



Norafin 

Spunlace in Protective Apparel

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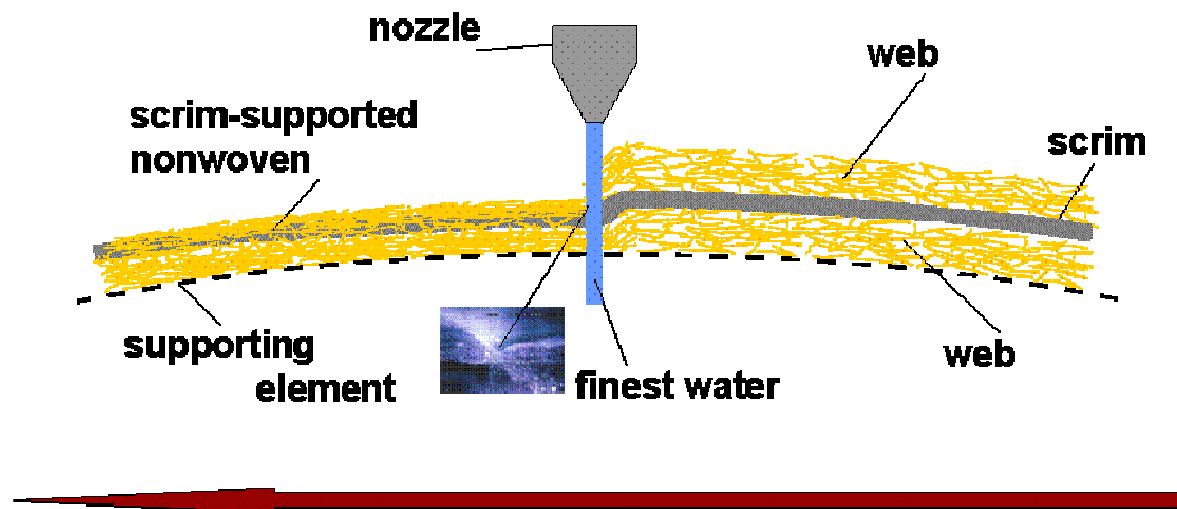
Table of Content

- Market Challenges
- The Hydroentangling Process
- Performance Advantages of Spunlaced Nonwovens
- Product Options
- Thermal Protective Performance (TPP)
- Spunlaced Nonwovens in Motor Sport Racing Suits
- Spunlace Nonwovens in Fire Fighter Suits

Market Challenges

- Increased performance requirements in protective apparel are presenting new challenges for the nonwovens manufacturer. As a result, alternate nonwoven technologies are being utilized
- One such technology is the spunlace (hydroentanglement) process

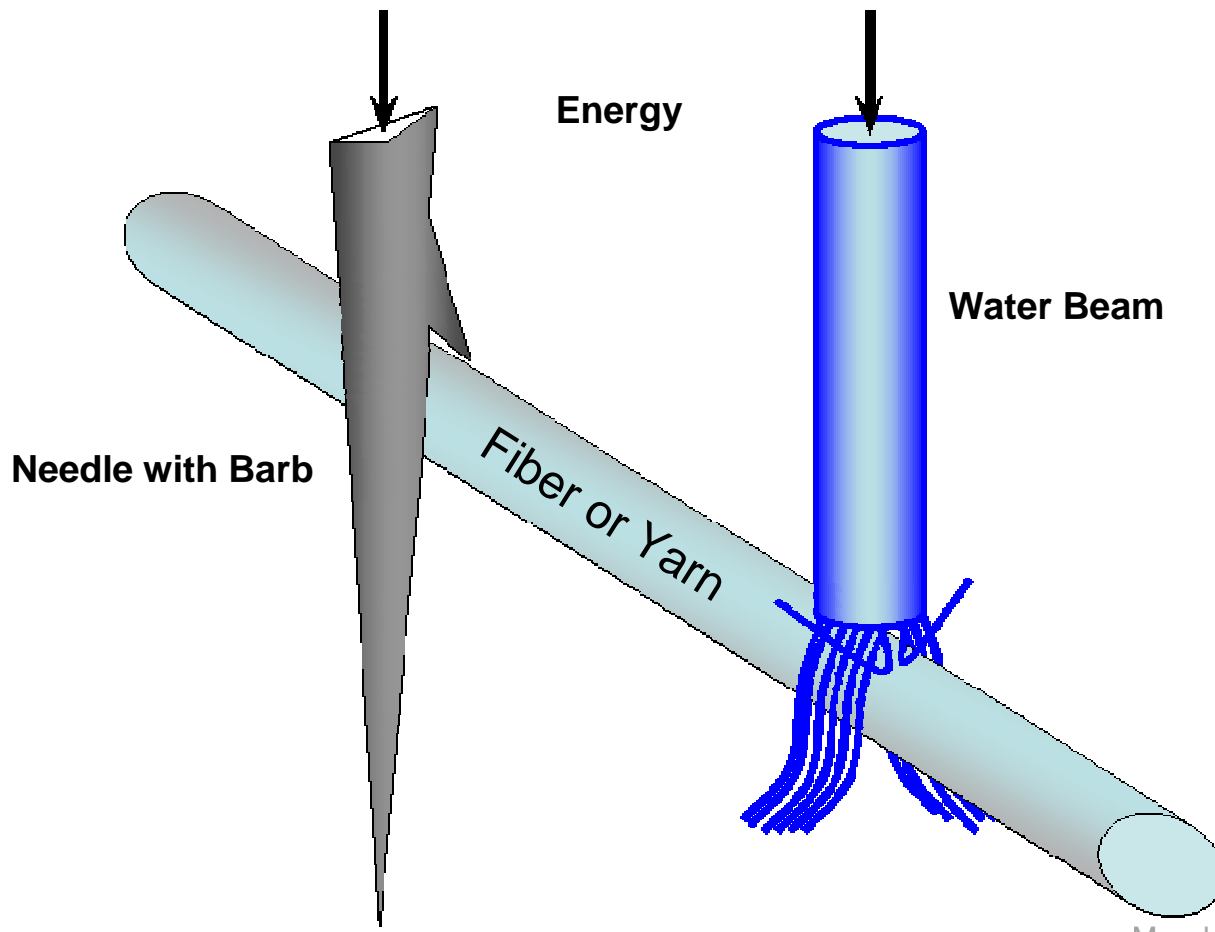
The Hydroentangling Process



Manufacturing process – process flow

- Thanks to the water fibers and scrim will not be scratched or destroyed
- No pressure spots or formed channels with fibers
- Open areas in between the fibers are removed and filled up with fiber strands

The Hydroentangling Process



Performance Advantages of Spunlaced Nonwovens

- Breathability
- Lower basis weight variations
- Superior uniformity of the web
- Improved insulation properties
- Well structured product appearance
- Drabability
- Soft-'textile'-touch
- Enhanced wearing comfort

Product Options

- Multi-layering capabilities for gradient functionalities
- Double-layering capabilities showing different functions on each side
- Multiple functions in just one layer
- Scrim supported / reinforced fabrics
- A wide range of fabric basis weights
(30 up to 800 g/m² = 0.9 oz/sq yd up to 23 oz/sq yd)
- Multi-dimensional structures
- Lighter end products

Thermal Protective Performance (TPP)

- The garment material's thermal insulation is tested in the presence of both direct flame and radiant heat
 - ✓ Same outershell and inner layer tested
 - ✓ Middle layer replaced with a spunlace material
 - ✓ Result: same PPT achieved by reducing the weight by 15% at the same time

Outershell	Moisture barrier/ thermal liner	Inner Layer	Total Weight (gsm)	TPP rating (2cal/cm ²)
PBI + Para-aramide	Spacer material + PTFE membrane	Aramide blend	580	23.3
PBI + Para-aramide	Norafin Spunlace + PTFE membrane	Aramide blend	580	26.9
PBI + Para-aramide	Norafin Spunlace + PTFE membrane	Aramide blend	500	22.9

580 g/m² = 16.8 oz/sq yd

500 g/m² = 14.5 oz/sq yd

Spunlaced Nonwovens in Motor Sport Racing Suits

Insulation Layer

Specialty high-temperature resistant fiber is transferred into a low-weight spunlace fabric

- Reduction of the number of insulation layers used
- Reduction in weight compared to the racing suit previously used
- Heat and mechanical resistance according to FIA Standard 8856-2000



Spunlace Nonwovens in Fire Fighter Suits

- Tests carried out with a 3-layer firefighter suit having a spunlace layer as second layer
 - ✓ Tested norms: EN ISO 6942 and EN 367
 - ✓ Results achieved: Classification on Level 2 of the norms

Heat Transfer Rate	Level 1	Level 2	3-layer product incl. spunlace nonwoven
Radiant Heat, Sensor of 24°C	≥ 10.0 s	≥ 18.0 s	19.7 s
Exposure to Flame, Sensor of 24°C	≥ 9.0 s	≥ 13.0 s	13.7 s

- ✓ Protects against exposure to flame or radiant heat given for 13.7 and 19.7 seconds respectively



Spunlace Nonwovens used in Cooling Technology



- Evaporative cooling that works with the body's heat and water
- Functionality from a high-performance nonwoven containing a super absorbent fiber
- Durable fabric which can be washed repeatedly
- Easy activation and reactivation in use
- Significant application potential, particularly in areas of high user sun exposure -> cooling effective up to 8 hours



Questions?

Thank you very much!