

A-7 LIQUID AND SOLID FUELED BOAT HEATING SYSTEMS

Based on ABYC's assessment of the existing technology, and the problems associated with achieving the goals of this standard, ABYC recommends compliance with this standard for all boats and associated equipment manufactured and/or installed after July 31, 2007.

7.1 PURPOSE

These standards and recommended practices are guides for the design, construction, and installation of permanently installed boat accommodation space heating units and systems.

7.2 SCOPE

These standards and recommended practices apply to permanently installed boat accommodation space heating units and systems using only liquid or solid fuels.

EXCEPTION: Heating appliances and systems fueled by liquefied petroleum gas (LPG), compressed natural gas (CNG), and heating systems that produce steam in a boiler are not covered by this standard.

NOTE: For requirements relating to LPG and CNG fuel systems, refer to ABYC A-1, Marine Liquefied Petroleum Gas (LPG) Systems, ABYC A-22, Compressed Natural Gas (CNG) Systems, ABYC A-26, LPG and CNG Fueled Appliances, contains requirements for all gaseous fueled appliances, including those used for comfort heating.

7.3 REFERENCED ORGANIZATIONS

ABYC - American Boat & Yacht Council, Inc. – 613 Third Street, Suite 10, Annapolis, MD 21403 (410) 990-4460 fax: (410) 990-4466. Web site: www.abycinc.org

ANSI - American National Standards Institute, 11 West 42nd Street, New York, NY 10036 (212) 642-4900. Web site: www.ansi.org

ASME - American Society Of Mechanical Engineers, 3 Park Avenue, New York, NY 10016 (212) 591-7722. Web site: www.asme.org

CFR - Code of Federal Regulations and other government publications. Obtain from the Superintendent Of Documents, United States Government Information, POB 371 954, Pittsburgh, PA 15250-7954 (202) 512-1800 or FAX (202) 512-2250. An excerpted edition of the 33 CFR, Rules And Regulations For Recreational Boats, is available from ABYC, Inc., 613 Third Street, Suite 10, Annapolis, MD 21403 (410) 990-4460 fax: (410) 990-4466. Web site: www.gpoaccess.gov

UL - Underwriters Laboratories, PO Box 13995, 12 Laboratory Drive, Research Triangle Park, NC 27709 (919) 549-1400. Web site: ul.com. Web site: www.ul.com

7.4 DEFINITIONS

For the purposes of this standard, the following definitions apply.

Accommodation Space - spaces designed for living purposes for persons aboard a boat. Examples of specific uses of accommodation spaces include: staterooms, heads (bathrooms), galley, pilothouse, navigation, workshop, and other similar people-oriented spaces. These uses contrast with engine and fuel tank compartments.

Attended Appliance - an appliance that is installed in the accommodation space of a boat and used when the occupants are in the accommodation space. An attended appliance requires action and attention by an operator, including operator initiated ignition.

Circulating Hot Liquid Heating Systems - any heating system designed to raise the temperature of a circulated liquid to a higher than ambient temperature; Liquid is distributed by means of a pipe or tubing network to heat distributors, generally a convector or a radiator, located in those areas or accommodation spaces to be heated. Such a system includes a circulating pump to positively distribute liquid from the heat source to the distributors and return.

Draft - the gas flow caused by the pressure differential in the exhaust of a heating unit at any specified time.

Flame Failure - the failure of combustion to continue after initial flame establishment.

Flame Failure Device - a device preventing fuel from flowing to a burner if flame is not present.

Forced Warm Air Heating System - a system that heats air to temperatures exceeding ambient, and circulates the warmed air by means of a fan to the area(s) to be heated.

High Temperature Limit Switch - an automatic device that shuts off the burner at a predetermined temperature.

Ignition Failure - the failure of a combustion type burner to establish proper flame when starting.

Liquid Fuels - kerosene, diesel oil, or alcohol.

Solid Fuels - coal, wood, and charcoal.

Readily Accessible - capable of being reached quickly and safely under emergency conditions without the use of tools.

Room Sealed Combustion System - a combustion system in which incoming air, the combustion chamber, and the outgoing products of combustion are sealed from the boat interior.

Unattended Appliance – an appliance that is intended to function without frequent attention by an operator and that may cycle on and off automatically, such as, refrigerators, or thermostatically controlled accommodation space heaters and water heaters.

7.5 GENERAL REQUIREMENTS

7.5.1 Electrical wiring serving heating units, and electrical components associated with the control and operation of all heating units, shall meet the requirements of ABYC E-11, AC & DC Electrical Systems.

7.5.2 Heating units using gasoline, in any form, as fuel or for priming, are prohibited.

EXCEPTION: Heating systems that utilize main propulsion engine liquid cooling system waste heat.

7.5.3 Printed instructions for proper installation, operation, maintenance, and refueling where applicable, shall be provided with each appliance.

7.5.3.1 The instructions shall include information on the risks associated with the air consumption of the appliance, and information for the installer relative to the installation of a warning label. See A-7.5.13.1 and A-7.12.

7.5.4 Heating units and their enclosures or jackets, if provided, shall have:

7.5.4.1 A means of securely fastening the unit in place against the pitch and roll experienced in marine applications; and

7.5.4.1.1 the outside, external surface temperature of the enclosure(s) or jacket(s) shall not exceed 180°F (82°C) with an ambient temperature of 77°F (25°C) when the unit is operating at maximum heat output. See A-7.9.2.2 and A-7.10.6.

7.5.5 Burner systems shall be capable of normal operation without creating a fire hazard when inclined at angles up to 30° from horizontal, in any direction, and continuous operation at angles of heel up to 30°.

7.5.6 On boats with gasoline engines, heating units, or systems used for accommodation space heating, shall be of the room sealed combustion system type.

7.5.7 When installed in spaces requiring ignition protection, all electrical components associated with the control and operation of heating units shall comply with the ignition protection requirements of ABYC E-11, AC & DC Electrical Systems.

NOTE: For boats with inboard gasoline engines, the Code of Federal Regulations, 33 CFR, Section 183.410, and ABYC E-11-AC & DC Electrical Systems.

7.5.8 Operating controls shall be readily accessible.

7.5.9 Ducts and air handling systems, shall meet the requirements of UL 181, *Factory-made Air Ducts and Air Connectors*.

7.5.10 Ducts and air handling systems shall be sized in accordance with the heating equipment manufacturer's recommendations.

7.5.11 Air handling systems, including discharge and return air systems, shall be so constructed and installed as to prevent harmful gasses from entering living spaces, and

7.5.11.1 shall be airtight, with respect to compartments containing engines or fossil fueled devices where the air handling system shares common partitions with or passes through those compartments, and

EXCEPTION: Accommodation spaces containing LPG or CNG appliances.

7.5.11.2 shall neither discharge to, nor return to, any compartments other than the one(s) intended to be serviced by that equipment.

7.5.12 On boats with non-room sealed combustion heating systems, a carbon monoxide detection system shall be installed in accordance with the requirements of ABYC A-24, Carbon Monoxide Detection Systems.

7.5.13 Non-room sealed combustion system appliances using liquid fuels shall be equipped with an oxygen depletion sensor that cuts off the fuel supply to the appliance when the room oxygen level falls below 95 percent of normal, and/or failure of oxygen sensor, and

7.5.13.1 in addition to the oxygen depletion sensor, the manufacturer of the appliance shall provide a warning label to alert the appliance operator to maintain adequate ventilation during appliance operation. See A-7.12 for label requirements.

7.6 EXHAUST SYSTEMS

7.6.1 Exhaust products shall be ducted to the exterior of the boat with a smoke pipe or stack, and cap, designed to minimize water entry, and back draft into accommodation spaces.

7.6.2 The flue system shall be continuous and sealed from the appliance to its terminus outside the boat, and

7.6.2.1 the system shall be accessible for inspection, and

7.6.2.2 the flue terminus shall not be positioned within 20 inches (510 mm) of a refueling fitting or fuel tank vent, and

7.6.2.2.1 shall be positioned to minimize exhaust re-entry into the boat through any openings into the accommodation spaces.

7.6.2.3 For boats with solid fueled appliances, the flue terminus/cap shall be fitted with a UL listed spark arrester.

7.6.2.4 Dampers, i.e., shut-off valves, shall not be installed in the flue systems of liquid fueled heating appliances.

7.6.3 Double or triple wall smoke stacks shall meet the requirements of UL 103, *Chimneys, Factory-built*, and

7.6.3.1 shall be installed in accordance with the instructions of the stack manufacturer.

7.7 LIQUID FUEL BURNERS

7.7.1 Ignition failure, or flame failure by the atomizing burner, shall cause complete shut-off of the fuel supply and all other burner operations, or

7.7.1.1 shall contain all fuel spilled within the appliance.

7.7.2 Restarting a burner(s) after ignition failure shall be possible only after operator attention and intervention.

7.7.3 Fuel lines, connections, and fuel filters, if used, shall comply with ABYC H-33, Diesel Fuel Systems.

7.7.4 A readily accessible manual or electrically operated (e.g., solenoid) shut-off valve shall be installed at the tank outlet.

7.8 FORCED WARM AIR HEATING UNITS

7.8.1 A high temperature limit switch, with manual reset, shall be integral with the heating unit.

7.8.1.1 This switch shall be separate and distinct from any other control, and

7.8.1.1.1 shall shut off the burner(s) if the heating unit's output air temperature exceeds 90% of the maximum rating of the duct material. See UL 181, *Factory-made Air Ducts and Air Connectors*.

7.9 CIRCULATING HOT LIQUID UNITS

7.9.1 A low liquid cutoff switch shall be integral with the appliance, and

7.9.1.1 shall be separate and distinct from any other control, and

7.9.1.2 shall automatically shut off the fuel supply to the burner if the liquid level falls below a pre-determined level.

7.9.2 A high temperature limit switch shall be integral with the heating unit, and

7.9.2.1 shall be separate and distinct from any other control, and

7.9.2.2 shall automatically shut off the burner if circulating liquid temperature exceeds 190° F (87°C).

7.9.3 A pressure safety relief valve, separate and distinct from any other control, shall be installed on each heating unit.

7.9.3.1 The relief valve shall be an ASME approved type and rated for hot liquid heating as follows:

7.9.3.1.1 The rating of the valve, in heat value BTU/hrs relieved, shall be at least 50 percent greater than the maximum input to the heating unit; and

7.9.3.1.2 the relief valve shall operate at a pressure no greater than 30 psig (206 kPa); and

7.9.3.1.3 the relief valve discharge shall be to a location that avoids danger to the boat's occupants.

7.10 RADIATION AND CONVECTION SELF-CONTAINED TYPE HEATING UNITS

7.10.1 Radiation and convection self-contained type heating units shall be considered attended appliances.

7.10.2 Solid fueled appliances shall be constructed and installed so that

7.10.2.1 a positive flow of flue gases is maintained at all times, and

7.10.2.2 combustion byproducts cannot be discharged into the accommodation spaces, and

7.10.2.3 under no conditions shall the operation or adjustments of controls or dampers restrict the flow of flue gases in such a way as to compromise compliance with A-7.10.2.1 and A-7.10.2.2.

7.10.3 Solid fuel type heating units shall be provided with grates and suitable ash pit.

7.10.4 Solid fuel type heating units shall be provided with adjustable openings in the ash pit and above the combustion area for draft adjustment.

7.10.5 Air space shall be provided around the unit to allow full convection of air.

7.10.6 With the appliance installed, the temperature of the surfaces below, and immediately surrounding, vertical combustible surfaces shall not rise more than 150°F (66°C) above the compartment's ambient temperature when tested with the temperature test of section 18 of UL 1100, *Alcohol and Kerosene Cooking Appliances for Marine Use*.

7.11 **HEATING UNIT MARKINGS**

7.11.1 A durable and permanently legible sign providing information on the proper operation and any unique hazards of the appliance shall be provided.

7.11.2 Each appliance shall be permanently marked or labeled with the following information:

7.11.2.1 manufacturer's name or trademark;

7.11.2.2 manufacturer's or prime seller's address;

7.11.2.3 model number;

7.11.2.4 serial number;

7.11.2.5 fuel/energy used.

7.12 **SAFETY LABELS AND WARNINGS**

7.12.1 Safety labels and warnings shall comply with the recommendations of ABYC T-5, Safety Signs and Labels, and shall contain at least the following informational elements:

7.12.1.1 the hazard intensity signal word;

7.12.1.2 the nature of the hazard;

7.12.1.3 consequences that can result if the instructions to avoid the hazard are not followed; and

7.12.1.4 instructions on how to avoid the hazard.

7.12.2 The warning label required in A-7.5.13.1 shall be a permanent, legible label installed on, or in the vicinity of the heating unit.