The Complexity of the Supply Chain for Firefighting PPE

May 2023

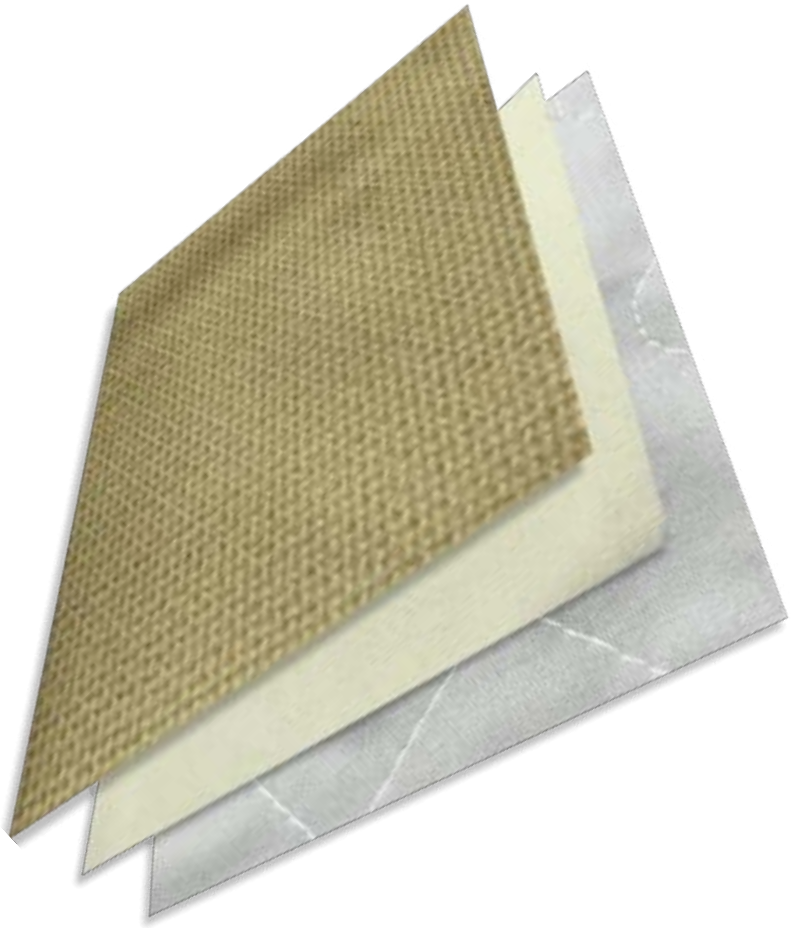
How is firefighting PPE made?

There are three main fabrics which make up a Structural Firefighting PPE composite.

1. **Outer Shell** – a woven fabric made of flame-resistant fibres provides the first line of defense against heat and flame. The outer shell has high tear and tensile strength and provides repellence from oils, chemicals and liquids.

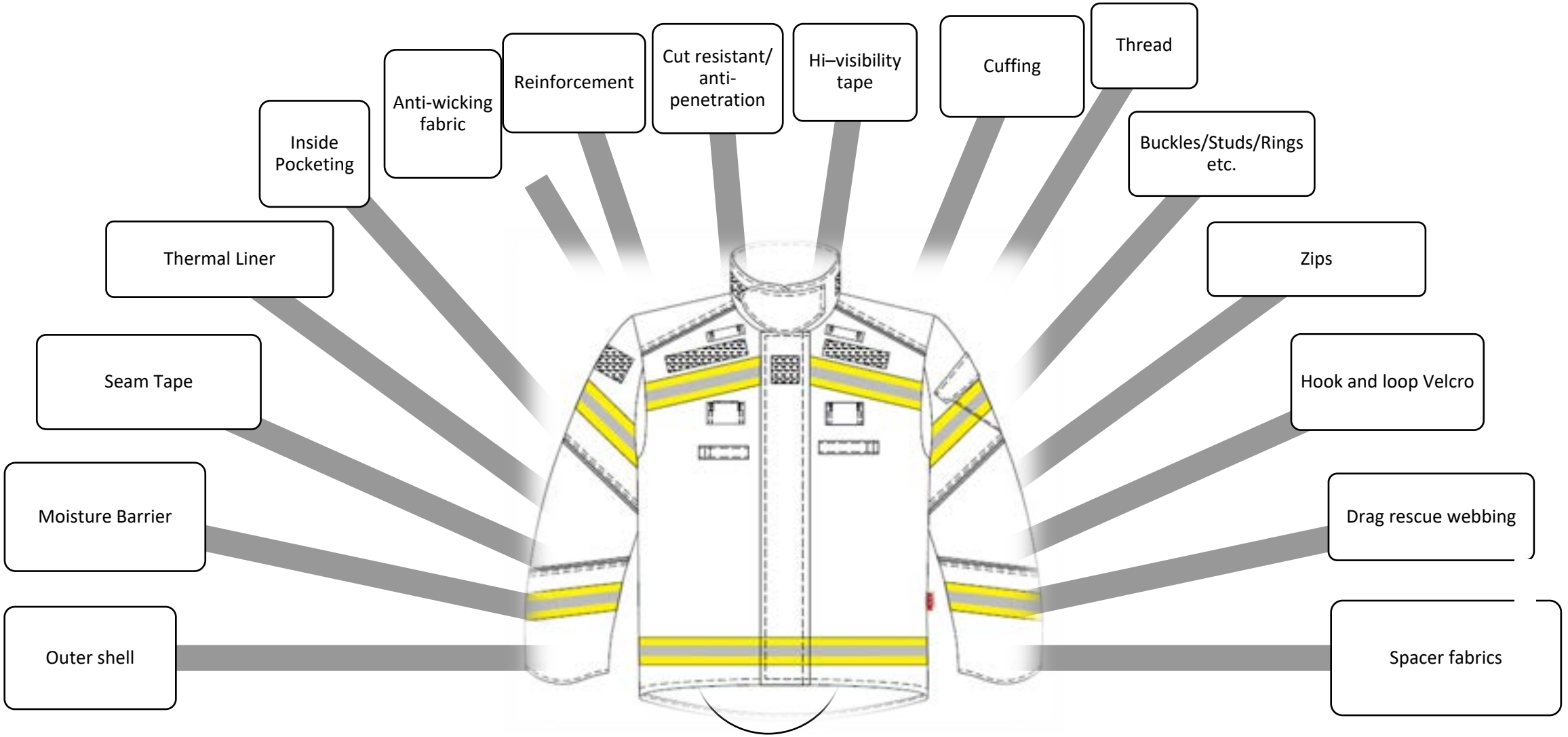
2. **Moisture Barrier** – a laminated waterproof breathable fabric which provides protection from: penetration by moisture (water), common chemicals such as sodium hydroxide, hydrochloric acid, sulphuric acid and o-xylene, bacteriophage (bodily fluids) and viruses and particulate smoke.

3. **Thermal Liner** – provides thermal protection and aids the wicking of sweat through the garment.



Other components

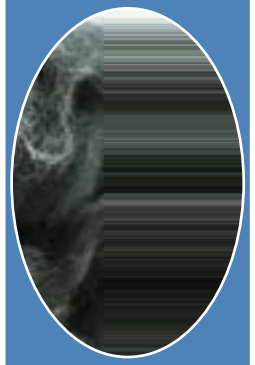
Supply Chain Complexity



Fabric Manufacturing Process

Fibre

3-6 months

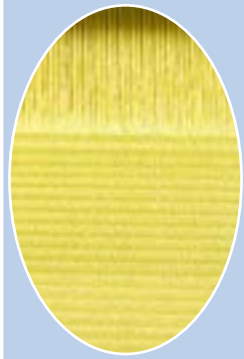


Blending

Carding

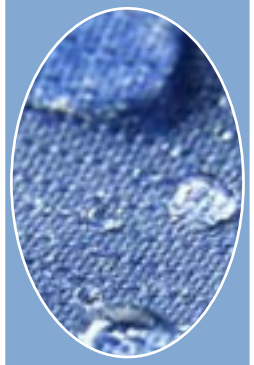
Spinning

Warping



Weaving

Dyeing



Finishing

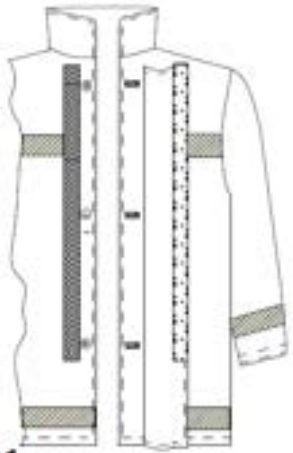
Laminating and Coating

Quilting

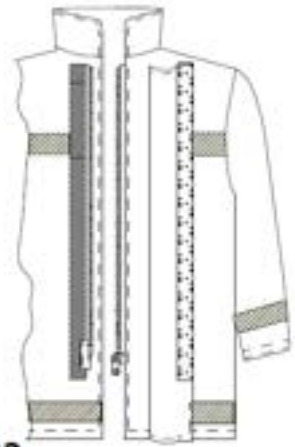
Up to 16 weeks

Entire Fabric Manufacturing Process 6 - 12 months

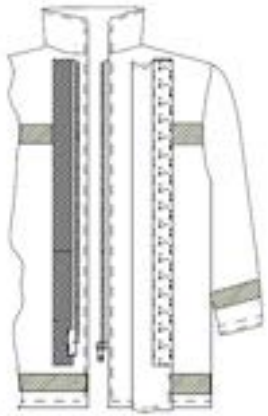
The effect of changes/options



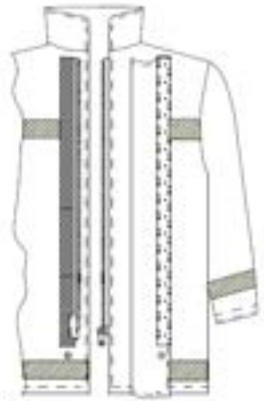
FFC01
VELCRO + BUTTONS



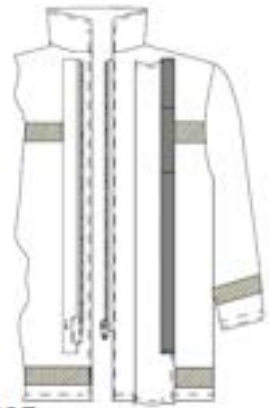
FFC02
30mm VELCRO + ZIP



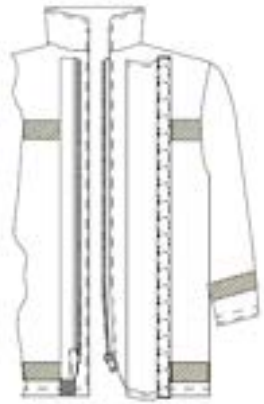
FFC03
50mm VELCRO + ZIP



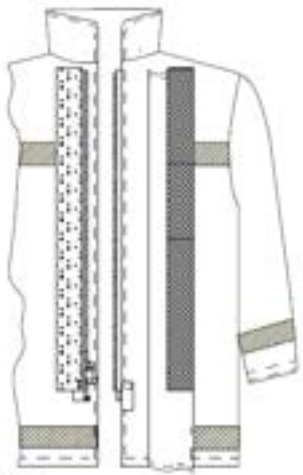
FFC04
VELCRO, ZIP+ PRESS STUD



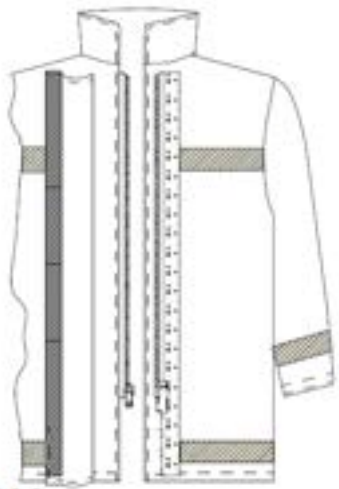
FFC05
30mm VELCRO + ZIP
(REVERSED VELCRO)



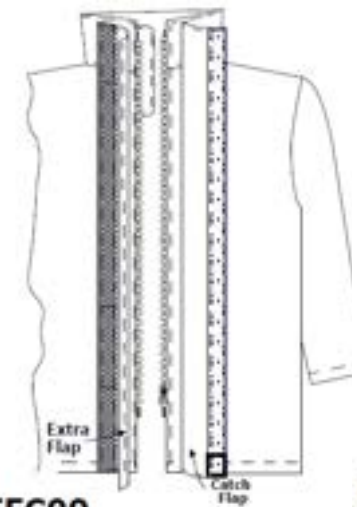
FFC06
30mm VELCRO + ZIP



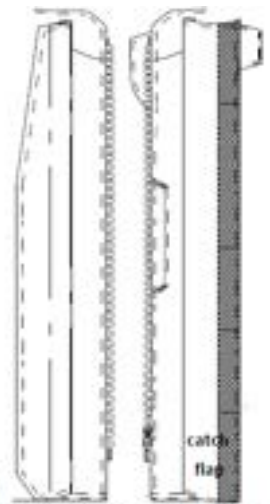
FFC07
30mm VELCRO + ZIP (shortened & reversed velcro)



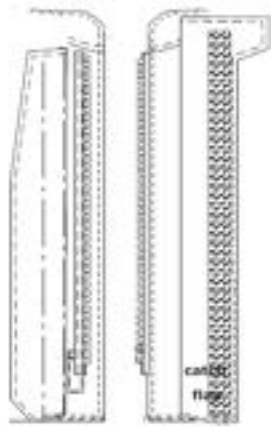
FFC08
30mm VELCRO + ZIP (reversed front)



FFC09
30mm VELCRO + ZIP (double flap)



FFC10
Velcro and zip opening (double



FFC11
Velcro and zip opening (double flap)

Critical Path Timeline

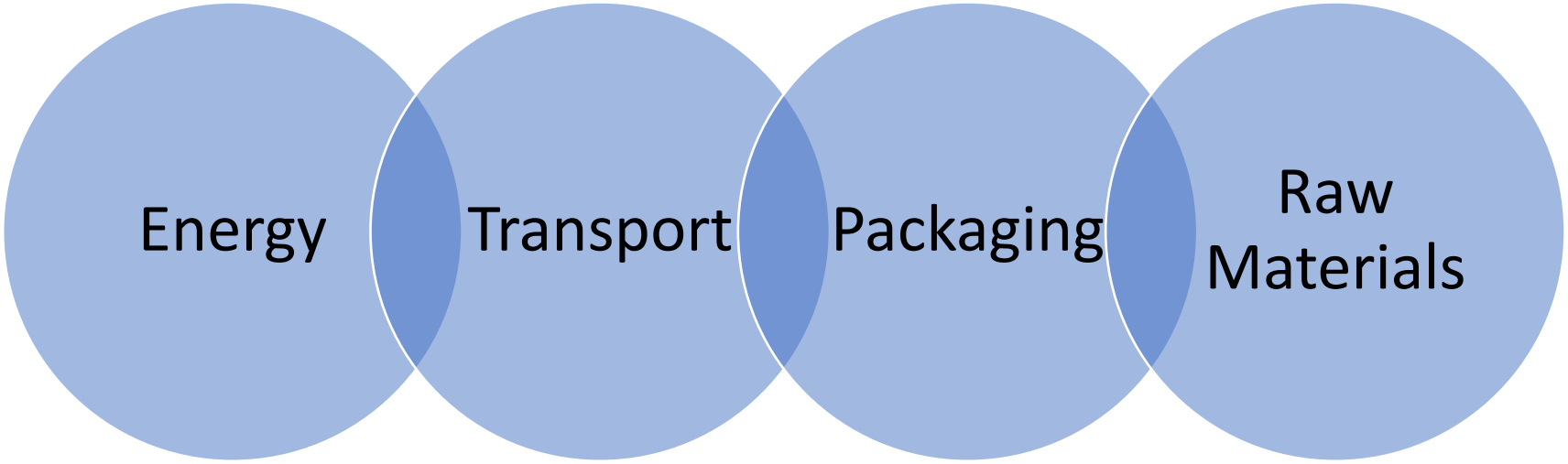
Average Leadtime for Production of ongoing styles: 30-38 weeks

For new developments add a further 28+ weeks

Financial Challenges

- The sustainability of a business relationship between supplier and buyer depends on financial stability
- In October 2022 the Annual Rate of Inflation reached a 41-year high.
- RPIX >20% 2021-present.

Unprecedented increases in costs from most sectors include:



Global Supply Chain

The "Domino Effect"

All firefighting PPE is sourced using a global supply chain

The world is a global village and events happening far away cause difficulties globally, especially when these factors are considered.

Effects of Global Conflict

Example: China

- Pre-eminent supplier of chemical raw material for para-aramid fibre
- Manufacturer site closures and staff absences
- Shipping delays and the container crisis has caused a worldwide shortage of raw materials (protective fabrics in this case).

Effects of Global Conflict

Example: Ukraine

- The war in Ukraine led to a much higher demand for aramid fibres used for military and defence applications.

- Many chemicals produced in Ukraine, Russia and Asia have become more difficult to obtain.

- Incredibly difficult situations in the oil and energy sectors (on which the textile industry is heavily reliant on).

Overview: Supply Chain Complexity

How can you help us mitigate these issues?

1. Provide accurate forecasting and budget planning to help suppliers ensure that the supply chain is aware of your needs.
2. Look forward – start understanding future demand now
3. Manage the expectation of delivery times for samples and tender responses
4. Work with suppliers on cost increases over a contract period.

Understanding specifications

May 2023

Why are standards so important?

To ensure that all firefighting PPE meets a minimum safety requirement

Meets essential health and safety requirement CAT III PPE immediately dangerous to life and health

Standards Organisations

ISO (International Organisation for Standardization) is an independent, non-governmental, international organization that develops standards to ensure the quality, safety, and efficiency of products, services, and systems.

NFPA (National Fire Protection Association) and publishes more than 300 consensus codes and standards intended to minimize the possibility and effects of fire and other risks.

The **European Committee for Standardisation (CEN)** is responsible for European standardisation. Together with ETSI and Cenelec, it forms the European system for technical standardisation.

The **British Standards Institute (BSI)** is responsible for UK standardisation.

Important Fire Fighting PPE Standards

	NFPA	ISO	EN	BSI
Structural Clothing	NFPA 1971	ISO 11999-3	EN469	EN469
Gloves	NFPA 1971	ISO 11999-4	EN659	EN659
Boots	NFPA 1971	ISO 11999-6	EN15090	EN15090
Hoods	NFPA 1971	ISO 11999-9	EN13911	EN13911
Wildland Clothing	NFPA 1977	ISO 15384	EN 15384	EN 15384
Technical Rescue Clothing	NFPA 1951	ISO 18639	EN 16689	EN 16689
Helmets	NFPA 1971	ISO 11999-5	EN443 / EN 16471 (Wildland), EN 16473 (Tech Rescue)	EN443 / EN 16471 (Wildland), EN 16473 (Tech Rescue)

Designation of Standards

From January 19th 2023, the only Designated Standard for structural firefighting is EN 469:2020, but with restrictions.

EN 469:2020 is Harmonised in the European Union and provides a legal presumption of conformity with the PPE Regulation (EU) 2016/425, with no restrictions.

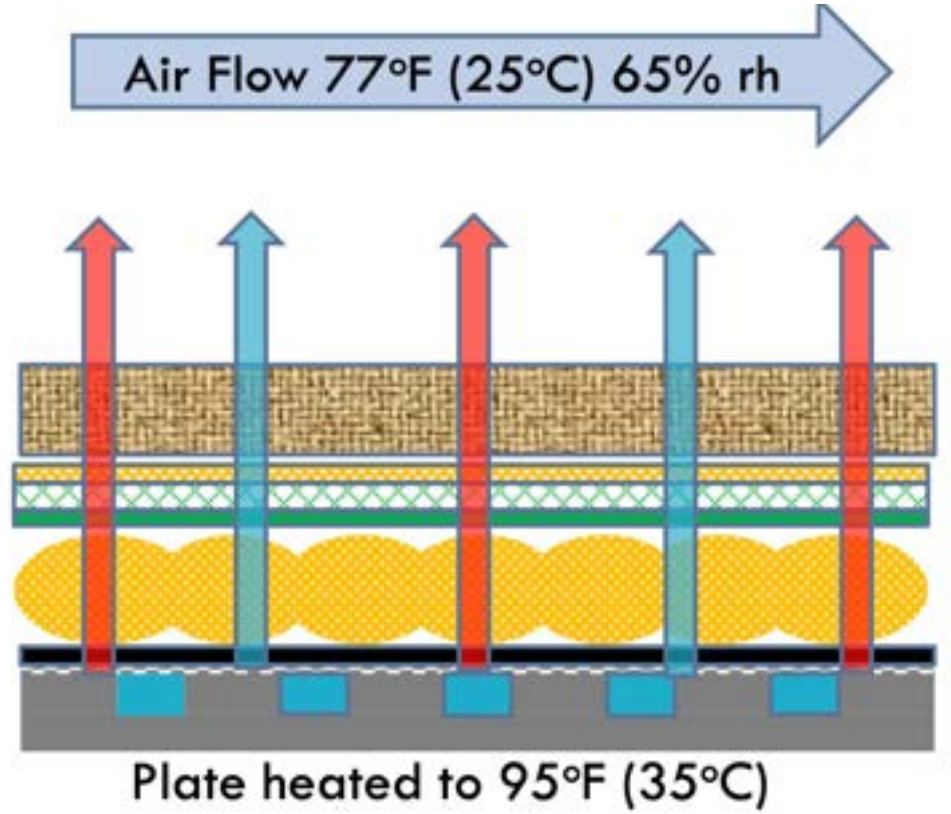
Test Methods

Heat Transfer Flame (HTI) and Radiant (RHTI)

Both tests expose the fabrics to an intensive heat and determine the Heat Transfer Index values of the HTI_{12}/$RHTI_{12}$ **(first degree burns)** and the HTI_{24} /$RHTI_{24}$ **(second degree burns)** and those of the HTI_{24}-HTI_{12} as **reaction time**. The EN469 standard is 13 seconds to second degree burn.

Test Methods

Breathability Testing – Water Vapour Resistance (Ret)



The lower the evaporative resistance the MORE breathable the fabrics are.

The EN469:2020 Requirement is <30m^{2}Pa/W

BSiF
BRITISH SAFETY INDUSTRY FEDERATION

Fire Sector Federation

PCIAW
PROFESSIONAL ASSOCIATION | CLOTHING INDUSTRY WORLDWIDE

FIA
Fire Industry Association
Leading Excellence in Fire Since 1916

Test Methods

Specification Writing

Providing a clear and objective specification is beneficial to both the supplier and the fire and rescue service

Reduces the number of questions during the tender process

Shows the fire and rescue service to be decisive and educated

Allow suppliers to ensure that you are receiving what you need

Increases quality of products provided for analysis

Reduces risk of challenge from non-winning bids

Simplifies analysis process

Provides valid and useful feedback to industry following tender

Specification Writing

If you were purchasing a garment or hood, what would be the most important things to consider in your specification?

Comfortable

Water resistant

Durable

How would you make sure your requirements are objective and clear?

Specification Writing

CONFIRM MINIMUM STANDARD REQUIRED FOR CERTIFICATION

There are designated standards in the UK

CONFIRM ANY ADDITIONAL PRE-TREATMENT REQUIREMENTS ABOVE AND BEYOND STANDARD

COMFORTABLE

DURABLE

WATER RESISTANT

Confirming accreditation of laboratories and language of test reports

Specification Writing

The Structural Firefighting Tunic and Trousers must be certified to EN469:2020 Protective Clothing for firefighters – performances requirements for protective clothing for firefighting activities

Additional Requirements:

Pre-treatment prior to all testing after washing will consist of a minimum of 40 laundry cycles as performed according to EN ISO 6330:2012 Procedure 6N (60ºC) with tumble drying (Procedure F) (max. 80ºC outlet temperature).

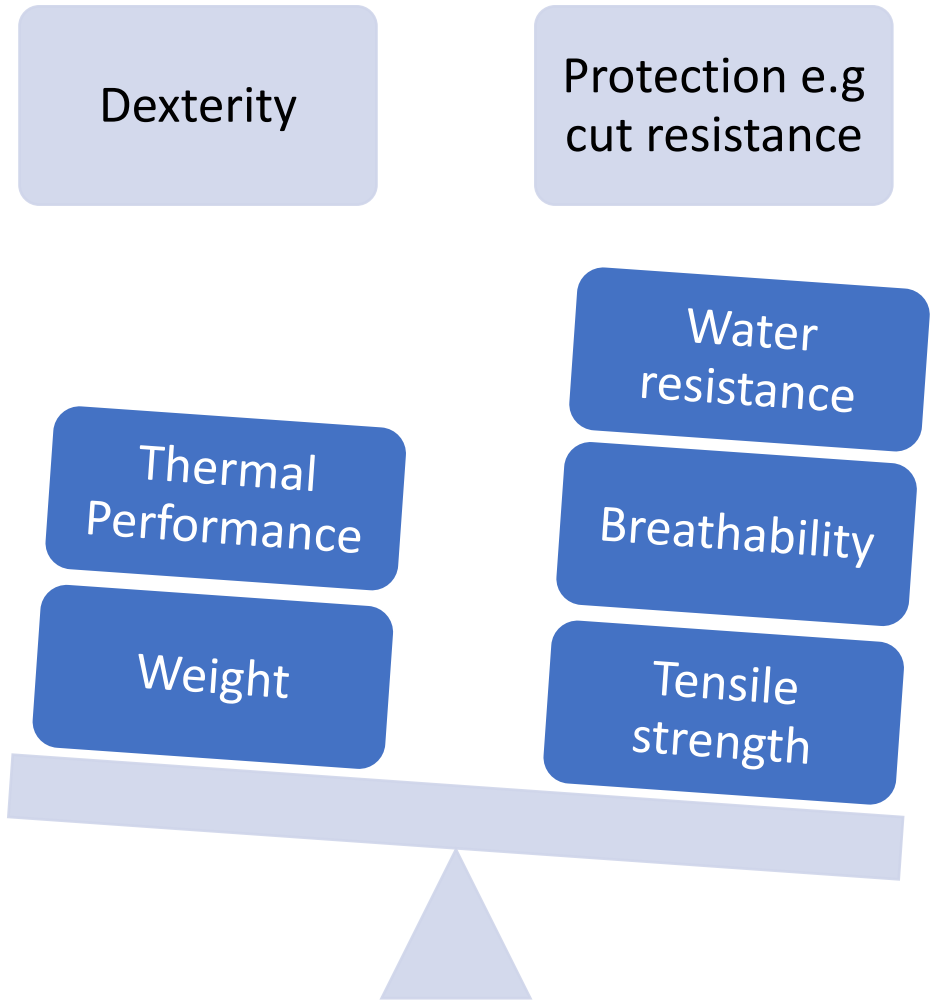
1. Water vapour resistance performance as determined by ISO 11092 shall be evidenced by independent test results. Performance required Ret < $20m^2Pa/W$

2. The outermost material when tested after pre-treatment in accordance with EN ISO 13934-1:2013 for woven textiles shall have a breaking load in both machine and cross direction of ≥ 1500 N.

3. The moisture barrier when tested after pre-treatment in accordance with EN ISO 811:2018 using a rate of increase in pressure of (0,98 ± 0,05) kPa/min shall achieve ≥ 100 kPa.

Compliance with the standards must be supported by independent certification from an organisation belonging to the United Kingdom Accreditation Service (UKAS) such as BTTG or equivalent test house capable of carrying out the required tests. For every test details of the original test house must be supplied. All test certification and reports must be submitted for evaluation purposes and be in the English language.

The Trade-Off



Improving Education

Understanding Test Method and Standards is essential for:

- Risk Management
- Global Market Research
- Effective Communication and Negotiation
- Understanding product value

Panel Discussion 1

Complexity of the supply chain

- How is firefighting PPE made
- Fabric Production
- Production Timelines
- Financial Challenges

The importance of standards

- Standards Organisations and Designated Standards
- Explaining Test Methods
- Specification Writing
- The trade-off
- The importance of education