Designation: F2771 – 10 (Reapproved 2016)

Standard Test Method for Determining the Luminance Curve of an Electroluminescent Lamp at Ambient Conditions[1]

This standard is issued under the fixed designation F2771; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method establishes the procedures for determining the visible performance change, which is defined by luminance, color and cosmetic appearance of an electroluminescent lamp during operation over an extended time.

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

F1595 Practice for Viewing Conditions for Visual Inspection of Membrane Switches

F2359 Test Method for Determining Color of a Membrane Switch Backlit with Diffuse Light Source

F2360 Test Method for Determining Luminance of a Membrane Switch Backlit with Diffuse Light Source

3. Terminology

3.1 *Definitions:*

3.1.1 *luminance, n*—measure of the brightness or luminous intensity of light, usually expressed in units of candelas per square metre (cd/m^2) or foot lamberts. 1 fL = 3.426 cd/m^2.

3.1.2 *luminance curve, n*—a graphical representation of the variation of luminance with time (implicitly under unvarying operating conditions).

3.1.3 *electroluminescent lamp (EL lamp), n*—essentially a capacitor structure with phosphor and a dielectric sandwiched between electrodes, one of which is transparent to allow light to escape. Application of an ac voltage across the electrodes generates a charging field within the phosphor, which causes it to emit light.

3.1.4 *time to half luminance (THL), n*—the elapsed operating time over which the luminance of a lamp maintained under constant power conditions is reduced to 50 % of its initial value.

3.1.5 *membrane switch, n*—a momentary switching device, in which at least one contact is on, or made of, a flexible substrate.

4. Summary of Test Method

4.1 This test method includes an initial measurement of the luminance, color, and appearance of a lamp when powered with a specified voltage source. After initial characterization, the lamp is maintained under the same power conditions for an extended interval in a controlled environment designed to interfere minimally with the operating characteristics of the lamp. The luminance, color and appearance of the lamps under test are measured and recorded at a predetermined schedule throughout the test (initially the intervals are shorter to capture the rapid rate of change and longer as the test progresses). One output of the measurement is to identify the time of operation by which the measured luminance is reduced to half that recorded at the initial characterization.

5. Significance and Use

5.1 To provide a standardized test method that can be used for a valid comparison of luminance time curves, color changes and cosmetic changes between lamps of various designs, fabrication techniques, and sources.

6. Interferences

6.1 *Humidity*—Performance characteristics can be skewed with the change of humidity.

6.2 *Temperature*—Performance characteristics can be skewed with the change of temperature.

6.3 *Power*—Performance characteristics can be skewed with variations in the voltage, frequency and waveform of the power applied to the lamp.

[1] This test method is under the jurisdiction of ASTM Committee F01 on Electronics and is the direct responsibility of Subcommittee F01.18 on Printed Electronics.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

7. Apparatus

7.1 Power source capable of providing an appropriate ac voltage, frequency and waveform. For example, operation at 110 ± 3 VRMS, at 400 ± 10 Hz, square wave which is prevalent in the industry.

7.2 Luminance measurement equipment as specified in Test Method F2360.

7.3 Color measurement equipment as specified in Test Method F2359.

8. Hazards

8.1 8.1 The procedure requires the verification of high voltage ac power. Proper precautions against personal hazards should be followed.

9. Preparation of Apparatus

9.1 A location should be established in which the lamp can remain while powered for the duration of the test, free from interference and in an environment of subdued ambient light. The location should minimize interference from radiance produced by other samples under test.

10. Conditioning

10.1 *Test Conditions*—It is recommended that these tests be conducted in a standard laboratory atmosphere of 23 ± 5°C and 50 ± 10 % relative humidity, for the sake of uniformity and consistency. Any variance from these conditions shall be noted.

10.1.1 Ambient life tests should be performed at a minimum of 40 % relative humidity. Dry atmospheres do not simulate typical use conditions.

10.1.2 Precondition lamp for a minimum of 12 h at temperature and humidity prior to initial measurement.

10.1.3 Power supply settings for the lamp should be established and not varied throughout the test.

11. Procedure

11.1 *Pre-Test Setup:*

11.1.1 The test sample must be powered between 3 to 10 min to allow the lamp to stabilize to test conditions and record actual duration.

11.1.2 Record date of the start of the test.

11.2 *Test Procedure:*

11.2.1 Mount EL lamp on a suitable test platform in a dark room as outlined in Test Method F2360.

11.2.2 Identify test area that is blemish free for initial measurements.

11.2.3 Before each measurement, inspect the lamp surface following Test Method F1595 to identify cosmetic blemishes, which might have occurred. Record the size and location of the blemishes. If blemishes appear in the test area of the lamp: *(a)* further quantitative measurements can be made in the same area and annotated to indicate the presence of a blemish, or *(b)* an adjacent area can be established for further use, if lamp uniformity is sufficient (any such change should be reported in the results), or *(c)* cancel the measurement series and begin test again with a new sample. It is recommended that the entire series of measurements be made without the inclusion of a discrete blemish in the measurement area.

11.2.4 Measure and record luminance and color of the lamps per Test Methods F2360 and F2359 regularly. Before each measurement, verify that the power applied remains unchanged. Significant alteration of the driving waveform will alter the appearance and the aging characteristics of the lamp. The frequency of measurement should be sufficient to allow the generation of an accurate profile of the luminance decay over time. It is suggested that a luminance change between data points should be no more than 5 % of the initial luminance.

11.2.5 For meaningful performance data the test is to continue until the luminance reaches any of the following conditions:

11.2.5.1 A luminance level that is 20-25 % of the initial luminance,

11.2.5.2 Time to half luminance (THL),

11.2.5.3 A percentage of initial luminance, and

11.2.5.4 Failure (absence of detectable luminance).

12. Calculation or Interpretation of Results

12.1 *Performance Curve:*

12.1.1 Plot a luminance curve as a function of time. See Fig. 1.

12.1.1.1 Identify THL on the curve. See Fig. 1.

12.1.2 Record color coordinates when measuring luminance.

13. Report

13.1 Report the following information:

13.1.1 Date of manufacture of sample,

13.1.2 Temperature,

13.1.3 Humidity,

13.1.4 Voltage, frequency and waveform of the power applied,

13.1.5 Packaging and storage conditions prior to test,

13.1.6 Luminance curve, and

13.1.7 Color coordinate data in tabular form as a function of time.

14. Precision and Bias

14.1 *Precision*—It is not possible to specify the precision of the procedure in Test Method F2771 for measuring the luminous curve because inter-laboratory studies have proven inconclusive due to insufficient participating laboratories with the appropriate equipment.

14.2 *Bias*—No information can be presented on the bias of the procedure in Test Method F2771 for measuring luminous curve because no standard sample is available for this industry.

15. Keywords

15.1 aging; electroluminescent; luminance; time to half luminance

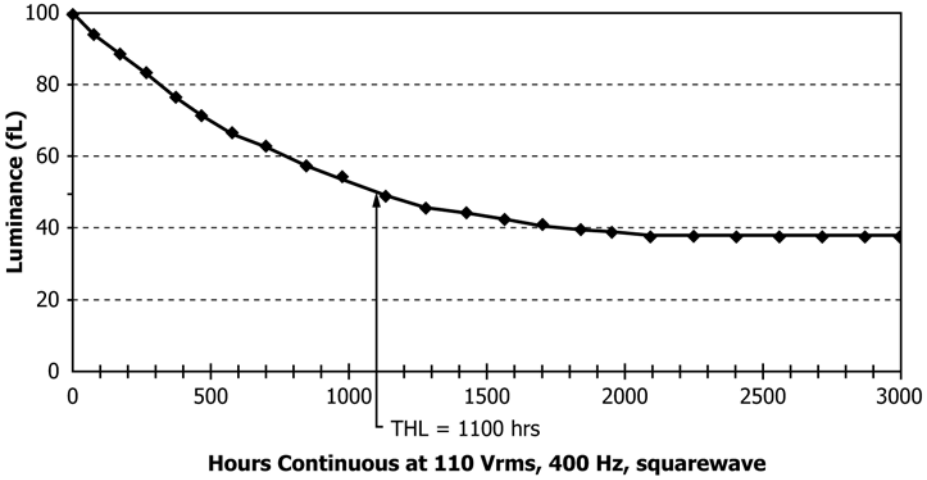

FIG. 1 Luminance Curve