



Fabric Specifications and Features



D I S T R I B U T I O N

Kermel Fabric Specifications

Quality Number	Test Method	9206	9207	9208	9814
Composition	IWS TM 115	70% Kermel 30% Viscose (V70)	70% Kermel 30% Viscose (V70)	100% Kermel	50% Kermel 50% Viscose (V50)
Design		Plain Weave	2/1 Twill	2/1 Twill	2/1 Twill
Weight g/m ² (± 5%)		160gsm	220gsm	210gsm	270gsm
Weight g/lm (± 5%)		240	330	315	405
Width (cm)	AS 2001.2.12	150 min	150 min	150 min	150 min
Tensile N Warp Weft	IWS TM 4	600 500	800 700	900 700	800 900
Tear Strength N Warp Weft	AS 2001.2.10	28 25	30 25	32 27	40 38
Abrasion	IWS TM 112	> 35000	> 35000	> 85000	> 65000
Seam Slippage	IWS TM 117	6 mm (max)	6 mm (max)	6 mm (max)	6 mm (max)
Relaxation Shrinkage %	AS 2001.5.3	< 3	< 3	< 3	< 3
Wash Shrinkage % 1x4m G, 5x4m G Warp/Weft	AS 2001.5.4	< 3	< 3	< 3	< 3
Flammability	EN 533 ^a	Index 3 ^b	Index 3 ^b	Index 3 ^b	Index 3 ^b
ATPV ^c - ASTM 1959-99 NFPA 70 E Hazard Risk Category		(7.2 cal/cm ² 240gsm Plain Weave) 1	(7.4 cal/cm ² 200gsm Twill Weave) 1		9 cal/cm ² 2

Notes –

a. EN 533 – see following table.

b. Index 3 – see following table.

c. ATPV – is equivalent to Arc Thermal Performance Value. The higher the value, the more insulated a person is from second-degree burns. Arc Thermal Performance Value is the minimum energy causing the predicted onset of second-degree burns.

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Test Method EN 533

Limited Flame Spread Materials and Material Assemblies		
Status: European Standard – Material Specification		
Scope: This standard specifies the requirements for the limited flame spread properties of materials and material assemblies.		
Contents		
Classification System	Tested According to EN 532	
	Index 1	Materials do not spread flame but may form a hole on contact with a flame.
	Index 2	Materials and material assemblies do not spread flame and do not form a hole on contact with a flame.
	Index 3	Materials and material assemblies do not spread flame and do not form a hole on contact with a flame. They also give limited after flame.

ASTM (American Society for Testing and Materials) Standards Summary (Electric Arc Flash Protection)

F1506-02a - Standard Performance Specification for Flame Resistant Textile Materials for Wearing Apparel for Use by Electrical Workers Exposed to Momentary Electric Arc and Related Thermal Hazards.

F1891-02b - Standard Specification for Arc and Flame Resistant Rainwear.

F1930-00 - Standard Test Method for Evaluation of Flame Resistant Clothing for Protection Against Flash Fire Simulations Using an Instrumented Manikin.

F1958/F1958M-99 - Standard Test Method for Determining the Ignitability of Non-flame-Resistant Materials for Clothing by Electric Arc Exposure Method Using Mannequins.

F1959/F1959M-99 - Standard Test Method for Determining the Arc Thermal Performance Value of Materials for Clothing.

F2178-02 - Test Method for Determining The Arc Rating Of Face Protective Products.

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Kermel® Fibre

Kermel® is a high technological polyamide-imide fibre which has very high resistance to abrasion, exceptional thermal insulation against radiant heat, is thermo stable, has thermal conductivity twice as low as any other aramid fibre and is inherently non-flammable, a permanent characteristic of its chemical structure. Kermel® is classified in the same Aramid family as Nomex®. It is also anti-static and has an excellent resistance to chemicals including cold acid and dilute alkali attacks. This makes it particularly useful where acid splashing is a major hazard. It also resists most solvents, chlorine bleach, detergents and water vapour. Kermel® is solution-dyed during the manufacturing process for lifelong colourfastness including UV light and washing. Kermel® does not pill, which means garments continue to look good as new for a long time.

Kermel® fibre and its blends are used in heat and fire protective clothing for fire brigades, military, police, chemical and petrochemical sectors, electric utilities and industrial applications worldwide.

FR Viscose Fibre

Viscose is a cellulose-based fibre produced primarily from wood, mainly beech. Viscose fibres are completely bio-degradable and compared to naturally grown cellulose fibres offer many advantages including absolute pureness, evenness of fibre quality and staple length, continuous quality level and constant technological properties. FR Viscose is a highly flame resistant adaptation of viscose that can boast high wearing comfort as well as optimum protection. Protective garments made from FR Viscose blends even when worn directly on the skin are soft, particularly friendly to the skin, absorptive and pleasant to wear.

Work garments made from FR Viscose blends offer protection against potential risks such as electric arcs, fire, temporary flames, sparks and molten metal splashes.

Composition and Blends

By constructing fabrics from blends of these fibres, unique fabric properties can be obtained that exhibit the best qualities of each of the individual component fibres. These include 100% Kermel® and various blends of Kermel®/FR Viscose. Blends of Kermel® and FR Viscose are categorised as Kermel® V. The numerals after Kermel® V blend always specify the percentage of Kermel® present in the fabric. For example, a V70 blend has a composition of 70% Kermel® and 30% FR Viscose.

When exposed to very high temperatures and flames, Kermel® V50 fabric carbonises and thickens. This process increases the protective barrier between the heat source and the skin. Both the Kermel® and FR Viscose fibres are stable under high heat conditions and will not drip, melt or burn like ordinary synthetic uniform fabrics containing polyester or nylon.

Kermel® is a smooth-surfaced fibre with an almost circular cross section. Its shape, combined with its chemistry, makes it as soft and comfortable as cotton. Blended with FR Viscose, it is the most comfortable permanently FR fabric available.

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Electric Arc Protection

In many workplace situations, an electric arc can be produced suddenly and the flow discharge can ignite an ordinary garment almost instantaneously.

In order to protect personnel working in these environments, garments are required that can offer protection from arcing fires and burns while remaining comfortable and aesthetically pleasing. Consequently, garments that provide protection from the dangers of electric arc are increasingly being considered in Occupational Health and Safety regulations.

The requirements for protective garments exposed to electric arc hazards are defined by several testing methods and standards. One of the most prevalent methods used for testing protective garments against electric arc is ENV 50354:2001-3. This method assesses the probable damage to fabrics and the wearer when exposed to an electric arc from 4kA to 7kA currents and reports the result in terms of whether the “Stoll Criterion” is met. Meeting this criterion indicates the wearer of the protective garment should not suffer second-degree burns as a result of the high voltage electric arc. The stringent testing methods required under USA ASTM and NFPA 70 E standards have been summarised in the ASTM and NFPA 70 E sections of this article.

Wool, for example, is a relative newcomer to electric arc protection and with its unique natural properties offers new and exciting possibilities. Tabled below are the ENV 50354:2001-3 Stoll Criterion results for two 100% Wool fabrics developed specifically to meet this stringent test method.

ENV 50354:2001-3 Stoll Criterion Results

Current At	4kA	Current At	7kA
2/2 Twill – single layer	Met	2/2 Twill – double layer	Met
2/2 Twill – double layer	Met	2/1 Twill Gaberdine – double layer	Met
2/1 Twill Gaberdine – single layer	Met		
2/1 Twill Gaberdine - double layer	Met		

Fibres suitable for electric arc protection include FR Wool, Kermel®, FR Viscose and their blends. Industry uses for fabrics with a high level of Electric Arc Protection include aluminium smelter wear, electrician’s work wear and industries where personnel are exposed to high voltages.

**Kermel® is not suitable for smelter wear environments.*

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Electric Arc Protection (continued)

**NFPA (National Fire Prevention Authority)
NFPA 70E (compatible with OSHA requirements) - Standard for Electrical Safety
Requirements for Employee Workplaces, 2000 Edition.**

The standard deals with the requirements to safeguard workers from the dangers of fire, shock, arc flash and arc blast.

Table 3 NFPA 70E

Standard for Electrical Safety Requirements for Employee Workplace 2000 Edition

Protective Clothing Characteristics

Hazard Risk Category	Work Wear Description (1/2/3/4) refers to the number of clothing layers	Minimum ATPV Ebt Rating For Work Wear cal/cm ²
0	Untreated Cotton (1)	n/a
1	FR Shirt and FR Pant (1)	5
2	Cotton* Undergarments + FR Shirt/Pant (2)	8
3	Cotton* Undergarments + FR Shirt/Pant + FR Coveralls (3)	25
4	Cotton* Undergarments + FR Shirt/Pant + Double Layer Switching Coat and Pant (4)	40

*Recommendation is 100% Cotton.

ATPV (Arc Thermal Performance Value) – the higher the value, the more insulated a person is from second-degree burns. Arc Thermal Performance Value is the minimum energy causing the predicted onset of second-degree burns.

HAF (Heat Attenuation Factor) – the higher the HAF percentage, the more heat is blocked by the fabric. The HAF is the total percentage of the arc, which the fabric blocks or prevents from passing through. If the fabric breaks open prior to reaching the second-degree burn level, then a third value, the Ebt, is calculated.

Ebt (Energy of Break-Open Threshold) – where under testing, one or a number of holes appear in the fabric through which the thermal energy is able to pass. The energy of break-open threshold is most often reported with multi-layer systems.

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Kermel® V50 and Electric Arc

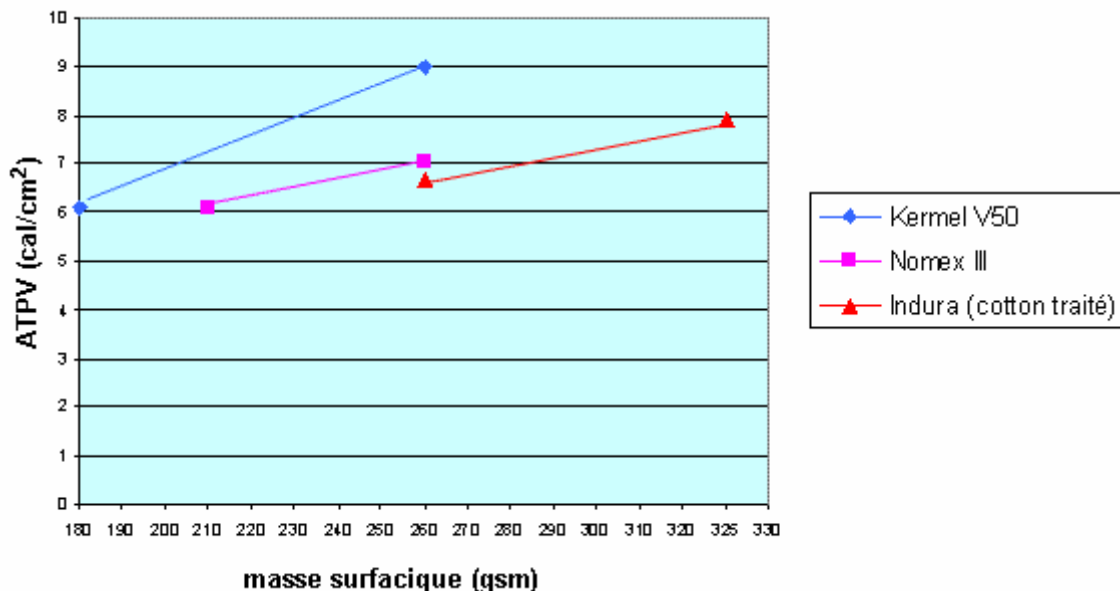
Kermel® V50 delivers on all fronts when it comes to worker FR safety and comfort, which is why Kermel® 100% and Kermel® blends have developed a reputation for being one of the world's renowned premium FR textiles.

Kermel® V50 260gsm (7.6oz) Twill Weave is a blend of 50% Kermel® and 50% FR Viscose, specifically designed to provide unparalleled protection against the risk and hazards associated with electric arc. The blend is inherently non-flammable and its high level of performance against heat and fire will last for the lifetime of the garment. When exposed to very high temperatures and flames, Kermel® V50 carbonises and thickens. This process increases the protective barrier between the heat source and the skin. Both the Kermel® and FR Viscose fibres are stable under high heat conditions and will not drip, melt or burn like ordinary synthetic uniform fabrics containing polyester or nylon. Under such conditions, the fabric maintains its mechanical characteristics.

The blend has a moisture regain comparable to that of 100% cotton and with its very soft touch, can be worn against the skin permanently and comfortably. Independent Arc Thermal Performance Value tests carried out on Kermel® V50 calculated an ATPV rating of 9 when compared to comparable weight Nomex® III (7) and Indura® (cotton traité 6.7). Under US standards, a minimum ATPV rating of 8 is required for Shirting and Pant/Coverall fabrics to meet the requirements of NFPA 70E Hazard Risk Category 2. The above ratings refer to single layer fabrics only and demonstrate that much higher ATPV, HAF and Ebt ratings would be attained if Kermel® V50 were used in a multi-layer system.

The following graph demonstrates the excellent ATPV rating of Kermel® V50 when compared to other comparable weight fabrics.

Protection A L'Arc Electrique test selon ASTM 1959-99
ATPV



Notes –

Kermel® V50 - the commencing 6.1 cal/cm² rating (ATPV) applies to 180gsm Plain Weave ascending to a 9 cal/cm² rating for 260gsm Twill.

Nomex® III - the commencing 6.1 cal/cm² rating (ATPV) applies to 210gsm Plain Weave ascending to a 7 cal/cm² rating for 260gsm Twill.

Indura® (cotton traité) - the commencing 6.7 cal/cm² rating (ATPV) applies to 260gsm ascending to a 7.9 cal/cm² rating for 325gsm.

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FAQ's About Kermel® V50

What are the main characteristics of Kermel® fibre?

Kermel® is an inherently non-flammable fibre which means it remains non-flammable, even after 200 wash cycles. Whilst Kermel® is known for its performance in terms of FR thermal insulation, it has excellent textile properties, which makes it extremely soft and comfortable to wear.

What are the advantages of being solution-dyed?

Kermel® fibre is even dyed before becoming yarn and the dye reaches the core of the fibre. The colour will take much longer to wear off or wash out. Kermel® fabrics have the best colourfastness of all FR fabrics to both sunlight and cleaning.

Can I get Kermel® V50 Shirts and Pants in white or other light colours?

No. Kermel® fibre is naturally yellow, due to the combined double bonds and can only be made in shades darker than yellow. Kermel® fibre is available in a range of 36 colours, of which 13 are standard colours.

Kermel® V50 is a synthetic fibre. Do I have to iron it at a low temperature?

No. Kermel® fibre is uniquely resistant to extreme high temperatures. It does not melt when exposed to high temperatures (its structure begins to change form at 600°F). You can iron Kermel® V50 using a hot iron.

Does Kermel® fibre protect against chemical products?

Most chemicals or acids will not affect Kermel® V50 however, without a barrier fabric attached, they can penetrate Kermel® V50 easily and reach the skin.

What are the main applications for Kermel® V50?

In Europe, Kermel® V50 is used by fire departments for station wear and by police departments for tactical and everyday uniform use. It is also used extensively in the oil, gas, and chemical industries.

What are the main differences between Kermel® V50 and Nomex®?

All Aramid fibres are permanently non-flammable and durable. The main difference is that Kermel® V50 is solution-dyed and offers improved colourfastness after exposure to light, extensive washing and wearing. Also, being 50% FR Viscose, Kermel® V50 has a much softer feel against the skin and has superior moisture absorption making it more comfortable in hot and humid weather. Kermel® V50 also has a higher resistance to pilling than Nomex® IIIA.

Do Shirts and Pants made from Kermel® V50 have a longer life than other fabrics?

Yes. Based on extensive wear trials, Kermel® V50 will last as long as Nomex® IIIA, three to four times longer than 100% cotton and twice as long as polyester cotton blends.

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Advantages of Kermel V50

Wicking and Comfort

Kermel® V50 has excellent moisture regain properties. The FR Viscose content absorbs moisture from the body and the air, which means less static build up and greater comfort when compared to Nomex® IIIA, which depends on added carbon anti-static fibres to prevent static cling.

Abrasion Resistance

In abrasion testing and actual field use Kermel® V50 is hard wearing and stands up well to abrasion. The aromatic structure and combined double bonds in the Kermel® portion of the fabric adds strength and durability to the blend. Kermel® V50 has almost twice the abrasion resistance of 7oz FR cotton. Most synthetic fabrics tend to pill due to the strength of the man made fibres. Kermel® V50 has superior resistance to pilling when compared to 6oz Nomex®.

Drying Time

In independent lab testing, Kermel® significantly outperforms FR cotton in drying time. After saturating both types of fabric of equal weight with water, Kermel® dried at a rate equal to approximately 30% faster than FR cotton over a period of two hours. Because Kermel® releases this perspiration more quickly, first responders are more comfortable than those wearing FR cotton and are more likely to avoid the extremes of heat exhaustion or hypothermia. This is because dry skin feels 20 times warmer than wet skin so the faster clothing dries the more comfortable the wearer stays.

Char Length

When exposed to flash fire, polyester, nylon or high synthetic content blends that contain wool, cotton or rayon will burn and melt. 100% cotton fabric will burn also increasing the risk of injury to the skin dramatically. Kermel® has a limiting oxygen index of 32%, which means a minimum of 32% oxygen is required to maintain combustion of Kermel®. Atmospheric air contains only 21% oxygen and will not support combustion of Kermel® V50. In vertical flame testing, Kermel® V50 outperforms Nomex® and FR Cotton. Being thermo stable, Kermel® V50 will continue to remain flexible and supple even when exposed to temperatures exceeding 500°F.

Colourfastness

Kermel® V50 is more colourfast to washing and exposure to light than FR Cotton, Nomex® or polyester/cotton blends by two times and 100% cotton fabrics by three to four times. Kermel® V50 can be washed more than 100 times without losing its shape, colour or professional appearance. Nomex® IIIA is dyed one piece at a time after spinning and weaving and its colour wears off after wearing and multiple washes. 100% cotton and polyester/cotton blends are also piece dyed with average to below average colourfastness results. Cotton also loses its shape after washing and wearing. The secret to Kermel® V50's ability to retain its colour is solution dyeing of the Kermel® fibre before weaving and finishing. It is also chemical and acid resistant and dry cleanable.

Soil/Stain Release

Soil or stain release finishes can be applied to fabrics which allow many oily stains to be removed during regular cleaning. Kermel® V50 releases dirt and grime during cleaning better than Nomex® and almost twice as well as FR Cotton.

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Utilisation and Care Instructions - Kermel®/FR Viscose

Industry	Kermel®	Kermel®/FR Viscose
Smelting	No	No
Fire Fighting	Yes	Yes
Emergency Services	Yes	Yes
Armed/Police Forces	Yes	Yes
Petrochemical	Yes	Yes
Electric Utilities	Yes	Yes

Laundering	Kermel®	Kermel®/FR Viscose
Dry Clean	Yes	Yes
Machine Washable	Yes	Yes

Machine Washing Instructions –

- Do not use soap.
- Do not use chlorine bleach.
- Do not boil.
- Wash in hot water using synthetic detergent.
- Rinse in warm water.
- Tumble dry on warm setting.
- Warm iron – no steam.
- Avoid over-drying.

Kermel®/FR Wool Blends

Quality Number	Test Method	9203	9204	9205	9209
Composition	IWS TM 115	50% Kermel 50% Wool	65% Kermel 35% Wool	65% Kermel 35% Wool	50% Kermel 50% Wool
Design		Double Plain	Plain Weave	2x1 Twill	Plain Weave
Weight (gsm)		330	170	230	170
Flammability	EN 533	Index 3	Index 3	Index 3	Index 3
Applications – Fire Brigade Turnout Wear, Anti-flash Garments for Artillery Crews, Wildland Fire Fighting, Emergency Services, Armed/Police Forces, Petrochemical and Electric Utilities.					

FR Wool

Wool is one of the oldest known natural fibres and is constantly in demand for its unique natural properties including comfort and inherent fire resistance, properties that science cannot yet replicate. The ability of Wool to absorb up to 30% of its weight in moisture vapour gives it superior comfort, insulation, anti-static properties and flame resistance. While Wool can absorb moisture, it also repels liquids. Wool has a natural elasticity greater than any other natural fibre, which makes it comfortable to wear as it fits the shape of the body. The natural flame resistance of Wool can be further enhanced by the addition of a durable flame retardant treatment, the result of which gives rise to what is commonly known as FR Wool.

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Disclaimer/Warranty

The test criteria and results referred to in this article have been obtained under laboratory conditions, undertaken in accordance with relevant and applicable international standards. As such, the reported results may not represent actual performance in individual end user workplace environments or conditions. The textile manufacturer and SpotNet Distribution stipulate that end users determine any fabric's suitability, or otherwise, after undertaking their own research and evaluation. The information and results shown in this article should only be used as a guide while that research and evaluation is being conducted. It is the responsibility of the end user to determine the protection level required for his unique use situation.

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