

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

1. AC Ungrounded Conductor is defined as:
 - a. a current carrying conductor that is intentionally maintained at ground potential
 - b. a conductor, not normally carrying current
 - c. current carrying conductor intentionally maintained at a potential other than ground
 - d. referred to as the green ground, or green with yellow stripe

2. In a 12-volt system, the power source for a bilge sump pump that draws 5 amps is located 50 feet from the pump. If the maximum allowable voltage drop is used for de-signing this circuit, what is the correct wire gauge to use to connect the shower sump pump to the source of power?
 - a. 6 gauge
 - b. 8 gauge
 - c. 12 gauge
 - d. 16 gauge

3. Two marine electrical technicians are discussing friction connectors. Tech A says that they may be used if the current in the circuit does not exceed 30 milli-amps. Tech B says that friction connectors must have no more than a 50 milli-volt drop for a 20-amp current flow and must pass a 6 pound pull test. Who is right?
 - a. Tech A
 - b. Tech B
 - c. Neither tech
 - d. Both techs

4. The current rating of the overcurrent protection (OCP) device for a non-motor load circuit shall not exceed the maximum current carrying capacity (ampacity) of the conductor being protected. Which of the following statements is true?
 - a. Each grounded conductor of a branch circuit shall be provided with OCP at the point of connection to the main switchboard within 7" of the source of power.
 - b. Branch circuit OCP devices (fuses or trip-free breakers) shall not exceed 100% of the conductor ampacity in Table 6 A-B.
 - c. A trip-free circuit breaker or a fuse shall be installed at the source of power for panelboards and switchboards and shall not exceed 100% of the load capacity of that panel or 100% of the ampacity of the feeder conductors without exception.
 - d. Each ungrounded conductor of a branch circuit shall be provided with OCP at the point of connection to the main switchboard unless the main circuit breaker or fuse provides such protection. 7" rule with 72" and 40" exceptions shall be met.

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5. DC panel boards may be combined with AC panel boards and installed on one common electrical panel board. Also, DC and AC may be on separate panel boards. Which of the following are true statements?
 - a. Panel boards must be installed in a readily accessible location.
 - b. Both AC and DC panel boards must always be marked with the system voltage.
 - c. Access to the DC system does not allow access to energized AC parts without the further use of tools.
 - d. a and c are correct.

6. A ring terminal crimped on a 4-gauge conductor and the terminal stud to which it is attached shall be capable of withstanding a pull off force (tensile test value) of:
 - a. 100 pounds for 30 seconds
 - b. 80 pounds for one minute and not break
 - c. 70 pounds for one minute without damage to any conductor strands
 - d. 80 pounds for one minute if soldered

7. Multiple engine installations, including auxiliary generator engines, require special ground connections. Which of the following is a true statement?
 - a. The engines shall be connected by a common ground conductor capable of carrying the cranking current of each engine.
 - b. Multiple outboard engines shall be connected at their battery terminals.
 - c. The addition of crossover (parallel) starting connections is covered by these ground connections.
 - d. The parallel start switch should be capable of carrying the smallest cranking motor current.

8. If an exhaust blower installed in a gasoline engine compartment draws 5 amps at 24 volts, and is located 30 feet from the circuit panel board breaker, using wire with 105 degree C insulation, what is the correct wire size for this installation?
 - a. #8 AWG
 - b. #10 AWG
 - c. #12 AWG
 - d. #14 AWG

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9. Two marine electrical technicians are discussing ignition protected electrical devices. Tech A says that electrical devices installed in a gasoline engine compartment or gasoline fuel compartment must be ignition protected with proper labeling. Tech B says that the same requirements apply to all compartments of a boat that contain LPG cylinders or appliances. Who is right?
- a. Tech A
 - b. Tech B
 - c. Both Techs
 - d. Neither Techs
10. Two conductors may be connected in parallel to supply a load in order to meet voltage drop requirements or radius bend restrictions, if:
- a. the conductors are 8 gauge or larger.
 - b. each conductor is routed separately from the parallel conductor.
 - c. the ampacity of each individual conductor is sufficient to carry the load shared by the paralleled conductors and the OCP is sized to protect a single conductor.
 - d. one of the paralleled conductors is 1/2 the length of the other.
11. Motors and motor operated equipment, except for engine cranking motors, shall be protected internally at the equipment, or by branch circuit overcurrent protection (OCP) devices suitable for motor current. Which of the following statements is correct?
- a. The OCP device shall be rated for the current carrying capacity (ampacity) of the motor's supply conductor and there would be no need for thermally responsive devices on the motor or motor operated equipment.
 - b. The protection provided shall preclude a fire hazard if the motor circuit is energized for 7 hours under any conditions of overload including locked rotor.
 - c. If a circuit breaker is used to replace a fuse in a motor circuit, there is no need to test the OCP as installed in order to assure compliance with the locked rotor requirement.
 - d. Trip delay time is not a consideration when selecting a circuit breaker to be used in a motor circuit.
12. Consider a 12-volt bow thruster with a current draw of 100 amps installed outside the engine compartment. It is installed 5 feet from its own battery using 105 degree C conductors. The positive, negative and grounding conductors are bundled together. What size conductor must be used to provide proper voltage drop and ampacity?
- a. 2 gauge
 - b. 4 gauge
 - c. 6 gauge
 - d. 8 gauge

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13. Two marine electrical technicians are discussing over-current protection identification for devices not installed in circuits where the location of the protective device makes obvious the protected circuit. Tech A says that main over-current protection devices must be marked to identify their function and, as applicable, the replacement type, class and rating. Tech B says that branch circuit over-current protection devices shall be marked or provided with a means to indicate their function, circuit, type, class, rating and, but this identification may be provided by a wiring diagram of the system with each boat. Who is right?
- a. Tech A
 - b. Tech B
 - c. Both Techs
 - d. Neither Techs
14. Busbars not at the DC grounded conductor potential or the DC grounding conductor potential shall be:
- a. protected from contact and accidental shorting, without exception.
 - b. protected from environmental contamination.
 - c. installed to provide at least 0.1 inch spacing from the mounting substrate, including all fasteners.
 - d. b and c are true statements.
15. Two marine electrical technicians are discussing the proper way to attach conductors to battery studs and other terminal studs throughout the boat. Tech A says that no more than 4 ring terminals or captive spades may be attached to any one terminal stud and that if additional connections are needed, two or more terminal studs shall be connected together by means of jumpers or copper straps. Tech B says that multiple conductors connected to a terminal stud shall be installed with the lowest ampacity (small diameter) conductor closest to the terminal base, followed by successively larger ampacity (larger diameter) terminals and that only one conductor can be crimped into any one of these ring or captive spade terminals. Who is right?
- a. Tech A
 - b. Tech B
 - c. Both techs
 - d. Neither tech

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16. DC conductors have insulation that is rated for specific temperatures from 60 degrees C to 200 degrees C as shown in Table 6 A&B where the allowable currents for different size conductors are shown. Tables 9 and 10 show allowable currents for different size conductors when specific circuit lengths are installed. Which statement is true?
- a. Table 6 A&B shows how the increased temperature of the engine space and bundling of conductors down rates the allowable amperage of a conductor.
 - b. Tables 9 & 10 shows how voltage drop requirements of 3% and 10% down rates the allowable amperage of conductors for 12 volt systems only.
 - c. In the event of a conflict between Table 6 and Table 9 or 10, use the smaller size conductor.
 - d. Voltage drop requirements (Tables 9 & 10) always over-ride the allowable amperage requirements (Table 6 A&B).
17. When considering busbar sizing (capacity):
- a. Manufacturers must specify their maximum capacity for current flow from end to end and the conditions of rating.
 - b. The capacity of custom built copper busbars can be estimated by beginning with the cross section area of the busbar in square mm.
 - c. Holes in the copper bus bar are a factor in estimating the capacity rating.
 - d. All of the above statements are true.
18. The 12-volt main panel board feeder conductors from the battery to the panel with an actual load of 40 amps are each 45' long. What size conductors should be installed between the battery and the panel board in order to not exceed the maximum allowable voltage drop, even though the panel board is physically located only 25' from the battery?
- a. 2 gauge
 - b. 4 gauge
 - c. 2/0 gauge
 - d. 4/0 gauge
19. Minimum Ampere Interrupting Capacity (AIC) for DC Overcurrent Protection (OCP) Devices is based on total connected battery capacity and other considerations as follows:
- a. Main OCP devices are treated the same as branch OCP devices.
 - b. Batteries or battery banks with over 2200 CCA must have OCP devices rated for the short circuit current rating of the batteries or rated at 20 KA at 125 volts DC.
 - c. Conventional batteries such as lead acid or gel cell, and high-tech batteries such as lithium ion are treated the same.
 - d. AIC ratings only apply to 12-volt systems.

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20. A battery switch is required in the positive conductor from each battery or battery bank if:
- a. The Cold Cranking Amps of the battery or battery bank is over 800 amps or 100-amp hours if CCA is not available.
 - b. Continuous power memory equipment is installed, safety equipment is installed, battery charging equipment is installed, or an impressed current system is installed.
 - c. The Cold Cranking Amps of the battery or battery bank is 800 amps or more; or 100-amp hours or more if CCA is not available.
 - d. Dedicated trolling motor batteries are installed with over current protection at the battery and a manual means of electrical disconnect separate from the trolling motor controls.