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Agenda item 9

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Working Group WG1

Author(s) / Submitter(s ) Mr. Ho-Jin Lee / Ministry of Oceans and Fisheries(Korea)

Mr. Ji-Min Yeo / Korea Association of Aids to Navigation

Establishment of the Korean Industrial Standards for Lanterns and Charging Controller

Related Recommendation: IALA Recommendation E-200-1~5('08.12)

Since 2002, the Republic of Korea has implemented an inspection system for the performance of AtoN equipment and supplies. Inspection of AtoN equipment and supplies is based on IALA recommendations. All lanterns are regularly inspected before use (once every three years).

The inspection system for the performance of AtoN equipment and supplies has been contributing to the marine traffic safety and has been enhancing AtoN user satisfaction by improving the quality of equipment and supplies and maintaining the high performance level.

In the Republic of Korea, on December 21, 2016, the Korean Industrial Standard (KS) for lantern (light-bulb, LED) and charging controller was established to further strengthen the quality control of AtoN equipment and Supplies.

The KS is a national standard based on the Industrial Standardization Act. Development of KS to be notified by Korean Agency for Technology and Standards (KATS) after getting approval from Korean Industrial Standards Commission. The KS for AtoN equipment and supplies is expected to not only improve the skill and technology of manufacturers but also enhance the performance and quality of the product.

「Safety and Performance requirement for LED lanterns」, one of the KS, are as follows. The Republic of Korea believes that it is necessary to operate the inspection system to improve the quality and performance of AtoN equipment and supplies, and IALA member is recommended to refer to this.

**LED Lantern for Aids to Navigation – Safety and Performance Requirements (Korean Industrial Standards)**

# scope of application

This standard set forth for the requirements for the safety and performance of LED lantern (here in after referred to “lantern”) for AtoN using LED module as a light source.

# Normative reference

The following citation standard are indispensable for its application on all or part. Citation standard with the year of publication, it applies only the edition cited. Citation standard does not have published year, it applies the latest edition of the referenced document (including any amendments) applies.

**KS C 8541,** Lithium Secondary Cells and Batteries : General

**KS C IEC 60050-845,** International Electro-technical Vocabulary － Chapter 845：Lighting

**KS D 9502,** METHODS OF NEUTRAL SALT SPRAY TESTING (NEUTRAL SALT, ACETIC ACID AND CASS TEST)

**KS C IEC 60068-2-5,** Environmental testing-Part2: Tests. Test Sa : Simulated solar radiation at ground level

**KS C IEC 60068-2-52,** Household and similar electrical appliances - Safety－Part 2－7：Particular requirements for washing machines

**KS C IEC 60529,** Degrees of protection provided by enclosures (IP Code)

**KS C IEC 60598-1,** Luminaires － Part 1：General requirements and tests

**KS C IEC 61547,** Equipment for general lighting purposes — EMC immunity requirements

**KS C CISPR 15,** Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment

**IALA Recommendations E-200-1,** Colour

**IALA Recommendations E-200-2,** Calculation, Definition and Notation of Luminous Range

**IALA Recommendations E-200-3,** Measurement

**IALA Recommendations E-200-4,** Determination and Calculation of Effective Intensity

ASTM D 256, Standard test methods for determining the izod pendulum impact resistance of plastics

ASTM D 638, Standard test method for tensile properties of plastics

ASTM D 648, Standard test method for deflection temperature of plastics under flexural load in the edgewise position

ASTM D 790, Standard test methods for flexural properties of unreinforced and reinforced plastics and electrical insulating materials

ASTM D 1003, Standard test method for haze and luminous transmittance of transparent plastics

# Terms and definitions

The terms, definitions and following apply to specified in IEC 60050-845 and IALA Recommendations E-200 series for the purpose of this standard.

## LED lantern

The LED lantern is lighting equipment that displays the location and function of the lighthouse, light beacon, light ship, light pole and bridge lights, light buoy. The light from the light source using the led module that refracted and reflected using the lens or reflector and then collecting the light using a light emitted to the outside.

## LED module

A device used as a light source including at least one LED and electrical and electronic components. Converters are excluded.

## Flashing lantern

The method of fixing optical system and flashing a light source. The lantern uses a fixed lens.

## Rotating lantern

Rotating the lens or the whole of the optical system of the upper lantern body for rotating.

## Rated voltage

The input voltage or voltage range of the lantern that manufacturer appears on the lantern body case.

## Rated power

The input power of the manufacturer lantern displayed in the body case.

## Light colour

The light radiated from the lantern and separated by white, red, green, yellow, blue / yellow.

## Rhythm characteristics

Lighthouse as well as the entire overnight indicator facilitates identification of light and general light. And defined the radiation period and characteristics of light for avoid the mistaken for another near night AtoN.

## Chromaticity

The characteristic of the colour stimulus can be defined by chromaticity coordinates, or dominant wave length (or complementary wave length) and purity.

## Fixed intensity

The intensity value of light that when maintained constant intensity, no darkness then.

## Effective intensity

The intensity value of rhythm characteristics that become flash by rotating flashing.

## Visible distance

The maximum distance that the light reached from the lantern.

## Nominal range of light

Visible distance of the uniform atmosphere (atmospheric transmittance 0.74) on a meteorological visibility 10 nautical mile (NM).

# Type(Format)

Type of lantern is separated as shown in Table 1 according to the light color, visible distance, Rhythm characteristics implementation method.

1. Type classification of lantern

|  |  |
| --- | --- |
| **Division** | **Kind** |
| **light color** | White |
| Red |
| Green |
| Yellow |
| Blue/Yellow |
| **Visible distance** | 3 NM |
| 5 NM |
| 7 NM |
| 8 NM |
| 10 NM |
| 15 NM |
| 18 NM |
| 20 NM |
| 26 NM |
| 27 NM |
| Rhythm characteristics implementation method | Flashing |
| Rotating |

Note : Nautical Mile (NM) does not belong to unit of length in the International System of Units   
 but used the marine field. It is used to define the international laws and treaties,   
 in particular the territorial sea.

# General information about the test

## General requirement and test

Lantern must be designed and manufactured to safety operation in normal use and so as not any risk to people and environment.

Compliance is determined by all the tests specified in the standard or the human eye.

## General details of test

The standard test is a type test.

Requirements and tolerances allowed by the standards are based on the experiments of the type test sample submitted by the manufacturer for the purpose. In principle, the type test sample must have a characteristic which represents the product of the manufacturer and is preferably close to the possible production centre point value.

All tests should be tested in the ambient temperature unless otherwise specified in the range of 10 ℃ 30 ℃

The test voltage may have a tolerance of ± 3%. Voltage range is measured from the mean value.

In addition, the total harmonic components cannot exceed the 3%. The harmonic components is defined as r.m.s sum of each harmonic components using the fundamental wave by 100%.

# Safety requirements

## Labelling requirement

### Product labelling requirement

It should be clear and robust displays the following information easliy indelibly way on the lantern bottom lantern body case for easy viewing.

a) The manufacturer's name or abbreviation

b) Rated voltage(**V**)/Rated power(**W**)

c) Light color(white, red, green, yellow, blue/yellow)

d) Manufacturing month and year

e) Production number and model name

f) Visible distance(NM)

g) Approval number

h) IP grade

i) The following information shall be displayed near the ground position of the lantern.

Ground position mark (EMB00006be0336b ) or Ground position mark (EMB00006be0336f )

### Packaging labelling

The manufacturer shall display the additional following issues on the manual or minimum packaging unit.

a) By weight including the control device (kg)

b) Lantern size (width (mm) x height (mm))

c) Rated current (A)

d) Rhythm characteristics implementation method

e) IP grade

f) A/S contact

g) Place of origin

### Instructions for use

If you have any special notice when you use the Lantern, it shall indicate on the packaging box or manual for users to easily view

### The durability of the display and ease of identification

Indication must be durable and be easy to read. Compliance is checked for gently rub for 15 seconds with a piece of cloth dampened with water and then dried and more rub for 15 seconds with a cloth soaked in petroleum spirit pieces

After test, displayed letters must be easy to read and the labels must be to not easily remove.

The petroleum spirit used should consist of nucleic acid solvent, containing the bulk of up to 0.1% fragrance, Curie-butanol 29%, 65 ℃ degree of initial boiling point, degree of 69 ℃ drying temperature and density of about 0.68 g / cm3.

## Structure

### Flashing lantern is to be divided into upper body and lower body.

Appearance of the Lantern is possible to design and dimensional changes within range dimension by visible distance to improve performance. Dimensions are shown in Table 2 by visible distance. Tolerance of dimension is to be ± 5%.

1. Appearance of the Lantern by visible distance

|  |  |  |  |
| --- | --- | --- | --- |
| **Visible distance** | **Power system\*** | **Width(mm)** | **Height(mm)** |
| 3 NM | Integral type | 300 | 600 |
| 5 NM | Integral type | 300 | 600 |
| 7 NM | Integral type | 500 | 700 |
| Discrete type | 300 | 600 |
| 8 NM | Discrete type | 400 | 700 |
| 10 NM | Discrete type | 500 | 800 |
| 15 NM | Discrete type | 500 | 1,000 |
| 18 NM | Discrete type | 700 | 1,200 |

\* Integral type is power integral type lantern including batteries and solar cells in lantern. Discrete type is common lantern. It does not include a storage battery and solar cell.

#### The upper body may be composed of an upper fixed plate, lens, LED module, the support modules and the lower body may be composed of lower body case, flashing apparatus, daylight sensor.

However, the mounting position of the accessory is not limited. Functionality and performance of the accessories follow in Annex A.

#### Flashing apparatus circuit parts should be reflected reverse polarity protection circuit and including a serial port(RS-232 port) for connection of other devices in the external, monitoring and control must be possible and It should be able to communication between other devices and lantern.

The protocol required for communication follow in Annex B.

#### Insulated wires of the lower body fixed to the protection cap and must be firmly supported by the terminal.

External structure of the lower body follows in Annex C.

### Rotating lantern shall be divided into upper body, lower body, control panel

Appearance of the Lantern is possible to design and dimensional changes within range dimension by visible distance to improve performance. Dimensions are shown in Table 2 by visible distance. Tolerance of dimension is to be ± 5%.

1. Appearance of the Lantern by visible distance

|  |  |  |
| --- | --- | --- |
| **Visible distance** | **Width(mm)** | **Height(mm)** |
| 20 NM | 700 | 1,000 |
| 26 NM |
| 27 NM | 900 | 1,800 |

#### The upper light body is composed of lens, lens guard or LED module, the LED module support fixture. The bottom light body is composed of the bottom body case, daylight sensor, rotation device. The control panel may be configured to lantern control device, the rotation device controller, a remote monitoring and control device, etc..

However, the mounting position of the accessory is not limited.

Function and performance of the accessories follow in Annex A.

* + - 1. The control panel operates safely using rated fuse, etc. and system must be protected. Surge protector device for device protective to lighting, etc. should be installed inside or outside.

### The lantern shall be at least IP66 when tested in accordance with KS C IEC 60529

However, indoor lantern is excluded.

### Daylight sensors should be firmly installed to the waterproofing, operated in the range of 150 ~ 200 lx then light-on and operated in the range of 50~100lx then the light-off.

## Vibrations test

When tested in accordance with 4.20 of KS C IEC 60598-1, it should be appropriate.

However, Rotating is excluded.

## Neutral Salt Spray Test

When tested in accordance with KS C IEC 60068-2-52, it should be appropriate

However, indoor lantern is excluded.

## Mechanical strength

When tested in accordance with 4.13of KS C IEC 60598-1, it should be appropriate

However, lens are excluded.

## Electric magnetic compatibility

When tested in accordance with KS C CISPR 15 and KS C IEC 61547, it should be appropriate.

## Insulation resistance and electric strength

When tested in accordance with Section 10 of KS C IEC 60598-1, it should be appropriate.

# The performance requirement

## Lighting characteristic

Lantern will be lighting–up at 106% and 92% of the rated voltage after allowing to stand for one hour each in lighting-off at -30 ℃ and 60 ℃

## Input power and the input current

Input power and input current test is to measure the input current and input power by supplying the rated voltage.

Input power and input current must be within ± 10% of the indicated value.

## Light range

### Flashing

* + - 1. When measured the floating light in the interval in that horizontal is 5, vertical is 0.1 in the 360, Horizontal light distribution should be emitting light more than 50% of the average intensity value of light that the minimum luminance value of the horizontal light distribution Within the two points angles on the distribution curve of the vertical divergence are 50% of the maximum average light intensity.

However, if a shield for use in a bridge, the horizontal light distribution is measured only up to 10 ° ~ 170 °.

* + - 1. The width of a shaft of light of the vertical divergence angle should be more than 1.5 in minimum, within 8 in maximum based on the angle between of the two points on the distribution curve is 50% of the maximum average intensity of light.

### Rotating

* + - 1. When measured the floating light in the interval in horizontal and vertical is 0.1 °, horizontal and vertical light distribution should be emitting light more than 50% of the maximum intensity value of light that the minimum luminance value within the two points angles on the distribution curve of the vertical divergence are 50% of the maximum average light intensity.
      2. The width of a shaft of light of the vertical divergence angle should be within ±4° based on the angle between of the two points on the distribution curve is 50% of the maximum average intensity of light.

## Rhythm characteristics

### Rhythm characteristics tolerance of the flashing lantern should be within ± 5% when measured in accordance with Annex E.

### Rhythm characteristics of the rotating lantern tolerance should be within ± 5% when measured by the test as rhythm characteristics of the Fl15s.

## Optical properties

### Light colour

When supplying the rated voltage to the lantern and measured light colour, it should be comply with Table 4 after aging that flashing is 20minutes and rotating is 1 hour.

1. Appearance of the Lantern by visible distance

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Light colour** | **Chromaticity coordinate** | **1** | **2** | **3** | **4** | **5** |
| White | x | 0.440 | 0.285 | 0.285 | 0.453 | 0.453 |
| y | 0.382 | 0.264 | 0.332 | 0.440 | 0.382 |
| Red | x | 0.710 | 0.690 | 0.660 | 0.680 |  |
| y | 0.290 | 0.290 | 0.320 | 0.320 |  |
| Green | x | 0.009 | 0.284 | 0.207 | 0.013 |  |
| y | 0.720 | 0.520 | 0.397 | 0.494 |  |
| Yellow | x | 0.5865 | 0.581 | 0.555 | 0.560 |  |
| y | 0.413 | 0.411 | 0.435 | 0.440 |  |
| Blue | x | 0.104 | 0.15 | 0.175 | 0.149 |  |
| y | 0.1 | 0.1 | 0.07 | 0.025 |  |

### Light Fixed Intensity and effective intensity

* + - 1. Flashing

When supplying the rated voltage to the lantern and measured fixed intensity and effective intensity in accordance with the test method of the 7.3.1.1 after aging for 20minutes, Average horizontal fixed intensity and effective intensity are complying with Table 5.

1. Flashing fixed intensity and effective intensity

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Visible distance** | **Power dissipation(W)** | **Fixed intensity(cd)** | **Effective intensity(cd)** | **Note** |
| 3 NM | 3 below | 21 | 15 | Effective luminous intensity is based on quick flashing (0.5 sec). |
| 5 NM | 5 below | 108 | 77 |
| 7 NM | 24 below | 378 | 270 |
| 8 NM | 30 below | 672 | 480 |
| 10 NM | 72 below | 1 960 | 1 400 |
| 15 NM | 400 below | 19 600 | 14 000 |
| 18 NM | 450 below | 68 600 | 49 000 |  |

\* Fixed intensity and effective intensity of the blue/yellow lantern is to be tested for each light color.

* + - 1. Rotating

When supplying the rated voltage to the lantern and measured fixed intensity and effective intensity in accordance with the test method of the 7.3.2.1 after aging for 1 hour, the fixed intensity and effective intensity are complying with Table 6.

1. Rotating fixed intensity and effective intensity

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Visible distance** | **Power dissipation(W)** | **Fixed intensity(cd)** | **Effective intensity(cd)** | **Note** |
| 20 NM | 450 below | 250 000 | 110 000 | Effective intensity is based on Fl 15s |
| 26 NM | 500 below | 3 000 000 | 1 200 000 |
| 27 NM | 700 below | 3 500 000 | 1 800 000 |

## Environmental Testing

Lantern shall be free from damage, cracks, deformation, etc. after all tests, and shall operate normally.

### Heat resistance

The Lantern allow to stand for 12 hours by rated voltage light up with fixed light in the environmental conditions of ambient temperature 60℃ ± 2 ℃

However, Rotating lantern is carried out only for the bottom case body, the rotating device, the control panel.

### Cold resistance

The Lantern allow to stand for 12 hours by rated voltage light up with fixed light in the environmental conditions of ambient temperature -30℃ ± 3 ℃

However, Rotating lantern is carried out only for the bottom case body, the rotating device, the control panel.

### Opening and closing Test

Lantern set up the a fixed Rhythm characteristics and carried out operation with one circuit that 0.5 sec On, 0.5 sec Off to the rated voltage to the impressed power. This process is repeated 15,000.

Note: The rotating lantern is only applicable for LED modules.

1. Quantity of test items per sample of LED lantern

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Division | | Test items | Sample quantities | | | |
| Sample 1 | Sample 2 | Sample 3 | Sample 4 |
| Safety | 1 | Display | ○ |  |  |  |
| 2 | structure | ○ |  |  |  |
| 3 | IP test (excluding medium and large lantern) | ○ |  |  |  |
| 4 | vibrations test | ○ |  |  |  |
| 5 | Neutral Salt Spray Test | ○ |  |  |  |
| 6 | mechanical strength | ○ |  |  |  |
| 7 | Electric magnetic compatibility |  | ○ |  |  |
| 8 | Insulation resistance and dielectric strength | ○ |  |  |  |
| Performance | 9 | lighting characteristic |  |  | ○ |  |
| 10 | Input power and input current |  |  | ○ |  |
| 11 | Light range |  |  | ○ |  |
| 12 | Rhythm characteristics |  |  | ○ |  |
| 13 | optical characteristic |  |  | ○ |  |
| 14 | Environment resistance Testing |  |  |  | ○ |
| Note : According to test the entire test inspection item specified in the standard, If you need additional sample for characteristics of the test items, It is possible to add it.  Note: The electromagnetic compatibility (EMC) of the Rotating lantern apply only control panel. | | | | | | |

ANNEX A (REGULATION)

Function and performance of the LED lantern accessories

This annex provides for the functional and performance requirements of the accessories that make up the LED lantern (Rotating and flashing).

**Flashing**

**Lantern lens**

* + - 1. The discoloration preventing agent and coating function should be added to prevent the discoloration to ultraviolet. It should be made to avoid deteriorate with the effects of light and seawater. The optical performance is injection molding excellent material as Acrylic or more equal. So shall be free from optical defects of air bubbles, inclusions, deformation, etc..
      2. The upper are to be integrated or firmly attached to anti-bird rods.

Lens is a colorless transparent, it should be so as not to deteriorate.

Performance shall conform to Annex table A. 1..

*Annex table A. 1 ― Performance of the lens*

|  |  |  |
| --- | --- | --- |
| Item | Performance standards | Test Methods |
| Izod Impact Strength (kgf∙cm/cm) | 1.6 | ASTM D256 |
| tensile strength (kgf/㎠) | 600 | ASTM D638 |
| Elongation percentage (%) | 5 | ASTM D638 |
| The load deflection Temperature (℃) | 80 | ASTM D648 |
| Vertical light transmittance (%) | 80 | ASTM D1003 |
| flexural modulus (kg/㎠) | 32 000 | ASTM D790 |

**Note**: The test method is as KS M standard tests also. The resulting value should be used to set   
the unit in this specification.

When the lens is tested according to 4 of KS C IEC 60068-2-5, it should be appropriate.

**A flashing apparatus and control panel**

A circuit board has to be coated to withstand a base and water and should not occurred short circuit itself.

Rhythm characteristics standard and adjustment method can be displayed inside or outside of the flashing apparatus and control panel or provided separately as a brochure.

If necessary, should be capable of synchronizing the flashing and should be able to remotely monitoring at the function of the lantern.

Electrical properties shall conform to Annex table A. 2.

*Annex table A. 2 ― flashing apparatus Electrical properties*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Visibility distance | Input Voltage | Power Consumption | no-load current | Maximum output current | Trigger current deviation |
| 3 NM | DC 3.7 V ± 10 % | 3 W below | Maximum 12 ㎃ below | 1 A below | - |
| 5 NM | DC 3.7 V ± 10 % | 5 W below | Maximum 12 ㎃ below | 1.5 A below | - |
| 7 NM | DC 3.7 V ± 10 % | 8 W below | Maximum 12 ㎃ below | 2.2 A below | - |
| DC 10 V ~ 14 V | 24 W below | Maximum 5 ㎃ below | - | ±10 % within |
| 8 NM | DC 10 V ~ 14 V | 30 W below | Maximum 5 ㎃ below | - | ±10 % within |
| 10 NM | DC 10 V ~ 14 V | 72 W below | Maximum 5 ㎃ below | - | ±10 % within |
| 15 NM | DC 10 V ~ 14 V | 400 W below | Maximum 50 ㎃ below | - | ±10 % within |
| AC 198 V ~ 242 V |
| 18 NM | DC 10 V ~ 14 V | 450 W below | Maximum 50 ㎃ below | - | ±10 % within |
| AC 198 V ~ 242 V |

Note: The no-load current test is to be tested in a state not connected to a serial port (RS-232 Port).

**daylight sensors**

Daylight sensors should be installed in the bottom lantern body, Must be avoid malfunctions due to lantern light.

When on and off, should not frequent on and off error in the critical situations(sunrise and sunset) and should be constitute the circuit to be automatic on and off.

**Power systems and solar of powered integrated lantern**

The power supply is a compact high-efficiency batteries and solar cells, it meets the quick flashing light Rhythm characteristics, it should be used no problem specification to demonstrate the required function.

storage battery that lantern mounted on the inside must meet the KS C 8541 and manufactured to the bottom body to replace if necessary

Solar cells is firmly installed in the lantern, so Solar cells should have no problems to vibrations, etc..

The power supply system must calculate the solar radiation and the load power. Given the rainy season, the number of working days should be more than 7days based on 4 seconds flashing 1 when no charge.

**The bottom body**

It should be used material at least copper with sufficient intensity and light of weight.

It can be attached to the flashing apparatus and daylight sensors.

This should be made firmly to avoid entering pond.

* + - 1. The lower end should be produced the bolt holes (PCD 200) with a diameter of 15 mm to mounting by respectively 4 bolts (90 intervals) or 3(120 interval).

**Rotating**

**Lantern lens**

Optical properties are produced by using the excellent material and should be free from defects of harmful air bubbles, inclusions, deformation.

When the lens is tested according to 4 of KS C IEC 60068-2-5, it should be appropriate.

Lens guard and heat sink

The material of the lens guard and Heatsink should use the strong with sea breeze and corrosion-resistant material

Lens guard and heatsink should be firmly produced, so trouble-free to assemble, disassemble, exchange and vibration.

Lens guard and heat sink should be made convenient for users to maintenance.

The material as Bolt, nut, washers used for Lens guard and heat sink should be used as a material more resistant SUS 304 to corrosion..

If each other using a metallic of a different material, lens guard and Heat sink should be manufactured to prevent deformation or damage according to contact, friction, compression strength.

Lens guard should be pass the corrosion test (KS D 9502 Neutral Salt Spray Test).

**Bottom light body**

**Daylight sensors**

* + - * 1. Daylight sensors should be installed in the bottom lantern body, avoided malfunctions due to lantern light.
        2. When on and off, should not frequent on and off error in the critical situations(sunrise and sunset) and should be constitute the circuit to be automatic on and off and It allows be operated in parallel with the on and off timer for 365 days.

**bottom body**

* + - * 1. The lower supporter should be produced and composed of rotation plate and the rotating device, and the bottom case.
        2. Rotation plate should be produced able to rotation by directly fixed to the rotor of the rotating device and the central axis of the rotating device.
        3. A lower body should be produced to prevent the worm and foreign matter from the outside flowing into the rotator.
        4. The lower body should be manufactured by firmly fixing the rotating device that prevent the shaking of external vibrations. The lower body are to be painted and surface treatment to prevent corrosion in seawater.

Rotating device

* + - * 1. Rotating device should be free from change in the rotation cycle to external shocks and vibrations.
        2. It should be manufactured to withstand the upper weight (lenses, etc.). It shall be operated without shaking the lens rotation during the rotation period.
        3. Rotation period should be produced to acceleration change to implement a range of rhythm characteristics of Fl5s-Fl20s
        4. Rhythm characteristics should satisfy the flashing time to test any rotation cycle in the range of Fll5s- Fl20s
        5. Flash time measures the width of the time between two points of 50% of the maximum light intensity value.
        6. Period of rotation of the rotating device shall be operated in the same rotation period of the per lens side.
        7. Appearance of the rotating device should be produced elegant and should be reduced weight to enable moving installation
        8. A controller for operating the rotating device is installed to a spare. When the main controller fails, immediately can be switched manually or automatically.
        9. When rotating device is stopped due to the influence of the outside, the controller should be produced to automatically restart

**Lantern control panel**

**lantern control device**

* + - * 1. It should be produced operating state of the LED module to enable remote monitoring.
        2. It can be produced to enable the on and off by automatically detecting light with daylight sensor, timer and manual operation should be also operate.

Electrical properties

Electrical properties shall conform to Annex table A. 3.

부표 A. 3 ― Control panel electrical properties

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Visibility distance | Input Voltage | Power Consumption | no-load current | Maximum output current | Trigger current deviation |
| 20 NM | AC 198 V ~ 242 V | 450 W below | Maximum 50 ㎃ below | - | ±10 % within |
| DC 10 V ~ 14 V |
| 26 NM | AC 198 V ~ 242 V | 500 W below | Maximum 50 ㎃ below |  | ±10 % within |
| 27 NM | AC 198 V ~ 242 V | 700 W below | Maximum 50 ㎃ below |  | ±10 % within |

Note: The no-load current test is to be tested in a state not connected to a serial port (RS-232 Port).

Rotation device controller

Rotation device controller should be produced able to vary a rotational speed of the motor.