U.S. Department of Transportation

United States Coast Guard

December 1999

Boating Safety Circular 81

THE FAR SIDE OF THE LAW

Cartoonist, Gary Larson, famous for his "The Far Side," once drew a cartoon in which the survivor of a shipwreck is floating in an inflatable liferaft with the logo, "A1," and watching a portable TV. Suddenly the announcer says:

" ... last month the A-1 Life Raft Co. issued a statement announcing that it was recalling 50,000 of its small rubber boats due to defective glue used in their manufacture, causing the boats to lose air and gradually sink over a matter of a few days ..."

Over the years a number of joke writers and cartoonists have lampooned the public's tendency to ignore recall notices they receive from manufacturers of various consumer products, particularly automobiles. Perhaps one reason why is the fact that many manufacturers attempt to minimize potentially adverse impacts on company sales by being deliberately vague about defects in the company's products.

However, the U.S. laws which require boat and engine manufacturers to notify owners and recall products which contain "defects which create a substantial risk of personal injury to the public," are actually very specific about the information a defect notice must contain. Let's take a moment and review the wording of the statute.

First of all, according to 46 U.S.C. 4310(d):

"The notification ... shall contain a clear description of the defect . . ."

Notice the use of the word, "shall;" it doesn't mean a clear description of the defect is optional. Yet we've received copies of notices to consumers in which a permanently installed gasoline fuel tank which leaks is described as "a fuel tank problem." Another manufacturer described a defective steering system as "potentially involving the steering operation of your boat."

Second, the notification shall contain:

"an evaluation of the hazard reasonably related to the defect or failure [to comply]."

Often we receive copies of defect notices to where no mention is made about the degree of danger to the consumer with continued use of the defective product. There is no mention, for example, about the fact that continued use of a boat with a leaking fuel tank may lead to a fire or explosion, or the fact that continued use of a boat with a "faulty steering system" actually means the steering system could suddenly lock making it impossible for the boat operator to turn to avoid a high speed collision.

The whole point of defect notification is to alert purchasers about substantial risk defects in boats and engines, which may cause fatalities or serious injuries. There are serious adverse impacts on safety when the public is deliberately misled about the degree of danger associated with the continued use of defective products.

USE CAUTION WITH AC (ALTERNATING CURRENT) ON BOARD

Having a source of alternating current (a.c.*)* on board a boat is really satisfying. It lets the boater operate all kinds of things he or she can't do with 12 volt direct current (d.c.) electricity, particularly large appliances like air conditioning, electric stoves and house size television sets. On a yacht with its

Inside:

own generator, a.c. can be had anywhere when the vessel is underway, or at rest. For most boaters with boats that have overnight accommodations, however, there are only two choices: an inverter to make a.c. from 12 volt d.c., or a shore power connection by a plug-in cable. The inverter output is limited by its design and the battery capacity available; the shore power cable only by the rating of the cable itself and the design of the shore power system on board.

The shore power cables available from the marine supply houses carry one of three common ratings for most boats under 40 feet:

(1) 20 ampere, 125 volt;
(2) 30 ampere, 125 volt; and
(3) 50 ampere, 125 volt.

All three are for single phase, two pole, three wire systems: a live conductor, a neutral conductor (usually white) and a green grounding (protective) wire. All three have their own distinctive plug terminal configurations to prevent the casual user from plugging the 20 amp plug into a 30 amp receptacle on the dock, or either the 20 amp or 30 amp into the 50 amp receptacle on the dock.

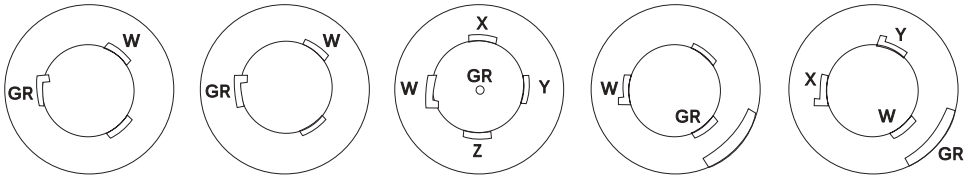
The 20 amp and 30 amp plug terminal arrangements are very similar, differing only in the radius on which they are arranged, the positioning on the plug being the same (see accompanying diagram from ABYC Standard E-8). With a worn socket on the dock and a little muscle, it is possible to force the 20 amp plug terminals onto a 30 amp socket and vice versa. Since most marinas are equipped with 30 amp receptacles, there is generally no problem for boats equipped with 30 amp cables. For the boat with only a 20 amp system and cable, frustration may cause an attempt at forcing the plug into the 30 amp socket. In most cases this does not create a problem, since the usage of power on board smaller boats is usually within the 20 amp range. There's no chance of getting mixed up with the 50 amp receptacle, *as long as the plug terminals have not been altered*. If there has been some alteration of the terminal with the "L" shape, all kinds of things become possible, some with fatal consequences.

If the 30 amp plug with an altered green wire (GR) terminal can be forced into the 50 amp receptacle, it is possible that the "GR" terminal could be inserted into the "W" terminal of the 50 amp, 2 pole, 3-wire receptacle on the dock. This would immediately electrify the metallic frame of every appliance on board to which the green "protective" wire is attached. The same could be true of the 50 amp 125/250 volt, 3-pole, 4-wire receptacle (3-phase a.c.) on which the "GR" terminal is on the outer rim of the receptacle, two of the three inside terminals being live.

Editor's Note: The article, *"Use Caution with AC On Board"* originally appeared in Boat and Motor Dealer Magazine, and is reprinted with the permission of the author, Mr. Ralph Lambrecht, a member of the American Boat and Yacht Council (ABYC) Electrical Project Technical Committee.

SHORE POWER CABLE CONFIGURATIONS

RECEPTACLE AND CONNECTOR -- LOCKING AND GROUNDING



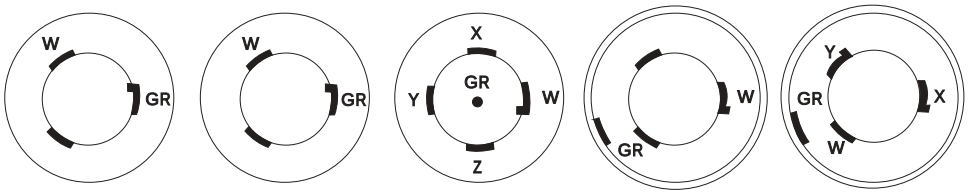
20 A 125V
2-POLE, 3-WIRE
NEMA L5-20

30 A 125V
2-POLE, 3-WIRE
NEMA L5-30

30 A 120/208V 30Y
4-POLE, 5-WIRE
NEMA L21-30

50 A 125V
2-POLE, 3-WIRE
NEMA SS-1

50 A 125/250V
3-POLE, 4-WIRE
NEMA SS-2



PLUG AND INLET -- LOCKING AND GROUNDING

Wiring: GR = green; W = white; Unmarked, X, Y, Z, = other colors, including black

Why would anyone be foolish enough to alter the "L" shaped "GR" terminal on the 20 or 30-amp, 2-pole, 3-wire plug? Only to be able to insert it into a 50 amp, 2-pole, 3-wire receptacle, which he or she may have wanted to do because all of the 20 amp or 30 amp receptacles on the dock are already occupied. If he or she gets the "GR" terminal of the plug into the "GR" terminal of the receptacle, there's no problem, except for having 67 percent too much amperage capacity on the line. If he or she does it wrong, someone could get a shock or worse.

On board, the green protective wire of the a.c. system is probably also connected to the d.c. negative terminal on or near the engine, in line with ABYC standard E-8. The purpose of this is to allow any leakage of a.c. current that may get into the d.c. ground by some minor fault, to get back to the shore "GR" terminal, rather than go into the water. Leakage of a.c. current into the water, even a very small amount not enough to open any circuit breakers, can create an electrical field around the boat which can be fatal to swimmers and divers. So, a.c. current into the green wire of the a.c. system due to an improperly inserted plug, can create big time problems on board the boat, and in the water. The a.c. receptacles in the head, galley and engine room should be equipped with ground fault circuit interrupters (GFCI) which will monitor the current flowing in the live and neutral conductors at the receptacle. If the current flow on the live and neutral conductor is not virtually the same (within 5 milliamps), the GFCI will interrupt the circuit. If the green wire is live or acting as a neutral conductor, the GFCI will open the circuit in both live and neutral conductors, *but not the green wire*, to which it is not connected.

A small percentage of patched up electrical connections may be seen during a stroll around the docks at some marinas: household extension cords, Y-connector cables to split a 50 amp receptacle into two 30 amp receptacles and various other "Rube Goldberg" adapters. Making the right connection to shore power for the boat is the responsibility of the skipper, not the dock operator. The yacht club in a major mid-west city thought so, but still found themselves as defendants in a lawsuit when a swimmer was electrocuted in the water behind a boat. The only thing that could be confirmed was that the 30 amp plug on the shore power cable from the boat had an altered "GR" terminal. Was it plugged into one of the 50 amp outlets in the dock box? It could be made to go in. No one knows, because the first thing they did when the electrical field in the water was detected, was to pull out the plug, and no one paid any attention.

SHORE POWER CORDS – PROPER USE AND MAINTENANCE

■ All shore power cords should be rated suitable for Marine Use, or better still, "UL-Marine" listed for marine shore power applications.

■ CAUTION -- Never use ordinary "outdoor use" extension cords to provide electrical shore power to the boat or any equipment, such as a battery charger on board the boat. These cords are not rated for and are not suitable for the severity of a marine environment. They can deteriorate and/or overheat causing electrical shock, a short circuit or a fire.

■ All shore power cords should have male (plug) and female (connector) ends of the locking type. Make sure that plugs and connector are turned to the full locked position by pulling on them. If they are properly locked, they will not pull out. A plug or connector not properly locked will become loose, causing arcing (sparks) on the contacts, resulting in a failure, and possibly a fire.

■ All male (plug) ends must be molded on or have weather-proof boots in order to provide a weatherproof seal when plugged into a receptacle.

■ All female connector ends must have a locking ring to secure the power cord to the inlet on the boat and provide a weatherproof seal.

■ Adapters should always be used at the shore end of a power cord.

■ Always make sure that the "Main" circuit breaker on the boat is turned "OFF" before connecting or disconnecting the shore power cord,

■ Always connect the female end of the cord to the boat before plugging the male end into shore power receptacle. Always disconnect the male end from the shore power receptacle before disconnecting the female end from the boat.

■ Never leave a shore power cord on the dock with only the plug end connected. A live cord end is dangerous, especially if it accidentally falls into the water.

■ Periodically check shore power cords for the following:

• Cuts, cracks or severe abrasions on the yellow cord covering.

• Bent, broken or loose plug blades.

• Plug blades or connector slots that show signs of overheating or arcing, such as:

☐ Brown or black discoloration on insulation around blades or slots.

☐ Discoloration and/or erosion of blade material

• Faulty locking rings due to cracking or damaged threads.

■ Do not allow cords to be pinched by a closed door or hatch. Pinch points create resistance and generate heat that can result in a fire.

■ Never coil a cord tightly on the dock. Such a coil acts as a heat generator and can cause a fire. Hang the cord loosely on a hook or support or lay it out in a loose coil of only a few turns.

■ Spray all contacts monthly with an electrical contact cleaner, corrosion inhibitor and lubricant, such as LPS-1 made by Holt Lloyd Corp. Please note that "WD-40" or silicone sprays are not appropriate because the film they leave increases contact resistance. The proper spray types can be found at electrical supply houses or stores such as Radio Shack.

■ If a shore power cord should become immersed in water, it should be immediately sprayed with fresh water, THOROUGHLY dried, and blades and contact slots sprayed with a moisture displacement before re-using.

Editor's Note: The preceding article, *"Shore Power Cords -- Proper Use and Maintenance"* is reprinted with the permission of the author, Mr. Bob Carlson, also a member of the American Boat and Yacht Council (ABYC) Electrical Project Technical Committee.

PROPELLER INJURY PROTECTION

In 1996, as part of an ongoing effort to reduce the incidence of propeller-related injuries and fatalities involving recreational boats, the Coast Guard awarded a boating safety grant to the Marine Technology Society to ascertain the "state-of-the-art" in propeller injury prevention devices. The findings of the earlier study revealed a number of devices being offered for sale ranging in sophistication from a simple ring surrounding the propeller to hydrodynamically advanced water jet propulsion systems. Essentially, no reliable information on the performance of these devices was available. Some of the significant concerns associated with the use of the devices were initial costs, possible losses in fuel economy, vessel maneuverability and human protection.

Therefore, in 1997, the Coast Guard awarded a second boating safety grant to quantify by field testing, the performance of a number of the devices identified in the earlier study. There were three primary areas of investigation:

(1) propulsion performance as exhibited by top speed, fuel economy, stopping time, acceleration time, and turning times;

(2) human protection improvement; and

(3) methods for safety enhancement other than propulsion system modifications.

Four different vessels using three propeller driven propulsion units and eight different guards or systems were evaluated in the field. Propeller guards, water jet propulsion, new propeller designs and the substitution of an axial jet for the propeller were all evaluated.

Note: While each of the devices/systems tested are available on the open market, each system type was not available for a wide range of engine horsepower ratings or for all brands of engines. All of the devices tested were "off the shelf" and no effort had been made by the manufacturers to optimize the device for the specific vessel and application.

All shielding devices and pump jet devices demonstrated a decrease in speed and economy performance when applied to planing vessels. Also, all of the devices, except the ring propeller and one of the ring guards demonstrated a decrease in stopping, turning and acceleration performance. All of the devices give some improvement in low speed human protection, but most of the devices offer a decrease in high-speed human protection.

None of the devices has the high degree of practicality in a wide range of operating environments (trash, weeds, shallow water, damage tolerance, etc.) as that established by an unguarded propeller. For planing vessels, the study concluded that some improvement in low-speed human protection can be achieved at the expense of decreased performance, decreased high speed protection and some decrease in practicality. The cost benefit ratio for using the tested devices on planing vessels is sensitive to both vessel type and operational environment.

When using shielding devices and pump jet devices on displacement vessels there is a small decrease in fuel economy, top speed, turning, stopping and acceleration performance. The decreased performance is small and not nearly as significant as the decrease for planing vessels. Since only low speeds are of interest for displacement vessels, the study concluded that all of the devices provide significant improvement in human protection. The practicality considerations are similar to those of planing vessels. For displacement

vessels, there are devices which offer significant improvement in human protection at small cost in performance, i.e., cages on rental houseboats. The device practicality is dependent on the operating environment.

Several methods other than propeller shielding have some potential for reducing the number of propeller injuries. The report concluded that the use of interlock devices and warning signs should enhance safety and possibly prevent some propeller injuries, but have a limited potential due to the difficulty of ensuring their use. Boating laws are effective only if compliance with the law can be measured easily. Since some, if not most, houseboat renters are inexperienced boaters, educational requirements for such operators emphasizing safety including propeller hazards should prevent some propeller injuries. The required use of a "person in the water" flag would raise awareness and help to develop a safety pattern that would prevent some propeller injuries. Since compliance with both of these requirements is easily observed even under casual observation, the report concludes that such requirements are enforceable. Additionally, if the penalty for noncompliance were significant, then their implementation could result in a completely new level of public awareness and concern. Therefore, the report concluded that boating laws requiring houseboat renter education and appropriate display of a "person in the water" flag should be developed and implemented.

Some ring guard designs had little or no cavitation/ventilation problems, while others had major problems, particularly in high speed turns and during low speed accelerations. The report concluded that the detailed design/fabrication of ring guards is very important since attention to the details determines the performance of the device.

The centrifugal pumpjet has no effective rudder since there are no steerable components in the water. As a result, there is no off-throttle steering with this type of drive. The report concluded that there are serious operational hazards associated with centrifugal jet pump drives when being operated by untrained individuals (even if they have extensive experience with propeller drives).

The report also concluded that the ring propeller is effective only in relatively clean water conditions and the repair costs for propeller damage will be significantly higher than for conventional propellers.

The report, *"Propeller Injury Protection – An Evaluation of Commercially Available Protection Devices,"* is the result of a boating safety grant awarded to the Marine Technology Society. Copies are available from Commandant (G-OPB-3), U.S. Coast Guard, Washington, DC 20593-0001.

SALE OF FOREIGN-BUILT BOATS BY IMPORTERS

All recreational boats sold or offered for sale in the United States must bear two identical Hull Identification Numbers consisting of a U.S. Coast Guard assigned Manufacturer Iderntification Code (MIC). Personnel from the Recreational Boating Product Assurance Division recently visited several boat shows where they encountered a number of foreign-built recreational boats which had Hull Identification Numbers in the newly required International Organization for Standardization (ISO) format. While use of the ISO HIN standard is mandatory for use on all craft to be used in the European Common Market, and is optional for U.S. manufacturers who export, **foreign-built boats imported into the United States must bear Hull Identification Numbers consisting of a U.S. Coast Guard assigned MIC.**

According to 46 U.S.C. 4307(a)(1)(A)(i),

"A person may not . . . sell or offer for sale, introduce or deliver for introduction into interstate commerce, or import into the United States, a recreational vessel . . . unless -- it conforms with this chapter or a regulation prescribed under this chapter. . ."

According to 33 CFR 181.23(a),

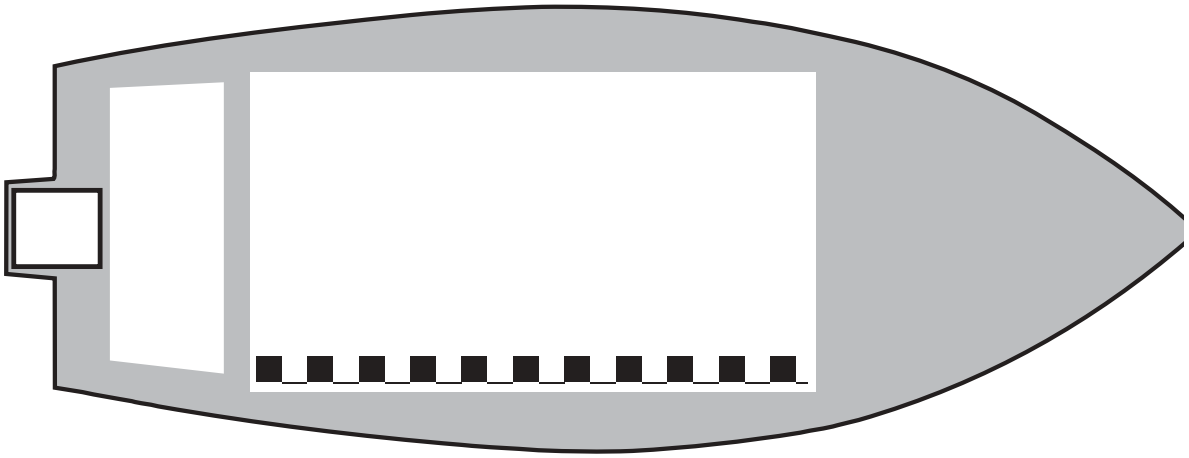
"A manufacturer (or importer) as defined in 181.3 of this part, must identify each boat produced or imported with two hull identification numbers that meet the requirements of this subpart."

The Coast Guard is one of several regulatory agencies which participated in the development of a Mutual Recognition Agreement (MRA) with the European Community (EC).

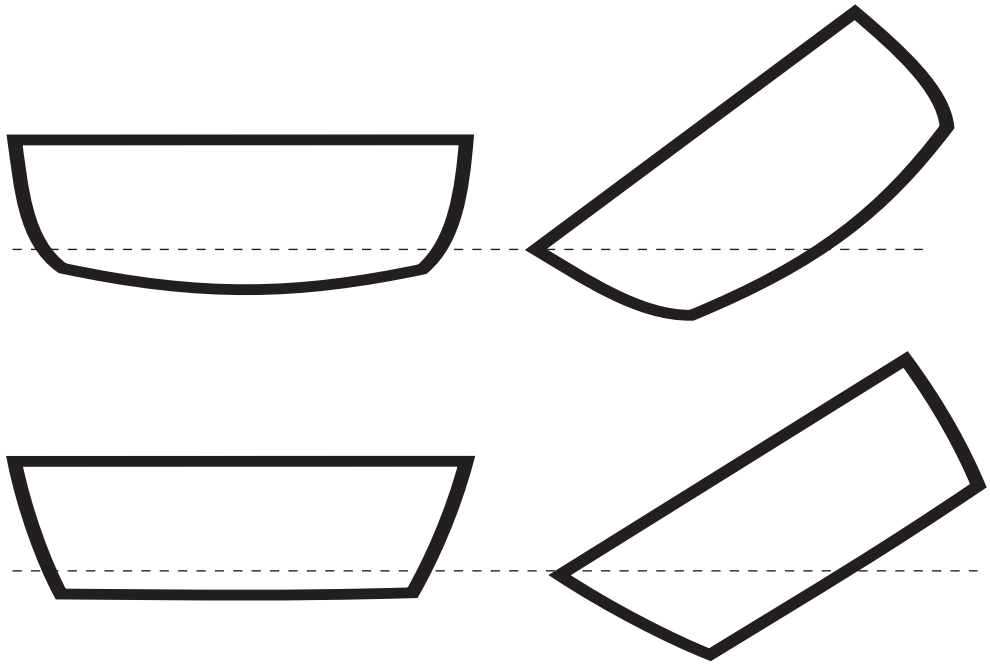
According to Section 2(b) of the Sectoral Annex for Recreational Craft (recreational boats), the EC has agreed that the relevant requirements for boats exported from Europe to the United States are any product falling under the scope of 46 U.S.C. Chapter 43; 33 CFR Parts 81, 84, 159, 179, 181, 183; and 46 CFR Part 58.

Therefore, boats exported from Europe must bear Hull Identification Numbers consisting of a MIC the U.S. Coast Guard assigned to the U.S. importer. Sale of a boat in the United States with an HIN consisting of the MIC another country assigned to a foreign manufacturer is prohibited.

WHAT IS THE MEANING OF THE TERM, OUTBOARD EXTREMITY OF EACH PASSENGER CARRYING AREA AS THE TERM IS USED IN SUBPARAGRAPHS 183.39(a)(2)(ii) and 183.41(a)(2)(iii) OF THE SAFE LOADING STANDARD?



WHAT IS THE MEANING OF THE TERM, UNTIL THE BOAT ASSUMES MAXIMUM LIST OR TRIM OR BOTH WITHOUT WATER COMING ABOARD AS THE TERM IS USED IN SUBPARAGRAPHS 183.39(a)(2)(ii) and 183.41(a)(2)(iii) OF THE SAFE LOADING STANDARD?



RADAR REFLECTORS - A GOOD WAY TO PREVENT COLLISIONS

Over the past few years all navigable waterways have experienced an increase in the number of users competing for access, but none more so than in coastal areas. Deep draft vessels have grown in size and number of transits; the inshore fishing fleet continues to be strong; confidence in our economy has prompted more people to purchase recreational craft, especially personal watercraft, and, more recently, there has been an increase in the number of high-speed ferries.

With the advent of improved radar technology and collision avoidance systems, mariners have increased their reliance on radar for navigation, especially when navigating in restricted visibility conditions. Radar is an effective navigational tool; however, for this technology to work effectively, a strong, repeatable radar return is required. Small vessels, especially those with non-metallic hulls, often go undetected on radar because of the weak radar returns they produce. A strong radar signature is vital for these vessels to reduce the risk of collision in low visibility conditions.

The most reliable way to ensure a strong radar signature is to provide flat metal surfaces well above the waterline, facing all directions. The easiest solution is to install a commercially available radar reflector at the highest point possible on the vessel. Although not a panacea because of their limited effectiveness, radar reflectors are highly recommended for all vessels of wood or fiberglass construction. They are readily available at marine supply stores and are relatively inexpensive. Radar reflectors come in many shapes and sizes and also have varying levels of effectiveness, so take some time to evaluate which one would be best suited for your particular vessel and boating environment.

NAVIGATION LIGHTS - BUYERS BEWARE

Navigation lights are essential to safe navigation at night. This has led some light manufacturers and some vessel operators to believe that having more lights or different lights will make your vessel more easily seen by other vessel operators. Actually, the Navigation Rules (COMDTINST M16672.2D) otherwise known as the "Rules of the Road," are very specific about the characteristics (color specifications and/or arcs of visibility) of navigation lights. Therefore, purchasers should avoid lights advertised as providing "an extra margin of safety" or as "an enhancement to their boat's existing navigation lighting system," because the use of such lights is a violation of the Navigation Rules.

According to Rule 20:

"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 . . ."*

Rule 21 defines the placement and arcs of visibility for the various navigation light fixtures.

Annex I to the Rules requires certain color specifications and minimum intensities for navigation light fixtures to ensure their visibility.

The intent of these three requirements is to establish stand-alone positioning for the prescribed lights and to create distinctive navigation light patterns for various vessel types. **Conspicuity is improved only by correct placement and the use of bigger and brighter legal navigation lights.**

Finally, navigation lights are items of safety equipment. Boats offered for sale to the public which are equipped with navigation lights which do not meet applicable requirements in the Navigation Rules are subject to defect notification and recall.

CALL THE COAST GUARD INFOLINE

1-800-368-5647

FOR INFORMATION ON:

• REGISTERING OR DOCUMENTING A BOAT
• MANUFACTURER'S BOATING SAFETY RECALLS
• OPERATOR EQUIPMENT CARRIAGE REQUIREMENTS
• COAST GUARD APPROVED LIFEJACKETS
• BOATING SAFETY COURSES