

(d) If the installation of the electrical equipment does not ensure a positive ground to the metal hull or equivalent conducting body, the apparatus must be grounded to the hull with a grounding conductor.

**§ 111.05-7 Armored and metallic-sheathed cable.**

When installed, the metallic armor or sheath must meet the installation requirements of IEC 92-3 or section 20 of IEEE Std 45.

[CGD 94-108, 61 FR 28276, June 4, 1996]

**§ 111.05-9 Masts.**

Each nonmetallic mast and topmast must have a lightning ground conductor in accordance with section 10 of IEC 92-401.

[CGD 94-108, 62 FR 23907, May 1, 1997]

SYSTEM GROUNDING

**§ 111.05-11 Hull return.**

(a) A vessel's hull must not carry current as a conductor except for the following systems:

(1) Impressed current cathodic protection systems.

(2) Limited and locally grounded systems, such as a battery system for engine starting that has a one-wire system and the ground lead connected to the engine.

(3) Insulation level monitoring devices if the circulation current does not exceed 30 milliamperes under the most unfavorable conditions.

(4) Welding systems with hull return except vessels subject to 46 CFR Subchapter D.

**§ 111.05-13 Grounding connection.**

Each grounded system must have only one point of connection to ground regardless of the number of power sources operating in parallel in the system.

**§ 111.05-15 Neutral grounding.**

(a) Each propulsion, power, lighting, or distribution system having a neutral bus or conductor must have the neutral grounded.

(b) The neutral of a dual-voltage system must be solidly grounded at the generator switchboard.

**§ 111.05-17 Generation and distribution system grounding.**

The neutral of each grounded generation and distribution system must:

(a) Be grounded at the generator switchboard, except the neutral of an emergency power generation system must be grounded with:

(1) No direct ground connection at the emergency switchboard;

(2) The neutral bus permanently connected to the neutral bus on the main switchboard; and

(3) No switch, circuit breaker, or fuse in the neutral conductor of the bus-tie feeder connecting the emergency switchboard to the main switchboard; and

(b) Have the ground connection accessible for checking the insulation resistance of the generator to ground before the generator is connected to the bus.

**§ 111.05-19 Tank vessels; grounded distribution systems.**

(a) If the voltage of a distribution system is less than 1,000 volts, line to line, a tank vessel must not have a grounded distribution system.

(b) If the voltage of a distribution system on a tank vessel is 1,000 volts or greater, line to line, and the distribution system is grounded (including high-impedance grounding), any resulting current must not flow through a hazardous (classified) location.

[CGD 94-108, 61 FR 28276, June 4, 1996, as amended at 62 FR 23907, May 1, 1997]

GROUND DETECTION

**§ 111.05-21 Ground detection.**

There must be ground detection for each:

(a) Electric propulsion system;

(b) Ship's service power system;

(c) Lighting system; and

(d) Power or lighting distribution system that is isolated from the ship's service power and lighting system by transformers, motor generator sets, or other devices.

**§ 111.05-23 Location of ground indicators.**

Ground indicators must:

(a) Be at the vessel's ship's service generator distribution switchboard for

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the normal power, normal lighting, and emergency lighting systems;

(b) Be at the propulsion switchboard for propulsion systems; and

(c) Be readily accessible.

(d) Be provided (at the distribution switchboard or at another location, such as a centralized monitoring position for the circuit affected) for each feeder circuit that is isolated from the main source by a transformer or other device.

NOTE TO PARAGRAPH (d): An alarm contact or indicating device returned to the main switchboard via a control cable, that allows the detecting equipment to remain near the transformer or other isolating device for local troubleshooting, is allowed.

[CGD 74-125A, 47 FR 15236, Apr. 8, 1982, as amended by CGD 94-108, 61 FR 28276, June 4, 1996; 62 FR 23907, May 1, 1997]

**§ 111.05-25 Ungrounded systems.**

Each ungrounded system must be provided with a suitably sensitive ground detection system located at the respective switchboard which provides continuous indication of circuit status to ground with a provision to momentarily remove the indicating device from the reference ground.

[CGD 94-108, 61 FR 28276, June 4, 1996]

**§ 111.05-27 Grounded neutral alternating current systems.**

Grounded neutral and high-impedance grounded neutral alternating current systems must have a suitably sensitive ground detection system which indicates current in the ground connection, is able to withstand the maximum available fault current without damage, and provides continuous indication of circuit status to ground. A provision must be included to compare indications under fault conditions with those under normal conditions.

[CGD 94-108, 62 FR 23907, May 1, 1997]

**§ 111.05-29 Dual voltage direct current systems.**

Each dual voltage direct current system must have a suitably sensitive ground detection system which indicates current in the ground connection, has a range of at least 150 percent of

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neutral current rating and indicates the polarity of the fault.

[CGD 94-108, 61 FR 28276, June 4, 1996]

**GROUNDING CONDUCTORS**

**§ 111.05-31 Grounding conductors for systems.**

(a) A conductor for grounding a direct-current system must be the larger of:

(1) The largest conductor supplying the system; or

(2) No. 8 AWG (8.4mm<sup>2</sup>).

(b) A conductor for grounding the neutral of an alternating-current system must meet Table 111.05-31(b).

TABLE 111.05-31(b)—NEUTRAL GROUNDING CONDUCTOR FOR ALTERNATING-CURRENT SYSTEM

Size of the largest generator cable or equivalent for parallel generators—AWG-MCM (mm <sup>2</sup> )		Size of the system grounding conductor—AWG(mm <sup>2</sup> )
Greater than	Less than or equal to	
.....	2 (33.6) .....	8 (8.4)
2 (33.6) .....	0 (53.5) .....	6 (13.3)
0 (53.5) .....	3/0 (85.0) .....	4 (21.2)
3/0 (85.0) .....	350 MCM (177) .....	2 (33.6)
350 MCM (177) .....	600 MCM (304) .....	0 (53.5)
600 MCM (304) .....	1100 MCM (557) .....	2/0 (67.5)
1100 MCM (557) .....	.....	3/0 (85.0)

**§ 111.05-33 Equipment safety grounding (bonding) conductors.**

(a) Each equipment grounding conductor must be sized in accordance with article 250-95 of the National Electrical Code (the NEC) (NFPA 70).

(b) Each equipment grounding conductor (other than a system grounding conductor) of a cable must be permanently identified as a grounding conductor in accordance with the requirements of article 310-12(b) of the NEC.

[CGD 94-108, 61 FR 28276, June 4, 1996, as amended at 62 FR 23907, May 1, 1997]

**§ 111.05-37 Overcurrent devices.**

(a) A permanently grounded conductor must not have an overcurrent device unless the overcurrent device simultaneously opens each ungrounded conductor of the circuit.

(b) The neutral conductor of the emergency-main switchboard bus-tie must not have a switch or circuit breaker.

[CGD 94-108, 61 FR 28276, June 4, 1996]