LM-79-08， LM-80-08， TM-21-11

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Content

- The relationship of the three standards
  - Different applications
  - Different scope
  - The relationship
- Introduction to LM-79-08
- Introduction to LM-80-08
- Introduction to TM-21-11

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The relationship of the three standards

Different applications

- LM-79: SSL Performance testing method
- LM-80:LED Measuring Lumen Maintenance of LED Light Sources
- TM-21: LED Projecting Long Term Lumen Maintenance of LED Light Sources

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The relationship of the three standards

Different Scopes:

- LM-79： Solid State Lighting products
- LM-80： LED light sources
- TM-21： LED light sources

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The relationship of the three standards

Relationship:

- Test (LM-79)- Burning-lifetime (LM-80)-Test (LM-79)……;
- The luminous maintenance is tested according to LM-79 at different stages;
- Once having enough luminous maintenance data, taking into TM-21 model for calculation;

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Introduction to LM-79

- Approved Method: **Electrical and Photometric Measurements of Solid-State Lighting Products**

Broad scope:

- The sample can work when connecting to the power supplier;

- No need more electronic circuit , no need external heat sink;

-could be luminaire or light source

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Introduction to LM-79

- Many testing items, many test methods
- Electrical parameters ()
- Photometric parameters (luminous flux, light distribution)

  -Integrating sphere system(…;…)

  -Gonio-photometry system(…)
- Colorimetric parameters

  - Integrating sphere system(…)

  - Gonio-photometry system(…)*

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Introduction to LM-79

- Contents
- 1.0 Introduction
  - -1.1 Scope
  - -1.2 General
  - -1.3 Nomenclature and Definitions
- 2.0 Ambient Conditions
  - -2.1 General
  - -2.2 Air Temperature
  - -2.3 Thermal Conditions for Mounting SSL Products
  - -2.4 Air Movement
- 3.0 Power Supply Characteristics
  - -3.1 Waveshape of AC power supply
  - -3.2 Voltage Regulation
- 4.0 Seasoning of SSL Product

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Introduction to LM-79

- 5.0 Stabilization of SSL Product
- 6.0 Operating Orientation
- 7.0 Electrical Settings
- 8.0 Electrical Instrumentation
  - -8.1 Circuits
  - -8.2 Uncertainties
- 9.0 Test Methods for Total Luminous Flux measurement
  - -9.1 Integrating sphere with a spectroradiometer
  - -9.1.1 Integrating sphere
  - -9.1.2 Sphere geometry
  - -9.1.3 Principle of measurement
  - -9.1.4 Spectroradiometer
  - -9.1.5 Self-absorption correction
  - -9.1.6 Calibration

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Introduction to LM-79

- **9.2 Integrating sphere with a photometer head (Sphere-photometer system**
  - -9.2.1 Integrating sphere
  - -9.2.2 Sphere geometry
  - -9.2.3 Principle of measurement
  - -9.2.4 Photometer head
  - -9.2.5 Self-absorption correction
  - -9.2.6 Determination of *f*'1, and Spectral Mismatch Correction Factor
  - -9.2.7 Calibration
- **9.3 Goniophotometer**
  - -9.3.1 Type of Goniometer
  - -9.3.2 Principle of Total Luminous Flux Measurement
  - -9.3.3 Scanning resolution
  - -9.3.4 Angle coverage
  - -9.3.5 Polarization
  - -9.3.6 Photometer head
  - -9.3.7 Calibration

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Introduction to LM-79

- 10.0 Luminous Intensity Distribution
- 11.0 Luminous Efficacy
- 12.0 Test Methods for Color Characteristics of SSL Products
  - -12.1 Method using a sphere-spectroradiometer system
  - -12.2 Method using a spectroradiometer or colorimeter spatially scanned
  - -12.3 Spectroradiometer parameters impacting measured color characteristics
  - -12.4 Colorimetric calculations
  - -12.5 Spatial non-uniformity of chromaticity
- 13.0 Uncertainty statement
- 14.0 Test Report
- References
- Annex (Informative)

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Introduction to LM-80

IES Approved Method for Measuring Lumen Maintenance of LED Light Sources

For LED engine, LED package, LED module

Only consider the failure model of luminous maintenance

Need external supports

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Introduction to LM-80

The choice of temperature testing point

Three temperature testing points

The key matters need to take care during the temperature control

The requirements in humidity control

The requirement of power supplier

The time cycle of continuous burning

The requirement of performance testing

Interval of testing

Total burning hours

Sampling rules, how many samples?

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Introduction to LM-80

1.0 Scope

2.0 References

2.1 Normative References

2.2 Non-Normative References

3.0 Definitions

3.1 Measurement Units

3.2 LED Source

3.3 Lumen Maintenance

3.4 Lumen Maintenance Life

3.5 LED Source Failure

3.6 Rated Lumen Maintenance Life, (Lp)

3.7 Case Temperature, (Ts)

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Introduction to LM-80

4.0 Ambient and Physical Conditions .

4.1 General

4.2 LED Unit Marking

4.3 Sample Selection

4.4 Environmental Conditions

4.4.1 Vibration

4.4.2 Temperature and Humidity

4.4.3 Airflow

4.4.4 Operating orientation and LED Unit Spacing

5.0 Electrical and Thermal Conditions

5.1 Input Voltage and Current

5.2 Line Voltage Waveshape

5.3 Input Current Regulation

5.4 Auxiliary Equipment including Drivers

5.5 Case Temperature

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Introduction to LM-80

6.0 Test and Measurement Procedures

6.1 Instrumentation

6.2 Photometry Measurement

6.3 Photometry Measurement Temperature

7.0 Lumen Maintenance Testing Method for LED Light Sources

7.1 Lumen Maintenance Testing Duration and Interval

7.2 Operating Cycle

7.3 Recording Failures

7.4 Chromaticity

8.0 Test Report

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Introduction to TM-21

Projecting Long Term Lumen Maintenance of LED Light Sources

Use the LM-80 data for calculation

Luminous maintenance

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Introduction to TM-21

- Sample size and calculation data
- It is encourage to adopt short interval and long time data
- Two calculations：
  -At the same burning conditions
  -The temperature of the actual temperature testing point
- The calculation from the same burning conditions
  -data collection and pre-processing
  -calculation tool
  -results
  -same process at the different temperatures
- The calculation from the actual temperature testing point
  - actual temperature is between two temperatures getting from the data

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Introduction to TM-21

- Scope
- Normative References
- Definitions
  - LED Light Source
  - DUT
  - Lumen Maintenance Life
- Test Data and Sample Size
  - Data to be Used
  - Sample Size Recommendation
  - Luminous Flux Data Collection

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Introduction to TM-21

- Lumen Maintenance Life Projection
  - Method
  - Procedures
    - Normalization
    - Average
    - Data Used for Curve-fit
    - Curve-fit
    - Adjustment of Results
    - Notation for Lumen Maintenance Life
- Temperature Data Interpolation
  - Selection of Test Case Temperatures
  - Convert All Temperatures to Kelvins
  - Use the Arrhenius Equation to Calculate the Interpolate Lumen Maintenance Life
  - Applicability of the Arrhenius Equation
  - Limit for Extrapolation
- Report

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