

Arc Flash Protection
NFPA 70E / ASTM F 1506
Third Edition

PROTECTION

from electric arc exposure

The intense energy and very short duration of an electric arc flash represents a very unique exposure. Everyday work clothes made from regular cotton or poly/cotton fabrics, regardless of weight, can be readily ignited at some exposure level and will continue to burn adding to the extent of injury sustained from the arc alone. NFPA 70E now requires employees to wear flame resistant (FR) protective clothing that meets the requirements of ASTM F1506 wherever there is possible exposure to an electric arc flash. It requires employers to perform a flash hazard analysis to determine the flash protection boundary distance.

The standard is designed to protect employees working inside these flash protection boundaries by requiring protective clothing for the corresponding Hazard/Risk Category that has an ATPV of at least the value listed in the "Protective Clothing Characteristics" section of the standard (see right). OSHA has confirmed that garments which meet the requirements of ASTM F1506 are in compliance with OSHA 29 CFR 1910.269 Electrical Power Generation, Transmission and Distribution, with regard to garments not contributing to burn severity.

Typical Protective Clothing Systems
Table 130.7(C)(11) Protective Clothing Characteristics

HAZARD RISK CATEGORY	CLOTHING DESCRIPTION (Typical Number of Clothing Layers in Parentheses)	MINIMUM ATPV RATING OF PPE cal/cm2
0	Non-melting, flammable materials 4.5 oz.(1)	N/A
1	FR Shirt and FR Pants (1)	4
2	Cotton Underwear Plus FR Shirt and FR Pants (2)	8
3	Cotton Underwear Plus FR Shirt and FR Pants Plus FR Coverall (3)	25
4	Cotton Underwear Plus FR Shirt and FR Pants Plus Double Layer Switching Coat and Pants (4)	40

11 CAL

LEVEL 2



1 ply 9 oz Navy Indura® Ultra Soft®
ATPV = 11.1 Cal/cm2

- Hood SWH-11
- Jacket 35" SWJ-11-(SIZE)
- Coat 50" SWC-11-(SIZE)
- Pant SWP-11-(SIZE)
- Bib Overall SWB-11-(SIZE)
- Legging SW-401-11
- Hooded Jacket SW-620-11-(SIZE)

20 CAL

LEVEL 2



1 ply 12 oz Grey Indura® Ultra Soft®
ATPV = 20.9 Cal/cm2

- Hood SWH-20
- Jacket 35" SWJ-20-(SIZE)
- Coat 50" SWC-20-(SIZE)
- Pant SWP-20-(SIZE)
- Bib Overall SWB-20-(SIZE)
- Legging SW-401-20
- Hooded Jacket SW-620-20-(SIZE)

32 CAL

LEVEL 3



9 oz over 7 oz Indura® Ultra Soft®
ATPV = 32.7 Cal/cm2

- Hood SWH-32
- Jacket 35" SWJ-32-(SIZE)
- Coat 50" SWC-32-(SIZE)
- Pant SWP-32-(SIZE)
- Bib Overall SWB-32-(SIZE)
- Legging SW-401-32
- Hooded Jacket SW-620-32-(SIZE)

FOR CHICAGO PROTECTIVE APPAREL'S NEW LIGHT-ENHANCING WINDOW WRITE "LE" AFTER YOUR HOOD'S PART NUMBER



When incident energy exceeds 40 cal/cm² at the working distance, greater emphasis than normal should be placed on de-energizing before working on or near the exposed electrical conductors or circuit parts.

45 CAL

LEVEL 4



9 oz over 12 oz Indura® Ultra Soft®
ATPV = 45.0 Cal/cm²

Hood	SWH-45
Jacket 35"	SWJ-45-(SIZE)
Coat 50"	SWC-45-(SIZE)
Pant	SWP-45-(SIZE)
Bib Overall	SWB-45-(SIZE)
Legging	SW-401-45

59 CAL

LEVEL 4



12 oz over 12 oz Indura® Ultra Soft®
ATPV = 59.0 Cal/cm²

Hood	SWH-59
Jacket 35"	SWJ-59-(SIZE)
Coat 50"	SWC-59-(SIZE)
Pant	SWP-59-(SIZE)
Bib Overall	SWB-59-(SIZE)
Legging	SW-401-59

76 CAL

LEVEL 4



12 oz over 7 oz over 12 oz Indura® Ultra Soft® ATPV = 76.2 Cal/cm²

Hood	SWH-76
Jacket 35"	SWJ-76-(SIZE)
Coat 50"	SWC-76-(SIZE)
Pant	SWP-76-(SIZE)
Bib Overall	SWB-76-(SIZE)
Legging	SW-401-76

107 CAL

LEVEL 4



Twaron® microfiber over CarbonX®
ATPV = 107.1 Cal/cm²

Hood	SWH-107
Jacket 35"	SWJ-107-(SIZE)
Coat 50"	SWC-107-(SIZE)
Pant	SWP-107-(SIZE)
Bib Overall	SWB-107-(SIZE)
Legging	SW-401-107



ARC-RELATED WORKWEAR

Navy Coverall
9 oz Navy Indura® Ultra Soft®, 11.1 ATPV
Part # 605-USN-(size)

Khaki Coverall
7 oz Khaki Indura® Ultra Soft®, 8.2 ATPV
Part # 605-USK-(size)

Medium Blue Work Shirt
7 oz Medium Blue Indura® Ultra Soft®, 8.2 ATPV
Part # 625-USB-(size)

Lightweight Work Shirt
5 1/2 oz Indura® Ultra Soft® Chambray, 5.2 ATPV
Part # 625-USCH-(size)

Khaki Work Shirt
7 oz Khaki Indura® Ultra Soft®, 8.2 ATPV
Part # 625-USK-(size)



Navy Work Pant
9 oz Navy Indura® Ultra Soft®, 11.1 ATPV
Part # 606-USN-(waist x inseam)

Denim Rugged Twill Work Pant
12-13 oz Denim Indura® Ultra Soft®, 10 ATPV
Part # 606-USD-(waist x inseam)

Brown Duck Lined Jacket
11 oz Indura® Ultra Soft® shell with
7 oz Indura lining, 34.5 ATPV
Part # 600-USBDK- (size)

Brown Duck Insulated Bib Overall
11 oz Indura® Ultra Soft® with
10.5 oz Moda-Quilt Lining, 43.7 ATPV
Part # 618-USBDK- (size)

Hooded Fleece/Jacket Liner
10 oz Navy Fleece Indura®, 17.7 ATPV
Part # 615-USFN-(size)



RUBBER INSULATED GLOVES

Refer to ASTM D 120-02 Standard Specification for Rubber Insulating Gloves and ASTM F 496-02 Standard Specification for In-Service Care of Insulating Gloves and Sleeves.

Class	Proof-test (A_C)	Max. use Voltage (A_C)
00	2,500	500
0	5,000	1,000
1	10,000	7,500
2	20,000	17,000
3	30,000	26,500
4	40,000	36,000



LINEMAN'S GLOVES

Class	Length	Size	Part Number
00	11"	8-12	LRIG-00-11-(size)
0	11"	8-12	LRIG-0-11-(size)
1	14"	8-12	LRIG-1-14-(size)
2	14"	8-12	LRIG-2-14-(size)
3	16"	8-12	LRIG-3-16-(size)
4	18"	8-12	LRIG-4-18-(size)

LEATHER PROTECTOR GLOVES

Refer to ASTM F 696-02, Standard Specification for Leather Protectors for Rubber Insulating Gloves and Mittens.



Class	Length	Sizes	Part Number
Low Voltage	10"	8 thru 12	PG-0-ADJS-(size)
High Voltage	12"	8 thru 12	LLPG-12-(size)
High Voltage	14"	9 thru 12	LLPG-14-(size)
High Voltage	16"	10 thru 12	LLPG-16-(size)

Remember, ASTM specifications require a minimum distance of 1" per 10,000 volts of A-C proof test between the edge of your rubber glove cuff and the edge of your protector cuff.

RUBBER GLOVE LINERS



Description	Part Number
Wool glove liner for warmth	M-W-100
Kevlar glove liner FR, cut and comfort	K-100
Cotton glove liner for comfort	C-100
CarbonX liner for Flame Resistance	CX-100



12" Glove Bag
Durable 12" bag for
11" Rubber gloves
Part # GB-12

14" Glove Bag
Durable 15" bag for
14" Rubber gloves
Part # GB-15

Durable Cordura® Nylon gear bag for
arc flash protective items.

Part # 909-ARC



FACE SHIELDS AND BRACKETS

Universal Cap Bracket



Slotted Cap Bracket



Universal Hat Bracket



Windows

ATPV	Description	Part Number
10 cal/cm ²	Full face window	WV-ARC-10
10 cal/cm ²	Window for use with chin guard	WV-CHN-10
25 cal/cm ²	Replacement window for flash hood	WV-ARC-25R
45 cal/cm ²	Replacement window for flash hood	WV-ARC-45R
107 cal/cm ²	Replacement window for flash hood	WV-ARC-107R

Brackets

Description	Part Number
Universal Cap Bracket	HB-2-CAP
Slotted Cap Bracket	HB-2-SLT
Universal Hat Bracket	HB-2-UNV

Accessories

Chin Guard	SW-CN-G
Hard Cap	E2RW-WE
Hard Hat	E1RW-WE

DOUBLE LAYER FR HOODS

CARBONX[®] Ultimate



Our CarbonX[®] Ultimate cut or flared hood provides an amazing 23 cal/cm² of protection. CarbonX[®] is a blend of carbon and Kevlar fibers.

Part# KCF-51

CARBONX[®] Classic



Again an amazing 23 cal/cm² protection with our Classic cut neck drape. CarbonX[®] is a blend of carbon and Kevlar fibers.

Part# KC-51

Nomex[®] Blend



Our Nomex[®] blend hood offers economy and 8.2 cal/cm² protection.

KN-51-NFPA

SIMPLIFIED, TWO-CATEGORY, FLAME-RESISTANT (FR) CLOTHING SYSTEM

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

H.1 Use of Simplified Approach. The use of Table H.1 is suggested as a simplified approach to assure adequate PPE for electrical workers within facilities with large and diverse electrical systems. The clothing listed in


Table H.1 fulfills the minimum FR clothing requirements of Table 130.7(C)(10) and Table 130.7(C)(11). The clothing systems listed in this table should be used with the other PPE appropriate for the Hazard/Risk Category. See Table 130.7(C)(11).

Table H.1 Simplified, Two-Category, Flame-Resistant Clothing System Clothing*

Clothing*	Applicable Tasks
Everyday Work Clothing FR long-sleeve shirt (minimum arc rating of 4) worn over an untreated cotton T-Shirt with FR pants (minimum arc rating of 8) or FR coveralls (minimum arc rating of 4) worn over an untreated cotton T-shirt (or an untreated natural fiber long sleeve shirt) with untreated natural fiber pants.	All Hazard/Risk Category 1 and 2 tasks listed in Table 130.7(C)(10). On systems operating at less than 1000 volts, these tasks include work on all equipment <i>except</i> <ul style="list-style-type: none"> • Insertion or removal of low-voltage motor starter "buckets," • Insertion or removal of power circuit breakers from switchgear cubicles or • Removal of bolted covers from switchgear. On systems operating at 1000 volts or greater, tasks also include the operation of switching devices with <i>equipment enclosure doors closed</i> .
Electrical "Switching" Clothing Multilayer FR flash jacket and FR bib overalls worn over either FR coveralls (minimum arc rating of 4) or FR long-sleeve shirt and FR pants (minimum arc rating of 4), worn over untreated natural fiber long-sleeve shirt and pants, worn over an untreated cotton T-shirt or Insulated FR coveralls (with a minimum arc rating of 25, independent of other layers) worn over untreated natural fiber long-sleeve shirt with untreated denim cotton blue jeans ("regular weight," minimum 12 oz/yd ² fabric weight), worn over an untreated cotton T-shirt.	All Hazard/Risk Category 3 and 4 tasks listed in Table 130.7(C)(10) On systems operating at 1000 volts or greater, these tasks include work on exposed live parts of all equipment. On systems of less than 1000 volts, tasks include insertion or removal of low-voltage motor starter MCC "buckets," insertion or removal of plug-in devices into or from busway, insertion or removal of power circuit breakers and removal of bolted covers from switchgear.

*Note other PPE required for the specific tasks listed in Tables 130.7(C)(10)(a) and 130.7(C)(10), which include arc-rated face shields or flash suit hoods, FR hardhat liners, safety glasses or safety goggles, hard hat, hearing protection, leather gloves, voltage-rated gloves, and voltage-rated tools.


Level 2 Kit Part#L2K-(size)



Includes:

35" Jacket (11cal/cm ²)	Class 0 rubber gloves
Over pant (11cal/cm ²)	Leather protector gloves
Face shield & cap bracket	Glove bag
	Gear bag

Level 4 Kit Part#L4K-(size)



Includes:

35" Jacket (45cal/cm ²)	Class 2 rubber gloves
Over pant (45cal/cm ²)	Leather protector gloves
Hood w/out hard cap	Glove bag
	Gear bag

Customized Flash Protection Kits

The following items come standard with all kits:

Gear bag is included

Face shield or hood will be included and match clothing protection level

If you select a rubber glove, the leather protector and glove bag will be included automatically.

Select from the list below to fill out your custom part number

	Clothing Style	Clothing Protection Cal/cm ²	Clothing Size	Glove Requirement	Glove Size
Example: KIT-	JP	20	XL	0	10
	Jacket & Pant (JP)	11	S	No Gloves (NG)	8
	Jacket & Bibs (JB)	20	M	Class 00 (00)	8.5
	Coat & Legging (CL)	32	L	Class 0 (0)	9
	Coverall (CV)	45	XL	Class 1 (1)	9.5
		59	2XL		10
		76	3XL		10.5
		106	4XL		11
Part# example	KIT-JP-20-XL-0-10				12

Table 130.7(C)(9)(a) Hazard/Risk Category Classification
 Task (Assumes Equipment Is Energized, and Work Is Done Within the Flash Protection Boundary)

Task	HAZARD/RISK CATEGORY			Task	HAZARD/RISK CATEGORY		
	V-RATED GLOVES	V-RATED TOOLS	V-RATED GLOVES		V-RATED TOOLS	V-RATED GLOVES	V-RATED TOOLS
Panelboards rated 240 V and below – Notes 1 and 3	—	—	—	Work on energized parts, including voltage testing	2*	Y	Y
Circuit breaker (CB) or fused switch operation with covers on	0	N	N	Application of safety grounds, after voltage test	2*	Y	N
CB or fused switch operation with covers off	0	N	N	Revenue meters (kW-hour, at primary voltage and current)	—	—	—
Work on energized parts, including voltage testing	1	Y	Y	Insertion or removal	2*	Y	N
Remove/install CBs or fused switches	1	Y	Y	Cable trough or tray cover removal or installation	1	N	N
Removal of bolted covers (to expose bare, energized parts)	1	N	N	Miscellaneous equipment cover removal or installation	1	N	N
Opening hinged covers (to expose bare, energized parts)	0	N	N	Work on energized parts, including voltage testing	2*	Y	Y
Panelboards or Switchboards rated >240 V and up to 600 V (with molded case or insulated case circuit breakers) – Notes 1 and 3	—	—	—	Application of safety grounds, after voltage test	2*	Y	N
CB or fused switch operation with covers on	0	N	N	NEMA E2 (fused contactor) Motor Starters, 2.3 kV through 7.2 kV	—	—	—
CB or fused switch operation with covers off	1	N	N	Contactor operation with enclosure doors closed	0	N	N
Work on energized parts, including voltage testing	2*	Y	Y	Reading a panel meter while operating a meter switch	0	N	N
600 V Class Motor Control Centers (MCCs) – Notes 2 (except as indicated) and 3	—	—	—	Contactor operation with enclosure doors open	2*	N	N
CB or fused switch or starter operation with enclosure doors closed	0	N	N	Work on energized parts, including voltage testing	3	Y	Y
Reading a panel meter while operating a meter switch	0	N	N	Work on control circuits with energized parts 120 V or below, exposed	0	Y	Y
CB or fused switch or starter operation with enclosure doors open	1	N	N	Work on control circuits with energized parts > 120 V, exposed	3	Y	Y
Work on energized parts, including voltage testing	2*	Y	Y	Insertion or removal (racking) of starters from cubicles, doors open	3	N	N
Work on control circuits with energized parts 120 V or below, exposed	0	Y	Y	Insertion or removal (racking) of starters from cubicles, doors closed	2	N	N
Work on control circuits with energized parts > 120 V, exposed	2*	Y	Y	Application of safety grounds, after voltage test	3	Y	N
Insertion or removal of individual starter “buckets” from MCC – Note 4	3	Y	N	Removal of bolted covers (to expose bare, energized parts)	4	N	N
Application of safety grounds, after voltage test	2*	Y	N	Opening hinged covers (to expose bare, energized parts)	3	N	N
Removal of bolted covers (to expose bare, energized parts)	2*	N	N	Metal Clad Switchgear, 1 kV and above	—	—	—
Opening hinged covers (to expose bare, energized parts)	1	N	N	CB or fused switch operation with enclosure doors closed	2	N	N
600 V Class Switchgear (with power circuit breakers or fused switches) – Notes 5 and 6	—	—	—	Reading a panel meter while operating a meter switch	0	N	N
CB or fused switch operation with enclosure doors closed	0	N	N	CB or fused switch operation with enclosure doors open	4	N	N
Reading a panel meter while operating a meter switch	0	N	N	Work on energized parts, including voltage testing	4	Y	Y
CB or fused switch operation with enclosure doors open	1	N	N	Work on control circuits with energized parts 120 V or below, exposed	2	Y	Y
Work on energized parts, including voltage testing	2*	Y	Y	Work on control circuits with energized parts > 120 V, exposed	4	Y	Y
Work on control circuits with energized parts 120 V or below, exposed	0	Y	Y	Insertion or removal (racking) of CBs from cubicles, doors open	4	N	N
Work on control circuits with energized parts > 120 V, exposed	2*	Y	Y	Insertion or removal (racking) of CBs from cubicles, doors closed	2	N	N
Insertion or removal (racking) of CBs from cubicles, doors open	3	N	N	Application of safety grounds, after voltage test	4	Y	N
Insertion or removal (racking) of CBs from cubicles, doors closed	2	N	N	Removal of bolted covers (to expose bare, energized parts)	4	N	N
Application of safety grounds, after voltage test	2*	Y	N	Opening hinged covers (to expose bare, energized parts)	3	N	N
Removal of bolted covers (to expose bare, energized parts)	3	N	N	Opening voltage transformer or control power transformer compartments	4	N	N
Opening hinged covers (to expose bare, energized parts)	2	N	N	Other Equipment 1 kV and above	—	—	—
Other 600 V Class (277 V through 600 V, nominal) Equipment – Note 3	—	—	—	Metal clad load interrupter switches, fused or unfused	—	—	—
Lighting or small power transformers (600 V, maximum)	—	—	—	Switch operation, doors closed	2	N	N
Removal of bolted covers (to expose bare, energized parts)	2*	N	N	Work on energized parts, including voltage testing	4	Y	Y
Opening hinged covers (to expose bare, energized parts)	1	N	N	Removal of bolted covers (to expose bare, energized parts)	4	N	N
				Opening hinged covers (to expose bare, energized parts)	3	N	N
				Outdoor disconnect switch operation (hookstick operated)	3	Y	Y
				Outdoor disconnect switch operation (gang-operated, from grade)	2	N	N
				Insulated cable examination, in manhole or other confined space	4	Y	N
				Insulated cable examination, in open area	2	Y	N

Legend:

V-rated Gloves are gloves rated and tested for the maximum line-to-line voltage upon which work will be done.

V-rated Tools are tools rated and tested for the maximum line-to-line voltage upon which work will be done.

2* means that a double-layer switching hood and hearing protection are required for this task in addition to the other Hazard/Risk Category 2 requirements of Table 130.7(C)(10) of Part II.

Y = yes (required) N = no (not required)

Notes:

- 1) 25 kA short circuit current available, 0.03 second (2 cycle) fault clearing time
- 2) 65 kA short circuit current available, 0.03 second (2 cycle) fault clearing time
- 3) For < 10 kA short circuit current available, the Hazard/Risk Category required may be reduced by one Number.
- 4) 65 kA short circuit current available, 0.33 second (20 cycle) fault clearing time
- 5) 65 kA short circuit current available, up to 1.0 second (60 cycle) fault clearing time
- 6) For < 25 kA short circuit current available, the Hazard/Risk Category required may be reduced by one Number.



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