U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

Air Traffic Organization Policy

ORDER
JO 3900.64

Effective Date:
5/21/2013

SUBJ: Air Traffic Organization Electrical Safety Program

1. This Order establishes the policy, procedures, and guidance for the Federal Aviation Administration (FAA) Air Traffic Organization (ATO) to provide practical safe working areas for employees related to the hazards arising from the exposure to electricity. Compliance with this Order will also assist in the prevention of electrical exposures in the workplace by providing guidelines and direction on implementation, employee training, design, and construction.

2. This Order is intended to meet the regulations established by the Occupational Safety and Health Administration (OSHA) and the consensus standards established by the National Fire Protection Association (NFPA), including the 2011 National Electrical Code (NFPA 70), the 2012 Standard for Electrical Safety in the Workplace (NFPA 70E), and the 2010 Recommended Practice for Electrical Equipment Maintenance (NFPA 70B).

3. This Order describes hazards associated with work on electrical and electrical power distribution systems as applied to the FAA work environment. Injuries associated with exposure to electrical energy can be detrimental to employee safety and health, the operation of the National Airspace System, and may result in significant Office of Workers' Compensation Programs costs to the Agency. Therefore, when electrical hazards cannot be eliminated, employees must be protected from these hazards utilizing electrical safety principles, the Energized Electrical Work Permit (EEWP), Personal Protective Equipment (PPE), insulated and insulating tools, and applicable training.

4. Consult an ATO Occupational Safety and Health (OSH) Professional to address electrical safety situations not addressed in this Order.

J. David Grizzle
Chief Operating Officer
Air Traffic Organization

Distribution: A-FAF/FAT-0 (STD)

Initiated By: AJW-23

Table of Contents

Paragraph *Page*

List of Tables

List of Figures

Chapter 1. General Requirements

1. Purpose of This Order. The FAA ATO seeks to provide a safe workplace for all employees by providing work procedures, guidance, and training related to workplace electrical hazards. The Electrical Safety Program (ESP) Order provides guidance to all FAA ATO employees, including managers and supervisors, who directly, and/or indirectly, work in or around areas with exposure to electrical hazards.

2. Audience. This Order affects all FAA ATO personnel managing and/or working on electrical equipment.

3. Where Can I Find This Order? You can find an electronic copy of this order on the Directives Management System (DMS) website: https://employees.faa.gov/tools_resources/orders_notices/. Or go to the MyFAA Employee website, select 'Tools and Resources', then select 'Orders and Notices'.

4. Policy. It is the ATO policy that employees comply with the ATO ESP as part of an incident prevention program. This guidance represents the minimum requirements for the ESP. Site-specific requirements may be more stringent based upon local risk assessments.

5. Responsibilities.

a. Vice Presidents within the ATO will ensure the overall implementation of this Order for the respective Service Units.

b. Director, Air Traffic Control Facilities will ensure the overall implementation of this Order for each Service Area (SA) within the ATO.

c. Manager, Electrical Safety Program (Environmental Occupational Safety and Health (EOSH) Services, AJW-23) will:

(1) Provide technical requirements and resources to ensure the overall implementation of this Order for the ATO.

(2) Provide technical assistance to the SAs/Service Centers (SCs)/Engineering Services (ES) Electrical Safety Team to assist in the implementation of this Order.

(3) Provide technical assistance to ES and acquisition teams to ensure new and legacy FAA facilities, systems, and equipment incorporate electrical safety requirements in design, construction, renovation, and implementation projects.

(4) Perform program audits for the national ESP. The frequency of the audit must not exceed 3 years.

(5) Provide national program oversight for the ESP.

(6) Ensure warning labels are created and installed for arc flash hazard assessments (AFHA) and analyses completed by EOSH Services.

d. SA Director of Operations will ensure the overall implementation of this Order for the SA within Technical Operations.

e. SC Planning and Requirements (P&R) Group Manager will provide oversight of the P&R teams to ensure support to the SA Directors concerning this Order.

f. SC Program Implementation Manager for Occupational Safety and Health Safety will:

(1) Ensure sufficient resources are requested and made available to the SA to support the effectiveness of this Order.

(2) Provide advice to management on issues or concerns related to the implementation of the Order.

(3) Ensure the implementation of training programs in accordance with (IAW) this Order.

g. SC Planning and Requirements OSH Specialists will:

(1) Oversee the technical requirements of this Order to ensure compliance with current FAA requirements, OSHA and applicable consensus standards.

(2) Serve as the subject matter expert to SA Directors regarding technical requirements of the ESP.

(3) Assist the ES EOSH Coordinator with review of engineering packages to ensure that proper electrical safety requirements are included.

(4) Maintain current knowledge on available electrical safety equipment to facilitate evaluations, recommendations, and the purchasing of appropriate equipment.

(5) Evaluate appropriate training materials and courses for the SA.

h. ES Managers will:

(1) Ensure new installations and upgrades, etc., performed at all facilities are coordinated through the Technical Support Center (TSC) and System Support Center (SSC) Manager.

(2) Ensure that all engineering packages meet or exceed the requirements contained in this Order, and assist the Contracting Officer's Technical Representative (COTR) with related contract requirements as needed.

(3) Submit engineering package for installations that will affect electrical systems to the TSC Manager, SSC Manager, and Safety and Environmental Compliance (SECM) for review.

(4) Ensure that facility single line diagrams are updated during construction, installation, modification, and renovation projects.

(5) Resolve non-compliant electrical safety issues associated with ES projects.

(6) Report any electrical incidents or accidents, or near-misses in accordance with accident reporting requirements in FAA Order 3900.19, Occupational Safety and Health Program, and report via FAA Form 3900-6, Safety Management Information System (SMIS).

(7) Ensure AFHA is performed on projects involving installation of new facilities or equipment where required.

(8) Ensure AFHA is performed during new equipment installations, modifications or renovations at operational facilities, where required.

(9) Successfully complete the Electrical Safety Qualified Person (ESQP) training course.

(10) Ensure affected employees have received electrical safety training and that all training is recorded in the appropriate system of record.

(11) Manage the electrical PPE testing/exchange program for all equipment that requires periodic testing for their employees.

(12) Provide appropriate PPE, including insulating gloves and tools, arc–rated PPE, and other equipment to all affected ES employees.

(13) Discuss safe working practices with employees during their mid-term and annual performance reviews and periodically observe employees performing work safely in daily activities.

(14) Ensure the integration of electrical safety requirements in all planning, design, construction, installation, commissioning, modification, and maintenance activities.

(15) Ensure the appropriate implementation of the EEWP.

(16) Ensure affected ES engineers and/or installers have received appropriate electrical systems technical training and electrical safety training on electrical systems they are designing, installing or modifying.

(17) Ensure warning labels are created and installed for arc flash hazard assessments and analyses completed by ES.

i. District Office Managers will:

(1) Ensure implementation and maintain compliance of the ESP throughout the District.

(2) Ensure the appropriate resources are available to support the ESP.

(3) Ensure Technical Services Operations Group (TSOG) reviews all project design and/or renovation documents for electrical safety issues.

(4) Ensure that all District Office personnel are trained to the appropriate level for assigned tasking, and that all training is recorded in the appropriate system of record.

(5) Ensure that appropriate PPE, including insulating gloves and tools, arc-rated PPE, and other equipment is available at all District and/or SSC work locations.

(6) Report any electrical incidents or accidents, or near-misses in accordance with accident reporting requirements in FAA Order 3900.19, and report via FAA Form 3900-6 SMIS.

(7) Ensure qualified personnel conduct accident investigations in accordance with FAA Order 3900.19, Chapter 7, Mishap Reporting and Investigation.

j. TSOG/TSC Manager will:

(1) Coordinate review of project documentation with the SECM and SSC Manager (e.g., engineering package specifications, scopes of work, transmittals, and drawings) as needed, to facilitate compliance with the ESP.

(2) Ensure the integration of electrical safety requirements in all construction, installation, commissioning, modification, maintenance, and other projects.

(3) Ensure that facility single line diagrams are kept current and/or updated during construction, installation, modification, and renovation projects.

(4) Provide assistance as required during installation, construction, renovation or maintenance activities at all facilities to ensure compliance with the ESP.

(5) Assist the District with the Joint Acceptance Inspection process to ensure compliance with the ESP program as required.

(6) Ensure the implementation of the ESP throughout the TSOG.

(7) Report any electrical incidents or accidents, or near-misses in accordance with accident reporting requirements in FAA Order 3900.19, and report via FAA Form 3900-6, SMIS.

(8) Ensure TSOG personnel are appropriately trained for the assigned tasking, and that all training is recorded in the appropriate system of record.

(9) Provide the appropriate PPE, including insulating gloves and tools, arc flash related PPE, and other equipment to all affected TSOG employees.

(10) Successfully complete the ESQP training course.

(11) Manage the electrical PPE testing/exchange program for all equipment that requires periodic testing for all TSOG employees.

(12) Discuss safe working practices with employees during their mid-term and annual performance reviews and periodically observe employees performing work safely in daily activities.

k. SECM/Environmental Protection Specialist, and ES EOSH Coordinator, and William J. Hughes Technical Center Safety Managers, will:

(1) Serve as the designated technical point of contact and provide oversight for the ESP.

(2) Assist respective training specialists in coordinating appropriate electrical safety training.

(3) Provide consultation for the completion and evaluation of the EEWP.

(4) Assist with the review of engineering package (e.g., specifications, scopes of work, transmittals, and drawings) for compliance with electrical safety requirements, and assist the COTR with related requirements, as needed.

(5) Successfully complete the ESQP training course.

l. SSC/Front Line Managers will:

(1) Implement the ESP at all facilities occupied and/or maintained by Technical Operations employees.

(2) Successfully complete the ESQP training course.

(3) Ensure affected employees have received the appropriate level of electrical safety and technical training including refresher training and the prerequisite first-aid and cardiopulmonary resuscitation (CPR) training (current certifications).

(4) Provide the appropriate PPE including insulating gloves and tools, arc-rated PPE, and other equipment to all affected SSC employees.

(5) Manage the electrical PPE testing/exchange program for all equipment that requires periodic testing.

(6) Discuss safe working practices with employees during their mid-term and annual performance reviews and periodically observe employees performing work safely in daily activities.

(7) Ensure new installation, construction, or renovation activities are coordinated through the local TSC Manager.

(8) Ensure the integration of electrical safety requirements in all construction, installation, commissioning, modification, maintenance, and other projects.

(9) Ensure that facility single line diagrams are maintained in a legible condition, kept current, and/or updated during construction, installation, modification, and renovation projects.

(10) Report any electrical incidents or accidents, or near-misses in accordance with accident reporting requirements in FAA Order 3900.19, and report via FAA Form 3900-6, SMIS.

(11) Ensure that the EEWP (see Appendix E) is appropriately completed and implemented prior to commencement of energized electrical work.

(12) Plan and/or modify employees' work schedules and tasks to minimize exposure to electrical hazards. Employees must not be permitted within the Limited Approach Boundary (LAB) while recognizably impaired due to illness, fatigue, or other reasons.

m. Second Level Engineering: Power Services Group (PSG)/Safety and Operations Support will:

(1) Ensure new installations and upgrades performed at all facilities are coordinated through ES as well as the TSC and SSC Manager.

(2) Successfully complete the ESQP training course.

(3) Submit engineering packages for installations that will affect existing electrical systems to ES, TSC Manager, SSC Manager, and SECM for review.

(4) Resolve non-compliant electrical safety issues associated with ES projects.

(5) Report all electrical incidents/accidents or near-misses in accordance with FAA Order 3900.19 accident reporting requirements and report via FAA Form 3900-6, SMIS.

(6) Ensure AFHA is performed on projects involving installation of new equipment or facilities, where required.

(7) Ensure AFHA is performed during modifications or renovations at operational facilities where required.

(8) Ensure the integration of electrical safety requirements in all planning, design, construction, installation, commissioning, and modification activities.

(9) Ensure the integration of electrical safety requirements in all maintenance activities and documents.

(10) Ensure that the EEWP (see Appendix E) is completed and implemented prior to commencement of work as appropriate.

(11) Ensure affected engineers/installers have received appropriate electrical systems technical training and electrical safety training on electrical systems they are designing, installing or modifying.

(12) Ensure warning labels are created for arc flash assessments and analyses completed by Second Level Engineering.

n. Employees at the FAA generally fall into the following categories, with the corresponding roles and responsibilities:

(1) Qualified Persons will:

(a) Successfully complete ESQP training and the specific technical training related to the construction and operation of the equipment and/or installations on which he/she will be working.

(b) Successfully complete training in First Aid and approved methods of resuscitation, including CPR and automatic external defibrillator (AED) use.

(c) Conduct a shock hazard analysis to determine the Limited, Restricted, and Prohibited approach boundaries on equipment not appropriately labeled prior to performing electrical work on exposed energized conductors or circuit parts.

(d) Don the appropriate PPE as listed on the warning label. In absence of a label, use NFPA 70E Table 130.7(C)(15)(a) located in Appendix A to determine the appropriate PPE and arc flash boundary.

(e) Develop, or assist in the development and review of, Lockout/Tagout (LOTO) procedures and hazard /risk evaluations.

(f) Assist in development of electrical safety and arc flash hazard surveys/evaluations (such as data collection).

(g) Complete the EEWP in accordance with this Order. (See Appendix D).

(h) Conduct a Job Briefing with all affected employees associated with the task prior to performing any electrical work. (See NFPA 70E 110.3(G)).

(i) Notify their manager whenever electrical safety equipment becomes defective and must be repaired or replaced.

(j) Properly use, maintain and inspect assigned PPE in accordance with this ESP.

(k) Communicate electrical safety concerns in their respective work area(s) to their manager.

(2) Unqualified Persons will:

(a) Not be within the LAB of exposed energized conductors or circuit parts unless escorted by a Qualified Person.

(b) Communicate electrical safety concerns in their respective work area(s) to their manager.

(c) Follow all caution and safety signs and notifications in their respective work areas.

(3) COTR/Contracting Officer will:

(a) Ensure that the contract explicitly requires contract personnel to comply with applicable requirements of this Order.

(b) Provide technical direction to the contractor, as needed.

(4) Contract Personnel will:

(a) Comply with applicable requirements of this Order.

(b) Provide the required training and PPE to their (contract) employees working in FAA work areas.

Chapter 2. Electrical Safety Program Requirements

1. Overview. The most effective way to prevent an electrical injury is to establish an electrically safe work condition. This ESP addresses electrical safety requirements for FAA workplaces that are necessary for the practical safeguarding of employees during activities such as, but not limited to, the installation, operation, maintenance, and demolition of electric conductors, electric equipment, signaling and communications conductors and equipment, and raceways. All contract personnel working in FAA work areas must comply with the applicable requirements of this Order. This ESP addresses LOTO concerning establishing an electrically safe work condition. Detailed LOTO requirements are located in FAA Order 3900.19, related Notices, and the Hazardous Energy Control Program.

2. Safe Work Practices.

a. Equipment must be placed in an electrically safe work condition before performing work within the LAB except in the following situations:

(1) Where deenergizing equipment introduces additional hazards or increased risk.

(2) Where performing the work in a deenergized state is infeasible due to equipment design or operational limitations.

(3) Where energized conductors and circuit parts operate at less than 50V.

(4) During testing and/or troubleshooting that requires the equipment to remain energized.

b. Consider all equipment energized until verified to be deenergized and placed in an electrically safe work condition.

c. The qualified person must perform a hazard identification and risk assessment before working on energized equipment. This includes the following:

(1) Determine if work will require contact with energized electrical conductors or circuit parts.

(2) Determine if an EEWP is required. Refer to Chapter 2, Paragraph 3.

(3) Determine if a second person is required. Refer to Appendix H for the Two-Person Rule Decision Tree.

(4) Confirm that PPE is appropriate for the assigned task.

d. Two-Person Requirements. (Refer to Appendix H for the Two-Person Rule Decision Tree).

(1) Two persons are required in the following situations:

(a) All work requiring an EEWP, including, but not limited to, physical alteration or repair of energized conductors or circuit parts, making or tightening connections, and removing or replacing components.

(b) Testing, troubleshooting, verifying equipment is in an electrically safe work condition, and voltage measurements conducted on exposed energized conductors or circuit parts:

(i) On three phase power distribution equipment.

(ii) Within the Restricted Approach Boundary (RAB) for other systems. Refer to NFPA 70E Tables 130.4(C)(a) and 130.4(C)(b).

(iii) When working space and clearances do not meet requirements referenced in Chapter 2, Paragraph 8 b. (2).

(iv) At the discretion of the Qualified Person and his or her manager, where additional hazards not covered within sections (A) or (B) are present.

(2) The second person must have the following qualifications:

(a) Certified in First Aid and approved methods of resuscitation, including CPR and AED use.

(b) Completed ESQP training.

(3) The second person is not required to have skills and knowledge on any specific equipment.

(4) The second person must remain attentive to the work being performed and is prohibited from work duties that would restrict his/her ability to sound an alarm and/or render aid.

(5) If the second person is within the LAB, the Qualified Person informs the second person of the possible hazards specific to that equipment.

e. Hierarchy of Controls. The hierarchy of controls illustrates the priority for addressing electrical hazards.

(1) Engineering Controls. Accomplished by reducing exposure to the hazard by using remote test points, bypass switches, or other means.

(2) Isolate the Hazard. If the exposure to the hazard cannot be reduced through design or engineering controls, establish an electrically safe work condition prior to performing work activities.

(3) Administrative Controls. Modify workers' work schedules and tasks in ways that minimize their exposure to electrical hazards.

f. Protective Measures for Existing Non-Compliant Clearance Issues. When there is insufficient work space around energized electrical equipment IAW OSHA 1910 Subpart S, and it is not feasible to place the equipment in an electrically safe work condition, the following protective measures must be implemented as applicable:

(1) Complete an EEWP if required.

(2) Place signs and barricades around the work area. Refer to Chapter 2, Paragraph 2. k. for additional information on signs and barricades.

(3) Restrict employee access to prevent interference with the worker.

(4) Place insulating blanket over the conductive parts of the obstruction (equipment rack, switchgear, etc.) where the worker may accidentally make contact.

(5) Ensure no conductive equipment is near the work area that may potentially contact the worker or the equipment.

g. Shock Hazard. A Shock Hazard is a dangerous condition associated with the possible release of energy caused by contact or approach to energized electrical conductors or circuit parts.

(1) A shock hazard analysis determines the hazardous voltage, boundary requirements, and PPE necessary to minimize the possibility of electric shock to personnel.

(2) The Limited, Restricted, and Prohibited approach boundaries will be determined by a Qualified Person prior to starting work.

(3) Approach boundaries must be determined using the NFPA 70E Table 130.4(C)(a) and 130.4(C)(b).

(a) LAB.

(i) Only Qualified Persons may enter the LAB when electric conductors and equipment involved are **not** in an electrically safe work condition.

(ii) If an Unqualified Person(s) needs to cross the LAB for the purpose of On-the-Job-Training, a Qualified Person must advise him/her of the possible hazards and escort the Unqualified Person(s) while inside the LAB.

(b) RAB. Unqualified Persons are prohibited from crossing the RAB.

(c) Qualified Persons must not approach or take any conductive object closer to exposed energized electrical conductors or circuit parts operating at 50 volts or more than the RAB unless the Qualified Person is isolated, insulated, or guarded from energized electrical conductors and no un-insulated part of the Qualified Person's body crosses the Prohibited Approach Boundary (PAB).

(d) PAB. Only a Qualified Person with the appropriate PPE is allowed inside the PAB.

h. Arc Flash.

(1) Arc flash hazards relate to the thermal effects of electricity when the electrical current sustains a short circuit between the energized buses of electrical equipment or between an energized part and ground potential. The associated bright light, heating and decomposition of metals produce enough heat to cause serious burns to human skin. Arc-rated (AR) clothing is designed to protect the worker from the thermal energy hazards associated with the arc flash event.

(2) Arc blast hazards address the mechanical forces associated with an arcing fault. The explosive reaction near the arc can cause parts of the electrical equipment to move rapidly away from the arc in all directions. AR clothing may not protect the worker from the physical effects of the arc blast event.

(3) Arc Flash Exposure.

(a) An arc flash may be caused by, but not limited to:

(i) Human error/unsafe work practices.

(ii) Contact with energized parts.

(iii) Short circuit current capacity exceeding electrical equipment rating.

(iv) Dropped tools/hardware across energized parts.

(v) Incorrect wiring practices.

(vi) Contamination, such as dust on insulating surfaces.

(vii) Corrosion of equipment parts and contacts.

(viii) Removal/Installation of equipment covers (i.e., dead front covers on panelboards).

(ix) Failure of internal or external mechanical parts and hardware, which can then contact energized components.

(b) A worker must wear AR PPE prior to crossing the arc flash boundary to perform a variety of tasks including but not limited to verifying equipment is deenergized, measuring voltage, removing covers from a power distribution panel or performing energized work.

(4) AFHA Requirements.

(a) The AFHA must determine the arc flash boundary, the incident energy at a specified working distance, and the personal protective equipment for the Qualified Person working within the arc flash boundary.

(b) The AFHA must be performed prior to installation of new facilities or when a major modification occurs at existing facilities. The AFHA must be reviewed periodically, not to exceed 5 years.

(c) Each AFHA must comply with this Order and FAA Order 6950.27, Short Circuit Analysis and Protective Device Coordination Study.

(d) The AFHA must take into consideration the design of the overcurrent device, its clearing time and the condition of maintenance.

(e) The arc flash boundary and PPE requirements may be determined using NFPA 70E Table 130.7(C)(15)(a) located in Appendix A until such time as the results of an AFHA are available.

(i) The maximum short circuit current and clearing time parameters in NFPA 70E Table 130.7(C)(15)(a) are assumed to be met for equipment downstream of the service entrance. This assumption is based on arc flash calculations performed on several types of FAA equipment and generic infinite bus calculations using voltage levels, transformer sizes, and protective device types common in the FAA. Supporting documentation is provided in Appendix J.

(ii) For any transformer size (kVA) larger than indicated in Appendix J at the respective voltage, contact a qualified engineer to perform an assessment or AFHA. For example, a 225kVA transformer at 208V would require further evaluation by a qualified engineer.

(iii) For any transformer with an impedance less than the 1.7% indicated in Appendix J, contact a qualified engineer to perform an assessment or AFHA.

(iv) For service entrance equipment, use NFPA 70E Table 130.7(C)(15)(a) to determine PPE **only** for operating a breaker with covers on or, opening a hinged cover to perform a visual inspection. All other tasks on service entrance equipment require establishing an electrically safe work condition if AFHA or assessment results are not available.

(v) Tasks not listed in NFPA 70E Table 130.7(C)(15)(a) require an assessment or AFHA as determined by a qualified engineer.

(vi) PPE categories are identified in NFPA 70E Table 130.7(C)(16).

(f) Guidance on generic warning labels for selected systems is located in the AFHA Flowchart in Appendix F. Sample generic labels are located in Appendix G.

(g) Requirements for single-phase and three-phase systems may be determined using the AFHA Flowchart in Appendix F.

(h) Requirements for DC systems may be determined using the AFHA Flowchart in Appendix F.

(i) PPE for DC systems <100V is defined as PPE Category 0.

(ii) PPE for DC systems >100V must be determined by a qualified engineer.

(5) AFHA Labeling Requirements.

(a) As stated in the National Electrical Code (NEC) and NFPA 70E 130.5(C), electrical equipment, such as switchboards, panelboards, industrial control panels, transformers, disconnect switches, and motor control centers that are in other than dwelling units and are likely to require examination, adjustment, servicing, or maintenance while energized must be field marked to warn qualified persons of potential electric arc flash hazards. The marking must be located to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

(b) Following the completion of the AFHA and shock hazard analysis, label the panelboards, switchgear, and electrical equipment as shown in Figure 2-1. The label must include the following information from the AFHA as a minimum:

(i) Arc Flash Boundary.

(ii) Incident Energy in calories per square centimeter (cal/cm2) at appropriate working distances.

(iii) PPE Category.

(iv) Nominal System Voltage.

(v) Class of Voltage Rated Gloves.

(vi) LAB in feet/inches.

(vii) RAB in feet/inches.

(viii) PAB in feet/inches.

(ix) Equipment Name.

(x) Date of Survey.

(c) Label Specifications.

(i) The label must be of the appropriate size for the equipment while remaining legible.

(ii) Warning label header for PPE Categories 0 – 4 must be orange with black lettering.

(iii) Danger label headers for hazards above PPE Category 4 must be red with white lettering to conform to OSHA recommendations.

(iv) Arc flash warning labels placed on equipment cabinets, other than switchgear, power panels or motor control centers, are applicable to the operation and/or maintenance of the power source disconnects (e.g. rack/cabinet circuit breakers) ONLY, and not to the maintenance of the electronic equipment/system.

(d) Generic Labels.

(i) Generic labels were developed using conservative methods, specifically for FAA equipment, excluding service entrance equipment. See Appendix G.

(ii) Contact ES, PSG, or EOSH Services for the specific required generic label(s).

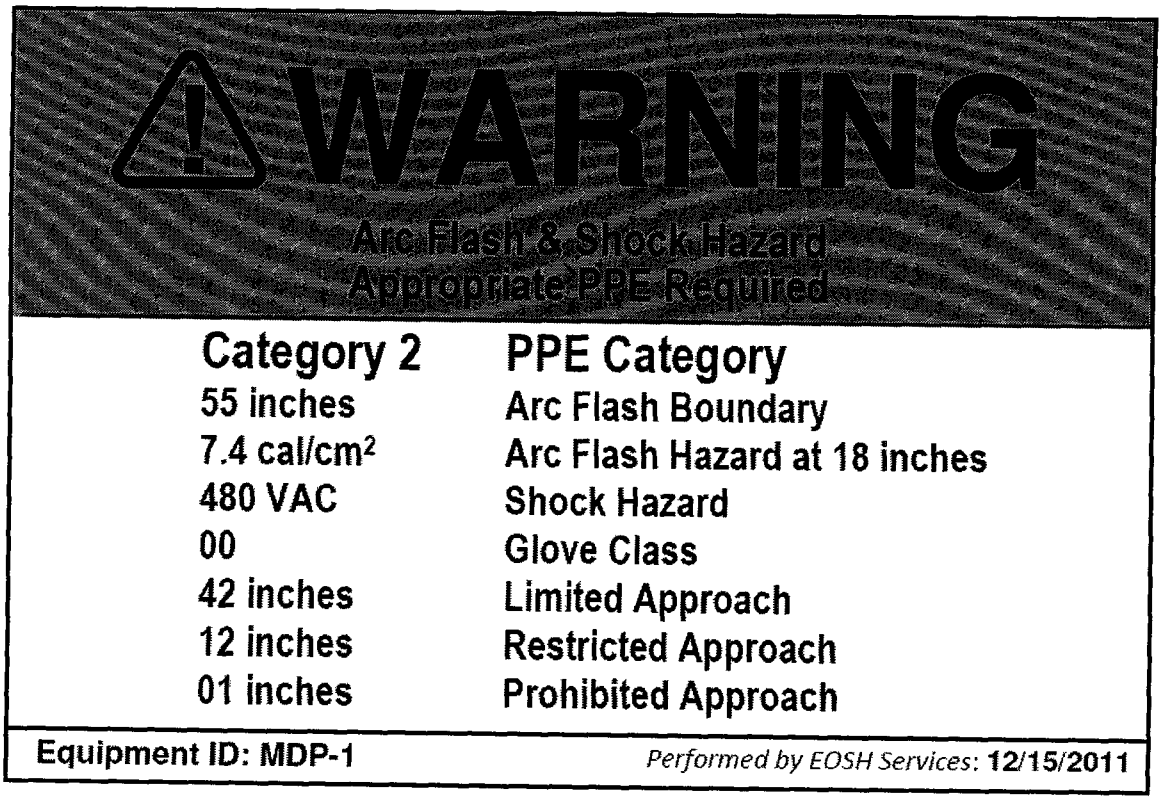
(e) Generic Label Application. Generic labels may be used when an AFHA or an arc flash assessment has not been performed on any of the following equipment:

(i) DC systems <100V.

(ii) Single-phase systems.

(iii) Three-phase systems operating at less than 240V and fed by a single transformer rated less than 125kVA.

Figure 2-1. Label Example



i. Infrared Inspection. Wear the proper PPE when performing Infrared Thermography in accordance with NFPA 70E Table 130.7(C)(15)(a) located in Appendix A or the warning label.

j. Work Positioning Considerations.

(1) Use the non-dominant hand to engage disconnect switches to the on or off position.

(2) Stand to the side of the electrical source while activating switches to reduce exposure of body to the electrical hazard.

(3) Turn head away from the equipment while operating switch/circuit breaker.

(4) Use the enclosure doors and components as barriers as much as possible.

Illumination. Adequate illumination and an unobstructed view of the work to be performed, as determined by the Qualified Person, are required prior to employees entering a work area containing energized electrical conductors or circuit parts.

k. Signs and Barricades.

(1) Use safety signs, safety symbols, etc., where necessary to warn employees of potential electrical hazards. (See NFPA 70E 130.7(E) and ANSI Z535.2).

(2) Use barricades in conjunction with safety signs where it is necessary to prevent or limit employee access to work areas. Do not use conductive barricades where it might cause an electrical hazard.

(a) The barricades must be located no closer than the LAB to the energized electrical conductor(s) or circuit part(s).

(b) If a Qualified Person determines that signs or barricades do not provide sufficient warning and protection from electrical hazards, an attendant must be stationed for the sole purpose to warn and protect employees.

3. Energized Electrical Work Permit. See Appendices D and E.

a. Energized work is not permitted, unless deenergizing (the equipment) introduces additional or increased hazards or is infeasible due to equipment design or operational limitations.

b. An EEWP is required when working on energized electrical conductors or circuit parts.

c. If the work task requires a worker to remove, change, or add any electrical component, the work task is not diagnostic in nature and an EEWP is required.

d. The manager cannot approve the EEWP if the Qualified Person determines that he/she cannot perform the energized work safely.

A blank EEWP is available at:
https://employees.faa.gov/org/linebusiness/ato/operations/technical_operations/atc_facilities/eosh_services/osh/es/regulation/

f. An EEWP is **not** required in the following situations:

(1) Performing lockout/tagout and verifying the system is deenergized.

(2) Low Voltage - An EEWP is not required for work at less than 50 volts to ground, unless a Qualified Person determines there is increased exposure to electrical burns or to explosion due to electric arcs.

(3) Testing, Troubleshooting, Voltage Measurement - A Qualified Person may perform diagnostics on energized electrical conductors or circuit parts related to testing, troubleshooting, and voltage measuring within the LAB, RAB, and PAB, provided electrical safe work practices and PPE are used.

(4) Performing visual inspection within the LAB, provided the RAB and PAB will not be crossed.

g. Use Qualified Personnel and Obtain Management Approval – A Qualified Person must make the decision to work energized on a case-by-case basis with management approval. By signing the permit approving energized work by the Qualified Person, the manager acknowledges the associated risks of the energized work. Energized electrical work may only proceed after approval of the FAA EEWP.

4. Training Requirements.

a. The National EOSH Training Standards for the Electrical Safety courses are available at the web link: http://eoshtnat.faa.gov/Library/index.cfm?Action=. Refer to Table 2-1 for training requirements.

b. The training curriculum must comply with the current National EOSH Training Standards. Employees who received ESQP training prior to 2009 must attend current ESQP training (e.g., minimum 16-hour) as soon as practical.

Table 2-1. Electrical Safety Training Requirements

CATEGORY	DUTIES	PREREQUISITES & REFRESHER TRAINING
Electrical Safety Qualified Person (ESQP) –Employees and managers of employees working on exposed energized conductors or circuit parts operating at 50V or greater or who must verify equipment is deenergized. ESQP training alone does not qualify the employee to work on specific equipment.	Perform work on energized electrical conductors or circuit parts requiring an EEWP. Perform any electrical work within the restricted approach boundary as defined by NFPA 70E Performs work on high voltage transformers and capacitors	• First Aid/CPR (including AED) training • Refresher training required every 3 years • Refresher training required for employees who fail to demonstrate adequate skill, and knowledge
Electrical Safety Unqualified Person – Employees who have no requirement to work on energized electrical equipment or who may be exposed to electrical hazards as a work task is performed nearby.	Air Traffic Controllers, Administrative Staff, Cleaning Service Personnel, Office Personnel, and employees trained in crafts other than electrical.	None
Electrical Safety-Electric Power Generation, Transmission, and Distribution – Employees who perform operation and maintenance of electric power generation, control, transformation, and distribution lines and equipment	Perform work on facilities with power generation capabilities (does not include emergency and standby power) or on installations that distribute power to 2 or more separate buildings or equivalent facilities which extend to the service point for each building or equivalent facility served for the purposes of : a) Work on energized electrical conductors or circuit parts requiring an EEWP b) Electrical work within the LAB and RAB. c) Work on transformers stepping up or stepping down power from the commercial meter point.	• First Aid/CPR (including AED) Training • Electrical Safety-Qualified Person • Refresher training required every 3 years • Refresher training required for employees who fail to demonstrate adequate skill, and knowledge

5. Personal Protective Equipment (PPE).

a. Hand Protection.

(1) General Requirements and Use.

(a) Rubber insulating gloves must be worn where there is a potential electric shock hazard (i.e., greater than 50 volts).

(b) Wear heavy-duty leather gloves over rubber insulating gloves where required for arc flash or shock protection.

(c) Heavy-duty leather gloves may be removed only for voltage levels below 250 V when increased dexterity for manipulating small parts is required.

(d) Rubber insulating gloves used without protectors must not be used with protectors until physically inspected and electrically retested by a North American Independent Laboratories (NAIL).

(e) Wear appropriately rated gloves for the voltage present. Refer to Table 2-2 for glove class and the associated voltages.

(f) Rubber insulating sleeves must be used to protect the upper arm when there is a potential to contact energized electrical conductors or circuit parts when reaching inside an enclosure (e.g., battery racks).

(2) Selection. Select gloves and sleeves based on the physical and electrical insulating properties.

(3) Testing Requirements. Front line managers must ensure a testing procedure/system is established to include the following:

(a) Using an approved testing laboratory to test the gloves and sleeves in accordance with the requirements of ASTM F496. The laboratory used for testing must be NAIL-accredited.

(b) Including a specific test or retest date recorded in documentation or marked on the glove or sleeve.

(c) Testing insulating gloves within 6 months of most recent test date.

(d) Testing sleeves within 12 months of most recent test date.

(e) Establishing disposition procedures for rubber insulating materials that fail inspection or electrical testing.

(4) Inspection and Maintenance.

(a) Prior to each use, insulating gloves must be air-tested by using a glove inflator or folding the cuff down several times to trap air and create a slight positive pressure inside the glove to test for any air leakage.

(b) Gloves must be thoroughly examined inside and out for cracks, cuts, tears, foreign debris or any products that could breach the integrity of the rubber.

(c) Gloves must be stored with the fingers up in the canvas storage bag to prevent debris from entering the open cuff. Do not fold gloves.

(d) Gloves that do not pass inspection must be properly disposed of and replaced.

(e) Rubber insulating equipment must be stored in a location as cool, dark, and dry as practical and free from ozone, chemicals, oils, solvents, damaging vapors and fumes, and away from electrical discharges and sunlight. Field storage must be in a bag, box, container, or compartment designed for the equipment.

(f) Clean the equipment in accordance with manufacturer's instructions.

Table 2-2. Glove Class Maximum Use Voltage

Maximum Use Voltage		
AC	**DC**	**Selection**
500	750	Class 00 Glove/Sleeve (beige label)
1,000	1,500	Class 0 Glove/Sleeve (red label)
7,500	11,250	Class 1 Glove/Sleeve (white label)
17,000	25,500	Class 2 Glove/Sleeve (yellow label)
26,500	39,750	Class 3 Glove/Sleeve (green label)
36,000	54,000	Class 4 Glove/Sleeve (orange label)

b. Head Protection.

(1) General Requirements and Use.

(a) Head protection must meet American National Standards Institute (ANSI) Z89.1, Requirements for Protective Headwear for Industrial Workers.

(b) Use Class G hardhats for electrical hazards up to 2,200V and Class E hardhats for electrical hazards up to 20,000V. Do not use a Class C hardhat for electrical work.

(c) A balaclava is required under the face shield when working in a PPE Category 2 environment, unless a flash suit hood is used.

(2) Inspection and Maintenance.

(a) Clean and inspect hardhats to each use. If visibly damaged, remove the hat from service.

(b) Visually inspect the inner lining and shell suspension for missing or worn parts prior to each use.

c. Face Protection.

(1) General Requirements and Use.

(a) Face shields must be nonconductive, non-melting and protect the face, ears, neck, and chin and have an arc rating suitable for the arc flash exposure.

(b) Do not wear face shields without an arc flash rating or those made from acetate or other similar melting materials where an arc flash exposure exists.

(c) Face shields must meet ANSI 87.1 and ASTM F2178.

(d) Additional lighting may be required in the work area, as some shields may reduce visibility.

(2) Inspection and Maintenance.

(a) Inspect face shields for cracks, chips, or signs of damage prior to each use.

(b) If any defects are noted, remove the shield from service.

d. Eye Protection.

(1) General Requirements and Use.

(a) Always wear non-conductive eye protection (safety glasses or goggles) for any PPE Category, including whenever a face shield or flash suit hood is required.

(b) Safety glasses/safety goggles must meet ANSI Z87.1, American National Standard for Occupational and Educational Personal Eye and Face Protection.

(c) Over-the-lens safety glasses may be worn over prescription eyeglasses.

(2) Inspection and Maintenance.

(a) Inspect safety glasses/safety goggles prior to each use.

(b) If visibly damaged, or if scratches to viewing surface impair vision, remove the glasses from service and replace.

e. Hearing Protection. General Requirements and Use.

(1) Wear ear canal inserts for all PPE Categories.

(2) Do not wear earmuffs when a potential arc flash exposure is present.

f. Foot Protection.

(1) Leather work shoes must be worn when performing work on equipment classified as PPE Category 1 through 4.

(2) Dielectric overshoes are required for insulated footwear used as protection against step and touch potential. The overshoes must meet the requirements of ASTM F1116 and F1117.

g. AR Clothing.

(1) General Requirements. Employees must wear all applicable PPE and AR clothing whenever there is the possibility of exposure to an arc flash.

(2) Limitations. Meltable fibers such as acetate, nylon, polyester, polypropylene, and spandex are not permitted in fabric under layers (undergarments) next to the skin; however, the elastic used on non-melting fabric undergarments or socks is permitted.

(3) AR Clothing Selection. Select clothing based on the maximum arc flash exposure hazard for the specific task. Clothing must be marked to indicate compliance with ASTM F1506.

(4) Specific clothing requirements for each PPE Category are located in NFPA 70E Table 130.7(C)(16) and Appendix I.

(5) Inspection and Maintenance.

(a) Inspect AR clothing for tears, fraying, missing closures, and significant wear prior to each use.

(b) Laundering. Follow manufacturer's recommended cleaning, maintenance, and care instructions to maintain AR integrity.

h. Insulating Blankets.

(1) General Requirements and Use.

(a) Use blankets to provide an insulated boundary between the worker and energized parts where there is a risk of contacting energized parts as determined by the Qualified Person.

(b) Blankets must meet ASTM D1048.

(c) The service and care of insulating blankets must meet ASTM F479, Standard Specification for In-Service Care of Insulating Blankets.

(d) Test insulating blankets by an approved laboratory every 12 months.

(2) Inspection and Maintenance.

(a) Visually inspect for defects before use and as needed if there is cause to suspect any damage.

(b) Place the blanket on a flat surface; roll the blanket from one corner towards the opposite and check for cracks, nicks, holes, etc., in the rubber. Next, turn the blanket over and repeat the procedure.

(c) Store rubber insulating blankets in a location as cool, dark, and dry as practical. Ensure the storage location is free as possible from ozone, chemicals, oils, solvents, damaging vapors and fumes, and away from electrical discharges and sunlight. Field storage must be in a bag, box, container, or compartment designed for the blanket.

(d) Clean the equipment in accordance with manufacturer's instructions.

i. Insulating Mats. General Requirements and Use.

(1) The Qualified Person must determine the use of insulating mats.

(2) Do not use mats as primary protection from electric shock.

(3) Mats must meet ASTM D178, Standard Specification for Rubber Insulating Matting, for material design specifications.

(4) Maintain mats in a safe, reliable condition.

(5) Visually inspect mats before each use, or at least annually, for signs of damage or wear.

(6) Testing is not required, but insulating mats must be replaced every three years, or sooner, if needed.

6. Insulated, Insulating, and Voltage Rated Tools. Employees must use insulated and/or insulating tools when working inside the LAB of exposed energized electrical conductors or circuit parts. Wrapping electrical tape or other materials around tool handles, jewelry or belt buckles DOES NOT provide shock protection and is prohibited.

a. Static Discharge Sticks.

(1) General Requirements and Use.

(a) Static discharge sticks are designed to safely remove the static charge after the equipment is deenergized. These are used on capacitor banks and other devices that can store energy.

(b) Use static discharge sticks in accordance with manufacturer's instructions.

(c) Do not use static discharge sticks on live equipment.

(d) Wear appropriate PPE while using static discharge sticks.

(e) A Qualified Person must select static discharge sticks that meet ASTM F711 and are marked as such.

(2) Inspection and Maintenance.

(a) Static discharge sticks must be marked with manufacturer's name, month, and year of manufacture.

(b) Clean each tool before and after each use.

(c) Visually inspect each tool before each use or at least annually.

(d) Remove the tool from service if visibly damaged.

(e) These devices do not require further dielectric (lab) testing because they function as devices to provide a safe ground potential when used in accordance with instructions.

b. Safety Grounding Equipment.

(1) General Requirements and Use.

(a) Use safety grounding equipment only on deenergized electrical equipment and power lines.

(b) Safety grounding equipment is used to provide personal protection in the event of induced voltages and unintentional line energization.

(c) Safety grounding equipment and grounding jumpers must be capable of conducting the maximum fault current at the point of grounding for the entire time it takes to clear the fault. Only electrical engineering personnel may select safety grounding equipment.

(d) Safety grounding equipment, which includes the clamp, ferrule, and cable, must meet ASTM F855 and ASTM F2249.

(e) Wear the appropriate PPE when using safety grounding equipment.

(2) Inspection and Maintenance.

(a) Visually inspect safety grounding equipment before each use and at least annually.

(b) If visibly damaged, remove the equipment from service.

c. Live Line Tools (Hot Sticks).

(1) General Requirements and Use.

(a) Live line tools allow workers to manipulate energized conductors and equipment (e.g., fused disconnects) from a safe distance.

(b) Wear the appropriate PPE while using live line tools.

(c) Live line tools must be selected by a Qualified Person to maintain the minimum approach distance (based on voltage) and meet ASTM F711.

(d) Use live line tools in accordance with manufacturer's instructions.

(2) Inspection and Maintenance.

(a) Clean each tool visually inspect before each use.

(b) If visibly damaged, remove the tool from service.

(3) Testing.

(a) Electrically test live line tools every 2 years or more frequently if suggested by the manufacturer.

(b) Test laboratories used for live line tools must meet the requirements of the ASTM F711.

(c) Test laboratories must be Nationally Recognized Testing Laboratory (NRTL) accredited.

(d) Testing must include a stamp, label, or other marking on the unit with accompanying documentation of results. Maintain the results for the life of the unit.

(e) Live line tools must also be marked with the test date.

d. Power Tools, Hand Tools, and Portable Electrical Equipment.

(1) General Requirements and Use.

(a) Power and hand tools and portable electrical equipment must be properly rated and used in accordance with manufacturer's instructions.

(b) Power tools that are not double-insulated (i.e., manufactured with non-metallic cases) must be removed from service.

(c) Use portable electrical equipment in conjunction with a ground fault circuit interrupter (GFCI).

(d) Do not use flexible cords as a substitute for fixed wiring.

(e) All flexible cords must contain a grounding conductor.

(f) Do not remove ground prong from plugs.

(g) Do not use adapter plugs (3 to 2 prong).

(2) Selection. Each hand tool and/or component must be permanently and legibly marked with the following:

(a) Manufacturer's name or trademark.

(b) Type or product reference.

(c) The double interlocking equilateral triangle international symbol.

(d) The voltage exposure rating up to 1000 VAC.

(3) Inspection and Maintenance. Inspect power tools, hand tools, and portable cord and plug equipment before and after each use and remove from service if visibly damaged.

7. Electrical Test Instruments and Equipment.

a. General Requirements and Use.

(1) All test instruments and accessories (e.g., test probes or replacement leads) must be properly rated for the voltage and current of the equipment being tested and be compatible with each other.

(2) Properly rated voltmeters are required for verification of deenergization (e.g., absence of voltage) and voltage measurements less than or equal to 600 volts.

(3) Use high voltage meters primarily for verification of deenergization on equipment greater than 600 volts. If voltage measurements on equipment greater than 600 volts are required, user must complete the appropriate training (e.g., Power Generation, Distribution, Transmission) prior to using the meter for this application.

(4) Employees must utilize probes of the proper length that will allow the worker's hands to remain outside of the prohibited approach boundaries.

(5) A pre- and post-check of the test equipment on a known source is required whenever using an electrical test instrument to verify the absence of voltage.

(6) Proper training is required prior to using any testing equipment.

(7) Non-Contact Devices. (e.g., tickers, neon's, clamp-on ammeters).

(a) These devices must be used IAW manufacturer's recommendations to perform testing and troubleshooting activities.

(b) Do not use these devices for verification of deenergization.

b. Testing and Calibration. Test and calibrate all test instruments IAW manufacturer's specifications.

c. Inspection and Maintenance.

(1) Maintain the test instruments in good condition and IAW manufacturer's specifications.

(2) Only Qualified Persons may use test instruments.

(3) Inspect test instruments and the associated test leads, cables, power cords, probes and connectors for damage or defects before each use.

(a) If damage or defects are noted, remove the equipment from service.

(b) Do not use defective equipment until it has been repaired, tested, and approved for use.

(4) Clean test instruments in accordance with manufacturer's instructions.

8. Design, Construction, and Acquisition Requirements.

a. Background. The goal of this section is to incorporate electrical safety into designs, installation, and modifications to reduce risk and incident energy exposure to the employee.

b. Design and Construction-General Requirements.

(1) All designs, installations, and major modifications must comply with FAA Order 6950.27. The electrical design specification must include a short circuit analysis, a protective device coordination study, and an AFHA, where required.

(2) Access, working space distances, and minimum headroom requirements must meet OSHA requirements (29 CFR 1910.303). Measure distances from the exposed live parts, or from the enclosure or opening, if the live parts are enclosed.

(3) Arc Flash Design and Specification Requirements.

(a) Design and specification requirements for arc flash hazard calculations are addressed by IEEE 1584, "Guide for Performing Arc-Flash Hazard Calculations", and NFPA 70E, Standard for Electrical Safety in the Workplace.

(b) Additional guidance may be found in FAA Order 6950.27

(4) Facility Service Entrance Disconnect Means.

(a) Install at a readily accessible location either outside of the building or structure or inside nearest the point of entrance of the service conductors.

(b) Service entrance disconnects must be properly identified.

(c) For all new facilities, electrical disconnects must be located where workers can step to the side and use their non-dominant hand while activating.

(d) For existing facilities, make every effort to install electrical disconnects where workers can step to the side and use their non-dominant hand while activating.

(5) Power Supply Requirements for Electric Fire Pumps.

(a) Install electrical disconnects between the fire pump controller and all its sources (e.g. transformer, engine generator) in accordance with NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection, and NFPA 70, Article 695, Fire Pumps. Installation of the service disconnects mitigate the arc flash hazards during controller maintenance and work.

(b) Consult a certified fire protection engineer during the design and installation process.

(6) Temporary Electrical Power and Lighting.

(a) Only a Qualified Person may make the connection for temporary power.

(b) Time Constraints.

(i) Temporary electrical power and lighting is permitted during the period of emergencies, construction, remodeling, maintenance, repair, or demolition of buildings, structures, equipment, and similar activities.

(ii) Temporary electric power and lighting installations are permitted for a period not to exceed 90 days for holiday decorative lighting and similar purposes.

(iii) Remove temporary electrical power and lighting immediately upon completion of construction or completion of the intended purpose.

(7) Flexible Cord Sets (Extension Cord).

(a) "Daisy Chaining" (connecting cords in series) is prohibited.

(b) Extension cords must be approved by recognized laboratories (such as Underwriters Laboratory, Factory Mutual, etc.).

(c) Extension cords connected to devices must be provided with strain relief.

(d) A single extension cord set connected to a permanent receptacle outlet is permitted when used to extend the length of the power supply cord on a tool or appliance to reach the receptacle outlet and is considered part of the utilization equipment, and not temporary wiring installation.

(e) Connecting a long extension cord set from a permanent outlet to power more than one piece of electric equipment is considered a temporary wiring installation.

(f) The use of more than one extension cord, connected in series or otherwise, to a permanent outlet, is considered temporary wiring.

(g) All extension cords must contain a grounding conductor (e.g., 3-prong plug).

(h) Do not remove ground prong from plugs.

(i) Do not use adapter plugs (3 to 2 prong).

(j) Extension cords are not to be used for the following:

(i) As a substitute for fixed wiring of a structure.

(ii) Where run through holes in walls, structural ceilings, suspended ceilings, or floors.

(iii) Where run through doorways, windows, or similar openings.

(iv) Where attached to building surfaces unless specifically permitted by NFPA 70.

(v) Where concealed by walls, floors, or ceilings or located above suspended or dropped ceilings.

(vi) Where installed in raceways, except as otherwise permitted in this code.

(vii) Where subject to physical damage.

(8) GFCI.

(a) All 125-volt, single-phase, 15-, 20-, and 30-ampere receptacle outlets that are not a part of the permanent wiring of the building or structure and that are in use by personnel must have GFCI protection.

(b) The GFCI device must be the first item in the series (e.g. connected directly to the power source).

(9) Illumination. In addition to the NEC, the Illuminating Engineering Society of North American (IESNA) Lighting Handbook (latest edition) specifies the following requirements for electrical equipment:

(a) Provide adequate illumination for all working spaces around electrical equipment, switchboards, panelboards, or motor control centers installed indoors.

(b) The lighting outlets must be arranged so that persons changing lamps or making repairs on the lighting system are not endangered by energized electrical conductor or circuit parts or other equipment.

(c) Position the control switches for light circuits away from exposed energized circuits and other potential electrical hazards.

(d) Ensure proper illumination is directed toward the electrical panel or equipment in order to prevent obstruction of light.

Appendix A. NFPA 70E Table 130.7(C)(15)(a)

Table 130.7(C)(15)(a) Hazard/Risk Category Classifications and Use of Rubber Insulating Gloves and Insulated and Insulating Hand Tools-Alternating Current Equipment (Formerly Table 130.7(C)(9)

Tasks Performed on Energized Equipment	Hazard/Risk Category	Rubber Insulating Gloves	Insulated and Insulating Hand Tools
Panelboards or other equipment rated 240 V and below Parameters Maximum of 25 kA short circuit current available, maximum of 0.03 sec (2 cycle) fault clearing time, minimum 18 in. working distance Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 19 in.			
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	0	N	N
Circuit breaker (CB) or fused switch operation with covers on	0	N	N
CB or fused switch operation with covers off	0	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	1	Y	Y
Remove/install CBs or fused switches	1	Y	Y
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	1	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	0	N	N
Work on energized electrical conductors and circuit parts of utilization equipment fed directly by a branch circuit of the panelboard	1	Y	Y
Panelboards or other equipment rated > 240 V and up to 600 V Parameters Maximum of 25 kA short circuit current available, maximum of 0.03 sec (2 cycle) fault clearing time, minimum 18 in. working distance Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 30 in.			
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	1	N	N
Circuit breaker (CB) or fused switch operation with covers on	0	N	N
CB or fused switch operation with covers off	1	Y	N
Work on energized electrical conductors and circuit parts, including voltage testing	2	Y	Y
Remove/install CBs or fused switches	2	Y	Y
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	1	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	0	N	N
Work on energized electrical conductors and circuit parts of utilization equipment fed directly by a branch circuit of the panelboard	2	Y	Y
600 V class motor control centers (MCCs) Parameters Maximum of 65 kA short circuit current available, maximum of 0.03 sec (2 cycle) fault clearing time, minimum 18 in. working distance Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 53 in.			
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	1	N	N

(continues)

Table 130.7(C)(15)(a) *Continued*

Tasks Performed on Energized Equipment	Hazard/Risk Category	Rubber Insulating Gloves	Insulated and Insulating Hand Tools
CB or fused switch or starter operation with enclosure doors closed	0	N	N
Reading a panel meter while operating a meter switch	0	N	N
CB or fused switch or starter operation with enclosure doors open	1	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	2	Y	Y
Work on control circuits with energized electrical conductors and circuit parts 120 V or below, exposed	0	Y	Y
Work on control circuits with energized electrical conductors and circuit parts >120 V, exposed	2	Y	Y
Application of temporary protective grounding equipment, after voltage test	2	Y	N
Work on energized electrical conductors and circuit parts of utilization equipment fed directly by a branch circuit of the motor control center	2	Y	Y
600 V class motor control centers (MCCs) Parameters: Maximum of 42 kA short circuit current available; maximum of 0.33 sec (20 cycle) fault clearing time; minimum 18 in. working distance Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 165 in.			
Insertion or removal of individual starter "buckets" from MCC	4	Y	N
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	4	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	1	N	N
600 V class switchgear (with power circuit breakers or fused switches) and 600 V class switchboards Parameters: Maximum of 35 kA short circuit current available; maximum of up to 0.5 sec (30 cycle) fault clearing time; minimum 18 in. working distance Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 233 in.			
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	2	N	N
CB or fused switch operation with enclosure doors closed	0	N	N
Reading a panel meter while operating a meter switch	0	N	N
CB or fused switch operation with enclosure doors open	1	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	2	Y	Y
Work on control circuits with energized electrical conductors and circuit parts 120 V or below, exposed	0	Y	Y
Work on control circuits with energized electrical conductors and circuit parts >120 V, exposed	2	Y	Y

Table 130.7(C)(15)(a) *Continued*

Tasks Performed on Energized Equipment	Hazard/Risk Category	Rubber Insulating Gloves	Insulated and Insulating Hand Tools
Insertion or removal (racking) of CBs from cubicles, doors open or closed	4	N	N
Application of temporary protective grounding equipment after voltage test	2	Y	N
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	4	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	2	N	N
Other 600 V class (277 V through 600 V, nominal) equipment Parameters: Maximum of 65 kA short circuit current available; maximum of 0.03 sec (2 cycle) fault clearing time; minimum 18 in. working distance (except as indicated) Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 53 in.			
Lighting or small power transformers (600 V, maximum) Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts) Opening hinged covers (to expose bare, energized electrical conductors and circuit parts) Work on energized electrical conductors and circuit parts, including voltage testing Application of temporary protective grounding equipment, after voltage test	 2 1 2 2	 N N Y Y	 N N Y N
Revenue meters (kW-hour, at primary voltage and current)—insertion or removal	2	Y	N
Cable trough or tray cover removal or installation	1	N	N
Miscellaneous equipment cover removal or installation	1	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	2	Y	Y
Application of temporary protective grounding equipment, after voltage test	2	Y	N
Insertion or removal of plug-in devices into or from busways	2	Y	N
NEMA E2 (fused contactor) motor starters, 2.3 kV through 7.2 kV Parameters: Maximum of 35 kA short circuit current available; maximum of up to 0.2 sec (12 cycle) fault clearing time; minimum 36 in. working distance Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 422 in.			
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	3	N	N
Contactor operation with enclosure doors closed	0	N	N
Reading a panel meter while operating a meter switch	0	N	N
Contactor operation with enclosure doors open	2	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	4	Y	Y
Work on control circuits with energized electrical conductors and circuit parts 120 V or below, exposed	0	Y	Y
Work on control circuits with energized electrical conductors and circuit parts >120 V, exposed	3	Y	Y

(continues)

Table 130.7(C)(15)(a) *Continued*

Tasks Performed on Energized Equipment	Hazard/Risk Category	Rubber Insulating Gloves	Insulated and Insulating Hand Tools
Insertion or removal (racking) of starters from cubicles, doors open or closed	4	N	N
Application of temporary protective grounding equipment, after voltage test	3	Y	N
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	4	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	3	N	N
Insertion or removal (racking) of starters from cubicles of arc-resistant construction, tested in accordance with IEEE C37.20.7, doors closed only	0	N	N
Metal clad switchgear, 1 kV through 38 kV Parameters: Maximum of 35 kA short circuit current available, maximum of up to 0.2 sec (12 cycle) fault clearing time; minimum 36 in. working distance Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 422 in			
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	3	N	N
CB operation with enclosure doors closed	2	N	N
Reading a panel meter while operating a meter switch	0	N	N
CB operation with enclosure doors open	4	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	4	Y	Y
Work on control circuits with energized electrical conductors and circuit parts 120 V or below, exposed	2	Y	Y
Work on control circuits with energized electrical conductors and circuit parts >120 V, exposed	4	Y	Y
Insertion or removal (racking) of CBs from cubicles, doors open or closed	4	N	N
Application of temporary protective grounding equipment, after voltage test	4	Y	N
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	4	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	3	N	N
Opening voltage transformer or control power transformer compartments	4	N	N
Arc-resistant switchgear Type 1 or 2 (for clearing times of < 0.5 sec with a perspective fault current not to exceed the arc-resistant rating of the equipment) Parameters: Maximum of 35 kA short circuit current available; maximum of up to 0.2 sec (12 cycle) fault clearing time; minimum 36 in. working distance Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters, 422 in.			
CB operation with enclosure door closed	0	N	N
Insertion or removal (racking) of CBs from cubicles, doors closed	0	N	N

Table 130.7(C)(15)(a) ***Continued***

Tasks Performed on Energized Equipment	Hazard/Risk Category	Rubber Insulating Gloves	Insulated and Insulating Hand Tools
Insertion or removal of CBs from cubicles with door open	4	N	N
Work on control circuits with energized electrical conductors and circuit parts 120 V or below, exposed	2	Y	Y
Insertion or removal (racking) of ground and test device with door closed	0	N	N
Insertion or removal (racking) of voltage transformers on or off the bus door closed	0	N	N
Other equipment 1 kV through 38 kV Parameters: Maximum of 35 kA short circuit current available; maximum of up to 0.2 sec (12 cycle) fault clearing time; minimum 36 in. working distance Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 422 in.			
Metal-enclosed interrupter switchgear, fused or unfused Switch operation of arc-resistant-type construction, tested in accordance with IEEE C37.20.7, doors closed only Switch operation, doors closed Work on energized electrical conductors and circuit parts, including voltage testing Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts) Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	0 2 4 4 3	N N Y N N	N N Y N N
Outdoor disconnect switch operation (hookstick operated)	3	Y	Y
Outdoor disconnect switch operation (gang-operated, from grade)	2	Y	N
Insulated cable examination, in manhole or other confined space	4	Y	N
Insulated cable examination, in open area	2	Y	N

Y = Yes (required). N: No (not required).

Notes:

(1) Rubber insulating gloves are gloves rated for the maximum line-to-line voltage upon which work will be done.

(2) Insulated and insulating hand tools are tools rated and tested for the maximum line-to-line voltage upon which work will be done, and are manufactured and tested in accordance with ASTM F 1505, *Standard Specification for Insulated and Insulating Hand Tools.*

(3) The use of "N" does not indicate that rubber insulating gloves and insulated and insulating hand tools are not required in all cases. Rubber insulating gloves and insulated and insulating hand tools may be required by 130.4, 130.8 (C) (7), and 130.8(D).

(4) For equipment protected by upstream current limiting fuses with arcing fault current in their current limiting range (½ cycle fault clearing time or less), the hazard/risk category required may be reduced by one number.

(5) For power systems up to 600 V the arc flash boundary was determined by using the following information: When 0.03 second trip time was used, that indicated MCC or panelboard equipment protected by a molded-case circuit breaker. Working distance used was 18 in. (455 mm). Arc gap used was 32 mm for switchgear and 25 mm for MCC and protective device type 0 for all. When 0.33 or 0.5 second trip time was used, that indicated a LVPCB (drawout circuit breaker) in switchgear. Working distance was 24 in. (610 mm). Arc gap used was 32 mm and protective device type 0 for all. All numbers were rounded up or down depending on closest multiple of 5.

(6) For power systems from 1 kV to 38 kV the arc flash boundary was determined by using the following information: No maximum values were given in the 2009 edition of NFPA 70E for short-circuit current or operating time. Two sets of equations were performed: 35 kA AIC and 0.2 second operating time and 26 kA AIC and 0.2 second operating time. 0.2 seconds was used by adding the typical maximum total clearing time of the circuit breaker to an estimated value for relay operation. This coincides with the IEEE 1584 values of 0.18 second operating time and 0.08 tripping time rounded off. A short-circuit current of 35 kA was used as a maximum (HRC-4 @ ~ 40 cal/cm^2) and 26 kA was used to compare the effects of lowering the short circuit current (HRC-4 @ ~ 30 cal/cm^2). Working distance used was 36 in. (909 mm), arc gap was 6 in. (455 mm), and protective device type 0 for all.

Appendix B. Definitions

1. Arc Flash Boundary. When an arc flash hazard exists, an approach limit at a distance from a prospective arc source within which a person could receive a second-degree burn if an electrical arc flash were to occur.

2. Arc Flash Hazard. A dangerous condition associated with the possible release of energy caused by an electric arc.

3. Arc-Rated (AR) Clothing and/or Personal Protective Equipment (PPE). The property of material whereby combustion is prevented, terminated, or inhibited following the application of a flaming or non-flaming source of ignition, with or without subsequent removal of the ignition source.

Note: Previously referred to as flame-resistant clothing.

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

5. Barrier. A physical obstruction that is intended to prevent contact with equipment or energized electrical conductors and circuit parts or to prevent unauthorized access to a work area.

6. Clearing time. The amount of time it takes for a protective device to open the circuit and completely de-energize the circuit.

7. Deenergized. Free from any electrical connection to a source of potential difference and from electrical charge; not having a potential different from that of the earth.

8. Electrical Near-Miss. An electrical incident where no property was damaged and no personal injury sustained, but where, given a slight shift in time or position, damage and/or injury easily could have occurred.

9. 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 established standards, tested to ensure the absence of voltage, and grounded if determined necessary.

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

11. Equipment. A general term including material, fittings, devices, appliances, luminaires, apparatus, machinery and the like, used as a part of, or in connection with, an electrical installation.

12. Exposed. (As applied to energized electrical conductors or circuit parts.) Capable of being inadvertently touched or approached nearer than a safe distance by a person. It is applied to electrical conductors or circuit parts that are not suitably guarded, isolated, or insulated.

13. Fault Current. A current that flows from one conductor to ground or to another conductor due to an abnormal connection (including an arc) between the two.

14. Grounded. Connected (connecting) to ground or to a conductive body that extends the ground connection.

15. Ground Fault Circuit Interrupter. A device intended for the protection of personnel that functions to deenergize a circuit or portion thereof within an established period of time when a current to ground exceeds the established values.

16. High Voltage. As defined by the NEC, high voltage is any voltage over 600 volts, nominal.

17. Incident Energy. The amount of energy impressed on a surface, a certain distance from the source, generated during an electrical arc event. One of the units used to measure incident energy is cal/cm^2.

18. Incident Energy Analysis. A component of an arc flash hazard analysis used to predict the incident energy of an arc flash for a specified set of conditions.

19. Insulated. Separated from other conducting surfaces by a dielectric (including air space) offering a high resistance to the passage of current.

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

21. Lockout. The placement of a lockout device (includes an authorized lock) on an energy-isolating device, in accordance with an established procedure, ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

22. Lockout/Tagout - Affected Employee. An FAA employee, contractor, sponsor employee or any other person whose job requires him/her to operate or use a machine or equipment on which installation, servicing, or maintenance is being performed under Lockout/Tagout, or whose job requires him/her to work in an area in which such work is being performed.

23. Major Modification. In the definition below, studies are defined as short circuit, coordination, and arc flash.

a. Addition of motor loads greater than or equal to 50HP – studies required for entire facility.

b. Addition or replacement of power panels – studies required for modified/affected panels.

c. Engine Generator replacement – studies required for entire facility.

d. Replacement of service transformer or modification of service entrance conductors – studies required at the entire facility – studies required for entire facility.

e. UPS replacement (excluding rack-mounted) – studies required for UPS and Maintenance Bypass Switch except where feeder breakers are replaced (reference 'g' in this definition).

f. Replacement of service entrance – studies required for entire facility.

g. Replacement of feeder circuit breakers (greater than or equal to 150A 3-p) – studies required for downstream equipment to the next overcurrent protective device.

h. Addition or replacement of distribution transformer – studies required for downstream equipment except when replaced with a transformer of the same size, type, and impedance.

i. Electrical Line Distribution power cable replacements – studies required for entire affected facility or facilities.

24. Motor Control Center. An assembly of one or more enclosed section having a common power bus and principally containing motor control units.

25. Panelboard. A single panel or group of panel units, designed for assembly in the form of a single panel, including buses and automatic overcurrent devices, and equipped with or without switches for the control of light, heat, or power circuits; designed to be placed in a cabinet or cutout box placed in or against a wall, partition or other support; and accessible only from the front. (See **Switchboard**).

26. Prohibited Approach Boundary (PAB). An approach limit at a distance from an exposed energized conductor or circuit part within which work is considered the same as making contact with the electrical conductor or circuit part.

27. Qualified Engineer. One who is experienced in performing arc flash hazard analyses and is familiar with the applicable standards and calculations included in NFPA 70E and IEEE 1584.

28. Qualified Person. One who has received the specific technical training related to the construction and operation of the equipment and installations **and** has successfully completed the Electrical Safety Qualified Person course.

a. Whether an employee is considered a "Qualified Person" will depend upon various circumstances in the workplace. It is possible and likely for an individual to be considered "qualified" with regard to certain equipment in the workplace, but "unqualified" as to other equipment.

b. An employee, who is undergoing on-the-job training for the purpose of obtaining the skills and knowledge necessary to be considered a qualified person and who, in the course of such training, has demonstrated an ability to perform specific duties safely at his or her level of training and who is under the direct supervision of a Qualified Person, will be considered a Qualified Person for the performance of those specific duties.

29. Receptacle. A receptacle is a contact device installed at the outlet for the connection of an attachment plug.

30. Restricted Approach Boundary (RAB). An approach limit at a distance from an exposed energized electrical conductor or circuit part within which there is an increased risk of shock, due to electrical arc over combined with inadvertent movement, for personnel working in close proximity to the energized electrical conductor or circuit part.

31. Service Entrance Equipment. The necessary equipment, usually consisting of a circuit breaker(s) or switch(es) and fuse(s) connected to the utility electric supply system. This equipment is intended to constitute the main control and cutoff of the supply.

32. Shock Hazard. A dangerous condition associated with a possible release of energy caused by contact or approach to energized electrical conductors or circuit parts.

33. Shock Hazard Analysis. An analysis to determine the exposure voltage, boundary requirements, and personal protective equipment necessary to minimize the possibility of an electric shock to personnel.

34. Step Potential. A ground potential gradient difference that can cause current flow from foot to foot, through the body.

35. Short Circuit Current. Current through an unintended path of low resistance that increases to an abnormally high level. The short circuit current is determined by the impedance of the path, and the combination of voltage and impedance from the supply system.

36. Switchboard. A large single panel, frame, or assembly of panels, which are mounted on the face, back, or both, switches, overcurrent and other protective devices, buses, and usually instruments. Switchboards are generally accessible from the rear as well as from the front and are not intended to be installed in cabinets. (See **Panel board**).

37. Touch Potential. A ground potential gradient difference that can cause current flow from hand to hand, hand to foot, or another path other than foot to foot, through the body.

38. Unqualified Person. A person who is not a Qualified Person. (See Chapter 1, Paragraph 6 n. (2)).

Appendix C. Drivers, Regulatory, and Consensus Requirements

1. Regulations and Consensus Standards.

a. Occupational Safety and Health Administration (OSHA) 29 CFR 1910, Occupational Safety and Health Standards

b. OSHA 29 CFR 1926, Safety and Health Regulations for Construction

c. 2011 National Fire Protection Association (NFPA) 70, National Electrical Code

d. 2012 NFPA 70E, Standard for Electrical Safety in the Workplace

e. 2010 NFPA 70B, Recommended Practice for Electrical Equipment Maintenance

f. 2002 IEEE 1584, Guide for Performing Arc Flash Hazard Calculations

g. Illuminating Engineering Society of North America (IESNA) Lighting Handbook

2. FAA Orders and Standards.

a. FAA Order 3900.19B, Occupational Safety and Health Program

b. FAA Order 6980.24B, Battery Theory and Selection Guidelines

c. FAA Order 6980.25C, Maintenance of Batteries For Standby Power

d. FAA Order 6980.31, Maintenance of Direct Current (DC) Bus Power System

e. FAA Order 6950.27, Short Circuit Analysis and Protective Device Coordination Study

f. FAA Standard FAA-STD-019, Lightning and Surge Protection, Grounding, Bonding and Shielding Requirements For Facilities and Electronic Equipment

g. FAA Human Factors Design Standard

3. Equipment Standards

a. American Society for Testing and Materials (ASTM) standard F711 2007, Standard Specification for Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used in Live Line Tools

b. ASTM F855 2009, Standard Specification for Temporary Protective Grounds to Be Used on Deenergized Electric Power Lines and Equipment

c. ASTM D178 2010, Standard Specification for Rubber Insulating Matting

d. ASTM D120 2009, Standard Specification for Rubber Insulating Gloves

e. ASTM D1048 2012, Standard Specification for Rubber Insulating Blankets

f. ASTM D1051 2008, Standard Specification for Rubber Insulating Sleeves

g. ASTM F479 2011, Standard Specification for In Service Care of Insulating Blankets

h. ASTM F496 2008, Standard Specification for In Service Care of Insulating Gloves and Sleeves

i. ASTM F1236 2012, Standard Guide for Visual Inspection of Electrical Protective Rubber Products

j. ASTM F1505 2010, Standard Specification for Insulated and Insulating Hand Tools

k. ASTM F1117 2008, Standard Specification for Dielectric Footwear

l. ASTM F696 2011, Standard Specification for Leather Protectors for Rubber Insulating Gloves and Mittens

m. American National Standards Institute (ANSI) ANSI Z535.2 2011, American National Standard for Environmental and Facility Safety Signs

Appendix D. EEWP Instructions

1. [Appendix E] Permit Layout. The EEWP is divided into three sections, which require user input from the requester, the Qualified Person performing the work, and the Front Line Manager authorizing the energized work. Energized work is not permitted, unless de-energizing (the equipment) introduces additional or increased hazards or is infeasible due to equipment design or operational limitations.

2. Part I –Description and Justification of the Work Requested. This section is to be completed by the requester. The scope of the work requested and the justification for energized work is entered in this section.

3. Part II – Procedures and Required PPE. This section must be completed by the Qualified Person performing the energized work. Details of the job description procedure, safe work practices, and shock and arc flash hazard analysis, and required PPE, must be entered in this section. The Qualified Person must specify whether the work described may be performed safely.

a. Shock Hazard Analysis. Refer to warning label, or the appropriate NFPA 70E Table 130.4(C)(a) or 130.4(C)(b) to determine approach boundaries.

b. Arc Flash Hazard Analysis. Refer to warning label or NFPA 70E Table 130.7(C)(15)(a), to determine the arc flash boundary.

c. Other Notes: This section is to record additional safety procedures or special requirements related to multi-employer worksites that may involve specific communication, or planning. If contract personnel are working on exposed energized conductors or circuit parts, a separate EEWP may need to be generated for the vendor's qualified persons.

4. Part III – Approval to Perform Work While Electrically Energized. This section must be completed by the Front Line Manager of the Qualified Person(s) doing the work. The manager must state the reason(s) for the work request and provide justification for not deenergizing the equipment.

a. The manager may approve or deny the request for the energized work.

b. The EEWP cannot be approved by the manager if the Qualified Person performing the work has determined that the energized work cannot be performed safely.

5. Electronic Version of EEWP. An electronic version of the EEWP is available from the OSH professionals in the Service Areas, and also at:
https://employees.faa.gov/org/linebusiness/ato/operations/technical_operations/atc_facilities/eosh_services/osh/es/regulation/

Appendix E. Energized Electrical Work Permit

FAA ENERGIZED ELECTRICAL WORK PERMIT

(PERMIT SHALL BE PRESENT AT JOBSITE WHILE ENERGIZED WORK IS BEING PERFORMED)

Note: *Work on energized electrical conductors or circuit parts by qualified persons related to tasks such as testing, troubleshooting, voltage measurement, etc., is permitted without this permit, only if the appropriate electrical safe work practices and PPE are used.*

PART I – DESCRIPTION AND JUSTIFICATION

(To be completed by the Requester)

Permit ID#:

Work Site:	Work Area:	
Facility Manager/Owner:	Phone:	Date Contacted:
Equipment Description:		Equipment ID#:

Project Start Date:	Project Start Time:	Project Duration:

Scope of Work:

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

Requested By:

(Requestor Signature)	(Title)	(Date)	(Phone)

PART II – PROCEDURES AND REQUIRED PPE

(To be completed by the Qualified Person performing the work)

DETAILED JOB DESCRIPTION PROCEDURE OR SOP REFERENCE TO BE USED WHILE PERFORMING THE WORK DESCRIBED ABOVE:

Shock Hazard Analysis:	**NOMINAL VOLTAGE** of exposed, energized circuit parts/conductors:		
	LIMITED Approach Boundary (exposed **movable** conductors) is:		
	LIMITED Approach Boundary (exposed **fixed** circuit parts) is:		
	RESTRICTED Approach Boundary is:		
	PROHIBITED Approach Boundary is:		
Arc Flash Hazard Analysis:	**FLASH** Boundary:	**Determined By:**	**Hazard Risk Category:**

PART II – PROCEDURES AND REQUIRED PPE

(To be completed by the Qualified Person performing the work)

DESCRIPTION OF SAFE WORK PRACTICES TO BE USED:

Yes	N/A	Equipment/Tools and Methods	In Place	Yes	N/A	PPE & Insulating/Shielding Materials	In Place
☐	☐	Restrict access to protect unqualified personnel	☐	☐	☐	Hardhat	☐
☐	☐	Eyewash/body irrigation facilities available	☐	☐	☐	Ear Canal Inserts	☐
☐	☐	Fire extinguisher accessible	☐	☐	☐	Insulating rubber gloves	☐
☐	☐	Emergency plan/phone numbers posted	☐	☐	☐	Leather protectors	☐
☐	☐	Communications equipment accessible	☐	☐	☐	Insulated sleeves	☐
☐	☐	Supplemental lighting (non-conductive)	☐	☐	☐	Safety glasses w side shields	☐
☐	☐	Fuse puller (non-conductive)	☐	☐	☐	Arc rated face shield	☐
☐	☐	Rope/handline (non-conductive)	☐	☐	☐	AR clothing (arc flash)	☐
☐	☐	Portable GFCI for tools (test before use)	☐	☐	☐	Leather work shoes	☐
☐	☐	Protective grounding set (inspect before use)	☐	☐	☐	Splash goggles	☐
☐	☐	Ladder (non conductive siderails)	☐	☐	☐	Splash face shield	☐
☐	☐	Means to secure doors/panels	☐	☐	☐	Apron/coverall (chemical resistant)	☐
☐	☐	Test equipment required	☐	☐	☐	Gloves (chemical resistant)	☐
☐	☐	Insulated rubber mat (rubber, voltage rated)	☐	☐	☐	Sleeves (chemical resistant)	☐
☐	☐	Insulated rubber blanket (rubber, voltage rated)	☐	☐	☐	Shoes (chemical resistant)	☐
☐	☐	Insulated tools (voltage rated – 1000V)	☐	☐	☐	Apron/coverall (chemical resistant)	☐
				☐	☐	Arc flash suit hood	☐

Means Used to Restrict Access:	☐ Warning signs/tags ☐ Barricades ☐ Attendants
Type/Ratings of Test Equipment:	
Type/Class of Insulating Materials:	
Type/Ratings of Chemical Resistant Materials:	
Type/NRR of Hearing Protection:	
Type/Rating of AR Clothing Ensemble:	
Special Notes:	

Pre-job Requirements (check when complete):

- ☐ Review electrical diagrams, nameplate, related Orders/manuals
- ☐ Notify affected operations/personnel
- ☐ Conduct job briefing with employees involved in task
- ☐ Remove conductive apparel/jewelry
- ☐ Restrict access to unqualified personnel
- ☐ Determine equipment, Tools, PPE needed for task
- ☐ Inspect/test PPE, insulating materials, tools and test equipment
- ☐ Check safe work clearances
- ☐ Put on PPE and use insulated tools where required
- ☐ Determine safe body positioning for work
- ☐ Open electrical enclosure
- ☐ Install protective barriers on exposed energized parts if applicable

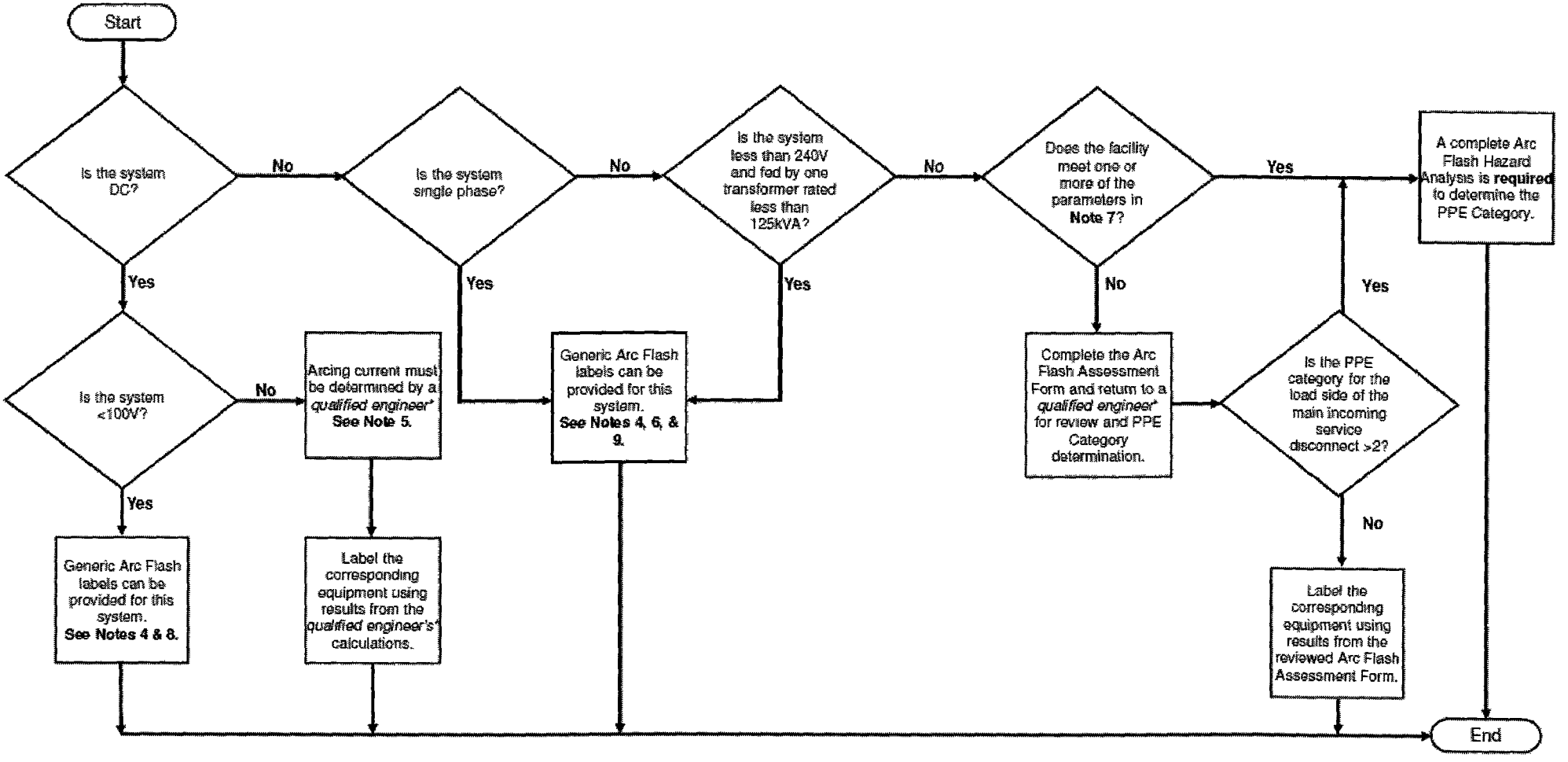
Other Notes:			
Qualified persons authorized to perform the work described (list names):			
Do you agree that the work described can be performed safely?	☐ Yes ☐ No (if no explain)		
Signature of the Qualified Person	(Qualified Person Signature/Title)	(Date)	(Phone)

PART III – APPROVAL TO PERFORM THE WORK WHILE ELECTRICALLY ENERGIZED

(To be completed by the manager of the Qualified Person performing the energized work)

Reason for Request:		**Next Date Available for Shutdown:**	
Justification for not De-energizing:			
Approval or Denial of Permit:	☐ I deny the energized work permit and require shutdown and lockout/tagout. ☐ I approve the energized work to be performed and acknowledge the associated risks.		
Signature of FAA Manager/Supervisor:	(FAA Manager/Supervisor or Authorized Designee Signature/Title)	(Date)	(Phone)

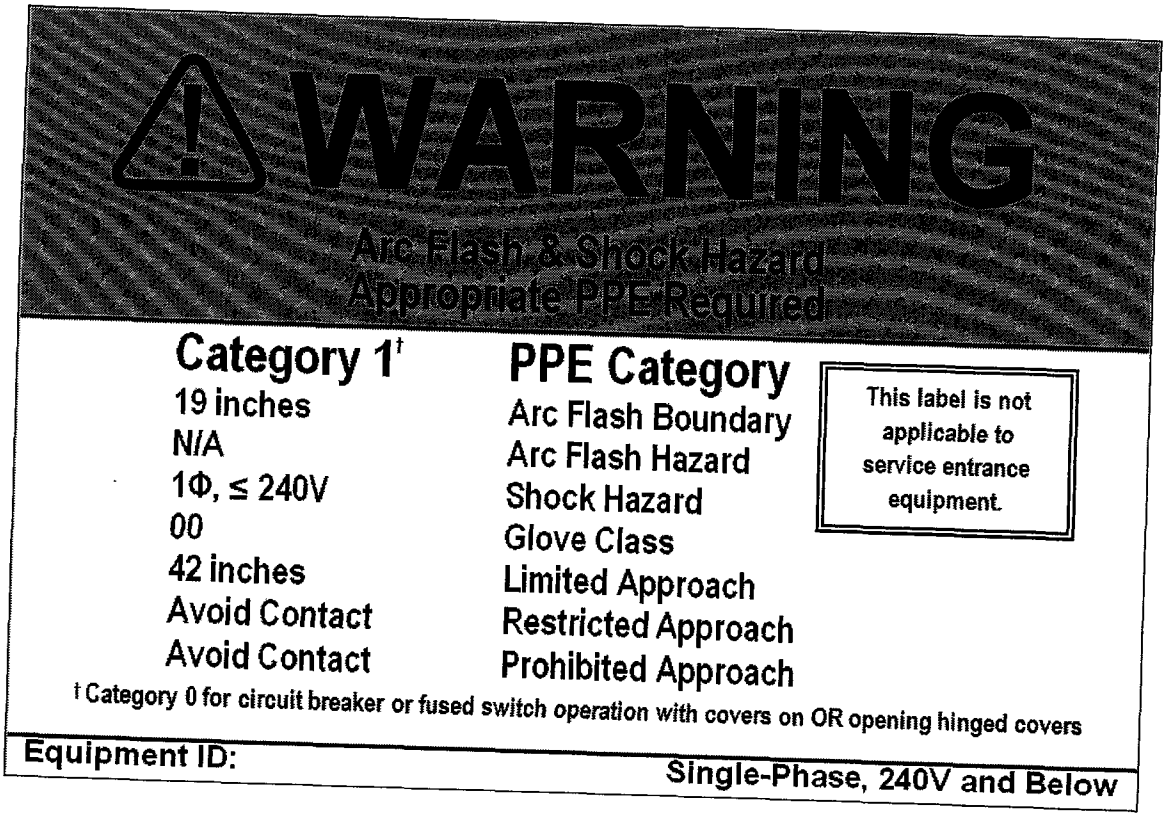
Note: When work is complete, the original EEWP must be retained by the FAA Manager/Supervisor for 3 (three) years.

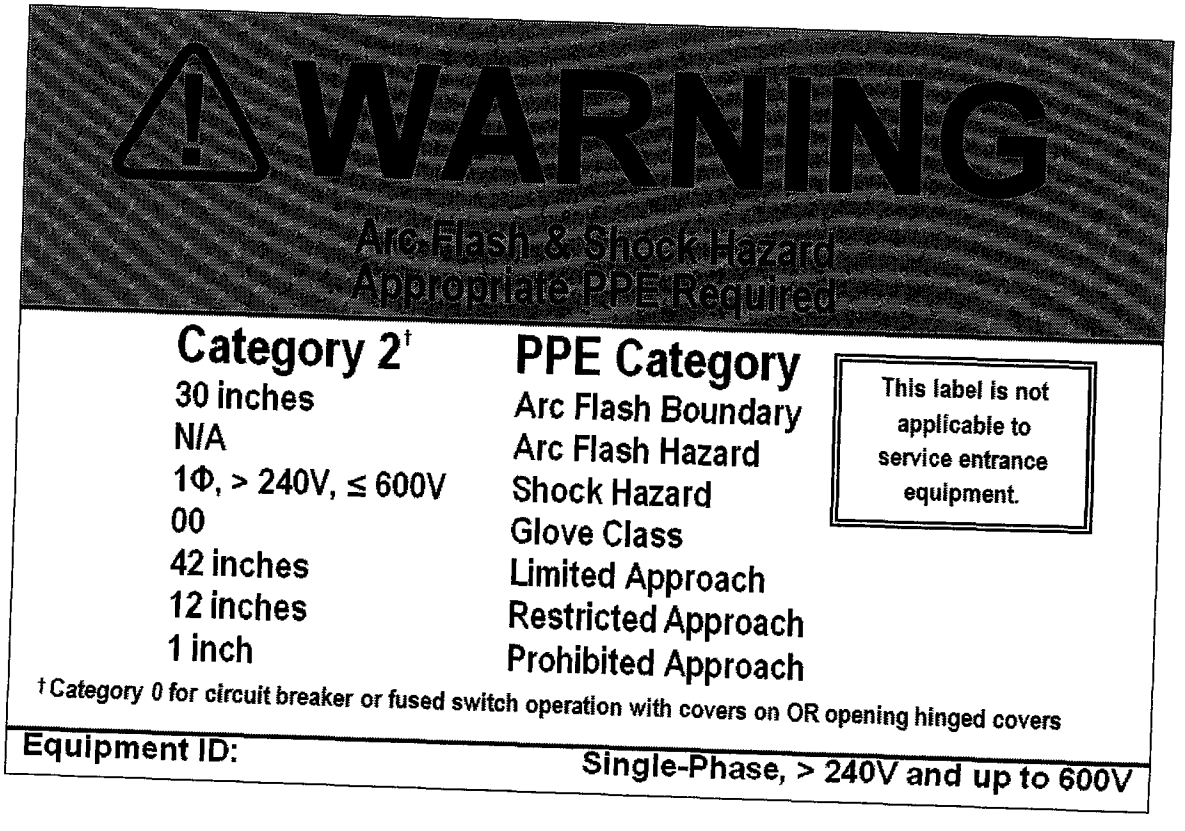


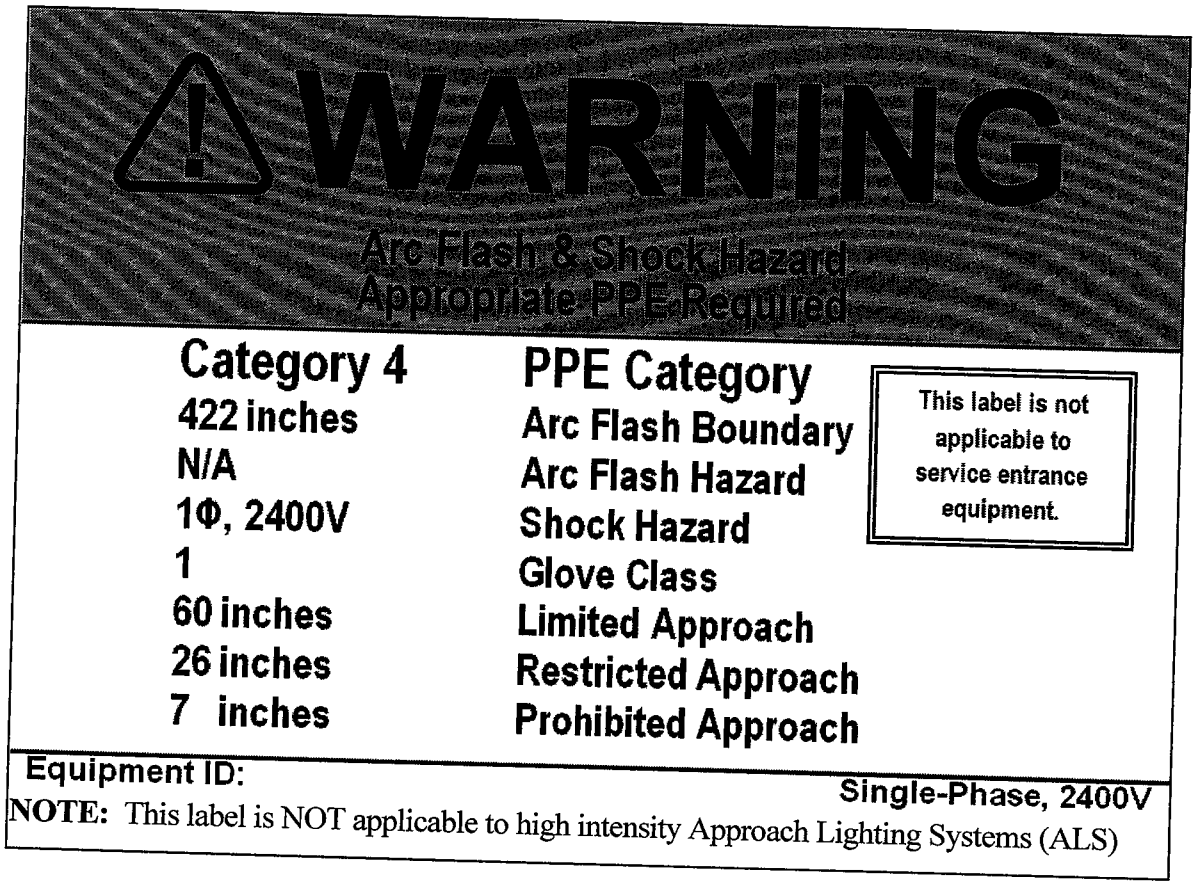
1. If a *qualified engineer** determines that a system may be hazardous due to possible configuration anomalies, an arc flash hazard analysis may be performed at his/her discretion.
2. This flow chart will be reviewed on a regular basis and may be modified as new requirements or guidance are published.
3. Per ***FAA Order 6950.27***, a short circuit analysis and protective device coordination study shall be completed as part of the initial design package and whenever existing facilities are undergoing major modifications to the facility power system or major electronic/electrical equipment installations are accomplished.
4. Work performed on a service entrance disconnect or power panel must be done in a deenergized state if an AFHA has not been performed; this excludes breaker operation with covers on or opening a hinged cover to perform a visual inspection. Refer to NFPA 70E Table 130.7(C)(15)(a) for these specific tasks on service entrance equipment.
5. With the calculated arcing current, use ***NFPA 70E table 130.7(C)(15)(b)*** to determine the required PPE.
6. If generic labels are not affixed to equipment, refer to NFPA 70E Table 130.(C)(15)(a)for PPE requirements. This table applies only to equipment downstream of the service entrance disconnect or power panel.
7. The facility is (a) fed by more than one transformer or (b) contains an engine generator with a manufacturer standby rating greater than or equal to 100kW.
8. If generic labels are not affixed to equipment, work can be performed in PPE Category 0 and Class 00 rubber insulating gloves. This applies only to DC equipment operating at less than 100V.
9. Generic labels will not be provided for high intensity ALS systems (ALSF-I, ALSF-II, ALSF-II/SSALR, SSALR, SSALF, or SSALS). Please complete the Assessment form located at http://arcflash.faa.gov to obtain calculations.

* One who is experienced in performing arc flash studies and is familiar with the applicable standards and calculations included in ***NFPA 70E*** and ***IEEE1584***.

Appendix G. Example Generic Labels







WARNING

Arc Flash & Shock Hazard
Appropriate PPE Required

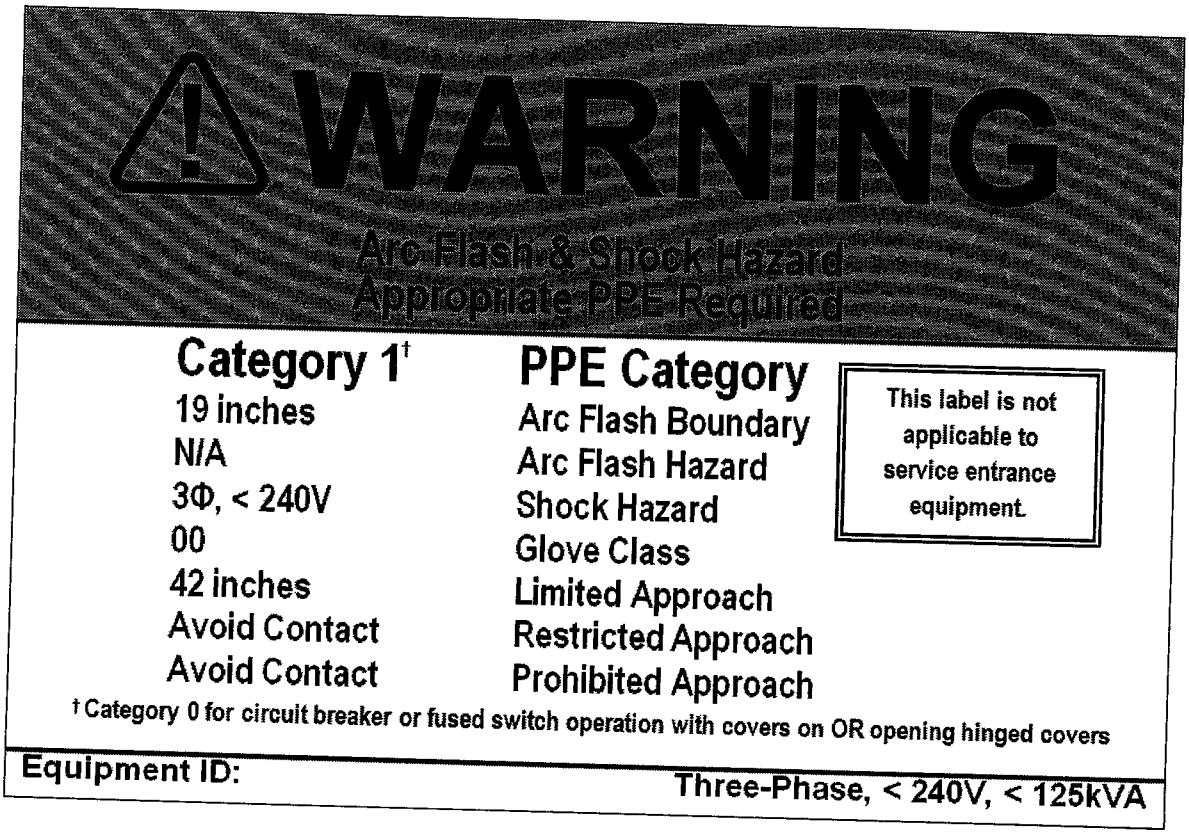
Category 4	PPE Category
422 inches	Arc Flash Boundary
N/A	Arc Flash Hazard
1Φ, 2400V	Shock Hazard
1	Glove Class
60 inches	Limited Approach
26 inches	Restricted Approach
7 inches	Prohibited Approach

This label is not applicable to service entrance equipment.

Equipment ID:

Single-Phase, 2400V

NOTE: This label is NOT applicable to high intensity Approach Lighting Systems (ALS)



WARNING

Arc Flash & Shock Hazard
Appropriate PPE Required

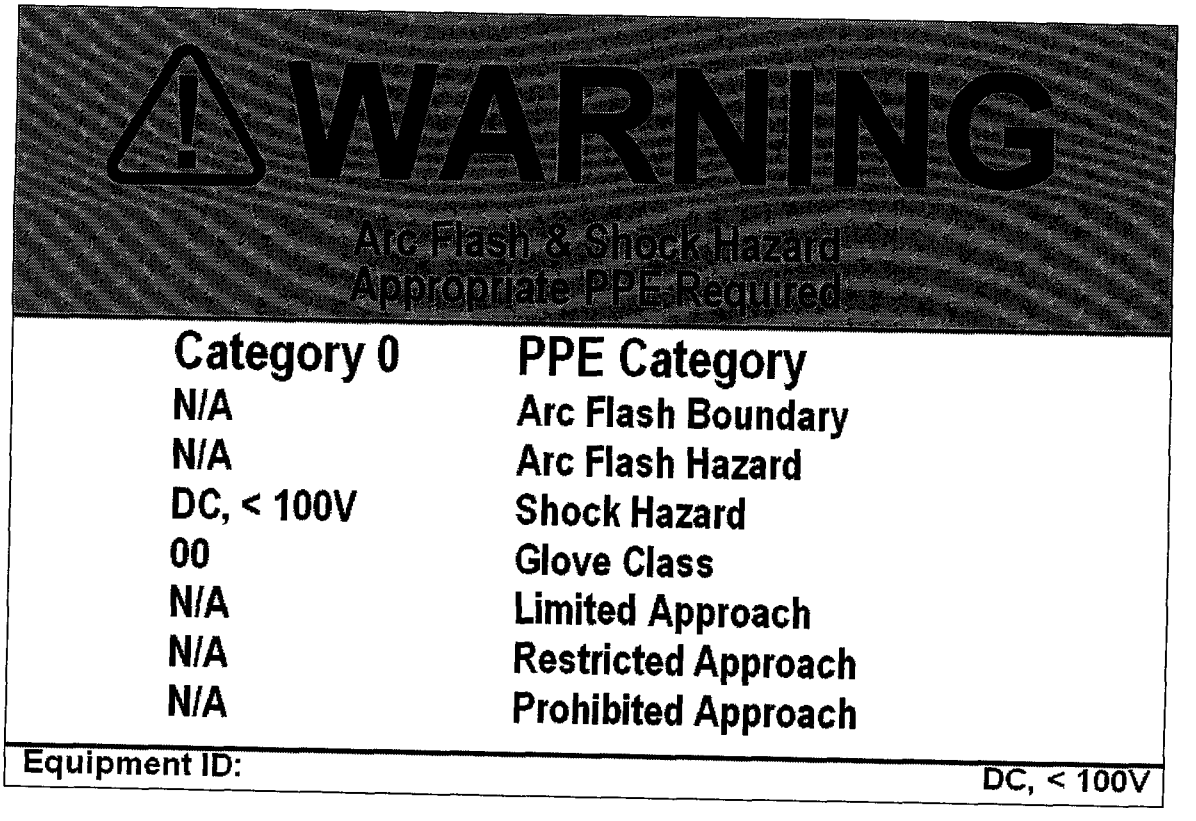
Category 1†	PPE Category
19 inches	Arc Flash Boundary
N/A	Arc Flash Hazard
3Φ, < 240V	Shock Hazard
00	Glove Class
42 inches	Limited Approach
Avoid Contact	Restricted Approach
Avoid Contact	Prohibited Approach

This label is not applicable to service entrance equipment.

† Category 0 for circuit breaker or fused switch operation with covers on OR opening hinged covers

Equipment ID:

Three-Phase, < 240V, < 125kVA

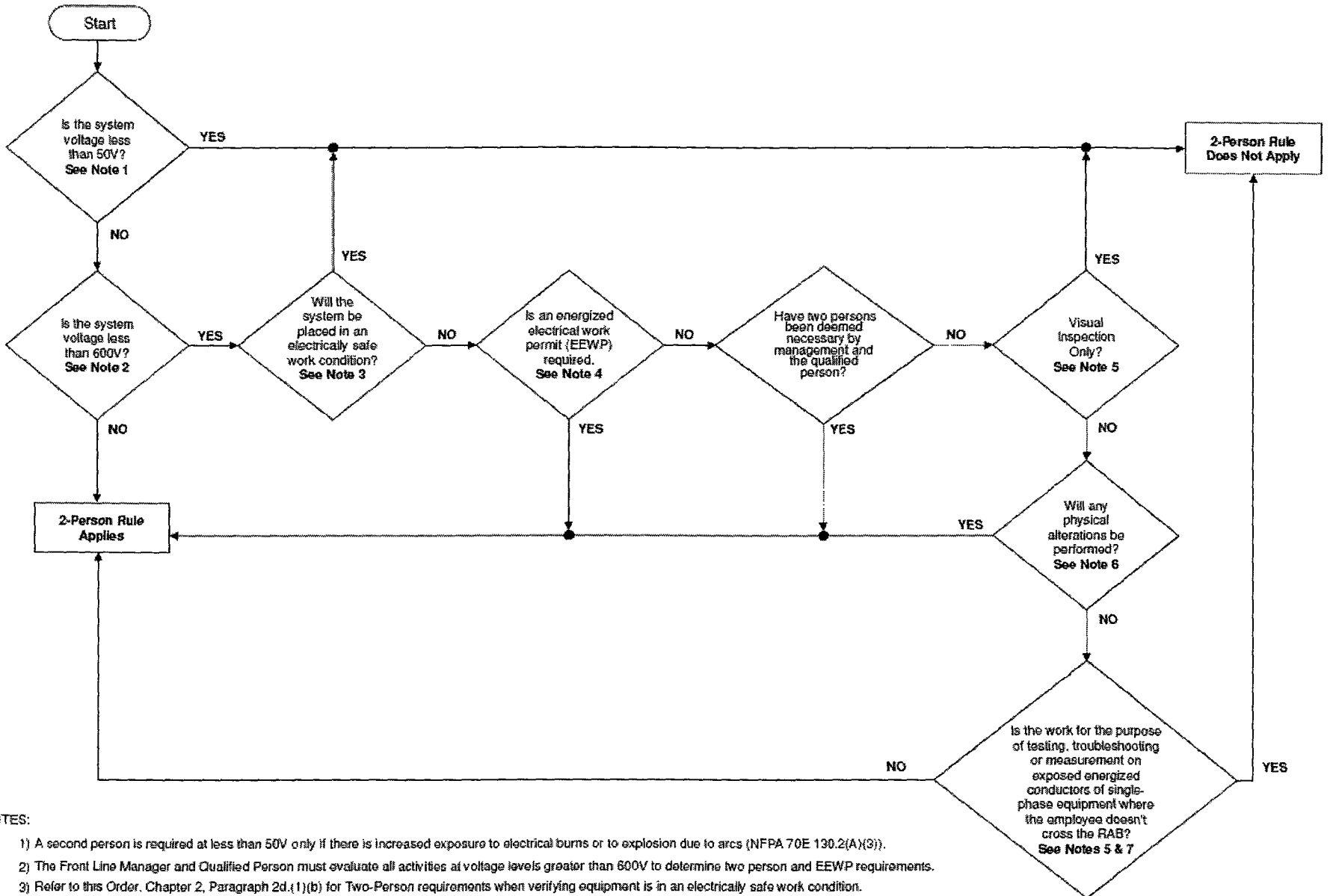


WARNING

Arc Flash & Shock Hazard
Appropriate PPE Required

Category 0	PPE Category
N/A	Arc Flash Boundary
N/A	Arc Flash Hazard
DC, < 100V	Shock Hazard
00	Glove Class
N/A	Limited Approach
N/A	Restricted Approach
N/A	Prohibited Approach

Equipment ID: DC, < 100V



NOTES:

1) A second person is required at less than 50V only if there is increased exposure to electrical burns or to explosion due to arcs (NFPA 70E 130.2(A)(3)).
2) The Front Line Manager and Qualified Person must evaluate all activities at voltage levels greater than 600V to determine two person and EEWP requirements.
3) Refer to this Order, Chapter 2, Paragraph 2d.(1)(b) for Two-Person requirements when verifying equipment is in an electrically safe work condition.
4) Refer to this Order, Chapter 2, Paragraph 3 for Energized Electrical Work Permit Requirements.
5) Two persons are required when an employee modifies, removes, or bypasses existing safety features of the equipment (e.g. removing a bolted cover from a power panel).
6) Physical alterations include, but are not limited to: making or tightening a connection, or removing or replacing components on energized equipment.
7) RAB <301V = avoid contact, 301-750V = one foot.

Appendix I. Personal Protective Equipment (PPE) Categories

PPE Category 0

- **Protective Clothing, Nonmelting or Untreated Natural Fiber (i.e., untreated cotton, wool, rayon, or silk or blends of these materials with a Fabric Weight of at Least 4.5 oz/yd^2**
  - 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)*

PPE Category 1

- **Arc-Rated Clothing, Minimum Arc Rating of 4 cal/cm^2** *(See Note 3)*
  - Arc-rated long sleeve shirt and pants or arc-rated coverall
  - Arc-rated face shield or arc flash suit hood *(See Note 2)*
  - 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)*

PPE Category 2

- **Arc-Rated Clothing, Minimum Arc Rating of 8 cal/cm^2** *(See Note 3)*
  - Arc-rated long-sleeve shirt and pants or arc-rated coverall
  - Arc-rated flash suit 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

PPE Category 3

- **Arc-Rated Clothing, Minimum Arc Rating of 25 cal/cm^2** *(See Note 3)*
  - Arc-rated long-sleeve shirt and pants or arc-rated coverall *(AR)*
  - Arc-rated flash suit hood
  - Arc-rated jacket, parka, rainwear, or hard hat liner *(AN)*
  - Arc-rated gloves *(See Note 1)*
  - Arc-rated arc flash suit jacket *(AR)*
- **Protective Equipment**
  - Hard Hat
  - Safety glasses or safety goggles *(SR)*
  - Hearing protection *(Ear Canal Inserts)*
  - Heavy duty leather gloves
  - Leather work shoes

PPE Category 4

- **Arc-Rated Clothing, Minimum Arc Rating of 40 cal/cm^2** *(See Note 3)*
  - Arc-rated long-sleeve shirt and pants or arc-rated coverall *(AR)*
  - Arc-rated flash suit hood
  - Arc-rated jacket, parka, rainwear, or hard hat liner *(AN)*
  - Arc-rated gloves *(See Note 1)*
  - Arc-rated arc flash suit jacket *(AR)*
- **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 NFPA 70E Table 130.7(C)(15)(a), 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 the value attributed to materials that describes their performance to exposure to an electric arc discharge. The arc rating is expressed in cal/cm2 and is derived from the determined value of 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 breakopen. Arc rating is reported as either ATPV or EBT, whichever is the lower value.

Appendix J. Short Circuit Current/Clearing Time Supporting Documentation

							Clearing Times (sec)	
Transformer Size (kVA)	System Type (phase)	Impedance (%)	Max. Available Fault Current (A)	Voltage (LL or Single Phase), (V)	Full Load Current (A)	Overcurrent Protective Device Size (A)	Fuses (Based on Bussmann Fusetron Type)	Molded Case Circuit Breaker (Based on Square D Type LA (400A or less) & LI (500A)
75	3	1.7	12,246	208	208	250	0.01	0.017
112 5	3	1.7	18,369	208	312.5	400	0.01	0.017
150	3	1.7	24,492	208	417	500	0.01	0.017
150	3	1.7	10,613	480	181	225	0.01	0.017
225	3	1.7	15,920	480	271	350	0.01	0.017
300	3	1.7	21,226	480	361	450	0.01	0.017
350	3	1.7	24,764	480	421	500	0.01	0.017
50	1	1.7	12,255	240	208	250	0.01	0.017
75	1	1.7	18,382	240	360	400	0.01	0.017
100	1	1.7	24,510	240	416	500	0.01	0.008

Assumptions: Minimum transformer impedance, 1.7%
Infinite bus on primary side of transformer.

Appendix K. Administrative Information

1. Distribution. To ATO field offices, all other offices can access this order on the DMS website referenced in Chapter 1, Paragraph 3.