

VESSELS UNDER SAIL - PROBLEMS IN THE FIELD

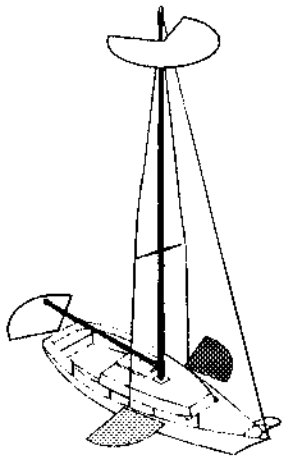
Problems in the Field:

Use of Powerboat Switch Panels on Sailboats:

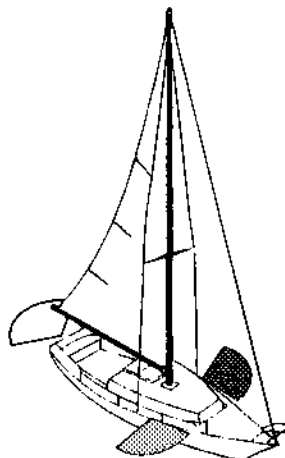
Any sailboat equipped with an auxiliary engine must be equipped with two different running light displays. Some sailboat manufacturers, however, are installing switch panels intended for use on a powerboat. A sailing vessel underway at night under sail alone, which displays the lights of a powerboat, would be expected to maneuver in accordance with the Navigation Rules for a powerboat.

turned off and a stern light and sidelights turned on when the vessel is under sail alone.

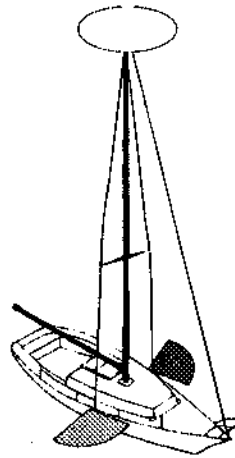
Display of running lights and the anchor light: Navigation lights tell boat operators something about each other's size, speed, course, and kind of boat (sail, power, anchored, etc.) and enable other vessels to properly apply the Rules of the Road. Some vessel operators have a tendency to display both their running lights (masthead light, sidelights and stern light) and their anchor light while their vessels are underway. Perhaps they think



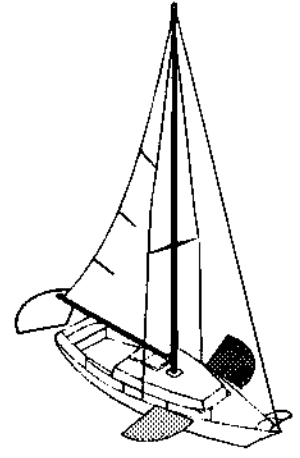
Under power



Under sail



Under power
Less than 12 Meters



Under sail

A powerboat switch panel often has only one switch for "running lights" which turns on the masthead light, sidelights and the stern light. A sailboat equipped with an auxiliary engine, however, must be capable of displaying: (1) running lights for when the vessel is under power (or under both sail and power); and (2) running lights for when the vessel is under sail alone.

In a sailboat equipped with an auxiliary engine fitted with a masthead light, separate side lights (or a combination side light fixture) and a stern light, the switch panel must include a separate circuit for the masthead light so it can be turned off when the vessel is under sail alone. In the case of a sailboat under 12 meters in length fitted with the optional all-around white light, in lieu of a masthead light and stern light, the switch panel must include three separate circuits so the all-round light (which might also be used as the anchor light) can be

display of the anchor light while underway makes them more visible; however, the Navigation Rules specifically prohibit the display of running lights and anchor lights simultaneously.

According to Rule 20(b), 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 prescribed in these Rules or do not impair their visibility or distinctive character". Owners are urged to make sure their running lights and anchor lights are equipped with separate switches and to refrain from displaying additional lights which might be confusing to other boaters operating at night.

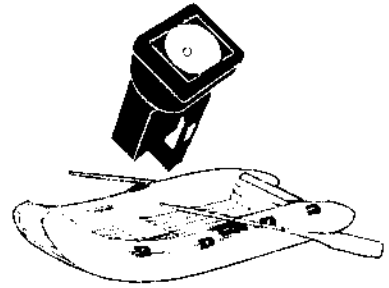
The use of white lights such as spreader lights or deck lights on a vessel can significantly impair the boat operator's night vision. If it becomes necessary to turn on such lights, turn them off as soon as possible.

VESSELS UNDER OARS

THE NAVIGATION RULES

RULE 25 - Sailing Vessels Underway and Vessels Under Oars

(d)(ii) A vessel under oars may exhibit the lights prescribed in this Rule for sailing vessels, but if she does not, she shall have ready at hand an electric torch or lighted lantern showing a white light which shall be exhibited in sufficient time to prevent collision.

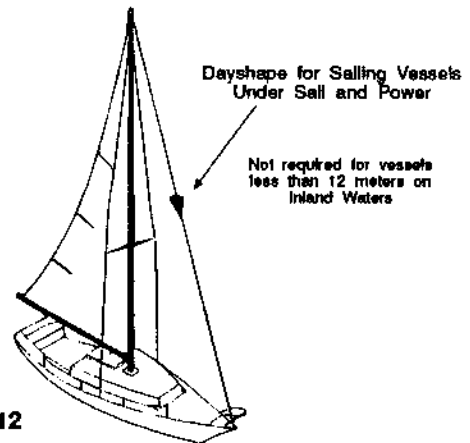


VESSELS UNDER BOTH SAIL AND POWER

THE NAVIGATION RULES

RULE 25 - Sailing Vessels Underway and Vessels Under Oars

(e) A vessel proceeding under sail when also being propelled by machinery, shall exhibit forward where it can best be seen a conical shape, apex downwards.



Note: Same under the Inland Rules except a vessel of less than 12 meters is not required to exhibit this shape but may do so.

ANCHORED VESSELS

THE NAVIGATION RULES

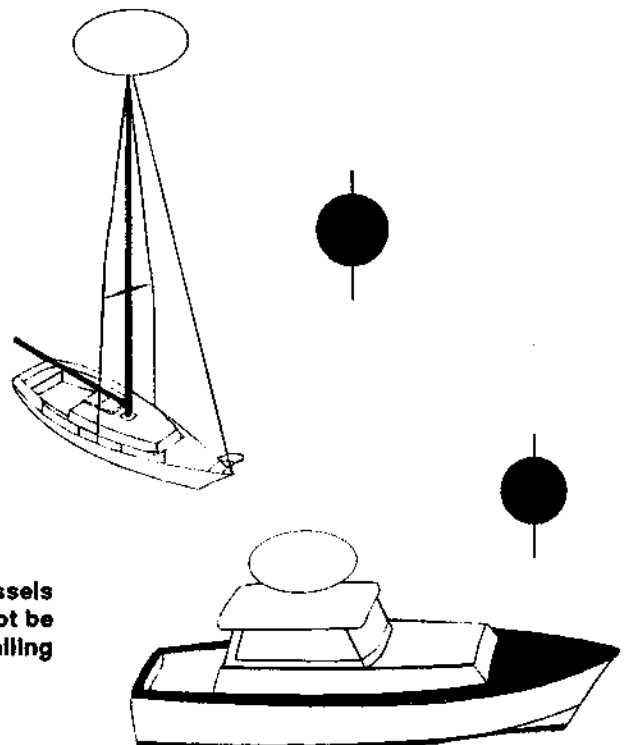
RULE 30 - Anchored Vessels and Vessels Aground

(a) A vessel at anchor shall exhibit where it can best be seen:

(i) in the fore part, an all-round white light or one ball; and

(ii) at or near the stern and at a lower level than the light prescribed in subparagraph (i), an all-round white light.

(b) A vessel of less than 50 meters in length may exhibit an all-round white light where it can best be seen instead of the lights prescribed in paragraph (a) of this Rule.



Dayshapes: A black ball day shape is to be displayed by all vessels at anchor during the day. The black ball day shape should not be confused with the inverted black cone which indicates a sailing vessel underway, motor sailing.

ANCHORED VESSELS

THE NAVIGATION RULES

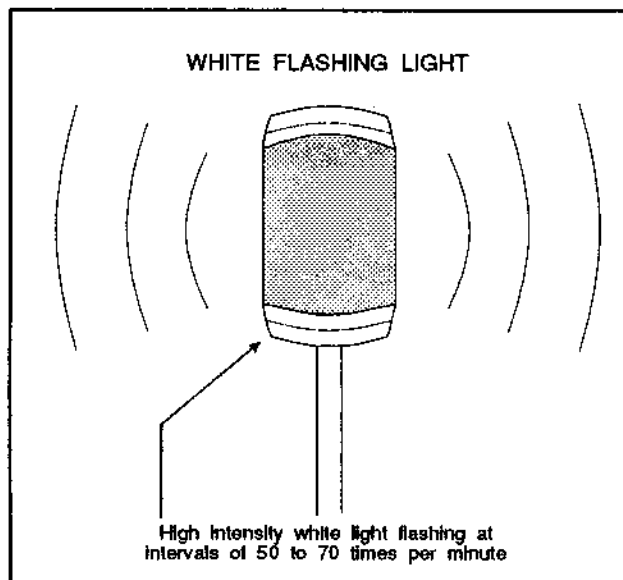
RULE 37 - Distress Signals:

When a vessel is in distress and requires assistance she shall use or exhibit the signals described in Annex IV to these Rules.

The distress signals for inland waters are the same as those for international waters with the following additional signal described: **Strobe Light**

Problems in the Field: Use of a strobe light as an anchor light: The strobe light often mounted at the top of the mast on sailboats is recognized as a distress signal only in inland waters and should never be used as an anchor light or running light. A strobe light does not meet the definition of an "all-round light" under Rule 21(e).

Improper use of strobe lights: The Coast Guard has received reports of the use of white strobe lights as "anti-collision" lights. A white strobe light is a distress light in inland waters and is prohibited under the International Rules (except for use as a distress signal on PFDs). Misuse of white strobe lights may result in civil penalties up to \$5,000.



Vessels using searchlights are reminded that improper use of searchlights violates both the Inland and the International Rules. Examples of violations include: (a) leaving searchlights on constantly while underway, interfering with the visibility of navigation lights; and (b) shining searchlights at other vessels, impairing the night vision of other mariners.

VERTICAL POSITIONING OF LIGHTS AND SHAPES

THE NAVIGATION RULES

ANNEX 1

Positioning and Technical Details of Lights and Shapes

1. Definition

The term "height above the hull" means height above the uppermost continuous deck. This height shall be measured from the position vertically beneath the location of the light.

2. Vertical positioning and spacing of lights

(a)*

(b) The vertical separation of masthead lights of power-driven vessels shall be such that in all normal conditions of trim the after light will be seen over and separate from the forward light at a distance of 1000 meters from the stem when viewed from sea level.

(c) The masthead light of a power-driven vessel of 12 meters but less than 20 meters in length shall be placed at a height above the gunwale of not less than 2.5 meters.

(d) A power-driven vessel of less than 12 meters in length may carry the uppermost light at a height of less than 2.5 meters above the gunwale. When however, a masthead light is carried in addition to sidelights and a sternlight or the all-round light prescribed in rule 23(c)(i) is carried in addition to sidelights, then such masthead light or all-round light shall be carried at least one meter higher than the sidelights.

(e)*

(f) (i) The masthead light or lights prescribed in Rule 23(a) shall be so placed as to be above and clear of all other lights and obstructions except as described in subparagraph (ii).

(ii)*

(g) The sidelights of a power-driven vessel shall be placed at a height above the hull not greater than three quarters of that of the forward masthead light. They shall not be so low as to be interfered with by deck lights.

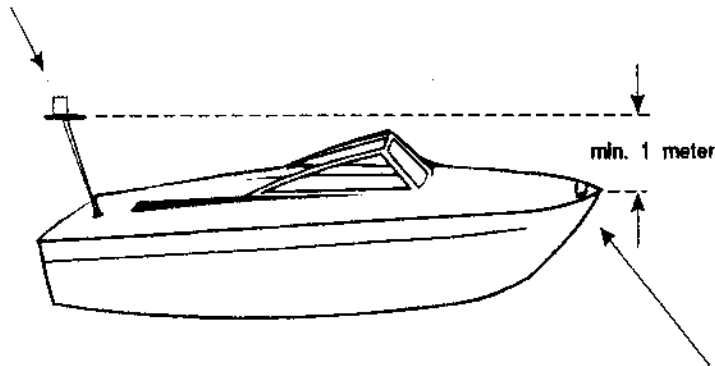
(h) The sidelights, if in a combined lantern and carried on a power-driven vessel of less than 20 meters in length, shall be placed not less than 1 meter below the masthead light.

(i)*

Note: The combination sidelight fixture referred to in (2)(b) above, must be placed far enough forward so the light can be seen when the boat is in a bow-high attitude.

Vertical Positioning of Navigation Lights
Power-driven Vessel less than 12 meters

All-Round Light



Combination Sidelight Fixture
(same vertical separation required
for separate sidelight fixtures)

See Note on Page 12

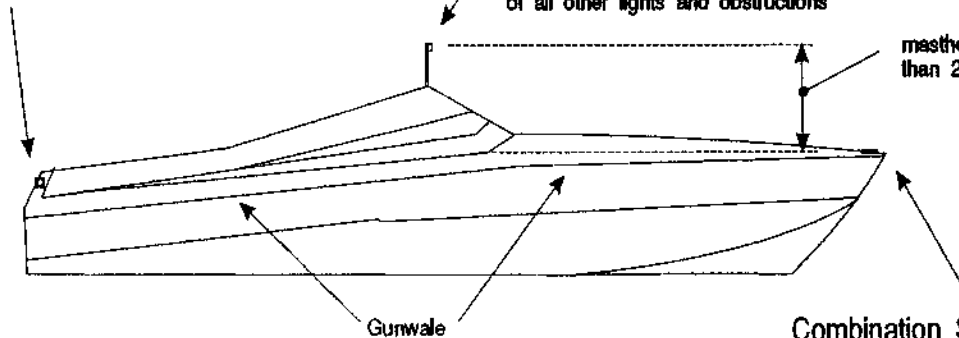
Vertical Positioning of Navigation Lights
Power-driven Vessel Less than 12 meters

Sternlight
at or near the stern

Masthead Light

at least one meter higher than sidelights**
as far forward as possible and above and clear
of all other lights and obstructions

masthead light may be less
than 2.5 m above the gunwale

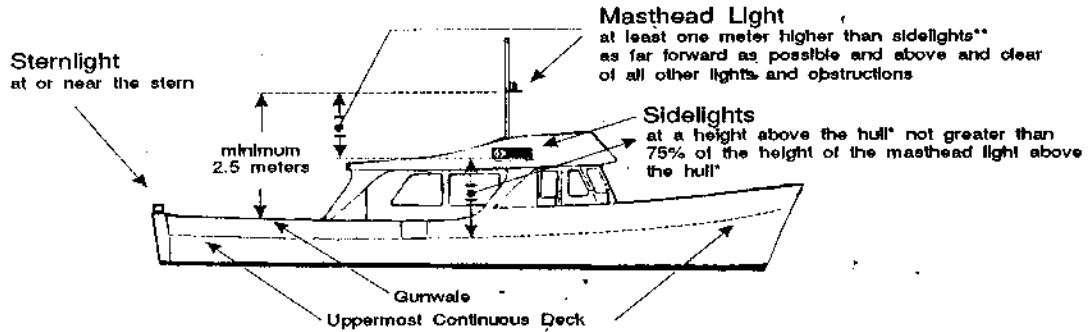


Combination Sidelight Fixture
at a height above the hull* not greater than
75% of the height of the masthead light
above the hull

*The term "height above the hull" means height above the uppermost continuous deck.

** The same vertical separation is required between masthead light and sidelights
if separate sidelight fixtures are used.

**Vertical Positioning of Navigation Lights
Power-driven Vessel Less than 20 meters**



*The term "height above the hull" means height above the uppermost continuous deck.
 ** The same vertical separation is required between masthead light and sidelights if combined combined sidelight fixture is used.

VERTICAL SEPARATION: PLACEMENT OF ALL-ROUND LIGHT AND COMBINATION SIDELIGHTS

According to Rule 23(a) of the Inland Navigation Rules, a power driven vessel underway shall exhibit:

(1) a masthead light forward; except that a vessel of less than 20 meters in length need not exhibit this light forward of amidships, but shall exhibit it as far forward as is practicable.

- (2) sidelights; and
- (3) a sternlight.

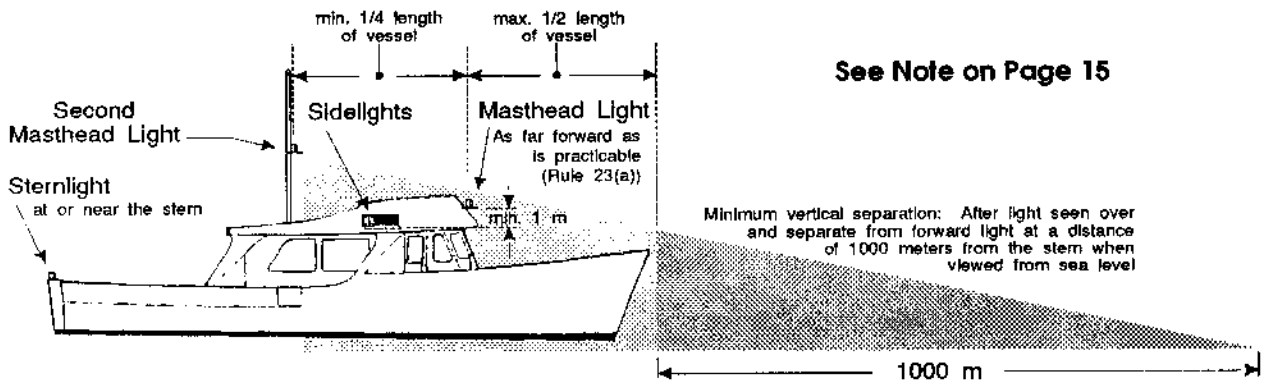
According to Rule 23(c), a power driven vessel of less than 12 meters in length may, in lieu of the lights prescribed above, exhibit an all-round white light and sidelights.

Subsection 84.03 of Annex I to the Inland Rules states that "The masthead light, or the all-round light described in Rule 23(c), of a power driven vessel of less than 12 meters in length, shall be carried at least one meter higher than the sidelights.

Section 2(d) of Annex I to the International Rules (COLREGS), however, refers only to masthead lights that are carried in addition to sidelights and a sternlight. An International Maritime Organization (IMO) interpretation of the COLREGS indicates that the same separation was intended for an all-round light used in lieu of a masthead light and sternlight.

Coast Guard standards personnel who are on factory visits are checking to make sure that the navigation lights on new boats manufactured have the required minimum one meter separation.

**Vertical and Horizontal Positioning of Two Masthead Lights
(Optional for Power-driven Vessel less than 50 meters)**



See Note on Page 15

Minimum vertical separation: After light seen over and separate from forward light at a distance of 1000 meters from the stern when viewed from sea level

HORIZONTAL POSITIONING OF LIGHTS AND SHAPES

THE NAVIGATION RULES

ANNEX I

Positioning and Technical Details of Lights and Shapes

3. Horizontal positioning and spacing of lights

(a) When two masthead lights are prescribed for a power-driven vessel, the horizontal distance between them shall not be less than one-half the length of the vessel but need not be more than 100 meters. The forward light shall be placed not more than one-quarter of the length of the vessel from the stern.

NOTE:

The Coast Guard wants to encourage the use of two masthead lights on power-driven vessels less than 50 meters in length. Therefore, under a Coast Guard interpretation of the above paragraph, power-driven vessels less than 50 meters in length do not have to meet the minimum horizontal separation requirements specified in subparagraph 3.(a) of Annex I.

(b) *

(c) *

4. *

5. Screens

(a)*

(b) On power-driven vessels less than 12 meters in length constructed after July 31, 1983, the masthead light, or the all-round light described in Rule 23(c) shall be screened to prevent direct illumination of the vessel forward of the operator's position

SHIELDING NAVIGATION LIGHTS

Many people go boating at night who can't see beyond their windshield. The problem is glare — one of the most frequent causes of nighttime boating accidents. Not the glare from lights on shore, but glare from their own lights — their navigation lights.

Many builders fail to actually test navigation light installations to determine whether glare at the helm is a problem. This means some boat operators are forced to find their own solutions. Sometimes glare is so severe people turn off their navigation lights or they put a sock over the masthead light. Others try

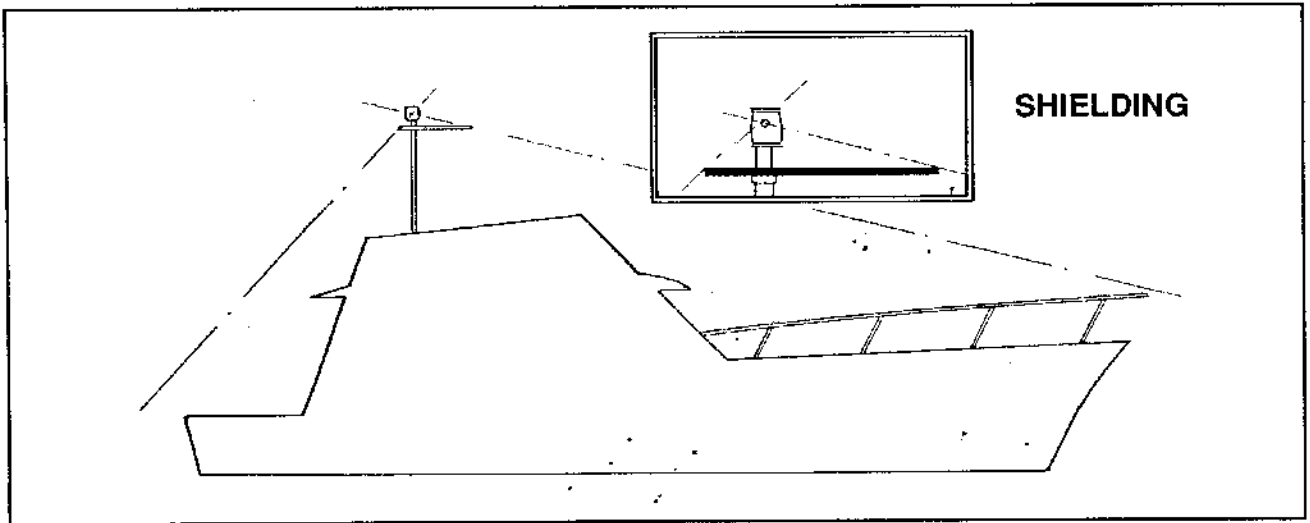
steering while standing up or while seated on the gunwale or seatback. That explains why collisions with other boats, aids to navigation or the shore aren't the only accidents caused by glare. There are also falls overboard.

The all-round light is the most frequent source of complaints about glare. The all-round light is a 360 degree light which may be installed on any powerboat less than 12 meters (39.36 feet) in length. Boats which lack a cabin, e.g. runabouts, bowriders, bassboats, etc., usually display an all-round light. One reason for the glare problem on these boats involves storage of the fixture during the day. The typical all-round light installation on a bowrider, for example, consists of a telescoping rod attached near the stern of the boat. During the day the boat operator can lower the light fixture to where it is flush with the deck or gunwale and out of the way. At dusk the boat operator loosens a threaded sleeve, pulls up the rod and tightens the sleeve again. With sidelights, usually combined into a single fixture on the bow, the boat now complies with the Inland Navigation Rules.

Unfortunately, the maximum height to which the telescoping rod will extend is usually dependent upon the distance from the gunwale to the bottom of the boat. The telescoping all-round light is also installed well aft on many boats. When fully extended, the all-round light may shine on the foredeck or bowrails, and obscure the operator's vision forward of the bow.

Masthead lights also cause nighttime visibility problems. The masthead light is a 225 degree light required on powerboats over 12 meters (39.36 feet) in length. Some builders of small cabin cruisers less than 12 meters also install masthead lights. On these boats the glare problem from navigation lights is a matter of appearance, rather than one of storage. Admittedly, a tall mast on a trawler usually contributes to the overall appearance of a boat, but putting a mast on a small cabin cruiser or a boat with a flying bridge tends to make either boat look top heavy. Perhaps this explains why masthead lights are frequently installed where they can produce dangerous amounts of glare.

On small cabin cruisers which lack enclosed wheelhouses the masthead light is often installed on top of the windshield and on boats with dual control stations, the tendency is to mount the masthead light in front of the helm on the flying bridge. The



problem with either installation is that unless the masthead light is installed high enough, the operator will have a great view of the forward part of the boat, but objects in front of the boat will be invisible.

There is another problem involving glare from a masthead light. When a masthead light is correctly mounted on the centerline of a boat, the light is visible from directly ahead to 22.5 degrees abaft the beam. Most boats with the exception of those with center consoles do not have centerline helm stations. The helm station is usually located on the starboard side of the boat. This means glare from the masthead light may shine on parts of the windshield, control console and maybe even on the boat operator. So glare on the bow isn't the only potential problem — there may also be glare near the helm.

A properly installed navigation light complies with the Rules of the Road and does not produce glare. This means the light shines in the correct direction, is invisible to the operator of the boat on which it is installed and does not shine on any parts of the boat. Basically, the boat should sit in a shadow. Instead of creating a shadow, the problem with most navigation lights is the light beam "spills" downward. As you increase the height of a navigation light, vertical spill onto surfaces of the boat will eventually cease and the boat will be in shadow. Unfortunately, on some powerboats this means raising the light to the point where a sleek runabout starts to resemble a sailboat. What needs to be done is to eliminate spill from the navigation light through what is known as "shielding."

"Shielding" a navigation light points the light beam in the direction it is designed to shine. A sawed off shotgun spreads shot over a wide area, but with

a normal length barrel, the blast is confined. The same is true of the beam in a navigation light. If you place a flat sheet of metal beneath a navigation light, you can prevent the light from spilling onto parts of the boat beneath the light. The shield trains the beam to travel in the correct direction and also acts as an umbrella which shades the boat and eliminates glare.

As you increase the size of the shield beneath a navigation light, the height of the mast to which the fixture is attached may be smaller. If a shield is large enough, an all-round light or masthead light need be no higher than the top of the operator's head when he or she is seated. A shield can also be shaped to throw a shadow which conforms to the exact shape of a boat.

The best way to design a navigation light installation which does not produce glare is to sit in the seat at the helm station in the dark. With the navigation lights on, the boat operator should be able to turn in any direction and not see light from any fixtures or glare on the boat structure. If light or glare is visible, a light must be moved higher or a larger shield must be installed beneath the fixture. If a light is high enough and is well-shielded, the entire boat will be bathed in shadow.

All-round lights. When selecting a location for the all-round light, there is a better way to install these lights than back in the stern that is not that much more expensive. First of all, remember that it is not a sternlight (see note). The Rules require a one meter (39.37 inch) vertical separation between sidelights and an all-round light or masthead light. Make a removable pole tall enough and rigid enough to hold a shielded all-round light above the operator's head. The farther forward the all-round light is installed,

the shorter the pole that is needed. The pole can be made even shorter if it is mounted on the console at the helm.

Masthead lights. Shielding a mast-head light requires two different kinds of shields. Like the all-round light, the light beam from a masthead light spills vertically below the bottom of the fixture. A masthead light should have a horizontal shield beneath the light to direct this part of the beam forward. Inside a masthead light are two vertical shields that aim the light 22.5 degrees abaft the beam on either side of the boat. On a small masthead light fixture, these shields are often too small and the light actually spills further to port or starboard and glare may fall on part of the boat structure or helm area. Extensions of these vertical shields on the outside of the light fixture will eliminate the glare problem. In most cases the extensions need be no longer than two or three inches. On boats where the masthead light is located on top of the windshield, simply shielding the light correctly should throw a shadow on the bow and prevent light from spilling onto the console or windshield.

Some designers are attacking the problem associated with glare from masthead lights on cabin cruisers with radar arches. These arches are good places to install masthead lights and all-round lights where they are above and clear of all other lights and obstructions. There the lights are also shielded, well above the operator's field of vision.

Some manufacturers of 12 meter to 20 meter express cruiser designs which incorporate a radar arch as a part of the vessel superstructure have found that the arch is a good place for mounting navigation lights. A recommended running light combination for these vessels is a masthead light at the top of the arch, a combined sidelight fixture on the bow and a sternlight at or near the stern. **Note: The sternlight should not be mounted on the arch behind the masthead light, because the two lights could be mistaken for an all-round light, an optional navigation light display on vessels less than 12 meters in length.**

With a masthead light at the top of the arch, a combined sidelight fixture on the bow and a sternlight at or near the stern, glare from all running lights is reduced and the length of the vessel is clearly defined, an important consideration on some of the larger and faster express cruiser designs because the distance from the stem

to the arch can be significant. In addition, mounting the masthead light on the arch will minimize or eliminate glare forward of the operator's position.

Other ways to reduce glare and improve nighttime visibility are to use brushed metal surfaces on rails, cleats, horns, etc., when possible. Try to avoid placing bright metal accessories directly in front of the helm position. Use a tinted windshield and tinted color or matte for decks. Use a textured surface on the foredeck. It will help reduce glare and also provide safer footing.

THE NAVIGATION RULES

ANNEX I

Positioning and Technical Details of Lights and Shapes

6. Shapes

(a) Shapes shall be black and of the following sizes:

(i) a ball shall have a diameter of not less than 0.6 meters;

(ii) a cone shall have a base diameter of not less than 0.6 meters and a height equal to its diameter;

(iii) *

(iv) *

(b) *

(c) In a vessel of less than 20 meters in length shapes of lesser dimensions but commensurate with the size of the vessel may be used and the distance apart may be correspondingly reduced.

Dayshapes: Shapes for recreational boats need not be as large as those for vessels larger than 20 meters in length, but they should meet the minimum sizes indicated below based on the size of the vessel and they must be constructed of black material. Shapes must be three-dimensional -- not flat cutouts of circles or cones.

Length	Diameter of Sphere*
65.6 ft. (20 m)	23.6 in.
40 ft.	14.5 in.
12 m	14.2 in.
35 ft.	13 in.
30 ft.	12 in.
10 m	11.8 in.
25 ft.	9 in.
7m	8.3 in.
20 ft.	7 in.

* The diameter of the base of the inverted cone should be the same as listed for a sphere. The length of the sphere should equal the diameter of the cone.

THE NAVIGATION RULES

ANNEX I

Positioning and Technical Details of Lights and Shapes

9. Horizontal sectors.

(a)(i) In the forward direction, sidelights as fitted on the vessel shall show the minimum required intensities. The intensities shall decrease to reach practical cutoff between 1 degree and 3 degrees outside the prescribed sectors.

(ii) For sternlights and masthead lights and at 22.5 degrees abaft the beam for sidelights, the minimum required intensities shall be maintained over the arc of the horizon up to 5 degrees within the limits of the sectors prescribed in Rule 21. From 5 degrees within the prescribed sectors the intensity may decrease by 50 percent up to the prescribed limits; it shall decrease steadily to reach practical cutoff at not more than 5 degrees outside the prescribed sectors.

(b) All-round lights shall be so located so as not to be obscured by masts, topmasts or structures within angular sectors of more than 6 degrees, except anchor lights prescribed in Rule 30 which need not be placed at an impracticable height above the hull.

10. Vertical sectors

(a) The vertical sectors of electric lights as fitted, with the exception of lights on sailing vessels underway shall ensure that:

(i) at least the required minimum intensity is maintained at all angles from 5 degrees above to 5 degrees below the horizontal;

(ii) at least 60 percent of the required minimum intensity is maintained from 7.5 degrees above to 7.5 degrees below the horizontal.

(b) In the case of sailing vessels underway the vertical sectors of electric lights as fitted shall ensure that:

(i) At least the required minimum intensity is maintained at all angles from 5 degrees above to 5 degrees below the horizontal;

(ii) at least 50 percent of the required minimum intensity is maintained from 25 degrees above to 25 degrees below the horizontal.

ALL VESSELS - PROBLEMS IN THE FIELD

Two of the biggest problems involving the installation of navigation lights are misalignment of fixtures and the use of non-marine light fixtures which do not meet the one to three degree cut-off

for sidelights and the five degree cut-off for masthead lights.

According to Rule 21(b):

"Sidelights" means a green light on the starboard side and a red light on the port side each showing an unbroken light over an arc of the horizon of 112.5 degrees and so fixed as to show the light from right ahead to 22.5 degrees abaft the beam on its respective side.

The widths of the horizontal sectors of an on-coming vessel determine which lights will be visible at a given aspect angle. The size and type of vessel determine the number of different lights which must be displayed and their placement. Small boats typically have fewer navigation lights than larger boats. Sailboats less than 20 meters in length under sail, for example, must show red and green sidelights and a white sternlight. In defining the widths of the sectors over which these lights must be visible, an angle is specified within which the intensity of the light must be greater than some minimum prescribed intensity.

Beyond the specified angle (22.5 degrees abaft the beam for each sidelight for example), the intensity of a light is required to decrease to "practical cut-off" within 3 degrees (for sidelights in the forward direction) or 5 degrees (for masthead lights, for sidelights abaft the beam and sternlights) outside the sector. This ensures that the light is visible at the prescribed distance and makes the correct placement of navigation lights particularly important.

Vertical sectors: Vertical sectors are important, particularly in situations in which a large vessel is bearing down upon a smaller vessel. A navigation light fixture which was installed in such a way that it did not provide the required minimum intensities above the horizontal, would not be visible to the operator of the larger vessel. Boat manufacturers should therefore avoid installing navigation lights beneath pulpits or decks where the fixtures are obscured from above.

Vertical Sectors on Sailboats: The different vertical sectors prescribed (b)(i) and (b)(ii) in Annex I allow for the fact that when a sailboat is underway under sail, the boat heels. Navigation light fixtures must still maintain a minimum required intensity at either angle of heel.