

Use of layered solutions to address COVID-19 contamination concerns with high arc suits

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The high arc-flash suit & COVID-19

Arc-flash suits are used for protection against high incident energy hazard levels.

While these suits are very effective, they can also be expensive, and end users are often limited to one shared product for multiple employees.

According to the Centers for Disease Control and Prevention (CDC), the recommended method to remove contamination to prevent the spread of COVID-19 is laundering and drying per instructions from the clothing manufacturer.¹

Shared products can often not be laundered between uses, which is the recommended way to remove contamination from clothing exposed to COVID-19.

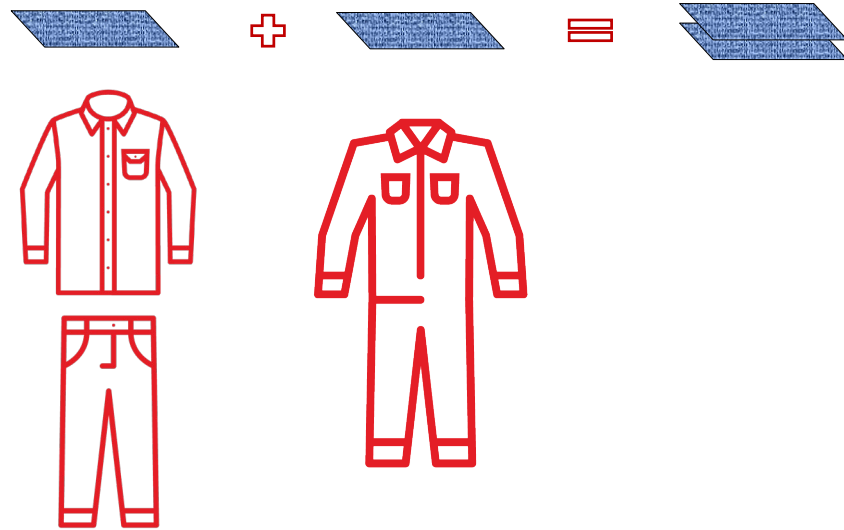
¹ <https://www.cdc.gov/coronavirus/2019-ncov/community/organizations/cleaning-disinfection.html>



If the arc-flash suit cannot be disinfected between uses, an alternative for consideration is the use layering to achieve the required protection levels.

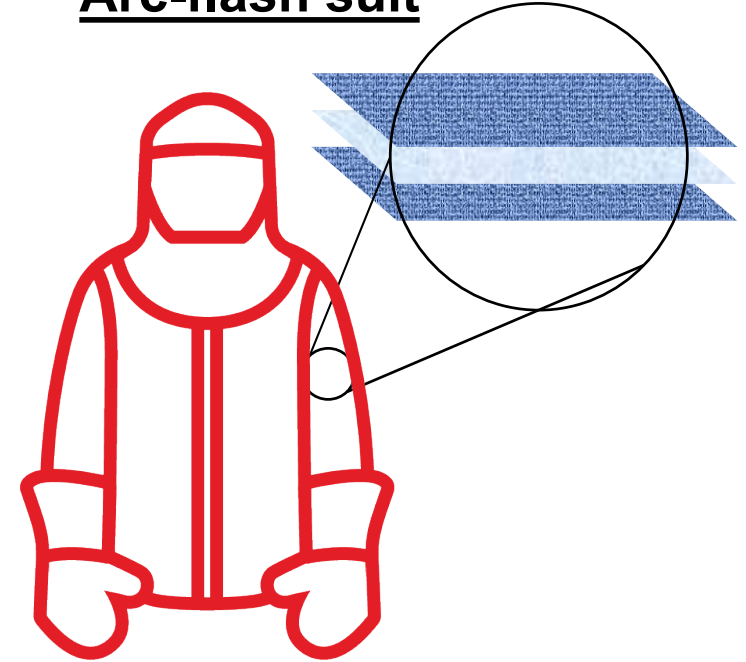
What is layering?

Layered protection



1. Each layer has an independent arc rating
2. Both layers are also tested together as a system
3. Layers can be worn independently or together

Arc-flash suit



1. Arc rating is for the entire system
2. Suits could include multiple layers but they are bonded together and can not be worn independently

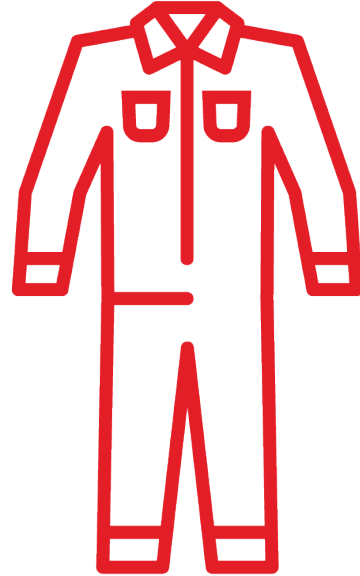
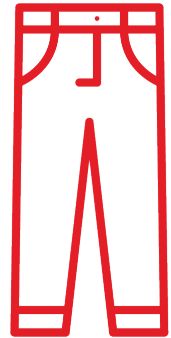
Why consider a layered solution during COVID-19?

1. Can be repeatedly laundered between use to decontaminate the garment(s) without compromising protection
2. Provides higher levels of arc protection than single layers
3. Costs a fraction as compared to high arc rated suits so each user can have own clothing
4. Offers customizable selection of protection for task at hand
 - Higher dexterity
 - Lower heat stress
 - Less fatigue
5. Layers can be added or removed more easily offering higher comfort levels (so long as the system meets the protection requirements)

Note that switching to a layered solution requires changes in work practice and requires education to ensure users are properly protected. Users must also wear other appropriate arc rated PPE such as, but not limited to head, neck, hand, and foot protection based on the hazard assessment.

Layered solutions: Example 1

The system must be tested together to determine the arc rating



33 cal/cm²

9.5 cal/cm²

Protera®

6.5oz/yd², 220 g/m²

Arc rated shirt & trousers

9.5 cal/cm²

Protera®

6.5oz/yd², 220 g/m²

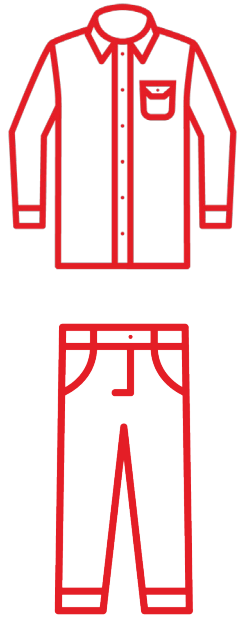
Arc rated coverall

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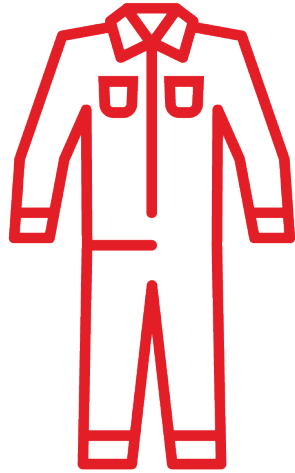
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Layered solutions: Example 2

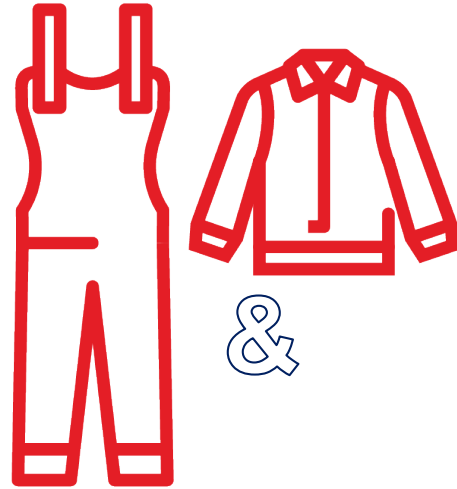
The system must be tested together to determine the arc rating



9.9 cal/cm²
Protera®
8.0oz/yd², 271 g/m²
Arc rated shirt & trousers



9.9 cal/cm²
Protera®
8.0oz/yd², 271 g/m²
Arc rated coverall



5.7 cal/cm²
Nomex® IIIA
6.0 oz/yd², 203 g/m²
Arc rated bib overall and jacket



66 cal/cm²



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Arc ratings for Nomex® single and multi layer offerings

Layering System	Layers	Outer/Inner/Middle	Weight (g/m ²)	OSY	Total Weight (g/m ²)	Total OSY	Arc Rating (cal/cm ²)	PPE Category
1	Nomex® IIIA	Outer	153	4.5	424	12.5	17.2	2
	Protera®	Inner	271	8.0				
2	Nomex® IIIA	Outer	203	6.0	356	10.5	18.8	2
	Nomex® IIIA	Inner	153	4.5				
3	Nomex® IIIA	Outer	203	6.0	406	12.0	27.1	3
	Nomex® IIIA	Inner	203	6.0				
4	Protera®	Outer	220	6.5	373	11.0	30.1	3
	Nomex® IIIA	Inner	153	4.5				
5	Protera®	Outer	220	6.5	423	12.5	31.5	3
	Nomex® IIIA	Inner	203	6.0				
6	Protera®	Outer	220	6.5	440	13.0	33	3
	Protera®	Inner	220	6.5				
7	Protera®	Outer	271	8.0	491	14.5	35.9	3
	Protera®	Inner	220	6.5				
8	Protera®	Outer	271	8.0	542	16.0	39.9	3
	Protera®	Inner	271	8.0				
9	Nomex® IIIA	Outer	203	6.0	559	16.5	43	4
	Nomex® IIIA	Middle	153	4.5				
	Nomex® IIIA	Inner	203	6.0				
10	Protera®	Outer	271	8.0	745	22.0	66	4
	Protera®	Middle	271	8.0				
	Nomex® IIIA	Inner	203	6.0				

Product	Weight (oz/yd ²)	Arc Rating (cal/cm ²)
Nomex® IIIA	4.5	4.6
Protera®	6.5	9.5
Protera®	8	9.9
Nomex® IIIA	6	5.7



Additional considerations

1. Non-melting, non-FR undergarments, such as a cotton T-shirt, are allowed to be worn as under layers; however, the added layer is not counted towards the arc rating of the system [NFPA® 70E section 130.7 (C) (12) (a)]
2. Putting on a 8 cal/cm² coverall over a 4cal/cm² pant and shirt does not mean that the system will be adequate for 12cal/cm² protection. The system must be tested together to determine arc rating.
3. An additional arc rated outer layer does not reduce the rating of the inner layer. For instance a 4cal/cm² arc rated high vis vest can be worn over an 8 cal/cm² shirt without lowering the shirt's rating. However, the system must be tested in order to claim a combined rating for shirt and vest together.
4. The arc rating of the system applies to covered areas of the body. Any additional exposed areas such as hands, feet, neck or head should be covered with appropriate arc rated PPE.
5. End users are responsible to select the correct layering system to match their incident energy level.



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