ArcWear
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VERIFICATION TESTING - EXPOSURE TO AN ELECTRIC ARC

Description
Crosstex Co., Ltd.,
Bib Coverall, Style ArcTex45-CT,
Fabric: 2 Layers Mfg. Westex, Style s/851, Sateen,
88% Cotton, 12% High Tenacity Nylon, Royal Blue, 10 oz/yd², 339 g/m²

Test Standard:
ASTM F2621/F2621M-21
Observation of Work Garment Exposed to An Electric Arc

Test Report:
K-580778-2207T05-R00

Sample Received	Test Date	Report Date
June 22, 2022	August 5, 2022	August 10, 2022

Prepared by

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For questions about the validity of this test report, please contact testing@arcwear.com

Revision History

Rev	Description		
00	Initial report creation		
	Issue Date August 10, 2022	Prepared by Yosbani Guerra	Approved by Claude Maurice
Rev	Description		
	Issue Date	Prepared by	Verified by

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QUALITY MANAGEMENT

The arc testing performed to the above mentioned Standard is accredited by the Standards Council of Canada (SCC) to conform to the requirements of CAN-P-4E (ISO/IEC 17025:2017). Accreditation by the Standards Council of Canada (SCC) is a mark of competence and reliability.

- The test performed does not apply to electrical contact or electrical shock hazard
- The test result is applicable only to the Test Specimens delivered to Kinectrics, other material, garment design or color may have a different response.
- It is the clients' responsibility to provide full and accurate information about the items supplied.
- No test is done to validate the fiber content or composition of the test item
- Photographs of the test specimens and waveforms of the arc current, voltage and calorimeters with the circuit and arc exposure calibration records are available from Kinectrics and provided to the client separately from this report.

1 Test Standard:

Electrical arc test according to ASTM F2621/F2621M-21
Standard Practice for Determining Response Characteristics and Design Integrity of Arc Rated Finished Products in an Electric Arc Exposure.

The purpose of the garment visual assessment criteria is to assess the observed effects on all components (sewing thread, closures, buttons, reflective tapes, logos, labels, embroideries, belts, optional extras, etc.) of the garment or garment assembly other than the material(s) of which the garment or garment assembly is made. This test method does not measure the arc rating values ATPV or EBT of the material or the test specimen. The procedure to determine this arc rating using instrumented panels is in ASTM F1959.

1.1 Test Description

The test method suggests the finished product be exposed to a level at least equal to the Arc Rating (ATPV or EBT) of the fabric or system but tests at lower level may be performed if requested by the client. The garment is mounted on the test mannequin and placed on the test fixture at the distance required. Following the arc exposure, the after flame is measured and the garment is examined. The base material is examined including the closure and overlap, reflective trim if applied and any accessories. 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. Details of the undergarment is given in Table 2-1. The indicator garment has correlation with the Stoll curve.

This test does not cover all instances of use and area of exposure. Other effects like noise, light emissions, pressure, shrapnel, electric shock, or toxic fumes are not covered by this standard.

2 Test Condition:

The following test circuit parameters and conditions were used.

- Electric arc current: 8 kA rms ± 10%, 60 Hz
- Open circuit voltage: 2500 V rms ± 10%, 60 Hz
- Nominal Heat Flux Density: 2100 kW/m^2 (50 cal/cm^2·s)
- Arc duration: Varied to obtain required incident energy
- Electrode gap: 305 mm (12 inches)
- Distance from mannequin to electrode: 305 mm (12 inches)
- Deviations and abnormalities: N/A

Table 2-1: Indicator Undergarment Details

Briefs Information and Weight: Jersey Knit, White, 100% Cotton, AAD 5.0 oz/yd^2, 171 g/m^2
T-Shirt Information and Weight: Jersey Knit, White, 100% Cotton, AAD 4.0 oz/yd^2, 136 g/m^2

3 Test Specimen:

The fabric description in Table 3-1 was provided by the producer or agency. Fiber content of the material is not verified by Kinectrics. The pre-test treatment of the test specimens and the measurement of the fabric weight prior to testing is given in Table 3-2. Photographs of the garment and identification tag is shown in Figures 3.1, 3.2. Photographs as dressed on the mannequin and after the arc exposure are shown in Section 6.

Table 3-1: Test Specimen Description

Crosstex Co., Ltd., Bib Coverall, Style ArcTex45-CT, Fabric: 2 Layers Mfg. Westex, Style s/851, Sateen, 88% Cotton, 12% High Tenacity Nylon, Royal Blue, 10 oz/yd², 339 g/m²
Material arc test report: Kinectrics Report K-418346-1201P13, 2012 - ATPV = 45 cal/cm²
Fabric Report discrepancies: Colour discrepancy between test specimen and material test report. Material Test Report fabric indicated as Navy.

Table 3-2: Treatment and Fabric Weight Prior to Testing

Pre-Treatment: Laundered 3 times and dried once, by ArcWear, in accordance with AATCC Test Method 135-18, Procedure 3, IV, Aiii
Pre-Conditioning: In controlled laboratory conditions for minimum 24 hrs.
Fabric weight as tested: Layer 1: 9.81 oz/yd², 333 g/m² Layer 2: 9.81 oz/yd², 333 g/m²

Figure 3.1: Photograph of the specimen.

4 Results and Observations:

A single arc exposure was performed on the front of one sample of each as provided. The exposure level was based on the EBT indicated in the garment plus a margin of up to 15% above as requested by the client. A summary of the test results is given in Table 4-1.

Table 4-1: Summary of Test Results

Test Identification	22-1725A	22-1725B
Arc Energy	4458 kJ	4458 kJ
Incident Energy	55 cal/cm²	52 cal/cm²
AF time of fabric	24 s	20 s
AF time of accessories	0 s	0 s
Melting and dripping	N	N
Break-Open	N	N
Closure failure	N	N

Note: Include all components other than the base material(s) of which the garment or garment assembly is made.

4.1 Observations:

Severe charring was evident on the front of both garments. Both garments had evidence of ablation of the first layer but no break-open to the undergarment. The second layer fabric was brittle and week, breaks apart easily when removed from the mannequin. There was 24 seconds of after-flame observed on specimen A and 20 seconds observed on specimen B. On examination of the garment after the test, there was no evidence of melting and dripping and the closure was functional. The undergarments had moderate discolouration and severe charring in the areas of long after-flame, no ignition observed.

5 Interpretation of Results:

This testing does not assign or confirm the arc rating of this product. The purpose of this test is to observe the response characteristics of this garment when exposed to an open-air electric arc at the arc energy level requested by the agency.

The garment remained closed and had no afterflame. The undergarment indicates has light discolouration and local spots of charring indicating smoke penetration and light thermal exposure in general but burn to the inside on small areas. The arc exposure level was 7 & 10 cal/cm² above the ATPV of the garment. The garment shall not be used above the labeled ATPV of the material.

6 Photographs

Photographs for the garments before and after the arc exposure are shown below.

Figure 6.1: Garments as tested before arc exposure.

Figure 6.2: Garments after arc exposure. (Test# 22-1725)

Figure 6.3: Exposure of garment and underlayer garment. (Test# 22-1725A)

Figure 6.4: Exposure of garment and underlayer garment. (Test# 22-1725B)