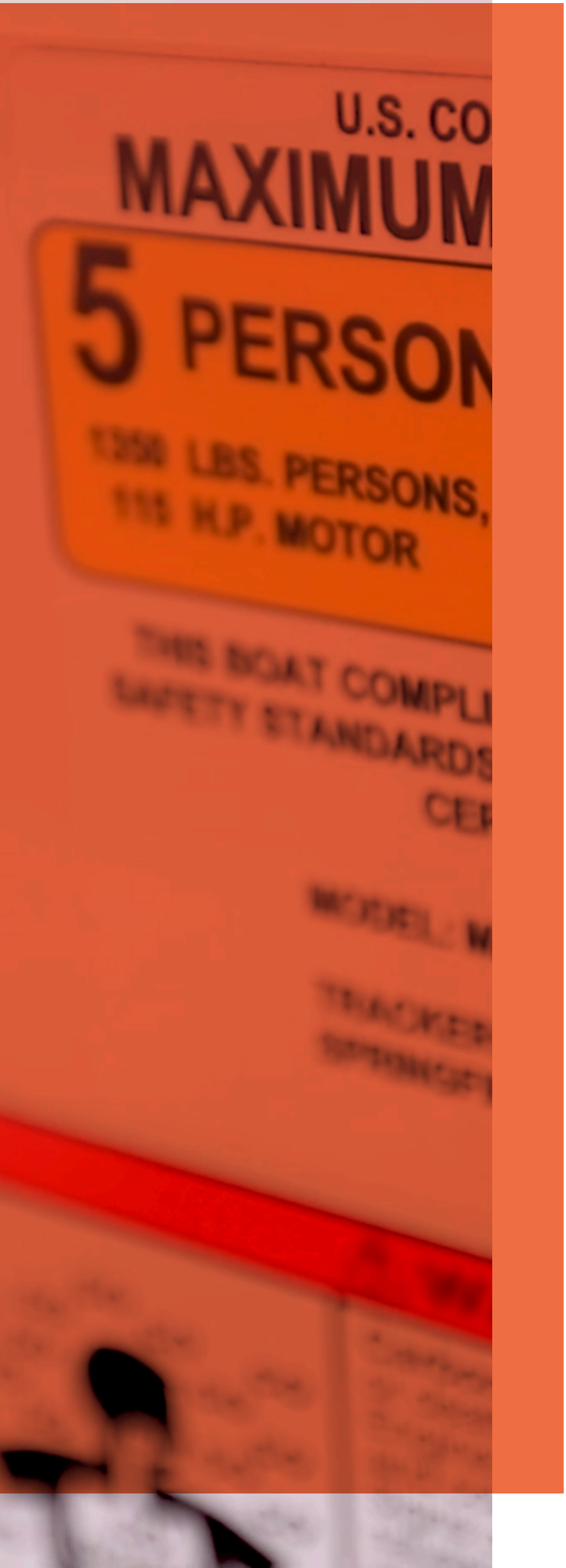


BOAT BUILDER'S HANDBOOK

2021 Edition

NAVIGATION LIGHTS

33 CFR 183 SUBPART M

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INTRODUCTION

Showing compliant navigation lights is a case of being both properly **CERTIFIED** (per 33 CFR Subpart M) and properly **CONFIGURED** (per the International and Inland Navigation Rules and Regulations – commonly referred to as the COLREGS or Rules of the Road). The official designation 'Navigation Rules' will be used in this chapter. The word "Rules" refers to 'Navigation Rules – International and Inland.

Showing proper navigation lights is an operator responsibility. There are no regulations to require a recreational boat manufacturer to install navigation lights. But, if installed (on new recreational boats), the USCG requires that the lights be properly certified and properly configured. [USCG authority is per 46 USC 4302(a)(2) wherein equipment installed on recreational boats must be installed properly and operate as intended.]

TAKE HEED: Boat builder compliance means fully meeting all applicable regulations. The Boatbuilder's Handbook provides a basic introduction and summary of the regulations. Builders need to refer to the actual regulations for the complete text of the regulation to ensure full compliance. It is the boat manufacturer's responsibility to review, understand, and comply with all applicable regulations. Boat builders should review the applicable Navigation Rules for the length and type of boat being built.

1.0 APPLICABILITY

There are no regulations that state that boat builders must install navigation lights. Showing proper navigation lights is an operator requirement. Obviously, many boat builders install lights to be able to sell the boats. When installed, the lights must be properly certified and configured.

2.0 NAVIGATION LIGHT CERTIFICATION

33 CFR Subpart M

Per 183.810: Boat manufacturers must install navigation lights that meet all technical standards (as proven by testing at a USCG approved laboratory) and bear a permanent and indelible marking "USCG" followed by the certified range in nautical miles (ex: USCG 2nm). The marking must be visible without removing or disassembling the light.

33 CFR Subpart M, which requires certification of navigation lights installed on new recreational boats, became effective November 2003. In most cases it is the navigation light manufacturer who has had light fixtures properly tested for visibility / cut-off angles / color at a USCG approved test facility.

33 CFR 183.810 calls for a fixture label with eight lines of information regarding the test process; recreational boat manufacturers universally opt for the simple alternative 'USCG 2nm' type marking on the navigation light fixtures because typically the navigation light is too small to accommodate all the information required by 33 CFR 183.810. In this case the required information must be displayed in the packaging or as an insert to the navigation light.

Boat manufacturers (a term which includes importers) must be certain that the model light installed is properly certified for new recreational boats. A navigation light manufacturer may have numerous other models of lights that are only for replacement on older boats.

If a navigation light does not show that it is USCG certified it is likely that the light is not in fact certified. The certification process is onerous, and certification is typically listed in the navigation light marketing materials. A vessel with navigation lights not properly marked will not pass a USCG inspection.

In some cases, such as with classic boat recreations, the boat builder will need to have custom order navigation lights tested at a USCG approved laboratory. The list of USCG approved labs for navigation light testing (under Marine Lighting – Navigation Light – 111.075) is at http://cgmix.uscg.mil/EQLabs.

3.0 NAVIGATION LIGHT CONFIGURATION

Navigation Rules & Regulations

The Navigation Rules are detailed - and cover all types of vessels. This guideline discussion is limited to the basic rules applicable to recreational boats. The Navigation Rules are available online at http://www.navcen.uscg.gov.

The Navigation Rules specify configuration (and alternatives) based on boat length. The international aspect of the rules means that lengths are given in meters. The primary length cut-offs for the various rules are:

7 meters	23.0 feet
12 meters	39.4 feet
20 meters	65.6 feet
50 meters	164.0 feet

Per 'Navigation Rules – International & Inland' Rule 21 'Definitions'
Masthead light – white light placed on fore and aft centerline showing an unbroken arc of the horizon of 225 degrees (meaning to 22.5 degrees abaft the beam on either side).

Sidelights – green light on the starboard side and red light on the port side each showing an unbroken arc of the horizon of 112.5 degrees (meaning from dead ahead to 22.5 degrees abaft the beam.

Sternlight – means a white light placed as nearly as practical at the stern showing an unbroken light over an arc of 135 degrees (meaning from dead astern to 67.5 degrees to either side.

One option is allowed:

On a vessel of less than 20 meters in length the sidelights may be combined into a single fixture on the fore and aft centerline.

Per 'Navigation Rules – International & Inland' Rule 22 'Visibility of Lights'
gives the required range of visibility for the masthead light, sidelights, and sternlight – this 'intensity' requirement varies with vessel length.

Per 'Navigation Rules – International & Inland' Rule 23 'Power Vessels Underway'
specifies that a power driven vessel underway shall exhibit a masthead light forward, sidelights, and a sternlight.

As before, there is an important option:

A power driven vessel of less that 12 meters in length may substitute a white all-round (showing 360 degrees) for the separate masthead light and sternlight.

3.1 LIGHTS OFF THE CENTERLINE (< 12 M) – INTERNATIONAL VS. INLAND

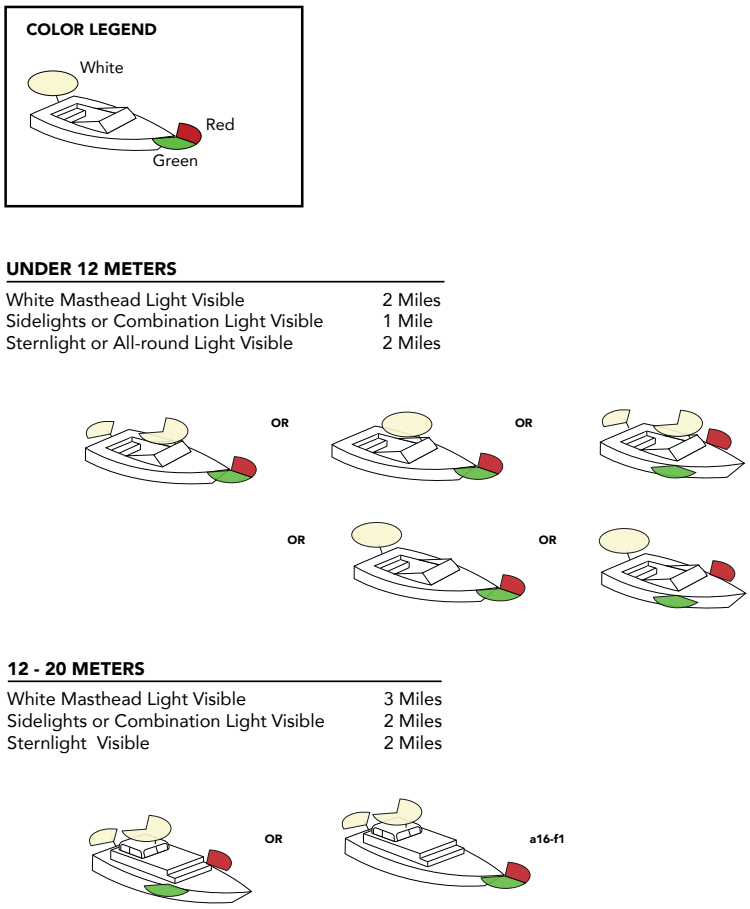
International Rule 23 (Lights and Shapes for Power-driven Vessels Underway), paragraph (d)(iii) states …***"the masthead light or all-round white light) on a power-driven vessel of less than 12 meters in length may be displaced from the fore and aft centerline of the vessel if centerline fitting is not practicable, provided that the sidelights are combined in one lantern which shall be carried on the fore and aft centerline of the vessel or located as nearly as practicable in the same fore and aft line as the masthead light or all-round white light."***

The Inland Rules are silent on this subject under Rule 23 – but the rules do allow for off-center lights (on a vessel of less than 12 m in length) . Check out the differences between the International and Inland Rule 21 Definitions of "Masthead light" and "Sidelights". The Inland Rules add: ***"... the masthead light shall be placed as nearly as practicable to the fore and aft centerline of the vessel."*** – and – ***"... the sidelights when combined in one lantern shall be placed as nearly as practicable to the fore and aft centerline of the vessel."***

- ✓ International Rules: masthead / all-round light installed off-center is acceptable as long as a combination sidelight is used and is installed centered or aligned with the masthead/all-round light.
- ✓ Inland Rules: allow off-center masthead / all-round lights with either combination or separate sidelights.

Figure 1 shows the required navigation light visibility and the configuration options on power driven vessels.

FIGURE 1 Power Driven Vessels Underway



Per 'Navigation Rules – International & Inland' Rule 25 – 'Sailing Vessels Underway and Vessels Under Oars' specifies that a sailing vessel underway shall exhibit sidelights and a sternlight (only). A vessel under oars may exhibit the same lights are prescribed for a sailboat.

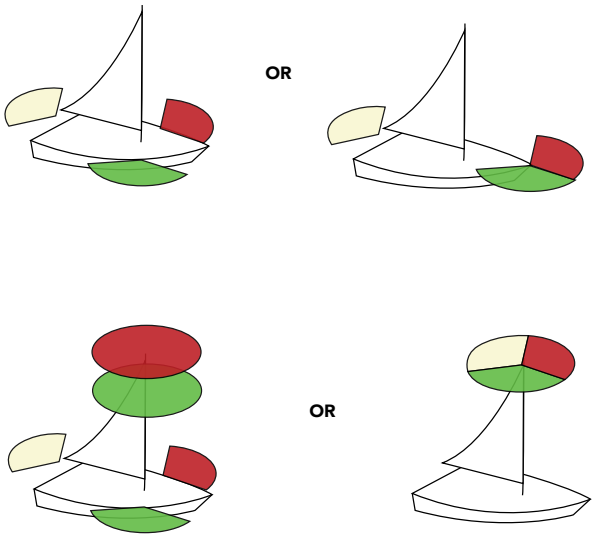
One option for sailing vessels of less than 20 meters in length is to show a single tri-color fixture at or near the top of the mast.

A sailing vessel with auxiliary power must be outfitted to show proper 'power vessel underway' lights whenever the engine is on line (either combined with sail or power alone).

Figures 2 & 3 show the navigation light options on sailboats and rowboats.

FIGURE 2 Sailing Vessels Under Sail Alone / Rowboats

	UNDER 12 METERS	**12-20 METERS**
Sidelights or Combination Light Visible	1 Mile	2 Miles
Sternlight Visible	2 Miles	2 Miles

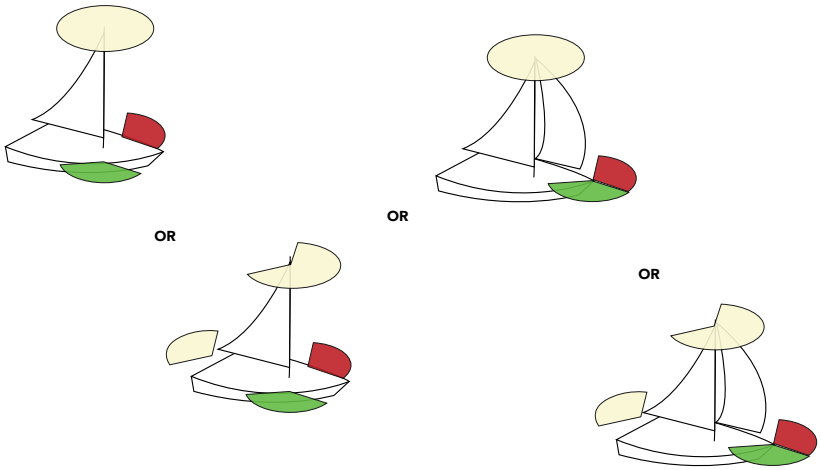


IMPORTANT NOTE: Sailboats under sail AND power or power ALONE must show navigation lights for powered vessels as shown in Figure M-1 (same configuration options / same visibility requirements).

FIGURE 3 Vessels Under Sail and Power or Sailboats Under Power Alone

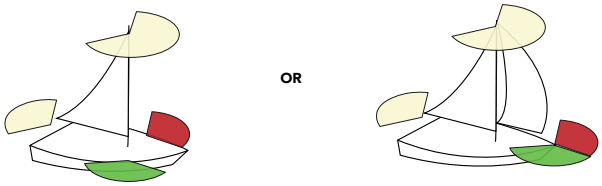
UNDER 12 METERS

White Masthead Light Visible	2 Miles
Sidelights or Combination Light Visible	1 Mile
Sternlight Visible	2 Miles



12 - 20 METERS

White Masthead Light Visible	3 Miles
Sidelights or Combination Light Visible	2 Mile
Sternlight Visible	2 Miles



3.2 VERTICAL POSITIONING / VERTICAL SEPARATION

Per Annex I of the International & Inland Rules, the navigation lights must have specified vertical and horizontal positioning and spacing on the boats. Again, the specific rules vary with boat length.

For vessels up to 12 meters in length:

The masthead (or alternate all-round light) must be at least 1 meter above the sidelights. (That distance is measured vertically.) See Figure 5.

If the sidelights get moved up to the edge of the hard-top, then the all-round light on a pole in the top of the hard-top needs to be that much higher to meet the 1 m vertical separation requirement.

For vessels 12 meters to 20 meters in length:

The masthead light must be at a 'height above the gunwale' of not less than 2.5 meters. Height above the gunwale' is not defined in the rules; it may be taken as the height above the continuous deck measured from the gunwale.

Sidelights should be at least one meter below the masthead light. That 'should' signifies USCG policy as, at present, there is no wording in the Navigation Rules specifically stating the vertical placement of sidelights on vessels of 12 meters in length or more up to 50 meters in length when only one masthead light is carried.

Under International Rules the sidelights must be positioned above the upper-most continuous deck; under Inland Rules the sidelight may be positioned above, at, or below the upper-most continuous deck.

Note: navigation sidelights installed below the uppermost continuous deck / sheer line are not acceptable for boats operating in international waters.

3.3 HORIZONTAL POSITIONING

There is no specific horizontal positioning requirements for vessels up to 12 meters in length.

(Rule 23 – 'Power-driven Vessels Underway' requires both a forward masthead light and a second masthead light for vessels over 50 meters in length; vessels of less than 50 meters may opt to have only one masthead light.)

For vessels up to 20 meters in length (with a safe assumption of only a single masthead light):

The masthead light is to be placed as far forward as practicable.

For vessels in the 20 meters to 50 meters length range with a single masthead light that light must be placed forward of amidships; this is a common design dilemma for yachts of this length. COLREGS International Rules Annex I Part 13 has an alternate lighting scheme for vessels that qualify. The boat builder also has the option to apply for a certificate of alternate compliance from the USCG District Commander.

The sidelights may be placed either fore of aft of the single masthead light.

3.4 VISIBILITY OBSTRUCTIONS

All navigation light definitions include the words ***"… an unbroken light over an arc of the horizon of …"***

Annex I states the horizontal and vertical 'prescribed sectors' for the sidelights, masthead lights, all-round lights and sternlights.

The 6 degree exception to this rule [Annex I, International para. 9(b); Inland para. 84.17(b)] only applies to all-round lights … ***"All-round lights shall be located as not to be obscured by masts, topmasts or structures within angular sectors of more than 6 degrees …"***

The 6 degree exception for all-round lights means an obstruction in any direction. Trigonometry can be used to determine and angle of obstruction. For example: a 2.5 inch diameter pole 24 inches from the light will be a 6 degree obstruction; a 5.0 inch diameter mast 48 inches from the light will be a 6 degree obstruction.

Sidelights and the sternlight cannot be obstructed in any way. Sidelights should not be installed on the cabin structure low enough where a bow railing can obstruct its sector of visibility. Likewise, sternlights should not be installed where mounted equipment such as radar or antenna will obstruct its sector of visibility.

3.5 LIGHT ARCS ALIGNED WITH BOTH BOAT CENTERLINE AND HORIZON

Alignment Rules: A key issue is that the Navigation Rules for light alignment in the horizontal sector (alignment with the centerline of the boat) and in the vertical sector (alignment with the horizon) are very different. Alignment with the centerline has strict cut-off rules; alignment with the horizon is much more lenient as the tilted lights may still show to 5 degrees above and below the horizon.

Horizontal Sectors – Annex I rules give the limits for **CUT-OFF** angles.

In the forward direction, sidelight intensities shall decrease to reach cut-off between 1 degree and 3 degrees outside the sector.

For sternlights, masthead lights and sidelights at 22.5 degrees abaft the beam, intensities shall decrease to reach cut-off outside the prescribed sector of not more than 5 degrees. See Figure 4.

Vertical Sectors – Annex I gives a range wherein **AT LEAST THE REQUIRED MINIMUM INTENSITY** is maintained. As long as the required visibility is maintained within the required range, it does not matter if the light also shows outside (above and below) the range.

All lights must show at the required intensity at all angles from **5 degrees above to 5 degrees below** the horizontal. See Figure 5.

Non-sailing vessels need to show 60% of intensity from 7.5 degrees above to 7.5 degrees below; sailing vessels need to show 50% of intensity from 25 degrees above to 25 degrees below.

A common problem – with lights mounted on a hard top – is that the light is not high enough to clear the hard top so it is visible 5 degrees below the horizon. Trigonometry returns: a rule of thumb is to have the light at least 1 foot above the (assumed level) hardtop for every 12 feet of length (from the light to the forward edge of the hard top. See Figure 6.

Sidelights mounted on slanted structures of the boat (or in the rub rail must be installed to be in alignment with both the boat centerline and with the horizon. This is particularly important for sidelights that are mounted below the sheer line in the flare of the bow.

Sidelights not aligned with the fore and aft centerline will cross forward of the bow at an excessive angle (or not show forward at all). Any lights not aligned with horizon may not show the required intensity above and below the horizon. Such lights need an attachment structure to bring them into compliance with proper horizontal and vertical alignment.

Lights installed below the sheer should be watertight.

FIGURE 4 Sidelight Alignment with the Centerline of the Boat

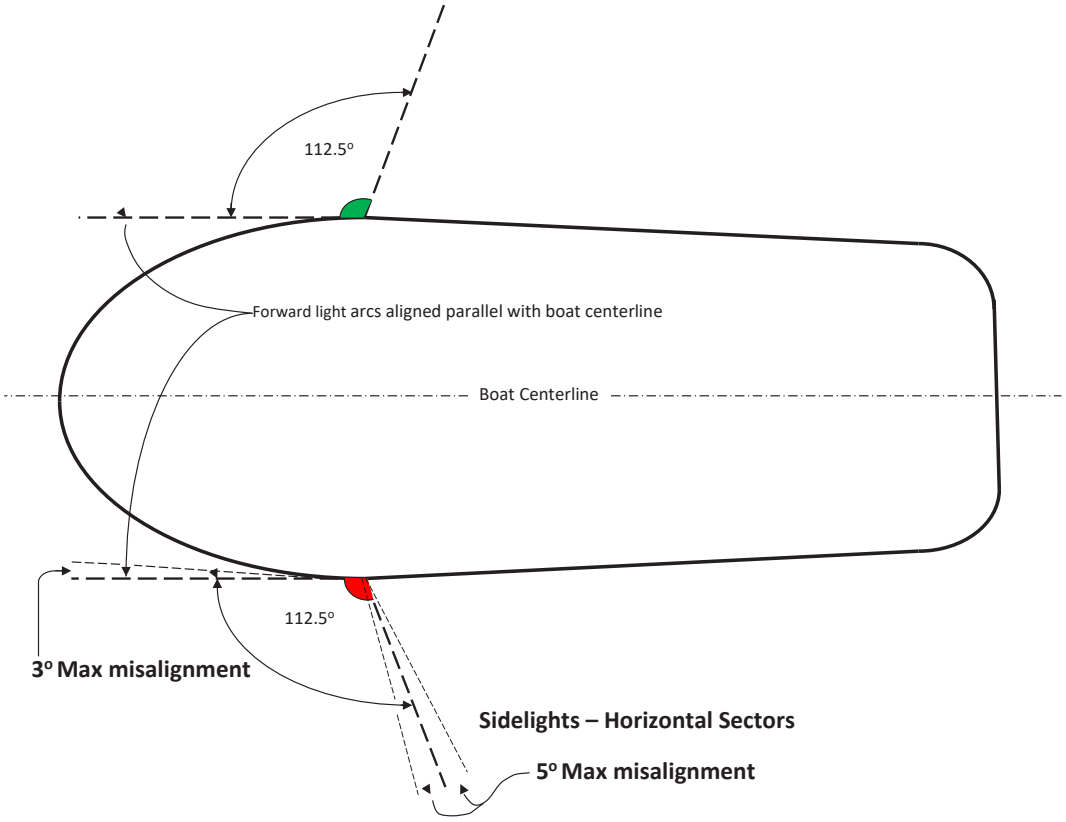
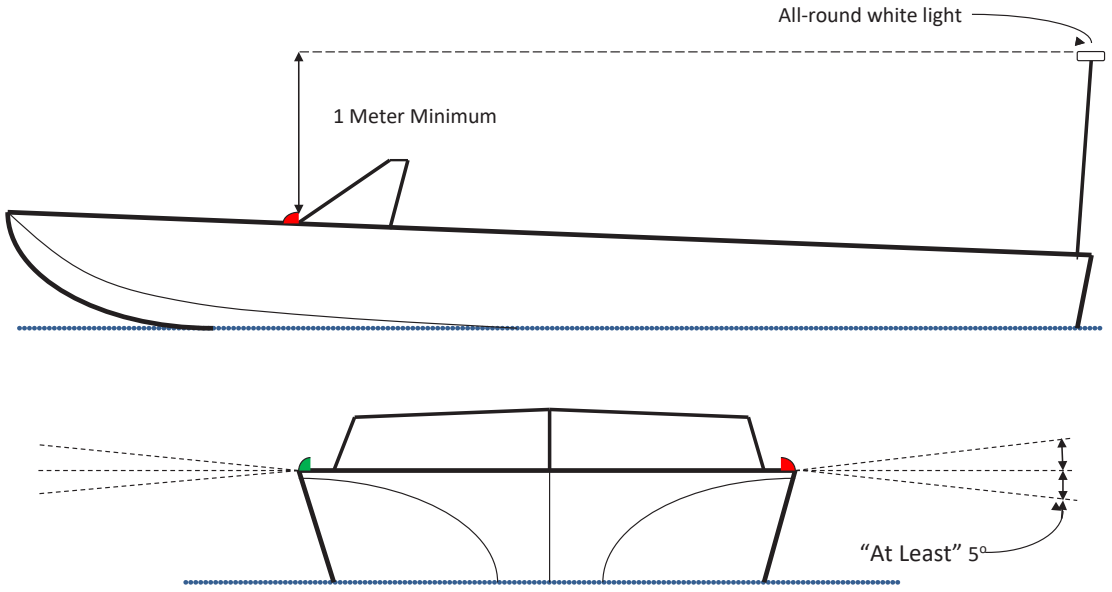


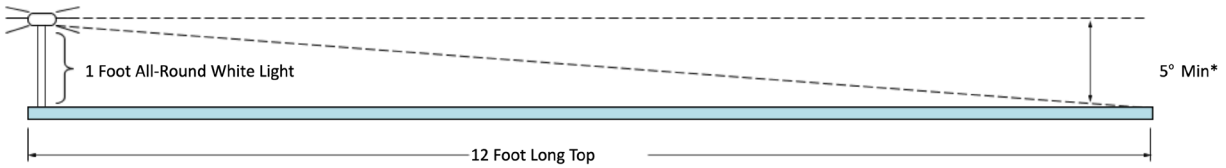
FIGURE 5 Vertical Separation and Sidelight Alignment with the Horizon

For Vessels <12m (39.4 Ft)
Masthead (or all-round) light: Minimum height above sidelights -- 1m (39.4 inches)



Sidelight vertical minimum intensity (i.e., minimum visible range) — at least 5° above & below horizontal

FIGURE 6. All-round Light Height Above Hardtop



A rule of thumb – for the masthead light / all-round light to show to the required 5 degrees below the horizontal: the masthead light / all-round light mounted above a hardtop / bimini should be at a height of 1 foot above the highest point of the structure for every 12 linear feet of the horizontal top structure.

DOCKING LIGHTS, UNDERWATER LIGHTS, ACCENT LIGHTING

The navigation rules prohibit the exhibition of additional lights that may be confused as navigation lights. The Navigation Rules, Part C, Rule 20, part (b) states: "The Rules concerning lights shall be complied with from sunset to sunrise, and during such times no other lights shall be exhibited, except such lights as cannot be mistaken for the lights specified in these Rules or do not impair their visibility or distinctive character, or interfere with the keeping of a proper look-out."

The 33 CFR Subpart M regulation regarding navigation light certification is attached as Appendix 1. For the Navigation Rules with respect to navigation light configuration go to

www.navcen.uscg.gov

Appendix 1. 33 CFR 183 SUBPART M – NAVIGATION LIGHTS

§ 183.801 APPLICABILITY.

This subpart applies to recreational vessel manufacturers, distributors, and dealers installing such equipment in new recreational vessels constructed after November 1, 2002.

§ 183.803 DEFINITIONS.

As used in this subpart:

Dealer means any person who is engaged in the sale and distribution of recreational vessels to purchasers who the seller in good faith believes to be purchasing any such recreational vessel for purposes other than resale.

Distributor means any person engaged in the sale and distribution of recreational vessels for the purpose of resale.

Manufacturer means any person engaged in:

(1) The manufacture, construction, or assembly of recreational vessels, or

(2) The importation of recreational vessels into the United States for subsequent sale.

Navigation lights are those lights prescribed by the Navigation Rules (COLREGS and their associated Annexes and Inland Navigation Rules (33 CFR subchapter E) to indicate a vessel's presence, type, operation, and relative heading.

§ 183.810 NAVIGATION LIGHT CERTIFICATION REQUIREMENTS.

(a) Except as provided by paragraph (b) of this section, each navigation light must -

(1) Meet the technical standards of the applicable Navigation Rules;

(2) Be certified by a laboratory listed by the Coast Guard to the standards of ABYC A-16 (incorporated by reference, see § 183.5) or equivalent, although portable battery-powered lights need only meet the requirements of the standard applicable to them; and

(3) Bear a permanent and indelible label that is visible without removing or disassembling the light and that states the following:

(i) "USCG Approval 33 CFR 183.810."

(ii) "MEETS___." (Insert the identification name or number of the standard under paragraph (a) (2) of this section, to which the laboratory type-tested.)

(iii) "TESTED BY___." (Insert the name or registered certification-mark of the laboratory listed by the Coast Guard that tested the fixture to the standard under paragraph (a)(2) of this section.)

(iv) Name of manufacturer.

(v) Number of model.

(vi) Visibility of the light in nautical miles.

(vii) Date on which the light was type-tested.

(viii) Identification and specifications of the bulb used in the compliance test.

(b) If a light is too small to attach the required label -

(1) Place the information from the label in or on the package that contains the light; and

(2) Mark each light "USCG" followed by the certified range of visibility in nautical miles (nm), for example, "USCG 2nm". Once installed, this mark must be visible without removing the light.