17th July 2017

Gebrik Fire Performance v7

Introduction

Rigid polyurethane (PUR) foams are widely used as an insulation material in a variety of building applications. Since the first oil crisis in the seventies and the resulting increase in energy cost, insulation materials have been gradually applied more and more in buildings. Since then, regulatory requirements and recommendations to achieve a certain U value have come into force in several countries. Consequently, the majority of new buildings have, to varying levels of extent, insulation installed.

The insulation capacity of PUR is exemplary and extremely competitive. It has excellent physical properties, eg mechanical strength, dimensional stability, water resistance, etc. Furthermore, it is light-weight, quick to install and its ability to be used to create composite panels and sandwich panels in a factory offer several advantages in comparison to site-assembled constructions. However, polyurethane foams are combustible and their use is controlled by the building regulations therefore all building products must comply with the fire standards described therein.

It is recognised that a fire will spread quickly when it finds sufficient flammable materials so it is crucial to use materials of limited combustibility on key surfaces, particularly within a room, (eg ceilings) but also on facades to minimise any risk of surface spread across the building. Therefore, the use of appropriate materials can dramatically reduce the speed flames spread through and across an area as well as minimise their contribution to the fire.

Statistically, the probability of fire starting in a dwelling is very low but the majority of fire deaths occur in dwellings. It is generally accepted that the most common cause of death in a fire is to be overcome by smoke and gases, which is confirmed by UK and US data. In the US, however, 66 per cent to 75 per cent of deaths are caused this way, compared with 40 per cent in the UK. The prevalence of greater compartmentalisation and use of fire doors in UK home design, so that fires are more likely to stay small, may be the reason why fire conditions differ between US and the UK. It is when the fire extends beyond the room of origin that the majority of fire deaths occur. Therefore, where a cavity is used in the superstructure, it too should be compartmentalised to minimise fire spread, which is typically done by applying intumescent strips to the outer face of the inner substrate at appropriate vertical and horizontal locations.

Many misconceptions have occurred concerning the performance in a fire situation of polyurethane based building products. This statement has therefore been produced to provide information on the rigorous testing of Gebrik, its conformance with the UK building regulations and its actual performance in a fire situation.

Meeting Building Regulations for Fire Safety
Building Control Alliance (BCA) Technical Guidance Note 18: Issue 1 June 2015 suggests four routes to compliance to achieve satisfactory levels of fire safety:

Option 1 – The use of materials of limited combustibility
Option 2 – Following a performance-based BR135
Option 3 – Submission of a performance-based desktop study report
Option 4 – Taking a holistic fire safety engineering approach

Option 1
This route to compliance may at first seem the best option however its linear approach may preclude the use of suitable materials that provide other benefits to the design, ie thermal performance, weathertightness, weight, appearance, cost, preferred method of construction, etc.

Option 2
Approved Documents B2 for England & Wales (ADB2) and Technical Handbooks Section 2 for Scotland (Domestic and Non-Domestic) refer to BR135 *'Fire Performance of External Insulation for Walls of Multi-Storey Buildings',* which sets out the performance criteria for an acceptable solution. Testing is carried out to BS8414, where Part 1 is for application of non-load bearing cladding to masonry structures and Part 2 is for application of non-load bearing cladding to steel framed structures.

Products successfully tested to these standards as part of a complete external cladding solution are deemed to comply with the Regulations and BCA Guidance Note 18 for the specific application in which they have been tested.

Option 3
It is unrealistic to test every variation within an external cladding solution due to the wide number of preferred methods of construction therefore a practical solution is to carry out a desktop study. This must be carried out by a "suitably qualified fire specialist stating whether, in their opinion, BR135 criteria would be met with the proposed system" and be supported by relevant test data to support their recommendation.

This is a sensible and practicable approach to determine the suitability for use of a preferred cladding solution where exact testing has not occurred and test data is not available - even more so, as new and innovative solutions become available or it is impractical for suppliers of some of the commodity or lower value items to carry out testing of a complete solution.

Option 4
A holistic solution should be carried out by a suitably qualified fire specialist to assess the fire safety of the building as a whole. Typically, the assessment will include not only the external cladding and its risk of spread, reaction to ignition, etc but also the building location, scale & geometry, methods of fire control and evacuation, etc.

This 'whole building' method of assessment is undoubtedly the most robust approach to fire safety in buildings over 18m as it uses scientific, engineering & evidence-based principles and research to ensure that every factor is considered.

Fire Safety Conclusion
Clearly when designing a building, the safety of its structure, occupants and surrounding community are of paramount importance. Fire safety is a key consideration and should never be a 'tick-box exercise', hence there is more than one route for fire safety compliance of buildings over 18m. As new materials and methods of construction become available it has never been more important to take a professional, balanced and informed approach to ensure the most appropriate solution is specified and used for the safety of the building occupiers and owners.

Gebrik Insulating Brick Cladding System

Introduction

Gebrik is a factory-produced insulating brick cladding system. Panels and corners are produced by casting brick slips in polyurethane, with a thin layer of sand combined with the PU during manufacture to encase the slips and create a 10mm gap to apply fixings, which mechanically secure the system to the substrate. Panel chambers are created where panels abut and site-injected with expandable PU foam to complete a watertight seal. Matching slips are then site-applied with system adhesive to maintain stretcher bond (none is required in the case of stack bond). Finally the system is pointed with lime, sand, cement mortar. The system is therefore intended to provide a decorative, non-load bearing facade which will insulate and protect the inner leaf from heat loss and water ingress.

BS8414/BR135

The Gebrik system has been tested in accordance with BS8414-1:2002 and BS8414-2:2005 therefore when classified in accordance with Annex A and B of BRE report (BR 135:2003 & 2013) *Fire Performance of External Insulation for Walls of Multi-Storey Buildings* has been shown to have met the performance criteria.

As a consequence of the BR135 Classification, Gebrik meets the fire safety requirements of the Building Regulations/Standards for external fire spread in accordance with Approved Documents B Volume 2, Technical Handbooks Section 2 and Building Control Alliance Technical Guidance Note 18.

Furthermore, a BR135 Assessment has been carried out, which is based on a desktop study of the Gebrik system and its application to light gauge steel framing and masonry substrates - both with and without cavities. The Assessment evaluates the various layers of the substrate that have been tested and provides a guide for façade designers in terms of which layers can vary from the material type and thickness tested.

EN13501-1:2007+A1:2009

The harmonized European Fire Standards are a set of test standards that have been accepted by all countries within the European Economic Community. This allows manufacturers to produce or import products that have been tested to a common standard without the need to test in each member state. Testing to these standards is now accepted in all EEC countries. Compliance with the European standards and regulations is mandatory.

All certified European test laboratories (“Notified Bodies”) who are listed with EOTA (European Organisation for Technical Approval) may perform these tests and issue the corresponding test reports (ITT – Initial Type Testing). In addition there may be national test or building regulation requirements that may need to be observed.

The European standard EN 13501-1: Reaction to Fire provides a number of performance criteria to measure the fire characteristics of building products. These cover spread of flame and contribution to fire as well the generation of smoke and the production of burning droplets. The table below provides an overview of the available classifications.

Additional requirements		
No Smoke	**No burning droplets falling/dripping**	**European class according to EN13501-1**
✓	✓	A1
✓	✓	A2-s1,d0
✓	✓	B-s1,d0
✓	✓	C-s1,d0
	✓	A2-s2,d0
	✓	A2-s3,d0

	✓ ✓	B,C-s2,d0 B,C-s3,d0
✓ ✓ ✓ ✓		A2-s1,d1 A2-s1,d2 B,C-s1,d1 B,C-s1,d2
		A2-s3,d2 B-s3,d2 BA2-s3,d2
✓	✓ ✓ ✓	D-s1,d0 D-s2,d0 D-s3,d0 E
✓		D-s1,d2 D-s2,d2 D-s3,d2
		E-d2
		F

Class A1 products will not contribute to the fire growth nor to the fully developed fire
Class A2 products will not significantly contribute to the fire growth and fire load in a fully developed fire
Class B products will not lead to a flashover situation, however they will contribute to the fully developed fire
Class C products may lead to a flashover situation, but only in the second part of the reference scenario test, ie after more than 10 minutes
Class D products may lead to a flashover situation, within the first part of the reference scenario test, ie within 10 minutes, but not within less than 2 minutes
Class E products may quickly lead to a flashover situation, possibly within the first two minutes of the reference scenario test.

The additional designations are:

Smoke	**Burning droplets**
s1, s2, s3	d0, d1, d2
s1 = little or no smoke generation	d0 = no droplets within 600 seconds
S2 = medium smoke generation	d1 = droplet form within 600 seconds but do not burn for more than 10 seconds
S3 = heavy smoke generation	d2 = Not as d0 or d1

The Gebrik system has been tested in accordance with EN13501-1:2007+A1:2009 to produce a classification of reaction to fire performance and has been classified as follows:

B - in relation to its fire behaviour
s1 - in relation to its smoke production
d0 - in relation to its flaming droplets/particles

Class 0

In accordance with BBA Certification No. 07/4403, the external surface of the Gebrik system is classified as Class 0 or 'low risk' as defined in the documents supporting the national Building Regulations. The system, therefore, may be used in accordance with the following provisions:

England and Wales – Approved Document B, paragraphs 13.5 and 13.7 (see Diagram 40)

Scotland – Mandatory Standard 2.6(1)(2), Annexes 2c and 2e.
(1) Technical Handbook (Domestic)
(2) Technical Handbook (Non-Domestic)

Northern Ireland – Technical Booklet E, Paragraph 4.3 (see also Diagram 4.1)

AQUARIAN CLADDING SYSTEMS

For more information regarding the guidance for use of Gebrik please refer to Section 9 *Properties in relation to fire* on p6 of BBA 07/4403.

Internal Testing Procedure

The data obtained by the BBA is as a result of tests carried out in accordance with the German test DIN 4102. Part B1 is carried out off-site and Part B2 is carried out in the factory laboratories. Details of each test are detailed below:-

Part B1

A 4-sided 'chimney' is built with the face of the panels facing inwards. A fire is lit within the chimney to test the spread of flames across the surface. The results of which prove the system will withstand fire. (Results are available upon request).

Part B2

A section of panel is placed in a chamber and held above a naked flame (photo 1). The foam is calibrated at 10mm intervals between 100mm and 150mm from the flame. The size of the flame is measured and held at the bottom edge of the test sample.

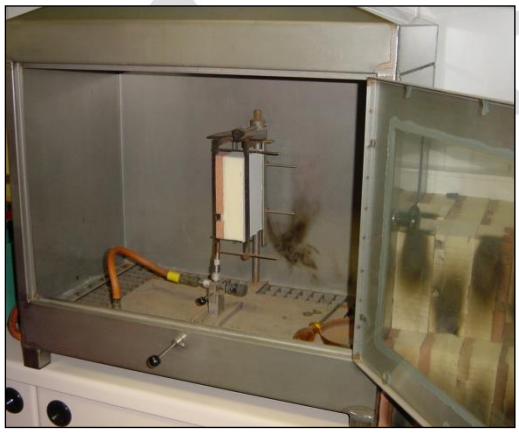


Photo 1

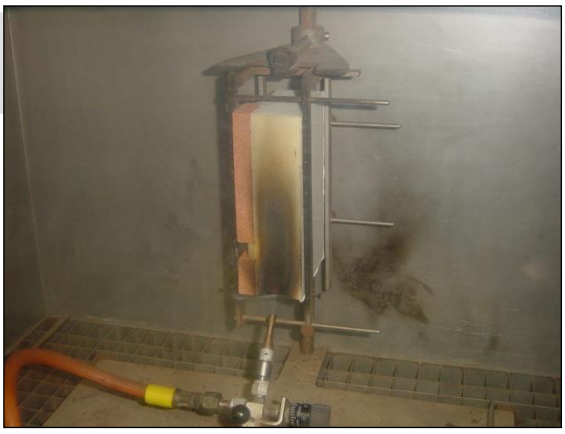
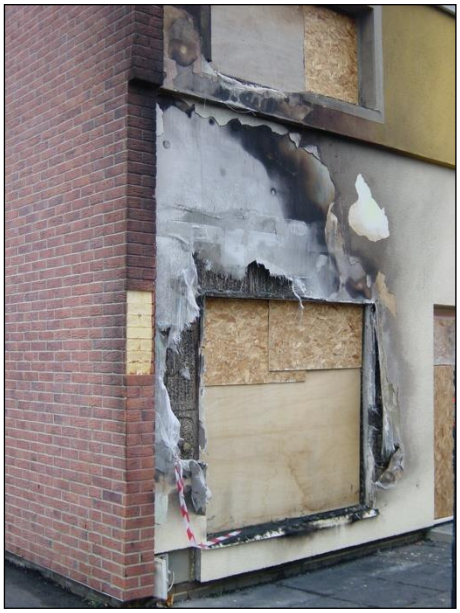


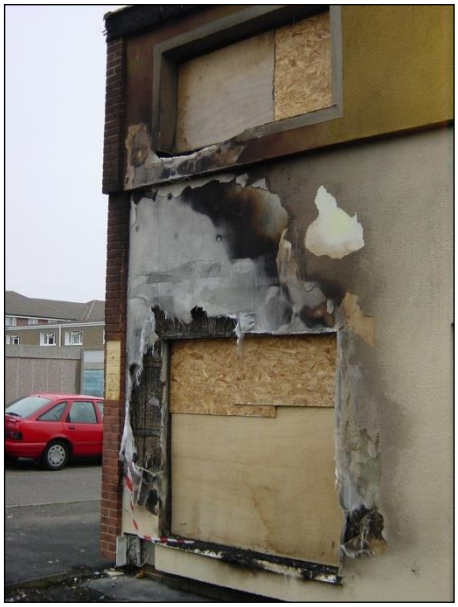
Photo 2

The foam will char (photo 2) but not melt nor spread the flame beyond the 150mm mark. Once the flame is removed from the test sample, the foam ceases to burn. (Tested samples are available upon request).

An Example of the Performance of Gebrik in Fire

Gebrik has been used on a scheme in Gosport, Hampshire to refurbish a series of social houses. It was used to predominantly clad gable ends whilst insulated render was used to clad the remainder of the buildings. As a result of vandalism, a house was set alight and at its peak it is alleged that approximately 3m high flames could be seen rising from the windows.





The expanded polystyrene (XPS) behind the render melted to leave the render flaking from the building. The fire was so intense that the bordering fence was heavily charred. The Gebrik remains intact and the only damage has been caused by smoke and a fireman, who has removed 7 slips to check the fire wouldn't continue behind the slips. There was no damage to the substrate so the damaged Gebrik area can simply be replaced with another corner.