ISA Recommendation

Performance Requirements on Indoor Ultraviolet LED Mosquito Light Traps

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International Solid State Lighting Alliance

Technical Committee on Standardization

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Foreword

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Content

Performance Requirements for Indoor Ultraviolet LED Mosquito Traps

1 Introduction

This document will effectively clarify the product parameters and performance indicators of UV LED mosquito traps, and further standardize the existing UV LED mosquito UV LED mosquito trap market.

2 Scope

This document specifies the technical requirements and test methods for ultraviolet LED mosquito traps (hereinafter referred to as "mosquito traps").

This document is applicable to all kinds of indoor ultraviolet LED mosquito traps with light source peak wavelength ranging from 365 nm to 400 nm, odor, temperature, carbon dioxide and other auxiliary LED ultraviolet mosquito traps, which can be used as a reference.

3 Normative references

The following documents are referenced to in the text in such a way that some or all of their content constitutes requirements 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.

CIE S 009/E:2002 *Photobiological Safety of Lamps and Lamp Systems*

CISPR 14-1 *Electromagnetic compatibility-Requirements for household appliances,electric tools and similar apparatus-Part 1:Emission*

CISPR 14-2 *Electromagnetic compatibility-Requirements for household appliances,electric tools and similar apparatus-Part 2:lmmunity*

IEC 60050-845:1987 *Electrotechnical terminology-Lighting*

IEC 60068-2-1 *Environmental testing-Part 2:Test methods-Tests A:Cold*

IEC 60068-2-2 *Environmental testing-Part 2:Test methods-Tests B:Dry heat*

IEC 60068-2-78 *Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state*

IEC 60068-2-14 *Environmental testing-Part 2:Test methods-Tests N:Chang of temperature*

IEC 60335-1/ED 4.1 *Household and similar electrical appliances-Safety-Part 1:General requirements*

IEC 60335-2-59/ED 3.2 *Household and similar electrical appliances-Safety-Part 2-59:Particular*

requirements for insect killers

IEC 61000-3-2 *Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤16 A per phase)*

IEC 62717 *LED modules for general lighting - Performance requirements*

4 Terms and definitions

The following terms and definitions defined in IEC 60050-845:1987, IEC 60335-2-59:2006/ED 3.1, CIE S 009/E:2002 apply to this document.

4.1 ultraviolet LED mosquito light trap

According to the characteristics of mosquitoes' phototaxis to a specific ultraviolet spectrum, special devices that use LED ultraviolet light sources to trap and effectively kill mosquitoes may include light sources, power grids, motors, power supplies, and control device.

4.2 radiant flux,radiant power

Φe；Φ；P

The power emitted, transmitted, or received in the form of radiation.

Units: W.

4.3 lifetime

Under specified conditions, the cumulative ignition time when the ultraviolet radiation flux of the 50% light source decays to 70% of the initial value.

Units: h.

4.4 ultraviolate radiation flux maintenance

The light source is ignited under specified conditions, and the ratio of the ultraviolet radiation flux at a specific time to the initial ultraviolet radiation flux during the life span is expressed as a percentage.

4.5 effective irradiance

The radiance of electromagnetic radiation weighted according to the prescribed action curve.

5 Technical requirements

5.1 Structure and appearance

5.1.1 Structure

Structure Mosquito traps are required to have a firm structure and will not pose a danger to the user or the surrounding environment in normal use.

5.1.2 Appearance

The mosquito trap should have no obvious damage, deformation, cracks, stains, rust and other defects, no burrs at sharp corners, no looseness, no missing assembly, and good coating adhesion.

During the service life, there should be no obvious appearance quality changes.

5.2 Safety performance

Mosquito traps should meet the safety requirements of IEC 60335-2-59:2006/ED 3.1.

5.3 EMC performance

5.3.1 The input current harmonics of the mosquito trap should meet the requirements of IEC 61000-3-2.

5.3.2 The radio disturbance characteristics of mosquito traps should meet the requirements of CISPR 14-1.

5.3.3 The electromagnetic compatibility and immunity of mosquito traps should meet the requirements of CISPR 14-2.

5.4 Environmental adaptation

The mosquito trap should be able to work normally in an environment with a temperature of -10 ℃～50 ℃ and a relative humidity of not more than 93%.

5.5 Electrical Characteristics

5.5.1 Power

The measured power of the mosquito trap does not differ from the nominal power by more than 10%.

5.5.2 Power factor

If the mosquito trap adopts an alternating current working plan, the actual power factor of the mosquito trap should not be less than 0.05 of the manufacturer's nominal value when the mosquito trap is working at the rated voltage and rated frequency.

The power factor of mosquito traps with a nominal power of no more than 5 W should be no less than 0.5, and the power factor of mosquito traps with a nominal power greater than 5 W should be no less than 0.7. If the mosquito trap is declared to have a high power factor, it should be no less than 0.9.

If the mosquito trap adopts a direct current working scheme, the requirements of this chapter do not apply to this scheme.

5.6 Optical Characteristics

5.6.1 Radiant flux

The radiation flux of the mosquito trap should not be less than 90% of the nominal value.

5.6.2 Spectral power distribution

The peak wavelength range of the ultraviolet LED light source should be between 365 nm and 400 nm.

Note: A data report of the spectral power distribution of radiant flux should be provided.

5.7 Reliability

5.7.1 Life

When the peak wavelength of the ultraviolet LED light source is within the range of 365 nm to 370 nm (inclusive), the lifetime of the ultraviolet LED light source should not be less than 7 500 h.

Under rated working conditions, the radiant flux maintenance rate for 1 500 h is not less than 93%; the radiant flux maintenance rate for 3 000 h is not less than 87%.

When the peak wavelength of the ultraviolet light source is in the range of 370 nm to 400 nm, the life of the ultraviolet LED light source should not be less than 15 000 h.

Under rated working conditions, the maintenance rate of radiant flux for 3 000 h is not less than 93%; the maintenance rate of radiant flux for 6 000 h is not less than 87%.

5.7.2 Switching times

After the mosquito trap has passed the switch test at least 5,000 times, it should still be able to work normally.

5.8 Radiation, toxicity and similar hazards

The effective radiation of the mosquito trap should meet the requirements of Ed 3.2 of IEC60335-2-59:2009.

5.9 Evaluation on anti-mosquito effect

The trapping rate of mosquito traps should be graded and evaluated according to Table 1.

Table 1 Classification of killing rates of different types of mosquito traps

Grade	Kill rate
Class A	20%≤P＜40%
Class B	40%≤P＜60%
Class C	P≥60%

5.10 Installation requirements

The recommended placement of mosquito traps should be combined with the actual place of use, and the precautions for its use should be indicated in the product manual.

5.11 Control functions

5.11.1 General requirements

Mosquito traps should have functions such as short-circuit prevention and current leakage prevention. Users can add functions such as remote communication and control, working status

detection and display according to their needs.

Functions such as automatic insect removal, wireless remote control, and automatic fault alarm can also be added as needed.

5.11.2 Time control function

Mosquito traps with time control function should be able to start or stop working at the set time, and the error should not exceed 10 min.

5.11.3 Remote communication and control

For mosquito traps with remote communication and control functions, real-time information is sent back to the master control terminal through the display of the machine, wireless base station and remote communication module. Control functions and other operations.

5.11.4 Working status detection and display

For mosquito traps with time control function, the control system can also include indication and display functions of basic working information such as the working status and malfunction of the mosquito trap.

5.11.5 Other protection

functions Mosquito traps should also have functions such as power-on self-test, dumping and power failure, and over-temperature protection.

6 Test method

6.1 Structure and appearance

Visual inspection.

6.2 Safety performance

The safety performance of the mosquito trap is tested in accordance with the method of IEC 60335-1/ED 4.1.

6.3 EMC Performance

6.3.1 The input current harmonics of the mosquito trap should be tested in accordance with the method of IEC 61000-3-2.

6.3.2 The radio disturbance characteristics of mosquito traps should be tested in accordance with the method of CISPR 14-1.

6.3.3 The electromagnetic compatibility immunity of mosquito traps should be tested in accordance with the method of CISPR 14-2.

6.4 Environmental adaptation

6.4.1 High temperature operation test

According to the provisions of CISPR 14-2: The test should be carried out in a test box, under the

condition of (nominal maximum working temperature + 10 ℃, relative humidity not exceeding 50%), the temperature tolerance is ± 2 K, and the continuous test is 168 h. At the end of the test, the test sample should be kept in the test box to restore the temperature to the ambient temperature at a rate of change not exceeding 1 K/min, and stabilize for 2 h. After the test, there should be no obvious damage to the sample, and the change in ultraviolet radiation flux should not exceed 10%.

6.4.2 Low temperature start test

According to the provisions of CISPR 14-1: The test should be carried out in a test box, under the condition of (nominal maximum working temperature -10 ℃), the temperature tolerance is ±2 K, and the temperature in the test box reaches the specified value and stabilizes 2 h, then the test sample is subjected to 300 cycles of 1 min on and 19 min off. The sample after the end of the cycle should be able to light up within 5 s in the low temperature state.When the test is over, the test sample should be kept in the test box to restore the temperature to the ambient temperature at a rate of change of not more than 1 K/min, and stabilize for 2 h. After the test, there should be no obvious damage to the sample, and the change in ultraviolet radiation flux should not exceed 10%.

6.4.3 High and low temperature impact test

According to the provisions of IEC 60068-2-14: The test should be carried out in a test box, with a low temperature of -10 ℃, exposure for 2 h, and a high temperature of 70 ℃, exposure for 2 h, one cycle, 15 cycles. After the test, there should be no obvious damage to the sample, and the change in ultraviolet radiation flux should not exceed 10%.

6.4.4 Constant damp heat test

According to the provisions of IEC 60068-2-78: The test should be carried out in a test box. The temperature in the test box is adjusted to 40 ℃±2 ℃, and then the relative humidity of the test box is adjusted to 93%±3% within 2 hours. After stabilization, a cycle of 60 min on and 120 min off is a cycle, and the cycle duration is 168 h. After the test, there should be no obvious damage to the sample, and the change in ultraviolet radiation flux should not exceed 10%.

6.5 Electrical Characteristics

The electrical characteristics are tested in accordance with the method in Appendix A of IEC62717.

6.6 Optical Characteristics

6.6.1 Radiant fiux

The radiant flux is measured in accordance with Appendix A of IEC62717, using a distributed radiometer/distributed spectroradiometer or integrating sphere radiometer/integrating sphere spectroradiometer to measure the total radiant flux of the UVA LED module. Use the integrating sphere radiometer/integrating sphere spectral radiometer, the inner wall coating of the integrating sphere should have flat spectral responsivity and no fluorescence in the measured ultraviolet band; should use the same spatial radiation distribution as the measured UVA LED module Reference standard lamp calibration system.

Note: The basic measurement principles and methods of radiant flux and luminous flux are

basically the same, but the requirements for optical radiation detectors are different.

6.6.2 Spectral power distribution

The spectral power distribution is tested in accordance with the method in Appendix A of IEC62717.

6.7 Reliability

6.7.1 Life

The life is tested in accordance with the method in Chapter 10 of IEC62717.

6.7.2 Switching times

Put the mosquito trap under the rated working conditions, assuming that it is turned on for 30 seconds and turned off for 30 seconds as a cycle. After continuous at least 5,000 cycles of the test, the product can still work normally.

6.8 Radiation, toxicity and similar hazards

Mosquito traps should be tested in accordance with the method in Chapter 32 of IEC 60335-2-59.

6.9 Evaluation of anti-mosquito effect

6.9.1 Test insects

Culex pipienspallens, Culex pipiensquinquefasciatus, Aedes albopictus Aedes albopictus, 3 to 5 days after emergence of adults (females do not suck blood), half male and female.

6.9.2 Equipment

The test room is approximately a square room with a volume of 28 m3 and a height of not less than 2.5 m. The two walls are equipped with closed glass windows that can observe each corner.

6.9.3 Test conditions

The temperature is 26±1 ℃, and the relative humidity is 65%±10%.

6.9.4 Test procedure

The test time is set to 24 h, starting at 5 pm. Place the tested device in the center of the test room with the light source 1.5 m away from the ground, put 100 mosquitoes into the test room, close the doors and windows, and switch on the tested device after the test insects return to normal activities. By 5 pm the next day, turn off the power and check the number of dead test insects. The test is set to be repeated more than 3 times, and a blank control test is set.

6.9.5 Calculation

The data of repeated testing is calculated and corrected for the kill rate according to formula (1) and formula (2), keeping 2 decimal places. The blank control mortality rate is less than 5%, no correction; the blank control mortality rate is 5% to 20%, corrected; the blank control mortality rate is greater than 20%, the experiment is invalid.

$$P = \frac{K}{N} \times 100\% \quad \cdots\cdots (1)$$

In the formula:

P—hunting rate;

K—the number of dead insects, units: PCS;

N—total number of insects to be processed, units: PCS.

$$P_l = \frac{P_t - P_0}{1 - P_0} \times 100\% \quad \cdots\cdots (2)$$

In the formula:

Pl—corrected killing rate;

Pt—processing and killing rate;

P0—control mortality.