DURABILITY TESTS

Firefighter suit outer shell: Comparisons of PBI vs. Meta-Aramid for UV resistance, washing stability and post flame-exposure performance

A firefighter's suit endures significant exposure to several factors that affect its lifespan. Among them, UV exposure and laundering can potentially weaken the outer shell. We've compared PBI outer shell fabrics with other aramid fabrics for UV resistance, washing stability, as well as post flame-exposure residual strength, which is critical for firefighter survival in catastrophic events.

1 UV RESISTANCE

The "Weather-Ometer" is recognized as an effective test for measuring the effects of UV exposure. Test samples are exposed to a continuous defined and normalized UV light exposure, which simulates real-world conditions and significantly accelerates ageing. It is not possible to test in real conditions over many years, so different fabrics are compared using this test method.

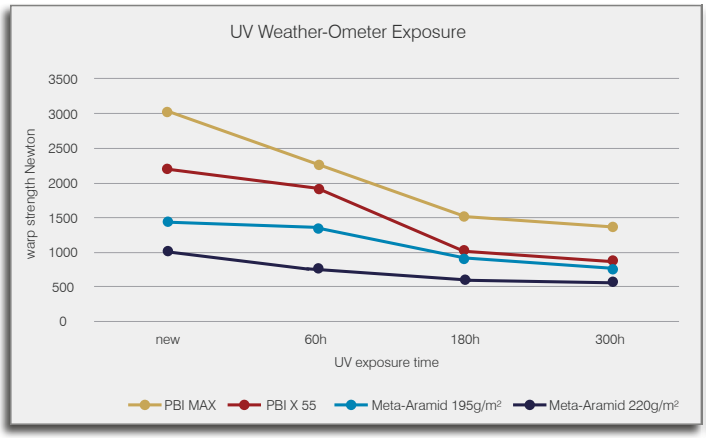
Unit: Atlas Ci 4000 Weather-Ometer
test: AATCC 16 E Colorfastness to Light

- Accelerated UV exposure
- Standard test: xenon arc irradiation at 1.1 irradiance, continuous exposure
- Simulates a long-term exposure to UV light
- Flame resistant outer shell fabrics are exposed to the UV light evenly over time
- PBI lab measures fabric's tensile strength (per ISO 13934-1 strip method) at the beginning and after 60, 180 and 300 hours of accelerated ageing and exposure

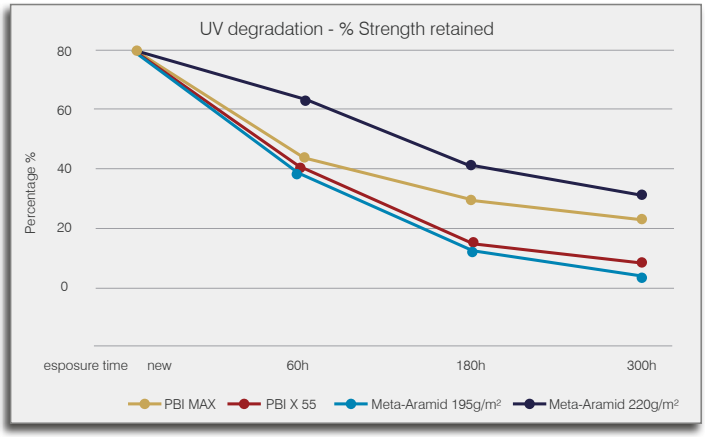
Results of known outer shell fabrics compared in Newton(N)s using the “Weather-Ometer”:

UV exposure	PBI Max	PBI X55	Meta-Aramid 195g/m²	Meta-Aramid 220g/m²
new	3042	2200	1411	988
60h	2259	1925	1341	750
180h	1530	1028	909	586
300h	1398	877	782	541

Strength of different outer shell fabrics after UV exposure (warp only)



Percentage of retained strength in different outer shell fabrics after UV exposure

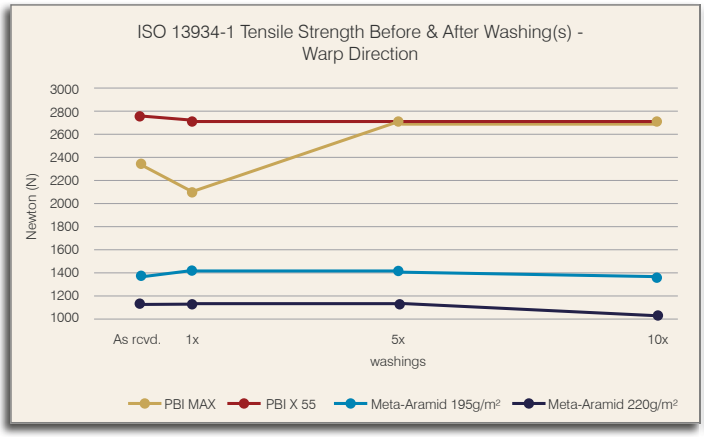


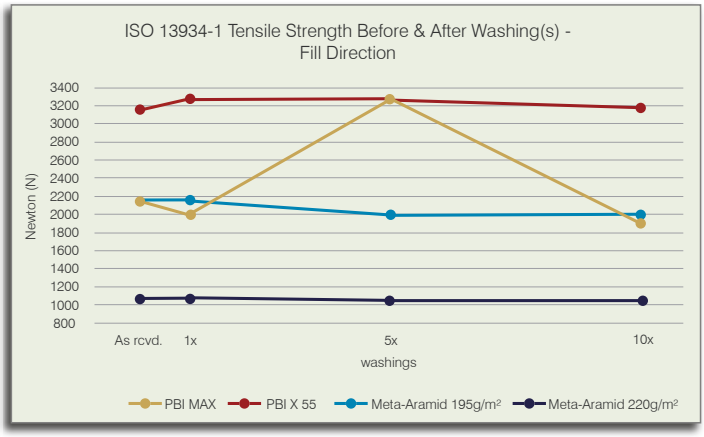
All fabrics lose strength over time when exposed to sun or UV light. It is important to compare different types of fabrics to evaluate residual strength over time. The graphic shows that fabrics with PBI have a higher residual strength over the entire period of exposure.

2 WASHING STABILITY

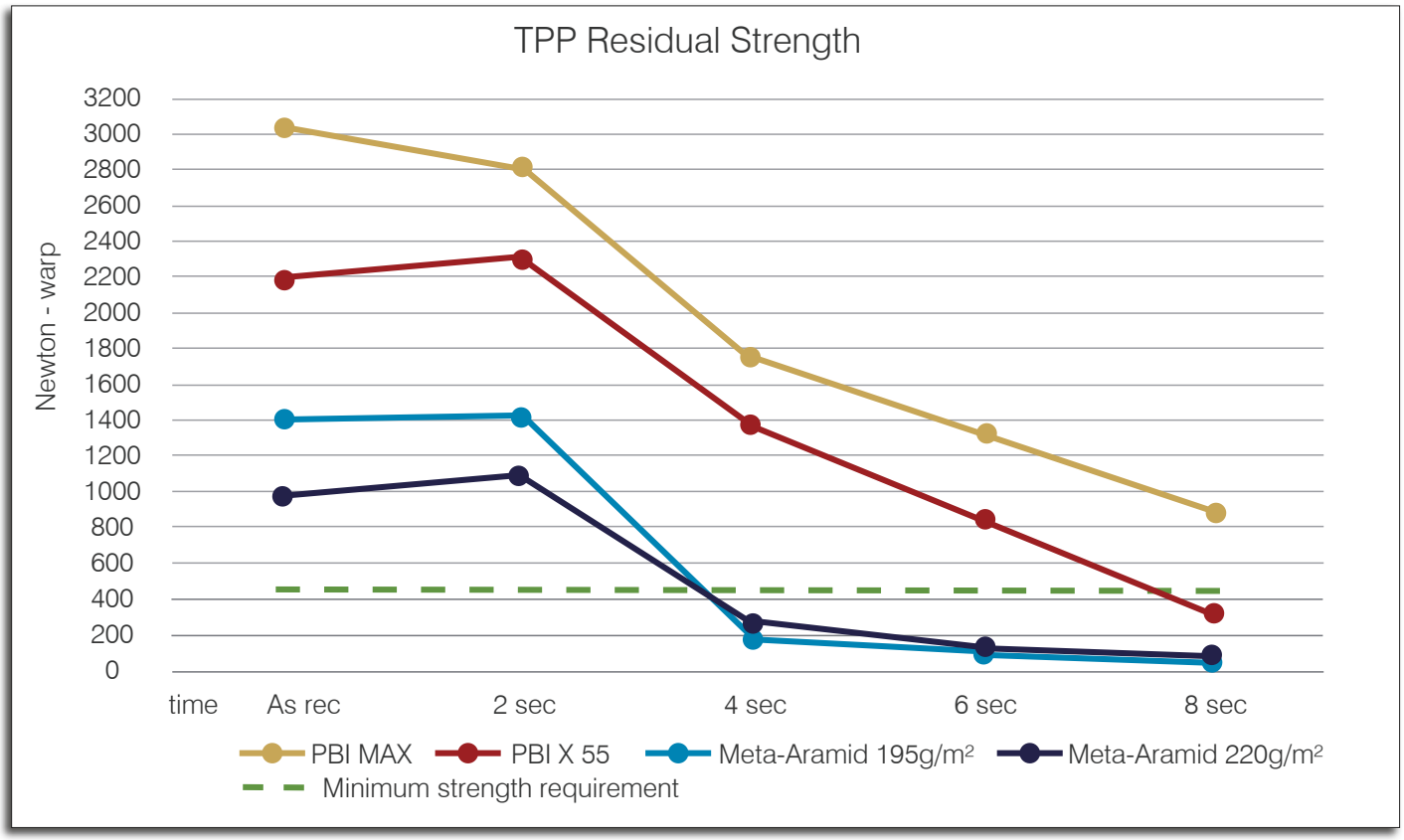
Before and after 1, 5 and 10 washing cycles, all fabrics have enough tensile strength to meet or exceed EN 469’s requirement at 450N. PBI outer shells maintain strength after repeated washings.

ISO 13934-1 - 2“ Strip									
Fabric	Unit of Measure	As Received		1x Laundered		5x Laundered		10x Laundered	
		Warp	Fill	Warp	Fill	Warp	Fill	Warp	Fill
PBI MAX	N	2359	2142	2119	1998	2738	3273	2741	1905
PBI X55		2771	3170	2731	3270	2738	3273	2741	3178
Meta-Aramid 195g/m²		1383	2163	1428	2160	1423	1995	1385	1998
Meta-Aramid 220g/m²		1147	1068	1141	1077	1153	1046	1045	1034





3 RESIDUAL TENSILE STRENGTH AFTER EXPOSURE TO FLAME



Under these extreme test conditions, the superior performance of PBI outer shell fabrics is obvious. The minimum requirement of EN 469 for non-thermally exposed fabric was added, which is at 450N to illustrate the performance against standards.

PBI outer shell fabrics maintain mechanical integrity and sufficient strength for longer than other fabrics. This is reflected impressively at the "instrumental manikin burn test" according to EN ISO 13506:2008 and is consistent with these results, demonstrating how PBI fabrics outperform other alternative products.

The UV resistance and durability of PBI fabrics is also significantly influenced by proper cleaning, maintenance, and storage of firefighting garments. It is important to follow the garment manufacturer' specification for cleaning and maintenance to ensure optimum levels of performance and protection for the lifetime of the gear.