Smoke Control Systems Guide

This introductory smoke control systems guide covers the main types of systems, the standards and legislation that govern them, and the responsibilities of duty holders for installation, maintenance and compliance.

What is a smoke control system?

A smoke control system is a critical life-safety provision when installed in a UK building.

They are designed to protect the people inside buildings by maintaining escape routes, reducing smoke spread during a fire aiding safe evacuation and ensuring firefighting personnel can access the premises without suffering smoke related injuries or complications.

In many buildings, including blocks of flats and high-rise commercial premises, a smoke control system, integrated with a fire detection and alarm system to operate correctly in a fire scenario, is a legal requirement under the Building Regulations and related standards.

While a buildings height influences design, a smoke control system can be required in any building with enclosed escape routes where smoke would otherwise compromise safe egress.

Main types of smoke control and smoke ventilation systems

There two main types of smoke control and smoke ventilation systems, **natural** and **mechanical**.

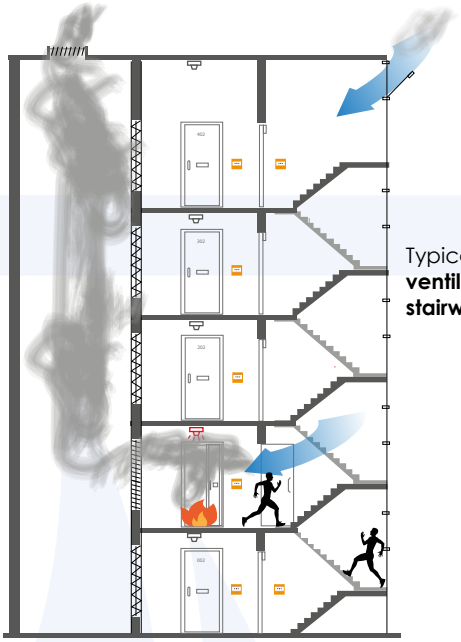
Natural Smoke Ventilation Systems:

These systems rely on the natural buoyancy of hot smoke rising to exhaust it through strategic openings such as shaft doors, roof vents, windows or AOV louvres. uildings up to around 30m in height.

AOVs (Automatic Opening Vent):
AOV's are a commonly used type of natural smoke control system allowing smoke to rise and escape via a shaft door, window and or roof vents which are activated to open by either a smoke or heat detector (which is triggered by hot smoke's innate buoyancy), or a manual smoke vent call point.

Smoke Shafts:
Smoke shafts are vertical ducts designed to serve multiple floors within a building, typically found in blocks of flats. Corridor vents connect to the shaft, allowing smoke to discharge safely to atmosphere at roof level. Smoke shafts are commonly used where extended corridors exceed the limits for simple natural ventilation and are frequently required under Approved Document B.

...Natural Smoke Ventilation Systems



Typical example of **natural smoke ventilation shaft** and **top of stairwell AOV**

Mechanical Smoke Ventilation Systems:

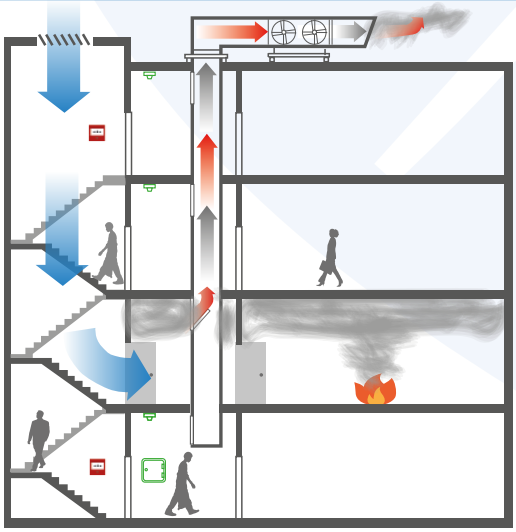
These systems are used where natural ventilation is impractical, for example in many high-rise developments, taller, larger buildings and or those with more complex layouts.

Mechanical ventilation:

Mechanical ventilation systems use fans and controls to extract smoke from a building

Pressurisation systems:

Pressurisation systems maintain higher air pressure in protected escape routes such as stairwells so that smoke is kept out. This is often a mechanical approach used in taller or larger complex buildings.



Typical example of **mechanical ventilation**

Typical example of a **pressurisation system** with staircase and firefighters' lift shaft protection, and air release in the façade(s) (Source: BS EN 1201-13 2022)

UK Smoke Control System requirements

Smoke control systems can form part of an overall fire strategy and must be integrated with the fire alarm and other life-safety systems. While the premises Fire Risk Assessment under the Regulatory Reform (Fire Safety) Order does not automatically mandate smoke control, it often identifies where smoke control is a proportionate life-safety measure, especially in multi-storey residential and high-risk buildings.

Residential Buildings:

Under Approved Document B, residential buildings over approximately 11 m (typically four storeys) normally require smoke control in common escape routes such as stairwells and corridors. This can be achieved with AOVs or equivalent smoke shafts providing the minimum free area required under Approved Document B (often 1.0m² in residential corridors, subject to design).

Guidance (such as BS 9991:2024) also influences how and where smoke control systems should be designed and can set specific performance criteria for tall residential blocks.

In many purpose-built blocks of flats designed around a stay-put strategy, smoke control systems are essential to maintaining tenable conditions in common corridors while individual flats remain compartmented.

In single-stair residential buildings, smoke control to corridors and stairwell cores is particularly critical, as the protected stairwell may be the sole means of escape for occupants above ground level.

High-Rise and Complex Buildings:

Buildings above certain height thresholds (e.g. over 30 m) generally need more engineered smoke control solutions, including mechanical smoke ventilation or pressurisation systems, especially when natural smoke ventilation alone cannot achieve the required performance.

Commercial and Other Buildings:

Smoke control systems may be required for commercial buildings with enclosed escape routes, atria or longer corridors to ensure smoke does not compromise evacuation. AOVs, mechanical systems or other designs can satisfy regulatory requirements, provided they meet the performance criteria of ADB and relevant British Standards.

Smoke Control Standards and Guidance in the UK

Smoke control systems must be designed by competent professionals, coordinated with fire strategy and fire detection systems, and installed in accordance with Approved Document B and relevant British Standards. Components must be certified and selected based on documented performance criteria.

Approved Document B – Building Regulations

Approved Document B sets out the performance requirements for fire safety in buildings, including smoke control to protected escape routes. It guides where and how smoke control measures should be applied in residential and other buildings.

BS EN 12101 Series

BS EN 12101 is a suite of standards (adopted in the UK) that governs the performance, testing and certification of smoke control system components such as vents, fans, dampers and control panels. Compliance with these standards (and UKCA marking) is expected for any life-safety smoke control product.

BS 9991:2024 Fire safety in the design, use and management of residential buildings. Code of practice

BS 9991 provides best-practice guidance for smoke control and evacuation in residential buildings, and recent editions include updated provisions on when natural and mechanical smoke ventilation systems are required based on building height and travel distances.

BS 9999:2017 Fire safety in the design, use and management of buildings. Code of practice

BS 9999 supplements ADB and BS 9991 for non-residential, complex or bespoke buildings, offering additional guidance on smoke control design, inspection and testing requirements.

BS 7346-8:2013 Components for smoke control systems - Code of Practice for planning, design, installation, commissioning and maintenance

BS 7346-8 outlines the planning, design, installation, commissioning and maintenance of smoke control (including ventilation) systems.

Replacement AOV Case Study

View our project case study where we replaced a rooftop louvre vent, installed louvre windows and serviced AOV domes.

View Case Study

Compliance

Smoke control systems are a vital aspect of fire safety and must be correctly specified, designed, installed, commissioned and maintained by competent professionals to ensure the system delivers when required.

A compliant smoke control and ventilation system can reduce the risk of a fire developing and limit smoke damage to a building and greatly reduces the chances of building occupants choking or being overwhelmed by smoke. It reduces the risk of smoke inhalation around escape routes such as corridors and staircases and makes it easier for emergency services to access a building.

Specification: A correctly specified smoke control system is a core part of a buildings fire strategy design and therefore specification typically rests with a fire safety specialist (competent person), such as fire engineers, fire risk assessors by way of the premises Fire Risk Assessment or Enforcing Authorities.

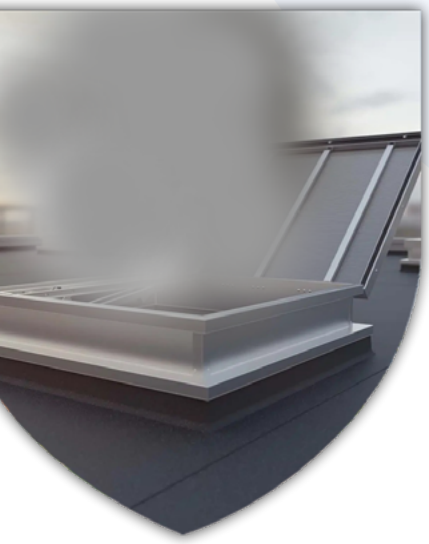
Design: The design of a smoke control system, depending on the specification, typically rests with specialist system manufacturers and installers depending on the type and complexity of the system required.

Installation: The installation of a smoke control system may take place over several phases of a buildings construction; therefore, all those involved should be competent persons / companies with a specialist system installer overseeing the installation.

Commissioning: New systems should be commissioned and tested to prove correct operation, with all cause and effects clearly documented showing how components operate in response to a fire.

Maintenance: Regular inspection and testing of AOVs, control panels, actuators, fans and associated equipment is essential to ensure smoke control systems are reliable when needed. Refer to the premises fire risk assessment and or a specialist service and maintenance provider as to the frequency of regular inspections.

BS7346:8 Mandates a minimum of **two service visits per year** by qualified engineers, including special inspections* during the changeover of maintenance providers.



Record keeping: Detailed records of all maintenance regimes, including daily or weekly tests, quarterly visual inspections and six-monthly / annual servicing and maintenance by competent engineers.

**BS7346:8 Components for Smoke Control Systems: Code of Practice for design installation, commissioning and maintenance recommends that special inspections of smoke vent systems are completed when a new contractor takes over maintenance. This will also be required as part of a building safety case for submission to the Building Safety Regulator under the Building Safety Act.*

The frequent lack of sufficient documentation available on site can make it difficult to ascertain the original design intent for systems, particularly fire engineered solutions that do not follow the approved guidance. In such cases an assessment must be made using fire engineering to arrive at appropriate performance criteria that can be tested to on site. Unless clear performance requirements are available then any regular testing and maintenance will be inadequate and inconclusive.

Failure to maintain smoke control systems may result in enforcement action by an Enforcing Authority such as the Fire and Rescue Authority.

Smoke control and ventilation systems with RES Fire & Security

At RES Fire & Security, our experienced service engineers can regularly inspect and test as well as service and maintain smoke control and ventilation systems six-monthly / annually to the requirements of both the system and premises. For premises with fire detection and alarm systems with complex ventilation systems our engineers work with specialist system manufacturers/maintenance providers.

We can also design, install and commission smoke control and ventilation systems based on the specification provided for your premises, working with specialist system manufacturers to ensure installations comply with current legislation and UK Building Regulations. Our experienced and highly trained installers ensure that your smoke control and ventilation system is installed correctly, thoroughly tested and handed over on time.

RES Fire & Security offer smoke control and ventilation systems services covering the South of England including London, Berkshire, Bracknell, Windsor, Middlesex & Surrey, Oxfordshire, Hampshire, Buckinghamshire, Hertfordshire, Essex & Kent, West & East Sussex, Reading, Maidenhead, Slough, Newbury and the surrounding areas.

Case Study: Smoke control and ventilation routine service and repair

View our project case study where we carried out a routine service on the aov system and subsequently carried out a repair.

View Case Study

Our Smoke Control & Ventilation System Services

- ✔ Servicing and maintenance
- ✔ Regular checks, tests
- ✔ Repair and/or upgrading of existing systems
- ✔ Design and installation

Protecting People and Property Since 1985

Further reference information:

Guide to assessing high rise residential smoke control systems
Link

Guidance on Smoke Control to Common Escape Routes in Apartment Buildings (Flats and Maisonettes) https://members.labc.co.uk/sites/default/files/SCA_Guide_Common_Escape_Routes_in_Apartments_Revision_3_1_July_2020.pdf

https://www.smokecontrol.org.uk/resources

SERTUS design and manufacture smoke ventilation solutions in the UK, with a clear focus on compliance, reliability and making delivery and support simple for customers https://sertus.uk/our-advantage

Key Smoke Control Terms

If you are a building's Responsible Person, and especially a Property Manager or Facilities Manager, understanding key smoke control terms is essential due to complex regulations, technical components, and industry-specific jargon.

A

Actuator: The motorised mechanism that automatically opens or closes a damper upon receiving an electrical signal from the control panel. Actuators are the essential operating component of Automatic Opening Vents (AOV's).

Annual Fire Damper Test: A mandatory inspection and drop test required by BS 9999 to verify that every fire damper closes fully and latches. This is a core component of your legal PPM schedule.

Automatic Fire Detection (AFD): Is the means by which any fire detection and alarm / smoke control system raises the alarm without human intervention by way of a smoke and or heat detector.

Automatic Opening Vent (AOV): Is an automated smoke control system, typically featuring vents, doors, windows, or rooflights with actuators, that opens automatically upon detecting smoke or heat during a fire.

B

Battery Back-up: a system that provides temporary power to electronics when the main power source fails. Often called an Uninterruptable Power Supply (UPS), it instantly switches to battery power to prevent system shutdown.

BS EN 1366-2: The European standard specifying the fire resistance testing requirements for fire dampers, including those operated by a fusible link. This standard validates that the damper can maintain integrity and insulation during a fire when activated by heat.

BS EN 1366-10: The European standard specifies the fire resistance testing requirements for smoke control dampers, including Motorised Fire Smoke Dampers (MSFDs). This standard is critical because it assesses the damper's ability to maintain its integrity and, where required, its insulation when exposed to fire, while also ensuring it can open and close before and after the fire test. It confirms the damper remains operational.

BS EN 12101: The European standard for smoke and heat control systems. It covers the requirements and testing methods for components like smoke vents, powered smoke exhausts, and natural smoke and heat exhaust ventilators.

Blade: The internal component of a damper that opens to allow airflow and closes to block it. Blades can be held open by a fusible link (in fire dampers) or operated by an actuator (in smoke dampers).

C

Commissioning: The rigorous process of testing and adjusting a newly installed smoke control system to ensure all components work together correctly according to the original design intent. Proper commissioning is legally required to validate the system.

Combination Fire Smoke Damper (CFSD): A damper designed to close automatically upon the detection of either heat (like a fire damper) or smoke (like a smoke damper), fulfilling both functions in a single unit.

Competent Person: Under the RRFSO 2005 (Article 18), a "competent person" is someone with sufficient training, experience, knowledge, and other qualities to assist the Responsible Person in undertaking preventative and protective fire safety measures. They must understand relevant legislation, fire development, and risks to properly manage fire safety.

D

Damper: A device installed within a duct or opening to regulate or stop airflow. In life safety, the key types are Fire Dampers and Smoke Dampers.

Drop Test: The physical, mechanical test is performed on a fire damper to ensure it closes and latches correctly. This is the primary test method for fusible-link-operated fire dampers.

Disclosure and Barring Service (DBS): A DBS check is a background check in England and Wales used for safer recruitment, verifying a person's criminal record to assess suitability for roles. Managed by the Disclosure and Barring Service, it searches police records for convictions, cautions, and, if applicable, barring list information.

F

Fire Damper: A device installed in ducts and air transfer openings within fire-resisting walls and floors. It is designed to close automatically upon the detection of heat (via a fusible link) to prevent the passage of fire, maintaining the integrity of the fire compartment.

Fireman's Override Switch: a secure, key-operated control allowing firefighters to take manual control of building systems, typically HVAC fans, smoke extraction dampers, or smoke vents during an emergency.

Fire Risk Assessment (FRA): An FRA is legally required for almost all non-domestic premises, including workplaces and the common parts of multi-occupied residential building. It is a systematic evaluation of a workplace or building to identify potential fire hazards, determine who is at risk, and implement measures to prevent fire and ensure safe escape.

Fusible Link: A heat-sensitive device that melts at a specific temperature (e.g., 72°C), causing a mechanical fire damper to close. It is the activation mechanism for non-electric fire dampers.

Free Area: The percentage of a damper's cross-sectional area that is open for airflow when in the open position. A critical factor in system design to ensure adequate ventilation.

Functional Operational Test: The test method for smoke dampers and MSFDs. It involves sending a signal from the control panel to verify the damper's actuator receives the command and the damper closes (and opens, if required) fully.

L

Louvre Systems: Louvre smoke control systems are automated ventilation units designed to exhaust smoke and heat from buildings during a fire, improving safety and visibility. These systems feature motorised, hinged louvre blades that open up to 90 degrees to allow for high-capacity smoke release and natural ventilation, commonly installed in facades, stairwells, or roofs.

M

Maintenance (PPM – Planned Preventive Maintenance): A scheduled programme of routine inspection, testing, and servicing. For smoke control systems, a PPM schedule is a legal requirement under BS 9999 to ensure ongoing compliance and operational readiness.

Mechanical Fan: a powered machine designed to create continuous flow of air, using rotating blades to move high volumes of air at low pressure.

Motorised Fire Smoke Damper (MSFD): An electronically operated damper that opens or closes via an actuator upon a signal from the smoke control system's panel. MSFDs are used in complex, addressable systems for precise zone control.

P

Pressure Sensor: a safety device that measures the air pressure difference between a protected area (like a stairwell) and a fire zone. It ensures the pressure is high enough to keep smoke out (pressurization) but not so high that doors cannot be opened for evacuation.

Pressurisation System: A smoke control pressurisation system protects escape routes (stairwells, lobbies) by using fans to inject air, creating higher pressure that prevents smoke infiltration. Designed to BS EN 12101-6 standards, it maintains clear air for occupants and firefighters, commonly used in high-rise buildings and hotels. Key components include supply fans, overpressure relief, and air release.

R

Remedial Work: Repairs or replacements identified as necessary during regular inspections and testing or service and maintenance visits. This can include replacing faulty detection, control panels, fire dampers, installing access hatches, or repairing actuators to return a system to a fully compliant state.

Regulatory Reform (Fire Safety) Order 2005 (RRFSO): The primary piece of fire safety legislation in England and Wales. It places the legal duty on the "Responsible Person" (typically the building owner and or Facilities / Property Manager) to ensure fire safety, which includes the maintenance of smoke control systems.

S

Smoke Control Association (SCA): Leads 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. https://www.smokecontrol.org.uk

Smoke Control System: A system comprising components like doors, windows, vents, shafts, dampers, fans, and controls designed to manage the movement of smoke during a fire, protecting escape routes and aiding firefighter access.

Smoke Damper: A device installed within HVAC ductwork designed to close automatically upon the detection of smoke. It is used to control the movement of smoke within a building and is typically activated by a signal from a smoke detector or the building's fire detection and alarm system panel.

Smoke Vent Call Point: often referred to as an Automatic Opening Vent (AOV) Manual Call Point or Manual Override Switch, is a safety device used to manually trigger a building's smoke ventilation system.

Smoke Vent Key Switch: a secure, authorized-access switch used to manually open, close, or test AOV systems in buildings. It acts as an override or test mechanism, allowing authorized personnel (firefighters or maintenance) to operate rooftop or high-level vents during emergencies or routine maintenance, separate from everyday comfort ventilation buttons.

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