



TAMPA ELECTRIC COMPANY ENERGY SUPPLY ELECTRICAL SAFETY PROGRAM

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OSHA - 29 CFR 1910.269: ELECTRICAL POWER GENERATION, TRANSMISSION & DISTRIBUTION

PURPOSE

The purpose of this program is to protect human life and reduce potential occupational exposure to electricity through arc flash/blast or shock. This program provides guidance on work practices, methods, and PPE requirements for employees who work on or near exposed energized electrical conductors or circuit parts.

INTRODUCTION

TAMPA ELECTRIC is dedicated to providing a safe and healthful workplace for its employees by communicating information concerning exposure to arc flash and blast hazards when performing electrical work. This program applies to Tampa Electric Energy Supply employees and contractors who have potential occupational exposure to electrical shock and/or arc flash and blasts and establishes requirements for control and personal protective equipment when working with electrical hazards.

Consideration shall be provided to all new installations to minimize arc flash hazard rating as low as reasonably achievable. Where feasible, new installations are designed for an arc hazard rating of 2 or lower. In instances where a hazard rating of 2 is not feasible, engineering controls and personal protective equipment shall be specified and utilized.

Tampa Electric Energy Supply employees and contractors should avoid energized electrical work unless it is absolutely necessary. Live parts will be de-energized before an employee works on or near them unless one of the following conditions applies:

- De-energizing introduces additional or increased hazards. Examples of “additional or increased” hazards would include, deactivation of emergency alarm systems, or shutdown of hazardous location ventilation systems.
- De-energizing is not possible due to equipment design or operational limitations. Examples of this situation would include testing and troubleshooting of electrical circuits that can only be performed with the circuit energized and work on circuits that form an integral part of a continuous process that would otherwise need to be completely shut down in order to permit work on one circuit or piece of equipment.
- Live parts are operating at less than 50 volts to ground and there is no increased exposure to electrical burns or to explosion due to electrical arcs.

This written program contains the following elements:

- Employee training
- Electrical equipment labeling
- Approach distances
- Installation, removal, and maintenance of temporary protective grounding equipment.
- Selection and use of de-energized vs. energized work methods.
- Personal Protective Equipment (PPE)
- Documentation and recordkeeping

REFERENCES

The TECO Energy Supply Electrical Safety Program is based on requirements and information from the following sources:

NFPA70E Standard for Electrical Safety in the Workplace, 2021 edition

Occupational Safety and Health Standards for General Industry, 29 CFR 1910.269

Occupational Safety and Health Standards for General Industry, 29 CFR 1910.331 through 1910.335

SCOPE

An arc flash hazard may exist when energized electrical conductors or circuit parts are exposed or when they are within equipment in a guarded or enclosed condition, provided a person is interacting with the equipment in such a manner that could cause an electric arc flash or blast. Examples of interaction with the equipment include, but are not limited to; opening/closing breakers, racking breakers in/out, and opening/closing potential transformer fuse drawers.

Under normal operating conditions, enclosed energized equipment that has been properly installed and maintained is not likely to pose an arc flash hazard. For any other electrical equipment that is in disrepair or has not been properly maintained, the shock and arc flash risk is elevated. Additional electrical safety precautions should be observed.

A shock hazard may exist when energized electrical conductors or circuit parts are exposed.

The requirements in this document apply to qualified employees and others (including contractors) who are exposed to a potential arc flash hazard or shock hazard.

Arc Flash guidelines do not apply to electronic equipment. While a shock potential can exist when working on electronic equipment with high voltages, an arc flash is unlikely. Examples include computers, video monitors, flame scanners, igniter circuits, DCS power supplies, turbine control power supplies, etc.

Exposed and energized control circuits that operate at 48 volt DC and 24 volt DC in switchgear and motor control centers do not create arc flash hazards.

Appropriate PPE shall be worn while operating or working on energized electrical equipment in accordance with this program. Personnel shall not work on energized circuits if the flash hazard risk assessment suggests that the intensity of the arc flash could expose the worker to 40 cal/cm² or greater regardless of the level of flash protection provided by PPE available at the plant. Above 40 cal/cm², no PPE will protect the employee from the pressure (arc blast) generated during an arcing fault. Equipment with an Arc Flash Hazard category greater than 4 (>4) requires the equipment to be de-energized to perform work where there is an arc flash hazard. Alternatively, the work may be performed at a greater distance where the incident energy level is less than 40 cal/cm² with properly rated PPE. Examples of alternatives could be using a longer reach tool or using a remote racking device.

RESPONSIBILITY

The facility director is responsible for the implementation of the Electrical Safety Program. This includes ensuring that equipment is labeled appropriately in accordance with completed arc flash calculation. Additionally, they shall ensure that labels are updated according to updated flash calculations when physical changes are made which affect arc flash calculations.

Duties supporting this objective may be assigned to appropriate personnel.

Supervisors and managers are responsible to monitor the electrical safety practices of personnel under their direction and assign only qualified employees to perform work on or near exposed energized equipment (within the Shock or Flash Protection Boundaries).

Supervisors and managers are responsible to ensure employees receive the necessary safety and technical training to perform their assigned duties.

Supervisors and managers shall require employees to hold thorough job risk briefings and require employees to use the correct personal protective equipment and tools.

Qualified employees are responsible to use their knowledge, skills, and experience to perform their job in a safe manner and follow established procedures. This includes knowledge of switchgear ratings, performs zero energy checks, erects barriers/postings, and ensures test equipment is operated properly. They are required to conduct a thorough job risk briefing. Additionally, they must properly choose, use, and care for PPE and tools for the job.

Station Electrical Engineer shall have access to most recent NFPA70E hard copy for any clarifications or guidance.

Hazard elimination shall be the first priority in the implementation of these safety-related work practices.

EMPLOYEE TRAINING

Target Audience - Employees who work on or near exposed energized electrical conductors or circuit parts.

Frequency - Initial training shall be provided to each affected employee prior to the assignment of tasks which may result in exposure to electrical hazards.

Additional training and retraining shall be conducted on an as needed basis:

- When it is found that an employee is not complying with the safety-related work practices.
- When new technology, new types of equipment, or changes in procedures are introduced.
- When the employee needs to review tasks that are performed less often than once per year.
- When safety-related practices are not part of the employee's regular job duties.
- When the employee's job duties change.
- Refresher training shall occur every three years.

Methods - Training shall be accomplished through by PowerPoint presentation with video, or other training materials determined adequate by the Safety Department.

Qualified employees shall be trained and competent in:

- Distinguishing exposed live parts from other parts of electrical equipment.
- Determining the nominal voltage of exposed live parts.
- Determining the approach distances specified in Appendix C corresponding to the voltage that the employee may be exposed to; and
- The proper use of special precautionary techniques, personal protective equipment (PPE), insulating and shielding materials, and insulated tools.
- Rescue (contact release) of a stricken coworker in case of electrical shock.
- Selecting and correct application of temporary protective grounding.
- Summoning First Aid treatment, including personnel to administer CPR/AED.
- Performing the job risk briefing and safety planning.
- Identifying electrical hazards.
- Assessing the associated risk.

Awareness level electrical safety training shall be provided to those employees that are not "qualified employees". The content of this training shall include:

- Identification of the hazards of electric shock and arc-flash.
- Distinguishing energized parts of electrical equipment from other parts and know how to treat them.
- Determining the applicable safe approach distance for any given voltage.

Documentation – All employee training will be documented electronically by the Safety department. Classroom training will require the attendees to sign a roster. Training documentation will contain the content of the training, each employee’s name, and dates of training. Documentation will be retained for the duration of the employee’s employment.

ELECTRICAL EQUIPMENT LABELING

See Appendix B for an example of the labeling used to warn employees of the electrical hazards.

All plant locations shall ensure a hazard analysis on their electrical equipment, and electrical equipment shall be labeled. The following information shall be provided at a minimum:

- Equipment Designation.
- Limited Approach Boundary.
- Restricted Approach Boundary.
- Flash Protection Boundary.
- Incident Energy at Working Distance.
- PPE Requirement Classification. (Note: Until a Hazard Risk Assessment has been completed, the default values noted in NFPA 70E Table 130.5(C), Table 130.7(C)(15)(a) or Table 130.7(C)(15)(b) when the requirements of these tables apply.)

Labels shall be updated as necessary to reflect current equipment conditions. Periodic audits, at frequencies not to exceed 5 years, shall be conducted to confirm accuracy of label information.

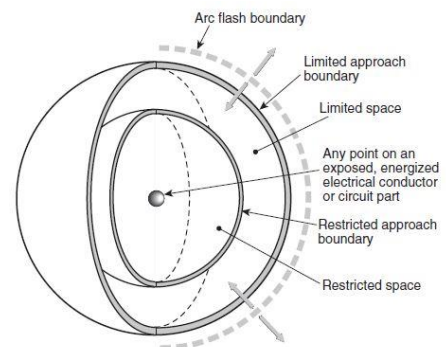
APPROACH DISTANCES AND BOUNDARIES

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.

Where defined shock and/or flash hazards exist, a shock and/or arc flash risk assessment shall be performed, and boundaries shall be determined and followed.

The risk assessment shall (1) identify the shock / arc flash hazards, (2) estimate the likelihood of occurrence of injury or damage to health and the potential severity of injury or damage to health and (3) additional protective measures such as PPE.

The estimate of the likelihood of occurrence of injury or damage to health and the potential severity of injury or damage to health shall take into consideration the following:



- (1) The design of the electrical equipment, including its overcurrent protective device and its operating time
- (2) The electrical equipment operating condition and condition of maintenance

If additional protective measures are required, they shall be selected and implemented according to following hierarchy of risk control. These are:

- (1) Elimination
- (2) Substitution
- (3) Engineering controls
- (4) Awareness
- (5) Administrative controls
- (6) PPE

When the additional protective measures include the use of PPE, the following shall be determined:

- (1) Appropriate safety-related work practices
- (2) The arc flash boundary
- (3) The PPE to be used within the arc flash boundary

Instances where arc flash hazards exist are defined by NFPA 70E as when energized electrical conductors or circuit parts are exposed or when they are within equipment in a guarded or enclosed condition, providing a person is interacting with the equipment in such a manner that could cause an electric arc.

Instances where a shock hazard exists are defined as when a person could contact/touch exposed energized conductors greater than 50 volts.

Safe approach distances to exposed fixed live parts can be determined by equipment labeling or where no label exists, referring to NFPA 70E Table 130.4(E)(a) for AC or Table 130.4 (E)(b) for DC, which is found in Appendix C "Approach Boundaries". Labeling or Appendix C will provide the Limited and Restricted Approach Boundaries associated with various system voltages for Shock Hazard protection.

The Flash Protection Boundary can be determined by equipment labeling. Where no label exists for AC voltages 50 to 480 volts, the power shall be disconnected at the feed. If the power cannot be disconnected at the feed contact the station electrical engineer. Where no label exists for voltages greater than 480V, contact the station electrical engineer. The station electrical engineer can rely on NFPA 70E Table 130.7(C)(15) for Arc Flash Hazard PPE rating where the listed available fault current and fault clearing times are not exceed as listed in the table.

When determining the appropriate location to establish the boundary, use the most conservative (the largest distance) of either the Flash Protection Boundary or the Limited Approach Boundary distance.

Shock Boundaries

Limited Approach and Restricted Approach Boundaries are designated for protection from shock hazard. These boundaries shall be established by at least one of the following methods when there is an exposed energized electrical conductor:

- Place a barricade made of Red Danger tape and tags to mark off the Limited Approach Boundary. Refer to the Work Area Protection Program for guidelines on proper placement of barricades.
- Post an attendant to control access to the work area (this may be the person performing the work).

Only qualified employees and informed unqualified employees, continuously escorted by a qualified employee, may cross the Limited Approach Boundary.

Only qualified employees may cross the Restricted Approach Boundary.

Qualified employees may not cross or take any conductive object closer than the Restricted Approach Boundary unless one of the following conditions applies:

- The qualified employee is insulated or guarded from the live parts and no uninsulated part of the qualified employee's body crosses the Restricted Approach Boundary.
- The live parts are insulated from the qualified employee and from any other conductive object at a different potential.
- This requires the use of voltage rated gloves and insulated tools whenever working inside the Restricted Approach Boundary.
- Complete an Energized Electrical Work Permit when required.

Qualified employees may only cross the Restricted Approach Boundary when the employee has received training applicable to the work to be performed.

The Shock Protection Boundaries may be less than the labeled value if the work area is a room, vault, or manhole where the boundary size is limited by the walls. Where this restriction exists, the boundary is defined by the wall and precautions will be taken according to the distance that boundary dictates. To prevent unintentional contact by an employee working in Restricted Approach Boundary, exposed energized conductors shall be guarded.

Arc Flash Boundary

The Flash Protection Boundary is designated for protection from an arc flash hazard, when there is an exposed energized electrical conductor or when personnel are interacting with the equipment in such a manner that could cause an electric arc even if the equipment is in a guarded or enclosed condition. This boundary shall be established by at least one of the following methods:

- Place a barricade and tags to mark off the Flash Boundary. (Refer to the Work Area Protection Program for guidelines on proper placement of barricades.), or
- Post an attendant to control access to the work area (this may be the person performing the work.)

Only qualified employees and/or others under close supervision of a qualified employee wearing appropriate personal protective clothing may cross the Flash Protection Boundary.

The Flash Protection Boundary may be less than the labeled value or the 4-foot minimum if the work area is a room, vault, or manhole where the boundary size is limited by the walls.

Examples of common interactions where an arc flash hazard exists include:

- Racking in or out a circuit breaker from an energized bus. (does not include Arc Resistant switchgear).
- Removing or inserting an MCC Bucket from an energized bus.
- Racking in and out energized 4.16 kilovolts (kV), 13.8 kV and Generator PT Fuse Drawers (Does not include Arc Resistant switchgear).
- Operating 13.8 kV and 4.16 kV primary disconnect switches.
- Work on energized electrical conductors and circuit parts, including voltage testing.
- Installation of Ground Clusters.
- Removing or replacing bolted access covers that expose bare energized conductors.
- Opening or closing hinge covers that expose bare energized conductors.
- Inserting or removing 120 volt AC or 125 volt DC Control Fuses when not protected by upstream overcurrent protection.

An Arc Flash hazard does not exist only if all of the following conditions apply:

- The equipment is properly installed.
- The equipment is properly maintained.
- The equipment is used in accordance with instructions included in the listing and labeling and in accordance with manufacturer's instructions.
- All equipment doors are closed and secured.
- All equipment covers are in place and secured.
- There is no evidence of failure.

If any of the above conditions are not met, then an Arc Flash Hazard may exist.

If the above conditions are met, a qualified person may perform the following tasks without arc flash PPE:

- Manipulating a panel mounted voltmeter switch or ammeter switch.
- Operating 480 volt disconnect switches in MCCs.
- Operating 480 volt molded case circuit breakers.
- Online generator and exciter brush maintenance when there are no grounds in the field circuit. (Refer to specific plant maintenance procedures for further information)

- Inserting or removing 120 volt AC or 125 volt DC Control Fuses when protected by upstream overcurrent protection.
- Inserting or removing 120/240 volt AC Motor Heater Fuses.
- Checking HEC Tags or Locks.
- Opening or closing a door or cover that does not expose energized conductors.
- Attaching a remote racking device.
- Re-lamping and replacing light fixtures
- Removing and replacing indicator light bulbs.
- Walking or standing in proximity to equipment without interaction, operating a 120/240 volt AC breaker.

GENERAL REQUIREMENTS

The primary and preferred method for electrical safety is to de-energize the equipment or conductors to which an employee might be exposed within the Limited Approach Boundary and establish an electrically safe work condition. An electrically safe work condition is achieved when the equipment is de-energized, the hazardous energy control program has been applied, the conductor/equipment has been tested to ensure it is de-energized (check it dead) and grounds are applied (if required).

An electrically safe work condition does not have to be established for equipment operating at less than 50 volts or if an electrically safe work condition creates increased or additional hazards or it is infeasible due to equipment design or operational limitations. Examples of work that might be performed within the Limited Approach Boundary of exposed energized conductors or circuit parts because of infeasibility due to equipment design or operational limitations include performing diagnostics and testing (e.g. start-up or troubleshooting) of electric circuits that can only be performed with the circuit energized and work on circuits that form an integral part of a continuous process that would otherwise need to be completely shut down in order to permit work on one circuit or piece of equipment.

Only qualified employees may work on or with exposed energized lines or parts of equipment. Only qualified employees may work in areas containing unguarded, un-insulated energized lines or parts of equipment operating at 50 volts or more. Appropriate safety related work practices shall be determined before any person is exposed to the electrical hazards involved by using both shock risk assessment and arc flash risk assessment.

When working on energized equipment 480 volts and above, a second qualified employee shall be present at all times when the work is being performed; with the exception of racking in and out circuit breakers.

Newly installed or modified electrical equipment or systems shall be inspected to verify compliance with applicable installation codes and standards prior to being placed into service.

Energized Electrical Work Permit (EEWP)

An EEWP shall be required whenever work is to be performed within the Restricted Approach Boundary of exposed energized electrical conductors or circuit parts by qualified employees or when the employee interacts with the equipment when conductors or circuit parts are not exposed but an increased likelihood of injury from an exposure to an arc flash hazard exists (See Appendix D for a sample EEWP). The EEWP is designed to ensure that appropriate safe measures are followed, and that the awareness of the hazards associated with the task are heightened. It also ensures that a risk assessment and arc flash risk assessment has been performed.

Tasks such as, but not limited to, the following are examples of work that DO require an EEWP:

- Installation/removal of panel cover on energized equipment greater than 240 VAC.
- Installation and/or removal of molded case circuit breaker from energized power panel.
- Installation or removal of a motor control center bucket.
- Hands on inspection of equipment.
- Troubleshooting and testing of circuits greater than 600 volts.

Tasks such as, but not limited to, the following are examples of work that DO NOT require an EEWP:

- Circuit breaker racking.
- PT fuse installation or removal.
- Troubleshooting, testing, and voltage measuring of circuits less than or equal to 600 volts.
- Opening hinged doors for visual inspection, ultrasound, or thermography of equipment outside of the Restricted Approach Boundary.
- Exciter brush maintenance
- High Potential Testing
- Meggering
- Access and egress or general housekeeping of areas outside of the Restricted Approach Boundary.

Where an EEWP is not required, the appropriate safe work practices, job safety briefing, and personal protective equipment in accordance with this procedure shall be followed.

Good Electrical Work Practices

Good work practices will minimize the risk of arc flash. The following work practices shall be implemented:

- Close and tighten door latches or door bolts before operating a starter, disconnect switch or breaker.
- Stand to one side and away as much as possible while operating a switch or breaker. If not required to wear a face shield, turn your head away, and look in the opposite direction of the door.
- Where it is possible, switch remotely.
- Follow PPE requirements as defined by the equipment labeling. For equipment that is not

labeled, contact the Station Electrical Engineer.

- Ensure the outermost boundary (Flash Protection or Limited Approach) is delineated.
- Where the design is such that racking breakers through closed and latched compartment doors, utilize racking handle cut-outs in doors.
- Utilize remote racking equipment when available.
- When inside the restricted approach boundary, remove conductive articles such as, but not limited to: rings, watches, necklaces, bracelets, key chains, keys, metal headgear, and metal framed glasses.
- Do not reach blindly into equipment. If your view is obstructed, you cannot work on live parts.
- Ensure that adequate illumination is provided to enable the personnel to perform the work safely.
- Insulate adjacent equipment, as much as practical, to eliminate arc-flash and shock hazards.
- Secure all doors, hinged panels, and the like to prevent their swinging into an employee and knocking the employee into exposed live parts.
- Before cutting or drilling into equipment, floors, walls, or structural elements that contain energized electrical lines, a risk assessment will be performed.
- Ensure equipment and tools are correctly rated and have been tested as required.
 - Rubber gloves (voltage rated)
 - Rubber blankets or insulation
 - Test equipment (voltage rated)
 - Insulated tools (voltage rated)
- Provide and maintain sufficient access and working space around electrical equipment to permit safe operation and maintenance.
- Do not use the working space for storage.
- Any contact with an energized component can be hazardous to your health. Report any shock or arc-flash event to your supervisor immediately and get appropriate medical evaluation.
- Use the Energized Work Methods on circuits and equipment operating at greater than 50 volts to ground when it is impossible or impractical to de-energize the system or equipment.
- Probe shrouds are recommended when taking readings on energized equipment to prevent electrical shorts in case of probe slip.
- Energization or operation of electrical equipment for the first time after installation or maintenance has an elevated risk factor. Additional electrical safety precautions should be observed.

Treat electrical equipment and lines as energized until verified to be de-energized, and if necessary, grounded. Grounds may be necessary if the equipment could be inadvertently energized by another energized source.

Two or more employees must not work on different phases of energized electrical equipment at the same time when they are within arms-reach of each other. This will reduce the shock hazard.

An additional qualified employee is required when a qualified employee is within the Restricted Approach Boundary and is working on energized equipment 480 volts and above. The duties of this person are:

- Observe the work from a clear viewpoint and be ready to perform a rescue immediately if necessary.
- Stage the appropriate tools and PPE required to perform a rescue. (For example, climbing tools and rubber gloves, dielectrically tested rescue hook to pull the victim off of energized equipment).
- To wear the same PPE & arc-flash apparel as the worker depending on proximity to the work.

Inspect the breaker to ensure it is in the open position and with springs discharged (if applicable) before reinstalling a breaker into the cubicle.

Before replacing a fuse, verify the replacement matches the rating and type for the equipment it protects.

Use fuse pullers and insulated gloves to remove fuses.

Before working on a capacitor, disconnect it from the voltage source, wait at least five minutes, and discharge it by either shorting the terminals, or allow proper amount of time for voltage to dissipate. Capacitors shall be discharged to less than 50 VDC. Whenever storing or handling capacitors, the terminals shall be shorted.

A qualified employee(s) must remain in the work area if there are energized lifted leads. The leads can be left unguarded if they are appropriately insulated, access is restricted, and the hazard is clearly identified in accordance with the work area protection program.

Cord and plug connected equipment supplied by 125 VAC, 15, 20, 30 ampere circuits, when utilized for maintenance and construction purposes, shall be energized via GFCI (Ground Fault Circuit Interrupters) protected source.

Where conductors are de-energized in order to cut, remove, or reroute them and conductor terminations are not within sight, such as where they are in a junction or pull box, additional steps to verify absence of voltage or identify the conductors shall be taken prior to cutting, removing, or rerouting the conductors.

Where work performed on equipment that is de-energized and placed in an electrically safe condition exists in a work area with other energized equipment that is similar in size, shape, and construction, either safety signs and tags, barricades, or attendants shall be utilized as a method to prevent the employee from entering look-alike equipment

Test Equipment

Only use multimeters rated as CAT III or CAT IV and ensure voltage and/or ampacity rating of meter is rated for the work being done. Refer to Appendix G for information regarding categories of insulation of test equipment

Inspect test meters/devices and leads for damage before use. Damaged devices or leads must not be used and must be replaced as soon as possible.

Verify that test meters/devices are operating properly and that appropriate settings are used:

- Verify that the test meters/devices have a sufficient range for the expected voltage.
- Verify voltage using the AC and DC scales where the possibility exists of both voltages being present.
- Test the meter/device on a known live source of equal voltage prior to and immediately after the voltage verification. This is a LIVE-DEAD-LIVE test.

Verify the absence of voltage prior to working on de-energized equipment with an appropriately rated contact or non-contact device.

Use test leads with insulated connectors in all possible applications. Ensure that test leads without shielded or shrouded connectors will not fall off their connection points.

PERSONAL PROTECTIVE EQUIPMENT

Once a determination has been made that there is no electrical hazard present, with zero energy checks, static discharges, clearances, etc., workers may remove their **electrical arc flash and shock PPE**.

All personnel shall don appropriate personnel protective equipment prior to entering a boundary. Normal PPE is required when performing other work or traveling by electrical equipment where covers/doors are in place.

Arc Rated (AR) Clothing

AR clothing shall be worn in accordance with the hazard ratings of the equipment being worked on. Please consult the chart in Appendix E for specifics.

Wear AR clothing loose, rather than tight. Air gaps provide insulating protection.

Dry AR clothing provides better protection than wet AR clothing.

AR pants may be worn with a leather belt. A belt worn may have a metal buckle.

Fabric softeners are flammable. Bleach used in laundering will degrade the protection level of AR clothing. Bleach and fabric softeners **shall not** be used in the laundering of AR clothing.

AR clothing shall be visually inspected before each use. AR apparel that is contaminated or damaged shall not be used. AR clothing that becomes contaminated with grease, oil, flammable liquids, or combustible liquids shall not be used. Change contaminated clothing before performing electrical tasks where arc flash is a hazard (See Appendix E for minimum PPE requirements). The garment manufacturer's instructions for care and maintenance of AR apparel shall be followed.

When AR apparel is worn to protect an employee, it shall cover all ignitable clothing and allow for movement and visibility. AR apparel must cover potentially exposed areas as completely as possible. AR shirt and coverall sleeves must be fastened, shirts shall be tucked in and AR shirts/jackets must be closed at the neck.

Non-melting, flammable garments (i.e., cotton, wool, rayon, silk, or blends of these materials) may be used as under layers beneath AR apparel. Meltable fibers such as acetate, nylon, polyester, polypropylene, and spandex shall not be permitted in fabric under layers next to the skin. (An incidental amount of elastic used on non-melting fabric underwear or socks shall be permitted).

Garments worn as outer layers over AR apparel (i.e., jackets, high visibility vest or rainwear) must be made from AR or Flame-Resistant material. Outer layers do not have to be rated for the arc flash hazard level as long as the inner layer is rated for arc flash hazard level.

Flash suits can cause heat stress and should not be donned until just before being exposed to the arc flash hazard. Flash suits must permit easy and rapid removal by the user. If cool vests are used, then they shall be FR rated.

AR clothing is selected based on Flash Hazard Risk Assessment tables and/or calculations. Equipment labels should state the clothing level required. Wear arc-flash apparel rated for the potential arc-flash conditions. The Arc Thermal Performance Exposure Value (ATPV) rating must be on the garment label.

Protection for the hands and feet are also required when wearing arc-flash apparel. Heavy-duty work shoes and voltage-rated gloves with leather protectors are appropriate for flash protection as well as shock protection. Also, non-voltage rated flame retardant gloves are appropriate.

Inspect all arc-flash PPE products for damage before and after every use. Check for rips and tears, as well as any soiling (especially oil or other combustible) which could adversely impact the arc-thermal performance characteristics of the product. Do not use PPE in need of repairs or cleaning.

Arc Rated Gloves

Arc rated gloves protect from arc flash heat exposure and are constructed of materials that are inherently flame resistant.

Arc rated gloves do not provide electrical protection and shall not be used when insulating voltage rated rubber gloves are required.

Voltage Rated Gloves

Rubber gloves with leather protectors shall be worn when working on exposed energized lines or equipment energized at 50 volts or more.

Voltage rated rubber gloves are also required in situations where personnel are within the established restricted approach boundary where inadvertent contact with energized parts is possible. If voltage rated gloves are not required, refer to the AR Clothing section for guidance on AR gloves.

Tasks such as, but not limited to, the following are examples of work that do require the use of voltage rated rubber gloves:

- Exciter brush maintenance.
- Installation or removal of a motor control center bucket.
- Work on energized electrical conductors and circuit parts.
- Troubleshooting and testing of circuits greater than 300V.

Tasks such as, but not limited to, the following are examples of work that do not require the use of voltage rated rubber gloves provided that insulated tools are being used where necessary:

- Racking in or out a circuit breaker.
- Racking in and out non-energized 4.16 kilovolts (kV) and 13.8 kV and Generator PT Fuse Drawers.
- Troubleshooting and testing (including contact voltage testing) of circuits less than or equal to 300 volts.
- Opening hinged doors for visual inspection of equipment.

Class 0, 1, 2, 3 and 4 rubber gloves must be worn with leather protectors. Only the prescribed leather protector should be worn with the class of rubber glove. When used at voltages between 250 and 500 volts, Class 00 gloves must be worn with leather protectors as well. Protector gloves need not be used with Class 00 gloves for work less than 250 volts where small equipment and parts manipulation require high finger dexterity. In instances where Class 00 gloves are used without leather protectors, they shall be electrically tested prior to their next use, or replaced with new.

Rubber gloves shall be visually inspected, and air tested prior to use. To air test, roll the cuff tightly toward the palm to trap air inside the glove. Check for punctures by either listening for escaping air or by holding the glove close to your cheek to feel the escaping air. Gloves believed to be defective shall not be used. Remove them from service and send them for testing.

Rubber gloves shall be electrically tested every 6 months or more often if field conditions warrant. Do not use rubber gloves past their test due date. Remove them from service and send them for testing.

Rubber gloves shall be stored in approved bags in a fully extended position. Rubber gloves shall not be folded. Bags shall be either hung up or placed in a special compartment. They shall not be placed where the tools or equipment can damage the rubber gloves. No items are permitted to be placed in the rubber glove bag along with the rubber gloves and protector gloves.

Two pairs of rubber gloves, one inside the other, shall not be worn.

Care shall be taken not to allow gloves to come in contact with oil-base products.

Protectors shall not be worn in place of work gloves.

After use, rubber gloves should be washed daily at the end of the shift prior to storage. Rinse gloves using water as necessary to remove perspiration. Drain excess water and hang to air-dry.

Do not mix and match rubber gloves. Keep them together as matched pairs.

Natural fabric liners may be worn under rubber gloves to absorb perspiration or in cold weather for warmth.

Replace damaged leather glove protectors if they have tears, cuts, holes or have oil, grease or other substances on them. Do not use leather protectors for any other purpose. Do not use gloves not designed to serve as "protectors" in lieu of protectors.

Rubber gloves shall be properly rated. See Appendix F for the voltage rating for each class glove.

Rubber Goods

Do not cut or modify rubber goods (except for voltage-rated barrier materials).

Inspect all rubber goods before use.

Rubber goods must be electrically tested at least annually per NFPA70E-2021 Table 130.7(C)(7)(B) (Refer to Appendix H). Do not use rubber goods past their test due date. Remove them from service & return for test.

Remove damaged rubber goods from service and return to be destroyed.

Store rubber goods in their natural shape. Do not fold, bend, or turn them inside out. Do not expose them to sunlight, direct heat, chemicals, or other harmful substances.

Include both exterior and interior surfaces when inspecting rubber goods. Look for the following defects:

- Cuts, snags, cracks, punctures, burns, swellings, abrasions.
- Embedded foreign objects.
- Contamination from materials such as oil, grease, or other damaging chemicals.
- Loss of elasticity when stretched.

Face / Eye Protection

Arc flash rated face shields worn over ANSI Z87 rated safety glasses shall be worn for protection against potential electrical arc hazard exposures rated 1 and higher. These face shields shall be properly rated for the Arc Hazard encountered. Normal PPE face shields used for eye and face protection from impact, grinding, chipping, etc. are not to be used as arc flash face shields due to their inability to provide adequate protection from an arc blast.

Avoid scratching or damaging the arc flash face shield. Hot surfaces can damage arc flash face shields. Care should be taken to prevent arc flash face shields from contacting hot surfaces. Scratches or damage may reduce its effective protection or impede sight. Replace if the shield is damaged.

Arc flash face shields worn for protection against electric arc must have Minimum Arc Thermal Performance Value (ATPV) of 8 cal/cm².

The surfaces of arc face shields and hood shields are *not* scratch or chemical resistant. Use only warm, soapy water for cleaning. Pat dry using a soft cloth.

HAND TOOLS AND TEST EQUIPMENT

Only manufacturer-rated insulated tools and handling equipment may be used to perform work within the Restricted Approach Boundary. Use of insulated hand tools inside the Restricted Approach Boundary is permissible to manipulate exposed energized parts operating at greater than 50 volts and up to 600 volts.

All electrical hand tools will be inspected by the user prior to use. Tools with damaged insulation or other defects shall not be used and shall be replaced. Tools should be inspected to:

- Ensure no breaks in the insulation.
- Verify test equipment is properly rated and used correctly.
- Verify test meters/devices are rated for the appropriate voltage.
- Visually inspect equipment and test leads for damage prior to use.
- Ensure test equipment is used on the proper setting and scale.

- Ensure test leads are secure and connected to correct points on test equipment.
- Perform “live-dead-live” checks and voltage checks on both AC and DC scales of test instruments where the possibility of both voltages being present exists.

Any test equipment not working properly must be repaired and tested prior to issue or being discarded.

Live line tools (such as hot sticks and rescue hooks), test equipment, and hand tools shall be rated for the voltage and energy level to be encountered.

Use insulated tools when working above energized equipment where a tool could fall, slip, or otherwise come in contact with exposed energized parts.

The use of insulated hand tools does not eliminate the need to use voltage rated gloves or other insulating barriers where a contact hazard exists with other exposed energized conductors/parts in the work area.

Live line tools, such as hot sticks and rescue hooks, shall be electrically tested at least every two years.

Prior to use, live line tools shall be inspected for defects, wiped down as appropriate, and checked for current test date.

Use live line tools, where appropriate, to maintain isolation distance from energized equipment.

BATTERIES AND BATTERY ROOMS

Battery Risk Assessment – Prior to any work on a battery system, a Risk Assessment shall be performed to identify the chemical, electrical shock, and arc flash hazards and assess the risks associated with the type of tasks to be performed.

Do not create sparks, arcs, or flames near battery areas. Flammable Hydrogen gas may be present in lead-acid battery charging areas. Prior to commencing work, monitor atmosphere to verify that hydrogen levels are below 10% LEL. Examine and maintain battery room ventilation systems to prevent buildup of explosive mixtures. This maintenance shall include a functional test of any associated detection and alarm systems.

Avoid conductive materials around batteries and avoid unintended contact between battery circuit and other equipment such as tools. Use non-sparking hand tools insulated for the maximum working voltage. Remove rings, watches, etc., before working on the batteries.

Do not remove flame arrestors from cells unless specific maintenance work is required. Immediately reinstall flame arrestors after work is completed.

Verify the location and functionality of an eyewash station before performing battery-related tasks. If there is no eyewash station, ensure that a portable unit is available before working on the batteries.

Take precautions to protect personnel from unintentionally contacting batteries and related equipment. For example, cover battery terminals with a rubber blanket. Keep metal tools off the top of the batteries.

Do not use mercury thermometers when taking electrolyte cell temperature. If the thermometer should break, mercury could run into the cell and possibly cause an explosion.

Wear the appropriate personal protective equipment in accordance with the PPE Program Hazard assessment as follows:

- Eye protection, full-face shield, chemical resistant protective gloves, full-body apron when:
 - Adding or removing electrolytes (acid).
 - Moving lead acid cells.
 - Checking specific gravity.
 - Washing or cleaning battery cells.
- Wear safety glasses and appropriate gloves to:
 - Adjust inter-cell connecting hardware and jumpers.
- Wear safety glasses to:
 - Read battery cell voltage.

Class 00 or higher rubber gloves with leather protectors shall be worn when working on exposed conductors or bus where the nominal battery voltage is in excess of 50 volts (example: torquing bus work and hooking up load banks). Where small equipment and parts manipulation require high finger dexterity and Class 00 gloves are used without leather protectors, they shall be electrically tested prior to their next use.

Do not smoke or create sparks, arcs, or flames in battery areas. Any activity that produces a spark, arc, or flame will require a [Hot Work Permit](#). If a device is used that produces significant heat or spark, atmospheric monitoring shall be conducted prior to and during the work activity to ensure an explosive atmosphere does not exist/develop.

The following warning signs shall be posted in locations near battery banks or battery charging:

- Electrical hazard warning signs indicating the shock hazard due to the battery voltage and the potential for arc hazard due to the prospective short-circuit current.
- Chemical hazard warning signs indicating the danger of hydrogen explosion from open flame and smoking and the danger of chemical burns from the electrolyte.
- Notice for personnel to use and wear protective equipment and apparel.
- Notice prohibiting access to unauthorized personnel.

New battery installations shall be designed and installed in accordance with applicable safety standards.

MINIMUM SAFE OPERATING DISTANCES NEAR POWERLINES

Minimum requirements for [Operating Cranes Near Electric Power Lines](#) except where electrical distribution and transmission lines have been de-energized and visibly grounded at point of work or where insulating barriers, not a part of or an attachment to the equipment or machinery, have been erected to prevent physical contact with the lines, equipment or machines shall be operated proximate to power lines only in accordance with the following:

- a. When operating cranes near power lines, the equipment clearance shall be a minimum of the following (per OSHA 1926.1408):
 - 10 feet for voltages up to and including 50kVac
 - 15 feet for voltages above 50 kVac up to and including 200 kVac.
 - 20 feet for voltages above 200 kVac up to and including 350 kVac.
 - 25 feet for voltages above 350 kVac up to and including 500 kVac.
 - 35 feet for voltages above 500 kVac up to and including 750 kVac.
 - 45 feet for voltages above 750 kVac up to and including 1,000 kVac.
- b. In transit with no load and boom lowered, the equipment clearance shall be a minimum of the following (per OSHA 1926.1411):
 - 4 feet for voltages up to and including 750 Vac.
 - 6 feet for voltages above 750 Vac up to and including 50 kVac.
 - 10 feet for voltages above 50 kVac up to and including 345 kVac.
 - 16 feet for voltages above 345 kVac up to and including 750 kVac.
- c. A qualified signal person shall be designated to observe clearance of the equipment and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means. At Tampa Electric, Energy Supply facilities, this requirement shall be met when the crane comes within a 20 foot radius of the overhead line. This designated person shall be in continuous contact with the crane operator, be equipped with a visual aid: such as, a range finder or aerial marker to assist in identifying the minimum clearance distance and be dedicated to the task of observing clearance.
- d. Cage-type boom guards, insulating links, or proximity warning devices may be used on cranes, but the use of such devices shall not alter the requirements of any other regulation of this part even if such device is required by law or regulation.
- e. Any overhead wire shall be considered as an energized line unless and until it has been tagged out, is visibly grounded, and clearance has been obtained from the Energy Control Center.
- f. Prior to work near transmitter/communication towers and or energized electrical conductors where an electrical charge can be induced in the equipment or materials being handled, the transmitter/communication towers and or energized electrical conductors shall be de-energized. If the transmitter/communication equipment towers or energized electrical conductors cannot be de-energized, then the following precautions shall be taken when necessary, to dissipate induced voltages:

- The equipment shall be provided with an electrical ground directly to the upper rotating structure supporting the boom.
- Ground jumper cables shall be attached to materials being handled by boom equipment. Crews shall be provided with nonconductive poles having large alligator clips or other similar protection to attach the ground cable to the load.
- Combustible and flammable materials shall be removed from the immediate area prior to operations.

Note: Before commencement of operations near electrical lines, the person responsible for the job shall notify the owners of the lines or their authorized representative providing them with all pertinent information and requesting their cooperation.

CURRENT AND POTENTIAL TRANSFORMERS

- a. No repair work shall be done on energized instrument transformers.
- b. The secondary winding of a current transformer shall be shorted out before the secondary circuit is opened and remain shorted until the circuit is closed. Failure to do this results in dangerous voltage in the secondary circuit.
- c. The secondary common return of wye-connected current transformers shall be grounded.
- d. When current transformer secondaries are delta-connected, one corner of the delta shall be grounded wherever practical.
- e. The cases of all current transformers shall be grounded except for the non-metallic case of 600-volt type.
- f. The lack of voltage on the low-voltage side of a potential transformer shall not be considered as positive indication that the high-voltage side is de-energized.

Motor Starters / Contactors

- a. The normal operation of a contactor trip circuit shall not be bypassed or circumvented, without reasonable precautions taken which must be approved by management via the temporary modification process.
- b. Testing and troubleshooting shall be performed by a qualified person **where an electrical hazard exists.**
- c. Under no circumstances shall a contactor be energized with the arc chutes removed.
- d. In cases where the contacts of the disconnecting devices cannot be seen to ensure a proper de-energized condition, a voltage tester shall be used to check for voltage before removing fuses.
- e. When working on contactors, all wiring within the contactor shall be tested for voltage.

Temporary Wiring

- a. All temporary wiring shall be properly tagged for identification with supply source and termination point information.
- b. Temporary wiring shall be done by qualified employees under the supervision of a qualified person.

Fuses

- a. Only qualified persons shall be allowed to pull fuses.
- b. When removing fuses, the circuit shall be de-energized, with the exception of control and motor heater fuses.
- c. When pulling fuses, refer to Appendix E and F for appropriate PPE.
- d. When changing fuses or fuse links, replacements shall be of the proper rating and type.

Electrical Testing Procedures

- a. Prior to electrical testing, the area to be tested shall be assessed for the need to be guarded or barricaded.
- b. Before using any test equipment, the employee shall inspect the equipment and check to make sure it is operating properly.
- c. All leads used in testing equipment shall be inspected for cuts, breaks or deterioration of insulation before they are used.
- d. Approved high-voltage leads and probes shall be used when testing any voltage above 480 volts.
- e. Extra precautions shall be taken while test running motors in the shop.
- f. Employees shall stay clear of any test equipment or equipment under test unless they are actually engaged in the work.
- g. Before a generator or exciter is meggered or high-voltage tested, the manufacturer's procedure shall be adhered to and all plant personnel shall be notified by use of the plant PA system and or radio.
- h. Prior to meggering, the system shall be inspected by the qualified person, who shall make all potential affected employees aware of the action by following the [Energy Supply Hazardous Energy Control Lockout Program](#). Refer to the HEC LOTO program for Special Situations with respect to meggering, testing, and positioning.

TEMPORARY PROTECTIVE GROUNDING FOR HIGH SIDE EQUIPMENT

Electric Delivery will perform all high-side grounding on equipment directly connected to Electric Delivery powerlines.

OTHER TEMPORARY PROTECTIVE GROUNDING

Where the possibility of **dangerous** induced voltages or stored electrical energy exists, test for voltage, and ground all phase conductors or circuit parts before touching them. Where it could be reasonably anticipated that the conductors or circuit parts being de-energized could contact other exposed energized conductors or circuit parts, apply ground connecting devices rated for the available fault duty.

When inspecting, installing, and removing temporary protective grounds wear electrical PPE that has the appropriate rating for the equipment or lines that require grounding.

Only qualified employees may assemble, control, inspect, test, install, and remove grounds.

Temporary protective grounding devices shall be tested at least every two years.

Use ground jumpers and clamps that have the appropriate rating for the equipment or lines that require grounding. They must be capable of conducting the maximum fault current that will flow until the fault condition clears.

Properly design, and construct/assemble all grounding devices as determined necessary for each specific instance needed. Prior to use, look for cuts in the protective sheath and damage to the conductors. Check clamps and connector strain relief devices for cracks and tightness. Check cables and clamps before and after each use.

Ensure that all energized temporary skid-mounted equipment is bonded to the plant grounding system.

After disconnecting a cable or equipment from a power source, it may retain a capacitive charge. Discharge and ground the cable or equipment before touching.

Do not ground through fuses, transformers or switching devices where you cannot visually verify the circuit continuity.

It is permissible to remove grounds temporarily for electrical tests. Employees involved in the testing process must wear appropriately rated rubber gloves and apply rubber insulation as necessary to isolate themselves from the hazardous test voltages.

Install and remove temporary protective grounds in accordance with the applicable work practice.

Installation

1. Verify that the circuit is de-energized and HEC applied prior to installing temporary protective grounds.
2. Select a grounding location(s) that is between the work location and all possible sources of power, but as close as practical to the work location.
3. Use the shortest grounding cable available.
4. Clean all clamp contact surfaces and connection points to remove oxidation and any other contaminants.
5. Secure the ground cables to minimize the whipping action that can occur when fault current flows through the cables.
6. Connect to the grounding point first, and then attach the other end to the line or equipment using a live-line tool or other insulating tool.
7. A grounding indicator that reveals the location of the ground(s) such as a green hasp that shall be attached to the master lock box. Refer to the Energy Supply Lock Out program.

Removal

1. Using a live-line tool or other insulating tool, remove the line or equipment connections first. Remove the grounding point connection last.
2. Verify that temporary protective grounding cables are off the lines or equipment before placing the equipment back in service.
3. Store ground sets and connection hardware in a clean and dry area when not in service.
4. Remove the green hasp grounding indicator from master lock box.

APPENDIX A – GLOSSARY

(1 of 6 pages)

Arc Flash Hazard – A source of possible injury or damage to health associated with the release of energy caused by an electric arc. An arc flash hazard may exist when energized electrical conductors or circuit parts are exposed or when they are within equipment in a guarded or enclosed condition, provided that a person is interacting with the equipment in such a manner that could cause an electric arc.

Arc Rated – Clothing or equipment that indicates it has been tested for exposure to an electric arc. Flame resistant clothing without an arc rating has not been tested for exposure to an electric arc. All arc rated clothing is also flame resistant.

Arc Thermal Performance Exposure Value (ATPV) – Maximum incident energy resistance demonstrated by a material, or layers of materials prior to material break-open or 50% probability of onset of a second-degree burn. Expressed in cal/cm² and indicated on clothing label.

Attendant – If signs and barricades do not provide sufficient warning and protection from electrical hazards, an attendant shall be stationed to warn and protect persons. The primary duty and responsibility of an attendant providing manual signaling and alerting shall be to keep unqualified employees outside a work area where the unqualified employee might be exposed to electrical hazards. An attendant shall remain in the area as long as there is a potential for exposure to the electrical hazards.

Available Fault Current – The largest amount of current capable of being delivered at a point on the system during a short circuit condition.

Balaclava (Sock Hood) – An arc-rated head protective fabric that protects the neck and head except for a small portion of the facial area.

Barricade – A physical obstruction such as tapes, cones, or A-frame-type wood or metal structures intended to provide a warning and to limit access.

Boundaries –

1. **Flash Protection Boundary** – When an arc flash hazard exists, an approach limit from an arc source at which incident energy equals 1.2 cal/ cm² (5 J/ cm²). This is the distance from a prospective arc source within which a person could receive a second degree burn if an electrical arc flash were to occur. Any person working within the arc protection boundary, when an arc flash hazard exists, must wear AR clothing and PPE in accordance with the Arc Flash Risk Assessment.

2. **Limited Approach Boundary** – An approach limit at a distance from an exposed energized electrical conductor or circuit part within which a shock hazard exists. Only qualified employees, or unqualified employees escorted by a qualified employee, may enter the limited approach boundary.

APPENDIX A – GLOSSARY

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3. **Restricted Approach Boundary** – An approach limit at a distance from an exposed energized electrical conductor or circuit 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. Only qualified employees can cross this boundary, doing so requires the use of shock protection techniques, special PPE, and equipment.

De-Energized – Free from any electrical connection to a source of potential difference or free of any electrical charge. Not having a potential difference from that of the Earth.

Diagnostic Testing – Activities such as verifying voltage, verifying current, measuring resistance, and installing/removing test equipment which does not involve modifying the system or equipment.

Electrical Hazard – A dangerous condition such that contact, or equipment failure can result in electric shock, arc flash burn, thermal burn, or arc blast injury.

Electrically Safe Work Condition – An electrical circuit or equipment is in the Electrically Safe Work Condition (considered de-energized) after the following steps are completed:

1. Disconnected from the voltage source(s).
2. Apply energy control.
3. Test to verify absence of voltage.
4. Evaluate the hazards involved in working on or near other exposed energized equipment.
5. Block or release stored mechanical energy that could affect the HEC isolation boundary or reenergize circuit parts.
6. Use covers or barriers as practical to eliminate hazards.
7. Use the recommended tools, PPE, and arc-flash apparel.
8. Ground the circuit/equipment as necessary.

Energized Work Method – Intentionally contacting energized parts or working within the restricted approach boundary while wearing proper PPE, or while using live-line tools.

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 electrical conductors or circuit parts that are not suitably guarded, isolated, or insulated.

Flash Hazard – A source of possible injury associated with the release of energy caused by an electric arc.

APPENDIX A – GLOSSARY

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

Flash Suit – A complete AR clothing and equipment system that covers the entire body, rated appropriately for the task, except for the hands and feet. This may include coveralls, pants, jacket, and bee-keeper-type hood fitted with a face shield.

Grounded – Equipment is adequately connected to the earth or some other conducting body that serves as a ZERO-voltage reference in place of the earth.

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

High voltage – Voltage greater than 600 volts (as defined by OSHA).

Incident Energy – The amount of thermal energy impressed on a surface, a certain distance from the source, generated during an electrical arc event. Incident energy is typically expressed in calories per square centimeter (cal/cm²).

Insulated – Separated from other conducting surfaces by a dielectric (including air space) offering a high resistance to the passage of current. The term “insulated” means electrically insulated (not thermal insulation). Use any insulated tool or object in accordance with the manufacturers rating and instructions.

Isolation – The act of separating a particular section of a circuit. This could be accomplished by racking out breakers, raising/lowering disconnect collars, etc.

Motor Control Center (MCC) – A floor-mounted assembly of one or more enclosed vertical sections having a common horizontal power bus and principally containing combination motor starting units, molded case circuit breakers, or fusible disconnects. The sections may incorporate vertical buses connected to the common power supply, which extends the common power supply to the individual units. (NFPA 70E – 600 volt Class MCC).

Movable Conductor – A conductor that is not rigid, tied, or bolted down. For example, an overhead line conductor, lead, loop, etc.

Nominal Voltage – A nominal value assigned to a circuit or system for the purpose of conveniently designating its voltage class (as 120/240 volts, 480Y/277 volts, 600 volts).

APPENDIX A – GLOSSARY

(4 of 6 pages)

Non-Contact Voltage Verification – Detecting voltage without direct physical contact with the source utilizing a sensor designed to sense the radiated field which surrounds live conductors (example: using an AC proximity tester (Tic Tracer)).

Properly Maintained (Condition of) – State of the electrical equipment considering the manufactures instructions, recommendations, applicable industry codes, standards, and recommended practices.

Qualified Employee or Person – One who has demonstrated skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training to identify the hazards and reduce the associated risk. The determination as to whether an employee is qualified considers both experience and training.

Employees shall be trained in and familiar with the safety-related work practices, safety procedures, and other safety requirements in this section that pertain to their respective job assignments. Employees shall also be trained in and familiar with any other safety practices, including applicable emergency procedures that are not specifically addressed by this section but that are related to their work and are necessary for their safety.

Qualified employees shall also be trained and competent in:

- The skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment.
- The skills and techniques necessary to determine the nominal voltage of exposed live parts.
- The minimum approach distances specified in this section corresponding to the voltages to which the qualified employee will be exposed.
- The proper use of the special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools for working on or near exposed energized parts of electric equipment.
- In Tampa Electric Energy Supply, qualified employees may include station electricians, maintenance personnel, operations personnel, and electrical engineers that have been trained in accordance with this program and meet the above-mentioned definition.

Risk – A combination of the likelihood of occurrence of injury or damage to health and the severity of injury or damage to health that results from a hazard.

Risk Assessment – An overall process that identifies hazards, estimates the likelihood of occurrence of injury or damage to health, estimates the potential severity of injury or damage to health, and determines if protective measures are required.

APPENDIX A – GLOSSARY

(5 of 6 pages)

Shock Hazard – A source of possible injury or damage to health associated with current through the body caused by contact or approach to energized electrical conductors or circuit parts.

Switchgear – A general term covering switching and interrupting devices and the combination with associated control metering, protective and regulating devices. Also, assemblies of these devices with associated interconnections accessories, enclosures and supporting structures used primarily in connection with distribution of power within a plant area. Also, a shortened term for switchgear assembly which is defined as assembled equipment (indoor/outdoor) including but not limited to one or more of the following: switching, interrupting, control, metering, protective and regulating devices, together with their supporting structures and enclosures, conductors, electric interconnections, and accessories.

Temporary Protective Ground – A temporary electrical connection, between a source of voltage and the earth, for the purpose of eliminating any difference in voltage between the two. Temporary protective grounds greatly reduce shock hazard for personnel working on de-energized lines or equipment. They also eliminate induced or static voltage charges on lines and equipment. Finally, they ensure that protective devices (relays and circuit breakers or fuses) will disconnect the energized source as quickly as possible.

Unqualified Employee or Person – A person who is not a qualified employee or qualified person.

Working Distance – The distance between a person’s face and chest area and a prospective arc source. The default distance is 18 inches based on the employee’s normal reach capability. (Average distance elbow to the end of hand).

Working Near (live parts) – Any activity inside a Limited Approach Boundary.

Working On (live parts) – Intentionally coming in contact with live parts with the hands, feet, or other body parts, with tools, probes, or with test equipment, regardless of the personal protective equipment a person is wearing. There are two categories of “working on”:

Diagnostic (testing) - taking readings or measurements of electrical equipment, conductors, or circuit parts with approved test equipment that does not require making any physical change to the electrical equipment, conductors, or circuit parts.

Repair - is any physical alteration of electrical equipment, conductors, or circuit parts (such as making or tightening connections, removing, or replacing components, etc.).

APPENDIX A – GLOSSARY

(6 of 6 pages)


Zero Energy Check – Performance of a “live/dead/live” check by the worker to ensure that equipment to be worked on or near has no electrical energy that could cause injury. A "live-dead-live" check will test the meter on a known live source, perform necessary checks and test the meter again on a known live source.


APPENDIX B – ELECTRICAL EQUIPMENT LABELS

(1 of 2 pages)

Labels to be used on all electrical equipment in Tampa Electric Power Stations.

Option 1:

| | |
|--|--------------|
|  <h2 style="margin: 0;">WARNING</h2> | |
| Arc Flash & Shock Hazard Appropriate PPE Required <small>Equipment Name: 1NHS-MCC-1B8A</small> <small>Protective Device: A1402B</small> | |
| Flash Protection Boundary | 3' 0" |
| Incident Energy (cal/cm ²) @ 1' 6" | 3.7 |
| Hazard Risk Category (PPE) | Cat 1 |
| Limited Approach Boundary | 3' 6" |
| Restricted Approach Boundary | 1' 0" |
| Prohibited Approach Boundary | 0' 2" |





1

Revised on: 12-Apr-10


Option 2:


| | |
|---|--------------|
| <h2 style="margin: 0;">WARNING</h2> <p style="font-size: 0.8em; margin: 0;">Arc Flash & Shock Hazard. Appropriate PPE Required</p> | |
| <small>Equipment Name: BB 120/240V Power Panel</small> <small>Protective Device: Fuse3</small> <small style="float: right;">Revised on: 21-Jan-11</small> | |
| Flash Protection Boundary | 1' 8" |
| Incident Energy (cal/cm ²) @ 1' 6" | 1.3 |
| Hazard Risk Category (PPE) | Cat 1 |
| Limited Approach Boundary | 3' 6" |
| Restricted Approach Boundary | 1' 0" |
| Prohibited Approach Boundary | 0' 2" |

Cat 1

Option 3 to be phased in:

| | |
|--|----------------|
|  <h2 style="margin: 0;">WARNING</h2> | |
| Revised on: 28-Jan-16 | |
| Arc Flash & Shock Hazard Appropriate PPE Required <small>Equipment Name: 0-NJS-SWG-601E PRI</small> <small>Protective Device: C1122</small> | |
| Flash Protection Boundary | 12' 5" |
| Incident Energy (cal/cm ²) @ 2' 0" | 17.65 |
| Hazard Risk Category (PPE) | Level 3 |
| Limited Approach Boundary | 3' 6" |
| Restricted Approach Boundary | 1' 0" |



3

APPENDIX B – ELECTRICAL EQUIPMENT LABELS Cont'd
(2 of 2 pages)

The orientation and location of the two or three labels varies based on available space on the electrical device. It is possible that the labels are not placed next to each other.

This label below will be used on ≥Cat 4 electrical equipment where a remote racking device is required.



APPENDIX C – APPROACH DISTANCES FOR SHOCK PROTECTION FOR AC VOLTAGES
(1 of 2 pages)

(Values from NFPA 70E Table 130.4 (E)(a))


| Nominal System Voltage (AC) Range, Phase to Phase | Limited Approach Boundary (Limited to Qualified Employees and Escorted Unqualified Employees) | | Restricted Approach Boundary (Qualified employees Only) |
|---|--|----------------------------|--|
| | Exposed Movable Conductor | Exposed Fixed Circuit Part | |
| Less Than 50 | Not Specified | Not Specified | Not Specified |
| 50 to 300 | 10 ft. | 3 ft. 6 In. | Avoid Contact |
| 301 to 750 | 10 ft. | 3 ft. 6 In. | 1 ft. |
| 751 to 15 kV | 10 ft. | 5 ft. | 2 ft. 2 in. |
| 15.1 kV to 36 kV | 10 ft. | 6 ft. | 2 ft. 9 in. |
| 36.1 kV to 46 kV | 10 ft. | 8 ft. | 2 ft. 9 in. |
| 46.1 kV to 72.5 kV | 10 ft. | 8 ft. | 3 ft. 6 in. |
| 72.6 kV to 121 kV | 10 ft. 8 in. | 8 ft. | 3 ft. 6 in. |
| 138 kV to 145 kV | 11 ft. | 10 ft. | 3 ft. 10 in. |
| 161 kV to 169 kV | 11 ft. 8 in. | 11 ft. 8 in. | 4 ft. 3 in. |
| 230 kV to 242 kV | 13 ft. | 13 ft. 0 in. | 5 ft. 8 in. |
| 345 kV to 362 kV | 15 ft. 4 in. | 15 ft. 4 in. | 9 ft. 2 in. |
| 500 kV to 550 kV | 19 ft. | 19 ft. | 11 ft. 8 in. |
| 765 kV to 800 kV | 23 ft. 9 in. | 23 ft. 9 in. | 15 ft. 11 in. |

APPENDIX C – APPROACH DISTANCES FOR SHOCK PROTECTION FOR DC VOLTAGES
(2 of 2 pages)

(Values from NPFA 70E Table 130.4 (E)(b))





| Nominal System Voltage (DC) Range | Limited Approach Boundary (Limited to Qualified Employees and Escorted Unqualified Employees) | | Restricted Approach Boundary (Qualified employees Only) |
|-----------------------------------|--|----------------------------|--|
| | Exposed Movable Conductor | Exposed Fixed Circuit Part | |
| Less Than 50V | Not Specified | Not Specified | Not Specified |
| 50V to 300V | 10 ft. | 3 ft. 6 In. | Avoid Contact |
| 301V to 1000V | 10 ft. | 3 ft. 6 In. | 1 ft. |
| 1100V-5000V | 10 ft. | 5 ft. | 1 ft. 5 in. |

APPENDIX D – ENERGIZED ELECTRICAL WORK PERMIT



| | | | |
|---|--|--|--------------------------|
|  TECO TAMPA ELECTRIC AN EMERA COMPANY | | Tampa Electric Energized Electrical Work Permit | Work Order Number: _____ |
| PART 1: Completed by Requester (TEC Employee) | | | |
| Description of circuit/equipment: | | | |
| Description of work to be done: | | | |
| Justification of why circuit cannot be de-energized, or the work deferred until the next scheduled outage. | | | |
| Requester Name: | | Requester Signature: | Date: |
| Approval to Perform Work Energized Management Name: | | Management Signature: | Date: |
| PART 2: Completed by Electrically Qualified Employee PERFORMING the work. | | | |
| Shock Risk Assessment Completed? <input type="checkbox"/> YES <input type="checkbox"/> NO | | Voltage Exposure: _____ | |
| Record Shock Hazard Boundaries: Limited: _____ Restricted: _____ | | | |
| Arc Flash Risk Assessment Completed? <input type="checkbox"/> YES <input type="checkbox"/> NO | | Incident Energy: _____ | |
| Record Arc Flash Hazard Boundary: _____ | | Working Distance: _____ | |
| Job Briefing completed prior to start of work? <input type="checkbox"/> YES <input type="checkbox"/> NO | | | |
| Safe Work Practices reviewed? <input type="checkbox"/> YES <input type="checkbox"/> NO | | | |
| Access Restriction? <input type="checkbox"/> YES <input type="checkbox"/> NO | | PPE Reviewed? <input type="checkbox"/> YES <input type="checkbox"/> NO | |
| Shock PPE: | | Arc Flash PPE: | |
| Do you agree that the above described work can be done safely? <input type="checkbox"/> YES <input type="checkbox"/> NO If NO, return to requester. Comments: <i>(Describe safe work practices and procedures to be used to mitigate the hazard)</i> | | | |
| Electrically Qualified Employee's Name: | | Electrically Qualified Employee's Signature: | Date: |
| Additional Electrically Qualified Employee's Name: | | Additional Electrically Qualified Employee's Signature: | Date: |
| Electrical Engineer/Supervisor's Name: | | Electrical Engineer/Supervisor's Signature: | Date: |
| PART 3: Acknowledgement that Work is Scheduled to be Performed on Energized Circuit/Equipment | | | |
| SPO/Team Leader or Designee Name: | | SPO/Team Leader or Designee Signature: | Date: |

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APPENDIX E – ARC RATED (AR) CLOTHING CATEGORIES



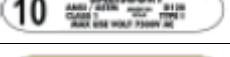
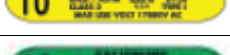


| Category Requirements | Description | Example |
|---|--|---|
| <p>All Arc Flash PPE Category 1 & 2 Tasks</p> | <p>AR long-sleeve shirt with AR pants (minimum arc rating of 8 cal/cm²) or AR Coveralls (minimum arc rating of 8 cal/cm²) and “non-melting” undergarments, Leather upper shoes, hard hat, Safety glasses or goggles, AR Face shield and Balaclava (or AR hood), Hearing protection, and Task Specific Gloves*.</p> |  |
| | <p>As needed: Flame Resistant Rainwear and Reflective Vest</p> | |
| <p>Face shield 10cal/cm² (required)</p> | <p>Salisbury model AS1000: TSN 207-5276 face shield, TSN 207-5277 shield frame, TSN 207-5278 chin cup</p> |  |
| <p>Balaclava 12/cal/cm²</p> | <p>Manufacturer and color vary TSN 207-5270</p> |  |
| <p>All Arc Flash PPE Category 3 & 4 Tasks</p> | <p>Arc Flash Suit (Minimum clothing system arc rating of 40 cal/cm²) and “non-melting” undergarments, Leather upper shoes, Hard Hat, Safety glasses/goggles, AR Hood and Face Shield, Hearing protection, and Task Specific Gloves*. Optional equipment: Balaclava</p> |  |
| | <p>As needed: Flame Resistant Rainwear and Reflective Vest</p> | |

APPENDIX F – GLOVE USE GUIDE

| Type | Description | Example |
|---|---|--|
| <p>Arc Rated Gloves (Provided as part of AR Category 4 Suit)</p> | <p>Gloves are <u>NOT</u> voltage rated and are <u>NOT</u> for electrical protection.</p> |  |
| <p>Leather Protectors</p> | <p>Used to protect rubber voltage gloves from damage. <u>NOT</u> to be used alone. (Length: 10in for Class 0, 14in for Class 2)</p> |  |

INSULATED GLOVE CLASSES

Di-electric gloves and insulating equipment shall be inspected before each use.

| Class Number | Test Voltage | AC Maximum Use Voltage | DC Maximum Use Voltage | Distances Between Gauntlet and Cuff (minimum) | Salisbury Label Color (other manufacturer labels may be different) |
|--------------|--------------|------------------------|------------------------|---|--|
| 00 | 2,500 VAC | 500 VAC | 750 VDC | 0.5 in (13 mm) | Beige  |
| 0 | 5,000 VAC | 1,000 VAC | 1,500 VDC | 0.5 in (13 mm) | Red  |
| 1 | 10,000 VAC | 7,500 VAC | 11,250 VDC | 1 in (25 mm) | White  |
| 2 | 20,000 VAC | 17,000 VAC | 25,500 VDC | 2 in (51 mm) | Yellow  |
| 3 | 30,000 VAC | 26,500 VAC | 39,750 VDC | 3 in (76 mm) | Green  |
| 4 | 40,000 VAC | 36,000 VAC | 54,000 VDC | 4 in (102 mm) | Orange  |

APPENDIX G – MULTIMETER INSULATION CATEGORIES

| Overvoltage Category | Application | Examples |
|----------------------|--|---|
| CAT IV | Three-phase at utility connection, any outdoor conductors | <ul style="list-style-type: none"> • Refers to the “origin of installation”; i.e., where low-voltage connection is made to utility power. • Electricity meters, primary overcurrent protection equipment. • Outside and service entrance, service drop from pole to building, run between meter and panel. • Overhead line to detached building, underground line to well pump. |
| CAT III | Three-phase distribution, including single-phase commercial lighting | <ul style="list-style-type: none"> • Equipment in fixed installations, such as switchgear and polyphase motors. • Bus and feeder in industrial plants. • Feeders and short branch circuits, distribution panel devices. • Lighting systems in larger buildings. • Appliance outlets with short connections to service entrance. |
| CAT II | Single-phase receptacle connected loads | <ul style="list-style-type: none"> • Appliance, portable tools, and other household and similar loads. • Outlet and long branch circuits. • Outlets at more than 10 meters (30 feet) from CAT III source. • Outlets at more than 20 meters (60 feet) from CAT IV source. |
| CAT I | Electronic | <ul style="list-style-type: none"> • Protected electronic equipment. • Equipment connected to (source) circuits in which measures are taken to limit transient over voltages to an appropriately low level. • Any high-voltage, low-energy source derived from a high winding resistance transformer, such as the high-voltage section of a copier. |

APPENDIX H – RUBBER INSULATING EQUIPMENT

| Rubber Insulating Equipment | When to Test |
|-----------------------------|---|
| Blankets | Before first issue; every 12 months thereafter* |
| Covers | If insulating value is suspect |
| Gloves | Before first issue; every 6 months thereafter* |
| Line Hose | If insulating value is suspect |
| Sleeves | Before first issue; every 12 months thereafter* |

**New insulating equipment is not permitted to be placed into service unless it has been electrically tested within the previous 12 months. Insulating equipment that been issued for service is not new and is required to be retested in accordance with the intervals in this table.*