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CHAPTER I—COAST GUARD, DEPARTMENT OF TRANSPORTATION (Continued)

(This Book contains Parts 110 to 139)

SUBCHAPTER J—ELECTRICAL ENGINEERING

SUBCHAPTER J—ELECTRICAL ENGINEERING

PART 110—GENERAL PROVISIONS

Subpart 110.01—Basis and Purpose of Regulations

Subpart 110.05—Application

Subpart 110.10—Reference Specifications, Standards, and Codes

Subpart 110.15—Definition of Terms Used in This Subchapter

Subpart 110.20—Equivalents

Subpart 110.25—Special Provisions

AUTHORITY: R.S. 4405, as amended, 4462, as amended, sec. 6(b)(1), 80 Stat. 938; 46 U.S.C. 375, 416, 49 U.S.C. 1655(b); 49 CFR 1.46(b) (35 FR 4959). Interpret or apply R.S. 4399, as amended, 4400, as amended, 4417, as amended, 4417a, as amended, 4418, as amended, 4421, as amended, 4426, as amended, 4427, as amended, 4433, as amended, 4453, as amended, 4488, as amended, 4491, as amended, sec. 14, 29 Stat. 690, as amended, sec. 10, 35 Stat. 428, as amended, 41 Stat. 305, as amended, sec. 5, 49 Stat. 1384, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 17, 54 Stat. 166, as amended, sec. 3, 54 Stat. 347, as amended, sec. 3, 70 Stat. 152, sec. 3, 68 Stat. 675; 46 U.S.C. 361, 362, 391, 391a, 392, 399, 404, 405, 411, 435, 481, 489, 366, 395, 363, 369, 367, 526p, 1333, 390b, 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 FR 9671, 3 CFR, 1965 Supp. unless otherwise noted.

SOURCE: CGFR 65-50, 30 FR 17036, Dec. 30, 1965, unless otherwise noted.

Subpart 110.01—Basis and Purpose of Regulations

§ 110.01-1 Purpose of regulations.

(a) The purpose of the regulations in this subchapter is to set forth uniform minimum requirements for electrical

apparatus and equipment when installed on various types of vessels in accordance with the intent of Title 52 of the Revised Statutes and acts amendatory thereof or supplemental thereto, as well as to implement various international conventions for safety of life at sea and other treaties which contain requirements regarding electrical apparatus or equipment. The regulations are necessary to implement the various provisions of law promulgated for the purpose of improving or promoting safety of life at sea.

§ 110.01-5 Assignment of functions.

(a) The Department of Transportation Act (Pub. L. 89-670, 80 Stat. 931-950, 49 U.S.C. 1651-1659), transferred to and vested in the Secretary of Transportation "* * * all functions, powers, and duties, relating to the Coast Guard, of the Secretary of the Treasury and of other officers and offices of the Department of the Treasury" (subsection 6(b)(1), 49 U.S.C. 1655(b)). This transfer is subject to certain conditions, modifications, and exceptions as set forth in such act. By a rule in 49 CFR 1.4(a) the Secretary of Transportation delegated to the Commandant, U.S. Coast Guard, authority to exercise certain functions, powers, and duties as set forth in subsections 6(a)(4), 6(b)(1), and 6(g) of such act (49 U.S.C. 1655), subject to conditions, exceptions and modifications as described in 49 CFR Part 1. By a rule in 49 CFR 1.9 the Secretary of Transportation continued in effect actions taken prior to April 1, 1967.

(b) The Commandant, U.S. Coast Guard, in a notice dated March 31, 1967, and effective April 1, 1967 (32 FR 5611), approved the continuation of orders, rules, regulations, policies, procedures, privileges, waivers, and other actions, which had been made, allowed, granted, or issued prior to April 1, 1967, and provided that they shall continue in effect according to their terms until modified, terminated, repealed, superseded, or set aside by appropriate authority.

[CGFR 68-32, 33 FR 5720, Apr. 12, 1968]

§ 110.01-10 Authority for regulations.

(a) *General.* (1) The authority to prescribe regulations generally is set forth in R.S. 4405 and 4462, as amended (46 U.S.C. 375 and 416), as well as in other provisions of Title 52 of the Revised Statutes and acts amendatory thereof or supplemental thereto. Under the provisions of R.S. 4403, as amended (46 USC 372), the Commandant, United States Coast Guard, superintends the administration of the vessel inspection laws and is required to produce a correct and uniform administration of the inspection laws, rules, and regulations.

(b) *Tank vessels.* The regulations regarding electrical apparatus and equipment which may be used on tank vessels interpret or apply R.S. 4417a and sec. 3(c) of Pub. L. 569, 83d Cong., 68 Stat. 676 (46 U.S.C. 391a, 50 U.S.C. 198), as well as Executive Order 11239, 30 FR 9671, 3 CFR, 1965 Supp.

(c) *Passenger vessels.* (1) The regulations regarding electrical apparatus and equipment which may be used on passenger vessels interpret or apply R.S. 4399, 4400, 4417, 4418, 4421, 4426, 4433, 4453, and 4488, as amended, section 14, 29 Stat. 690, section 10, 35 Stat. 428, 41 Stat. 305, 49 Stat. 1384, 1544, section 3, 54 Stat. 346, and sec. 3(c), Pub. L. 569, 83d Cong., 68 Stat. 676 (46 U.S.C. 361, 362, 391, 392, 399, 404, 411, 435, 481, 366, 395, 363, 369, 367, 1333, 50 U.S.C. 198), as well as Executive Order 11239, 30 FR 9671, 3 CFR, 1965 Supp.

(d) *Cargo and miscellaneous vessels.* (1) The regulations regarding electrical apparatus and equipment which may be installed on cargo and miscellaneous vessels interpret or apply R.S. 4399, 4400, 4417, 4418, 4421, 4426, 4427, 4433, 4453, and 4488, as amended, section 14, 29 Stat. 690, section 10, 35 Stat. 428, 41 Stat. 305, 49 Stat. 1544, and sec. 3(c), Pub. L. 569, 83d Cong., 68 Stat. 676 (46 U.S.C. 361, 362, 391, 392, 399, 404, 405, 411, 435, 481, 366, 395, 363, 367, 50 U.S.C. 198), as well as Executive Order 11239, 30 FR 9671, 3 CFR, 1965 Supp.

(e) *Uninspected vessels.* (1) The regulations regarding electrical apparatus and equipment which may be installed on uninspected vessels interpret or apply section 17, 54 Stat. 166, as amended (46 U.S.C. 526p).

(f) *Exemptions.* (1) Public vessels owned by the United States, other

than those engaged in commercial service, are to be exempt from the regulations in this subchapter. Certain other vessels may be exempt from the requirements of the regulations in this subchapter when so provided by law.

(g) *Mobile offshore drilling units.* The citation regarding authority to prescribe requirements for mobile offshore drilling units is in Subchapter I-A of this chapter.

(Sec. 2, 87 Stat. 418 (46 U.S.C. 86); sec. 3, 82 Stat. 341, as amended (46 U.S.C. 367); R.S. 4405, as amended (46 U.S.C. 375); sec. 10, 35 Stat. 428 (46 U.S.C. 395); R.S. 4423, as amended (46 U.S.C. 400); R.S. 4429, as amended (46 U.S.C. 407); R.S. 4430, as amended (46 U.S.C. 408); 88 Stat. 423 (46 U.S.C. 411); R.S. 4434, as amended (46 U.S.C. 412); R.S. 4462, as amended (46 U.S.C. 416); sec. 1, 73 Stat. 475 (46 U.S.C. 481); sec. 4, 67 Stat. 462 (43 U.S.C. 1333(d)); sec. 6(b)(1), 80 Stat. 937 (49 U.S.C. 1655(b)(1)); 49 CFR 1.46(b) and (n)(6))

[CGFR 65-50, 30 FR 17036, Dec. 30, 1965, as amended by CGD 73-251, 43 FR 56837, Dec. 4, 1978]

Subpart 110.05—Application

§ 110.05-1 Vessels subject to the requirements of this subchapter.

(a) This subchapter shall be applicable to all vessels as indicated in columns 3, 4, and 5 of Table 110.05-1(a) and shall apply to all such United States flag vessels, and to all foreign vessels which carry passengers from any port in the United States to the extent prescribed by law, except as follows:

(1) Any vessel of a foreign nation signatory to the International Convention for Safety of Life at Sea, 1960, and which has on board a current, valid safety certificate.

TABLE 110.05-1(a)

Method of propulsion	Size of other limitations [1]	Classes of vessels (including motorboats) examined or inspected under various Coast Guard regulations					
		Vessels inspected and certificated under Subchapter D—Tank Vessels [2]	Vessels inspected and certificated under either Subchapter H—Passenger Vessels [2345] or Subchapter T—Small Passenger Vessels [234]	Vessels inspected and certificated under Subchapter I—Cargo and Miscellaneous Vessels [25]	Vessels subject to provisions of Subchapter C—Uninspected Vessels [23678]	Vessels subject to provisions of Subchapter U—Oceanographic Vessels [25679]	Vessels subject to the provisions of Subchapter O—Certain Bulk Dangerous Cargoes [10]
Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8
Steam	Vessels not over 65 feet in length.	All vessels carrying combustible or flammable liquid cargo in bulk.	All vessels carrying more than 6 passengers. [7]	All tugboats and towboats.	All vessels except those covered by columns 3, 4, 5, and 7.	None	All vessels carrying in bulk the cargoes listed in table I of pt. 153 and table 4 of pt. 154. [13]
	Vessels over 65 feet in length.	All vessels carrying combustible or flammable liquid cargo in bulk. [5]	1. All vessels carrying more than 12 passengers on an international voyage, except yachts. 2. All vessels of not over 15 gross tons which carry more than 6 passengers. [7] 3. All other vessels carrying passengers [7] except: a. Yachts. b. Documented cargo or tank vessels issued a permit to carry not more than 16 persons in addition to the crew.	All vessels except those covered by columns 3 and 4.	None	All vessels engaged in oceanographic research.	Do.

TABLE 110.05–1(a)

Method of propulsion	Size of other limitations [1]	Classes of vessels (including motorboats) examined or inspected under various Coast Guard regulations: Vessels inspected and certificated under Subchapter D—Tank Vessels [2]	Vessels inspected and certificated under either Subchapter H—Passenger Vessels [2345] or Subchapter T—Small Passenger Vessels [234]	Vessels inspected and certificated under Subchapter I—Cargo and Miscellaneous Vessels [25]	Vessels subject to provisions of Subchapter C—Uninspected Vessels [23678]	Vessels subject to provisions of Subchapter U—Oceanographic Vessels [25679]	Vessels subject to the provisions of Subchapter O—Certain Bulk Dangerous Cargoes [10]
Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8
			c. Towing and fishing vessels, in other than ocean and coastwise service, may carry persons on the legitimate business of the vessel, in addition to crew, but not to exceed one for each net ton of the vessel.				
Motor	Vessels not over 15 gross tons.	All vessels carrying combustible or flammable liquid cargo in bulk.	All vessels carrying more than 6 passengers. [7]	Those vessels carrying dangerous cargoes when required by 46 CFR Part 98 or 146.	All vessels except those covered by columns 3, 4, 5, and 7.	None	Do.
	Vessels over 15 gross tons except seagoing motor vessels of 300 gross tons and over.	All vessels carrying combustible or flammable liquid cargo in bulk. [5]	1. All vessels carrying more than 12 passengers on an international voyage, except yachts.	All vessels carrying freight for hire except those covered by columns 3 and 4.	All vessels except those covered by columns 3, 4, 5, and 7.	None	Do.

			2. All vessels not over 65 feet in length which carry more than 6 passengers.[7] 3. All other vessels of over 65 feet in length carrying passengers for hire except documented cargo or tank vessels issued a permit to carry not more than 16 persons in addition to the crew.				
Motor	Seagoing motor vessels of 300 gross tons and over.	All vessels carrying combustible or flammable liquid cargo in bulk.[5]	1. All vessels carrying more than 12 passengers on an international voyage, except yachts. 2. All other vessels carrying passengers,[7] except: a. Yachts. b. Documented cargo or tank vessels issued a permit to carry not more than 16 persons in addition to the crew.	All vessels except those covered by columns 3 and 4, and those engaged in the fishing, oystering, clamming, crabbing, or any other branch of the fishery, kelp, or sponge industry.	All vessels except those covered by columns 3, 4, 5, and 7.	All vessels engaged in oceanographic research.	Do.
Sail	Vessels not over 700 gross tons.	All vessels carrying combustible or flammable liquid cargo in bulk.	All vessels carrying more than 6 passengers.[7]	Those vessels carrying dangerous cargoes when required by 46 CFR Part 98 or 146.	None	None	Do.
	Vessels over 700 gross tons.	All vessels carrying combustible or flammable liquid cargo in bulk.	All vessels carrying passengers for hire.	Those vessels carrying dangerous cargoes when required by 46 CFR Part 98 or 146.	None	None	Do.
Non-self-propelled.	Vessels less than 100 gross tons.	All vessels carrying combustible or liquid cargo in bulk.	All vessels carrying more than 6 passengers.[7]	Those vessels carrying dangerous cargoes when required by 46 CFR Part 98 or 146.	All barges carrying passengers except those covered by column 4.	None	All tank barges carrying in bulk the cargoes listed in table 151.05 of this chapter.[11,12]

TABLE 110.05-1(a)

Method of propulsion	Size of other limitations [1]	Classes of vessels (including motorboats) examined or inspected under various Coast Guard regulations: Vessels inspected and certificated under Subchapter D—Tank Vessels [2]	Vessels inspected and certificated under either Subchapter H—Passenger Vessels [2345] or Subchapter T—Small Passenger Vessels [234]	Vessels inspected and certificated under Subchapter I—Cargo and Miscellaneous Vessels [25]	Vessels subject to provisions of Subchapter C—Uninspected Vessels [23678]	Vessels subject to provisions of Subchapter U—Oceanographic Vessels [25679]	Vessels subject to the provisions of Subchapter O—Certain Bulk Dangerous Cargoes [10]
Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8
	Vessels 100 gross tons or over.	All vessels carrying combustible or flammable liquid cargo in bulk.	All vessels carrying passengers for hire.	All seagoing barges except those covered by columns 3 and 4; and those inland barges carrying dangerous cargoes when required by 46 CFR Part 98 or 146.	All barges carrying passangers except those covered by columns 4 and 7.	All seagoing barges engaged in oceanographic research.	Do.

[1]Where length is used in this table it means the length measured from end to end over the deck, excluding sheer. This expression means a straight line measurement of the overall length from the foremost part of the vessel to the aftermost part of the vessel, measured parallel to the centerline.

[2]Subchapters E (Load Lines), F (Marine Engineering), J (Electrical Engineering), and N (Dangerous Cargoes) of this chapter may also be applicable under certain conditions. The provisions of 46 U.S.C. 170 and Subchapter N (Dangerous Cargoes) of this chapter apply whenever explosives or dangerous articles or substances are on board vessels (including motorboats), except when specifically exempted by law.

[3]Public nautical schoolships, other than vessels of the Navy and Coast Guard, shall meet the requirements of Part 167 of Subchapter R (Nautical Schools) of this chapter. Civilian nautical schoolships, as defined by 46 U.S.C. 1331, shall meet the requirements of Subchapter H (Passenger Vessels) and Part 168 of Subchapter R (Nautical Schools) of this chapter.

[4]Subchapter H (Passenger Vessels) of this chapter covers only those vessels of 100 gross tons or more. Subchapter T (Small Passenger Vessels) of this chapter covers only those vessels of less than 100 gross tons.

[5]Vessels covered by Subchapter H (Passenger Vessels) or I (Cargo and Miscellaneous Vessels) of this chapter, where the principal purpose or use of the vessel is not for the carriage of liquid cargo, may be granted a permit to carry a limited amount of flammable or combustible liquid cargo in bulk. The portion of the vessel used for the carriage of the flammable or combustible liquid cargo shall meet the requirements of Subchapter D (Tank Vessels) in addition to the requirements of Subchapter H (Passenger Vessels) or I (Cargo and Miscellaneous Vessels) of this chapter.

[6]Any vessel on an international voyage is subject to the requirements of the International Convention for Safety of Life at Sea, 1960.

[7]The meaning of the term "passenger" is as defined in the Act of May 10, 1956 (Sec. 1, 70 Stat. 151; 46 U.S.C. 390). On oceanographic vessels scientific personnel on board shall not be deemed to be passengers nor seamen, but for calculations of lifesaving equipment, etc., shall be counted as persons.

[8]Boilers and machinery are subject to examination on vessels over 40 feet in length.

[9]Under 46 U.S.C. 441 an "oceanographic research vessel" is a vessel "* * * being employed exclusively in instruction in oceanography or limnology, or both, or exclusively in oceanographic research, * * *." Under 46 U.S.C. 443, "an oceanographic research vessel shall not be deemed to be engaged in trade or commerce." If or when an oceanographic vessel engages in trade or commerce, such vessel cannot operate under its certificate of inspection as an oceanographic vessel, but shall be inspected and certificated for the service in which engaged, and the scientific personnel aboard then become persons employed in the business of the vessel.

[10]Bulk dangerous cargoes are cargoes specified in table 151.01-10(b), in table I of Part 153, and in table 4 of Part 154 of this chapter.

[11]For manned tank barges see § 151.01-10(e) of this chapter.

[12]Except those cases excluded under 46 U.S.C. 170 or 391a.

(2) Any vessel of a foreign nation having inspection laws approximating those of the United States together with reciprocal inspection arrangements with the United States, and which has on board a current, valid certificate of inspection issued by its government under such arrangements.

(3) Any vessel operating exclusively on inland waters which are not navigable waters of the United States.

(4) Any vessel laid up and dismantled and out of commission.

(5) With the exception of vessels of the U.S. Maritime Administration, any vessel with the title vested in the United States and which is used for public purposes.

[CGFR 65-50, 30 FR 17036, Dec. 30, 1965, as amended by CGFR 67-83, 33 FR 1110, Jan. 27, 1968; CGFR 70-10, 35 FR 3712, Feb. 25, 1970; CGD 73-96, 42 FR 49025, Sept. 26, 1977]

§ 110.05–3 Amendments to the regulations.

(a) The regulations in this subchapter are not retroactive in effect unless specifically provided for in the regulation at the time it is amended or added.

(b) The regulations amended or added subsequent to November 19, 1952, are applicable to installations contracted for on or after the effective date of such regulations.

§ 110.05–5 Specific application noted in text.

At the beginning of the various parts, subparts, and sections, a more specific application is generally given for particular portions of the text involved. This application sets forth the types, sizes or services of vessels to which the text pertains, and in many cases limits the application of the text to vessels contracted for before or after a specific date. As used in this subchapter, the term "vessel contracted for" includes not only the contracting for the construction of a vessel, but also the contracting for a material alteration to a vessel, the contracting for the conversion of a vessel to a passenger vessel, and the changing of service or route of a vessel if such change increases or modifies the general requirements for the vessel or increases the hazards to which it might be subject.

§ 110.05–8 Electrical systems internal to pressure vessels for human occupancy (PHVO).

Electrical systems internal to a pressure vessel for human occupancy (PVHO) need not meet the requirements of this subchapter, but must meet the requirements of subpart B (Commercial Diving Operations) of part 197 of this chapter.

(46 U.S.C. 239; 46 U.S.C. 390b; 46 U.S.C. 391a; 33 U.S.C. 1509(b); 43 U.S.C. 1333(d)(1); 43 U.S.C. 1331 et seq., as amended by Sec. 203 and 208 of Pub. L. 95-372; 46 U.S.C. 395; 46 U.S.C. 375; 46 U.S.C. 391; 46 U.S.C. 392; 46 U.S.C. 416; 49 U.S.C. 1655(b); 49 CFR 1.46 (b) and (s))

[CGD 76-009, 43 FR 53683, Nov. 16, 1978]

Subpart 110.10—Reference Specifications, Standards, and Codes

§ 110.10–1 General.

The following specifications, standards, and codes, to the extent specified in the text, form a part of this subchapter:

(a) Rules for the Classification and Construction of Steel Vessels, of issue in effect on the date the vessel is contracted for, issued by American Bureau of Shipping, 45 Broad Street, New York, N.Y., 10004.

(b) Publications of issue in effect on the date the vessel is contracted for, issued by National Fire Protection Association, 60 Batterymarch Street, Boston, Mass., 02110, as listed in this paragraph.

(1) The National Electrical Code.

(2) Code for Use of Flammable Anesthetics (Safe Practice for Hospital Operating Rooms).

(c) Standards of issue in effect on the date the vessel is contracted for, issued by National Electrical Manufacturers Association, 155 East 44th Street, New York, N.Y., 10017, as listed in this paragraph.

(1) NEMA Standards Publication Molded Case Circuit Breakers.

(2) NEMA Standards for Large Air Circuit Breakers.

(3) NEMA Standards Publication Motors and Generators (MG1).

(d) Standards of issue in effect on the date the vessel is contracted for, issued by the Institute of Electrical and Electronic Engineers, Box A, Lenox Hill Station, New York, N.Y., 14481, as listed in this paragraph.

(1) IEEE Standard No. 45—Recommended Practice for Electrical Installations on Shipboard.

(2) American National Standards Institute, Inc. (formerly United States of America Standards Institute, Inc.; American Standard) Definition of Electrical Terms, ANSI C42.

(e) Standards issued by Underwriters' Laboratories, Inc., 207 East Ohio Street, Chicago, Ill., 60011, as listed in this paragraph, each of issue in effect on the date the vessel is contracted for:

(1) Standard for Snap Switches.

(2) Standard for Knife Switches.

(3) Standard for Fuses.

(4) Standard for Industrial Control Equipment.

(5) Standard for Branch-Circuit and Service Circuit Breakers.

(6) Standard for Panelboards.

(7) Standard for Edison-Base Lampholders.

(8) Standard for Marine Type Electric Lighting Fixtures.

(9) Standard for Attachment Plugs and Receptacles.

(10) Standard for Flexible Cord and Fixture Wire.

(11) Standard for Electric-Discharge-Lamp Accessory Equipment.

(12) Standard for Elevator Electric Contracts and Elevator Hoistway Door Interlocks.

(13) Standard for Portable Electric Lamps.

(14) Standard for Wire Connectors and Soldering Lugs.

(15) Standard for Outlet Boxes and Fittings.

(16) Standard for Enclosed Switches.

(17) Standard for Commercial Electric Cooking Appliances.

(18) Standards for Industrial Control Equipment for Use in Hazardous Locations, Subject 698.

(f) Specifications and Guides issued by the U.S. Navy Bureau of Ships, Washington, D.C. 20360, of issue in effect on the date the vessel is contracted for, as listed in this paragraph.

(1) MIL-C-915 Interim Specifications Cable, Cord and Wire, Electrical (shipboard use).

(2) MIL-C-2194 Military Specifications Cable, Power, Electrical, Reduced Diameter Type, Naval Shipboard.

(3) MIL-C-23206 Military Specifications Cable, Special Purpose, Electrical (Nuclear Plant).

(4) NavShips 250-660-23, Cable Comparison Guide.

(g) Standards of issue in effect on the date the vessel is contracted for, issued by USA Standards Institute, 70 East 45th Street, New York, N.Y. 10017.

(1) Safety Code for Elevators, Dumbwaiters, and Escalators.

(h) Recommended practices in effect on the date the vessel is contracted for, issued by Instrument Society of America, 530 William Penn Place, Pittsburgh, Pa. 15219:

(1) Recommended Practice, Intrinsically Safe and Non-Incendive Electrical Instruments (RP 12.2).

[CGFR 65-50, 30 FR 17036, Dec. 30, 1965, as amended by CGFR 66-33, 31 FR 15288, Dec. 6, 1966; CGFR 66-71, 31 FR 16781, Dec. 31, 1966; CGFR 70-143, 35 FR 19907, Dec. 30, 1970; 36 FR 5606, Mar. 25, 1971]

§ 110.10-5 Copies of specifications, standards and codes.

(a) Copies of the specifications, standards, and codes referred to in this subpart may be obtained from the issuing authority except:

(1) Military specifications may be obtained from the Commanding Officer, Naval Supply Depot, 5801 Tabor Avenue, Philadelphia, Pa. 19120.

(2) NavShips 250-660-23 may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

(b) Copies of the specifications, standards, and codes referred to in this subpart are available for reading purposes at Coast Guard Headquarters upon request.

Subpart 110.15—Definition of Terms Used in This Subchapter

§ 110.15-1 Approved.

This term means approved by the Commandant, United States Coast Guard, unless otherwise stated.

§ 110.15-5 Boat deck.

This term means the deck or decks on which lifeboats are stowed.

§ 110.15-10 Bulkhead deck.

This term means the uppermost deck up to which the transverse watertight bulkheads are carried.

§ 110.15-15 Cable terms.

(a) *Cable.* (1) A cable is either a stranded conductor with or without insulation and other coverings (single conductor cable), or a combination of conductors insulated from one another (multiple-conductor cable).

(b) *Cable designations.* (1) Abbreviations given in Columns 1 to 5, inclusive, of Table 110.15-15(b)(1) may be employed in connection with lighting and power, communication, and telephone cable. Thus, in the abbreviation DRL-4, "D"=double conductor, light and power (column 1), "R"=rubber insulated (75C) (column 2), "L"=lead and steel armored (columns 3 and 4), and "-4"=No. 14 American wire gage, 4,110 circular mils (column 5). In the abbreviation CTIA-12, "C"=communication (column 1), "T"=thermoplastic (column 2), "I"= moisture resistant jacket (column 3), "A"=aluminum armored (column 4), and "-12"=12 conductor (column 5).

(2) The trade designations given in Table 110.15-15(b)(2) may be used to designate the type of flexible cord and fixture wire.

§ 110.15-20 Coast Guard District Commander.

This term means an officer of the Coast Guard designated as such by the Commandant to command all Coast Guard activities within his district, which includes the inspection, enforcement, and administration of Title 52, Revised Statutes, and Acts amendatory thereof or supplemental thereto, and rules and regulations thereunder.

TABLE 110.15-15(b)(1)—LIGHTING AND POWER, COMMUNICATIONS, AND TELEPHONE CABLE SYMBOLS

Column 1	Column 2	Column 3	Column 4	Column 5
Symbol designating cable type	Symbol designating type of insulation	Symbol designating type of outer covering	Symbol designating type of armor	Symbol designating wire size for light and power cable or number of conductors for communication or number of pairs of conductors for telephone cable
S=Single conductor light and power. D=Double conductor light and power. T=Three conductor light and power. F=Four conductor light and power. M=Multiple conductor. C=Communications. TT=Telephone. TTC=Inter-cabin telephone. P=Portable. W=Switchboard. BW=Bell wire.	R=Rubber 75 C. B=Rubber 85 C. T=Thermoplastic. V=Varnished cloth. AV=Asbestos-varnished cloth. TA=Asbestos thermoplastic. M=Mineral. S=Silicone.	A=Braid and armor. L=Lead and armor. I=Moisture resistant jacket, Type T or N as designated, and armor. J=Moisture resistant jacket unarmored (for NEC portable cords and telephone cable only).	None=steel. A=aluminum. B=bronze.	Circular mil size in thousands, or number of conductors, or number of pairs of conductors.

TABLE 110.15-15(b)(2)—PORTABLE CORD AND FIXTURE WIRE SYMBOLS

Trade name of wire or cord	Designation
Asbestos-covered heat-resistant fixture wire.	AF
Silicone rubber insulated fixture wire	SF-2
Silicone rubber insulated fixture wire, flexible stranding.	SFF-2
Asbestos-covered heat-resistant cord.	AFC, AFPD
Rubber-jacketed heat-resistant cord.	AFS, AFSJ
Heat-and moisture-resistant cord	AVPD
Lamp cord	C
Cotton-covered heat-resistant fixture wire, stranded or flexible stranded.	CF
Cotton-covered heat-resistant cord	CFC, CFPD
Elevator cable	E, EO, ET
Rubber-covered fixture wire, flexible stranding.	FF-2
Heat-resistant rubber-covered fixture wire, flexible stranding.	FFH-2
Heater cord	HC, HPD
Jacketed heater cord	HS
Rubber-jacketed heater cord	HSJ
Braided heavy duty cord	K
Reinforced cord	P, P-2
Twisted portable cord	PD
Moisture-proof reinforced cord	PW, PW-2
Rubber-covered stranded fixture wire	RF-2
Heat-resistant rubber-covered stranded fixture wire.	RFH-2
Hard service cord	S
Hard service cord, oil-resistant	SO
Hard service cord, thermoplastic covered	ST
Junior hard service cord	SJ
Junior hard service cord, oil-resistant	SJO
Junior hard service cord, thermoplastic covered.	SJT
Thermoplastic-covered stranded fixture wire.	TF
Thermoplastic-covered fixture wire, flexible stranding.	TFF

[CGFR 65-50, 30 FR 17036, Dec. 30, 1965, as amended by CGFR 68-65, 33 FR 19987, Dec. 28, 1968]

§ 110.15-25 Coastwise.

Under this designation shall be included all vessels normally navigating the waters of any ocean or the Gulf of Mexico 20 nautical miles or less offshore.

§ 110.15-30 Commandant.

This term means the Commandant of the Coast Guard.

§ 110.15-35 Control equipment terms.

(a) *Electric controllers.* An electric controller is a device, or group of devices, which serves to govern, in some predetermined manner, the electric power delivered to the apparatus to which it is connected.

(b) *Basic functions.* The basic functions of a controller are the functions of those of its elements which govern the application of electric power to the connected apparatus.

(c) *Manual controller.* A manual controller is an electric controller having all of its basic functions performed by devices which are operated by hand.

(d) *Full magnetic controller.* A full magnetic controller is an electric controller having all of its basic functions performed by devices which are operated by electromagnets.

(e) *Contactor.* A contactor is a device for repeatedly establishing and interrupting an electric power circuit.

(f) *Starter.* A starter is an electric controller for accelerating a motor from rest to normal speed, and to stop the motor.

(g) *Automatic starter.* An automatic starter is a starter in which the influence directing its performance is automatic.

(h) *Autotransformer starter.* An autotransformer starter is a starter which includes an autotransformer to furnish reduced voltage for starting of an alternating current motor. It includes the necessary switching mechanism, and it is frequently called a compensator or autostarter.

(i) *Overload protection (overcurrent protection).* Overload protection is the effect of a device operative on excessive current, but not necessarily on short circuit, to cause and maintain the interruption of current flow to the device governed.

(j) *Overload relay.* An overload relay is an overcurrent relay which functions at a predetermined value of overcurrent to cause disconnection of the load from the power supply.

NOTE: An overload relay is intended to protect the load (for example, motor armature) or its controller, and does not necessarily protect itself.

(k) *Normally open and normally closed.* The terms "Normally Open" and "Normally Closed" when applied to a magnetically operated switching device, such as a contactor or relay, or to the contacts thereof, signify the position taken when the operating magnet is deenergized. These terms apply only to nonlatching types of devices.

(l) *Temperature compensated overload relay.* A temperature compensated overload relay is an overload relay which functions at any current in excess of a predetermined value essentially independent of ambient temperature.

§ 110.15-40 Corrosion-resistant finishes.

The following treatments listed in this section, when properly done and of sufficiently heavy coating, are considered satisfactory corrosion-resistant finishes:

(a) Electroplating of cadmium, chromium, nickel, silver, or zinc.

(b) Sherardizing.

(c) Galvanizing.

(d) Painting. Thorough cleaning and degreasing, followed by bonderizing or the equivalent, followed by the application of zinc chromate primer or the equivalent, followed by one or more applications of enamel.

[CGFR 65-50, 30 FR 10736, Dec. 30, 1965, as amended by CGFR 66-71, 31 FR 16781, Dec. 31, 1966]

§ 110.15-45 Corrosion-resistant or noncorrodible materials.

Silver, corrosion-resisting steel, copper, brass, bronze, copper-nickel, certain copper-nickel alloys, and certain aluminum alloys are considered satisfactory corrosion-resistant or noncorrodible materials.

§ 110.15-50 Electrochemistry.

(a) *Storage battery.* A storage battery is a connected group of two or more electrolytic cells for the generation of electric energy in which the cells after being discharged may be restored to a charged condition by an electric current flowing in a direction opposite to the flow of current when the cell discharges.

(b) *Dry cell.* A dry cell is a cell in which the electrolyte is immobilized.

(c) *Primary cell.* A primary cell is a cell which produces electric current by electrochemical reactions without regard to the reversibility of those reactions. (Some primary cells are reversible to a limited extent.)

§ 110.15-55 Embarkation deck.

This term means the deck or decks from which passengers embark into lifeboats or the deck or decks on which passengers are assembled preparatory to embarking into lifeboats.

[CGFR 65-50, 30 FR 10736, Dec. 30, 1965, as amended by CGFR 66-71, 31 FR 16781, Dec. 31, 1966]

§ 110.15-60 Emergency squad.

This term means that part of the crew designated by the station bill to form the nucleus of a damage control party.

§ 110.15-65 Equipment enclosure terms.

(a) *Enclosed (inclosed).* Enclosed means surrounded by a case which will prevent a person from accidentally contacting live parts.

(b) *Nonwatertight equipment.* Nonwatertight equipment means enclosed equipment, the enclosure of which is not sufficiently effective to be classed as either drip-proof or watertight.

(c) *Drip-proof equipment.* Drip-proof equipment means enclosed equipment so constructed or protected that its successful operation is not interfered with when subjected to falling moisture or dirt.

(d) *Watertight equipment.* Watertight equipment means enclosed equipment so constructed that a stream of water from a hose (not less than 1 inch in diameter) under a head of about 35 feet from a distance of about 10 feet, and for a period of 5 minutes, can be played on the apparatus without leakage. The hose nozzle should be adjusted to give a solid stream at the enclosure.

(e) *Explosion-proof equipment.* Explosion-proof equipment means equipment enclosed in a case which is capable of withstanding an explosion of a specified gas or vapor which may occur within it, and of preventing the ignition of the specified gas or vapor surrounding the enclosure by sparks, flashes, or explosions of the gas or vapor within.

(f) *Weathertight equipment.* Weathertight equipment means equipment so constructed or protected that exposure to a beating rain will not result in the entrance of water.

(g) *Totally enclosed equipment.* Totally enclosed means so enclosed as to prevent circulation of air between the inside and the outside of the case, but

not necessarily sufficiently to be termed airtight.

§ 110.15-70 Equivalent.

This term, when used in connection with a unit, material, process, finish, etc., means the equivalent as determined by the Coast Guard.

§ 110.15-75 Ferry.

Under this designation shall be included those vessels in other than ocean or coastwise service having provisions only for deck passengers and/or vehicles, operating on a short run on a frequent schedule between two points over the most direct water route, and offering a public service of a type normally attributed to a bridge or tunnel.

§ 110.15-80 Flashpoint.

This term indicates the temperature in degrees Fahrenheit at which a liquid gives off a flammable vapor when heated in an open-cup tester.

§ 110.15-85 Generation and distribution terms.

(a) *Connected load.* The connected load is the sum of the continuous ratings of the load consuming apparatus connected to the system or any part thereof.

(b) *Load factor.* Load factor is the ratio of the average load over a designated period of time to the connected load.

(c) *Peak load.* Peak load is the maximum load consumed or produced by a unit or group of units in a stated period of time. It may be the maximum instantaneous load or the maximum average load over a designated interval of time.

NOTE: Maximum average load is ordinarily used. In commercial transactions involving peak load (peak power) it is taken as the average load (power) during a time interval of specified duration occurring within a given period of time, that time interval being selected during which the average power is greatest.

(d) *Ground (earth).* A ground is a conducting connection, whether intentional or accidental, by which an electric circuit or equipment is connected to the earth, or to some conducting body, of relatively large extent, which serves in place of the earth. It is used for establishing and maintaining the potential of the earth (or of the conducting body) or approximately that potential, or conductors connected to it, and for conducting ground current to and from the earth (or the conducting body).

NOTE: On shipboard the "ground" or "earth" is the metal hull and all conductive parts connected thereto.

(e) *Grounded (earthed).* Grounded means that the system, circuit, or apparatus referred to is provided with a ground.

(f) *Ground-return circuit (earth-return circuit).* A ground-return circuit in which the earth is utilized to complete the circuit.

(g) *Ground current.* Ground current is current flowing in the earth or in a grounding connection.

(h) *Voltage to ground.* The voltage to ground is the voltage between any live conductor of a circuit and the earth.

NOTE: Where safety considerations are involved, the voltage to ground which may occur in an ungrounded circuit is usually the highest voltage normally existing between the conductors of the circuit, but in special circumstances higher voltages may occur.

(i) *Ground indication.* A ground indication is an indication of the presence of a ground on one or more of the normally ungrounded conductors of a system.

(j) *Circuit.* A circuit is a conducting part or a system of conducting parts through which an electric current is intended to flow.

(k) *Feeder (in interior wiring).* A feeder is a set of conductors originating at a main distribution center, and supplying one or more secondary distribution centers, one or more branch-circuit distribution centers, or any combination of these two types of equipment.

(l) *Lighting feeder.* A lighting feeder is a feeder supplying principally a lighting load.

(m) *Power feeder.* A power feeder is a feeder supplying principally a power or heating load.

(n) *Branch circuit.* A branch circuit is that portion of a wiring system ex-

tending beyond the final overcurrent device protecting the circuit.

(o) *Motor branch circuit.* A motor branch circuit is a branch circuit supplying energy only to one or more motors and associated motor controllers.

(p) *Lighting branch circuit.* A lighting branch circuit is a circuit supplying energy to lighting outlets only. (Lighting branch circuits also may supply portable desk or bracket fans, small heating appliances, motors of ¼ hp and less, and other portable apparatus of not over 660 watts each.)

(q) *Appliance branch circuit.* An appliance branch circuit is a circuit supplying energy to one or more outlets to which appliances are to be connected; such circuits to have no permanently-connected lighting fixtures not a part of an appliance.

(r) *Outlet.* An outlet is a point on the wiring system at which current is taken to supply fixtures, lamps, heaters, motors, or current-consuming equipment generally.

NOTE: The use of the term outlet for a point in the wiring system where a switch is located is deprecated, unless qualified to make the meaning clear.

(s) *Lighting outlet.* A lighting outlet is an outlet intended for the direct connection of a lampholder, a lighting fixture or a pendant cord terminating in a lampholder.

(t) *Receptacle outlet.* A receptacle outlet is an outlet intended to be equipped with one or more receptacles, not of the screw-shell type, or provided with one or more points of attachment within one foot, intended to receive attachment plugs.

(u) *Plug (plug adaptor).* An attachment plug is a device which, by insertion in a receptacle, establishes connection between the conductors of the attached flexible cord and the conductors connected permanently to the receptacle.

(v) *Appliance.* Appliances are current-consuming equipment, fixed or portable; for example, heating, cooking and small motor-operated equipment.

(w) *Portable appliance.* A portable appliance is an appliance, fixed or portable, served by means of a flexible extension cord and/or attachment plug.

(x) *Accessible (as applied to wiring methods).* Accessible means not permanently closed in by the structure or finish of the ship; capable of being removed without disturbing the ship structure or finish.

(y) *Accessible (as applied to equipment).* Accessible means admitting close approach because not guarded by locked doors, elevation or other effective means.

[CGFR 65-50, 30 FR 17036, Dec. 30, 1965, as amended by CGFR 66-33, 31 FR 15288, Dec. 6, 1966]

§ 110.15-90 Great Lakes.

Under this designation shall be included all vessels navigating the Great Lakes.

§ 110.15-95 Headquarters.

This term means the office of the Commandant, U.S. Coast Guard, Washington, D.C. 20591.

[CGFR 65-50, 30 FR 17036, Dec. 30, 1965, as amended by CGFR 68-32, 33 FR 5720, Apr. 12, 1968]

§ 110.15-100 Instrument and meter terms.

(a) *Instrument.* An instrument is a device for measuring the value of the quantity under observation. An instrument may be an indicating instrument or a recording instrument. The term "instrument" is used in two different senses: (1) Instrument proper consisting of the mechanism and the parts built into the case or made a corporate part thereof, and (2) the instrument proper together with any necessary auxiliary devices, such as shunt, shunt leads, resistors, reactors, capacitors or instrument transformers. The term "meter" is also used in a general sense to designate any type of measuring device, including all types of electric measuring instruments. Such use as a suffix or as part of a compound word (e.g., voltmeter, frequency meter) is universally accepted. Meter may be used alone with this wider meaning when the context is such as to prevent confusion with the narrower meaning of electricity meter.

(b) *Indicating instrument.* An indicating instrument is an instrument in

which only the present value of the quantity measured is visually indicated.

(c) *Ammeter.* An ammeter is an instrument for measuring the magnitude of an electric current. It is provided with a scale, usually graduated in either amperes, milliamperes, microamperes or kiloamperes. If the scale is graduated in milliamperes, microamperes or kiloamperes, the instrument is usually designated as a milliammeter, a microammeter or a kiloammeter.

(d) *Frequency meter.* A frequency meter is an instrument for measuring the frequency of an alternating current.

(e) *Power-factor meter.* A power-factor meter is a direct-reading instrument for measuring power factor. It is provided with a scale graduated in power factor.

(f) *Voltmeter.* A voltmeter is an instrument for measuring the magnitude of electric potential difference. It is provided with a scale, usually graduated in either volts, millivolts, or kilovolts. If the scale is graduated in millivolts or kilovolts the instrument is usually designated as a millivoltmeter or a kilovoltmeter.

(g) *Wattmeter.* A wattmeter is an instrument for measuring the magnitude of the active power in an electric circuit. It is provided with a scale usually graduated in either watts, kilowatts, or megawatts. If the scale is graduated in kilowatts or megawatts, the instrument is usually designated as a kilowattmeter or megawattmeter.

(h) *Instrument shunt.* An instrument shunt is a particular type of resistor designed to be connected in parallel with a circuit of an instrument to extend its current range. The shunt may be internal or external to the instrument proper.

(i) *Intrinsically safe instrument and equipment or wiring.* The term "intrinsically safe" when used with instruments and equipment or wiring shall mean such instruments and equipment or wiring that is incapable of releasing sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of a specific hazardous atmospheric mixture in its most easily ignited concentration. Abnormal conditions will include accidental damage to any part of the instrument and equipment or wiring, insulation, failure of electrical components, and other faulty conditions.

[CGFR 65-50, 30 FR 17036, Dec. 30, 1965, as amended by CGFR 66-33, 31 FR 15288, Dec. 6, 1966]

§ 110.15-105 International voyage.

(a) The term "international voyage," as used in this subchapter, shall have the same meaning as that contained in Regulation 2(d), Chapter I, of the International Convention for Safety of Life at Sea, 1960; i.e., " 'International voyage' means a voyage from a country to which the present Convention applies to a port outside such country, or conversely; and for this purpose every territory for the international relations of which a Contracting Government is responsible or for which the United Nations is the administering authority is regarded as a separate country."

(b) The International Convention for Safety of Life at Sea, 1960, does not apply to vessels "solely navigating the Great Lakes of North American and the River St. Lawrence as far east as a straight line drawn from Cap de Rosiers to West Point, Anticosti Island and, on the north side of Anticosti Island, the 63d Meridian." Accordingly, such vessels shall not be considered as being on an "international voyage" for the purpose of this subchapter.

(c) For the purpose of this subchapter the term "territory" as used in paragraph (a) of this section shall be considered to include the Commonwealth of Puerto Rico, the Canal Zone, all possessions of the United States, and all lands held by the United States under a protectorate or mandate.

(d) Although voyages between the continental United States and Hawaii or Alaska, and voyages between Hawaii and Alaska are not "international voyages" under the provisions of the International Convention for Safety of Life at Sea, 1960, such voyages are similar in nature and shall be considered as "international voyages" and subject to the same requirements for the purpose of this subchapter.

§ 110.15-110 Lakes, bays, and sounds.

Under this designation shall be included all vessels navigating the waters of any of the lakes, bays, or sounds other than the waters of the Great Lakes.

§ 110.15-115 Locations.

(a) *Corrosive location.* Corrosive locations shall be deemed to be locations exposed to the weather on vessels operating in salt water.

(b) *Damp or wet location.* Damp or wet locations shall be deemed to be locations exposed to the weather, machinery spaces, cargo spaces, refrigerated spaces, galley, laundry, public washrooms or toilets equipped with baths or showers, and similar locations. Areas directly inside of access doors to a weather deck will also be classed as wet locations where the access door is not suitably protected against entrance of rain or spray by an overhanging deck or by other means.

(c) *Dry location.* Dry locations shall be deemed to be passengers' and crew's quarters, pantries, passageways adjacent to quarters, public washrooms and toilets which are not equipped with baths or showers, radio room, gyro room, and chart room.

§ 110.15-120 Marine inspector or inspector.

These terms mean any person from the civilian or military branch of the Coast Guard assigned under the superintendence and direction of an Officer in Charge, Marine Inspection, or any other person as may be designated for the performance of duties with respect to the inspection, enforcement, and administration of Title 52, R.S., and acts amendatory thereof or supplemental thereto, and rules and regulations thereunder.

§ 110.15-125 Motorboat.

This term means any vessel indicated in Columns 4 or 5 of Table 110.05-1(a), 65 feet in length or less which is propelled by machinery (including steam). The length shall be measured from end to end over the deck excluding sheer. This term includes a boat temporarily or permanently equipped with a detachable motor and any such boat when so propelled is subject to the applicable provisions of the Act of April 25, 1940, as amended (secs. 1 to 22, 54 Stat. 163-167, as amended, 46 U.S.C. 526-526u), and the regulations promulgated thereunder. For the purpose of this subchapter motorboats are included under the term "vessel" unless specifically noted otherwise. The various classes of motorboats are as follows:

Class A—Any motorboat less than 16 feet in length.
Class 1—Any motorboat 16 feet or over and less than 26 feet in length.
Class 2—Any motorboat 26 feet or over and less than 40 feet in length.
Class 3—Any motorboat 40 feet or over and not more than 65 feet in length.

§ 110.15-128 Nuclear energy, radioactive material, and nuclear vessel.

(a) The term "nuclear energy" means all forms of energy released by nuclear fission or radioactive decay, or by any other form of nuclear transformation.

(b) The term "radioactive material" means any material or combination of materials that spontaneously emits ionizing radiation.

(c) The term "nuclear vessel" means any vessel in which power for propulsion, or for any other purpose, is derived from nuclear energy; or any vessel handling or processing substantial amounts of radioactive material other than as cargo.

[CGFR 68-82, 33 FR 18904, Dec. 18, 1968]

§ 110.15-130 Ocean.

Under this designation shall be included all vessels navigating the waters of any ocean or the Gulf of Mexico more than 20 nautical miles offshore.

§ 110.15-135 Officer in Charge, Marine Inspection.

This term means any person from the civilian or military branch of the Coast Guard designated as such by the Commandant and who, under the superintendence and direction of the Coast Guard District Commander, is in charge of an inspection zone for the performance of duties with respect to the inspections, enforcement, and administration of Title 52, Revised Stat-

utes, and acts amendatory thereof or supplemental thereto, and rules and regulations thereunder.

§ 110.15-140 Passenger.

A passenger is every person other than the master and members of the crew or other persons employed or engaged in any capacity on board a vessel in the business of that vessel. In the case of a vessel on an international voyage a child under one year of age is not counted as a passenger.

§ 110.15-155 Propulsion engine.

This term means one or more machines driving a single propeller or paddlewheel shaft for propulsion of the vessel.

§ 110.15-160 Qualified person.

(a) A qualified person is one who by his special knowledge, ability, and experience is able to competently and safely perform the required functions and duties.

§ 110.15-165 Rivers.

Under this designation shall be included all vessels whose navigation is restricted to rivers and/or canals, exclusively, and to such other waters as may be so designated by the Coast Guard District Commander.

§ 110.15-170 Recognized classification society.

The term "recognized classification society" means the American Bureau of Shipping or other classification society recognized by the Commandant.

§ 110.15-175 Rotating machinery; enclosure, ventilation and protection terms.

(a) *Self-ventilated machine.* A self-ventilated machine is one which has its ventilating air circulated by means integral with the machine.

(b) *Separately ventilated machine.* A separately ventilated machine is one which has its ventilating air supplied by an independent fan or blower external to the machine.

(c) *Enclosed self-ventilated machine.* An enclosed self-ventilated machine is a machine having openings for the admission and discharge of the ventilating air, which is circulated by means integral with the machine, the machine being otherwise totally enclosed. These openings are so arranged that inlet and outlet ducts or pipes may be connected to them.

NOTE: Such ducts or pipes, if used, must have ample section and be so arranged as to furnish the specified volume of air to the machine, otherwise the ventilation will not be sufficient.

(d) *Enclosed separately ventilated machine.* An enclosed separately ventilated machine is a machine having openings for the admission and discharge of the ventilating air, which is circulated by means external to and not a part of the machine, the machine being otherwise totally enclosed. These openings are so arranged that inlet and outlet duct pipes may be connected to them.

(e) *Open machine.* An open machine is one having ventilating openings which permit passage of external cooling air over and around the windings.

(f) *Totally enclosed machine.* A totally enclosed machine is one so enclosed as to prevent exchange of air between the inside and the outside of the case, but not sufficiently enclosed to be called airtight.

(g) *Totally enclosed fan-cooled machine.* A totally enclosed fan-cooled machine is a totally enclosed machine equipped for exterior cooling by means of a fan or fans, integral with the machine but external to the enclosing parts.

(h) *Protected machine.* A protected machine is an open machine in which all openings giving direct access to live or rotating parts (except smooth shafts) are limited in size by the design of the structural parts, or by screens, grilles, expanded metal, etc., to prevent accidental contact with such parts. Such openings are of such size as not to permit the passage of a cylindrical rod ½ inch in diameter, except where the distance from the guard to the live or rotating parts is more than 4 inches they are of such size as not to permit the passage of a cylindrical rod ¾ inch in diameter.

(i) *Dripproof machine.* A dripproof machine is one in which the ventilating openings are so constructed that successful operation is not interfered with when drops of liquid or solid particles strike or enter the enclosure at

any angle from 0° to 15° downward from the vertical.

(j) *Explosion-proof machine.* An explosion-proof machine is one enclosed in a case which is capable of withstanding an explosion of a specified gas or vapor which may occur within it, and of preventing the ignition of the specified gas or vapor surrounding the enclosure by sparks, flashes or explosions of the gas or vapor within.

(k) *Waterproof machine.* A waterproof machine is a totally enclosed machine so constructed that a stream of water from a hose (not less than 1 inch in diameter) under a head of 35 feet and from a distance of about 10 feet can be played on the machine from any direction for a period of 5 minutes without leakage, except that leakage which may occur around the shaft may be considered permissible, provided it is prevented from entering the oil reservoir and provision is made for automatically draining the machine. The hose nozzle should be adjusted to give a solid stream at the enclosure. The machine should be provided with a check valve for drainage or a tapped hole at the lowest part of the frame which will serve for application of drain pipe or drain plug.

(l) *Nonsparking fan.* A nonsparking fan is incapable in either normal or abnormal operating conditions of producing sparks of sufficient energy to ignite a flammable mixture. Fans of the following design characteristics are nonsparking:

(1) Blades or housing of nonmetallic construction.

(2) Blades and housing of nonferrous material.

(3) Blades and housing of noncorrosive (stainless) steel.

(4) Ferrous blades and housing with not less than one-half inch design tip clearance.

(5) Blades of aluminum or magnesium alloy and a ferrous housing with a nonferrous insert ring at the periphery of the impeller.

Any combination of an aluminum alloy or a magnesium alloy component and a ferrous component is considered by the Coast Guard to be a sparking hazard. This consideration applies without regard as to which material is used as the fixed or rotating component.

[CGFR 65-50, 30 FR 17040, Dec. 30, 1965, as amended by CGFR 70-143, 35 FR 19907, Dec. 30, 1970; CGFR 72-35, 37 FR 4961, Mar. 8, 1972; CGD 72-35 CR, 37 FR 16547, Aug. 16, 1972]

§ 110.15-177 Rules of the Road.

(a) The term "Rules of the Road" means the statutory and regulatory rules governing navigation of vessels. These rules are also published by the Coast Guard in pamphlet form as follows:

(1) Navigation Rules,—International—Inland (CG-169).

(2) Rules of the Road—Great Lakes (CG-172).

(3) Rules of the Road—Western Rivers (CG-184).

(b) The current editions of the "Rules of the Road" pamphlets may be obtained from any Marine Inspection Office.

(Convention on the International Regulations for Preventing Collisions at Sea, 1972 (as rectified). E. O. 11964 (42 FR 4327); Pub. L. 95-75, 91 Stat. 308)

[CGFR 75-50, 30 FR 17036, Dec. 30, 1965, as amended by CGD 77-052, 42 FR 56331, Oct. 25, 1977]

§ 110.15-180 Short international voyage.

For the purpose of this subchapter, the expression "short international voyage" means an international voyage in the course of which a vessel is not more than 200 miles from a port or place in which the passengers and crew could be placed in safety, and which does not exceed 600 miles in length between the last port of call in the country in which the voyage begins and the final port of destination.

§ 110.15-185 Switching equipment.

(a) *Switches*—(1) *Switch.* A switch is a device for making, breaking or changing the connections in an electric circuit.

(2) *Knife switch.* A knife switch is a form of air switch in which the moving element, usually a hinged blade, enters or embraces the contact clips. In some cases, however, the blade is not hinged and is removable.

(3) *Rated continuous current (of a switch or circuit breaker).* The rated continuous current of a switchgear device, or an assembly, is the maximum direct current, or rms current, in amperes at rated frequency which it will carry continuously without exceeding the limit of observable temperature rise.

(4) *Rated voltage (of a switch or circuit breaker).* The rated voltage of a device, or an assembly, is the voltage to which its operating and performance characteristics are referred.

(5) *General use switch.* A general use switch is a switch intended for use in general distribution and branch circuits. It is rated in amperes and is capable of interrupting the rated current at the rated voltage.

(6) *Isolating switch.* An isolating switch is a switch intended for isolating an electric circuit from the source of power. It has no interrupting rating and is intended to be operated only after the circuit has been opened by some other means.

(7) *Motor-circuit switch.* A motor-circuit switch is a switch intended for use in a motor branch circuit. It is rated in horsepower and is capable of interrupting the maximum operating overload current of a motor of the same rating at the rated voltage.

(8) *"T" rated switch.* A "T" rated switch is a switch intended to control tungsten-filament lamp loads.

(9) *Master switch.* A master switch is a switch which dominates the operation of contactors, relays, or other remotely operated devices.

(b) *Interrupting devices*—(1) *Circuit breaker.* A circuit breaker is a device for closing and interrupting a circuit between separable contacts under both normal and abnormal conditions.

NOTE: Ordinarily circuit breakers are required to operate relatively infrequently, although some classes of breakers are suitable for frequent operation.

NOTE: Normal indicates the interruption of currents not in excess of the rated continuous current of the circuit breaker. Abnormal indicates the interruption of currents in excess of such rated continuous current, such as short circuits.

(2) *Rated interrupting current (rated interrupting capacity).* The rated interrupting current of a circuit breaker is the highest current which the breaker is rated to interrupt at rated voltage and under specified operating duty. (As applied to breakers which allow the current to reach its maximum value, the rated interrupting current is the current at the start of the interrupting process. As applied to breakers which prevent the current from reaching its maximum value, the rated interrupting current is the highest available current of the circuit which the breaker is rated to interrupt.)

(3) *Reverse-power tripping.* Reverse-power tripping signifies the tripping of a circuit breaker upon reversal of power in the main circuit.

NOTE: In direct-current practice the terms "reverse power" and "reverse current" are synonymous.

(4) *Undervoltage tripping.* Undervoltage tripping signifies the tripping of a circuit breaker by automatic means when the main circuit voltage decreases to a predetermined value.

(5) *Nonautomatic tripping.* Nonautomatic tripping signifies the tripping of a circuit interrupter only in response to an act of an operator.

(c) *Fuses*—(1) *Fuse.* A fuse is an overcurrent protective device with a circuit opening fusible member which is heated and severed by the passage of overcurrent through it.

(2) *Voltage rating.* The voltage rating of a fuse is the rms alternating or direct voltage for which it is designed.

(3) *Current rating.* The current rating of a fuse is the designated rms alternating, or direct current which it will carry continuously under stated conditions.

(d) *Relays*—(1) *Relay.* A relay is a device that is operative by a variation in the conditions of one electric circuit to effect the operation of other devices in the same or another electric circuit.

NOTE: Where relays operate in response to changes in more than one condition, all functions should be mentioned.

(2) *Current relay.* A current relay is one that functions at a predetermined value of current. It may be an overcurrent relay, an undercurrent relay, a combination of both.

(3) *Overload relay.* An overload relay is an overcurrent relay which functions at a predetermined value of overcurrent to cause disconnection of the load from the power supply.

NOTE: An overload relay is intended to protect the load (for example, motor armature) or its controller, and does not necessarily protect itself.

(4) *Voltage relay.* Voltage relay is one that functions at a predetermined value of voltage. (It may be an overvoltage relay, an undervoltage relay, or a combination of both.)

(5) *Instantaneous.* Instantaneous is a qualifying term applied to a relay indicating that no delay is purposely introduced in its action.

(6) *Inverse time.* Inverse time is a qualifying term applied to a relay indicating that its time of operating decreases as the magnitude of the operating quantity increases.

(7) *Overcurrent protection (overload protection).* Overcurrent protection operates to disconnect the protected equipment on excessive current.

(8) *Undervoltage protection (lowvoltage protection).* Undervoltage or lowvoltage protection is the effect of a device operative on the reduction or failure of voltage to cause and maintain the interruption of power in the main circuit.

(9) *Undervoltage release (lowvoltage release).* Undervoltage or lowvoltage release is the effect of a device operative on the reduction or failure of voltage to cause the interruption of power in the main circuit, but not to prevent the reestablishment of the main circuit on return of voltage.

(10) *Overspeed protection.* Overspeed protection operates to disconnect the protected equipment when the speed of rotation is in excess of a predetermined amount.

(e) *Regulators*—(1) *Regulator.* A regulator is a device which functions to maintain a designated characteristic at a predetermined value, or to vary it according to a predetermined plan.

(2) *Generator voltage regulator.* A generator voltage regulator is a regulator which functions to maintain the voltage of a synchronous generator, condenser, motor, or of a direct-current generator, at a predetermined value, or vary it according to a predetermined plan.

(f) *Switchgear assemblies*—(1) *Power switchboard.* A power switchboard is a type of switchboard including main circuit switching and interrupting devices, together with their interconnections.

(2) *Live-front switchboards.* A live-front switchboard is one having exposed live parts on the front.

(3) *Dead-front switchboard.* A dead-front switchboard is one having no exposed live parts on the front, which constitutes a grounded metal barrier between the operator and the apparatus.

(4) *Distribution switchboard.* A distribution switchboard is a power switchboard used for the distribution of electric energy at the voltages common for such distribution within a ship.

NOTE: Knife switches, air circuit breakers, and fuses are generally used for circuit interruption on distribution switchboards, and voltages seldom exceed 600. However, such switchboards often include switchboard equipment for a high tension incoming supply circuit and a stepdown transformer.

(5) *Automatic transfer equipment.* An automatic transfer equipment is one which automatically transfers a load so that a source of power may be selected from two or more incoming lines.

§ 110.15-190 Vessel.

(a) Where the word "vessel" is used in this subchapter, it shall be considered to include all vessels indicated in Columns 3, 4, and 5 of Table 110.05-1(a) except as otherwise noted.

(1) *Cargo vessel.* Where the term "cargo vessel" is used in this subchapter it shall be considered to include all vessels indicated in Column 5 of Table 110.05-1(a) except as otherwise noted.

(2) *Passenger vessel.* Where the term "passenger vessel" is used in this subchapter it shall be considered to include all vessels indicated in Column 4 of Table 110.05-1(a) except as otherwise noted.

(3) *Tank barge; tank ship; tank vessel.* For definitions of these terms as used in this subchapter, see

40-130 O—79——3

§ 111.70-5 (i), (j), and (k) of this subchapter.

(4) *Barge.* Where the term "barge" is used in this subchapter, it shall be considered to include all nonself-propelled vessels.

§ 110.15-195 Western rivers.

For the purpose of this subchapter the term "western rivers" is as defined in CG-184, "Rules of the Road—Western Rivers."

Subpart 110.20—Equivalents

§ 110.20-1 Conditions under which equivalents may be used.

(a) Where in this subchapter it is provided that a particular fitting, material, appliance, apparatus, or equipment, or type thereof, shall be fitted or carried in a vessel, or that any particular provision shall be made or arrangement shall be adopted, the Commandant may accept in substitution therefor any other fitting, material, appartus, or equipment, or type thereof, or any other arrangement: *Provided,* That he shall have been satisfied by suitable trials that the fitting, material, appliance, apparatus, or equipment, or type thereof, or the provision or arrangement is at least as effective as that specified in this subchapter.

(b) In any case where it is shown to the satisfaction of the Commandant that the use of any particular equipment, apparatus, or arrangement is unreasonable or impracticable, the Commandant may permit the use of alternate equipment, apparatus, or arrangement to such an extent and upon such condition as will insure, to his satisfaction, a degree of safety consistent with the minimum standards set forth in this subchapter.

Subpart 110.25—Special Provisions

§ 110.25-1 Vessels acquired or documented under the Act of August 9, 1954.

(a) Vessels acquired or documented under the Act of August 9, 1954 (sec. 3, 68 Stat. 675, 50 U.S.C. 198), shall be subject to the applicable provisions of Title 52 of the Revised Statutes, acts amendatory thereto and the rules and regulations thereunder.

(b) Unapproved lifesaving, firefighting, and other equipment may be continued in service so long as, in the opinion of the Officer in Charge, Marine Inspection, such equipment is in good and serviceable condition. All replacements shall be in accordance with Coast Guard requirements for new vessels.

§ 110.25-5 Installations of equipment made during the Unlimited National Emergency declared by the President on May 27, 1941.

Boilers, pressure vessels, machinery, piping, electrical, and other installations, including lifesaving, firefighting, and other safety equipment installed on vessels during the Unlimited National Emergency declared by the President on May 27, 1941, and prior to the termination of Title V of the Second War Powers Act, as extended (sec. 501, 56 Stat. 180, 50 U.S.C., App. Sup. 635), which do not fully meet the detail requirements of the regulations in this chapter, may be continued in service if found to be satisfactory by the Commandant for the purpose intended.

PART 111—ELECTRICAL SYSTEM; GENERAL REQUIREMENTS

Subpart 111.01—Application

Sec.

Subpart 111.05—General Requirements

Subpart 111.10—Generators

AUTHORITY: R.S. 4405, as amended, sec. 5, 49 Stat. 1384, as amended, sec. 3, 70 Stat. 152, R.S. 4417a, as amended, R.S. 4462, as amended, R.S. 4488, as amended, R.S. 4491, as amended, sec. 17, 54 Stat. 166, as amended, sec. 6(b)(1), 80 Stat. 937; 46 U.S.C. 375, 369, 390b, 391a, 416, 481, 489, 526p, 49 U.S.C. 1655(b)(1); 49 CFR 1.46(b); unless otherwise noted.

SOURCE: CGFR 70-143, 35 FR 19907, Dec. 30, 1970, unless otherwise noted.

Subpart 111.01—Application

§ 111.01-1 General.

The provisions of this part, with the exception of Subpart 111.90 shall, unless otherwise indicated, apply to all vessels contracted for on or after November 19, 1952. The provisions of Subpart 111.90 shall apply to all vessels contracted for prior to November 19, 1952.

§ 111.01-5 Should; meaning of.

In order to have, wherever possible in this part, the identical wording contained in section 35 of the American Bureau of Shipping Rules for the Classification and Construction of Steel Vessels, the word "should" has been used instead of "shall." Therefore, in each such instance where the word "should" is used in this part (except § 111.05-10 (c), (d), and (f)) to describe, or as applicable to, the equipment or installation, it is to be considered the same as the word "shall" in describing Coast Guard requirements.

Subpart 111.05—General Requirements

§ 111.05-1 Construction and installation.

Electrical apparatus and wiring systems shall be in accordance with the requirements of this part. The requirements of this part are applicable to all vessels but may be modified by the Commandant for vessels certificated for limited service or for vessels less than 300 gross tons. The requirements of this part are minimum requirements and it is recommended that details not covered by the regulations be in general conformity with Standard No. 45 of the Institute of Electrical and Electronic Engineers. (See § 110.10-1(d) of this subchapter.)

§ 111.05-5 Plan approval.

(a) *General.* (1) The required plans listed in this subpart are general in character, but include all plans which normally show construction and safety features coming under the cognizance of the Coast Guard. In the case of a particular vessel, all of the plans enumerated may not be applicable, and it is intended that only those plans and specifications be submitted as will clearly show the vessel's arrangement, construction and required equipment.

(2) In the list of required plans given in this section, those indicated by an asterisk cover the electrical items necessary for the approval of the installation by the American Bureau of Shipping for vessels classed by that organization. When prints bearing record of such approval by the American Bureau of Shipping are forwarded to the Coast Guard they will, in general, be accepted as satisfactory except insofar as the law or the regulations in this Chapter contain requirements which are not covered by the American Bureau of Shipping.

(b) *Procedure for submittal of plans.* (1) As the relative locations of shipyards, design offices, and Coast Guard offices vary throughout the country, no specific routing will be required in the submittal of plans. In general, one of the procedures outlined in this paragraph would apply, but in a particular case, if a more expeditious procedure can be used, there will be no objection to its adoption.

(2) The plans may be submitted to the Officer in Charge, Marine Inspection at or nearest the place where the vessel is to be built. This procedure will be most expeditious in the case of those offices where personnel and facilities are available for examination and approval of the plans locally.

(3) The plans may be submitted directly to the Commandant (MMT), U.S. Coast Guard, Washington, D.C. 20591. In this case, the plans will be returned directly to the submitter, with a copy of the action being forwarded to the interested Officer in Charge, Marine Inspection.

(4) The plans may be submitted directly to the following field technical offices:

(i) Commander, 3d Coast Guard District(mmt), Governors Island, New York, N.Y. 10004, for the geographical area covered by the 1st and 3d Coast Guard Districts.

(ii) Commander, 8th Coast Guard District(mmt), Hale Boggs Federal Building, 500 Camp Street, New Orleans, La. 70130, for the geographical area covered by the 2d, 7th, and 8th Coast Guard Districts.

(iii) Commander, 12th Coast Guard District (mmt), 630 Sansome Street, San Francisco, Calif. 94126, for geographical area covered by 11th, 12th, 13th, 14th, and 17th Coast Guard Districts.

(iv) Commander 9th Coast Guard District (mmt), Federal Office Building, 1240 East 9th Street, Cleveland, OH. 44199, for the geographical area covered by the 9th Coast Guard District.

(v) Commander, 5th Coast Guard District(mmt), Federal Building, 431 Crawford Street, Portsmouth, Va. 23705, for the geographical area served by the 5th Coast Guard District.

(5) In the case of classed vessels, upon specific request by the submitter, the American Bureau of Shipping will arrange to forward the necessary plans to the Coast Guard indicating its action thereon. In this case, the plans will be returned as noted in paragraph (b)(3) of this section.

(c) *Number of plans required.* Three copies of each plan are normally required so that one can be returned to the submitter. If the submitter desires additional approved plans, a suitable number should be submitted to permit the required distribution.

(d) *Electrical plans required for new construction.*[1] (1) * Specifications.

(2) * General arrangements.

(3) * Switchboard front, rear, end, and section views.

(4) * Switchboard wiring diagram.

(5) * Switchboard material and nameplate list.

(6) * Elementary wiring diagram of metering and automatic switchgear.

[1] The items marked with an asterisk (*) indicate such items may require the approval of the American Bureau of Shipping.

(7)* Description of operation of propulsion control and bus transfer switchgear.

(8)* Elementary (one line) wiring diagram of power system (supplemented by cable lists, panelboard summaries, etc., if desired) giving:

(i)* Type and size of generators;

(ii)* Type and size of generator cables, bus-tie cables, feeders, and branch circuit cables;

(iii)* Power, lighting, and interior communication panelboards showing number of circuits and rating of energy consuming devices.

(iv) Type and capacity of storage batteries.

(v) Rating of circuit breakers and switches, interrupting capacity of circuit breakers, and rating or setting of over-current devices.

(9)* Electric plant summary showing connected loads and calculated operating loads for various conditions of operation.

(10)* Isometric or deck wiring plans of power system, including symbol list.

(11)* Elementary wiring diagram of steering gear circuits.

(12)* Elementary wiring diagram and isometric or deck wiring diagrams of electric watertight door system, fire-screen door holding system, and power-operated lifeboat winches.

(13)* Generators and propulsion motors. Manufacturer's outline drawing of each giving nameplate data, degree of enclosure, type of insulation, temperature rise above stated ambient temperature, duty cycle, and application or name of auxiliary driven.

(14)* Motor starters. Manufacturer's enclosure outline drawing, control elementary wiring diagram, and application of each. For lifeboat winch motor starters, see § 111.80-55.

(15) Distribution panelboards, branch boxes, enclosed switches, push-button stations, control switches, etc. Manufacturer's outline drawing or suitable identification on deck wiring plan symbol list. For lifeboat winch control switches, see § 111.80-55.

(16) Isometric or deck wiring plan of lighting feeders.

(17)* Deck plans of lighting system showing location of cables, fixtures, and wiring devices, cable sizes and types, and manufacturer's name and identification of fixtures and wiring devices. If manufacturer's name and identification are contained in a symbol list, the corresponding symbol marking should be employed on the deck plans.

(18) Elementary and isometric or deck wiring diagrams of sound powered telephone system, general alarm system, emergency loudspeaker system, and similar systems with material identified by name of manufacturer and drawing and/or catalog number. If manufacturer's name and identification are contained in a symbol list, the corresponding symbol marking should be employed on the deck plans.

(19) Elementary and deck wiring plans of fire detecting and alarm system, manual alarm system, smoke detecting system, carbon dioxide extinguishing system alarms, and supervised patrol system, with material identified by name of manufacturer and drawing and/or catalog number. If manufacturer's name and identification are contained in a symbol list, the corresponding symbol marking should be employed on the deck plans.

(20) Schematic and/or logic diagrams for automated or centrally controlled propulsion or auxiliary machinery.

(21) The operating, maintenance, and instruction manuals for automated or centrally controlled propulsion or auxiliary machinery systems that include operational test procedures for verifying the operation of the required safety devices and systems.

(22) For tank vessels, mobile offshore drilling units, and other vessels carrying hazardous materials as indicated in § 111.80-5, plans showing the location of each item of electrical equipment that is in a hazardous location. Plans must include a symbol list and manufacturer's name and identification.

(e) *Electrical plans required for repairs and alterations of existing vessels.* (1) No repairs or alterations affecting the safety of the vessel shall be made without the knowledge of the Officer in Charge, Marine Inspection.

(2) Drawings of alterations shall be approved before work is started unless deemed unnecessary by the Officer in

Charge, Marine Inspection. The general scope of the plans shall be as noted in paragraph (d) of this section. Drawings will not be required for repairs in kind.

(f) *Location of splices.* The plans described in paragraphs (d)(10), (d)(12), (d)(16), (d)(17), (d)(18), (d)(19) and (e)(2) of this section must show the location of each cable splice.

[CGFR 70-143, 35 FR 19907, Dec. 30, 1970; 36 FR 5606, Mar. 25, 1971, as amended by CGFR 72-35, 37 FR 4961, Mar. 8, 1972; CGD 74-305, 41 FR 26013, June 24, 1976; CG 78-108, 43 FR 46546, Oct. 10, 1978; CGD 73-251, 43 FR 56837, Dec. 4, 1978]

§ 111.05-10 Testing and inspection.

(a) *Application.* This section shall be applicable to all vessels, both those existing as of November 18, 1952, and those contracted for on and after November 19, 1952.

(b) *General.* (1) The general requirements for inspection of vessels are contained in Part 31, Part 71, and Part 91 of this chapter. The contents of this section supplement the general requirements contained in other parts of this chapter.

(2) In the inspection of electrical equipment and installations, the rules promulgated by the American Bureau of Shipping respecting materials and construction, and the certificate of classification referring thereto, except when otherwise provided for by the rules and regulations of this subchapter, shall be accepted as standard.

(i) The requirements of this paragraph shall not be construed to imply that ship tests or factory inspections of electrical apparatus or equipment of the types regularly conducted by the American Bureau of Shipping will be conducted by the Coast Guard. Shoptests of electrical apparatus or equipment will be conducted by the Coast Guard only when specifically required by the regulations in this chapter or when specifically requested, either by the manufacturer, shipbuilder, owner, or the Coast Guard, and agreed to by all concerned.

(c) *Initial inspection*—(1) *Scope.* The initial inspection, which may consist of a series of inspections during the construction of the vessel, shall include a complete inspection of the electrical installation and electrical equipment or apparatus. The inspection shall be such as to insure that the arrangement, materials, and installations thereof, fully comply with the applicable regulations in this chapter and are in accordance with approved plans. The inspection shall also be such as to insure that the workmanship of all equipment and apparatus and the installation thereof is, in all respects, satisfactory.

(2) *Inspections required.* The specific inspections described in this paragraph are intended as suggestions to the marine inspector. It is not the intention of this paragraph to require, in the case of any particular vessel, any tests which, in the opinion of the Officer in Charge, Marine Inspection, are unnecessary.

(3) *Electric cable.* Electric cable should be checked during installation for size and type as shown on the approved plans. The adequacy of cable supports should be checked, and it should be ascertained that no cable is installed in the proximity of steam pipes or other hot objects and that the cables have not been damaged during the installation due to excessive pulling force having been applied, or due to sharp bends or sharp or rough edges of cable supports or bulkhead penetrations, or similar abrasions. Cable penetrations required to be watertight should be checked for proper packing of the terminal or stuffing tubes, including provisions for future takeup of gland nuts.

(4) *Generators.* Generators should be checked for general condition, both electrical and mechanical, voltage regulation, parallel operation, operation of safety devices such as reverse-current or reverse-power trips, overcurrent trips, overspeed trips, low oil pressure trips, and similar devices.

(5) *Rotating electrical machinery.* Rotating electrical machinery should be checked to assure that rotating and/or uninsulated electrical parts are adequately shielded from accidental contact by personnel.

(6) *Switchboards.* Switchboards should be checked for hand-rails, guardrails, working spaces, insulating floor covering, drip covers, and enclosures for backs and ends. Switchboard

mounted apparatus should be checked for identifying nameplates. Circuit nameplates should be compared with the rating or setting of the overcurrent devices and with the approved plans. The accessibility of items requiring maintenance or adjustment should be checked. Meters should be checked for proper calibration. The operation of automatic switchgear and mechanical interlocks should be observed.

(7) *Motor starters.* Motor starters should be checked to assure proper starting of the motor under service conditions and to assure that properly rated overcurrent devices are installed. A wiring diagram made of durable metal or plastic for each motor starter should be permanently secured to the inside of its enclosure door. Each motor starter not completely disconnected from all sources of potential when the disconnect switch is opened (due to electrical interlocked circuits necessary for proper operation of the apparatus or for other valid reasons) should be checked to assure that attention is directed to such conditions by a suitable sign.

(8) *Disconnect switches.* The presence and location of disconnect switches required for motor starters, fuses, etc., should be checked. When a switch or circuit breaker on a switchboard or distribution panel is intended to serve as a motor and controller disconnect switch, it shall be determined that the applicable requirements of the regulations in this subchapter have been met.

(9) *Accessibility.* The accessibility of electrical apparatus for normal inspection and maintenance should be observed. The accessibility of junction boxes and the like in way of paneling should be noted during construction of a vessel. Hinged doors of motor starters and similar apparatus should be checked for interference with adjacent structural parts or apparatus.

(10) *Panelboards.* The rating or setting of the overcurrent devices should be compared with the values given on the circuit directory and with the approved plans. The accuracy of the directory description of loads served by each circuit should be checked.

(11) *Grounding.* It should be determined that metal enclosures for electrical equipment are grounded, either by the method of mounting or by ground leads. Portable equipment should be checked for grounding through the grounding conductor of the supply cable.

(12) *Emergency lighting and exit lights.* The adequacy of emergency lights and exit lights should be checked at night with all general lighting turned off.

(13) *General alarm system.* The general alarm system should be checked with a sound level meter, the sound level of the bells being measured in each stateroom for passengers or crew with doors closed. Where the background noise level is questionable, the background noise level should be measured while the vessel is underway. For the required sound levels, see § 113.25-10(c) of this subchapter.

(14) *Emergency loudspeaker system.* The emergency loudspeaker system should be checked with a sound level meter, the sound level being measured at several locations in the vicinity of each lifeboat handling station, each lifeboat embarkation station, each passenger assembly station, and throughout crew quarters. Where the background noise level is questionable, the background noise level should be measured while the vessel is underway. For the required sound levels, see Table 113.50-15 of this subchapter. It should be demonstrated that voice reproduction is of good quality and intelligibility is of a high order. It should be demonstrated that grounding or opening either conductor or "shorting" both conductors to a typical lifeboat station loudspeaker or to a typical embarkation deck loudspeaker, each to be selected by an inspector, will not reduce the output of any one of the remaining loudspeakers by more than three decibels.

(15) *Fire detecting systems.* Fire detecting systems should be checked for compliance with the applicable regulations in this chapter and for conformance with the approved plans. Power supply circuits and thermostat circuits should be checked for supervision.

(16) *Communication systems.* All communication systems should be

checked for performance and for compliance with the regulations in this chapter.

(17) *Insulation resistance.* All electric power and lighting cable and equipment should be checked for proper insulation resistance to ground and between conductors.

(18) *Automated machinery.* All propulsion and auxiliary machinery control and safety systems installed to comply with the requirements for an automated or centralized control machinery system shall be checked for material condition, operation, and set point.

(d) *Inspection for certification*—(1) *General.* The inspection of electrical installations at the annual or biennial inspection incident to reissuance of a certificate of inspection shall include an inspection of all items enumerated in paragraph (c) of this section to the extent necessary to determine mechanical and electrical condition and performance. Particular note should be made of circuits added or modified after the initial inspection.

(2) *Fire detecting system.* Fire detecting thermostats should be tested at regular intervals (at least 25 percent of those installed tested annually) to detect any change in operating characteristics. A portable hand light with an open end sheet metal shield (such as a No. 3 fruit can) replacing the usual guard and globe would usually serve as a source of heat to operate the thermostat without damage to paint work or to the thermostat itself. Any thermostat requiring a time to operate materially different from the average when covered with the heating device should be suspected of being defective and forwarded to Coast Guard Headquarters for further testing.

(3) *Vital machinery.* Motors, motor starters and control switches used with machinery vital to the safety or propulsion of the vessel should be visually examined for condition and suitable name plate ratings. When there is evidence of deterioration, they should be opened for closer inspection.

(4) *Storage batteries.* Storage batteries used for emergency lighting, diesel-engine-driven emergency generator starting, general alarm, and similar systems should be checked for capacity. Storage batteries supplying emergency lighting should be required to carry the connected loads for the prescribed length of time.

(e) *Repairs or alterations.* An inspection, either general or partial, depending upon the circumstances, shall be made whenever any important repairs or alterations are undertaken.

[CGFR 70-143, 35 FR 19907, Dec. 30, 1970; 36 FR 5606, Mar. 25, 1971]

§ 111.05-15 General considerations.

(a) *General.* (1) Electrical installations on vessels shall be such that (i) services essential for safety will be maintained under various emergency conditions; and (ii) the safety of passengers, crew, and vessel from electrical hazards will be assured.

(2) Electrical equipment should be so placed or protected as to minimize the possibility of mechanical injury or damage from the accumulation of dust, oil vapors, steam, or dripping liquids. Apparatus liable to arc should be ventilated or placed in ventilated compartments in which flammable gases, acid fumes, and oil vapors cannot accumulate. Skylights and ventilators are to be so arranged as to avoid the possibility of flooding the apparatus.

(b) *Protection from bilge water.* All generators, motors, and electric couplings are to be so arranged that they cannot be damaged by bilge water, and if necessary a watertight coaming should be provided to form a well around the base of such equipment with provisions for removing water from the well.

(c) *Accessibility.* The design and arrangement of electrical apparatus should provide accessibility to parts requiring inspection or adjustment. Armature and field coils, rotors and revolving fields should be removable, and where air ducts are used there should be means of access.

(d) *Watertight equipment.* All electrical equipment exposed to the weather or located in spaces where they would be exposed to seas, splashing, or other severe moisture condition, shall be of the watertight type or be protected by means of watertight enclosures which shall be such as to prevent the exposure of the equipment to temperatures in excess of

those for which they have been designed.

(e) *Corrosion-resistant parts.* Enclosures, working and other parts of electrical equipment which would be damaged or rendered ineffective by corrosion, shall be made of corrosion-resistant materials or of material rendered adequately corrosion resistant.

(f) *Grounding of permanent equipment.* (1) All exposed metal parts of electrical machines or equipment which are not intended to be "live," but are liable to become "live" under fault conditions, shall be grounded and all electrical apparatus shall be so constructed and so installed that danger of injury in ordinary handling shall not exist.

(2) Metal frames of all portable lamps, tools, and similar apparatus supplied as ship's equipment and rated 100 volts or more shall be grounded through a suitable conductor in the supply cable.

(g) *Limitations of procelain use.* Porcelain should not be used for lamp sockets, switches, receptacles, fuse blocks, etc., where the material is rigidly fastened by machine screws or the equivalent.

§ 111.05-20 Temperature ratings.

(a) In the requirements of this subchapter, except as noted in paragraph (b) of this section, an ambient temperature of 40° C. has been assumed for all locations except boiler and enginerooms while for these latter spaces 50° C. has been assumed as the ambient temperature. Where the ambient temperature is in excess of these values, the total temperature specified shall not be exceeded. Where equipment has been rated on ambient temperatures less than those contemplated, consideration will be given to the use of such equipment provided the total temperature for which the equipment is rated will not be exceeded.

(b) For the assumed ambient temperature for lighting fixtures see § 111.75-20(a)(4). For the assumed ambient temperature for thermal trip circuit breakers see § 111.50-15(e)(6)(i).

§ 111.05-25 Nature of electrical supply.

(a) *Standard systems.* The following systems of distribution are recognized as standard:

(1) Two-wire with direct current or single-phase alternating current;

(2) Three-wire with direct current or single-phase alternating current;

(3) Three-wire, three-phase alternating current; and

(4) Four-wire, three-phase alternating current.

(b) *Standard voltages.* The voltages given in Table 111.05-25(b) are recognized as standard.

TABLE 111.05-25(b)—STANDARD VOLTAGES

Equipment	Direct current (volts)	Alternating current (volts)
Lighting	115	115 and 120.
Power	115 and 230	115, 120, 208, 220, and 440.
Generators	120 and 240	120, 125, 216, 230 and 450.
Propulsion	1,000 maximum	7,500 maximum.

(c) *Standard frequency.* A frequency of 60 hertz is recognized as standard for alternating-current lighting and power systems.

(d) *Others.* Special consideration will be given to systems, voltages, or frequencies differing from the recognized standard.

§ 111.05-30 Insulation materials.

(a) *Definition of terms.* Certain terms used in this section are defined as follows:

(1) "Experience" means successful operation for a long time under actual operating conditions of machines designed with temperature rise at or near the temperature rating limit. (NEMA Publication No. MG 1)

(2) "Accepted test" means a test on a system or model system which simulates the electrical, thermal, and mechanical stresses occurring in service. (NEMA Publication No. MG 1)

(b) *Class designation.* Insulation material referred to in this subchapter is designated by class as described in this section.

(c) *Class A Insulation.* A Class A insulation system is one that has a suitable thermal endurance when operated at the limiting Class A temperature

specified in the temperature rise standard for the machine under consideration, as determined by the manufacturer's experience or by an accepted test. Typical materials or combinations of materials used in Class A systems include cotton, paper, cellulose acetate films, enamel-coated wire or similar organic materials impregnated with suitable substances. (NEMA Publication No. MG 1)

(d) *Class B Insulation.* A Class B insulation system is one that has a suitable thermal endurance when operated at the limiting Class B temperature specified in the temperature rise standard for the machine under consideration, as determined by the manufacturer's experience or by an accepted test. Typical materials or combinations of materials used in a Class B system include mica, glass fiber, asbestos, or other materials, not necessarily inorganic, with compatible bonding substances having suitable thermal stability. (NEMA Publication No. MG 1)

(e) *Class C Insulation.* A Class C insulation system contains materials consisting entirely of mica, porcelain, glass, quartz, or similar inorganic materials. (ANSI C-50)

(f) *Class F Insulation.* A Class F insulation system is one that has a suitable thermal endurance when operated at the limiting Class F temperature specified in the temperature rise standard for the machine under consideration, as determined by the manufacturer's experience or accepted test. Typical materials or combinations of materials used in a Class F system include mica, glass fiber, asbestos or similar materials, not necessarily inorganic, with compatible bonding substances having suitable thermal stability. (NEMA Publication No. MG 1)

(g) *Class H Insulation.* A Class H insulation system is one that has a suitable thermal endurance when operating at the limiting Class H temperature specified in the temperature rise standard for the machine under consideration, as determined by the manufacturer's experience or an accepted test. Typical materials or combinations of materials used in Class H systems include mica, glass fiber, asbestos, silicone elastomer, or similar materials, not necessarily inorganic, with compatible bonding substances, such as silicone resins, having suitable thermal stability. (NEMA Publication No. MG 1)

[CGFR 72-35, 37 FR 4961, Mar. 8, 1972]

Subpart 111.10—Generators

§ 111.10-1 Power requirements.

(a) *Propulsion.* The power for the main propulsion equipment may be derived from a single generator.

(b) *Ship's service.* (1) All ocean vessels using electricity for ship's service power or light shall be provided with at least two ship's service generating sets. The capacity of the generating sets shall be sufficient to carry the necessary sea load under normal operation with any one generating set in reserve.

(2) As an alternative to paragraph (b)(1) of this section, a ship's service system consisting of one large steam turbogenerator designed for continuous operation and a smaller automatically started standby generator will be permitted. The smaller generator should normally not be smaller than one-half the capacity of the larger unit and in every case shall be of sufficient size to provide for the at-sea hotel and cargo services and to simultaneously maneuver the vessel at a reasonable speed. The larger unit shall have an adequate capacity to handle all normal sea loads including all hotel and cargo services.

(3) On a vessel having a single propulsion boiler, a source other than steam must drive one of the generators required by subparagraph (1) of this paragraph.

(c) *Emergency power and lighting.* See Part 112 of this subchapter for requirements.

[CGFR 70-143, 35 FR 19907, Dec. 30, 1970, as amended by CGFR 72-35, 37 FR 4961, Mar. 8, 1972]

§ 111.10-5 Prime movers.

(a) In general, compliance of prime movers with the rules promulgated by the American Bureau of Shipping will be considered as satisfactory evidence

of structural and operational efficiency of prime movers.

(b) Special consideration will be given to the structural and operational features of prime movers for small vessels or of unusual design not contemplated by the rules of the American Bureau of Shipping.

§ 111.10-10 Excitation.

(a) *General.* Direct-current rotating exciters shall conform to all the applicable requirements for direct-current generators.

(b) *Propulsion.* Separately excited propulsion generators should be provided with more than one means of excitation. Exciters may be either direct connected or independent generating sets. Current may be derived from the ship's service power or lighting sets.

§ 111.10-15 Generator construction.

(a) *General.* (1) In general, compliance of generators with the rules promulgated by the American Bureau of Shipping will be considered as satisfactory evidence of the structural efficiency of generators.

(2) Special consideration will be given to the construction of generators for small vessels or of unusual design not contemplated by the rules of the American Bureau of Shipping.

(b) *Circulating currents.* Means shall be provided to prevent circulating currents from passing between the journal and the bearing, where the design and arrangement of the machine is such that damaging current may be expected.

(c) *Moisture condensation prevention.* All emergency generators and all generators whose weight excluding the shaft is over 1,000 pounds should be provided with means to prevent moisture condensation in the machine when idle. Where steam heating coils are installed for this purpose, there are to be no pipe joints inside the casings.

(d) *Terminal arrangement.* All generator terminals should be protected against accidental contact, mechanical damage, and where necessary, against dripping moisture by drip shields or drip-proof enclosures. Where cables enter dripproof enclosures from the sides or top, they should be provided with terminal tubes.

(e) *Nameplates.* (1) All generators shall be fitted with nameplates of corrosion-resistant material marked with the following information:

(i) Manufacturer's type and frame designations;

(ii) Output;

(iii) Kind of rating;

(iv) Temperature rise at rated load;

(v) Design ambient temperature;

(vi) Revolutions per minute at rated load;

(vii) Voltage;

(viii) Amperes at rated load; and,

(ix) Type of windings for direct-current machines.

(2) For alternating-current generators, in addition to the required information listed in paragraph (a)(1) of this section, the following information also shall be set forth:

(i) Number of phases;

(ii) Frequency;

(iii) Power factor;

(iv) Exciter voltage; and,

(v) Exciting current in amperes at rating.

(f) *Temperature detectors.* Alternating-current generators of 500 kva and above, when access to coils is difficult, and all alternating-current propulsion generators, should be provided with means for obtaining the temperatures of the stationary windings. The temperature should be indicated at a convenient location, preferably the control panel.

(g) *Ventilation and protection.* (1) Propulsion and ship's service generators not enclosed ventilated shall have all openings protected with substantial wire or mesh screen to prevent personnel injury, and shall be provided with protection against dripping liquids equivalent to that of a drip-proof machine.

(2) Where the protection of the generator is not the equivalent of a protected machine as defined in § 110.15-175(h) of this subchapter, the arrangement will require specific approval for each installation.

(3) Dampers shall be provided in ventilation air ducts except where recirculating systems are used.

(h) *Fire extinguishing.* Fire extinguishing systems suitable for fires in

electrical equipment are to be fitted to propulsion generators which are enclosed or in which the air gap is not directly exposed. See Part 34 of Subchapter D (Tank Vessels), Part 76 of Subchapter H (Passenger Vessels), and Part 95 of Subchapter I (Cargo and Miscellaneous Vessels) of this chapter for details of the systems.

(i) *Insulation of windings.* Armature and field coils should be treated to resist oil and water.

(j) *Lubrication*—(1) *Ship's service generators.* In general, all generators should be located with their shafts in a fore and aft direction on the vessel, and they must lubricate and operate satisfactorily when permanenetly inclined to an angle of 15° athwarthship and 5° fore and aft; the bearings are to be so arranged that they will not spill oil under a momentary roll of 30°. Where it is not practicable to mount the generators with armature shafts in the fore and aft direction their lubrication will require special consideration. Generators depending on forced lubrication, unless otherwise approved, should be provided with means to shut down their prime movers automatically on failure of the lubricating system. Provision is to be made to prevent oil or oil vapor from passing into the machine windings.

(2) *Emergency generators.* For lubrication of emergency diesel-driven generator sets also see Subpart 112.50 of this subchapter.

[CGFR 70-143, 35 FR 19907, Dec. 30, 1970; 36 FR 5606, Mar. 25, 1971]

§ 111.10-20 Voltage regulation.

(a) *Ship's service generator.* (1) Ship's service generator's inherent voltage regulation characteristics shall comply in general with all the applicable requirements contained in Table 111.10-20(a)(1).

TABLE 1.10-20(a)(111)—GENERATOR VOLTAGE REGULATION

Type of generator	Load variation	Voltage variation (maximum)
Direct-current shunt or stabilized shunt wound generator.	100 percent to 20 percent (decreasing) 20 percent to 100 percent (increasing)	8 percent voltage rise. 12 percent voltage drop.
Direct-current compound wound generator and direct-current shunt wound generator with voltage regulator.	20 percent to 100 percent (increasing) 20 percent to 100 percent (increasing) 100 percent to 20 percent (decreasing)	2½ percent. 3 percent from average of ascending and descending curves.
Direct-current 3-wire generator (In addition to the above).	Rated current on either positive or negative and 25 percent rated current on neutral and rated voltage positive to negative.	Negative to neutral and positive to neutral 2 percent of rated positive to negative voltage.
Alternating-current generator and regulator (no reactive droop compensation).	0 percent to 100 percent (increasing) 100 percent to 0 percent (decreasing). (At rated power factor).	1 percent of rated voltage from a median value halfway between highest and lowest values attained. [1]
Two or more alternating-current generators and regulators with reactive droop compensation adjusted for a voltage droop of not more than 4 percent of rated voltage for a reactive load change from 0 percent to 60 percent of continuous kilovolt-ampere rating.	0 percent to 100 percent (increasing) 100 percent to 0 percent (decreasing). (At rated power factor).	Not more than 4 percent droop and no point more than 1 percent of rated voltage from the average curve drawn through a plot of settled voltage versus load for any increasing or decreasing load between zero and full load.

[1]Maybe 2½ percent for emergency generator.

(2) Generators shall, where practicable, be tested with their own driving units. When tested with temporary driving units, allowance shall be made

for the expected speed regulation of the driving units to assure satisfactory voltage regulation, as provided by Table 111.10-20(a)(1), after assembly with the permanent driving units.

(3) Where automatic voltage regulators are not supplied, the d.c. ship's service generators should be approximately flat compounded except that, if the load fluctuation does not interfere with the operation of vital auxiliaries, shunt wound generators without voltage regulators or stabilized shunt wound machines may be used.

(4) In general a separate regulator should be supplied for each alternating-current generator. When it is intended that two or more generators will be operated in parallel, reactive droop compensating means should be provided to divide the reactive power properly between the generators. The regulator in conjunction with the exciter and the generator characteristics should be capable of performing in accordance with conditions set forth in subparagraphs (1) and (2) of this paragraph.

§ 111.10-25 Parallel operation.

In general, when the installation is such that two or more generators are to be operated in parallel, the load on any generator should not differ more than plus or minus 15 percent of its rated kilowatt load from its proportionate share, based on the generator ratings, of the combined load for any steady state condition in the combined load between 20 percent and 100 percent of the sum of the rated loads of all generators. The starting point for the determination of the foregoing load distribution requirements should be at 75 percent load with each generator carrying its proportionate share.

§ 111.10-30 Temperature limitations.

Generators shall be designed for an ambient temperature of 50° C. When tested in accordance with ANSI C-50 the temperature rises shall not exceed the values given in Tables 111.10-30(a1) and 111.10-30(a2). Where provisions are made for insuring an ambient temperature of 40° C. or less, the temperature rises may be 10° C. higher than the values given in the tables.

TABLE 111.10-30(a1)—LIMITS OF TEMPERATURE RISES FOR DIRECT-CURRENT GENERATORS BASED ON 50° C AMBIENT TEMPERATURE [1]

Part of generator	Limits of temperature rises—degrees centigrade (measured by thermometer) [2] [3]					
	Class A insulation		Class B insulation		Class H insulation	
	Continuous	At end of 2-hour overload	Continuous	At end of 2-hour overload	Continuous	At end of 2-hour overload
All insulated windings other than items next following	40	55	60	75	80	105
Single-layer field windings with exposed uninsulated surfaces and bare copper windings	50	65	70	85	100	125
Cores and mechanical parts in contact with or adjacent to insulation	40	55	60	75	80	105
Commutator and collector rings	55	65	75	85	95	115
German silver or grid shunts on series field windings	175		175		([1])	
Bearings	35		40		([1])	

[1] Special consideration shall be given to other parts of the machine such as bearings, etc.
[2] Where other methods are used refer to ANSI C-50 for temperature rise limits.
[3] For Class F insulation refer to NEMA-MG1.

TABLE 111.10-30(a2)—LIMITS OF TEMPERATURE RISES FOR ALTERNATING-CURRENT GENERATORS BASED ON 50° C. AMBIENT TEMPERATURE [1] [2]

Item	Determined by—	Limits of temperature rises, degrees centigrade [3]					
		Salient pole generators			Turbine type generators		
		Class A insulation	Class B insulation	Class H insulation	Class A insulation	Class B insulation	Class H insulation
Armature windings of machines of 1,500 kva. and less.	Thermometer	40	60	100			
Armature windings of machines of 750 kva. and less.	do				40	60	100
Armature windings with 2 coil sides per slot in stators of machines above 1,500 kva.	Imbedded detector	50	70	110			
Armature windings with 2 coil sides per slot in stators of machines above 750 kva.	do				50	70	110
Insulated field windings	Resistance	50	70	110	80	120	
Collector rings	Thermometer	55	75	115	55	75	115
Cores and mechanical parts in contact with or adjacent to insulation.	do	40	60	100	40	60	100
Bearings	do	35	40	([3])	35	40	([3])

[1] For generators having 25 percent overload rating for 2 hours, the temperature at the end of the overload run when conducted immediately following the continuous run shall not exceed the figures in the table by more than 15° C. except for collector rings which shall be in accordance with the table.

[2] Special consideration shall be given to other parts of the machine such as bearings, etc.

[3] For Class F insulation, refer to NEMA-MG1.

[CGFR 70-143, 35 FR 19907, Dec. 30, 1970; 36 FR 5606, Mar. 25, 1971]

§ 111.10-35 Dielectric strength of insulation.

Generators shall be capable of withstanding without damage a dielectric test in accordance with ANSI C-50.

§ 111.10-40 Tests.

Sufficient tests should be made by the manufacturer to insure that the machine is in accordance with these regulations.

Subpart 111.15—Storage Batteries

§ 111.15-1 General requirements.

(a) *Power and light batteries.* Power and lighting batteries may be of the lead acid or alkaline type, or any other approved type, due consideration being given to suitability for any specific application. The cells shall be constructed so as to prevent spilling of electrolyte due to an inclination of 40° from the normal.

(b) *Emergency and general alarm storage batteries.* When batteries are used for emergency lighting and power loads or for general alarm system loads, the requirements of Part 112 of this subchapter are also applicable.

(c) *Categories.* Batteries shall be classified into three types depending upon power output of the battery charger.

(1) *Large.* Large batteries shall be considered those connected to a battery charger whose output is more than 2 kw. (calculated from the maximum obtainable charging current and the normal voltage of the battery).

(2) *Moderate.* Moderate batteries shall be considered those connected to a battery charger whose output is between 0.2 kw. and 2 kw. (calculated from the maximum obtainable charging current and the normal voltage of the battery).

(3) *Small.* Small size batteries shall be considered those connected to a battery charger whose output is less than 0.2 kw. (calculated from the maximum obtainable charging current and the normal voltage of the battery).

(d) *Nameplates.* Each tray shall be provided with a durable nameplate securely attached, bearing the manufacturer's name or trade mark and type designation, the ampere-hour rating at a specific rate of discharge, and the specific gravity of the electrolyte (for a lead acid battery when fully charged). Data molded on the tray

case will be acceptable in lieu of a nameplate.

§ 111.15-5 Battery installation.

(a) *Large storage batteries.* Large batteries should be installed in a room assigned to batteries only, but may be installed in a box on deck if a room is not available. Lighting equipment installed in a battery room shall be explosion proof suitable for Class I, Group B locations. Devices liable to arc, such as switches, battery chargers, and similar devices shall not be installed in battery rooms. The overload protective device required by § 111.15-25 should be placed in each conductor adjacent to but outside the room. Electric cables other than those serving the battery or battery room lighting should be routed around rather than through the battery room.

(1) A "danger notice" shall be permanently secured to the doors of the battery room or to the covers of battery deck boxes indicating that a naked light or smoking in these rooms or in this vicinity is prohibited.

(b) *Batteries of moderate size.* Batteries of moderate size as described in § 111.15-1(c)(2) should preferably be installed in a battery room or in a box on deck, but may also be installed in a box or locker in some suitable space such as an engineroom, storeroom, or similar space or may be installed open in the engineroom or in a similar well-ventilated compartment if protected from falling objects. Batteries should not be installed in sleeping spaces. Engine cranking batteries should be located as closely as possible to the engine or engines served.

(c) *Batteries of small size.* Batteries of small size as described in § 111.15-1(c) (3) may be installed in such places as open working spaces and boat engine compartments provided that the space is ventilated.

§ 111.15-6 Arrangement.

(a) *Battery trays.* Battery trays should be chocked with wood strips or equivalent to prevent movement and each tray should be fitted with nonabsorbent insulating supports on the bottom and with similar spacer blocks at the sides or with equivalent provisions to secure air circulation space all around each tray. Battery trays should be so arranged that the trays are accessible and with not less than 10 inches head room.

(b) *Tiers.* When batteries are arranged in two or more tiers, all shelves should have not less than 2 inches space front and back for circulation of air.

§ 111.15-10 Ventilation.

(a) *General.* All rooms, lockers, and boxes for storage batteries should be arranged or ventilated to avoid accumulation of flammable gas.

(b) *Battery rooms.* (1) Battery rooms which contain large battery banks as defined in § 111.15-1(c)(1) must be ventilated by mechanical exhaust.

(i) Adequate openings for air inlet, whether or not connected to ducts, must be provided near the floor or the bottom of lockers or boxes. In every case, the quantity of the air expelled must not be less than:

$$(q=3.89\ \text{in.})$$

where:

q=Quantity of expelled air in cubic feet per hour.

i=Maximum charging current during gas formation, or one-fourth of the maximum obtainable charging current of the charging facility, whichever is greater.

n=Number of cells.

(2) All other battery rooms must be ventilated by either—

(i) Ducts installed from the top of the room to the open air with no part more than 45° from the vertical and not containing appliances that impede the free passage of air or gas mixtures, such as flame arresters; or,

(ii) Mechanical exhaust, as provided in the requirements of subparagraph (1) of this paragraph.

(c) *Battery lockers.* Battery lockers should be ventilated, if practicable similarly to battery rooms by a duct led from the top of the locker to the open air or to an exhaust ventilation duct, but the duct may terminate not less than 3 feet above the top of the locker in machinery spaces and similar well-ventilated compartments. Louvers or equivalent should be provided near the bottom for entrance of air.

(d) *Deck boxes.* Deck boxes should be provided with a duct from the top of

the box terminating at least 4 feet above in a gooseneck, mushroom head, or equivalent to prevent entrance of water. Holes for air inlet should be provided on at least two opposite sides of the box. The entire deck box, including openings for ventilation, should be weathertight to prevent entrance of spray or rain.

(e) *Boxes for small batteries.* Boxes for small batteries require no ventilation other than openings near the top to permit escape of gas.

(f) *Power ventilation.* When power ventilation is required:

(1) The system must be separate from ventilation systems for other spaces;

(2) Electric motors, unless of a type which is totally enclosed and explosion proof, must be located outside of the ducts and outside the compartment required to be ventilated;

(3) Blower blades must be a nonsparking combination; and

(4) The system must be interlocked with the battery charger so that the battery cannot be charged without ventilation.

[CGFR 70-143, 35 FR 19907, Dec. 30, 1970, as amended by CGFR 72-35, 37 FR 4961, Mar. 8, 1972]

§ 111.15-15 Protection from corrosion.

(a) Shelves in battery rooms or lockers for acid batteries should have a watertight lining of sheet lead of 1/16-inch thickness carried up not less than 3 inches on all sides. For alkaline batteries the shelves should be similarly lined with steel not less than 1/32-inch thick. Alternatively, a battery room may be fitted with a watertight lead pan for acid batteries, steel for alkaline batteries, over the entire deck, carried up not less than 6 inches on all sides. Deck boxes should be lined in accordance with the above alternative method. Boxes for small batteries should be lined to a depth of 3 inches consistent with the methods described above.

(b) Alternate lining materials may be used in lieu of lead or steel if it can be established that the material is corrosion-resistant to the specified electrolyte used in the batteries.

§ 111.15-20 Conductors.

When conductors enter battery rooms the holes shall be made watertight. All connections within battery rooms shall be resistant to the electrolyte. Cables shall be sealed to resist the entrance of electrolyte by spray or creepage. The size of the connecting cables is to be based on current-carrying capacities given in Table 111.60-1(e)(1)(i) and the starting rate of charge or maximum discharge rate, whichever is the greater, shall be taken into consideration in determining the cable size.

§ 111.15-25 Overload and reverse current protection.

(a) An overload protective device shall be placed in each battery conductor, except that engine cranking batteries and batteries with a nominal potential of 6 volts or less need not be protected against overload. For large storage batteries the overcurrent devices shall be located adjacent to but outside of the battery room.

(b) The charging equipment (except when a rectifier is employed) for all batteries with a nominal voltage more than 20 percent of line voltage shall provide automatic protection against reversal of current.

Subpart 111.20—Transformers

§ 111.20-1 General requirements.

All transformer windings should be treated to resist moisture, sea atmosphere, and oil vapors.

§ 111.20-5 Temperature rise.

(a) The temperature rise, based on an ambient temperature of 40° C., shall not exceed the following:

(1) For Class A insulation: 55° C.

(2) For Class B insulation: 80° C.

(3) For Class H insulation: 150° C.

40-130 O—79——4

(b) If the ambient temperature exceeds 40° C. the transformer shall be derated so that the total temperature given in this section is not exceeded. Temperatures are to be taken by the resistance method of temperature determination.

Subpart 111.25—Motors

§ 111.25–1 General requirements.

The requirements for generators contained in § 111.10–15 (a), (b), (c), (f), (g), (h), (i), and (j) are also applicable to motors, except that § 111.10–15 (c) (f), and (h) are applicable to propulsion motors only.

§ 111.25–5 Nameplates.

(a) All motors shall be fitted with nameplates of corrosion-resistant material. The nameplates shall be marked with the following information:

(1) Manufacturer's type and frame designation;

(2) Output (hp.);

(3) Kind of rating;

(4) Design ambient temperature;

(5) Temperature rise at rated load;

(6) Revolutions per minute at rated load;

(7) Voltage;

(8) Amperes at rated load; and,

(9) Type of winding (for direct-current machines).

(b) For alternating-current motors in addition to the required information listed in paragraph (a) of this section, the nameplates also shall be marked with the following information:

(1) Number of phases;

(2) Frequency;

(3) Power factor (synchronous motors only);

(4) Exciter voltage (synchronous motors only);

(5) Exciter current (synchronous motors only);

(6) Secondary voltage (polyphase wound-rotor induction motors only);

(7) Secondary amperes at rated load (polyphase wound-rotor induction motors only);

(8) For motors rated at ½ horsepower or larger, except a polyphase woundrotor motor, a code letter to show its input in kilovolt-amperes with locked rotor selected from Table 111.25–5(b)(8); and

TABLE 111.25-5(B)(8)—LOCKED ROTOR INDICATING CODE LETTERS—Continued

Code letter	*KVA per hp. with locked rotor*
A	0–3.14
B	3.15–3.54
C	3.55–3.99
D	4.0–4.49
E	4.5–4.99
F	5.0–5.59
G	5.6–6.29
H	6.3–7.09
J	7.1–7.99
K	8.0–8.99
L	9.0–9.99
M	10.0–11.19
N	11.2–12.49
P	12.5–13.99
R	14.0–15.99
S	16.0–17.99
T	18.0–19.99
U	20.0–22.39
V	22.4 and up

(9) For multispeed motors, amperes at rated load for each winding or winding connection.

(c) For nonvital motors, such as winch motors, refrigeration motors, water cooler motors, galley appliance motors, and similar motors, nameplates with standard commercial markings will be acceptable. Nameplates for motors located in corrosive locations shall be made of corrosion-resistant material.

§ 111.25–10 Temperature limitations.

(a) Motors for use in the engine room or boiler room shall be designed for an ambient temperature of 50° C. Motors for use in locations where the ambient temperature will not exceed 40° C. may be designed for an ambient temperature of 40° C. Motors, when tested in accordance with ANSI C-50 shall not exceed the limits of temperature rises given in Tables 111.25–10(a1) and 111.25–10(a2).

TABLE 111.25-10(a1).—LIMITS OF TEMPERATURE RISES FOR DIRECT-CURRENT MOTORS [1]

Part of motor and type of enclosure	Limits of temperature rises; degrees centigrade (thermometer method) [2] [3]					
	Class A insulation		Class B insulation		Class H insulation	
	40° C. ambient temperature	50° C. ambient temperature	40° C. ambient temperature	50° C. ambient temperature	40° C. ambient temperature	50° C. ambient temperature
All insulated windings other than item next following:						
Open and semienclosed	50	40	70	60	110	100
Totally enclosed	55	45	75	65	115	105
Single-layer field windings with exposed uninsulated surfaces and bare copper windings:						
Open and semienclosed	60	50	80	70	130	120
Totally enclosed	65	55	85	75	135	125
Cores and mechanical parts in contact with or adjacent to insulation:						
Open and semienclosed	50	40	70	60	110	100
Totally enclosed	55	45	75	65	.....	.....
Commutators and collector rings:						
All types	65	55	85	75	125	115
Bearings:						
Open and semienclosed	40	35	45	40	([1])	([1])
Totally enclosed	45	40	50	45	([1])	([1])

[1] Special consideration shall be given to other parts of the machine, such as bearings, etc.
[2] Where other methods are used refer to ANSI C-50 for temperature rise limits.
[3] For Class F insulation refer to NEMA-MG1.

TABLE 111.25-10(a2).—LIMITS OF TEMPERATURE RISES FOR ALTERNATING-CURRENT MOTORS [1] [2]

Part of motor and type of enclosure	Limits of temperature rises; degrees centigrade (thermometer method) [3] [4]					
	Class A insulation		Class B insulation		Class H insulation	
	40° C. ambient temperature	50° C. ambient temperature	40° C. ambient temperature	50° C. ambient temperature	40° C. ambient temperature	50 ° C. ambient temperature
Coil windings, cores and mechanical parts in contact with, or adjacent to insulation:						
All except totally enclosed	50	40	70	60	110	100
Totally enclosed	55	45	75	65	115	105
Collector rings, commutators (the class of insulation refers to insulation affected by the heat from the commutator or collector rings, which insulation is employed in the construction of the commutator or collector rings or is adjacent thereto):.						
All types	65	55	85	75	125	
Bearings:						
Open and semienclosed	40	35	45	40	([2])	([2])
Totally enclosed	45	40	50	45	([2])	([2])

[1] Squirrel-cage windings and mechanical parts not in contact with or adjacent to insulation may reach such temperatures as will not be injurious in any respect.
[2] Special consideration shall be given to other parts of the machine, such as bearings, etc.
[3] Where other methods are used refer to ANSI C-50 for temperature rise limits.
[4] For Class F insulation refer to NEMA-MG1.

§ 111.25–15 Duty cycle.

Motors shall be rated for continuous duty, except that motors for the applications listed in Table 111.25-15(a) may be short-time rated motors as indicated. Any other motors of similar duty may have consistent short-time ratings.

TABLE 111.25-15(a)

Application of motor	*Minimum short-time rating of motor in hour*
Deck winch and direct acting capstan.	½.
Deck winch with hydraulic transmission..	Continuous at no load, followed by ½ hour at full load.
Direct acting windlass	¼.
Windlass with hydraulic transmission..	½ hour idle pump operation followed by ¼ hour full load operation.
Steering gear, direct acting	1.
Steering gear, indirect drive	Continuous operation at 15 percent load followed by 1 hour at full load.
Watertight door operators	½[2].
Lifeboat winches	⅓[3].

§ 111.25-20 Dielectric strength of insulation.

Motors shall be capable of withstanding without damage a dielectric test in accordance with ANSI C-50.

§ 111.25-25 Terminal arrangement.

All motors shall be provided with terminal leads in terminal boxes secured to the frames. Terminal boxes shall be dripproof or watertight, consistent with the motor enclosure. The ends of motor terminal leads shall be fitted with connectors. As an alternate to this arrangement, the frames of motors may be fitted with terminal tubes through which the cable shall pass to suitable terminals inside the frame.

§ 111.25-30 Enclosure and protection.

(a) *General.* Motors for use in the engineroom or spaces where subject to mechanical injury, or dripping of oil or water, shall be either of the waterproof or dripproof protected type, or they may be of the open type if protected in accordance with § 111.10-15(g). Care shall be exercised in locating motors high enough to avoid bilge water. Motors shall not be located beneath and covered by the floorplates unless otherwise approved by the Commandant.

(b) *Pump motors.* Motors for operating plunger and close coupled pumps should have the driving end entirely enclosed or designed to prevent leakage from entering the motor.

(c) *Motors for use on weather decks.* Motors for use on weather decks shall be of the waterproof type or shall be enclosed in waterproof housings, drained as described in § 110.15-175(k) of this subchapter.

(d) *Motors installed below decks.* Motors installed below decks should be located in as dry a place as practicable and proximity to steam, water, and oil piping should be avoided.

(e) *Motors for hazardous locations.* Motors for use in hazardous locations shall comply with the requirements of § 111.80-5.

§ 111.25-35 Current ratings.

For continuous duty motors, the current values given in the Table 111.25-35 (a) shall be used for the purpose of determining the current-carrying capacity of conductors, switches, branch-circuit overcurrent devices, etc., in lieu of the actual current ratings marked on the motor nameplate. For multi-speed motors, for motors of unusual speeds, and for other than continuous duty motors, the nameplate current values shall be used. The motor-running overcurrent protection shall be based on the motor nameplate current rating or ratings.

TABLE 111.25-35(a)—APPROXIMATE FULL-LOAD CURRENTS OF CONTINUOUS DUTY MOTORS[1]

Motor horsepower	Full-load current—amperes					
			3-phase, alternating-current induction motors			
	Direct-current motors		Squirrel-cage		Wound-rotor	
	115 volts	230 volts	220 volts	440 volts	220 volts	440 volts
1/16	2.0	1.0	0.90	0.45	.....	.....
¼	2.6	1.3	1.16	.58	.....	.....
⅓	3.2	1.6	1.4	.70	.....	.....
½	4.5	2.3	1.9	.95	.....	.....
¾	6.5	3.3	2.6	1.3	.....	.....
1	8.5	4.3	3.4	1.7	5.4	2.7
1¼	10.5	5.3	.....	.....	.....	.....
1½	12.5	6.3	5.0	2.5	6.8	3.4
1¾	14.5	7.3	5.8	2.9	7.2	3.6
2	16.3	8.3	6.3	3.1	8.0	4.0
2½	20.5	10.3	7.6	3.8	8.8	4.4
3	23	12.3	9.0	4.5	10.5	5.3
4	31	16.0	.....	.....	.....	.....
5	40	19.8	14.5	7.2	16	8.0

TABLE 111.25-35(a)—APPROXIMATE FULL-LOAD—Continued

CURRENTS OF CONTINUOUS DUTY MOTORS [1]

Motor horsepower	Full-load current—amperes					
			3-phase, alternating-current induction motors			
	Direct-current motors		Squirrel-cage		Wound-rotor	
	115 volts	230 volts	220 volts	440 volts	220 volts	440 volts
6	47	23.4	17.2	8.6	18	9
7½	58	28.7	21	10.5	23	11.5
9	68	34.3	24.8	12.4	26	13
10	75	38	26	13.5	29	14.5
12½	93	47	34	17	36	18
15	112	56	40	20	42	21
17½	131	65	46	23	48	24
20	150	74	52	26	54	27
22½	167	83	58	29	60	30
25	185	92	65	32	68	34
27½	202	101	70	35	72	36
30	220	110	78	39	80	40
35	257	128	92	46	94	47
40	294	146	102	51	104	52
45	329	163	116	58	116	58
50	364	180	126	63	128	64
60	432	215	152	76	154	77
75		265	188	94	188	94
100		353	250	125	250	125
125		440	310	155	310	155
150		535	370	185	370	185
200		720	490	245	490	245

[1] Table 111.25-35(a) gives values that are approximate, and typical only of motors for usual speeds and frequencies. For low speed and special motors, the full-load currents are somewhat higher than the values shown. For this reason, the values shown should be used only for estimating purposes and the selection of cable. They should not be used in the selection of overload relay heaters and coils.

[CGFR 70-143, 35 FR 19907, Dec. 30, 1970; 36 FR 5606, Mar. 25, 1971]

Subpart 111.30—Switchboards

§ 111.30-1 General requirements.

(a) *General.* Controlling appliances for propulsion and ship's service equipment should include the apparatus necessary for starting, stopping, reversing, and controlling the speed of motors, together with essential safety devices. All wearing parts are to be readily renewable.

(b) *Switchboard installation and location.* Switchboards shall be installed in as dry a place as possible. Switchboards shall be secured to a solid foundation, shall clear overhead deck beams by at least 4 inches and shall be either self-supporting or braced to the bulkhead or deck above. In case the latter method is used, means of bracing shall be flexible to allow deflection of the ship's structure without buckling the control cell or assembly structure. In a passenger ship where there is only one main generating station, the main switchboard shall be located in the same main fire zone. A clear working space of not less than 36 inches shall be provided in front of the switchboard. Working space in the rear of the switchboard shall not be less than the values shown in Table 111.30-1(b) unless specifically approved otherwise or construction is in accordance with paragraph (b)(1) of this section.

(1) Where the size or design of a vessel precludes the use of switchboards with adequate clear working space in the rear of the switchboard, the switchboard may be constructed to be accessible from the front only. In addition to the construction requirements in this support, switchboards, accessible from the front only shall be constructed to meet the following requirements unless specifically approved otherwise:

(i) Mounting panels for fuses, instrument transformers, transducers and the like shall be mounted within 20 inches of the front of the switchboard.

(ii) Horizontal pans of sheet metal, expanded metal, or substantial screen shall be placed at the bottom of cubicles containing fuses, instrument transformers, etc., to prevent dropping tools into live buses.

(iii) Bus bars where taps are taken off shall be located within 20 inches of the front of the switchboard. Where it is necessary to locate bus bars deeper than 20 inches in order to accommodate large circuit breakers, such circuit breakers shall be the draw-out type.

(iv) Primary bus bars shall be accessible through removable panels.

TABLE 111.30-1(b)—WORKING SPACE IN REAR OF SWITCHBOARDS

Potential between phases or conductors of opposite polarity	Switchboard width	Clear working space in rear of switchboard in inches	
		Accessible from one end only	Accessible from both ends
50 volts or less	Single panel not exceeding 42 inches in width	[1] 24	18
	More than one panel or single panel exceeding 42 inches in width.	[1] 30	24
Over 250 volts but less than 600 volts.	Single panel not exceeding 42 inches in width	[1] 30	24
	More than one panel or single panel exceeding 42 inches in width.	[1] 36	30
600 volts or over	Any width	[1]38	[1]38

[1] May be reduced not more than 6 inches in way of stiffeners and frame or by equipment on a single panel in the switchboard.

(v) There shall be at least 6 inches between adjacent rows of circuit breakers.

(vi) Deck mounted switchboards shall have the spaces between the switchboard enclosure and the vessel's structure covered over by sheet metal to prevent the accumulation of dirt in inaccessible places.

(c) *Switchboard mechanical protection.* The sides of switchboards shall be enclosed and the space in the rear of switchboards made inaccessible to other than qualified persons. Nonconducting mats or gratings shall be provided on deck in the front and rear of switchboards. Nonconducting handrails at the front and nonconducting guardrails at the rear shall be provided. Each switchboard shall have a drip-cover over the top. Hinged panels of dead front switchboards shall be provided with positioners and stops.

(d) *Switchboard construction.* Switchboards shall be of sturdy construction with a metal frame. Insulating material used as panels, bases, bus and connection supports should be made of impregnated ebony, asbestos, laminated phenolic material or any incombustible equivalent. Panels may be made of metal if the live parts mounted thereon are properly insulated. The supporting framework for all panels is to be of rigid construction. No wood should be used in the construction of switchboards except that hardwood or nonconducting handrails and guardrails shall be provided for the protection of personnel from live parts.

(e) *Dead front type switchboard.* Dead front type switchboards shall be used where the voltage between poles or to ground is above 250 volts direct current or 55 volts alternating current.

(f) *Corrosion-resistant parts.* Parts of switchboards and control assemblies liable to damage by corrosion should be made of noncorrodible material or of material made corrosion resistant.

(g) *Mechanical strength of working parts.* All levers, handles, handwheels, interlocks and their connecting links, shafts and bearings for the operation of switches and contactors should be of such proportions that they will not be broken or distorted by manual operation.

(h) *Nameplates.* Nameplates shall be provided for each (piece of apparatus to indicate clearly its service. Nameplates for feeders and branch circuits shall include the circuit designation, description of the load served, and the rating or setting of the overcurrent protective device.

(i) *Protection of instrument circuits.* Except as otherwise provided in this paragraph, instruments, pilot lights, ground detector lights, potential transformers, and other switchboard devices shall be supplied by circuits protected by overcurrent devices.

(1) Circuits, the opening of which would create a hazard in the operation

of the vessel, shall not be protected against overcurrent. Such circuits will usually include electric propulsion control circuits, voltage regulator supply circuits, and ship's service generator circuit breaker tripping control circuits.

(2) The secondary circuit of a current transformer shall not be fused. When a current transformer supplies electrical energy to a device located remote from the current transformer, the circuit extending from the current transformer shall be protected by a film cutout or high voltage protector which will short the transformer in case of an open circuit.

(j) *Grounding of instruments, relays, meters, and instrument transformers.* Metal cases of instruments, relays, meters, and instrument transformers and the secondary windings of instrument transformers located on switchboards shall be grounded.

[CGFR 70-143, 35 FR 19907, Dec. 30, 1970; 36 FR 5606, Mar. 25, 1971]

§ 111.30-5 Switchboard bus bars and wiring.

(a) *General.* Buses shall be designed on the basis of generator capacity and feeder loads. For a single generator, the generator bus shall have a capacity not less than the continuous rating of the generator plus any overload rating in excess of 30 minutes' duration. For more than one generator with all generating capacity feeding through one section of the bus, the capacity of the bus for the first generator shall be the same as for a single generator. For each subsequent generator the bus capacity shall be increased by 80 percent of the continuous rating of each added generator. The capacity of connection buses for each generator unit shall be not less than the continuous rating of the generator plus any overload rating in excess of 30 minutes' duration. All other bus bars and bus connections shall be designed for at least 75 percent of the combined fullload rated currents of all apparatus they supply, plus not less than 50 percent of the combined ratings of the spare switches or circuit breaker elements connected to the bus, except that when feeders supply one unit or any group of units in continuous operation they shall be designed for full load, and except that the capacity of feeder buses need not be greater than the generator buses that supply them.

(b) *Bus bar rating.* Bus bar sizes shall be not less than that indicated for the ampere ratings in Table 34 (appendix) of IEEE Standard No. 45.

(c) *Arrangement of bus bars and wiring.* The arrangement of bus bars and wiring on the back of switchboards shall be such that all lugs are readily accessible. Soldering lugs, where used, should have a solder contact length at least 1½ times the diameter of the conductor and all nuts and connections should be fitted with locking devices to prevent loosening due to vibration.

(d) *Spacings.* Except at switching mechanisms, contactors, pilot lights, and similar switchboard mounted equipment, the spacings in a switchboard shall be not less than those indicated in Table 111.30-5(d). Spacings at switchboard mechanisms, contactors, pilot lights, and similar switchboard mounted equipment shall conform to the requirements for the respective equipment as required by this subchapter.

TABLE 111.30-5(d)—SWITCHBOARD SPACINGS

Voltage involved	Minimum spacing in inches between live parts of opposite polarity		Minimum spacing in inches through air or over surfaces between uninsulated live-metal parts and grounded dead metal.
	Over surface	Through air	
125 or less	¾	½	½
126 through 250	1¼	¾	½
251 through 600	2	1	1

(e) *Switchboard wiring.* Instrument and control wiring should be of the stranded type not smaller than 4,000 CM and should have flame-retarding insulation. Wiring from hinged panels should be of the extra flexible type.

§ 111.30-10 Switchboard mounted equipment.

(a) *General.* Air circuit breaker contacts shall be kept at least 12 inches from the ship's structure unless insu-

lation barriers are installed. For live front switchboards the clearance between current-carrying parts and base channel shall not be less than 4 inches. Voltage regulator element shall be totally enclosed. Where rheostats or other devices that may operate at high temperatures are mounted on the switchboard, they shall be naturally ventilated and so isolated by barriers as to prevent excessive temperature of copper or adjacent devices. When this cannot be accomplished the rheostat or other device shall be mounted separate from the switchboard. In general, all fuses, except for instrument and control circuits, shall be mounted on or be accessible from the front of the switchboard. All wiring on the back of boards for voltmeter, pilot and ground lamps shall be protected by fuses.

(b) *Equipment.* Contactors, relays, switches, circuit breakers, etc., shall conform to the applicable requirements of such devices given in this subchapter.

(c) *Connections.* The connections between a direct-current generator and the bus bars shall be in accordance with Figures 1 to 10, inclusive, appendix, IEEE Standard No. 45. Other connections not less effective will be considered.

§ 111.30-15 Ship's service generator and distribution switchboards.

(a) *General.* Ship's service generator and distribution switchboards must provide adequate control of the generation and distribution of electric power.

(b) *Equipment for direct-current switchboards.* For direct-current switchboards, in addition to complying with paragraph (a) of this section, the following equipment shall be required:

(1) An unfused generator switch or links which will completely disconnect the generator and its circuit breaker from the bus. This disconnecting means need not be provided if the generator circuit breaker is of the drawout type which either disconnects all conductors, or, in the case of dual voltage systems, disconnects all ungrounded conductors or disconnecting links and is supplemented by a switch in the generator neutral conductor. For generators and switchboards in separate spaces see § 111.50-5(a)(1).

(2) For 2-wire machines, an ammeter for each generator and, for 3-wire machines, an ammeter for each positive and negative lead and a center zero ammeter in the ground connection at the generator switchboard. Ammeters shall be so located in the circuits as to indicate total generator current.

(3) For each 2-wire generator, a voltmeter with voltmeter switch for connecting the voltmeter to indicate generator voltage and bus voltage. Where a shore connection is installed, one of these voltmeter switches shall also provide for reading shore connection voltage.

(4) For each 3-wire generator, a voltmeter with voltmeter switch for connecting the voltmeter to indicate generator voltage, positive to negative, and bus voltage positive to negative, positive to neutral, and neutral to negative. Where a shore connection is installed, one of these voltmeter switches shall provide also for reading shore connection voltage, positive to negative, positive to neutral, and neutral to negative.

(5) A field rheostat for each generator.

(6) A pilot lamp for each generator connected between generator and circuit breaker.

(7) Adequate means for ground detection shall be provided on the ship's service generator and distribution switchboard for the following systems: ship's main power system, ship's main lighting system, and ship's emergency lighting system.

(i) When the ground detection means for these systems are ground lamps, a normally closed spring-return-to-normal switch shall be provided in the ground connection.

(ii) If lamps are used for ground detection they shall have a rating of not more than 25 watts nor less than 5 watts operating at approximately one-half voltage in the absence of grounds.

(iii) For dual voltage direct current systems, a zero center ammeter with a full-scale deflection of 150 percent of the neutral current rating shall be provided to indicate the presence and the polarity of the ground.

(8) A circuit breaker or fused switch for each shore power feeder installed, with a pilot light connected to the shore side thereof.

(c) *Equipment for alternating-current switchboards.* For alternating-current switchboards, in addition to complying with paragraph (a) of this section, the following equipment shall be required:

(1) An unfused generator switch or links which will completely disconnect the generator and its circuit breaker from the bus. This disconnecting means need not be provided if the generator circuit breaker is of the drawout type which either disconnects all conductors, or, in the case of dual voltage systems, disconnects all ungrounded conductors and is supplemented by a switch or disconnecting links in the generator neutral conductor. For generators and switchboards in separate spaces see section 111.50-5(a)(1).

(2) An ammeter for each generator with a selector switch to read the current of each phase.

(3) A voltmeter for each generator with voltmeter switch for connecting the voltmeter to read generator voltage of each phase and bus voltage of one phase; where a shore connection is installed, one of these voltmeter switches shall provide also for reading voltage of each phase of the shore connection.

(4) A synchroscope and synchronizing lamps with selector switch to provide for paralleling in any combination.

(5) Control for prime mover speed for paralleling.

(6) An indicating wattmeter for each generator arranged for parallel operation.

(7) A frequency meter with selector switch to connect to any generator.

(8) A field rheostat for each generator and each exciter.

(9) A double-pole field switch with discharge clips and resistor for each generator.

NOTE: For generators with variable voltage exciters or rotary amplifier exciters, each controlled by a voltage regulator unit acting on the exciter field, the field switch, the discharge resistor and the generator field rheostat may be omitted.

(10) A pilot lamp for each generator connected between generator and circuit breaker.

(11) A voltage regulator complete with all accessories, including a voltage regulator functional cutout switch.

(12) Adequate means for ground detection.

(i) For ungrounded systems, see section 111.30-15(b)(7) for details of the ground indicator lamps.

(ii) For dual-voltage, grounded-neutral, alternating current distribution systems, an ammeter shall be provided to indicate current flowing in the ground connection. The ammeter shall have a full scale range of 10 amperes. An ammeter switch of the spring return to "on" (ammeter read) type shall be provided. Where the ammeter is located remote from the ground connection and a current transformer is used, a suitable protective device shall be provided near the current transformer to prevent high voltage in the event of an open circuit. The ammeter and associated equipment shall be capable of sustaining without damage the maximum fault current available.

(13) A circuit breaker or fused switch for each shore power feeder installed, with a pilot light connected to the shore side thereof.

[CGFR 70-143, 35 FR 19907, Dec. 30, 1970; 36 FR 5606, Mar. 25, 1971]

§ 111.30-20 Emergency and interior communication switchboards.

Emergency and interior communication switchboards when fitted shall comply with the applicable provisions of § 111.30-15 and of Part 112 of this subchapter.

§ 111.30-30 Tests for switchboards.

(a) Switchboards shall meet the test requirements of section 35, American Bureau of Shipping Rules for the Classification and Construction of Steel Vessels.

Subpart 111.35—Electric Propulsion

§ 111.35-1 Electric couplings.

(a) *Enclosure and ventilation.* Electrical couplings shall be enclosed and ventilated as required for generators.

All windings shall be specially treated to resist moisture, oil, and salt air.

(b) *Accessibility for repairs.* The couplings should be designed to permit removal as a unit without moving the engine.

(c) *Excitation.* Excitation should be provided as for propulsion generators and motors.

(d) *Nameplates.* All electric propulsion couplings shall be fitted with nameplates of corrosion-resistant material. The nameplates shall be marked with the following information:

(1) Manufacturer's type and frame designation;

(2) Output (hp);

(3) Kind of rating;

(4) Design ambient temperature;

(5) Temperature rise at rated load;

(6) Revolutions per minute at rated load;

(7) Voltage;

(8) Exciter voltage; and,

(9) Exciting current in amperes at rated load.

(e) *Temperature limitations.* The limits of temperature rise should be the same as for alternating-current generators, except that when a squirrel-cage element is used the temperature of this element may reach such values as are not injurious. Depending upon the cooling arrangements the maximum temperature rise may occur at other than full load rating so that heat runs will require special consideration; for this purpose, when an integral fan is fitted the coupling temperatures should not exceed these limits when operated continuously at 70 percent of full load r.p.m., full excitation and rated torque.

(f) *Electric coupling control equipment.* Electric coupling control equipment should be combined with the prime-mover speed and reversing control and should include a two-pole disconnect switch, short circuit protection only, ammeter for reading coupling current discharge resistor and interlocking to prevent energizing the coupling when the prime-mover control levers are in an inappropriate position.

§ 111.35-5 Electric propulsion control.

(a) General: The arrangement of bus bars and wiring on the back of propulsion control assemblies should be such that all parts, including the connections are accessible. Adequate clearance should be provided between parts of opposite polarity and between live parts and ground to prevent arcing. All nuts and connections should be fitted with locking devices to prevent loosening due to vibration.

(b) Prime mover control: Where required by the system of control, means should be provided at the control assembly for controlling the prime-mover speed and for mechanically tripping the throttle valve.

(c) Protection: The control assembly should be protected at the sides and back, by a wire mesh, expanded metal grill, or other means if a bulkhead does not perform this function. The access doors to high voltage compartments should be interlocked to prevent opening unless the main generator field circuit is de-energized. A warning plate giving the maximum voltage inside the enclosure should be provided on all doors entering the enclosure. Where steam and oil gages are mounted on the main control assembly, provision should be made so that the steam or oil will not come in contact with the energized parts in case of leakage.

(d) Switches: All switches are to be arranged for manual operation and so designed that they will not open under ordinary shock or vibration; contractors, however, may be operated pneumatically, by solenoids, or by other means in addition to the manual method which should be provided unless otherwise approved. Generator and motor switches should preferably be of the air-break type but for alternating-current systems, where they should be designed to open full load current at full voltage, oil-break switches using nonflammable liquid may be used if provided with leakproof nonspilling tanks. Where necessary, field switches should be arranged for discharge resistors, unless discharge resistors are permanently connected across the field. For alternating-current systems, means should be provided for de-energizing the excita-

tion circuits by the unbalance relay and ground relay.

(e) Interlocks: All levers for operating contactors, line switches field switches and similar devices should be interlocked to prevent their improper operation. Interlocks should be provided with the field lever to prevent the opening of any main circuits without first reducing the field excitation to zero, except that when the generators simultaneously supply power to an auxiliary load apart from the propulsion, the field excitation need only be reduced to a low value.

(f) Instruments and markings: The necessary instruments to indicate existing conditions at all times are to be provided and mounted on the control panel convenient to the operating levers and switches. Instruments and other devices mounted on the switchboard are to be plainly labeled and the instruments provided with a distinguishing mark to indicate full load conditions. Metallic cases of all permanently installed instruments and the secondary windings of instrument transformers shall be permanently grounded.

(g) Locations: Either wheelhouse or engineroom control may be used; however, when wheelhouse control is used an arrangement shall be provided whereby the propulsion equipment can also be controlled from the engineroom, except when otherwise approved for small vessels for limited service. When the equipment is arranged for control from two or more stations, a selector switch shall be provided for connecting the control circuit to the delegated station controller. This selector switch shall be interlocked to prevent transfer of the control without removing power and to prevent restarting from the incoming control station until the control is first returned to the "Off" position.

(h) Indicators:

(1) When two or more control stations are provided, indicating lights should be located at each control to show the station which is in control.

(2) When two or more control stations are provided, additional indicating lights should be located at each control station, except at the engineroom control, to show whether the field circuits are energized or de-energized.

(3) A propeller shaft speed indicator should also be provided at each control station.

(i) Multiple units: Systems having two or more propulsion generators or two or more motors on one propeller shaft should be so arranged that any unit may be cut out of service without preventing the operation of the remaining units.

(j) Ground detection and protection from electrical faults: Ground detection together with means of protecting the propulsion generators and motors from electrical faults should be provided. For alternating-current systems, the grounding arrangment of the generator neutral should limit the current at full load voltage to not more than 20 amperes upon a fault to ground in the propulsion system. Phase unbalance and ground relays should be provided which will open the generator and motor field circuits upon the occurrence of a fault. For direct-current systems the ground detector may consist of a voltmeter or lights. Provision should be made for protection against severe overloads, excessive currents, and electrical faults likely to result in damage to the plant. Protective equipment should be capable of being so set as not to operate on the overloads or overcurrents experienced in a heavy seaway or when maneuvering.

(k) Features for other services: If the propulsion generator is used for other purposes than for propulsion, such as dredging, cargo oil pumps, and other special services, overload protection in the auxiliary circuit and means for making voltage adjustments should be provided at the control board. When propulsion alternating-current generators are used for other services for operation in port, the port excitation control should be provided with a device that should operate just below normal idling speed of the generator to automatically remove excitation.

(l) Propulsion control apparatus shall meet the test requirements of section 35 of the American Bureau of Shipping "Rules for Building and Classing of Steel Vessels".

Subpart 111.40—Distribution Panelboards (Switchboard and Panelboard Types)

§ 111.40-1 General requirements.

(a) *Location.* Panelboards should be located in accessible positions and not in such spaces as bunkers, storerooms, cargo holds, compartments allotted alternately to passengers or cargo or locations exposed to the weather.

(b) *Enclosure.* The enclosure of distribution panelboards shall be as follows:

(1) *Switchboard type.* Distribution panels of the switchboard type, unless installed in machinery spaces or in compartments assigned exclusively to electric equipment and accessible only to qualified personnel, shall be completely enclosed or otherwise protected against accidental contact and unauthorized operation.

(2) *Panelboard type.* Panelboards not exposed to moisture, and particularly flush mounted panelboards in way of joiner work in passenger and crew accommodations and public spaces, may be of nonwatertight construction. Elsewhere panelboards generally shall be of dripproof construction.

(3) *Watertight panelboards.* Where panelboards must be located where a watertight enclosure is necessary, the switches shall be externally operative.

(c) *Locking.* The cabinet or enclosing case of panelboards shall be locked closed where accessible to passengers.

(d) *Construction.* Switchboard type panelboards shall conform to the applicable requirements of subpart 111.30 except that units constructed to be completely serviced from the front need not be accessible from the rear. Unspecified panelboard construction details shall conform with the requirements of Underwriters' Laboratories, Inc., Standard for Panelboards.

(e) *Switching devices.* Panelboards for distribution to motors, appliances, lighting, or other branch circuits, except general alarm circuits, shall be fitted with multipole switches or circuit breakers having a pole for each conductor. Overcurrent protection shall be provided for each ungrounded conductor of feeders and each conductor of branch circuits. For setting of overcurrent devices see Subpart 111.50. The rating of the disconnecting device shall be coordinated with the voltage and current requirements of the load, and in no case less than 30 amperes.

(f) *Overcurrent protection of and number of overcurrent devices on one panelboard.* Not more than 42 overcurrent devices of a lighting or appliance branch circuit panelboard shall be installed in any one cabinet. Panelboards supplying lighting and appliance branch circuits and panelboards having switching devices rated at 30 amperes or less shall have overcurrent protection not in excess of 200 amperes.

(g) *Relative arrangement of switches and fuses.* Panelboards having switches on the load side of any type of fuses shall not be installed.

(h) *Directory.* Panelboard switching units shall be numbered and the panelboard provided with a circuit directory card and cardholder. After installation the directory card shall be marked for each circuit with the circuit designation, description of load served, and the rating or setting of the appropriate overcurrent protective device.

Subpart 111.50—Overcurrent Protection

§ 111.50-1 Installation of overcurrent protective devices.

(a) *General requirements.* Overcurrent protection for conductors is provided for the purpose of opening the electric circuit if the current reaches a value which will cause an excessive or dangerous temperature in the conductor or conductor insulation. A grounded conductor is considered to be protected from overcurrent if a protective device of a suitable rating or setting is provided in each ungrounded conductor of the same circuit, except as otherwise required by paragraph (d) of this section. For the minimum size of the grounded neutral conductor of a multiwire feeder see Table 111.60-10.

(b) *Overcurrent protection of conductors.* Conductors shall be protected in accordance with their current-carrying capacities, as given in Tables

111.60-1(e)(1)(i) and 111.60-1(e)(1)(ii), except as follows:

(1) *Fuses.* If the allowable current-carrying capacity of the conductor does not correspond to a standard size fuse, the next larger size or rating may be used but not exceeding 150 percent of the allowable current-carrying capacity of the conductor. Plug fuses and fuseholders (see § 111.50-15(b)) shall not be used in circuits exceeding 125 volts between conductors. The screw shell of plug-type fuseholders shall be connected to the load of the circuit.

(2) *Circuit breakers.* If the allowable current-carrying capacity of the conductor does not correspond to a standard rating of circuit breakers, the next larger rating may be used but not exceeding 150 percent of the allowable current-carrying capacity of the conductor. The effect of the temperature on the operation of thermally controlled circuit breakers should be taken into consideration in the application of such circuit breakers when they are subjected to extremely low or extremely high temperatures.

(c) *Thermal devices.* Thermal cutouts, thermal relays, and other devices not designed to open short circuits, shall not be used for protection of conductors against overcurrent due to short circuits or grounds, but may be used to protect motor branch circuit conductors from overload if said devices are protected in accordance with § 111.70-15(m).

(d) *Ungrounded conductors.* An overcurrent device (fuse or overcurrent trip unit of a circuit breaker) shall be placed in each ungrounded conductor. A branch switch or circuit breaker shall open all conductors of the circuit, including grounded conductors. Individual single-pole circuit breakers with operating handles yoked together may be used for the protection of each conductor of ungrounded two-wire circuits.

(e) *Grounded conductor.* No overcurrent device shall be placed in any permanently grounded conductor, except as permitted in this paragraph.

(1) *Simultaneous opening.* When the overcurrent device simultaneously opens all conductors of the circuit.

(2) *Motor-running protection.* For motor-running protection as provided in § 111.70-15(i) and (j).

§ 111.50-5 Location of overcurrent protective devices.

(a) *Location in circuit.* Overcurrent devices shall be located at the point where the conductor to be protected receives its supply, except as provided by this paragraph.

(1) The generator overcurrent protective device shall be located on the ship's service generator switchboard when the generator and switchboard are located in the same space or when the generator and switchboard are located in different spaces but not separated by more than 25 feet. When the generator and switchboard are located in different spaces and separated by more than 25 feet, the generator overcurrent protective device shall be located in the same space as the generator.

(2) The overcurrent protection for shore connection conductors shall be located on the switchboard to which connected.

(3) If the overcurrent device protecting the larger conductors also protects the smaller conductors in accordance with Tables 111.60-1(e)(1)(i) and 111.60-1(e)(1)(ii).

(4) If the smaller conductors have a current-carrying capacity of not less than the sum of the allowable current-carrying capacities for the conductors of the one or more circuits or loads supplied, and the tap is not over 5 feet long and does not extend beyond the switchboard, panelboard, or control device which it supplies.

(5) If the smaller conductors have a current-carrying capacity at least one-third that of the conductor from which they are supplied, and provided the tap is suitably protected from mechanical injury, is not over 25 feet long, and terminates in a single circuit breaker or set of fuses which will limit the load on the tap to that allowed by Tables 111.60-1(e)(1)(i) and 111.60-1(e)(1)(ii). Beyond this point the conductors may supply any number of circuit breakers or sets of fuses.

(b) *Location on vessel.* Overcurrent devices shall be located where they will be readily accessible; not exposed

to mechanical injury; not in the vicinity of easily ignitible material nor where explosive gas or vapor may accumulate; and, preferably in combination with distribution panelboards, switchboards, motor controllers, and similar electrical equipment.

[CGFR 70-143, 35 FR 19907, Dec. 30, 1970; 36 FR 5606, Mar. 25, 1971]

§ 111.50-10 Enclosures for overcurrent protective devices.

(a) *General.* Overcurrent devices shall be enclosed in metal boxes or cabinets, unless a part of a specially approved assembly which affords equivalent protection, or unless mounted on switchboards, panelboards, or controllers located in compartments or enclosures free from easily ignitible material and accessible only to qualified persons. The operating handle of a circuit breaker may be accessible without opening a door or cover.

(b) *Exposed to weather.* Enclosures for overcurrent devices shall not be installed in locations exposed to the weather, unless unavoidable, in which case the enclosure shall be watertight.

(c) *Disconnection of fuses and thermal cutouts.* Disconnecting means shall be provided on the supply side of and adjacent to all cartridge fuses or thermal cutouts so that each individual circuit containing fuses or thermal cutouts can be independently disconnected from the source of electrical energy except as indicated in this paragraph.

(1) Instrument fuses located on switchboards operating at potentials not exceeding 600 volts need not have a disconnecting device provided a fuse puller is available.

(2) A single disconnecting means may be used to disconnect a group of circuits each protected by fuses or thermal cutouts under the conditions described in § 111.70-30(o).

(3) No disconnect means shall be provided for general alarm feeders and branch circuits covered by § 113.25-10(b) of this chapter.

(d) *Arcing or suddenly moving parts.* Arcing or suddenly moving parts shall comply with the requirements of this paragraph.

(1) Fuses and circuit breakers shall be so located or shielded that persons will not be burned or otherwise injured by their operation.

(2) Handles or levers of circuit breakers, and similar parts which may move suddenly in such a way that persons in the vicinity are liable to be injured by being struck by them, shall be guarded or isolated.

§ 111.50-15 Construction and use of overcurrent devices.

(a) *Fuse types prohibited.* Plug fuses of the Edison-base type and renewable link cartridge-type fuses shall not be used.

(b) *Plug fuses and fuseholders of Type S.* Plug fuses and fuseholders of Type S may be employed for applications at not over 125 volts; 0 to 15 amperes, 16 to 20 amperes, and 21 to 30 amperes.

(c) *Cartridge fuses and fuseholders.* National Electrical Code standard nonrenewable cartridge fuses may be used for applications not exceeding 600 volts, 0 to 600 amperes. Special cartridge fuses may be used in instruments and the like when specifically approved.

(d) *Construction and marking of fuses.* Fuses shall be constructed in accordance with Underwriters' Laboratories, Inc., "Standard for Fuses." Standard cartridge fuses shall be marked with the label of Underwriters' Laboratories, Inc. Special cartridge fuses shall be inspected under Underwriters' Laboratories, Inc., reexamination service.

(e) *Circuit breakers.* Circuit breakers shall conform to the requirements contained in this paragraph.

(1) *Method of operation.* In general, circuit breakers shall be capable of being closed or opened by hand without employing any other source of power, although normal operation may be by other power such as electrical, pneumatic, and the like. Large circuit breakers which are to be closed and opened by electrical, pneumatic, or other power shall be capable of being closed by hand for maintenance purposes and shall also be capable of being tripped by hand under load without the use of power.

(2) *Injury to operator.* Circuit breakers shall be arranged and mounted so that their operation is not likely to injure the operator.

(3) *Indication.* Circuit breakers shall indicate whether they are in the open or closed position.

(4) *Nontamperable.* An air circuit breaker, used for branch circuits, shall be of such design that any alteration of its trip point (calibration), or in the time required for its operation, will be difficult.

(5) *Marking.* Circuit breakers shall be marked with their rating in such a manner that the marking will be visible after installation.

(6) *Construction and interrupting rating.* The construction and rating of feeder and branch-circuit circuit breakers rated not more than 600 amperes and not more than 600 volts shall conform with the requirements of Underwriters' Laboratories, Inc., "Standard for Branch Circuit and Service Circuit Breakers," except as indicated in this subparagraph.

(i) Circuit breakers installed in enginerooms, boilerrooms and auxiliary machinery spaces shall be calibrated for an ambient temperature of 50° C. and circuit breakers so calibrated may be used in other locations.

(ii) Circuit breakers with interrupting ratings of over 10,000 amperes should be rated according to the applicable National Electrical Manufacturers Association standard.

(7) *Removable from front.* Circuit breakers of the molded-case type when installed on generator or distribution switchboards shall be mounted or arranged in such a manner that the circuit breaker may be removed from the front without first disconnecting copper or cable connections or deenergizing the supply.

§ 111.50–20 Interrupting rating of fuses and circuit breakers.

(a) *General.* All circuit breakers and all fuses shall have sufficient interrupting capacity to interrupt the maximum short circuit current available at the point of application of the circuit breaker or fuse in the electrical system. This paragraph does not prohibit the use of circuit breakers incorporating current limiting fuses.

(b) *Current limiting fuses.* If a current limiting fuse is used its selection and application shall be governed by the following design parameters:

(1) The maximum fuse rating shall be selected which will give adequate protection, on fault currents, to the device it backs up. In no case shall the device being backed up be called upon to interrupt fault currents in excess of 90 percent of its interrupting rating.

(2) Fault currents cleared by the device backed up shall not cause damage or any change in the time-current characteristics of the current-limiting fuse.

(3) Fuses should be so applied that single-phase operation of any three-phase connected motor will be precluded.

(c) *Calculation of short-circuit currents.* The available short-circuit current should be determined from the aggregate contribution of all generators that can be simultaneously operated in parallel and of the largest motor load which can be expected to be in operation, with a three-phase fault on the load terminals of the protective device. Under these conditions, three-pole circuit breakers should be selected on the basis of the average asymmetrical rms value of the currents in the three phases; fuses should be selected on the basis of the maximum asymmetrical rms value of current occurring in any of the three phases. Detailed short-circuit current calculations should be submitted for all systems with an aggregate generating capacity in excess of 750 kilowatts. For smaller systems when calculations are not submitted and for preliminary purposes of all systems, the following short-circuit currents are assumed unless unusual machine subtransient reactances are specified or known to exist.

(1) The maximum short-circuit current of a direct-current system will be assumed to be equal to 10 times the aggregate normal rated generator currents plus six times the aggregate normal rated current of all motors which may be in operation.

(2) The maximum asymmetrical short-circuit current for AC systems shall be assumed to be equal to 10 times the aggregate normal rated gen-

erator currents plus four times the aggregate normal rated current of all motors which may be in operation.

(3) The average asymmetrical short-circuit current for AC systems shall be assumed to be equal to 8½ times the aggregate normal rated generator currents plus 3½ times the aggregate normal rated current of all motors which may be in operation.

[CGFR 70-143, 35 FR 19907, Dec. 30, 1970; 36 FR 5606, Mar. 25, 1971]

§ 111.50-25 System protection.

(a) *General.* Insofar as is possible, the selection, arrangements and performance of the various overcurrent protective devices should be made with the following objectives in mind:

(1) *Continuity of service.* Continuity of service under short-circuit conditions through the selective operation of the various protective devices.

(2) *High-speed clearance.* High-speed clearance of low impedance short-circuits in order that short-circuit currents of large magnitude will cause minimum damage to the system and equipment and minimize the hazard of fire.

Subpart 111.55—Switches and Circuit Breakers

§ 111.55-1 General requirements.

(a) *Grounded conductor.* No switch or circuit breaker shall disconnect the grounded conductor of a circuit unless the switch or circuit breaker simultaneously disconnects the ungrounded conductor or conductors.

(b) *Three-way and four-way switches.* Three-way and four-way switches shall be so wired that all switching is done only in the ungrounded circuit conductor.

(c) *Enclosures.* Switches and circuit breakers, except pendent and surface-type snap switches and knife switches mounted on an open-faced switchboard or panelboard, shall be of the externally operative type enclosed in metal boxes or cabinets.

(d) *Knife switches.* (1) Single-throw knife switches shall be so placed that gravity will not tend to close them. Double-throw knife switches may be mounted so that the throw will be either vertical or horizontal as preferred, but, if the throw be vertical, a locking device shall be provided which will insure the blade remaining in the open position when so set.

(2) Knife switches rated for more than 1,200 amperes at 250 volts or less, and for more than 600 amperes at 251 to 600 volts, shall be used only as isolating switches and shall not be opened under load. To interrupt currents greater than 1,200 amperes at 250 volts or less, or 600 amperes at 251 to 600 volts, a circuit breaker or a switch of special design approved for such purpose shall be used. Knife switches of lower rating may be used as general use switches and may be opened under load. Motor-circuit switches may be of the knife switch type. (See § 111.70-30 (d), (e), and (f)).

(3) Knife switches, unless of the double-throw type, shall be so connected that the blades are dead when the switch is in the open position.

(e) *Circuit connections.* Circuits shall be connected to the fuse end of switches and to the coil end of circuit breakers, except that generators or incoming feeders may be connected to either end of circuit breakers.

(f) *Accessibility and grouping.* Switches and circuit breakers, so far as practicable, shall be readily accessible and shall be grouped.

(g) *Circuit breakers as switches.* A circuit breaker operable directly by applying the hand to a lever or handle may serve as a switch provided it has the number of poles required for such switch.

(h) *Grounding of enclosures.* Enclosures for switches or circuit breakers shall be grounded.

(i) *Rating of snap switches.* Snap switches shall be rated as described in this subparagraph depending upon the load controlled.

(1) *Non-inductive loads.* For non-inductive loads other than tungsten-filament lamps, switches shall have an ampere rating not less than the ampere rating of the load.

(2) *Tungsten-filament lamp loads.* For tungsten-filament lamp loads, and for combined tungsten-filament and non-inductive loads, switches shall have a "T" rating not less than the ampere rating of the load.

(3) *Inductive loads.* Switches controlling inductive loads shall have an ampere rating twice the ampere rating of the load unless they are of a type approved as part of an assembly or for the purpose employed.

(4) *Motor-circuit switches.* For switches controlling motors see § 111.70-30.

§ 111.55-5 Detailed requirements.

(a) *Circuit breakers.* Circuit breakers shall comply with § 111.50-15(e).

(b) *Knife switches.* The construction of knife switches shall conform to the requirements of Underwriters' Laboratories, Inc., "Standard for Knife Switches".

(c) *Snap switches.* The construction of snap switches shall conform with the requirements of Underwriters' Laboratories, Inc., "Standard for Snap Switches," and the switches shall be so labeled.

(d) *Enclosed switches.* Enclosed switches shall conform to the requirements of Underwriters' Laboratories, Inc., "Standard for Enclosed Switches," except that sheet metal enclosures shall not be employed for use in corrosive locations unless one of the conditions covered in this subparagraph is complied with:

(1) The enclosure is fabricated of corrosion-resistant material.

(2) The enclosure is fabricated of sheet steel not less than ⅛-inch in thickness and hot dip galvanized after fabrication.

(3) The enclosure is fabricated of sheet steel not less than 3/16-inch in thickness and given a corrosion-resistant finish in accordance with § 110.15-40 of this subchapter.

Subpart 111.60—Wiring Materials and Methods

§ 111.60-1 Electric cable.

(a) *General.* The intent and purpose of this section is to provide that conductors shall have mechanical strength, insulation, and current-carrying capacity adequate for the particular conditions under which they are used.

(b) *Construction.* Electric cables shall be constructed and tested by the manufacturer in accordance with the requirements of section 18, IEEE Standard No. 45.

(1) *Classes of cables.* The classes of cables covered by this standard are:

(i) Lighting and power cables.

(ii) Multiconductor cable.

(iii) Communication and telephone cable.

(iv) Intercabin telephone cable.

(v) Switchboard wire.

(vi) Bell wire.

(2) *Cable classes by type of insulation.* The above cables are classed in accordance with the type of conductor insulation as:

(i) Rubber insulated (75 C) and (85 C).

(ii) Varnished cloth.

(iii) Asbestos-varnished cloth.

(iv) Thermoplastic insulated.

(v) Mineral insulated.

(vi) Asbestos thermoplastic insulated.

(vii) Silicone insulated.

(3) *Cable classes, by type of mechanical covering.* The above cables are classed in accordance with the type of mechanical covering as:

(i) Braid and armor.

(ii) Lead and armor.

(iii) Moisture resistant jacket, type T or N as designated, and armor.

(iv) Moisture resistant jacket unarmored (for NEC portable cords and telephone cable only).

(v) Mineral insulated metal sheathed, type MI.

(c) *Cable marking.* Cable complying with the requirements of this section shall be identified by providing a marker tape under the cable sheath. The marker tape shall give at regular and frequent intervals: (1) Manufacturer, (2) applicable specification, and (3) year of manufacture.

(d) *Cable applications*—(1) *Damp or wet locations.* Electric cable for installation in damp or wet locations shall have an outer covering of lead and armor, moisture resistant jacket and armor or mineral insulated-metal sheathed. The cable insulation may be either rubber, thermoplastic, varnished cloth, asbestos-varnished cloth, asbestos thermoplastic, mineral, or silicone, except that rubber or thermoplastic insulated power and lighting cable shall not be used in locations

40-130 O—79——5

where the ambient temperature exceeds 50° C.

(2) *Corrosive locations.* The armor of cables in corrosive locations shall be either bronze or aluminum and the sheath on mineral insulated-metal sheathed cables shall be seamless annealed copper.

(3) *Dry locations.* Cables for installation in dry locations shall be any cable constructed and classed as to type of insulation and mechanical covering in accordance with paragraph (b) (2) and (3) of this section.

(4) *Power and lighting cable.* Cable for power and lighting applications shall be power and lighting cable of the types described in this subpart except that 600-volt communication cable may be used in control and indicating circuits of power and lighting equipment.

(5) *Interior communication and telephone cable.* Cable for interior communication apparatus operating on potentials not exceeding 300 volts shall be either communication cable, telephone cable, or power and lighting cable of the types described in this subpart.

(6) *Intercabin telephone cable.* Intercabin telephone cable may be used for telephone systems installed for the convenience of passengers or crew and not essential for the operation of the vessel.

(7) *Bell wire.* Bell wire may be used for call bell circuits of 25 volts or less installed for the convenience of passengers or crew if properly installed in protected raceways.

(8) *Switchboard wire.* Switchboard wire may be used only on switchboards, motor controllers and the like.

(9) *Multiconductor.* Multiconductor cable may be used for instrumentation circuits provided the cable contains seven or more conductors, the average current per conductor does not exceed 2 amperes, and the maximum current in any one conductor does not exceed 3 amperes.

(e) *Current-carrying capacity*—(1) *General.* The maximum current-carrying capacities of electric lighting and power cables for continuous service are given in Tables 111.60-1(e)(1)(i) and 111.60-1(e)(1)(ii). The maximum current-carrying capacity of interior communication cable is 7.5 amperes.

TABLE 111.60-1(e)(1)(i)—WIRES AND CABLES [1]—MAXIMUM CURRENT-CARRYING CAPACITIES, DIRECT-CURRENT, FOR CONTINUOUS SERVICE, 50° C. AMBIENT [2 3] (CONCENTRIC STRANDING, 600 VOLTS [4] OR LESS, DIRECT-CURRENT) (ALTERNATING-CURRENT RATINGS FOR CABLES ARE THE SAME AS GIVEN FOR DIRECT-CURRENT UP TO 700,000 CIRCULAR MILS; FOR 700,000 CIRCULAR MILS AND ABOVE, SEE TABLE 111.60-1(e)(1)(ii))

Conductor size		Current in amperes											
		1-conductor				2-conductor				3-conductor			
Area (circular mils)	Nearest AWG	R	V	AV	MI	R	V	AV	MI	R	V	AV	MI
2,000,000		1,048	1,380	1,538									
1,750,000		934	1,231	1,373									
1,500,000		846	1,095	1,228									
1,250,000		743	970	1,020									
1,000,000		640	831	925									
950,000		617	812	904									
900,000		592	779	866									
850,000		578	752	838									
800,000		557	725	807									
750,000		538	696	776									
700,000		516	666	741									
650,000		486	623	694		382	503	560		331	428	476	
600,000		466	597	665		363	481	535		317	407	452	
550,000		441	563	627		344	462	514		302	386	428	
500,000		418	534	594		323	431	480		285	367	408	
450,000		392	498	554		306	406	452		265	341	379	
400,000		369	464	516		284	377	418		248	319	354	
350,000		340	429	477		261	351	390		230	294	327	
300,000		301	389	432		238	315	351		209	267	297	
250,000		270	348	387		212	281	312		186	238	264	

TABLE 111.60-1(e)(1)(i)—WIRES AND CABLES [1]—MAXIMUM CURRENT-CARRYING CAPACITIES, DIRECT-CURRENT, FOR CONTINUOUS SERVICE, 50° C. AMBIENT [2 3] (CONCENTRIC STRANDING, 600 VOLTS [4] OR LESS, DIRECT-CURRENT) (ALTERNATING-CURRENT RATINGS FOR CABLES ARE THE SAME AS GIVEN FOR DIRECT-CURRENT UP TO 700,000 CIRCULAR MILS; FOR 700,000 CIRCULAR MILLS AND ABOVE, SEE TABLE 111.60-1(e)(1)(iii)—Continued

Conductor size		Current in amperes											
		1-conductor				2-conductor				3-conductor			
Area (circular mils)	Nearest AWG	R	V	AV	MI	R	V	AV	MI	R	V	AV	MI
212,000	4/0	241	310	345	308	193	254	283	.....	169	215	239	.....
168,000	3/0	208	273	304	264	167	223	248	.....	148	187	208	.....
133,000	2/0	180	237	264	228	145	194	214	.....	130	163	181	.....
106,000	1/0	155	206	229	196	128	170	189	.....	112	142	158	.....
83,700	1	133	177	197	168	111	148	165	.....	98	122	135	.....
66,400	2	115	152	169	144	96	128	142	.....	86	106	118	.....
52,600	3	99	132	147	124	85	111	124	.....	75	92	102	.....
41,700	4	85	114	127	108	74	97	108	72	66	80	89	72
33,100	5	71	99	110	94	64	85	95	63	57	70	78	63
26,300	6	63	86	96	80	56	74	82	56	49	61	67	56
20,800	7	54	74	82	.....	49	64	71	.....	44	52	58	.....
16,500	8	46	66	73	56	24	55	61	40	39	46	51	40
10,400	10	34	49	54	44	32	24	47	32	29	35	39	32
6,530	12	24	32	35	32	22	27	30	24	21	23	26	24
4,110	14	15	.....	20	24	14	.....	19	20	13	.....	17	20

[1] The values given in this table may be used provided the cable installation is limited to double banking. Where this limitation is exceeded, the values given in this table shall be decreased 5 percent for each additional bank.

[2] The values given in this table are based upon an ambient temperature of 50° C and maximum conductor temperatures of:
75° C for rubber (R) insulated cables;
85° C for varnished cloth (VC) insulated cables; mineral insulated (MI) cables; and
95° C for asbestos-varnished cloth (AVC) insulated cables.

[3] If ambient temperatures differ from 50° C the value shown above shall be multiplied by the following factors.

[4] For voltages greater than 600 volts, current rating shall be decreased 2 percent for each thousand volts increase over 600 volts.

Type of cables	Ambient temperature		
	40° C	60° C	70° C
Rubber insulated cables	1.18	.....	.....
Varnished cloth insulated cables and mineral-insulated cables	1.13	0.84	.....
Asbestos-varnished cloth insulated cables	1.11	0.88	0.75

TABLE 111.60-1(e)(1)(ii) [1]—WIRES AND CABLES—MAXIMUM CURRENT-CARRYING CAPACITIES. ALTERNATING CURRENT FOR CONTINUOUS SERVICE (VALUES ARE IN AMPERES—600 VOLTS OR LESS). (ALTERNATING-CURRENT RATINGS FOR CABLES OF LESS THAN 700,000 CIRCULAR MILS ARE THE SAME AS THOSE FOR CABLES GIVEN IN TABLE 111.60-1(e)(1)(i)).

[60-cycle alternating current]

Conductor size	Concentrically stranded conductor			Annular conductor	
Area in circular mils	Rubber insulated	Varnished cloth insulated	Asbestos-varnished cloth insulated	Varnished cloth insulated	Asbestos-varnished cloth insulated
2,000,000	932	1,229	1,440	1,417	1,590
1,750,000	864	1,125	1,305	1,294	1,450
1,500,000	791	1,023	1,199	1,160	1,315
1,250,000	719	920	1,070	1,021	1,150
1,000,000	631	808	925	877	990
950,000	609	790	899	840	955
900,000	587	760	867	803	920
850,000	568	735	838	777	885
800,000	548	711	803	747	848
750,000	529	683	775	708	810
700,000	509	656	740	675	775

[1] Footnotes 1, 2, 3, and 4 of table 111.60-1(e)(1)(i) are applicable to this table.

(2) *Conductors in multiple.* Conductors may be run in multiple provided they are of the same length and have the same circular mil area and type of insulation. Where conductors are run in multiple, they shall be arranged and terminated at both ends in such a manner as to insure equal division of the total current between all conductors that are involved.

(f) *Temperature limitation.* No cable shall be used under such condition that its temperature, even when carrying current, will exceed the temperatures specified in Tables 111.60-1(e)(1)(i) for the type of insulation involved.

(g) *Conductor size for varnished cloth insulated cables.* Varnished cloth insulated power and lighting cables in sizes smaller than No. 12 AWG shall not be used. Rubber thermoplastic, or asbestos-varnished cloth insulated power and lighting cables may be used in size No. 14 AWG and larger.

(h) *Substitute cable.* Electric cable constructed in accordance with Military Specifications MIL-C-915 or MIL-C-2194 may be substituted for the equivalent IEEE type cable specified in this Section. Type MSCA cable (MIL-C-2194) may be used as a substitute for communication and telephone cable constructed in accordance with IEEE Standard No. 45. The maximum current for any conductor shall not exceed the current-carrying capacities specified in the publication "Cable Comparison Guide," NavShips 250-660-23.

(i) *Special purpose cable*—(1) *Instrumentation cable.* Electric cable constructed in accordance with Military Specifications MIL-C-915, MIL-C-2194 or MIL-C-23206 of the types TTHFWA, TTRSA, PI, 1SWA, 2SWA, 3SWA, may be used for instrumentation circuits to connect such items as indicator lights, sensors, selector switches, and pushbuttons where the voltage of the circuit does not exceed 100 volts. The maximum current for any conductor shall not exceed the current-carrying capacities specified in the publication "Cable Comparison Guide," NavShips 250-660-23.

(2) *Thermocouple cable.* Electric cable constructed in accordance with Military Specification MIL-C-915 of the types PBJX, PBTM and PBTX may be used as conductors between thermocouple sensors and their registering equipment.

(3) *Other types of cable.* Other types of cable will be given special consideration by the Commandant where the cable does not penetrate a watertight bulkhead and is suitably protected from mechanical damage.

(j) *Alternating-current cable installations.* In order to avoid overheating by induction all phase wires should be contained within the same armor by use of multiple conductor cables. Single-conductor cables may be used when carrying negligible currents or when all the following conditions are met.

(1) Single-conductor alternating-current cables are to be supported on nonfragile insulators and the protective metal covering of each run of cable should be grounded at the middle only.

(2) Closed magnetic circuits around individual cables are not permitted and magnetic materials between cables of a group should be avoided.

(3) In order to minimize harmful inductive effect, cables in groups of considerable length should be transposed.

(k) *Multiconductor alternating-current cables.* Multiconductor alternating-current cables are to be mounted on approved supports and if provided, the lead sheath shall be grounded at several points.

(l) *Deck and bulkhead penetrations.* Where cables pass through watertight decks or bulkheads, a watertight stuffing tube shall be employed. Where cables pass through nonwatertight bulkheads, beams or similar structural parts where the bearing surface is less than one-fourth inch, the holes shall be fitted with bushings having rounded edges and a bearing surface for the cable of at least one-fourth inch in length. Where cables pass through nonwatertight bulkheads, deck beams, or similar structural parts where the bearing surface is one-fourth inch or greater in length, all burrs shall be removed in way of the hole and sharp edges shall be eliminated. Where cables pierce main vertical zone bulkheads, arrangements shall be made to

ensure that the fire-resistance of the bulkheads is not impaired.

(m) *Grounding of cable metallic covering.* For multiconductor multiphase cable each metallic-sheathed cable and each armored cable are to have the metallic covering electrically and mechanically continuous and grounded to the metal hull at each end of the run, except that final subcircuits may be grounded at the supply end only. Single conductor alternating-current cable shall be grounded at the midpoint only.

(n) *Mechanical protection.* All cables in bunkers and where particularly liable to damage such as locations in way of cargo ports, hatches, tank tops, and where passing through decks, shall be protected by removable metal coverings, angle irons, pipe, or other equivalent means. All such metallic coverings are to be electrically continuous and grounded to the metal hull. Horizontal pipes or the equivalent used for cable protection should be provided with drainage holes, and, where they are carried through decks or bulkheads, arrangements should be made to insure the integrity of the water or gas-tightness of the structure.

[CGFR 70-143, 35 FR 19907, Dec. 30, 1970; 36 FR 5606, Mar. 25, 1971]

§ 111.60-5 Portable electric cord and fixture wire.

(a) *General.* The construction of portable electric cords and fixture wire shall be in accordance with Underwriters' Laboratories, Inc., "Standard for Flexible Cord and Fixture Wire."

(b) *Application, portable cords.* Portable cords may be used only for the connection of portable lamps or appliances and for the connection of stationary lamps or small stationary equipment not suitable for fixed wiring. When used they shall be of the type indicated in Table 111.60-5(b). Types of portable cords other than those listed in Table 111.60-5(b) and the uses for the types listed other than those uses permitted by this paragraph shall be subject to special investigation and shall not be employed before being approved.

(1) *Damp or wet locations or for hard service.* Portable cords for use in damp or wet locations or for hard service shall be type S, SO, ST, SJ, SJO, SJT, HS, HSJ, AFS, or AFSJ, and portable cords for use where exposed to oil or oil vapor shall be type SO or SJO.

(2) *Dry locations.* Portable cords for use in dry locations and not for hard services shall be type C, P, P-2, PD, PW, PW-2, K, HC, HPD, AVPD, or one of the types listed for damp or wet locations in subparagraph (1) of this paragraph.

(3) *Extra hard service.* Portable cords for use in damp or wet locations and requiring a length in excess of 5 feet shall be type S, SO, or ST.

(c) *Allowable current-carrying capacity.* The allowable current-carrying capacities of flexible cord and fixture wire are given in Table 111.60-5(c).

(d) *Conductor size.* Portable cord or fixture wire shall not be smaller than No. 18 AWG.

(e) *Splices.* Portable cords shall be used only in continuous lengths without splices or taps.

(f) *Pull at joints and terminals.* Portable cords shall be so connected to devices and to fittings that tension will not be transmitted to joints or terminal screws. This shall be accomplished by a knot in the cord, winding with tape, by a special fitting designed for that purpose, or by other equivalent means.

(g) *Fixture wire, application.* Fixture wire may be used in the interior of lighting fixtures, instruments, and the like. When used, fixture wire shall be one of the types covered in this paragraph.

(1) Either type AF, SF-2, or SFF-2 fixture wire shall be used for applications where the temperature will exceed 90° C.

TABLE 111.60-5(b)—PORTABLE CORDS

Trade name	Type letter (National Electrical Code)	Maximum voltage	Conductor insulation	Braid on each conductor	Cord outer covering	Maximum temperature°C.	Use	
Lamp cord	C	300	Rubber	Cotton	None	60	Dry places	Not hard usage.
Twisted portable cord	PD	300	do	do	Cotton or rayon	60	do	Do.
Reinforced cord	P-2	300	do	do	Cotton over rubber filler	60	do	Do.
	P	600						
Moistureproof reinforced cord	PW-2	300	do	do	Cotton, moisture-resistant finish over rubber filler.	60	do	Do.
	PW	600						
Braided heavy duty cord	K	300	do	do	Two cotton, moisture-resistant finish.	60	do	Do.
Junior-hard service cord	SJ	300	do	None	Rubber	[1]60	Damp places	Hard usage.
	SJO		Thermoplastic or rubber.		Oil-resistant compound			
	SJT				Thermoplastic			
Hard service cord	S	600	Rubber	do	Rubber	60	do	Extra hard usage.
	SO		Thermoplastic or rubber.		Oil resistant compound			
	ST				Thermoplastic			
Heater cord	HC	300	Rubber and asbestos	Cotton	None	90	Dry places	Not hard usage.
	HPD			None	Cotton or rayon			
Rubber-jacketed heater cord	HSJ	300	do	do	Cotton and rubber	[2]90	Damp places	Hard usage.
Jacketed heater cord	HS	300	do	do	Cotton, and rubber or neoprene	[2]90	do	Do.
Heat-and moisture-resistant cord.	AVPD	300	Asbestos and varnished cloth.	do	Asbestos, flame-retardant, moisture resistant.	110	Dry places	Not hard usage.
Rubber-jacketed heat-resistant cord.	AFSJ, AFS	300	Impregnated asbestos.	do	Rubber	[2]150	Damp places	Hard usage.
Elevator cable	E	300	Rubber	Cotton	Three cotton, outer one flame-retardant, moisture-resistant.	60	Elevator lighting and control.	
	EO		Thermoplastic	Rayon	One cotton and neoprene jacket [3]			
	ET				Three cotton, outer one flame-retardant, moisture-resistant.			

[1] The temperature limit for Type SJ, SJO, or SJT cord is 75° C instead of 60° C if both the conductor insulation and jacket employ compounds which are recognized as suitable for use at 75° C. Such cords are recognized specifically for use on electric refrigerators or in similar applications on appliances where cord replacement is not a problem. Such cords shall be marked by having a green thread (which indicates a temperature limit or 75° C) either immediately under the insulation or under the separator of one conductor.

[2] The temperature limit indicated applies only to the individual conductors where the cord is employed within an appliance. The temperature limit on the jacket of Type HS rubber-jacketed heater cord and Type AFS or AFSJ rubber-jacketed heat-resistant cord is limited to 75° C. The temperature limit on the jacket of Type HSJ rubber-jacketed heater cord is limited to 60° C, unless the jacket is marked by means of indent printing or indelible-ink printing at intervals of two feet or less with the value "75° C."

[3] Rubber-filled or varnished tapes may be substituted for the inner braids.

TABLE 111.60-5(c)—MAXIMUM CURRENT-CARRYING CAPACITIES IN AMPERES [1] [2]

Size AWG	Portable cord: Rubber types C, E, EO, K, P, P-2, PD, PW, PW-2 / Thermoplastic type ET	Portable cord: Rubber types S, SO, SJ, SJO / Thermoplastic types ST, SJT	Portable cord: Types AFS, AFSJ, HC, HPD, HS, HSJ	Portable cord: Type AVPD	Fixture wire: Rubber types RF-2, FF-2, RFH-2, FFH-2	Fixture wire: Thermoplastic types TF, TFF / Cotton type CF / Asbestos type AF / Silicone rubber type SF-2, SFF-
18	5	7	10	17	5	6
16	7	10	15	22	7	8
14	15	15	20	28	.....	17
12	20	20	30	36	.....	.....
10	25	25	35	47	.....	.....
8	35	.....	.....	.....	.....	.....
6	45	.....	.....	.....	.....	.....
4	60	.....	.....	.....	.....	.....
2	80	.....	.....	.....	.....	.....

[1] If the number of current-carrying conductors in a cord exceeds three, the allowable current-carrying capacity of each conductor shall be reduced to 80 percent of the values in the table.

[2] In no case shall conductors be associated together in such a way with respect to the kind of circuit, the wiring method employed, or the number of conductors, that the limiting temperature of the conductors will be exceeded.

(h) *Fixture wire, voltage limitation.* Fixture wire shall not be used for applications exceeding 300 volts.

(i) *Fixture wire, stranded.* Fixture wire shall be of the stranded type.

(j) *Hookup wire, application.* Hookup wire for use within the components of alarm panels. IC equipment and electronic control equipment shall be in accordance with § 113.05-10 of this subchapter.

§ 111.60-10 Circuit loads and demand factors.

Generator, feeder, and bus-tie cables shall be selected on the basis of a computed load of not less than the demand load given in Table 111.60-10.

TABLE 111.60-10—DEMAND LOADS

Type of circuit	Demand load
Generator cables	115 percent of continuous generator rating.
Switchboard bus-tie, except ship's service to emergency switchboard bus-tie.	75 percent of generating capacity of the larger switchboard.
Emergency switchboard bus-tie	115 percent of continuous rating of emergency generator.
Feeder supplying two or more motors	125 percent of the rating of the largest motor plus 100 percent of the sum of the ratings of all other motors supplied and including 50 percent of the rating of the spare switches or circuit breakers on the distribution panel. [1]
Feeder supplying two or more cargo winch motors arranged for the "Burtoning" method of cargo handling.	125 percent of the rating of the largest motor plus 35 percent of the sum of the ratings of all other motors supplied. [1]
Feeder supplying two or more 'tween deck cargo winch motors, cargo elevator motors, or cargo cranes.	125 percent of the rating of the largest motor plus 50 percent of the sum of the ratings of all other motors supplied.
Galley equipment feeder	100 percent of either the first 50 KW or one-half the connected load, whichever is the larger, plus 65 percent of the remaining connected load, plus 50 percent of the rating of the spare switches or circuit breakers on the distribution panel.
Lighting feeder	100 percent of the connected load plus the average active circuit load for the spare switches or circuit breakers on the distribution panels.
Grounded neutral of a dual voltage feeder	100 percent of the capacity of the ungrounded conductors when grounded neutral is not protected by a circuit breaker overcurrent trip, or not less than 50 percent of the capacity of the ungrounded conductors when the grounded neutral is protected by a circuit breaker overcurrent trip or overcurrent alarm.

[1] Where a large number of motors are supplied from one feeder and the character of the load is such that not all motors will be operated simultaneously, a smaller demand load may be approved.

§ 111.60-15 Propulsion cables.

(a) During installation each propulsion cable end must be sealed until permanently attached to a terminal.

(b) Each propulsion cable terminal must be sealed after installation of the cable to prevent admission of moisture and air.

(c) Each propulsion cable support must be strong enough to withstand short circuited conditions, may not be spaced more than 3 feet apart from each adjacent support, and must be arranged to prevent chafing of the cable.

[CGD 74-305, 41 FR 26013, June 24, 1976]

§ 111.60-20 Generator cables.

Where the ship's service generators are located in separate spaces, the generator cables between the circuit breakers and the switchboard shall be separated throughout their length as widely as practicable. Generator cables are not to be installed in the bilges.

§ 111.60-25 Ship's service cables.

(a) *Cable joints and sealing.* The cable ends of all feeders and power branch circuits to vital auxiliaries are to be effectively sealed against the admission of moisture by methods such as taping in combination with insulating compound or, in the case of type MI, by fittings designed for that purpose.

(b) *Cable supports and radii of bends.* Where cables are run-in groups they shall be supported in metal hangers arranged as far as practicable to permit painting of the surrounding structure without undue disturbance to the installation. Single cable runs may be supported by metal clips screwed directly to deck or bulkhead except on watertight bulkheads. Cables grouped in a single hanger shall be limited to two banks. Supports shall be spaced no more than 18 inches apart where vertical and 14 inches where horizontal. Cables shall be strapped in position at every hanger on vertical runs and at not less than every fourth hanger on horizontal runs, except that at turns of horizontal runs the cable shall be strapped at each hanger. Cables running transversely to and supported by clips or straps on the under side of beams shall be run on backing plates, cable racks, or the equivalent. Metal supports shall be designed to secure cable without damage to insulation or armor and shall be so arranged that the cables will bear over a length of at least ½ inch. Leaded and armored cables shall not be bent to a smaller radius than 8 cable diameters; other cables may be bent to a 6-cable diameter radius.

(c) *Feeder and branch circuit cables.* Cables of every description shall be located with a view to avoiding, as far as practicable, spaces where excessive heat and gases may be encountered, as well as spaces where they may be exposed to damage, such as exposed sides of deckhouses. Electrical conductors shall not enter oil tanks except as permitted by §§ 111.80-8 and 38.15-15 of this chapter. Conductors shall avoid cofferdams adjacent to and extending below the tops of oil tanks except as permitted by §§ 111.80-5, 111.80-8, and 111.85-10.

(d) *Cables behind paneling.* Cables may be installed behind paneling provided all connections are readily accessible and the location of concealed connection boxes is indicated.

(e) *Cables behind sheathing.* Cables may be installed behind sheathing but they must not be installed behind nor imbedded in structural insulation; they should pass through such insulation at right angles and should be protected by continuous pipe with a stuffing tube at one end. For deck penetrations this stuffing tube should be at the upper end of the pipe and for bulkhead penetrations it should be on the uninsulated side of the bulkhead. For refrigerated space insulation the pipe should be of a phenolic or similar heat insulating material joined to the bulkhead stuffing tube or a section of such material should be inserted between the bulkhead stuffing tube and the metallic pipe.

(f) *Ship's structure as a conductor.* The ship's structure shall not be used as a normal current-carrying conductor for a ship's power, heating, or lighting system, except when approved for special purposes. Such hull return shall not be used on tankers. Current-carrying parts are to be substantially protected against accidental contact.

For current-carrying capacities of conductors, see Tables 111.60-1(e)(1)(i) and 111.60-1(e)(1)(ii).

(g) *Circuits derived from autotransformers.* Branch circuits shall not be supplied through autotransformers (transformers in which a part of the winding is common to both primary and secondary circuits).

(h) *Polarity identification of conductors.* (1) On systems having a grounded conductor, the grounded conductor shall be identified throughout the vessel by means of a white or natural gray conductor outer covering, and any conductor so identified shall not be used as an ungrounded conductor of a circuit unless the conductor is rendered permanently unidentified by painting or other effective means at each outlet. On ungrounded systems, it is recommended that conductor identification be consistent throughout the vessel.

(2) An insulated conductor of a portable cable intended to be used as a grounding conductor shall have a continuous identifying marker readily distinguishing it from the other conductors. The identifying marker shall consist of either a braid finished to show a green color or a green colored insulation. The requirements of this subparagraph shall be effective on vessels contracted for on or after November 19, 1956.

(i) *Through feed arrangements.* Where a feeder supplies more than one distribution panel or panelboard, it may be continuous from the switchboard to the farthest panel or it may be severed at any intermediate panel. If the bus bars of any distribution panel or panelboard carry "through" load, the size of the buses should be designed for the total current. The size of feeder conductors should normally be uniform for the total length, but may be reduced at any intermediate distribution panel or panelboard provided that the smallest section of the feeder is protected by the overcurrent device at the distribution switchboard.

(j-l) [Reserved]

(m) *Connections to terminals.* (1) Connection of conductors to terminal parts shall insure a thoroughly good connection without damaging the conductors and shall be made by means of pressure connectors, solder lugs, or splices to flexible leads either soldered, brazed, or welded, except that No. 10 or smaller conductors may be connected by means of clamps or screws with terminal plates having upturned lugs. Terminals for more than one conductor shall be of a type approved for that purpose.

(2) Connectors, or lugs of the setscrew type shall not be used with stranded conductors smaller than No. 14 AWG unless provided with a nonrotating follower traveling with the setscrew and making pressure contact with the conductor.

(3) Pressure-type wire connectors, fixture splicing connectors, and lugs shall conform to the requirements of Underwriters' Laboratories, Inc., "Standard for Wire Connectors and Soldering Lugs," and shall be so listed by Underwriters' Laboratories, Inc.

(4) Terminal blocks shall employ terminal screws not smaller than 6-32, and spacings not less than that shown in Table 111.60-25(m)(4).

TABLE 111.60-25(m)(4)—TERMINAL BLOCK SPACINGS

Voltage involved	Minimum spacings in inches between parts of opposite polarity and between live parts and ground	
	Through air	Over surface
0-250	¼	⅜
251-600	⅜	⅜

(n) *Circuits in vicinity of magnetic compass.* Precautions should be taken in connection with apparatus and wiring in the vicinity of the magnetic compass to prevent disturbance of the needle from external magnetic fields.

(o) *Segregation of vital circuits*—(1) *General.* Power feeders supplying apparatus required for handling the vessel are not to be used for supplying apparatus which is to be disconnected when the vessel is underway unless the branch circuits for the latter are so arranged that they may be disconnected at panelboards without interfering with the operation or protection of those circuits necessary for the safe operation of the vessel. In gener-

al, separate feeders should be run for such groups as engineroom and fireroom auxiliaries, motors for cargo-handling gear, radio transmitters, arc searchlights, and ventilation sets.

(2) *Passenger vessels.* On passenger vessels constructed with firescreen bulkheads forming fire zones, distribution systems shall be so arranged that fire in any main fire zone will not interfere with essential services in any other main fire zone. This requirement will be met if main and emergency feeders passing through any zone are separated both vertically and horizontally as widely as is practicable.

[CGFR 70-143, 35 FR 19907, Dec. 30, 1970, as amended by CGD 74-305, 41 FR 20613, June 24, 1976]

§ 111.60-30 Engine starting.

Battery systems for engine-starting purposes may be of the one-wire system. The ground lead should be carried to the engine frame.

§ 111.60-35 Lightning ground conductor.

Lightning ground conductor should be fitted to each wooden mast or topmast. They need not be fitted to steel masts.

§ 111.60-40 Cable splicing.

(a) A cable may be spliced only 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.

(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 to determine the condition of the insulation.

(b) A splice authorized by this section must be made by a qualified person with a one cycle compression tool and must have the following:

(1) A pressure-type butt connector that is listed by Underwriters' Laboratories, Inc. under U.L. 486 "Standard for Wire Connectors and Soldering Lugs".

(2) Replacement insulation that—

(i) Has the same or greater thickness than that of the cable insulation;

(ii) Has electrical properties that are the same as or better than the electrical properties of the cable insulation; and

(iii) Has a heat transfer capability that is the same as or better than that of the original cable insulation;

(3) A watertight replacement jacket that is heat shrinkable or prestretched tubing of the same or a greater thickness than that of the cable jacket and that has properties that are the same as or better than those of the cable jacket.

(4) For armored cable, replacement armor or a jumper that connects to the cable armor on each side of the splice and that maintains the electrical continuity of the cable armor.

(c) Each butt connector, the replacement insulation, and the watertight replacement jacket used in a splice must be chemically compatible with each other and with the materials of the cable.

(49 CFR 1.4(b))

[CGD 74-305, 41 FR 26013, June 24, 1976]

Subpart 111.65—Generator Circuits and Protection

§ 111.65-1 Ship's service generators.

(a) *General.* Each generator of 25 kw. and over, and each generator regardless of size if arranged for parallel operation shall be protected by an individual trip-free air circuit breaker having inverse time overcurrent trips. The pickup setting of the long-time overcurrent trip of the circuit breaker shall not exceed 115 percent of the generator rating for continuous rated machines and shall not exceed 15 percent above the overload rating for special rated machines. Each generator of less than 25 kw. not arranged for parallel operation may be protected by individual fuses in lieu of an individual circuit breaker.

(b) *Alternating-current generators.* Where three or more generators are arranged for parallel operation, the circuit breakers shall have, in addition

to inverse time trips, instantaneous trips set at a value in excess of the maximum asymmetrical short circuit current available from the associated generator. In order to provide the optimum degree of protection for generators, the short-time trips shall be set at the lowest values of current and time which will coordinate with the trip settings of feeder circuit breakers supplied by the generator to provide the continuity of service and high-speed clearance specified in § 111.50-25.

(c) *Direct-current generators.* In addition to the inverse time overcurrent trips, direct-current generator circuit breakers shall be provided with an instantaneous trip set at the lowest value of current which will coordinate with the trip settings of feeder circuit breakers supplied by the generator to provide the continuity of service and high-speed clearance specified in § 111.50-25.

(d) *Generator circuits for parallel operation.* Each direct-current generator arranged for parallel operation shall be provided with a reverse-current device. Each alternating-current generator arranged for parallel operation shall be provided with a reverse power relay.

§ 111.65-5 Three-wire direct-current generators.

(a) *Circuit breaker poles.* Separate circuit breaker poles should be provided for the positive, negative, and also for the equalizer leads unless protection is provided by the main poles. When equalizer poles are provided for the three-wire generators, the overload trips should be of the "Algebraic" type. If a neutral pole is provided in the generator circuit breaker, no overload trip element shall be provided for the neutral pole. A neutral overcurrent relay and alarm system should be provided and set to function at a current value equal to the neutral rating.

(b) *Equalizer buses.* For three-wire generators the circuit breaker shall protect against a short circuit on the equalizer buses.

(c) *Neutral grounding, main switchboard.* The neutral of three-wire dual-voltage direct-current systems should be solidly grounded at the generator switchboard with a zero center ammeter in the ground connection. The zero center ammeter shall have a full-scale reading of 150 percent of the neutral current rating of the largest generator and be marked to indicate the polarity of grounds. The ground connection should be made in such a manner that it will not prevent checking the insulation resistance of the generator to ground before the generator is connected to the bus.

(d) *Neutral grounding, emergency switchboard.* The neutral of three-wire direct-current emergency power systems should be grounded at all times. No direct ground connection should be provided at the emergency switchboard, the neutral bus or buses being solidly and permanently connected to the neutral bus of the main switchboard. No interrupting device should be provided in the neutral conductor of the bus-tie feeder connecting the two switchboards.

§ 111.65-10 Three-wire single-phase and four-wire three-phase generators.

(a) *Circuit breaker poles.* Circuit breaker poles shall be provided for each generator lead, except that circuit breaker poles need not be provided in the neutral of dual voltage systems.

(b) *Neutral grounding, main switchboard.* The neutral of dual-voltage alternating-current systems shall be solidly grounded at the generator switchboard with an ammeter in the ground connection. The ground connection shall be made in such a manner that it will not prevent checking the insulation resistance of the generator to ground before the generator is connected to the bus.

(c) *Neutral grounding, emergency switchboard.* The neutral bus of the emergency switchboard shall be grounded at all times and in the same manner as described for three-wire direct-current systems in § 111.65-5(d).

§ 111.65-15 Propulsion circuits.

Overcurrent protection of propulsion motors, generators, and circuits will require special consideration in each case. For general requirements see § 111.35-5(j).

Subpart 111.70—Motor Circuits and Protection

§ 111.70-1 Motor feeder overcurrent protection.

(a) *General.* The following provisions contained in this section specify overcurrent devices intended to protect feeder conductors supplying motors against overcurrents due to short circuits or grounds.

(b) *Rating or setting, motor loads.* (1) A feeder which supplies motors shall be provided with overcurrent protection which shall not be greater than the largest rating or setting of the branch circuit protective device, for any motor of the group (based on Tables 111.70-10(b1), 111.70-10(b2), and 111.70-10(b3)) plus the sum of the full-load currents of the other motors of the group.

(2) If two or more motors of equal horsepower rating are the largest in the group, one of these motors should be considered as the largest for the above calculation.

(3) If two or more motors of a group must be started simultaneously, it may be necessary to install larger feeder conductors and correspondingly larger ratings or settings of feeder overcurrent protective devices.

(4) Where larger capacity feeders are installed to provide for future additions or changes, the feeder overcurrent protection may be based on the rated current-carrying capacity of the feeder conductors.

§ 111.70-5 Motor-branch-circuits.

(a) *General.* The branch circuit cables for motor loads shall be not smaller than No. 14 AWG.

(b) *Individual motors.* Branch-circuit conductors supplying a single motor shall have a current-carrying capacity not less than 125 percent of the motor full-load current rating. Minimum cable sizes are given in Table 111.70-10(b3).

(c) *Wound-rotor secondary.* The conductors connecting the secondary of a wound-rotor alternating-current motor to its controller shall have a current-carrying capacity not less than 125 percent of the full-load secondary current of the motor. Where the secondary resistor is separate from the controller, the current-carrying capacity of the conductors between the controller and resistor shall be not less than 110 percent of the full-load secondary current.

(d) *Several motors.* Conductors supplying two or more motors shall have a current-carrying capacity of not less than 125 percent of the full-load current rating of the highest rated motor in the group plus the sum of the full-load current ratings of the remainder of the motors in the group. Also see Table 111.60-10.

(e) *Individual multispeed motors.* For multispeed motors the conductors between the controller and the motor windings or winding connections shall have a current-carrying capacity of not less than 125 percent of the full-load current rating of the associated winding or winding connection.

§ 111.70-10 Motor-branch-circuit short circuit protection.

(a) *General.* The provisions covered by this section specify overcurrent devices intended to protect the motor-branch-circuit conductors, the motor control apparatus, and the motors against overcurrent due to short circuits or grounds. They are in addition to or amendatory of the provisions of subpart 111.50.

(b) *Rating or setting for individual motors.* The motor-branch-circuit over-current device shall be capable of carrying the starting current of the motor. Overcurrent protection shall be considered as being obtained when this overcurrent device has a rating or setting not exceeding the values given in Tables 111.70-10(b1) and 111.70-10(b2).

(1) If the values for motor-branch-circuit protective devices given in Tables 111.70-10(b1) and 111.70-10(b2) do not correspond to the standard sizes or ratings of fuses, nonadjustable circuit breakers, or thermal devices, or possible settings of adjustable circuit breakers, adequate to carry the load, the next higher size, rating or setting may be used.

TABLE 111.70-10(b1)—MAXIMUM RATING OR SETTING OF MOTOR BRANCH CIRCUIT PROTECTIVE DEVICES FOR MOTORS MARKED WITH A CODE LETTER INDICATING LOCKED ROTOR KVA

Type of motor [2]	Percent of full-load current [1]	
	Fuse rating [3]	Circuit breaker setting; time-limit type
All a.c. single-phase and polyphase squirrel cage and synchronous motors with full-voltage, resistor or reactor starting:		
Code Letter A	150	150
Code Letter B to E	250	200
Code Letter F to V	300	250
All a.c. squirrel cage and synchronous motors with autotransformer starting:		
Code Letter A	150	150
Code Letter B to E	200	200
Code Letter F to V	250	200

[1] For certain exceptions to the values specified, see § 111.70-10(b).
[2] For motors not marked with a code letter, see table 111.70-10(b2).
[3] See also table 111.70-10(b3).

TABLE 111.70-10(b2)—MAXIMUM RATING OR SETTING OF MOTOR BRANCH CIRCUIT PROTECTIVE DEVICE FOR MOTORS NOT MARKED WITH A CODE LETTER INDICATING LOCKED ROTOR KVA

Type of motor [3]	Percent of full-load current [1] [2]		
	Fuse rating	Circuit breaker setting	
		Instantaneous type	Time limit type
Single-phase, all types	300	.....	250
Squirrel cage and synchronous (full-voltage, resistor and reactor starting)	300	.....	250
Squirrel cage and synchronous (auto-transformer starting):			
Not more than 30 amperes	250	.....	200
More than 30 amperes	200	.....	200
High-reactance squirrel cage:			
Not more than 30 amperes	250	.....	250
More than 30 amperes	200	.....	200
Wound rotor	150	.....	150
Direct current:			
Not more than 50 horsepower	150	250	150
More than 50 horsepower	150	175	150

[1] For certain exceptions to the values specified see § 111.70-10(b).
[2] Synchronous motors of the low-torque low-speed type (usually 450 r.p.m. or lower) such as are used to drive reciprocating compressors, pumps, etc., which start up unloaded, do not require a fuse rating or circuit breaker setting in excess of 200 percent of full-load current.
[3] For motors marked with a code letter, see table 111.70-10(b1).

(2) Where the overcurrent protection specified in tables 111.70-10(b1) and 111.70-10(b2) is not sufficient for the starting current of the motor, it may be increased but shall in no case exceed 400 percent of the motor full load current.

(3) Table 111.70-10(b3) tabulates usual values of motor-branch-circuit protection, motor-running protection, and minimum cable size for various motor full load currents for ease of reference.

(c) *Several motors on one branch circuit.* Two or more motors may be connected to the same branch circuit under the conditions covered in this paragraph.

(1) Two or more motors each not exceeding 1 horsepower in rating and each having a full load rated current not exceeding 6 amperes, may be used on a branch circuit protected at not more than 20 amperes at 125 volts or less, or 15 amperes at 600 volts or less. Individual running overcurrent protection is unnecessary for such motors unless required by the provisions of § 111.70-15 (c) or (d).

(2) Two or more motors of any ratings, each having individual running overcurrent protection, may be connected to one branch circuit provided all of the conditions contained in this subparagraph are complied with.

(i) Each motor-running overcurrent device must be approved for group installation.

(ii) Each motor controller must be approved for group installation.

(iii) The branch circuit must be protected by an overcurrent device having a rating or setting equal to that specified in paragraph (b) of this section for the largest motor connected to the branch circuit plus an amount equal to the sum of the full load current ratings of all other motors connected to the circuit.

(iv) The branch circuit overcurrent protection must not be greater than that allowed by § 111.70-15(m) for the

thermal cutout or relay protecting the smallest motor of the group.

(v) The conductors of any tap supplying a single motor need not have individual branch circuit protection, provided they comply with either of the following: (*a*) No conductor to the motor shall have a current-carrying capacity less than that of the branch circuit conductors, or (*b*) no conductor to the motor shall have a current-carrying capacity less than one-third that of the branch circuit conductors, with a minimum in accordance with § 111.70-5(b), the conductors to the motor-running protective device being not more than 25 feet long and being protected from mechanical injury.

(d) *Combined overcurrent protection.* Motor-branch-circuit overcurrent protection and motor-running overcurrent protection may be combined in a single overcurrent device if the rating or setting of the device provides the running overcurrent protection specified in § 111.70-15(b), (c), and (d).

(e) *Group control branch circuit overcurrent protection.* In lieu of the requirements of § 111.70-15(m) and paragraph (b) of this section, a motor-branch-circuit of group control panels may be considered to be protected against overcurrent by an instantaneous trip circuit breaker set to trip at a value not exceeding 1,500 percent of the motor full load current, provided that all the conditions of this paragraph are fulfilled.

(1) The thermal cutout, thermal relay or other device for motor-running protection shall be capable of operation without damage to itself from a current up to the setting of the branch-circuit circuit breaker.

(2) The motor controller shall be capable of opening the circuit without damage to itself resulting from a current up to the setting of the branch-circuit circuit breaker.

(f) *Overcurrent devices; in which conductor.* Overcurrent devices shall comply with the provisions of Subpart 111.50.

(g) *Rating of circuit breakers.* Circuit breakers for motor-branch-circuit protection shall have a continuous current rating of not less than 115 percent of the full load current rating of the motors.

(h) *Special requirements for over 600 volts.* Each motor-branch-circuit and feeder of more than 600 volts shall be protected against overcurrent by means of a circuit breaker of suitable rating so arranged that it can be serviced without hazard.

TABLE 111.70–10(b3)—CONDUCTOR SIZE AND OVERCURRENT PROTECTION FOR MOTORS

Minimum size conductor AWG and MCM										For running protection of motors (amperes) [1]		Maximum allowable rating or setting of branch circuit protective devices (amperes) [2]							
1-conductor				2-conductor			3-conductor												
Full load current rating of motor in amperes	R	VC	AVC	R	VC	AVC	R	VC	AVC	Maximum rating of nonadjustable protective devices	Maximum setting of adjustable protective devices	With code letters F to V, inclusive, or without code letters: Single-phase and squirrel cage and synchronous, full voltage, resistor and reactor starting		With code letters B to E, inclusive: Single-phase and squirrel cage and synchronous, full voltage resistor or reactor starting. With code letters F to V, inclusive: Auto-transformer starting. Without code letters: Squirrel cage and synchronous, auto-transformer starting; high reactance squirrel cage. [3](Both not more than 30 amperes)		With code letters B to E, inclusive: Squirrel cage and synchronous, auto-transformer, starting. Without code letters: Squirrel cage and synchronous, auto-transformer starting; high reactance squirrel cage. [3](Both more than 30 amperes)		With code letter A: All motors. Without code letters: Direct-current and wound rotor motors	
												Fuses	Circuit breakers (nonadjustable trip)	Fuses	Circuit breakers (nonadjustable trip)	Fuses	Circuit breakers (nonadjustable trip)	Fuses	Circuit breakers (nonadjustable trip)
[4] 1	14	12	14	14	12	14	14	12	14	[5] 2	[5] 1.15	15	15	15	15	15	15	15	15
[4] 2	14	12	14	14	12	14	14	12	14	[5] 3	[5] 2.3	15	15	15	15	15	15	15	15
[4] 3	14	12	14	14	12	14	14	12	14	[5] 4	[5] 3.45	15	15	15	15	15	15	15	15
[4] 4	14	12	14	14	12	14	14	12	14	[5] 6	[5] 4.6	15	15	15	15	15	15	15	15
5	14	12	14	14	12	14	14	12	14	[5] 6	[5] 5.75	15	15	15	15	15	15	15	15
6	14	12	14	14	12	14	14	12	14	[5] 8	[5] 6.9	20	15	15	15	15	15	15	15
7	14	12	14	14	12	14	14	12	14	[5] 10	[5] 8.05	25	20	20	15	15	15	15	15
8	14	12	14	14	12	14	14	12	14	[5] 10	[5] 9.2	25	20	20	20	20	20	15	15
9	14	12	14	14	12	14	14	12	14	[5] 12	[5] 10.35	30	30	25	20	20	20	15	15
10	14	12	14	14	12	14	14	12	14	[5] 12	[5] 11.5	30	30	25	20	20	20	15	15
11	14	12	14	14	12	14	14	12	14	[5] 15	[5] 12.65	35	30	30	30	25	30	20	20
12	14	12	14	14	12	14	14	12	14	15	13.8	40	30	30	30	25	30	20	20
13	12	12	14	12	12	14	12	12	14	15	14.95	40	40	35	30	30	30	20	20
14	12	12	14	12	12	14	12	12	12	20	16.1	45	40	35	30	30	30	25	30
15	12	12	14	12	12	14	12	12	12	20	17.25	45	40	40	30	30	30	25	30

TABLE 111.70–10(b3)—CONDUCTOR SIZE AND OVERCURRENT PROTECTION FOR MOTORS—Continued

Full load current rating of motor in amperes	Minimum size conductor AWG and MCM									For running protection of motors (amperes) [1]		Maximum allowable rating or setting of branch circuit protective devices (amperes) [2]							
	1-conductor			2-conductor			3-conductor					With code letters F to V, inclusive, or without code letters: Single-phase and squirrel cage and synchronous, full voltage, resistor and reactor starting		With code letters B to E, inclusive: Single-phase and squirrel cage and synchronous, full voltage resistor or reactor starting. With code letters F to V, inclusive: Auto-transformer starting. Without code letters: Squirrel cage and synchronous, auto-transformer starting; high reactance squirrel cage. [3](Both not more than 30 amperes)		With code letters B to E, inclusive: Squirrel cage and synchronous, auto-transformer, starting. Without code letters: Squirrel cage and synchronous, auto-transformer starting; high reactance squirrel cage. [3](Both more than 30 amperes)		With code letter A: All motors. Without code letters: Direct-current and wound rotor motors	
	R	VC	AVC	R	VC	AVC	R	VC	AVC	Maximum rating of nonadjustable protective devices	Maximum setting of adjustable protective devices	Fuses	Circuit breakers (nonadjustable trip)	Fuses	Circuit breakers (nonadjustable trip)	Fuses	Circuit breakers (nonadjustable trip)	Fuses	Circuit breakers (nonadjustable trip)
16	12	12	14	12	12	12	12	12	12	20	18.4	50	40	40	40	35	40	25	30
17	12	12	12	12	12	12	10	12	12	20	19.55	60	50	45	40	35	40	30	30
18	12	12	12	10	12	12	10	12	12	25	20.7	60	50	45	40	40	40	30	30
19	12	12	12	10	12	12	10	10	12	25	21.8	60	50	50	40	40	40	30	30
20	10	12	12	10	12	12	10	10	12	25	23.0	60	50	50	40	40	40	30	30
22	10	12	12	10	10	12	10	10	10	30	25.3	70	70	60	50	45	50	35	40
24	10	12	12	10	10	12	8	10	10	30	27.6	80	70	60	50	50	50	40	40
26	10	10	12	8	10	10	8	10	10	30	29.9	80	70	70	70	60	70	40	40
28	8	10	12	8	10	10	8	8	10	35	32.2	90	70	70	70	60	70	45	50
30	8	10	10	8	10	10	8	8	10	35	34.5	90	100	80	70	60	70	45	50
32	8	10	10	8	10	10	7	8	8	40	36.8	100	100	80	70	70	70	50	50
34	8	10	10	7	8	10	7	8	8	40	39.1	110	100	90	70	70	70	60	70
36	8	10	10	7	8	10	6	8	8	45	41.4	110	100	90	100	80	100	60	70
38	7	10	10	7	8	8	6	7	8	45	43.7	125	100	100	100	80	100	60	70
40	7	8	10	6	8	8	5	7	8	50	46.0	125	100	100	100	80	100	60	70

42	7	8	10	6	8	8	5	6	7	50	48.3	125	125	110	100	90	100	70	70
44	6	8	8	6	8	8	5	6	7	60	50.6	125	125	110	100	90	100	70	70
46	6	8	8	5	7	8	4	6	6	60	52.9	150	125	125	100	100	100	70	70
48	6	8	8	5	7	8	4	6	6	60	55.2	150	125	125	100	100	100	80	100
50	6	8	8	5	7	7	4	5	6	60	57.5	150	125	125	100	100	100	80	100
52	5	8	8	4	6	7	4	5	6	60	59.8	175	150	150	125	110	125	80	100
54	5	7	8	4	6	7	3	5	5	70	62.1	175	150	150	125	110	125	90	100
56	5	7	8	4	6	7	3	5	5	70	64.4	175	150	150	125	125	125	90	100
58	4	7	8	4	6	6	3	4	5	70	66.7	175	150	150	125	125	125	90	100
60	4	6	7	3	5	6	3	4	5	70	69.0	200	150	150	125	125	125	90	100
62	4	6	7	3	5	6	2	4	5	80	71.3	200	175	175	125	125	125	100	100
64	4	6	7	3	5	6	2	4	4	80	73.6	200	175	175	150	150	150	100	100
66	4	6	6	3	5	5	2	3	4	80	75.9	200	175	175	150	150	150	100	100
68	4	6	6	3	5	5	2	3	4	80	78.2	225	175	175	150	150	150	110	125
70	3	5	6	2	4	5	1	3	4	90	80.5	225	175	175	150	150	150	110	125
72	3	5	6	2	4	5	1	3	3	90	82.8	225	200	200	150	150	150	110	125
74	3	5	6	2	4	5	1	2	3	90	85.1	225	200	200	150	150	150	125	125
76	3	5	6	2	4	5	1	2	3	90	87.4	250	200	200	175	175	175	125	125
78	3	5	5	1	3	4	1	2	3	90	89.7	250	200	200	175	175	175	125	125
80	2	4	5	1	3	4	0	2	3	100	92.0	250	200	200	175	175	175	125	125
82	2	4	5	1	3	4	0	2	2	100	94.3	250	225	225	175	175	175	125	125
84	2	4	5	1	3	4	0	2	2	100	96.6	250	225	225	175	175	175	150	150
86	2	4	5	1	3	4	0	1	2	100	98.9	300	225	225	175	175	175	150	150
88	2	4	5	1	3	3	0	1	2	110	101.2	300	225	225	200	200	200	150	150
90	2	4	4	0	2	3	0	1	2	110	103.5	300	225	225	200	200	200	150	150
92	2	3	4	0	2	3	00	1	2	110	105.8	300	250	250	200	200	200	150	150
94	1	3	4	0	2	3	00	1	2	110	108.1	300	250	250	200	200	200	150	150
96	1	3	4	0	2	3	00	1	1	125	110.4	300	250	250	200	200	200	150	150
98	1	3	4	0	2	3	00	1	1	125	112.7	300	250	250	200	200	200	150	150
100	1	3	4	0	2	2	00	0	1	125	115	300	250	250	200	200	200	150	150
105	1	3	3	00	1	2	000	0	1	125	120.75	350	300	300	225	225	225	175	175
110	0	2	3	00	1	2	000	0	0	150	126.5	350	300	300	225	225	225	175	175
115	0	2	3	00	1	1	000	00	0	150	132.25	350	300	300	250	250	250	175	175
120	0	2	2	000	0	1	4/0	00	0	150	138	400	300	300	250	250	250	200	200
125	00	1	2	000	0	1	4/0	00	0	150	143.75	400	350	350	250	250	250	200	200
130	00	1	2	000	0	1	4/0	00	00	150	149.5	400	350	350	300	300	300	200	200
135	00	1	2	4/0	0	0	4/0	000	00	175	155.25	450	350	350	300	300	300	225	225
140	00	1	1	4/0	00	0	250	000	00	175	161	450	350	350	300	300	300	225	225
145	000	0	1	4/0	00	0	250	000	00	175	166.75	450	400	400	300	300	300	225	225
150	000	0	1	4/0	00	0	300	000	000	175	172.5	450	400	400	300	300	300	225	225
155	000	0	1	4/0	00	00	300	4/0	000	200	178.25	500	400	400	350	350	350	250	250
160	000	0	0	250	000	00	300	4/0	000	200	184	500	400	400	350	350	350	250	250
165	000	0	0	250	000	00	300	4/0	000	200	189.75	500	500	450	350	350	350	250	250
170	4/0	00	0	250	000	00	350	4/0	4/0	200	195.5	500	500	450	350	350	350	300	300
175	4/0	00	0	300	000	000	350	250	4/0	225	201.25	600	500	450	350	350	350	300	300
180	4/0	00	0	300	4/0	000	350	250	4/0	225	207	600	500	450	400	400	400	300	300
185	4/0	00	00	300	4/0	000	350	250	4/0	225	212.75	600	500	500	400	400	400	300	300
190	4/0	00	00	300	4/0	000	400	250	4/0	225	218.5	600	500	500	400	400	400	300	300
195	250	000	00	350	4/0	000	400	300	250	225	224.25	600	500	500	400	400	400	300	300
200	250	000	00	350	4/0	4/0	450	300	250	250	230	600	500	500	400	400	400	300	300

40-130 O—79——6

TABLE 111.70-10(b3)—CONDUCTOR SIZE AND OVERCURRENT PROTECTION FOR MOTORS—Continued

Minimum size conductor AWG and MCM										For running protection of motors (amperes) [1]		Maximum allowable rating or setting of branch circuit protective devices (amperes) [2]							
1-conductor			2-conductor			3-conductor						With code letters F to V, inclusive, or without code letters: Single-phase and squirrel cage and synchronous, full voltage, resistor and reactor starting		With code letters B to E, inclusive: Single-phase and squirrel cage and synchronous, full voltage resistor or reactor starting. With code letters F to V, inclusive: Auto-transformer starting. Without code letters: Squirrel cage and synchronous, auto-transformer starting; high reactance squirrel cage. [3](Both not more than 30 amperes)		With code letters B to E, inclusive: Squirrel cage and synchronous, auto-transformer, starting. Without code letters: Squirrel cage and synchronous, auto-transformer starting; high reactance squirrel cage. [3](Both more than 30 amperes)		With code letter A: All motors. Without code letters: Direct-current and wound rotor motors	
Full load current rating of motor in amperes	R	VC	AVC	R	VC	AVC	R	VC	AVC	Maximum rating of nonadjustable protective devices	Maximum setting of adjustable protective devices	Fuses	Circuit breakers (nonadjustable trip)	Fuses	Circuit breakers (nonadjustable trip)	Fuses	Circuit breakers (nonadjustable trip)	Fuses	Circuit breakers (nonadjustable trip)
210	250	000	00	350	250	4/0	450	300	250	250	241.5	.....	600	600	500	450	500	350	350
220	300	4/0	000	400	250	4/0	500	350	300	300	253	.....	600	600	500	450	500	350	350
230	300	4/0	000	450	300	250	550	350	300	300	264.5	.....	600	600	500	500	500	350	350
240	300	4/0	000	450	300	250	550	400	350	300	276	.....	600	600	500	500	500	400	400
250	350	250	4/0	500	300	250	600	400	350	300	287.5	.....	.....	.....	500	500	500	400	400
260	350	250	4/0	500	350	300	650	450	350	300	299	.....	.....	.....	600	600	600	400	400
270	350	250	4/0	550	350	300	650	450	400	350	310.5	.....	.....	.....	600	600	600	450	500
280	400	250	250	600	350	300	.....	500	400	350	322	.....	.....	.....	600	600	600	450	500
290	400	300	250	600	400	350	.....	500	450	350	333.5	.....	.....	.....	600	600	600	450	500
300	450	300	250	650	400	350	.....	550	450	350	345	.....	.....	.....	600	600	600	450	500
320	500	350	300	.....	450	400	.....	600	500	400	368	.....	.....	.....	.....	.....	.....	500	500
340	550	350	300	.....	500	450	.....	650	550	400	391	.....	.....	.....	.....	.....	.....	600	600
360	600	400	350	.....	550	450	.....	.....	600	450	414	.....	.....	.....	.....	.....	.....	600	600
380	650	450	350	.....	600	500	.....	.....	650	450	437	.....	.....	.....	.....	.....	.....	600	600
400	700	450	400	.....	650	550	.....	.....	.....	500	460	.....	.....	.....	.....	.....	.....	600	600

420	750	500	450	600	500	483	
440	800	550	450	650	600	506	
460	850	600	500		600	529	
480	950	650	550		600	552	
500	1,000	650	550		600	575	

[1] Values may be modified as permitted by § 111.70-15.

[2] Values may be modified as permitted by § 111.70-10.

[3] High reactance squirrel cage motors are those designed to limit the starting current by means of deep-slot secondaries or double-wound secondaries and are generally started on full voltage.

[4] For the grouping of small motors under the protection of a single set of fuses, see § 111.70-10(c).

[5] For running protection of motors of 1 horsepower or less, see § 111.70-15(c).

§ 111.70-15 Motor overload protection.

(a) *General.* The following provisions in this section specify overcurrent devices intended to protect the motors, the motor-control apparatus, and the branch circuit conductors against excessive heating due to motor overloads.

(b) *Continuous duty motors more than one horsepower.* Each continuous duty motor rated more than one horsepower shall be protected against overcurrent by one of the means covered in this paragraph. For multispeed motors each separate winding or winding connection shall be considered separately.

(1) A separate overcurrent device which is responsive to motor current. This device shall be rated or set at not more than 115 percent of the motor full load current rating. For multispeed motors this device shall be rated or set at not more than 115 percent of the full load current rating of each separate winding or winding connection. This value may be modified as permitted by paragraph (g) of this section.

(2) A thermal protector integral with the motor, approved for use with the motor which it protects on the basis that it will prevent dangerous overheating of the motor due to overload or failure to start. If the motor current interrupting device is separate from the motor and its control circuit is operated by a protective device integral with the motor, it shall be so arranged that the opening of the control circuit will result in interruption of current to the motor.

(3) For sealed (hermetic-type) refrigeration motors the protective device specified in paragraph (b)(1) or (2) of this section shall be rated or set to trip at not more than 125 percent of the motor full load line current.

(c) *Continuous duty motors, one horsepower or less, manually started.* Any motor of one horsepower or less which is portable, is manually started, and is within sight from the starter location, shall be considered as protected against overcurrent by the overcurrent device protecting the conductors of the branch circuit. This branch circuit overcurrent device shall not be larger than that specified by table 111.70-10(b3), except that any such motor may be used at 125 volts or less on a branch circuit protected at 20 amperes. Any such motor which is out of sight from the started location and any such motor which is not portable, shall be protected as specified in paragraph (d) of this section for automatically started motors.

(d) *Continuous duty motors, one horsepower or less, automatically started.* Each continuous duty motor rated at one horsepower or less which is automatically started shall be protected against overcurrent by the use of one of the means covered in this paragraph.

(1) In the same manner as provided for motors rated at more than one horsepower by paragraph (b) (1) or (2) of this section.

(2) If part of an approved assembly which does not normally subject the motor to overloads and which is also equipped with other safety controls which protect the motor against damage due to stalled rotor current,

the motor will be considered to be protected. Where such protective equipment is used, it shall be indicated on the nameplate of the assembly where it will be visible after installation.

(3) If the impedance of the motor windings is sufficient to prevent overheating due to failure to start, the motor may be protected as specified in paragraph (c) of this section for manually started motors.

(e) *Wound-rotor secondaries.* The secondary circuits of wound-rotor alternating-current motors, including conductors, controllers, resistors, etc., shall be considered as protected against overcurrent by the motor-running overcurrent device.

(f) *Intermittent and similar duty.* A motor used for a condition of service which is inherently short time is considered as protected against overcurrent by the branch circuit overcurrent device, provided the overcurrent protection does not exceed that specified in Tables 111.70-10(b1) and 111.70-10(b2). Any motor is considered to be for continuous duty unless the nature of the apparatus which it drives is such that the motor cannot operate continuously with load under any condition or unless permitted by § 111.25-15.

(g) *Selection or setting of protective devices.* Where the values specified for motor-running overcurrent protection do not correspond to the standard sizes or rating of fuses, nonadjustable circuit breakers, thermal cutouts, thermal relays, the heating elements of thermal trip motor switches, or possible settings of adjustable circuit breakers adequate to carry the load, the next higher size, rating, or setting may be used, but not higher than 130 percent of the full-load current rating of the motor except that for sealed (hermetic-type) refrigeration motors the rating or setting of the protective device shall not be higher than 140 percent of the full-load current rating of the motor. If not shunted during the starting period of the motor (see paragraph (h) of this section), the protective device shall have sufficient time delay to permit the motor to start and accelerate its load.

(h) *Shunting during starting period.* If the motor is manually started (including starting with a magnetic starter having pushbutton control) the running overcurrent protection may be shunted or cut out of the circuit during the starting period of the motor, provided the device by which the overcurrent protection is shunted or cut out cannot be left in the starting position, and the motor shall be considered as protected against overcurrent during the starting period if fuses or time-delay circuit breakers, rated or set at not over 400 percent of the full-load current of the motor, are so located in the circuit as to be operative during the starting period of the motor. The motor-running overcurrent protection shall not be shunted or cut out during the starting period if the motor is automatically started.

(i) *Fuses; in which conductor.* If fuses are used for motor-running protection, a fuse shall be inserted in each ungrounded conductor, except that a fuse shall also be inserted in a grounded conductor under the circumstances set forth in footnote 1 of Table 111.70-15(j) for circuits supplied by wye-delta or delta-wye connected transformers.

(j) *Devices other than fuses; in which conductors.* If devices other than fuses are used for motor-running protection, Table 111.70-15(j) shall govern the minimum allowable number and location of overcurrent units, such as trip coils, relays, or thermal cutouts.

(k) *Number of conductors disconnected by overcurrent device.* Motor-running protective devices, other than fuses, thermal cutouts, or thermal protectors, shall simultaneously open a sufficient number of ungrounded conductors to interrupt current flow to the motor.

(l) *Motor controller as running protection.* A motor controller may also serve as the running overcurrent device if the number of overcurrent units complies with Table 111.70-15(j), and if these overcurrent units are operative in both the starting and running position in the case of a direct-current motor, and in the running position in the case of an alternating-current motor.

(m) *Thermal cutouts and relays.* Thermal cutouts, thermal relays and other devices for motor-running protection which are not capable of opening short circuits, shall be protected

by fuses or circuit breakers with ratings or settings of not over 4 times the rating of the motor for which they are designed, unless approved for group installation, and marked to indicate the maximum rating or setting of the overcurrent device by which they must be protected.

(n) *Rating of protective devices.* Motor-running overcurrent devices other than fuses shall have a rating of at least 115 percent of the full-load current rating of the motor.

(o) *Automatic restarting.* A motor-running protective device which can restart a motor automatically after

TABLE 111.70-15(j)—MINIMUM NUMBER AND LOCATION OF MOTOR RUNNING PROTECTIVE DEVICES

Kind of motor	Supply system	Number and location of overcurrent units, such as trip coils, relays, or thermal cutouts
1-phase alternating-current or direct-current.	2-wire, 1-phase alternating-current or direct-current, ungrounded.	1 in either conductor.
1-phase alternating-current or direct-current.	2-wire, 1-phase alternating-current or direct-current, one conductor grounded.	1 in ungrounded conductor.
1-phase alternating-current or direct-current.	3-wire, 1-phase alternating-current or direct-current, grounded neutral.	1 in either ungrounded conductor.
3-phase alternating-current.....	3-wire, 3-phase alternating-current, ungrounded.	2 in any 2 conductors. [1]
3-phase alternating-current.....	3-wire, 3-phase, one conductor grounded.	2 in ungrounded conductors.
3-phase alternating-current.....	3-wire, 3-phase alternating-current, grounded neutral.	2 in any 2 conductors. [1]
3-phase alternating current.....	4-wire, 3-phase alternating-current, grounded neutral or ungrounded.	2 in any 2 conductors, except the neutral. [1]

[1] In the case of distribution systems supplying wye-delta or delta-wye connected transformers (having the wye neutral point in the primary ungrounded or not connected to the circuit) three running overcurrent units shall be provided for the protection of 3-phase 3-wire motors.

overcurrent tripping shall not be installed.

(p) *Special requirements for over 600 volts.* Running overcurrent protection for a motor of over 600 volts shall consist of a circuit breaker, or of overcurrent units integral with the controller which shall simultaneously open all ungrounded conductors to the motor. The overcurrent device shall have a setting as specified by this section.

§ 111.70-20 Motor controllers, general requirements.

(a) *Suitability.* Each controller shall be capable of starting and stopping the motor which it controls, and for an alternating-current motor shall be capable of interrupting the stalled-rotor current of the motor.

(b) *Rating.* The controller shall have a horsepower rating, which shall not be lower than the horsepower rating of the motor, except as otherwise permitted by this paragraph.

(1) For a stationary motor rated at ⅛ horsepower or less that is normally left running and is so constructed that it cannot be damaged by overload or failure to start, such as clock motors and the like, the branch circuit overcurrent device may serve as the controller.

(2) For stationary motors rated at 2 horsepower or less, and 300 volts or less, the controller may be a general use switch having an ampere rating at least twice the full-load current rating of the motor.

(3) For portable motors rated at ⅓ horsepower or less, the controller may be an attachment plug and receptacle.

(4) A branch-circuit circuit breaker, rated in amperes only, may be used as a controller. When this circuit breaker is also used for overcurrent protection, it shall conform to the appropriate provisions of this part governing overcurrent protection.

(c) *Need not open all conductors.* Except when the motor controller serves also as a disconnecting means (see § 111.70-30(1)) the controller need not open all conductors to the motor.

(d) *In grounded conductors.* One pole of the controller may be placed in a permanently grounded conductor provided the controller is so designed that the pole is the grounded conductor cannot be opened without simulta-

neously opening all conductors of the circuit.

(e) *Adjacent to motor and driven machinery.* Generally a controller shall be located adjacent to the motor and its driven machinery. Where it is desired to group motor controllers at a central location or where, for other reasons, it is not feasible to locate a controller adjacent to the motor and its driven machine, the installation shall comply with one of the conditions listed in this paragraph.

(1) The motor and controller disconnecting means required by § 111.70-30 shall be capable of being locked in the open circuit position. However, if the disconnecting means is not within sight of the controller location or is more than 50 feet distant from the controller, paragraph (e)(1) or (2) of this section shall be complied with.

(2) A manually operable switch which will disconnect the motor from its source of supply shall be provided adjacent to the motor location. This switch shall be rated in accordance with the appropriate requirements of § 111.70-30.

(3) A maintaining type switch in the motor control circuit shall be provided adjacent to the motor which will prevent the motor from being energized.

(f) *Number of motors served by each controller.* Each motor shall be provided with an individual controller, except that for motors of 600 volts or less, a single controller may serve a group of motors under any one of the conditions provided by this paragraph.

(1) If a number of motors drive several parts of a single machine or piece of apparatus.

(2) If a group of motors is under the protection of one overcurrent device as permitted in § 111.70-10(c)(1).

(g) *Adjustable-speed motors.* Adjustable-speed motors, if controlled by means of field regulation, shall be so equipped and connected that they cannot be started under weakened field unless the motor is designed for such starting.

(h) *Speed limitation.* Machines of the types listed in this paragraph shall be provided with speed limiting devices, unless the inherent characteristics of the machine, the system, or the load and the mechanical connection thereto are such as safely to limit the speed, or unless the the machine is always under the manual control of a qualified operator.

(1) Separately excited direct-current motors.

(2) Series motors.

(3) Motor-generators and converters which can be driven at excessive speed from the direct-current end, as by reversal of current or decrease in load.

(i) *Enclosure*—(1) *General.* All controlling apparatus, except as otherwise permitted below, shall be protected by enclosing cases, either dripproof or watertight, depending on their location. Cable entrance plates, if provided, for watertight enclosures and at the top of dripproof enclosures shall be at least ⅛-inch thick and be fitted with gaskets. Watertight enclosures shall be provided with external feet or lugs for mounting.

(2) *Open type.* Control apparatus may be of the open type provided it is located in a compartment or enclosure assigned solely to electrical control equipment and accessible only to qualified persons. Where the compartment is used for other apparatus and the location of an open controller is such that it is subject to accidental contact, adequate guardrails or the equivalent shall be provided.

(j) *Hinged doors.* All controller hinged doors having either a height exceeding 45 inches or a width exceeding 24 inches shall be provided with door positioners and stops. Equipment mounted on a hinged door shall be constructed or shielded in such a manner that no live parts of the door mounted equipment will be exposed to accidental contact by a person with the door open and the circuit energized.

(k) *Grounding.* Controller cases, except insulating covers of snap switches, shall be grounded.

(l) *Construction.* The construction of controlling apparatus and their enclosures shall conform to the requirements of Underwriters' Laboratories, Inc., "Standard for Industrial Control Equipment," except that sheet metal enclosures for installation in corrosive locations shall not be installed unless one of the conditions covered in this paragraph is complied with.

(1) The enclosure is fabricated of corrosion-resistant material.

(2) The enclosure is fabricated of sheet steel not less than ⅛ inch in thickness and hot dip galvanized after fabrication.

(3) The enclosure is fabricated of sheet steel not less than 3/16 inch in thickness and given a corrosion resistant finish in accordance with § 110.15-40 of this subchapter.

(m) *Wearing parts.* All wearing parts of controller should be readily accessible for inspection and renewal.

(n) *Protection against low voltage.* Motor controllers for motors of 2 horsepower or larger shall be provided with protection against low voltage. Low-voltage release should be provided only on controllers for auxiliaries which are vital to the operation of the propelling equipment where automatic restart after a voltage failure will not be hazardous. Otherwise, low-voltage protection should be used. To permit prompt restoration of service after interruption, the starting current and short-time sustained current of all low-voltage release load shall be within the capacity of one generator.

(o) *Manually operated controllers.* Manually operated controllers shall be arranged for operation without opening the enclosing case. In the panel type the starting arm shall be arranged so that the motor will stop if the arm is left on a starting point. In regulating drum controllers the resistor shall be proportioned for the duty cycle.

(p) *Alternating-current manual auto-starters.* Alternating-current manual auto-starters with self-contained auto-transformers should be provided with switches on the quick-make-and-break type and the starters should be arranged so that it will be impossible to throw to the running position without having first thrown to the starting position. Switches should be preferably of the contractor or air-break type. In case oil is necessary, the starter should not leak when tilted to an angle of 15 degrees and should be constructed to prevent the liquid from splashing out due to the rolling of the vessel.

(q) *Identification of controllers.* A controller shall be marked with the maker's name or identification symbol, the voltage, the current or horsepower rating, and such other data as may be needed properly to indicate the motor which it controls. The identification data necessary to indicate the motor which the controller controls shall be on the external surface of the enclosure. A heat resistant durable type wiring diagram of the controller shall be permanently attached to the inside of the controller door.

[CGFR 70-143, 35 FR 19907, Dec. 30, 1970; 36 FR 5606, Mar. 25, 1971]

§ 111.70-25 Group control panels.

(a) *General.* The provisions in this section are in addition to and amendatory of the other provisions of this subpart and are applicable to two or more motor controllers grouped into a motor control center and supplied by a common feeder. The provisions of this paragraph are not applicable to the controllers for two or more motors driving several parts of a single machine or piece of apparatus when the controllers are grouped or installed in a single enclosure.

(b) *Arrangement.* Each controller and its associated motor overcurrent protective device, motor branch circuit overcurrent protective device and disconnecting means shall be mounted in a common metal enclosure provided with a hinged door.

(c) *Door interlock.* The hinged door required above shall be interlocked with the disconnect device to prevent the door being opened with the circuit energized.

(d) *Working space.* Working space, generally not less than 30 inches and at no point less than 24 inches, shall be provided in front of group control boards. Where access to the rear is required for making connections and for subsequent inspections, or for other purposes, space adequate for the work to be done, and in no case less than 18 inches shall be provided.

(e) *Nameplates.* Circuit nameplates in accordance with § 111.30-1(h) shall be provided.

§ 111.70-30 Disconnecting means.

(a) *General.* The provisions contained in this section are intended to

require disconnecting means for motors and controllers capable of disconnecting them from the circuit.

(b) *Type.* The disconnecting means shall be an enclosed, externally operable, motor-circuit switch, rated in horsepower, or a circuit breaker, except as permitted in the paragraphs (c), (d), (e), (f), and (g) of this section. Every switch in the motor branch circuit within sight from the controller location shall comply with these requirements.

(c) *One-eighth horsepower or less.* For stationary motors of ⅛ horsepower or less, the branch circuit overcurrent device may serve as the disconnecting means.

(d) *Two horsepower or less.* For stationary motors rated at 2 horsepower or less and 300 volts or less, the disconnecting means may be a general-use switch having an ampere rating at least twice the full-load current rating of the motor.

(e) *Over 2 horsepower to and including 50 horsepower.* The disconnecting means shall be a motor-circuit switch rated in horsepower, or a circuit breaker, except that for a motor with an auto transformer type of controller, the disconnecting means may be a general use switch if all the provisions contained in this paragraph are complied with.

(1) The motor drives a generator which is provided with overcurrent protection.

(2) The controller is:

(i) Capable of interrupting the stalled-rotor current of the motor.

(ii) Provided with a low-voltage release, and

(iii) Provided with running overcurrent protection not exceeding 115 percent of the motor full-load current rating.

(3) Separate fuses or a circuit breaker, rated or set at not more than 150 percent of the motor full-load current are provided in the motor branch circuit.

(f) *Exceeding 50 horsepower.* For stationary motors rated at more than 50 horsepower, the disconnecting means may be a motor-circuit switch also rated in amperes, a general-use switch, or an isolating switch. Isolating and general-use switches for motors exceeding 50 horsepower, not capable of interrupting stalled-rotor currents, shall be plainly marked "Do not open under load."

(g) *Portable motors.* For portable motors an attachment plug and receptacle may serve as the disconnecting means.

(h) *Current-carrying capacity.* The disconnecting means shall have a current-carrying capacity of at least 115 percent of the current rating of the motor.

(i) *Poles; in which conductors.* The disconnecting means shall simultaneously open all conductors.

(j) *To be indicating.* The disconnecting means shall plainly indicate whether it is in the open or closed position.

(k) *To disconnect both motor and controller.* The disconnecting means shall disconnect both the motor and the controller from all supply conductors. The disconnecting means may be in the same enclosure with the controller.

(l) *Switch or circuit breaker as both controller and disconnecting means.* A switch or circuit breaker complying with the provisions of § 111.70-20(b) may serve as both controller and disconnecting means if it opens all conductors to the motor, is protected by an overcurrent device (which may be the branch circuit fuses) which opens all ungrounded conductors to the switch or circuit breaker, and is one of the types listed in this paragraph.

(1) An air-break switch operable directly by applying the hand to a lever or handle.

(2) A circuit breaker switch operable directly by applying the hand to a lever or handle.

(3) An oil switch used on a circuit whose rating does not exceed 600 volts or 100 amperes, or on a circuit exceeding this capacity if under expert supervision and by special approval.

(4) The oil switch or circuit breaker specified above may be both power and manually operable. If power operable, provisions shall be made to lock it in the open position. The overcurrent device protecting the controller may be part of the controller assembly or may be separate. An autotransformer type controller is not included

above and will require a separate disconnecting means.

(m) *Panelboard or switchboard devices, as disconnecting means.* A branch circuit switch or circuit breaker may serve as the disconnecting means provided it conforms to all the requirements of this section. When provision for locking in the open circuit position is required by paragraph (n) of this section, accessibility for manual operation of any other switch or circuit breaker on the panelboard or switchboard shall not be hindered.

(n) *In sight from controller location.* The disconnecting means shall be located within sight of controller location or be arranged to be locked in the open circuit position. A distance of more than 50 feet is considered equivalent to being out of sight. The disconnecting means shall be located in the same ship's compartment with the controller.

(o) *Motors served by a single disconnecting means.* Each motor shall be provided with individual disconnecting means, except that for motors of 600 volts or less a single disconnecting means may serve a group of motors under any one of the conditions provided by this paragraph. The disconnecting means serving a group of motors shall have a rating not less than is required by paragraph (b) of this section for a single motor whose rating equals the sum of the horsepowers or currents of all motors of the group.

(1) If a number of motors drive several parts of a single machine or piece of apparatus such as metal and woodworking machines, cranes, and hoists.

(2) If a group of motors is under the protection of one set of overcurrent devices as permitted by § 111.70-10(c).

(p) *Readily accessible.* The disconnecting means shall be readily accessible.

§ 111.70-35 Heater circuits.

Where motors, master switches, and similar enclosures, except motor controllers, are fitted with electric heaters located inside the enclosures and energized from a separate circuit, the heater circuits shall be disconnected in the same manner as required for control, interlock and indicator circuits in § 111.70-40(e)(2). In the case of deck machinery, when the location of the motor, master switch, or similar enclosure is remote from the motor and controller disconnect device, a warning sign may be affixed to the unit enclosure warning the operator of the presence of two sources of potential within the unit enclosure and giving the location of the heater circuit disconnect device in lieu of the disconnect arrangement required by § 111.70-40(e)(2). Electric heaters installed within motor controllers and energized from a separate circuit shall be disconnected in the same manner as required by § 111.70-40(e).

§ 111.70-40 Remote-control, electrical interlock, and indicator circuits.

(a) *General.* The deviations from the general requirements in this subchapter as covered by this section are intended to provide for peculiar conditions governing remote-control, electrical interlock, and indicator circuits.

(b) *Overcurrent protection.* Conductors of control, electrical interlock, and indicator circuits of motor controllers shall be considered as being properly protected against overcurrent by the branch-circuit overcurrent device where the conductors are wholly within the controller enclosure. Conductors of control, electrical interlock, and indicator circuits external to the controller enclosure shall be considered as being properly protected against overcurrent under any one of the conditions listed in this paragraph.

(1) If the rating or setting of the branch-circuit overcurrent device is not more than 500 percent of the current-carrying capacity of the control, electrical interlock, or indicator circuit conductors.

(2) By overcurrent devices, in both sides of the line, having a rating or setting of not more than 500 percent of the current-carrying capacity of the control, electrical interlock, or indicator circuit conductors, except that where under operating conditions there is no appreciable difference in potential between the external conductors, overcurrent protection need only be provided at the supply of that side of the line.

(3) If the opening of the control, electrical interlock, or indicator circuit would create a hazard, no overcurrent protection shall be provided.

(4) For overcurrent protection of steering gear control and indicator light circuits see § 111.80-70.

(c) *Accidental ground.* It is recommended that remote control circuits be so arranged that an accidental ground will not start the motor.

(d) *Source of potential.* The potential for a control, interlock, or indicator circuit shall be derived from the load side of the motor and controller disconnect means specified by § 111.70-30, except that where the control functions are such that such circuits must be common to two or more controllers, the switching arrangements specified by paragraph (e) of this section, shall be complied with.

(e) *Switching.* In the design of control, interlock, and indicator circuits, all possible steps shall be taken to eliminate more than one source of potential in an enclosure. Where the control functions are such as to make it impracticable to energize a control, interlock, or indicator circuit from the load side of the motor and controller disconnect means specified by § 111.70-30, one of the following alternative methods of switching shall be employed.

(1) The potential of the control, interlock, or indicator circuits shall be limited to not more than 24 volts, in which case no disconnecting means need be provided.

(2) The conductors of control, interlock, or indicator circuits shall be disconnected from all sources of potential by a disconnect device independent of the motor and controller disconnect device specified by § 111.70-30. The two independent devices shall be located immediately adjacent one to the other, and a sign, warning the operator to open both devices to disconnect completely the motor and controller, shall be permanently attached to the exterior of the door of the main disconnect device.

(3) The conductors of control, interlock, or indicator circuits shall be disconnected from all sources of potential by a disconnect device actuated by the opening of the controller door, this device and its connections (including terminal blocks, when employed, for terminating the ship's wiring) being such that there are no electrically uninsulated or unshielded surfaces.

Subpart 111.75—Lighting Circuits and Protection

§ 111.75-1 Lighting feeders.

(a) Passenger quarters, crew quarters, and public spaces: On passenger vessels constructed with firescreen bulkheads forming fire zones, the lighting distribution system shall be so arranged that fire in any main fire zone will not interfere with the lighting in any other main fire zone. This requirement will be met if main and emergency feeders passing through any zone are separated both vertically and horizontally as widely as is practicable.

(b) Machinery spaces: Lighting for enginerooms, for the boilerrooms, and for the auxiliary machinery spaces shall, where practicable, be supplied from two or more feeders, one of which may be an emergency feeder.

(c) Cargo spaces: Separate feeders shall be provided for cargo space lighting. The distribution panels shall be located outside of the cargo spaces.

(d) Special requirements for emergency lighting, feeders, and branch circuits are given in § 112.05-10 of this subchapter.

§ 111.75-3 Transformer feeder circuits.

The conductors of transformer primary and secondary feeder circuits shall be provided with short circuit protection and shall be protected by overcurrent devices located at the source of supply to the primary, rated or set at 100 percent of the smaller of the primary and secondary feeder conductors (taking into account the transformer ratio as necessary). The rating or setting of the overcurrent devices shall not exceed 115 percent of the rated primary current of the transformer.

§ 111.75-5 Lighting branch circuits.

(a) General. Lighting branch circuit conductors shall be not smaller than No. 14 AWG, except that taps to lampholders within a lighting fixture may be not smaller than No. 18 AWG

where the branch circuit is protected by an overcurrent device rated or set at not more than 15 amperes.

(b) *15-ampere lighting branch circuits.* The connected load on a lighting branch circuit shall not exceed 12 amperes, computed on the basis of the lamp sizes to be installed, but in no case less than 50 watts per outlet unless the design of the fixture precludes the possibility of installing lamps of a higher wattage than those originally installed. Circuits supplying electric discharge type lamps shall be computed on the basis of ballast input current. Receptacle outlets provided for the convenience of passengers or crew to which no ship's service apparatus, such as room fans, desk lamps, table lamps, etc., will be connected, need not be counted as a connected load.

(c) *20-ampere lighting branch circuits.* Lighting branch circuits supplying only fixed nonswitched lighting fixtures for cargo hold or deck lighting may be supplied by 20-ampere branch circuits wired with not less than No. 12 AWG conductors, provided all the following conditions are complied with:

(1) Fixture wire or portable cord, if employed in the lighting fixtures, shall not be smaller than No. 14 AWG.

(2) The connected load shall not exceed 16 amperes.

(3) 30-ampere lighting branch circuits: Lighting branch circuits supplying only fixed nonswitched lighting fixtures having only lampholders of the mogul type, or other lampholding devices required for lamps exceeding the maximum rating of medium-base lamps (300 watts), may be supplied by 30-ampere branch circuits wired with not smaller than No. 10 AWG conductors, provided all of the following conditions are complied with:

(i) Fixture wire, if employed in wiring the lighting fixtures, shall be not less than No. 12 AWG.

(ii) The connected load shall not exceed 24 amperes.

(4) Multilamp fixtures: Multilamp fixtures employing a large number of low-wattage lamps, where the total load of the fixture exceeds 12 amperes, may be supplied by a polyphase branch circuit provided all the conditions covered in this paragraph are complied with.

(i) The branch circuit is controlled from the distribution panelboard only by a common closing, common trip circuit breaker having a pole for each circuit conductor.

(ii) The potential between any two conductors of the polyphase circuit does not exceed 120 volts.

(iii) The current in any conductor of the polyphase branch circuit does not exceed 12 amperes.

(d) *Connections to screw-shell lampholders.* On branch circuits with a grounded conductor, the screw shell of lampholders shall be connected to the grounded neutral.

(e) *Fixture wires or flexible cords.* Fixture wire or flexible cord, size No. 16 or No. 18 AWG, shall be considered as protected by 15-ampere overcurrent devices.

§ 111.75-10 Low-voltage system, 0 to 50 volts.

(a) *Lighting.* Where a low-voltage system is used for lighting, standard lamp sockets and receptacles shall be used, and no branch circuit is to be fitted with more than eight lamp sockets or receptacles. Each lighting branch circuit shall be wired with not less than No. 12 AWG conductors, and shall be protected by fuses of no greater capacity than 20 amperes, except that special circuits supplying appliances shall have receptacles of 20-ampere rating and shall be wired with not smaller than No. 10 AWG conductors. Where a low-voltage, low-amperage system is used, such as for interior communication, no electrical connection is to be made to a standard voltage system unless specifically approved.

§ 111.75-15 Lighting requirements.

(a) *General requirements*—(1) *Passageways, public spaces, etc.* The supply to lights in passageways, public spaces, and berthing compartments accommodating more than 25 persons shall be divided between two or more branch circuits one of which may be an emergency.

(2) *Machinery spaces.* Where practicable, alternate groups of lights in an engineroom, a boilerroom, and an aux-

iliary machinery space shall be arranged so that the failure of one branch circuit will not leave large areas in darkness.

(b) *General lighting requirements*—(1) *Crew spaces and work spaces.* All spaces where members of the crew are regularly employed or quartered shall be adequately lighted. The minimum standard for natural lighting is that it will be possible on a clear day to read print such as that of an ordinary newspaper in any part of the clear working space. When it is not possible to provide adequate natural lighting, artificial lighting may be accepted on the same basis.

(2) *Washrooms, toilet rooms, etc.* Washrooms, toilet rooms, and hospital spaces are in particular to be well lighted.

(3) *Artificial lighting.* In every space apportioned to the crew, provision shall be made for efficient illumination at night and in dull weather by artificial lighting.

(4) *Berth lights.* Special provisions shall be made for berth lights for each member of the crew.

(c) *Berth lights.* Berth lights shall be permanently mounted and wired without the use of portable cords. The berth light shall have a minimum horizontal projection so that it will be difficult completely to cover the light with bedding.

(d) *Exit lights.* (1) Exit lights are required by § 78.47-40 of this chapter.

(2) The word "Exit" shall be in red block letters not less than 2 inches high and of such type that it can be seen from a distance.

(e) *Lifeboat floodlights.* (1) Illumination for lifeboat launching operations is required by §§ 33.20-1(c)(3), 75.50-10, and 94.50-10 of this chapter. The power supply to the lifeboat branch circuits shall be from the emergency source as specified in § 112.05-10 of this subchapter.

(2) Lifeboat floodlights: The arrangement of branch circuits to lifeboat floodlights shall be such that the floodlights at adjacent lifeboats are supplied by different branch circuits.

(3) Lifeboat floodlights shall be arranged so that the floodlights may be quickly directed either to the launching gear or to the lifeboat alongside. Means of training the floodlights shall be positive and shall not require the use of tools. The floodlights shall be connected to the supply circuit by means of a short length of heavy-duty portable cord, Type S or the equivalent, and no receptacle outlet shall be employed.

(4) Vessels having liferafts, authorized in lieu of lifeboats for which approved launching devices are provided, shall be fitted with floodlights for illuminating the liferafts, launching devices, and water into which the liferafts are launched. Such floodlights shall be arranged as required by paragraph (e)(2) of this section for lifeboats. Means shall also be provided for illuminating the stowage position of liferafts for which approved launching devices are not provided.

(f) *Pilot ladders.* Means shall be provided and used on all vessels engaged on voyages in which pilots are likely to be embarked at night for illuminating the pilot ladders.

(g) *Navigation lights*—(1) *Application.* The provisions of this subpart, with the exception of paragraph (g)(8) of this section shall apply to all vessels contracted for on or after November 19, 1952. Vessels contracted for prior to November 19, 1952, shall meet the requirements of paragraph (g)(8) of this section.

(2) *General requirements.* (i) All vessels and motorboats shall be equipped with navigation lights and shapes as prescribed by law and regulation.

(ii) Navigation light circuits: The feeder supplying a navigation light panel shall be protected by overcurrent devices rated or set at not less than 30 amperes. The navigation light panel shall be fitted with 10-ampere main fuses and with three-ampere branch circuit fuses as indicated on Figure 111.75-15(g)(3).

(3) *Navigation light indicator panel.* (i) Self-propelled vessels of 1,600 gross tons and over shall be provided with a navigation light indicator panel located in the wheelhouse to control electric side, masthead, range, and stern lights. The panel shall provide visible and audible indications of the failure of any of the above-named navigation lights. The power supply shall meet

the requirements of § 112.05-10(b)(2) of this subchapter.

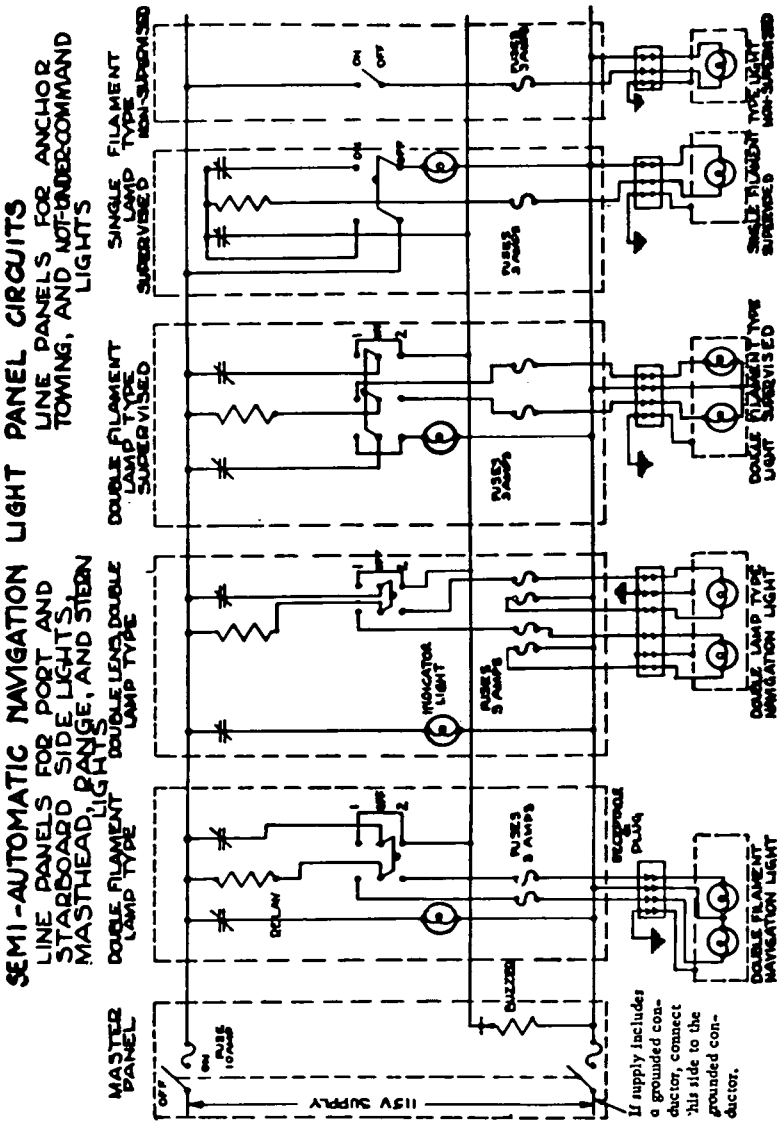
(ii) Recommended circuit diagrams for navigation light indicator panels are shown in Figure 111.75-15(g)(3) of this subchapter. Other circuit diagrams may be submitted for approval.

(4) *Construction of navigation lights.* Navigation lights shall be of an approved type.

(5) *Installation of navigation lights.* (i) Navigation lights shall be installed in such a manner that the angles of visibility and the minimum heights above the deck required by the applicable Rules of the Road will be assured.

(ii) The light from a navigation light shall not be obscured by any part of the vessel's structure or rigging.

FIGURE 111.75-15(g)(3)



(iii) Navigation lights shall be wired by means of a short length of heavy-duty portable cable to a watertight receptacle outlet located adjacent thereto. Where the double lens, two-lamp type electric navigation light is installed, each lamp shall be connected to its branch circuit conductors by means of an individual portable cable and receptacle plug.

(6) *Light screens.* Light screens required by the Rules of the Road for port and starboard side lights shall be painted with a glossy black paint and shall project not less than 3 feet forward of the center of the light source.

(7) *Light intensity standards.* (i) Navigation lights shall be of sufficient intensity so that the candlepower outside the lens is not less than that amount corresponding to the required distance of visibility as specified in Table 111.75-15(g) (7)(i).

TABLE 111.75-15(g)(7)(i)

Distance of visibility, in nautical miles	*Candlepower*
1	1.0
2	5.5
3	17.6
5	100.0

NOTE: In Table 111.75-15(g)(7)(i) the standards are based upon a transmissivity factor of 70 percent per sea-mile and a practical threshold of vision of ⅔-sea-mile candles.

(ii) The standard incandescent lamps listed in Table 111.75-15(g)(7)(ii) are recommended for vessels having 115-volt electrical systems.

TABLE 111.75-15(g)(7)(ii)

Distance of visibility, in nautical miles	Color	Wattage	
		With fresnel lens	Without fresnel lens
1	Red		25
1	Green	25	50
2	White		15
2	Amber		25
2	Red	40	100
2	Green	75	200
3	White		25
3	Amber	25	75
5	White	40	100

NOTE: In table 111.75-15(g)(7)(ii) the recommended lamp wattages for lights with fresnel lenses assume a lamp-to-light ratio of 1 to 4. The following filter efficiencies are assumed: Amber—30 percent; red—5 percent; green—2 percent. For this table it is also assumed the lamps have the following intensities: 15w.—11cp.; 25w.—21cp.; 40w.—37cp.; 50w.—50cp.; 75w.—90cp.; 100w.—130cp.; 200w.—290cp. The computations are based upon

Allards Law, using the formula:

$$I_o = E_o D^2 \div T^D$$

Where:

I_o = Intensity of the source in candlepower.
E_o = The practical threshold of vision, ⅔ sea-mile candles.
D = Distance light must be seen in nautical miles.
T = 0.7, the transmissivity factor, or fraction of light passing through each nautical mile of atmosphere on a "dark night with a clear atmosphere."

(8) *Navigation lights for existing vessels.* (i) Navigation lights on vessels contracted for prior to November 19, 1952, shall meet the requirements covered in this section.

(ii) Existing arrangements, materials, and facilities previously approved will be considered satisfactory so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standard as the original installation.

(iii) All new installations or major replacements shall meet the applicable specifications or requirements.

(h) *Signaling lights*—(1) *Application.* The provisions of this subpart, with the exception of paragraph (h)(5) of this section, shall apply to vessels contracted for on or after November 19, 1952. Vessels contracted for prior to November 19, 1952, shall meet the requirements of paragraph (h)(5) of this section.

(2) *General requirements.* Except as modified by § 33.50-1 of this chapter, all ocean and coastwise self-propelled vessels of over 150 gross tons shall be equipped with an efficient daylight signaling light of the type covered by this subpart.

(3) *Signaling lamp circuit.* A separate branch circuit shall be provided to supply the signaling lamps required by this paragraph. The branch circuit shall be supplied either from the emergency lighting panel required by § 112.05-10(b)(2) emergency source of emergency lighting and power as provided for in § 112.15-5(h) of this subchapter, or from a source as approved in the case of vessels not fitted with

an emergency lighting and power system.

(4) *Detail requirements.* (i) The signaling light shall consist of a device which produces a narrow high-intensity beam of light suitable for daylight blinker communication at speeds up to nine words (180 dots and/or dashes) per minute.

(ii) The axial candlepower of the beam shall be not less than 60,000 candlepower. The beam shall have a total horizontal and vertical divergence of approximately 6 degrees. This divergence is defined as the angular limits of the beam where the candlepower has fallen to one-tenth of the axial candlepower.

(iii) In addition to the requirements of paragraph (h)(4) (ii) of this section, the candlepower of the beam in every direction within an angle of 0.7° from the axial shall be not less than 50 percent of the axial candlepower.

(iv) The signaling light shall be fitted with a suitable sighting arrangement capable of directing the beam on to the receiving station.

(v) Signaling may be effected by keying the current through the lamp, by movement of shutters, or by other approved means.

(vi) The signaling light may be either a fixed unit mounted on the top of the wheelhouse, a semifixed unit with arrangements for quick mounting at either wing of the navigating bridge, or a portable unit.

(vii) Fixed or semifixed signaling lights shall be energized from the emergency lighting and power system as required by § 112.15-5(h) of this subchapter. Portable signaling units shall be energized from a self-contained storage battery capable of operating the unit 2 hours continuously without recharging.

(5) *Signaling light for existing vessels.* (i) Signaling lights on vessels contracted for prior to November 19, 1952, shall meet the requirements in this section.

(ii) Ocean and coastwise ships over 150 gross tons shall be equipped with an efficient signaling lamp. This lamp shall be permanently fixed above the bridge and equipped with a Fresnel lens and high-speed bulb, operated by a weatherproof key fitted with a suitable condenser. The lamp shall be so connected that it can be operated from the normal source of ship's current, the emergency source, and other emergency batteries if provided.

(iii) Existing arrangements, materials, and facilities previously approved will be considered satisfactory so long as they are maintained in good condition and meet all test requirements to the satisfaction of the Officer in Charge, Marine Inspection, having jurisdiction. Minor repairs and minor alterations may be made to the same standard as the original installation. All new installations or major replacements shall meet the applicable specifications or requirements for new vessels.

§ 111.75-20 Lighting fixtures.

(a) *General requirements.* (1) Construction details shall be in accordance with Underwriters' Laboratories, Inc., "Standard for Marine Type Electric Lighting Fixtures Subject 595."

(2) Open arc lamps shall not be used for applications other than for searchlights and for motion picture projectors.

(3) Fixture globes shall be protected by guards except in living quarters, wheelhouse, gyro room, radio room, galley, and similar spaces where not subject to mechanical damage.

(4) Fixtures shall be of such construction, or so installed, that the conductors in outlet boxes will not be subjected to temperatures greater than that for which the conductors are approved (75° C. for rubber insulated conductors, 85° C. for varnished-cloth insulated and mineral-insulated conductors, 95° C. for asbestos-varnished-cloth insulated conductors, and 105° C. for MIL-C-2194 type SGA cable). For the purpose of this section, an ambient temperature of 25° C. will be assumed for passenger and crew quarters, public spaces, cargo spaces, and open deck areas, an ambient temperature of 40° C. will be assumed for auxiliary machinery and work spaces, and an ambient temperature of 50° C. will be assumed for the engine and boiler-rooms.

(5) Fixtures shall be so constructed, or installed, or equipped with shades and/or guards that combustible mate-

rial will not be subjected to temperatures in excess of 90° C.

(6) Fixtures shall not be used as connection boxes for circuits other than the branch circuit supplying the fixture except that two or more circuits may supply the fixture when:

(i) One or more lamps of a multilamp fixture are supplied from an emergency lighting circuit; or

(ii) When the number of lamps of a fixture exceeds the capacity of a single circuit. When more than one circuit is employed in a fixture, the circuits shall be as widely separated as possible and the different circuits clearly identified at terminal points. Also see § 111.75-5(c)(4).

(7) For wiring of explosion-proof equipment see § 111.80-5.

(b) *Lighting fixture installations.* (1) Fixtures installed in locations exposed to the weather and in other locations occasionally exposed to splashing water shall be of watertight construction. Fixtures installed in other wet or damp locations shall be of at least dripproof construction as installed.

(2) Any combustible bulkhead or ceiling finish exposed between the edge of a fixture canopy or pan and the outlet box shall be covered with noncombustible material.

(3) In a completed installation, each outlet box shall be provided with a cover unless it is covered by means of a fixture canopy, lampholder, or similar device.

(4) Fixtures, lampholders, and receptacle outlets shall be securely supported. Fixtures shall not be supported by the screw shell of a lampholder.

(5) Pendent fixtures shall be suspended by, and supplied through threaded rigid conduit stems.

(6) Tablelamps, desklamps, floorlamps, and similar equipment shall be secured in place to prevent displacement by the roll or pitch of the vessel.

(c) *Grounding of lighting equipment.* (1) Lighting equipment (including fixtures) shall be grounded.

(2) Equipment shall be considered as grounded when mechanically connected in a permanent and effective manner to the metal structure of the ship, the armor of armored cable, or a grounding connector.

§ 111.75-25 Appliance circuits.

(a) *General.* Branch circuits which supply appliance loads, electric heater loads, and isolated small motor loads may be connected to distribution panelboards supplying lighting provided the required branch circuit capacity does not exceed 30 amperes.

(b) *Overcurrent protection.* The rating or setting of branch circuit overcurrent devices shall not be in excess of the current-carrying capacity of the circuit conductors except as provided in § 111.50-1(b). If the circuit supplies only a single appliance or device, the rating or setting of the branch circuit overcurrent device shall not exceed 150 percent of the rating of the appliance or device or 15 amperes whichever is the higher.

§ 111.75-30 Receptacle outlets.

(a) *General.* (1) A sufficient number of receptacle outlets shall be located throughout crew's accommodations to permit the use of electric razors, radios, and the like without using portable cords of excessive length.

(2) A sufficient number of receptacle outlets shall be located throughout the machinery spaces to permit lighting of any machine vital to the operation of the vessel with a portable light having a 75-foot portable cord. The requirements of this subparagraph shall be effective on vessels contracted for on or after November 19, 1956.

(b) *Grounding.* Receptacle outlets and attachment plugs for the attachment of portable lamps, tools, and similar apparatus supplied as ship's equipment and operating at 100 volts or more, shall provide a grounding pole and a grounding conductor in the portable cord to ground the dead metal parts of the portable apparatus. For portable devices made entirely of nonconducting material or so constructed that dead metal parts will not become energized under any conditions, the grounding conductor in the portable cord and the grounding pole of the attachment plug need not be furnished. Portable apparatus shall be deemed to be any apparatus served by means of a flexible extension cord, whether the apparatus is permanently mounted or not.

40-130 O—79——7

(c) Receptacle outlets provided for the convenience of, and located in quarters for, passengers or crew for connecting portable appliances operating at 100 volts or more, shall provide a grounding pole.[1]

(d) Receptacle outlets of the type providing a grounding pole shall be of a distinctive design that will not permit the dead metal parts of portable apparatus to be connected to a live conductor.

(e) Receptacle outlets for use in damp or wet locations shall be so designed that, when the plug is in place, the plug will be held in positive contact and will establish and maintain a watertight integrity of the enclosure.

(f) Receptacle outlets for use in damp or wet locations shall be so designed that, when the plug is not in place, the plug opening may be closed to establish and maintain a watertight integrity of the enclosure. Where threaded caps are used for this purpose, the cap shall be mechanically fastened to the cover or enclosure by a strong link or hinged strap.

(g) Receptacle outlets for use in locations exposed to the weather shall be so designed that, with the plug opening uncovered, water will not collect in the interior of the box.

(h) Receptacle outlets for use in locations where accessible to other than qualified persons shall, with the plug opening uncovered, present no live parts. Any screw, rivet, contact, or the like, which is accessible and in electrical connection with any live-metal part, shall be connected in a hole not more than nine thirty-seconds of an inch in diameter and recessed not less than three-sixteenths of an inch in the clear.

(i) When it is necessary to transmit current in one direction between two receptacle outlets by means of a portable cable with a plug on each end (such as a battery charging lead between a receptacle outlet on a ship and a receptacle outlet in a lifeboat), the plug which may be energized when not inserted in the receptacle outlet, shall be of the female type. When receptacle outlets may be used as a source of power as well as to receive power (such as the receptacles on barges that may have to supply power to adjoining barges in some makeups and receive power from the towboat or adjoining barge in other makeups) the receptacles shall be of the male, reverse service type. Plugs of associated portable cable shall be of the female type and shall be provided at both ends of the portable lead. The female type plug specified in this paragraph shall comply with the requirements of paragraph (h) of this section.

(j) A receptacle outlet installed on a lifeboat for the purpose of connecting it to the ship's electrical system shall be of the type that will permit the plug to pull free should the lifeboat be lowered.

(k) Where receptacle outlets on a ship are connected to different potentials, or to different types of potentials, receptacle outlet types shall be selected so that a portable device cannot be plugged into a receptacle outlet of an unsuitable potential.

(l) Receptacle outlets and plugs for use in damp or wet locations shall be constructed of corrosion-resistant materials, or of materials with corrosion-resistant finishes, except that receptacle outlets and plugs for use in corrosive locations shall be constructed of corrosion-resistant materials.

(m) Interior units of receptacle outlets and plugs shall conform to the requirements of Underwriters' Laboratories, Inc., "Standard for Attachment Plugs and Receptacles."

§ 111.75-35 Outlet boxes.

(a) *General.* The requirements of this section are applicable to outlet boxes for use with lighting fixtures, wiring devices, and the like, including separately installed connection and junction boxes, having a volume of not more than 100 cubic inches. Boxes of large size will require special consideration. An outlet box shall be installed at each outlet, switch, receptacle, or junction point. In the complete installation, each outlet or junction box shall be provided with a cover unless a fixture canopy, switch cover, receptacle cover, or similar cover is used.

[1] Applicable to vessels contracted for on or after January 1, 1964. Vessels contracted for before January 1, 1964, need not provide a type with grounding pole if operating at 125 volts or less.

(b) *Cables entering boxes.* Cables entering boxes or fittings shall be protected from abrasion, and shall conform to the requirements of this paragraph.

(1) Openings through which conductors enter shall be adequately closed.

(2) The cable armor shall be secured to the box or fitting.

(3) In damp or wet locations, the cable entrance shall be made watertight by means of a terminal or stuffing tube, except that cables entering the bottom of dripproof enclosures need not be made watertight.

(c) *Size.* Outlet boxes shall have an internal depth of at least 1½ inches, except that when an outlet box is incorporated in a fixture the depth may be decreased to not less than 1 inch provided the outlet box volume is not less than 20 cubic inches. The free space within an outlet box for each conductor, not counting fixtures wires, shall be not less than that given in table 111.75-35(c). Table 111.75-35(c) applies where no fitting or devices, such as cable clamps, hickeys, switches, or receptacles are contained in the box. Where one or more such devices are contained in the box, each such device shall count as one conductor. Each conductor terminated in the box is counted as one conductor.

TABLE 111.75-35(c)—OUTLET BOX SIZE

AWG size of conductor, No.—	*Free space in cubic inches for each conductor within box*
14	2.0
12	2.25
10	2.5
8	3.0

(d) *Degree of enclosure.* Outlet boxes for use in damp or wet locations shall be of watertight construction.

(e) *Mounting and grounding.* Outlet boxes shall be securely fastened in place and grounded to the hull of the vessel. Outlet boxes of watertight construction shall have external mounting feet or lugs.

(f) *Penetration of walls.* Holes in the walls of watertight outlet boxes for the purpose of providing means for the attachment of parts on the exterior or interior thereof, or for securing the cover and the like, shall not penetrate the total thickness of the box wall.

(g) *Construction.* The construction of outlet boxes shall conform with the requirements of Underwriters' Laboratories, Inc., "Standard for Outlet Boxes and Fittings", except that sheet steel outlet boxes shall not be installed in corrosive locations.

Subpart 111.80—Special Requirements for Certain Locations and Systems

§ 111.80-1 Application.

The requirements of this subpart contain special requirements relative to electrical installations in specific areas and to specific electrical systems. Except as modified by this subpart, all other applicable rules contained in this subchapter shall also apply to such installations and systems.

§ 111.80-5 Wiring methods and materials for hazardous locations.

(a) *General.* (1) The provisions of this section apply to locations in which equipment and wiring are subjected to the conditions indicated by the classifications covered by paragraphs (a)(8) through (10) of this section. It is necessary that each compartment or area containing electrical equipment be considered individually in order to determine its hazard classification. Except as modified by this section, all other applicable rules contained in this subchapter shall apply to electrical equipment and wiring installed in hazardous locations.

(2) The term "explosion-proof" as used in this section shall mean enclosed in a case which is capable of withstanding an explosion of a specified gas or vapor which may occur within it, and of preventing the ignition of a specified gas or vapor surrounding the enclosure by sparks, flashes, or explosion of the gas or vapor within, and which operates at such an external temperature that a surrounding flammable atmosphere will not be ignited thereby.

(3) The term "intrinsically safe" when used with instruments and equipment or wiring shall mean such instruments and equipment or wiring that is incapable of releasing sufficient

electrical or thermal energy under normal or abnormal conditions to cause ignition of a specific hazardous atmospheric mixture in its most easily ignited concentration.

(i) Intrinsically safe instruments and equipment or wiring may be installed in any hazardous area for which it has been approved by the Commandant. It may be used in lieu of explosion-proof equipment. Detailed requirements are contained in § 111.80-8.

(4) Through the exercise of ingenuity in the layout of electrical installations for hazardous locations, it is frequently possible to locate much of the equipment in less hazardous or in nonhazardous areas and thus reduce the amount of special equipment required. The amount of electrical equipment or wiring in hazardous locations shall be minimized.

(5) The intent of this section is to require a form of construction of equipment, and of installation that will insure safe performance under conditions of proper use and maintenance. It is necessary, therefore, that more than ordinary care be exercised with regard to the installation and maintenance of equipment and wiring in hazardous areas.

(6) Explosion-proof switches and switches controlling explosion-proof equipment shall have a pole for each circuit conductor.

(7) Electrical equipment is approved for location and for specific hazardous atmospheres of gas, vapor, or dust, that are present. Hazardous air mixtures that are not oxygen enriched are grouped on the basis of their characteristics in Article 500 of the National Electric Code, which is reproduced in Table § 111.80-5(a)(7). Other chemicals and materials which generate hazardous atmospheres and are not listed in Table 111.80-5(a)(7) are listed in Table 151.05 of this chapter.

TABLE 111.80-5(a)(7) HAZARDOUS ATMOSPHERES

GROUP A
Acetylene.
GROUP B
Butadiene.[1]
Ethylene oxide.[2]
Hydrogen.
Manufactured gases containing more than 30 percent hydrogen (by volume).
Propylene oxide.[2]
GROUP C
Acetaldehyde.
Cyclopropane.
Diethyl ether.
Ethylene.
Isoprene.
Unsymmetrical dimethyl hydrazine (UDHM 1, 1-dimethyl hydrazine).
GROUP D
Acetone.
Acrylonitrile.
Ammonia.
Benzene.
Butane.
1-butanol (butyl alcohol).
2-butanol (secondary butyl alcohol).
n-butyl acetate.
Isobutyl acetate.
Ethane.
Ethanol (ethyl alcohol).
Ethyl acetate.
Ethylene dichloride.
Gasoline.
Heptanes.
Hexanes.
Methane (natural gas).
Methanol (methyl alcohol).
3-methyl-1-butanol (isomyl alcohol).
Methyl ethyl ketone.
Methyl isobutyl ketone.
2-methyl-1-propanol (isobutyl alcohol).
2-methyl-2-propanol (tertiary butyl alcohol).
Petroleum naptha.[3]
Octanes.
Pentanes.
1-pentanol (amyl alcohol).
Propane.
1-propanol (propyl alcohol).
2-propanol (isopropyl alcohol).
Propylene.
Styrene.
Toluene.

[1]Group D equipment may be used for this atmosphere if such equipment is isolated as required by paragraph (b)(10) of this section.

[2]Group C equipment may be used for this atmosphere if such equipment is isolated as required by paragraph (b)(10) of this section.

[3] A saturated hydrocarbon mixture boiling in the range of 20-135° C (68-275° F). Also known by the synonyms benzine, ligroin, petroleum ether or naphtha.

Vinyl acetate.
Vinyl chloride.
Xylenes.

GROUP E

Metal dust, including aluminum, magnesium, and their commercial alloys, and other metals of similar hazardous characteristics.

GROUP F

Carbon black.
Coal.
Coke dust.

GROUP G

Flour.
Starch.
Grain dust.

(8) Class I locations are those in which flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures. Class I locations shall include the following:

(i) Class I, division 1, locations: (*a*) In which hazardous concentrations of flammable gases or vapors exist continuously, intermittently, or periodically under normal operating conditions; (*b*) in which hazardous concentrations of such gases or vapors may exist frequently because of repair or maintenance operations or because of leakage; or (*c*) in which breakdown or faulty operation of equipment or processes which may release hazardous concentrations of flammable gases or vapors, might also cause simultaneous failure of electrical equipment. This classification would usually include locations such as cargo tanks, cargo pumprooms, cofferdam areas, and in some cases open deck areas, storage and mixing rooms for paint and allied products, storage rooms for oil, oil lamps and the like, battery rooms, and hospital operating rooms in which combustible anesthetics may be administered.

(ii) Class I, division 2, locations: (*a*) In which flammable volatile liquids or flammable gases are handled, processed or used, but in which the hazardous liquids, vapors, or gases will normally be confined within closed containers or closed systems from which they can escape only in case of abnormal operation of equipment; (*b*) in which hazardous concentrations of gases or vapors are normally prevented by positive mechanical ventilation, but which might become hazardous through failure or abnormal operation of the ventilating equipment; or (*c*) which are adjacent to class I, division 1 locations, and to which hazardous concentrations of gases or vapors might occasionally be communicated unless such communication is prevented by adequate positive-pressure ventilation from a source of clean air, and effective safeguards against ventilation failure are provided. This classification would usually include locations where flammable volatile liquids or flammable gases or vapors are used, but which in the judgment of the Commandant would become hazardous only in case of an accident or of some unusual operating conditions. The quantity of hazardous material that might escape in case of accident, the adequacy of ventilating equipment, and the total area involved shall receive consideration in determining the classification and extent of each hazardous area.

(iii) Special limitations and requirements for electrical installations in hazardous locations on tank vessels are contained in Subpart 111.85.

(9) Class II locations are those, (i) in which combustible dust is or may be in the air continuously, intermittently, or periodically under normal conditions, in quantities sufficient to produce explosive or ignitable mixtures, (ii) where mechanical failure or abnormal operation of machinery or equipment might cause such mixtures to be produced, and might also provide a source of ignition through simultaneous failure or electrical equipment, operation of protection devices, or from other causes, or (iii) in which dusts of an electrically conducting nature may be present.

(*a*) This classification would usually include the working areas handling bulk grain and similar products, coal pulverizing plants (except where the pulverizing equipment is essentially dusttight), and the like.

(10) Class III locations are those in which easily ignitable fibers or materials producing combustible flyings are handled or used.

(i) Easily ignitable fibers and combustible flyings will include rayon, cotton (including cotton linters and cotton waste), sisal or henequen, istle, jute, hemp, tow, cocoa fiber, oakum, baled waste, kapok, Spanish moss, excelsior, sawdust, and other materials of similar nature.

(ii) Class III locations will usually include areas where the above products are handled in bulk, and in carpenter shops and similar locations.

(11) Where it is specified in this section that equipment shall be approved for class I or class II locations, approval by an independent testing laboratory is required. This approval shall be based on the tests outlined in the Underwriters' Laboratories, Inc., "Standards for Industrial Control Equipment for Use in Hazardous Locations, Subject 698". Equipment that bears the Underwriters' Laboratories, Inc., label is acceptable for the class of hazardous locations indicated on the label.

(b) *Electrical installations in Class I, Division 1, Groups A, B, C, and D hazardous location*—(1) *Meters, instruments and relays.* Meters, instruments and relays, including kilowatt-hour meters, instrument transformers and resistors, rectifiers, and thermionic tubes, shall be provided with explosion-proof enclosures approved for class I locations.

(2) *Switches, circuit breakers, motor controllers and fuses.* Switches, circuit breakers, motor controllers and fuses, including pushbuttons, relays and similar devices, shall be provided with enclosures, and the enclosures in each case together with the enclosed equipment, shall be approved as a complete assembly for use in class I locations.

(3) *Control transformers and resistors.* Transformers, impedance coils and resistors used as, or in conjunction with, control equipment for motors, generators and appliances, together with any switching mechanism associated with them, shall be provided with explosion-proof enclosures approved for class I locations.

(4) *Motors and generators.* Motors, generators and other rotating electrical machinery shall be of an enclosed explosion-proof type approved for class I locations. Belt drives shall not be used in hazardous locations.

(5) *Lighting fixtures.* Each lighting fixture shall be approved as a complete assembly for class I locations, and shall be clearly marked to indicate the maximum wattage of lamps for which it is approved. Fixtures intended for portable use shall be specifically approved as a complete assembly for that use.

(i) *Mechanical injury.* Each fixture shall be protected against mechanical injury by a suitable guard. Pendent fixtures having rigid conduit stems longer than 12 inches shall have permanent and effective bracing against lateral displacements.

(ii) *Supports.* Boxes, box assemblies, or fittings used for the support of lighting fixtures shall be approved for the purpose and for class I locations.

(6) *Appliances, fixed and portable.* Appliances, including electrically heated and motor-driven appliances, shall be approved for class I locations.

(7) *Flexible cords.* A flexible cord may be used only for connections between a portable lamp or a portable appliance and the fixed portion of its supply circuit, and, where used, shall be of a type approved for extra hard usage; shall contain, in addition to the conductors of the circuit, a grounding conductor, shall be connected to terminals or to supply conductors in an approved manner, shall be supported by clamps or by other suitable means in such a manner that there will be no tension on the terminal connections, and shall be provided with suitable seals where the flexible cord enters boxes, fittings, or enclosures of the explosion-proof type.

(i) Where flexible cords may be exposed to liquids having a deleterious effect on the insulation or sheath, they shall be of a type approved for use under such conditions.

(8) *Receptacle and attachment plugs.* Receptacles and attachment plugs shall be of the polarized type providing for connection to the grounding conductor of the flexible cord and shall be approved for class I locations.

(9) *Signal, alarm, remote-control and communication systems.* Signal, alarm, remote-control and communication systems, irrespective of voltage, shall be approved for class I locations.

(10) *Wiring methods.* (i) Electric cables shall be leaded and armored, or impervious sheathed and armored, or mineral-insulated metal sheathed.

(ii) The cable entrance to each explosion-proof device shall be sealed to prevent the passage of gases, vapors, or flame from within the explosion-proof enclosure.

(iii) The seal fitting shall be located as close as practicable to, but in no case more than 18 inches from, the enclosure, and shall be connected thereto by means of a short length of rigid metal conduit with threaded explosion-proof joints each having at least five full threads engaged. Type MI cables, however, shall enter enclosures directly through explosion-proof fittings especially approved for class I locations.

(iv) Except for type MI cables, all cable covering except the individual conductor insulation shall be removed in way of the seal fitting, and the seal fitting filled with a sealing compound.

(v) The sealing compound shall be approved for the purpose, shall not be effected by the surrounding atmosphere or liquids, and shall not have a melting point of less than 93° C.

(vi) In the completed seal, the minimum thickness of the sealing compound shall be not less than the trade size of the conduit, and in no case less than ⅝ inch.

(vii) Splices and taps shall not be located in the seal fittings, nor shall other fittings in which splices or taps are made be filled with compound.

(c) *Electrical installations in class I, division 2, groups A, B, C, and D hazardous locations*—(1) *Equipment with sliding contacts or contacts for making or breaking current, relays, switches, circuit breakers, motor controllers, and fuses.* All switching and current interrupting mechanisms shall be provided with explosion-proof enclosures approved for class I locations, unless provided with explosion-proof enclosures otherwise suited to the location where installed with features described in paragraph (c)(2) of this section, and interruption of current occurs in a chamber hermetically sealed against the entrance of gases and vapors or the current interrupting contacts are oil immersed and the device is approved for the location.

(2) *Meters, instruments, transformers, resistors, thermionic tubes, solenoids, and impedance coils.* Equipment which does not incorporate sliding or make and break contacts shall be provided with explosion-proof enclosures approved for class I locations, unless provided with nonexplosion-proof enclosures otherwise suited to the location where installed with vents adequate to permit prompt escape of any gases or vapors. The maximum operating temperature of any exposed surface shall not exceed 80 percent of the ignition temperature in degrees centigrade of the gas or vapor involved.

(3) *Motors and generators.* Motors, generators, and other rotating electrical machinery in which are employed sliding contacts, centrifugal or other types of switching mechanism (including motor overcurrent devices), or integral resistance devices, either while starting or while running, shall be of enclosed explosion-proof type approved for Class I locations. Non-explosion-proof enclosed motors such as squirrel cage induction motors without brushes, switching mechanisms, and similar motors are permitted.

(4) *Lighting fixtures.* Each lighting fixture shall either be approved for Class I locations or shall be provided with globes and guards and, under normal operating conditions, the lamps shall not reach surface temperatures exceeding eighty percent (80%) of the ignition temperature in degrees centigrade of the gas or vapor involved. Pendent fixtures shall be in accordance with paragraph (b)(5)(i) of this section.

(5) *Appliances, fixed and portable.* Motors, switches, circuit breakers and fuses shall conform to paragraphs (c)(1) through (3) of this section. Electrically heated appliances shall be approved for Class I locations.

(6) *Flexible cords.* Flexible cords shall conform to paragraph (b)(7) of this section.

(7) *Receptacles and attachment plugs.* Receptacles and attachment plugs shall conform to paragraph (b)(8) of this section.

(8) *Wiring methods.* Explosion-proof enclosures and equipment shall conform to paragraph (b)(10) of this section. Non-explosion-proof equipment and enclosures shall conform to Subpart 111.60.

(d) *Electrical installations in Class II hazardous locations*—(1) *Switches, circuit breakers, motors controllers, and fuses.* Switches, circuit breakers, motor controllers and fuses, including pushbuttons, relays and similar devices, which are intended to interrupt current in the normal performance of the function for which they are installed, or which are installed where dusts of an electrically conducting nature may be present, shall be provided with dusttight enclosures approved for Class II locations.

(i) Disconnecting and isolating switches containing no fuses and not intended to interrupt current, and which are not installed where dust may be of an electrically conducting nature, shall be provided with tight metal enclosures which shall be equipped with close-fitting covers, or with other effective means to prevent the escape of sparks or burning material, and shall have no openings (such as holes for attachment screws) through which, after installation, sparks or burning material might escape, or through which exterior accumulations of dust or adjacent combustible material might be ignited.

(2) *Control transformers and resistors.* Transformers, impedance coils and resistors used as, or in conjunction with, control equipment for motors, generators and appliances, and any overcurrent devices or switching mechanisms associated with them, shall have dusttight enclosures approved for Class II locations.

(3) *Motors and generators.* Motors, generators, and other rotating electrical machinery shall be totally enclosed not ventilated, totally enclosed pipe-ventilated, or totally enclosed fan-cooled, and shall be approved for Class II locations.

(4) *Appliances, fixed and portable.* Appliances, fixed and portable, including electrically heated and motor-driven appliances, shall be approved for Class II locations.

(5) *Lighting fixtures.* Each lighting fixture, fixed or portable, shall be approved for Class II locations, and shall be clearly marked to indicate the maximum wattage of the lamp for which it is approved. Each fixture shall be protected against mechanical injury by a suitable guard. Pendent fixtures having rigid conduit stems longer than 12 inches shall have permanent and effective bracing against lateral displacement. Boxes, box-assemblies, or fittings used for the support of lighting fixtures shall be approved for the purpose and for Class II locations.

(6) *Receptacles and attachment plugs.* Receptacles and attachment plugs shall be polarized-type providing for connection to the grounding conductor of the flexible cord, and shall be approved for Class II locations.

(7) *Signal, alarm, remote-control, and communication systems.* (i) Switches, circuit breakers, relays, contactors, and fuses which may interrupt other than voice current, and current-breaking contacts for bells, horns, howlers, sirens and other devices in which sparks or arcs may be produced shall be provided with dusttight enclosures approved for Class II locations.

(ii) Resistors, transformers, and choke coils which may carry other than voice currents, and rectifiers, thermionic tubes, and other heat generating equipment or apparatus shall be provided with dusttight enclosures approved for Class II locations.

(8) *Wiring methods*—(i) *Fittings and boxes.* Fittings and boxes shall be provided with threaded boxes for terminal tubes, shall have close-fitting covers, and shall have no openings (such as holes for attaching screws) through which sparks or burning material might escape. Fittings or boxes in which taps, joints or terminal connections are made, or which are used in locations where dusts are of an electrically conducting nature, shall be approved for Class II locations.

(ii) *Electric cables.* Electric cables shall be leaded and armored, impervious sheathed and armored, or mineral-insulated metal sheathed. Cable entrances shall be made dusttight by terminal tubes or, in case of Type MI

cable, by fittings designed for that purpose.

(iii) *Flexible connections.* Where necessary to employ flexible connections, dusttight flexible connectors, flexible metal conduit, or flexible cord approved for extra hard usage and provided with bushed fittings shall be used, except that where dusts are of an electrically conducting nature, flexible metal conduit shall not be used, and flexible cords shall be provided with dust seals at both ends. Where flexible cords are subject to oil or other corrosive conditions, the conductors shall be of a type approved for the condition. An additional conductor for grounding shall be provided in the flexible cord.

(e) *Electrical installations in Class III hazardous locations*—(1) *Switches, circuit breakers, motor controllers, and fuses.* Switches, circuit breakers, motor controllers, and fuses, including pushbuttons, relays, and similar devices shall be provided with tight metal enclosures which shall be equipped with close-fitting covers, or with other effective means to prevent escape of sparks or burning material, and shall have no openings (such as holes for attachment screws) through which, after installation, sparks or burning material might escape, or through which exterior accumulations of fibers or flyings or adjacent combustible material might be ignited.

(2) *Control transformers and resistors.* Transformers, impedance coils and resistors used as, or in conjunction with, control equipment for motors, generators and appliances, shall conform to paragraph (d)(2) of this section.

(3) *Motors and generators.* Motors, generators, and other rotating electrical machinery shall be totally enclosed not ventilated, totally enclosed pipe-ventilated, or totally enclosed fan-cooled.

(4) *Appliances, fixed and portable.* Appliances, fixed and portable, shall conform to the requirements of the following:

(i) *Heaters.* Electrically heated appliances shall be provided with dusttight enclosures, and shall be approved for Class III locations.

(ii) *Motors.* Motors of motor-driven appliances shall conform to subparagraph (3) of this paragraph. Appliances which may be readily moved from one location to another shall conform to requirements for the most hazardous location.

(iii) *Switches, circuit breakers, motor controllers and fuses.* Switches, circuit breakers, motor controllers and fuses shall conform to the requirements of paragraph (d)(1) of this section.

(5) *Lighting fixtures.* Lighting fixtures shall conform to the requirements of this subparagraph.

(i) *Construction.* Each fixture shall be of dusttight type so designed that in the event of burnout of lamp or lampholder, no spark or hot metal can escape from the fixture. Unless each fixture is so constructed that it will not accept a lamp of larger wattage than that for which it is designed, it shall be clearly marked to indicate the maximum wattage of lamp that should be used.

(ii) *Mechanical injury.* A fixture which may be exposed to mechanical injury shall be protected by a suitable guard.

(iii) *Supports.* Boxes, box assemblies, or fittings used for the support of lighting fixtures shall be of a type approved for the purpose.

(iv) *Portable lamps.* Portable lamps shall be dusttight and shall be protected with substantial guards. Lampholders shall be of unswitched type with no exposed metal parts. Unless the portable lamp is so constructed that it will not accept a lamp of larger wattage than that for which it is designed, it shall be clearly marked to indicate the maximum wattage of lamp that should be used.

(6) *Receptacles and attachment plugs.* Receptacles and attachment plugs shall conform to the requirements of paragraph (d)(6) of this section.

(7) *Signal, alarm, remote-control and communication systems.* Signal, alarm, remote-control and communication systems shall conform to the requirements of paragraph (d)(7) of this section.

(8) *Wiring methods*—(i) *Fittings and boxes.* Fittings and boxes in which taps, joints, or terminal connections

are made shall be provided with close-fitting covers, or other effective means to prevent the escape of sparks or burning material, and shall have no openings (such as holes for attaching screws) through which, after installation, sparks or burning material might escape, or through which exterior accumulations of fibers or flyings or adjacent combustible materials might be ignited.

(ii) *Electric cables.* Electric cables shall conform to the requirements of paragraph (d)(8)(ii) of this section.

(iii) *Flexible connections.* Flexible connections shall conform to the requirements of paragraph (d)(8)(iii) of this section.

(9) *Maximum operating temperatures.* In general, maximum surface temperatures under operating conditions shall not exceed 165° C. for equipment which is not subjected to overloading, and 102° C. for equipment such as motors, power transformers, etc., which may be overloaded.

[CGFR 70-143, 35 FR 19907, Dec. 30, 1965; 36 FR 5606, Mar. 25, 1971, as amended by CGD 73-6R, 38 FR 22788, Aug. 24, 1973; CGD 73-6CR, 38 FR 32914, Nov. 29, 1973]

§ 111.80-8 Intrinsically safe systems.

(a) *Application.* Intrinsically safe systems may be installed in any hazardous area as permitted by § 111.80-5(a)(3)(ii).

(b) *General requirements.* (1) Intrinsically safe systems shall be approved by the Commandant for each specific atmosphere.

(2) The recommended practice for "Intrinsically Safe and Non-Incendive Electrical Instruments (RP 12.2)" published by the Instrument Society of America is recognized as a guide for approval of intrinsically safe equipment by the Commandant.

(c) *Submittals required for approval.* (1) Detailed assembly drawings, list of materials, wiring diagrams, and descriptions of operation. The hazardous atmosphere class and group as defined in § 111.80-5(a) shall be indicated.

(2) Detailed analysis of the maximum possible energy that may be released under normal and abnormal conditions.

(i) The term "normal condition" means that equipment operating at maximum available voltage and current.

(ii) The term "abnormal condition" means that equipment operating under conditions resulting from accidental damage to any part of the equipment or wiring, insulation or other failure of electrical components, application of overvoltage, adjustment and maintenance operations, and other similar conditions. The analysis of an "abnormal condition" of equipment will be considered to be not more than two independent faults in a combination.

(d) *Coast Guard evaluation and test procedure.* (1) The material submitted shall be evaluated for suitability and energy level. Paragraph (d)(3) of this section contains data pertaining to energy level which will be used in evaluation of the material submitted.

(i) Where evaluation indicates the current and voltage levels are not more than that listed in Table 111.80-8(d)(1) for ignition of the specific atmospheric mixture of the gas group involved, the requirements for testing may be waived by the Commandant.

TABLE 111.80-8(d)(1)—PERCENTAGE OF CURRENT AND VOLTAGE LEVELS FOR IGNITION OF SPECIFIC ATMOSPHERIC MIXTURES OF A GAS GROUP

	No normally operating contacts (percent)	Normally operating contacts (percent)
Normal conditions	25	25
Abnormal conditions	50	25

(ii) Where evaluation indicates the current and voltage levels are more than that listed in Table 111.80-8(d)(1) for ignition of the specific atmospheric mixture of the gas group involved, or in any case where the complexity of the circuit is such that circuit analysis is not acceptable, the Commandant will require the equipment to be tested by an approved laboratory.

(2) For purposes of evaluation, energy that may be released from a capacitive and inductive circuit can be calculated by the following methods:

(i) Capacitors; the maximum energy, "*W*," available from capacitors is the total stored energy as determined by the following formula:

$$W = \tfrac{1}{2}CV^2$$

Where:

C is capacitance in farads.
V is the maximum instantaneous voltage on the capacitor in volts.
W is energy in joules.

(ii) Inductors; the maximum energy available from an inductor when the current is interrupted is the total stored energy, "*W*," as determined by the following formula:

$$W = \tfrac{1}{2}LI^2$$

Where:

W is energy in joules.
L is the inductance in henries.
I is the maximum instantaneous value of the interrupted current in amperes.

(3) Gases are grouped according to their ignitability as specified in § 111.80-5(a)(7). The energy required for igniting the most easily ignited mixture of a typical member of each group of gases under conditions more severe than are likely to be encountered in a practical installation have been determined by experiment. Figures 111.80-8(d)(3)(i) through 111.80-8(d)(3)(iii) are plots of the lowest level of current as a function of inductance for ignition of the specific gas group involved. Figures 111.80-8(d)(3)(iv) through 111.80-8(d)(3)(vi) are plots of the lowest level of capacitor voltage as a function of capacitance for ignition of the specific gas group involved. These plots may be used for determining acceptable current and voltage levels for use in connection with intrinsically safe calculations.

(e) *Testing requirements.* (1) Tests conducted for purposes of compliance with paragraph (d)(1) of this section shall experimentally determine whether or not the most ignitable gas involved can be ignited as a result of any possible function, malfunction, or failure of the component concerned.

(2) Independent laboratories that are acceptable to the Commandant shall perform the required tests in accordance with a testing procedure approved by the Commandant. The original three copies of the laboratory test report shall be submitted to the Commandant (without cost to the Coast Guard) directly by the laboratory, and one copy will be forwarded to the manufacturer when he is advised of the Commandant's actions taken under this section. The independent laboratory shall inform the Commandant in advance when designated tests will be performed so that a marine inspector may be present.

(f) *Wiring installation.* The wiring installation for the intrinsically safe section of each approved installation shall comply with Subpart 111.60 except where exempted by this subpart and:

(1) The cable insulation shall be compatible with the liquid or vapor to which it may be exposed.

(2) The intrinsically safe conductors shall be separated from all other conductors to insure that the intrinsically safe circuit is not compromised by becoming energized by other conductors through damage or failure of insulation or by induction from other sources.

Inductance vs. Current, B Group

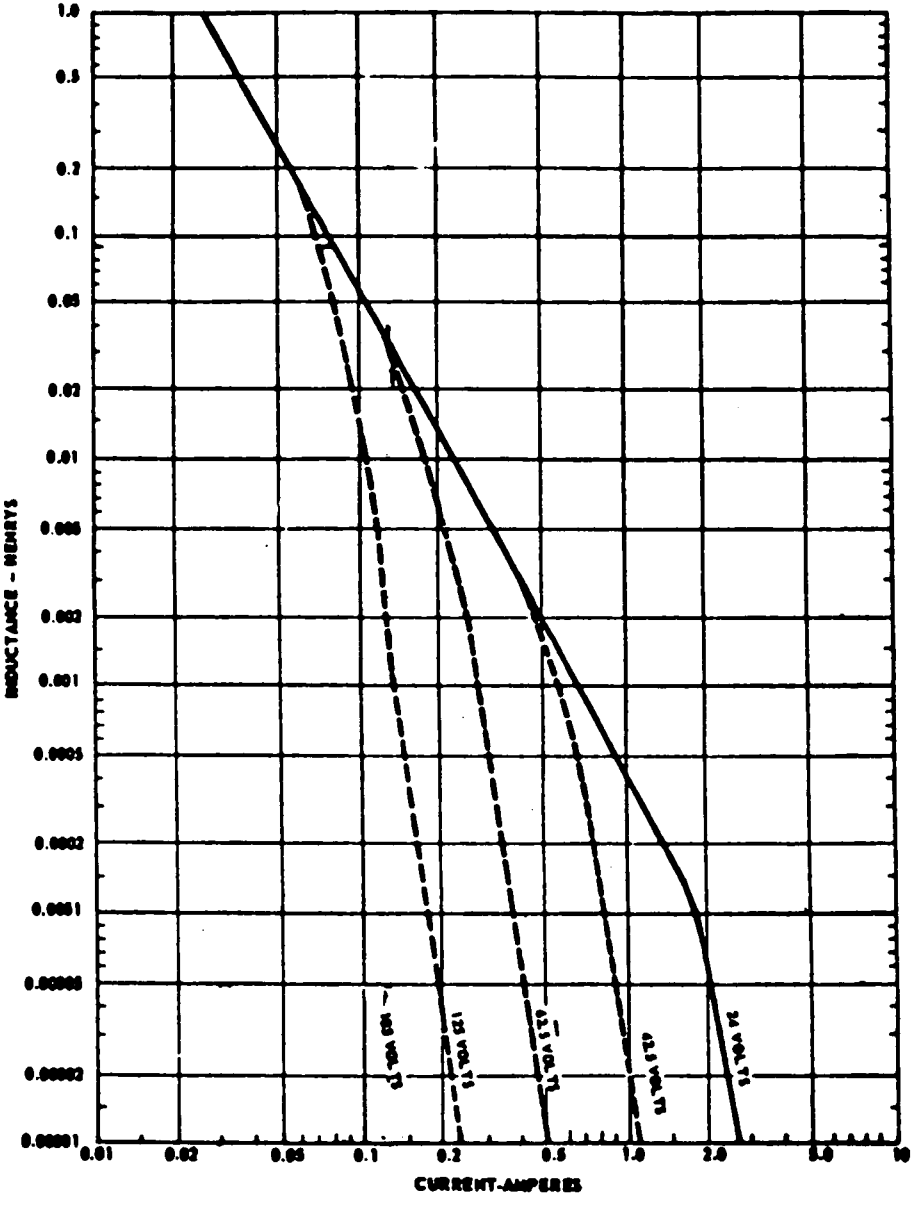


Figure 111.80–8(d)(3)(i)

Inductance vs. Current, C Group

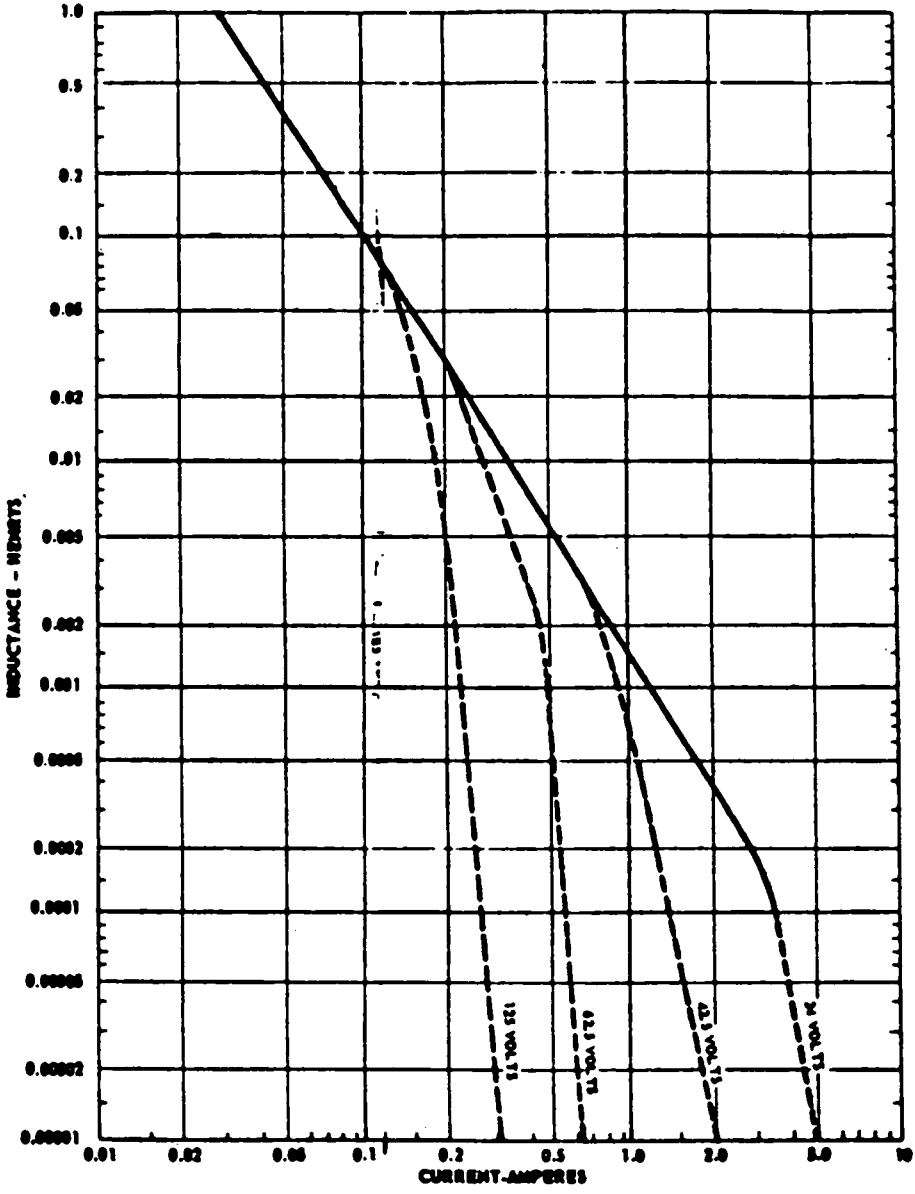


Figure 111.80–8(d)(3)(ii)

Inductance vs. Current, D Group

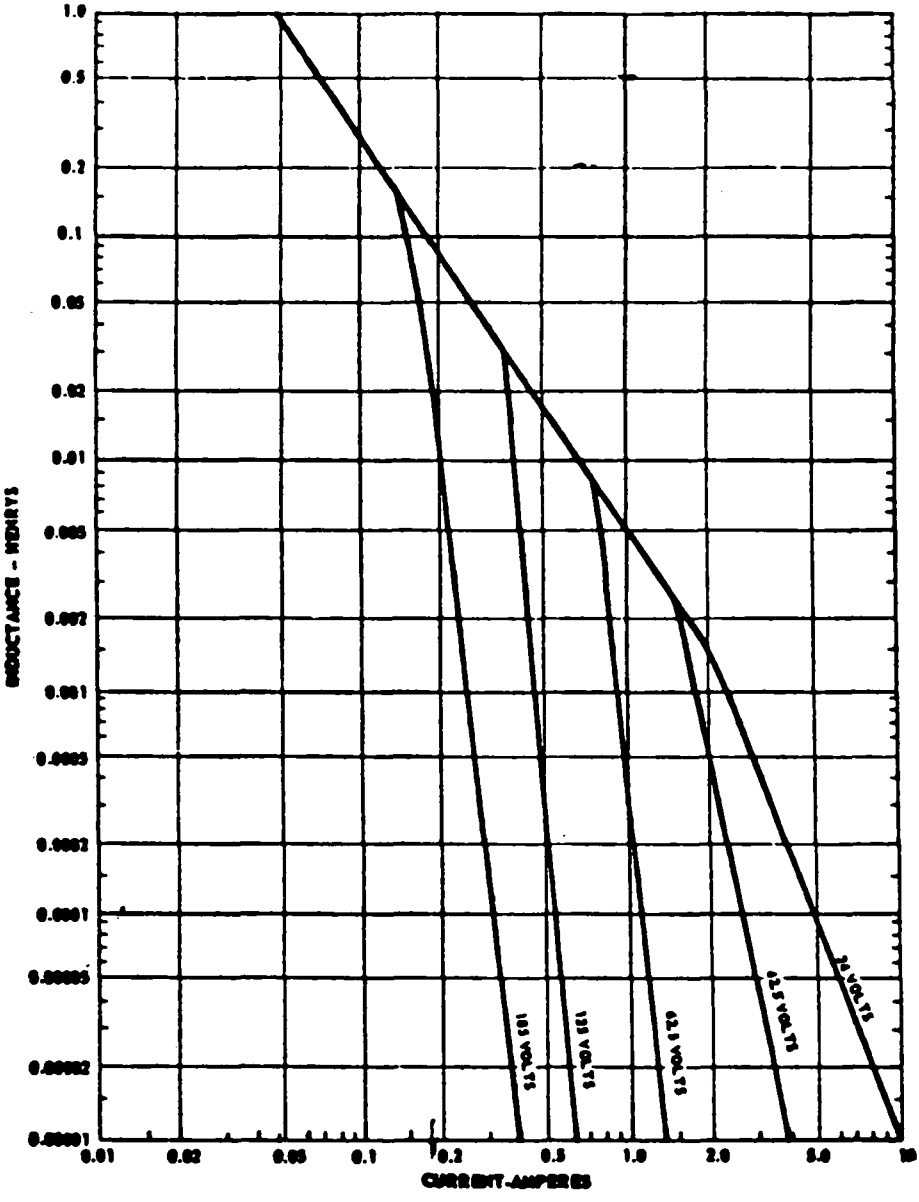


Figure 111.80–8(d)(3)(iii)

Capacitance vs. Voltage, B Group

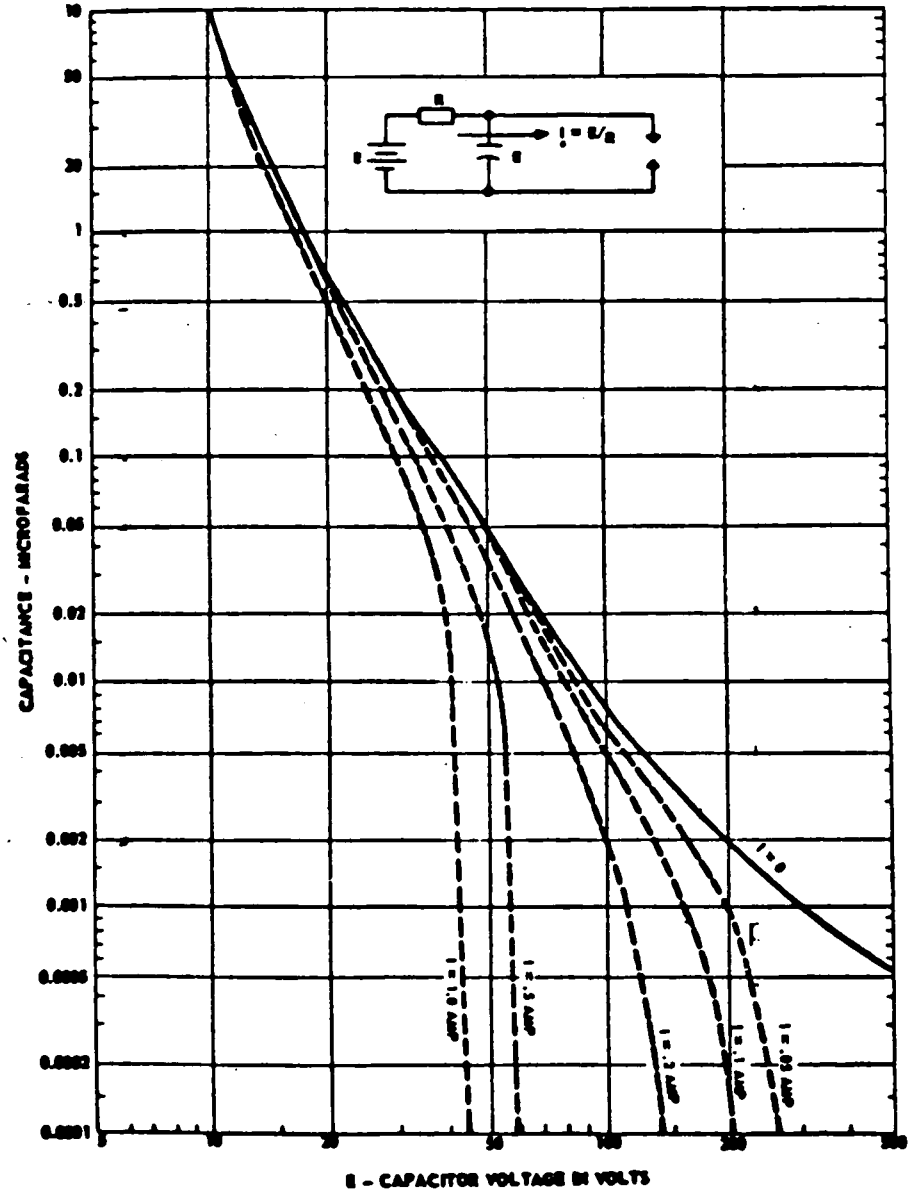


Figure 111.80–8(d)(3)(iv)

Capacitance vs. Voltage, C Group

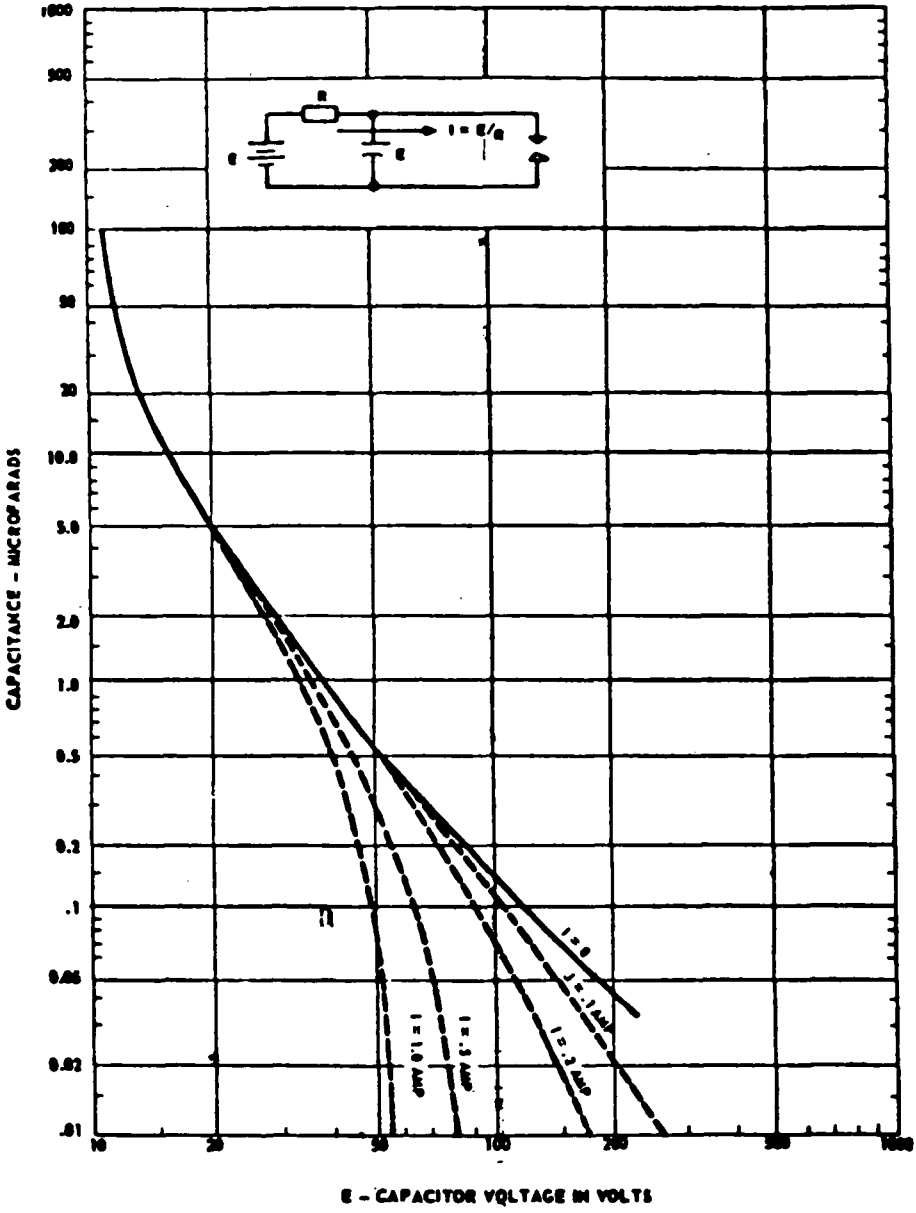


Figure 111.80–8(d)(3)(v)

Capacitance vs. Voltage, D Group

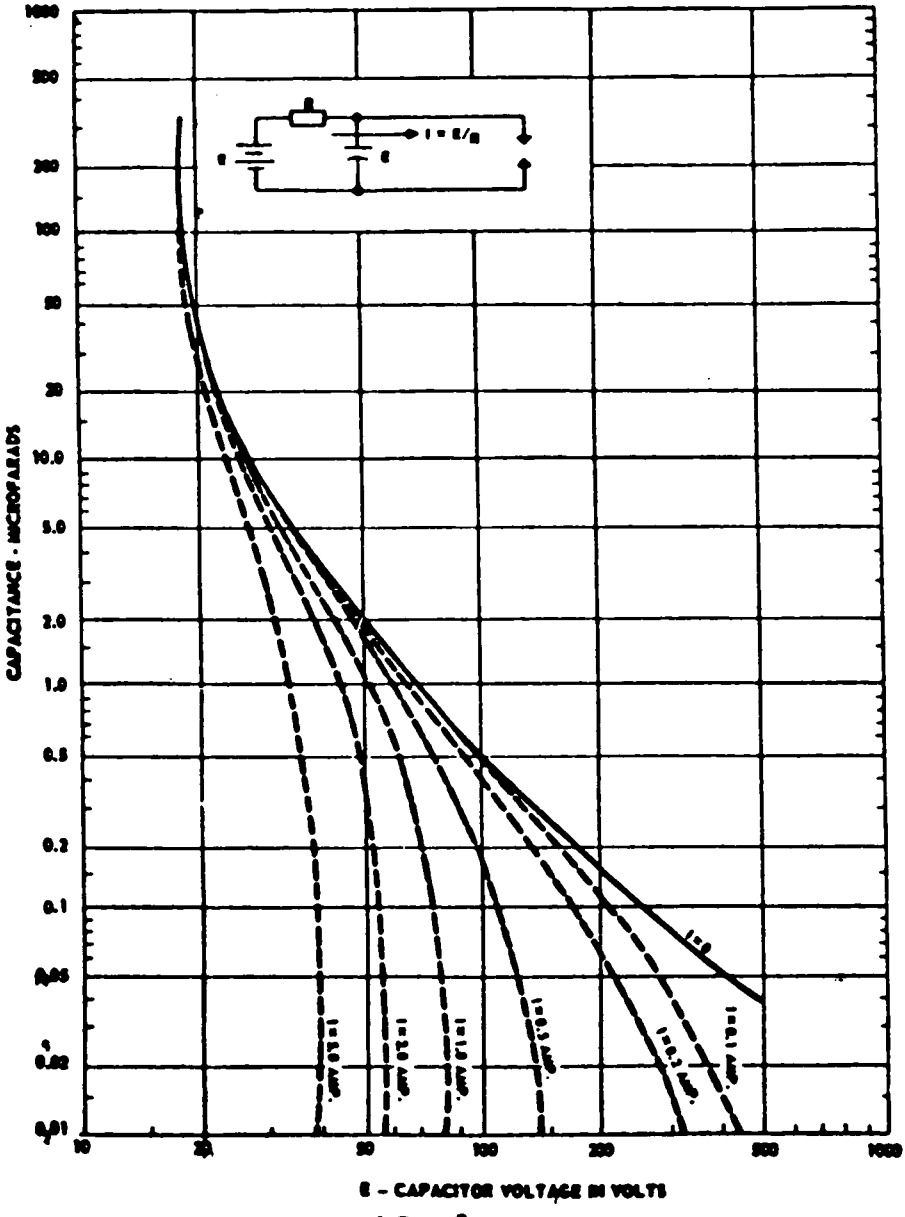


Figure 111.80–8 (d)(8)(vi)

40-130 O—79——8

§ 111.80-10 Ventilation systems.

(a) Cargo ventilation fans, machinery spaces ventilation fans, and accommodation ventilation fans shall, if practicable, be supplied by separate feeders. All electrical ventilation systems shall be provided with remote control means for stopping the motors in case of fire or other emergency. For the machinery space ventilation, there shall be provided a control located in the passageway leading to, but outside of, the space. For all other ventilation systems there shall be provided two emergency stop stations. One of these stations shall be in the wheelhouse, fire control room, the inside passageway near the wheelhouse door, or in an accessible position in the passageway leading to, but outside of, the space ventilated. The second emergency stop station shall be located as distant as practicable from the other, except that the ventilation circuit breakers at the main ship's service switchboard may be considered as the second station provided all are grouped together and are conspicuously marked "In Case of Fire Trip To Stop Ventilation." The means provided for stopping ventilation fans from the main ship's service switchboard shall not interfere with power to other circuits. The remote emergency stop stations shall be protected by enclosures with glass paneled doors on the front of which shall be marked "In Case of Fire Break Glass and Operate Switch To Stop Ventilation." Each control switch shall have the "stop" position clearly identified and shall be provided with a nameplate identifying the system with which it is associated. This remote control system shall be of the undervoltage protection type and so arranged that damage to the master switch or cable will automatically stop the fans. For automatic shutdown of mechanical ventilation in spaces protected by a carbon dioxide fire extinguishing system, see §§ 34.15-35, 76.15-35, and 95.15-35 of this chapter.

(1) The requirements of this paragraph shall not be construed to include a closed ventilation system for a motor or generator, diffuser fans for refrigerated spaces, or room circulating fans, or exhaust fans for private toilets of an electrical rating comparable to that of room circulating fans.

(2) The remote control means for stopping accommodation and machinery space ventilation fans required by this paragraph shall be provided on all passenger vessels on an international voyage regardless of the date of construction.

§ 111.80-13 Remote shutdown requirements.

Machinery driving forced and induced draft fans, fuel oil transfer pumps, fuel oil unit and service pumps, and other similar fuel pumps, shall be fitted with remote controls from a readily accessible position outside of the space concerned so that they may be stopped in the event of fire occurring in the compartment in which they are located. These controls shall be suitably protected against accidental operation or tampering, and shall be suitably marked. All passenger ships on an international voyage, regardless of the date of construction, shall comply with the requirements of this paragraph. Refer to § 58.01-25(a) of this chapter.

§ 111.80-15 Shore connection boxes.

(a) Shore connection boxes shall be of ample size to accommodate the connections of the portable and fixed cables, and shall be of watertight construction when installed in damp or wet locations.

(b) Shore connection boxes for installation in corrosive locations shall not be constructed of sheet metal unless the conditions of § 111.55-05(d) are met.

(c) The minimum spacing between live parts and between live parts and ground in shore connection boxes shall meet the requirements of table 111.30-5(d). Means other than friction between parts shall be provided to prevent cable lugs from rotating.

(d) Shore connection boxes shall be arranged for bottom entrance of portable cable and shall provide a protected enclosure while in use.

§ 111.80-20 Hospital operating rooms.

(a) *Application.* The requirements of this section are applicable to any area of a hospital in which it is intended to

administer to a patient any combustible anesthetic agent in the course of examination or treatment, and to any room used for storage of combustible anesthetic or disinfecting agents.

(b) *General requirements.* The electrical installations and electrical equipment in anesthetizing locations and in storage locations for combustible anesthetic or disinfecting agents shall comply with "Code for Use of Flammable Anesthetics (Safe Practice for Hospital Operating Rooms)" published by National Fire Protection Association. The requirements of "Class I, Group O, Division 1 locations of Article 500 of the National Electrical Code" as referred to in "Code for Use of Flammable Anesthetics (Safe Practice for Hospital Operating Rooms)" shall be construed to mean the requirements for class I, group C locations covered in § 111.80-5.

§ 111.80-25 Locations where gasoline or other highly volatile motor fuel is carried in vehicles.

(a) *Application.* The provisions of this section are applicable to spaces which are "specially suitable for vehicles" as defined in §§ 70.10-44 and 90.10-38 of this chapter. Electrical requirements for spaces other than those "specially suitable for vehicles" are contained in § 146.27-30 of this chapter.

(b) *General requirements.* Electrical equipment which tends to produce arcs or sparks, such as cutouts, switches, receptacles, lampholders, generators, motors, or other equipment having make-or-break or sliding contacts, when installed within 18 inches of the deck, shall be of a type approved for class I, group D locations, in accordance with § 111.80-5(b). Electrical equipment installed at or over 18 inches above the deck shall be of the totally enclosed type or dripproof protected equipment provided with suitable guards or screens to prevent escape of sparks or hot metal particles.

§ 111.80-30 Motion picture projection rooms and projection equipment.

(a) *General—(1) Professional type projectors.* The professional type of projectors shall be located in a projector room. Such rooms shall not be considered as a hazardous location as defined in § 111.80-5. (The professional projector employs a 35-millimeter film which is 1⅜ inches wide and has on each edge 5.4 perforations per inch.)

(2) *Nonprofessional type projectors.* Projectors of the nonprofessional or miniature type may be operated without a projection room.

(3) *Film.* Only acetate or slow-burning film may be used. Nitrocellulose film is specifically prohibited.

(b) *Equipment and projectors of the professional type—(1) Motor driven projectors.* A motor driven projector and an enclosure for an arc or incandescent lamp shall be approved by Underwriters' Laboratories, Inc. A qualified projectionist shall be in charge of the projector when it is in use.

(2) *Conductor size.* Conductors supplying outlets for projectors of the professional type shall not be smaller than No. 8 AWG, and shall be of sufficient size for the projector employed.

(3) *Conductor insulation.* Conductors having a maximum operating temperature of 200° C. shall be used on all lamps or other equipment when the ambient temperature at the conductors as installed will exceed 50° C.

(4) *Flexible cords.* Cords approved for hard service shall be used on portable equipment.

(5) *Lamp guards.* Incandescent lamps in projector rooms shall be provided with guards unless otherwise protected by noncombustible shades or other enclosures.

(6) *Location of equipment.* Motor-generator sets, transformers, rectifiers, rheostats, and similar equipment for the supply or control of current to arc lamps on projectors shall, if practicable, be located in separate rooms. If placed in the projector room, they shall be so located or guarded that arcs or sparks cannot come in contact with film. Motor-generator sets shall have the commutator end or ends totally enclosed.

(7) *Equipment prohibited.* No switches, overcurrent devices, or other equipment, not normally required or used for projectors, sound reproduction, flood, or other special effect lamps or other equipment, shall be installed in projector rooms, except

remote-control switches for control of auditorium lights.

[CGFR 70-143, 35 FR 19907, Dec. 30, 1970, as amended by CGFR 72-35, 37 FR 4962, Mar. 8, 1972]

§ 111.80-35 Electric elevators and dumbwaiters.

(a) *Application.* The requirements of this section are applicable to electric elevators and dumbwaiters.

(b) *General requirements.* The electrical control and interlock circuits of elevators and dumbwaiters shall be in accordance with American Standards Association Safety Code for Elevators, Dumbwaiters, and Escalators. The construction of control switches shall conform with the requirements of Underwriters' Laboratories, Inc., "Standard for Elevator Electric Contacts and Elevator Hoistway Door Interlocks."

§ 111.80-40 Submersible motor-driven bilge pumps.

(a) *Application.* The requirements of this section are applicable to submersible motor-driven bilge pumps required on certain vessels by section 56.50-55 of this chapter.

(b) *General requirements.* (1) The electric motor driving the submersible bilge pump shall be installed in an open end air bell of rugged construction and of such proportions that flooding of the compartment, in which it is located, to the bulkhead deck will not cause water to enter the motor.

(2) The motor may be of the open type provided it is protected against splashing water from the bottom.

(3) Cables to the motor shall enter through the open bottom of the air bell.

(4) The motor shall be capable of continuous operation at rated load under any condition, dry or with water in air bell at any level up to maximum.

(5) The motor controller shall be located above the bulkhead deck with a master switch at the controller and a master switch at the motor. The master switch at the motor shall be connected in such a manner that it will be completely disconnected from the circuit when the motor is started or stopped from the remote master switch.

(6) The motor shall be energized from the final source of emergency lighting and power.

§ 111.80-45 Electric power-operated watertight door systems.

(a) *Application.* The provisions of this section are applicable to electric power-operated watertight door systems required by subpart 73.35 of this chapter, except that only paragraph (g) of this section shall be applicable to installations contracted for prior to November 19, 1952.

(b) *General requirements.* The watertight door operating system shall comply with the specification requirements of subpart 163.001 of this chapter.

(c) *Power supply.* The power supply to power-operated watertight door systems shall comply with the applicable requirements contained in this paragraph.

(1) The source of power for electric motor-driven door operators shall be the sources of the emergency lighting and power system as required by subpart 112.15 of this chapter.

(2) If the peak current resulting from the simultaneous starting of all doors is too great for the temporary or final source of supply, the control shall be so arranged that when the central master switch is put to "close" the doors will start to close serially at intervals of not more than 3 seconds, preference being given to the doors starting with those in the lowest part of the vessel. The total time for all doors to be closed shall not exceed 60 seconds.

(3) The power supply for hydraulically operated watertight door systems employing a hydraulic system common to more than one watertight door shall be an accumulator tank of sufficient capacity to open all doors twice and to close all doors three times, and one or more motor-driven hydraulic pumps capable of being operated from the final source of the emergency lighting and power system.

(i) The motor-driven hydraulic pumps automatically shall maintain the accumulator tank pressure within the design limits, and shall be located and controlled from above the bulkhead deck.

(ii) The accumulator tank capacity required by paragraph (c)(3)(i) of this section shall be available when the accumulator tank pressure is at the automatic pump "cut-in" pressure.

(4) The source of power for hydraulically operated watertight door systems employing an independent hydraulic system for each door operator shall be as required by paragraphs (c)(1) and (2) of this section.

(5) The power supply for other types of watertight door operators shall be as approved by the Commandant.

(d) *Distribution.* Distribution of electric power to the watertight door operators shall comply with the following:

(1) Distribution panelboards used in connection with watertight door systems shall be located above the bulkhead deck and shall be provided with means for locking to prevent unauthorized access to the switching devices or fuses.

(2) Feeders supplying several watertight door operators shall be located above the bulkhead deck.

(3) A separate branch circuit shall be provided for each watertight door operator.

(e) *Overcurrent protection.* Overcurrent devices employed in watertight door system feeders and branch circuits shall be arranged to isolate a fault with as little disruption of the system as possible. The relationship between loads and rating or setting of overcurrent devices shall comply with the following:

(1) The rating or setting of each feeder overcurrent device shall be not less than 200 percent of its maximum load.

(2) The rating or setting of a branch circuit overcurrent device shall be not more than 25 percent of that of the feeder overcurrent device.

(f) *Cable.* All cable used in connection with watertight door system feeder circuits or branch circuits shall be leaded and armored, impervious sheathed and armored, or mineral-insulated, metal sheathed.

(g) *Existing vessels.* (1) Existing arrangements, materials, and facilities previously approved but not meeting the applicable specifications or requirements set forth in paragraphs (b) through (f) of this section may be continued in service so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standards as the original installation provided that in no case will a greater departure from the standards of paragraphs (b) through (f) of this section be permitted than presently exist.

(2) All new installations or major replacements shall meet the applicable specifications or requirements for vessels contracted for on or after November 19, 1952.

§ 111.80-50 Firescreen door holding and release systems.

(a) *Application.* When an electric firescreen door holding and release system is installed in compliance with the requirements of section 72.05-25(b)(9) of this chapter, the provisions of this section with the exception of paragraph (e) shall apply to all installations contracted for on or after November 19, 1952. Installations contracted for prior to November 19, 1952, shall meet the requirements of paragraph (e) of this section.

(b) *Definitions.* (1) The term "firescreen door" will be used in this section to designate any self-closing door required to comply with § 72.05-25(b)(9) of this chapter.

(2) The term "firescreen holding device" will be used in this section to designate any device designed and installed for the purpose of holding open a firescreen door.

(3) The term "local control station" will be used in this section to designate any manually operated device installed adjacent to a firescreen door for the purpose of releasing the door so that the firescreen door self-closing mechanism may close the door.

(4) The term "central control station" will be used in this section to designate any manually operated device installed to release the firescreen doors from the wheelhouse or fire control room.

(c) *General.* (1) The firescreen door holding and release system requirements contained in this section presuppose that the firescreen doors will

be held open by electromagnets, door release being effected by deenergizing the electromagnets.

(2) The Commandant may accept any other means for firescreen door holding and releasing not less effective than the electromagnetic type covered by this section.

(d) *General requirements.* (1) The firescreen door holding and release system shall consist of an electromagnet for each firescreen door, a self-alining armature plate on each door to be seized and held by the electromagnet when the firescreen door is fully open, a control station switch located adjacent to the door to interrupt the supply potential to the electromagnet, and a central control located in the wheelhouse or fire control room to interrupt remotely potential to all holding magnets.

(2) The firescreen door holding circuit shall be arranged so that loss of potential from any cause will release the doors, except that momentary interruptions of the circuit that may result from the operation of automatic bus-transfer devices in connection with the emergency lighting and power system, will not release the doors.

(3) The central control station shall consist of an enclosed switch, circuit breaker, or magnetic contactor of ample rating to interrupt the connected load. The switching unit shall be externally operative and maintaining in both the "hold doors" and "release doors" positions.

(4) The local control station shall consist of an enclosed externally operative fused switch having a rating of not less than 10-T amperes, 125 volts, and may be either the momentary contact type or the maintaining contact type. A single door holding-magnet shall be connected to the fuse end of this local control station. Where several doors are in close proximity to each other, a single local control station switch of ample rating may be used to release simultaneously these several doors.

(5) A door-holding electromagnet shall be designed for a nominal pull of approximately 200 pounds. When the arrangement of the electrical supply involves transfer relays to transfer the supply from a normal to a temporary source, a door-holding electromagnet shall be designed so that, with a pull on the armature of 110 pounds, the armature will be held in the sealed position for approximately one-fourth second after the circuit to the electromagnet is opened. The electromagnet shall be designed for continuous duty in an ambient temperature of 50° C. with a temperature rise by thermometer measurement of not more than 55° C. for Class A insulation nor more than 75° C. for Class B insulation. The electromagnet coil shall be vacuum impregnated and the magnet enclosure shall be either dripproof or watertight as required by location.

(6) The source of power for the firescreen door holding and release system shall be the source of the emergency lighting and power system as required by Subpart 112.15 of this subchapter.

(7) On large vessels, where the closing of all firescreen doors simultaneously would seriously interfere with firefighting operations or with the evacuation of passengers, it is recommended that the firescreen door release system be subdivided into several circuits. The circuits shall be arranged so that it will be possible to isolate any compartment in which a fire is reported by a sufficient number of closed firescreen doors effectively to stop all draft to the fire area. An effective draft stop will entail closing:

(i) All firescreen doors in the area between the main vertical zone bulkheads immediately forward and aft of the fire area;

(ii) All firescreen doors in the main vertical zone bulkheads immediately forward and aft of the fire area; and,

(iii) All firescreen doors in the next adjacent main vertical zones, forward and aft of the fire area. The firescreen door tripping arrangement shall be specifically approved for each vessel.

(e) *Existing vessels.* Firescreen door holding and release systems on vessels contracted for prior to November 19, 1952, shall meet the requirement covered in this paragraph.

(1) Existing arrangements, materials, and facilities previously approved will be considered satisfactory so long as they are maintained in good condi-

tion to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standard as the original installation.

(2) All new installations or major replacements shall meet the applicable specifications or requirements for vessels contracted for on or after November 19, 1952.

§ 111.80-55 Electric power-operated lifeboat winches.

(a) *Application.* The provisions of this section, with the exception of paragraph (h) of this section shall apply to all vessels contracted for on or after November 19, 1952. The provisions of paragraph (h) of this section shall apply to all vessels contracted for prior to November 19, 1952.

(b) *General.* The provisions of this section supplement the requirements of § 33.10-5 and Subparts 75.30, 94.35, and 160.015 of this chapter.

(c) *General construction requirements.* (1) Control and power circuit switches and motor controllers installed in conjunction with lifeboat winches shall be specifically approved for use with lifeboat winches.

(2) Switches and motor controllers shall be of a design not likely to be adversely affected by corrosion of the working parts. Particular attention shall be given to hinged parts of contactors and relays. Structural parts, such as the enclosing cases, if not constructed of corrosion-resistant materials, shall be given a durable corrosion-resistant finish.

(3) Insulating materials shall be limited to those which exhibit the lowest relative water absorption and/or the least effect of such water absorption upon the dielectric properties consistent with the other necessary characteristics.

(4) Where gaskets are used to provide a water seal between parts of an assembly, the gasket shall be secured in place in such a manner as to prevent its falling out or becoming loose when the unit is disassembled.

(5) Holes in the walls of equipment housings for the purpose of providing means for the attachment of parts on the interior thereof, or for securing covers and the like, shall not penetrate the total thickness of the housing wall.

(6) Totally enclosed units shall be provided with a suitable valve, or with at least one hold closed by a ¼-inch pipe plug, for draining condensed moisture. The valve or hole shall be located at the bottom, or as near the bottom as practicable, of the enclosure in order that it may drain the enclosure satisfactorily.

(7) Main line emergency disconnect switches, when installed in a location accessible to passengers, shall be provided with means whereby the switch can be locked in the open-circuit position by means of a padlock or the equivalent. The switch shall have no provisions for locking in the closed-circuit position.

(d) *Detail construction requirements*—(1) *Enclosures.* Each enclosure for motor controller and switching devices, when installed in locations exposed to the weather, shall be watertight.

(2) *Electrical clearances.* The minimum creepage and air clearance distance between live parts of different polarity of motor controllers, master switches, and control circuit limit switches shall be not less than the values shown in Table 111.80-55(d)(2). It is desirable to exceed these values where possible. The electrical clearances for power circuit limit switches and main line emergency disconnect switches shall be not less than the general requirements for such devices given in this part.

(3) *Motors.* Motors shall be of waterproof construction in accordance with the general requirements of this part.

TABLE 111.80-55(d)(2)—MINIMUM SPACINGS IN INCHES

Location	Potential involved in volts		
	0-150	151-300	301-600
Between any uninsulated live part and an uninsulated live part of opposite polarity an uninsulated grounded part other than the enclosure or an exposed metal part.	Through air ¼-	5/16	3/8
	Over surface ½-	3/8	3/4

TABLE 111.80-55(d)(2)—MINIMUM SPACINGS IN INCHES—Continued

Location		Potential involved in volts		
		0-150	151-300	301-600
Between any uninsulated live part and the walls of a metal enclosure, including fittings for cable entrance.	Through air ½-	½	½	½
	Over surface ¾-	¾	¾	¾

(e) *Wiring of lifeboat winch components.* (1) When the motor controller of a lifeboat winch power unit is located adjacent to the winch, the main line emergency switch shall disconnect all parts of the lifeboat winch power unit, including the motor controller and limit switches, from all sources of potential. Any other power circuit switches employed shall be connected in series with the main line emergency switch and ahead of the motor controller. The main line emergency switch shall serve as the motor and controller disconnect required by the general requirements of this part, and shall have a horsepower rating not less than that of the winch motor.

(2) When the motor controller of a lifeboat winch power unit is remotely located with relation to the winch, a switch shall be provided at the controller arranged to disconnect the entire winch electrical installation from all sources of potential. In such cases, the main line emergency switch shall be connected in series with this circuit disconnect switch and ahead of the power circuit limit switches, when employed, and ahead of the motor controller.

(3) Davit arm limit switches whether connected in the power circuit or in the control circuit, shall disconnect all ungrounded conductors of the circuit controlled.

(4) Where one motor is used with two winches, a main line emergency switch, a clutch interlock switch, and a master switch shall be provided for each winch, except that a single main line emergency switch located in accordance with subparagraph (5) of this paragraph with respect to both winches will be accepted. The main line emergency switches shall be connected in series ahead of the motor controller. The master switches shall be connected in parallel and each in series with the corresponding clutch interlock switch for that winch. The clutch interlock switches shall open the circuit to its master switch except when the power unit is clutched to the associated winch. Means shall be provided to prevent the power unit from being clutched to both winches simultaneously.

(5) Typical lifeboat winch wiring diagrams and arrangement drawings are shown on Figures 111.80-55(e)(5)(i) through 111.80-55(e)(5)(iv), the arrangement of the equipment shown being diagrammatical. (The fact that some show direct-current motors and some show alternating-current motors has no particular significance.) In actual installations the main line emergency disconnect switch shall be so located as to be adjacent to the master switch, within reach of the winch operator, in a position accessible to the person in charge of the boat stowage, and in a position, for gravity davit installations, from which the movement of both davit arms can be observed as they approach the final stowed position. Special consideration will be given to other arrangements where complete compliance with these location requirements cannot be met.

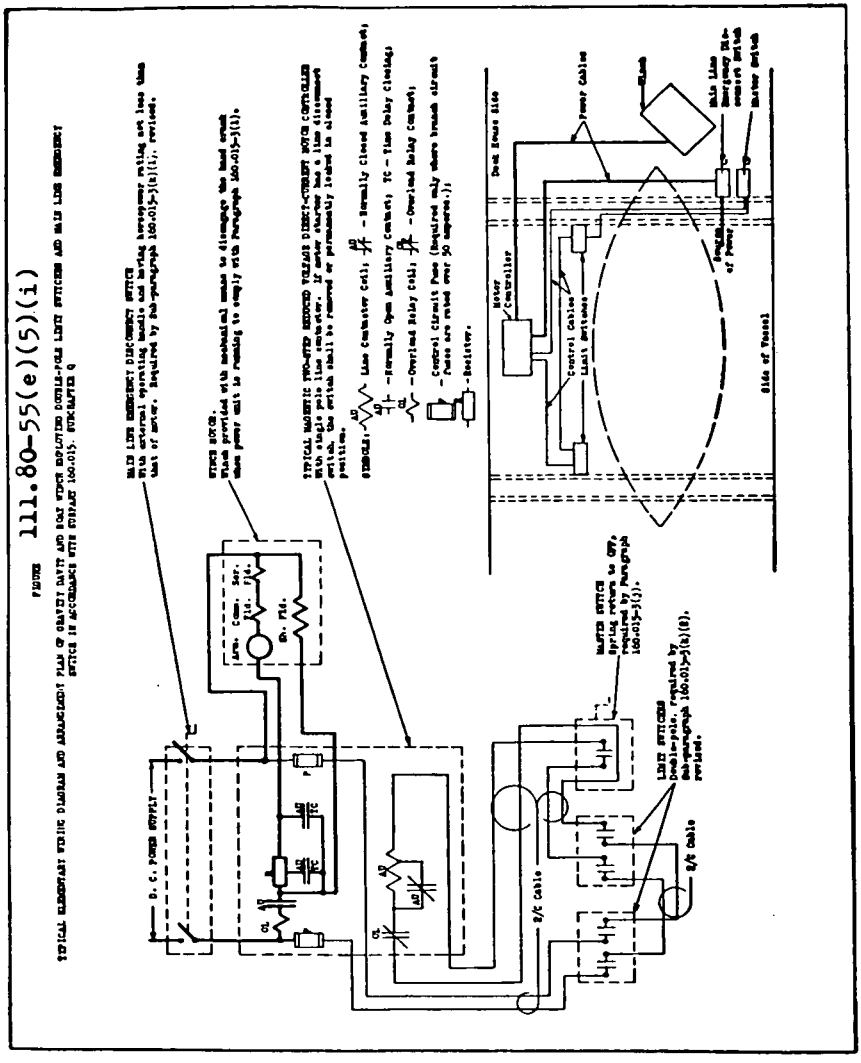


FIGURE 111.80-55(e)(5)(i)

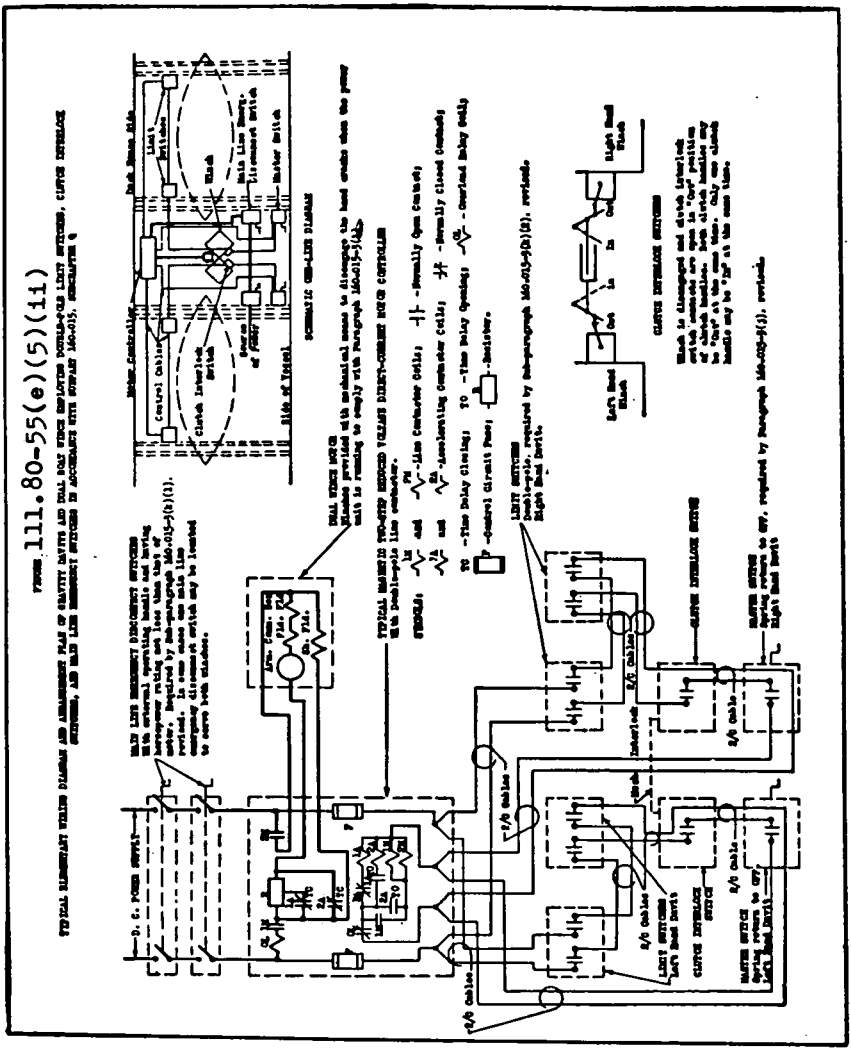


FIGURE 111.80-55(e)(5)(11)

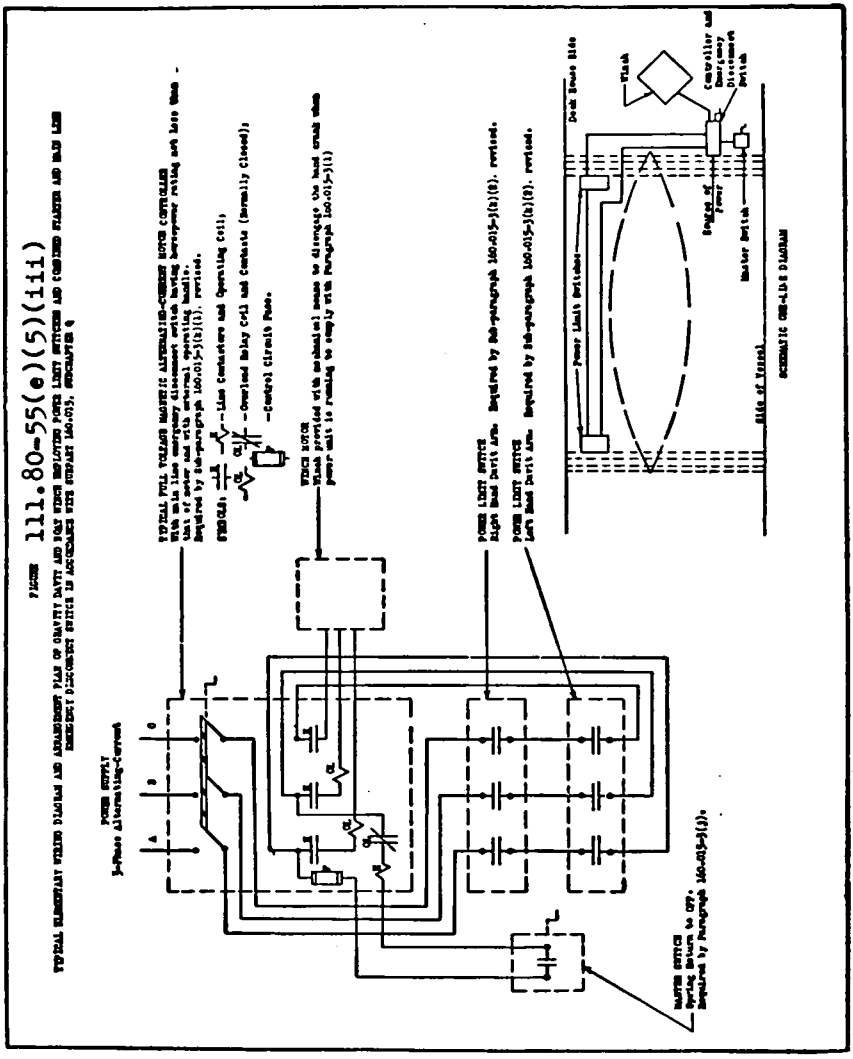


FIGURE 111.80-55(e)(5)(iii)

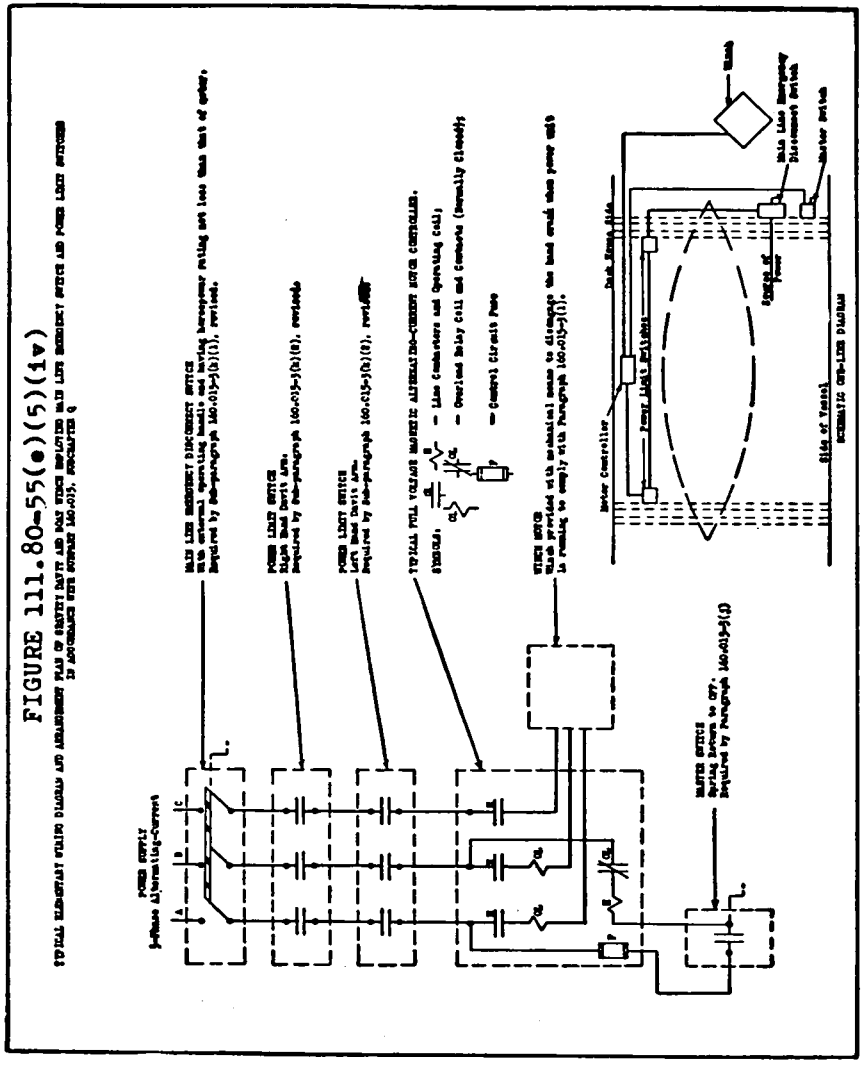


FIGURE 111.80-55(e)(5)(iv)

(f) *Procedure for approval of lifeboat winch electrical installations and equipment*—(1) *Switches.* Manufacturers of master switches, limit switches, and main line emergency disconnect switches desiring to qualify their products for use in connection with lifeboat winch installations shall submit for review detail assembly drawings of the unit, identifying each part used in the assembly and the material specification, including finish, if any, of each part. After the detail assembly drawings have been reviewed sample units may be requested for testing. Units found to comply with the requirements of this section will be listed by the Coast Guard as being satisfactory for use as lifeboat winch auxiliary equipment.

(2) *Motor controllers.* Manufacturers of motor controllers desiring to qualify their products for use in conjunction with lifeboat winch installations shall submit for review detail assembly drawings and material lists of the enclosing cases to be furnished, and detail assembly drawings and material lists and/or samples of contactors, relays, resistors, and other motor-controller components to be employed. For each installation of lifeboat winch motor controllers there shall be submitted for approval a drawing showing the enclosure outline, front view assembly, wiring diagram, and material list, together with the name or other identification of the vessel on which the motor controllers will be installed. No general approval of motor controllers will be given.

(3) *Motors.* For each installation of lifeboat winch motors, manufacturers outline drawings giving nameplate data and degree of enclosure shall be submitted, together with the name or other identification of the vessel on which the motor will be installed. No general approval of motors will be given.

(4) *Shipboard installation drawing.* For each shipboard installation of electric power-operated lifeboat winches, an elementary wiring diagram, and isometric or deck wiring diagram as required by § 111.05-5 shall be submitted.

(g) *Testing of lifeboat winch electrical equipment.* The electrical equipment shall be given periodic inspections and tests as required by §§ 78.17-55 and 97.15-40 of this chapter.

(h) *Electric power-operated lifeboat winches for existing vessels.* (1) The electrical equipment installed in connection with electric power-operated lifeboat winches used with gravity davits on passenger vessels and cargo vessels contracted for prior to November 19, 1952, and on tank vessels contracted for on or after November 19, 1952, shall comply with the requirements of § 160.015-3(k) of this chapter and with the wiring arrangements of paragraph (e) of this section.

(2) New materials installed to effect compliance with this paragraph shall comply with the applicable requirements of this section. Existing materials continued in service shall comply with the requirements of this section insofar as it is reasonable and practicable.

(3) Modification of existing lifeboat winch electrical installations to effect compliance with this paragraph shall have been completed not later than October 1, 1952.

(4) The electrical equipment installed in connection with electric power-operated lifeboat winches used with other than gravity davits on vessels contracted for prior to November 19, 1952, previously approved, but not meeting the applicable specifications or requirements set forth in paragraphs (b) through (e) of this section, may be continued in service so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standards as the original installation; however, in no case, will a greater departure from the standards of paragraphs (b) through (e) of this section be permitted than presently exist. All new installations or major replacements shall meet the applicable specifications or requirements for new vessels.

[CGFR 70-143, 35 FR 19907, Dec. 30, 1970; 36 FR 5606, Mar. 25, 1971]

§ 111.80-60 Electric air heaters.

(a) *Application.* (1) The provisions of this section with the exception of paragraph (c) shall apply to all vessels

contracted for on or after November 19, 1952. The provisions of paragraph (c) of this section shall apply to all vessels contracted for prior to November 19, 1952.

(2) The provisions of this section are applicable to electrically energized units or panels, to be employed in heating a room or compartment for the comfort of the occupants thereof. The provisions of this section are not applicable to electrically energized units employed to heat the air in enclosed apparatus, such as motors, controllers, or the like.

(b) *General requirements.* (1) Electric heaters shall be so constructed that the risk of fire is reduced to a minimum. Unspecified construction and circuit details shall be in accordance with Underwriters' Laboratories, Inc., "Standard for Electric Space-Heating Equipment."

(2) Heaters shall be designed to heat the surrounding air principally by convection. Heater elements shall be of the enclosed type. The heater element case or jacket should be of a corrosion-resistant material.

(3) Heaters shall be provided with a thermal cutout of the manually-reset type that will prevent overheating, and with a suitable regulating switch.

(4) Heaters for bulkhead mounting shall have their top slanted or otherwise designed to prevent hanging towels, etc., on the heaters. When heaters are of the portable type, an acceptable clip or bracket shall be fitted to hold the heater in a fixed position.

(5) The external temperature of the heater enclosing case shall not exceed a temperature of 125° C., except that the external temperature of the enclosing case of flush-mounted heaters shall not exceed a temperature of 100° C. When heaters are mounted upon, or adjacent to, the deck or bulkhead, the construction of the heater shall be such that the nearest deck or bulkhead surface will not exceed a temperature of 55° C. For test purposes, an ambient temperature of 25° C. will be used.

(c) *Electric air heaters on vessels contracted for prior to November 19, 1952.* (1) Existing arrangements, materials, and equipment previously approved shall be considered satisfactory so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standard as the original installation.

(2) All new installations or major replacements shall meet the applicable specifications or requirements for vessels contracted for on or after November 19, 1952.

§ 111.80-65 Electric cooking equipment and motor-driven commissary equipment.

(a) *Application.* The provisions of this section with the exception of paragraph (d) shall apply to all vessels contracted for on or after November 19, 1956. The provisions of paragraph (d) of this section shall apply to all vessels contracted for prior to November 19, 1956.

(b) *Electric cooking equipment requirements.* (1) All equipment attachments and devices shall be of rugged construction and so designed as to permit complete cleaning, maintenance and repair with ease.

(2) Doors shall be provided with heavy-duty hinges and locking devices to prevent accidental opening in a heavy sea.

(3) Where necessary for safety of personnel, grab rails shall be provided. Ranges shall be provided with sea rails with adjustable barriers to resist accidental cook pot movement.

(4) Means shall be provided to effect positive grease or fat collection and to prevent spillage thereof onto the deck.

(5) All equipment shall be mounted to prevent dislodgment by roll and/or pitch, whether arranged for fixed wiring or for portable wiring.

(6) Each equipment unit shall be provided with means for disconnecting it from all circuit conductors. The disconnecting means shall plainly indicate whether it is in the open or closed circuit position and shall be located in the same compartment with, and within sight of, its associated equipment. The disconnecting means may be an integral part of the equipment provided this device remains unaffected by the heat of the equipment of which it is a part. If the disconnecting means is made part of the equipment,

it shall be so located as to be accessible in the event of a fire on the cooking surfaces.

(7) Unspecified construction and circuit details shall be in accordance with Underwriters' Laboratories, Inc., "Standard for Commercial Electric Cooking Appliances."

(c) *Motor-driven commissary equipment requirements.* (1) All equipment shall be rigidly constructed and self-supporting, and shall be securely mounted whether arranged for fixed wiring or for portable wiring unless such mounting would defeat the utility of the equipment.

(2) The enclosures of motors and controls shall be either watertight or totally enclosed or comparable protection provided.

(d) *Electric cooking equipment and motor-driven commissary equipment on vessels contracted for prior to November 19, 1956.* (1) Existing arrangements, materials, and equipment previously approved shall be considered satisfactory so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standard as the original installation.

(2) All new installations or major replacements shall meet the applicable requirements for vessels contracted for on or after November 19, 1956.

§ 111.80-70 Electric steering gear.

(a) *General.* This section contains requirements for steering gear installations where the main or both the main and auxiliary steering means is electric power driven and where the steering control means is electric powered. Where two steering gear power motors and two separate and independent means for controlling the rudder from the pilothouse are provided, there will be two steering systems each consisting of a power motor, control system, and steering gear feeder. In general these two systems are to be separate on a port and starboard basis. For any different arrangement of the steering gear system, special consideration and approval will be required with the intent of obtaining a steering installation which will be equivalent to the one covered in this section.

(b) *Feeder circuits.* Electric and electro-hydraulic steering gear shall be served by two feeder circuits from the ship's service switchboard except in special cases where the length of circuit is very short. One of the circuits may be taken from the emergency switchboard if the rating of the emergency generator is sufficient to supply the steering gear in addition to the emergency loads. The circuits shall be separated throughout their length as widely as practicable. Each circuit shall have adequate current carrying capacity for supplying all motors and control equipment normally connected to it and which operate simultaneously.

(c) *Overcurrent protection for steering systems*—(1) *Motor circuits.* Each steering gear circuit shall be protected only by a circuit breaker with instantaneous trip located on the switchboard from which it emanates.

(i) *Direct-current motors.* For direct-current steering gear motors, each circuit breaker shall be of the instantaneous trip type only, set to trip at a current of not less than 300 percent and not greater than 375 percent of the rated full-load current of one steering gear main motor.

(ii) *Alternating-current motors.* For alternating-current steering gear motors, each circuit breaker shall be of the instantaneous trip type only, set to trip at a current of approximately 175 percent of the locked rotor current of one steering gear main motor.

(iii) *Use of fuses.* On vessels of a size that may be steered by hand, fused switches may be substituted for the instantaneous trip circuit breakers required by this paragraph if the arrangement of the steering gear is such that it is possible to shift to hand steering without delay.

(2) *Motors.* Main steering gear motors and motors associated with steering control systems shall not be provided with a motor-running protective device. In lieu of a motor-running overcurrent protection, the motor starter shall be fitted with a protective device responsive to motor current, motor temperature or to both current and temperature which will operate an

indicating light at the propulsion control station in case of overload which would cause overheating of the motor. This device shall follow as closely as practicable the temperature of the motor.

(3) *Control circuits.* Short circuit protection only shall be provided for the control circuits of controllers of steering gear power motors and motors used for control systems. This protection shall be instantaneous and rated at 400-500 percent of the current-carrying capacity of the conductors.

(4) *Control systems.* Pilothouse steering control systems and any other electric means for controlling the rudder remote from the steering gear room shall be provided with short circuit protection only. The protection shall be instantaneous and rated at 400-500 percent of the current-carrying capacity of the control system conductors. The protection means shall be located in the steering gear room just after the disconnecting means required by paragraph (d)(1) of this section.

(5) *Indicating and alarm circuits.* Indicating and alarm circuits shall be protected by overcurrent devices, in both sides of the line having a rating or setting of not more than 500 percent of the current-carrying capacity of the control, electrical interlock, or indicator circuit conductors, except that where under operating conditions there is no appreciable difference in potential between the external conductors, overcurrent protection need only be provided at the supply of that side of the line.

(d) *Control of motors and control systems.* (1) Means shall be provided in the steering gear room for starting and stopping the steering gear power motors and any motors that are part of the pilot-house control system.

(2) Where two separate and independent steering control systems are installed, the means of switching shall be provided in the pilothouse to select the steering control system which is to be used for steering. This selection shall be accomplished by one operating handle but the switches for each system shall be in separate enclosures or shall be separated by suitable fire-resistant barriers. The handle shall have positions for "port control", "off", and "starboard control" with such an arrangement to necessitate the passing through the "off" position when transferring from one steering system to the other.

(3) The selecting means in the pilothouse shall be so arranged that the steering gear power motor for the steering system selected will automatically be started if not already running. Any ancillary device necessary to activate the selected remote means for controlling the rudder shall be automatically operated upon starting the steering gear power motor.

(e) *Disconnecting and switching means.* (1) The steering gear power motors and control systems shall be connected to the respective steering gear feeder circuits in the steering gear room. Separate means shall be provided in the steering gear room for disconnecting the motor and control systems from the power source.

(2) If a means of transfer is provided in the steering gear room so arranged that either steering gear power motor and associated control system can be connected to either of the two steering gear feeder circuits, interlocks shall be provided to prevent both steering systems from being connected to the same feeder circuit simultaneously.

(f) *Indicating and alarm systems for steering installations.* (1) A pilot light for each steering gear power motor and each auxiliary motor vital to the control of the rudder shall be provided at the propulsion control station, and other locations if desired, to indicate when the motors are energized.

(2) The opening of a steering gear feeder circuit breaker shall automatically be indicated at the propulsion control station by the sounding of an audible alarm.

(3) The opening of a steering gear feeder circuit fuse shall automatically be indicated in the wheelhouse by the sounding of an audible alarm.

(4) For the requirements pertaining to overload indicating lights for steering gear motors, see paragraph (c)(2) of this section.

Subpart 111.85—Special Requirements for Tank Vessels

§ 111.85-1 Application—TB/ALL.

(a) *General.* The requirements of this subpart contain special requirements relative to electrical installations on tank vessels. Except as modified by this subpart and regulations of Subchapter D of this chapter, all other applicable regulations contained in this Subchapter J shall also apply to tank vessels.

(b) *Symbols.* The vessels and services to which each regulation applies are indicated by letters in the heading of the section or paragraph. The first letter or two letters indicates the type of vessel and the letter or letters following the oblique line indicates the waters in which such vessels may operate. The letters are described as follows:

(1) "T" signifies a tank ship.

(2) "B" signifies a tank barge when it precedes an oblique line; or it signifies service on bays, sounds, and lakes other than the Great Lakes when it follows an oblique line.

(3) "ALL" signifies service on all waters.

(4) "O" signifies service on ocean waters.

(5) "C" signifies service on coastwise waters.

(6) "L" signifies service on Great Lakes waters.

(7) "R" signifies service on river waters.

§ 111.85-5 Definitions.

(a) *General—TB/ALL.* Certain terms used in this subpart are defined in this section.

(b) *Cargo—TB/ALL.* The term "cargo" means combustible liquid, flammable liquid, or liquefied flammable gas unless otherwise stated.

(c) *Cofferdam—TB/ALL.* The term "cofferdam" means a void or empty space separating two or more compartments for the purpose of isolation or to prevent the contents of one compartment from entering another in the event of the failure of the walls of one to retain their tightness.

(d) *Combustible liquid—TB/ALL.* The term "combustible liquid" means any liquid having a flashpoint above 80° F. (as determined from an open-cup tester, as used for test of burning oils). Combustible liquids having lethal qualities are those having the characteristics of class "B" or "C" poisons as defined in §§ 146.25-10 and 146.25-15 of this chapter. In the regulations of this subchapter, combustible liquids are referred to by grades, as follows:

(1) *Grade D.* Any combustible liquid having a flashpoint below 150° F. and above 80° F.

(2) *Grade E.* Any combustible liquid having a flashpoint of 150° F. or above.

(e) *Flashpoint—TB/ALL.* The term "flashpoint" indicates the temperature in degrees Fahrenheit at which a liquid gives off a flammable vapor when heated in an open-cup tester. For the purpose of the regulations in this subchapter, flashpoints determined by other testing methods will be equivalent to those determined with an open-cup tester, as follows:

TABLE 111.85-5(e)—EQUIVALENT FLASHPOINTS

Open-cup tester	Tag closed-cup tester (A. S. T. M.)	Pensky-Martens closed tester (A. S. T. M.)
° F.	° F.	° F.
80	75	.....
150	.....	140

(f) *Gas free—TB/ALL.* The term "gas free" means free from dangerous concentrations of flammable or toxic gases.

(g) *Flammable liquid—TB/ALL.* The term "flammable liquid" means any liquid which gives off flammable vapors (as determined by flashpoint from an open-cup tester, as used for test of burning oils) at or below a temperature of 80° F. Flammable liquids having lethal qualities are those having the characteristics of class "B" or "C" poisons as defined in §§ 146.25-10 and 146.25-15 of this chapter. Flammable liquids are referred to by grades, as follows:

40-130 O—79——9

(1) *Grade A.* Any flammable liquid having a Reid[1] vapor pressure of 14 pounds or more.

(2) *Grade B.* Any flammable liquid having a Reid[1] vapor pressure under 14 pounds and over 8½ pounds.

(3) *Grade C.* Any flammable liquid having a Reid[1] vapor pressure of 8½ pounds or less and a flashpoint of 80° F. or below.

(h) *Liquified flammable gas—TB/ALL.* The term "liquefied flammable gas" means any flammable gas having a Reid [1] vapor pressure exceeding 40 pounds, which has been liquefied.

(i) *Tank barge—B/ALL.* The term "tank barge" means any tank vessel not equipped with means of self-propulsion.

(j) *Tank ship—T/ALL.* The term "tank ship" means any tank vessel propelled by power or sail.

(k) *Tank vessel—TB/ALL.* The term "tank vessel" means any vessel especially constructed or converted to carry liquid bulk cargo in tanks.

(l) *Cargo handling room.* A cargo handling room is any enclosed space where cargo is pumped, compressed, or processed. Examples of cargo handling rooms are pumprooms, compressor rooms, and cargo valve rooms.

[CGFR 70-143, 35 FR 19907, Dec. 30, 1970; 36 FR 5606, Mar. 25, 1971]

§ 111.85-10 Special requirements for tank vessels contracted for on or after November 19, 1955—TB/ALL.

(a) *Application.* The requirements of this section apply to all tank vessels contracted for on or after November 19, 1955.

(b) *General.* The special installation requirements are contained in §§ 32.45-1 and 38.15-15 of this chapter, and, in some instances and to some degree, are repeated in this section for completeness of this subchapter.

(1) *Cable location.* Where practicable, electric cable shall be located well inboard from the sides, preferably along or near the centerline, to reduce the risk of injury in the event of collision, but it shall be kept clear of cargo tank openings. Specific additional requirements for cargo pumprooms and enclosed spaces immediately above or adjacent to cargo tanks are covered in paragraph (c) of this section.

(2) *Electrical equipment in cargo tanks.* Except as permitted by paragraph (d) of this section for Grade E cargo tanks, no electrical equipment may be installed in cargo tanks except approved intrinsically safe equipment and approved submergible pumps. The installation of submergible pumps must be restricted to closed tank systems such as refrigerated or compressed gas tanks and must comply with the following:

(i) Provisions shall be made to exclude air from the tanks containing cargo in either vapor or liquid phase. The pump motor shall be deenergized when this condition is not met.

(ii) A liquid level sensing device shall be provided that will automatically shut down the motor and sound an alarm at a predetermined low liquid level. The alarm location may be the station from which cargo handling is controlled or such other location outside the cargo area which is acceptable to the Commandant.

(iii) Details of the power cable, tank penetrations, and cable connection to the pump motor shall be submitted.

(iv) Means for positively disconnecting the power supply between the switchboard and the pump motor panels shall be provided; i.e., disconnect links, lockable circuit breakers, etc.

(3) *Electrical equipment in secondary barrier spaces.* No electrical equipment shall be installed in secondary barrier spaces except for approved intrinsically safe equipment and approved submergible pumps when the space is properly inerted.

(4) *Explosion-proof installations.* Where explosion-proof equipment is required, the equipment and installation thereof shall comply with § 111.80-5.

(5) *Portable equipment.* Illumination may be obtained in any compartment

[1] American Society for Testing Materials Standard D-323 (most recent revision), Method of Test for Vapor Pressure of Petroleum Products (Reid Method).

by the use of approved explosion-proof, self-contained, battery-fed lamps. Otherwise, no portable electrical equipment of any type shall be used in bulk cargo tanks, fuel oil tanks, cargo handling rooms, or enclosed spaces immediately above or adjacent to bulk cargo tanks unless all the following conditions are met:

(i) The compartment itself is gas free.

(ii) The compartments adjacent and diagonally adjacent are either (*a*) gas free, (*b*) inerted, (*c*) filled with water, (*d*) contain grade E liquid and are closed and secured, or (*e*) are spaces in which flammable vapors and gases normally are not expected to accumulate; and,

(iii) All other compartments of the vessel in which flammable vapors and gases normally may be expected to accumulate are closed and secured.

(c) *Installation requirements on tank vessels handling grade A, B, C, or D liquid cargo.* The requirements of this paragraph apply only to tank vessels handling grade A, B, C, or D liquid cargo.

(1) *Electrical devices.* Power devices, switchboards, distribution panels, switches, fuses, and other circuit interrupting devices shall not be installed in cargo handling rooms nor in enclosed spaces immediately above or adjacent to cargo tanks. Storage batteries shall not be located in cargo handling rooms.

(2) *Lighting of cargo handling rooms and certain enclosed spaces.* Lighting for cargo handling rooms and enclosed spaces immediately above or adjacent to cargo tanks shall comply with either of the following:

(i) Cargo handling rooms shall be lighted through permanently fixed glass lenses fitted in the bulkhead and/or overhead. Each fixed glass lens shall be of rugged construction and arranged to maintain the watertight and gastight integrity of the structure. The fixed glass lens may form a part of a lighting fixture if all the following conditions are complied with: (*a*) No means of access to the interior of the fixture from the cargo handling room is provided; (*b*) the fixture is vented to the engineroom or a similar nonhazardous area; (*c*) the fixture is wired from outside the cargo handling room; and (*d*) the maximum observable temperature on the cargo handling room surface of the glass lens based on an ambient temperature of 40° C. shall not exceed 180° C.

(ii) Where the location of a cargo handling room does not permit the lighting arrangement of paragraph (c)(2)(i) of this section, or where the lighting arrangement of paragraph (c)(2)(i) of this section, if used, would not provide the required illumination, approved explosion-proof lighting fixtures may be installed. Specific approval by the Commandant is required for the installation of approved, explosion-proof lights associated wiring and accessories.

(3) *Lighting of enclosed spaces.* Lighting of the enclosed space immediately above or adjacent to cargo tanks shall either comply with the requirements of paragraph (c)(1) of this section applicable to cargo handling rooms, or may be effected or supplemented by means of explosion-proof fixtures located in these spaces.

(4) *Cable.* Through runs of electric cable, regardless of how they may be protected, are prohibited in cargo handling rooms except where permitted by § 111.80-8. In any enclosed space immediately above or adjacent to cargo tanks other than cargo handling rooms, through runs of electric cable are permitted.

(5) *Weather decks.* On each tank vessel subject to the requirements of this section, all motors, their control equipment, and other electrical equipment and installations located on or above the weather decks within 10 feet of a cargo tank opening, cargo handling room door, ventilation outlet, or cargo tank vent termination shall be explosion proof. Explosion proof equipment installed in locations exposed to the weather shall be waterproof, enclosed in a watertight housing, or protected against the entrance of water by a Coast Guard approved method.

(6) *Additional requirements.* In addition to the requirements of paragraph

(c)(5) of this section, electrical equipment on each tank ship that is contracted for after May 22, 1975, must be explosion proof if it is located in the weather in the cargo deck space, in enclosed spaces having an opening or access located within the cargo deck space, or in enclosed spaces having an opening or access located within three meters (approx. 10 feet) of a cargo tank vent outlet, a cargo tank ullage opening, a cargo pipe flange, a cargo valve, a cargo pumproom entrance, or a cargo pumproom ventilation opening. For the purpose of this paragraph, the term "cargo deck space" means the volume bounded by the open deck over the cargo tank block (including all ballast tanks within the cargo tank block), extending to the full width of the vessel, plus three meters (approx. 10 feet) fore and aft of the cargo tank block and up to a height of 2.4 meters (approx. 8 feet) above the deck.

(d) *Installation requirements on tank vessels handling grade E liquid cargo.* The requirements of this paragraph apply to tank vessels handling grade E liquid cargo only.

(1) Storage batteries must not be located in cargo handling rooms.

(2) Impressed cathodic protection systems may be used in Grade E cargo tanks. No electrical equipment is permitted in these tanks except impressed cathodic protection system anodes, submergible pumps, and intrinsically safe equipment.

[CGFR 70-143, 35 FR 19907, Dec. 30, 1970, as amended by CGFR 72-35, 37 FR 4962, Mar. 8, 1972; CGFR 74-118, 40 FR 17754, Apr. 22, 1975]

§ 111.85-90 Special requirements for tank vessels constructed prior to November 19, 1955—TB/ALL.

(a) *General installation requirements for tank vessels the construction or conversion of which was started on or after November 10, 1936, but prior to November 19, 1955*—(1) *Application.* The requirements of this paragraph shall apply to all tank vessels the construction or conversion of which was started on or after November 10, 1936, but prior to November 19, 1955.

(2) *General.* The electrical installation shall be in compliance with this paragraph, and to the extent that such installation is not covered by this paragraph, it shall be at least equivalent to the Commandant's general requirements.

(3) *Existing arrangements.* (i) Existing arrangements, materials, and facilities previously approved will be considered satisfactory so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs or minor alterations may be made to the same standards as the original installation.

(ii) Any major change in the electrical installation or any conversion shall comply with the requirements of §§ 111.85-1 and 111.85-10.

(4) *Location of cables.* Where practicable, electrical cable is to be located well inboard from the sides, preferably along or near the centerline, to reduce the risk of injury in the event of collision, but it shall be kept clear of cargo tank openings. Except where grade E liquids only are involved, feeders shall be run as far as practicable to avoid cargo pumprooms and enclosed spaces immediately adjoining cargo tanks.

(5) *Cable armor.* The armor on all cables shall be electrically and mechanically continuous.

(6) *Locations of circuit-interrupting devices.* Except where grade E liquids only are involved, switchboards, distribution panels, switches, fuses, and other current-interrupting devices shall not be fitted in cargo pumprooms or enclosed spaces immediately adjoining cargo tanks.

(7) *Portable equipment.* Portable extension cables and fittings are to be of an approved type.

(8) *Overload protection.* Main distribution circuits shall be protected against overload by circuit breaking devices, the capacity of which shall be marked at each such device.

(9) *Storage batteries.* Storage batteries shall not be located in cargo pumprooms. The space in which they are located shall be well ventilated and they shall be protected against mechanical and electrical injury including short circuiting and overloading.

Batteries shall be secured against movement and acid batteries shall be set in leadlined trays at least 3 inches deep of at least 4-pound sheet lead.

(10) *Installations made during the Unlimited National Emergency.* Electrical equipment installed during the Unlimited National Emergency as defined in § 110.25-5 of this subchapter and not complying with the requirements of the regulations in this subchapter may be continued in service if found to be satisfactory by the Commandant for the purpose intended.

(11) *Portable equipment.* When the vessel is not gas free, no portable electrical equipment shall be used in the cargo or fuel oil tanks, the cargo pumprooms or any enclosed space immediately above or adjacent to the bulk cargo tanks, except as permitted by § 111.80-5.

(b) *Cargo pumprooms and enclosed spaces of tank vessels constructed on or after July 1, 1951, but prior to November 19, 1955*—(1) *Application.* The requirements of this paragraph shall apply to cargo pumprooms and enclosed spaces immediately above the bulk cargo tanks of all tank vessels carrying Grade A, B, C, or D liquid cargo the construction or conversion of which vessels was started on or after July 1, 1951, but prior to November 19, 1955. There are no special restrictions in regard to the electrical installations in cargo pumprooms and enclosed spaces of tank vessels carrying only Grade E liquid cargo.

(2) *Equipment.* No electric lighting or power circuit-interrupting or power devices shall be installed in pumprooms or enclosed spaces immediately above the bulk cargo tanks. Through runs of electrical cable are permitted.

(3) *Lighting.* Lighting of pumprooms or the enclosed spaces immediately above the bulk cargo tanks shall be effected by means of approved explosion-proof or magazine type lighting fixtures. When the vessel is not gas free no portable lighting equipment shall be used except as permitted by § 111.80-5.

(c) *General cargo spaces of tank vessels constructed on or after July 1, 1951, but prior to November 19, 1955.* Regardless of location, general cargo spaces of tank vessels carrying Grade E liquid cargo only and constructed on or after July 1, 1951, but prior to November 19, 1955, shall have no special restrictions in regard to electrical installations.

(d) *Cargo pumprooms and enclosed spaces of tank vessels constructed on or after November 10, 1936, but prior to July 1, 1951*—(1) *Application.* The requirements of this paragraph shall apply to cargo pumprooms for Grade A, B, C, or D liquid and to enclosed spaces required to segregate Grade A, B, C, or D liquid cargo tanks from other spaces, on all tank vessels the construction or conversion of which was started on or after November 10, 1936, and prior to July 1, 1951.

(2) *Wiring.* Wiring is to be leaded and armored and shall be run through approved gastight fittings having stuffing glands at inlets and outlets.

(3) *Boxes.* Joints in wiring shall be made only in wiring appliances, such as junction boxes, outlet boxes, etc., and such boxes shall be completely metallic and shall be gastight.

(4) *Lighting fixtures.* Lighting fixtures shall be of approved type.

(5) *Motors.* Electric motors shall be of approved type either totally enclosed or ventilated to the atmosphere by suction and discharge air ducts. Separately ventilated motors are to have pressure type ventilation and shall be arranged with an automatic shutoff to open the circuit when the ventilating fan motor stops. The system is to be so interlocked that the pump motor cannot be started prior to a circulation of air. The air ducts are to lead to and from the atmosphere outside the pumproom and are to terminate not less than 3 feet above the deck and not less than 6 feet from any cargo tank vent. (See § 32.60-20 of this chapter.)

(e) *General installation requirements for tank vessels the construction or conversion of which was started prior to November 10, 1936*—(1) *Application.* The requirements of this paragraph shall apply to all steel hull tank vessels the construction or conversion of which was started prior to November 10, 1936.

(2) *General requirements.* The electrical installation shall be maintained in a safe and in a good mechanical condition, and shall comply with the regulations in effect when the vessel was built, or to the requirements of a recognized classification society. Any major change in the electrical installation or any conversion shall comply with the requirements covered by §§ 111.85-1 and 111.85-10.

(3) *Pumprooms and enclosed spaces.* The electrical installation in pumprooms and enclosed spaces immediately adjoining cargo tanks (except in pump-engine rooms as provided in § 32.70-20 of this chapter) of steel hull tank vessels handling Grade A, B, C, or D products shall be made to comply with §§ 111.50-1, 111.50-15, 111.60-5, 111.85-10(b) (1) and (2) and 111.85-90(a) (2) and (9), (b), and (d), to the extent that the changes required are, in the opinion of the Officer in Charge, Marine Inspection, necessary in the interest of safety.

(4) *Portable equipment.* When the vessel is not gas free, no portable electrical equipment shall be used in the cargo or fuel oil tanks, the cargo pumprooms, or any enclosed space immediately above or adjacent to the bulk cargo tanks, except that lighting in these spaces may be effected by the use of approved explosion-proof self-contained, battery-fed lamps.

[CGFR 70-143, 35 FR 19907, Dec. 30, 1970; 36 FR 5606, Mar. 25, 1971]

Subpart 111.90—Electrical Equipment and Installations on Vessels Contracted for Prior to November 19, 1952

§ 111.90-1 General.

The electrical installations on existing vessels shall be maintained in good electrical and mechanical condition to the satisfaction of the Office in Charge, Marine Inspection.

§ 111.90-5 Major alterations.

Major alterations and major extensions to electrical installations on existing vessels shall be made to the same standard as required for new vessels. Minor repairs and minor alterations may be made to the same standard as the original installation as described in §§ 111.85-90, 111.90-10, 111.90-15, 111.90-20, and 111.90-25. In no case will a greater departure from the standards of this subchapter be permitted than presently exist.

§ 111.90-10 Vessels contracted for prior to July 2, 1937.

(a) Except as otherwise provided for tank vessels in § 111.85-90, the installation on vessels contracted for between June 30, 1928, and July 1, 1937, inclusive, using electricity for any purpose, shall be in keeping with the best modern practice.

(b) Except as otherwise provided for tank vessels in § 111.85-90, the changes or alterations in the electrical installations on vessels contracted for prior to June 30, 1928, shall be in accordance with the requirements of this section.

§ 111.90-15 Vessels contracted for between July 2, 1937, and January 1, 1939.

Except as otherwise provided for tank vessels in § 111.85-90, the electrical installation on vessels contracted for between July 2, 1937, and January 1, 1939, inclusive, shall be in accordance with the "Recommended Practice for Electrical Installations on Shipboard," AIEE Standard No. 45, October 1930, as published by the American Institute of Electrical Engineers.

§ 111.90-20 Vessels contracted for between January 2, 1939, and June 1, 1941.

Except as otherwise provided for tank vessels in § 111.85-90, the electrical installation on vessels contracted for between January 2, 1939, and June 1, 1941, inclusive, shall be in accordance with the "Recommended Practice for Electrical Installations on Shipboard," AIEE Standard No. 45, December 1938, as published by the American Institute of Electrical Engineers.

§ 111.90-25 Vessels contracted for between June 2, 1941, and November 18, 1952.

(a) Except as otherwise provided for tank vessels in § 111.85-90, the electrical installation on vessels contracted for between June 2, 1941, and November 18, 1952, inclusive, shall be in accordance with the "Recommended Practice for Electrical Installations on Shipboard," AIEE Standard No. 45,

July 1940, as published by the American Institute of Electrical Engineers.

(b) Except as otherwise provided for tank vessels in § 111.85-90, the specification covering electrical installations titled "United States Coast Guard, Merchant Marine Inspection, Specification for Electrical Installations on Merchant Vessels," dated August 31, 1944, revised March 6, 1945, is, during the Unlimited National Emergency, applicable as alternative provisions to those contained in this section for vessels the contract for the construction of which was signed prior to September 2, 1945.

(c) Except as otherwise provided for tank vessels in § 111.85-90, those parts of the specification covering electrical installations titled "United States Coast Guard, Merchant Marine Inspection, Specification for Electrical Installations on Merchant Vessels," dated August 31, 1944, revised March 6, 1945, specified in paragraphs 1, 4, and 5, thereof relating to electric cable, are, during the Unlimited National Emergency, applicable as alternative provisions to those contained in this Section for vessels the contract for the construction of which was signed on and after September 2, 1945.

Subpart 111.92—Mobile Offshore Drilling Units

AUTHORITY: Sec. 2, 87 Stat. 418 (46 U.S.C. 86); sec. 3, 82 Stat. 341, as amended (46 U.S.C. 367); R.S. 4405, as amended (46 U.S.C. 375); sec. 10, 35 Stat. 428 (46 U.S.C. 395); R.S. 4423, as amended (46 U.S.C. 400); R.S. 4429, as amended (46 U.S.C. 407); R.S. 4430, as amended (46 U.S.C. 408); 88 Stat. 423 (46 U.S.C. 411); R.S. 4434, as amended (46 U.S.C. 412); R.S. 4462, as amended (46 U.S.C. 416); sec. 1, 73 Stat. 475 (46 U.S.C. 481); sec. 4 67 Stat. 462 (43 U.S.C. 1333(d)); sec. 6(b)(1), 80 Stat. 937 (49 U.S.C. 1655(b)(1)); 49 CFR 1.46(b) and (n)(6).

SOURCE: CGD 73-251, 43 FR 56837, Dec. 4, 1978, unless otherwise noted.

§ 111.92-1 Definition.

As used in this subpart, "semi-enclosed location" means a location where natural conditions of ventilation are notably different from those on open decks due to the presence of structures such as roofs, windbreaks or bulkheads.

§ 111.92-3 Intrinsically safe electrical equipment.

(a) This section applies to each mobile offshore drilling unit.

(b) Only intrinsically safe electrical equipment approved for a Class I, Division 1 Location may be installed in the following locations:

(1) The internal space of each pressure vessel, tank, pipe, or gas vent of the mud circulating system between the well and the final degassing discharge.

(2) Any space in which an oil-gas-air mixture is continuously present under normal operational conditions.

§ 111.92-5 Class I, Division 1 locations.

The following are Class I, Division locations:

(a) An enclosed space that contains any part of the mud circulating system that has an opening into the space and is between the well and final degassing discharge.

(b) An enclosed or semi-enclosed location that is below the drill floor, and contains a possible source of gas release.

(c) An enclosed space that is on the drill floor, and is not separated by a solid, gas-tight floor from the spaces specified in paragraph (b) of this section.

(d) A space that would normally be considered a Division 2 location under § 111.92-7 but where combustible or flammable gases might accumulate.

(e) A location in the weather, or a semi-enclosed location, except as provided in paragraph (b) of this section that is within 1.5 m (5 ft.) of the boundary of any—

(1) Equipment or opening specified in paragraph (a) of this section;

(2) Ventilation outlet, access, or other opening to a Class I, Division 1 space; or

(3) Gas vent outlet.

(f) Except as provided in § 111.92-9, an enclosed space that has an opening into a Class I, Division 1 location.

§ 111.92-7 Class I, Division 2 locations.

The following are Class I, Division 2 locations:

(a) An enclosed space that has any open portion of the mud circulating system from the final degassing dis-

charge to the mud suction connection at the mud pit.

(b) A location in the weather that is—

(1) Within the boundaries of the drilling derrick up to a height of 3 m (10 ft.) above the drill floor;

(2) Below the drill floor and within a radius of 3 m (10 ft.) of a possible source of gas release; or

(3) Within 1.5 m (5 ft.) of the boundaries of any ventilation outlet, access, or other opening to a Class I, Division 2 space.

(c) A location that is—

(1) Within 1.5 m (5 ft.) of a semi-enclosed Class I, Division 1 location indicated in § 111.92-5(b); or

(2) Within 1.5 m (5 ft.) of a Class I, Division 1 space indicated in § 111.92-5(e).

(d) A semi-enclosed area that is below and contiguous with the drill floor to the boundaries of the derrick or to the extent of any enclosure which is liable to trap gasses.

(e) A semi-enclosed derrick to the extent of its enclosure above the drill floor or to a height of 3 m (10 ft.) above the drill floor, whichever is greater.

(f) Except as provided in § 111.92-9 an enclosed space that has an opening into a Class I, Division 2 location.

§ 111.92-9 Contiguous locations.

An enclosed space that has direct access to a Division 1 or Division 2 location is the same division as that location, except—

(a) An enclosed space that has direct access to a Division 1 location is not a hazardous location if—

(1) The access has self-closing gastight doors that form an air lock;

(2) The ventilation causes greater pressure in the space than in the Division 1 location; and

(3) Loss of ventilation overpressure activates an alarm at a manned station;

(b) An enclosed space that has direct access to a Division 1 location can be considered as a Division 2 location if—

(1) The access has a self-closing, gastight door that opens into the space and that has no hold-back device;

(2) Ventilation causes the air to flow with the door open from the space into the Division 1 location; and

(3) Loss of ventilation activates an alarm at a manned control station; and

(c) An enclosed space that has direct access to a Division 2 location is not a hazardous location if—

(1) The access has a self-closing, gastight door that opens into the space and that has no hold-back device;

(2) Ventilation causes the air to flow with the door open from the space into the Division 2 location; and

(3) Loss of ventilation activates an alarm at a manned control station.

§ 111.92-11 Electrical equipment in classified locations.

Electrical equipment and devices installed in spaces made non-hazardous by the methods indicated in § 111.92-9 must only be essential equipment.

Subpart 111.94—Mobile Offshore Drilling Unit Industrial Systems

§ 111.94-1 Industrial systems.

A system on a mobile offshore drilling unit that is used only for the industrial function of the unit and meets the National Electric Code need not meet this subchapter except—

(a) The Underwriters' Laboratories, Inc. standards in § 110.10-1(e) of this subchapter;

(b) NEMA standards in § 110.10-1(c) (1) and (2) of this subchapter.

(c) Section 111.05-5—Plan approval;

(d) Section 111.05-15—General consideration;

(e) Section 111.60-25(f)—Ship structure as a conductor;

(f) Section 111.60-30—Engine starting;

(g) Subpart 111.92—Mobile offshore drilling units; and

(h) Cables that penetrate a deck or bulkhead must—

(1) Be installed in accordance with § 111.60-(k); and

(2) Meet the flammability test requirements of Section 18.13.5 of IEEE Std. No. 45.

AUTHORITY: Sec. 2, 87 Stat. 418 (46 U.S.C. 86); sec. 3, 82 Stat. 341, as amended (46 U.S.C. 367); R.S. 4405, as amended (46

U.S.C. 375); sec. 10, 35 Stat. 428 (46 U.S.C. 395); R.S. 4423, as amended (46 U.S.C. 400); R.S. 4429, as amended (46 U.S.C. 407); R.S. 4430, as amended (46 U.S.C. 408); 88 Stat. 423 (46 U.S.C. 411); R.S. 4434, as amended (46 U.S.C. 412); R.S. 4462, as amended (46 U.S.C. 416); sec. 1, 73 Stat. 475 (46 U.S.C. 481); sec. 4, 67 Stat. 462 (43 U.S.C. 1333(d))); sec. 6(b)(1), 80 Stat. 937 (49 U.S.C. 1655(b)(1)); 49 CFR 1.46(b) and (n)(6).

[CGD 73-251, 43 FR 56838, Dec. 4, 1978]

PART 112—EMERGENCY LIGHTING AND POWER SYSTEM

Sec.

AUTHORITY: R.S. 4405, as amended, 4462, as amended, sec. 6(b)(1), 80 Stat. 938; 46 U.S.C. 375, 416, 49 U.S.C. 1655(b); 49 CFR 1.46(b) (35 FR 4959). Interpret or apply R.S. 4399, as amended, 4400, as amended, 4417, as amended, 4417a, as amended, 4418, as amended, 4421, as amended, 4426, as amended, 4427, as amended, 4433, as amended, 4452, as amended, 4488, as amended, 4491, as amended, sec. 14, 29 Stat. 690, as amended, sec. 10, 35 Stat. 428, as amended, 41 Stat. 305, as amended, sec. 5, 49 Stat. 138, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 17, 54 Stat. 166, as amended, sec. 3, 54 Stat. 347, as amended, sec. 3, 70 Stat. 152, sec. 3, 68 Stat. 675; 46 U.S.C. 361, 362, 391, 391a, 392, 399, 404, 405, 411, 435, 481, 489, 366, 395, 363, 369, 367, 526p, 1333, 390b, 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 FR 9671, 3 CFR, 1965 Supp.

SOURCE: CGFR 65-50, 30 FR 17085, Dec. 30, 1965, unless otherwise noted.

Subpart 112.01—Application

§ 112.01-1 General.

The provisions of this part, with the exception of Subpart 112.90, shall apply to all vessels contracted for on or after November 19, 1952. The provisions of Subpart 112.90, shall apply to all vessels contracted for prior to November 19, 1952.

CROSS REFERENCE: See § 110.05-3 of this subchapter for application of amendments to regulations.

Subpart 112.05—General Requirements

§ 112.05-1 Intent.

(a) The intent of the provisions in this part is to assure that vessels are provided with a dependable, independent emergency source of electrical power with sufficient capacity to supply all those services that are necessary for the safety of the passengers and/or the crew in an emergency.

(b) Nonemergency loads may be supplied from the emergency source only when the emergency source has adequate capacity to supply all loads that may be connected to the emergency source simultaneously.

§ 112.05-5 Emergency source of supply.

(a) The emergency source of supply shall be of a type and capacity in accordance with Table 112.05-5(a), except as otherwise provided by § 112.05-15.

(b) The emergency source of supply shall be independent of the vessels' ship's service lighting and powerplant and propulsion plant.

(c) The complete emergency installation shall function satisfactorily when the ship is inclined 22½ degrees and/or when the trim of the ship is 10 degrees.

(d) The emergency source of supply shall be located aft of the collision bulkhead and outside the machinery casing.

(1) On passenger vessels the emergency source of supply shall be located above the bulkhead deck or above the freeboard deck, whichever is the higher.

(2) On cargo and miscellaneous vessels, including tankships and barges, the emergency source of supply shall be located above the freeboard deck, or above the uppermost continuous deck, whichever is the higher.

TABLE 112.05-5(a)

Size of vessel and service	Type or types of emergency source of power	Period of operation and minimum capacity of emergency source of power
Passenger vessels over 65 feet in length		
Ocean and Coastwise	Storage battery or	36 hours.

TABLE 112.05-5(a)—Continued

Size of vessel and service	Type or types of emergency source of power	Period of operation and minimum capacity of emergency source of power
	An automatically started generator driven by a suitable prime mover with an independent fuel supply and an automatic load transfer from a temporary source of emergency power consisting of a storage battery of sufficient capacity to supply the temporary emergency source loads for not less than ½ hour.	36 hours (generator) and ½ hour (battery).
Other than Ocean and Coastwise, 100 g.t. and over. [1]	Storage battery with automatic transfer gear or diesel or gas turbine generator with automatic starting and transfer gear.	8 hours or twice the time of run, whichever is the smaller.
Other than Ocean and Coastwise, over 15 g.t. but less than 100 g.t. [1]	Storage battery or diesel or gas turbine generator with automatic or manual operation [2].	8 hours or twice the time of run, whichever is smaller.
Cargo and miscellaneous self-propelled vessels and tank ships; barges with sleeping accommodations for more than six persons. [3]		
All waters, 1,600 g.t. and over.....	Storage battery or diesel or gas turbine generator automatic or manual operation.	12 hours.
All waters, 300 g.t. and over, but less than 1,600 g.t.	Storage battery or diesel or gas turbine generator, automatic or manual operation, or approved relay-controlled battery-operated lanterns [5].	12 hours or twice the time of run, whichever is the smaller. [4]

[1] See also § 112.05-15.
[2] See also §§ 112.35-1 and 112.35-5.
[3] Applicable to barges contracted for on or after Nov. 19, 1958.
[4] Minimum period of operation of relay-controlled, battery-operated lanterns may be less than 12 hours but not less than 6 hours.
[5] Battery-operated lanterns shall have rechargeable batteries, shall incorporate an automatic battery charger that will maintain the battery in a fully charged condition, and shall not be readily portable.

(e) When a compartment containing the emergency source of electric power, or vital components thereof, adjoins a space containing either the ship's service generators or machinery necessary for the operation of the ship's service generators, all common bulkheads and/or decks shall be protected by approved "structural insulation" or other approved material. This protection shall be such as to be capable of preventing an excessive temperature rise in the space containing the emergency source of electric power, or vital components thereof, for a period of at least one hour in the event of fire in the adjoining space. Bulkheads or decks meeting Class A-60 requirements, as defined by § 72.05-10 in Subchapter H (Passenger Vessels) of this chapter, will be considered as meeting the requirements of this paragraph.

(f) Except for those cables used to connect equipment located in the engineroom or boilerroom, all cables emanating from the emergency switchboard shall be run so as to avoid penetrating the boundaries of the engineroom, boilerroom or the uptakes and casings of these spaces. All such cables shall be kept clear of the bulkheads and decks forming these boundaries.

(g) The emergency switchboard shall be installed as near as practicable to the emergency source of power.

(h) When the emergency source of power is a generator, the emergency switchboard shall be located in the same space as the emergency source of power, unless the operation of the emergency switchboard would thereby be impaired.

[CGFR 65-50, 30 FR 17085, Dec. 30, 1965, as amended by CGFR 67-88, 32 FR 20815, Dec. 27, 1967; CGFR 68-65, 33 FR 19991, Dec. 28,

1968; CGFR 72-35, 37 FR 4962, Mar. 8, 1972]

§ 112.05-10 Emergency lights.

(a) Emergency lights supplied by an automatic emergency lighting system shall form a part of the regular lighting system, and shall be continuously lighted at all times passengers or crew are aboard, except as provided by paragraph (b) of this section and § 112.05-15(c), and except when the emergency lights consist of relay-controlled battery-operated lanterns. (See footnote 5 in Table 112.05-5(a).)

(b) *Emergency lighting feeders.* (1) For vessels provided with firescreen bulkheads forming fire zones, at least one emergency lighting feeder shall be provided to supply only the emergency lights between two adjacent main vertical fire zone bulkheads. The emergency lighting feeder shall be separated as widely as possible from any general lighting feeder supplying the same space.

(2) On vessels fitted with an automatic emergency lighting and power system, a separate emergency lighting feeder shall be provided for emergency lights located in, or controlled from, the wheelhouse. A distribution panel for these lights with a fused switch or circuit breaker for each branch circuit shall be provided. Circuits to navigation lights not controlled by the navigation light panel, signal lights, and emergency lights on open decks, wheelhouse, chartroom, and fire control room shall be supplied from this wheelhouse distribution panel. The supply to the navigation light indicator panel shall be either a separate circuit from the emergency switchboard or a through feed, without switch or overcurrent protection, from the feeder supplying the wheelhouse emergency lighting panel. For overcurrent protection of the feeder supplying a navigation light panel see § 111.75-15(g)(2)(ii) of this chapter.

(3) On vessels provided with both a temporary and a final emergency lighting source of supply, a separate feeder to the wheelhouse shall be provided for the lifeboat floodlights. This feeder shall supply a distribution panelboard having a fused switch or circuit breaker for each brand circuit. This feeder may be connected to the final emergency lighting source of supply. On vessels without a temporary source of supply, these lights, when provided, may be supplied by the same feeder as other emergency lights controlled from the wheelhouse.

(c) Emergency lights for the illumination of boats and embarkation decks, lifeboat launching gear, wheelhouse, chart room, and navigating instruments need not be continuously lighted and, except as provided otherwise in this paragraph, shall be controlled by switches located in the wheelhouse.

(1) On "island type" vessels, such as tankers and Great Lakes' bulk freighters, lighting for illumination of lifeboats, launching gear and embarkation areas remote from the wheelhouse island may be controlled from a central location within the island involved in lieu of from the wheelhouse.

(d) Emergency lights shall be marked with a letter "E" of at least ½-inch in height as required by § 78.47-33 of Subchapter H (Passenger Vessels), and § 97.37-25 of Subchapter I (Cargo and Miscellaneous Vessels) of this chapter.

(e) On a mobile offshore drilling unit, the distribution panels required in paragraph (b) of this section may be in the control room.

(f) On a mobile offshore drilling unit, the switches required in paragraph (c) of this section may be in the control room.

(Sec. 2, 87 Stat. 418 (46 U.S.C. 86); sec. 3, 82 Stat. 341, as amended (46 U.S.C. 367); R.S. 4405, as amended (46 U.S.C. 375); sec. 10, 35 Stat. 428 (46 U.S.C. 395); R.S. 4423, as amended (46 U.S.C. 400); R.S. 4429, as amended (46 U.S.C. 407); R.S. 4430, as amended (46 U.S.C. 408); 88 Stat. 423 (46 U.S.C. 411); R.S. 4434, as amended (46 U.S.C. 412); R.S. 4462, as amended (46 U.S.C. 416); sec. 1, 73 Stat. 475 (46 U.S.C. 481); sec. 4, 67 Stat. 462 (43 U.S.C. 1333(d)); sec. 6(b)(1), 80 Stat. 937 (49 U.S.C. 1655(b)(1)); 49 CFR 1.46(b) and (n)(6).)

[CGFR 65-50, 30 FR 17086, Dec. 30, 1965, as amended by CGFR 70-143, 35 FR 19955, Dec. 30, 1970; CGD 73-251, 43 FR 56838, Dec. 4, 1978]

§ 112.05-15 Emergency lighting system for small passenger vessels.

(a) Small passenger vessels, certificated to operate only between sunrise and sunset, may be permitted to operate without an emergency lighting system.

(b) Small passenger vessels, certificated to operate not more than 15 miles offshore, may be permitted to operate without an emergency lighting system provided all of the conditions, where applicable, contained in this paragraph are complied with.

(1) The source of supply of the general lighting system must be independent of the propulsion plant.

(2) On vessels required to meet at least a one compartment standard of subdivision, the source of supply of the general lighting system must be located above the bulkhead deck.

(c) On small passenger vessels having no sleeping accommodations for passengers and requiring not more than 10 emergency lights, the automatic emergency lighting system need not form a part of the regular lighting system and need not be continuously lighted. Individual storage-battery-operated automatic emergency lighting units will be acceptable for such vessels in lieu of a single source emergency lighting system provided the units incorporate an automatic battery charger, are not readily portable, and have sufficient capacity for not less than 6 hours continuous operation.

Subpart 112.10—Classifications of Emergency Lighting and Power Systems

§ 112.10-1 General.

(a) Emergency lighting and power systems are classified in accordance with the method provided to cause the system to apply potential to the emergency loads and in accordance with the basic function of the system.

§ 112.10-5 Manual emergency lighting and power system.

(a) A manual emergency lighting and power system is one in which a single manual operation, such as the manual operation of a switch from an "off" to an "on" position, is required to cause the emergency lighting and power system to supply power to the emergency loads.

§ 112.10-10 Automatic emergency lighting and power system.

(a) An automatic emergency lighting and power system is one in which a specified reduction in potential from the ship's service power and lighting plant will cause the emergency lighting and power system to supply power to the emergency loads.

§ 112.10-15 Temporary source of emergency lighting and power.

(a) A temporary source of emergency lighting and power is one of limited capacity designed to carry, for a short time, selected emergency loads while an emergency source of larger capacity is being started.

§ 112.10-20 Final source of emergency lighting and power.

(a) A final source of emergency lighting and power is one designed to function subsequent to the termination of the temporary source.

Subpart 112.15—Emergency Loads

§ 112.15-1 Temporary emergency source loads.

(a) The emergency lighting and power loads listed in this section shall be arranged so that they can be energized from the temporary emergency source.

(b) Navigation light indicator panel, if required by § 113.55-25 of this subchapter.

(c) A sufficient number of lights throughout machinery spaces to permit the performance of essential operations and observations under emergency conditions and to facilitate restoration of service.

(d) Lighting for passageways, stairways, and escape trunks in passenger quarters, crew quarters, public spaces, machinery spaces and work spaces, adequate to permit passengers and crew readily to find their way to open decks and to lifeboat embarkation and assembly points with all watertight doors and fire screen doors closed.

(e) Illuminated signs bearing the word "Exit" in red letters shall be installed in such locations throughout a passenger vessel so that from any portion of the vessel normally accessible to the passengers or crew, except machinery spaces, and except stores and similar spaces where the crew are not normally employed, and with all fire doors in stairway inclosures and main vertical zone bulkheads closed and all watertight doors closed, the direction of escape to the open deck will be apparent. For the purpose of this paragraph, individual staterooms and other similar small rooms will not be required to have such signs, but upon emerging from such rooms the direction of escape shall be apparent. (Also see § 111.50-15(d) of this subchapter.)

(f) General illumination for safe operation of watertight doors, if installed and power operated.

(g) One or more lights in galleys, pantries, steering gear rooms, emergency power rooms, chartroom, wheelhouse, mess rooms, and recreation rooms:

(h) Lighting for boat and embarkation decks and passenger assembly points for safe embarkation into the lifeboats.

(i) Electric communication systems essential under temporary emergency conditions and which do not have an independent storage battery source of power.

(j) Watertight door system, if installed and power operated.

(k) Emergency loudspeaker system, if installed.

(l) Fire screen door holding and release system, if installed.

(m) Supply to motor-generator or other conversion equipment where a temporary emergency source of alternating current is necessary for essential communication systems, emergency or safety requirements.

(n) Lights must provide continuous illumination for—

(1) The launching gear of a lifeboat or a liferaft; and

(2) The entire process of launching a lifeboat or a liferaft from its stowed position until waterborne.

[CGFR 65-50, 30 FR 17086, Dec. 30, 1965, as amended by CGFR 70-143, 35 FR 19955, Dec. 30, 1970; CGFR 72-45, 37 FR 5032, Mar. 9, 1972]

§ 112.15-5 Final emergency source loads.

(a) The emergency lighting and power loads listed in paragraphs (b) to (i), inclusive, of this section shall be arranged so that they can be energized from the final source. It is recommended that loads listed in paragraphs (j) to (p), inclusive, of this section be arranged so that they can be energized from the final source where the capacity and character of the emergency plant will permit.

(b) All loads listed in § 112.15-1, as indicated.

(c) Each electric blow-out preventer control system on a mobile offshore drilling unit.

(d) Charging panels of temporary emergency battery and of starting battery for diesel engine driving emergency generator.

(e) One of the bilge pumps, if dependent upon the emergency generator for its source of power to comply with Part 56 of this chapter.

(f) One of the fire pumps, if dependent upon the emergency generator for its source of power to comply with Part 34 of Subchapter D (Tank Vessels), Part 76 of Subchapter H (Passenger Vessels), Part 95 of Subchapter I (Cargo and Miscellaneous Vessels), or Part 108 of Subchapter IA (Mobile Offshore Drilling Units) of this chapter.

(g) Sprinkler system pump or water spray extinguishing system pump, if dependent upon the emergency generator for its source of power to comply with Part 76 of Subchapter H (Passenger Vessels) of this chapter.

(h) Daylight signaling lights, if installed.

(i) Smoke detector system, if installed.

(j) Radio installation, if installed.

(k) Radio direction finder, if installed.

(l) Loran, if installed.

(m) Radar plan position indicator, if installed.

(n) Gyrocompass, if installed.

(o) Depth sounder, if installed.

(p) Electric whistle and siren control, if installed.

(Sec. 2, 87 Stat. 418 (46 U.S.C. 86); sec. 3, 82 Stat. 341, as amended (46 U.S.C. 367); R.S. 4405, as amended (46 U.S.C. 375); sec. 10, 35 Stat. 428 (46 U.S.C. 395); R.S. 4423, as amended (46 U.S.C. 400); R.S. 4429, as amended (46 U.S.C. 407); R.S. 4430, as amended (46 U.S.C. 408); 88 Stat. 423 (46 U.S.C. 411); R.S. 4434, as amended (46 U.S.C. 412); R.S. 4462, as amended (46 U.S.C. 416); sec 1, 73 Stat. 475 (46 U.S.C. 481); sec. 4, 67 Stat. 462 (43 U.S.C. 1333(d)); sec. 6(b)(1), 80 Stat. 937 (49 U.S.C. 1655(b)(1)); 49 CFR 1.46(b) and (n)(6).)

[CGFR 65-50, 30 FR 17087, Dec. 30, 1965, as amended by CGFR 70-143, 35 FR 19955, Dec. 30, 1970; CGD 73-251, 43 FR 56838, Dec. 4, 1978]

§ 112.15-10 Single automatically started source loads.

When only a single automatically started source of emergency lighting and power is installed, the circuits listed in § 112.15-5, as indicated, shall be arranged so that they can be energized from the single emergency source of supply.

§ 112.15-15 Manually started source loads.

(a) When a manually started emergency lighting and power system is installed, the circuits listed in § 112.15-5, as indicated, shall be arranged so that they may be energized from the emergency source of supply.

Subpart 112.20—Operation of Emergency Systems Having Both a Temporary and a Final Source of Emergency Lighting and Power

§ 112.20-1 Emergency loads.

(a) The emergency loads listed in Subpart 112.15, as indicated, shall normally be energized from the ship's service generating plant through automatic transfer switches.

§ 112.20-5 Failure of power from the normal source.

(a) In the event of a reduction of potential of the normal source by 15 to 40 percent of normal value, the loads listed in § 112.15-1 shall automatically be supplied from the temporary source of emergency lighting and power. For systems in which a reduction of frequency of the normal source or final source will adversely affect the emergency system and emergency loads, suitable means shall be provided to transfer the loads listed in § 112.15-1 to the temporary source.

§ 112.20-10 Diesel or gas turbine driven emergency source of power.

(a) Simultaneous with the operation described in § 112.20-5, the diesel or gas turbine engine driving the final source (emergency generator) shall automatically be started with no load connected to the emergency generator.

[CGFR 68-65, 33 FR 19991, Dec. 28, 1968]

§ 112.20-15 Potential of final source.

(a) When the potential of the final source (emergency generator) reaches 85 to 95 percent of normal value, the emergency loads listed in Subpart 112.15, as indicated, shall automatically be transferred to this final source.

(b) When potential from the ship's service generating plant has been restored to normal, the emergency loads may be manually transferred to the normal source and the emergency generator manually stopped.

(c) Should the potential of the final source (emergency generator), while supplying the emergency loads, fall below 75 to 85 percent of normal value, the temporary emergency loads shall again be transferred to the temporary source as described in § 112.20-5.

Subpart 112.25—Operation of Emergency System Having an Automatic Starting Diesel-Engine or Gas Turbine Driven Emergency Generator as the Sole Source of Emergency Lighting and Power

§ 112.25-1 Emergency loads.

(a) The emergency loads listed in § 112.15-5, as indicated, shall normally be energized from the ship's service generating plant through automatic transfer switches.

§ 112.25-5 Reduction of potential.

(a) In the event of failure of power from the normal source, such as a reduction of potential by 15 to 40 percent of normal value, the engine driving the emergency generator shall automatically be started with no load connected to the emergency generator.

§ 112.25-10 Operation requirements.

(a) When the potential of the emergency generator reaches 85 to 95 percent of normal value, the emergency loads shall automatically be connected to the emergency generator.

(b) When potential from the ship's service generating plant has been restored to normal, the emergency loads may be manually transferred to the normal source and the emergency generator manually stopped.

Subpart 112.30—Operation of Emergency Systems Having an Automatically Connected Storage Battery as the Sole Source of Emergency Lighting and Power

§ 112.30-1 Emergency loads.

(a) The emergency loads listed in § 112.15-5, as indicated, shall normally be energized from the ship's service generating plant through automatic transfer switches.

§ 112.30-5 Reduction of potential.

(a) Upon reduction of potential from the normal source by 15 to 40 percent of normal value, the emergency loads shall automatically be disconnected from the normal source and connected to the emergency storage battery.

§ 112.30-10 Operation requirements.

(a) Upon restoration of potential from the normal source of 85 to 95 percent of normal values, the emergency loads shall automatically be transferred back to the normal source.

Subpart 112.35—Operation of a Manually Controlled Emergency System Having a Storage Battery or a Diesel-Engine or Gas Turbine Driven Generator as the Sole Source of Emergency Lighting and Power

§ 112.35-1 Manual operation requirements.

(a) Manually started emergency lighting and power systems shall require only a single manual operation, such as the manual operation of a switch from an "off" to an "on" position, to cause the emergency system to supply its connected loads.

§ 112.35-5 Means for starting.

(a) The starting means shall be located in the wheelhouse or so as to be under the control of the chief engineer.

Subpart 112.40—Installations Requiring an Alternating-Current Temporary Source of Supply

§ 112.40-1 General requirements.

(a) Installations requiring alternating current for the operation of communication equipment or other apparatus essential under temporary emergency conditions shall be provided with the necessary conversion equipment. Where such conversion equipment will be operating both under normal conditions and under temporary emergency conditions, the conversion equipment shall be provided in duplicate.

Subpart 112.45—Visible Indicators and Test Switch

§ 112.45-1 Visible indicators.

(a) Visible indicators shall be provided in the machinery space to indicate when the emergency battery is being discharged and when the emergency loads are being supplied by an automatically controlled emergency source of supply (storage battery or emergency diesel or gas turbine generator).

[CGFR 65-50, 30 FR 17085, Dec. 30, 1965, as amended by CGFR 68-65, 33 FR 19991, Dec. 28, 1968]

§ 112.45-5 Test switch.

(a) A test switch shall be provided at the emergency switchboard or other location as may be approved to simulate a failure of potential from the normal source, the operation of which switch will cause the emergency loads to be transferred.

Subpart 112.50—Emergency Diesel-Engine-Driven Generator Sets

§ 112.50-1 General requirements.

(a) The diesel engine of the generator set shall be complete with all accessories necessary for operation and protection of the engine, shall have a self-contained cooling system of size to assure continuous engine operation using 100° F. air, and the fuel used shall have a flashpoint of not less than 110° F. The room in which the set is located shall be provided with suitable intake and exhaust ducts to supply adequate cooling air. The diesel engine as installed shall be without starting aid except that a thermostatically controlled electric water jacket heater, connected to the final emergency bus, may be employed. The diesel engine as installed shall be capable of carrying its full rated load within 20 seconds after cranking is initiated with the intake air, room ambient, and starting equipment all at a temperature of 32° F. The diesel engine shall be started by either hydraulic or electric means. The generator sets shall lubricate and operate satisfactorily when permanently inclined to an angle of 22½° athwartship and 10° fore and aft, and shall be arranged so that it will not spill oil under a vessel roll of 30° each side of the vertical. Units shall shut down automatically upon loss of lubricating oil pressure, dangerous overspeeding, and operating of the fixed carbon dioxide system in the emergency generator room. An audible alarm device shall be provided to sound on low oil pressure and high cooling water temperature.

(b) Hydraulic starting means shall comply with the following conditions:

(1) The hydraulic cranking device shall be a self-contained system which will provide the required cranking forces and engine starting RPM as recommended by engine manufacturer.

(2) Electrically operated means shall automatically provide and maintain the stored hydraulic pressure within the predetermined pressure limits.

(3) The means of automatically maintaining the hydraulic system within the predetermined pressure limits shall be energized from the final emergency bus.

(4) Means shall be provided to manually recharge the hydraulic system.

(5) Charging of the hydraulic cranking system shall not create an absence of hydraulic power for engine starting at any time.

(6) The capacity of the hydraulic cranking system shall provide not less than six cranking cycles. Each cranking cycle shall provide the necessary number of revolutions at the required RPM to permit the diesel engine to meet the requirements of carrying its full rated load within 20 seconds after cranking is initiated with intake air, room ambient temperature and hydraulic cranking system at 32° F.

(7) Capacity of the hydraulic cranking system sufficient for three starts under conditions of subparagraph (6) of this paragraph shall be held in reserve and arranged so that the operation of a single control by one person will isolate the discharged or initially used part of the system and permit the reserve capacity to be employed.

(c) Electrical starting means shall comply with the following conditions:

(1) The starting battery shall be of sufficient capacity to provide not less than six consecutive cranking cycles. Each cycle shall consist of not less than one-half minute of battery rest.

(2) At the end of the sixth cranking cycle the battery voltage while cranking the engine, shall be not less than 50 percent of nominal battery voltage.

(3) The cranking cycles shall be with the intake air, room ambient, and starting battery at a temperature of not more than 32° F.

[CGFR 67-88, 32 FR 20815, Dec. 27, 1967, as amended by CGFR 70-143, 35 FR 19955, Dec. 30, 1970]

Subpart 112.51—Emergency Gas Turbine Driven Generator Sets

§ 112.51-1 General requirements.

(a) The gas turbine of the generator set shall be complete with all accessories necessary for operation and protection of the engine; shall have a self-contained cooling system of a size so as to assure continuous engine operation using 100° F. air; and the fuel used shall have a flashpoint of not less

40-130 O—79——10

than 110° F. The room in which the set is located shall be provided with suitable intake and exhaust ducts to supply adequate cooling air. The gas turbine as installed shall be without starting aid. The gas turbine as installed shall be capable of carrying its full rated load within 20 seconds after cranking is initiated with the intake air, room ambient, and starting equipment all at a temperature of 32° F. The gas turbine shall be started by either hydraulic or electric means. The generator sets shall lubricate and operate satisfactorily when permanently inclined to an angle of 22½° athwartship and 10° fore and aft, and shall be arranged so that it will not spill oil under a vessel roll of 30° each side of the vertical. Units shall shutdown automatically upon loss of lubricating oil pressure, dangerous overspeeding, and release of carbon dioxide in the emergency generator room. Audible alarms shall be provided for high gas temperature, high oil temperature, overspeed, low oil pressure, and, if provided, high cooling water temperature. Details of the required shutdowns and alarms are contained in § 58.10-15(g) of Subchapter F (Marine Engineering) of this chapter.

(b) When hydraulic starting means are employed the requirements of § 112.50-1(b) shall be complied with. When electric starting means are employed the requirements of § 112.50-1(c) shall be complied with.

[CGFR 68-65, 33 FR 19991, Dec. 28, 1968]

Subpart 112.55—Storage Battery Installation

§ 112.55-1 General requirements.

(a) Storage batteries for emergency lighting and power systems, including starting batteries for emergency diesel-engine driven generator sets, shall be of a design and construction proven successful in merchant marine service, and capable of withstanding the roll and pitch of a vessel and exposure to salt air. Positive plates of lead-acid batteries shall be at least 0.25 inch thick, and the specific gravity of the electrolyte when fully charged shall be 1.210 to 1.220, both inclusive, at 25° C., except that thin positive plate construction (0.125 inch thick minimum) may be used for engine cranking batteries. The fully charged specific gravity of the electrolyte of lead-acid engine cranking batteries shall not exceed 1.260 at 25° C. for high watering space type batteries or 1.285 at 25° C. for normal watering space type batteries.

§ 112.55-5 Emergency lighting loads.

(a) When supplying emergency lighting loads, the storage battery initial voltage shall not exceed the standard system voltage by more than 5 percent.

§ 112.55-10 Storage battery requirements.

(a) Storage battery installations for emergency lighting and power, including starting batteries for emergency diesel-engine driven generator sets, shall include the necessary apparatus automatically to maintain the battery in a fully charged condition. At all times when the ship's service source of supply is available, the battery shall be furnished a continuous trickle charge, except that after a battery discharge, the battery shall be automatically charged at a higher rate until the battery voltage increases to a predetermined point. Charging operations shall not create an absence of battery power at any time. Instruments to show the rate of charge shall be provided.

§ 112.55-15 Capacity of storage battery.

(a) The capacity of a storage battery shall be ample to close each watertight door three times and to open each watertight door two times, and to carry the remaining emergency loads continuously for the duration of time required by § 112.05-5(a), at the end of which time the potential of the storage battery shall be not less than 87.5 percent of standard system voltage. The nominal potential of a lead-acid storage battery will be taken as 2.0 volts per cell; the nominal potential of nickel-alkaline storage batteries will be taken as from 1.2 to 1.4 volts per cell.

§ 112.55-20 Diesel engine cranking batteries.

(a) Batteries used for starting emergency diesel engine generator sets shall be either the lead-acid or nickel-cadmium type.

Subpart 112.90—Emergency Lighting and Power Systems for Vessels Contracted for Prior to November 19, 1952

§ 112.90-1 General.

(a) Existing arrangements, materials, and facilities previously approved, but not meeting the applicable specifications or requirements set forth in Subparts 112.05 through 112.55, may be continued in service so long as they are maintained in good condition to the satisfaction of the Office in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standards as the original installation: *Provided,* That, in no case, will a greater departure from the standards of Subparts 112.05 through 112.55 be permitted than presently exist.

(b) All new installations or major replacements shall meet the applicable specifications or requirements for new vessels.

§ 112.90-3 Emergency lighting and power systems for passenger vessels, contracted for prior to November 19, 1952, on an international voyage.

(a) The emergency lighting and power systems for passenger vessels, contracted for prior to November 19, 1952, on an international voyage shall meet the applicable standards of Subparts 112.05 through 112.55.

[CGFR 67-87, 32 FR 19182, Dec. 20, 1967]

§ 112.90-5 Emergency lighting system for ocean and coastwise passenger vessels, contracted for prior to November 19, 1952, other than passenger vessels on an international voyage.

(a) The emergency lighting system for ocean and coastwise vessels, contracted for prior to November 19, 1952, other than passenger vessels on an international voyage, shall be in accordance with this section.

(b) Provision shall be made on all passenger vessels for an electric or other system of lighting, sufficient for all requirements of safety, in the different parts of the ship. There shall be a self-contained source capable of supplying, when necessary, this safety lighting system, and placed in the upper parts of the ship above the margin line.

(c) The exit from every main compartment occupied by passengers or crew shall be continuously lighted by an emergency lamp. The power for these emergency lamps shall be so arranged that they will be supplied from the independent installations referred to in paragraph (b) of this section in the event of failure of the main generating plant.

(d) On all passenger vessels contracted for on and after July 1, 1935, or where existing emergency installations operated by internal combustion engines are replaced, the emergency generator shall be driven by a diesel or semi-diesel engine, equipped with means for quick starting. Such emergency equipment shall be located in steel or iron compartments or rooms on the deck above the weather deck and isolated from the passenger and crew quarters. Where existing installations of emergency engines and generators are located in wooden compartments or rooms, such compartments or rooms shall be made fire-resistant by lining same with asbestos board having a thickness of not less than one-quarter inch over which iron or steel sheathing shall be fitted.

(e) Provision shall be made on all passenger vessels, where the boat deck is more than 30 feet above the water line at the lightest seagoing draft, for readily and continuously available illumination from the vessel of lifeboats when along side and in process of, or immediately after, being launched. There shall be a self-contained source capable of supplying, when necessary, this safety lighting system and placed in the upper part of the vessel above the bulkhead deck.

(1) The emergency generating set will ordinarily provide a satisfactory source of illumination, and, where used for this purpose, it shall be of sufficient power to provide for such il-

lumination in addition to other demands made upon the set.

[CGFR 65-50, 30 FR 17085, Dec. 30, 1965, as amended by CGFR 67-87, 32 FR 19182, Dec. 20, 1967]

§ 112.90-10 Emergency lighting system for passenger vessels, contracted for prior to November 19, 1952, other than ocean and coastwise passenger vessels and passenger vessels on an international voyage.

(a) The emergency lighting system for passenger vessels, contracted for prior to November 19, 1952, other than ocean and coastwise passenger vessels and passenger vessels on an international voyage, shall be in accordance with this section.

(b) All vessels engaged in the passenger service, which are electrically lighted by dynamos or other electric units, located below the deep-load line of the vessel, shall have on board an emergency electric lighting system located above the deep-load line to light the vessel sufficiently to enable the passengers and crew to find their way to the exits in the event of failure of the main lighting system. The emergency lighting system shall at all times be ready for immediate use, and shall be installed and arranged so that all emergency lights may be switched on from the pilothouse, navigation bridge, or a central station.

(c) On all passenger vessels contracted for on and after July 1, 1935, or where existing emergency installations operated by internal-combustion engines are replaced, the emergency generator shall be driven by a diesel or semi-diesel engine, equipped with means for quick starting. Such emergency equipment shall be located in steel or iron compartments or rooms on the deck above the weather deck and isolated from the passenger and crew quarters. Where existing installations of emergency engines and generators are located in wooden compartments or rooms, such compartments or rooms shall be made fire-resistant by lining same with asbestos board having a thickness of not less than one-quarter inch over which iron or steel sheathing shall be fitted.

(d) Provision shall be made on all passenger vessels, where the boat deck is more than 30 feet above the water line at the lightest seagoing draft, for readily and continuously available illumination from the vessel of lifeboats when alongside and in process of, or immediately after, being launched. There shall be a self-contained source capable of supplying, when necessary, this safety lighting system and placed in the upper part of the vessel above the bulkhead deck.

(1) The emergency generating set will ordinarily provide a satisfactory source of illumination, and, where used for this purpose, it shall be of sufficient power to provide for such illumination in addition to other demands made upon the set.

[CGFR 65-50, 30 FR 17085, Dec. 30, 1965, as amended by CGFR 67-87, 32 FR 19182, Dec. 20, 1967]

PART 113—COMMUNICATION AND ALARM SYSTEMS AND EQUIPMENT

Subpart 113.01—Application

Sec.

Subpart 113.05—General Provisions

Subpart 113.10—Automatic Fire Detecting and Alarm Systems

Subpart 113.15—Manual Fire Alarm Systems

Subpart 113.20—Automatic Sprinkler Systems

Subpart 113.25—General Alarm Systems

AUTHORITY: R.S. 4405, as amended, 4462, as amended, sec. 6(b)(1), 80 Stat. 938; 46 U.S.C. 375, 416, 49 U.S.C. 1655(b); 49 CFR 1.46(b) (35 FR 4959). Interpret or apply R.S. 4399, as amended, 4400, as amended, 4417, as amended, 4417a, as amended, 4418, as amended, 4421, as amended, 4426, as amended, 4427, as amended, 4433, as amended, 4453, as amended, 4488, as amended, 4491, as amended, sec. 14, 29 Stat. 690, as amended, sec. 10, 35 Stat. 428, as amended, 41 Stat. 305, as amended, sec. 5, 49 Stat. 1384, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 17, 54 Stat. 166, as amended, sec. 3, 54 Stat. 347, as amended, sec. 3, 70 Stat. 152, sec. 3, 68 Stat. 675; 46 U.S.C. 361, 362, 391, 391a, 392, 399, 404, 405, 411, 435, 481, 489, 366, 395, 363, 369, 367, 526p, 1333, 390b, 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 FR 9671, 3 CFR, 1965 Supp.

SOURCE: CGFR 65-50, 30 FR 17089, Dec. 30, 1965, unless otherwise noted.

Subpart 113.01—Application

§ 113.01-1 Vessels subject to requirements.

(a) The provisions of this part shall apply to all vessels except as specifically noted in this part.

Subpart 113.05—General Provisions

§ 113.05-1 Supplementary requirements.

(a) The provisions of this part are supplementary to the general requirements for electrical systems and apparatus contained in this subchapter.

§ 113.05-5 Equipment of an approved type.

(a) Where equipment in this part is required to be of an approved type, such equipment shall be of a type approved by the Commandant.

(b) Specifications for many of the items required to be of an approved type have been promulgated and are contained in Subchapter Q (Specifications) of this chapter. In general, such specifications are of interest only to the manufacturer of specific items of equipment.

§ 113.05-10 Wiring.

(a) Hook-up wire for use within the components of the equipment specified in this part shall be of soft stranded annealed copper of suitable cross section to provide ample and safe current carrying capacity and mechanical strength. Hook-up wire shall be in accordance with MIL-W-76, MIL-W-16878 types B, C, D, E, EE, and FF, or with Subpart 111.60 of this subchapter.

(b) All external wiring and wiring between components shall be in accordance with Subpart 111.60 of this subchapter.

Subpart 113.10—Automatic Fire Detecting and Alarm Systems

§ 113.10-1 Application.

(a) Where an electric fire detecting and alarm system is installed, the provisions of this subpart, with the exception of § 113.10-90, shall apply to all installations contracted for on or after November 19, 1952. Installations contracted for prior to November 19, 1952, shall meet the requirements of § 113.10-90.

(b) For the vessels on which an automatic fire detecting and alarm system is required see Part 76 of Subchapter H (Passenger Vessels) of this chapter.

§ 113.10-5 General requirements.

(a) Fire alarm annunciators, power supply, fire detectors, test stations, and vibrating bells shall be of a type approved by the Commandant, U.S. Coast Guard. Systems installed on vessels contracted for on or after November 19, 1959, shall meet the requirements of Subpart 161.002 of this chapter in effect on the date of contracting.

(b) All electric cables installed in conjunction with fire detecting and alarm system shall be either leaded and armored, impervious sheathed and armored or mineral insulated metal sheathed.

(c) Cable runs between the fire alarm annunciator and fire detecting zones shall be as direct as possible, and shall avoid, where possible, staterooms, lockers, and other enclosed spaces where this cable could be damaged by a localized fire or by other causes.

(d) Conductors for several fire detecting zones may be run in a multiconductor cable, but a conductor shall not be used as a common return from two or more zones.

(e) Connection boxes containing conductors to more than one fire detecting zone shall be of watertight construction and the cable entrances shall be made tight by means of terminal or stuffing tubes.

(f) Connection boxes for fire detector stations, manual alarm stations, test stations, or other boxes containing the conductors of a single fire detecting zone, may be of nonwatertight construction, if installed in a dry location.

[CGFR 65-50, 30 FR 17090, Dec. 30, 1965, as amended by CGFR 70-143, 35 FR 19955, Dec. 30, 1970]

§ 113.10-90 Equipment and installations on vessels contracted for prior to November 19, 1952.

(a) Existing arrangements, materials, and facilities previously approved,

but not meeting the applicable specifications or requirements set forth in § 113.10-5, may be continued in service so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standards as the original installation: *Provided,* That, in no case, will a greater departure from the standards of § 113.10-5 be permitted than presently exist. All new installations or major replacements shall meet the applicable specifications or requirements.

(b) All conductors shall conform to specifications for interior communication cable contained in the marine rules as adopted by the Institute of Electrical and Electronic Engineers as regards construction, size, leading, armoring, protection, support, and details of installation, with the following exceptions:

(1) All conductors shall be lead sheathed to protect against moisture and conductors exposed to mechanical injury shall be leaded and armored.

(2) Lead-sheathed conductors may be used for voltages of 60 volts or less.

(3) In single-wire, closed-circuit systems (series) approved metallic sheathed wire shall be used in connecting thermostats in each thermostat zone, but approved multiconductor cable may be used to connect the several individual zones to the annunciator panel.

Subpart 113.15—Manual Fire Alarm Systems

§ 113.15-1 Application.

(a) Where an electric manual fire alarm system is installed, the provisions of this subpart, with the exception of § 113.15-90, shall apply to all installations contracted for on or after November 19, 1952. Installations contracted for prior to November 19, 1952, shall meet the requirements of § 113.15-90.

(b) For the vessels on which a manual fire alarm system is required, see Part 76 of Subchapter H (Passenger Vessels) of this chapter.

§ 113.15-5 General requirements.

(a) Manual fire alarm annunciator, power supply, manual stations, and vibrating bells shall be of a type approved by the Commandant. Systems installed on vessels contracted for on or after November 19, 1959, shall meet the requirements of Subpart 161.002 of Subchapter Q (Specifications) of this chapter.

(b) All electric cables installed in conjunction with manual fire alarm systems shall be either leaded and armored, impervious sheathed and armored or mineral insulated metal sheathed.

(c) Cable runs between the annunciator and fire alarm zones shall be as direct as possible, and shall avoid, where possible, staterooms, lockers, and other enclosed spaces where the cable could be damaged by a localized fire or by other causes.

(d) Conductors for several fire alarm zones may be run in a multiconductor cable, but a conductor shall not be used as a common return from two or more zones.

(e) Connection boxes containing conductors to more than one fire alarm zone shall be of watertight construction and the cable entrances shall be made tight by means of terminal or stuffing tubes.

(f) Connection boxes for manual stations, or other boxes containing the conductors of a single fire alarm zone, may be of nonwatertight construction if installed in a dry location.

§ 113.15-90 Equipment and installations on vessels contracted for prior to November 19, 1952.

(a) Existing arrangements, materials, and facilities previously approved, but not meeting the applicable specifications or requirements set forth in § 113.15-5, may be continued in service so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standards as the original installation: *Provided,* That, in no case, will a greater departure from the standards of § 113.15-5 be permitted than presently exist. All new installations or major replace-

ments shall meet the applicable specifications or requirements.

(b) All conductors shall conform to specifications for interior communication cable contained in the marine rules as adopted by the Institute of Electrical and Electronic Engineers as regards construction, size, leading, armoring, protection, support and details of installation, with the following exceptions:

(1) All conductors shall be lead sheathed to protect against moisture and conductors exposed to mechanical injury shall be leaded and armored.

(2) Lead-sheathed conductors may be used for voltages of 60 volts or less.

(3) In single-wire, closed-circuit systems (series) approved metallic sheathed wire shall be used in connecting thermostats in each thermostat zone, but approved multiconductor cable may be used to connect the several individual zones to the annunciator panel.

[CGFR 65-50, 30 FR 17089, Dec. 30, 1965, as amended by CGFR 66-71, 31 FR 16782, Dec. 31, 1966]

Subpart 113.20—Automatic Sprinkler Systems

§ 113.20-1 Application.

(a) When an automatic sprinkler system is installed, the provisions of this subpart, with the exception of § 113.20-90, shall apply to all installations contracted for on or after November 19, 1952. Installations contracted for prior to November 19, 1952, shall meet the requirements of § 113.20-90.

§ 113.20-5 General requirements.

(a) The general requirements for automatic sprinkler systems are contained in Subpart 76.25 of Subchapter H (Passenger Vessels) of this chapter.

(b) The sprinkler alarm system, including annunciator, power supply, alarm switches, and bells shall be of an approved type.

(c) All electric cable employed in a sprinkler alarm system shall be either leaded and armored, impervious sheathed and armored or mineral insulated metal sheathed.

(d) All connection boxes, alarm switches, pressure switches, or level switches, etc., employed in the system shall be of watertight construction.

§ 113.20-90 Equipment and installations on vessels contracted for prior to November 19, 1952.

(a) Existing arrangements, materials, and facilities previously approved, but not meeting the applicable specifications or requirements set forth in § 113.20-5, may be continued in service so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standards as the original installation: *Provided,* That, in no case, will a greater departure from the standards of § 113.20-5 be permitted than presently exist. All new installations or major replacements shall meet the applicable specifications or requirements.

(b) All conductors shall conform to specifications for interior communication cable contained in the marine rules as adopted by the Institute of Electrical and Electronic Engineers as regards construction, size, leading, armoring, protection, support, and details of installation, with the following exceptions:

(1) All conductors shall be lead-sheathed to protect against moisture and conductors exposed to mechanical injury shall be leaded and armored.

(2) Lead-sheathed conductors may be used for voltages of 60 volts or less.

(3) In single-wire, closed-circuit systems (series) approved metallic sheathed wire shall be used in connecting thermostats in each thermostat zone, but approved multi-conductor cable may be used to connect the several individual zones to the annunciator panel.

(c) Where a motor-driven sprinkler pump is installed, it shall be capable of being operated from the emergency electrical circuit in case of failure of the main power.

[CGFR 65-50, 30 FR 17089, Dec. 30, 1965, as amended by CGFR 66-71, 31 FR 16782, Dec. 31, 1966]

Subpart 113.25—General Alarm Systems

§ 113.25-1 Application.

(a) The provisions of this subpart, with the exception of §§ 113.25-25 and 113.25-90, shall apply to all manned vessels of over 100 gross tons, except barges, scows, and similar vessels, contracted for on or after November 19, 1952.

(b) The provisions of § 113.25-25 shall apply to all manned ocean and coastwise barges of over 100 gross tons, where the crew is divided into watches for the purpose of steering, contracted for on or after November 19, 1952.

(c) The provisions of § 113.25-30 shall apply to all barges of 300 gross tons and over contracted for on or after November 19, 1958, with sleeping accommodations for more than 6 persons.

(d) The provisions of § 113.25-90 shall apply to all manned vessels of over 100 gross tons, except barges, scows, and similar vessels, contracted for prior to November 19, 1952.

§ 113.25-5 Operation.

(a) The general alarm system shall consist of electric vibrating bells and in certain cases flashing red lights (see § 113.25-10(d)) located throughout passengers' and crew's quarters, machinery spaces, and work spaces, and so located as to warn all occupants in an emergency. The general alarm system shall be operated by means of manually operated contact makers with one contact maker located in the wheelhouse. Except for the one located in the wheelhouse, all contact makers shall be protected against tampering by an enclosure provided with a breakable transparent window.

(b) On passenger vessels and cargo and miscellaneous vessels the general alarm system shall be operated by two readily accessible, manually operated contact makers. One contact maker shall be located in the same space as the feeder distribution panel, or, if no feeder distribution panel is provided, in the same space as the branch circuit distribution panel. The other contact maker shall be located in the wheelhouse. Where the general alarm power supply is in or adjacent to the wheelhouse only one contact maker need be provided. One additional contact maker may be installed at an accessible location.

(c) On tank vessels four manually operated contact makers shall be provided in accessible locations for operating the general alarm system. The contact makers shall be provided at the following locations: (1) Wheelhouse, (2) space where feeder distribution panel is located, (3) deck officers' quarters furthest from engineroom, and (4) engineroom. Where feeder distribution panels are not provided a contact maker shall be provided in the same space as the branch circuit distribution panel. Where the general alarm power supply is located in or adjacent to the wheelhouse the requirement that a contact maker be provided in the space where the feeder distribution panel is located is not applicable.

(d) On vessels on which an emergency squad is organized, on vessels having a manual fire alarm system, and on all passenger vessels (regardless of date of construction) on an international voyage, an independent manually operated contact maker shall be located in the wheelhouse and so connected as to operate only the general alarm bells located in crew's quarters and machinery spaces.

(1) In lieu of this arrangement on vessels on an international voyage, a separate special alarm system may be fitted for the same purpose, and to sound in the same areas.

(e) Each mobile offshore drilling unit must have a manually operated contact maker for the general alarm system—

(1) In the main control room;

(2) At the drilling console;

(3) In the space that has the feeder distribution panel;

(4) In the wheelhouse if a wheelhouse is installed; and

(5) In a location that is as far as practicable from each other contact maker.

(Sec. 2, 87 Stat. 418 (46 U.S.C. 86); sec. 3, 82 Stat. 341, as amended (46 U.S.C. 367); R.S. 4405, as amended (46 U.S.C. 375); sec. 10, 35 Stat. 428 (46 U.S.C. 395); R.S. 4423, as amended (46 U.S.C. 400); R.S. 4429, as

amended (46 U.S.C. 407); R.S. 4430, as amended (46 U.S.C. 408); 88 Stat. 423 (46 U.S.C. 411); R.S. 4434, as amended (46 U.S.C. 412); R.S. 4462, as amended (46 U.S.C. 416); sec. 1, 73 Stat. 475 (46 U.S.C. 481); sec. 4, 67 Stat. 462 (43 U.S.C. 1333(d)); sec. 6(b)(1), 80 Stat. 937 (49 U.S.C. 1655(b)(1)); 49 CFR 1.46 (b) and (n)(6).

[CGFR 67-87, 32 FR 19182, Dec. 20, 1967, as amended by CGFR 68-65, 33 FR 19992, Dec. 28, 1968; CGD 73-251, 43 FR 56838, Dec. 4, 1978]

§ 113.25-10 General requirements.

(a) *Power supply.* (1) The power supply for the general alarm system shall be a storage battery located above the bulkhead deck or above the freeboard deck, whichever is the higher, and in a protected area outside the machinery casing.

(2) The nominal potential of the general alarm system shall be not less than 6 volts and not more than 120 volts.

(3) The general alarm system supply shall be one of the following types:

(i) One storage battery, used for no other purpose, in combination with an automatic charging panel that will maintain the battery in a fully charged condition at all times except immediately following a discharge. The storage battery shall have sufficient capacity to supply the general alarm system continuously for a period of at least 8 hours without being recharged;

(ii) Duplicate storage batteries so connected, in combination with a manual two-position transfer switch (having no OFF position), that one battery will be charged while the other battery is available for furnishing power to the system. Control, indicator, and alarm loads may be supplied from these batteries. Each of the two storage batteries shall have sufficient capacity to supply the general alarm system continuously for a period of at least 4 hours and to supply all other connected loads at normal expected demand for a period of at least 1 week and at maximum expected demand for a period of at least 8 hours without being recharged.

(iii) A circuit connected to the temporary emergency bus of an emergency switchboard as provided for by § 112.15-1 (i) of this subchapter; or

(iv) A circuit from an interior communication switchboard, the interior communication switchboard being supplied by duplicate storage batteries so connected, in combination with a manual two-position transfer switch (having no OFF position), that one battery will be charged while the other battery is available for furnishing power to the switchboard. The interior communication batteries shall each be of sufficient capacity to supply without recharging the general alarm system continuously for a period of 4 hours and to supply all other connected loads at normal expected demand for a period of at least 1 week and at maximum expected demand for a period of at least 8 hours.

(4) When the general alarm system is the only load supplied by the general alarm system battery or batteries, the battery or batteries shall be protected against overcurrent by enclosed fused switches or circuit breakers, having provisions for locking to prevent either unauthorized operation of the switch or circuit breaker or unauthorized tampering with the fuses. The fused switch or circuit breaker shall be located outside of, but adjacent to, the battery room or battery locker, and the capacity of the fuses or circuit breaker shall be not less than 200 percent of the connected load.

(5) When the general alarm system is supplied from an emergency or interior communication switchboard, or when the duplicate general alarm batteries supply other loads as permitted by paragraph (a)(3)(ii) of this section, the fused switch or circuit breaker supplying the general alarm system shall have provisions for locking to prevent unauthorized operation of the switch or circuit breaker and unauthorized tampering with the fuses.

(b) *Distribution of general alarm system feeders and branch circuits.* (1) A feeder distribution panel shall be provided to divide the system into the required number of zone feeders. The distribution panel shall afford overcurrent protection for each zone feeder, but no disconnect switches shall be provided. The distribution panel shall be located in an enclosed space adjacent to the general alarm

battery enclosure. If the arrangement of the vessel is such that only one zone feeder is required, the branch circuit distribution panel required by this paragraph may be substituted for the feeder distribution panel.

(2) At least one feeder shall be provided for each vertical fire zone in which general alarm bells are located.

(3) One or more branch circuit distribution panels shall be provided for each zone feeder with at least one fused branch circuit for each deck level. The distribution panel shall be located above the bulkhead deck or above the freeboard deck, whichever is the higher, in the zone served, and no disconnect switches shall be provided for the branch circuits.

(4) No more than five general alarm bells shall be connected to one branch circuit, and a branch circuit shall not supply bells on more than one deck level.

(5) On vessels not divided into fire zones by main vertical fire bulkheads, the vessel shall be divided into vertical zones not exceeding 150 feet in length and a general alarm feeder provided for each such zone in which general alarm bells are required.

(6) On vessels where accommodation spaces are located only at the extremities of the vessels, other arrangements of feeders and branch circuits will be considered.

(7) General alarm feeders and branch circuit cables shall be located in passageways and shall avoid staterooms, lockers, galleys, machinery spaces, and other enclosed spaces except insofar as it is necessary to supply general alarm bells in those spaces.

(c) *Location of general alarm bells.* (1) General alarm bells shall be so distributed throughout passengers' and crew's quarters in such number and in such a manner as to obtain in each room with the door closed either:

(i) A sound level of not less than 75 decibels relative to 0.0002 microbar at 1,000 hertz (zero db); or

(ii) A sound level of 6 decibels above the ground noise level existing when the vessel is underway in moderate weather, whichever is the higher.

(2) General alarm bells shall be so distributed throughout public spaces, work spaces, and machinery spaces in such number and in such a manner as to warn all occupants in an emergency.

(d) *Location of flashing lights.* (1) In spaces where the ambient noise level is so high that it is not practicable to comply with paragraph (c)(1) of this section, the vibrating bell or bells within the noisy spaces shall be augmented by flashing red lights.

(2) The flashing red lights shall be of sufficient intensity and number and so located as to warn occupants of the space of an emergency.

(3) The flashing red lights shall be energized whenever the general alarm bells with which they are associated are energized.

[CGFR 65-50, 30 FR 17089, Dec. 30, 1965, as amended by CGFR 66-33, 31 FR 15296, Dec. 6, 1966; CGFR 67-87, 32 FR 19182, Dec. 20, 1967; CGFR 68-65, 33 FR 19992, Dec. 28, 1968; CGFR 70-143, 35 FR 19955, Dec. 30, 1970]

§ 113.25-15 Detail requirements.

(a) *Storage batteries.* (1) Storage batteries shall comply with the requirements of Subpart 112.55 of this subchapter.

(2) At the end of the discharge period specified by § 113.25-10(a), the battery potential shall be not less than 80 percent of nominal potential under load.

(b) *Contact maker.* (1) The contact maker shall be a normally open circuit spring-return-to-normal type of enclosed watertight switch.

(2) The contact maker shall be designed to close its contacts when a substantial operating handle is rotated in a clockwise direction through an arc of approximately 60 degrees.

(3) The switch handle shall have means provided for locking in the ON position by means of a spring loaded locking pin.

(4) The OFF and ON positions of the operating handle shall be indicated by means of prominently raised letters.

(5) The contact maker shall be provided with mechanical stops to limit the rotation of the operating handle.

(6) The contact maker shall have an inductive load rating not less than the connected load. On large vessels, consideration will be given to the use of

auxiliary devices to interrupt the load current.

(c) *Vibrating bells and flashing lights.* (1) Vibrating bells installed in conjunction with a general alarm system shall be of a type approved by the Commandant.

(2) General alarm system vibrating bells shall produce a signal of a tone distinct from that of any other bell signals on the vessel.

(3) Flashing red lights installed in conjunction with a general alarm system shall be of a type approved by the Commandant.

(d) *Electric cable and distribution fittings.* (1) All cable installed in conjunction with general alarm systems shall be either leaded and armored, impervious sheathed and armored or mineral insulated metal sheathed.

(2) Cable entrances to all bells and distribution fittings shall be made watertight by means of terminal or stuffing tubes.

(3) Distribution panels shall be of watertight construction and shall be of a type requiring the use of a tool to gain entrance to the box.

(4) All fuses employed in a general alarm system shall be 250-volt National Electric Code standard, non-renewable cartridge fuses bearing the approval label of a recognized testing organization.

(5) General alarm system fuse capacities shall be selected to obtain as wide a differential as possible between branch circuit fuses and feeder fuses. The capacity of a feeder fuse shall be approximately 200 percent of the load supplied, and the capacity of a branch circuit fuse shall not exceed 50 percent of the capacity of the feeder fuse.

[CGFR 65-50, 30 FR 17089, Dec. 30, 1965, as amended by CGFR 68-65, 33 FR 19992, Dec. 28, 1968]

§ 113.25-20 Marking of equipment.

(a) Each general alarm system fused switch and distribution panel shall be provided with a permanent nameplate on the outside of the door describing its function. The rating of fuses shall also be indicated for fused switches.

(b) The general alarm contact maker shall be marked with lettering on a corrosion-resistant plate or with a sign in red letters on a suitable background "GENERAL ALARM."

(c) A contact maker to operate only the general alarm bells in crew quarters, machinery and work spaces shall be marked as described in paragraph (b) of this section, except with the words "CREW ALARM."

(d) General alarm bells shall be marked in not less than ½-inch red letters "GENERAL ALARM—WHEN BELL RINGS GO TO YOUR STATION."

(e) Each general alarm system distribution panel shall be provided with a directory attached to the inside of the cover giving the designation of each circuit, the area supplied by each circuit, and the rating of all circuit fuses.

CROSS REFERENCES: See also §§ 78.47-5 and 78.47-7 of Subchapter H (Passenger Vessels) and §§ 97.37-5 and 97.37-7 of Subchapter I (Cargo and Miscellaneous Vessels) of this chapter.

§ 113.25-25 General alarm system for manned ocean and coastwise barges.

(a) Each manned ocean and coastwise barge of over 100 gross tons, where the crew is divided into watches for the purpose of steering the vessel, shall be provided with a suitable alarm bell installation.

§ 113.25-30 General alarm system for barges of 300 gross tons and over with sleeping accommodations for more than six persons.

The general alarm system for barges of 300 gross tons and over with sleeping accommodations for more than 6 persons shall conform to the requirements of Subpart 113.25 except—

(a) The number and location of contact makers shall be based upon the design, service, and operation of the particular barge. Contact makers located in the primary work area, quarters area, galley and mess area, machinery spaces and the bridge or control area should be considered; and

(b) Where the design of the barge prohibits the installation of distribution panels above the main or freeboard deck, the panels may be placed below the deck, but as high in the vessel as practicable.

[CGFR 72-35, 37 FR 4962, Mar. 8, 1972]

§ 113.25-90 General alarm system for existing vessels.

(a) All vessels of over 100 gross tons the construction of which was begun on or after September 1, 1943, but prior to November 19, 1952, shall have all sleeping accommodations, public spaces, and machinery spaces equipped with a sufficient number of alarm bells so located as to warn all occupants. The system shall operate from a continuous source of electric energy capable of supplying the system for a period of at least 8 hours without being dependent upon the main, auxiliary or emergency generating plants. Each bell shall produce a signal of a tone distinct from that of other bell signals in the vicinity and shall be independently fused with each of these fuses located above the bulkhead deck. The bells shall be controlled by a manually operated contact maker located in the pilothouse, or, if specific approval is given by the Commandant, in the fire control station. The characteristics of the contact maker shall be such that it possesses:

(1) Positive contact;

(2) Watertightness (when located in open spaces subject to weather);

(3) Means whereby its electrically open or closed position can be determined by sense of touch;

(4) Means to effect a make-and-break circuit for signalling; and

(5) Self-maintaining contacts.

(b) All vessels of over 100 gross tons the construction of which was begun prior to September 1, 1943, shall have all sleeping accommodations equipped with a sufficient number of alarm bells so located as to warn all the occupants. The alarm bells, if electric, shall be operated from an open switch from the pilothouse or bridge. The bells shall be of such size, character, and construction as to provide an alarm throughout the spaces for which they are provided.

(c) Existing arrangements, materials, and equipment previously approved shall be considered satisfactory so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standard as the original installation. All new installations or major replacements shall meet the applicable specifications or requirements for new vessels.

(d) All passenger vessels, regardless of the date of construction, on an international voyage shall have general alarm systems meeting the requirements in §§ 113.25-5(d) and 113.25-10(b).

[CGFR 65-50, 30 FR 17089, Dec. 30, 1965, as amended by CGFR 67-87, 32 FR 19183, Dec. 20, 1967]

Subpart 113.30—Sound Powered Telephone and Voice Tube Systems

§ 113.30-1 Application.

(a) The provisions of this subpart, with the exception of § 113.30-90, shall apply to all self-propelled vessels contracted for on or after November 19, 1952. Vessels contracted for prior to November 19, 1952, shall meet the requirements of § 113.30-90.

§ 113.30-5 General requirements.

(a) Vessels shall be provided with an efficient means of communication between each of the following:

(1) Wheelhouse;

(2) Engine room;

(3) Steering gear room, if located outside of engine room; and

(4) After steering station, if required.

(b) Vessels equipped with a gyro-compass system shall be provided with an efficient means of communication between the master gyro-compass and the wheelhouse repeater compass. Whenever the master gyro-compass is located within any compartment adjoining or opening into the wheelhouse, the master gyro-compass shall be considered as being located in the wheelhouse and no communication therewith is required.

(c) Vessels equipped with a radar plan position indicator installation remotely located from the wheelhouse shall be provided with an efficient means of communication between the wheelhouse and the radar plan position indicator.

(d) Where emergency squad equipment is stowed in lockers or spaces remote from the wheelhouse, an efficient means of communication shall be

provided between the wheelhouse and the emergency squad equipment stowage space or spaces.

(e) Communication to radio and radio direction-finder shall comply with the requirements of this paragraph. The term "radio installation" shall be construed to mean either the radiotelegraph installation or, where only a radiotelephone is installed, the radiotelephone installation.

(1) Vessels equipped with a radio installation shall be provided with an efficient means of communication between the radio room and the wheelhouse and one other place, if any, from which the vessel may be navigated under normal conditions, as opposed to other such places established solely for emergency functions, or places used solely for docking or maneuvering, or places used occasionally while navigating the vessel in close quarters. As used in this paragraph only a location which includes the necessary apparatus to steer the vessel, give engine orders, and control the whistle will be considered a place from which the vessel may be navigated.

(i) Where the operating position of the emergency radio installation is not located in the compartment normally used for operating the main radio installation, an efficient means of communication shall be provided between the emergency radio room and the wheel-house and one other place, if any, from which the vessel may be navigated under normal conditions, as opposed to other such places established solely for emergency functions, or places used solely for docking or maneuvering, or places used occasionally while navigating the vessel in close quarters.

(2) Vessels equipped with radio direction-finding apparatus shall be provided with an efficient means of communication between the wheelhouse and the direction-finding apparatus.

(i) Whenever the direction-finder receiver is located on the navigating bridge of a ship or within any compartment adjoining or opening onto the wheelhouse of a ship, the direction-finding apparatus shall be considered as being located in the wheelhouse, and no communication is required.

(3) The communication systems required by this paragraph shall be independent of any other system on the ship, and the location of the termination of these systems shall be subject to approval by the Federal Communications Commission.

(f) Vessels equipped with smoke detecting systems, contracted for on or after January 1, 1962, where detecting cabinets are not located in the pilothouse shall be provided with an efficient means of direct communication between the pilothouse and the stations where the detecting cabinets are located.

(g) An efficient means of communication shall be provided between the wheelhouse and the bow or forward lookout station. This communication need not be by means of sound powered telephone or voice tube if other suitable means is provided or if the vessel configuration is such that direct voice communication between the wheelhouse and bow or forward lookout station is effective. When a sound powered telephone is installed, the requirements of § 113.30-20(b) are applicable.

§ 113.30-10 Voice tubes, general requirements.

(a) Voice tubes may be employed to comply with the requirements of this subpart where the required length of voice tube as installed will not exceed 125 feet.

(b) Where the length of voice tube as installed is not over 75 feet, the tube used shall be at least 2 inches outside diameter.

(c) Where the length of voice tube as installed is over 75 feet and not over 125 feet, the tube shall be at least 2½ inches outside diameter.

(d) Sound powered telephone equipment may be installed in all cases where voice tube communication is permitted.

§ 113.30-15 Voice tubes, detail requirements.

(a) Voice tubes and voice tube fittings shall be constructed of brass or other corrosion-resistant material having a wall thickness of approximately 0.042 inch.

(b) Voice tubing shall be run as direct as possible, and the cross-section of the tube shall be constant throughout the run. Any constriction in the tube such as a dent; reducer coupling, sharp elbow, T connection, or any flat surface shall be avoided. Flexible tubes or bends shall be used in place of fittings wherever possible. Joints in tubing shall be protected by a close fitting sleeve and the joint soldered or filled with white lead.

(c) Voice tubes shall be supported at least every 8 feet on straight runs and at bends as required.

(d) Voice tubes shall be protected where liable to injury and shall not be run in bunkers, cargo spaces, or through machinery spaces unless unavoidable.

(e) Voice tubes shall be provided with drain plugs at the bottom of each vertical run and at all other places where water can collect.

(f) Each voice tube shall be terminated at each end by a suitable mouthpiece with a whistle indicator. Watertight mouthpieces shall be used in locations exposed to the weather.

(g) All voice tubes shall be provided with designating nameplates.

§ 113.30-20 Sound powered telephone system, general requirements.

(a) Where a voice tube installation would require a length of the tube exceeding 125 feet or where for other reasons efficient communication cannot be obtained by a voice tube installation, approved sound powered telephone equipment shall be installed as the means of communication required by this subpart.

(b) The telephone stations listed in § 113.30-5(a) through (d), (f), and (g) may be installed on the same circuit. However, when included on the same circuit with other required stations, the bow or forward lookout telephone must be provided with a wheelhouse cut-out switch if the telephone is located in the weather. Other stations which are desirable for the operation of the vessel, such as captain's and chief engineer's office and stateroom, emergency power room, CO_2 control room, fire pumproom, etc., will be considered for inclusion on this circuit.

(c) Sound powered telephone systems may, in all cases, be installed in lieu of voice tube systems.

(d) Except as provided in paragraph (b) of this section, telephone stations not specifically required by this subpart which are located in the weather shall not be included on a telephone circuit which includes any of the required telephone stations.

(e) Jack boxes or headsets shall not be utilized on a telephone installation that includes any of the stations required by this subpart.

§ 113.30-25 Sound powered telephone system, detail requirements.

(a) Sound powered telephone equipment used on a telephone circuit that includes any of the stations required by this subpart shall be of a type approved by the Commandant.

(b) Sound powered telephone stations installed in locations exposed to the weather shall be of watertight construction, and the audible signal shall be mounted external to the station enclosure.

(c) Sound powered telephone stations installed in wheelhouse or machinery spaces shall be of at least dripproof construction.

(d) In noisy locations, a telephone booth or other suitable auxiliary equipment shall be provided if necessary in order that a telephone conversation can be carried on while the vessel is being navigated.

(e) In noisy locations where the magneto-operated telephone station sound signal cannot be heard throughout the space, the sound signal shall be supplemented by an additional sound signal energized from the vessel's electrical system and magneto actuated. This supplementary sound signal shall not be combined with any other signal or alarm system, such as an engineers' signal and alarm panel.

(f) When two or more telephone stations are located in close proximity to each other, a suitable means shall be provided to indicate the station called.

(g) The sound powered telephone talking circuit shall be electrically independent of the calling circuits. A short circuit, open circuit, or ground on either side of the calling circuit shall not affect the talking circuit in

any way. All circuits shall be insulated from ground.

(h) Sound powered telephone circuits shall be run in leaded and armored, impervious sheathed and armored or mineral-insulated metal sheathed cable. All connection boxes employed shall be watertight.

(i) Telephone cables shall be run as close to the fore and aft centerline of the vessel as is practicable and through runs of cable should avoid such spaces as machinery room and galleys.

§ 113.30-90 Sound powered telephone and voice tube systems for existing vessels.

(a) Vessels contracted for prior to November 19, 1952, shall meet the requirements contained in this section.

(b) Except as otherwise required by paragraph (d) of this section, existing arrangements, materials, and facilities previously approved will be considered satisfactory so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standard as the original installation.

(c) All new installations or major replacements shall meet the applicable specifications or requirements for new vessels.

Subpart 113.35—Engine Order Telegraph Systems

§ 113.35-1 Application.

(a) The provisions of this subpart, with the exception of § 113.35-90, shall apply to all self-propelled vessels contracted for on or after November 19, 1952. Installations contracted for prior to November 19, 1952, shall meet the requirements of § 113.35-90.

§ 113.35-5 General requirements.

(a) All vessels, except as otherwise provided for in this section, shall have installed an efficient means for transmitting engine orders from the wheelhouse to the engine room and of transmitting acknowledgment of engine orders from the engine room to the wheelhouse.

(1) On vessels with more than one propulsion engine, this efficient means of transmitting engine orders shall be provided for each engine.

(2) On double-ended vessels with two wheelhouses, this efficient means of transmitting engine orders shall be provided between the engine room and each wheelhouse.

(3) On vessels provided with a means of steering from the top of the wheelhouse as well as from the wheelhouse, this efficient means of transmitting engine orders shall also be provided between the engine room and the top of the wheelhouse.

(b) The efficient means of transmitting engine orders may be of the engine gong and sound tube type, the mechanical engine order telegraph type, the electric engine order telegraph type, or other types as may be approved.

(c) Small vessels on which the propulsion plant is controlled entirely from the wheelhouse with no means of normal engine control from the engine room, need not be provided with an engine order telegraph system between the wheelhouse and the engine room.

§ 113.35-10 Engine gong systems, general requirements.

(a) An engine gong system shall consist of pull handles located in the wheelhouse mechanically connected by wires and chains to gongs located in the engine room.

(1) A sound tube of proper size shall be run between the wheelhouse and the engine room and so arranged as to return the sound of the gong signals to the wheelhouse.

(2) A speaking tube or other device for the purpose of conversation between the wheelhouse and the engine room shall also be provided.

(b) The sound tube and the speaking tube shall comply with the requirements of § 113.30-15 except that the sound tube shall be terminated by a flared sounder in lieu of whistle mouthpieces and the sound tube size shall be not less than 2½ inches outside diameter.

(c) The engine room gong and the termination of the sound tube and the

speaking tube in the engine room shall be at the engine control station.

(d) The gong pull installation shall comply with the applicable requirements of § 113.35-25.

§ 113.35-15 Engine gong systems, application.

(a) Engine gong systems shall not be employed on vessels where the length of sound tube as installed will exceed 40 feet.

§ 113.35-20 Mechanical engine order telegraph systems, general requirements.

(a) Mechanical engine order telegraph systems shall consist of transmitters and indicators mechanically connected to each other by means of chains and wires.

(b) Transmitters and indicators shall be provided with dials divided into sectors or divisions with the various engine orders engraved thereon.

(c) Rotation of the transmitter handle and its associated pointer shall drive the indicator pointer in synchronism. The indicator pointer, always having the same angular position as the transmitter handle and its associated pointer, shall point to the order corresponding to the order on the transmitter.

(d) The engine room indicator shall be equipped with a reply handle and associated pointer driving a reply pointer in the wheelhouse transmitter for acknowledgement of orders.

(e) Each transmitter and each indicator shall be provided with an audible signal device to indicate, in the case of an indicator, the receipt of an order and, in the case of a transmitter, the acknowledgement of an order. The audible signal device shall not be dependent upon any source of power for operation other than that of the movement of the transmitter or indicator handle.

(f) The dials of transmitter instruments shall be illuminated in such a manner as not to interfere with navigating the vessel at night.

(g) Transmitter and indicator operating handles shall be of substantial size so that engine orders may be determined from a distance.

§ 113.35-25 Mechanical engine order telegraph systems, detail requirements.

(a) Telegraph wire shall be No. 10 Stubs Gage (0.134 inch diameter) soft brass wire and shall be stretched approximately 20 percent before installation.

(b) Pulleys shall be provided whenever a bend in the run of the telegraph wire is made, and at each pulley sheave a length of brass telegraph chain shall be employed.

(c) Pulleys shall be in line with the wire and chain.

(d) Turnbuckles shall be provided in each lead at each instrument to adjust the handles and pointers to the central position of the order, and shall be provided at other locations throughout the system as necessary to take up slack in the lead wires and to center the chains at the pulleys.

(e) Where telegraph leads pass through watertight decks or bulkheads, stuffing tubes shall be employed.

(f) On long horizontal runs, the telegraph wire shall be supported on roller bearers at approximately every 5 feet of run. When telegraph leads are run behind sheathing or when subject to mechanical damage, the leads shall be run "in pipe."

(g) All fittings used in telegraph installations shall be constructed of brass, bronze, or other corrosion-resistant materials.

(h) Positive locking devices, such as keys, shall be used in securing handles and similar parts to their associated shafts to ensure continuous operation of the shaft in response to movement of the handle.

(i) Transmitter dials shall be arranged with the "STOP" order at the top vertical position of the operating handle. On ahead orders the operating handle shall be moved toward the bow of the vessel and on astern orders the operating handle shall be moved toward the stern of the vessel.

(j) Indicator dials shall be arranged with the "Stop" order at either the bottom or top position of the reply handle to suit bulkhead or pedestal (console) mounting respectively.

(l) Indicator dials on double-ended vessels shall not be marked with the designations "AHEAD" and

40-130 O—79——11

"ASTERN," but the reply handle and indicator arrow shall point in the direction in which it is desired that the engine operate.

[CGFR 65-50, 30 FR 17089, Dec. 30, 1965, as amended by CGFR 68-65, 33 FR 19992, Dec. 28, 1968]

§ 113.35-30 Mechanical engine order telegraph systems, operation.

(a) Where more than one transmitter, located in the wheelhouse, the wings of the navigating bridge, and/or the top of the wheelhouse, operate a common indicator in the engine room, all the transmitters shall be mechanically interlocked and operate in synchronism. The method of mechanical interlocking shall be such that a failure of the transmission wire or chain at any transmitter located topside will not interrupt or disable other topside transmitters.

§ 113.35-35 Mechanical engine order telegraph systems, application.

(a) Mechanical engine order telegraph systems may be installed on all vessels to provide the communication required by this subpart where the length of cables or other mechanical limitations will not prevent the efficient operation of the system.

§ 113.35-40 Electric engine order telegraph systems, general requirements.

(a) Electric engine order telegraph systems shall consist of transmitters and indicators electrically connected to each other.

(b) Transmitters and indicators shall be provided with dials divided into sectors or divisions with the various engine orders engraved thereon.

(c) Rotation of the transmitter handle and its associated pointer shall drive the indicator pointer in synchronism. The indicator pointer, always having the same angular position as the transmitter handle, shall point to the order corresponding to the order on the transmitter.

(d) For acknowledgement of orders, the engine room indicator shall be equipped with a handle and generator actuating a motor and pointer on the transmitter, similar to the facilities provided for transmitting orders.

(e) Audible signals associated with the system shall consist of a vibrating bell at each instrument. The vibrating bell at both transmitter and indicator shall ring continuously at all times when the transmitter arrow and the reply arrow do not point to the same order.

(f) The dials of transmitter instruments shall be illuminated in such a manner as not to interfere with navigating the vessel at night.

(g) Transmitter operating handles shall be of substantial size so that the engine order may be determined from a distance.

[CGFR 65-50, 30 FR 17089, Dec. 30, 1965, as amended by CGFR 68-65, 33 FR 19992, Dec. 28, 1968]

§ 113.35-45 Electric engine order telegraph systems, detail requirements.

(a) Telegraph instruments shall form watertight enclosures for the electrical components.

(b) Materials used in the construction of telegraph instruments shall be corrosion-resistant.

(c) Transmitter and indicator dials shall be in accordance with paragraphs (i) and (j), respectively, of § 113.35-25.

(d) Electric cable used in conjunction with electric telegraphs shall be leaded and armored, impervious sheathed and armored or mineral-insulated metal sheathed and all connection boxes shall be of watertight construction.

(e) Each system shall be provided with an alarm device which automatically sounds audibly and indicates visually in the event of loss of potential to the system.

(1) This alarm device shall be located in the wheelhouse.

(2) Means shall be provided to silence the audible signal.

(3) Where the supervisory power supply is a dry cell battery or some other low capacity source, there shall be no electric drain on the supervisory power supply after the audible signal has been silenced; the visible indication may be extinguished to effect this. Upon reestablishment of potential to the telegraph system, the audible signal shall sound again until the alarm circuit is returned to normal

unless restoration of this alarm circuit is effected automatically.

[CGFR 65-50, 30 FR 17089, Dec. 30, 1965, as amended by CGFR 68-65, 33 FR 19992, Dec. 28, 1968]

§ 113.35-50 Electric engine order telegraph system, operation.

(a) Where more than one transmitter, located in the wheelhouse, the wings of the navigating bridge, and/or the top of the wheelhouse, operate a common indicator in the engine room, either the transmitters shall operate in synchronism in accordance with paragraph (b) of this section, or the transmitters shall operate under the control of a transmitter transfer control in accordance with paragraph (c) of this section.

(b) All transmitter handles and pointers and all reply pointers shall operate in synchronism. Where the transmitters are mechanically interlocked to effect synchronous operation, the requirements of § 113.35-30(a) shall be met.

(c) All transmitters shall operate under the control of a transmitter transfer control so that movement of any one transmitter handle automatically connects that instrument electrically to the engine room indicator and simultaneously disconnects electrically all other transmitters. The reply pointers of all transmitters shall operate in synchronism at all times.

§ 113.35-55 Electric engine order telegraph systems, application.

(a) Electric engine order telegraph systems may be installed on all vessels to provide the communication required by this subpart, except that passenger vessels of 20,000 gross tons or over equipped with an electric engine order telegraph system shall be provided with a stand-by system, either electrical or mechanical.

§ 113.35-90 Engine order telegraph systems for existing vessels.

(a) The engine order telegraph installations on vessels contracted for prior to November 19, 1952, shall meet the requirements in this section.

(b) Existing arrangements, materials, and facilities previously approved will be considered satisfactory so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standard as the original installation.

(c) All new installations or major replacements shall meet the applicable specifications or requirements for new vessels.

Subpart 113.40—Rudder Angle Indicator Systems

§ 113.40-1 Application.

(a) The provisions of this subpart, with the exception of § 113.40-90 shall apply to all self-propelled vessels contracted for on or after November 19, 1952. Vessels contracted for prior to November 19, 1952, shall meet the requirements of § 113.40-90.

§ 113.40-5 General requirements.

(a) The exact position of the rudder, if power operated, shall be indicated at the principal steering station. When non-follow-up steering control is installed at the after steering station, a separate rudder angle indicator system shall be installed for that station. See Part 57 of Subchapter F (Marine Engineering) of this chapter.

§ 113.40-10 Detail requirements.

(a) The rudder angle indicator system shall consist of a transmitter located at the rudder head and actuated by movement of the rudder, the angular movements of the rudder being transmitted to a remote indicator(s).

(b) The indicator instrument shall consist of a fixed dial with angular positions of the rudder right and left of an amidship position indicated thereon. Indications of rudder angle shall be by means of a moving pointer.

(1) The movement of the indicator pointer shall be consistent with the movement of the steering wheel or control.

(c) The indicator(s) shall be located in direct line of vision of the helmsman and shall be provided with dial illumination in such a manner as not to interfere with navigating the vessel at night.

(d) The method of transmitting rudder movement between the transmitter and the indicator(s) may be either by self-synchronous generator and motor(s), by mechanical telegraphs, or by other equivalent means.

(e) The electric rudder angle indicator system shall comply with the applicable requirements of §§ 113.35-40 and 113.35-45 (a) to (d), inclusive.

(f) Mechanical methods of transmitting rudder angles shall be in accordance with approved installation drawings submitted for each installation.

§ 113.40-90 Rudder angle indicator systems for existing vessels.

(a) Rudder angle indicator systems on vessels contracted for prior to November 19, 1952, shall meet the requirements in this section.

(b) Existing arrangements, materials, and facilities previously approved will be considered satisfactory so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standard as the original installation.

(c) All new installations or major replacements shall meet the applicable specifications or requirements for new vessels.

Subpart 113.45—Refrigerated Spaces Alarm Systems

§ 113.45-1 Application.

(a) The provisions of this subpart, with the exception of § 113.45-90, shall apply to all vessels contracted for on or after November 19, 1952. The provisions of § 113.45-90 shall apply to all vessels contracted for prior to November 19, 1952.

§ 113.45-5 General requirements.

(a) Each refrigerated space accessible to ship's personnel during a voyage and which can be so locked from the outside that it cannot be opened from the inside, shall be fitted with an alarm system operated from within each refrigerated space.

(b) The alarm system may be either a mechanical pull operating a jingle bell or an electrical push button operating a vibrating bell or other audible device.

(c) The mechanical pull or electrical push button shall be located at the exit from the refrigerated compartment.

(d) The audible signal shall be located where a person is regularly employed.

(e) Where a common audible signal is provided for more than one lockable refrigerated compartment, an annunciator shall be provided to locate the compartment from which the signal was initiated.

§ 113.45-90 Refrigerated spaces alarm systems on existing vessels.

(a) Refrigerated spaces alarm systems on vessels contracted for prior to November 19, 1952, shall meet the requirements in this section.

(b) Existing arrangements, materials, and facilities previously approved will be considered satisfactory so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standard as the original installation.

(c) All new installations or major replacements shall meet the applicable specifications or requirements for new vessels.

Subpart 113.50—Emergency Loudspeaker System

§ 113.50-1 Application.

(a) The provisions of this subpart, with the exception of § 113.50-90, shall apply to all ocean and coastwise passenger vessels contracted for on or after November 19, 1952. Ocean and coastwise vessels contracted for prior to November 19, 1952, shall meet the requirements of § 113.50-90.

§ 113.50-5 General requirements.

(a) All ocean and coastwise passenger vessels certificated to carry 500 or more persons, including officers and crew, and/or all passenger vessels whose lifeboats are stowed more than 100 feet from the navigating bridge, shall be equipped with an approved loudspeaker system which will enable

an officer on the bridge to broadcast separately or collectively to the stations listed in this paragraph.

(1) Lifeboat stations, port.

(2) Lifeboat stations, starboard.

(3) Lifeboat embarkation stations, port.

(4) Lifeboat embarkation stations, starboard.

(5) Public spaces used for passenger assembly stations.

(6) Crew quarters.

(7) Accommodation spaces and service spaces.

(b) The system shall be controlled from a single location on the navigating bridge.

(c) Loudspeakers, as designated by the Commandant, at lifeboat and embarkation stations shall be arranged for two-way conversation with the navigating bridge.

(d) The emergency loudspeaker system shall be of a type approved by the Commandant. Systems installed on vessels contracted for on or after November 19, 1958, shall meet the requirements of Subpart 161.004 of Subchapter Q (Specifications) of this chapter.

[CGFR 65-50, 30 FR 17089, Dec. 30, 1965, as amended by CGFR 67-87, 32 FR 19183, Dec. 20, 1967]

§ 113.50-10 Power supply.

(a) The loudspeaker system shall be energized from the source of emergency lighting and power as required by Subpart 112.15 of this subchapter.

(b) Where the loudspeaker system requires a power supply of a character different from that available from the temporary source of emergency lighting and power, conversion equipment as required by Subpart 112.40 of this subchapter shall be provided.

§ 113.50-15 Location of loudspeakers and amplifiers.

(a) *General.* (1) Loudspeakers shall be located with due regard to the intended service and to minimize as much as possible the effect of feedback and other interference.

(2) In general, loudspeakers on open decks shall be directed toward the after end of the vessel and outboard by an angle of approximately 15 degrees.

(b) *Boat deck loudspeakers.* (1) A loudspeaker shall be located at each lifeboat handling station. The axis of the loudspeaker shall be directed aft and outboard in such a manner that the sound level at the lifeboat handling station will be not less than the levels given in Table 113.50-15.

TABLE 113.50-15—MINIMUM SOUND LEVEL REQUIREMENTS FOR LOUDSPEAKER SYSTEMS

[All data given in decibels] [1]

Location	Ground noise level minimum	Signal level		Voice level	
		Above ground noise	Total	Above ground noise	Total
Lifeboat stations	80	20	[2]100	15	[3]95
Embarkation deck and exterior passenger assembly points	80	20	[2]100	15	[3]95
Interior passenger assembly points	75	20	[3]95	15	[3]90
Crew quarters	60	18	[3]78	12	[3]72

[1] The zero decibel level shall be 0.0002 dyne per square centimeter.

[2] Measured at a distance of 10 feet from the loudspeaker and on the axis thereof.

[3] Measured in rooms with the doors to the passageways closed.

(c) *Lifeboat embarkation and passenger assembly station loudspeakers.* (1) Loudspeakers shall be distributed throughout the lifeboat embarkation deck and locations designated by the vessel's station bill for the assembly of passengers in an emergency, in such number as to provide an even distribution of sound at a level not less than that specified in Table 113.50-15. An even distribution of sound level is considered satisfied if the variation does not exceed plus or minus 3 decibels.

(d) *Crew quarters' loudspeakers.* (1) Loudspeakers shall be distributed in passageways throughout crew quarters in such number as to provide a sound level not less than that specified in Table 113.50-15 in each room with the doors closed.

(e) *Amplifier.* (1) The emergency loudspeaker amplifier, if not located in the same enclosure with the control

panel, shall be located in the wheelhouse or in a compartment adjoining or opening into the wheelhouse.

[CGFR 65-50, 30 FR 17089, Dec. 30, 1965, as amended by CGFR 66-71, 31 FR 16782, Dec. 31, 1966]

§ 113.50-20 Distribution of cable runs.

(a) Cable runs to the different loudspeaker groups shall be as widely separated from each other as possible to limit the extent of damage to the system from a single casualty. In addition, the distribution shall be such that a casualty to the port or starboard supplies to loudspeakers on boat and embarkation decks will render not more than half of the loudspeakers in the group inoperative. This may be accomplished by feeding the loudspeakers of a particular group alternately from a port and starboard multi-conductor cable.

(b) Cable runs shall, where possible, be located in passageways and shall avoid staterooms, lockers, and other enclosed spaces.

§ 113.50-25 Type of cable and equipment enclosures.

(a) All cable used in connection with the system shall be either leaded and armored, impervious sheathed and armored or mineral insulated metal sheathed.

(b) All junction or connection boxes employed in the distribution system shall be of watertight construction.

§ 113.50-30 Shipboard tests.

(a) The operation of the system shall be observed to determine that voice reproduction is of good quality and intelligibility of a high order.

(b) Sound levels shall be measured with a sound level meter to demonstrate that the levels listed in Table 113.50-15 are met.

(1) Where the ground noise level with the vessel under way in moderate weather is in excess of the values listed in Table 113.50-15, the signal and voice levels shall be increased correspondingly so that the differential between ground noise level and the signal and voice levels shall be not less than the differential given in this table.

(c) It shall be demonstrated that grounding either conductor or "shorting" both conductors to any one lifeboat station loudspeaker, or to an embarkation deck loudspeaker, will not reduce the output of any one of the remaining loudspeakers by more than 3 decibels.

§ 113.50-35 Operation of emergency loudspeaker systems.

(a) The emergency loudspeaker system shall be used at the discretion of the master and shall function entirely independently of any public address or music distribution system.

(b) The emergency loudspeaker system shall not be used for entertainment purposes.

(c) The complete emergency loudspeaker system shall be given an operating test at least once every week. These tests shall be made by a licensed officer and the condition of the equipment entered in the vessel's log.

(d) When a vessel is equipped with a public address or music distribution system, means shall be provided adjacent to the emergency loudspeaker system control panel to silence the public address or music distribution systems.

§ 113.50-90 Emergency loudspeaker systems for existing vessels.

(a) *Existing vessels.* Emergency loudspeaker systems on ocean and coastwise passenger vessels contracted for prior to November 19, 1952, shall meet the requirements of this section.

(b) *General requirements.* (1) All passenger vessels the construction of which was begun prior to January 1, 1937, on which lifeboats are stowed more than 100 feet from the navigating bridge, and all passenger vessels the construction of which was begun prior to November 19, 1952, but on and after January 1, 1937, certificated to carry 1,000 persons or more, including officers and crew, shall be equipped with a loudspeaker system which shall enable an officer on the bridge to broadcast separately or collectively to the stations listed in this subparagraph.

(i) Lifeboat stations, port and starboard. (The deck or decks on which life-

boats are stowed and from which they are launched.)

(ii) Embarkation deck, port and starboard. (The deck or decks, designated by construction design or by the vessel's station bill, used for the embarkation of passengers and crew into lifeboats. If lifeboat stations are used for embarkation purposes, this requirement will be omitted.)

(iii) Main quarters for crew. (The quarters of the emergency squad, deck crew, and stewards assigned to passenger quarters.)

(iv) Public spaces. (The spaces designated by the vessel's station bill where passengers and crew are to assemble in an emergency.)

(v) Accommodation spaces and service spaces.

(2) The Commandant may, in special cases, exempt passenger vessels the construction of which was begun prior to January 1, 1937, having a small number of especially accessible lifeboats stowed more than 100 feet from the bridge: *Provided, however,* That no such vessel certificated to carry more than 200 persons, including officers and crew, shall be so exempted.

(3) Details of the system shall be in general agreement with §§ 113.50-5 through 113.50-35 insofar as is reasonable and practicable.

(4) Existing arrangements, materials, and facilities previously approved, but not meeting the applicable specifications or requirements set forth in §§ 113.50-5 through 113.50-35, may be continued in service so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standards as the original installation provided that, in no case, will a greater departure from the standards of §§ 113.50-5 through 113.50-35 be permitted than presently exist. All new installations or major replacements shall meet the applicable specifications or requirements, for new vessels.

[CGFR 65-50, 30 FR 17089, Dec. 30, 1965, as amended by CGFR 67-87, 32 FR 19183, Dec. 20, 1967]

Subpart 113.65—Whistle Operators

§ 113.65-1 Application.

(a) The provisions of this subpart, with the exception of § 113.65-90, shall apply to all vessels contracted for on or after November 19, 1952. Vessels contracted for prior to November 19, 1952, shall meet the requirements of § 113.65-90.

§ 113.65-5 General requirements.

(a) The general requirements for whistles, sirens and foghorns are contained in Part 25 of Subchapter C (Uninspected Vessels), Part 32 of Subchapter D (Tank Vessels), Part 77 of Subchapter H (Passenger Vessels), and Part 96 of Subchapter I (Cargo and Miscellaneous Vessels), of this chapter.

(b) Mechanical whistle or siren pull leads shall be as direct as possible and amply protected. When the leads are suspended for more than 15 feet, they should be supported from a corrosion-resistant cable with suitable bearers. The system shall be provided with ample corrosion-resistant springs to relieve all weight on the lever and for the proper functioning of the system.

(c) Materials and mechanical details shall be in general accordance with the requirements for mechanical telegraphs given in § 113.35-25 except that bronze or stainless steel aircraft type wire rope or other means specifically approved may be used in lieu of the brass wire specified.

(d) When electrically operated whistles and sirens are installed, all parts shall be independent of the primary system.

(e) When electrically operated valves for whistles or sirens are located more than 5 feet from the whistle, an automatic drain feature for the steam whistle pipe shall be installed.

(f) The supply for an electrically operated whistle or siren shall be from the emergency lighting and power system as required by Part 112 of this chapter.

[CGFR 65-50, 30 FR 17089, Dec. 30, 1965, as amended by CGFR 66-71, 31 FR 16782, Dec. 31, 1966]

§ 113.65-90 Whistle operators for existing vessels.

(a) Whistle operators on vessels contracted for prior to November 19, 1952, shall meet the requirements in this section.

(b) Existing arrangements, materials, and facilities previously approved will be considered satisfactory so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standard as the original installation.

(c) All new installations or major replacements shall meet the applicable specifications or requirements for new vessels.

Subpart 113.70—Smoke Detector Systems

§ 113.70-1 Application.

(a) Where a smoke detector system is installed, the provisions of this subpart, with the exception of § 113.70-90, shall apply to all installations contracted for on or after November 19, 1952. Installations contracted for prior to November 19, 1952, shall meet the requirements of § 113.70-90.

(b) For the vessels on which a smoke detector system is required, see Part 76 of Subchapter H (Passenger Vessels) of this chapter.

§ 113.70-5 General requirements.

(a) The smoke detector control unit shall be of a type approved by the Commandant. Systems installed on vessels contracted for on or after November 19, 1959, shall meet the requirements of Subpart 161.002 of Subchapter Q (Specifications) of this chapter.

(b) All electric cable installed in conjunction with the smoke detector system shall be either leaded and armored, impervious sheathed and armored or mineral insulated metal sheathed.

(c) Cable runs between the smoke detector control unit and the supply switchboard shall be as direct as possible and shall avoid staterooms, lockers, and other enclosed spaces where the cable could be damaged by a localized fire or by other causes.

§ 113.70-10 Power supply.

(a) On vessels fitted with an automatically started emergency lighting and power system, the smoke detector system shall be supplied by a branch circuit from the emergency switchboard. On vessels fitted with a temporary source of emergency lighting and power, the branch circuit may be connected to the temporary emergency source of supply.

(b) On vessels not fitted with an automatically started emergency lighting and power system, the smoke detector system shall be supplied from a source as approved by the Commandant.

§ 113.70-90 Equipment and installations on vessels contracted for prior to November 19, 1952.

(a) Existing arrangements, materials, and facilities previously approved, but not meeting the applicable specifications or requirements set forth in §§ 113.70-5 and 113.70-10, may be continued in service so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standards as the original installation: *Provided,* That, in no case, will a greater departure from the standards of §§ 113.70-5 and 113.70-10 be permitted than presently exist. All new installations or major replacements shall meet the applicable specifications or requirements for new vessels.

PARTS 114-139 [Reserved]

INDEX

SUBCHAPTER J—ELECTRICAL ENGINEERING

A

B

C

D

40-130 O—79——12

E

F

G

H

I

J

K

L

M

N

O

P

40-130 O—79——13

Q

R

S

T

U

V

W