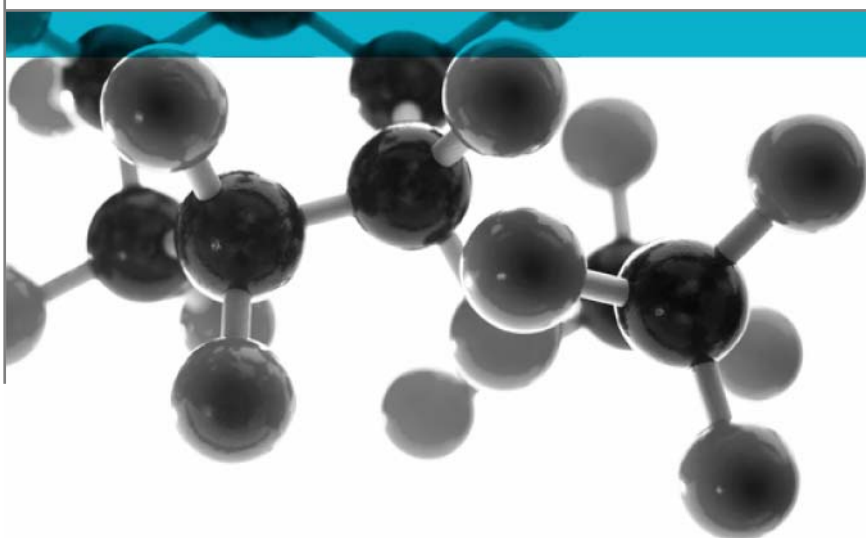


NF X 10-702: Parts 1, 2, 3, 4 & 5



Fire test methods, Determination of the opacity of smoke in a non-renewed atmosphere.

A Report To: Xiamen Wain Electrical Co., Ltd

Document Reference: 308703

Date: 2nd September 2011

Issue No.: 1

Page 1

**Testing
Advising
Assuring**



0249

Executive Summary

Objective To determine the performance of the following product when tested in accordance with NF X 10-702:

| Generic Description | Product reference | Thickness | Density |
|---|---|------------|-----------------------|
| Fibre glass reinforced polycarbonate material | Material used to produce "Heavy Duty Connector" | 6mm | 1.33g/cm ³ |
| Individual components used to manufacture composite: | | | |
| Polycarbonate | "PC" | Not stated | Not stated |
| GRP | "GF20" | Not stated | Not stated |
| Please see page 5 of this test report for the full description of the product tested | | | |

Test Sponsor Xiamen Wain Electrical Co., Ltd, 759-3 Chengbei Industrial Zone, Chaoyuan Road, Tongan District, Xiamen, China



Summary of Test Results: The average values of VOS₄ and Dmax for the three specimens tested in the flaming mode were

VOS₄ = 141.2

Dmax = 523

Date of Test 14th July 2011

Signatories

| | |
|---|--|
|  |  |
| Responsible Officer B. Dean * Fire Scientist | Authorised T. Mort* Senior Technical Officer |

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

Report Issued: 2nd September 2011

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Test Details

Introduction

The principle of the test method of NF X 10-702 "Determination Of The Opacity Of Smoke In A Non-renewed Atmosphere" 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. 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.

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 14th July 2011 at the request of Xiamen Wain Electrical Co., 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 20th June 2011.

The specimens were conditioned to the requirements of NF X 10-702, i.e. conditioned to equilibrium weight at $23 \pm 2^\circ\text{C}$ and $50 \pm 5\%$ RH for a period of at least 48 hours before testing.

Exposed face

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.

Test procedure

The test was performed in accordance with the procedure specified in NF X 10-702 and this report should be read in conjunction with the following standards:

Part 1 – Description of the testing device and method for control and adjustment of the testing device.

Part 2 – Test method applicable to the materials not covered by parts 3, 4, 5 and subsequent parts.

Part 3 – Test method for materials used in upholstered furniture.

Part 4 – Test method for materials used as wall linings.

Part 5 – Test method for materials used in wall panels or interior panes.

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 | | Fibre glass reinforced polycarbonate material |
| Product reference | | Material used to produce "Heavy Duty Connector" |
| Name of manufacturer | | Xiamen Wain Electrical Co., Ltd |
| Colour reference | | "Grey" |
| Overall thickness | | 6mm (stated by sponsor) 5.96mm (determined by Exova Warringtonfire) |
| Overall density | | 1.36g/cm ³ (stated by sponsor) 1.33g/cm ³ (determined by Exova Warringtonfire) |
| Polycarbonate | Generic type | Polycarbonate (PC) |
| | Product reference | "PC" |
| | Name of manufacturer | See Note 1 below |
| | Trade name of flame retardant | See Note 1 below |
| | Generic type of flame retardant | Non-halogen flame retardant See Note 1 below |
| | Amount of flame retardant | 0.5 to 5% |
| Glass fibre | Type | Fibrous glass |
| | Product reference | "CAS Number - 65997-17-3" |
| | Name of manufacturer | See Note 1 below |
| Resin to glass ratio (by weight) | | 4 : 1 |
| Percentage glass reinforcement (by weight) | | 20% |
| Brief description of manufacturing process | | Design mould → Injection moulding → Deburring → Semi-finished products (reinforced PC body in practice) |

Note 1. The sponsor of the test was unable to provide this, or further information, as their supplier is unwilling to provide this information.

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 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 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.

Initial test results

One specimen was tested in the flaming mode and one specimen in the non-flaming mode to determine the mode which gives the highest VOS₄ and IFp values.

The results are given below:

| | | |
|-----------------------------------|---|-------|
| Flaming Mode VOS ₄ | = | 160.0 |
| Non-Flaming Mode VOS ₄ | = | 0.0 |

In accordance with the requirements of STM-S-001, 6.2.1: Technical Specification of Special Conditions Relevant to the SNCF and RATP, the partial smoke index (IFp) was also calculated in the case of both the flaming mode and the non-flaming mode utilising the equation shown below:

$$IFp = \frac{Dm}{100} + \frac{VOS_4}{30}$$

NB. In accordance with STM-S-001, 6.2.2, the maximum specific optical density Dm following correction of the neutral filter is limited to 792.

The following results were obtained:

| | | |
|----------------------|---|-------|
| Flaming Mode IFp | = | 10.57 |
| Non-Flaming Mode IFp | = | 1.33 |

The specimen tested in the flaming mode gave the highest VOS₄ and IFp values, therefore, two further specimens were tested and the results of the three specimens tested in the flaming mode are presented in Appendix 1.

Average test results

The average values of VOS₄ and Dmax for the three specimens tested in the flaming mode were:

| | | |
|------------------------|----------|--------------|
| VOS₄ | = | 141.2 |
| Dmax | = | 523 |

VOS₄ is the smoke value during the first four minutes of the tests and is calculated as follows:

$$VOS_4 = D_1 + D_2 + D_3 + \frac{D_4}{2}$$

Where D₁, D₂, D₃ and D₄ are the values of specific optical density recorded at the 1st, 2nd, 3rd and 4th minutes respectively.

Dmax deviation The maximum difference between two values of Dmax was found to be 11.

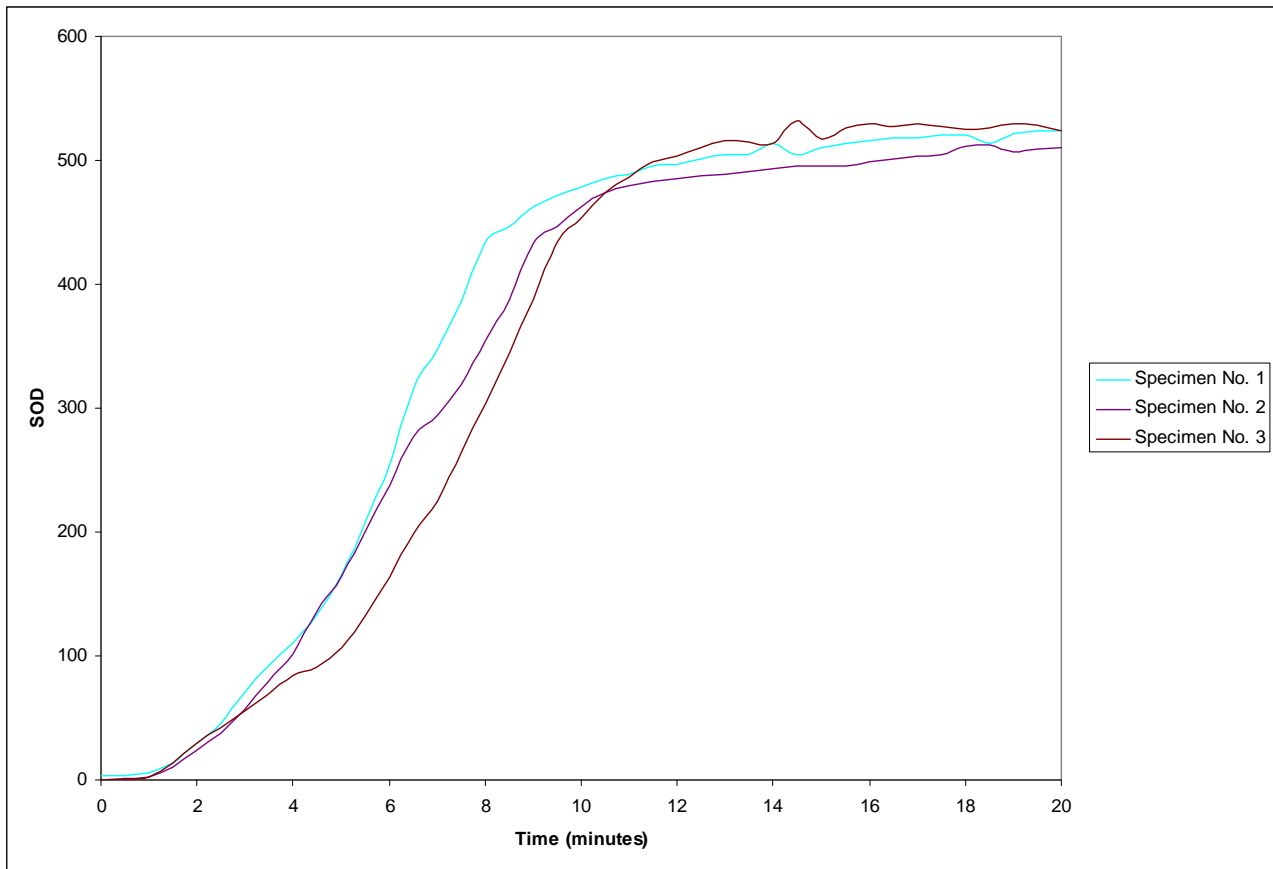
Validity The specification and interpretation of fire test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. For these reasons it is recommended that the relevance of test reports over five years old should be considered by the user. The 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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Table 1

| TIME: mins:secs | Specific Optical Density (D_s) | | |
|--------------------|------------------------------------|------------|------------|
| | Flaming Mode | | |
| | Specimen 1 | Specimen 2 | Specimen 3 |
| 0:00 | 3 | 0 | 0 |
| 0:30 | 3 | 0 | 1 |
| 1:00 | 6 | 2 | 2 |
| 1:30 | 14 | 10 | 14 |
| 2:00 | 29 | 24 | 30 |
| 2:30 | 46 | 38 | 42 |
| 3:00 | 70 | 57 | 56 |
| 3:30 | 92 | 79 | 69 |
| 4:00 | 110 | 101 | 84 |
| 4:30 | 133 | 135 | 91 |
| 5:00 | 166 | 165 | 107 |
| 5:30 | 209 | 201 | 133 |
| 6:00 | 255 | 238 | 164 |
| 6:30 | 316 | 277 | 199 |
| 7:00 | 348 | 294 | 225 |
| 7:30 | 386 | 319 | 265 |
| 8:00 | 434 | 355 | 303 |
| 8:30 | 447 | 388 | 344 |
| 9:00 | 462 | 433 | 387 |
| 9:30 | 472 | 447 | 434 |
| 10:00 | 478 | 462 | 453 |
| 10:30 | 485 | 474 | 474 |
| 11:00 | 489 | 479 | 486 |
| 11:30 | 495 | 483 | 499 |
| 12:00 | 497 | 485 | 503 |
| 12:30 | 501 | 488 | 510 |
| 13:00 | 504 | 489 | 516 |
| 13:30 | 505 | 491 | 515 |
| 14:00 | 514 | 493 | 514 |
| 14:30 | 504 | 495 | 532 |
| 15:00 | 510 | 496 | 517 |
| 15:30 | 514 | 496 | 526 |
| 16:00 | 516 | 499 | 530 |
| 16:30 | 518 | 501 | 527 |
| 17:00 | 518 | 503 | 529 |
| 17:30 | 520 | 505 | 527 |
| 18:00 | 521 | 511 | 525 |
| 18:30 | 514 | 513 | 526 |
| 19:00 | 522 | 507 | 529 |
| 19:30 | 524 | 509 | 528 |
| 20:00 | 524 | 510 | 524 |

Graph of Specimens Tested in the Flaming Mode



Observations

| Steady state conditions | | | | | | |
|---|--|----------|---------------|----------------|--------------------------|---|
| Back wall temperature | Within tolerance | | | | | |
| ND2 filter correction factor (for use when necessary) | N/A | | | | | |
| Furnace Voltage (mV) | 9.24 | | | | | |
| Specimen No. | Test Mode | Mass (g) | Mass Loss (%) | Thickness (mm) | Time to reach $D_s = 16$ | Observations |
| 1 | 25kW/m ² in the presence of a pilot flame | 44.44 | 68.2 | 5.81 | 1:35 | <p>In the case of each specimen, light coloured smoke was produced from the early stages of the test.</p> <p>In the case of each specimen, ignition of the specimen occurred at approximately ten seconds test duration.</p> <p>In the case of specimen numbers one, two and three; the flaming ceased at approximately eight minutes fifty seconds, eight minutes thirty-five seconds and nine minutes twenty seconds test duration.</p> <p>In the case of each specimen, the specimen expanded such that the surface of the specimen had risen by approximately 10mm.</p> |
| 2 | | 45.49 | 62.7 | 6.05 | 1:44 | |
| 3 | | 47.20 | 53.3 | 6.04 | 1:37 | |
| 4 | 25kW/m ² in the absence of a pilot flame | 45.45 | 27.0 | 5.97 | 8:37 | <p>Light coloured smoke was produced from the early stages of the test.</p> <p>The specimen expanded such that the surface of the specimen had risen by approximately 10mm.</p> |

Revision History

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

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

