

1.1. Specifying an AtoN Light System

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A typical AtoN light system comprises a lantern, a power source, connecting cables, and a mounting structure. The lantern is fitted with a flasher/lampchanger, a twin filament flasher unit or an LED light source with or without flasher circuitry. To select the appropriate components of an AtoN light system, consider:

A. Range of Lights

Luminous range is the maximum distance, at which a given light signal can be seen.

Geographical range is luminous range that takes into account light elevation, observer's height of eye, refraction and curvature of the earth.

Although a lantern configuration can be said to provide a stated range, actual luminous range can vary widely from location to location. For example, a lantern configuration providing over 15 nm range off an uninhabited island in the Gulf of Benin in West Africa will be seen less than 3 nm in the immediate vicinity of a major port like Genoa.

Light ranges that are depicted on charts or in "Lists of Lights" are luminous ranges obtained on a "dark clear night" with the Transmissivity-of-light factor (T) that the relevant national Light House Authority has decreed, and are referred to as "nominal ranges".

In reality, the actual performance of a lantern configuration is measured in cd intensity and the surest way to specify a lantern configuration to provide a particular luminous range is to convert the latter to cd intensity. Otherwise any range that is specified has to take into account the following factors:

B. Transmissivity (T) of light through the atmosphere:

T = 0.74 - indicating objects will be seen at 10 nm on a dark, clear night - is used in most countries, with "nominal" light ranges;

T = 0.85 - indicating objects will be seen at 20 nm on a dark, clear night - is sometimes used in tropical waters.

Background Lighting Factor (BLF) can reduce the effective intensity of a light by a factor of >100 in major ports.

The following table provides ranges (nautical miles) for different intensities and transmissivity values.

Intensity/Range Table for Darkness (T-0.74)

INTENSITY (candelas)	RANGE IN NAUTICAL MILES		
	TRANSMISSIVITY		
	0.74	0.85	0.90
1	1.0	1.1	1.1
2	1.4	1.5	1.6
3	1.6	1.8	1.9
4	1.8	2.1	2.2
5	2.0	2.3	2.4
6	2.2	2.4	2.6
7	2.3	2.6	2.8
8	2.4	2.7	3.0
9	2.5	2.9	3.1
10	2.6	3.0	3.2
11	2.6	3.1	3.4
12	2.7	3.2	3.5
13	2.8	3.3	3.7
14	2.9	3.4	3.8
15	3.0	3.5	3.9
16	3.1	3.6	4.0
17	3.2	3.7	4.1
18	3.2	3.8	4.2
19	3.3	3.9	4.3
20	3.3	4.0	4.4
25	3.6	4.3	4.8
30	3.8	4.6	5.1
35	4.0	4.8	5.4
40	4.1	5.1	5.7
45	4.3	5.3	6.0
50	4.4	5.5	6.2
55	4.6	5.7	6.4
60	4.7	5.8	6.7
65	4.8	6.0	6.9
70	4.9	6.1	7.0
75	5.0	6.2	7.2
80	5.1	6.4	7.4
85	5.2	6.5	7.6
90	5.3	6.7	7.7
95	5.4	6.8	7.9
100	5.4	6.9	8.0
110	5.5	7.1	8.3
120	5.6	7.2	8.5
130	5.8	7.4	8.8
140	5.9	7.6	9.0
150	6.0	7.8	9.2
160	6.1	8.0	9.4
170	6.2	8.1	9.6
180	6.3	8.3	9.8
190	6.4	8.4	10.0
200	6.5	8.5	10.1
220	6.7	8.8	10.5
240	6.8	9.0	10.7
270	7.0	9.3	11.2
300	7.2	9.6	11.5
330	7.3	9.8	11.9
360	7.5	10.0	12.2
400	7.7	10.4	12.6

INTENSITY (candelas)	RANGE IN NAUTICAL MILES		
	TRANSMISSIVITY		
	0.74	0.85	0.90
450	7.9	10.6	13.0
500	8.1	11.0	13.5
550	8.2	11.3	13.8
600	8.4	11.6	14.2
650	8.6	11.8	14.5
700	8.7	12.0	14.8
800	8.9	12.4	15.4
900	9.2	12.8	15.9
1,000	9.4	13.2	16.3
1,100	9.6	13.5	16.8
1,200	9.8	13.8	17.1
1,300	9.9	14.1	17.5
1,400	10.1	14.3	17.8
1,500	10.2	14.5	18.2
1,600	10.3	14.7	18.5
1,700	10.5	15.0	18.8
1,800	10.6	15.2	19.0
1,900	10.7	15.3	19.3
2,000	10.8	15.5	19.6
2,200	11.0	15.8	20.0
2,400	11.2	16.1	20.4
2,700	11.4	16.5	21.0
3,000	11.7	16.9	21.5
3,500	12.0	17.5	22.3
4,000	12.2	17.9	23.0
5,000	12.7	18.8	24.2
6,000	13.1	19.5	25.2
7,000	13.5	20.0	26.0
8,000	13.8	20.5	26.7
9,000	14.1	21.0	27.4
10,000	14.3	21.4	28.0
15,000	15.2	23.0	30.3
20,000	15.9	24.1	32.0
30,000	16.8	25.8	34.5
40,000	17.5	27.0	36.2
50,000	18.1	28.0	37.6
70,000	18.9	29.4	39.8
100,000	19.8	31.0	42.1
150,000	20.8	32.8	44.8
200,000	21.5	34.1	46.7
300,000	22.6	35.9	49.4
400,000	23.3	37.2	51.4
500,000	23.9	38.3	53.0
700,000	24.8	39.9	55.4
1,000,000	25.7	41.5	57.9
1,500,000	26.8	43.5	60.8
2,000,000	27.6	44.9	62.9
3,000,000	28.6	46.8	65.9
4,000,000	29.4	48.2	68.0
5,000,000	30.0	49.4	69.7
7,000,000	31.0	51.0	72.2
10,000,000	31.9	52.8	76.0

Intensity/Range Table for Daylight (T-0.74)

RANGE (nautical miles)	INTENSITY (candelas)
1	4,600
2	25,000
3	75,000
4	182,000
5	383,000
6	745,000
7	1,400,000
8	2,400,000
9	4,100,000
10	6,900,000

C. Geographical Range

Taking into account the fact that curvature of the earth, refraction, elevation/focal plane height of the light and the observer's height of eye, can limit the luminous range, at which a light is seen, is illustrated below.



Elevation of Light (m)	Range in Nautical Miles to Observed Light								
	Observer's Height (m)								
	2	3	5	7	10	16	20	26	30
2	5.7	6.4	7.4	8.2	9.3	11.0	12.0	13.2	14.0
3	6.4	7.0	8.1	8.9	9.9	11.6	12.6	13.9	14.6
5	7.4	8.1	9.1	9.9	11.0	12.7	13.6	14.9	15.7
7	8.2	8.9	9.9	10.7	11.8	13.5	14.5	15.7	16.5
10	9.3	9.9	11.0	11.8	12.8	14.5	15.5	16.8	17.5
16	11.0	11.6	12.7	13.5	14.5	16.2	17.2	18.5	19.2
20	12.0	12.6	13.6	14.5	15.5	17.2	18.2	19.4	20.2
26	13.2	13.9	14.9	15.7	16.8	18.5	19.4	20.7	21.5
30	14.0	14.6	15.7	16.5	17.5	19.2	20.2	21.5	22.2

Note:

Approximate Observer Heights;

Leisure Craft –	2 to 3m
Fishing Vessels –	3 to 5m
Coastal Vessels and Cutters	8 to 12m
Ocean going freighters, tankers and containers –	15 to 30m

D. Colour of Light

The colour of lens, sector insert or LED light source depends upon the type of light application (Lateral, Cardinal, Isolated Danger, Safe Water or Special, Bridge or Offshore Structure) and, in the case of the first 5 applications mentioned, the IALA Buoyage Region A or B, in which the lantern configuration is to be installed. Refer to the IALA Pamphlet "Maritime Buoyage System" or the relevant local regulatory authority.

E. Flash Period/Rhythm

Rules for the timing sequences of approved flash characters are found in the IALA Recommendation for the Rhythmic Characters of Lights on Aids to Marine Navigation and in the IALA Recommendations for the Marking of Offshore Structures. Reference can also be made to the relevant local regulatory authority. Lights may only be synchronised, if the period of the chosen flash character is the same.

F. Selecting the Required Lantern Configuration

Once the required level of intensity has been determined, inspect the Intensity Tables of individual lantern configurations, to select those that meet the requirement for effective intensity, taking into account the required flash character sequence.

In the tables in most lantern brochures for filament lamp lanterns, effective intensity is calculated by the IALA adopted, Schmidt-Clausen method with cd output increasing with the duration of on time. Where coloured lenses or sector inserts are required, the intensity correction factor that is indicated in the relevant brochure is also applied.

In Marine LED lanterns, effective intensity is best calculated via a spreadsheet, provided by the Supplier, for each lantern option, for different values of power input, percentage duty cycle and flash duration.

G. Determining the Required Power System

First establish whether AC power is available at the chosen site. If it is, consider how reliable the supply is and whether battery back up is required and for how many nights. Most light sources are available for connection either directly to a secure AC supply or via an AC/DC power supply unit that can be fitted, either externally or within a lantern housing. If AC power is not available, you will need to size a DC power system, either a primary non-rechargeable battery bank or, more usually, a solar power system.

When an AtoN light source is powered via a DC battery bank, the electrical load that it draws dictates the size of the battery. To determine the daily ampere hour (Ah/day at specified voltage) or watt-hour load of the light, filament lamp and LED light source lanterns have to be considered separately.

With filament lamp lanterns, multiply the average lamp current, corrected for surge effect by the product of the percentage duty cycle and the mean operating day (a 14-hour night is generally used as the norm over the period of a year). To determine the percentage duty cycle of a rhythmic light, divide its total on time by the period of the light and multiply by 100.

For example, 0.3 seconds on, 0.7 second off is a 30% duty cycle. To be precise, also allow for the quiescent drain of the lantern electronics (<0.1Ah/day at 12V in modern AtoN lanterns).

In LED lanterns, the calculation should be conducted via a spreadsheet, compiled by the manufacturer, for each lantern option, for different values of power input, percentage duty cycle

and flash duration and including the quiescent drain of the lantern electronics.

Once the mean daily load has been calculated, you can determine the battery size, allowing for battery discharge rates and days in reserve, where relevant, and avoiding deep discharges. An IALA solar sizing programme can be used to identify the most efficient solar configuration for any installation. Also check that power supply wiring is the appropriate size to ensure that closed circuit voltage at the light source is sufficient at every ambient temperature during operating periods. Alternatively, you should be able to rely on the power control circuitry of a modern AtoN lantern and use a higher voltage battery, to absorb any power losses between battery bank and light source.

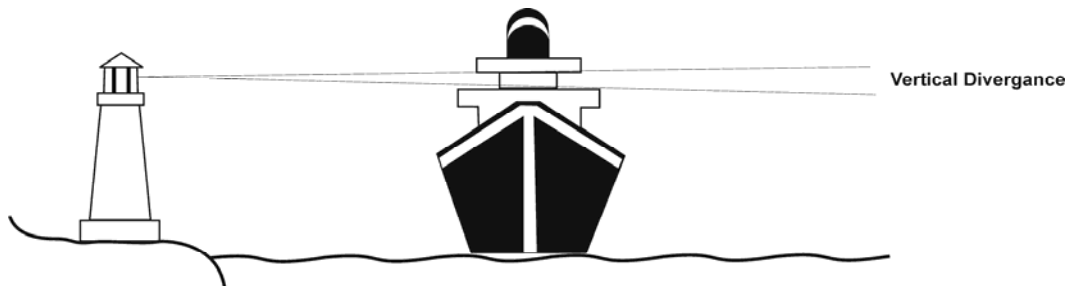
H. Site Considerations

Check:

The geographical table (page 4), to confirm that the proposed elevation/ focal plane height of the light source is high enough for the required light range.

Whether the vertical divergence of the chosen lantern is wide enough to be seen by SOLAS vessels at their closest point of approach to it. This minimum range will depend upon observer's height and Focal Plane Height or elevation of the light.

Beam limits are defined by vertical divergence at 10% intensity in filament lamps and at 50% intensity in LED lanterns. Some LED lanterns have vertical divergence designed specifically for inland waterways where this problem may arise.



If the installation is in an open or unenclosed area, specify a battery box to accommodate the batteries. A wide range of weatherproof battery boxes is available.

Select an appropriate support structure for the location and the specified light system. Lantern suppliers should be able to supply a full range of support structures, from short pedestals; stanchions and single lift arrangements to GRP and steel towers. In some instances, self-contained LED light arrangements may provide sufficient range and power to meet the requirement.