

TEST REPORT

WARRES NO. L12349

NAVAL ENGINEERING STANDARD 713: ISSUE 3
DETERMINATION OF THE TOXICITY INDEX
OF THE PRODUCTS OF COMBUSTION FROM SMALL
SPECIMENS OF MATERIALS

SPONSORED BY

SMYTH INTERNATIONAL B.V.
Edisonstraat 9c, 2723 RS Zoetermeer, The Netherlands



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PURPOSE OF TEST

To determine the performance of specimens of a material when they are subjected to the conditions of test specified in Naval Engineering Standard 713, Issue 3 "Determination of the toxicity index of the products of combustion from small specimens of materials".

SCOPE OF TEST

NES 713: Issue 3 specifies a test method for determining the combustion characteristics of a series of materials. The test explores the toxicity of the products of combustion in terms of small molecular species arising when a small sample of material is completely burnt in excess air under specified conditions of the test. The test does not necessarily determine the total toxicity of all constituents of the products of combustion under actual fire conditions.

The test may be used to compare the particular combustion characteristics of a series of materials, both natural and synthetic types. Combustion characteristics tests alone are not suitable for assessing the total fire hazard of products under actual fire conditions.

DEFINITION

Naval Engineering Standard 713 defines Toxicity Index as follows:-

The numeric summation of the toxicity factors of selected gases produced by complete combustion of the material in air under the conditions specified. The toxicity factors are derived from the calculated quantity of each gas that would be produced when 100g of the material is burnt in air in a volume of 1m³ and the resulting concentration fatal to man at a 30 minute exposure time. An index of 1 for a given volume will, on average, bring about death in 30 minutes.

These values are given the symbol Cf in this report and are taken from Appendix A, Paragraph 3 of NES 713 Issue 3.

DESCRIPTION OF TEST SPECIMENS

The description of the specimens given below has been prepared from information provided by the sponsor of the test.

The product was a 3.5mm thick coated laminate referenced "Colour phenolic laminate".

The sponsor requested that details of composition of the product should not be included in the test report, however, composition details have been provided and are held in our confidential file relating to this investigation.

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

CONDITIONING OF SPECIMENS

The specimens were received on 17 March 1993.

Prior to the test the specimens were conditioned at a temperature of $23 \pm 2^{\circ}\text{C}$ and $50 \pm 5\%$ for 24 hours.

DATE OF TEST

The test was performed on 2 April 1993.

TEST PROCEDURE

The test was performed in accordance with the procedure specified in NES 713: Issue 3 and this report should be read in conjunction with that Standard.

TEST RESULTS

The test results relate only to the behaviour of the specimens under the particular conditions of test; they are not intended to be the sole criterion for assessing the potential 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 of the product may significantly affect the performance during the test and may therefore invalidate the test results. Care should be taken to ensure that any product which is supplied or used is fully represented by the specimens which were tested.

This test result alone does not assess the fire hazard of the material, or a product made from this material, under actual fire conditions. Consequently, the results of this test alone are not to be quoted in support of claims with respect to the fire hazard of the material or product under actual fire conditions. The results when used alone are only to be used for research and development, quality control and material specifications.

Toxicity index per 100g material:-

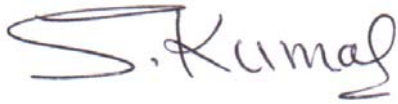
Test Run 1	1.80
Test Run 2	2.19
Test Run 3	2.08
Average	2.02

Tables 1, 2 and 3 give the individual toxicity index for all gases found on each test run and also the total toxicity index. Figures in 0 in column 3 of the tables are for the concentration from the background determination.

CONCLUSION

The test results show a toxicity index of 2.02.

Responsible Officer



S. Kumar
Manager - Standard Testing

Approved



pp R. J. SHAW
Director
for and on behalf of
WARRINGTON FIRE RESEARCH CENTRE

Date of issue: 6 May 1993

Test No: 1

Test Mass: 5.82844g

Residue Mass: 3.91364g

TABLE 1

GAS	ANALYSIS METHOD	LIMIT OF DETECTION (ppm)	CONCENTRATION OBSERVED ppm (Background)	Co	Cf	Co/Cf
Carbon Dioxide	CIT	2.0	11000 (6900)	70345	10000	0.70
Carbon Monoxide	CIT	1.0	30 (3)	463	4000	0.12
Phenol	CIT	5.0	0	0	250	0.00
Phosgene	CIT	1.0	0	0	25	0.00
Ammonia	CIT	1.0	0	0	750	0.00
Hydrogen Sulphide	CIT	0.5	0	0	750	0.00
Sulphur Dioxide	CIT	0.1	16	274	400	0.69
Formaldehyde	CIT	0.5	0	0	500	0.00
Hydrogen Chloride	CIT	0.2	0	0	500	0.00
Hydrogen Bromide* ³	CIT	-	0	0	150	0.00
Hydrogen Cyanide	CIT	0.2	0	0	150	0.00
Nitrogen Oxides	CIT	0.1	5 (3)	34	250	0.14
Hydrogen Fluoride	CIT	1.0	0	0	100	0.00
Acrylonitrile	CIT	0.5	3.5	60	400	0.15

Toxicity Index =1.80

Notes

1. CIT = Colorimetric Indicator Tube
2. A concentration of zero is assumed for a CIT showing no reaction.
3. The absence of hydrogen chloride may be taken as a reliable indication of the absence of hydrogen bromide.
4. Figures in () in column 3 of the tables are for the concentration from the background determination.

Test No: 2

Test Mass: 6.42268g

Residue Mass: 4.27125g

TABLE 2

GAS	ANALYSIS METHOD	LIMIT OF DETECTION (ppm)	CONCENTRATION OBSERVED ppm (Background)	Co	Cf	Co/Cf
Carbon Dioxide	CIT	2.0	11500 (6900)	71621	10000	0.71
Carbon Monoxide	CIT	1.0	40 (3)	576	4000	0.14
Phenol	CIT	5.0	0	0	250	0.00
Phosgene	CIT	1.0	0	0	25	0.00
Ammonia	CIT	1.0	0	0	750	0.00
Hydrogen Sulphide	CIT	0.5	0	0	750	0.00
Sulphur Dioxide	CIT	0.1	25	389	400	0.97
Formaldehyde	CIT	0.5	0	0	500	0.00
Hydrogen Chloride	CIT	0.2	0	0	500	0.00
Hydrogen Bromide ⁽³⁾	CIT		0	0	150	0.00
Hydrogen Cyanide	CIT	0.2	0	0	150	0.00
Nitrogen Oxides	CIT	0.1	6 (3)	47	250	0.19
Hydrogen Fluoride	CIT	1.0	0	0	100	0.00
Acrylonitrile	CIT	0.5	4.5	70	400	0.18

Toxicity Index =2.19

Notes

1. CIT = Colorimetric Indicator Tube
2. A concentration of zero is assumed for a CIT showing no reaction.
3. The absence of hydrogen chloride may be taken as a reliable indication of the absence of hydrogen bromide.
4. Figures in () in column 3 of the tables are for the concentration from the background determination.

Test No: 3

Test Mass: 5.53984g

Residue Mass: 3.65333g

GAS	ANALYSIS METHOD	LIMIT OF DETECTION (ppm)	CONCENTRATION OBSERVED ppm (Background)	Co	Cf	Co/Cf
Carbon Dioxide	CIT	2.0	11250 (6900)	78522	10000	0.79
Carbon Monoxide	CIT	1.0	30 (3)	487	4000	0.12
Phenol	CIT	5.0	0	0	250	0.00
Phosgene	CIT	1.0	0	0	25	0.00
Ammonia	CIT	1.0	0	0	750	0.00
Hydrogen Sulphide	CIT	0.5	0	0	750	0.00
Sulphur Dioxide	CIT	0.1	15	271	400	0.68
Formaldehyde	CIT	0.5	0	0	500	0.00
Hydrogen Chloride	CIT	0.2	0	0	500	0.00
Hydrogen Bromide ⁽³⁾	CIT		0	0	150	0.00
Hydrogen Cyanide	CIT	0.2	0	0	150	0.00
Nitrogen Oxides	CIT	0.1	6 (3)	54	250	0.22
Hydrogen Fluoride	CIT	1.0	0	0	100	0.00
Acrylonitrile	CIT	0.5	6	108	400	0.27

Toxicity Index =2.08

Notes

1. CIT = Colorimetric Indicator Tube
2. A concentration of zero is assumed for a CIT showing no reaction.
3. The absence of hydrogen chloride may be taken as a reliable indication of the absence of hydrogen bromide.
4. Figures in () in column 3 of the tables are for the concentration from the background determination.