
Boeing BSS 7239 Toxic Gas Generation of "Lucia CS"

A Report To: **Camira Transport Fabrics Ltd.**
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Submitted by: Element Fire Testing

Report No. 24-002-051(A)
3 Pages + Appendix

Date: March 7, 2024

1.0 ACCREDITATION

ISO/IEC 17025 for a defined Scope of Testing by the American Association for Laboratory Accreditation (A2LA), Certificate Number: 6524.03.

2.0 SPECIFICATIONS OF ORDER

Determine toxic gas production according to Boeing BSS 7239, as per Camira Transport Fabrics Ltd. reference Purchase Order No. 81A25913 and Element Quotation No. 24-002-518531 dated February 9, 2024.

2.1 History of Revision

This is the original.

3.0 SAMPLE IDENTIFICATION

Material Identification	"Lucia CS"
Supplied Material Form	100% Trevira CS Flame Retardant Polyester Flat Woven Fabric
Material Thickness	1 mm
Date of Material Receipt	2024-02-09
Element Sample Identification Number	24-002-S0051
Date of Test	2024-02-15

4.0 SUMMARY OF TEST PROCEDURE

Specimens are exposed to the combustion conditions described in ASTM E 662 - *Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials*. Testing is performed in each of the flaming and non-flaming modes. For each mode, an established volume of the smoke generated by those tests is then separately sampled (drawn) from the chamber at specific flow rates, through an infrared analyzer (for carbon monoxide), and through liquid chemical impingers designed to trap the other target gas species. These specific gases are recognized as the primary toxicants and irritants that can be found in the products of combustion for many material fires. Each impinger solution is then further analyzed using an ion chromatograph, or other appropriate analytical techniques, in order to determine the relative concentration of each of the targeted gas species that were collected from the sampled volume of gas. No performance criteria are cited in Boeing BSS 7239. "Typical" industry criteria are included for comparison purposes only.

5.0 TEST RESULTS

Boeing BSS 7239 Rev.: A (1-18-88)

Toxic Gas Generation

Carbon Monoxide (CO ppm)	Flaming Mode	Non-Flaming Mode	Typical Specified Maxima	Possible Result
at maximum:	220	2	3500	Pass
Other Gases Sampled	Flaming Mode	Non-Flaming Mode	Typical Specified Maxima	Possible Result
Nitrogen Oxides (as NO ₂ ppm)	8	9	100	Pass
Sulfur Dioxide (SO ₂ ppm)	<6	<6	100	Pass
Hydrogen Chloride (HCl ppm)	58	46	500	Pass
Hydrogen Fluoride (HF ppm)	<12	<12	200	Pass
Hydrogen Cyanide (HCN ppm)	<1.2	<1.2	150	Pass

Boeing BSS 7239 Rev.: A (1-18-88)

Toxic Gas Generation

Additional Information	Flaming Mode	Non-Flaming Mode	Typical Specified Maxima	Possible Result
Original Weight (g)	1.57	1.45	-	-
Final Weight (g)	0.5	0.91	-	-
Weight Loss (g)	1.07	0.54	-	-
Weight Loss (%)	68.2	37.2	-	-
Time to Ignition (s)	5	Did not ignite	-	-
Burning Duration (s)	170	-	-	-

6.0 COMMENTS AND CONCLUSIONS

Boeing BSS 7239 is solely a test procedure and as such, has no specific pass/fail criteria of its own. The reference criteria cited are typical for the transportation industry and are listed for reference purposes only. They may or may not apply to this specific product.

The upholstery fabric identified in this report meets the typically-specified industry requirements as they pertain to toxic gas generation (Boeing BSS 7239).



Mel Garces,
Senior Technologist.



Ian Smith,
Technical Manager.

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A.0 APPENDIX

A.1 Boeing BSS 7239 Rev.: A (1-18-88) Toxic Gas Sampling and Analytical Procedures

A.1.1 Toxic Gas Generation

Gases produced for analysis are generated in a specified, calibrated smoke chamber during standard rate of smoke generation testing (typically ASTM E 662), in both flaming combustion and non-flaming pyrolytic decomposition test modes.

A.1.2 Carbon Monoxide (CO)

CO is monitored continuously during the 20 minute test using a non-dispersive infrared (NDIR) analyzer. Data are reported in ppm by volume at 1.5 and 4.0 minutes and at maximum concentrations.

A.1.3 Acid Gas Sampling

HCN, HF, HCl, NOX and SO₂ are sampled by drawing 1 litre of the chamber atmosphere through two midjet impingers, each containing 10 ml of 0.25N NaOH, at a rate of 400 ml per minute. The 2.5 minute sampling period is commenced at the 4 minute mark. Determinations are performed in both the flaming and non-flaming modes and data are reported in parts per million (ppm) by volume in air.

A.1.4 Analysis of Impingers for Hydrogen Cyanide (HCN)

Cyanide in the NaOH impinger, as NaCN, is converted to CNCl by reaction with chloramine-T at pH greater than 8 without hydrolyzing to CNO⁻. After the reaction is complete, CNCl forms a red-blue colour on addition of a pyridine-barbituric acid reagent. Cyanide is quantified by spectrometric measurement of the increase in colour 578 nm.

Reference: Element SOP 00-13-SP-1216 based on ASTM Method D 2036-91

A.1.5 Analysis of Impingers for Hydrogen Fluoride (HF)

Fluoride, as NaF, in the NaOH impinger is determined using SPADNS colorimetry.

Reference: Element SOP 01-13-SP-1295

A.1.6 Analysis of Impingers for Hydrogen Chloride (HCl)

Alkali halides (chloride) formed in the NaOH solution are measured using ion chromatography and conductivity detection.

Reference: Element SOP 02-13-SP-1402

A.1.7 Analysis of Impingers for Nitrogen Oxides (NO_x)

Nitrite and nitrate formed in the alkaline solution are determined using ion chromatography and conductivity detection. The nitrite and nitrate results are combined and the total expressed as nitrogen dioxide (NO₂).

Reference: Element SOP 02-13-SP-1402

A.1.8 Analysis of Impingers for Sulfur Dioxide (SO₂)

SO₂ is trapped in the NaOH impinger as sulfite and sulfate (SO₃⁻² and SO₄⁻²). Hydrogen peroxide is added to convert SO₃⁻² to SO₄⁻². Resulting sulfate is determined using ion chromatography and conductivity detection.

Reference: Element SOP 02-13-SP-1402

Bombardier SMP 800-C Toxic Gas Generation of "Lucia CS"

A Report To: **Camira Transport Fabrics Ltd.**
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1.0 ACCREDITATION

ISO/IEC 17025 for a defined Scope of Testing by the American Association for Laboratory Accreditation (A2LA), Certificate Number: 6524.03.

2.0 SPECIFICATIONS OF ORDER

Determine toxic gas production according to Bombardier SMP 800-C, as per Camira Transport Fabrics Ltd. reference Purchase Order No. 81A25913 and Element Quotation No. 24-002-518531 dated February 9, 2024.

2.1 History of Revision

This is the original.

3.0 SAMPLE IDENTIFICATION

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4.0 SUMMARY OF TEST PROCEDURE

Specimens are exposed to the combustion conditions described in ASTM E 662 - *Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials*. Testing is performed in each of the flaming and non-flaming modes. For each mode, an established volume of the smoke generated by those tests is then separately sampled (drawn) from the chamber at specific flow rates, through infrared analyzers (for carbon monoxide and carbon dioxide), and through liquid chemical impingers designed to trap the other target gas species. These specific gases are recognized as the primary toxicants and irritants that can be found in the products of combustion for many material fires. Each impinger solution is then further analyzed using an ion chromatograph, or other appropriate analytical techniques, in order to determine the relative concentration of each of the targeted gas species that were collected from the sampled volume of gas. Results are then compared for acceptance against established threshold or critical concentration criteria for each species.

5.0 TEST RESULTS

Bombardier SMP 800-C Rev. 6 (2009-08-31)

Toxic Gas Generation

Carbon Monoxide (CO ppm)	Flaming Mode	Non-Flaming Mode	Specified Maxima	Result
at maximum:	256	7	3500	Pass
Carbon Dioxide (CO ₂ ppm)	Flaming Mode	Non-Flaming Mode	Specified Maxima	Result
at maximum:	11464	11	90000	Pass

Bombardier SMP 800-C Rev. 6 (2009-08-31)

Toxic Gas Generation

Other Gases Sampled	Flaming Mode	Non-Flaming Mode	Specified Maxima	Result
Nitrogen Oxides (as NO ₂ ppm)	1	1	100	Pass
Sulfur Dioxide (SO ₂ ppm)	<1	<1	100	Pass
Hydrogen Chloride (HCl ppm)	12	15	500	Pass
Hydrogen Fluoride (HF ppm)	<2	<2	100	Pass
Hydrogen Bromide (HBr ppm)	<0.5	<0.5	100	Pass
Hydrogen Cyanide (HCN ppm)	<0.2	<0.2	100	Pass

Additional Information	Flaming Mode	Non-Flaming Mode	Specified Maxima	Result
Original Weight (g)	1.53	1.58	-	-
Final Weight (g)	0.42	1.04	-	-
Weight Loss (g)	1.11	0.54	-	-
Weight Loss (%)	72.5	34.2	-	-

Time to Ignition (s)	5	Did not ignite	-	-
Burning Duration (s)	180	-	-	-

6.0 CONCLUSIONS

The upholstery fabric identified in this report, meets the Bombardier requirements as they pertain to toxic gas production (Bombardier SMP 800-C).



Mel Garces,
Senior Technologist.



Ian Smith,
Technical Manager.

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A.0 APPENDIX**A.1 Bombardier SMP 800-C Rev. 6 (2009-08-31) Toxic Gas Sampling and Analytical Procedures****A.1.1 Toxic Gas Generation**

Gases produced for analysis are generated in a specified, calibrated smoke chamber during standard rate of smoke generation testing (typically ASTM E 662), in both flaming combustion and non-flaming pyrolytic decomposition test modes.

A.1.2 Carbon Monoxide (CO) and Carbon Dioxide (CO₂)

CO and CO₂ are monitored continuously during the 20 minute test using a non-dispersive infrared (NDIR) analyzer. Data are reported in ppm by volume at 1.5 and 4.0 minutes and at maximum concentration.

A.1.3 Acid Gas Sampling

HCN, HF, HCl, HBr, NO_x and SO₂ are sampled by drawing 6 litres of the chamber atmosphere through two midget impingers, each containing 10 ml of 0.25N NaOH, at a rate of 375 ml per minute. The 16 minute sampling period is commenced at the 4 minute mark. All determinations are performed in both the flaming and non-flaming modes and all data are reported in parts per million (ppm) by volume in air.

A.1.4 Analysis of Impingers for Hydrogen Cyanide (HCN)

Cyanide in the NaOH impinger, as NaCN, is converted to CNCl by reaction with chloramine-T at pH greater than 8 without hydrolyzing to CNO⁻. After the reaction is complete, CNCl forms a red-blue colour on addition of a pyridine-barbituric acid reagent. Cyanide is quantified by spectrometric measurement of the increase in colour 578 nm. Reference: Element SOP 00-13-SP-1216 based on ASTM Method D 2036-91

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Fluoride, as NaF, in the NaOH impinger is determined using SPADNS colorimetry.

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A.1.6 Analysis of Impingers for Hydrogen Chloride (HCl) and Hydrogen Bromide (HBr)

Alkali halides (chloride and bromide) formed in the NaOH solution are measured using ion chromatography and conductivity detection.

Reference: Element SOP 02-13-SP-1402

A.1.7 Analysis of Impingers for Nitrogen Oxides (NO_x)

Nitrite and nitrate formed in the alkaline solution are determined using ion chromatography and conductivity detection. The nitrite and nitrate results are combined and the total expressed as nitrogen dioxide (NO₂).

Reference: Element SOP 02-13-SP-1402

A.1.8 Analysis of Impingers for Sulfur Dioxide (SO₂)

SO₂ is trapped in the NaOH impinger as sulfite and sulfate (SO₃⁻² and SO₄⁻²). Hydrogen peroxide is added to convert SO₃⁻² to SO₄⁻². Resulting sulfate is determined using ion chromatography and conductivity detection.

Reference: Element SOP 02-13-SP-1402