



ELECTRICAL PERSONAL PROTECTIVE EQUIPMENT STANDARD

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Summary of Modifications

The following is a summary of changes made since the document was last approved and published.

Revision 4.0 **Date:** 2022-06-01 (EGD-484)

Location of Change	Summary of Change
Sections 1.1, 1.3, 1.6, 1.7, 1.8, and table 1	Hyperlinks updated
Section 1.6	Compliance date removed
Section 1.8 and table 11	Related standards updated
Table 1	Updated M&R standard (SUN-00055)
Table 2, and sections 2.4.1, 2.4.2	Wording revised
Section 2.4.2 and table 5	Arc flash PPE category 5 added
Table 3	Revised for alignment with CSA Z462-2021 and NFPA 70E-2021. Note 1 revised to align with IEEE 1584-2018
Table 4A	Revised to align with CSA Z462-2021 table V.1 and figure V.1
Table 5	Added note to refer the user to PPE manufacturer's manual for proper use and selection
Table 6	Updated to reflect pre-checking the arc rating value. Added canadian standard for temporary protective grounds
Appendix A	New appendix based on CSA Z462-2021 figure V.1 and to be used with table 4A
Appendix B table 11	Updated requirements for dielectric footwear. Revised wording
Glossary	Added the definition of arc rating and energy of breakopen threshold (E_{BT})

Revision 3.0 **Date:** 2019-01-08

Location of Change	Summary of Change
Table 3	Revised for alignment with CSA Z462-2018 and NFPA 70E-2018

Revision 2.0 **Date:** 2016-04-26

Location of Change	Summary of Change
Tables 6, 8, 11	Electrical safety tools and equipment have been added

CONTENTS	PAGE
1. Introduction	4
1.1 Purpose of the Standard	4
1.2 Intended Audience	4
1.3 Scope of the Standard.....	4
1.4 Application of the Standard	5
1.5 Reviews, Revisions, and Approvals	5
1.6 Interpretation and Implementation of the Standard.....	5
1.7 Audits, Assessments, and Reporting	6
1.8 Related Standards and Information.....	6
2. Electrical Personal Protective Equipment	6
2.1 Introduction	6
2.2 Expected Outcomes	6
2.3 Inputs and Outputs.....	6
2.4 Process Overview	8
2.5 Minimum Requirements	27
Appendix A – Arc Flash PPE Categories Selection Flow Chart	28
Appendix B – Minimum Specifications for Electrical PPE	29
Appendix C – Glossary.....	34
Bibliography	36

LIST OF TABLES

Table 1 Electrical PPE Process Inputs	7
Table 2 Electrical PPE Process Outputs	7
Table 3 Tasks Requiring Arc Flash PPE	10
Table 4A AC Arc Flash PPE Category	13
Table 4B DC Arc Flash PPE Category	17
Table 5 Required PPE per Arc Flash Category	18
Table 6 Electrical PPE Pre-Check Requirements	21
Table 7 Arc Flash PPE Use Requirements	23
Table 8 Electrical PPE Maintenance and Testing	24
Table 9 Voltage Requirements for Testing of Rubber Gloves and Sleeves	26
Table 10 Electrical PPE Process Requirements	27
Table 11 Minimum Specifications for Electrical PPE	29

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1. Introduction

1.1 Purpose of the Standard

The purpose of this Standard is to protect the health of Suncor personnel and contractors by properly applying the requirements of electrical personal protective equipment (PPE) in areas where there may be a risk of injury or exposure to electrically hazardous conditions. The Standard includes specification, identification, use, maintenance, and testing of electrical PPE.

The Electrical Personal Protective Equipment Standard is a supporting Standard for the [Electrical Safety Risk Management Standard SUN-00115](#), Element 9 of Suncor's [Operational Excellence Management System \(OEMS\)](#), and Element 2 of Suncor's [OEMS](#).

1.2 Intended Audience

The primary audience for this Standard includes all personnel who perform energized work tasks. This Standard applies to all business areas.

The intended audience for this Standard includes:

- All Cross Functional Team (CFT) members responsible for Business Units (BUs) and assets
- Functional Maintenance and Reliability Leaders
- All Suncor and contractor Electrical Personnel

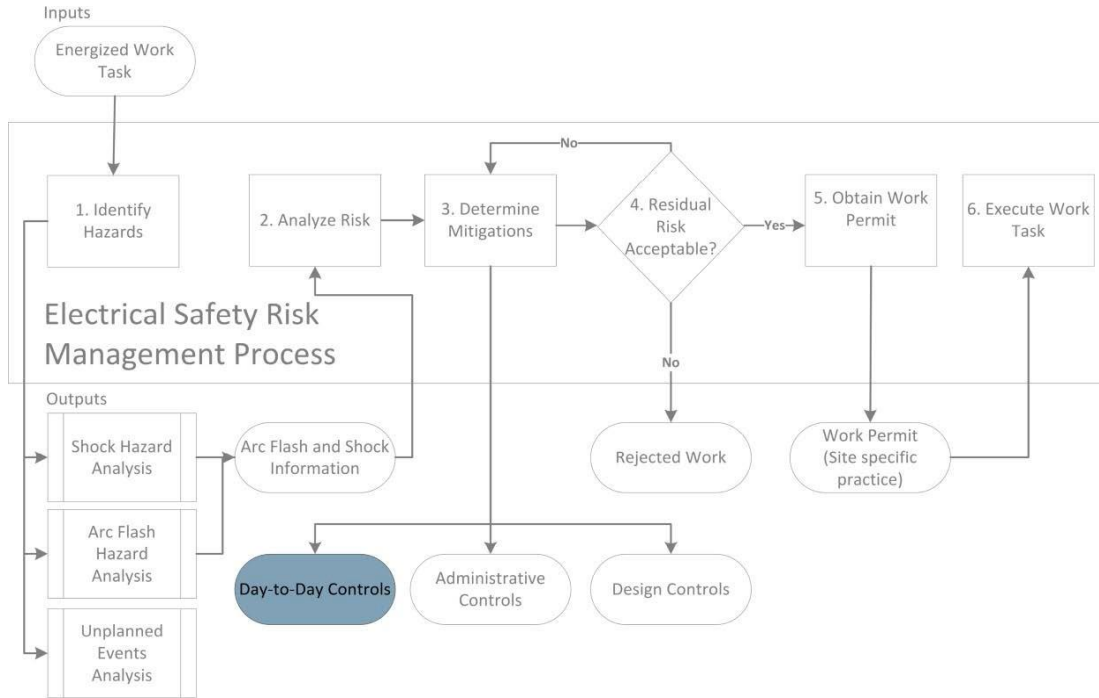
1.3 Scope of the Standard

This Standard applies only to electrical PPE required for energized work tasks. Requirements for other PPE such as fall protection, ladders, personal gas monitoring must be followed as per site specific Company Policy.

This Standard does not apply to uniforms (such as attire) or protection from any other site and trade specific hazards.

There are numerous protective and preventive measures for electrical hazards. These measures must be applied, including identification of hazards and analyzing risks, as per the process outlined in the [Electrical Safety Risk Management Standard SUN-00115](#).

The following diagram illustrates the Electrical Safety Risk Management Process and indicates the area where the Electrical PPE process is found—Day-to-Day Controls.



This Standard includes the following information for the Electrical Personal Protective Equipment Standard process:

- Introduction
- Expected outcomes
- Inputs and outputs
- Illustrated process overview with accompanying description
- Minimum requirements, including accountabilities and responsibilities

1.4 Application of the Standard

This Standard shall apply to all Suncor operated facilities. This Standard does NOT apply to:

- Retail
- Non-operated facilities

Where codes and/or regulations impose requirements not reflected in this Standard, the most stringent requirements shall apply.

1.5 Reviews, Revisions, and Approvals

This Standard shall be reviewed, at a minimum, every five years.

This Standard is subject to Continuous Improvement (CI) based on Suncor’s shared experiences and Lessons Learned. Revisions to the Standard are the responsibility of Enterprise Technical Subject Matter Experts in consultation with Suncor Excellence Networks.

Revisions must be approved by Enterprise Technical Leadership.

1.6 Interpretation and Implementation of the Standard

The Electrical Suncor Technical Excellence Network (STEN) shall be responsible for clarifying all aspects of this Standard.

A Technical Deviation is required if there is a need to deviate from any aspect of this Standard, and shall

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be submitted in writing per the [Technical Deviation Specification CTS-0002](#).

Business areas shall adopt a risk-based approach for implementation of the Standard. A risk-based assessment aids in establishing priorities for implementation and allows the business to set appropriate compliance targets to ensure safe, cost-effective, and reliable operations.

Business area management should assess the risks to their business based on the expected outcomes, inputs and outputs, minimum requirements, and performance indicators specified in this Standard.

1.7 Audits, Assessments, and Reporting

The processes described in this Standard shall be audited per the requirements of Element 11 of Suncor's OEMS.

1.8 Related Standards and Information

The following reference list supports the contents of this document:

- [Electrical Safety Risk Management Standard \(SUN-00115/MRS-GS-SAS-001\)](#)
- [Technical Deviation Specification CTS-0002](#)
- [Maintenance and Reliability \(M&R\) Standard \(SUN-00055/MRS-GS-RMG-001\)](#)
- [Maintenance and Reliability Glossary \(MRS-GL-RIM-002\)](#)
- [Environment, Health, and Safety Policy \(SUN-00006/CO-PS06A\)](#)
- Canadian Standards Association (CSA) Z462 Workplace Electrical Safety
- National Fire Protection Association (NFPA) 70E Standard for Electrical Safety in the Workplace

2. Electrical Personal Protective Equipment

2.1 Introduction

The Electrical Personal Protective Equipment (PPE) process provides a framework for determining the electrical PPE required for specific energized work tasks. It provides requirements for the selection, use, and maintenance of electrical PPE for alternating current (AC) and direct current (DC) systems.

Electrical PPE is the last line of defense when an electrical worker is exposed to electrical hazards, including shock and arc flash.

2.2 Expected Outcomes

Selection and use of proper electrical PPE ensures workers:

- Are protected when [working on](#) energized equipment
- Maintain electrical PPE to be in optimal working order

2.3 Inputs and Outputs

The following tables provide input and output information associated with the Electrical PPE process.

Table 1 Electrical PPE Process Inputs

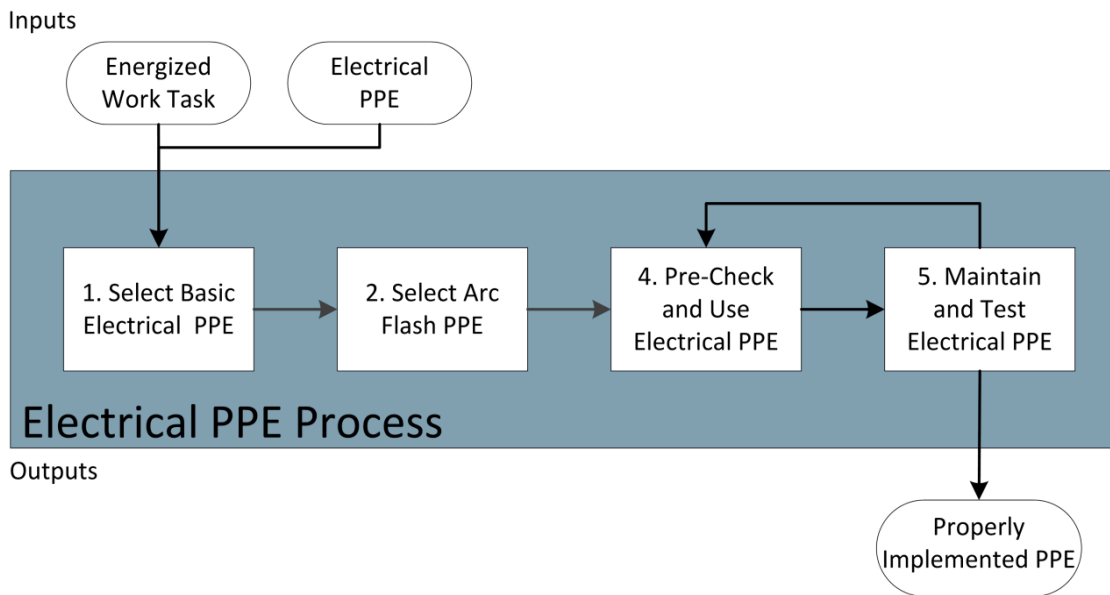
Input	Description	Provider
Working on Electrical Equipment	<p>Coming in contact or within the limited approach boundary of energized electrical conductors or circuit parts with the hands, feet, or other body parts, with tools, probes, or with test equipment, regardless of the PPE a person is wearing. There are two categories of <i>working on</i>:</p> <ul style="list-style-type: none"> • Diagnostic testing—taking readings or measurements of electrical equipment with approved test equipment that does not require making any physical change to the equipment • Repair—any physical alteration of electrical equipment such as making or tightening connections or removing or replacing components 	<p>Requestor for identified work</p> <p>See Section 6 of the Maintenance and Reliability (M&R) Standard (SUN-00055/MRS-GS-RMG-001) for more information on work selection.</p>
Shock and Arc Flash Hazard Levels	<p>Shock hazards are defined by approach boundaries in SUN-00115.</p> <p>Arc flash incident energy levels are provided either by calculation or the “table method” where calculations haven’t been completed.</p>	<ul style="list-style-type: none"> • CSA Z462 or NFPA 70E provide approach boundaries • Engineering provides calculated incident energy levels or electrical parameters.
Electrical PPE and Tools	PPE and tools required to protect the worker from electrical hazards	<ul style="list-style-type: none"> • Electrical Supervisor (or equivalent) • Maintenance Leader (or equivalent)

Table 2 Electrical PPE Process Outputs

Output	Description	Recipient
Properly Implemented PPE	<p>Worker applies electrical PPE in a safe and appropriate manner, including:</p> <ul style="list-style-type: none"> • Selection • Pre-check • Use • Maintenance 	End user

2.4 Process Overview

The following diagram identifies the Electrical PPE process.



Prerequisites

- A [competent electrical worker](#)

Process Description

2.4.1. Select Basic Electrical PPE.

The basic electrical PPE and garments required for all energized work tasks are:

- Flame resistant or natural, non-melting undergarments
- Hard hat
- Safety glasses or goggles
- Hearing protection (ear canal inserts)
- Heavy duty leather gloves or arc rated gloves
- Leather footwear** (see note in [table 5](#))
- Arc rated clothing (per next section 2.4.2.)

Note that if there is a shock hazard, insulated PPE such as rated gloves, sleeves and blankets, as applicable, must be used. See [table 9](#).

For the minimum specifications and reference standards for PPE, refer to *Appendix B - Minimum Specifications for Electrical PPE*.

2.4.2. Determine need for Arc Flash PPE

Complete the following steps to identify arc flash PPE required for tasks involving different levels of arc flash hazard:

- Examine equipment hazard labels, studies, or equivalent to identify energy levels and approach boundaries for tasks to be completed.
- Determine if arc flash PPE is required for the task to be completed using Table 3 below. If likelihood is 'Yes', arc flash PPE is required.

c) Identify the arc flash PPE required.

When arc flash PPE is required, determine the calculated incident energy level from labels or studies, or utilize the 'table method' (tables 4A and 4B below) where calculated incident energy levels do not exist.

Arc flash PPE categories under the table method are numbered 1 to 5, with 5 being the most severe exposure allowed under the table method. The category dictates the level of arc flash protection clothing that must be worn.

Note that suitable PPE is available well above the category 5 (75 cal/cm²) limit when using calculated incident energy values.

[Arc flash boundary](#) indicates the distance from live parts within which an unprotected person may receive a second-degree burn if an arc flash occurs. Electrical PPE of the proper category must be worn within this boundary.

Identify the equipment type and its parameters, and then determine the corresponding arc flash PPE category and [arc flash boundary](#) in *Tables 4A or 4B Arc Flash PPE Category* below.

d) Determine the PPE for the applicable arc flash category.

If a detailed arc flash study has been done, it must be used instead of the table method.

If using the table method, identify the electrical PPE required for the arc flash category using *Table 5 Required PPE per Arc Flash Category* below.

2.4.3. Pre-check and use Electrical PPE

To ensure optimal performance, properly pre-check and use electrical PPE.

a) Pre-check electrical PPE.

All electrical PPE requires a detailed pre-check prior to every use.

Table 6 provides pre-check requirements for electrical PPE.

b) Use electrical PPE.

Identify general requirements for the use of arc flash hazard specific PPE per table 7.

2.4.4. Maintain and Test Electrical PPE

Table 8 provides maintenance and testing requirements for electrical PPE.

Table 9 shows the voltage requirements for the testing of rubber gloves and sleeves.

Table 3 Likelihood of Occurrence of Arc Flash

Task	Equipment Condition	Likelihood of Occurrence
<p>Reading data from a meter while operating a meter switch. Reading data from a relay or similar.</p> <p>Infrared thermography or other non-contact inspections from outside the restricted approach boundary (does not include opening doors and covers).</p> <p>Work on control circuits with <u>exposed</u> energized conductors, nominal 125 V ac or dc, or below without any other exposed energized equipment over nominal 125 V ac or dc (includes opening hinged doors to gain access).</p> <p>Examination of insulated cable without manipulation.</p> <p>For dc systems, maintenance on a single cell of a battery system or multi-cell units in an open rack.</p>	Any	No

Task	Equipment Condition	Likelihood of Occurrence
<p>For ac systems, work on energized electrical conductors and circuit parts, including electrical testing.</p> <p>Operation of a circuit breaker or switch the first time after installation or completion of work or maintenance in the equipment.</p> <p>For dc systems, working on energized electrical conductors and circuit parts of series-connected battery cells, including electrical testing.</p> <p>Removal or installation of circuit breakers or switches.</p> <p>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.</p> <p>Application of temporary protective grounding equipment, after voltage test.</p> <p>Working on control circuits with exposed energized electrical conductors and circuit parts, greater than nominal 125 V ac or dc.</p> <p>Insertion or removal of individual starter buckets from MCC.</p> <p>Insertion or removal (racking) of circuit breakers or starters from cubicles, doors open or closed.</p> <p>Insertion or removal of plug-in devices into or from busways.</p> <p>Examination of insulated cable with manipulation of cable.</p> <p>Working on exposed energized electrical conductors and circuit parts of equipment directly supplied by a panelboard or MCC.</p> <p>Insertion or removal of revenue meters (kW-hour, at primary voltage and current).</p> <p>Insertion or removal of connector covers or battery intercell connector(s).</p> <p>For dc systems, working on exposed energized electrical conductors and circuit parts of utilization equipment directly supplied by a dc source.</p> <p>Opening voltage transformer or control power transformer compartments.</p>	<p>Any</p>	<p>Yes</p>

Table 4A AC Arc Flash PPE Category (reference to table V.1 of CSA Z462-21)
Note: For use of the AC table, use the procedure flow chart in appendix A

(1) Equipment	(2) Nominal voltage	(3) Upstream device at same voltage in separate compartment *	(4) Arc flash PPE category	(5) Arc-flash boundary
Panelboard, Motor control centre (MCC), Disconnect switch, or Other equipment (rated ≤ 800 A) Minimum working distance: 46 cm	240 V (1φ)	Transformer:		
		≤ 15 kVA	N/A	<0.46 m
		≤ 50 kVA (Z ≥ 1.8%), or ≤ 75 kVA (Z ≥ 3%)	2	1.5 m
		≤ 250 kVA	4	3.0 m
		Fuses:		
		≤ 150 A	N/A	<0.46 m
		≤ 600 A	2	1.5 m
		≤ 800 A	4	3.0 m
		Circuit breaker with fixed or adjustable T/M or M trip unit:		
		≤ 80 A	N/A	<0.46 m
		≤ 300 A	2	1.5 m
		≤ 800 A	4	3.0 m
		Panelboard, Motor control centre (MCC), Disconnect switch, or Other equipment (rated ≤ 800 A) Minimum working distance: 46 cm	208 V (3φ)	Transformer:
≤ 10 kVA	N/A			< 0.46 m
≤ 45 kVA (3φ), or 3 x 10 kVA (1φ)	2			2.0 m
≤ 150 kVA (3φ), or 3 x 25 kVA (1φ)	4			4.5 m
Fuses:				
≤ 60 A	N/A			<0.46 m
≤ 200 A	2			2.0 m
≤ 800 A	4			4.5 m
Circuit breaker with T/M or M trip unit:				
Fixed or adjustable magnetic not set at lowest setting:				
≤ 30 A	N/A			<0.46 m
≤ 90 A	2			2.0 m
≤ 400 A	4			4.5 m
Adjustable magnetic set at lowest setting:				
≤ 225 A	2			2.0 m
≤ 600 A	4			4.5 m
Panelboard, Motor control centre (MCC), Disconnect switch, or Other equipment (rated ≤ 800 A) Minimum working distance: 46	480 to 600 V (3φ)	Transformer:		
		≤ 45 kVA (3φ), or 3 x 10 kVA (1φ)	2	2.0 m
		≤ 225 kVA (3φ), or 3 x 50 kVA (1φ)	4	4.5 m
		≤ 500 kVA (3φ), or 3 x 75kVA (1φ)	5	6.5 m

(1) Equipment	(2) Nominal voltage	(3) Upstream device at same voltage in separate compartment *	(4) Arc flash PPE category	(5) Arc-flash boundary
cm		Fuses:		
		≤ 40 A	N/A	<0.46 m
		≤ 200 A	2	2.0 m
		≤ 800 A	4	4.5 m
		≤ 1200 A	5	6.5 m
		Circuit breaker with T/M or M trip unit:		
		Fixed or adjustable magnetic not set at lowest setting:		
		≤ 20 A	N/A	<0.46m
		≤ 80 A	2	2.0 m
		≤ 350 A	4	4.5 m
		≤ 600 A	5	6.5 m
		Adjustable magnetic set at lowest setting:		
		≤ 225 A	2	2.0 m
		≤ 600 A	4	4,5 m
		≤ 800 A	5	6.5 m
		Circuit breaker with adjustable LSIG trip unit:		
		ST Pickup: ≤ 6500 A ST Delay: ≤ 0.5 s INST Pickup: ≤ 18 000 A	4	4.5 m
		ST Pickup: ≤ 6500 A ST Delay: ≤ 0.3 s INST Pickup: ≤ 28 000 A	4	4.5 m
		ST Pickup: ≤ 6500 A ST Delay: ≤ 0.1 s	4	4.5 m
		ST Pickup: ≤ 10 000 A ST Delay: ≤ 0.5 s INST Pickup: ≤ 30 000 A	5	6.5 m
ST Pickup: ≤ 10 000 A ST Delay: ≤ 0.3 s	5	6.5 m		
Switchgear, Switchboard, or Other equipment (rated > 800 A) Minimum working distance: 46 cm	480 to 600 V (3φ)	Fuses:		
		≤ 400 A	4	4.5 m
		≤ 800 A	5	6.5 m
		Circuit breaker with fixed or adjustable T/M or M:		
		Fixed or adjustable magnetic not set at lowest setting:		
		≤ 175 A	4	4.5 m
		≤ 350 A	5	6.5 m
		Adjustable set at lowest setting:		
		≤ 400 A	4	4.5 m
		≤ 600 A	5	6.5 m
Circuit breaker with adjustable LSIG trip unit:				

(1) Equipment	(2) Nominal voltage	(3) Upstream device at same voltage in separate compartment *	(4) Arc flash PPE category	(5) Arc-flash boundary
		ST Pickup: ≤ 3500 A ST Delay: ≤ 0.5 s INST Pickup: ≤ 9500 A	4	4.5 m
		ST Pickup: ≤ 3500 A ST Delay: ≤ 0.3 s INST Pickup: ≤ 16 000 A	4	4.5 m
		ST Pickup: ≤ 3500 A ST Delay: ≤ 0.1 s INST Pickup: ≤ 30 000 A	4	4.5 m
		ST Pickup: ≤ 6000 A ST Delay: ≤ 0.5 s INST Pickup: ≤ 18 000 A	5	6.5 m
		ST Pickup: ≤ 6000 A ST Delay: ≤ 0.3 s INST Pickup: ≤ 29 000 A	5	6.5 m
		ST Pickup: ≤ 6000 A ST Delay: ≤ 0.1 s	5	6.5 m
Switchgear, Motor control centre (MCC), or Enclosed disconnect switch Minimum working distance: 91 cm	1 to 15 kV (3φ)	Fuses: ≤ 400 A	4	9.0 m
		Circuit breaker (5 cycles) with protection relay:		
		Instantaneous (50), or Definite time (50 or 51) Pickup: ≤ 7500 A Time delay: ≤ 0.1 s	4	9.0 m

Legend:

T/M = thermal magnetic trip unit

M = magnetic (instantaneous only) trip unit

LSIG = long time, short time, instantaneous, and ground fault protection trip unit

ST = short time protection function

INST = instantaneous protection function

* The upstream fuses or circuit breaker, at the same voltage, shall be installed outside the equipment or in a fully separated compartment. For overcurrent protection and differential protection, the current transformers used for the current measurement shall be located outside the equipment.

The upstream protection device shall be at the same voltage and shall not be located at primary side of upstream transformer.

An upstream transformer is considered at the same voltage of the equipment because the secondary nominal voltage is at the same voltage.

Upstream overcurrent protection devices shall be in a normal equipment condition.

The upstream protection device (fuses or circuit breaker) shall have the required short circuit interrupting capacity for the location where it is installed.

Notes:

1. See Table 6 for a list of protective clothing and PPE for each arc flash PPE category.
2. Three-phase equipment based on typical IEEE 1584 parameters.

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3. *A 2 s arc duration at the stated working distance is assumed if the upstream protective device fault clearing time is expected to be longer than 2 s. It is assumed the worker's movement is not restrained in front of the equipment.*
4. *Fault clearing time of overcurrent protection device at primary side of transformer is assumed to be longer than 2 s.*
5. *Fault clearing times are conservative. An incident energy analysis could provide more representative and lower results.*
6. *The arc flash PPE category is valid for an available three-phase bolted short circuit at the equipment of*
 - a. *≤ 600 V: 500 A to 106 kA; and*
 - b. *601 to 15 kV: 200 A to 65 kA.*
7. *Typical fuse specifications:*
 - a. *208 V to 600 V: Fast acting or time delay fuse of Class CC, J, L, T, RK1, or RK5; and*
 - b. *1 to 15 kV: E or R rated fuses.*
8. *Typical circuit breaker used at 600 V and less:*
 - a. *MCCB: moulded case circuit breaker;*
 - b. *MCP: motor control protector combined with motor overload protection;*
 - c. *ICCB: insulated case circuit breaker; and*
 - d. *LVPCB: low voltage power circuit breaker.*
9. *Typical circuit breaker trip unit used at 600 V and less:*
 - a. *T/M: fixed or adjustable thermal (overload) magnetic (instantaneous) trip unit;*
 - b. *M: fixed or adjustable magnetic (instantaneous only) trip unit; and*
 - c. *LSIG: long time (I_r , t_r), short time (I_{sd} , t_{sd}), instantaneous (I_i), and ground fault (I_g , t_g) trip unit.*
10. *For short time (ST) protection on LSIG trip unit, the I^2t function can be turned on or off.*
11. *Low voltage circuit breaker override is equivalent of an instantaneous.*
12. *The PPE category based on upstream three phase transformers in this Table shall have an impedance equal to 3% or higher. When based on the three times single phase transformers rating, the transformer shall have an impedance of 1.8% and higher. The PPE Category based on upstream three phase transformers with an impedance lower than 3% may be based on the three times single phase transformer rating.*

Table 4B DC Arc Flash PPE Category (reference to table 6B of CSA Z462-21)

Equipment	Arc Flash PPE Category	Arc Flash Boundary
Storage batteries, direct-current switchboards, and other DC supply sources 100 V < Voltage < 250 V Parameters: <ul style="list-style-type: none"> • Voltage < 250 V • Maximum arc duration and minimum working distance: 2 seconds at 455 mm (18 inches) 		
Short-circuit current < 4 kA	2 (8 cal/cm ²)	0.9 m (3 feet)
4 kA ≤ short-circuit current < 7 kA	2 (8 cal/cm ²)	1.2 m (4 feet)
7 kA ≤ short-circuit current < 15 kA	3 (25 cal/cm ²)	1.8 m (6 feet)
Storage batteries, direct-current switchboards, and other DC supply sources 250 V ≤ Voltage ≤ 600 V Parameters: <ul style="list-style-type: none"> • 250 V ≤ Voltage ≤ 600 V • Maximum arc duration and minimum working distance: 2 seconds at 455 mm (18 inches) 		
Short-circuit current < 1.5 kA	2 (8 cal/cm ²)	0.9 m (3 feet)
1.5 kA ≤ short-circuit current < 3 kA	2 (8 cal/cm ²)	1.2 m (4 feet)
3 kA ≤ short-circuit current < 7 kA	3 (25 cal/cm ²)	1.8 m (6 feet)
7 kA ≤ short-circuit current < 10 kA	4 (40 cal/cm ²)	2.5 m (8 feet)

Notes:

1. Incident energy must be calculated if it is outside the parameters of this table.
2. Apparel that can be expected to be exposed to electrolyte must meet both of the following conditions:
 - a. Be evaluated for electrolyte protection in accordance with CAN/CGSB/CSA Z16602 or ASTM F1296; and
 - b. Be arc-rated in accordance with ASTM F1891, or equivalent.
3. A 2 second arc duration is assumed if there is no overcurrent protective device or if the fault clearing time is not known. If the fault clearing time is known and is less than 2 seconds, an incident energy analysis could provide a more representative result.
4. When determining available fault current, the effects of cables and any other impedances in the circuit should be included. The best method is power system modelling software. Battery cell short-circuit current can be obtained from the battery manufacturer.
5. The methods for estimating the dc arc flash incident energy that were used to determine the categories for this Table are based on open-air incident energy calculations. If the specific task is within an enclosure, it would be prudent to consider additional PPE protection beyond the value shown in this table. Research with ac arc flash has shown a multiplier of as much as 3x for arc-in-a-box (508 mm [20 in] cube) versus open air.

Table 5 Required PPE per Arc Flash Category (reference to table 6C of CSA Z462-21)

Note: User must refer to the PPE manufacturer's manual for proper use and selection

Arc Flash PPE Category	Arc Flash PPE Components
<p>1 (0 to 4 cal/cm²)</p>	<p>Arc-rated clothing, minimum arc rating of 4 cal/cm² (16.75 J/cm²) (Note 1):</p> <ul style="list-style-type: none"> • Arc-rated long-sleeve shirt and pants or arc-rated coverall • Arc-rated face shield or arc flash suit hood (Note 2) • Arc-rated jacket, parka, high-visibility apparel, rainwear, or hard hat liner (AN)(Note 3) <p>Protective equipment:</p> <ul style="list-style-type: none"> • Hard hat • Safety glasses or safety goggles (SR) • Hearing protection (ear canal inserts) (Note 4) • Heavy duty leather gloves, arc-rated gloves, or rubber insulating gloves with leather protectors (SR) (Note 5) • Leather footwear (AN) (Note 6)
<p>2 (>4 to 8 cal/cm²)</p>	<p>Arc-rated clothing, minimum arc rating of 8 cal/cm² (33.5 J/cm²) (Note 1):</p> <ul style="list-style-type: none"> • Arc-rated long-sleeve shirt and pants or arc-rated coverall • Arc-rated arc flash suit hood; or arc-rated face shield (Note 2) and arc-rated balaclava • Arc-rated jacket, parka, high-visibility apparel, rainwear, or hard hat liner (AN) (Note 3) <p>Protective equipment:</p> <ul style="list-style-type: none"> • Hard hat • Safety glasses or safety goggles (SR) • Hearing protection (ear canal inserts) (Note 4) • Heavy duty leather gloves, arc-rated gloves, or rubber insulating gloves with leather protectors (SR) (Note 5) • Leather footwear (Note 6)

Arc Flash PPE Category	Arc Flash PPE Components
<p>3 (>8 to 25 cal/cm²)</p>	<p>Arc-rated clothing, selected so that the system arc rating meets the required minimum arc rating of 25 cal/cm² (104.7 J/cm²) (Note 1):</p> <ul style="list-style-type: none"> • Arc-rated long-sleeve shirt (AR) • Arc-rated pants (AR) • Arc-rated coverall (AR) • Arc-rated arc flash suit jacket (AR) • Arc-rated arc flash suit pants (AR) • Arc-rated arc flash suit hood • Arc-rated gloves, or rubber insulating gloves with leather protectors (SR) (Note 5) • Arc-rated jacket, parka, high-visibility apparel, rainwear, or hard hat liner (AN) (Note 3) <p>Protective equipment:</p> <ul style="list-style-type: none"> • Hard hat • Safety glasses or safety goggles (SR) • Hearing protection (ear canal inserts) (Note 4) • Leather footwear (Note 6)
<p>4 (>25 to 40 cal/cm²)</p>	<p>Arc-rated clothing, selected so that the system arc rating meets the required minimum arc rating of 40 cal/cm² (167.5 J/cm²) (Note 1):</p> <ul style="list-style-type: none"> • Arc-rated long-sleeve shirt (AR) • Arc-rated pants (AR) • Arc-rated coverall (AR) • Arc-rated arc flash suit jacket (AR) • Arc-rated arc flash suit pants (AR) • Arc-rated arc flash suit hood • Arc-rated gloves, or rubber insulating gloves with leather protectors (SR) (Note 5) • Arc-rated jacket, parka, high-visibility apparel, rainwear, or hard hat liner (AN) (Note 3) <p>Protective equipment:</p> <ul style="list-style-type: none"> • Hard hat • Safety glasses or safety goggles (SR) • Hearing protection (ear canal inserts) (Note 4) • Leather footwear (Note 6)

Arc Flash PPE Category	Arc Flash PPE Components
<p>5 (>40 to 75 cal/cm²)</p>	<p>Arc-rated clothing, selected so that the system arc rating meets the required minimum arc rating of 75 cal/cm² (314 J/cm²) (Note 1):</p> <ul style="list-style-type: none"> • Arc-rated long-sleeve shirt (AR) • Arc-rated pants (AR) • Arc-rated coverall (AR) • Arc-rated arc flash suit jacket (AR) • Arc-rated arc flash suit pants (AR) • Arc-rated arc flash suit hood • Arc-rated gloves, or rubber insulating gloves with leather protectors (SR) (Note 5) • Arc-rated jacket, parka, high-visibility apparel, rainwear, or hard hat liner (AN) (Note 3) <p>Protective equipment:</p> <ul style="list-style-type: none"> • Hard hat • Safety glasses or safety goggles (SR) • Hearing protection (ear canal inserts) (Note 4) • Leather footwear (Note 6)

Legend:

AN = as needed (optional)

AR = as required

SR = selection required

Notes:

1. Arc rating is defined in Clause 3 of CSA Z462-21.
2. Face shields shall meet the requirements of Clause 4.3.7.3.10 c of CSA Z462-21. An arc flash suit hood may be worn in lieu of a face shield.
3. The arc rating of outerwear worn over arc-rated clothing that are not used as part of a layered system, shall not be required to be equal to or greater than the estimated incident energy exposure.
4. Other types of hearing protection may be used in lieu of or in addition to ear canal inserts provided they are worn under an arc-rated arc flash hood.
5. 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.
6. Footwear other than leather or dielectric may be used, provided it has been tested for and demonstrates no ignition, melting, or dripping at or greater than the minimum arc rating for the respective arc flash PPE category.

Table 6 Electrical PPE Pre-Check Requirements

PPE & Tools	Prior to use, ensure the PPE / tools:
Hard hat	<ul style="list-style-type: none"> • Has no cracks, stickers, or paint on it • Has a valid date • Has working webbing and adjusting mechanisms • Has a properly adjusted harness
Leather footwear	<ul style="list-style-type: none"> • Is clean—if excessively damaged or dirty they may not perform as intended
Arc-rated clothing	<ul style="list-style-type: none"> • Is clean and not contaminated due to chemicals or hydrocarbon stains • Is not torn, ripped, punctured or frayed • Has all zippers, buttons, snaps and Velcro functioning properly • Is the proper arc flash PPE category and has the arc rating value on the manufacture’s label
Rubber insulating gloves	<ul style="list-style-type: none"> • Has a valid date stamp for testing • Is not cracked, torn, or punctured • Passes an air roll test to confirm they do not leak
Rubber insulating mats/sleeves/blankets	<ul style="list-style-type: none"> • Is undamaged • Is voltage checked and has stamps tested
Leather protective gloves	<ul style="list-style-type: none"> • Is clean with no oil, chemicals, mud, or dirt stains • Has no foreign material inside of the gloves that could cause damage
Balaclava	<ul style="list-style-type: none"> • Has no rips or tears • Is the proper arc flash PPE category and has the arc rating value on the manufacture’s label
Arc flash hoods and arc rated face shields	<ul style="list-style-type: none"> • Has an acceptable hard hat • Has working suspension and lightener • Has a clean face shield with no damage to the lens • Has no rips or tears on the arc rated clothing
Hot sticks (live-line tools)	<ul style="list-style-type: none"> • Tested within last 24 months • No mechanical damage or contamination • Mechanical and connecting functions OK

Table 6 Electrical PPE Pre-Check Requirements (continued)

PPE & Tools	Prior to use, ensure the PPE / tools:
Test instruments (contact & proximity)	<ul style="list-style-type: none"> • Ensure no defects or damage on leads, cables, probes, connectors, etc. • Inspect plugs and fuses if applicable • Ensure plug placement and settings correct • Test on known source before & after use
Temporary protective grounds	<ul style="list-style-type: none"> • Verify suitability for fault current availability per CAN/ULC 61230 or ASTM F855 • Tested within last 36 months • Inspect leads, insulation, and connections • Mechanical and connecting functions OK
Insulated hand tools	<ul style="list-style-type: none"> • Verify double triangle symbol and insulation level for task • Inspect insulation condition and cleanliness

Table 7 Arc Flash PPE Use Requirements

PPE & Tools	Use requirements:
Arc flash suits	<ul style="list-style-type: none"> • Permits easy and rapid removal by the wearer • Has an arc rating that is suitable for the arc flash exposure (includes entire suit and hood's face shield) • If exterior air is supplied into the hood by a hood ventilation system, ensure ventilation components are: <ul style="list-style-type: none"> ✓ Covered by arc rated materials with an arc rating equivalent to the suit; or ✓ Constructed of non-melting, non-flammable materials
Head protection	<ul style="list-style-type: none"> • Use an arc rated balaclava with an arc rated face shield when the back of the head is within the arc flash boundary (an arc rated shield may be used instead of an arc rated face shield and balaclava) • Use an arc rated hood when the anticipated energy exposure exceeds 12 cal/cm²
Face protection	<ul style="list-style-type: none"> • Use face shields with an arc rating suitable for the arc flash exposure • Use face shields with a wrap-around guarding to protect the following: <ul style="list-style-type: none"> ✓ Face ✓ Chin ✓ Forehead ✓ Ears ✓ Neck area • Do not use face shields without an arc rating
Hand protection	<ul style="list-style-type: none"> • Wear heavy-duty leather gloves or arc rated gloves where necessary for arc flash protection
Clothing	<ul style="list-style-type: none"> • Do not use clothing with fabrics, zipper tapes, or bindings made from the following materials: <ul style="list-style-type: none"> ▪ Acetate ▪ Acrylic ▪ Nylon ▪ Polyester ▪ Polyethylene ▪ Polypropylene ▪ Spandex
Foot protection	<ul style="list-style-type: none"> • Use heavy-duty leather footwear in all exposures greater than 4 cal/cm²
Temporary protective ground assembly	<ul style="list-style-type: none"> • Minimize unsecured conductor lengths to minimize conductor movement in the event of a fault

Table 8 Electrical PPE and Tool Maintenance and Testing

PPE & Tools	To maintain and/or test this PPE:
Hard hat	<ul style="list-style-type: none"> • Clean by immersing for one minute in hot (approximately 140°F) water and detergent, scrubbing and rinsing in clear water • Avoid solvents and other harsh cleaners
Footwear	<ul style="list-style-type: none"> • Repair or replace excessively worn, defective or contaminated footwear
Rubber insulating gloves	<ul style="list-style-type: none"> • Test before first issue and then every 6 months • Test as per the voltage requirements for the testing of rubber gloves and sleeves (table 9 below)
Rubber insulating blankets, sleeves	<ul style="list-style-type: none"> • Clean with mild soap or detergent and warm water (no solvents) • Test every 12 months per ASTM F496
Arc-rated clothing	<ul style="list-style-type: none"> • Launder and repair arc-rated clothing as per <i>ASTM F1449/NFPA 2112</i> • Do not mix arc-rated garments with items made of other materials in the same wash • Do not use bleaches or other treatments unless recommended by the manufacturer • Observe manufacturer’s recommendation for laundering instructions • Do not wash in temperatures over 165°F • Store to prevent damage
Safety glasses and arc-rated face shields	<ul style="list-style-type: none"> • Clean with mild soap or detergent and warm water (no solvents) • For special lenses, such as those with an anti-fog coating, use a standard lens cleaner or a solution of mild detergent and warm water • Use a soft, lint-free cloth for drying • Never clean with a paper towel or untreated paper; this will cause scratches • Use manufacturer’s supply cleaning materials for their product, if provided
Temporary protective grounds	<ul style="list-style-type: none"> • Clean with mild soap or detergent and warm water (no solvents) • Test every 3 years per ASTM F2249
Insulated hand tools	<ul style="list-style-type: none"> • Clean mild soap or detergent and warm water (no solvents) • Refer to manufacturer’s recommendations for testing (no standard exists)



Hot sticks & live-line tools	<ul style="list-style-type: none">• Test per IEEE 978 every 2 years• Inspect and clean with mild soap or detergent and warm water (no solvents)• Visually inspect and ensure mechanically fit prior to each use
Rubber insulating mats	<ul style="list-style-type: none">• Clean with mild soap or detergent and warm and water (no solvents)• Test per ASTM D178 as required (no timing standard exists)
Personal protective grounds	<ul style="list-style-type: none">• Clean with mild soap or detergent and warm water (no solvents)• Test per ASTM F2249 every 3 years

Table 9 Voltage Requirements for Testing of Rubber Gloves and Sleeves

Class Designation of Glove or Sleeve	Maximum AC Use Voltage rms, V	Maximum DC Use Voltage avg, V	Distances between Gauntlet and Cuff, min
00	500	750	13 mm (0.5 in)
0	1000	1500	13 mm (0.5 in)
1	7500	11250	25 mm (1 in)
2	17000	25500	51 mm (2 in)
3	26500	39750	76 mm (3 in)
4	36000	54000	102 mm (4 in)

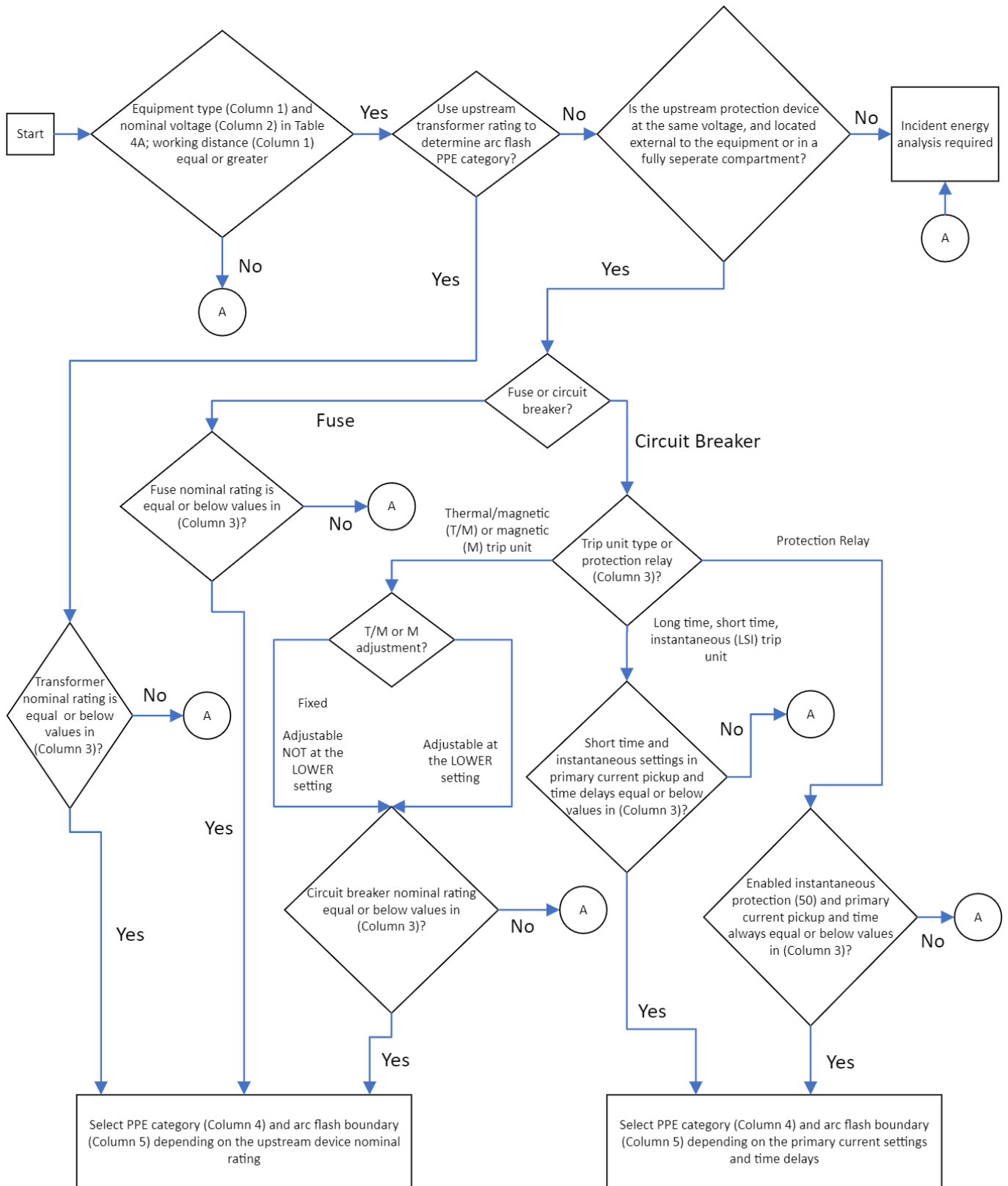
2.5 Minimum Requirements

The following table outlines roles [accountable \(A\)](#) and [responsible \(R\)](#) for the Electrical Personal Protective Equipment Standard process requirements. Lead roles represent all disciplines associated with the function within their organization.

Table 10 Electrical PPE Process Requirements

Minimum Requirement	Maintenance Leader	Electrical Supervisor (or equivalent)	Electrical Worker
2.5.1 The following electrical PPE shall be used for all energized work tasks: <ul style="list-style-type: none"> • Hard hat • Safety glasses or goggles • Hearing protection (ear canal inserts) • Heavy duty leather gloves (or arc-rated gloves, as required) • Leather footwear • Arc-rated clothing 	A	R	R
2.5.2 Additional electrical PPE and tools shall be identified according to specific tasks, equipment, and energy level (if available).	A	R	R
2.5.3 PPE required for arc flash shall be used when required by specific task and equipment.	A	R	R
2.5.4 Electrical PPE and tools shall be properly pre-checked.	A	R	R
2.5.5 Electrical PPE and tools shall be properly used.	A	R	R
2.5.6 Electrical PPE and tools shall be maintained and stored in an acceptable manner.	A	R	R
2.5.7 Proper testing of electrical PPE and tools shall be conducted.	A	R	R

Appendix A – Arc Flash PPE Categories Selection Flow Chart




Appendix B – Minimum Specifications for Electrical PPE

Use the following table to identify the minimum specifications and reference standards for electrical PPE.

Table 11 Minimum Specifications for Electrical PPE

PPE & Tools	Minimum Specification	Reference Standards
Head protection	<ul style="list-style-type: none"> • Non-conductive, approved Class E head protection complying with <i>CSA Z94.1-15</i> or <i>ANSI Z89.1-14</i>, as applicable • Type I or Type II • Suspension system – four or six points of support • Hard hat liner to be made from FR materials 	<p><i>CSA Z94.1-15, Industrial Protective Headwear</i></p> <p><i>ANSI Z89.1-14, Industrial Head Protection</i></p>
Eye and face protection	<ul style="list-style-type: none"> • Fit properly • Made of polycarbonate material with no metal parts • Face shields must be the same cal/cm² incident energy rating as arc rated clothing • Store face shield in a suitable manner • Safety glasses shall be anti-fogging, anti-scratch and anti-static with 99.95% UV protection, and meet <i>CSA Z94.3-20</i> or <i>ANSI Z87.1-20</i> standard, as applicable • Clearly marked to identify the manufacturer • Personnel requiring corrective lenses for normal vision and are required to wear eye protection, must wear goggles or spectacles of one of the following types: <ul style="list-style-type: none"> ✓ Spectacles with protective lenses that provide optical correction ✓ Goggles that can be worn over spectacles without disturbing the adjustment of the spectacles ✓ Goggles that incorporate corrective lenses mounted behind the protective lenses 	<p><i>CSA Z94.3-20, Eye and Face Protectors</i></p> <p><i>ANSI Z87.1-20, American National Standard for Occupational and Educational Personal Eye and Face Protection Devices</i></p> <p><i>ASTM F2178-20, Standard Specification for Arc Rated Eye of Face Protective Products</i></p>

PPE & Tools	Minimum Specification	Reference Standards
Rubber insulating gloves	<ul style="list-style-type: none"> • Rubber insulating gloves must combine high dielectric, flexibility, and physical strength. • A glove system consists of two main elements and an optional third element: <ul style="list-style-type: none"> ✓ Rubber insulating gloves ✓ Liner gloves (optional) ✓ Leather protector gloves • Type II — Ozone resistant • Voltage rating of the glove must be at least equal to or higher than the maximum circuit voltage to be worked on • Gloves shall always be purchased with leather protectors and a canvas storage bag • Leather protectors shall meet the requirements of ASTM F696-06 	<p><i>ASTM D120-22, Standard Specification for Rubber Insulating Gloves</i></p> <p><i>ASTM F496-20, Standard Specification for In-Service Care of Insulating Gloves and Sleeves</i></p> <p><i>ASTM F696-06, Standard Specification for Leather Protectors for Rubber Insulating Gloves and Mittens</i></p>
Rubber insulating sleeves	<ul style="list-style-type: none"> • Sleeves must comply with all the requirements of ASTM D1051-19 • Type II — Ozone resistant • Voltage rating of the sleeve must be at least equal to or higher than the maximum circuit voltage to be worked on • Construction — Molded or dipped • Sleeves shall always be purchased with a storage bag or box • Other required accessories include the following: <ul style="list-style-type: none"> ✓ Harness (one required per pair of sleeves) ✓ Buttons (four required per pair of sleeves) ✓ Straps with buttons (two required per pair of sleeves) 	<p><i>ASTM D1051-19, Standard Specification for Rubber Insulating Sleeves</i></p>

PPE & Tools	Minimum Specification	Reference Standards
<p>Dielectric footwear (when specifically required for shock hazards)</p>	<ul style="list-style-type: none"> • Dielectric footwear must comply with all the requirements of <i>CSA Z195-14</i> or <i>ASTM F2413-18</i>, as applicable • Electric hazard resistant (EH) as per <i>ASTM F2413-18</i> or electric shock resistant (ESR) as per <i>CSA Z195-14</i> (orange omega label as shown below) 	<p><i>CSA Z195-14, Protective Footwear</i></p> <p><i>CSA Z195.1-16, Guideline for Selection, Care and Use of Protective Footwear</i></p> <p><i>ASTM F1117-03, Standard Specification for Dielectric Footwear</i></p> <p><i>ASTM F2412-18, Standard Test Methods for Foot Protection</i></p> <p><i>ASTM F2413-18, Standard Specification for Performance Requirements for Protective (Safety) Toe Cap Footwear</i></p>
<p>Raingear</p>	<ul style="list-style-type: none"> • Shall meet the requirements of <i>ASTM F1891-19</i> • For performing energized electrical work in inclement weather, the outer layer must be AR material with an arc rating appropriate for the task—this includes raingear and winter wear • Raingear shall include reflective material for increased visibility as per <i>ANSI/ISEA 107-2020</i>, performance class 3 • Style is full-length raincoats and rain jackets with detachable hoods, and rain pants • Arc rated clothing shall meet the requirements of <i>ASTM F1506-20</i> and shall be labeled with the following: <ul style="list-style-type: none"> ✓ Manufacturer ✓ Arc rating in calories per square centimeter (ATPV or E_{BT}) ✓ Care instructions ✓ Fabric fiber content ✓ Garment size ✓ Manufacturer tracking code 	<p><i>ASTM F1891-19, Standard Specification for Arc and Flame Resistant Rainwear</i></p> <p><i>ANSI/ISEA 107-2020, American National Standard for High-Visibility Safety Apparel</i></p> <p><i>ASTM F1506-20, Standard Performance Specification for Flame Resistant and Electric Arc Rated Protective Clothing Worn by Workers Exposed to Flames and Electric Arcs</i></p>

PPE & Tools	Minimum Specification	Reference Standards
Hearing protection	<ul style="list-style-type: none"> • Hearing protection must be used when the calculated arc flash incident energy exposure is greater than 1.2 cal/cm² • Ear plugs or earmuffs without metal frame shall be required • Ear plug styles are cylindrical, tapered, or hex • Earmuffs are to be made of a mixture of plastics and foam with soft ear cushions 	<i>CSA Z94.2-14, Hearing Protection Devices – Performance, Selection, Care, and Use</i>
Arc-rated clothing	<ul style="list-style-type: none"> • Shall meet the requirements of <i>ASTM F1506-20</i> • Construction materials – inherent flame-resistant fabric or chemically treated cotton (or equivalent) • Arc-rated clothing shall meet the requirements of <i>ASTM F1506-20</i> and shall be labeled with the following: <ul style="list-style-type: none"> ✓ Arc rating in calories per square centimeter (ATPV or E_{BT}) ✓ Manufacturer ✓ Care instructions ✓ Fabric fiber content ✓ Garment size ✓ Manufacturer tracking code • Can be single or multiple layers • Tight fitting clothing should be avoided as air gap provides thermal insulation • Apparel should not interfere with work task • Undergarments should be natural (i.e.: 100% cotton). Avoid flammable or meltable synthetic materials such as acetate, nylon, polyester and spandex 	<i>ASTM F1506-20, Standard Performance Specification for Flame Resistant and Electric Arc Rated Protective Clothing Worn by Workers Exposed to Flames and Electric Arcs</i> <i>ASTM F1959-14, Standard Test Method for Determining the Arc Rating of Materials for Clothing</i>
Rubber insulating mats	<ul style="list-style-type: none"> • Shall meet the requirements of <i>ASTM D178-19</i> • Type IIA ozone resistant or type IIB flame resistant • Voltage class of mats per gloves 	<i>ASTM D178-19, Standard Specification for Rubber Insulating Matting</i>
Rubber insulating blankets	<ul style="list-style-type: none"> • Shall meet the requirements of <i>ASTM D1048-20</i> • Type IIA ozone resistant or type IIB flame resistant • Voltage class of blankets per gloves 	<i>ASTM D1048-20, Standard Specification for Rubber Insulating Blankets</i>

PPE & Tools	Minimum Specification	Reference Standards
Insulated hand tools	<ul style="list-style-type: none"> • Shall meet the requirements of <i>ASTM F1505-16</i> • Rated 1000VAC / 1500VDC • Insulating layer protected by outer layer 	<i>ASTM F1505-16, Standard Specification for Insulated and Insulating Hand Tools</i>
Hot sticks and live line tools	<ul style="list-style-type: none"> • Shall meet the requirements of <i>ASTM F711-17</i> • Fiber reinforced plastic rod/tube construction • Appropriate ends to accommodate grounds, high voltage testers, etc. 	<i>ASTM F711-17, Standard Specification for Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used in Live Line Tools</i>
Digital multi-meters	<ul style="list-style-type: none"> • Certified, listed, or approved by a testing laboratory or certification body accredited by the authority having jurisdiction (CSA, UL, FM, Intertek, TÜV, etc.) • Minimum Category III • Include fused leads and shielded plugs 	<i>ANSI/ISA/CSA/UL 61010-1-12, Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements</i>
Low voltage proximity detectors	<ul style="list-style-type: none"> • Certified, listed, or approved by a testing laboratory or certification body accredited by the authority having jurisdiction (CSA, UL, FM, Intertek, TÜV, etc.) • Category IV 1000V • Dual sensitivity 	
High voltage proximity detectors	<ul style="list-style-type: none"> • Range up to 240kVAC / 500kVAC • Visual + audible annunciator 	
Personal protective grounds	<ul style="list-style-type: none"> • Shall meet the requirements of <i>ASTM F855-20</i> or <i>CAN/ULC 61230-09</i> (generally sized for high X/R ratios) • Connection accessories suitable for studs or flat bus as appropriate 	<i>ASTM F855-20, Standard Specification for Temporary Protective Grounds to Be Used on De-energized Electric Power Lines and Equipment</i> <i>CAN/ULC 61230-09, Live Working – Portable Equipment for Grounding and Bonding</i>

Appendix C – Glossary

accountable (A)	A designation for a person who delegates responsibility for tasks and deliverables, and approves (signs-off) and is answerable to the success or failure of that task or deliverable through to its completion. Only one person is accountable for a specified task or deliverable.
arc flash hazard	<p>A dangerous condition associated with the release of energy caused by an electric arc.</p> <p>Note: Under normal operating conditions, enclosed energized equipment that has been properly installed and maintained is not likely to pose an arc flash hazard. An arc flash hazard can exist when energized electrical conductors or circuit parts are <u>exposed</u>, or are within equipment in a guarded or enclosed condition, or if a person is interacting with the equipment in a manner that could cause an electric arc.</p>
arc flash boundary	When an arc flash hazard exists, the arc flash boundary is an approach limit defined as a distance from energized electrical conductors or circuit parts within which a person could receive a second degree burn; for example: from an incident energy exposure of 1.2 cal/cm ² or 5.0 joules/cm ² .
arc rating	The value attributed to materials that describes their performance to exposure to an electrical arc discharge. The arc rating is expressed in cal/cm ² and is derived from the determined value of the arc thermal performance value (ATPV) or energy of breakopen threshold (E _{BT}) (should a material system exhibit a breakopen response below the ATPV value). Arc rating is reported as either ATPV or E _{BT} , <u>whichever is the lower value</u> .
arc thermal performance value (ATPV)	In arc testing, the incident energy on a material or a multi-layer system of materials that results in a 50% 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, cal/cm ² .
continuous improvement	An ongoing effort to improve products, services, or processes.
Competent Electrical Worker	<p>As a pre-requisite, a competent electrical worker must have an official certification as a Certified Power System Electrician, Journeyman Electrician, Powerline Technician, Certified Electrical Technologist or Professional Electrical Engineer.</p> <p>In addition, a competent electrical worker must also possess:</p> <ul style="list-style-type: none"> • Electrical safety training as defined by the Electrical Safety Risk Management Standard • Equipment-specific knowledge • Validated experience with the work methods required to undertake specific work tasks

electrical PPE	Personal protective equipment (PPE) required to protect the worker from electrical hazards.
Electrical Supervisor	Supervises electrical workers. Must understand work scopes and electrical risks involved, and assign work within worker competency.
energized	Electrically connected to, or having a source of, voltage.
energy of breakopen threshold (E_{BT})	In arc testing, the incident energy (cal/cm ²) on a material or a material system that results in a 50 percent probability of breakopen. Breakopen is a material response evidenced by the formation of one or more holes of a defined size [an area of 1.6 cm ² (0.5 in ²) or an opening of 2.5 cm (1.0 in) in any dimension] in the innermost layer of arc-rated material that would allow thermal energy to pass through the material.
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. This term is applied to electrical conductors or circuit parts that are not suitably guarded, isolated, or insulated.
responsible (R)	Person(s) who do the work to complete the task.
working on electrical equipment	Coming in contact or proximity with energized electrical conductors or circuit parts with the hands, feet, or other body parts, with tools, probes, or with test equipment, regardless of the PPE a person is wearing. There are two categories of <i>working on</i> : <ul style="list-style-type: none"> • Diagnostic testing—taking readings or measurements of electrical equipment with approved test equipment that does not require making any physical change to the equipment • Repair—any physical alteration of electrical equipment such as making or tightening connections or removing or replacing components

Bibliography

Additional References

Consult the following references for additional information.

ASTM F1449, Standard Guide for Industrial Laundering Care and Maintenance of Flame Resistant or Arc Rated Clothing

NFPA 2112, Standard on Flame-Resistant Clothing for Protection of Industrial Personnel Against Short-Duration Thermal Exposures from Fire

CSA Z94.1, Industrial Protective Headwear

ANSI Z89.1, Industrial Head Protection

CSA-Z94.3, Eye and Face Protectors

ANSI Z87.1-20, American National Standard for Occupational and Educational Personal Eye and Face Protection Devices

ASTM F2178, Standard Specification for Arc Rated Eye of Face Protective Products

ASTM D120, Standard Specification for Rubber Insulating Gloves

ASTM F496, Standard Specification for In-Service Care of Insulating Gloves and Sleeves

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

ASTM D1051, Standard Specification for Rubber Insulating Sleeves

CSA Z195, Protective Footwear

CSA Z195.1, Guideline for Selection, Care and Use of Protective Footwear

ASTM F1117, Standard Specification for Dielectric Footwear

ASTM F2412, Standard Test Methods for Foot Protection

ASTM F2413, Standard Specification for Performance Requirements for Protective (Safety) Toe Cap Footwear

CSA Z94.2, Hearing Protection Devices – Performance, Selection, Care, and Use

ASTM F1891, Standard Specification for Arc and Flame Resistant Rainwear

ANSI/ISEA 107, American National Standard for High-Visibility Safety Apparel

ASTM F1506, Standard Performance Specification for Flame Resistant and Electric Arc Rated Protective Clothing Worn by Workers Exposed to Flames and Electric Arcs

ASTM F1959, Standard Test Method for Determining the Arc Rating of Materials for Clothing

ASTM D178, Standard Specification for Rubber Insulating Matting

ASTM D1048, Standard Specification for Rubber Insulating Blankets

ASTM F1505, Standard Specification for Insulated and Insulating Hand Tools

ASTM F711, Standard Specification for Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used in Live Line Tools

ANSI/ISA/CSA/UL 61010-1, Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements

ASTM F855, Standard Specification for Temporary Protective Grounds to Be Used on De-energized Electric Power Lines and Equipment



CAN/ULC 61230, Live Working – Portable Equipment for Grounding and Bonding

ASTM F2249, Standard Specification for In-Service Test Methods for Temporary Grounding Jumper Assemblies Used on De-Energized Electric Power Lines and Equipment



Enterprise Governing Documents - Approval Information

Approver:	Sunny Mohar
Title:	Director of Reliability and Operations Support
Date:	2022/06/01 11:30:41 AM Mountain Time
EGD Request #:	EGD-484