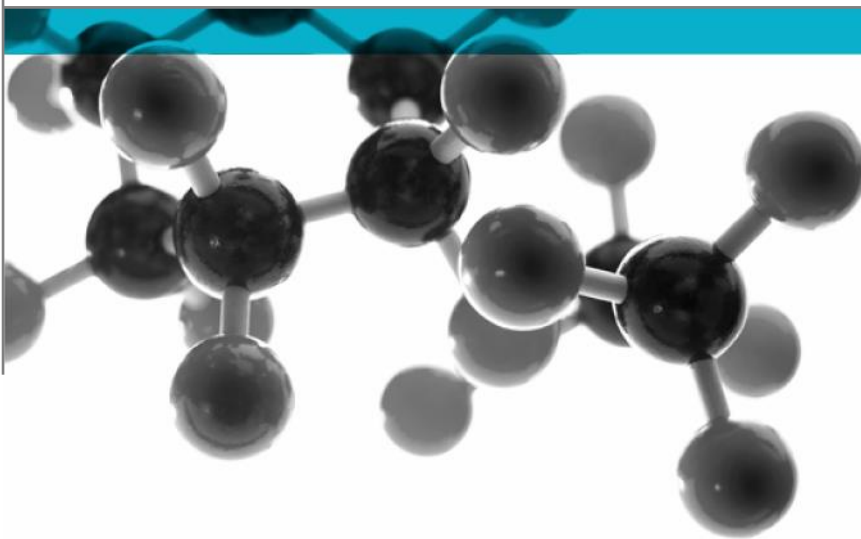


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# BS 476 Part 3: 2004



## External Fire Exposure Roof Test

A Report To: Tuff Waterproofing Ltd

Document Reference: 346191

Date: 15<sup>th</sup> January 2015

Issue No.: 3

Page 1

Testing  
Advising  
Assuring



## Executive Summary

**Objective** To determine the fire performance of the following product when tested in accordance with BS 476: Part 3: 2004

Generic Description	Product reference	Thickness	Weight per unit area or density
A composite roof sample consisting of a GRP moulded sheet applied to a oriented strand board	"TuffStuff GRP Waterproofing System"	20mm*	14.31kg/m <sup>2</sup> *
<b>Individual components used to manufacture composite:</b>			
Chippings	"TuffStuff Granulated Slate Coating"	0.25mm - 0.5mm	0.05g/cm <sup>2</sup> - 0.06g/cm <sup>2</sup>
Coating	"TuffStuff GRP Roofing Resin"	Not stated	1.1g/cm <sup>2</sup>
Moulded sheet			
• Gel coating	"TuffStuff Roofing Top Coat"	Not stated	0.5kg/m <sup>2</sup>
• Resin	"TuffStuff GRP Roofing Resin"	Not stated	1.1g/cm <sup>2</sup>
• Glass reinforcement	"450g/m <sup>2</sup> Chopped Strand Mat"	Not stated	450g/m <sup>2</sup>
Oriented strand board	"18mm Oriented Strand Board 3 T&G Decking"	18mm	11.7kg/m <sup>2</sup>
*determined by <b>Exova Warringtonfire</b>			
<b>Please see page 5,6 and 7 of this test report for the full description of the product tested</b>			

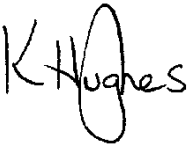

**Test Sponsor** Tuff Waterproofing Ltd, Unit 5, First Avenue, Aviation Way, Sherburn-in-Elmet, North Yorkshire, LS25 6PD

**Test Results** **In Accordance With The Designations Defined In BS 476: Part 3: 2004 The Test Specimens Are In Category "EXT. F. AA".**

**Date of Test:** 31<sup>st</sup> October 2014

**Reason for revision** This document replaces Issue 2 (dated 14<sup>th</sup> January 2015) of the same number which has been withdrawn. At the sponsors request the catalyst details on page 6 have been amended.

## Signatories

	
Responsible Officer K. Hughes * Technical Officer	Authorised S. Deeming* Operations Manager

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

Report Issued: 15<sup>th</sup> January 2015

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## Test Details

<b>Purpose of test</b>	<p>To determine the performance of specimens of a roof construction when they are subjected to the conditions of the test specified in BS 476: Part 3: 2004, "British Standard Specification for Fire Tests on Building Materials and Structures - External Fire Exposure Roof Tests".</p> <p>The test was performed in accordance with the test procedures specified in BS 476: Part 3: 2004 and this report should be read in conjunction with that British Standard.</p>
<b>Scope of test</b>	<p>The tests are designed to enable measurement of:</p> <ul style="list-style-type: none"> <li>a) capacity of a representative section of a roof to resist penetration by fire when the external surface is exposed to radiation and flame; and</li> <li>b) distance of the spread of flame on the outer surface of the roof covering under certain conditions.</li> </ul> <p>Roofs are graded according to the angle at which they are tested, the time for which they resist penetration by fire and the distance of superficial spread of flame on their external surface.</p> <p>The test specimens are tested at an angle of 45° to the horizontal (sloping position) unless the roof construction is used at an angle of less than 10° to the horizontal, in which case the specimens are tested horizontally (flat position).</p>
<b>Fire test study group/EGOLF</b>	<p>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.</p>
<b>Instruction to test</b>	<p>The test was conducted on the 31<sup>st</sup> October 2014 at the request of a representative of the sponsor of the test.</p>
<b>Provision of test specimens</b>	<p>The specimens were supplied by the sponsor of the test. <b>Exova Warringtonfire</b> was not involved in any selection or sampling procedure.</p>
<b>Conditioning of specimens</b>	<p>The specimens were received on the 3<sup>rd</sup> October 2014. Prior to testing the specimens were conditioned to equilibrium in an atmosphere having a temperature of 23 ±2°C and a relative humidity of 45 to 55%.</p>
<b>Orientation of specimens</b>	<p>The specimens were tested in the flat position.</p>

## 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		A composite roof sample consisting of a GRP moulded sheet applied to a oriented strand board
Product reference		"TuffStuff GRP Waterproofing System"
Name of manufacturer		<b>See Note 1 below</b>
Overall thickness of composite		20mm (determined by <b>Exova Warringtonfire</b> )
Weight per unit area of composite		14.31kg/m <sup>2</sup> (determined by <b>Exova Warringtonfire</b> )
Chippings	Generic type	Granulated slate
	Product reference	"TuffStuff Granulated Slate Coating"
	Name of manufacturer	<b>See Note 1 below</b>
	Thickness	0.25mm - 0.5mm
	Weight per unit area	0.05g/cm <sup>2</sup> - 0.06g/cm <sup>2</sup>
	Colour reference	"Grey"
	Flame retardant details	<b>See Note 1 below</b>
Coating	Generic type	Unsaturated polyester resin in styrene monomer
	Product reference	"TuffStuff GRP Roofing Resin"
	Name of manufacturer	<b>See Note 1 below</b>
	Colour reference	<b>See Note 1 below</b>
	Number of coats	<b>See Note 1 below</b>
	Application rate per coat	1.1g/cm <sup>2</sup>
	Application method	<b>See Note 1 below</b>
	Curing process per coat	<b>See Note 1 below</b>
Flame retardant details	<b>See Note 1 below</b>	

Continued on next page

Moulded sheet	Product reference		<b>See Note 1 below</b>	
	Name of manufacturer		<b>See Note 1 below</b>	
	Colour reference		<b>See Note 1 below</b>	
	Thickness		<b>See Note 1 below</b>	
	Weight per unit area		<b>See Note 1 below</b>	
	Gel coating	Generic type	Unsaturated polyester resin in styrene monomer	
		Product reference	"TuffStuff Roofing Top Coat"	
		Name of manufacturer	<b>See Note 1 below</b>	
		Colour reference	"Grey"	
		Application rate	0.5kg/m <sup>2</sup>	
		Application method	Roller applied	
	Resin	Flame retardant details	<b>See Note 1 below</b>	
		Generic type	Unsaturated polyester resin in styrene monomer	
		Product reference	"TuffStuff GRP Roofing Resin"	
		Name of manufacturer	<b>See Note 1 below</b>	
		Weight per unit area	1.1g/cm <sup>2</sup>	
	Glass reinforcement	Flame retardant details	<b>See Note 1 below</b>	
		Generic type	E-glass	
		Product reference	"450g/m <sup>2</sup> Chopped Strand Mat"	
		Number of layers	One	
		Weight per unit area of each layer	450g/m <sup>2</sup>	
		Configuration of glass reinforcement	Chopped strand mat	
	Name of manufacturer		E-Glass CSM	
	Resin to glass ratio (by weight)		3:1	
	Percentage glass reinforcement (by weight)		25%	
	Curing process (duration and temperature)		2% MEKP catalyst + cobalt	
Oriented strand board	Generic type	<b>See Note 1 below</b>		
	Product reference	"18mm Oriented Strand Board 3 T&G Decking"		
	Thickness	18mm		
	Weight per unit area	11.7kg/m <sup>2</sup>		
	Name of supplier	Norbord		
	Flame retardant details	<b>See Note 2 Below</b>		

Continued on next page

Brief description of manufacturing process	Timber OSB3 18mm T & G substrate panel. Single laminate consisting of 450g/m <sup>2</sup> chopped strand mat, unsaturated polyester resin in styrene monomer at 3:1 resin to CSM ratio cured with MEKP catalyst at 2%. 0.5mm polyester topcoat applied by roller, cured with MEKP catalyst at 2%. Slate chippings scattered on to wet top coat by hand.
--------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

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

**Note 2: The sponsor of the test has confirmed that no flame retardant additives were utilised in the production of the component.**

The description of the specimens as given above is not as detailed as would usually be the case for descriptions included in **Exova Warringtonfire** test reports and the description may not fully comply with the requirements of the test standard. In all other respects however the tests were conducted fully in accordance with the requirements of the test standard and the test results are valid.

## Test Results

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### Results

The test results relate only to the behaviour of the test specimens of the construction under the particular conditions of test, they are not intended to be the sole criterion for assessing the potential fire hazard of the construction in use.

The test results relate only to the specimens of the roof construction which were tested. Small differences in the composition or thickness of the construction may significantly affect the results of the test and may therefore invalidate the test results. Care should be taken to ensure that any construction which is supplied or used is fully represented by the specimens which were tested.

The results of the tests on each of the specimens are given in Table 1.

**In Accordance With The Designations Defined In BS 476: Part 3: 2004 The Test Specimens Are In Category “EXT. F AA”.**

### 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**

<b>PRELIMINARY IGNITION TEST WITH BURNING BRANDS (STAGE 1)</b>	Specimen No:		
		1	
Room temperature at start of test (°C)	19		
Time to fire penetration (if applicable) (min:sec)	Did not penetrate		
Duration of flaming after withdrawal of the test flame (if applicable) (min:sec)	0:09		
Maximum flame spread distance (if applicable) (mm)	Nil		

<b>SPREAD OF FLAME TEST WITH BURNING BRANDS AND SUPPLEMENTARY RADIANT HEAT (STAGE 2)</b>	Specimen No:		
	2	3	4
Room temperature at start of test (°C)	20	23	23
Duration of flaming after withdrawal of the test flame (if applicable) (min:sec)	4:56	4:40	4:03
Maximum flame spread distance (if applicable) (mm)	Nil	Nil	Nil
Additional observations: In the case of all three specimens ignition on the surface of the specimen occurred within the first minute of the test.			

<b>PENETRATION TEST WITH BURNING BRANDS, WIND AND SUPPLEMENTARY RADIANT HEAT (STAGE 3)</b>	Specimen No:		
	5	6	7
Room temperature at start of test (°C)	24	25	25
Time to fire penetration (if applicable) (min:sec)	Did not penetrate	Did not penetrate	Did not penetrate
Additional observations: In the case of all three specimens flaming penetration did not occur.			

## Classification Of Specimens

The following is reproduced from Clause 4 of BS 476: Part 3: 2004.

### 4 Classification

#### 4.1 Roof system

Roof systems shall be designated by the letters EXT.F or EXT.S to indicate whether the test results apply to a flat (horizontal) or an inclined roof system, respectively

#### 4.2 Fire Resistance of roof system

##### 4.2.1 Coding system

Roof systems subject to conditions of external fire shall be classified according to both the time of penetration and the distance of spread of flame along their external surface.

Each category designation shall consist of two letters, e.g. AA, AC, BB, these being determined as specified in 4.22 and 4.23

##### 4.2.2 Fire penetration (first letter)

- A. Those specimens that have not been penetrated within one hour
- B. Those specimens that are penetrated in not less than 30 min.
- C. Those specimens that are penetrated in less than 30 min.
- D. Those specimens that are penetrated in the preliminary flame test

##### 4.2.3 Spread of flame (second letter)

- A. Those specimens on which there is no spread of flame
- B. Those specimens on which the spread of flame is less than or equal to 533mm, with averaged results rounded up or down to the whole number, as normally practised
- C. Those specimens on which the spread of flame is greater than 533mm, with averaged results rounded up or down to the whole number, as normally practised
- D. Those specimens that continue to burn for five minutes after withdrawal of the test flame or spread more than 381mm across the region of burning in the preliminary test.

##### 4.2.4 Suffix "X"

Attention shall be drawn to dripping from the underside of the specimen, any mechanical failure, and any development of holes, by adding a suffix "X" to the designation to denote that one or more of these took place during the test.

EXAMPLE 1 EXT.F.AA is a flat roofing system with one hour fire penetration resistance on which there was no spread of flame.

EXAMPLE 2 EXT.S.CCX is an inclined roofing system with less than 30 min fire penetration resistance, on which the spread of flame exceeded 533mm and further deterioration took place.

## Revision History

Issue No : 2	Issue Date: 11 <sup>th</sup> November 2014
Revised By: K Hughes	Approved By: S Deeming
Reason for Revision: This document replaces Issue 1 (dated 11 <sup>th</sup> November 2014) of the same number which has been withdrawn. The incorrect name and address was detailed in the issue 1 document. The correct details are now detailed in this issue 2 report.	

Issue No : 3	Issue Date: 15 <sup>th</sup> January 2015
Revised By: K Hughes	Approved By: S Deeming
Reason for Revision: This document replaces Issue 2 (dated 14 <sup>th</sup> January 2015) of the same number which has been withdrawn. At the sponsors request the catalyst details on page 6 have been amended.	