Input paper: [[1]](#footnote-1) ENG18-3.2.1.2

Input paper for the following Committee(s): check as appropriate Purpose of paper:

**□** ARM **X** ENG **□** PAP **X** Input

**□** DTEC **□** VTS **□** Information

Agenda item [[2]](#footnote-2) X

Technical Domain / Task Number 2 Task 2.1.6

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Explanation For the Conversion Measurement Method of

Effective Intensity in the Draft IALA Guideline of Measurement of Marine Lights Performance

# Summary

China MSA had submitted the draft guideline of measurement of marine lights performance to ENG17. During the intersessional meeting of ENG17, the visual signalling group of the working group one(WG1) of the ENG committee discussed parts of this guideline, in which the conversion measurement method of effective intensity in the guideline had been questioned. And this input paper is to explain this method to prove its rationality.

## Purpose of the document

To explain the conversion measurement method of effective intensity in the draft guideline.

## Related documents

1. IALA G1135-Determination and Calculation of Effective Intensity
2. ENG17-3.1.1.13.2 ANNEX B Draft IALA Guideline - Measurement of Marine Lights Performance 1

# Background

Three methods introduced in the draft guideline regarding measurement of the effective intensity of rhythmic light, which are direct measurement method, conversion measurement method and estimation measurement method, are from the input paper "ENG15-3.1.1.1.2\_Measurement and Calculation of Effective Intensity of Aids to Navigation Light" submitted by China MSA. Wherein, the conversion measurement method is summarized by China MSA based on the peak-to-effective intensity factor method introduced in the guideline G1135 as well as the practice of the laboratory measurement of China.

# Discussion

The brief outline of this method is as follows.

Firstly, the AtoN light is installed in the goniophotometer, and the specification peak Intensity I0 of the fixed light is measured while meeting the requirements of light stability and measuring distance. Note that the photometer used in the goniophotometer is a conventional one at this time.

Secondly, a fast photometer is used to obtain the fixed illuminance value E0 at any position. Then set the AtoN light to the rhythm light state, and after it is stabilized, the fast photometer is used to measure the curve of the illuminance of each flash at the same position overtime for at least one character period.

Thirdly, the curve of illuminance changing over time is calculated according to the modified Allard method described in IALA Recommendation R0204 to obtain the effective illuminance .

Finally, the effective intensity of the rhythm light in the direction of (0,0) is calculated according to formula 1.



Equation 1 Effective of the intensity of the rhythmic light in (0,0) direction

Where:

is the effective intensity of the rhythm light in the direction (0,0).

I0 is the specification peak intensity of fixed light, which is the average value of three measurements.

E0  is the illuminance of fixed light state at a certain position.

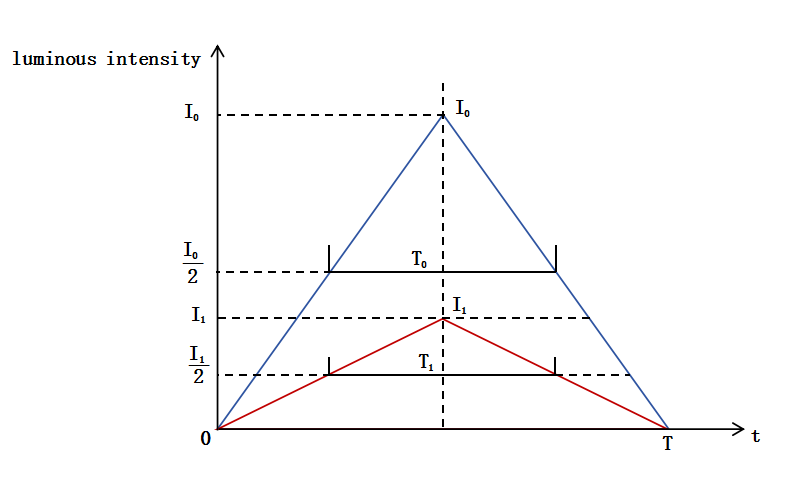
E0,eff is the effective illuminance in the rhythmic light state at the same position as the measurement of E0.

This method is mainly based on the peak-to-effective intensity factor mentioned in Appendix B of IALA guideline G1135 to calculate the effective intensity of a flash, that is, the effective intensity is equal to the peak intensity of the flash multiplied by this factor. Table 1 is excerpted from Appendix B of G1135, which provides peak-to-effective intensity factors for several common flash shapes other than night blue light.

Table 1



As can be seen from Table 1, when the flash shape is fixed, the peak-to-effective intensity factor depends only on one parameter, that is the flash duration, and the duration is the length between 50% of peak intensity, not the whole flash duration. Based on this method, for the measurements at two different positions introduced in the conversion measurement method in the draft guideline, assuming the AtoN light is LED, as long as the LED driver is the same one, the relative flash shape in all directions is the same and the flash in all directions peaks at the same time and goes off at the same time.Therefore, the flash duration is equal. Then from Table 1, it can be seen that the peak-to-effective intensity factors in all directions are equal, so the ratio of the peak intensity and effective intensity in each direction is equal, that is, Equation 1. An example of this is shown in Figure 1, assuming that the AtoN light is a PWM LED light, where the bigger size and the smaller size of the two triangles are single flash waveforms measured in the direction of (0,0) and (30°,0) respectively, the flash period is T. I0 is the flash peak intensity of the single flash waveform in the direction of (0,0) and T0 is its flash duration. I1 is the flash peak intensity of the single flash waveform in the direction of(30°,0), and T1 is its flash duration. If the peak-to-effective intensity factor in the direction of (0,0) is f0, then its effective intensity value is =f0. Similarly, if the peak-to-effective intensity factor in the direction of (30°,0) is f1, then its effective intensity value is I1,eff=f1I1. According to the definition of flash duration in G1135, the luminous intensity at the two endpoints of T0 and T1 is /2 and I1/2 respectively, then it can be inferred from the segment ratio theorem that T0=T/2, T1=T/2, so T0=T1. As can be seen from Table 1, when both of the flash shape and the flash duration are the same, the peak-to-effective intensity factor are the same, that is, f0=f1, so /=I1,eff/I1. That means Equation 1 is workable. So the conversion measurement method is rational.



*Figure 1 – single flash shapes measured in the (0,0) direction and (30°,0) direction*

Here is the application scenario of the conversion measurement method: If it is not possible to place the fast photometer at the fixed point of the goniophotometer mentioned in the direct measurement method to test the change of the rhythmic light intensity over time, the conversion measurement method can be used. The premise is that the flashing light is isotropic and the waveform is consistent. For LED AtoN lights, the same driver is required. If the LED uses a modulated mode, non-high-frequency modulated light is required. Otherwise, its specification peak intensity test result needs to be stable. The specific measurement method of stability is provided in the subsection of the conversion measurement method in the draft guideline.

# References

1. IALA G1135-Determination and Calculation of Effective Intensity

# Action requested of the Committee

The Committee is requested to take the explanation above into account when reviewing the draft guideline of measurement of marine lights performance.

1. Input document number, to be assigned by the Committee Secretary [↑](#footnote-ref-1)
2. Leave open if uncertain [↑](#footnote-ref-2)