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Ballasts for tubular fluorescent lamps – Performance requirements

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**BALLASTS FOR TUBULAR FLUORESCENT LAMPS –
PERFORMANCE REQUIREMENTS**

FOREWORD

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International Standard IEC 60921 has been prepared by subcommittee 34C: Auxiliaries for lamps, of IEC technical committee 34: Lamps and related equipment

The first edition needed to be revised completely in line with changes in IEC 60081:1997, Amendment 2:2003, covering special North American requirements for voltage at lamp terminations and preheat conditions. Additionally, it was decided to delete all EMC-related requirements, as EMC varies from region to region.

This consolidated version of IEC 60921 consists of the second edition (2004) [documents 34C/642/FDIS and 34C/659/RVD] and its amendment 1 (2006) [documents 34C/728/FDIS and 34C/746/RVD].

The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience.

It bears the edition number 2.1.

A vertical line in the margin shows where the base publication has been modified by amendment 1.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

This standard is to be read in conjunction with IEC 61347-2-8.

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
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INTRODUCTION

This standard covers performance requirements for ballasts for tubular fluorescent lamps. It should be read in conjunction with IEC 61347-2-8, with which all ballasts covered by the present standard should comply.

Unless otherwise stated on the lamp data sheet mentioned in IEC 60081 and IEC 60901, it may be expected that ballasts which comply with this standard, when associated with lamps complying with IEC 60081 or IEC 60901, and, where appropriate, operated with a starter complying with IEC 60155 or starting devices complying with IEC 60927, will ensure satisfactory starting of the lamps at an air temperature immediately around the lamps between 10 °C and 35 °C and for voltages between 92 % and 106 % of rated supply voltage, and also proper operation between 10 °C and 50 °C at rated supply voltage.

The compatibility of lamps and ballasts is evaluated with the use of special inductive ballasts called “reference ballasts” having particular characteristics which are stable and reproducible. These ballasts are used when testing commercial ballasts and when selecting reference lamps. Moreover, the testing of ballasts presents particular difficulties, which require a proper definition of testing methods. Such tests will generally be made with reference lamps and, in particular, by comparing the results obtained when such lamps are operated on a reference ballast with the results obtained when the same lamps are operated on the ballast being tested.

NOTE Requirements are also included for all those features of reference ballast construction and performance which are considered necessary to ensure accurate and reproducible results when testing ballasts, particularly with regard to the selection of reference lamps.

For checking the lamp power and current of lamps operated without a starter, this standard specifies a measurement in a reference ballast circuit that makes no provision for separate power sources to heat the cathodes during lamp operation. Although the influence on the ballast specification is small, it has nevertheless been deemed useful for some pre-heated low-voltage cathode lamps, operated without a starter, to include provision for two alternative methods of measurement of lamp power and current:

- a) measurement of lamp power and current without additional cathode heating;
- b) measurement of lamp power and current with additional cathode heating.

The test method to be adopted for appraisal should be stated by the manufacturer.

Two alternative circuits are specified for the measurement of impedance at audio frequencies. The less complex circuit could be used when there is no doubt about the inductive character of the impedance. If there is any doubt, the other circuit should be used.

BALLASTS FOR TUBULAR FLUORESCENT LAMPS – PERFORMANCE REQUIREMENTS

1 Scope

This standard specifies performance requirements for ballasts, excluding resistance types, for use on a.c. supplies up to 1 000 V at 50 Hz or 60 Hz, associated with tubular fluorescent lamps with pre-heated cathodes operated with or without a starter or starting device and having rated wattages, dimensions and characteristics as specified in IEC 60081 and 60901. It applies to complete ballasts and their component parts such as resistors, transformers and capacitors.

A.C. supplied electronic ballasts for tubular fluorescent lamps for high frequency operation specified in IEC 61347-2-3 are excluded from the scope of this standard.

NOTE In some regions there are laws on EMC for luminaires. The controlgear also contributes to this EMC behaviour. See Bibliography for further references.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60081, *Double-capped fluorescent lamps – Performance specifications*

IEC 60901, *Single-capped fluorescent lamps – Performance specifications*

IEC 61347-1, *Lamp controlgear – General and safety requirements*

IEC 61347-2-8, *Lamp controlgear – Particular requirements for ballasts for fluorescent lamps*

3 Terms and definitions

For the purposes of the present document, the definitions of IEC 61347-2-8 together with the following apply.

3.1

(peak) lead circuit ballast

ballast having a leading lamp current with respect to the line voltage as a result of a capacitor which is connected in series with the lamp

4 General notes on tests

4.1 Tests according to this specification are type tests.

NOTE The requirements and tolerances permitted by this standard are based on testing of a type test sample submitted by the manufacturer for that purpose. In principle this type test sample should consist of units having characteristics typical of the manufacturer's production and be as close to the production centre point values as possible.

It may be expected with the tolerances given in the standard that products manufactured in accordance with the type test sample will comply with the standard for the majority of the production.

Due to the production spread, it is inevitable, however, that there may sometimes be ballasts outside the specified tolerances.

For guidance of sampling plans and procedures for inspection by attributes, see IEC 60410.

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

4.3 One specimen shall be submitted to all tests.

4.4 In general all tests are made on each type of ballast or, where a range of similar ballasts is involved, for each rated wattage in the range or on a representative selection from the range as agreed with the manufacturer.

4.5 The tests shall be made under the conditions specified in Annex A.

4.6 All ballasts specified in this standard shall comply with the requirements of IEC 61347-2-8.

4.7 Attention is drawn to lamp performance standards which contain "information for ballast design"; this should be followed for proper lamp operation; however, this standard does not require the testing of lamp performance as part of the type test approval for ballasts.

5 Marking

The following information shall be included either on the ballast or be made available in the manufacturer's catalogue or the like:

5.1 Circuit power-factor, for example λ 0,85.

If the power-factor is less than 0,85 leading, it shall be followed by the letter C, for example λ 0,80 C.

For ballasts intended for the additional application of operated lamps in series, the appropriate power-factors shall be included.

The following additional marking shall be included, if appropriate:

5.2 The symbol \bar{z} which indicates that the ballast is designed to comply with the conditions for audio-frequency impedance (see Clause 14).

6 Voltage at terminations of lamp or starter (if any)

The test shall be carried out in accordance with the measuring conditions of A.4.

6.1 For lamps operated with a starter

A ballast, when operated at any voltage between 92 % and 106 % of its rated voltage, shall provide the following open-circuit voltages:

- a) at terminations of the starter, an r.m.s. voltage of at least the value given in IEC 60081 or IEC 60901 on the relevant lamp data sheet;
- b) at lamp terminations, a peak voltage (excluding the surge of the starter) not exceeding the value given in IEC 60081 or IEC 60901 on the relevant lamp data sheet.

When ballasts are designed to operate lamps in parallel circuits, the relevant requirements shall be met for each separate lamp, even in the most adverse load conditions.

6.2 For lamps operated without a starter

A ballast, when operated at any voltage between 92 % and 106 % of its rated voltage, shall provide an open-circuit voltage at lamp terminations such that:

- a) its r.m.s. value is at least the value given in IEC 60081 or IEC 60901 on the relevant lamp data sheet;
- b) its peak value does not exceed the value given in IEC 60081 or IEC 60901 on the relevant lamp data sheet;
- c) its crest factor (ratio of peak value to r.m.s. value) of open circuit voltage does not exceed the value given in IEC 60081 or IEC 60901 on the relevant lamp data sheet.

When ballasts are designed to operate lamps in parallel circuits, the relevant requirements shall be met for each separate lamp, even in the most adverse load conditions.

NOTE 1 For the checking of open-circuit voltage at lamp terminations, the maximum value of the four possible measurements between lamp terminals is taken

NOTE 2 For ballasts with a step-up transformer it is likely that a capacitor is used in series to form lead circuit or peak lead circuit ballasts. A lead circuit ballast typically has an open circuit voltage crest factor of 1,55 to 2,0 and in a peak lead ballast it is 2,0 to 2,3.

6.3 For lamps operated without a starter (North American practice)

A ballast, when operated at any voltage between 90 % and 110 % of its rated voltage, shall provide an open-circuit voltage at lamp terminations such that:

- a) its r.m.s. value is not less than the minimum and not greater than the maximum values given in IEC 60081 or IEC 60901 on the relevant lamp data sheet;
- b) its peak value to starting aid is at least the value given in IEC 60081 or IEC 60901 on the relevant lamp data sheet;
- c) its crest factor (ratio of peak value to r.m.s. value) of open circuit voltage across lamp and to starting aid does not exceed the value given in IEC 60081 or IEC 60901 on the relevant lamp data sheet.

When ballasts are designed to operate lamps in parallel circuits, the relevant requirements shall be met for each separate lamp, even in the most adverse load conditions.

NOTE 1 For the checking of open-circuit voltage at lamp terminations, the maximum value of the four possible measurements between lamp terminals is taken.

NOTE 2 For ballasts with a step-up transformer it is likely that a capacitor is used in series to form lead circuit or peak lead circuit ballasts. A lead circuit ballast typically has an open circuit voltage crest factor of 1,55 to 2,0 and in a peak lead circuit ballast it is 2,0 to 2,3.