ISA Recommendation

Technical Requirement for LED Fish Gathering Luminaires of Fishing Vessels

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International Solid-State Lighting Alliance

Technical Committee on Standardization

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Foreword

The International Solid State Lighting Alliance (ISA) is an international, not-for-profit organization that promotes the sustainable development and application of Solid State Lighting (SSL) worldwide. The SSL industry association includes numerous corporate members and research organizations globally.

ISA Recommendations provide useful methods for lighting practices and technical specifications of products recommended by the ISA, for standardization purposes, especially for areas not covered by the current international standards, and thus are proposed for consideration for use in future international standards or regional standards.

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Technical requirement for LED fish gathering luminaires of fishing vessels

1. Scope

This document specifies the terms and definitions, classification rules, technical requirements, and testing methods for LED fish gathering luminaires of fishing vessels.

This document applies to luminaires that incorporate LED light sources for fish gathering used over water or under water operation with supply voltages up to 1,000V.

This document cannot be applied to fish gathering luminaires with other light sources , such as metal halide luminaires, tungsten filament luminaires, etc.

This document can be used as a basis for the development, production and inspection of LED fish gathering luminaires for fishing vessels, and as a reference for product application and selection.

2. Normative references

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

CISPER 15 *Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment*

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

IEC 60068-2-6 *Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)*

IEC 60068-2-11 *Basic environmental testing procedures — Part 2: tests —Test Ka: Salt mist*

IEC 60068-2-52 *Environmental testing - Part 2-52: Tests - Test Kb: Salt mist, cyclic (sodium chloride solution)*

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

IEC 60598-1 *Luminaires — Part 1: General requirements and tests*

IEC 60598-2-18 *Luminaires - Part 2: Particular requirements - Section 18: Luminaires for swimming pools and similar applications*

IEC 61000-3-2 *Electromagnetic compatibility — Limits — Limits for harmonic current emission (equipment input current ≤16 A per phase)*

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

IEC 62722-2-1 *Luminaire performance — Part 2-1:Particular requirements for LED luminaires*

ISO 16539 *Corrosion of metals and alloys — Accelerated cyclic corrosion tests with exposure to synthetic ocean water salt-deposition process — "Dry" and "wet" conditions at constant absolute humidity*

CISPR 15:2018 *Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment*

3. Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60598-1 and the following apply.

3.1 LED fish gathering luminaire

A device with LED as a light source for light trapping and gathering certain kinds of fish for fishing, including an LED light source, a heat dissipation part, a driving power supply, an installation part and other parts. Also known as "fishing trapping luminaire" or "fishing aggregation luminaire".

3.2 overwater LED fish gathering luminaire

It is placed beside the hull of offshore and ocean fishing vessels for overwater trapping fishes.

3.3 underwater LED fish gathering luminaire

It is placed beside the hull of inshore and ocean fishing vessels for underwater trapping fishes.

4. Classification

4.1 Classification by light source color

According to the color of LED light sources used in the fish gathering luminaires, it can be divided into monochromatic LED fish gathering luminaires (red, yellow, blue and green) and polychromatic led fish gathering luminaires.

4.2 Classification by using places

According to the occasion of fish gathering luminaire being used, it can be divided into overwater LED fish gathering luminaires and underwater LED fish gathering luminaires.

5. Technical Requirements

5.1 Safety Requirements

5.1.1 General requirements

The safety requirements of LED fish gathering luminaries shall comply with the applicable requirements of IEC 60598-1 and the following provisions.

5.1.2 Marking on Luminaires

Each LED fish gathering luminarie shall be clearly and firmly marked on the appropriate part and shall contain the following:

a) Mark of origin (this may take the form of a trade mark, the manufacturer's identification mark or the name of the responsible vendor).
b) Rated voltages in volt.
c) The rated maximum ambient temperature ta and the applicable environment.
d) Symbol for class II or class III luminaires where applicable.
e) Marking with IP numbers, the applicable underwater depth grade shall be indicated for underwater luminaires.
f) Maker's model number or type reference.
g) Rated wattage.
h) Symbol for blue hazard and the minimum distance from lighted objects.
i) The luminous efficiency or luminous efficiency grade, the maximum luminous efficiency shall be given for adjustable light lamps.
j) The rated color temperature value in the main working mode shall be given for adjustable light lamps;
k) Declared life and warranty period;
l) Other use restrictions.

5.1.3 Provision for earthing

Chapter 7 of IEC 60598-1 is not applicable.

The LED fish gathering luminaries shall be of class II or III structure, and no components can be bridged between the input terminal of power supply and the metal shell.

5.1.4 Insulation resistance

The insulation resistance of LED fish gathering luminaries shall be measured before and after the constant damp heat test and salt mist Ka test. Before the test, the cold insulation resistance of LED fish gathering luminaries shall not be less than 100MΩ, and after the test, its insulation resistance shall not be less than 10MΩ.

5.1.5 Protection grade

The protection grade of overwater LED fish gathering luminaries shall reach IP66/ IP67 or above.

The protection grade of the body of underwater LED fish gathering luminaries shall be reach IP66/ IP68. If the control gear for underwater light luminaires is placed on the ship and separated from the underwater light source, the protection grade of the control gear shall reach IP66/ IP67 or above.

The working water depth of IP68 shall be declared by the manufacturer and divided into three grades according to Table 1. The working water depth level of LED fish gathering luminaries shall not be lower than Grade 3.

Table 1 IP68 working depth class

Grade	Claimed working depth *H* (m)
Grade 1	$H \geq 200$
Grade 2	$100 \leq H < 200$
Grade 3	$1.5 \leq H < 100$

5.1.6 Wind resistance

The LED overwater fish gathering luminaires shall be able to withstand the wind force of no less than Grade 8 (wind speed: 62km/h-74km/h).

The device for fixing the luminaires or external parts to the support shall be suitable for the weight of the luminaires or external parts, and the mounting screw shall not be loose and the shell part shall not be deformed.

5.1.7 Impact resistance

The shell of overwater LED fish gathering luminaires shall be able to withstand the impact of the IK08 grade, and the mechanical strength shall meet the requirements specified in 4.13 of IEC 60598-1.

The shell of underwater LED fish gathering luminaires shall be able to withstand the impact of IK10 grade, and the mechanical strength shall meet the requirements specified in 4.13 of IEC 60598-1.

5.2 Performance requirements

5.2.1 Power supply adaptability

When the input voltage fluctuation range is - 10% ~ 20% of the rated input voltage and the frequency fluctuation range is - 5% ~ 5% of the rated input frequency, the LED fish gathering luminaire shall be able to keep on working state, and the light source shall not flicker or extinguish.

5.2.2 Input power

The difference between the actual power consumed and the nominal power shall be within ± 10% of the nominal power when the LED fish gathering luminaire works under the rated working voltage and rated frequency.

5.2.3 Power factor

The measured power factor value shall not be less than 5% of the manufacturer's or sales mark value and shall not be less than the requirements in Table 2 when the LED fish gather luminaire is operated at the rated working voltage and rated operating frequency.

Table 2 power factor requirements of LED fish gathering luminaire

power range of LED fish gathering luminaire W	Minimum power factor
$P \leq 100$	0.90
$100 < P \leq 300$	0.92
$P > 300$	0.95

5.2.4 Initial luminous efficiency

The LED fish gathering luminaires are classified into three levels according to their initial luminous efficiency with different light source colors. The initial luminous efficiency of the LED fish gathering luminaires shall not be lower than Grade 3 (See Table 3).

Table 3 requirements for initial luminous efficiency of LED fish gathering luminaire

color	Peak wavelength range or CCT	Light efficiency grade lm/W		
		Grade 1	Grade 2	Grade 3
Red light (Overwater)	615nm～635nm	80	70	60
Red light (underwater)		60	50	40
Green light (Overwater)	520nm～545nm	180	160	140
Green light (underwater)		140	120	100
Cyan light (Overwater)	450nm～492nm	110	100	90
Cyan light (underwater)		70	60	50
White light (Overwater)	2500K～11000K	135	125	105
White light (underwater)		110	100	80
Note: the initial luminous efficiency of LED fish gathering luminaire with other colors is under consideration				

5.2.5 Peak luminous intensity

When the producer or seller gives the peak luminous intensity, the initial value of the peak luminous intensity of the LED underwater fish gathering luminaire shall not be less than 75% of the rated peak luminous intensity.

Note: This clause is only applicable to underwater LED fish gathering luminaire, and there is no requirement for overwater LED fish gathering luminaire.

5.2.6 correlated color temperature (CCT)

The maximum deviation (ΔT) between the initial correlated color temperature and the rated correlated color temperature (T) meets the formula (1).

$$\Delta T=0.0000108\times T^2+0.0262\times T+8 \cdots\cdots (1)$$

5.2.7 Switch test

LED fish gathering luminaire shall be able to pass at least 12,500 power switch tests and still be able to work normally.

5.2.8 Declared lifetime and luminous flux maintenance factor

The declared lifetime of LED fish gathering luminaire shall not be less than 25 000h.

The luminous flux of LED fish gathering luminaire shall not be lower than 96% of the initial value after 3 000h.

5.3 Environmental adaptability

5.3.1 Slat Mist Kb

LED overwater fish gathering luminaire shall be able to work normally in the continuous marine environment, and its spare parts shall not produce visible obvious corrosion.

5.3.2 Seawater corrosion

In normal use, the parts in contact with seawater shall be immersed in artificial sea water at 25℃ for 14 days. After treatment, the parts shall not show corrosion marks or surface roughness, and the erasable corrosion traces shall be ignored.

Note: This clause is only applicable to underwater LED fish gathering luminaire, and there is no requirement for overwater LED fish gathering luminaire.

5.3.3 Vibration

The anti-vibration test shall be conducted for overwater LED fish gathering luminaires. After turning on, the luminaire shall not flicker, extinguish or be damaged.

Note: This clause only applies to overwater LED fish gathering luminaire.

5.3.4 High temperature operation

The overwater LED fish gathering luminaires shall be able to start and work normally under the environment of temperature (55±2) ℃, and the starting time shall be less than or equal to 3s. The light source shall not flicker or go out during the starting and working process.

Note: This clause is only applicable to overwater LED fish gathering luminaire. There is no specific requirement for underwater LED fish gathering luminaire.

5.3.5 Low temperature start-up

The overwater LED fish gathering luminaire shall be able to start and work normally under the environment of temperature (-25±2) ℃, and the starting time shall be less than or equal to 3s. The light source shall not flicker or go out during the starting and working process.

5.3.6 Temperature shock

The overwater LED fish gathering luminaire shall be able to start normally after being impacted by high temperature (85±2) ℃ and low temperature (-25±2) ℃ without power supply. The starting time shall be less than or equal to 3s, and the light source shall not flicker or extinguish.

5.3.7 Steady damp-heat

LED fish gathering luminaire can work normally when the temperature is (55±2) ℃, and the relative humidity is 90% RH ~ 95% RH, and the light source shall not flicker and extinguish.

Note: This clause is only applicable to overwater LED fish gathering luminaire. There is no specific requirement for underwater LED fish gathering luminaire.

5.4 Electromagnetic compatibility (EMC)

5.4.1 Radio disturbance characteristics

The radio disturbance characteristics of LED fish gathering luminaire shall meet the requirements of CISPER 15.

5.4.2 Input current harmonics

The input current harmonics of LED fish gathering luminaire shall meet the requirements of IEC 61000-3-2.

5.4.3 EMC immunity

The EMC immunity of LED fish gathering luminaire shall meet the requirements of IEC 61547.

6. Test method

6.1 General requirements for tests

Unless otherwise specified, the test shall be conducted in the environment without convection wind with the ambient temperature of (25±5) ℃ (optical parameter performance test of (25±1) ℃) and the maximum relative humidity not exceeding 65%.

Before measurement, the display value of power supply voltage should be kept within ± 2% and ± 0.5% during measurement.

The total harmonic content of the power supply voltage shall not exceed 3%.

6.2 Safety requirements

The test method for the safety requirements of LED fish luminaires (5.1.1-5.1.1) are in accordance with the methods specified in IEC 60598-1.

6.3 Performance requirements

6.3.1 Power supply adaptability

The control gear of LED fish luminaire is connected to an AC power supply with voltage regulation and frequency conversion. Tests are performed according to the four combinations in Table 4, and the time for each test is 60 mins.

Table 4 Power input fluctuation

Combination of Numbers	Input voltage fluctuation	Input frequency fluctuation
1	+20%	+5%
2	+20%	-5%
3	-10%	+5%
4	-10%	-5%

6.3.2 Input power and power factor

The input power and power factor test of LED fish luminaire are carried out according to the method specified in IEC 62722-2-1.

6.3.3 Initial luminous efficiency, peak luminous intensity and CCT

The initial luminous efficiency, peak light intensity and related color temperature of LED fish luminaire are carried out according to the method specified in IEC 62722-2-1.

6.4 Environmental adaptability

6.4.1 Salt Mist Kb

The overwater LED fish gathering luminaire shall be tested according to 9.4.2 of IEC 60068-2-52:2017.

6.4.2 Seawater corrosion

The overall seawater corrosion test of underwater LED fish gathering luminaire shall be conducted in accordance with the method specified in 6.2 of IEC 60598-2-18, and the key components such as screws and fasteners shall be tested according to ISO 16539.

6.4.3 Vibration

The vibration test of overwater LED fish gathering luminaire shall be tested according to the following methods:

a) The overwater LED fish gathering luminaire shall be installed on the vibration table according to the actual use state and powered on;

b) According to the frequency range and amplitude specified in Table 4, the overwater LED fish gathering luminaire shall be scanned at a rate of no more than 1 oct/ min to check for resonance;
c) If there is no obvious resonance point, 90 mins vibration resistance test shall be carried out at 30 Hz;
d) The test shall be conducted on three mutually perpendicular axes, and other conditions during the test shall meet the requirements of IEC 60068-2-6;
e) In the test, if the measured resonance frequencies are close to each other, the frequency sweep test shall be used for the anti-vibration test, and the duration is 120 mins.

Table 5 vibration test parameters

Test	Frequency Hz	Amplitude mm	Acceleration m/s^2
1	2～25	±1.6	—
2	25～100	—	±39（4.0G）

6.4.4 High temperature operation

The specimen of overwater LED gathering luminaires is introduced into the test chamber with the temperature of (55±2) ℃ for 4h with the rated voltage and rated frequency. The start-up time of the specimen shall be recorded, and the specimen shall continue to work for 16h to observe its working state. Other conditions during testing shall be in accordance with the requirements of IEC 60068-2-2.

6.4.5 Low temperature start-up

The specimen of overwater LED gathering luminaires is introduced into the test chamber with the temperature of (-25±2) ℃ for 4h with the rated voltage and rated frequency. The start-up time of the specimen shall be recorded, and the specimen shall continue to work for 16h to observe its working state. Other conditions during the test shall meet the requirements of IEC 60068-2-1.

6.4.6 Temperature shock

The unpowered specimen of overwater LED gathering luminaires is introduced into the hot and cold shock chamber with the high temperature (85±2) ℃ and the low temperature (-25± 2) ℃. The temperature shall be changed for 10 min, and kept at high and low temperature for 60 min. This cycle of high and low temperature shall be conducted 100 times.

After the test, the specimen shall be placed under normal atmospheric pressure and indoor conditions for 2 h and kept working for 16 h. then the appearance and electrical properties of the specimen shall be tested.

6.4.7 Steady damp-heat

The constant humidity and heat test of the specimen of LED overwater gathering luminaires shall be carried out according to the following methods:

a) Before the test, the cold insulation resistance of the specimen shall be measured according to subclause 5.1.4;

b) The specimen shall be put into the effective space of the test box. The specimen shall be preheated without humidification, and the temperature shall be raised from room temperature to （55±2）℃ within 2 hours. When the temperature of the specimen is stable, the relative humidity shall be increased to 90% - 95%;

c) The specimen shall be introduced at the temperature of （55±2）℃ and relative humidity of 90% ～ 95% for 96h, then dropped to 20℃ within 1h-2h. Then the specimen shall be taken out and recovered at room temperature;

d) The lighting test shall be conducted at the first hour, after 50h and the last two hours in the whole test period;

e) According to subclause 5.1.4, the thermal insulation resistance of the specimen shall be tested, and the lighting test shall be conducted after the room temperature is restored;

f) Other conditions during the test shall meet the requirements of IEC 60068-2-78.

6.5 Electromagnetic compatibility (EMC)

Electromagnetic compatibility test requirements are as follows:

a) The radio disturbance characteristics of LED fish luminaires shall be tested according to the requirements of CISPR 15-2015, and the test results shall meet the requirements of 5.4.1;

b) The EMC immunity of LED fish luminaires shall be tested according to the requirements of IEC 61547 and the test results shall meet the requirements of 5.4.2;

c) The input current harmonic of LED fish luminaires should be tested according to the requirements of 61000-3-2, and the test results should meet the requirements of 5.4.3.