

IALA Recommendation E-110

for the

Rhythmic Characters of Lights on Aids to Navigation

Edition 2

December 2005

Edition 1 Published May 1998



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Document Revisions

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

Date	Page / Section Revised	Requirement for Revision
October 2005	Tables amended to provide graphic representation	Provide clearer representation of characteristics and keep in line with revised edition of IALA Navguide.

IALA Recommendation on the Rhythmic Characters of Lights on Aids to Navigation

THE COUNCIL:

RECOGNISING the need to provide guidance on the classes and limits within which the rhythmic characters of lights on aids to navigation should be determined;

RECOGNISING ALSO that such guidance should enable a common approach to be made world-wide, thus greatly assisting mariners, who, while passing through waters of different authorities, should not be confused by light characters that are difficult to read or understand, or that exist in too great a diversity;

TAKING INTO CONSIDERATION the proposals of the IALA Engineering Committee;

ADOPTS the rhythmic characters of lights on aids to navigation set out in the Annex to this Recommendation;

RECOMMENDS that:

Lighthouse Authorities:

1. For new lights, determine their rhythmic characters by use of the Annex to this Recommendation; and,
2. For existing lights, endeavour to make them conform to the Annex to this Recommendation as soon as practicable.

NOTE – IALA Recommendation E-110 for the rhythmic characters of lights on aids to navigation Edition 2 – December 2005 replaces Edition 1 - May, 1998.

ANNEX

The rhythmic characters of lights on aids to navigation

1. INTRODUCTION

This Annex has been prepared to harmonise, on a world wide basis, the determination of the rhythmic characters of lights on aids to navigation. References to the IALA Maritime Buoyage System are included where appropriate.

In the table entitled “Classification of the rhythmic characters of lights, each class or sub-class of light character is described in general terms by a statement in the third column, which is headed “General description”. These statements have been adopted by the International Hydrographic Organization and national hydrographic organizations for use in their publications, and they are written so as to include, in one class or another, the light characters that exist on aids to marine navigation. Therefore the classes that are recommended by IALA are not fully described in the third column of the table, and further necessary details for the design of recommended light characters are given in the fourth column, which is headed “IALA Specification”. It is essential that the third and fourth columns are read together, and the rhythmic characters of lights conform with the requirements of the “IALA’s Specification” if they are to conform with these Recommendations.

2. TEMPORAL CONSIDERATIONS

The persistence of vision of a light, after extinction of the light, can reach 0.15 second; and the incandescence and nigrescence times associated with an incandescent source may together make a significant contribution to the duration of an appearance of light. These facts may be important, according to the circumstance, if the duration of an interval of darkness in a rhythmic character is made too short.

An authority should choose the rates for all its quick lights and all its very quick lights to be either 60 and 120 flashes per minute or 50 and 100 flashes per minute; the former set of rates is recommended as preferable. The latter set of rates has been defined for the benefit of those authorities that use buoy lanterns having mantle burners, for which the incandescence and nigrescence times together are too long to make the rate of 120 flashes per minute practical. Those authorities must perforce take the slower of the two specified rates for their very quick lights, and hence must also take the slower of the two specified rates for their quick lights in order to keep a recognizable distinction between the rates that they use. This document contains further recommendations for those same authorities with regard to the

classes of flashing lights to ensure that their quick lights can be discriminated.

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 recognized. Other distinctions should be made, if possible, between the characters, such as making periods clearly dissimilar or the numbers in groups different.

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. 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 of not more than one third of the duration of the longer flash.

3. COLOUR CONFUSIONS

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. It is probably advisable for authorities to avoid choosing rhythmic characters with high rates of flashing for Green lights.

4. THE IALA MARITIME BUOYAGE SYSTEM

The Appendix to this document classifies the rhythmic characters of the lights for the marks in the IALA Maritime Buoyage System with some remarks and further recommendations. All the characters used should be in conformity with the general recommendations of this document.

Lights of different colours are used to assist recognition of the marks in the IALA Maritime Buoyage System: Red and Green lights for the lateral marks, White lights for the cardinal, isolated-danger and safe-water marks, and Yellow lights for the special marks. The lights of the special marks should not show any of the rhythmic characters that have been assigned to the marks showing White lights.

The White lights of the cardinal marks are given a characteristic identity by the use of flashes at the rates for very quick lights or quick lights as the whole or a part of each of the rhythmic characters assigned to them. Recognition of any one of the four cardinal marks does not require identification of which of the two rates is being shown unless two similar marks are in the same area, and even then the periods of the rhythmic characters will be different.

4.1 DEFINITIONS AND REMARKS

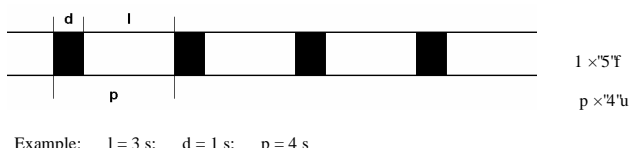
1. A rhythmic light is a light showing intermittently with a regular periodicity. The rhythmic character of such a light is the sequence of different appearances presented by the light during a period.
2. A light must, on a given bearing, maintain a consistent character.
3. These Recommendations are applicable to the rhythmic characters presented by all-round lights, sector lights, leading lights and direction lights.
4. The International Dictionary of Aids to Marine Navigation, Chapter 2, Visual Aids, should be consulted for definitions of the types and characteristics of lights on aids to navigation.

4.2 MAXIMUM PERIODS

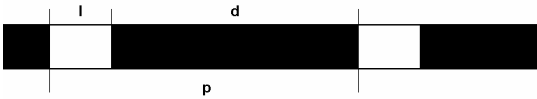
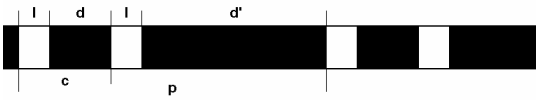
It is recommended that the periods of the characters of rhythmic lights should not exceed the following values.

<i>Class</i>	<i>Maximum period</i>
Isophase light	12 s
Single-occulting light Single-flashing light Group very quick light	} 15 s
Group-occulting light of two eclipses Long-flashing light Group-flashing light of two flashes Group quick light	} 20 s
Group-occulting light of three or more eclipses Group-flashing light of three or more flashes Composite group-flashing light Morse Code light	} 30 s

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CLASSIFICATION OF THE RHYTHMIC CHARACTERS OF LIGHTS					
	Class	Abbreviation	General description	IALA Specification	Particular use in the IALA Maritime Buoyage System
1	FIXED LIGHT	F	A light showing continuously and steadily.	A single fixed light should be used with care because it may not be recognized as an aid to navigation light. _____	A single fixed light shall not be used.
2	OCCULTING LIGHT		A light in which the total duration of light in a period is longer than the total duration of darkness and the intervals of darkness (eclipses) are usually of equal duration.	A light in which the total duration of light in a period is <i>clearly</i> longer than the total duration of darkness and all the eclipses are of equal duration.	
2.1	Single-occluding light	Oc	An occulting light in which an eclipse is regularly repeated	The duration of an appearance of light should not be less than three times the duration of an eclipse. The period should not be less than 2 s 	A single-occluding <i>White</i> light indicates a safe-water mark.
2.2	Group-occluding light	Oc(#) eg. Oc(2)	An occulting light in which a group of eclipses, specified in number, is regularly repeated.	The appearances of light between the eclipses in a group are of equal duration, and this duration is clearly shorter than the duration of the appearance of light between successive groups. The number of eclipses in a group should not be greater than four in general, and should be five only as an exception. The duration of an appearance of light within a group should not be less than the duration of an eclipse. The duration of an appearance of light between groups should not be less than three times the duration of an appearance of light within a group. In a group of two eclipses, the duration of an eclipse together with the duration of the appearance of light within a group should not be less than 1 s. In a group of three or more eclipses, the duration of an eclipse together with the duration of an appearance of light within the group should not be less than 2 s.	A group-occluding <i>Yellow</i> light indicates a special mark.



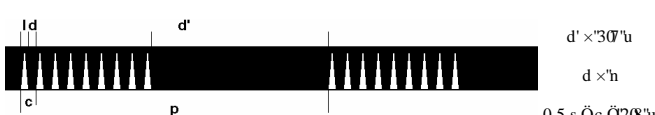
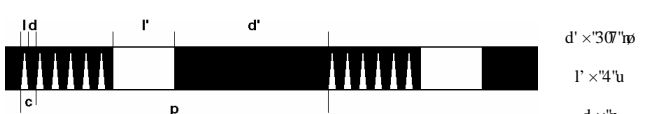
CLASSIFICATION OF THE RHYTHMIC CHARACTERS OF LIGHTS					
	Class	Abbreviation	General description	IALA Specification	Particular use in the IALA Maritime Buoyage System
				<p>Oc(2)</p> <p>Example: $l' = 6\text{ s}; l = 2\text{ s}; d = 1\text{ s}; c = 3\text{ s}; p = 10\text{ s}$</p>	
2.3	Composite group-occulting light	Oc(# + #) eg.Oc(2 + 1)	A light similar to a group-occulting light except that successive groups in a period have different numbers of eclipses.	<p>This class of light character is not recommended because it is difficult to recognize.</p> <p>Oc(2+1)</p> <p>Example: $l'' = 9\text{ s}; l' = 3\text{ s}; l = 1\text{ s}; d = 1\text{ s}; c = 2\text{ s}; p = 16\text{ s}$</p>	
3	ISOPHASE LIGHT	Iso	A light in which all the durations of light and darkness are clearly equal.	<p>The period should never be less than 2 s, but preferably it should not be less than 4 s in order to reduce the risk of confusion with occulting or flashing lights of similar periods.</p> <p>Example: $l = d = 2\text{ s}; p = 4\text{ s}$</p>	An isophase <i>White</i> light indicates a safe-water mark.
4	FLASHING LIGHT		A light in which the total duration of light in a period is shorter than the total duration of darkness and the appearances of light (flashes) are usually of equal duration.	<p>A light in which the total duration of light in a period is <i>clearly</i> shorter than the total duration of darkness and all the flashes are of equal duration.</p>	
4.1	Single-flashing light	Fl	A flashing light in which a flash is regularly repeated (at a rate of less than 50 flashes per minute).	<p>The duration of the interval of darkness (eclipse) between two successive flashes should not be less than three times the duration of a flash. The period should not be less than 2 s (or not less than 2.5 s in those countries where a quick rate of 50 flashes per minute is used).</p> <p>Example: $d = 3\text{ s}; l = 1\text{ s}; p = 4\text{ s}$</p>	A single-flashing <i>Yellow</i> light indicates a special mark.

CLASSIFICATION OF THE RHYTHMIC CHARACTERS OF LIGHTS					
	Class	Abbreviation	General description	IALA Specification	Particular use in the IALA Maritime Buoyage System
4.2	Long-flashing light	LFI	A single-flashing light in which an appearance of light of not less than 2 s duration (long flash) ¹ is regularly repeated.	 <p>Example: d = 8 s; l = 2 s; p = 10 s</p>	A long-flashing <i>White</i> light with a period of 10 s indicates a safe-water mark.
4.3	Group-flashing light	Fl(#) eg. Fl(2)	A flashing light in which a group of flashes, specified in number, is regularly repeated.	<p>The eclipses between the flashes in a group are of equal duration, and this duration is clearly shorter than the duration of the eclipse between successive groups.</p> <p>The number of flashes in a group should not be greater than five in general, and should be six only as an exception.</p> <p>The duration of an eclipse within a group should not be less than the duration of a flash.</p> <p>The duration of an eclipse between groups should not be less than three times the duration of an eclipse within a group.</p> <p>In a group of two flashes, the duration of a flash together with the duration of the eclipse within the group should not be less than 1 s.</p> <p>In a group of three or more flashes, the duration of a flash together with the duration of an eclipse within a group should not be less than 2 s (or not less than 2.5 s in those countries where a quick rate of 50 flashes per minute is used).</p>  <p>Example: d' = 6 s; d = 2 s; l = 1 s; c = 3 s; p = 10 s</p>	<p>A group-flashing <i>White</i> light with a group of two flashes, in a period of 5 s or 10 s, indicates an isolated-danger mark.</p> <p>A group-flashing <i>Yellow</i> light with a group of four, five or (exceptionally) six flashes indicates a special mark</p>

¹ 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. 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 of not more rhythmic character of such a light is than one third of the duration of the longer flash.

CLASSIFICATION OF THE RHYTHMIC CHARACTERS OF LIGHTS					
	Class	Abbreviation	General description	IALA Specification	Particular use in the IALA Maritime Buoyage System
4.4	Composite group-flashing light	Fl(# + #) eg Fl(2 + 1)	A light similar to a group-flashing light except that successive groups in a period have different numbers of flashes.	<p>Light characters should be restricted to (2 + 1) flashes in general, and should be (3 + 1) flashes only as an exception.</p> <p>Example: $d'' = 9\text{ s}$; $d' = 3\text{ s}$; $d = 1\text{ s}$; $l = 1\text{ s}$; $c = 2\text{ s}$; $p = 16\text{ s}$</p>	<p>A composite group-flashing <i>Red</i> or <i>Green</i> light with a group of (2 + 1) flashes indicates a modified lateral (preferred-channel) mark.</p> <p>A composite group-flashing <i>Yellow</i> light indicates a special mark.</p>

CLASSIFICATION OF THE RHYTHMIC CHARACTERS OF LIGHTS					
	Class	Abbreviation	General description	IALA Specification	Particular use in the IALA Maritime Buoyage System
5	QUICK LIGHT		A light in which flashes are repeated at a rate of not less than 50 flashes per minute but less than 80 flashes per minute.	A light in which identical flashes are repeated at the rate of 60 (or 50) flashes per minute. The higher rate of flashing is preferred.	
5.1	Continuous quick light	Q	A quick light in which a flash is regularly repeated.	<p>Example: $l = d = 0.5 \text{ s}; p = 1 \text{ s}$</p>	A continuous quick <i>White</i> light indicates a north cardinal mark.
5.2	Group quick light	Q(#) eg Q(3) eg Q(9) eg Q(6) +LFI	A quick light in which a specified group of flashes is regularly repeated.	<p>The number of flashes in a group should be three or nine. An exceptional light character is reserved for use in the IALA Maritime Buoyage System to indicate a south cardinal mark.</p> <p>Q(3)</p> <p>Example: $d' = 7.5 \text{ s}; l = d = 0.5 \text{ s}; c = 1 \text{ s}; p = 10 \text{ s}$</p> <p>Q(9)</p> <p>Example: $d' = 6.5 \text{ s}; l = d = 0.5 \text{ s}; c = 1 \text{ s}; p = 15 \text{ s}$</p> <p>Q(6)+LFI</p> <p>Example: $d' = 7 \text{ s}; l' = 2 \text{ s}; l = d = 0.5 \text{ s}; c = 1 \text{ s.}; p = 15 \text{ s}$</p>	<p>A group quick <i>White</i> light with a group of three flashes, in a period of 10 s, indicates an east cardinal mark.</p> <p>A group quick <i>White</i> light with a group of nine flashes, in a period of 15 s, indicates a west cardinal mark.</p> <p>A group quick <i>White</i> light with a group of six flashes followed by a long flash of not less than 2 s duration, in a period of 15 s, indicates a south cardinal mark.</p>

CLASSIFICATION OF THE RHYTHMIC CHARACTERS OF LIGHTS					
	Class	Abbreviation	General description	IALA Specification	Particular use in the IALA Maritime Buoyage System
6	VERY QUICK LIGHT		A light in which flashes are repeated at a rate of not less than 80 flashes per minute but less than 160 flashes per minute.	A light in which identical flashes are repeated at the rate of 120 (or 100) flashes per minute. The higher rate of flashing is preferred.	
6.1	Continuous very quick light	VQ	A very quick light in which a flash is regularly repeated.	 <p>Example: $l = d = 0.25 \text{ s}; p = 0.5 \text{ s}$</p>	A continuous very quick <i>White</i> light indicates a north cardinal mark.
6.2	Group very quick light	VQ(#) eg VQ(3) eg VQ(9) eg VQ(6)+LFI	A very quick light in which a specified group of flashes is regularly repeated.	<p>The number of flashes in a group should be three or nine. An exceptional light character is reserved for use in the IALA Maritime Buoyage System to indicate a south cardinal mark.</p> <p>VQ(3)</p>  <p>Example: $d' = 3.75 \text{ s}; l = d = 0.25 \text{ s}; c = 0.5 \text{ s}; p = 5 \text{ s}$</p> <p>VQ(9)</p>  <p>Example: $d' = 5.75 \text{ s}; l = d = 0.25 \text{ s}; c = 0.5 \text{ s}; p = 10 \text{ s}$</p> <p>VQ(6)+LFI</p>  <p>Example: $d' = 5 \text{ s}; l' = 2 \text{ s}; l = d = 0.25 \text{ s}; c = 0.5 \text{ s}; p = 10 \text{ s}$</p>	<p>A group very quick <i>White</i> light with a group of three flashes, in a period of 5 s, indicates an east cardinal mark.</p> <p>A group very quick <i>White</i> light with a group of nine flashes, in a period of 10 s, indicates a west cardinal mark.</p> <p>A group very quick <i>White</i> light with a group of six flashes followed by a long flash of not less than 2 s duration, in a period of 10 s, indicates a south cardinal mark.</p>

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APPENDIX - RHYTHMIC CHARACTERS OF THE LIGHTS IN THE IALA MARITIME BUOYAGE SYSTEM		
<i>Mark</i>	<i>Rhythmic character of the light</i>	<i>Remarks and further recommendations</i>
LATERAL	All recommended classes of rhythmic character ² , but a composite group flashing light with a group of (2+1) flashes is solely assigned to modified lateral marks that indicate preferred channels.	Only the colours Red and Green are used.
Modified lateral (preferred channel)	Composite group flashing light with a group of (2+1) flashes, in a period of not more than 16 s.	
CARDINAL		Only the colour White is used.
North cardinal	(a) Continuous very quick light. (b) Continuous quick light.	
East cardinal	(a) Group very quick light with a group of three flashes, in a period of 5 s. (b) Group quick light with a group of three flashes, in a period of 10 s.	
South cardinal	(a) Group very quick light with a group of six flashes followed by a long flash of not less than 2 s duration, in a period of 10 s. (b) Group quick light with a group of six flashes followed by a long flash of not less than 2 s duration, in a period of 15 s.	The duration of the eclipse immediately preceding a long flash should be equal to the duration of the eclipses between the flashes at the very quick rate. The duration of a long flash should not be greater than the duration of the eclipse immediately following the long flash. The duration of the eclipse immediately preceding a long flash should be equal to the duration of the eclipses between the flashes at the quick rate. The duration of a long flash should not be greater than the duration of the eclipse immediately following the long flash.
West cardinal	(a) Group very quick light with a group of nine flashes, in a period of 10 s. (b) Group quick light with a group of nine flashes, in a period of 15 s.	
ISOLATED DANGER	(a) Group-flashing light with a group of two flashes, in a period of 5 s. (b) Group-flashing light with a group of two flashes, in a period of 10 s.	Only the colour White is used. The duration of a flash together with the duration of the eclipse within the group should be not less than 1 s and not more than 1.5 s. The duration of a flash together with the duration of the eclipse within the group should be not less than 2 s and not more than 3 s.
SAFE-WATER	(a) Long-flashing light with a period of 10 s. (b) Isophase light. (c) Single-occluding light. (d) Morse Code light with the single character "A".	Only the colour White is used.
SPECIAL	(a) Group-occluding light. (b) Single-flashing light, but not a long-flashing light with a period of 10 s. (c) Group-flashing light with a group of four, five or (exceptionally) six flashes. (d) Composite group-flashing light. (e) Morse Code light, but not with either of the single characters "A" or "U" ³ .	Only the colour Yellow is used. A group-flashing light with a group of five flashes at a rate of 30 flashes per minute, in a period of 20 s, is assigned to Ocean Data Acquisition Systems (ODAS) buoys.

² A single fixed light shall not be used on a mark within the scope of the IALA Maritime Buoyage System because it may not be recognized as an aid to navigation light.

³ A Morse Code white light with the single character "U" is assigned to offshore structures.