

# **BRITISH STANDARD 4782 : 1971**

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## **SPECIFICATION FOR BALLASTS FOR DISCHARGE LAMPS (EXCLUDING BALLASTS FOR TUBULAR FLUORESCENT LAMPS)**

**BRITISH STANDARDS INSTITUTION**  
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**SPECIFICATION FOR**  
**BALLASTS FOR DISCHARGE LAMPS**  
**(EXCLUDING BALLASTS FOR TUBULAR**  
**FLUORESCENT LAMPS)**

**BS 4782 : 1971**

**BRITISH STANDARDS INSTITUTION**

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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 5000, fully indexed and with a note of the contents of each, will be found in the British Standards Yearbook, which may be purchased from BSI Sales Department. It may also be consulted in many public libraries and similar institutions.

This standard makes reference to the following British Standards:

BS 2757. Classification of insulating materials for electrical machinery and apparatus on the basis of thermal stability in service.

BS 2782. Methods of testing plastics.

BS 3677. Schedule of fluorescent mercury discharge lamps.

BS 3767. Schedule of sodium discharge lamps.

*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 on this standard:  
Committee reference LGE/21      Draft for comment 70/24932

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## CO-OPERATING ORGANIZATIONS

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

- \*Association of Public Lighting Engineers
- British Glass Industry Research Association
- British Railways Board
- Council of British Manufacturers of Petroleum Equipment
- Department of Employment and Productivity (H.M. Factory Inspectorate)
- Department of the Environment (Building Research Station)
- Department of the Environment (Ministry of Transport)
- \*Department of the Environment (Public Building and Works)
- Department of Trade and Industry (Marine Division)
- \*Electricity Council, the Central Electricity Generating Board and the Area Boards in England and Wales
- \*Engineering Equipment Users' Association
- Glass Manufacturers' Federation
- Illuminating Engineering Society
- Institution of Electrical Engineers
- Institution of Municipal Engineers
- \*Lighting Industry Federation Ltd.
- London Transport Executive
- Ministry of Defence, Navy Department
- National Physical Laboratory (Department of Trade and Industry)
- Royal Institute of British Architects
- Society of British Gas Industries
- Society of Glass Technology

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:

- Association of Supervisory and Executive Engineers
- British Electrical and Allied Manufacturers' Association
- Electrical Contractors' Association (Incorporated)
- Electrical Sign Manufacturers' Association

BRITISH STANDARD SPECIFICATION FOR

**BALLASTS FOR HIGH PRESSURE MERCURY  
VAPOUR AND LOW PRESSURE SODIUM  
VAPOUR DISCHARGE LAMPS**

**FOREWORD**

This British Standard supersedes BS 3707 and BS 3768 which were first published, respectively, in February and July, 1964. The standard has been prepared under the authority of the Illumination Industry Standards Committee and is based upon a draft proposed by the Lighting Industry Federation.

In order to obtain satisfactory performance of sodium vapour lamps and high pressure mercury vapour lamps, together with their associated ballasts, it is necessary that certain features of their design be properly co-ordinated. However it is essential that specifications for them be written in terms of measurements made against some common baseline of reference, which must be reasonably permanent and reproducible.

These conditions may be fulfilled by special or selected inductive ballasts which are called 'reference ballasts'. These ballasts may be used for the testing of ordinary ballasts and for the selection of reference lamps.

Moreover, the testing of ballasts for discharge lamps presents particular difficulties which require a proper definition of testing methods. This testing will, in general, be made with reference lamps and, in particular, by comparing results obtained on such lamps with ballasts to be tested and with a reference ballast.

In the relation between ballast and luminaire (lighting fitting), this standard introduces a new concept: the rated maximum winding temperature  $t_w$  which must not be exceeded in order to achieve sufficient ballast life. For the time being this method is an alternative to the fixed temperature limits of the superseded standards BS 3707 and BS 3768. The concept is explained in Appendix-D.

**SPECIFICATION**

**1. GENERAL**

**1.1 SCOPE**

This British Standard comprises a general section, one covering the requirements for safety and construction and one section covering the performance of ballasts,

for use on 50 Hz supplies associated with sodium lamps having rated wattages, dimensions and characteristics as specified in BS 3767 and high pressure mercury vapour (h.p.m.v.) lamps, having rated wattages, dimensions and characteristics as specified in BS 3677.

The sections covering the requirements for safety and construction are also applicable to ballasts for high pressure sodium vapour lamps and metal halide lamps.

Safety requirements are covered by 1.1 to 1.4 inclusive and 2.1 to 2.11 inclusive.

NOTE. The titles of the British Standards referred to in this standard are listed on page 2.

## 1.2 DEFINITIONS

For the purposes of this British Standard the following definitions apply:

(1) *Ballast*. A device connected between the supply and one or more discharge lamps, which serves mainly to limit the current of the lamp or lamps to the required value.

NOTE. It may also include means for transforming from the supply voltage and arrangements to correct the power-factor and suppress radio interference.

(2) *Independent ballast*. A ballast consisting of one or more elements so designed that it (or they) can be mounted separately outside a luminaire and without an additional enclosure.

(3) *Built-in ballast*. A ballast exclusively designed to be built into a luminaire, a box, an enclosure or the like, e.g. the base compartment of a street lighting column.

(4) *Reference ballast*. A special inductive-type ballast designed for the purpose of providing comparison standards for use in testing ballasts, and for the selection of reference lamps. It is essentially characterized by a stable voltage-to-current ratio, which is relatively uninfluenced by variations in current, temperature and magnetic surroundings, as outlined in this standard.

(5) *Reference lamp*. A lamp selected for testing ballasts which, when associated with a reference ballast under the conditions specified in Appendices B and C, has electrical characteristics which are close to the values given on the appropriate lamp sheets in BS 3767 and BS 3677 within the limits defined in Appendix B.

(6) *Calibration current (of a reference ballast)*. The value of the current on which the calibration and control of the ballast are based.

NOTE. Such a current normally approximates to the nominal operating current of the lamp for which the ballast is intended.

(7) *Supply voltage*. The voltage applied to the complete circuit of lamp(s) and ballast.

(8) *Working voltage*. The highest r.m.s. voltage which may occur across any insulation, transients being neglected, in open circuit conditions or during lamp operation.

(9) *Rated voltage*. The declared voltage(s) of the supply on which the ballast is intended to be used.

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(10) *Rated maximum operating temperature (of a winding)  $t_w$* . The operating temperature of a ballast winding which gives an expectancy of 10 years' continuous service (at that temperature).

(11) *Rated temperature rise (of a winding)  $\Delta t$* . The declared temperature rise of a winding when tested in accordance with Appendix C under normal operating conditions at rated voltage and frequency.

(12) *Ballast rating*. The wattage(s) of the lamp(s) with which the ballast is intended to be used.

(13) *Short-circuit current*. The r.m.s. current passed by a short-circuiting link connected directly across the lamp terminals of the ballast circuit.

(14) *Open-circuit voltage*. The r.m.s. voltage appearing at the lamp terminals of a ballast, when the lamp is disconnected and a voltage is applied to the input terminals.

### 1.3 TESTS

**1.3.1** Tests in accordance with this British Standard are type tests. They shall be made to the requirements, under the conditions and in the order specified in Appendix C.

**1.3.2** The following numbers of samples shall be submitted:

- (1) For type tests of ballasts without temperature marking: one sample.
- (2) For type tests of ballasts with temperature  $t_w$  and temperature rise  $\Delta t$  markings: ten samples, of which seven are for the endurance test and three are for checking  $t_w$  and/or  $\Delta t$ .

### 1.4 CLASSIFICATION

Ballasts shall be classified as follows according to the method of installation:

- (1) Independent ballasts.
- (2) Built-in ballasts.

## 2. SAFETY AND CONSTRUCTIONAL REQUIREMENTS

### 2.1 CONSTRUCTIONAL REQUIREMENTS

**2.1.1 General.** Ballasts shall be mechanically robust and shall be so designed and constructed as to minimize the effects of atmospheric moisture and temperature changes during use.

Adequately robust means of fixing shall be provided.

**2.1.2 Independent ballasts.** An independent ballast shall be so designed that when correctly mounted:

- (1) any condensation falling on it shall not reach the terminals or leads;
- (2) there are no cavities on the exterior where moisture can collect;
- (3) the terminals or leads shall be readily accessible and identifiable.

## 2.2 MARKING

The following information shall be durably and legibly marked on the ballast:

- (1) Mark of origin; this may take the form of a trade mark, or the manufacturer's name or the name of the responsible vendor.
- (2) Type designation, e.g. manufacturer's catalogue number or model reference.
- (3) Rated voltage or voltage range.
- (4) Rated frequency.
- (5) Rated wattage of the lamp(s) and, if necessary, the designation of the type or types of lamp for which the ballast is designed. If the ballast is to be used with more than one lamp the number of lamps and their wattage shall be indicated.
- (6) Terminal marking, which may take the following forms:
  - a. When a ballast has more than two terminals or leads, other than earthing terminals, they shall be identified clearly and their rated voltage indicated. This may be implemented by numbering, and/or lettering, and/or colouring of the terminals or leads.
  - b. The earthing terminal (if any) shall be clearly and durably marked with the symbol  $\perp$ . This symbol shall not be placed on screws, removable washers or other removable parts.

In addition, the following marking shall be used if applicable:

- (7) Ballasts with a rated maximum operating temperature of a winding shall be marked with the claimed value following the symbol  $t_w$ . The values selected shall be in multiples of 5 °C.

Preferred values are 90 °C, 105 °C, 120 °C.

- (8) Ballasts with  $t_w$  marking may also be marked with the rated temperature rise of the winding following the symbol  $\Delta t$ .

- (9) Symbol for independent ballast, i.e. 

(10) For ballasts which, at the manufacturer's choice, have to be tested for a period of 60 days during the endurance test with the symbol D6, placed between brackets immediately after the  $t_w$  indication. The endurance test period of 30 days need not be marked.

(11) For ballasts for which a constant 'S' other than 4500 is claimed by the manufacturer, the symbol 'S' together with its appropriate value in thousands, e.g. 'S6'. The following values of 'S' are preferred: 4500, 5000, 6000, 8000, 11 000, 16 000.

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

## 2.3 TERMINALS

2.3.1 When terminals are provided they shall permit the connection of conductors with cross-sectional areas as shown in Table 1.

2.3.2 Terminal screws shall have an ISO metric thread or a thread comparable in pitch and mechanical strength and shall not be used to fix any other component.

TABLE 1. TERMINAL SIZES



| Lamp type                                      | Rating                    | Cross-sectional area of conductor           |
|------------------------------------------------|---------------------------|---------------------------------------------|
| Mercury, metal halide and high pressure sodium | Up to and including 150 W | 0.75 mm <sup>2</sup> to 2.5 mm <sup>2</sup> |
|                                                | Above 150 W               | 1.5 mm <sup>2</sup> to 4.0 mm <sup>2</sup>  |
| Low pressure sodium                            | All BS 3767 ratings       | 0.75 mm <sup>2</sup> to 2.5 mm <sup>2</sup> |

Terminals shall be fixed in such a way that they cannot work loose and that creepage distances and clearances are not reduced below the values which are given in 2.5, when the clamping screws are tightened or loosened (see Appendix C.5.1).

Terminals may be protected against loosening by two fixing screws or by a suitable locking device. Covering with sealing compounds is not considered sufficient.

Terminals shall be so designed that the core of the conductor is held between two metal surfaces and that they allow a connection to be made with adequate pressure and without damage to the conductor.

Terminals shall be so designed that the conductor cannot slip out when the screw is tightened. Further, they shall allow a wire to be connected without special preparation (such as the soldering of the strands of the conductor, use of cable lugs, formation of eyelets, etc.).

A conductor will be considered to be damaged if it shows deep incisions or shearing.

Any terminal for external wiring shall be so placed that when the connection of the conductors is correctly made there is no risk of accidental contact between live parts of opposite polarity or between such parts and accessible metal parts.

All external terminals shall be so located that the wires can be introduced and connected easily and so that the cover, if any, can be fixed without risk of damage to the wires.

NOTE. Requirements for screwless terminals are under consideration.

**2.3.3** The earthing terminal (if any) shall be of a type in which the conductor is secured by means of a screw, which shall not work loose in normal use. It shall be placed near to the main terminals.

It shall also be in effective electrical contact with all exposed metal parts and comply with the requirements of 2.3.1 and 2.3.2. The metal of the earth terminal shall be such that there is no danger of corrosion resulting from contact with the copper of the earthing conductor.

The screw and other parts of the earthing terminal shall be made of brass or other non-ferrous material, and the contact surface shall be bare metal. Parts made of iron may also be used if adequate measures are taken to prevent corrosion of these parts. It shall not be possible to loosen the earthing terminal screw without the aid of a tool. The earthing terminal shall have no other use than the earthing of the ballast.

## 2.4 SCREWS, CURRENT-CARRYING PARTS AND CONNECTIONS

**2.4.1** Screws for electrical or other purposes the failure of which might cause the ballast to become unsafe shall withstand the mechanical stresses occurring in normal use.

1

Screws transmitting contact pressure and screws having a nominal diameter less than 3 mm shall screw into metal. Compliance shall be checked by inspection and by the test given in C.5.1

**2.4.2** Screws in engagement with a thread of insulating material shall have a length of engagement of at least 3 mm plus one third of the nominal screw diameter, except that this length need not exceed 8 mm. Correct introduction of the screw into the screw hole or nut shall be ensured.

Compliance shall be checked by inspection, by measurement and by manual test.

The requirement with regard to correct introduction is met if introduction of the screw in a slanting manner is prevented, for example by guiding the screw by the part to be fixed, by a recess in the female thread or by the use of a screw with the leading thread removed.

**2.4.3.** Electrical connections shall be so designed that contact pressure is not transmitted through the insulating material other than ceramic, pure mica or other material with characteristics no less suitable, unless there is sufficient resiliency in the metal parts to compensate for any possible shrinkage of the insulating material.

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**2.4.4** Self-tapping screws shall not be used for the connection of current-carrying parts.

Self-tapping screws may be used to provide earthing continuity, provided that it is not necessary to disturb the connection in normal use and at least two screws are used for each connection.

Compliance with the requirements of **2.4.3** and **2.4.4** shall be checked by inspection.

**2.4.5** Screws and rivets which serve as electrical as well as mechanical connections shall be locked against loosening.

Compliance shall be checked by inspection and by manual test.

Spring washers may provide satisfactory locking. For rivets, a non-circular shank or an appropriate notch may be sufficient to prevent rotation.

Sealing compound which softens on heating provides satisfactory locking only for screw connections not subject to normal use.

**2.4.6** Current-carrying parts shall be of copper, an alloy containing at least 50% copper, or other metal no less resistant to corrosion than copper and having mechanical properties no less suitable.

Compliance shall be checked by inspection and by tests as appropriate.

The requirement does not apply to screws which do not essentially carry current, such as terminal screws.

## **2.5 CREEPAGE DISTANCES AND CLEARANCES**

Creepage distances and clearances shall be not less than the values given in Table 2. Creepage distances shall be measured along the external surfaces of insulating material.

The contribution to the creepage distance of any groove less than 1 mm wide shall be limited to its width.

Any air gap of less than 1 mm shall be ignored in computing the total air path.

A detachable enclosure shall have an insulating lining if, in the absence of such a lining, the creepage distance or clearance between live parts and the enclosure are smaller than the value prescribed above.

TABLE 2. CREEPAGE DISTANCES AND CLEARANCES IN AIR

|                                                                                                                                                                                                              | Creepage distances and clearances for working voltages |                                          |                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|------------------------------------------|------------------------------------------|
|                                                                                                                                                                                                              | above 24 V<br>up to and including 250 V                | above 250 V<br>up to and including 500 V | above 500 V<br>up to and including 750 V |
| <i>Creepage distance and clearance</i>                                                                                                                                                                       | mm                                                     | mm                                       | mm                                       |
| 1. between live parts of different polarity                                                                                                                                                                  | 3 (2)                                                  | 5                                        | 6                                        |
| 2. between live parts and accessible metal parts which are permanently fixed to the auxiliary, including screws or devices for fixing covers or fixing the auxiliary to its support                          | 4 (2)                                                  | 6                                        | 7                                        |
| <i>Clearance</i>                                                                                                                                                                                             |                                                        |                                          |                                          |
| 3. between live parts and a flat supporting surface or a loose metal cover, if any, if the construction does not ensure that the value under 2 above is maintained under the most unfavourable circumstances | 6                                                      | 10                                       | *                                        |

\*Under consideration.

NOTE. The values between brackets apply to creepage distances and clearances completely protected against dirt. Completely sealed-off or compound-filled distances are not checked.

## 2.6 PROTECTION AGAINST ACCIDENTAL CONTACT (FOR INDEPENDENT BALLASTS ONLY)

**2.6.1** The enclosures of independent ballasts shall have no opening giving access to live parts other than those necessary for the use and working of the auxiliary.

In addition, independent ballasts shall be so constructed and enclosed that they are sufficiently protected against accidental contact with live parts when installed as in normal use.

Lacquer or enamel is not deemed to be adequate protection or insulation for the purpose of this requirement.

**2.6.2** Parts providing protection against accidental contact shall have adequate mechanical strength and shall not work loose in normal use. It shall not be possible to remove them without the use of tools.

Compliance with regard to the protection against accidental contact shall be

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checked by means of the standard test finger shown in Fig. 6, using an electrical contact indicator. The finger shall be applied in every possible position and, if necessary, with a force of 30 N.

It is recommended that a voltage of not less than 40 V be used with an indicator lamp for the indication of electrical contact.

## 2.7 RESISTANCE TO HEAT AND FIRE

**2.7.1** External parts of insulating material, providing protection against electric shock, and parts of insulating material retaining live parts in position, shall be sufficiently resistant to heat.

Compliance shall be checked by the following test:

Enclosures and other external parts of insulating material shall be subjected to a ball-pressure test by means of the apparatus shown in Fig. 9.

The surface of the part under test shall be placed in the horizontal position and a steel ball of 5 mm diameter pressed against this surface by a force of 20 N.

The test shall be made in a heating cabinet at a temperature which is  $50 \pm 5^\circ\text{C}$  in excess of the temperature rise of the relevant part determined during the test of 2.11, with a minimum of  $125^\circ\text{C}$  for parts retaining live parts in position.

After one hour the ball shall be removed and the diameter of the impression measured. This diameter shall not exceed 2 mm.

The test shall not be made on parts of ceramic material.

NOTE. The Vicat test, as given in BS 2782, is under consideration as an alternative test.

**2.7.2** External parts of insulating material shall be resistant to abnormal heat and fire. A test to check compliance is under consideration.

## 2.8 RESISTANCE TO CORROSION

The outer surface of iron cores of built-in ballasts, if exposed, shall be adequately rust-protected, e.g. by varnish or other means.

## 2.9 MECHANICAL STRENGTH

The enclosures of independent ballasts shall have sufficient mechanical strength to allow them to withstand, without damage, the mechanical hazards resulting from the test specified in Appendix C.5.3.

## 2.10 MOISTURE RESISTANCE AND INSULATION

**2.10.1** All ballasts shall be moisture-resistant and shall not show any appreciable damage after being subjected to the moisture treatment which is described in Appendix C.5.4.

**2.10.2** Insulation shall be adequate:

- (1) between live parts of different polarity which can be separated;
- (2) between live parts and external parts including fixing screws.

The insulation resistance measured immediately after the moisture test under the conditions specified in Appendix C shall be not less than 2 MΩ.

Immediately after the insulation resistance test, the ballast shall, in addition, withstand a voltage test made under the conditions which are specified in Appendix C.5.4, the test voltage corresponding to the value given in Table 3.

**TABLE 3. TEST VOLTAGES**

| Working voltage                       | Test voltage |
|---------------------------------------|--------------|
| Up to and including 250 V             | 2000 V       |
| Above 250 V up to and including 500 V | 2500 V       |
| Above 500 V up to and including 750 V | *            |

\*Under consideration.

For the definition of working voltage, see 1.2 (8). However, for the insulation between live parts and external parts the test voltage shall be based on the rated voltage of the ballast if this voltage is higher than the working voltage.

**2.11 THERMAL REQUIREMENTS****2.11.1 Temperature rise**

**2.11.1.1** *Ballasts without temperature marking(s).* When ballasts are tested in accordance with the requirements of Appendix C.5.8.1, temperature rises shall not exceed the appropriate values given in Table 4.

**2.11.1.2**

*Limitation of ballast heating for ballasts with temperature markings.*

When the ballast is tested in accordance with the requirements of appendix C.5.8.2, the temperature shall not exceed the appropriate values given in Table 4 for the test under normal and abnormal conditions.

Unless otherwise indicated on the ballast, the limiting temperatures specified in column headed 'S4.5' in Tables 5 and 6 apply. The use of constants other than S4.5 shall be justified in accordance with appendix D.



TABLE 4. MAXIMUM TEMPERATURES

| Parts                                                                                                                                                              | Limiting temperatures                    |                                          |                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|------------------------------------------|--------------------------------------------|
|                                                                                                                                                                    | Normal operation at 100 % of rated volts | Normal operation at 110 % of rated volts | Abnormal operation at 110 % of rated volts |
|                                                                                                                                                                    | °C                                       | °C                                       | °C                                         |
| <i>a. Ballasts without temperature markings</i>                                                                                                                    |                                          |                                          |                                            |
| Windings of enamelled or varnished wire                                                                                                                            |                                          |                                          |                                            |
| – with layers separated by paper or the like                                                                                                                       |                                          | 95                                       | 170                                        |
| – with layers not separated by paper or the like                                                                                                                   |                                          | 85                                       | 170                                        |
| <i>b. Ballasts with marking of rated maximum temperature of the windings (<math>t_w</math>) and rated temperature rise of the windings (<math>\Delta t</math>)</i> |                                          |                                          |                                            |
| windings                                                                                                                                                           | $\Delta t + 25^*$                        |                                          | see Tables 5 and 6†                        |
| <i>c. For all ballasts</i>                                                                                                                                         |                                          |                                          |                                            |
| Capacitors adjacent to capacitor enclosure                                                                                                                         |                                          | 50                                       | 60                                         |
| – without temperature marking                                                                                                                                      |                                          |                                          |                                            |
| – with indication of rated maximum operating temperature ( $t_c$ )                                                                                                 |                                          | $t_c$                                    | $(t_c + 10)$                               |
| Case of an independent ballast                                                                                                                                     |                                          | 85                                       | 135                                        |
| Terminals for external wiring                                                                                                                                      |                                          | 85                                       | –                                          |
| Parts made of:                                                                                                                                                     |                                          |                                          |                                            |
| – wood-filled phenolic mouldings                                                                                                                                   |                                          | 110                                      |                                            |
| – mineral-filled phenolic mouldings                                                                                                                                |                                          | 145                                      |                                            |
| – urea mouldings                                                                                                                                                   |                                          | 90                                       |                                            |
| – melamine mouldings                                                                                                                                               |                                          | 100                                      |                                            |
| – laminated, resin-bonded paper                                                                                                                                    |                                          | 110                                      |                                            |
| – rubber                                                                                                                                                           |                                          | 70                                       |                                            |
| – thermoplastics materials                                                                                                                                         |                                          | – ‡                                      |                                            |

\*The difference between the values of  $t_w$  and the temperature rise of the windings gives an indication of the margin available for the thermal ambient immediately surrounding the ballast.

†The limiting temperatures under abnormal conditions correspond to the maximum temperature the ballast may reach during the endurance test (see Appendix C.9.). This maximum temperature corresponds to an endurance period of 20 days in the case of ballasts tested for 30 days, and 40 days for those tested for 60 days.

‡The temperature of thermoplastics material, other than that used for the insulation of the wiring, which provides protection against contact with live parts or supporting such parts, is also determined. The value so obtained will serve in order to establish the conditions of the test specified in 2.7.1.

If materials of manufacturing methods are used other than those indicated in Table 4, they shall not be exposed to temperatures higher than those that have been proved to be permissible for these materials.



The limiting temperature in Table 4 shall not be exceeded when the ballast is operated at its maximum ambient temperature. The values in the table are based on an ambient temperature of 25 °C.

The test shall be carried out according to the conditions specified in Appendix C.5.8.

**TABLE 5. LIMITING TEMPERATURES FOR 30 DAYS ENDURANCE TEST**

Limiting temperatures of windings under abnormal operating conditions and at 110 % of rated voltage for ballasts subjected to an endurance test duration of 30 days shall be:

| Constant S     | Limiting temperature (°C) |     |     |     |     |     |
|----------------|---------------------------|-----|-----|-----|-----|-----|
|                | S4.5                      | S5  | S6  | S8  | S11 | S16 |
| for $t_w =$ 90 | 171                       | 161 | 147 | 131 | 119 | 110 |
| 95             | 178                       | 168 | 154 | 138 | 125 | 115 |
| 100            | 186                       | 176 | 161 | 144 | 131 | 121 |
| 105            | 194                       | 183 | 168 | 150 | 137 | 126 |
| 110            | 201                       | 190 | 175 | 156 | 143 | 132 |
| 115            | 209                       | 198 | 181 | 163 | 149 | 137 |
| 120            | 217                       | 205 | 188 | 169 | 154 | 143 |
| 125            | 224                       | 212 | 195 | 175 | 160 | 149 |
| 130            | 232                       | 220 | 202 | 182 | 166 | 154 |
| 135            | 240                       | 227 | 209 | 188 | 172 | 160 |
| 140            | 248                       | 235 | 216 | 195 | 178 | 166 |
| 145            | 256                       | 242 | 223 | 201 | 184 | 171 |
| 150            | 264                       | 250 | 230 | 207 | 190 | 177 |



**TABLE 6. LIMITING TEMPERATURES FOR 60 DAYS ENDURANCE TEST**

Limiting temperatures of windings under abnormal operating conditions and at 110 % rated voltage for ballasts marked 'D6' that are subjected to an endurance test duration of 60 days, shall be:

| Constant $S$   | Limiting temperature ( $^{\circ}\text{C}$ ) |     |     |     |     |     |
|----------------|---------------------------------------------|-----|-----|-----|-----|-----|
|                | S4.5                                        | S5  | S6  | S8  | S11 | S16 |
| for $t_w =$ 90 | 158                                         | 150 | 139 | 125 | 115 | 107 |
| 95             | 165                                         | 157 | 145 | 131 | 121 | 112 |
| 100            | 172                                         | 164 | 152 | 137 | 127 | 118 |
| 105            | 179                                         | 171 | 158 | 144 | 132 | 123 |
| 110            | 187                                         | 178 | 165 | 150 | 138 | 129 |
| 115            | 194                                         | 185 | 171 | 156 | 144 | 134 |
| 120            | 201                                         | 192 | 178 | 162 | 150 | 140 |
| 125            | 208                                         | 199 | 184 | 168 | 155 | 145 |
| 130            | 216                                         | 206 | 191 | 174 | 161 | 151 |
| 135            | 223                                         | 213 | 198 | 180 | 167 | 156 |
| 140            | 231                                         | 220 | 204 | 186 | 173 | 162 |
| 145            | 238                                         | 227 | 211 | 193 | 179 | 168 |
| 150            | 246                                         | 234 | 218 | 199 | 184 | 173 |

NOTE 1. The difference between  $t_w$  and 55, 75 or  $\Delta t$  values gives an indication of the margin of heating available when the ballast is built into a fitting.

NOTE 2. All tests for temperature rise (normal and abnormal operation) are made at 1.1 times the rated voltage except for  $t_w$  and  $\Delta t$  tests which are made at rated voltage (see Appendix C.5.8.2).

NOTE 3. If materials or manufacturing methods other than those indicated in Table 4 are used, they shall not be exposed to temperatures higher than those which are proved to be permissible.

NOTE 4. The values in Table 4 are based on an ambient temperature of 35 °C for ballasts for high pressure mercury vapour lamps and an ambient temperature of 15 °C for ballasts for sodium vapour lamps.

NOTE 5. The temperature rises of the ballast windings under abnormal conditions correspond to a ballast life of at least 20 days.

The temperature rise values for abnormal operation relate only to switch-start ballasts for sodium lamps (see Appendix C.5.8.1).

NOTE 6. If  $t_w$  values of 125 °C and 130 °C are required, then provisionally, the constant 4500 may be used in the formula in Appendix C.5.9. A change in this constant for  $t_w$  values greater than 120 °C is under consideration (see explanatory Appendix D).

## 2.11.2 Endurance.

This test shall be applied only to ballasts that are marked with the rated maximum operating temperature ( $t_w$ ). The test shall be carried out on 7 new ballasts that have not been subjected to the preceding tests. They shall not be used for further testing.

Before the test, the ballast shall start and operate a lamp normally and the lamp arc current shall be measured under normal conditions of operation and at rated voltage. The windings of the ballasts shall withstand the thermal endurance test described in Appendix C.5.9. The thermal conditions shall be so adjusted that the objective duration of the test shall be either 30 days or 60 days for ballasts marked with 'D6'. If no indication is given, the test period shall be 30 days.

After the test, when the ballasts have returned to room temperature, they shall satisfy the following requirements:

- (a) At rated voltage the ballast shall start the same lamp, and the lamp arc current shall not exceed 115 % of the value measured before the test, as described in paragraph 2 of this subclause.

NOTE. This test is to determine any adverse change in ballast setting.

- (b) The insulation resistance between the winding and the ballast case measured at approximately 500 V d.c. shall be not less than 1 M $\Omega$ .
- (c) The ballast shall withstand a voltage test as specified in 2.10.2. The test voltage, however, shall be twice the working voltage.

The result of the test shall be considered to be satisfactory if at least 6 of the 7 ballasts satisfy these requirements. The ballasts shall be deemed not to comply with the requirements of this British Standard if more than 2 ballasts fail the test.

In the case of 2 failures, the test shall be repeated with 7 more ballasts, and if any of these ballasts fails the test, the lot shall be deemed not to comply with the requirements of this British Standard.

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### 3. PERFORMANCE REQUIREMENTS

#### 3.1 GENERAL

It may be expected that ballasts which comply with the requirements of this British Standard when associated with lamps complying with the requirements of BS 3677 or BS 3767, as appropriate, will ensure satisfactory starting and operation of the lamp at temperatures down to  $x^{\circ}\text{C}$  or up to  $y^{\circ}\text{C}$  at 92 % of rated voltage.

NOTE. The temperatures  $x^{\circ}\text{C}$  and  $y^{\circ}\text{C}$  are under consideration.

#### 3.2 OPEN-CIRCUIT VOLTAGE (FOR MERCURY BALLASTS AND STARTERLESS SODIUM BALLASTS)

At any voltage between 92 % and 106 % of its rated voltage and at rated frequency, the open-circuit voltage of the ballast shall comply with the appropriate values given in Table 7

In addition, for sodium lamp starterless ballasts only, the ratio of the peak to r.m.s. values of the open-circuit voltage waveshape shall be equal to or greater than 1.4.

**TABLE 7 OPEN-CIRCUIT VOLTAGE (50 Hz)**

| Lamp type |        | Rating       | Minimum open-circuit voltage (r.m.s.) |
|-----------|--------|--------------|---------------------------------------|
| Mercury   |        | W            | V                                     |
|           |        | 50           | 198                                   |
|           |        | 80           | 198                                   |
|           |        | 125          | 198                                   |
|           |        | 250          | 198                                   |
|           |        | 400          | 198                                   |
|           |        | 700 (LV)     | 198                                   |
|           |        | 1000 (LV)    | 198                                   |
|           |        | 1000 (HV)    | 325                                   |
|           |        | 2000         | 340                                   |
| Sodium    | U-bend | 35           | 390                                   |
|           |        | 55           | 410                                   |
|           |        | 90           | 420                                   |
|           |        | 135          | 540                                   |
|           |        | 180          | 575                                   |
|           | Linear | 60           | 510                                   |
|           |        | 140          | 430                                   |
|           |        | 175          | 610                                   |
|           |        | 200 (902 mm) | 420                                   |