Recommendations

RC3

for loss prevention in electronic equipment installations: part 1 – fire prevention

FPA
Fire Protection Association

InFiReS

LOSS PREVENTION RECOMMENDATIONS

These recommendations are part of a series of insurer documents developed under the Insurers' Fire Research Strategy Funding Scheme (InFiReS) and published by the FPA. InFiReS membership comprises a group of UK Insurers that actively support a number of expert working groups developing and promulgating best practice for the protection of property and business from loss due to fire and other risks. The technical expertise for the Recommendations is provided by the Technical Directorate of the FPA and experts from the Insurance Industry who together forms the InFiReS Process Steering Group.

The aim of the FPA Series of Recommendations is to provide loss prevention guidance for industrial and commercial processes and systems. The series continues a long tradition of providing authoritative guidance on loss prevention issues started by the Fire Offices' Committee (FOC) of the British Insurance Industry over a hundred years ago and builds upon earlier publications from the LPC and the ABI.

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Copies of RC3: Part 1 may be obtained from the publications department of the FPA, at the above address. Other parts are in preparation.

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INTRODUCTION

Electronic equipment installation protection can vary from just limited structural protection to a high level of protection involving duplicated fire suppression systems, alarm systems and structural protection. The chosen level of protection depends upon the specific hazards, the position of the installation and the perceived business impact of material losses and consequential losses.

In considering protection against fire the following factors should be taken into account:

(a) probability of fire occurring;

(b) potential significance of a loss;

(c) consequential losses.

Fire protection is then based on:

(a) elimination of life safety and environmental threats;

(b) the impact of significant threats based on criticality of the electronic equipment;

(c) detection of actual incidents;

(d) fire suppression and protection;

(e) the level of segregation of the installation from other areas based on its criticality.

A risk assessment may be used to decide the criticality of an electronic installation and can be applied to the small 'electronic office' or to the large purpose-built computer facility. This approach is used in BS 6266: 2002[1] and

examples of the category types are given below. This process may involve a checklist of hazards versus risk. Alternatively this can be done at a company executive level via subjective assessment of the costs of partial or total loss of the electronic equipment installation and of the consequential losses. The categories of risks relating to electronic equipment installations can be described as follows.

RISK CATEGORY A: SLIGHT

Typical features are as follows:

(a) modern small office environment;

(b) personal computers – not networked;

(c) equipment is standard and easily replaceable;

(d) operations can be transferred to another location without great difficulty;

(e) critical files can be backed up periodically, for example on CD-ROM;

(f) potential for business interruption is slight.

RISK CATEGORY B: LOW

Typical features are as follows:

(a) modern commercial /industrial environment;

(b) networked personal computers;

(c) equipment is standard and easily replaceable;

(d) operations can be transferred to another location with some difficulty;

(e) files can be backed up periodically on a central server;

(f) loss can affect a number of PCs or central storage facility;

(g) potential for business interruption is low.

RISK CATEGORY C: MODERATE

Typical features are as follows:

(a) dedicated equipment room;

(b) centralised server/computer facility;

(c) equipment is standard but not immediately replaceable;

(d) operations can be transferred to another location with some difficulty;

(e) files can be backed up periodically on a central server;

(f) loss affects short-term business operations.

RISK CATEGORY D: HIGH

Typical features are as follows:

(a) dedicated equipment room(s);

(b) centralised server/computer facility;

(c) some equipment is non-standard and not replaceable in the short term;

(d) operations are not easily transferrable without robust contingency plans;

(e) files can be backed up periodically on central server;

(f) loss affects medium-term business operations.

CATEGORY E. CRITICAL

Typical features are as follows:

(a) dedicated premises;

(b) centralised server/computer facility;

(c) equipment is high value or purpose built and not replaceable;

(d) operations are not easily transferrable without extensive and regularly tested contingency plans;

(e) data is backed up on a continual basis on central server(s) and/or remotely;

(f) no downtime or very little downtime can be tolerated.

The highest level of protection is provided for on-line electronic equipment whose loss and thus non-availability to process data could have an impact on:

- life support;
- manufacturing production;
- commercial service;
- business profitability or continuity.

The guidance set out in this document is intended to reduce significantly the risks for installations in the High or Critical categories. The guidance can be selectively applied for lower category installations depending on the criticality of the installation, the size of asset and the potential consequential loss. This should be done in consultation with insurers and fire authorities. Ensuring that the design, installation (including installing practice) and maintenance of all protection measures conforms to a recognised quality system (i.e. BS EN ISO 9000[2]) is important in providing protection that is effective and fit for the purpose. Recommended measures include the provision of gaseous, total flooding, fire extinguishing systems. The health and safety considerations involved in the design and operation of such systems should be addressed by an appropriate risk assessment. General recommendations for the accommodation and environment of computer equipment may be found in BS 7083[3]. Although the FPA *Recommendations for Loss Prevention in Electronic Equipment Installations* are primarily concerned with the prevention of loss in electronic data processing caused by fire, loss due to other causes should also be considered. This might be, for instance, malicious or accidental damage by persons to the computer hardware, to other vital equipment and functions, or to the building. Separate documents have been published to cover these possibilities.

SCOPE

These Recommendations are applicable to installations for commercial electronic data processing, electronic communications equipment, electronic equipment and industrial process control where fire might cause substantial material damage and/or business interruption losses. They are not intended to cover desk-top computers or remote terminals although they may be used as a guide for the protection of that type of equipment. This document may also be useful where a small group of desk-top computers is installed in a certain location.

All installations included within the scope of these Recommendations will be referred to in this document as electronic equipment installations.

1 DEFINITIONS

1.1 *Aspirating (smoke sampling) system*

A fire detection system that monitors a protected space for the presence of smoke by drawing an air sample from the protected space, through pipework, to a central detection point. The air sample is tested for the quantity of smoke present and an alarm condition is signalled at a pre-determined response level.

1.2 *Coincidence connection*

A facility incorporated into a fire detection and alarm system, whereby the detection of the products of combustion (e.g. smoke from a fire) by at least two separately identifiable detection sources generates a suitable output for triggering, for example, the release of a gaseous total flooding extinguishing system.

1.3 *Electronic equipment area*

The room or enclosure which contains the machinery and electronic equipment necessary to receive or transmit data, to process it and produce the output or feed the output to controlled processes. The electronic equipment area may comprise the processing equipment area, communications areas and other areas such as uninterruptible power supply (UPS) rooms (industrial processing plant may also constitute part of the area at risk).

1.4 *Fire resistance*

The period for which an element of structure satisfies the relevant requirements of the test for fire resistance specified in the appropriate part of BS 476[4].

Note: In BS 476: Part 31.1[5] a method is described to test for smoke leakage around smoke stop doors. Guidance on acceptable leakage rates is given in section 4.2 of the *LPC Design Guide for the Fire Protection of Buildings*[6] (*LPC Design Guide*).

1.5 *Hazard*

This is a material or situation with the potential to cause harm.

1.6 *Media stores*

The ready-use paper store, magnetic media library and other media storage areas.

1.7 *Non-combustible*

The property of a material which satisfies the requirements of non-combustibility when tested in accordance with BS 476: Part 4[7].

1.8 *Operations room (also known as the bridge or control room)*

A room in which the general running of the electronic equipment installation is managed. This room may be remote from the electronic equipment installation.

1.9 *Protected enclosure*

An enclosed volume protected by a fire-resisting enclosure and a fire detection and/or extinguishing system in which the electronic equipment and other related equipment is installed.

1.10 *Protected space*

That area or volume protected by a fire detection and/or extinguishing system in which the electronic equipment and other related equipment is installed.

1.11 *Risk*

This is the product of the probability of a situation arising and the consequence or extent of damage to be expected when that situation arises.

2 LOCATION AND CONSTRUCTION OF INSTALLATIONS

2.1 Areas containing electronic equipment installations should preferably be housed in a separate building of non-combustible construction (including its linings) having a fire resistance of at least 60 minutes. The building should be reserved solely for the electronic equipment installation and processes associated directly with it.

2.2 Where the electronic equipment installation area is bounded partly or wholly by external walls which may be subjected to exposure to any external fire, all window openings therein should be protected by a glazing system having a fire resistance of at least 60 minutes (see section 4.3 of the *LPC Design Guide*[6]). Buildings should be segregated from hazardous processes by adequate distances or by barriers designed to retain the hazard.

2.3 Where the electronic equipment installation area forms a part of larger premises it should be separated from those premises by non-combustible elements of construction having a minimum period of fire resistance as given in

Table 1 - Electronic equipment area fire separation

Fire separation (min)		Type and use of adjoining area
Walls	**Floors**	
60 (60)	60 (60)	Other electronic equipment areas, other suites etc
120 (90)	120 (90)	Low hazard factories, shops, canteens etc
240 (120)	240 (120)	Storage warehouses, high hazard processes etc

Values in ( ) are for fully sprinklered buildings.
Reduction of fire resistance below 60 minutes is not acceptable in any area.

Table 1. Where appropriate, any opening therein should be protected by a fire-resisting element such as a door or shutter. Guidance on the protection of openings in fire resisting compartments is given in chapter 4 of the *LPC Design Guide*[6]. Doors should be self-closing. Consideration should also be given to the use of smoke check doors in accordance with section 4.2.6 of the *LPC Design Guide*[6].

2.4 Any areas where large quantities of paper or other combustible materials are handled or stored should be separated from the areas containing the main electronic equipment by walls or partitions of non-combustible construction. These should have at least 60 minutes fire resistance extending from the main floor to the structural ceiling. Every opening therein should be protected by self-closing doors of at least 60 minutes fire resistance.

2.5 Any wall or ceiling lining and any suspended ceiling should be made of non-combustible materials. Where false floors are built to provide under-floor voids to accommodate cabling and other services above existing true floors, they should be of adequate strength, non-combustible and should not incorporate materials having a melting point lower than 600°C. The design of such a floor should be such that it retains its integrity and provides adequate thermal insulation in the event of a fire developing in the void beneath. Where combustible materials are used the raised floor should be faced on the underside with non-combustible material. In order to prevent water damage to the installation from external sources, the main floor level should be raised and sills fitted at all door openings. Ramps may be included to allow wheeled access across the sills. Particular care should be taken to prevent flooding of cable voids formed by cutting ducts in floors. The main ceiling and the true floor of the electronic equipment area should be made water resistant and dust proof by suitable means to ensure long term protection.

2.6 Service pipes carrying water (e.g. central heating), other than pipes for sprinkler protection of the electronic equipment area, should not be brought into the electronic equipment area unless a water supply is essential for the efficient operation of the installation. In such cases provision should be made for cutting off any water supplies in an emergency, other than those to sprinkler systems. Bunding of pipes and the use of leakage detection systems should also be considered.

2.7 Electronic equipment areas should not be located in basements. Where this is not practical, precautions should be taken to prevent flooding and there should be adequate access for firefighting personnel. Particular care will also be needed to ensure that ventilation and over-pressure facilities for gaseous fire suppression systems are adequate if the areas are in basements.

2.8 Where large discharges or deposits of water may occur (e.g. from the operation of sprinklers or leakage of water services), adequate facilities should be available to enable removal of the water.

2.9 Small workshops required for the maintenance of electronic equipment installations may form part of the electronic equipment area only if they are adequately separated from critical areas by fire-resistant compartmentation of at least 60 minutes fire resistance.

2.10 Where electronic equipment hardware is not confined to a dedicated area but is decentralised within a large area (e.g. computer-controlled fabrication hardware in a manufacturing complex), then consideration should be given to segregating the hardware, by fire-resistant compartmentation, from the manufacturing process.

3 SERVICES

3.1 All air conditioning ducts, including insulation and lining, should be constructed of non-combustible materials. In large electronic equipment areas, consideration should be given to an air-conditioning system independent from the rest of the building. All air ducts should include automatic dampers (see clause 3.7) operated by a signal from a smoke detection system.

3.2 Any filter media should also be non-combustible and regularly cleaned or replaced to remove accumulations of combustible materials.

3.3 Manually operated and suitably labelled 'Emergency Override' switches that can shut

down the air conditioning system should be provided. The switches should be located near the main exit door and be within reach of work stations close to or within the area where system operators may be based.

3.4 The air conditioning duct on the delivery side of the fan should be protected by smoke detectors, as part of the detection system described in section 4.

3.5 Only indirectly heated air should be used in the air conditioning system.

3.6 Special arrangements should be made to prevent the accumulation of heat and smoke in the electronic equipment area by, for instance, the use of extract systems.

3.7 To ensure control of fire spread and integrity of the space in the event of extinguishant discharge, the air conditioning system (including dampers) should be interfaced with the fire protection system (see section 4).

3.8 Facilities should be provided for extinguishant and products of combustion to be extracted, when it is safe to do so.

3.9 Emergency escape lighting systems should be provided and should comply with BS 5266, as should the testing and maintenance of the systems.

3.10 The building housing the electronic equipment area should be equipped with a lightning protection system following the FPA *Recommendations for the Protection of Buildings from Lightning*[8]. Consideration should also be given to providing transient voltage protection on power and telecommunication lines and electrical bonding of equipment.

3.11 All new electrical installations should meet the current IEE Regulations[9].

Cables should be installed in conduit or trunking, or clipped to the slab or perimeter or on a tray. Loose bundles of cables are not acceptable.

Power and communications cables should be segregated.

In ceiling and floor voids used as air handling plenums, PVC power cables should be in metal conduit or metal trunking. Data cables should preferably meet the recommendations in 4.7.3 of the *LPC Design Guide*[6]. As a minimum, smoke detection shall be provided in the void.

It is recommended that flame retardant cables that are low smoke producing are used where appropriate. These should also produce non-corrosive smoke and comply with BS 7211[10].

All services, cable ducts and other potential routes for fire spread should be fire stopped, to ensure the required integrity of the construction.

4 FIRE PROTECTION

4.1 Automatic fire detection system

4.1.1 The electronic equipment and all associated areas (including floor and ceiling voids) which contain components critical to function should be protected by a fire detection and fire alarm system in accordance with this document and BS 6266. Such a system should be LPCB approved. (Where conflict exists between this document and BS 6266 this document should prevail.) Manufacturers' requirements, where applicable, should also be consulted. Adjacent areas should be protected by an LPCB approved fire detection and fire alarm system installed in accordance with BS 5839 - 1[11].

4.1.2 All fire detectors should be sited in the most advantageous position to detect the anticipated phenomenon (see BS 5839 - 1[11] and BS 6266: 2002[1]).

4.1.3 Where problems exist that may prevent the rapid detection of a fire (such as fast air currents caused by air conditioning) the additional or alternative measures given in Appendix A of this document should be considered. Appendix A is mainly concerned with conventional point detection but specialised detection operating on other principles, such as aspirating systems (see clause 4.1.6), may also be appropriate.

4.1.4 The operation of the fire alarm system covering the protected space should automatically initiate emergency shut-down procedures for all electrical power supplies in the electronic equipment area and shut down any air conditioning system serving the protected space. (See clause 3.3.) The only exception to the above is where an automatic shut down of equipment controlled from a continuously manned electronic equipment area would result in extensive business interruption. In such cases the installation should be capable of being shut down manually in a pre-determined manner, acceptable to the fire insurers, on the indication of the operation of the fire alarm system.

4.1.5 Coincidence connection: if it is intended that gaseous extinguishing systems are to be actuated by the operation of a fire detection system, then every care should be taken to prevent unwanted discharge. This could be caused by false alarms in the detection system. A method of minimising the possibility of false alarm leading to unwanted discharge is by using coincidence connection of smoke detectors. The following recommendations should be adopted when using coincidence connection:

(a) all smoke detectors should conform to BS EN 54-7[12];

(b) operation of the first detector should result in an indication of fire at the fire alarm control and indicating equipment;

Table 2 – Selection of extinguishing methods

	Gaseous extinguishing		CO_2		Sprinkler	High expansion foam
	Total flood	Local	Total flood	Local		
Electronic equipment areas or other personnel occupied enclosures containing critical equipment	✓		✓*		✓	
Equipment cabinets in electronic equipment areas that do not have a gaseous extinguishing total flooding system		✓		✓		
Bulk paper storage and/or handling areas or other risks presenting deep-seated carbonaceous fire hazards			✓		✓	
Plant areas housing equipment such as generators, air handling units etc	✓		✓		✓	
Floor voids where separate flooding is required	✓		✓			✓

* Manually operated systems only.

(c) if the control and indicating equipment can uniquely identify the status of each detector on a circuit (i.e. addressable system), then the detector and confirmation detector(s) may be connected on the same detection circuit. For non-addressable systems, coincidence detectors need to be installed on separate detection circuits;

(d) due to the principle of operation of coincidence connection it is recommended that the density of detectors is increased to 15m^2 per detector for all protected spaces, or greater as given in Appendix A of this document;

(e) where the fire hazard requires the use of both photo-optical and ionisation chamber point smoke detectors, a minimum of two of each type should be provided in the protected space (or subdivision of the protected space), with at least one of each type per circuit (for non-addressable systems). The two types of detectors should be evenly distributed over the protected space (for example a ceiling void).

Note: When fire detection is used to actuate fire extinguishing systems, reference should be made to BS 7273 -1[13].

4.1.6 Aspirating systems may be used as additional protection to the more conventional point smoke detection. If such systems are used, the following points should be considered:

(a) detectors should be LPCB approved;

(b) if the level of response to smoke is adjustable, then qualified personnel should make all adjustments. The adjustments should ensure the optimum response to smoke without unduly increasing the risk of false alarm;

(c) the siting and spacing for all parts of the system should be in accordance with manufacturers' instructions and the BFPSA *Code of Practice for Category 1 Aspirating Detection Systems*[14];

(d) the system should not be used directly to initiate extinguishant discharge, unless prior agreement has been given by the insurers.

4.1.7 An indicator panel associated with the fire detection and fire alarm system should be installed in a readily visible position adjacent to the electronic equipment area. Panels used for the indication of the status of the extinguishing system should be located outside each entrance to the electronic equipment area. All manual controls for the extinguishing system should be readily accessible.

4.1.8 Use of in-cabinet detection and extinguishing systems should be considered. These would allow a logical shut down of equipment on first detection in order to protect data. Extinguishment would be on second detection. If such devices are used they should, where applicable, conform to an appropriate standard and be installed by qualified personnel to the manufacturers' instructions. There should be remote indication of the operation of any concealed detectors.

4.2 *Fixed automatic extinguishing systems*

4.2.1 Electronic equipment and adjacent areas (including associated floor and ceiling voids) should be protected by one of the following fixed automatic extinguishing systems:

(a) a sprinkler installation in accordance with the *LPC Rules for Automatic Sprinkler Installations*[15]. The Rules contain special requirements for sprinkler protected electronic equipment areas;

Note: Sprinkler systems may in some cases be unsuitable for floor void protection.

(b) a gaseous extinguishing total flooding system in accordance with the appropriate part of BS ISO 14520[16]. Guidance on the selection of gaseous extinguishing systems can be found in *Gaseous Fire Protection Systems*[17] (LPR16) published by the FPA;

(c) a carbon dioxide total flooding system in accordance with BS 5306-4[18].

(d) a high expansion foam system in accordance with BS 5306 : Section 6.2[19] (recommended for use in floor voids only).

System selection depends largely on the specific hazards presented by the risk to be protected. In general however, the applications recommended in Table 2 should be used.

Note: EU Regulation 5748/99 prohibits the use of all non-critical Halon systems and requires their decommissioning by 31/12/03.

4.2.2 Procedures should be established for ventilating the protected enclosure after discharge of the extinguishing agent. Where foam is used, special facilities may be required for removal after discharge.

4.2.3 In order to minimise the period during which protection is not provided following discharge, procedures for the replacement of extinguishing agent supplies should be established and, where appropriate, the provision of stand-by supplies should be considered, especially for critical installations where minimal disruption is required.

4.2.4 The operation of the gaseous total flooding systems should comply with the health and safety requirements contained in Halon Alternatives Group (HAG) report *A review of the toxic and asphyxiating hazards of clean agent replacements for Halon 1301*[20]. These are summarised in LPR16[17]. The requirements for operation of each type of system are set out below. People must not be present in the protected space during the discharge of:

(a) any carbon dioxide total flooding systems;

(b) any other gaseous extinguishing total flooding system where the designed concentration exceeds the LOAEL (lowest observed adverse effects level) as given in the HAG report for each gas.

4.2.4.1 *Carbon dioxide*

When the protected enclosure is normally unoccupied, operation of the automatic fire detection system should automatically actuate the extinguishing system. When the protected enclosure is occupied, a carbon dioxide total flooding system should be in the 'manual only' operating mode and its controls should be located outside the computer area or near the main exit door. Entry to the computer area should be possible only when the system is under manual control.

4.2.4.2 *Gaseous extinguishment*

When the protected enclosure is unoccupied, operation of the automatic fire detection system should automatically actuate the extinguishing system.

Restrictions on the operation of the system are given in the HAG toxicity report and summarised in LPR 16[17]. These are determined by the maximum concentration of extinguishant expected in the protected space.

The following precautions are relevant to automatically operated gaseous extinguishing total flooding systems in areas which may be occupied:

(a) to allow the protected areas to be evacuated prior to extinguishing agent discharge, a time delay may be incorporated in the automatic system. The delay period will depend upon potential speed of fire spread and the means of escape from the protected area, but it should not exceed 30 seconds unless prior agreement has been obtained from the appropriate authority (this will normally be the Health and Safety Executive and/or the local fire authority);

(b) where a time delay facility is provided the system may also be equipped with a single action biased switch (hold switch), located within the protected space, which can stop the countdown to discharge from continuing whilst being held. Upon release of the switch, and provided the system remains in 'alarm', the countdown should restart from the beginning.

An audible warning that the hold switch is being operated should be provided, which may be the same as the time delay signal. The design and location of the hold switch and circuit should be such that there is no possibility of accidental operation by falling objects or stacking of equipment against it.

A vent or vents may need to be provided to the enclosure to ensure that pressures generated by the gaseous extinguishing system do not cause the protected enclosure either to explode or implode. The vent size requirement will depend on type of the gas, the pressure flux that the enclosure can withstand, and the amount of natural enclosure leakage.

A smoke and gas clearance system should be provided so that the enclosure can be vented to outside after operation of the system. The operation mechanism should be outside the enclosure since the enclosure may not be safe to enter after a fire with a gas release, as breakdown products can be toxic.

4.3 *Portable fire extinguishers*

4.3.1 Electronic equipment and adjacent areas should be provided with portable fire extinguishers manufactured to BS EN 3[21] and distributed according to BS 5306: Part 8[22].

4.3.2 Carbon dioxide extinguishers should be available in electronic equipment and adjacent areas to deal with fires in electrical and electronic equipment.

4.3.3 Extinguishers using water or water based extinguishing media (rated as at least 13A per unit as defined in BS EN 3[21]) should also be available to deal with fires in paper and similar materials when present in significant quantities.

4.3.4 All staff should be trained in the use of extinguishers with particular attention to their use on electronic equipment.

4.4 *Hose reels*

4.4.1 If it is appropriate for the risk and staff are trained in their use fire hose reels may be provided.

Fire hose reels should comply with BS EN 671-1[23] and be maintained in accordance with BS 5306-1[26].

5 COMMISSIONING OF FIRE PROTECTION SYSTEMS

5.1 In order to confirm that fire protection systems are fully functioning and adequate for their purpose, commissioning tests should always be undertaken as part of the standard acceptance procedures.

5.2 All fire detection systems should be checked for correct operation, for example, by simulating a fire condition as described in clause 5.3. All functions and indicators should be checked including the operation of coincidence connection of smoke detectors (where included). Where detection systems are used to initiate extinguishant discharge, the systems should be checked for operation from detector through to all actuating mechanisms. Simulators may be used where 'one-shot' devices are incorporated as actuators.

5.3 Due to the prevailing air movement conditions that may exist in the protected area, placing a smoke source close to a detector is not considered to be a realistic simulation of a fire condition. It is usual practice to carry out smoke tests within the protected area. The type of test depends on the sensitivity required of the fire detection system and the materials existing in the protected area. The detection system should respond within 2 minutes from the start of each test, with the air conditioning system either on or off.

(a) High sensitivity tests assess, for example, the system's ability to detect overheating of cable and electronic components in equipment. This is usually used for aspirating detection.

An example of such a test is the vaporising of PVC insulation on a specified length of a standard cable under a known electric current.

The high sensitivity detection system should also be able to respond to the series of standard tests given below.

(b) Standard sensitivity tests to assess normal room space protection.

These tests usually use fire simulation methods using proprietary devices producing smoke by chemical means.

Combustible materials should not be ignited and real fires should not be used to assess installed equipment.

In all cases the manufacturers' recommendations should be followed.

5.4 Where the fire detection system is designed to actuate a total flooding extinguishing system, it is recommended that the commissioning test is in the form of:

(a) checking the electrical operation of the systems (see clause 5.2.);

(b) where required, testing the integrity of the enclosure. One method of testing the enclosure is by using 'door fan' apparatus. Such testing is described in Appendix B;

(c) ensuring that the fire extinguishing equipment is satisfactorily connected and fit for the purpose. This may be checked by passing pressurised air through the pipework and nozzles. (It should be noted that pressurised air does not simulate the characteristics of CO_2.)

5.5 Details of commissioning/acceptance testing of specific extinguishing systems are contained in the appropriate parts of BS 5306[24].

5.6 A full site gaseous extinguishing discharge test should not be carried out unless it can be shown that no other commissioning method can be used. If a discharge test is to be used, then it should be undertaken in accordance with LPS 1230[25].

6 MAINTENANCE OF FIRE PROTECTION SYSTEMS

6.1 In order for the reliable and continued operation of the fire protection systems, a maintenance plan should be drawn up which should include details of routine tests.

6.2 The fire detection system should be maintained in accordance with BS 5839-1[11] and any additional maintenance required particular to the equipment should be carried out as defined by the manufacturer.

6.3 Carbon dioxide and other gaseous total flooding fire extinguishing systems should be maintained in accordance with the requirements of BS ISO 14520[16] and BS 5306-4[18].

6.4 Automatic sprinkler installations should be maintained in accordance with the requirements of Technical Bulletin 203 of the *LPC Rules for Automatic Sprinkler Installations incorporating BS EN 12845*[15].

6.5 Hose reels and portable fire extinguishers should be maintained in accordance with BS 5306-1[26] and BS 5306-3[27], respectively.

6.6 The effects of alterations to the electronic equipment area or equipment layout should be considered, as they are very likely to affect the performance of the protection system. Particular attention should be paid to fire stopping and room integrity.

7 PROTECTION OF RECORDS

7.1 The amount of record media (paper, magnetic tapes, memory drums etc.) within the computer area should be kept to a minimum.

7.2 All record media on which data is recorded and which are essential to the completion of an operation should, while not in use, be stored outside the computer area, preferably in an area remote from the computer area. Storage should be in a fire-resisting room or fire-resisting storage cabinet. Such rooms or storage cabinets should be specifically designed to give protection against the effects of heat and moisture in the event of fire, taking into account the types of record media to be stored. (Conventional data cabinets do not normally offer adequate fire resistance.) Records of primary importance should be designated as vital records and may require additional protection measures, such as subdivision and storage in a number of smaller, protected, fire-resisting cabinets, located separately.

7.3 Rooms used for the storage of records should be equipped with suitable fire protection system(s) and portable extinguishers.

7.4 Where in the interest of efficiency it is necessary to keep records referred to in 7.2 in the electronic equipment area for short periods they should be stored in a cabinet as described in 7.2.

7.5 Duplicates should be made of records such as program tapes, disc packs etc, which may be used unchanged from time to time unless, for example, the data can be reconstructed at reasonable cost. These should not be stored in the same location as those referred to in 7.2 but in another building, adequately separated from that housing the electronic equipment area. This is especially important for vital records. It is also advisable that all operating manuals are duplicated and stored safely.

7.6 Records should be protected against electrostatic discharge and electromagnetic field influences.

7.7 Multiple generations of records should be kept (if other records of equal value are not available) and should be stored as described in 7.5. Different generations should be stored separately, if possible.

8 HOUSEKEEPING PROCEDURES AND GENERAL CONSIDERATIONS

8.1 Any flammable materials (e.g. flammable cleaning fluids) used for computer maintenance, should be stored outside the electronic equipment area.

8.2 Smoking, eating and drinking should be prohibited within the electronic equipment area.

8.3 Combustible materials including paperwork and hard copy files should not be allowed to accumulate on desks or floors. Clear desk policies are recommended and adequate storage cupboards should be provided.

8.4 Waste paper should not be allowed to accumulate in the computer area, and metal bins with self-closing lids should be provided and emptied as necessary.

8.5 Voids should be maintained clean and free from litter, by adopting a regular cleaning policy.

8.6 Cleaners or other personnel having access to the electronic equipment area but not trained in the operation of the fire protection equipment should be supervised by staff who are so trained.

8.7 An effective cable management plan should be maintained to eliminate unnecessary or badly installed cable, especially under floor voids.

8.8 The electrical wiring and equipment associated with the equipment should be regularly inspected, tested and maintained as required by the IEE Wiring Regulations[9] and manufacturers' instructions.

8.9 Consideration should be given to the selection of furniture with minimum content of combustible materials. (For example, furniture should conform to the crib 5 test of BS 5852-2[28,29,30].)

8.10 Floor tile removers should be readily available and located with the portable fire extinguishing appliances and staff should be trained in their use.

8.11 Notices on the action to be taken in the event of and following a fire, or the operation of an automatic extinguishing system, should be prominently displayed. Measures or means should be available to ascertain when an area is safe to enter following a discharge. All personnel, including visiting workers, should be familiarised with the procedures.

9 BUSINESS CONTINUITY MEASURES

9.1 A list of contingency measures and plans of action should be drawn up. Advice on such procedures is available in BS/ISO/IEC 17799:2000[31]. The plans and measures should cater for the following:

(a) the loss of equipment or records due to fire or other hazard;

(b) the loss of equipment or records due to faults or major failures;

(c) the re-siting or alteration of equipment or records;

(d) restriction of access to the equipment after an incident.

9.2 The plan should include detailed procedures that would enable full recovery from back up tapes/media. The plan procedures, together with the backups, should be managed (controlled and guarded) as vital records.

No plan is effective unless it is tested. There are three levels of testing to check procedures, vital records and vital business processes:

(a) paper exercise;

(b) recovery exercise;

(c) recovery and production run and service restoration from recorded system.

The frequency of testing should depend on the criticality of the risk.

9.3 The measures should ensure that, where losses occur, experts in the salvage and reclamation of data processing equipment are available as soon as possible.

9.4 In order to minimise interruption of computer time, consideration should be given to obtaining, under contract, either an immediate computer back up service operation by a specialist computer company or delivery of portable computer recovery centres to the site. The business continuity plan should describe the procedure to obtain a restart from scratch in the shortest possible time. In some cases, duplicate (back to back) computer systems may be justified to help minimise disruption. Alternatively, companies operating in proximity to another having the same computer facilities, or divisions of the same company, may be able to set up a mutual aid arrangement.

9.5 Should any alterations in the electronic equipment area layout or equipment siting be planned, the insurer and companies installing the fire protection systems should be informed in the early stages.

APPENDIX A : SMOKE DETECTOR SPACING AND SITING IN ADVERSE ENVIRONMENTS

Where problems exist that may prevent the rapid detection of a fire (e.g. such as fast air movements caused by air conditioning) the measures indicated below should be adopted for the spacing and siting of point smoke detectors:

Risk type	Detector spacing/siting
General electronic equipment area	25m^2 per detector
Electronic equipment area where functions are financially or commercially critical	15m^2 per detector
Paper storage (bulk and roll)	100m^2 per detector
Air conditioning installation and ventilation ducts and plenums	Sited at all inlets and outlets where the dilution factor is low and within ducts, where practical
	Specialised duct mounted detectors should be sited in accordance with the manufacturers' instructions
Ceiling and floors voids	15m^2 per detector for air velocities up to and including 4m/s
	10 m^2 per detector for air velocities above 4m/s
Equipment cabinets in electronic equipment area	Sited in accordance with manufacturers' instructions

Note: The use of high sensitivity detection (e.g. aspirating systems) should also be considered.

APPENDIX B: ENCLOSURE LEAK TESTING USING DOOR FAN APPARATUS

Equipment knows as 'door fan' apparatus has been developed from technology previously used to assess energy loss from buildings. The equipment provides a simple and repeatable means of checking the integrity of enclosures protected by gaseous extinguishing systems by detecting and quantifying leakage without discharging any gas.

The equipment comprises a special door fan, a research quality diagnostic tool, which measures air escape from enclosures. The door fan is a large variable speed fan which is fitted and sealed into a door enclosure panel and connected to a computing control centre. The temporary installation is readily portable so that it can be quickly and easily erected. Once turned on, the fan speed is adjusted to blow enough air through to create a pressure difference between the inside and outside of the enclosure of at least 10Pa. The pressure causes air to be moved through any leaks. These can be pinpointed using a chemical smoke to detect their magnitude and location. The leaks can then be sealed. In addition to leakage detection, the door fan apparatus can also measure the extent of leakage. The Equivalent/Effective Leakage Area (ELA) can be determined by taking a series of readings at different pressures using manometers measuring the pressure at the fan inlet and in the enclosure. The ELA is the size of hole the enclosure would have if all the cracks, gaps and holes were brought together to form one single hole. By sealing parts of the enclosure (e.g. ceiling area) with plastic sheeting, relative ELAs at high and low levels and in designated sections of the enclosure can be ascertained. These results can then help in determining the effect the leaks would have in retaining the extinguishant agent for the required hold time.

Gas cylinders have been properly secured.

PUBLICATIONS REFERRED TO

1 BS 6266: 2002: Code of practice for fire protection for electronic equipment installations

2 BS EN ISO 9000: 2000 Quality management systems. Fundamentals and vocabulary

3 BS 7083: 1996: Guide to the accommodation and operating environment for information technology (IT) equipment

4 BS 476: Fire tests on building materials and structures. (Series of several parts)

5 BS 476-31.1: 1983: Fire tests on building materials and structures. Methods for measuring smoke penetration through doorsets and shutter assemblies. Method of measurement under ambient temperature conditions

6 LPC Design Guide for the Fire Protection of Buildings 2000 (Fire Protection Association, 1999)

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

8 FPA Recommendations for the Protection of Buildings from Lightning. (Fire Protection Association, 2003) in preparation

9 IEE Wiring Regulations. Sixteenth edition. Also available as BS 7671: 2001: Requirements for electrical installations: IEE Wiring Regulations: Sixteenth edition

10 BS 7211: 1998: Specification for thermosetting insulated cables (non-armoured) for electric power and lighting with low emission of smoke and corrosive gases when affected by fire

11 BS 5839-1: 2002: Fire detection and alarm systems for buildings. Code of practice for system design, installation, commissioning and maintenance

12 BS EN 54-7: 2001: Fire detection and fire alarm systems. Smoke detectors. Point detectors using scattered light, transmitted light or ionisation

13 BS 7273-1: 2000: Code of practice for the operation of fire protection measures. Electrical actuation of gaseous total flooding extinguishing systems

14 BFPSA Code of Practice for Category 1 Aspirating Detection Systems: (British Fire Protection Systems Association, BFPSA)

15 LPC Rules for Automatic Sprinkler Installations incorporating BS EN 12845, (Fire Protection Association, 2003)

16 BS ISO 14520-1: 2000: Gaseous fire-extinguishing systems. Physical properties and system design. General requirements

17 Gaseous Fire Protection Systems, LPR16, (Fire Protection Association 2000)

18 BS 5306-4: 2001 Fire extinguishing installations and equipment on premises. Specification for carbon dioxide systems

19 BS 5306-6.2: 1989 Fire extinguishing installations and equipment on premises. Foam systems. Specification for medium and high expansion foam systems

20 A review of the toxic and asphyxiating hazards of clean agent replacements for Halon 1301: (Halon Alternatives Group, 1995)

21 BS EN 3: 1996: Portable fire extinguishers: Parts 1 to 6

22 BS 5306-8: 2000: Fire extinguishing installations and equipment on premises. Selection and installation of portable fire extinguishers. Code of practice

23 BS EN 671-1: 2001: Fixed fire fighting systems - hose systems: Hose reels with semi-rigid hose

24 BS 5306: Fire extinguishing installations and equipment on premises. (Several parts)

25 LPS 1230: Requirements for Fire Testing of Fixed Gaseous Fire Extinguishing Systems: 2001 - Loss Prevention Standard, BRE Certification, Garston, Watford.

26 BS 5306-1: 1976: Fire extinguishing installations and equipment on premises. Hydrant systems, hose reels and foam inlets

27 BS 5306-3: 2000: Fire extinguishing installations and equipment on premises. Maintenance of portable fire extinguishers. Code of practice

28 BS 5852: 1990: Methods of test for assessment of the ignitability of upholstered seating by smouldering and flaming ignition sources

29 BS 5852-1: 1979: Fire tests for furniture. Methods of test for the ignitability by smokers' materials of upholstered composites for seating

30 BS 5852-2: 1982: Fire tests for furniture. Methods of test for the ignitability of upholstered composites for seating by flaming sources

31 BS ISO/IEC 17799: 2000: Information technology. Code of practice for information security management