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Protecting People, Property and the Planet

Passive Fire Protection

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Part of the BRE Trust

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Introduction

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The presentation will cover

- Fires in a compartment – what are you engineering against.
- Reaction to fire testing
- Fire resistance testing
- Installation issues

Building Regulations - Fire safety Functional Requirements

B1 Means of Warning and Escape

B2 Internal Fire Spread (Linings)

B3 Internal Fire Spread (Structure)

B4 External Fire Spread

B5 Access and Facilities for the Fire Service

Address Life Safety Issues

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Passive Fire Protection

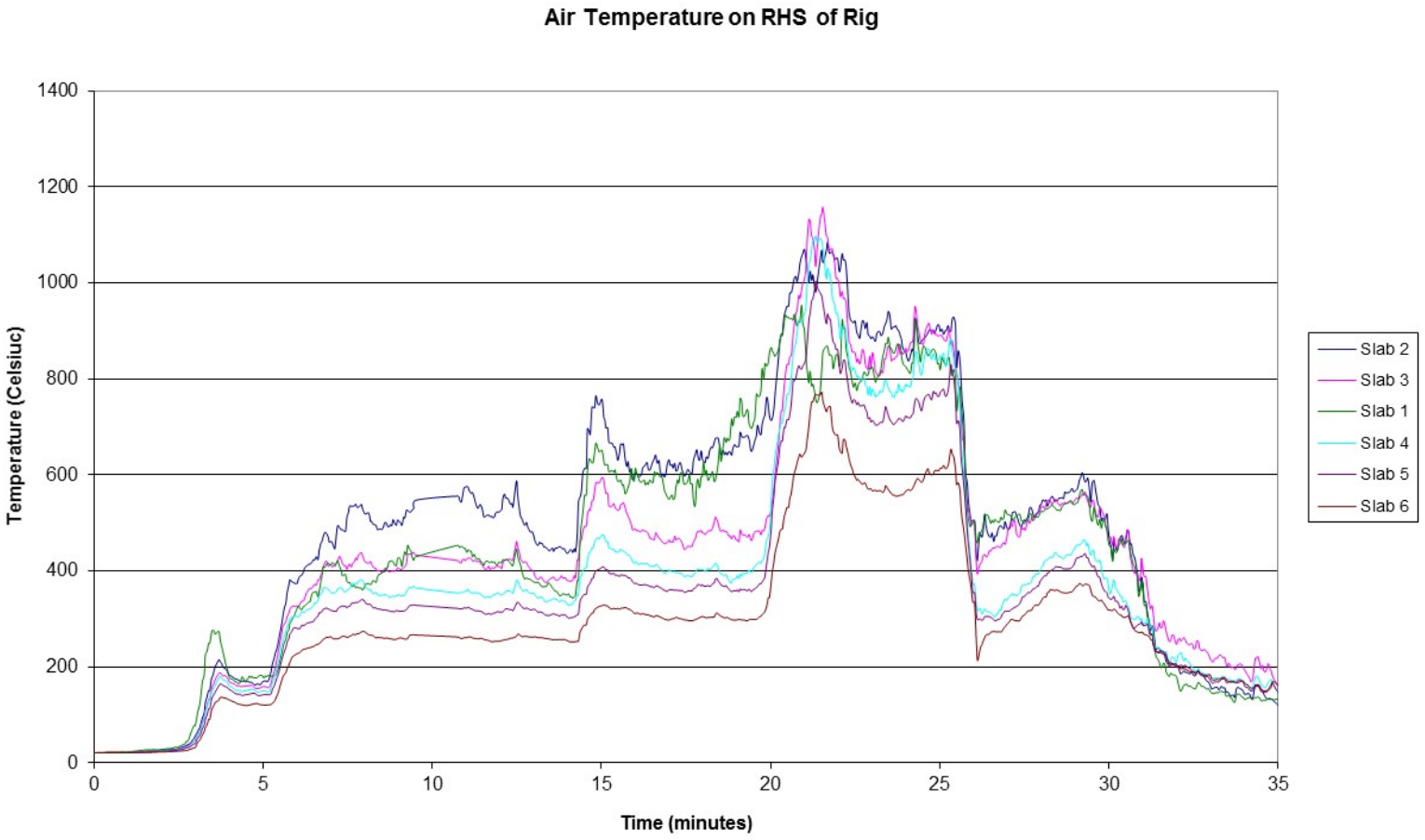
- Temperatures in excess of 1100 deg C.
- Build up of pressure.
- Duration of fire?

  Windsor Tower, Madrid - 24 hours to extinguish.

  If you have sufficient fuel and oxygen - there is no limit to the fire duration.

- Buncefield - 5 days

Fire in an underground carpark



Underside of roof slab – reinforced concrete.

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Fire damage

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Testing of materials and structures - Reaction to Fire

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Reaction to fire tests

- Tests fall into two categories.
  - System tests – the tests assess the product in end use application
  - ‘Material’ tests. Produces data on the fundamental properties of a material.

Material tests

BS EN ISO 1182:2010 Reaction to fire tests for products —non-combustibility test

- Sample diameter 45mm
- Sample height 50mm
- Tested at 750ºC
- In conjunction with BS EN ISO 1716 can lead to A1 classification.

(BS 476 Part 11 & Part 4)

Material tests

BS EN ISO 1716:2010 Reaction to fire tests for products — Determination of the gross heat of combustion (calorific value)

- Testing of </= 1g
- Product finely divided
- Sample burnt in pure oxygen
- Measure of energy released.

In conjunction with SBI can lead to ‘A2’ classification.

System tests

BS EN 13823:2010+A1:2014. Reaction to fire tests for building products — Building products excluding floorings exposed to the thermal attack by a single burning item

- ‘SBI’ tests

- ‘L’ Shaped sample 1500mm high x 500mm wide and 1500mm high x 1000mm wide.

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System tests

BS EN 13823:2010+A1:2014. Reaction to fire tests for building products — Building products excluding floorings exposed to the thermal attack by a single burning item

- 30kW burner on the front face of the sample

The report details

- Heat release
- Smoke
- Flaming material

In conjunction with BS EN ISO 11925 can lead to B,C or D classifications

System tests

BS EN ISO 11925-2:2010 Reaction to fire tests Ignitability of products subjected to direct impingement of flame Part 2: Single-flame source test

Sample size. 250mm x 90mm

20mm test flame.

Can lead to ‘E’ Classification

System tests

BS 476: Fire tests on building materials and structures.

Part 6: method of tests for fire propagation for products

Part 7: Method of test to determine the classification of the surface spread of flame of products

Class 0. – is not a classification identified in any British Standard (defined in Approved Document B).

System tests

Class 0. – is not a classification identified in any British Standard (defined in Approved Document B).

It is a combined result from:

BS476 part 6 – Fire propagation index of less than 12 and a sub index (i1) of not more than 6.

BS 476 Part 7 – class 1.

System tests

Considerations

- The test result applies to the system as a whole.

- The scope of the test result may be applicable only to the configuration as tested or variations may be allowed**.**

- Information on the application of test results.

    - Classification documentation (EN13501 series of standards).
    - Product standards
    - Extended application documents

System tests

Other examples

Roofs - BS476-3/ CEN/TS 1187:2012

BS 8414 Parts 1 & 2.

IMO tests

Testing for the transport industry. (BS6853/45545).

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Testing of materials and structures - Fire resistance

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What you are trying to achieve with the passive fire protection.

- The ‘fabric’ of the building should be designed, constructed and maintained to reduce or eliminate the spread of fire products around the building.
- To contain the fire to the area of origin.
- Protect lives and the structure of the building.

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Why is passive fire protection so important?

- Maintains structural stability of steel frame buildings
- Reduces deflection of floors
- Maintains compartmentation
- Reduces spread of smoke
- Maintains escape routes

What happens if it fails?

- Potential building collapse
- Potential loss of life
- Major rebuilding cost

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What needs to be considered?

- Walls – load and non load bearing
- Walls - external
- Floors (above and below!)
- Doors
- Ventilation
- Cable penetration
- Gas/water/ drainage
- Structural elements (beams and columns)
- Voids and cavities (cladding)
- Reaction to fire properties

All of the above are tested.

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Testing of systems

- But how do we know that the systems will work?
- We test them.
- We produce test reports that describe the test set up and results obtained.
- We produce classification reports

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Passive Fire Protection - Duct Type A

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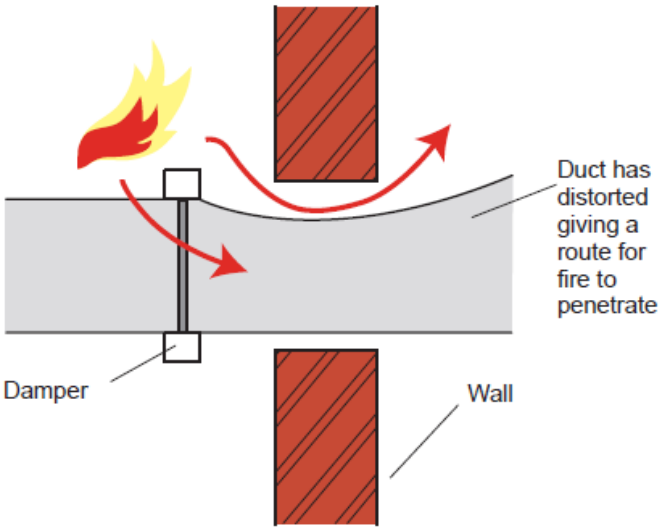
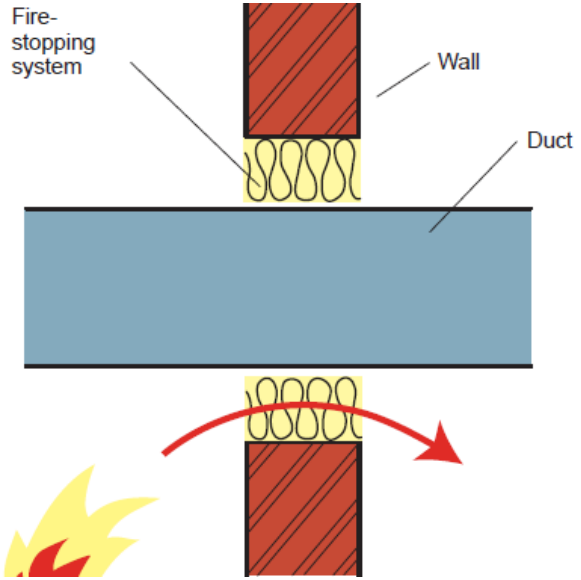
Passive Fire Protection

Risk/ Threat





Testing of systems – ductwork

- The ductwork systems are constructed in a floor furnace.
- Hanger spacing and construction of system must be representative of end use.
- Additional features such as compartment wall and sections of ductwork external to the furnace are a feature of the test programme.

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Testing of systems

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FireTesting at BRE Garston

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Installer issues

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Walls and Penetrations

How would you fire seal this?

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Ad–hoc fire stopping.

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Gap sealing

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Fire stopping

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Fire Stopping

Stone mineral wool batt and mastic systems.

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Further Information

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Simple guides to installing and inspecting passive fire protection

- Good Building Guide GBG 81
- Presents basic information
- Directs the reader to more comprehensive documents

GOOD BUILDING GUIDE GBG 81

INSTALLING FIRE-RESISTING DUCTWORK AND DAMPERS

Norman Macdonald and Ian Stewart

This Good Building Guide is designed to illustrate the importance of correctly installing fire-resisting ductwork and dampers to ensure the safety of building occupants and the protection of property in the event of a fire. Some key fundamentals for the guidance of specifiers, manufacturers, contractors and approval authorities are given, together with useful references to more comprehensive documents. The importance of adequate testing, product quality, installation, maintenance and the critical role of third-party certification schemes are highlighted.

In the year ending 31 March 2009, there were approximately 75,000 fires in buildings in the UK, resulting in some 350 lives lost and about 10,000 non-fatal injuries. The annual cost to the UK of fires in buildings is several billion pounds in lost property and business. Therefore, it is vital to keep our buildings as fire safe as possible.

A critical weakness in the fire safety of any building can be the penetration of fire compartment walls and floors by building services such as cables, pipes and ductwork, including dampers. Potential fire spread via a ductwork system is of particular concern as it is designed to distribute air throughout the building. A fire attacking such a system that is not designed and installed properly has the potential to spread fire, smoke and toxic gases rapidly to more than one compartment within the building with consequences for life safety and property protection.

This guide highlights the importance of correct installation of ducts and dampers in buildings and focuses on some of the key points and issues. The guide assumes that the overall design and function of the complete ductwork and damper system, including any associated

(a) (b) (c)

Figure 1: (a) Fire-resisting duct system, (b) steel fire damper, (c) intumescent fire damper

active fire protection systems such as smoke detectors, have been designed following the relevant codes, guides and standards.

When discussing dampers, the guidance in this document has focused on steel dampers. It may be that an intumescent damper is also suitable for certain situations. In this case, some of the guidance may not be appropriate.

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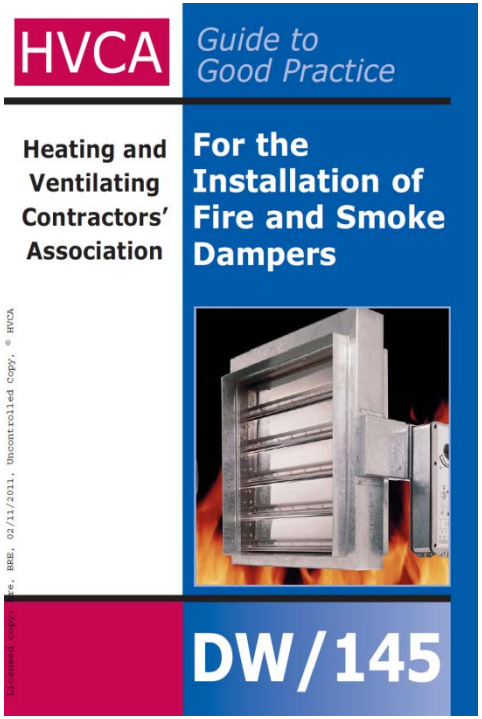
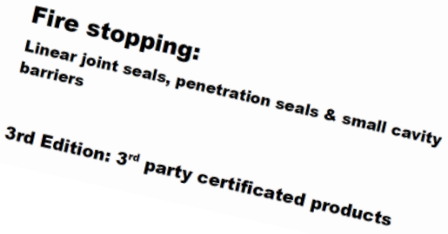
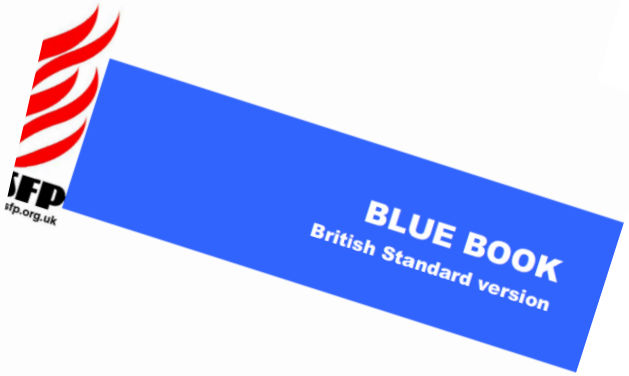
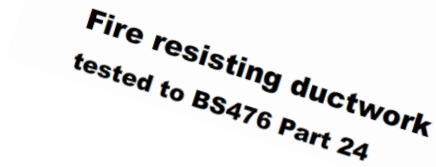
ASFP & B&ES Guides









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Thank you for your attention

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