New Paltz
STATE UNIVERSITY OF NEW YORK

POLICIES AND PROCEDURES

DEPARTMENT: Environmental Health and Safety

SUBJECT: ARC FLASH and Electrical Safety Program

Reviewed	04/2009	01/2012	03/2014	08/2016	03/2017			
Revised	04/2009	01/2012	03/2014	08/2016	03/2017			

Original Date of Issue: 04/14/2009

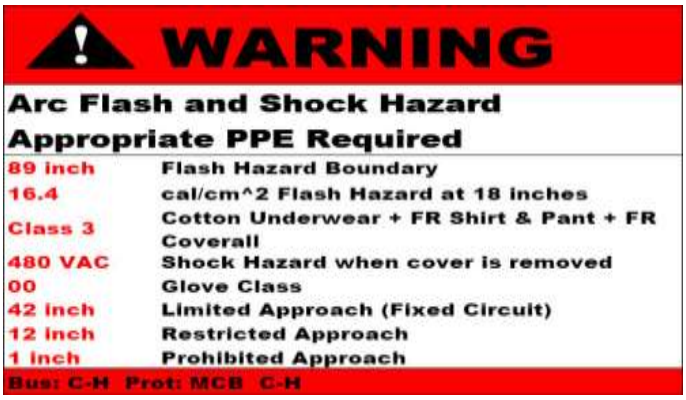
1. Background

This guidance document provides guidelines on selection of Personal Protective Equipment (PPE) for protection from electric arc flash from equipment for which detailed arc hazard analysis has not been performed. This guidance applies to situations in which staff may be exposed to arc flash from high voltage switches or live unguarded electrical wires, parts or equipment with voltages above 50 Volts. PPE is not required when working in proximity to electrical equipment in enclosed panels with no exposed connectors, where electrical work is not being performed and where no high voltage switch is being operated.

An arc flash may occur when electrical current "short circuits," that is, flows from energized wires or equipment to ground, or between energized wires or equipment with different phases or potential. An arc flash may also occur during movement of energized electrical contactors, such as switches. The arc flash creates electrically conductive superheated plasma that can reach temperatures of 5000° F and above. Occurring in a fraction of a second, it produces a brilliant flash, intense heat, and a shock wave. The magnitude of the energy and other factors will determine the severity of the arc flash.

This guidance is derived from the National Fire Protection Association's (NFPA) NFPA 70E, *Standard for Electrical Safety in the Workplace.* This document will summarize key provisions of NFPA 70E as they apply to work conducted by SUNY NP FOC employees. Refer to NFPA 70E for additional information.

This guidance should be used unless there is a detailed arc hazard analysis and Hazard Mitigation Plan that has calculated arc flash energy and established PPE requirements for the specific equipment being worked on. Those pieces of equipment which have undergone a detailed arc flash analysis shall be labeled with a label such that pictured below. You must follow the specifications on those labels.



2. <u>Definitions</u>

Arc Rating [NFPA 70E] – The maximum incident energy resistance demonstrated by a material (or a layered system of materials) prior to break open or at the onset of a second-degree skin burn. Arc rating is normally expressed in cal/cm^2.

Boundaries:
Limited Approach Boundary - a shock protection boundary to be crossed by only qualified persons (at a distance from a live part) which is not to be crossed by unqualified persons unless escorted by a qualified person". The limited approach boundary is the minimum distance from the energized item where unqualified personnel may safely stand. No untrained personnel may approach any closer to the energized item than this boundary. . See Tables 1a and 1b in this document.

Restricted Approach Boundary
A shock protection boundary to be crossed by only qualified persons (at a distance from a live part) which, due to its proximity to a shock hazard, requires the use of shock protection techniques and equipment when crossed. To cross the Restricted Approach Boundary into the *Restricted Space*, the qualified person, who has completed required training, must wear appropriate personal protective equipment (PPE). Also, he must have a written approved plan for the work that they will perform and plan the work to keep all parts of the body out of the *Prohibited Space*. See Tables 1a and 1b in this document.

Prohibited Approach Boundary
A shock protection boundary to be crossed by only qualified persons (at a distance from a live part) which, when crossed by a body part or object, requires the same protection as if direct contact is made with a live part. Only qualified personnel wearing appropriate personal protective equipment (PPE), having specified training to work on energized conductors or components, and a documented plan justifying the need to perform this work may cross the boundary and enter the *Prohibited Space*. Therefore, personnel must obtain a risk assessment before the prohibited boundary is crossed. . See Tables 1a and 1b in this document.

Circuit Breaker [NFPA 70E] – A device designed to open and close a circuit by non-automatic means and to open the circuit automatically when a predetermined over current occurs without damage to itself when properly applied within its rating.

Dead Front [NFPA 70E] – Without live parts exposed to a person on the operating side of the equipment.

Disconnecting Means [NFPA 70E] – A device, or group of devices, or other means by which the conductors of a circuit can be disconnected from their source of supply.

Electrical Glove Class (as specified on Arc Flash Labels):

Electrical protective gloves are categorized by the level of voltage protection provided, which are rated by Class. Ozone resistance is noted by Type. Type I gloves **are not** ozone resistant. Type II gloves **are** resistant to ozone.

- Class 00 - 500 Volts Maximum
- Class 0 - 1,000 Volts Maximum
- Class 1 - 7,500 Volts Maximum
- Class 2 - 17,000 Volts Maximum
- Class 3 - 26,5000 Volts Maximum
- Class 4 - 36,000 Volts Maximum

Electrical Hazard [NFPA 70E] – A dangerous condition such that contact or equipment failure can result in electric shock, arc flash burn, thermal burn or blast.

Entry into the Flash Protection Boundary occurs when the face, head or trunk of the person crosses the boundary. Within this boundary workers are required to wear appropriate PPE. [Note: if hands cross the boundary, PPE is required on the hands and arms]

Exposed (as applied to live parts) [NFPA 70E] – Capable of being inadvertently touched or approached nearer than a safe distance by a person. It is applied to parts that are not suitably guarded, isolated, or insulated.

Exposed (to arc flash hazard) – Within the flash protection boundary during work activities on or close to unguarded energized electric wires or equipment, or activation of unguarded energized electrical switches. This includes opening of electrical enclosures.

Flash Hazard [NFPA 70E] – A dangerous condition associated with the release of energy caused by an electric arc.

Flash Protection Boundary [NFPA 70E] – An approach limit at a distance from exposed live parts within which a person could receive a second degree burn if an electrical arc flash were to occur.

Flash Suit [NFPA 70E] – A complete system of fire retardant clothing and equipment that covers the entire body, except for the hands and feet including pants, jacket, and bee-keeper type hood fitted with a face shield.

Opening Door - To move (as a breaker box door) from a closed position by making available for entry, by turning back (as a barrier) or by removing (as a panel cover or obstruction).

Qualified Person [NFPA 70E] – One who has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training on the hazards involved.

Working On (live parts) [NFPA 70E] – Coming into contact with live parts greater than 50 Volts with the hands, feet, or other body parts, with tools, probes, or with test equipment, regardless of the PPE a person is wearing.

3. <u>Responsibilities</u>

Only Qualified Person(s) (defined above) are allowed to work on electrical equipment.

Supervisors of Qualified Persons shall ensure that employees comply with the requirements set forth in this guidance, including the correct use of PPE, that employees are assigned work for which they are qualified, and that appropriate training has been conducted for staff to perform their jobs safely. Supervisors are also required to ensure the availability of the correct PPE for their employees.

Individuals opening or exposing energized electrical wires or equipment are responsible for assessing the requirements of this guideline and taking appropriate measures to protect themselves and others from potential arc flash hazards. These measures include confirming and wearing the correct PPE. Ensuring the PPE is in good repair prior to use and replaced when found not to be in good repair. See the SUNY NP Personal Protective Equipment procedure for a complete listing of responsibilities associated with any PPE.

Employees will perform only those tasks for which they are qualified, shall understand the basic principles of high voltage electricity, hazardous energy control and electrical safety procedures. Employees shall use the proper tools and required PPE, and shall request supplemental training and information whenever necessary.

4. Safeguarding Electrical Parts and Equipment

Whenever possible, live parts to which an employee might be exposed shall be put into an electrically safe work condition before an employee works on or near them. This may be done by de-energizing and locking out, insulating or enclosing.

When safeguarding is not feasible, precautions for protection from arc flash and electric shock are required.

5. "Dead Front" Equipment

Dead front equipment is equipment within enclosures or panels without live parts exposed to a person on the operating side of the equipment. This includes disconnects, control panels, switches, breakers, and motor controls within enclosures with the doors closed and secured.

Arc flash PPE is not required when operating this equipment. It is a recommended practice for electricians and other employees who commonly operate this equipment to wear non-melting clothes and safety glasses.

It is also a good practice when an employee is switching disconnect switches for him/her to stand to the hinge side of door, so that he/she is out of the direct line of fire if a catastrophic fault occurs when the switch is operated. Further protection would be afforded by taking a deep breath and facing away from the switch, before throwing the switch.

6. Exposure to Arc Flash

The potential for arc flash exists when there is a potential for an electrical current to short circuit. A short circuit occurs when current flows from energized wires or equipment to ground, or between energized wires or equipment with different phases or potential. An arc flash may also occur during movement of energized electrical contactors.

Exposure to an arc flash hazard occurs when a person is close enough to a potential source of arc flash that he/she may be injured if there is no protection such as an electrical enclosure or barrier.

Tasks such as opening electrical panels can result in an exposure to an arc flash hazard and may require protection. Servicing, maintenance and testing of energized circuits, or within equipment with energized circuits, creates an additional risk for arc flash through accidental contact of tools or equipment with un-insulated energized wires or parts.

Hazard distance requiring the use of PPE is defined by the Flash Protection Boundary.

7. <u>Flash Protection Boundary</u>

The Flash Protection Boundary is the distance from a potential source of arc flash within which arc flash PPE is required. Inside this boundary, it is estimated that a person could receive a second degree burn if an electrical arc flash were to occur. Entry into the Flash Protection Boundary occurs when the face, head or trunk of the person crosses the boundary.

Diagram 1

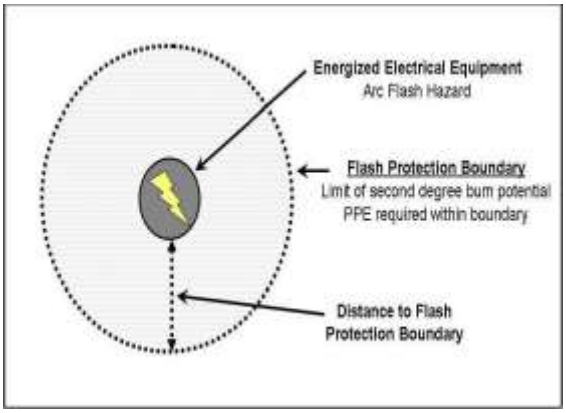
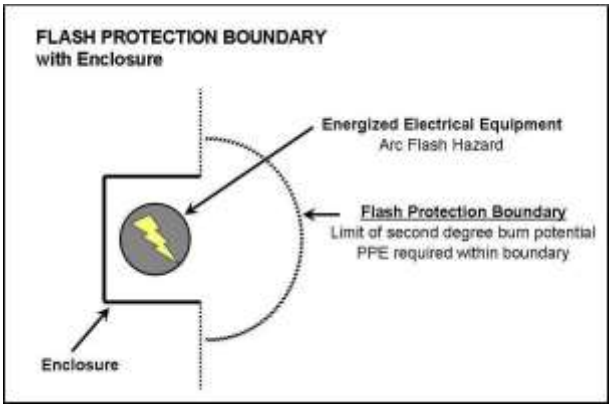


Diagram 2



Equipment-specific arc flash boundaries may depend upon numerous factors such as available fault level and trip characteristics of the upstream protective device, as determined in an arc hazard analysis. Default Flash Protection Boundaries are provided in this table based on the most conservative assumptions in NFPA 70E and may be used if there are no detailed arc hazard analyses and equipment-specific Hazard Mitigation Plan.

Arc in air (Diagram 1) means unenclosed, so that flash energy is dispersed in all directions. This type of exposure may occur when an employee is testing live wiring outside of an enclosure.

Most exposures will occur with equipment in enclosures (Diagram 2). The enclosure will direct the arc flash energy in the direction of the opening. This protects people away from the opening but increases the energy directed towards anyone in front of the opening.

Limited Approach Boundary - a shock protection boundary to be crossed by only qualified persons (at a distance from a live part) which is not to be crossed by unqualified persons unless escorted by a qualified person". The limited approach boundary is the minimum distance from the energized item where unqualified personnel may safely stand. No untrained personnel may approach any closer to the energized item than this boundary. . See Tables 1a and 1b in this document.

Restricted Approach Boundary
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See Tables on Next Page….

Table 1a Approach Boundaries to Energized Electrical Conductors or Circuit Parts for Shock Protection for Alternating-Current Systems (All dimensions are distance from energized electrical conductor or circuit part to employee.)

1	2	3	4
	Limited Approach Boundary (B)		Restricted Approach Boundary (B):
Nominal System Voltage Range, Phase to Phase (A)	Exposed Movable Conductors (C)	Exposed Fixed Circuit Part	Includes Inadvertent Movement Adder
< 50 V	Not Specified	Not Specified	Not Specified
50 V - 150 V(D)	3.0 m (10 ft 0 in)	1.0 m (3 ft 6 in)	Avoid Contact
151 V - 750 V	3.0 m (10 ft 0 in)	1.0 m (3 ft 6 in)	0.3 m (1 ft 0 in)
751 V - 15 kV	3.0 m (10 ft 0 in)	1.5 m (5 ft 0 in)	0.7 m (2 ft 2 in)
15.1 kV - 36 kV	3.0 m (10 ft 0 in)	1.8 m (6 ft 0 in)	0.8 m (2 ft 7 in)
36.1 kV - 46 kV	3.0 m (10 ft 0 in)	2.5 m (8 ft 0 in)	0.8 m (2 ft 9 in)
46.1 kV - 72.5 kV	3.0 m (10 ft 0 in)	2.5 m (8 ft 0 in)	1.0 m (3 ft 3 in)
72.6 kV - 121 kV	3.3 m (10 ft 8 in)	2.5 m (8 ft 0 in)	1.0 m (3 ft 4 in)
138 kV - 145 kV	3.4 m (11 ft 0 in)	3.0 m (10 ft 0 in)	1.2 m (3 ft 10 in)
161 kV - 169 kV	3.6 m (11 ft 8 in)	3.6 m (11 ft 8 in)	1.3 m (4 ft 3 in)
230 kV - 242 kV	4.0 m (13 ft 0 in)	4.0 m (13 ft 0 in)	1.7 m (5 ft 8 in)
345 kV - 362 kV	4.7 m (15 ft 4 in)	4.7 m (15 ft 4 in)	2.8 m (9 ft 2 in)
500 kV - 550 kV	5.8 m (19 ft 0 in)	5.8 m (19 ft 0 in)	3.6 m (11 ft 10 in)
765 kV - 800 kV	7.2 m (23 ft 9 in)	7.2 m (23 ft 9 in)	4.9 m (15 ft 11 in)

Note (1): For arc flash boundary, see 130.5(A)

Note (2): All dimensions are distance from exposed energized electrical conductors or circuit part to employee

(A): For single-phase systems above 250V, select the range that is equal to the system's maximum phase-to-ground voltage multiplied by 1.732.

(B): See definition in Article 100 and text in 130.4(D)(2) and Informative Annex C for elaboration.

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

Table 1b Approach Boundaries to Energized Electrical Conductors or Curcuit Parts for Shock Protection, Direct-Current Voltage Systems

1	2	3	4
	Limited Approach Boundary		Restricted Approach Boundary;
Nominal Potential	Exposed Movable	Exposed Fixed	Includes Inadvertent
< 100 V	Not Specified	Not Specified	Not Specified
100 V - 300 V	3.0 m (10 ft 0 in)	1.0 m (3 ft 6 in)	Avoid Contact
301 V - 1 kV	3.0 m (10 ft 0 in)	1.0 m (3 ft 6 in)	0.3 m (1 ft 0 in)
1.1 kV - 5 kV	3.0 m (10 ft 0 in)	1.5 m (5 ft 0 in)	0.5 m (1 ft 5 in)
5 kV - 15 kV	3.0 m (10 ft 0 in)	1.5 m (5 ft 0 in)	0.7 m (2 ft 2 in)
15.1 kV - 45 kV	3.0 m (10 ft 0 in)	2.5 m (8 ft 0 in)	0.8 m (2 ft 9 in)
45.1 kV - 75 kV	3.0 m (10 ft 0 in)	2.5 m (8 ft 0 in)	1.0 m (3 ft 2 in)
75.1 kV - 150 kV	3.3 m (10 ft 8 in)	3.0 m (10 ft 0 in)	1.2 m (4 ft 0 in)
150.1 kV - 250 kV	3.6 m (11 ft 8 in)	3.6 m (11 ft 8 in)	1.6 m (5 ft 3 in)
250.1 kV - 500 kV	6.0 m (20 ft 0 in)	6.0 m (20 ft 0 in)	3.5 m (11 ft 6 in)
500.1 kV - 800 kV	8.0 m (26 ft 0 in)	8.0 m (26 ft 0 in)	5.0 m (16 ft 5 in)

Note: All dimensions are distance from exposed energized electrical conductors or circuit parts to worker.

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

8. Personal Protective Equipment (PPE) Classifications

For all work involving potential exposure to energized unguarded or un-insulated electrical equipment and exposure to Arc Flash, non-melting clothing must be worn. Non-melting clothes are natural fibers such as cotton and wool. Synthetic clothing can melt and burn rapidly when exposed to heat or flame and can increase burn injuries. Electrical safety programs will also generally prohibit employees from wearing metallic jewelry and recommend not wearing clothing with metal closures (e.g., zippers, snaps).

In addition to non-melting clothing, the appropriate level of PPE must be worn for tasks in which exposure to an arc flash hazard within the flash protection boundary is possible.

PPE is designated according to Arc Rating. The higher the energy exposure, the higher the Arc Rating expressed in cal/cm^2. Typically, Flash Suits and Flash Hoods are rated on the inside tag, expressing what the Arc Rating is for that garment.

Electrical Glove Class (as specified on Arc Flash Labels):

Electrical protective gloves are categorized by the level of voltage protection provided, which are rated by Class. Ozone resistance is noted by Type. Type I gloves **are not** ozone resistant. Type II gloves **are** resistant to ozone.

- Class 00 - 500 Volts Maximum
- Class 0 - 1,000 Volts Maximum
- Class 1 - 7,500 Volts Maximum
- Class 2 - 17,000 Volts Maximum
- Class 3 - 26,5000 Volts Maximum
- Class 4 - 36,000 Volts Maximum

The following levels of protective clothing are specified in NFPA 70E Table for protection from arc flash and on Arc Flash Label. (Glove Class separated in above section)

Level 0 –
Non-Melting Long Sleeve Shirt;
Non-Melting Long Pants.
Safety Glasses.

Level 1 –
Minimum Arc Rating 4 cal/cm^2.
Flame Resistant (FR) Long Sleeve Shirt;
FR or Denim Long Pants;
FR Coveralls may be used instead of FR Shirt and Pants.
Hard Hat (Class E),
Arc Rated Face shield,
Ear plugs
Leather Work Shoes.

Level 2 -
Minimum Arc Rating 8 cal/cm²
Cotton Underwear ***plus*** FR Long Sleeved Shirt;
FR or Denim Long Pants;
FR Coveralls may be used instead.
Hard Hat (Class E),
Safety Glasses or Goggles,
Arc Rated Flash Hood (20 cal/cm² or equivalent) or Arc Rated Face Shield, Hearing Protection ear plugs,
Leather Work Shoes.

Level 3 –
Minimum Arc Rating 25 cal/cm².
Cotton Underwear ***plus*** FR Long Sleeved Shirt;
FR or Denim Long Pants; ***plus*** FR Coveralls.
Hard Hat (Class E),
Safety Glasses or Goggles,
Arc Rated Flash Suit w/ Hood (40 cal/cm² or equivalent),
Hearing Protection – ear plugs,
Leather Work Shoes.

Level 4 -
Minimum Arc Rating 40 cal/cm².
Cotton Underwear ***plus*** FR Long Sleeved Shirt;
FR or Denim Long Pants; ***plus*** Multi-Layer Arc Rated Flash Suit
(100 cal/cm² or equivalent).
Hard Hat (Class E),
Safety Glasses or Goggles,
Arc Rated Flash Suit Hood (100 cal/cm² or equivalent),
Hearing Protection,
Leather Work Shoes.

9. Inspection, Maintenance, Cleaning and Storage of PPE

PPE may be individually assigned or available to a group.

For individually assigned PPE, the person to whom the equipment is assigned is responsible for inspection, maintenance and storage of the PPE.

For group equipment, such as 100 cal/cm² suits, a person shall be assigned responsibility for inspection, maintenance and storage of the equipment.

The user must inspect all PPE prior to and after each use for damage and defects. Any damage, defects, or problems with the equipment must be reported to the Responsible Individual.

SUNY NP FOC will follow manufacturer's recommendations for laundering protective clothing and will provide for special care of treated fabrics, when required.

SUNY NP FOC will follow manufacturer's recommendations for cleaning and storing of other protective equipment. Storage bags and designated, secure, readily accessible storage areas are recommended.

10. Selection of PPE

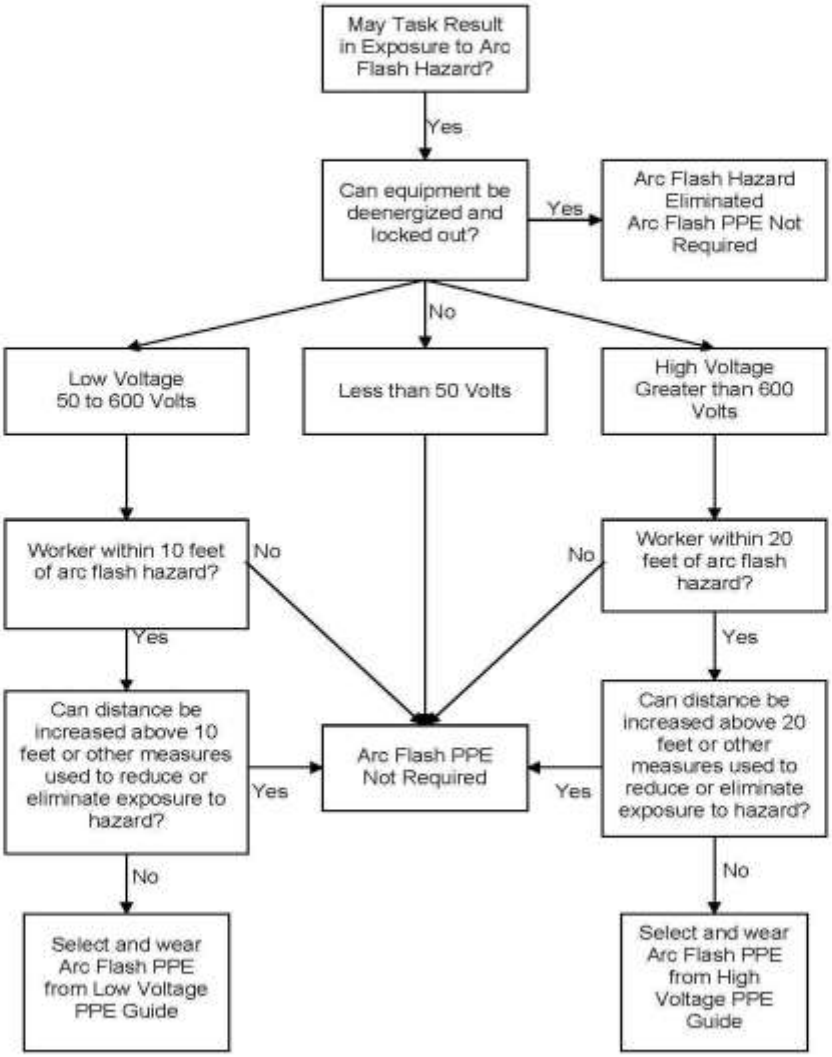
PPE for protection from arc flash must be selected by trained and qualified employees.

Training and authorization must be appropriate for the level of energy and type of PPE being used. As an example, a person trained and authorized for 480 volt work may not be sufficiently trained or authorized for 4160 volt work.

Selection of PPE is task and equipment based (for covered equipment not already labeled with specific Arc Flash Specifications).

First follow table in Section 11 to determine whether Arc Flash PPE is required. If Arc Flash PPE is required then determine what PPE level is required in sections 12 and 13 (AC equipment and DC equipment) along with Arc Flash Boundaries.

Quick Reference for Selecting Arc Flash PPE



11. Arc Flash Hazard Identification for AC and DC Systems/equipment not already labeled.

Task	Equipment Condition*	Arc Flash PPE Required
Reading a panel meter while operating a meter switch	Any	No
Normal operation of a circuit breaker (CB), switch,	All of the following:	
contractor, or starter		
	The equipment is properly installed	
	The equipment is properly maintained	No
	All equipment doors are closed and secured	
	All equipment covers are in place and secured	
	There is no evidence of impending failure	
	One or more of the following:	
	The equipment is not properly installed	
	The equipment is not properly maintained	Yes
	Equipment doors are open or not secured	
	Equipment covers are off or not secured	
	There is evidence of impending failure	
For ac systems: Work on energized electrical conductors	Any	Yes
and circuit parts, including voltage testing		
For dc systems: Wor on energized electrical conductors		
and circuit parts of series-connected battery cells,	Any	Yes
including voltage testing		
Voltage testing on individual batter cells or	All of the following:	
individual multi-cell units		
	The equipment is properly installed	No
	The equipment is properly maintained	
	Covers for all other equipment are in place and secured	
	There is no evidence of impending failure	
	One or more of the following:	
	The equipment is not properly installed	Yes
	The equipment is not properly maintained	
	Equipment doors are open or not secured	
	Equipment covers are off or not secured	
	There is evidence of impending failure	
Removal or installation of CBs or switches	Any	Yes
Removal of bolted covers (to expose bare energized		
electrical conductors and circuit parts).	Any	Yes
For dc systems, this includes bolted covers, such		
as battery terminal covers.		

11. Arc Flash Hazard Identification for AC and DC Systems/equipment not already labeled continued.

Task	Equipment Condition*	Arc Flash PPE Required
Removal or installation of covers for equipment	All of the following:	
such as wireways, junction boxes, and cable		No
trays that does not expose bare energized	The equipment is properly installed	
electrical conductors and circuit parts.	The equipment is properly maintained	
	There is no evidence of impending failure	
	One or more of the following:	
	The equipment is not properly installed	
	The equipment is not properly maintained	Yes
	Equipment doors are open or not secured	
	Equipment covers are off or not secured	
	There is evidence of impending failure	
Removal of battery intercell connector covers	All of the following:	
	The equipment is properly installed	No
	The equipment is properly maintained	
	Covers for all other equipment are in place and secured	
	There is no evidence of impending failure	
	One or more of the following:	
	The equipment is not properly installed	Yes
	The equipment is not properly maintained	
	Equipment doors are open or not secured	
	Equipment covers are off or not secured	
	There is evidence of impending failure	
Opening hinged door(s) or covers(s) (to expose bare	Any	Yes
energized electrical conductors and circuit parts)		
Perform infrared thermography and other noncontact	Any	No
inspections outside the restricted approach boundary.		
This activity does not include opening of doors or covers		
Application of temporary protective grounding	Any	Yes
equipment after votage test		
Work on control circuits with exposed energized		
electrical conductors and circuit parts, 120 volts or	Any	No
below without any other exposed energized equipment		
over 120 V including opening of hinged covers to		
gain access		
Work on control circuits with exposed energized		
electrical conductors and circuit parts, greater than	Any	Yes
120 volts		
Insertion or removal of individual starter buckets from	Any	Yes
motor control center (MCC)		
Insertion or removal (racking) of CBs or starters from	Any	Yes
cubicles, doors open or closed		

11. Arc Flash Hazard Identification for AC and DC Systems/equipment not already labeled continued.

Task	Equipment Condition*	Arc Flash PPE Required
Insertion or removal of plug-in devices into or from busways	Any	Yes
Insulated cable examination with no manipulation of cable	Any	No
Insulated cable examination with manipulation of cable	Any	Yes
Work on exposed energized electrical conductors and circuit parts of equipment directly supplied by a panelboard or motor control center	Any	Yes
Insertion and removal of revenue meters (kW-hour, at primary voltage and current)	Any	Yes
For dc systems, insertion or removal of individual cells or multi-cell units of a battery system in an enclosure	Any	Yes
For dc systems, insertion or removal of individual cells or multi-cell units of a battery system in an open rack	Any	No
For dc systems, maintenance on a single cell of a battery system or multi-cell units in an open rack	Any	No
For dc systems, work on exposed energized electrical conductors and circuit parts of utilization equipment directly supplied by a dc source	Any	Yes
Arc-resistant switchgear Type 1 or 2 (for clearing times of <0.5 sec with a prospective fault current not to exceed the arc-resistant rating of the equipment) and metal enclosed interrupter switchgear, fused or unfused of arc-resistant type construction, tested in accordance with IEEE C37.20.7:	All of the following: The equipment is properly installed The equipment is properly maintained All equipment doors are closed and secured All equipment covers are in place and secured There is no evident of impending failure	No
*Insertion or removal (racking) of CBs from cubicals *Insertion or removal (racking) of ground & test device *Insertion or removal (racking) of voltage transformers on or off the bus	Onre or more of the following: The equipment is not properly installed The equipment is not properly maintained Equipment doors are open or not secured Equipment covers are off or not secured There is evidence of impending failure	Yes
Opening voltage transformer or control power transformer compartments	Any	Yes
Outdoor disconnect switch operation (hookstick operated) at 1 kV through 15 kV	Any	Yes
Outdoor disconnect switch operation (gang-operated, from grade) at 1 kV through 15 kV	Any	Yes

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

* The phrase *properly installed*, as used in this table, means that the equipment is installed in accordance with applicalbe industry codes and standards and the manufacturer's recommendations.

*The phrase *properly maintained*, as used in this table, means that the equipment has been maintained in accordance with the manufacturer's recommendations and applicable industry codes and standards.

*The phrase *evidence of impending failur*e, as used in this table, means that there is evidence of arcing, overheating, loose or bound equipment parts, visible damage, deterioration, or other damage.

12. Arc Flash Hazard PPE Level and Arc Flash Boundary for non-labeled covered AC equipment

Equipment	Arc Flash PPE Level	Arc Flash Boundary
Panelboards or other equipment rated 240 V and below		
Parameters:	1	485 mm
Maximum of 25 kA short-circuit current available;		
maximum of 0.03 sec (2 cycles) fault clearing time;		(19in)
working distance 455 mm (18in)		
Panelboard or other equipment rated >240 V and up to		
600 V	2	99 mm
Parameters:		
Maximum of 25 kA short-circuit current available;		(3ft)
maximum of 0.03 sec (2 cycles) fault clearing time;		
working distance 455 mm (18in)		
600-V class motor control centers (MCCs)		
Parameters:	2	1.5 m
Maximum of 65 kA short-circuit current available;		
maximum of 0.03 sec (2 cycles) fault clearing time;		(5ft)
working distance 455 mm (18in)		
600-V class motor control centers (MCCs)		
Parameters:	4	4.3 m
Maximum of 25 kA short-circuit current available;		
maximum of 0.33 sec (20 cycles) fault clearing time;		(14ft)
working distance 455 mm (18in)		
600-V class switchgear (with power circuit breakers or		
fused switches) and 600 V class switchboards	4	6 m
Parameters:		
Maximum of 35 kA short-circuit current available;		(20ft)
maximum of 0.5 sec (30 cycles) fault clearing time;		
working distance 455 mm (18in)		
Other 600-V class (277 V through 600 V, nominal)		
equipment	2	1.5 m
Parameters:		
Maximum of 65 kA short-circuit current available;		(5ft)
maximum of 0.03 sec (2 cycles) fault clearing time;		
working distance 455 mm (18in)		
NEMA E2 (fused contactor) motor starters, 2.3 kV		
through 7.2 kV	4	12 m
Parameters:		
Maximum of 35 kA short-circuit current available;		(40ft)
maximum of 0.24 sec (15 cycles) fault clearing time;		
working distance 910 mm (36in)		
Metal-clad switchgear, 1 kV through 15 kV		
Parameters:	4	12 m
Maximum of 35 kA short-circuit current available;		
maximum of 0.24 sec (15 cycles) fault clearing time;		(40ft)
working distance 910 mm (36in)		

12. Arc Flash Hazard PPE Level and Arc Flash Boundary for non-labeled covered AC equipment continued

Equipment	Arc Flash PPE Category	Arc Flash Boundary
Arc-resistant switchgear Type 1 or 2 [for clearing times of <0.5 sec (30 cycles) with a perspective fault current not to exceed the arc-resistant rating of the equipment], and metal-enclosed interrupter switch-gear, fused or unfused of arc-resistant-type construction, tested in accordance with IEEE C37.20.7,	N/A (doors closed)	N/A (doors closed)
1 kV through 15 kV Parameters: Maximum of 35 kA short-circuit current available; maximum of 0.24 sec (15 cycles) fault clearing time; working distance 910 mm (36in)	4 (doors open)	12 m (40ft)
Other equipment 1 kV through 15 kV Parameters: Maximum of 35 kA short-circuit current available; maximum of 0.24 sec (15 cycles) fault clearing time; working distance 910 mm (36in)	4	12 m (40ft)
Note: For equipment rated 600 volts and below, and protected by upstream current-limiting fuses or current-limiting circuit breakers sized at 200 amperes or less, the arc flash PPE category can be reduced by one number but not below arc flash PPE category 1.		

13. Arc Flash Hazard PPE Level and Arc Flash Boundary for non-labeled covered DC equipment

Equipment	Arc Flash PPE Category	Arc Flash Boundary
Storage batteries, dc switchboards, and other dc supply sources		
100 V > Voltage < 250 V		
Parameters:		
Voltage: 250 V		
Maximum arc duration and working distance:		
2 sec @ 455 mm (18in)		
Short-circuit current < 4 kA	1	900 mm (3ft)
4 kA ≤ short-circuit current < 7 kA	2	1.2 mm (4ft)
7 kA ≤ short-circuit current < 15 kA	3	1.8 mm (6ft)
Storage batteries, dc switchboards, and other dc supply sources		
250 V ≤ Voltage ≤ 600 V		
Parameters:		
Voltage: 600 V		
Maximum arc duration and working distance:		
2 sec @ 455 mm (18in)		
Short-circuit current 1.5 kA	1	900 mm (3ft)
1.5 kA ≤ short-circuit current < 3 kA	2	1.2 m (4ft)
3 kA ≤ short-circuit current < 7 kA	3	1.8 m (8ft)
7 kA ≤ short-circuit current < 10 kA	4	2.5 m (8ft)
Note: Apparel that can be expected to be exposed to electrolyte must meet both of the following conditions:		
(1) Be evaluated for electrolyte protection in accordance with ASTM F1296, *Standard Guide for Evaluating Chemical Protective Clothing*		
(2) Be arc-rated in accordance with ASTM F1891, *Standard Specification for Arc Rated and Flame Resistant Rainwear, or equivalent*		