

ADVISORY NOTE 36

ASFP Position on Smoke Shaft Construction Materials

Selection of smoke shaft construction materials

There has recently been discussion within ASFP and other trade associations regarding the choice of material used in the construction of smoke control shafts.

The Smoke Control Association produced a statement on this issue on 3rd May 2024, a copy of which is appended to this note. Having reviewed the text, ASFP members endorse the recommendations within the SCA statement, and as such the ASFP position is set out below.

The issue is that smoke control systems are often installed as a series of different components, under separate contract packages, and possibly without consideration of the overall system performance.

The system should be designed in accordance with BS 7346-8, the code of practice for planning, design, installation, commissioning and maintaining smoke control systems.

Gypsum based shaft wall systems have not previously been tested to BS EN 1366-8 and are not marketed as such. Conversely the minimum negative pressure threshold (500 Pa) within BS EN 1366-8 and BS EN 13501-4 may well be significantly beyond the necessary requirements of a naturally ventilated smoke control system but could, in some instances, easily be exceeded by a mechanical system.

As most of the gypsum based wall systems comprise double skin arrangements, should a wall become damaged through excess pressure, this may not always be visible from the outside but could compromise the integrity of the wall.

Therefore, until such time as more data is available, the ASFP 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.

The relevant tests are detailed in BS EN 1366-8. BS EN 1366-8 contains tests to determine air leakage, integrity, insulation, maintenance of cross-sectional area and mechanical stability under pressure. These are the characteristics which can be classified in accordance with BS EN 13501-4.

As a minimum, materials used in the construction of smoke control duct systems should be classified in accordance with BS EN 13501-4 with the following characteristics:

- Integrity (E) – 60 or 120 minutes depending on duct location and building height.
- Insulation (I) – 60 or 120 minutes depending on duct location and building height.
- Smoke leakage resistance (S), and an accompanying negative pressure classification; 500 (Pa) for natural systems, 500/1000/1500 (Pa) for mechanical systems depending on design.
- Materials should also be classified A1 for Reaction to Fire performance in accordance with BS EN 13501-1.

The only possible alternative to the above, at the current time, is to use a fully enclosed concrete or blockwork shaft. These are a satisfactory alternative to smoke control duct systems tested to BS EN 1366-8. Due consideration should be given to rendering or lining blockwork shafts as a consequence of porosity of the blockwork.

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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
- Smoke Control Ducts – BS EN 12101-7
- Smoke Control Dampers – BS EN 12101-8
- 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.

There are currently multiple standards, guides and codes of practice that provide differing performance requirements for smoke shafts and smoke control ducts e.g. BS 9991, BS 9999, BS 7346-8, ASFP Blue Book and the BS EN 12101 series. Further, different terminology and applications are referenced across these documents which has caused some confusion in the industry.

As buildings continue to increase in height there is always competition for space on the floor plate and the size of smoke ducts or, shafts may be constrained. To accommodate increased leakage and pressure drop, larger fans are required leading to increased negative pressures in shafts and ducts.

To satisfy these requirements it is becoming ever more important that the materials and products being used for duct construction should be tested to withstand these conditions.

BS EN 12101-7:2011 'Smoke and Heat Control Systems – Smoke Duct Sections' is the product standard for smoke control ducts, but this standard is rarely accepted by test houses as it does not cover ducts that are constructed on site. In lieu of this, **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.

Building designers involved in the specification and design of smoke control systems are advised to consider the material being used for smoke duct or shaft construction. The materials and construction types previously mentioned are capable of providing the level of fire resistance required, but several are not suitable to withstand the leakage, insulation and pressure requirements of a smoke shaft or duct.

As a minimum, the SCA recommends that to meet the requirements of *The Construction Products (Amendment etc.) (EU Exit) Regulations 2019* the duct materials should be tested in accordance with BS EN 1366-8, classified to BS EN 13501-4 (and BS EN 12101-7, if possible) with the following characteristics:

- Integrity (E) – 60 or 120 minutes depending on duct location and building height.
- Insulation (I) – 60 or 120 minutes depending on duct location and building height.
- Smoke Sealed (S).
- Pressure; 500 (Pa) for natural systems, 500/1000/1500 (Pa) for mechanical systems depending on design.
- Materials should be Class A1 reaction to fire.

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