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.
## Outer Shells at a Glance

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Nomex IIIA®</th>
<th>Advance™*</th>
<th>Omni Vantage™</th>
<th>Advance Ultra™</th>
<th>Armor 7.0™</th>
<th>Gemini™ XT</th>
<th>PBI Max™</th>
<th>Millenia™ XT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fiber Content</td>
<td>93% Nomex®</td>
<td>60% Kevlar®</td>
<td>40% Kevlar®</td>
<td>60% Kevlar®</td>
<td>75% Kevlar®</td>
<td>55% Kevlar®</td>
<td>65% Kevlar®</td>
<td>60% Technora®</td>
</tr>
<tr>
<td></td>
<td>5% Kevlar®</td>
<td>30% Basofil®</td>
<td>20% Nomex®</td>
<td>25% Nomex®</td>
<td>20% PBO</td>
<td>37% PBI</td>
<td>35% PBI</td>
<td>40% PBO</td>
</tr>
<tr>
<td></td>
<td>2% Carbon</td>
<td>30% Basofil®</td>
<td>20% Nomex®</td>
<td>25% Nomex®</td>
<td>20% PBO</td>
<td>37% PBI</td>
<td>35% PBI</td>
<td>40% PBO</td>
</tr>
<tr>
<td></td>
<td>3% Kevlar®</td>
<td>30% Nomex®</td>
<td>20% PB-O</td>
<td>35% PB-O</td>
<td>40% PB-O</td>
<td>2% Carbon</td>
<td>30% PB-O</td>
<td>20% PB-O</td>
</tr>
<tr>
<td></td>
<td>2% Carbon</td>
<td>30% Basofil®</td>
<td>20% Nomex®</td>
<td>25% Nomex®</td>
<td>20% PBO</td>
<td>37% PBI</td>
<td>35% PBI</td>
<td>40% PBO</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Product Fabric Code</th>
<th>24xx</th>
<th>34xx</th>
<th>15xx</th>
<th>64xx</th>
<th>47xx</th>
<th>41xx</th>
<th>62xx</th>
<th>33xx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (oz / yd²)</td>
<td>7.5</td>
<td>7.2</td>
<td>7.8</td>
<td>7.5</td>
<td>7.0</td>
<td>7.5</td>
<td>7.5</td>
<td>7.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weave</th>
<th>Plain</th>
<th>Ripstop</th>
<th>Ripstop</th>
<th>Ripstop</th>
<th>Comfort-Twill</th>
<th>Plain</th>
<th>Comfort-Twill</th>
<th>Ripstop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yarn</td>
<td>100% Spun</td>
<td>100% Spun</td>
<td>100% Spun</td>
<td>100% Spun</td>
<td>50% Spun/ 50% Filament</td>
<td>92% Spun/ 8% Filament</td>
<td>70% Spun/ 30% Filament</td>
<td>100% Spun</td>
</tr>
<tr>
<td>Warranty (years)</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Taber Abrasion Resistance (ASTM D 3884, H-18 wheel, 500g weight)</th>
<th>Good</th>
<th>High</th>
<th>Good</th>
<th>High</th>
<th>Good</th>
<th>High</th>
<th>Good</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tear Strength (lbs) (ASTM D 5587 without slippage)</td>
<td>55 x 40</td>
<td>40 x 30</td>
<td>30 x 25</td>
<td>45 x 35</td>
<td>90 x 110</td>
<td>50 x 55</td>
<td>125 x 145</td>
<td>90 x 100</td>
</tr>
<tr>
<td>Tensile Strength After 10 Launderings (ASTM D 5034)</td>
<td>340 x 320</td>
<td>450 x 400</td>
<td>365 x 275</td>
<td>565 x 560</td>
<td>555 x 505</td>
<td>380 x 345</td>
<td>420 x 445</td>
<td>570 x 565</td>
</tr>
<tr>
<td>Tensile Strength After a 10-Second TPP Exposure (lbs)</td>
<td>6 x 5</td>
<td>18 x 17</td>
<td>16 x 14</td>
<td>165 x 150</td>
<td>14 x 14</td>
<td>16 x 13</td>
<td>19 x 19</td>
<td>250 x 210</td>
</tr>
<tr>
<td>Resistance to Water Absorption (Modified AATCC 42)</td>
<td>Good</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Flame Resistance (ASTM D 6413)</td>
<td>Moderate</td>
<td>Good</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Tested with Crosstech® moisture barrier and Nomex® on Aramid batting inner liner (NFPA 1971)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outer Shell Thermal Decomposition Temperature (°F)</td>
<td>660 - 750</td>
<td>660 - 900</td>
<td>750 - 1000</td>
<td>750 - 1000</td>
<td>660 - 900</td>
<td>800 - 1100</td>
<td>800 - 1100</td>
<td>1000 - 1200</td>
</tr>
<tr>
<td>Price Level</td>
<td>$</td>
<td>$$</td>
<td>$$$</td>
<td>$$$</td>
<td>$$$</td>
<td>$$$</td>
<td>$$$</td>
<td>$$$</td>
</tr>
</tbody>
</table>

* 8% black solution-dyed Fusion also available
**8% Vectran in natural; 8% Technora in black

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## Outer Shells

### 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

<table>
<thead>
<tr>
<th>Color</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow</td>
<td><img src="image" alt="Yellow" /></td>
</tr>
<tr>
<td>Natural</td>
<td><img src="image" alt="Natural" /></td>
</tr>
<tr>
<td>Black</td>
<td><img src="image" alt="Black" /></td>
</tr>
<tr>
<td>Royal Blue</td>
<td><img src="image" alt="Royal Blue" /></td>
</tr>
<tr>
<td>Navy</td>
<td><img src="image" alt="Navy" /></td>
</tr>
</tbody>
</table>

### 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

<table>
<thead>
<tr>
<th>Color</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Khaki</td>
<td><img src="image" alt="Khaki" /></td>
</tr>
<tr>
<td>Black</td>
<td><img src="image" alt="Black" /></td>
</tr>
<tr>
<td>Navy</td>
<td><img src="image" alt="Navy" /></td>
</tr>
<tr>
<td>Yellow</td>
<td><img src="image" alt="Yellow" /></td>
</tr>
</tbody>
</table>

### 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

<table>
<thead>
<tr>
<th>Color</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goldern Brown</td>
<td><img src="image" alt="Goldern Brown" /></td>
</tr>
<tr>
<td>Black</td>
<td><img src="image" alt="Black" /></td>
</tr>
<tr>
<td>Yellow</td>
<td><img src="image" alt="Yellow" /></td>
</tr>
</tbody>
</table>
### Outer Shells

**Advance Ultra® – 7.5 osy**  
Product Fabric Code: 64xx  
- Ripstop weave  
- 60% Kevlar®  
  20% Nomex®  
  20% PBO  
- Balance between high performance and value  
- High strength after thermal exposure  
- Excellent abrasion resistance

**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

**Gemini XT™ – 7.5 osy**  
Product Fabric Code: 41xx  
- Plain weave with filament matrix (simulated ripstop)  
- 55% Kevlar®  
  37% PBI  
  8% Vectran® in natural; 8% Technora in black  
- Remains smooth after multiple launderings  
- Filament technology incorporated for improved trapezoidal tear resistance  
- Retained strength and flexibility after thermal exposure
Outer Shells

**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

**Millenia™ XT – 7.5 osy**
Product Fabric Code: 33xx

- 60% Technora®
  40% PBO
- Superior strength and abrasion resistance
- Exceptional thermal stability
- Extreme durability and overall wear life
Outer Shells

- **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

- **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

- **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.
# Thermal Liners at a Glance

<table>
<thead>
<tr>
<th>Attributes</th>
<th>XLT-Lite™ Chambray</th>
<th>Aralite® NP</th>
<th>Aralite® SL3</th>
<th>Defender® M SL2</th>
<th>Synergy II 2-layer</th>
<th>PBI ThermalGUARD™</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facecloth</td>
<td>100% Nomex®</td>
<td>100% Nomex®</td>
<td>100% Nomex®</td>
<td>65% Lenzing FR®</td>
<td>100% Nomex®</td>
<td>Proprietary PBI Blend</td>
</tr>
<tr>
<td></td>
<td>3.25 osy</td>
<td>3.4 osy</td>
<td>3.4 osy</td>
<td>3.2 osy</td>
<td>3.3 osy</td>
<td>3.6 osy</td>
</tr>
<tr>
<td></td>
<td>100% Spun</td>
<td>100% Spun</td>
<td>100% Spun</td>
<td>100% Spun</td>
<td>100% Spun</td>
<td>100% Spun</td>
</tr>
<tr>
<td></td>
<td>Calendered</td>
<td>Calendered</td>
<td>Calendered</td>
<td>Calendered</td>
<td>Calendered</td>
<td>Calendered</td>
</tr>
<tr>
<td>Batting</td>
<td>Reprocessed Aramid</td>
<td>Aramid</td>
<td>Kevlar® / Nomex® E-89®</td>
<td>Kevlar® / Nomex® E-89® Spunlace</td>
<td>Kevlar® / Nomex® E-89® Spunlace</td>
<td>80% Aramid 20% PBI</td>
</tr>
<tr>
<td></td>
<td>4.5 osy</td>
<td>3.8 osy</td>
<td>3-layers E-89® Spunlace (3 x 1.5 osy)</td>
<td>2-layers Spunlace (2 x 2.3 osy)</td>
<td>2-layers Apertured Spunlace (1.5 osy + 2.3 osy)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Needlepunch</td>
<td>Needlepunch</td>
<td>Needlepunch</td>
<td>Needlepunch</td>
<td>Needlepunch</td>
<td>Needlepunch</td>
</tr>
<tr>
<td></td>
<td>(3 x 1.5 osy)</td>
<td>(2 x 2.3 osy)</td>
<td>(1.5 osy + 1.8 osy)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product Fabric Code</td>
<td>xxNx</td>
<td>xx0x</td>
<td>xx3x</td>
<td>xxAx, xxEx</td>
<td>xxix, xxCx</td>
<td>xxWx</td>
</tr>
<tr>
<td>Weight (oz / yd²)</td>
<td>7.75</td>
<td>7.2</td>
<td>8.0</td>
<td>7.8</td>
<td>7.1</td>
<td>6.8</td>
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<tr>
<td>Water Management</td>
<td>Absorbing</td>
<td>Absorbing</td>
<td>Absorbing</td>
<td>Absorbing</td>
<td>Absorbing</td>
<td>Absorbing</td>
</tr>
<tr>
<td>Drying Time</td>
<td>Long</td>
<td>Long</td>
<td>Long</td>
<td>Long</td>
<td>Long</td>
<td>Long</td>
</tr>
<tr>
<td>Water Affinity</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>(Amount of water absorbed from spraying after 5 launderings)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facecloth Slipperiness</td>
<td>Good</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>(Based on friction coefficient) Represents ease of donning / doffing and mobility</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Heat Loss (W/m²)</td>
<td>220 - 250</td>
<td>235 - 265</td>
<td>250 - 280</td>
<td>265 - 295</td>
<td>265 - 295</td>
<td>270 - 300</td>
</tr>
<tr>
<td>Tested with Crosstech® moisture barrier and Kevlar® / Nomex® outer shell (ASTM 1868)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermal Protective Performance (cal / cm²)</td>
<td>45 - 48</td>
<td>40 - 43</td>
<td>40 - 43</td>
<td>38 - 41</td>
<td>38 - 41</td>
<td>39 - 42</td>
</tr>
<tr>
<td>Tested with Kevlar® / Nomex® outer shell</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price Level</td>
<td>$</td>
<td>$$</td>
<td>$$$</td>
<td>$</td>
<td>$</td>
<td>$$$</td>
</tr>
</tbody>
</table>

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*High:* Far exceeds in relative performance.

*Good:* Exceeds in relative performance.

*Moderate:* Average in relative performance.

All weights are nominal.
## Thermal Liners at a Glance

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Caldura® NPi</th>
<th>Caldura® SL2i</th>
<th>Glide™ Pure</th>
<th>Glide™ 2-layer</th>
<th>Quantum3D® SL2i</th>
<th>Glide™ PBI G2™</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facecloth</td>
<td>61% Kevlar® 34% Lenzing FR® 5% Nylon 3.8 osy 50% Spun / 50% Filament</td>
<td>61% Kevlar® 34% Lenzing FR® 5% Nylon 3.8 osy 50% Spun / 50% Filament</td>
<td>60% Kevlar® 28% Nomex® 14% Lenzing FR® 3.6 osy 60% Filament / 40% Spun</td>
<td>60% Kevlar® 28% Nomex® 14% Lenzing FR® 3.6 osy 60% Filament / 40% Spun</td>
<td>61% Kevlar® 34% Lenzing FR® 5% Nylon 3.8 osy 50% Spun / 50% Filament</td>
<td>60% Kevlar® 28% Nomex® 14% Lenzing FR® 3.6 osy 60% Filament / 40% Spun</td>
</tr>
<tr>
<td>Batting</td>
<td>Aramid 3.8 osy Needlepunch</td>
<td>Kevlar® / Nomex® E-89® 2-layers E-89® Spunlace (1.5 osy + 2.3 osy)</td>
<td>Kevlar® / Nomex® 50% Nomex® 4.0 osy Needlepunch</td>
<td>Kevlar® / Nomex® E-89® 2-layers E-89® Spunlace (1.5 osy + 2.3 osy)</td>
<td>Kevlar® / Nomex® 2-layers Spunlace (1.5 osy + 2.3 osy 3D layer)</td>
<td>80% Aramid 20% PBI 2-layers Apertured Spunlace (1.4 osy + 1.8 osy)</td>
</tr>
<tr>
<td>Product Fabric Code</td>
<td>xx7x</td>
<td>xxQx</td>
<td>xxVx</td>
<td>xxBx</td>
<td>xxZx</td>
<td>xxHx</td>
</tr>
<tr>
<td>Weight (oz / yd²)</td>
<td>7.6</td>
<td>7.7</td>
<td>7.6</td>
<td>7.4</td>
<td>7.7</td>
<td>6.8</td>
</tr>
<tr>
<td>Water Management</td>
<td>Wicking</td>
<td>Wicking</td>
<td>Wicking</td>
<td>Wicking</td>
<td>Wicking</td>
<td>Wicking</td>
</tr>
<tr>
<td>Drying Time</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Water Affinity (Amount of water absorbed from spraying after 5 launderings)</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Facecloth Slipperiness (Based on friction coefficient)</td>
<td>High</td>
<td>High</td>
<td>Exceptional</td>
<td>Exceptional</td>
<td>High</td>
<td>Exceptional</td>
</tr>
<tr>
<td>Total Heat Loss (W/m²)</td>
<td>Tested with Crosstech® moisture barrier and Kevlar® / Nomex® outer shell (ASTM 1868)</td>
<td>220 - 250</td>
<td>265 - 295</td>
<td>225 - 255</td>
<td>265 - 295</td>
<td>250 - 280</td>
</tr>
<tr>
<td>Thermal Protective Performance (cal / cm²)</td>
<td>Tested with Kevlar® / Nomex® outer shell</td>
<td>40 - 43</td>
<td>37 - 40</td>
<td>39 - 42</td>
<td>38 - 41</td>
<td>40 - 43</td>
</tr>
<tr>
<td>Price Level</td>
<td>$$$</td>
<td>$$$$</td>
<td>$$$</td>
<td>$$$$</td>
<td>$$$$$</td>
<td>$$$$$</td>
</tr>
</tbody>
</table>

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## Thermal Liners

### Water Management: Facecloth

<table>
<thead>
<tr>
<th>Spun</th>
<th>Spun / Filament</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water absorbing (best suited in low activity)</td>
<td>Water wicking (best suited in low- to mid-level activity)</td>
</tr>
<tr>
<td>Traditional cloth feel</td>
<td>Low coefficient of friction (good mobility and ease when donning and doffing)</td>
</tr>
<tr>
<td>Slower drying time</td>
<td>Moderate drying</td>
</tr>
<tr>
<td>Prone to pilling</td>
<td>Low pilling</td>
</tr>
</tbody>
</table>

### XLT-Lite® Chambray – 7.75 osy

- Product Fabric Code: `xxNx`
- Facecloth: 100% spun
  - Calendered
  - Plain weave
- Reprocessed aramid batting
- Absorbing liner system
- High TPP
- Economical alternative

### Defender® M SL2 – 7.8 osy

- Product Fabric Codes: `xxEx` (desert sand) `xxAx` (camo)
- Facecloth: 100% spun
  - Plain weave
- Kevlar® / Nomex® spunlace batts
- Absorbing liner system
- High THL for better comfort

### 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
Thermal Liners

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

**PB I ThermalGUARD™** – 6.8 osy  
Product Fabric Code: **xxWx**
- Facecloth: 100% spun  
  Calendered  
  Plain weave
- PBI / Nomex® spunlace batts
- Lightweight  
  High thermal resistance  
  Absorbing liner system  
  Optimal balance between THL & TPP

**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
Thermal Liners

Quantum3D® SL2i – 7.7 osy
Product Fabric Code: xxZx

- Facecloth: 50% spun / 50% filament
  Checkered box weave
- Kevlar® / Nomex® spunlace batts
  3D layer + flat layer
- Wicking liner system
- Increased TPP over standard 2-layer spunlace batts
- High THL for better comfort

Glide™ PBI G2™ – 6.8 osy
Product Fabric Code: xxHx

- Facecloth: 60% filament / 40% spun
  Twill weave
- 80% Nomex® / 20% PBI spunlace batts
- Exceptional thermal resistance
- Wicking liner system
- 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 for 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

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Crosstech® Black Moisture Barrier</th>
<th>Gore® RT7100 Moisture Barrier</th>
<th>Stedair® 4000</th>
<th>Stedair® 3000</th>
<th>Stedair® Gold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer</td>
<td>W.L. Gore</td>
<td>W.L. Gore</td>
<td>Stedfast</td>
<td>Stedfast</td>
<td>Stedfast</td>
</tr>
<tr>
<td>Product Fabric Code</td>
<td>xxx3</td>
<td>xxx0</td>
<td>xxxG</td>
<td>xxxD</td>
<td>xxxN</td>
</tr>
<tr>
<td>Weight (oz / yd²)</td>
<td>4.7</td>
<td>4.6</td>
<td>5.5</td>
<td>5.2</td>
<td>5.2</td>
</tr>
<tr>
<td>Film</td>
<td>Bi-component ePTFE/FR PU</td>
<td>Bi-component ePTFE/FR PU</td>
<td>Bi-component ePTFE/FR PU</td>
<td>Bi-component ePTFE/FR PU</td>
<td>Bi-component ePTFE/FR PU</td>
</tr>
<tr>
<td>Fabric Substrate</td>
<td>100% Nomex IIIA® Woven Pajama-check</td>
<td>15% Kevlar® / 85% Nomex® Needle Punched Non-woven</td>
<td>100% Nomex IIIA® Woven Pajama-check</td>
<td>33% Kevlar® / 67% Nomex® E-89™ Non-woven Spurliace</td>
<td>80% Nomex IIIA® / 20% PBI Woven Pajama-check</td>
</tr>
<tr>
<td>Warranty (Years)</td>
<td>3.5 Material and Labor</td>
<td>3 Materials</td>
<td>4 Material and Labor</td>
<td>3 Material and Labor</td>
<td>4 Material and Labor</td>
</tr>
<tr>
<td>Total Heat Loss (W/m²²)</td>
<td>250 - 280</td>
<td>235 - 265</td>
<td>260 - 290</td>
<td>235 - 265</td>
<td>260 - 290</td>
</tr>
<tr>
<td>Tested with various outer shell fabrics and Nomex® on aramid batting inner liner (ASTM F 1868)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermal Protective Performance (cal / cm²)</td>
<td>37 - 40</td>
<td>40 - 43</td>
<td>39 - 41</td>
<td>42 - 45</td>
<td>40 - 43</td>
</tr>
<tr>
<td>Tested with various outer shell fabrics and Nomex® on aramid batting inner liner (NFPA 1971)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Substrate Durability</td>
<td>High</td>
<td>Moderate</td>
<td>High</td>
<td>Moderate</td>
<td>High</td>
</tr>
<tr>
<td>Film Durability</td>
<td>High</td>
<td>Good</td>
<td>High</td>
<td>Good</td>
<td>High</td>
</tr>
<tr>
<td>Price Level</td>
<td>$$$</td>
<td>$</td>
<td>$$$</td>
<td>$</td>
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- **High**: Far exceeds in relative performance.
- **Good**: Exceeds in relative performance.
- **Moderate**: Average in relative performance.

All weights are nominal.
Moisture Barriers

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

Gore® RT7100
Moisture Barrier – 4.6 osy
Product Fabric Code: xxx0

- ePTFE-based film laminated to Kevlar® / Nomex® needle punched non-woven substrate
- Bi-component film technology
- Liquid penetration resistant
- Cost-competitive alternative
- Breathability does not decrease after high heat exposure

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
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
Honeywell is proud to be the exclusive corporate sponsor of the United States Fire Administration/National Fallen Firefighters Foundation’s National Fire Service Vulnerability Assessment Project.

**Proudly Supporting**

- IAFC International Association of Fire Chiefs
- The IAFF Fire Fighters Burn Foundation
- Firefighter Cancer Support Network
- International Association of Black Professional Fire Fighters
- International Association of Women in Fire & Emergency Services
- NFFF National Fallen Firefighters Foundation
- NVFC National Volunteer Fire Council

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Honeywell Life Safety
Honeywell First Responder Products
#1 Innovation Court
Dayton, Ohio 45414
Tel: 800-688-6148
www.HoneywellFirstResponder.com