CAPITAL TESTING AND CERTIFICATION SERVICES
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TEST REPORT

Test Method: ASTM E662-21ae1, Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials

Rendered To: Camira Transport Fabrics Ltd.
The Watermill, Wheatley Park
Mirfield, West Yorkshire, WF14 8HE
United Kingdom

Product Description: Lucia CS

Report Number: S-2384

Original Issue Date: 03/01/2023

Test Date: 02/17/2023

Pages: 6

IAS ACCREDITED Testing Laboratory
TL-224

I. SCOPE

This report contains the results from a specimen tested in accordance with ASTM E662, *Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials*. This fire-test-response standard covers determination of the specific optical density of smoke generated by solid materials and assemblies mounted in the vertical position in thicknesses up to and including 1 inch.

II. SUMMARY OF TEST METHOD

The testing is conducted in an 18 ft^3 chamber a photometric system consisting of a light source mounted at the bottom of the chamber and a photocell mounted at the top of the chamber. A vertical light path measures the varying light transmission as smoke accumulates. The light transmittance measurements are used to calculate specific optical density of the smoke generated during the time period to reach the maximum value.

At the beginning of each testing day, the chamber is preheated and checked for airtightness. An electrically heated radiant-energy source is positioned so as to produce an irradiance level of 2.5 W/cm^2 averaged over the central 1.5 in. (38.1 mm) diameter area of a vertically mounted specimen that is facing the radiant heater. The nominal 3 by 3 in. specimen is mounted within a holder which exposes an area measuring 2.56 by 2.56 in. This exposure provides the non-flaming mode of the test. For the flaming mode, the radiant energy source is utilized, and a six-tube multi-directional burner is added to apply a row of equidistant flames across the lower edge of the exposed specimen area and the trough on the specimen holder. The test specimens are exposed to the flaming and non-flaming conditions within a closed chamber for 20 minutes or until 3 minutes after the minimum light transmittance value has been reached.

III. TEST SPECIMENS

Test specimens should be representative of the material or system which the test is intended to examine. The test specimens should be 3 by 3 +0, -0.03 in. (76.2 by 76.2, +0, -0.8 mm) by the intended installation thickness up to and including 1 in. (25.4 mm).

Prior to testing, the specimens are placed into a 140 ± 5°F (60 ± 3°C) oven for 24 hours. After 24 hours have elapsed, the specimens are conditioned to constant weight at an ambient temperature of 73 ± 5°F (23 ± 3°C) and a relative humidity of 50 ± 5 %.

PRODUCT / SPECIMEN INFORMATION	
Material Description*	Lucia CS Manufacturer: Camira Transport Fabrics Production Date: 07/12/2022 Lot Number: 502506
Specimen Description / Mounting Method	Specimens were prepared by Capital Testing. The specimens were stapled to ½" millboard using 5 standard size staples oriented horizontally with 1 staple in the center and 1 staple in each of the 4 quadrants (ASTM E662-21ae1, Section 8.3.2.5). Shape: Square
Orientation(s) Tested	Warp direction oriented vertically
Color	Havana* - Black
Specimens Selected By	Client
Specimens Prepared By	Capital Testing
Date Received	12/12/2022
Conditioning Time (days)	3

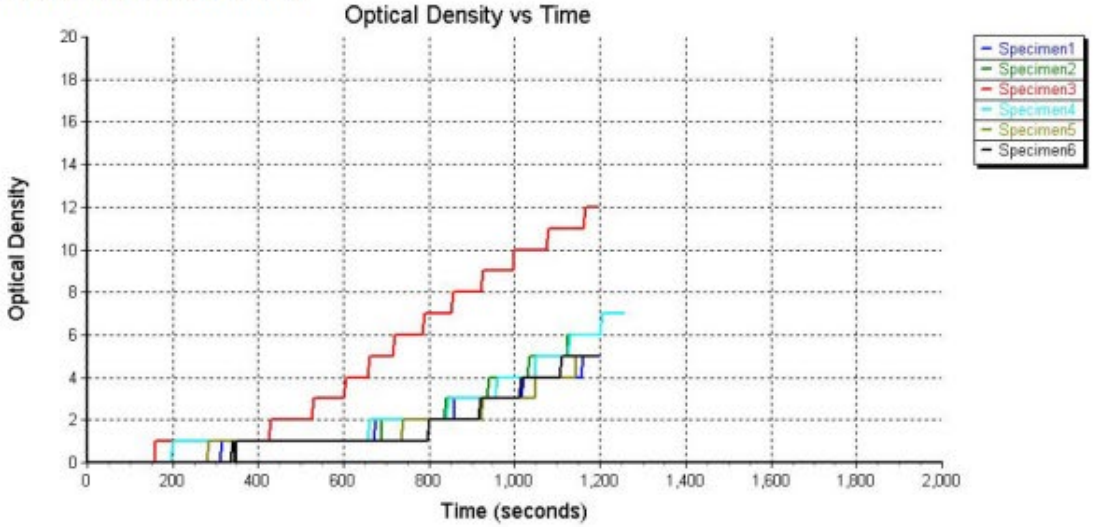
* Information provided by the Client

IV. NON-FLAMING MODE DATA AND RESULTS

NON-FLAMING MODE

	Unit	Specimen 1	Specimen 2	Specimen 3	Specimen 4	Specimen 5	Specimen 6	Average
Room Temp.	°F	70.8	70.8	71.3	69.5	69.9	70.3	**70.4**
Room Humidity	%RH	47.4	46.4	42.3	45.0	43.6	43.0	**44.6**
Chamber Temp.	°F	95.3	96.5	97.4	97.0	94.7	94.1	**95.8**
Exposure Time	s	1200	1200	1200	1200	1200	1200	**1200**
Length	in	3.000	2.988	2.991	2.973	2.985	2.994	**2.989**
Width	in	2.980	3.000	3.000	2.994	2.985	2.999	**2.993**
Thickness	in	0.025	0.024	0.024	0.024	0.022	0.021	**0.023**
Weight	g	1.55	1.58	1.55	1.53	1.50	1.55	**1.54**
Ds (90 s)	-	0	0	0	0	0	0	**0**
Ds (240 s)	-	0	0	1	1	0	0	**0**
Dm	-	5	6	12	7	5	5	**7**
Dm (corr)	-	5	6	12	7	5	5	**7**
t_{Dm}	s	0	0	0	0	0	0	**0**

Ds (1.5) = specific optical density at 1.5 minutes
Ds (4.0) = specific optical density at 4 minutes
Dm = maximum specific optical density
Dm (corr) = corrected maximum specific optical density
t_{Dm} = time to maximum specific optical density



V. NON-FLAMING MODE OBSERVATIONS

All: Shrank. Some molten material flowed into the sample trough. Black after testing. Fully consumed.
1: Began shrinking and melting at 13s.
2: Began shrinking and melting at 11s.
3: Began shrinking and melting at 10s.
4: Began shrinking and melting at 11s.
5: Began shrinking and melting at 11s.
6: Began shrinking and melting at 12s.

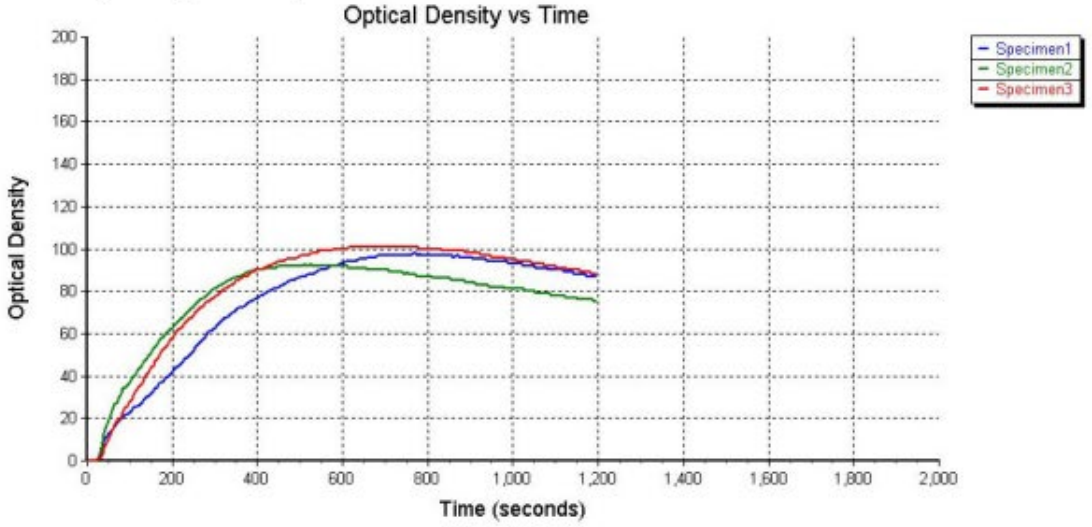
Smoke Color: ☐ White ☒ Grey ☐ Black ☐ Other: _____

VI. FLAMING MODE DATA AND RESULTS

FLAMING MODE

	Unit	Specimen 1	Specimen 2	Specimen 3	Average
Room Temp.	°F	70.7	70.8	69.0	**70.2**
Room Humidity	%RH	50.9	48.8	47.4	**49.0**
Chamber Temp.	°F	94.3	95.1	96.4	**95.3**
Exposure Time	s	1200	1200	1200	**1200**
Length	in	2.991	2.994	2.999	**2.995**
Width	in	3.000	3.000	2.999	**3.000**
Thickness	in	0.024	0.025	0.024	**0.024**
Weight	g	1.55	1.55	1.56	**1.55**
Ds (90 s)	-	22	35	25	**27**
Ds (240 s)	-	50	71	67	**63**
Dm	-	98	93	101	**97**
Dm (corr)	-	89	85	93	**89**
t_{Dm}	s	765	510	650	**642**

Ds (1.5) = specific optical density at 1.5 minutes
Ds (4.0) = specific optical density at 4 minutes
Dm = maximum specific optical density
Dm (corr) = corrected maximum specific optical density
t_{Dm} = time to maximum specific optical density



VII. FLAMING MODE OBSERVATIONS

All: Some molten material flowed into the sample trough. Black after testing. Fully consumed.

1: Ignited at 3s. Flame out at 64s.
2: Ignited at 3s. Flame out at 65s.
3: Ignited at 3s. Flame out at 59s.

Smoke Color: ☐ White ☒ Grey ☐ Black ☐ Other: _____

VIII. REMARKS

Specimens were tested as-received and not laundered prior to testing at the specification of the client. Orientation screening was not performed at the request of the client. All specimens were tested with the warp direction vertical. Test performed concurrently with test numbers S-2384 TX1 and S-2384 TX2 for BSS7239 and SMP800C, respectively. The result for specimens 3NF exceeded the minimum value of the non-flaming set by more than 50%, therefore an additional three specimens were tested as specified in ASTM E662-21ae1 Section 10.1.1. Reported weights and thicknesses include the fabric material only. Specimens 1NF, 2NF, 1F, and 2F were run by CK.

IX. DISCUSSION

Interpreting Results

ASTM E662 results are frequently used by code officials and regulatory agencies to determine whether a product is suitable for its intended application. The test standard itself does not establish specific performance criteria or contain a classification system. Check appropriate regulations and consult the authority having jurisdiction (AHJ) to determine the suitability of a material for the intended application.

ASTM E662 Standard Language and Disclaimers

The following language was taken directly from the ASTM E662 standard. It has been included for informational purposes.

ASTM E662-21ae1, Section 1.5 - This standard measures and describes the response of materials, products, or assemblies to heat and flame under controlled conditions, but does not by itself incorporate all factors required for fire hazard or fire risk assessment of the materials, products or assemblies under actual fire conditions.

ASTM E662-21ae1, Section 5.1 - This test method provides a means for determining the specific optical density of the smoke generated by specimens of materials and assemblies under the specified exposure conditions. Values determined by this test are specific to the specimen or assembly in the form and thickness tested and are not to be considered inherent fundamental properties of the material tested. Thus, it is likely that closely repeatable or reproducible experimental results are not to be expected from tests of a given material when specimen thickness, density, or other variables are involved.

ASTM E662-21ae1, Section 5.2 - The photometric scale used to measure smoke by this test method is similar to the optical density scale for human vision. However, physiological aspects associated with vision are not measured by this test method. Correlation with measurements by other test methods has not been established.

ASTM E662-21ae1, Section 5.4 - The test method is of a complex nature and the data obtained are sensitive to variations which in other test methods might be considered to be insignificant.

ASTM E662-21ae1, Section 6.3 - The results of the test apply only to the thickness of the specimen as tested. There is no common mathematical formula to calculate the specific optical density of one thickness of a material when the specific optical density of another thickness of the same material is known.

ASTM E662-21ae1, Section 13 Note 6 - Prior to the adoption of this test method, it was customary to report the maximum smoke accumulated as Dm (corr), and for that reason it has been included as a part of the test report. Subsequently, a statistical analysis of the round-robin data upon which the precision statement is based, showed that the Dm values were more uniform. Therefore, it is required that both Dm and Dm (corr) be reported.

X. AUTHORIZED SIGNATURES

Report Written By:

Victoria Gastrock
Lab Technician I

02/24/2023
Date

Reviewed and Approved By:

Chris Palumbo
Sr. Manager of Product Testing

03/01/2023
Date

XI. REVISION HISTORY

Revision Number	Date	Summary
0	03/01/2023	Original Report Issued

XII. ACREDITATION

Capital Testing and Certification Services is an ISO/IEC 17025 accredited testing laboratory whose scope includes ASTM E662. Accrediting Body: International Accreditation Service, Inc. (IAS). Testing Laboratory TL-224.

CAPITAL TESTING AND CERTIFICATION SERVICES
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TEST REPORT

Test Method: 14 CFR Part 25, Appendix F, Part I – Vertical Flammability – 12 Second Exposure

Rendered To: Camira Transport Fabrics
The Watermill, Wheatley Park
Mirfield, West Yorkshire, WF14 8HE
United Kingdom

Product Description: Lucia CS

Report Number: V22-011

Original Issue Date: 12/30/2022

Test Date: 12/23/2022

Pages: 5

IAS ACCREDITED Testing Laboratory
TL-224

I. SCOPE

This test report contains the results of a specimen tested in accordance with the vertical flammability test described in 14 CFR Part 25, Appendix F, Part I. This test method is commonly used to demonstrate compliance with FAR §25.853, FAR §25.855, FAR §29.853, Docket 90-A, and NFPA 130. This test method is equivalent to the Horizontal Bunsen Burner Test method described in Chapter 3 of the FAA handbook.

II. SUMMARY OF TEST METHOD

Specimens are mounted horizontally in a U-shaped frame with a minimum exposed area of 51 mm x 305 mm (2 in. x 12 in.). The frame supports the specimen along the top and the side edges, with the unsupported bottom edge of the specimen being unfinished and/or unprotected. The gas flow and burner are adjusted such that the flame height is 38 mm (1.5 in.), the bottom edge of the specimen is 19 mm (0.75 in.) above the top of the burner, and the burner is centered along the bottom edge of the front face of specimen. The specimen is exposed to a flame with a minimum temperature of 843°C (1550°F) for 12 seconds. The flame time is then recorded, as well as drip flame time if applicable. Flame time is the measure of how long the material stays alight after the burner is extinguished. Drip flame time begins when a flaming drip hits the floor of the cabinet. If a drip reignites previous drips, the drip flame time is the sum of all drip flame times up to that point which occurred for that specimen. Otherwise, it is the maximum drip flame time. The burn length is recorded as the farthest evidence of damage due to combustion. This is defined as areas of partial consumption, charring, and embrittlement due to flame impingement. It does not include soot, staining, warping, discoloration, shrinking, or melting which occurred outside of areas of flame impingement.

III. DISCUSSION

The following Pass/Fail criteria is contained in 14 CFR Part 25, Appendix F, Part I – Vertical Flammability and the FAA Handbook Chapter 1:

I. The average flame time for all specimens tested will not exceed 15 seconds.

II. The average drip flame time for all specimens tested will not exceed 5 seconds.

III. The average burn length for all specimens tested will not exceed 203 mm (8 in.).

NFPA 130 and Docket 90-A reference the FAA vertical flammability test but have slightly differing Pass/Fail criteria. The performance criteria set forth by NFPA 130 and Docket 90-A follows:

I. The average flame time for all specimens tested will not exceed 10 seconds.

II. No flaming dripping will be allowed.

III. The average burn length for all specimens tested will not exceed 152 mm (6 in.).

IV. TEST SPECIMENS

Test specimens are rectangular in shape with a width of 76 mm (3 in.) and a length of 330mm (13 in.), unless the actual size of the part is smaller in its real-world application. The specimens will be cut from either a fabricated part as installed or cut from a section simulating the part. The edge to which the burner will be applied must not consist of a finished or protected edge. Laminated parts will not be separated into component layers for testing. Directional parts will be tested in the directions which differ the most (e.g., warp and fill for textiles). Specimen thickness is limited to 25 mm (1 in.) with the following exceptions: If the part is used in several thicknesses, the minimum thickness will be tested; Foam parts will have a maximum thickness of 13 mm (0.5 in.).

A minimum of three specimens must be tested. The specimens will be conditioned at 21° + 3°C (70° + 5°F) and 50% +5% relative humidity for at least 24 hours. Specimens will be removed from the conditioning environment one at a time immediately prior to testing.

PRODUCT / SPECIMEN INFORMATION	
Product Description*	Lucia CS Manufacturer: Camira Transport Fabrics Production Date: 07/12/2022 Lot Number: 502506
Specimens Selected By	Client
Specimens Prepared By	Capital Testing
Date Received	12/12/2022
Conditioning Time (days)	3
Color	Havana* - Black

* Information provided by the Client

V. TEST RESULTS

Exposure Time (seconds):	12
Measured Flame Temperature (°F):	1675
Gas Pressure (psi):	2.5

LONGITUDINAL DIRECTION

Burn Number	Weight (g)	Thickness (in.)	Flame Time (s)	Burn Length (in.)	Drip Flame Time (s)
1	6.75	0.020	0.0	1.9	N/A
2	6.79	0.021	0.0	1.6	N/A
3	6.75	0.022	0.0	2.8	N/A
Average	6.76	0.021	0.0	2.1	N/A

TRANVERSE DIRECTION

Burn Number	Weight (g)	Thickness (in.)	Flame Time (s)	Burn Length (in.)	Drip Flame Time (s)
1	6.76	0.022	7.7	4.0	N/A
2	6.82	0.022	1.4	3.7	N/A
3	6.63	0.021	0.0	2.3	N/A
Average	6.74	0.022	3.0	3.3	N/A

Flame Time	The measure of how long the material stays alight after the burner is extinguished.
Burn Length	The furthest evidence of damage due to combustion (does not include soot, staining, warping, discoloration, shrinking, or melting which occurs beyond flame impingement).
Drip Flame Time	Maximum time a flaming drip continues flaming after hitting the floor. If a droplet reignites previous drips, this time is the sum of all drip flame times to this point.
DNI	Did Not Ignite
N/A	Not Applicable

VI. OBSERVATIONS AND REMARKS

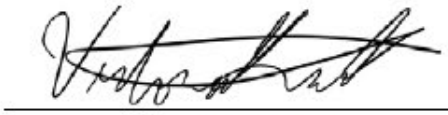
All: Melting occurred beyond the flame front.

Specimens were not laundered prior to testing and were tested as received at the specification of the client.

Longitudinal direction refers to flame travel in the warp direction. Transverse direction refers to flame travel in the weft direction.

VII. AUTHORIZED SIGNATURES

Report Written By:



Victoria Gastrock
Lab Technician I

12/27/2022
Date

Reviewed and Approved By:

Chris Palumbo
Sr. Manager of Product Testing

12/30/2022
Date

VIII. REVISION HISTORY

Revision Number	Date	Summary
0	12/30/2022	Original Report Issued

IX. ACREDITATION

Capital Testing and Certification Services is an ISO/IEC 17025 accredited testing laboratory whose scope includes 14 CFR Part 25, Appendix F, Part I. Accrediting Body: International Accreditation Service, Inc. (IAS). Testing Laboratory TL-224.