

BASEMENT SMOKE VENTILATION

EXPLAINED

Basements present unique fire safety challenges compared to upper storeys as smoke cannot escape naturally through openings. Fire service access and intervention is also inherently more difficult as access to the fire compartment is against the direction smoke and heat travel (which is upwards). Fire safety guidance therefore treats basements as higher-risk areas requiring more stringent smoke control provisions.

Purpose of basement smoke ventilation

The primary purpose for smoke ventilation in basements is not for means of escape but rather to aid firefighting operations. Once the fire has developed, the basement level can act like a pressure chamber as there are typically no natural release paths to external air given it is underground. This build-up of smoke and compartment pressure can present very challenging conditions for the fire service as it will be released through the path of least resistance, i.e. the stair when the fire service opens the door to access the basement.

The primary purpose of smoke ventilation in basements is therefore to alleviate this smoke and pressure build-up, making fire service interventions safer. It can also be used for post-firefighting smoke clearance.

Sufficient heat and pressure build-up will create relief paths (e.g. through window breakage)



No natural relief paths for heat and smoke

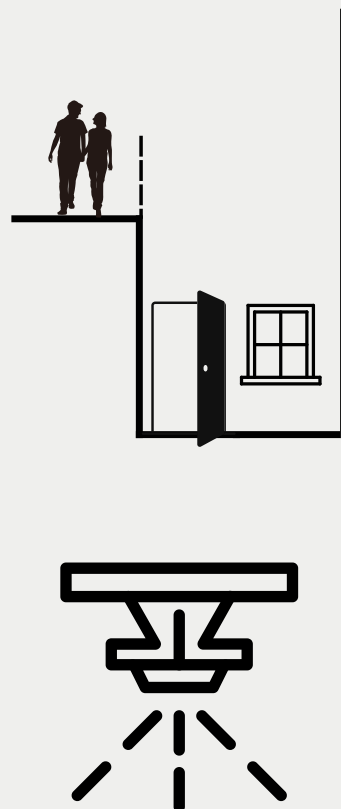
Types of smoke ventilation

Standard fire safety guidance recommends that qualifying basement storeys have either:

- Natural smoke ventilation - via permanent vents or break-out panels at high level, giving a minimum free area (typically 2.5% of floor area), discharging to open air away from escape routes. This can be in the form of panels that will need to be manually opened / broken by the fire service; or
- Mechanical smoke ventilation - where natural venting is impractical, the alternative is a mechanical system providing a specified number of air changes per hour (commonly 10 ACH) with fire-rated ductwork and standby power. Note: a mechanical smoke ventilation system is reliant on sprinkler protection being provided in order to cool the hot smoke sufficiently for the mechanical system to remain operational.

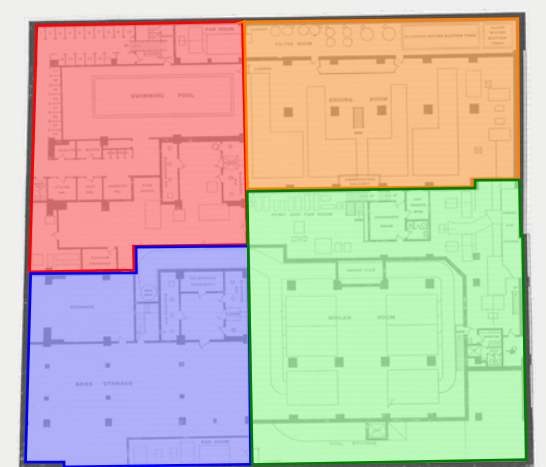
Key fire engineering considerations

Basements with openings to external: it is relatively common that a basement level has openings (e.g. doors or windows) to external air via lightwells or due to a sloping site. In these cases, designated smoke ventilation may not be required, depending on the basement layout.

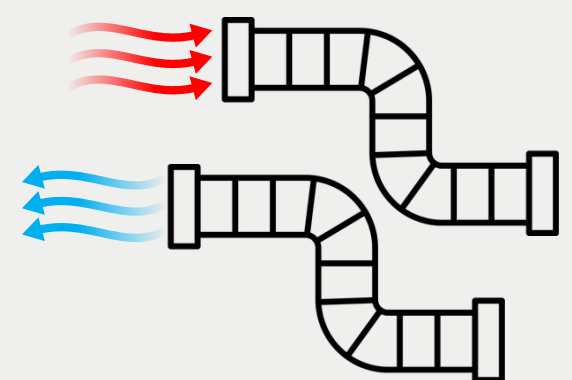


Ventilation strategy selection: natural ventilation relies on buoyancy-driven flow whereas mechanical smoke ventilation actively extracts the smoke. Selection of smoke ventilation strategy should be considered holistically along with the wider fire strategy and other fire safety systems such as fire suppression.

Smoke zones: it is common to divide larger basements into different zones and separate these zones via fire resisting construction. The system and fan selection can thereby be designed based on 10 ACH for the largest smoke zone / compartment rather than the entire basement level, making fan sizes more manageable.



Make-up air: mechanical smoke ventilation systems require adequate make-up air to function effectively. Without this, extract rates risk falling short of the design intent. Note: make-up air ducts generally also require fire resistance to ensure the operation of the system as a whole.



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