Table 1 Incident Energy Analysis Method PPE Selection Guidelines

Incident Energy Exposures ≤ 1.2 cal/cm^2	
Protective clothing, nonmelting (in accordance with ASTM F 1506-08) or untreated natural fiber	Shirt (long sleeve) and pants (long) or coverall
Other personal protective equipment:	Face shield for projectile protection (AN) Safety glasses or safety goggles (SR) Hearing protection Heavy-duty leather gloves or rubber insulating gloves with leather protectors (AN)
Incident Energy Exposures 1.2 to 12 cal/cm^2	
Arc-rated clothing and equipment with an arc rating equal to or greater than the determined incident energy *(See Note 2.)*	Arc-rated long-sleeve shirt and arc-rated pants or arc-rated coverall or arc flash suit (SR) *(See Note 2.)* Arc-rated face shield and arc-rated balaclava or arc flash suit hood (SR) *(See Note 1.)* Arc-rated jacket, parka, or rainwear (AN)
Other PPE:	Hard hat Arc-rated hard hat liner (AN) Safety glasses or safety goggles (SR) Hearing protection Heavy-duty leather gloves or rubber insulating gloves with leather protectors (SR) *(See Note 3.)* Leather work footwear
Incident Energy Exposure ≥ 12 cal/cm^2	
Arc-rated clothing and equipment with an arc rating equal to or greater than the determined incident energy *(See Note 2.)*	Arc-rated long-sleeve shirt and arc-rated pants or arc-rated coverall and/or arc flash suit (SR) Arc-rated arc flash suit hood Arc-rated gloves Arc-rated jacket, parka, or rainwear (AN)
Other PPE:	Hard hat Arc-rated hard hat liner (AN) Safety glasses or safety goggles (SR) Hearing protection Arc-rated gloves or rubber insulating gloves with leather protectors (SR) *(See Note 3.)* Leather work footwear

Table 1 - Continued

SR: Selection of one in group is required.

AN: As needed.

Notes:

(1) Face shields with a wrap-around guarding to protect the face, chin, forehead, ears, and neck area are required by 130.8(C)(10)(c). Where the back of the head is inside the arc flash boundary, a balaclava or an arc flash hood shall be required for full head and neck protection.

(2) Arc ratings can be for a single layer, such as an arc-rated shirt and pants or a coverall, or for an arc flash suit or a multi-layer system consisting of a combination of arc-rated shirt and pants, coverall, and arc flash suit.

(3) Rubber insulating gloves with leather protectors provide arc flash protection in addition to shock protection. Higher class rubber insulating gloves with leather protectors, due to their increased material thickness, provide increased arc flash protection.

Task	Equipment Condition*	Likelihood of Occurrence†*
Reading a panel meter while operating a meter switch.	Any	No
Performing infrared thermography and other non-contact inspections outside the restricted approach boundary. This activity does not include opening of doors or covers.		
Working on control circuits with exposed energized electrical conductors and circuit parts, nominal 125 volts ac or dc, or below without any other exposed energized equipment over nominal 125 volts ac or dc, including opening of hinged covers to gain access.		
Examination of insulated cable with no manipulation of cable.		
For dc systems, insertion or removal of individual cells or multi-cell units of a battery system in an open rack.		
For dc systems, maintenance on a single cell of a battery system or multi-cell units in an open rack.		
For ac systems, work on energized electrical conductors and circuit parts, including voltage testing.	Any	Yes
For dc systems, working on energized electrical conductors and circuit parts of series-connected battery cells, including voltage testing.		
Removal or installation of CBs or switches.		
Opening hinged door(s) or cover(s) or removal of bolted covers (to expose bare, energized electrical conductors and circuit parts). For dc systems, this includes bolted covers, such as battery terminal covers.		
Application of temporary protective grounding equipment, after voltage test.		
Working on control circuits with exposed energized electrical conductors and circuit parts, greater than 120 volts.		
Insertion or removal of individual starter buckets from ~~MCC.~~ motor control center (MCC).		
Insertion or removal (racking) of ~~CBs~~ circuit breakers (CBs) or starters from cubicles, doors open or closed.		
Insertion or removal of plug-in devices into or from busways.		
Examination of insulated cable with manipulation of cable.		
Working on exposed energized electrical conductors and circuit parts of equipment directly supplied by a panelboard or motor control center.		
Insertion or removal of revenue meters (kW-hour, at primary voltage and current).		
Removal of battery conductive intercell connector covers.		
For dc systems, working on exposed energized electrical conductors and circuit parts of utilization equipment directly supplied by a dc source.		
Opening voltage transformer or control power transformer compartments.		
Operation of outdoor disconnect switch (hookstick operated) at 1 kV through 15 kV.		
Operation of outdoor disconnect switch (gang-operated, from grade) at 1 kV through 15 kV.		
Operation of a ~~circuit breaker (~~ CB~~)~~, switch, contactor, or starter.	Normal	No
Voltage testing on individual battery cells or individual multi-cell units.		
Removal or installation of covers for equipment such as wireways, junction boxes, and cable trays that does not expose bare, energized electrical conductors and circuit parts.		
Opening a panelboard hinged door or cover to access dead front overcurrent devices.		
Removal of battery nonconductive intercell connector covers.		
Maintenance and testing on individual battery cells or individual multi-cell units in an open rack	Abnormal	Yes
Insertion or removal of individual cells or multi-cell units of a battery system in an open rack.		
Arc-resistant switchgear Type 1 or 2 (for clearing times of ≤ less than 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 CSA C22.2 No. 022 or IEEE C37.20.7.~~ 1 kV through 15 kV.		
Insertion or removal (racking) of CBs from cubicles:		

Task	Equipment Condition‡	Likelihood of Occurrence‡ *
Insertion or removal (racking) of ground and test device; or		
Insertion or removal (racking) of voltage transformers on or off the bus.		
Equipment condition considered to be "normal" if all of the following circumstances apply:		
(1) The equipment is properly installed in accordance with the manufacturer's recommendations and applicable industry codes and standards.		
(2) The equipment is properly maintained in accordance with the manufacturer's recommendations and applicable industry codes and standards.		
(3) The equipment is used in accordance with instructions included in the listing and labeling and in accordance with manufacturer's instructions.		
(4) Equipment doors are closed and secured.		
(5) Equipment covers are in place and secured.		
(6) There is no evidence of impending failure such as arcing, overheating, loose or bound equipment parts, visible damage, or deterioration.		

‡ * As defined in this standard, the two components of risk are the likelihood of occurrence of injury or damage to health and the severity of injury or damage to health that results from a hazard. Risk assessment is an overall process that ~~includes estimates of~~ involves estimating both the likelihood of occurrence ~~of injury or damage~~ and severity to ~~health~~ determine if additional protective measures are required. The estimate of the likelihood of occurrence contained in this table does not cover every possible condition or situation~~.~~ , nor does it address severity of injury or damage to health. Where this table identifies "No" ~~for~~ as an estimate of likelihood of occurrence, it means that an arc flash incident is not likely to occur. Where this table identifies "Yes" ~~for~~ as an estimate of likelihood of occurrence, it means that additional protective measures are required to be selected and implemented according to the hierarchy of risk control identified in 110.1(~~G~~ H).

Informational Note No. 1: An example of a standard that provides information for arc-resistant switchgear referred to in Table 130.5 (C) is IEEE C37.20.7, *Guide for Testing Metal-Enclosed Switchgear Rated Up to 38 kV for Internal Arcing Faults*.

Informational Note No. 2: Improper or inadequate maintenance can result in increased fault clearing time of the overcurrent protective device, thus increasing the incident energy. Where equipment is not properly installed or maintained, PPE selection based on incident energy analysis or the PPE category method might not provide adequate protection from arc flash hazards.

Informational Note No. 3: Both larger and smaller available fault currents could result in higher incident energy. If the available fault current increases without a decrease in the fault clearing time of the overcurrent protective device, the incident energy will increase. If the available fault current decreases, resulting in a longer fault clearing time for the overcurrent protective device, incident energy could also increase.

Informational Note No. 4: The occurrence of an arcing fault inside an enclosure produces a variety of physical phenomena very different from a bolted fault. For example, the arc energy resulting from an arc developed in the air will cause a sudden pressure increase and localized overheating. Equipment and design practices are available to minimize the energy levels and the number of procedures that could expose an employee to high levels of incident energy. Proven designs such as arc-resistant switchgear, remote racking (insertion or removal), remote opening and closing of switching devices, high-resistance grounding of low-voltage and 5000-volt~~s~~ (nominal) systems, current limitation, and specification of covered bus or covered conductors within equipment are available to reduce the risk associated with an arc flash incident. See Informative O for ~~Safety-Related Design Requirements~~ safety-related design requirements.

Informational Note No. 5: For additional direction for performing maintenance on overcurrent protective devices, see Chapter 2, Safety-Related Maintenance Requirements.

Informational Note No. 6: See IEEE 1584, *Guide for Performing Arc Flash Calculations*, for more information regarding incident energy and the arc flash boundary for three-phase systems.