



Confidential Report

Our Ref: E-033104



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Manchester, M17 1EH, UK.
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Email: onestopshop@bttg.co.uk
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Date: 15 December 2023

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Client: Sirius Produkt Kft
1044 Budapest
Szilaspatak sor 42/b
Hungary

Job Title: RALPH manikin testing of one firefighters ensemble

Client's Order No: --

Date of Receipt: 16 November 2023
Date of Test Start: 11 December 2023

Description of Sample(s): One firefighters ensemble, referenced:

Dávid-MR-tbr-23-01

Also supplied was a. generic cotton T-shirt

Work Requested: We were asked to make the following test:

ISO 13506-2: 2017 on the BTTG male manikin (RALPH)
8 seconds flame exposure time
After 1 wash at 40°C



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Ralph Manikin Testing of a Firefighters Ensemble

Reference Dávid-MR-tbr-23-01

1. Samples

One firefighters ensemble referenced Sample Description: Dávid-MR-tbr-23-01 was submitted for test. The ensemble comprised:-

Outer fabric	35% modacrylic, 25% viscose (FR), 25% Pyron, 13% aramid, 2% antistatic fibre (carbon)
Moisture barrier:	Clemmons (Outlast, Textile 100% PES Coating PCM capsules), 98% polyester, 2% carbon
Lining:	59% Modacrylic, 37% pamut, 2% antistatic fibre, 2% elastane (sleeve cuff)

The firefighters garment was worn with a generic cotton T-shirt supplied by the client.

The jacket and trouser were sized: L
The T-shirt was sized: L

All garments were considered to be a “good” fit on the manikin.

2. Method of Test

Testing was undertaken on the “male” heat sensing manikin known as RALPH (Research Aim Longer Protection against Heat) developed at BTTG™. This version of RALPH together with the associated test facility has been built to comply with ISO 13506-1: 2017 and ISO 13506-2: 2017.

RALPH has a total of 123 sensors distributed over the head, torso, legs and arms monitor the temperature on the surface of the manikin during a test. (The hands and feet of the manikin are not sensed).

From the temperatures recorded predictive percentage burn injury at Pain, 1st, 2nd and 3rd degree levels are calculated using the Takata and Stoll skin model as specified in Annex C of ISO 13506-2: 2017.

During a test the manikin is challenged by a flame engulfment apparatus consisting of 12 burners (in two tiers of six) surrounding the manikin in a hexagonal pattern. The manikin is placed at the centre of the hexagonal pattern. The lower set of six burners are pointed at the legs and lower body of the manikin whilst the upper set of six burners are pointed at the upper body and head.

The tests were performed under the following conditions:

Mean heat flux:	84kW/m ² ± 5% (i.e. 79.8kW/m ² – 88.2kW/m ²)
Flame exposure time:	8 seconds
Data acquisition time:	120 seconds



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3. Cleansing Pretreatment

Prior to test the garments were washed once at 40°C according to EN ISO 6330: 2021 Procedure 4N. The garments were dried by normal temperature tumble drying.

4. Summary of Results

See pages 4-6.

Notes Relating to Interpretation of Results

The RALPH manikin test has been developed to provide information on the flammability and heat transfer performance of clothing systems when subjected to flame envelopment such as might only reasonably be expected to occur under "emergency" conditions. It is essentially intended to compare one clothing system with another, it does not purport to provide information in terms of the "survivability" of a given event. The following points should also be borne in mind when assessing the results obtained.

- (a) These results were obtained using the specified test conditions and do not necessarily represent the behaviour of the clothing system under other conditions of test or use.
- (b) The fit of the garments has an important bearing on the heat transfer results obtained during the test. For this test all the garments were considered to be a "good" fit.
- (c) It must be stressed that whilst the test conditions used can be considered very severe there may be occasions where the clothing system is subjected to even greater challenge which could result in serious injury to the wearer.
- (d) The RALPH manikin together with the associated test facility has been built to comply with ISO 13506-2: 2017. Due to the use of differing technologies by laboratories it is not possible at this present time to compare results between laboratories. Therefore Pass/Fail criteria cannot be set at this point in time.
- (e) The burn injury results are expressed according to clause 8.3.3 of ISO 13506-2: 2017 which calculates the percentage burn injury based on the total area of manikin covered by the garments under test being 100%. For this test, therefore, the head is not included in the calculations.
- (f) These particular test results must be considered as indicative only in that no replicate testing was carried out.
- (g) These results must not be used in advertising or promotional literature without the written permission of BTTG™.



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4. Summary of Results

Observations during the test

The reflective strips on both garments charred and the exposed touch and close fasteners melted. There was no obvious ignition of the suit apart from approximately 8 seconds of surface afterflame immediately following the burners being switched off plus a further 10 seconds of flaming from the bottom edge of the back of the jacket. There was no “break-open” of the outer fabric of both garments during the test.

After test examination

Jacket: The exposed areas of the outer fabric were very charred and weak. The moisture barrier was destroyed. Inside the jacket appeared undamaged apart from at the bottom where flames from the burners had gone between the jacket and trouser causing localised charring of the lining.

Trouser: The exposed areas of the outer fabric were very charred and weak. The moisture barrier was destroyed. Inside the trouser appeared to be undamaged.

Underwear: The T-shirt appeared to be undamaged but heavily stained.

Burn Injury Prediction

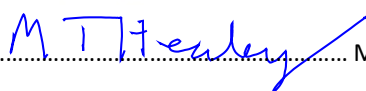
The results below are expressed according to clause 8.3.3 of ISO 13506-2: 2017 which calculates the percentage burn injury based on the total area of manikin covered by the garments under test being 100%. For this test, therefore, the head is not included in the calculations.

Burn Injury Prediction (according to ISO 13506-2: 2017 clause 8.3.3)				
Pain	1st° Burn	2nd° Burn	3rd° Burn	2nd° + 3rd° Burn
9.8%	0.0%	0.0%	0.0%	0.0%

See page 5 for the burn injury prediction diagram. See page 6 for the burn injury development with time

The 95% confidence limit for this test is ± 15% of the measured value.

Reported by:  Yan Wei Lee, Technical Officer

Countersigned by:  M T Healey, Principal Technician

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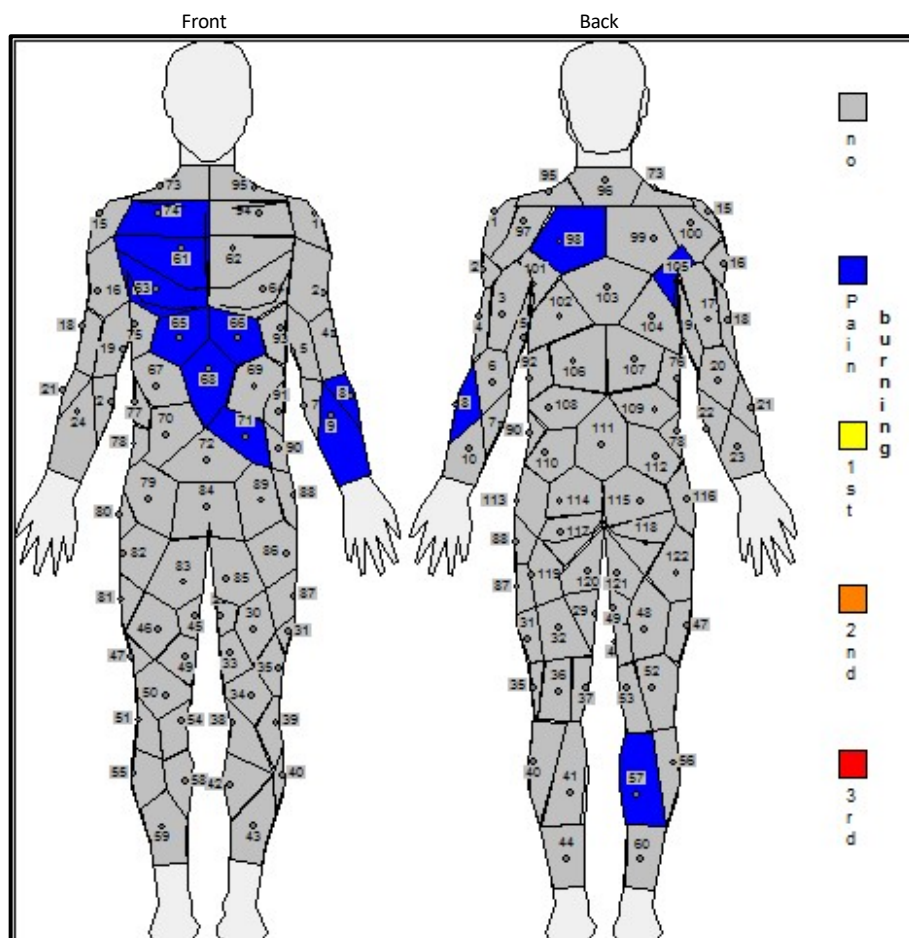
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RALPH MANIKIN TEST – BURN INJURY PREDICTION AT 120s

Sample: Firefighters ensemble, referenced: Dávid-MR-tbr-23-01
Tested with a generic cotton T-shirt

Flame Exposure Time: 8 seconds (data acquisition time 120 seconds)



Burn Injury Prediction (according to ISO 13506-2: 2017 clause 8.3.3)				
Pain	1st° Burn	2nd° Burn	3rd° Burn	2nd° + 3rd° Burn
9.8%	0.0%	0.0%	0.0%	0.0%



TESTING • CERTIFICATION • AUDITING

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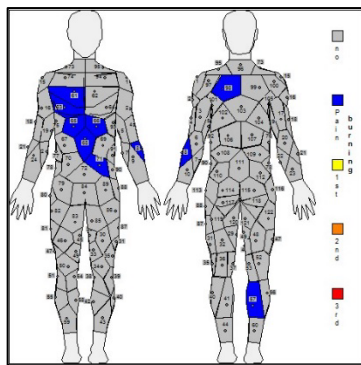
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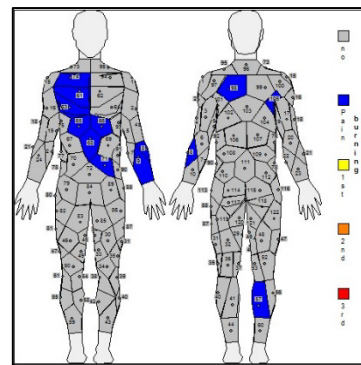
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RALPH MANIKIN TEST – BURN INJURY DEVELOPMENT WITH TIME

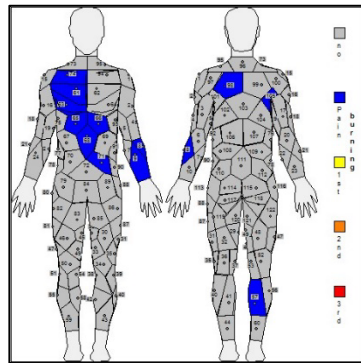
Sample: Firefighters ensemble referenced: Dávid-MR-tbr-23-01
 Tested with a generic cotton T-shirt



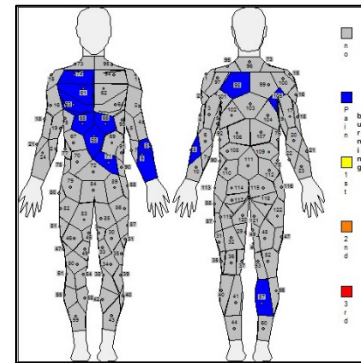
At 30 seconds



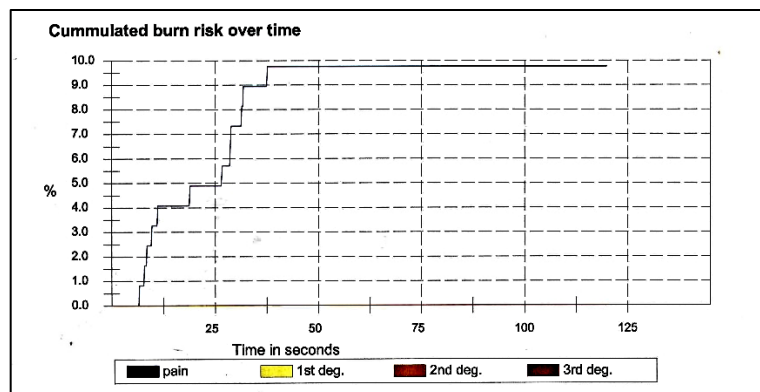
At 60 seconds



At 90 seconds



At 120 seconds



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