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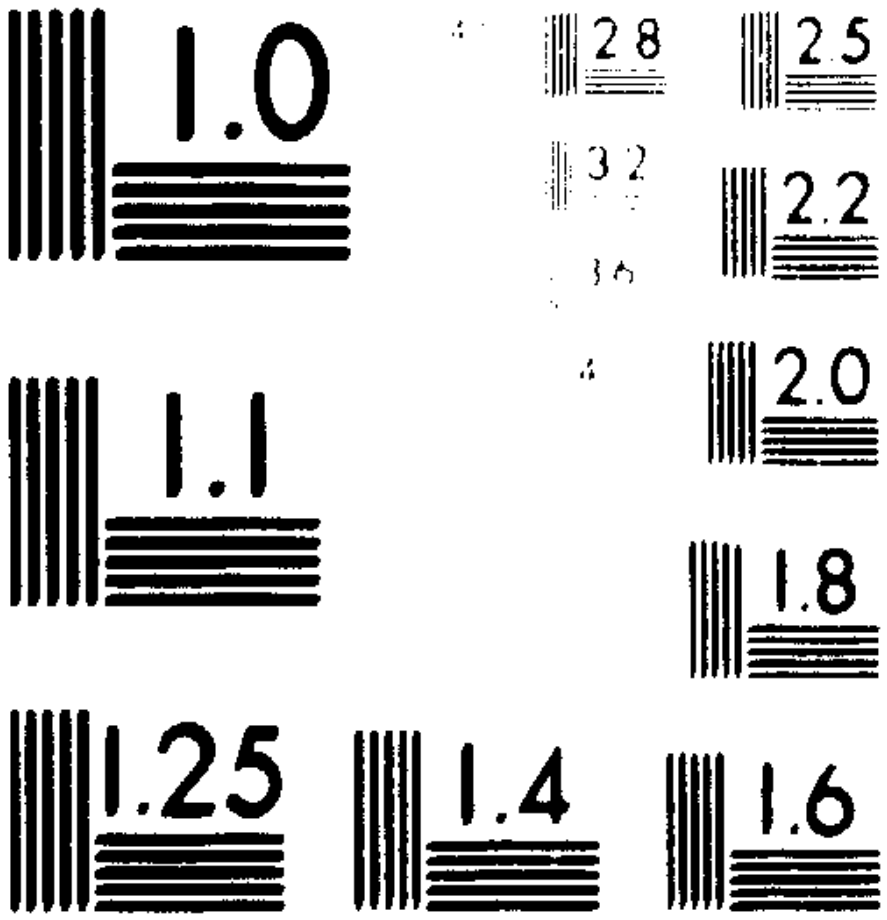
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org



Report No 6/1983

UNIDO Contract No T81/97

FIRE SAFETY CODE FOR BUILDINGS

Prepared by

H L Malhotra, BSc(Eng), MICE, FIFireE*
Senior Principal Scientific Officer

and

R E H Read, FRICS
Professional and Technical Officer

of the

Fire Research Station, Boreham Wood,

Hertfordshire, UK

Prepared on behalf of

United Nations Industrial and Development Organization (UNIDO)

for the

United Nations Development Project for Brazil

(DP/BRA/75/003)

Project Manager

Dr B S Krishnamachar

Final Draft

September 1983

*retired 1.3.1983, now practicing as a private structural fire protection consultant.

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CHAPTER 1

SAFETY OBJECTIVES

1.1 The regulations in this code have three aims, to provide a reasonable level of safety for the occupants of a building on fire, to minimise the chances of fire spread to adjacent buildings and to mitigate fire damage.

1.2 The aims are achieved by specifying requirements for the location, layout and construction of buildings, by the provision of fire protection systems where appropriate and by providing facilities for the fire brigade to suppress the fire.

1.3 The regulations are intended for new buildings and whilst some of the provisions are appropriate for existing buildings as well, direct application to all existing constructions is not foreseen. Alternative solutions would be needed in many cases for which different types of regulations are needed.

CHAPTER 2

TECHNICAL CONCEPTS

2.1 The safety objectives are achieved by specifying requirements which aim to prevent fires, provide protection against fires which occur and have facilities and systems to control and suppress fires. The requirements have been arranged so that the designer can proceed in a logical fashion from the location of the building to its internal design.

2.2 Buildings are divided into 13 different types on the basis of their occupancy. Where a particular building use does not seem to be covered, the building authority can decide its category to that closely representative of its hazard and fire protection needs. Basements, high rise buildings and shopping complexes have been dealt with separately because of their special problems.

2.3 Fire protection terms and expressions used in the regulations have precise technical or specific meaning attached to them as described in Chapter 3. Where the meanings are related to compliance in a test or to a specification given in a standard or a code these are referenced in Chapter 12.

2.4 The regulations consider 20 main fire protection measures which are described in Chapter 5 on the basis of their function and the associated performance criteria. Where these are not possible a constructional specification is given.

2.5 The most important factor influencing the design and layout of many buildings is the provision of adequate escape routes. In view of this, Chapter 6 is devoted exclusively to their design.

2.6 The general application of fire protection requirements for buildings is given in Chapter 7 with the corresponding sections having the same numbering system as the measures in Chapter 5. Chapter 8 deals with special requirements or relaxations for each of the building types. Type 1 buildings (single family dwelling houses) have no requirements for means of escape on the assumption that normal means should prove to be adequate and rescue is not difficult.

2.7 Chapter 9 gives special requirements for basements, high rise buildings and shopping complexes, each of which presents special risks and requires additional or more stringent requirements.

2.8 Chapter 10 provides some general guidance on the provision of alternative protection systems, particularly the use of analytical procedures to meet some of the performance levels demanded in Chapters 7, 8 and 9. These should be discussed with the building control authority to establish their validity and applicability so that they could be accepted as an alternative.

2.9 The management of large buildings and those frequented by members of the public has special responsibility to maintain vigilance and to take actions on the occurrence of a fire. Some suggestions are given in Chapter 11 and will be amended by the building authority in special cases on the basis of its assessment of the hazard.

2.10 Chapter 12 lists all the standards and codes to which reference is made in these regulations together with other documents which will assist with design.

CHAPTER 3

DEFINITIONS

3.1 Access room. A room which provides the only escape route from an inner room.

3.2 Accommodation stairway. A stairway not being an escape stairway.

3.3 Apartment. A dwelling unit, in a larger block, in which the habitable rooms and kitchen are at one level or are not separated by more than half a storey in height.

3.4 Basement. A storey any part of which is below ground level and does not have a doorway leading direct to the outside.

3.5 Boundary. The boundary of the land belonging to the building. In the case of buildings adjoining a street, canal or river, the centre line of such a street, canal or river is deemed to be the notional boundary.

3.6 Building authority. The authority having the responsibility for the implementation of the regulations.

3.7 Building Type. Categorization of buildings into one of the types listed in Chapter 4 on the basis of their major use.
Major use means that more than 50 per cent of the building is used for that purpose on a regular basis. If different parts of a building are used for different purposes and the parts are compartmented from each other, then each part can be considered to be a building of a different type.

3.8 Cavities or concealed spaces. Cavities and concealed spaces are voids within a construction or between different parts of a construction. For example, spaces within a hollow wall, floor or roof and behind a suspended ceiling are to be treated as cavities.

3.9 Compartmentation. Division of a building into fire sections, each bounded by walls and floors capable of containing a fire starting within the compartment, or preventing a fire from an adjacent compartment entering. Compartments can be formed on one floor by vertical divisions, or extend no more than two storeys in height except for protected stairways.

3.10 Dead end. An area in a storey from which escape is possible in one direction only.

3.11 Direct distance. The shortest distance to the storey exit from any point on the floor where occupants may be present, ignoring internal walls and partitions.

3.12 Door closer/Automatic door closer. A mechanical or electro-mechanical device for closing a door from the open position. The device should be sufficiently strong to close the door from any angle of swing against the pressure of any latch that may be present and to keep it closed in the absence of a latch. An automatic door closer is generally an electrically operated system which closes a door from the open position on receiving an electrical signal from a central system or from a specified fire detector.

3.13 Duplex. A dwelling unit, in a larger block, in which the habitable rooms and kitchen are divided between two or more levels which are more than half a storey in height.

3.14 Elements of construction. Structural and non-structural elements which make up a building and include the structural frame, beams, columns. floors, walls, doors and windows. The lowest floor of a building and the roof constructions where structurally isolated are excluded.

3.15 Escape stairway. A stairway delivering to a final exit and forming part of an escape route required under these regulations.

3.16 External cladding. Protective and/or decorative materials forming the external envelope of a building.

Wall cladding is either a discrete material or the outer layer of a composite not more than 25 mm in thickness.

Roof cladding is the protective covering to keep the building weather proof and may consist of tiles, sheet materials or a roof deck.

3.17 Final exit. The termination of an escape route from a building (usually a door) giving direct access to a street or other open space outside the building to, or from which, the occupants may disperse safely.

3.18 Fire damper. A mechanical device installed inside a duct which closes to form a barrier across the duct against the passage of flames and hot gases when a fire enters the duct system and raises the temperature of a fusible link or other operating mechanism above a prescribed level (usually between 60° and $80^{\circ}C$).

3.19 Fire detector. An electrically operated device which responds to a fire by detecting heat or smoke and is capable of sending an electrical signal to a monitoring or warning system.

A fire detector may be designed to respond to temperature rise, or to the presence of smoke by a photo-electric or an ionization device, or by an infra-red sensing system. Each type has its response characteristics and its suitability for a particular use is defined in the appropriate standards.

3.20 Fire door. A door or shutter which together with its frame and furniture is designed to resist the passage of smoke or hot gases and flames when in the closed position. A door designed primarily for resisting the passage of smoke is termed a Smoke Control door and a door designed for resisting the passage of fire is termed a Fire-resisting door. A fire resisting door will not provide complete resistance to smoke passage unless specially designed for this purpose.

3.21 Fire extinguisher. A portable or a fixed device which emits a fire extinguishing agent automatically or on manual operation, and is capable of extinguishing a fire of a known small size.

Different extinguishing media are required for fires of different types and guidance on their safe and effective use is given in appropriate standards.

3.22 Fire extinguishing systems. Fixed equipment to control or extinguish a fire in the immediate vicinity of where the fire starts. Usually coming into operation automatically.

Such systems include sprinkler installations and fixed CO_2 or similar systems for special risks.

3.23 Fire-fighting stairway. A protected stairway which can be used by the fire brigade to obtain access from the ground level to other storeys.

3.24 Fire hydrant. A water supply system provided to enable the control of a fire by the fire brigade or other trained personnel. The fire hydrant supply should be independent of the normal water supply to the building, and in high rise buildings provision made for appropriate pressure to be available at all levels.

3.25 Fire lift. A lift installed for normal purposes in a building but provided with a priority switch which enables the lift to be brought under the exclusive control of the fire brigade in the event of a fire or other emergency.

3.26 Fire load. The combustible content in a building or a compartment which on burning provides the fire against which protection has to be provided. Fire load is comprised of furniture, fittings, furnishings, stored goods, materials of construction and fuels. It is commonly expressed as MJ/m^2 of the floor area of a compartment. The nature and the amount of fire load, as well as the ventilation conditions, influence the potential severity of fire that may occur.

3.27 Fire resistance. The ability of elements of construction to withstand the combustion of the fire load in a building whilst continuing to fulfil their loadbearing and/or separating functions.

Fire resistance is determined by subjecting constructions to tests specified in Standards (eg. ABNT-1192-1977) and is the time for which the appropriate criteria of performance are satisfied. It is expressed in minutes and for grading purposes a scale in steps of 30 minutes is used.

3.28 Fire resistance requirement. The period of fire resistance appropriate for elements of building construction specified in the code on the basis of the use and the size of the building.

3.29 Fire safety management. A control and surveillance system under the control of the management of a building to ensure the proper functioning of all safety systems and prompt action in case of a fire.

3.30 Fire safety signs. Signs which give a particular fire safety message, obtained from a combination of geometric form and a safety colour together with a safety symbol or text (ie words, letters, numbers) or both.

3.31 Fire sealing. The closure of gaps and openings where fire resisting constructions adjoin each other, or around penetrations, in order to prevent the passage of flames and hot gases.

3.32 Fire warning systems. An audible or visual warning system to inform the occupants of a building, the management or the fire brigade, of the occurrence of a fire. The system may be manually operated or be of an automatic type linked to a fire sensing device such as a detector.

3.33 Flammability classification. A measure of the contribution made by linings on walls and ceilings to the growth of fire during the early stages. Products are evaluated by the use of standard tests and graded into different categories on the basis of their performance. Non-combustible materials, in general, make the least contribution to flame spread.

3.34 Gangway. A route provided for access between a seatway and the exits from an auditorium or other place of assembly provided with rows of seats.

3.35 Height of a building. The height of the topmost habitable floor above the level of the footway, paving or ground measured at the centre line of the building face giving the maximum value.

3.36 High rise buildings. Buildings which have floors at a height of more than 20 m above ground level, or comprise more than 8 storeys above ground level.

3.37 Hose reels. A first-aid fire fighting device consisting of a hose connected to a water supply system with a nozzle at the other end to provide either a jet or a spray for the control of small fires.

3.38 Inner Room. A room from which escape is possible only by passing through an access room.

3.39 Internal linings. Exposed surface materials of walls and ceilings of a room, circulation area or a compartment and including folding or removable partitions, rooflights and glazing. Doors; frames to doors, windows and rooflights etc.; fireplace surrounds, mantle shelves, removable fittings, architraves, picture rails, skirting and other narrow members are excluded.

The linings may be discrete materials or made up composites with surface finishes having thicknesses up to 25 mm.

3.40 Lighting, emergency. Lighting provided for use when the normal lighting fails.

This lighting includes:

(a) escape lighting - that part of emergency lighting which is provided to ensure that the means of escape can be safely and effectively used at all material times; and

(b) standby lighting - that part of emergency lighting which may be provided to enable normal activities to continue.

3.41 Lighting, maintained. A lighting system in which all emergency lighting lamps are in operation at all material times.

3.42 Manual fire-fighting equipment. Portable or fixed equipment which can be used by the occupants of a building, trained personnel or the fire brigade, to extinguish a fire in its early stages. Such equipment includes fire extinguishers and hose reels.

3.43 Means of escape. Provision of corridors, lobbies, stairways etc. giving a safe route, or routes, for the occupants from any part of the building to a place of safety.

In general the occupants are expected to be able to use such means without any aid, but in special occupancies (eg. hospitals) due to a lack of mobility external aid may have to be allowed for.

3.44 Non-combustible. Non-combustibility of a material is established by subjecting it to a standard test (eg. ISO 1182).

3.45 Occupancy loading. The number of people likely to be present in a given building under normal circumstances.

Occupancy rates for different types of buildings are usually tabulated and the occupancy loading for a floor can be calculated from such data. Escape facilities are provided to deal with the normal occupancy loading.

3.46 Open-spatial planning. An arrangement whereby several floors or working levels are contained in one uncompartmented volume.

Examples of such planning include split level floors, floors or levels arranged as a spiral throughout the height of the building or compartment, and atria.

3.47 Place of safety. A place in which the occupants are protected from the effects of a fire (eg. a protected area within the building leading to a final exit).

3.48 Pressurization. A method of protecting escape routes against the ingress of smoke by maintaining the air within them at pressures higher than those in adjacent parts of the building.

3.49 Protected corridor. A corridor enclosed with fire resisting construction.

3.50 Protected lobby. A small hall or corridor enclosed with fire resisting construction and affording sole means of access into a protected stairway.

3.51 Protected stairway. An escape stairway, including any exit passageway leading to the final exit, designed as a vertical fire resisting compartment.

3.52 Rate of heat release classification. Heat produced on the decomposition of linings and other combustible materials when tested in an appropriate test.

3.53 Rate of smoke production. A measure of the production of smoke on the decomposition of contents, linings or materials of construction of a building. The evaluation is made by the use of standard tests which measure the rate at which smoke is evolved under specified decomposition conditions and should enable assessment of the aggregated smoke release.

3.54 Relevant boundary. That part of the boundary which is adjacent to and either coincides with, is parallel to or is at an angle of not more than 80° with, the side of the building.

3.55 Seatway. The space provided in front of a row of seats, which affords access to the seats within that row.

3.56 Shopping Complex. A covered and enclosed shopping area of 1 or more storeys in height and possibly incorporating other building types.

3.57 Smoke control methods. Systems installed to prevent smoke logging of escape routes and other specified areas by the use of ventilation or mechanical extraction systems or pressurization.

3.58 Storey exit. A door giving direct access to a protected lobby, protected stairway, external escape route or final exit.

3.59 Travel distance. The actual distance an occupant has to travel from any part of the building to a storey exit. The position of doors, walls, partitions, fittings, etc. should be taken into account.

3.60 Unprotected area. Any window, door or other opening in an external wall or side of a building, any part of an external wall which does not have the minimum fire resistance required and any area of external cladding of lower grading than Class C (see 5.3.2).

3.61 Wall. Includes any part of a roof pitched at an angle of 70° or more to the horizontal and adjoins a space within the building to which persons have access not limited to the purposes of maintenance or repair.

3.62 Width. The width of a stairway is measured between the finished surface of enclosing walls and/or inner side of balustrading and such width shall not include any projections other than handrails which should project no more than 7.5cm onto the required width of the stairway. The width of a doorway is measured between door jambs.

CHAPTER 4

BUILDING TYPES

4.1 For the purposes of this Code buildings (or parts) are divided into the following types:-

Type	Use
1	Single family dwelling houses
2	Apartments and duplexes
3	Institutional
4	Hotel, etc
5	School
6	Office
7	Shop
8	Assembly
9	Industrial (single-storey)
10	Industrial (multi-storey)
11	Car Park
12	Storage (low fire load)
13	Storage (high fire load)

4.2 For the purposes of this Chapter, a description of the types of occupancy falling within different Building Types is given below:

TYPE 3: Children's homes, Old people's homes, Special schools for handicapped children, Hospitals, Private nursing homes, Sanatoria and Prisons.

TYPE 4: Hotels, Motels, Hostels, Lodging houses, Boarding houses, Residential clubs, Residential colleges and schools.

TYPE 5: Non-residential colleges and schools.

TYPE 7: Shops, stores, etc, Betting offices, Beauty parlours, Hairdressers, Restaurants and Cafe's.

TYPE 8: Non-residential clubs, Museums, Art galleries, Libraries, Sports stadia, Swimming baths, Theatres, Cinemas, Casinos, Concert Halls and Dance Halls.

TYPE 12: Storage buildings with a fire load density of less than 2000 MJ/m^2 of floor area.

TYPE 13: Storage buildings with a fire load density of not less than 2000 MJ/m^2 of floor area.

CHAPTER 5

FIRE PROTECTION MEASURES

5.0 General

This chapter defines the functional requirements for purposes of fire protection in buildings; these are supplemented by performance standards where this is possible and prescribed as constructional standards in other cases. The precise requirements on levels of protection and the design of fire protection measures are contained in Chapters 6-9.

5.1 Separation between buildings

5.1.1 All buildings shall be separated from each other to prevent fire spread from building to building.

5.1.2 (a) The minimum separation distance shall be related to the nature of:

(i) the external enclosure and the extent of unprotected area;

(ii) the roof covering;

and is the maximum required by either (i) or (ii) above.

(b) The separation distance shall be measured from the external facade of the building to a facing building or, in its absence, taken as twice the distance from the notional boundary.

5.1.3 (a) The unprotected area of external walls is expressed as a percentage and areas not exceeding 10 per cent of the wall are disregarded provided no individual portion is greater than 200 cm^2. Wall mounted air-conditioning units may also be disregarded provided they are adequately fixed to resist collapse in a fire and have steel enclosures and steel grilles.

(b) Screen walls (elementos vazados) when constructed of brick or concrete not less than 10 cm thick and having not less than 50 per cent solid material, can be treated as walls with ≯50 percent unprotected area (Table 7.1).

5.1.4 For buildings without internal compartmentation the whole of the external wall should be considered as a unit. For buildings with internal compartmentation, where the compartment boundaries extend to the external wall, each compartment is considered separately and the separation distance is that determined from the more severe requirement.

5.2 External enclosures

5.2.1 The nature of the external enclosures to buildings shall

(a) not lead to spread of fire from building to building and shall possess flammability characteristics appropriate to the separation between buildings;

(b) not assist in the vertical spread of fire over the facade of multi-storey buildings.

5.2.2 The external enclosure comprises the external cladding and the roof covering. For the purposes of these regulations the external enclosure is classified according to the tests specified under 5.3 for internal surfaces. Roof coverings which consist of rigid non-combustible materials shall be considered to have a Class A performance.

5.3 Internal surfaces

5.3.1 The internal surfaces of walls and ceilings shall

(a) not assist the rapid growth of fire, and

(b) possess surface flammability characteristics appropriate for the building type and the location in the building.

5.3.2 Internal surfaces shall be classified into one of the following classes.

(a) Class A surfaces are provided by materials which are non-combustible by nature. Non-combustibility is established by subjecting samples of a material to the test specified in ISO 1182-1979[1]. If the furnace or the speciman temperature does not exceed the initial test temperature by more than 50°C, or none of the specimens flame for more than 10 seconds, the material shall be regarded as non-combustible and qualify for Class A.

(b) Class B surfaces are surfaces of low flammability which do not burn easily and do not generate more than a limited amount of heat and smoke on their decomposition. The performance is judged by subjecting samples of materials to an appropriate test designed to measure flame spread, heat release and smoke production. Either of the performance levels given below may be used for this purpose.

(i) BS 476 : Part 6[2] - Index $i_1 \geqslant 6$, $I \geqslant 12$.

BS 476 : Part 7[3] - Class 1

(ii) ASTM E84[4] - Flame spread index $\geqslant 25$

Smoke index $\geqslant 450$

(c) Class C surfaces are surfaces of low flame spread which do not assist rapid flame spread. The performance is judged by subjecting samples of materials to an appropriate test designed to measure flame spread. Either of the performance levels given below may be used for this purpose.

(i) BS 476 : Part 7[3] - Class 1

(ii) ASTM E84[4] - Flame spread index $\geqslant 75$

5.3.3 Tests shall be conducted on samples of materials representative of their use in practice consisting of discrete materials or composite products with the finishes of the type likely to be present. Tests other than those specified shall be used only by the agreement of the building authority.

5.4 Means of escape

5.4.1 All buildings other than Type 1, shall have adequate means of escape provided for the safe evacuation of the number of occupants expected to be in the building on the basis of its declared use and occupancy loading.

5.4.2 The escape routes shall be adequate in number and lead to the outside of the building or, in case of large buildings, to a place of safety within the building and thence to a safe area outside.

5.4.3 The design and protection of the escape route(s) shall be in accordance with the specifications given in Chapter 6 amended as appropriate for a given building type in Chapters 7-9.

5.5 Smoke control

5.5.1 All buildings, other than Type 1, shall be provided with appropriate means to keep escape routes and other specified areas clear of smoke during a fire.

5.5.2 Such areas can be kept reasonably clear of smoke for a limited time by the provision of fire doors. For extra protection, smoke can be controlled by evacuation, using natural or mechancial means, or by pressurization.

5.5.3 Measures shall also be adopted to prevent the transfer of smoke to unaffected areas through ventilation and other ducted systems.

5.5.4 The design of smoke control systems for escape routes shall be in accordance with the requirements given in Chapters 6, 8 and 9 and the appropriateness of a given system shall be to the satisfaction of the building authority.

5.5.5 The design of mechanical ventilation and other systems shall conform to 7.5.

5.6 Fire warning systems

5.6.1 All buildings, other than Type 1, shall be provided with adequate means to inform occupants of the outbreak of a fire.

5.6.2 Fire warning systems shall be installed as specified in 7.6.

5.7 Fire detection

5.7.1 All buildings specified in Chapters 7-9 shall be provided with a suitable fire detection system.

5.7.2 Fire detectors of the following types may be used,

(a) photo-electric for smoke detection

(b) ionization for smoke detection

(c) infra-red for flame detection

(d) thermal for temperature detection

The use of a particular type in a building shall be to the satisfaction of the building authority.

5.7.3 Fire detection systems shall be installed as specified in 7.7.

5.8 Fire doors

5.8.1 All doorways within fire resisting walls and partitions shall be fitted with fire doors which maintain the effectiveness as a fire barrier of the wall or partition in which they are situated.

5.8.2 (a) All fire doors, except where otherwise provided under (b) or (c) below, shall have the same fire resistance as the wall or partition in which they are erected.

(b) Any door between a protected stairway and a protected lobby shall have a fire resistance of half hour, or half that required for the door between the lobby and the floor area, whichever is greater.

(c) Fire doors of lower performance acceptable in selected situations shall have fire resistance not inferior than that given under item 9 of Table 5.1.

5.8.3 The performance of fire doors shall be judged either on the basis of the standard fire resistance test(s) using the criteria specified in 5.12.4, or by reference to an appropriate constructional specification given in 5.12.5.

5.8.4 All fire doors shall have means for keeping them closed, or for closing in the event of fire, in accordance with 7.8.

5.9 Lighting

5.9.1 Adequate artificial lighting shall be provided in all buildings to a sufficient standard to enable people to escape and, except for buildings Type 1, shall remain in operation for the duration for which it is needed.

5.9.2 In addition, all buildings specified in Chapters 7-9 shall be provided with escape lighting which shall also ensure that any fire alarm call points and fire fighting equipment can be readily located.

5.9.3 Lighting systems shall conform to the requirements given in 7.9.

5.10 Signs

5.10.1 All buildings, other than Type 1, shall be provided with appropriate fire safety signs to enable occupants

(a) to reduce the probability of a fire occurring, and

(b) to take proper action in a fire

5.10.2 Fire safety signs include emergency signs which indicate escape routes, warning signs of potential risks, mandatory signs which require actions or activities which will contribute to safety, prohibition signs which debar actions or activities which will be detrimental to safety and fire equipment signs which indicate the location of fire-fighting equipment and how it should be used.

5.10.3 Fire safety signs shall conform to the requirements given in 7.10.

5.11 Compartmentation

5.11.1 All buildings, other than Type 1,shall be provided with compartment floors and compartment walls to limit the size of a potential fire.

5.11.2 In single storey buildings, limits are placed on the size of the floor area. In the case of building Types 12 and 13, limits are also placed on their cubic capacity in order to prevent large unmanageable fires.

5.11.3 In multi-storey buildings, a uniform limit is placed on the floor area of a compartment at ground or upper floor levels. For basements, compartments of smaller size have been specified.

5.11.4 In certain building types, and in all high rise buildings, there is a mandatory requirement for certain walls and certain floors to be compartment walls and compartment floors.

5.11.5 All buildings, other than Type 1, shall comply with the relevant compartmentation requirements specified in 7.11.

5.11.6 In buildings where an approved type of automatic sprinkler system is installed, the compartment sizes can be doubled.

5.12 Fire resistance

5.12.1 All loadbearing elements of construction and all separating elements of construction shall possess fire resistance to prevent collapse of the building and to prevent the spread of fire.

5.12.2 All columns, beams, floors, external walls, compartment walls and other specified walls shall have the appropriate fire resistance relevant for the building type as specified in 7.12.

5.12.3 All external walls shall have appropriate fire resistance when exposed to conditions simulating an internal fire. They shall also withstand fire exposure on the external face if they are nearer than 5 m to the adjacent building.

5.12.4 Any requirement that an element of construction, door or other part of a building shall have fire resistance of a specified period shall be construed as meaning that it shall be so constructed that a specimen constructed to the same specification, if exposed to the appropriate method of test[5], would satisfy the requirements of that test as to stability, integrity and insulation for not less than the period specified in Table 5.1

Table 5.1 Provisions as to method of test and minimum period of fire resistance

Part of building	Method of test	Minimum period as to		
		Stability	Integrity	Insulation
1 Column	Exposure of all exposed faces +	*		
2 Beam		*		
3 Floor	Exposure of underside	*	*	*
4 External wall > 5 m from the adjacent building	Exposure of inside	*	*	*
5 External wall ≯ 5 m from the adjacent building	Exposure of each side seperately	*	*	*
6 Compartment wall		*	*	*
7 Other specified wall		*	*	*
8 Doors within a compartment wall or floor	Exposure of each face separately when fitted in its frame		※	※
9 Doors specified in 7.8.1(b)			20	20

+ If this is not known, the instructions of the standard should be followed. (An exposed face includes any face within, or forming part of, any element not affording the same period of fire-resistance required for the column or beam).

* Period of fire resistance specified under Section 7.12.

※ Period of fire resistance specified under Section 7.12 for the wall or floor containing such door, except where otherwise permitted under 5.8.2(b).

5.12.5 In lieu of test data, the building authority can accept evidence to show that the construction is capable of providing the necessary degree of fire resistance on the basis of:

(a) in the case of fire doors, an appropriate specification[6,7]; or

(b) experimental data, or calculations, undertaken by a competent expert or authority.

5.13 Penetration of fire barriers

5.13.1 Every imperfection of fit between fire resisting elements, fire barriers, and where penetrations are made in fire barriers, shall be fire sealed such that the integrity of the fire barriers is maintained.

5.13.2 Fire seals shall be either non-combustible or be shown by tests to restrict passage of smoke and flame.

5.13.3 Any pipe or duct passing through a fire barrier shall not impair the integrity of the barrier. Unless the constructional system has been shown by test to be satisfactory, it shall conform to the constructional specification in 7.13.

5.13.4 Any refuse chute (dutos de lixeira) shall

(a) be so installed as not to provide a passage for the vertical transfer of fire; and

(b) conform to the appropriate constructional specification in 7.13.

5.14 Cavities and concealed spaces

5.14.1 All cavities in elements of construction shall be closed or obstructed by cavity barriers to prevent the spread of fire within the cavity from one space to another and by-passing fire barriers.

5.14.2 Cavities at the perimeter of constructional elements, or openings in them, shall be sealed and all large cavities shall be subdivided by cavity barriers.

5.14.3 Cavity barriers shall be constructed such that a fire will not enter an adjacent area at an earlier time than through the normal fire resisting construction. In the absence of test evidence, the construction shall conform to the requirements in 7.14.

5.15 Lifts

5.15.1 The installation of lifts in buildings shall be such that smoke and hot gases are not able to enter higher storeys without restriction and adversely affect the usefulness of escape routes. The protection of lift shafts shall be in accordance with the requirements given in 7.15.

5.15.2 Lifts which are provided for use by the fire brigade shall be designed to remain operable during a fire and shall follow the constructional details given in 9.2.

5.15.3 Lifts shall not be provided with call buttons which react to a fire and signal the lift to travel to the affected floor.

5.16 Manual fire fighting equipment

5.16.1 Manual fire fighting equipment shall be provided in all buildings, other than Type 1, to enable the occupants or other trained personnel to control and extinguish a small fire.

5.16.2 Manual fire fighting equipment consisting of fire extinguishers and fire hoses shall be provided.

5.16.3 The type and location of fire extinguishers shall be suitable for the anticipated fire hazard and the occupants of the building shall be familiar with their use.

5.16.4 Hose racks (or other approved storage facility) and hydraulic hose reels shall be located in a prominent position, clearly marked and available at all times for use by the occupants.

5.16.5 The type and installation of manual fire fighting equipment shall

(a) be in accordance with the specification in 7.16

(b) be approved by the fire brigade.

5.17 Fire extinguishing systems

5.17.1 Fire extinguishing systems shall be provided in all buildings where special risks are present or where additional safeguards are needed to enable suppression and extinguishment of a fire.

5.17.2 Fire extinguishing systems include automatic sprinkler installations and fixed systems using carbon dioxide, dry powder, halon, foam or water spray.

5.17.3 The provision of fire extinguishing systems shall be to the satisfaction of the fire brigade and in compliance with the standards of installation and construction given in 7.17.

5.17.4 The provision of sprinkler installations where non-obligatory shall enable adjustments to be made to the compartmentation limits in accordance with 5.11.6 and 7.10.

5.18 Water supplies for fire fighting

5.18.1 The availability of adequate water supplies for use by the fire brigade shall be ensured in the planning of all buildings.

5.18.2 In high rise buildings, shopping complexes and other buildings presenting special risks in the view of the building authority, provision shall be made for the siting of hydrants in and outside the building and for rising mains.

5.18.3 The installation of hydrants and rising mains shall be in accordance with 7.18.

5.19 Fire brigade access

5.19.1 Access shall be available for the fire brigade to reach the outside of a building with the appliances appropriate for the type of fire to be anticipated in that building. In large buildings and high rise buildings the provision of special hard standing areas shall be considered and agreed with the fire brigade.

5.19.2 In high rise buildings provision shall be made for the fire brigade to have protected entry into the building with access to all floors for purposes of rescue and fire fighting.

5.19.3 The provision of fire brigade access shall be as specified in 7.19.

5.20 Site and building plan

5.20.1 Plans shall be prepared of the site, the building and other facilities specified in 7.20 for the guidance and use of the fire brigade to assist with their rescue and fire fighting functions in all basements, high rise buildings and other buildings where required by the fire brigade.

CHAPTER 6

ESCAPE ROUTE DESIGN

6.0 General

Provision of means of escape from all buildings other than Type 1 shall conform to the specifications given in this chapter, amended in specific cases as shown in Chapter 8 for various building types and in Chapter 9 for basements, high rise buildings and shopping complexes. The requirements utilise standards and codes used in a few selected countries. Where other equivalent standards or codes are available they can be used by agreement of the building authority.

6.1 Number of exits and escape routes

6.1.1 There shall be not less than 2 exits or escape routes available from any storey or room (except where conforming with 6.1.2) and additional escape routes shall be provided as necessary to meet requirements for travel distance and occupancy loading.

6.1.2 Subject to limitations of travel distance a single exit or escape route may be accepted in the case of

(a) a building

  (i) specified under Chapter 8; or

  (ii) comprising not more than 3 storeys above the ground storey, or having any storey where the floor level is at a height not greater than 10 m above ground level, whichever is the lesser.

(b) a storey

  (i) specified under Chapter 8; or

  (ii) in a part of a building conforming to (a) (ii) above.

(c) a room -

(i) specified under Chapter 8; or

(ii) which is not likely to be occupied by more than 50 persons.

(d) an inner room (not being a bedroom) where -

(i) the total travel distance, including the portion through the access room, does not exceed the limits specified under 6.2, and

(ii) the access room is not an area of higher fire risk and is in the control of the same occupier, and

(iii) the enclosures between the inner and access rooms are not carried full height, or a vision panel is provided between the two rooms in a suitable position and is of a suitable size to enable the occupant(s) in the inner room to have early warning of fire in the access room.

6.2 Distances of travel

6.2.1 The escape routes from any storey shall be of such a number and so situated that the distance of travel from any point to the nearest storey exit (or door to an adjacent compartment in a hospital or similar building Type 3) does not exceed the appropriate limits:

(a) specified under Chapter 8; or

(b) set out in Table 6.1 in respect of any other situations.

6.2.2 The travel distances shown in Table 6.1 can be increased by 30 per cent when a sprinkler system is provided, or by 50 per cent when a detection and alarm system is installed (with or without a sprinkler system).

TABLE 6.1. Maximum permitted distances of travel in a storey

Building Types	Travel distance (m)	
	Available direction of travel	
	In 1 direction	In more than 1 direction
9 and 10 (High fire risk) and 13	10	20
9 and 10 (Medium fire risk)	20	40
9 and 10 (Low fire risk)	30	60
11	Not permitted	40
Other types	20	40

TABLE 6.2. Occupancy loading

Description of room or storey	Floor space (m^2)* per person
1. Assembly (a) closely seated audience or dancing	0.5
(b) exhibition	1.5
2. Car parks/	30.0
3. Committee room, conference room, meeting room, common room, reading room, staffroom or waiting room	1.0
4. Factory	10.0
5. Kitchen	7.0
6. Library	7.0
7. Office	7.0
8. Restaurants and Lounges	1.0-1.5+
9. Shops and Showrooms (a) sparsely occupied areas	7.0
(b) areas not sparsely occupied (including supermarkets)	2.0
10. Shopping Malls	0.75
11. Storage	15.0

NOTES FOR TABLE 6.2

* excluding stair enclosures, lifts and sanitary accommodation

/ alternatively, 2 persons per parking space

+ depending upon layout of seating viz closely or widely spaced.

The notional occupancy loading of a room or storey =

$$\frac{\text{area of room or storey}}{\text{floor space per person}}$$

When an area is provided with fixed seating, the notional occupancy loading shall be taken as the number of seats provided except where the building, or part, is licensed for a larger number of occupants.

The occupancy loading of a multi-storey building is calculated for each storey and totalled.

6.3 Width of exits and escape routes

6.3.1 The number of occupants for whom provision shall be made, where not otherwise known, shall be calculated from the values given in Table 6.2.

6.3.2 (a) The width of a single exit or escape route, or the total width of all exits and escape routes, shall be -

(i) not less than specified in Chapter 8; or

(ii) (when not specified in Chapter 8) calculated from Table 6.3.

(b) Escape stairways, and exits from them, shall be not less than the width of the exit(s) they serve, and in any case shall be not less than -

(i) 1 m, in the case of escape stairways serving a building Type 2; or

(ii) 1.2 m, in the case of any building permitted to be served by a single stairway (other than stairways serving building types 1 and 2); or

(iii) as given in Table 6.4.

6.3.3 Where 2 or more escape routes are required (except in the case of buildings Type 2) the width, or total width, of escape routes and stairways shall be such that if any one escape route or stairway is not usable the remainder have adequate capacity for the occupants.

TABLE 6.3. Minimum clear width of escape routes within a storey and of any exit

Maximum number of persons	50	150	240	360
Width (cm) of doors and corridors	80	100	120	180

NOTE: i) Between 240 and 360 persons interpolation is permitted

ii) Maximum width of a single leaf door, 120 cm

iii) Minimum width of corridors, 120 cm

TABLE 6.4. Width of stairways serving basements and for buildings requiring 2 or more stairways

Number of floors served	Width (m)		
	1.20	1.50	1.80
	Number of persons 1 stairway can accommodate		
1	240	300	360
2	285	360	435
3	330	420	510
4	375	480	585
5	420	540	660
6	465	600	735
7	510	660	810
8	550	720	885

NB. for buildings exceeding 8 storeys, see 9.2.5.

6.4 Siting of exits and escape stairways

6.4.1 The siting of escape stairways in buildings (or parts) served by 2 or more such stairways shall:

(a) be such that they afford effective alternative directions of travel from any point on a storey; and

(b) access to any stairway is obtained from any point on that storey without passing through any other such stairway.

6.4.2 Alternative directions of travel shall only be considered to be available from any point on a storey where such routes diverge at an angle of not less than 45° except where the divergent routes are separated by fire-resisting construction.

6.4.3 In buildings comprising

(a) open spatial planning, the escape stairways shall be sited at the extremities of the building away from open connections between floors.

(b) a central core arrangement, the access doors to the escape stairways shall be sited remote from one another and shall not be approached from (or linked by) a lobby, corridor or lift hall common to both escape stairways.

6.4.4 Accommodation stairways and escalators shall

(a) be so sited that their location does not prejudice the means of escape at the upper floor level(s); and

(b) be limited in any case to serve not more than two floors in the absence of any requirements for compartmentation.

6.5 Discharge from escape stairways and final exits

6.5.1 Final exits shall deliver to the street at ground level or to a point in the open air from which safe alternative escape can be made.

6.5.2 Any final exit shall be immediately apparent to any persons using a stairway which serves beyond the point of final exit.

6.5.3 Buildings with not more than 3 floors above the ground storey may have exit doors or external stairways delivering to an arcade or courtyard with only 1 exit provided the distance between the line of the exit doors or foot of the external stairway and the line of the exit from the arcade or courtyard does not exceed the narrowest dimension of the arcade or courtyard by more than 10 m.

6.5.4 Any external portion of an escape route between a final exit and the street level where across a concourse, pedestrian walkway etc shall be protected with balustrading not less than 1.1 m in height.

6.5.5 Final exits shall be located clear of any windows, doors or other opening from a basement.

6.6 Design and construction of escape stairways

6.6.1 Every escape stairway shall be arranged with treads, risers, going, headroom, handrails and balustrading in accordance with the recommendations contained under reference 8.

6.6.2 Any external stairway, gangway or balcony exceeding 15 m above ground level shall be constructed with solid treads, risers and balustrading.

6.7 Protection of escape stairways

6.7.1 Every internal escape stairway shall be a protected stairway except in the case of:

(a) a stairway serving a building Type 1; or

(b) where otherwise provided under Chapter 8.

6.7.2 The distance between any opening in the external enclosures to the building and any opening in the enclosures to the stairway shall be not less than 2 m, and the enclosures within that distance, and 10 m vertically below, shall be of imperforate fire-resisting construction.

6.7.3 Any wall or portion within 2 m, or within 10 m vertically below any external stair (other than at top floor level of a stair not being a basement stair) shall be imperforate (other than fire-resisting self-closing doors serving that stairway) and be of fire-resisting construction.

6.8 Protected stairways

6.8.1 The enclosure of a protected stairway shall have the requisite fire resistance specified under item 7 of Table 5.1 and any part of such enclosure which is common to the enclosure of any other protected stairway shall not contain a door or any other opening.

6.8.2 Every protected stairway shall:

(a) be entered from only 1 storey exit at each level; and

(b) not contain any accommodation or cupboards.

6.9 Protected lobbies

6.9.1 A protected stairway shall be approached only by way of a protected lobby or protected corridor in the following conditions:

(a) if it is the only stairway serving that building, or part, (except that a lobby on the top storey is not mandatory);

(b) where it communicates with a car park;

(c) where it directly serves a boiler room, transformer chamber or other area of high fire risk;

(d) where required under Chapters 8 or 9.

6.9.2 Every protected lobby forming part of an escape route shall be so constructed that the clearance between the edges of the doors when fully open is not less than 50 cm and either:

(a) the distance between the doors in the closed position is not less than 1 m; or

(b) where the distance between the doors when in the closed position is less than 1 m, the planes of the doors are at an angle to one another of not less than 90°C.

6.10 Corridors

6.10.1 (a) The enclosures to protected corridors shall be carried up full height to the underside of the structural floor above.

(b) The enclosures to all other corridors shall be either carried up full height to the underside of the structural floor above, or to an imperforate suspended ceiling. All openings (other than to an enquiry or reception area) in the corridors shall be provided with doors.

6.10.2 Dead end corridors shall be constructed as protected corridors.

6.10.3 Corridors connecting alternative storey exits (other than corridors in Type 2 buildings) shall be sub-divided by a fire door, except in the case of corridors not exceeding 12 m in length.

6.10.4 Where any corridor communicates with any other corridor, such corridors shall be separated by a fire door.

6.10.5 Where any dead end corridor communicates with any corridor affording alternative means of escape, such corridors shall be separated at their junction by fire doors.

In the case of T junctions, fire doors shall be located within the main corridor on both sides of the junction with the dead end corridor.

In the case of any corridor connecting alternative storey exits and having a dead end extension beyond a protected stairway, a fire door shall be located across the corridor to separate (a) the access to such stairway from the dead end portion, from (b) the portion of the corridor connecting with the alternative storey exit(s).

6.10.6 Recesses off corridors not exceeding 2 m in depth, or extensions of corridors beyond protected stairways not exceeding 2m in length, are not required to meet the requirements of 6.10.2 and 6.10.5 in respect of dead end situations unless:

(a) the corridor is otherwise required to be a protected corridor; or

(b) the accommodation served is otherwise required to be separated from other parts of the building by fire-resisting construction.

6.11 Doors on escape routes

6.11.1 All doors affording means of escape from and within a building shall:

(a) be fitted only with simple fastenings which can be operated from the escape side of the door without the use of a key subject to any special provisions acceptable to the fire brigade for the purposes of security. Except that exit doors in places of assembly, and in premises where large numbers of the public may be present, shall be kept free from fastenings other than panic bolts conforming to reference 9.

(b) be hung to open -

(i) clear of any steps, landings, corridors and escape routes;

(ii) in the direction of escape (except where used by not more than 50 persons).

(c) where hung to swing both ways, and on all doors sub-dividing or separating corridors, be provided with at least a vision panel the bottom of which, in the case of buildings likely to be frequented by persons in wheelchairs, shall be not higher than 1 m above floor level.

6.11.2 Revolving doors and automatic sliding doors where provided across exit routes shall have either -

(a) swing doors immediately adjacent of the required width; or

(b) such doors shall be designed to become outward opening doors from any position of opening in case of emergency.

6.12 Miscellaneous requirements

6.12.1 The floors of gangways, corridors, lobbies, landings and passages forming part of escape routes shall have non-slippery even surfaces.

6.12.2 Lobbies, corridors, passageways etc forming part of an escape route shall have a clear headroom of not less than 2 m and there shall be no projection from any wall (except normal handrails) ceilings or false ceilings below this height which would impede the free flow of persons using them.

6.12.3 The clear height of any doorway in an escape route shall be not less than 1.9 m.

6.12.4 Ramps shall have an easy gradient and in no case be steeper than 1 in 10, or 1 in 12 in the case of ramps intended for use by wheelchairs or handicapped persons.

6.12.5 Clear access shall be provided from all parts of each storey or floor up to and between escape stairways and exits.

6.13 Escape routes across roofs

6.13.1 The escape route shall be protected with balustrading not less than 1.1 m in height.

6.13.2 The escape route and its supporting structure shall be constructed as a fire-resisting floor.

6.13.3 Where such an escape route is in one direction only, any ventilation outlets or other extract system, together with any doors, rooflights or windows which are not fire-resisting, shall not be sited within 3 m of such a route.

6.14 Ladders

Ladders affording escape shall be constructed of non-combustible materials and if -

(a) sloping, shall be fixed at an angle not steeper than 60° to the horizontal and be provided with flat treads 13 cm in depth and not more than 20 cm apart,

(b) vertical, be in accordance with reference 10.

6.15 Balconies

Balconies affording alternative routes of escape shall

(a) be of sufficient length to permit persons escaping to reach a place of safety; and

(b) be protected with balustrading not less than 1.1 m in height.

6.16 Windows

Windows affording alternative routes of escape shall be constructed as to be capable of providing a readily accessible opening -

(a) the bottom of which is not more than 1.1 m from the floor of the room;

(b) which measures, when the window is open, not less than 85 cm in height by 50 cm in width.

6.17 Glazing

6.17.1 Glazing which can satisfy the criteria of stability, integrity and insulation can be used without restriction within fire-resisting enclosures subject to fitness against damage from impact or rapid cooling.

6.17.2 Glazing which is not able to satisfy the insulation criterion for fire resistance shall conform with the limitations of maximum area and siting in Table 6.6 appropriate to its position and size except where otherwise prohibited under Chapter 8.

TABLE 6.5. Fire-resistant glazing to stairways, lobbies and corridors

Position of glazing	Buildings, or parts of buildings, served by a single stairway		Parts of buildings with access to more than 1 stairway	
	Maximum total area of glazing in			
	wall/partition	any leaf of a fire-resisting door	wall/partition	any leaf of a fire-resisting door
Directly between a protected stairway and the floor area or a non fire-resisting corridor	Nil	25% of door area	Unlimited above 1.1m height	50% of door area
Between a protected stairway and fire-resisting lobby or fire-resisting corridor	Unlimited above 1.1m height	Unlimited	Unlimited	Unlimited
Between a fire-resisting lobby and the floor area	ditto	Unlimited	Unlimited	Unlimited
Between a fire-resisting corridor forming a dead-end and the floor area	ditto	Unlimited	Unlimited above 1.1m height	Unlimited
Between a fire-resisting corridor (not forming a dead end) and the floor area	Does not apply	Does not apply	Unlimited	Unlimited
Within the enclosures to a fire-fighting lobby approach stairway and lobby	Does not apply	Does not apply	Nil	Unlimited above 1.1m height

CHAPTER 7

GENERAL REQUIREMENTS

7.0 General

This chapter contains the general requirements for fire protection measures to be provided in buildings. The requirements are based on the fire protection measures listed in Chapter 5. Additional requirements or relaxations for various building types will be found in Chapter 8 and Chapter 9 for basements, high rise buildings and shopping complexes. Where performance is expressed in relation to one or more tests, alternatives can be used only by satisfying the building authority of their effectiveness.

7.1 Separation between buildings

The minimum separation between buildings shall comply with table 7.1

Table 7.1 Minimum separation between buildings

Type of external enclosure	Percentage of unprotected area	Minimum separation (m)
Class A	Nil	No restriction
Class B or C	Nil	5
Class A	$\geq$ 50	5
Class A	$>$ 50	15
Class B or C	$\geq$ 50	15
No restriction	$>$ 50	30

7.2 External enclosures

7.2.1 The nature of the external cladding to buildings shall comply with table 7.1 in relation to the separation between buildings, subject to the external cladding to buildings comprising

(a) 4-8 storeys in height, being not inferior than Class C, and

(b) over 8 storeys in height, being Class A.

7.2.2 The nature of external coverings to roofs shall comply with table 7.2.

TABLE 7.2 Minimum requirements for roof coverings

Building height (storeys)	Minimum separation between buildings (m)	Minimum performance of roof covering
⩽ 8	< 5	Class A
	5 - 15	Class C
	> 15	no restriction
> 8	⩽ 15	Class C
	> 15	no restriction

7.3 Internal surfaces

The surface of walls and ceilings in all buildings (except buildings Type 1) shall be not inferior than set out in Table 7.3.

TABLE 7.3 Surfaces of walls and ceilings

Class of surface	Building Type		
	Rooms and other areas	Corridors and lobbies	Protected stairways
A	-	-	all
B	3 and 8	all	-
C	all (except 3 and 8)	-	-

7.4 Means of escape

All buildings (other than buildings Type 1) shall be provided with escape routes designed in accordance with the provisions contained in Chapter 6 except where ctherwise provided in Chapters 8 and 9 for specific buildings.

7.5 Smoke control

7.5.1 (a) Every protected stairway enclosure, protected lobby and protected corridor shall be provided with doors capable of resisting the passage of smoke; and

(b) Every such stairway and lobby shall be provided with means -

(i) for smoke clearance, or

(ii) for the prevention of smoke entry by pressurization.

7.5.2 Except where escape routes are protected in accordance with 7.5.1 (b) (ii) above, every -

(a) protected stairway enclosure shall be provided with a vent at the top having a clear openable area of not less than 1 m^2.

(b) protected lobby shall be provided with:

(i) openable windows at each storey level; and

(ii) adequate permanent ventilation not less than 4000 cm^2 where such lobby connects a protected stairway with either an enclosed car park or a boiler room, transformer chamber or other area of high fire risk; or 500 cm^2 in any other case.

7.5.3 Ventilation of fire-fighting stairways shall be in accordance with 9.2. 18.

7.5.4 Any open well provided for ventilation of a protected stairway or protected lobbies shall be not less than 10 m^2 in horizontal cross-sectional area, or 3000 cm^2 for each metre of height of the building, whichever is the greater, and approximately square in shape on plan.

7.5.5 Any ventilation shafts serving a protected stairway or protected lobbies not on an external wall or adjacent to an open well shall be fully open to the external air at top and bottom, shall be separated from other ventilation shafts and where serving -

(i) any lobbies, shall have a minimum internal dimension of 1 m, with a minimum internal area of 25% of the lobby floor area or 3 m^2 whichever is the greater;

(ii) the stairway, shall have a minimum internal dimension of 750 mm, with a minimum internal area of 15% of the horizontal cross-sectional area of the stairway, or 1.5 m^2, whichever is the greater.

7.5.6 All buildings (other than building type 1) shall be provided with means for clearing smoke as follows:

(a) all upper storeys which have unfenestrated areas, and the upper storeys of buildings sealed for the purposes of full air conditioning, shall be provided with openable means for cross ventilation totalling not less than 2.5% of the floor area.

(b) all basement storeys not provided with openable windows shall be provided with smoke clearing outlets which shall

(i) be situated at high level in well distributed positions along street frontages or adjacent to external walls easily accessible to the fire brigade;

(ii) be as numerous and as large as possible;

(iii) total not less than 2.5% of the floor area they serve; and

(iv) may be covered with breakable covers.

7.5.7 All windows and vents required by this Code to be openable shall be fitted with:

(a) simple lever handles, or

(b) locks which can be operated by the fire brigade with a square ended key,

and such windows and vents shall be clearly identifiable.

7.5.8 Where such openings are not easily accessible, provision shall be made for their operation by remote control mechanism which, in the case of any vents situated at the top of internal protected stairway enclosures shall be located adjacent to the entrance doorway in the ground/access storey and be clearly marked as to its function and means of operation.

7.5.9 Breakable covers provided on smoke cleaning outlets shall be capable of being opened by the fire brigade from outside the building and a permanent notice identifying the area which they serve shall be provided on or adjacent thereto.

7.5.10 Where it is not possible or convenient for a smoke clearing outlet to terminate at a level accessible to the fire brigade, the shafts may be led up through the building to discharge direct to the open air at a suitable point and the outlets shall be unobstructed or covered only with a grille or louvres constructed of steel.

7.5.11 Any shafts serving smoke clearing outlets shall be:

(a) provided separately from different basement levels and from such accommodation as boiler rooms, rooms containing oil filled switchgear storage space and car parks; and

(b) throughout their length of not less cross sectional area than the smoke outlet they serve; and

(c) enclosed with solid non-combustible material having not less than the period of fire-resistance required for the storey served, or through which they pass, whichever is the higher.

7.5.12 Any pressurization system for the protection of escape routes shall be designed in accordance with reference 11.

7.5.13 Mechanical ventilation and air-conditioning plant shall be installed in accordance with references 12 and 13.

7.5.14 Mechanical ventilation systems shall be designed and adjusted to ensure that the normal movement of air flow is away from protected stairways, exits and routes of escape.

7.5.15 Any system of mechanical ventilation involving the recirculation of air shall be provided with an optical smoke detector situated in the extract system ductwork at a point before the separation of the recirculated air which, on the smoke reaching an optical density within the system of 0.05/m shall prevent recirculation of the polluted air by either shutting down the system or by diverting the extract air to outside the building.

7.5.16 Mechanical ventilation arrangements serving stairways, residential accommodation, offices, separated stages, trade uses, spraying booths, car parks and garages, boiler chambers and chambers containing oil immersed electrical plant, shall each be separate independent systems.

7.6 Fire Warning systems

The installation and servicing of electrical fire alarm systems shall comply with the relevant provisions contained under reference 14.

7.7 Fire detection

7.7.1 A fire detector operated alarm system shall be installed in building types 7 and 8 when accommodating more than 20 persons, and in any other building (except Type 1):

(a) where an outbreak of fire cannot be readily seen from any part of any floor area;

(b) within any fire risk area not normally occupied by persons;

(c) where required in Chapter 8.

7.7.2 The installation and servicing of fire detection systems shall comply with the relevant provisions contained under reference 14.

7.8 Fire doors

7.8.1 All fire doors shall comply with 5.8.2(a) except in the case of

(a) doors complying with 5.8.2(b); or

(b) i. entrance doors to apartments and duplexes;

ii. bedroom doors of building types 3 and 4; and

iii. doors subdividing or separating corridors;

where they shall comply with 5.8.2(c)

7.8.2 All fire doors (except to cupboards and service ducts) shall be fitted with a self-closing device which

(a) shall be of type which cannot readily be disconnected or immobilized and shall not embody a stand-open action;

(b) shall override any latches fitted to the door(s); or

(c) in the absence of a suitable latch or other positive device for holding the door shut in its frame, shall be of a type which has shown by a fire-resistance test of a complete door assembly to be capable of holding the door closed in the frame throughout the full period of exposure in such a test.

7.8.3 No means of holding any fire door open, or of overriding the self-closing device, shall

(a) be permitted on fire doors to fire-fighting stairways or to protected stairways and their associated lobbies serving buildings (or parts) containing sleeping accommodation.

(b) be provided elsewhere, other than an electromagnetic or similar device or system which enables the door to close automatically in the event of

i. the detection of smoke

ii. failure of the power supply

iii. operation of a manual or automatic fire alarm system

iv. manual operation at a central control point

and such doors shall be suitably marked on both sides, at about eye level, with the appropriate mandatory fire safety sign.

7.8.4 Unless shown to be satisfactory by a fire-resistance test of a complete door assembly, no part of a hinge on which any fire door is hung, and which provides the sole means of support at the hanging edge, shall be made either of combustible material or of non-combustible material having a melting point of less than 800°C.

7.8.5 Fire doors to cupboards and service ducts in lieu of being self-closing shall be kept locked shut when not in use and be so marked on the outside with the appropriate mandatory fire safety sign.

7.8.6 All other fire doors (except where referred to in 7.8.3 (b)) shall be kept shut when not in use and (except for entrance doors to apartments and duplexes and bedroom doors in building types 3 and 4) shall be marked on both sides, at about eye level, with the appropriate mandatory fire safety sign.

7.8.7 The extent of glazing permitted in any fire door shall comply with 6.17, subject to any requirements under Chapter 8.

7.9 Lighting

7.9.1 Artificial lighting provided in accordance with 5.9.1 shall, except for buildings Type 1, be provided either by:

(a) current supplied by a protected circuit which, in the case of stairways, shall be separate from any electrical circuit supplying lighting to any other part of the same escape route; or

(b) maintained lighting.

7.9.2 Escape lighting shall be provided in all buildings, except for buildings Type 1 or where otherwise provided under Chapter 8, within-

(a) any underground or windowless accommodation; and

(b) any escape route.

7.9.3 The provision and installation of escape lighting for:

(a) cinemas, dance halls, ball rooms and ten-pin bowling establishments, shall comply with the relevant provisions contained under reference 15.

(b) other premises, shall comply with the relevant provisions contained under reference 16.

7.10 Signs

7.10.1 All exits:

(a) in assembly buildings, shall be provided with internally illuminated exit signs;

(b) elsewhere (except where used for normal egress) shall be marked with Emergency signs and such signs shall be readily visible so that the occupants of the building can clearly see where the exits are and where to go in an emergency at any time.

7.10.2 Directional signs shall be provided, as necessary, to indicate the routes of escape.

7.10.3 Appropriate warning, mandatory, prohibition and fire equipment signs shall be provided in all buildings except buildings Type 1.

7.10.4 Fire safety signs shall comply with reference 17 except in the case of internally illuminated exit signs which shall comply with reference 18.

7.11 Compartmentation

7.11.1 All buildings (except buildings Type 1) shall be divided into compartments by the provision of compartment walls and compartment floors such that no compartment exceeds the limits of floor area and cubic capacity set out in Tables 7.4 or 7.5 as appropriate.
The compartment sizes can be doubled when an approved type of automatic sprinkler system is installed.

7.11.2 The following walls and floors shall be constructed as compartment walls or compartment floors.

(a) any floor specified in Table 7.6;

(b) any wall separating buildings Type 1;

(c) any wall separating an apartment or duplex from any other part of the same building;

(d) any wall or other enclosure to a protected stairway; and

(e) any wall or floor separating different building types.

TABLE 7.4 Limits for compartments (single storey)

Building Type	Floor area (m^2)	Cubic capacity (m^3)
2 to 11	2000	No limit
12 and 13	2000	10,000

TABLE 7.5 Limits for compartments (multi storey)

Building Type	Floor area (m^2)		Cubic capacity (m^3)
	Basements	Elsewhere	
All	300	600	No limit

TABLE 7.6 Provision of compartment floors

Building Type	Height (storeys)	Location of floor
All (except 9)	-	Floor between ground & basement storeys
All (except 9)	-	Floor between basement storeys
2,3 and 4	-	All floors*
Other than types)	>8	All floors
2,3,4 and 9)	4 - 8	Alternate floors

* except floors within a duplex.

7.12 Fire resistance

7.12.1 (a) The fire resistance requirements specified in Table 7.7 shall apply to the following elements of construction in a building, except as amended in (b), (c) or (d) below:

i. columns;

ii. beams;

iii. floors;

iv. loadbearing walls;

v. external walls;

vi. compartment walls;

vii. enclosures to protected stairways and lobbies.

(b) Compartment walls separating buildings Type 1 shall have a fire resistance of at least 1 hour.

(c) Compartment walls or compartment floors separating part of a building comprising building types 2, 3 or 4 from other building types shall have fire resistance of at least 1 hour.

(d) Compartment walls in a building Type 2 of more than four storeys in height, where separating -

i. any two apartments or duplexes; or

ii. any apartment or duplex from a common internal corridor;

are not required to have more than 1 hour fire resistance.

7.12.2 The fire resistance of any element of construction shall be not less than that required for any element which it supports or carries.

7.12.3 Every element of construction required to have a fire resistance of 1 hour or more shall be constructed of non-combustible materials (as classified under clause 3.44) but this restriction does not apply to surface finishes or linings.

7.12.4 Fire doors shall comply with 7.8

7.12.5 Any other requirement concerning fire-resisting construction in this code, means that such construction shall provide at least ½ hour fire resistance.

TABLE 7.7 Minimum period of fire-resistance

Building Type	Fire resistance (hours)				
	* Basement	Height of Building (storeys)			
		⩾1	⩾4	⩾8	>8
1	1	½	½	-	-
2	1	½	1	1½	2
3	1	½	1	2	3
4	1	½	1	1½	2
5	1	½	1	2	2
6	1	½	1	2	2
7	1	½	1	2	3
8	2	1	1	1½	2
9	-	1	-	-	-
10	2	1	1½	2	3
11	2	1	1	2	3
12	2	1	1½	2	3
13	2	1	1½	3	4

* see also clause 9.1.6

7.13 Penetration of fire barriers

7.13.1 Except where otherwise shown by test to be satisfactory, any pipe passing through an element of structure, or cavity barrier, shall have a nominal internal diameter not exceeding -

(a) 3.5 cm if constructed of any material and comprises any service other than permitted under (b) or (c) below;

(b) 10 cm if constructed of UPVC and comprises water or drainage services provided with water seals;

(c) 15 cm if constructed of metal which, if exposed to a temperature of 800 ^{o}C, will not soften and will not fracture to such an extent as to permit flames or hot gases to pass through the wall of the pipe.

7.13.2 Ventilation ducts passing through fire barriers shall either -

(a) be fitted with fusible link operated fire dampers where they pass through the fire barrier; or

(b) be enclosed within a shaft affording not less than the highest period of fire-resistance required for the storeys or areas through which it passes and be fitted with fusible link operated fire dampers at any point where the ventilation duct, or branch, enters or leaves such enclosure.

7.13.3 Extract ducting servicing kitchens(other than in building types 1 and 2) shall -

(a) be independent of any other ventilation system;

(b) be enclosed throughout their length with construction affording not less than the period of fire-resistance required for the storey in which the kitchen is situated, or through wnich the duct passes, whichever is the higher;

(c) not be fitted with fire dampers.

7.13.4 (a) Refuse chutes (dutos de lixeira) shall be:

i) of non-combustible construction, not more than 0.40 m in diameter;

ii) fitted with a non-combustible hopper at each access level; and

iii) provided at their tops with permanent ventilation not less than 350 cm^2.

(b) Access to any refuse chute shall be by way of a fire-resisting lobby which is:

i) not less than 0.70 m wide and has an area of not less than 0.8 m^2; and

ii) fitted with a self closing door affording not less than a half hour period of fire resistance.

7.14 Cavities and concealed spaces

7.14.1 Every cavity (other than within a cavity wall constructed with not less than 7.5 cm brick or block leaves) shall be subdivided by means of

(a) a cavity barrier in the same plane as any element which abuts it and is required to be fire-resisting.

(b) cavity barriers in such positions that the distance between them does not exceed 10 m in any direction.

7.14.2 Every cavity barrier shall afford not less protection against fire than the materials comprising the abutting elements of construction and shall be capable of resisting fire penetration in the test described in Section 5.12 and provide insulation for a period of not less than 20 minutes, or that needed to prevent fire passage from one area to another, whichever is the greater.

7.15 Lifts

7.15.1 Lift shafts shall be enclosed throughout their height with fire-resisting construction except where such shafts are --

(a) not enclosing a fire lift, and

(b) wholly contained within the enclosures of a protected stairway.

7.15.2 The installation of an electric lift shall be in accordance with the provisions contained under reference 19.

7.15.3 The design and performance of an electric fire lift shall comply with 9.2.19

7.16 Manual fire fighting equipment

7.16.1 Portable fire extinguishers shall be installed in accordance with the recommendations under reference 20.

7.16.2 Hoses shall be installed in accordance with the recommendations under reference 21 or 22.

7.17 Fire extinguishing systems

7.17.1 Automatic sprinkler installations shall conform either to the Rules of the Fire Offices' Committee[23] or of the National Fire Protection Association[24].

7.17.2 Foam inlets shall be installed in accordance with the recommendations under reference 21.

7.17.3 Carbon dioxide systems shall be installed in accordance with the recommendations under reference 25.

7.17.4 Halon systems shall be installed in accordance with the recommendations under reference 26.

7.17.5 Water spray fixed systems shall be installed in accordance with the recommendations under reference 27.

7.17.6 Dry Powder systems shall be installed in accordance with the recommendations under reference 28.

7.18 Water supplies for fire fighting

7.18.1 All buildings shall be provided with an adequate supply of water for fire-fighting purposes by means of -

(a) external fire hydrants and any relevant water legislation for the area, or

(b) a static or natural water supply satisfactory to the fire brigade.

7.18.2 The provision and siting of external hydrants shall conform either to the requirements of the Corpo do Bombereiros (CB)[29] or the Insurance Bureau (IRB)[30].

7.18.3 The provision and siting of rising mains shall comply with the relevant provisions contained under reference 21 except that:

(a) rising mains shall not be situated within stairway enclosures;

(b) landing valves shall not be situated more than 5 m from the access to the storey; and

(c) the rising mains shall also be connected to a water storage tank (or tanks) having a minimum capacity of -

30.000 L for industrial buildings; or

6.000 L for residential and other buildings.

7.19 Fire brigade access

7.19.1 Every building shall be provided with suitable access for fire-fighting purposes by means of a public highway, private road, footpath or other route -

(a) having sufficient width, clearance, height and turning circle for fire-fighting vehicles and suitably positioned in relation to the external wall of the building for the use of fire-fighting appliances, having regard to:

(i) the size of the building;

(ii) the height of the building above ground level;

(iii) the nature of the business carried on in the building; and

(iv) the availability of wet rising mains affixed to the building; or

(b) in accordance with Tables 7.8 and 7.9.

7.19.2 Lobby approach protected stairways with an associated fire lift shall be provided (for use by the fire brigade) in every high rise building in accordance with 9.2 and such stairways shall be designated as fire-fighting stairways.

TABLE 7.8 Minimum space and loading requirements for turntable ladders

Minimum				
Width (m)	Clearance height (m)	Turning circle (diameter) (m)	Width of gateways etc (m)	Carrying capacity (tonnes)
4.3	4.0	21.3	3.1	14.2

TABLE 7.9 Positioning of access to buildings for pumping appliances

Capacity of building (m^3)	Positioning of access
$\not>$ 7100	Within 45 m of a suitable entrance to the ground storey
7100 - 28500	Along the face of (a) and (b)
28500 - 56500	Along 2 perimeter walls
56500 - 85000	Along 3 perimeter walls
$>$ 85000	Along all perimeter walls

NOTES

(a) every perimeter wall giving suitable access to the interior of the building, where the total length of such a wall exceeds 1/6 of the combined length of all perimeter walls;

(b) in any case, at least 1 perimeter wall giving such access.

7.20 Site and building plan

7.20.1 Scale plans (at 1:100) shall clearly indicate the location of of the following (where applicable):

(a) surrounding streets,

(b) exits, stairways and corridors,

(c) gas and oil main controls,

(d) electrical main and sub-main controls,

(e) ventilation plant and control switches (including pressurization controls),

(f) sprinkler valves,

(g) fire hoses,

(h) hydrants and rising mains,

(i) shutters and doors released automatically in the event of fire, and any central control point for release,

(j) smoke outlets,

(k) openable windows in sealed buildings,

(l) main and any secondary, fire alarm panels,

(m) pump rooms in buildings having wet rising mains,

(n) fire lifts,

(o) automatic fire extinguishing systems,

(p) dangerous chemicals,

(q) all compressed gases (including LPG).

7.20.2 The plan(s) shall

(a) be mounted on a rigid surface and displayed in a location (or locations) agreed with the fire brigade,

(b) incorporate a 'You are here' indicator.

CHAPTER 8

SPECIAL REQUIREMENTS

8.0 General

The general fire protection requirements for all buildings are specified in Chapter 7. In this chapter the requirements are amended where appropriate in relation to each building type listed in Chapter 4 either to allow a less stringent specification without affecting the safety level or to provide a higher level of protection because of the use of the building. Requirements particular to a given building type are also included.

8.1 Type 1. Single family dwelling houses

8.1.1 Only those requirements specified in 7.1, 7.2, 7.12, 7.14, 7.18 and 7.19 are mandatorily applied to these buildings.

8.2 Type 2. Apartments and duplexes

8.2.1 Every apartment and duplex shall be provided with 2 exits except in the case of an apartment having all rooms situated either:

(a) at access level, where the bedrooms are entered from the entrance hall and are not situated more than 7.5 m from the entrance door ; or

(b) on the floor above the access level, where the bedrooms are entered from the stair landing and are not situated more than 7.5 m from the head of the stair.

8.2.2 The distance of travel from any apartment or duplex to the nearest storey exit or smoke door across an internal corridor shall not exceed the appropriate limits given in tables 8.1, 8.2 or 8.3 as appropriate.

TABLE 8.1 Maximum permitted distance of travel within internal escape corridors provided with smoke doors

Available direction of travel	Travel distance (m)	
	Stairway or smoke door	Overall
(a) Escape in one direction	4.5	15
(b) Escape in more than one direction	4.5	30

TABLE 8.2 Maximum permitted distances of travel within internal escape corridors not provided with smoke doors

Available direction of travel	Travel distance (m)
(a) Escape in one direction	15
(b) Escape in more than one direction	40

TABLE 8.3 Maximum permitted distances of travel within internal escape corridors where every dwelling has alternative means of escape

Available direction of travel	Travel distance (m)
(a) Escape in one direction	40
(b) Escape in more than one direction	50

8.2.3 Permanent, or automatic opening, ventilation not less than 1.5m^2 in free area shall be provided direct to the outer air at both ends of each common corridor and shall be sited on opposite faces of the building.

8.2.4 Where Table 8.1 is used in connection with single stairway buildings, every dwelling shall be entered from the portion of the common corridor remote from the stairway.

8.2.5 Where Table 8.2 is used, ventilation openings in accordance with 8.2.3 above shall be situated not more than 60 m apart.

8.2.6 Doors to apartments or duplexes leading onto internal access corridors shall not contain any glazing except where such glazing complies with 6.17.1.

8.2.7 The external walls of any apartment or duplex entered from a common external access balcony where escape is available in one direction only, shall not contain any glazing below a height of 1.1 m except:

(a) where such glazing complies with 6.17.1, or

(b) in the case of the apartment or duplex further most from the stairway.

8.2.8 Where any building comprises apartments or duplexes above any other type of occupancy,

(a) the lift(s) serving the apartments or duplexes shall not communicate with the other parts of the building; and

(b) the stairway(s) serving the apartmentsor duplexes

i. in the case of a single stairway, shall not communicate with the other parts of the building;

ii. in the case of two or more stairways, one stairway shall not communicate with the other parts of the building and the remaining stairway(s) may communicate with such other parts subject to the stairway(s) being approached at each such level by way of a protected lobby provided with not less than 500 cm^2 permanent ventilation.

8.3 Type 3. Institutional

8.3.1 The distances of travel within any storey shall comply with table 6.1 except in the case of Old People's Homes, Schools for handicapped children and in hospitals (or parts of hospitals) accommodating handicapped persons, where such distances shall not exceed:

(a) 10 m for escape in one direction only, and

(b) 20 m for escape in more than one direction.

8.3.2 (a) The widths of exits and escape routes within storeys where provision for evacuation involves the use of wheelchairs and/or beds shall (subject to complying with table 6.3) be not less than:

(i) 91 cm for wheelchairs, or

(ii) 1.5 m for beds; and

(b) The slope of any such ramp shall comply with 6.12.4.

8.3.3 Where any storey comprises 2 or more compartments, 1 of the exits from each compartment may be by way of an adjacent compartment subject to the floor area of the adjacent compartment being not less than 2 x total occupancy loading of both such compartments.

8.3.4 A fire detector operated fire alarm system complying with 7.7 shall be provided throughout all buildings type 3.

8.4 Type 4. Hotels etc

8.4.1 All bedrooms shall be approached from protected corridors (or protected lobbies).

8.4.2 The distances of travel within any storey shall comply with table 8.4.

TABLE 8.4 Maximum permitted distances of travel in a storey containing bedrooms

Available direction of travel	Travel distance (m)	
	Rooms/suites	Corridors
(a) Escape in one direction only	10	7.5
(b) Escape in more than one direction	20	30

8.4.3 Any lift connecting bedroom floors with:

(a) a basement storey, or

(b) a lounge, kitchen, storage or similar fire risk area situated at a lower level,

shall be approached at such levels by a protected lobby or protected corridor which, in the case of basements, shall be provided with not less than 500 cm^2 permanent ventilation.

8.4.4 Where any building comprises hotel bedrooms above any other type of occupancy, the lifts and stairways serving the hotel accommodation shall comply with 8.2.8.

8.4.5 A fire detector operated alarm system complying with 7.7 shall be provided throughout all buildings type 4 where the occupancy level exceeds either:

(a) 10 per floor; or

(b) 50 total occupancy.

8.4.6 Escape lighting shall comply with the provisions contained under 7.9 except in the case of any building comprising not more than two storeys in height and having a floor area of not more than 300 m^2.

8.4.7 Kitchens shall be enclosed with construction affording not less than a half hour period of fire resistance.

8.4.8 Every building type 4 shall comply with the limits for compartments set out under 7.11 except that the requirements in connection with the provision of compartment floors may be relaxed to permit an unenclosed stairway or escalator connecting not more than two storeys comprising public areas.

8.5 Type 5. Schools

8.5.1 Subject to limitations of travel distance, a single escape route is permitted in any building (or part)

(a) comprising not more than one storey above the ground storey, and

(b) accommodating not more than 120 pupils at the upper storey level.

8.5.2 Escape lighting shall be provided within any corridor, lobby or stairway in all buildings other than single storey buildings.

8.6 Type 6, Offices

8.6.1 In buildings (or parts) permitted to be served by a single escape route, the escape stairway may be unprotected in premises comprising:

(a) a ground and a basement storey or a ground and first storey only, where such stairway delivers not more than 3 m from a final exit; or

(b) basement, ground and first storeys where the stairway serving the first storey complies with (a) above and the basement is served by a protected stairway delivering to an independent final exit.

8.6.2 In the case of office buildings comprising open spatial planning, the width of escape stairways and exits therefrom shall comply with table 6.4

8.6.3 Where more than 1 escape route is available from a storey, 1 of the escape routes from that storey (or part) may be by way of a flat roof provided that -

(a) such roof is part of the same building from which escape is being made, and

(b) the route across the roof leads to another storey exit and is adequately defined and is protected and constructed in accordance with 6.13.

8.6.4 In buildings comprising offices in different occupation, the means of escape from each tenancy shall be independent of passing through any other tenancy. Either -

(a) the common corridors between different tenancies shall be constructed as protected corridors, or

(b) an automatic fire detection system shall be installed throughout to give warning of an outbreak of fire in any unattended tenancy.

8.7 Type 7.Shops

8.7.1 Buildings type 7 may be served by a single escape route:

(a) where such buildings comprise not more than basement, ground and first storeys and the distances of travel comply with the limits given in table 6.1, or

(b) in the case of a ground storey

(i) shop which is not used for storage and/or sale of highly flammable liquids or materials, or

(ii) restaurant having seating and/or standing accommodation for not more than 100 persons, where the travel distance does not exceed 20 m.

8.7.2 In buildings permitted to be served by a single escape route, the escape stairway may be unprotected in -

(a) premises (not being a restaurant):

(i) comprising a ground and a basement storey or a ground and first storey only, where such stairway delivers not more than 3 m from a final exit, or

(ii) comprising basement, ground and first storeys where the stairway serving the first storey complies with (i) above and the basement is served by a protected stairway delivering to an independent final exit; or

(b) restaurants comprising a basement or first storey only and having accommodation for not more than 30 persons, where the stairway and exitway leading therefrom is separated from the ground and any basement storeys by imperforate fire-resisting construction.

8.7.3 Kitchens shall be enclosed with fire-resisting construction.

8.7.4 Escape lighting shall be provided in accordance with 7.9 except in the case of:

(a) a ground storey sales area -

(i) not exceeding 280 m^2 in floor area, and

(ii) in which the distance of travel from any point does not exceed 20 m.

(b) stairways in buildings -

(i) comprising not more than two storeys above ground level, and

(ii) having no sales floor exceeding 280 m^2.

8.7.5 Automatic sprinkler protection complying with 7.17 shall be provided throughout

(a) any multi-storey building exceeding 7000 m^3; or

(b) any single storey building exceeding 10000 m^3.

8.8 Type 8. Assembly buildings

8.8.1 (a) There shall be not less than 2 exits available from any room, floor, storey or tier frequented by members of the public, except (subject to limitations of travel distance) in the case of -

i. Boxes;

ii. Rooms accommodating not more than 30 people;

iii. Premises complying with 8.8.3 (a) (i) which are situated at ground level and in which no special hazards are involved.

(b) Additional exits shall be provided as necessary to comply with 8.8.3 and travel distances.

8.8.2 (a) Subject to limitations of travel distance, there shall be not less than 2 escape routes available from any area used by performers and/or staff only, except in the case of any area (not being an under stage area, stage, working levels above the stage, projection room or rewind room) -

i. where the travel distance does not exceed 7.5 m,

ii. which are occupied by not more than 15 persons,

iii. which do not connect directly with a platform or stage, stage basement or other area of fire risk, and

iv. which (if situated in a dead end), is served by a protected escape route not exceeding 7.5 m to a protected stairway or final exit.

(b) All dressing rooms shall be provided with at least 1 exit independent of any exit by way of a platform or stage.

(c) One exit from a separated stage shall be by way of a final exit.

8.8.3 (a) (i) Not less than 2 exits, each not less than 2.0 m wide, shall be provided from any room, floor, storey or tier; and

(ii) the total exit width required shall be calculated on the basis of 1 m for every 100 persons.

(b) The minimum width of exits used by performers shall be not less than 1.1 m (or 1.5 m where outsize costumes are likely to be used).

8.8.4 In any area with provision for a closely seated audience, not less than half the exits from that area shall be sited remote from the stage, screen or performing area.

8.8.5 (a) The exits and escape routes from each floor, storey or tier shall:

i. be sited remote from and (except where permitted under (c) below) be independent of each other;

ii. be located so as to prevent dead ends; and

iii. be (so far as is practicable) distributed uniformly around the perimeter of the floor area, storey or tier they serve.

(b) Each exit shall deliver to the open air by way of -

i. a final exit; or

ii. a protected stairway; or

iii. a protected corridor leading direct to a final exit or protected stairway.

(c) Not more than half the required number of exits from any floor storey or tier may discharge into common escape routes, subject to any one escape route serving not more than two exits.

8.8.6 The width of any stairway, lobby, corridor or passage used as an escape route shall be not less than the width or total width of the exit or exits they serve.

8.8.7 The distances of travel set out in table 6.1 may be exceeded in large undivided areas (such as exhibition halls) where

(a) well distributed exits are provided not more than 60 m apart, and

(b) such exits are clearly visible.

8.8.8 (a) Where permanent provision is made for a closely seated audience and in all cases of stepped tiers, all seating (except for chairs in boxes or other approved enclosures) shall be fixed firmly to the floor.

(b) Elsewhere, all chairs or other single seats in assembly buildings (except for chairs in boxes or other approved enclosures) shall be -

i. secured together in lengths of not fewer than 4 seats; and

ii. provision shall be made for adequately fixing to the floor except where it is considered reasonable to use floor bars.

(c) The layout and spacing of seating shall comply with 8.8.9 below.

8.8.9 (a) Gangways not less than 1.2 m wide shall be provided:

i. around the perimeter of all areas of fixed seating; and

ii. such that no block of seating exceeds 20 seats in width by 15 rows deep.

(b) Seatways shall be not less than 0.9 m wide.

Where seats tip up automatically, the minimum width of the seatway shall be taken as the distance between the back of one seat unit and the maximum projection of the seat unit behind when the seat is 'up'.

In any other case, the minimum width of the seatways shall be taken as the distance between perpendiculars from the back of one seat unit to the front of the seat unit immediately behind.

8.8.10 No floor or tier shall be constructed with a slope of more than 35° to the horizontal.

8.8.11 The exposed edge of any balcony or raised tier of seating shall be protected by an upstand or balustrade not less than 1.1 m above the finished floor level, except that where situated in front of a seatway the protection -

(a) may be reduced to 78 cm, and

(b) shall be designed and constructed to discourage the placing of articles thereon and to ensure as far as is practicable that anything so placed will not fall to the level below.

8.8.12 Stepped side gangways shall be provided with a handrail fixed at a height of 84 cm measured vertically from the centre of the step and projecting not more than 7.5 cm from the wall.

8.8.13 No gangway, route of escape or final exit shall be provided with a check barrier other than a rope which shall -

(a) be fitted with automatic catches or slip connections;

(b) be arranged so as not to trail on the floor when parted; and

(c) the fittings shall not project into the gangway, route of escape or exit.

8.8.14 (a) Seating in cinemas, theatres and dance halls shall be made of materials which are not easily ignitable and shall resist smouldering from lighted cigarettes.

(b) Where fixed seating is provided, a gangway not less than 50 cm wide, shall be provided between the walls and the seating if the surface of the walls have a flammability classification inferior than Class A.

8.8.15 Scenery and properties used on an open stage shall be constructed of

(a) non-combustible materials; or

(b) inherently non-flammable materials;or

(c) timber, hardboard or plywood impregnated to achieve a flammability classification not inferior than Class B; or

(d) durably flame-proofed fabric.

8.8.16 The construction and finishings of exhibition stands shall conform to 8.8.15.

8.8.17 Escape lighting complying with 7.9 shall be provided throughout all assembly buildings other than within any ground floor premises having accommodation for not more than 100 persons.

8.8.18 No openings shall be provided -

(a) directly between any dressing room and an auditorium or hall, or

(b) in premises, having permanent provision for a closely seated audience, between the auditorium or hall and any cloakroom, kitchen or servery.

8.8.19 Protected lobby access shall be provided -

(a) to any escape stairway serving premises situated more than:

i.12 m above, or

ii.6 m below,

street or ground level.

(b) between a separated stage and the dressing rooms, corridor or stairway serving dressing rooms.

(c) between a separated stage and an exit being a final exit.

(d) between any exit from any working levels above the stage which communicate with another part of the premises.

(e) to any communication between a portion of the premises used by the public and a projection room or rewinding room.

8.8.20 Any protected lobby required under (a) (d) or (e) above shall be provided with not less than 500 cm^2 permanent ventilation.

8.8.21 Mechanical ventilation-

(a) provided within public portions of assembly buildings shall be independent of the remainder of the building;

(b) in premises used for stage presentations shall be such that the direction of air movement is from the auditorium towards the stage.

8.8.22 In theatres provided with a safety curtain in the proscenium opening,

(a) the stage area shall be provided with -

i. mechanical extract ventilation at high level over the stage; and

ii. a lantern light not less in cross sectional area than 1/10 the stage area and designed to open by a fusible link set to operate at $\geq 74^{\circ}C$, or by a smoke activated device, with a manual override facility positioned near to the safety curtain release at stage level.

(b) the scene store shall be provided with -

i. permanent ventilation; and

ii. either a lantern light (or window) having an effective area not less than 1/10 floor area; or a flue having an effective area not less than 1/20 floor area and which is

normally closed by a drop shutter; in either case arranged to open by a fusible link set to operate at $\geq 74^{\circ}C$ or by a smoke activated device.

8.9 Type 9. Single storey industrial

8.9.1 For the purposes of these regulations,

(a) Low fire risk buildings (or parts) are those in which there are few flammable and no explosive materials and where there is little risk of fire breaking out and no likelihood that fire or smoke or fumes will spread rapidly. Such premises include buildings (or parts) used for heavy engineering, those where only "wet" processes are carried out and those where only non-combustible materials are present.

(b) Medium fire risk buildings (or parts) are those not comprising low or high fire risks, and would include (for example) purpose built premises for light engineering.

(c) High fire risk buildings (or parts) are those in which there is present any material, dust, vapour, gas or liquid in such quantity or disposition, or of such a nature as will be likely, when ignited, to cause fire, smoke or fumes to spread rapidly.

8.9.2 The distances of travel set out in table 6.1 may be exceeded in large undivided premises where -

(a) well distributed exits are provided not more than 60 m apart;

(b) such exits are clearly visible; and

(c) there is no area of high fire risk.

8.9.3 Automatic sprinkler protection complying with 7.17 shall be provided throughout any building exceeding 10,000 m^3.

8.10 Type 10. Multi-storey industrial

8.10.1 For the purposes of this code, "low fire risk""medium fire risk" and "high fire risk" are described in 8.9.1.

8.10.2 Subject to limitations of travel distance, a single escape stairway may be provided in the case of a building, or part,

(a) of Low risk, comprising not more than 2 storeys above the ground storey; or

(b) of Medium risk comprising not more than 1 storey above the ground storey.

8.10.3 The distances of travel set out in Table 6.1 may be exceeded in large undivided premises where -

(a) well distributed exits are provided not more than 60 m apart;

(b) such exits are clearly visible; and

(c) there is no area of high fire risk.

8.10.4 The means of escape from each tenancy within factories in different occupation shall be independent of passing through any other tenancy.

8.10.5 Automatic sprinkler protection complying with 7.17 shall be provided throughout any building exceeding 10,000 m^3.

8.11 Type 11. Car parks

8.11.1 There shall be not less than 2 escape routes provided from any car park except in the case of a single storey car park situated:

(a) at ground level, where the travel distance does not exceed 30 m; or

(b) at basement or first floor level, where the travel distance does not exceed 20 m.

8.11.2 In the case of a single storey car park situated at basement or first floor level where more than 1 escape route is required, one of the escape routes may be by way of the ramp subject to:

(a) a raised footpath being provided of the appropriate width, and

(b) the sides of a basement ramp being separated from the basement by non-combustible fire-resisting construction.

8.11.3 In the case of split level parking, access to one exit may be by way of the ramps between 2 adjacent levels provided that the distance of travel from any point does not exceed:

(a) 20 m to the ramp, and

(b) 40 m (overall) to the storey exit.

8.11.4 All escape stairways shall be located against an outside wall and shall deliver direct to the open air.

8.11.5 The location of any ramp shall not prejudice the means of escape from other portions of the building not comprising car parking.

8.11.6 (a) Every car parking level shall be provided with provision for cross-ventilation equivalent to not less than 3 air changes per hour (or 6 air changes per hour where many cars are expected to be moving at the same time).

(b) Where natural cross-ventilation cannot be provided to meet the provisions in (a) above, mechanical ventilation shall also be provided which shall be designed to operate as two independent systems - each providing half of the required amount of ventilation.

8.11.7 Automatic sprinkler protection complying with 7.17 shall be provided throughout any car park exceeding 500 m^2.

8.12 Type 12. Storage buildings (low fire load)

8.12.1 Automatic sprinkler protection complying with 7.17 shall be provided throughout any building exceeding 10,000 m^3 with a fire loading exceeding 1000 MJ/m^2 of floor area.

8.13 Type 13. Storage buildings (high fire load)

8.13.1 Automatic sprinkler protection complying with 7.17 shall be provided throughout any building exceeding 3000 m^3 and

(a) such protection shall be suitable for the nature and method of storage of the building contents,

(b) special attention shall be paid to high rack storage systems.

CHAPTER 9

BASEMENTS, HIGH RISE BUILDINGS AND SHOPPING COMPLEXES

9.1 Basements

9.1.1 There shall be not less than 2 escape routes provided from any basement storey except in the case of a single basement where:

(a) the limits of travel distance comply with Table 6.1, and

(b) not more than 50 persons are likely to be present at any one time.

9.1.2 (a) Where a protected stairway forms the only escape route from an upper storey of a building, or part, it shall not be continued down to serve any basement storey.

(b) Where there is more than 1 protected stairway serving the upper storeys of a building, or part, all but 1 of such stairways may connect with the basement storey(s) provided they are approached at each basement storey level by way of a protected lobby provided with ventilation in accordance with 7.5.2.

(c) All protected stairways serving more than 1 basement and not in accordance with (b) above shall be approach only by way of a protected lobby or protected corridor.

9.1.3 Means for clearing smoke from all basement storeys shall be provided in accordance with 7.5.6.

9.1.4 Escape lighting shall be provided within any -

(a) public area, corridor, protected route or escape stairway serving any underground car park where less than 30% of the perimeter of the car park is open to the external air;

(b) basement required to have not less than two escape routes and any corridor lobby or escape stairway serving such a storey.

9.1.5 Every basement storey shall comprise one or more compartments in accordance with 7.11.

9.1.6 Every element of construction comprising, or within, a basement storey shall have not less than twice the period of fire-resistance required for the ground storey in accordance with 7.12 appropriate to the building type, subject to a maximum of 4 hours.

9.1.7 Plans for use by the fire brigade shall be provided in accordance with 7.20 in respect of every building having -

(a) 2 or more basements, or

(b) a single basement where appropriate to its size or use.

9.2 High rise buildings

9.2.1 The external enclosures shall be Class A in accordance with the requirements under 7.2.

9.2.2 The surfaces of walls and ceilings shall,

(1) in the case of protected stairways, be Class A, and

(b) elsewhere, be not interior than Class B.

9.2.3 Every false ceiling shall be constructed of, and suspended by, non-combustible materials.

9.2.4 All combustible partitions within a high rise building shall have a fire resistance of at least half an hour.

9.2.5

(a) The width of escape stairways and exits leading therefrom shall, except in the case of buildings Type 2, comply with Tables 9.1 or 9.2 as appropraite.

(b) Where Table 9.2 is used, such table is based on the immediate evacuation of 2 floors only and the fire warning system should comprise a two-stage alarm.

9.2.6 Every escape stairway shall be approached only by way of protected lobby or protected corridor.

9.2.7 Where any part of a high rise building does not exceed 20 m in height or comprise more than 8 storeys above ground level, the design of escape routes serving such part alone can be in accordance with Chapter 6.

9.2.8 Escape lighting shall be provided within any corridor, lobby or escape stairway.

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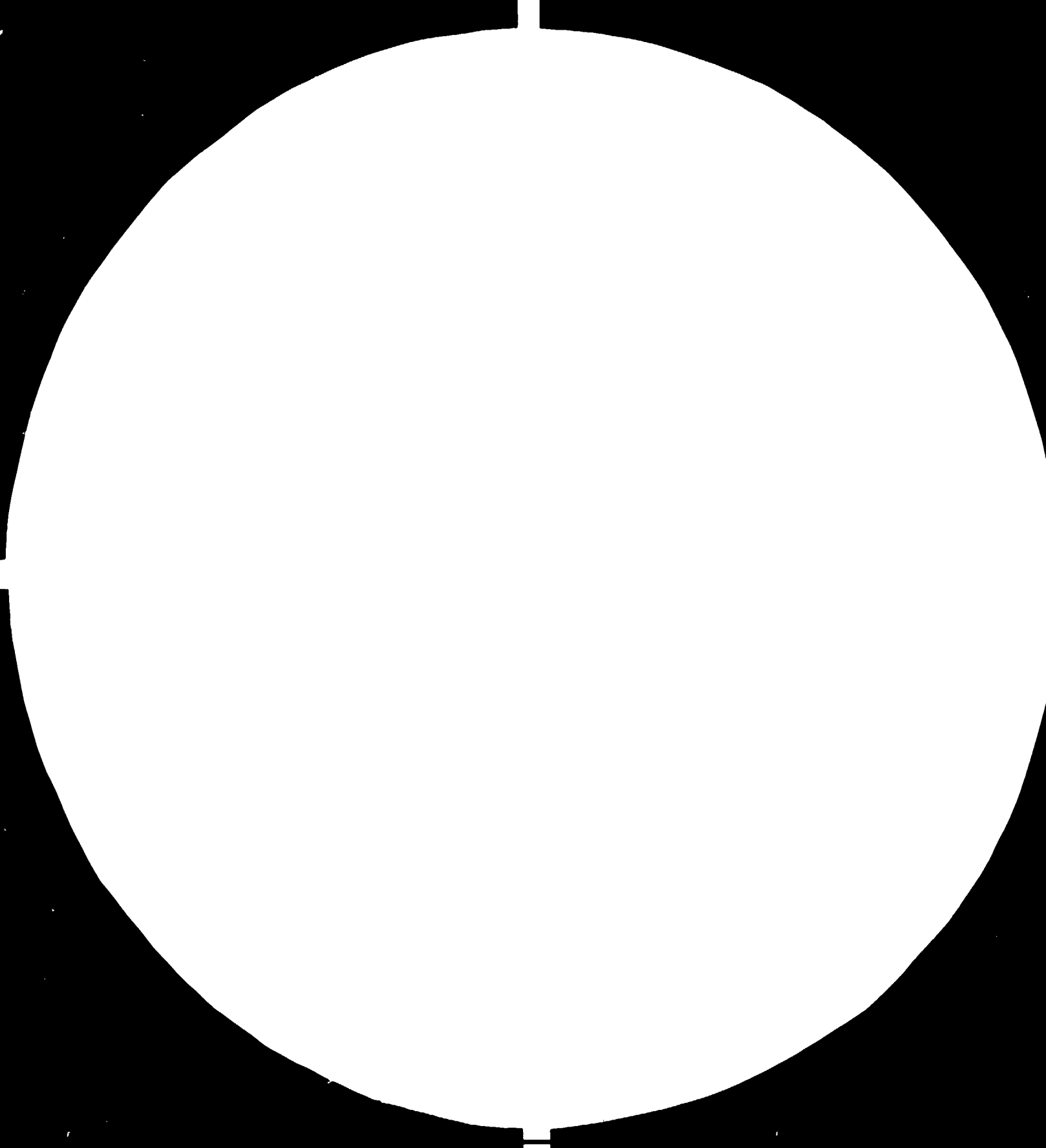

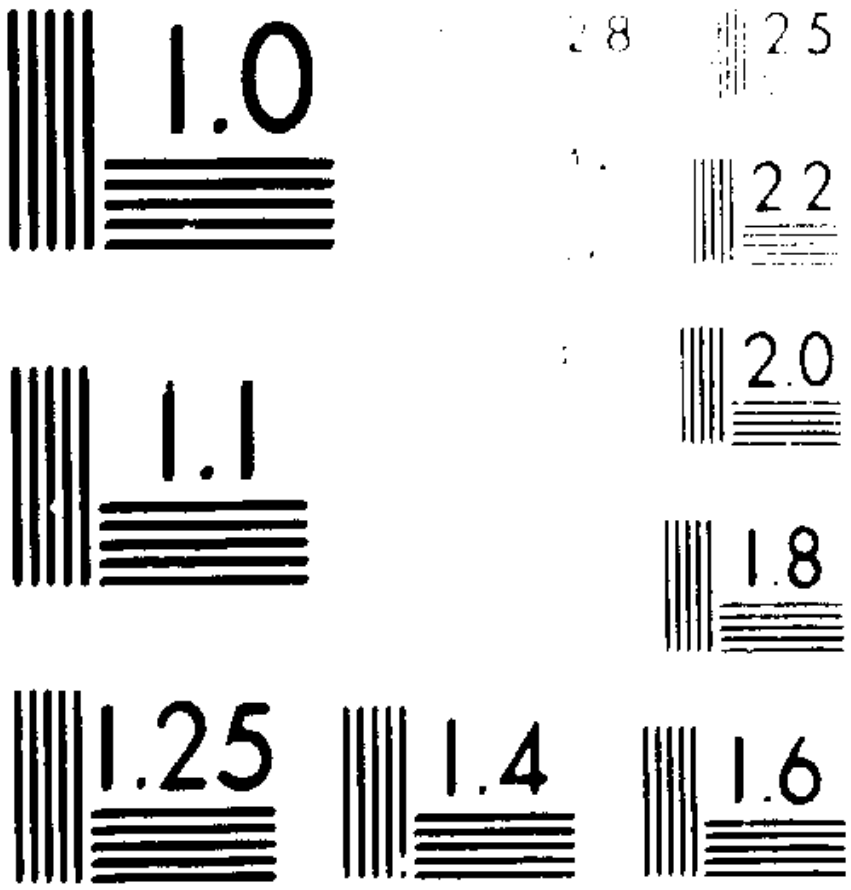
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TABLE 9.1. Width of stairways serving any storey exceeding 8 storeys above ground level

Number of floors served	Width (m)		
	1.20	1.50	1.80
	No. of persons 1 stairway can accommodate		
9	600	780	960
10	645	840	1035
For each additional storey add	45	60	75

TABLE 9.2. Width of stairways for office buildings exceeding 8 storeys above ground level

Maximum number of persons per storey	Width (m)
130	1.20
160	1.50
190	1.80

9.2.9 Every storey in a high rise building shall comprise a compartment and additional compartmentation shall be provided as necessary in accordance with 7.11.

9.2.10 Where any window or unprotected area in the external face of a building is vertically above any window or unprotected area in the storey below, imperforate fire resisting construction shall be provided between such windows or areas not less than 1 m vertically or as a horizontal projection.

9.2.11 Every element of construction within a high rise building shall afford not less than a two hour period of fire resistance in accordance with 7.12 appropriate to the building type.

9.2.12 Every high rise building shall be provided with:

(a) hoses in accordance with 7.16; and

(b) wet rising mains in accordance with 7.16.

9.2.13 An automatic sprinkler system (or other appropriate system complying with 7.17) shall be provided throughout every high rise building except in the case of:

(a) any building Type 2; and

(b) bedrooms of buildings Type 4.

9.2.14 Every high rise building shall be provided with access for fire appliances within 18 m of a suitable entrance on the ground storey to the nearest protected stairway to each rising main. Such road should be within sight of the building and there should be unrestricted access across the intervening space.

9.2.15 One or more escape stairways in every high rise building shall be designated for the use of the fire brigade and shall be provided with a protected lobby and associated fire lift such that -

(a) the distance travelled from any part of a storey to the nearest fire lift lobby door does not exceed 60 m, and

(b) there is one such stairway and associated fire lift for each 900 m^2 of floor area, or part thereof, measured in any storey exceeding 8 storeys above ground level.

9.2.16 The construction of such stairways shall comply with the following:

(a) The perimeter walls shall be of brick, concrete or other substantial non-combustible construction having a fire resistance of not less than that required for the elements of structure for the storey in which they are situated.

(b) The interior walls shall be of substantial non-combustible construcure having a fire resistance of not less than half an hour.

(c) Each associated lift lobby shall conform with the following:

(a) Area - 5.5 m^2 (minimum) 20 m^2 (maximum).

(b) Length - 8 m maximum on any one side.

9.2.17 Each such stairway shall -

(a) be entered direct from an open space to which there is suitable fire brigade access.

(b) serve every storey in the part of the building in which it is situated, except that:

(i) the lift need not serve a topmost storey exclusively consisting of plant rooms, and

(ii) access between a stairway and a storey at the fire brigade access level may be omitted.

9.2.18

(a) Every such protected stairway designated for the use of the fire brigade shall be provided with -

i. an openable vent at the top of the stairway of not less than 5% of the horizontal cross-sectional area of the stairway - the vent so sited as not to be affected by adverse wind pressures; and

ii. openable windows at each storey level of not less than 15% of the horizontal cross-sectional area of the stairway.

(b) Every protected lift lobby serving such stairways shall be provided with -

i. a permanent vent as near ceiling level as possible and having a clear area of not less than 500 cm^2; and

ii. an openable window of not less than 25% of the horizontal cross-sectional area of the lobby, with the top of the window sited as near to the ceiling as is practicable.

(c) Where such fire lift lobby windows are within the enclosures of a vertical vent shaft, the top 1/3 of the window shall be arranged as a bottom hinged section opening out to a maximum of 30° from the vertical, (with metal side baffles), and the remaining 2/3 arranged as outward opening side hung casements.

(d) Any such lobbies at basement level which cannot be provided with windows, shall be each provided with a smoke clearing outlet at high level having a minimum cross-sectional area of 1 m^2 and where permanent ventilation is provided in accordance with (b) (i) above, the smoke outlets may be covered with breakable covers.

(e) The requirements for smoke control under 7.5.4 to 7.5.16 shall be complied with.

9.2.19

(a) The design and performance of an electric fire lift shall comply with the following:

i. The internal floor area, rated load, height of car and dimensions of car and landing doors shall be for an 8 person lift as specified under reference 31.

ii. The lift landing doors shall be power operated sliding panel type.

iii. The rated speed of the lift shall be such that it will run its full travel in not more than 1 minute.

iv. An exclusive sub-main circuit should be provided to the lift.

v. Cables shall be run through a safe or protected route to the motor room. Particular care shall be taken to protect the cables and controls from the effects of possible water penetration.

vi. A switch operated control shall be provided at fire brigade access level adjacent to the lift opening whereby firemen can obtain immediate control of the lift without interference by ordering call points.

vii. Provision for emergency operation of an electric lift shall generally be in accordance with Clause 12.5 of reference 19. Provided that wherever practicable and possible, facilities for hand winding shall be available.

(b) Fire lifts shall not be used as service/goods lifts.

9.2.20 Plans for use by the fire brigade in accordance with 7.20 shall be provided in every high rise building.

9.3 Shopping complexes

9.3.1 Provision for means of escape from each premises shall be in accordance with Chapters 6 and 8 appropriate to the building type.

9.3.2 The final exits from any shopping complex shall be of such a number and so situated that the distance of travel from the exit of any unit to the nearest final exit does not exceed the appropriate limits set out in Table 9.3.

9.3.3 The widths of final exits from any covered shopping complex shall be not less than the total of all exits within 40m of the final exit together with an allowance for the occupancy loading of persons already in the mall (item 10, Table 6.2).

TABLE 9.3 Maximum permitted distances of travel within a mall

Available direction of travel	Travel distance (m)	
	Open mall	Covered mall
(a) Escape in 1 direction only	25	Not permitted
(b) Escape in more than 1 direction	Unlimited	40*

*80 m (maximum) between final exits

9.3.4 Smoke control within enclosed malls shall be properly designed to prevent smoke logging of the escape routes. The system shall consist of smoke reservoirs, mechanical extraction and fresh air inlets. Advice on the design of such systems is given in reference 32. Alternative methods of smoke control shall be accepted only if they can be shown to be equally effective.

9.3.5 Fire warning and detection systems shall be provided in accordance with Chapters 7 and 8. In shopping complexes comprising, or including, covered malls a public address system shall be provided for use by the fire brigade or other nominated responsible person(s), and such system shall be extended, as necessary, to public areas in separated buildings forming part of the complex.

9.3.6 Escape lighting shall be provided throughout any shopping complex.

9.3.7 All fire safety signs provided in accordance with 7.10 shall be clearly visible and prominently located.

9.3.8 Every shop or other occupancy within a shopping complex shall comprise a compartment and additional compartmentation shall be provided as necessary in accordance with 7.11.

9.3.9 All elements of construction and the enclosing walls of all shops or other occupancy comprising a shopping complex shall:

(a) afford not less than the period of fire-resistance required under 7.12 appropriate to the building type, and

(b) be constructed of solid non-combustible material.

9.3.10 Water supplies for fire fighting shall be in accordance with Chapter 7 provided that, in the case of hydrants, no hydrant shall be more than:

(a) 60 m apart inside the shopping complex, or

(b) 90 m apart outside.

9.3.11 (a) Sprinkler protection shall be installed throughout any shopping complex other than in the case of a shopping complex with at least five

shop units and having a total floor area of not more than 3000 m^2.

( ) Where sprinkler protection is considered inappropriate for a particular occupancy, or risk, other appropriate protection shall be provided in accordance with the relevant recommendations under 5.17 and 7.17.

9.3.12 Every shopping complex shall be provided with access for fire appliances in accordance with 7.19, provided that such vehicular access shall:

(a) be not more than 40 m from any entry doorway or opening into the complex, and

(b) such entry points shall in no case be more than 80 m apart.

9.3.13 Plans for use by the fire brigade in accordance with 7.20 shall be provided in every shopping complex.

CHAPTER 10

FIRE SAFETY ASSESSMENT

10.1 Requirements for fire protection specified in these regulations are a composite of functional requirements, performance standards and constructional specifications. Under ideal conditions the functional requirements with some reference to performance standards should suffice. However the regulations are based on knowledge generally available and make simplifications to provide authorities and designers with clear guidance.

10.2 The continuing research and development in the fire protection field is updating this knowledge and it is therefore possible to have valid alternative solutions to some of the specifications which have been provided. Building authorities should be willing to consider such alternatives provided they can be supported by expert fire protection engineers.

10.3 It is possible to consider dispensation or adjustment of requirements in one or more of the following areas:

(a) Use of data on actual fire load in a building,

(b) Fire resistance requirements based on data in (a),

(c) Determination of fire resistance of a construction by calculation or assessment,

(d) Influence of sprinklers on fire severity,

(e) Effect of fire detection and warning systems on the design of escape routes, and

(f) Permanent site supervision and safety management effects on escape provisions.

10.4 The authorities shall provide training and educational facilities or encourage technical institutes to do so for the regulatory staff, fire fighters, design engineers and architects.

CHAPTER 11

FIRE SAFETY MANAGEMENT

11.1 The management of all commercial, industrial and public buildings is encouraged to make plans for dealing with a fire emergency. These should include:

(a) Trained personnel to supervise observance of safety procedures in normal work,

(b) Trained personnel to deal with a fire emergency by dealing with the fire, informing the fire brigade and guiding occupants to a place of safety,

(c) Safety officers on each floor, or in each section, to guide occupants to safety,

(d) Inspection of fire extinguishing systems and devices provided for the detection and extinguishing of fires,

(e) Preparation of a plan in conjunction with the fire brigade on actions to be taken in case of a fire,

(f) Regular training and periodic checking to find the level of preparedness amongst the staff, and

(g) Clear instructions to the staff on actions to be taken when a fire occurs.

11.2 A senior member of the staff should be nominated as a fire safety officer and given authority to stop unsafe practices. The management should keep a record of fire incidents and study them to prevent their recurrence.

CHAPTER 12

STANDARDS AND CODES

12.1 List of references

1 ISO 1182 : 1979 (alternative references BS 476 : Part 4 : 1970 and ASTM E.136-79)

2 BS 476 : Part 6 : 1981

3 BS 476 : Part 7 : 1971

4 ASTM E.84-81a

5 ABNT MB-1192/77 and ABNT MB-564/77 (alternative references ISO 834 : 1975, ISO 3008 : 1976, ISO 3009 : 1976, BS 476 : Part 8 : 1972; ASTM E.119-81, E.152-80 and E.163-80).

6 ABNT EB-920

7 ABNT EB-132

8 BS 5395 : 1977

9 BS 5725 : Part 1 : 1981

10 BS 4211 : 1967

11 BS 5588 : Part 4 : 1978

12 BS 5720 : 1979

13 CP 413 : 1973

14 BS 5839 : Part 1 : 1980

15 CP 1007 : 1955

16 BS 5266 : Part 1 : 1975

17 BS 5499 : Part 1 : 1978

18 BS 2560 : 1978

19 BS 5655 : Part 1 : 1979

20 BS 5306 : Part 3 : 1980

21 BS 5306 : Part 1 : 1976

22 NFPA 14-1983

23 Rules of the Fire Offices Committee for Automatic Sprinkler Installations, 29th Edition, London. FOC. 1973 (alternative reference BS 5306 : Part 2 : 1979)

24 NFPA 13-1983

25 BS 5206 : Part 4 : 1979 (alternative reference NFPA 12-1980)

26 BS 5306 : Part 5 : 1982 (alternative reference NFPA 12A-1980 and 12B-1980)

27 NFPA 15-1982

28 NFPA 17-1980

29 CB ..... (alternative reference BS 5306 : Part 1)

30 IRB ..... (alternative reference BS 5306 : Part 1)

31 BS 5655 : Part 5 : 1979

32 Morgan H P. Smoke control methods in enclosed shopping complexes of one or more storeys: a design summary. Building Research Establishment Report. London. HMSO. 1979.

12.2 Titles of Brazilian Standards

ABNT.	EB-132/61	Portas Corta Fogo de Madeira Revestidas de Metal
ABNT	EB-920/80	Porta Corta Fogo para Saidas de Emergencia.
ABNT	MB-564/77	Metodo de Ensaio ao Fogo de Portas e Vedacoes
ABNT	MB-1192/77	.....

12.3 Titles of ISO Standards

ISO 834 : 1975	Fire resistance tests. Elements of building construction.
ISO 1182 : 1979	Fire tests. Building materials. Non-combustibility test.
ISO 3008 : 1976	Fire resistance tests. Door and shutter assemblies.
ISO 3009 : 1976	Fire resistance tests. Glazed elements.

12.4 Titles of British Standards*

CP 413 : 1973 Code of practice for Ducts for building services.

CP 1007 : 1955 Maintained lighting for cinemas.

BS 476 : Part 4 : 1970 Fire tests on building materials and Structures. Non-combustibility test for materials.

BS 476 : Part 6 : 1981 ibid. Method of test for fire propagation for products.

BS 476 : Part 7 : 1971 ibid. Surface spread of flame tests for materials.

BS 476 : Part 8 : 1972 ibid. Test methods and criteria for the fire resistance of elements of construction.

BS 2560 : 1978 Specification for exit signs (internally illuminated).

BS 4211 : 1967 Steel ladders for permanent access.

BS 5266 : Part 1 : 1975 Code of practice for the emergency lighting of premises other than cinemas and certain other specified premises used for entertainment.

BS 5306 : Part 1 : 1976 Code of practice for fire extinguishing installations and equipment on premises. Hydrant systems, hose reels and foam inlets.

BS 5306 : Part 2 : 1979 ibid. Sprinkler systems.

BS 5306 : Part 3 : 1980 ibid. Portable fire extinguishers.

BS 5306 : Part 4 : 1979 ibid. Carbon dioxide systems.

BS 5306 : Part 5 : Section 5.1 : 1982. ibid. Halon 1301 total flooding systems.

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*Published by British Standards Institution, London (UK)

BS 5395 : 1977 Code of Practice for stairs.

BS 5499 : Part 1 : 1978 Fire safety signs, notices and graphic symbols. Specification for fire safety signs.

BS 5588 : Part 4 : 1978 Code of practice for fire precautions in the design of buildings. Smoke control in protected escape routes using pressurization.

BS 5655 : Part 1 : 1979 Lifts and service lifts. Safety rules for the construction and installation of electric lifts.

BS 5655 : Part 5 : 1979 ibid. Specification for dimensions of standard lift arrangements.

BS 5720 : 1979 Code of practice for mechanical ventilation and air conditioning in buildings.

BS 5725 : Part 1 : 1981 Emergency exit devices. Specification for panic bolts and panic latches mechanically operated by a horizontal push-bar.

BS 5839 : Part 1 : 1980 Fire detection and alarm systems in buildings. Code of practice for installation and servicing.

12.5 Titles of ASTM[ø] and NFPA[+] standards

ASTM E.84-81a	Standard Test Method for Surface Burning Characteristics of Building Materials.
ASTM E.119-81	Standard Methods of Fire Tests of Building Construction and Materials.
ASTM E.136-79	Standard Test Method for Behaviour of Materials in a Vertical Tube Furnace at 750°C.
ASTM E.152-80	Standard Methods of Fire Tests of Door Assemblies.
ASTM E.163-80	Standard Methods of Fire Tests of Window Assemblies.
NFPA 12-1980	Standard on Carbon Dioxide Extinguishing Systems.
NFPA 12A-1980	Standard on Halon 1301 Fire Extinguishing Systems.
NFPA 12B-1980	Standard on Halon 1211 Fire Extinguishing Systems.
NFPA 13-1983	Standard for the Installation of Sprinkler Systems.
NFPA 14-1983	Standard for the Installation of Standpipe and Hose Systems.
NFPA 15-1982	Standard for Water Spray Fixed Systems f. Protection.
NFPA 17-1980	Standard for Dry Chemical Extinguishing Systems.

ø American Society for Testing and Materials, Philadelphia, Pa 19103 (USA)

+ National Fire Protection Association, Quincy, MA 02269 (USA)