Document Revisions

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**IALA Guideline No. ####**

**On**

**Selection of Rhythmic Characters of Lights on Aids to Navigation**

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

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Selection of Rhythmic Characters of Lights on Aids to Navigation

# Introduction

This Guideline is intended for provision of guidance at selecting the rhythmic characters defined in Recommendation E-110 [1], including temporal considerations, colours, use of simultaneous fixed and flashing signals, user considerations, synchronization and sequencing.

[After this Guideline is published and feedback from AtoN authorities is analysed, the intention is to reduce the content of the Recommendation E-110.]

# Background

In foreseeable future majority of AtoN lights on fixed and floating marks will be converted to LED or other emerging sources. There is much more scope for selection of light signal character to exploit the new technologies while there are issues with rapid signal profile of new light sources in non-rotational optics that can be mitigated by introducing fixed and flashing characters.

Increasing ease of time linking rhythmic characters between AtoNs for synchronisation and sequencing can be more cost effectively achieved.

# Scope AND Purpose

This document applies to marine aids to navigation signal lights on fixed and floating applications. It is intended for provision of integrated guidance on the following topics:

* general temporal considerations
* selection of colours
* flash duration
* character length
* use of simultaneous fixed and flashing signals
* synchronization and sequencing
* sharing of good practice by inclusion of examples in appendices.

# Definitions / Acronyms

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# GENERAL TEMPORAL CONSIDERATIONS

The persistence of vision of a light, after extinction of the light, can reach 0.15 second. If the duration of an interval of darkness in a rhythmic character is made too short, the flashes may merge, obstructing identification of an AtoN. Therefore, duration of an eclipse should not be reduced to under 0.15 second (subject to further testing).

The periods of the characters of rhythmic lights should be selected in accordance with location specific navigational requirements and results of corresponding risk assessments. Historically, periods of up to 30 seconds have been used for major landfall lights. Where possible, it is recommended to limit the rhythmic character length to 16 seconds (to be verified by trials).

In order to maintain spatial awareness, eclipse length of a group flashing light should not exceed 8 seconds (to be verified by trials). When longer eclipse is required to avoid confusion with other lights, introduction of a fixed and flashing character is recommended to retain spatial awareness at close ranges. Fixed flashing should be considered also for shorter eclipses when high speed craft or close manoeuvring to the aid to navigation is expected.

To ensure that their quick lights can be discriminated, an authority should preferably choose the rates for all its quick lights to be 60, very quick lights 120, and ultra quick lights 240 flashes per minute. The repetition rate for ultra quick lights should not exceed 300 flashes per minute because at faster rates the sequence of flashes might resemble appearances of steady light in some circumstances.

Discrimination of different rates of flashing is not immediately easy unless there is a ratio of at least three to one between the rates. If this ratio cannot be attained, particular care will be required if flashing, quick, very quick and ultra quick lights of the same colour in the same area

are to be correctly and readily identified. Other distinctions should be made, if possible, between the characters, such as making periods clearly dissimilar or the numbers in groups different.

Methods like implementing different rhythmic characters of lined-up AtoN lights, for example, increasing the number of flashes of lateral buoy lights (gates) in accordance with the distance along the channel can be used to increase the spatial awareness of the mariner.

The term "long flash", which is used in the descriptions of the long-flashing light and of the light characters reserved for south cardinal marks, means an appearance of light of not less than 2 seconds duration. The term "short flash" is not commonly used and does not appear in the Classification ([1]). If an authority requires discrimination between two flashing lights that only differ in having flashes of different durations, then the longer flash should be described as "long flash" and be of not less than 2 seconds duration, and the shorter flash may be described as "short flash" and should be between 0.3 to 0.5 seconds, but not more than one third of the duration of the longer flash.

Several countries have defined specific rhythmic character subsets for use mainly on their floating marks. Examples of national flash characters are provided in Annexes.

# SELECTION OF COLOUR

It is safer to assume that a confusion between White and Yellow as colours for lights is liable to occur, and therefore the rhythmic character of a Yellow light should always be chosen with the understanding that the colour of the light might be mistaken for White.

A Green light that is showing flashes of very short duration can be mistaken for a White light (or

a Blue light), so authorities should take care that the colour of a Green light is clearly recognizable at the maximum required range if the duration of a flash in the rhythmic character is very short (below 0.5 second). It is advisable for authorities to avoid choosing rhythmic characters with high rates of flashing for Green lights (above 60 flashes per minute).

Use of colour in AtoN signalling is described in detail in the IALA Maritime Buoyage System and further covered by IALA Recommendation E-200-1 – Marine Signal Lights, Part 1 – Colours.

# use of fixed and flashing signals

Replacing an eclipse of a rhythmic character of AtoN light with a low-intensity light signal enhances the ability of the mariner to maintain spatial awareness and improves identification at close range. In cases when traditional rotating optics of a lighthouse are replaced with flashing LED lights, implementation of fixed and flashing character allows to retain an effect similar to the residual light between flashes of rotating optics. Trials have shown that a fixed light signal component of 1% of peak luminous intensity can be considered sufficient for majority of fixed and flashing character applications. Careful consideration of conspicuity implications is necessary to avoid reduction of fixed/flashing component contrast by fixed luminous intensity level above 5% (up to 10% in high background lighting conditions).

The fixed component can be applied to a number of rhythmic characters, provided that the low intensity phase (longest eclipse in the group character) is longer than the high intensity phase (flash). Nevertheless, fixed phase can be also used with occulting characters. For charting purposes, placement of an “F” in front of the character abbreviation signifies application of a combination of the low intensity fixed light signal with the main character. For example, the following abbreviations are already in use: FFl, FIso, FLFl.



*Figure 1. Chart fragment showing a 6M FFl(1)R light (Estonian AtoN 300, Vahemadala Lighthouse)*



*Figure 2. Chart fragment showing a15M FFl light (Estonian AtoN 935, Sõrve Lighthouse)*

This class of light character should be used with care because the fixed component of the light may not be visible at all times over the same distance as the rhythmic component.

Some results of trials and application examples are provided in the annexes.

# synchronization and sequencing

Synchronization and sequencing of AtoN lights are useful methods of increasing spatial awareness of mariners. Both can be combined with fixed and flashing rhythmic characters. Where possible, effect of sequencing of lights should be tried out on an AtoN lights simulator before deployment to evaluate the benefits.

Experience has shown that synchronizing the first gate on a channel improves spatial awareness.

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Technical aspects of implementation are described in the Guideline 1069 – Synchronization of Lights.

# REFERENCES

[1] IALA Recommendation E-110 - Selection of Rhythmic Characters of Lights on Aids to Navigation

[2] IALA Recommendation E-200-1 on Marine Signal Lights Part 1 – Colours.

[3] IALA Guideline 1069 – Synchronization of Lights.

[4] Fixed Flashing Lights Viewing Trial. Malcolm Nicholson. Presentation at IALA ENG1.

[5] Trials and Implementation of the Fixed and Flashing Rhythmic Character on Estonian AtoN. Aivar Usk. IALA ENG1 input paper ENG1-9.4.4.

[6] National AtoN character list (German list). Frank Hermann. IALA ENG2 input paper ENG2-9.5.

[7] National AtoN character list (Estonian list). Pärtel Keskküla. IALA ENG2 input paper ENG2-9.7.

[8] National AtoN character list (French list). Yves-Marie Blanchard / Michel Cousquer. IALA ENG2 input paper ENG2-9.12.