EPIC
ENGINEERED PANELS IN CONSTRUCTION

Insulated panels for external roof and wall cladding




A guide to fire safety and performance in fire

Issued January 2012

Foreword

Insulated panels are used extensively for the external roof and wall cladding of buildings in most construction sectors. They are selected for their thermal and energy saving properties and their construction and installation benefits. Insulated panels are single piece factory engineered units comprising two metal faces and a fully insulating core.

Over the past 15 years the performance in fire of insulated panels has been analysed in depth. In particular studies have highlighted the differences in design, materials and method of fixing between external roof and wall panels and other sandwich type panels designed specifically for internal applications.

In addition, since 2004 only fully certificated panels to Insurance Industry tested standards have been manufactured in the UK resulting in a further improvement in their performance in fire.

The Guide has been prepared to provide comprehensive information on the fire safety and performance in fire of external roof and wall panels. External roof and wall panels are uniquely designed for the external envelope and are securely fixed to the main building structure. They perform totally differently in fire compared to free standing internal systems. This is borne out by large scale tests and real fire scenarios.

Studies have also shown that rarely have external roof and wall panels been involved in the initial stages of a fire, only becoming involved as a result of a fully developed fire.

European fire classifications

UK Classifications for reaction to fire; fire resistance; and external performance (roofs) based on European harmonised fire tests were agreed in 2001 and now run concurrently with the original UK BS 476 classifications. Both classifications are referred to in this Guide for ease of comparison and reference.

New thermal performance requirements

In addition to the requirements for fire performance, specifiers and designers must also take into account the new thermal performance and airtightness regulations for the external roof and wall systems of buildings [Amendment to Building Regulations: Approved Document L2: 2010 [1]]; and in Building [Scotland] Regulations – Technical Handbook 2010: Section 6 Energy.

The Case Studies in Section 11 of this Guide illustrate that the engineered junction details, which have been designed to meet the Energy Conservation Regulations, have also benefited the fire performance of Insulated Panels and can readily be used to support good fire engineering practice.

The EPIC Fire Guide 2011

The EPIC Fire Guide 2011 updates the original 2002 Fire Guide and for the first time links the performance of Insulated Panels in actual fires with the indicated performance of the large scale Insurance Industry tests.

The guide is divided into two parts.

Part 1

Sections 1 to 4 review the development of insulated panels; their performance in fire; and the regulatory requirements for external cladding and roofing in England, Wales and Northern Ireland and also in Scotland.

Sections 5 and 6 cover the specific requirements governing fire safety in hospitals and schools. In sections 7 and 8 additional fire precautions that may be desirable to minimise property damage and business interruption are also covered together with an overview of fire safety engineering techniques and how they may be applied to assess the impact of materials used in the external building envelope.

Part 2

Sections 10 to 12 describe the tests required to meet regulatory and insurance requirements. The Insurance Industry large scale tests in particular are then linked to the fire research findings and the evidence of actual fire case histories to illustrate how indicative these tests can be in determining fire performance, particularly during the developing stages of a fire.

Appendix

An additional Appendix provides guidance on the fire safety procedures that are appropriate where construction work is involved or is carried out in the proximity of insulated panels. A substantial number of major fires can be attributed to the poor management of fire safety both during construction and maintenance operations and as part of the day-to-day operation of the building. This Appendix refers equally to all forms of roof and wall cladding and not specifically to insulated panels.

Download EPIC information from the website

This guide to Fire safety and performance in fire together with other guides, can readily be downloaded from the EPIC website at ***www.epic.uk.com***

Contents

Part 1: General information and regulatory requirements

Part 2: Understanding how insulated panels react in fire

Appendix: Management of fire safety

Whilst every attempt has been made to verify the guidance given, it should not be regarded as definitive. Because individual manufacturers' products vary, the performance should always be confirmed with them.

PART 2
Understanding how insulated panels react in fire

Part 2 of the EPIC Fire Guide looks at the performance in fire of Insulated Panels:-

- **To satisfy the Regulatory Requirements (See Part 1 – section 2)**
- **To satisfy the requirements of the Insurance Companies**
- **In a real fire scenario through the analysis of Case Studies**

EPIC has conducted or commissioned the majority of the major research studies into the performance of Insulated Panels in fire through small and large scale tests and also extensive research into major fires and specifically where Insulated Panels may have been used in the construction.

This Part of the Guide should be of particular interest to building designers, Insurance Companies, Fire Services and other building professionals who wish to have a detailed appreciation of the way Insulated Panels actually perform.

9 Understanding how insulated panels react in fire
Tests to meet Regulatory requirements

Fire testing in relation to the regulations is relatively small scale and only gives an indication of the way a product may perform in fire and a comparison of the relative ranking of various products.

The fire performance of insulated panels is influenced by the nature of the protective facings, the design of the panel joints and the detailing at junctions. It is only possible to determine the likely practical performance by considering the insulated panel system under realistic large scale testing (see Section 11).

This section briefly describes the fire tests relevant to insulated panels. The relationship between the British Standard and the new European Harmonised classifications is summarized in Section 3 – Tables 2 and 3.

In assessing the performance of panel systems various fire test procedures are available. These are generally divided into two main categories:

a) reaction to fire tests;

b) fire resistance tests.

9.1 Reaction to fire tests

These are small scale tests designed to check the performance of Insulated Panels in terms of the surface properties and integrity i.e. flame spread, heat contribution and no penetration particularly at joints. The test is normally carried out on the internal face but both faces can be tested if required, for example when a Panel is to be used internally.

In the European standardised tests classification is in accordance with BS EN 13501-1 and in the British Standard test in terms of performance in Tests BS 476: Part 7 and BS476: Part 6. Insulated Panels achieve Euroclass B, or Class 0 to BS 476 Parts 6 & 7, which is within the requirements.

9.2 External Fire Performance – Roofs

This is a small scale test designed to check surface spread of flame and penetration of fire from for example a burning brand falling on the roof.

In the European test classification is in accordance with BS EN 13501-5 (ENV 1187 Method 4) and in the British Standard test the performance is measured in BS 476: Part 3. Insulated Panels achieve Euroclass B_{roof}(t4) or class AA or AB to BS 476 Part 3), which is within the requirements.

9.3 Fire Resistance – see section 3.3.2

Where required Insulated Panels can be tested to illustrate their capability to meet certain fire resistance criteria set out in the Regulations to prevent fire spread between buildings or compartments i.e. for walls on or close to a boundary or fire escape route and also for use as compartment walls.

In the European standardised test classification is in accordance with EN 13501-2[20]. The European harmonised test is fundamentally similar to the British Standard BS 476 Part 20[21] & Part 22 tests. These are well tried and proven tests and Insulated Panels are classified in terms of their performance in minutes – 15, 30, 45 etc.

Fire resistance ratings are specific to each panel type and are dependent upon the joint design, formulation of the PIR or MW core material and the thickness of the panel being tested.

10 Understanding how insulated panels react in fire
Large Scale Tests

10.1 Insurance Industry tests

Whilst the small scale Reaction to Fire tests above (9.1 and 9.2) have a proven track record to show that materials meet the regulatory requirements, they only test a small sample of product and therefore are ineffective in identifying the likely performance in a large scale fire and potential failures in any joints.

Over the past 30 years the major insurance organisations (Loss Prevention Certification Board (LPCB) and FM Global (FM)) – see Section 7, have developed their own test procedures on a larger scale, with enhanced heat sources that are intended to establish the performance in fire of Insulated Panels, particularly during the development phase of a fire.

The LPS 1181 test consists of a room that measures 10 m x 4.5 m x 3 m high (Figure 16) and most importantly assesses panels as they are installed in practice. A heat source comprising a 35kg timber crib to simulate a real fire is placed in the corner of the building (Figure 17) and the room configuration gives rise to a severe test generating 510 KW over the period of the test with a maximum heat output of around 1MW. The crib is placed adjacent to a panel joint. Experience has shown that this configuration seriously challenges the panel and the panel jointing system.

Panels receive an LPS Certification providing that the flame spread is limited and there is no flashover within the compartment.

The corresponding FM Approvals testing regime includes a number of tests outlined in Section 7 on page 34. Tests range from small scale laboratory based tests to larger room and room corner tests.

Figure 16. Fully instrumented test building

Figure 17. Observation and recording

10.2 Information from large scale tests

EPIC has supported the view of the Insurance Companies and Fire Services that a large scale and more challenging test is essential to give a better indication of the way Insulated Panels may perform in an actual fire.

In 1999/2000 EPIC conducted one of Europe's largest fire research programmes [22] using the LPS 1181 test to determine the fire performance of a range of panels and also other comparable cladding systems. Warrington Fire Research carried out the tests and the research programme was conducted by Arup Fire. A summary of the tests and the results can be viewed on www.epic.uk.com/fire_tests.jsp

The benefits of the LPS 1181 test are that the configuration allows the metal faced Insulated Panels to be firmly fixed to the supporting framework, as in practice, and for the engineered joints to perform as designed to protect the core material and provide low air permeability. After the tests the panels can be easily demounted and inspected.

These large scale tests give a good indication how Insulated Panels may perform in the developing stage of a fire. The most relevant tests in the EPIC/Arup programme were those with PIR (polyisocyanurate) and MW (Mineral Wool) lamella cores that meet the Insurance Industry certification requirements. All Insulated Panels produced in the UK since 2004 are of this type.

The principle features, which have been confirmed by the analysis of actual fires, are as follows.

- Structural integrity of the external roof and wall panels and the fixings hold the panels in place
- The core is primarily affected by heat conduction. There is minor buckling at the internal joints and some flame impingement on the core material. There is no instant heat release or significant contribution to the fire source
- Externally the joints are unaffected and there is no smoke release through the joints
- There is no hidden flaming or fire spread down the cores of the panels and any minor flaming at the joints extinguishes as the fire source dies down

Fire Research and Fire Case Studies

11.1 Fire research

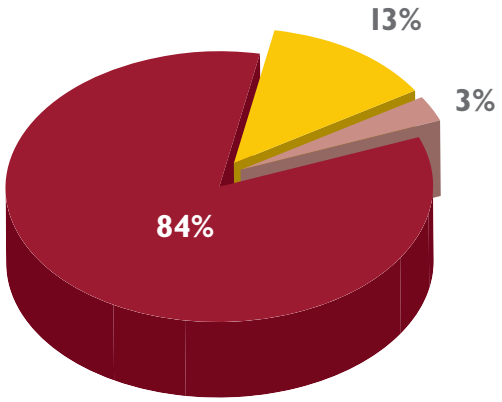
A major programme to better understand the influences behind major fires was initiated by EPIC in the 1990s as a result of a number of fires in the food industry. This study conducted by EPIC was the first major study of its kind specifically analysing fires and the associated type of construction. The research studied over 400 major fires in the industrial and commercial sector with a loss of more than £500,000 during the period 1992 – 2001.

The Research highlighted a number of important features.

- 80% of major fires were associated with high internal fire loads of the contents
- Contents such as chemicals, plastics, paper, furniture, fabrics, rubber and timber are likely to result in a total/major loss
- Major losses are independent of the type of construction
- 97% of major fires were in buildings constructed with 'traditional materials' – brick, metal cladding, asbestos cladding, slate etc
- 3% involved rigid urethane constructions against an estimated 15% of building stock in these sectors
- Whereas 13% (equivalent to 27% of monetary loss) of the fires involved panels with polystyrene cores used internally

Real fires history 1992-2001: Industrial and commercial buildings.
(Source EPIC/FPA Records + 500K Loss).

Analysis by number of fires	No.
Traditional – Brick – Metal systems with mineral fibre insulation	150
Polystyrene sandwich panel systems	23
PUR/PIR external cladding	6
Total fires	**179**



11.2 Case Studies

Sections 9 and 10 illustrate the type and extent of the information that can be obtained from small to large scale fire tests.

In particular the performance in the LPS 1181 tests has been proven to give a good idea of likely performance in the developing stages of a fire. The LPS 1181 large scale fire tests indicate good structural integrity and low contribution from Certificated PIR (and MW) cored Insulated Panels.

However all fire situations are different and this was highlighted by the research described in Section 11.1. It was noted that the contents of the building, the fire load of the contents, and their proximity to the walls have a significant bearing to the development and outcome of the fire.

The final part of the research programme into the performance of Insulated Panels in fire was to check the indicated performance against actual fires. To achieve this link EPIC and EPIC member companies, supported by Tenos Fire Consultants, conducted a series of studies into actual fires in which PIR cored insulated panels had become involved.

The following case histories analyse the performance of rigid urethane insulated panels in actual building fires and clearly illustrate that PIR cored Insulated Panels perform well in actual fire scenarios.

Case Studies A-C focus on whether there was any fire spread or significant contribution to the fire and assesses the performance of panels either side of a fire resisting compartment wall.

- Study A: Clifton Comprehensive School
- Study B: R A Wood Adhesive tapes
- Study C: Suffolk Food Hall

Case Studies D-F analyse the performance of panels from external fire attack.

- Study A: Wharfdale Hospital
- Study E: Spider Transport
- Study F: Eagle Global Logistics

The advanced formulations of the PIR insulation cores of Certificated Panels give significantly improved performance over the PUR cores of pre-2004 panels in terms of higher temperature before any involvement; extensive formation of protective char; and low smoke generation.

Summary

School – roof application
PIR cored Insulated Panels

Fire
- **High fire load – paint and solvents**
- **Local and intense**

Observation
- **Minimal contribution of core to fire**
- **No fire spread within panels**
- **No fire spread across fire stop partition**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11.2.1 Case study A

Clifton Comprehensive School (July 2004)
Location: Rotherham

Building description

The area associated with the fire was part of a development at the school nearing completion at the time of the incident. A passageway had been constructed to provide an escape corridor between the two flat roofs. The floor of the passageway was of concrete slab construction. Blockwork walls, that formed the corridors on the ground and first floors, had been carried to 1370mm above the concrete slab of the passageway thereby forming the lower walls of the passageway.

The upper walls of the passageway consisted of partitioning between the top of the blockwork walls and the underside of the insulated roof panels. The partitioning was constructed using a 70mm stud partition system consisting of metal studding fixed to the top of the blockwork wall. The top of the vertical studding terminated in an inverted 'U' channel that ran the full length of the roof. Fire resisting board, approximately 25mm thick, had been installed between the top of the inverted 'U' channel and the underside of the insulated roof panels.

The roof was constructed using insulated roof panels with a core of PIR (polyisocyanurate) approved to LPS 1181 Part 1. The insulated roof panels had not been cut into and the panels passed over the top of the partition system. Each side of the partition system had been clad with fire resisting board, approximately 15mm thick.

Fire

The fire was reported at 19.37 hrs when smoke was seen to be coming from the centre of the new roof section. From subsequent investigation it was believed that the fire occurred in a drum of roof sealant containing solvents that was accidentally or purposely ignited with a naked flame. The roof sealant was both the material first ignited; and the material mainly responsible for development of the fire.

The fire burned fiercely with flames impinging on the left hand blockwork wall, the partition and Insulated Panels above. Flame and hot smoke traveled down the passageway at high level in both directions.

The deformation of the purlins immediately above the seat of the fire shows that this was a very hot fire. The internal faces of eight roof panels in the immediate area of the fire had delaminated and deformed, exposing the insulation.

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Observation

In spite of the substantial quantity of insulation exposed, there was no evidence that the insulation contributed to the spread of this fire; although it is probable that, while the fire was burning, the insulation charred and some smoke would have been produced.

From the physical evidence of the limited spread of heat and smoke to the roof void to the west of the passageway, it is clear that the general construction of the passageway and the partition system worked effectively as fire resisting barriers. There was only limited spread of heat and smoke between the top of the partition and the underside of the Insulated Panels. There was no evidence of heat or smoke spread through the insulation of the Insulated Panels.

Comment

The Insulated Roof Panels did not contribute to the cause of this fire. There was no significant involvement from the core material and no fire spread within the core despite exposure to the fire.

Summary

Factory – roof application across compartment wall

PIR cored Insulated Panels

Fire
- **High fire load – plastics, adhesives & solvents**
- **Major fire leading to collapse of structure**

Observation
- **Extensive charring of core**
- **No fire spread through core**
- **No fire spread round panel over compartment wall**
- **Integrity maintained over compartment wall**
- **Satisfies AD-B requirement as an 'alternative' construction over compartment wall**

11.2.2 Case study B

RA Wood Adhesive Tapes (November 2009)
Location: Cannock, Staffordshire

Building description

The main building consisted of a steel frame with the lower part of the external walls and interior walls constructed of blockwork

The production area of the RA Wood Adhesive Tapes tenancy was separated from the two storey office and welfare facilities accommodation by nominally 30 minute fire resisting construction; and from the adjoining tenancy by a compartment party wall of two leaves of 200mm blockwork encapsulating the vertical portal frame stanchions for the full height of the building.

The upper parts of the external walls and roof comprised Insulated Panels with a core of PIR (Polyisocyanurate) approved to LPS 1181 Part 1 Grade EXT-B.

The head of the party compartment wall was fire stopped to the underside of the Insulated Roof Panels over-sailing the wall using sand cement mortar.

It is understood that the Insulated Roof Panels did not incorporate a band of limited combustibility material providing a break in the PIR core of the panel at the point where the panels over-sailed the party compartment wall. At the time that the building was constructed, this was a recommendation in clause 9.29 of Approved Document B (2000 edition) and in the current 2006 edition of Approved Document B the recommendation (now in clause 8.30) refers to the width of this band being 300mm.(*)

* Advisory guidance note: Building Regulations Fire Safety (Part B) – Buildings other than Dwelling Houses FAQs **www.planningportal.gov.uk/buildingregulations/approveddocuments/partb/faqs/other**

" However, an alternative approach might be to use a panel system which has been shown in a large scale test to resist internal and external surface flaming and concealed burning."

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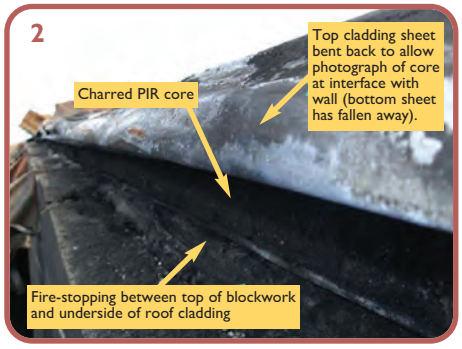

Fire

From statements made it is understood that the fire started with a suspected ignition event involved a high level light fitting towards the northeast corner of the production area. This was a large fire requiring attendance by 60 fire service personnel. The intensity of the fire resulted in the penetration of fire through the roof and flaming well above the height of the building. The report at the time stated that the Fire Service took the decision to allow the fire to burn out and to carry out appropriate procedures to prevent spread of fire to adjacent buildings. It is understood that the fire burned through into the following morning before reducing to an intensity at which fire-fighters were able to extinguish the fire.

Photograph 1 taken from an aerial platform position to the south side of the building and looking along the line of the compartment wall separating the RA Wood Adhesive Tapes (to the west) and Joinery company (to the east) illustrates how the fire completely destroyed the roof structure to the left whilst the roof over the adjacent joinery company is still in place.

The complete collapse of steel supporting structure shown in the photograph, and the presence of melted aluminium from door controls indicates that global temperatures attained in the production area compartment were significantly in excess of 650°C. The reported fire duration and evidence of the temperatures achieved indicate that that the overall fire exposure of the wall separating the production areas of the two tenancies was at least equivalent to a 60 minute fire resistance test.

Photograph 2 shows shows the charred PIR core of the roof cladding where the PIR core remained in place to the center of the blockwork leaf on the RA Wood Adhesive Tapes side of the party wall.

Photograph 3 was taken from inside the adjacent joinery company looking up at the underside of the roof cladding along the party wall line.

There was smoke leakage into their premises and this was also evidenced by the striations of smoke staining on the roof soffit and local loss of the plastisol coating to the steel skin close to the apex. However, it was clear from the inspection that there was no loss of fire compartmentation provided by the party wall and the fire did not spread to the adjoining tenancy.

The roof cladding over the adjacent joinery company remained sufficiently intact to provide continued weather protection and to allow that business to resume operations shortly after the fire was extinguished by the fire service.

11.2.2 Case study B (continued)

RA Wood Adhesive Tapes (November 2009)
Location: Cannock, Staffordshire

Comment

The following conclusions can be drawn from the site inspection:

- The fire was sufficiently intense to have subjected the party wall between the adjacent tenancies to a level of exposure equivalent to at least 60 minutes in a standard fire resistance test.
- The fire compartmentation provided by the party wall prevented fire spread to the adjacent premises.
- The charring exhibited by the PIR core material indicated the formation of a sufficiently stable char within the panel to provide an effective fire stop between the steel skins of the cladding at the head of the compartment party wall.
- The omission of a band of material of limited combustibility in the composite roof panel at the point of intersection with the head of the party wall (as recommended by Approved Document B guidance) did not result in a break-down of fire compartmentation and clearly shows that PIR insulated Panels may be considered as 'an alternative approach' under the requirements of the AD-B.
- The findings of the site inspection provides evidence that the use of a LPS 1181 Grade EXT-B certificated Insulated Panel with PIR core can provide sufficient resistance to fire propagation and erosion such that the functional requirement of the Building Regulations (Regulation B3) can be satisfied without providing a 300mm wide band of limited combustibility material to replace the PIR core where Insulated Panel passes over a compartment wall – see advisory note above. (i.e. it is not necessary to adopt the recommendation of clause 8.30 of Approved Document B).

Summary

Abstract
Converted Farm Building – Retail
PIR cored Insulated Panels
Internal fire attack from plant fire

Observation

- **Local charring of the core**
- **No fire spread through the PIR core**
- **Integrity maintained – no promotion of fire spread**


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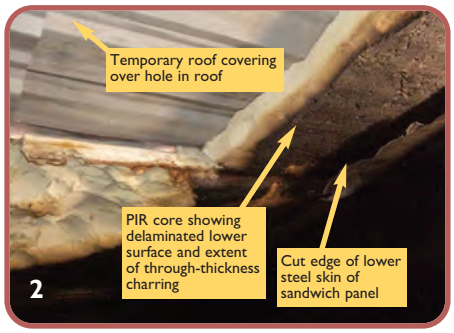

11.2.3 Case study C

Suffolk Food Hall (January 2010)
Location: Wherstead, Ipswich, Suffolk

Building description

The building was a converted farm building comprising a timber frame construction with PIR cored insulated roof panels approved by LPCB to LPS 1181 Part 1 Grade EXT-B. The walls were a metal clad built-up system with glass fibre insulation.

Fire

The fire occurred in the building services/M&E mezzanine area directly under the roof and involved the combustible services and the timber construction in the area. Based on the charring rate of timber the depth of charring indicated an exposure of the panels equivalent to between 20 and 25 minutes in a fire resistance test.

Photograph 1 shows the extent of charring to the timber at the seat of the fire and the relationship to the panels. Photograph 2 shows a cross-section where the panel has been cut away and illustrates only partial internal charring of the PIR core with the majority of the core unaffected.

Comment

The following conclusions can be drawn from the site inspection:

- The fire was sufficiently intense to have subjected the roof membrane and wall separating the plant area from the retail space to a level of exposure equivalent to approximately 20-25 minutes in a standard fire resistance test.
- Fire did not spread from the mezzanine plant area to the rest of the building.
- The PIR core material of the roof sandwich panels did not transmit fire from one side of the walls enclosing the plant area to the other.
- There was no fire spread within the PIR core

Summary

Hospital – wall application
PIR cored Insulated Panels

Fire
External façade fire
High fire load – paint and bulding materials

Observation
- **No ignition or involvement from PIR core**
- **No fire spread within core**
- **No promotion of fire spread**

11.2.4 Case study D

Wharfdale Hospital (July 2003)
Location: Silsden, West Yorkshire

Building description

The building consisted of three storeys constructed around a quadrangle. A two-storey section bisected the quadrangle to form a triangular piece of land at ground floor level.

The building had a steel frame and all floors were concrete, the upper two concrete floors being on steel decking. The first and second floors were clad with 70mm thick PIR Insulated Panels approved by LPCB to LPS 1181 Part 1 2003 as Grade EXT-B. At the time of the fire, the ground floor had a steel framework in place for cladding but no cladding had been fixed. All steel beams had been coated with an intumescent paint to give a standard of fire resistance of one hour.

Fire

The premises were still under construction when the fire occurred. At the date of the fire the ground floor was in use as a storage area for building materials. The fire occurred in stored materials (plastics and paints) in the open ground floor of one section of the building. Damage was caused to the steel beams that supported the first floor, the profiled steel sheets that rested on the beams and the concrete floor that had been laid on the profiled steel sheets.

The intensity of the fire was such that it had removed the intumescent coating to the beams supporting the first floor. Although rated to provide a one-hour standard of fire resistance the intumescent coating resisted the fire for less than half an hour in this fire. The beams had distorted and the concrete floor at first floor level had dipped above the fire. The expansion of the beams had pushed out the supporting columns. The concrete floor above had cracked due to the movement of the beams.

The fire played up the external facing of the building, affecting the panels on the first and second floors.

Observations

- There was no fire spread to the upper floors
- There was damage to the external skin of the cladding to the upper floors but no spread in the insulation of the wall panels and no fire spread to the eaves
- The exterior facing of the panels to the first and second floors was damaged by heat and smoke


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Comments

In spite of the significant heat generated by this fire (sufficient to damage the intumescent coating and distort the steel beams); the orientation of the cladding panels (directly above the fire); and the fact that fire stopping was not in place; the cores of the panels, did not ignite, did not promote fire spread within the core or to the eaves and did not significantly contribute to the products of combustion. The panels on this project are approved by LPCB to LPS 1181 Part 1 2003 as Grade EXT-B.

Summary

Distribution warehouse application
PIR cored Insulated Panels

Fire
- **External fire – arson**
- **Lorry fire**

Observation
- **No contribution from panels**
- **No penetration into building**
- **No fire spread within panels**

'Explosion' of debris from both sides and top of vehicle – fireball projected onto building cladding.

11.2.5 Case study E

Spider Transport (September 2008)
Location: Rathnew, Wicklow, Republic of Ireland

Building description

The building was used as a warehouse and distribution centre, and is constructed of a steel frame with brickwork lower walls and Insulated Panels with a PIR core, approved to LPS 1181 Part 1 Grade EXT-B, installed as the upper wall cladding.

Of particular note is that there is a design gap between the drip flashing and the bottom edge of the Insulated Panels. This gap above the drip flashing coupled with the corrugated profile of the Insulated Panels meant that the bottom of the insulating core of the Insulated Panels was exposed to any flame impingement on that part of the blockwork wall and the cladding above.

There was also a similar gap above the up-and-over door between the head flashing and the bottom edge of the Insulated Panels.

Fire

A truck had been parked across the two main "up and over" doors of the building to prevent unauthorised access during the night. Arsonists set the cab on fire and this quickly spread throughout the vehicle. The intensity of the fire and the proximity of the truck to the building meant that the panels were soon exposed to what is referred to in the investigation report as "prolonged flame impingement" during the 25 minutes before the fire brigade arrived (the isolated location meant that the alarm was not raised until 15 minutes after the fire started). At one stage there was also an explosion and a fireball projected onto the panel facing as conditions worsened.

11.2.5 Case study E (continued)

Spider Transport (September 2008)
Location: Rathnew, Wicklow, Republic of Ireland

Observations

An examination of the Insulated Panels both above and at the sides of the up and over doors showed the outer and inner skins to be intact with no deformation. In fact it was extremely difficult to prise open the outer skins to examine the inner core.

The lower edges of the Insulated Panels immediately above the up and over door on the right were prised open. The inner core had charred but had remained in-situ and there was no evidence of deformation or delamination. In addition, there was no evidence that the core of the Insulated Panels had assisted fire spread.

The proprietary wallboard at the right side of the up and over door (adjacent to where the front of the vehicle had been) had cracked as a result of heat. However, even at this location the outer and inner skins of the Insulated Panels were found to be intact with no deformation.

The lower edges of the Insulated Panels, immediately above where the proprietary wallboard had cracked with the heat, were prised open. The inner core had charred only at the edge nearest the roller-shutter door. The core had remained in-situ and there was no evidence of deformation or delamination. In addition, there was no evidence that the core of the Insulated Panels had assisted fire spread.

Comment

Key considerations were whether the panels contributed in any way to the spread of the fire and whether they helped prevent fire entering the building.

The report concluded that there were no signs of any spread of heat through the panel core, or that the panels contributed to the damage caused by the fire in any way. Furthermore, there was no delamination of the metal panel lining and the insulation core stayed in place, important points in maintaining system integrity and fire resistance

Despite the ferocity of the fire, the inside of the premises was unaffected and business resumed as normal the next day.

Summary

Abstract
Distribution warehouse application
PIR cored Insulated Panels
External fire attack from adjacent burning building

Observation
- **Paint coating burnt off on adjacent walls**
- **No ignition of PIR core**
- **No flames or smoke entered the building**

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11.2.6 Case study F

Eagle Global Logistics (January 2005)
Location: Thurrock, Essex

Building description

The building was one of a pair of logistic warehouses with a separation distance of 8.7 m. These were conventional steel frame buildings clad with PIR cored insulated panels approved by LPCB to LPS1181 Part 1Grade EXT-B on the walls and a built-up metal clad roof system with glass fibre insulation.

Fire

The devastating fire in one of the pair was sufficiently intense to result in collapse and the building was completely burnt out.The fire Consultant's assessment report stated that the insulated panels did not contribute to the spread of fire and the cores only burnt when exposed to direct intense flame attack.

In the second building the LPCB approved panels which were only 8.7 metres from the burnt out unit, played a significant role in preventing fire spread to an adjacent building. The severe heat and flames generated by the burning building were so intense that the paint coating on the PIR cored insulated panels on part of the next-door building was burnt off but the PIR core did not ignite and no flames or smoke entered the adjoining building.

Comment

Inspite of the intense heat sufficient to collapse the building there was no evidence to suggest that the panels contributed to the spread of the fire within the building. Neither is there any evidence that the fire spread through the cores of the panels.

Appendix: Management of fire safety

This appendix refers equally to all forms of roof and wall cladding and not specifically to insulated panels. It covers the management of fire safety both during construction and maintenance operations and as part of the day-to-day operation of the building.

Statistics suggest that 70% of all major fires occur as a result of poor management and maintenance rather than as a result of inadequate design or the nature of the processes carried out within buildings.

Risk assessments may have been made at the planning stages of a building and if so will have covered its operation and use and also any foreseen maintenance activities relating to the equipment or fabric of the building. Against this background, this appendix highlights specific maintenance and construction issues that are known to have been the cause of a number of significant fires.

The subjects detailed in this section are part of a wider inspection programme recommended by the insurance companies and which is set out in full on the 'Self Inspection forms for Commercial/Industrial Premises' available from those companies.

Generally the nature of the external cladding, including insulated panels with the most commonly used rigid urethane and mineral fibre cores, will not have a significant effect on the likelihood of a fire starting. However, the specific procedures highlighted in this section are advisable where combustible insulation is utilised.

The role of fire safety management

It is essential that any person who is responsible for the operation of a building should implement procedures to prevent a fire occurring and minimise its effects in the event that these procedures are not successful. Ideally such procedures, and details of the buildings construction and fire safety systems should be documented in a fire safety manual. This manual might typically include the following items:

a) fire safety policy statement;

b) safety management structure and responsibilities;

c) details of building construction relevant to fire safety;

d) actions to be taken in a fire emergency;

e) fire drills and staff training;

f) housekeeping (e.g. removal of combustible waste);

g) planned maintenance of fire safety measures;

h) safety procedures for hot works and other maintenance;

i) security (to combat arson);

j) contingency plans for salvage and damage control;

k) record keeping;

l) procedures for updating manual and auditing its implementation.

Good fire safety management can be a key factor in minimising the risk of fire in buildings. Detailed guidance on management procedures for fire safety will be given in a forthcoming part of BS 5588 [20], which is currently in the course of preparation.

Hot works

Hot work is work that involves open flames or sparks or any other activity that generates heat. Fires involving hot work have led to multi-million pound losses. Most frequently the cause is carelessness and ineffective supervision while hot work operations are being carried out.

The sources of heat most commonly involved which may be used in conjunction with or in close proximity to roof and wall cladding systems include:

- gas and electric welding and cutting equipment
- blowlamps and blowtorches
- grinding wheels and cutting discs

Hot working should be avoided whenever possible, but when making structural changes to a steel framed building or when installing or modifying steel pipe work, cutting, grinding and welding appropriate precautions should be taken.

During hot works and cutting operations it is recommended that any exposed combustible cores are protected by temporary coverings.

Such coverings and screens need to be manufactured from non-combustible or non-flammable materials. Welding blankets are the preferred solution for protecting all exposed surfaces, including ends or edges of panels. Preferably no hot work should be carried out in the immediate vicinity of any exposed insulant of whatever type. Low flame spread plastic coverings, which are intended to prevent damage to finished items during construction do not provide the required levels of protection to resist welding or cutting sparks or splatter.

All works should be properly supervised and a full inspection carried out on completion. Personnel engaged to carry out this work should be competent and fire extinguishers should be on hand at all times.

Experience has shown that a satisfactory standard of care is far more likely to be achieved where a formalised permit to work – a 'Hot Works Permit' – is in force, issued under the supervision of an experienced person who has the authority to ensure compliance with the procedures.

A typical Hot Works Permit:

- specifies the particular job to be carried out
- lists any special conditions
- specifies the area where the work is to be done
- is issued for a set time period.

Follow-up checking:

A fire watch should continue for at least one hour after work is completed, to detect and extinguish any incipient burning in the work area and in all adjoining areas to which sparks and heat may spread. These could include floors above and below and areas on the other side of walls to where the work is being carried out.

Appendix: Management of fire safety

Cutting panels

Neither hot cutting techniques nor grinding wheels should be used to cut any type of insulated panels and in particular panels incorporating combustible cores.

Panels should be cut with a powered reciprocating saw and all exposed site cut panels should be protected with a suitable edge protection lacquer.

Holes and apertures are frequently cut to take cabling and wiring through panels, particularly in the food processing and cold store industries, where polystyrene has been the common core insulation. It is essential that full inspection is carried out to ensure that:

- the work has been properly carried out and that the cabling/wiring is fully protected against chaffing and abrasion
- any holes or apertures are properly closed off according to the manufacturers instructions, including where necessary the use of fire stopping materials.

Exposed cores

Any core material of an insulated panel or any insulated cladding system that becomes exposed as a result of cutting penetrations, maintenance work or impact damage should always be protected with metal closure flashings, as soon as practical, following the panel manufacturers recommended procedures.

Rubbish/waste management

A common source of extensive fire damage is fires started, deliberately or accidentally, in skips and rubbish containers located adjacent to the external wall of a building.

Whenever practical skips and other rubbish should be kept well away from the external walls of a building. Waste in the open is particularly attractive to an arsonist and strict controls on the storage and disposal arrangements are essential.

- All waste stored in the open should be at least 10 metres from the building and a minimum of 2 metres from the perimeter fence. If this is not possible, lockable enclosed metal skips or a secure enclosed store or compound should be provided, located as far as practical from door and window openings.
- All waste should be deposited in appropriate containers or designated areas provided.These should be clearly marked and should not be under canopies or trees.
- Aerosol cans, containers of flammable liquids and gas cylinders (even if empty) should be kept separately and disposed of as directed by the local authority.They should not be placed in skips with other waste.

Internal self-inspection Reports

Self-inspection systems are recommended by insurance companies as part of an on-going programme to increase awareness of fire hazards and reduce risks. Internal Fire Inspection Reports are available which illustrate the areas that could be part of a self-inspection system.

The reports cover a much wider inspection programme than is directly relevant to the envelope cladding of a building. Examples from a typical list relating to panels and insulated cladding are:

Electrical equipment

- Is there any temporary wiring/cabling
- Is the wiring/cabling passing through panels correctly installed?

Gas cylinders

- Are gas cylinders stored in a secure fire safe compound outside the building?

Fork lift truck/electric vehicle charging area

- Is the charging area clean and tidy?
- Are the low voltage charging cable connectors undamaged?
- Has storage been allowed in the charging area?

Hot work

- Have hot work permits been used as required?

Waste management/rubbish

- Are all idle pallets and waste skips at least 6 metres clear of buildings?

Fire safety during construction

A large proportion of all fires occur when buildings are being constructed, modified or extended.

The Health and Safety at Work Act 1974 is applicable to all work carried out during the construction phase. Under this act the employer has a duty to keep the workplace in a safe condition without causing risk to health. The Act is enforceable by the Health and Safety Executive.

Guidance in respect of construction, including alterations and extensions is given in: “Fire Prevention on Construction Sites” published by the Fire Protection Association [23]; and “Fire Safety in Construction Work” pubished by the Health and Safety Executive [24].

Where temporary buildings are introduced within, or adjacent to the building envelope, only those site buildings that comply with the LPS 1195 standard should be used.

The procedures recommended for hot work above should be implemented.

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EPIC was set up in 1991 to promote quality roofing and cladding systems through the use of factory-engineered panels. Insulated panels maximise thermal efficiency whilst reducing the risk and effects of condensation and significant energy loss through air leakage.

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This guide on Fire safety and the performance of Insulated Panels in fire can be downloaded from the EPIC website at **www.epic.uk.com**

EPIC have also published a series of other Guides including:

– Insulated Panels, Requirements and compliance – Building Regulations: Conservation of fuel and power 2010
– Insulated Panels, The Fire Safety Order (2005)*
– Insulated Panels. Identification and disposal*

* These guides are available in hard copy form and through the website.

Acknowledgements

EPIC would like to thank the following organisation for their guidance, help and assistance in the production of this fire guide

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