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textile research institute



ENAC
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Att. Samit V. Chaudhari

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

N° 2020ID0093

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.

APPLICANT

HONEYWELL TECHNOLOGY SOLUTIONS LAB PVT LTD

Date of reception 03/11/2020

Date Test Starting: 03/11/2020
Ending: 23/11/2020

IDENTIFICATION AND DESCRIPTION OF SAMPLES

REFERENCES

Coverall INACCA12RB

TESTS CARRIED OUT

- MASS PER UNIT AREA.
- PRE-TREATMENT FOR DOMESTIC WASHING AND DRYING PROCEDURES FOR TEXTILE TESTING.
- STANDARD PRACTICE FOR DETERMINING RESPONSE CHARACTERISTICS AND DESIGN INTEGRITY OF ARC RATED FINISHED PRODUCTS IN AN ELECTRIC ARC EXPOSURE.

PHOTOGRAPHY



Reference ⁽¹⁾
Coverall INACCA12RB

RESULTS/RESULTADOS

MASS PER UNIT AREA

Standard

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

Conditioning date

03/11/2020

Test date

10/11/2020

Atmosphere for conditioning testing

Temperature (21±1) °C

Relative humidity

(65±2) %

Type of fabric

Woven fabric

State of the specimens

Original

Previous treatment

Null

Reference

Coverall INACCA12RB

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)
9,87	334,55	2,16	66,91

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RESULTS/RESULTADOS

PRE-TREATMENT FOR DOMESTIC WASHING AND DRYING PROCEDURES FOR TEXTILE TESTING

Standard

AATCC 135:2018

Standard deviation

Reference

Sample 1 Coverall INACCA12RB

Washing machine

13373I12

Washing cycles

3

Washing procedure

IV

Dryer machine

Whirlpool 13098I12

Drying procedure

Aiii

Washing powder

AATCC 1993 WOB

Start and finish date

04/11/2020 - 04/11/2020

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RESULTS/RESULTADOS

MASS PER UNIT AREA

Standard

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

Conditioning date

04/11/2020

Test date

10/11/2020

Atmosphere for conditioning testing

Temperature (21±1) °C

Relative humidity

(65±2) %

Type of fabric

Woven fabric

State of the specimens

Washed

Previous treatment

3 washing cycles, according to standard AATCC 135:2018, washed procedure 3/IV/Aiii

Reference

Coverall INACCA12RB

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)
10,37	351,49	2,27	70,30

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RESULTS/RESULTADOS

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 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 seams, 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

Coverall INACCA12RB

Test conditions	
Data test	20/11/2020
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	04/11/2020 - 04/11/2020

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

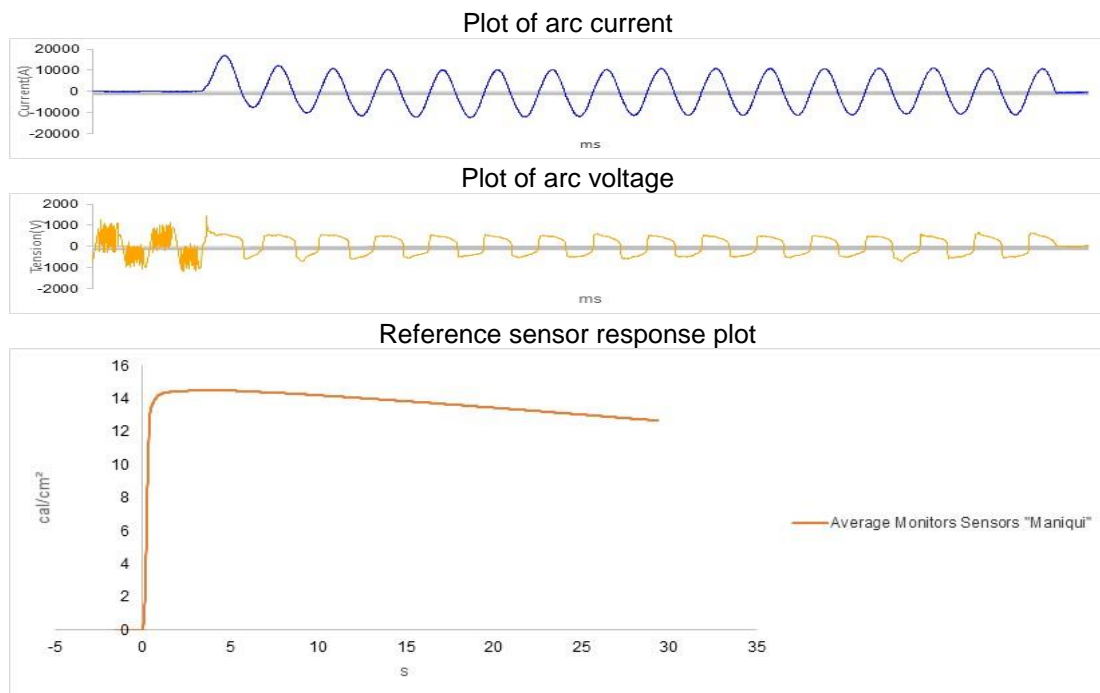
Sample tested	Mannequin A
Reference	Coverall INACCA12RB
Arc Rating	ATPV = 13 cal/cm ² 1208P49 - Arcwear
Pre-treatment	3 washing cycles at 49°C, according to standard AATCC TM135-2018, method 3IV and type Aiii drying
Garment layers and components According to the information supplied by the manufacturer	
Layer 1	Navy Blue woven fabric style 100C-320FR MaDEIRA-320, 100% Cotton, 320 g/m ² , manufacturer XM Textiles.
Closure Type(s)	Covered zipper and hook and loop closure.
Pockets	Two cargo pockets with flap closed by buttons.
Reflective trim	One around chest, one around sleeves, and one around legs.
Others	Hook and loop at waist.
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 Coverall INACCA12RB



Current Total RMS (kA)	7,9	Current Peak (kA)	17,0	Arc Voltage (V)	1440,0
Duration (cycles nº)	15,7	Duration (ms)	313,7	Arc Energy (kJ)	998,7

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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 Coverall INACCA12RB

Property	Mannequin A	Remark
Exposure level	14,51 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 Coverall INACCA12RB

Mannequin A
Original material



Tested material



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Summary of results

GARMENT TESTED ACCORDING TO THE STANDARD ASTM F2621-2019

ATPV = 13 cal/cm²

To cover hazard/risk category 2 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

Lucia Martinez
Head of PPE and Ballistics department

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