

SUBJECT: UCF Electrical Safety Procedure	Effective Date: 2/20/14	Procedure Number: FS 2014 EHS0010
	Supersedes:	Page Of 1 20
	Responsible Authority: Associate Vice President, Administration and Finance (Facilities and Safety)	

APPLICABILITY/ACCOUNTABILITY

This procedure applies to all members of the university community working on or near energized electrical equipment or systems of 50-600 volts.

BACKGROUND INFORMATION

The University of Central Florida (UCF) is committed to providing a safe working and learning environment, and to upholding environmentally sound practices in all university-related activities. Through this commitment, the university aims to limit injuries and illnesses, environmental incidents, and property damage or loss.

PROCEDURE STATEMENT

This procedure provides information to supervisors and employees for the control of electrical hazards while performing repairs or maintenance operations. It establishes minimum standards to prevent hazardous electrical exposures to personnel, and to ensure compliance with regulatory requirements.

Employees are required to work only on de-energized equipment, unless additional or increased hazards result from de-energizing equipment, or it is not possible to complete critical work due to equipment design or operational limitations.

DEFINITIONS

Arc flash – electrical explosion (light and heat) produced by an electric arc supplied with sufficient electrical energy to cause substantial damage, harm, fire, or injury

Electric arc – form of electricity discharge with a high current density

Energized electrical work – any inspection, repair, or maintenance work where the employee is making direct contact with an energized system or equipment

Energized electrical work permit – written document utilized by the UCF management to review safety hazards and to ensure all safety precautions are taken before authorizing any energized electrical work

Licensed electrician – employees who are properly licensed by a Florida County, Division of Building Safety to perform electrical work

Lock-out/tag-out – systematic installation of locks, locking devices, and tags to ensure that dangerous energy is properly shut off, that every possible residual energy is released, and that the system is not started up again prior the completion of the maintenance or servicing work

Minor non-compliance. - the occurrence of an unsafe activity or operation not in accordance with all applicable requirements for safety and health or UCF safety and health procedures, and that does not pose an immediate life-threatening danger to the employee

Major non-compliance. - the occurrence of an unsafe activity or operation not in accordance with all applicable requirements for safety and health, or UCF safety and health procedures, and that does pose an immediate life-threatening danger to the employee, or which violates license or permit requirements, as applicable

University community - includes all faculty, staff, students, employees of auxiliaries and Direct Support Organizations, and visitors

RESPONSIBILITIES

Environmental Health and Safety (EH&S)

- Interpret the standards and regulations as they apply;
- Evaluate work being performed and determine compliance with this procedure;
- Provide or coordinate training for work units on the content of this procedure;
- Maintain all training records through the EH&S Training Coordinator and provide records to the Facilities and Safety (F&S) Training Coordinator; and
- Evaluate the overall effectiveness of the electrical safety program at least annually, and whenever an electrical accident occurs.

Supervisors

- Lead by example and promote electrical safety awareness to all employees;
- Enforce compliance with the provisions of the electrical safety procedure;
- Ensure employees receive training appropriate to their assigned electrical tasks;
- Develop and maintain a list of all training received by the workers under their supervision;
- Ensure employees are provided with, and use, appropriate Personal Protective Equipment;
- Ensure proper storage of Personal Protective Equipment (PPE) when not in use; and
- Keep records of all energized electrical work permits.

Employees

- Follow the work practices described in this document, including the use of appropriate protective equipment and tools;
- Attend all training required by this procedure;
- Immediately report any concerns related to electrical safety to the supervisor; and
- Do not perform any electrical work without proper training and appropriate Personal Protective Equipment (see Appendix C - Minimum PPE for Common Electrical Work Tasks).

The following list includes examples of common jobs the employees are expected to do:

- Changing bulbs
- Changing ballasts
- Troubleshooting
 - Variable Frequency Drives (VFD)
 - Variable Speed Drives (VSD)
 - Light dimming panels
 - Electrical outlets
- Voltage measuring

Employees must work with safety always in mind, and are encouraged to exercise the right to stop any work that poses a danger to life or property.

TRAINING

Employees working on or near energized or potentially energized electrical circuitry shall be trained in safe electrical work practices and procedures.

Employees must receive training in avoiding the electrical hazards associated with working on or near exposed energized parts prior to performing any electrical work. Such training will be provided when the employee is initially assigned to the job. This training will be either provided or coordinated by EH&S. Refresher training will be provided every year, when hazards change, or when new technologies or new types of equipment are introduced.

The following requirements are to be included in the training of Qualified Electrical Workers (QEW):

- Electrical Safety Training
 - Universal electrical safety procedures
 - Skills and techniques necessary to distinguish exposed live parts from other parts of electrical equipment
 - NFPA 70-E (Standard for Electrical Safety Workplace)
 - Selection and use of proper work practices, Personal Protective Equipment, tools, insulating and shielding materials, and equipment for working on or near energized parts
 - The approach distances and the corresponding voltages to which the QEW will be exposed
- Lock-out/Tag-out Training, including safe work practices required to de-energize electrical equipment safely

NOTE: Employees must also be trained in recognizing signs and symptoms of electric shock, heart and fibrillation, electric burns, and in proper first aid protocols for these conditions. Therefore, they must have the following training:

- Basic Cardio Pulmonary Resuscitation (CPR) and Use of Automated External Defibrillator (AED)
- Basic first aid

Licensed electricians will still need to complete the CPR/AED training, as well as the Basic First Aid training.

WORKING ON DE-ENERGIZED EQUIPMENT

Electrically Safe Condition - The most important principle of electrical safety is to assume all electric circuits are energized unless each involved worker ensures they are not. After following proper lock-out/tag-out procedures, every circuit and conductor must be tested every time work is performed on them. Proper PPE must be worn until the equipment is proven to be de-energized.

- Voltage rated gloves and leather protectors must be worn;
- Electrically insulated shoes should be worn;
- Approved insulating mats must be used;
- Safety glasses must be worn; and
- The required Arc Flash PPE must also be worn.

There are six steps to ensure conditions for electrically safe work:

1. Identify all sources of power to the equipment, and then check applicable up-to-date drawings, diagrams, and identification tags.
2. Remove the load current, and then open the disconnecting devices for each power source.
3. Where possible, visually verify that blades of disconnecting devices are fully open or that draw-out type circuit breakers are fully withdrawn.
4. Apply lock-out/tag-out devices in accordance with the UCF Procedure.
5. Test each phase conductor or circuit part with an adequate voltage detector to verify that the equipment is de-energized. Test each phase conductor or circuit part both phase-to-phase and phase-to-ground. Check the voltage detector before and after each test to be sure it is working.
6. Properly ground all possible sources of induced voltage and stored electric energy (such as capacitors) before touching. If conductors or circuit parts that are being de-energized could contact other exposed conductors or circuit parts, apply ground-connecting devices rated for the available fault current.

The process of de-energizing is "live" work and can result in an arc flash due to equipment failure. When de-energizing, follow the procedures described in "Working On or Near Energized Equipment" (see below).

Lock-out/Tag-out - All electrical workers from Facilities Operations and Sustainability and Energy Management will be trained on, and follow, the requirements of the UCF Lock-out/Tag-

out Procedure. This is a pre-requisite for performing any electrical work. (For work performed as part of a Facilities Planning or Facilities Improvement project, the contractor will provide verification of a Lock-out/Tag-out Procedure to the Project Manager.)

WORKING ON OR NEAR ENERGIZED EQUIPMENT

Working on live circuits means actually touching energized part, while working near live circuits means working close enough to energized parts to pose a risk even though work is performed on de-energized parts.

When opening and closing disconnects, use the left-hand rule when possible (stand to the right side of the equipment and operate the disconnect switch with the left hand). It is imperative that workers ensure that only one hand is in contact with the equipment.

All jobs on or near energized systems or equipment shall require the presence of a minimum of two workers. One of them will perform the electrical work and the other will stay away of the prohibited approach boundary. The second worker is not expected to do electrical work. The job of the second worker is to protect the area from unauthorized personnel, pay attention to the safety of the worker doing the electrical work (be a “safety buddy”), and be ready to respond to emergencies.

Energized Electrical Work Permit

- If live parts are not placed in an electrically safe condition, work to be performed shall be considered energized electrical work and shall be performed by written permit only, issued by the Assistant Director of the department in charge of the job or his designee. (A sample permit is included in Appendix A.)
- The supervisor will be responsible for keeping the records of all energized electrical work permits.
- Work related to testing, troubleshooting, and voltage measuring may be completed without a permit, provided appropriate safe work practices and PPE are used.
- Energized Work Permits shall be submitted to the appropriate supervisor and issued by the Assistant Director of the department performing the job.
- The permit must be posted in an appropriate location where the energized work is taking place for the duration of the task.

Approach Distances to Exposed Live Parts - The National Fire Protection Association (NFPA) defines four approach distances for shock hazards and one for arc flash:

- The Limited Approach Boundary is the distance from an exposed live part within which a shock hazard exists.

- The Restricted Approach Boundary is the closest distance to exposed live parts a worker can approach without proper PPE and tools. Inside this boundary, accidental movement can put a part of the body or conductive tools in contact with live parts or inside the prohibited approach boundary. To cross the Restricted Approach Boundary, the qualified person must:
 1. Have an energized work permit that is approved by the Assistant Director of the department in charge of the job;
 2. Use PPE suitable for working near exposed live parts and rated for the voltage and energy level involved;
 3. Be certain that no part of the body enters the prohibited space; and
 4. Minimize the risk from unintended movement by keeping as much of the body as possible out of the restricted space; body parts in the restricted space should be protected.
- The Prohibited Approach Boundary is the minimum approach distance to exposed live parts to prevent flashover or arcing. Approaching any closer is comparable to making direct contact with a live part. To cross the Prohibited Approach Boundary, the worker must:
 1. Have specified training to work on exposed live parts;
 2. Have a plan with proper written work procedures and that justifies the need to work that close;
 3. Provide a risk analysis that includes the competency of the workers;
 4. Have (2) and (3) approved by authorized management, and documented through the issuance of an Energized Electrical Work permit; and
 5. Use PPE appropriate for working near exposed live parts and rated for the voltage and energy level involved.
- The Flash Protection Boundary is the 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. To cross the Flash Protection Boundary, the worker must:
 1. Use PPE appropriate for working near exposed live parts and rated for the voltage and energy level involved;
 2. Maintain the flash protection boundary of 4 feet for systems of 600 volts and less based on an available bolted fault current of 50 kA, a clearing time of 6 cycles for

the circuit breaker to act, or any combination of fault currents and clearing times not exceeding 300 kA cycles; and

3. Use barriers such as insulated blankets to protect against accidental contact or wear proper PPE when working on energized parts and inside the flash protection boundary for nearby live exposed parts.

Observing a safe approach distance from exposed energized parts is an effective means of maintaining electrical safety. As the distance between an individual and live parts increases, the potential for an electrical injury decreases.

Safe approach distances to fixed live parts can be determined by referring to Appendix B, which contains a table listing the Limited, Restricted, and Prohibited approach distances to live parts.

Workers shall not cross or take any conductive object closer to live parts operating at 50 volts or more than the Restricted Approach Boundary unless one of the following conditions applies:

- The worker is insulated or guarded from the live parts and no part of the body of that employee crosses the Prohibited Approach Boundary without insulation; and
- The live parts are insulated from the worker and from any other conductive object at a different potential.

Crossing the Prohibited Approach Boundary is considered the same as making contact with energized parts. The worker shall only cross this boundary when all of the following precautions have been taken:

- The worker has specific training to work on energized parts;
- The worker has obtained an approved Energized Electrical Work Permit; and
- The worker has obtained appropriate PPE, which are rated for the voltage and energy level involved for working on energized parts.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

General Requirements:

- Employees working in areas where there are potential electrical hazards must use Personal Protective Equipment (PPE) that is appropriate for the specific work to be performed. The electrical tools and protective equipment must be specifically approved, rated, tested for the levels of voltage to which an employee may be exposed, and inspected before work.

- Employees shall wear nonconductive head protection whenever there is a danger of head injury from electric shock or burns due to contact with live parts, or from flying objects resulting from an electrical explosion.
- Employees shall wear protective equipment for the eyes whenever there is a danger of injury from electric arcs, flashes, or from flying objects resulting from an electrical explosion.
- Employees shall wear rubber insulating gloves where there is a danger of hand or arm contact with live parts or possible exposure to arc flash burn.
- Where insulated footwear is used as protection against step and touch potential, dielectric overshoes shall be required. Insulated soles shall not be used as primary electrical protection.
- Face shields must have arc rating for electrical work. Safety glasses or goggles must always be worn underneath face shields.
- Additional illumination may be needed when using tinted face shields as protection during electrical work.
- Electrical protective equipment must be selected to meet the criteria established by the American Society of Testing and Materials (ASTM) and by the American National Standards Institute (ANSI).
- Insulating equipment made of materials other than rubber shall provide electrical and mechanical protection at least equal to that of rubber equipment.
- PPE must be maintained in a safe, reliable condition and be inspected for damage before each day's use, and immediately following any incident that can reasonably be suspected of having caused damage.
- Employees must use insulated tools and handling equipment that are rated for the voltages to be encountered when working near exposed energized conductors or circuits. Tools and handling equipment should be replaced if the insulating capability is decreased due to damage.
- Fuse handling equipment (insulated for circuit voltage) must be used to remove or install fuses.
- Ropes and hand lines used near exposed energized parts must be non-conductive.
- Protective shields, barriers, or insulating materials must be used to protect each employee from shock, burns, or other electrical injuries that might result from that person accidentally contacting energized equipment, or where dangerous electric heating or arcing might occur.

SELECTION OF PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment shall be provided to and used by all employees. For systems that are 600 volts or less, the Flash Protection Boundary shall be a minimum of four (4) feet. For systems above 600 volts, the Flash Protection Boundary shall be determined through engineering analysis.

The specific PPE to be worn can be determined by the hazard level of the task (Appendix C). This table was based on the National Fire Protection Agency (NFPA) 70E Table 130.7 (C) (9) (a) and Table 130.7 (C) (10).

Flame-Resistant (FR) Apparel

- FR apparel shall be visually inspected before each use. FR apparel that is contaminated or damaged shall not be used. Protective items that become contaminated with grease, oil, flammable liquids, or combustible liquids shall not be used.
- The garment manufacturer's instructions for care and maintenance of FR apparel shall be followed.
- When the apparel is worn to protect an employee, it shall cover all ignitable clothing and allow for movement and visibility.
- FR apparel must cover potentially exposed areas as completely as possible. FR shirt sleeves must be fastened and FR shirts/jackets must be closed at the neck.
- Non-melting, flammable garments (i.e., cotton, wool, rayon, silk, or blends of these materials) shall be used as under layers beneath FR apparel.
- Fibers that can melt, such as acetate, nylon, polyester, polypropylene, and spandex shall not be permitted in fabric under layers next to skin. (An incidental amount of elastic used on non-melting fabric underwear or socks shall be permitted.)
- Garments worn as outer layers over FR apparel (i.e., jackets or rainwear) must also be made from FR material.
- Flash suits must permit easy and rapid removal by the user.

Rubber Insulating Equipment

- Rubber insulating equipment includes protective devices such as gloves, sleeves, blankets, and matting.
- Rubber insulating gloves shall be inspected, tested, and certified every six (6) months by a company dedicated to that business.

- Insulating equipment must be inspected for damage before each day's use and immediately following any incident that could have caused damage.
- An air test must be performed on rubber insulating gloves before each use.
- Insulating equipment found to have defects that might affect its insulating properties, must be removed from service until testing indicates that it is acceptable for continued use. This testing must be performed by at least two qualified workers.
- Where the insulating capability of protective equipment is subject to damage during use, the insulating material shall be protected by an outer covering of leather or other appropriate materials.
- Rubber insulating equipment must be tested according to the schedule supplied by the manufacturer.
- Rubber insulating equipment must be stored in an area protected from light, temperature extremes, excessive humidity, ozone, and other substances and conditions that may cause damage.
- Repairs to rubber insulating equipment are not allowed; damaged equipment shall be disposed of, and new equipment acquired.

Insulated Tools and Materials

- Only insulated tools and equipment shall be used within the Limited Approach Boundary of exposed energized parts.
- Insulated tools shall be rated for the voltages on which they are used.
- Insulated tools shall be designed and constructed for the environment to which they are exposed and the manner in which they are used.
- Fuse or fuse holder handling equipment, insulated for the circuit voltage, shall be used to remove or install a fuse if the fuse terminals are energized.
- Ropes and hand-lines used near exposed energized parts shall be nonconductive.
- Portable ladders used for electrical work shall have nonconductive side rails.

Entry Restrictions

- Barricades shall be used in conjunction with safety signs to prevent or limit access to work areas containing live parts. Conductive barricades shall not be used where they might cause an electrical hazard. Barricades shall be placed no closer than the Limited Approach Boundary (Appendix B).

- If signs and barricades do not provide sufficient protection, an attendant will be assigned to warn and protect pedestrians. The primary duty of the attendant shall be to keep an unauthorized person out of the work area where an electrical hazard exists. The attendant shall remain in the area as long as there is a potential exposure to electrical hazards.

PORTABLE ELECTRICAL EQUIPMENT AND EXTENSION CORDS

The following requirements apply to the use of cord-and-plug-connected equipment and flexible cord sets (extension cords):

- Extension cords may only be used to provide temporary power. Extension cords are considered to be temporary wiring, and must also comply with the section on “Temporary Wiring” in this procedure.
- Extension cords shall be the same size or larger than the overcurrent protection.
- Daisy chains of cords are not allowed.
- Extension cords shall be of a minimum construction of 2/12 AWG with ground.
- Portable cord-and-plug-connected equipment and extension cords must be visually inspected before use on any shift for external defects such as loose parts, deformed and missing pins, or damage to outer jacket or insulation, and for possible internal damage such as pinched or crushed outer jacket. Any defective cord or cord-and-plug-connected equipment must be removed from service and disposed of.
- Extension cords must be of the three-wire type. Extension cords and flexible cords must be designed for hard or extra hard usage (for example, types S, ST, and SO). The rating or approval must be visible.
- Job-made extension cords are forbidden per the electrical code.
- Personnel performing work on renovation or construction sites using extension cords, or where work is performed in damp or wet locations, must be provided, and must use, a Ground-Fault Circuit Interrupter (GFCI) and perform work under such conditions only when critical to do so.
- Portable equipment must be handled in a manner that will not cause damage. Flexible electric cords connected to equipment may not be used for raising or lowering the equipment.
- Extension cords must be protected from damage. Sharp corners and projections must be avoided. Flexible cords may not be run through windows or doors unless protected from damage, and then only on a temporary basis. Flexible cords may not be run above

ceilings, or inside or through walls, ceilings or floors, and may not be fastened with staples or otherwise hung in such a fashion as to damage the outer jacket or insulation.

- Cords must be covered by a cord protector or tape when they extend into a walkway or other path of travel to avoid creating a trip hazard.
- Extension cords used with grounding-type equipment must contain an equipment-grounding conductor (i.e., the cord must accept a three-prong, or grounded plug) and a light indicator when energized.
- Attachment plugs and receptacles may not be connected or altered in any way that would interrupt the continuity of the equipment-grounding conductor. Additionally, these devices may not be altered to allow the grounding pole to be inserted into current connector slots. Clipping the grounding prong from an electrical plug is prohibited.
- Flexible cords may only be plugged into grounded receptacles. The continuity of the ground in a two-prong outlet must be verified before use. If an ungrounded receptacle is identified, it shall be reported to Supervisor and Work Control for corrective action.
- All portable electric equipment and flexible cords used in highly conductive work locations, such as those with water or other conductive liquids, or in places where employees are likely to contact water or conductive liquids, must be approved for those locations.
- Employees' hands must be dry when plugging and unplugging flexible cords and cord-and-plug connected equipment if energized equipment is involved.
- If the connection could provide a conducting path to employees' hands (for example, if a cord connector is wet from being immersed in water), the energized plug and receptacle connections must be handled only with insulating protective equipment.
- Locking type connectors must be UL approved and properly locked into the connector.
- Lamps for general illumination must be protected from breakage, and metal shell sockets must be grounded.
- Temporary lights must not be suspended by their cords, unless they have been designed for this purpose.
- Portable lighting used in wet or conductive locations, such as tanks or boilers, must be operated at no more than 12 volts or must be protected by GFCIs.

The previous requirements do not apply to power strips for computers.

TEMPORARY WIRING

Temporary electrical power and lighting installations of 600 volts or less, including flexible cords, cables, and extension cords, may only be used during and for renovation, maintenance, repair, or experimental work. The duration for temporary wiring used for decorative lighting for special events and similar purposes may not exceed 90 days, and no extension cords shall be used for this purpose. The following additional requirements apply:

- Ground-fault protection (or GFCI) must be provided on all temporary-wiring circuits, including extension cords, used on construction sites.
- In general, all equipment and tools connected by cord-and-plug must be grounded. Double-insulated tools and appliances with two-prong plugs are acceptable.
- Cheaters (3-conductors to 2-conductors) are not allowed.
- Feeders must originate in an approved distribution center, such as a panel board, that is rated for the voltages and currents the system is expected to carry.
- Branch circuits must originate in an approved power outlet or panel board.
- Neither bare conductors nor single wire earth returns may be used for the wiring of any temporary circuit.
- Receptacles must be of the grounding type. Unless installed in a complete metallic raceway, each branch circuit must contain a separate equipment-grounding conductor, and all receptacles must be electrically connected to the grounding conductor.
- Flexible cords and cables must be of an approved type and suitable for the location and intended use. They may only be used for pendants, wiring of fixtures, connection of portable lamps or appliances, elevators, hoists, connection of stationary equipment where frequently interchanged, prevention of transmission of noise or vibration, data processing cables, or where needed to permit maintenance or repair. They may not be used as a substitute for fixed wiring; run through holes in walls, ceilings, or floors; run through doorways, windows, or similar openings; attached to building surfaces; or concealed behind building walls, ceilings or floors.
- Suitable disconnecting switches or plug connects must be installed.
- Lamps for general illumination must be protected from accidental contact or damage, either by elevating the fixture or by providing a suitable guard. They should be suitable for rough duty. Hand lamps supplied by flexible cord must be equipped with a handle of molded composition or other approved material, and must be equipped with a substantial bulb guard.

- Flexible cords and cables must be protected from accidental damage. Sharp corners and projections are to be avoided. Flexible cords and cables must be protected from damage when they pass through doorways or other pinch points. Cords crossing a walking path require additional protection.

WET AREAS

Work in wet or damp work locations (i.e., areas surrounded or near water or other liquids) should not be performed unless it is absolutely critical. Electrical work should be postponed until the liquid can be cleaned up. The following special precautions must be incorporated while performing work in damp locations:

- Only use electrical cords that have GFCIs;
- Place a dry barrier over any wet or damp work surface;
- Do not work in areas where there is standing water;
- Remove standing water before beginning work;
- Do not use electrical extension cords in wet or damp locations; and
- Keep electrical cords away from standing water.

VEHICULAR AND MECHANICAL EQUIPMENT

No university personnel shall use vehicular or mechanical equipment (e.g., aerial lifts and bucket trucks) within 50 feet of overhead transmission, distribution, or power substation.

EQUIPMENT LABELING

Switchboards, panel boards, industrial control panels, and motor control centers must be labeled to warn workers of potential electric arc flash hazards.

- The term Industrial Control Panel covers every enclosure that may contain exposed energized conductors or components.
- Marking (labeling) is intended to reduce the occurrence of serious injury or death due to arcing faults to workers working on or near energized electrical equipment.
- Markings (labels) shall be located so they are visible to personnel before examination, adjustment, servicing, or maintenance of the equipment.
- The DANGER label in Figure 1 (or its equivalent) shall be used when information is not presently available. This is the minimum NEC 110.16 requirement.

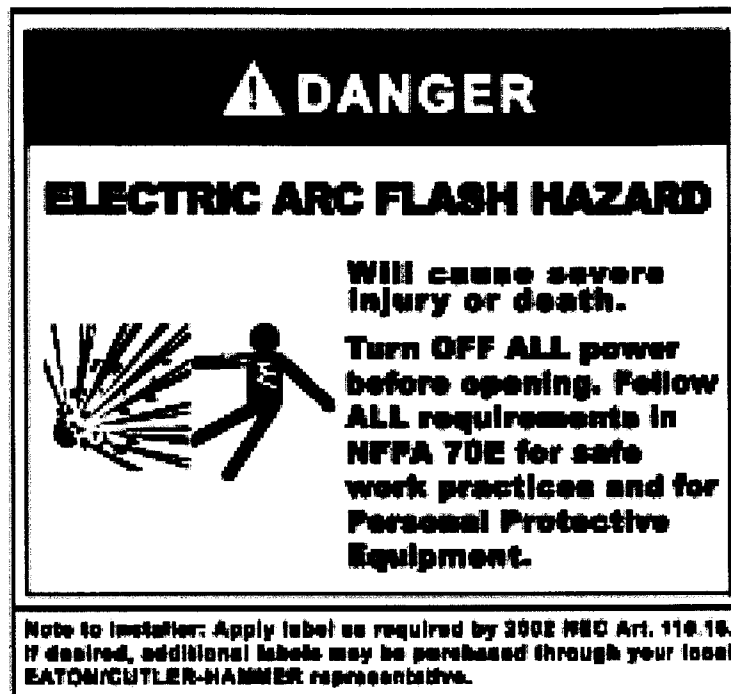


Figure 1 – Minimum Required Label

- The DANGER label should remind a worker who intends to open the equipment for analysis or work that:
 1. Electric arc flash hazard exists;
 2. Power shall be turned off before opening; and
 3. All requirements of NFPA 70E for safe work practices must be followed, and to wear appropriate Personal Protective Equipment (PPE) for the specific hazard.
- The second DANGER label in Figure 2 (or its equivalent) shall be used when a worker or electrical engineer determines the values of the shock and flash protection information.
- The Supervisor and Work Control shall be notified for proper action if the Danger label is not present.

<h1 style="margin: 0;">! DANGER</h1>	
<h2 style="margin: 0;">Arc Flash & Shock Hazard</h2> <h3 style="margin: 0;">Appropriate PPE Required</h3>	
FLASH PROTECTION Flash Hazard Category <u>4</u> Min. Arc Rating (cal/cm²) <u>40</u> Flash Protection Boundary _____ PPE: <ul style="list-style-type: none"> □ Cotton underwear □ FR shirt and pants (or FR coveralls) □ Full flash suit and hood □ Hard hat □ Safety glasses or goggles □ Hearing protection □ Leather gloves and shoes 	SHOCK PROTECTION _____ VAC Shock Hazard (kV) _____ Limited Approach Boundary _____ Restricted Approach Boundary _____ Prohibited Approach Boundary _____ PPE: <ul style="list-style-type: none"> □ Class _____ □ Voltage _____ □ _____
Equipment ID: _____	

Figure 2 – The Preferred Label

- When arc flash and shock data are available for industrial control panels, labels shall include information on flash hazard boundary, the hazard category, required PPE, minimum arc rating, limited approach distances, restricted approach distances and prohibited approach distances.
- An unauthorized person must not be near open energized equipment.

CONTRACTOR EMPLOYEES

- Contractors are required to comply with applicable Safety and Health regulations from OSHA, NFPA, EPA, and NEC as well as any regulation from the State, County, or City.
- Contractors may be required to submit copies of their safety program to the safety coordinator upon request.

OTHER PRECAUTIONS

- Employees shall not reach blindly into areas that might contain exposed live parts.
- Employees shall not enter spaces containing live parts unless illumination is provided that allows the work to be performed safely.
- Conductive articles of jewelry and clothing (including, but not limited to, watchbands, bracelets, rings, key chains, necklaces, metalized aprons, cloth with conductive thread, metal headgear, or metal frame glasses) shall not be worn where they present an electrical contact hazard with exposed live parts.

- Conductive materials, tools, and equipment that are in contact with any part of an employee's body shall be handled in a manner that prevents accidental contact with live parts. Such materials and equipment include, but are not limited to, long conductive objects such as ducts, pipes, tubes, conductive hose and rope, metal-lined rules and scales, steel tapes, pulling lines, metal scaffold parts, structural members, and chains.
- When an employee works in a confined or enclosed space (such as a manhole or vault) that contains exposed live parts, the employee shall use protective shields, barriers, or insulating materials, as necessary, to avoid contact with these parts. Doors, hinged panels, and the like shall be secured to prevent them from swinging into employees. (Refer to the *Confined Space Entry Procedure*.)

MINOR NON-COMPLIANCE

If a Minor Non-Compliance deficiency is noted, EH&S shall:

- Send an email to the supervisor within five (5) calendar days, listing deficiencies and recommendations for corrective actions;
- Conduct a follow-up inspection within 30 calendar days to ensure corrective actions are implemented; (The number of days is program-specific.)
- Send an email to the department director, requesting a correction plan and expected completion date if deficiencies are not corrected;
- Conduct a second follow-up inspection within seven (7) calendar days to ensure corrective actions are implemented;
- Send an email to the Assistant Vice President of the department in charge of the project, requesting a correction plan and expected completion date if the deficiency is not corrected;
- Conduct a third follow-up inspection within seven (7) calendar days to ensure corrective actions are implemented; and
- Refer the non-compliance findings and request for corrective actions to the Vice President and the Institutional Safety Council, as appropriate, for additional action if the corrective actions are not implemented.

After receiving the notification from EH&S, the supervisor (and the department director, and the Assistant Vice President, if necessary) shall:

- Ensure that all corrective actions recommended by EH&S are implemented;
- Coordinate with EH&S to provide re-training on the safety and health procedures, if necessary;

- Recommend disciplinary actions for the responsible personnel if the Minor Non-Compliance has not been corrected after the third notification; and
- Coordinate payment to EH&S of \$50 for the second follow-up inspection and \$100 for the third follow-up inspection, if necessary.

MAJOR NON-COMPLIANCE

If a Major Non-Compliance deficiency is noted, EH&S shall:

- Direct individuals in the area to stop the unsafe operation immediately;
- Notify the supervisor and the director of EH&S. The director of EH&S shall notify the appropriate university officials of the risk to the university community and continued operations;
- Send an email the day of the occurrence to the department director, with a copy to the supervisor, with the non-compliance findings and with a request for immediate corrective actions;
- Conduct a follow-up inspection the next day or before the operation resumes, to verify corrective actions are implemented;
- Send an email to the Assistant Vice President, Facilities if the unsafe situation is not corrected; and
- Refer the case to the Provost and the Safety Council, as appropriate, for further action.

After receiving the notification from EH&S, the Supervisor (and the department director, and the Assistant Vice President, as appropriate) shall:

- Ensure that all corrective actions recommended by EH&S are implemented;
- Coordinate with EH&S to provide re-training on safety and health procedures before sending the employee back to the worksite or operation that was found in non-compliance;
- Recommend appropriate disciplinary actions, up to and including termination of the responsible person(s), if the Major Non-Compliance was not corrected after the second notification; and
- Coordinate payment of fines incurred from regulatory agencies, when applicable.

INITIATING AUTHORITY

Associate Vice President for Administration and Finance (Facilities and Safety)

RELATED INFORMATION

As stated in the "UCF Design, Construction, and Renovation Standards (09-13-11), Division 1 General Requirements, Section Environmental Health and Safety Construction Information", contractors are individually responsible for meeting and monitoring their job-specific OSHA requirements.

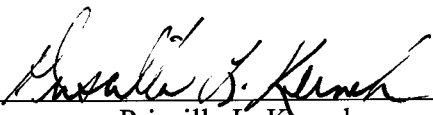
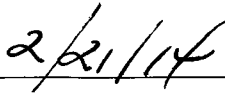
RELATED DOCUMENTS

Environmental Health and Safety Policies and Procedures

National Fire Protection Agency (NFPA) 70E Table 130.7 (C) (9) (a) and Table 130.7 (C) (10)

CONTACTS

Director, Environmental Health and Safety, (407) 823-6300

Approved By:	Date Approved:
 Priscilla L. Kernek Associate Vice President Administration and Finance Facilities and Safety	 2/21/14

APPENDIX A

ENERGIZED ELECTRICAL WORK PERMIT

PART I: TO BE COMPLETED BY THE REQUESTER:

Job/Work Order Number _____

- 1) Description of circuit/equipment/job location _____

- 2) Detailed description of work to be done: _____

- 3) Justification of why the circuit/equipment cannot be de-energized or the work deferred until the next scheduled outage: _____

Requester/Name _____

Title _____

Date _____

PART II: TO BE COMPLETED BY THE ELECTRICALLY QUALIFIED PERSONS DOING THE WORK:Check when
Complete

- 1) Detailed job description procedure to be used in performing the above described work: _____
_____ ☐
- 2) Description of the Safe Work Practices to be employed: _____
_____ ☐
- 3) Results of the Shock Hazard Analysis: _____
_____ ☐
- 4) Determination of Shock Protection Boundaries: _____
_____ ☐
- 5) Results of the Arc Flash Hazard Analysis: _____
_____ ☐
- 6) Determination of the Arc Flash Protection Boundary: _____
_____ ☐
- 7) Necessary Personal Protective Equipment to perform the assigned task safely: _____
_____ ☐
- 8) Means employed to restrict the access of unqualified persons from the work area: _____
_____ ☐
- 9) Evidence of completion of a Job Briefing, including discussion of any job-specific hazards: _____
_____ ☐
- 10) Do you agree the above described work can be done safely?
☐ Yes ☐ No (If no, return to requester)

I, _____ acknowledge that I have all training and knowledge to be a Qualified Electrical Worker at UCF. I also acknowledge that I have all the equipment, tools, and personal protective equipment to perform this job safely. I am responsible to work with safety always in mind and I understand that I have the right to stop any electrical work that poses a danger to my life, safety or UCF property.

Qualified Electrical Worker _____

Date _____

Qualified Electrical Worker _____

Date _____

PART III: APPROVAL(s) TO PERFORM THE WORK WHILE ELECTRICALLY ENERGIZED:

Supervisor

Assistant Director of department performing the job

Date

APPENDIX B

Approach Boundaries to Energized Electrical Conductors or Circuit Parts for Shock Protection (All dimensions are distance from energized electrical conductor or circuit part to employee.)

Limited Approach Boundary

Nominal System Voltage Range, Phase to Phase	Exposed Movable Conductor	Exposed Fixed Circuit Part	Restricted Approach Boundary; Includes Inadvertent Movement Adder	Prohibited Approach Boundary
Less than 50	Not specified	Not specified	Not specified	Not specified
50 to 300 volts	10 ft. 0 in.	3 ft. 6 in.	Avoid contact	Avoid contact
301 to 750 volts	10 ft. 0 in.	3 ft. 6 in.	1 ft. 0 in.	0 ft. 1 in.
751 to 15 kV	10 ft. 0 in.	5 ft. 0 in.	2 ft. 2 in.	0 ft. 7 in.
15.1 kV to 36 kV	10 ft. 0 in.	6 ft. 0 in.	2 ft. 7 in.	0 ft. 10 in.
36.1 kV to 46 kV	10 ft. 0 in.	8 ft. 0 in.	2 ft 9 in.	1 ft. 5 in.
46.1 kV to 72.5 kV	10 ft. 0 in.	8 ft. 0 in.	3 ft 3 in.	2 ft. 2 in.
72.6 kV to 121 kV	10 ft. 8 in.	8 ft. 0 in.	3 ft. 4 in.	2 ft. 9 in.
138 kV to 145 kV	11 ft 0 in.	10 ft. 0 in.	3 ft. 10 in.	3 ft. 4 in.
161 kV to 169 kV	11 ft 8 in.	11 ft. 8 in.	4 ft. 3 in.	3 ft. 9 in.
230 kV to 242 kV	13 ft. 0 in.	13 ft. 0 in.	5 ft. 8 in.	5 ft. 2 in.
345 kV to 362 kV	15 ft. 4 in.	15 ft. 4 in.	9ft. 2 in.	8 ft. 8 in.
500 kV to 550 kV	19 ft. 0 in.	19 ft. 0 in.	11 ft. 10 in.	11 ft. 4 in.
765 kV to 800 kV	23 ft. 9 in.	23 ft. 9 in.	15 ft. 11 in.	15 ft. 5 in.

APPENDIX C

Minimum Personal Protective Equipment (PPE) for Common Electrical Work Tasks

(Not an all-inclusive listing of jobs)

Panel boards or other equipment rated 240 Volts and below		
Jobs performed on Energized Equipment	Hazard/Risk Category	Minimum PPE
<ul style="list-style-type: none"> ➤ Perform infrared thermography and other non-contact inspections outside the restricted approach boundary. ➤ Circuit breaker or fused switch operation with covers on. ➤ Circuit breaker or fused switch operation with covers off. ➤ Opening hinged covers (to expose bare, energized electrical conductors and circuit parts. 	Hazard/Risk Category 0 ➤ Protective Clothing, Non-melting (according to ASTM F 1506-00) or Untreated Natural Fiber ➤ FR Protective Equipment	<ul style="list-style-type: none"> • Long sleeve shirt • Long pants • Safety glasses or safety goggles • Hearing protection • Leather gloves (as needed)
<ul style="list-style-type: none"> ➤ Work on energized electrical conductors and circuit parts, including voltage testing. ➤ Remove or install circuit breakers or fused switches. ➤ Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts. ➤ Work on energized electrical conductors and circuit parts of utilization equipment fed directly by branch circuit of the panel board. 	Hazard/Risk Category 1 ➤ FR Clothing, Minimum Arc Rating of 4 ➤ FR Protective Equipment	<ul style="list-style-type: none"> • Long sleeve shirt and long pants (Cal rating of 4) or Coveralls (Cal rating of 4) • Face-shield or flash suit hood (Cal rating of 4) • Jacket, parka, or rainwear(as needed) • Hardhat • Safety glasses or safety goggles • Hearing protection • Rubber insulating gloves • Insulated and Insulating hand tools • Leather gloves and work shoes (as needed)
Panel boards or switchboards Rated greater than 240 Volts and up to 600 Volts (with molded case or insulated case circuit breakers)		
<ul style="list-style-type: none"> ➤ Circuit or fused switch operation with covers on. 	Hazard/Risk Category 0 ➤ Protective Clothing, Non-melting (according to ASTM F 1506-00) or Untreated Natural Fiber ➤ FR Protective Equipment	<ul style="list-style-type: none"> • Long sleeve shirt • Long pants • Safety glasses or safety goggles • Hearing protection • Leather gloves (as needed)
<ul style="list-style-type: none"> ➤ Perform infrared thermography and other non-contact inspections outside the restricted approach boundary. ➤ Circuit breaker or fused switch operation with covers off. 	Hazard/Risk Category 1 ➤ FR Clothing, Minimum Arc Rating of 4 ➤ FR Protective Equipment	<ul style="list-style-type: none"> • Long sleeve shirt and long pants or Coveralls (Cal rating of 4) • Arc Flash Suite Hood or Face-Shield (Cal rating of 4) • Jacket, parka, or rainwear(as needed) • Hardhat • Safety glasses or safety goggles • Hearing protection • Rubber insulating gloves • Insulated and Insulating hand tools • Leather gloves and work shoes (as needed)
<ul style="list-style-type: none"> ➤ Work on energized electrical conductors and circuit parts, including voltage testing. ➤ Work on energized electrical conductors and circuit parts of utilization equipment fed directly by a branch of the panel board or switchboard. 	Hazard/Risk Category 2* ➤ FR Clothing, Minimum Arc Rating of 8 ➤ FR Protective Equipment	<ul style="list-style-type: none"> • Long sleeve shirt and long pants or Coveralls (Cal rating of 8) • Arc Flash Suit Hood or Face-Shield (Cal rating of 8) and Balaclava (Cal rating of 8) • Jacket, parka, or rainwear(as needed) • Hardhat • Safety glasses or safety goggles • Hearing protection • Rubber insulating gloves • Insulated and insulating hand tools • Leather gloves and work shoes (as needed)
600 Volts Class Motor Control Centers (MCCs)		
<ul style="list-style-type: none"> ➤ Circuit breaker or fused switch or starter operation with enclosure doors closed. ➤ Reading a panel meter while operating a meter switch. ➤ Work on control circuits with energized electrical conductors and circuit parts 120V or below, exposed. 	Hazard/Risk Category 0 ➤ Protective Clothing, Non-melting (according to ASTM F 1506-00) or Untreated Natural Fiber ➤ FR Protective Equipment	<ul style="list-style-type: none"> • Long sleeve shirt • Long pants • Safety glasses or safety goggles • Hearing protection • Leather gloves (as needed)

<ul style="list-style-type: none"> ➤ Perform infrared thermography and other non-contact inspections outside the restricted approach boundary. ➤ Circuit breaker or fused switch or starter operation with enclosure doors open. ➤ Opening hinged covers (to expose bare, energized electrical conductors and circuit parts) 	<p>Hazard/Risk Category 1</p> <ul style="list-style-type: none"> ➤ FR Clothing, Minimum Arc Rating of 4 ➤ FR Protective Equipment 	<ul style="list-style-type: none"> • Long sleeve shirt and long pants (Cal rating of 4) or Coveralls (Cal rating of 4) • Face-shield or flash suit hood (Cal rating of 4) • Jacket, parka, or rainwear(as needed) • Hardhat • Safety glasses or safety goggles • Hearing protection
<ul style="list-style-type: none"> ➤ Work on energized electrical conductors and circuits parts, including voltage testing. ➤ Work on control circuits with energized electrical conductors and circuit parts over 120V, exposed. ➤ Application of safety grounds, after voltage test. ➤ Work on energized electrical conductors and circuit parts of utilization equipment fed directly by a branch circuit of the motor control center. 	<p>Hazard/Risk Category 2*</p> <ul style="list-style-type: none"> ➤ FR Clothing, Minimum Arc Rating of 8 ➤ FR Protective Equipment 	<ul style="list-style-type: none"> • Long sleeve shirt and long pants (Cal rating of 8) OR Coveralls (Cal rating of 8) • Arc flash suit hood or Face-shield (Cal rating of 8) and Balaclava (Cal rating of 8) • Jacket, parka, or rainwear(as needed) • Hardhat • Safety glasses or safety goggles • Hearing protection • Rubber insulating gloves • Insulated and insulating hand tools • Leather gloves (as needed) • Leather work shoes (as needed)
<ul style="list-style-type: none"> ➤ Insertion or removal of individual starter “buckets” from MCC. ➤ Removal of bolted covers (to expose bare, energized electrical conductors, and circuit parts. 	<p>Hazard/Risk Category 4</p> <ul style="list-style-type: none"> ➤ FR Clothing, Minimum Arc Rating of 4 ➤ FR Protective Equipment 	<ul style="list-style-type: none"> • Long sleeve shirt and long pants (Cal rating of 40) OR Coveralls (Cal rating of 40) • Arc rated arc flash suit jacket (Cal rating of 40) • Arc rated arc flash suit hood (Cal rating of 40) • Arc rated jacket, parka, or rainwear (as needed) • Hardhat • FR hard hat liner (as required) • Safety glasses or safety goggles • Hearing protection • Rubber insulating gloves • Leather work shoes (as needed)
<u>Other 600 Volts Class (277 Volts through 600 Volts, nominal) Equipment</u>		
<ul style="list-style-type: none"> ➤ Opening hinge covers (to expose bare, energized electrical conductors and circuit parts). ➤ Cable trough or tray cover removal or installation. ➤ Miscellaneous equipment cover removal or installation. 	<p>Hazard/Risk Category 1</p> <ul style="list-style-type: none"> ➤ FR Clothing, Minimum Arc Rating of 4 ➤ FR Protective Equipment 	<ul style="list-style-type: none"> • Long sleeve shirt and long pants (Cal rating of 4) or Coveralls (Cal rating of 4) • Face-shield or flash suit hood (Cal rating of 4) • Jacket, parka, or rainwear(as needed) • Hardhat • Safety glasses or safety goggles • Hearing protection
<ul style="list-style-type: none"> ➤ Removal of bolted covers (to expose bare energized electrical conductors and circuit parts). ➤ Work on energized electrical conductors and circuit parts, including voltage testing. ➤ Application of safety grounds, after voltage test. ➤ Revenue meters (kW-hour, at primary voltage and current). Insertion or removal. ➤ Insertion or removal of plug-in devices into or from busways. 	<p>Hazard/Risk Category 2*</p> <ul style="list-style-type: none"> ➤ FR Clothing, Minimum Arc Rating of ➤ FR Protective Equipment 	<ul style="list-style-type: none"> • Long sleeve shirt and long pants (Cal rating of 8) OR Coveralls (Cal rating of 8) • Arc flash suit hood or Face-shield (Cal rating of 8) and Balaclava (Cal rating of 8) • Jacket, parka, or rainwear(as needed based on conditions) • Hardhat • Safety glasses or safety goggles • Hearing protection • Rubber insulating gloves • Insulated and insulating hand tools • Leather gloves and work shoes (as needed)