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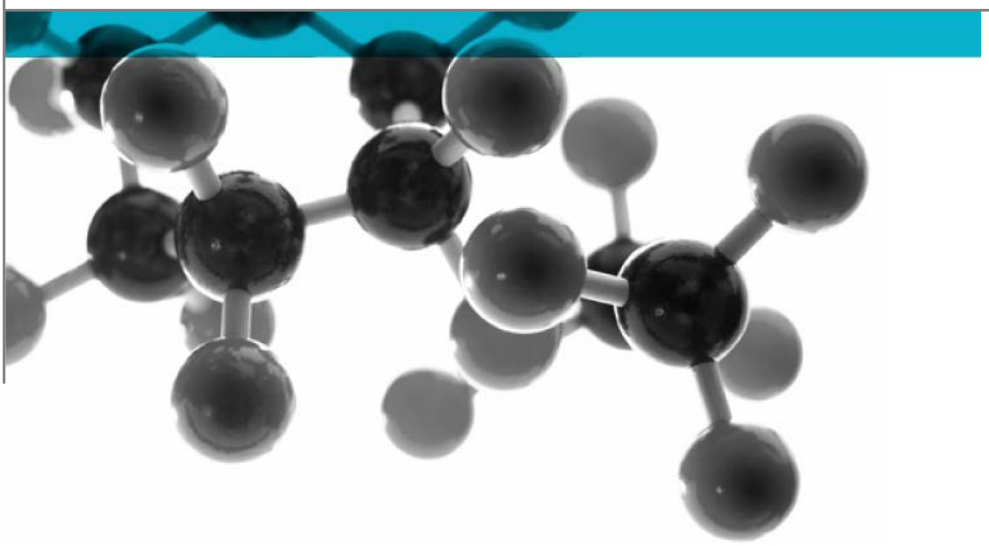
# BS EN ISO 4589-2: 1999



**Determination of Burning Behaviour By Oxygen Index**

A Report To: Shore Auto Rubber Exports PVT. Ltd.

Document Reference: 397434

**Date:** 18th May 2018

**Issue No.: 2**



Testing
Advising
Assuring



0249

# Executive Summary

**Objective** To determine the oxygen index of the following product when tested in accordance with BS EN ISO 4589-2: 1999

| Generic Description | Product reference | Thickness | Density / specific gravity / weight per unit area |
|---|---|---|---|
| Silicone hose with three layers of fabric reinforcement | No specific reference assigned | 7.24mm * | 1.25g/cm$^3$ * |
| **Individual components used to manufacture composite:** | | | |
| Rubber | "58170C" | Unwilling to provide | 1.25 |
| Polyester fabric (Embedded in rubber) | "145 +/- 5 grams per square meter" | 3 x 0.6mm | Unwilling to provide |
| *** Determined by Exova Warringtonfire** | | | |
| **Please see page 5 of this test report for the full description of the product tested** | | | |

**Test Sponsor** Shore Auto Rubber Exports PVT. Ltd., Gat No. 7, Post-Chimbli, Taluka – Khed, Pune 410501, India

**Test Results:** **When tested in accordance with the procedure specified in BS EN ISO 4589 - 2: 1999 the material shows an oxygen index of 33.8%**

**Date of Test** 2nd May 2018

**Reason for Revision** This document replaces issue 1 (dated 11th May 2018) of the same number which has been withdrawn. The sponsor has requested that a number of changes are made to the product description; the sponsor has provided the correct details and these are detailed in this issue 2 test report.

# Signatories

Responsible Officer
T. Mort *
Senior Technical Officer

Authorised
S. Deeming *
Business Unit Head

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

Report Issued: 18th May 2018

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# Test Details

**Purpose of test**

To assess the performance of a material when it is tested in accordance with BS EN ISO 4589 - 2: 1999 "Plastics - Determination of burning behaviour by oxygen index".

The test was performed in accordance with the procedure specified in BS EN ISO 4589-2:1999 - Plastics - Determination of burning behaviour by oxygen index, and this report should be read in conjunction with that BS EN ISO Standard.

**Scope of test**

BS EN ISO 4589 – 2: 1999 specifies test methods for determining the minimum concentration of oxygen, in a mixture with nitrogen that will support combustion of small vertical test specimens under specified test conditions. The results are defined as oxygen index values.

**Instruction to test**

The test was conducted on the 2nd May 2018 at the request of Shore Auto Rubber Exports Pvt., 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**

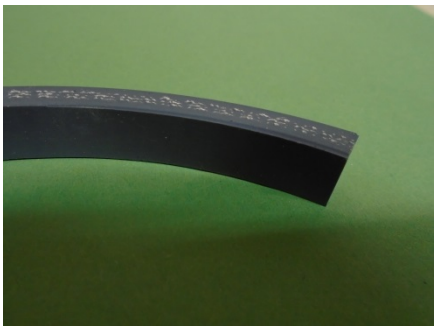
The specimens were received on the 14th March 2018.

Prior to test the specimens were conditioned to equilibrium with air at 23 ± 2$^0$C and a relative humidity of 50 ± 5 per cent for at least 88 hours.

**Condition of specimen edges**

Layered product, with no layer covering the edges

**Photograph of specimen**



**Method of testing**

Specimens measuring nominally 80mm long by 10.5mm wide by 7.49mm thick were used. The thickness of the specimens used conforms with the requirements specified in Table 2 of the standard for test specimen Form III for sheet materials, as received. The specimens were tested in accordance with the test procedure specified in Clause 8 of the Standard using the Concept Equipment Limiting Oxygen Index apparatus.

# Description of Test Specimens

The description of the system given below has been prepared from information provided by the sponsor of the test. This information has not been independently verified by **Exova Warringtonfire.**

All values quoted are nominal, unless tolerances are given.

| | | |
|---|---|---|
| General description | | Silicone hose with three layers of fabric reinforcement |
| Product reference of overall composite | | No specific reference assigned |
| Name of manufacturer of overall composite | | Shore Auto Rubber Exports Pvt. Ltd. |
| Thickness of overall composite | | 6 ± 1mm (up to 7.5mm at the overlap) (stated by sponsor)<br>7.24mm (determined by **Exova Warringtonfire**) |
| Specific gravity | | 1.25 (stated by sponsor) |
| Density overall composite | | 1.25g/cm$^3$ (determined by **Exova Warringtonfire**) |
| Rubber | Generic type | Silicone |
| | Product reference | "58170C" |
| | Name of manufacturer/ further details | Shore Auto Rubber Exports Pvt. Ltd. is compounding the rubber in house. The raw material is bought out along with the pigment, accelerators and fillers. |
| | Thickness | **See Note 1 Below** |
| | Specific gravity | 1.25 |
| | Colour reference | "Grey" |
| | Flame retardant details | **See Note 2 Below** |
| Polyester fabric (Embedded in rubber) | Generic type | Polyester fabric |
| | Product reference | "145 +/- 5 grams per square meter" |
| | Name of manufacturer | **See Note 1 Below** |
| | Colour reference | "White" |
| | Number of layers | 3 |
| | Thickness per layer | 0.6 ± 0.1mm |
| | Density / weight per unit area per layer | **See Note 1 Below** |
| | Type of weave / cell dimensions | **See Note 1 Below** |
| | Flame retardant details | **See Note 3 Below** |
| Brief description of manufacturing process | | The Inner Rubber Liner, Fabric Plies and Outer Layer, all 3 are calendared and wrapped on the tool. Following this, they are cured, extracted from the mandrel, and then post-cured. |

**Note 1: The sponsor was unwilling to provide this information.**

**Note 2: The sponsor was unable to provide this information as they are not the manufacturer of the raw material. The base raw material used is FR 8775U from Bluestar Silicones. Bluestar Silicones adds the flame retardants and the sponsor is not aware of the flame retardants contained within the base raw material purchased. The sponsor does the compounding inhouse by adding pigments, accelerators and other fillers.**

**Note 3: The sponsor of the test has confirmed that no flame retardant additives were utilised in the production of the component.**

# Test Results

**Applicability of test results**

The test results relate only to the behaviour of the specimens under the particular conditions of this test, they should not be used to infer the fire hazards of the material in other forms or under other fire conditions.

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 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.

In accordance with Sections 8 and 9 of the Standard, the results obtained are given in appendix A.

**Conclusion**

**When tested in accordance with the procedure specified in BS EN ISO 4589 - 2: 1999 the material shows an oxygen index of 33.8%**

**Validity**

The specification and interpretation of fire test methods is 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 A**

## MATERIAL TESTED

### Part 1 - Preliminary oxygen concentration

| | | | | |
|---|---|---|---|---|
| Oxygen Concentration (%) | 36.0 | 32.0 | 34.0 | 33.0 |
| Burning Period (s) | >180 | 41.5 | >180 | 37.5 |
| Length Burnt (mm) | 30 | 10 | 30 | 10 |
| Response ('X' or 'O') | X | O | X | O |

### Part 2 - Determination of the oxygen index value

| $N_T$ series measurements | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $N_L$ series measurements (8.6.1 & 8.6.2) | | | | | | | (8.6.3) | | | | $C_f$ |
| Oxygen Concentration (%) | 33.0 | 33.2 | 33.4 | 33.6 | 33.8 | | 33.8 | 33.6 | 33.8 | 34.0 | 33.8 |
| Burning Period (s) | 41.0 | 61.0 | 39.5 | 81.5 | >180 | | >180 | 121.5 | 153.0 | >180 | >180 |
| Length Burnt (mm) | 10 | 10 | 10 | 10 | 20 | | 20 | 20 | 20 | 20 | 30 |
| Response ("X" or "O") | O | O | O | O | X | | X | O | O | X | X |
| Column (2,3,4 or 5) | 5 | | | | | | Row (1 to 16) | 4 | | | |
| k value from table 4 | -0.14 | | | | | | | | | | |

Hence k = -0.14

Oxygen index value OI = $C_F$ + kd
d is oxygen concentration increment

OI = 33.8 + ( x 0.2)

Oxygen index value = 33.8 (to one decimal place for reporting)

= 33.77 (to two decimal places, for calculation of and verification of *d* as required in Part 3)

Standard Deviation = 0.15 Therefore, the test result is valid.

### Part 3 – Burning characteristics of the material

No relevant ancillary characteristics or behaviour such as, charring, dripping, severe shrinkage, erratic burning, or after-glow were observed during the test.

# Revision History

| | |
|---|---|
| Issue No : 2 | Issue Date: 18th May 2018 |
| Revised By: T.Mort | Approved By: B. Dean |
| Reason for Revision: This document replaces issue 1 (dated 11th May 2018) of the same number which has been withdrawn. The sponsor has requested that a number of changes are made to the product description, the sponsor has provided the correct details and these are detailed in this issue 2 test report. | |

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| Reason for Revision: | |