



Boating Safety Circular 80

DON'T INSTALL GENERATOR SETS ON THE CHEAP

With the proliferation of accessories requiring 110 volt AC electrical power, most people with boats having sleeping and cooking accommodations would like to have a source of such energy. Given that the boat has AC circuit wiring and a distribution panel board installed, the simplest sources are a shore power connection while at the dock and an inverter while at sea. An inverter converts low voltage DC to high voltage AC with reasonable efficiency. This is limited to battery capacity; or, if the engine is running, to the alternator output. This will handle modest accessory loads for a while, but any heavy AC load will deplete the battery in short order. An extra battery held in reserve for cranking the engine and a battery disconnect/selector switch is almost a necessity.

For heavier loads such as electric stoves, air conditioning, or water heaters, shore power or a separate source of AC power on board such as a generator set is the only way to go. Some larger boats can be obtained with a generator set already permanently installed, using the main engine fuel source. These are comparatively expensive installations running to several thousand dollars or considerably more, depending on output capacity. Even if not so equipped originally, these larger boats may have a space set aside for their installation, usually in the engine compartment. But not just any generator set should be installed in the boat interior. It must be a "marine" generator set: liquid cooled with provisions for exterior discharge of exhaust gasses. If installed in a boat using gasoline as fuel, it must be "ignition-protected": creating no sparks or other sources of ignition that can set off a gasoline vapor explosion. A gasoline generator set, even if installed in a compartment separate from the main engines or fuel tanks, needs to be an ignition-protected

type. The carburetor also needs a backfire flame arrester.

Such generators are inherently expensive. Liquid cooling usually means a heat exchanger to separate the engine cooling liquid from the sea water. Water jacketed manifolds and high rise elbows with water discharge into the exhaust hose are standard. When looking in the many catalogs that come through the mail or passing through a large hardware store, boat owners will see generator sets with outputs of 2 to 5 kilowatts for prices from \$300 to \$600, a far cry from a \$3,000 built-in generator set. What a temptation: cheap AC power for the boat! Such generators are not intended for installation in enclosed spaces, on land, or on the water, and come equipped with warnings to that effect. Their specifications are: air-cooled, gasoline fuel in an integral tank on the generator set, direct exhaust discharge, and no ignition-protection or backfire flame arrester.

Does this mean they should never be used or installed on a boat? Not necessarily. The key word here is "on" not "in." Such generator sets are all right when running in the open air above deck. They may be noisy, but they will do the job. A three sided enclosure with a top will shield some of the noise and still allow for adequate air cooling. These would be basically short usage installations, certainly not to be left running for extended periods. The limited fuel tank size would take care of that. They can be

Inside:

Voluntary Compliance Testing	3
SBREFA	4
What Is a 100 MPH Life Vest?	6
Gel Cell Batteries	6

one source for restoring a dead battery to life so the main engine can be started - always a secure feeling when you sit around at anchor most of the night using up battery power for anchor and cabin lights, alarms and stereo music.

All generator sets need to be used with caution, whether liquid cooled permanently installed in the engine compartment or sitting out on the open deck. Internal combustion engines, particularly gasoline engines, are a source of carbon monoxide (CO). This can have an insidious way of getting back into the boat, even if discharged to the exterior. Wind direction, being tied up next to a dock or sea wall or next to another boat may let CO into the boat through an open port or cabin ventilator. One of the riskiest but common procedures on boats equipped with a generator set and air conditioning is to close the cabin up on a hot night and go to sleep with the generator set and air conditioning on. If doing that, a working carbon monoxide alarm is essential. Even though the engine compartment is separated from the cabin space by a bulkhead, this may not be absolutely vapor tight. If an exhaust leak is present and the cabin is at a slightly lower pressure than the engine space, it can become a serious situation. It's not a bad idea to keep the engine compartment ventilation blower running whenever the built-in generator set is running. It brings in fresh air and purges any fumes in the space.

INSPECT FLAME ARRESTERS TO SAVE LIVES

Most boaters driving gasoline powered inboard boats know that there is something on top of the carburetor. They probably think it's to keep bugs, loose clothing and other airborne objects from being sucked into the engine. Those who are more knowledgeable may know it is a backfire flame arrester, but don't know how important it is. Some might even think about taking it off to "let the engine breathe" better and increase speed, even one-tenth of a mile per hour.

On one boat some years back, with a V-6 stern drive, the arrester had been replaced with an automotive paper element air cleaner. The owner still had the sack from the auto parts store with the sales slip. There was an engine compartment explosion and ensuing fire. A little girl, who was

asleep on cushions under the fore deck, never made it out. They sued the boat manufacturer, the stern drive manufacturer and even GM [General Motors], which made the basic engine. They didn't get a dime.

Backfire flame arresters serve a very important safety function. All gasoline engines with carburetors tend to vent fuel vapor after shutdown. If shut down from high speed, they are hot and will boil off some of the fuel in the float bowl. This vapor goes into the engine compartment and will linger for a while unless taken out by the ventilation blower. The vapor itself does no harm, as long as there is no source of ignition present. Sources of ignition can be electrical or from a backfire in the engine intake system when it is restarted. Most of us have heard a backfire. On a boat, flames spouting out of the carburetor can ignite that fuel vapor in the engine compartment.

The operating principle of the flame arrester is to cool and quench the flame front by forcing it to pass between some closely spaced metal elements that act as a heat sink. Since the engine must take in air without too much restriction, many elements are required with many small spaces between, hence the typical arrester design of a circular shape that is six or more inches in diameter and an inch or more in height. Some form of delayed or late ignition takes place in one of the cylinders at a time when the intake valve is open and the resulting flame ignites the fuel and air vapor in the intake manifold. The pressure created has to go somewhere, and that's back out through the carburetor or intake system. With a working flame arrester, only the pressure is released and none of the flame gets out.

A damaged flame arrester is little, if any, better than none at all. The slip of a tool that spreads the metal elements apart, even in one spot, can let that flame pass through. Damaged arresters should be replaced, and inspection of the arrester should be a part of every commissioning. Occasional careful cleaning with oil and grease solvers will keep the engine breathing normally. A tight metal-to-metal

Editors Note: The two preceding articles, *"Don't Install Generator Sets on the Cheap"* and *"Inspect Flame Arresters to Save Lives"* originally appeared in Boat and Motor Dealer Magazine, and are reprinted with the permission of the magazine and their author, Mr. Ralph Lambrecht.

joint is probably the best, with an elastic stop nut used on the hold down stud to make sure it stays tight.

Most two-cycle gasoline engines don't need flame arresters. Such inboard engines are found on personal watercraft and jet boats, basically outboard powerheads coupled to water jet pumps. Backfire flame arresters and the power heads of such engines are required to pass similar tests to be certified (as an acceptable means of backfire flame control). This consists of being subjected to a 50-cycle test procedure in which the carburetor, with the arrester installed, is mounted on top of a cylindrical chamber simulating the volume of an intake manifold. The outside of the carburetor is in another chamber of several cubic feet in volume with a spring-loaded lid. Both chambers are filled with an explosive mixture of propane and air. The mixture in the chamber below the carburetor is ignited by a spark plug. The resulting explosion and flame front must not ignite the mixture in the upper chamber. To complete the test cycle, the mixture in the upper chamber may also be ignited by another spark plug to prove that it was in the explosive range. There must never be an incident where the upper chamber mixture is ignited as a result of the mixture in the lower chamber.

Federal law requires that inboard gasoline engines be equipped with an acceptable means of backfire flame control (a Coast Guard approved device or one which meets UL 1111 or SAE 1928). It's a good safety precaution and one that has prevented a lot of boat fires and saved more than a few lives over the years.

VOLUNTARY COMPLIANCE TESTING PROGRAM

The Coast Guard has implemented a free program to test recreational boats voluntarily supplied by manufacturers for compliance with the Safe Loading, Safe Powering and Flotation Standards. Under the program, manufacturers may request compliance testing early in a production run. Early testing can minimize the financial risk associated with Coast Guard imposed recalls and reduce the numbers of noncomplying boats reaching the public. Points to consider for this voluntary program are:

1. Testing is free, but is limited to boats subject to standards, e.g., boats less than 20 feet in length.

2. Boats which fail testing will be re-tested after the manufacturer's corrections are made.

3. If the boat fails compliance testing and the numbers of noncomplying boats is significant, the Coast Guard could require defect notification, recall and repair of all affected units. Therefore, manufacturers are encouraged to have a boat tested early in the production run to minimize the risks associated with a recall.

4. Manufacturers can bring their boats to the test facility in Solomons, Maryland for testing, or the Coast Guard will make arrangements to pick up and return boats which are provided voluntarily.

5. Manufacturers may witness compliance testing and ask questions about testing methods, techniques and procedures.

6. Boats provided for testing will incur some damage:

a. Holes are drilled at selected locations on the topsides and in the cockpit sole to allow the escape of entrapped air.

b. Boats are submerged in a tank for 18 hours prior to testing; flotation foam may absorb water during this process and may retain it after testing.

We encourage all manufacturers of boats which are subject to the Display of Capacity Information, Safe Loading, Safe Powering, and Flotation Standards to consider voluntary compliance testing as part of their business strategies. The testing is free, it helps ensure that a manufacturer's products meet minimum safety standards, and it reduces the risk of a costly recall campaign in the future.

The Coast Guard laboratory tested about 50 boats during 1998 and expects to test more next year. Manufacturers who would like to learn more about the voluntary compliance testing program should contact:

Mr. Gary Larimer
(E-mail GLarimer@comdt.uscg.mil)
1-800-368-5647 or (202) 267-0986

SMALL BUSINESS REGULATORY ENFORCEMENT FAIRNESS ACT (SBREFA)

Is your company a small business entity? The Coast Guard has established a program for responding to small entity inquiries concerning information on and advice about compliance with statutes and regulations under our jurisdiction.

Small entity means a small business, small organization, or small governmental organization. (It does not apply to individual persons.)

Small business or small business concern means an enterprise that is independently owned and operated and which is not dominant in its field of operation. (15 U.S.C. 632)

Small organization means any not-for-profit enterprise which is independently owned and operated and is not dominant in its field. (5 U.S.C. 601(4))

Small governmental jurisdiction means governments of cities, counties, towns, townships, villages, school districts, or special districts, with a population of less than 50,000. (5 U.S.C. 601(5))

Small Business Administration Size Standards. If you have any questions concerning size standards, please contact the U.S. Small Business Administration, Office of Size Standards at 202-205-6618. The Small Business Administration also provides assistance to small businesses.

The Small Business Administration Web site can be accessed at <http://www.sbaonline.sba.gov>

Coast Guard contacts. Small businesses may contact the following individuals for assistance in complying with and applying Recreational Boating Safety regulations:

General Recreational Boating Safety Inquiries:

Senior Chief Petty Officer Al Johnson
[tel: 617-223-8463; fax: 617-223-8471]
Commander (osr),
First Coast Guard District,
Boston, MA. [CT, MA, ME, NH, NJ, NY, PA, RI, VT]

Mr. Steve Phillips
[tel: 757-398-6204; fax: 757-391-8107]
Commander (Aoax)
U. S. Coast Guard Atlantic Area
Portsmouth, VA
[DC, DE, MD, NC, NJ, NY, PA, VA]

Lieutenant Junior Grade Keirsten Current
[tel: 305-536-4498; fax: 305-536-4498]
Commander (osr)
Seventh Coast Guard District
Miami, FL
[FL, GA, PR, SC, VI]

Mr. Kevin Kelly
[tel: 504-589-6770; fax: 504-589-5653]
Commander (osr)
Eighth Coast Guard District
New Orleans, LA
[AL, AR, CO, FL, GA, IL, IN, IO, KS, LA, MI, MN MS,
ND, NE, NM, OH, OK, SD, TN, TX, WI, WV, WY]

Mr. Frank Jennings
[tel: 216-902-6094; fax: 216-902-6018]
Commander (o)
Ninth Coast Guard District
Cleveland, OH
[IL, IN, MI, MN, OH, PA, WI]

Lieutenant Commander Dennis Otschi
[tel: 510-437-3831; fax: 510-437-3223]
Commander (Poo)
U. S. Coast Guard Pacific Area
Long Beach, CA
[AZ, CA, NV, UT]

Mr. Dolph Diemont
[tel: 206-220-7257; fax: 206-220-7265]
Commander (osr)
Thirteenth Coast Guard District
Seattle, WA
[ID, MT, OR, WA]

Mr. Kent Richards
[tel: 800-541-2161; fax: 808-541-2161]
Commander (oax)
Fourteenth Coast Guard District
Honolulu, HI
[AMSAM, CNMI, GU, HI]

Ms. Sue Hargis
[tel: 907-463-2297; fax: 907-463-2299]
Commander (moc)
Seventeenth Coast Guard District
Juneau, AK
[AK]

Interpretation of Federal Requirements on Recreational Boating Safety Inquiries:

Boat and associated equipment manufacturer requirements.

Mr. Peter Eikenberry
[tel: 202-267-6894; fax: 202-267-4285]
Commandant (G-OPB-3)
U. S. Coast Guard Headquarters
Washington, DC

Boat and associated equipment defect notification and recall requirements.

Mr. Alston Colihan
[tel: 202-267-0981; fax: 202-267-4285]
Commandant (G-OPB-3)
U. S. Coast Guard Headquarters
Washington, DC

Recreational Boat Compliance Testing

Mr. Gary Larimer
[tel: 202-267-0986; fax: 202-267-4285]
Commandant (G-OPB-3)
U. S. Coast Guard Headquarters
Washington, DC

Boat operator and equipment carriage requirements.

Mr. Carl Perry
[tel: 202-267-0979; fax: 202-267-4285]
Commandant (G-OPB-1)
U. S. Coast Guard Headquarters
Washington, DC

Boating Accident Report Database (BARD) statistics.

Mr. Bruce Schmidt
[tel: 202-267-0955; fax: 202-267-4285]
Commandant (G-OPB-1)
U. S. Coast Guard Headquarters
Washington, DC

Federal Marine Event Permitting Procedure Regulations.

Mr. Carl Perry
[tel: 202-267-0979; fax: 202-267-4285]
Commandant (G-OPB-1)
U. S. Coast Guard Headquarters
Washington, DC

Further Information on Specific Regulatory Projects Inquiries:

Federal Requirements for Wearing Personal Flotation Devices.

Mr. Carl Perry
[tel: 202-267-0979; fax: 202-267-4285]
Commandant (G-OPB-1)
U. S. Coast Guard Headquarters
Washington, DC

Federal Requirements for Education in Recreational Boating Safety.

[tel: 202-267-0577; fax: 202-267-4285]
Commandant (G-OPB-2)
U. S. Coast Guard Headquarters
Washington, DC

Vessel Identification System.

Ms. Jeanne Timmons
[tel: 202-267-0857; fax: 202-267-4423]
Commandant (G-OPB-2)
U. S. Coast Guard Headquarters
Washington, DC

Standards for Navigation Lights Used on Recreational Boats.

[tel: 202-267-0984; fax: 202-267-4285]
Commandant (G-OPB-3)
U. S. Coast Guard Headquarters
Washington, DC

National Boating Safety Activities: Funding for National Nonprofit Public Service Organizations.

[tel: 202-267-1077; fax: 202-267-4285]
Commandant (G-OPB-1)
U. S. Coast Guard Headquarters
Washington, DC

Propeller Injury Prevention Involving Rented Boats.

[tel: 202-267-0984; fax: 202-267-4285]
Commandant (G-OPB-3)
U. S. Coast Guard Headquarters
Washington, DC

Amendments to Hull Identification Number Regulations.

Mr. Alston Colihan
[tel: 202-267-0981; fax: 202-267-4285]
Commandant (G-OPB-3)
U. S. Coast Guard Headquarters
Washington, DC

Regattas and Marine Parades Permitting Procedures.

Mr. Carl Perry
[tel: 202-267-0979; fax: 202-267-4285]
Commandant (G-OPB-1)
U. S. Coast Guard Headquarters
Washington, DC

The Small Business and Agriculture Regulatory Enforcement Ombudsman and 10 Regional Fairness Boards were established to receive comments from small businesses about Federal agency enforcement actions. The Ombudsman will annually evaluate the enforcement activities and rate each agency's responsiveness to small business. If you wish to comment on the enforcement actions of the U.S. Coast Guard call 1-888-REG-FAIR (1-888-734-3247).

100 MPH LIFEVESTS DO NOT PROTECT WEARERS FROM TRAUMATIC INJURY IN A HIGH SPEED CRASH

Several life preserver (PFD) manufacturers have advertised their products as "100 mile per hour lifevests." This has led many readers of the advertisements to the false conclusion that such products will protect riders of Personal Watercraft (PWCs) from injuries in high speed crashes. The impact rating of a life preserver has nothing to do with protecting the operator or passengers on a PWC from impact trauma. In fact, Underwriters Laboratories (UL) Standard 1123, "Marine Buoyant Devices," was revised recently to change the name of the "Impact Test" to the "Dynamic Strength Test" in order to better reflect the intent of the evaluation.

If a life preserver is strength tested at 100 miles per hour (mph), the statement means only that the fasteners, e.g., snaps, buckles, etc., have supposedly been tested at 100 mph. In one such test, the lifevest is attached to a wooden frame and dropped from a helicopter at the rated speed to see if the buckles remain fastened.

The use of a "100 mph lifevest" does not mean that a wearer would be less susceptible to traumatic injuries. As one boating safety specialist has pointed out -- following a 100 mph accident, hopefully, the 100 mph lifevest will still be fastened around the victim's battered, bruised and possibly dead body.

COMPLIANCE GUIDELINES AVAILABLE

If you are a recreational boat manufacturer and have difficulty navigating the Code of Federal Regulations for compliance with applicable U.S. Coast Guard safety standards, the American Boat and Yacht Council (ABYC) might have just the product for you. ABYC publishes four "Compliance Guidelines" that explain, interpret and clarify the regulations. The Guidelines complement the regulations by explaining various means a manufacturer may use to achieve compliance, and diagrams and tables are also provided.

The available titles are:

Flotation Compliance Guideline

Electrical System Compliance Guideline

Fuel System Compliance Guideline

Ventilation Compliance Guideline

As of today, the guidelines cost \$23.00 each, which includes \$3.00 shipping and handling. Reduced prices are available for orders in larger quantities. The full set of four is \$72.00. For complete ordering instructions, call ABYC in Edgewater, Maryland at (410) 956-1050.

GEL CELL BATTERIES UPDATE

In **Boating Safety Circular 78** (August 1996) the Coast Guard published an advisory concerning the installation and charging of gel cell batteries. Some people misconstrued this advisory to mean that gel cell batteries are inherently dangerous.

Gel cell batteries are not inherently dangerous. They are much safer than non-sealed wet cell storage batteries. When installed and maintained in accordance with the manufacturer's instructions gel cell batteries will provide safe service. Any battery, whether wet cell, gel cell, a sealed battery, or other type has the potential to be dangerous if not properly installed or maintained, especially if it is not properly charged. Overcharging and overheating are the two main culprits that damage batteries.

The Coast Guard's concern is not with gel cell batteries, but with the proper installation and maintenance of all batteries. In the cases reported to us the batteries were installed in closed compartments and overcharged, causing excessive heat and production of hydrogen gas.

Hydrogen gas is produced in the charging process and is extremely flammable. In unsealed batteries this gas is vented to the atmosphere. In sealed batteries it is recombined into the electrolyte and it is only vented to the atmosphere if there is excessive pressure from overcharging. Any battery if overcharged, will overheat and cause a build up of pressure inside the battery which may result in a hazardous situation. The Coast Guard's intent is to warn all boat operators/owners that all batteries have to be installed and maintained properly.

All batteries must be installed and maintained in accordance with the manufacturer's instructions to be used safely. On boats with permanently installed gasoline engines, except outboard engines, batteries must also be installed in accordance with Federal regulations in 33 CFR 183.420.