MAZE
FIRE CONSULTING

100 Gray's Inn Road
Fire Strategy Report
RIBA Stage 3

Issuing consultant: Alex Manning **Issue:** 01 **Date:** 30 May 2023
Project No: 220278 **Document No:** MZ-220278-04-FSS-01-ISS01

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Executive Summary

No.	Fire Safety Measure	Performance Standard
1	Evacuation Philosophy	The building will adopt a simultaneous evacuation strategy; this means that upon sounding of the alarm, all occupants within the building should begin their evacuation. No delay between alarm activation and evacuation is currently proposed.
2	Fire Detection system	Typically, a category M system is the minimum requirement for a building with a Risk Profile A2. However, this has been raised to a category L1 and shall be provided throughout this building in accordance with the guidance in BS 5839-1 to provide early notification of a fire to occupants. The increase in provision from a category M to an L1 fire alarm system permits variations to the means of escape approaches.
3	Audible Alarm system	Audible warning will be provided to the development using sounders in accordance with BS 5839-6.
4	Back-up Power Supply	Where such systems are required, power and control cables should be installed in accordance with BS 8519:2020.
5	Internal Fire Spread (Linings)	All internal linings shall limit the surface spread of flame when tested under the European classifications in accordance with BS EN 13501: Part 1.
6	Sprinkler System	Sprinkler protection is being provided due to CLT structure and will be provided in accordance with BS EN 12845.
7	Loadbearing Elements of Structure	A specialist fire engineering analysis has been conducted that calculated the burnout time of a performance-based fire in the building, due to the CLT structure. With the current design the fire will burnout in 92 minutes. This is less than the general requirement for structural fire protection requirements from BS 9999 of 120 minutes, and as such compliant.
8	External Fire Spread	Unprotected areas on each façade shall not exceed the maximum calculated area permissible.
9	Fire Service Access	Fire mains are required to be included as part of the works which means fire access should be provided to within 18m of each dry fire main inlet.
10	Firefighting Shaft	Fire Fighting shafts are to be provided. A minimum of two firefighting shafts with lifts are required. Fire fighting shafts should be located so that every part of every storey is no more than 60m from a fire main.
11	Fire Mains	The dry riser outlets should be placed within the fire-fighting lobbies, accessible at each floor. Further guidance on the design and construction of fire mains is given in BS 9990. The maximum hose laying length from the fire main outlet to the furthest point inside must be less than 60m.
12	Fire Hydrants	Existing fire hydrants are located within 100m of the proposed dry main inlets.
13	Emergency Lighting and Exit Signage	Emergency lighting should be in accordance with BS 5266-1. Emergency lighting must be automatic and provide a minimum of 1-hour illumination. Exit signage should be located and operated in accordance with BS 5499-4. The signs designated as E001 and E002 in BS EN ISO 7010:2012+A5 should be used with the appropriate directional arrow in accordance with BS 5499-4.
14	Portable Fire Extinguishers	Portable fire extinguishers should be provided as per the recommendations of BS 5306-8 and may be dependent upon a fire risk assessment of the building.
15	Smoke Management Systems	Various smoke management/control systems are required as follows: - Smoke and heat ventilation from Fire Fighting shafts - Ventilation to basement

The development is considered to comply with the Codes and Standards as listed within this document, provided that the recommendations within this report are adopted and the deviations from the prescriptive code requirements as listed below are accepted by the Authority having Jurisdiction (AHJ).

Note: The deviations from the prescriptive code requirements have been discussed with the Design Team. However, should the prescriptive code deviations not be accepted by the AHJ, then the proposed design will need to be revised to ensure prescriptive code compliance can be achieved.

Quality Management

Issue No.	Date			
01	30/05/2023	Reason for issue:	First issue	
		Prepared by:	Alex Manning Associate	
		Reviewed by	Andrew Martyn Principal Consultant	

Validity

This report is formulated on the basis of the information and experience available at the time of preparation. It is applicable to the above-mentioned project only in accordance with the client's instructions. It is only valid provided no other modifications are made other than those for which a formal opinion has been sought and given by Maze Fire Consulting Limited.

Project Office

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Contents

1. Introduction

1.1 Client and Project

Maze Fire Consulting Limited (referenced throughout This Report as 'Maze Fire') has been appointed by Global Holdings as a specialist fire and life safety consultant for the design of the 100 Gray's Inn Road in London, UK.

The ultimate client is Lawnmist Limited.

1.2 Project Address

100 Gray's Inn Road, London, UK.

1.3 Project Description

The project is understood to entail building work constituting a 'new build' development.

The 100 Gray's Inn Road features a 9 storey Office building with 1 level of basement. An indicative site layout of the scheme is shown in the Figure below.

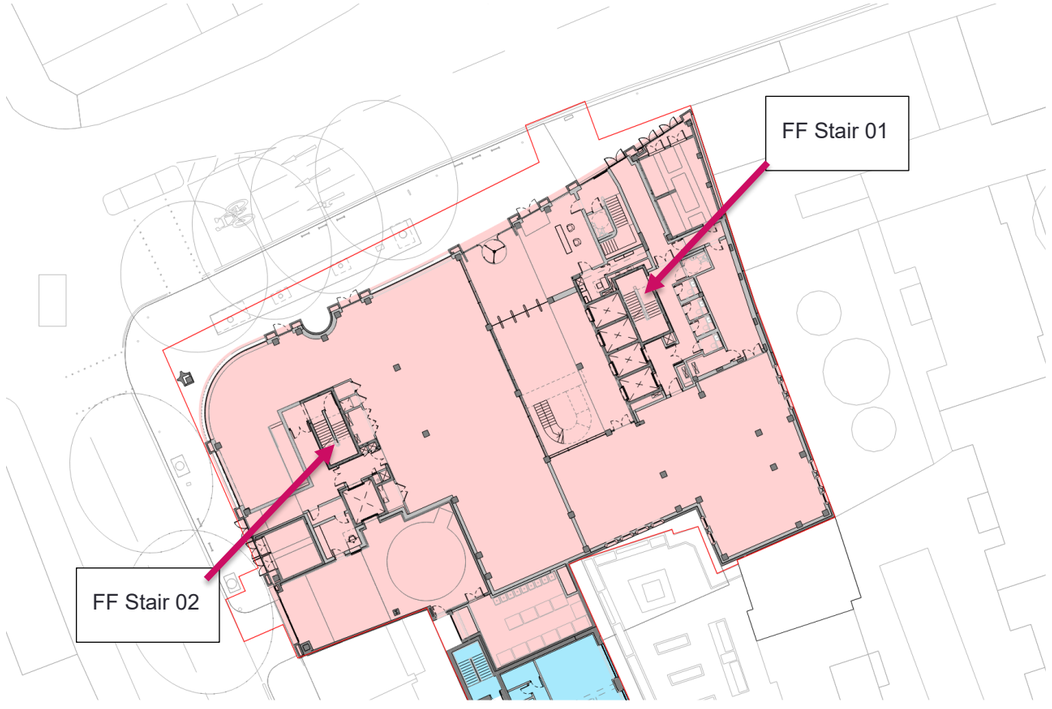


Figure 1 – Proposed Site Plan

1.4 Description of Work

This fire safety strategy (hereby referenced as 'This Report') covers the fire safety design of the entirety of the scheme described herein.

Services during Detailed Design stage will focus on delivering a Detailed Design fire strategy report which records the developing details of the fire safety strategy. It also records fire safety design decisions, key risks, possible mitigation steps and addresses compliance with the appropriate Statutory Framework to provide a reasonable standard of fire and life safety for the building occupants. The report may be used to support the building regulation application.

This Report presents a performance specification of the fire safety measures provided in the design in order to satisfy the fire regulations. For the purposes of This Report, the fire safety objectives are for the design to meet the regulatory requirements described in Section 1.8

1.5 Authority Having Jurisdiction

The authority having jurisdiction for the project will be Sweco Building Control.

1.6 Stage of Project

The project follows the RIBA Plan of Work to coordinate the overall brief, design, construction and operation of the building.

This Report has been based on the design information provided by others, as described in Section 1.9 The project is currently at RIBA Detailed Design and This Report represents a fire safety strategy to a " stage of works.

1.7 Limits of Report

It is important to note that This Report does not represent a detailed design or specification of all aspects of a building; it is a series of recommendations that others may consider and relate to the design of the scheme. The information contained herein constitutes a performance specification and therefore does not address detailed aspects of design, such as system design (active or passive) nor construction details.

This Report has been developed with reference to statutory guidance documents and their impact on the strategic aims of the Fire Strategy. This Report will reference relevant design standards however it is not practical to reproduce all details contained within those documents.

Where a detailed design has to be developed by others, on the basis of this performance specification, it would be appropriate for the reader to refer to, and read in conjunction with, those documents referenced in This Report.

Any diagrams incorporated into This Report are illustrative and intended to further convey specific aspects of the fire safety strategy only. Diagrams are not a substitute for the architectural general arrangement, fire strategy drawings or the detailed systems drawings and specifications, which should be referred to in conjunction with This Report.

This Report is primarily concerned with life safety. Property protection is not specifically considered although the fire safety provisions described herein will offer some inherent degree of property protection by nature. Unless otherwise specified, the information herein does not specifically address:

- Insurance requirements
- Property protection or loss of operation
- Fire safety during construction
- Detailed management procedures or duties under the Regulatory Reform (Fire Safety) Order (RRO).

It is noted that This Report addresses so far as necessary, the evacuation of persons with restricted mobility. This Report however does not address the requirements of any specific accessibility issues (outside of those directly related to means of escape) and separate advice should be sought from others on this topic accordingly.

While arson as a single point of ignition will be incorporated in the analysis, simultaneously multiple ignition sources, use of accelerants, sabotage of fire protection systems or terrorism are not included as part of This Report scope.

It should however be noted, as is advised, that when requested to develop alternative fire safety design solutions for the project, fire and smoke damage may vary when compared to a building design that wholly complies with the prescriptive guidance.

It is recommended that the building owners or occupiers liaise with their relevant insurers as to the fire safety design contained herein.

This Report has been developed for Detailed Design and represents a fire safety strategy to a '' stage of works. It is limited to the scope of works as defined for Detailed Design in our fee proposal dated 04 Jan 2023.

1.8 Regulatory Framework

1.8.1 General

The following legislation has been considered in the preparation of this fire safety strategy.

1. The Building Regulations 2010
2. The Building (Amendment) Regulations 2018
3. The Regulatory Reform (Fire Safety Order) 2005
4. The Construction (Design and Management) Regulations 2015

1.8.2 The Building Regulations

The building will be subject to the operation of the Building Regulations 2010 (as amended) and will therefore need to comply with the requirements of Schedule 1 Part B of The Regulations relating to, the following areas.

- B1 – Means of Warning and Escape
- B2 – Internal Fire Spread (Linings)
- B3 – Internal Fire Spread (Structure)
- B4 – External Fire Spread
- B5 – Access and Facilities for the Fire Service.

The Ministry of Housing, Communities and Local Government (MHCLG) has produced a number of guidance documents to assist designers in meeting the relevant requirements of the Building Regulations; these 'Approved Documents' provide guidance on different aspects of the Regulations.

Approved Document B – Volumes 1 and 2 (ADB) provide design guidance on ways in which the functional fire safety requirements can be satisfied. However, the document is intended to provide guidance on the more common building situations and there is no obligation to adopt any particular solution contained in an Approved Document if the relevant requirement can be met in some other way for example by using the following, as applicable:

- the guidance contained within British Standard 9999 Fire Safety in the design management and use of buildings – Code of practice (BS 9999) and / or
- British Standard 9991 Fire safety in the design, management and use of residential buildings. Code of practice (BS 9991).

Regulation 38

Regulation 38 of the Building Regulations states that, where building work involves the erection or extension of a relevant building or relevant change of use of a building which affects fire safety, it is necessary that the fire safety information for the building shall be given to the Responsible Person at the completion of the project or when the building or extension is first occupied. This is to be provided to the Responsible Peron by the person carrying out the work.

This information will facilitate the production of the fire risk assessment which is a requirement of the Regulatory Reform (Fire Safety) Order, outlined below. The list of information considered in the preparation of This Report should be provided with This Report as detailed in Section 1.9. The fire safety information in this fire safety strategy may be used to supplement the information required to be given to the responsible person. As a minimum it will be necessary for the occupier of the building to be given this fire safety strategy and all 'as built' fire strategy plans.

1.8.3 Applied Guidance to the Building Regulations

This fire safety strategy adopts the following guidance as the basis of design for the project, noting the scope and limits of This Report outlined in this chapter.

Approved Document B

ADB Volume 2 gives guidance on each of the technical parts of the regulations with respect to buildings other than dwellings.

The Approved Documents provide guidance for common building situations. In addition to guidance, some approved documents include or refer to provisions that must be followed exactly, as required by regulations or where methods of test or calculation have been prescribed by the Secretary of State. See notes on Regulation 38 above as an example. Each approved document relates only to the particular requirements of the Building Regulations 2010 that the document addresses. However, building work must also comply with all other applicable requirements of the Building Regulations 2010 and all other applicable legislation.

BS 9999: 2017

British Standard 9999: 2017 Fire Safety in the design management and use of buildings – Code of practice uses a risk based approach to fire safety in buildings. It defines a number of 'Risk Profiles' depending on the type of occupancy, building contents and the provision of automatic fire detection and / or suppression. The recommended fire safety measures for a building, including specifications for means of escape and fire resistance ratings, depend on the Risk Profile.

For a given Risk Profile, the standard lays down a "minimum package" of fire safety measures, including specifications for fire detection and warning systems and provisions for the protection of escape routes. Certain additional measures – notably enhanced fire detection and warning systems – will allow relaxations (within defined limits) of some of the requirements for means of escape.

This fire safety strategy has adopted BS 9999 as the basis of the design.

Performance Based Design

Where aspects of the design deviate from the above design guidance, fire safety engineering analyses are carried out to demonstrate compliance with the functional requirements of the building regulations or equivalence to the prescriptive guidance.

1.8.4 The Regulatory Reform (Fire Safety) Order 2005

The operation of the building will be subject to The Regulatory Reform (Fire Safety) Order 2005, (FSO).

Responsibility for complying with the FSO rests with the "responsible person" as defined by Article 3, reproduced as follows:

(1) *in relation to a workplace, the employer, if the workplace is to any extent under his control;*

(2) *in relation to any premises not falling within paragraph (a)—*

a. the person who has control of the premises (as occupier or otherwise) in connection with the carrying on by him of a trade, business or other undertaking (for profit or not); or

b. the owner, where the person in control of the premises does not have control in connection with the carrying on by that person of a trade, business or other undertaking.

If there is more than one responsible person in any type of premises, all must take reasonable steps to work with each other.

Under the FSO, the Responsible Person must carry out an assessment of the risks stemming from the possibility of fire in the premises and must implement fire precautions where necessary to the extent that is reasonable and practicable to control those risks.

On occupation of the building, or part thereof, the 'responsible person' as defined in the FSO is required by law to undertake a 'suitable and sufficient' fire risk assessment. This fire safety strategy will not satisfy this obligation; instead it should be used as a basis for understanding the fire safety provisions provided in the

building in order to undertake the risk assessment. The fire risk assessment will help identify risks that can be removed or reduced and to decide the nature and extent of the general fire precautions that need to be taken to protect people against the fire risks that remain. It should pay particular attention to those at special risk, such as the disabled and those with special needs, and must include consideration of any dangerous substance likely to be on the premises.

1.8.5 Construction (Design and Management) Regulations 2015

The Construction (Design and Management) Regulations 2015 (CDM) are applicable for the design and construction stages of this project. The CDM aims to integrate health and safety into the management of the project and to encourage everyone involved to work together to

- Improve the planning and management of projects from the very start.
- Identify hazards early on, so they can be eliminated or reduced at the design or planning stage and the remaining risks can be properly managed.
- Target effort where it can provide the most benefit in terms of health and safety.
- Discourage unnecessary bureaucracy.

These Regulations are intended to focus attention on planning and management throughout construction projects, from design stage and onwards. The aim is for health and safety considerations to be treated as an essential, but normal part of a project's development - not an afterthought or bolt-on extra.

Guidance on fire safety for construction sites is given in the HSE publication HSG 168 however does not form part of this fire safety strategy. Where our role on the project involves the preparation or modification of designs, this will be undertaken in conjunction with the project's principal designer and CDM Coordinator to ensure that any foreseeable risks during construction and the maintenance and use of the building are sufficiently controlled. These risks will typically be summarised in the principal designer's or principal contractor's risk register.

1.9 Information Considered

The following information has been considered in the preparation of this fire safety strategy.

- Architectural drawings prepared by Piercy & Company as listed in the table below
- Fire Safety Strategy drawings for the project, prepared by Piercy & Company.
- *Design for burnout (analysis of likely auto-extinction) and radiation to neighbouring buildings* Report undertaken by Ignis

Table 1: Referenced Architectural Drawings

No.	Title	Revision	Date
13636-PCO-XX-XX-DR-A-00-002	Proposed Site Plan	P02	31/03/2023
13636-PCO-100-00-DR-A-03-099	Proposed GA Plan - Level B01	P05	31/03/2023
13636-PCO-100-00-DR-A-03-100	Proposed GA Plan - Level 00	P05	31/03/2023
13636-PCO-100-00-DR-A-03-101	Proposed GA Plan - Level 01	P05	31/03/2023
13636-PCO-100-00-DR-A-03-102	Proposed GA Plan - Level 02	P05	31/03/2023
13636-PCO-100-00-DR-A-03-103	Proposed GA Plan - Level 03	P05	31/03/2023
13636-PCO-100-00-DR-A-03-104	Proposed GA Plan - Level 04	P05	31/03/2023
13636-PCO-100-00-DR-A-03-105	Proposed GA Plan - Level 05	P05	31/03/2023
13636-PCO-100-00-DR-A-03-106	Proposed GA Plan - Level 06	P05	31/03/2023
13636-PCO-100-00-DR-A-03-107	Proposed GA Plan - Level 07	P05	31/03/2023
13636-PCO-100-00-DR-A-03-108	Proposed GA Plan - Level 08	P05	31/03/2023
13636-PCO-100-00-DR-A-03-109	Proposed GA Plan - Level 09	P05	31/03/2023
13636-PCO-100-00-DR-A-03-110	Proposed GA Plan - Roof	P05	31/03/2023

Any change in the information listed above to suit future re-organisation will require further assessment to confirm compliance with the intent of the design objectives, and a potential revision of This Report or a subsequent Fire Strategy may be required.

Table 1: Referenced Fire Safety Strategy Drawings

No.	Title	Revision	Date
13636-PCO-100-00-DR-A-08-099	Fire Strategy - Level B01	P03	31/03/2023
13636-PCO-100-00-DR-A-08-100	Fire Strategy - Level 00	P03	31/03/2023
13636-PCO-100-00-DR-A-08-101	Fire Strategy - Level 01	P03	31/03/2023
13636-PCO-100-00-DR-A-08-102	Fire Strategy - Level 02	P02	31/03/2023
13636-PCO-100-00-DR-A-08-105	Fire Strategy - Level 05	P03	31/03/2023
13636-PCO-100-00-DR-A-08-108	Fire Strategy - Level 08	P03	31/03/2023
13636-PCO-100-00-DR-A-08-109	Fire Strategy - Level 09 Roof Terrace	P03	31/03/2023

1.10 Record of Statutory Consultation

At the date of issue of this document, formal consultation has taken place with Sweco Building Control with respect to the building regulations application, including a Qualitative Design Review (QDR) that took place on 12/12/2022, and subsequently documented in the Maze Fire report: 100 Gray's Inn Road Initial QDR Report (ref: MZ-220278-004-QDR-01-ISS01).

It is common practice for the building control body to consult with the relevant fire authority, being the Fire Service, noting formal consultation has not been advised to have taken place. A key part of the purpose of statutory consultation with the fire authority is to allow observations to be made in regard to the proposals for the scheme with respect to the functional requirements of the Building Regulations and provide for an opportunity to make the applicant aware of actions that may have to be taken to meet the subsequent requirements of the FSO.

The consultation period should allow for agreement that the functional requirements of the Building Regulations are being met, and where possible via a collaborative process with all stakeholders involved where possible.

1.11 Project Stakeholders

This Report has been developed with the relevant project stakeholders as identified in the table below:

Table 3: Project Stakeholders

Organisation	Role
Sweco Building Control	Authority Having Jurisdiction
Piercy & Company	Architecture and Planning
Max Fordham	MEP Engineer
Heyne Tillett Steel	Structural Engineer
Maze Fire Consulting Ltd.	Fire and Life Safety Engineer
IGNIS	Specialist Fire Engineer for CLT Structure
Lawnmist Limited	Client

1.12 Reference Documents

Figure 1outlines the key codes and standards that will be used as a basis of design. This list is not exhaustive. Where referenced in This Report, codes and standards will follow the guidance of the editions outlined.

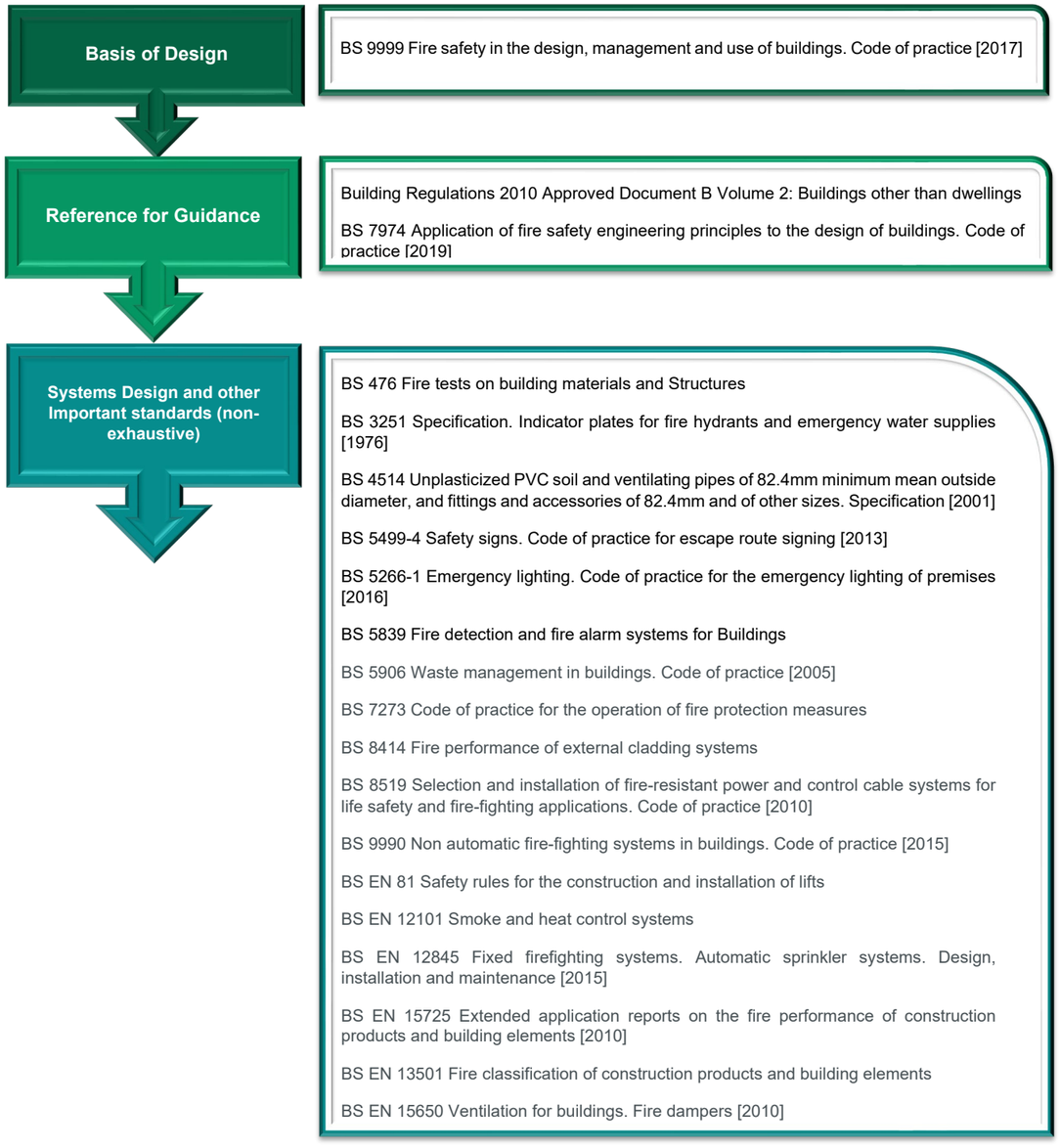


Figure 2: Design Basis

2. Building Characteristics

2.1 General Site Description

The project site is located at 100 Gray's Inn Road, London, UK.

The following building particulars have been used in the development of this fire safety strategy:

- Number of Storeys: 1 basement and 9 above grade (incl. ground)
- Height of the building: 35.37m
- Height of floor of top storey above ground level: 28.86m to Level 08 (internal), 32.37m to Roof Terrace
- Approximate Floor Area: 1500m²

2.2 Function or Use of the Building

2.2.1 BS 9999 Risk Profile

Building uses are classified within different risk profiles, which represent different levels of hazard (as described in Section 6.1 of BS 9999). A risk profile should reflect the occupancy characteristic and the fire growth rate. A risk profile can apply to a whole building or to a compartment within the building and should relate to the main use of the building or compartment.

The building is primarily considered to be of Occupancy Characteristic A - Occupants who are awake and familiar with the building.

The fire growth rate should be categorised in accordance with Table 3 of BS 9999 and is primarily considered to be a medium growth rate (Category 2). However the proposed exposed cross-laminated timber (CLT) structure (see Section 2.4.4) is considered to increase this overall growth rate to fast (Category 3).

As sprinklers are being provided this growth rate can be reduced by one level giving a final building Risk Profile of A2.

The Retail/Restaurant unit will be Risk Profile B2, as it is for Occupants who are awake and familiar with the building.

2.3 Materials of Construction and Structural Characteristics

We have been advised by Piercy & Company that the general building construction materials will be cross-laminated timber (CLT) for the structure and floors supporting the building, with concrete cores and brick-slip facades.

2.4 Fire Hazards

2.4.1 General Layout

The internal layout as indicated on the architectural drawings developed at the time of This Report, meets the requirements of BS 9999 and is satisfactory in respect of signing and wayfinding of emergency routes for escape and firefighting equipment and access. Therefore, it does not result in any apparent way finding difficulties within the public or private areas of the 100 Gray's Inn Road.

2.4.2 Activities

Activities are considered to be consistent with a building containing mainly Office occupancies. No processes or activities have been identified that indicate excessive fire risks.

2.4.3 Ignition Sources

Typical ignition sources comprise the following:

- Office equipment - Personal Computers, Copiers/ Printers, Vending equipment etc
- Smoking related materials - lighters etc
- Cooking appliances - Grill/Toaster, Microwave oven, Ring/hot plate etc
- Space heating appliances
- Central and water heating appliances
- Electrical distribution - batteries, generators, Wiring, cabling, plugs, Heating equipment etc
- Electric lighting - Fluorescent lights, Spotlights etc
- Other appliances - Audio equipment, Battery charger, Kettle, TV, Hoover, etc

The potential ignition sources are expected to be consistent with well managed Office building types.

2.4.4 Unusual or High Hazard Factors

CLT structures are considered to be a higher fire risk than other types of construction, as ultimately the timber is combustible. Detailed fire engineering calculations have therefore been performed by a specialist consultant, IGNIS, to perform an auto-extinguishment analysis (or "burnout calculations") for the office parts of the building, partially made of exposed CLT, as well as an external fire spread radiation calculation to the neighbouring buildings. The detailed analysis is contained in the report "*Project: 100 & 88 Gray's Inn Road / 127 Clerkenwell Road, London (UK) Fire Design of Structural Timber – Design for burnout (analysis of likely auto-extinction) and radiation to neighbouring buildings*", Version 0, dated 11/04/2023 by IGNIS.

3. B1 – Means of Warning and Escape

3.1 Functional Requirement of the Building Regulations

The functional requirement contained within Schedule 1 Part B1 of The Building Regulations states that:

(1) *The building shall be designed and constructed so that there are appropriate provisions for the early warning of fire, and appropriate means of escape in case of fire from the building to a place of safety outside the building capable of being safely and effectively used at all material times.*

3.2 General Philosophy

The general principle to be followed when designing for means of escape is that when occupants are confronted by fire within a building they can turn away and walk to a place of safety in a different direction by their own unaided efforts. Escape in a single direction is only allowed when the distances are short and people could be expected to escape before the fire becomes large enough as to block the escape route.

3.3 Evacuation Policy

The building will adopt a simultaneous evacuation strategy; this means that upon sounding of the alarm, all occupants within the building should begin their evacuation. No delay between alarm activation and evacuation is proposed.

3.4 Classification of Occupancy

The building is considered to be primarily of Office i.e. large occupancy (Risk Profile A2). It will also contain ancillary occupancies as outlined below:

- Shop and Commercial: Shop/retail/trade (B2)
- Industrial: Plant Rooms (A3)
- Storage and other non-residential: Loading Bay (A3), Staff changing/locker room (A3), Cleaners' room (A3), Storage (A3)

3.5 Means of Warning

In accordance with BS 9999 the minimum standard of fire alarm should be based on the Risk Profile of the building.

Typically, a category M system is the minimum requirement for a building with a risk profile A2. However, this has been raised to a category L1 and shall be provided throughout this building in accordance with the guidance in BS 5839-1, to provide early notification of a fire to occupants. The increase in provision from a category M to an L1 fire alarm system can permit variations to the means of escape approaches, however it has been decided not to do so due to the CLT structure risk.

An L1 category is specified as systems installed throughout all areas of the building. The objective of a Category L1 system is to offer the earliest possible warning of fire, so as to achieve the longest available time for escape.

3.6 Horizontal Means of Escape

The horizontal means of escape considers the escape from any point on a level to a storey exit on that level.

The means of escape design depends on the occupancy, occupancy numbers, number of escape routes, escape route widths and travel distances.

3.6.1 Occupancy Load Factors

The occupancy numbers for each floor are based on a floor space factor as given in Table 9 of BS 9999 or if occupancy numbers are known then the designed occupancy number will be used.

Table 4: Main Occupancy Occupant Load Requirement

Occupancy	Occupant Floor Space Factor (m^2/person)
Office i.e. large occupancy	6
Shop/retail/trade	2
Loading Bay	2 per space
Staff changing, locker room, Reception, Plant, Storage	30

3.6.2 Occupancy Calculations

The total occupant load has been calculated and represented in the table below, for each floor.

Table 5: Occupancy Numbers

Floor	Area (m^2)	Occupancy (people)
Basement – Retail/Restaurant	142	71
Basement – Plant Areas	501	17
Basement – Staff/Cycle store	183	6
Level 00 – Reception	196	7
Level 00 – Office	256	43
Level 00 – Retail/Restaurant	438	219
Level 00 – Loading Bay and Refuse Store	185	3
Level 01 – Office	1038	173
Level 02 – Office	1084	181
Level 03 – Office	1049	175
Level 04 – Office	1018	170
Level 05 – Office	989	165
Level 06 – Office	986	165
Level 07 – Office	986	165
Level 08 – Office	843	141
Level 09 – Rooftop Terrace	340	57*

Note *: These people are from the lower floors, and are therefore not included in the overall upper building occupancy calculations.

3.7 Number of Escape Routes

The minimum number of exits permitted per room or storey is described in the table below in accordance with the requirements of BS 9999. Additional exits may be required to meet the travel distance or common path of travel requirements outlined in the travel distance section of This Report.

Table 6: Required number of escape routes and exits – BS 9999 Table 10

Maximum number of persons	Minimum number of escape routes/exits
60	1
600	2
More than 600	3

3.8 Minimum Width of Escape Routes / Storey Exits

Minimum widths of egress are given in the following table based on Section 16.6.1 of BS 9999. However, doors should have an absolute minimum width of 850mm regardless of the risk profile.

There is also a clause that restricts capacities further with any door less than 1050mm in clear width. However, all major storey exit doors will be provided with 1050mm clear openings

Measurements from the plans provided suggest that this requirement is met, but this should be confirmed by the architect.

Table 7: Minimum Exit Widths

Floor	Occupancy (people)	Min. exit width per person (mm/person)	Min. Exit Width Required	Provided
Basement – Retail/Restaurant	71	4.1	2 x 1050mm	Yes
Basement – Plant Areas	17	4.6	850mm each	Yes
Basement – Staff/Cycle store	6	4.6	850mm each	Yes
Level 00 – Reception	7	3.6	850mm each	Yes
Level 00 – Office	43	3.6	1050mm	Yes
Level 00 – Retail/Restaurant	219	4.1	2 x 1050mm	Yes
Level 00 – Loading Bay and Refuse Store	3	4.6	850mm	Yes
Level 01 – Office	173	3.6	2 x 1050mm	Yes
Level 02 – Office	181	3.6	2 x 1050mm	Yes
Level 03 – Office	175	3.6	2 x 1050mm	Yes
Level 04 – Office	170	3.6	2 x 1050mm	Yes
Level 05 – Office	165	3.6	2 x 1050mm	Yes
Level 06 – Office	165	3.6	2 x 1050mm	Yes
Level 07 – Office	165	3.6	2 x 1050mm	Yes
Level 08 – Office	141	3.6	2 x 1050mm	Yes
Level 09 – Rooftop Terrace	57	3.6	1050mm	Yes

Some exit doors are proposed to be inward opening i.e. the open against the flow of escape. This would normally restrict the capacity to a maximum of 60 people through these doors, regardless of the width. This would be the case for the pass door from Reception.

However, it is proposed that the exit doors from the Retail/Restaurant Unit on Level 00 will be powered open on fire alarm activation, as well as a fail-safe option. This will significantly reduce the risk of queuing occurring as the doors will be opened allow a free flow for escape to occur.

3.9 Travel Distance and Escape Routes

The limitations on travel distance are given in Table 11 of BS 9999 and represented in the following table.

Where the internal layout of partitions and fittings, etc. is not known at this time, direct distances have been assessed, these distance limits apply to the nearest storey exit.

Table 8: Main Occupancy Travel Distance requirements

	One directiononly (m)		More than onedirection (m)	
Risk Profile	Direct (Unknown)	Actual	Direct (Unknown)	Actual
A2	15	22	37	55
A3	12	18	30	45
B2	13	20	33	50

3.10 Vertical Means of Escape

The stairs should be protected stairs, enclosed in fire resisting construction.

3.10.1 Facilities for Mobility Impaired Persons

Consideration should be given to the management procedure for the evacuation of disabled persons.

Personal emergency evacuation plans (PEEPs) are recommended for all people requiring assistance to leave the building. These procedures should be detailed within the documentation required to meet Regulation 38. See Section 1.8.2.

Visitors who are likely to require assistance in the event of an evacuation should be encouraged to make themselves known to staff on arrival. Management should be encouraged to have available, especially at reception, staff who are trained in disability awareness. This will make this process more comfortable for disabled people and more effective for management. The generic PEEPs should provide a wide range of guidance for differing disabilities and be adapted for the individual premises. They need to include what the visitor should do in an evacuation, and what the management response will be. They should also reflect what specific fire safety provisions are provided for disabled persons on the premises, e.g. fire alarms adapted for people who are deaf and hard of hearing. It is important that the generic PEEP is discussed with each visitor and their particular needs taken into account where possible.

A refuge should be provided for each protected stairway affording egress from each storey. Each refuge should provide an area accessible to a wheelchair with minimum dimensions of 900mm x 1400mm. To enable wheelchair users to manoeuvre themselves into the refuge, the door width should have a clear opening of not less than 850mm, and the corridor width should be not less than 900mm. Refuges are permitted to be located in protected lobbies or protected corridors; however, it should be ensured that the wheelchair space does not

reduce the width of the escape route. Where the wheelchair space is located within the protected stairway access to the wheelchair space should not obstruct the flow of persons escaping.

Refuges should be clearly identified by appropriate fire safety signs and an emergency voice communication (EVC) system should be provided so that occupants of the refuge can alert the management of the building that they need assistance, and so that they can be reassured that assistance will be provided. The EVC system should comply with BS 5839-9, consisting of Type B outstations which communicate with a master panel located adjacent to the main fire alarm panel.

One lift in each escape core will be designated as an evacuation lift, which can be used by the management to evacuate persons from refuges down to ground. The evacuation lift will need to be designed in accordance with Annex G of BS 9999.

3.10.2 Width of Escape Stairs

The absolute minimum for escape stairs should no less than 1100mm for downward travel, as both stairs are for fire-fighting purposes, and 1200mm for upward travel.

The required width of the escape stairs depends upon how many stairs are available for means of escape, the number of people needing to use the stairs and the evacuation strategy.

The total minimum width of all escape stairs is calculated as 1.7mm per person as per Table 13 of BS 9999, which for the upper levels is therefore (1335x1.7) = 2270mm. Two 1200mm wide, lobby-protected stairs are provided, which therefore means 2400mm of total width is provided.

The minimum 1200mm clear width of the two stairs will also be more than sufficient for the Basement occupancy of 23 people.

The Retail/Restaurant will need to provided their own internal stair to assist in the evacuation of the Basement level.

3.10.3 Final Exits

The width of the final exit route from the stair to outside should be at least as wide as the minimum required width of the escape route it serves (1200mm). For the fire-fighting stairs, the final exit will need to be at least 500mm wider than required for escape to allow the fire-fighters to enter the building; therefore the final exits will be at least 1700mm in clear width.

3.10.4 Enclosure of Stairs

The stair should be a protected stair, enclosed in fire resisting construction (REI 120 to each side separately), leading to a final exit.

3.10.5 Basement Stairs

Where multiple escape stairs serve the upper storeys, only one needs to end at ground level, which will be FF Stair 02. Fire compartmentation is provided in FF Stair 02 to separate the flight of stairs leading down to the Basement. Other stairs may connect with the basement storeys if there is a protected lobby or a protected corridor between the stairs and accommodation at each basement level.

3.10.6 Construction of Escape Stairs

The flights and landings of the escape stair should be constructed of materials achieving Euroclass A2 or better (limited combustibility). Materials achieving Euroclass B or worse may be added to the top horizontal surface.

3.10.7 Protected Lobbies/Corridors

As per BS 9999 17.2.4 the following situations have meant that protected lobbies or protected corridors should be provided at all storeys above ground, except the top storey:

- The stair serves an occupiable storey greater than 18m above ground level.
- The stair is a firefighting stair.

A protected lobby should be provided between an escape stair and a place of special fire hazard to protect from the ingress of smoke. This lobby should have a minimum 0.4m² of permanent ventilation or be protected by a mechanical smoke control system. All ancillary accommodation, with the exception of communal lounges, common amenity areas and transformer, switchgear and battery rooms for low voltage or extra low voltage equipment, should be treated as places of special fire hazard.

3.10.8 Use of Space Within Protected Stairs

If sanitary accommodation opens into the protected stairway, it must not be used as a cloakroom. A gas water heater or sanitary towel incinerator may be installed in the accommodation, but no other gas appliances may be installed.

3.10.9 Lift Installations

Generally, lifts should not be used within a building when there is a fire situation, unless their use forms part of a management plan for evacuating people and the lifts are appropriately sited and protected with safety features to ensure they remain usable during a fire.

However, as part of The London Plan 2021 requirements, an evacuation lift will be provided in each staircore, with the entrance off the fire-fighting lobbies. In the FF Stair 02 the fire-fighting lift will also be usable for evacuation, whilst in FF Stair 01 the evacuation lift will be a separate lift to the fire-fighting lift.

Guidance on the design and use of evacuation lifts is given in Annex G to BS 9999.

All lifts that open directly onto an accommodation space will be provided fire/smoke curtains that will close on fire alarm activation in lieu of protected lobbies.

3.11 Sprinklers

Sprinkler protection will be provided due the increased risk associated with the CLT structure. The system will be designed by a specialist in accordance with BS EN 12845 to meet the sprinkler hazard classification requirements of a Category OH3 system.

The final design and validation of the sprinkler system would be subject to the appointed 3rd party specialist sprinkler contractor in due course.

3.12 Protected Escape Routes and BS 7671:2008 + A2:2022

Electrical services should generally be installed and maintained in accordance with BS 7671:2018+A2:2022. It should be noted that Amendment 2 to the guidance, current as of 28th September 2022 and published more recently than BS 9999, places in Section 422.2 additional restrictions on the presence of cables and other electrical equipment within 'protected escape routes' of fire-fighting shafts. It is recommended that the electrical engineer for the project be made aware by the design team of this fire strategy in order that their detailed design can be appropriately harmonised, taking into account any protected escape routes and the restrictions which will apply.

3.13 General Provisions

The following general provisions should be provided to all escape routes:

3.13.1 Headroom in Escape Routes

All escape routes should have clear headroom of not less than 2m.

3.13.2 Doors on Escape Routes

All doors on escape routes should not be fitted with lock, latch or bolt fastening, and are to be provided with simple fastenings i.e. thumb turns or push pads to allow them to be open. Any security devices should be provided with an over-ride that allows them to release without a key/fob.

Electrically powered locks should return to the unlocked position if the fire detection and alarm system operates, there is loss of power/system error or the security mechanism override is activated.

Security mechanism overrides for electrically powered locks should be a Type A call point as described in BS 7273-4. The call point should be positioned on the side approached by people escaping. If the door provides escape in either direction, a call point should be installed on both sides of the door.

The door of any doorway or exit should always be hung to open in the direction of escape if the number of persons that might be expected to use the door at the time of a fire is more than 60 (see also Section 3.8)

Where doors are hung to swing both ways, they should be fitted with vision panels. Vision panels are also required if the door is dividing a corridor on an escape route.

3.13.3 Emergency Lighting

Emergency escape lighting will be installed to provide temporary illumination in the event of failure of the primary power supplies to the normal lighting system. As part of the emergency lighting system, escape lighting will be provided to ensure the escape routes are sufficiently illuminated to enable occupants to escape. Additionally, emergency escape lighting will be provided as follows:

Table 9: Provisions for Emergency Lighting

Use of the building or part of the building	Areas requiring escape lighting
Office / Industrial / Storage and other non-residential	Underground or windowless accommodation
	Stairs either: • in a central core • that serve storey(s) more than 18m above ground level
	Internal corridors more than 30m long
	Open-plan areas of more than 60m²
Shop and Commercial	Underground or windowless accommodation
	Stairs either: • in a central core • that serve storey(s) more than 18m above ground level
	Internal corridors more than 30m long
	Open-plan areas of more than 60m
	All escape routes (other than the following exception) to which the public are admitted*. The exception is shops that meet all of the following: • have a maximum of three storeys • have no sales floor of more than 280m • are not a restaurant or bar
Any purpose groups	All toilet accommodation with a minimum floor area of 8m²
	Electricity and generator rooms
	Switch room/battery room for emergency lighting system
	Emergency control rooms

* Including external escape routes.

Typical mounting height of luminaires is at least 2m as specified in BS EN 1838. This may need adjusting based on effects of glare or specific smoke control strategies.

Emergency lighting should be in accordance with BS 5266-1. Emergency lighting must be automatic and provide a minimum of 1-hour illumination.

3.13.4 Exit Signage

Every doorway or other exit providing access to a means of escape, other than exits in ordinary use (e.g. main entrances), should be distinctively and conspicuously marked by an exit sign in accordance with BS ISO 3864-1 and BS 5499-4.

Exit signage should be located and operated in accordance with BS 5499-4. The signs designated as E001 and E002 in BS EN ISO 7010:2012+A5 should be used with the appropriate directional arrow in accordance with BS 5499-4.

Colorimetric and Photometric Requirements

Powered - internally illuminated escape route signs should be as follows:

- Colorimetric and photometric requirements specified in BS ISO 3864-4 Table 2 and the luminance contrast requirements specified in BS ISO 3864-4 Table 3 should be met.
- The minimum luminance of the safety colour green should be at least 2 cd/m² and the luminance of the contrast colour white 5 to 15 times that.
- The ratio of maximum to minimum luminance within either green or white should not exceed 10:1.
- Response times should conform to BS EN 1838.
- Durations should be the same as the Emergency Lighting.

Externally illuminated escape signs and unpowered internally illuminated escape route signs (i.e. normal lighting conditions) should meet the colorimetric and photometric requirements specified in BS ISO 3864-4 Table 1. The illuminance on any part of the face should not be less than 5 lux.

Sign Height and Viewing Distances

The maximum viewing distance normal to escape route signs should be determined from the sign height and distance factors using the recommendations given in BS 5499-4. The angle of viewing should also be considered when calculating these factors.

3.14 Primary and Secondary Power Supplies

To reduce the risk of the loss of electrical supply to fire protection systems that are required to operate continuously during a fire a secondary power supply should be provided. This supply should be of sufficient capacity to maintain supplies to all life safety and fire equipment installations. The secondary power system should be designed to operate safely in fire conditions. The means for the provision of a secondary supply should include the overall electrical distribution system within the building, and also the power needs for other equipment requiring a secondary power supply.

The management procedures for the building should prohibit the isolation of circuits supplying power to the above-mentioned equipment during a fire emergency.

Power supplies should meet the following specific recommendations:

- A secondary power supply independent of the primary power supply to the building, e.g. an automatically started generator or a supply from another substation, should be provided which, independently of the primary supply, is of sufficient capacity to maintain in operation for at least 3 h the following:
  - any powered smoke control systems (including systems using pressure differentials)
  - any fire and rescue service communication systems and
  - any other fire protection or fire-fighting equipment, except automatic fire detection and fire alarm systems and evacuation lifts.
- The secondary power supply should be capable of providing the power supply for the items detailed in the 3 points above within 15s of the failure of the primary electrical supply.
- Where the secondary electrical supply is to be taken from a separate substation (whether utility or private) to that supplying the primary electrical supply, the following criteria should be met.
  - The electrical supplies to the two independent substations should be taken from two separate high-voltage supplies, and not originate from the same substation.
  - The failure of one substation should not lead to the failure of the other.
  - The two independent substations should be adequately separated. Where the substations are located within the building they serve, the following criteria should be met:
    - Each substation should be enclosed within a fire-resisting structure having a minimum of 2 h fire resistance
    - The two substations should be located in two separate parts of the building.
  - Supply cables from the high-voltage substations should enter directly the high-voltage/low-voltage switch rooms and not pass through the building.
  - The two sets of supply cables should be adequately separated from each other to avoid a single fault affecting both supplies.
- Cables supplying current to the life safety installations should be installed in accordance with BS 7671 and the manufacturer's instructions. The cables should have an inherently high resistance to fire and be protected where necessary against mechanical damage. Cables, switchgear and other equipment transmitting the secondary power supply should be separate from those of the primary supply, or be physically protected so that a breakdown, or any cause of breakdown, on one supply would not lead to a simultaneous failure of the other supply.
- The primary and secondary power supply cables should be terminated in a changeover device located within the plant room(s) housing the life safety and fire protection equipment.
- The changeover device should automatically affect the transition from the primary to the secondary power supply if the primary supply to the particular plant fails.
- Any electrical substation or enclosures containing any distribution board, generator, powered smoke control plant, pressurization plant, communication equipment, and any other equipment associated with life safety and fire protection systems, should be separated from the building by construction with a duration of fire resistance of not less than 2 h.
- Secondary power supplies should be provided for the following:
  - sprinkler pumps
  - firefighters' lifts
  - fire-fighting shafts (associated equipment and normal lighting)
  - fire-fighting intercommunications installations
  - smoke control systems
  - evacuation lifts.

4. B2 – Internal Fire Spread (Linings)

4.1 Functional Requirement of the Building Regulations

The functional requirement contained within Schedule 1 Part B2 of The Building Regulations states that:

(1) *To inhibit the spread of fire within the building the internal linings shall –*

a. Adequately resist the spread of flame over their surfaces; and

b. Have, if ignited, a rate of heat release which is reasonable in the circumstances.

(2) *In this paragraph "internal linings" mean material lining any partition, wall, ceiling or other internal structure.*

4.2 Surface Linings

The interior wall and ceiling surfaces in a building can have a significant influence on how fast a fire may develop. It is particularly important that, in circulation spaces including staircases, where the rapid spread of fire is most likely to prevent occupants from escaping, surface linings are restricted by making provision for them to have low rates of heat release and surface spread of flame.

The wall and/or ceiling linings must satisfy the classifications given in Table 33 of BS 9999 when tested under the European classifications in accordance with BS EN 13501: Part 1.

Table 10: Classification of wall and ceiling linings

Area	European Class	National Class
Small rooms not exceeding 30m²	D-s3, d2	3
Other rooms	C-s3, d2	1
Other circulation spaces	B-s3, d2*	0

*Wall coverings which conform to BS EN 15102, achieving at least class C-s3, d2 and bonded to a class A2-s3, d2 substrate, will also be acceptable.

Note 1: when a classification includes 's3, d2' this means that there is no limit on the production of smoke or flaming droplets/particles.

Note 2: a product achieving a classification 'A' achieves a higher standard than the minimum classifications set out in the table above.

Parts of walls in rooms may be of lower performance than stated in the table above, but no worse than class D-s3, d2. In any one room, the total area of lower performance wall lining should be less than an area equivalent to half of the room's floor area, up to a maximum of 60m².

For the purposes of this requirement, a wall includes the internal surface of internal and external glazing (except glazing in doors) and any part of a ceiling which slopes at an angle greater than 70° to the horizontal.

A 'wall' does not include

- Doors and door frames.
- Window frames and frames in which glazing is fitted.
- Architraves, cover moulds, picture rails, skirtings and similar narrow members.
- Fireplace surrounds, mantle shelves and fitted furniture.

For the purposes of this requirement, a ceiling includes glazed surfaces, any part of a wall at 70° or less to the horizontal, the underside of a gallery or the underside of a roof exposed to the room below.

A 'ceiling' does not include

- Trap doors and their frames.
- The frames of windows or rooflights and frames in which glazing is fitted.
- Architraves, cover moulds, picture rails, exposed beams and similar narrow members.

4.3 Light Diffusers and Roof Lights

Where thermoplastic light diffusers in suspended ceilings or roof lights are used, these should meet the guidance detailed in BS 9999 Section 34.1.2 and 34.1.3.

Lighting diffusers which form part of a ceiling which are constructed of thermoplastic material may be incorporated in ceilings to rooms and circulation spaces, but not to protected stairways, if both of the following conditions are met:

- Except for the upper surfaces of the thermoplastic panels, wall and ceiling surfaces exposed in the space above the suspended ceiling should comply with the table above.
- Diffusers should be classified as one of the following:
  - TP(a) rigid - no restrictions on their extent.
  - TP(b) - limited in their extent (refer to Table 34 and Figure 39 of BS 9999).

5. B3 – Internal Fire Spread (Structure)

5.1 Functional Requirement of the Building Regulations

The functional requirement contained within Schedule 1 Part B3 of The Building Regulations states that:

(1) *The building shall be designed and constructed so that, in the event of fire, its stability will be maintained for a reasonable period.*

(2) *A wall common to two or more buildings shall be designed and constructed so that it adequately resists the spread of fire between those buildings.*

(3) *To inhibit the spread of fire within the building, it shall be sub-divided with fire-resisting construction to an extent appropriate to the size and intended use of the building comprising either or both of the following –*

a. *Sub-division of the building with fire-resisting construction;*

b. *Installation of suitable automatic fire suppression systems.*

(4) *The building shall be designed and constructed so that the unseen spread of fire and smoke within concealed spaces in its structure and fabric is inhibited.*

5.2 Loadbearing Elements of Structure

The period of fire resistance required is linked to the risk profile for the building taking into account the height of the top floor, depth of any basement and whether the building is sprinklered or not.

As the building is classified as Risk Profile A2 with a height to the rooftop terrace just over 30m, in accordance with Table 23 of BS 9999, 120 minutes fire resistance should be applied to the structure and for compartmentation purposes between floors. It should be noted that 120 minutes fire protection means that the structure/construction etc have been tested to withstand a standard fire test curve for the set period.

Due to the CLT structure increasing the fire risk within the building a performance-based fire design route has been chosen to determine the actual fire type/duration etc that is likely to occur in various worst-case scenarios. As part of the fire strategy, detailed fire engineering calculations of the CLT structure have been performed by a specialist consultant, IGNIS. The calculations performed are as follows

- An auto-extinguishment analysis (or "burnout calculations") for the office parts of the building, partially made of exposed CLT;
- An external fire spread radiation calculation to the neighbouring buildings (see Section 6.3 for further details).

The detailed analysis is contained in the report "Project: 100 & 88 Gray's Inn Road / 127 Clerkenwell Road, London (UK) Fire Design of Structural Timber – Design for burnout (analysis of likely auto-extinction) and radiation to neighbouring buildings", Version 0, dated 11/04/2023 by IGNIS.

This report has not been verified by Maze, but results of the burnout calculations indicate that a fire within the building will be auto-extinguished in 92 minutes. This report has concluded that no additional fire protection (other than that stated in the IGNIS report) needs to be applied to the CLT structure of to the floors to achieve compliance within regards to Part B3 of the Building Regulations. The report is to be reviewed by the Regulatory Authorities who will determine the design's compliance with Regulation B3.

5.3 Compartmentation

Compartment walls and floors should form a complete barrier to fire between the compartments they separate. Where a compartment wall or floor meets another compartment wall or external wall the junction should maintain the fire resistance of the compartmentation.

Key requirements are as follows:

- In accordance with Table 28 in BS 9999, the maximum floor area of any one storey in the building or any one storey in a compartment for a multi storey A2 building is unlimited, so long as the requirements of 'Typical Compartmentation Provisions' (below) are also met.
- As the building is greater than 30m, every floor will be a compartment floor.

5.3.1 Typical Compartmentation Provisions

The table below sets down typical compartmentation provisions for the scheme. Where walls are shared between fire separating elements, the higher standard of fire rating should be applied to the shared wall.

Table 11: Typical Fire resistance requirements

Area	Fire resistance of construction	Fire resistance of any doors (Integrity only)*
Compartment walls separating occupancies	REI 120 to each side separately	FD 120 S
Compartment walls	REI 120 to each side separately	FD 120 S
Protected shaft	REI 120 to each side separately	FD 120
Enclosure to a protected stairway	REI 120 to each side separately	FD 60 S
Firefighting shafts	REI 120 from the side remote from the shaft	FD 60 S
Construction that separates firefighting shaft from rest of building	REI 60 from the shaft side	FD 60 S
Construction that separates firefighting stair, firefighting lift shaft and firefighting lobby	REI 60 to each side separately	FD 60 S
Enclosure to a protected lobby	REI 30 to each side separately	FD 30 S
Enclosure to a protected corridor	REI 30 to each side separately	FD 20 S
Sub-division of a corridor	REI 30 to each side separately	FD 20 S
Construction that encloses places of special fire hazard	REI 30 to each side separately	FD 30
Fire resisting sub-division	REI 30 to each side separately	FD 20 S
Cavity barriers	E 30 and EI 15 to each side separately	FD 30
Ducts passing through cavity barriers	E 30 from the outside	FD 30
Casing around a drainage system	EI 30 from the outside	FD 30
Enclosure of any life-safety related equipment	REI 120 to each side separately.	FD 60

* S = Smoke resisting door, R = Loadbearing, E = Integrity, I = Insulation

5.3.2 Fire Doors

Fire doors should normally be self-closing unless they give access to cupboards or service risers, in which case they should be kept locked. Fire doors should meet the specified level of integrity but do not usually need to be insulated as there is no fire load immediately adjacent to a door.

Doors installed on site should conform, in dimensions and workmanship, to the manufacturer's specification for the appropriate fire resistance test report/assessment. Doors should be hung to ensure a good fit to the frame when closed, and the junction between door assembly and surrounding structure should be adequately sealed.

Security requirements should not override the need to provide adequate means of escape.

Integrated elements such as locks, letter plates and security viewers should not reduce the fire resistance of the door.

5.3.3 Securing of External Wall Cladding

Maze Fire is not aware of the external wall construction detail and have not been engaged to review this detail. If external cladding is used, this should be restrained at the junction of compartment walls and floors to resist movement in the event of fire.

5.3.4 Risers / Service Ducts / Shafts

Where any service risers pass through compartment floors, they should either be treated as protected shafts and enclosed in fire resisting construction equal to the compartment floor through which they are passing, or they should be fire stopped in line with the compartment floors.

5.3.5 Cavity Barriers

There are limits to the extent to which any cavities can exist, for example between walls and cladding and between ceilings and roofs. Cavity barriers should close gaps around windows and separate cavities on compartment lines.

Cavity barriers shall be provided in floor and ceiling voids (where these are present) to sub-divide the concealed space and reduce the potential for fire or smoke to spread over large areas of the building unchecked. They shall be located not more than 20m apart in the large open plan spaces and they shall be aligned with partition walls wherever practicable. In areas where there are smaller rooms cavity barriers shall be provided such that no undivided void is greater than 20m in any one direction. The maximum distance between cavity barriers must be reduced to 10m if the surfaces of the cavity do not have a Class 0 or Class 1 surface spread of flame rating.

Cavity barriers shall also be provided at the junction of compartment walls and other construction where there is a void and in other construction where there are large, concealed voids and around openings.

Cavity barriers shall be constructed to achieve at least 30 minutes fire resistance for integrity and 15 minutes fire resistance for insulation.

Where combustible insulations or other materials are in close proximity to the cavity barrier, the fire resistance of the cavity barriers will be increased to 30 minutes integrity and 30 minutes insulation.

Cavity barriers should generally be provided in accordance with Figure 35 of BS 9999 (reproduced in the following figure).

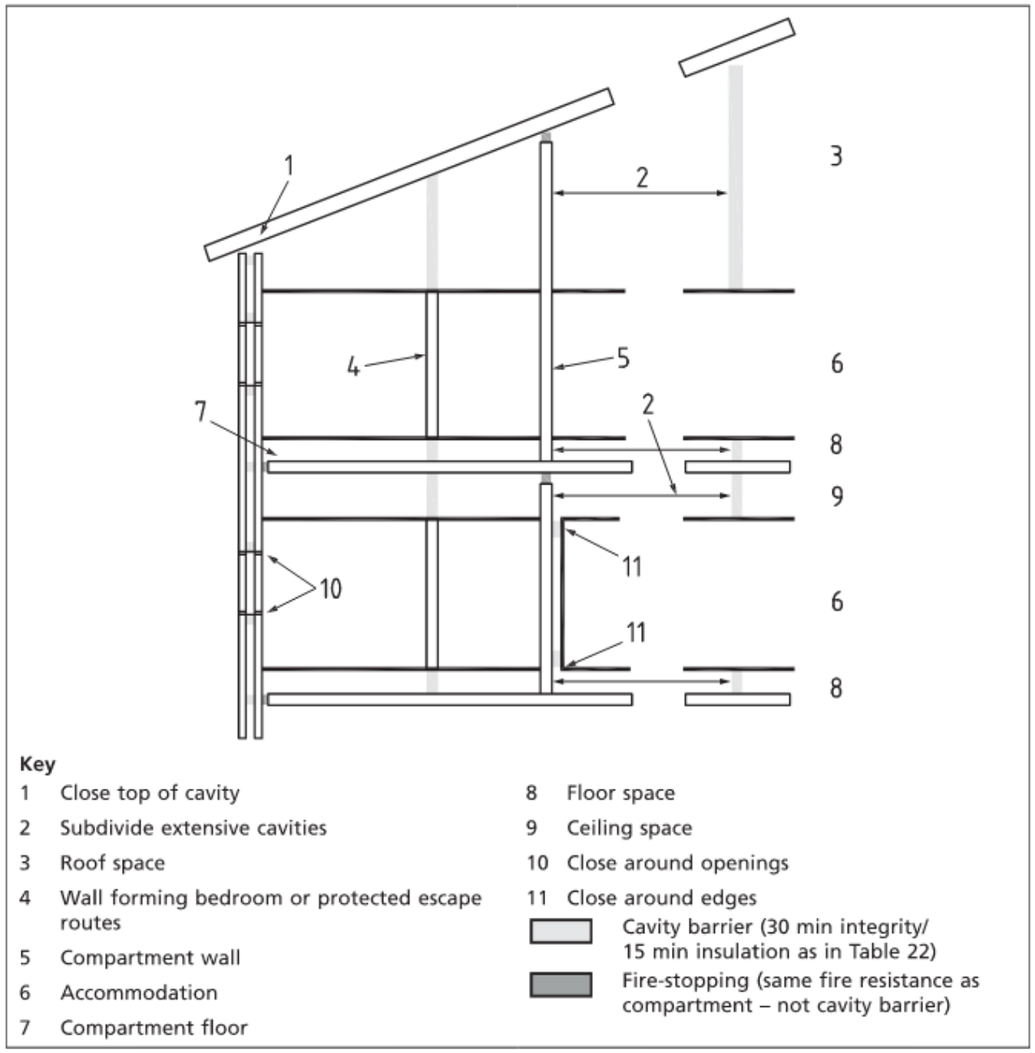


Figure 3: Cavity barrier and fire-stopping provision (Figure 35 of BS 9999)

Cavity barriers should be provided to close the edges of any cavities, including around openings* (but see also note below: Figure36 of BS 9999). As set out in BS 9999, cavity barriers are also required:

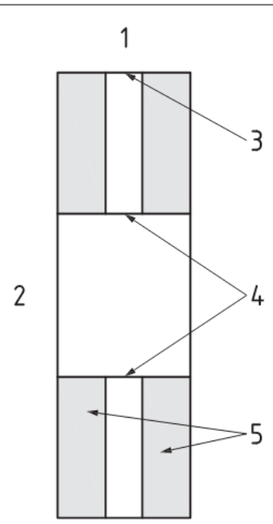
- at the junction between an external cavity wall* and every compartment floor and compartment wall and
- at the junction between an internal cavity wall* and every compartment floor, compartment wall or other wall or door assembly which forms a fire resisting barrier.

*This provision is not required where the cavity wall conforms with Figure 36 of BS 9999. This figure is reproduced below. Note that in this type of configuration it is permissible for combustible material (lowest classification Euroclass B) to be placed within the cavity.

Every cavity barrier should be constructed to provide at least 30 min fire resistance. It may be formed by any construction provided for another purpose if it meets the provisions for cavity barriers. Cavity barriers in a stud wall or partition, or provided around openings, may be formed of:

- steel at least 0.5 mm thick or
- timber at least 38 mm thick or
- polythene-sleeved mineral wool, or mineral wool slab, in either case under compression when installed in the cavity or
- calcium silicate, cement-based or gypsum-based boards at least 12 mm thick.

Further information regarding the requirements for construction and fixing of cavity barriers is set out in Section 5 of 33.1 of BS 9999, including requirements to specific configurations and reaction to fire requirements for surfaces within or adjacent to cavities.



Key

1 Section through cavity wall
2 Opening
3 Close cavity at top of wall (unless cavity is totally filled with insulation)
4 Close cavity around opening
5 Two leaves of brick or concrete each at least 75 mm thick

NOTE 1 Cavities may be closed with a material that might not meet the various recommendations in Table 22 for cavity barriers. The purpose of closing the cavity is to restrict airflow within the cavity.

NOTE 2 Cupboards for switch boards, service boxes, service panels, etc. may be installed provided that:

- *there are no more than two cupboards per compartment;*
- *the openings in the outer wall leaf are not more than 800 mm × 500 mm for each cupboard; and*
- *the inner leaf is not penetrated except by a sleeve not more than 80 mm × 80 mm, which is fire-stopped.*

NOTE 3 Combustible materials may be placed within the cavity.

Figure 4: Cavity wall exclusions Figure 36 of BS 9999

5.3.6 Installation of Ductwork Systems

Ductwork that passes through escape routes or breaches compartmentation will be fire rated in line with the methods outlined in Section 32.5.2 of BS 9999 as follows:

- Method 1 – thermally actuated fire dampers.
- Method 2 – fire-resisting enclosures.
- Method 3 – protection using fire-resisting ductwork.
- Method 4 – automatically actuated fire and some dampers triggered by smoke detectors.

In such cases, both fire dampers and fire and smoke dampers shall be tested to BS EN 1366-2:1999 and be classified to BS EN 13501-3: 2005. They require an E (fire dampers) or ES (smoke and fire dampers) classification to be the same fire resistance standard as the wall/floor through which the duct passes.

5.3.7 Protection of Openings

Where services penetrate compartment walls, floors and between the junction with the walls or façade; suitable fire stopping should be provided.

Pipes which pass through a fire separating element (unless within a protected shaft) will meet the following provisions:

Option 1 - proprietary seals (any pipe diameter)

Provide a proprietary sealing system which has been shown through test evidence to maintain the fire resistance of the compartmentation.

Option 2 – pipes with a restricted diameter

When a proprietary sealing system is not used, fire stopping may be used around the pipe, where every effort is made to keep the opening as small as possible. Any mastic used for the protection of pipe penetrations should be compatible with the pipework material and size to maintain the prescribed standard of fire resistance, tested and installed in accordance with the manufacturer's instructions.

The nominal internal diameter of the pipe should not be greater than that detailed in Table 31 of BS 9999 and graphically represented in the figure below:

Option 3 – sleeving

A pipe of lead, aluminium, aluminium alloy, fibre-cement or uPVC, with a maximum nominal internal diameter of 160mm, may be used with a sleeving of non-combustible pipe.

5.3.8 Fire Stopping

Penetrations through lines of fire-resisting separation will be fire-stopped to achieve the same fire resistance as the separation.

All pipes, ductwork and services passing through fire-resisting separations will be either enclosed in fire-resisting construction (i.e. shafts) of matching fire resistance or provided with fire dampers of matching fire resistance. Certain small-diameter pipes require only fire-stopping around the pipe, dependent on pipe material and the type of fire-resisting barrier penetrated. The ASFP Red Book provides information on fire stopping and penetration seals, the following figure is recreated from the Red Book and gives examples of where fire stopping is typically required.

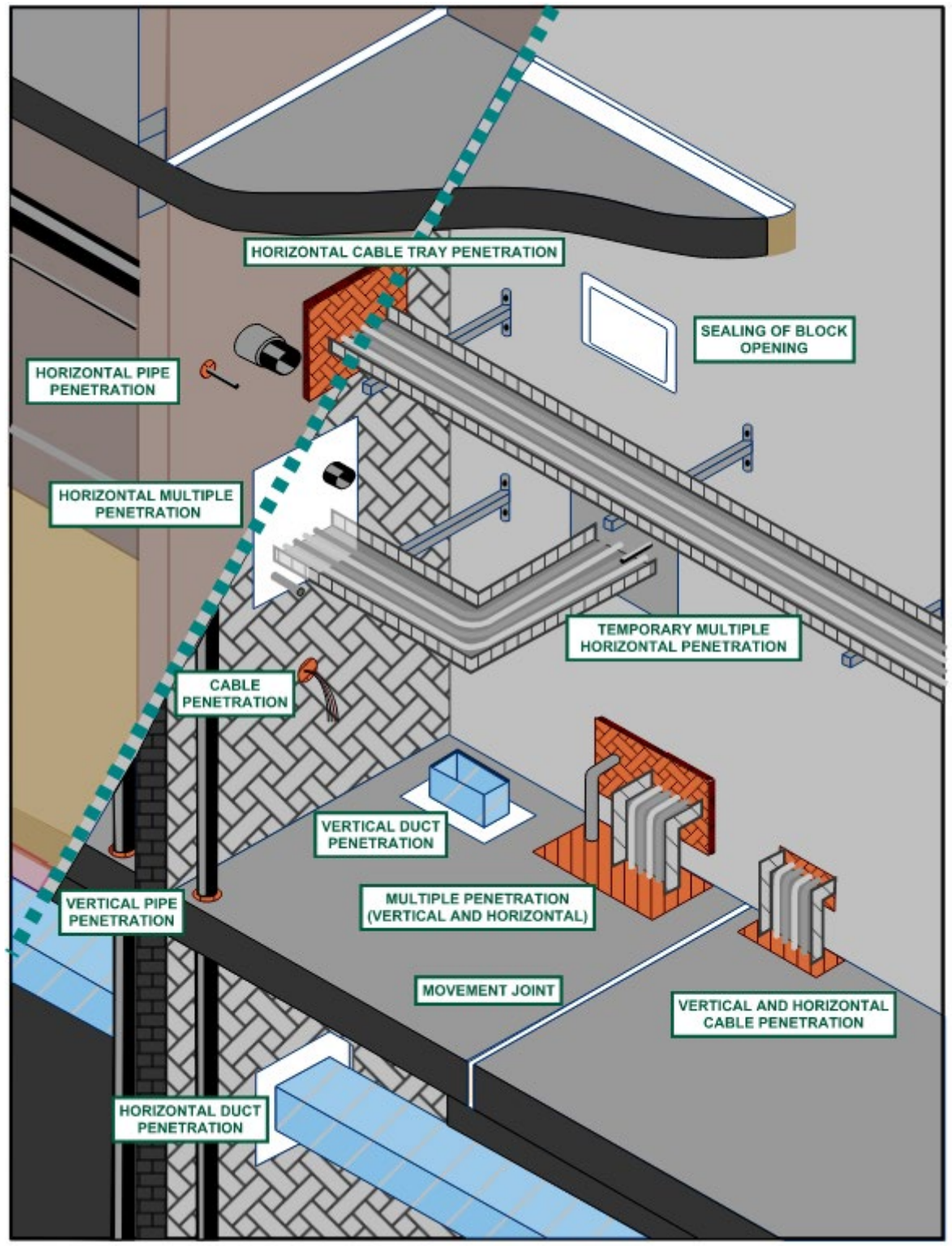


Figure 5: Examples of locations where fire stopping should be provided (Recreated from ASFP Red Book)

6. B4 – External Fire Spread

The functional requirements of Part B4 to the Building Regulations 2010 (as amended) are set down for clarity below.

References to applicable guidance within this section are made with regard to the amended Approved Document B Volume 1 - 2019 (ADB V1 2019).

6.1 Functional Requirement of the Building Regulations

The functional requirement contained within Schedule 1 Part B4 of The Building Regulations states that:

(1) *The external walls of the building shall adequately resist the spread of fire over the walls and from one building to another, having regard to the height, use and position of the building.*

(2) *The roof of the building shall adequately resist the spread of fire over the roof and from one building to another, having regard to the use and position of the building.*

6.2 External Wall Construction

6.2.1 General

The guidance in this section is designed to reduce the risk of vertical fire spread as well as the risk of ignition from flames coming from adjacent buildings. To review fire resistance requirements for external walls, see Section 5.3.1.

6.2.2 Combustibility of External Walls

External walls should be constructed using a material that does not support fire spread and therefore endanger people in or around the building. Flame spread over or within an external wall construction should be controlled to avoid creating a route for rapid fire spread bypassing compartment floors or walls.

External wall surfaces near to other buildings should not be readily ignitable, to avoid fire spread between buildings.

The external walls of buildings should either meet the guidance given in Section 35 of BS 9999 or meet the performance criteria given in the BRE Report Fire performance of external thermal insulation for walls of multi-storey buildings (BR 135) for external walls using full-scale test data from BS 8414-1:2015 or BS 8414-2:2015.

6.2.3 External Surfaces

The external surfaces of walls should meet the provisions in Figure 47 of BS 9999. The requirements are summarised below:

Table 12: Reaction to fire performance of external surface of walls

Less than 1000mm from the relevant boundary	1000mm or more from the relevant boundary
Class B-s3, d2 or better	From ground level to 18m: class C-s3, d2 or better From 18m in height and above: class B-s3, d2 or better

6.2.4 Materials / Products

In a building with a storey 18m or more in height, any insulation product, filler material (not including gaskets, sealants and similar) etc. used in the construction of an external wall should be of limited combustibility or better.

Note 1: Whilst the guidance above applies to any insulation product, filler material (not including gaskets, sealants and similar) etc. used in the construction of an external wall, consideration should be given to the choice of material used for any other parts of an external wall or attachments to the wall which could impact on the risk of fire spread over the wall.

6.2.5 Cavities and Barriers

Cavity barriers should have sufficient fire test evidence that they will operate in the proposed façade system.

They should be provided in accordance with Section 5.3.6 of This Report.

Surfaces which face into cavities should also meet the provisions of Table 12.1 of ADB, and provisions in Section 5.3.6.

6.3 Space Separation

The requirements of B4 of the Building Regulations are considered to be met if the external walls of the building adequately resist the spread of fire over the walls and from one building to another, having regard to the height, use and position of the building.

Detailed external fire spread calculations were therefore carried out by IGNIS (see Section 2.4.4) using the performance-based fire models, and it was concluded that the radiation emitted on any one floor at a time will sufficiently deplete over the distance to the neighbouring buildings sot that the incident radiation is below the set level of 12.6kW/m^2. Therefore, the proposed scheme will not create an unacceptable external fire spread risk to adjacent sites.

6.4 Roof Construction

The recommendations in this section are principally concerned with the performance of roofs when exposed to fire from the outside. The separation distance is the minimum distance from the roof (or part of the roof) to the relevant boundary. Separation distances should be as recommended in the following table by the type of roof covering and the size and use of the building.

In addition, roof covering products (and/or materials) defined in Commission Decision 2000/553/EC of 6 September 2000, implementing Council Directive 89/106/EEC, can be considered to fulfil all of the requirements for the performance characteristic 'external fire performance' without the need for testing, provided that any national provisions on the design and execution of works are fulfilled, and can be used without restriction.

7. B5 – Access and Facilities for the Fire Service

7.1 Functional Requirement of the Building Regulations

The functional requirement contained within Schedule 1 Part B5 of The Building Regulations states that:

(1) *The building shall be designed and constructed so as to provide reasonable facilities to assist firefighters in the protection of life.*

(2) *Reasonable provision shall be made within the site of the building to enable fire appliances to gain access to the building.*

7.2 Provision of Fire Fighting Shafts

7.2.1 General Provisions

Relevant requirements, as specified in BS 9999, for the provision of fire fighting shafts are as follows:

- Buildings with floor levels more than 18m above fire and rescue service vehicle access level should be provided with fire fighting shafts containing fire fighting lifts.
- Firefighting shafts are not required to serve a basement that is not large or deep enough to need one.
- As the building has a minimum area of 900m² and occupiable floors greater than 18m above fire fighting access a minimum of two firefighting shafts with lifts are required.
- Fire fighting shafts should serve all floors through which they pass.
- Fire fighting shafts should be located to meet the maximum hose distances. As the development will be sprinklered, sufficient firefighting shafts should be provided such that every part of every storey is no more than 60m from a fire main.
- Outlets from the fire main should be located in the firefighting lobby
- Smoke control should be provided as per Section 27.1 of BS 9999.
- Only services associated with the firefighting shaft, such as ventilation systems and lighting for the firefighting shafts, should pass through or be contained within the firefighting shaft.

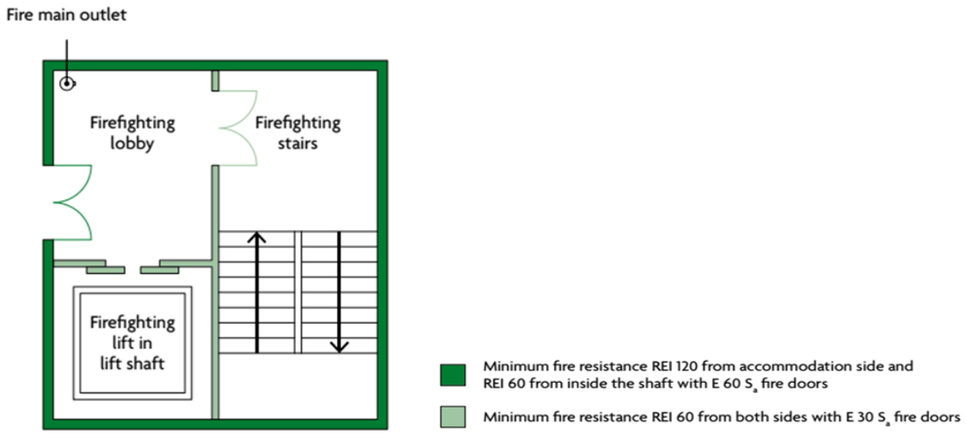


Figure 6: Typical Components of Fire Fighting Shafts

7.2.2 Fire Fighting Stairs

A fire-fighting stair should have an unobstructed width (measured between the walls and/or balustrades) of 1.1m. The width should be kept clear for a vertical distance of 2m.

The handrails and strings that do not intrude more than 100 mm into these widths may be discounted when calculating.

Clear signage should be provided on the landing in the stair to identify the storey level.

To prevent smoke from basement storeys penetrating the stair enclosure above ground level, fire-fighting stairs serving floors both above and below ground level should be separated at ground floor level by a fire door.

Fire-fighting stairs should be designed in accordance with BS 5395-1.

Emergency escape lighting in fire-fighting stair enclosures should be in accordance with BS 5266-1.

7.2.3 Fire Fighting Lobbies

A fire-fighting lobby serves the firefighters lift and an approach stair and should have a clear floor area of not less than 5m².

The clear floor area should not exceed 20m² for lobbies serving up to four lifts, or 5m² per lift for lobbies serving more than four lifts. All principal dimensions should be not less than 1.5m and should not exceed 8m in lobbies serving up to four lifts, or 2m per lift in lobbies serving more than four lifts.

The doors between the fire-fighting stair and fire-fighting lobby should be kept free from any fastenings, and doors from the fire-fighting lobby into the accommodation should be readily and easily openable by the fire and rescue service.

Fire-fighting lobbies containing lifts should be clearly and conspicuously marked with a notice conforming to BS ISO 3864-1, stating 'Firefighters lift lobby: do not obstruct lift doors. Do not use for storage'.

7.2.4 Fire Fighting Lifts

A firefighting lift installation includes all of the following:

- lift car
- lift well
- lift machinery space
- lift control system
- lift communications system.

The lift shaft should be constructed in accordance with Section 6 of BS 9999 and lift installations should conform to BS EN 81-72 and BS EN 81-20.

Both fire-fighting lifts are dual entry but will be provided with 60minutes fire/smoke curtains on the non-lobby sides (as well as FD60 lift doors) on every floor served. This will provide the necessary separation to maintain the 120-minute enclosure. Therefore the risk of a fire on a floor impacting on one of the fire-fighting lifts is considered to be low.

7.3 Access for Vehicles

Fire mains are required to be included as part of the works which means fire access should be provided to within 18m of each dry fire main inlet.

The access route is indicated in the following figure.

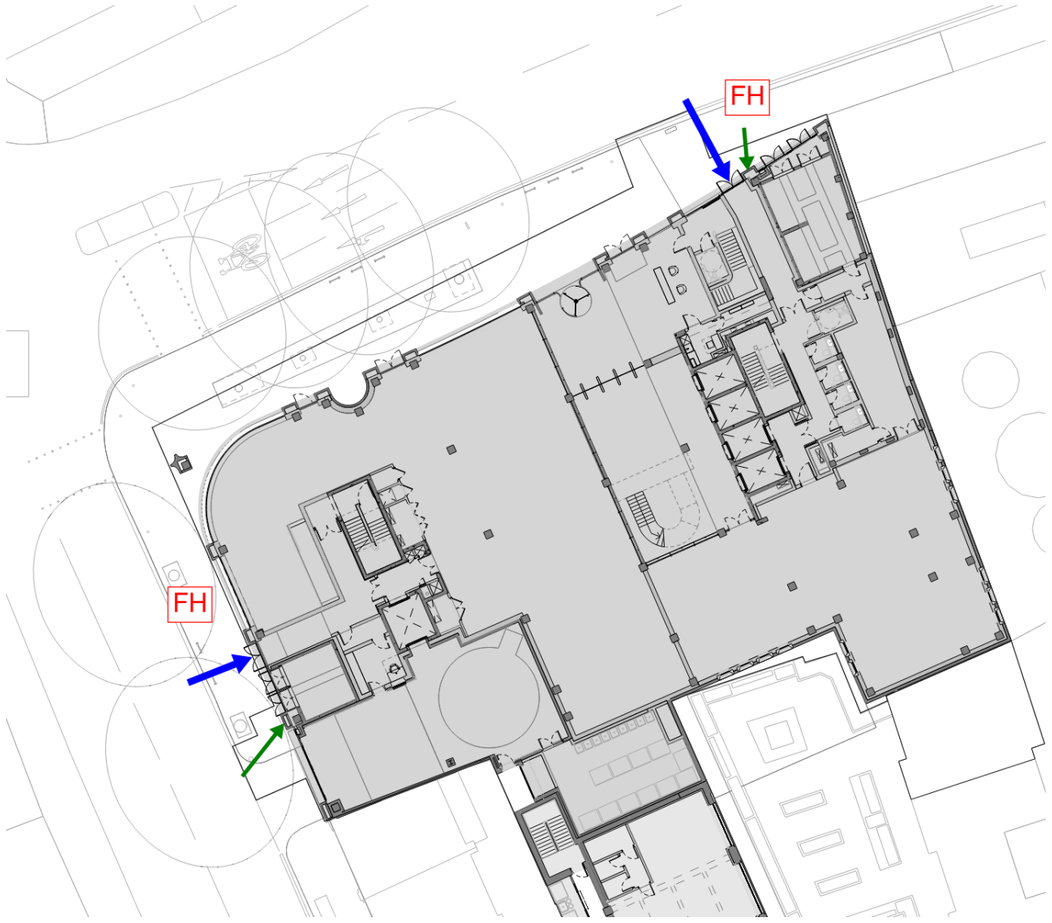


Figure 7: Fire Service Access and Facilities (blue arrows are entrance to fire-fighting shafts, green arrows are dry main inlets and FH are existing fire hydrants)

The required dimensions of access routes and hard-standings vary according to the fire appliances that are used, typical access route requirements are provided in Table 20 of BS 9999. As the developments highest occupiable floor is greater than 11m, a high reach appliance will be referenced. Requirements are detailed in the below table:

Table 13: Measurements for high reach appliance vehicle access route (Table 20 of BS 9999)

Minimum width of road between kerbs (m)	Minimum width of gateways (m)	Minimum turning circle between kerbs (m)	Minimum turning circle between walls (m)	Minimum clearance height (m)	Minimum carrying capacity (tonnes)
3.7	3.1	26	29	4	17

Should any security features be added to the access route (e.g. gates), it will be necessary to ensure these do not prevent the fire service gaining access to this route.

7.4 Fire Mains and Hydrants

The dry riser outlets should be placed within the fire-fighting lobbies, accessible at each floor. Further guidance on the design and construction of fire mains is given in BS 9990. The maximum hose laying length from the fire main outlet to the furthest point inside must be less than 60m.

For buildings fitted with dry fire mains, both of the following apply:

- Access should be provided for a pumping appliance to within 18m of each fire main inlet connection point. Inlets should be on the face of the building.
- The fire main inlet connection point should be visible from the parking position of the appliance.

There are existing public fire hydrants location on Gray's Inn Road and Clerkenwell Street, which are both located less than 100m from the proposed dry main inlets. Therefore, no additional new private hydrants are not required.

7.5 Smoke Control

The following section provides details of the requirements and provisions for smoke control in the development.

7.5.1 Fire-fighting Shafts

Both the stair and lobby of the firefighting shaft should be provided with a means of venting smoke and heat (see clause 27.1 of BS 9999). Only services associated with the firefighting shaft, such as ventilation systems and lighting for the firefighting shaft, should pass through or be contained within the firefighting shaft.

The two fire-fighting shafts will both be provided with a mechanical smoke ventilation system which demonstrates equivalent or better conditions in the lobby and stairs than would be provided by a natural shaft conforming to 27.1.4.2.3 of BS 9999 and as described in BRE Project Report 79204 [N1].

Mechanical Ventilation Systems

The design of the mechanical smoke ventilation system should limit pressure differentials so that door opening forces do not exceed 100 N at the door handle when the system is in operation, taking door closer forces into account where applicable. The primary objective of the system should be to maintain smoke-free conditions in the staircase during both means of escape and fire-fighting operations. The route of the exhaust air and the air flow should be determined within the space being ventilated, ensuring that replacement inlet air is provided. The ventilation rate should be decided through an assessment of any specific risks within the building and should be validated through CFD analysis or mathematical calculation.

Within the modelling process, the following criteria should be taken into account:

- fire locations (both close to and far from the point of extract)
- pressure differences across the lobby door with a variety of extraction rates, where variable extract rates are used
- fire pressure and increasing fire growth
- glazing failure temperatures
- a variety of door opening sizes for the stair or lobby door (when closed, partially open and fully open).

The design and installation of the system should be in accordance with BS 7346-8. A power supply in accordance with BS 8519 should be provided to the fans and all actuators and controls. The system should be provided with a standby fan that operates automatically upon failure of the duty fan. Both fans should be in accordance with BS EN 12101-3. The stair should be provided with an automatic natural vent as described in 27.1.4.1, Table 21. Where mechanical systems are used, replacement air should be provided to prevent damage to the system and to ensure that excessive depressurization of the ventilated area does not occur.

The design of the system should ensure that the source of inlet air does not compromise normal passive fire separation. Any such inlets should be automatic in operation and should not be temperature controlled. Mechanical extract may be designed such that the system provides a steady extraction rate, or alternatively the system may be provided with a variable rate of extraction, to reflect the different door opening and closing events that occur during a fire. The decision regarding the variation in ventilation rates should reflect the specific risks present within the building (e.g. excessive depressurization of the lobby when all the doors are closed). Where a mechanical smoke ventilation system uses a shaft, it should meet the following recommendations:

- The top of the lobby vent should be located as close to the ceiling of the lobby as is practicable and should be at least as high as the top of the door connecting the lobby to the stairwell.
- The lobby vents, in the closed position, should either:
  - have a minimum fire and smoke resistance performance of 60 min and a leakage rate no greater than 200 m³/h/m² when tested in accordance with BS EN 1366-2 or
  - be in accordance with BS EN 12101-8.
- The smoke shaft should be constructed of materials classified as A1 in accordance with BS EN 13501-1:2007+A1, or of materials determined to be non-combustible when tested in accordance with BS 476-4, or of any material which when tested in accordance with BS 476-11 does not flame or cause any rise in the temperature on either the centre of the specimen or the furnace thermocouples.
- Any smoke shaft which penetrates fire compartments should, as a minimum, maintain the same level of fire compartmentation as that which has been breached.
- No services other than those relating to the smoke shaft should be contained within the smoke shaft.
- Fans should be capable of handling gas temperatures of 300°C for a continuous period of not less than 60 min and tested in accordance with BS EN 12101-3
- It should operate automatically either on activation of the sprinkler system or by an automatic fire detection system in accordance with BS 5839-1:2017.
- The system should have a power supply in accordance with BS 8519.apend
- Any ductwork should be fire-resisting (Method 2 or Method 3; see 32.5.2) maintaining at least 75% of the cross-sectional area of the duct. The fire resistance should be not less than 60 min or equivalent to the fire resistance rating of any compartment boundary through which it passes, whichever is the greater.
- Where only a single mechanical extract is provided the fans should be duty/standby fans, as fan failure would result in failure of the system.
- An automatic vent positioned at the head of each fire-fighting stair open to the roof with an aerodynamic free area of 0.7m², are also required.

7.5.2 Basement

Heat and smoke from basement fires vented via stairs can inhibit access for firefighting personnel. This may be reduced by providing smoke outlets, or smoke vents, which allow heat and smoke to escape from the basement levels to the open air. They can also be used by the fire and rescue service to let cooler air into the basements.

Each basement space should have one or more smoke outlets. Where this is not practicable (for example, the plan area is deep and the amount of external wall is restricted by adjoining buildings), the perimeter basement spaces may be vented, with other spaces vented indirectly by opening connecting doors. This does not apply for places of special fire hazard. If a basement is compartmented, each compartment should have one or more smoke outlets, rather than indirect venting. A basement storey or compartment containing rooms with doors or windows does not need smoke outlets.

Outlet ducts or shafts, including any bulkheads over them, should be enclosed in construction of class A1 rating and fire resistance at least equal to that of the element through which they pass. Natural smoke outlet shafts should be separated from each other using construction of class A1 rating and fire resistance at least equal to that of the storeys they serve, where the shafts are either from different compartments of the same basement storey or from different basement storeys.

Mechanical Smoke Extract

The basement storey is fitted with a sprinkler system and as such a mechanical smoke extraction system will be provided as an alternative to natural venting.

The air extraction system should comply with all of the following:

- it should give at least 10 air changes per hour
- it should be capable of handling gas temperatures of 300°C for not less than one hour
- it should do either of the following:
  - be activated automatically if the sprinkler system activates
  - be activated by an automatic fire detection system that conforms to BS 5839-1 (minimum L3 standard).