



## Protective Apparel

### FLAME-RESISTANT PROTECTION APPAREL

#### WORKSafe® Flame-Resistant (FR) Workwear

Where there are flammable materials being handled, processed, stored or in anyway present in the workplace, hazards such as flash fires and explosions may occur due to accidental ignition of these materials. In various industries such as petrochemical and oil drilling, workers are exposed to risks of fire accidents which may cause severe or even fatal burns. If a flash fire does occur, wearing WORKSafe® FR Workwear would prevent fatal burn injuries by creating a flame-resistant barrier which retards the flames and is self-extinguishing, thereby minimizing burn injuries.

All WORKSafe® FR Workwear are:

- **CE Category II certified and marked**
- **Tested and certified as a complete garment under EN ISO 11612:2008**

All WORKSafe® FR Workwear are made of only quality FR fabrics and key accessories that are tested to EN ISO 11612 standards. In addition, only nickel-free buttons are used in WORKSafe® FR clothing, together with shorter stitches, double-stitching at all seams and bar-tacking at stress areas for enhanced durability.

#### When selecting FR Workwear, you should look for:

- Excellent fabric integrity - it should not melt and should provide the user with a barrier or insulating layer against exposure to flame
- Antistatic properties - the fabric should not act as an ignition source via static electricity
- Global safety standards e.g. NFPA 2112:2012, EN ISO 11612:2008 - both the fabric and full garment should be properly tested
- Flame-resistant key accessories e.g. threads, zippers, reflective strips, pocket linings
- Comfort:
  - Fit and mobility - FR Workwear should allow for maximum body movement and dissipation of thermal heat in the event of flash fire
  - Softness and weight - FR Workwear should be soft and lightweight
  - Moisture absorption - FR Workwear should be highly breathable and designed to help wearers feel cool and dry

#### Difference between Flame-Resistant and Flame-Retardant Materials:

**Flame-Resistant:** Aramid fibers (aromatic polyamides) that are naturally flame-resistant without any chemical treatment or process. These fibers have slower flaming combustion and self-extinguish when exposed to a flame of short duration during testing. Flame-resistant materials do not melt, drip, burn nor support combustion in air. Its properties cannot be altered through cleaning and it's generally strongly abrasion-resistant.

**Flame-Retardant:** Fibers that have undergone a chemical treatment so that the material is rendered flame-resistant. The flame retardancy of the fibers deteriorate over time due to repeated washing and laundering.



### The Flame-Resistant Materials we Use:

**Nomex® IIIA:** A meta-aramid fiber manufactured by DuPont™. It has a blend of 93% NOMEX®, 5% Kevlar®, and 2% P140 (static dissipative fiber). NOMEX® III A, as a fabric, has been tested to NFPA 2112 and NFPA 70E HRC 1 arc rating (USA) as well as EN ISO 11612 (Europe) standards.

There's only one DuPont™ Nomex® brand fiber. That's why for over 30 years, industrial workers and the people who protect them have demanded a genuine product. Fires are unpredictable and even a split second can make all the difference. DuPont™ Nomex® brand fabrics and garments are subjected to rigorous testing in a variety of conditions by DuPont™ scientists and engineers who know and support the latest OSHA and NFPA standards; who constantly innovate, finding new ways to help safeguard your workers from fire and electric arc hazards; who are always working to offer solutions that help make protective gear stronger, more durable and safer. Nomex® brand fibers possess inherent flame-resistant qualities that can't be washed out or worn away, so it lasts. Nomex® brand garments are lightweight and comfortable for every worker. Clothe your crews with the name that means superior protection: DuPont™ Nomex®\*.

*\*DuPont™, Nomex® and Kevlar® are registered trademarks of E.I. du Pont de Nemours and Company.*



**PDS International Pte Ltd is an official licensed garment manufacturer of DuPont™ Nomex®. Be sure you have the authentic product! Check that you have a sewn-on Nomex® brand tag complete with usage and care instructions.**

### The Flame-Retardant Materials we Use:

**Pyrovatex®:** A durable flame-retardant product for cellulosic fibres. Pyrovatex® is a treated fabric that offers the best overall fire protection available for cotton, as proven by comprehensive testing according to international flame-retardant standards. Treated fabrics barely shrink when exposed to heat and fires, thereby ensuring that the skin is not exposed to hazardous conditions. Treated cotton, unlike synthetics, will not melt in the presence of heat from fires. Treated fabrics also offer excellent thermal protection where heat is an added danger.

Key characteristics of Pyrovatex®:

- Outstanding durability to wash and wear, which ensures long life of the clothing.
- Finishes have negligible influence on fabric colouration and therefore preserve flexibility to meet specific color demands.
- Treated fabrics have good compatibility with other treatments, permitting the creation of multifunctional garments.

*\*Pyrovatex® is a registered trademark of Huntsman Corporation.*



## EN ISO 11612



ADAPTED FROM EN ISO 11612:2008

### PROTECTIVE CLOTHING AGAINST HEAT AND FLAME

#### All fabrics, hardware used in garment shall not:

- At a temperature of 180°C, ignite or melt, and shrink >5%
- At a temperature of 260°C, ignite or melt, and shrink >10%
- Be made of any material known to be harmful to the wearer
- Possess a pH-value of  $\leq 3.5$  and  $\geq 9.5$ , for textiles
- After 5 cleaning cycles, exceed: 3% shrinkage (woven, non-woven and sheet materials) 5% shrinkage (knitted materials)

#### Physical requirements for outer material:

- Tensile strength: withstands  $\geq 300\text{N}$  force in both the machine and cross directions
- Tear strength: withstands  $\geq 15\text{N}$  force in both the machine and cross directions
- Burst strength for knitted materials: withstands  $\geq 200\text{kPa}$
- Seam strength: withstands  $\geq 225\text{N}$

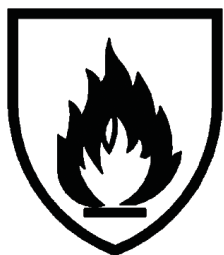
#### Usage and Care of WORKSafe® FR Workwear:

- For a correct fit, try garment on before washing or wearing.
- Wash garments separately from other garments.
- Machine wash with hot water and heavy duty detergent (60°C/140°F).
- Tumble dry low (71°C/160°F).
- Do not line-dry in direct sunlight.
- Wash your new workwear before wearing and after each subsequent wearing to thoroughly remove potentially flammable fabric processing aides/finishes, greases, oily soil and other flammable contaminants.
- Always wear 100% natural fiber undergarments with all flame-resistant garments.
- Antistatic garments should be used in conjunction with proper grounding procedures for maximum protection against the threat of spark. Do not remove garments when in a hazardous environment.

For further details, please refer to the respective product care instruction labels.



**EN ISO 11612**

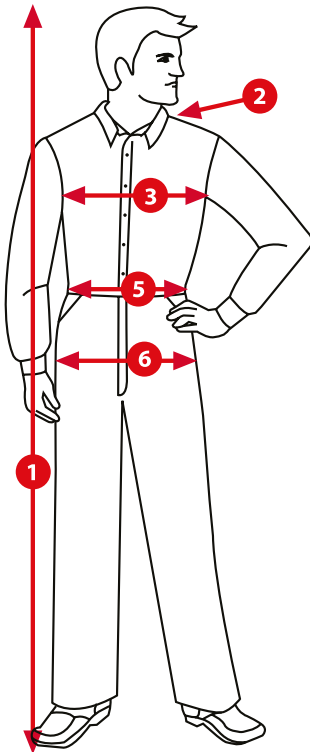


**A1 A2 B\* C\* D\* E\* F\***

**Guidelines to consider before buying FR Workwear**

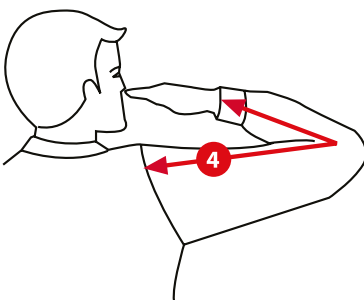
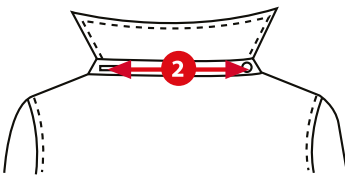
- There should be substantial overlap between gloves and sleeves so that contact with heat, flame or hot material is avoided
- Trousers bottoms should overlap top of footwear whilst walking or crawling
- Openings should be capable of being closed to prevent entry of heat, flame or hot material
- There should be quick-release fasteners to allow rapid removal during emergencies

Letter code	Description	Grading		
Limited flame spread <b>A1</b>  Tested in accordance with ISO 15025:2000, procedure A	Single layer garments incl. seams/innermost lining and the outer material of multilayered garments incl. seams, shall meet the following: <ul style="list-style-type: none"> <li>• no flaming to the top or either side edge</li> <li>• no hole formation</li> <li>• no melting or suffering flaming or molten debris</li> <li>• afterflame and afterglow each, shall be <math>\leq 2s</math></li> </ul>			
Limited flame spread <b>A2</b>  Tested in accordance with ISO 15025:2000, procedure B	Hemmed specimens from single layer garments shall meet the following: <ul style="list-style-type: none"> <li>• no flaming to the top or either side edge</li> <li>• no melting or suffering flaming or molten debris</li> <li>• afterflame and afterglow each, shall be <math>\leq 2s</math></li> </ul>			
Convective heat <b>B</b>  Tested in accordance with ISO 9151	Single or multilayer garments and/or clothing assemblies that offer protection against convective heat shall meet at least a performance level of B1.	Performance levels (B*)	Range of HTI <sup>a</sup> 24 values min. <sup>5</sup> max.	
		<b>B1</b>	<b>4.0</b>	<b>&lt;10.0</b>
		<b>B2</b>	<b>10.0</b>	<b>&lt;20.0</b>
		<b>B3</b>	<b>20.0</b>	
		<sup>a</sup> Heat transfer index, as defined in ISO 9151		
Radiant heat <b>C</b>  Tested in accordance with ISO 6942	Single or multilayer garments and/or clothing assemblies that offer protection against radiant heat shall meet at least a performance level of C1.	Performance levels (C*)	Heat transfer factor RHTI <sup>a</sup> 24 values min. <sup>5</sup> max.	
		<b>C1</b>	<b>7.0</b>	<b>&lt;20.0</b>
		<b>C2</b>	<b>20.0</b>	<b>&lt;50.0</b>
		<b>C3</b>	<b>50.0</b>	<b>&lt;95.0</b>
		<b>C4</b>	<b>95.0</b>	
		<sup>a</sup> Radiant heat transfer index, as defined in ISO 6942		
Molten aluminium splash <b>D</b>  Tested in accordance with ISO 9185	Single or multilayer garments and/or clothing assemblies that offer protection against molten aluminium splash shall meet at least a performance level of D1.	Performance levels (D*)	Molten aluminium splash min. <sup>9</sup> max.	
		<b>D1</b>	<b>100</b>	<b>&lt;200</b>
		<b>D2</b>	<b>200</b>	<b>&lt;350</b>
		<b>D3</b>	<b>350</b>	
Molten iron splash <b>E</b>  Tested in accordance with ISO 9185	Single or multilayer garments and/or clothing assemblies that offer protection against molten iron splash shall meet at least a performance level of E1.	Performance levels (E*)	Molten iron splash min. <sup>9</sup> max.	
		<b>E1</b>	<b>60</b>	<b>&lt;120</b>
		<b>E2</b>	<b>120</b>	<b>&lt;200</b>
		<b>E3</b>	<b>200</b>	
Contact heat <b>F</b>  Tested in accordance with ISO 12127	Tested at 250°C, single or multilayer garments and/or clothing assemblies that offer protection against contact heat shall meet at least a performance level of F1.	Performance levels (F*)	Threshold time min. <sup>5</sup> max.	
		<b>F1</b>	<b>5.0</b>	<b>&lt;10.0</b>
		<b>F2</b>	<b>10.0</b>	<b>&lt;15.0</b>
		<b>F3</b>	<b>15.0</b>	



**Measurement Guide**

- Height:** Stand straight against a wall without your shoes. Make a mark level with the top of your head. Measure from this point down to the floor.
- Neck:** Measure around the base of the neck where a collared shirt would fit, or measure a collarband on a shirt that fits you well. Lay the collarband flat. Measure from the beginning of the button hole to the center of the button
- Chest:** Measure well up under your arms, across your shoulder blades and over the fullest part of your chest. Hold firmly, but not tightly. Be sure the tape is level and straight across your back. Stand naturally.
- Sleeve:** Bend the elbow slightly. Start at the shoulder and measure to the elbow and down to the wrist bone.
- Waist:** First, remove your belt. Then, measure over shirt (not over pants) at the position where you normally wear your pants. Hold the tape firmly, but not tightly.
- Hips:** Stand with your heels together. Measure around the fullest part of the hips, holding tape measure level.



**WORKSafe® Coverall/Insulated Coverall\***

SIZES	S	M	L	XL	2XL	3XL	4XL
<b>Collar</b>	15	16	16.5	17	17.5	18	-
<b>Shirt L</b>	18.5	19	19.5	20	20.5	21	-
<b>Shoulder</b>	17.5	18.5	19.5	20.5	21.5	22.5	-
<b>Chest</b>	40	42	44	46	48	50	-
<b>Waist R</b>	31	33	35	37	39	41	-
<b>Waist E</b>	35	37	39	41	43	45	-
<b>Arm H</b>	20	21	22	23	24	25	-
<b>Sleeve</b>	22.5	23	23.5	24	24.5	25	-
<b>Cuff</b>	9	9.5	10	10.5	11	11.5	-
<b>Pants L</b>	39	40	41	42	43	43	-
<b>Hip</b>	40	41	42.5	44	46	48	-
<b>Crotch</b>	27	28	29	30	31	32	-
<b>Thigh</b>	25.5	26.5	27.5	28.5	29.5	30.5	-
<b>Bottom</b>	17	17	17	17	18	18	-

**LEGENDS:**

- Shirt L** : Shirt Length
- Waist R** : Waist Relaxed
- Arm H** : Arm Hole
- Pants L** : Pants Length
- Waist E** : Waist Extended

\* These are actual body measurements in inches.



### WORKSafe® Jacket/Shirt\*

SIZES	S	M	L	XL	2XL	3XL	4XL/MTM
Collar	15	16	16.5	17	17.5	18	-
Length	28	28.5	29.5	30.5	31.5	32	-
Shoulder	17.5	18.5	19.5	20.5	21.5	22.5	-
Chest	39	41	43	45	47	49	-
Waist	38	40	42	44	46	48	-
Hip	39	41	43	45	47	49	-
Sleeve	22.5	23	23.5	24	24.5	25	-
Cuff	9	9.5	10	10.5	11	11.5	-

### WORKSafe® Pants\*

SIZES	S	M	L	XL	2XL	3XL	4XL/MTM
Length	38.5	39.5	40.5	41.5	42.5	43	-
Waist	28	30	32	34	36	38	-
Hip	38	39.5	41	42.5	44.5	46.5	-
Crotch	26	26.5	27.5	28.5	29.5	30.5	-
Thigh	25	26	27	28.5	29.5	30.5	-
Bottom	17	17	17	17	18	18	-

### WORKSafe® Labcoat (Unisex)\*

SIZES	XS	S	M	L	XL	2XL	3XL
Chest	32-35.5	36-38	38.5-42	42.5-50	46.5-50	50.5-54	54.5-58
Hip	33.5-36	36.5-39	39.5-42	42.5-46	46.5-50.5	51-54	55.5-59.5

\* These are actual body measurements in inches.