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IS 16104 (2012): d.c.OR a.c. Supplied Electronic Control Gear for LED Modules - Performance Requirements [ETD 23: Electric Lamps and their Auxiliaries]



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वाले इलेक्ट्रॉनी कंट्रोलगियर — कार्यकारिता अथवा

*Indian Standard*

d.c. OR a.c. SUPPLIED ELECTRONIC CONTROL  
GEAR FOR LED MODULES — PERFORMANCE  
REQUIREMENTS

ICS 29.140.99

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**BUREAU OF INDIAN STANDARDS**  
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NEW DELHI 110002

## FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Electric Lamps and Their Auxiliaries Sectional Committee had been approved by the Electrotechnical Division Council.

This standard specifies the d.c. or a.c. supplied electronic control gear for LED modules — Performance requirements for supply voltages up to and including 1000 V d.c. and a.c. supplies up to and including 1 000 V at 50 Hz.

The safety requirements have been covered in a separate standard IS 15885 (Part 2/Sec 13) : 2012 'Safety of lamp controlgear: Part 2 Particular requirements, Section 13 d.c. or a.c. supplied electronic controlgear for LED modules'.

This standard is to be read in conjunction with IS 15885 (Part 2/Sec 13).

This standard is based on IEC 62384 : 2006 'd.c. or a.c. supplied electronic control gear for LED modules — Performance requirements', issued by the International Electrotechnical Commission (IEC).

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

## Indian Standard

# d.c. OR a.c. SUPPLIED ELECTRONIC CONTROL GEAR FOR LED MODULES — PERFORMANCE REQUIREMENTS

### 1 SCOPE

This standard specifies performance requirements for electronic control gear for use on d.c. supplies up to 1 000 V and a.c. supplies up to 1 000 V at 50 Hz or at an output frequency which can deviate from the supply frequency, associated with LED modules according to IS 16103 (Part 1) : 2012 'LED modules for general lighting: Part 1 Safety requirements'. Control gear for LED modules specified in this standard are designed to provide constant voltage or current. Deviations from the pure voltage and current types do not exclude the gear from this standard.

#### NOTES

- 1 The tests in this standard are type tests. Requirements for testing individual control gear during production are not included.
- 2 Requirements for control gear which incorporate means for varying the output power are under consideration.
- 3 It may be expected that control gear complying with this standard will ensure satisfactory operation between 92 percent and 106 percent of the rated supply voltage, taking into account the specifications of the LED module manufacturer.

### 2 REFERENCES

The standards listed below contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed as follows:

<i>IS No.</i>	<i>Title</i>
10673 : 1983	Sampling plans and procedures for inspection by attributes for electronic items
15885 (Part 1) : 2011	Safety of lamp controlgear: Part 1 General requirements
15885 (Part 2/ Sec 13) : 2012	Safety of lamp controlgear: Part 2 Particular requirements, Section 13 d.c. or a.c. supplied electronic controlgear for LED modules

### 3 TERMS AND DEFINITIONS

For the purpose of this standard, the definitions given in IS 15885 (Part 1) and the following shall apply.

**3.1 Total Circuit Power** — Total power dissipated by control gear and LED module(s) in combination, at rated supply voltage of the control gear and at the highest rated output load.

**3.2 Circuit Power Factor** — Ratio of the measured circuit power to the product of the supply voltage (r.m.s.) and the supply current (r.m.s.).

**3.3 High Audio-Frequency Impedance Control Gear** — Control gear the impedance of which in the frequency range 250 Hz to 2 000 Hz exceeds the values specified in 11.

### 4 GENERAL NOTES ON TESTS

**4.1** The tests according to this standard 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 however, it is inevitable that there will sometimes be products outside the specified tolerances. For guidance of sampling plans and procedures for inspection by attributes, *see* IS 10673.

**4.2** For tests which are carried out with a LED module or LED modules, this (these) LED module(s) shall fulfil the following requirements:

The wattage of the LED module(s) when measured at its (their) rated voltage or rated current (d.c. and/or a.c.) shall not differ from the rated wattage by more than +6 percent and –0 percent.

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

**4.4** One specimen shall be submitted to all the tests.

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

**4.6** The tests shall be made under the conditions specified in A-1. Since up to now data of LED modules

are not published in an IEC Standard, they shall be made available by the LED module manufacturer.

4.7 All control gear covered by this standard shall comply with the requirements of IS 15885 (Part 2/ Sec 13).

4.8 The tests shall be carried out with the length of the output cable of both 20 cm and 200 cm unless otherwise declared by the manufacturer.

## 5 CLASSIFICATION

### 5.1 Classification According to the Load

- a) *Single Value Load Control Gear* — This type of control gear is designed for use with one specific output wattage range which may be dissipated by one or more LED modules.
- b) *Multiple Value Load Control Gear* — This type of control gear is designed for use with one or more LED modules with a total load within the declared wattage range.

### 5.2 Classification According to the Output Voltage

- a) Control gear having a stabilised output voltage; and
- b) Control gear without a stabilised output voltage.

### 5.3 Classification According to the Output Current

- a) Control gear having a stabilised output current; and
- b) Control gear without a stabilized output current.

## 6 MARKING

### 6.1 Mandatory Marking

6.1.1 Control gear shall be clearly marked as follows:

Circuit power factor, for example  $\lambda = 0.9$

If the power factor is less than 0.95 leading, it shall be followed by the letter 'C', for example  $\lambda = 0.9 C$ .

6.1.2 In addition to the above mandatory marking, the following information shall either be given on the control gear or made available in the manufacturer's catalogue or the like:

- a) *If applicable* — limits of the permissible temperature range;
- b) *If applicable* — an indication that the control gear has a stabilised output voltage;
- c) *If applicable* — an indication that the control gear has a stabilised output current;
- d) *If applicable* — an indication that the control

gear is suitable for operation with a mains supply dimmer; and

- e) *If applicable* — an indication of the operation mode, for example phase control.

### 6.2 Optional Marking

The following information may either be given on the control gear or made available in the manufacturer's catalogue or the like:

- a) Total circuit power;
- b) *If applicable* — the symbol  $\Sigma$  which indicates that the control gear is designed to comply with conditions for audio-frequency impedance; and
- c) *If applicable* — a symbol which indicates that the control gear is a short-circuit proof type (the symbol is under consideration).

### 6.3 BIS Certification Marking

The control gear may also be marked with the Standard Mark.

6.3.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

## 7 OUTPUT VOLTAGE AND CURRENT

### 7.1 Starting and Connecting Requirements

After starting or connecting a LED module, the output should be within 110 percent of its rated value within 2 s. Maximum current or maximum voltage shall not exceed the values given by the manufacturer. This performance is tested with the minimum rated power.

NOTE — If the output voltage is a.c., 110 percent is the percentage of the r.m.s. value, if d.c., 110 percent is the percentage of the d.c. value.

### 7.2 Voltage and Current During Operation

For control gear having a non-stabilised output voltage, when supplied with the rated supply voltage, the output voltage shall not differ by more than  $\pm 10$  percent from the rated voltage of the LED modules; for control gear having a stabilised output voltage when supplied at any supply voltage between 92 percent and 106 percent of the rated supply voltage, the output voltage shall not differ by more than  $\pm 10$  percent from the rated voltage of the LED modules.

For control gear having a non-stabilised output current, when supplied with the rated supply voltage, the output

current shall not differ by more than  $\pm 10$  percent from the rated current of the LED modules; for control gear having a stabilised output current when supplied at any supply voltage between 92 percent and 106 percent of the rated supply voltage, the output current shall not differ by more than  $\pm 10$  percent from the rated current of the LED modules.

Multiple load control gear shall be tested with both the minimum and maximum load.

### 7.3 Capacitive Load Requirement

If the LED module or any additional control unit connected to the convertor contain capacitors in the control and/or driving circuitry on the module, current pulses may be generated when connecting the LED module to the control gear. This shall not disturb the control gear overcurrent detection nor the starting process of the control gear.

For test conditions (*see* A-2) Figure 1A describes a test circuit during the starting process of the control gear and Fig. 1B describes a test circuit for connecting the load during steady state operation.

#### 7.3.1 Compliance Requirement

When connecting the measurement circuit to the control gear, the detection device shall not trip.

### 7.4 Voltage Surges During Switching and Operation

Voltage surges superimposed on the output voltage shall not exceed the values specified below (values under consideration).

## 8 TOTAL CIRCUIT POWER

At rated voltage, the total circuit power shall not be more than 110 percent of the value declared by the manufacturer, when the control gear is operated with LED module(s).

## 9 CIRCUIT POWER FACTOR

The measured circuit power factor shall not be less than the marked value by more than 0.05 when the control gear is operated on its rated wattage with LED module(s) and the whole combination is supplied with rated voltage and frequency.

## 10 SUPPLY CURRENT

At rated voltage, the supply current shall not differ by more than +10 percent from the value marked on the control gear or declared in the manufacturer's literature, when that control gear is operated on its rated wattage with LED module(s).

## 11 IMPEDANCE AT AUDIO FREQUENCIES

Control gear marked with the audio frequency symbol

≠ [*see* 6.2(b)] shall be tested in accordance with A-3 using the circuit in Fig. 2.

For every signal frequency between 400 Hz and 2 000 Hz, the impedance of the control gear when operated with the rated LED module load at rated voltage and frequency shall be inductive in characteristic. Its impedance in ohms shall be at least equal to the resistance of the resistor which would dissipate the same power as the LED module control gear combination when operating at its rated voltage and frequency. The control gear impedance is measured with a signal voltage equal to 3.5 percent of the rated supply voltage of the control gear.

Between 250 Hz and 400 Hz, the impedance shall be at least equal to half the minimum value required for frequencies between 400 Hz and 2 000 Hz.

NOTE — Radio interference suppressors consisting of capacitors of less than 0.2  $\mu\text{F}$  (total value) which may be incorporated in the control gear may be disconnected for this test.

## 12 OPERATIONAL TESTS FOR ABNORMAL CONDITIONS

The control gear shall not be damaged under following conditions :

- a) **Test without LED Module(s) Inserted** — The control gear shall be supplied with rated voltage for 1 h without LED module(s) inserted. At the end of this test, the LED module(s) shall be connected and shall operate normally.
- b) **Test for Reduced LED Module Resistance** — Under consideration.
- c) **Tests for Short-Circuit Proof Control Gear** — The control gear is short-circuited for 1 h or until a protecting device opens the circuit.

After these tests and after restoration of a possible protecting device, the control gear shall function normally.

## 13 ENDURANCE

**13.1** The control gear shall be subjected to a temperature cycling shock test and a supply voltage switching test as follows:

- a) *Temperature Cycling Shock Test* — The non-energised control gear shall be stored firstly at  $-10^{\circ}\text{C}$  or if the control gear is marked with a lower value, at that value for 1 h. The control gear is then moved into a cabinet having a temperature of  $t_c$  and stored for 1 h. Five such temperature cycles shall be carried out.
- b) *Supply Voltage Switching Test* — At rated supply voltage the control gear shall be switched on and off for 30 s. The cycling shall



be repeated 200 times with no load and 800 times with maximum load conditions.

LED modules failing during this test shall be replaced immediately.

At the end of these tests the control gear shall operate an appropriate LED module or LED modules correctly for 15 min.

**13.2** The control gear shall then be operated with an appropriate LED module/with appropriate LED

modules at rated supply voltage and at the ambient temperature which produces  $t_c$ , until a test period of 200 h has passed. At the end of this time, and after cooling down to room temperature, the control gear shall operate an appropriate LED module/appropriate LED modules correctly for 15 min. During this test the LED module(s) is (are) placed inside the test enclosure in an ambient temperature of  $25 \pm 5^\circ\text{C}$ .

**13.3** A guide to quoting product life and failure rate is given in Annex B.

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## ANNEX A

(Clauses 4.6, 7.3 and 11)

### TESTS

#### A-1 GENERAL REQUIREMENTS

##### A-1.1 General

All tests are type tests. One sample shall be submitted to all the tests.

##### A-1.2 Ambient Temperature

The tests shall be made in a draught-free room and at an ambient temperature within the range of  $20^\circ\text{C}$  to  $27^\circ\text{C}$ .

##### A-1.3 Supply Voltage and Frequency

- a) *Test Voltage and Frequency* — Unless otherwise specified, the control gear to be tested shall be operated at its rated supply voltage and frequency.

When a control gear is marked for use on a range of supply voltages, or has different separate rated supply voltages, any voltage for which it is intended may be chosen as the rated voltage.

- b) *Stability of Supply Voltage and Frequency* — During the tests, the supply voltage and the frequency shall be maintained constant within  $\pm 0.5$  percent. However, during the actual measurement, the voltage shall be adjusted to within  $\pm 0.2$  percent of the specified testing value.
- c) *Supply Voltage Waveform* — The total harmonic content of the supply voltage shall not exceed 3 percent. Harmonic content being defined as the root-mean-square (r.m.s.) summation of the individual components using the fundamental as 100 percent.

##### A-1.4 Magnetic Effects

Unless otherwise specified, no magnetic object shall be allowed within 25 mm of any outer surface of the control gear under test.

##### A-1.5 Instrument Characteristics

- a) *Potential Circuits* — Potential circuits of instruments connected across the LED module shall not pass more than 3 percent of the nominal running current of the LED module.
- b) *Current Circuits* — Instruments connected in series with the LED module shall have a sufficiently low impedance such that the voltage drop shall not exceed 2 percent of the objective LED module voltage.
- c) *rms Measurements* — Instruments shall be essentially free from errors due to waveform distortion and shall be suitable for the operating frequencies.

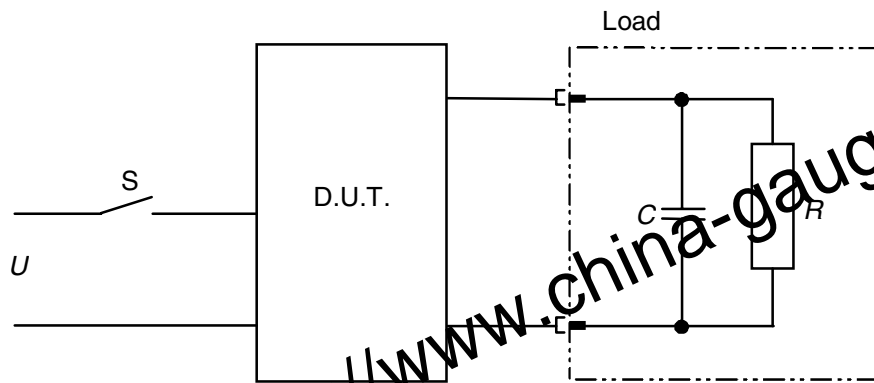
NOTE — Care shall be taken to ensure that the earth capacitance of the instruments does not disturb the operation of the unit under test. It may be necessary to ensure that the measuring point of the circuit under test is at earth potential.

#### A-2 MEASUREMENT OF CAPACITIVE LOAD CURRENT

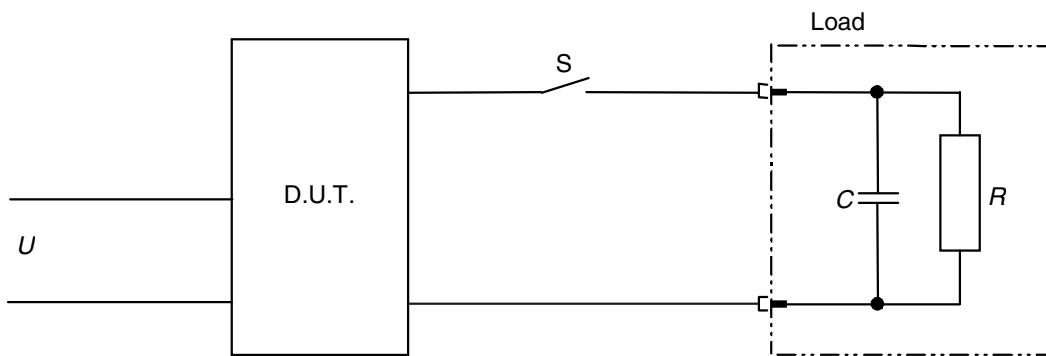
Figure 1A and 1B illustrates the test circuit for the current when connecting a load.

#### A-3 MEASUREMENT OF IMPEDANCE AT AUDIO-FREQUENCIES

The circuit of Fig. 2 illustrates a complete bridge which permits a full determination of the audio-frequency



1A Test Circuit for Current During the Starting Process



1B Test Circuit for Current when Connecting the Load During the Steady State Operation

**Key to Figures 1A and 1B**

$U$  — Supply 50 Hz (60 Hz)

$S$  — Switch

$D.U.T.$  — Control gear under test

$R$  — Resistor which gives the nominal output current of the  $D.U.T.$

For voltage sources:  $R = U^2/P_{Max}$

For current sources:  $R = P_{Max}/I^2$

$C$  — Suitable capacitor

For control gear intended to drive the LED module which includes a logic circuitry

a) for voltage sources:  $C = 20 \mu F/A$

b) for current sources:  $C = 400 \mu F$

For control gear intended to drive the LED module which does not include a logic circuitry

c) for voltage sources:  $C = 1 \mu F/A$

d) for current sources:  $C = 1 \mu F$

LOAD: Equivalent load for the LED module

All dimensions in millimetres.

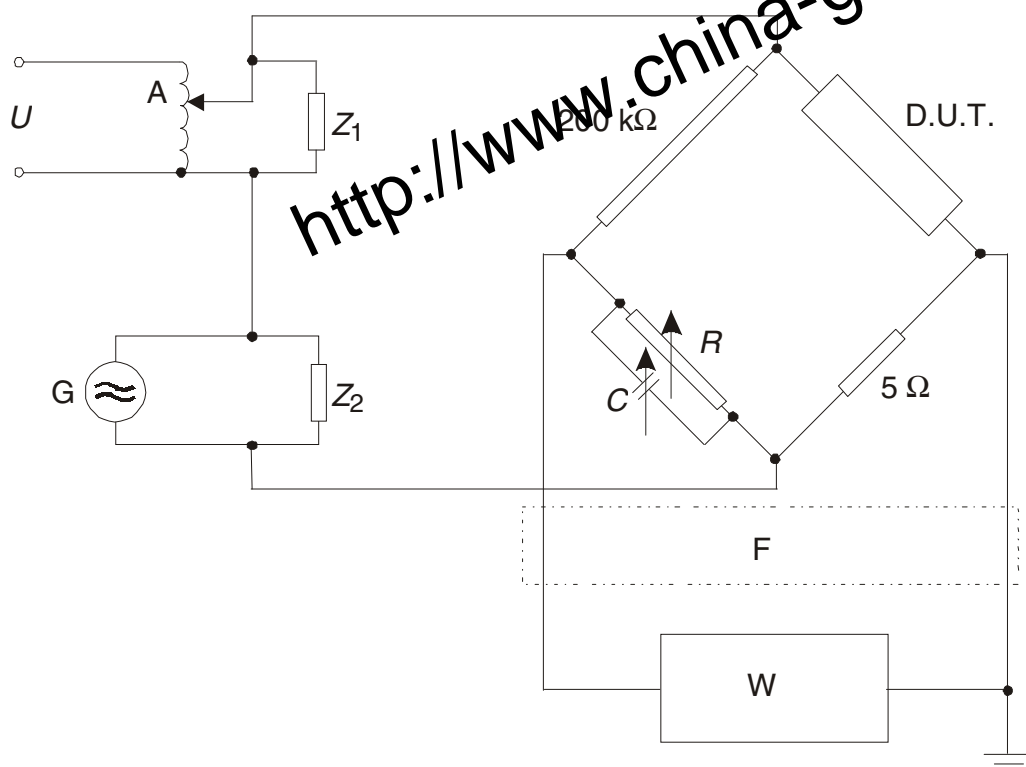
FIG. 1 TEST CIRCUIT FOR THE CURRENT WHEN CONNECTING A LOAD

impedance  $Z$  of the LED module-control gear assembly that is not only its absolute value (modulus) but its variation as well.

Let  $R'$  and  $R''$  represent the values of the resistors shown in Fig. 2 by the values of  $5 \Omega$  and  $200 \text{ k}\Omega$  respectively

(the latter at least not being critical). When by adjustments of  $R$  and  $C$  a balance is obtained for a given audio-frequency selected on the wave analyser (or any other suitable selective detector), we have in general:

$$Z = R'R''(1/R + j\omega C)$$



- $U$  — Supply 50 Hz (60 Hz)
- $G$  — Generator 250 Hz...2 000 Hz
- $A$  — Supply transformer 50 Hz (60 Hz)
- $D.U.T.$  — Controlgear — LED-module-combination under test
- $Z_1$  — Impedance of value sufficiently high for 50 Hz (60 Hz), sufficiently low for 250 Hz to 2 000 Hz (for example resistance  $15 \Omega$  and capacitance  $16 \mu\text{F}$ ).
- $Z_2$  — Impedance of value sufficiently low for 50 Hz (60 Hz), sufficiently high for 250 Hz to 2 000 Hz (for example inductance  $20 \text{ mH}$ )
- $F$  — Filter 50 Hz (60 Hz)
- $W$  — Selective voltmeter or wave analyser

NOTES

- 1 The value of  $200 \text{ k}\Omega$  for one branch of the bridge is not critical.
- 2 The impedance  $Z_1$  and/or  $Z_2$  are/is not necessary if the corresponding source has a low impedance for the currents of the other.

All dimensions in millimetres.

FIG. 2 MEASUREMENT OF IMPEDANCE AT AUDIO-FREQUENCIES

**ANNEX B**  
(Clause 13.3)

**A GUIDE TO QUOTING PRODUCT LIFE AND FAILURE RATE**

**B-1** To allow the lifetime and failure rate of different electronic products to be meaningfully compared by a user it is recommended that the following data be provided by the manufacturer in a product catalogue:

- a) Maximum surface temperature, symbol  $t_1$  ( $t$ -lifetime) of the electronic product or the maximum part temperature which affects product life, measured under normal operating conditions, at the nominal voltage or at the maximum of the rated voltage

range, that allows a life of 50 000 h to be achieved.

- b) Failure rate, if the electronic product is operated continuously at the maximum temperature  $t_1$  defined in (a)]. Failure rate should be quoted in units of failure in time (fit).

For the method used to obtain the information given in (a) and (b) (mathematical analysis, reliability test, etc), the manufacturer should, on request, provide a comprehensive data file containing the details of the method.

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### Amendments Issued Since Publication

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