

and switchboards of at least 610 millimeters (24 inches) in front of the switchboard, and at least 455 millimeters (18 inches) behind the switchboard. Rear access is prohibited when the working space behind the switchboard is less than 455 millimeters (18 inches).

(f) Nonconducting mats or grating must be provided on the deck in front of each switchboard and, if accessible from the rear, on the deck in the rear of the switchboard.

(g) All uninsulated current carrying parts must be mounted on noncombustible, nonabsorbent, high dielectric insulating material.

(h) Equipment mounted on a hinged door of an enclosure must be constructed or shielded so that a person will not accidentally contact energized parts of the door mounted equipment when the door is open and the circuit energized.

(i) In the design of a control, interlock, or indicator circuit, the disconnect device and its connections, including each terminal block for terminating the vessel's wiring, must not have any electrically unshielded or uninsulated surfaces.

(j) Switchboards and distribution panels must be sized in accordance with §111.30-19(a) in subchapter J of this chapter.

[CGD 85-080, 61 FR 997, Jan. 10, 1996, as amended by CGD 97-057, 62 FR 51050, Sept. 30, 1997]

§ 183.340 Cable and wiring requirements.

(a) If individual wires, rather than cable, are used in systems greater than 50 volts, the wire must be in conduit.

(b) All cable and wire must:

(1) Have stranded copper conductors with sufficient current carrying capacity for the circuit in which they are used;

(2) Be installed in a manner to avoid or reduce interference with radio reception and compass indication;

(3) Be protected from the weather;

(4) Be installed with metal supports spaced not more than 610 millimeters (24 inches) apart, and in such a manner as to avoid chafing and other damage. The use of plastic tie wraps must be limited to bundling or retention of multiple cable installations, and not

used as a means of support, except that on vessels of not more than 19.8 meters (65 feet) in length, installations in accordance with paragraph 14.h of ABYC E-8, and paragraph 15.h of ABYC E-9, are acceptable as meeting the requirements of this section;

(5) Not be installed with sharp bends;

(6) Be protected by metal coverings or other suitable means if in areas subject to mechanical abuse. Horizontal pipes used for protection shall have 6 millimeter (.25 inch) holes for drainage every 1,520 millimeters (5 feet);

(7) Be suitable for low temperature and high humidity if installed in refrigerated compartments;

(8) Not be located in a tank unless the cable provides power to equipment in the tank; and

(9) Have sheathing or wire insulation compatible with the fluid in a tank when installed as allowed by paragraph (b)(8) of this section.

(c) Conductors in power and lighting circuits must be No. 14 American Wire Gauge (AWG) or larger. Conductors in control and indicator circuits must be No. 22 AWG or larger.

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

(1) Meet Section 310-13 of the NEC (NFPA 70), except that asbestos insulated cable and dry location cables cannot be used;

(2) Be listed by Underwriters Laboratories (UL), as UL Boat or UL Marine cable; or

(3) Meet §111.60-1 in subchapter J of this chapter for cable, and §111.60-11 in subchapter J of this chapter for wire.

(e) Cable or wire serving vital systems listed in §182.710 of this chapter or emergency loads must be routed as far as practicable from high risk fire areas, such as galleys, laundries, and machinery spaces.

(f) Cable or wire serving duplicated equipment must be separated so that a casualty that affects one cable does not affect the other.

(g) Each connection to a conductor or terminal part of a conductor must be made within an enclosure and have either:

(1) A pressure type connector on each conductor;

(2) A solder lug on each conductor;

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(3) A splice made with a pressure type connector to a flexible lead or conductor; or

(4) A splice that is soldered, brazed, or welded to a flexible lead or conductor.

(h) A connector or lug of the set screw type must not be used with a stranded conductor smaller than No. 14 AWG except if there is a nonrotating follower that travels with the set screw and makes pressure contact with the conductor.

(i) Each pressure type wire connector and lug must meet UL 486A, "Electric Wire Connectors and Soldering Lugs for Use With Copper Conductors," or other standard specified by the Commandant. The use of twist-on type wire nuts is permitted under the following conditions:

(1) The connections must be made within an enclosure and the insulated cap of the connector must be secured to prevent loosening due to vibration; and

(2) Twist-on type connectors may not be used for making joints in cables, facilitating a conductor splice, or extending the length of a circuit.

(j) Each terminal block must have 6-32 terminal screws or larger.

(k) Wire connectors utilized in conjunction with screw type terminal blocks must be of the captive type such as the ring or the flanged spade type.

(l) A cable must not be spliced in a hazardous location.

(m) A cable may be spliced in a location, other than a hazardous location, under the following conditions:

(1) A cable installed in a subassembly may be spliced to a cable installed in another subassembly;

(2) For a vessel receiving alterations, a cable may be spliced to extend a circuit;

(3) A cable having a large size or exceptional length may be spliced to facilitate its installation; and

(4) A cable may be spliced to replace a damaged section of the cable if, before replacing the damaged section, the insulation resistance of the remainder of the cable is measured, and it is determined that the condition of the insulation is unimpaired.

(n) All material in a cable splice must be chemically compatible with all other material in the splice and with the materials in the cable.

(o) Ampacities of wires must meet Section 310-15 of the NEC (NFPA 70), or other standard specified by the Commandant. Ampacities of cable must meet table A6 of Institute of Electrical and Electronic Engineers (IEEE) Standard 45, "Recommended Practice for Electrical Installations on Shipboard," or other standard specified by the Commandant. Ampacities for Navy cable must meet NAVSEA Design Data Sheet (DDS) 304-2 "Electrical Cable, Ratings and Characteristics" as appropriate.

(p) Conductors for direct current systems must be sized so that the voltage drop at the load terminals does not exceed 10 percent. Table 183.340(p) indicates the size of conductor required for corresponding lengths and steady state (stable) values to obtain not more than this voltage drop at the load terminals of a two conductor circuit.

TABLE 183.340(p)—CONDUCTOR SIZES FOR AMPERES—LENGTHS

Total current on circuit, amperes	Length of conductor in meters (feet) from source of current to most distant fixture										
	3.1(10)	4.5(15)	6.1(20)	7.6(25)	9.2(30)	10.7(35)	12.2(40)	13.7(45)	15.2(50)	16.8(55)	18.3(60)
	12-volts, 2 wire—10 percent drop wire sizes (A.W.G.)										
5	14	14	14	14	14	14	14	14	12	12	12
10	14	14	14	12	12	12	10	10	10	10	8
15	14	14	12	10	10	10	8	8	8	8	8
20	12	12	10	10	8	8	8	8	6	6	6
25	10	10	10	8	8	8	6	6	6	6	4

Other values can be computed by means of the following formula:

$$cm = \frac{K \times I \times L (\times 2 \text{ for two-wire circuit})}{E}$$

Where:

cm=Circular-mil area of conductor

K=3.28 ohms/mil-meter (metric)

=10.75 ohm/mil-foot (english)

(a constant representing the resistance of copper).

I=Load current, in amperes.

L=length of conductor from center of distribution, in meters (feet).

E=Voltage drop at load, in volts.

(q) If used, each armored cable metallic covering must:

(1) Be electrically continuous; and

(2) Be grounded at each end of the run to:

(i) The metallic hull; or

(ii) The common ground plate on nonmetallic vessels; and

(3) Have final sub-circuits grounded at the supply end only.

(r) A portable or temporary electric cord or cable must be constructed and used in compliance with the requirements of §111.60-13 in subchapter J of this chapter for a flexible electric cord or cable.

[CGD 85-080, 61 FR 997, Jan. 10, 1996; 61 FR 20557, May 7, 1996, as amended by CGD 97-057, 62 FR 51050, Sept. 30, 1997; CGD 85-080, 62 FR 51358, Sept. 30, 1997]

§ 183.350 Batteries—general.

(a) Where provisions are made for charging batteries, there must be natural or induced ventilation sufficient to dissipate the gases generated.

(b) Each battery must be located as high above the bilge as practicable, secured to protect against shifting with the roll and pitch of the vessel, and free from exposure to water splash or spray.

(c) Batteries must be accessible for maintenance and removal.

(d) Connections must be made to battery terminals with permanent type connectors. Spring clips or other temporary type clamps are prohibited.

(e) Batteries must be mounted in trays lined with, or constructed of, a material that is resistant to damage by the electrolyte.

(f) Battery chargers must have an ammeter connected in the charging circuit.

(g) If the batteries are not adjacent to a distribution panel or switchboard that distributes power to the lighting, motor, and appliance circuits, the bat-

tery lead must have a fuse in series as close as practicable to the battery.

(h) Batteries used for engine starting are to be located as close as possible to the engine or engines served.

[CGD 85-080, 61 FR 997, Jan. 10, 1996; 61 FR 20557, May 7, 1996]

§ 183.352 Battery categories.

This section applies to batteries installed to meet the requirements of §183.310 for secondary sources of power to vital loads, or sources of power to final emergency loads.

(a) *Large.* A large battery installation is one connected to a battery charger having an output of more than 2 kilowatts (kw), computed from the highest possible charging current and the rated voltage of the battery installation.

(b) *Small.* A small battery installation is one connected to a battery charger having an output of 2 kw or less, computed as above.

[CGD 85-080, 61 FR 997, Jan. 10, 1996, as amended by CGD 97-057, 62 FR 51050, Sept. 30, 1997]

§ 183.354 Battery installations.

(a) *Large batteries.* Each large battery installation must be located in a locker, room or enclosed box solely dedicated to the storage of batteries. Ventilation must be provided in accordance with §111.15-10 in subchapter J of this chapter. Electrical equipment located within the battery enclosure must be approved by an independent laboratory for Class I, Division 1, Group B hazardous locations and meet §111.105 in subchapter J of this chapter.

(b) *Small batteries.* Each small battery installation must be located in a well ventilated space and protected from falling objects. A small battery installation must not be in a closet, storeroom or similar space.

§ 183.360 Semiconductor rectifier systems.

(a) Each semiconductor rectifier system must have an adequate heat removal system that prevents overheating.

(b) Where a semiconductor rectifier system is used in a propulsion system or in other vital systems it must:

(1) Have a current limiting circuit;