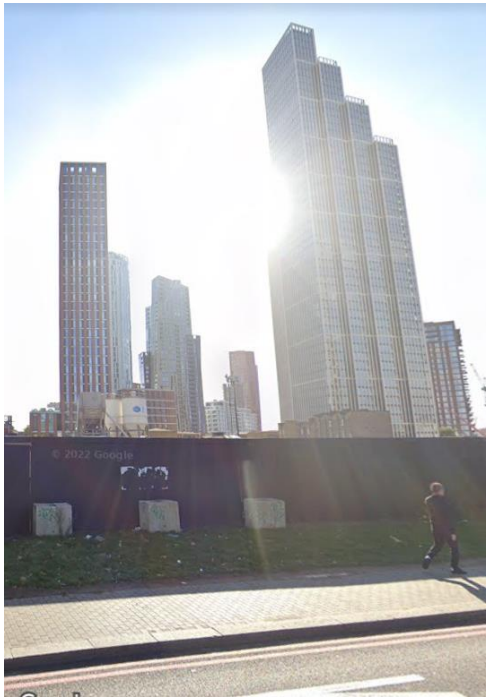
Colt International Ltd

BS 9991 Update


BS 9991 – Fire Safety in the Design Management and use of Residential Buildings – Code of Practice

Introduction




CONSIDERATIONS AND CHALLENGES

Legislation and Guidance Updates

Building Safety Act

- Sprinklers for buildings over 10m
- Single stair residential buildings up to 18m only

London Plan

- Evacuation lifts

ADB Changes

- If an evac lift (and lobby is provided, then it should be afforded the same protection as the stair.

BS 9991 Update

Grenfell Phase 2 Report
SCA Maintenance Guide
SCA AOV Guide
SCA Controls Guide

BS 9991 Update

Timeline:

- November 2020 – Initial drafting commences
- August 2021 – Draft for Public Comment published
- October 2021 – DPC closes,
  - 1866 comments
  - 50 comment resolution meetings + editorial and sub-working groups
- November 2024 – New version BS 9991: 2024 published

Second stairwell requirement to be imposed in blocks taller than 18 metres, Gove says

BS 9991 Update

Information about this document

This is a full revision of the document, and introduces the following principal changes:

- expansion of scope to cover care homes;
- restriction of scope to specific reaction-to-fire classifications for load-bearing elements of structure;
- clarification of the maximum building height covered by the scope;
- revision of recommendations for single-stair buildings, including the introduction of an 18 m height limit;
- revision of height limits for installation of sprinklers;
- changes to variations permitted by sprinklers;
- removal of national classifications for combustibility;
- introduction of European classifications for fire resistance of fire doors;

New dedicated section on care homes

50m, although there are still some recommendations regarding buildings that are taller

In line with statement from Michael Gove

Water mist is no longer considered an alternative to sprinklers

Goodbye BS 476

BS 9991 Update

- updating of recommendations relating to lifts, including expanded recommendations for evacuation lifts;
- updating of recommendations relating to smoke control, including changing the related annex (previously Annex A, now Annex F) from an informative to a normative annex;
- updating of recommendations relating to power supplies, external wall systems, kitchens, balconies and escape from basements;
- updating of recommendations relating to ancillary areas; and
- general update to take into account new and revised standards published since 2015.

Product certification. Designers and specifiers are advised to consider the desirability of using products, fittings and accessories that are supported by recognized UKAS-accredited third-party assessment.

Better evacuation strategies for people requiring level access – evacuation lifts and protected waiting spaces

Refence to single supply buildings removed

BS 9991 Update

7 Means of Escape from Flats & Maisonettes

Up to 11m:	Single stair permitted 4.5m TD, AOV to head of stair or every landing, as before
11m to 18m:	Single stair permitted 7.5m TD, 15m with sprinklers and smoke ventilation AOV to head of stair Smoke vent to corridor: AOV, Natural Shaft, MSVS or PDS
Over 18m:	Single stair not permitted 15m TD with sprinklers and smoke ventilation AOV to head of stair Smoke vent to corridor: Natural Shaft, MSVS or PDS
Over 30m	as above except Natural Shafts not permitted – only MSVS or PDS
Basements	Greater than 10m deep - PDS

Travel distances – 15m is measured apartment door to stair door not to lobby door

Aerodynamic free area (Aa) now required for all natural vent requirements = 0.7, 0.9 or 1.0m^2

The is an essential characteristic for all Natural Smoke and Heat Exhaust Ventilators and should be declared on a Declaration of Performance

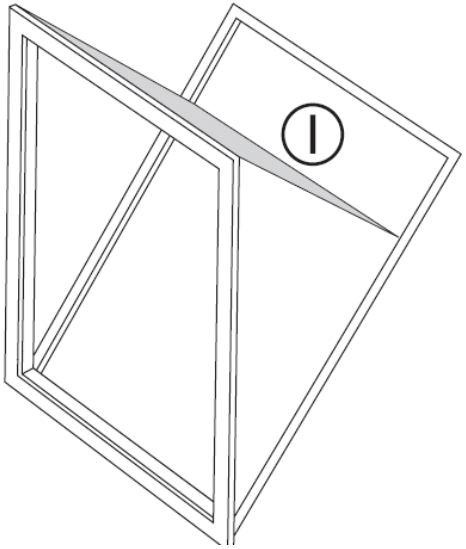
Natural AOVs – Automatic Opening Vents

Lobbies / corridors should be ventilated by an AOV with a free area of at least 1.5m^2

AS PER CURRENT VERSION OF ADB:

1.5m^2 can only be achieved via open area at 90^0 to direction of airflow, ie area ①.

Total Area = ① only = 1.5m^2



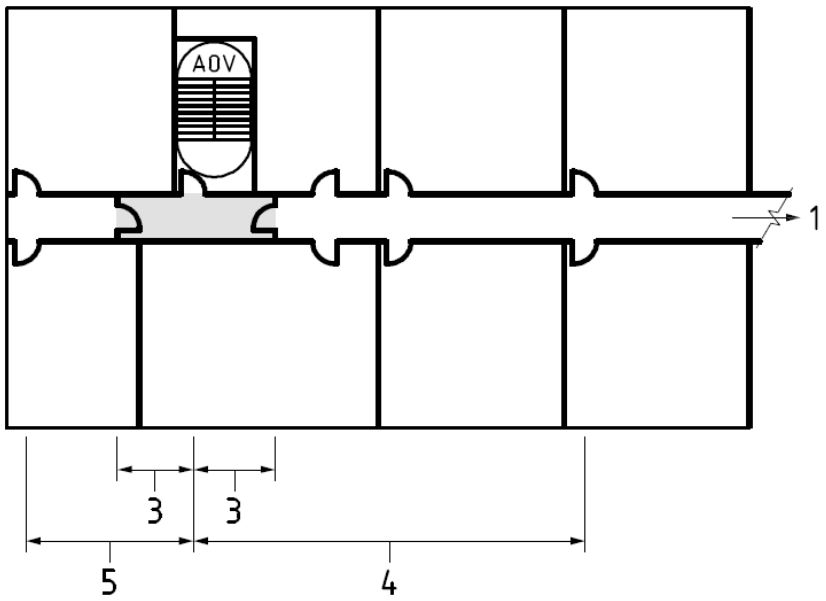
To achieve 1.5m^2, a 1.5m wide vent will need to open over 1m – fall risk?
Remotely operated vents – finger trapping?
Site fitting of motors to windows - quality?

Natural AOVs – Automatic Opening Vents

Under the CPR, Smoke ventilators should be CE or UKCA marked to EN 12101-2, ensuring:

- Compatibility of components
- Reliability
- Robustness
- Resilience to heat
- Opening under wind

Section 7 - Means of Escape from Flats & Maisonettes



l) Access to stairs from corridors with single direction of travel from end of corridor

Key

1	Route to alternative exit
2	Max. travel distance 30 m [max. 45 m if sprinklers are fitted (see Clause **17**)]
3	Max.travel distance 7.5 m
4	Max. travel distance 30 m [max. 45 m if sprinklers are fitted (see Clause **17**) and the corridor is provided with a smoke control system]
5	Max. travel distance 7.5 m [max. 15 m if sprinklers are fitted (see Clause **17**) and the corridor is provided with a smoke control system]
6	Max. travel distance 7.5 m [max. 15 m if sprinklers are fitted (see Clause **17**)]
7	No maximum or minimum distance limit
AOV	AOV at head of stair with an aerodynamic free area (Aa) of not less than 0.7 m^2
	Self-closing E 30 S_{a4} or FD 30S fire door
	Self-closing E 30 S_{a4} or FD 30S fire door (can be swung in either direction)
	Area requiring a smoke control system
	Area requiring a smoke control pressurization system

NOTE 1 The figures show the principles for protection and limits and are not the only acceptable configuration.

NOTE 2 The central fire door may be omitted where the maximum travel distance does not exceed 15 m.

NOTE 3 The openable vents to the stairway may be replaced by a single AOV at the head of the stair, with an aerodynamic free area (Aa) of 0.7 m^2 operated from a remote switch located at the final exit from the stair.

NOTE 4 The arrangements shown also apply to the top storey and storeys below ground level.

NOTE 5 The extension of travel distances where sprinklers are fitted is not applicable in specialized housing or care homes.

Evacuation Lifts

7.4 Provision, design and operation of lifts used for evacuation

NOTE 1 This subclause makes extensive reference to BS EN 81-76. At the time of publication of this edition of BS 9991, the final draft FprEN 81-76 is being prepared after addressing comments to prEN 81-76 made at its public consultation. When BS EN 81-76 is published, it is expected that users of BS 9991 will adopt its requirements for evacuation lifts.

NOTE 2 BS 8899 provides guidance for the improvement and maintenance of firefighting and evacuation provisions in existing lifts.

7.4.1 General

Buildings that are provided with passenger lift access to an upper or lower level should also be provided with a means of using lifts for escape.

Any lift provided for means of escape should be designed and programmed to function as an evacuation lift in accordance with **7.4.2** (see also **7.4.5**).

At least one evacuation lift should be provided for each escape stairway, or more if required by capacity assessment (see Note 2). Where escape stairways are provided in more than one location, there should be at least one evacuation lift per escape stairway in each location, or more if required by capacity assessment.

NOTE 1 It is not acceptable to provide two lifts in a single location to meet the provision of one lift per stair where the stairs are provided in separate locations.

NOTE 2 When published, BS EN 81-76[11] is expected to include guidance on the context of and parameters needed for capacity assessment.

For buildings with a storey at 50 m or more above ground level and designed with a stay put strategy, every lift should be designed as a firefighters lift programmed to function as an evacuation lift, until the lift is recalled using the firefighters lift switch (see also **7.4.5**).

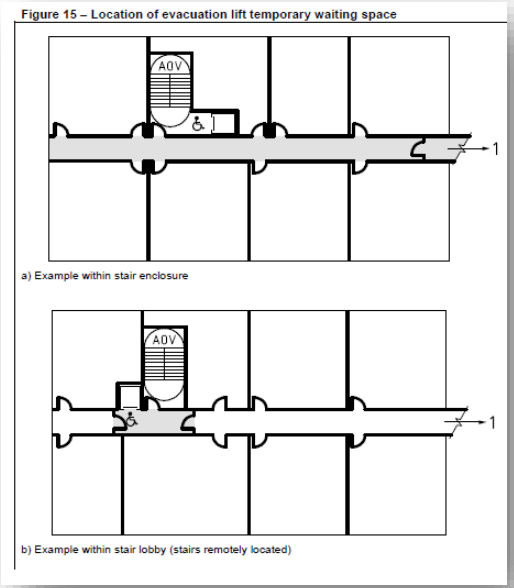
Section 7 Means of Escape from Flats & Maisonettes

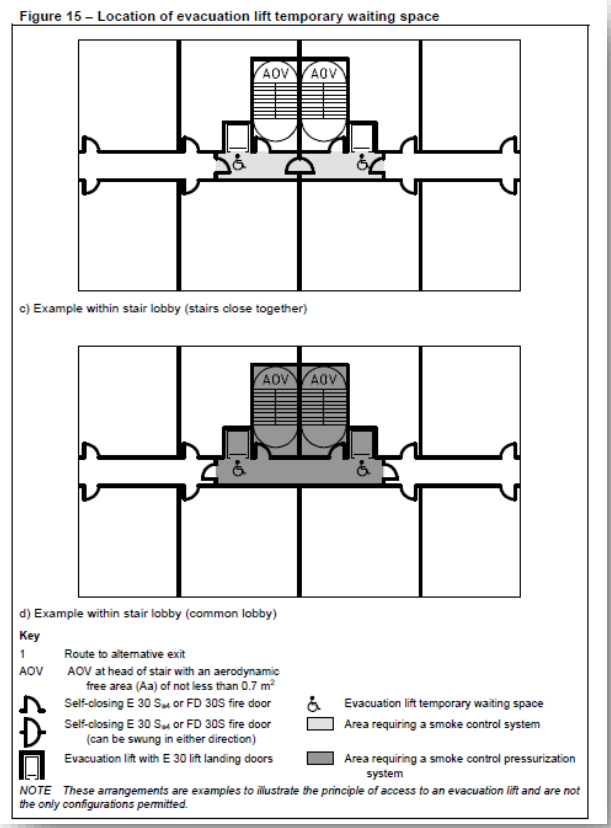
Evacuation Lift lobbies – offered same protection as the stair

Under 11m – no additional requirements

Over 11m – needs to be protected from smoke ingress

If both lifts are in same lobby, then PDS is required





Section 20 - Smoke Control

Smoke control should be provided in accordance with the relevant subclause as summarized in Table 3.

All of the smoke control systems should be designed to operate independently and should not adversely affect each other's performance. All heating, ventilation and air conditioning (HVAC) systems that might be alongside a smoke control system should be shut down when the smoke control system is running. If the HVAC system is integrated with the smoke control system, the HVAC system should be designed as a smoke control system and use the associated components.

The smoke control system should be located such that it is maintainable from the common parts of the building.

Where the vents discharge into a smoke shaft, the vents on the fire floor, at the top of the smoke shaft and on the stairway should all be configured to open simultaneously upon automatic activation of the system in the common corridor or lobby. The vents from the corridors or lobbies on all other storeys should be configured to remain closed.

Any components selected to realize the smoke control design should be in accordance with Annex G, **G.5**.

For mechanical smoke ventilation systems (MSVS), a computational fluid dynamics (CFD) analysis should be undertaken to demonstrate that the system achieves the desired performance. For example, it should be verified that the proposed smoke ventilation system protects the stair enclosure from smoke ingress, both during the means of escape phase and when the stair door is held open during firefighting operations.

i.e. no more comparing mechanical against a natural solution

Section 20 - Smoke Control

NOTE 1 When undertaking CFD analysis, and whilst the principal objective is to protect the stair from the ingress of smoke and maintain it smoke-free, it might be considered acceptable by the designer for a very small amount of smoke to be shown to enter the stair enclosure temporarily (e.g. when a door opens and closes), if it is demonstrated that the smoke is subsequently quickly removed by the smoke ventilation system. However, this is considered to fall within the bounds of uncertainty when undertaking CFD simulation.

NOTE 2 A CFD analysis is based upon building-specific geometries and, ideally, includes a sensitivity analysis. Guidance on CFD analysis is available from the Smoke Control Association [21].

NOTE 3 Use in the CFD analysis of tenability-based acceptance criteria within the stair enclosure in terms of visibility and toxicity is not considered to be good practice.

Unless a simultaneous evacuation arrangement is deemed appropriate, there should be no sounders attached to the smoke detectors within common parts.

NOTE 4 The purpose of smoke detectors is to operate the smoke control system, not to raise an alarm.

All connections between the smoke detection, vent control panels and actuator mechanisms should be within an environment that provides protection from expected fire conditions.

Where any part of the control mechanism is powered by electricity, a secondary supply should be provided in accordance with BS 8519 and BS EN 12101-10.

Table 3 – Summary of smoke control provisions

Location	Limitations	Description	Free area of vent (m^2)		Vent control	Subclause
			Minimum free area[A)]	Aerodynamic free area[B)]		
Single staircase above ground, for buildings with no storey at 11 m or more above ground level						
Stair	Single direction travel distance limited to 4.5 m from furthest apartment to stair door (see Figure 9)	Manual window/openable vent on each landing; or	1.0 m^2	0.7 m^2	Manual[C)]	**7.2.4**, **20.2.1** and Annex G
		Openable vent on each landing operated from manual call point on each landing; or	N/A	0.7 m^2	Remote[D)]	
		Openable vent at head of the stairs operated by manual call point at final exit from stair	N/A	0.7 m^2	Remote[D)]	
	Apartment opens directly into stair (see Figure 9)	AOV at head of stair operated on detection of smoke within stair enclosure and manual call point at final exit from stair	N/A	0.7 m^2	Automatic[E)]	
	Single direction travel distance from furthest apartment to stair door is over 4.5 m	Ventilate lobby in same manner as a building between 11 m and 18 m above ground level	Treat as building over 11 m	Treat as building over 11 m	Automatic[E)]	**20.2.2**
Staircase above ground, for buildings with a storey at 11 m or more above ground level						
Stair	Above ground	AOV at head of stair operated on detection of smoke within stair enclosure and manual call point at final exit from stair	N/A	0.7 m^2	Automatic[E)]/ Remote[D)]	**7.2.3**, **20.2.2** and Annex G

Section 20 - Smoke Control

Table 3 – Summary of smoke control provisions

Location	Limitations	Description	Free area of vent (m^2)		Vent control	Subclause
			Minimum free area[A)]	Aerodynamic free area[B)]		
Lobby and/or corridor (that connects to an escape or firefighting stairway)	• Above ground • On an external wall • Suitable only for buildings with a floor level up to 18 m above ground level	AOV in each corridor operated on detection of smoke in corridor, only the AOV on the fire floor to open, along with the AOV at the top of the stair	N/A	0.9 m^2	Automatic[E)]	**20.2.2.2**a)
	Suitable only for buildings with a floor level up to 30 m above ground level	Natural shaft with a smoke control damper[C)] in each corridor operated on detection of smoke in corridor, only the damper on the fire floor to open, along with the AOV at the top of the stair and top of the smoke shaft	1.0 m^2	N/A	Automatic[E)]	**20.2.2.2**b)
	Suitable for all building heights	Mechanical shaft system with performance-based design	As per design	As per design	Automatic[E)]	**20.2.2.3**
	Suitable for all building heights	Pressure differential system in accordance with BS EN 12101-13 for residential stair and lobby/corridor	As per design	As per design	Automatic[E)]	**20.2.2.3**a)

Table 3 – Summary of smoke control provisions

Location	Limitations	Description	Free area of vent (m^2)		Vent control	Subclause
			Minimum free area[A]	Aerodynamic free area[B]		
Basements						
Stair	Lowest floor <10 m below ground level	Final exit door or AOV[F]	1.0 m^2	0.7 m^2	Automatic[E]/ Remote[D]	**20.3**
Lobby	Lowest floor <10 m below ground level	Manual window/openable vent to each lobby direct to open air; or	1.0 m^2	N/A	Manual[C]	
		At each basement level open to a common shaft	1.0 m^2	N/A	Automatic[E]	
Stair/lobby	Lowest floor >10 m below ground level	Pressure differential system in accordance with BS EN 12101-13 for firefighting stairway and lobby/corridor	As per design	As per design	Automatic[E]	
Evacuation lift lobbies						
Evacuation lift lobbies	Where provided	Smoke control system should offer equivalent level of protection to the evacuation lift lobby as to the stair and should not extract from the lift lobby itself	As per design	As per design	Automatic[E]	**7.4.4**

A) Measured in accordance with Figure 32.
B) Aerodynamic area of AOV as defined in BS EN 12101-2.
C) Manually opening vents should be in accordance with **20.2.1.2**a)1).
D) Remotely opening vents should be in accordance with **20.2.1.2**a)2).
E) Systems operating automatically should be in accordance with **20.2.2.1**.
F) The door to the final exit may serve as a vent or a separate AOV can be provided.

Section 21 – Power Supplies

Where dual power supplies are recommended by the relevant British Standard for life safety and firefighting systems, the primary power source should be taken from the public electricity supply.

The secondary source should come from one of the following (see Note 1):

a) a life safety generator; or

b) an independent high voltage supply fed from an independent utility primary network substation to that feeding the primary supply; or

c) an uninterruptible power supply (UPS) (see **21.2**) according to the electrical load requirements.

NOTE 1 In the case of sprinkler systems, a diesel-driven fire pump set for fire protection service is also an acceptable form of secondary source.

The electrical supply arrangements should be in accordance with BS 7671.

NOTE 2 Particular attention is drawn to the requirement in BS 7671 for suitable support of cabling to avoid obstruction of escape routes and firefighting access due to the failure of fixings.

NOTE 3 Typical supply configuration diagrams are shown in BS 8519:2020, Figure 1.

When assessing the appropriateness of the secondary source of supply, the life safety and firefighting loads to be served by the secondary source should be identified in accordance with BS 8519.

NOTE 4 BS 8519 does not recommend dual low voltage utility supplies due to the need for the two supplies to be independent from each other.

In the event of the failure of the primary power source, the supply should automatically switch over to the secondary source. Failure of one source should not result in the failure of the alternative source of supply or in the loss of supply to the life safety and firefighting equipment.

The change-over device should be an automatic transfer switch (ATS) conforming to BS EN 60947-6-1 and should be a single component with an integral controller from the same manufacturer.

The change-over device should provide the facility to monitor the status of the primary and secondary sources of supply availability, as well as the position of the change-over device, i.e. “On Primary Supply” or “On Secondary Supply”. The ATS should also provide indication of a fault within the ATS device. This indication should be provided to the fire alarm system and should be duplicated to the firefighting lift control switch when the ATS device is serving a firefighters lift installation within a firefighting shaft.

Section 52 – Maintenance of Fire Protection Measures

h) the relevant part of BS EN 12101 for smoke control systems;

NOTE 1 Further information regarding testing, inspection and maintenance of MSVSs is given in the Smoke Control Association publication Guidance on smoke control to common escape routes in apartment buildings (flats and maisonettes) *[20].*

More detail in Annex J – no longer a cross reference to BS 9999

Smoke control is a life safety system, testing and maintenance is required under the **Regulatory Reform (FS) Order**.

Frequency	Facilitator	Scope
Daily	Occupier	Check for faults, alarms, status
Weekly	Occupier	Test
Quarterly	Occupier	Full test
Yearly	Competent person	Maintenance inspection Performance test
5 yearly*	Competent Electrician	Statutory inspection of fixed wiring installation

Section 56 – Residential Care Homes

56.2 Smoke protection of evacuation lift lobbies

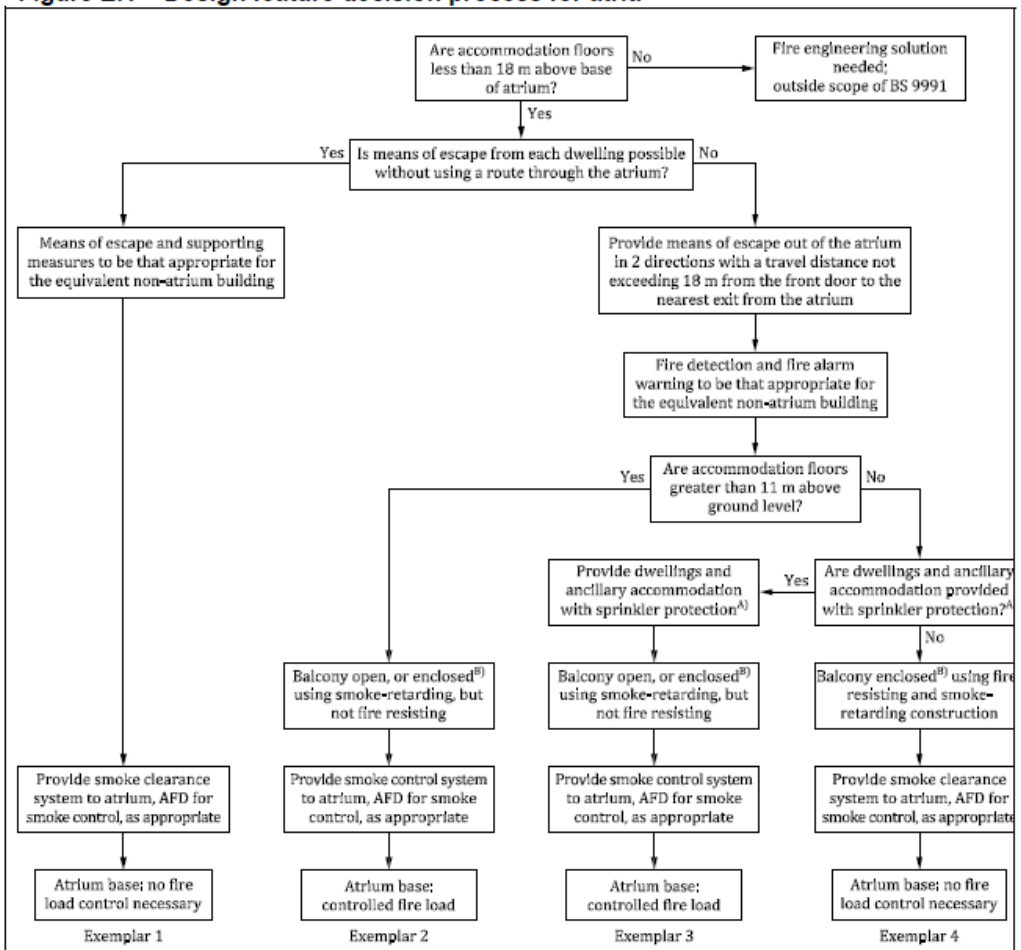
In lobbies serving evacuation lifts within care homes, smoke protection should be provided by one of the following methods:

a) smoke ventilation measures in the areas adjacent to those lobbies to aid occupants while waiting for evacuation and to protect the lift shaft from smoke ingress. This should be either natural ventilation in accordance with **20.2.2.2** or mechanical smoke ventilation in accordance with **20.2.2.3**b); or

b) pressure differential system to the lobby in accordance with **20.2.2.3**a).

Annex E – Atria

Figure E.1 – Design feature decision process for atria



[A] Where sprinklers are required within dwellings, they should be installed in accordance with BS 9251:2021 or BS EN 12845:2015+A1 (see Clause **17**). Where sprinklers are required to cover the atrium base, they should be installed in accordance with BS 9251:2021, **5.6** and Table 4, or BS EN 12845:2015+A1, as appropriate.

[B] Where balconies are enclosed, ventilation should be provided in accordance with Clause **20**.

NOTE For exemplars 1 to 4, see Figure E.2 to Figure E.5.

Annex G – Smoke Control

Shafts

G.5.1 Smoke shafts

G.5.1.1 General

Any smoke shaft that penetrates a fire compartment should have at least the same level of fire compartmentation as that which has been breached.

G.5.1.2 Construction

Smoke control shafts should be constructed from class A1 materials.

NOTE It can be desirable to fully render brick or blockwork shafts, or to line brick, blockwork or flexible wall construction shafts with a DW144 steel duct.

All shafts/ducts should leak not more than 3.8 $m^3/h/m^2$ of the surface area of the shaft/duct at 50 Pa negative pressure, and should be smooth and flush internally.

If smoke control ducting is used as an alternative to a smoke control shaft, it should conform to BS EN 1366-8.

Note:

- **Leakage rate/pressure is not a performance target, it is a performance characteristic.**
- **Ducts and shafts should withstand a suitable pressure for the system design 500 – 1000Pa typically.**
- **Pre-dates the Gypsum board/shaftwall 'controversy' that is ongoing at the moment.**

Smoke Shafts

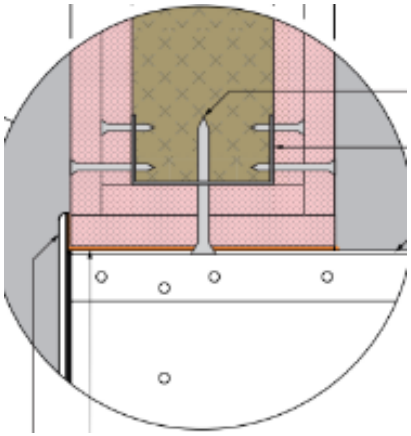
Shaft types:

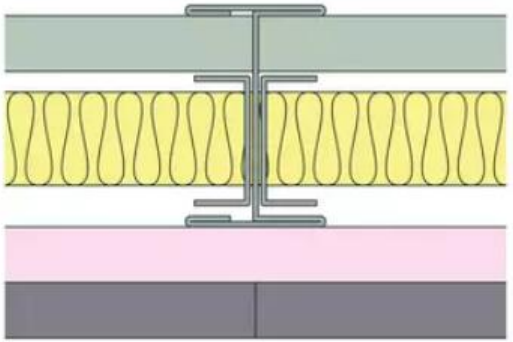
A: Gypsum or plasterboard – symmetrical wall construction aka flexible wall construction

B: Rigid construction – concrete or blockwork

These are standard wall constructions and if tested in A, are also covered for B.

Shaftwall by British Gypsum (other asymmetric wall systems are available), is not a standard wall construction because it is ‘asymmetric’. Builders like it because it can be constructed from one side and there are so many existing buildings constructed like this





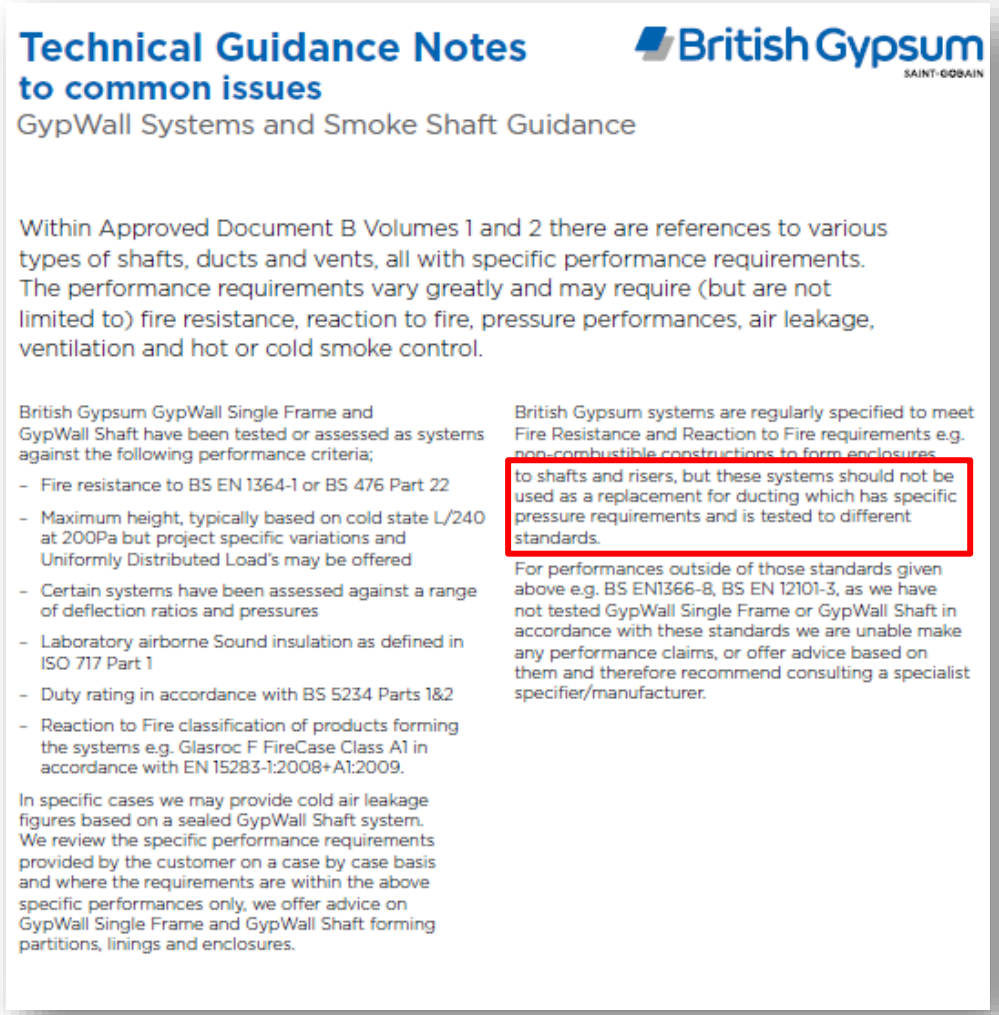
Smoke Shafts

BG have stated that their Shaftwall products are not a replacement for ducted systems and may not provide the required pressure or leakage classifications expected from a smoke control duct.

Is a smoke shaft a collection of walls or a duct?

Construction Products Regulation implies it is a duct & Smoke Control Association have stated that a building component used to move smoke from one compartment to another is a duct and should be constructed from EN 1366-8 materials, e.g:

Promat
Durasteel
Fire Protection
Flamebar



Technical Guidance Notes to common issues

British Gypsum

GypWall Systems and Smoke Shaft Guidance

Within Approved Document B Volumes 1 and 2 there are references to various types of shafts, ducts and vents, all with specific performance requirements. The performance requirements vary greatly and may require (but are not limited to) fire resistance, reaction to fire, pressure performances, air leakage, ventilation and hot or cold smoke control.

British Gypsum GypWall Single Frame and GypWall Shaft have been tested or assessed as systems against the following performance criteria;

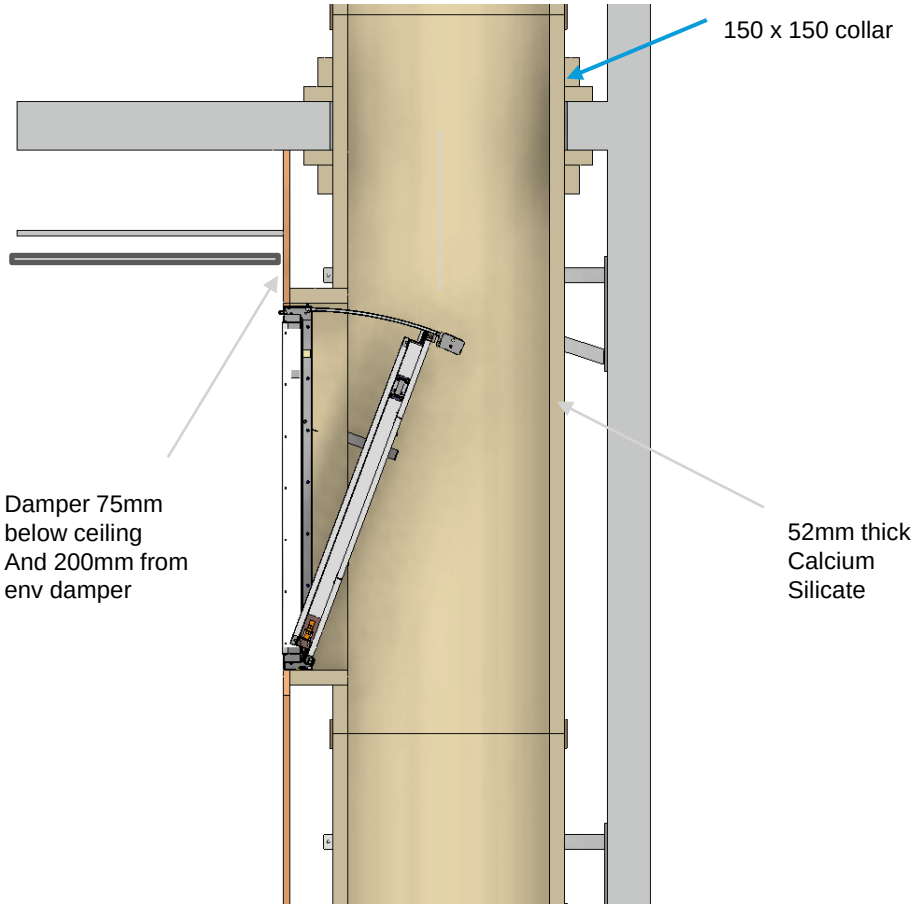
- Fire resistance to BS EN 1364-1 or BS 476 Part 22
- Maximum height, typically based on cold state L/240 at 200Pa but project specific variations and Uniformly Distributed Load's may be offered
- Certain systems have been assessed against a range of deflection ratios and pressures
- Laboratory airborne Sound insulation as defined in ISO 717 Part 1
- Duty rating in accordance with BS 5234 Parts 1&2
- Reaction to Fire classification of products forming the systems e.g. Glasroc F FireCase Class A1 in accordance with EN 15283-1:2008+A1:2009.

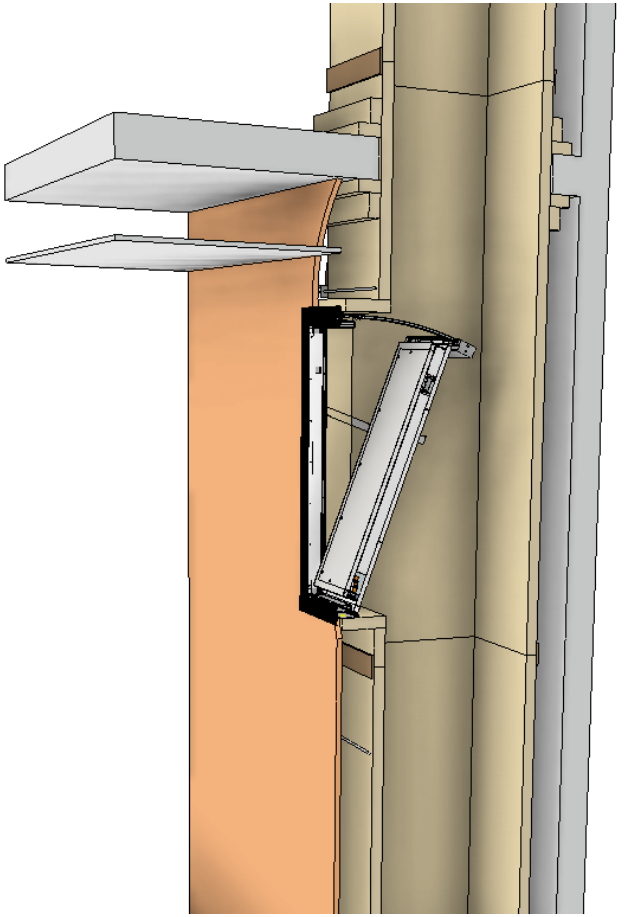
In specific cases we may provide cold air leakage figures based on a sealed GypWall Shaft system. We review the specific performance requirements provided by the customer on a case by case basis and where the requirements are within the above specific performances only, we offer advice on GypWall Single Frame and GypWall Shaft forming partitions, linings and enclosures.

British Gypsum systems are regularly specified to meet Fire Resistance and Reaction to Fire requirements e.g. non-combustible constructions to form enclosures to shafts and risers, but these systems should not be used as a replacement for ducting which has specific pressure requirements and is tested to different standards.

For performances outside of those standards given above e.g. BS EN1366-8, BS EN 12101-3, as we have not tested GypWall Single Frame or GypWall Shaft in accordance with these standards we are unable make any performance claims, or offer advice based on them and therefore recommend consulting a specialist specifier/manufacturer.

Smoke Control Ducts





Annex G – Smoke Control

Dampers

G.5.5 Smoke control dampers

Smoke control dampers should conform to BS EN 12101-8. They should be tested in accordance with BS EN 1366-10 from both sides in the application proposed, and classified in accordance with BS EN 13501-4 to achieve the same level of fire resistance as the compartment barriers and associated smoke control ducts.

Smoke control dampers should be classified as V_{ew} (walls, shaft walls and builders work shafts), H_{ow} (floors) or V_{ed} /H_{od} when used with smoke control ducts (BS EN 1366-8 and BS EN 1366-9), all in accordance with BS EN 13501-4.

In addition, they should be classified for reduced leakage S1000.

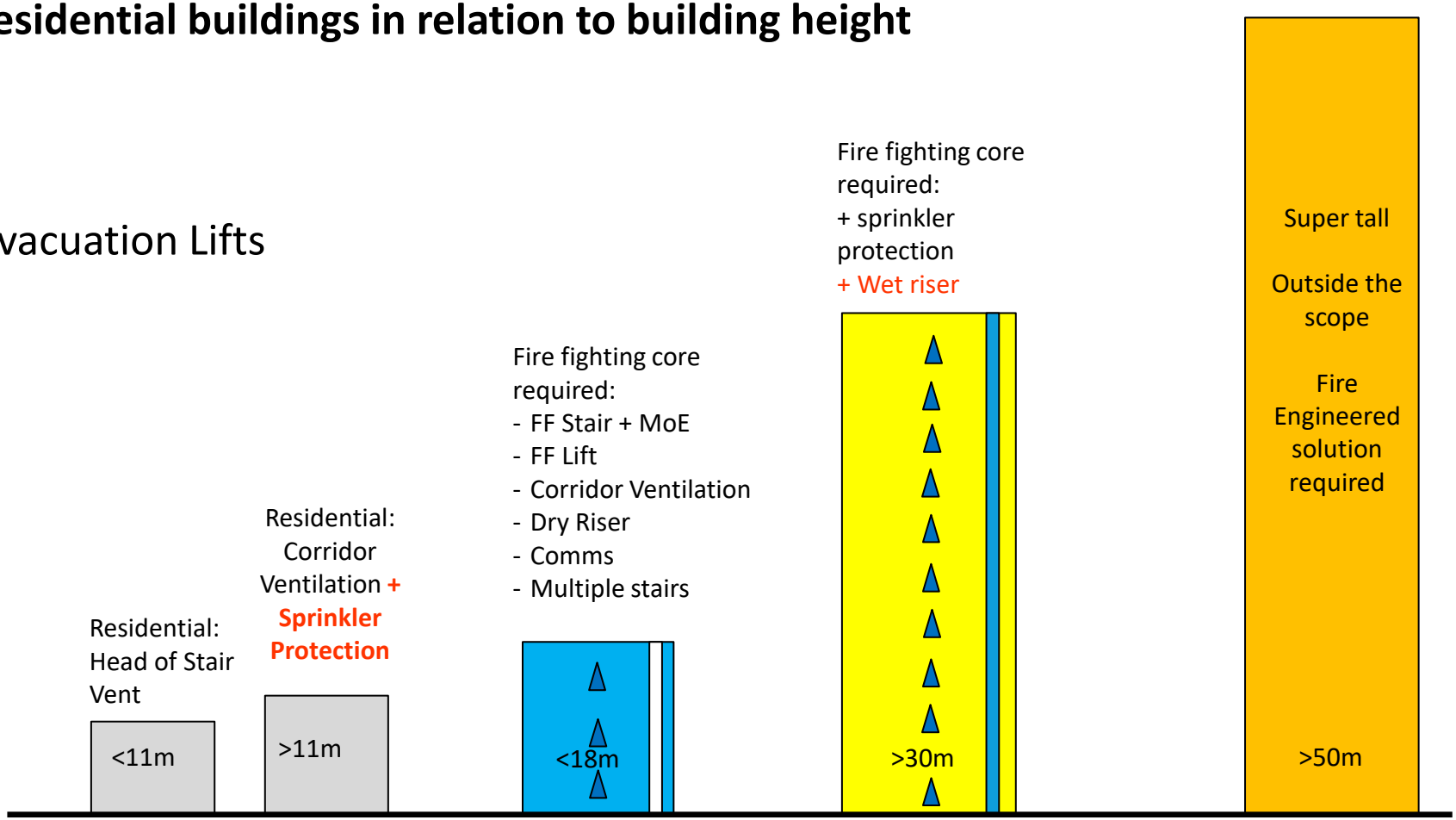
Smoke control dampers should be either AA or MA depending on the override functionality of the control panel. If override of the dampers is allowed during a smoke incident, then the smoke control dampers should be MA.

NOTE As firefighters are unlikely to want to interfere with an automatic system, AA smoke control dampers are acceptable as long as any manual testing override functionality of the panel is immobilized during a smoke incident. When alarms are cleared, or overridden, functionality will be returned for smoke clearance depending on new alarms or alarm isolation.

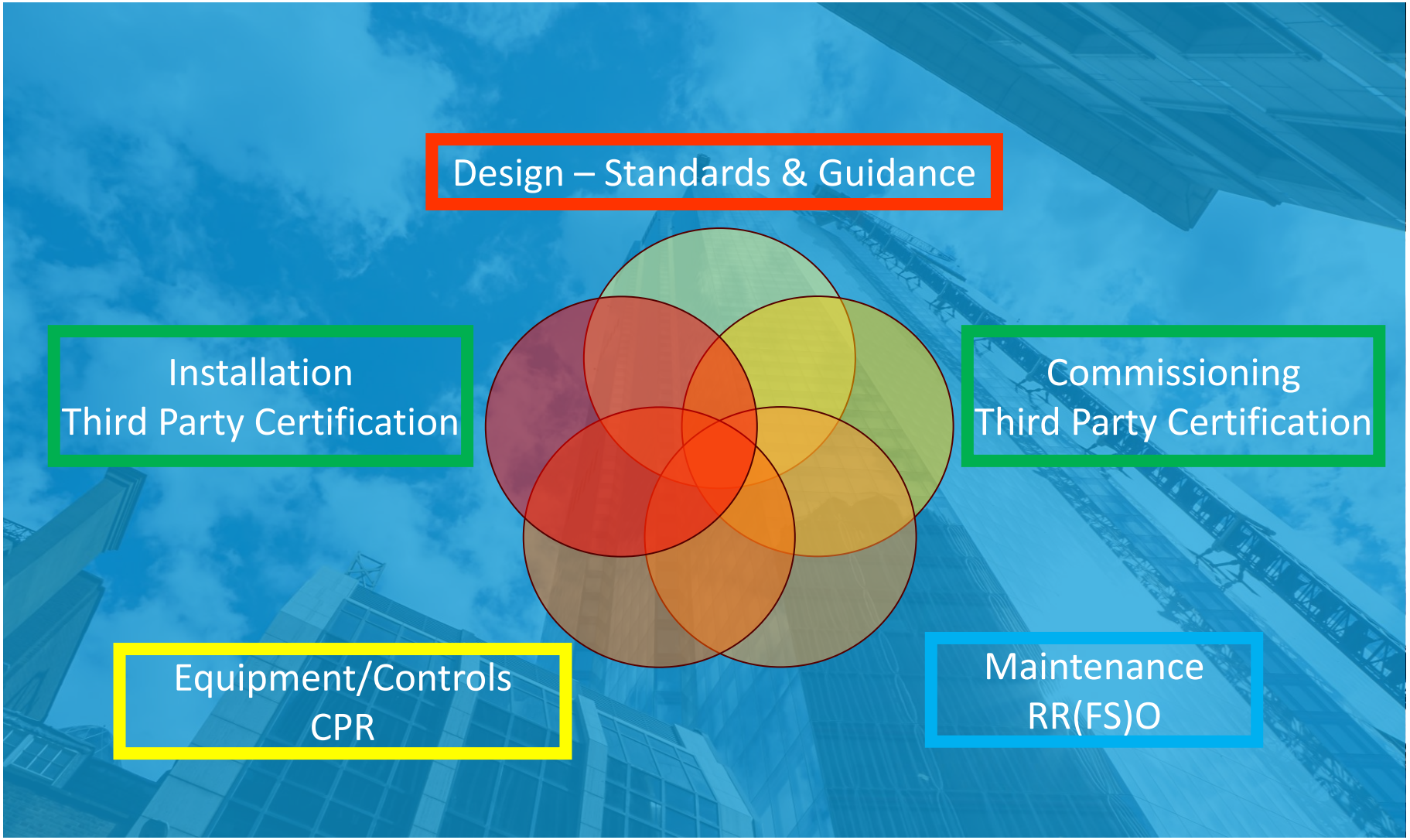
Smoke control dampers should have a minimum operations classification of C_{10000}. They are under the control of a system and should be tested/operated in accordance with Annex J, **J.3.5**.

All duct-mounted smoke control dampers should be provided with an access door both sides unless they are readily accessible from the end of a duct. All access doors should be suitable for the duct to which they are to be fitted.

Changes to BS 9991: Sliding scale of protection in high rise residential buildings in relation to building height



Conclusions



Introduction

Boland's Quay, Dublin


Southbank Tower, London


Canada Gardens, London


Battersea Power Station, London


10 George Street, Edinburgh

Thank you