

Specification for

Commercial refrigerated storage cabinets of the closed reach-in type

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Refrigeration, Heating and Air Conditioning Standards Policy Committee (RHE/-) to Technical Committee RHE/19, upon which the following bodies were represented:

- British Gas plc
- British Hotels and Restaurants and Caterers' Association
- British Refrigeration Association
- British Retailers' Association
- Cooperative Union
- Department of Health
- Ice Cream Federation Ltd.
- Institute of Refrigeration
- Institution of Electrical Engineers
- Institution of Environmental Health Officers
- Institution of Grocery Distribution
- London Refrigeration Society
- Ministry of Agriculture, Fisheries and Food
- Retail Consortium
- United Kingdom Association of Frozen Food Producers

The following body was also represented in the drafting of the standard, through subcommittees and panels:

Department of the Environment (Property Services Agency)

This British Standard, having been prepared under the direction of the Refrigeration, Heating and Air Conditioning Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 1 April 1992

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Foreword

This revision of BS 2501 has been prepared under the direction of the Refrigeration, Heating and Air Conditioning Standards Policy Committee (RHE/-). It supersedes BS 2501:1976, which is withdrawn.

The standard is complementary to BS 2502 which deals with refrigerating equipment of larger capacity.

Reference should be made to BS 3053 for the requirements for commercial refrigerated cabinets intended for the sale and/or display of food products and to BS 4434 for the safe use of refrigerating equipment.

During the preparation of this revision the “Montreal Protocol” was ratified. This will have an effect on the availability and handling of refrigerants in the future.

It is intended to review the requirements of the standard as refrigerant technology and alternative refrigerants are developed.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 20, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Section 1. General

1 Scope

This British Standard specifies the construction, the methods of calculating internal volumes and shelf areas, and the method of determining performance of refrigerated storage cabinets of the closed reach-in type, for commercial use in catering and similar applications. The cabinets are intended for use in climates having dry bulb temperatures and relative humidities from 16 °C and 80 % to 40 °C and 40 %.

The approximate limits of internal temperatures intended to be covered by this standard are between – 30 °C and + 10 °C.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this British Standard, the definitions given in BS 5643 apply together with the following.

2.1

test room climate class

a test room climate numbered between 1 and 5 which is related to dry bulb temperature and relative humidity (see Table 4)

2.2

cabinets of the closed reach-in type

cabinets having access at the top and/or sides, fitted with lids or doors which are kept closed in normal use, and where the contents in any part of the interior may be reached without stepping into the refrigerated space

2.3

condensing unit

the high-pressure components of a refrigerating system, including a power driven compressor, a condenser and, if required, a liquid receiver

2.4

open-type compressor unit

a unit in which the compressor and the motor are separately mounted and mechanically linked through a belt or equivalent drive

2.5

hermetically sealed compressor unit

a refrigerant compressor and motor assembly enclosed in a shell, rendered gas-tight by welding or other suitable means

2.6

semi-hermetically sealed compressor unit

a refrigerant compressor and motor assembly enclosed in a shell, rendered gas-tight by bolting

2.7

automatic defrosting

the defrosting of a cabinet or part of a cabinet where the frequency and duration of the defrost operation and removal of the defrost water from the refrigerated space do not require any action by the user

2.8

semi-automatic defrosting

the defrosting of a cabinet or part of a cabinet when the start of each defrost operation is by action of the user, the defrost water being removed from the refrigerated space without any action by the user

2.9

manual defrosting

the defrosting of a cabinet or part of a cabinet when the start and duration of each defrost operation is by action of the user, the defrost water, frost or ice being removed from the refrigerated space with or without any action by the user

2.10

refrigerating system

the condensing unit, evaporator(s), valves, piping and other components through which the refrigerant circulates

2.11

refrigerant

the medium for conveying heat in a refrigerating system. This medium is evaporated by absorbing heat at a lower temperature and liquefied by surrendering heat at a higher temperature

2.12

high-pressure side

the portion of a refrigerating system subject to the higher or condenser pressure

2.13

low-pressure side

the portion of a refrigerating system subject to the lower or evaporator pressure

2.14

evaporator (cooling unit)

the portion of a refrigerating system in which liquid refrigerant is evaporated by the reception of heat

2.15

refrigerator

a cabinet or cabinets, provided with means for being cooled, together with the associated refrigerating system which may be located within a cabinet or part of which may be remote

2.16

door aperture size

the product of the smallest length and width (or height, as appropriate) of the opening area of the cabinet

2.17

overall dimensions

the dimensions of the rectangular parallelepiped with vertical sides within which the cabinet, including its projecting accessories, is contained

2.18

gross volume

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

2.19

normal conditions of use

those operating conditions which occur when the cabinet, including all permanently located accessories, has been set up and sited in accordance with the recommendations of the manufacturer and is in service for storage intended for commercial use in catering and similar applications

this includes the effects of actions by non-technical personnel for the purpose of loading, unloading, cleaning, defrosting, the manipulation of accessible controls and of any removable accessories etc., according to the manufacturer's instructions, but not those resulting from interventions by technical personnel for the purposes of maintenance or repair

2.20

net 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

2.21

total storage volume

the sum of the storage volumes of all compartments, such as the fresh food storage compartment, chiller compartment and food freezing compartment

2.22

net shelf area

the sum of the areas of the shelves, the bottoms of suspended containers and the bottom of the lining, in all refrigerated compartments

2.23

volume of the evaporator space

the product of depth, width and height measurements of the evaporator space

2.24

volume of fixed shelves and partitions

the product of thickness and area, the thickness of a fixed shelf or partition being the distance between the outer surfaces

2.25

M-packages

test packages equipped with temperature sensors

Section 2. Calculation of internal volumes and shelf spaces

3 Calculation of internal volumes and shelf spaces

3.1 Units of measurement

3.1.1 Volumes

All volumes shall be stated in metres cubed, to the nearest 0.01 m^3 , for volumes up to and including 0.70 m^3 , and to the nearest 0.05 m^3 for larger capacities.

3.1.2 Areas

All areas shall be stated in metres squared to the nearest 0.01 m^2 .

3.2 Dimensions of evaporator space

The depth, width and height of the evaporator space shall be the mean horizontal and vertical dimensions of the evaporator, including baffles, fixed drip trays and other fitments if any, provided a usable gap of 100 mm or more exists between the evaporator space and the adjacent lining or shelf. Otherwise, the dimensions concerned shall be increased by the width of the gap.

3.3 Volume of the evaporator space

When calculating the volume of the evaporator space, the depth, width and height measurements shall be obtained as described in 3.2.

3.4 Net storage volume

When calculating the net storage volume, the total volume shall be divided into convenient units of 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 fittings shall be excluded.

NOTE When cooling is provided by fan-circulated air the volume of the space occupied by the cold-air duct, evaporator, fan and other accessories is not included in the gross volume.

Where the evaporator space contains compartments intended for use, the volumes of such compartments, computed as separate cabinets, shall be added.

The measured net storage volume shall be at least 97 % of that stated by the manufacturer.

3.5 Calculation of net shelf area

In computing the area of a shelf, the width and depth shall be the horizontal distances measured between the surfaces of the lining adjacent to the shelf, or between the surface of the lining and the farther edge of the shelf. The area of the bottom of the lining shall be the product of the inside horizontal depth and width.

Where a shelf or partition has less than 25 mm horizontal clearance at any edge, it shall be regarded as a full shelf or partition in that direction for the purpose of calculating shelf areas.

Whenever the space occupied by a removable drip tray is included in the net storage volume the part of the shelf supporting the drip tray or the bottom of the drip tray shall be considered as a food shelf area, providing that definite manual operation is needed for defrosting. When any shelf is cut away, the area of the recess shall be deducted.

3.6 Volume of fixed shelves and partitions

3.6.1 General

When calculating the volume of shelves or partitions, if the surfaces are corrugated or fitted with pipe grids, the outer surface shall be as defined in 3.5. Where a shelf or partition has less than 25 mm clearance at any edge, it shall be regarded as a full shelf or partition in that direction for the purpose of calculating volumes.

3.6.2 Refrigerated corrugated, or pipe grid shelves and partitions

If a shelf or partition is corrugated or fitted with pipe grids the outer surface shall be defined, for the purpose of calculating volumes, as the plane joining the outer apices of the corrugations or pipes, unless the distance between adjacent corrugations or pipes is greater than 100 mm.

3.6.3 Fractional shelves and partitions

Where a fixed fractional shelf or partition leaves less than 25 mm clearance between any edge and the inner lining of the cabinet it shall be regarded for this purpose as a full shelf or partition in that direction.

Section 3. Construction

4 Construction

4.1 General

4.1.1 The cabinet and its parts shall be constructed with adequate strength and rigidity for normal conditions of handling, transport and use.

4.1.2 Levelling screws shall be provided for adjusting the level of the cabinet.

NOTE Cabinets which are constructed in sections should be so designed that all joints between the sections are rigid and airtight after erection.

4.1.3 Moving parts that would otherwise constitute an accident hazard, shall be effectively guarded when the cabinet and refrigerating systems are in operation, so that when tested in accordance with **B.9** it shall not be possible for mechanical contact to take place. All parts that require adjustment and/or periodical servicing shall be accessible.

4.1.4 Pipes and connections to moving or resiliently mounted parts shall be arranged so as not to foul or to transmit vibrations to other parts. All other pipes and connections shall be anchored, and free length shall be provided to prevent failure due to fatigue.

NOTE Where necessary, pipes and valves should be thermally insulated.

4.1.5 Internal lamps where fitted shall be mounted in suitable fittings and provided with guards for protection against mechanical damage.

4.1.6 Internal fans shall be suitable for operation at the lowest air temperature likely to occur.

4.1.7 Cabinets shall be fitted with a suitable indicating device, which shall be visible from outside the cabinet, to show the internal cabinet air temperature.

When tested in accordance with **A.5**, the temperature value shown on test at any instant by the device shall be not greater than the corresponding highest air temperature in the warmest part of the net storage volume [see **B.5.2.1 b)** or **B.5.2.2 b)**] nor less than the corresponding lowest air temperature in the coldest part of the net storage volume [see **B.5.2.1 c)** or **B.5.2.2 c)**].

Such indicating devices shall not be fitted to:

- a) normally closed top-access cabinets having an average air temperature under test [see **B.5.2.1 a)** or **B.5.2.2 a)**] of -10°C or colder;
- b) cabinets intended exclusively for the storage of non-perishable drinks.

4.1.8 Where interior fittings, such as sliding shelves, baskets, trays or drawers, are fitted, they shall retain their shape and ease of movement when fully loaded to the manufacturer's specifications. Where these fittings are provided with stops to prevent accidental removal, they shall be self-supporting when loaded and withdrawn to the limit of the stops.

Interior fittings and their supports shall be removable for cleaning of the fittings and supports, pan and the internal surfaces of the cabinet.

Vertical adjustment not exceeding 25 mm shall be provided for shelves, trays and pans.

NOTE Shelves, baskets, rails, etc., and their supports should be sufficiently strong for the duty required. [See **6.2 e)**]. There should be no sharp edges or corners likely to cause injury under normal conditions of use.

4.1.9 When tested in accordance with **A.5**, the temperature range of operation shall conform with the design temperature storage range.

4.2 Cabinet

4.2.1 Materials

Materials used in the construction of the cabinet shall be free from defects which are liable to cause undue deterioration or failure.

Under normal conditions of use, the materials used shall not shrink, warp or expand. All materials shall be resistant to attack by indigenous insects, pests and vermin; where liable to be exposed to moisture, food products or chemically active substances, they shall be resistant and shall not be toxic nor contaminate stored products placed in contact with them. Sealing materials used shall not lose any of their essential properties, such as adhesion, plasticity and moisture resistance.

NOTE Materials should comply with British Standards where applicable.

4.2.2 Interior and exterior finish

Interior and exterior finishes shall be durable and capable of being cleaned effectively and hygienically. All permanent construction joints and seams within the refrigerated volume shall be sealed to prevent the entry and accumulation of potentially contaminating substances. Finishes shall not crack, chip, flake, rub off nor soften under conditions of normal service and cleaning. All metal parts and fixings used inside or on the outside, where they are liable to be exposed to moisture, shall be corrosion resistant or adequately protected against corrosion.

Where organic finishes are employed, they shall be corrosion resistant.