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(iv) Be fitted with suitable, corrosion resistant, compression fittings; and

(v) Be installed with two clamps at each end of the hose, if designed for use with clamps. Clamps must not rely on spring tension and must be installed beyond the bead or flare or over the serrations of the mating spud, pipe, or hose fitting.

(f) A fuel line subject to internal head pressure from fuel in the tank must be fitted with a positive shutoff valve located at the tank which is operable from a safe location outside the space in which the valve is located.

(g) A vessel less than 79 feet (24 meters) in length may comply with one of the following standards in lieu of the requirements of paragraphs (e) and (f) of this section.

(1) ABYC H-33.

(2) Chapter 5 of NFPA 302.

(3) 33 CFR Chapter I, subchapter S (Boating Safety).

§ 28.340 Ventilation of enclosed engine and fuel tank spaces.

(a) *Applicability.* Each vessel with a gasoline outboard engine or gasoline storage tank must comply with the requirements of this section.

(b) *Ventilation of spaces containing gasoline.* Each space that contains a gasoline engine, a gasoline storage tank, or gasoline piping connected to an integral gasoline tank must be open to the atmosphere and so arranged as to prevent the entrapment of vapors or be ventilated by a mechanical exhaust system with a nonsparking fan. The fan motor must comply with 46 CFR 111.105-23.

(c) *Alternative standards.* A vessel less than 65 feet in length with ventilation installations in accordance with NFPA 302, chapter 2, section 2-2, or ABYC H-2 and 33 CFR part 183, subpart K, will be considered as meeting the requirements of this section.

§ 28.345 Electrical standards for vessels less than 79 feet (24 meters) in length.

(a) A vessel less than 79 feet (24 meters) in length with an alternating current electrical distribution system may comply with the requirements of ABYC E-8 and either paragraph (c) or (d) of this section, as applicable, in lieu of

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meeting the requirements of §§ 28.350 through 28.370.

(b) A vessel less than 79 feet (24 meters) in length with a direct current system may comply with the requirements of ABYC E-1, ABYC E-9, and either paragraph (c) or (d) of this section, as applicable, in lieu of meeting the requirements of §§ 28.350 through 28.370.

(c) In addition to paragraph (a) or (b) of this section, the vessel may comply with the requirements of NFPA 302, chapters 7 and 8.

(d) In addition to paragraph (a) or (b) of this section, the vessel may comply with the requirements of 33 CFR part 183, subpart I and § 28.370.

§ 28.350 General requirements for electrical systems.

(a) Electrical equipment exposed to the weather or in a location exposed to seas must be waterproof, watertight, or enclosed in a watertight housing.

(b) Aluminum must not be used for current carrying parts of electrical equipment or wiring.

(c) As far as practicable, electrical equipment must not be installed in lockers used to store paint, oil, turpentine, or other flammable or combustible liquid. If electrical equipment, such as lighting, is necessary in these spaces, it must be explosion-proof or intrinsically safe.

(d) Explosion-proof and intrinsically safe equipment must meet the requirements of 46 CFR part 111, subpart 111.105.

(e) Metallic enclosures and frames of electrical equipment must be grounded.

(f) Each vessel with a nonmetallic hull must have a continuous, non-current carrying grounding conductor which connects together the enclosures and frames of electrical equipment and which connects metallic items such as engines, fuel tanks, and equipment enclosures to a common ground point.

(g) The equipment grounding conductor must be sized in accordance with section 250-95 of NFPA Standard 70.

§ 28.355 Main source of electrical power.

(a) *Applicability.* Each vessel that relies on electricity to power any of the

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following essential loads must have at least two electrical generators to supply these loads:

- (1) The propulsion system and its necessary auxiliaries and controls;
 - (2) Interior lighting;
 - (3) Steering systems;
 - (4) Communication systems;
 - (5) Navigation equipment and navigation lights;
 - (6) Fire protection or detection equipment;
 - (7) Bilge pumps; or
 - (8) General alarm system.
- (b) Each generator must be attached to an independent prime mover.

§ 28.360 Electrical distribution systems.

(a) Each electrical distribution system which has a neutral bus or conductor must have the neutral bus or conductor grounded.

(b) A grounded electrical distribution system must have only one connection to ground. This ground connection must be at the switchboard or, on a nonmetallic vessel, at the common ground point.

§ 28.365 Overcurrent protection and switched circuits.

(a) Each power source must be protected against overcurrent. Overcurrent devices for generators must be set at a value not exceeding 115 percent of the generator full load rating.

(b) Except for a steering circuit, each circuit must be protected against both overload and short circuit. Each overcurrent device in a steering system power and control circuit must provide short circuit protection only.

(c) Each ungrounded current carrying conductor must be protected in accordance with its current carrying capacity by a circuit breaker or fuse at the connection to the switchboard or distribution panel bus.

(d) Each circuit breaker and each switch must simultaneously open all ungrounded conductors.

(e) The grounded conductor of a circuit must not be disconnected by a switch or an overcurrent device unless all ungrounded conductors of the circuit are simultaneously disconnected.

(f) Navigation light circuits must be separate, switched circuits having

fused disconnect switches or circuit breakers so that only the appropriate navigation lights can be switched on.

(g) A separate circuit with overcurrent protection at the main distribution panel or switchboard must be provided for each radio installation.

§ 28.370 Wiring methods and materials.

(a) All cable and wire must have insulated, stranded copper conductors of the appropriate size and voltage rating for the circuit.

(b) Each conductor must be No. 22 AWG or larger. Conductors in power and lighting circuits must be No. 14 AWG or larger. Conductors must be sized so that the voltage drop at the load terminals is not more than 10 percent.

(c) Cable and wiring not serving equipment in a high risk fire area such as a galley, laundry, or machinery space must be routed as far as practicable from these spaces. As far as practicable, cables serving duplicated essential equipment must be separated so that a casualty that affects one cable does not affect the other.

(d) Cable and wire for power and lighting circuits must:

(1) For circuits of less than 50 volts, meet 33 CFR 183.425 and 183.430; and

(2) For circuits of 50 volts or greater:
(i) Meet sections 310-13 and 310-15 of NFPA 70, except that asbestos insulated cable and dry location cable must not be used;

(ii) Be listed by Underwriters Laboratories Inc. as UL Boat or UL Marine Shipboard cable; or

(iii) Meet 46 CFR part 111, subpart 111.60.

(e) All metallic cable armor must be electrically continuous and grounded to the metal hull or the common ground point at each end of the cable run, except that final sub-circuits (those supplying loads) may be grounded at the supply end only.

(f) A wiring termination and connection must be made in a fire retardant enclosure such as a junction box, fixture enclosure, or panel enclosure. A fire retardant plastic enclosure is acceptable.