American Electrical Institute

# CONTINUING EDUCATION FOR FLORIDA ELECTRICIANS

*NFPA 70e Chapters 1, 2, and 3 Update (5 hours technical)*

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# NFPA 70e Chapters 1, 2 and 3 Update

**Course Description:** This course will help electrical contractors review the terms defined in Article 100 and will also cover Article 104.1 through 310.5 to help understand the requirements for safe work practices to protect against major electrical hazards.

**Course Objectives:**

- Understand over 100 electrical definitions
- Prepare student for numerous career applications
- Stress practical skills and knowledge

## Section 1: NFPA 70E Article 100

**Accessible (as applied to equipment).**
Admitting close approach; not guarded by locked doors, elevation, or other effective means.

**Approved.**
Acceptable to the authority having jurisdiction.

**Arc Flash Hazard.**
A source of possible injury or damage to health associated with the release of energy caused by an electric arc.

**Informational Note No. 1:** The likelihood of occurrence of an arc flash incident increases when energized electrical conductors or circuit parts are exposed or when they are within equipment in a guarded or enclosed condition, provided a person is interacting with the equipment in such a manner that could cause an electric arc. An arc flash incident is not likely to occur under normal operating conditions when enclosed energized equipment has been properly installed and maintained. See 110.4(D) for further information.

**Informational Note No. 2:** See Table 130.5(C) for examples of tasks that increase the likelihood of an arc flash incident occurring.

**Arc Flash Suit.**
A complete arc-rated clothing and equipment system that covers the entire body, except for the hands and feet.

**Informational Note:** An arc flash suit may include pants or overalls, a jacket or a coverall, and a beekeeper-type hood fitted with a face shield.

**Arc Rating.**
The value attributed to materials that describes their performance to exposure to an electrical arc discharge. The arc rating is expressed in cal/cm2 and is derived from the determined value of the arc thermal performance value (ATPV) or energy of breakopen threshold (EBT) (should a material system exhibit a breakopen response below the ATPV value). Arc rating is reported as either ATPV or EBT, whichever is the lower value.

**Informational Note No. 1:** Arc-rated clothing or equipment indicates that it has been tested for exposure to an electric arc. Flame-resistant clothing without an arc rating has not been tested for exposure to an electric arc. All arc-rated clothing is also flame resistant.

**Informational Note No. 2:** ATPV is defined in ASTM F1959/F1959M, Standard Test Method for Determining the Arc Rating of Materials for Clothing, as the incident energy (cal/cm2) on a material or a multilayer system of materials that results in a 50 percent probability that sufficient heat transfer through the tested specimen is predicted to cause the onset of a second degree skin burn injury based on the Stoll curve.

**Informational Note No. 3:** EBT is defined in ASTM F1959/F1959M, Standard Test Method for Determining the Arc Rating of Materials for Clothing, as the incident energy (cal/cm2) on a material or a material system that results in a 50 percent probability of breakopen. Breakopen is a material response evidenced by the formation of one or more holes of a defined size [an area of 1.6 cm2 (0.5 in.2) or an opening of 2.5 cm (1.0 in.) in any dimension] in the innermost layer of arc-rated material that would allow thermal energy to pass through the material.

1. An arc flash incident is not likely to occur under normal operating conditions when _____ energized equipment has been properly installed and maintained.
    a. Enclosed
    b. Guarded
    c. Open
    d. Active

2. What type of gear can an arc flash suit include?
    a. beekeeper-type hood fitted with a face shield
    b. Pants or overalls
    c. A jacket or a coverall
    d. All listed answers

3. Arc rating is reported as either_____, whichever is the lower value.
    a. BTE or PTAV
    b. cal/cm2
    c. ATPV or EBT
    d. ASTM

4. What is an arc rating expressed in?
    a. cal/cm2
    b. ATPV or EBT
    c. BTE or PTAV
    d. ASTM

5. What has arc-rated clothing or equipment been tested for exposure to?
    a. Voltage
    b. Current
    c. An electric arc
    d. All listed answers

**Attachment Plug (Plug Cap) (Plug).**
A device that, by insertion in a receptacle, establishes a connection between the conductors of the attached flexible cord and the conductors connected permanently to the receptacle.

**Authority Having Jurisdiction (AHJ).**
An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

**Informational Note:** The phrase "authority having jurisdiction," or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

**Balaclava.**
An arc-rated head-protective fabric that protects the neck and head except for a small portion of the facial area.

**Informational Note:** Some balaclava designs protect the neck and head area except for the eyes while others leave the eyes and nose area unprotected.

**Automatic.**
Performing a function without the necessity of human intervention.

**Barricade.**
A physical obstruction such as tapes, cones, or A-frame-type wood or metal structures intended to provide a warning and to limit access.

**Barrier.**
A physical obstruction that is intended to prevent contact with equipment or energized electrical conductors and circuit parts.
**Bonded (Bonding).**
Connected to establish electrical continuity and conductivity.

**Bonding Conductor or Jumper.**
A reliable conductor to ensure the required electrical conductivity between metal parts required to be electrically connected.

**Boundary, Arc Flash.**
When an arc flash hazard exists, an approach limit from an arc source at which incident energy equals 1.2 cal/cm$^2$ (5 J/cm$^2$).

**Informational Note:** According to the Stoll skin burn injury model, the onset of a second degree burn on unprotected skin is likely to occur at an exposure of 1.2 cal/cm$^2$ (5 J/cm$^2$) for one second.

**Boundary, Limited Approach.**
An approach limit at a distance from an exposed energized electrical conductor or circuit part within which a shock hazard exists.

6. Performing a function without the necessity of human intervention best describes what listed term?
    a. Controller
    b. Balaclava
    c. Controlled
    d. Automatic

7. What is an arc-rated head-protective fabric that protects the neck and head except for a small portion of the facial area?
    a. Automatic
    b. Balaclava
    c. Barricade
    d. Barrier

8. What is a physical obstruction such as tapes, cones, or A-frame-type wood or metal structures intended to provide a warning and to limit access?
    a. Barrier
    b. Automatic
    c. Balaclava
    d. Barricade

9. What is a physical obstruction that is intended to prevent contact with equipment or energized electrical conductors and circuit parts?
    a. Barrier
    b. Automatic
    c. Balaclava
    d. Barricade
10. According to the_____ , the onset of a second degree burn on unprotected skin is likely to occur at an exposure of 1.2 cal/cm$^2$ (5 J/cm$^2$) for one second.
    a. Stoll skin burn injury model
    b. Skin burn injury model
    c. Stoll burn injury model
    d. Stoll skin burn model

**Boundary, Restricted Approach.**
An approach limit at a distance from an exposed energized electrical conductor or circuit part within which there is an increased likelihood of electric shock, due to electrical arc-over combined with inadvertent movement.

**Building.**
A structure that stands alone or that is cut off from adjoining structures by fire walls with all openings therein protected by approved fire doors.

**Cabinet.**

An enclosure that is designed for either surface mounting or flush mounting and is provided with a frame, mat, or trim in which a swinging door or doors are or can be hung.

**Circuit Breaker.**
A device designed to open and close a circuit by nonautomatic means and to open the circuit automatically on a predetermined overcurrent without damage to itself when properly applied within its rating.

**Informational Note:** The automatic opening means can be integral, direct acting with the circuit breaker, or remote from the circuit breaker.

**Conductive.**
Suitable for carrying electric current.

**Conductor, Bare.**
A conductor having no covering or electrical insulation whatsoever.

**Conductor, Covered.**
A conductor encased within material of composition or thickness that is not recognized by NFPA 70, National Electrical Code, as electrical insulation.

**Conductor, Insulated.**
A conductor encased within material of composition and thickness that is recognized by NFPA 70, National Electrical Code, as electrical insulation.

**Controller.**
A device or group of devices that serves to govern, in some predetermined manner, the electric power delivered to the apparatus to which it is connected.

**Current-Limiting Overcurrent Protective Device.**
A device that, when interrupting currents in its current-limiting range, reduces the current flowing in the faulted circuit to a magnitude substantially less than that obtainable in the same circuit if the device were replaced with a solid conductor having comparable impedance.

11) What is an enclosure that is designed for either surface mounting or flush mounting and is provided with a frame, mat, or trim in which a swinging door or doors are or can be hung÷

A) Closet
B) Container
C) Cabinet
D) Enclosure

12) What is a device designed to open and close a circuit by nonautomatic means and to open the circuit automatically on a predetermined overcurrent without damage to itself when properly applied within its rating?

A) Fuse
B) Circuit Breaker
C) Edison cut out
D) All listed answers

13) What do you call a conductor having no covering or electrical insulation whatsoever?

A) Conductive
B) Conductor, Covered
C) Conductor, Insulated
D) Conductor, Bare

14) What is a conductor encased within material of composition or thickness that is not recognized by NFPA 70, National Electrical Code, as electrical insulation?

A) Conductor, bare
B) Conductor, covered
C) Conductor, insulated
D) Conductive

15) What is a device or group of devices that serves to govern, in some predetermined manner, the electric power delivered to the apparatus to which it is connected?

A) Controller
B) Switch
C) Bypass
D) PLC

**Cutout.**
An assembly of a fuse support with either a fuseholder, fuse carrier, or disconnecting blade. The fuseholder or fuse carrier may include a conducting element (fuse link), or may act as the disconnecting blade by the inclusion of a nonfusible member.

**De-energized.**
Free from any electrical connection to a source of potential difference and from electrical charge; not having a potential different from that of the earth.

**Device.**
A unit of an electrical system, other than a conductor, that carries or controls electric energy as its principal function.

**Disconnecting Means.**
A device, or group of devices, or other means by which the conductors of a circuit can be disconnected from their source of supply.

**Disconnecting (or Isolating) Switch (Disconnector, Isolator).**
A mechanical switching device used for isolating a circuit or equipment from a source of power.

**Dwelling Unit.**
A single unit providing complete and independent living facilities for one or more persons, including permanent provisions for living, sleeping, cooking, and sanitation.

**Electrical Hazard.**
A dangerous condition such that contact or equipment failure can result in electric shock, arc flash burn, thermal burn, or arc blast injury.

**Informational Note:** Class 2 power supplies, listed low voltage lighting systems, and similar sources are examples of circuits or systems that are not considered an electrical hazard.

**Electrical Safety.**
Identifying hazards associated with the use of electrical energy and taking precautions to reduce the risk associated with those hazards.

**Electrical Safety Program.**
A documented system consisting of electrical safety principles, policies, procedures, and processes that directs activities appropriate for the risk associated with electrical hazards.

16) What is free from any electrical connection to a source of potential difference and from electrical charge; not having a potential different from that of the earth known as?

A) Device
B) De-energized
C) Disconnecting Means
D) Current-Limiting Overcurrent Protective Device

17) What is a device, or group of devices, or other means by which the conductors of a circuit can be disconnected from their source of supply?

A) Current-Limiting Overcurrent Protective Device
B) De-energized
C) Device
D) Disconnecting Means

18) What is a dangerous condition such that contact or equipment failure can result in electric shock, arc flash burn, thermal burn, or arc blast injury?

A) Electrical arc
B) Electrical hazard
C) Safety hazard
D) Unsafe hazard

19) A Class 2 power _____ considered an electrical hazard.

A) Is not
B) Is
C) May be
D) No listed answer

20) What is known as identifying hazards associated with the use of electrical energy and taking precautions to reduce the risk associated with those hazards?

A) Electrical arc
B) Electrical Safety
C) Safety hazard
D) Electrical Safety Program

**Electrically Safe Work Condition.**
A state in which an electrical conductor or circuit part has been disconnected from energized parts, locked/tagged in accordance with established standards, tested to verify the absence of voltage, and, if necessary, temporarily grounded for personnel protection.

**Informational Note:** An electrically safe work condition is not a procedure, it is a state wherein all hazardous electrical conductors or circuit parts to which a worker might be exposed are maintained in a de-energized state for the purpose of temporarily eliminating electrical hazards for the period of time for which the state is maintained.

**Enclosed.**
Surrounded by a case, housing, fence, or wall(s) that prevents persons from unintentionally contacting energized parts.

**Enclosure.**
The case or housing of apparatus — or the fence or walls surrounding an installation to prevent personnel from unintentionally contacting energized electrical conductors or circuit parts or to protect the equipment from physical damage.

**Energized.**
Electrically connected to, or is, a source of voltage.
**Equipment.**
A general term, including fittings, devices, appliances, luminaires, apparatus, machinery, and the like, used as a part of, or in connection with, an electrical installation.

**Equipment, Arc-Resistant.**
Equipment designed to withstand the effects of an internal arcing fault and that directs the internally released energy away from the employee.

**Informational Note No. 1:** An example of a standard that provides information for arc-resistant equipment is IEEE C37.20.7, Guide for Testing Switchgear Rated Up to 52 kV for Internal Arcing Faults.

**Informational Note No. 2:** See 0.2.4(9) for information on arc-resistant equipment.

**Exposed (as applied to energized electrical conductors or circuit parts).**
Capable of being inadvertently touched or approached nearer than a safe distance by a person. It is applied to electrical conductors or circuit parts that are not suitably guarded, isolated, or insulated.

**Exposed (as applied to wiring methods).**
On or attached to the surface or behind panels designed to allow access.

**Fault Current.**
The amount of current delivered at a point on the system during a short-circuit condition.

**Fault Current, Available.**
The largest amount of current capable of being delivered at a point on the system during a short-circuit condition.

**Informational Note No. 1:** A short circuit can occur during abnormal conditions such as a fault between circuit conductors or a ground fault. See **Figure 100.0**.

**Informational Note No. 2:** If the dc supply is a battery system, the term available fault current refers to the prospective short-circuit current.

**Informational Note No. 3:** The available fault current varies at different locations within the system due to the location of sources and system impedances.

21) What best defines being surrounded by a case, housing, fence, or wall(s) that prevents persons from unintentionally contacting energized parts?

A) Equipment
B) Enclosure
C) Enclosed
D) Cabinet

22) What best defines something that is electrically connected to, or is, a source of voltage?

A) Hot
B) Energized
C) Live
D) All listed answers

23) What is equipment designed to withstand the effects of an internal arcing fault and that directs the internally released energy away from the employee?

A) Enclosure
B) Equipment
C) Equipment, Arc-Resistant
D) Cabinet

24) What is the amount of current delivered at a point on the system during a short-circuit condition?

A) Short circuit
B) Fault Current, Available
C) Fault Current
D) Short

25) What is the largest amount of current capable of being delivered at a point on the system during a short-circuit condition?

A) Short
B) Fault Current
C) Short circuit
D) Fault Current, Available

**Fitting.**
An accessory such as a locknut, bushing, or other part of a wiring system that is intended primarily to perform a mechanical rather than an electrical function.

**Fuse.**
An overcurrent protective device with a circuit-opening fusible part that is heated and severed by the passage of overcurrent through it.

**Informational Note:** A fuse comprises all the parts that form a unit capable of performing the prescribed functions. It may or may not be the complete device necessary to connect it into an electrical circuit.

**Ground.**
The earth.

**Ground Fault.**
An unintentional, electrically conductive connection between an ungrounded conductor of an electrical circuit and the normally non–current-carrying conductors, metallic enclosures, metallic raceways, metallic equipment, or earth.

**Grounded (Grounding).**
Connected (connecting) to ground or to a conductive body that extends the ground connection.

**Grounded, Solidly.**
Connected to ground without inserting any resistor or impedance device.

**Grounded Conductor.**
A system or circuit conductor that is intentionally grounded.

**Ground-Fault Circuit Interrupter (GFCI).**
A device intended for the protection of personnel that functions to de-energize a circuit or portion thereof within an established period of time when a current to ground exceeds the values established for a Class A device.

**Informational Note:** Class A ground-fault circuit interrupters trip when the current to ground is 6 mA or higher and do not trip when the current to ground is less than 4 mA. For further information, see ANSI/UL 943, Standard for Ground-Fault Circuit Interrupters.

**Grounding Conductor, Equipment (EGC).**
The conductive path(s) that provides a ground-fault current path and connects normally non–current-carrying metal parts of equipment together and to the system grounded conductor or to the grounding electrode conductor, or both.

**Informational Note No. 1:** It is recognized that the equipment grounding conductor also performs bonding.

**Informational Note No. 2:** See 250.118 of *NFPA 70*, *National Electrical Code*, for a list of acceptable equipment grounding conductors.

26) What is an overcurrent protective device with a circuit-opening fusible part that is heated and severed by the passage of overcurrent through it?

A) Circuit breaker
B) Breaker
C) Fuse
D) Overload

27) What is an unintentional, electrically conductive connection between an ungrounded conductor of an electrical circuit and the normally non–current-carrying conductors, metallic enclosures, metallic raceways, metallic equipment, or earth?

A) Current fault
B) Short circuit
C) Fault current
D) Ground fault

28) What best defines connected to ground without inserting any resistor or impedance device.?

A) Grounded, Solidly
B) Grounded (Grounding)
C) Grounded Conductor
D) Grounding Conductor, Equipment (EGC)

29) What is a device intended for the protection of personnel that functions to de-energize a circuit or portion thereof within an established period of time when a current to ground exceeds the values established for a Class A device?

A) Grounded (Grounding)
B) Ground-Fault Circuit Interrupter (GFCI)
C) Arc Fault Circuit Interrupter (AFCI)
D) Grounding Conductor, Equipment (EGC)

30) At what current to ground will a Class A ground-fault circuit interrupter trip?

A) 3 mA
B) 5 mA
C) 4 mA
D) 6 mA

**Grounding Electrode.**
A conducting object through which a direct connection to earth is established.

**Grounding Electrode Conductor.**
A conductor used to connect the system grounded conductor or the equipment to a grounding electrode or to a point on the grounding electrode system.

**Guarded.**
Covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats, or platforms to remove the likelihood of approach or contact by persons or objects to a point of danger.

**Hazard.**
A source of possible injury or damage to health.

**Incident Energy.**
The amount of thermal energy impressed on a surface, a certain distance from the source, generated during an electrical arc event. Incident energy is typically expressed in calories per square centimeter (cal/cm$^2$).

**Incident Energy Analysis.**
A component of an arc flash risk assessment used to predict the incident energy of an arc flash for a specified set of conditions.

**Insulated.**
Separated from other conducting surfaces by a dielectric (including air space) offering a high resistance to the passage of current.

**Informational Note:** When an object is said to be insulated, it is understood to be insulated for the conditions to which it is normally subject. Otherwise, it is, within the purpose of these rules, uninsulated.

**Interrupter Switch.**
A switch capable of making, carrying, and interrupting specified currents.

**Interrupting Rating.**
The highest current at rated voltage that a device is identified to interrupt under standard test conditions.

**Informational Note:** Equipment intended to interrupt current at other than fault levels may have its interrupting rating implied in other ratings, such as horsepower or locked rotor current.

**Isolated (as applied to location).**
Not readily accessible to persons unless special means for access are used.

31) What is a conducting object through which a direct connection to earth is established?

A) Grounding Electrode
B) Grounding Conductor, Equipment (EGC)
C) Grounding Electrode Conductor
D) Ground-Fault Circuit Interrupter (GFCI)

32) What best defines something that is covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats, or platforms to remove the likelihood of approach or contact by persons or objects to a point of danger?

A) Shielded
B) Guarded
C) Fenced
D) Protected

33) What best defines a source of possible injury or damage to health?

A) Dangerous
B) Hazard
C) Current
D) Wattage

34) What is the amount of thermal energy impressed on a surface, a certain distance from the source, generated during an electrical arc event known as?

A) Energy
B) Incident Energy Analysis
C) Incident Energy
D) Potential

35) What is a switch capable of making, carrying, and interrupting specified currents?

A) Material Interrupting Rating
B) Interrupting Rating
C) Material Rating
D) Interrupter Switch

**Labeled.**
Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

**Listed.**
Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

**Informational Note:** The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

**Luminaire.**
A complete lighting unit consisting of a light source, such as a lamp or lamps, together with the parts designed to position the light source and connect it to

the power supply. It may also include parts to protect the light source or the ballast or to distribute the light. A lampholder itself is not a luminaire.

**Maintenance, Condition of.**
The state of the electrical equipment considering the manufacturers' instructions, manufacturers' recommendations, and applicable industry codes, standards, and recommended practices.

**Motor Control Center.**
An assembly of one or more enclosed sections having a common power bus and principally containing motor control units.

**Outlet.**
A point on the wiring system at which current is taken to supply utilization equipment.

**Overcurrent.**
Any current in excess of the rated current of equipment or the ampacity of a conductor. It may result from overload, short circuit, or ground fault.

**Informational Note:** A current in excess of rating may be accommodated by certain equipment and conductors for a given set of conditions. Therefore, the rules for overcurrent protection are specific for particular situations.

**Overload.**
Operation of equipment in excess of normal, full-load rating, or of a conductor in excess of rated ampacity that, when it persists for a sufficient length of time, would cause damage or dangerous overheating. A fault, such as a short circuit or ground fault, is not an overload.

**Panelboard.**
A single panel or group of panel units designed for assembly in the form of a single panel, including buses and automatic overcurrent devices, and equipped with or without switches for the control of light, heat, or power circuits; designed to be placed in a cabinet or cutout box placed in or against a wall, partition, or other support; and accessible only from the front.

**Premises Wiring (System).**
Interior and exterior wiring, including power, lighting, control, and signal circuit wiring together with all their associated hardware, fittings, and wiring devices, both permanently and temporarily installed. This includes: (a) wiring from the service point or power source to the outlets; or (b) wiring from and including the power source to the outlets where there is no service point. Such wiring does not include wiring internal to appliances, luminaires, motors, controllers, motor control centers, and similar equipment.

**Informational Note:** Power sources include, but are not limited to, interconnected or stand-alone batteries, solar photovoltaic systems, other distributed generation systems, or generators.

36) What is a complete lighting unit consisting of a light source, such as a lamp or lamps, together with the parts designed to position the light source and connect it to the power supply?

A) Assembly
B) Lighting unit
C) Luminaire
D) Light emitting diode

37) What listed term best describes the state of the electrical equipment considering the manufacturers' instructions, manufacturers' recommendations, and applicable industry codes, standards, and recommended practices?

A) Maintenance records
B) Maintenance, Condition of
C) Manufacturer's instructions
D) Specification manual

38) What is an assembly of one or more enclosed sections having a common power bus and principally containing motor control units?

A) Motor control center
B) Motor control assembly
C) Motor center
D) Assembly motor center

39) What term best describes a point on the wiring system at which current is taken to supply utilization equipment?

A) Receptacle
B) Outlet
C) Plug
D) All listed answers

40) What is current in excess of the rated current of equipment or the ampacity of a conductor?

A) Overcurrent
B) Overload
C) Over voltage
D) Short circuit

**Qualified Person.**
One who has demonstrated skills and knowledge related to the construction and operation of electrical equipment and installations and has received safety training to identify the hazards and reduce the associated risk.

**Raceway.**
An enclosed channel of metal or nonmetallic materials designed expressly for holding wires, cables, or busbars, with additional functions as permitted in this standard.

**Hazardous.**
Involving exposure to at least one hazard.

**Receptacle.**
A contact device installed at the outlet for the connection of an attachment plug, or for the direct connection of electrical utilization equipment designed to mate with the corresponding contact device. A single receptacle is a single contact device with no other contact device on the same yoke. A multiple receptacle is two or more contact devices on the same yoke.

**Risk.**
A combination of the likelihood of occurrence of injury or damage to health and the severity of injury or damage to health that results from a hazard.

**Risk Assessment.**
An overall process that identifies hazards, estimates the likelihood of occurrence of injury or damage to health, estimates the potential severity of injury or damage to health, and determines if protective measures are required.

**Informational Note:** As used in this standard, arc flash risk assessment and shock risk assessment are types of risk assessments.

**Service Drop.**
The overhead conductors between the utility electric supply system and the service point.

**Service Lateral.**
The underground conductors between the utility electric supply system and the service point.

**Service Point.**
The point of connection between the facilities of the serving utility and the premises wiring.

**Informational Note:** The service point can be described as the point of demarcation between where the serving utility ends and the premises wiring begins. The serving utility generally specifies the location of the service point based on the conditions of service.

**Shock Hazard.**
A source of possible injury or damage to health associated with current through the body caused by contact or approach to exposed energized electrical conductors or circuit parts.

**Informational Note:** Injury and damage to health resulting from shock is dependent on the magnitude of the electrical current, the power source frequency (e.g., 60 Hz, 50 Hz, dc), and the path and time duration of current through the body. The physiological reaction ranges from perception, muscular contractions, inability to let go, ventricular fibrillation, tissue burns, and death.

41) What best defines a person who has demonstrated skills and knowledge related to the construction and operation of electrical equipment and installations and has received safety training to identify the hazards and reduce the associated risk?

A) Qualified Person
B) AHJ
C) Building official
D) All listed answers

42) What is a contact device installed at the outlet for the connection of an attachment plug, or for the direct connection of electrical utilization equipment designed to mate with the corresponding contact device?

A) Outlet
B) Raceway
C) Cable tray
D) Receptacle

43) What is a combination and likelihood of occurrence for injury or damage to health and the severity of injury or damage to health that results from a hazard?

A) Risk analysis
B) Risk assessment
C) Risk
D) Hazard

44) What are the overhead conductors between the utility electric supply system and the service point called?

A) Service Lateral
B) Service Drop
C) Service Point
D) All listed answers

45) What is a source of possible injury or damage to health associated with current through the body caused by contact or approach to exposed energized electrical conductors or circuit parts called?

A) Hazardous
B) Hazard
C) Shock Hazard
D) Potential release

**Short-Circuit Current Rating.**
The prospective symmetrical fault current at a nominal voltage to which an apparatus or system is able to be connected without sustaining damage exceeding defined acceptance criteria.

**Single-Line Diagram.**
A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used in the circuit or system.

**Special Permission.**
The written consent of the authority having jurisdiction.

**Step Potential.**
A ground potential gradient difference that can cause current flow from foot to foot through the body.

**Structure.**
That which is built or constructed.

**Switch, Isolating.**
A switch intended for isolating an electric circuit from the source of power. It has no interrupting rating, and it is intended to be operated only after the circuit has been opened by some other means.

**Switchboard.**
A large single panel, frame, or assembly of panels on which are mounted on the face, back, or both, switches, overcurrent and other protective devices, buses, and usually instruments. These assemblies are generally accessible from the rear as well as from the front and are not intended to be installed in cabinets.

**Switchgear, Metal-Clad.**
A switchgear assembly completely enclosed on all sides and top with sheet metal, having drawout switching and interrupting devices, and all live parts enclosed within grounded metal compartments.

**Switchgear, Metal-Enclosed.**
A switchgear assembly completely enclosed on all sides and top with sheet metal (except for ventilating openings and inspection windows), containing primary power circuit switching, interrupting devices, or both, with buses and connections. This assembly may include control and auxiliary devices. Access

to the interior of the enclosure is provided by doors, removable covers, or both. Metal-enclosed switchgear is available in non-arc-resistant or arc-resistant constructions.

**Switching Device.**
A device designed to close, open, or both, one or more electric circuits.

**Touch Potential.**
A ground potential gradient difference that can cause current flow from hand to hand, hand to foot, or another path, other than foot to foot, through the body.

**Ungrounded.**
Not connected to ground or to a conductive body that extends the ground connection.

**Unqualified Person.**
A person who is not a qualified person.

**Utilization Equipment.**
Equipment that utilizes electric energy for electronic, electromechanical, chemical, heating, lighting, or similar purposes.

46) What is the written consent of the authority having jurisdiction known as?

A) Special Permission
B) Permission
C) Special inspection
D) Inspection

47) What is a ground potential gradient difference that can cause current flow from foot to foot through the body?

A) Hazard
B) Potential
C) Step Potential
D) Arc hazard

48) What term best defines that which is built or constructed?

A) Multi family dwelling
B) Building
C) Single family dwelling
D) Structure

49) What type of assemblies are generally accessible from the rear as well as from the front and are not intended to be installed in cabinets?

A) Panelboard
B) Switchboard
C) Disconnect
D) Switchgear, Metal-Clad

50) What is a device designed to close, open, or both, one or more electric circuits?

A) Disconnect
B) Switchboard
C) Panelboard
D) Switching Device

## Section 2: NFPA 70e Chapters 1,2, and 3

### 105.1 Scope.
Chapter **1** covers electrical safety-related work practices and procedures for employees who are exposed to an electrical hazard in workplaces covered in the scope of this standard.

### 105.2 Purpose.
These practices and procedures are intended to provide for employee safety relative to electrical hazards in the workplace.

**Informational Note:** For general categories of electrical hazards, see Informative Annex K.

### 105.3 Responsibility.
**(A) Employer Responsibility.**
The employer shall have the following responsibilities:
(1) Establish, document, and implement the safety-related work practices and procedures required by this standard.
(2) Provide employees with training in the employer's safety-related work practices and procedures.

**(B) Employee Responsibility.**
The employee shall comply with the safety-related work practices and procedures provided by the employer.

### 105.5 Organization.
Chapter **1** of this standard is divided into five articles. Article **100** provides definitions for terms used in one or more of the chapters of this document. Article **105** provides for application of safety-related work practices and procedures. Article **110** provides general requirements for electrical safety-related work practices and procedures. Article **120** provides requirements for establishing an electrically safe work condition. Article **130** provides requirements for work involving electrical hazards.

51) Whose responsibility is it to provide employees with training in the employer's safety-related work practices and procedures and establish, document, and implement the safety-related work practices and procedures required by this standard?

A) Site management company
B) Employee Responsibility
C) Employer Responsibility
D) The hazard specific entity

52) How many articles is chapter 1 divided into?

A) 5
B) 4
C) 6
D) 7

53) What Article provides for application of safety-related work practices and procedures?

A) 110
B) 100
C) 105
D) 120

**110.1 Priority.**
Hazard elimination shall be the first priority in the implementation of safety-related work practices.

**Informational Note No. 1:** Elimination is the risk control method listed first in the hierarchy of risk control identified in 110.5(H)(3). See Annex F for examples of hazard elimination.

**Informational Note No. 2:** An electrically safe work condition is a state wherein all hazardous electrical conductors or circuit parts to which a worker might be exposed are placed and maintained in a de-energized state, for the purpose of temporarily eliminating electrical hazards. See Article 120 for requirements to establish an electrically safe work condition for the period of

time for which the state is maintained. See Informative Annex F for information regarding the hierarchy of risk control and hazard elimination.

**110.2 General.**
Electrical conductors and circuit parts shall not be considered to be in an electrically safe work condition until all of the requirements of Article **120** have been met.

Safe work practices applicable to the circuit voltage and energy level shall be used in accordance with Article 110 and Article 130 until such time that electrical conductors and circuit parts are in an electrically safe work condition.

**Informational Note:** See **120.5** for the steps to establish and verify an electrically safe work condition.

**110.3 Electrically Safe Work Condition.**
Energized electrical conductors and circuit parts operating at voltages equal to or greater than 50 volts shall be put into an electrically safe work condition before an employee performs work if any of the following conditions exist:

(1) The employee is within the limited approach boundary.
(2) The employee interacts with equipment where conductors or circuit parts are not exposed but an increased likelihood of injury from an exposure to an arc flash hazard exists.

**110.4 Energized Work.**

**(A) Additional Hazards or Increased Risk.**
Energized work shall be permitted where the employer can demonstrate that de-energizing introduces additional hazards or increased risk.

**Informational Note:** Examples of additional hazards or increased risk include, but are not limited to, interruption of life-support equipment, deactivation of emergency alarm systems, and shutdown of hazardous location ventilation equipment.

**(B) Infeasibility.**
Energized work shall be permitted where the employer can demonstrate that the task to be performed is infeasible in a de-energized state due to equipment design or operational limitations.

**Informational Note:** Examples of work that might be performed within the limited approach boundary of exposed energized electrical conductors or circuit parts because of infeasibility due to equipment design or operational limitations include performing diagnostics and testing (for example, start-up or troubleshooting) of electric circuits that can only be performed with the circuit energized and work on circuits that form an integral part of a continuous process that would otherwise need to be completely shut down in order to permit work on one circuit or piece of equipment.

**(C) Equipment Operating at Less Than 50 Volts.**
Energized electrical conductors and circuit parts that operate at less than 50 volts shall not be required to be de-energized where the capacity of the source and any overcurrent protection between the energy source and the worker are considered and it is determined that there will be no increased exposure to electrical burns or to explosion due to electric arcs.

**(D) Normal Operating Condition.**
Normal operation of electric equipment shall be permitted where a normal operating condition exists. A normal operating condition exists when all of the following conditions are satisfied:

(1) The equipment is properly installed.
(2) The equipment is properly maintained.
(3) The equipment is used in accordance with instructions included in the listing and labeling and in accordance with manufacturer's instructions.
(4) The equipment doors are closed and secured.
(5) All equipment covers are in place and secured.
(6) There is no evidence of impending failure.

**Informational Note:** The phrase properly installed means that the equipment is installed in accordance with applicable industry codes and standards and the manufacturer's recommendations. The phrase properly maintained means that the equipment has been maintained in accordance with the manufacturer's recommendations and applicable industry codes and

standards. The phrase evidence of impending failure means that there is evidence such as arcing, overheating, loose or bound equipment parts, visible damage, or deterioration.

54) What is the first priority in the implementation of safety-related work practices?

A) A note pad
B) Hazard elimination
C) PPE
D) Job analysis data sheet

55) At what voltage are energized electrical conductors and circuits required to be put in an electrically safe working condition when an employee is within a limited approach boundary?

A) 12 volts and above
B) 50 volts and above
C) 24 volts and above
D) 36 volts and above

56) In general, at what voltage do conductors not need to be de-energized to perform work on the system?

A) 50 volts or less
B) 49 volts or less
C) 51 volts or less
D) 60 volts or less

**110.5 Electrical Safety Program.**
**(A) General.**
The employer shall implement and document an overall electrical safety program that directs activity appropriate to the risk associated with electrical hazards.

**Informational Note No. 1:** Safety-related work practices such as verification of proper maintenance and installation, alerting techniques, auditing

requirements, and training requirements provided in this standard are administrative controls and part of an overall electrical safety program.

**Informational Note No. 2:** See Informative Annex P for information on implementing an electrical safety program within an employer's occupational health and safety management system.

**Informational Note No. 3:** IEEE 3007.1, Recommended Practice for the Operation and Management of Industrial and Commercial Power Systems, provides additional guidance for the implementation of the electrical safety program.

**Informational Note No. 4:** IEEE 3007.3, Recommended Practice for Electrical Safety in Industrial and Commercial Power Systems, provides additional guidance for electrical safety in the workplace.

**(B) Inspection.**
The electrical safety program shall include elements to verify that newly installed or modified electrical equipment or systems have been inspected to comply with applicable installation codes and standards prior to being placed into service.

**(D) Awareness and Self-Discipline.**
The electrical safety program shall be designed to provide an awareness of the potential electrical hazards to employees who work in an environment with the presence of electrical hazards. The program shall be developed to provide the required self-discipline for all employees who must perform work that may involve electrical hazards. The program shall instill safety principles and controls.

**(E) Electrical Safety Program Principles.**
The electrical safety program shall identify the principles upon which it is based.

**Informational Note:** For examples of typical electrical safety program principles, see Informative Annex E.

**(1) Elements of a Risk Assessment Procedure.**
The risk assessment procedure shall address employee exposure to electrical hazards and shall identify the process to be used before work is started to carry out the following:
(1) Identify hazards
(2) Assess risks
(3) Implement risk control according to the hierarchy of risk control methods

**Informational Note No. 1:** The risk assessment procedure could include identifying when a second person could be required and the training and equipment that person should have.

**Informational Note No. 2:** For more information regarding risk assessment and the hierarchy of risk control, see Informative Annex F.

**(2) Human Error.**
The risk assessment procedure shall address the potential for human error and its negative consequences on people, processes, the work environment, and equipment relative to the electrical hazards in the workplace.

**Informational Note:** The potential for human error varies with factors such as tasks and the work environment. See Informative Annex Q.

**(3) Hierarchy of Risk Control Methods.**
The risk assessment procedure shall require that preventive and protective risk control methods be implemented in accordance with the following hierarchy:
(1) Elimination
(2) Substitution
(3) Engineering controls
(4) Awareness
(5) Administrative controls
(6) PPE

**Informational Note No. 1:** Elimination, substitution, and engineering controls are the most effective methods to reduce risk as they are usually applied at the source of possible injury or damage to health and they are less likely to be affected by human error. Awareness, administrative controls, and

PPE are the least effective methods to reduce risk as they are not applied at the source and they are more likely to be affected by human error.

**Informational Note No. 2:** See Informative Annex F for more information regarding the hierarchy of risk control methods and examples of those methods.

57) Who is responsible to implement and document an overall electrical safety program that directs activity appropriate to the risk associated with electrical hazards?

A) Employer
B) Employee
C) Owner
D) Construction management company

58) An electrical safety program shall be developed to provide the required _____ for all employees who must perform work that may involve electrical hazards.

A) Procedures
B) Self-discipline
C) Steps
D) Items

59) What Informative Annex has information regarding risk assessment and the hierarchy of risk control?

A) E
B) F
C) Q
D) B

A) **Job Safety Planning and Job Briefing.**
Before starting each job that involves exposure to electrical hazards, the employee in charge shall complete a job safety plan and conduct a job briefing with the employees involved.

(1) Job Safety Planning.
The job safety plan shall be in accordance with the following:
(1) Be completed by a qualified person
(2) Be documented
(3) Include the following information:
a. A description of the job and the individual tasks
b. Identification of the electrical hazards associated with each task
c. A shock risk assessment in accordance with 130.4 for tasks involving a shock hazard
d. An arc flash risk assessment in accordance with 130.5 for tasks involving an arc flash hazard
e. Work procedures involved, special precautions, and energy source controls

**(2) Job Briefing.**
The job briefing shall cover the job safety plan and the information on the energized electrical work permit, if a permit is required.

**(3) Change in Scope.**
Additional job safety planning and job briefings shall be held if changes occur during the course of the work that might affect the safety of employees.

**(J) Incident Investigations.**
The electrical safety program shall include elements to investigate electrical incidents.

**Informational Note:** Electrical incidents include events or occurrences that result in, or could have resulted in, a fatality, an injury, or damage to health. Incidents that do not result in fatality, injury, or damage to health are commonly referred to as a "close call" or "near miss."

**(K) Electrically Safe Work Condition Policy.**
An electrical safety program shall include an electrically safe work condition policy that complies with **110.3**.

**(L) Lockout/Tagout Program.**
The electrical safety program shall include the information required by one of the following:
(1) A lockout/tagout program in accordance with **120.1(A)**
(2) A reference to the employer's lockout/tagout program established in accordance with **120.1(A)**

**(M) Auditing.**
**(1) Electrical Safety Program Audit.**
The electrical safety program shall be audited to verify that the principles and procedures of the electrical safety program are in compliance with this standard. Audits shall be performed at intervals not to exceed 3 years.

**(2) Field Work Audit.**
Field work shall be audited to verify that the requirements contained in the procedures of the electrical safety program are being followed. When the auditing determines that the principles and procedures of the electrical safety program are not being followed, the appropriate revisions to the training program or revisions to the procedures shall be made. Audits shall be performed at intervals not to exceed 1 year.

**(3) Lockout/Tagout Program and Procedure Audit.**
The lockout/tagout program and procedures required by Article **120** shall be audited by a qualified person at intervals not to exceed 1 year. The audit shall cover at least one lockout/tagout in progress. The audit shall be designed to identify and correct deficiencies in the following:
(1) The lockout/tagout program and procedures
(2) The lockout/tagout training
(3) Worker execution of the lockout/tagout procedure

**(4) Documentation.**
The audits required by **110.5(M)** shall be documented.

60) Before starting each job that involves exposure to electrical hazards, what is the person in charge required to complete?

A) A job safety plan and conduct a job briefing with the employees involved
B) Lock out tag out
C) Provide a lock box
D) All listed answers

61) What is the maximum period allowed before auditing your electrical safety program?

A) 3 months
B) 3 years
C) 6 years
D) 1 year

62) What is the maximum period allowed before doing a field audit?

A) 6 years
B) 3 months
C) 1 year
D) 3 years

**110.6 Training Requirements.**
**(A) Electrical Safety Training.**
The training requirements contained in **110.6(A)** shall apply to employees exposed to an electrical hazard when the risk associated with that hazard is not reduced to a safe level by the applicable electrical installation requirements. Such employees shall be trained to understand the specific hazards associated with electrical energy. They shall be trained in safety-related work practices and procedural requirements, as necessary, to provide protection from the electrical hazards associated with their respective job or task assignments. Employees shall be trained to identify and understand the relationship between electrical hazards and possible injury.

**Informational Note:** For further information concerning installation requirements, see NFPA 70, National Electrical Code.

**(1) Qualified Person.**

A qualified person shall be trained and knowledgeable in the construction and operation of equipment or a specific work method and be trained to identify and avoid the electrical hazards that might be present with respect to that equipment or work method.

(a) Such persons shall also be familiar with the proper use of the special precautionary techniques, applicable electrical policies and procedures, PPE, insulating and shielding materials, and insulated tools and test equipment.

(b) A person can be considered qualified with respect to certain equipment and tasks but still be unqualified for others.

(c) Such persons permitted to work within the limited approach boundary shall, at a minimum, be additionally trained in all of the following:

(1) Skills and techniques necessary to distinguish exposed energized electrical conductors and circuit parts from other parts of electrical equipment

(2) Skills and techniques necessary to determine the nominal voltage of exposed energized electrical conductors and circuit parts

(3) Approach distances specified in Table 130.4(E)(a) and Table 130.4(E)(b) and the corresponding voltages to which the qualified person will be exposed

(4) Decision-making process necessary to be able to do the following:

a. Perform the job safety planning

b. Identify electrical hazards

c. Assess the associated risk

d. Select the appropriate risk control methods from the hierarchy of controls identified in 110.5(H)(3), including PPE

(d) An employee who is undergoing on-the-job training for the purpose of obtaining the skills and knowledge necessary to be considered a qualified person, and who in the course of such training demonstrates an ability to perform specific duties safely at his or her level of training, and who is under the direct supervision of a qualified person shall be considered to be a qualified person for the performance of those specific duties.

(e) Employees shall be trained to select an appropriate test instrument and shall demonstrate how to use a device to verify the absence of voltage, including interpreting indications provided by the device. The training shall include information that enables the employee to understand all limitations of each test instrument that might be used.

(f) The employer shall determine through regular supervision or through inspections conducted on at least an annual basis that each employee is complying with the safety-related work practices required by this standard.

**(2) Unqualified Persons.**
Unqualified persons shall be trained in, and be familiar with, any electrical safety-related practices necessary for their safety.

**(3) Additional Training and Retraining.**
Additional training and retraining in safety-related work practices and applicable changes in this standard shall be performed at intervals not to exceed 3 years. An employee shall receive additional training or retraining if any of the following conditions exists:
(1) The supervision or annual inspections indicate the employee is not complying with the safety-related work practices.
(2) New technology, new types of equipment, or changes in procedures necessitate the use of safety-related work practices different from those that the employee would normally use.
(3) The employee needs to review tasks that are performed less often than once per year.
(4) The employee needs to review safety-related work practices not normally used by the employee during regular job duties.
(5) The employee's job duties change.

63) What section has the training requirements that apply to employees exposed to an electrical hazard when the risk associated with that hazard is not reduced to a safe level by the applicable electrical installation requirements?

A) 110.6(A)
B) 110.5(M)
C) 120
D) 120.5

64) What is the maximum period allowed before employees require additional training and retraining in safety-related work practices?

A) 3 months
B) 3 years
C) 6 years
D) 1 year

**(4) Type of Training.**
The training required by 110.6(A) shall be classroom, on-the-job, or a combination of the two. The type and extent of the training provided shall be determined by the risk to the employee.

**Informational Note:** Classroom training can include interactive electronic or interactive web-based training components.

**(5) Electrical Safety Training Documentation.**
The employer shall document that each employee has received the training required by **110.6(A)**. This documentation shall be in accordance with the following:

(1) Be made when the employee demonstrates proficiency in the work practices involved
(2) Be retained for the duration of the employee's employment
(3) Contain the content of the training, each employee's name, and dates of training

**Informational Note No. 1:** Content of the training could include one or more of the following: course syllabus, course curriculum, outline, table of contents, or training objectives.

**Informational Note No. 2:** Employment records that indicate that an employee has received the required training are an acceptable means of meeting this requirement.

**(B) Lockout/Tagout Procedure Training.**

**(1) Initial Training.**

Employees involved in the lockout/tagout procedures required by 120.2(B) shall be trained in the following:

(1) The lockout/tagout procedures

(2) Their responsibility in the execution of the procedures

**(2) Retraining.**

Retraining in the lockout/tagout procedures shall be performed as follows:

(1) When the procedures are revised

(2) At intervals not to exceed 3 years

(3) When supervision or annual inspections indicate that the employee is not complying with the lockout/tagout procedures

**(3) Lockout/Tagout Training Documentation.**

(a) The employer shall document that each employee has received the training required by **110.6(B)**.

(b) The documentation shall be made when the employee demonstrates proficiency in the work practices involved.

(c) The documentation shall contain the content of the training, each employee's name, and the dates of the training.

Informational Note:

Content of the training could include one or more of the following: course syllabus, course curriculum, outline, table of contents, or training objectives.

**(C) Emergency Response Training.**

**(1) Contact Release.**

Employees exposed to shock hazards and those responsible for the safe release of victims from contact with energized electrical conductors or circuit parts shall be trained in methods of safe release. Refresher training shall occur annually.

**(2) First Aid, Emergency Response, and Resuscitation.**

(a) Employees responsible for responding to medical emergencies shall be trained in first aid and emergency procedures.

(b) Employees responsible for responding to medical emergencies shall be trained in cardiopulmonary resuscitation (CPR).

(c) Employees responsible for responding to medical emergencies shall be trained in the use of an automated external defibrillator (AED) if an employer's emergency response plan includes the use of this device.
(d) Training shall occur at a frequency that satisfies the requirements of the certifying body.

**Informational Note:** Employees responsible for responding to medical emergencies might not be first responders or medical professionals. Such employees could be a second person, a safety watch, or a craftsperson.

65) Who is responsible for documenting that the required training in 110.6(A) for each employee has been done?

A) supervisor
B) Foreman
C) Employer
D) Qualified person

66) After you have been trained on lockout/tagout procedures, when is supplemental training required?

A) When supervision or annual inspections indicate that the employee is not complying with the lockout/tagout procedures
B) When the procedures are revised
C) At intervals not to exceed 3 years
D) All listed answers

67) How often is refresher training required to occur for those responsible in the safe release of victims from contact with energized electrical conductors or circuit parts?

A) Annually
B) At intervals not to exceed 3 years
C) When the procedures are revised
D) All listed answers

**(3) Training Verification.**
Employers shall verify at least annually that employee training required by **110.6(C)** is current.

**(4) Documentation.**
The employer shall document that the training required by **110.6(C)** has occurred.

**110.8 Test Instruments and Equipment.**
**(A) Testing.**

Only qualified persons shall perform tasks such as testing, troubleshooting, and voltage measuring on electrical equipment where an electrical hazard exists.

**(B) Rating.**
Test instruments, equipment, and their accessories shall be as follows:
(1) Rated for circuits and equipment where they are utilized
(2) Approved for the purpose
(3) Used in accordance with any instructions provided by the manufacturer
**Informational Note:** See UL 61010-1, Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements, for rating and design requirements for voltage measurement and test instruments intended for use on electrical systems 1000 volts and below and UL 61010-2-033, Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use — Part 2-033: Particular Requirements for Hand-Held Multimeters and Other Meters, for Domestic and Professional use, Capable of Measuring Mains Voltage.

**(C) Design.**
Test instruments, equipment, and their accessories shall be designed for the environment to which they will be exposed and for the manner in which they will be utilized.

**(D) Visual Inspection and Repair.**
Test instruments and equipment and all associated test leads, cables, power cords, probes, and connectors shall be visually inspected for external defects and damage before each use. If there is a defect or evidence of damage that might expose an employee to injury, the defective or damaged item shall be

removed from service. No employee shall use it until a person(s) qualified to perform the repairs and tests that are necessary to render the equipment safe has done so.

### 110.9 Portable Cord- and-Plug-Connected Electric Equipment.

This section applies to the use of cord- and plug-connected equipment, including cord- and plug-connected test instruments and cord sets (extension cords).

#### (A) Handling and Storage.

Portable equipment shall be handled and stored in a manner that will not cause damage. Flexible electric cords connected to equipment shall not be used for raising or lowering the equipment. Flexible cords shall not be fastened with staples or hung in such a fashion as could damage the outer jacket or insulation.

#### (B) Grounding-Type Equipment.

(a) A flexible cord used with grounding-type utilization equipment shall contain an equipment grounding conductor.
(b) Attachment plugs and receptacles shall not be connected or altered in a manner that would interrupt continuity of the equipment grounding conductor. Additionally, these devices shall not be altered in order to allow use in a manner that was not intended by the manufacturer.
(c) Adapters that interrupt the continuity of the equipment grounding conductor shall not be used.

#### (D) Conductive or Wet Work Locations.

Portable cord-and-plug-connected electric equipment used in conductive or wet work locations shall be approved for use in those locations. In work locations where employees are likely to contact or be drenched with water or conductive liquids, ground-fault circuit-interrupter protection for personnel shall be used.
**Informational Note:** The risk assessment procedure can also include identifying when the use of portable tools and equipment powered by sources other than 120 volts ac, such as batteries, air, and hydraulics, should be used to minimize the potential for injury from electrical hazards for tasks performed in conductive or wet locations.

68) How often is refresher training required to be verified by the employer as required by 110.6(C)?

A) When the procedures are revised
B) At intervals not to exceed 3 years
C) Annually
D) All listed answers

69) What are you required to do If there is a defect or evidence of damage that might expose an employee to injury with regards to electrical testing equipment?

A) Plug it in to see if it arcs
B) Repair it immediately
C) Replace it immediately
D) Remove it from service

70) What is a flexible cord used with grounding-type utilization equipment required to contain?

A) Grounding electrode conductor
B) A twisted shielded pair
C) Stranded conductors
D) An equipment grounding conductor

**(E) Connecting Attachment Plugs.**
(a) Employees' hands shall not be wet when plugging and unplugging flexible cords and cord- and plug-connected equipment if energized equipment is involved.
(b) Energized plug and receptacle connections shall be handled only with insulating protective equipment if the condition of the connection could provide a conductive path to the employee's hand (e.g, if a cord connector is wet from being immersed in water).
(c) Locking-type connectors shall be secured after connection.

**(F) Manufacturer's Instructions.**
Portable equipment shall be used in accordance with the manufacturer's instructions and safety warnings.

**110.10 Ground-Fault Circuit-Interrupter (GFCI) Protection.**

**(A) General.**

Employees shall be provided with ground-fault circuit-interrupter (GFCI) protection where required by applicable state, federal, or local codes and standards. Listed cord sets or devices incorporating listed GFCI protection for personnel identified for portable use shall be permitted.

**(B) Maintenance and Construction.**

GFCI protection shall be provided where an employee is operating or using cord sets (extension cords) or cord- and plug-connected tools related to maintenance and construction activity supplied by 125-volt, 15-, 20-, or 30-ampere circuits. Where employees operate or use equipment supplied by greater than 125-volt, 15-, 20-, or 30-ampere circuits, GFCI protection or an assured equipment grounding conductor program shall be implemented.

**Informational Note:** Where an assured equipment grounding conductor program is used, a special purpose ground-fault circuit interrupter may provide additional protection. See Informative Annex O.

**(C) Outdoors.**

GFCI protection shall be provided when an employee is outdoors and operating or using cord sets (extension cords) or cord- and plug-connected equipment supplied by 125-volt, 15-, 20-, or 30-ampere circuits. Where employees working outdoors operate or use equipment supplied by greater than 125-volt, 15-, 20-, or 30-ampere circuits, GFCI protection or an assured equipment grounding conductor program shall be implemented.

**Informational Note:** Where an assured equipment grounding conductor program is used, a special purpose ground-fault circuit interrupter may provide additional protection. See Informative Annex O.

**(D) Testing Ground-Fault Circuit-Interrupter Protection Devices.**

GFCI protection devices shall be tested in accordance with the manufacturer's instructions.

**110.11 Overcurrent Protection Modification.**
Overcurrent protection of circuits and conductors shall not be modified, even on a temporary basis, beyond what is permitted by applicable portions of electrical codes and standards dealing with overcurrent protection.

**Informational Note:** For further information concerning electrical codes and standards dealing with overcurrent protection, refer to Article 240 of NFPA 70, National Electrical Code.

71) How is portable equipment required to be used in accordance with?

A) Local codes
B) Manufacturer's instructions and safety warnings
C) Section 139(C)
D) All listed answers

72) What Informative annex has information for an assured equipment grounding conductor program when used and where a special purpose ground-fault circuit interrupter may provide additional protection?

A) Informative Annex F
B) Informative Annex D
C) Informative Annex O
D) Informative Annex G

73) How are GFCI protection devices required to be tested in accordance with?

A) Manufacturer's instructions
B) Local codes
C) Section 139(C)
D) All listed answers

**200.1 Scope.**
Chapter **2** addresses the requirements that follow.
(1) Chapter **2** covers practical safety-related maintenance requirements for electrical equipment and installations in workplaces as included in **90.2**. These requirements identify only that maintenance directly associated with employee safety.
(2) Chapter **2** does not prescribe specific maintenance methods or testing procedures. It is left to the employer to choose from the various maintenance methods available to satisfy the requirements of Chapter **2**.
(3) For the purpose of Chapter **2**, maintenance shall be defined as preserving or restoring the condition of electrical equipment and installations, or parts of either, for the safety of employees who work where exposed to electrical hazards. Repair or replacement of individual portions or parts of equipment shall be permitted without requiring modification or replacement of other portions or parts that are in a safe condition.

**Informational Note:** Refer to NFPA 70B, Recommended Practice for Electrical Equipment Maintenance; ANSI/NETA MTS, Standard for Maintenance Testing Specifications for Electrical Power Distribution Equipment and Systems; and IEEE 3007.2, Recommended Practice for the Maintenance of Industrial and Commercial Power Systems, for guidance on maintenance frequency, methods, and tests.

**Article 205 General Maintenance Requirements**
**205.1 Qualified Persons.**
Employees who perform maintenance on electrical equipment and installations shall be qualified persons as required in Chapter **1** and shall be trained in, and familiar with, the specific maintenance procedures and tests required.

**205.2 Single-Line Diagram.**
A single-line diagram, where provided for the electrical system, shall be maintained in a legible condition and shall be kept current.

**205.4 Overcurrent Protective Devices.**
Overcurrent protective devices shall be maintained in accordance with the manufacturers' instructions or industry consensus standards. Maintenance, tests, and inspections shall be documented.

**205.5 Spaces About Electrical Equipment.**
All working space and clearances required by electrical codes and standards shall be maintained.

**Informational Note:** For further information concerning spaces about electrical equipment, see Article 110, Parts II and III, of NFPA 70, National Electrical Code.

**205.6 Grounding and Bonding.**
Equipment, raceway, cable tray, and enclosure bonding and grounding shall be maintained to ensure electrical continuity.

**205.7 Guarding of Energized Conductors and Circuit Parts.**
Enclosures shall be maintained to guard against unintentional contact with exposed energized conductors and circuit parts and other electrical hazards. Covers and doors shall be in place with all associated fasteners and latches secured.

**205.9 Clear Spaces.**
Access to working space and escape passages shall be kept clear and unobstructed.

74) What are you supposed to do when you maintain, test, and inspect overcurrent protective devices?

A) Document each occurrence
B) Label them with a dated sticker
C) Attach a legible marking
D) All listed answers

75) What Article in the National Electrical Code has further information concerning spaces about electrical equipment?

A) 110
B) 115
C) 200
D) 240

76) Covers and doors shall be in place with all associated fasteners and _____ secured.

A) Internal components
B) Markings
C) Latches
D) Equipment

**205.11 Warning Signs.**
Warning signs, where required, shall be visible, securely attached, and maintained in legible condition.

**205.13 Single and Multiple Conductors and Cables.**
Electrical cables and single and multiple conductors shall be maintained free of damage, shorts, and ground that would expose employees to an electrical hazard.

**205.14 Flexible Cords and Cables.**
Flexible cords and cables shall be maintained to preserve insulation integrity.
**(1) Damaged Cords and Cables.**
Cords and cables shall not have worn, frayed, or damaged areas that would expose employees to an electrical hazard.
**(2) Strain Relief.**
Strain relief of cords and cables shall be maintained to prevent pull from being transmitted directly to joints or terminals.
**(3) Repair and Replacement.**
Cords and cord caps for portable electrical equipment shall be repaired and replaced by qualified personnel and checked for proper polarity, grounding, and continuity prior to returning to service.

**210.2 Area Enclosures.**
Fences, physical protection, enclosures, or other protective means, where required to guard against unauthorized access or unintentional contact with exposed energized conductors and circuit parts, shall be maintained.

**210.3 Conductors.**
Current-carrying conductors (buses, switches, disconnects, joints, and terminations) and bracing shall be maintained to perform as follows:

(1) Conduct rated current without overheating
(2) Withstand available fault current

**210.4 Insulation Integrity.**
Insulation integrity shall be maintained to support the voltage impressed.

**215.2 Open Wiring Protection.**
Open wiring protection, such as location or barriers, shall be maintained to prevent unintentional contact.

**Article 225 Fuses and Circuit Breakers**
**225.1 Fuses.**
Fuses shall be maintained free of breaks or cracks in fuse cases, ferrules, and insulators. Fuse clips shall be maintained to provide adequate contact with fuses. Fuseholders for current-limiting fuses shall not be modified to allow the insertion of fuses that are not current-limiting. Non-current limiting fuses shall not be modified to allow their insertion into current-limiting fuseholders.

**230.2 Guards, Barriers, and Access Plates.**
Guards, barriers, and access plates shall be maintained to prevent employees from contacting moving or energized parts.

**Article 235 Hazardous (Classified) Locations**
**235.1 Scope.**
This article covers maintenance requirements in those areas identified as hazardous (classified) locations.

**Informational Note No. 1:** These locations need special types of equipment and installation to ensure safe performance under conditions of proper use and maintenance. It is important that inspection authorities and users exercise more than ordinary care with regard to installation and maintenance. The maintenance for specific equipment and materials is covered elsewhere in Chapter **2** and is applicable to hazardous (classified) locations. Other maintenance will ensure that the form of construction and of installation that makes the equipment and materials suitable for the particular location are not compromised.

**Informational Note No. 2:** The maintenance needed for specific hazardous (classified) locations depends on the classification of the specific location. The design principles and equipment characteristics, for example, use of positive pressure ventilation, explosionproof, nonincendive, intrinsically safe, and purged and pressurized equipment, that were applied in the installation to meet the requirements of the area classification must also be known. With this information, the employer and the inspection authority are able to determine whether the installation as maintained has retained the condition necessary for a safe workplace.

77) Flexible cords and cables are required to be maintained to preserve - _____ integrity.

A) Insulation
B) Electrical
C) Tension
D) All listed answers

78) What is the purpose of insulation integrity?

A) To support the current impressed
B) To support the voltage impressed
C) To support the wattage impressed
D) To support the force impressed

79) What do Fuse clips provide?

A) Contact with the fuses
B) Rigidity
C) Resistance
D) All listed answers

**235.2 Maintenance Requirements for Hazardous (Classified) Locations.**
Equipment and installations in these locations shall be maintained such that the following criteria are met:
(1) No energized parts are exposed.
Exception to (1): Intrinsically safe and nonincendive circuits.
(2) There are no breaks in conduit systems, fittings, or enclosures from damage, corrosion, or other causes.
(3) All bonding jumpers are securely fastened and intact.
(4) All fittings, boxes, and enclosures with bolted covers have all bolts installed and bolted tight.
(5) All threaded conduit are wrenchtight and enclosure covers are tightened in accordance with the manufacturer's instructions.
(6) There are no open entries into fittings, boxes, or enclosures that would compromise the protection characteristics.
(7) All close-up plugs, breathers, seals, and drains are securely in place.
(8) Marking of luminaires (lighting fixtures) for maximum lamp wattage and temperature rating is legible and not exceeded.
(9) Required markings are secure and legible.

**Article 240 Batteries and Battery Rooms**
**240.1 Ventilation.**
When forced or natural ventilation systems are required by the battery system design and are present, they shall be examined and maintained to prevent buildup of explosive mixtures. This maintenance shall include a functional test of any associated detection and alarm systems.
**Informational Note:** "Natural ventilation" implies there are no mechanical mechanisms. Maintenance includes activities such as inspection and removal of any obstructions to natural air flow.

**240.2 Eye and Body Wash Apparatus.**
Eye and body wash apparatus shall be maintained in operable condition.

**Article 245 Portable Electric Tools and Equipment**
**245.1 Maintenance Requirements for Portable Electric Tools and Equipment.**
Attachment plugs, receptacles, cover plates, and cord connectors shall be maintained such that the following criteria are met:
(1) There are no breaks, damage, or cracks exposing energized conductors and circuit parts.

(2) There are no missing cover plates.
(3) Terminations have no stray strands or loose terminals.
(4) There are no missing, loose, altered, or damaged blades, pins, or contacts.
(5) Polarity is correct.

**Article 250 Personal Safety and Protective Equipment**
**250.1 Maintenance Requirements for Personal Safety and Protective Equipment.**
Personal safety and protective equipment such as the following shall be maintained in a safe working condition:
(1) Grounding equipment
(2) Hot sticks
(3) Rubber gloves, sleeves, and leather protectors
(4) Test instruments
(5) Blanket and similar insulating equipment
(6) Insulating mats and similar insulating equipment
(7) Protective barriers
(8) External circuit breaker rack-out devices
(9) Portable lighting units
(10) Temporary protective grounding equipment
(11) Dielectric footwear
(12) Protective clothing
(13) Bypass jumpers
(14) Insulated and insulating hand tools

80) What does the term “Natural ventilation” mean?

A) There are positive mechanisms for air flow
B) There are mechanical mechanisms for ventilation
C) There are no positive mechanisms air flow
D) There are no mechanical mechanisms for ventilation

81) How many items are specifically listed for personal safety and protective equipment to be maintained in a safe working condition?

A) 10
B) 9
C) 5
D) 14

**250.2 Inspection and Testing of Protective Equipment and Protective Tools.**

**(A) Visual.**

Safety and protective equipment and protective tools shall be visually inspected for damage and defects before initial use and at intervals thereafter, as service conditions require, but in no case shall the interval exceed 1 year, unless specified otherwise by the applicable state, federal, or local codes and standards.

**(B) Testing.**

The insulation of protective equipment and protective tools, such as items specified in **250.1(1)** through **250.1(14)**, that is used as primary protection from shock hazards and requires an insulation system to ensure protection of personnel, shall be verified by the appropriate test and visual inspection to ascertain that insulating capability has been retained before initial use, and at intervals thereafter, as service conditions and applicable standards and instructions require, but in no case shall the interval exceed 3 years.

**250.3 Safety Grounding Equipment.**

**(A) Inspection.**

Personal protective ground cable sets shall be inspected for cuts in the protective sheath and damage to the conductors. Clamps and connector strain relief devices shall be checked for tightness. These inspections shall be made at intervals thereafter as service conditions require, but in no case shall the interval exceed 1 year.

**250.4 Test Instruments.**

Test instruments and associated test leads used to verify the absence or presence of voltage shall be maintained to assure functional integrity. The maintenance program shall include functional verification as described in 110.8(E).

82) What is the maximum interval where a visual inspection of safety, protective equipment and protective tools is required to be conducted?

A) 1 year
B) 6 months
C) 3 years
D) 3 months

83) What is the maximum interval where the inspection of insulation for equipment and protective tools, such as items specified in **250.1(1)** through **250.1(14)** is required to be conducted?

A) 1 year
B) 6 months
C) 3 years
D) 3 months

84) What is the maximum interval where the inspection of personal protective ground cable sets, clamps, and connector strain relief is required to be conducted?

A) 6 months
B) 1 year
C) 3 years
D) 3 months

85) What section includes a description of functional verification?

A) 110.8(D)
B) 110.8(F)
C) 110.8(G)
D) 110.8(E)

**Article 300 Introduction**
**300.1 Scope.**
Chapter **3** covers special electrical equipment in the workplace and modifies the general requirements of Chapter **1**.

**Introduction300.3 Organization.**
Chapter 3 of this standard is divided into articles. Article 300 applies generally. Article 310 applies to electrolytic cells. Article 320 applies to batteries and battery rooms. Article 330 applies to lasers. Article 340 applies to power electronic equipment. Article 350 applies to research and development (R&D) laboratories. Article 360 applies to safety-related requirements for capacitors.

**Article 310 Safety-Related Work Practices for Electrolytic Cells**
**310.1 Scope.**
The requirements of this article shall apply to the electrical safety-related work practices used in the types of electrolytic cell areas.
Informational Note No. 1: See Informative Annex L for a typical application of safeguards in the cell line working zone.
Informational Note No. 2: For further information about electrolytic cells, see NFPA 70, National Electrical Code, Article 668.
Informational Note No. 3: For further information about electrical safety-related work practices in electrolytic cell lines, see IEEE 463, Electrical Safety Practices in Electrolytic Cell Line Working Zones.

**310.2 Definitions.**
For the purposes of this article, the definitions that follow shall apply.

**Battery Effect.**
A voltage that exists on the cell line after the power supply is disconnected.
**Informational Note:**
Electrolytic cells can exhibit characteristics similar to an electrical storage battery and a shock hazard could exist after the power supply is disconnected from the cell line.

**Safeguarding.**
Safeguards for personnel include the consistent administrative enforcement of safe work practices. Safeguards include training in safe work practices, cell line design, safety equipment, PPE, operating procedures, and work checklists.

**310.5 Safeguarding of Employees in the Cell Line Working Zone.**
**(A)(1) General.**
Each task performed in the electrolytic cell line working zone shall be analyzed for the likelihood of arc flash injury. If there is a likelihood of personal injury, appropriate measures shall be taken to protect persons exposed to the arc flash hazards, including one or more of the following:
(1) Providing appropriate PPE [see **310.5(D)(2)**] to prevent injury from the arc flash hazard
(2) Altering work procedures to reduce the likelihood of occurrence of an arc flash incident
(3) Scheduling the task so that work can be performed when the cell line is de-energized

86) What does chapter 3 in this information cover?

A) Special operation systems in the workplace
B) Special conditions in the workplace
C) Special electrical equipment in the workplace
D) Modern low voltage equipment in the workplace

87) What does Article 350 in this information apply to?

A) Safety-related requirements for capacitors
B) Research and development (R&D) laboratories
C) Safety-related requirements for inductors
D) Batteries and battery rooms

88) What does informative Annex L cover in this publication?

A) Battery rooms
B) Electrolytic cells
C) Electrical Safety Practices
D) Typical application of safeguards in the cell line working zone

89) What best defines a voltage that exists on the cell line after the power supply is disconnected?

A) Hysteresis
B) Battery Effect
C) Eddy current
D) Copper effect

90) What can safeguards for personnel include?

A) Work checklists
B) Cell line design
C) Safety equipment
D) All listed answers

# Source Materials – NFPA 70e Chapter 1, 2, and 3 Updates

Na﷿onal Fire Protec﷿on Associa﷿on – NFPA 70e Chapter 1 – Safety-Related Work Pra﷿es
https://www.nfpa.org/codes-and-standards/7/0/e/nfpa-70e

Na﷿onal Fire Protec﷿on Associa﷿on – NFPA 70e Chapter 2 – Safety-Related Maintenance Requirements
https://www.nfpa.org/codes-and-standards/7/0/e/nfpa-70e

Na﷿onal Fire Protec﷿on Associa﷿on – NFPA 70e Chapter 3 – Safety Requirement for Special Equipment
https://www.nfpa.org/codes-and-standards/7/0/e/nfpa-70e