

Safety and Health Policy and Procedure Manual
ELECTRICAL SAFETY-RELATED WORK PRACTICES
Section 0190

Table of Contents

[I. INTRODUCTION](#)

[II. STANDARDS](#)

[III. SCOPE](#)

[IV. PURPOSE](#)

[V. TRAINING](#)

- A. Occupation
- B. Contents of Training

[VI. SELECTION AND USE OF WORK PRACTICES](#)

[VII. WORKING ON OR NEAR EXPOSED DE-ENERGIZED PARTS](#)

- A. General Requirements
- B. Procedures

[VIII. WORKING ON OR NEAR EXPOSED ENERGIZED PARTS](#)

- A. Working on Energized Equipment
- B. Overhead Lines
- C. Illumination
- D. Confined or Enclosed Work Spaces
- E. Conductive Materials and Equipment
- F. Portable Ladders
- G. Conductive Apparel
- H. Housekeeping
- I. Interlocks

[IX. USE OF EQUIPMENT](#)

- A. Handling
- B. Visual Inspection
- C. Grounding-type Equipment
- D. Conductive Work Locations
- E. Connecting Attachment Plugs

[X. ELECTRIC POWER AND LIGHTING CIRCUITS](#)

- A. Routine Opening and Closing of Circuits
- B. Reclosing Circuits after Protective Device Operations
- C. Overcurrent Protective Modification

[XI. TEST EQUIPMENT AND INSTRUMENTS](#)

[XII. OCCASIONAL USE OF FLAMMABLE OR IGNITABLE MATERIALS](#)

[XIII. SAFEGUARDS FOR PERSONNEL PROTECTION](#)

- A. Use of Protective Equipment
- B. Alerting Techniques

Appendices

- A. [Training for Qualified and Unqualified Persons Checklist/ Unqualified Persons Roster](#)
- B. [Training for Qualified Person Checklist/ Qualified Persons Roster](#)
- C. [Approach Distance for Qualified Persons to Alternating Current](#)

SECTION 0190

I. INTRODUCTION

Electrical hazards are probably the most common hazards throughout UNCG. Practically all workplaces have electrical installations and use electricity. Thus, it is very important that all UNCG employees be familiar with electrical hazards and know how to protect themselves when working on, near, or with electricity. In most cases, UNCG electrical and electronic equipment is designed for both maximum safety and efficiency. However, potentially hazardous conditions such as inadvertent contact with hazardous voltages may exist while performing servicing and maintenance, handling materials, or cleaning. Also, the improper use of electrical extension cords and portable electrical equipment can result in hazardous exposure.

II. STANDARDS

OSHA 29 CFR 1910 - General Industry Safety Related Work Practices

[1910.331 Scope](#)

[1910.332 Training](#)

[1910.333 Selection and Use of Work Practices](#)

[1910.334 Use of Equipment](#)

[1910.335 Safeguards for Personal Protection](#)

III. SCOPE

This section provides the basic procedures for protecting UNCG employees from hazardous electrical exposure and other electrical hazards.

IV. PURPOSE

This UNCG Electrical Safety-Related Work Practices Procedure covers the electrical safety-related work practices for both qualified and unqualified persons as described in Occupational Safety and Health Administration (OSHA) standards 29 CFR 1910.331 through .335. Qualified persons are those who have training in avoiding the electrical hazards of working on or near exposed energized parts. Unqualified persons are those with little or no such training.

The safety-related work practices covered include persons working on, near, or with the following UNCG installations:

1. **Premises wiring:** Installations of electric conductors and equipment within or on buildings or other structures, and on other premises such as yards, parking and other lots, and electrical substations;
2. **Wiring for connection to supply:** Installations of conductors that connect to the supply of electricity.

3. **Other wiring:** Installations of other outside conductors on the premises; and
4. **Optical fiber cable:** Installations of optical fiber cable where such are made along with electric conductors.

Other work covered by "unqualified" persons, per OSHA's Electrical Safety Related Work Practices, include work on, near or with:

1. Generation, transmission, and distribution installations;
2. Communications installations; and
3. Installations in vehicles.

Excluded work by "qualified" persons, per OSHA, include work on or directly associated with:

1. Generation, transmission, and distribution installations for the generation, control, transformation, transmission, and distribution of electric energy (including communication and metering) located in buildings used for such purposes or located outdoors.

Note 1: Work on or directly with installation of "utilization" equipment is covered by these safety-related work practices for installations which are not an integral part of a generating installation.

Note 2: Work on or directly with generation, transmission, or distribution installations include:

- (a) Repairing overhead or underground distribution lines or repairing a feed-water pump for a boiler;
- (b) Line clearance tree trimming and pole replacement;
- (c) Work on electric utilization circuits in a generating plant provided that:
 - (1) The circuits are commingled with installation of power generation equipment or circuits; and
 - (2) The generation equipment or circuits present greater electrical hazards than those posed by the utilization equipment or circuits (exposure to higher voltage or lack of overcurrent protection).

2. Communication installations covered by OSHA Standard 29 CFR 1910.168, Telecommunications.

3. Installations in vehicles such as automotive vehicles other than mobile homes and recreational vehicles.

V. TRAINING

All UNCG employees facing a risk of electrical shock that is not reduced to a safe level by proper electrical installation per the National Electrical Code and OSHA standards,

must be trained per OSHA Standard 29 CFR 1910.332. The Department Head is responsible for assuring the training is completed for both qualified and unqualified employees and that copies of the appropriate training rosters (found in [Appendix A](#) or [B](#)) are forwarded to the Office of Safety. The Office of Safety can assist departments with their training needs.

UNCG employees in the following occupations must be trained, as well as other employees who may reasonably be expected to face comparable risk of injury due to electric shock or other electrical hazards.

A. Occupation

- Supervisors (including, but not limited to, Physical Plant and Residence Life Maintenance)
- Electrical and electronic engineers
- Electrical and electronic equipment assemblers
- Electrical and electronic technicians
- Electricians
- Machine operators
- Material handling equipment operators
- Mechanics and maintenance workers (including generator mechanics)
- Painters
- Riggers and equipment installers including roustabouts (tent erectors)
- Telephone services
- Engineers
- Welders

Employees in these groups do not have to be trained if their work, or the work of those they supervise, does not bring them, or the employees they supervise, close to exposed parts of electric circuits operating at 50 volts or more to ground.

B. Contents of Training

Employees must be trained concerning this section which includes the safety-related work practices required by OSHA Standard 1919.331 through .335 that pertain to their respective job assignments. Also, unqualified employees facing a risk of electric shock must be trained in and familiar with any electrically related safety practices not covered by the OSHA Standards, but which are necessary for their safety as specified by their supervisor.

Those qualified persons permitted to work on or near exposed energized parts shall receive minimum training in and be familiar with the following:

1. The skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment;
2. The skills and techniques necessary to determine the nominal voltage of exposed live parts (i.e. use of diagnostic equipment); and
3. The clearance distances specified for working on or near exposed energized parts and the corresponding voltages to which the qualified person will be exposed.

Qualified persons whose work on energized equipment involves either direct contact or contact by means of tools or materials also must be trained concerning:

The capability of working safely on energized circuits and are familiar with the proper use of special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools.

The training for qualified and unqualified employees must involve classroom and on-the-job training. The degree of training provided is determined by the risk to the employee. Contact the Office of Safety for assistance or more information concerning who should be trained and the content of the training.

VI. SELECTION and USE OF WORK PRACTICES

Safety-related work practices are employed to prevent electric shock or other injuries resulting from direct or indirect electrical contact, when work is performed near or on equipment or circuits which are or may be energized. The specific safety-related work practices must be consistent with the nature and extent of the associated electrical hazard including:

1. **De-energized parts:** Live parts to which an employee may be exposed are de-energized before the employee works on or near them, unless:
 - It is demonstrated and approved by the Office of Safety that de-energizing introduces additional or increased hazard or is unfeasible due to equipment design or operational limitations; and
 - Where live parts operate at less than 50 volts to ground, if there is no increased exposure to electrical burns or to explosion due to electric arcs.

Examples of increased or additional hazards include interruption of life support equipment, deactivation of emergency alarm systems, shutdown of ventilation in hazardous locations, or removal of illumination for an area.

Examples of work that may be performed pending Office of Safety approval on or near energized circuit parts because of unfeasibility due to equipment design or operation limitations include testing of electrical 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 shutdown in order to permit work on one circuit or piece of equipment.

2. **Energized Parts:** If the exposed live parts are not de-energized, for reasons of increased or additional hazards or unfeasibility, other safety-related work practices must be used to protect employees who may be exposed to the electrical hazards involved. These work practices must protect employees against contact with energized circuit parts, directly with any part of their body or indirectly through some other conductive object.

The work practices must be suitable for the conditions under which the work is performed and for the voltages of exposed electric conductors or circuit parts.

VII. WORKING ON OR NEAR EXPOSED DE-ENERGIZED PARTS

A. General Requirements

When UNCG employees work on exposed de-energized parts or near enough to them for exposure to any electrical hazard they present, the following safety-related work practices will be followed.

1. Treat any conductors and parts of electric equipment as energized that have been de-energized, but have not been properly locked or tagged out and tested to a zero energy state. **LOCKOUT/TAGOUT SHOULD ALWAYS BE USED.**
2. While any employee is exposed to contact with parts of fixed electric equipment or circuits (fastened in place or connected by permanent wiring methods) which have been de-energized, the circuits energizing the parts shall be locked out or tagged or both. Locking and tagging procedures complying with [Section 0100](#) of this manual and NCOSHA Standard 1910.147 Lockout/Tagout, may be used provided that electrical safety hazards are covered and additional safety measures, such as removal of an isolating circuit element, are used for tagging without a lock and a qualified person tests the circuit.

B. Procedures

The following procedures shall be followed.

1. De-energizing equipment:

- (a) Safe procedures for de-energizing circuits and equipment shall be determined before circuits or equipment are de-energized.
- (b) Circuits and equipment to be worked on shall be disconnected from all electric energy sources. Control circuit devices, such as push buttons, selector switches, and interlocks shall not be used as the sole means for de-energizing circuits or equipment. Interlocks for electric equipment must not be used as a substitute for lockout and tagging procedures.
- (c) Stored electrical energy which might endanger personnel must be released, such as discharging capacitors, short-circuiting neutrals and grounding high capacitance elements. If the capacitors or associated equipment are handled, they shall be treated as energized.
- (d) Stored non-electrical energy (hydraulic, pneumatic, etc.) in devices that could re-energize electric circuit parts, are to be blocked or relieved so that the circuit parts can not be accidentally energized by the device.

2. Application of locks and tags:

- (a) A lock and tag is placed on each disconnecting means used to de-energize circuits and equipment on which work is performed. Where a lock cannot be

applied and it has demonstrated that tagging procedures will provide the safety equivalent to a lock, a tag may be used without a lock as specified by this procedure. The tag is attached so as to prevent persons from operating the disconnecting means unless they resort to undue force or use tools.

(b) Each tag shall contain a statement prohibiting unauthorized operation of the disconnecting means and the name of the responsible party for removal of the tag.

(c) Tags are used without locks only when a lock cannot be applied, or where it has been demonstrated that tagging procedures provide a level of safety that is equivalent to a lock.

(d) When a tag is used without a lock, the tag is supplemented by at least one additional safety measure that provides a level of safety equivalent to that obtained by the use of a lock, such as removal of an isolating circuit element, (i.e. fuse), blocking of a controlling switch, or opening of an extra disconnecting device.

(e) Locks are used without tags only under the following conditions:

- (1) Only one circuit or piece of equipment is de-energized; and
- (2) The lockout period does not extend beyond the workshift; and
- (3) Employees exposed to the hazards associated with re-energizing the circuit or equipment are familiar with this electrical safety-related work practices locking and tagging procedure.

Note: It is highly recommended that tags be used at all times for identification purposes.

3. Verification of De-energized Condition:

The following requirements shall be met before any circuit or equipment is considered de-energized or worked on as de-energized.

(a) A qualified person operates the equipment operating controls or otherwise verifies that the equipment cannot be restarted.

(b) A qualified person tests the circuit and parts with a voltage meter and verifies that the circuit elements and equipment parts are de-energized. The test shall confirm there is no energized condition from inadvertent induced voltage or unrelated voltage backfeed. When voltage over 600 volts nominal is tested, the test equipment shall be checked for proper operation immediately before and after the test. Procedures shall be prepared which state that testing will be performed.

4. Re-energizing Equipment:

The following requirements are met in the order given before circuits or equipment are re-energized, even temporarily.

(a) A qualified person conducts tests and visual inspections, as necessary, to verify that all tools, electrical jumpers, shorts, grounds and other such devices have been removed, so that circuits and equipment can be safely energized.

(b) Employees exposed to the hazards of re-energizing the circuit are warned to stay clear.

(c) Each lock and tag is removed by the person who applied it or under their direct supervision. However, if the person is absent from the workplace, his or her lock and tag may be removed by a qualified person designated by supervision to perform the task provided that:

(1) Supervision ensures the person is not available at the workplace, and

(2) Supervision ensures that the person is aware that their lock and tag has been removed before resuming work at that workplace.

(d) A visual determination is made to ensure that all people are clear of the circuits and equipment.

(e) The steps taken to energize equipment should be in reverse order of those used to de-energize equipment in an attempt to lessen the amp surge to equipment.

NOTE: Be aware of loaded circuits, the amp surge during re-energization can cause an explosion at the disconnecting device.

VIII. WORKING ON OR NEAR EXPOSED ENERGIZED PARTS

UNCG employees are considered working on or near exposed energized parts when working on exposed live parts, either by direct contact or contact by means of tools or materials, or when working near enough to energized parts to be exposed to any hazard they present.

A. Working on Energized Equipment

Only qualified UNCG persons are permitted to work on electric circuit parts or equipment that have not been de-energized utilizing lockout/tagout procedures. Qualified persons are those persons authorized by their supervisor as capable of working safely on energized circuits and are familiar with the proper use of special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools.

B. Overhead Lines

When any UNCG work is to be performed near overhead electric lines, the lines must be de-energized and grounded, or other protective measures taken before the work is started. If lines must be de-energized, make arrangement with the person or organization that operates or controls the electric circuits to de-energize and ground the line. When protective measures are used such as guarding, isolating, or insulating, the

measure must prevent the qualified persons performing the work from contacting the lines with any part of their body, or indirectly through conductive materials, tools, or equipment. Only qualified persons of power transmission and distribution organizations are allowed to install insulating devices on overhead power transmissions and distribution lines.

1. Unqualified Persons

(a) Unqualified persons working in an elevated location near overhead lines, are not allowed to come close or to handle conductive objects which may contact or come closer to any unguarded, energized overhead line than the following distances:

<u>Voltage to Ground</u>	<u>Distances</u>
(1) 50kV or below	10 ft. (305 cm)
(2) over 50kV	10 ft. + 4 in. (c)/10kV over 50kV

(b) Unqualified persons working on the ground in the vicinity of overhead lines are not allowed to bring any conductive object or any insulated object which does not have the proper insulating rating closer to unguarded, energized overhead lines than the distance specified above.

2. Qualified Persons

Qualified persons (authorized by their supervisor) working in the vicinity of overhead lines, whether in an elevated position or on the ground, are not allowed to approach or take any conductive object without an approved insulating handle closer to exposed energized parts than in the table shown in Appendix D unless the following measures are taken.

(a) The person is insulated from the energized part by using the proper gloves, with sleeves if necessary, rated for the voltage involved, or

(b) The energized part is insulated from all other conductive objects at a different potential and from the person, or

(c) The person is insulated from all conductive objects at a potential different from the energized part.

3. Vehicular and Mechanical Equipment

(a) A clearance of ten feet (305 cm) must be maintained at UNCG for all vehicles or mechanical equipment capable of having parts or its structure elevated near energized overhead lines such as cranes, mobile scaffolds, elevating platforms, dump trucks, flatbed trailer cranes, etc.

If the voltage of the overhead line is greater than 50kV, the clearance is increased four inches (10 cm) for every 10kV over 50kV.

Under any of the following conditions, the above clearance may be reduced:

(1) For vehicles in transit with their structures lowered, the clearance may be reduced to four feet (122 cm) for 50kV or four feet plus four inches for every 10kV over 50kV.

(2) If insulating barriers are installed to prevent contact with the lines, and if the barriers are rated for the voltage of the line being guarded and are not a part of an attachment to the vehicle or its raised structure, the clearance may be reduced to distance within the designed working dimensions of the insulating barrier.

(3) If the equipment is an aerial lift insulated for the voltage involved, and if the work is performed by a qualified person, the clearance between the uninsulated portion of the lift and the power line may be reduced to distance given in the table for Approach Distance for Qualified Persons shown in [Appendix C](#).

(b) Persons working on the ground are not allowed to contact the vehicle or mechanical equipment or any of its attachments, unless:

(1) The person uses protective equipment rated for the voltage; or

(2) The equipment is located so that no uninsulated part that may provide a conductive part to persons on the ground can come closer to the line than ten feet or ten feet plus four inches for every ten kV over 50kV.

(c) When any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines is intentionally grounded, persons working on the ground near the point of the grounding may not stand at the grounding location whenever there is a possibility of overhead line contact. Also, additional precautions are taken as necessary to protect persons from hazardous ground potentials which can develop within a few feet or more outward from the grounding point such as barricades or insulation.

C. Illumination

Persons are not allowed to enter or perform work in any UNCG spaces containing exposed energized parts, unless illumination is provided that enables the persons to perform the work safely and there are no obstructions which preclude observation of the work to be performed.

D. Confined or Enclosed Work Spaces

Persons working in UNCG confined or enclosed spaces, such as manholes or vaults, that contain exposed energized parts must be provided and must use protective shields, protective barrier, or insulating materials to avoid inadvertent contact with exposed energized parts.

Doors, hinged panels, and the like are secured to prevent their swinging into a person and causing the person to contact exposed energized parts.

All work that is to be performed in confined spaces is subject to the Permit Required Confined Space Policy that is located under [Section 0040](#) of this manual.

E. Conductive Materials and Equipment

Conductive materials and equipment that are in contact with any part of a person's body must be handled in a manner that will prevent them from contacting exposed energized conductors or circuit parts.

If a person must handle long dimensional conductive objects such as metal ducts, pipes, rods, etc. in areas with exposed live parts, work practices must be used such as the use of insulation, guarding and materials handling techniques which will minimize the hazard.

F. Portable Ladders

All portable ladders used must have nonconductive side rails is used where the person using the ladder(s) could contact exposed energized parts.

G. Conductive Apparel

UNCG employees must not wear conductive articles of jewelry and clothing such as watch bands, bracelets, rings, key chains, necklace, metalized aprons, cloth with conductive thread, metal headgear, etc., if they might contact exposed energized parts. However, such articles may be worn if they are rendered nonconductive by covering, wrapping, or other insulating means as approved by the Office of Safety.

H. Housekeeping

Housekeeping duties must not be performed close enough for contact with live parts unless adequate safeguards such as insulating equipment or barriers are provided. Electrically conductive cleaning materials including conductive solids such as steel wool, metalized cloth, and silicon carbide, as well as conductive liquid solutions must not be used near energized parts unless procedures are followed which prevent electrical contact.

I. Interlocks

Only qualified persons are allowed to defeat or bypass an electrical safety interlock while following the specified procedures for working on or near exposed energized parts, and then only temporarily while he or she is working on the equipment. Also, the interlock system must be returned to its operable condition when this work is completed.

IX. USE OF EQUIPMENT

This procedure applies to the use of cord-and-plug-connected equipment, including flexible cord sets such as extension cords.

A. Handling

Portable equipment must not be handled at UNCG in a manner which may cause damage. Flexible electric cords connected to equipment must not be used for raising or lowering equipment. Also, flexible cords must not be fastened with staples or otherwise hung in such a fashion as could damage the outer jacket or insulation.

B. Visual Inspection

1. Portable cord-and plugged-connected equipment and flexible cord sets (extension cords) used at UNCG must be visually inspected by the user before use on any shift for external defects such as loose parts, deformed and missing pins, or damage to the outer jacket or insulation and for possible internal damage such as pinched or crushed outer jacket.
2. When defects or evidence of damage which might expose employees to injury are detected, the defective or damaged item must be removed from service, and not used until it is repaired and tested to ensure it is safe to use.
3. Prior to connecting an attachment to a receptacle, ensure the plug and receptacle contacts mate.

C. Grounding-type Equipment

1. Flexible cords used with grounding-type equipment must contain an equipment grounding conductor. Two wire "ZIP cords" are not permissible for use as extension cords and shall not be used on campus regardless of the UL listing.
2. Attachment plugs and receptacles must not be connected or altered in a manner which prevents proper continuity of the ground at the point where plugs are attached to receptacles. Also, plugs and receptacle must not be altered to allow the grounding pole to be inserted into current connector slots.
3. Adapters which interrupt the continuity of the equipment grounding connection must not be used.

D. Conductive Work Locations

All portable electric equipment and flexible cords used in highly conductive work location at UNCG, such as those with water or other conductive liquids, or in places where employees are likely to contact water or conductive liquids, must utilize ground fault circuit interrupters for those locations.

E. Connecting Attachment Plugs

1. Employees' hands must not be wet when plugging and unplugging flexible cords and cord-and-plug-connected equipment.
2. If cord connectors are wet from being immersed in water or the condition of the connection could provide a conducting path to employees' hands, the energized plug and receptacle connections must be handled only with approved insulating protective equipment authorized by supervision or allowed to dry before use.
3. Locking-type connectors (twist lock) shall be properly secured after connection.

X. ELECTRIC POWER AND LIGHTING CIRCUITS

A. Routine Opening and Closing of Circuits

Load rated switches, circuit breakers, or other devices specifically designed as disconnecting means must be used for opening, reversing, or closing circuits under load conditions.

Cable connectors not of the load-break type, fuses, terminal lugs, and cable splice connections must not be used for opening, reversing, or closing circuits under load conditions, except in an emergency.

B. Reclosing Circuits after Protective Device Operation

After a circuit is de-energized by a circuit protective device, the circuit must not be manually re-energized until it has been determined that the equipment and circuit can be safely energized.

Repetitive manual reclosing of circuit breakers or re-energizing circuits through replaced fuses is prohibited at UNCG.

When it can be determined from the design of the circuit and the overcurrent device involved that the automatic operation of a device was caused by an overload rather than a fault condition, no examination of the circuit or connected equipment is needed before re-energizing the circuit provided the load has been reduced to at least 80% of the load rating.

C. Overcurrent Protective Modification

Overcurrent protection of circuits and conductors must be modified, even on a temporary basis, beyond that allowed by OSHA Standard 29 CFR 1910.304 (e), Overcurrent Protection Installation Requirements.

XI. TEST EQUIPMENT AND INSTRUMENTS

A. Only qualified persons approved and authorized by their supervisor are allowed to perform testing work on electric circuits or equipment.

B. All test instruments and equipment and all associated test leads, cables, power cords, probes must be visually inspected for external defects and damage before the equipment is used. If defects or damage are observed that might expose an employee to injury, the items must be removed from service and not used until repaired and tested to render the equipment safe.

C. Test instruments and their accessories must be rated for the circuits and equipment tested for the environment where they are used.

XII. OCCASIONAL USE OF FLAMMABLE OR IGNITABLE MATERIALS

Appropriate protective measures, such as, but not limited to, flammable storage cabinets and mechanical ventilation must be taken throughout UNCG to prevent hazardous conditions from developing where flammable materials are present occasionally and electric equipment capable of igniting the flammable materials may be used. Flammable materials which may be ignited by electrical equipment if not properly controlled include, but are not limited to: flammable gases, vapors, or liquids; combustible dust, and ignitable fibers. For more information or assistance contact the Office of Safety.

Electrical installation requirements for locations where flammable materials are present of a regular basis are found in [Section 0120, Lockout/Tagout Procedure](#) of the *UNCG Safety and Health Policy and Procedure Manual*. For additional information, see NIOSH Standard 29 CFR 1910.307, Hazardous (classified) Locations or consult Article 500 of the National Electric Code.

XIII. SAFEGUARDS FOR PERSONNEL PROTECTION

A. Use of Protective Equipment

1. Personal Protective Equipment

- (a) UNCG employees working in areas where there are potential electrical hazards must be provided with and use electrical protective equipment appropriate for the parts of the body to be protected and the work performed. Personal protective equipment requirements are contained in [Section 0130](#) of *UNCG's Safety and Health Policy and Procedure Manual* which complies with OSHA Standard 29 CFR 1910 Subpart I.
- (b) Protective equipment must be maintained in a safe, clean, reliable condition and is periodically inspected or tested, as required by [Section 0130](#) of this manual and OSHA Standard 1910.137, Electrical Protective Devices.
- (c) Where the insulating capability of protective equipment is subject to damage during use, the insulating capability of protective equipment is subject to damage during use, the insulating material must be protected by covering with leather or other such appropriate materials.
- (d) Nonconductive ANSI 289.1, 1986 Class "B" approved head protection must be worn wherever there is danger of head injury from electrical shock or burns due to contact with exposed energized parts.
- (e) Protective equipment for the eyes must be worn where there is danger of eye and/or face injury from electric arcs and flashes or flying objects resulting from electrical explosions.

2. General Protective Equipment and Tools

(a) Insulated tools and handling equipment must be used by employees working near exposed energized conductors or circuit parts if the tools and/or equipment may make contact with the conductors or parts.

The insulating material of tools and equipment must be protected where it is subject to damage.

(1) Fuse handling equipment, insulated for the circuit voltage, must be used to remove or install fuses when the fuse terminals are energized.

NOTE: Many explosions happen during this procedure. Therefore, extra precaution must be taken.

(2) All ropes and handlines used near exposed energized parts must be nonconductive.

(b) Protective shields, protective barriers, or insulating materials must be used to protect employees from shock, burns, or other electrically related injuries while employees are working near exposed energized parts which might be contacted or where dangerous electric heating or arcing might occur.

When normally enclosed live parts are exposed for maintenance or repair, the parts must be guarded to protect unqualified persons from contact with the live parts.

B. Alerting Techniques

The following alerting techniques must be used to warn and protect UNCG employees from electrical shock hazards, burns, or failure of electrical equipment parts. Contact the Office of Safety for more specific details.

1. Safety Signs and Tags:

Safety signs, safety symbols, or accident prevention tags must be used where necessary to warn employees about electrical hazards which may endanger them, as required by OSHA Standard 29 CFR 1910.145, Specifications for Accident Prevention Signs and Tags. In most cases, DANGER signs and tags will be used indicating an electrical hazard.

2. Barricades:

Barricades must be used in conjunction with safety signs where necessary to prevent or limit employee and student access to work areas exposing employees to uninsulated energized conductors or circuit parts. Conductive barricades must not be used where they might cause an electrical contact hazard.

3. Attendants:

An attendant must be stationed to warn and protect employees and students where signs and barricades do not provide sufficient warning and protection.

Appendix A, Section 0190

THE UNIVERSITY OF NORTH CAROLINA at GREENSBORO TRAINING FOR QUALIFIED AND UNQUALIFIED PERSONS CHECKLIST				
Frequency: Initially and as changes occur				
Inspected By:		Responsible Personnel:		
Location:		Department:		Area:
GENERAL				
This form is designed for use in training qualified and unqualified persons concerning electrical safety-related work practices as specified in OSHA Standard 29 CFR 1910.332. Refer to OSHA Standard 1910.331 for more specific details.				
EMPLOYEES REQUIRING TRAINING				
Those employees facing a risk of electrical shock that is not reduced to a safe level by the OSHA electrical installation requirements specified in OSHA standard 1910.303 through .308 must be trained. These employees include those listed in Section 0120 and all others who may reasonably be expected to face a comparable risk of injury due to electric shock or other electrical hazards.				
Exception: Employees in the listed groups do not need to be trained if their work or the work of those they supervise does not bring them or the employees they supervise close enough to exposed parts of electric circuits operating at 50 volts or more to ground for a hazard to exist.				
DEFINITIONS (Needed for this checklist)				
<p>1. Qualified Person: Those employees who have training in avoiding the electrical hazards of working on or near exposed energized parts. Whether an employee is considered to be a "qualified person" will depend upon various circumstances in the workplace. It is possible, and in fact, likely for an individual to be considered "qualified" with regard to certain equipment in the workplace, but "unqualified" as to other equipment. OSHA standard 1910.332(b)(3), specifies the training requirements for qualified persons.</p> <p>An employee who is undergoing on-the-job training and who, in the course of such training, has demonstrated an ability to perform duties safely at his or her level of training and who is under the direct supervision of a qualified person is considered to be a qualified person for the performance of those duties.</p>				
<p>2. Unqualified Person: Those employees who have little or no training in avoiding electrical hazards when working on or near electrical equipment.</p>				
Note: Inspection checklists cannot possibly cover all the items and situations which may be encountered in the workplace. Thus, this sheet can only service as a guide. Refer to the References on Page 3 for more information and details as well as other reference sources.				
No.	INSPECTION	YES	NO	COMMENTS
	CONTENT OF TRAINING Employees are trained in and familiar with the following electrical safe-related work practices pertaining to their respective job assignments.			
1	OSHA standard 1910.331, Scope, Electrical Safety-Related Work Practices.			

	<ul style="list-style-type: none"> A. Covered work by both qualified and unqualified persons B. Other covered work by unqualified persons C. Excluded work by qualified persons 			
2	<p>OSHA standard 1910.332, Training, Electrical Safety-Related Work Practices.</p> <ul style="list-style-type: none"> A. Scope/application B. Training contents C. Type of training 			
3	<p>OSHA standard 1910.333, Selection and Use of Work Practices</p> <ul style="list-style-type: none"> A. General provisions B. Working on or near exposed deenergized parts C. Working on or near exposed energized parts (qualified persons only) 			
4	<p>OSHA standard 1910.334, Use of Equipment</p> <ul style="list-style-type: none"> A. Portable electric equipment B. Electric power and lighting circuits C. Test instruments and equipment D. Occasional use of flammable or ignitable materials 			
5	<p>OSHA standard 1910.335, Safeguards for Personnel Protection</p> <ul style="list-style-type: none"> A. Use of protective equipment B. Alerting techniques 			

Appendix B, Section 0190

**THE UNIVERSITY OF NORTH CAROLINA at GREENSBORO
QUALIFIED PERSON CHECKLIST**

(For Employees Working On or Near Exposed Electrical Conductors)

This checklist covers the specific items in OSHA's Electrical Safety-Related Work Practices standard 29 CFR 1910.331- .355 which pertain to qualified persons. It should be used by qualified person instructors to ensure that qualified persons are properly trained. Prior to using this checklist all qualified persons should have received the same training provided unqualified persons. Thus, this checklist is for supplemental training for qualified persons. Refer to the complete OSHA standard for more details since this checklist is only a summary.

Department: _____ **Location:** _____
Training Location: _____ **Trainer:** _____ **Title:** _____
Training Date: _____ **Training Time: From:** _____ **To:** _____

CONTENT OF TRAINING

Check

<p>1. Definitions A. Qualified Persons: Those who have training in avoiding the electrical hazards of working on or near exposed energized parts. B. Unqualified Person: Those who have little or no training in avoiding electrical hazards of working on or near exposed energized parts.</p>	
<p>2. Training and familiar with A. Skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment, B. Skills and techniques necessary to determine the nominal voltage of exposed live parts, and C. The clearance distance specified in 1910.333(c)(3)(i) and (ii). See table S-5 for qualified person clearance.</p>	
<p>3. Deenergized Parts A. Live parts that operate at fifty volts or more to ground must be deenergized unless it can be demonstrated that deenergizing introduces additional or increased hazards or is infeasible due to equipment design or operational limitations including: (1) interruption of life support equipment (2) deactivation of emergency alarm system, (3) shutdown of hazardous location ventilation equipment, (4) removal of illumination for an area, (5) testing of electric circuits, that can only be performed while energized, (6) work on circuits that form an integral part of a continuous industrial process in a chemical plant that would otherwise need to be completely shut down in order to permit work on one circuit or piece of equipment.</p>	
<p>4. Energized Parts A. Safety related work practices shall be used that (1) protect against contact with energized circuit parts directly or indirectly through conductive objects and (2) are suitable for the work condition and voltage level. B. Working on or near exposed deenergized parts (1) Deenergized conductors and parts shall be treated as energized unless locked out or tagged per the standard. (2) Lockout and Tagging</p>	

(a) Lockout and tagging procedure comply with OSHA lockout/tagout standard, 29 CFR 1910.147 and address the electrical safety hazards covered by this electrical standard

(b) Written lockout/tagout procedures are maintained including:

- (i) deenergizing equipment (safe procedures)
- (ii) control circuits and interlocks not used as the sole means for deenergizing,
- (iii) stored electric energy released,

- capacitors discharged and high capacitance elements are short circuited and grounded, if there is danger,
- if capacitors or associated equipment are handled, they are treated as energized

(iv) stored non-electric energy in devices that could reenergize electric circuit parts are blocked or relieved

(v) application of locks and tags

A. Use a lock and tag unless a lock cannot be applied or if the employer demonstrates tagging procedures providing a level of safety equivalent to using a lock.

B. Each tag contains a statement prohibiting unauthorized operation and removal.

C. Tags used without locks shall be supplemented by at least one additional safety measure (removal of an isolating circuit element, blocking a controlling switch, opening an extra disconnecting device).

D. A lock is used without a tag only when

- one circuit or piece of equipment is deenergized, and
- the lockout period does not exceed the work shift, and
- exposed employees are familiar with this procedure.

E. Verification (by qualified person)

- shall operate the controls or otherwise verify that the equipment cannot be restarted,
- shall test the circuit elements and parts to verify deenergization including checks for inadvertent induced voltage or unrelated voltage backfeed
- for circuits over 600 volts nominal test equipment is checked immediately before and after the test

F. Reenergizing (by qualified person)

- conduct tests and visual inspections to verify removal of:
 - tools, jumpers, shorts, grounds, and other devices
- warn employees
- lock and tag removed by the employee who applied it or under his or her direct supervision.
- When an employee is absent, his or her lock and tag may be removed by a qualified person per written procedure per this standard.

(3) Working on or near energized parts (only qualified persons)

(a) Qualified 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.

(b) Overhead lines

(i) If work is performed near overhead lines, the lines shall be deenergized and grounded or other protective measures shall be provided before work is started.

(ii) Qualified person working in the vicinity of overhead lines, elevated or on the ground, may not approach or take any conductive object without an approved insulated handle closer than shown in Table S-5 below.

TABLE S-5 - APPROACH DISTANCES FOR QUALIFIED EMPLOYEES ALTERNATING CURRENT

<u>Voltage Range (phase to phase)</u>	<u>Minimum Approach Distance</u>
300V and less	Avoid contact.
Over 300V, not over 750V	1 ft. 0 in. (30.5 cm)
Over 750V, not over 2kV	1 ft. 6 in. (46 cm)
Over 2kV, not over 15kV	2 ft. 0 in. (61 cm)
Over 15kV, not over 37kV	3 ft. 0 in. (91 cm)
Over 37kV, not over 87.5kV	3 ft. 6 in. (107 cm)
Over 87.5kV, not over 121kV	4 ft. 0 in. (122 cm)
Over 121kV, not over 140kV	4 ft. 6 in. (137 cm)

(iii) Vehicular and mechanical equipment

A. Any vehicle or mechanical equipment capable of having parts elevated near energized overhead lines shall be operated so that a clearance of ten feet is maintained for voltage to 50kV plus four inches for every 10kV above 50kV.

5. Illumination

Illumination required for entry into spaces containing exposed energized parts.

6. Confined and Enclosed Spaces

Spaces containing exposed energized parts shall not be entered unless protective shields,

barriers, or insulating materials are provided and used.	
<ul style="list-style-type: none"> Doors and hinged panels, etc. shall be secured. 	
7. Conductive Materials	
<ul style="list-style-type: none"> Use work practices to prevent conductive objects from contacting energized parts. 	
8. Portable Ladders shall have nonconductive siderails.	
9. Conductive apparel such as jewelry, watch bands, bracelets, rings, key chains, necklaces, etc. may not be worn if they might contact exposed energized parts unless rendered nonconductive.	
10. Only qualified persons may temporarily defeat an electrical safety interlock.	
11. Electric power and lighting circuits	
A. Routine opening and closing of circuits	
<p>(1) Load rated switches, circuit breakers, or other devices designed for disconnecting shall be used for opening, reversing, or closing circuits under load conditions.</p> <p>(2) Reclosing circuits after protective device operation.</p> <p>(a) A qualified person shall determine that equipment can be safely reenergized after a circuit protective device deenergizes a circuit.</p> <p>(b) Repetitive manual reclosing of circuit breakers or replacing fuses is prohibited.</p>	
B. Overcurrent protection may not be modified.	
12. Test instruments and equipment (used by qualified person only).	
A. Visual inspection prior to use.	
B. Rated equipment used as specified.	
13. Occasional use of flammable or ignitable materials.	
A. Measures must be taken to prevent hazardous conditions from developing.	
14. Personal protective equipment shall be provided, used and maintained.	
15. Insulated tools or handling equipment shall be used when working near energized parts.	
16. Alerting techniques shall be used to warn and protect employees from electrical hazards including:	
<ul style="list-style-type: none"> signs and tags barricades attendants 	

Route copies to: Office of Safety

**THE UNIVERSITY OF NORTH CAROLINA at GREENSBORO
APPROACH DISTANCES for QUALIFIED PERSONS
to ALTERNATING CURRENT**

Voltage Range (phase to phase)	Minimum Approach Distance
300V and less	Avoid contact
Over 300V, not over 750V	1 ft. 0 in. (30.5 cm)
Over 750V, not over 2kV	1 ft. 6 in. (46 cm)
Over 2kV, not over 15kV	2 ft. 0 in. (61 cm)
Over 15kV, not over 37kV	3 ft. 0 in. (91 cm)
Over 37kV, not over 87.5kV	3 ft. 6 in. (107 cm)
Over 87.5kV, not over 121kV	4 ft. 0 in. (122 cm)
Over 121kV, not over 140kV	4 ft. 6 in. (137 cm)