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SPECIFICATION FOR
HOUSEHOLD REFRIGERATORS/FREEZERS

SRI LANKA STANDARDS INSTITUTION

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SLS 723:1985

Gr. 16

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SRI LANKA STANDARD

SPECIFICATION FOR HOUSEHOLD REFRIGERATORS/FREEZERS

FOREWORD

This Sri Lanka Standard was authorized for adoption and publication by the Council of the Sri Lanka Standards Institution on 1985-11-20, after the draft, finalized by the Drafting Committee on Household Refrigerators/Freezers, has been approved by the Electrical Engineering Divisional Committee.

All values in this standard have been given in SI units.

This Sri Lanka Standard Specification prescribed the general constructional requirements and the methods of determining the performance and computing the volume and shelf area of electrical refrigerators/freezers designed for household use.

References have been made in this standard with regard to general and safety requirements as well as methods of tests to SLS 579 which is a necessary adjunct to this specification, should however any deviation exist between the requirements of SLS 579 and those of this specification, the provision of this latter shall apply.

For the purpose of deciding whether a particular requirement of this specification is complied with, the final value, observed or calculated, expressing the result of a test or observation shall be rounded off in accordance with CS 102. The number of figures to be retained in the rounded off value, shall be the same as that of the specified value in this specification.

The assistance derived from the publications of the British Standards Institution, and International Organization for Standardization in the preparation of this specification is gratefully acknowledged.

1 SCOPE

1.1 This standard covers the methods of determining the performance of self-contained refrigerators/freezers intended for household use.

1.2 This standard does not apply to refrigerators/freezers designed for commercial use.

2 DEFINITIONS

For the purpose of this specification, the following definitions shall apply:

2.1 definitions relating to compression-type refrigerators/freezers

2.1.1 compression-type refrigerator/freezer : An appliance in which cooling is effected by the evaporation of a liquid refrigerant, in a heat exchanger (evaporator). The vapour thus formed is restored to the liquid state by mechanical compression to a higher pressure and cooling subsequently in another heat exchanger (condenser).

2.1.2 evaporator : A heat exchanger in which low pressure (after expansion) liquid refrigerant is vaporized by absorbing heat from the medium to be refrigerated.

2.1.3 condensor : A heat exchanger in which compressed refrigerant vapour is liquified by rejecting heat to an external cooling medium.

2.1.4 hermetically sealed compressor unit : A refrigerating compressor and motor assembly enclosed in a shell, rendered gas-tight by welding or other suitable means.

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

2.1.6 pressure reducer : A device in which the pressure of the refrigerant is reduced from that of the condensed liquid to that of the evaporator.

2.1.7 refrigerant compressor : A mechanically operated device which withdraws refrigerant vapour from the evaporator and discharges it at a higher pressure to the condenser.

2.1.8 thermostat : A device which automatically regulates the operation of the refrigerating system according to a preset temperature of the evaporator or of the food storage compartment.

2.2 definitions relating to absorption-type refrigerators

2.2.1 absorption-type refrigerator : A refrigerator in which cooling is effected by evaporation of a liquid refrigerant in a heat exchanger (evaporator). The resulting vapour is then absorbed by an absorbent medium from which it is subsequently expelled by heating to a higher partial vapour pressure and liquified by cooling in another heat exchanger (condenser).

2.2.2 absorption refrigerating system : A complete system essentially comprising a condenser, an evaporator an absorber, and all other parts

containing refrigerant permanently interconnected by welding, brazing or other means by the manufacturer.

2.2.3 absorber : A device in which the refrigerant vapour is absorbed by an absorbent medium. The heat evolved in the process is removed by a cooling medium.

2.2.4 boiler : A heat exchange in which the absorbed refrigerant is expelled from the absorbent medium by the application of heat.

2.2.5 condenser : A heat exchanger in which the vapourized refrigerant, after leaving the boiler, is liquidified by rejecting heat to an external cooling medium.

2.2.6 evaporator : A heat exchanger in which the liquid refrigerant after expansion or drop in partial pressure is vapourized by absorbing heat from the medium to be refrigerated.

2.3 definitions applicable to household refrigerators of all types

2.3.1 household refrigerator/freezer : An insulated cabinet with suitable volume, cooled by an energy consuming means, and having two or more compartments of which at least one compartment (the fresh food compartment) is suitable for storing in frozen foods, and at least one compartment (the food freezing compartment) is suitable for freezing fresh food at - 18°C or colder for deep freezers and -6°C or colder for household refrigerators.

2.3.2 fresh food storage compartment for refrigerators : Compartments (which may be subdivided into special compartments) intended for the storage of unfrozen foods.

2.3.3 food freezing compartment : The portion of the storage volume intended for following operations:

i) Freezing of water and food

ii) Storage of frozen foods.

2.3.4 overall dimensions (doors or lids closed) : The dimensions of the rectangular parallel piped whose base is horizontal within which the appliance is inscribed, including the fittings but not the handle, the protrusion of which if any is separately specified.

2.3.5 overall space required in use (doors or lids open) : The overall dimensions, 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 doors, or lids including top-opening lids to the minimum angle permitting removal of all removable parts (such as containers and shelves) including the drip tray with water, if this has to be removed and emptied manually (see Fig. 1).

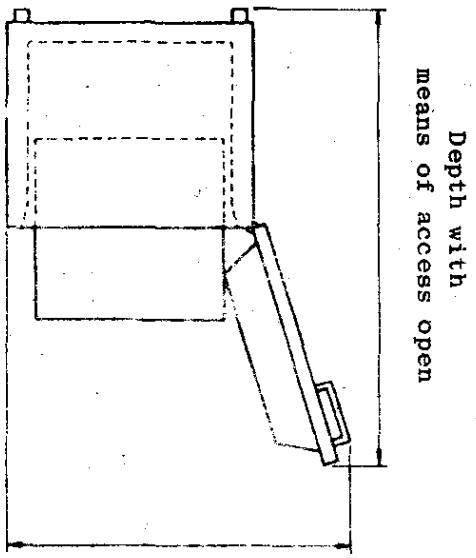


FIGURE 1 : Overall space required in use

2.3.6 stable operating conditions : Conditions obtaining when the highest and lowest of three successive determinations of the temperature, taken at intervals of at least 1 hour (when, relevant, at the same point of the operating cycle) do not differ by more than 1 °C.

2.3.7 mean temperature (at a point) : The average of the extreme values of the temperature determined at a particular point inside the appliance during a complete cycle of the thermostat.

2.3.8 mean interval temperature : The average of the mean temperatures at specified points within an appliance given in Fig. 9.

2.4 volumes

2.4.1 gross volume : The total volume of the food compartments within the inside walls of the appliance, without fittings the door or lids being closed, except when cooling is provided by forced air in which case the gross volume is calculated by substracting from the total volume the volume rendered unusable by cold air ducting,evaporator, fan and other associated accessories.

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

2.4.3 storage volume of a compartment : The part of the volume of any compartment that remains after deduction of the volume of components and of spaces recognized as unusable for the storage of food.

2.4.4 rated storage volume of a compartment : The storage volume of a compartment stated by the manufacturer.

2.5 storage areas

2.5.1 shelf : Any horizontal surface (shelf, partition etc.) on which food can be placed being formed by one component or by components fitted side by side which may be fixed or removable.

2.5.2 storage shelf area : Sum of the horizontal areas of the compartments recognized as usable for the storage of food.

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

2.6 defrosting

2.6.1 automatic defrosting : A method of defrosting that will maintain the specified storage condition without the intervention of the user to remove frost accumulation.

2.6.2 semi-automatic defrosting : A method of defrosting whereby the actions necessary to remove frost accumulation is initiated by the used and normal operation is restored automatically.

NOTE - Semi-automatic defrosting may be accelerated by the application of heat.

2.6.3 manual defrosting : A method of defrosting whereby the action necessary to remove frost accumulation and to restore normal operation are both initiated by the user.

2.7 definitions relating to performance requirements of apparatus

2.7.1 ambient temperature : It is the temperature of the space surrounding the refrigerator under test. It is the arithmetical mean of the value of temperatures measured at three points located 25 cm from the side walls and front wall of the refrigerator, on the perpendiculars passing through the geometrical centres of the surfaces of these walls.

2.7.2 percentage running time (apparatus with on/off control): The percentage running time, under given conditions of ambient temperature and of mean internal temperature, is the ratio:

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

Where,

D is the total duration of the test, and

d is the duration of compressor operation during the total time period D

3 CLASSIFICATION

This SLS provides for the following two classes based on the ambient temperature.

a) Temperate class (N), refrigerators/freezers the main testing of which is based on an ambient temperature of 32°C.

b) Tropical class (T), refrigerators/freezers the main testing of which is based on ambient temperature of 43°C.

4. DESIGN, MATERIALS AND CONSTRUCTION

4.1 General

Refrigerators/freezers shall be constructed in such a manner to ensure good performance and durability in use. This can be tested in accordance with clause 10 of this standard.

4.2 Materials and finishes

All surface finishes shall be durable, colour fast, scratch resistant, smooth, washable and sufficiently resistant to impact. Metals and alloys that are used in the construction of the cabinets and doors and are not intrinsically corrosion resistant shall be effectively protected against corrosion. None of the materials used inside the refrigerators/freezers shall contaminate food placed in contact with them or transmit poisonous substances to food. They should be resistant to corrosion to the action of moisture and food acids. Sealing compounds shall be of odourless, non-toxic, non-oxidisable waterproof material, and shall function satisfactorily under service conditions.

Materials used for the compressor, condensor, evaporator, other pressure vessels, valves and piping which are subjected to the refrigerant pressure shall not deteriorate as a result of the action of the refrigerant lubricating oil or a mixture thereof.

4.3 Air tightness and thermal insulation

4.3.1 *Door seals*

They shall not allow any leakage of air into or out of an appliance and satisfy the test in accordance with 10.1 of this standard.

4.3.2 *Thermal insulation*

It shall be efficient and the insulating material shall be such that under normal working conditions.

a) Its insulating efficiency will remain substantially constant throughout the useful life of the appliance.

b) It will not allow an excessive accumulation of moisture on the outer surface of the appliance.

When an appliance is tested in accordance with 10.8, no moisture condensed on its external surface shall be visible to the unaided eye.

4.4 Doors, lids and fittings

4.4.1 Hinges, handles and associated components shall be strong and resistant to corrosion. They shall be able to withstand at least 100,000 openings and closings without deterioration which may affect, the air tightness of the refrigerator/freezer. The fastening system shall be such as to enable the doors to be easily closed and opened. It should be efficient and capable of maintaining its proper function.

4.4.2 Rerrigerators/rreezers with a volume of 60 litres or more, if provided with a door lock, the door shall be capable of being opened from inside. The force required for opening of the door shall not exceed 70 N.

The opening of doors shall be sufficient for easy removal of the shelves.

4.5 Interior fittings

Shelves shall be easily removable. Shelves and similar fittings, their mountings shall be of adequate strength and securely fitted. Their mechanical strength shall confirm to the test specified in clause 10.12 of this standard.

4.6 Defrost water collection

4.6.1 Each appliance shall be provided with one of the following means for collecting the defrost water.

a) a removable tray,

b) a fixed receptacle with provision for draining, or

c) any other acceptable means.

4.6.2 The volume of drip trays (either internal or external) of evaporators that are semi-automatically or manually defrosted shall be at least equal to the volume obtained by multiplying the total external and internal areas (mm^2) of the related evaporator (s) by 3 mm.

4.7 Refrigerating system

4.7.1 The mechanical operation of the refrigerators/freezers shall not give rise to undue noise or vibration.

4.7.2 The design of the condenser shall be such as to minimize the accumulation of dust.

4.7.3 Pipes and fittings to moving or resiliently mounted parts shall be so arranged as not to generate noise, not to touch or to transmit vibrations to other parts and shall be so designed as to prevent failure due to fatigue. All other pipes and fittings shall be securely anchored. Where necessary pipes and valves shall be properly insulated.

4.7.4 Suitable means shall 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 refrigerators/freezers and its surroundings.

4.7.5 All parts of compression type and absorption type refrigerating systems that are subjected to internal pressure shall be designed to withstand, without leakage, the pressure that may occur in normal service and transit.

The parts of the refrigerating circuit subjected to internal pressure shall be perfectly airtight. They should be designed to withstand, without permanent deformation, the saturated vapour pressure of the refrigerant at temperatures of :

a) 43°C for the low pressure side.

b) 65°C for the high pressure side.

TABLE 1 - Saturated vapour pressures

Refrigerant	43°C	65°C
	Pressures in bars	
R 12	10.51	17.22
R 22	16.98	28.02

4.8 Components

a) **General** : Components such as plugs, lampholders, switches and the like shall comply with the requirements of the relevant Sri Lanka Standard Specifications.

b) **Door operated switches** : Door operated switches shall be placed or protected so that they are unaffected by defrost water or by liquids that might be spilled inside the appliance.

c) **Lamp holders** : Lamp holders shall be of the insulated type and shall be so fitted that they will not work loose in normal use. Lamps and lampholders shall be effectively protected against mechanical shock and ingress of water. When doors and fittings are tested in accordance with clause 10 lampholders shall not move from the position in which they were installed. Screw type lampholders shall have the centre connected to the live supply.

d) **Power supply cord** : The power supply cord shall comply with **SLS 579** cl. **26**, with nominal conductor cross sectional area of at least 1.5 mm^2 and length (effective length) of minimum 1.5 metres.

The power supply cord shall have a permissible current capacity of not less than the maximum working current of load connected to the cord.

4.8.1 *Wiring and conductors*

a) The earthing shall comply with **SLS 579** cl. **28**. Accessible metal parts which may become live in the event of an insulation fault shall be

permanently and reliably electrically connected to an earthing terminal within the appliance (or to an earthing terminal adjacent to the supply connections) by means of a conductor of resistance not greater than that of the earth continuity conductor of the flexible supply cord of the appliance.

b) Internal wiring shall be adequately protected or enclosed wireways shall be smooth and free from sharp edges, burrs etc. that may cause abrasion of the insulation of the wiring.

c) Holes thro' which insulated wires pass shall be provided with bushings or rounded to a radius of at least 1.5 mm.

d) Bushings shall be of a material that is resistant to corrosion and wear under normal conditions. They shall be smooth and shall retain their form throughout the useful life time of the appliance.

e) Electrical insulation on internal wiring shall be such that it cannot be damaged in normal use.

f) Joints, unless made with a suitable mechanical connector shall be soldered, brazed or welded and covered with insulation at least equivalent to that of the conductor concerned. Soldering flux shall be such that they do not cause corrosion of the wires or insulation.

g) Conductors shall be so supported and connected that undue mechanical stress on the conductors and their terminal is avoided.

4.8.2 *Live parts*

a) Live parts, other than those of lampholders, shall not be exposed during normal use.

b) A live part that passes thro' the thermal insulation material of an appliance shall not be in direct contact with the material but shall be adequately shielded from it or so arranged that there is adequate space between it and the material.

c) Bases on which live parts are mounted shall be of tough moisture resistant non-combustible insulating materials.

4.8.3 *Motors*

Electric motors for hermetically sealed compressors shall be so connected that the constant presence of oil and refrigerant under working pressure and temperature has no action on the insulation nor the windings. They shall be of a type which have a high starting torque and have adequate capacity to operate under normal conditions.

4.8.4 *Overload protectors*

The motor shall be connected through a current of temperature sensitive protective device which is capable of automatically disconnecting it from the line in case of the motor is overloaded either during starting or running.

5 DETERMINATION OF DIMENSIONAL CHARACTERISTICS

5.1 Accuracy of measurements and units

Liner dimensions shall be measured to the nearest millimetre areas estimated should be expressed in square decimetres, to the first decimal.

Volumes estimated should be expressed in cubic decimetres or litres to the first decimal.

5.2 Determination of volumes

5.2.1 *Gross volume storage compartment*

The gross volume of the refrigerator/freezer shall be calculated by any suitable method. The total volume should be divided into convenient units of the volume of geometric shape which can easily be measured, shapes formed in the wall of the food compartment and in the door (bulges, hollows etc.) are taken into account in calculating the gross volume but internal filling should be excluded.

5.2.2 *Rated gross volume*

The measured gross volume shall not be less than the rated gross volume by more than 3% of the latter.

The rated gross volume shall be stated in cubic centimetres or litres.

5.2.3 *Storage volume of food storage compartment*

The storage volume is the sum of the storage volume of the fresh food storage compartment and the storage volume of the low temperature frozen food storage compartments.

5.2.4 *Volume of the evaporator space*

The volume of the evaporator space is the product of the depth, the width and height, as defined below:

Depth

The depth of the evaporator space shall be the mean horizontal distance between the front and rear surfaces 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 cabinet's enclosed space to the foremost part of the evaporator or evaporator door if fitted.

Width

The width of the evaporator space should 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 evaporator or the rib and the inside wall of the lining such space should be computed as part of the evaporator space.

Height

Vertical distance between the lower limit of the evaporator and the upper portion of the food storage compartment. If the free space between the upper evaporator surface and the upper partition of the food storage compartment exceeds 40 mm it shall be added to the storage of the fresh food storage compartment. The evaporator height shall include the drip tray except in the case when its storage height is greater than 40 mm and a definite manual operation is also needed to initiate defrosting.

5.2.4.1 Volumes of shelves and partitions

a) Thickness

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

b) Full partitions

The volume of a full partition is the product of its thickness and its depth, width or height whichever two of these are applicable. The depth, width and height are those dimensions of the cabinet applying in the plane of the partition.

c) Fractional partitions

The volume of a permanently fixed partition is the product of its thickness and its depth, width or height, whichever two of these are applicable. The depth, width or height are the distances, normal to the lining from adjacent surfaces to the farther edges of the partitions, or to the evaporator in cases where the fractional partition touches it.

A horizontal partition the edges of which are more than 70 mm from the lining of the cabinet is regarded as a fractional partition. A vertical partition, the edges of which are more than 100 mm from the lining of the cabinet, is regarded as a fractional partition.

5.2.4.2 Storage volume of low-temperatures compartments

The storage volume of low-temperature compartments is the sum of the volumes of all the compartments of this type in a given refrigerator.

5.3 Determination of storage shelf areas

5.3.1 *General*

The areas of the fresh food storage compartment and of the food freezing compartment shall be expressed in square decimetres. For the purpose of

calculating the storage shelf area, the bottom of the enclosed space shall be considered as a shelf and included in the storage shelf area.

When an inner wall is not vertical, measure the dimension of the shelf with reference to the vertical plane cutting the surface of the wallat the mid height between the shelf under consideration and the shelf or horizontal surface immediately above.

5.3.2 *Full shelves composed of a single part*

For the purpose of calculating of a full shelf composed of a single part, determine the width and the depth as follows:

a) Width

Measure the mean distance, parallel to the surface of the shelf, either between the inner surfaces of the side walls of the enclosed space of the cabinet (D') if this does not exceed the actual width by more than 20 mm or between the vertical planes tangential to the side edges of the cabinet shelf (D), as shown in figure 2 (a).

b) Depth

If the door of the appliances is not provided with shelves measure the mean distance, parallel to the surface of the shelf, either between the inner surfaces of the front and rear walls of the enclosed space of the cabinet (D') if this does not exceed the actual depth by more than 20 mm, or between the vertical planes tangential to the front and rear edges of the cabinet shelf (D), as shown in figure 2 (b).

If the door of the appliance is provided with shelves, measure the mean distance, parallel to the surface of the shelf, either between the rear inner surface of the enclosed space of the cabinet and the vertical plane tangential to the front edge of the cabinet shelf (D') as shown in Fig.2(c). To determine the depth of the bottom of an appliance, measure the mean distance, parallel to the surface of the cabinet bottom, between the rear inner surface and the front edge of the enclosed space of the cabinet (D_2) as shown in Fig.2(c).

5.3.3 *Fractional shelves*

For the purpose of calculating the area of a fractional shelf measure the width and depth parallel to the surface of the shelf from the adjacent surfaces of the enclosed space of the cabinet to the further edge of the shelf.

5.3.4 *Cut-away shelves*

When a shelf is cut away, deduct the area of the portion cut away.

5.3.5 *Juxtaposed shelves*

In the case of juxtaposed shelves, if the distance between two parts does not exceed 20 mm determine the dimensions as for a full shelf composed of a single part, and if the distance between two parts is more than 20 mm determine the dimensions of the two parts separately as shown in Figure 2 (d).

5.3.6 *Door shelves*

For the purpose of calculating the area of a door shelf, determine the width and the depth as follows:

a) **Width** - Measure the mean distance, parallel to the surface of the shelf, either between the inner surfaces of the side walls of the door compartment or between the side edges of the retainer bar.

b) **Depth** - Measure the mean distance, parallel to the surface of the shelf, between the surface of the door wall and the either the vertical plane tangential to the front of the shelf or the retainer bar (D_1) as shown in Figure 2 (c).

5.3.7 *Drip tray*

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

5.3.8 *Baskets*

For the purpose of calculating the storage shelf area, determine the area of a basket as the product of its two mean horizontal dimensions. See Fig. 3.

6 OPERATIONAL SPECIFICATIONS

6.1 No-load adjustment check

Under the conditions specified in sections 7 to 10, it should be possible to obtain the following temperatures, at least for one position of the thermostat.

6.1.1 At ambient temperature of 32°C (temperate class) and 43°C (tropical class) the mean internal temperature of the fresh food storage compartment should not be above.

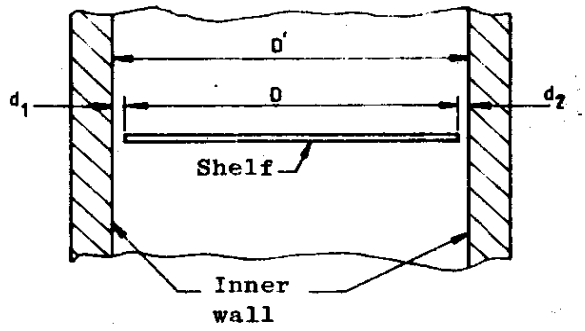
a) + 5°C for the temperate class

b) + 7°C for the tropical class.

The temperature being measured at the three specified points in the compartment ranging from 0° to 10°C.

6.2 No load performance : no load efficiency of the refrigrating unit

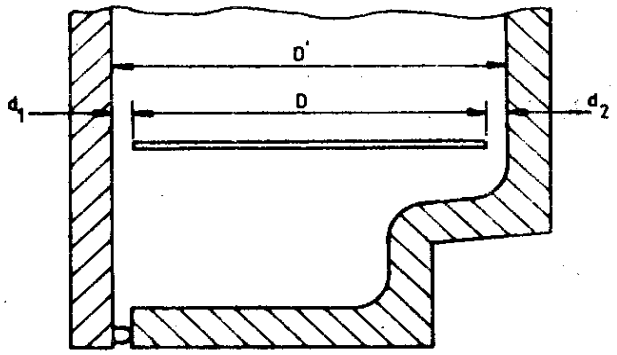
6.2.1 At ambient temperature of 16°C (temperate class) and +18°C (tropical class) the temperatures t_1, t_2 and t_3 of the fresh food storage compartment shall not be below 0°C.



a) Determination of width

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

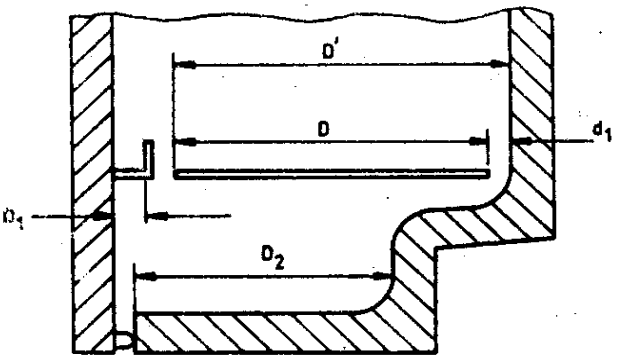
If $d_1 + d_2 > 20$ mm:
dimension of the shelf = D



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

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

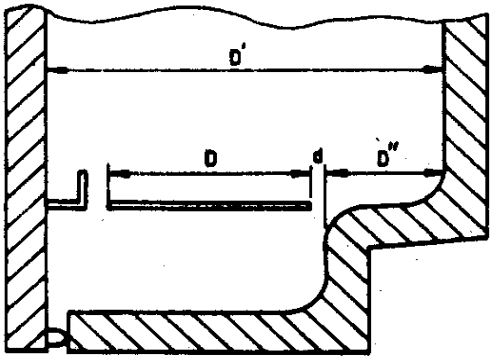
If $d_1 + d_2 > 20$ mm:
dimension of the shelf = D



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

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

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



d) Determination of depth of a shelf with juxtaposed parts

If d < 20 mm:
dimension of the shelf = D'

If d > 20 mm:
2 shelves of dimension D and D''

FIGURE 2 : Examples of determination of the area of a shelf

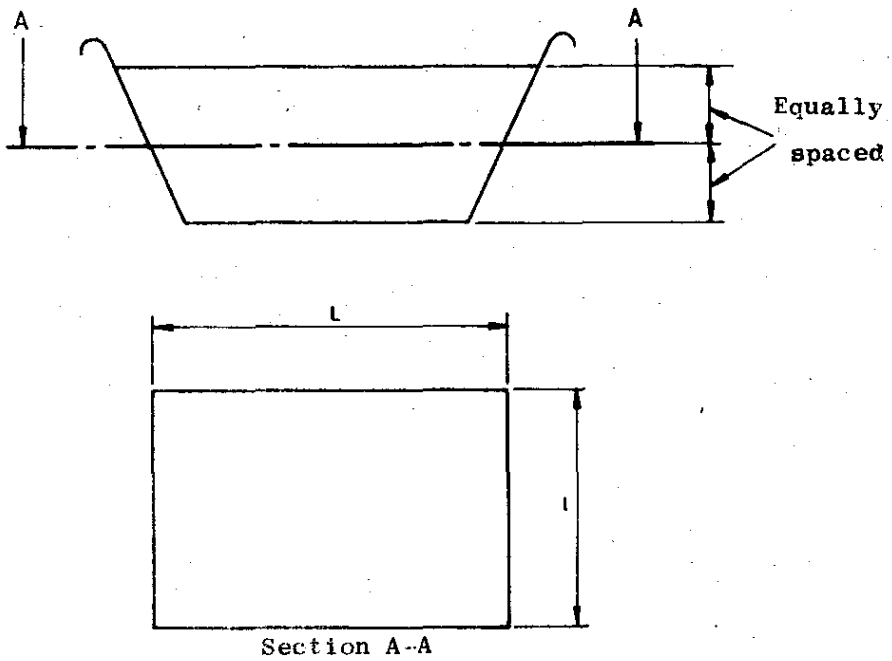


FIGURE 3 - Example of determination of mean dimensions for calculation of the area of a basket.

6.2.2 With the refrigerator working under no-load condition as specified in the clause 10.4 and 10.5 measure.

a) At ambient temperature of 32°C (temperate) or 43°C (tropical)

i) the power consumption.

ii) the percentage running time (when the refrigerator is fitted with on/off control).

b) At ambient temperature of 25°C (for both the temperate and tropical classes), the rated power consumption.

6.2.3 If the rated power consumption is stated by the manufacturers the measured value shall not be above what is claimed.

If the percentage running time is stated by the manufacturers the measured value shall not be above what is claimed.

6.3 Ice making

6.3.1 The quantity of ice the refrigerator is capable of producing within 24 hours or the time necessary for the freezing of the water in the ice tray is measured under the conditions specified in clause 10.6 of the ambient temperature of 32°C, for the temperate class and 43°C for the tropical class.

6.3.2 If the ice making capacity is stated by the manufacturer the value measured shall not be below that what is claimed.

7 MARKING, INSTRUCTION FOR USE AND MAINTENANCE

7.1 Marking

7.1.1 Each refrigerator shall have the following information marked in a permanent and legible manner on one or several locations where it is readily visible, either when the refrigerator is away from a wall or after the removal, without the help of tools, of a flap or grill.

a) the manufacturer's mark or the trade mark;

b) the model (or commercial designation) of the refrigerator;

c) the rated gross volume in cubic decimetres or litres;

d) identification of the model of refrigerating system;

e) the designation of the fluid refrigerant used, and its mass;

f) all other indications relating to the power source and those required by safety regulations other complementary in formation (i.e. full load current wiring diagram, voltage frequency of supply etc.);

g) the rated storage volume of the fresh food storage compartment expressed either in cubic decimetres or in litres; and

h) the rated freezing capacity, expressed in kilograms (per 24h).

NOTE -- Any other information considered desirable may also be marked.

7.1.2 *Identification of food freezing compartments*

Food freezing compartments shall be identified by a food freezer symbol of form and proportions as shown in Figure 4 and of such a size that the three star symbol height is not less than 5 mm.

The food freezer symbol shall be placed on the access door or lid of the compartment.

The symbol shall not make use of more than two colours or exhibit more than two contrasting surface finishes.

There shall be no other marking or decoration on the appliance that can be confused with the food freezer symbol.

a) One star compartment:

A compartment in which the temperature, does not exceed - 6 ^{o}C

b) Two star compartment:

A compartment in which the temperature does not exceed - 12 ^{o}C

(c) Three star compartment:

A compartment in which the temperature does not exceed - 18°C.

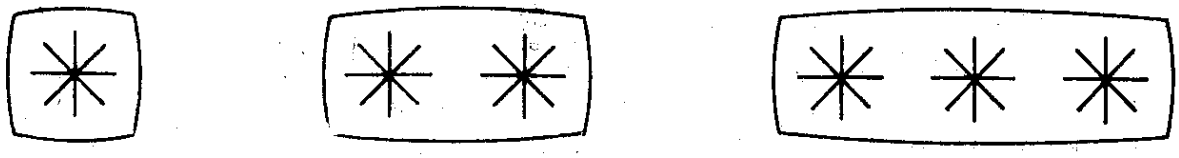


FIGURE 4

7.2 Instructions for use and maintenance

Every refrigerator/freezer shall be accompanied, on delivery, with instructions for use and maintenance, together with the technical information specified in 7.1.

a) installation requirements (best location, levelling, connection if required for defrost water disposal, connection to energy source);

b) overall space required in use (see 2.4.5) with sketches showing the appliance with the means of access open and closed;

c) for appliances that are intended to be build in, the recess dimension together with any additional ventilation requirements;

d) instructions for the use of the controls;

EXAMPLE:

Thermostat, indicator lights, air circulation and defrosting control; the fact that the temperature within the compartment(s) may be affected by such factors as the location of the refrigerator, the ambient temperature and the frequency of door opening if appropriate, a warning shall be given that the temperature control setting may have to be varied to allow for these factors.

e) recommendations on loading the appliance (in particular, for the food freezing compartment, advice that the product being frozen shall not be in direct contact with the products being stores);

f) information on the maintenance and cleaning of the appliance;

g) information on defrosting;

h) an instruction not to exceed the storage time(s) recommended by the food manufacturers for commercially quick frozen food in compartments marked either the symbol in Fig. 4;

j) the precautions necessary to prevent undue rise in temperature of the frozen food while defrosting the refrigerator/freezer, such as wrapping the frozen food in several thickness of newspaper;

k) an explanation that a rise in temperature of frozen food during defrosting may shorten the storage life;

l) the action to be taken when the refrigerator/freezer is turned off and taken out of service temporarily or for an extended period, for example; that it shall be emptied, defrosted, cleaned and dried, etc.;

m) an instruction that for doors or lids fitted with locks and keys, the keys should be kept out of the reach of children and not in the vicinity of the refrigerator/freezer, in order to prevent children from being locked inside.

8 GENERAL TEST CONDITIONS

Unless otherwise specified conduct the test under the following conditions:

a) defrosting trays, ice trays, shelves and fittings shall be in their normal positions with all containers empty;

b) each specified voltage and frequency shall be subjected to a tolerance of - 1.0 per cent;

c) each appliance shall be placed on a wooden platform having a solid top and all sides open for free air circulation under the platform. The top of the platform shall be 300 mm above the floor of the test room and shall extend not less than 300 mm and not more than 600 mm beyond the back, front and each side of the appliance, see Fig. 5;

d) three vertical black false partitions shall be so fixed to the platform that one is parallel to the back of the appliance and the other two are 300 mm from and parallel to the sides of the appliance, the partitions being at least 1 m wide and extending for at least 300 mm above the top of the appliance;

e) appliance shall be shielded from any air currents having a velocity greater than 0.25 m/s. ;

f) appliance shall have been run for 24 h at an ambient temperature of $32\ ^{\circ}C \pm 1\ ^{\circ}C$ in the case of temperate class appliances and $43 \pm 1\ ^{\circ}C$ in the case of tropical class appliances;

g) the relative humidity shall be between 45 per cent and 75 per cent. For temperate class appliance and between 75 per cent and 90 per cent for tropical appliance;

h) adjustment of the thermostat:

When a given value is specified for the internal mean temperature for the purpose of a test, this means that the thermostat is placed, at the begining of the test, in a position such that the temperature t_m is obtained with a tolerance of $\pm 0.5\ ^{\circ}C$.

The adjustment of the thermostat is determined for example, by a preliminary test and not changed during the test.

If greater accuracy is required for a particular test, the operating characteristics to be measured is estimated by determining its values at two values of the mean internal temperature t_m within the range of +2 °C. The operating characteristic at the specified internal temperature is then determined by interpolation.

9 MEASUREMENT

9.1 Measuring instruments - Instrument accuracy

9.1.1 Watt-hour meters shall be accurate to at least ± 1 per cent.

9.1.2 The temperature shall be measured with thermocouples, or other temperature probes, the sensitive parts of which are inserted in the centre of a tinned copper cylinder, weighing 25 g and of minimum external area (diameter = height = about 15.2 mm). Temperature measuring instruments should be accurate to ± 0.3 °C.

9.2 Temperature measurement conditions

9.2.1 *Ambient temperature*

The temperature ta_1, ta_2 and ta_3 shall be measured at the places defined in clause 2.8 and the ambient temperature calculated as indicated.

9.2.2 *Temperature of fresh food storage compartment*

The temperature t_1, t_2 and t_3 shall be measured at the places shown on Fig.6 half way between the rear wall of the refrigerator and internal side of the closed door, and the mean internal temperature calculated as indicated.

9.2.3 If internal fitments do not allow the temperatures t_1, t_2 and t_3 to be read at the points specified, readings shall be taken in positions no more than 25 mm from the points specified. If the interior arrangements of the normal temperature food storage compartment does not conform to those shown in Fig. 6 the temperature t_1, t_2 and t_3 shall be read in positions determined by analogy with the positions indicated.

9.2.4 The temperatures may be read or, preferably, recorded. The temperature sensitive element of the temperature measuring instruments shall be separated from any heat conducting surface by at least 13 mm of air space. Connections from the measuring instruments shall be arranged in such a manner as not to interfere with the air seal of the food storage compartment.

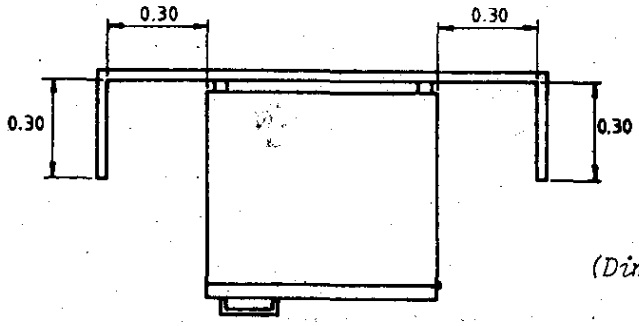
9.3 Operating time measurement conditions

When the appliance is run "on/off" the operating time shall be recorded.

Note - In the case of automatic defrost, the measurement is carried out-

a) with the automatic defrost control disconnected, if the defrost occurs once a day,

b) with the automatic defrost control connected if the defrost occurs at each cycle.



(Dimensions in metres)

FIGURE 5 - Partitions to restrict air circulation (Plan)

9.3.1 Voltage to a synchronous clock is applied from a relay which is inserted in series in the power supply circuit. The running time is the difference between the begining and end readings of this clock.

9.4 **Test packages**

9.4.1 *Shape, sizes and tolerances*

When tests are carried out with a loaded appliance, test packages of right angles parallel piped shape shall be used.

The size of the test packages, prior to freezing, and their mass, packaging included, shall be as shown in table 2.

TABLE 2 - Size and mass of the test packages

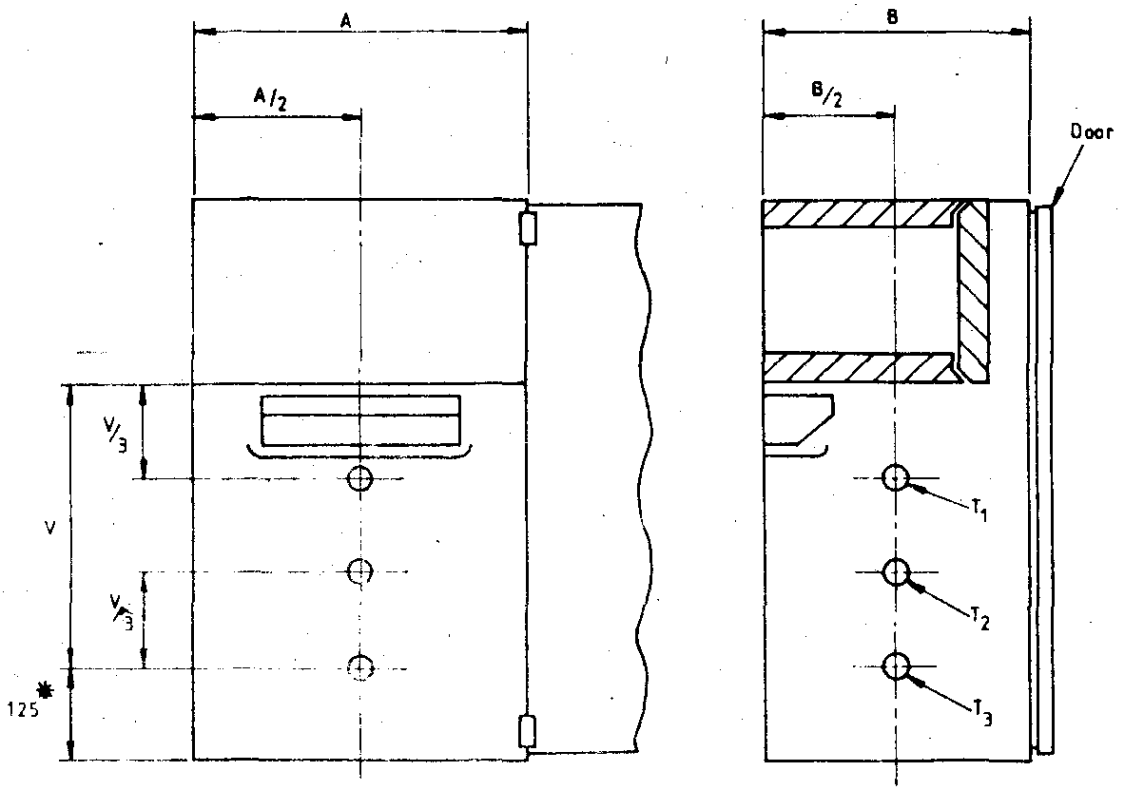
Size*	Mass +
mm x mm x mm	g
25 x 50 x 100	125
50 x 100 x 100	500
50 x 100 x 200	1000

+ Tolerance on mass ± 2 percent

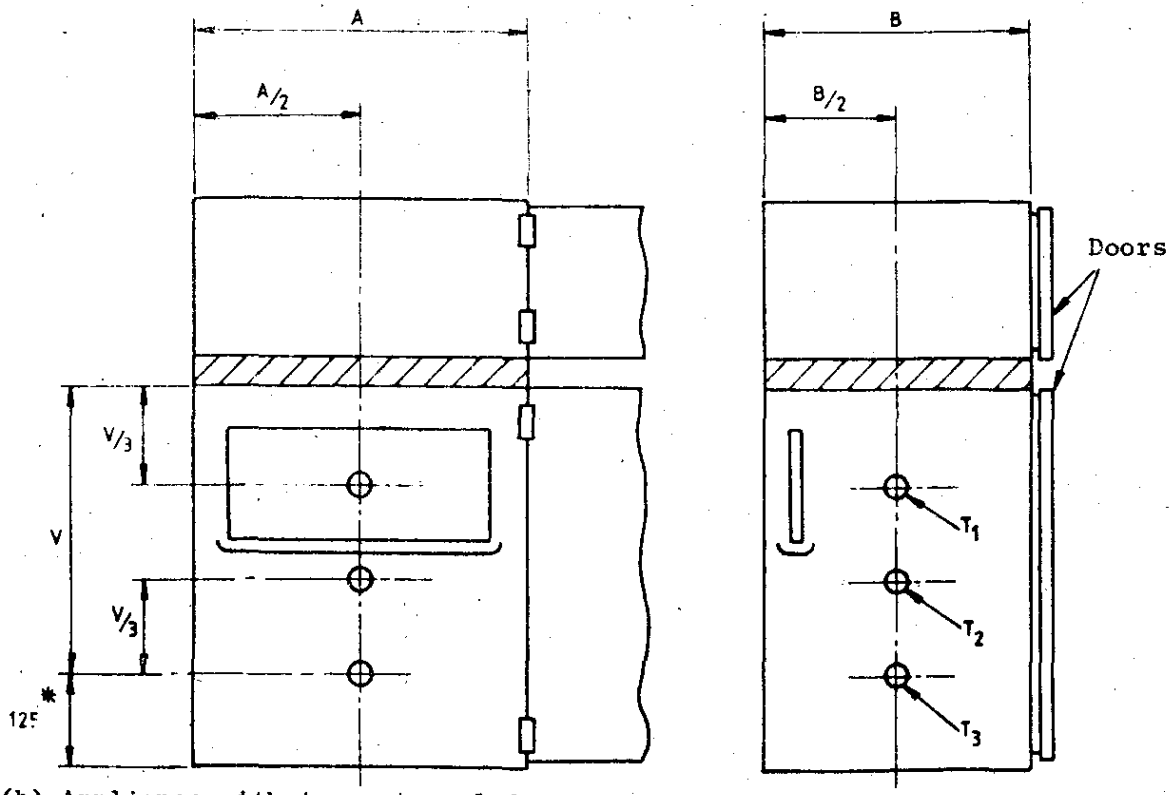
* *Tolerance on linear dimensions :*

± 1.5 mm for dimensions 25 and 50 mm

± 3.0 mm for dimensions 100 and 200 mm



(a) Appliance with one external door



(b) Appliance with two external doors.

* 125 mm above the bottom of cabinet or 25 mm above the cover of a closed container.

All dimensions are in millimetres.

FIGURE 6 - Positions of temperature measuring point (T) fresh food storage compartment.

9.4.2 *Composition*

The packages shall consist of

a) A suitable filling material containing, per 1000 g.

230.0 g of oxy-ety-methyl cellulose

764.2 g of water

5.0 g of sodium chloride

0.8 g of parachlorometacresol

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

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

After filling, the wrapping sheet shall be sealed.

9.4.3 *"M" packages*

Some 500 g packages (50mm x 100mm x 100mm) shall be equipped as "M" packages for temperature measurements by the insertion in the geometrical centre of each of these packages of a thermocouple or other temperature sensor of equipment sensitivity. All precautions shall be taken to minimize extraneous conduction of heat.

10 METHODS OF TEST

10.1 Test of air tightness of door(s) or lid seal(s)

10.1.1 *Purpose*

The purpose of this test is to ensure that the gasket of the door of the food storage compartment adequately prevents any ingress of the surrounding air.

10.1.2 *Test conditions*

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

10.1.3 *Procedure*

Insert a strip of paper 50 mm wide. 0.08 mm thick and of suitable length at any point of the seal and close the door or lid normally on it.

Assess the seal by checking that the strip of paper does not slide freely.

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

10.2 Test of force required to open the door(s) or lid(s)

10.2.1 *Test conditions*

The ambient temperature shall be between 16 °C and 32 °C. The appliance shall be switched off and in equilibrium with the ambient temperature.

10.2.2 Before commencing the test, leave the door or lid closed for a period of 1 hour.

Apply an opening force of 70N to the inside of each door or lid at the mid point of the edge farthest from the hinge axis in a direction perpendicular to the plane of the door or lid.

Adopt either of the following methods of measurement as appropriate.

a) Apply the force at a point on the outer surface of each 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 mid point of the edge farthest from the hinge axis, apply a force to the handle of each door or lid, 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.

10.3 Test of the durability of hinges, handles and seals of external door(s) and lid(s)

10.3.1 *Test conditions*

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

The refrigerator/freezer shall be switched off and in equilibrium with the ambient temperature. The angle of opening for the test shall be 45°.

10.3.2 *Procedure*

Load the door shelves as described as follows:

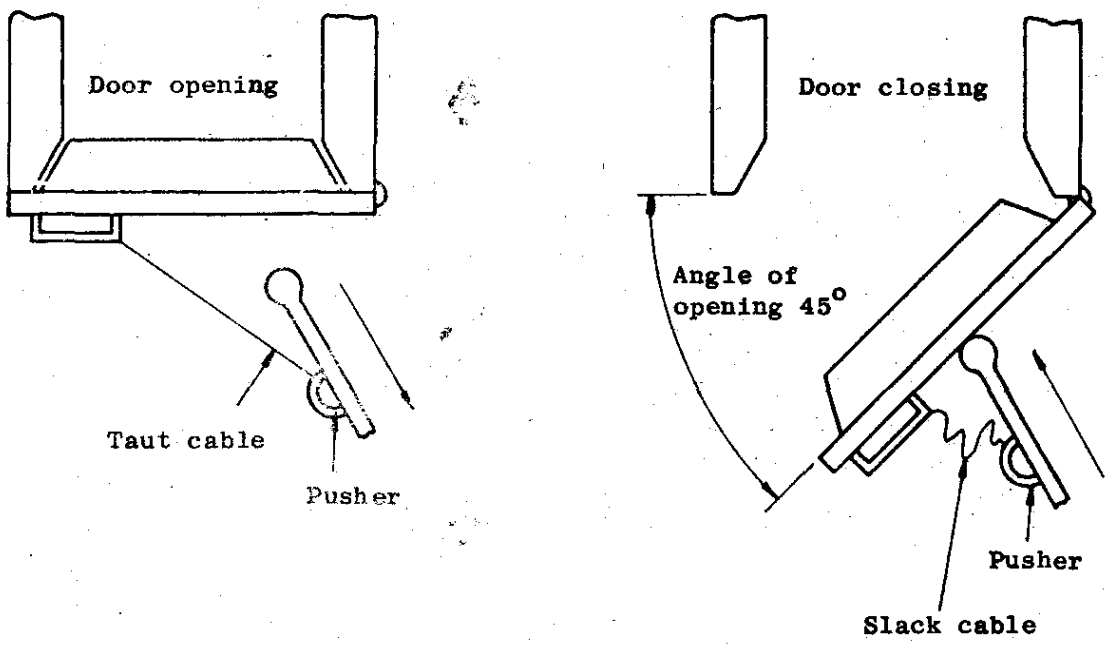
Operate the opening and closing sequences described in Fig. 7 (a) and 7 (b) at a rate of 20 to 25 cycles per minute, the opening of the door taking place in the first quarter part of the period of the cycle.

10.3.3 *Opening sequence*

Open the door by a controlled, approximately sinusoidal movement from an angle of opening at 0° to angle of between 5° and 15° then follow this by a free movement to the angle of opening of 45°.

10.3.4 *Closing sequence*

Move the door by a controlled movement from the angle of opening of 45° to an angle of between 40° and 35°, then follow this by free movement of the door and its closing as in normal operation.



7 (a) 7 (b)

FIGURE 7 - Door and fittings test

The test report shall indicate whether the durability of the hinges, handles and seals complies with the requirements of 4.4.1.

*80 mm diameter cylindrical weights of 500 g and 100 g sufficient to load the fresh food storage compartment, plus cylindrical weights of different diameter but similar mass per unit area sufficient to load any door shelves on which 80 mm diameter weights cannot be accommodated.

10.4 No load adjustment tests

10.4.1 *Purpose*

The purpose of these tests is to determine the adjustable range of the thermostat while providing a satisfactory temperature range.

10.4.2 *First test*

Low ambient temperature.

10.4.2.1 Procedure

Ambient temperature shall be

a) 16 °C for temperate class

b) 18 °C for the tropical class.

Test time

The test time shall be the time required, after steady state conditions are obtained for performing the prescribed measurements.

10.4.2.2 Measurements

The temperatures t_1, t_2 and t_3 of the fresh food storage compartment in Fig. 6.

10.4.2.3 Results to be obtained

At ambient temperature of +16 °C temperate class and +18 °C (tropical class), the temperatures t_1, t_2, and t_3 of the fresh food storage compartment should not be below 0 °C.

10.4.3 *Second test*

High ambient temperature

10.4.3.1 Procedure

Ambient temperature shall be

a) 32 °C for the temperate class

b) 43 °C for the tropical class

Test time

The test time shall be the time required, after steady state conditions are obtained, for performing the prescribed measurements.

10.4.3.2 Measurements

The following temperatures shall be measured:

a) temperatures t_1, t_2, and t_3 of the fresh food storage compartment Fig. 6

b) mean internal temperature t_m of the fresh food storage compartment.

10.4.3.3 Results to be obtained

At ambient temperatures of 32 °C (temperate class) and 43 °C (tropical class) the mean internal temperature t_m of the fresh food storage compartment shall not be above.

a) +5 °C for the temperate class

b) +7 °C for the tropical class

The temperature being measured at the three specified points in the compartment shall be in the range 0 ° to 10 °C.

10.5 No load operation test

10.5.1 *No load operation test at the basic test temperature*

(to be carried out at the same time as the test described in **10.4.3** *)*

10.5.1.1 Purpose

The purpose of this test is to check the no load characteristics of the refrigerating unit i.e. the no-load power consumption and the percentage running time.

10.5.1.2 Procedure

Ambient temperature shall be :

a) 32°C for the temperate class

b) 43 °C for the tropical class

Test time

The test should be confined for 24 hours after steady-state conditions are obtained.

Thermostat setting

The thermostat should be set in the position corresponding to :

a) t_m = +5 °C for the temperate class

b) t_m = +7 °C for the tropical class

This test should be conducted under the conditions prescribed in 8(h).

10.5.1.3 Measurements

The following measurements shall be made.

a) Power consumption while testing.

b) for the apparatus with "on/off" control, the data necessary to estimate the percentage running time. (see 9.3)

10.5.2 *Measuring the rated power consumption*

10.5.2.1 Purpose

The purpose of this test is to check the no-load consumption of the refrigerator under appropriate conditions providing a sonsumption approximately that experienced under normal operation.

10.5.2.2 Procedure

a) The ambient temperature shall be 25 °C for both the temperate and tropical classes.

b) The test shall be continued for 24 hours after steady-state conditions are obtained.

c) Thermostat shall be set in the position corresponding to t_m = +5 °C. for tropical class.

This test shall be conducted under the conditions prescribed in the 8(h).

10.5.2.3 Measurement

The power consumption while testing shall be measured.

10.5.2.4 Results to be obtained

The requirements laid down in 6.2 shall be met.

10.6 Ice making test

10.6.1 *Purpose*

The purpose of this test is to check the ice making capability of the refrigerator.

10.6.2 *Procedure*

a) The ambient temperature shall be

32 °C for the temperate class

43 °C for the tropical class

b) Test time - After steady state conditions are obtained the test shall be continued for the freezing time as defined in 10.6.3.

c) The thermostate shall be set in the following position:

$t_m = +5 \pm 1$ °C for the temperate class;

$t_m = +7 \pm 1$ °C for the tropical class

until the steady state conditions are obtained.

The ice tray or trays shall then be filled with water up to 5 mm from the top and promptly placed in the ice compartment as recommended by the manufacturer.

The temperature of water, at the moment of placing the ice tray into the ice compartment, shall be:

20 ± 1 °C for the temperate class

30 ± 1 °C for the tropical class.

The contact surface of the ice tray or trays shall be wetted to provide proper contact with the evaporator.

The thermostat, after placing of the ice tray in the ice compartment, shall be set to the lowest temperature position that will ensure the temperature conditions laid down in 10.6.3.

10.6.3 *Results to be obtained*

Throughout the freezing time, no t_1, t_2 and t_3 temperature shall drop below 0 °C. The ice trays shall be examined, at an interval after the freezing time stated by the manufacturer or estimated from the stated ice making capabilities of the apparatus in 24 hour lapses, to ascertain that the requirements laid

down in clause 6.3 have been met. Should the first test fail, two further tests shall be made and the result from each shall be positive.

10.7 Odour and taste test

Clean the appliance with pure water and operate it for 48 h under normal operating conditions with the thermostat so set that a mean internal temperature (t_m) of 5 $\pm$ 2 °C is attained in the fresh food storage compartment(s). Place the following articles at approximately the geometric centre of the appliance.

a) A pyrex or similar dish, about 100 mm in diameter, containing approximately 100 ml of pure water;

b) A smooth glass plate, carrying a slice of first grade fresh unsalted butter of thickness approximately 5 mm and mass approximately 5 g to 15 g

c) Check samples, hermetrically sealed, of similar quantities of water and butter.

Run the appliance for 48 h, then remove the samples, allow them to rise to a temperature of 20 °C $\pm$ 2 °C and compare the odour and flavour of the sealed and unsealed samples. If no change in the odour or flavour of the butter can be detected, the appliance shall be deemed to have passed the test, but if a noticeable change has occured, disregard the results of the first test and, after the appliance has been defrosted, operated for 1 week and again defrosted repeat the test, recording the results of the second test only.

10.8 Thermal insulation test

For this test relative humidity shall be as follows:

a) for class N ; between 67% and 73%;

b) for class T ; between 75% and 85%.

So set the thermostat that a mean internal temperature (t_m) of

i) 5 $\pm$1 °C in the case of a temperate class appliance and 7 $\pm$1 °C in the case of a tropical class appliance is attained in the fresh food storage compartments of domestic refrigerators/freezers and,

ii) not higher than 18 °C is attained in the case of a food freezer.

Run the appliance for one hour after stable operating conditions have been reached and then examine it for visible condensed moisture in the external surface of the appliance.

10.9 Internal temperature of domestic food freezer

10.9.1 *Apparatus*

The test packs specified in 9.4 but not pre-frozen.

10.9.2 *Procedure*

Place in the storage space of the appliance the number of test packs equivalent to the maximum load stated in the manufacturers instructions. Place in the position shown in the appropriate diagram in Fig.9 the test packs fitted with thermocouples. Run the appliance until stable operating conditions have been reached then determine the mean temperature of each measuring point.

10.10 Freezing capacity of domestic food freezers

Conditions and apparatus

Conduct the test at an ambient temperature of 32 ± 1 °C, using test packs 9.4 that have been stored at a temperature of 32 ± 1 °C for at least 24h. With the thermostat, if manually adjustable, set to give the lowest temperature, operate the appliance when it is empty until stable conditions have been reached, then place at the approximate geometric centre of the appliance 1 kg of test packs for each 20 l (or part thereof) the gross capacity of the appliance, and position packs containing thermocouples as shown in Fig. 8. Close the door(s) of the appliance, note the time, record the temperature of the test packs until the temperature of the entire load has been reduced to not higher than - 18 °C and again note the time and calculate the freezing capacity by computing the weight of the packs in kgs that can be frozen to - 18 °C in 24 h.

$$\text{freezing capacity} = \frac{L \times 24}{T} \text{ kg/24h}$$

where; L = load of test packs, in kg; and

T = time taken to reduce load temperature to - 18 °C, h.

10.11 Electrical insulation and leakage current test

The provision of clause 14 of **SLS 579 : 1982** shall apply.

10.12 Mechanical strength of shelves and similar components

The ambient temperature shall be between 16 °C and 32 °C. The refrigerator/freezer shall be at rest with the door open.

The components to be tested shall be in turn loaded with 80 mm diameter cylindrical weights of, in general 1 kg but of only 0.5 kg in the case of components above which the clear height in normal service cannot exceed 150 mm, with the exception of compartments specially designed to hold eggs.

The weights, shall be placed with their axes vertical and in such a way that the maximum possible number is accommodated without one weight being placed over another and without over lapping the edge of the component under test.

When tested accordingly, the trays and shelves, their mountings, and the walls of the cabinet, shall shown no sign of damage or distortion.

11 CONFORMITY WITH THE STANDARD SPECIFICATIONS

11.1 Type tests

Type tests are intended to assess the conformity of general characteristics and design of a given type of refrigerator/freezer, to the standard specifications.

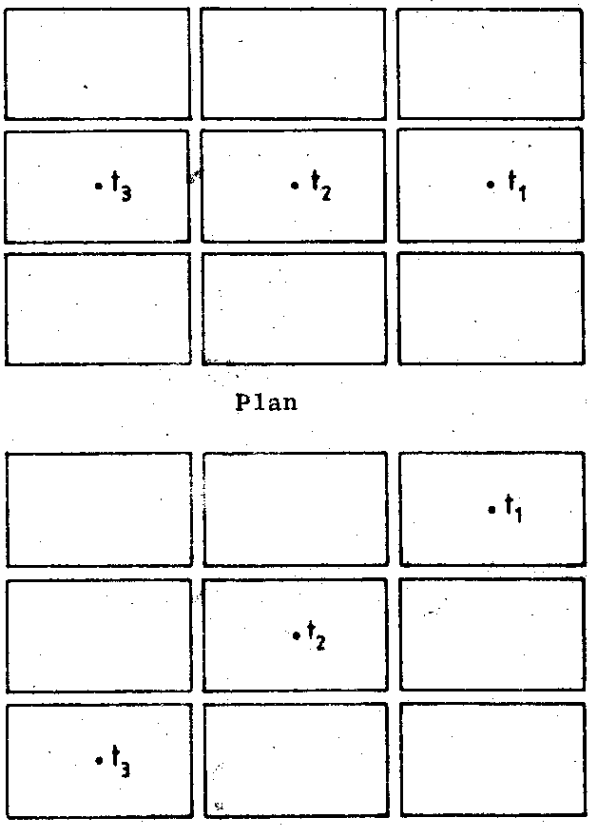


Figure 8 - Stacking of test packs with temperature probes for evaluating freezing capacity.

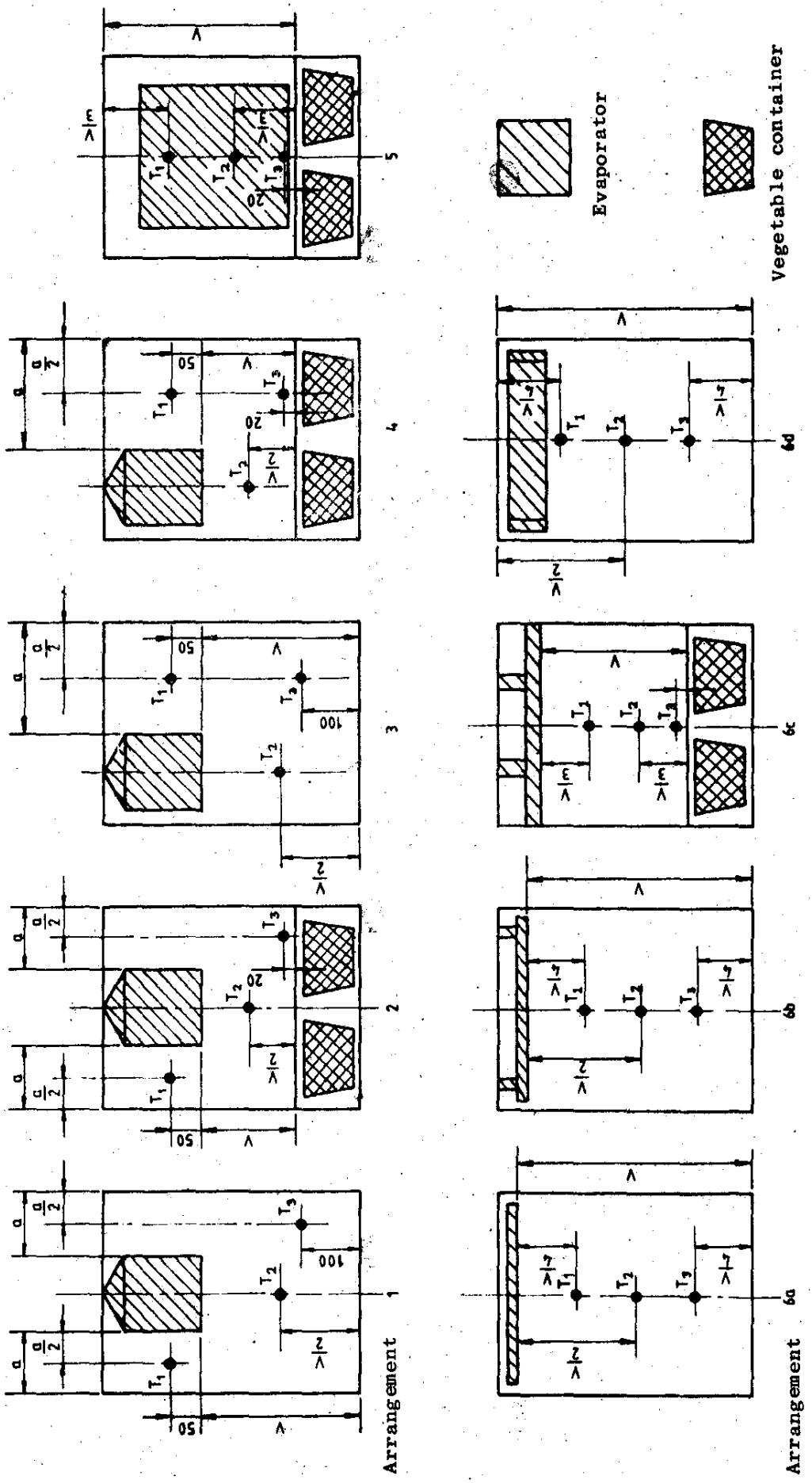


FIG 9 - Temperature measurement points in Refrigerators with different evaporator arrangements

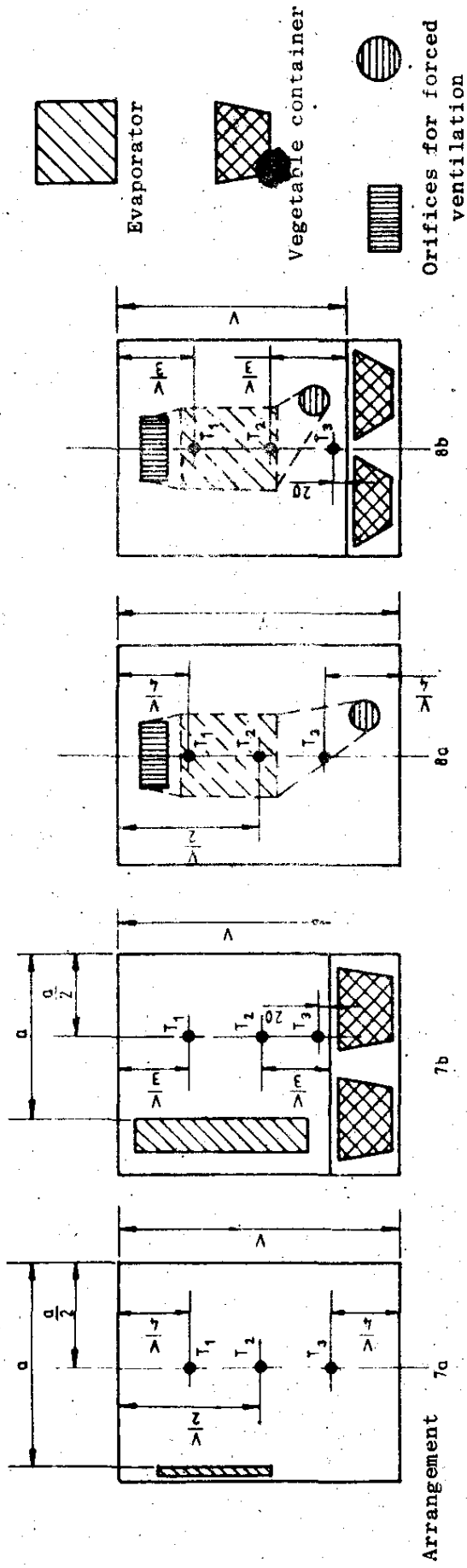


FIGURE 9 (Continued) - Temperature measurement points in refrigerators with different evaporator arrangements

11.2 Following shall constitute the type tests, for refrigerator/freezer (see clause 10).

a)	Door seal test	(Cl. 10.1)
b)	Door and fittings test	(Cl. 10.3)
c)	No load adjustment test	(cl. 10.4)
d)	No load operation test	(cl. 10.5)
e)	Ice making test	(cl. 10.6)
f)	Thermal insulation test	(cl. 10.8)
g)	Electric insulation resistance test	(cl. 10.11)
h)	Test for mechanical strength of shelves and similar components	(cl. 10.12)

11.3 Production routine test

11.3.1 Every domestic refrigerator/freezer after completion shall be subjected to the following routine tests at the manufacturer's works site which shall be carried out without loading the refrigerator/freezer.

11.3.2 *For refrigerators/freezers*

a) Thermostat test *

b) Door seal test (cl.10.1).

c) Electric insulation test (cl. 10.11)

11.4 Samples for tests

11.4.1 *Type test*

Two refrigerators/freezers of each size shall be sent along with manufactures detailed specification to the recognized testing authority for purposes of type tests. The samples shall be picked up at random from stock or routine production.

11.4.2 *Acceptance tests*

The number of samples shall be as agreed between the customer and the manufacturer.

** The thermostat setting should be such that when set at any point, it should not cut in before the system is balanced under any operating condition.*

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