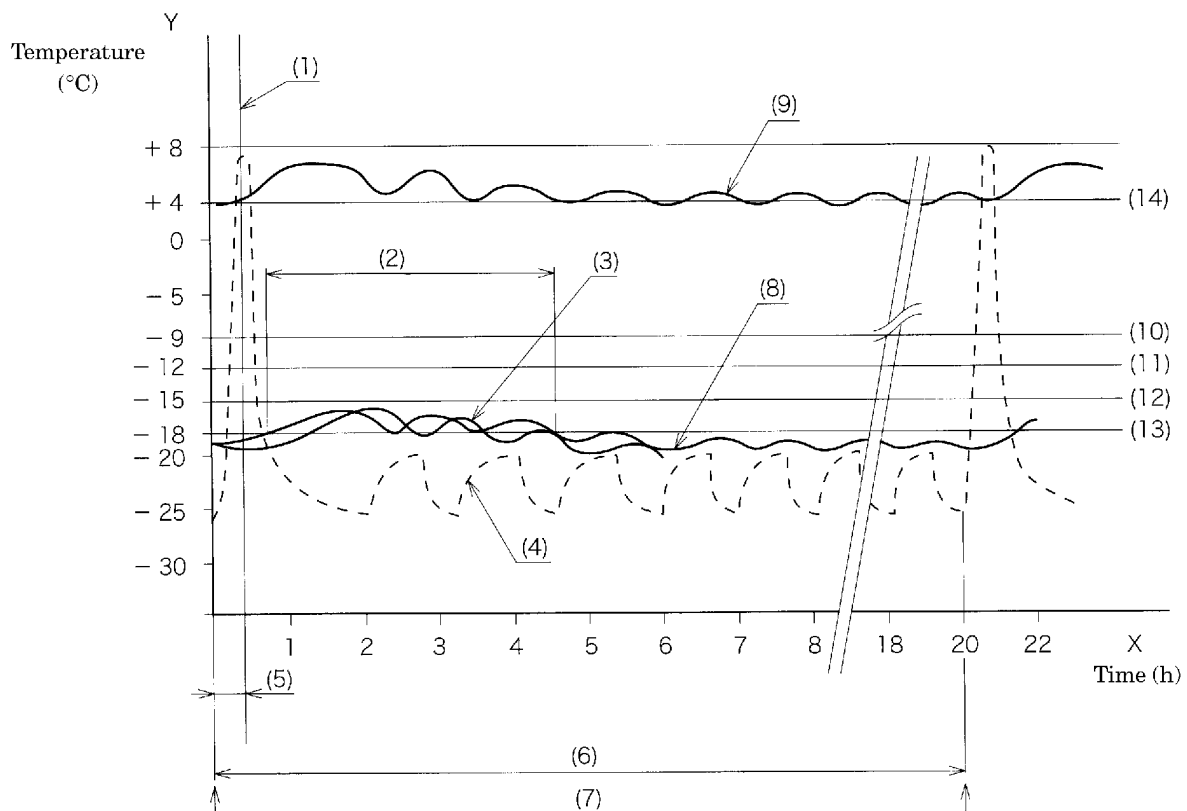
Appliances having additional frozen food storage compartments shall comply simultaneously with the conditions specified in table 1 and with the relevant star classification temperature specified in 3.2.6.

Table 1 Storage compartment temperatures

Ambient temperature	Fresh food storage compartment (see 3.4.2.1)		Frozen food storage compartment and "three star" compartment (see 3.4.2.2)	"Two star" compartment and section (see 3.4.2.2 and 3.4.6.3)	"One star" compartment (see 3.4.2.2)	Cellar compartment (see 3.4.2.3)	Chill compartment (see 3.4.2.4)
	t_{1m}, t_{2m}, t_{3m}	t_{ma}	t^{***}	t^{**}	t^*	$t_{c1m}, t_{c2m}, t_{c3m}$	t_{cc}
+15 to +30	$0 \leq t_{1m}, t_{2m}, t_{3m} \leq +8$	$\leq +4$	≤ -18	≤ -12	≤ -6	$+8 \leq t_{c1m}, t_{c2m}, t_{c3m} \leq +14$	$-3 \leq t_{cc} \leq +3$

Table 2 In the case of frost-free system appliances, permissible limit temperatures during defrosting cycle

Ambient temperature	Fresh food storage compartment (see 3.4.2.1)		Frozen food storage compartment and “three star” compartment (see 3.4.2.2)	“Two star” compartment and section (see 3.4.2.2 and 3.4.6.3)	“One star” compartment (see 3.4.2.2)	Cellar compartment (see 3.4.2.3)	Chill compartment (see 3.4.2.4)
	t_{1m}, t_{2m}, t_{3m}	t_{ma}	t^{***}	t^{**}	t^*	$t_{c1m}, t_{c2m}, t_{c3m}$	t_{cc}
+15 to +30	$0 \leq t_{1m}, t_{2m}, t_{3m} \leq +10$	$\leq +7$	≤ -15	≤ -9	≤ -5	$+8 \leq t_{c1m}, t_{c2m}, t_{c3m} \leq +14$	$-3 \leq t_{cc} \leq +3$
NOTE 1 The duration of the temperature deviation above the chill temperature (table 2) as a result of a defrost cycle shall not be greater than 4 h or 20 % of the duration of the operating cycle, whichever is the shorter. NOTE 2 In the case of t^{***}, the duration of the deviation shall be measured from the moment when the first t_F exceeds -18 °C to that moment when the last t_F returns permanently to -18 °C or colder. NOTE 3 In the case of t_a, the duration of the deviation shall be measured from the moment when t_a exceeds $+4\text{ °C}$ to that moment when t_a returns permanently to $+4\text{ °C}$ or colder. NOTE 4 These two deviations of t_{ma} and t^{***} need not occur simultaneously (see figure 2 for example).							



- (1) Commencement of the refrigerating process
- (2) 20 % of the duration of the operating cycle (4 h max.) when the temperature rise of metals for a food freezer compartment (or a frozen food storage compartment) is within the permissible value
- (3) Instantaneous temperature value of metals
- (4) Temperature of evaporator
- (5) Automatic defrosting cycle
- (6) Operating cycle
- (7) Power-on of the means of defrosting
- (8) Arithmetic mean value (t_{Fa}) of instantaneous temperature value (t_F) of metal
- (9) Arithmetic mean value (t_a) of instantaneous temperature value (t_i) of metal
- (10) $t^{**} + 3 \text{ K}$
- (11) t^{**}
- (12) $t^{***} + 3 \text{ K}$
- (13) t^{***}
- (14) t_{ma}

Figure 2 Example of an operating cycle of a frost-free refrigerator-freezer

6.2.2 Freezing capacity The freezing capacity measured in accordance with clause 17 on the first appliance tested shall not be less than the rated freezing capacity by more than 15 % of the latter. If the result of the test carried out on the first appliance is less than the declared value minus 15 %, the test shall be carried out on a further three appliances.

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

The minimum freezing capacity in accordance with **3.1.4** or **3.2.6** and the requirement of **17.1.3**, as appropriate, shall be respected.

6.2.3 Energy consumption If the energy consumption is stated by the manufacturer, the value measured in the energy-consumption test on the first appliance tested shall not be greater than the rated energy consumption by more than 15 % of the latter. If the result of the test carried out on the first appliance is greater than the declared value plus 15 %, the test shall be carried out on a further three appliances.

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

6.2.4 Ice making If the ice-making capacity is stated by the manufacturer, the value measured in accordance with clause **18** shall not be less than the declared value by more than 15 % of the latter.

If the ice-making capacity obtained from the first test is less than the declared value minus 15 %, the test shall be carried out on a further three appliances.

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

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

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

The arithmetical mean of the periods of temperature rise of these three appliances shall be equal to or greater than the declared value minus 10 %.

6.2.6 Refrigerating speed For the refrigerating speed, when the test is performed in accordance with the method in clause **20**, the mean fresh food storage compartment temperature t_3 and the temperature at the measurement point of the mean frozen food storage compartment temperature shall reach the specified temperature within 3 h. However, it shall not apply to a food freezer compartment and a specific fresh food storage compartment.

7 Determination of linear dimensions, volumes and areas The measurements are carried out on the appliance as delivered and not operating. If there is a cellar compartment, the volume of which is adjustable, the measurements shall be made with this compartment adjusted to both its minimum and maximum volumes (see **7.2.3**).

7.1 Determination of linear dimensions Linear dimensions shall be measured to the nearest millimetre.

7.2 Determination of volumes Volumes shall be expressed in a whole number of cubic metres or of litres.

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

When the gross volume is determined, internal fittings such as shelves, removable partitions, containers, evaporators, thermostats and interior light housings shall be considered as not being in place. However, the gross volume shall take into account the exact shapes of the walls if they contain depressions or projections (see example in figure 22).

7.2.2 Determination of the total storage volume The total storage volume of the appliance shall be the sum of the storage volumes of all the compartments including two star sections, as applicable.

For the determination of storage volumes, the total volume of devices and of spaces considered unusable for the storage of food shall be deducted from the gross volume calculated in accordance with 7.2.1 [see 7.2.3 for fresh food storage, chill and cellar compartments, and 7.2.4 and 7.2.5 for low-temperature compartments (or cabinets) and food freezer compartment(s) (or cabinets), and 7.2.6 for two star section, if applicable].

7.2.3 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, as defined in 7.2.3.1, if applicable;
- the volume of any housings (such as those for interior lights, thermostats and other devices);
- the volume of shelves, partitions, retainers and other accessories, whose wall thickness is greater than 13 mm, as defined in 7.2.7.1;
- the space between the inner door protrusion (dykes) and the inner liner of the fresh food storage compartment and chill and cellar compartments.

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.

7.2.3.1 Volume of the evaporator space The volume of the evaporator space shall be the product of the depth, width and height, defined as follows.

7.2.3.1.1 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.

7.2.3.1.2 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 computed as part of the evaporator space.

7.2.3.1.3 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 height of the drip tray in a cabinet and the defrost water receptacle of a similar kind shall be included in the evaporator height, except in the case where the depth of the drip tray is more than 40 mm and the case of the manually defrosted type.

7.2.4 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 appliance.

The volumes of these compartments shall be determined in a similar manner to that specified in **7.2.2** and **7.2.3**, as appropriate.

7.2.5 Storage volume of food freezer compartments (or cabinets) and frozen food storage compartments (or cabinets) For the determination of the storage volume of these compartments (or cabinets), the total volume which is unsuitable for storage shall be determined and then deducted from the gross volume determined as indicated in **7.2.1**.

The total volume to be deducted shall comprise (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 appliances fitted with automatic icemakers, when the volume occupied by a removable storage bucket shall be included in the storage volume unless it is specified in the instructions for use that this volume is suitable for the storage of ice only;
- c) the volume of spaces between the front stack(s) of the test package load (see **13.1.2.3**) and the inner vertical surface of the door or any projection from the door where the horizontal distance between the front face of the stack(s) and the inner door surface or projection exceeds 15 mm;
- d) the volume of all fixed components within the load limits;
- e) the volume of spaces which are to be kept free for the good performance of the refrigerating system;
- f) the volume of all removable parts which are stated by the manufacturer as necessary for the proper functioning of the appliance, except shelves and partitions whose thickness is not greater than 13 mm (see **7.2.7.1**);

- g) the volume rendered unusable by the use of removable parts (for example, baskets, shelves) necessary for obtaining satisfactory thermal and mechanical characteristics (see also **8.3.4**);
- h) any volume where the vertical clearance is less than 52 mm (see figure 24);
- i) any volume where it is impossible to place an “M” package of nominal dimensions;
- j) storage volume of “two star” sections.

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

7.2.6 “Two star” sections and/or compartments in food freezer compartments (or cabinets) and in “three star” compartments (or cabinets) A “two star” section or compartment is permitted both in the door and in the remaining storage volume when all the following conditions are met:

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

7.2.7 Volumes of shelves and partitions (for example, see figure 25)

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

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

7.2.7.2 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.

7.2.7.3 Fractional shelves and partitions 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, if applicable.

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

7.2.8 Determination of total rated volume The total rated volume of a product shall be the grand total of the rated volume of all compartments (cabinets) concerned with doors closed.

7.2.8.1 Calculation of rated volume For removable components without using a tool (a shelf, a vegetable container, a drip tray, a meat pan, a basket, an interior light cover, etc.), remove them and calculate as follows.

- a) Calculate each volume including the shaded portion²⁾ in figure 26 to figure 38 with respect to a fresh food storage compartment and a frozen food storage compartment.

Note ²⁾ The shaded portion shown in the figure:

 indicates a portion included in rated volume, and  indicates a portion not included in rated volume.

- b) Calculate each rated volume by subtracting the volume of the portion shown with  in figure 26 to figure 38 and the volume of each of the following items from the volume calculated in a):
- a guide frame of an interior fan, a guide plate of air, a circulation path of air, an evaporator, piping for cooling, a door for an evaporator, etc. For those which do not attain the objective of refrigeration without them, do not calculate by including them in rated volume even if they are removable without using a tool;
 - part occupied by the projection of the inside of the door;
 - part considered not to be in practical use, which is a space between the projection of the inside of the door and the neighboring wall of the enclosed space of the cabinet;
 - part occupied by the projection such as a panel of control device, a support of tray and shelf, a shelf suspending part, a knob of control device, an interior light;
 - the volume of a shelf which cannot be removed without using a tool shall be the product of the area of a shelf multiplied by the distance between the face on which food is put and its underside;
 - space of the outside of load limit and load limit line.

7.2.8.2 Determination of rated volume The determination of rated volume shall be as follows.

- a) For rated volume (total rated volume for a refrigerator-freezer), sum up each rated volume of a fresh food storage compartment or a frozen food storage compartment calculated in **7.2.8.1 a)** and round the fractions of one decimal place in accordance with **JIS Z 8401**.
- b) For the fresh food storage compartment rated volume and frozen food storage compartment rated volume of a refrigerator-freezer, first, round the fractions of one decimal place of the calculated value of a fresh food storage compartment or a frozen food storage compartment, whichever is smaller, in accordance with **JIS Z 8401**. Next, determine the fresh food storage compartment rated volume or the frozen food storage compartment rated volume by obtaining the difference between the total rated volume determined in **7.2.8.1 a)** and the total rated volume determined in **7.2.8.1 b)**.

7.2.8.3 Explanation of figures Figures shown in figure 26 to figure 38 are for calculating the rated volume of a refrigerator, a refrigerator-freezer and a frozen food storage cabinet. Even if there is a space of not less than the dimension in the figures, when a gap is not in practical use according to the decorative rim and other structures of less than the specified dimension, it shall not be included in a calculation of rated volume.

7.3 Determination of storage shelf area The area shall be expressed in square centimetres or square metres.

7.3.1 Determination of the area of shelves

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

- Width: mean distance measured parallel to the surface of the shelf between the inner surfaces of the side walls of the enclosed space of the cabinet, where this dimension does not exceed the actual width of the shelf by more than 20 mm [see figure 18 a)].
- Depth: mean distance measured parallel to the surface of the shelf (or of bottom of the appliance) between the inner surfaces of the front and rear walls of the enclosed space of the cabinet, where this dimension does not exceed the actual depth of the shelf by more than 20 mm [see figure 18 b)]. When the door of an upright-type appliance is provided with shelves, this distance shall be determined by analogy [see figures 18 c) and 18 d)].

7.3.1.2 Fractional shelves For the purpose of calculating the area of fractional shelves, the width and depth shall be measured parallel to the surface of the shelves in a similar way to that for full shelves (see **7.3.1.1**), but taking into account figure 18 e).

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

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

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

- Width: mean distance between the inner surfaces of the side walls of the door compartment or between the side edges of the retainer bar.
- Depth: mean distance between the surface of the door wall and the vertical plane tangential to the inner front surface of the shelf or retainer bar [see figure 18 c)].

7.3.1.6 Baskets and containers The area shall be the product of the two mean horizontal dimensions [see figure 19 a)].

7.3.1.7 Particular cases

7.3.1.7.1 General The bottom of the enclosed space of the cabinet shall be considered as a shelf. When an inner wall is not vertical, the dimension of the shelf shall be measured at the mid-height between the shelf under consideration and the shelf or horizontal surface immediately above.

7.3.1.7.2 Fresh food storage, chill and cellar compartments, if any Any part of full shelves, baskets or of 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)].

7.3.1.7.3 Food freezer compartments (or cabinets) and low-temperature compartments (or cabinets) Any part of full shelves, baskets or of 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.

7.3.2 Drip tray When the space occupied by a drip tray is included in the storage volume, the part of a shelf supporting a drip tray or the bottom part of a drip tray is taken as a portion of the storage shelf area, and the definite manual operation to initiate defrosting shall be required.

7.3.3 Suspended containers

7.3.3.1 Fresh food storage, chill and cellar compartments, if any 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.

7.3.3.2 Food freezer compartments (or cabinets) and low-temperature compartments (or cabinets) For a food freezer compartment (or cabinet) or frozen food storage compartment (or cabinet), the dimension of the minimum vertical clearances specified in **7.3.3.1** is 52 mm in all cases.

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

8 General test conditions The order of carrying out the tests need not necessarily follow the sequence of the clauses given in this 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 subclause concerning the test.

The storage plans shall be in accordance with this Standard (see **13.1.2**).

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

8.1.1 Ambient temperature Tests shall be carried out under the following conditions of ambient temperature:

- a) for checking the storage temperatures of refrigerators and refrigerator-freezers:
+15 °C and +30 °C
- b) for checking the storage temperatures of frozen food storage cabinets and food freezers:³⁾
+30 °C

Note ³⁾ The purpose of this test is to confirm the storage temperature limit in the range of all ambient temperatures and the test at the maximum ambient temperature is considered to be good enough.

- c) for checking the temperature rise time and food freezing capacity of all appliances, as applicable:³⁾
+25 °C
- d) for all other tests, at the temperature stated in the test specifications.

The temperature at each measurement point (see **3.4.10**) shall be kept constant within ± 1 K of the nominal ambient temperature both during the periods required for obtaining stable operating conditions and during the tests.

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

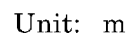
8.1.2 Humidity Unless otherwise specified, relative humidity shall be 75 % or under.

8.1.3 Installation of appliances Each appliance shall be placed on a wooden solid-top platform, painted dull black, open for free air circulation under the platform. The bottom of the platform shall be at least 0.05 m above the test room floor and shall extend at least 0.3 m beyond all sides of the appliance, except at the rear where it shall extend to the vertical partition.

The air temperature in the bottom of the platform shall be measured at a location of 20 mm to 30 mm from the bottom of the platform on the vertical axis passing through the geometric centre of an appliance using metals (see **3.3.9**). At this time, the difference between air temperature and ambient temperature shall be ± 1 K.

Circulation of air about the appliance shall be restricted by surrounding the appliance by three vertical partitions, painted dull black 15 mm to 30 mm in thickness, arranged as follows:

- a) one of the partitions shall be placed parallel to the rear of the appliance, against the stops or at the distance specified by the manufacturer in connection with the required overall space;
- 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.



- 1) Distance between the wall of the test room and the partition.
- 2) A distance of 0.3 m from the side centre of the appliance and wind velocity of 0.5 m/s or less.
- 3) T_{a3} indicates the measurement point of air temperature.

Figure 3 Installation condition of partitions

The vertical partitions shall present no discontinuity. They shall be of such a height that they extend at least 0.3 m above the top of the appliance.

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

Air circulation in the test room shall be such that the specified ambient temperatures are obtained within the limits of the specified tolerances.

The appliance under test shall be shielded from any air currents of velocity above 0.5 m/s.

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

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

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

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

8.2.1 Dimensions and tolerances

- a) **Dimensions and mass** The size, prior to freezing, and their mass, packaging included, shall be as specified in table 3.

Table 3 Dimensions and mass of test packages

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

- b) **Tolerances**

1) **Linear dimensions:**

± 1.5 mm for dimensions 25 mm and 50 mm

± 3.0 mm for dimensions 100 mm and 200 mm

2) **Mass:** ± 2 %.

8.2.2 Composition The packages shall consist of the following.

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

230.0 g of oxyethylmethylcellulose

764.2 g of water⁴⁾

5.0 g of sodium chloride

0.8 g of 6-chloro-*m*-cresol.

Note ⁴⁾ 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°C (its thermal characteristics correspond to those of lean beef).

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

232 g oxyethylmethylcellulose

725 g of water

43 g of sodium chloride

0.6 g of 6-chloro-*m*-cresol.

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

For the measurement of a chill compartment, only the test packages with a freezing point of -5°C shall be used. However, since the test packages with a freezing point of -5°C cannot be obtained in Japan, the test packages with a freezing point of -1°C may be substituted.

- b) 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.

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

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

8.3 Operating requirements for the appliance

8.3.1 Thermostat setting The thermostat setting requirements are specified for each test.

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

8.3.2 Anti-condensation heaters

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

8.3.2.2 Heaters for guarantee (heater for thermal insulation, freeze proofing heater, etc.) In the energy-consumption test, when the heater for guarantee works under the ordinary condition (ambient temperature of +15 °C to +30 °C), “turn-on” shall be set.

8.3.3 Electric power supply

8.3.3.1 Electric power source The appliance shall be tested at the rated voltage and frequency, or at the mean of the rated voltage range $\pm 2\%$ and the rated frequency range $\pm 1\%$.

8.3.3.2 Power sources other than electricity Not specified.

NOTE : Although it is specified in the corresponding International Standard that the appliance driven by the power source other than electricity shall be tested under the condition indicated in the rating plate, it is deleted in this Standard since use is limited to the electric type.

8.3.3.3 Two or more power sources Not specified.

NOTE : Although it is specified in the corresponding International Standard that the appliance driven by two or more power sources shall be tested under each condition indicated in the rating plate (see **8.3.3.1** and **8.3.3.2**), it is deleted in this Standard since use is limited to the electric type.

8.3.4 General conditions for the use of baskets, containers, and shelves and trays All shelves, and only those baskets, containers and trays which have been taken into consideration when determining the storage volume, shall be in position.

8.4 Measuring instruments Temperatures shall be measured either with “M” packages or with metals.

The temperatures shall be recorded. Temperature-measuring instruments shall be accurate to within ± 0.3 K.

The relative humidity shall be measured and recorded at a point which is representative. The accuracy of the measuring instruments shall be such that the result, expressed as the dew point, is accurate to within ± 0.3 K.

Watt-hour meters shall be readable to $0.001 \text{ kW}\cdot\text{h}$ and be accurate to within $\pm 1\%$. The measuring accuracy shall be stated in the test report.

8.5 Measurement of internal temperature

8.5.1 Measurement of the temperature of the fresh food storage compartment and cellar compartment The temperatures t_{1m} , t_{2m} , t_{3m} and t_{c1m} , t_{c2m} , t_{c3m} (see **3.8**) shall be measured using metals. However, the refrigerating capacity test of the refrigerator-freezer measured by “M” package is excluded.

The measurement point for storage temperature measurement shall be located at T_1 , T_2 , T_3 and T_{c1} , T_{c2} , T_{c3} as shown in figure 14, figure 15a and figure 15b.

In the refrigerating capacity test of the refrigerator-freezer, the centre of “M” package shall be located at the measurement point, supported or suspended so that the maximum surface may become horizontal, and placed at a distance of 25 mm or more from the heat transfer surface. The instantaneous temperature values of “M” package, t_1 , t_2 , t_3 and t_{c1} , t_{c2} , t_{c3} shall be recorded. For the method to place the “M” package, for example, the block of expanded polystyrene (EPS) of the same size as that of “M” package may be used.

The temperatures of measurement points, t_{1m} , t_{2m} , t_{3m} and t_{c1m} , t_{c2m} , t_{c3m} shall be taken as the integral mean temperature of t_1 , t_2 , t_3 and t_{c1} , t_{c2} , t_{c3} during the operating cycle at intervals of 60 s or less, respectively.

The storage temperatures t_{ma} (see 3.4.2.1) and t_{cma} (see 3.4.2.3) shall be taken as the average value of the mean temperatures, t_{1m} , t_{2m} , t_{3m} and t_{c1m} , t_{c2m} , t_{c3m} , respectively.

If internal components do not allow the temperatures t_1 , t_2 , t_3 and t_{c1} , t_{c2} , t_{c3} to be read at the points specified, readings may be taken in positions such that one of the surfaces of the metal or the “M” package is no more than 25 mm from the point specified.

If the interior arrangement of the fresh food storage compartment and cellar compartment does not conform to those shown in figures 14 and 15, the temperatures t_1 , t_2 , t_3 and t_{c1} , t_{c2} , t_{c3} shall be read in positions determined by analogy with the positions indicated.

8.5.2 Measurement of the temperature of the chill compartment For determination of storage temperature of chill compartment, the storage plan shall be in accordance with 13.1.2.1.

The temperature t_{cc} (see 3.4.2.4) shall always be measured in “M” packages positioned or suspended at least 25 mm away from all walls and ceiling and from the other packages of the test load.

The temperature t_{cc} shall be recorded at intervals of 60 s or less during the operating cycle.

In chill compartments “M” packages shall be placed where the highest and lowest temperatures are expected.

In the case of a chill compartment with special subdivisions (shelves, etc.) which are part of the design, if the dimensions are too small to allow the horizontal positioning of the “M” packages, it is permissible to position them vertically.

Moreover, if the dimensions are too small to accommodate an “M” package (for example in door shelves), a special support may be used to position the “M” package next to the shelf and as close as possible to the door liner.

8.5.3 Measurement of the temperature of food freezer compartments (or cabinets) and frozen food storage compartments (or cabinets) or sections (see also 7.2.6) The temperatures shall be measured in “M” packages which are distributed throughout the load of test packages specified in the storage plan (see 13.1.2.2).

The measurement during the operating cycle shall be recorded at intervals of 60 s or less.

The temperature of each compartment (or cabinet) or section is then the maximum temperature of the warmest “M” package in that compartment (or cabinet) or section. The conditions given in table 2 shall be respected.

8.6 Measurement of percentage running time When the cycle operation of the appliance is performed under the storage condition of ambient temperature (see clause 13), as specified in 8.7, the test shall be performed for 24 h or more, and the operation time shall be measured.

8.6.1 Refrigerating appliances driven by electric power The timer which synchronizes with the operation of a refrigerating system shall be used. When the refrigerating appliance is connected to a power supply circuit in series and the current relay is magnetized by current, voltage is introduced to a synchronous system timer, and the reading of the start and end of the test shall be recorded. The difference between the two reading values is operation time.

Instead, a current value or a power value may be recorded by an ammeter or a wattmeter, and the period of operation and suspension may be calculated from the graph.

8.6.2 Refrigerating appliances driven by non-electric power The proper measuring device to record the operation time of the refrigerating system shall be used.

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

8.7.1 Refrigerating appliances (except frost-free system appliances) For the refrigerating appliances which perform the cycle operation and are not automatically defrosted, the test period shall be the control cycle of an integral number of times.

For the automatically defrosted refrigerator, the test period shall be as follows.

- a) Operating cycle of an integral number of times, which is 24 h or more.
- b) When the first defrosting was initiated, but was not completed within a period of time of 24 h, the test is completed at the end of duration of defrosting cycle.
- c) When defrosting was not initiated within a period of time of 24 h, the test period shall be extended to 48 h, and during the extended period, a) and b) mentioned above shall be introduced.
- d) When defrosting was not started within a period of time of 48 h, defrosting shall not be taken into consideration.

8.7.2 Automatically defrosted refrigerating appliances (frost-free system appliances) The test period is 24 h or more, which starts at the beginning of the control cycle and is completed at the end of the control cycle. When one control cycle is not completed within a period of time of 24 h, the test shall be continued until the control cycle is completed.

When one control cycle is not completed within a period of time of 72 h, the test is closed in 72 h.

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

9.1 Procedure The ambient temperature shall be between +15 °C and +30 °C.

The appliance shall be switched off and shall be in equilibrium with the ambient temperature before carrying out the test.

A strip of paper 50 mm wide and 0.08 mm thick and of suitable length shall be inserted at any point of the seal, and the door or lid shall be closed normally on it.

The verification of the thickness of the paper used shall be in accordance with **JIS P 8118**.

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

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

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

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

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

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

10.1 Procedure The ambient temperature shall be between +15 °C and +30 °C. The appliance shall be switched off and be in equilibrium with the ambient temperature.

The door or lid shall be closed for a period of 1 h, after which an “opening” test shall be carried out under the following conditions.

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

The method of measurement shall be one of the following:

- a) by applying the force at a point on the outer surface of the door or lid corresponding to the internal measuring point (for example, with the aid of a suction pad);
- b) if the handle of the door or lid is at the midpoint of the edge farthest from the hinge axis, by applying a force to the handle, the value of the force required to open the door or lid from the inside being determined by proportional calculation from the distances of the handle and of the internal measuring point from the hinge axis.

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

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

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

11.1 External door(s) and lid(s)

11.1.1 Procedure The ambient temperature shall be between +15 °C and +30 °C.

The appliance shall be switched off.

The inner door(s) shall be loaded as specified in **12.1.2** or **13.1.2.3.7**, as appropriate.

11.1.1.1 Opening sequence (see figure 4) The movement of the door shall be controlled from an angle of 0° to an angle of opening between 5° and 15°, followed by a free movement of the door, the controlled movement being approximately sinusoidal. The opening of the door shall take place in the first quarter of the period of the cycle.

11.1.1.2 Closing sequence (see figure 4) The movement of the door shall be controlled from the angle of opening of 45° to an angle between 40° and 35°, followed by the free movement of the door and its closing as in normal use.

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

11.2 Lid(s) and internal door(s) Test procedure is under consideration.

11.3 Test report The test report shall indicate whether the hinges and handles meet the requirements of **5.4**, and whether the seals meet the requirements of the last paragraph of **5.3**.

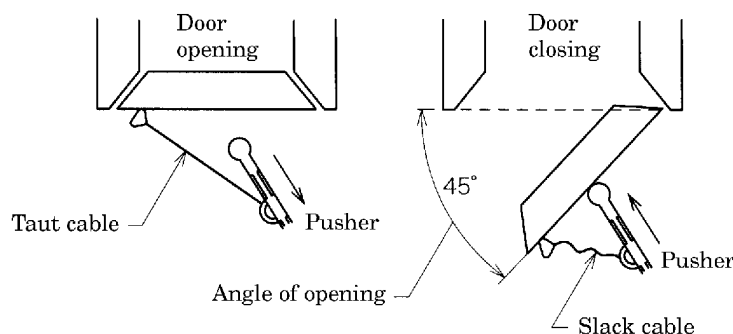


Figure 4 Example of opening and closing of external door(s) and strength of components (shelves and containers) used for storing food

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