



Guidance on the Specification of Products and Systems for Smoke Shafts - WP001

White Paper

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Introduction

The latest version of the SCA Guidance on Smoke Control to Common Escape Routes in Apartment Buildings specifies the applicable standards for all system components and is a valuable resource for specifiers, purchasers and approving authorities.

Smoke shafts are the most commonly employed solution for protection of common escape routes in residential apartment buildings. This document summarises the latest advice on such systems and discusses common areas of non-compliance which can be easily overlooked yet can have serious safety and financial consequences on projects.

The primary objective of this document is to ensure that purchasers are able to fully understand submissions from specialists and can feel confident in questioning potential irregularities or inconsistencies; to ensure specifiers include relevant clauses in specifications and recommend the use of a knowledgeable, qualified organisation; and to offer advice to building control on what to look out for when assessing a smoke shaft system.

Smoke shaft selection considerations

Guidance for natural smoke shafts is contained in Approved Document B (ADB) of the Building Regulations but unlike natural ventilation and pressurisation systems, mechanical smoke shafts do not yet appear in the Building Regulations and are treated as a fire engineered solution, often employed to justify escape travel distances in excess of those specified in Approved Document B. This means that, whilst they are now very common, their use is subject to approval by the authority having jurisdiction (AHJ), usually the Local Authority Building Control department or an approved inspector.

Further to the Construction Products Regulation (CPR), from 1st July 2013 construction products placed on the market and covered by a harmonised have to be accompanied by a DOP and be CE marked. Compliance with the Construction Products Regulation (CPR) is evidenced by the manufacturer issuing a Declaration of Performance (DoP) for their product and if these products are designed to protect life they must be tested to an Assessment & Verification of Constancy of Performance (AVCP) Level 1. This means that the manufacturer must appoint a Notified Body accredited to the relevant part of EN12101 to issue a certificate of constancy of performance for the product which is necessary to allow the manufacturer to issue the DoP. The DoP will contain information about the key characteristics of the product.

Current Building Regulations and British Standards do not adequately detail the design and specification of mechanical smoke shafts and consequently there are a number of 'grey areas' that can be misinterpreted. The lack of clear guidance on best practice can result in solutions that could compromise the safety of building occupants and make it difficult to assess the suitability of proposals from vendors. Furthermore, the financial advantages of using non-certified products are considerable.

The design of these systems can involve complex fire engineering requiring a high level of skill and experience. Many factors must be taken into account in arriving at a final solution including external elements such as the action of sprinklers, fire detection/alarm systems, compartmentation, shaft integrity and fire door selection. An audit of the responsible designer's competence is recommended including proof of an appropriate level of PI insurance.

Smoke Control Association members are required to hold a minimum level of £5m PI insurance and to be third party certified which may include design within the scope of the certification. The SCA website features a list of members and the scope of activities undertaken. It is also recommended that the complete system is under the control of the smoke control specialist rather than placing vital system components and parts in other packages, e.g. fans, dampers or cabling.

Smoke shaft ventilators

The extract point from the lobby into the smoke shaft is fitted with a smoke control damper to permit the evacuation of the quantity of air/smoke specified in the system design for mechanical systems, or to give the specified free area in natural shaft systems. The damper must be designed to have a free area and resistance to flow that meets the system design requirements.

The damper on the fire floor is required to open to ventilate the lobby, while all dampers on other floors must remain closed to prevent smoke spreading between floors. In the absence of clear guidance in the Building Regulations, a number of approaches have been used for this application, ranging from modified fire dampers to fire doors with actuators screwed on to them.

The latest version of the SCA Guide aims to clear confusion and ensure consistency and safety in such applications by recommending that products should be multi-zone smoke control dampers CE marked to BS EN 12101 Part 8. The use of fire doors with actuators is allowed under ADB but is not a solution recognised by the SCA or which in practice will have any evidence to meet the requirements of ADB. Similarly, other ad-hoc tested products or products meeting the requirements of EN 12101-2 are not permitted as they are not tested to demonstrate that they can maintain compartmentation or integrity in a multi-compartment smoke shaft. Whilst some of these approaches may be sound in practice, the absence of conformance to a recognised product standard makes it difficult to assess the suitability of proposed solutions and is a source of potential risk.

The use of fire dampers CE marked to EN 15650 with replacement actuators is not acceptable. The fire damper test requires the damper to fail in the open position which makes them inappropriate for shaft control systems where a smoke damper is required. This should fail in the last safe condition as determined by the system cause and effect and have a smoke leakage classification.

Natural ventilators

All smoke control ventilators for single compartment use should be CE marked to BS EN 12101 part 2.

Typically used at the top of the stairwell and at the head of natural smoke shafts, these products may be used for both inlet and outlet according to the design of the system.

Where roof mounted hinged single flap ventilators are used for smoke extract a minimum opening angle of 140° is recommended. It is no longer acceptable to install an actuator onto an existing window or vent unless the combination of both window and actuator have been fully tested and a Declaration of Performance is provided by the manufacturer.

Control panels

BS EN 12101 Smoke and heat control systems: *Part 10 power supplies* is harmonised under the Construction Products Regulation. All power supplies for smoke control systems shall be CE marked to BS EN12101 part 10. This should be evidenced by the manufacturer's Declaration of Performance.

All control equipment used for smoke control systems should comply with ISO 21927-09 which is the mirror standard to EN 12101-9 which has not yet been accepted by the EC. ISO 21297-09 is not always specified as it is best practice guidance, however BS EN 12101-10 is a harmonised standard and therefore a legal requirement under the CPR. Failure to comply may result in action from Trading Standards.

Smoke extract fans with inverter control

All fans used for smoke extract shall be tested and certified to BS EN 12101-3 smoke and heat control systems - Specification for powered smoke and heat control ventilators. Designers of smoke control systems who wish to use variable speed operation should satisfy themselves that the combination of fan and inverter are compatible and will operate satisfactorily under the design conditions.

In the event of a fire then the inverter should be bypassed in fire mode and the fans run at full speed or one of the following two conditions should be met:

- 1) Fan and inverter have been tested to EN12101-3 together;
- 2) The fan is de-rated in accordance with EN12101-3 and suitable filters fitted.

Fans are tested and certified at full speed only, whether they are tested direct on line or with an inverter.

If a non-tested combination of fan and inverter are installed it is difficult to predict their performance in a fire situation. Some manufacturers offer tested fan and inverter combinations, however many have not yet carried out such tests.

Electrical wiring

To ensure correct operation of the smoke ventilation system, power and control cables must maintain their integrity during a fire incident. Cables should comply with the following categories for fire survival in accordance with BS 8519 as appropriate for different applications:

- Category 1 (PH30/F30 minute survival time) – activation and monitoring only
- Category 2 (PH60/F60 minute survival time) – Means of escape systems
- Category 3 (PH120 + Annex B/F120 minute survival time) – Firefighting systems

The minimum category for control cables for smoke control systems is Category 2 with Category 1 being limited to activation and monitoring (e.g. smoke detection) for means of escape systems.

Where the function of the system is to support firefighting activities then the system is regarded as a Category 3 system in accordance with BS 8519, and both power and control cables should have a 120 minute fire survival time.

Power distribution

For mechanical systems the primary and secondary power cables should only come together in the fire resisting enclosure or fire resisting roof area housing the fan control panel by means of an automatic transfer switch (ATS) conforming to BS EN 60947-6.

Where the availability of the safety and firefighting equipment is conditional to the occupation of the building, a bypass arrangement should be incorporated to enable the changeover device to be maintained without loss of service from the critical plant.

Non-compliant automatic transfer switches are very common and often go unnoticed in tender submissions.

Ductwork

Smoke control ductwork should comply with BS EN 12101-7:2011 Smoke and Heat Control Systems.

Any smoke control ducts should as a minimum be classified to BS EN 13501-4.

Multi-compartment smoke control ducts shall be tested to EN1366-1 and then EN1366-8. Single compartment smoke control ducts shall be tested to EN1366-9.

Unclassified ductwork is often used for external sections and whilst in reality it may be fit for purpose, there is no justification for using it in the building regulations or British Standards so there is the risk of rejection by approving authorities.

Summary

The lack of guidance relating to mechanical smoke shafts and their omission from Approved Document B of the Building Regulations increases the temptation to use noncertified product and systems in an effort to make short-term financial gains.

Compromising on smoke ventilation exposes building occupants to life threatening risk and consequentially businesses to severe financial penalties.

Smoke shafts remain key in providing the necessary protection for common escape routes in residential apartment buildings and the various elements contained in this document require careful consideration on every project, regardless of size and scale.

Specifiers, purchasers and approving authorities should encourage consistency by ensuring that products and systems comply with relevant standards, categories and classifications and that they are properly tested and certified. Further systems should be designed, installed, tested, commissioned and maintained by competent persons. A more in-depth review of standards for all system components can be found in the SCA Guidance Document on Smoke Control to Common Escape Routes in Apartment Buildings.

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