

MSC Guidelines for Ship Service Generator Switchboard

Procedure Number: E2-21

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References:

- a) 46 CFR Subchapter J, 1996 with amendments effective December 1, 2008
- b) International Electrotechnical Commission (IEC) 600092-302, "Electrical Installations on Ships"
- c) IEEE Std 45, "Recommended Practice for Electrical Installations on Shipboard", either 1998 or 2002 as incorporated for a specific section
- d) Navigation and Inspection Circular (NVIC) 2-89, "Guide for Electrical Installations on Merchant Vessels and Mobile Offshore Drilling Units", can be found at: http://www.uscg.mil/hq/g-m/nvic/2_89/n2-89.pdf
- e) Safety Of Life at Sea (SOLAS), 1974 and amendments, Chapter II-1, Part D
- f) American Bureau of Shipping (ABS), "Rules for Building and Classing Steel Vessels", 2003
- g) American Bureau of Shipping (ABS), "Rules for Building and Classing Mobile Offshore Drilling Units", 2001

Contact Information:

If you have any questions or comments concerning this document, please contact the Marine Safety Center by e-mail or phone, referring to Procedure Number: **E2-21**.

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Responsibilities:

Using applicable portions of references (a) through (f), the submitter shall provide sufficient documentation and plans to indicate compliance with the applicable requirements. For a typical electrical load analysis, plans include one line diagrams, load analysis (plans and calculations), Short Circuit Analysis and switchboard and generator details. The submission shall be made in triplicate. To facilitate plan review and project management, all plans and information specified in these guidelines should be submitted as one complete package through a single point of contact for the project.

General Guidance:

- ❑ Each self-propelled vessel must have at least two electric generating sources that are capable of providing continuous and uninterrupted power. Using the load analysis, verify that the aggregate capacity of these generators is sufficient for the ship's service loads. (111.10-3)
- ❑ The current carrying capacity of the generator cables must not be less than 115% of the continuous generator rating or 115% of the overload rating for a unit with a 2-hour or greater overload rating. (111.12-9)

General Guidance
(continued):

- ❑ A generator shall be protected by an individual, air, and trip-free circuit breaker, located on the switchboard, with a longtime overcurrent trip set at 115% (maximum) of the continuous generator rating or 115% of the overload for a unit with a 2 hour or greater overload rating. (111.12-11(b) & (d))
- ❑ Instantaneous trip protection shall be provided if three or more generators can be paralleled. The trip shall be set above but as close as practicable to the maximum asymmetrical short circuit current available from any one generator. (111.12-11(c) & (e))
- ❑ Reverse power or reverse current relays shall be provided for each generator that is arranged for parallel operation. (111.12-11(f))
- ❑ Each switchboard must be equipped with the following components for each connected generator: (111.30-25(b))
 - Generator power pilot lamp
 - Circuit Breaker meets 111.12-11 and 111.50-5
 - Ammeter/switch capable of indicating the separate phase currents
 - Voltmeter capable of indicating phase, bus and shore power voltages
 - A voltage regulator and voltage regulator cutout switch
- ❑ Each switchboard must be equipped with the following components: (111-30-25(e) & (f))
 - Ground detection (If neutral grounded system, a meter is required)
 - Frequency meter
 - Exciter field rheostat- manual voltage regulation with an exciter field rheostat is not required if (1) the number of generators is in excess of the number required to comply with 46 CFR 111.10, or (2) there is a back-up voltage regulator for each generator set which is pre-wired and can be switched into service on failure of the primary voltage regulator. In the latter case, it is permissible to stop the generator set, switch voltage regulators and restart the machine.
 - Shore power breaker or fused switch
 - Shore power pilot light
- ❑ For generators capable of parallel operation, the switchboard shall be equipped with the following components: (111.30-25(d))
 - Speed control for each generator prime mover
 - Wattmeter for each generator
 - Synchroscope, synchronizing lamps and switch arrangement.
- ❑ The neutral of a dual voltage system must be solidly grounded at the generator switchboard. (111.05-15)

General Guidance
(continued):

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- ❑ The capacity of the ship's service generators, excluding the generator with the largest capacity, shall be sufficient to supply those services necessary for normal operational conditions and comfortable conditions of habitability. (111.10-4(b))
 - ❑ The generator and its switchboard shall be located in the same space; a control room inside the machinery casing is considered the same space. (111.12-11(g))
 - ❑ Bus bars shall be sized to limit the bus bar temperature to 50⁰C at rated current. Refer to reference (c), section 7.10 or reference (b), clause 7. (111.30-19)
 - ❑ The switchboard/breakers shall have an interrupting rating greater than the maximum asymmetrical short circuit current. This shall be verified by the short circuit analysis. (111.52)
 - ❑ Switchboard instrument circuits, except the following, must have overcurrent protection (111-30-17((b))
 - Voltage regulator
 - An electric propulsion control
 - Circuit breaker tripping control device
 - Device that creates vessel hazard if tripped
 - ❑ Current transformer secondary circuits shall not be fused. (111.30-17(d))
 - ❑ The generator shall be rated for a 50⁰ C ambient temperature otherwise the generator shall be de-rated. (111.01-15(e))
 - ❑ Prime movers shall conform to design requirements of 46 CFR 58.01-5, 58.10 and 111.12-1, except MODUs which must meet sections 4-3-4/3.17 and 4-3-4/3.19 of reference (g).
 - ❑ If the generator is directly coupled to the prime mover, the prime mover must automatically shutdown in the event of loss of lube oil pressure to the generator bearing. (111.12-1(c))
 - ❑ Generator excitation shall be in accordance with sections 4-83/13.2(a), 4-8-5/5.5.1, 4-8-5/5.5.2 and 4-8-5/5.17.6 of reference (f) or, for MODUs, 4-3-4/3.21.1 and 4-3-4/3.23.3 of reference (g). A static exciter is not acceptable unless provided with a permanent or residual magnetism type exciter capable of voltage buildup after two months of no operation. (111.12-3)
 - ❑ Voltage regulation and parallel operation shall conform to sections 4-2-3/7.5.2, 4-2-4/7.5.2, 4-8-3/3.13.2 and 4-8-3/3.13.3 of reference (f) or for MODUs, 4-3-4/3.21.2, 4-3-4/3.21.3, 4-3-4/3.23.2 and 4-3-4/3.23.3 of reference (g). (111.12-7)

General Guidance
(continued):

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- ❑ Switchboards for low voltages shall meet the construction guidelines of reference (b) or reference (c), 2002 edition, Section 8.3 and the nameplate requirements of 111.30-15. (111.30-5)
 - Dead front type
 - Front panel sections shall be hinged unless rear access is available
 - Hinged panels over 45” height or 24” width shall be provided with panel positioners
 - Drip proof covers
 - Non-conducting handrail attached to board front and backs
 - Sheet metal end covers with ventilation louvers/grilles
 - Each device must have a nameplate indicating the device function
 - Each breaker must have a nameplate indicating connected load and breaker setting.
 - ❑ Switchboards for medium voltages shall meet the construction guidelines of IEC 92-503 (b) or reference (c), 2002 edition, Section 8.4 and the nameplate requirements of 111.30-15. (111.30-5)
 - ❑ Switchboard wiring shall not be less than AWG 14, rated at 90° C or higher, stranded, flame retardant meeting UL 1581 test VW-1 or IEC 332-1. (111.30-19(b))
 - ❑ The generator circuit breaker must have poles for each generator lead with the exception of the neutral lead. (111.12-11(h))
 - ❑ The generator circuit breaker shall not automatically close after tripping. (111.12-11(j))
 - ❑ The switchboard shall be located in a dry location and shall be accessible from the front and rear. Ample space shall be provided in front of the board for maintenance. An insulating mat shall be provided in the front and rear of the board. (111.30-1)
 - ❑ Switchboard components and bus bar connections must be accessible from the rear of the switchboard or be located within 20 inches of the switchboard front. (111.30-3)
 - ❑ Circuit breakers shall be arranged such that they may be removed from the switchboard front without unbolting bus or cable connections or de-energizing the power (except switchboards divided into sections). (111-30-4)

Disclaimer:

This guidance is not a substitute for applicable legal requirements, nor is it itself a rule. It is not intended to nor does it impose legally-binding requirements on any party. It represents the Coast Guard’s current thinking on this topic and may assist industry, mariners, the general public, and the Coast Guard, as well as other federal and state regulators, in applying statutory and regulatory requirements. You can use an alternative approach for complying with these requirements if the approach satisfies the requirements of the applicable statutes and regulations. If you want to discuss an alternative, you may contact the Marine Safety Center (MSC), the unit responsible for implementing this guidance.