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**Review of reports and data
for Aero-Therm thermal
reflective coating**

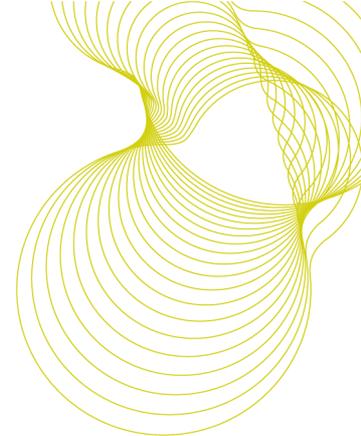
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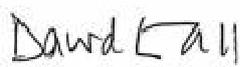
17th September 2015

Report number: 299166



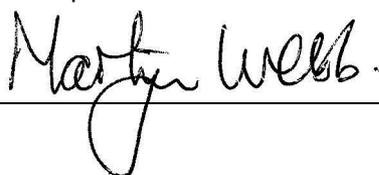
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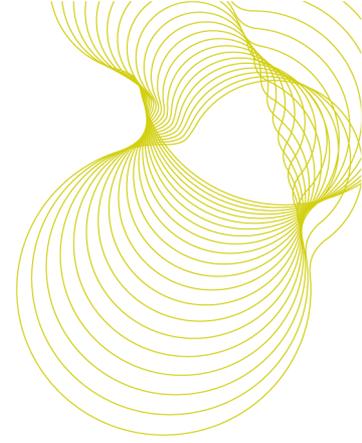
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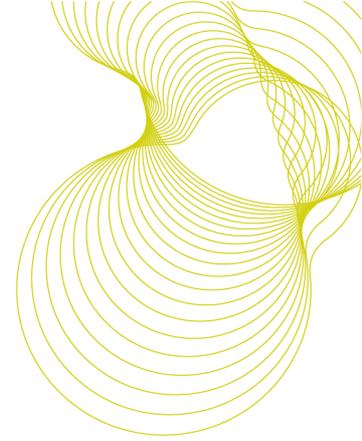
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1 Executive summary

This Report is an overview of work undertaken for Aero-Therm Products Ltd, by third parties, other than BRE. The Executive Summary is based on the information contained in this Report, and the following information can be summarised for the Aero-Therm thermal reflective coating.

The information given in this Executive Summary should be read in conjunction with the detail contained within the remainder of this Report, and the third party reports to which the comments relate.

A. National Technical Approval

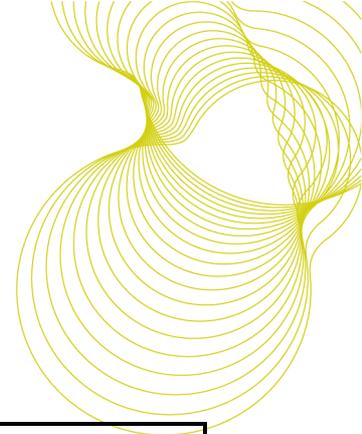
A National Technical Approval has been provided for review and has been issued by a third party notified body in the Czech Republic, for use in the Czech Republic. The Czech notified body has developed a bespoke test programme for the product to demonstrate the suitability of the Aero-Therm product for internal use in a building. The body who issued the National Technical Approval, TZUS (Authorised Body No. 204) is listed in Czech Accreditation Institute's website <http://www.cia.cz/en/>. The organisation is internationally recognised for accreditation of test and certification bodies. The National Technical Approval issued by TZUS follows in principle with the general characteristics and format as would be issued by a UK National Technical Approval body.

B. CE Marking

Under the Construction Products Regulation, from 1st July 2013, it became mandatory for manufacturers, distributors and importers to CE Mark their product if it is covered by a harmonised technical standard. The CE mark needs to be carried by a product when placed on the market in a European Economic Area member state. The Aero-Therm product carries a CE Mark which has been undertaken against a harmonised European Standard, EN 15824 and a Declaration of Performance has been issued. The testing to support the Declaration of Performance appears to have been undertaken by a suitable Notified Body - TZUS (Notified Body No 1020).

C. Reaction to Fire classification

Characteristic	Achieved by Aero-Therm product	Minimum classification required by Building Regulation B.1 (dwellings)
Reaction to Fire classification	A2 – s1, d0	D – s3, d2 ⁽¹⁾



EN 13501-1		C – s3, d2 ⁽¹⁾
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⁽¹⁾refer to Table 1 of Approved Document B.1

Characteristic	Achieved by Aero-Therm product	Minimum classification required by Building Regulation B.2 (buildings other than dwellings)
Reaction to Fire classification EN 13501-1	A2 – s1, d0	D – s3, d2 ⁽²⁾ C – s3, d2 ⁽²⁾ B – s3, d2 ⁽²⁾

⁽²⁾refer to Table 10 of Approved Document B.2

Based on the above information, the Aero-Therm product appears to satisfy the requirement for Reaction to Fire classification for UK Building Regulation Approved Documents B.1 and B.2.

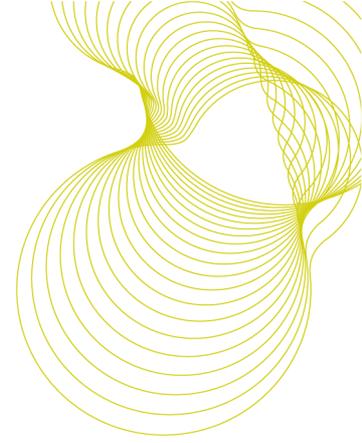
D. Product certificate

The Product Certificate issued for use in the Czech Republic by TZUS quotes “the Authorised Body has reviewed documents submitted by the manufacturer, performed the initial type-testing of the product sample, assessed factory production control and has stated that :

- The product fulfils the requirements derived from related essential requirements given in the Czech Government Decree as stated in the TZUS certificate 204/C5/2013/010-032028 dated 12.08.2013, and detailed in the national technical approval No. 010-032026 dated 08.08.2013
- The factory production control complies with the technical documentation and ensures that products put on the market meet the requirements laid down in the article mentioned in the national technical approval No. 010-032026 dated 08.08.2013 and comply with relevant technical documentation according to Article 4 Clause 3 of the Czech Government Decree as stated in the TZUS certificate 204/C5/2013/010-032028 dated 12.08.2013”

Reputable product certification schemes would generally comprise similar characteristics, i.e.:

- Initial and on-going compliance of the quality management system, e.g. with ISO 9001 or Factory Production Control (FPC) requirements
- Initial and on-going compliance of the product with a set of technical requirements, e.g. a product standard, a recognised industry standard or documented set of technical criteria



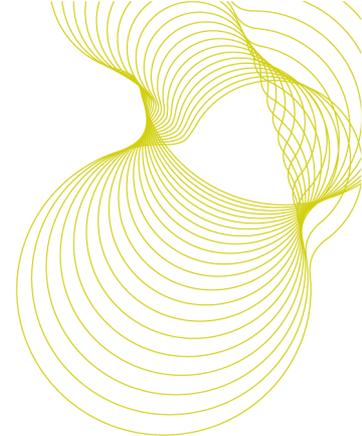
E. Thermal Testing report and certificate

Thermal conductivity or resistivity (“U-value” or “R-value” respectively) ‘hot box testing’ is normally conducted on conventional thermal insulation products. As described in this Report, the Aero-Therm thermal reflective coating is stated to behave in a different way to conventional thermal insulation products and so Aero-Therm and TZUS developed a bespoke procedure to assess the product’s thermal performance.

When tested by TZUS under laboratory conditions the following observations were made:

Characteristic	Building with Aero-Therm applied	Building without Aero-Therm applied
Time needed to reach 23°C (from nominal 15°C)	30 min	41 min
Time to drop 3°C (from nominal 21°C)	55 min	30 min
Power consumption in a 4 day period	27.2 kWh	33.17 kWh
Total saving in consumption using Aero-Therm in a 4 day period	5.97 kWh	-

This testing was undertaken by TZUS, a testing facility that is recognised under the International Laboratory Accreditation Cooperation (ILAC) agreement, by virtue of its accreditation to the International Standard for the ‘general requirements for the competence of testing and calibration laboratories’, ISO 17025.



2 Introduction

At the request of Mr Craig Clement of Aero-Therm Products Limited, a review of testing and certification already undertaken on the Aero-Therm thermal reflective coating by other bodies was undertaken. The information reviewed was provided by Aero-Therm Products Ltd.



Figure 1 – representative picture showing containers of the Aero-Therm product.

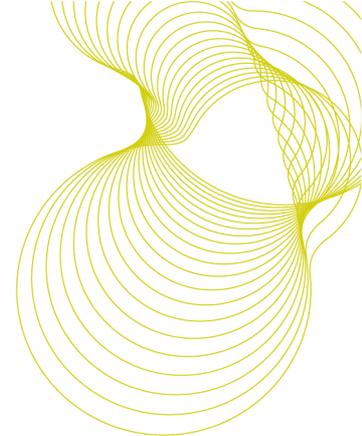
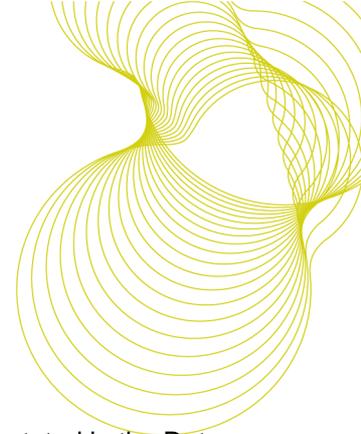


Figure 2 – representative picture showing Aero-Therm coating applied to a wall.

Aero-Therm is described by the manufacturer as a thermal reflective coating. It is described on the website <http://www.aerotherm.co.com>⁽¹⁾ as 'tiny glass microspheres and aerogel (the world's best performing insulant, used by NASA in their space shuttles) that together work by absorbing then reflecting heat back into the room'.

It is claimed that it can be applied with a notched trowel and smoothed over with a flat float.

⁽¹⁾website referenced on 03.09.2015

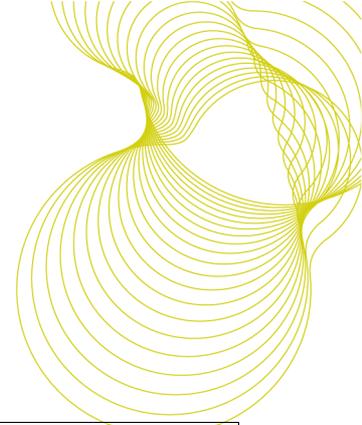


The Aero-Therm product is described as having the following technical specification, as stated in the Data Sheet provided by Aero-Therm Products Ltd dated June 2015:

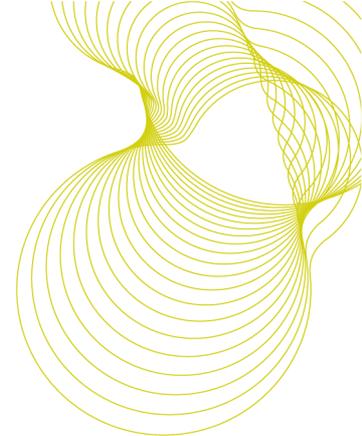
BASIC TECHNICAL INFORMATION	
Form of material	water-based sealant
Function	heat reflection, thermal insulation
Composition	glass microspheres, aerogel, dispersion, additives
Insulants	glass microspheres, aerogel
Application thickness	0.8 to 1.0 mm
Minimum lifetime	25 years provided that application technology is followed.

BASIC CHARACTERISTICS	PROPERTIES/CLASSIFICATION	TECHNICAL SPECIFICATION
Water Vapour permeability EN ISO 7783-2	V2—medium	EN 15824
Water permeability EN 1062-3	W1 high	EN 15824
Adhesion EN 1542	≥ 1.00 MPa	EN 15824
Durability	NPD	EN 15824
Thermal conductivity (W/mK) EN 12667	0.047	EN 15824
Reaction to fire EN 13501-1+A1	A2 – s1, d0	EN 15824

CHARACTERISTICS	PROPERTIES/CLASSIFICATION	TECHNICAL SPECIFICATION
Adhesion for application onto Steel	0.5 ±0.1(MPa)	CSN EN ISO 4624
Adhesion for application onto Stainless Steel	0.6 ±0.1(MPa)	CSN EN ISO 4624
Heat-storage capacity of the material, drop in temperature of contact and evaluation according to CSN 730540-2	Complies	CSN 730540-2
Specific thermal capacity C_p according to CSN EN ISO 11357-1 at 22 °C	1.213(J/g.°C)	(CSN) EN ISO 11357-1 (CSN) EN ISO 11357-4
Emissivity E , spherical emissivity at 20 °C (Taylor method)	0.93 (-)	Mid IR Integrat IT / PIKE Technologies/ diffuse reflectance integrating sphere/
Diffusion equivalent air layer thickness S_d	0.19 (m)	(CSN) EN ISO 7783-2
Fire-technical characteristic — index of flame propagation along the surface of building materials i_s	0 (mm/min)	CSN 73 0863
Density (Specific density) ρ_y	0.325 g/ml	(CSN) EN ISO 787-10 (CSN) EN ISO 1183-1, part B (CSN) EN ISO 2811-1
Specific surface density with 1-mm thick layer in dry state P_s	0.184 kg/m ²	Manufacturers Data Sheet



<p>Presence of dangerous substances</p>	<p>None present</p>	<p>None of the chemicals listed by the European Chemical Agency published in accordance with Article 59(10) of the REACH Regulation as listed http://echa.europa.eu/candidate-list-table are present in Aero-Therm</p>
<p>Radionuclide content Specific activity 226Ra, Specific Activity Index use in buildings with rooms intended for living or staying - no more than 150 Bq/kg ,</p>	<p>max. of 1 complies</p>	<p>Decree No. 307/2002 Coll. Of the State Office for Nuclear Safety (SUJB), on Radiation Protection, as amended by Decree No. 499/2005 Coll. and Decree No. 389/2012 Coll.</p>
<p>Sensory evaluation of odour (ESN) EN 1230-1</p>	<p>indirect contact with foodstuffs in interiors of buildings grade 0</p>	<p>Decree No. 38/2001 Coll. of the Ministry of Health on hygienic requirements for products intended to come into contact with foodstuffs and meals with foodstuffs and meals</p>



3 Details of the work carried out

Test reports and certificates of the Aero-Therm thermal reflective coating were provided by Aero-Therm Products Ltd, as being undertaken by the respective third parties as detailed in this section of the compilation report. This information was provided to BRE on 04.09.2014.

BRE has undertaken a review of the work already undertaken by third parties in respect of appropriateness of current regulations and certification aspects for use in the UK. Regulatory aspects include UK Building Regulations and the EU Construction Products Regulation (CPR) 305/2011.

It has been confirmed by the manufacturer, Thermo Industry a.s., that the constituents and proportions currently used in the Aero-Therm product are the same as the original product on which the testing and certificates are based. This was stated in a declaration from Thermo Industry a.s., dated 14.11.2014.

The test reports and certificates provided to BRE by Aero-Therm Products Ltd have been issued by the following bodies, as listed below.

Technický a zkušební ústav stavební Praha, s.p (TZUS), Czech Republic:

TZUS is a testing facility that is recognised under the International Laboratory Accreditation Cooperation (ILAC). ILAC develops and harmonises laboratory and inspection accreditation practices, and enables global recognition of laboratories and inspection facilities via the ILAC Arrangement.

In the Czech Republic the national accreditation body is the Czech Accreditation Institute (CAI).

CAI has accredited TZUS to ISO 17025 for testing of building materials, products, components, structures, bridges, and tests of thermal properties. The following certificates of accreditation issued by CAI refer:

Certificate 149/2014 issued 04.03.2014

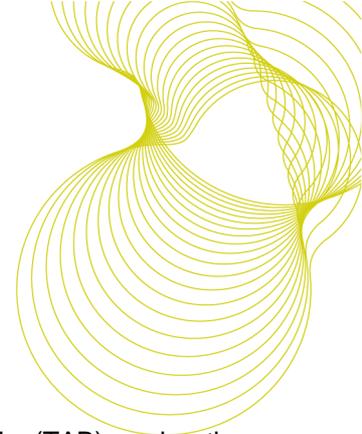
Certificate 480/2013 issued 22.08.2013

Certificate 208/2014 issued 02.04.2014

Certificate 643/2014 issued 09.10.2014

Additionally, CAI has accredited TZUS to EN 45011 / ISO 17065 for certification activities of building materials, products, and personnel. The following certificate of accreditation issued by CAI refers:

Certificate 574/2014 issued 11.09.2014



TZUS is also a notified body under (No. 1020) and Technical Assessment Body (TAB) under the Construction Products Regulation (CPR) 305-2011, covering various building materials, products and disciplines including fire.

Thermo Industry, a.s., Czech Republic:

Thermo Industry is the manufacturer of the Aero-Therm thermal reflective coating and in this case has issued a CE Marking Declaration of Performance under the requirements of the CPR, as its obligation as the manufacturer of the product.

Centrum Staveního Inženýrství a.s., Czech Republic:

Centrum Staveního Inženýrství a.s (CSI) is a testing facility that is recognised under the International Laboratory Accreditation Cooperation (ILAC).

The Czech Accreditation Institute (CAI) has accredited CSI to ISO 17025 for testing of various building materials, products and components, and covers numerous tests including fire and thermal properties. The following certificates of accreditation issued by CAI refer:

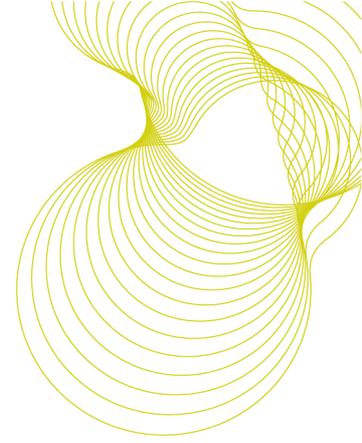
Certificate 465/2014 issued 9.7.2014

Certificate 573/2014 issued 8.9.2014

Additionally, CAI has accredited CSI to EN 45011 for certification activities of various building materials and products. The following certificate of accreditation issued by CAI refers:

Certificate 554/2013 issued 7.10.2013

CSI is also a notified body under (No. 1390) and Technical Assessment Body (TAB) under the Construction Products Regulation (CPR) 305-2011, covering various building materials, products and disciplines including fire.



The following documents were reviewed:

A. National Technical Approval

Issued by TZUS.

Certificate number 010-026496 dated 21.05.2010 refers

B. CE Marking - Declaration of Performance

Issued by Thermo Industry a.s.

Declaration of Performance number 01/2014/TI/AE dated 05.05.2015 refers

Issued by Aero-Therm Products Limited

Declaration of Performance number 01/2014/TI/AE dated 12.06.2015 refers

C. Reaction to Fire test report

Issued by Centrum Staveního Inženýrství a.s.

Classification Report No. PK-10-056 dated 15th July 2010 refers

D. Product certificate

Issued by TZUS

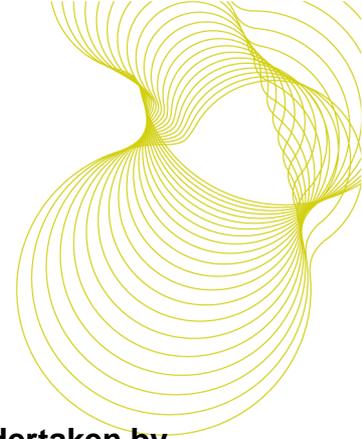
Certificate number 204/C5/2013/010-032028 dated 12.08.2013 refers

E. Thermal Testing report and certificate

Issued by TZUS

Certificate number 010-033223 dated 30.04.2014 refers

Report number 010-033222 dated 30.04.2014 refers



4 Results, comments and observations of the work already undertaken by third parties

Approach

The following review is based upon the reports and certificates provided to BRE by Aero-Therm Products Ltd, for work undertaken by other third parties. BRE has provided commentary on the appropriateness of the work undertaken in respect to regulations and certification aspects for use in the UK. BRE does not take any responsibility for the content of the work undertaken by third parties on the Aero-Therm thermal reflective coating.

A. National Technical Approval

Background:

National Technical Approvals are usually established when certification or approval is not possible if, for example, there is no established product or performance Standard for the product. A National Technical Approval is a favorable technical assessment of the product's fitness for an intended use and is designed to reduce technical barriers in the construction products sector within the country of its use, as there may be regional or national requirements and considerations that the product should meet to be suitable for use within that country.

Observations:

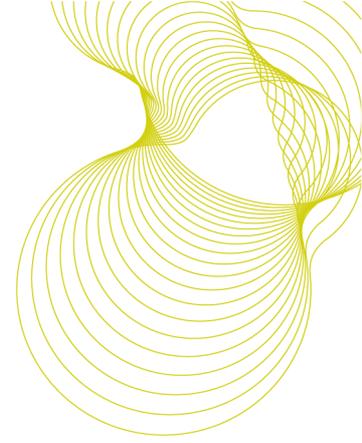
Certificate number 010-026496 issued by TZUS refers.

The National Technical Approval confirms the following product characteristics, verified against European Standard test methods:

- Surface finish adhesion 0.25 MPa min
- Water vapour transmission rate $S_d \leq 0.7$ m
- Emission of Volatile Organic Compound (VOC) no release of dangerous substances
- Odour degree 2 max

It is stated that surveillance of the certificated product will be performed at least once in every 12 months.

Overall, the characteristics chosen for testing by TZUS appear to be reasonable in demonstrating general suitability for internal use in a building. It is not clear why reaction to fire testing has not been undertaken in this case. However, it should be noted that reaction to fire classification has been undertaken separately, as noted in section 'C' below.



B. CE Marking - Declaration of Performance

Background:

When the Construction Products Regulation (CPR) came into effect on 1st July 2013 it became a legal requirement for whoever (i.e. manufacturer, distributor or importer) places the product on the market within the EU to comply with the requirements of the CPR if the product is within the scope of a harmonised European Specification. The following link is a list of current harmonised European Specifications. Therefore if the product is within the scope of one of the harmonised European Standards, then CE Marking under the CPR is a now a legal requirement.

http://ec.europa.eu/enterprise/policies/european-standards/harmonised-standards/construction-products/index_en.htm

Observations:

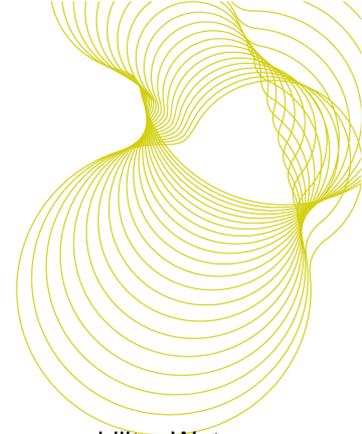
Declaration of Performance (DoP) number 01/2014/TI/AE issued by Thermo Industry a.s. refers, where Thermo Industry a.s. is the manufacturer of the product.

Additionally, Aero-Therm Products Ltd, provided a DoP as a distributor of the Aero-Therm thermal reflective coating.

EN 15824:2009 is a current harmonised European Standard entitled 'Specifications for external renders and internal plasters based on organic binders'. The scope of the Standard is 'factory-made renders and plasters based on organic binders used for external or internal covering on walls, columns, partitions and ceilings. This European Standard is also applicable to renders and plasters with inorganic binders such as silicates, silanes, siloxanes and silicones.'....'This European Standard is not applicable to coating materials and coating systems according to EN 1062-1 and EN 13300.'

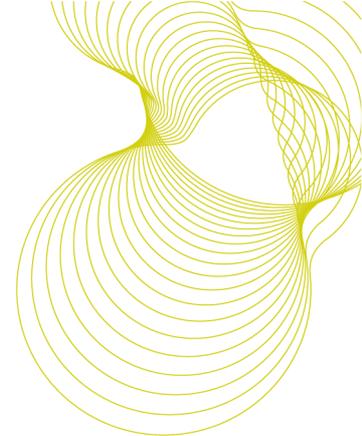
The DoP states performance/class for the following basic characteristics:

- Water vapour permeability	V2 mean
- Water permeability	W1 high
- Bond strength	≥ 0.80 MPa
- Durability	NPD ("no performance determined")
- Thermal conductivity λ	0.047 W/mK
- Reaction to fire	A2 – s1, d0
- Dangerous substances	None present



For CE marking purposes, Table ZA.1 of EN 15824 requires Water vapour permeability, Water permeability and Durability to be declared for external renders only, whereas the DoP states that Aero-Therm is intended for internal use.

Table ZA.2 of EN 15824 states the various Attestation of Conformity Systems that are relevant depending on the intended use and composition of the product. On the DoP the manufacturer has stated Aero-Therm to be Attestation of Conformity System 3. For CE marking purposes this means that the testing used to support the DoP must be carried out by a notified body. The DoP states that TZUS undertook the testing for the purpose of the DoP. TZUS is a notified body for EN 15824 Attestation System 3 testing under the CPR.



C. Reaction to Fire test report

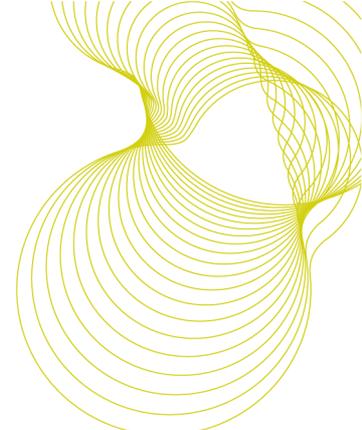
Background:

As required by UK Building Regulation, Approved Document B, Volume 1 (dwellings): 2006 Edition incorporating 2010 and 2013 amendments: section B.2 (internal fire spread – linings), section 3.1 states that 'subject to the specific provisions described in paragraphs 3.2 to 3.16, the surface lining of walls and ceilings should meet the following classifications:'

Table 1 Classification of linings		
Location	National class ⁽¹⁾	European class ⁽¹⁾⁽³⁾⁽⁴⁾
Small rooms ⁽²⁾ of area not more than 4m ²	3	D-s3, d2
Domestic garages of area not more than 40m ²		
Other rooms ⁽²⁾ (including garages)	1	C-s3, d2
Circulation spaces within dwellinghouses		

Notes:

1. See paragraph B2.v.
2. For meaning of room, see definition in Appendix E.
3. The National classifications do not automatically equate with the equivalent classifications in the European column, therefore products cannot typically assume a European class, unless they have been tested accordingly.
4. When a classification includes 's3, d2', this means that there is no limit set for smoke production and/or flaming droplets/particles.



Approved Document B, Volume 2 (buildings other than dwellings): 2006 Edition incorporating 2007, 2010 and 2013 amendments: section B.2 (internal fire spread – linings), section 6.1 states that ‘subject to the specific provisions described in paragraphs 6.2 to 6.16, the surface lining of walls and ceilings should meet the following classifications:’

Table 10 Classification of linings		
Location	National class ⁽¹⁾	European class ⁽¹⁾⁽²⁾⁽⁴⁾
Small rooms ⁽²⁾ of area not more than: a. 4m ² in residential accommodation b. 30m ² in non-residential accommodation	3	D-s3, d2
Other rooms ⁽²⁾ (including garages)	1	C-s3, d2
Circulation spaces within dwellings		
Other circulation spaces, including the common areas of blocks of flats	0	B-s3, d2 ⁽⁴⁾

Notes:

1. See paragraph B2.v.
2. For meaning of room, see definition in Appendix E.
3. The National classifications do not automatically equate with the equivalent classifications in the European column, therefore, products cannot typically assume a European class, unless they have been tested accordingly.
4. When a classification includes ‘s3, d2’, this means that there is no limit set for smoke production and/or flaming droplets/particles.
5. Wallcoverings which conform to BS EN 15102:2007 *Decorative wallcoverings – roll and panel form products*, which achieve at least Class C-s3,d2 and are bonded to a Class A2-s3,d2 substrate will also be acceptable.

EN 15824 states that the Reaction to Fire classification shall be Euroclass A1 to F.

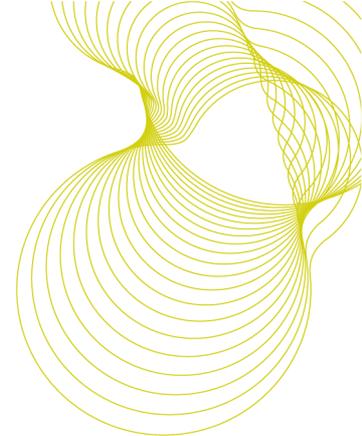
Observations:

Fire Classification Report No. PK-10-056 issued by Centrum Staveního Inženýrství a.s. refers.

The declared Reaction to Fire classification is:

- A2 – s1, d0

The obtained rating would enable the use of the product in escape routes as well as the above listed locations.



D. Product certificate

Background:

Whereas individual test reports or certificates of conformity may imply a one-off statement of conformity (i.e. 'on the day it was tested, the product met the requirements of a test'), product certification implies initial and on-going compliance with a set of criteria.

Product certification usually consists of the following generic criteria

- Initial compliance of the quality management system, e.g. with ISO 9001 or Factory Production Control (FPC) requirements
- Initial compliance of the product with a set of technical requirements, e.g. a product standard, a recognised industry standard or documented set of technical criteria
- On-going compliance of the quality management system, e.g. with ISO 9001 or Factory Production Control (FPC) requirements. Maintained by regular auditing of the system by a third party certification body.
- On-going compliance of the product with a set of technical requirements, e.g. a product standard, a recognised industry standard or documented set of technical criteria. Maintained by regular testing by the third party certification body.

Observations:

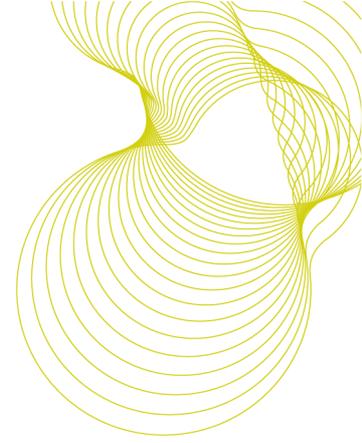
Certificate number 204/C5/2013/010-032028 issued by TZUS refers.

The product certificate is based on the National Technical Approval reference 010-032027 (08.08.2013).

The product certificate states that 'the Authorised Body (TZUS) performs at least once every 12 months the surveillance of proper function of the factory production control, selects samples at the factory and performs an audit-testing of samples to assess whether the characteristics of the product comply with the national technical approval ...'

The nature of the product certificate appears to be the same in content to 'normal' generic product certification as described in the Background above, namely initial FPC and product assessment, plus on-going regular auditing of FPC and product.

Evidence was supplied to confirm that regular product audit testing takes place, as well as regular surveillance of the production management system.



E. Thermal Testing report and certificate

Background:

Thermal conductivity or resistivity (“U-value” or “R-value” respectively) does not appear to be relevant to this type of thermal reflective coating. U-value testing/calculation is normally conducted on conventional thermal insulation products. As described in this Report, the Aero-Therm thermal reflective coating is stated to behave in a different way to conventional thermal insulation products and so an alternative methodology is necessary to determine its thermal performance.

Consequently, thermal testing was undertaken by TZUS, and the results given in the Observations section below were observed.

Observations:

Certificate number 010-033223 and Report number 010-033222 issued by TZUS refer.

TZUS is a testing facility that is recognised under the International Laboratory Accreditation Cooperation (ILAC) agreement, by virtue of its accreditation to the International Standard for the ‘general requirements for the competence of testing and calibration laboratories’, ISO 17025.

Key criteria reported from testing:

Characteristic	Building with Aero-Therm applied	Building without Aero-Therm applied
Time needed to reach 23°C (from nominal 15°C)	30 min	41 min
Time to drop 3°C (from nominal 21°C)	55 min	30 min
Power consumption in a 4 day period	27.2 kWh	33.17 kWh
Total saving in consumption using Aero-Therm in a 4 day period	5.97 kWh	-

It should be noted that the results given by TZUS in the above detailed report were obtained during laboratory-condition testing. In practice different users may experience different savings due to the varying condition of the home to the test conditions and due to an individual’s different tolerance to temperature.

=====REPORT ENDS=====