



# BOATBUILDER'S HANDBOOK

[ REVISED NOVEMBER, 2003 ]



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Administered By The U.S. Coast Guard.*



## PART 2

*Revised November, 2003*

# U.S. Coast Guard Boating Safety Circulars

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### NOTICE:

It is the responsibility of the Boat Manufacturer to ensure that the applicable Federal Regulations have not been updated since the reference date. The U.S. Coast Guard, Office of Boating Safety website (<http://www.uscgboating.org>) contains an index and links to current recreational Boat Manufacturing Federal Regulations for reference.



# Boating Safety Circular 64

## A SHORT HISTORY OF THE BOATING SAFETY CIRCULAR

The first Boating Safety Circular was published on November 1, 1969 and to quote from the Foreword to that issue:

"The Commandant, U.S. Coast Guard has established the Boating Safety Circular as a means to 'pass the word' to boat and equipment manufacturers, distributors, dealers, and to certain others concerned with boating safety. The need for a way to do this became evident soon after the establishment of the Office of Boating Safety [now the Office of Navigation Safety and Waterway Services]. Many letters we received asked for explanations of various rules and regulations for pleasure craft or requested information which would be of general interest. This Circular will give us the means to communicate better on these matters and help us all to work toward our common goal of safe boating. The Boating Safety Circulars are informational only -- nothing appearing in them will establish or change any law or regulations -- and will be of direct value as a source of information on established or proposed regulations or standards. They will improve coordination and help us to provide better service to the public. The Circular will not be a regular periodical, but will be issued from time to time as needed to maintain good communications. Issues will be consecutively numbered so that readers will know if an issue has failed to reach them."

Although we have changed our layout from time to time, tried various issue number systems and made the Circular a quarterly rather than an "as needed" publication, very little has changed in the purpose of the Boating Safety Circular or in its

content. Because of increased interest in the Circular and numerous requests for back issues, in addition to our regular features, this issue contains a compendium of articles from all previous BSCs which contain material we still consider important.

Some of the articles on the following pages have been edited to include stories covering the same subjects published in later issues. Others have been rewritten to reflect changes in applicability, availability of materials and differences in technology or the "state of the art." Although each article ends with a reference to the issue in which it appeared for the benefit of readers who want to review them, we will no longer provide copies of back issues.

## AN ACCIDENT WAITING TO HAPPEN REMEMBER YOUR SOUND SIGNALS IN RESTRICTED VISIBILITY

About a year ago a 110 foot crewboat servicing offshore oil rigs in the Gulf of Mexico rammed a fishing party boat that was at anchor with 20 passengers on board. The operators of both vessels were to blame for this accident in which the fishing boat sank and one passenger drowned.

The crewboat operator, who relied totally upon his vessel's radar as a means of maintaining a proper lookout, was travelling at a speed of about 18 knots in a fog that had reduced visibility to a quarter of a mile. The operator apparently

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overlooked the possibility that other vessels could be in the vicinity and might not present as strong an image on the radarscope as that of a drilling rig or a production platform.

The fishing vessel was anchored in the fog and the operator had not sounded the required signals. The operator mistakenly believed that the Navigation Rules required sounding fog signals only when other vessels were around. Furthermore, he failed to sound the required signals when he first noticed the contact on his own vessel's radar approximately 10 minutes before the fatal collision.

In fact, the Rules are very specific about when signals must be sounded, their interval and their duration. Rule 35 of the Navigation Rules states, in part, that:

In or near an area of restricted visibility, during daylight hours or at night, the following signals must be sounded:

The operator of a power-driven vessel making way through the water must sound one prolonged blast at intervals of not more than 2 minutes.

The operator of a power-driven vessel underway, but stopped and making no way through the water, must sound at intervals of not more than 2 minutes, two prolonged blasts in succession with an interval of about 2 seconds between them.

The operator of a sailing vessel, a vessel engaged in fishing and a vessel engaged in towing or pushing another vessel must sound at intervals of not more than 2 minutes, three blasts in succession -- one prolonged followed by two short blasts. The operator of a vessel engaged in fishing, when at anchor, and the operator of a vessel restricted in its ability to maneuver when carrying out work at

anchor, must sound the same signal, one prolonged followed by two short blasts.

The operator of a vessel at anchor must at intervals of not more than one minute ring the bell rapidly for about 5 seconds. A vessel at anchor may also sound three blasts in succession -- one short, one prolonged and one short blast to give warning of its position and of the possibility of collision to an approaching vessel.

The operator of a vessel of less than 12 meters in length is not required to give the above signals, but if they are not, some other efficient sound signal must be made at intervals of not more than 2 minutes.

All operators of recreational boats are reminded of the importance of sounding proper signals while underway or at anchor during periods of limited visibility. Boat operators in the Gulf of Mexico are asked to be particularly careful to sound proper signals under such conditions because of the large number of high speed vessels servicing offshore structures.

The Coast Guard publishes these rules in a book titled "NAVIGATION RULES, INTERNATIONAL AND INLAND" (COMDTINST M16672.2A) which may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. The current price is \$6.50 per copy and the stock number is 050-012-00192-8. The book may be ordered in two ways -- by telephone or mail. To order by telephone, call (202) 783-3238, ask for the book by name, and give the stock number. You may pay using your VISA or MasterCard.

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Boating Safety Circulars are for information only. No Federal statute or regulation is established or changed in this circular

VESSEL	SIGNAL DURATION	SIGNAL INTERVAL
POWER-DRIVEN UNDERWAY	ONE PROLONGED BLAST  ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ [4 - 6 seconds]	EVERY 2 MINUTES
POWER-DRIVEN AT REST	TWO PROLONGED BLASTS  ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ [4 - 6 seconds]  2 second pause  ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ [4 - 6 seconds]	EVERY 2 MINUTES
SAILING VESSEL VESSEL FISHING VESSEL PUSHING OR TOWING	ONE PROLONGED & TWO SHORT BLASTS  ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ [4 - 6 seconds]  ZZZZ [one second]    ZZZZ [one second]	EVERY 2 MINUTES
FISHING WHEN AT ANCHOR RESTRICTED IN ABILITY TO MANEUVER	ONE PROLONGED & TWO SHORT BLASTS  ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ [4 - 6 seconds]  ZZZZ [one second]    ZZZZ [one second]	EVERY 2 MINUTES
VESSEL AT ANCHOR or to give warning of position and possibility of collision to approaching vessel:	RING BELL RAPIDLY FOR 5 SECONDS  ONE SHORT BLAST, ONE LONG BLAST AND ONE SHORT BLAST  ZZZZ [one second]  ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ [4 - 6 seconds]  ZZZZ [one second]	EVERY 1 MINUTE  AS NECESSARY
LESS THAN 12 METERS IN LENGTH	SOME TYPE OF SOUND SIGNAL	EVERY 2 MINUTES

## **DON'T BUILD A BOAT WITHOUT THEM**

If someone sues your company and you can present evidence that shows that your company's products are built in compliance with the latest voluntary safety standards and recommended practices, as well as applicable Federal standards, the plaintiff's attorneys will have a hard time disproving your interest in the safety of purchasers of your products. On the other hand, a company that ignores existing voluntary marine standards and recommended practices, for a propane gas system installation for example, would have a hard time proving that they had considered the degree of hazard and the potential for an accident.

The law in recent years has tended to place full responsibility for injuries caused by defective products upon the product manufacturer. This is because the manufacturers can design, build and market products in ways that will reduce if not eliminate most unreasonable and unnecessary hazards. In the absence of applicable Federal standards, the best way to assure the safety of purchasers of the products you manufacture is to build them in compliance with recognized voluntary industry standards and recommended practices.

If one of your company's boats is totally destroyed by a fire or explosion, you will be in a better position in a product liability suit if you can show by means of an identical model that your boats and their equipment are built to the latest voluntary standards and recommended practices. If there is a recognized voluntary marine standard or recommended practice covering a particular installation, follow it.

A generator designed for use on a recreational vehicle, e.g. on land, does not comply with marine standards and therefore should not be installed on a boat. Similarly, heating appliances designed for use in a home probably cannot withstand a marine environment.

For the purposes of this discussion, standards are proven and broadly accepted engineering practices or requirements for a material, product, process, procedure or test method. Recommended practices are guides to standard engineering practice, but may be of a more general nature, or may cover practices or requirements that have not yet gained broad acceptance.

The Coast Guard issued safety standards for recreational boats are relatively new and are very limited in scope, particularly because Federal standards must be based upon a demonstrated

need -- accident statistics. The Display of Capacity Information, Safe Loading, Safe Powering and Flotation Standards issued in 1972 were developed to reduce drownings and allow victims to recover from capsizing and swamping accidents; the Electrical and Gasoline Fuel Systems Standards to reduce fires and explosions; and the Start-In-Gear- Protection Standard to reduce falls overboard in small boats.

As early as 1925, however, other organizations have been issuing voluntary standards and recommended practices for boats. The objective of voluntary standards organizations is to make the technical knowledge, experience and skill of engineers from various boat and engine manufacturing companies working together with marine surveyors and other public members, useful to the boating industry, the public, Government and educational institutions. Today, these organizations have standards and recommended practices covering everything from the design and construction of cleats and chocks to the installation and maintenance of heating, refrigeration and air conditioning equipment; from marine-type electric lighting fixtures to exhaust systems, steering systems and control systems. In fact, there is probably a recognized industry standard covering just about every facet of boat construction.

Most of the recreational boating safety standards that exist in the United States today are the result of work done by broad based committees in the National Fire Protection Association (NFPA) and the American Boat and Yacht Council (ABYC). The Society of Automotive Engineers (SAE) Marine Technical Committee and by the various technical committees supported by the Boating Industry Associations (BIA), now the National Marine Manufacturers Association have also made valuable contributions. The Marine Department of Underwriters' Laboratories (UL) has contributed test procedures and an inspection service to implement the standards developed by the other organizations. The various technical committees in these organizations revise and update their standards annually.

The National Fire Protection Association's NFPA 302, "Fire Protection Standard for Pleasure and Commercial Motor Craft," adopted in 1925, exerted very strong influence on the standards for electrical and fuel systems published by the American Boat and Yacht Council, the BIA, and in turn, the Coast Guard. Portions of NFPA 302 are incorporated by reference in the Coast Guard Electrical System

Standard. For many years, NFPA 302 was the principal reference used by marine surveyors inspecting boats prior to granting insurance by marine underwriters.

From the day it was founded in 1954, the American Boat and Yacht Council has been the most broadly based of the standards writing organizations in the recreational boating field in the United States. The majority of ABYC members are associated with the boat building field in some capacity; however, there are members from the other standards writing organizations, the public, yachting organizations, the Coast Guard, Underwriters' Laboratories, marine surveyors and insurance companies. The ABYC publishes a book, "Standards and Recommended Practices For Small Craft," which to quote from the preface, "is the product of a consensus of representatives of government, industry and public sectors." The book is a guide to aid manufacturers, consumers and the general public in the design, construction, equipage and maintenance of small craft.

The SAE Marine Technical Committee has issued several marine safety standards primarily related to gasoline inboard engines. Portions of the SAE standards covering fuel hoses are incorporated by reference in the Coast Guard Fuel System Standard. SAE also publishes the standards for propeller

shaft taperings and propeller hub dimensions used by all U.S. propeller manufacturers.

Underwriters' Laboratories, Inc. is a nonprofit, independent organization testing for public safety. UL's Marine Department provides a service to manufacturers of marine devices for testing, labeling and listing those products as meeting the requirements set forth in the UL Marine Specifications. UL's findings are recognized by insurance rating bureaus, Federal agencies, State, county and municipal authorities and inspectors. These specifications or standards usually equal or exceed the requirements of Coast Guard regulations and the other marine industry standards. The Coast Guard does not directly accept UL listing as evidence of compliance with its regulations; however, we are usually confident that a product installed in a boat will meet Coast Guard requirements if it displays the UL label.

In the absence of an applicable Federal standard, boat manufacturers, marine equipment manufacturers, installers and boat owners, are strongly urged to follow the latest voluntary standards and recommended practices available.

Want to find out more about voluntary standards and recommended practices? The following is a listing of the major marine standards organizations and the materials they publish:

American Boat and Yacht Council  
P. O. Box 747  
Millersville, MD 21108  
(301) 923-3932

National Fire Protection Assn.  
Batterymarch Park  
Quincy, Massachusetts 02269  
(617) 770-3500

Underwriters' Laboratories, Inc.  
Publications Stock  
333 Pfingsten Road  
Northbrook, Illinois 60062

Society of Automotive Engineers  
400 Commonwealth Drive  
Warrendale, Pennsylvania 15096

American Bureau of Shipping  
45 Eisenhower Drive  
Paramus, New Jersey 07652  
(212) 440-0300

ABYC Standards and Recommended  
Practices for Small Craft  
Price: \$100.00 for nonmembers  
plus \$20.00 annually for updates

NFPA 302  
Pleasure and Commercial Motor Craft  
Price: \$8.50

UL Marine Products Directory  
Price: \$1.15

UL Standards  
Prices vary

SAE Standards  
Price: \$7.00 each

SAE Marine Standards  
Price: \$22.00 per volume  
(4 volume set)

ABS Rules for Reinforced  
Plastic Vessels  
Price: \$10.00

ICOMIA  
Vale Road, Oatlands, Weybridge  
Surrey KT13 9NS England

Det norske Veritas  
P. O. Box 300  
1983N-1322 HOVIK  
Norway

International Council of Marine  
Industry Associations (ICOMIA)

Rules for Construction and  
Certification of Vessels Less  
Than 15 Metres  
Price: NOK 120,-

Rules for Classification of High  
Speed Light Craft 1985  
Price: NOK 300,-

[BSCs 61 & 62]

## APPLICABILITY

Paragraph 183.3(e) defines a monohull boat as any boat on which the line of intersection of the water surface and the boat at any operating draft forms a single closed curve or "footprint." A catamaran, trimaran or pontoon boat, for example, is not a monohull boat.

We wish to reiterate this definition in order to clear up some confusion about the Product Assurance Compliance Testing Program, and tests that are performed on what appear to be multihulled boats. Some manufacturers have disputed the applicability of the regulations to their boats, when in fact, the regulations are actually quite clear in their definition of what constitutes a monohull boat.

The key words in the definition of a monohull boat are "at any operating draft." When a boat is operated, it is assumed that the boat is carrying the weights used by the manufacturer in calculating the values displayed on the capacity label. As a result, if the hull configuration forms a single closed curve at any operating draft when the boat is loaded with the Maximum Weight Capacity for outboard boats, or with the Maximum Weight Capacity and weights simulating the weight of the largest engine offered by the manufacturer for inboard boats, then the boat is considered a monohull.

Any recreational boat which appears to have a waterline which forms more than one closed curve after being immersed in water before loading, but which becomes a waterline with one closed curve after loading, will be tested for compliance with all applicable regulations. The passenger weights will be distributed in accordance with the seating arrangements of the various boats tested.

For the purposes of the Coast Guard Compliance Testing Program, each boat selected for testing will be tested in the manner described above. The

tests will be discontinued if any boat clearly displays a waterline with two or more footprints when loaded as described above. [BSC 51]

## PERSONS CAPACITY, PORTABLE FUEL TANKS AND OUTBOARD POWERED BOATS

When performing the calculations and tests under the Safe Loading Standard, be sure to include the weight of a portable fuel tank.

Section 183.41 in the Safe Loading Standard prescribes the method for determining the persons capacity of boats powered by outboards of more than two horsepower. First of all, the regulations require subtracting the combined weights of the motor, controls, battery and full "portable" fuel tank (Col 6 of Table 4) from the Maximum Weight Capacity. - If the resulting number is more than 550 pounds, it is the Maximum Persons Capacity; HOWEVER, - If the resulting number is 550 pounds or less, then the manufacturer must perform the stability test in 183.41(a)(2).

Manufacturers must include the weight of a full portable fuel tank in these calculations even if the boat is equipped with a permanently installed fuel tank. Many boat owners carry a portable tank as a reserve for the permanently installed tank, so the regulations require the inclusion of that weight when calculating the Maximum Persons Capacity.

The stability test is performed with the weight of the motor and controls, battery and full portable fuel tank (if any) in normal operating positions. Weights are added along the outer edge of the passenger carrying area until the boat assumes maximum list without water coming aboard. The total weight added is divided by 0.6. Then, the lesser of the two values obtained (calculation method vs. stability test) is the Maximum Persons Capacity. [BSC 62]

## **LABEL REQUIREMENTS FOR BOATBUILDERS AND IMPORTERS**

**ARE YOU PREPARED TO PAY UP TO \$2000 PER COPY FOR LABEL ERRORS ON THE BOATS YOU BUILD OR IMPORT? IF NOT, THEN READ ON VERY CAREFULLY.**

Coast Guard standards people have found that many boat manufacturers do not completely understand the label requirements in Subchapter S (Boating Safety) of Title 33, Code of Federal Regulations. These regulations require four labels or markings: a certification label, a Hull Identification Number (actually two HINs), a U.S. Coast Guard Maximum Capacities label and a label for boats equipped with powered ventilation. A fifth, a start-in-gear protection label, does not apply to boats, but is required on outboard motors and controls.

The following explains the requirements for these labels. That is, who is responsible for affixing the labels (a separate section addresses importers); what information each label must contain; when to affix the label; where to affix the label; the reason for the label; and how to affix the label. Descriptions are included of the various types of violations or failures to comply with these requirements and **WHAT THE MANUFACTURER MUST DO IF LABELS DO NOT COMPLY**. Some label violations only require correction in future production. Some types of violations, however, require notification (of the failure to comply) and correction in accordance with 46 U.S.C. 4310.

46 U.S.C. 4310 requires, in part, every manufacturer who discovers that a boat fails to comply with an applicable standard or regulation, to notify the first retail purchaser. Paragraph 4310 further requires the manufacturer to correct the failure to comply without charge to the retail purchaser. The full requirements for notification and correction are in paragraph 4310 of the U.S. Code and Part 179 of Title 33, Code of Federal Regulations.

Manufacturers, dealers or distributors of boats that do not comply may be liable to civil penalties of \$2000 for each violation, up to a maximum of \$100,000 for a related series of violations. In addition, a manufacturer's failure either to furnish the notification required by 46 U.S.C. 4310, or to exercise reasonable diligence in fulfilling obligations under Paragraph 4310, may result in the assessment of additional penalties of the same size for the same series of violations mentioned above. To summarize, you could be penalized for:

- (1) The noncompliance; AND
- (2) Failure to notify, OR failure to exercise reasonable diligence in the notification and correction.

Whether penalties are assessed, or how large the assessment, is based on the facts of each case. (46 U.S.C. 4311)

### **CERTIFICATION LABEL**

**ABC BOAT COMPANY  
CITY, STATE**

**THIS BOAT COMPLIES WITH U.S. COAST GUARD SAFETY  
STANDARDS IN EFFECT ON THE DATE OF CERTIFICATION**

**MODEL T-205  
ABC12345C090**

**WHO:** Manufacturers of boats and associated equipment that must comply with standards in 33 CFR 183 must affix a certification label. The standards which currently apply are the requirement for the Display of Capacity Information in Subpart B, the Safe Loading Standard in Subpart C, the Safe Powering Standard in Subpart D, the Flotation Standard in Subparts F, G and H, the Electrical Standard in Subpart I, the Fuel Standard in Subpart J and the Ventilation Standard in Subpart K.

The standards and the boats to which they apply are summarized below:

Standards	Apply to
Display of Capacity Information	Monohull boats less than 20 feet in length except sailboats, canoes, kayaks and inflatables
Safe Loading	
Safe Powering (Outboards only)	
Flotation	
Ventilation	All gasoline powered boats including most outboards
Electrical Systems	Boats that have gasoline engines for electrical generation, mechanical power or propulsion except outboards.
Fuel Systems	

A boat intended solely for export which bears a label stating that fact, is not required to bear a certification label.

**WHAT:** The certification label must contain the following information in letters at least one-eighth of an inch in height that contrast with the basic color of the label (181.17):

1. The name and address (City and State) of the manufacturer(181.15(a)):

a. If the boat is foreign-made, the importer is considered the statutory manufacturer, and the importer's name and U.S. address must appear on the label; or

b. If a private label merchandiser (PLM) will sell the boat, then the PLM's address may appear on the label. A PLM is any company in the business of selling or distributing under its own trade name, boats manufactured by another. Display of the name and address of the PLM on the certification label does not make the company responsible for compliance with standards and regulations that are applicable to the manufacturer.(181.3(g))

2. A certification of compliance statement which states either:  
(181.15(a) and (b))

a. "This (insert 'Boat' or 'Equipment') Complies with U.S. Coast Guard Safety Standards in Effect On (insert month and year of date of certification)"; or

b. If the item being certified is a boat, the label may show the words, "This Boat Complies With U.S. Coast Guard Safety Standards In Effect On The Date Of Certification".

Note: The date shown in the certification statement must be no earlier than when construction or assembly began and no later than the date on which the boat or item of associated equipment leaves the factory for the purposes of sale, or is imported (181.15(b)). The boat or item of associated equipment must comply with all applicable Coast Guard safety standards in effect on this date (181.3(d)). The date of certification may be permanently stamped, embossed, or engraved on the label.(181.17(b))

3. Optional Information (181.15(d) and (e)): The manufacturer may, in addition to the required information, include any or all of the following:

a. Model name or designation

b. Hull Identification Number if a boat, or serial number if an item of associated equipment. (Note: Display of the HIN on the certification label does not satisfy the requirement to display an HIN on the transom and a second HIN on some interior area of the boat.(181.29)

c. Model Year.

**WHEN:** The manufacturer must affix the certification label before the boat or item of associated equipment leaves the place of manufacture for the purposes of sale. If the boat or item of associated equipment is foreign-made, the manufacturer must affix the certification label before it is imported. (181.9)

**WHERE:** The regulations do not specify a location for the certification label.

**HOW:** The regulation does not prescribe specific methods for affixing the certification label, nor does it prescribe specific materials for the construction of the label. Instead, the requirements for affixing the label are stated in general terms of the performance required: The label must resist the weather and wear encountered in normal use of the boat or item of associated equipment (material that can withstand exposure to water, oil, salt spray, direct sunlight, heat, cold and wear expected in normal use), and the label must be made so that it shows visible traces of any attempt to alter or remove information on it (181.19). If an item of associated equipment is so small that a certification label cannot be affixed to it, a certification label with the information required by 33 CFR 181.15 may be printed on the smallest container in which the item is packed, or on a slip of paper packed with the item.(181.11(b))

**WHY:** The certification label shows that the builder or importer of the boat or item of associated equipment states that it complies with all applicable U.S. Coast Guard safety standards.

## **POSSIBLE VIOLATIONS AND CORRECTIVE ACTION REQUIRED**

1. Not Certified When Required: No certification label on boats subject to the standards in 33 CFR 183 requires the manufacturer to obtain labels for current production immediately.

2. Letter Size Too Small: The manufacturer must obtain labels which meet all applicable requirements when existing supply is exhausted.

## **HULL IDENTIFICATION NUMBERS**

**ABC12345C090**

**WHO:** Regulations require manufacturers to affix two Hull Identification Numbers (HINs) on every boat used or intended for use on waters subject to Federal jurisdiction. For an imported boat, the U.S. importer is considered to be the manufacturer. Manufacturers and importers of sailboards are not required to affix HINs.(181.21 and 181.23)

**WHAT:** Each HIN consists of 12 consecutive characters at least one-fourth of an inch high. The 12 characters include the Manufacturer Identification Code, Hull Serial Number, Date of Certification or Manufacture, and the Model Year.

1. *Manufacturer Identification Code (MIC)*: The first three characters of every HIN affixed by a manufacturer or importer are the Manufacturer Identification Code which is assigned to the manufacturer by the Coast Guard. The Coast Guard will issue a MIC to U.S. builders of recreational boats and U.S. importers of foreign-built boats.(181.25 and 181.31) Manufacturers and importers may obtain a MIC by sending a letter to Commandant (G-NAB-6), U.S. Coast Guard, Washington, D.C. 20593-0001 and requesting one. The letter should briefly describe the types and sizes of boats the company will manufacture or import.

Note:

a. In the case of boats imported from Canada, the U.S. importer does not need to obtain a MIC or affix the HIN. MICs issued by Transport Canada and HINs affixed to Canadian-built boats are compatible with the U.S. system.

b. In the case of boats built or imported by individuals for their own use and not for the purposes of sale, the entire HIN is assigned by the State Boating authorities (see list on page 40) in the State of residence.

2. *Hull Serial Number*: Characters four through eight are hull serial numbers assigned by the manufacturer. They must be letters of the English alphabet, Arabic numerals, or both, except that the letters I, O and Q must not be used.(181.25(b))

3. *Month and Year of the Date of Certification*: The ninth and tenth characters in each HIN are the month and year of the date of certification. If a boat is not subject to a standard, characters nine and ten are the date of manufacture. By definition, the date of manufacture is the date construction or assembly of a boat begins. Character nine is the month of certification (or manufacture) using letters of the English alphabet starting with January as "A" and ending with December as "L". Character 10 is the last digit of the year of certification (or manufacture).(181.25(c))

4. *Model Year*: Characters 11 and 12 are Arabic numerals representing the model year, such as 86 for 1986, 87 for 1987 and so on. By definition, "model year" means the period beginning August 1 of any year and ending on July 31 of the following year. Each model year is designated by the year in which it ends.(181.3(g))

5. *Additional Characters*: Additional information displayed on the boat within two inches of the primary hull identification number, must be separated from the hull identification number by means of borders or must be on a separate label so that it will not be interpreted as part of the Hull Identification Number.(181.27)

6. *Uniqueness of the HIN*: No person may assign the same HIN to more than one boat. The combination of the same hull serial number and two different dates of certification or model years is a unique and unrepeatable serial number. For example, the two HINs ABC00001C090 and ABC00001C091 are unique numbers because their model years are different.(181.27)

**WHEN**: There is no specific requirement in the regulations for when the manufacturer must affix the HINs. In effect, 46 U.S.C. 4307 requires the manufacturer to affix the HINs before the boat is moved in interstate commerce, sold or offered for sale or imported into the United States.

**WHERE**: A Hull Identification Number must not be attached to parts of the boat that are removable:

1. The manufacturer must affix the **primary** Hull Identification Number:

a. *On boats with a transom*, to the starboard outboard side of the transom within two inches of the top of the transom, gunwale, or hull/deck joint, whichever is lowest.

b. *On boats without a transom or on boats on which it would be impractical to use the transom*, to the starboard outboard side of the hull, aft, within one foot of the stern and within two inches of the top of the hull side, gunwale or hull/deck joint, whichever is lowest.

c. *On catamarans and pontoon boats which have readily replaceable hulls*, to the aft crossbeam within one foot of the starboard hull attachment.

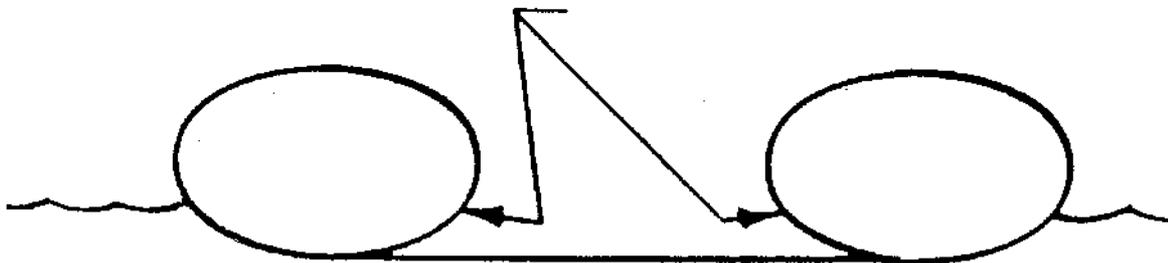
Note: If the HIN would not be visible because of rails, fittings, or other accessories, the HIN must be affixed as near as possible to the location specified in paragraph (a) of this section.

2. The manufacturer must affix a duplicate Hull Identification Number: According to §181.29(b), "The duplicate hull identification number must be affixed in an unexposed location on the interior of the boat or beneath a fitting or item of hardware."

Many manufacturers believe that this section requires a hidden location for the second HIN. Some inflatable manufacturers have petitioned the Coast Guard for an exemption from the requirement for the duplicate HIN because they can't find a place to hide it. No exemptions have been granted.

The Coast Guard recognizes that on some boats there is no place to hide a duplicate HIN. Manufacturers of dinghies with no removable fittings can affix the duplicate HIN to the inboard surface of the hull side beneath a thwart or support for a seat. Manufacturers of small boats which do not have seats should affix the duplicate HIN somewhere on the inboard surface of the hull.

When an inflatable boat is fully inflated, there are unexposed surfaces in the lower portion of its main buoyancy air chambers. A person looking at the boat would not be able to see a second HIN affixed to the lower inboard quadrant of a main buoyancy air chamber.



**HOW:** Each HIN must be carved, burned, stamped, embossed, molded, bonded, or otherwise permanently affixed to the boat so that alteration, removal, or replacement would be obvious. If the HIN is on a separate plate, the plate must be fastened in such a manner that its removal would normally cause some scarring of or damage to the surrounding hull area. Any plate must be bonded or welded in addition to any riveting. In other words, the HIN should be affixed so that a thief cannot remove it easily, but if sufficient efforts are made to remove it, the transom surface is damaged or changed enough to show that the HIN has been removed. (181.29(c))

**WHY:** The HIN provides a uniform positive identification of a boat. In turn this provides for:

1. Identifying the standards that apply to a particular boat.
2. Identifying boats involved in a defect notification campaign.
3. Identifying boats for State registration.
4. Tracing lost or stolen boats.

#### **POSSIBLE VIOLATIONS AND CORRECTIVE ACTION REQUIRED:**

1. No HIN When Required: Complete absence of an HIN on boats subject to the HIN requirement requires manufacturers to take immediate steps to affix HINs to current production.

2. HIN Markings Not Permanent: If the method used would allow the HIN to be removed or altered easily without changing the appearance of the transom, make corrections on current production. Saving a few cents per unit by putting flimsy HINs on boats is more than offset by the cost of a penalty assessment if the HINs are not permanent.

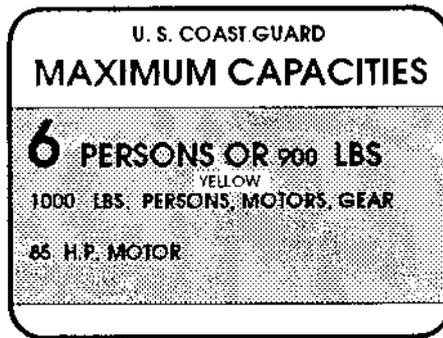
3. Spaces or Symbols Between Characters: The HIN must be 12 consecutive characters with no spaces, slashes or hyphens between them. Examples of improper HINs are: ABC 00001 C090, ABC-00001-C090, or ABC/00001/C090. Manufacturers shall immediately correct the HIN display in current production.

4. HIN Not 12 Characters: The HIN must be 12 characters. The most likely cause of short HINs is less than five hull serial numbers. Zeros or other characters (except the letters I, O and Q) may be used to make the serial number the required length, such as 00001 or AAAA1. A manufacturer must not use more than 12 characters (181.27). If additional information is displayed on the boat within two inches of the primary hull identification number, that information must be separated from the HIN by means of borders or must be on a separate label so that it will not be interpreted as part of the HIN. Manufacturers shall immediately correct the HIN display in current production.

5. Improper Date of Certification or Model Year: The ninth and tenth characters in each HIN are the month and year of the date of certification. Character nine is a letter starting with January as "A" and ending with December as "L". Character 10 is the last digit of the year of certification. Characters 11 and 12 are the model year such as 86 for 1986, 87 for 1987 and so on. By definition, "model year" means the period beginning August 1 of any year and ending on July 31 of the following year. Manufacturers shall immediately correct the HIN display in current production.

Note: While the Coast Guard currently requires corrective action only on future production for incorrect HINs, some States are refusing to register new boats with HINs in the old format. These States have titling and registration systems designed to coincide with model year instead of the date of certification or manufacture. Any boat manufacturer or importer who still uses the old HIN format could be making it very difficult for some buyers of new boats to register them.

**U.S. COAST GUARD MAXIMUM CAPACITIES LABEL (33 CFR 183.23(a))**



**WHO:** Manufacturers of boats subject to the Safe Loading and Safe Powering Standards must affix the U.S. Coast Guard Maximum Capacities label. The Safe Loading Standard (Subpart C of Part 183) applies to monohull boats less than 20 feet in length, except sailboats, canoes, kayaks and inflatables. The Safe Powering Standard (Subpart D of Part 183) applies to monohull boats less than 20 feet in length that use one or more outboard motors for propulsion, except sailboats, canoes, kayaks and inflatables

**WHAT:** The U.S. Coast Guard Maximum Capacities label must display Maximum Horsepower (if an outboard boat), the Maximum Persons Capacity in pounds and the number of people and the Maximum Weight Capacity (persons, motor and gear for outboards)(persons and gear for inboards, inboard-outdrives and boats without mechanical propulsion). The manufacturer calculates the capacities shown on the marking in accordance with the standards in 33 CFR 183. The capacity information must be displayed within a yellow area (see illustration for minimum character sizes) and must be displayed in the following format with no substitution of words:

1. For outboard boats (183.25(b)(1)):

**U.S. COAST GUARD MAXIMUM CAPACITIES**

**XX PERSONS OR XXX POUNDS  
XXX POUNDS PERSONS, MOTOR, GEAR  
XX HORSEPOWER MOTOR**

**OR**

**U.S. COAST GUARD MAXIMUM CAPACITIES**

**XX PERSONS OR XXX POUNDS  
XXX POUNDS PERSONS, MOTOR, GEAR  
XX HORSEPOWER MOTOR WITH REMOTE STEERING  
XX HORSEPOWER MOTOR WITHOUT REMOTE STEERING**

2. For inboard boats and inboard-outdrive boats (183.25(b)(2)):

**U.S. COAST GUARD MAXIMUM CAPACITIES**

**XX PERSONS OR XXX POUNDS  
XXX POUNDS PERSONS, GEAR**

3. For boats rated for motors of 2 horsepower or less (183.25(b)(3)):

**U.S. COAST GUARD MAXIMUM CAPACITIES**

**XX PERSONS OR XXX POUNDS  
XXX POUNDS PERSONS, MOTOR, GEAR  
XX HORSEPOWER MOTOR**

4. For boats rated for manual propulsion (183.25(b)(4)):

**U.S. COAST GUARD MAXIMUM CAPACITIES**

**XX PERSONS OR XXX POUNDS  
XXX POUNDS PERSONS, GEAR**

**This Boat Not Rated for Propulsion By A Motor**

Note: Abbreviations for the words "Horsepower" (HP) and "Pounds" (LBS) may be used.

**WHEN:** There is no specific requirement in the regulations for when the manufacturer must affix the U.S. Coast Guard Maximum Capacities label. In effect, 46 U.S.C. 4307 requires the manufacturer to affix the capacity label before the boat is moved in interstate commerce, sold or offered for sale or imported into the United States.

**WHERE:** The label must be clearly visible to the operator when getting the boat underway.

**HOW:** The regulation does not prescribe specific methods for affixing the U.S. Coast Guard Maximum Capacities label, nor does it prescribe specific materials for the construction of the label. Instead, the requirements for affixing the label are stated in general terms of the performance required: The label must resist the weather and wear encountered in normal use of the boat (material that can withstand exposure to water, oil, salt spray, direct sunlight, heat, cold and wear expected in normal use), and the label must be made so that it shows visible traces of any attempt to alter or remove information on it. (183.27)

**POSSIBLE VIOLATIONS AND CORRECTIVE ACTION REQUIRED**

1. No Capacity Information: Carry out the notification and correction procedures prescribed in 46 U.S.C. 4310 and 33 CFR 179.
2. Overrated Maximum Horsepower, Maximum Persons or Maximum Weight Capacities: Carry out the notification and correction procedures prescribed in 46 U.S.C. 4310 and 33 CFR 179.
3. Display of Capacity Information Using Improper Wording or in Improper Format: Correct the label wording or format as soon as possible in current production. Errors requiring notification or correction are determined on a case by case basis.
4. Display of a U.S. Coast Guard Maximum Capacities label on boats not subject to the Safe Loading or Safe Powering Standards: Cease the illegal display on current production. Boats not subject to standards may display a "capacity label" as long as it does not say "U.S. Coast Guard" on it.
5. Poor Location: Correct current production. Location errors requiring notification or correction are determined on a case by case basis. The marking should be readable from the helm on boats with remote steering. On boats with direct tiller steering, the label can be affixed to the inside surface of the hull near the operator's seat where the operator can see it while steering or operating the engine.
6. Minimum Character Size: Coast Guard standards personnel have found that some boat manufacturers are affixing capacity labels which bear characters which do not meet the minimum size width specified in the regulations. In some cases the numbers, including the large numbers used to

indicate whole numbers of persons, are inscribed with a ballpoint pen. The regulations in §183.25(c)(2) state that the stroke width of the numbers shall be one-sixth of the height, which must not be smaller than one-half inch. If the numbers are written in by hand, use a felt tip marker and make sure that the strokes are heavy enough so that they are clearly visible. Correct minimum character sizes when new labels are ordered.

### COMBINED CERTIFICATION AND U.S. COAST GUARD MAXIMUM CAPACITIES LABEL



The combined display of the certification statement and capacity information on one label is not a U.S. Coast Guard requirement. However, manufacturers seem to prefer the combined label in lieu of two separate labels. The labels may be combined, provided the following guidelines are met:

1. The two information displays are separated by a prominent line or border; and
2. The U.S. Coast Guard Maximum Capacities portion of the label is clearly the most prominent because of:
  - a. Larger type face, or
  - b. Bolder type face.

### BLOWER LABEL

**WHO:** Manufacturers of boats that are required to have an electrical exhaust blower must display a label advising the boat operator of the necessity to ventilate the bilges. Each compartment in a boat that is not open to the atmosphere and which contains a permanently installed gasoline engine with a cranking motor (starter) must be equipped with a blower.

**WHAT:** Each boat required to have an exhaust blower must have a label that contains at least the following information:

**“WARNING -- GASOLINE VAPORS CAN EXPLODE. BEFORE STARTING ENGINE OPERATE BLOWER FOR FOUR MINUTES AND CHECK ENGINE COMPARTMENT BILGE FOR GASOLINE VAPORS.”**

**WHEN:** The regulations do not specify when the blower label must be affixed. In effect, 46 U.S.C. 4307 requires the blower label to be affixed before the boat is moved in interstate commerce, sold or offered for sale or imported into the United States.

**WHERE:** The blower label must be in plain view of the operator and as close as practicable to each ignition switch.

**HOW:** The regulation does not prescribe specific methods for affixing the blower label.

**POSSIBLE VIOLATIONS:** No serious violations found to date.

### **START-IN-GEAR PROTECTION LABEL**

**WHO:** Manufacturers of any outboard motor which is capable of developing a static thrust of 115 pounds or more at any motor operating speed with any propeller or jet attachment recommended for or shipped with the motor must bear a Start-In-Gear Protection Label. Manufacturers of starting controls must display on such controls a tag or label indicating whether or not they have been equipped with a start-in-gear protection device.

#### **WHAT:**

1. **On Outboard Motors:** An outboard motor designed for remote starting that does not have a built in start-in-gear protection device must have a tag or label containing the following information:

**“STARTING CONTROLS INSTALLED WITH THIS MOTOR MUST COMPLY WITH USCG REQUIREMENTS FOR START-IN-GEAR PROTECTION IN 33 CFR 183, SUBPART L.”**

2. **On Starting Controls:** Starting controls must have a tag or label with the following information to indicate whether or not they have been equipped with a start-in-gear protection device:

**“THIS CONTROL WILL (or WILL NOT) PROVIDE START-IN-GEAR PROTECTION MEETING USCG REQUIREMENTS OF 33 CFR 183, SUBPART L.”**

#### **WHEN:**

1. **On Outboard Motors:** The Start-In-Gear Protection label or tag must be affixed on or before the time of sale.

2. **On Starting Controls:** Although the regulations do not specify when the Start-In-Gear Protection label or tag must be affixed on starting controls, it should be affixed on or before the time of sale so that installers of such equipment can match them with compatible outboard motors.

#### **WHERE:**

1. **On Outboard Motors:** The Start-In-Gear Protection label or tag must be affixed at the location of the control connection.

2. **On Starting Controls:** The regulations do not specify a location for the Start-In-Gear Protection label or tag.

**WHY:** Because any manufacturer, distributor or dealer installing an outboard motor which displays a label indicating that the motor is equipped with a start-in-gear protection device must be able to properly match it with a compatible starting control that contains a start-in-gear protection device.

**HOW:** The letters and numbers on the tag or label must be at least 1/8 inch high.

**POSSIBLE VIOLATIONS:** No serious violations found to date.

## **IMPORTED BOATS**

### **Sales of Foreign-Built Boats**

**NO PERSON MAY SELL A BOAT WHICH DOES NOT COMPLY WITH APPLICABLE SAFETY STANDARDS AND REGULATIONS.**

**WHO:** "Recreational vessel manufacturer" means a person engaged in the manufacturing, construction, assembly, or IMPORTATION of recreational vessels . . ." (46 U.S.C. 2101(26)).

That is, under Federal law, the U.S. importer of a foreign-built boat is subject to the same Coast Guard regulations as a U.S. manufacturer. A foreign manufacturer cannot export boats to the United States without having a U.S. importer.

Note: The importer must be a legal resident of the United States.

**WHAT:** Boats imported into the United States must bear the labels described on the previous pages as evidence that they comply with applicable safety standards and regulations. (Part 181)

**WHEN:** The Hull Identification Number and Certification Label must be affixed before a boat is imported (181.9). Under certain conditions, an importer may bring a boat that does not comply into the United States:

#### **1. Importer Will Make Repairs Necessary to Bring Boat Into Compliance.**

a. **Declaration Form.** The importer must file a declaration (form CG-5096 available from Customs officials at the time of entry) with the Customs Service. An entry on the form states that the importer will perform any work necessary to make the boat comply with applicable regulations and standards before anyone offers it for sale.

b. **Bond.** The Customs Service will require the importer to post a bond (an amount of money which represents a certain percentage of the value of the boat). The bond is a form of collateral: a guarantee that the importer will perform the work necessary to bring the boat into compliance. Usually the importer must bring the boat into compliance within 90 days after entry. The Customs Service will return the bond when the importer provides Customs and the Commandant of the Coast Guard with a signed statement that the boat now complies, a description of the the work performed, and identification of who performed it.

#### **2. Special Persons Who May Import Boats That Do Not Comply.**

Some people can bring noncomplying boats into the U.S., without previously posting a bond, and not worry about making corrections. These people include foreign military personnel assigned to the United States, delegates and foreign employees of the United Nations and similar organizations, and members of the foreign diplomatic community assigned to the United States. However, these individuals may not sell a noncomplying boat unless it has been brought into compliance.

### 3. Boats Imported for Tests or Experiments.

Noncomplying boats or associated equipment imported for tests or experiments may remain in the United States for as long as 1 year. The Customs Service requires the consignee (recipient of the product) to submit a signed declaration to the District Director of Customs giving name and U.S. address, entry number (assigned by Customs) and date, and the make and model of boats or a description of equipment and components. The consignee must provide a description of the tests and experiments that will be performed, the estimated time needed to complete them, and what will be done with the boat or equipment after the tests or experiments are finished. In addition the consignee should specify, if possible, the city and State where the boat, equipment or component will be kept while in the United States.

[BSCs 2-73, 27, 46, 57, 60 & 62]

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#### THE EFFECT OF HOLES ON LOAD CAPACITY

Several years ago an independent laboratory bought a 17-foot inboard-outdrive runabout manufactured by a well-known and respected company for compliance testing. Its U.S. Coast Guard Maximum Capacities label showed that the boat was certified for a Maximum Weight Capacity of 1550 pounds. The boat was equipped with generous ventilation louvers in the aft quarter of each hull side. They ventilated the engine space and also made a rather handsome and distinctive styling device.

When the lab tested the boat for load capacity, its static float plane was drawn from the extreme point of the bow to the stern, under every point of major water ingress (entry). Sketch "A" shows how this is done. More to the point, the load tests resulted in a capacity figure for the 17-footer of 730 pounds, slightly less than half the figure on the capacity label.

Further investigation showed that the builder had drawn the static float plane at gunwale level. In other words, with the boat immersed to its "float plane" for testing, water would pour through the ventilation louvers and the 3-inch plus ducts to the engine space. Thus, it becomes obvious that what may be good for ventilation may be very bad for a boat's static float plane and testing for Maximum Weight Capacity.

Subpart C of Part 183 of Title 33, Code of Federal Regulations contains the regulations on Maximum Weight Capacity and Safe Loading. Paragraph 183.33(b)(1) says "Maximum displacement is the weight of the volume of water displaced by the boat at its maximum level immersion in calm water without water coming aboard. For the purposes of this paragraph, a boat

is level when it is transversely level and when either of the two following conditions is met:

(1) The forward point where the sheer intersects the vertical centerline plane, and the aft point where the sheer intersects the upper boundary of the transom (stern), are equidistant above the water surface or are equidistant below the water surface; OR

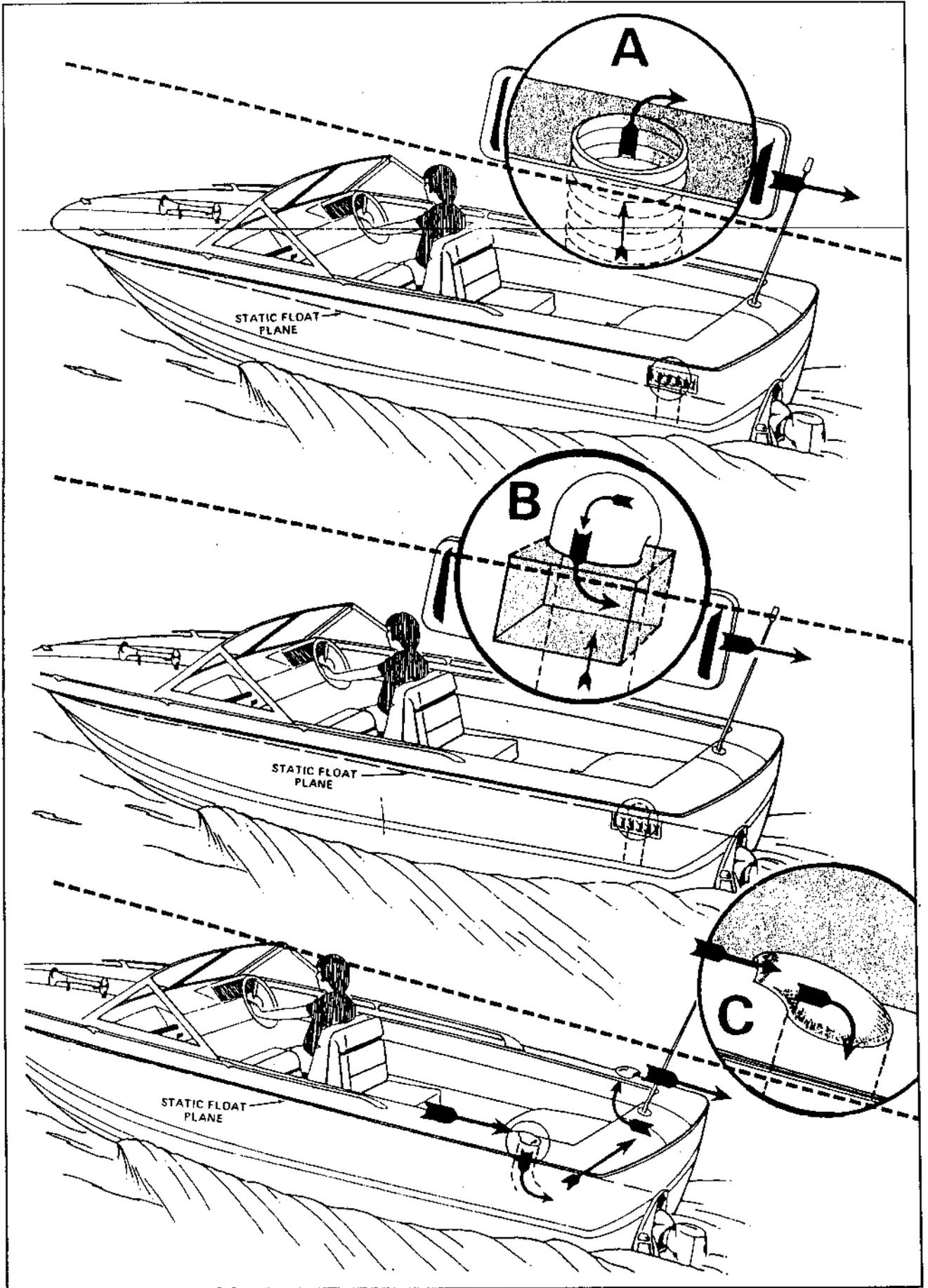
(2) The most forward point of the boat is level with or above the lowest point of water ingress."

Paragraph 183.35, Maximum Weight Capacity - Outboard boats - is worded like §183.33 with the exception of one phrase, which follows: "Maximum displacement is the weight of the volume of water displaced by the boat at its maximum level immersion in calm water without water coming aboard except for water coming through one opening in the motorwell with its greatest dimension not over 3 inches for outboard motor controls or fuel lines . . ."

The ABYC publication "Standards and Recommended Practices for Small Craft" contains a similar definition of the static float plane, but with a cautionary note that ventilation openings may become points of major leakage.

Some boats, as we mentioned, have been built with engine or fuel space ventilating louvers installed in the extreme quarter of each side of the hull. In the two most common sizes, the small louvers have an area of eight square inches and the large ones measure 14 square inches. Remember that any opening larger than three inches in its greatest dimension is a "major means of water ingress" or entry. The accompanying sketch "A" shows how to draw the static float plane in instances where ventilation louvers are in the hull sides.

In some instances we have found that recalculation of the Maximum Weight and Maximum Persons



Capacities using the correct static float plane gives figures that seem much too small for the size of the boat. When recalculation of the static float plane lowers capacity figures drastically, the float plane and the capacity figures can be raised in relatively simple ways. An effective way is shown in sketch "B". Here a box is built with the louver on one side. The ventilating tube is fastened to an opening in the top of the box. The tube then rises up and loops over and up under the gunwale, effectively restoring the static float plane to its original point.

Another, and possibly the simplest way to raise the float plane, is to close the louvers and install vents on the aft deck or gunwale, as shown in sketch "C".

[BSC 21]

## WHEN A BEER KEG WON'T WORK

One of the most frequently asked questions from boat owners is how to build a replacement fuel tank. Our first advice is to try to purchase the tank from the original boat manufacturer or from an established supplier of marine fuel tanks. A great deal of engineering is required to build a safe and satisfactory fuel tank for a boat. Your local welding or tinsmith's shops may not know all of the answers and you have to live (or die) with their solutions.

If you have to build the tank yourself or have it fabricated locally, get a copy of American Boat and Yacht Council Standard H-24, Gasoline Fuel Systems. The standard isn't a substitute for proper engineering design, but it covers the safety aspects of a good design.

For example, Table 1 of H-24 lists most of the materials commonly used for boat fuel tanks along with a minimum thickness or sheet metal gauge. The minimum thicknesses are specified for corrosion resistance, not for strength. The thickness and reinforcement should be determined by calculation or testing. In most cases you can determine those requirements by examining the fuel tank you are replacing.

Not all of the materials listed in Table 1 of H-24 are equally durable:

- \* Don't use copper for fuel tanks because it is impossible to make a durable soldered joint. Copper also causes a gum to form in gasoline unless the inside surface of the tank is completely coated with tin.

- \* Don't use terneplate (lead-tin alloy coated steel) because it develops pinholes due to accelerated

corrosion in salt water. Terneplate is the metal used for most automobile fuel tanks. Coast Guard regulations prohibit its use for tanks in certain new boats.

- \* Don't use stainless steel for a flat sided tank, for a cylindrical tank larger than 20 gallons or for any tank which might be in contact with bilge water. Stainless steel hardens and cracks if the sides of the tank flex or vibrate. It also develops pinholes when stagnant water lays in contact with the metal.

- \* Aluminum is the best choice for most custom fuel tanks, but only the marine alloys of aluminum, 5052, 5083 or 5086, which have very low copper content. Many local welding shops have the necessary shielded arc equipment (Heli-arc) to weld aluminum and the price is reasonable.

- \* Nickel-copper alloys which are sold under the trade name MONEL<sup>®</sup>, and copper-nickel alloys are good materials for fuel tanks because of their superior corrosion resistance, but they are expensive. Also, sometimes it is hard to find the necessary sizes and thicknesses without going to the factory. Nickel-copper alloys are approximately 70 percent nickel and 30 percent copper. These alloys have virtually no reaction with fuel. Copper-nickel alloys are 90 percent copper and 10 percent nickel and react about the same as pure copper with fuel and barnacles. These are the high and low of commercial products. A higher nickel content means a higher price. An alloy that is 60 percent nickel and 40 percent copper is suitable for a gasoline fuel tank.

- \* Hot-dipped galvanized steel is the lowest cost material. These tanks must be galvanized, that is, dipped in molten zinc, after they are completely fabricated. Do not confuse this with galvanized sheet metal which is OK for roofing, but should never be used for fuel tanks. Even the hot-dipped galvanized tanks should not be counted on for more than 10 years useful life. A brown or white gritty material in your fuel filter may be the first sign that the tank is ready to fail because the galvanized coating has corroded.

- \* Finally, fiberglass can be the best or the worst of materials for fuel tanks. Most gasoline stations have huge underground fuel storage tanks made of fiberglass. These tanks and the ones labeled by Underwriters' Laboratories for boats are the best. They are expensive and are probably beyond the ability of most small shops to make properly. The worst of the fiberglass tanks are little more than plywood covered with fiberglass.

If your boat is diesel powered, you must not use fuel tanks made of copper, copper-nickel or copper-silicon or those which are galvanized on the inside. All of the other materials which are suitable for gasoline are also OK for diesel. Many diesel powered boats use black iron or plain steel tanks. These have a limited life and must be checked frequently after five years of service; however, a leak in a diesel tank is not nearly as dangerous as in a gasoline tank.

H-24, Gasoline Fuel Systems, is available from the American Boat and Yacht Council, P. O. Box 747, Millersville, MD 21108. The price is \$7.00 per copy plus \$1.00 postage and handling. [BSC 62]

## KEEPING OUT OF HARM'S WAY

**Don't Use Automotive Parts:** While some marine engine components seem overly expensive compared to their automotive equivalents, there are major differences in the environments in which they are designed to operate. Some automotive fuel components release fuel and vapor into the engineroom and some automotive electrical components emit sparks. Fuel vapors do not accumulate beneath the hood of a car, but they quickly reach explosive levels in the engineroom on a boat.

Prior to the publication of the Coast Guard Electrical and Fuel System Standards, there were no marine equivalents for many of the automotive components described below. What are the differences?

**Alternators:** A standard automotive alternator has exposed electrical contacts that can create sparks and ignite fuel vapors in the engineroom. On marine alternators, which must meet the ignition protection requirements in §183.410(a), the contacts are sealed inside.

**Distributors:** Automotive distributors create high energy sparks internally that can escape through a vent which permits the release of ozone gas. Marine distributors are ignition-protected and the vent has a flame arrestor device to prevent sparking that could cause a fire or explosion in the engineroom.

**Starters, Generators, Accessory Motors (hydraulic pump, tilt drive, etc.):** These motors have brushes and an armature which spark in normal operation in an automobile. To meet the requirements of §183.410(a), the marine versions of these motors

are usually completely sealed. Marine starters are also equipped with an additional seal between their motor section and bendix gear section.

**Starter solenoids:** Each time the solenoid operates it creates a high energy spark internally. A vent hole in the automotive starter solenoid for the release of ozone, is absent on a marine starter solenoid that is ignition-protected.

**Carburetors:** The float chambers on carburetors are vented to permit the free flow of fuel into and out of the chambers. On automotive carburetors any overflow from the vents flows outside the carburetor into the engineroom. On a marine carburetor the vents lead into the carburetor throat so that any overflow is consumed by the engine.

**Fuel Pumps:** Automotive fuel pumps have a vent hole that will leak gasoline into the engineroom if the fuel pump diaphragm fails. The Coast Guard Fuel System Standard requires that each diaphragm pump must not leak fuel if the primary diaphragm fails.

To someone who is repairing and replacing the components mentioned above, the automotive component might seem like a bargain, but have you looked at the value of a human life lately? [BSC 57]

**Batteries:** Some serious fires and explosions have occurred on boats equipped with side terminal batteries and portable fuel tanks. New batteries no longer have the terminals on opposite corners on the top of the battery; now they're located side by side near the top.

If the battery is not properly insulated and secured in a battery box when a boat equipped with one of the new batteries is steered into a sharp turn, the battery can slide across the deck bringing the terminals into contact with the side of the fuel tank, causing a spark and then an explosion.

If the batteries are tightly secured and the positive terminals insulated, as is required by the Electrical Systems Standard, these accidents can be prevented.

**Battery Installation: Limiting Movement:** The Electrical Systems Standard calls for restraint of each battery in both horizontal and vertical directions. Inboard boat manufacturers are required to install batteries in such a way that they will not move more than one inch in three different directions -- vertically, horizontally fore and aft, and horizontally port to starboard -- when subjected to a 90 pound test force for one minute. Installers of batteries would be wise to try to meet the same requirement. The typical commercially available plastic battery box, in addition to being resistant to

the electrolyte in a battery (usually sulphuric acid), protects the battery terminals, and will prevent the maximum one inch movement. The box must be securely fastened and spacing material resistant to the electrolyte must be placed inside to restrict battery movement within the battery box.

**Battery Installation in Relation to Fuel System:** The regulations prohibit a boat manufacturer from installing a battery directly above or below a fuel tank, fuel filter or fitting in a fuel line. Leaking fuel could damage the casing of a battery installed beneath a fuel system component. Also, leaking electrolyte from a battery installed above a fuel system component, could create leaks in the fuel system.

[BSC 56]

## **BULLDOZERS, CHAINSAWS AND BOATS**

The phrase, "product liability," invokes images of consumers who are killed, crippled or disfigured; hours of testimony; hordes of lawyers; reputations jeopardized; and finally an expensive settlement. A good reputation and a quality product help to build a solid market. Don't jeopardize your reputation or your market. Our case in point concerns the sale of "scrap."

We continue to encounter cases concerning companies which have sold boats or engines as "scrap." Products sold as scrap were supposed to have been destroyed, but they found their way back into use on the water.

Don't endanger a good reputation and a good market by selling an inferior product that could land your company in court with a product liability suit. If you sell a "scrap boat," "scrap motor" or any other non-production item to someone else, you always run the risk that your "scrap" might find its way back into the hands of a consumer who will use that product in its designed capacity.

If there is an accident, no matter what kind of disclaimer you wrote to absolve your company of responsibility concerning use of a boat or engine sold for salvage, your company could still be taken to court in a product liability lawsuit.

In one instance we found a scrap dealer who was buying both scrap boats and scrap engines and reassembling them into a finished product. Several dealers were misled into thinking the boats were "factory seconds," rejected by the manufacturer for minor cosmetic flaws and then purchased by the scrap dealer.

Actually, the boats were defective and didn't comply with Coast Guard regulations. They were considered unrepairable by the manufacturer: experimental units, freight damaged units, units returned for warranty work, prototypes, etc. To make matters worse, the engines and the manner in which they were installed by the scrap dealer, contained deficiencies in the electrical system, shift system and transom seal, all of which affected the overall safety of the boats.

The original boat manufacturer removed company identification information (HINs, certification labels, and capacity labels) prior to the sale and included an invoice stating the conditions of the sale, e.g. "boats sold as is," "sold as scrap," etc. Under the conditions of the original manufacturer's sale of the boats, the scrap dealer was supposed to remove any salvageable material and then destroy the boats.

Unfortunately, these "scrap boats" could still be used as boats and the scrap dealer was not aware of the Federal prohibition against the sale of a defective or noncomplying boat. Several consumers ended up buying boats that appeared to be a bargain, but were really very dangerous.

We hear that the major automobile companies don't take any chances when they sell experimental cars and production prototypes for "salvage" to a scrap company. They pick up each vehicle with a crane, raise it to a height of about 50 feet and drop it, first on the front end and then on the rear end. They make sure that vehicles sold as scrap end up as scrap and do not find their way back to the nation's highways.

Take similar precautions with your products. Keep unrepairable and dangerous boats and engines out of the hands of consumers. Don't force your company into making an expensive settlement. If you send something to the scrap heap, make sure it stays there.

[BSC 60]

## **QUESTIONS MOST OFTEN ASKED BY DEALERS**

**Q:** *What is my responsibility if I sell or install a larger outboard motor than the Maximum Horsepower Capacity displayed on the boat's Maximum Capacities label?*

**A:** The present Coast Guard Safe Powering regulations require the manufacturer to calculate the Maximum Horsepower Capacity for boats (less than 20 feet in length) propelled by outboards,

and display this capacity on the boat for the use of the owner or prospective owner in matching a suitable outboard motor to the boat. A dealer who sells or installs an outboard motor of greater horsepower than that displayed on the capacity label on a boat is not in violation of the present Coast Guard regulations. However, the Coast Guard cannot speculate on the impact this action might or might not have on a civil suit initiated by the consumer in a product liability litigation under State law.

In this regard, we suggest that the dealer act only after obtaining proper legal advice. Every dealer should consult an attorney concerning responsibility under civil or common law, before completing the sale of a boat with an outboard of greater horsepower than the calculated capacity. Also, the dealer should consult the local Boating Law Administrator to be sure that there is no violation of State laws, and that the customer will be able to use the boat on State waters or adjoining State waters.

**Q: When, if ever, could a dealer be considered a manufacturer as is defined by 46 U.S.C. 2101 (formerly the Act), and therefore be held responsible for defect notification and correction?**

**A:** According to 46 U.S.C. 2101, "recreational vessel manufacturer" means a person engaged in the manufacturing, construction, assembly, or importation of recreational vessels, components or associated equipment. As a result, a dealer can get classified as a manufacturer by the word, "assembly." When accessories are attached to the boat at the time of sale by the dealer, the dealer is considered a manufacturer, in respect to those items installed by the dealer.

In that respect, the dealer could be required to conduct defect notification and correction for assembly errors or for choosing equipment which creates a substantial risk of personal injury to the public.

We consider the administration of proper defect notification systems a "Team Effort." Dealers should exercise diligence and care in properly recording "warranty card" information. The warranty cards can provide a sound system for maintaining a list of first purchasers. Care and accuracy in taking the warranty card information and return of the cards to the manufacturer will guarantee an effective result in the event of a defect campaign for both the dealer and the manufacturer.

[BSC 1-73]

## DEALERS, PRODUCT LIABILITY AND THE "COMMERCIAL BOAT"

Several States have reported to the Coast Guard that some dealers are selling "commercial boats" to people who intend to use them for recreational purposes. This may be a violation of 46 U.S.C. 4307 which could result in a \$2000 fine.

Builders of boats intended for commercial use do not have to manufacture them in compliance with the same Coast Guard safety standards and regulations that apply to recreational boats. However, there are also some recreational boat builders who don't want to build their boats to the standards and are calling them commercial boats.

While there is no Federal law prohibiting sales of commercial boats, the dealer who knowingly sells a boat that doesn't comply with applicable standards may suffer serious financial penalties if the purchaser has an accident.

So, don't sell a product that is an obvious attempt to dodge Coast Guard safety standards. If you sell a boat that doesn't comply, make sure that the buyer knows what is missing and the danger involved. Because if you don't, you can bet that the plaintiff's attorneys in a product liability suit will never let you forget it.

[BSC 53]

## CHARACTERISTICS OF SELECTED PLASTIC FOAMS

Federal boating standards developed by the Coast Guard do not specify the materials a manufacturer must use for flotation; however, they forbid the use of air chambers that are integral with the hull for flotation. Rather, the regulations specify that a flotation material must be capable of withstanding the combined effects of petroleum products, bilge solvents and fresh and salt water.

Foamed plastics can be made in an almost infinite range of densities and with either an open or closed cell formulation. Five or six basic formulations cover the range of foamed plastic types that are or could be available for use as flotation material. Their suitability is briefly discussed in the following paragraphs.

Make a physical check of the gasoline resistance of a particular foam in the following fashion. Weigh and then completely submerge a 1-inch cube of the foam in gasoline for 24 hours. Recheck its dimensions and weight. No appreciable change in size or weight should have taken place.

The commonest and cheapest flotation material is foamed polystyrene. It is produced from

expandable beads (popcorn). It is also extruded in the form of boards or billets. The ordinary product called Styrofoam<sup>®</sup>, easily dissolves in gasoline and is extremely flammable. Nevertheless, special compounds of foamed polystyrene are available that are resistant to solvents and are self-extinguishing. Major objections to foamed polystyrene are that it cannot be foamed-in-place, nor can it be made at the boat builder's plant.

Polyurethane foam is next to polystyrene in frequency of use. Usually, the boat builder uses it for foamed-in-place flotation. Otherwise, the builder molds it into shape before installation. Its cost is almost the same as polystyrene. In a practical sense, polyurethane foam is very resistant to gasoline and oil. They affect it only to the extent of causing slight swelling after hours of complete immersion when low densities (1.5 to 2 pounds per cubic foot) are used. At densities of 4.0 pounds per cubic foot and above, hydrocarbon solvents have no detectable impact on these foams. Polyurethane is not fireproof, but can be made so that it is self-extinguishing.

Polyethylene foam is already in use for flotation. It is moderate in cost, solvent-resistant, tough and flexible. Several small boat and canoe makers use it for buoyant liners or upright flotation sponsons under the trade name of Ethafoam<sup>®</sup>. Again, although not fireproof, it is classified as slow-burning.

Polyvinyl chloride foams (PVC) have been increasingly used for core materials in fiberglass

sandwich construction, partly replacing end-grain balsa for stiffening decks and cockpit soles. Although the cost is double that of balsa, PVC foam is fireproof, doesn't rot, and is nonabsorbent. Note that though fireproof, it does melt. Some boats, especially imported ones, use PVC foam for flotation material.

Acrylonitrile-butadiene-styrene (no wonder they call it ABS) is a thermoplastic foam sandwich material used for the hulls of many canoes and some small boats. It is usually referred to by its trade name, Royalex<sup>®</sup>. Its density of 30 pounds per cubic foot, about the same as many woods, makes it suitable for flotation material.

Foamed epoxy resin has properties quite like polyurethane foam. It is quite resistant to solvents and absorbs only the slightest amount of water. Density can range from 2.0 pounds to 20 pounds per cubic foot. The epoxy can be foamed in place or precast blocks or slabs can be installed. Epoxies are not used for flotation because they cost twice or three times the price of polyurethane foam. Low-priced epoxies or a series of price rises in polyurethane could change the picture completely.

Please note that this discussion of flotation materials is not all inclusive. Likewise, the list on the previous page is neither Coast Guard certified, nor a "Coast Guard Approved" list. It merely presents the physical properties of some flotation materials to interested boat manufacturers.

[BSC 3-74]

SELECTED PLASTIC FOAM TYPES AND CHARACTERISTICS

TYPE	DENSITY LBS/CUFT	GASOLINE RESISTANCE	BUOYANCY LOSS IN WATER
Extruded Polystyrene, ( Styrofoam )	1.8 to 4.3	Poor	Nil
Expanded Bead Polystyrene	1.0 to 5.0	Poor	< 2%
Extruded Polyethylene ( Ethafoam )	2.0 to 9.0	Slight Swelling	< 0.5%
Polyurethane (Pour-in- place or slab)	1.5 to 70	Good	< 0.1% (short term) See Note 2
Polyvinyl Chloride ( PVC )	2.0 to 6.0	Good	Nil
ABS (Royalex)	30	Good	Nil
Epoxy	2.0 to 20	Good	< 0.1%

Note: Over a long period polyurethane foam with a density less than 2.0 pounds per cubic foot will absorb an enormous amount of water. Therefore, low density polyurethane foam (<2.0 lbs/ft<sup>3</sup>) should not be used for flotation material below the cockpit sole or in the bilge.

## SOLE COST AND EXPENSE

46 U.S.C. 4304 (formerly Section 15 of the Act) requires builders to correct defects or failures to comply with applicable regulations "at their sole cost and expense." The Coast Guard recognizes there are some corrections which the boat owner can perform easily, such as replacing an erroneous capacity label. But don't ask the owner to make corrections requiring special tools or expertise that he or she might not have, e.g. properly mixing two part foam flotation. If the owner performs a retrofit that is considered inadequate, the Coast Guard's only recourse will be to require you to perform it again. For some the second correction, may be more difficult than the first one.

If you choose to ask an owner to perform a correction, the instructions in your defect notice must include a statement to the effect that if the owner does not wish to do it, then you will do it. Also, the notice must describe when, where and how you will do it. And remember that the phrase "sole cost and expense" includes costs to transport the boat to and from where you will perform the retrofit.

Where a question arises concerning the degree to which you might reasonably expect an owner to make the necessary corrections, contact your local Coast Guard MSO/MIO Office. They will be able to help you determine the best way to conduct a campaign that does not place an undue burden on you or the consumer. (BSC 63)

## ALCOHOL - BOOTLEG FUEL?

Is your boat powered by a gasoline engine? If your answer was yes, you've got a problem. Your boat's fuel system may be leaking. Besides fuel leaks, which increase your chances of having a fire or an explosion, the life of your engine might also be shorter. The culprit is alcohol.

Right now your fuel tank probably contains a certain percentage of alcohol mixed with gasoline. The pump where you bought your fuel probably lacked a sign stating that it contained alcohol. The guy who sold it to you might not have known the fuel contained alcohol either. So where did the alcohol come from?

Because of Federal air quality standards, the petroleum industry has reduced the amount of lead released into the atmosphere from exhaust emissions by blending alcohol and gasoline. Recently the EPA ordered a cut in the lead content

of gasoline to less than one-half of one percent. Some older engines may need a special additive to provide valve lubrication.

Unleaded gasoline, "superunleaded," etc., may be a blend of ethanol (ethyl alcohol aka "grain alcohol") and gasoline. The largest selling alcohol-gasoline (gasohol) blend in the United States contains about 10 percent ethanol. In Brazil some vehicles run on a 100 percent ethanol fuel. Most of the methanol (wood alcohol) produced in the U.S., is a by-product of natural gas production. Methanol sells for about half as much as gasoline. One major fuel supplier is reported to be using up to 10% methanol in its leaded fuel.

Unfortunately, while the Clean Air Act sets maximum allowable concentrations for the amount of ethanol an unleaded fuel may contain, no Federal limits are set for the amount of methanol a fuel may contain. As a result, anyone in the fuel distribution chain can boost the octane level and in turn the profit on a gallon of gasoline simply by adding a quantity of methanol.

**The Danger:** While alcohol boosts the octane level of gasoline, it also attacks the rubber fuel hoses and even the metal components in fuel systems. Nitrile rubber fuel hoses, the most common fuel hose material used for a number of years, suffer increased swelling and elongation when soaked in alcohol-gasoline blends. Alcohol will permeate most fuel hose currently being installed in boats; that is, it will pass clear through the hose. The maximum detrimental effects occur at methanol concentrations of about 10 to 25 percent. Some bootleg alcohol-gasoline blends have been found to contain as much as 30 percent methanol! For some unknown reason, increases in the swelling and permeability of nitrile rubber fuel hoses are larger for alcohol-gasoline blends than for either gasoline or alcohol alone.

Some types of synthetic rubber and plastic used in critical components such as fuel pumps, accelerator pumps, hoses, and other components such as gaskets and seals, deteriorate progressively as the concentration of methanol is increased. Methanol-gasoline blends used in fuel systems damage carburetors and plug filters, particularly when there is water in addition to alcohol in the fuel system.

Corrosion of metals is also a problem with alcohol-gasoline blends. The template (lead-tin alloy) coatings used in portable fuel tanks and older permanently installed fuel tanks can be attacked by blends, leading to subsequent corrosion of the steel tank itself. The resulting rust from the tank can plug fuel filters. Laboratory tests with six

metals (aluminum, brass, magnesium, steel, terre alloy and zinc) in alcohol-gasoline blends showed that all of them with the exception of brass exhibited at least some evidence of corrosion after 26 weeks of storage. Corrosion inhibitors added to the fuel by some suppliers can reduce this problem.

Corrosion of metal fuel system parts and the deterioration of synthetic rubber and plastic parts can be greatly accelerated by heat. Permeation of fuel hoses is essentially a chemical reaction. Heat accelerates this chemical reaction. Where hoses attach to fuel pumps on inboard and sterndrive engines, the rate of permeation can be considerably greater.

**Phase Separation:** Since water contamination of fuel distribution systems as well as condensation in fuel tanks can easily occur, phase separation with alcohol-gasoline blends can also be a major problem. All alcohols absorb water. The water it holds will corrode metal. Phase separation occurs when the alcohol-gasoline mixture is overloaded with water. The fuel separates into two layers: a gasoline rich layer on top and a alcohol-water layer at the bottom. Besides causing tank corrosion, this alcohol-water layer stalls your engine.

**Buying Fuel:** Currently there is no Federal requirement that fuel pumps display information concerning the concentration of alcohol in the fuels they are dispensing, so when you buy gasoline for your boat, you will have no way of knowing whether someone has added methanol. Only a few States require labeling on gas pumps. You should assume that your fuel contains alcohol and take precautions to reduce the harm it causes.

**Inspect Hoses:** If you have an inboard or sterndrive gasoline powered boat, inspect the markings on your fuel distribution lines. If they are not marked SAE J1527DEC85, they should be replaced as soon as practical with hose meeting that specification. This same advice applies to permanently installed fuel systems on outboard powered boats. Some outboard engine owner's manuals advise against the use of fuels containing methanol. The hoses for portable tanks and those supplied with outboard motors usually are not a problem because they are out in the open air.

Owners of gasoline powered boats should inspect their fuel hoses regularly, especially near the engine where engine heat can accelerate deterioration. Look for hoses that are dry and cracked or soft and mushy. A hose that has failed should be replaced immediately, preferably with hose meeting SAE Standard J1527DEC85. Owners of outboards should consider using this hose because it will last longer with regular gasoline or alcohol

blends.

If hose meeting the new standard is not available, use any hose marked "USCG Type A." A deteriorated fuel hose should be replaced immediately regardless of the marking. The signs of deterioration vary depending upon whether the fuel lines contain any fuel or not. A deteriorated fuel hose that contains no fuel is stiff and the cover is brittle and may have cracks. If the hoses are soft and swollen they are permeated by alcohol and/or gasoline. They too should be replaced immediately.

Boats with older hoses, particularly those that were manufactured prior to August 1978, the effective date of the Coast Guard Fuel System Standard, may have a serious problem because older hoses will fail rapidly in contact with alcohol. A fuel system containing a lot of hose full of fuel is particularly suspect, because the greater the length of the hose, the more the fuel that can escape. A hose ten feet long can dump a cup of fuel each day.

As we stated earlier, because permeation is essentially a chemical reaction, and heat accelerates chemical reactions, pay particular attention to where the hose attaches to the fuel pump on inboards and sterndrives when looking for damaged hoses.

**Replacing Hoses:** The Coast Guard realizes that many boat owners prefer to do their own maintenance rather than hire a professional marine mechanic. The price of the recommended replacement hose is considerably higher, but worth it, considering the danger a fire or explosion presents with fuel hoses that are susceptible to damage by alcohol. Just buying the right kind of hose won't solve the problem. Owners who choose to do the work themselves must be particularly careful to make a safe installation:

1. Replace deteriorated hose with new hose labeled "USCG Type A1" or "USCG Type B1" depending on whether the existing hose is Type A or Type B. If in doubt, use Type A1. The newest alcohol resistant fuel hose will be marked "SAE J 1527". If you can't get SAE J1527 and your existing hose is deteriorated, it is better to buy the older spec hose (SAE J30) rather than continue to use the deteriorated hose. Many dealers and suppliers of fuel hose will have hose in stock that does not meet SAE J1527. Such old spec hose is safe only for use in fill lines and vent lines. The danger involving these hoses is less stringent because normally they do not hold fuel for more than a few minutes.

Owners who are unable to find hose meeting the recommended specifications are urged to try to

find fuel which has the correct octane rating for their engine and which does not contain alcohol. Some States do not require the fuel pumps to be labeled with alcohol content. In that case you must make inquiries, particularly from an authorized dealer for your brand of engine.

2. Avoid emptying fuel lines full of gasoline into bilges; use a bucket to catch fuel drained from hoses.

3. Use hose clamps that do not rely solely on the spring tension of the clamp and be sure all connections are clamped securely to fittings. The clamps should be installed beyond the bead or flare or over the serrations of the mating spud, pipe or hose fitting.

4. Be sure to select fuel hose that will properly fit the metal fittings on the connections at each end. Do not buy a larger diameter hose than is necessary and then rely on the tightness of the clamps to compress the hose onto the fitting. If the inside diameter of the hose is larger than the fitting it slips over, you can tighten the clamps forever and the connections will still leak fuel.

5. Finally, in addition to fully ventilating the engine compartment after changing hoses, operate the blower for at least four minutes before starting the engine.

We expect fuel suppliers will add corrosion inhibitors to alcohol-gasoline blends to protect metal fuel system components. Many of the engine builders have already upgraded the gaskets and plastic parts in carburetors, fuel pumps and filters. In spite of these actions, many existing boats may develop fuel system leaks or other problems from the use of alcohol in gasoline.

In the opinions of many experts, this is not a problem which will simply go away. Also, it is not solely dependent on the decision to reduce the lead content of fuel. In a partial response to the problem, many States are requiring labeling on gas pumps dispensing alcohol-gasoline blends. Economics and availability seem to nominate alcohol as the fuel for now and the future. Be prepared. Make sure your fuel hoses can hold their alcohol. [BSCs 59, 60 & 63]

## SEAT FASTENERS CAN LET YOU DOWN

The following article by Pete Current, Resource Manager for Fishtrap Lake, U.S. Army Corps of Engineers, is reprinted courtesy of the National Water Safety Congress Journal, Burke, Virginia.

### DANGER FROM BEHIND

On 16 April 1983 Fishtrap Lake experienced a fatal drowning accident. This drowning was unique in that it brought to light an equipment failure that may be responsible for other deaths. Early on the morning of the accident, the victim and a close friend launched their boat and proceeded to their favorite fishing spot. Upon reaching that point, the victim sat down in the front pedestal-mounted folding seat and leaned forward to bait his line. After baiting his line, the victim straightened up and leaned back in his seat. At that instant, the seat back fell away and the victim tumbled backward into the lake. The victim could not swim, was not wearing a PFD and the water was cold (48°). Attempts by his companion to rescue the victim were not successful. Investigation of the accident revealed the seat back pivot point hinge pin was an aluminum rivet that had sheared.

The following month a fishing tournament was being held at Fishtrap and I displayed a photograph of the broken seat at the weigh-in station and asked the organizers to check boat seats of participants. Approximately 175 boats were checked and 48 seats were found to be defective. A local vendor participating in the tournament secured his tools and repaired the defective seats. All of the defective seats had aluminum hinge pin rivets. They were replaced with steel rivets. I talked with many fishermen over the summer and was shocked to learn that the failure of folding seat backs (with aluminum hinge pin rivets) was quite common. Most failures resulted in the fisherman falling into the boat but a few fell overboard.

If you own a boat equipped with folding pedestal seats, or if you know of someone who does, please check the seat thoroughly and replace any aluminum hinge pin rivets with steel pins or steel bolts. This simple check could save a life or prevent an injury.

Editor's Note: Although Mr. Current recommends steel pins or bolts, the Coast Guard would prefer that owners use stainless steel bolts.

The American Boat and Yacht Council (ABYC) is currently working on a standard for seat fastenings for boats. It will probably be a year or more before

the standard is published, but in the meantime several recommended practices have been developed.

Several serious accidents have been caused when the helm seat collapsed or came loose from the boat during critical maneuvers. The operators were seriously injured (at least one broken back) and swimmers who were run down sustained crippling injuries. Several fishermen have been thrown overboard when the fastenings on their pedestal seats pulled out of a plywood deck.

The ABYC committee discovered that the lateral force on a seat in a boat can exceed four to five times the weight of the person sitting in that seat. In other words, it is conceivable that a snap turn in rough water could exert as much as a 1000 pound pull sideways on a seat. In the case of a pedestal seat, this in turn could exert a 3000 or 4000 pound pull on the fasteners around the base: too much for screws in plywood, particularly after the plywood has gotten wet.

The committee also found that a healthy young man can exert 1500 to 2000 pounds of force when bracing his feet between a foot rest and the seat back. This force is multiplied by the lever action of a pedestal seat assembly.

Most of the accidents which have occurred involved a seat which was held down by gimlet or sheet metal screws fastened through the plywood or fiberglass cockpit sole. In most cases the plywood was wet and in some cases had turned black from contact with the screw, indicating some incipient rot. The common practice of fastening the seats in a boat over the top of indoor/outdoor carpeting or vinyl fabric almost guarantees that the plywood will eventually be weakened by moisture. The ABYC committee agreed that the best method for fastening a seat was through-bolting with generous sized washers or backing plates. Some types of blind fasteners might offer an equivalent level of integrity to through-bolting; however, these should be tested, since several engineers reported having encountered failures of some types of blind bolt fasteners.

Some engineers reported successful experiences with tapping plates placed underneath the cockpit sole and fastened with self-tapping stainless steel screws. That installation must be done very carefully, because it is easy to strip out the aluminum plate if the pilot hole is drilled oversize. Finally, if all else fails, wood screws or stainless steel sheet metal screws can be made to hold, if they are large

enough and if they enter at least one inch of solid wood underneath the plywood.

One engineer reported successful use of #14 x 1 3/4" stainless steel sheet metal screws. They have more thread -- and therefore more holding power -- than the conventional tapered wood screw. Even with long screws of adequate size, care should be taken against weakening the wood by moisture and rot. A teaspoonful of wood preservative squirted into the pilot hole before sinking the screw might make such a fastener more durable.

In making the above recommendations neither the ABYC committee, nor the Coast Guard means to imply that the aluminum pins used by seat manufacturers are always inadequate. The suitability of any hinge pin material depends upon the design of the joint, the hinge material used, the amount of load exerted on the pin, the use of washers or sleeves to carry the load and lubrication of the joint.

Most of the "defective" seats referred to in the National Water Safety Congress Journal article had aluminum hinges fastened with aluminum rivets. The rivets had worn away to the point where the inspectors thought they might fail soon. [BSCs 52, 57 & 58]

## REPAIRING BLISTERS IN FIBERGLASS HULLS

Blisters form when water penetrates beneath the gel coat. The water reacts chemically with the polyester resin in the laminate to form a sticky liquid containing acetic acid. The blisters swell as more water is drawn into them by osmosis.

Reports by boat builders, marine surveyors, and material suppliers were submitted to the National Boating Safety Advisory Council (NBSAC) Committee on Osmotic Blistering. The following is a summary of the current information for repairing fiberglass boats which have osmotic blisters.

(1) Puncture all blisters and allow them to drain. Then wash them with fresh water.

(2) Allow the hull to dry. The boat should be in a dry place or at least protected from rain. The longer the drying period, the better. Thirty days is usually long enough, but two or three months isn't too long.

(3) Gouge, grind, or carve out any soft laminate or areas where glass fibers appear in the holes. Do not sandblast or vapor blast the holes, because

there is too much danger of damaging good laminate. If the blisters are close together in a large area, some people recommend carefully removing all of the gel coat in the affected area with a coarse disc sander. Some yards in England are using an electric heat gun to soften the gel coat and removing it with a putty knife. Regardless of whether or not you remove the gel coat, you should carefully sand the bottom of the hull to remove all of the bottom paint to prepare the hull for a coating of epoxy.

(4) Fill all the holes and fair out any gouges. Deep holes (more than one ply) and large holes (more than a couple of inches wide) should be built up with multiple plies of cloth or mat and epoxy laminating resin. Fair shallow holes and gouges with a mix of epoxy resin and phenolic microballoons. Do not use any type of commercial body putty or polyester resin, because water will penetrate and pop the patches out.

(5) Coat the entire underwater surface with 10-12 mils (0.010-0.012") of two part epoxy resin. Do not use any type of paint product containing a solvent. There are many epoxy systems available which are sold specifically for this purpose. Some have a relatively low viscosity and may require four coats to acquire the proper coating thickness. Other epoxy systems are advertised as "high build" and need only two or three coats. If the gel coat was removed, this coating should be about 18 mils (.018").

(6) When the surface has cured according to the epoxy system manufacturer's instructions, sand lightly and apply standard anti-fouling paint. There is some concern by many repair yards that even a carefully repaired hull may blister again.

The NBSAC Committee on Osmotic Blistering believes that blisters will get progressively worse if they are not properly treated when first discovered. The Committee also believes that even if the initial blistering condition is confined to only part of the bottom, you should assume that the entire bottom needs treatment. It doesn't hurt to apply this treatment to a sound hull or to a new boat as a preventative measure, but it probably isn't cost-beneficial.

It appears that most boats do not develop blisters, but for those that do, this treatment does not cost much more if it is applied after blisters first appear.

[BSC 62]

## RULES OF THE ROAD: NAVIGATION LIGHTS

Navigation lights are essential to safe boating at night. Under ordinary conditions they tell boatmen something about each other's size, speed, course, and kind of boat (sail, power, tugboat, anchored, etc.). Although it is the boat operator's responsibility to carry and use navigation lights, some manufacturers have chosen to install them before offering their boats for sale.

In some instances the Coast Guard has found that manufacturers are installing navigation lights that cannot pass the requirements of either set of rules - Inland or International. Boat buyers and boat owners assume that the equipment installed on their boats at the time of purchase complies with all legal requirements. Deficient, shoddy and improperly installed equipment seriously endangers their lives as well as the lives of others who operate their boats at night.

In order to reduce the dangers to which the members of the boating public are exposed, under current policy, the boat manufacturer is responsible for the adequacy of navigation lights that the company installs at the factory. Specifically, if a manufacturer decides to offer a boat for sale with navigation lights installed the company must:

- (1) Install lights that satisfy the requirements of International Rules; or
- (2) Install lights that satisfy the Federal requirements detailed in the special rules that apply to Inland Waters; or
- (3) Be able to prove that failure to install lights in a legal configuration was the result of a specific order to the contrary from the buyer.

Under this policy, boats that are manufactured with installed navigation lights that do not meet either Federal or international requirements, contain a defect that creates a substantial risk of personal injury to the public. Thus, such boats are subject to the defect notification requirements in 46 U.S.C. 4310. This policy is in the best interests of both the boat manufacturers and the boating public.

### 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 will check to make sure that the navigation lights on new boats have the required minimum one meter separation.

#### **Masthead Lights and Sternlights:**

Some people have received information to the effect that the masthead light and sternlight may be combined into the same fixture on boats up to 20 meters in length, in effect, creating an all-round light (225 degree masthead light + 135 degree sternlight). This information is incorrect.

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 21(c), of the Inland Navigation Rules, "Sternlight" means a white light placed as nearly as practicable at the stern showing an unbroken light over an arc of the horizon of 135 degrees and so fixed as to show the light 67.5 degrees from right aft on each side of the vessel.

Finally, paragraph (2)(f)(i) of Annex I to the Inland Navigation Rules states, in part, that "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..."

As a result, an all-round light fixture is not permitted by the Navigation Rules, because the sternlight must be as near as possible to the stern

and the masthead light must be as far forward as practicable. Obviously these requirements can't be met if the two lights are in the same fixture or even mounted close together.

Only a power driven vessel of less than 12 meters may display an all-round light and sidelights in lieu of a masthead light, sternlight and sidelights (Rule 23(a)).

[BSCs 24, 54 & 60]

## **A GOOD WAY TO DIE**

How many times have you dismissed a headache and slight nausea as minor seasickness brought on by the combined effects of the sun and the waves or too many beers? Did you ever stop to think that you might have been a victim of carbon monoxide poisoning? The following describes some typical boating fatalities caused by carbon monoxide poisoning and what boat owners can do to prevent them.

The victims of carbon monoxide poisoning feel no particular pain except, perhaps, a severe headache which they usually attribute to some other cause. In fact, carbon monoxide will dull the senses to the point where the victims feel no fear or danger and have no will to save themselves. An hour after they drift into unconsciousness they are dead.

In one accident reported to the Coast Guard, a couple and their two daughters were killed by exhaust fumes that escaped from a cracked generator exhaust manifold. The owner of the boat had left the generator running overnight to supply electricity for a small heater in the cabin. The generator was installed in the engineroom but there were holes in the engineroom bulkhead, left there by the builder and by various mechanics who had worked on the boat since it left the factory.

Inspect the engine and generator exhaust systems for cracks in the hot, unjacketed sections of the exhaust manifolds. Check the tightness of the bolts holding the exhaust manifolds to the engine blocks.

*Are the engineroom bulkheads completely sealed against leaks into accommodation areas? Don't bet your life on the integrity of the engine exhaust system. All holes in the engineroom bulkhead for plumbing, wiring and controls should be sealed by whatever means is most convenient. Seal larger holes with pieces of plywood. Fill spaces around wiring and plumbing with caulking, electrician's putty or the nondrying putty material used by*

heating and ventilating contractors to seal pipes in the sides of air conditioning equipment.

Don't let anyone tell you that holes are necessary in the engineroom bulkhead for ventilation of the framing. If ventilation is needed, it can be provided on either side of the bulkhead, rather than through it. Sealing the holes in engineroom bulkheads will also make the cabin much quieter while the boat is underway.

*Was the generator installed by the boat manufacturer?* Don't install a portable generator below decks. No portable generators meet the Coast Guard Electrical and Fuel System Standards. The fuel tank is usually on the top of the generator directly above electrical components that are not ignition-protected, a potentially serious fire hazard on a boat. The exhaust system on a portable generator is usually constructed of nonmarine alloys that will rust through after brief exposure to a salt water environment. The carburetors on most portable generators are not intended for marine use.

*Do not use any flame producing device in an unventilated area.* Any heater, stove or lantern that produces an open flame uses oxygen. The argument that these devices do not produce carbon monoxide does not apply when they are used in enclosed spaces. Alcohol heaters and stoves, propane heaters and stoves, catalytic heaters, oil lamps, gasoline lanterns, even charcoal stoves consume oxygen. When the amount of oxygen in the air gets below a certain level, these devices produce carbon monoxide because of incomplete combustion of their fuel. Ventilation must be provided whenever any device producing an open flame is used in a boat cabin.

Another accident reported to the Coast Guard involved a large twin screw yacht. The owner and three of his guests who were below during a cruise across a lake were killed by carbon monoxide gas that had seeped into the cabin after escaping from a loose hose coupling on the exhaust pipe for one of the engines.

Employees of the yard that built the boat were probably the last ones to see that exhaust pipe in daylight prior to the accident, some three years after the boat left the factory.

On this particular boat a four inch diameter copper exhaust pipe extended from the exhaust manifold on the engine, to the aft engineroom bulkhead and then behind various pieces of mahogany cabinetry in the aft head and stateroom to the transom. At the engineroom bulkhead

where the two sections of copper exhaust pipe met, a length of rubber hose was slipped over the two sections of copper pipe and clamped in place.

Prior to the accident the boat's engines had been overhauled. In order to remove the engines from the boat, mechanics had disconnected both exhaust manifolds and twisted the exhaust pipes out of the way. This was easily done because the pipe rotated in the rubber connection at the bulkhead. When they replaced the engines and reconnected the engine exhaust pipe, the mechanics failed to inspect the other end of that rubber hose connection behind the engineroom bulkhead in the after stateroom. The movement of the forward section of the exhaust pipe had loosened the clamp holding the rubber hose to the rear section. Normal engine vibration probably caused the failure several hours prior to the fatal voyage.

*Are rubber exhaust hose connections held by double hose clamps?* Be sure that all rubber hose connections in the exhaust system are fitted with two clamps at each end. Double clamping will go a long way toward preventing the exhaust hose from coming loose due to vibration.

*Are the exhaust hoses intended for marine use?* Make sure the hoses aren't burned through or beginning to show signs of advanced age. If you replace them, be absolutely certain that they are labeled by the manufacturer for use in a marine exhaust system.

*Are the exhaust system connections accessible for thorough inspections?* If you own a double cabin cruiser or motor yacht, the exhaust lines probably pass through the aft stateroom on their way to the transom. There may be a rubber hose connection at the transom, at the engineroom bulkhead and at each end of any muffler installed in that exhaust line. All of these joints should be accessible for a complete inspection. If you find that the exhaust lines run behind cabinetry, as they do on many boats, now is the time to provide access. Cut holes or install removable panels so that inspection is relatively easy. You will want to inspect these connections at least twice every season. A crack or leak in the exhaust line is easy to detect while the engine is running. These are wet exhaust lines. A leak or crack will cause a steady drip of water.

In still another accident, a boat owner was cruising across a bay for a rendezvous with fellow yacht club members while his wife slept on the V-berth up forward. Upon arrival at their destination, the owner found that his wife was dead.

Most boats have a fairly large cabin structure forward of a cockpit area. When the boat is underway, the air swirls around the cabin structure and hardtop into the cockpit and often the cabin crating a low pressure area. This low pressure area will draw air from anywhere, over the transom or even through a sink drain that exits the hull side above the waterline. The exhaust gases are then recirculated throughout the cockpit and cabin areas. This happens regardless of whether the boat is traveling upwind or downwind.

Some people refer to it as the "station wagon effect." Some station wagons have a deflector on the rear edge of the roof to keep road dust from being sucked into the car through the open tailgate window.

On a boat the best solution to the potential for this type of carbon monoxide poisoning is to provide alternate sources of air for the cockpit and cabin areas. Leave a port in the windshield open and open a deck hatch. If you can feel a flow of air coming aft through the cabin and cockpit areas, you probably won't have much of a problem with carbon monoxide being pulled forward and into the boat. Exhaust deflectors can help, but they won't totally eliminate the problem.

Remember that carbon monoxide is a clear and odorless gas that may be present even if the telltale smoke associated with exhaust emissions is not. Don't wait to feel the symptoms of carbon monoxide poisoning. Check your boat's exhaust system frequently.

[BSC 58]

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## SALES OF DEFECTIVE PRODUCTS PROHIBITED

### § 4307. Prohibited acts

#### (a) A person may not-

(1) manufacture, construct, assemble, sell or offer for sale, introduce or deliver for introduction into interstate commerce, or import into the United States, a recreational vessel, associated equipment, or component of the vessel or equipment unless -

(A)(i) it conforms with this chapter or a regulation prescribed under this chapter; and

(ii) it does not contain a defect which has been identified, in any communication to such person by the Secretary or the manufacturer of that vessel, equipment or component, as creating a substantial risk of personal injury to the public; or

(B) it is intended only for export and is so labeled, tagged, or marked on the recreational vessel or equipment, including any markings on the outside of the container in which it is to be exported;

(2) affix, attach, or display a seal, document, label, plate, insignia, or other device indicating or suggesting compliance with standards of the United States Government on, in, or in connection with, a recreational vessel or item of associated equipment that is false or misleading; or

(3) fail to provide a notification as required by this chapter or fail to exercise reasonable diligence in carrying out the notification and reporting requirements of this chapter.

(b) A person may not operate a vessel in violation of this chapter or a regulation prescribed under this chapter.

The defect notification and recall regulations administered by the Coast Guard apply to manufacturers and importers of boats and associated equipment (outboards, inboards or sterndrives). These regulations apply when a boat or motor fails to comply with applicable Federal safety standards or contains a defect which creates a substantial risk of personal injury to the public.

Federal statutes (see 46 U.S.C. 4307 above) prohibit the sale of a boat or item of associated

equipment if the Coast Guard or the manufacturer has informed the seller that it contains a defect which creates a substantial risk of personal injury to the public. This prohibition has been in existence since August 1971 for boats which do not comply with an applicable Federal safety standard or regulation. Even if the original manufacturer of the product is no longer in business, if it contains a substantial risk defect, the product must be repaired before it can be sold. [BSC 60]