National Electrical Code (NEC) Article 690 Practice Test (Sample)

Study Guide

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Questions

1. **What is a module circuit as defined in Article 690?**
   - A. A module circuit encompasses the conductors from the PV module to the inverter.
   - B. A module circuit includes the battery connection.
   - C. A module circuit is limited to the electrical panel connections.
   - D. A module circuit is the sequence of module arrangements in series.

2. **What labeling is required for PV system equipment?**
   - A. Environmental impact labels
   - B. Location-specific labels
   - C. Field labels for application
   - D. Cost assessment labels

3. **What is crucial for the rapid shutdown of all PV systems connected to the same device?**
   - A. Clear labeling of each device
   - B. Routine maintenance checks
   - C. Simultaneous activation of the shutdown function
   - D. Individual system performance monitoring

4. **What percentage of the maximum currents calculated must overcurrent devices for PV source circuits be sized at a minimum?**
   - A. 75 percent
   - B. 100 percent
   - C. 125 percent
   - D. 150 percent

5. **How often are PV systems recommended to be inspected according to Article 690?**
   - A. Monthly
   - B. Every five years
   - C. At least once a year
   - D. Once after installation only

6. **How should equipment grounding conductors for photovoltaic (PV) system circuits be sized?**
   - A. Based on the total circuit load
   - B. According to manufacturer specifications
   - C. In accordance with NEC guidelines
   - D. In accordance with 250.122

7. **What is the main purpose of a grounding electrode system in PV installations?**
   - A. To connect to the utility grid
   - B. Safety and protection
   - C. To enhance energy production
   - D. To support system efficiency

8. **For PV systems, where are circuits terminating on buildings not considered controlled conductors?**
   - A. Interiors of buildings
   - B. Exterior of buildings
   - C. Rooftops only
   - D. Underground installations

9. **What should the markings on the disconnecting means include?**
   - A. PV SYSTEM DISCONNECT or equivalent
   - B. WARNING: High Voltage
   - C. Solar Energy Source
   - D. Power Supply OFF

10. **What is the main purpose of Article 690.1?**
   - A. To outline safety procedures for installation
   - B. To list equipment standards for solar systems
   - C. To define equipment requirements for PV systems
   - D. To provide installation guidelines for batteries

Answers

1. A
2. C
3. C
4. C
5. C
6. D
7. B
8. B
9. A
10. C

Explanations

1. What is a module circuit as defined in Article 690?

A. A module circuit encompasses the conductors from the PV module to the inverter.

B. A module circuit includes the battery connection.

C. A module circuit is limited to the electrical panel connections.

D. A module circuit is the sequence of module arrangements in series.

A module circuit, as defined in Article 690 of the National Electrical Code (NEC), refers to the conductors that connect a photovoltaic (PV) module to the inverter. This includes the wiring that carries the direct current (DC) generated by the solar panels to the inverter, where it is converted to alternating current (AC) for use in the electrical system. The importance of this definition lies in understanding how the electrical flow is managed from the solar modules, ensuring proper installation, safety, and code compliance in photovoltaic systems.   While other components like battery connections or electrical panel connections are essential parts of a solar energy system, they fall under different categories and definitions within the NEC. The module circuit specifically refers to the part of the system responsible for the immediate transition of energy between the solar modules and the inverter, emphasizing its role in enabling the effective transformation of solar energy into usable electrical power.

2. What labeling is required for PV system equipment?

A. Environmental impact labels

B. Location-specific labels

C. Field labels for application

D. Cost assessment labels

Field labels for application are essential in photovoltaic (PV) systems as they provide critical information for installers, inspectors, maintenance personnel, and emergency responders. These labels are part of the safety measures outlined in the National Electrical Code (NEC) for ensuring that all relevant data is accessible at the point of installation and operation. They typically include information such as the system's voltage, main disconnect locations, the presence of DC and AC circuits, and any specific hazards associated with the PV equipment. By requiring these labels, the NEC aims to enhance safety and facilitate efficient operation and maintenance of PV systems. Proper labeling helps prevent accidents and ensures that everyone interacting with the system understands its components and any potential risks. This is particularly important in emergency situations, where quick identification of critical information can influence a rapid response. In contrast, the other options do not align with NEC requirements for direct labeling of PV systems. Environmental impact and cost assessment labels are not mandated by the NEC, while location-specific labels may pertain to certain conditions but do not specifically encompass the comprehensive safety and operational information provided by field labels.

3. What is crucial for the rapid shutdown of all PV systems connected to the same device?

A. Clear labeling of each device

B. Routine maintenance checks

C. Simultaneous activation of the shutdown function

D. Individual system performance monitoring

The requirement for simultaneous activation of the shutdown function in photovoltaic (PV) systems is critical because it ensures that when a rapid shutdown is initiated, all connected systems respond at the same time. This is particularly important for safety reasons, as it minimizes the risk of electric shock or fire hazards that could occur if some systems remain energized while others are shut down. Under the National Electrical Code (NEC) guidelines, rapid shutdown systems are designed to quickly reduce the voltage in the conductors to a safe level without delay, protecting first responders and reducing risks during emergencies. The ability to activate the shutdown simultaneously ensures that the entire array of PV systems disconnected from the grid effectively reduces voltage, thereby safeguarding both personnel and property. In contrast, while clear labeling, routine maintenance checks, and individual system performance monitoring are certainly valuable practices for overall safety and efficiency of PV systems, they do not directly address the immediate safety concern of reducing voltage during a shutdown scenario. Thus, simultaneous activation of the shutdown function stands out as the key factor for effective rapid shutdown in a coordinated manner across all connected PV systems.

4. What percentage of the maximum currents calculated must overcurrent devices for PV source circuits be sized at a minimum?

A. 75 percent

B. 100 percent

C. 125 percent

D. 150 percent

The overcurrent devices for photovoltaic (PV) source circuits must be sized to a minimum of 125 percent of the maximum current calculated. This requirement is outlined in the National Electrical Code (NEC) to ensure safety and proper operation of the electrical system. Sizing the overcurrent device at this percentage provides a buffer that accounts for potential overloads and variations in current that could occur during normal operation, such as fluctuations in solar energy output due to environmental factors. It helps to prevent nuisance tripping and allows the system to handle variations in current without compromising safety. By adhering to this sizing requirement, the system is better protected from conditions that could lead to overheating or damage, ensuring that system components operate efficiently and reliably over their intended lifespan.

5. How often are PV systems recommended to be inspected according to Article 690?

A. Monthly

B. Every five years

<u>C. At least once a year</u>

D. Once after installation only

According to Article 690 of the National Electrical Code, it is recommended that photovoltaic (PV) systems be inspected at least once a year. This annual inspection is important for several reasons. First, regular inspections help ensure that the PV system is operating efficiently and safely. Over time, components can degrade due to environmental factors, such as weather conditions, dust accumulation, and physical damage. An annual inspection allows for timely identification and remediation of any issues that could affect performance or pose safety risks. Second, regular assessment contributes to the maintenance and longevity of the system. By checking the electrical connections, module integrity, and inverter functionality annually, owners can ensure their systems reach their full operational life while maintaining optimal energy production. Lastly, complying with this annual inspection recommendation helps ensure safety standards are met and can be crucial for warranty and insurance purposes. Other options suggest either more frequent inspections, which may not be necessary for all systems, or less frequent ones, which could lead to overlooking critical maintenance needs. Thus, the recommendation for an annual inspection strikes an optimal balance between proactive maintenance and practical implementation for most PV systems.

6. How should equipment grounding conductors for photovoltaic (PV) system circuits be sized?

A. Based on the total circuit load

B. According to manufacturer specifications

C. In accordance with NEC guidelines

<u>D. In accordance with 250.122</u>

The appropriate approach to sizing equipment grounding conductors for photovoltaic (PV) system circuits is specified in NEC 250.122. This provision outlines the criteria for determining the minimum size of equipment grounding conductors based on the rating of the overload protective device. It ensures that the grounding conductors are adequately sized to facilitate the effective clearing of ground faults, enhancing safety and functionality in the system. By following the guidelines in 250.122, the grounding conductor can properly handle fault currents without compromising the integrity of the PV system or the safety of individuals. This standardization takes into account various system configurations and helps to ensure a consistent application across different installations, thus reducing risks associated with improper grounding. While other options may mention generic circuit loads or manufacturer specifications, these do not provide the authoritative and standardized approach that NEC guidelines and specifically Article 250.122 do, making it essential for compliance and safety in PV installations.

7. What is the main purpose of a grounding electrode system in PV installations?

A. To connect to the utility grid

B. Safety and protection

C. To enhance energy production

D. To support system efficiency

The main purpose of a grounding electrode system in photovoltaic (PV) installations is primarily centered on safety and protection. Grounding provides a pathway for electrical faults to dissipate safely into the ground, mitigating the risks of electric shock to personnel and equipment. It serves to protect the system components from damage due to lightning strikes, surges, or accidental contact with energized parts. By establishing a grounding system, the installation ensures that in the event of a fault, the electricity is directed safely, preventing harm to individuals and reducing fire hazards. While grounding may indirectly influence system efficiency and performance, its foremost function is to create a safe operational environment for both equipment and individuals. This emphasis on safety is vital in addressing the unique risks associated with electrical installations, particularly those exposed to outdoor elements and the possibility of weather-related electrical surges.

8. For PV systems, where are circuits terminating on buildings not considered controlled conductors?

A. Interiors of buildings

B. Exterior of buildings

C. Rooftops only

D. Underground installations

In photovoltaic (PV) systems, circuits that terminate on the exterior of buildings are not considered controlled conductors due to safety and accessibility concerns. The exterior of structures is typically more susceptible to environmental factors and requires careful consideration in terms of installation and maintenance. The distinction lies primarily in how accessible these areas are for personnel and the potential hazards that may arise from exposure to weather, wildlife, and other external elements. Circuits on the exterior may also pose risks such as electrical shock to individuals who might be in proximity to the equipment, especially during adverse weather conditions. In contrast, interior installation locations typically allow for better control over environmental conditions and accessibility for maintenance, leading to a greater level of safety. Rooftops, while they might be part of building structures, are often treated similarly to exterior areas due to height and exposure, and underground installations follow a separate set of rules regarding conductor control. Overall, the classification of exterior circuits as uncontrolled takes into account both safety practices and compliance with NEC requirements to ensure safe installation and operation of PV systems.

9. What should the markings on the disconnecting means include?

A. PV SYSTEM DISCONNECT or equivalent

B. WARNING: High Voltage

C. Solar Energy Source

D. Power Supply OFF

The requirement for markings on disconnecting means in photovoltaic (PV) systems is outlined in NEC Article 690. Specifically, the marking indicating "PV SYSTEM DISCONNECT" or an equivalent term is crucial for safety and clarity. This designation is essential in conveying the purpose of the disconnecting means, which is to allow individuals to safely disconnect the solar energy system from the electrical supply during maintenance, emergency situations, or other operational needs. Having clear and specific markings helps ensure that anyone interacting with the system—such as emergency responders, maintenance personnel, or electricians—can quickly identify the disconnecting means, understand its function, and act accordingly. This is vital not only for the safety of individuals but also for the protection of the equipment and the integrity of the solar energy system. Markings like "WARNING: High Voltage," while important for indicating the potential dangers associated with the system's operation, do not specifically identify the purpose of the disconnect. Similarly, "Solar Energy Source" and "Power Supply OFF" provide useful information but lack the specificity that "PV SYSTEM DISCONNECT" conveys regarding operational procedures. Having a standardized phrase contributes to uniformity and reduces the risk of misinterpretation during critical situations.

10. What is the main purpose of Article 690.1?

A. To outline safety procedures for installation

B. To list equipment standards for solar systems

C. To define equipment requirements for PV systems

D. To provide installation guidelines for batteries

The main purpose of Article 690.1 in the National Electrical Code (NEC) is to establish the fundamental requirements for photovoltaic (PV) systems. This article outlines the essential equipment and installation standards that must be adhered to in order to ensure the safety, reliability, and effectiveness of solar energy systems. It serves to categorize the equipment used in these installations, ensuring that they meet specific performance and safety guidelines. By delineating the equipment requirements, Article 690.1 plays a critical role in the overall integrity of PV systems. It ensures that the components used—such as modules, inverters, and mounting systems—are better understood in terms of their compliance with established safety standards. This cohesive framework ultimately aids in protecting both the system's performance and the safety of individuals involved in the installation and maintenance of such systems. While the other choices touch upon aspects related to solar systems, such as safety procedures, equipment standards, and installation guidelines, they do not encapsulate the core focus of Article 690.1, which is specifically about defining the equipment requirements for PV systems.