



Bespoke Fire Safety Training

NOS-3

Evaluate Design Submissions
Against Approved Document B

Insulating Core Panels

(slides)

FPA
Fire Protection Association

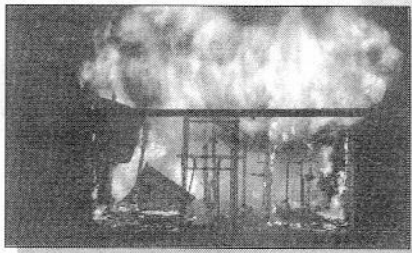
Course code:
NOS-3

Course title:
**Evaluate Design Submissions
Against Approved Document B**

Subject:
Insulating Core Panels

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Introduction



"There have been two firefighters killed fighting a fire in a building containing sandwich panels there have been no civilian fatalities However, there have been a number of "near misses"

"[The] special problem is primarily one of speed; the development and spread of a fire and the general build-up of dangerous conditions in a building containing sandwich panels. These fires are in most ways the same as any other fire - but much faster.

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Introduction

Use

- Insulating core panel systems are used for external cladding as well as for internal structures.
- The most common use of insulating core panels for internal structures, is either to provide an enclosure to be used as a cold store, or an area where the maintenance of a hygienic environment is essential, such as food preparation industries.

FPA **Introduction**

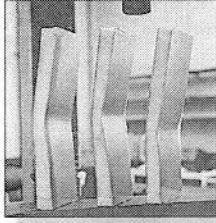
Construction

The most common forms of insulation in present use are:

- expanded polystyrene,
- extruded polystyrene,
- polyurethane,
- mineral fibre.

However panels with the following core materials are also in use:

- polyisocyanurate,
- modified phenolic.



FPA **Fire behaviour of the core materials and fixing systems**

- Large quantities of smoke.
- Delamination between the facing and core material
- If the fire starts to heat up the support fixings or structure to which they are attached, then there is a real chance of total collapse of the panel system.
- Fire can spread behind the panels, hidden from the occupants of occupied rooms/spaces. Due to the insulating properties of the cores, it may not be possible to track the spread of fire, even using thermal imaging equipment

CORE TYPE	Fire Load	Ease of Ignition	Fire Spread	Fire Resistance	Thermal Insulation	Smoke Production
Expanded Polystyrene	5	5	5	5	2	5
Polyurethane Foam	5	5	3	5	1	4
Polyisocyanurate Foam	5	3	3	4	1	4
Modified Phenolic Foam	5	2	3	3	Not Available	3
Glass Foam	1	1	1	1	Not Available	1
Mineral Wool	1	1	1	1	3	1

1 = Best
5 = Worst

FPA **Design recommendations**

Adopt one or more of the following at the design stage:

- removing the risk
- separating the risk from the panels by an appropriate distance
- providing a fire suppression system for the risk
- providing a fire suppression system for the enclosure
- providing fire-resisting panels
- specifying appropriate materials/fixing and jointing systems

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Specifying panel core materials

The provision of core materials which may be appropriate to the application concerned.

Mineral fibre cores:

- cooking areas,
- hot areas,
- bakeries,
- fire breaks in combustible panels,
- fire stop panels,
- general fire protection.

All cores:

- chill stores,
- cold stores,
- blast freezers,
- food factories,
- clean rooms.

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Specifying materials/fixing and jointing systems

The following are methods by which the stability of panel systems may be improved in the event of a fire, (although they may not all be appropriate in every case).

- 1) connecting all the parts together
- 2) building superstructure should be protected
- 3) non-combustible panels at intervals
- 4) fully encapsulated by non-combustible facing materials which remain in place during a fire.
- 5) incorporate pre-finished and sealed areas for penetration of services.

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General

- Panels or panel systems should not be used to support machinery or other permanent loads.
- Any cavity created by the arrangement of panels, their supporting structure or other building elements should be provided with suitable cavity barriers.



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Insulating Core Panels

(handout)

FIRE BEHAVIOUR OF INSULATING CORE PANELS USED FOR INTERNAL STRUCTURES

Introduction

In 1999, the Fire Research and Development Group produced a report which said that

"there is wide concern over the problems of fighting fires in buildings containing sandwich panels. There have been two firefighters killed fighting a fire in a building containing sandwich panels, but to date there have been no civilian fatalities. However, there have been a number of "near misses" and there are naturally concerns that circumstances may be different in some future event".

The report went on to say that

"fires involving sandwich panels present a special problem to the fire crews attending. This special problem is primarily one of speed; the development and spread of a fire and the general build-up of dangerous conditions in a building containing sandwich panels. These fires are in most ways the same as any other fire - but much faster. This means that the Officer-in-Charge must react more quickly, must be more responsive to new information and evidence of the changing conditions, and needs to withdraw teams or call for more resources earlier, possibly before the real need is apparent".



Insulating core panel systems are used for external cladding as well as for internal structures.

However, whilst both types of panel system have unique fire behaviour characteristics, it is those used for internal structures that can present particular problems with regard to fire spread.

The most common use of insulating core panels for internal structures, is either to provide an enclosure to be used as a cold store, or an area where the maintenance of a hygienic environment is essential, such as food preparation industries.

The panels typically consist of an inner core sandwiched between, and bonded to, a membrane such as facing sheets of galvanised steel, often bonded with a PVC facing for hygiene purposes.

The panels are then formed into a structure by jointing systems, usually designed to provide an insulating and hygienic performance. The panel structure can be free standing, but is

usually attached to the building structure by lightweight fixings and hangers.

The most common forms of insulation in present use are:

- expanded polystyrene,
- extruded polystyrene,
- polyurethane,
- mineral fibre.

However panels with the following core materials are also in use:

- polyisocyanurate,
- modified phenolic.

Fire behaviour of the core materials and fixing systems

The degradation of polymeric materials can be expected when exposed to radiated/conducted heat from a fire, with the resulting production of large quantities of smoke.

It is recognised that the potential for problems in fires involving mineral fibre cores is less than those for polymeric core materials.

In addition, irrespective of the type of core material, the panel, when exposed to the high temperatures of a developed fire, will tend to delaminate between the facing and core material, due to a combination of expansion of the membrane and softening of the bond line. That is, the large steel sheets which were bonded to the core, will fall off the walls and ceiling.

The stability of the system will then depend on the residual structural strength of the non-exposed facing, the joint between panels and the fixing system.

Most jointing or fixing systems for these systems have an extremely limited structural integrity performance in fire conditions. If the fire starts to heat up the support fixings or structure to which they are attached, then there is a real chance of total collapse of the panel system.

The insulating nature of these panels, together with their sealed joints, means that fire can spread behind the panels, hidden from the occupants of occupied rooms/spaces.

This can prove to be a particular problem to fire fighters as, due to the insulating properties of the cores, it may not be possible to track the spread of fire, even using infra red detection equipment.

This difficulty, together with that of controlling the fire spread within and behind the panels, is likely to have a detrimental effect on the performance of the fixing systems, potentially leading to their complete and unexpected collapse, together with any associated equipment.

Of course, there are many other hazards associated with core panels as demonstrated in the table below.

CORE TYPE	Fire Load	Ease of Ignition	Fire Spread	Fire Resistance	Thermal Insulation	Smoke Production
Expanded Polystyrene	5	5	5	5	2	5
Polyurethane Foam	5	5	3	5	1	4
Polyisocyanurate Foam	5	3	3	4	1	4
Modified Phenolic Foam	5	2	3	3	Not Available	3
Glass Foam	1	1	1	1	Not Available	1
Mineral Wool	1	1	1	1	3	1

1 = Best

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Fire fighting

When compared with other types of construction techniques, these panel systems therefore provide a unique combination of problems for fire fighters, including:

- hidden fire spread within the panels,
- production of large quantities of black toxic smoke, and
- rapid fire spread leading to flashover.

These three characteristics are common to both polyurethane and polystyrene cored panels, although the rate of fire spread in polyurethane cores is significantly less than that of polystyrene cores, especially when any external heat source is removed.

In addition, irrespective of the type of panel core, all systems are susceptible to:

- delamination of the steel facing,
- collapse of the system,
- hidden fire spread behind the system.

Design recommendations

To identify the appropriate solution, a risk assessment approach should be adopted. This would involve identifying the potential fire risk within the enclosures formed by the panel systems and then adopting one or more of the following at the design stage:

- removing the risk,
- separating the risk from the panels by an appropriate distance,
- providing a fire suppression system for the risk,
- providing a fire suppression system for the enclosure,
- providing fire-resisting panels,
- specifying appropriate materials/fixing and jointing systems (see below).

Specifying panel core materials

Where at all possible the specification of panels with core materials appropriate to the application will help ensure an acceptable level of performance for panel systems, when involved in fire conditions.

The following are examples in the provision of core materials which may be appropriate to

the application concerned.

Mineral fibre cores:

- cooking areas,
- hot areas,
- bakeries,
- fire breaks in combustible panels,
- fire stop panels,
- general fire protection.

All cores:

- chill stores,
- cold stores,
- blast freezers,
- food factories,
- clean rooms.

This part of Appendix F then goes on to say that core materials may be used in other circumstances where a risk assessment has been made and other appropriate fire precautions have been put in place.

Specifying materials/fixing and jointing systems

The following are methods by which the stability of panel systems may be improved in the event of a fire, (although they may not all be appropriate in every case).

- a. Insulating envelopes, support systems, and supporting structure should be designed to allow the envelope to remain structurally stable by connecting all the parts together so that if some supports fail, the remaining supports will take up the load.
- b. The building superstructure, together with any elements providing support to the insulating envelope, should be protected to prevent early collapse of the structure or the envelope.

Note: Irrespective of the type of panel provided, it will remain necessary to ensure that the supplementary support method supporting the panels remains stable for an appropriate time period under fire conditions. It is not practical to fire protect light gauge steel members such as purlins and sheeting rails which provide stability to building superstructures and these may be compromised at an early stage of a fire. Supplementary fire protected heavier gauge steelwork members could be provided at wider intervals than purlins to provide restraint in the event of a fire.

- c. In designated high risk areas, consideration should be given to incorporating non-combustible insulant cored panels into wall and ceiling construction at intervals, or incorporating strips of non-combustible material into specified wall and ceiling panels, in order to provide a barrier to fire propagation through the insulant.

- d. Correct detailing of the insulating envelope should ensure that the combustible insulant is fully encapsulated by non-combustible facing materials which remain in place during a fire.
- e. The panels should incorporate pre-finished and sealed areas for penetration of services.

General

Panels or panel systems should not be used to support machinery or other permanent loads.

Any cavity created by the arrangement of panels, their supporting structure or other building elements should be provided with suitable cavity barriers.