

Test Report

WARRES No. 126686

Determination of Weighted Summation of Toxic Fume, R,
As Described in Annex B (Informative) of
BS 6853:1999, Code of Practice for Fire Precautions
in the design and construction of Passenger
Carrying Trains

Sponsored By

Four 4-Rail Services Limited
12 Magnet Road
East Lane Business Park
Wembley
Middlesex
HA9 7RG

Warrington
FIRE
research

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Introduction

Warrington Fire Research Centre was commissioned to carry out an area based toxicity test in accordance with the method recommended in BS6853:1999 Informative Annex B.2. This standard recommends that the test is carried out using the apparatus detailed in prEN2824 but the ignition cone used should conform with the requirements given in BS ISO 5659-2 and that the quantitative determination of the gases emitted should be carried out in accordance with the procedure specified in prEN2826.

Test Method

The principle of the test methods detailed in prEN2825 and prEN2826 is to expose a material to specified thermal conditions of pyrolysis and combustion in a continuous procedure. The change in optical density of the smoke produced when dispersed within a fixed volume of air is recorded throughout the period of test. Quantitative determination of toxic gases emitted is carried out using wet analysis.

The test method provides a means for the comparative assessment of products, however, it does not model a real fire situation and the results cannot therefore be used to describe the fire hazard of materials under actual fire conditions.

Description Of Test Specimens

The description of the specimens given below has been prepared from information provided by the sponsor of the test. All values quoted are nominal, unless tolerances are given.

6mm thick 'Glasroc', a glass fibre reinforced gypsum board, manufactured by British Gypsum, was coated on one face with one clear coat of 'Protectosil', an anti-graffiti coating, brush applied at a coverage rate of from 100 to 200ml/m².

The sponsor was unwilling to provide further details of the manufacturer and composition of the coating.

The specimens were supplied by the sponsor. Warrington Fire Research Centre was not involved in any selection or sampling procedure.

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Conditioning Of Specimens

The specimens were received on the 21st August 2002.

The specimens were conditioned at temperatures of $23 \pm 3^{\circ}\text{C}$ and a relative humidity of $50 \pm 5\%$ RH, for a minimum period of 24 hours prior to testing.

Date Of Test

The test was performed on the 23rd August 2002.

Test Procedure

The test was performed in accordance with the procedure specified in prEN2825 and prEN2826 amended in accordance with the recommendations given in BS6853:1999 Annex B and this report should be read in conjunction with these and other related Standards.

Specimens were tested in the flaming mode in a horizontal position by exposure to the heating arrangement specified in ISO 5659-2. The heat flux was 25kW/m^2 .

The sampling and analysis of the fire gases generated during the test is conducted using a variety of methods.

In all cases, the sample is taken from the geometric centre of the chamber with sample lines being kept as short as possible to minimise sample losses.

For the analysis of oxides of carbon and nitrogen, continuous measurements are made throughout the duration of the test. For the other gases, single point analysis is conducted, the gases being absorbed into an aqueous media and analysed remotely. Two types of media are used, 0.1m sodium hydroxide solution and 0.3% hydrogen peroxide solution.

The gases are sampled over a two minute period commencing when smoke density has reached 85% obscuration by bubbling the gases through the aqueous media using a fitted funnel Dreschel bottle arrangement.

Analysis of the gases is conducted using the methods given in ISO TR 9122-3, 1996.

Carbon dioxide (CO_2) and carbon monoxide (CO) are determined continuously using precalibrated non-dispersive infra-red analysers with ranges of 0 to 1% and 0 to 0.5% respectively. The values reported are those measured at 85% smoke obscuration.

Oxides of nitrogen (NO_x) are determined continuously using a chemi-luminescence analyser with a range of 0 to 500ppm. Again, the values reported are those measured at 85% smoke obscuration.

Hydrogen cyanide (HCN) is determined from gases absorbed into a 0.1m solution of sodium hydroxide and analysed using ion chromatography via an ion exchange column and eluent as specified in ISO-9122-3. The concentration determined is an average over each 2 minute period beginning at 85% smoke obscuration.

Hydrogen chloride (HCl), hydrogen bromide (HBr), hydrogen fluoride (HF) and sulphur dioxide (SO_2) are absorbed into a 0.3% solution of hydrogen peroxide and are also analysed by ion chromatography as specified in ISO 9122-3.

The ion chromatograph used to analyse the absorbed gases is located at the Warrington Fire Research Centre laboratory in London. Sealed bottles containing the absorbed species are transported to this laboratory for analysis.

Test Results

The test results relate only to the behaviour of the specimens of the product under the particular conditions of test; they are not intended to be the sole criterion for assessing the potential smoke and toxicity hazard of the product in use.

The test results relate only to the specimens of the product in the form in which they were tested. Small differences in the composition or thickness of the product may significantly affect the performance during the test and will therefore invalidate the test results. It is the responsibility of the supplier of the product to ensure that the product which is supplied is identical with the specimens which were tested.

One specimen was tested to determine the $D_{S_{max}}$ and time to $D_{S_{max}}$. From the results of this test time to reach 85% of $D_{S_{max}}$ was calculated. The results are given below:

$D_{S_{max}}$: 26
 Time to $D_{S_{max}}$ (T_{max}) : 15:00
 Time to 85% of $D_{S_{max}}$ (T_{max} 85%) : 9:30

Three further specimens were then tested. Gases generated were sampled after 9 minutes 30 seconds test duration. The quantitative determinations were then carried out using the procedures described. The test results obtained are given in Table 1.

TABLE 1

Gas	Specimen No 1	Specimen No 2	Specimen No 3	Average
Carbon Monoxide	8.08	7.65	8.19	7.97
Carbon Dioxide	1726.88	1701.65	1709.78	1712.77
Sulphur Dioxide	0.25	0.25	0.25	0.25
Hydrogen Chloride	1.12	1.12	0.98	1.08
Hydrogen Bromide	0.00	0.30	0.30	0.20
Hydrogen Fluoride	0.00	0.00	0.00	0.00
Hydrogen cyanide	0.10	0.31	0.31	0.24
Nitrogen Oxides	3.01	4.43	3.89	3.78

Note: All values given are in g/m^2 .

Weighted Summation of Toxic Fume, R

The test results obtained for toxicity measurements were used to calculate the weighted summation index, R, as described in BS 6853:1999, Clause B.4.2.

The R Value determined was 0.76.

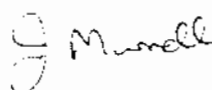
Validity

The specification and interpretation of fire test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. For these reasons it is recommended that the relevance of test reports over five years old should be considered by the user. The laboratory that issued the report will be able to offer, on behalf of the legal owner, a review of the procedures adopted for a particular test to ensure that they are consistent with current practices, and if required may endorse the test report.

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Responsible Officer

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Testing Department

Approved

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Technical Manager
Technical Department
For and on behalf of
WARRINGTON FIRE RESEARCH CENTRE

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