

Block M, Former Hospital. Gravesend. Strawberry Star.

FIRE ENGINEERING
FIRE STRATEGY REPORT

REVISION 01 – 23 AUGUST 2022



STAGE 2

Audit sheet.

Rev.	Date	Description of change / purpose of issue	Prepared	Reviewed	Authorised
00	22/08/2022	First issue to client	JW	LG	LG
01	23/08/2022	Revised to include latest ground floor layout	JW	LG	LG

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1. Introduction.

1.1 Overview

Hoare Lea have been commissioned to provide fire safety engineering advice for Block M of the Former Hospital development in Gravesend. This outline fire report addresses the main fire safety items and principles and provides an overview of the requirements and recommendations the scheme will need to meet and is based on the guidance of Approved Document B[1], BS 9999[2] and BS 9991[3].

1.2 Guidance

This fire report addresses the fire items based on the current revision of BS 9991 (2015); however, a revised edition of BS 9991 is expected to be released in 2022 and therefore the design may need to be reviewed to the latest version of the guidance when published. Potential revisions to the guidance may include the requirement for staircase lobbies and a pressurisation system (note that this is based on a draft revision and is not yet confirmed).

1.3 Scheme description

The proposed development comprises a thirteen-storey building with apartments and an internal and external amenity area, across the first to twelfth floors, and a commercial unit on the ground floor with residential amenity areas and plant rooms. There is a small basement area accessed via a staircase that solely houses the commercial sprinkler tank. The basement is completely separated from the main building.

The first to seventh upper floors of Block M are served by two staircases that are accessed on the ground floor, with one of the staircases serving the eighth to twelfth floors. An image of the ground floor is shown below in Figure 1.

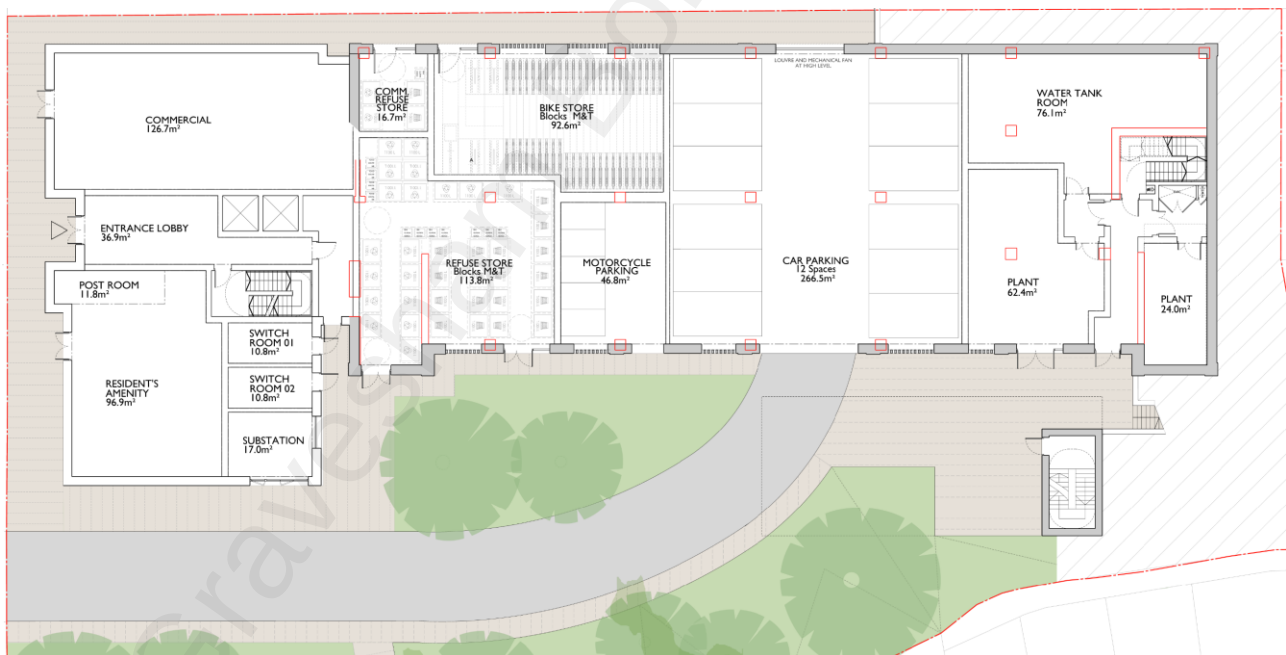


Figure 1: Ground floor plan

1.4 Drawings

This report is based on the drawings listed in Table 1 below, which have been provided by RM_A Architects.

Table 1: Drawings used for Stage 2 Fire Strategy Report

Title	Drawing number	Date	Revision
Floor Plan 00 Ground M Block Extract	2244_0020_D	19/08/22	E
Floor Plan 01 First M Block Extract	2244_0021_D	10/08/22	D
Floor Plan 06 Sixth M Block Extract	2244_0026_D	10/08/22	D
Floor Plan 07 Seventh M Block Extract	2244_0027_D	10/08/22	D

2. Means of warning and escape.

2.1 Fire evacuation strategy

The occupants of the residences will adopt a 'stay put' strategy where only the occupants from the apartment of fire origin evacuate. The occupants of neighbouring flats or of the commercial unit remain in place, separated by a high level of compartmentation, unless advised otherwise by the Fire Service either directly or via the evacuation alert system.

The occupants of the commercial unit directly beneath the residential build-up will operate a simultaneous evacuation strategy in which the occupants of the unit will evacuate immediately on activation of the fire detection system. The occupants of residences in the other parts of the building remain in place, separated by a high level of compartmentation.

2.2 Risk profile

Occupants of the commercial unit are considered to have a 'B2' risk profile, as per BS 9999, which represents occupants that are awake but unfamiliar with the building and that fire growth rate is classed as medium due to the provision of a fire suppression system.

Occupants of the residential amenity are considered to have a 'A1' risk profile, as per BS 9999, which represents occupants that are awake and familiar with the building and that fire growth rate is classed as low due to the provision of a fire suppression system.

2.3 Fire alarm and detection requirements

An L1 automatic fire detection and alarm system is required for the commercial unit, as per BS 5839-1[4].

In accordance with BS 9991, each residential apartment should be supplied with an independent fire alarm and detection system. All apartments have open-plan design in the residences; therefore a grade D LD1 fire detection and alarm system will be provided to the apartments in accordance with BS 5839-6[5].

In addition to the automatic fire detection and alarm system, an evacuation alert system will be provided, in accordance with BS 8629[6], with control panel on the Fire Service access route to the building and sounders on all floors to alert occupants to evacuate.

The automatic smoke ventilation system within the residential common lobbies will require smoke detectors, therefore, a category L5 fire alarm and detection system should be provided as per BS 5839-1. This should activate the smoke ventilation system, the automatic openable vents (AOVs) in the common corridors and at the head of the staircase.

The building comprises apartments and has a floor over 11m, therefore the apartments will be provided with residential sprinkler systems in accordance with BS 9251[7] and the commercial unit will be provided with a commercial sprinkler system in accordance with BS EN 12845[8].

2.4 Commercial unit occupancy and means of escape

The commercial unit currently comprises a single means of escape, therefore the maximum occupancy of the unit is 60. The unit has a total floor area of 128m²; therefore, should two means of escape be provided (with both doors opening outwards) then the resulting maximum occupancy would be 128, based on 1m² per person floor space factor.

2.5 Travel distances

BS 9999 recommends the following travel distances for the non-residential parts of the development. Note that these travel distances are applicable once the fit-out is known, where the fit-out is not known, the travel distances should be reduced by one third.

Table 2: Travel distances (after fit-out)

Unit	Two-way travel	One-way travel
Residential amenity	65m	26m
Bike store	25m	45m
Commercial unit	50m	20m
Plant room (within room)	-	9m
Plant room (overall)	18m	45m

The travel distances, as measured on the plans in Table 1, are within the limits in Table 2.

2.6 Apartments

2.6.1 Open plan apartments

All apartments within the development are open plan by design. These are acceptable under the current BS 9991 guidance based on the following:

- The apartments are protected with automatic sprinklers to BS 9251;
- The apartments are provided with Category LD1 Grade D detection and alarm systems;
- The size of the apartment does not exceed 16m x 12m in area;
- The apartments are single level only;
- The ceilings within the apartment are higher than 2.25m;
- The kitchen should be enclosed in open plan apartments having an area exceeding 8m x 4m. Cooking appliances in apartments smaller than 8m x 4m should not be adjacent to the entrance of the apartment.

Note that the proposed layouts are larger than the scope of the guidance. Open plan apartments larger than 8m x 4m with open kitchens are considered acceptable with the provision of sprinklers and LD1 detection as long as the cooking equipment is separated from the escape route.

A widely accepted design criterion is for apartment layouts to be designed so that escaping occupants are not forced to approach closer than 1.8m to cooking appliances, this is shown in Figure 2. However, this is subject to agreement with the Statutory Authority, who may request computational fluid dynamics (CFD) analysis be undertaken.

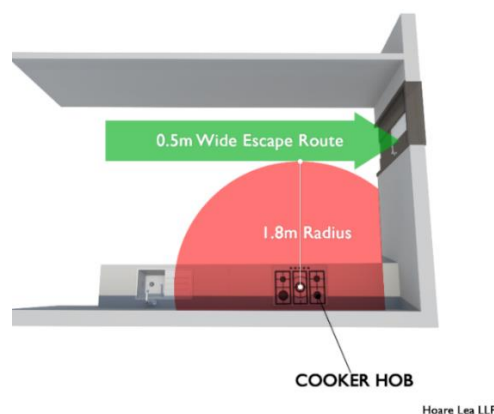


Figure 2: Separation distance between cooker hobs and escape route

2.6.2 Residential common escape routes

On the first to seventh floors, residents have access to two staircases. The staircases are located at each end of the building, with the majority of residents having escape routes in two directions. The maximum travel distance for these occupants is 29m and is compliant with BS 9991. There are four apartments on the upper levels with a single direction travel distance to the closest staircase of no more than 7.5m which is a compliant distance with BS 9991. The travel distances for a typical floor are shown below in Figure 3.

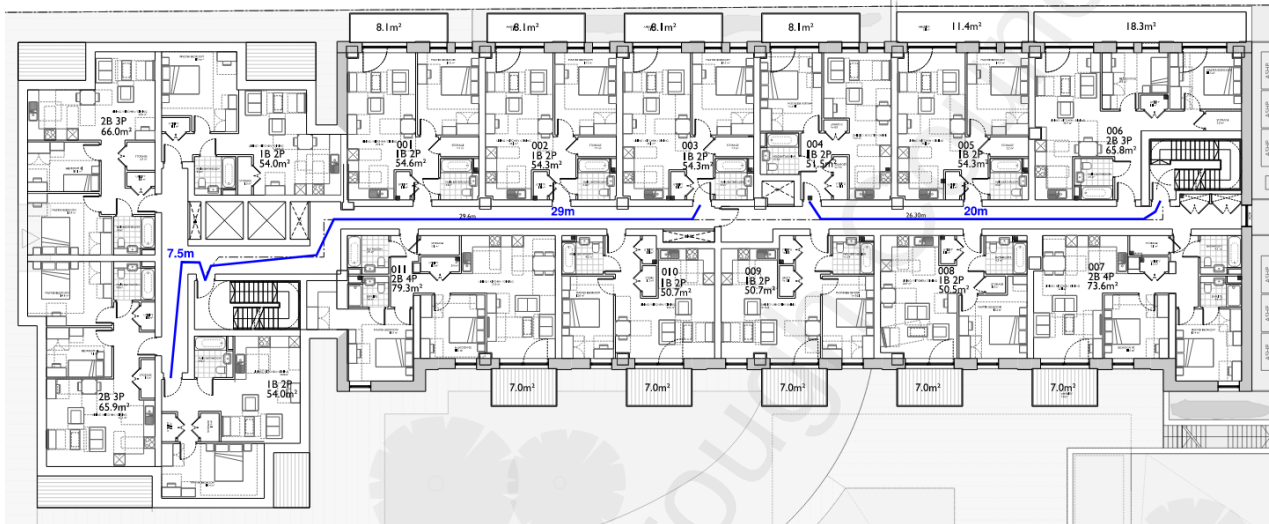


Figure 3: First floor (typical floor) layout

Note that on the seventh floor, there is an external terrace for residents, with access to the common corridor serving the north core, and a residential lounge allowing access to the south staircase. The lounge is currently shown to provide direct access to the means of escape staircase; however a protected lobby will be provided that is connected to the natural smoke shaft serving the floors below, or via an AOV directly to outside with free area 1.5m².

On the eighth to thirteenth floors the occupants have access to a single staircase. The maximum travel distance on these floors is 7.5m from apartment door to staircase door and therefore is compliant with BS 9991 requirements.

To protect the staircases from smoke ingress, two natural smoke shafts are provided, one for each corridor serving the two staircases. The smoke shafts will have a minimum free area of 1.5m² and will have automatic opening vents into the corridors of the same free area. The AOVs will operate automatically on activation of the fire detection system in the common corridors. The north smoke shaft will serve the upper levels where a single staircase is present. To provide air inlet to the extracted smoke from the corridor there will be a 1m² AOV at the head of each staircase.

Both natural smoke shafts are required to extend a minimum of 2.5m above the ceiling of the highest storey served by each smoke shaft. The opening at the top should also be located at least 500mm above any surrounding structures within a 2m radius along the horizontal plane (to prevent exposure to adverse wind conditions).

2.7 Common stair requirements

Two staircases will serve the first to seventh floors, with the north staircase serving the eighth to twelfth floors.

The north staircase will be a firefighting staircase and have clear width of 1200mm. The staircase discharges at ground floor via a protected corridor. Since the staircase forms a single escape route for occupants of the upper floors, the staircase is not connected to any ancillary accommodation at any level where there is no alternative means of escape.

The south staircase will have clear width of 1100mm and will discharge at ground floor via a protected corridor to the courtyard to the west of the building. Note that the corridor serves plant rooms, however occupants using the south staircase have alternative means of escape at all levels and therefore connections to ancillary accommodation is permitted providing that protected lobbies are provided with permanent ventilation of 0.4m².

2.8 General means of escape requirements

2.8.1 Emergency lighting

Suitable lighting should be provided to all premises to enable the safe movement of persons along escape routes to a place of relative or ultimate safety. Emergency escape lighting, when needed, should be provided in accordance with BS 9999, BS 9991, BS 5266-1[9] and BS EN 1838[10].

2.8.2 Emergency 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[11] and BS 5499-4[12].

2.8.3 Door fastening

Any door located on an escape route should meet the guidance of BS 9999 and BS 9991.

3. Internal fire spread requirements (linings).

3.1 Wall and ceiling linings

In order to prevent rapid flame spread throughout the development, the materials used in the construction of a building should have specified periods of fire resistance. All wall and ceiling linings should meet the relevant classifications outlined in Table 3 below. Further information can be found in Section 35.1 of BS 9999 or Section 20 of BS 9991.

Table 3. Surface spread of flame classification for wall and ceiling linings

Location	National Class	European Class ^{Note 1,}
Small rooms of area not more than 4m ² in residential accommodation	3	D-s3, d2
Other rooms	1	C-s3, d2
Circulation spaces within dwellings	1	C-s3, d2
Other circulation spaces, including the common areas of residential sections	0	B-s3, d2

NOTE Linings which can be effectively tested for "surface spread of flame" are rated for performance by reference to the method specified in BS 476-7:1987[13], under which materials or products are classified 1, 2, 3 or 4, with Class 1 being the highest. Class 0 is better than Class 1. It is not identified in any BS test standard. A Class 0 product is either:

- a) composed throughout of materials of limited combustibility; or
- b) a material having a Class 1 surface spread of flame and which has a fire propagation index (I) of not more than 12 and a sub-index (i1) of not more than 6.

The fire propagation index is established by reference to the method specified in BS 476-6[14].

European classifications are described in BS EN 13501-1:2007+A1[15].

3.2 Roof lights and lighting diffusers

Thermoplastic materials may be used in windows, roof lights and lighting diffusers in suspended ceilings provided that they meet the recommendations of Table 34 of BS 9999.

4. Internal fire spread requirements (structure).

4.1 Elements of structure

Each member forming part of the structural frame of the buildings or any other beam or column should be provided with 120 minutes fire resistance. Structures supporting only the roof of the building do not require any fire resistance unless the stability of the building depends on the roof.

4.2 Fire resistance

Table 4 states the fire resistance requirements to walls and floors within the building. Fire doors should be specified in accordance with BS 9999 and BS 9991, referencing the following tables where relevant.

Table 4: Fire resistance

Wall or floor separating/ enclosing	Fire resistance of wall or floor [minutes]
Floors (all compartmented)	120
Staircases	120
Firefighting lift/ passenger lift cores	120
Enclosing common corridors	60
Separation between apartments on the same level	60
Internal partitions within apartments	Not fire resisting
External walls and windows of apartments where internal angles are formed	60
External walls <1m from the site boundary	120 (from both inside-outwards & outside-inwards)
External walls on the site boundary	60
Separation of commercial unit from the residential parts of the building	120
Plant rooms and refuse store	60
Rooms with plant for life safety plant equipment	120

4.3 Sprinklers

Due to the height of the building, sprinklers are required to be provided throughout the development, including the residences, amenity areas, refuse store and retail unit. The residences will be sprinklered using a BS 9251 system, and the residential amenity areas and retail unit will be provided with a commercial system compliant with BS EN 12845. Note that the sprinkler tank for the commercial system is located in a dedicated basement accessed from the courtyard.

5. External fire spread.

5.1 Space separation analysis

A full review of external fire spread will be carried out at RIBA stage 3; however, given the dimensions of apartments and distance from the facades to neighbouring buildings and notional boundaries where applicable, the areas of facades for the residential floors are unlikely to require to be fire resisting.

The commercial unit, cycle store, car park and plant rooms on the ground floor are within approximately 2m of the site boundary, therefore it is expected that some fire resisting construction will be required to these areas given their higher fire risk than the apartments on the upper floors. Areas requiring fire resistance will be confirmed at later stages of the design. It is not expected that any facades are within 1m of the site boundary, however any facades that are within 1m will require fire resisting from inside-outwards and outside-inwards.

5.2 External wall materials

In accordance with Regulation 7(2), as the building has a storey height in excess of 18m above the lowest adjacent external ground level, the external wall construction, and specified attachments including balconies, solar shading or solar panels, should achieve European Classification A2-s1, d0 or Class A1. This does not apply to the following:

- cavity trays when used between two leaves of masonry;
- any part of a roof (other than any part of a roof which falls within paragraph (iv) of Regulation 2(6)) if that part is connected to an external wall;
- door frames and doors;
- electrical installations;
- insulation and water proofing materials used below ground level;
- intumescent and fire stopping materials where the inclusion of the materials is necessary to meet the requirements of Part B of Schedule 1;
- membranes;
- seals, gaskets, fixings, sealants and backer rods;
- thermal break materials where the inclusion of the materials is necessary to meet the thermal bridging requirements of Part L of Schedule 1; or
- window frames and glass.

Additional guidance on the application of this Regulation is provided in Section 10 of Approved Document B (2019), including guidance on membranes, window spandrel/infill panels, thermal breaks and shop signage.

It is recognised that the recent changes to the Building Regulations are not reflected in the guidance of BS 9991 (2015). On this basis, it is, therefore, proposed to supplement this report with the relevant section of Approved Document B which accounts for the aforementioned changes.

6. Fire Service access requirements.

6.1 Fire Service access strategy

Fire Service access to the commercial unit and ancillary areas on the ground floor will be directly from outside.

Fire Service access to the residences on the upper floors will be via either the firefighting shaft at the north of the building, or the means of escape staircase at the south of the building. The firefighting shaft to the north will include a firefighting lift serving all upper levels. Both staircases will be provided with dry risers.

The inlet to the firefighting staircase dry riser is recommended to be on the north façade adjacent to the entrance, the dry riser inlet to the south staircase is recommended to be within 18m of the fire appliance location in the courtyard. This results in a greater than 18m distance from the inlet to the staircase, however given that the staircase serves a top floor less than 30m, the water pressure required is expected to be less than a compliant dry riser arrangement in a taller building (up to 50m).

Control panels for the fire alarm system, smoke ventilation systems and the evacuation alert system are recommended to be located on the Fire Service access route on ground floor, with repeater panels at the means of escape staircase access route.

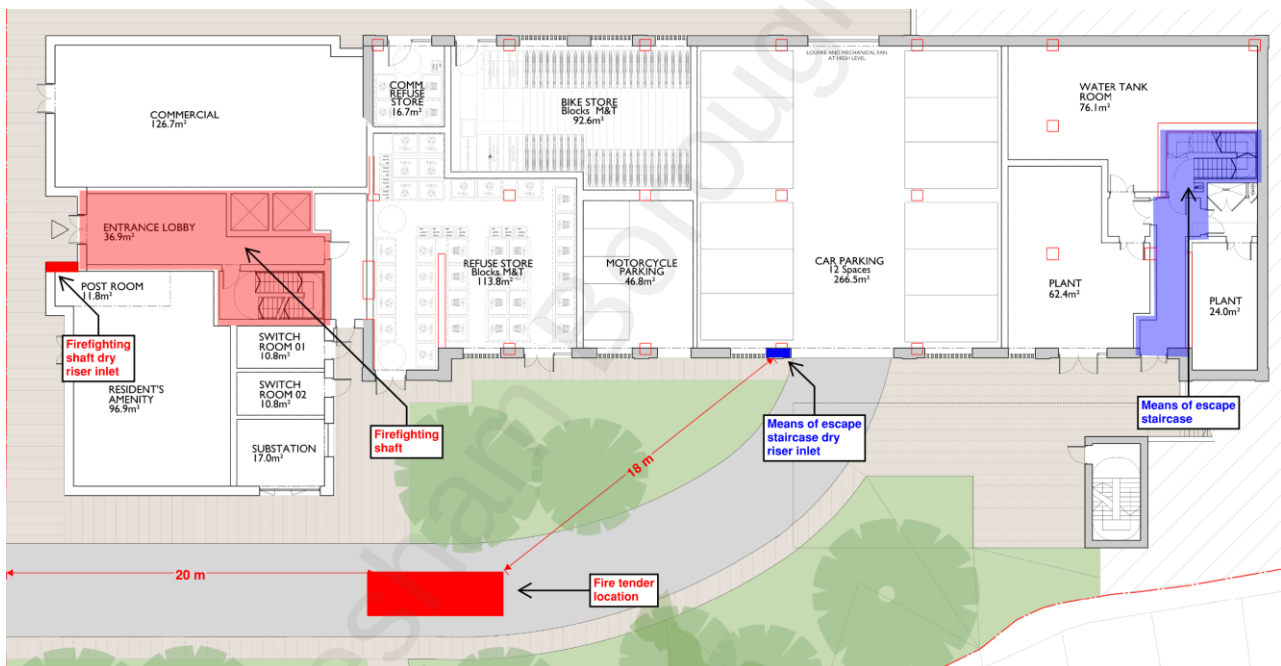


Figure 4: Fire Service access

6.2 Provision of firefighting facilities

The firefighting shaft will include the following:

- Firefighting lift conforming to BS EN 81-72[16];
- Minimum width of 1100mm (between walls providing the handrail does not protrude more than 100mm);
- 2 hours fire protection around the stair and lift shaft;
- Smoke-ventilated common corridor;
- AOV at the head of the staircase;
- Water protection to the firefighting lift shaft; and,
- Dry riser outlets on each floor.

6.3 Firefighting vehicle access

There should be access for a pumping appliance within 18m of the fire main inlet connection point on the face of the building. The inlet should be visible from the appliance.

The access route for the typical appliances will satisfy Table 5 below.

Table 5: Measurements for typical vehicle access route

Appliance type	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)
Pump	3.7	3.1	16.8	19.2	3.7	14.0
High reach	3.7	3.1	26.0	29.0	4.27	32.0
Special appliance	6.1	3.1	27.5	32.0	4.27	32.0

6.4 Fire hydrants

Fire hydrants should be provided where the building will be located more than 100m from an existing hydrant. New hydrants should be within 90m of the building.

7. References.

- [1] Approved Document B – Volume 2, HM Government, 2019 (incorporating 2020 amendments).
- [2] Fire safety in the design, management and use of buildings, BS 9999:2017.
- [3] Fire safety in the design, management and use of residential buildings, BS 9991:2015.
- [4] Fire detection and fire alarm systems for buildings – Part 1, BS 5839-1:2017.
- [5] Fire detection and fire alarm systems for buildings – Part 6, BS 5839-6:2019.
- [6] Code of practice for the design, installation, commissioning and maintenance of evacuation alert systems for use by fire and rescue services in buildings containing flats, BS 8629:2019.
- [7] Fire sprinkler systems for domestic and residential occupancies, BS 9251:2021.
- [8] Fixed firefighting systems – Automatic sprinkler systems, BS EN 12845:2015.
- [9] Emergency lighting – Part 1, BS 5266-1:2016.
- [10] Lighting applications – Emergency lighting, BS EN 1838:2013.
- [11] Graphical symbols – Safety colours and safety signs - Part 1, BS ISO 3864-1:2011.
- [12] Safety signs - Part 4, BS 5499-4:2013.
- [13] Fire tests on building materials and structures – Part 7, BS 476-7:1997.
- [14] Fire tests on building materials and structures – Part 6, BS 476-6:1989+A1:2009.
- [15] Fire classification of construction products and building elements – Part 1, BS EN 13501-1:2018.
- [16] Safety rules for the construction and installation of lifts – Part 72: Firefighters lifts, BS EN 81-72:2015.



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