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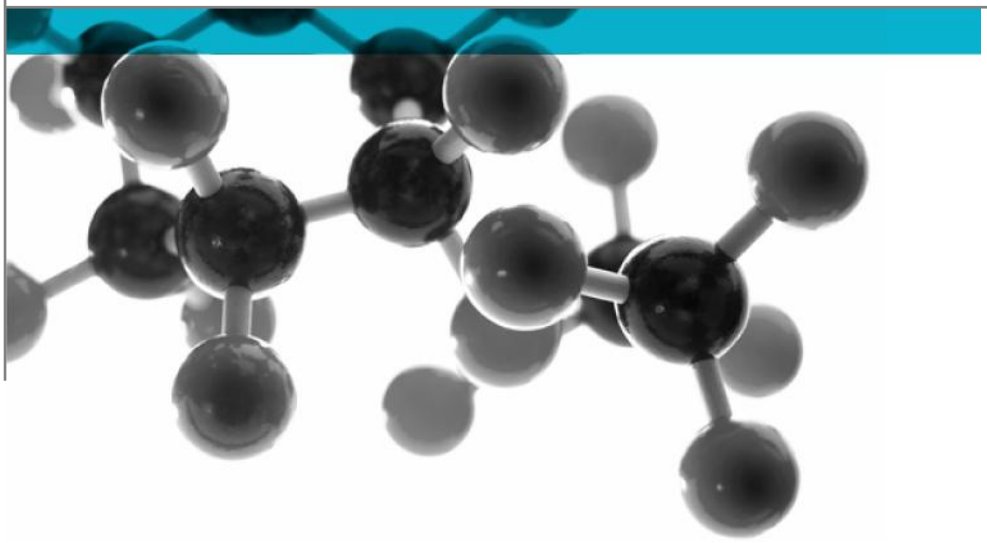
Defence Standard 02-711: Issue 3: 3rd February 2012



Determination of the Smoke Index of the Products of Combustion from Small Specimens of Materials

A Report To: CD (UK) Ltd.

Document Reference: 341073

Date: 19th June 2014

Issue No.: 1

Testing
Advising
Assuring

UKAS TESTING
0249

Executive Summary

Objective

To determine the smoke index of the products of combustion from small specimens of the following product in accordance with Defence Standard 02-711: Issue 3.

Generic Description	Product reference	Thickness	Density
A solid surface sheeting material comprised of mineral filled polymethylmethacrylate	"Corian®"	12mm	Between 1.6 and 1.8g/cm³
Please see page 5 of this test report for the full description of the product tested			

Test Sponsor

Cd (UK) Ltd., Wakefield House, Gildersome Spur, Morley, Leeds, LS27 7JZ

Summary of Test Results:

The tests provide an average smoke index of 0.04.

Date of Test

16th June 2014

Signatories

Responsible Officer C. Lester * Technical Officer	Authorised S. Deeming * Operations Manager

* For and on behalf of **Exova Warringtonfire**.

Report Issued: 19th June 2014

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Test Details

Purpose of test

The principle of the test method of Ministry of Defence Standard 02-711 (NES 711): Issue 3, Publication Date 2012 - Incorporating Naval Engineering Standard NES 711 Category 2 (Issue 2 Publication Date January 1981) 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 the test. The resulting smoke density/time curve is used to calculate the smoke index.

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.

Scope of test

The standard gives details of one of a series of test methods for determining the combustion characteristics of materials. The test explores the smoke production potential of a small sample of material under specified conditions of pyrolysis and combustion. It does not necessarily indicate the smoke production under the other thermal exposure conditions.

The test is useful for the quality control of materials and for research and development. It may be used to compare the combustion characteristic of a series of materials. Combustion characteristics tests alone are not suitable for assessing the total fire hazard of products but may be used to specify a quality of a raw material or product.

The method is based on that developed by the American National Bureau of Standards and described by Gross D, Loftus J J and Robertson A F in ASTM Special Technical Publication No 422, 166-204 (1967), but modifications have been incorporated as a result of work carried out at AMTE (Dockyard Laboratory), Portsmouth.

NOTE. STP No 422, 166-204 (1967) is superseded by ASTM E662 Specific Optical Density of smoke generated by solid materials.

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 has 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 16th June 2014 at the request of CD (UK) Ltd., the sponsor of the test.

Provision of test specimens

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

Conditioning of specimens

The specimens were received on the 21st May 2014.

The specimens were conditioned at temperatures of 23 ± 2°C and a relative humidity of 50 ± 5% RH, for 24 hours.

Specimen orientation

One of two identical faces of the specimens was exposed to the radiant heat of the test when the specimens were mounted in the test position.

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.

Generic type	A solid surface sheeting material comprised of mineral filled polymethylmethacrylate
Product reference	"Corian®"
Name of manufacturer	DuPont De Nemours
Thickness	12mm (stated by sponsor) 11.67mm (determined by **Exova Warringtonfire**)
Density	Between 1.6 and 1.8g/cm³ (stated by sponsor) 1.76g/cm³ (determined by **Exova Warringtonfire**)
Colour reference	"Glacier White"
Flame retardant details	**See Note 1 Below**
Brief description of manufacturing process	**See Note 2 Below**

Note 1: The sponsor of the test has confirmed that no flame retardant additives were utilised in the production of the product.

Note 2: The sponsor of the test has provided this information but at the specific request of the sponsor, these details have been omitted from the report and are instead held on the confidential file relating to this investigation.

Test Method

The specimen is exposed to specified standard thermal conditions of pyrolysis (smoldering conditions) and combustion (flaming conditions) in a continuous process. The changes in optical density of smoke produced when dispersed within a fixed volume of air are recorded throughout the period of the test. The results are determined from the specific optical density which is a measurement characteristic of the concentration of smoke. The specific optical density (D_s) is calculated from:

$$D_s = \frac{V}{A.L.} \log_{10} \frac{100}{T}$$

Where V = volume of the test chamber
A = exposed area of test specimen
L = path length through smoke
T = light transmittance (%)

The Smoke Index is calculated from the following equation:

$$Smoke\ Index = \frac{D_s\ at\ T70}{t} 70 + \frac{D_s\ at\ T40}{t} 40 + \frac{D_s\ at\ T10}{t} 10 + \frac{D_s\ at\ Tmin \frac{(x - Tmin)}{x - y}}{tmin}$$

Where DS at T70 = specific optical density corresponding to 70% transmittance
DS at T40 = specific optical density corresponding to 40% transmittance
DS at T10 = specific optical density corresponding to 10% transmittance

t70 = time (in minutes) from start of test to reach 70% transmittance
t40 = time (in minutes) from start of test to reach 40% transmittance
t10 = time (in minutes) from start of test to reach 10% transmittance

x = lowest transmittance reference value reached during test, ie either 70%, 40% or 10%.
Y = next lower transmittance reference value to x, either 40%, 10% or 0%.

Three specimens were tested. The specimens were partially wrapped in aluminium foil which covered the edges and back face, and placed on a backing board of non-combustible insulation board.

This assembly was then placed in a holder to allow the specimen to be held in the vertical plane parallel to the radiant heat source (25kW/m^2). The door of the chamber was closed and the recorder started. After 5 minutes test duration, the flame source was ignited to enable the pilot flames to impinge onto the surface of the specimen. The test was continued for a further 15 minutes, as required by the Standard.

Test Results

Applicability of test results

"These test results alone do not assess the fire hazard of the materials or a product made from these materials under actual fire conditions. Consequently the results of these tests alone shall not be quoted in support of claims with respect to the fire hazard of these materials or products under actual fire conditions. The results when used alone should only be used for research and development, quality control and material specification".

Results

The results can be summarised as follows:

Smoke Index	Test 1	-	0.03
	Test 2	-	0.04
	Test 3	-	0.05
Average Smoke Index		-	**0.04**

The individual test results used to calculate the smoke index values and the test observations are detailed in Appendix 1 of this report.

Conclusion

Results of tests to Ministry of Defence Standard 02-711 (NES 711): Issue 3, Publication Date 3rd February 2012 - Incorporating Naval Engineering Standard NES 711 Category 2 (Issue 2 Publication Date January 1981) (Issue 2) show the average Smoke Index of the sample tested to be **0.04.**

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.

Appendix 1

Smoke Index NES 711

Test 1

Time to 70% Trans	-	Did Not Reach
Time to 40% Trans	-	Did Not Reach
Time to 10% Trans	-	Did Not Reach
Time to Min % trans	-	20
Minimum % Trans	-	92.8
Maximum DS	-	4.28
Maximum corrected DS	-	3.12
Clear beam correction factor	-	1.2
Smoke Index	-	0.03

Test 2

Time to 70% Trans	-	Did Not Reach
Time to 40% Trans	-	Did Not Reach
Time to 10% Trans	-	Did Not Reach
Time to Min % trans	-	20
Minimum % Trans	-	91.5
Maximum DS	-	5.12
Maximum corrected DS	-	3.96
Clear beam correction factor	-	1.2
Smoke Index	-	0.04

Test 3

Time to 70% Trans	-	Did Not Reach
Time to 40% Trans	-	Did Not Reach
Time to 10% Trans	-	Did Not Reach
Time to Min % trans	-	20
Minimum % Trans	-	91.3
Maximum DS	-	5.23
Maximum corrected DS	-	4.65
Clear beam correction factor	-	0.6
Smoke Index	-	0.05

Average specimen thickness	-	11.71 mm

Revision History

Issue No :	Issue Date:
Revised By:	Approved By:
Reason for Revision:	

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