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

*Appareils de réfrigération à usage ménager — Caractéristiques et
méthodes d'essai*

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Foreword

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

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

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.

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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*

IEC 60335-2-24:—¹⁾, *Household and similar electrical appliances — Safety — Part 2-24: Particular requirements for refrigerating appliances, ice-cream appliances and icemakers*

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.).

1) To be published. (Revision of IEC 60335-2-24:2002)

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

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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 $-6\text{ }^{\circ}\text{C}$

3.3.5.2**two-star compartment**

frozen-food storage compartment in which the temperature is not warmer than $-12\text{ }^{\circ}\text{C}$

3.3.5.3**three-star compartment**

frozen-food storage compartment in which the temperature is not warmer than $-18\text{ }^{\circ}\text{C}$

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

compartment suitable for freezing foodstuffs from ambient temperature down to $-18\text{ }^{\circ}\text{C}$, 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 $-12\text{ }^{\circ}\text{C}$

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.

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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

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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.

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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.

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6 Storage temperatures

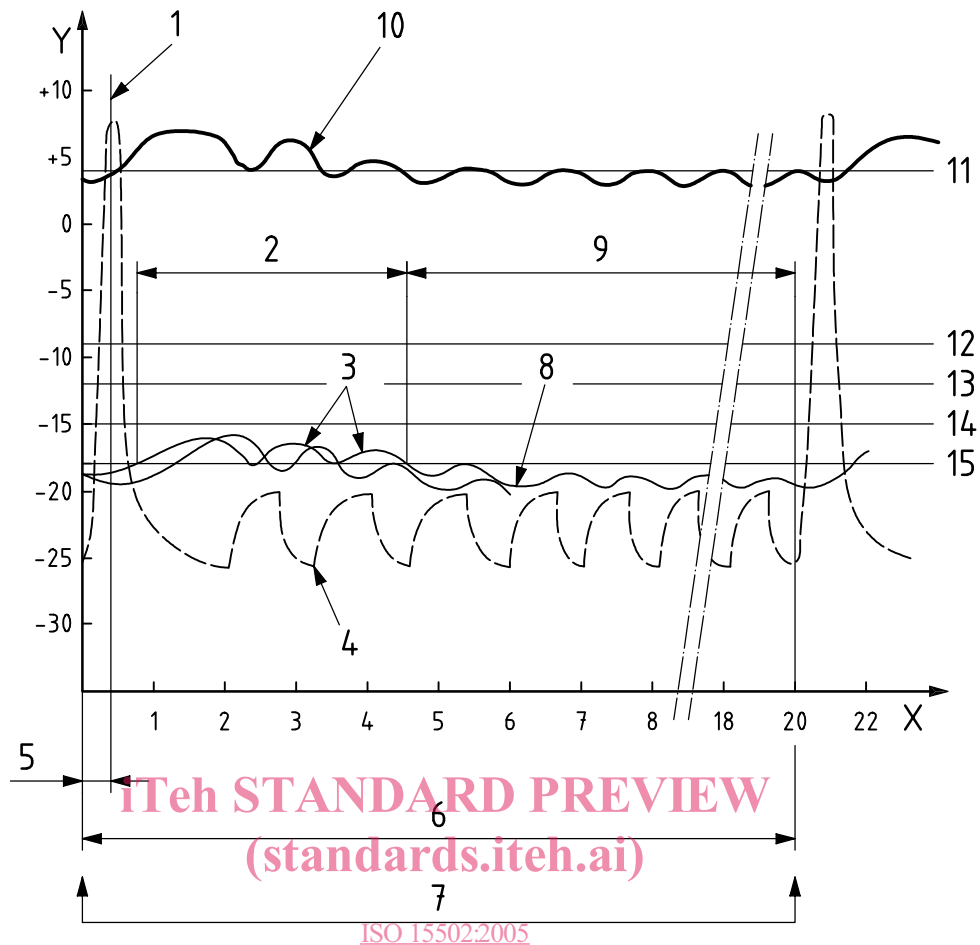
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Under the conditions specified in Clause 13, the refrigerating appliance shall be capable of maintaining, simultaneously, the required storage temperatures in the different compartments and the permitted temperature deviations (during the defrost cycle) 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	$+8 \leq t_{cm} \leq +14$	$-2 \leq t_{cc} \leq +3$
<p>^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.</p>					

**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