APPENDIX F

Fire Safety in Design, Management and Use of Buildings

The information in this section is not exhaustive. Designers / Consultants should refer to the relevant British Standard Codes of Practice and Technical Booklet 'E', etc, for guidance on specific matters.

(1) Under BS9999 – 2008, buildings require a ***Risk Profile*** according to:

- Occupancy
- Fire Growth Rate
- Management Level

Oaklee properties have an *Occupancy Characteristic* 'C' which refers to 'occupants who are likely to be asleep' (sleeping risk)

This characteristic is further defined 'Ci' – unmanaged flats, and 'Cii' – managed flats

(2) Fire Growth Rates fall under 4 categories:

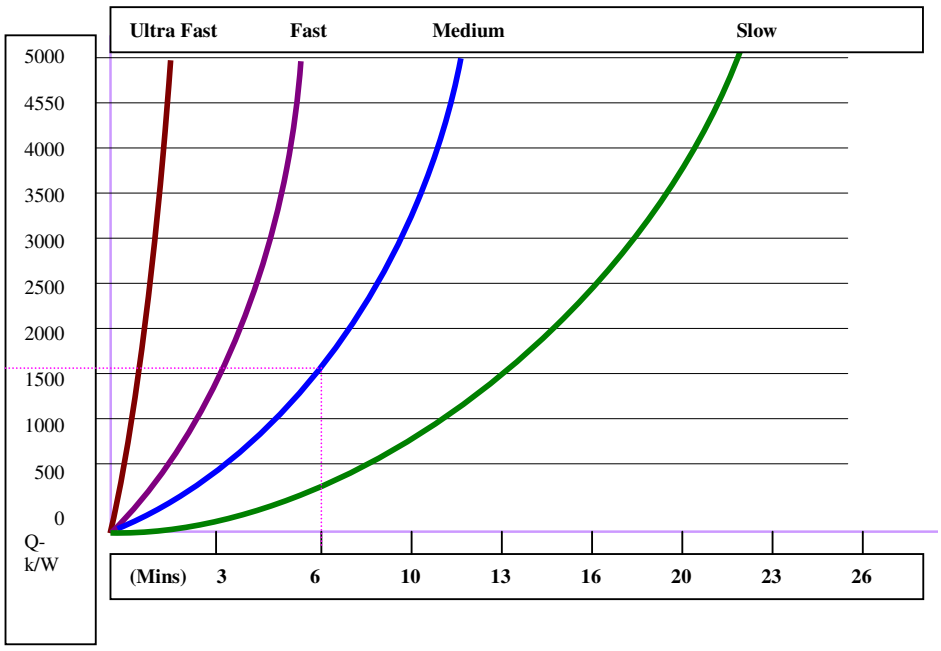
1 = Slow

2 = Medium

3 = Fast

4 = Ultra Fast

Fig.1 Fire Growth Rate



Fire Growth Rate from ignition to 26 minutes / 5000 Kw

Fire Growth Rate from ignition to 6 minutes / 1500 Kw

The majority of Oaklee properties have a reduced fire load and are therefore categorised as Fire Growth Rate 1 or 2. The Risk Profile therefore becomes 'Ci.1 or 2 and Cii.1 or 2

(3) Management Level can be broadly described as:

1 = Proactive

2 = Reactive

3 = Passive

A Management Level is assessed is relation to the following factors:

- Planning for changes in risk profile
- Resources and authority
- Staffing level (staff-occupant ratio)
- Fire Safety Training
- Work control (e.g. repairs to structure)
- Communications procedures
- Maintenance and testing of fire safety systems
- Liaison with fire & rescue service
- Contingency planning

(In order to achieve a level 1 fire safety management overall, it will be necessary for a level 1 to be achieved for all factors; for a level 2 fire safety management, it will be necessary to achieve at level 2 or level 1 for all factors)
A minimum Management Level 2 must be achieved for Type 'C' Occupancies

Having determined the occupancy type, fire growth rate and management level, the building may now be given a Risk Profile 'tag' (eg Cii.1.1) indicating a sleeping risk with supervision; slow fire growth rate and pro-active management level

It shall be the responsibility of the client to provide details of the Risk Profile at commencement of the design stage. This Risk Profile will determine the Minimum Fire Safety Package for the building.

(4) Fire Safety Package

A fire safety package (FSP) consists of Fire Protection and Prevention Measures and the level of fire safety management, provided for a building.

(4.1) Minimum FSP for Risk Profile Ci and Cii

(4.1.1) Minimum level of Automatic Fire Detection and Alarm Systems

- Ci.1, Ci.2, Cii.1 and Cii.2 = Supplementary system in dwellings and LD2 system in common parts

Table 1 — Minimum Grade and Category of fire detection and fire alarm system for protection of life in typical dwellings

Type of Property	Grade & Category
Single-family dwellings and shared (not more than 6 persons) houses with no floor greater than 200 m2 in area	
Rented bungalow, flat or other single-storey unit	D – LD2
Rented two storey house;	D – LD2
Three-storey house	D – LD2
Four (or more) storey house	B – LD2
Single-family dwellings and shared (not more than 6 persons) houses with one or more floors greater than 200 m2 in area	
Bungalow, flat or other single-storey unit	D – LD2
Two-storey house	D – LD2
Three- (or more) storey house	A – LD2
Houses in multiple occupation (more than 6 persons) (HMOs)	
HMOs of one or two-storey with no floor greater than 200 m2 in area	D – LD2
Other HMOs:	
Individual dwelling units, within the HMO, comprising two or more rooms	D – LD2
Communal areas of the HMO	A – LD2
Sheltered housing:	
Individual dwelling units only	C – LD2
Common Areas and ancillary rooms	A – LD1
Housing providing supported living in the community	
Dwellings of 1 to 3 storeys occupied by no more than six residents	C – LD1
Dwellings of 1 to 3 storeys occupied by more than six residents	A – LD1
Other Dwellings (including Residential Care Premises)	A – LD1

System Category

Category LD1: systems installed throughout all areas of the building. The objective of a Category LD1 system is to offer the earliest possible warning of fire, so as to achieve the longest ASET (available safe escape time)

Category LD2: systems installed only in defined parts of the building. A Category LD2 system should include the coverage necessary to satisfy the recommendations for a Category L3 system; the objective of a Category LD2 system is identical to that of a Category LD3 system, with the

additional objective of affording early warning of fire in specified areas of high fire hazard level and/or high fire risk;

System Grade

Grade A: A fire detection and fire alarm system, which incorporates control and indicating equipment conforming to BS EN 54-2, and power supply equipment conforming to BS EN 54-4, and which is designed and installed in accordance with all the recommendations of sections 1 to 4 inclusive of BS 5839-1:2002.

Grade B: A fire detection and fire alarm system comprising fire detectors (other than smoke-alarms and heat-alarms), fire alarm sounders, and, either, control and indicating equipment that conforms to BS EN 54-2 or power supply complying with BS EN 54-4

Grade C: A system of fire detectors and alarm sounders (which may be combined in the form of smoke-alarms) connected to a common power supply, comprising the normal mains and a standby supply, with central control equipment.

Grade D: A system of one or more interlinked mains-powered smoke-alarms, each with a 10 year Lithium battery back-up supply. (The system may, in addition, incorporate one or more mains-powered heat alarms, each with a 10 year Lithium Battery supply.)

4.1.2 Reference in any documentation to automatic fire detection and warning systems should take the form of the above designation e.g. "Grade A Category LD1"

4.1.3 Where a supplementary system is installed (e.g. a BS 5839-1 LD system supplemented by smoke-alarms), it is essential that occupiers are aware of the separate nature of the systems. For example, occupiers of a house in multiple occupation or sheltered dwelling need to be aware of the need to maintain any smoke alarms provided in individual dwellings, even though a separate system is installed for protection of escape routes.

4.1.4 A supplementary system of interlinked, mains-operated smoke-alarms should be sited in each habitable room within the dwelling, including any store / cloakroom greater than $1m^2$ but excluding sanitary accommodation and kitchen. Where the living / kitchen area is open plan, a smoke-alarm in the living area will suffice. Where the kitchen is separated, a smoke-alarm in the living room and a CO or heat-alarm in the kitchen will suffice.

A supplementary System need not be connected to control and monitoring equipment or to smoke-alarm systems in other dwellings. The purpose is to give early warning to the occupants of the dwelling only, in the first instance, and to reduce the amount of unwanted fire signals to an acceptable level. In the event that no action is taken, or the occupant is absent, the LD3 element of the LD2 system will activate and initiate an evacuation from the effected zone

4.1.5 An automatic fire detection and warning system should be so installed that the fire and rescue service can be alerted at an early stage of the development of a fire. It is preferable for the fire alarm devices to sound only in the zone in which the fire has been detected (as well as at the main control panel, at all repeater panels and at any central receiving station).

In certain circumstances, as determined by a fire risk assessment, the Automatic Fire Alarm system may be required to be so programmed that:

- The system initiates a pre-alarm for a predetermined period to permit staff to investigate the source of alarm.

- The system initiates 'silence alarm' after three minutes of activation and remains in alert mode.

4.1.6 Designers should insure that the type and model of fire panel selected provides open protocol and software and that spare parts are readily available from a number of providers.

4.2 Residential Care (including Supported Housing providing care)

While a minimum Grade A Category LD1 system should be provided throughout all parts of Residential Care premises, detectors need not normally be provided in the following areas:

4.2(a) voids and roof spaces of any depth which contain only:

(i) MICC or wiring clipped to a metal tray
or within metal conduit or trunking, and or;

(ii) non-combustible pipework and ducts, and or;

(iii) metal or plastic pipes used for water supply or drainage;

4.2(b) bath/shower rooms;

4.2(c) toilets in staff areas;

4.2(d) small cupboards (less than $1m^2$);

4.2(e) any room / area with a negligible fire load or ignition source.

In any case the omission of detectors should be subject to a risk assessment.

5. Emergency Escape Lighting

- Risk Profile C = All common internal and external escape routes conforming to BS 5499 (EN 7010 pending)

6. Minimum Door Width

- C = 800mm (1000mm for wheelchair)

7. Minimum Stair Width

- C = 1000mm between handrails

8. Fire Doors

In certain circumstances it may be permissible to omit fire doors within individual flats.

Fire rating of fire doors should achieve a minimum of 30 minutes
In all cases, frame-fixed cold smoke seals shall be included
unless intumescent strips are also included, door stops shall achieve 30mm
Letter-plates shall not compromise the integrity of the door
Self-closing devises, where installed, shall be capable of over-riding latches, frames and smoke seals and shall cause the door to close slowly (e.g. 45 seconds)

Where practicable, corridor compartment doors should be capable of opening through 90º. For certain purpose groups, a proprietary automatic hold-open device shall be fitted to corridor compartment doors and to other doors so specified, to assist in the day to day function of the premises. All doors fitted with such a device shall be capable of activation by the fire alarm system so that they will close automatically in the zone of detection.

9. Portable Fire Equipment.

9.1 Portable fire equipment shall only be provided as specified by the client. Where required, 6ltr Water, 2kg CO^2, 6ltr Foam, 6kg Powder extinguishers and domestic fire blanket shall be the preferred choice.

10. ASET (Available Safe Escape Time)

The purpose of the FSP is to provide the maximum ASET. A fire Risk Assessment may determine a greater or lesser level of protection. It is therefore necessary for the agent to provide 1:50 M&E drawings at the earliest possible stage prior to commissioning work.

10.2 Travel Distance

- C1 (low fire load) = 27m for two-way travel; 13m for one-way travel
- C2 (medium fire load) = 18m for two-way travel; 9m for one way travel

While travel distance in an important factor in the FSP, travel time should also be considered, particularly in regard to a purpose group with mobility impairments.

11. The design stage

11.1 The basic fire safety strategy should be decided at the outset of the design process, so that all sectors of the ensuing process can be coordinated.

The designer should consider the method(s) of procurement, construction, installation, integration, and commissioning, and seek to ensure that the various elements can be properly inspected and tested, and maintained and repaired, that they can (as far as possible) be protected from abuse during normal use of the building, and that there is sufficient management documentation.

11.2 Products specified should be of a type appropriate for the actual use of the building, e.g. a fragile lining might not be a good idea if trolleys are going to impact it. Any structural fire protection systems in the plane of a fire compartment wall or floor should not compromise the broader and different fire resistance criteria needed for the compartment wall/floor itself.

11.3 The selection of fire protection systems by designers should take account of:

- Life cycle cost considerations and how frequently the system or its components will need to be replaced;
- Maintenance needs to ensure that the recommended performance (e.g. fire rating) has not been compromised;
- Access for periodic inspection and replacements during the lifetime of the building;
- Durability issues – wetting, freeze-thaw, movement and aggressive environments – which can reduce performance over a period of time, and:
- Product Certification; designers are advised to ensure certification by third-party product and installation approval schemes.

11.4 It is important that:

- The material or product specified is appropriate for its end use;
- The material or product specified has appropriate field of application reports showing it to be fit for the intended application. Test reports are inadequate for this purpose;
- The correct construction or installation of the material or product is described and is not compromised by inadequate understanding or knowledge of the contractor or sub-contractors;
- All systems can be adequately commissioned and tested.

Attention is drawn to the current Construction (Design and Management) Regulations and the Building Regulations in respect of the requirement to provide documentation concerned with communication of information.

11.5 The designer should ensure that:

- Contractor(s) and sub-contractor(s) understand what the systems are expected to do and how to construct or install them;
- Where a lot of different people are likely to be responsible for the construction, installation or maintenance of different parts of the fire safety system, there is adequate management co-ordination;
- Managers understand what the systems do, and how to test or evaluate the installation.

12. The construction stage

12.1 Product installation; Designers are advised to ensure that installation is undertaken by third-party accredited contractors who understand the fire safety issues for the relevant trades.

12.2 The construction management is responsible for quality monitoring during construction. Where there are a variety of different trades working on a building there might be serious interference by a later tradesperson. For example, a ventilation engineer might compromise previously installed structural passive fire protection which obstructs a new ducting system. Where it might not be reasonable to expect all contractors to understand the needs of the fire safety strategy or take responsibility for them, it might be necessary to develop procedures to integrate different trades and to allocate responsibility and accountability, or appoint an independent supervisor.

12.3 It is important that:

- the passive fire protection products constructed or installed are those specified (and not substitutes);
- the passive fire protection is located and fixed properly in accordance with the manufacturer's instructions (e.g. cavity barriers);
- the specified fire resistance periods can be achieved (e.g. by providing an appropriate number of layers of plasterboard);
- the active systems installed are those specified (and not substitutes);
- the active systems are installed properly and in accordance with the manufacturer's instructions;
- actuation equipment is properly installed and tested and cause-and-effect tables are fully tested;
- all systems are adequately commissioned and tested.

NOTE: Detailed guidance on passive fire protection in buildings is given in the ASFP publication *'Ensuring best practice for passive fire protection in buildings'* This document is the output from a DTI Research project to monitor and assess the quality of installed passive fire protection system in buildings.

13. Designing so that a building can be managed

13.1 The key management issues relating to a new project should be identified at the earliest possible stage (preferably at the concept stage) and should be taken into account when designing the building. Liaison with other agencies, e.g. building control bodies, fire prevention officers, health and safety inspectors and insurance bodies, should be initiated as early as possible.

13.2 Although the formal responsibilities of the designer and the fire safety engineer largely end once the building is completed and occupation and/or use has commenced, many, if not all, of the systems included will entail management assumptions. Some of these will be implicit, e.g. the assumption that structural fire protection remains in place, or the assumption that the fire load within the building does not exceed certain assumed limits, but many others will be explicit, in particular with regard to maintenance and testing of active systems.

13.3 By careful and considered design or location, the designer or fire engineer can provide the building with facilities and equipment which can assist fire safety managers in carrying out their duties in preventing the occurrence of fire.

The day-to-day activity of the fire safety manager is made more difficult if the fire safety design conflicts with the normal, everyday, use of the building, e.g. by placing fire doors across through-routes, or if it fails to take account of real behavior during an incident, such as counter-flows in escape routes as parents search for children.

13.4 In practice, the designer or fire safety engineer can assist the work of the fire safety manager by ensuring that:

a) active fire safety systems are able to be properly maintained and tested;
b) passive fire safety systems are not likely to be made ineffective, e.g. during repair work to or penetrations of fire-resisting walls, or by blocking of escape routes;
c) the building design accurately reflects the anticipated use, fire loading and management of the building, e.g. by making appropriate provisions for disabled people;
d) suitable facilities and equipment are provided to prevent fires from occurring, including suitable housekeeping measures and security measures
e) suitable facilities and equipment are provided for use in the event of a fire, to contain the fire as far as possible and to enable effective evacuation;
f) contingency planning is taken into account at the design stage.

13.5 Designers should familiarize themselves with the responsibilities and tasks of the fire safety manager so that these can be taken into account in the design.

14. Management input

14.1 In designing management systems, designers should take account of human behavior and should ensure that the fire safety systems will be appropriate for what people actually do, not what the designer would like them to do.

14.2 Fire safety systems should be considered as an inherent part of the basic design, and not as supplementary to other matters such as services or finishes. Where there are conflicts of interest, compromises can be necessary. In any case, a flexible approach is essential if novel problems are to be solved. There can be conflicts between the fire safety requirements and the normal use of the building or with building services or with other safety systems, e.g. a door to restrict the movement of fire or smoke will also restrict the movement of people.

14.3 There can also be confusion between a fire door, which needs to be kept shut, and a fire exit door, which may be kept open. These conflicts can, however, normally be overcome as there is no purpose in putting in place fire safety measures which do not allow the normal use of the building or will be negated by such normal use.

14.4 A clear statement of the design requirements for the management of the complex has to be obtained from the client and conveyed to the design team: architect, designer (and fire safety engineer).

Good management at the design stage is necessary to ensure that full benefit is taken of the experience of specialists in relevant areas. All parties involved in the design of a building should cooperate to ensure that fire safety systems are compatible and that if any changes are made, the consequential effects can be accommodated.

14.5 In particular:

a) the owner/developer should give the design team a comprehensive brief on the requirements for management of the building. If it is to be a multi-occupancy complex then this brief should include the management requirements for the components;
b) those responsible for the future management of the building should, as far as possible, form part of the design team. They should monitor the development of the design concept and the detail of the systems they will eventually have to use and maintain. When construction is under way, they should have access to the site so that they can inspect and understand the various fire safety systems, some of which will not be visible when installation is complete;

c) the principles and details of all life safety systems should be fully discussed and agreed with the regulatory authorities and all affected specialists in the design team.

14.6 Other aspects to consider are the management of environmental issues, e.g. water run-off, and the long-term implications of the proposed design for management over the life of the building.

15. Designing for the management of fire prevention

15.1 By careful and considered design or location, the designer can provide the building with facilities and equipment which can assist the fire safety manager in carrying out their duties in preventing fire occurring.

15.2 Recommendations for provisions to assist with good housekeeping, building maintenance and security are given in **15.3** to **15.4**

15.3 Good housekeeping is essential to reduce the chances of fire starting or developing, and escape routes being blocked. The designer should provide means for as many of the following items as necessary:

- keeping combustible materials separate from possible ignition sources;
- safe storage of flammable liquids, paints and polishes in appropriate containers;
- safe storage of other hazardous items, e.g. LPG cylinders, aerosol cans;
- ensuring that escape routes can readily be kept clear;
- ensuring that fire doors can readily be kept closed;
- waste control and waste disposal;
- carrying out catering and cooking in appropriately designed and protected facilities;
- protection for essential hot work or heat-dissipating processes.

15.4 In addition:

a) buildings should be designed and laid out in such a way that all escape routes can be maintained free from obstruction;

b) adequate provision should be made for enclosed and/or secure storage areas within the building;

c) storage should be provided so that goods, materials, unwanted furniture, etc., need not be stored within escape routes;

d) seating areas should not be provided within escape corridors;

e) surface finishes and coverings (including carpets) on walls, ceilings and floors within escape routes should be such that maintenance would not require the use of materials that might propagate surface spread of flame and/or fire, or adversely affect the means of preventing such propagation;

f) floor surfaces within escape routes should be maintainable, even and slip-resistant;

g) provision should be made for refuse, waste paper, etc., to be stored separately pending its removal from the premises, so that it does not accumulate on the premises. Wherever possible, it should be possible for all combustible waste to be baled and removed from the premises daily;

h) means should be provided of restricting goods in store rooms so that they are not stacked close to windows, and if there is a sprinkler and/or detection system, that they are stacked not higher than the height recommended in BS EN 12845, BS 5306-2 and BS 5839-1; and subsequent amendments.

i) where it is expected that large fixtures will be introduced into the building (e.g. shop fittings, linings, special displays), the provision for their siting should be such that exits can be kept clear and unobstructed, and exit signs will be visible from the relevant parts of the premises.

16. Equipment and fittings maintenance

16.1 A significant way of preventing fire incidents is to maintain equipment and fittings that might start a fire and to control materials that might allow a fire to develop and spread. The designer should provide means for the fire safety manager to inspect and maintain as many of the following items as necessary:

- potential sources of ignition such as gas, oil and electrical heating installations;
- other electrical and gas installations;
- other heat-dissipating equipment (e.g. factory machines, factory processes or office machines);
- floor coverings, furniture, furnishings, décor, scenery, props, curtains and drapes;
- any other equipment that presents a particular fire risk, such as oxygen-handling equipment (e.g. oxygen tents).

17 Security

17.1 Good security arrangements can reduce the risk of serious fires by arson. In order to reduce the likelihood of arson, and to mitigate its effects if it does occur, the designer should provide means for as many of the following as are deemed appropriate:

- security against intruders;
- intruder detection;
- means of controlling of ignition sources and easily ignitable materials;
- fire detection;
- fire suppression;
- compartmentation;
- segregation of materials and/or processes that could present a risk;
- limiting the proximity of ancillary buildings and of external storage, particularly of combustibles and waste.

17.2 The designer should ensure that security arrangements do not prevent occupants from reaching a place of relative or ultimate safety. Security of the building can be in both directions: ingress and egress. In certain premises, such as homes for people with mental ill health, the need to restrict the occupants from leaving the premises should be integrated with adequate and manageable emergency egress.

17.3 The selection of hardware should take account of the types of people using the building. When planning the security arrangements, the designer should take account of the needs of members of the fire and rescue service who might need to enter the building to effect rescue or fire-fighting, and those of insurers. Means of shutting down equipment, stopping machines and processes and isolating power supplies, where appropriate, should be provided.

18. Designing for the management of fire protection

18.1 Fire protection is needed to assist and protect occupants in the process of moving safely away from danger after a fire has started, via notification of systems such as fire alarm systems, passive and/or active fire safety systems.

A careful and considered approach to the design of fire protection systems can assist the fire safety manager in enabling people to evacuate the building, and enabling the fire and rescue service to gain access, in the event of a fire occurring.

18.2 Systems are sometimes unavailable because of maintenance, testing, repair, breakdown or impairment. There should be clearly defined limits for the periods when a system is out of commission, and special procedures, including those relating to evacuation, should also be implemented. In some cases it can be necessary to have a duplicate system.

The equipment provided should be such that there is likely to be spare parts, replacement components, or replacement equipment in total, available for the working life of the building.

18.3 Systems that are prone to false alarms or failures on a regular basis are more likely to be taken out of service by occupants than systems that function correctly.

Systems that are prone to false alarms on a regular basis, even if they are retained in service, can make building occupants complacent and therefore unlikely to react to an alarm signal speedily, thus putting occupants at risk in the event of an actual fire occurring.

The equipment provided should be sufficiently reliable that it is possible to depend on it in an emergency, and should not be prone to false alarms or failures. The design measures taken to avoid unwanted fire signals should be detailed in commissioning certificate.

18.4 Similarly, equipment should be provided that is expected to be durable over a reasonable working life, within the relevant environmental and operational conditions, and able to continue working even with some parts temporarily inoperable.

18.5 The design of the equipment provided should be such that it can be readily and easily tested and maintained, both as an item and as part of a larger system, in such a way as to minimize business interruption. There should be an available source of spare parts for the equipment.

If successful operation of a system depends upon devices in other systems (e.g. smoke control systems and fire detection systems), it should be possible to test the systems as a complete entity as well as individually.

19. Other factors

19.1 Account should be taken of the functionality and ergonomics of fire safety equipment to ensure that it is compatible with the normal use of the building. Equipment provided solely for fire safety can present injury risks (e.g. self-closing fire doors can present problems to people who are unable to move rapidly, have limited strength or are in a wheelchair).

19.2 The designer should provide for the following where appropriate:

- protection against common mode failures, e.g. with any building management system;
- vandal-proofing and tamper-proofing;
- weather resilience, especially of escape routes (e.g. final exit doors opening into areas prone to snowdrifts) and air-intakes (e.g. for smoke control);
- reliability of water supplies;
- interactions between normal heating, ventilation and air conditioning systems (HVACs) and smoke control systems;
- insure that the type and model of smoke extraction selected provides open protocol and software and that spare parts are readily available from a number of providers
- software-controlled safety systems, means of testing, resilience, failure modes and manual overrides;
- protection of safety-critical software;
- protection of safety-critical electrical and electronic equipment from the risk of damage by discharge of water.

  All equipment and systems should be in accordance with the appropriate British Standards.

19.3 There might well be a threat to fire protection systems if subsequent trades cause damage to these systems, or change the construction features such that the intended operation cannot be provided or achieved. The later installation of electrical and IT cable systems, building service pipe work, for example, often causes significant damage to the usefulness of fire

compartments in buildings, and work should not be signed off until the passive fire protection measures have been checked for continued functionality. Such cold work checking can be as important as control of hot-work permits for work on buildings.

19.4 Changes to the construction or use of a building need to take into account any impact on the available fire safety systems (active and passive). The maintenance of all fire compartment boundaries is crucial to the fire safety strategy in buildings.

19.5 Effective maintenance is equally important externally and internally to the building. A building designed for fire safety should not be compromised by the addition of combustible products or by removal of, or damage to, existing systems. The risk of spread of fire externally over a building should be taken into account. Materials used for repair or modification should not impair the fire safety strategy.

19.6 The key actions can be summarised as:

- consider building life issues;
- ensure that building services aid the fire safety strategy; not obstruct it;
- consider the use of hot and cold work permits of work;
- maintain, monitor and record the well-being of all fire safety facilities;
- ensure that those responsible are appropriately empowered.

The maintenance requirements should be detailed in the fire safety manual for the building.

20. A fire risk assessment may highlight issues for remedial action within the defects period. It is therefore recommended that the Fire Safety Officer be consulted prior to handover to ensure that passive and active fire protection measures are adequate for the risk profile of the building.