

**SPECIFICATION FOR
ELECTRICALLY-HEATED
CATERING EQUIPMENT**

Part 12. Bains-marie

BS 4167 : Part 12 : 1971

THIS BRITISH STANDARD, having been approved by the Electrical Industry Standards Committee, was published under the authority of the Executive Board on 31 March, 1971.

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The Institution desires to call attention to the fact that this British Standard does not purport to include all the necessary provisions of a contract.

A complete list of British Standards, numbering over 5000, fully indexed and with a note of the contents of each, will be found in the British Standards Yearbook. The BS Yearbook may be consulted in many public libraries and similar institutions.

This standard makes reference to the following British Standards:

- BS 729. Zinc coatings on iron and steel articles.
- BS 1224. Electroplated coatings of nickel and chromium.
- BS 1344. Methods of testing vitreous enamel finishes.
- BS 1358. Colours for vitreous enamel finishes.
- BS 1484. 10-gallon tinned steel milk can and lid.
- BS 1872. Electroplated coatings of tin.
- BS 2135. Capacitors for radio interference suppression.
- BS 2660. Colours for building and decorative paints.
- BS 3042. Standard test fingers for checking protection against electric shock and mechanical hazard.
- BS 3535. Safety isolating transformers for industrial and domestic purposes.
- BS 3831. Vitreous enamel finishes for domestic and catering appliances.
- BS 4410. The connection of flexible cables and cords to appliances.
- BS 6500. Insulated flexible cords.

The following BSI references relate to the work on this standard:
Committee reference ELE/75 Draft for comment 70/16649

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CO-OPERATING ORGANIZATIONS

The Electrical Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

Associated Offices' Technical Committee
 Association of Manufacturers of Domestic Electrical Appliances
 Association of Consulting Engineers
 Association of Mining Electrical and Mechanical Engineers
 *Association of Supervising and Executive Engineers
 *British Electrical and Allied Manufacturers' Association
 British Radio Equipment Manufacturers' Association
 British Railways Board
 Crown Agents for Oversea Governments and Administrations
 *Department of Employment and Productivity
 Electric Cable Makers' Confederation
 Electrical Contractors' Association (Incorporated)
 Electrical Contractors' Association of Scotland
 Electrical Research Association
 *Electricity Council, the Central Electricity Generating Board
 and the Area Boards in England and Wales
 Electronic Engineering Association
 Engineering Equipment Users' Association
 Institution of Electrical Engineers
 Lighting Industry Federation
 Ministry of Defence
 Ministry of Defence, Army Department
 Ministry of Defence, Navy Department
 Ministry of Power
 *Ministry of Public Building and Works
 Ministry of Technology
 Municipal Passenger Transport Association (Incorporated)
 National Inspection Council for Electrical Installation Contracting
 National Physical Laboratory (Ministry of Technology)
 Oil Companies Materials Association
 Post Office
 Public Transport Association (Incorporated)
 South of Scotland Electricity Board

The Government departments and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committees entrusted with the preparation of this British Standard:

Association of Supervisory Staffs, Executives and Technicians
 Caterers' Association of Great Britain
 Catering Equipment Manufacturers' Association
 Cookery and Food Association
 County Councils Association
 Department of Education and Science
 Department of Health and Social Security
 Electrical Association for Women
 Greater London Council
 Hospital Caterers' Association
 Industrial Catering Association
 Institution of Hospital Engineers
 Institutional Management Association
 National Association of Restaurant Engineers
 Tea Bureau

SPECIFICATION FOR ELECTRICALLY-HEATED CATERING EQUIPMENT

Part 12. Bains-marie

FOREWORD

This British Standard has been prepared under the authority of the Electrical Industry Standards Committee.

Users of this standard should satisfy themselves that the installation of equipment meets the requirements of the model byelaws issued by the Ministry of Housing and Local Government and the Department of Health for Scotland. Pressure generating appliances shall additionally comply with the requirements of the Factory Act, 1961, where applicable.

This standard covers appliances for a.c. and d.c., but as appliances for d.c. are necessarily more complex than for a.c., organizations inviting tenders to this specification should make it clear in their initial enquiry whether the equipment is for use on a.c. or d.c.

The equipment described in this standard is not necessarily suitable for use in ships or road vehicles.

NOTE. The values of force are expressed in this standard in terms of the newton (symbol N). This is the unit of force in the international (SI) system. The newton is that force which, when acting on a body of mass one kilogram, gives it an acceleration of one metre per second squared.

SPECIFICATION

1. SCOPE

This Part of BS 4167 specifies the general requirements and tests for bains-marie intended for storage of hot food during cooking and preparatory to serving in catering establishments.

The standard applies to equipment designed for operation on either single-phase or polyphase supplies where the voltage to earth does not exceed 250 V a.c. or d.c.

It establishes a satisfactory standard of safety and performance when the equipment is used under normal conditions.

2. DEFINITIONS

NOTE. The terms 'voltage' and 'current' imply the r.m.s. values, unless otherwise specified. For the purposes of this Part of this British Standard the following definitions apply:

(1) *Rated voltage*. Denotes the voltage (for a three-phase appliance the line to line voltage) assigned to the equipment and marked on it.

(2) *Rated current or input*. The current or input assigned to the appliance by the maker and marked on it.

(3) *Rated voltage range*. The voltage limits assigned to the appliance by the maker and marked on it.

(4) *Maximum rated input*. The maximum rated input, when an input range is marked on the appliance, is the highest input of the range. When the mean input is marked, the maximum rated input is given by the formula:

$$\text{Mean rated input} \times \left[\frac{\text{maximum rated voltage}}{\text{mean rated voltage}} \right]^2$$

(5) *Extra low voltage*. Voltage normally not exceeding 50 V a.c. with a maximum voltage to earth of 30 V, or 50 V d.c.

(6) *Non-detachable flexible cord or cable*. A flexible cord or cable, so connected to the equipment that it can only be removed with the use of tools.

(7) *Thermostat*. A preset or adjustable device which, in normal use, keeps the temperature of the appliance, or of parts of it, between certain limits by automatically opening and closing the circuit or by varying the current.

(8) *Thermal cut-out*. A safety device limiting the temperature of an appliance under abnormal conditions by automatically opening the circuit or by reducing the current. The device may be reset by hand or may be self-resetting and is so constructed that there is no provision for adjustment of the setting by the user.

(9) *Energy regulator*. A device which provides a variable rate of energy transmitted to an electrically heated appliance by changing the ratio of the ON and OFF periods in a progressive manner between the minimum and maximum setting.

(10) *Transportable appliance*. An appliance which can readily be removed from one place to another.

(11) *Stationary appliance*. An appliance intended to be fixed to its supporting surface or used in one place.

(12) *Capacity*. The amount of liquid contained when the appliance is filled to a level 75 mm-below overflow.

(13) *Indicated level*. The maximum level to which an appliance may be filled for correct operation.

(14) *Float switch*. A liquid-level float-operated electrical switch.

(15) *Open well type*. An appliance where any food containers rest in water in a heated well.

(16) *Fitted container type.*

a. Dry heat. An appliance where any fitted food containers are surrounded by warm air generated within the appliance.

b. Wet heat. An appliance where any fitted food containers are surrounded by steam generated within the appliance.

3. GENERAL REQUIREMENTS

3.1 The appliance shall be so designed and constructed that in normal use it is reliable and will operate without danger to the user or surroundings.

3.2 Where an appliance incorporating a bain-marie also incorporates other electrically heated units, the other units shall comply with the relevant Parts of this standard.

3.3 TESTS. Compliance shall in general be checked by carrying out the relevant tests specified.

3.4 Instructions for connecting, maintaining and operating the equipment shall be available for each appliance.

4. GENERAL CONDITIONS OF TESTS

4.1 The tests are type tests and are made on a single sample as delivered which shall pass all the relevant tests and specific requirements.

4.2 Unless otherwise specified, the tests shall be carried out in the order of the clauses.

4.3 The tests shall be carried out at an ambient temperature of $20 \pm 5^{\circ}\text{C}$ unless otherwise specified. Details of the test room and of the preparation of the appliance before testing are given in Appendix A.

4.4 Surface, wall and floor temperatures shall be measured by fine wire thermocouples which are positioned so that they have the minimum effect on the temperature of the part under test. The temperature of the liquid shall be measured by means of a mercury in glass thermometer.

4.5 Appliances designed for both a.c. and d.c. operation shall be tested using the system of supply which will prove most exacting to the appliance. When testing with d.c. the possible influence of polarity on the operation of switching devices shall be taken into account.

4.6 When it is specified that the appliance shall be connected to a test voltage so that the input is greater than the rated input, the test voltage as defined in the relevant clauses applies only to heating elements without appreciable positive temperature coefficient of resistance. In general the temperature coefficient is deemed to be appreciable if, at rated voltage, the input of the equipment in the cold condition differs by more than 25 % from the input at operating temperature.

For the other heating elements the test voltage shall be determined in the following manner.

The rated voltage shall be applied until the heating element reaches its operating temperature. The voltage shall then be rapidly increased to the value necessary to give the required test loading, and the tests are made as specified, this value of the voltage being maintained throughout.

4.7 Where it is stipulated that equipment shall be operated at extra low voltage from a particular transformer supplied with it the test shall be made with this transformer.

4.8 Unless otherwise specified, appliances with thermostats or regulating or limiting devices shall be tested with these devices at their maximum setting, if the setting is intended to be altered by the user.

5. FINISH

5.1 Finishes shall not be subject to excessive deterioration in normal use and shall adequately protect against corrosion at the temperature and in the humidity conditions to which they will be subjected in normal use.

The finish of parts which are liable to come in contact with liquid shall be capable of being kept hygienically clean and shall be of such a material or so protected as to avoid contamination of the contents.

5.1.1 TESTS. Compliance shall be checked by visual examination for signs of pin holes, blistering, peeling, roughness or exposed untreated areas and for paint finishes by the tests of 5.2 and 5.3.

5.2 The appliance shall be operated at its rated input with all controls used in normal operation set at maximum for a continuous period of 5 h, as specified in 5.2.1 and 5.2.2. Afterwards there shall be no appreciable change of colour on any part of the appliance and the finish shall not become tacky or show other signs of deterioration.

After the initial burning-off period, there shall be no detectable odour from the appliance when the appliance is operated normally.

5.2.1 Open well and wet heat types. Fill with water to the indicated level, topping up as necessary. No covers or containers to be fitted.

5.2.2 Dry heat type. Place the containers in the well; remove the container covers.

5.3 Paint films shall be subjected to a scratch test with a steel ball 1 mm in diameter. The ball shall be mounted in an apparatus in such a way that it shall be pressed against the surface with a force of 16 N and it shall be caused to move once over the surface for a distance of approximately 65 mm at a speed of 30 mm/s to 40 mm/s. The design of the apparatus shall be such that the ball shall be applied to the surface gently, e.g. by allowing the ball carrier to run down a ramp.

The ball shall not penetrate completely through the film and if flakes are lifted from the edge of the scratch the major dimension of every flake shall be less than 1 mm. For electrically conducting paints penetration shall be determined by visual observation. For other paints penetration shall be shown by an electrical contact indicator, the voltage applied between the ball and the metal surface to which the paint shall be applied being not greater than 6 V.

The ball shall be cleaned after each test and inspected frequently to ensure that it has not worn significantly.

5.4 The colour of paint and similar finishes on exterior surfaces shall be in accordance with BS 1358* or BS 2660†.

5.4.1 TEST. Compliance shall be checked by inspection.

5.5 Finishes other than painted finishes shall comply with one of the following British Standards as appropriate:

BS 729, 'Zinc coatings on iron and steel articles'.

BS 1224, 'Electroplated coatings of nickel and chromium' (Service condition No. 2).

BS 1344, 'Methods of testing vitreous enamel finishes'.

BS 1484, '10-gallon tinned steel milk can and lid'.

BS 1872, 'Electroplated coatings of tin' (classification 12S or 12C).

BS 3831, 'Vitreous enamel finishes for domestic and catering appliances'.

5.5.1 TEST. Compliance shall be checked as detailed in the appropriate standard.

* BS 1358, 'Colours for vitreous enamel finishes'.

† BS 2660, 'Colours for building and decorative paints'.

6. VOLTAGE RATING

6.1 The highest rated voltage shall be 250 V for single-phase a.c. or d.c. or 440 V for 3-phase—4 wire a.c. No individual component other than the contact assembly of switching devices shall have a rated voltage exceeding 250 V.

6.1.1 TEST. Compliance shall be checked by inspection of the marking.

7. MARKING

7.1 The equipment shall be marked with the following particulars:

- (1) The number of this British Standard, i.e. BS 4167 : Part 12.
- (2) Rated voltage or voltage range in volts.
- (3) Nature of supply, if necessary for the correct operation of the appliance (e.g., single-phase a.c. or 3-phase—4 wire a.c. or d.c.).
- (4) Rated input in watts or kilowatts.
- (5) Maker's name or trade mark.
- (6) Maker's model or serial number.

7.2 Heating elements shall be marked with the rated voltage in volts, rated input in watts or kilowatts.

7.3 Any cover giving access to live parts at a voltage exceeding 250 V shall be marked with the word WARNING and the appropriate voltage. This marking shall not be incorporated with the markings specified in 7.1.

7.4 If the appliance can be set to different rated voltages, the voltage to which the appliance is set shall be easily and clearly discernible.

It shall be sufficient if the rated voltage to which the appliance is set is determined from instructions fixed to the appliance.

7.5 For an appliance where the difference between the limits of the rated voltage range is more than 10 % of the mean value of the range, the upper and lower limits of the rated input shall be marked on the equipment so that the relation between input and voltage appears distinctly.

If the difference between the limits of the rated voltage range is not more than 10 % of the mean value of the range, the marking of rated input shall relate to the mean of the voltage range. (Alternatively, the upper and lower limits of the rated input may be marked.)

If the input of the appliance in the cold condition differs by more than 25 % from the input at operating temperature, the input in cold condition shall be marked in addition and shall be placed between brackets.

7.6 Appliances shall have the maximum level to which they may be filled, i.e. the 'Indicated level', marked in such a position as to be easily visible to the operator when being filled by hand.

7.7 If abbreviations are employed the following letters shall be used:

- | | |
|------------------------|---------|
| (1) Volts | V |
| (2) Amperes | A |
| (3) Watts or kilowatts | W or kW |

7.8 The symbols for the nature of the supply shall be as follows:

- (1) Alternating current $\sim$.
- (2) A.C. 3 phase — 4 wire 3N $\sim$.
- (3) Direct current --- .

7.9 Regulating devices shall have indications for their different positions by figures, letters or other visual means.

7.10 Adjustable thermostats, energy regulators or the like shall be provided with an indication of the direction of adjustment to increase or decrease the temperature.

NOTE. An indication of + and — is deemed to be sufficient.

7.11 Switches shall be marked or placed so as to indicate their function. There shall be a clear indication of the OFF position on manually operated switches.

7.12 TEST. Compliance with the requirements of 7.1 to 7.11 shall be checked by inspection.

7.13 Marking of the appliance shall be durable, resistant to heat and easily legible, and shall be placed on the main part of the appliance so that it is clearly discernible from the outside, if necessary after the removal of a cover. This cover shall be removable without the use of tools, except in the case of stationary appliances, and then only if the cover has also to be removed for servicing. Marking shall not be placed on any removable part which can be replaced in such a way that the marking is misleading.

7.14 Marking of heating elements shall be easily legible and shall be placed on a main part of the element in such a way that it is clearly discernible when the element is removed from the appliance. The marking of the element shall be durable and resistant to heat.

7.15 TEST. Compliance with requirements of 7.13 and 7.14 shall be checked at the conclusion of all the tests in this specification by inspection, and by the tests detailed in Appendix B.

NOTE. Attention is drawn to certification facilities offered by BSI; see the back cover of this standard.

8. PROTECTION AGAINST ELECTRIC SHOCK

8.1 The enclosure of the appliance shall have no openings giving access to live parts other than openings necessary for the use and working of the equipment. Where such openings are necessary, sufficient protection against contact with live parts shall be provided.

NOTE. Lacquering or enamelling is not deemed to be adequate protection or insulation for the purpose of this requirement.

8.1.1 TEST. Compliance shall be checked by inspection and by means of the test fingers A and D prescribed in BS 3042*.

Test finger A is inserted into such holes and apertures as are accessible in every way possible, without appreciable force as follows:

A transportable appliance weighing not more than 35 kg shall be tested with the appliance in all positions, except that when inserted into apertures which are only accessible when the appliance is overturned, the circular stop plate on the test finger shall not be inserted beyond the plane of the opening in the base.

A transportable appliance weighing more than 35 kg shall be tested with the appliance in its normal position or positions of use.

A stationary appliance is tested with the appliance installed in position.

In no case shall it be possible for test finger A to touch live parts, even if the position of the jointed members is altered after insertion.

If the aperture is such that it prevents the entry of the tip of the test finger A, then test finger D is applied, with a force not exceeding 30 N. If this test finger then enters, the test with test finger A is repeated, the finger if necessary being pushed through the aperture.

The test shall be made after the removal of all parts which can be removed without the use of tools.

A voltage of not less than 40 V is used with a lamp for indication of contact.

8.2 Edison type screw lampholders shall be fully shrouded or otherwise protected so as to prevent contact with the cap of the lamp during insertion and withdrawal unless access to the lamp can be gained only with the use of a tool. The screwed shell shall be contacted to the terminal intended for the neutral connection.

* BS 3042. 'Standard test fingers for checking protection against electric shock and mechanical hazard'.

8.2.1 TEST. Compliance shall be checked by applying the standard test finger according to 8.1.1.

8.3 Operating spindles of knobs, etc., shall be adequately insulated from live parts.

8.4 For appliances other than those designed for extra low voltages, handles, levers and knobs shall be either of insulating material or adequately covered by insulating material if their shafts or fixings can become live in the event of an insulation fault. For a stationary appliance, this requirement does not apply to handles, levers and knobs, other than those of electrical components, provided they are either reliably connected to an earthing terminal or separated from live parts by earthed metal.

8.5 TESTS. Compliance with the requirements of 8.3 and 8.4 shall be checked by inspection and the tests of Clause 12.

8.6 Parts providing protection against accidental contact with live parts, or parts which are liable to become live in the event of a defect, shall have adequate mechanical strength and shall not work loose during normal use. It shall not be possible to remove these parts without the use of tools.

8.6.1 TEST. Compliance shall be checked by inspection and by manual test, after the tests prescribed by Clause 18 have been completed.

9. INPUT

9.1 The input of the appliance at rated voltage and with the elements at operating temperature shall not differ from the rated input by more than $\pm 7.5\%$.

9.1.1 TEST. Compliance shall be checked by the following test:

The appliance shall be connected to the rated voltage and prepared as in 5.2.1 or 5.2.2 as appropriate. The input shall be measured as soon as it reaches a steady value.

If the appliance is marked with a rated voltage range the test shall be made either at both the upper and lower limits of the range if the difference between these limits is more than 10 % of the mean value of the range or at the mean value of the range if the difference between the limits is not more than 10 % of the mean value of the range.

10. OPERATION UNDER OVERLOAD CONDITIONS

10.1 The appliance shall be designed and constructed to withstand electrical overloads liable to occur in normal use.