

National Marine Manufacturers Association
Compliance Specialist Examination
A.C. Electrical 2022MY
ABYC E-11 (7/18)

1. AC wiring requirements include which of the following:
 - a. AC conductors shall be bundled, sheathed, or otherwise kept separate from DC conductors.
 - b. All AC current carrying conductors and the grounding conductor shall be contained in the same sheath, bundle or raceway.
 - c. Unused openings in boxes, cabinets, and weatherproof enclosures shall be fixed with closing devices.
 - d. All of the above are correct.

2. According to ABYC Standards, the AC grounded (neutral/white) conductor shall:
 - a. not be connected to AC grounding conductor (green) at the dock shore power supply.
 - b. be connected to the AC grounding conductor (green) at the inverter output in the invert mode, generator output, and at the secondary of an isolation or polarization transformer, a procedure called grounding the neutral at the source of power on the boat.
 - c. be connected to the engine negative terminal or its bus.
 - d. never be grounded on board the boat.

3. An Equipment Leakage Circuit Interrupter or a Type A Residual Current Device:
 - a. Shall be installed in addition to or incorporated with the main shore power disconnect breakers or the breakers within 10' of the shore connection, whichever is closer to the shore power connection.
 - b. Shall be installed in a readily accessible location.
 - c. Is not required if an isolation transformer is installed within 10' of the shore power entry or the electrical attachment point of a permanently installed shore cord.
 - d. all of the above are true.

4. When twin 30-amp, 125-volt shore power is installed, ABYC recommends that the neutrals (grounded/white conductor) for each shore service:
 - a. not be connected together on the boat.
 - b. be connected together at a combined neutral bus bar at the AC distribution panel.
 - c. be connected to the AC grounding bus on the boat.
 - d. be connected to the engine negative terminal or its bus.

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5. Two Electrical Technicians are discussing markings that are required for AC wiring. Tech A says that AC conductors must be rated for 600 volts and must have their jackets and individual conductors marked with the voltage, type or style, gauge, and temperature rating of the insulation. Tech B says that AC flexible cords have the same ratings and requirements. Which Tech is right?
 - a. Tech A
 - b. Tech B
 - c. Both Techs
 - d. Neither Techs

6. The AC Grounding Conductor does not normally carry current but is a very important part of the AC electrical system. Which of the following statements are true regarding this conductor:
 - a. This conductor is used to connect the metallic current carrying parts of AC electrical equipment to the AC grounding bus, engine negative terminal or its bus and to the source ground.
 - b. This conductor may be referred to as the ground conductor.
 - c. This conductor must have a Galvanic Isolator installed in series on all boats with an AC electrical system.
 - d. All of the above are true statements.

7. The AC ungrounded conductor from the source of power to the main switchboard (not a branch circuit) must have over current protection at the source or within 7" or within 40" if the conductor is sheathed. The circuit breaker that is used for this purpose is rated:
 - a. Not to exceed the maximum current requirements of the load
 - b. For at least 150% of the nominal voltage of the supply circuit
 - c. For no more than the maximum current carrying capacity of the conductor being protected
 - d. For no more than 150% of the ampacity of the conductor if the correct size breaker is not available.

8. Each boat equipped with an AC shore power system MUST have Ground Fault Protection as follows:
 - a. Proper installation of an ELCI or a Type A RCD or an isolation transformer within 10' of the shore power entry.
 - b. The Type A IEC compliant RCD shall be rated for 125/250-volt 60 Hz applications.
 - c. If included, the circuit breaker shall also meet the requirements of E-11.10.2.
 - d. All 3 of the above are true.

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9. Consider an isolation transformer and a polarization transformer. Which statement(s) below is/are correct?
- Polarization transformers must be tested and labeled by an independent laboratory.
 - An isolation transformer provides isolation for the ungrounded and grounded conductors but keeps the grounding conductor uninterrupted
 - In order for a polarization transformer to provide isolation, a galvanic isolator must be added in series with the grounding conductor between the shore power inlet and the transformer because the polarization transformer does not involve the grounding conductor.
 - All of the above are correct.
10. AC circuit breakers must be installed that have the following requirements:
- Ampere interrupting capacity based on twice the installed shore power and Table 4 B and be manually reset trip-free type.
 - Main breakers must be marked to indicate their function and, as applicable, the replacement type, class and rating and branch breakers shall have a means to identify their function and, as applicable, the replacement type, class and rating.
 - Current rating not exceeding the maximum current carrying capacity of the conductor being protected unless the 150% exception applies for branch and main circuits.
 - All of the above are necessary for AC circuit breakers.
11. Downrating the ampacity (reducing the allowed current carrying capability) of AC conductors to avoid excessive heat build-up is required because of which of the following:
- Bundling of conductors for any distance.
 - The grounding conductor is counted when considering the number of conductors that are bundled.
 - Bundling of conductors for a distance of 24" or more and the temperature of the compartment in which the conductors are installed (inside or outside the engine room).
 - The AC grounding conductor must be one size smaller than the current carrying conductors

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12. ABYC E-11 requires the installation of an Equipment Leakage Circuit Interrupter (ELCI) or a Type A Residual Current Device (RCD) on all boats with AC shore power. Which statement below is true?
- These devices block galvanic current above 30 ma and detect the reversal of the ungrounded and grounded conductors which provides protection from in-water shock hazards.
 - These devices detect equipment ground fault leakage current greater than 30 ma and disconnect all current carrying conductors from the supply source within 100 milli seconds for protection of personnel and equipment.
 - All RCD devices available for marine use are acceptable for meeting the requirement for ground fault protection for all boats.
 - Installation of either of these devices removes the requirement for GFCI breakers in the head, galley, and other wet areas.
13. Marine electrical tech A says that non-metallic conductor support is ok for all AC conductors. Marine electrical tech B says that all AC cables from the shore power inlet to the main shore power breaker (or to the main breaker installed within 10' of the shore inlet) must be installed in conduit or supported by metal straps or clamps. Which tech is right?
- Tech A
 - Tech B
 - Both are right
 - Neither are right
14. The transfer of AC power to a circuit from one source to another shall be made:
- by a means that connects to the new power source before disconnecting from the present power source.
 - by a means that disconnects the present source before connecting to the new source in all AC electrical systems utilizing more than one source of power.
 - by a means that opens all current carrying conductors, including neutrals, before closing the alternate source circuit, to maintain isolation of power sources, unless the system uses equipment meeting the requirements of ABYC A-32 Power Conversion Equipment and Systems.
 - by a means that opens all current carrying conductors when an isolation or polarization transformer is installed.

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15. Two marine electrical technicians are having a discussion. Tech A says that reverse polarity indicating devices providing a continuous audible or visible signal shall be installed on all boats with 120-volt shore power systems to respond to the reversal of the ungrounded and grounded conductors. Tech B says that reverse polarity indicating devices providing a continuous audible or visible signal shall be installed in 120-volt shore power systems to respond to the reversal of the ungrounded and grounded conductors if the polarity of the system must be maintained, or branch circuit breakers are single pole, or no transformer is installed. Which Tech is correct?
- Tech A
 - Tech B
 - Both techs
 - Neither techs
16. AC panel boards have several markings and required equipment under certain conditions. Which statement below is correct regarding AC panel boards?
- A system voltmeter or ammeter is required on any AC panel board.
 - 3 phase system panel boards must have the system voltage, phase, and number of conductors indicated and a Warning about safety when working on 3 phase wiring systems.
 - The face of an AC system panel board must be permanently marked with the system voltage and either "VAC" or system frequency.
 - A system voltmeter, of any type, shall be installed if the panelboard is permanently connected to an electric motor, or a generator or an inverter or inverter/charger.
17. Which statement below is correct regarding the function or installation of a galvanic isolator?
- A galvanic isolator is a device installed in series with the grounded conductor to block AC fault current below 1 amp and pass low voltage galvanic current
 - A galvanic isolator is a device installed in series with the AC grounding conductor to eliminate galvanic corrosion remove the requirement for a Warning label at the shore power connection.
 - A galvanic isolator is a device installed in series with the AC grounding conductor to block low voltage DC galvanic current and permit the passage of AC current normally associated with the AC grounding conductor.
 - A galvanic isolator is a device installed between the grounded conductor and the grounding conductor to reduce low voltage galvanic current and reduce galvanic corrosion.

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18. AC electrical equipment and appliances have specific mechanical and electrical installation requirements. Which statement below best describes these requirements?
- a. Not all AC appliances designed for permanent installation have to be securely mounted to the boat's structure.
 - b. Current carrying parts of the fixed AC electrical equipment shall be designed so that the current carrying components of the device are effectively insulated from all exposed electrically conductive components.
 - c. All exposed electrically conductive, non-current-carrying components of fixed AC electrical equipment and appliances, shall be connected to the grounded conductor.
 - d. If an AC appliance has a neutral to ground bonding strap, it must not be removed.
19. What is the maximum size circuit breaker that can be used to protect an AC branch circuit that has two 14-gauge, 105 degree C, triplex conductors bundled together for a distance of 15' outside the engine compartment of a gasoline powered boat?
- a. 20 amp
 - b. 15 amp
 - c. 30 amp which is less than 150% of maximum ampacity
 - d. 25 amp which is the next larger standard current rating breaker
20. Four 12 gauge triplex AC conductors, each containing a black, white and green wire are rated at 105 degrees C that are bundled together inside the gasoline engine compartment for a distance of 7', must have the ampacity of each current carrying conductor down rated from the maximum current allowed without any bundling of conductors in the same environment:
- a. From 45 amps to 22.5 amps
 - b. From 38.3 amps to 19.1 amps
 - c. From 38.3 amps to 23.0 amps
 - d. From 45 amps to 31.5 amps