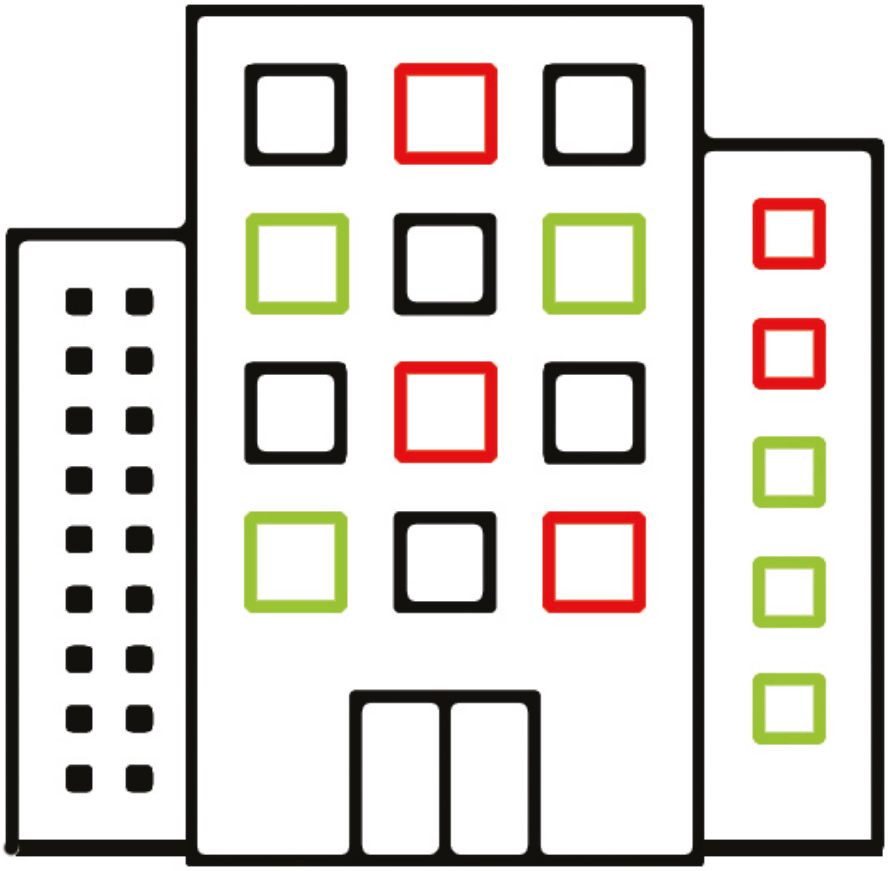
Smoke Control Solutions for Higher Risk Residential Buildings

A PRACTICAL GUIDE TO BUILDING REGULATION COMPLIANCE



About this Guide

Introduction

Welcome to this brief guide to smoke control for residential developments. The first part of this document contains an introduction to smoke control, the regulations that surround it, and the most common system types. Following this, the guide is offers a flowchart representation of the system selection process that can be used to define the appropriate approach to a project or sense-check an existing proposal. Finally, the document presents several options for a standardised modular approach to the products required to implement a solution.

The purpose of this guide

This guide is aimed at mechanical and electrical contractors, fire engineers and design professionals engaged in designing and implementing multi-storey residential developments that require smoke control provision. This document will assist in defining an appropriate approach to use for a project and offer guidance on suitable products to meet the requirements. Further project-specific advice is available from the **Group SCS Specialist Contracting team** or from the **Approved Installer Network**.

The purpose of smoke control

Smoke control is provided in residential buildings for two main reasons:

01

To ensure the stairways remain relatively free from smoke and heat in the event of a fire within a dwelling and to enable occupants of the building to escape safely.

In tall buildings (with a floor over 18m high) smoke control is used to assist firefighters in gaining access to fight the fire from inside the building. In commercial buildings there is a requirement for a dedicated firefighting lobby, however for residential buildings the access lobby between the apartment and stair serves this purpose and a fire fighting lobby is not needed.

02

A secondary purpose of the system may be to provide background ventilation to evacuate heat from common lobbies and stairwells.

These objectives are achieved by some form of smoke control within the common lobby connecting the apartments to the stairs to ventilate any smoke escaping from the apartment on fire and so protect the stairs.

Rules and regulations

The Building Regulations (or equivalent outside England and Wales) must be complied with, specifically **Approved Document B**, which relates to fire safety. The other standards of relevance are the European EN12101 series relating to products for smoke and heat ventilation systems, and BS 9991:2015 Fire safety in the design, management and use of residential buildings.

Code-compliant and fire-engineered solutions

Where the building complies with the recommendation of ADB, implementing a smoke control solution is very straightforward and the requirements are well-detailed within the regulations. No special approval is required as long as one of the prescribed solutions is installed.

Where the building design falls outside of the direct requirements of ADB, and in residential buildings this will usually relate to the distance escaping occupants must travel to a place of safety (escape travel distance), then the smoke control system will usually be a fire engineered solution. This is because providing a higher level of smoke control is normally used as a justification for the longer escape travel distance.

CODE-COMPLIANT

The prescriptive smoke control measures contained within the current edition of ADB include automatic opening ventilators (AOV), natural smoke shafts (BRE shafts), and pressurisation systems.

FIRE-ENGINEERED

Fire-engineered smoke control measures are usually some form of mechanical extract system, or mechanical smoke shaft. These are designed using computational fluid dynamic modelling to prove their performance against an envisaged set of parameters such as the size of fire in an apartment. The performance is often compared to the prescriptive smoke control provision to demonstrate the superiority of the proposal over the code compliant system. The use of a fire-engineered solution will be subject to approval by the building control authority and a submission must be made to the building control officer or authority having jurisdiction and this should be done before the implementation phase. There are standardised mechanical smoke shaft systems that have Local Authority Building Control type approval which means that they are automatically accepted for use in England and Wales and these do not require individual approval.

The main smoke control system types

Stairwell ventilators

A stairwell ventilator is an automatic opening ventilator providing a minimum of 1.0m² of free area, calculated as described in table D7 of ADB. It is located at the highest point in a stairwell and can take a number of forms, commonly louvred, hatch type, window and roof window.

Primary purpose:

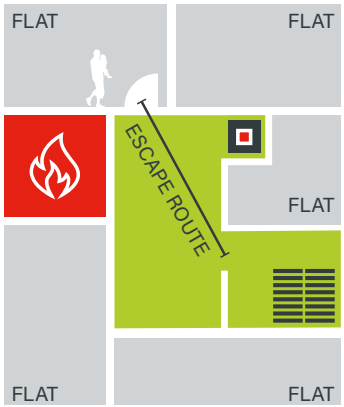
The stairwell ventilator usually serves one of two purposes: evacuating any smoke getting into the stairwell in small buildings, or more commonly providing replacement air for a lobby smoke extract system in larger buildings. In this case, there will be some means of evacuating smoke from a lobby or corridor which could be an automatic opening ventilator (AOV), or a natural or mechanical smoke shaft system and the stairwell ventilator provides fresh air to replace the smoke being extracted. For details of product specifications see the **Guide to Stairwell Ventilators**.

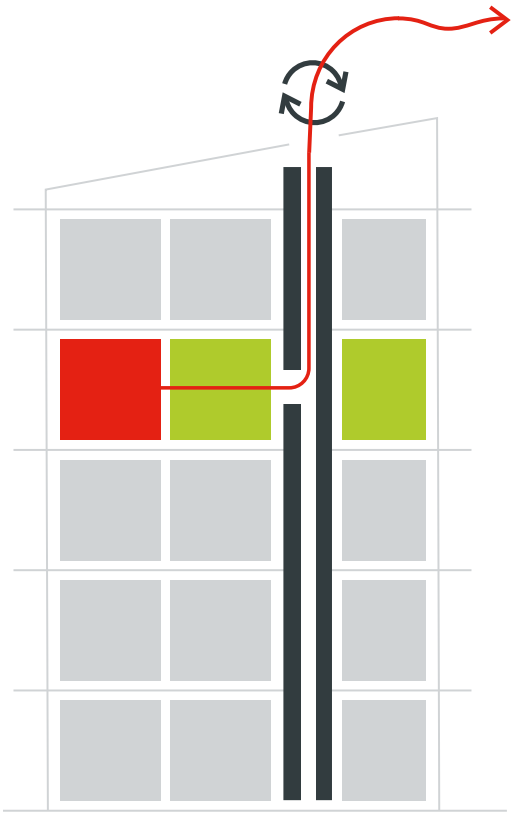
Automatic Opening Ventilators (AOV)

Smoke ventilators can be used to ventilate lobbies directly to the atmosphere. These may be a proprietary ventilator or a combination of an actuator and a window or roof light. They should provide a minimum free area of 1.5m². In single staircase buildings, the ventilator should open automatically on detection of smoke in the lobby. In multiple staircase buildings the ventilator can be operated manually. In both cases, opening the AOV should also cause the stairwell ventilator to open. For further details, see the **Guide to AOV Kits**.

BRE Shafts

Natural smoke shafts, commonly known as BRE shafts, are described within ADB (Volume 1, p32, paragraphs 3.50 – 3.53) and should comprise a vertical shaft with a minimum free area of 1.5m², with a ventilator into the shaft at each lobby and at the head of the stair providing a minimum free area 1.0m². The ventilator into the shaft should be opened automatically on detection of smoke in the lobby. Equipment specifications and standards are available in the **AOV Kits brochure**.



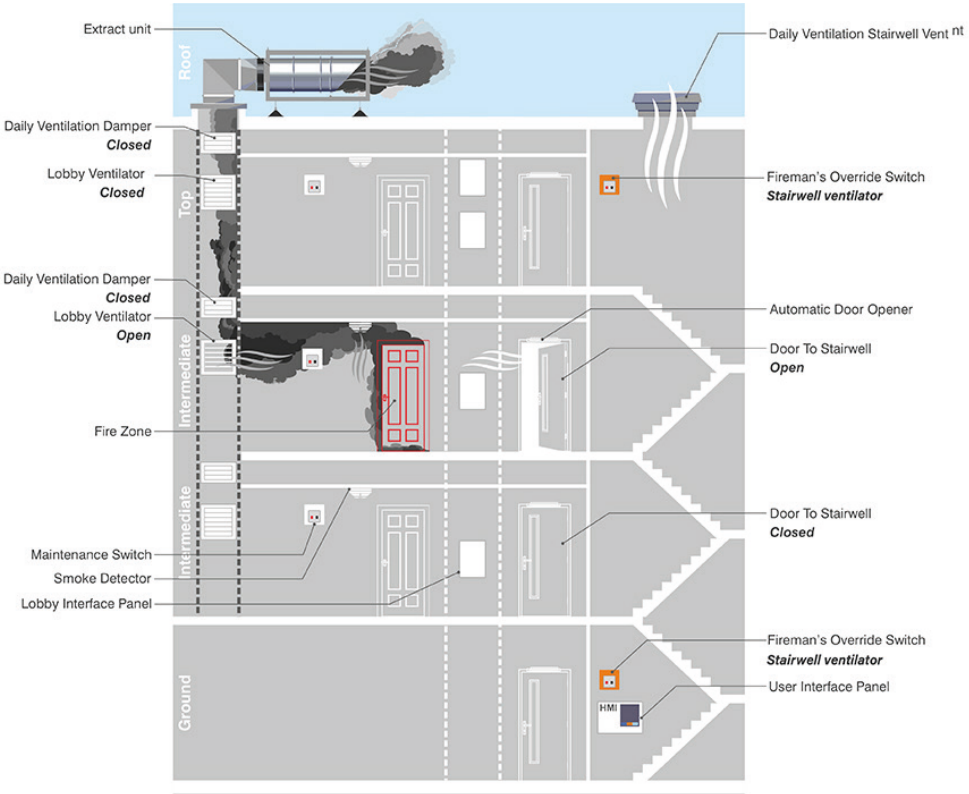


Mechanical extract systems

Mechanical shafts are similar to BRE shafts but the addition of extract fans to mechanically extract smoke from the lobbies means that a smaller shaft and ventilators can be employed. Shaft area typically reduces from 1.5m^2 to 0.6m^2 meaning that more space is freed for other use within the building. Extract fans are usually mounted on the roof.

The automatic opening ventilator above the stairwell is used to provide replacement air for the smoke shaft. There is a risk of lobby de-pressurisation when using mechanical extract in confined spaces like residential buildings, which could make it difficult to open exit doors from the lobby. Common methods to overcome this are mechanically opening the stair door, pressure sensing fan control, or reverse-hanging the stair/lobby door.

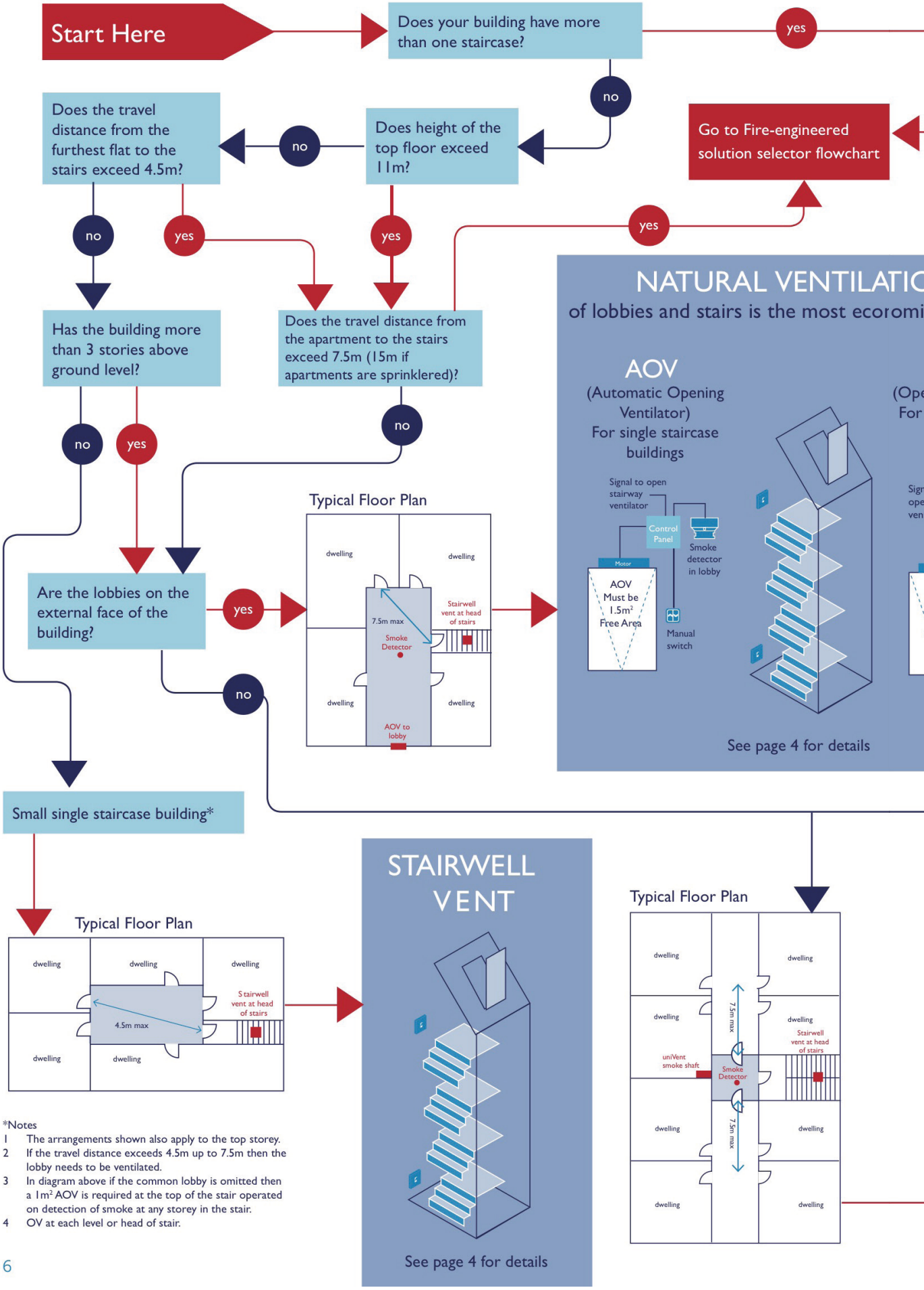
To ensure effective smoke clearance, the extract shaft should be located as far away as practicable from the stairwell, which is the source of replacement air. This is particularly important in buildings with extended travel distance where the exhaust position would ideally be at least 5m away from the stairwell vent to prevent smoke being drawn into the building. See the Group SCS **Guide to Smoke Shafts** for more detailed information.



Pressurisation Systems

Pressurisation systems protect the lobbies and staircases against the ingress of smoke by raising the pressure in these areas relative to the fire zone. In residential buildings, they would commonly comprise run-and-standby fans to pressurize the stair and an air release path from the lobby usually via a rising duct, similar to a BRE shaft. The design procedure and equipment specifications are detailed within BS EN12101-6. Pressurisation systems offer the highest standard of protection, however their use has declined with the rise in use of CFD modelling to design mechanical smoke shafts as these are generally simpler to install and commission.

Building Regulation compliant solutions



*Notes

1 The arrangements shown also apply to the top storey.
2 If the travel distance exceeds 4.5m up to 7.5m then the lobby needs to be ventilated.
3 In diagram above if the common lobby is omitted then a 1m² AOV is required at the top of the stair operated on detection of smoke at any storey in the stair.
4 OV at each level or head of stair.

Does the travel distance from the apartment to the stairs/protected area exceed 30m?

no

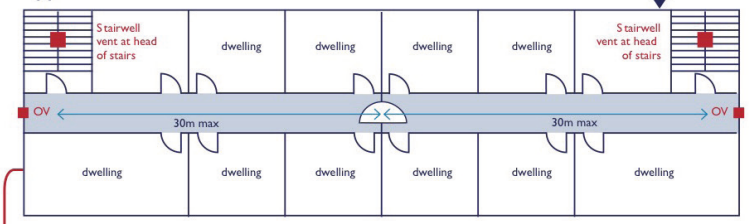
Are there any deadends from the apartment to the stairwell?

yes

no

yes

Typical Floor Plan

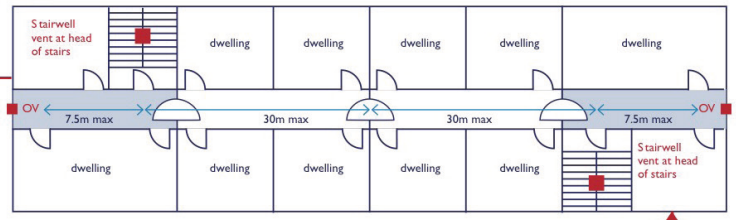


Does the travel distance from the furthest flat in the the deadend corridor exceed 7.5m (15m if sprinklered?)

yes

no

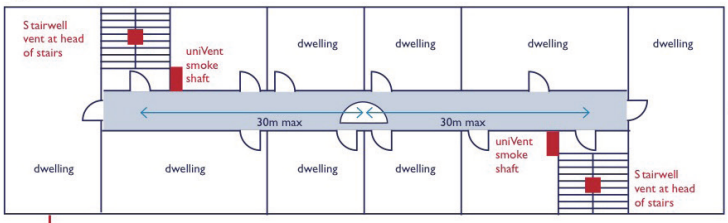
Typical Floor Plan



Are the lobbies on the external face of the building?

yes

Typical Floor Plan



no

ON
cal solution

OV
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multi staircase
buildings

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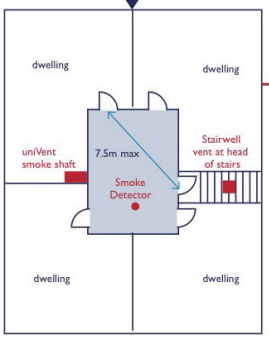
tilator

Control Panel

Motor

OV
Must be
1.5m²
Free Area

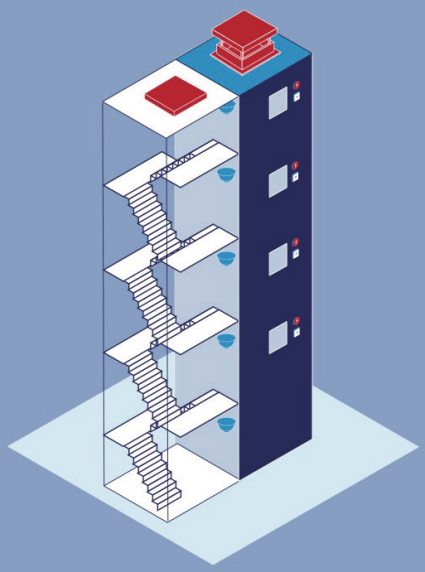
Manual switch



Typical Floor Plan

UNIVENT SMOKE SHAFT

is most likely solution



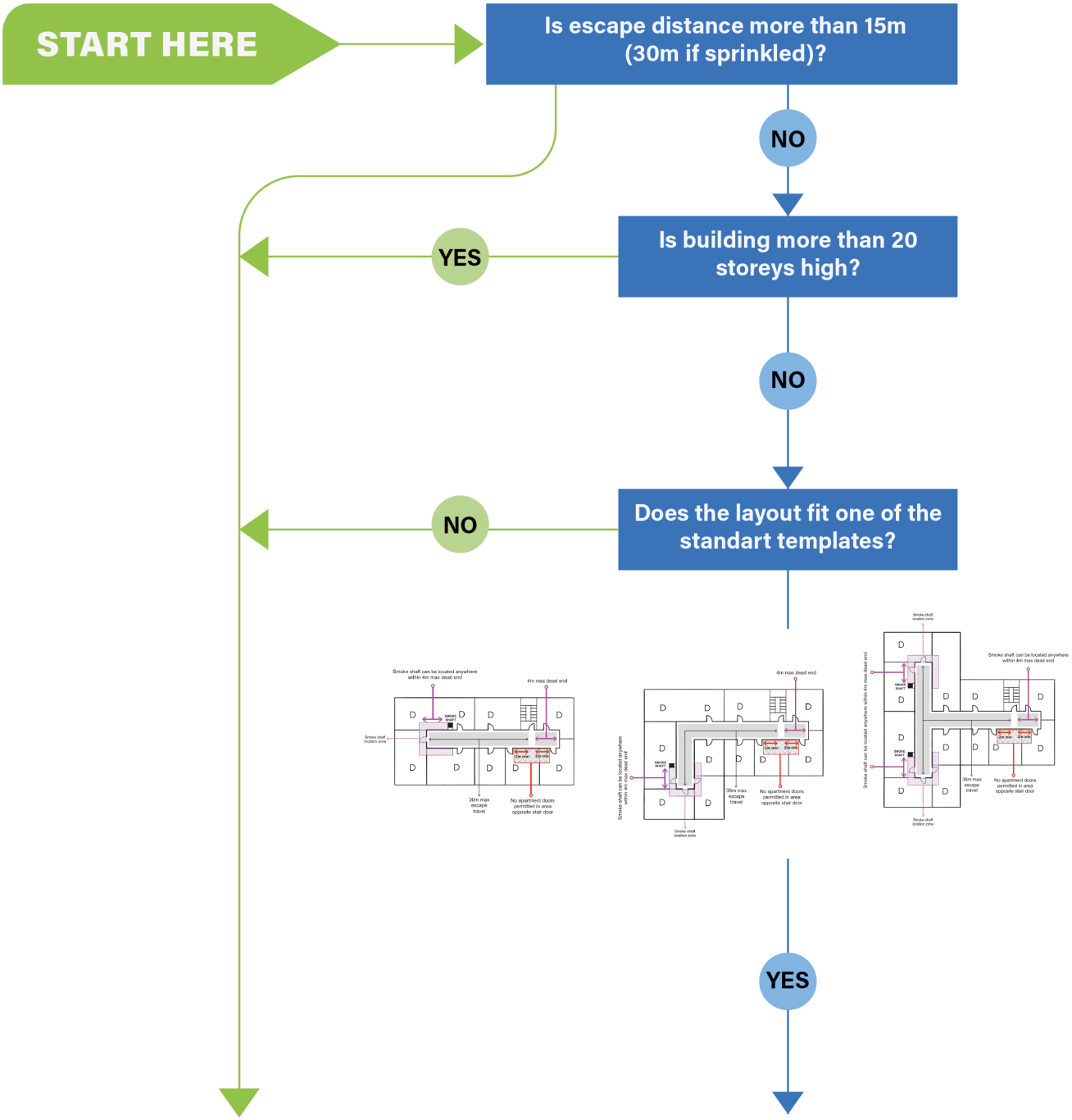
Stairwell Vent
Go to page 4

Natural Ventilation AOV
Go to page 4

Mechanical Extract Systems
Go to page 5

AOV Kits
Go to pages 9-11

Fire-engineered solution selector



BESPOKE DESIGN

Consider employing a specialist to design and model a bespoke solution.

UNIFORCE

Mechanical Smoke Shaft

The Modular Range

Principles and benefits of the standardised approach

Our standardised approach to smoke control is designed to explicitly address the recommendations of the **Hackitt Review** and ensure that all parts of the supply chain can discharge their obligations. By creating a golden thread of information about each HRRB specifiers can benefit from a range of resources created by smoke control professionals, including:

Peer-reviewed design for standard layouts

Control documents in place for each stage of implementation

System information available on day one

UniForce

Mechanical Smoke Ventilation System

View on website

What the system does

UniForce is a fire-engineered smoke control solution designed to extract smoke from the lobbies while fresh air is drawn in from the staircase to maintain suitable conditions both for means of escape and firefighting.

System specification

The system operates automatically upon detection of smoke from either a standalone smoke detector or the building fire alarm system, with manual overrides for firefighting and maintenance use.

Benefits

- Packaged pre-tested modular system for easy installation and commissioning
- Easily selected from a selector tool
- All documentation available online
- Optional CFD modelling available

Suitable for:

Buildings up to 20 storeys high

Max escape travel distance 30m per floor

Optional daily ventilation available

UniVent

Natural Smoke Shaft (BRE Shaft)

View on website

What the system does

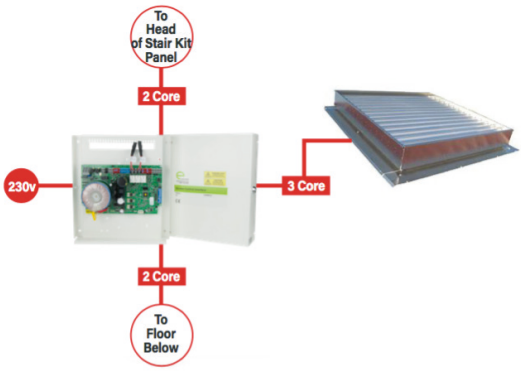
A modular Natural Smoke Shaft System used to protect common escape routes in buildings.

System specification

UniVent was designed using the fundamentals of lean construction so that it requires no bespoke design or on-site programming and is automatically configured to operate to the design control philosophy.

Benefits

- Packaged pre-tested modular system for easy installation and commissioning
- Product information and documentation available online
- Optional CFD modelling available



Main features:

Requires no bespoke design or on-site programming

Can be used on almost all higher risk residential buildings

Works straight out of the box

AOV Kits

Automatic Opening Vent Kits

Shop Online

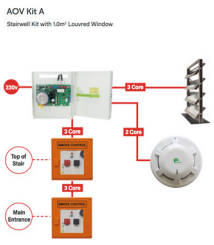
What the system does

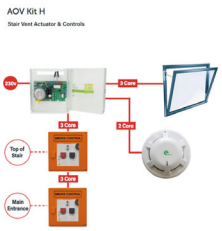
Automatic Opening Vents (AOVs) are used in many applications, including ventilation and smoke clearance in buildings. Our range of kits contains all components for common applications and is available to purchase online.

When the system is suitable

The kits are suitable for most common applications, such as stairwell ventilation and lobby protection.

Available to order online





Benefits:

Datasheets for all components available online

Select and order all AOV kits from our online shop

All products are CE-marked

UniJet

Car Park Ventilation System

View on website

What the system does

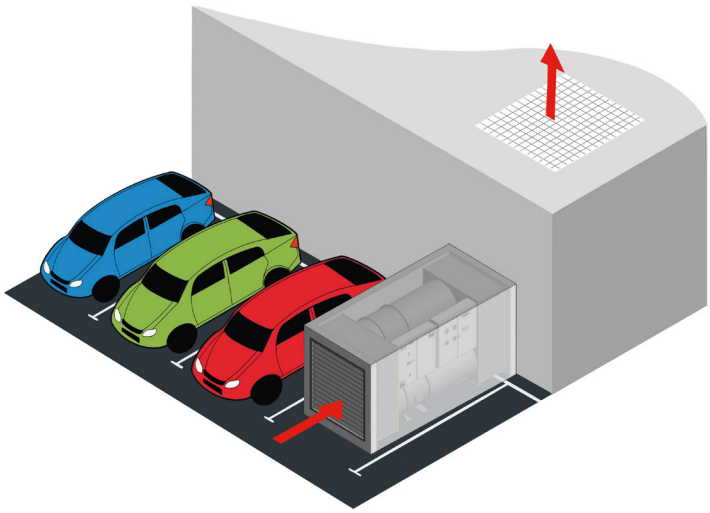
UniJet is a packaged car park ventilation system designed to provide smoke clearance and pollution ventilation to covered car parks to comply with current building regulations.

System specification

The UniJet car park ventilation system delivers combined pollution and smoke clearance using jet fans to provide an energy efficient and safe solution whilst requiring the least possible plant space.

Benefits

- Packaged main extract plant room
- Tested prior to location on-site
- All system documents available online
- Optional CFD models available
- Modular control system incorporating CO sensing



Main Features:

Delivers combined pollution and smoke clearance using jet fans

Fully automatic controls monitor CO levels and smoke or temperature conditions

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