Littelfuse®

Expertise Applied | Answers Delivered

ARC-FLASH ENERGY REDUCTION WORKBOOK

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IMPORTANT: READ AND FOLLOW INSTRUCTIONS THOROUGHLY

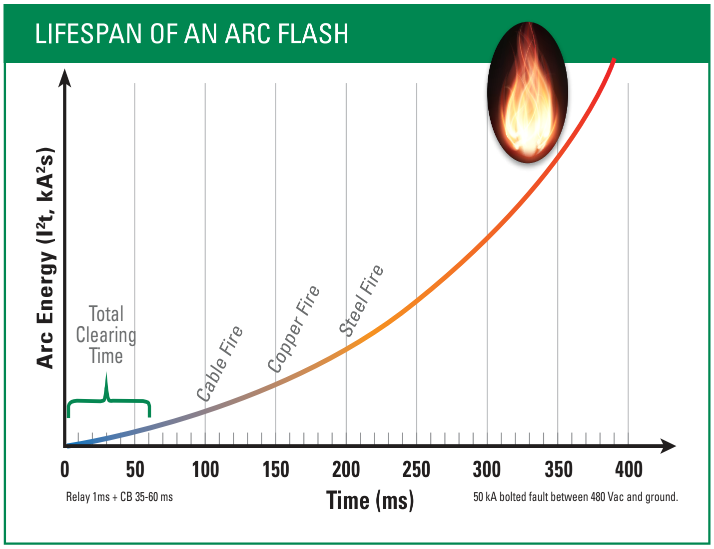
INTRODUCTION

The purpose of this document is to help the plant engineer or electrician create a preliminary calculation of the reduction of Incident Energy by applying a Littelfuse Arc-Flash Relay. All nameplate data should be collected by a qualified individual. The calculations below provide a typical-case scenario in 3-phase systems, as defined by IEEE 1584 calculations, and are for illustration purposes only. Actual values may vary.

To determine your specific scenario, you must contact your Arc-Flash Hazard Assessment Provider or a licensed Professional Engineer. See page 12 for Full Disclaimers.

WARNING! It is important to remember that performing an Arc-Flash Hazard Assessment is not an option. Arc-Flash Hazard Assessments are required by OSHA and NFPA 70E as a part of an Electrical Hazard Assessment. Arc-Flash Assessments are a serious life safety issue and essential part of a safe and comprehensive electrical safety program. OSHA and NFPA require employers to identify all potential electrical hazards in the workplace, such as shock and Arc-Flash Hazards, reduce or eliminate the hazards, train and qualify their employees, and provide them with PPE that will protect them from such hazards.

LIFESPAN OF AN ARC FLASH



HOW TO USE THIS WORKBOOK

SCENARIO I

CALCULATION WITH KNOWN INCIDENT ENERGY (IE) VALUE OF YOUR PROTECTED EQUIPMENT

- **Start on Page 2.**
- **Follow 2 Steps:**

Step 1 - **Estimate your IE with the Littelfuse Arc-Flash Relay**

Step 2 - **Calculate the REDUCTION in IE because of the addition of the Littelfuse Arc-Flash Relay**

SCENARIO II

CALCULATION WITH UNKNOWN INCIDENT ENERGY (IE) VALUE OF YOUR PROTECTED EQUIPMENT

- **Start on Page 4.**
- **Follow 5 Steps:**

Step 1 - **Collect your data**

Step 2 - **Determine available fault current**

Step 3 - **Estimate your IE with your EXISTING protection**

Step 4 - **Estimate your IE with the Littelfuse Arc-Flash Relay**

Step 5 - **Calculate the REDUCTION in IE because of the addition of the Littelfuse Arc-Flash Relay**

PPE Required

SCENARIO I: Step 1

STEP 1 - DETERMINE YOUR INCIDENT ENERGY WITH THE LITTELFUSE ARC-FLASH RELAY

1A. Calculate New CB Clearing Time (NCBCT): Which is constant and independent of Instantaneous, Short Time, or Long Time Trip (LSI) settings. (LSI settings are still valid for bolted faults. However, the Arc-Flash Relay replaces LSI settings for arcing faults.

[ ] **CBCT** + [1 ms] **AFRCT** = [ ] **NCBCT** → Round your NCBCT value up to nearest value per tables below. (25, 50 or 75 ms) → [ ] **NCBCT rounded**

▲ Enter your Manufacturer-Specified Circuit Breaker (CB) Total Clearing Time

▲ Add 1 ms for Arc-Flash Relay Clearing Time

▲ New CB Clearing Time

1B. Determine New Incident Energy (NIE): If rounded **NCBCT** value is **25 ms**, use **Table 5**.
If rounded **NCBCT** value is **50 ms**, use **Table 6**.
If rounded **NCBCT** value is **75 ms**, use **Table 7**.
If rounded **NCBCT** value is >**75 ms**, contact your licensed Professional Engineer.

1C. Determine Your SCC: ■ **Enter** the Available Bolted Fault Current (kA). ▶ [ ] **SCC**

■ **Round up** your SCC value to the nearest SCC value in the tables below. (65, 55, 45, etc.)

■ Using Rounded SCC and the columns relevant to Your Voltage and Your Equipment Type, **Locate** corresponding IE values, and enter in Line 1D.

[ ] **SCC rounded**

Use value from your equipment

Table 5: NCBCT Value of **25 ms**

	VOLTAGE			
	480 V/ 600 V		5 kV	15 kV
	EQUIPMENT		EQUIPMENT	
SCC (kA)	MCC/ PB	SWGR	SWGR	SWGR
65	5.4	3.1	3.0	–
55	4.6	2.7	2.5	–
45	3.8	2.2	2.0	–
35	2.9	1.7	1.5	8.1
30	–	–	–	7.0
25	2.1	1.2	1.1	5.8
20	–	–	–	4.6
15	1.2	0.8	0.6	3.5
10	0.8	0.5	0.4	2.3
7.5	0.6	0.4	0.3	1.8
5	–	–	–	1.2

Table 6: NCBCT Value of **50 ms**

	VOLTAGE			
	480 V/ 600 V		5 kV	15 kV
	EQUIPMENT		EQUIPMENT	
SCC (kA)	MCC/ PB	SWGR	SWGR	SWGR
65	10.8	6.2	6.0	–
55	9.2	5.3	5.0	–
45	7.5	4.4	4.0	–
35	5.8	3.4	3.1	16.2
30	–	–	–	13.9
25	4.2	2.4	2.2	11.6
20	–	–	–	0.3
15	2.5	1.4	1.3	7.0
10	1.7	1.0	0.8	4.7
7.5	1.3	0.8	0.6	3.5
5	–	–	–	2.3

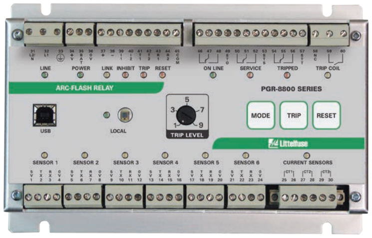
Table 7: NCBCT Value of **75 ms**

	VOLTAGE			
	480 V/ 600 V		5 kV	15 kV
	EQUIPMENT		EQUIPMENT	
SCC (kA)	MCC/ PB	SWGR	SWGR	SWGR
65	16.2	9.3	8.9	–
55	13.7	8.0	7.4	–
45	11.3	6.5	6.0	–
35	8.7	5.1	4.6	24.3
30	–	–	–	20.9
25	6.2	3.7	3.2	17.4
20	–	–	–	13.9
15	3.8	2.3	1.9	10.4
10	2.5	1.5	1.2	7.0
7.5	1.9	1.1	0.9	5.3
5	–	–	–	3.5

1D. Your New IE: → [ ] **NIE1** → [ ] **NIE1** → [ ] **NIE1**

SCENARIO I: Step 2

STEP 2 - CALCULATE YOUR REDUCTION IN IE BY ADDING THE LITTELFUSE ARC-FLASH RELAY



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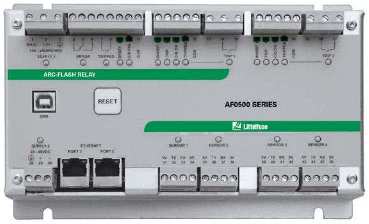

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2A. Enter your KNOWN Incident Energy (IE) based on your Existing Protection.

Incident Energy for Instantaneous = [IE1]

2B. Copy New Incident Energy (NIE1) from Step 1E (pg 7).

New Incident Energy = [NIE1]

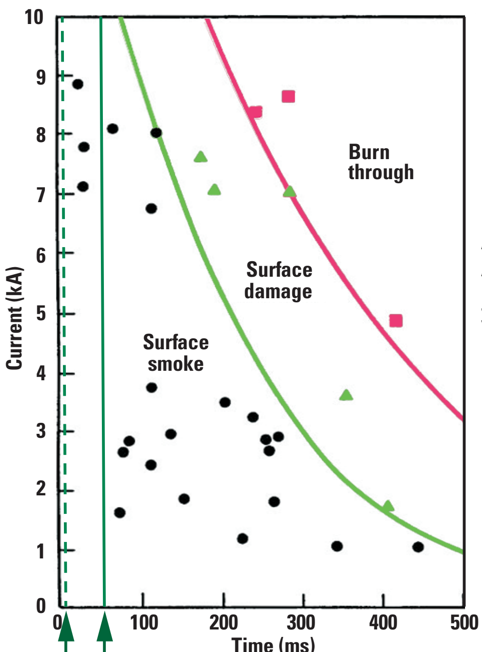
2C. Calculate the IE Reduction:

Reduction = [1 – [NIE1] / [IE1]] x 100 = ______________ %

▲ Copy **NIE1** value from **Step 2B** above

▲ Copy **Incident Energy (IE)** value from **Step 2A** above

2D. Impact on Equipment and Personnel



51 ms total clearing time with a typical circuit breaker & Littelfuse Arc-Flash Relay.

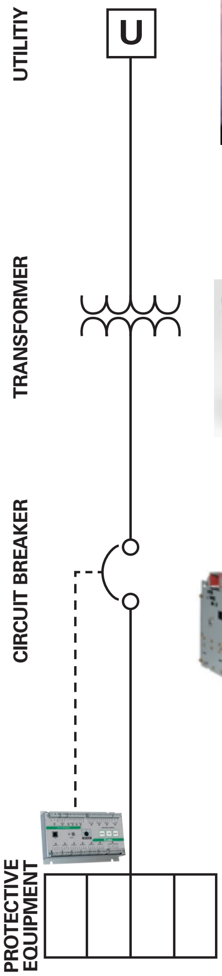
1 ms trip time with a Littelfuse Arc-Flash Relay.

Arc Damage Curve Showing Arc Current Versus Arc Duration.

Johns Hopkins APL Technical Digest, Volume 25, Number 2 (2004).

SCENARIO II: Step 1

STEP 1 - DATA COLLECTION: In order to run the preliminary calculations, a qualified person must collect all the nameplate data from your equipment. Complete steps 1-4 for <u>each</u> piece of equipment that you are considering for installation of a Littelfuse Arc-Flash Relay.



1A: SERVICE

Service Name	Primary Voltage (kV)	Available Bolted Fault Current (kA)
S1	S2	S3

1B: TRANSFORMERS

Transformer Name	Size kVA	Secondary Voltage	Secondary Connection	Impedance %Z
T1	T2	T3	T4	T5

1C: CIRCUIT BREAKER

Equipment Name	Manu-facturer & Model	Current Rating/ Frame	Sensor/ Plug Rating	Fault Current Rating kAIC	Inst Trip Max	Short Time Trip Max.	Long Time Trip Max.	CB Min. Clearing Time (ms)*
CB1	CB2	CB3	CB4	CB5	CB6	CB7	CB8	CB9

*CB mechanical clearing time, including tripping and clearing times

1D: PROTECTED EQUIPMENT TYPE

☐ Switchgear ☐ Motor Control Cabinet ☐ Panelboard

1E: PROTECTED EQUIPMENT

Equipment Name	Manu-facturer & Model	Voltage Rating	Current Rating	Fault Current Rating kAIC	Available Bolted Fault Current (kA)
E1	E2	E3	E4	E5	SCC

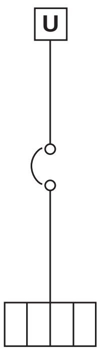
SCENARIO II: Step 2

STEP 2 - DETERMINE AVAILABLE FAULT CURRENT (SCC)

2A. If known, enter Available Bolted Fault Current (kA) at the Load from bottom of Page 4: [ ] **SCC (pg 4)** **Continue to Page 6 ▶**

2B. If NOT known: **Proceed to Step 2C ▼**

2C. Calculate the Available Bolted Fault Current Value (kA) at Transformer Secondary Terminals:

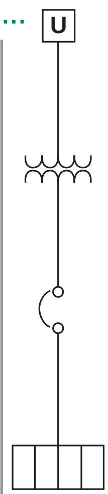


IF: You know your Available Bolted Fault Current at the Service, and you have NO Transformer installed between Service & Load:

Available Fault Current = [ ] S3 (pg 4) = [ ] SCC

Continue to Page 5 ▶

OR...



IF: A Transformer IS installed between Service & Load:

Determine Full-load Current = [[ ] T2 (pg 4) / ([ ] T3 (pg 4) x 1.73)] x 1000 = [ ] FLC

Estimated Available Fault Current* = [ ] FLC x 1 / [ ] T5 (pg 4) = [ ] SCC

Convert value from % to decimal.

*Calculation for estimated available bolted fault current does not include adjustments for X/R or motor contribution.

Continue to Page 6 ▶

2D. If the Available Bolted Fault Current value at the Service is NOT known:
Call your utility provider or consult a Professional Engineer.

SCENARIO II: Step 3—480 V OR 600 V

STEP 3 - DETERMINE YOUR INCIDENT ENERGY WITH YOUR EXISTING PROTECTION

3A. If [E3 (pg 4)] **= 480 V** or **600 V**, use **Table 1** or **Table 2** below to determine Incident Energy for Instantaneous, Short Time, & Long Time.

If [E3 (pg 4)] **= 5 kV** or **15 kV,** proceed to **Page 7**. ▶

3B. Copy values from **1C: CB** Table on Page 1.

CB6 (pg 4)	CB7 (pg 4)	CB8 (pg 4)

3C. Round up to nearest Fault Clearing Time as shown in tables below. (select 0.5, 0.33 or 0.1)

CB6	CB7	CB8

If value >0.5, please consult a licensed Professional Engineer.

3D. Calculate Existing Incident Energy (IE): Copy your **SCC value (from pg 5)**.

Round your SCC value up to nearest value as shown in tables below.

Using values from **3C**, **locate** corresponding IE values, and enter in **Line 3E**.

[SCC (pg 5)]

Round your SCC value up to nearest value per table. (65, 55, 45, etc)

[SCC rounded]

For Switchgear

Table 1: Estimated Incident Energy (IE) for 480 V & 600 V Switchgear with **Safe Working Distance=24”**

	ROUNDED CLEARING TIME (SECONDS)		
	0.5	0.33	0.1
SCC (kA)	IE (cal/cm²)	IE (cal/cm²)	IE (cal/cm²)
65	62.2	41.1	12.4
55	52.9	34.9	10.6
45	43.5	28.7	8.7
35	34.1	22.5	6.8
25	24.6	16.2	4.9
15	14.9	9.9	3.0
10	10.1	6.6	2.0
7.5	7.6	5.0	1.5

For MCCs & Panelboards

Table 2: Estimated Incident Energy (IE) for 480 V & 600 V MCCs & Panelboards with **Safe Working Distance=18”**

	ROUNDED CLEARING TIME (SECONDS)		
	0.5	0.33	0.1
SCC (kA)	IE (cal/cm²)	IE (cal/cm²)	IE (cal/cm²)
65	107.9	71.2	21.6
55	91.3	60.3	18.3
45	74.8	49.4	15.0
35	58.2	38.4	11.6
25	41.7	27.5	8.3
15	25.0	16.5	5.0
10	16.7	11.0	3.3
7.5	12.6	8.3	2.5

Tables based on IEEE 1584 method and Ungrounded Systems.

3E. Your Existing IE:

[IE1] Incident Energy for Rounded Long Time

[IE2] Incident Energy for Rounded Short Time

[IE3] Incident Energy for Rounded Instantaneous

SCENARIO II: Step 3—5 kV or 15 kV

STEP 3 - DETERMINE YOUR INCIDENT ENERGY WITH EXISTING PROTECTION

3A. **If** [E3 (pg 4)] = **5 kV** or **15 kV**, use **Table 3** or **Table 4** below to determine Incident Energy for Instantaneous, Short Time, & Long Time.

If [E3 (pg 4)] = **480 V** or **600 V**, go back to **Page 6**.

3B. Copy values from **1C: CB** Table on Page 1.

[CB6 (pg 4)] [CB7 (pg 4)] [CB8 (pg 4)]

3C. Round up to nearest Fault Clearing Time as shown in tables below. (select 0.5, 0.33 or 0.1)

[CB6] [CB7] [CB8]

If value >0.5, please consult a licensed Professional Engineer.

3D. **Calculate Existing Incident Energy (IE): Copy** your **SCC value (from pg 5)**.

Round your SCC value up to nearest value as shown in tables below.

Using values from **3C**, **locate** corresponding IE values, and enter in **Line 3E**.

[SCC (pg 5)]

Round your SCC value up to nearest value per table. (65, 55, 45, etc)

[SCC rounded]

For 5 kV

Table 3: Estimated Incident Energy (IE) for **5 kV** Switchgear with **Safe Working Distance=36"**

	ROUNDED CLEARING TIME (SECONDS)		
	0.5	0.33	0.1
SCC (kA)	IE (cal/cm²)	IE (cal/cm²)	IE (cal/cm²)
65	59.3	39.1	11.9
55	49.6	32.8	9.9
45	40.1	26.5	8.0
35	30.7	20.3	6.1
25	21.5	14.2	4.3
15	12.5	8.2	2.5
10	8.1	5.4	1.6
7.5	6.0	3.9	1.2

For 15 kV

Table 4: Estimated Incident Energy (IE) for **15 kV** Switchgear with **Safe Working Distance=36"**

	ROUNDED CLEARING TIME (SECONDS)		
	0.5	0.33	0.1
SCC (kA)	IE (cal/cm²)	IE (cal/cm²)	IE (cal/cm²)
35	162.2	107.0	32.4
30	139.0	91.7	27.8
25	115.8	76.5	23.2
20	92.7	61.2	18.5
15	69.5	45.9	13.9
10	46.3	30.6	9.3
7.5	34.8	22.9	7.0
5	23.2	15.3	4.6

Tables based on IEEE 1584 method and Ungrounded Systems.

3E. Your Existing IE:

[IE1] Incident Energy for Rounded Long Time

[IE2] Incident Energy for Rounded Short Time

[IE3] Incident Energy for Rounded Instantaneous

SCENARIO II: Step 4

STEP 4 - DETERMINE YOUR INCIDENT ENERGY WITH THE LITTELFUSE ARC-FLASH RELAY

4A. Copy your results: from **Step 3** (pg 6 or 7, **Line 3E**). This is your Incident Energy based on your Existing Protection.

Incident Energy for Instantaneous = [ ] **IE1**

Incident Energy for Short Time = [ ] **IE2**

Incident Energy for Long Time = [ ] **IE3**

4B. Calculate New CB Clearing Time (NCBCT): Which is constant and independent of Instantaneous, Short Time, or Long Time Trip (LSI) settings. (LSI settings are still valid for bolted faults. However, the Arc-Flash Relay replaces LSI settings for arcing faults.

[ ] **CB9 (pg 4)** + [1 ms] **AFRCT** = [ ] **NCBCT** → Round your NCBCT value up to nearest value per tables below. (25, 50 or 75 ms) → [ ] **NCBCT rounded**

▲ Enter Circuit Breaker (CB) Clearing Time from C9, pg 1

▲ Add 1 ms for Arc-Flash Relay Clearing Time

▲ New CB Clearing Time

4C. Determine New Incident Energy (NIE): If rounded **NCBCT** value is **25 ms**, use **Table 5**.
If rounded **NCBCT** value is **50 ms**, use **Table 6**.
If rounded **NCBCT** value is **75 ms**, use **Table 7**.
If rounded **NCBCT** value is >**75 ms**, contact your licensed Professional Engineer.

4D. Determine Your SCC:
- **Enter** your SCC value from page 5. ▶ [ ] **SCC**
- **Round up** your SCC value to the nearest SCC value in the tables below. (65, 55, 45, etc.) → [ ] **SCC rounded**
- Using Rounded SCC and the columns relevant to Your Voltage and Your Equipment Type, **Locate** corresponding IE values, and enter in **Line 4E**.

Enter Voltage Rating from Pg 1 ▼ [ ] **E3 (pg 4)**

Table 5: NCBCT Value of **25 ms**

	VOLTAGE			
	480 V/ 600 V		5 kV	15 kV
	EQUIPMENT		EQUIPMENT	
SCC (kA)	MCC/ PB	SWGR	SWGR	SWGR
65	5.4	3.1	3.0	–
55	4.6	2.7	2.5	–
45	3.8	2.2	2.0	–
35	2.9	1.7	1.5	8.1
30	–	–	–	7.0
25	2.1	1.2	1.1	5.8
20	–	–	–	4.6
15	1.2	0.8	0.6	3.5
10	0.8	0.5	0.4	2.3
7.5	0.6	0.4	0.3	1.8
5	–	–	–	1.2

Table 6: NCBCT Value of **50 ms**

	VOLTAGE			
	480 V/ 600 V		5 kV	15 kV
	EQUIPMENT		EQUIPMENT	
SCC (kA)	MCC/ PB	SWGR	SWGR	SWGR
65	10.8	6.2	6.0	–
55	9.2	5.3	5.0	–
45	7.5	4.4	4.0	–
35	5.8	3.4	3.1	16.2
30	–	–	–	13.9
25	4.2	2.4	2.2	11.6
20	–	–	–	0.3
15	2.5	1.4	1.3	7.0
10	1.7	1.0	0.8	4.7
7.5	1.3	0.8	0.6	3.5
5	–	–	–	2.3

Table 7: NCBCT Value of **75 ms**

	VOLTAGE			
	480 V/ 600 V		5 kV	15 kV
	EQUIPMENT		EQUIPMENT	
SCC (kA)	MCC/ PB	SWGR	SWGR	SWGR
65	16.2	9.3	8.9	–
55	13.7	8.0	7.4	–
45	11.3	6.5	6.0	–
35	8.7	5.1	4.6	24.3
30	–	–	–	20.9
25	6.2	3.7	3.2	17.4
20	–	–	–	13.9
15	3.8	2.3	1.9	10.4
10	2.5	1.5	1.2	7.0
7.5	1.9	1.1	0.9	5.3
5	–	–	–	3.5

4E. Your New IE: → [ ] **NIE1** → [ ] **NIE1** → [ ] **NIE1**

SCENARIO II: Step 5

STEP 5 - CALCULATE YOUR REDUCTION IN INCIDENT ENERGY BECAUSE OF THE ADDITION OF THE LITTELFUSE ARC-FLASH RELAY

5A. Copy New Incident Energy (NIE1) from Step 4E (pg 8).

New Incident Energy = [NIE1]

Incident Energy for Short Time = [IE1] (crossed out)

Incident Energy for Long Time = [IE1] (crossed out)

} NOT NEEDED WITH USE OF ARC-FLASH RELAY

5B. To Calculate the IE Reduction:

Copy **NIE1** value from **Step 5A** above ▼

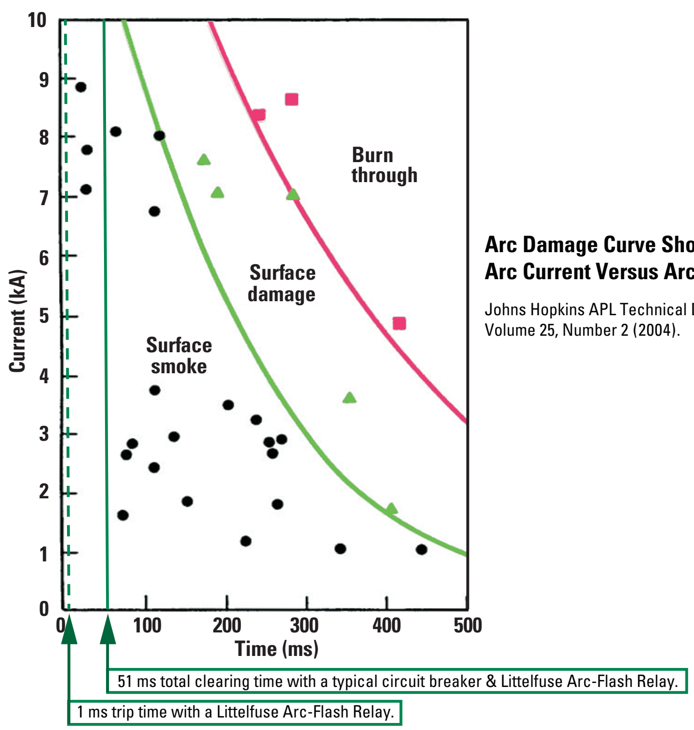
Copy **Incident Energy (IE)** value from **Step 3E** (pg 6 or 7) ▼

Reduction for Instantaneous = [1– [NIE1] / [IE1]] **x 100 =** ______________ **%**

Reduction for Short Time = [1– [NIE1] / [IE2]] **x 100 =** ______________ **%**

Reduction for Long Time = [1– [NIE1] / [IE3]] **x 100 =** ______________ **%**

5C. Impact on Equipment and Personnel



Arc Damage Curve Showing Arc Current Versus Arc Duration.

Johns Hopkins APL Technical Digest, Volume 25, Number 2 (2004).

NFPA70E (FROM ANNEX H)

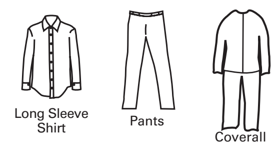
Guidance on Selection of Arc-rated Clothing and other Personal Protective Equipment (PPE) for Use When Incident Exposure is Determined by a Hazard Analysis.

Talk to your Arc-Flash Hazard Assessment Provider or licensed Professional Engineer to determine what your PPE needs might be based on your New Incident Energy value.

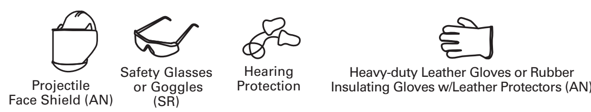
INCIDENT ENERGY EXPOSURE	PROTECTIVE CLOTHING AND PPE

Less than or Equal to 1.2 cal/cm²

Protective clothing, non-melting (in accordance with ASTM F 1506-08) or untreated natural fiber

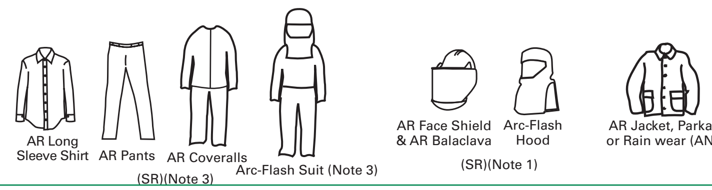


Other personal protective equipment

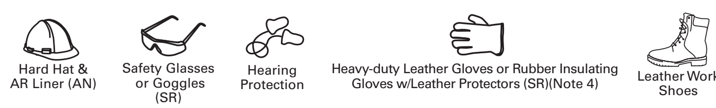


Greater than 1.2 to 12 cal/cm²

Arc-rated clothing and equipment with an arc rating equal to or greater than the incident energy determined in a hazard analysis (See Note 3)

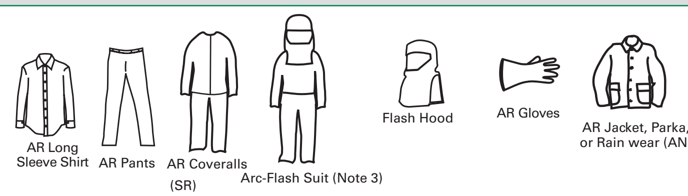


Other personal protective equipment

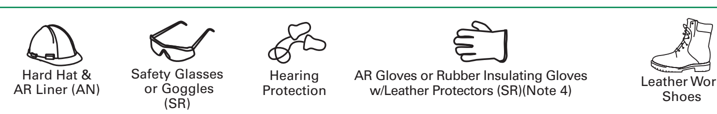


Greater than 12 cal/cm²

Arc-rated clothing and equipment with an arc rating equal to or greater than the incident energy determined in a hazard analysis (See Note 3)



Other personal protective equipment



AR = Arc-Rated
AN = As needed [in addition to the protective clothing and PPE required by 130.5(B)(1).
SR = Selection of one in group is required by 130.5(B)(1).

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). For full head and neck protection , use a balaclava or an arc-flash hood.
2. All items not designated "AN" are required by 130.7(C).
3. 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.
4. 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.

DISCLAIMER - for illustrative purposes only. PPE may vary depending on specific task.
For more information refer to NFPA 70 E Standard for Electrical Safety in work place.

DISCLAIMER

NOTE: This workbook contains references to miscellaneous codes and standards. This material is not the complete and official position of IEEE or the NFPA on the referenced subject. Always consult the applicable code or standard in its entirety for more complete information.

The calculation models that have been produced in this workbook for the Arc-Flash Incident Energy values are based on industry consensus standard NFPA 70E Standard for Electrical Safety in the Workplace 2012 Edition which utilizes the IEEE 1584 Guide for Performing Arc-Flash Hazard Calculations – 2002 calculation model. It is assumed all existing installed equipment meets all applicable codes and standards and can withstand the potential fault which can occur at a given point in the electrical system.

The Incident energy values calculated are used to approximate the appropriate Personal Protective Equipment (PPE) that is needed should an Arc-Flash occur. All calculations should be modeled within the facility's engineering study and confirmed by your Arc-Flash Assessment Provider or a Licensed Professional Engineer. Extra care must be used when selecting PPE. This workbook approximates the thermal effects of an Arc-Flash event and not the potential blast effects. Many variables contribute to the end result. In the event an Arc-Flash occurs, there is no guarantee a person will be completely protected with the PPE determined by the Arc-Flash Hazard Analysis.

The complete Engineering Study including a Short-Circuit Study, Coordination Study, and Arc-Flash Hazard Assessment should be updated when changes are made to the system. The Short-Circuit Study models the electrical system impedance and then calculates bolted fault duty at all the buses included in the study. The short-circuit fault current is a function of the utility short-circuit capacity, on-site source contributions such as motors and in-service generators, and system impedance such as cables and transformers.

To assure continuing device coordination and trip times as listed in your engineering study, it is essential that all protective devices are maintained, tested and calibrated at regular intervals, as recommended by the manufacturer. Changing, or upgrading equipment in order to lower hazard levels, may also require changes of protective devices to insure coordination with upstream or downstream equipment. Overcurrent protective devices or settings that were installed at the time the engineering study was completed should not be modified or replaced with unlike components without updating the Coordination Study and Arc-Flash Hazard Assessment. If using fuses, they must be replaced with the same brand and rating to insure proper coordination (as required).

Circuit breakers and fuses must have an interrupting rating which exceeds the maximum bolted fault current available at its location. Switchgear equipment must have a momentary rating of equal or greater value than the calculated bolted fault current at its location. Arc-Flash calculations use this level of bolted fault current for determining arcing fault current and incident energy levels.

The Arc-Flash Hazard Assessment depends on operation of the protective devices as shown on the manufacturer's TCC curves. These devices may be normally inactive for long periods. It is essential that all protective devices and associated relays and sensors are tested and calibrated at regular intervals, as recommended by the manufacturer. Proper testing, inspection, and calibration at regular intervals will help ensure clearing times of protective devices as calculated in the studies, thereby protecting personnel.

Changes in the electrical system configuration, including but not limited to, available short-circuit current, system impedance, or protective device clearing times, will invalidate incident energy (cal/cm^2) values calculated. Recalculation of incident energy values are required to be performed upon changes to the electrical system in order to maintain a safe and compliant facility according to NFPA 70E Article 130.5.

In order to maintain a safe and compliant facility, it is imperative that the Engineering/Arc-Flash Assessment study is updated as changes are made in the facility. Changes in the electrical system within the facility, including impedance, protective device settings, and Short-Circuit duties will affect the incident energy values calculated. As a result, any changes in the electrical system will invalidate the approximated values. Contact your Arc-Flash Assessment Provider or a licensed Professional Engineer to update or maintain your engineering study.

Technical Advice Disclaimer

The instructions for performance of a preliminary calculation as set forth in this workbook are provided for informational purposed only without warranty, fitness for any particular purpose, or any guarantee as to your specific scenario, and are not intended to be relied upon as authoritative or as a substitute for obtaining the advice of your Arc-Flash Assessment Provider or licensed Professional Engineer.

Liability Disclaimer

Littelfuse assumes no liability for any consequences, damages, or loss of production as a result of use or misuse of the information or calculations contained in this workbook.

Additional technical information and application data for Littelfuse protection relays, fuses and other circuit protection and safety products can be found on **www.littelfuse.com/protectionrelays**. For questions, contact our Technical Support Group **(800-832-3873)**. Specifications, descriptions and illustrative material in this literature are as accurate as known at the time of publication, but are subject to changes without notice. All data was compiled from public information available from manufacturers' manuals and datasheets.

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