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Agrément Certificate
20/5821
Product Sheet 1

ARMATHERM THERMAL BREAKS

ARMATHERM FRR

This Agrément Certificate Product Sheet(1) relates to Armatherm FRR. The product is used to form a structural thermal break between adjoining steel members or steel and concrete members, primarily where external steel members meet the supporting structure at the building envelope.

(1) Hereinafter referred to as 'Certificate'.

CERTIFICATION INCLUDES:

- factors relating to compliance with Building Regulations where applicable
- factors relating to additional non-regulatory information where applicable
- independently verified technical specification
- assessment criteria and technical investigations
- design considerations
- installation guidance
- regular surveillance of production
- formal three-yearly review.

KEY FACTORS ASSESSED

Structural performance — the product can be used in building constructions designed for static loading (see section 6).
Behaviour in relation to fire — the product is not classified as non-combustible; however, constructions incorporating the product, and suitable fire protection, can provide adequate fire resistance (see section 7).
Thermal performance — the product contributes towards the overall thermal insulation of the building envelope by reducing thermal bridging between the internal and external elements (see section 8).
Resistance to moisture — the product has satisfactory resistance to moisture (see section 9).
Durability — under normal service conditions, the product will have a service life equal to that of the building in which it is installed (see section 11).

The BBA has awarded this Certificate to the company named above for the product described herein. This product has been assessed by the BBA as being fit for its intended use provided it is installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Date of First issue: 30 October 2020

Hardy Giesler
Chief Executive Officer

Regulations

In the opinion of the BBA, Armatherm FRR, if installed, used and maintained in accordance with this Certificate, can satisfy or contribute to satisfying the relevant requirements of the following Building Regulations (the presence of a UK map indicates that the subject is related to the Building Regulations in the region or regions of the UK depicted):

The Building Regulations 2010 (England and Wales) (as amended)

Requirement:	**A1**	**Loading**
Comment:		The product has sufficient strength and stiffness to transmit the design loads, in accordance with sections 6.1 to 6.5 of this Certificate.
Requirement:	**B3(1)**	**Internal fire spread (structure)**
Comment:		A construction incorporating the product can achieve adequate fire resistance. See sections 7.1, 7.2 and 7.5 of this Certificate.
Requirement:	**L1(a)(i)**	**Conservation of fuel and power**
Comment:		The product can contribute to satisfying this Requirement. See section 8.1 of this Certificate.
Regulation:	**7(1)**	**Materials and workmanship**
Comment:		The product is acceptable. See section 11 and the *Installation* part of this Certificate.
Regulation:	**7(2)**	**Materials and workmanship**
Comment:		The product is unrestricted by this Regulation. See section 7.1 and the *Installation* part of this Certificate.
Regulation:	**26**	**CO_2 emission rates for new buildings**
Regulation:	**26A**	**Fabric energy efficiency rates for new dwellings (applicable to England only)**
Regulation:	**26A**	**Primary energy consumption rates for new buildings (applicable to Wales only)**
Regulation:	**26B**	**Fabric performance values for new dwellings (applicable to Wales only)**
Comment:		The product can contribute to a building satisfying these Regulations; however, compensating fabric/services measures may be required. See section 8.1 of this Certificate.

The Building (Scotland) Regulations 2004 (as amended)

Regulation:	**8(1)**	**Durability, workmanship and fitness of materials**
Comment:		The product is acceptable. See sections 10 and 11 and the *Installation* part of this Certificate.
Regulation:	**9**	**Building standards applicable to construction**
Standard:	1.1(a)(b)	Structure
Comment:		A structure incorporating the product has sufficient strength and stiffness to sustain and transmit the design loads in accordance with sections 6.1 to 6.5 of this Certificate, with reference to clauses 1.1.1[(1)(2)], 1.1.2[(1)(2)], 1.1.3[(1)(2)] and 1.1.5[(1)(2)] of this Standard.
Standard:	2.3	Structural protection
Comment:		A construction incorporating the product can achieve adequate fire resistance, with reference to clauses 2.3.1[(1)(2)] and 2.3.2[(1)(2)]. See sections 7.1, 7.2 and 7.5 of this Certificate.
Standard:	6.1(b)	Carbon dioxide emissions
Comment:		The product, when used in conjunction with additional insulation, can contribute to satisfying this Standard, with reference to clauses 6.1.1[(1)], 6.1.2[(2)] and 6.1.6[(1)]. See section 8.1 of this Certificate.

Standard:	6.2	Building insulation envelope
Comment:		The product can contribute to satisfying this Standard, with reference to clauses 6.2.3[(1)], 6.2.5[(2)], 6.2.10[(1)] and 6.2.12[(2)]. See section 8.1 of this Certificate.
Standard:	7.1(a)(b)	Statement of sustainability
Comment:		The product can contribute to satisfying the relevant requirements of Regulation 9, Standards 1 to 6, and therefore will contribute to a construction meeting a bronze level of sustainability as defined in this Standard. See section 8.1 of this Certificate.
Regulation:	**12**	**Building standards applicable to conversions**
Comment:		Comments in relation to the product under Regulation 9, Standards 1 to 6, also apply to this Regulation, with reference to clause 0.12.1[(1)(2)] and Schedule 6[(1)(2)].

(1) Technical Handbook (Domestic).
(2) Technical Handbook (Non-Domestic).

The Building Regulations (Northern Ireland) 2012 (as amended)

Regulation:	**23**	**Fitness of materials and workmanship**
Comment:		The product is acceptable. See section 11 and the *Installation* part of this Certificate.
Regulation:	**30**	**Stability**
Comment:		The product has sufficient strength and stiffness to sustain and transmit the design loads in accordance with sections 6.1 to 6.5 of this Certificate.
Regulation:	**35(1)**	**Internal fire spread — Structure**
Comment:		A construction incorporating the product can achieve adequate fire resistance. See sections 7.1, 7.2 and 7.5 of this Certificate.
Regulation:	**39(a)(i)**	**Conservation measures**
Regulation:	**40(2)**	**Target carbon dioxide emission rate**
Comment:		The product can contribute to a building satisfying these Regulations; however, compensating fabric/services measures may be required. See section 8.1 of this Certificate.

Construction (Design and Management) Regulations 2015
Construction (Design and Management) Regulations (Northern Ireland) 2016

Information in this Certificate may assist the client, designer (including Principal Designer) and contractor (including Principal Contractor) to address their obligations under these Regulations.

See sections: 3 *Delivery and site handling* (3.2) of this Certificate.

Additional Information

NHBC Standards 2020

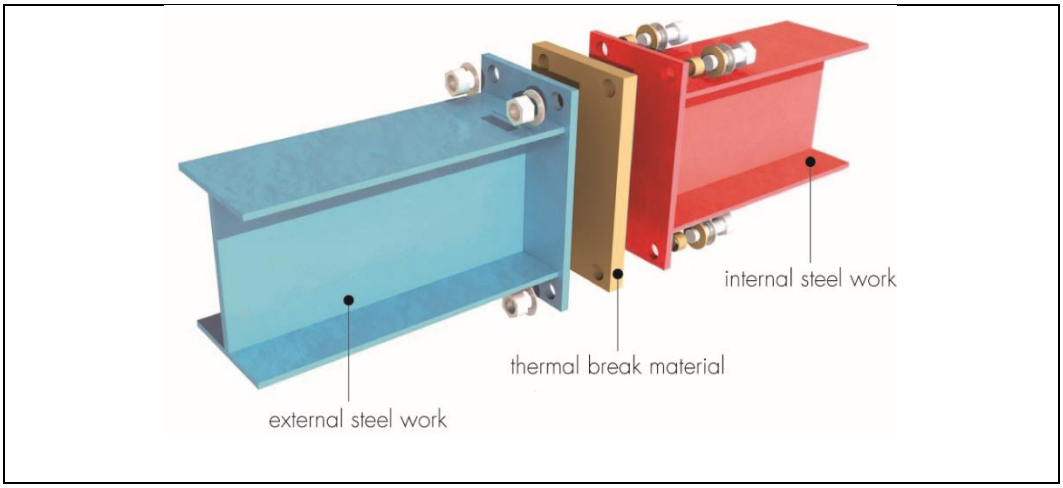
In the opinion of the BBA, Armatherm FRR, if installed, used and maintained in accordance with this Certificate, can satisfy or contribute to satisfying the relevant requirements in relation to *NHBC Standards*, Chapter 7.1 *Flat roofs and balconies*.

Technical Specification

1 Description

1.1 Armatherm FRR is a medium weave phenolic cotton laminate used in steel-to-steel and steel-to-concrete structural connections as a structural thermal break, to reduce thermal bridging within the building envelope.

Figure 1 Armatherm FRR – steel-to-steel connection



1.2 Armatherm FRR is available in various thicknesses, with the nominal characteristics given in Table 1, below. The plate dimensions are specified according to project-specific requirements and any holes for fixings are machined by the Certificate holder according to the construction drawings.

Table 1 Nominal characteristics

Thickness (mm)	6, 10, 12, 15, 25, 50
Nominal density (kg.m^{-3})	1380
Characteristic compressive strength f_{ck} (N·mm^{-2})	273
Design compressive strength(1) f_{cd} (N·mm^{-2})	218
Elastic modulus (N·mm^{-2})	5610
Thermal conductivity λ (W/mK)	0.35

(1) The partial material factor of 1.25 for joints has been applied in accordance with BS EN 1993-1-8 : 2005 and its National Annex.

1.3 Armatherm FRR bushings and washers are available for use with bolts on the external side of the steel connection, to reduce the heat transfer through the bolt. Bushing and washer details are summarised in Tables 2 and 3, respectively.

Table 2 Bushing detail

Bolt size	Hole in Armatherm FRR plate (mm)	Clearance hole in structure (mm)	Standard bushing length (mm)
M12	14	20	10
M16	18	24	13
M20	22	28	13
M24	26	32	17
M28	30	36	20

Table 3 Washer detail

Bolt size	Washer internal diameter (mm)	Washer external diameter (mm)	Thickness (mm)
M12	14	30	6
M16	18	40	6
M20	22	47	6
M24	26	50	6
M28	30	65	6

1.4 Ancillary items for use with the product but outside the scope of the Certificate, include:

- structural supporting elements — steelwork, concrete etc
- stainless steel bolts.

2 Manufacture

2.1 Armatherm FRR is manufactured by moulding and extrusion a blend of thermosetting resin and fibrous reinforcement into sheets, which are then laminated into plates of the appropriate thickness.

2.2 The plates (incorporating any holes), bushings and washers are machined from the sheet material by CNC machining.

2.3 As part of the assessment and ongoing surveillance of product quality, the BBA has:

- agreed with the manufacturer the quality control procedures and product testing to be undertaken
- assessed and agreed the quality control operated over batches of incoming materials
- monitored the production process and verified that it is in accordance with the documented process
- evaluated the process for management of nonconformities
- checked that equipment has been properly tested and calibrated
- undertaken to carry out the above measures on a regular basis through a surveillance process, to verify that the specifications and quality control operated by the manufacturer are being maintained.

3 Delivery and site handling

3.1 Each thermal break plate has a label bearing the Certificate holder's details and a pad identification code.

3.2 Depending on the order size, Armatherm FRR will be supplied either boxed or palleted. Palleted deliveries are secured with shrink-wrap and/or banding.

3.3 During off-loading care must be taken to avoid damage to the packaging. Prior to installation, the product must be stored in a clean and dry environment, under cover and away from direct sunlight and solvents or other harmful chemicals. Any product that is damaged should not be used.

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on Armatherm FRR.

Design Considerations

4 Use

Armatherm FRR thermal break plates are satisfactory to reduce the thermal bridging (ie by reducing thermal transmittance through the connection) adjoining steel members or steel and concrete members, primarily where external steel members meet members at the building envelope. They can be used in the following applications (see Figures 2 and 3) in new-build and refurbishment projects(1):

- balconies
- canopies
- beam connections
- masonry shelf angles
- roof penetrations
- rain screens
- column bases
- connections between new and existing construction.

(1) The specific design of these applications is outside the scope of this Certificate:

Figure 2 Typical example applications of Armatherm FRR at external walls

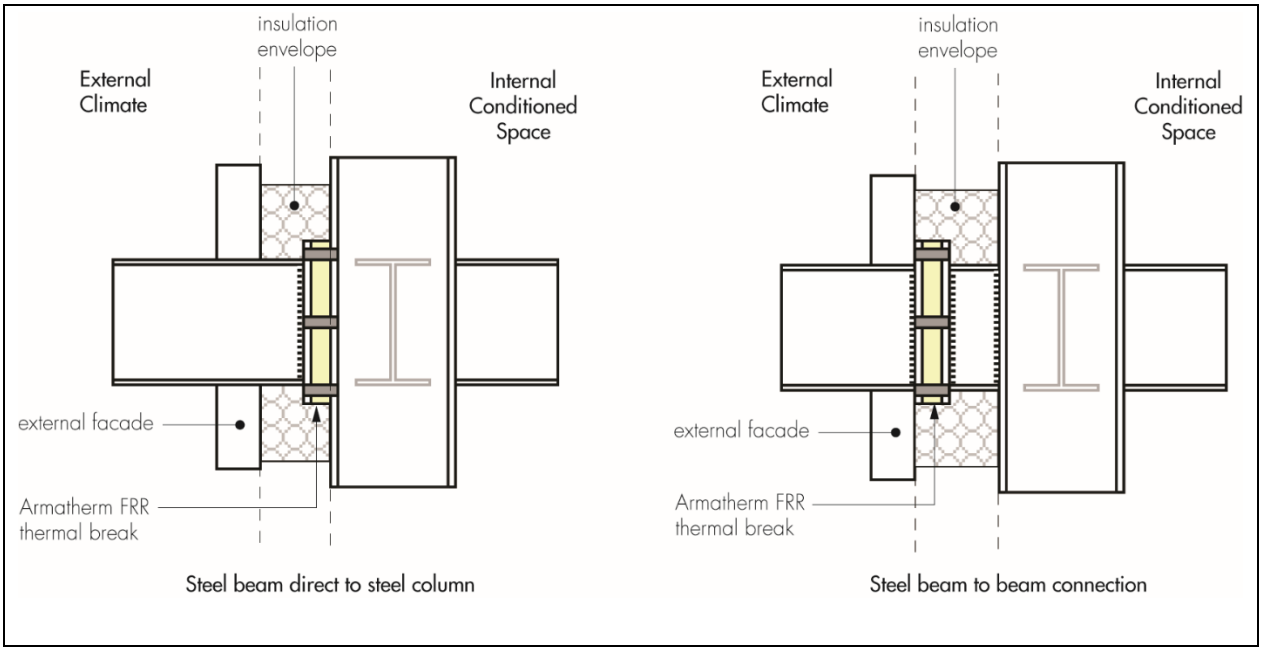
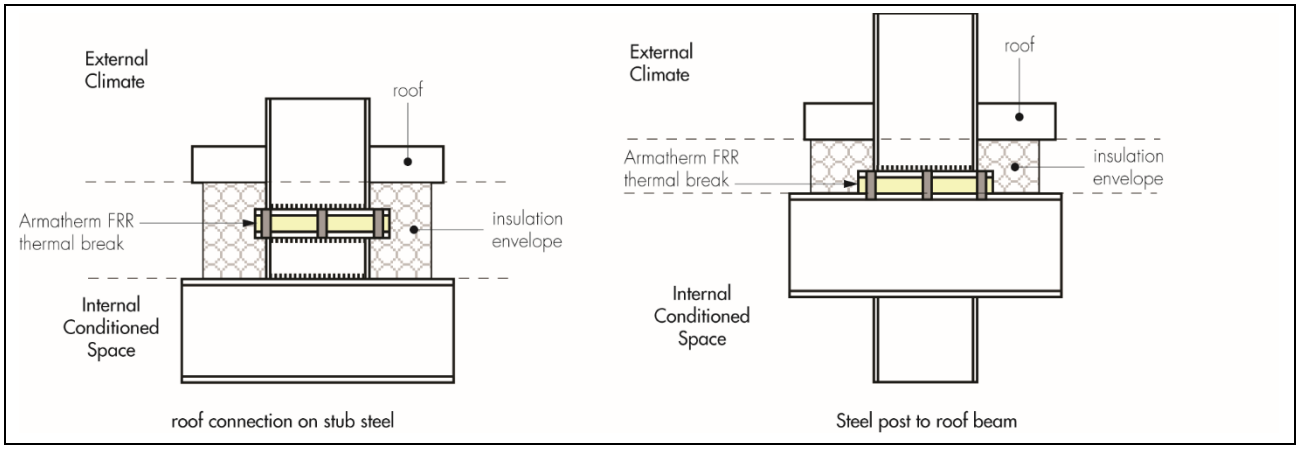


Figure 3 Typical example applications of Armatherm FRR at roof level



5 Practicability of installation

The product is designed to be installed by general builders or contractors in accordance with the Certificate holder's instructions and the requirements of this Certificate.

6 Structural performance

6.1 Armatherm FRR can be used for all types of building construction applications designed for static loading as specified in section 4.1 of this Certificate.

6.2 The design compressive strength (f_{ck})(1) and compressive modulus for Armatherm FRR are 218 N·mm^{-2} and 5610 N·mm^{-2} respectively.

(1) Design compressive strength (*f*ck) has been calculated in accordance with BS EN 1993-1-8 : 2005.

6.3 The Armatherm FRR thermal break materials exhibit levels of initial creep behaviour; therefore, when considering additional rotation due to compression of the thermal break plates, the designer should include an allowance for long term creep, by increasing predicted long-term deformation by 25%.

6.4 The thermal break plate does not contribute to shear resistance but introduces bending on the bolts by virtue of the gap created. Therefore, a thermal break plate in a connection must be considered as a 'pack' in terms of connection design. Where packs are used in connections, and depending on the thickness of the packs, it may be necessary to reduce the shear resistance of the bolts within the connection in accordance with BS EN 1993-1-8 : 2005.

6.5 Assessment of structural performance for individual installations of connections that include thermal break plates should be carried out by a suitably experienced and qualified engineer and designed in accordance with BS EN 1993-1-8 : 2005 and the Steel Construction Institute (SCI) industry guidance. The engineer should confirm that:

- the thermal break plate can resist the applied compression forces
- any additional rotation due to the compression of the thermal break plate (including allowance for long term creep) is acceptable
- the shear resistance of the bolts is acceptable given that there may be a reduction in resistance due to packs and large grip lengths
- for non-pre-loaded bolt systems, the shear resistance of the bolts is adequate.

6.6 Where Armatherm FRR bushings and washers are used, the stress in the bushing and washer due to the axial force in the bolt must not exceed the design resistance of the material.

7 Behaviour in relation to fire

7.1 The product has reaction to fire classifications(1) of B-s1, d0 for 20 to 50 mm thicknesses and C-s1, d0 for a 12 mm thickness, in accordance with BS EN 13501-1 : 2018. Other thicknesses have not been classified. The product is therefore not classified as 'non-combustible' or 'of limited combustibility'. These classifications are valid for construction applications mechanically installed over any substrate with a density equal to or greater than 5887kg/m3, with a minimum thickness of 0.8 mm, a reaction to fire classification of A1 and a minimum melting point of 1000˚C.

(1) Refer to reports WF 419612 and WF 409980 (available from the Certificate holder).

7.2 When properly installed, the product is largely protected by the building fabric panels and, as it is considered to be present in relatively small quantities, is unlikely to significantly affect the overall fire performance of the building.

7.3 Designers should refer to the relevant national Building Regulations and guidance for detailed conditions of use, particularly in respect of requirements for fire resistance, cavity barriers, service penetrations and combustibility limitations for other materials and components used in the overall wall construction (for example, thermal insulation).

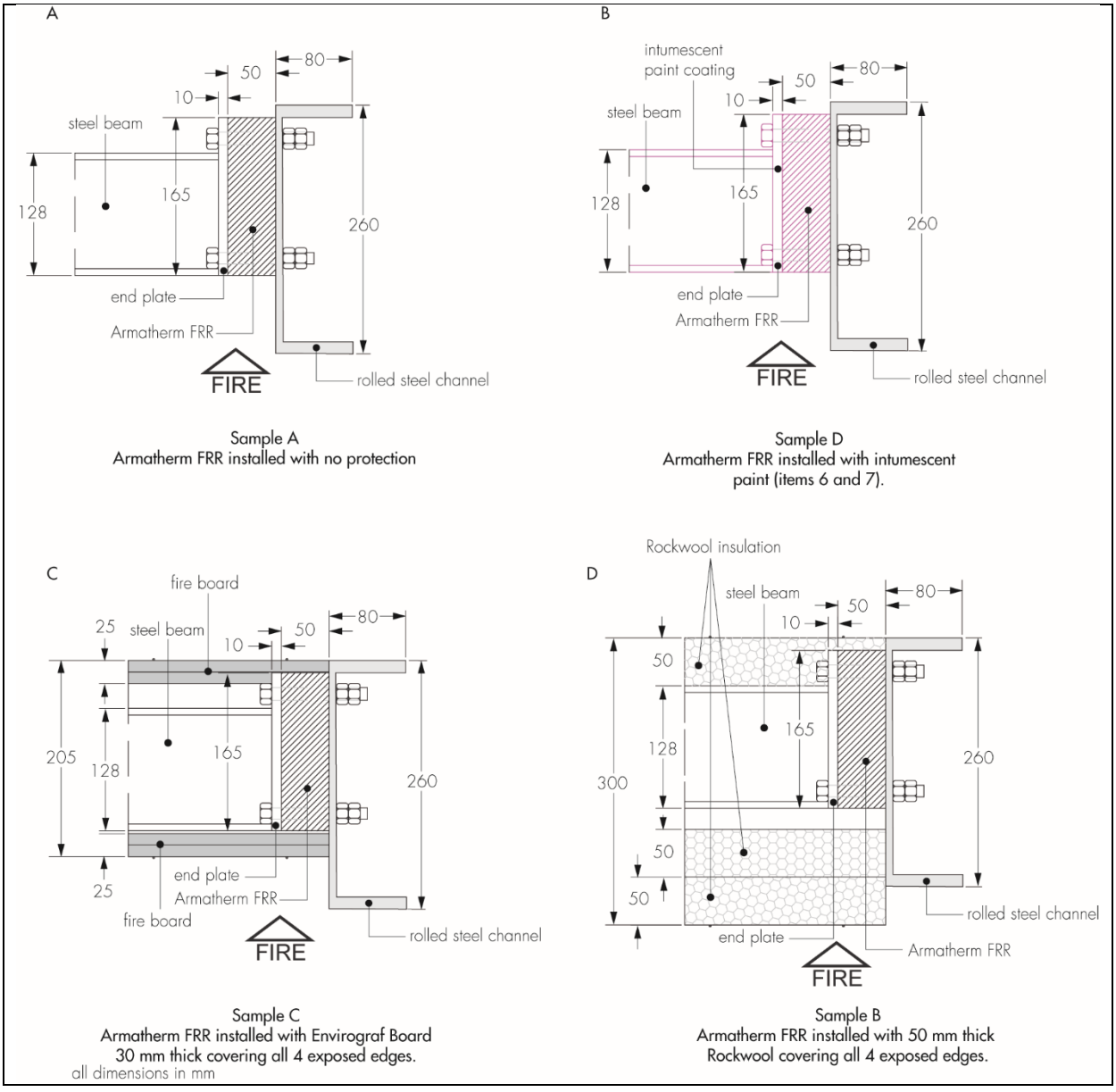
7.4 To achieve the required period of fire resistance as required in the documents supporting the national Building Regulations, the product requires protection from fire, which must be provided by the internal and external linings of the building. Incorporation of the product must not interfere with the provision of effective cavity barriers and fire-stopping around services and penetrations of the building envelope.

7.5 A typical balcony construction incorporating the product with various protective linings was subjected to ad-hoc fire resistance testing based on BS EN 1363-1 : 2020 (WF report No 423386 dated 1st April 2020) and obtained the results given in Table 4, below.

Table 4 Fire performance

Fire protection	Period of fire resistance (minutes)
No protection	40
Single coat of Envirograf EP/FS/INT Steel Intumescent Paint Primer and triple coat of Envirograf #EP/FS/P-1L Steel Intumescent Paint. Overall dry film thickness was 0.5 mm.	60
Double layer of 12 mm thick Envirograf STB/91 fire board complete with foil cover. Overall thickness of the system was 30 mm.	84
Double layer of 50 mm thick foil-faced Rockwool Ablative coated batt insulation, fixed in place with tying wire. Overall thickness of the system was 100 mm.	121

Figure 4 Construction detail for fire resistance test



7.6 The fire resistance of other structural elements incorporating the product may be established by testing in accordance with the relevant standards BS EN 1363-1 : 2020, BS EN 1365-1 : 2012, BS EN 1365-2 : 2014, BS EN 1365-3 : 2000 or BS EN 1365-5 : 2004.

7.7 Designers must ensure that the design and construction of elements incorporating the product provide the level of fire resistance required by the documents supporting the relevant national Building Regulations.

8 Thermal performance

8.1 The linear thermal transmittance psi (ψ) value and minimum temperature factor (f_{Rsi}) of a junction incorporating the product should be determined in accordance with BS EN ISO 10211 : 2017 and BRE Report BR 497 : 2007, using the dimensions of the components and an average thermal conductivity of 0.35 $W \cdot m^{-1} \cdot K^{-1}$ for the Armatherm FRR plate.

8.2 The effect of thermal bridging at the junction between steel-to-steel or steel-to-concrete must be minimised. The performance of this junction will be dependent upon other elements not covered by this Certificate, and a suitable assessment of all junction details must be carried out.

9 Resistance to moisture

Armatherm FRR has a water absorption 0.05 $kg.m^{-2}$ when tested in accordance with BS EN 1609 : 2013.

10 Maintenance

The product is situated within the building structure and should not require maintenance.

11 Durability

When used and installed in accordance with this Certificate and the Certificate holder's instructions, protected from the external environment by the building envelope and in a steel structure designed in accordance with BS EN 1993-1-1 : 2005, the product will have a service life equal to that of the structure, taken as not less than 60 years.

Installation

12 General

12.1 Installation must be in accordance with industry guidance, eg the Eurocodes, the National Structural Steel Specification (NSSS) and the National Structural Concrete Specification (NSCS).

12.2 Armatherm FRR must be installed in accordance with the Certificate holder's recommendations, the requirements of this Certificate and the specifications laid down by a suitably qualified and experienced engineer.

12.3 The steel end plates to which the thermal break will be connected must be inspected to ensure there are no irregularities and that they are free from dirt or contaminants.

12.4 One of the end plates can be simply held on one side of the assembly by the bolts until the other end plate is located. The bolts can then be loosely tightened prior to alignment and, following this, can be torqued to an appropriate level.

12.5 After installation, the structural thermal break plate should be protected from the environment and the risk of site damage until the cladding/ finishes has been completed.

Technical Investigations

13 Tests

Tests were carried out and the results assessed to determine:

- compressive strength
- long term creep

- density
- elasticity modulus
- thermal conductivity
- water absorption.

14 Investigations

The manufacturing process was evaluated, including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used.

Bibliography

BRE Report BR 497 : 2007 *Conventions for Calculating Linear thermal transmittance and Temperature Factors*

BS EN 1363-1 : 2020 *Fire resistance tests – General requirements*
BS EN 1365-1 : 2012 *Fire resistance tests for loadbearing elements – Walls*
BS EN 1365-2 : 2014 *Fire resistance tests for loadbearing elements – Floors and roofs*
BS EN 1365-3 : 2000 *Fire resistance tests for loadbearing elements – Beams*
BS EN 1365-5 : 2004 *Fire resistance tests for loadbearing elements – Balconies and walkways*

BS EN 1993-1-1 : 2005 *Eurocode 3 — Design of steel structures — General rules and rules for buildings*

BS EN 1993-1-8 : 2005 *Eurocode 3 — Design of steel structures — Design of joints*
NA to BS EN 1993-1-8 : 2005 UK National Annex to *Eurocode 3 — Design of steel structures —Design of joints*

BS EN 13501-1 : 2018 *Fire classification of construction products and building elements — Classification using data from reaction to fire tests*

BS EN ISO 10211 : 2017 *Thermal bridges in building construction — Heat flows and surface temperatures — Detailed calculations*

BS EN 1609 : 2013 *Thermal insulating products for building applications — Determination of short term water absorption by partial immersion*

15 Conditions

15.1 This Certificate:

- relates only to the product/system that is named and described on the front page
- is issued only to the company, firm, organisation or person named on the front page – no other company, firm, organisation or person may hold or claim that this Certificate has been issued to them
- is valid only within the UK
- has to be read, considered and used as a whole document – it may be misleading and will be incomplete to be selective
- is copyright of the BBA
- is subject to English Law.

15.2 Publications, documents, specifications, legislation, regulations, standards and the like referenced in this Certificate are those that were current and/or deemed relevant by the BBA at the date of issue or reissue of this Certificate.

15.3 This Certificate will remain valid for an unlimited period provided that the product/system and its manufacture and/or fabrication, including all related and relevant parts and processes thereof:

- are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA
- continue to be checked as and when deemed appropriate by the BBA under arrangements that it will determine
- are reviewed by the BBA as and when it considers appropriate.

15.4 The BBA has used due skill, care and diligence in preparing this Certificate, but no warranty is provided.

15.5 In issuing this Certificate the BBA is not responsible and is excluded from any liability to any company, firm, organisation or person, for any matters arising directly or indirectly from:

- the presence or absence of any patent, intellectual property or similar rights subsisting in the product/system or any other product/system
- the right of the Certificate holder to manufacture, supply, install, maintain or market the product/system
- actual installations of the product/system, including their nature, design, methods, performance, workmanship and maintenance
- any works and constructions in which the product/system is installed, including their nature, design, methods, performance, workmanship and maintenance
- any loss or damage, including personal injury, howsoever caused by the product/system, including its manufacture, supply, installation, use, maintenance and removal
- any claims by the manufacturer relating to CE marking.

15.6 Any information relating to the manufacture, supply, installation, use, maintenance and removal of this product/system which is contained or referred to in this Certificate is the minimum required to be met when the product/system is manufactured, supplied, installed, used, maintained and removed. It does not purport in any way to restate the requirements of the Health and Safety at Work etc. Act 1974, or of any other statutory, common law or other duty which may exist at the date of issue or reissue of this Certificate; nor is conformity with such information to be taken as satisfying the requirements of the 1974 Act or of any statutory, common law or other duty of care.

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