



Testing of Protective Clothing

Test item	Fire fighter hood
Type	Protective clothing for fire fighters- Requirements and test methods for fire hoods for fire fighters
Customer	Devold of Norway AS Molvaersveien 12 6030 Langevag Norway
Applied method	EN 13911:2004

Tarmo Mannelin
Specialist

Sanna Karkkula
Senior Specialist



1. Description and identification of test item

Tested item: Fire fighter hood (two layers of fabric) , colour Black

Description: Knitted fabric: art 269-817 (50% Lenzing FR/ 40% WO/ 8% PA/ 2% Negastat, 230 g/m²)
Seam: flat lock



2. Scope of testing

Testing dates: 2014-06-13 - 2014-09-26

The laboratory tests were performed at the PPE laboratory at FIOH, except bursting strength was subcontracted from accredited laboratory. Practical performance test was carried out at fire station Leppävaara, Espoo.

The following tests were carried out:

Requirement		Test method
Flame spread, seam	EN 13911:2004, 6.1.2	EN ISO 15025:
Heat transfer (flame)	EN 13911:2004, 6.1.3	EN 367:1992
Heat transfer (radiation), 20 kW/m ²	EN 13911:2004, 6.1.4	EN ISO 6942:2002 met B
Residual strength of material	EN 13911:2004, 6.1.5	EN ISO 13938-1:1999* and EN ISO 6942:2002 met A, 10 kW/m ²
Heat resistance	EN 13911:2004, 6.1.6	ISO 17493:2000
Seam breaking strength	EN 13911:2004, 6.1.7	EN ISO 13938-1:1999*
Performance requirement tests -donning -practical performance	EN 13911:2004, 6.2	EN 13911:2004, Annex A EN 13911:2004, Annex B

*subcontracted from accredited laboratory

2.1 Sampling and conditioning

Receiving date: 2014-06-03

Condition: Intact

Sampling method The customer supplied hoods and fabric samples.

Conditioning: Samples were conditioned at least 24 hours in an atmosphere having a temperature of (20 ± 2)°C and a relative humidity of (65 ± 5)% before laboratory testing.
No conditioning before testing the practical performance tests.



2.2 Pre-treatment

Washing parameters:

Washing machine: Type A washer

Type of detergent: IEC reference detergent

Washing procedure: 6N, temperature 60°C

Total dry mass: 2 kg

Drying procedure: F, tumble dry

Ballast: Knitted fabric (310 g/m²)

Samples were washed five times and dried after last washing cycle

3. Test results

3.1 Flame spread

Seam after pre-treatment	Afterflame	Afterglow [s]	Hole formation, flaming debris, flaming to top or either side edge	Seam
1	0	0	no	closed
2	0	0	no	closed
	0	0	no	

3.2 Heat transfer (flame)

Specimen after pre-treatment	HTI t_{24} [s]	HTI t_{12} [s]	$t_{24} - t_{12}$ [s]
1	11,8	7,6	4,2
2	11,8	7,5	4,3
3	11,7	7,3	4,4
Lowest value	11,7	7,3	4,2

3.3 Heat Transfer (radiation)

Specimen after pre-treatment	RHTI t_{24} [s]	RHTI t_{12} [s]	$t_{24} - t_{12}$ [s]
1	23,8	13,5	10,3
2	23,3	13,1	10,2
3	23,0	12,9	10,1
Lowest value	23,0	12,9	10,1

3.4 Residual strength of material when exposed to radiant heat

Pre-treatment: 5x washing

Number of test specimens: 2

Radiant heat pre-treatment: EN ISO 6942:2002 met A, 10 kW/m², 3 min

Mean bursting: 300 kPa



3.5 Heat resistance

Dimensions of the specimen: 375 mm x 375 mm
Test temperature: (180±5)°C Time of exposure: 5 min

after pre-treatment	Shrinkage warp [%]	Shrinkage weft [%]	Ignition	Melting of dripping	Splitting or delimitation	Other observations
1	5,3	5,3	no	no	no	no
2	6,4	6,7	no	no	no	no
3	7,2	7,0	no	no	no	no
Mean	6,2	6,3	no	no	no	no

3.6 Seam breaking strength

Pre-treatment: 5x washing Number of test specimens: 3
Mean bursting: 600 kPa

3.7 Performance requirement tests

Annex A of EN 13911

The fire hood retained its shape and fit when compared for the first don to after 50 dons.

Annex B of EN 13911

	Test subject A	Test subject B
Head measurement	58 cm	54 cm
Tested hood condition	used at annex A test	as received
Masks	full face mask with adjustable attachment to helmet	full face mask

Both test subjects wore protective clothing (EN 469), breathing apparatus (EN 136, EN 137), helmet (EN 443) and gloves (EN 659).

Test activities were done at fire station Leppävaara as specified in Annex B expect walking time was 15 min and climbing replaced. Test activity climbing ladders was replaced climbing stairs with nodding head movement.

Information recorded	Assessment	
	Test subject A	Test subject B
Ease of donning and doffing	Easy to don	Easy, is not tight
Comfort	First feel itchy, but not for long	Good
Closeness of fit	Good, bib part was good, goes well under the coat	Good
Field of vision	Good	Good, the hood bit rise over the mount.
Interference with the mask	Good	Good, no complaining
Freedom of head movement	Followed well head movements	Good
Any other comments volunteered by the wearer	Wondered if thick hood reduce hearing of the head phone	Breathability could be better, after exercise hood was totally wet



4. Summary of the test results

Test	Requirement	Result
Flame spread, seam	EN 13911:2004, 6.1.2 no flaming to the top or either side edge; no flaming or molten debris; afterglow shall not spread, no hole formation, Afterflame time $\leq 2s$, Afterglow time $\leq 2s$ Seam shall stay closed	The seam meets the requirement
Convective heat	EN 13911:2004, 6.1.3 $HTI_{24} \geq 8 s$ $HTI_{24}-HTI_{12} \geq 3 s$	Two layers fabric meets the requirement
Radiant heat	EN 13911:2004, 6.1.4 $HTI_{24} \geq 11 s$ $HTI_{24}-HTI_{12} \geq 3 s$	Two layers fabric meets the requirement
Residual strength of material	EN 13911:2004, 6.1.5 burst strength ≥ 300 kPa	Two layers fabric meets the requirement
Heat resistance	EN 13911:2004, 6.1.6 shrink $\leq \pm 10 \%$, no melting, dripping, ignition and no break	One layer of fabric meets the requirement
Seam breaking strength	EN 13911:2004, 6.1.7 burst strength ≥ 450 kPa	The seam meets the requirement
Performance requirement	EN 13911:2004, 6.2 Hood shall <ul style="list-style-type: none"> - be close fitting and able to worn without discomfort or significant restriction to head movement - have a yoke creating an interface with the protective clothing - retain its shape - maintained the interface between the breathing apparatus - not have breaks in construction - be compatible with various head sizes and shapes 	The hood meets the requirements

End of test report