



## Govmark Position Paper on Combustion Toxicity

The toxicity of burning materials has been an ongoing concern in the fire testing community for many years.

With regards to building codes, the federal government never opted to mandate combustion toxicity testing.

In 1986, New York State did issue a law that required the combustion toxicity testing of wallcoverings and draperies.

The two test protocols at that time were the NBS (National Bureau of Standards) test and the Pittsburgh test. The NBS test was later adopted by NFPA under standard number 269.

The tests entailed the use of mice or rats that were placed in an airtight chamber which received the combustion product of the burning material.

The classification was based on the amount of the burning material that would result in the death of 50% or more of the test animals that were exposed to the combustion product.

The New York law did not list any pass/fail criteria. It only required that the test report be filed with the State of New York.

In the 1998, New York State rescinded the law. (Attached is a copy of the New York State rescission.)

Govmark has consulted with NFPA and a major testing laboratory which previously performed the tests. Neither was able to furnish the name of any testing laboratory performing live animal combustion toxicity testing at this time (August 2016).

-- Continued on Page 2 --



Going further back in time to the late 60's/early 70's, the airline industry was also trying to assess the various gases given off by burning materials.

While the Federal Aviation Administration limits the smoke production of certain materials used in aircraft interiors, they opted not to require the measurement of toxic gases.

Independently of the FAA, both Boeing and Airbus developed their own tests which measure six different gases through analytical procedures as opposed to live animal testing.

Listed below are the gases and the suggested maximum limits:

<u>Combustion By Product</u>	<u>Suggested Maximum Limits at 4 Minutes (ppm)</u>
CO	Carbon Monoxide
HF	Hydrogen Fluoride
HCl	Hydrogen Chloride
HCN	Hydrogen Cyanide
SO <sub>2</sub>	Sulphur Dioxide
NO, NO <sub>2</sub>	Nitrous Gases

The Boeing test has been adopted in North American specifications for public transportation carriers such as buses, vans, and railcars.

Similar tests are mandated for European railcars and Worldwide passenger vessels.

Available as a separate document is the Govmark Testing Services quotation to perform the Boeing test.

Attached hereto are summaries and sketches of the tests referenced in this document.



STATE OF NEW YORK  
DEPARTMENT OF STATE  
ALBANY, NY 12231-0001

ALEXANDER F. TREADWELL  
SECRETARY OF STATE

*COPY*

December 21, 1998

Anderson Laboratories, Inc.  
30 River Street  
Dedham, MA 02026

Dear Laboratory Director:

This letter is to inform you that as of November 18, 1998, the Combustion Gas Toxicity Testing program found in Article 15 - Part 1120 of the New York State Uniform Fire Prevention and Building Code has been repealed.

As of November 18, 1998, we will no longer require combustion gas toxicity testing or accept such filings. The Department of State registry system for the filing of Parts A, B, and C of the registry form has been discontinued.

Enclosed is a copy of page 14 from the New York State Register which contains the Rule Making Activities pertaining to Part 1120 of Title 9 NYCRR.

Thank you for your participation and cooperation over the past several years. Should you have any questions, please feel free to call me at (518) 474-6746.

Best regards,

*Jerry Clark*

Jerry Clark, Bureau Chief  
Hazardous Materials Bureau  
Office of Fire Prevention and Control

OJC:lm

Inhalation Toxicity of Products of Combustion (Cup Furnace)

PURPOSE OF TEST:

To measure the effect that the fumes (products of combustion) given off by burning or smoldering material will have on laboratory rats inhaling the fumes.

BRIEF DESCRIPTION OF TEST:

The test apparatus is basically a two part design. One part of the apparatus is a small furnace in which the material to be tested is burned. The other part is the exposure chamber in which the heads of 6 laboratory rats (weighing 225 to 325 grams) are exposed to the products of combustion that will be given off by the test sample being burned.

The first step is to determine the temperature at which the material will self ignite. Once this temperature is determined, tests are conducted at the below listed furnace temperatures:

The Non Flaming Mode:      Self Ignition Temperature - 25° C  
The Flaming Mode:            Self Ignition Temperature + 25° C

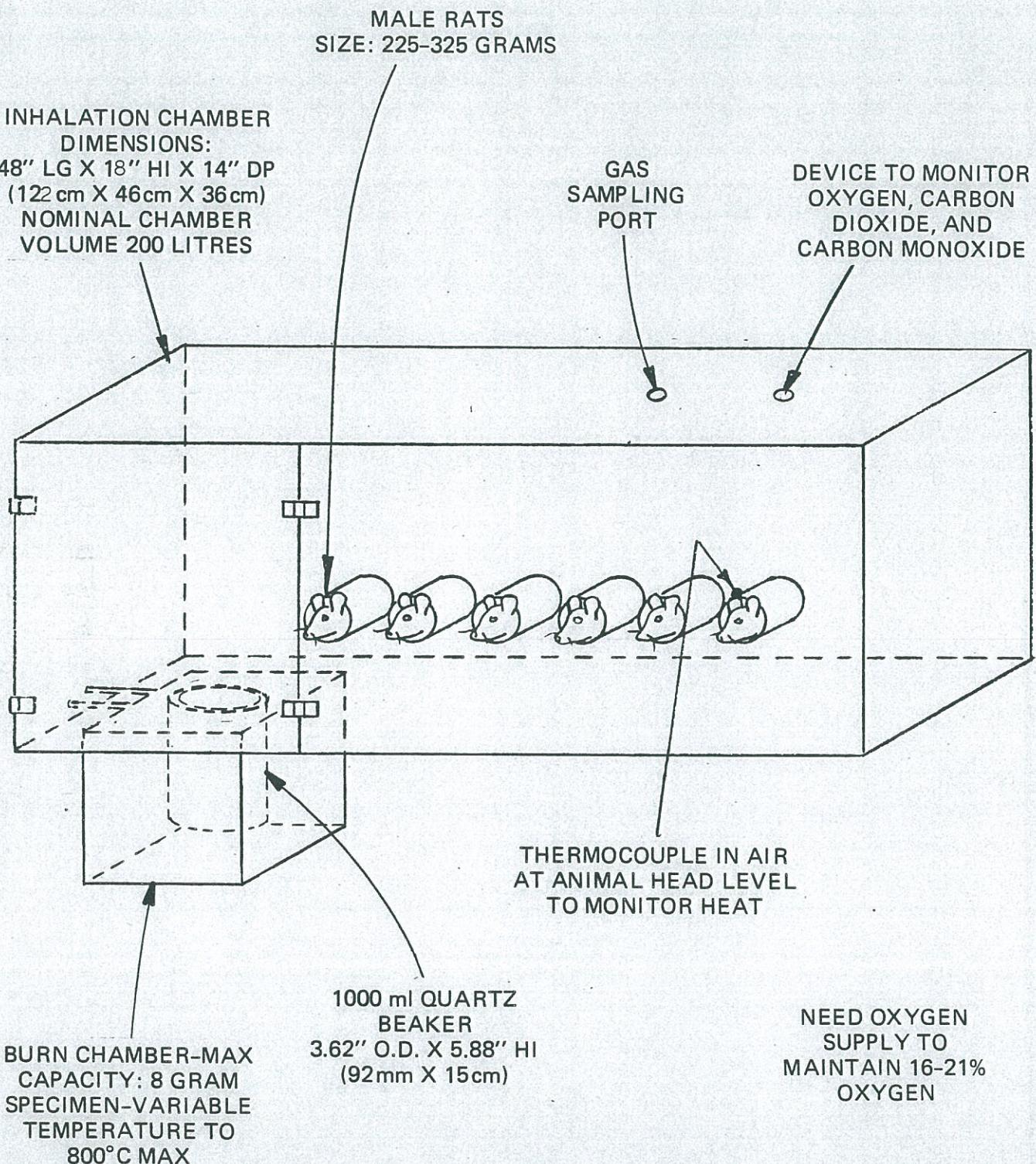
Example:

Self Ignition Temperature of Douglas Fir is 465° C

Non Flaming Test:    465° C - 25° C = 400° C

Flaming Test:            465° C + 25° C = 490° C

The material is placed into the test furnace at the specified temperature. The test animals are exposed to the products of combustion for a period of 30 minutes. The number of dead test animals is counted immediately after the 30 minute period. The test animals are monitored for an additional 14 days, and any deaths during this period are also recorded.




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NBSIR 82-2532 (PROPOSED METHOD)  
INHALATION TOXICITY OF  
PRODUCTS OF COMBUSTION  
(CUP FURNACE)

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TOXICITY-PRODUCTS OF COMBUSTION  
(PITTSBURGH TEST)

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PURPOSE OF TEST:

To measure the effect that the fumes (products of combustion) given off by burning or smoldering material will have on laboratory mice inhaling the fumes.

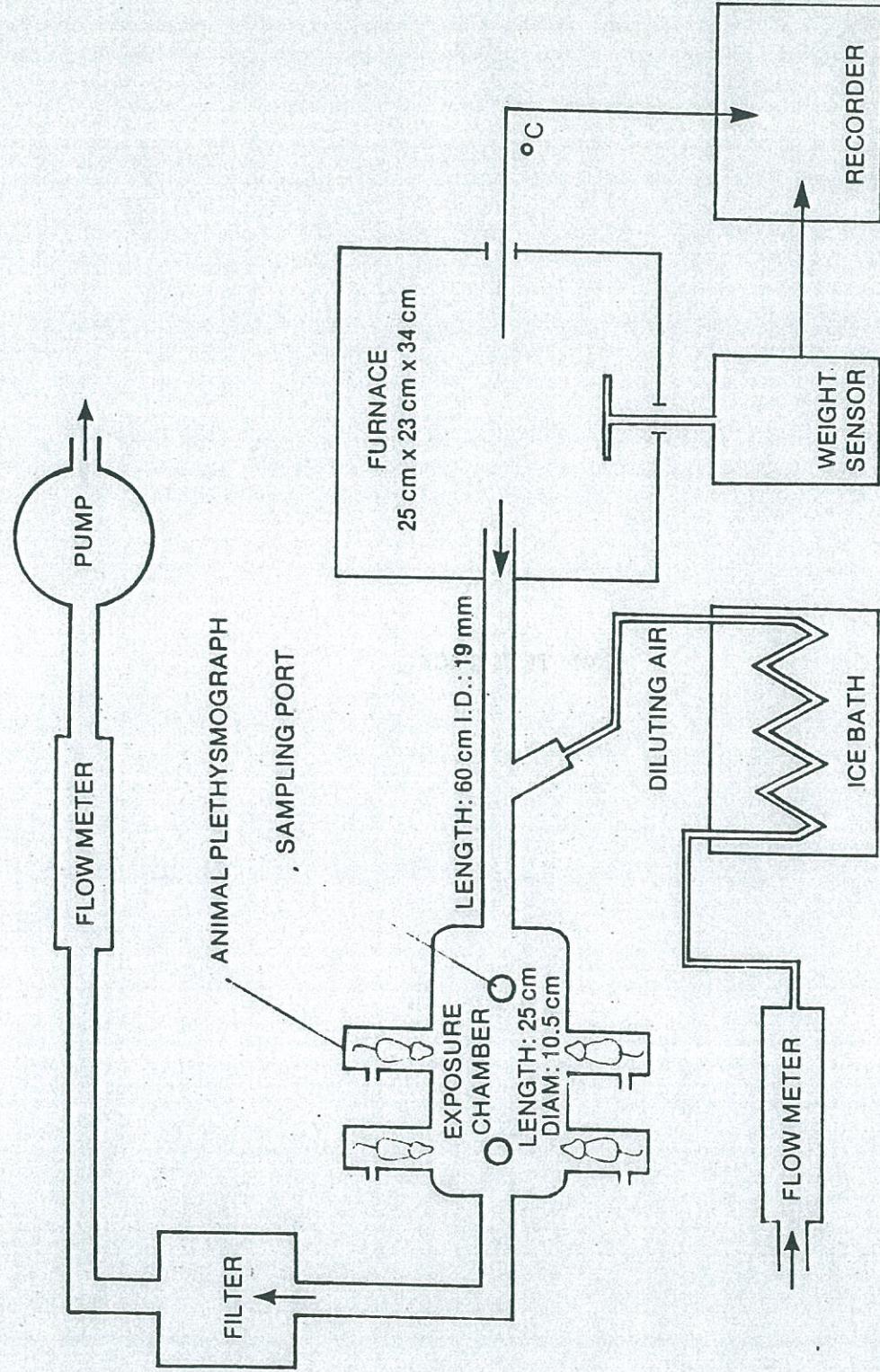
BRIEF DESCRIPTION OF TEST:

The test apparatus is basically a two part design. One part is the test furnace which will heat the material under test at a programmed rate starting at room temperature and increasing 20° C per minute until the maximum temperature of 800° C is reached. The second piece of equipment is an exposure chamber which holds four mice weighing 25 to 28 grams each. The mice are placed in the chamber and restrained so that only their heads are exposed to the fumes given off by the burning material.

The material is placed in the test furnace at room temperature and heated at the rate of 20° C per minute. At the point where the material loses 1% in weight, the test furnace is connected to the exposure chamber so that the test fumes are now inhaled by the mice. The mice are exposed to the fumes for a period of 30 minutes. At the end of the 30 minute period, room air is drawn through the exposure chamber for a period of 10 minutes. At the end of this additional 10 minute period, the number of dead mice is counted.

In order to arrive at the LC<sub>50</sub>, additional tests have to be run. The number of additional tests that are run depends on the method of calculation used. According to Mark Gold of Anderson Labs, a formula based on geometric progression determines the number of tests that are to be run, using differing weights of the material under evaluation.

## TEST APPARATUS SET UP



**TEST:** BSS 7239**Boeing Specification Support Standard: Test Method for Toxic Gas Generation by Materials on Combustion****SCOPE:**

To assess the level of specific toxic gases generated when aircraft materials are combusted.

**PURPOSE OF TEST:**

Measure 6 specific products of combustion to establish maximum values.

**BRIEF DESCRIPTION OF TEST:**

The test specimen, 3" x 3" (75 mm x 75 mm), is held inside a metal frame. The face of the test specimen is exposed to a heating source with a total flux of 2.5 W/cm<sup>2</sup>.

Two separate sets of tests are conducted:

**NON FLAMING MODE:**

The face of each specimen is exposed to a radiant heat source of 2.5 W/cm<sup>2</sup>. A separate specimen is prepared and tested for each gas to be extracted.

**FLAMING MODE:**

The face of each specimen is exposed to both a radiant heat source of 2.5 W/cm<sup>2</sup> and 6 small igniting flames. A separate specimen is prepared and tested for each gas to be extracted.

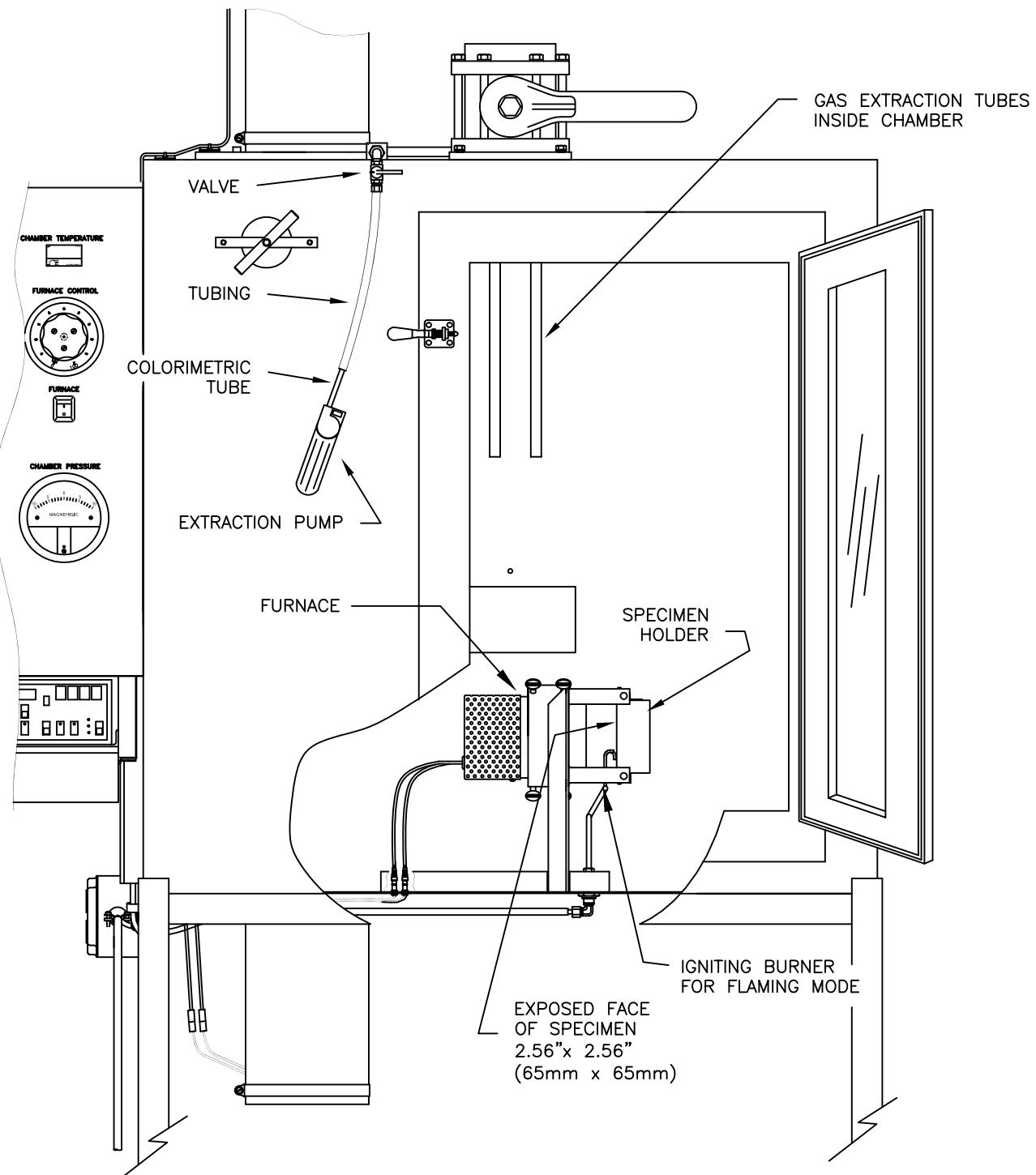
Four minutes after the start of the test the combustion product is collected in a gas detector tube, used in combination with an extraction pump. As the combustion product is drawn through the detector tube, a reagent inside the tube stains and indicates the concentration of a specific gas produced during combustion.

Alternatively, certain gases can be measured through a flue gas analyzer and wet chemistry.

**SUGGESTED MAX VALUES:** Flaming or Non Flaming Mode**Flaming or Non Flaming Mode:**

<b><u>Combustion By-Product:</u></b>	<b><u>Maximum Permitted at 4 Minutes:</u></b>	
Carbon Monoxide	CO	3,500 ppm
Hydrogen Fluoride	HF	200 ppm
Hydrogen Chloride	HCl	500 ppm
Hydrogen Cyanide	HCN	150 ppm
Sulphur Dioxide	SO <sub>2</sub>	100 ppm
Nitrous Oxides	NO, NO <sub>2</sub>	100 ppm

Full document text is available from: The Boeing Co.




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### **BSS 7239**

**Boeing Specification Support Standard**  
**Test Method for Toxic Gas Generation**  
**by Materials on Combustion**

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