MSC Guidelines for Review of Electrical One-Line Diagram

Procedure Number: E2-7 Revision Date: 02/04/00

References

a. 46 CFR Subchapter J
b. National Electric Code, current edition
c. American Bureau of Shipping; *Rules for Building and Classing Steel Vessels*, current edition
d. SOLAS, Consolidated Edition, 1997 or most recent edition
e. NVIC 2-89, *Guide for Electrical Installations on Merchant Vessels and Mobile Offshore Drilling Units*

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These guidelines were developed by the Marine Safety Center staff as an aid in the preparation and review of vessel plans and submissions. They were developed to supplement existing guidance. They are not intended to substitute or replace laws, regulations, or other official Coast Guard policy documents. The responsibility to demonstrate compliance with all applicable laws and regulations still rests with the plan submitter. The Coast Guard and the U. S. Department of Transportation expressly disclaim liability resulting from the use of this document.

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System	**Ref (46 CFR)**
1. Generators	
❑ At least two ship service generators?	111.10-3
❑ Can they be paralleled?	111.12-7 111.12-11(c)(2)&(f) ABS 4/5C2.19.2-4
❑ With any Ship Service Generator down, can the	

System	**Ref (46 CFR)**
1. Generators (continued)	
remaining set/sets carry the load?	111.10-4(a)
❑ Continuos and uninterrupted source	111.10-4(b)&(c)
2. Generator cable size	
❑ At least 115% of full current	111.12-9
❑ Approved type (see Attachment (1))	111.60-1
3. Generator Circuit Breakers	
❑ Must be less than 115% of Generator Rating	111.12-11(d)
❑ Located on S.S. Gen switchboard	
4. Buses	
❑ Generator - carry at least the current rating of the largest generator	111.30-19
❑ General requirements	111.30-19
5. Grounded Systems	
❑ Neutral Grounding - If there is a neutral bus or conductor it must be grounded.	111.05-15
❑ --Important-- If tank vessel, less than 1000 volts line-to-line, it must not have a grounded distribution system. NOTE: This also means no four (4) conductor cable.	111.05-19
❑ Emergency power generation system	111.05-17
• Can't be grounded directly at emergency switchboard	
❑ If it has a neutral bus it must be permanently connected to the bus on the main switchboard	
❑ Must not have a switch, circuit breaker, or fuse in the neutral conductor of the bus-tie connecting the emergency to main switchboard	
❑ Must have only one point of connection to ground and must be provided at generator switchboard	111.05-13 111.05-17(a)

System	**Ref (46 CFR)**
6. Ground Detection	111.05-21
❑ There must be ground detection for: • Electric propulsion systems • Ship's Service power • Lighting Systems • Power or lighting that is isolated from ship's • Service power by transformers or motor generators.	
❑ Located at ship's service switchboard except for propulsion system which will be at propulsion switchboard	111.05-23
❑ If neutral grounded, must have a ground ammeter	111.05-27
7. Steering Gear system	
❑ Instantaneous C.B. set at 175% to 200% of locked-rotor current?	58.25
❑ Low voltage release required	
❑ Feeder circuits required - at least two and they must have a current carrying capacity of 125% of full load rating of motor	
❑ Feeder circuits must have two sources of power one being the ship service switchboard, the other can be the emergency switchboard	
❑ Proper alarms	
9. Motors	
❑ Branch-circuit conductors supplying a single motor shall have an ampacity not less than 125% of the motor full-load current rating	111.60-7 ref. NEC 430-22
10. Cable Protection (Fuse or Circuit Breaker)	111.50-3
❑ In general, sized to the allowable current carrying capacity of the conductor	
❑ If not standard size, the next larger size may be used but must not be larger than 150%	
11. Transformers	
❑ High or Medium voltage supply requires two	111.10-9

System	**Ref (46 CFR)**
11. Transformers (continued)	
❑ Overcurrent Protection	111.20-15 reference
600 Volts or less - primary overcurrent device rated or set at not more than 125%	NEC 450-3
12. Bus-tie between main and emergency switchboard	112.05-3
❑ Must disconnect automatically upon loss of potential at the emergency switchboard	
❑ Be arranged to prevent parallel operation of an emergency source with any other source	
13. Cable sizing	
❑ Sized for demand loads, see table 111.60-7	111.60-7
❑ Minimum cable conductor size	111.60-4
❑ Power & Lighting - 14AWG, Thermocouple or pyrometer cable - 22AWG, Otherwise - 18AWG	
14. Lighting	
❑ Cable for 15 amperes or less lighting branch circuits shall be 14 awg or larger. Cable for 20 ampere circuits shall be 12 awg or larger. All cable shall be of a suitable type.	111.75.5
❑ Navigation Lights:	
Navigation light feeder shall be a suitable size and type and protected by overcurrent protection rated at twice that of the Navigation light panels main fuses. The Navigation light panel shall be supplied from the emergency switchboard if required to have an emergency power source.	111.75-17(a) 111.60-1 112.43-13
❑ Verify selective tripping of circuit breakers.	111.51
15. Batteries	
❑ Battery installation properly classed as large(>2KW), moderate (0.2-2.0KW) or small (<0.2KW)	111.15.2

System	**Ref (46 CFR)**
15. Batteries (continued)	
❑ Proper ventilation for battery category	111.15-10
❑ Overload protection device on ungrounded Battery conductor	111.15-25(a)
16. Emergency Power	112.05-3(a)
❑ See CFR	112.05-5(c)
17. Fire and Bilge Pumps	
❑ May be required on certain vessels to be powered by the emergency power source.	112.15-5(d)&(e)
18. Emergency Loads energized from final emergency power source:	112.15-5
❑ Nav Lights	
❑ Emerg, Lighting, Including lifeboat launching areas	
❑ Each Elevator in a passenger vessel	
❑ Charging panels for temporary emerg. batteries,	
❑ General alarm batteries and starting batteries for engines/turbines that drive emergency generators.	
❑ Bilge pump if required by part 56	
❑ Fire pump (see 112.15-5(e))	
❑ Nav equipment	
❑ Steering gear feeder (see 111.93)	
19. Engineers' Assistance Alarm	113.27-1
❑ Operated from engine control room or maneuvering platform (If no engine control room)	
❑ Be audible in the engineers' accommodation spaces	
❑ Powered from the general alarm power source	

Electrical One-Line Diagram (continued)

System	**Ref (46 CFR)**
1. Generator Circuit Breakers	
❑ If instantaneous trip - must be set as close as practical, above max asymmetrical short circuit	111.12-11(g)
2. Buses	
❑ If more than 3000 KW of ship service power the switchboard must have at least two sections of the main bus connected by a disconnect switch or removable links or non-automatic circuit breaker	111.30-24
3. Grounded Systems	
❑ If dual voltage see 111.05-29	
4. Ungrounded system	111.05-25
5. Steering Gear system	
❑ 1600 GT over must have steering failure alarm system fed from final emerg. power source through emerg. dist. panel in the wheel house if installed and instantaneous C.B. set at 400 to 500% of current-carrying capacity of smallest alarm interconnecting conductor.	113.43-5
6. Motors	
❑ If more than one motor on a branch-circuit see NEC 430-24	
❑ Circuit Breakers - Generally for a.c., (max) 250% of full load. See ABS Rules as referenced by 111.70-l(a)	111.60-7 ref. NEC 430-22
❑ Disconnects located in sight of motor and externally operable.	111.70-l(c)
7. Low Voltage Release	111.70-3 (b)
❑ Required for fire pump, elevator and steering gear or auxiliary that is vital to the vessel's propulsion system (See exemptions)	
❑ If starting current and short-time sustained current of additional LVR load is within the capacity of one generator.	

System	**Ref (46 CFR)**
8. Low Voltage Protection ❑ Required if motor is 2 HP. (1.5KW) or more	111.70-3 (c)
9. Neutrals & Disconnect switches ❑ Each generator switchboard must have a disconnect switch, link or circuit breaker that disconnects each generator conductor. ❑ If there is a switch in the neutral there must also be some type of disconnect switch or circuit breaker for each ungrounded conductor.	111.30-25
10. Transformers ❑ If current is less than 9 amps see exceptions in NEC 450-3(b). Also if protection on primary and secondary see NEC 450-3(b)(2). Ratings then primary (250%) and secondary (125%).	
11. Bus-tie between main and emergency switchboard NOTE: There are some exceptions ❑ If arranged for feedback operation, it must open automatically upon overload of emergency power source	112.05-3
12. Remote stops ❑ Two remote stops provided for power ventilation (This has changed, see reference) ❑ Machinery remote stop shall be provided for each forced or induced draft for, fuel oil pump etc.	111.103-1 111.103.9
13. Segregation of vital circuits ❑ Circuits supplying equipment vital to the propulsion, control or safety of the vessel must not supply other equipment	111.60-9
14. Lighting ❑ Lighting branch circuits must be protected by overcurrent protection rated for 20 amperes or	111.75-5(d)

System	Ref (46 CFR)
14. Lighting (continued)	
less. (See section 1, Lighting, Appliance & Receptacle Circuit) Note: Exception 21	
❑ Cable for 15 amperes or less lighting branch circuits shall be 14 awg or larger. Cable for 20 ampere circuits shall be 12 awg or larger. All cable shall be of a suitable type.	111.75.5
❑ Two lighting circuits for machinery spaces	111.75-15(b)
❑ Verify Navigation light indicating panel has fusing. Main fuse must be twice the rating of the largest branch fuse and greater then the maximum panel load. Branch fuses should protect the lights and associated cable. Check size and type of cable should portable cable be used.	111.75-17(b)&(e) 111.60-l(a)
❑ Self-propelled vessels must have dual light sources for side, masthead, stern and range lights. Not applicable for supply boats.	11.75-17(c)
❑ Appliances and Appliance Circuits shall have overcurrent protection rated at not more than 150% of the rating of the appliance or 15 amperes, whichever is higher.	111.77-1
❑ Battery Operated Lanterns • Must be relay controlled so that the loss of normal power causes the lantern to light • May be used to meet table 112.05(a) • 3 hour life	112.39

System	Ref (46 CFR)
1. Remote stops	
❑ Wired so damage to switch or cable will automatically stop equip.	111.103-7

System	Ref (46 CFR)
2. Lighting	
❑ 25 or 30 ampere lighting branch circuits shall be only nonswitched lighting fixtures for cargo holds or deck lighting. Cable shall be 10 AWG or larger and of a suitable type.	111.75-5(e) 111.60-l(a)
❑ Verify lifeboat and or liferaft flood lights are provided with proper cable and overcurrent protection. These lights shall be off the emergency power circuit.	111.75-16 111.60-1 112.43-11 112.43-7
❑ A signal light is required on vessels over 300 gross tons on international voyages vessels 150 to 300 gross ton can have a hand held type. Cable size and overcurrent protection should be checked. A suitable type light would be left to the OCMI. The signal light shall be on the emergency power source.	111.75-18 112.43-9