

ELECTRICAL SAFETY IN THE WORKPLACE

Elizabeth City State University – Environmental Health and Safety Office

1.0 Purpose and Scope

The purpose of this procedure is to define and establish the safety precautions and responsibilities for safe work practices when working on or near electrical circuits of 50 to 600 volts that are not building electrical service entrance panels. It also establishes requirements for Personal Protective Equipment (PPE), energized work, and electrical training.

The safety-related work practices covered include persons working on, near, or with the following ECSU 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;
4. Optical fiber cable: Installations of optical fiber cable where such are made along with electric conductors.

For work that is performed on or near electrical power generation, transmission, distribution, building electrical service entrance panels, or electrical circuits 600 volts/above.

2.0 Applicability

This procedure applies to all ECSU employees that perform, supervise and/or execute electrical work, or work in the vicinity of electrical systems.

This procedure complies with OSHA Part 1910 Subpart S – Electrical, and NFPA 70E (2004) – *Standard for Electrical Safety in the Workplace*.

Definitions

Arc – The passage of substantial electric current through ionized air.

Arc Flash – The expanding arc or fireball emanating from the source of the arc. It may be from a fraction of an inch to ten feet or more in size. It involves extremely intense heat and may ignite anything combustible in its path. The duration is usually a fraction of a second. An arc flash can reach temperatures of 35,000 degrees and can produce a concussive force of expanding gases and metal plasma.

Arc Rating - The maximum incident energy resistance demonstrated by a material (or a layered system of materials) prior to breakopen or at the onset of a second-degree skin burn. Arc rating is normally expressed in cal/cm².

(NFPA fine print note): Breakopen is a material response evidenced by the formation of one or more holes in the innermost layer of flame-resistant material that would allow flame to pass through the material.

Arc Thermal Performance Value (ATPV) – this is the rating of a protective garment or shield. Refers to the maximum amount of energy that the garment or shield can withstand without breaking open or transmitting heat that would cause more than a second-degree burn.

Bolted Fault Current – The maximum current flow possible with a very near zero resistance fault, equivalent to two wires with lugs bolted together.

Contractor – service provider that performs facility-related work including equipment service/maintenance or construction type activities. Contractors are typically hired to install new equipment, perform service, maintain or modify an existing facility or related equipment. Contractors may be called upon to perform a wide variety of work

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including but not limited to construction activities, demolition, crane/rigging services, electrical contracting, mechanical contracting, painting, landscaping/lawn care, janitorial services, etc.

Curable Burn – An electrical burn that is second degree or less.

Energized – Electrically connected to or having a source of voltage.

Energized Electrical Work – Work performed on or near energized electrical systems or equipment with exposed components operating at 50 volts or greater and as defined by Restricted Approach Boundary and Prohibited Approach Boundary terminology.

Equipment – A general term including material, fittings, devices, appliances, luminaires (fixtures), apparatus, and the like used as a part of, or in connection with, an electrical installation.

Exposed – Capable of being inadvertently touched or approached by personnel nearer than a safe distance. This applies to parts that are not suitably guarded, insulated, or isolated. For the purposes of NFPA Article 450, the word exposed means that the circuit is in such a position that, in case of failure of supports or insulation, contact with another circuit may result.

Exposed - (as applied to live parts) - Capable of being inadvertently touched or approached nearer than a safe distance by a person. It is applied to 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.

Facility – any UNC Charlotte facility that is owned and maintained by UNC Charlotte / State of North Carolina.

Flame Resistant (FR) - The property of a material whereby combustion is prevented, terminated, or inhibited following the application of a flaming or non-flaming source of ignition, with or without subsequent removal of the ignition source.

(NFPA fine print note): Flame resistance can be an inherent property of a material, or it can be imparted by a specific treatment applied to the material.

Flammable Material – Any substance that is easily ignited and is capable of burning with great rapidity and flame. Flammable liquids have a flash point below 100 degrees Fahrenheit.

Flash Hazard Analysis – A study investigating a worker's potential exposure to arc-flash energy, conducted for the purpose of injury prevention and determination of safe work practices and the appropriate levels of PPE.

Flash Protection Boundary – An approach limit at a distance from exposed live parts within which a person could receive a second degree burn if an electrical arc flash were to occur **(see illustration 1A, page 5)**.

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 to a point of danger or contact by persons or objects.

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.

(NFPA Fine Print Note): Class A ground-fault circuit-interrupter trips when the current to ground has a value in the range of 4 mA to 6 mA. For further information, see UL 943, Standard for Ground-Fault Circuit Interrupters.

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Hi-pot Testing - The Hi-pot test is a nondestructive test that determines the adequacy of electrical insulation for the normally occurring overvoltage transient. This is a high-voltage test that is applied to all devices for a specific time in order to ensure that the insulation is not marginal. Another reason for conducting the hipot test is that it also detects possible defects such as inadequate creepage and clearance distances introduced during the manufacturing process

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

Insulated Tools – Tools tested and approved by the manufacturer for the rated voltage or tools that are covered, surrounded or separated with a nonconductive material in order to prevent or reduce the transfer of electricity. Insulated tools are rated to a specific voltage.

Limited Approach Boundary – An approach limit at a distance from an exposed live part within which a shock hazard exists (**see illustration 1A, page 5**).

May – Indicates permission is granted.

Near – Conditions where contact with exposed electrical components is possible by slipping, tripping, falling, the actions of others, or inadvertent action of reasonable probability.

Prohibited Approach Boundary – An approach limit at a distance from an exposed live part within which work is considered the same as making contact with the live part (**see illustration 1A, page 5**).

Qualified Person – A qualified person shall be trained and knowledgeable of the construction and operation of equipment or a specific work method and be trained to recognize 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, personal protective equipment, including arc-flash, insulating and shielding materials, and insulated tools and test equipment. A person can be considered qualified with respect to certain equipment and methods but still be unqualified for others.
- (b) 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 shall be considered to be a qualified person for the performance of those duties.
- (c) Such persons permitted to work within the Limited Approach Boundary of exposed live parts operating at 50 volts or more shall, at a minimum, be additionally trained in all of the following:
 - (1) The skills and techniques necessary to distinguish exposed energized parts from other parts of electrical equipment
 - (2) The skills and techniques necessary to determine the nominal voltage of exposed live parts
 - (3) The approach distances specified in Table 130.2(C) and the corresponding voltages to which the qualified person will be exposed
 - (4) The decision-making process necessary to determine the degree and extent of the hazard and the personal protective equipment and job planning necessary to perform the task safely

Restricted Approach Boundary – An approach limit at a distance from an exposed live part within which there is an increased risk of shock, due to electrical arc over combined with inadvertent movement, for personnel working in close proximity to the live part (**see illustration 1A, page 5**).

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Service Equipment – The necessary equipment, usually consisting of a circuit breaker or switch and fuses, and their accessories, located near the point of entrance of supply conductors to a building or other structure, or an otherwise designated area, and intended to constitute the main control and cutoff of the supply.

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Responsibilities

4.1 Technicians – Technicians performing work on energized equipment shall follow the requirements of this procedure, wear appropriate PPE, and bring forward any electrically hazardous or unsafe condition to the attention of their Supervisor.

4.2 Supervisors – Supervisors will ensure that their Technicians have been trained in the details of this procedure. When hazardous or unsafe conditions are brought forward by Technicians, the Supervisor will address these conditions with the appropriate individuals to make the condition safe.

Supervisors will ensure that their Technicians follow the requirements of this procedure. Through supervisory inspections (conducted at least annually) on each applicable employee, Supervisors shall verify that each employee is complying with these safety related work practices. Supervisors must ensure that each employee understand what specific tasks the employee is qualified to perform.

4.3 Qualified Persons – When electrical equipment is open and energized parts are exposed, only qualified persons with the proper PPE are allowed to cross the Flash protection Boundary and the Limited Approach boundary. It is the responsibility of the qualified person to prevent any unqualified or qualified person without proper PPE from entering the work area.

4.4 Management / Department Leadership – Management personnel are responsible for full implementation and compliance of this procedure. They will ensure that Technicians have the necessary skills, training and protective equipment to perform work on energized equipment in accordance with this procedure.

4.5 Contractors - must comply with all NC-OSHA, NEC and NFPA electrical and hazardous energy safety rules and regulations when completing work on campus. Contractors must provide all information concerning the contractor safety program to the University Project Manager or his/her designee when requested, including all requirements as determined by the work to be completed.

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4.6.1 Periodically audit the program to ensure the procedures are being followed.

4.6.2 Provide technical assistance as needed for the development of non-standard procedures.

4.6.3 Ensure all electrical safety policies are reviewed at least annually.

Requirements

5.1 Work Procedures – If live exposed electrical parts are not placed in an electrically safe work condition (i.e., for the reasons of increased or additional hazards or infeasibility), work to be performed under this procedure shall be considered energized electrical work and shall be performed by a **ECSU – Energized Electrical Work Permit (See Form A). This permit must be completed by the qualified employee and authorized by their supervisor.** In addition safe work practices and PPE shall be used to protect employees who might be exposed to the electrical hazards. Such work practices and PPE shall protect employees from arc flash and from contact with live parts directly with any part of the body, or indirectly through some other conductive object. The work practices used shall be suitable for the conditions under which the work is to be performed and for the voltage level of the live parts. **Note:** Certain task such as troubleshooting to diagnosis problems, testing, voltage measuring, etc. may be completed without an energized work permit, provided appropriate safe work practices and PPE are provided and used.

5.1.1 Electrical Service Equipment shall not be worked energized because of the large fault currents available and potentially long clearing times typically seen with electrical service equipment. This includes all panels and equipment where electricity enters each building or structure.

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- 5.1.2 Lockout/Tagout** – Every attempt must be made to de-energized electrical equipment prior to work. Equipment shall be rendered electrically safe by reviewing the University Lockout / Tagout program and following the applicable hazardous energy control procedure. The hazardous energy control procedures shall identify the type and magnitude of the hazardous energy, the means and methods that will be used to protect employees during servicing, replacement or installation of equipment. This includes safe work practices and PPE requirements.
- 5.1.3 Flash Protection Boundaries** - Flash protection boundaries must be calculated in accordance with NFPA 70E 130.3(A) and must be used only under engineering supervision.
- 5.1.4 Approach Boundaries** - Employees considered Qualified Persons shall not approach or take any conductive object closer to live parts than the restricted approach boundary given in Table 1, unless:
- (a) The qualified person is insulated or guarded from the live parts (insulating gloves compliant with Table 2), arc-face shield and protective clothing are considered insulation only with regard to the energized parts upon which work is being performed), and no uninsulated part of the qualified person’s body enters the prohibited space set forth in Table 1, OR
 - (b) The live part is insulated from the employee and from any other conductive object at a different potential.

Table 1 – Approach Boundaries

All dimensions are distance from live part to associate.

Nominal System Voltage Range Phase to Phase Voltage	Limited Approach Boundary		Restricted Approach Boundary	Prohibited Approach Boundary
	Exposable Movable Conductor	Exposed Fixed Circuit Part		

Illustration 1A -- Approach Boundaries

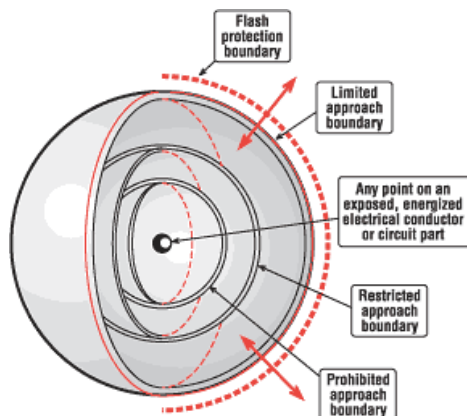


Table 2 – Glove Classifications – Shock Protection by Voltage Maximum

Approach Boundaries – Shock Prevention	
Maximum Voltages per Glove Class	

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Glove Class	Maximum AC Voltage Allowed
00	500 V
0	1 kV
1	7.5 kV
2	17 kV
3	26.5 kV
4	36 kV

5.1.5 Conductive Materials, Tools and Equipment – Conductive materials, tools and equipment shall be handled so that accidental contact with live parts does not occur. Employees will ensure they will not bring conductive materials within the Limited Approach Boundary specified in Table 1. Conductive apparel such as earrings, bracelets, rings, necklaces, belt buckles and metal buttons shall not be worn inside the Flash Protection Boundary or the Limited Approach boundary..

5.1.6 Insulated Tools and Equipment – Employees shall use insulated tools and equipment, when working inside the limited approach boundary. The insulated tools shall be protected from damage and inspected prior to use. Fuse or fuse holder handling equipment, insulated for the circuit voltage, shall be used to remove or install a fuse if either of the fuse terminals are energized.

5.1.6.1 Test Instruments and Equipment – Electrical circuit testing instruments like voltage testers (multimeters), ammeters, megohmmeters, etc. are designed for use on energized equipment, however, care must be taken to use them on circuits for which the equipment is rated. Misapplication of the equipment can result in equipment failure, flashover and severe burns. Instruments must be used in accordance with manufacturers' recommendations. 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 time the equipment is used. If there are indications that instruments are not working properly or if there is visible damage, the instruments will immediately be taken out of service. Only company-approved test equipment shall be used. Do not use "light-up type" voltage detectors because they work on the principle of electric field detection and may give inaccurate readings in multi-circuit environments.

5.1.6.2 Protective Shields – Protective shields, barriers or insulating materials shall be used to protect employees from shock, burns or other electrically related injuries due to accidental contact with energized parts within the restricted approach boundary that the employee is not working on. This provision applies to situations where uninsulated parts of the employees body (such as the back, shoulders, arms) come in close with energized parts that the employee is not working on.

5.1.6.3 Portable Ladders – Portable ladders shall have non-conductive side rails if they are used where the employee or ladder could contact energized parts.

5.1.6.4 Safety Interlocks – Only employees considered Qualified Persons following the requirements for working inside the restricted approach boundary are permitted to defeat or bypass an electrical safety interlock over which the person has sole control, and then only temporarily, while the qualified person is working on the equipment. The safety interlock system shall be returned to its operable condition when the work is completed.

5.1.6.5 Ground Fault Circuit Interrupters (GFCIs)

- (1) Approved GFCI protection shall be provided and used for all 125 volt (nominal) single phase 15, 20 and 30 amp receptacle outlets that are not part of the permanent wiring of the building or structure. GFCIs shall be used whenever

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employees are working on a construction project, working with temporary wiring or working in wet areas. Extension cords used for construction or used in wet applications shall be equipped with Ground Fault Circuit Interrupters (GFCI) protection, unless a breaker, receptacle, or portable GFCI unit provides GFCI protection.

- (2) Portable and permanent GFCIs shall be tested prior to each use. GFCIs have a built-in test circuit, which imposes an artificial ground fault on the load circuit to assure that the ground-fault protection is still functioning. GFCI units shall be tested by pressing the “test” button and the “reset” with a load on the circuit to verify the GFCI cuts power to the load. A trained and qualified electrical worker should also test permanent GFCIs monthly. This testing shall be documented and records retained for the life of the unit.

5.2 Personal Protective Equipment

5.2.1 General – Employees working energized exposed live parts equipment within the Limited Approach Boundary shall wear protective clothing and other personal protective equipment in accordance with this procedure and as indicated by hazard classification in Table 1. The PPE and clothing requirements may be determined by conducting a Flash Hazard Analysis or by using the requirements presented in the following table:

Table 1 -- Hazard/Risk Category Classifications -- NFPA 70E -- Table 130.7 (C)(9)(a)

Task (Assumes Equipment Is Energized, and Work Is Done Within the Flash Protection Boundary)	Hazard/ Risk Category	V-rated Gloves	V-rated Tools
Panelboards Rated 240 V and Below — Notes 1 and 3			
Circuit breaker (CB) or fused switch operation with covers on	0	N	N
CB or fused switch operation with covers off	0	N	N
Work on energized parts, including voltage testing	1	Y	Y
Remove/install CBs or fused switches	1	Y	Y
Removal of bolted covers (to expose bare, energized parts)	1	N	N
Opening hinged covers (to expose bare, energized parts)	0	N	N
Panelboards or Switchboards Rated >240 V and up to 600 V (with molded case or insulated case circuit breakers) — Notes 1 and 3			
CB or fused switch operation with covers on	0	N	N
CB or fused switch operation with covers off	1	N	N
Work on energized parts, including voltage testing	2*	Y	Y
600 V Class Motor Control Centers (MCCs) — Notes 2 (except as indicated) and 3			
CB or fused switch or starter operation with enclosure doors closed	0	N	N
Reading a panel meter while operating a meter switch	0	N	N
CB or fused switch or starter operation with enclosure doors open	1	N	N
Work on energized parts, including voltage testing	2*	Y	Y
Work on control circuits with energized parts 120 V or below, exposed	0	Y	Y
Work on control circuits with energized parts >120 V, exposed	2*	Y	Y
Insertion or removal of individual starter “buckets” from MCC — Note 4	3	Y	N
Application of safety grounds, after voltage test	2*	Y	N
Removal of bolted covers (to expose bare, energized parts)	2*	N	N
Opening hinged covers (to expose bare, energized parts)	1	N	N

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Table 1 -- Hazard/Risk Category Classifications -- NFPA 70E -- Table 130.7 (C)(9)(a)

Task (Assumes Equipment Is Energized, and Work Is Done Within the Flash Protection Boundary)	Hazard/ Risk Category	V-rated Gloves	V-rated Tools
600 V Class Switchgear (with power circuit breakers or fused switches) — Notes 5 and 6			
CB or fused switch operation with enclosure doors closed	0	N	N
Reading a panel meter while operating a meter switch	0	N	N
CB or fused switch operation with enclosure doors open	1	N	N
Work on energized parts, including voltage testing	2*	Y	Y
Work on control circuits with energized parts 120 V or below, exposed	0	Y	Y
Work on control circuits with energized parts >120 V, exposed	2*	Y	Y
Insertion or removal (racking) of CBs from cubicles, doors open	3	N	N
Insertion or removal (racking) of CBs from cubicles, doors closed	2	N	N
Application of safety grounds, after voltage test	2*	Y	N
Removal of bolted covers (to expose bare, energized parts)	3	N	N
Opening hinged covers (to expose bare, energized parts)	2	N	N
Other 600 V Class (277 V through 600 V, nominal) Equipment — Note 3			
Lighting or small power transformers (600 V, maximum)	—	—	—
Removal of bolted covers (to expose bare, energized parts)	2*	N	N
Opening hinged covers (to expose bare, energized parts)	1	N	N
Work on energized parts, including voltage testing	2*	Y	Y
Application of safety grounds, after voltage test	2*	Y	N
Revenue meters (kW-hour, at primary voltage and current)	—	—	—
Insertion or removal	2*	Y	N
Cable trough or tray cover removal or installation	1	N	N
Miscellaneous equipment cover removal or installation	1	N	N
Work on energized parts, including voltage testing	2*	Y	Y
Application of safety grounds, after voltage test	2*	Y	N
NEMA E2 (fused contactor) Motor Starters, 2.3 kV Through 7.2 kV			
Contactor operation with enclosure doors closed	0	N	N
Reading a panel meter while operating a meter switch	0	N	N
Contactor operation with enclosure doors open	2*	N	N
Work on energized parts, including voltage testing	3	Y	Y
Work on control circuits with energized parts 120 V or below, exposed	0	Y	Y
Work on control circuits with energized parts >120 V, exposed	3	Y	Y
Insertion or removal (racking) of starters from cubicles, doors open	3	N	N
Insertion or removal (racking) of starters from cubicles, doors closed	2	N	N
Application of safety grounds, after voltage test	3	Y	N
Removal of bolted covers (to expose bare, energized parts)	4	N	N
Opening hinged covers (to expose bare, energized parts)	3	N	N
Metal Clad Switchgear, 1 kV and Above			
CB or fused switch operation with enclosure doors closed	2	N	N
Reading a panel meter while operating a meter switch	0	N	N
CB or fused switch operation with enclosure doors open	4	N	N

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Table 1 -- Hazard/Risk Category Classifications -- NFPA 70E -- Table 130.7 (C)(9)(a)

Task (Assumes Equipment Is Energized, and Work Is Done Within the Flash Protection Boundary)	Hazard/ Risk Category	V-rated Gloves	V-rated Tools
Work on energized parts, including voltage testing	4	Y	Y
Work on control circuits with energized parts 120 V or below, exposed	2	Y	Y
Work on control circuits with energized parts >120 V, exposed	4	Y	Y
Insertion or removal (racking) of CBs from cubicles, doors open	4	N	N
Insertion or removal (racking) of CBs from cubicles, doors closed	2	N	N
Application of safety grounds, after voltage test	4	Y	N
Removal of bolted covers (to expose bare, energized parts)	4	N	N
Opening hinged covers (to expose bare, energized parts)	3	N	N
Opening voltage transformer or control power transformer compartments	4	N	N
Other Equipment 1 kV and Above			
Metal clad load interrupter switches, fused or unfused	—	—	—
Switch operation, doors closed	2	N	N
Work on energized parts, including voltage testing	4	Y	Y
Removal of bolted covers (to expose bare, energized parts)	4	N	N
Opening hinged covers (to expose bare, energized parts)	3	N	N
Outdoor disconnect switch operation (hookstick operated)	3	Y	Y
Outdoor disconnect switch operation (gang-operated, from grade)	2	N	N
Insulated cable examination, in manhole or other confined space	4	Y	N
Insulated cable examination, in open area	2	Y	N

Note:
V-rated Gloves are gloves rated and tested for the maximum line-to-line voltage upon which work will be done.
V-rated Tools are tools rated and tested for the maximum line-to-line voltage upon which work will be done.
2* means that a double-layer switching hood and hearing protection are required for this task in addition to the other Hazard/Risk Category 2 requirements of Table 130.7(C)(10).

Y = yes (required) N = no (not required)

Footnotes:

1. 25 kA short circuit current available, 0.03 second (2 cycle) fault clearing time.
2. 65 kA short circuit current available, 0.03 second (2 cycle) fault clearing time.
3. For < 10 kA short circuit current available, the hazard/risk category required may be reduced by one number.
4. 65 kA short circuit current available, 0.33 second (20 cycle) fault clearing time.
5. 65 kA short circuit current available, up to 1.0 second (60 cycle) fault clearing time.
6. For < 25 kA short circuit current available, the hazard/risk category required may be reduced by one number.

- 5.2.2 Examples of PPE** - Some examples of PPE include:
 Hard Hats - Class G or Class E (depending of working voltage)
 Insulating gloves rated for the voltage being worked
 Leather protectors for insulating gloves
 Flame resistant and/or cotton underwear, shirt, pants, and coveralls
 Flame resistant switching hood
 Safety glasses (no metal frames) or goggles
 Face shield
 Hearing protection
 Leather boots (EH rated)

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5.2.3 Using Flame Resistant Clothing - Where it has been determined that work will be performed in areas where there are electrical hazards, Flame Resistant (FR) clothing and PPE, **per Table 2**, shall be used by employees working within the Flash Protection Boundary. Clothing made from synthetic materials such as acetate, nylon, polyester, rayon, or cotton blends containing these materials are prohibited.

5.2.4 Inspecting and Maintaining PPE

5.2.4.1 Safety and protective equipment and 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 one year.

5.2.4.2 Protective equipment shall be maintained in a safe, reliable condition and shall be inspected before each use and as otherwise recommended by the manufacturer. All inspections shall be documented and records retained for the life of the equipment.

NOTE: The PPE requirements contained in this section are designed to protect an employee from arc-flash and shock hazards. Electrical PPE will limit a burn to the skin to a curable burn (second degree or less). Because of the explosive nature of some catastrophic electric failures, physical trauma may occur. The potential for physical trauma injuries should be considered prior to the start of the project. Objects that could cause injury in an explosive arc flash should be removed or padded.

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Table 2 -- Protective Clothing and Personal Protective Equipment (PPE) Matrix

Protective Clothing and Equipment	Protective Systems for Hazard/Risk Category					
Hazard / Risk Category Number	-1 (note 3)	0	1	2	3	4
Non-melting (according to ASTM F 1506-00) or Untreated Natural Fiber						
a. T-shirt (short-sleeve)	X			X	X	X
b. Shirt (long-sleeve)		X				
c. Pants (long)	X	X	X (note 4)	X (note 6)	X	X
FR Clothing (Note 1)						
a. Long-sleeve shirt			X	X	X (note 9)	X
b. Pants			X (note 4)	X (note 6)	X (note 9)	X
c. Coverall			(note 5)	(note 7)	X (note 9)	(Note 5)
d. Jacket, parka, or rainwear			AN	AN	AN	AN
FR Protective Equipment						
a. Flash suit jacket (multilayer)						X
b. Flash suit pants (multilayer)						X
c. Head protection						
1. Hard hat			X	X	X	X
2. FR hard hat liner					AR	AR
d. Eye protection		—	—	—	—	—
1. Safety glasses	X	X	X	AL	AL	AL
2. Safety goggles				AL	AL	AL
e. Face and head area protection		—	—	—	—	—
1. Arc-rated face shield, or flash suit hood				X (note 8)		
2. Flash suit hood					X	X
3. Hearing protection (ear canal inserts)				X (note 8)		
f. Hand protection			—	—	—	—
Leather gloves (Note 2)			AN	X	X	X
g. Foot protection						
Leather work shoes			AN	X	X	X

AN = As needed

AL = Select one in group

AR = As required

X = Minimum required

Notes:

- See Table 130.7(C)(11). Arc rating for a garment is expressed in cal/cm².
- If voltage-rated gloves are required, the leather protectors worn external to the rubber gloves satisfy this requirement.
- Hazard/Risk Category Number "-1" is only defined if determined by Notes 3 or 6 of Table 130.7(C)(9)(a).
- Regular weight (minimum 12 oz/yd² fabric weight), untreated, denim cotton blue jeans are acceptable in lieu of FR pants. The FR pants used for Hazard/Risk Category 1 shall have a minimum arc rating of 4.
- Alternate is to use FR coveralls (minimum arc rating of 4) instead of FR shirt and FR pants.
- If the FR pants have a minimum arc rating of 8, long pants of non-melting or untreated natural fiber are not required beneath the FR pants.
- Alternate is to use FR coveralls (minimum arc rating of 4) over non-melting or untreated natural fiber pants and T-shirt.
- A faceshield with a minimum arc rating of 8, with wrap-around guarding to protect not only the face, but also the forehead, ears, and neck (or, alternatively, a flash suit hood), is required.
- Alternate is to use two sets of FR coveralls (the inner with a minimum arc rating of 4 and outer coverall with a minimum arc rating of 5) over non-melting or untreated natural fiber clothing, instead of FR coveralls over FR shirt and FR pants over non-melting or untreated natural fiber clothing.

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5.3 Training

5.3.1 General Requirements - Safety training shall be provided to employees who face the risk of electrical hazards within the scope of their work tasks or environment. Employees will be trained in safety related work practices and procedures as needed to provide them protection from the electrical hazards associated with their respective job tasks. This training should include the identification of electrical hazards and potential injuries. Training shall consist of classroom training, on the job training, or a combination of both. The degree of training shall be determined by the risk to the employee and the job task assigned. Retraining shall be provided anytime there is a change in the process and when an audit or incident investigation indicates a need. All training shall be documented and retained for the duration of employment.

5.3.2 Qualified Person Training

5.3.2.1 A qualified person shall be trained and knowledgeable of the construction and operation of equipment or a specific work method, and be trained to recognize and avoid the electrical hazards that might be present with respect to that equipment or work method. Employees who are qualified persons shall also be familiar with the proper use of special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools and test equipment. A person can be considered qualified with respect to certain equipment and methods but unqualified for others.

5.3.2.2 Such persons permitted to work within limited approach of exposed energized conductors and circuit parts shall, at a minimum, be additionally trained in all of the following:

- (1) The skills and techniques necessary to distinguish exposed energized parts from other parts of electric equipment;
- (2) The skills and techniques necessary to determine the nominal voltage of exposed energized parts;
- (3) The approach distances specified in Table 1 and the corresponding voltages to which the qualified person will be exposed; and
- (4) The decision-making process necessary to determine the degree and extent of the hazard and the personal protective equipment and job planning necessary to perform the task safely.

5.3.3 Qualified persons working on or near exposed energized parts shall be trained in emergency actions (i.e. removing victim from live circuits), first aid and cardiopulmonary resuscitation (CPR).

5.3.3.1 Unqualified Person Training - Unqualified persons shall be trained in and familiar with any of the electrical safety related practices that are necessary for their safety. This includes, but is not limited to the general training requirements listed above.

ELECTRICAL SAFETY IN THE WORKPLACE

Elizabeth City State University – Environmental Health and Safety Office

Form A Elizabeth City State University -- ENERGIZED ELECTRICAL WORK PERMIT

Extended Duration

One-time Use Only

Department:

Building:

Room/Area:

Job Supervisor/Responsible Engineer:

Date Start:

Expiration Date:

Description of work to be done:

Description of Circuit/Equipment:

Justification for why equipment cannot be de-energized:

TO BE COMPLETED BY THE ELECTRICALLY QUALIFIED PERSONS DOING THE WORK:

Workers must be trained, qualified, and have full knowledge of equipment.

Ensure Shock Protection Boundary of at least 10 feet unless specified on electrical equipment.

Ensure Arc Flash Protection Boundary of at least 4 feet unless specified on electrical equipment.

All Natural Fiber Outerwear is being worn

Fire Retardant Clothing is being worn

Required Additional PPE:

Safe work practices to be followed:

All measuring / testing tools (Voltmeter, Multi-meter, Ampere meter, etc.) are rated to be safely used on the equipment to be worked on.

Safety watch is required. This person must be trained in CPR, qualified to do the work, and be able to cut off all power sources, and have immediate access to a telephone or radio to call 911 in case of emergency.

Insulated tools and equipment required:

Remove all jewelry and metal apparel.

Use safety signs, attendants, or other means of barricading to restrict the access of unqualified persons from the work area

YES NO Do you agree the work can be completed safely?

AUTHORIZED WORKERS that understand and agree to the above:

Printed or typed name(s):

Signature(s) & Date(s):

Printed or typed name(s):

Signature(s) & Date(s):

APPROVAL(S) TO PERFORM THE WORK WHILE ELECTRICALLY ENERGIZED:

Departmental Supervisor:

Date:

ELECTRICAL SAFETY IN THE WORKPLACE

Elizabeth City State University – Environmental Health and Safety Office

Departmental Manager:

Date:

A copy of this form must be kept on file in Electrical Department and sent to EHS Office.