

Title:

Determination of Class 0
and Class A Performance to
show Conformity to the
Building Regulatory
Requirements
for Asian and Indian Markets

Product:

Wet Felt Ceiling Tile

Report No:

158423

Issue No:

3

Prepared for:

Armstrong World Industries
Inc.,
Innovation Centre,
2500 Columbia Avenue
LANCASTER
PA 17603
USA

Date:

6th November 2008

Executive Summary

Building Regulations in India and Asia are based on those used in the United Kingdom and the test methods specified are primarily British Standard methods. The Armstrong World Industries plant in Shanghai manufacture Wet Felt Mineral Fibre Suspended Ceiling tiles for the Indian and Asian markets. The plant produce a limited range of tiles, the formulation of each was studied to identify those parameters which are modified and which may have an effect on the fire performance of the tiles.

The extremes of the range of these parameters was identified and testing conducted to BS 476 Parts 6 and 7 and ASTM E84 on tiles having the minimum and maximum of the following parameters:

- Maximum and minimum paint application rates
- Maximum and approximately the minimum organic content
- Maximum and minimum backcoat application rate

The results of the tests show that all the tiles have a classification based on tests to BS 476 Parts 6 and 7 of Class 0 and to ASTM E84 of Class A.

Opinion

Based on these test results, therefore, it is our opinion that all the tile currently manufactured at the Shanghai plant, based on the formulations held on the technical file at Warringtonfire and summarised in Clause 2.2 of this report can be said to meet the requirements of the Building Regulations for India and Asia and are deemed satisfactory for use in Class 0 or Class A areas.

1. Introduction

Building Regulations in India and Asia are based on those used in the United Kingdom and the test methods specified are primarily British Standard methods. The Indian and Asian requirements are based on flame spread and contribution to fire in very general terms, the British Standard test methods giving the required information to show compliance. Flame spread and the contribution to a fire can be assessed using the BS 476: Part 7 and BS 476: Part 6 test methods. Due to the general manner in which the Indian and Asian regulations are written however other test methods can also be used to show compliance such as ASTM E84, the tunnel test which determines flame spread within a 25 foot tunnel.

Armstrong World Industries manufacture suspended ceiling systems in Shanghai which are sold onto the Indian and Asian markets. A range of wet felt tiles are manufactured which are generally of similar formulation but that differ slightly in their organic content and face patterns. This assessment looks at the differences in the formulation of the tiles and the potential effect this may have on the fire performance and hence classification of the tiles and thus their suitability for the Indian and Asian markets.

2. Details of product range.

2.1 General

The products may all be described as 'Wet Felt Mineral Fibre Ceiling Tile', and is used together with metal grid to form suspended systems.

2.2 Product description

The product range, 'Wet Felt Mineral Fibre Ceiling Tile', is described briefly below and fully in the test reports provided in support of this assessment listed in Clause 3.1. This is inclusive of the following product families:

ANF,	Elite,
Bajkal,	Fine Fissured,
Classic Lite.	Fine Fissured Plank,
Cortega,	Minatuff,
Dune,	Skylite,
Dune Plank,	Beauti-Sky,
Dune Max,	

Product description:

General Description	Wet felt mineral fibre ceiling tile		
Overall thickness of ceiling tile	15mm		
Coatings 1 (Test face)	-	Generic type	A water based finish coatings
	-	Application rate	160 to 260 g/m ²
	-	Percentage solids	48%
Coatings 2 (Intermediate)	-	Generic type	A water based finish coatings
	-	Application rate	170 to 330 g/m ²
	-	Percentage solids	48%
Coatings 3 (Primer)	-	Generic type	A water based finish coatings
	-	Application rate	170 to 260 g/m ²
	-	Percentage solids	48%

Core	-	Generic type	Wet felt mineral tile
	-	Total organic content	21 to 28%
	-	Density	Less than 450 kg/m ³
Coating (Reverse Face)	-	Generic type	Melamine backcoat
	-	Application rate per coat	170 to 235 g/m ²
		Percentage Solids	46%

Full details of the composition of the products together with details of their manufacture are also held on technical file at Warrington Fire.

3. Purpose of the tests

The Armstrong World Industries plant in Shanghai produces a range of wet felt mineral fibre ceiling tiles which are sold on the Indian and Asian Markets. The purpose of this report is to provide evidence from tests to BS 476 Parts 6 and 7 to show that the entire range of product manufactured has a Class 0 fire performance and that additionally to provide evidence from tests to ASTM E84 to show that the entire range of product manufactured has a Class A fire performance.

In order to determine which specimens were to be tested the formulation details of the entire product range were studied and specimens selected which were at the extreme ends of the following parameters which may effect fire performance:

- Maximum and minimum paint application rates
- Maximum and minimum organic content
- Maximum and minimum backcoat application rate

Other parameters such as face pattern were also considered. Although density and thickness are also important to fire performance (kpc), the plant manufactures only one density and one thickness therefore these are constants in this assessment.

4 Test Methods

4.1 BS 476 Part 7

This method is the currently the primary reaction to fire test in the UK for wall and ceiling products. The method is used to assess the spread of flame characteristics of products to show compliance with their end -use in certain areas of buildings which are controlled by Regulation. The method consists of exposing a minimum of 6 specimens of the product to be evaluated to the gradient of irradiance from a 0.9 m² radiant panel for a 10 minute period. The highest classification which can be achieved by this method is Class 1 which equates to a flame spread on the specimen of less than 165 mm in 1.5 minutes. It should be noted that flaming which has a duration of less than 3s is deemed not to contribute to the overall fire spread.

4.2 BS 476 Part 6

Known as the fire propagation test, this method is complimentary to BS 476 Part 7 in that together they determine Class 0. The test method provides a rudimentary measurement of heat release which is expressed in the form of an index. The calculation to provide the index is time weighted and therefore products which release heat early in a fire with receive a high index value.

The test method consists of exposing the product to a row of small flames for 20 minutes, and a additional impressed irradiance of 2 kW from the 3rd to the final minute of the test. The temperature of the evolved combustion products is recorded. This is then compared with the temperatures generated from a non-combustible board. The product can be classified Class 0 provided

- i) the product is Class 1 (see BS 476 Part 7)
- ii) the product achieves a cumulative index after 3 minutes of less than 6
- iii) the product achieves a total cumulative index over the entire test duration of less than 12

Together therefore these tests can be used to shown compliance with the Building Regulations in the UK.

4.3 ASTM E84

This test is the principle test method within the USA for determining the potential of building materials to spread flame. The test is conducted with the specimen in the ceiling position with the surface being evaluated in a face down orientation. The purpose of the test is to determine the relative burning behaviour of the material by observing the flame spread along the specimen and the amount of smoke produced over a 10 minute period and comparing this to the performance of Red Oak.

The test apparatus consists of a tunnel 7.6m long and 0.55m wide. The ignition source consists of 2 burners, the flames from which the impinge directly onto the specimen.

Distance of flame spread is plotted against time and the area under the curve determined. From this information a flame spread index is calculated.

The smoke density value is also calculated from the value under the curve divided by the equivalent value for Red Oak and multiplied by 100. The following classifications apply:

Class	Flame Spread	Smoke Index
A	0-25	0-450
B	26-75	0-450
C	76-200	0-450

5 Test reports in support of this assessment

Name of Laboratory	Test reports	Test method
Warringtonfire	WF 148562, 148564, 148566, 148568	BS476 Part 7
Warringtonfire	WF 148569, 148572, 148573, 148575	BS 476 Part 6
HPVA	T – 11796, T – 11797, T – 11798, T – 11799	ASTM E 84

6 Test results

6.1 BS 476 Part 7

Report No	Parameter	Class	Results	
			1.5 mins	10 mins
148568	Minimum paint application rate	1	<50	<50
148562	Maximum paint application rate	1	<50	<50
148568	Organic content (21.5%)	1	<50	<50
148564	Organic content (28%)	1	<50	<50
148568	Backcoat application rate (184 g/m ²)	1	<50	<50
148562	Maximum backcoat application rate (220 g/m ²)	1	<50	<50
148568	Minimum backcoat melamine content	1	<50	<50
148566	Maximum backcoat melamine content	1	<50	<50

6.2 BS 476 Part 6

Report No	Parameter	Class	Results	
			i ₁	I
148575	Minimum paint application rate	0	4.72	9.19
148569	Maximum paint application rate	0	2.19	5.30
148575	Organic content (21.5%)	0	4.72	9.19
148572	Organic content (28%)	0	3.84	8.43
148575	Backcoat application rate (184 g/m ²)	0	4.72	9.19
148569	Maximum backcoat application rate (220 g/m ²)	0	2.19	5.30
148575	Minimum backcoat melamine content	0	4.72	9.19
148573	Maximum backcoat melamine content	0	4.02	6.77

6.3 ASTM E84

Report No	Parameter	Class	Results	
			Flame Spread Index	Smoke Developed Index
T-11798	Minimum paint application rate	A	15	0
T-11796	Maximum paint application rate	A	20	0
T-11798	Organic content (21.5%)	A	15	0
T-11799	Organic content (28%)	A	15	10
T-11798	Backcoat application rate (184 g/m ²)	A	15	0
T-11796	Maximum backcoat application rate (220 g/m ²)	A	20	0
T-11798	Minimum backcoat melamine content	A	15	0
T-11797	Maximum backcoat melamine content	A	20	0

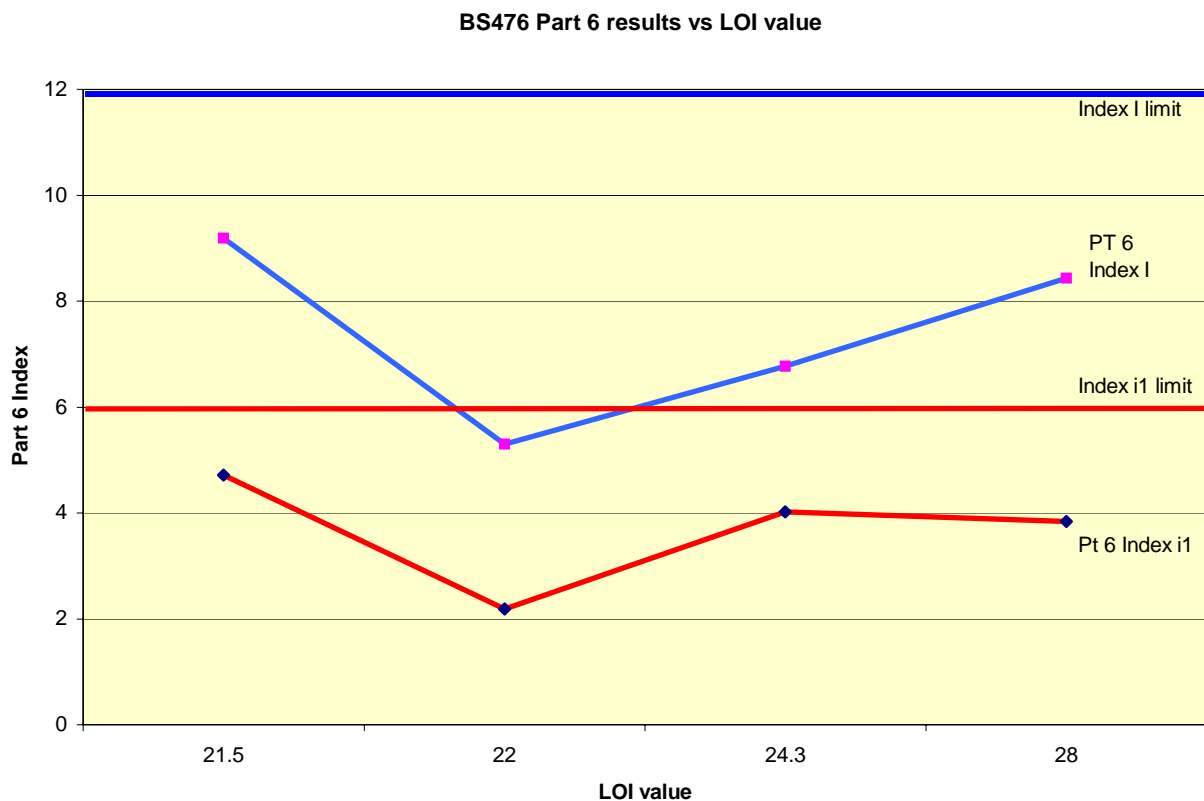
7. Discussion

These tests were conducted to assess the performance of the range of wet felt mineral fibre ceiling tiles produced at the Armstrong World Industries plant in Shanghai. The tests were conducted mainly on the extremes of the range of product parameters in order to provide comprehensive coverage of the fire performance of the entire range manufactured at the plant and placed on the Indian and Asian markets. The only exceptions to this are to the organic content and the application rate of the backcoat. The highest organic content for the range of core board manufactured at the Shanghai plant is 28% and this has been tested to all test methods. The core board with the lowest organic content has an LOI measured as 16%. Board of a nominal percentage of 21.5% has been tested to all three tests, the results of which fall comfortably within Class 0. The results of product with 16% organic content would therefore also fall within Class 0 as the organic content is much lower than those tested and is still evenly dispersed in the same manner as with the tile of higher organic content. The lower backcoat application rate (165 g/m²) on this tile would also reduce the amount of heat generated by the tile.

The results of the tests to ASTM E84 are all similar, the maximum flame spread index being 20 with an allowed classification limit of 25. The smoke index maximum was 10 where a limit of 450 is allowed. Based on these results, the flame spread characteristics of the board with an organic content of 16% would, in our opinion, would also be Class A.

The results of the BS 476 Part 7 tests are all identical for the various boards with the different organic contents, the maximum flame spread distance being less than 50mm where the classification limit is 165mm. In our opinion, the classification of the board with the organic content of 16% would also have the same performance.

The results to BS476 Part 6 are a little more variable. These are shown graphically below. The graph shows that the results from the boards of different organic content. All results are below the criteria required to be Class 0 and lend confidence to the opinion that boards with an organic content of 16% ie less than that of those tested would also have the same classification



From the results obtained it is our opinion that the Armstrong World Industries, Shanghai plant's entire manufacturing range of tiles with the organic contents between 16 to 28% and paint and backcoat application rates detailed in Clause 2.2 of this report will give a Class 0 performance when tested to BS 476 Part 6 and 7 or a Class A performance to ASTM E84, the values obtained from each of the respective tests falling well within the classification criteria.

8 Opinion

Based on these results, therefore, it is our opinion that all the tile currently manufactured at the Shanghai plant, based on the formulations held on the technical file at Warringtonfire and summarised in Clause 2.2 can be said to meet the requirements of the Building Regulations for India and Asia and are deemed satisfactory for use in Class 0 or Class A areas.

9 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 and assessments 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.

Any change in the formulation of the individual component parts of the tiles manufactured at the Shanghai plant which are covered by this report may negate this assessment. It is recommended that any such changes are notified to Warringtonfire.

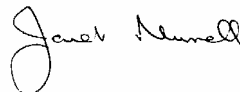
This report may only be reproduced in full. Extracts or abridgements shall not be published without permission of Warringtonfire

SIGNED



.....
Leigh Hill
Technical Consultant
Technical Department

APPROVED



.....
Janet Murrell
Technical Manager
Technical Department
on behalf of:
Bodycote warringtonfire

This copy has been produced from a .pdf format electronic file that has been provided by Bodycote **warringtonfire** to the sponsor of the report and must only be reproduced in full. Extracts or abridgements of reports must not be published without permission of Bodycote **warringtonfire**. The original signed paper version of this report is the sole authentic version. Only original paper versions of this report bear authentic signatures of the responsible Bodycote **warringtonfire** staff.



Bodycote warringtonfire • Head Office • Holmesfield Road • Warrington • Cheshire • WA1 2DS • United Kingdom
Tel: +44 (0) 1925 655 116 • Fax: +44 (0) 1925 655 419 • Email: Info@warringtonfire.net • Website: www.warringtonfire.net

