IALA RECOMMENDATION (INFORMATIVE)

R0203
DEFINITIONS OF MARINE SIGNAL LIGHTS TERMS OF MEASUREMENT

Edition 2.0
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10, rue des Gaudines – 78100 Saint Germain en Laye, France
Tél. +33 (0)1 34 51 70 01 – contact@iala-aism.org
www.iala-aism.org
International Association of Marine Aids to Navigation and Lighthouse Authorities
Association Internationale de Signalisation Maritime

DOCUMENT REVISION

Revisions to this document are to be noted in the table prior to the issue of a revised document.

Date	Details	Approval
December 2008	First issue	Council 44
December 2022	Edition 2.0 entire update and the measurement method part will be a new guideline.	Council 76

THE IALA COUNCIL

RECALLING:

The function of IALA with respect to Safety of Navigation, the efficiency of maritime transport and the protection of the environment.

Article 8 of the IALA Constitution regarding the authority, duties and functions of the Council.

RECOGNIZING:

1 that for the adequate performance of marine signal lights, both their photometric and colorimetric parameters have to be ensured;

2 that a great variety of light sources have been and are still being developed;

3 that there are many different methods and equipment for the measurement of light.

NOTING that

1 defined standards for photometry and colorimetry should be used worldwide to ensure the quality of signal lights for mariners;

2 that this document only applies to Marine Aid-to-Navigation signal lights that are installed after the publication date of this document;

3 that there should be available laboratories, which are working according to this documentation, for all IALA members and other appropriate authorities that could be operated by themselves, by other authorities in the same country or another country, or by private companies;

CONSIDERING the proposals of the ENG Committee,

ADOPTS the Recommendation on Marine Aid to Navigation signal lights in the Annex of this Recommendation; and,

INVITES Members and Marine Aids to Navigation authorities worldwide to implement the provisions of the Recommendation,

RECOMMENDS that

National members and other appropriate authorities providing Marine Aids to Navigation services carry out photometric and colorimetric measurements of Marine Aid-to-Navigation signal lights in accordance with this Recommendation;

Industrial members shall specify the performance of their visual aids-to-navigation in accordance with this Recommendation;

REQUESTS the ENG Committee or such other committee as the Council may direct to keep the Recommendation under review and to propose amendments as necessary.

REVOKES IALA Recommendation *E-200-3 Edition 1*.

ANNEX A DEFINITIONS OF MARINE SIGNAL LIGHTS TERMS OF MEASUREMENT

A.1. OVERVIEW

The definitions contained within this annex should be considered as the minimum requirement in terms of luminous intensity and colour when reporting on the performance of a marine signal light. Where additional definitions are required for a particular application, they shall not conflict with definitions given below.

A.2. STANDARD MEASUREMENT CONDITIONS

The measurement geometry will be based on the X-Y coordinate system as defined in CIE 043-1979, where the datum (reference direction) is X=0° (defined during measurement) and Y=0° (i.e., horizontal).

Ambient temperature is to be 25.0 °C with an acceptable interval of ± 1.2 °C for LED-based light sources, or ± 3.0 °C for other types of light sources.

The measurements are to be made in still air, with a tolerance interval of 0 m/s to 0.25 m/s.

The light under test should be supplied with the rated voltage at the power terminals, or in the case of individual LED devices, they should be supplied with the rated current. The tolerance interval shall be one of:

- ± 0.4 % for RMS AC voltage,
- ± 0.2 % for DC voltage,
- ± 0.2 % for DC current.

A.3. LUMINOUS INTENSITY VERSUS ANGLE

In this section, we define terms that are related to the measurement of luminous intensity as a function of horizontal and vertical angle. This would describe the performance of the light based on the direction that it is viewed from.

Vertical Divergence	The average of all measured Full Width Half Maximum (FWHM) values shall be reported as the vertical divergence, along with the maximum deviation of the maximum intensity from an elevation of Y=0 °.
Horizontal Divergence	The Full Width Half Maximum (FWHM) values as measured along the horizontal plane shall be reported as the horizontal divergence. If the intensity does not fall to half maximum at any point around the light, then the horizontal divergence is 360°.
Specification Peak Intensity	– *Omnidirectional light:* the intensity is defined as the 10th percentile of the intensity measured around the entire light at an elevation of Y=0°. – *Directional light without a required boundary*: the intensity at the optical centroid axis of the light. – *Sector intensity:* the intensity is defined as the 10th percentile of the intensity measured within the Sector Width at an elevation of Y=0°. – *Rotating optic:* This is the peak intensity of the individual beams when the optic is not rotating.

A.4. LUMINOUS INTENSITY VERSUS TIME

In this section, we define terms that are related to the measurement of luminous intensity as a function of time.

Flash Duration	The duration of the measured flash profile should be taken from the point in time when the intensity first exceeds 50 % of the peak intensity value to the point in time when the intensity finally falls below 50 % of the peak intensity value. The end of a flash should be considered as when the intensity falls below 5 % of the peak intensity value for more than 100 ms.
Effective Intensity	The effective intensity shall be determined using the method described in IALA Recommendation *R0204.* The effective intensity shall be based on the Specification Peak Intensity scaled to represent the temporal effects of the light. When a group of flashes make up a flash character, the reported effective intensity shall be that of the lowest individual flash effective intensity in the group.
Nominal Range	The nominal range shall be determined using the reported effective intensity by applying the method described in IALA Recommendation *R0202.* The application of performance measurement uncertainty shall allow for 95% confidence in the result.

A.5. COLOUR AND SECTORS

Signal Colour	The measured colour of the light should be reported in x, y coordinates according to the *CIE 1931* chromaticity chart. Compliance, or not, with the appropriate IALA colour region should also be reported with reference to IALA Recommendation *R0201*.
Sector Colour Boundary	The sector colour boundary is the angle at which the colour of the sector exits the colour region as defined in IALA Recommendation *R0201*. If Sector Colour Boundaries of the same Signal Colour occur within 0.1° of each other, then only the Sector Colour Boundary where the colour first exits the sector shall be recorded.
Sector Intensity Boundary	The angle of the Full Width Half Maximum intensity of an individual sector.
Sector Width	The angle between the innermost limits of either the Sector Colour Boundaries or Sector Intensity Boundaries.
Sector Boundary	The angle that is equidistant between the Sector Width limits of adjacent sectors.
Sector of Uncertainty	The Sector of Uncertainty shall be the largest angle between adjacent recorded Sector Widths.

A.6. REFERENCES

[1] CIE. (2004). Standard S 010/E:2004 - Photometry - The CIE System of Physical Photometry.

[2] CIE. (2015). Test Method for LED Lamps, LED Luminaires and LED Modules.

[3] CIE. (2018). Technical Report 015:2018 - Colorimetry.