

An Introduction to Pressurization

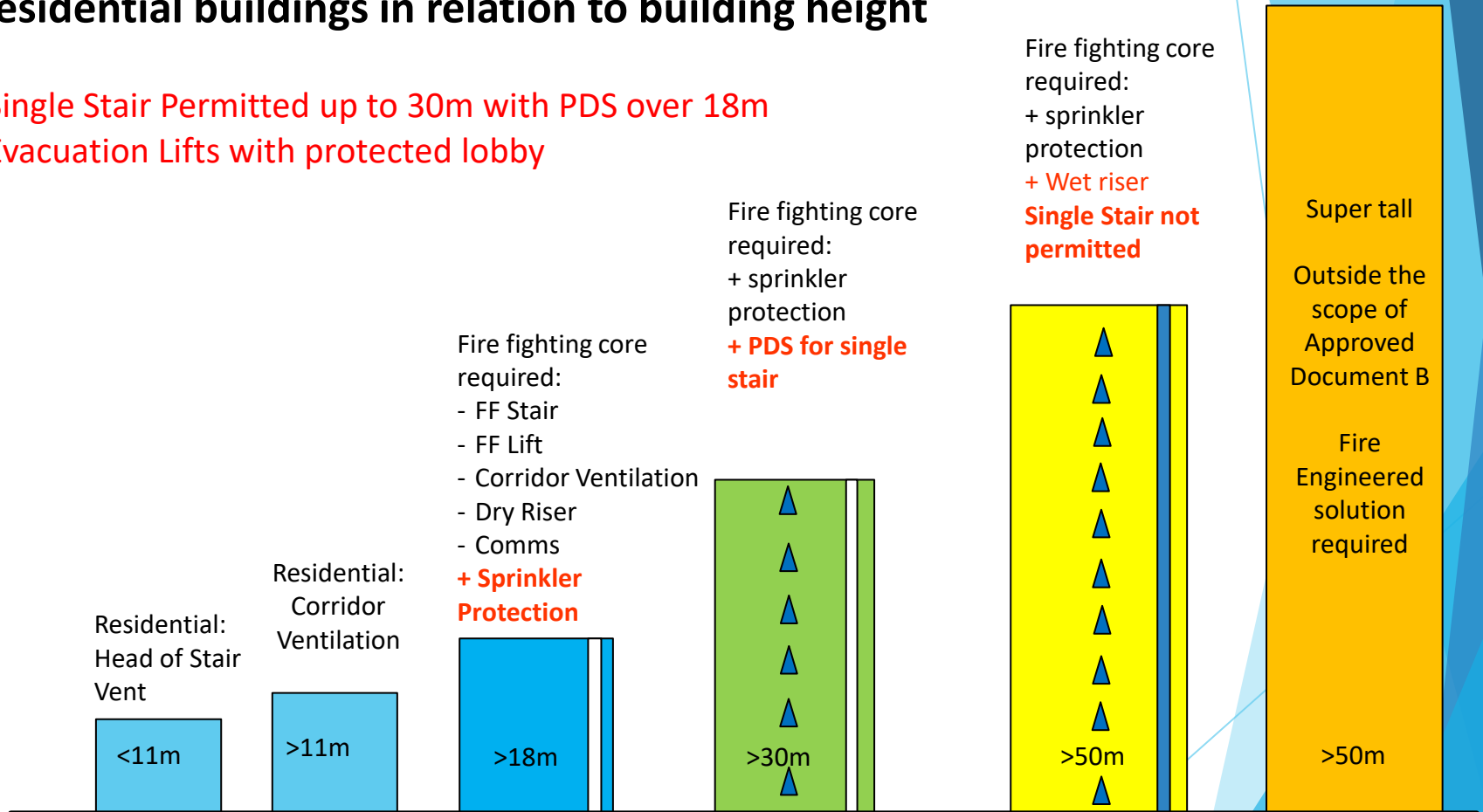
► Pressurization Systems - Why Pressurize?

- Approved Document B to the Building Regulations requires smoke ventilation to escape stairs in residential buildings and to fire fighting stairs in all buildings and, under most circumstances, adjacent common lobbies and/or corridors.
- Pressurization is one way of meeting this requirement
- Alternatives to Pressurization are:
 - Natural AOVs
 - Natural Shafts
 - Mechanical Shaft Systems (MSVS)
- BS 9991 currently under review - next version is likely to recommend pressurization for single stair residential buildings up to 30m
- London Plan requires all buildings with a lift to have an evacuation lift, to allow evacuation of all occupants regardless of their ability - lifts and the lobby approach will also need protection. The new draft of BS 9991 is currently the only guidance to cover evacuation lifts



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

Single Stair Permitted up to 30m with PDS over 18m
Evacuation Lifts with protected lobby



▶ Pressurization Systems - Why Pressurize?

- Alternative to natural ventilation when escape stairs or fire fighting stairs are landlocked
- A requirement for some fire fighting stairs
- An alternative to lobbies and/or discounting of a stair in some buildings
- BS EN 12101-6:2005 was superseded in 2005 and split into two standards Part 6 is a specification for the equipment and Part 13 covers the Design, calculation methods, acceptance testing and maintenance

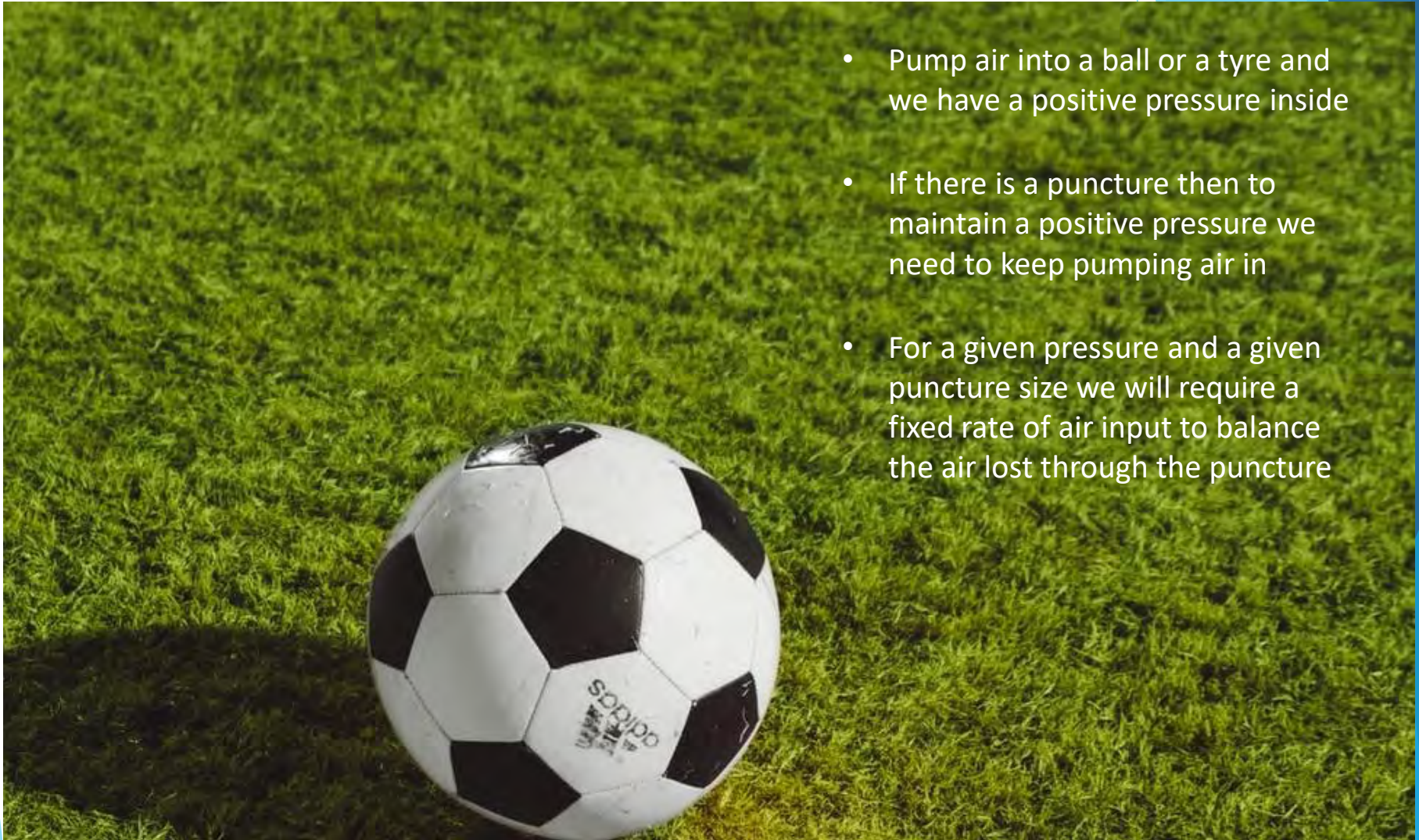


► Pressurization Systems - Why Pressurize?



BS 9999: 2017 recommends pressurization (designed to EN12101-6) to:

- Replace separation of dead end corridors with a fire door
- Replace protected lobbies in single stair buildings, buildings over 18m, buildings with phased evacuation and buildings where a stair has not been discounted in the sizing of escape widths
- Allow a single stair to extend down to a basement
- Protect fire fighting shafts over 10m deep and over 30m tall (Class B)

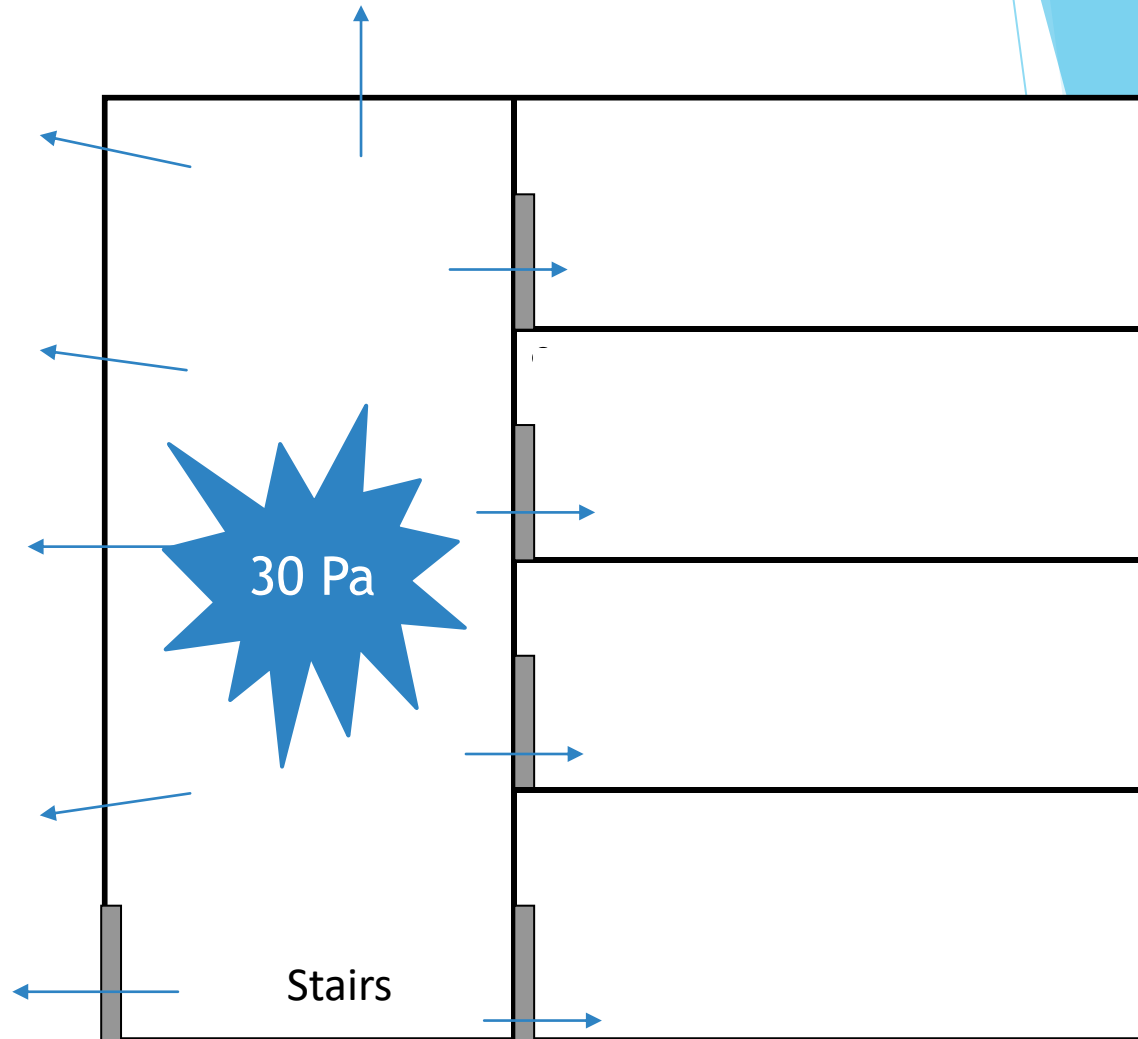


- Pump air into a ball or a tyre and we have a positive pressure inside
- If there is a puncture then to maintain a positive pressure we need to keep pumping air in
- For a given pressure and a given puncture size we will require a fixed rate of air input to balance the air lost through the puncture

► Pressurization Systems - Doors closed principle

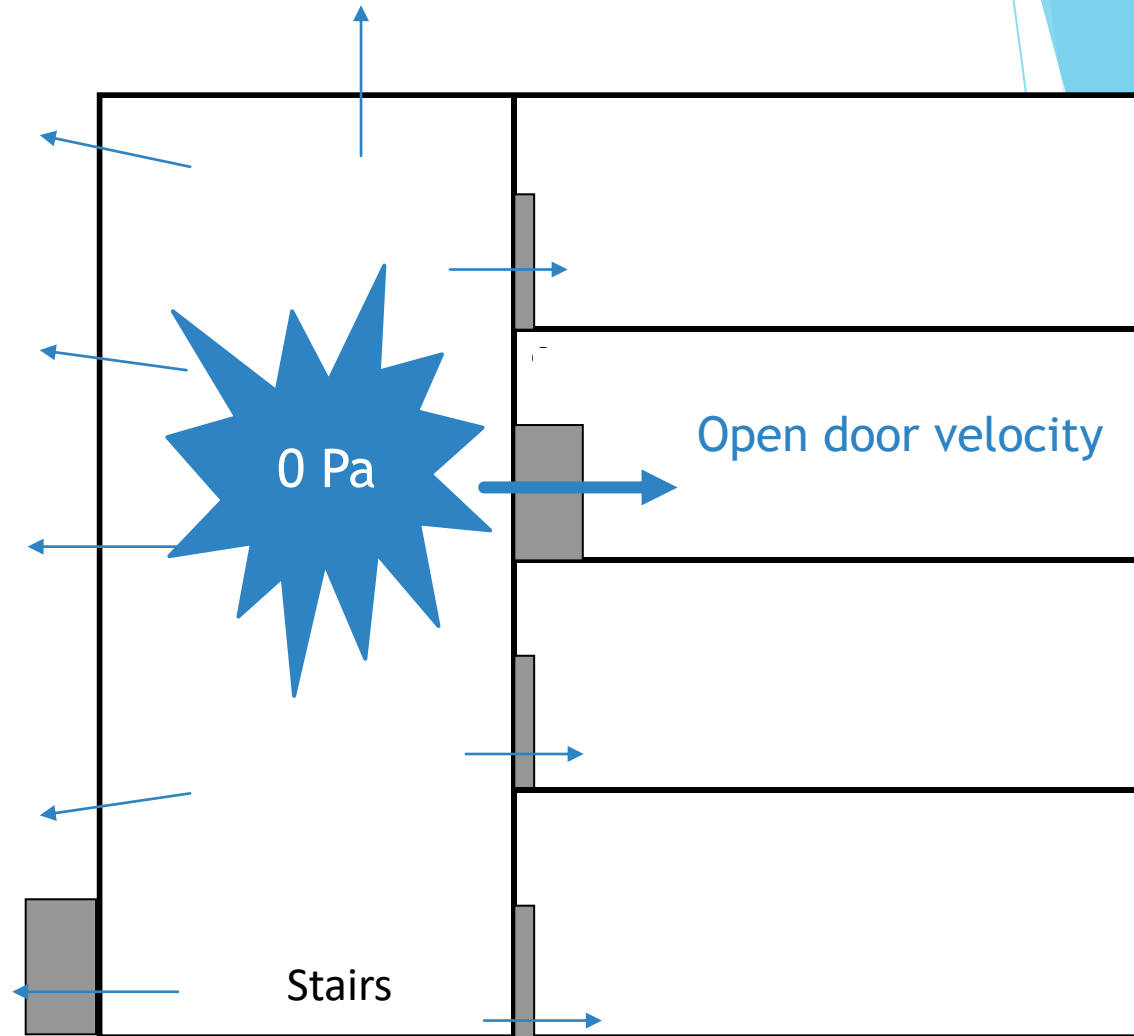
1. Estimate area of all leakage paths from doors, walls, windows and openings to pressurized and unpressurized spaces.

2. Calculate flow through each leakage path at the required pressure difference: 5 Pa to pressurized spaces (e.g. lobbies) and 30Pa to unpressurized spaces, e.g. unprotected accommodation or outside.



► Pressurization Systems - Doors open principle

1. Add the area of the open door(s) to the leakage areas.
2. Calculate the pressure needed to generate the required velocity 1 or 2m/s.
3. Calculate the airflow needed to generate this pressure with the additional leakage



- ▶ Pressurization Systems
- ▶ EN 12101-6/13 Building Classification

The 2005 standard classified system into 5 classes - these are replicated in the National Annex of Part 13

System Class	Application	Typical Building Type
A	Means of Escape Stay put policy	Residential
B	Means of Escape and Fire fighting	Where fire fighting core is required
C	Means of Escape Simultaneous Evac.	Commercial
D	Means of Escape Sleeping Risk	Hotels/Hospitals
E	Means of Escape Phased Evacuation	High rise offices

► Pressurization Systems - Installations



Oxford Road, Leicester – Class A



West India Quay, London – Class B

All Pressurization systems require 3 basic components:

- A means of supplying clean air to Pressurized areas – Supply fans
- A means of ensuring excessive pressure differentials do not occur – Pressure Relief
- A means of relieving pressure from the accommodation – Accommodation Air Relief



▶ Pressurization Systems - Which areas do we Pressurize?



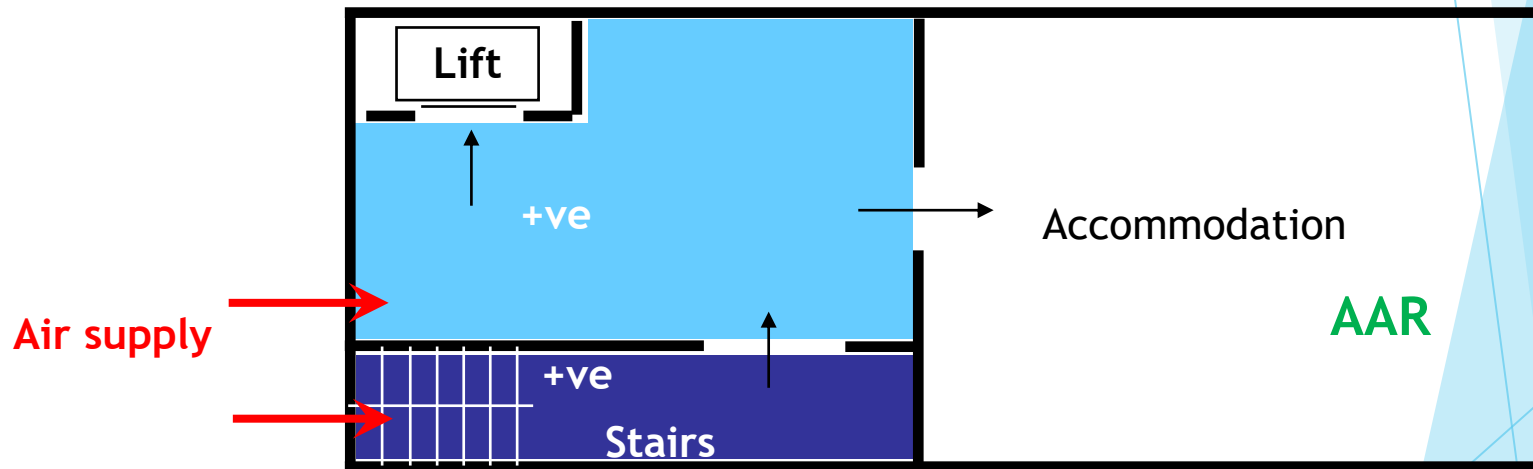
The first decisions to be made for any system:

- What class of Pressurization system is required?
- What areas need protection?
 - Is there a lift?
- How is accommodation air relief to be provided?

► Pressurization Systems - Stairs, lobby & lift

Pressurize stairs and lobbies.
Used to extend protection to lobbies

Class A, C, D and E – with disabled refuge or evacuation lift (ref London Plan)

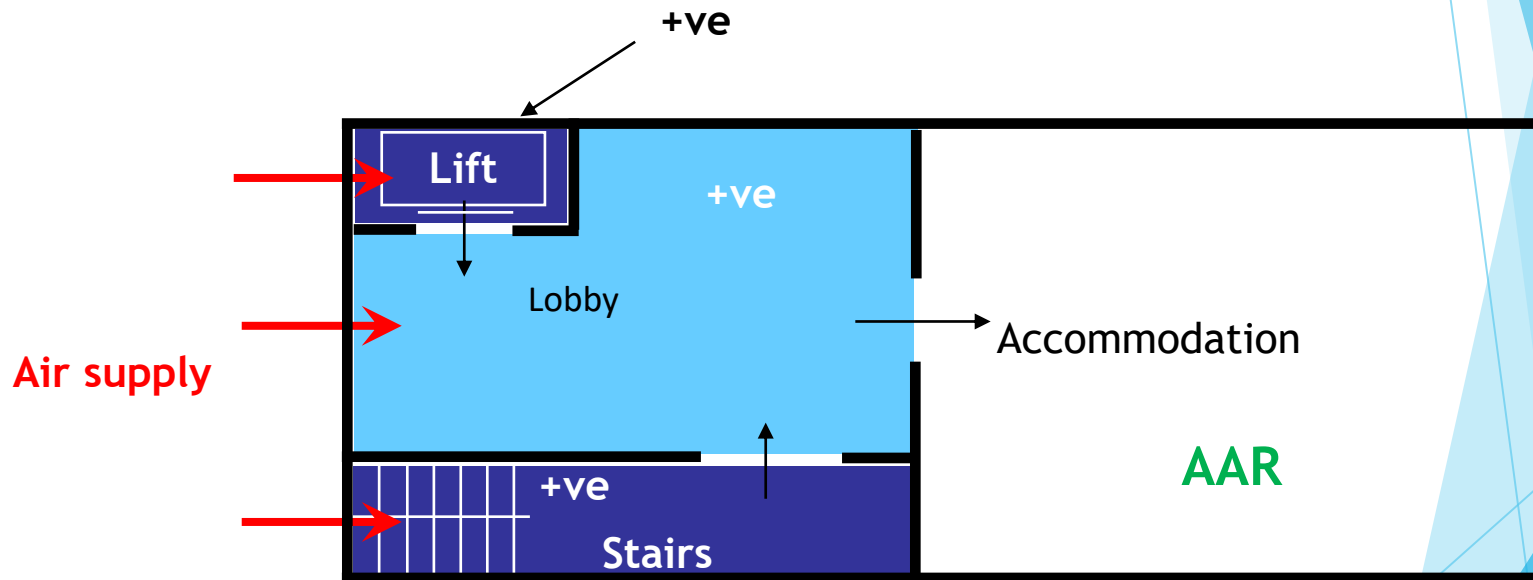


► Pressurization Systems - Stairs, lobby & lift

Pressurize stairs, lift and lobby.

Used to extend protection to lobbies

Generally only used in fire fighting – Class B



► Pressurization Systems - What performance is required?

EN 12101-13:

Depending upon the class of system we have set criteria to achieve:

- Pressure differentials – Now 30Pa
- Velocity through open door – 1.0 or 2.0m/s
- Limited door opening force < 100N (this is still high and would be difficult for some people to open – inclusive design considerations should restrict this to < 30N in near future)

Table 1 — Design requirements of a PDS

Parameter	Class 1	Class 2
Door opening force	≤ 100 N	
Pressure differential	≥ 30 Pa	
Airflow velocity	≥ 1 m/s	≥ 2 m/s
Initiation time	≤ 60 s	
Operation time	≤ 120 s	
Response time	≤ 5 s	

NOTE Refer to Clause 8 when measuring the normative requirements given in Table 1.

5.2 Application of Class 1 and Class 2

5.2.1 Class 1

Class 1 will be required:

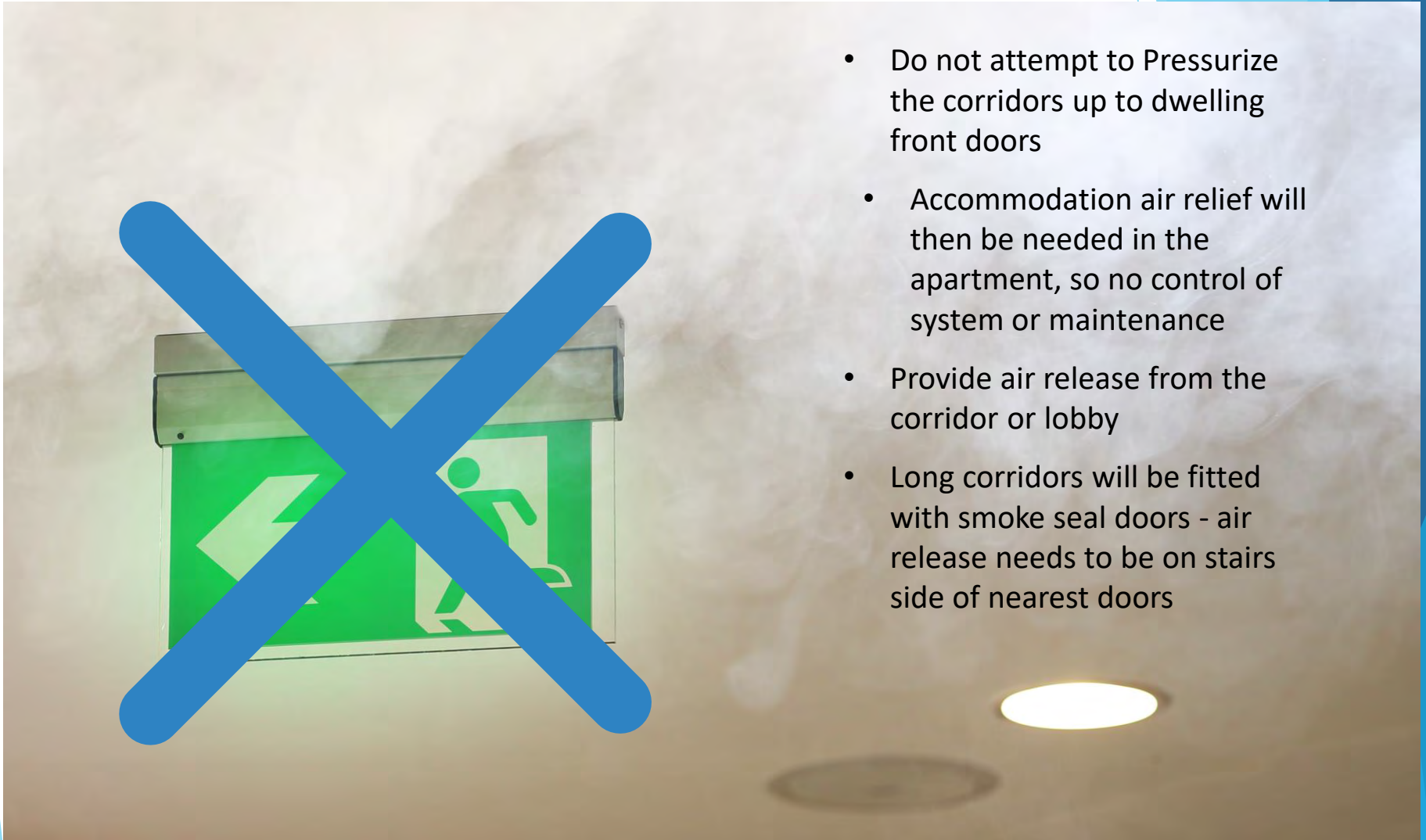
- in buildings with automatic water extinguishing systems using quick response sprinkler according to [EN 12259-1](#) (with response time index (RTI) ≤ 50) which operate in response to temperatures ≤ 72 °C; or
- in residential buildings up to 30 m or below the high-rise buildings limit (in accordance with national requirements); or
- in residential buildings, if there are at least two rooms without fire load between the protected space and the potential fire source and self-closing doors are present; or
- if accepted by authorities having jurisdiction.

5.2.2 Class 2

Class 2 will be required:

- where Class 1 is not applicable; or
- if required by authorities having jurisdiction.

- ▶ Pressurization Systems - Residential
- ▶ Means of escape - Defend in Place



- Do not attempt to Pressurize the corridors up to dwelling front doors
- Accommodation air relief will then be needed in the apartment, so no control of system or maintenance
- Provide air release from the corridor or lobby
- Long corridors will be fitted with smoke seal doors - air release needs to be on stairs side of nearest doors

▶ Pressurization Systems - Installations

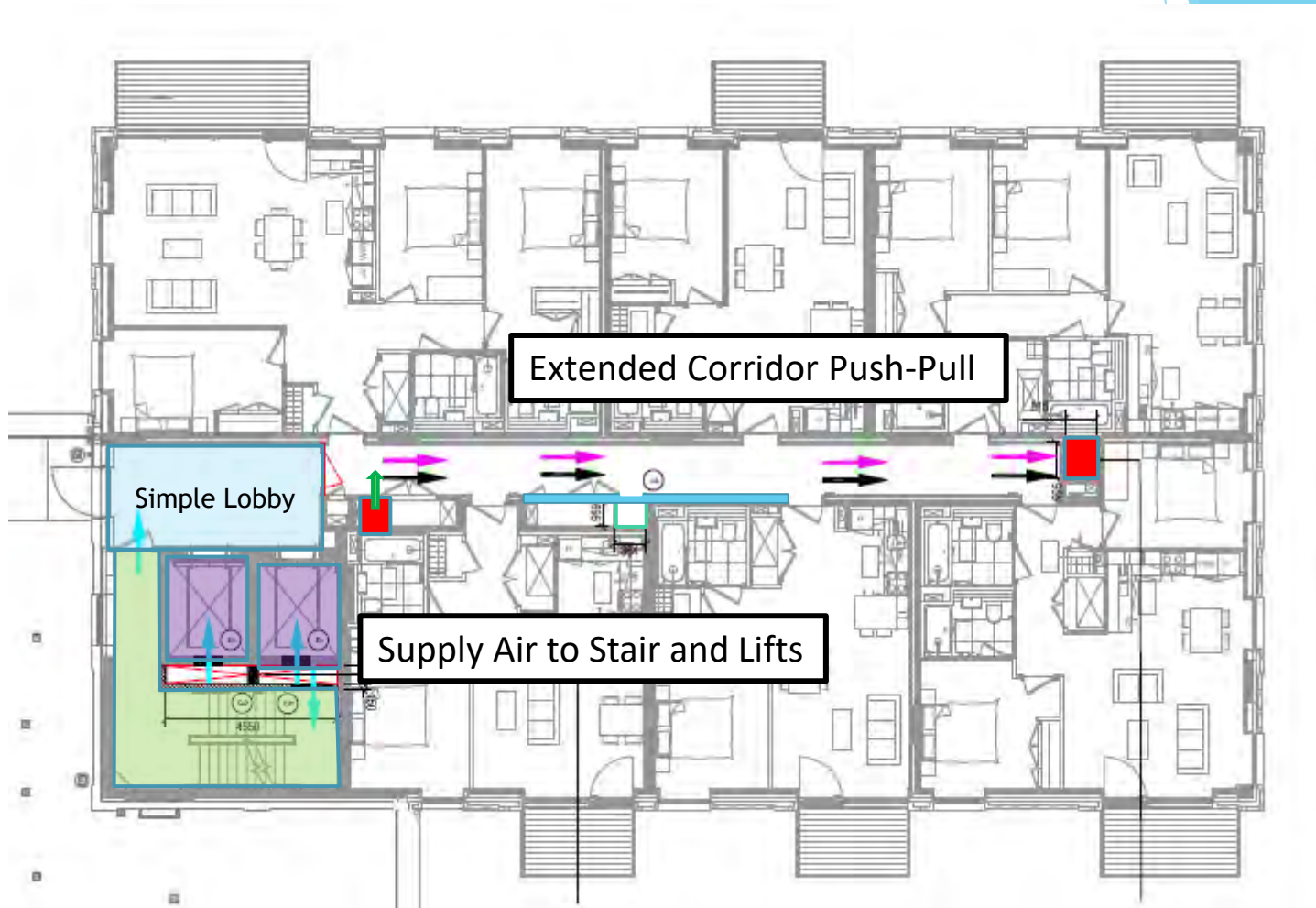
13-19 Leinster Square - Class A



Wallis House, Great West Quarter Class A



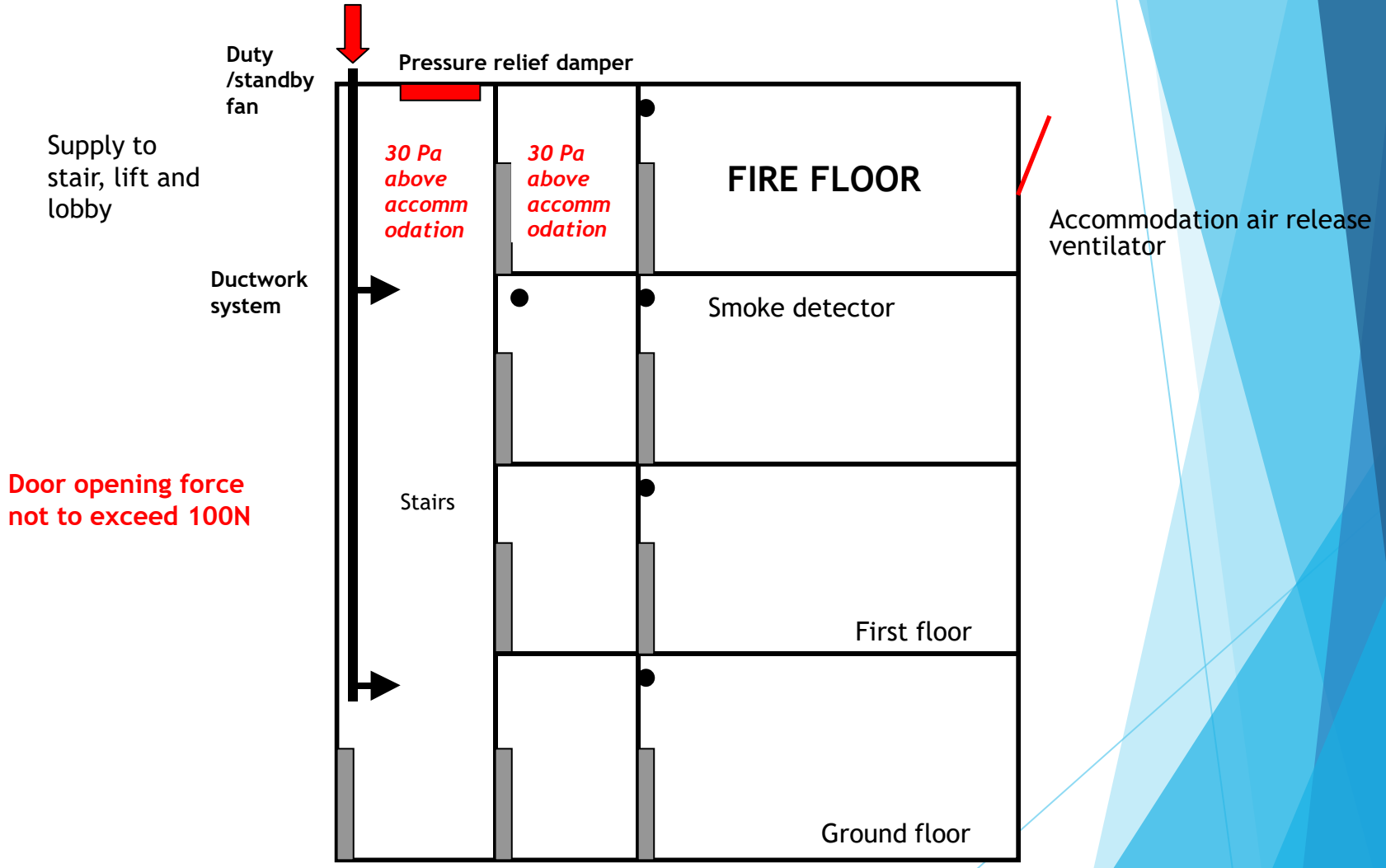
► Pressurization Systems - BS9991 - Extended Corridors



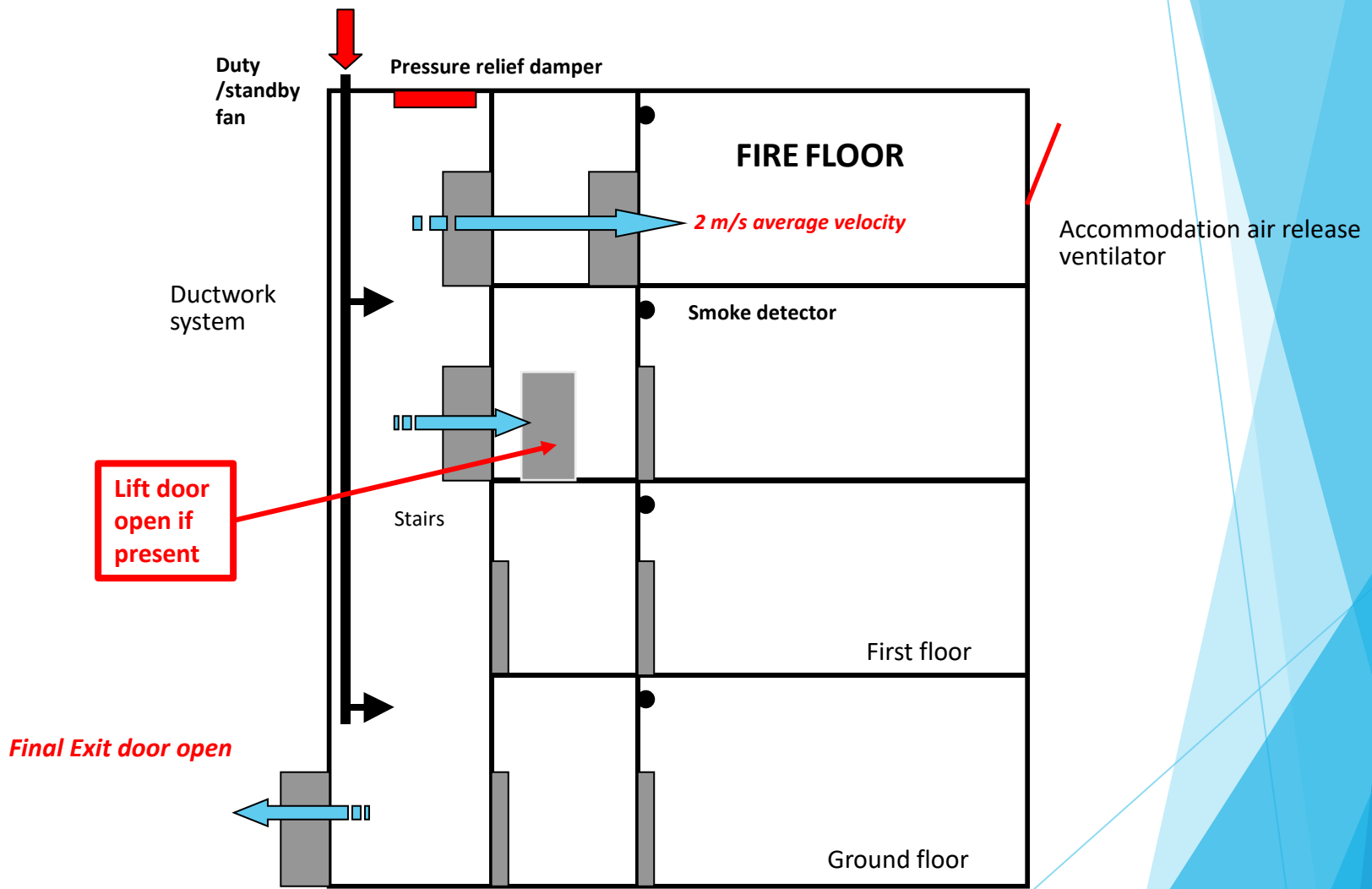


- Requirement for stairs set by ADB and BS 9999
- Pressurized lobbies essential
- Lobbies may contain fire fighting lift, which also needs to be Pressurized

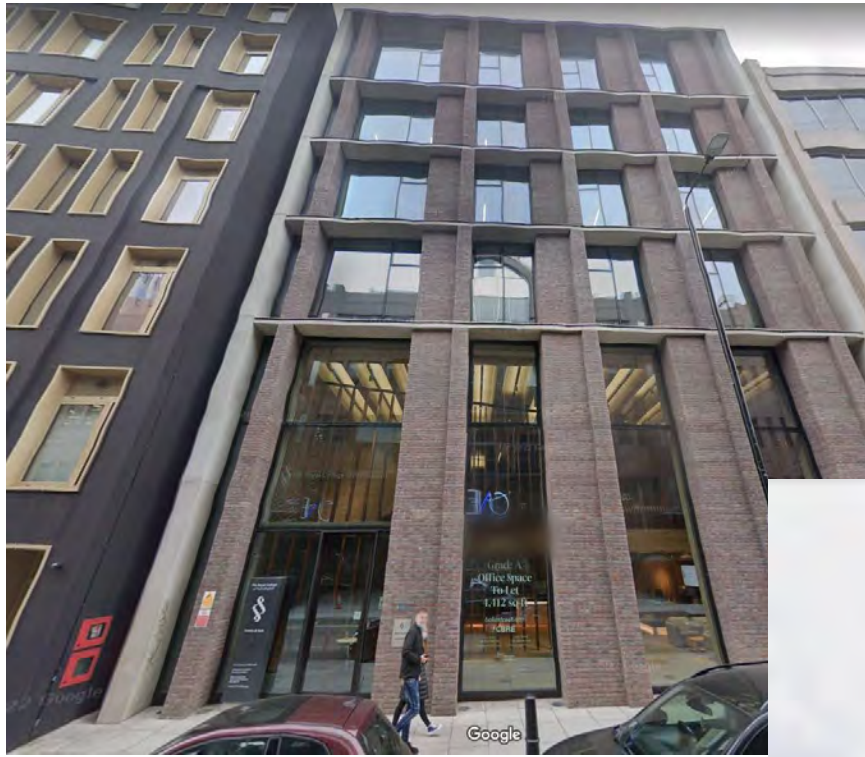
► Pressurization Systems - Class B - Doors closed



► Pressurization Systems - Class B - Doors open



► Pressurization Systems - Installations



**Royal College of Pathologists
Class B**

**Monument Building, London
Class B**



▶ Pressurization Systems - Installations



**58 Victoria Embankment
Class B**

New London Embassy



► Pressurization Systems - Equipment

Fans

- ambient rated
- duty + standby (or standby motor) if only one MOE route; usually in series to save space
- One fan set may supply stairs, lobbies and lift shaft
- not usually attenuated unless needed for test periods
- In 1 hour fire rated enclosure or roof

Power supplies

- primary + secondary
- Mains + generator or separate mains supply

Grilles

- one per 3 storeys in stair
- one per lobby
- one per 30m in lift shaft

Pressure relief

- usually gravity damper in stair
- inverter control of fans possible but difficult due to response speed requirement

▶ Pressurization Systems - Equipment



Twin air intakes on separate facades of the building with motorised dampers and smoke detector control

Volume control dampers on each section of ducting

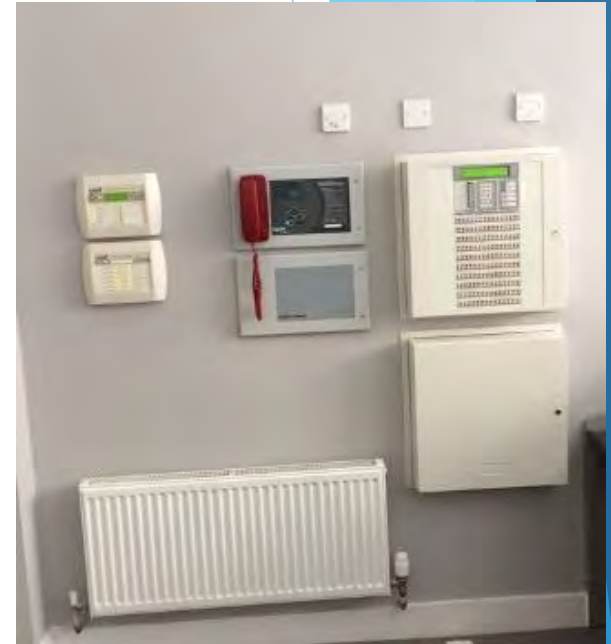


Accommodation air release can be achieved by:

- Leakage can be from building fabric, HVAC ductwork, permanent trickle vents, but not window breakage
- Natural ventilators - must comply with EN12101-2 and must be provided on at least 2 facades, discount the side with the largest vent area (2.5m/s)
- Natural shafts - terminations need to be located to minimise adverse wind effects (2m/s)
- Mechanical shafts - should not cause excess pressure differentials so speed may need to vary depending on the operating stage

► Pressurization Systems - Controls

- **Initiation – From automatic fire detection system**
 - Needs to identify fire floor (AAR only from fire floor)
 - Locate detector close to door to Pressurized space
- **Class B initiation**
 - Can be manual switch from MOE state or direct from automatic fire detection system
- **Accommodation air release**
 - only opened on fire floor (to prevent risk of fire/smoke spread)
- **Fire fighter controls**
 - provided at base of stair



- ✓ All doors must be fitted and close properly
- ✓ All finishes must be complete - carpets laid etc
- ✓ All false ceilings must be in place
- ✓ There must be no temporary openings or unsealed service penetrations



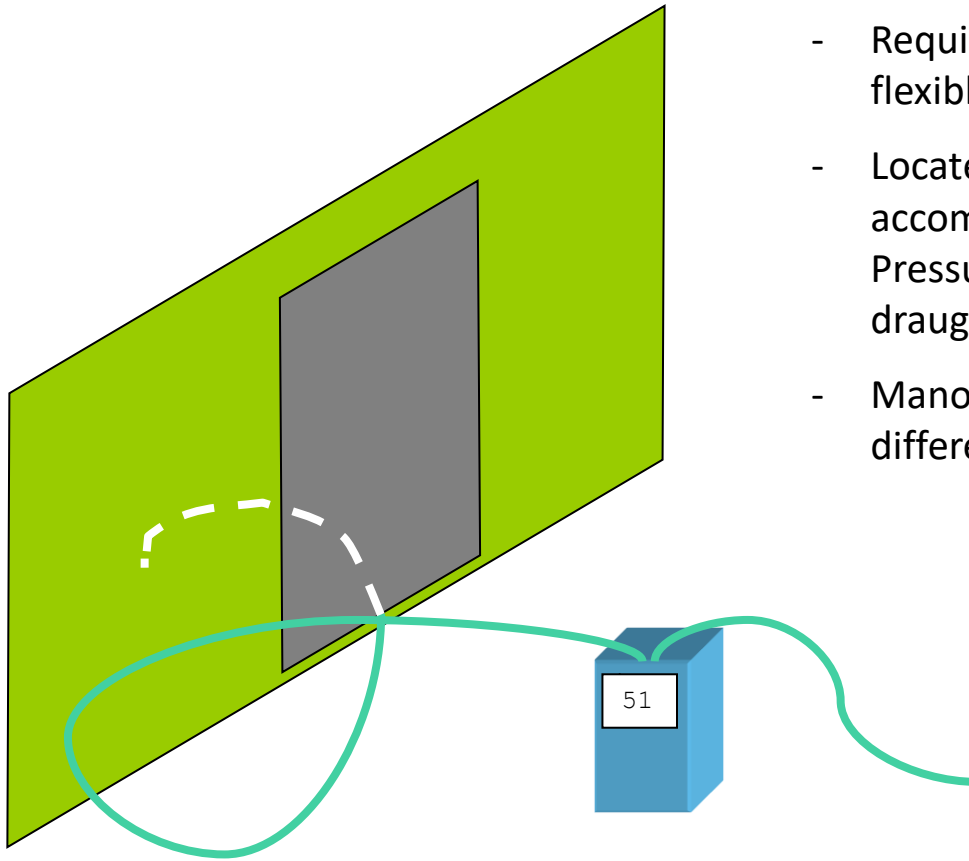
▶ Pressurization Systems - Performance testing



- While the test method aims to neutralise the effects of wind, testing on windy (and especially blustery) days should be avoided if possible
- Be prepared and organised before starting testing since there is a maximum time limit between test stages of 15 minutes
- Ensure all other H&V systems are shut down

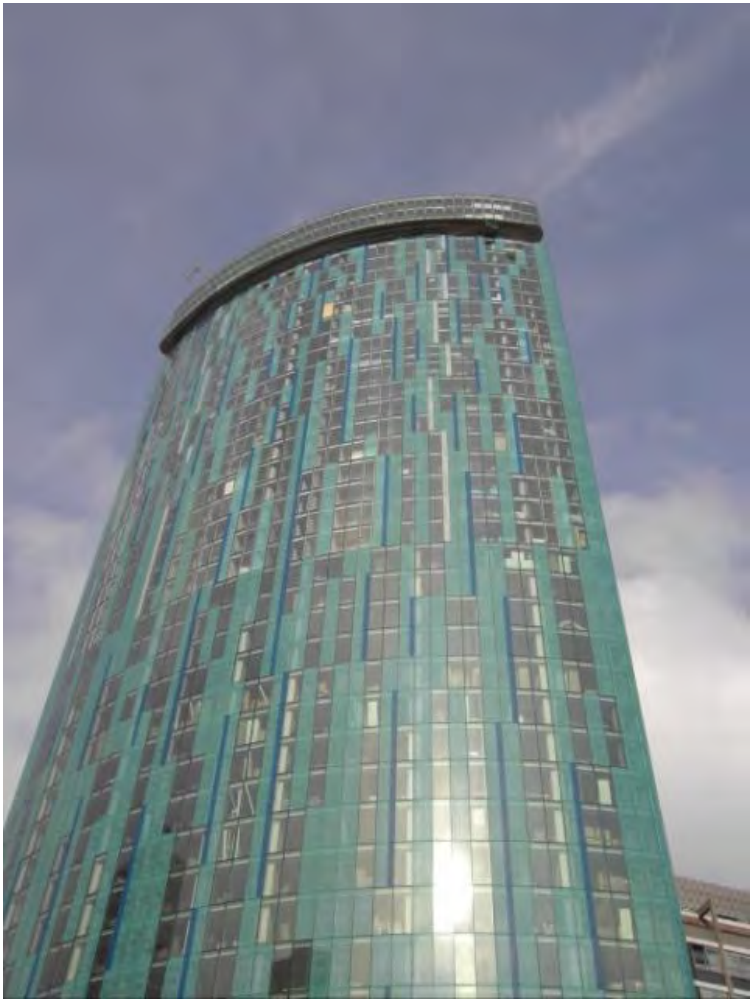
▶ Pressurization Systems - Measurement Techniques

- Pressure differential

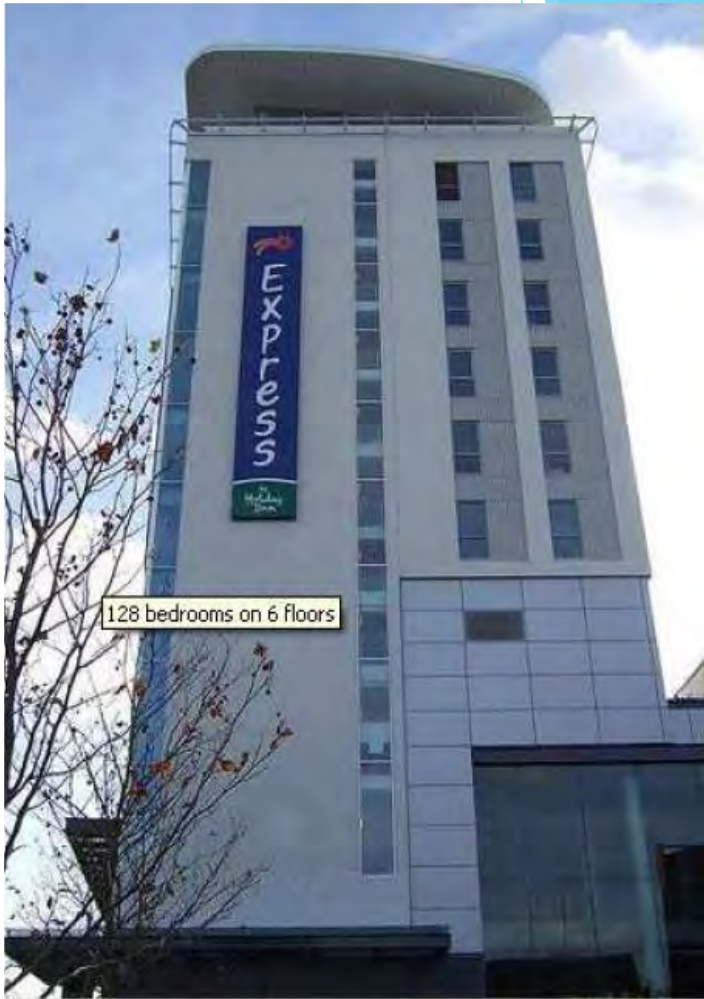


- Requires a manometer and 2 long flexible tubes
- Locate end of one tube in the accommodation and the other in the Pressurized space, both away from draughts and at least 50mm above floor
- Manometer then reads pressure differential directly

► Pressurization Systems - Installations



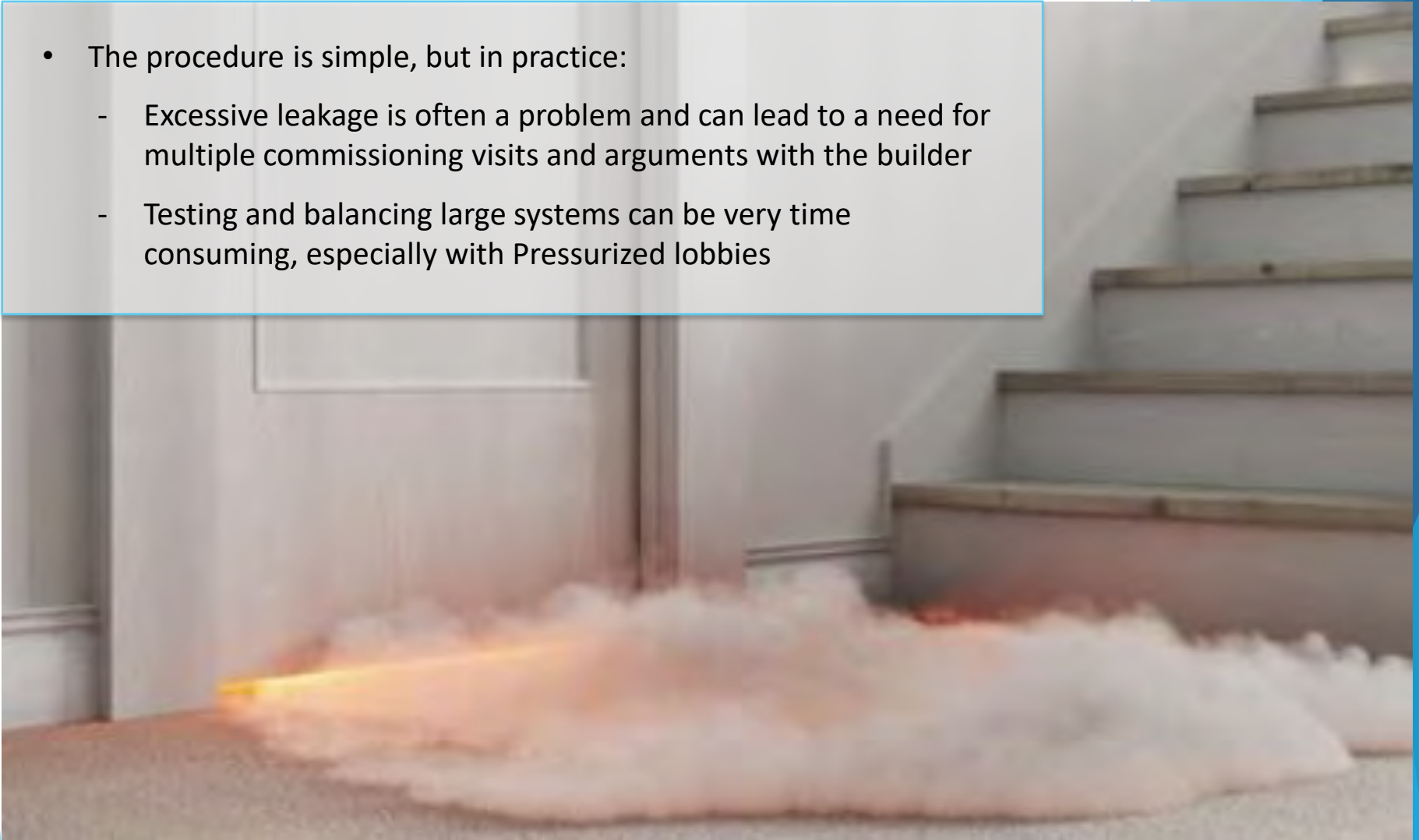
Beetham Tower, Birmingham – Class B



Holiday Inn Express, Hull – Class B

▶ Pressurization Systems - Performance testing

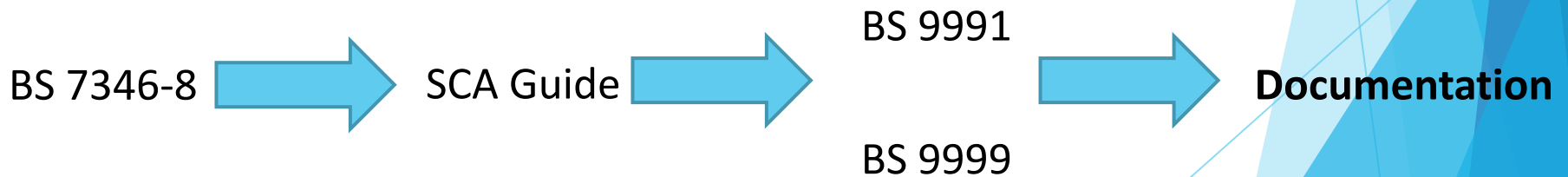
- The procedure is simple, but in practice:
 - Excessive leakage is often a problem and can lead to a need for multiple commissioning visits and arguments with the builder
 - Testing and balancing large systems can be very time consuming, especially with Pressurized lobbies



▶ Pressurization Systems - Performance testing

Testing and maintenance

- Smoke control systems are primarily for life safety, covered by the Regulatory Reform Order. Testing and maintenance is covered by BS 9999 Annex I
- Regular testing – weekly
- Three monthly full test
- Annual inspection and maintenance by a competent person



Testing and Maintenance

Frequency	Duty Holder	Scope
Daily	Responsible Person	Check for faults, alarms, status
Weekly	Responsible Person	Test
Quarterly	Responsible Person	Full test
Yearly	Responsible/Competent Person	Maintenance inspection Performance test
5 yearly*	Responsible/Competent Electrician	Statutory inspection of fixed wiring installation

Third Party Certification



CERTIFICATED INSTALLER OF ACTIVE FIRE PROTECTION

Certificate number: IFCC 3141

This is to certify that

Colt International Ltd

Colt House
Ridgeway Office Park
Bedford Road
Petersfield
Hampshire GU32 3QF
Tel: 02392 491184

Installers of the following Smoke / Fire protection systems:
Smoke and Fire Curtain Barriers Smoke Control Systems

have successfully completed the requirements of IFCC schemes:

- SDI 05 "Requirements for Contractors Installing, Commissioning and Servicing Active and Fixed Barriers for Fire and Smoke Control"
- SDI 19 "Requirements for Contractors Installing Smoke Control Systems".

This includes the verification/inspection of **fire strategy verification, system design and installation** of smoke & fire protection curtains / smoke control systems, the assessment and verification of the Quality Control system, competency assessment of individuals (as listed in the company's client secure section of the IFCC website) and continuing surveillance including random site audits.



Initial Certification: 27 September 2018
Valid to: 26 September 2023
Issue status: 1

Ian Woodhouse
Director of Certification

IFC Certification Ltd, 20 Park Street, Princes Risborough, Buckinghamshire, HP27 9AH, UK.
Tel: +44 (0)1294 275300 Fax: +44(0)1294 274932 E-mail: info@ifccertification.com Web: www.ifccertification.com
Registered No: 4777998 England

The certificate and schedule are held in force by regular annual surveillance visits by IFC Certification. The holder should contact IFC Certification to validate its status. This certificate remains the property of IFC Certification and must be returned to them on demand.



Certificate of Conformity -

Page 1 of 1

This certificate is issued by the IFCC certified contractor in accordance with IFCC Certification Scheme Regulations and Procedures to indicate the compliance of a smoke control system installation. It confirms that the project has been completed having full regard to the requirements of the appropriate system design and its installation instructions and that the claimed performance is substantiated by appropriate certification test and/or assessment evidence. Note: No changes shall be made to the installed products and systems without consulting the installer identified below. Failure to do so will invalidate this certificate. This certificate shall only remain valid subject to annual services/maintenance of the system.

Client Details	
Client name	
Installation details	
Completion date	18/01/2023
Contract ref	
Description of works	Supply, install and commission of 1 No. 10 level natural smoke shaft (Block B residential) and 1 No. 9 level Coltshaft variable unsprinklered commercial (Block C offices).
Scope of works	Full - Design, Install, Commission & Maintain Smoke Control System
Building type	Residential (dwellings)
Organisation Responsible for the Fire Strategy	
Phase	
Items in scope of work not completed and exceptions	
Results of commissioning tests	Block B - no further performance testing required. Block C - results of Commissioning Test recorded airflows over 100% refer to 1

Contractor Details			
Company name	Colt International Ltd	IFCC Certificate Number
Address	Colt House, Ridgeway Office Park Bedford Road Petersfield Hampshire GU32 3QF United Kingdom		
Phone	02392 451111		
Signatory for works		
Signature		Date	14/03/2023

