TEXAS WOMAN'S UNIVERSITY™

Electrical Work Safety Program

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TEXAS WOMAN'S UNIVERSITY

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I. PURPOSE

This Electrical Work Safety Program has been developed in accordance with the following:

- U.S. Occupational Safety and Health Administration (OSHA) regulations:
  - 29 CFR 1910.147 – The Control of Hazardous Energy (Lockout/Tagout)
  - 29 CFR 1910.333 – Selection and Use of Work Practices (Electrical Safety)
  - 29 CFR 1910.137 – Electrical Protective Equipment Standard
- National Fire Protection Association (NFPA) 70E, Standard for Electrical Safety in the Workplace, 2021 Edition
- Texas Woman's University Regulations and Procedures Policy 04.430: Environmental Health and Safety

This program establishes the minimum requirements for safe electrical work at Texas Woman's University (TWU) campuses and is applicable to the maintenance or service of equipment, machines, or electrical systems. This program is being implemented in order to reduce the electrical hazards to employees conducting electrical work by requiring such work to be conducted on electrically safe or de-energized equipment whenever possible and requiring proper procedures and equipment when energized work is necessary.

This program will apply to TWU employees and, where applicable as noted below, to contractors who may be performing work on campus.

The intent of this program is to inform TWU employees and contractors of their roles and responsibilities before, during, and following electrical work. These practices and procedures are intended to provide for employee and contractor safety relative to electrical hazards in the workplace.

Workplace safety is in everyone's best interest. Any violations of this program or any other programs or standards should be reported immediately to your supervisor or to the TWU Office of Environmental Health & Safety (EH&S).

II. DEFINITIONS

The following regulatory definitions are relevant to the TWU Electrical Work Safety Program:

Arc Flash Hazard - A source of possible injury or damage to health associated with the release of energy caused by an electric arc.

Arc Flash PPE Category - A number from 1 to 4 indicating the level of hazard/risk involved in conducting energized work on a particular electrical system or equipment (where 4 is the highest hazard/risk) and corresponding to levels of required personal protective equipment (PPE).

Arc Flash Risk Assessment – 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, arc flash protection boundary, and appropriate levels of personal protective equipment (PPE).

Arc Flash Suit - A complete arc-rated clothing and equipment system that covers the entire body, except for the hands and feet. This includes pants, jacket, and beekeeper-type hood fitted with a face shield.

Arc Rating - The value attributed to materials that describes their performance to exposure to an electrical arc discharge. The arc rating is expressed in calories per square centimeter (cal/cm^2) and is derived from the determined value of the arc thermal performance value (ATPV) or energy of breakopen threshold (E_{BT}), should a material system exhibit a breakopen response below the ATPV value, derived from the determined value of ATPV or E_{BT}, whichever is the lower value.

Balaclava (Sock Hood) - An arc-rated hood that protects the neck and head except for the facial area of the eyes and nose. Balaclavas are worn with arc-rated face shields and helmets when the head is within the arc flash protection boundary.

Boundary, Arc Flash - When an arc flash hazard exists, an approach limit from an arc source at which incident energy equals 1.2 cal/cm^2 (5 J/cm^2). The arc flash boundary separates an area in which a person is likely exposed to a second degree burn injury.

Boundary, Limited Approach - An approach limit at a distance from an exposed energized electrical conductor or circuit part within which a shock hazard exists.

Boundary, Restricted Approach - An approach limit at a distance from an exposed energized electrical conductor or circuit part within which there is an increased likelihood of electric shock, due to electrical arc-over combined with inadvertent movement.

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 - A state in which an electrical conductor or circuit part has been disconnected from energized parts, locked/tagged in accordance with TWU's Lockout/Tagout (Hazardous Energy Control) Program, tested to verify the absence of voltage, and, if necessary, temporarily grounded for personnel protection.

Enclosed - Surrounded by a case, housing, fence, or wall(s) that prevents persons from unintentionally contacting energized parts.

Energized - Electrically connected to, or is, a source of voltage.

Fault Current - The amount of current delivered as a point on the system during a short-circuit condition. A fault current is a current that leaves the intended circuit path to return to the source of supply.

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

Hazard/Risk Class - See Arc Flash PPE Category.

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/cm^2).

Lockout - The placement of a lockout device on an energy isolating device, in accordance with an established program, ensures that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

Maintenance, Condition of - The state of the electrical equipment considering the manufacturers' instructions, manufacturers' recommendations, and applicable industry codes, standards, and recommended practices. The condition of maintenance for a piece of equipment plays a major role in the safety of not only the maintenance employee, but also the person operating the equipment.

Normal Operating Condition - A normal operating condition exists when all of the following conditions are satisfied:

- 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
- The equipment doors are closed and secured
- All equipment covers are in place and secured
- There is no evidence of impending failure

Qualified Person - One who has demonstrated skills and knowledge related to the construction and operation of electrical equipment and installations and has received safety training to identify the hazards and reduce the associated risk. Such persons shall be familiar with the proper precautionary techniques, applicable electrical policies and procedures, PPE, insulating and shielding materials, and insulated tools and test equipment. A person can be considered to be qualified with respect to certain equipment and methods but still be unqualified for others.

Risk Assessment - An overall process that identifies hazards, eliminates 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.

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. Injury and damage to health resulting from shock is dependent on the magnitude of the electrical current, the power source frequency (e.g., 60 Hz, 50 Hz, dc), and the path and time duration of current through the body. The physiological reaction ranges from perception, muscular contractions, inability to let go, ventricular fibrillation, tissue burns, and death.

Working Distance - The distance between a person's face and chest area and a prospective arc source. Incident energy increases as the distance from the arc source decreases.

III. COMPLIANCE

All TWU employees and contractors are required to comply with the restrictions and limitations imposed upon them by this program when conducting electrical work such as the installation, removal, inspection, operation, maintenance, and demolition of electric conductors, electric equipment, signaling and communications conductors and equipment, and raceways.

Only employees with proper skills and knowledge (i.e. Qualified Persons), including training on both TWU's Lockout/Tagout (Hazardous Energy Control) Program and this Electrical Work Safety

Program, may conduct electrical work in accordance with this program. Contractors must have an electrical work safety program sufficient to protect TWU employees, students, and visitors in place before beginning any applicable work on site.

IV. APPLICABILITY

A. Relation to Lockout/Tagout (Hazardous Energy Control) Program

Electrical work involving potential exposure to energized electrical conductors or circuit parts should be avoided to the maximum extent possible. This includes **any** work where equipment or electrical systems are not in an electrically safe work condition. In other words, electrical work should be conducted under the TWU Lockout/Tagout Program except under the limited exceptions provided in this program. If electrical work must be conducted on or near energized electrical conductors or circuit parts, an Energized Electrical Work Permit justifying why the work cannot be completed in an electrically safe work condition, and listing required safety measures, must be issued before the work may proceed. The only exception to the requirement to complete a permit is for work that is solely diagnostic as described in Energized Electrical Work Permit section below.

B. Work on Totally Enclosed Equipment

Electrical work that **does not involve any potential exposure** to energized electrical conductors or circuit parts is not normally covered by this program. However, if there is reason to believe there is an increased likelihood of injury from exposure to an arc flash hazard from equipment that is totally enclosed (such as malfunctioning equipment), the equipment should be treated as if there are exposed energized parts, including use of an Energized Electrical Work Permit.

Compliance with the TWU Lockout/Tagout Program is still required if employees or others are exposed to other energy sources (e.g. steam, stored pressure, temperature extremes, moving parts, etc.).

Examples of work on totally enclosed equipment include operating switches on equipment which all covers, guards, and shielding are wholly intact. Nevertheless, the following practices are recommended even when operating disconnects, control panels, switches, breakers, and motor controls within enclosures with doors/panels closed and secured:

- Wear non-melting clothes and safety glasses
- Stand to the hinge side of door
- Take a deep breath and face away from the switch before throwing it

4.3 Responsibility

Electrical safety is a shared responsibility between employers and employees. Employee electrical safety requires a collaborative effort between workers and management.

1. Employer Responsibility

Texas Woman's University shall establish, document, and implement the safety-related work practices and procedures required by the NFPA 70E standard and provide employees with training in the same.

2. Employee Responsibility

The employee shall comply with the safety-related work practices and procedures provided by Texas Woman's University. Regardless of the TWU electrical safety plan, it is the employee who has the biggest impact on his or her own electrical safety. Employees also have a responsibility to know their limitations; only they can determine if they are truly qualified to safely perform a task on a piece of equipment.

C. Priority

Hazard elimination shall be the first priority in the implementation of safety-related work practices. The electrical safety program shall include a risk assessment procedure and shall comply with NFPA 70E 110.1(H) (1) through 110.1(H) (3).

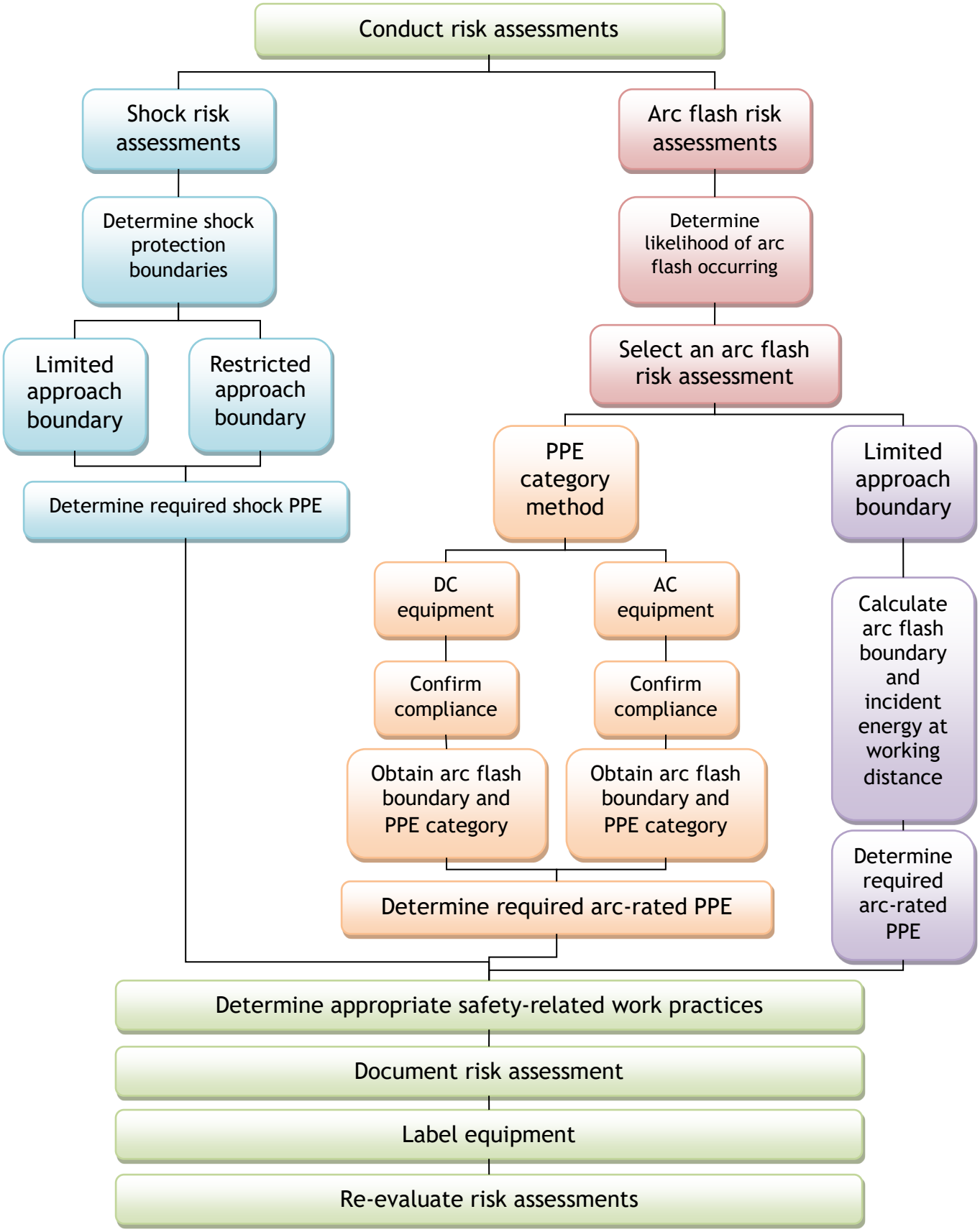
V. RISK ASSESSMENTS

A. Risk Assessment Procedure

The following risk assessment procedures shall address employee exposure to electrical hazards and shall identify the process to be used before work is started to carry out the following:

- Identify hazards
- Assess risks
- Implement risk control according to the hierarchy of risk control methods

The flowchart on the next page describes the process of a risk assessment.


Conduct risk assessments
Shock risk assessments
Arc flash risk assessments
Determine shock protection boundaries
Determine likelihood of arc flash occurring
Limited approach boundary
Restricted approach boundary
Select an arc flash risk assessment
Determine required shock PPE
PPE category method
Limited approach boundary
DC equipment
AC equipment
Calculate arc flash boundary and incident energy at working distance
Confirm compliance
Confirm compliance
Obtain arc flash boundary and PPE category
Obtain arc flash boundary and PPE category
Determine required arc-rated PPE
Determine required arc-rated PPE
Determine appropriate safety-related work practices
Document risk assessment
Label equipment
Re-evaluate risk assessments

B. Hierarchy of Risk Control Methods

The risk assessment procedure shall require that preventive and protective risk controls be implemented in accordance with the following hierarchy:

- Elimination
- Substitution
- Engineering controls
- Awareness
- Administrative controls
- PPE

C. Arc Flash Risk Assessment

TWU shall conduct an arc flash risk assessment of the electrical systems employees will be working with to identify arc flash hazards, estimate the likelihood of occurrence of injury or damage to health and the potential severity of injury or damage to health, and to determine if additional protective measures are required, including the use of PPE. The arc flash risk assessments should evaluate each piece of equipment or at each point in the electrical system where TWU employees will conduct work. Where this is not feasible, the analysis will be conducted as far "downstream" (load side) in the electrical system as possible. Due to the technical complexity of an arc flash risk assessment, it will generally be conducted by an outside electrical engineering firm who will follow the assessment procedures in NFPA 70E. The assessment must take into consideration the design of the overcurrent protective devices and opening time, **including its condition of maintenance**.

Once an arc flash risk assessment has been conducted, it must be updated when a major modification or renovation takes place. Arc flash risk assessments must also be reviewed periodically, at intervals not exceeding 5 years.

The results of the arc flash risk assessment will include, at a minimum: the identification of the equipment analyzed, appropriate safety-related work practices, the arc flash boundary in feet, the PPE to be used within the arc flash boundary, and all backup data indicating how these results were obtained (such as the design of the electrical equipment, operating condition and condition of maintenance). If an arc flash hazard does not exist for a piece of equipment or point in the system, that information will be documented as well.

For equipment or points in the system that have not yet been specifically evaluated as part of the arc flash risk assessment, one of two approaches may be taken to determine the arc flash hazard:

1. Assume that electrical systems and attached equipment will have the same potential arc flash hazards as the nearest analyzed "upstream" (line side) point in the system, or
2. For tasks involving exposure to voltages **less than 600 volts** (involving equipment that has **not** been specifically evaluated as part of the arc flash risk assessment), use Tables 1, 2, and 3 below to identify the required arc flash PPE for the task and voltage in question.

Tables 1, 2, and 3 may not be used for equipment/systems that have been specifically evaluated as part of the arc flash risk assessment.

Important: Pay particular attention to the notes at the bottom of the table; if the equipment in question is known to not meet the specifications listed in the notes (whether due to original equipment specifications or maintenance issues) Table 1 **cannot** be used.

Table 1 - Arc Flash Hazard Identification for Alternating-Current (AC) and Direct-Current (DC) Systems

Task	Equipment Condition*	Arc Flash PPE Required
Reading a panel meter while operating a meter switch	Any	**No**
Normal operation of a circuit breaker (CB), switch, contactor, or starter	Normal operating condition	**No**
	Other than normal operating condition	**Yes**
For ac systems: Work on energized electrical conductors and circuit parts, including voltage testing	Any	**Yes**
For dc systems: Work on energized electrical conductors and circuit parts of series-connected battery cells, including voltage testing	Any	**Yes**
Voltage testing on individual battery cells or individual multi-cell units	Normal operating condition	**No**
	Other than normal operating condition	**Yes**
Removal or installation of CBs or switches	Any	**Yes**
Removal or installation of covers for equipment such as wireways, junction boxes, and cable trays that does not expose bare energized electrical conductors and circuit parts	Normal operating condition	**No**
	Other than normal operating condition	**Yes**
Removal of bolted covers (to expose bare energized electrical conductors and circuit parts). For dc systems, this includes bolted covers such as battery terminal covers.	Any	**Yes**
Removal of battery nonconductive intercell connector covers	Normal operating condition	**No**
	Other than normal operating condition	**Yes**
Opening hinged door(s) or cover(s) to expose bare energized electrical conductors and circuit parts	Any	**Yes**
Perform infrared thermography and other noncontact inspections outside the restricted approach boundary. This activity does not include opening of doors or covers.	Any	**No**
Application of temporary protective grounding equipment after voltage test	Any	**Yes**
Work on control circuits with exposed energized electrical conductors and circuit parts, 120 volts or below without any other exposed energized equipment over 120 V including opening of hinged covers to gain access	Any	**No**
Work on control circuits with exposed energized electrical conductors and circuit parts, greater than 120 V	Any	**Yes**

Task	Equipment Condition*	Arc Flash PPE Required
Insertion or removal of individual starter buckets from motor control center (MCC)	Any	**Yes**
Insertion or removal (racking) of CBs or starters from cubicles, doors open or closed	Any	**Yes**
Insertion or removal of plug-in devices into or from busways	Any	**Yes**
Insulated cable examination with **no** manipulation of cable	Any	**No**
Insulated cable examination with manipulation of cable	Any	**Yes**
Work on exposed energized electrical conductors and circuit parts of equipment directly supplied by a panelboard or motor control center	Any	**Yes**
Insertion and removal of revenue meters (kW-hour, at primary voltage and current)	Any	**Yes**
For dc systems, insertion or removal of individual cells or multi-cell units of a battery system in an enclosure	Any	**Yes**
For dc systems, insertion or removal of individual cells or multi-cell units of a battery system in an open rack	Any	**No**
For dc systems, maintenance on a single cell of a battery system or multi-cell units in an open rack	Any	**No**
For dc systems, work on exposed energized electrical conductors and circuit parts of utilization equipment directly supplied by a dc source	Any	**Yes**
Arc-resistant equipment with the DOORS CLOSED and SECURED, and where the available fault current and fault clearing time does not exceed that of the arc-resistant rating of the equipment in one of the following conditions: • Insertion or removal of individual starter buckets • Insertion or removal (racking) of CBs from cubicles • Insertion or removal (racking) of ground and test device • Insertion or removal (racking) of voltage transformers on or off the bus	Normal operating condition	**No**
	Other than normal operating condition	**Yes**
Opening voltage transformer or control power transformer compartments	Any	**Yes**
Outdoor disconnect switch operation (hookstick operated) at 1kV through 15kV	Any	**Yes**
Outdoor disconnect switch operation (gang-operated, from grade) at 1kV through 15kV	Any	**Yes**

Note: Hazard identification is one component of risk assessment. Risk assessment involves a determination of the likelihood of occurrence of an incident, resulting from a hazard that could cause injury or damage to health. The assessment of the likelihood of occurrence contained in this table does not cover every possible condition or situation. Where this table indicates that arc flash PPE is not required, an arc flash is not likely to occur.

* The phrase *properly installed*, as used in this table, means that the equipment is installed in accordance with applicable industry codes and standards and the manufacturer's recommendations. The phrase *properly maintained*, as used in this table, means that the equipment has been maintained in accordance with the manufacturer's recommendations and applicable industry codes and standards. The phrase *evidence of impending failure*, as used in this table, means that there is evidence of arcing, overheating, loose or bound equipment parts, visible damage, deterioration, or other damage.

Table 2 - Arc Flash Hazard PPE Categories for Alternating-Current (AC) Systems

Equipment	PPE Category	Arc-Flash Boundary
Panelboards or other equipment rated 240 V and below Parameters: Maximum of 25 kA available fault current; maximum of 0.03 sec (2 cycles) fault clearing time; minimum working distance 455 mm (18 in.)	**1**	**19 in.**
Panelboards or other equipment rated >240 V and up to 600 V Parameters: Maximum of 25 kA available fault current; maximum of 0.03 sec (2 cycles) fault clearing time; minimum working distance 455 mm (18 in.)	**2**	**3 ft.**
600-V class motor control centers (MCCs) Parameters: Maximum of 65 kA available fault current; maximum of 0.03 sec (2 cycles) fault clearing time; minimum working distance 455 mm (18 in.)	**2**	**5 ft.**
600-V class motor control centers (MCCs) Parameters: Maximum of 42 kA available fault current; maximum of 0.33 sec (20 cycles) fault clearing time; minimum working distance 455 mm (18 in.)	**4**	**14 ft.**
600-V class switchgear (with power circuit breakers or fused switches) and 600 V class switchboards Parameters: Maximum of 35 kA available fault current; maximum of up to 0.5 sec (30 cycles) fault clearing time; minimum working distance 455 mm (18 in.)	**4**	**20 ft.**
Other 600-V class (277 V through 600 V, nominal) equipment Parameters: Maximum of 65 kA available fault current; maximum of up to 0.03 sec (2 cycles) fault clearing time; minimum working distance 455 mm (18 in.)	**2**	**5 ft.**
NEMA E2 (fused contactor) motor starters, 2.3 kV through 7.2 kV Parameters: Maximum of 35kA available fault current; maximum of up to 0.24 sec (15 cycles) fault clearing time; minimum working distance 910 mm (36 in.)	**4**	**40 ft.**

Equipment	PPE Category	Arc-Flash Boundary
Metal-clad switchgear, 1 kV through 15 kV Parameters: Maximum of 35 kA available fault current; maximum of up to 0.24 sec (15 cycles) fault clearing time; minimum working distance 910 mm (36 in.)	**4**	**40 ft.**
Metal enclosed interrupter switchgear, fused or unfused type construction, 1 kV through 15kV Parameters: Maximum of 35kA available fault current; maximum of 0.24 sec (15 cycles) fault clearing time; minimum working distance 910 mm (36 in.)	**4**	**40 ft.**
Arc-resistant equipment up to 600-volt class AND 1 kV through 15 kV Parameters: DOORS CLOSED AND SECURED; with an available fault current and a fault clearing time that does not exceed the arc-resistant rating of the equipment* **For DOORS OPEN, refer to the corresponding non-arc-resistant equipment section of this table*	**N/A**	**N/A**
Other equipment 1 kV through 15 kV Parameters: Maximum of 35 kA available fault current; maximum of up to 0.24 sec (15 cycles) fault clearing time; minimum working distance 910 mm (36 in.)	**4**	**40 ft.**

Note: For equipment rated 600 volts and below and protected by upstream current-limiting fuses or current-limiting circuit breakers sized at 200 amperes or less, the arc flash PPE category can be reduced by one number but not below arc flash PPE Category 1. Equipment shall be used in accordance with the manufacturer's instructions.

Table 3 – Arc Flash Hazard PPE Categories for Direct-Current (DC) Systems

Equipment	PPE Category	Arc-Flash Boundary
Storage batteries, dc switchboards, and other dc supply sources Parameters: 100 V ≥ voltage ≥ 250 V Maximum arc duration and working distance: 2 sec @ 455 mm (18 in.)		
Available fault current < 4 kA	**2**	**3 ft.**
4 kA ≤ available fault current < 7 kA	**2**	**4 ft.**
7 kA ≤ short-circuit current < 15 kA	**3**	**6 ft.**
Storage batteries, dc switchboards, and other dc supply sources Parameters: 250 V < Voltage ≤ 600 V Maximum arc duration and working distance: 2 sec @ 455 mm (18 in.)		
Available fault current < 1.5 kA	**2**	**3 ft.**
1.5 kA ≤ available fault current < 3 kA	**2**	**4 ft.**
3 kA ≤ available fault current < 7 kA	**3**	**6 ft.**
7 kA ≤ available fault current < 10 kA	**4**	**8 ft.**

Notes:

1. Apparel that can be expected to be exposed to electrolyte must be evaluated for electrolyte protection per ASTM F1296 as well as be arc rated. Contact the Office of Environmental Health & Safety for assistance.
2. A two-second arc duration is assumed if there is no overcurrent protective device (OCPD) or if the fault clearing time is not known. If the fault clearing time is known and is less than 2 seconds, an incident energy analysis could provide a more representative result.

D. Shock Risk Assessment

TWU is also required to perform an analysis of the shock hazards for each piece of equipment or at each point in the electrical system where TWU employees will conduct work. This may be determined as part of the arc flash risk assessment but must also be evaluated immediately prior to conducting the work as part of preparing an Energized Electrical Work Permit. Employees and their supervisors must evaluate the shock hazards associated with all exposed electrical conductors and circuit parts in the area of the work task in question to estimate the likelihood of occurrence of injury or damage to health and the potential severity of injury or damage to health, as well as to determine if additional protective measures are required, including the use of PPE.

If additional protective measures are required, they shall be selected and implemented according to the hierarchy of risk control. When the additional protective measures include the use of PPE, the following shall be determined:

- The voltage to which personnel will be exposed.
- The boundary requirements.
- The personal and other protective equipment required to protect against the shock hazard.

The results of a shock risk assessment shall be documented and will include the limited approach and restricted approach boundaries in feet. The aforementioned boundaries shall be applicable where personnel are approaching exposed energized electrical conductors or circuit parts.

The limited approach and restricted approach boundaries are determined by reviewing **all** energized electrical conductors or circuit parts that employees are exposed to during a particular task (generally all electrical conductors or circuit parts that are not fully enclosed). The nominal system voltage range (phase to phase) determines the boundary distances from any part of the exposed electrical conductors or circuit parts.

Table 4 – Shock Hazard Approach Boundaries for Alternating-Current (AC) Systems

Nominal System Voltage, Phase to Phase*	Limited Approach Boundary		Restricted Approach Boundary; Includes Inadvertent Movement Adder
	Exposed Movable Conductor **	Exposed Fixed Circuit Part	
Less than 50V	Not specified	Not specified	Not specified
50 to 150V	10 ft. 0 in	3 ft. 6 in	Avoid contact
151 to 750V	10 ft. 0 in	3 ft. 6 in	1 ft. 0 in
751 to 15kV	10 ft. 0 in	5 ft. 0 in	2 ft. 2 in

* For single phase systems above 250V, select the range that is equal to the maximum phase-to-ground voltage multiplied by 1.732.

** Exposed movable conductors describes a condition in which the distance between the conductor and a person is not under the control of the person. The term is normally applied to overhead line conductors supported by poles.

Table 5 – Shock Hazard Approach Boundaries for Direct-Current (DC) Systems

Nominal Potential Difference	Limited Approach Boundary		Restricted Approach Boundary; Includes Inadvertent Movement Adder
	Exposed Movable Conductor *	Exposed Fixed Circuit Part	
Less than 50V	Not specified	Not specified	Not specified
50 to 300V	10 ft. 0 in	3 ft. 6 in	Avoid contact
301 to 1kV	10 ft. 0 in	3 ft. 6 in	1 ft. 0 in
1.1 to 5kV	10 ft. 0 in	5 ft. 0 in	1 ft. 5 in

* Exposed movable condition describes a condition in which the distance between the conductor and a person is not under the control of the person. The term is normally applied to overhead line conductors supported by poles.

VI. JOB SAFETY PLANNING AND JOB BRIEFING

Before starting each job that involves exposure to electrical hazards, the employee in charge shall complete a job safety plan and conduct a job briefing with the employees involved.

A. Job Safety Planning

The job safety plan shall be in accordance with the following:

- Be completed by a qualified person
- Be documented
- Include the following information:
    - A description of the job and the individual tasks.
    - Identification of the electrical hazards associated with each task.
    - A shock risk assessment for tasks involving a shock hazard.
    - An arc flash risk assessment for tasks involving an arc flash hazard.
    - Work procedures involved, special procedures, and energy source controls.

B. Job Briefing

The job briefing shall cover the job safety plan and the information on the energized electrical work permit, if a permit is required. Where exposure to potential electrical hazards is involved, the employee in charge should be qualified for the tasks to be performed (i.e., for working at the applicable voltage).

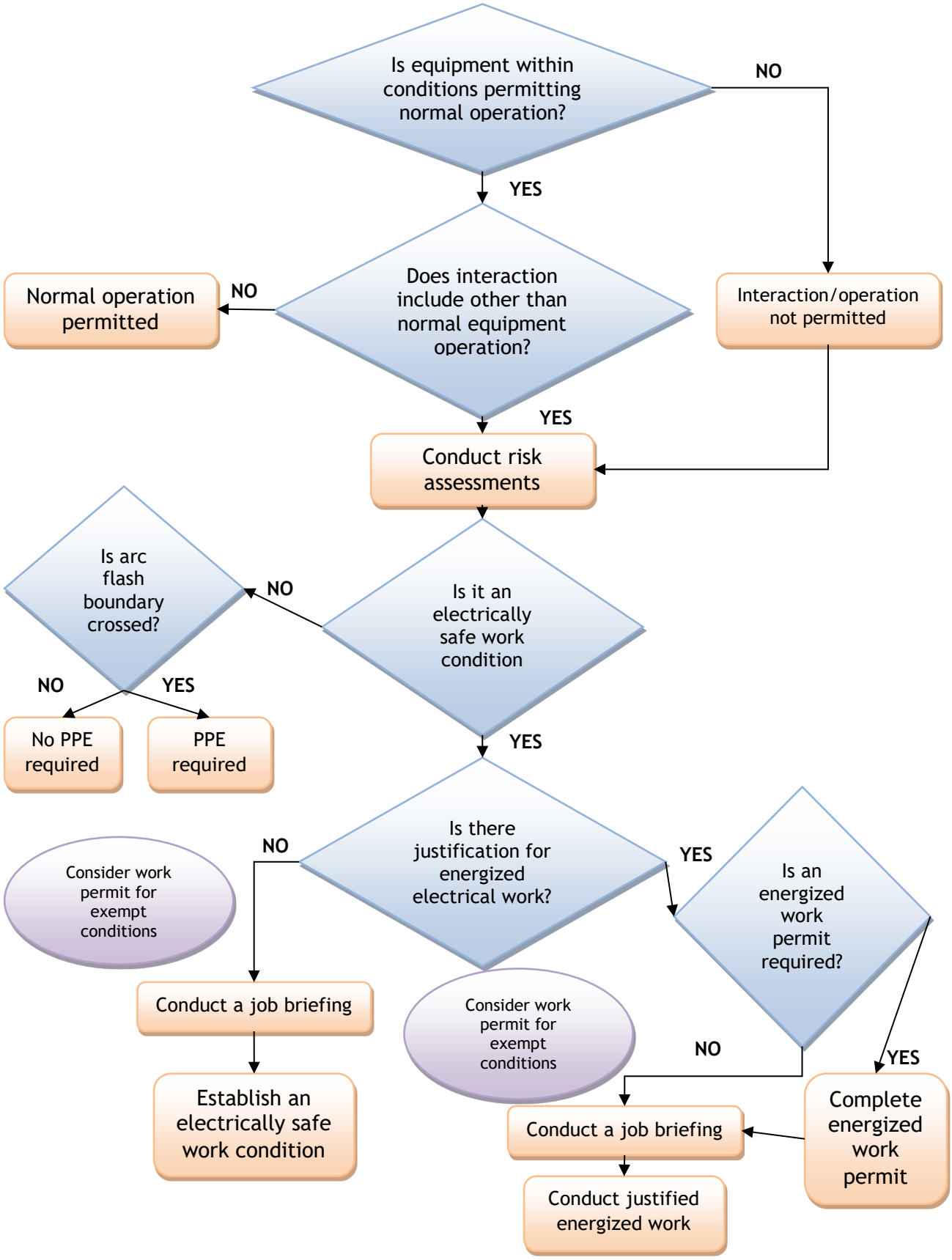
C. Change in Scope

Additional job safety planning and job briefings shall be held if changes occur during the course of the work that might affect the safety of employees. Any change in scope, procedure, task, safety, and so forth must not be done without consideration for the effect of that change on the risk assessment, work permit, and worker safety.

VII. WORK INVOLVING ELECTRICAL HAZARDS

This section outlines the requirements for work involving electrical hazards such as the electrical safety-related work practices, assessments, precautions, and procedures when an electrically safe work condition cannot be established. The arc flash protection boundary determined by the arc flash risk assessment, and the limited approach and restricted approach boundaries determined by the shock risk assessment, must be enforced and adhered to at all times by TWU employees and contractors.

A sample flowchart outlining the thought process behind conducting electrical work can be found on the next page.


Is equipment within conditions permitting normal operation?
NO
YES
Does interaction include other than normal equipment operation?
NO
Normal operation permitted
Interaction/operation not permitted
YES
Conduct risk assessments
Is it an electrically safe work condition
NO
Is arc flash boundary crossed?
NO
YES
No PPE required
PPE required
YES
Is there justification for energized electrical work?
NO
Consider work permit for exempt conditions
Conduct a job briefing
Establish an electrically safe work condition
YES
Is an energized work permit required?
Consider work permit for exempt conditions
NO
YES
Complete energized work permit
Conduct a job briefing
Conduct justified energized work

A. Equipment Operating at Less Than 50 Volts

Under normal conditions, electrical conductors energized at a voltage level less than 50 volts do not present an electrical shock hazard. As a result, Table 4 and Table 5 list "Not Specified" for the various boundaries. Energized electrical conductors and circuit parts that operate at less than 50 volts shall not be required to be de-energized where the capacity of the source and any overcurrent protection between the energy source and the worker are considered and it is determined that there will be no increased exposure to electrical burns or to explosion due to electric arcs.

However, a thermal hazard can exist in circuits that have a significant capacity to deliver energy, even when the voltage level is less than 50 (for example, battery installations where arcing could result from a short circuit). Only Qualified Persons who have an adequate level of experience for the particular task being conducted should perform work on equipment with less than 50 volts; and they should undertake appropriate safety precautions even if not specified above. Additionally, equipment shall be used and serviced in accordance with the manufacturer's instructions.

B. Limited Approach Boundary

The limited approach boundary may only be crossed by Qualified Persons (as defined above) who have an adequate level of experience for the particular task being conducted, **and** who have completed the training required by the Employee Training section below.

The determination of who is a Qualified Person for a particular task must be determined **jointly** by supervisors overseeing the work, and the employee(s) conducting the work.

All unqualified persons (other employees, contractors, students, etc.) must be prevented from crossing the limited approach boundary. If an unqualified person must cross the limited approach boundary, that person must be directly and continuously supervised by a Qualified Person.

Any tools and/or handling equipment within the limited approach boundary must be appropriately insulated as per the Insulated Tools and Equipment section below. Conductive articles of clothing or jewelry that could present an electrical hazard shall also not be worn within the limited approach boundary.

Anyone within the limited approach boundary must be alert at all times; no one will be permitted to cross the limited approach boundary while their alertness is impaired due to illness, fatigue, or other reasons.

C. Restricted Approach Boundary

The restricted approach boundary may only be crossed by Qualified Persons who have an adequate level of experience for the particular task being conducted **AND** are protected by PPE suitable for the full circuit voltage **AND** must possess a signed Energized Electrical Work Permit. The appropriate voltage rated PPE must cover any part of the body within the restricted approach boundary. For restricted approach boundaries listed as "Avoid Contact" in Table 4 and Table 5 above, the appropriate voltage rated PPE must cover any part of the body that may come in contact with energized electrical conductors or circuit parts. If the voltage rated PPE cannot protect all parts of the body that may come in contact with energized parts, voltage rated insulating blankets, covers or similar equipment must be used.

No unqualified persons may cross the restricted approach boundary **for any reason**, even if they are supervised by a Qualified Person.

"Crossing" the restricted approach boundary is defined as both crossing it with any part of the body or crossing it with any tool or piece of equipment (i.e., a Qualified Person may **not** avoid the need for an Energized Electrical Work Permit by keeping their body outside of the boundary but crossing it with a tool).

D. Arc Flash Protection Boundary

The arc flash protection boundary may only be crossed by individuals protected from thermal hazards by appropriate arc-rated PPE. Appropriate arc-rated PPE is that which has a sufficient arc rating for the equipment the work is being conducted on as determined by an arc flash risk assessment and indicated on equipment labels (see below).

As discussed in the Arc Flash Risk Assessment section above, if the arc flash risk assessment has not been conducted for the particular equipment to be worked on, the arc flash hazards (including the arc flash protection boundary) will be presumed to be the same as the nearest analyzed "upstream" point in the system. Alternately, for tasks involving exposure to voltages

less than 600 volts, Table 2 or 3 may be used to determine the appropriate arc-rated PPE to be used.

The appropriate arc-rated PPE will cover **any** part of the body that crosses the arc flash protection boundary.

Important: If the arc flash analysis indicates that the thermal hazards exceed 40 cal/cm^2 (greater than the hazard requiring PPE Category 4), then work on the affected equipment will only be permitted in accordance with the TWU Lockout/Tagout Program (i.e., work on or near such energized electrical conductors or circuit parts is **not permitted**).

E. Relationship Between Shock Hazard and Arc Flash Boundaries

Shock hazard boundaries will always have the same relation to each other, the restricted approach boundary will be closest to the electrical equipment and the limited approach boundary will be the farthest (See Table 4 and Table 5). However, the arc flash protection boundary distance can vary significantly depending on the specifics of the electrical equipment and may not always fall at the same point in relation to the shock protection boundaries. In other words, the arc flash protection boundary may be farther from the energized parts than the limited approach boundary, could be very close to the restricted approach boundary, or somewhere in between. Therefore, the requirements for crossing the arc flash protection boundary must be adhered to as well as the appropriate shock protection boundary. For example: unqualified personnel crossing the arc flash protection boundary and the limited approach boundary would have to be wearing appropriate arc flash PPE AND be escorted by a Qualified Person at all times.

F. Physical Barriers

Physical barriers consisting of caution tapes, sawhorses, portable gates or similar must be placed at the limited approach boundary or the arc flash protection barrier, whichever is farther from the energized conductor or circuit part, to prevent unqualified individuals from entering the area. If the electrical work is being conducted in a small area with adequate access control (e.g., a small locked mechanical room), physical barriers may not be required. However, if the area is sufficiently large that other employees or contractor could enter the area without the knowledge of the Qualified Person(s) conducting the work, then barriers will still be required.

If physical barriers may not be sufficient to prevent unqualified individuals from entering the area, an attendant will be stationed to warn and prevent unqualified individuals from entering the area.

VIII. PERSONAL PROTECTIVE EQUIPMENT (PPE)

PPE for electrical work must be selected and used to protect against both shock hazards and arc flash hazards in accordance with the Risk Assessment and Job Safety Analysis sections above. In short, shock protection PPE must be rated for the full voltage of any exposed energized conductor or circuit part the employee could be exposed to, and arc flash PPE must meet the rating determined by the arc flash analysis as described below.

Employees exposed to electrical hazards when the risk associated with that hazard is not adequately reduced by the applicable electrical installation requirements shall be provided with, and shall use, protective equipment that is designed and constructed for the specific part of the body to be protected and for the work to be performed.

PPE for electrical work must be selected and used to protect against both shock hazards and arc flash hazards in accordance with the Risk Assessment and Job Safety Analysis sections above. In short, shock protection PPE must be rated for the full voltage of any exposed energized conductor or circuit part the employee could be exposed to, and arc flash PPE must meet the rating determined by the arc flash analysis as described below.

A. Arc Flash PPE

Arc flash personal protective equipment (PPE) protects primarily against thermal hazards and is rated by the incident energy (in cal/cm^2) it is capable of withstanding, known as an arc rating. A "PPE Category" consists of pieces of PPE which are worn together, and which all have a certain minimum arc rating. Table 6 below indicates the requirements at TWU for each PPE Category. The appropriate PPE Category is primarily determined by the results of the Arc Flash Risk Assessment which will list the potential incident energy from which the proper PPE Category can be found or will provide the PPE Category specifically (on older labels). Alternatively, where the ris assessment and equipment labeling has not been done, PPE

Category can be determined by selecting the appropriate task and voltage from Table 1 or Tables 2 and 3 if the maximum voltage is less than 600 volts.

Table 6 - Arc Flash PPE Requirements

PPE Category	Required PPE Description

1	• **Arc-Rated Clothing - required minimum arc rating 4 cal/cm²**
	  ○ Arc-rated long-sleeve shirt and pants OR arc-rated coverall
	  ○ Arc-rated face shield OR arc flash suit hood
	  ○ Arc-rated jacket, parka, rainwear, hard hat liner, or high-visibility apparel (AN)
	• **Protective Equipment**
	  ○ Hard hat
	  ○ Safety glasses OR goggles (SR)
	  ○ Hearing protection (ear canal inserts)
	  ○ Heavy duty leather gloves, arc-rated gloves, OR rubber insulating gloves with leather protectors (SR)
	  ○ Footwear tested to not ignite, melt, or drip at the incident energy level (AN)

2	• **Arc-Rated Clothing - required minimum arc rating 8 cal/cm²**
	  ○ Arc-rated long-sleeve shirt and pants OR arc-rated coverall
	  ○ Arc-rated flash suit hood OR arc-rated face shield and arc-rated balaclava
	  ○ Arc-rated jacket, parka, rainwear, hard hat liner, or high-visibility apparel (AN)
	• **Protective Equipment**
	  ○ Hard hat
	  ○ Safety glasses OR goggles (SR)
	  ○ Hearing protection (ear canal inserts)
	  ○ Heavy duty leather gloves, arc-rated gloves, OR rubber insulating gloves with leather protectors (SR)
	  ○ Footwear tested to not ignite, melt, or drip at the incident energy level

3	• **Arc-Rated Clothing - required minimum arc rating 25 cal/cm²**
	  ○ Arc-rated long-sleeve shirt (AR)
	  ○ Arc-rated pants (AR)
	  ○ Arc-rated coverall (AR)
	  ○ Arc-rated flash suit jacket and pants (AR)
	  ○ Arc-rated flash suit hood
	  ○ Arc-rated jacket, parka, rainwear, hard hat liner, or high-visibility apparel (AN)
	• **Protective Equipment**
	  ○ Hard hat
	  ○ Safety glasses or goggles (SR)
	  ○ Hearing protection (ear canal inserts)
	  ○ Arc-rated gloves or rubber insulating gloves with leather protectors (SR)
	  ○ Footwear tested to not ignite, melt, or drip at the incident energy level

4	• **Arc-Rated Clothing - required minimum arc rating 40 cal/cm²**
	  ○ Arc-rated long-sleeve shirt (AR)
	  ○ Arc-rated pants (AR)
	  ○ Arc-rated coverall (AR)
	  ○ Arc-rated flash suit jacket and pants (AR)
	  ○ Arc-rated flash suit hood
	  ○ Arc-rated jacket, parka, rainwear, hard hat liner, or high visibility apparel (AN)
	• **Protective Equipment**
	  ○ Hard hat
	  ○ Safety glasses OR goggles (SR)
	  ○ Arc-rated gloves or rubber insulating gloves with leather protectors (SR)
	  ○ Hearing protection (ear canal inserts)
	  ○ Footwear tested to not ignite, melt, or drip at the incident energy level

AN: As needed (optional). AR: As required. SR: Selection required.

As noted above, if the arc flash analysis indicates that the thermal hazards exceed 40 cal/cm^2 (required for PPE Category 4), then work on the affected equipment will only be permitted in accordance with the TWU Lockout/Tagout Program (i.e. work on or near such energized electrical conductors or circuit parts is **not permitted**).

Voltage rated gloves and leather protectors provide adequate arc flash/thermal protection for the hands, and do not have to have a specific arc-rating. Footwear tested to not ignite, melt, or drip at the incident energy level is required for all PPE Categories, but do not have to meet a minimum arc rating; examples include leather and dielectric shoes.

Note that only those parts of the body that are within the arc flash protection boundary must be protected with PPE necessary to protect from the thermal hazards. Table 6 assumes that the entire body will be within this boundary, but there may be some instances where this is not the case.

Either arc-rated, flame resistant or non-melting flammable materials may be worn under arc flash PPE meeting the requirements of Table 6, but fibers that can melt such as acetate, nylon, polyester, polypropylene, and spandex, may not be. Employees who conduct electrical work must **not** wear clothing with fibers that can melt, other than an incidental amount of elastic in garments such as underwear and socks.

Outerwear such as rain gear and parkas must also be arc-rated. Use of any such clothing or other items, such as hard hat liners, that are not arc-rated is prohibited within the arc flash protection boundary. If you are wearing arc-rated PPE and such outerwear is needed to protect against weather or provide enhanced visibility on top of the main arc-rated PPE, the outer garments do not need to be equal to the incident energy as long as they have an arc rating.

Arc flash clothing must cover potentially exposed areas as completely as possible. Sleeves shall be fastened at the wrists, shirts will be tucked into pants, and shirts, coveralls, and jackets shall be closed at the neck. Tight-fitting clothing shall be avoided as loose-fitting clothing provides more thermal protection. However, the apparel must interfere with the work task as little as possible while still providing the required protection.

B. Shock Protection PPE

As noted in the Restricted Approach Boundary section above, the appropriate voltage rated PPE must cover any part of the body within the restricted approach boundary. For restricted approach boundaries listed as "Avoid Contact" in Table 4 and Table 5, above, the appropriate voltage rated PPE must cover any part of the body that may come in contact with energized electrical conductors or circuit parts. If the voltage rated PPE cannot protect all parts of the body that may come in contact with energized parts, voltage rated insulating blankets, covers or similar equipment must be used.

Shock protection PPE for the hands generally consists of insulating gloves with leather protectors. Insulating gloves must be rated for the maximum voltage of any exposed energized electrical conductors or circuit parts. Leather protectors must always be worn over insulating gloves to prevent compromising the insulating properties of the inner gloves, and to provide additional thermal protection.

If there is a potential for contact of the head with energized electrical conductors or circuit parts, nonconductive head protection must be worn. This can generally be accomplished by wearing an arc-rated helmet and face shield. If the risk of contact is only to the top of the head, a Class E hard hat is sufficient. Appropriate hard hats are incorporated into arc-rated face shields and suit hoods used at TWU.

If work on energized electrical conductors or circuit parts involves step and touch sock potential (from stepping on live conductors, or standing on conductive surfaces for example), then dielectric overshoes must also be used.

C. Rubber Insulating Gloves

Employees shall use insulated gloves when working inside the limited approach boundary, as outlined in Table 7 below.

Table 7 – Maximum Use Voltage for Rubber Insulating Gloves

Class Designation of Glove or Sleeve	Maximum ac Use Voltage rms, volts	Maximum dc Use Voltage avg, volts	Distances Between Gauntlet and Cuff, minimum
00	500	750	12 mm (0.5 in.)
0	1,000	1,500	13 mm (0.5 in.)
1	7,500	11,250	25 mm (1 in.)
2	17,000	25,500	51 mm (2 in.)
3	26,500	39,750	75 mm (3 in.)
4	36,000	54,000	102 mm (4 in.)

D. Other PPE

Safety glasses or goggles must be worn whenever conducting work on energized electrical conductors or circuit parts, even when the head is not in the arc flash protection boundary. Eye injuries can occur from arc blasts, even when outside of the arc flash protection boundary, and from normal work that might cause flying objects. Safety glasses or goggles must be also be worn beneath face shields or arc flash suit hoods to adequately protect the eyes from flying objects during an arc flash incident.

Hearing protection (consisting of ear canal insert type ear plugs) must also be worn whenever conducting work within the arc flash protection boundary to protect against the noise associated with a potential arc blast.

E. PPE Care and Maintenance

All PPE must be inspected by the user prior to **each** use, and immediately following any incident that can reasonably be suspected of having caused damage. Any PPE that is damaged or contaminated (with grease, oil or flammable liquids) shall not be used. PPE shall be maintained in a safe, clean, and reliable condition and in accordance with the manufacturer's instructions. PPE shall be stored in a manner that prevents damage from physically damaging conditions and from moisture, dust, other deteriorating agents or contamination.

In addition to the above visual inspection, insulating gloves and sleeves must be "air tested" daily before use. This is completed by rolling the cuff tightly to trap air inside, applying pressure to areas of the glove, and listening for escaping air. The glove is then turned inside out, and the air test is repeated.

Electrical shock protective equipment shall be tested by an outside testing firm in accordance with ASTM standards at the intervals outlined in Table 8.

Table 8 – Rubber Insulating Equipment, Maximum Test Intervals

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 has been issued for service is not new and is required to be retested in accordance with the intervals in this table.

IX. INSULATED TOOLS AND EQUIPMENT

Employees shall use insulated tools (including test equipment) and/or handling equipment when working inside the limited approach boundary as per the following:

- Insulated tools shall be rated for the maximum voltage of any exposed conductor or circuit part that the tool could come in contact with.
- Insulated tools shall be designed and constructed for the environment to which they are exposed and the manner in which they are used.
- Insulated tools shall be protected from damage to the insulating material.
- Fuse or fuseholder handling equipment, insulated for the circuit voltage, must be used to remove or install fuses that are energized.
- Ropes and handlines used within the limited approach boundary must be nonconductive.
- Portable ladders must have nonconductive side rails when used inside the limited approach boundary or where the employee or ladder could contact exposed energized electrical conductors or circuit parts.
- Protective shields, protective barriers, or insulating materials shall be used to protect each employee from shock, burns, or other electrically related injuries while an employee is working within the limited approach boundary of energized conductors or circuit parts that might be unintentionally contacted or where dangerous electric heating or arcing might occur. Insulated covers, shields, or similar equipment must be used if voltage rated PPE cannot protect all parts of the body that may unintentionally come in contact with energized electrical conductors or circuit parts.

Insulated tools and equipment shall be inspected prior to each use. The inspection will look for damage to the insulation or damage that may limit the tool from performing its intended function or increase the potential for an incident (e.g., damaged tip on a screwdriver). If any issues are noted during the visual inspection, the equipment will immediately be taken out of service. Rubber covers, shields and line hoses need to be tested by an outside testing firm in accordance with ASTM standards if the insulating value is suspect due to physical damage, wear or other issues noted during inspection.

In addition to the above requirements, electrical test equipment used for the testing for the absence of voltage on conductors or circuit parts must be verified to be operating properly

before and after the voltage test is performed. This is generally achieved by using the test equipment on electrical equipment such as a nearby outlet that is known to be energized.

X. EQUIPMENT LABELING

Electrical equipment such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are in other dwelling units and that are likely to require examination, adjustment, servicing, or maintenance while energized shall be marked with a label containing the results of the arc flash and shock risk assessments for that piece of equipment.

The labels shall read "WARNING: ARC FLASH AND SHOCK HAZARD" or similar and will have graphics and/or colors to make them stand out from the equipment and surrounding labels. The labels shall contain the following information:

- The identity of the equipment.
- The date of the arc flash risk assessment.
- Arc flash protection boundary in feet.

- Available incident energy in cal/cm^2 (and the corresponding working distance) or the arc flash PPE Category required by the equipment (but not both).
- The nominal system voltage.
- The limited approach boundary in feet/inches.
- The restricted approach boundary in feet/inches.

If the arc flash analysis indicates that the thermal hazards of working on a piece of equipment exceed 40 cal/cm^2, this will be indicated on the label and the arc flash and shock hazard boundaries will not need to be listed as live work is prohibited on such equipment.

XI. ATTENDANTS

Any work on energized electrical conductors or circuit parts **must involve at least two Qualified Persons**, one of which will act as the Attendant who will be equipped with communication equipment and will summon emergency assistance as necessary. TWU Department of Public

Safety (DPS) is trained and equipped (including automatic external defibrillators) to provide first aid to TWU employees. The Attendant shall be stationed to keep unqualified employees outside a work area where the unqualified employee might be exposed from electrical hazards. The Attendant shall remain in the area as long as there is a potential for employees to be exposed to the electrical hazards. The Attendant should have no other duty than to deliver the warning.

Exception: An attendant is not required if the work is **solely diagnostic** in nature **AND** the task involves exposure to voltages **less than 600 volts**. Work that is considered solely diagnostic would include visual inspection and crossing the restricted approach boundary to use voltage meters and similar diagnostic equipment. Any work that involves tightening electrical connections, adding or removing conductors or circuit parts or other modification to the equipment is **NOT** diagnostic and requires an attendant. However, having an attendant is still **STRONGLY** encouraged as shock and arc flash hazards still exist when conducting diagnostic work, and without an attendant there may be no one to assist in an emergency.

The Attendant must not cross the restricted approach boundary as part of the work task. Thus, if a task requires more than one employee to cross the restricted approach boundary, there must always be one additional employee to act as the attendant (e.g., if the task requires two employees within the restricted approach boundary, then a third employee is required to act as the Attendant).

The Attendant must be equipped with the PPE required based on the shock and arc flash hazard boundaries he or she will be crossing.

If an electrical injury occurs, the Attendant must **FIRST** remove the source of electricity if he can do so safely, **THEN** request emergency assistance from DPS.

XII. ENERGIZED ELECTRICAL WORK PERMIT

No work may be performed within the restricted approach boundary unless the work meets one of the following exceptions:

1. De-energizing the equipment poses additional or increased hazards (acceptable examples include interruption of life support equipment, deactivation of emergency alarm systems, and shutdown of hazardous location ventilation equipment),
2. The task to be performed is infeasible in a de-energized state due to equipment design or operational limitations (acceptable examples include performing diagnostics and testing of electrical circuits that can only be performed with the circuit energized and work on circuits that form and 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), or
3. The energized electrical conductors and circuit parts operate at less than 50 volts to ground and there is no increased exposure to electrical burns or to explosion due to electric arcs.

IF THE TASK DOES NOT meet one of the above exceptions; it **MUST BE** conducted under the requirements of the TWU Lockout/Tagout program (i.e. live work is **not** permitted).

IF THE TASK DOES meet one of the above exceptions; it **MUST BE** performed under an authorized Energized Electrical Work Permit. A paper copy of the permit can be found in Attachment 1 below; the digital permit can be found by visiting TWU's CampusOptics permit at https://twu.campusoptics.com/pr/electrical-work.

In addition to work performed within the restricted approach boundary, an Energized Electrical Work Permit is required if an employee is to interact with equipment when conductors or circuit parts are not exposed but an increased likelihood of injury from an exposure to an arc flash hazard exists.

Exception: An Energized Electrical Work Permit is not required if the work is **solely diagnostic** in nature. Work that is considered solely diagnostic would include thermal, ultrasound, and visual inspections and crossing the restricted approach boundary to use voltage meters and similar diagnostic equipment. Any work that involves tightening electrical connections, adding or removing conductors or circuit parts or other modification to the equipment is **NOT** diagnostic and requires a permit. Even if diagnostic work is being conducted without a permit, **all of the other rules under this program must be followed**, including use of proper PPE for the applicable shock and arc flash hazards. Additionally, equipment shall be used in accordance with manufacturer's instructions.

Before electrical work within the restricted approach boundary can proceed, an Energized Electrical Work Permit must be completed and signed by all employees involved in the work and their supervisor. If it is expected that a particular task will require crossing the restricted approach boundary, the permit should be obtained prior to beginning the work.

The permit shall be reviewed with all employees involved in the work, and their supervisor, as part of a required job briefing conducted prior to beginning the work. The job briefing shall cover such subjects as hazards associated with the job, work procedures involved, special precautions, energy source controls, and PPE requirements. Important information from the job briefing shall be noted on the permit as well.

All safety requirements (procedures, equipment, PPE, etc.) indicated as necessary by the permit must be implemented/obtained prior to beginning the work. When the work is complete, the completed permit must be forwarded to EH&S (if a paper copy).

An Energized Electrical Work Permit may be authorized for a recurring task if the task and associated risks are very consistent and can be adequately described on the permit (paper copy only). This is indicated on the permit by checking the "Extended Duration" checkbox. If there is any variation in the risks associated with the recurring task, the permit must require the appropriate level of protection for the highest level of risk (e.g., the highest voltage and highest HRC that might be involved in completing the recurring task). Employees and supervisors should carefully consider all possible versions of the permitted task before authorizing such a permit. A copy of any extended duration permits must be forwarded to EH&S immediately after it is approved.

XIII. GENERAL ENERGIZED ELECTRICAL WORK RULES

Once the Energized Electrical Work Permit is completed and authorized, work may begin. The following rules must be adhered to at all times when conducting work on energized electrical conductors or circuit parts:

- Employees shall be alert for changes in the job or task that may expose them to additional hazards that were not part of the original plan.
- Employees shall not reach blindly into areas that might contain exposed energized electrical conductors or circuit parts.

- Employees shall not enter areas containing electrical hazards unless illumination is provided that enables the employees to perform the work safely. Where lack of illumination or an obstruction precludes observation of the work to be performed, employees shall not perform any task within the limited approach boundary of energized electrical conductors or circuit parts operating at 50 volts or more or where an electrical hazard exists.
- Conductive materials shall be handled in a manner that prevents accidental contact with energized electrical conductors or parts. Long objects that are difficult to control should be handled by two employees, one at each end.
- Metal "fish lines" or fish lines with a metal "nosing" should not be used for work associated with exposed energized electrical conductor or circuit part. Nonconductive pulling and fishing equipment should be used.
- Employees shall use protective shields, protective barriers, or insulating materials as necessary to avoid inadvertent contact with exposed energized electrical conductor or circuit part in enclosed or confined workspaces. If the space meets the definition of a "confined space", the TWU Confined Space Entry Program applies (live electrical work in a "permit-required" confined space will require both a confined space entry permit and an energized electrical work permit).
- If employees may be exposed to hazards from equipment or systems adjacent to the area where the live work is being conducted, the adjacent equipment or systems may need to be locked out in accordance with the TWU Lockout/Tagout program.

XIV. EMPLOYEE TRAINING

In addition to the requirement for employees to receive sufficient education and training to meet the definition of a Qualified Person above, all employees who will be unescorted within the limited approach boundary shall receive training on the following:

- Skills and techniques necessary to distinguish exposed energized electrical conductors and circuit parts from other parts of electrical equipment.
- Skills and techniques necessary to determine the nominal voltage of exposed energized electrical conductors and circuit parts.
- How to determine limited and restricted approach boundaries and recognize that these boundaries are related to protection from exposure to electrical shock and

electrocution, specified in NFPA 70E Table 130.4(E) (a) and Table 130.4(E) (b) and the corresponding voltages to which the qualified person will be exposed.

- Decision-making process necessary to be able to do the following:
  a. Perform the job safety planning.
  b. Identify electrical hazards.
  c. Assess the associated risk.
  d. Select the appropriate risk control methods from the hierarchy of controls, including personal protective equipment.
- How to select an appropriate test instrument to verify the absence of voltage, including interpreting indications provided by the device. The training shall include information that enables the employee to understand all limitations of each test instrument that might be used.
- Emergency procedures including how to release victims from contact with energized electrical conductors or circuit parts.
- Requirements under this program and TWU's Lockout/Tagout Program.

Training shall be provided through a combination of classroom training developed and provided by EH&S and on-the-job training provided by employee's supervisor. Tasks that are performed less often than once per year shall require retraining before the performance of the work practices involved.

Classroom training and necessary on the job training shall be provided to employees prior to conducting any work on energized conductors or circuit parts. Retraining will be conducted at least every three years and when any of the following occur:

- The supervision or Lockout/Tagout periodic inspections indicate that an employee is not complying with the safety-related work practices.
- New technology, new types of equipment, or changes in procedures necessitate the use of safety-related work practices.
- The employee needs to review tasks that are performed less often than once per year.
- The employee needs to review safety-related work practices that are not normally used by the employee during regular job duties.
- The employee's job duties change.

TWU shall document that each employee exposed to electrical safety risk has received the required training and said documentation will be in accordance with the following:

- Be made when the employee demonstrates proficiency in the work practices involved.
- Be retained for the duration of the employee's employment.
- Contain the content of the training, each employee's name, and dates of training.

XV. CONTRACTORS

This section describes the responsibilities of contractors performing electrical work at TWU facilities, as well as the responsibilities of the TWU employees overseeing those contractors.

The TWU employees responsible for bringing contractors on site must ensure that the contractor is provided with the following:

- Information about known electrical hazards related to the contractor's work, which might not be recognized by the contractor.
- Known hazards about the installed equipment that the contractor needs to perform the risk assessments required by NFPA 70E.
- Reports of observed violations of NFPA 70E by the contractor's employees.

The contactor shall ensure that each of their employees is instructed in the hazards communicated to them by TWU. This will be in addition to the basic training required by NFPA 70E. The contractor is also responsible for ensuring compliance with NFPA 70E and the contractor's electrical safety program.

The contractor shall inform TWU of the following:

- Any unique hazards presented by the contractor's work.
- Hazards identified during the course of work by the contract employer that were not communicated to the contractor by TWU. This information must be communicated via a documented meeting.
- The measures the contractor took to correct any violations reported by TWU and to prevent such violation from recurring in the future.

XVI. ATTACHMENTS

A. Attachment 1 – Energized Electrical Work Permit

TEXAS WOMAN'S UNIVERSITY

ENERGIZED ELECTRICAL WORK PERMIT

*****Return completed and approved form to EH&S for recordkeeping*****

SECTION I

Work Order # _____

Extended Duration: ☐	One time use only: ☐	Date Start:	Expiration Date:
Building:	Room/Area:	Job Supervisor:	
Description of work to be done:			
Description of circuit/equipment to be worked on:			
Justification for why equipment cannot be de-energized:			

SECTION II

Results of Shock Risk Assessment

Shock Hazard Maximum Voltage _____ ***(for ANY exposed conductor/part in the work area)***	Glove Voltage Rating _____ (***Inspect and air test gloves before use and check certification date***)

Shock Hazard Approach Boundaries for Alternating-Current (AC) Systems (See Table 5 in the Electrical Work Safety Program for DC info)

Nominal System Voltage, Phase to Phase*	Limited Approach Boundary		Restricted Approach Boundary; Includes Inadvertent Movement Adder
	Exposed Movable Conductor **	**Fixed Circuit Part**	
Less than 50V	Not specified	Not specified	Not specified
50 to 150V	10 ft. 0 in	3 ft. 6 in	Avoid contact
151 to 750V	10 ft. 0 in	3 ft. 6 in	1 ft. 0 in
751 to 15kV	10 ft. 0 in	5 ft. 0 in	2 ft. 2 in

* For single phase systems above 250V, select the range that is equal to the maximum phase-to-ground voltage multiplied by 1.732.

** Exposed movable conductors describes a condition in which the distance between the conductor and a person is not under the control of the person. The term is normally applied to overhead line conductors supported by poles.

Limited Approach Boundary _____ ft.	**Restricted Approach Boundary** _____ ft.

SECTION III

Required PPE

PPE Category (circle): 1 2 3 4	Flash Protection Boundary _____ ft.

*Check boxes below to confirm the required items have been obtained and will be used during the live electrical work. Non-melting undergarments are always required. PPE listed below assumes that entire body will be within the arc protection boundary. If this is not the case, arc-rated PPE must cover the parts of the body within the arc protection boundary. Safety glasses and hearing protectors are **always** required when conducting live electrical work.*

Required for **PPE Category 1** (minimum arc rating for PPE: 4 cal/cm^2)

☐ Hard hat ☐ Safety glasses ☐ Hearing protection ☐ Heavy-duty leather gloves ☐ Rated footwear

[AND]

☐ Arc-rated shirt (long sleeve) and pants **[OR]** ☐ Arc-rated coverall

[AND]

☐ Arc-rated face shield **[OR]** ☐ Arc flash suit hood

Required for **PPE Category 2** (minimum arc rating for PPE: 8 cal/cm^2)

☐ Hard hat ☐ Safety glasses ☐ Hearing protection ☐ Heavy-duty leather gloves ☐ Rated footwear
[AND]
☐ Arc-rated shirt (long sleeve) and pants **[OR]** ☐ Arc-rated coverall
[AND]
☐ Arc-rated face shield and arc-rated balaclava **[OR]** ☐ Arc-rated flash suit hood

Required for **PPE Category 3** (minimum arc rating for PPE: 25 cal/cm^2)

☐ Hard hat ☐ Safety glasses/goggles ☐ Hearing protection ☐ Arc-rated gloves ☐ Rated footwear
[AND]
☐ Arc-rated shirt (long sleeve) and pants **[OR]** ☐ Arc-rated coverall **[OR]** ☐ Arc-rated flash suit (jacket/pants/hood)

Required for **PPE Category 4** (minimum arc rating for PPE: 40 cal/cm^2)

STOP! THINK! RE-EVALUATE FEASIBILITY OF LOCKOUT.

☐ Hard hat ☐ Safety glasses/goggles ☐ Hearing protection ☐ Arc-rated gloves ☐ Rated footwear
[AND]
☐ Arc-rated shirt (long sleeve) and pants **[OR]** ☐ Arc-rated coverall **[OR]** ☐ Arc-rated flash suit (jacket/pants/hood)

LIVE ELECTRICAL WORK MAY NOT PROCEED IF THE INCIDENT ENERGY IS >40 cal/cm^2 OR PPE CATEGORY IS >4!

SECTION IV

Mandatory Requirements for All Permits (check off when completed)

☐ Necessary insulated/voltage-rated tools, covers, shields, and testing equipment is available.

☐ Attendant worker must be able to cut off all power sources in the event of an emergency and have emergency communication equipment (i.e., radio, cell phone). Attendant worker is not permitted to assist in electrical work.

☐ All workers, including Attendant, must be appropriately trained, qualified, and have full knowledge of equipment.

☐ Set up barriers (caution tape/barricades) at the limited approach or arc flash boundary (whichever is farther out).

☐ Remove all metal apparel that may cross restricted approach boundary or otherwise present an electrical contact hazard (rings, watches, necklaces, metal frame glasses).

☐ Job briefing including discussion of any job specific hazards (describe hazards below):

_____

_____

_____

Additional Safety Requirements (check off when completed, if required for this work task)

☐ Non-conductive head wear (i.e., Class E hard hat), required if there is a potential for head contact at any voltage.

☐ Check here if any additional information is added to this work permit such as special requirements, procedures, or written work plans (examples include lockout procedures for adjacent equipment and confined space entry permits).

SECTION V

Approvals to Perform the Work while Electrically Energized

This permit is not approved unless signed by the employees conducting the work and their supervisor. Signature of workers verifies that they are a properly trained Qualified Person who is informed of all relevant hazards

_____ Supervisor	_____ Attendant
_____ Worker	_____ Worker
_____ Worker	_____ Worker
_____ Worker	_____ Worker