technical specification
smoke venting systems
An Introduction to FDS

FDS sets the standards the rest of the industry follows

Providing a complete service for all of your smoke ventilation system needs. FDS offers the full package, whether that be scoping, design, specification, supply, installation, commissioning, project management or even service and maintenance.

Our aim is to give you a smoke ventilation solution that is reliable, effective and compliant. One that fits the building in question so well, it not only exceeds all building regulations but provides an effective and unobtrusive solution. Your needs and your requirements are our first priority.

We have decades of fire engineering experience to draw upon, and our proven track record in the industry illustrates how deep our technical insight into smoke ventilation systems runs.

That insight runs through everything FDS does. We have a holistic understanding of projects, from fire safety design to installation. We also factor in considerations such as value engineering and efficient use of internal space. We do all of this whilst adhering to both industry guidelines and the strict legal requirements for smoke venting.

One of the biggest changes in the way people live in the UK over the last quarter of a century has been the rise of city dwelling. It is in these newer city buildings where FDS smoke ventilation systems are most valuable, whether those are residential, commercial or even above and below ground car parks.

Our technical expertise, client focus and design flexibility means we can offer a fire safety system which is appropriate to the situation. The adaptability inherent in FDS designs allows customers to, for example, maximise saleable or rentable space in commercial buildings, adhere to specific regulations in residential accommodation and ensure a building’s all-round profitability.

Our innovation means that both main and M&E contractors, M&E consultants, developers, architects, fire safety engineers and building owners all benefit from advanced design technology that saves lives and safeguards property.

The Regulatory Background

The specification of smoke venting systems is subject to a number of important legislative requirements.

Approved Document B (Fire Safety)

This is the primary piece of Building Regulations legislation, that sets out national guidance standards for fire safety in new buildings of every kind. Its focus is to ensure escape routes for smoke venting (i.e. the staircase in most cases) are kept free of smoke and toxins, so that occupants can evacuate the building and aid firefighters in their operations.

BS9991, BS9999 and BS9999: 2008 – Code of Practice for Fire Safety in the Design, Management and Use of Buildings

These two documents have been designed specifically to allow for a more detailed design of a fire strategy than ADB. BS9999 focuses on residential accommodations (excluding hotels) and takes into account recent industry developments, such as water mist systems and mechanical ventilation systems. In contrast, BS9999 looks at the building from a risk-based approach, where the end approach is specific to the building in question.

Smoke Control Association (SCA) – Guidance on Smoke Control to Common Escape Routes in Apartment Buildings (Flats and Maisonettes)

Going further than ADB, BS9991 and BS9999, the SCA document provides guidance on the design of smoke control systems in apartment buildings. It sets out the information and parameters that designers should incorporate into designs when using calculations and/or CFD models and provides recommendations to designers on the information to be provided to the approving authority.
They come in many forms and vastly differ in sophistication and complexity, but the benefits of a well designed smoke ventilation system remain the same.

Approved Document B (ADB) demands all fire-fighting shafts and common areas in buildings are ventilated, both to remove smoke, toxins and heat and maintain acceptable conditions for means of escape and fire-fighting. In buildings less than 18m in height, the systems protect staircases from smoke ingress and for buildings above this height (even though they must be provided with fire fighting shafts), ADB does not call for any further systems.

Commercial buildings differ, as code compliant buildings less than 18m in height may not need to be provided with any smoke ventilation. However, above this height smoke venting should be provided, in order to protect the fire fighting shaft. The most suitable type of smoke venting system is governed by a variety of factors – building height, travel distances in common corridors, window size etc. In multi-storey buildings there are typically three main types of systems that can be used: natural, mechanical and pressurisation.

They can:
- Protect escape route (i.e. corridor and staircase) for means of escape and/or fire fighting
- Protect fire fighting shaft (commercial buildings only)

When fire breaks out, natural venting systems create airways using natural air flow dynamics to remove harmful smoke. This can be done by opening windows or vents, with an automatic opening vent (AOV) or, when there is no external wall, a vertical smoke shaft.

The main types of Smoke Ventilation Systems provided by FDS are: Natural, Mechanical, Pressurisation and Car Park systems.

Natural Systems (Page 6)
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Mechanical Systems (Page 7)
A mechanical smoke ventilation system (MSVS) is an alternative method, which can be applied in the event of an inadequate natural smoke venting system or when a building layout is not code compliant. When used, an MSVS should demonstrate equivalent or better conditions than the natural smoke venting system.

Pressurisation Systems (Page 8)
A further alternative to an MSVS is a pressurisation system. This could be implemented to protect the staircase and fire fighting shaft for means of escape and to assist fire fighting depending on the building type and height.

Car Park Systems (Page 9)
Car parks are required to be provided with adequate ventilation to dilute or exhaust the vehicle pollutants in general operations (to satisfy Approved Document F (ADF)) and smoke clearance in case of fire (to satisfy Approved Document B (ADB)). This can be achieved using natural or mechanical ventilation systems, depending on the car park requirements and layout.
Natural Smoke Ventilation Systems

In the event of a fire, using natural smoke ventilation systems with an open airway and natural flow dynamics will help remove smoke, which is arguably the biggest threat to life.

This can be attained by opening windows or vents, an automatic opening vent (AOV) or, where there is no external wall, a vertical smoke shaft. Fire Design Solutions provide a complete turnkey package for natural smoke ventilation systems. Our systems provide a reliable and cost-effective method of meeting the requirements of Approved Document B.

Natural Ventilation Systems and Smoke Shafts

Natural smoke venting systems for residential developments consist of either Automatic Opening Vents (AOVs) mounted close to ceiling level on external walls, or vertical natural smoke shafts.

For perimeter AOVs, Approved Document B states an outward opening bottom or side hinge must be used. When the window is fully opened by actuators, it must achieve a free area of at least 1.5m² through which smoke fumes can escape.

The vertical smoke shafts must also achieve at least 1.5m² in cross section, with openings from the lobby/corridor and at the top of the shaft with a minimum free area of 1.0m². The opening at roof level must be at least 0.5m above any surrounding structures within 2.0m and extend at least 2.5m above the ceiling of the highest storey served by the shaft.

Our natural smoke venting systems for commercial premises operate in exactly the same manner, except obey the regulations BS9999-2008 that the shaft area must be at least 3m² and openings at each floor and the shaft head must be at least 1.5m² in free area.

Mechanical Smoke Ventilation Systems (MSVS)

A mechanical smoke ventilation system (MSVS) is an alternative method to the natural smoke venting system discussed in Approved Document B, BS 9991 and BS 9999.

Our systems comprise a mechanical extract shaft that serves the common corridor and/or lobby. Replacement air is generally provided from the stairs by means of a pressure-controlled door closer. This depressurizes the stairs, allowing a large quantity of fresh air to be pulled through the lobby meaning smoke cannot flow into the stairs.

On detection of smoke within a lobby, only the fire damper to the shaft on the fire floor will open (all other dampers are locked shut) and the vent at the head of the staircase opens. The fan at the top of the stairs extracts the smoke and prevents migration of smoke into the adjacent compartments.
Pressure Differential Systems

Pressure differential systems can be achieved by two methods: Pressurisation and Depressurisation. The former maintains a positive pressure within the protective space, whereas the latter removes hot gases from the fire zone at a lower pressure than adjacent protected space.

In all cases, the aim of the system is to establish a pressure differential across any leakage paths, ensuring smoke will move away from the protected space. This is achieved by maintaining the protected space at a pressure higher than that of the fire accommodation.

Air intake is provided by drawing air in from outside the building in such a way that it is not contaminated by smoke from within the building, via fans and ductwork. An important design consideration is to allow for air release. In order to ensure air flowing from pressurised to unpressurised spaces it must leak externally so the pressure differential can be maintained between the two spaces.

Pressurisation Systems vs. Smoke Extraction Systems

Based on the high level of compartmentation, if a fire size is expected to be like one in a block of flats (such as in a hotel bedroom or student accommodation), a smoke extraction system is the most suitable solution. However, in commercial accommodations, such as an office or retail, a pressurisation system such as those described above would be most applicable. This is due to the potential fire size as a result of the open layouts.

Mechanical ventilation for environmental purposes only

Where car parks have openings equal to 2.5% of the floor area, with at least half of those openings evenly distributed on opposing walls, this satisfies the requirements of Approved Document B (i.e. smoke clearance) but requires to be provided with mechanical ventilation to satisfy Approved Document F (i.e. environmental ventilation).

In most enclosed or basement car parks, natural ventilation will not be suitable and a mechanical ventilation system will be required. This mechanical smoke extraction system should include a minimum of two extract fans, each providing 50% of the extraction at ten air changes per hour. Impulse/induction fans are positioned to direct air towards the main extract fans.

An independent power supply should be provided to operate in the event of a mains supply failure. Extract, impulse and induction fans should be rated at 300° for 1 hour.

Mechanical ventilation systems require a carbon monoxide detection system to operate the fans as necessary to achieve the air change rate for day to day ventilation. In the event of a fire, a smoke detection system is required to bring the system into operation to achieve the appropriate smoke clearance air change rate.

Enhanced Smoke Clearance

When a residential staircase also serves the car park it should be provided with adequate compartmentation and should be accessed at car park level via a ventilated lobby. To omit the 0.4m² lobby vents, the car park should be sufficiently depressurised with increased extraction preventing the ingress of smoke into the lobby and staircase.

Car Park Systems

Car park systems are required to exhaust pollutants produced by vehicles and, in the event of fire, clear smoke to assist the fire service. Depending on the type of car park, there are a variety of ventilation systems that can be utilised.

Pressurisation Systems

Based on the high level of compartmentation, if a fire size is expected to be like one in a block of flats (such as in a hotel bedroom or student accommodation), a smoke extraction system is the most suitable solution. However, in commercial accommodations, such as an office or retail, a pressurisation system such as those described above would be most applicable. This is due to the potential fire size as a result of the open layouts.
Design and Technical Support

The Complete Fire Engineering Service

Design services

We provide an end-to-end service to deliver the ideal smoke venting system design and installation for your project. Our aim isn’t just to satisfy the requirements of legislation and the building regulations, but to add value by developing a system that maximises space within the building while maintaining the very highest standards of safety.

Consultancy

We employ a team of highly qualified and hugely experienced fire engineering consultants. These experts work together to provide architects and developers with truly creative solutions that integrate perfectly with the wider building design and make a real difference to the overall cost of a smoke ventilation project.

Installation

Fire Design Solutions has an experienced and professional team of project managers and engineers to install our systems. Our client-focused approach ensures the smooth and efficient delivery of our projects on schedule and to budget, affording you complete peace of mind.

Commissioning

Our fully qualified and considerably trained engineers will test and commission the installed systems prior to client handover. We will also undertake any required demonstrations to various approving authorities to ensure they are satisfied and the system meets the design requirements.

Computational Fluid Dynamics (CFD) Modelling

An integral part of the FDS service offering

Computational Fluid Dynamics is a design tool that aids with the detailed design of mechanical smoke venting systems. The software allows the designer to model complex airflows, fire patterns and smoke behaviour within the building, and to visually inspect and analyse the airflow patterns, ensuring the best possible system is designed.

Once the system has been installed the results of CFD modelling can be authenticated. This will then reassure all approving authorities that each component has been fully installed and operating correctly. CFD analysis is required when applying a fire engineered solution that is not code compliant or an ADB prescribed solution. FDS presents the CFD results in a report suitable for submission to Building Control and as part of our service, will take the design through the approvals process.

Service & Maintenance

Fire Design Solutions provides planned maintenance and emergency call out service support. Our maintenance service is not only comprehensive, but cost-effective too, ensuring optimum product performance. In the event of equipment failure, our response and repair service is fast and efficient.

Fire Design Solutions also offers preventative maintenance support that will extend the life of a system, reduce the likelihood of equipment failure and ensure all legislative obligations are met. We can offer full maintenance service on fire safety systems regardless of manufacturer or installer, including:

• Smoke control systems, including mechanical and natural smoke venting systems
• Car park ventilation systems
• Fire alarm systems
• Corridor environmental systems
• 24 hour emergency call out
• Fully trained engineers
• Technical support
• Spares support
• Service log books and specific site file histories
• 6 monthly scheduled preventative maintenance visits

Our experienced engineers provide a quick and efficient maintenance call out and repair service to building owners and operators. This gives you total peace of mind that your smoke control system will protect life and property in the event of a fire.
standards that are far from standard