

# *W*arrington **FIRE** *research*

**Test Report**  
**WARRES No. 133452**  
**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**  
**Acourete**

## **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.

The specimens comprised "ACOURETE FIBER" (colour reference "White"), a sound absorption blanket having an overall thickness of 5mm and a density of 600 g/m<sup>3</sup>.

The sponsor stated that the main material utilised in the production of the blanket was polypropylene based fibers and the remainder (<5%) was polyester resin. The blanket was produced utilising a melt-blown process at high temperature, high pressure and high speed.

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

## **Conditioning Of Specimens**

The specimens were received on the 10 July 2003.

The specimens were conditioned at temperatures of 23 ± 3°C and a relative humidity of 50 ± 5% RH, for a minimum period of 24 hours prior to testing.

## **Date Of Test**

The test was performed on the 21 July 2003.

## **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<sup>2</sup>.

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<sub>2</sub>) 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<sub>x</sub>) are determined continuously using a chemiluminescence 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 0.1 m 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<sub>2</sub>) are absorbed into a 0.3% solution of hydrogen peroxide and are also analysed by ion chromatography as specified in ISO 9122-3.

## **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<sub>smax</sub> and time to D<sub>smax</sub>. From the results of this test time to reach 85% of D<sub>smax</sub> was calculated. The results are given below:

D<sub>smax</sub>: 82

Time to D<sub>smax</sub> (T<sub>max</sub>): Not Applicable

Time to 85% of D<sub>smax</sub> (T<sub>m,,85%</sub>) : Not Applicable

Three further specimens were then tested. As D<sub>smax</sub> was not reached until 20 minutes, as stated in Annex B, paragraph B.2 of "BS 6853:1999 Code of practice for fire precautions in the design and construction of passenger trains", the gases generated were sampled after 20 minutes 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	26.23	24.22	24.72	25.06
Carbon Dioxide	3192.61	3299.52	3202.56	3231.56
Sulphur Dioxide	ND	ND	ND	ND
Hydrogen Chloride	ND	ND	ND	ND
Hydrogen Bromide	0.04	0.04	0.05	0.04
Hydrogen Fluoride	ND	ND	ND	ND
Hydrogen cyanide	ND	ND	ND	ND
Nitrogen Oxides	0.83	0.83	0.66	0.77

Where ND indicates non-detected.

Note: All values given are in g/m<sup>2</sup>.

## **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 0.42

## **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**



**B KINSELLA**  
Testing Officer  
Reaction to Fire Testing

### **Approved**



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For and on behalf of  
**WARRINGTON FIRE RESEARCH CENTRE**

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