FSGA/HAAF GARRISON
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GARRISON SAFETY SOP – ANNEX V

ELECTRICAL SAFETY

FSGA/HAAF Safety Program SOP
5 November 2024

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1. Purpose:

This Annex to the FSGA/HAAF Garrison Safety and Occupational Health (SOH) SOP provides safety-related work practices that shall be employed to prevent electric shock or other injuries resulting from either direct or indirect electrical contacts when work is performed near or on equipment or circuits which are or may be energized. The specific safety-related work practices shall be consistent with the nature and extent of the associated electrical hazards. Electrical work performed at FSGA/HAAF shall be performed in compliance with OSHA regulations, National Electric Code (NEC), NFPA 70E and other applicable requirements. This chapter is only intended to be a general guide and is not to be used as a substitute for the referenced regulations. The referenced regulations are extensive, and many requirements are not included in this chapter.

2. Scope

This Annex to the Garrison SOH SOP applies to all military and civilian personnel assigned to the FSGA/HAAF Garrison. It is intended to provide additional information so all levels of leadership, SMs, and civilian workforce can properly implement the Garrison SOH Program.

3. References

29 CFR 1910 Subpart S, OSHA Standards for General Industry, Electrical

29 CFR 1926 Subpart K, OSHA Standards for Construction Industry, Electrical

NFPA 70, National Electric Code

NFPA 70E, Standard for Electrical Safety in the Workplace

AR 25-400-2, The Army Records Information Management System (ARIMS)

AR 385-10, The Army Safety Program

DA Pam 25-403 – Guide to Recordkeeping in the Army

DA Pam 385-10, Army Safety Program

4. Records Management:

Records created throughout the processes prescribed by this Annex will be identified, maintained, and disposed of according to AR 25-400-2 (The Army Records Information Management System (ARIMS) and DA Pam 25-403 (Guide to Recordkeeping in the Army). The primary means of recordkeeping for the Garrison Safety Office (GSO) will be the Army Safety Management Information System (ASMIS) located at https://mishap.safety.army.mil . Record titles and descriptions are available on the ARIMS website https://www.arims.army.mil

5. Responsibilities

Directorate of Public Works (DPW):

- Ensure electrical panels, disconnects, and distribution systems are labeled IAW NFPA 70E (latest edition).
- Ensure electrical distribution systems are inspected and maintained in a state of good repair.

- Ensure only authorized employees work on electrical distribution equipment, are properly trained, and ensure they adhere to safety regulations and standards.
- Ensure compliance with safety requirements when working on or near electrical circuits or electrical distribution systems.

6. Policy and Procedures

- **Energized Electrical Work.** Work on energized lines or equipment should only be considered if it has been determined the task is not feasible in a de-energized state or when deenergizing introduces greater hazards. Many installations, renovations, service, maintenance, and testing procedures will require some phase of the process to be performed energized. The decision to work energized should only be made after extensive planning and analysis. Both NFPA 70E and OSHA define when working energized is allowed and set rigid safety limits on voltage exposures, work zone boundary requirements, and personal protective equipment (PPE) that is required.

Working on high voltage energized lines or equipment requires more extensive planning, work practice controls, level of protection, and specialized training.

- **Job Briefings.** Before starting each job, the person in charge shall conduct a job briefing with the employees involved. The briefing shall cover subjects such as hazards associated with the job, procedures involved, special precautions, energy source controls, PPE requirements, and the information on the Job Hazard Analysis (JHA), if required. Additional briefings will be held if changes that might affect the safety of employees occur during the course of the work.
    - Repetitive or Similar Tasks. If the work to be performed during the shift are repetitive and similar, at least one job briefing shall be conducted before the start of the first job of the day or shift.
    - Routine Work. Prior to starting work, a brief discussion will be satisfactory if the work involved is routine and if the employee is qualified for the task. A more extensive discussion shall be conducted if either of the following apply:
        - The work is complicated or particularly hazardous.
        - The employee cannot be expected to recognize and avoid the hazards involved in the job.
- **Electrical Safety Auditing.**
    - Electrical Safety Program. The electrical safety program shall be audited to verify the principles and procedures of the electrical safety program are in compliance with NFPA 70E.
    - The frequency of the audit shall not exceed 3 years.
- **Field Work.** Field work shall be audited to verify the requirements contained in the procedures of the electrical safety program are being followed. When the auditing determines that the principles and procedures of the electrical safety program are not being followed, the appropriate revisions to the training program or revisions to the procedures shall be made.
    - Documentation. The audit shall be documented.

- **Arc Flash Hazard.** Employees performing energized work have the danger of electrical shock resulting from direct contact of energized conductors with parts of their body. Most electrical accidents are not the result of direct electric shocks, but rather from arc flashes. An electric arc or an arcing fault is a flashover of electrical current through air in electrical equipment from one exposed energized conductor to another or to ground. An arc flash can occur when the insulation or air separation between high voltage conductors is compromised. Under these conditions, a plasma arc ("arc flash") may form between the conductors, unleashing a potentially explosive release of thermal energy. Arc flash hazard is the danger of excessive heat exposure and serious burn injury due to arcing faults in electrical power systems. Electric arcs have extremely high temperatures, radiate intense heat, can ignite clothes, and cause severe burns that can be fatal.

  The intense heat from an electrical arc, which has been measured to be as high as 35,000°F, causes the sudden expansion of air which results in a blast with very strong air pressure. The amount of energy released is a function of system voltage, fault current magnitude, and fault duration. An electrical arc can be initiated by:

  - Over-voltages across narrow gaps (air gap between conductors is narrow).
  - Dust or impurities on insulating surfaces which provides a path for current allowing it to flashover and create arc discharge across the surface.
  - Corrosion of electrical equipment provides impurities on the insulating surface which weakens the contact between conductor terminals.
  - Condensation and moisture can cause tracking on the surface of insulating materials creating a flashover to ground.
  - Accidental contact or dropping of tools causing a spark discharge.
  - Failure of insulating materials.
  - Improper equipment design.
  - Improper work procedures.
- **Justification for Energized Electrical Work.** The decision to work on energized equipment should only be made after careful analysis of the determination of what constitutes "infeasibility". NFPA 70E and OSHA require employers to prove that working in a de-energized state creates more or worse hazards or is not practical because of equipment design or operational limitations. Examples include working on life-support systems, emergency alarm systems, ventilation equipment for hazardous locations, or work on circuits that are part of a continuous process that cannot be completely shut down. In addition, some maintenance and testing operations can only be done on energized electric circuits or equipment.

  The decision-making process which leads to energized work should only be made by personnel experienced in safe electrical work practices and must be documented in writing in a Job Hazard Analysis (JHA). ***(See FSGA/HAAF SOH SOP, Annex G, Job Hazard Analysis (JHA)*** The JHA will identify the expected nominal voltage, appropriate approach boundaries to be followed, safe work practices and procedures, as well as the personal protective equipment (PPE) which must be worn. Justification requests include a sign-off provision before any energized work is authorized. The process of de-energizing an electrical circuit

can also result in an arc flash due to equipment failure. Therefore, de-energizing electrical circuits must follow appropriate lockout/tagout procedures.

- **Approach Boundaries.** NFPA 70E defines a series of boundaries when working on energized circuits or equipment. The four approach boundaries, from safe distance leading to the energized circuit, are as follows:

  1. Arc Flash Boundary
  2. Limited Approach Boundary
  3. Restricted Approach Boundary
  4. Prohibited Approach Boundary

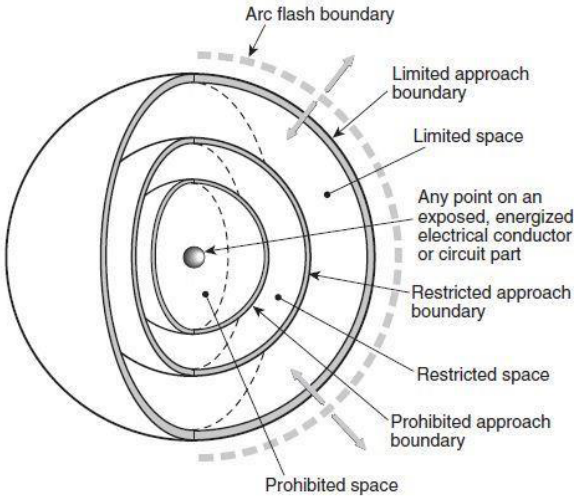

Figure C.1.2.4 Limits of Approach.

The Arc Flash Boundary is designed to protect workers from arc flash and the other three boundaries (Limited Approach Boundary, Restricted Approach Boundary, and Prohibited Approach Boundary) are designed to protect workers from electric shock.

- **Arc Flash Boundary.** The Arc Flash Boundary is the minimum safe distance from energized equipment that has a potential for an arc fault. It is defined as the distance at which the potential incident energy from an arcing fault falling on the surface of the skin is 1.2 calories/cm2 for 0.1 second. With this exposure, a worker may receive a 2nd degree burn to exposed skin. The Arc Flash Boundary is a function of the arc flash incident energy, the higher the arc flash energy, the farther the boundary. Within this boundary workers are required to wear protective clothing in accordance with Table 130.7(C)(16) Protective Clothing and Personal Protective Equipment (PPE).

  The Arc Flash Boundary for an electrical system is determined using the calculating methods contained in NFPA 70E and IEEE Standard 1584. The equations are based on the voltage level, fault level, and the trip time of the protective device. For systems of 600 volts and less, the Arc Flash Boundary is 4 feet, based on an available bolted fault current of 50 kA (kilo amps) and a clearing time of 6 cycles (0.1 seconds) for the circuit breaker to act, or any combination of fault currents and clearing times not exceeding 300 kA cycles. Refer to NFPA 2012 70E Informative Annex D or IEEE 1584 for all other fault currents and clearing times. Determination of the Arc Flash Boundary is an important component of an arc flash hazard analysis. There are software programs available to help determine the Arc Flash Boundary and complete an arc flash hazard assessment.

- **Limited Approach Boundary.** The Limited Approach Boundary is the minimum permitted distance that unqualified and unprotected personnel may approach an energized component. Before crossing the Limited Approach Boundary and entering the limited space, a suitably qualified person must use the appropriate PPE and be trained to perform the required work. Where there is a need for an unqualified person to cross the Limited Approach Boundary, a qualified person shall advise him/her of the possible hazards and continuously escort the unqualified person while inside the Limited Approach Boundary. Under no circumstances shall the escorted unqualified person be permitted to cross the Restricted Approach Boundary. The Limited Approach Boundary is based solely on the nominal voltage and is specified in NFPA 70E 2012 Table 130.4(C)(a) Approach Boundaries to Energized Electrical Conductors or Circuit Parts for Shock Protection for Alternating-Current Systems. Note: For Arc Flash Boundary, see NFPA 70E 2012 130.5(A).
- **Restricted Approach Boundary.** The Restricted Approach Boundary is the closest distance to exposed energized parts a qualified person can approach without proper PPE and tools. Inside this boundary, accidental movement can put a part of the body or conductive tools in contact with energized parts or inside the Prohibited Approach Boundary. To cross the Restricted Approach Boundary, NFPA 70E requires the qualified person to:
    - Have a documented plan that is approved by the supervisor responsible for the safety plan.
    - Use PPE suitable for working near exposed energized parts and rated for the voltage and energy level involved.
    - Be certain that no part of the body enters the prohibited space.
    - Minimize the risk from unintended movement, by keeping as much of the body as possible out of the restricted space; body parts in the restricted space should be protected.

    Similar to the Limited Approach Boundary, the Restricted Approach Boundary is based solely on the nominal voltage and is specified in NFPA 2012 70E Table 130.4(C)(a) Approach Boundaries to Energized Electrical Conductors or Circuit Parts for Shock Protection for Alternating-Current Systems.
- **Prohibited Approach Boundary.** The Prohibited Approach Boundary is the minimum approach distance to exposed energized parts to prevent flashover or arcing. Approaching any closer is comparable to making direct contact with an energized part. To cross the Prohibited Approach Boundary, NFPA 70E requires the qualified person to:
    - Have specified training to work on exposed energized parts.
    - Have a documented plan with proper written work procedures and justifying the need to work that close.
    - Conduct a written risk analysis.
    - Obtain approval by the manager responsible for the safety plan.
    - Use PPE appropriate for working near exposed energized parts and rated for the voltage and energy level involved.

    Similar to the limited approach and restricted approach boundaries, the Prohibited Approach Boundary is based solely on the nominal voltage and is specified in NFPA 70E 2012 Table 130.4(C)(a).

NFPA 70E 2012 Table 130.4(C)(a) Approach Boundaries to Energized Electrical Conductors or Circuit Parts for Shock Protection, Alternating-Current Systems.

Nominal System Voltage Range, Phase to Phase	Limited Approach Boundary		Restricted Approach Boundary; Includes Inadvertent Movement Adder	Prohibited Approach Boundary
	Exposed Movable Conductor	Exposed Fixed Circuit Part		
0 to 50 volts	Not specified	Not specified	Not specified	Not specified
51 to 300 volts	10 ft. 0 in.	3 ft. 6 in.	Avoid contact	Avoid contact
301 to 750 volts	10 ft. 0 in.	3 ft. 6 in.	1 ft. 0 in.	0 ft. 1 in.
751 to 15,000 volts	10 ft. 0 in.	5 ft. 0 in.	2 ft. 2 in.	0 ft. 7 in.

Refer to the NFPA 70E 2012 Standard for Electrical Safety in the Workplace
Note: For Arc Flash Boundary, see 130.5(A).
[a] For single-phase systems, select the range that is equal to the system's maximum phase-to-ground voltage multiplied by 1.732.
[b] See definition in Article 100 and text in 130.4(D)(2) and Annex C for elaboration.
[c] This term 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.

NFPA 70E 2012 Table 130.4(C)(b) Approach Boundaries to Energized Electrical Conductors or Circuit Parts for Shock Protection, Direct-Current Voltage Systems.

Nominal System Voltage Range, Phase to Phase	Limited Approach Boundary		Restricted Approach Boundary; Includes Inadvertent Movement Adder	Prohibited Approach Boundary
	Exposed Movable Conductor	Exposed Fixed Circuit Part		
<100 V	Not specified	Not specified	Not specified	Not specified
100 V – 300 V	10 ft. 0 in.	3 ft. 6 in.	Avoid contact	Avoid contact
301 V to 1 kV	10 ft. 0 in.	3 ft. 6 in.	1 ft. 0 in.	0 ft. 1 in.
1.1 kV – 5 kV	10 ft. 0 in.	5 ft. 0 in.	1 ft. 5 in.	0 ft. 4 in.

[a] All dimensions are distance from exposed energized electrical conductors or circuit parts to worker.
[b] This term 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.
For single-phase systems, select the range that is equal to the system's maximum phase-to-ground voltage multiplied by 1.732.

Determination of the limited approach, restricted approach, and prohibited approach boundaries are components of a shock hazard analysis. The Arc Flash Boundary, and the rules governing access within it, take precedence over the shock hazard boundaries (limited, restricted, and prohibited approach boundaries). For example, if the Arc Flash Boundary is greater than the Limited Approach Boundary, then no unqualified person can be permitted in the limited approach area and even qualified workers must wear the appropriate PPE. All boundary determinations for energized work, for both arc flash hazard analysis and shock hazard analysis, should be included in the Job Hazard Analysis (JHA).

Table 130.7(C)(7)(c) Rubber Insulating Equipment, Maximum Test Intervals

Rubber Insulating Equipment	When to Test	Governing Standard for Test Voltage*
Blankets	Before first issue; every 12 months thereafter	ASTM F 479
Covers	If insulating value is suspect	ASTM F 478
Gloves	Before first issue; every 6 months thereafter	ASTM F 496
Line hose	If insulating value is suspect	ASTM F 478
Sleeves	Before first issue; every 12 months thereafter	ASTM F 496

* ASTM F 478, Standard Specification for In-Service Care of Insulating Line Hose and Covers; ASTM F 479, Standard Specification for In-Service Care of Insulating Blankets; ASTM F 496, Standard Specification for In-Service Care of Insulating Gloves and Sleeves.

[a] If the insulating equipment has been electrically tested but not issued for service, it is not permitted to be placed into service unless it has been electrically tested within the previous 12 months.

- **Preventive Measures.** There are many operational and maintenance practices which will help minimize the potential for arc flash, reduce the incident energy, reduce the arcing time, or remotely place the worker from the energy source. Inspection and maintenance procedures designed to eliminate or prevent dust, impurities, and corrosion at electrical contact surfaces will greatly reduce the risk for arc flash. The following measures should be considered for new and existing electrical systems:
  - Use corrosion resistant terminals.
  - Insulate exposed metal parts such as spanners and bus bars.
  - Inspect contacts on a regular basis and replace contacts of the fuse holder or the fuse holder itself when excessive pitting is found.
  - Inspect for excessive moisture, water, or ice on insulating surfaces of high voltage equipment.
  - Close off all open areas of panels and switchgear to prevent rodents and birds from entering.
  - Use infrared thermography to inspect for poor electrical connections and overheated conductors.
  - Retrofit panel covers with access points for infrared thermography testing, such as IR ports, IR panes, or IR windows, to avoid taking measurements with the cover removed.
  - Use insulated tools whenever working on electrical equipment.
  - Use spanners, wrenches, and screwdrivers with torque control to prevent the use of excessive force which may lead to slippage of the tool.
  - When replacing relays or breakers, use solid state trip devices.
  - Replace time-delay relays with instantaneous relays for high voltage systems.
  - Review fuse sizes to determine if smaller fuses could be used. A smaller fuse would operate quicker and reduce the arc energy exposure if the main breaker fails or should a fault occur between the transformer and the main breaker.

- Retrofit older switchgears with remote control switches which have the breaker switches remote from the breaker unit, such as on a non-breaker unit, in a separate control panel, or in a remote room. These remote-control switches place distance between the electrical conductors and the worker.
- The use of microprocessor relays can be programmed to manually close breakers 3 to 10 seconds after initiating a “close” cycle, which allows workers to evacuate the immediate vicinity before the breaker is actually closed.
- Placing a barrier or portable shield between the electrical equipment and the operator limits the arc flash exposure.

All preventive measures for electrical systems should be documented in writing, such as in JHAs, SOPs or Desk Guides. Electrical equipment inspection scheduling should also be documented in writing. The purpose of a sound preventive maintenance program for electrical equipment is to identify a problem, and make the necessary repair or replacement, to reduce the potential for arc flash.

- **Equipment Labeling.** Electrical equipment such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are in other than dwelling units, and are likely to require examination, adjustment, servicing, or maintenance while energized, shall be field marked with a label containing all the following information:
  - At least one of the following:
    - Available incident energy and the corresponding working distance
    - Minimum arc rating of clothing
    - Required level of PPE
    - Highest Hazard/Risk Category (HRC) for the equipment
  - Nominal system voltage
  - Arc flash boundary.

  Exception: Labels applied prior to September 30, 2011, are acceptable if they contain the available incident energy or required level of PPE.

  The method of calculating and data to support the information for the label shall be documented.

- **Hazard Risk Categories and PPE.** NFPA 70E 2012 Table 130.7(C)(16) Protective Clothing and Personal Protective Equipment (PPE) defines five hazard risk categories for electrical exposures, from 0 to 4 in increasing severity, to determine the level of arc flash protection clothing that is needed. The appropriate hazard risk category (HRC), and type of PPE which will be needed, are determined in the arc flash hazard analysis calculations. In addition, NFPA 70E contains a guide which provides general guidance on HRC and suggests PPE for various electrical tasks being performed within the Arc Flash Boundary. Reference NFPA 70E 2012 Table 130.7(C)(15)(a) Hazard/Risk Category Classifications and Use of Rubber Insulating Gloves and Insulated/Insulating Hand Tools – Alternating Current Equipment (formerly Table 130.7(C)(9). NFPA 70E reminds users that this guide should be used in conjunction with an arc flash hazard analysis and that analysis takes precedence over the compliance guide if there is a dispute.

- Identify hazard/risk category from Table 130.7(C)(15)(a) and (b)
- Review requirements of 130.7(C)(15) Selection of PPE When Required for Various Tasks
- Table 130.7(C)(16) shall be used to determine the required PPE for the task. Table 130.7(C)(16) lists the requirements for protective clothing and other protective equipment based on Hazard/Risk Categories 0 through 4. This clothing and equipment shall be used when working within the Arc Flash Boundary.

Informational Note No. 1: *See Annex H for a suggested simplified approach to ensure adequate PPE for electrical workers within facilities with large and diverse electrical systems.*

Informational Note No. 2: *The PPE requirements of this section are intended to protect a person from arc flash and shock hazards. While some situations could result in burns to the skin, even with the protection described in Table 130.7(C)(16), burn injury should be reduced and survivable. Due to the explosive effect of some arc events, physical trauma injuries could occur. The PPE requirements of this section do not address protection against physical trauma other than exposure to the thermal effects of an arc flash.*

Informational Note No. 3: *The arc rating for a particular clothing system can be obtained from the arc-rated clothing manufacturer.*

NFPA 70E 2012 Table 130.7(C)(16) Protective Clothing and Personal Protective Equipment (PPE)

Hazard/ Risk Category	Protective Clothing and PPE
0	**Protective Clothing, Non-melting or Untreated Natural Fiber (i.e., untreated cotton, wool, rayon, or silk, or blends of these materials) with a fabric weight at least 4.5 oz/yd²** Shirt (long sleeve) Pants (long) **Protective Equipment** Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Heavy duty leather gloves (AN) *(see Note 1)*
1	**Arc-Rated Clothing, Minimum Arc Rating of 4 ca./cm²** *(see Note 3)* Arc-rated long-sleeve shirt and pants or arc-rated coverall Arc-rated face shield *(see Note 2)* or arc flash suit hood Arc-rated jacket, parka, rainwear, or hard hat liner (AN) **Protective Equipment** Hard hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Heavy duty leather gloves *(see Note 1)* Leather work shoes (AN)
2	**Arc-Rated Clothing, Minimum Arc Rating of 8 cal/cm²** *(see Note 3)* Arc-rated long-sleeve shirt and pants or arc-rated coverall Arc-rated flash hood or arc-rated face shield *(see Note 2)* and arc-rated balaclava Arc-rated jacket, parka, rainwear, or hard hat liner (AN) **Protective Equipment** Hard hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Heavy duty leather gloves *(see Note 1)* Leather work shoes

3	**Arc-Rated Clothing Selected so that the System Arc Rating Meets the Required Minimum Arc Rating of 25 cal/cm²** *(see Note 3)* Arc-rated long-sleeve shirt (AR) Arc-rated pants (AR) Arc-rated coverall (AR) Arc-rated arc flash suit jacket (AR) Arc-rated arc flash suit pants (AR) Arc-rated arc flash suit hood Arc-rated gloves *(see Note 1)* Arc-rated jacket, parka, rainwear, or hard hat liner (AN) **Protective Equipment** Hard hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Leather work shoes
4	**Arc-Rated Clothing Selected so that the System Arc Rating Meets the Required Minimum Arc Rating of 40 cal/cm²** *(see Note 3)* Arc-rated long-sleeve shirt (AR) Arc-rated pants (AR) Arc-rated coverall (AR) Arc-rated arc flash suit jacket (AR) Arc-rated arc flash suit pants (AR) Arc-rated arc flash suit hood Arc-rated gloves *(see Note 1)* Arc-rated jacket, parka, rainwear, or hard hat liner (AN) **Protective Equipment** Hard hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Leather work shoes

AN: as needed (optional). AR: as required. SR: selection required.
Notes:
(1) If rubber insulating gloves with leather protectors are required by Table 130.7(C)(9), additional leather or arc-rated gloves are not required. The combination of rubber insulating gloves with leather protectors satisfies the arc flash protection requirement.
(2) Face shields are to have wrap-around guarding to protect not only the face but also the forehead, ears, and neck, or, alternatively, an arc-rated arc flash suit hood is required to be worn.
(3) *Arc rating* is defined in Article 100 and can be either the arc thermal performance value (ATPV) or energy of break open threshold (EBT). ATPV is defined in ASTM F 1959, *Standard Test Method for Determining the Arc Thermal Performance Value of Materials for Clothing*, as the incident energy on a material, or a multilayer system of materials, that results in a 50 percent probability that sufficient heat transfer through the tested specimen is predicted to cause the onset of a second-degree skin burn injury based on the Stoll curve, in cal/cm2. EBT is defined in ASTM F 1959 as the incident energy on a material or material system that results in a 50 percent probability of break open. Arc rating is reported as either ATPV or EBT, whichever is the lower value.

Most people working with electricity only require clothing that meets Category 1 or 2 protection characteristics. NFPA 70E standards are aimed more towards those workers who work in Category 3 or 4 hazard operations. Their clothing must meet APTV rating minimums throughout the life of the garment, thus each piece of clothing must also be designed to withstand a cleaning process to remove soils and then be returned to service without damage to the fabric. The hazard risk category for a particular electrical task should be included in the Job Hazard Analysis (JHA).

- Personal Protective Equipment. NFPA 70E and OSHA Standards include provisions for the selection, use, storage, and replacement of PPE whenever employees are assigned to work on energized electrical circuits or equipment. The intent of these standards is to protect employees from both arc flash and shock hazards. Employees shall receive training to ensure they fully understand the use of PPE during energized work is never a substitute for safe electrical work practices. Even if the appropriate PPE is selected and worn during energized work, there is no guarantee that an injury will be prevented. PPE ensures the degree of burn will be reduced during an arc flash or electric shock, not eliminated.

As required by NFPA 70E, supervisors shall ensure an arc flash hazard analysis is conducted to determine the Arc Flash Boundary, the incident energy at the working distance, and the PPE that people within the Arc Flash Boundary shall use.

Exception: *The requirements of 130.7(C)(15) and 130.7(C)(16) shall be permitted to be used in lieu of determining the incident energy at the working distance.*

The arc flash hazard analysis will be included or attached as part of the Job Hazard Analysis (JHA). The employer will assign, and the worker is required to wear, the PPE adequate to protect the body from the calculated exposure. PPE requirements determined in the arc flash hazard analysis are designed to protect against electric shock and arc flash burns, however PPE does not protect against physical injuries from arc blasts. Therefore, a PPE hazard assessment is also needed, along with the arc flash hazard analysis, to determine if head impact protection and reinforced footwear will be needed.

The minimum PPE required for energized electrical work is an untreated natural fiber long sleeve shirt, long pants, safety glasses with side shields (for HRC category 0 work), hearing protection (ear canal inserts) and heavy-duty leather gloves. Employees performing energized work are not allowed to wear clothing made from untreated synthetic materials, such as acetate, nylon, or polyester.

It is important to select the appropriate PPE for the electrical task following careful analysis. Multi-layer arc-rated clothing is generally more comfortable than a single layer of thick, heavy clothing. In addition, multiple layers of clothing retain air spaces between the layers which provide greater thermal insulation than a single layer. Although it would be easier to insist on category 4 PPE for all energized work, in order to avoid completing a time-consuming arc flash hazard analysis, this approach should not be considered. The use of restrictive or excessive PPE can cause overheating of the worker, poor visibility, and restricted movement. If category 4 PPE is needed for the task, allow the worker to practice wearing the clothing prior to working on energized circuits.

NFPA 70E requires the storage and protection of PPE in a manner which prevents damage from moisture, dust, and other deteriorating agents and conditions. Always follow the care and laundering instructions from the protective clothing manufacturer to ensure longevity of the garment. Protective clothing contaminated with grease, oil, or other flammable materials should be removed from service. The expected useful life of PPE can be obtained from the manufacturer. However, the useful life suggested by a manufacturer is usually applicable for normal wear and tear. OSHA requires visual inspection of PPE prior to use and replacement of any item that appears to have deteriorated, even if the PPE has not yet reached its expected useful life.

- **Insulated Tools and Equipment.** Employees shall use insulated tools or handling equipment, or both, when working inside the Limited Approach Boundary of exposed energized electrical conductors or circuit parts where tools or handling equipment might make accidental contact. NFPA 2012 Table 130.7(C)(15)(a) and Table 130.7(C)(15)(b) provide further information for tasks that require insulated and insulating hand tools. Insulated tools shall be protected from damage to the insulating material. For more on insulating and equipment requirements, refer to NFPA 2012 130.7(D)(1).

7. Training Requirements

- **Qualified Persons.** Employees who work on energized circuits and equipment and who face a risk of electrical hazard that is not reduced to a safe level will receive the level of training necessary to gain knowledge and understanding of the existence, nature, causes and methods to prevent electrical hazards. NFPA 70E has specific training requirements for "Qualified Persons" and "Unqualified Persons". Initial training for energized work should include:
    - Conditions and operations having the potential for arc flash
    - Nature and causes of arc flash
    - Arc Flash Boundary
    - Approach boundaries (LAB, RAB, and PAB)
    - Hazard risk categories
    - Incident energy levels
    - ATPV of PPE
    - Selection, use, and limitations of PPE
    - Inspection, care, maintenance, and storage of PPE
    - Useful life and replacement of PPE
    - Review of standards and codes (including OSHA and NFPA 70E)
    - Safe electrical work practices (refer to OSHA Standards 1910.332 to 335, and 1926.416)
    - Safety – related maintenance procedures
    - Safety requirements for special equipment
    - First aid and CPR procedures
    - Warning signs and labels
    - Requirements for qualified personnel
    - Testing and troubleshooting
    - Voltage detection equipment use, settings and understanding of readings
    - Temporary grounds
    - Protective barriers
    - Infrared thermography
    - Review of the Job Hazard Analysis (JHA)
    - Specific training on electrical hazards and controls in the workplace
- **Type of Training.** Training required shall be classroom or on-the-job type, or a combination of the two. The degree of training provided shall be determined by the risk to the employee.
- **Emergency Procedures.** Employees exposed to shock hazards and those employees responsible for taking action in case of emergency shall be trained in methods of release of

victims from contact with exposed energized electrical conductors or circuit parts. Employees shall be regularly instructed in methods of first aid and emergency procedures, such as approved methods of resuscitation, if their duties warrant such training. Training of employees in approved methods of resuscitation, including cardiopulmonary resuscitation and automatic external defibrillator (AED) use if available, shall be certified by the employer annually.

  - Any work requiring an JHA will have a standby person present in the event of an electrical incident.
  - Standby personnel shall receive training in accordance with the Emergency Procedures above.

- **Unqualified Persons.** Unqualified persons shall be trained in, and be familiar with, any electrical safety related practices necessary for their safety.
- **Retraining.** An employee shall receive additional training (or retraining) under the following conditions:
  - At intervals not to exceed three years
  - Whenever an employee doesn't understand the training, hazards in their work area, or corrective measures available
  - Changes in the workplace render previous training obsolete or inadequate
  - Changes in the types of electrical systems or equipment used
  - Inadequacies in an employee's knowledge of safe energized electrical work.
- **Training Documentation.** Training shall be documented by means of a written certification record. The certification record should contain:
  - Name of the employee trained
  - Date(s) of the training
  - Signature of the person conducting the training or signature of the employer

8. Job Hazard Analysis (JHA)

- **When Required.** When working within the Limited Approach Boundary or the Arc Flash Boundary of exposed energized electrical conductors or circuit parts that are not placed in an electrically safe work condition (for the reasons of increased or additional hazards or infeasibility per 130.2(A)), work to be performed shall be considered energized electrical work and shall be performed by written permit only. The JHA shall include the following provisions:
  - A description of the circuit and equipment to be worked on and their location.
  - Justification for why the work must be performed in an energized condition (NFPA 2012 130.2(A)).
  - A description of the safe work practices to be employed (NFPA 2012 130.3(B)).
  - Results of the shock hazard analysis including expected voltage exposures (NFPA 2012 130.4(A)).

        - Limited Approach Boundary.
        - Restricted Approach Boundary.
        - Prohibited Approach Boundary.
        - The necessary shock and other PPE to safely perform the assigned task.
    - Results of the arc flash hazard analysis.
    - Means employed to restrict the access of unqualified persons from the work area (NFPA 2012 130.3(A)).
    - Evidence of completion of a job briefing, including a discussion of any jobspecific
    - hazards.
    - Energized work approval (authorizing or responsible management) signatures(s).
- **Exemptions to JHA.** An exemption to the Job Hazard Analysis (JHA) is allowed when work performed within the Limited Approach Boundary by qualified persons relates to tasks such as testing, troubleshooting, or voltage measuring if appropriate safe work practices are followed and the appropriate PPE in accordance with NFPA chapter 1 is provided and used. However, at a minimum a JHA must be completed to include arc flash hazard analysis and PPE hazard assessment, and the energized work must be discussed with the worker's supervisor or alternate prior to beginning work (see Job Briefings, 31-5. Paragraph "b.").
- A copy of applicable regulations NFPA 70, 70E, NEC, and 29 CFR should be available for any employee working with equipment that is covered in these regulations.

Appendix A – Abbreviations

AR	Army Regulation
ARIMS	Army Records Information Management System
ASMIS	Army Safety Management Information System
CFR	Code of Federal Regulations
CO	Carbon Monoxide
COR	Contract Office Representative
DA Pam	Department of the Army Pamphlet
DPW	Directorate of Public Works
DoDI	Department of Defense Instruction
FSGA	Fort Stewart Garrison
GC	Garrison Commander
GSO	Garrison Safety Office

HAAF	Hunter Army Airfield
OSHA	Occupational Safety and Health Administration
POC	Point of Contact
PPE	Personal Protective Equipment
RM	Risk Management
SM	Service Member
SOH	Safety and Occupational Health
SOHMS	Safety and Occupational Health Management Systems
SOP	Standard Operating Procedure
USO	Unit Safety Officer

APPENDIX B – ANNUAL GSO REVIEWS

DATE	REVIEWED BY	CHANGES Y/N	SUMMARY OF CHANGES
	MASNICK.GREGORY.SEAN.1058383160 Digitally signed by MASNICK.GREGORY.SEAN.1058383160 Date: 2024.11.06 09:53:47 -05'00'		