NMMA CERTIFICATION PROGRAM
CORRECTIONS REPORT

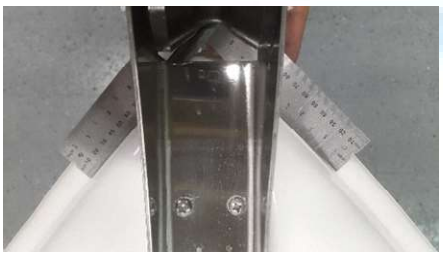
BOAT BODEL: SM12X

PREPARED BY: Mel Freire /Product Engineer

NAVIGATION LIGHTS

Bow Green/Red lights
Arcs of visibility were calculated according to boat's boat geometry and light's dimension and tested with a horizontal / vertical laser level to comply with A-16.6.4

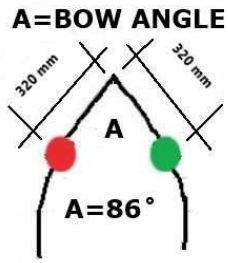
Measurements:
Bow's angle was obtained using a digital rule angle finder (See picture#1, 2 and 3)



Pic. 1

Pic. 2

Pic. 3



We obtained 86° for the Bow angle and the distance from tip of the Bow to the navigation light location was measured giving 320 mm which is still on the same bow angle line (See picture#4 and 5).

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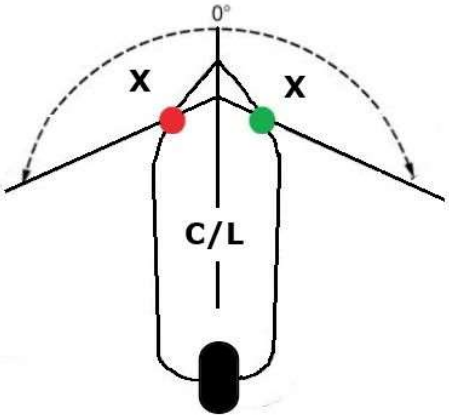
Now we need to obtain "Angle X" (Visibility Arch) which should be 112.5° to comply with A-16.6.4 (See picture#4 and 5).



Pic. 4 **Pic. 5**

Navigation lights technical data

The lights installed in the Sardine Marine boat model SM12X are Oznium brand with high intensity LED type.

Marine LED Navigation Light Technical Info	
Dispersion Angle	112.5 degree
Visibility	More than 1 nautical mile
Connection Type	2 Red/Black wires
Dimmable	No
IP Rating	IP68
LED Type	2835 LED

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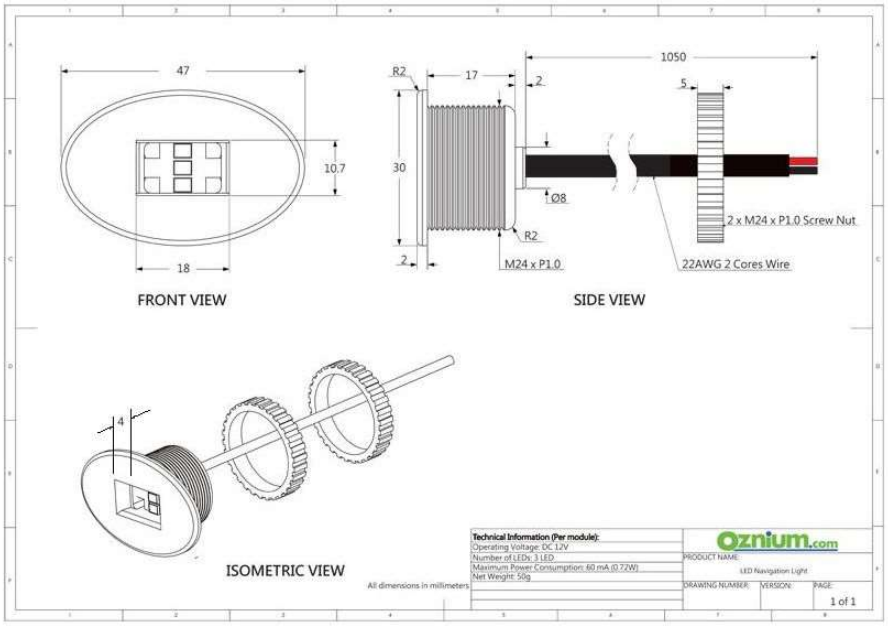
Number of LEDs	3 pcs on each light
Operating Voltage Range	12 VDC
Wire Gauge	Marine type, 22 AWG
Wire Length	1 meter
Weight	47g (per light)
Housing Material	Aluminum
Installation Hole	24mm

	Current (mA)	Luminous Flux (lumens)	Wavelength (nm)
Red	65	9.1	621.3
Green	60	13.89	521.6

Navigation light diagram



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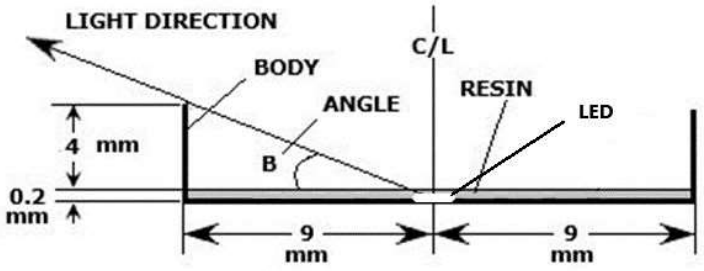
Calculating real visual angle of navigation light alone
From the diagram we have the dimensions of the navigation light body
(See pic#: 6)

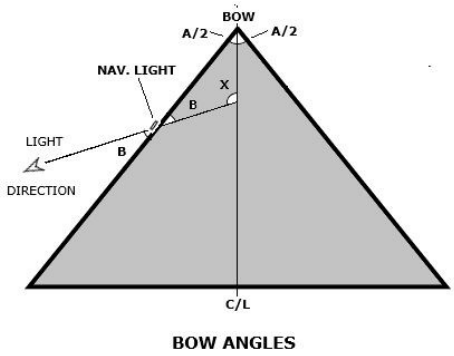


Pic. 6

We need now to calculate "Angle B", from Pic. 8 which the maximum light direction angle. From the manufacturer's Navigation Light diagram, we know its sides: Adjacent which is 9mm and Opposite which is 4mm+0.2 mm, where 0.2 is assumed the resin thickness that covers the light.
Adjacent side= 9 mm
Opposite side=4.2 mm

From Trigonometric theorem:
Tangent B = Opposite side/ Adjacent side
Tangent B = 4.2/9 = 0.46; Therefore, solving tangent
B = 25°

We found out which was the real visual angle of the navigation light alone, now we need to take into consideration the bow angle A and how is the light angle with respect to Boat's Center Line (See picture#: 7).



Pic. 7

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Calculating Angle X (Visibility Arch)

We already know the following angles:

A=86°
B=25°

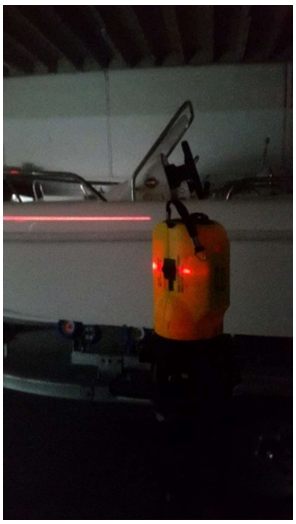
From trigonometric theorem:
The sum of all angles in a triangle must be equal to 180°

Therefore: X + B + A/2 = 180 ; X = 180 – B – A/2; X = 180 – 25 – 86/2

X = 112°

Laser Test
Even though the angle X calculation gave a very close result to the "112.5° Arc of Visibility" required on the norm. We performed a physical test using a laser level instrument that measures also angles in degrees in order to corroborate X angle calculations

Procedure:
Step 1.-The laser lever/angle was placed parallel to the boat (Amidships) and perpendicular to its Center line at a distance of 1500 mm to its port side.
(see picture # 8)



Pic. 8

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Step 2.-The laser lever/angle was aimed to the board side navigation light for horizontally and vertically calibration level (see picture # 9).

Pic. 9

Step 3.-Then, the navigation lights were turned on and the laser lever/angle was kept aimed to the navigation light to check if the light could be seen (Could not be seen at start point) (see picture # 10).

Pic. 10

Step 3.-This procedure was repeated moving away from the boat's port side until the navigation light could be seen directly aimed with the laser instrument. Every change of position the angle's degree was read (see picture # 11, and 12).

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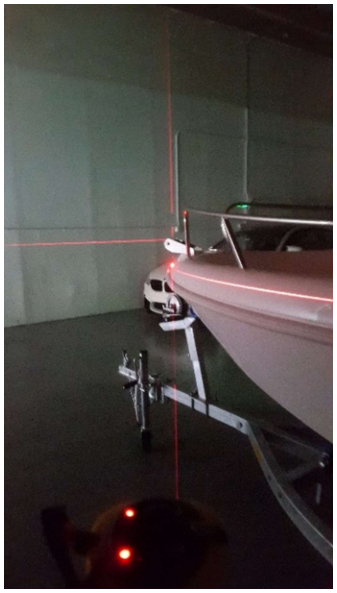
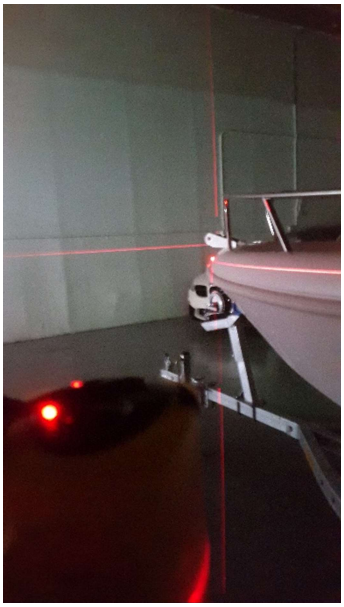
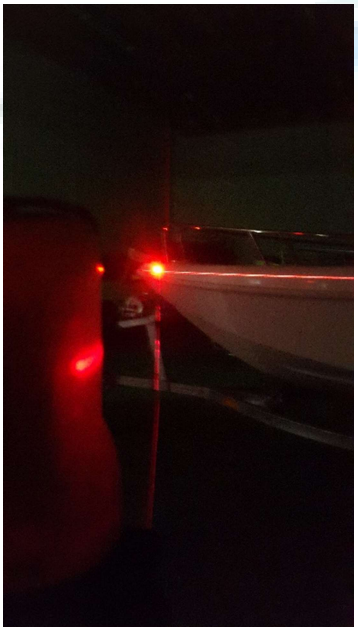


Pic. 131



Pic. 12

Step 4.-Once the light could be seen, at that particular point the angle in the laser is read and the result was in 111.9° (see picture # 13A and 13B).



Pic. 13A

Pic. 13B

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