



**Berry Amendment Compliant
Fabric Selector Guide**

Outer Shells

The **outer shell** represents the first line of defense for the firefighter. Its main purpose is to provide flame, thermal, and abrasion resistance to the outermost exposed area of the turnout gear system. Water shedding is also an important characteristic of outer shells and the reason that they are treated with durable water-repellant finishes.

Outer shells possess differentiating attributes that are significantly influenced by the chemistry of the fiber, the blend, and the weave. It is important to note that all outer shells meeting the NFPA standard are third-party tested to help provide firefighters with dependable protection against the hazards described above.

Selecting the right outer shell is a function of matching key attributes with the unique needs of each fire department.

DuPont™
Nomex.

DuPont™
Kevlar.

Outer Shells at a Glance



Attributes	Nomex IIIA®	Advance™**	Omni Vantage™	Armor 7.0™	PBI Max™	Gemini™
Fiber Content	93% Nomex® 5% Kevlar® 2% Carbon	60% Kevlar® 40% Nomex®	40% Kevlar® 30% Basofil® 30% Nomex®	75% Kevlar® 25% Nomex®	65% Kevlar® 35% PBI	55% Spun Kevlar® 37% PBI 8% filament Kevlar®
Product Fabric Code	24xx	34xx	15xx	47xx	62xx	42xx
Weight (oz / yd²)	7.5	7.2	7.8	7.0	7.0	7.5
Weave	Plain	Ripstop	Ripstop	Comfort-Twill	Comfort-Twill	Plain
Yarn	100% Spun	100% Spun	100% Spun	50% Spun/ 50% Filament	70% Spun/ 30% Filament	92% Spun/ 8% Filament
Warranty (years)	0	3	3	4	5	5
Taber Abrasion Resistance (ASTM D 3884, H-18 wheel, 500g weight)	Good	High	Good	Good	Good	High
Tear Strength (lbs) (ASTM D 5587 without slippage)	55 x 40	40 x 30	30 x 25	90 x 110	125 x 145	45 x 45
Tensile Strength After 10 Launderings (lbs) (ASTM D 5034)	340 x 320	450 x 400	365 x 275	555 x 505	420 x 445	230 x 220
Tensile Strength After a 10-Second TPP Exposure (lbs)	6 x 5	18 x 17	16 x 14	14 x 14	19 x 19	16 x 13
Resistance to Water Absorption (Modified AATCC 42)	Good	High	High	High	High	High
Flame Resistance (ASTM D 6413)	Moderate	Good	High	High	High	High
Thermal Protective Performance (cal / cm²) Tested with Crosstech® moisture barrier and Nomex® on Aramid batting inner liner (NFPA 1971)	39 - 42	39 - 42	44 - 47	39 - 42	40 - 43	38 - 41
Outer Shell Thermal Decomposition Temperature (°F)	660 - 750	660 - 900	750 - 1000	660 - 900	800 - 1100	800 - 1100
Price Level	\$	\$\$	\$\$\$	\$\$\$	\$\$\$\$	\$\$\$\$

* 8% black solution-dyed Fusion also available

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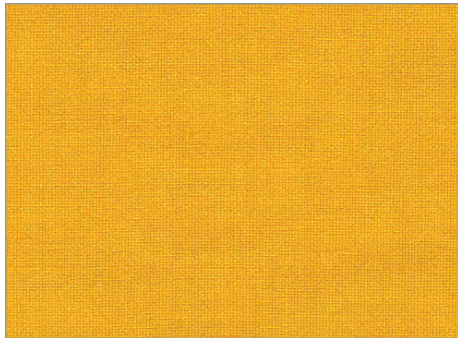
High: Far exceeds in relative performance.
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Outer Shells

YELLOW



Nomex IIIA® – 7.5 osy
Product Fabric Code: **24xx**

- Plain weave
- 93% Nomex®
5% Kevlar®
2% carbon fiber
- Most economical choice
- Balances FR properties with superior textile characteristics
- Wide selection of colors

BLACK



ROYAL BLUE



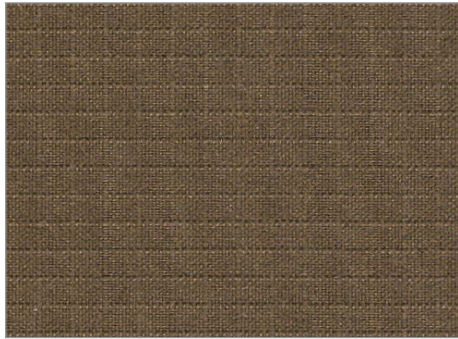
NAVY



NATURAL



KHAKI



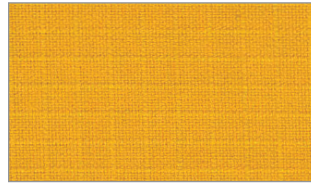
Advance™ – 7.2 osy
Product Fabric Code: **34xx**

- Ripstop weave
- 60% Kevlar®
40% Nomex®
- Proven reliable overall performance
- Good durability
- Remains supple after thermal exposure

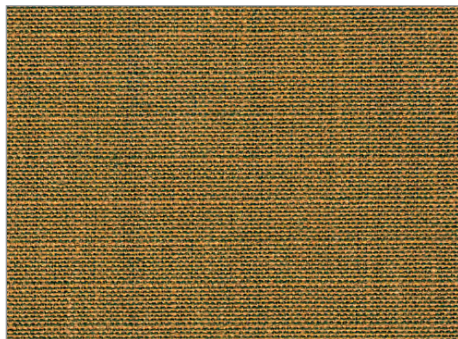
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YELLOW



GOLDEN BROWN



Omni Vantage™ – 7.8 osy
Product Fabric Code: **15xx**

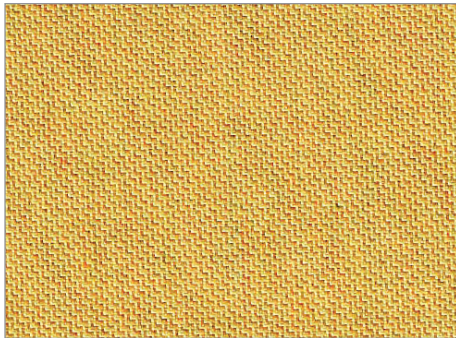
- Ripstop weave
- 40% Kevlar®
30% Basofil®
30% Nomex®
- Good thermal damage tolerance
- Remains supple after thermal exposure
- Superior net effect on thermal protective performance

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Outer Shells

GOLD



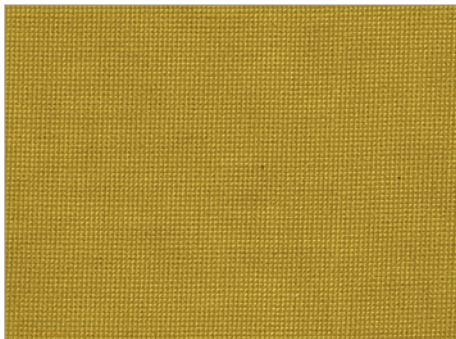
Armor 7.0™ – 7.0 osy
Product Fabric Code: **47xx**

- Comfort-twill weave
- 75% Kevlar®
25% Nomex®
multifilament technology
- Exceptional strength
- Exceptional comfort and flexibility
- Retains integrity after thermal exposure
- Excellent tear resistance

BLACK



GOLD



PBI Max™ – 7.0 osy
Product Fabric Code: **62xx**

- Comfort-twill weave
- 65% Kevlar®
35% PBI
- Superior tear strength
- Exceptional comfort and flexibility
- Retains integrity after thermal exposure

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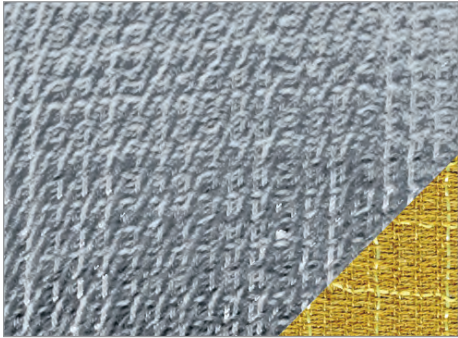
NATURAL



Gemini™ – 7.5 osy
Product Number: **42xx**

- Plain Weave with filament matrix (simulated ripstop)
- 55% Spun Kevlar®
37% PBI
8% filament Kevlar®
- Remains smooth after multiple launderings
- Filament technology incorporated for improved trapezoidal tear resistance
- Retained strength and flexibility after thermal exposure

SILVER

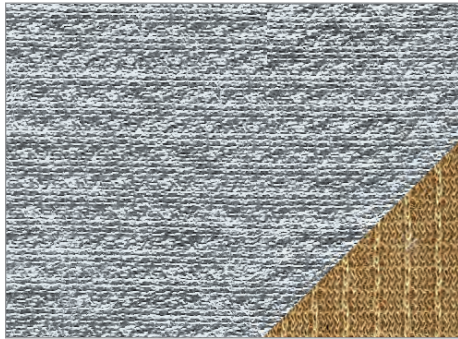


Z-Flex Aluminized PBI and Kevlar® – 7.4 osy

Product Fabric Code: **78xx**

- 3D mock-knit substrate with aluminum laminate
- 67% Kevlar®
33% PBI
- New weave structure delivers comfort of a knit, but strength of a woven
- Innovative 5-layer composite for durability and comfort
- Superior radiant protection, insulation, and durability

SILVER



Aluminized PBI and Kevlar® – 7.0 osy

Product Fabric Code: **76xx**

- Knit substrate with aluminum laminate
- 67% Kevlar®
33% PBI
- Used in proximity environments where high radiant heat is encountered
- High dexterity of substrate improves wearability of aluminized layer

SILVER




Aluminized Kevlar® – 8.5 osy

Product Fabric Code: **77xx**

- Knit substrate with aluminum laminate
- 100% Kevlar®
- Used in proximity environments where high radiant heat is encountered
- Good value

Thermal Liners



The **thermal liner** is the third layer and closest to the body – considered a critical component of the turnout system. Typically, it consists of a multi-layer combination that includes a facecloth fabric quilted to a single layer of needle punched or several layers of spunlaced batting. When combined with the moisture barrier, the inner liner is responsible for a significant part of the thermal protection (up to 70%) of a turnout system. The main function of the thermal liner is to minimize, to a safer level, the amount of heat transfer from the firefighting environment to the body of the firefighter. It follows that the thermal liner is the major contributor to the TPP (Thermal Protective Performance) rating of a turnout system.

The facecloth enhances mobility by minimizing the friction between the wearer's skin and clothing against the turnout and contributes to the effective water management for overall comfort.

DuPont™
Nomex.

DuPont™
Kevlar.

Thermal Liners at a Glance



Attributes	Aralite® NP	Aralite® SL3	Synergy II 2-layer
Facecloth	100% Nomex® 3.4 osy 100% Spun	100% Nomex® 3.4 osy 100% Spun	100% Nomex® 3.3 osy 100% Spun Calendered
Batting	Aramid 3.8 osy Needlepunch	Kevlar® / Nomex® E-89™ 3-layers E-89™ Spunlace (3 x 1.5 osy)	Kevlar® / Nomex® E-89™ 2-layers E-89™ Spunlace (1.5 osy + 2.3 osy)
Product Fabric Code	xx0x	xx3x	xxix
Weight (oz / yd²)	7.2	8.0	7.1
Water Management	Absorbing	Absorbing	Absorbing
Drying Time	Long	Long	Long
Water Affinity (Amount of water absorbed from spraying after 5 launderings)	High	High	High
Facecloth Slipperiness (Based on friction coefficient) Represents ease of donning / doffing and mobility	Moderate	Moderate	Good
Total Heat Loss (W/m²) Tested with Crosstech® moisture barrier and Kevlar® / Nomex® outer shell (ASTM 1868)	235 - 265	250 - 280	265 - 295
Thermal Protective Performance (cal / cm²) Tested with Kevlar® / Nomex® outer shell	40 - 43	40 - 43	38 - 41
Price Level	\$\$	\$\$\$	\$\$

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Thermal Liners at a Glance



Attributes	Caldura® NPi	Caldura® SL2i	Glide™ Pure	Glide™ 2-layer
Facecloth	61% Kevlar® 34% Lenzing FR® 5% Nylon 3.8 osy 50% Spun / 50% Filament	61% Kevlar® 34% Lenzing FR® 5% Nylon 3.8 osy 50% Spun / 50% Filament	60% Kevlar® 26% Nomex® 14% Lenzing FR® 3.6 osy 60% Filament / 40% Spun	60% Kevlar® 26% Nomex® 14% Lenzing FR® 3.6 osy 60% Filament / 40% Spun
Batting	Aramid 3.8 osy Needlepunch	Kevlar® / Nomex® E-89™ 2-layers E-89™ Spunlace (1.5 osy + 2.3 osy)	50% Kevlar® 50% Nomex® 4.0 osy Needlepunch	Kevlar® / Nomex® E-89™ 2-layers E-89™ Spunlace (1.5 osy + 2.3 osy)
Product Fabric Code	xx7x	xxQx	xxVx	xxBx
Weight (oz / yd²)	7.6	7.7	7.6	7.4
Water Management	Wicking	Wicking	Wicking	Wicking
Drying Time	Medium	Medium	Medium	Medium
Water Affinity (Amount of water absorbed from spraying after 5 launderings)	Medium	Medium	Medium	Medium
Facecloth Slipperiness (Based on friction coefficient) Represents ease of donning / doffing and mobility	High	High	Exceptional	Exceptional
Total Heat Loss (W/m²) Tested with Crosstech® moisture barrier and Kevlar® / Nomex® outer shell (ASTM 1868)	220 - 250	265 - 295	225 - 255	265 - 295
Thermal Protective Performance (cal / cm²) Tested with Kevlar® / Nomex® outer shell	40 - 43	37 - 40	39 - 42	38 - 41
Price Level	\$\$\$	\$\$\$\$	\$\$\$	\$\$\$\$

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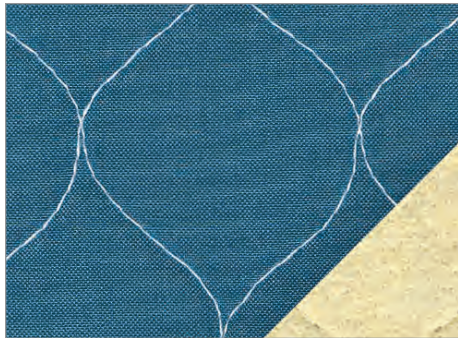
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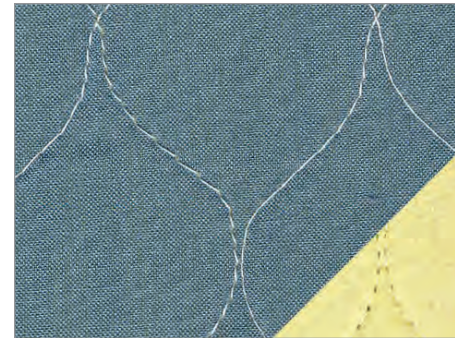


Water Management: Facecloth	
Spun	Spun / Filament
Water absorbing (best suited in low activity)	Water wicking (best suited in low- to mid-level activity)
Traditional cloth feel	Low coefficient of friction (good mobility and ease when donning and doffing)
Slower drying time	Moderate drying
Prone to pilling	Low pilling



Aralite® NP – 7.2 osy
Product Fabric Code: **xx0x**

- Facecloth: 100% spun Plain weave
- Aramid batting
- Absorbing liner system
- Good facecloth and batting durability
- Good price/value and thermal protection



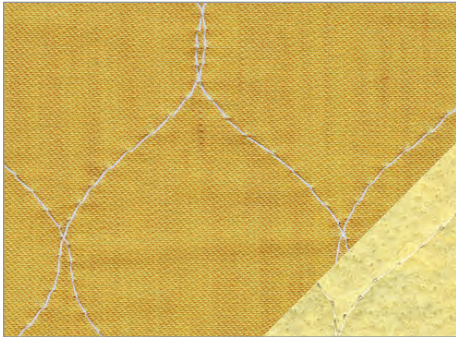
Aralite® SL3 – 8.0 osy
Product Fabric Code: **xx3x**

- Facecloth: 100% Spun Plain weave
- Kevlar® / Nomex® E-89™ spunlace batts
- Absorbing liner system
- Optimal balance between THL & TPP



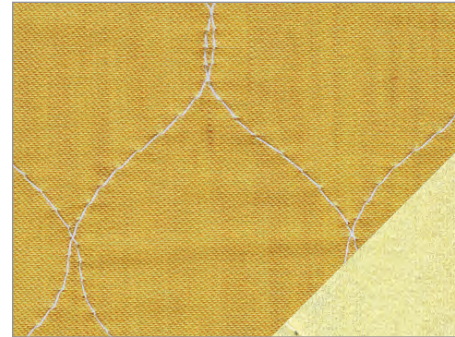
Synergy II 2-layer – 7.1 osy
Product Fabric Codes: **xxix**

- Facecloth: 100% spun Calendered Plain weave
- Kevlar® / Nomex® E-89™ spunlace batts
- Absorbing liner system
- High THL for better comfort
- Premium hand



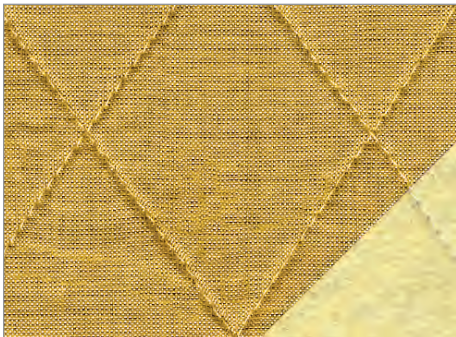
Caldura® NPI – 7.6 osy
Product Fabric Code: **xx7x**

- Facecloth: 50% spun / 50% filament
Twill weave
- Aramid batting
- Wicking liner system
- Versatile performance with good facecloth durability
- An economical filament system



Caldura® SL2i – 7.7 osy
Product Fabric Code: **xxQx**

- Facecloth: 50% spun / 50% filament
Twill weave
- Kevlar® / Nomex® E-89™ spunlace batts
- Wicking liner system
- High THL for better comfort
- Good slipperiness for easier donning and doffing



Glide™ Pure – 7.6 osy
Product Fabric Code: **xxVx**

- Facecloth: 60% filament / 40% spun
Twill weave
- Kevlar® / Nomex® needlepunch batt
- Wicking liner system
- Optimal balance between THL & TPP
- Exceptional slipperiness for easier donning and doffing



Glide™ 2-layer – 7.4 osy
Product Fabric Code: **xxBx**

- Facecloth: 60% filament / 40% spun
Twill weave
- Kevlar® / Nomex® E-89™ spunlace batts
- Wicking liner system
- High THL for better comfort
- Exceptional slipperiness for easier donning and doffing

Moisture Barriers



The **moisture barrier** is the second layer of the turnout gear system, consisting primarily of a barrier laminated to a fabric substrate.

The barrier layer is designed to permit the transfer of perspiration vapor while blocking external liquid penetration. The fabric substrate acts to protect the barrier and contributes marginally to the overall thermal protection.

Moisture barriers allow body heat in the form of perspiration vapor to escape for heat stress relief. They also provide liquid penetration resistance against blood, body fluids, NFPA common chemicals*, and water, helping the firefighter stay dry and protected. When tested in comparison to a urethane-only barrier technology, an expanded polytetrafluoroethylene (ePTFE) combination barrier provides higher levels of breathability and durability.

Lightweight moisture barriers that use Nomex® and Kevlar® nonwoven and woven substrates offer enhanced comfort.

* NFPA Common Chemicals:

- (1) Aqueous film-forming foam (AFFF), 3 percent concentrate
- (2) Battery acid (37 percent by weight sulfuric acid to water)
- (3) Fire-resistant hydraulic fluid, phosphate ester base
- (4) Surrogate gasoline fuel C as defined in ASTM D 471, Standard Test Method or Rubber Property-Effect of Liquids, a 50/50 percent by volume of toluene and iso-octane
- (5) Swimming pool chlorinating chemical containing at least 65 percent free chlorine (saturated solution)

Moisture Barriers at a Glance



Attributes	Stedair® 4000	Stedair® 3000	Stedair® Gold	Crosstech® Black Moisture Barrier
Manufacturer	Stedfast	Stedfast	Stedfast	W.L. Gore
Product Fabric Code	xxxG	xxxD	xxxN	xxx3
Weight (oz / yd²)	5.5	5.2	5.2	4.7
Film	Bi-component ePTFE/FR PU	Bi-component ePTFE/FR PU	Bi-component ePTFE/FR PU	Bi-component ePTFE/FR PU
Fabric Substrate	100% Nomex IIIA® Woven Pajama-check	33% Kevlar® / 67% Nomex® E-89™ Non-woven Spunlace	80% Nomex IIIA®/ 20% PBI Woven Pajama-check	100% Nomex IIIA® Woven Pajama-check
Warranty (Years)	4 Material and Labor	3 Material and Labor	4 Material and Labor	3.5 Material and Labor
Total Heat Loss (W/m²) Tested with various outer shell fabrics and Nomex® on aramid batting inner liner (ASTM F 1868)	260 - 290	235 - 265	260 - 290	250 - 280
Thermal Protective Performance (cal / cm²) Tested with various outer shell fabrics and Nomex® on aramid batting inner liner (NFPA 1971)	39 - 41	42 - 45	40 - 43	37 - 40
Substrate Durability	High	Moderate	Hgh	High
Film Durability	High	Good	High	High
Price Level	\$\$\$	\$\$	\$\$\$\$	\$\$\$

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Stedair® 4000 – 5.5 osy
Product Fabric Code: **xxxG**

- ePTFE-based film laminated to Nomex IIIA® woven pajama-check substrate
- Exceptional breathability and durability
- ePTFE film with hydrophilic and oleophobic polymer layer
- Breathability does not decrease after abrasion



Stedair® 3000
5.2 osy
Product Fabric Code: **xxxD**

- ePTFE-based film laminated to Kevlar® / Nomex® E-89™ non-woven substrate
- ePTFE film with hydrophilic and oleophobic polymer layer
- Very good breathability
- Good price / value
- Breathability does not decrease after abrasion



Stedair® Gold – 5.2 osy
Product Fabric Code: **xxxN**

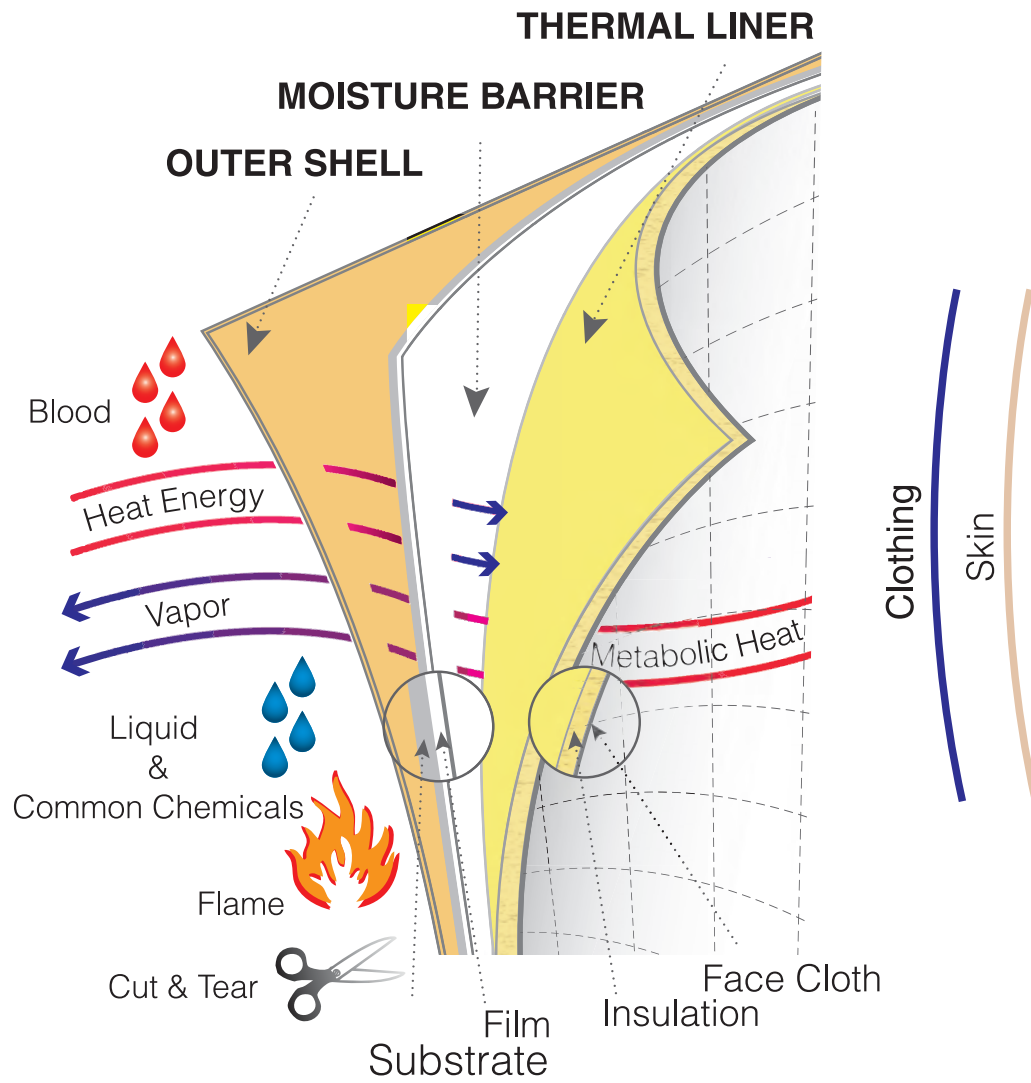
- ePTFE-based film laminated to Nomex IIIA® woven pajama-check substrate
- High substrate thermal resistance
- Exceptional breathability and durability
- ePTFE film with hydrophilic and oleophobic polymer layer
- Limited number of certified composites available
- Breathability does not decrease after abrasion



**Crosstech® Black
Moisture Barrier** – 4.7 osy
Product Fabric Code: **xxx3**

- ePTFE-based film laminated to Nomex IIIA® woven pajama-check substrate
- Superior liquid penetration resistance
- Exceptional heat-stress relief and durability
- Enhanced bi-component technology
- Breathability does not decrease after high heat exposure

Turnout Gear System



Performance characteristics of turnout gear are determined by the choice of combined fabric components. Fire-protective clothing typically consists of three layers: outer shell, moisture barrier, and thermal liner. Each layer serves specific multiple functions and, as a composite, is expected to help provide the firefighter with adequate heat, flame, liquid, chemical, and mechanical protection.

DuPont™ Nomex® and Kevlar® provide proven protection, durability and comfort from the inside out. 70% of a turnout's thermal protection comes from the inner components of DuPont™ Nomex® and Kevlar®.

General Performance Criteria

Protection:

- Thermal, chemical, viral, cut, durability
- Tensile, tear, UV, safety, comfort
- Breathability, weight, dryness, mobility, fit, minimal life-cycle cost
- Initial price + maintenance costs



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NFFF
National Fallen Firefighters Foundation



NVFC
National Volunteer Fire Council

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FDSOA
Fire Department Safety Officers Association



Congressional Fire Services Institute



ISFSI
International Society of Fire Service Instructors



NFPA
National Fire Protection Association



FEMSA
Fire Equipment Manufacturers & Suppliers Association



Military Firefighter Heritage Foundation



Honeywell Life Safety

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