

# Smoke Shaft Construction

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## SCA – The Voice of the Smoke Control Industry

As experts in smoke control, SCA members lead the way in promoting and enhancing the design, manufacture, installation and maintenance of life safety smoke ventilation systems and ensuring only independently tested and certified products are installed in buildings.

SCA members strive to lead the market and to ensure that all smoke ventilation systems and products are designed and installed in accordance with all relevant regulations and standards, for the benefit of building owners, building occupants and the wider community.

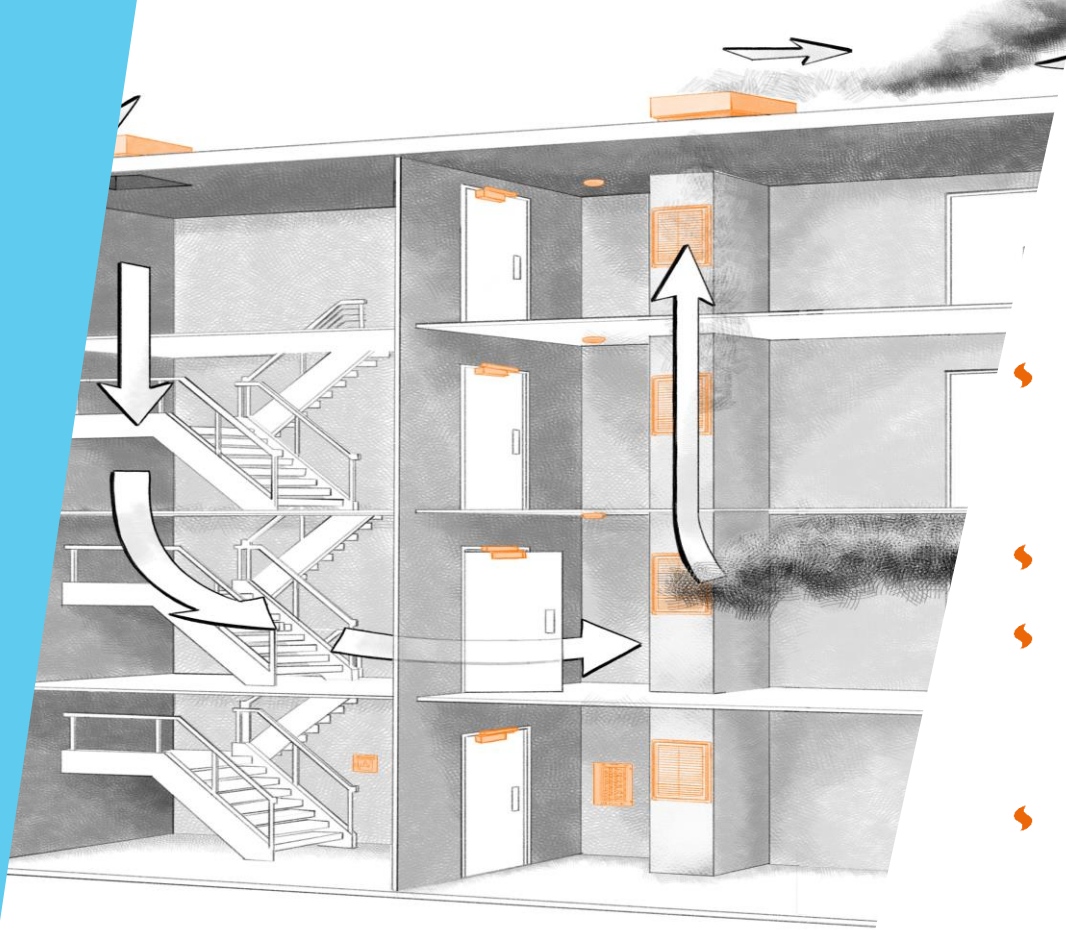
Find out more at:

[www.smokecontrol.org.uk](http://www.smokecontrol.org.uk)



# Smoke Shaft Construction Overview

- ✦ What is a smoke shaft
- ✦ What are the functional requirements
- ✦ Traditional materials & Specification UK
- ✦ Standards for smoke control ducts
- ✦ Typical furnace test
- ✦ Danger of non-tested solutions
- ✦ Caution!
- ✦ Solutions
- ✦ Take Aways



# What is a Smoke Shaft?

- ✦ A non-combustible vertical construction that provides a clear path for smoke from protected areas of a building to outside.
- ✦ Used for extract & pressurisation air relief
- ✦ The term “shaft” is used generically to describe a vertical construction through a building.
- ✦ The term “duct’ is often used to describe pre-fabricated construction assembled on site.
- ✦ Inlet paths and reversible systems likely to fall under the same requirements

The use of language eg “smoke ducts” or “smoke shafts” is not important when referring to elements that perform the same function.

# What are the functional requirements?



- ✦ Maintain building compartmentation.
  - ✦ Resistance to fire EIS
- ✦ Reaction to fire
- ✦ Maintain clear path for smoke
- ✦ Ability to resist pressure
  - ✦ Powered or Natural
- ✦ Durability for life of building
- ✦ Facilitate the incorporation of certified smoke control dampers to EN12101-8

# Traditional Construction Materials UK

- Historic practice based on availability and testing of materials and standards of the time
  - Block work or poured concrete construction
  - Plasterboard/Gypsum/Shaftwall construction
  - Mixture of construction materials
  - Commonly referred to as builders work construction
  - Metal duct insulated or uninsulated



# Traditional UK Construction Specification

- Specification applied to builders work construction
  - Reaction to fire non-combustible - Class A1 per ADB
  - Leakage 3.8m<sup>3</sup>/hr/m<sup>2</sup> at 50Pa per EN12101-6 (2013)
  - Compartmentation BS 476
  - Note EN12101-6 (2013) states blockwork should be lined
  - Gypsum board systems tested to BS EN1364-1 not suitable for smoke extract
- Fire rated metal duct specified against BS standards covering smoke control ducts
  - BS 476
  - Multi compartment BS EN 1366-8 & BS EN 13501-4 (Single to BS EN 1366-9)
  - CE marking EN12101-7. NB-Limitation on interpretation
- Back stop is Building Regulation 7
  - Materials and workmanship Approved Document 7 - NB hierarchy of selection
- Should name duct or shaft rather than function determine test requirement?

# Standards for Smoke Control Ducts



EN12101 suite of standards apply



The test & classification standards for smoke control ducts are clear



Multi compartment BS EN1366-8  
Single compartment BS EN1366-9



Classification to BS EN13501-4

4-sided construction to ensure smoke seal

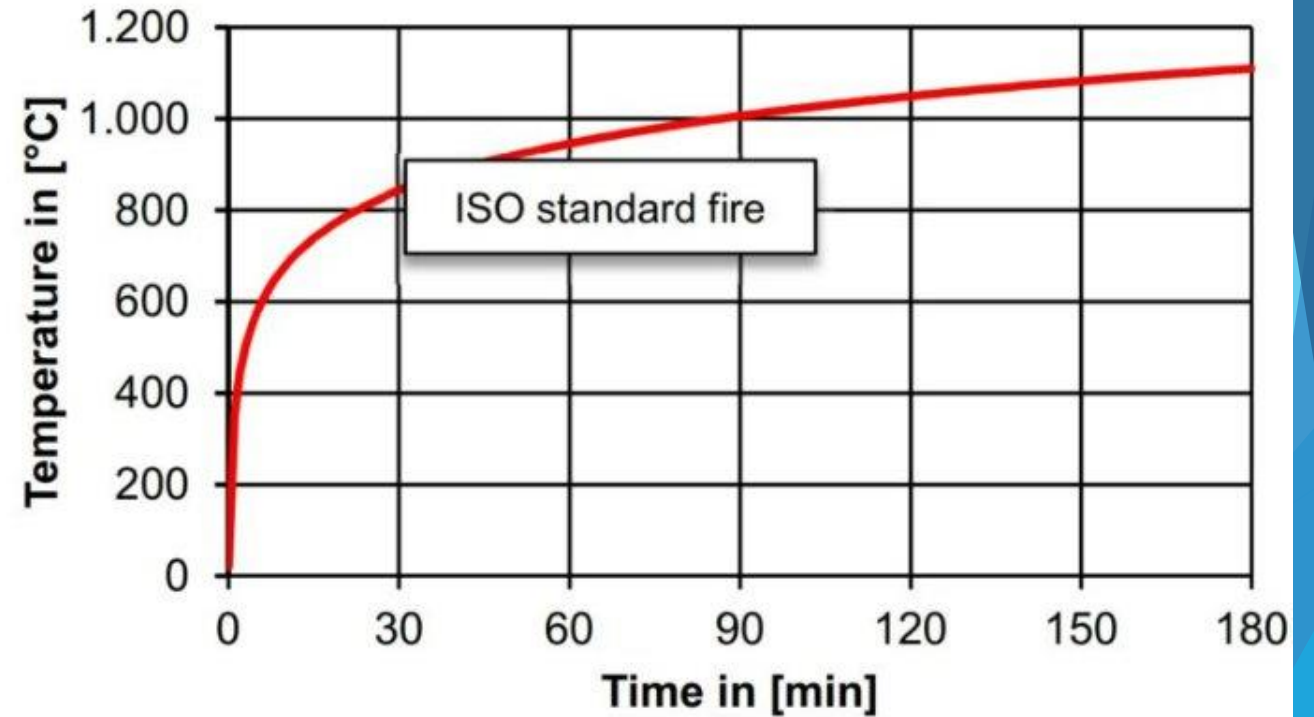




# Typical Furnace Test



## ISO Fire Curve



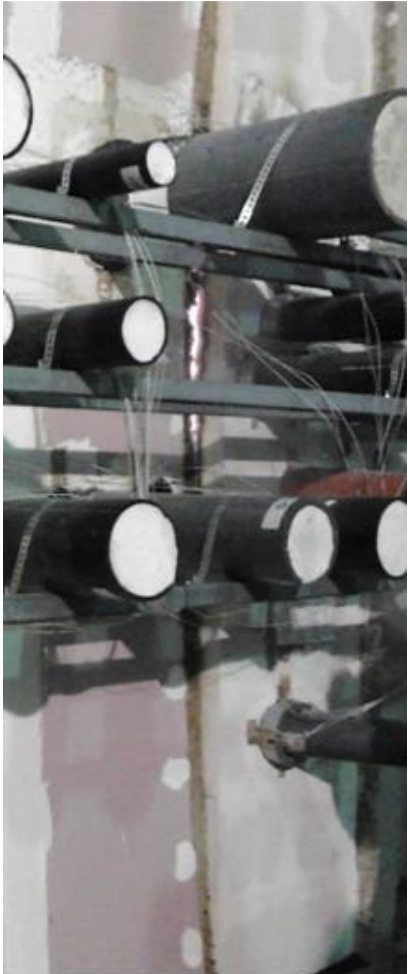
Test on smoke control damper in  
glass filled gypsum board shaft

# Danger of non tested solutions



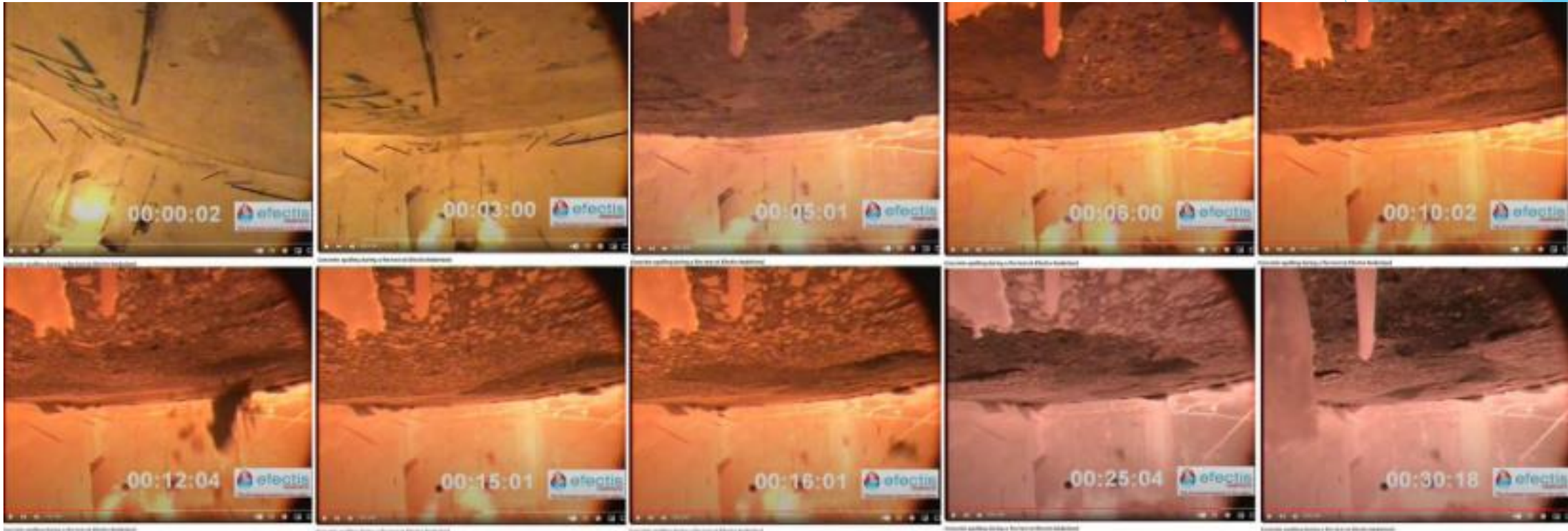
Test on cellular concrete  
Smoke sealing breached

# Danger of non tested solutions



Flexi walls deflect  
Smoke sealing breached

# Danger of non tested solutions



Concrete spalling  
Smoke sealing can be breached

# Caution!

Also note

- Industry statements from FIS, SCA and GPDA
  - Shaft wall not tested for use as smoke shaft
- EN13501-5 Service Ducts
  - No smoke rating not suitable for smoke extract
  - Asymmetric construction
  - Not 4 sided
- per EN1366-15
  - Concrete spalling risk
  - Construction of duct walls from multiple materials

## FIS issues safety alert on smoke shafts

Apr 30, 2024 | Tech



**SCA STATEMENT ON SMOKE SHAFT CONSTRUCTION MATERIALS**  
"The Smoke Control Association recommends that the materials and products used for smoke control ducts and shafts are tested in accordance with the test standards referred to in BS EN 12101-7 for multi-compartment smoke control ducts which is BS EN 1366-8. BS EN 1366-8 covers air leakage, integrity, insulation, maintenance of cross-sectional area and mechanical stability under pressure, characteristics which are detailed within BS EN 13501-4."

Natural and Mechanical Smoke Ventilation Systems are commonly used to provide vital life safety smoke protection to stairs, lobbies and corridors in multi-level buildings, particularly residential buildings, and other type of buildings taller than 18m requiring a firefighting shaft. These systems serve multiple levels and require a means of transferring the smoke from the floor of fire origin to outside the building. This is frequently achieved by providing a common duct through the building with dampers on every level and either a natural smoke ventilator, or smoke extract fans at the final point of discharge. On detection of the fire, only the dampers on the floor of fire origin open - all the others remain closed, the rooftop ventilator opens, or the smoke extract fans start, and smoke and heat are removed from the lobby or corridor with clear air being drawn in from the stair. Other variations are also possible, but the general principle is similar.

The standards for the various elements are covered by The Construction Products (Amendment etc.) (EU Exit) Regulations 2019 in the UK, which designates that the products should conform to:

- Natural Smoke & Heat Exhaust Ventilators – BS EN 12101-2
- Powered Smoke & Heat Exhaust Ventilators – BS EN 12101-3
- Natural Smoke & Heat Exhaust Ventilators – BS EN 12101-7
- Powered Smoke & Heat Exhaust Ventilators – BS EN 12101-8
- Smoke Control Dampers – BS EN 12101-10
- Smoke Control Dampers – BS EN 12101-10
- Power Supplies – BS EN 12101-10

There are other standards for example covering cabling, but these are not of relevance for this document. All members of the Smoke Control Association have signed up to the SCA Membership Criteria and should be delivering smoke control dampers, fans and ventilators that are compliant with the above standards. However, the ducts are generally outside of the scope of the smoke control contractor, so it is often the responsibility of the building designer to specify the correct duct materials.

Depending on the individual project, different phrases are used to describe the duct, such as shaft, smoke shaft, riser, or chimney. However, the function is always the same – to permit the transportation of smoke and heat in the event of a fire, from the location of origin to outside, while maintaining fire separation from the rest of the building.

There are many materials used to construct the duct, depending on who provides it. If it is within the M&E scope, it is often metal ductwork and may be constructed from galvanized steel or fire rated duct materials. If provided by the builder, it may be cast concrete or blockwork and if in the drylining package then gypsum board, plasterboard or similar, however, this is by no means exhaustive.

**Disclaimer**  
Whilst the Smoke Control Association, SCA, endeavours to ensure the accuracy and completeness of the contents of this document it accepts no responsibility in respect of loss or damage occasioned as a result of reliance placed upon any part of its contents.

systems in the construction of smoke shafts  
based systems are being specified to construct  
in some high-rise buildings. Members are  
tested for fire resistance, sound insulation, air  
to replicate the pressure differential conditions or  
which may be required for this application.

their tender requests and project  
any specific requirement to meet  
is classified to BS EN 13501-4 or  
matters members should seek  
Services Designers and consult with  
ons. They are also reminded to be  
responsibility for the design,  
files.

team on 0121 707 0077 or

May 2024 the Smoke Control  
materials and products used for  
the test standards referred  
to which is BS EN 1366-8.

of cross-sectional area  
detailed within BS EN

### INTRODUCTION

Issue 1, 2024-05-03  
ple standards, guides and codes of practice that provide differing  
ts for smoke shafts and smoke control ducts e.g. BS 9991, BS 9999,  
k and the BS EN 12101 series. Further, different terminology and  
ed across these documents which has caused some confusion in

increase in height there is always competition for space on the floor  
se ducts or, shafts may be constrained. To accommodate  
essure drop, larger fans are required leading to increased negative  
cts.

ents it is becoming ever more important that the materials and  
duct construction should be tested to withstand these conditions.

ke and Heat Control Systems – Smoke Duct Sections’ is the  
e control ducts, but this standard is rarely accepted by test  
r ducts that are constructed on site. In lieu of this, the Smoke  
mends that the materials and products used for smoke control  
d in accordance with the test standards referred to in BS EN  
tment smoke control ducts which is BS EN 1366-8.

akage, integrity, insulation, maintenance of cross-sectional area  
nder pressure, characteristics which are detailed within BS EN

in the specification and design of smoke control systems are  
aterial being used for smoke duct or shaft construction. The  
types previously mentioned are capable of providing the level of  
several are not suitable to withstand the leakage, insulation and  
smoke shaft or duct.

the SCA recommends that to meet the requirements of The Construction  
ment etc.) (EU Exit) Regulations 2019 the duct materials should be tested  
BS EN 1366-8, classified to BS EN 13501-4 (and BS EN 12101-7, if  
following characteristics:

0 or 120 minutes depending on duct location and building height.  
0 or 120 minutes depending on duct location and building height.

for natural systems, 500/1000/1500 (Pa) for mechanical systems  
should be Class A1 reaction to fire.

# Solutions



**Smoke duct/shafts  
must be designed  
into the system  
based on the  
application**

Spatial, technical  
requirements, insulation,  
finishing, buildability,  
durability, cost  
effectiveness

# Solutions



**Smoke duct/shafts must be designed into the system based on the application**

Spatial, technical requirements, insulation, finishing, buildability, durability, cost effectiveness



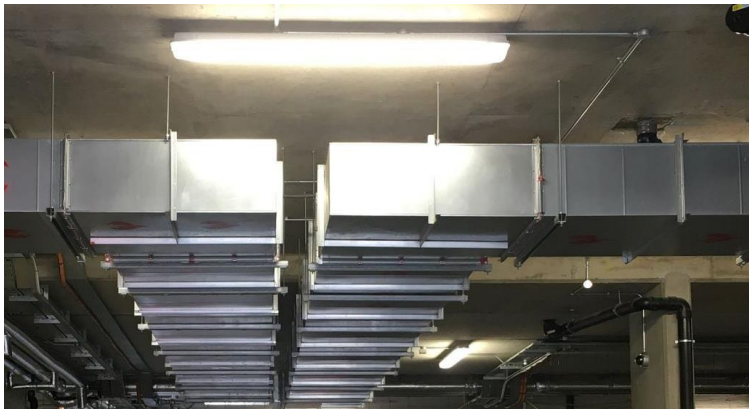
**Follow a linear approach based on standards for ducts**

BS EN1366-8/BS EN13501-4

Tested products available

- Metal duct insulated or uninsulated
- Construction using insulated board products eg glass filled gypsum

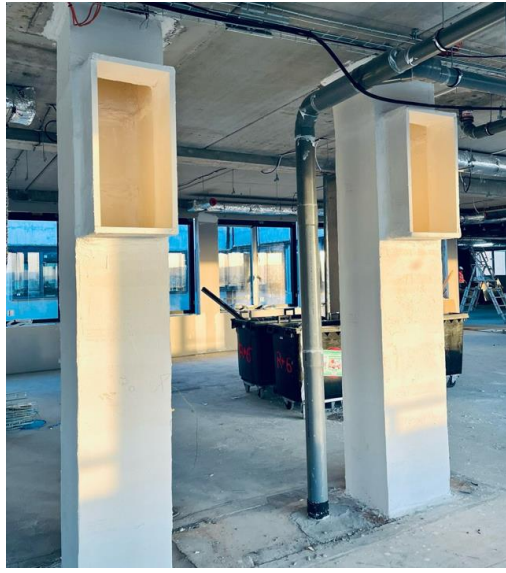
# Solutions



Insulated or uninsulated metal ductwork tested and classified to BS EN1366-8 and BS EN13501-4



# Solutions



Insulated board system using glass filled gypsum tested and classified to BS EN1366-8 and BS EN13501-4

# Solutions



**Smoke duct/shafts must be designed into the system based on the application**

Spatial, technical requirements, insulation, finishing, buildability, durability, cost effectiveness



**Follow a linear approach based on standards for ducts**

BS EN1366-8/BS EN13501-4  
Tested products available

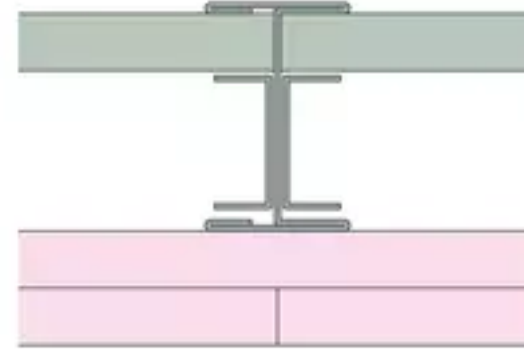
- Metal duct insulated or uninsulated
- Construction using insulated board products eg glass filled gypsum



**Adopt an approach based on Building Regulation 7**

Builders work construction untested for application

# Solutions



Concrete/Block/Shaftwall no formal rating as a smoke shaft

# Take Aways



Smoke shaft is an integral part of a smoke control system



Smoke Control systems must be designed as a system integrated into the building



Smoke shafts/ducts need to meet all requirements for the specific application



Specialist designers should be engaged at an early date. Don't accept generic cut and paste designs



Design based on standards and test evidence reduces risk



Competence based on SKEB. Competence includes Behaviour. Choose your designer carefully!

# Thank you - Please post questions



on the conference message board



to Smoke Control Association at [www.smokecontrol.org.uk](http://www.smokecontrol.org.uk)



or myself at [ian.doncaster@fireandsmokesolutions.co.uk](mailto:ian.doncaster@fireandsmokesolutions.co.uk)