

OPERATING POLICY AND PROCEDURE

PHYSICAL PLANT

OPERATING POLICY AND PROCEDURE

PP/OP 02.05: Working on Exposed Energized Parts

DATE: February 16, 2010

PURPOSE

The purpose of this Physical Plant Operating Policy and Procedure (PP/OP) is to provide electrical safety related work practices for nonqualified person(s) with limited exposure [those with little or no training], workers expected to be exposed to hazards in the normal course of their duties, and qualified person(s) [those who have specific training in avoiding the electrical hazards of working on or near exposed energized parts] in an effort to avoid on-the-job injuries and property damage.

REVIEW

The PP/OP will be reviewed by February of each even numbered year (ENY) by the associate director for business office and material resources for physical plant with recommendations forwarded to the managing director for physical plant.

POLICY AND PROCEDURE

1. General Statement

Tagout/lockout and safety-related work practices shall be employed to protect all employees from electrical shock or other injuries resulting from either direct or indirect electrical contacts, when work is performed near or on equipment or circuits which are or may be energized. The specific-related work practices shall be consistent with the nature and extent of the associated electrical hazards.

2. Three Levels of Potential Staff Exposure

Designation

a. Non-Qualified Person:

As determined by their supervisor, person(s) NOT required to perform electrical work.

A “non-qualified person” is an individual whose duties (i.e. Administrative/Office Staff, Other Specialty Craftsperson), **as determined by their supervisor**, do not require exposure to electrical hazards through their normal duties. Due to their normal work duties, these persons have little training and do not require specific training in avoiding possible electrical hazards that may be encountered while working on or near exposed energized parts. These persons may also include those who are unfamiliar with the equipment or systems on which work is to be performed. These person(s) are considered to have no training.

This person is NOT authorized to perform work on exposed energized or potentially exposed energized parts.

b. Exposed Worker NOT performing Electrical Work:

Person(s) with minimal training, **as determined by their supervisor whose duties require exposure to electrical hazards through their normal duties, but are NOT actually performing the electrical work.**

This person may have been trained in accordance with 29 CFR 1910 parts 331 – 335. However, they have not received training with NFPA 70 E for avoiding electrical hazards of working on or near exposed energized electrical parts.

c. Qualified Person:

As determined by their supervisor, person(s) required to perform electrical work.

A “qualified person” is an individual who has been trained in accordance with 29 CFR 1910 parts 331 – 335 and NFPA 70 E. This individual has received training for avoiding electrical hazards and for working on or near exposed energized electrical parts. This individual is familiar with the electrical and electronic construction, operation, and hazards of a piece of equipment or system that they are working on. They know the proper use of precautionary work procedures, personal protective equipment, insulating and shielding materials and techniques, and the proper insulated tools required to work on energized circuitry.

This person is authorized to perform work on exposed energized or potentially exposed energized parts ONLY as long as documented VALID training IS ON FILE.

3. Definitions:

- a. **De-energized Parts:** As used in this procedure refers to electrical parts and components to which the “qualified person” may be exposed. The electrical potential has been removed and they have been tested, verified and red tagged/locked as having no electrical potential.

- b. **Energized Parts:** As used in this procedure refers to electrical parts and components that have or may have an electrical potential more than 50 volts AC or 100 volts DC either phase-to-ground or phase- to-phase and is capable of a current flow of greater than .005 ampere. Assume all electrical parts and components are energized until they tested, and verified to be de-energized.
- c. **Hazardous Voltage:** As used in this procedure refers to any electrical circuitry that is operating at more than 50 volts AC or 100 volts DC either phase-to-ground or phase-to-phase and is capable of a current flow of greater than .005 ampere.
- d. **Energized Parts Work (or hot work):** As used in this procedure refers to any work on or close to exposed (unguarded, uncovered, or uninsulated) hazardous voltage or where there is a potential to come in contact with hazardous voltage.
- e. **Safety Backup:** An individual who is trained in and familiar with the hazards and the methods of the work being performed. This individual's only responsibility is to ensure that safe work procedures are followed, to summon rescue help, and assist in rescue efforts when help arrives.

4. Labeling

- a. Electrical panelboards rated 240 volts and below shall be labeled with a standard Arc Flash Warning label that identifies a Flash Protection Boundary of 48" and Personal Protective Equipment (PPE) as follows:
 - Class 1-Work on energized conductors and/or parts; removal/installation of circuit breakers or switches; removal of bolted covers.
- b. Electrical panelboards, switchboards, and motor control centers (MCC's) rated more than 240 volts and less than 600 volts and less than 1200 amps shall be labeled with an Arc Flash Warning label that identifies a Flash Protection Boundary of 48" and Personal Protective Equipment (PPE) as follows:
 - Class 1-Non-contact inspections other than operation of circuit breaker handles (with covers on); circuit breaker or fused switch operations (covers off or doors open); opening of hinged covers to expose energized parts.
 - Class 2*-Work on energized conductors and parts; work on control circuits if voltage is 120 volts or greater; application of safety grounds after voltage test.
 - Class 4-Insertion or removal of individual starter buckets from MCC; removal of bolted covers to expose energized parts.
- c. Electrical panelboards, switchboards, and Meter Control Centers (MCC's) at any voltage and rated more than 600 volts and panelboards, switchboards, and MCC's of any voltage with a rating of 1200 amps or more shall have their available short-circuit current calculated by Physical Plant Engineering Services and labeled with a custom label with an Arc Flash Warning label that identifies a Flash Protection Boundary determined by the calculations and Personal

Protective Equipment (PPE) as follows

Class 1-Non-contact inspections other than operation of circuit breaker handles (with covers on); circuit breaker or fused switch operations (covers off or doors open); opening of hinged covers to expose energized parts; cable trough/tray/miscellaneous cover removal or installation.

Class 2-non-contact inspections; opening hinged covers to expose energized parts.

Class 2*-work on energized conductors and parts; work on control circuits if voltage is 120 volts or greater; application of safety grounds after voltage test; insertion of plug in devices.

Class 4-Insertion/removal (racking) of circuit breakers from cubicles; removal of bolted covers to expose energized parts.

d. Location/Placement of Labels

(1) Equipment in locations accessible to the public:

Labels shall be adhered to the inside of the panelboard door or placed in a durable clear plastic envelope fastened to the inside of the panelboard door.

(2) Equipment in locations not accessible to the public:

Labels shall be adhered to the equipment in a location that allows service personnel to readily see and read the label

5. Procedures for Working on Energized, Hazardous Voltage, Electrical Circuitry

a. Guidelines

- (1) Only “qualified persons” are permitted to work on energized electrical equipment such as electrical panels, wiring and switches. They shall follow all safe practices and procedures for the area and equipment/processes being worked on. Personal protective equipment (PPE) such as gloves, safety shoes, hard hats, eye/face protection, insulated fuse pullers, insulated hand tools and non-conductive ropes and hand lines should meet industry standards (NFPA-70E Article 250.2, subsection A) for electrical work as required. All personal jewelry (i.e., rings, earrings, watches, necklaces, etc.) will be removed before working on or around energized electrical equipment.
- (2) Live parts to which an employee may be exposed shall be de-energized and red tagged/locked out before the employee works on or near them, unless it can be demonstrated that de-energizing introduces additional or increased hazards or is not feasible due to equipment design or operational limitations. All electrical parts and components are assumed to be energized until tested and verified to be de-energized.

Live parts that operate at less than 50 volts to ground need not be de-energized if there will not be increased exposure to electrical burns or to explosion due to electric arcs.

- (3) If the exposed live parts are not de-energized and red tagged/locked, specific permission from the respective director must be obtained prior to proceeding further (i.e., for reasons of increased or additional hazards or infeasibility), other safety-related work practices shall be used to protect employees who may be exposed to the electrical hazards involved. Such work practices shall protect employees against contact with energized circuit parts directly with any part of their body or indirectly through some other conductive object.
- (4) Anytime work is to be done on energized electrical circuitry, a Safety Backup will be employed.
- (5) Safe distances, spacing, and other required barriers shall be observed.
- (6) At least one or more persons per “crew” should be trained in CPR and should NOT be the person actually performing the work.
- (7) All electrical equipment shall be considered energized, until proven otherwise.
- (8) De-energize all circuits before beginning work. The use of Lockout/Tagout procedures will be accomplished to prevent electrical circuits from inadvertent energization.
- (9) Use double insulated or grounded electrical tools to protect employees. Use Ground Fault Circuit Interrupters (GFCI’s) in wet or damp environments and/or with extension cords. Do not render electrical interlocks inoperative by removal, modification, or destruction.
- (10) High voltage or areas with exposed live parts must have a sign stating “Danger – Keep Out.” “Qualified persons” who work on exposed energized parts must barricade/secure the area prior to leaving it.
- (11) All disconnects, circuit breakers, and control boxes shall be clearly labeled to identify the corresponding equipment they control. All voltage and amp ratings shall be clearly identified as specified by the National Electric Code (NEC).
- (12) Use non-conductive ladders when working near electrical equipment or energized electrical conductors.

- (13) Use protective equipment/devices such as rubber mats and blankets to provide insulation from other electrical energy and/or grounding sources. Other personal protective equipment is available as required.

b. Personal Protective Equipment and Care

- (1) Persons working in areas where there is potential electrical hazards shall be provided with, and shall use, electrical protective equipment that is appropriate for the specific parts of the body to be protected and for the work to be performed.
- (2) Gloves and mats shall be rated for the voltage(s) involved. Minimum voltage rating on gloves and mats shall be 1,000 volts.
- (3) The user of rubber insulating gloves shall perform a visual and a roll up pressure inspection of the gloves prior to each use to ensure they are free from defects (cuts, tears, holes, foreign objects, etc.)
- (4) All work on energized equipment will be conducted while standing on an insulated floor mat rated for the voltages involved, except when performing measurements of calibration of equipment at or below 600 volts-to-ground or phase-to-phase. Rubber insulating blankets and mats have specific requirements to ensure that they are free from defects (cuts, tears, holes, foreign objects, etc.)
- (5) All personal protective equipment shall be maintained in a safe, reliable condition and shall be annually (NFPA-70E Article 250.2, subsection-B) inspected and tested.
- (6) Non-conductive protective head gear shall be worn wherever there is a danger of head injury from electrical shock or burns due to contact with exposed energy parts.
- (7) Protective eye and face wear shall be worn whenever danger exists of eye or facial injuries from electrical arcs or flashes or from flying objects resulting from an electrical explosion.

c. Working On or Near Exposed De-Energized Parts

- (1) Conductors and parts of electric equipment that have been de-energized but have not been locked or tagged out shall be treated as energized. This applies to work being performed on exposed de-energized parts or near enough to them to expose employees to any electrical hazard present.

- (2) A Lockout/Tagout Program has been established by Physical Plant (Reference PP/OP 02.07). Whenever possible and the electrical equipment allows for it, the lockout/tagout program will be followed in isolating de-energized electrical equipment. Work on energized electrical components that does not employ the use of the lockout/tagout program will only be done after the written approval of the appropriate Director.

d. Working On or Near Exposed Energized Parts

This applies to work being performed on electric circuit parts or equipment that has not been de-energized. Such person(s) shall be qualified as defined above to work 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.

e. Illumination

- (1) “Qualified person(s)” shall not enter or place parts of their body into spaces containing exposed energized unless illumination is provided that enable them to perform the work safely.
- (2) Where lack of illumination or an obstruction precludes observation of the work to be performed, “qualified person(s)” shall not perform tasks near exposed energized parts. They shall not reach blindly into areas which may contain energized parts.

f. Confined Space or Enclosed Work Spaces

A confined space entry permit must be obtained and safety backup in place prior to a “qualified person” working in a confined or enclosed space (such as a manhole or vault) that contains exposed energized parts. They shall be provided with and shall use protective shields, protective barriers, or insulating materials as necessary to avoid inadvertent contact with these parts. Doors, hinged panels, and similar items shall be secured to prevent their swinging into and causing the person to contact exposed energized parts.

g. Conductive Materials and Equipment

Conductive materials and equipment that are in contact with any part of a “qualified person’s” body shall be handled in a manner that will prevent them from contacting exposed energized conductors or circuit parts. If long dimensional conductive objects (such as ducts and pipes) must be handled in areas with exposed live parts, work practices (such as the use of insulation,

guarding, and materials handling techniques) shall be employed eliminating or minimizing the hazard.

h. Portable Ladders

Portable ladders shall have non-conductive siderails if they are used where the qualified person(s) or the ladder could contact exposed energized parts.

i. Housekeeping

- (1) Where live parts present an electrical contact hazard, qualified persons may not perform housekeeping duties at such distances to the parts that there is a possibility of contact, unless adequate safeguards (such as insulating equipment or barriers) are utilized.
- (2) Electrically conductive cleaning materials shall not be used in proximity to energized parts unless procedures are followed which will prevent electrical contact.

j. Extension Cords

- (1) Extension cords should not be allowed to stand in water or create tripping hazards.
- (2) Extension cords should not be a replacement for permanent wiring.
- (3) Never use defective electrical equipment or extension cords such as plugs that have been altered. Remove from service until repaired by a qualified person.

k. Training

- (1) Qualified persons shall be trained in accordance with the components detailed in 29 CFR 1910.331-335 and NFPA 70 E as they pertain to respective job assignments.
- (2) Qualified persons shall, at a minimum, be trained in and familiar with the following:
 - a. The skills and techniques necessary to distinguish exposed live parts from other parts of electrical equipment,

- b. The skills and techniques necessary to determine the nominal voltage of exposed live parts, and
 - c. The clearance distances specified in the standard and the corresponding voltages to which the qualified person will be exposed.
- (3) Training will consist of annual classroom and/or on-the-job type instruction and will be determined by the degree of risk to the person. This training will be conducted annually and copies for verification purposes will be kept in both the training and safety offices.

6. Sequence of Process Events

a. Application

- (1) This application applies to work performed on exposed live parts (involving either direct contact or by means of tools or materials) or near enough to them for qualified person(s) to be exposed to any hazard they present.
- (2) Only qualified persons may work on electric circuit parts or equipment that has not been de-energized under the lockout/tagout program. Such persons shall be qualified as defined above to work 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.
- (3) Preparation for “Hot Work”

Qualified persons must review the Energized Parts Work Permit (Attachment A) “Required Precautions Checklist” and ensure compliance with the established authorized process.
- (4) Energized Parts Work Permit (Attachment A)

The qualified person will verbally notify the appropriate director of the need for an Energized Parts Work Permit. The appropriate Superintendent will complete the Energized Parts Work Permit (Attachment A). The superintendent will review all aspects of the Energized Parts Work Permit and process to determine if there is a way for Lockout. If lockout cannot be applied, appropriate actions shall be taken to ensure all affected personnel are notified and safe practices implemented. At that time, the appropriate superintendent will authorize the energized work process.

A permit will be issued only for the duration of the work process to be performed.

All completed permits will be forwarded to the Physical Plant Safety Office for permanent file.

7. TTU personnel and other authorized personnel shall wear the appropriate PPE, based on the guidelines in the following table:

<i>Hazard/Risk Category Classifications and Use of Rubber Insulating Gloves and Insulated and Insulating Hand Tools [this table found in NFPA 70E, Table 130.7 (C) (9)]</i>			
<i>Tasks Performed on Energized Equipment</i>	<i>Hazard/Risk Category</i>	<i>Rubber Insulating Gloves</i>	<i>Insulated and Insulating Hand Tools</i>
Panelboards or Other Equipment Rated 240 V and Below <25KA			
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	0	N	N
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 electrical conductors and circuit parts, including voltage testing	1	Y	Y
Remove/install CBs or fused switches	1	Y	Y
See Exhibit 130.5			
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	1	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	0	N	N
Work on energized electrical conductors and circuit parts of utilization equipment fed directly by a branch circuit of the panelboard	1	Y	Y
Panelboards or Switchboards Rated >240 V and up to 600 V (with molded case or insulated case circuit breakers)—Note 1			
Perform infrared thermography and other non-contact inspections outside the Restricted Approach Boundary	1	N	N
CB or fused switch operation with covers on	0	N	N
CB or fused switch operation with covers off	1	Y	N
Work on energized electrical conductors and circuit parts, including voltage testing	2*	Y	Y
Work on energized electrical conductors and circuit parts of utilization equipment fed directly by a branch circuit of the panelboard or switchboard	2*	Y	Y
600 V Class Motor Control Centers (MCC's)-Note 2 (except as indicated)			
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	1	N	N
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
Application of safety grounds, after voltage test	2	Y	N
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	4	N	N
Opening hinged covers to expose bare, energized electrical conductors and circuit parts)	2	N	N
600 v Class Switchgear (with power circuit breakers or fused switches)—Note 4			

<i>Hazard/Risk Category Classifications and Use of Rubber Insulating Gloves and Insulated and Insulating Hand Tools [this table found in NFPA 70E, Table 130.7 (C) (9)]</i>			
<i>Tasks Performed on Energized Equipment</i>	<i>Hazard/Risk Category</i>	<i>Rubber Insulating Gloves</i>	<i>Insulated and Insulating Hand Tools</i>
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	2	N	N
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
Work on energized electrical conductors and circuit parts, including voltage testing	2*	Y	Y
Work on control circuits with energized electrical conductors and circuit parts 120 V or below, exposed	0	Y	Y
Work on control circuits with energized electrical conductors and circuit parts >120 V, exposed	2*	Y	Y
Insertion or removal (racking) of CBs from cubicles, doors open or closed	4	N	N
See exhibit 130.8			
Application of safety grounds, after voltage test	2*	Y	N
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	4	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	2	N	N
Other 600 V Class (277 V through 600 V, nominal)			
Equipment			
Lighting or small power transformers (600 V, maximum)			
Removal of bolted covert (to expose bare, energized electrical conductors and circuit parts)	2	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	1	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	2	Y	Y
Applications 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 electrical conductors and circuit parts, including voltage testing	2	Y	Y
Application of safety grounds, after voltage test	2	Y	N
Insertion or removal of plug-in devices into or from busways	2	Y	N

8. PPE for Hazard/Risk Categories 0, 1, and 2 shall be as shown in the following table:

<i>Protective Clothing and Personal Protective Equipment (PPE) [this table found in NFPA 70E, Table 130.7 (C)(10)]</i>	
<i>Hazard/Risk Category</i>	<i>Protective Clothing and PPE</i>
Hazard/Risk Category 0 Protective Clothing, Non-melting (according to ASTM F 1506-00) or Untreated Natural Fiber FR Protective Equipment	Shirt (long sleeve) Pants (long) Safety glasses or safety goggles (SR) Hearing Protection (ear canal inserts) Leather gloves (AN) (Note 2)
Hazard/Risk Category 1 FR Clothing, Minimum Arc Rating of 4 (Note 1) FR Protective Equipment	Arc rated long-sleeve shirt (Note 3) Arc-rated pants (Note 3) Arc-rated coverall (Note 4) Arc-rated face shield or arc flash suit hood (Note 7) Arc-rated jacket, parka, or rainwear (AN) Hard Hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Leather gloves (Note 2) Leather work shoes (AN)
Hazard/Risk Category 2 FR Clothing Minimum Arc Rating of 8 (Note 1) FR Protective Equipment	Arc-rated long-sleeve shirt (Note 5) Arc-rated pants (Note 5) Arc-rated coverall (Note 6) Arc-rated face shield or arc flash suit hood (Notes 7 & 8) Arc-rated jacket, parka or rainwear (AN) Hard Hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Leather gloves (Note 2) Leather work shoes (AN)
Hazard/Risk Category 2* FR Clothing Minimum Arc Rating of 8 (Note 1) FR Protective Equipment	Arc-rated long-sleeve shirt (Note 5) Arc-rated pants (Note 5) Arc-rated coverall (Note 6) Arc-rated arc flash suit hood (Note 10) Arc-rated jacket, parka or rainwear (AN) Hard Hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Leather gloves (Note 2) Leather work shoes (AN)
Hazard/Risk Category 3 FR Clothing Minimum Arc Rating of 25 (Note 1)	Arc-rated long-sleeve shirt (AR) (Note 8) Arc-rated pants (AR) (Note 8) Arc-rated coverall (AR) (Note 8) Arc-rated arc flash suit jacket (AR) (Note 8) Arc-rated arc flash suit pants (AR) (Note 8) Arc-rated arc flash suit hood (Note 8) Arc-rated jacket, parka or rainwear (AN)

<i>Protective Clothing and Personal Protective Equipment (PPE) [this table found in NFPA 70E, Table 130.7 (C)(10)]</i>	
<i>Hazard/Risk Category</i>	<i>Protective Clothing and PPE</i>
FR Protective Equipment	Hard Hat FR hard hat liner (AR) Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Arc –rated gloves (Note 2) Leather work shoes
Hazard/Risk Category 4	
FR Clothing Minimum Arc Rating of 40 (Note 1)	Arc-rated long-sleeve shirt (AR) (Note 9) Arc-rated pants (AR) (Note 9) Arc-rated coverall (AR) (Note 9) Arc-rated arc flash suit jacket (AR) (Note 9) Arc-rated arc flash suit pants (AR) (Note 9) Arc-rated arc flash suit hood (Note 9) Arc-rated jacket, parka or rainwear (AN)
FR Protective Equipment	Hard Hat FR hard hat liner (AR) Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Arc-rated gloves (Note 2) Leather work shoes

Notes:

1. See NFPA 70E Table 130.7 (C) (11). Arc rating for a garment or system of garments is expressed in cal/cm².
2. If rubber insulating gloves with leather protectors are required by Table 130.7 (C) (9), additional leather or arc-rated gloves are not required. The combination of rubber insulating gloves with leather protectors satisfies the arc flash protection requirement.
3. The FR shirt and pants used for Hazard/Risk Category 1 shall have a minimum arc rating of 4.
4. Alternate is to use FR coveralls (minimum rating of 4) instead of FR shirt and FR pants.
5. FR shirt and FR pants used for Hazard/Risk Category 2 shall have a minimum arc rating of 8.
6. Alternate is to use FR coveralls (minimum arc rating of 8) instead of FR shirt and FR pants.
7. A face shield with a minimum arc rating of 4 for Hazard/Risk Category 1 or a minimum arc rating of 8 for Hazard/Risk Category 2, with wrap-around guarding to protect not only the face, but also the forehead, ears, and neck (or, alternately, an arc-rated flash suit hood), is required.
8. Alternate is to use a face shield with a minimum arc rating of 8 and a balaclava (sock hood) with a minimum arc rating of 8 and which covers the face, head and neck except for the eye and nose area.

9. Accountability

Directors are responsible for ensuring compliance of this PP/OP.

RESPONSIBILITY

<u>Position</u>	<u>Section</u>	<u>Month</u>
Review Associate Director For Business Office & Material Resources for Physical Plant	Feb	(ENY)
	Approved: _____ Reviewer	
	Approved: _____ Managing Director for Physical Plant	