Sandwich Panels: fire testing, insurance industry demands and case studies from real fires in the UK.

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UK Trade Association for PIR Core Sandwich Panels.
Fire Performance of Sandwich Panels

- General Introduction
- UK Insurance Industry Attitudes & Design Guidance.
- Fire testing –
  - EN13501 (Euroclassification)
  - Loss Prevention Certification Board
  - FM Global
- UK Fire Fighter Attitudes
- Real Fire Case Studies
- Summary

What is a sandwich panel?

- Also called composite or insulated panels
- Insulation core with metal facings
- Interlocking joint detail
- Typically 1 metre wide and up to 30 metres long
- Insulation types include PIR, mineral fibre, polyurethane and EPS.
- European Standard EN14509.
What are insulated panels used for?

- External fabric - core now PIR or mineral fibre in UK. Historically was generally polyurethane.
- Internal boxes within buildings – e.g. cold stores, food processing areas – core now PIR or mineral fibre in Ireland & UK. Historically was generally EPS.

Building types and applications

- Industrial
- Commercial
- Distribution
- Retail
Internal applications

UK Building Regulation Reaction to Fire Tests

- Key objective is specifically life safety rather than property conservation.

- UK National tests are generally small scale and do not differentiate well between different levels of performance.

- New European system – EN 13501.
  - All combustible core panels achieve Euroclass B
  - Some achieve S1 or S2 smoke classification
  - Some achieve D0 burning droplets classification.
Euroclassification - EN13501

PIR Core  B, S2, D0
PIR Core  B, S1, D0

UK Insurance Industry Reaction
The fundamental problem is that from the mid-1980s serious fires involving certain types of sandwich panels have created Insurer concerns about the fire performance of all sandwich panel systems.

How did insurers react?

Commercial Property Insurance

Where does the underwriter turn to for help?
Commercial Property Insurance

Figure 5: Fire claims are the most costly in commercial property insurance

Source: Datamonitor analysis of ABI statistics

Snapshot of UK food sector losses

- Egg packers  Lincoln  2005
- Bakery  Carlisle  2005
- Pasta/pizza  Humberside  2005
- Tea blenders  Knowsley  2005
- Distribution  Manchester  2006
- Bakery  Sheffield  2006
- Chicken processors  Co. Down  2006
- Biscuits  Bloxwich  2006
- Distribution  Chester-le-Street  2006
- Bakery  Bathgate  2006
- Bakery  Harrogate  2007
- Seafood processor  Annan  2007
Key challenges for insurers

- Promoting testing and certification schemes for the fire performance of panels
- Identification of panel type and aiding holistic fire risk assessment of existing buildings
- Establishing real reasons for large losses
- Developing good design advice with dissemination to architects, developers etc.

Loss Prevention Certification Board

- Completely independent – Part of Building Research Establishment in UK
- LPCB provide research, testing and fire test approvals.
- LPCB still has very close connections to ABI, FPA and Lloyds.
- LPS 1181 is a wall and ceiling lining test to evaluate insulated panels.
Comparative - Fire Performance Data

EPIC - ARUP Warrington - LPCB- LPS 1181 Fire Tests

Thick char protects core foam from fire attack.

FM Global

- Major insurer with own test facilities and standards for building cladding systems.
- FMRC 4880 approval requirements for class 1 fire classification with no height restriction.
- Approved suppliers are subject to detailed quality surveillance.
FM Grades

FMRC 4880 Class 1 - Walls & Ceilings
– No height restriction
– Max 50ft height
– Max 30ft height

FM Global 50ft Wall Test On Kingspan Panels

A pass can result in unlimited height approval
For insurance underwriting purposes, Insurers use the Design Guide for the Fire Protection of Buildings as a basis for providing guidance on what they require for property protection purposes, subject to a broad based risk assessment. In respect of external composite (Sandwich) panels, these must be suitable for the intended end use application and should either have non-combustible cores or be LPCB approved to the appropriate requirements of LPS 1181 (see paragraph 3.11) and fully satisfy insurers fire resistance requirements (insulation and integrity) through appropriate testing.”
Holistic fire safety engineering

Combining personnel protection with property conservation

The 4 key fire safety design priorities for new build

Fire protection solutions for:

1. Maintaining the structural integrity of the building framework – passive fire protection
2. Protection of contents - sprinklers
3. External roofs and walls of the building – approved panels
4. Internal compartment walls and enclosures – approved panels

Fire Safety Management policies and operational procedures
FM 50 ft Fire Test Using Cardboard Cartons

Demonstrates speed of fire development in high bay racking situation.

UK Fire Protection Association guidance

- New Core Documents –
  Essential Principles
  Protected Zones
Risk assessment based
Points based system
Only acceptable panel systems are those approved by LPCB (essentially PIR & mineral fibre)

Fire Protection Association guidance – Stand Alone Cold Stores

Risk assessment based
Points based system
Recognises that stand alone stores generally present less risk but
Recommends panel cores approved by LPCB. (essentially PIR & mineral fibre)
Fire-Fighter Attitudes

Wiltshire,
Suffolk,
Greater Manchester
Hereford & Worcester
West Midlands
Cheshire

Conclusions
• No brigade visited has a ‘no-entry’ policy.
• Brigades recognise dangers of internal panel systems.
• Large uncompartmented buildings and lack of fire sprinklers of more concern.

Real Fire Case Studies
Case Studies

Panasonic - Steel frame and site assembled mineral fibre roof and wall system
- Contents - Electrical consumer goods

Italy - Concrete frame - roof structure and metal clad wall
- Contents – Electrical consumer goods and scooters

Boots (UK) - Polyurethane insulated roof Nottingham and wall system
- Contents - Aerosol canisters and cosmetic products

Case Studies on LPCB / FM Approved panels.

- We have comprehensive case study information on major fires in the following buildings –
  - Hospital
  - Warehouse
  - School
  - Food retail
  - Factories

- All case studies are independently investigated and have all been published where we have permission.

- We have never had situation where PIR core LPCB/FM approved panels have caused fire propagation.
LPCB Approved PIR core roof panels.

Serious fire in roof void.

Independent investigation by Tenos.
Clifton Comprehensive, Rotherham

Damage in elevated walkway.

Damage to ridge in elevated walkway.
The PIR core insulated roofing sheets did not contribute to the fire.

The LPCB approved panels helped prevent fire spread above the internal compartment wall.
Wharfdale Hospital

LPCB Approved PIR panels

Very high Fire load (intumescent coated beams distorted and compartment floor cracked).

Independent investigation completed by Tenos.

Wharfdale Hospital

10 metre high flames impinged directly onto panels.
Panel cut away to expose steel columns for inspection.

Core unaffected

PIR core is virtually unaffected when steel is pulled away.
Tenos Conclusion - 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.

External Arson in Co. Wicklow.
External Arson in Co. Wicklow.

Arson in Co. Wicklow
Arson in Co. Wicklow

- Fire developed very quickly
- Burned for 25 minutes before fire fighting commenced
- Direct flame impingement on panels
- High levels of radiated heat on panels
- Core remained in place
- No fire spread via the PIR core
- PIR did not contribute to heat damage
The block work fire wall was exposed to fire equivalent to ‘at least 60 minutes in a standard fire resistance test’.  

The charring exhibited by the PIR …provided an effective fire stop between the steel skins of the cladding at the head of the compartment wall’
Conclusions

- LPCB & FM tests provide realistic full scale tests – only PIR core or mineral fibre core panels can meet certification requirements.
- Real fire case studies indicate that PIR core panels perform well.
- The design process must be based on holistic fire risk assessment – building fabric is a key part of the solution.
- Future building regulation, sustainability and environmental performance requirements make sandwich panels the optimum choice.

Any Questions?
Wall penetrations.

**Figure 32. Wall penetration**

- 6mm @ butyl rubber sealant
- Galvanised stopper
- Pipewrapping by others
- Non-combustible insulation by others
- Silicon flexible pipe flashing or similar to suit high temperature conditions by others
- Internal cover strip to match liner material
- Foil tape (G.F.R.P.) flexible pipe flashing or similar by others

**Figure 34. Hot flue – wall**

- Insulated panel
- Site applied
- Internal cover flashing to match liner material
- It is advisable to locate pipe/ducting within the rain-scarpings of outer sheet profile