ELECTRICAL
J.A. Rosa Construction, LLC

Contents

11.A GENERAL

11.A.1 Approval and qualification.

All electrical wiring and equipment shall be a type listed by a nationally recognized testing laboratory for the specific application for which it is to be used.

All electrical work shall comply with the applicable National Electrical Safety Code (NESC).

Electrical work shall only be performed by qualified personnel with verifiable credentials who are familiar with applicable code requirements. Such persons shall be capable of working safely on energized circuits and shall be familiar with the proper use of special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools.

Employees performing electrical work shall be trained in electrical safety-related work practices that pertain to their job assignments. Annually, all employees shall be trained in electrically related safety practices.

Only qualified persons may work on electric circuit parts or equipment that have not been deenergized. OSHA light requirements state that all light fixtures must have protective plates. If light fixtures are in an area where they could be damaged, they must be guarded by strong barriers to prevent shattering. This is also the requirement for covers of pull boxes, junction boxes, and fittings.

General construction areas require a minimum of 5 foot-candles of illumination. JA Rosa will strive for 10 foot-candles when feasible.

11.A.2 Isolation.

a. Before work begins, the person in charge shall ascertain by inquiry, by direct observation, or by instruments, whether any part of an electric power circuit (exposed or concealed) is located such that the performance of work could bring any person, tool, or

machine into physical or electrical contact with it.

b. Whenever possible, all equipment and circuits to be worked on shall be de-energized before work is started and personnel protected by clearance procedures, lockout/tagout, and grounding. On each machine operated by electric motors, positive means shall be provided for rendering such controls or devices inoperative while repairs or adjustments are being made to the machines they control.

c. Before an employee performs any service or maintenance on an energized system, the system's energy must be isolated from its power source to prevent an unexpected start up, shielded to prevent shock hazards, or release of kinetic or stored energy. Personnel and resources shall not be considered protected until hazardous energy control procedures have been implemented.

d. Live parts of wiring or equipment shall be guarded to protect all persons or objects from electrical hazard.

e. Transformer banks and high voltage equipment shall be protected from unauthorized access; entrances not under constant observation shall be kept locked; metallic enclosures shall be grounded; and signs warning of high voltage and prohibiting unauthorized entrance shall be posted at entrances.

f. Enclosure gates or doors shall swing outward or provide clearance from installed equipment.

11.A.3 Flexible cords (Construction site).

a. For construction sites, all flexible cords shall be inspected by the user of the cord at least daily. And include a GFCI to prevent shock.

b. Flexible cord sets used on construction sites or in damp locations shall contain the number of conductors required for the service plus an equipment ground wire. The cords shall be hard usage or extra hard usage.

c. Electric wire and flexible cord passing through work areas shall be protected from damage (including that caused by foot traffic, vehicles, sharp corners, protections, and pinching). Flexible cords and cables passing through holes shall be protected by bushings or fittings.

d. Flexible cord shall be used only in continuous lengths without splice or tap, except hard service flexible cords No. 12 or larger with molded or vulcanized splices may be used if a qualified electrician makes the splices, the insulation is equal to the cable being spliced, and wire connections are soldered.

e. Patched, oil-soaked, worn, or frayed electric cords or cables shall not be used.

f. Extension cords or cables shall not be secured with staples, hung from nails, or suspended by bare wire.

11.A.4 When it is necessary to work on energized lines or equipment, rubber gloves and other protective equipment or hotline tools meeting the provisions of ANSI and ASTM standards shall be used. For work on energized equipment, only tools insulated for the voltage shall be used.

11.A.5 Whenever it is necessary to work on energized parts greater than 50 volts to ground, a risk/hazard analysis will be conducted in accordance with NFPA 70E, Part II, Appendix D.

11.A.6 An electrical arc flash hazard analysis shall be conducted in accordance with the NEC (NFPA 70E, Part II, Chapter 2-1) to determine the flash hazard protection boundary before a person approaches any exposed electrical conductor or circuit part that has not been placed in an electrically safe work condition.

11.A.7 For systems that are 600 volts and below, the flash protection boundary shall be 4 ft (1.2 m), based upon the product of clearing times of 6 cycles (0.1 second) and available bolted fault current of 50 kiloamp (kA) or any combination not exceeding 300 kA cycles (5000 ampere seconds). For clearing times and bolted fault currents other than 300 kA cycles (5000 ampere seconds), or under engineering supervision, the flash protection boundary shall

alternatively be permitted to be calculated in accordance with the following general formula.

$$D_c = \left[2.65 \times MVA_b \times t\right]^{1/2}$$

or

$$D_c = \left[53 \times MVA \times t\right]^{1/2}$$

Where:

MVA_{bf} = bolted fault megavolts-amperes (MVA) available at the point involved

MVA = the MVA rating of the transformer. For transformers with MVA ratings below 0.75 MVA, multiply the transformer MVA rating by 1.25

t = time or arc exposure in seconds

11.A.8 At least two persons shall be assigned to work together in the following situations:

a. Work on energized overhead lines.

b. Work at substations/power plants where wiring is congested.

c. Work-involving handling energized conductors or apparatus.

One person shall be trained to recognize situations that are dangerously close to live conductors or performance of unsafe electrical acts. This person shall be delegated to watch the movements of the other(s) doing the work so that he/she can warn them if they get dangerously close to live conductors or perform other unsafe acts. He/she can also assist in case of an accident.

11.A.9 Switch boxes, receptacle boxes, metal cabinets, enclosures around equipment, and temporary power lines shall be marked to indicate the maximum operating voltage.

11.A.10 Insulation mats or platforms of substantial construction and providing good footing shall be placed on floors and on the frames of equipment having exposed live parts so that the operator or persons in the vicinity cannot touch such parts unless standing on the mats, platforms, or insulated floors.

11.A.11 Suitable barriers or other means should be provided to ensure that workspace for electrical equipment cannot be used as

a passageway when energized parts of electrical equipment are exposed.

11.A12 Do not wear Items with metal fasteners (zippers, buckles, buttons), and Athletic wear with metal-infused fabrics when working with energized parts of electrical equipment.

11.A.13 When working on elevated components, all ladders must be non-conductive, i.e., non-metallic.

11.A.14 When fuses are installed or removed with one or both terminals energized, special tools insulated for the voltage shall be used.

11.A.15 Attachment plugs and receptacles.

a. Plugs and receptacles shall be kept out of water unless of an approved submersible type.

b. Attachment plugs for use in work areas shall be constructed so that they will endure rough use and shall be equipped with a cord grip to prevent strain on the terminal screws.

c. Attachment plugs and other connectors supplying equipment at more than 300 volts shall be skirted or otherwise designed so that arcs will be confined.

d. When a National Electrical Manufacturers Association (NEMA) standard configuration exists for a particular voltage, amperage, frequency, or type of current, the NEMA standard plug and receptacle shall be used.

11.A.16 Portable hand lamps.

a. Portable hand lamps shall be of molded composition or another type approved for the purpose.

b. Metal-shell, paper-lined lamp holders shall not be

used.

c. c. Hand lamps shall be equipped with a handle

and with a substantial guard over the bulb. The guard shall be attached to the lamp holder or the handle.

11.B OVERCURRENT PROTECTION, DISCONNECTS, AND SWITCHES

11.B.1 All circuits shall be protected against overload.

a. Overcurrent protection shall be based on the current carrying capacity of the conductors supplied and the power load being used.

b. No overcurrent device shall be placed in any permanently grounded conductor except where the overcurrent device simultaneously opens all conductors of the circuit or where the device is required by NEC 430 for motor overload protection.

c. Overcurrent protection devices must be readily accessible, clearly labeled, not exposed to physical damage, not placed in the vicinity of easily ignitable materials, and located or shielded such that their operation will not expose employees to injury due to arching or the sudden movement of parts.

d. Circuit breakers shall clearly indicate whether they are in the open (de-energized) or closed (energized) position.

e. Enclosures containing overcurrent protective devices shall be provided with lockable, close-fitting doors. At least 36 in (91.4 cm) clearance must be maintained around all sides of the enclosure. On vessels or floating plant where the 36 in (91.4 cm) clearance is not feasible, sufficient clearance for fully opening the door and/or servicing the electrical enclosure shall be maintained.

11.B.2 Disconnects.

a. Disconnecting means shall be located or shielded so that persons will not be injured when the disconnect is operated.

b. Enclosures for disconnecting means shall be securely fastened to the surface and fitted with covers.

11.B.3 Switches.

a. A readily accessible, manually operated switch shall be provided for each incoming service or supply circuit.

b. Switches shall be of the externally operable type mounted in an enclosure listed for the intended use and installed to minimize the danger of accidental operation.

11.B.4 Switches, fuses, and automatic circuit breakers shall be marked, labeled, or arranged for ready identification of the circuits or equipment that they supply.

11.B.5 Switches, circuit breakers, fuse panels, and motor controllers located out-of-doors or in wet locations shall be in a weatherproof enclosure or cabinet.

11.C GROUNDING

11.C.1 All electrical circuits shall be grounded in accordance with the NEC and the NESC unless otherwise noted in this manual.

a. A ground shall be provided for non-current carrying metallic parts of such equipment as generators (if not exempted by NEC 250.34), electrically powered arc welders, switches, motor controller cases, fuse boxes, distribution cabinets, frames, non- current carrying rails used for travel and motors of electrically operated cranes, electric elevators, metal frames of non-electric elevators to which electric conductors are attached, other electric equipment, and metal enclosures around electric equipment.

b. Portable Generators. The frame of portable

generators shall not be required to be grounded and shall be permitted to serve as the grounding electrode for a system supplied by the generator under the following conditions:

(1)The generator supplies ONLY equipment mounted on the generator, cord-and-plug-connected equipment through receptacles mounted on the generator, or both; and

(2)The non-current-carrying metal parts of the equipment and the equipment grounding conductor terminals of the receptacles are bonded to the generator frame.

c. Vehicle-Mounted Generators. The frame of a vehicle shall be permitted to serve as the grounding electrode for a system supplied by a generator located on the vehicle under the following conditions:

(1) The frame of the generator is bonded to the vehicle frame, and

(2)The generator supplies only equipment located on the vehicle or cord-and-plug-connected equipment through receptacles mounted on the vehicle, or both equipment located on the vehicle and cord-and-plug-connected equipment through receptacles mounted on the vehicle or on the generator, and

(3)The non-concurrent-carrying metal parts of equipment and the equipment grounding conductor terminals of the receptacles are bonded to the generator frame, and

(4)The system complies with all other provisions of NEC 250.

d. A system that is required to be grounded by NEC 250.30 shall be bonded to the generator frame where the generator is a component of a separately derived system.

e. Portable and semi-portable electrical tools and equipment shall be grounded by a multi-conductor cord

having an identified grounding conductor and a multi-contact polarized plug and receptacle.

f. Semi-portable equipment, floodlights, and work lights shall be grounded. The protective ground should be maintained during moving unless supply circuits are de-energized.

g. Tools protected by an approved system of double insulation, or its equivalent, need not be grounded. Double-insulated tools shall be distinctly marked and listed by a nationally recognized testing laboratory.

11.C.2 Grounding rod and pipe electrodes.

a. Electrodes of rod or pipe shall be free from non-conducting coatings and, if practicable, shall be embedded below permanent moisture levels.

b. Grounding rod and pipe electrodes shall be in unbroken 8-ft (2.4-m) lengths and driven to full depth. Where rock bottom is encountered, the electrode shall be driven at an angle not to exceed 45° from the vertical or shall be buried in a trench that is at least 2.5 ft (0.7 m) deep.

c. A single electrode that does not have a resistance to ground of 25 ohms or less, shall be augmented by one additional electrode spaced no closer than 6 ft (1.8 m) to the first electrode.

d. Electrodes of iron or steel shall be at least 5/8 in (1.5 cm) diameter. Nonferrous rods, or their equivalent, shall be listed by a nationally recognized testing laboratory and shall be at least 0.5 in (1.2 cm) diameter.

e. Electrodes of pipe or conduit shall be at least 3/4 in (1.9 cm) trade size. Pipes and conduit of iron or steel shall have the outer surface galvanized or otherwise metal-coated for corrosion control.

f. Grounding electrode systems of permanent facilities

shall be in accordance with NEC 250.

11.C.3 Conductors used for bonding or grounding stationary and movable equipment shall be of ample size to carry the anticipated current.

a. When attaching bonding and grounding clamps or clips, a secure and positive metal-to-metal contact shall be made.

b. The ground end shall be attached first. The equipment end should be attached and removed by insulated tools or other suitable devices.

c. When removing grounds, the grounding device shall be removed from the line or equipment first, using insulated tools or other suitable devices.

d. Bonding and grounding attachments shall be made before systems are activated and shall not be broken until after systems are de-activated.

11.C.4 Grounding circuits shall be checked to ensure that the circuit between the ground and a grounded power conductor has a resistance low enough to permit sufficient current flow to allow the fuse or circuit breaker to interrupt the current.

11.C.5 All receptacle outlets that provide temporary electrical power during construction, remodeling, maintenance, repair, or demolition, shall have ground-fault circuit-interrupter (GFCI) protection for personnel. GFCI protection shall be provided on all circuits serving portable electric hand tools or semi-portable electric power tools (such as block/brick saws, table saws, air compressors, welding machines, and drill presses).

a. The GFCI device shall be calibrated to trip within the threshold values of 5 ma +/- 1 ma as specified in UL Standard 943. GFCI devices shall be tested before initial use and before use after modification. Testing shall be

documented.

b. Receptacle outlets that are not part of the permanent wiring of the building or structure shall be GFCI protected by one of the following means:

(1) A receptacle outlet with integral GFCI protection,

(2) A standard receptacle outlet connected downstream of a receptacle outlet with integral GFCI protection, or

(3) Receptacles are protected by a GFCI-type circuit breaker.

c. Receptacle outlets that are part of the permanent wiring of the building or structure (including portable generators) shall use a portable GFCI device if the receptacle outlets are not already GFCI protected. The portable GFCI device shall be as near as practicable to the receptacle outlet.

d. Electric tool circuits that are "hard-wired" directly to an electrical source of power shall be GFCI protected by a GFCI- type circuit breaker.

e. GFCIs shall be installed in accordance with the NEC. The permanent wiring shall consist of electrical circuits grounded in accordance with the NEC.

f. GFCIs may be sensitive to some equipment (such as concrete vibrators, etc.). In these instances, an assured equipment grounding conductor program in accordance with Appendix D is acceptable in lieu of GFCIs if the exception is documented on an AHA and documents the following:

(1) The conditions, or need, for the exception; and
(2) Implementation of the requirements of the assured equipment grounding conductor program.
(3) The request for the exception, the AHA, and the assured grounding program plan must be submitted and accepted by the safety manager or site supervisor prior to

implementing the program.

11.D TEMPORARY WIRING AND LIGHTING

11.D.1 A sketch of proposed temporary power distribution systems shall be submitted to the SAFETY MANAGER OR SITE SUPERVISOR and accepted for use before temporary power is installed. The sketch shall indicate the location, voltages, and means of protection of all circuits, including receptacles, disconnecting means, grounding, GFCIs, and lighting circuits.

11.D.2 Testing.

a. Temporary electrical distribution systems and devices shall be checked and found acceptable for polarity, ground continuity, and ground resistance before initial use and before use after modification. GFCI shall be evaluated monthly.

b. Ground resistance and circuits shall be measured at the time of installation and shall comply with 11.C.02 and 11.C.04. The measurement shall be recorded and a copy furnished to the SAFETY MANAGER OR SITE SUPERVISOR.

11.D.3 The vertical clearance of temporary wiring for circuits carrying 600 volts or less shall be:

a. 10 ft (3 m) above finished grade, sidewalks, or from any platform.

b. 12 ft (3.6 m) over areas subject to vehicular traffic other than truck traffic.

c. 18 ft (5.4 m) over public streets, alleys, roads, and driveways.

11.D.4 Wet locations.

a. Where a receptacle is used in a wet location, it shall be contained in a weatherproof enclosure, the integrity of which is not affected when an attachment plug is inserted.

b. All temporary lighting strings in outdoor or wet locations (such as tunnels, culverts, valve pits, floating plant, etc.) shall consist of lamp sockets and connection plugs permanently molded to the hard service cord insulation.

11.D.5 Wires shall be insulated from their supports.

11.D.6 Temporary lighting.

a. Bulbs attached to temporary lighting strings and extension cords shall be protected by guards unless the bulbs are deeply recessed in a reflector.

b. Unless designed for suspension, temporary lights shall not be suspended by their electric wire.

c. Exposed empty light sockets and broken bulbs shall be replaced immediately.

d. Portable electric lighting used in confined wet and/or other conductive locations (e.g., drums, tanks, and vessels) should be operated at 12 volts or less. > See also 11.G; for additional information see of the NEC 410.

11.D.7 When temporary wiring is used in tanks or other confined spaces, an approved switch, identified and marked, shall be provided at or near the entrance to such spaces for cutting off the current in emergencies.

11.D.8 Non-metallic sheathed cable may be used as allowed by the NEC and as follows:

a. Along studs, joists, or similar supports closely following the building finish or running boards when 7 ft 8 in (2.3 m) or more above the floor.

b. When attached to each cabinet, box fitting, or fixture by means of a cable clamp.

Non-metallic sheathed cable may not be used where precluded by the NEC nor as portable extension cords, lying on the ground subject to any type of traffic, where subject to frequent flexing, or as service entrance cable.

11.D.9 Temporary lighting circuits shall be separate from electric tool circuits. Receptacle circuits shall be dedicated to either temporary lighting or electric tools and shall be labeled **"LIGHTS ONLY"** or **"TOOLS ONLY**," as applicable.

11.E OPERATIONS ADJACENT TO OVERHEAD LINES

11.E.1 Overhead transmission and distribution lines shall be executed towers and poles that provide safe clearances over roadways and structures.

a. Clearances should be adequate for the movement of vehicles and for the operation of construction equipment.

b. All electric power or distribution lines shall be placed underground in areas where there is extensive use of equipment having the capability to encroach on the clear distances specified in 11.E.04.

c. Protection of outdoor trolleys and portable cables rated above 600 volts for supplying power to moveable construction equipment such as gantry cranes, mobile cranes, shovels, etc., shall conform to NESC.

11.E.2 Work activity adjacent to overhead lines shall not be initiated until a survey has been conducted to ascertain the safe clearance from energized lines. ***> See 11.A.02***

11.E.3 Any overhead wire shall be considered energized unless the person owning such line or operating officials of the electrical utility supplying the line certifies that it is not energized and it has been visibly grounded and evaluated.

11.E.4 Operations adjacent to overhead lines are prohibited unless at least one of the following conditions is satisfied:

a. Power has been shut off, and positive means have been taken to prevent the lines from being energized.

b. Equipment, or any part, does not have the capability of coming within the minimum clearance from energized overhead lines as specified in Table 11-1, or the equipment has been positioned and blocked to assure no part, including cables, can come within the minimum clearances as specified in Table 11-1; a notice of the minimum required clearance has been posted at the operator's position (electric line derrick trucks and aerial lifts are not required to comply with this requirement).

c. In transit with the boom lowered and no load, the equipment clearance shall comply with Table 11-1.

TABLE 11-1

MIMIMUM CLEARANCE FROM ENERGIZED OVERHEAD ELECTRIC LINES

Nominal system voltage	Minimum rated clearance
0 - 50 kV	9.8 ft (3 m)
51 - 200kV	14.7 ft (4.5 m)
201 - 300 kV	19.7 ft (6 m)
301 to 500 kV	24.6 ft (7.5 m)
501 - 750 kV	34.4 ft (10.5 m)
751 - 1000 kV	44.3 ft (13.5 m)

11.E.5 Work activity that could affect or be affected by overhead lines shall not be initiated until coordinated with the appropriate utility officials.

11.E.6 Standard emergency communication procedures shall be established and rehearsed to ensure rapid emergency shutdown for all work being conducted on overhead power lines.

11.E.7 Floating plant and associated equipment shall not be sited or placed within 20 ft (6 m) of overhead transmission or distribution lines.

11.E.8 Cage boom guards, insulating links, or proximity warning devices may be used on cranes, but such devices should not alter the requirements of any other regulation of this part - even if such device is required by law or other regulation. Insulating links shall be capable of withstanding a 1-minute dry low frequency dielectric test of 50,000 volts, alternating current.

11.E.9 Induced currents.

a. Before work near transmitter towers where there is potential for an electrical charge to be induced in equipment or materials, the transmitter should be de-energized, or tests shall be conducted to determine if an electrical charge could be induced.

b. The following precautions shall be taken to dissipate induced voltages:

(1) The equipment shall be provided with an electrical ground to the upper rotating structure supporting the boom, and

(2) Ground jumper cables shall be attached to materials being handled by boom equipment when electrical charge could be induced while working near energized transmitters. Crews shall be provided with nonconductive poles having large alligator clips or other similar protection to attach the ground cable to the load and insulating gloves will be used.

11.F BATTERIES AND BATTERY CHARGING

11.F.1 Batteries of the non-sealed type shall be stored in enclosures with outside vents or in well-ventilated rooms and be so arranged as to prevent the escape of fumes, gases, or electrolyte spray into other areas.

11.F.2 Ventilation shall be provided to ensure diffusion of battery gases to prevent the accumulation of an explosive mixture.

11.F.3 Battery storage and handling.

a. Racks and trays shall be substantial and shall be treated to make them resistant to the electrolyte.

b. Floors should be of acid-resistant construction or protected from accumulation of acid.

c. Facilities for quick drenching of the eyes and body shall be provided for emergency use within 25 ft (7.6 m) of battery handling areas.

d. Facilities shall be provided for flushing and neutralizing spilled electrolyte and for fire protection.

11.F.4 Battery charging.

a. Battery charging installations shall be in areas designated for that purpose.

b. Charging apparatus shall be protected from mechanical damage.

c. When charging batteries, the vent caps shall be kept in place to avoid spray of electrolyte. Care shall be taken to ensure vent caps are functioning.

d. Prior to charging batteries, the electrolyte level shall be checked and adjusted to the proper level if necessary.

11.G HAZARDOUS (CLASSIFIED) LOCATIONS

11.G.1 Locations of electrical equipment and wiring shall be classified on the properties of the flammable vapors, liquids or gases, or combustible dusts or fibers that may be present therein and the likelihood that a flammable or combustible concentration or quantity is present. In classifying locations, each room, section, or area shall be classified on an individual basis in accordance with the definitions given in Table 11-2.

11.G.2 All equipment, wiring methods, and installations of equipment in hazardous (classified) locations shall be either listed as intrinsically safe, listed for the hazardous location, or demonstrated to be safe for the location.

11.G.3 Only equipment and wiring listed as intrinsically safe shall be permitted in those hazardous (classified) locations.

11.G.4 Equipment and wiring listed for the hazardous (classified) location shall be approved not only for the class of location but also for the ignitable or combustion properties of the specific gas, vapor, dust, or fiber that will be present.

a. This equipment shall not be used unless it is marked to show the class, group, and operating temperature or temperature range for which it is approved.

b. With the following exceptions, the temperature marking shall not exceed the ignition temperature of the specific gas, vapor, dust, or fiber:

TABLE 11-2

HAZARDOUS (CLASSIFIED) LOCATIONS

Class I Highly flammable gases or vapors		Class II Combustible dusts		Class III Combustible fibers or flyings	
Division 1	Division 2	Division 1	Division 2	Division 1	Division 2
locations where Hazardous concentrations are probable or where accidental occurrence should be simultaneous with failure of electrical equipment	locations where flammable concentrations are possible, but only in the event of process closures, rupture, ventilation failure, etc.	locations where hazardous concentrations are probable where their existences would be simultaneous with electrical equipment failure, or where electrically conducting dusts are involved	locations where hazardous concentrations are not likely, but where deposits of the dust might interfere with heat dissipation from electrical equipment or ignited by electrical equipment	locations in which easily ignitable fibers or materials producing combustible flyings are handled, manufactured, or used	locations in which such fibers or flyings are stored or handled, except in the process of manufacture

Groups:

A - atmospheres containing acetylene

B - atmospheres containing hydrogen or gases or vapors of equivalent hazard

C - atmospheres containing ethyl-ether vapors, ethylene, or cyclopropane

D - atmospheres containing gasoline, hexane, naphtha, benzene, butane, propane, alcohol, acetone, benzol, or natural gas

E - atmospheres containing metal dust, including aluminum, magnesium, and other metals of equally hazardous characteristics

F - atmospheres containing carbon black, coke, or coal dust

G - atmospheres containing flour, starch, or grain dusts

(1) Equipment of the non-heat producing type (e.g., junction boxes and conduit) and equipment of the heat producing type having a maximum temperature of not more than 212 °F (100 °C) need not have a marked operating temperature or temperature range.

(2) Fixed lighting fixtures marked for use only in Class I, Division 2 locations need not be marked to indicate the group.

(3) Fixed general-purpose equipment in Class I locations, other than lighting fixtures, which is acceptable for use in Class II, Division 2, and Class III locations need not be marked with the class, group, division, or operating temperature.

(4) Fixed dust-tight equipment, other than lighting fixtures, which is acceptable for use in Class II, Division 2, and Class III locations need not be marked with the class, group, division, or operating temperature.

11.G.5 Equipment that is safe for the hazardous (classified) location shall be of a type and design that will provide protection from the hazards arising from the combustibility and flammability of vapors, liquids, gases, dusts, or fibers.

11.G.6 Equipment approved for a specific hazardous location shall not be installed or intermixed with equipment approved for another specific hazardous location.

11.G.7 All wiring components and utilization equipment required to be explosion proof (vapor, dust, or fiber tight) shall be maintained in that condition.

a. There shall be no loose or missing screws, gaskets, threaded connections, or other impairments to this tight condition.

b. Conduits shall be threaded and made wrench-tight: where it is impractical to make a threaded joint tight, a bonding jumper shall be used.

TABLE 11-3

ALTERNATING CURRENT - MINIMUM DISTANCES

Voltage range (phase-to-phase)	Minimum working and clear hot stick distance	
	(phase-to-ground)	(phase-to-phase)
2.1 - 15 kV	2.0 ft (0.6 m)	2.0 ft (0.6 m)
15.1 – 35 kV	2.3 ft (0.7 m)	2.3 ft (0.7 m)
35.1 – 46 kV	2.6 ft (0.8 m)	2.6 ft (0.8 m)
46.1 – 72.5 kV	3.0 ft (0.9 m)	3.0 ft (0.9 m)
72.6 - 121 kV	3.3 ft (1.0 m)	4.6 ft (1.4 m)
138 - 145 kV	3.6 ft (1.1 m)	4.9 ft (1.5 m)
161 - 169 kV	3.6 ft (1.1 m)	5.6 ft (1.7 m)
230 - 242 kV	4.9 ft (1.5 m)	8.2 ft (2.5 m)
345 - 362 kV	6.9 ft (2.1 m) *	13.1 ft (4.0 m) *
500 - 552 kV	10.8 ft (3.3 m) *	19.7 ft (6.0 m) *
700 - 765 kV	11.8 ft (3.6 m) *	30.5 ft (9.3 m) *

* For 345-362 kilovolt (kV), 500-552 kV, and 700-765 kV, the minimum working distance and the minimum clear hot stick distance may be reduced provided such distances are not less than the shortest distance between the energized part and a grounded surface.

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(2) The energized part is insulated or guarded from the employee and any other conductive object at a different potential; or

(3) The employee is isolated, insulated, or guarded from any other conductive object(s), as during live-line, bare-hand work.

c. The minimum phase to ground working distance and minimum clear hot stick distances in Table 11-3 shall not be violated. The minimum clear hot stick distance refers to the distance from the hot end of live-line tools to the lineman when performing live-line work. Conductor support tools (such as link sticks, strain carriers, and insulator cradles) may be used provided the clear length of insulation is at least as long as the insulator string or as long as the minimum phase to ground distance in Table 11-3.

11.G.8 When de-energizing lines and equipment operated more than 600 volts, and the means of disconnecting from electric energy is not visibly open or visibly locked out, provisions a through g below are required.

a. The section of line or equipment to be de-energized shall be clearly identified and shall be isolated from all sources of voltage.

b. Notification and assurance from the safety manager or site supervisor shall be obtained that:

(1) All switches and disconnectors through which electric energy may be supplied to the section of line or equipment to be worked have been de-energized,

(2) All switches and disconnectors are plainly tagged, indicating that persons are at work, and

(3) All switches and disconnectors capable of being rendered inoperable are rendered inoperable.

c. After all designated switches and disconnectors have been opened, rendered inoperable, and tagged, visual inspections shall be conducted to ensure that equipment or lines are de- energized.

d. Protective grounds shall be applied on the disconnected lines or equipment to be worked on.

e. Guards or barriers shall be erected as necessary to adjacent energized lines.

f. When more than one independent crew requires the same equipment to be de-energized, a prominent tag for each such independent crew shall be placed on the line or equipment by the designated employee in charge.

g. Upon completion of work on de-energized lines or equipment, each designated person-in-charge shall determine that all employees in the crew are clear and that protective grounds installed by the crew have been removed and shall report to the SAFETY MANAGER OR SITE SUPERVISOR that all tags and locks protecting the crew may be removed.

11.G.9 When opening or closing a disconnect switch or circuit breaker on a power transmission/distribution line, exposure to potential explosion shall be limited. Safe operating procedures should be established to minimize the risk of explosion.

11.G.10 When a crew working on a line or equipment can clearly see that the means of disconnecting from electrical energy are visibly open or visibly locked-out, the following provisions are required.

a. Guards or barriers shall be erected as necessary to adjacent energized lines.

b. Upon completion of work on de-energized lines or equipment, each designated person-in-charge shall determine that all employees in the crew are clear that all protective grounds installed by the crew have been removed and shall report to the SAFETY MANAGER OR SITE SUPERVISOR that all tags and locks protecting the crew may be removed.

11.G.11 Grounding.

a. De-energized conductors and equipment that are to be grounded shall be assessed for voltage.

b. When attaching grounds, the ground end shall be attached first, and the other end shall be attached and removed by insulated tools or other suitable devices.

c. When removing grounds, the grounding device shall first be removed from the line or equipment using insulating tools or other suitable devices.

d. Grounds shall be placed between the work location and all sources of energy and as close as practicable to the work location, or grounds shall be placed at the work location.

(1) If work is to be performed at more than one location in a line section, the line section must be grounded and short circuited at one location in the line section and the conductor to be worked on shall be grounded at each work location.

(2) The minimum distance in Table 11-3 shall be maintained from ungrounded conductors at the work location.

(3) Where the making of a ground is impracticable, or the conditions resulting from it would be more hazardous than working on the lines or equipment without grounding, the grounds may be omitted and the line or equipment worked as energized.

e. Grounds may be temporarily removed only when necessary for test purposes and extreme caution should be exercised during the test procedures. The lines or equipment from which grounds have been removed shall be considered energized.

f. When grounding electrodes are used, such electrodes shall have a resistance to ground low enough to remove the danger of harm to personnel or permit prompt operation of protective devices.

g. Grounding to tower shall be made with a tower clamp capable of conducting the anticipated fault current.

h. A ground lead, to be attached to either a tower ground or driven ground, shall be capable of conducting the anticipated fault current and shall have a minimum conductance of No. 2 American Wire Gauge (AWG) copper.

11.G.12 All hydraulic fluids used for the insulated

sections of derricks, trucks, aerial lifts, and hydraulic tools that are used on or around energized lines and equipment shall be of the insulating type (the requirements for fire resistant fluids do not apply to hydraulic tools covered by this requirement).

11.G.13 Tools.

a. All pneumatic tools that are used on or around energized lines or equipment shall have non-conducting hoses of adequate strength for the normal operating pressures and have an accumulator on the compressor to collect moisture.

b. Portable metal or conductive ladders shall not be used near energized lines or equipment except in specialized work such as in high voltage substations where nonconductive ladders might present a greater hazard than conductive ladders. Conductive or metal ladders shall be prominently marked as conductive, and all precautions shall be taken when used in specialized work.

c. Tape or rope measures that are metal or contain conductive strands shall not be used when working on or near energized parts.