



**BS 5717 : 1984**

**IEC 458 : 1982**

UDC 621.327.534.15 : 621.382.3

© British Standards Institution. No part of this publication may be photocopied or otherwise reproduced without the prior permission in writing of BSI.

---

# British Standard Specification for **Transistorized ballasts for tubular fluorescent lamps**

---

Ballasts transistorisés pour lampes tubulaires à fluorescence — Spécification

Transistorierte Vorschaltgeräte für röhrenförmige Leuchtstofflampen

**British Standards Institution**

**AVA** **Documents**  
Document Sharing Hub

## Contents

|                                                                                          | Page               |                                                                                | Page |
|------------------------------------------------------------------------------------------|--------------------|--------------------------------------------------------------------------------|------|
| National foreword                                                                        | Inside front cover | <b>Tables</b>                                                                  |      |
| Committees responsible                                                                   | Back cover         | 1. Open-circuit voltage for lamps with either high or low resistance cathodes  | 4    |
| <b>Specification</b>                                                                     |                    | 2. Dummy cathode resistors                                                     | 5    |
| Introduction                                                                             | 1                  | 3. Regulation check resistors                                                  | 6    |
| 1. Scope                                                                                 | 1                  | 4. Maximum current in any lead to a cathode (low and high-resistance cathodes) | 7    |
| 2. Definitions                                                                           | 1                  | 5a. Pulse voltages                                                             | 8    |
| 3. Marking                                                                               | 2                  | 5b. Long duration pulse voltages                                               | 8    |
| 4. General requirements                                                                  | 3                  | 5c. Short duration pulse voltages                                              | 9    |
| 5. General notes on tests                                                                | 3                  | 6. Creepage distances and clearances in air                                    | 11   |
| 6. Performance requirements                                                              | 4                  |                                                                                |      |
| 7. Safety requirements                                                                   | 7                  | <b>Figures</b>                                                                 |      |
| <b>Appendices</b>                                                                        |                    | 1. Suitable circuit for the measurement of lamp current and luminous flux      | 19   |
| A. Tests                                                                                 | 13                 | 2. Standard test finger                                                        | 20   |
| B. Reference ballasts                                                                    | 15                 | 3. Suitable circuit for producing and applying long-duration pulses            | 21   |
| C. Reference lamps                                                                       | 16                 | 4. Circuit for measuring short-duration pulse energy                           | 23   |
| D. Explanation of the derivation of the values of pulse voltages given in sub-clause 7.1 | 17                 | 5. Suitable circuit for producing and applying short-duration pulses           | 25   |

## National foreword

This British Standard has been prepared under the direction of the Electrical Illumination Standards Committee. It implements CENELEC Harmonization Document No. 302 S2 and is identical with IEC Publication 458 : 1982 'Transistorized ballasts for tubular fluorescent lamps' published by the International Electrotechnical Commission (IEC).

This standard is a revision of BS 5717 : 1979, which is withdrawn.

**Terminology and conventions.** The text of the international standard has been approved as suitable for publication as a British Standard without deviation. Some terminology and certain conventions are not identical with those used in British Standards.

Wherever page numbers are quoted, they are IEC page numbers.

## Cross-references

| International standards | Corresponding British Standards                                                                                                                  |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| IEC 81 : 1974           | BS 1853 Tubular fluorescent lamps for general lighting service<br>Part 1 : 1979 Specification for internationally specified lamps<br>(Identical) |
| IEC 82 : 1980           | BS 2818 : 1981 Specification for ballasts for tubular fluorescent lamps<br>(Identical)                                                           |
| IEC 598-1 : 1979        | BS 4533 : Luminaires<br>Part 101 : 1981 Specification for general requirements and tests<br>(Technically equivalent)                             |
| IEC 598-2-22 : 1980     | Section 102.22 : 1981 Specification for luminaires for emergency lighting<br>(Identical)                                                         |

**Textual errors.** When adopting the text of the international standard the textual errors listed below were discovered. They have been marked in the text and have been reported to IEC in a proposal to amend the text of the international standard.

In 7.3, in the final paragraph, line 2, 'Part 1. General requirements and tests' should be inserted after 'Luminaires'.

In the title of figure 1, 'luminuous' should be read as 'luminous'.

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

British Standard Specification for

## Transistorized ballasts for tubular fluorescent lamps

### INTRODUCTION

In order to obtain satisfactory performance of fluorescent lamps and transistorized ballasts, it is necessary that certain features of their designs be properly co-ordinated. It is essential, therefore, that specifications for them be written in terms of measurement made against some common base-line of reference, which must be reasonably permanent and reproducible.

These conditions may be fulfilled by reference ballasts. Moreover, the testing of ballasts for fluorescent lamps 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 accordance with IEC Publication 82: Ballasts for Tubular Fluorescent Lamps.

This standard applies to transistorized ballasts only for use with lamps which are internationally the most in demand.

### 1. Scope

This standard specifies requirements for transistorized ballasts for use on d.c. supplies, having rated voltages not exceeding 250 V, associated with fluorescent lamps with pre-heated cathodes, operated without a starter switch and complying with IEC Publication 81: Tubular Fluorescent Lamps for General Lighting Service.

This standard also covers ballasts for maintained emergency lighting. It does not cover transistorized ballasts for railways or for aircraft; independent ballasts are also excluded. Details of sampling and quantitative conditions of compliance are not included.

*Notes 1.* — The majority of applications are for extra-low voltage supplies.

2. — It may be expected that ballasts complying with this standard, when associated with lamps which comply with IEC Publication 81, will provide satisfactory starting of the lamp at an air temperature immediately around the lamp between 10 °C and 35 °C at the minimum of the rated voltage range, and operation between 10 °C and 50 °C within the rated voltage range.

3. — The lamp electrical characteristics, on the lamp data sheets in that publication, apply to lamps operated with a reference ballast at its rated voltage, in an ambient temperature of 25 °C.

### 2. Definitions

For the purpose of this standard the following definitions shall apply:

#### 2.1 Transistorized ballast

A d.c./a.c. inverter using transistors and other solid-state devices which may include stabilizing elements for supplying power to one or more fluorescent lamps.

BS 5717 : 1984

## 2.2 Rated voltage range

The voltage range marked on the ballast and the range of supply voltage over which the ballast may be operated.

## 2.3 Design voltage

The voltage declared by the manufacturer to which all the ballast characteristics are related.

## 2.4 Working voltage (symbol $U$ )

The highest r.m.s. voltage  $U$  which may occur across any insulation, transients being neglected, in open-circuit conditions or during lamp operation.

## 2.5 Ballast lumen factor

The ratio of the light output of the lamp when the ballast under test is operated at its design voltage, compared with the light output of the same lamp operated with the appropriate reference ballast at its rated voltage and frequency.

## 2.6 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 the magnetic surroundings, as outlined in this standard.

## 2.7 Maintained emergency lighting

Lighting where the lamps are energized at all times when normal or emergency lighting is required.

*Note.* — Luminaires for maintained emergency lighting are specified in IEC Publication 598-2-22, Luminaires. Part 2: Particular Requirements. Section Twenty-two — Luminaires for Emergency Lighting.

## 2.8 Maximum case temperature (symbol $t_o$ max.)

Case temperature when ballast is operated with lamp(s) alight and at the maximum voltage of the rated voltage range.

# 3. Marking

## 3.1 Mandatory

Ballasts shall be provided with durable and legible marking as follows:

- a) Mark of origin (trade mark, manufacturer's identification mark or name of the responsible supplier).
- b) Type.
- c) Wiring diagram indicating the position of terminals. In the case of ballasts not having terminals, a clear indication shall be given on the wiring diagram of the significance of the code used for the connecting wires.
- d) Rated voltage range.

*Note.* — Normally the ratio of the maximum and minimum voltages of the rated voltage should be about 1.4, but since the majority of applications are for extra-low voltage supplies a more realistic ratio would be 1.20 to 1.25. In the case of rated voltages not greater than 15 V, these should be rounded off to the nearest 0.5 V. Those above 15 V should be rounded to the nearest 1 V.

- e) Rated supply current range for the maximum permissible lamp load and for the rated voltage range.

*Note.* — Ballasts designed to operate various numbers and ratings of lamps draw different supply currents at the same supply voltage according to the constitution of their load.

- f) Rated wattage and, if necessary, the designation of the type(s) of lamp for which the ballast is designed. If the ballast is to be used with more than one lamp, the number and wattages of each lamp are to be indicated.
- g) Rated operating frequency (at design voltage with lamp operating).
- h) Open-circuit voltage and voltage to earth if this is greater.

### 3.2 *Non-mandatory*

In addition, the following information may either be marked or made available by the manufacturer.

- a) Design voltage. This value should be 80% to 95% of the maximum value of the rated voltage range.
- b) Ballast lumen factor (%).
- c) Heat sink(s) required additional to ballast.
- d) Maximum permissible case temperature, and position of measurement.
- e) Whether the ballast is suitable for use only on battery supplies not having trickle or intermittent re-charging circuits.
- f) Whether the ballast is proof against supply voltage polarity reversal.
- g) If applicable, symbol for earthing terminal.

## 4. General requirements

Ballasts shall be so designed and constructed that in normal use their performance is reliable and without danger to the user or surroundings. Capacitors and other components complying with the requirements of the relevant IEC publications for those components and not requiring additional protection shall not be subjected to further testing or appraisal as part of the ballast. Those components which rely upon the construction of the ballasts for electrical and mechanical safety shall be tested in accordance with the relevant clauses of this standard. Compliance for ballasts and other elements is checked by carrying out all the tests specified.

## 5. General notes on tests

- 5.1 The tests are type tests.
- 5.2 The tests shall be carried out in the order of the clauses unless otherwise specified.
- 5.3 The type tests shall be carried out on one sample consisting of one or more items submitted for the purpose of the type tests.

*Note.* — Certain countries require three ballasts to be tested and in such cases, if more than one ballast fails, the type is rejected. If one ballast fails, the test shall be repeated using three other ballasts and all of these shall comply with the test requirements.

## 6. Performance requirements

For ballast designs where the test conditions of Sub-clauses 6.1 and 6.2 cannot be applied, there is no requirement at present.

Tests shall be made under the conditions specified in Appendix A.

For type testing, one sample shall be taken.

*Note.* — For transistorized ballasts, for non-maintained emergency lighting, modifications of the requirements of Sub-clauses 6.1 up to and including 6.6, to permit relaxed lamp life requirements, are under consideration.

### 6.1 Open-circuit voltage at terminations of lamp

A ballast when operated at any voltage within its rated voltage range shall provide an open-circuit voltage at the lamp termination such that:

- the minimum r.m.s. voltage across the lamp is at least that shown in the third column of Table I;
- the peak voltage across the lamp does not exceed that shown in the fourth or fifth column of Table I, as applicable;
- if a starting aid is used, the minimum peak voltage from one end of the lamp to the starting aid is at least that shown in the sixth column of Table I.

When ballasts are designed to operate lamps in parallel circuits, the relevant requirements shall be met for each separate lamp, independent of the number of inserted lamps.

Lamps operated with transistorized ballasts complying with this standard shall have a starting aid as specified in IEC Publication 81, except in the case of lamps with bulb diameter 16 mm maximum where the starting aid shall be positioned 7 mm from the lamp.

TABLE I

*Open-circuit voltage for lamps with either high or low resistance cathodes*

| Rated lamp<br>wattage | Nominal<br>dimensions | Open-circuit voltage<br>at lamp terminations |                         |                          | Voltage to<br>starting aid |
|-----------------------|-----------------------|----------------------------------------------|-------------------------|--------------------------|----------------------------|
|                       |                       | Minimum                                      | Maximum (V peak)        |                          | Minimum                    |
|                       |                       |                                              | Symmetrical<br>inverter | Asymmetrical<br>inverter |                            |
| (W)                   | (mm)                  | (V r.m.s.)                                   |                         |                          | (V peak)                   |
| 6                     | 224 × 15              | 100                                          | 550                     | 700                      | 290                        |
| 8                     | 300 × 15              | 100                                          | 550                     | 700                      | 290                        |
| 13                    | 525 × 15              | 200                                          | 550                     | 700                      | 290                        |
| 15 (T8)               | 450 × 25              | 180                                          | 550                     | 700                      | 260                        |
| 20                    | 590 × 38              | 180                                          | 550                     | 700                      | 260                        |
| 30 (T8)               | 900 × 25              | 205                                          | 550                     | 700                      | 300                        |
| 30 (T12)              | 900 × 38              | 200                                          | 550                     | 700                      | 290                        |
| 40                    | 1 200 × 38            | 205                                          | 550                     | 700                      | 300                        |

During these tests, each lamp cathode shall be replaced by a resistor having a value in accordance with Table II.

*Note.* — The maximum values in Table I are higher than those recommended in IEC Publication 81, because of the greater voltage range of the supply voltage; this may lead to a decreased lamp life performance.

TABLE II

*Dummy cathode resistors*

| Rated lamp<br>wattage<br><br>(W) | Objective resistance                                       |                                                             |
|----------------------------------|------------------------------------------------------------|-------------------------------------------------------------|
|                                  | For lamps with low-<br>resistance cathodes<br>( $\Omega$ ) | For lamps with high-<br>resistance cathodes<br>( $\Omega$ ) |
| 6                                | 9                                                          | 65                                                          |
| 8                                | 9                                                          | 65                                                          |
| 13                               | 9                                                          | 65                                                          |
| 15 (T8)                          | 9                                                          | 22                                                          |
| 20                               | 9                                                          | 19                                                          |
| 30 (T8)                          | 9                                                          | 22                                                          |
| 30 (T12)                         | 9                                                          | 19                                                          |
| 40                               | 9                                                          | 19                                                          |

6.2 *Pre-heat conditions*6.2.1 *Minimum voltage across lamp cathode*

With a resistor of the objective value specified in Table II substituted for each lamp cathode and when operated at any voltage within the rated voltage range, the ballast shall deliver a voltage at each resistor of at least 3.05 V r.m.s. for low-resistance cathode lamps and of at least 6.5 V r.m.s. for high-resistance cathode lamps.

6.2.2 *Maximum voltage across lamp cathode*a) *Ballasts for lamps with low-resistance cathodes*

With a resistor of the objective value specified in Table II substituted for each lamp cathode and when operated at any voltage within the rated voltage range, the ballast shall deliver a voltage at each resistor not exceeding 6.5 V r.m.s.

b) *Ballasts for lamps with high-resistance cathodes*

With a resistor of the objective value specified in Table II substituted for each lamp cathode and when operated at any voltage within the rated voltage range, the ballast shall deliver a voltage at each resistor not exceeding 11.0 V r.m.s.

However, in those cases where the voltage does exceed either 6.5 V or 11.0 V, a regulation check shall be made using a resistor of the value specified in the second column of Table III substituted for each lamp cathode and when the ballast is operated at any voltage within its rated voltage range, the current passed by each resistor shall not exceed the appropriate value shown in the third column of Table III.

TABLE III

*Regulation check resistors*

| Rated lamp wattage<br>(W) | Regulation check resistors objective resistance<br>( $\Omega$ ) | Maximum current in regulation check resistor<br>(A r.m.s.) |
|---------------------------|-----------------------------------------------------------------|------------------------------------------------------------|
| 6                         | 31                                                              | 0.34                                                       |
| 8                         | 31                                                              | 0.34                                                       |
| 13                        | 31                                                              | 0.34                                                       |
| 15 (T8)                   | 16                                                              | 0.65                                                       |
| 20                        | 14                                                              | 0.76                                                       |
| 30 (T8)                   | 14                                                              | 0.76                                                       |
| 30 (T12)                  | 12                                                              | 0.88                                                       |
| 40                        | 12                                                              | 0.88                                                       |

**6.3 Lamp current and luminous flux**

The ballast shall limit the arc current delivered to a reference lamp to a value not exceeding 125% of that delivered to the same lamp when operated with a reference ballast. The ballast under test shall be operated at its design voltage and the appropriate reference ballast shall be operated at its rated voltage and frequency in accordance with Appendices B and C respectively.

Under the same conditions, the ratio of the luminous flux shall be not less than that derived from the ballast lumen factor.

*Note.* — Any test circuit corresponding to that of Figure 1, page 44, can be used to make the measurements.

**6.4 Supply current**

At the design voltage, the supply current shall differ by not more than  $\pm 15\%$  from the value marked on the ballast when the latter is operated with a reference lamp.

Under the same conditions, and with the addition of a non-inductive resistor in series with the input to the ballast, any r.m.s. alternating current component of the d.c. input current shall not exceed 10%. The d.c. voltage drop in the resistor shall not exceed 2% of the design voltage.

**6.5 Maximum current in any lead to a cathode**

With an appropriate reference lamp in circuit and with the ballast in normal operation and at a supply voltage equal to the maximum of the rated voltage range, the current flowing in any one of the four leads to the cathode terminations shall not exceed the value indicated in Table IV.

TABLE IV

*Maximum current in any lead to a cathode  
(low and high-resistance cathodes)*

| Rated lamp<br>wattage<br>(W) | Maximal current in any<br>lead to a cathode<br>(A) |
|------------------------------|----------------------------------------------------|
| 6                            | 0.28                                               |
| 8                            | 0.25                                               |
| 13                           | 0.29                                               |
| 15 (T8)                      | 0.55                                               |
| 20                           | 0.65                                               |
| 30 (T8)                      | 0.63                                               |
| 30 (T12)                     | 0.75                                               |
| 40                           | 0.75                                               |

#### 6.6 Lamp operating current wave-shape

The waveform of the current supplied in the steady state to a reference lamp, associated with a ballast supplied at its design voltage, shall be such that the maximum ratio of peak value to root-mean-square (r.m.s.) value shall not exceed 1.7.

#### 6.7 Endurance

The ballast shall be mounted in accordance with the manufacturer's instructions (including heat sink, if specified) and operated in association with an appropriately rated lamp(s) at the maximum voltage of the rated voltage range, and in an ambient temperature  $t$  °C, such that the maximum permissible case temperature is reached (see Item *d*) of Sub-clause 3.2).

The ballast shall then be operated in an ambient temperature which shall be varied from  $t_{\min} = (t - 5) \pm 2$  °C to  $t_{\max} = (t + 10) \pm 2$  °C;  $t_{\max}$  and  $t_{\min}$  shall be maintained for 1 h.

After five such cycles, the ambient temperature shall be maintained at  $t_{\max}$  until a total test period has passed. At the end of this time, and after cooling to room temperature, the ballast shall not show any deterioration impairing safety.

The total test period shall be as follows:

For ballasts for maintained emergency lighting: 500 h  
For all other ballasts: 200 h

All ballasts marked for emergency lighting use shall restart and operate the lamps at the design voltage of the ballast.

#### 6.8 Radio interference

No requirements at present.

#### 6.9 Acoustic noise

No requirements at present.

#### 7. Safety requirements

Tests shall be made under the conditions specified in Appendix A.