

BRITISH STANDARD 3456 : Section A4 : 1971

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SPECIFICATION FOR THE TESTING AND APPROVAL OF HOUSEHOLD ELECTRICAL APPLIANCES

Section A4 ELECTRICALLY-HEATED BLANKETS

BRITISH STANDARDS INSTITUTION

SPECIFICATION FOR
THE TESTING AND APPROVAL OF
HOUSEHOLD ELECTRICAL APPLIANCES

**Part A. Heating and Cooking
Appliances**

**SECTION A4
ELECTRICALLY-HEATED
BLANKETS**

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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.

In order to keep abreast of progress in the industries concerned, British Standards are subject to periodical review. Suggestions for improvements will be recorded and in due course brought to the notice of the committees charged with the revision of the standards to which they refer.

A complete list of British Standards, numbering over 9,000, fully indexed and with a note of the contents of each, will be found in the BSI Catalogue which may be purchased from BSI Sales Department. The Catalogue may be consulted in many public libraries and similar institutions.

This standard makes reference to the following British Standards:

- BS 800. Limits of radio interference.
- BS 2576. Determination of breaking load and extension of strips of woven textile fabric.
- BS 2963. Methods of test for the flammability of fabrics.
- BS 3535. Specification for safety isolating transformers for industrial and domestic purposes.
- BS 3955 Electrical controls for household and similar general purposes
Part 3. General and specific requirements.
- BS 4265 Specification for cartridge fuse links for miniature fuses.
- BS 6500 Specification for insulated flexible cables and cords.

British Standards are revised, when necessary, by the issue either of amendment slips or of revised editions. It is important that users of British Standards should ascertain that they are in possession of the latest amendments or editions.

The following BSI references relate to the work of this standard:
Committee references ELE/82, ELE/82/9

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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 Consulting Engineers
- *Association of Manufacturers of Domestic Electrical Appliances
- Association of Mining Electrical and Mechanical Engineers
- Association of Supervisory 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 Ltd.
- Ministry of Defence
- Ministry of Defence, Army Department
- *Ministry of Defence, Navy Department
- *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 committee entrusted with the preparation of this standard:

- British Electrical Approvals Board for Domestic Appliances
- British Textile Employers' Association
- Consumer Council
- Department of Health and Social Security
- Electrical Association for Women
- Fire Protection Association
- Home Office
- Institution of Electrical and Electronics Technician Engineers Ltd.
- Institution of Fire Engineers
- Joint Fire Research Organisation of Fire Officers' Committee
- National Bedding Federation
- Radio and Electronic Component Manufacturers' Federation
- Royal Institute of British Architects
- Small Electric Motor Manufacturers' Association.
- Women's Advisory Committee of BSI

BRITISH STANDARD SPECIFICATION FOR
THE TESTING AND APPROVAL OF HOUSEHOLD
ELECTRICAL APPLIANCES

Part A. Heating and Cooking Appliances

SECTION A4

ELECTRICALLY-HEATED BLANKETS

FOREWORD

This revised British Standard has been prepared under the authority of the Electrical Industry Standards Committee, and is one of a series of specifications for the testing and approval of household electrical appliances*. This Section A4 details requirements which depart from or are additional to those given in BS 3456, Section A1, 'General requirements' (1966 edition).

When first published in 1963 this section of BS 3456 superseded BS 2612 which was then withdrawn but whereas BS 2612 applied only to bedwarmer blankets (now known as pre-heating blankets), this specification also includes requirements for all-night over-blankets, and all-night under-blankets which are energized at extra-low voltage.

It does not apply to all-night under-blankets operated at mains voltage; further requirements for these will be given consideration. The present edition introduces requirements for electric blankets which are controlled completely or in part by electronic means. It also introduces additional requirements, principally in the marking, component parts and supply connection clauses and changes in the machine to be used for the mechanical strength test.

This edition also includes requirements for electric blankets using adhesive construction.

It is emphasized that this revision of Section A4, which supersedes the 1963 edition, has to be read in conjunction with BS 3456 : Section A1 : 1966 and not with BS 3456 : Part 1 : 1969, 'General requirements'. It is intended that this section when next revised will, however, be a Section of BS 3456 : Part 2, 'Particular requirements', and as such will then be read in conjunction with the aforementioned Part 1.

* See the back cover of this standard.

SPECIFICATION

SCOPE

1. This Section A4 of Part A applies to electrically-heated blankets, for household use, having a nominal surface area of one side of not less than 0.4 m², intended for connection to direct current and/or single-phase alternating current supply circuits at any voltage up to and including 250 V.

The specification applies to pre-heating blankets, all-night over-blankets and ELV under-blankets for all-night use and to blankets which are controlled completely or in part by electronic means. It also applies to blankets employing adhesives in their construction.

It applies also to other ELV blankets, but the term ELV blanket as used in this specification refers only to those intended to be energized through a transformer supplied with the blanket. The specification does not apply to electric heating pads nor to electrically-heated mattresses, i.e. upholstered bedheaters of such materials and thickness that they are unlikely to be slept on when folded. It also does not apply to all-night under-blankets operated at mains voltage; further requirements for these will be given consideration.

Blankets complying with this British Standard are not necessarily suitable for maintaining a constant body temperature. Such blankets, for use in the nursing of babies, or aged or infirm people, are not covered by this standard. However, special requirements for low temperature ELV all-night under-blankets for the elderly, but not intended for medical treatment, are included and are detailed in Appendix E.

This Section A4 is to be read in conjunction with Section A1, 'General requirements'. The blankets are required to comply in all respects with the requirements specified in Section A1, except in so far as they are modified by this Section A4.

DEFINITIONS

2. For the purposes of this section of this British Standard, the following additional definitions apply:

- I. *Electric blanket*. A substantially flat, flexible, electrically-heated appliance designed for the general application of heat to a bed.
- II. *All-night blanket*. An electric blanket designed to be energized while the bed is occupied.
- III. *Pre-heating blanket*. An electric blanket not designed to be energized while the bed is occupied.
- IV. *Under-blanket*. A blanket designed to be situated under the occupant of the bed.
- V. *Over-blanket*. A blanket designed to be situated over the occupant of the bed.
- VI. *Extra-low-voltage blanket (ELV blanket)*. A blanket designed for use on a.c. at a rated voltage not exceeding 30 V and supplied complete with its isolating transformer.

- VII. *Enclosure.* The permanent external covering which contains the heating element, thermostats and other current-carrying parts of the blanket.
- VIII. *Detachable cover.* A cover for the blanket, intended and designed to be readily removable by the user.
- IX. *Heating element.* The electrical heating conductor complete with the core, if any, on which the conductor may be wound, and any other integral conductors, and integral insulation or coverings.
- X. *Control unit.* Any external device incorporated in the blanket circuit by means of which the blanket input may be varied or regulated.
- XI. *Conductive sheet type heating element.* A heating element in the form of a flexible sheet of conductive material or of material with a conductive coating.
- XII. *Element connecting electrode.* The flexible conductor which is in contact with the surface of a conductive sheet type element and serves to conduct the current to the element.
- XIII. *Electronically controlled blanket.* An electric blanket incorporating an over-temperature sensing system with an electrical feed back to a control unit wholly or partially constructed from active electronic components.
- XIV. *Active electronic component.* A component in which electrical conduction takes place principally by means of electrons passing through a vacuum, ionized gas, or semiconductor material and which provides a gain in voltage, current or power.
- XV. *Blanket using adhesive construction.* A blanket in which the enclosure material is bonded together by means of an adhesive or chemical bonding agent and where the heating element may be secured in position by similar means.
- XVI. *Blanket container.* The box or package in which an individual electric blanket is offered for sale.
The top of the container is the largest surface carrying promotional matter or a description of the contents.
In the case of the normal rectangular box, the surface opposite to the top is the bottom and the other four surfaces are the sides.
- XVII. *Electronic circuit.* A circuit that employs active electronic components.

GENERAL REQUIREMENTS

- 3. The requirements of Section A1 apply.

GENERAL CONDITIONS OF TEST

- 4. The requirements of Section A1 apply with the following modifications and additions:

To Subclauses 4b and c:

Tests are made on representative samples, A and B and, if necessary, further samples C and D and on certain additional components. The tests applied and the order in which they are made is as follows:

SAMPLE A. Tests of Clauses 9, 12, 16(i), 13, 14, 15, 22 (except (d)(ii) and e), 11b, 28, 9 (repeat), 13 (repeat for adhesive construction only), 16(ii), 19a, 18a, 18b, 18c, 14 (repeat), 15 (repeat), 7j, 18e, 18g, 11c, 18d, 19a and 19b.

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SAMPLE B. Tests of Clauses 5, 7, 8, 9, 11a, 19b(ii) and (iii), 19(1), 9.1, 19b(i), c, d, h, j, k, m and n, 20 (excluding 20c(iv)), 21, 22e, 23, 25, 26 and 27.

SAMPLE C. Tests of Subclause 20c(iv), where applicable.

SAMPLE D. Tests of Subclauses 19p and 19f, where applicable.

SAMPLE E. Tests of Subclause 18f, where applicable.

Components. Where practicable these components will be taken from Sample B blanket. Failing this they are examined to ensure that they are equivalent to the components in the blanket.

For blankets of adhesive construction the sample lengths of element for the tests of Subclauses 19e, f and g shall be taken from Sample B blanket or if necessary from Sample C blanket.

Control unit	Clause 17
3 m length of element	Clause 19g
1 m length of element	Clause 19e
10 m length of element	Clause 19f
6 samples of any internal thermostat or thermal cut-out, each complete with a 150 mm length of element attached to each termination	Clause 19k
3 of each internal thermal control device	Clause 20
3 manually-operated switches (if such are fitted)	Clause 21a
3 adjustable controls intended to be operated by the user in electronic control units	Clause 21.V
3 inlet/connector assemblies (if fitted)	Clause 22d(iii)
For blankets incorporating conductive sheet type elements, the following are required in place of the above lengths of element:	
18 m of element connecting electrodes	Clause 19g
2 m length of heating element	Clauses 19b and 19c

The following additional subclause applies:

- I. Blankets shall be placed between sheets of lagging material supported on a piece of plywood, 20 mm thick, at a height of not less than 300 mm above the floor. The size of the plywood shall be such that the lagging can be spread flat and supported over its whole area. Except where otherwise stated, the size of the sheets of lagging material shall be such that the edges extend at least 100 mm beyond the outline of the heated area.

The thicknesses of the sheets of lagging material shall be as determined in Appendix A.

NOTE. Polyurethane foam on a polyester base and hair felt are suitable lagging materials.

VOLTAGE RATING

5. The requirements of Section A1 apply.

CLASSIFICATION**6. Control units shall be Class II.**

Electric blankets are not classified according to the degree of protection against electric shock.

The following additional classification applies:

I. Blankets shall be classified according to their use:

- a. Pre-heating under-blankets.*
- b. All-night under-blankets.*
- c. All-night over-blankets.*

MARKING**7. The requirements of Section A1 apply with the following modifications and additions:**

To Subclause 7a:

Detachable control units shall be marked with:

Rated voltage or voltage range in volts.

Nature of supply.

Rated output in watts (for control units of ELV blankets only).

Rated input in watts (for blankets and for control units other than those for ELV blankets).

Name or trade mark of the manufacturer or responsible vendor.

Model or type reference.

Blankets shall be marked with the following additional markings, which shall be not less than 2.5 mm high:

CAUTION

Use only with switch supplied. If damaged return to manufacturer. (Applicable to blankets incorporating any component of an overheat protection system, inside cord switch.)

Read carefully the instruction leaflet for use and storage.

Use only as an under-blanket } (as appropriate).

Use only as an over-blanket }

Switch off or disconnect from the supply (as applicable) before getting into bed. (Not applicable to all-night blankets.)

Do not use folded, rucked or creased.

Do not switch on if wet. (Not applicable to ELV blankets.)

Do not launder

Do not dry clean

Do not launder or dry clean

Launder according to the instruction leaflet } (as appropriate)

Dry clean according to the instruction leaflet }

Launder or dry clean according to the instruction leaflet }

Use only with the control unit supplied. (Applicable to blankets with which a hazard could arise if the control unit were not used.)

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For launderable blankets, if the washing instructions are given in accordance with the Home Laundering Consultative Council Scheme, full drying instructions shall also be provided on the label adjacent to the washing instructions.

If a detachable cover is available it shall be marked with the following markings, which shall be not less than 2.5 mm high:

Detachable Cover for Electric Blanket (quote type(s) or model(s) for which the cover is suitable).

Read carefully the instruction leaflet for use and storage of the blanket.

Use only as an under-blanket or over-blanket (as appropriate).

Switch off or disconnect from the supply (as applicable) before getting into bed. (Not applicable to all-night blankets.)

Do not use folded, rucked or creased.

Do not switch on if wet. (Not applicable to ELV blankets.)

Use only with the control unit supplied. (Applicable to blankets with which a hazard could arise if the control unit were not used.)

FOR OTHER DETAILS SEE LABEL ON THE BLANKET.

This cover may be laundered or dry cleaned in accordance with the manufacturer's instructions and must be removed for this purpose.

Name of manufacturer or responsible vendor.

The following additional subclauses apply:

- I. Full printed instructions on the correct installation, use and storage of the blanket shall be supplied with each blanket. These instructions shall be given adequate prominence and shall contain the substance of the following:

- (i) Important instructions—retain for future reference.

CAUTION

- (ii) Before connecting the appliance check that the supply voltage is the same as that stated on the blanket and/or control unit.
- (iii) Use only as an under-blanket } (as appropriate).
Use only as an over-blanket }
- (iv) See that the blanket is switched off or disconnected from the supply before getting into bed. (Not applicable to all-night blankets.)
- (v) See that the blanket is switched to an appropriate low heat setting before getting into bed. (Not applicable to pre-heating blankets and for all-night blankets may be omitted if the controller automatically switches the blanket to an appropriate low heat setting within 1 hour after switching on.)
- (vi) Never leave an infant, helpless person or person insensitive to heat lying unattended on or under the blanket while it is switched on. (Not applicable to pre-heating blankets.)
- (vii) Do not use folded, rucked or creased.



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- (viii) This blanket must not be used above the occupant of the bed and must be secured to the mattress in the following manner: (here give the necessary instructions). (Not applicable to over-blankets.)
- (ix) Do not insert pins.
- (x) Do not switch on the blanket if it is wet. (Not applicable to ELV blankets.) If wet the blanket should be dried by . . . (here give the necessary instructions).
- (xi) Do not launder or dry clean (as appropriate).
- (xii) Launder or clean (if appropriate) in the following manner: (here give the necessary instructions). It is necessary to dry the blanket thoroughly before plugging into the supply.
- (xiii) Do not coil or lay any part of the flexible cord across the blanket.
- (xiv) Do not tuck in the wired area.
- (xv) Examine the blanket frequently for signs of wear or damage in either the blanket or the flexible cord. If there are such signs or if it has been misused, return the blanket to the manufacturer immediately, giving the reasons for its return. In any case it should be returned to the manufacturer for inspection every . . . years (this period shall not exceed 3 years).
- (xvi) Use only with the control unit or transformer supplied by the manufacturer (as applicable).
- (xvii) Never place the head end of the blanket at the foot of the bed (applicable only to blankets in which different specific loadings are provided for the head and foot portions of the heated area).
- (xviii) Never place additional articles such as pillows or coats on the heated area.
- (xix) Avoid pressing sharp creases into the blanket. When not in use store as follows: (here give the necessary instructions).
- (xx) As the colours of the wires in the mains lead of this appliance may not correspond with the coloured markings identifying the terminals in your plug, the wire coloured brown or marked with the longitudinal identifying rib should be connected to the terminal in the plug marked with the letter L or coloured red and the other wire to the terminal marked N or coloured black (as applicable).
- (xxi) Upon switching on and also before getting into bed, check that the control system is functioning properly by (here shall be given the instructions for use on the check safety circuit (where applicable)).
- (xxii) Always use the blanket with the switch fitted as it is part of the overheat protection system for the blanket. If the switch is damaged or needs replacing it is essential that it is returned to the manufacturer for repair. (Applicable to blankets incorporating any component of an overheat protection system, inside a cord switch.)

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- II. Blankets shall carry a label attached to the end of the flexible cord giving the instructions for connecting to the supply and the appropriate warning regarding fusing as required for Class II appliances specified in Section A1.

TEST. Compliance is checked by inspection.

- III. Any blanket container shall give a prominent indication of the classification according to use as specified in Clause 6.

In the case of pre-heating underblankets the following shall apply.

The classification according to use as specified in Clause 6 may be employed as required by the manufacturer but, notwithstanding, a legend is to be marked on the blanket container in one of the following forms:

- 1 PRE-HEATING UNDERBLANKET — KEEP
DISCONNECTED FROM POWER SUPPLY WHILST BED IS
OCCUPIED
- 2 PRE-HEATING UNDERBLANKET — KEEP SWITCHED
OFF WHILST BED IS OCCUPIED

Containers for blankets without an integral switch shall carry legend 1.

Containers for blankets with an integral switch shall carry either legend 1 or legend 2.

The appropriate legend shall be printed in lettering no less than 6 mm in height in a legible face either on the top or on any two sides of a box or on the largest face of a package and shall be separated by at least 12 mm from all other lettering or art work. The legend shall occupy not more than five lines of print and shall be in a colour which shows a clear and strong contrast with its background.

TEST. Compliance is checked by inspection.

NOTE. Futura Medium and Futura Condensed type faces are considered to meet the legibility requirements of this clause.

- IV. For under-blankets a label shall be sewn to one edge of the blanket, or shall be fixed to the means of securing the blanket to the mattress specified in Subclause 19a, stating the following:

This blanket must not be used above the occupant of the bed and must be secured to the mattress in the following manner (here give the necessary instructions).

NOTE. Where the blanket securing instructions are given on the label sewn to one edge of the blanket, this information may be included on the label sewn to the edge of the blanket for Clause 7a.

TEST. Compliance is checked by inspection.

PROTECTION AGAINST ELECTRIC SHOCK

8. The requirements of Section A1 apply with the following additional sub-clause:

- I. Conductive sheet type elements shall be incorporated only in ELV blankets.

INPUT

9. The requirements of Section A1 apply with the following modifications and additions:

To Subclause 9a:

The input of the blanket at rated voltage and operating temperature shall not differ from the rated input by more than 10 %.

TEST. The blanket is placed in the standard test bed specified in Subclause 4.I. The input is measured when a steady temperature has been attained with all thermostats (if any) in the closed position. For ELV blankets it is checked that the rated output voltage of the transformer matches the rated voltage of the blanket. A voltage is then applied to the input winding of the transformer such that the rated voltage is applied to the blanket and the blanket input is measured on the output side of the transformer.

The following additional subclauses apply:

- I. The input of any one circuit, at the voltage necessary to give the maximum rated input of the blanket, shall not exceed 180 W.
TEST. Compliance is checked by inspection and, if necessary, by measurement of resistance.
- II. In ELV all-night under-blanket heating elements the current in any conductor within the blanket shall not exceed that which gives a dissipation of 10 W at maximum rated voltage in that particular circuit. This requirement does not apply to any length of flexible cord within the blanket enclosure (see Clause 22), or to conductive sheet type elements.
TEST. Compliance is checked by inspection and, if necessary, by measurement of resistance.
- III. For blankets incorporating conductive sheet type elements, the input at operating temperature shall not exceed the input at switch-on from ambient temperature.
TEST. Compliance is checked during the test of Subclause 9a by measuring the input at the instant of switch-on and comparing this with the input measured at operating temperature.

OPERATION UNDER OVERLOAD CONDITIONS

10. The requirements of Section A1 apply. Compliance is checked by the tests of Clause 28.

HEATING

11. The requirements and tests of Section A1 apply to control units.

For blankets the requirements of Section A1 apply with the following modifications and additions to the test:

- a. The blanket is placed in the standard test bed specified in Subclause 4.I. Element temperatures are measured by fine wire thermocouples, not larger than 0.40 mm diameter. For blankets incorporating conductive sheet type elements the thermocouple junctions are attached to one face of brass or copper discs 15 mm diameter and 0.5 mm thick. The

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opposite faces of the discs are coated with a non-conductive lacquer, and placed on a conducting side of the element. The discs are secured to the element by adhesive tape or other suitable means. For other blankets a 15 mm length of the thermocouple wires adjacent to the junction is bound to the element by textile thread.

Where the elements are free to move, within tunnels or the like, they are positioned in such a way that adjacent runs are as close together as the construction permits in the vicinity of the point of temperature measurement.

The blanket is operated at the voltage required to provide an input of 1.10 times the maximum rated input. The test is continued until steady conditions are obtained.

Where a control unit providing automatic control can be adjusted by the user it is adjusted to the most unfavourable setting and operated at the most unfavourable ambient temperature between 0°C and 15°C. Electronically controlled blankets are operated at that voltage in the range 0.94 to 1.06 times the rated voltage, or the limits of the voltage range, and at that ambient temperature in the range 0°C to 25°C, and at that setting of the manual control, which produces the most unfavourable condition.

Under these conditions the temperature limits of Section A1 apply. In addition the following temperature limits and additional tests apply for heating elements and plastics sleeves containing heating elements.

- (i) *For blankets* with two or more internal thermostats or thermal control devices, or one thermostat and one thermal control device per circuit, the element temperature shall not exceed 100 °C at the first operation of the thermostat or control device and 95 °C thereafter.
- (ii) *For blankets* with not more than one internal thermostat or thermal control device per circuit, either internal or external, the device is short-circuited for the test. The element temperature rise above ambient shall not exceed 80 degC.
- (iii) *For blankets* with no thermostats or thermal control devices, either internal or external, the element temperature rise above ambient shall not exceed 80 degC.

In addition, where heating elements are taken out of the blanket within a plastics sleeve, the temperature of the element sheath within the sleeve shall not exceed 95 °C (80 degC rise for blankets without thermostats, or with short-circuited thermostats). The temperature on the outside of the sleeve shall not exceed 85 °C (70 degC rise for blankets without thermostats, or with short-circuited thermostats).

If compliance with the above test (i) depends upon the operation of one of the thermostats, or thermal control devices, that thermostat or device is then short circuited. The temperature of the element at the first operation shall not exceed 100 °C and 95 °C thereafter.

The test is then repeated with all thermostats or thermal control devices short-circuited and the element temperature rise above ambient shall not exceed 100 degC.

b. All-night blankets shall be capable of adjustment to give a heat output which shall not cause any danger, by heatstroke, to the health of the user.

TEST. Compliance is checked by the following test:

The conditions of test are the same as in Subclause 11*a* except that the control unit is set to the lowest position at which current will flow in the blanket either continuously or intermittently according to the type of controller, at any ambient temperature between 0°C and 15°C. The test is then made at this ambient temperature, a resistance grid as shown in Fig. 1 being placed, with the 300 mm dimension parallel to the element runs.

The resistance grid is connected to a suitable temperature recorder. The temperature is recorded until steady temperature conditions are reached. At no ambient temperature between 0°C and 15°C shall the temperature recorded exceed 35°C for any position of the grid in the upper (i.e. head) half and 40°C in the lower (i.e. foot) half of the heated area.

For overblankets the grid is placed under the appliance, for underblankets the grid is placed over the appliance.

For all-night blankets provided with a device for automatically switching to a low heat the controller is set to the maximum position at the beginning of the test and not changed subsequently. If the controller is voltage sensitive with respect to this test, the test is repeated at 0.94 times the minimum rated voltage. The appropriate temperatures specified above apply after the blanket has been switched on for 1 hour.

c. ELV blankets containing heating element conductors, element connecting electrodes, connecting leads or busbars with two or more wires in parallel shall not attain excessive temperatures in normal use, in the event of any of these wires being broken. For any length of supply flexible cord within the blanket enclosure the requirements of Clause 16 and Subclause 22*b* of this Section A4 apply.

NOTE. For the purposes of this requirement, a conductor is defined as a single wire in stranded, braided or multicore elements, element electrodes, connecting leads or busbars.

TEST. Compliance is checked by the following test:

All but one of the wires in the heating conductor are severed at that position in the blanket which will give the most unfavourable results. The severed wires are then folded back to leave a gap of approximately 15 mm.

The blanket is then again subjected to test under the conditions specified in Subclause 11*a* for 8 hours. The unsevered wire shall not attain such a temperature that it will scorch the material used for the blanket enclosure placed in contact with it.

If the current passing through one wire is likely to cause this to open circuit during the test, a greater number of wires, which will give the most unfavourable result, shall be left unsevered.

Where compliance with this requirement is dependent upon electrical insulation between the individual wires, the conductor is disconnected from its terminations and all the severed ends of the wires are fanned out. The insulation resistance between wires is then measured at 500 V d.c. and shall be not less than 0.1 M Ω between any two wires.

ELECTRICAL INSULATION AT OPERATING TEMPERATURE

12. The requirements of Section A1 apply to control units.

The requirements of Section A1 apply to blankets with the following modifications to the test:

Blankets, other than ELV blankets, are placed between sheets of metal foil of a size sufficient to cover the area containing all current carrying components in the blanket. The blanket and foils are then placed in the standard test bed specified in Subclause 4.1.

The metal foils are electrically connected together and pressed into intimate contact with the blanket by an evenly distributed pressure of 0.35 kN/m² on the upper sheet of lagging material.

The tests are made with all thermostats in the blanket circuit in the closed position.

To Subclause 12a:

The leakage current which may flow from any pole of the supply mains to the metal foil shall not exceed 2 mA per square metre of the area bounded by the heating element for positions 1 and 2 of the changeover switch in Fig. 2A of Section A1.

SPILLAGE

13. The requirements of Section A1 apply.

TESTS. Compliance is checked by the following tests (as appropriate):

- (i) Blankets other than ELV blankets are completely immersed, up to and including the flexible cord entry, in a saline solution at ambient temperature for a period of 1 hour. The appliance inlet, if any, is immersed as far as possible, without wetting the engagement face. The solution is composed of 10 g of common salt to 5 litres of water. A voltage of 250 V a.c. is then applied between the blanket circuit and the saline solution and the current flowing shall not exceed 5 mA.

- (ii) ELV blankets are laid out flat on the standard test bed specified in Subclause 4.I without any top lagging material, but with a waterproof membrane between the blanket and lower lagging material, and operated at maximum rated voltage $+10\%$. A half litre of saline solution, as detailed in Test (i) above, is then poured slowly, during a half minute period, over the surface of the blanket at that position which is considered to give the most unfavourable result. Two metal plates each measuring $100\text{ mm} \times 25\text{ mm}$ and weighing 0.6 kg are allowed to rest on the upper surface of the blanket. A measuring circuit having a total resistance of $500\ \Omega$ is connected between the two plates which are then moved over the surface of the blanket until the maximum current flows. If the output terminals of the transformer or any metal parts directly connected thereto are accessible the measurement is made between any one plate and each terminal in turn.

Under these conditions the current flowing shall not exceed 5 mA .

- (iii) For ELV blankets incorporating conductive sheet type elements, the blanket is laid flat on the standard test bed specified in Subclause 4.I without any top lagging material, but with a waterproof membrane between the blanket and lower felt, and operated at maximum rated voltage $+10\%$. The input current is noted and a half litre of saline solution, as detailed in Test (i) above, is then poured slowly, during a half minute period, over the surface of the blanket. The input current shall not increase by more than 10% or, if there is a safety device, it shall operate within 30 seconds after conclusion of wetting.

On completion of each of the above tests the blanket is thoroughly rinsed in fresh water and allowed to dry for at least 24 hours at a temperature of 20°C to 40°C before proceeding with subsequent tests. During drying the blanket is stretched, as nearly as possible, back to its original dimensions.

Where it is possible to carry out Test (iii) immediately after Test (ii) with a single application of saline solution, rinsing and drying is effected only after Test (iii).

For blankets using adhesive construction, the appropriate test above is repeated at the end of the endurance test of Clause 28 and for such blankets which are intended to be laundered, this repeat test is carried out, before the final laundering specified in Clause 16.

MOISTURE TREATMENT

14. The requirements of Section A1 apply.

INSULATION RESISTANCE AND ELECTRIC STRENGTH

15. The requirements of Section A1 apply to control units.

For blankets other than ELV blankets, the requirements of Section A1 apply with the following modifications to the tests:

The blanket is tested under the conditions specified in Clause 12, except that it is not energized.

To Subclause 15a:

The test voltage is applied between current carrying parts of the blanket and the metal foil and is 2000 V.

No flashover or breakdown shall occur during the test.

To Subclause 15b:

The insulation resistance between the current carrying parts of the blanket and the metal foil shall be not less than 2 M Ω .

MECHANICAL STRENGTH

16. The requirements of Section A1 apply to control units, transformers (other than those covered by BS 3535), switches, connectors and the like, with the following addition to the test for control units:

The control unit is dropped on its base ten times from a height of 150 mm on to a steel plate at least 5 mm thick placed on a flat concrete block.

After this test the unit shall remain safe within the meaning of this specification.

The requirements of Section A1 apply to blankets, the test being replaced by the following:

Blankets intended to be laundered are laundered three times in accordance with the manufacturer's instructions.

For blankets using adhesive construction two of these launderings are carried out before Test (i) and the remaining laundering immediately before Test (ii).

For blankets using adhesive construction but not intended to be laundered, the blanket is completely immersed up to the flexible cord entry, with the exception of any connector, in a saline solution at ambient temperature for a period of one hour. The solution is composed of 10 g of common salt to 5 litres of water. After this treatment, the blanket is thoroughly rinsed in fresh water and allowed to dry for at least 24 hours at a temperature of 20 °C to 40 °C. During drying the blanket is stretched, as nearly as possible, back to its original dimensions.

With any permanently attached flexible cord supported in a manner which will not affect the results of the test, the blanket is placed on a test machine similar in essential features to that shown in Figs. 2A and

2B, the ends of the blanket being connected by adjustable webbing so as to make a continuous belt.

One edge of the blanket is secured over its entire length to the driving bar by means of a clamping bar as shown in Fig. 4. The clamping bar, which is constructed of semi-circular steel channels and incorporates 4 mm diameter holes placed 250 mm apart is attached to the driving bar by means of 3.5 mm diameter screws, passing through the clamp and screwing into the tapped holes in the driving bar. Attached to the lower edge of the clamping bar are wire swivels, 15 mm deep, 35 mm wide and spaced 10 mm apart, running the width of the clamping bar. Adjustable webbing straps with clips that hold the blanket are attached to the lower end of the clamp bar by means of the wire swivels. The webbing straps are adjusted so that the square section bar and carriers are lifted 50 mm above their position of rest and the tension on the straps is not subsequently altered. The straps shall be so positioned that they do not ride up on the rubber balls. The total mass of the bottom roller and bearing carriers is to be 6 kilograms per metre of attached edge of blanket, with a minimum of 6.5 kilograms. The blanket is then driven over the rollers by rotating the large driving sprocket at a speed of $33\frac{1}{3}$ r.p.m. as follows:

(i) 1000 times with an end attached to the driving bar.

1000 times with a side attached to the driving bar and the same surface in contact with the drum.

(ii) 1000 times with the previous end attached to the driving bar and the alternative surface in contact with the drum.

1000 times with the previous side attached to the driving bar and the alternative surface in contact with the drum.

The tests of (i) are carried out before the test of Clause 28 and the tests of (ii) are carried out after the tests of Clause 28 (see Subclause 4b).

When it is obvious which end of the blanket is intended to be positioned at the head of the bed, it is this end which is attached to the driving bar.

After the tests of this clause the samples shall show the following:

No damage to the enclosure or displacement of the heating element such as would impair the safety of the appliance.

No breakage of the conductors or the heating element.

No failure of constructional stitching or glued or welded joints, such as would impair the safety of the appliance.

No loosening of the flexible cord anchorage.

No loosening or breakage of connections.

No open circuiting of the heating or control circuits or control devices incorporated in the appliance.

Damage to the enclosure which would impair the safety of the appliance is, for example, cracking or tearing of the covering. Small holes in textile

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material not forming insulation or providing protection against moisture are ignored. Safety is also considered to be impaired if, for example, heating elements have moved in their pockets sufficiently for two parts of the element to come into contact with each other.

On completion of all tests, the flexible cord, if any, within the blanket is examined. In the case of ELV blankets, there shall be no breakage of wires, and for all other blankets, not more than 10 % of the wires in any one core shall be broken.

Where securing tapes or similar fixing means are provided to prevent rucking in use, the blanket is operated under the conditions specified in Subclause 9a and, when steady conditions have been attained, the following test is applied:

The enclosure of the blanket is securely held in a clamp which grips the entire edge of one side of the blanket opposite to the side incorporating fixing tapes or the like. A gradually applied pull of 50 N is applied for 1 minute to each tape or other securing means in the direction of intended use. The pull is applied 3 times to each tape or securing means, in turn. There shall be no damage to the tape or to the enclosure.

STABILITY**17. The requirements of Section A1 apply to control units only.****ABNORMAL OPERATION****18. The requirements of Section A1 apply. The tests are replaced by the following:**

a. The blanket is placed in the standard test bed as described in Subclause 4.I, and a parallel fold is arranged at any place in the blanket chosen to produce the most unfavourable results. The fold shall be at right angles to the direction of the element runs or as near to this as is practicable to avoid including thermostats, if this is possible. Where the element is located in tunnels, it is positioned in the centre of the tunnels in the fold.

For under-blankets, the whole blanket is covered by the upper lagging sheet. For pre-heating blankets, a three-thickness, 40 mm wide fold is arranged over a 400 mm length with the fold fanned out at both ends as shown in Fig. 3. For an ELV all-night under-blanket the width of the fold is 75 mm.

For over-blankets, half the wired area including the folds is covered by the upper lagging sheet which extends across the full width of the blanket and is parallel to the shorter edges of the blanket. The test is made without any top covering if this produces a more unfavourable result. A fold of any width up to 75 mm and of any number of thicknesses up to five, chosen to produce the most unfavourable results, is arranged over a 400 mm length with the fold fanned out at both ends.

The temperatures of the outer surface of the heating element are measured by fine wire thermocouples attached as prescribed in Subclause 11a. Any external switch or adjustable control unit is set at **Documentation** positions giving the most unfavourable temperature conditions in the blanket and the ambient temperature is set at that value between 0°C **Spring Club**