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**Boeing BSS 7239 Toxic Gas Generation of
of "EPDM 35 FST"**

A Report To: **Caoutchouc Pro-Flex Inc.**
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Submitted by: Element Fire Testing

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3 Pages + Appendix

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ACCREDITATION To ISO/IEC 17025 for a defined Scope of Testing by the International Accreditation Service

SPECIFICATIONS OF ORDER

Determine toxic gas production according to Boeing BSS 7239, as per Pro-Flex Inc. reference Purchase Order No. AC-006204 and Element Quotation No. 18-002-580,964 accepted August 6, 2019.

SAMPLE IDENTIFICATION (Element sample identification number: 19-002-S0581)

Rubber compound, identified as:

"EPDM 35 FST"

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 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 concentration of each of the targeted gas species that occurred in the sampled volume of gas. No performance criteria are cited in Boeing BSS 7239. "Typical" criteria are included for relative comparison purposes only.

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	Result
at 1.5 minutes:	<1	<1	-	-
at 4.0 minutes:	<1	<1	-	-
at maximum:	92	525	3500	Pass
Other Gases Sampled	Flaming Mode	Non-Flaming Mode	Typical Specified Maxima	Result
Nitrogen Oxides (as NO ₂ ppm)	<1	<1	100	Pass
Sulfur Dioxide (SO ₂ ppm)	34	12	100	Pass
Hydrogen Chloride (HCl ppm)	61	62	500	Pass
Hydrogen Fluoride (HF ppm)	<12	<12	200	Pass
Hydrogen Cyanide (HCN ppm)	1	1	150	Pass

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

Toxic Gas Generation

Additional Information	Flaming Mode	Non-Flaming Mode	Typical Specified Maxima	Result
Original Weight (g)	112.57	116.61	-	-
Final Weight (g)	89.38	107.42	-	-
Weight Loss (g)	23.19	9.19	-	-
Weight Loss (%)	20.6	7.9	-	-
Time to Ignition (s)	30	Did not ignite	-	-
Burning Duration (s)	Not determinable	-	-	-

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 rubber compound identified in this report, when tested at an approximate thickness of 14 mm, meets the typically-specified industry requirements as they pertain to toxic gas generation (Boeing BSS 7239).

Note: This is an uncontrolled electronic copy of the report. Signatures are on file with the original.

Mel Garces,
Senior Technologist.

Ian Smith,
Technical Manager.

Note: This report and service are covered under Element Materials Technology Canada Inc. Standard Terms and Conditions of Contract which may be found on our company's website at www.element.com/terms/terms-and-conditions.

APPENDIX

(1 Page)

Methods of Analysis

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

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.

Acid Gas Sampling

HCN, HF, HCl, NO_x 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.

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: In-house SOP 00-13-SP-1216 based on ASTM Method D 2036-91

Analysis of Impingers for Hydrogen Fluoride (HF)

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

Reference: In-house SOP 01-13-SP-1295

Analysis of Impingers for Hydrogen Chloride (HCl)

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

Reference: In-house SOP 02-13-SP-1402

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: In-house SOP 02-13-SP-1402

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: In-house SOP 02-13-SP-1402