



BSS 7239-88
Test Method for Toxic Gas Generation by
Materials on Combustion

5301

Project No. 16987-119566

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Prepared for:

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Abstract

Specimens submitted by Warren Environmental and identified as "5301", were tested in accordance with BSS 7239-88 by the procedures reported herein. Concentrations of the gases CO, HF, HCl, NO_x, SO₂, and HCN were determined. For results see page 6, table 2

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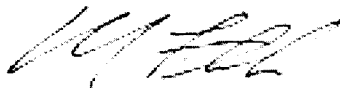
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INTRODUCTION

The determination of the gaseous products of smoke (often called "fire gases"), including those due to either pyrolysis or combustion, is a difficult problem. The composition of the smoke from most products is affected by the nature of the fire test procedure that created the smoke (i.e., flaming or nonflaming conditions, specimen size and configuration, external applied heat flux, etc.). Gas sampling considerations include the time at which sampling of the atmosphere was initiated and the duration of the sampling (smoke concentrations can change with time); the position of the sampling probe (concentrations can change with location in a chamber); the method of sampling (a major cause of error in fire gas analysis); and the actual method of analysis. Sampling and analysis of fire gases are described in some detail in ASTM E800 ("Standard Guide for Measurement of Gases Present or Generated During Fires"), to which the reader is referred.

One of the common test methods for creating "smoke" is the ASTM E662 smoke chamber (a method fundamentally the same as BSS 7238), which provides for both flaming and nonflaming combustion of 76 mm x 76 mm (3-in. x 3-in.) specimens exposed to an external radiant heat flux of 25 kW/m². The smoke is retained within the confines of the 500-L chamber. For this test procedure, analysis of gaseous components is performed starting at four minutes into the test run. Only the flaming exposure is specified. Actual analysis of the gases of interest may be performed directly using Dräger® colorimetric gas analysis tubes; by trapping the gases in solution impingers (bubblers) and subsequently analyzing the anions by ion-selective electrodes, titration or liquid chromatography; or by instruments designed to measure the specific gas(es) of interest (e.g., gas chromatographic methods, NDIR or FTIR analyzers).

The following gases are required to be measured by this test standard:

CO	carbon monoxide
HF	hydrogen fluoride
HCl	hydrogen chloride
NO _x	nitrogen oxides (both NO, nitric oxide, and NO ₂ , nitrogen dioxide, are detected)
SO ₂	sulfur dioxide
HCN	hydrogen cyanide



In our test procedures, Dräger® colorimetric gas analysis tubes are used. These devices are small glass tubes containing one or more chemical indicators/absorbents that change color when a specific gas reacts with the chemical inside the tube. The length of the coloration is proportional to the concentration of the gas when a fixed volume of the test atmosphere is drawn through the tube (which is accomplished by a hand pump). These tubes have several distinct advantages over other analytical methods for fire gases under the conditions of this test procedure. They are pre-calibrated; they are relatively simple to operate; there is nothing between the gas of interest and the analysis tube; the results are straight-forward and immediate; and this single technique can be used for each of the gases specified (plus several other common gases). Other procedures require more extensive instrumentation with calibration by standard solutions or gases; they introduce additional sampling concerns (which are different for each gas); and no single technique can be used for the six gases specified.

Information is available on each of the Dräger tubes describing the potential interferences for each tube and the range of concentrations over which the tube is calibrated. The stated accuracy of these tubes is in the range of 10-15 percent; however, the combination of sampling errors and analytical uncertainty in other methods could also approach this. In our procedure, we burn several test specimens and take an average of these readings in an effort to minimize the uncertainty in the results.

This standard is intended to measure and describe the properties of materials or products in response to heat and flame under controlled laboratory conditions and is not intended to describe or appraise the fire hazard or fire risk of materials, products, or assemblies under actual fire conditions.

TEST PROCEDURE

Specimens were exposed to flaming conditions in the smoke chamber, in accordance with the procedures in ASTM E662. Gas analyses for the species listed below were performed using Dräger® gas detector tubes. Specimens were exposed to flaming conditions for four minutes; then the igniter was extinguished, the specimen was displaced from the radiant heat flux, any excess pressure within the chamber was released, and the analyses were started within one minute.



Gas samples were extracted using the gas analysis tubes from points approximately six inches from the top of the chamber and four inches from either side wall. Although this is not the same location as given in BSS 7239

(i.e., 12 in. from the ceiling, in the center of the chamber), our sampling location was determined after considerable reflection on the advantages and disadvantages of various sampling schemes using these tubes. It is our belief that there would be no difference in the two sampling locations using our method of specimen exposure and sampling methodology.

Different tubes were drawn simultaneously from two different locations at opposite sides of the chamber in order to reduce the total time required for sampling. For replicate tests, tubes were drawn by a different operator from the other location. The gases more likely to change concentration due to reaction with moisture or soot in the chamber (i.e., HCl, HCN, HF) are drawn first in order to minimize their residence time in the chamber; while CO is sampled last, since its concentration will not change with time.

Table 1 is a listing of the specific gas detector tubes used in this study

Table 1. Identification of Gas Analysis Tubes used

Gas	Draeger Tube No.	Concentration Range, ppm	Number of Strokes
CO	5/c	100 - 700	2
HF	1.5/b	1.5 - 15	20
HCl	1/a	1-10	10
NO _x	2/a	5-100	5
SO ₂	0.5/a	1 - 25	10
HCN	2/a	2 - 30	5

CRITERIA

In general the airline industry limits (in ppm) are as follows: CO=3500, HF=200, HCl=500, SO₂ =100 and HCN=150. These limits are not set by the BSS 7239 standard.

Other limits may be required depending on the end use of the product so it is recommended that the proper governing organizations be contacted.



RESULTS

Specimens submitted by: Warren Environmental

Date received: June 17, 2004

Date tested: June 23, 2004

Specimen ID: 5301

Description of specimen: 100% Solid Epoxy

Environmental conditions: 75°F and 51% r.h.

The test specimen identification is as provided by the client and Omega Point Laboratories, Inc. accepts no responsibility for any inaccuracies therein. Omega Point did not select the specimen and has not verified the composition, manufacturing techniques or quality assurance procedures.

Specimen preparation and mounting method: The test material submitted was a 3" x 3" x 0.67" white plastic. The specimen was subjected to the standard conditioning and mounting methods.

**Table 2. Test Results with notations
(concentrations in ppm unless otherwise noted)**

No.	HCl	HCN	HF	NO _x	SO ₂	CO
1 Flaming	1	2	N.D.	40	N.D.	190
2 Flaming	1	2	N.D.	20	N.D.	180
Average	1	2	N/A	30	N/A	185

NOTES:

N.D. = "none detected"

N/A = Not Available

CONCLUSION

The toxicity values for this material meet the general airline industry requirements.

