

BS 6853:1999

**Area based toxic fume
test used in the design
and construction of
Passenger
Carrying Trains**

**Additional WF Report
Number:**

162809

Date:

16th March 2007

Test Sponsor:

**Rudolf Rost Sperrholz
GmbH**



**Bodycote warringtonfire Additional
Test Report No. 161850**

**Determination of Weighted
Summation of Toxic Fume, R,
As Described in Annex B
(Informative) of
BS 6853:1999, Incorporating
Amendment 1,
Code of Practice for Fire Precautions
in the design and construction of
Passenger
Carrying Trains**

Sponsored By

**E. Wood Limited
Standard Way
Northallerton
North Yorkshire
DL6 2XA**

This test report is additional to that issued as WF No. 161850 dated the 16th March 2007 and has been issued at the request of the representative of the sponsor. The original test report remains valid and is not replaced by this additional test report. The product referred to in the original report and this additional test report has not been re-tested since the original test and neither has a technical review of the original test report resulting in any technical changes been carried out.

The sponsor's original name has been removed and E. Wood Limited has been inserted. The name of the manufacturer of the coating and product reference of the coating were omitted from the original report for confidentiality reasons, however, these details are included in this report. The sponsor of the test has stated that the product described in this additional report is identical to the product which was tested. The original and the alternative names and addresses of the sponsor have been documented and the documentation is maintained in the confidential file covering this investigation.

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Test Details

Introduction

Warringtonfire was commissioned to carry out an area based toxicity test in accordance with the method recommended in BS6853:1999 Incorporating Amendment 1, 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.

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.

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.

Fire test study group/EGOLF

Certain aspects of some fire test specifications are open to different interpretations. The Fire Test Study Group and EGOLF have identified a number of such areas and have agreed Resolutions which define common agreement of interpretations between fire test laboratories which are members of the Groups. Where such Resolutions are applicable to this test they have been followed.

Instruction to test

The test was conducted on the 26th February 2007 at the request of the sponsor of the test.

Provision of test specimens

The specimens were supplied by the sponsor of the test. **Bodycote warringtonfire** was not involved in any selection or sampling procedure.

Conditioning of specimens

The specimens were received on the 12th February 2007.

The specimens were conditioned at temperatures of $23 \pm 2^\circ\text{C}$ and a relative humidity of $50 \pm 5\%$ RH, for a minimum period of 24 hours prior to testing.

Test Face

The coated face of the specimen was exposed to the radiant heat source.

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.

General description		Coated birch plywood (with WBP gluing)
Overall thickness		18mm (determined by Bodycote warringtonfire)
Overall weight per unit area		13.3 kg/m ² (determined by Bodycote warringtonfire)
Coating product (Test face)	Generic type	Waterborne intumescent
	Product reference	"Copon LS100"
	Name of manufacturer	Copon E Wood Limited
	Colour	"White"
	Number of coats	Two
	Application rate per coat	6.7g/m ²
	Total thickness of coating	150 microns
	Application method	Spray
	Specific gravity	1.3
	Flame retardant details	See Note 1 below
Curing process per coat	Air dry	
Plywood	Product reference	"Finnish Birch Plywood"
	Generic type	Birch plywood
	Name of manufacturer	Rudolph Rost
	Thickness	18mm
	Density	680kg/m ³
Flame retardant details	See Note 1 below	
Brief description of manufacturing process of coatings		Made under high speed dispersion

Note 1. The representative of the original sponsor of the test has confirmed that no flame retardant additives were utilised in the production of the component

Test Procedure

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 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 0.1M 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.

Test Results

Applicability of 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.

Gases sampled

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

DS_{max}	: 54
Time to DS_{max} (T_{max})	: 20:00
Time to 85% of DS_{max} (T_{max} 85%)	: 14:00

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

Gas	Specimen No 1	Specimen No 2	Specimen No 3	Average
Carbon Monoxide	21.92	28.25	22.82	24.33
Carbon Dioxide	2059.23	2057.49	2025.59	2047.44
Sulphur Dioxide	ND	ND	0.41	0.14
Hydrogen Chloride	ND	ND	ND	ND
Hydrogen Bromide	ND	ND	ND	ND
Hydrogen Fluoride	ND	ND	ND	ND
Hydrogen cyanide	0.22	0.52	0.48	0.41
Nitrogen Oxides	7.60	6.27	7.10	6.99

Where ND indicates non-detected.

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 1.19.

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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Report Issued: 16th March 2007

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Table 1

Testing with Flame Application									
Specimen	D _s after t in minutes							D _s max. within 1.5 min	D _s max. within 4 min
	1	1.5	2	3	4	5	6		
Smoke run	19	26	30	35	39	40	42	26	39

Observations during test

In the case of each specimen, light coloured smoke was produced from the early stages of the test.

In the case of the initial specimen tested to obtain a smoke density curve, ignition of the specimen occurred after approximately thirty-nine seconds test duration and the flaming continued until the end of the test.

In the case of the first specimen tested for toxic gas emission, ignition of the specimen occurred after approximately one minutes test duration and the flaming continued until the end of the test.

In the case of the second specimen tested for toxic gas emission, ignition of the specimen occurred after approximately one minute nine seconds test duration and the flaming continued until the end of the test.

In the case of the third specimen tested for toxic gas emission, ignition of the specimen occurred after approximately one minute twenty-nine seconds test duration and the flaming continued until the end of the test.



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