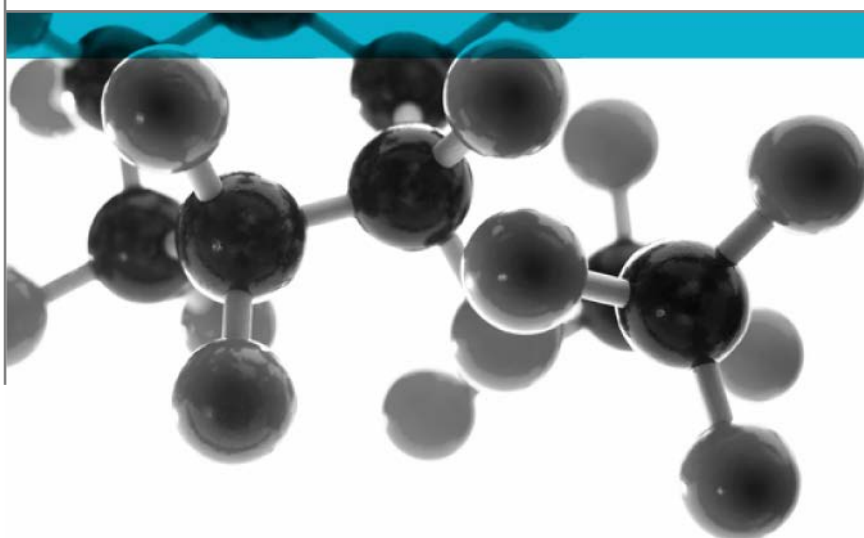


BS EN ISO 1716:2018



Determination Of The Heat Of Combustion For Building Products

A Report To: ARC Building Solutions

Document Reference: 421699

Date: 11th December 2019

Issue No.: 1

Page 1



Executive Summary

Objective To determine the performance of the following composite when tested in accordance with BS EN ISO 1716: 2018.

Generic Description	Product reference	Thickness	Weight per unit area or density
Foil faced insulation	"ARC Foil Encapsulated Insulation"	Not stated	Not stated
Individual components used to manufacture composite:			
Aluminium foil	Not stated	Not stated	48g/m ²
Glass fibre scrim material	"70941"	Unable to provide	16g/m ²
Low density polyethylene	"Riblene GP 20 R"	Not stated	21g/m ²
Hot melt adhesive	"Pressen 2016"	Not stated	10g/m ²
Mineral wool insulation	"RS33OEM"	100-150mm	33kg/m ³
Please see page 5 of this test report for the full description of the product tested			

Test Sponsor ARC Building Solutions, Unit H1/H2, Gildersome Spur, Leeds L527 7J2

Test Results:	Component part	PCS per mass (MJ/kg)	PCS per area (MJ/m ²)
	Aluminium foil	0.0000	0.0000
	Scrim	2.8652	0.0458
	Coating	45.9764	0.9655
	Adhesive	42.0905	0.4209
	Mineral wool	0.6878	2.2699
	Total product:	1.0905	3.7021

Date of Test 10th & 16th September 2019

Signatories


Responsible Officer H Harper* Testing Officer


Authorised S. Deeming * Business Unit Head

* For and on behalf of [Warringtonfire](#).

Report Issued: 11th December 2019

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Test Details

Purpose of test	To determine the calorific potential of a building material during combustion when it is tested in accordance with the test specified in BS EN ISO 1716:2018 "Reaction To Fire Tests For Building Products – Determination Of The Heat Of Combustion". The test was performed in accordance with the procedure specified in BS EN ISO 1716:2018 and this test report should be read in conjunction with that European Standard. This test was conducted under the requirements of our UKAS flexible scope of accreditation.
Scope of test	BS EN ISO 1716 specifies a method of test for determining the heat of combustion of building materials at constant volume in a bomb calorimeter. Results are reported as individual values which may be interpreted by reference to other documents; e.g. EN 13501-1:2018 "Fire Classification of Construction Products and Building Elements Part 1 Classification using Test Data from Reaction to Fire Tests. The test is intended for materials or products whether composite products or coated products.
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 has 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 10th & 16th September 2019 at the request of ARC Building Solutions, the sponsor of the test.
Provision of test specimens	The specimens were supplied by the sponsor of the test. Warringtonfire was not involved in any selection or sampling procedure.
Conditioning of specimens	The specimens were received on the 15th August & 12th September 2019. Prior to test the prepared specimens were conditioned for at least 48 hours at a temperature of $23 \pm 2^{\circ}\text{C}$ and a relative humidity of $50 \pm 5\%$, in accordance with BS EN 13238:2010.
Test procedure	The specimens were tested using an additional combustible substance of known and high calorific value which for this test was paraffin oil. The specimens were tested using the crucible/cigarette method in an isoperibol bomb calorimeter. The water equivalent (E) of the bomb calorimeter was 0.01011 MJ/K.

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 [Warringtonfire](#). All values quoted are nominal, unless tolerances are given.

General description		Foil faced insulation
Product reference		"ARC Foil Encapsulated Insulation"
Name of manufacturer		See Note 1 below
Thickness		See Note 1 below
Weight per unit area		See Note 1 below
Product configuration		- Aluminium foil - Scrim - Coating - Adhesive - Mineral wool
Aluminium foil (test face)	Generic type	Aluminium foil
	Product reference	See Note 1 below
	Detailed description / composition details	See Note 1 below
	Name of manufacturer	See Note 1 below
	Thickness	See Note 1 below
	Weight per unit area	48g/m ²
	Colour reference	See Note 1 below
	Flame retardant details	See Note 1 below
Scrim	Generic type	Glass fibre scrim material
	Product reference	"70941"
	Name of manufacturer	See Note 1 below
	Colour reference	See Note 1 below
	Thickness	See Note 1 below
	Weight per unit area	16g/m ²
	Cell dimensions	2x2
	Flame retardant details	See Note 2 below
Coating	Generic type	Low density polyethylene
	Product reference	"Riblene GP 20 R"
	Name of manufacturer	Eni Versalis
	Colour reference	See Note 1 below
	Thickness	See Note 1 below
	Weight per unit area	16g/m ²
	Density	0.915-0.935g/cm ³
	Flame retardant details	See Note 2 below
Adhesive	Generic type	Hot melt adhesive
	Product reference	"Pressen 2016"
	Name of manufacturer	Beardow Adams
	Colour reference	See Note 1 below
	Application rate	10g/m ²
	Application method	Spray gun
	Flame retardant details	See Note 1 below

Insulation	Generic type	Mineral wool insulation
	Product reference	"RS33OEM"
	Name of manufacturer	Knauf Insulation
	Colour reference	See Note 1 below
	Thickness	100-150mm
	Density	33kg/m ³
	Weight per unit area	3.3kg/m ²
	Generic type of resin	See Note 1 below
	Product reference of resin	See Note 1 below
	Amount of resin	See Note 1 below
	Generic type of oil	See Note 1 below
	Product reference of oil	See Note 1 below
	Amount of oil	See Note 1 below
	Flame retardant details	See Note 1 below
Brief description of manufacturing process		See Note 1 below

Note 1: The sponsor was unable 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 given above is therefore not as complete as would normally be the case for descriptions included in [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.

The specimen was heterogeneous in nature. The specimen comprised one substantial component, and four external non substantial components.

The table below gives the thickness and the weight per unit area values of the component parts of the specimen.

Component description	Location / type	Thickness (mm)	Weight / unit area (kg/m ²)
Aluminium foil	External non substantial	Not stated	0.048
Scrim	External non substantial	Unable to provide	0.016
Coating	External non substantial	Not stated	0.021
Adhesive	External non substantial	Not stated	0.010
Mineral wool	Substantial	100-150	3.30

Specimen preparation

The sample was composed of a heterogenous material which was impossible to separate into its constituents. The specimens were therefore prepared from individual specimens of the individual constituent parts supplied by the manufacturer, who also provided evidence of the ratio of masses of components in the finished product together with their mass per unit area values. These were then ground and reduced to a fine powder and mixed thoroughly together prior to conditioning for test.

Test Results

Results of test

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.

The test results relate to the behaviour of the test specimen of a product under the particular conditions of the test; they are not intended to be the sole criterion for assessing the potential fire hazard of the material in use.

The test results are given in Table 1 of this report.

Results on component layers already tested

The table below details the results of previous analysis of calorific value for the component part/s being evaluated in this report:

These results are used in this report to provide total product evaluation.

Copies of all test reports are held on our confidential file at [Warringtonfire](#).

Component part	Report No.	Average Calorific Value (MJ/kg)	Average Calorific Value (MJ/m ²)
Aluminium foil	Not applicable	0.0000	0.0000
Scrim	418846	2.8652	0.0458
Coating	418847	45.9764	0.9655
Adhesive	417911	42.0905	0.4209
Mineral wool	417909	0.6878	2.2699

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

Table 1 - Bomb Calorimeter Calculations**Product / Layer Description**

The product is heterogenous and fabricated as follows:

Component Part	Type	Description
1	External Non Substantial	Aluminium foil
2	External Non Substantial	Scrim
3	External Non Substantial	Coating
4	External Non Substantial	Adhesive
5	Substantial	Insulation

Component Part 1**Aluminium foil (External Non Substantial)**

Mass of sample:- 0.0480 kg/m²

Results obtained:-

<u>Test 1:-</u>	sample weight =	0.0000 g		
	calorific value =	0.0000 MJ/kg	=	0.0000 kJ/kg
	temperature rise =	0.0000 °C		
<u>Test 2:-</u>	sample weight =	0.0000 g		
	calorific value =	0.0000 MJ/kg	=	0.0000 kJ/kg
	temperature rise =	0.0000 °C		
<u>Test 3:-</u>	sample weight =	0.0000 g		
	calorific value =	0.0000 MJ/kg	=	0.0000 kJ/kg
	temperature rise =	0.0000 °C		
			Average =	0.0000 kJ/kg
				<u>0.0000 MJ/kg</u>

(Calorific value x mass per unit area)

Average gross calorific potential = 0.0000 kJ/m²
0.0000 MJ/m²

Component Part 3 **Coating (External non substantial)**

Mass of sample:- 0.0210 kg/m²

Results obtained:-

<u>Test 1:-</u>	sample weight =	0.7035	g			
	calorific value =	45.9594	MJ/kg	=	45959.4	kJ/kg
	temperature rise =	4.7316	°C			
<u>Test 2:-</u>	sample weight =	0.7284	g			
	calorific value =	46.0081	MJ/kg	=	46008.1	kJ/kg
	temperature rise =	4.7521	°C			
<u>Test 3:-</u>	sample weight =	0.7157	g			
	calorific value =	45.9618	MJ/kg	=	45961.8	kJ/kg
	temperature rise =	4.7616	°C			
				Average =	45976.4	kJ/kg
					45.9764	MJ/kg

Gross Calorific Potential Per Unit Area
(Calorific value x mass per unit area)

Test 1:-	965.147	kJ/m²
Test 2:-	966.170	kJ/m²
Test 3:-	965.198	kJ/m²

Average gross calorific potential = **965.5050 kJ/m³**
0.9655 MJ/m³

Component Part 4 Adhesive (External non-substantial)

Mass of sample:- 0.010 kg/m²

Results obtained:-

<u>Test 1:-</u>	sample weight =	0.7246	g		
	calorific value =	42.6592	MJ/kg	=	42659.2 kJ/kg
	temperature rise =	4.5375	°C		

Test 2:- sample weight = 0.7297 g
calorific value = 41.6699 MJ/kg = **41669.9 kJ/kg**
temperature rise = 4.554 °C

Test 3:-

sample weight =	0.7006	g		
calorific value =	41.9424	MJ/kg	=	41942.4 kJ/kg
temperature rise =	4.3821	°C		

Average = **42090.5** kJ/kg
 42.0905 MJ/kg

Gross Calorific Potential Per Unit Area

(Calorific value x mass per unit area)

Test 1:- **426.592** kJ/m²

Test 2:- **416.699** **kJ/m²**

Test 3:- **419.424** kJ/m²

Average gross calorific potential = **420.9050 kJ/m³**
0.4209 MJ/m³

Component Part 5 **Insulation (Substantial)**

Insulation (Substantial)

Mass of sample:- 3.3000 kg/m²

3.3000 kg/m²

Test 1:- sample weight = 0.7224 g
calorific value = 0.6398 MJ/kg = **639.8 kJ/kg**
temperature rise = 1.4904 °C

Test 2:-

sample weight =	0.7316	g		
calorific value =	0.7721	MJ/kg	=	772.1 kJ/kg
temperature rise =	1.5600	°C		

Test 3:- sample weight = 0.7203 g
calorific value = 0.6516 MJ/kg = **651.6 kJ/kg**
temperature rise = 1.5314 °C

Average = **687.8333** kJ/kg
0.6878 MJ/kg

Gross Calorific Potential Per Unit Area

(Calorific value x mass per unit area)

Test 1:- **2111.340** kJ/m²

Test 2:- **2547.930** kJ/m²

Test 3:- **2150.280** kJ/m²

Average gross calorific potential = **2269.850 kJ/m³**
2.2699 MJ/m³

Calculation of Total Calorific Potential (MJ/kg) for the Product

Mass per 1m ² of Component 1	0.0480	kg
Mass per 1m ² of Component 2	0.0160	kg
Mass per 1m ² of Component 3	0.0210	kg
Mass per 1m ² of Component 4	0.0100	kg
Mass per 1m ² of Component 5	3.3000	kg

Total Mass per 1m ² of Product	3.3950	kg
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Percentage Mass of Constituent Parts

% Component 1	1.4138	%
% Component 2	0.4713	%
% Component 3	0.6186	%
% Component 4	0.2946	%
% Component 5	97.2018	%

Average Calorific Potential Component 1	0.0000	MJ/kg
Average Calorific Potential Component 2	2.8652	MJ/kg
Average Calorific Potential Component 3	45.9764	MJ/kg
Average Calorific Potential Component 4	42.0905	MJ/kg
Average Calorific Potential Component 5	0.6878	MJ/kg

Contribution of Each Component to Total Calorific Potential

Component 1	0.0000	MJ/kg
Component 2	0.0135	MJ/kg
Component 3	0.2844	MJ/kg
Component 4	0.1240	MJ/kg
Component 5	0.6686	MJ/kg

Total Calorific Potential for the Total Product**1.0905 MJ/kg****Summary of Results**

Component Part	PCS per Mass (MJ/kg)	PCS per Area (MJ/m ²)
1 Aluminium foil	0.0000	0.0000
2 Scrim	2.8652	0.0458
3 Coating	45.9764	0.9655
4 Adhesive	42.0905	0.4209
5 Insulation	0.6878	2.2699
Total Product	1.0905	3.7021

Revision History

Issue No :	Re-issue Date:
Revised By:	Approved By:
Reason for Revision:	

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