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Tests marked with * are not included within the scope of the ENAC accreditation

WOOL RESERARCH ASSOCIATION
P O SANDIZ BAUG KOLSSHET ROAD
IN-400607 THANE
MAHARASHTRA

Att. SEEMA PATEL

REPORT ISSUED BY THE RESEARCH ASSOCIATION OF THE TEXTILE INDUSTRY, AITEX

Nº 2020EP1951

The test was carried out at Polígono Industrial Fuente del Jarro. C/ Ciudad de Gibraltar, 5; 46988 – Paterna (Valencia); which property is shared at 50% between research institutes AITEX and ITE.

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Rev.1 This revision cancels and replaces the previous
Error in transcription of results

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ITE
INSTITUTO TECNOLÓGICO DE LA ENERGÍA

APPLICANT

WOOL RESERARCH ASSOCIATION

Date of reception 17/08/2020

Date Test Starting: 17/08/2020
Ending: 14/09/2020

IDENTIFICATION AND DESCRIPTION OF SAMPLES

REFERENCES
25 Cal Arc Flash Shirts

TESTS CARRIED OUT

- PHOTOGRAPHY.
- MASS PER UNIT AREA.
- STANDARD PRACTICE FOR DETERMINING RESPONSE CHARACTERISTICS AND DESIGN INTEGRITY OF ARC RATED FINISHED PRODUCTS IN AN ELECTRIC ARC EXPOSURE.

PHOTOGRAPHY

Reference [1]
25 Cal Arc Flash Shirts

MASS PER UNIT AREA

Standard
ASTM D3776/3776M-09a (R2017) Option C

Conditioning date	02/09/2020	**Test date**	03/09/2020

Atmosphere for conditioning testing

Temperature	(21±1) ºC	**Relative humidity**	(65±2) %

Type of fabric
Woven fabric
State of the specimens
Washed
Previous treatment
Washed by the customer
Reference
25 Cal Arc Flash Shirts

Mass per unit area (oz/yd^2)	Mass per unit area (g/m^2)	Mass per unit area (oz/yd)	Mass per unit area (g/m)
21,96	744,50	4,80	148,90

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STANDARD PRACTICE FOR DETERMINING RESPONSE CHARACTERISTICS AND DESIGN INTEGRITY OF ARC RATED FINISHED PRODUCTS IN AN ELECTRIC ARC EXPOSURE

Test description

One garment was exposed to an arc incident energy level at least el equal or above to Arc Rating of the fabric or fabric system used in garment construction. Following the arc exposure, the garment is examined. Areas of particular interest are seems, integrity of the closure systems, overlap of important areas, reflective trim or other accessories. The front area is examined for evidence of arc energy that may enter and expose the under-layers. A lightweight undergarment may be used to provide a heat sensitive indicator which is used to help in the evaluation of thermal energy through the closures or interface.

The following test data was recorded for each trial:

Arc exposure electrical conditions: arc trial number, RMS arc current, peak.

Temperature rise response from two monitor sensors for each Mannequin in each trial, plot of average responses from two monitor sensors

Photographs before and after electric arc exposure

Video

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STANDARD PRACTICE FOR DETERMINING RESPONSE CHARACTERISTICS AND DESIGN INTEGRITY OF ARC RATED FINISHED PRODUCTS IN AN ELECTRIC ARC EXPOSURE

Standard
ASTM F2621-2019
Reference
25 Cal Arc Flash Shirts

Test conditions	
Data test	14/09/2020
Stainless steel electrodes, gap of the electrodes	(300 ± 5) mm.
Distance between the electrodes and sample	(300 ± 5) mm.
Arc current	(8 ± 1) kA
Fuse wire	0.5 mm.
Number of samples tested	1
Starting and ending pre-treatment date	-

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STANDARD PRACTICE FOR DETERMINING RESPONSE CHARACTERISTICS AND DESIGN INTEGRITY OF ARC RATED FINISHED PRODUCTS IN AN ELECTRIC ARC EXPOSURE

Sample tested	Mannequin A
Reference	25 Cal Arc Flash Shirts
Arc Rating	ATPV = 27 cal/cm^2 2020EP0020
Pre-treatment	Pre-treatment by the customer.
Garment layers and components According to the information supplied by the manufacturer	
Layer 1	Red woven fabric style X-Fire N150, 93% Meta-Aramid, 5% Para-Aramid, 2% Anti-Static, 150 g/m², manufacturer Teijin India.
Layer 2	Yellow + Gray woven fabric style T70 + TV120, Spunlace 80% Meta-Aramid, 20% Para-Aramid, quilted to 120 GSM, woven fabric Grey 50% Meta-Aramid, 50% FR Lenzing, 200 g/m², manufacturer Ibena China.
Closure Type(s)	Covered zipper closed by hook and loop.
Pockets	No.
Reflective trim	One at chest, one at each shoulder.
Others	Elastic at cuffs.
Indicator fabric	
Used in evaluation (yes/no)	Yes
Indicator fabric type	140 g/m^{2}100% Cotton

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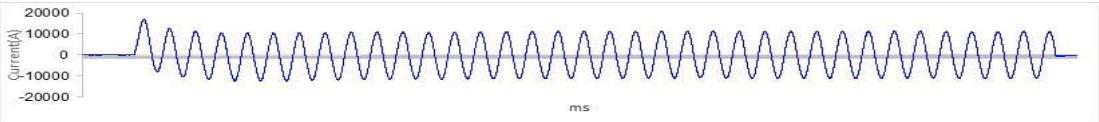
STANDARD PRACTICE FOR DETERMINING RESPONSE CHARACTERISTICS AND DESIGN INTEGRITY OF ARC RATED FINISHED PRODUCTS IN AN ELECTRIC ARC EXPOSURE

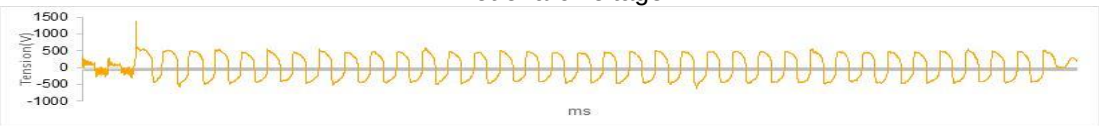
Electrical current and response sensor plot:

Mannequin A 25 Cal Arc Flash Shirts

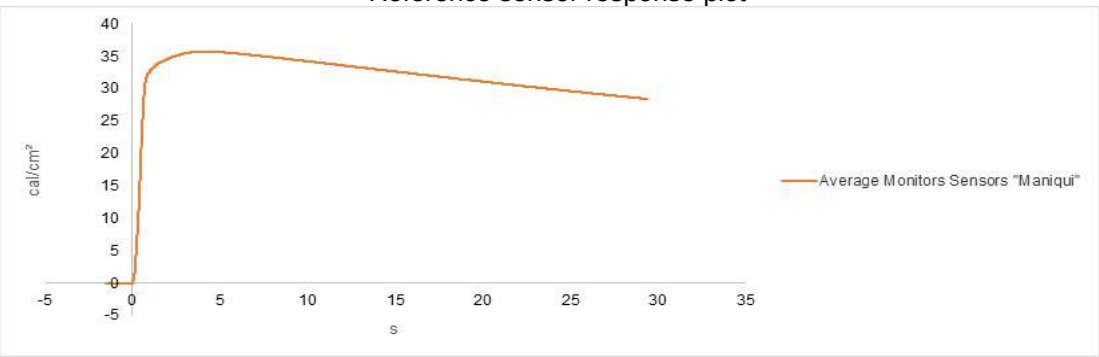
Plot of arc current



Plot of arc voltage



Reference sensor response plot



Current Total RMS (kA)	7,9	**Current Peak (kA)**	17,0	**Arc Voltage (V)**	1389,0
Duration (cycles nº)	35,8	**Duration (ms)**	717,0	**Arc Energy (kJ)**	2037,0

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STANDARD PRACTICE FOR DETERMINING RESPONSE CHARACTERISTICS AND DESIGN INTEGRITY OF ARC RATED FINISHED PRODUCTS IN AN ELECTRIC ARC EXPOSURE

Results

Mannequin A 25 Cal Arc Flash Shirts

Property	Mannequin A	Remark
Exposure level	35,72 cal/cm^2	
Burn	---	
After-flame	0 s.	
Break Open	No	
Ablation	Yes	
Melting or Dripping	No	
Charring	Yes	
Embrittlement	Yes	
Shrinkage	No	
Functioning of garment closures	Correct	
Indicator fabric evaluation	Without combustion	

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STANDARD PRACTICE FOR DETERMINING RESPONSE CHARACTERISTICS AND DESIGN INTEGRITY OF ARC RATED FINISHED PRODUCTS IN AN ELECTRIC ARC EXPOSURE

Pictures
Mannequin A 25 Cal Arc Flash Shirts

Mannequin A
Original material

Tested material

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Summary of results

GARMENT TESTED ACCORDING TO THE STANDARD ASTM F2621-2019 ATPV = 27 cal/cm^2 To cover hazard/risk category 3 according to NFPA 70E

Arc Flash PPE category according to standard NFPA70E Edition 2018 Table 130.7 (C) (16) - Personal Protective Equipment (PPE)

PPE category	Minumum Arc Rating (cal/cm^2)
1	4
2	8
3	25
4	40

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Lucia Martinez
Head of PPE and Ballistics department

Digitally signed by MIGUEL ANGEL PEREZ ESLAVA - NIF:33567494Y
Date: 2020.09.14 12:30:06 +02:00
Reason: Autorizado
Location: Alcoy

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