

FPA Design guide

for the Fire
Protection of
Buildings

STAND-
ALONE COLD
STORES 1:

DESIGN
PRINCIPLES



This document is one of a number which go to make up the *FPA Design Guide for the Fire Protection of Buildings*, a development from the *LPC Design Guide for the Fire Protection of Buildings 2000*. That development is part of a programme of work being carried out by the Fire Protection Association under the sponsorship of the Insurers' Fire Research Strategy Funding Scheme (InFiRes). The scheme is operated by a group of insurance companies supporting a series 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 *Design Guide* is provided by the Technical Directorate of the FPA and experts from the insurance industry who form the InFiRes Passive Working Group.

The aim of the *FPA Design Guide* is to provide loss prevention guidance for those who design, construct and equip industrial and commercial buildings. The *Design Guide* documents continue a long tradition of providing authoritative guidance on loss prevention issues started by the Fire Offices' Committee of the British insurance industry over a hundred years ago and build upon earlier publications from the LPC and the Association of British Insurers.

Lists of other publications on loss control are available at www.thefpa.co.uk and from the FPA at:

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Copies of publications can be purchased from the FPA at that address or by telephoning 020 7902 5300 or e-mailing fpa@thefpa.co.uk.

FPA Design Guide: Essential Principles

The objectives of the Design Guide are:

- to minimise the effect of fire on a business
- to limit the effects of business interruption
- to allow a business to be trading within 24 hours of a fire
- to protect the buildings within a business

by defining essential principles to be espoused in the design and construction of commercial and industrial premises, principles which will result in buildings which are safer from the risk of fire and better able to cope with the effect of fire in the event that it breaks out.

The essential principles are:

1. Use building materials which will not make a significant contribution to a fire at any stage of its growth;
2. Design a building's structure to have resistance to collapse or excessive deflection in the event of a fire;
3. Construct a building in such a way as to minimise the extent of fire and smoke damage in the event of fire;
4. Incorporate all necessary safeguards against the threat of arson;
5. Construct the building in such a way that fire cannot spread in from an adjoining building or other external fire source;
6. Install an appropriate automatic fire alarm system;
7. Ensure that fire protection systems are regularly inspected and maintained;
8. Initiate a comprehensive regime of fire safety management for the premises;
9. Give regard, at the design stage, to the potential damage from firefighting water and plan to minimise any undesired environmental effects that might relate thereto;
10. Specify only third-party certificated fire protection products;
11. Commission competent, specialist installers to fit fire protection products/systems;
12. Ensure that services and related components are designed/constructed/installed to guard against their becoming accidental sources of ignition.

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FPA Design Guide for the
Fire Protection of Buildings

STAND-ALONE COLD STORES 1: DESIGN PRINCIPLES

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1. SCOPE

The *FPA Design Guide for the Fire Protection of Buildings* is made up of many documents, including a number of premises-specific sector guides. Each sector guide is in two parts: part 1 covers the design principles for a particular type of premises and part 2 is concerned with fire safety management.

This present document deals with the design principles for passive fire safety in stand-alone cold stores ('cold stores' in the rest of the document). It describes measures and makes recommendations which, if adopted, will assist in the design and construction of cold store buildings (or extensions thereto) which are less likely to catch fire. Should fire occur, however, the applied design principles will help minimise fire and smoke damage and thus minimise business interruption.

In addition, this guide may also help in identifying ways to reduce fire risks in existing cold stores and assist in protecting the material assets of a cold storage business. It is recommended that reference is also made to the *Code of Practice for Fire Protection in the Food and Drink Industry* (ref. 1) which will assist in understanding the need to protect the material assets of a food industry premises.

This document contains a number of references to the *LPC Design Guide for the Fire Protection of Buildings 2000*, which was published by the FPA in 1999. A new Design Guide, a multi-part work (see inside front cover) is in preparation by the FPA and when completed will cover more ground than the original. While the new version is under development, references continue to be made to relevant information in the 2000 version.

The audience

This advice is addressed mainly to those professionals - architects, developers, fire engineers and builders - who need to understand and apply the principles of fire safety in the design and construction of cold stores. It will also be of value to those who survey and assess the fire safety attributes of such premises on behalf of insurance companies.

Since its approach is based on essential principles it should also be of help to the owners of, and fire safety managers in, cold storage businesses.

What kinds of buildings?

The advice contained in this sector guide assumes that the building under consideration is a stand-alone cold store, a refrigerated or temperature-controlled storage building. The document's measures are applicable to both proposed new buildings and extensions to existing buildings.

The document's recommendations are not intended for application to:

- a cold store attached to a food factory;
- a cold store attached to another property.

Design recommendations for passive fire safety in food factories, which may contain chill rooms or structures, are contained in another Design Guide document, *Food processing factories: 1: Design principles* (ref. 2).

2. RISK ASSESSMENT

A variety of factors need to be taken into account when designing passive fire protection into a commercial building. These include:

- the types of processes to be carried out;
- the nature of, and fire hazards represented by, the equipment and goods in the building, and in particular their likelihood to catch fire;
- the fire load within the building
- the financial exposure.

Once these prime sources of hazard are understood, then it is possible to proceed to design the building in the knowledge that the fire risk, among others, will be catered for.

In a stand-alone cold store the principal role of the building is the storage of goods in a temperature-controlled environment. A secondary activity involves the presence of delivery vehicles and their unloading, related to which is the in-store use of fork lift trucks for conveying goods to different parts of the store.

At a cold store there are a number of areas, such as:

- electrical switchrooms;
- plant rooms;
- external yards;

which will normally be considered to be of higher risk. Fire containment measures shall be specified and maintained accordingly in such locations.

Apart from such areas, cold stores are normally rated to be low risk in terms of activity and the nature of the goods stored in them, so that the principal risk attaches to the outer envelope (the building) and the nature of its construction.

Even so, bearing in mind the need to assess and eliminate as far as possible the potential hazards, it is necessary to carry out an assessment of the likely fire hazards so that they are properly understood before embarking on the design and construction of a cold store. In general terms, however, there are fewer fire hazards within a cold store than in, say, a food processing plant.

As for arson, if the cold store is located on a secure site then the risk of arson attack is significantly reduced. If that is not the case, then it will be necessary for the external cladding to provide fire resistance adequate to the arson risk assessment.

2.1 Existing buildings

Fire prevention in a building is achieved through a combination of measures, including the passive fire safety recommendations in documents such as this and the installation of appropriate active fire safety systems and equipment.

Since stand-alone cold stores may be considered to be low risk in terms of process fire hazards, then with regard to the special risk that might exist in the form of sandwich panels, it is unlikely to be necessary to consider replacing existing panels (see Technical Briefing: *Fire Performance of Sandwich Panel Systems*, ref. 3). It is important to identify any higher risks that might exist in that respect and upgrade as quickly as possible to the recommendations given in this document.

Continuous monitoring of fire safety management routines, including staff training, is also very important and may well improve the risk before other measures are implemented.

2.2 New cold stores

For new buildings, the recommendations of this document, subject to the risk assessment, shall be followed. The essentials of the risk assessment are:

- identify the potential fire hazards
- remove or replace hazards where possible
- reduce remaining hazards if possible
- design the building and its equipment/contents to cope with the fire hazards that remain.

The subject of risk assessment will be dealt with in greater depth in the accompanying fire risk management document.

3 FIRE SAFETY MANAGEMENT

3.1 General

There is always a risk that the construction of a building and its internal structures (in particular, in cold stores, insulated temperature-controlled enclosures) may contribute to the spread of fire; disproportionate damage may be significantly reduced by maintaining a good standard of fire safety management. This subject is covered in more detail in the fire safety management document that augments these design principles but the following sections survey topics of particular relevance and may help identify improvements of safety standards in existing buildings.

Good housekeeping is vital. In terms of fire prevention this embraces a combination of fire safety measures which are calculated to keep a premises safe from the risk of fire breaking out. Such measures will include: cleanliness and tidiness; regular clearance of wastes; safe storage of flammable and combustible materials; maintenance of buildings and machinery in safe conditions; supervision of subcontractors; inspection of heating and lighting; the prohibition of smoking in inappropriate areas.

3.2 Services

Electrical and/or other services are a potential inception risk and a competent and suitably qualified person shall regularly check all equipment on a schedule established under the risk assessment.

Services' pipework/ducting etc have the potential to cause fire safety problems when entering/leaving walls, especially those of structures made from sandwich panels:

- As far as possible, services' penetrations through sandwich panels shall be avoided.
- If this is not possible, any gaps shall be adequately sealed to prevent fire attacking the core. These filled gaps shall be examined at regular intervals and, if defective, made good by a competent specialist contractor. Guidance from the sandwich panel system manufacturer's design/installation manual shall be followed.
- Electrical cables passing through sandwich panels used in temperature-controlled areas may be enclosed in an appropriate conduit (for example, PVC rather than metal) to prevent thermal bridging, but a risk assessment shall be undertaken to ensure that this does not increase the fire risk.
- Care shall be taken when installing/locating high temperature electrical fittings such as halogen lamps, with reference being made to the risk assessment.
- Electrical equipment located near sandwich panels shall be examined and tested at least annually per the appropriate Standard (ref. 4).
- Attaching items to sandwich panels shall be avoided as far as practical. Where this is not possible, care shall be taken to ensure that the core is not left exposed or damaged.

3.3 Vehicles

Delivery vehicles can constitute a fire hazard.

- Petrol and diesel vehicles shall never be allowed inside a cold store, but design provision needs to be made for them to come close to the building for unloading via fork lift truck and/or dock levellers.
- All vehicle parking areas shall be designed to be located well clear of the cold store and, for reasons of security, visiting drivers shall not have free access to the building.

There is a range of recommended loss control measures related to the use of fork lift trucks (see *Recommendations for the use of fork lift trucks*, ref. 5). These include:

- There need to be adequately protected entrances, with fire roller shutters, for transit by fork lift trucks.

- Facilities for battery recharging for electrically powered fork lift trucks in a location well away from any identified inception risks and combustible materials and within a fire-resisting enclosure of not less than 60 minutes' fire resistance or such other duration that shall be agreed with the property insurer.

3.4 Arson prevention

A perception of the problems and potential occurrence of arson is vital for the company fire safety manager, who should be aware that, in industry and commerce, more than 50 per cent of fires are started deliberately, some of them by members of the workforce. The FPA's book *The Prevention and Control of Arson* (ref. 6) deals fully with the subject and includes a chapter called 'Designing against arson'. It is a major topic to be considered in the risk assessment, particularly if the location of the cold store is an area where arson is common. Those designing and building cold stores need to be aware of the gravity of the problem and to bear in mind at least the following so that a new store will be better protected against the potential arsonist.

- Potential arsonists shall be kept at bay by properly organised physical and electronic security measure, including perimeter fencing, secure doors and windows, an intruder alarm system and even monitored CCTV.
- Adequate security is of particular importance when the building is located in a rural area when fire brigade response may be slower than in town.
- Cold stores may have accumulated quantities of delivery pallets (plastic and wooden) on the premises. These are favourite targets of the arsonist and provision shall be made for secure storage areas outdoors and not within 10m of the outer walls of the store or of plant or adjacent premises' buildings or within 2m of the perimeter fence.
- Arsonists exist within the workforce, so provision shall be made to prevent the storage of pallets and other combustible materials within 10m of sandwich panel structures in a cold store.
- Waste materials are attractive to the arsonist and a code of practice for dealing with commercial and industrial waste is included in the FPA's book *Fire Safety and Waste Materials* (ref. 7).

3.5 Maintenance programmes

- All cold store equipment, particularly any that is identified as a potential source of ignition or inception risk, shall be regularly maintained by suitably qualified staff or by competent subcontractors and a maintenance record shall be available for inspection by the insurer or regulatory body. The use of thermal imaging cameras to inspect machinery and equipment for overheating, as part of routine maintenance, can detect problems which other inspection might miss.
- Electrical equipment shall be inspected and maintained by a competent and suitably qualified person working for an appropriately qualified contractor. (Suitable individual qualifications are, for example, City and Guilds courses 2381 (16th edition IEE Wiring Regulations: BS 7671 (ref. 4) and current legislation) or 2391 (Inspection, testing and certification of electrical installations). Maintenance companies should qualify for membership of NICEIC or ECA or (in Scotland) SELECT.) The National Association of Professional Inspectors and Testers (NAPIT) and the Safety Assessment Federation (SAFed) are two UKAS accredited inspection bodies for companies which do not carry out electrical installations/alterations but do perform independent inspection and testing in accordance with the IEE Regulations.
- Hot work processes such as welding are a common cause of fire and shall only be undertaken when no viable alternative method is available. A hot work permit scheme shall be enforced and hot working precautions shall be taken, whether the hot work is being performed by suitably qualified staff or by competent subcontractors. They shall operate in compliance with an appropriate hot work permit scheme (see, for example, *FPA Hot Work Permit Scheme* (ref. 8), and see also the sample forms in the Appendix below).

3.6 Fire-resisting compartmentation

Compartment walls are not normally installed in cold stores.

- Where fire-resisting compartmentation is installed, the importance of designing to allow for 'hot state' movement, as outlined in the *LPC Design Guide for the Fire Protection of Buildings 2000* (ref. 9) cannot be overemphasised, since it will reduce the possibility of early failure of compartment walls.
- If sandwich panels (see section 4.4) constitute the compartment wall then the panels shall also meet the fire resistance requirements of, for example, a standard such as LPS 1208 (ref. 10).
- Compartment walls shall be maintained in good condition. All fittings installed shall be able to maintain the prescribed level of fire resistance
- Any doors or services shall have the same fire resistance (integrity) as the wall (see *LPC Design Guide for the Fire Protection of Buildings 2000*).

3.7 Cavity barriers

- Cavity barriers, particularly those installed within the roof space above temperature-controlled areas, shall be regularly checked for any breach that will affect their performance under fire conditions.
- It shall have been proved by test that, if services are to pass through a cavity barrier, the barrier is suitable for the passage of services

3.8 Roof spaces and roof void walkways

Certain plant used in cold stores may be located high up in roof spaces, on specially constructed structures, above and independent of the insulated envelopes below. Conditions of cavity barriers in such areas need regular checking and any damage that might affect their performance under fire conditions shall be rectified. It is considered important, in the design of a cold store and as an aid to inspection, to include walkways at this higher level.

3.9 Refrigeration defrost systems

Electronic defrost systems could pose a potential fire risk. Other systems (e.g. off cycle/reverse cycle/hot gas/saturated discharge vapour) present little or no potential fire risk. However, it is essential to carry out frequent routine maintenance, as stipulated by the manufacturer, on all these systems.

3.10 Documentation of fire safety management procedures

Log books or equivalent records shall be maintained to demonstrate to insurers and other bodies that fire safety management procedures, including maintenance routines, are being carried out properly. The *FPA Workplace Fire Safety Log Book* (ref. 11) provides a comprehensive set of record sheets (on paper and on CD-ROM) for the fire safety manager.

3.11 Upgrading existing stand-alone cold store buildings

The information in the fire safety management and risk assessment sections (above) will assist in identifying some of the areas where attention may be needed. Recommended actions are given in Table 1. This is not an exhaustive list and is intended to show examples of what might be possible.

Appropriate remedial action may allow the risk category to be lowered (see section 4, Design considerations).

3.12 Managing fire safety

The risk that the style/design of the construction of a cold store and its insulated, temperature-controlled enclosures may contribute to the spread of fire may be significantly reduced by the maintenance of a good standard of fire safety management.

Table 1. Recommended measures for upgrading existing stand-alone cold store buildings

Item	Action	Remarks
Services passing through sandwich panels	Ensure any gap sealed by suitable method. All electrical cables to be enclosed in PVC conduit.	For small gaps use intumescent mastic.
Services subject to mechanical damage	Protect by suitable conduit or enclosure.	
Badly installed or maintained electrical equipment	Rectify immediately.	Ensure work carried out by a suitably qualified, competent electrician/engineer.
Cavity barriers	Where not fitted above temperature enclosure, arrange for suitable barriers to be installed.	Check that system has required fire resistance.
	Damaged barriers to be replaced.	Use specialist installers.
Non-fire-rated sandwich panels	Subject to the risk assessment, consider replacement or upgrading. Expert advice shall be sought from a suitably qualified organisation or person.	Some systems exist that allow joint system to be improved to reduce risk of fire spread. Adequate support to sandwich panels vital.

4. DESIGN CONSIDERATIONS

4.1 General principles

In general, the larger the area and volume of a building, (1) the greater is the risk to the property and the people within it in the event of fire and (2) the more difficult is the task of finding and fighting the fire. Cold stores are fairly low-risk premises but it is possible to include, in the design of any cold store, features which will help to control the spread of fire and smoke within such a building. The following topics are of importance.

Internal space separation

The walls, floors and ceilings used to subdivide buildings shall be designed to withstand fire for the periods required by Table 7.

Compartmentation

This is the principle of the subdivision of a building's volume into smaller, fire-resisting compartments each likely to withstand and contain a fire occurring within it for a specified period of time, the time depending on a variety of factors, including the risks represented by and within particular compartments.

Protection of openings

Openings in compartment walls need to be protected in such a way as to offer resistance to fire (for example, by suitable doors and shutters). Openings in compartment floors for stairways, lifts or escalator shafts need to be protected.

Fire stopping

Wall and ceiling cavities, and openings around service ducts, pipework and conduits, need to be fire-stopped where they pass across or penetrate compartment boundaries and the stopping shall extend for the full thickness of the wall.

Ducts/ducting

Air conditioning and other ducting needs to be provided with fire dampers (see below) where it passes through compartment boundaries, so as to control the spread of fire and smoke.

Fire-resisting ductwork will maintain compartmentation in situations where it is necessary for ducting to pass through compartment walls or floors but where fire-resisting dampers are not used. Such ducts shall provide the same fire resistance in terms of integrity (and, if necessary, insulation) as the walls or floors of a compartment.

Fire-resisting ducts are tested for compliance with the requirements of BS 476 (ref.12): Part 24, *Fire tests on building materials and structures: Method for determination of the fire resistance of ventilation ducts*.

Fire damper

Such a damper in a duct is designed to close completely as soon as a fire is detected. Its purpose is to maintain compartmentation where an air distribution duct passes through the wall or floor of a compartment and to provide the same fire resistance as required for the wall or floor.

Fire venting

Single-storey buildings and, to an extent, some multi-storey buildings can be provided with a limited degree of fire protection by properly designed and installed roof venting. Such a system, by venting smoke and hot gases, can help limit the spread of fire and smoke and facilitate firefighting. Where a sprinkler system is installed then the venting and sprinkler systems shall be designed so as to be mutually compatible.

Other features

- (a) The ability of a cold store to perform its function can be impaired by the effect of fire on the building services, including electrical power and light supplies, equipment fuelled by gas and oil, and air conditioning systems.
- (b) Heating, lighting and power services can act as sources of fire, which is why service ducting and voids above suspended ceilings and the like need to be protected to limit their capacity to act as a pathway for fire spread.
- (c) Internal construction elements (such as temperature-controlled storage rooms) made from sandwich panels with combustible cores will contribute to the fire load within a cold store and have aided rapid fire development. This hazard receives particular attention in this document.

4.2 Surveying the potential risks: a quantitative assessment

Guidance on: (1) restricting the use of building products that make a contribution to a fire; (2) requirements for fire-resisting compartmentation; and (3) the sizes of compartment areas, is given in the *LPC Design Guide for the Fire Protection of Buildings 2000*. What follows is intended for application specifically to cold stores and permits a type of quantitative fire risk assessment. The following requirements are specific to stand-alone cold stores:

Figure 1 plots the steps in carrying out the assessment. Table 2 looks at opportunities for making improvements within broad types of risks.

In order to provide for some flexibility in fire performance, the risk-based approach which is employed uses three degrees of risk, low, medium and high.

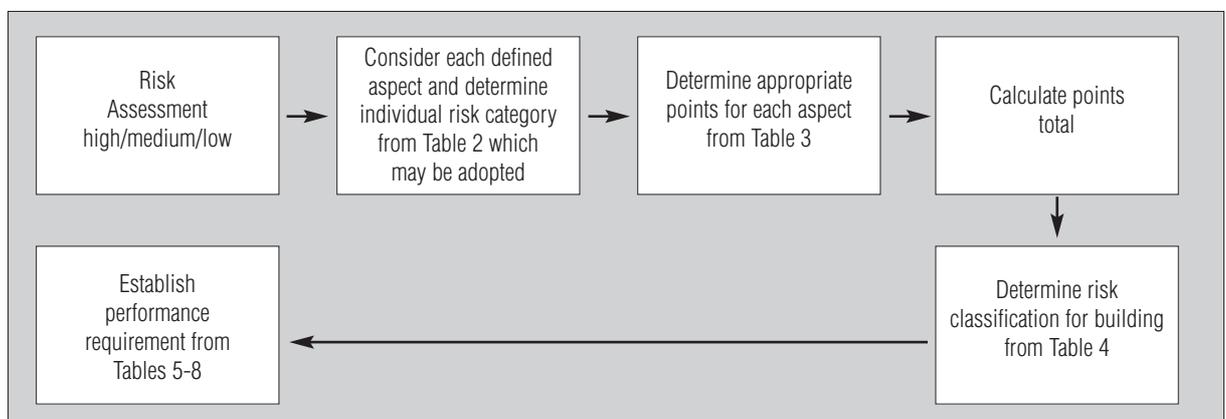


Figure 1 Risk based approach to arrive at appropriate requirements

Note: All aspects listed in Table 2 shall be considered.

4.2.1 Planning essentials

Table 2 and subsequent tables may be used to undertake a basic, quantitative fire risk assessment, a survey which will help to establish suitable fire performance levels within the cold store which is being planned. It does not provide, however, a definitive solution to the design problem and is not intended to take the place of, or equate to, the kind of thorough risk assessment which a fire surveyor would undertake for an insurer. For example, poor site security and a high incidence of arson attack in the locality may make a cold store an unattractive risk from an insurance viewpoint. Moreover, it could not take the place of the kind of comprehensive fire risk assessment which an employer may be required to make under existing fire legislation.

It is imperative that, from the outset, and in the interest of achieving a building design in which fire protection is a high priority, the most comprehensive possible consultation takes place among all interested parties, in particular architects, any fire safety engineers involved with the project, the architects' clients, the building owners or occupiers, their fire safety managers, the insurers of the premises, and any risk managers called upon for advice.

Because each individual cold store might contain different degrees of risk in different categories, a points system has been developed to take such variations into account.

Aspect	Risk category		
	High	Medium	Low
Financial exposure	←=====→		
Fire brigade response (It is recommended that cold stores are fitted with automatic fire detection and alarm systems in the interest of aiding an early response from brigades. See 4.9.)	←=====→		
Vulnerability to fire spread and disproportionate damage	Construction/ compartmentation standard not in accordance with <i>LPC Design Guide for the Fire Protection of Buildings 2000</i> . Inadequate fire protection.	Adequate standard of fire protection following fire risk assessment.	Sprinklered risk (or appropriate equivalent). Fire-resisting compartmentation in accordance with <i>LPC Design Guide for the Fire Protection of Buildings 2000</i> .
Standard of fire safety management (Includes good housekeeping; fire drills; arson control measures; electrical safety inspections; general maintenance routines; review of risk assessment.)	No evidence of a suitable standard of fire safety management.	Adequate standard of fire safety management.	Risks controlled by a well-documented fire safety management system. Risk of ignition minimised by appropriate specification of refrigeration equipment.
Fire load	Significant quantity of combustible goods with no active fire protection system. Storage risks not fully sprinklered.	Storage risks fully sprinklered in accordance with <i>LPC Sprinkler Rules</i> (ref. 13).	No ignition source or inception risk present. Suitable automatic extinguishing system for racked storage systems. Low fire load.
Possibility of arson attack	Poor site security. Uncontrolled waste build-up in yard areas Area has high incidence of arson attack.	Some public access to external fabric but good standard of fire safety management. The 10m rule is enforced.	Secure site. (All physical and electronic systems fully operational and maintained. Perimeter secure. Visitor access strictly controlled.)

Table 3. Points rating from risks identified in Table 2.

The points ratings given in this table are not untypical but note that all property insurers are likely to operate their own points systems and that some variations are to be expected.

Aspect	Risk category		
	High risk	Medium risk	Low risk
Financial exposure	50	30	20
Fire brigade response	30	15	5
Vulnerability to fire spread and disproportionate damage	100	50	20
Standard of fire safety management	50	30	5
Fire load	30	15	5
Possibility of arson attack	50	25	15

Table 4. Risk classification based on total points from Table 3.

High risk	Medium risk	Low risk
310-186	185-101	100-70

4.3 Construction materials and fire spread

Section 4.1 drew attention to some of the principal considerations faced by the designer, in terms of building configuration, to restrict the spread of fire and smoke in, for example, a cold store. The purpose of section 4.3 is to emphasise the need to specify materials which will make the minimum contribution to a building's fire load in the event of a fire.

Legislation and guidance

Part B of Schedule 1 to the Building Regulations 2000 (Statutory Instrument 2000, No.2531) (ref. 14) deals with fire safety and paras B2 to B4 of the Schedule deal with fire spread inside and outside a building and the need to employ methods of construction and building materials which will inhibit fire spread. Approved Document B (ref. 15) presents (for England and Wales) possible technical solutions for fire safety problems in various types of buildings to aid compliance with the Building Regulations. Documents similar to Approved Document B exist in respect of building control legislation in Scotland, Northern Ireland and the Republic of Ireland.

Traditional materials

Traditional building elements/materials such as brick, concrete, timber, steel and plaster do not usually make a significant contribution to the fire load of industrial premises compared to the contents of such buildings. British Standard 476: *Fire tests on building materials and structures* (ref. 12) is cited frequently in Approved Document B and those who supply materials to the construction industry will make reference to this and other Standards with which their products comply. Architects and builders will have established sources of reference, such as online information services, for the specification of materials and products that are appropriate for particular purposes, including fire safety, but if they are in doubt they should consult the insurer for guidance.

Sandwich panels

In recent times there has been much more concern attached to the use of insulated composite panels (sandwich panels), either in the form of: (1) claddings (built-up systems or sandwich panels) used for the external envelope of most types of industrial buildings; or (2) sandwich panels or wall and ceiling lining systems used internally in a building in the construction of internal elements of the building. Section 4.4 concentrates on sandwich panels.

4.4 Insulated composite panels (sandwich panels)

One of the key objectives of this document is to promote the use, for stand-alone cold stores, of internal and external construction elements that are either non-combustible or have been shown by appropriate fire testing to possess satisfactory fire performance properties. It is recognised that sandwich panels are the building material commonly chosen for a number of applications in cold stores and the following subsections provide general guidance on the choice of sandwich panels which have been tested to a relevant standard (in the example, Loss Prevention Standards 1181: 2003: Part 1 for the external envelopes of buildings, Part 2 for use within buildings) (refs 16 and 17) and also tested by an accredited test laboratory (in the example, FRS tests to Loss Prevention Certification Board standards).

4.4.1 External fabric

In consideration of the use of sandwich panels for either the external walls or the roof of a cold store building which is also subject to building regulations' requirements, Table 5 lists categories of sandwich panels which pass LPS 1181: Part 1 tests and are suitable for particular risk designations. In addition to the above, the product's certification shall also demonstrate the capacity of the product to resist an external arson attack.

Table 5. Choice of sandwich panels for the external fabrics of cold stores, with reference to degrees of risk.

High risk	Medium risk	Low risk
LPS 1181:Part 1 EXT A30	LPS 1181-3 Grade A	LPS 1181:Part 1 EXT B
LPS 1181:Part 1 EXT A60		LPS 1181-3 Grade B

Note: LPS 1181: Part 1 is based on LPS 1181-3 (ref. 18) and panels supplied for test are supported by roof purlins and mid-rails.

4.4.2 Temperature-controlled areas

Tables 6 and 7 relate to the choice of sandwich panels for the construction of temperature-controlled areas within the envelope of a cold store and list categories of panels which comply with LPS 1181: Part 2 tests. The tests for these panels require the panels to be supported from outside (as they would be in practice). Two thermal exposures are provided to represent different risk levels.

Table 6. Choice of sandwich panels for use for constructing temperature controlled areas within cold stores, with reference to degrees of risk.

High risk	Medium risk	Low risk
LPS 1181:Part 2 INT-1	LPS 1181:Part 2 INT-2	LPS 1181:Part 2 INT-3 IACSC fire stop panel (see ref. 24)

Table 7. Fire resistance requirements for sandwich panels used for temperature controlled areas within cold stores. Note that INT-1 is not required for this application.

Grade of panel	Fire resistance (see LPS 1208)		Wall and ceiling lining test Thermal exposure	
	Integrity (minutes)	Insulation (minutes)	Level	Source
INT-2	30	30	Standard	Timber crib
INT-3	Not applicable	Not applicable	Standard	Timber crib

4.5 Compartmentation

Compartmentation is not commonly encountered in cold stores but some fire-resisting separation may be required if the overall plan area of the cold store is particularly large or if there is reason to regard the building as high risk. Some guidance on acceptable floor areas is given in 4.6 below:

4.5.1 Compartmentation using sandwich panels

It is important to follow the detailed advice for compartmentation given in the *LPC Design Guide for the Fire Protection of Buildings 2000*. Loss Prevention Standard 1208, *Fire performance requirements for metal-faced fire-resisting insulated panels* (ref. 10), supports the fire resistance requirements given in the LPC Design Guide and the LPCB has approved products to that Standard, subject to the stated field of application. Some such panels are included in the LPCB's *List of approved fire and security products and services* (ref. 19) and may be specified as appropriate.

4.6 Recommended maximum floor areas

If the anticipated risk in a cold store is considered high, it is recommended that the floor area specified shall be less than allowed for in relation to a lower risk. It should be noted, however, that the risk of flashover being reached in a small compartment may be greater than in a large compartment.

The recommendation of this document is that the area is limited to no more than that shown in Table 8.

Table 8. Recommended maximum floor areas for stand-alone cold stores.			
Recommended floor areas			
	If high risk	If medium risk	If low risk
	Less than 1000m ²	2000m ²	4000m ²

Notes:

- Recommended floor areas may be increased if a suitable automatic extinguishing system is provided (but this must be agreed by the insurer).

4.7 Protection of services

Detailed guidance is given in Part 4 of the *LPC Design Guide for the Fire Protection of Buildings 2000*.

Where services pass through designated fire-resisting elements, then the penetration seals/fire stops specified shall provide the same level of fire resistance as the element of construction, in terms of integrity, and if at all possible, insulation.

Even when services pass through partitions and ceilings that are not designated as fire resisting, they shall still be adequately sealed to prevent fire from attacking any combustible core inside sandwich panels. Care shall be taken to ensure that the type of seal specified is appropriate for the specific application.

Apertures cut into panels containing combustible cores for services to pass through shall be protected by a suitable non-combustible lining material

Combustible services such as cables shall be kept well away from hot processes or potential ignition sources or be suitably protected.

Electrical cables shall always be placed in an appropriate and suitable conduit when passing through sandwich panels used in temperature-controlled areas.

Some guidance on the selection and specification of suitable sealing systems may be obtained by reference to the Code of Practice of the Intumescent Fire Seals Association (IFSA) (ref. 20).

Where conveyor belts pass through apertures made in walls designated as fire resisting then these need protecting by a suitable fire-resisting conveyor closer. More guidance may be found in the *LPC Design Guide for the Fire Protection of Buildings 2000*.

4.7.1 Third-party certification

In all cases it is necessary to use suitably certificated products (certificated by a nationally accredited, independent, third-party certification body) and such products shall be installed and maintained by an appropriately assessed and qualified, competent contractor.

In the case of the United Kingdom, for example, the United Kingdom Accreditation Service (UKAS) bears responsibility for assessing and accrediting the competence of organisations in a number of related fields, including not only testing but, also, the certification of systems and products.

UKAS maintains a directory of accredited UK test laboratories and also lists such information on its web site, www.ukas.org/testing. By pursuing its 'single search' option and, as examples, the choices 'Construction', 'Fire resistance and protection, reaction to fire' and 'Extinguishers, hydrants and extinguishing systems', the visitor will be presented with a small number of test laboratories with competence in that combination of features.

4.8 Resistance to external fire exposure

A good standard of fire safety management and adequate site security will reduce the possibility of an arson attack or accidental ignition of combustible goods around the site perimeter. Care in the specification and detail design of the external fabric of the building is an essential factor in improving the risk. Refer to *The Prevention and Control of Arson* (ref. 6), for a wealth of fire safety management advice about arson control (in industrial and commercial premises) which is of value to the developer and architect. See Part 5 of the *LPC Design Guide for the Fire Protection of Buildings 2000* for more information and guidance.

4.9 Active fire protection methods

When fitting fire detection or suppression systems, it is necessary to use suitably certificated components (certificated by a nationally accredited, independent, third-party certification body) and such systems shall be installed and maintained by an appropriately assessed and qualified, competent contractor. See 4.7.1.

Detection

Early detection of a fire is essential and, as a minimum, all areas shall be fitted with an appropriate fire alarm installation, which incorporates a monitored remote signalling system to a permanently manned alarm receiving centre (ARC).

The detection and alarm system itself shall comply with BS 5839: *Fire detection and alarm systems for buildings: Part 1: Code of practice for system design, installation, commissioning and maintenance: 2002* (ref. 21). The installation shall be installed in accordance with category P1 as defined within BS 5839: Part 1: 2002 unless a risk evaluation has been undertaken and agreed with the property insurer to reduce the level of coverage within the protected building.

Alarm receiving centre elements of an alarm system shall be installed in accordance with an approved standard, for example, BS 5979: 2000: *Code of practice for remote centres receiving signals from security systems* (ref. 22), or an equivalent.

Suppression

If the risk assessment leads to a recommendation for the installation of sprinklers in a cold store then care shall be taken to make reference to established information sources, in particular the measures relating to low temperature conditions. See, in particular, Technical Bulletin 219, 'Sprinkler protection of cold stores', of the *LPC Rules for Automatic Sprinkler Installations incorporating BS EN 12845* (ref. 13).

Where sprinklers are installed, particularly when the construction does not conform to the recommendations in this document, care is required in locating the sprinkler heads to give maximum coverage of walls, ceilings and roof/ceiling and other voids. Sprinkler systems shall comply with BS EN 12845: 2003: *Fixed firefighting systems – automatic sprinkler installations – design, installation and maintenance* (ref. 23) and, where appropriate, with the additional requirements contained in the Technical Bulletins in the *LPC Rules for Automatic Sprinkler Installations incorporating BS EN 12845* (ref. 13).

Where there are ceiling or roof voids, it may be necessary to upgrade the sprinkler water supply, to protect against the possibility of a premature collapse of the ceiling, leading to the simultaneous operation of the sprinkler heads above and below the ceiling.

4.10 Smoke control

Smoke control systems (equipment such as dampers in ductwork) can facilitate the escape of occupants and can assist firefighters if fire breaks out. Some passive systems will significantly reduce the amount of smoke that can spread into other compartments by providing effective sealing of gaps around doors and service penetrations.

With the current development of European design and product standards and appropriate test requirements, more use of such systems may be made in the future.

4.11 Measures against arson

Arson prevention has already been discussed as a fire safety management topic (3.4, above). As well as acting to minimise its incidence, by good building security and by measures such as security fences, CCTV and controlled access, attention shall also be given to design features of sites and building features to repel the arsonist. It is important, for example, that doors and windows cannot be breached and that all relevant aspects of design, even so far as eliminating features outside a main building that might be used as hiding places by the arsonist, are taken into consideration.

5 SPECIFIC CONSTRUCTIONAL CONSIDERATIONS

5.1 Pressure release valves

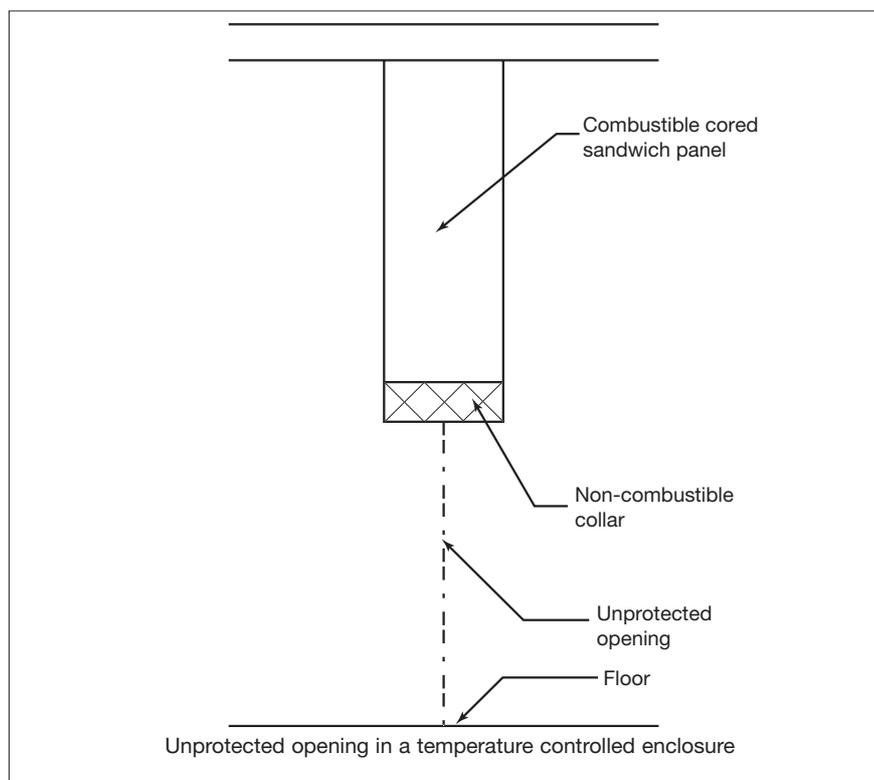
These are normally installed in cold stores. Where they are fitted in walls designated to be fire resisting, these shall not cause any breach of the integrity of the wall.

Where they are located in a wall not required to be fire resisting, the design shall be such as to prevent transmission of a fire to any combustible core.

5.2 Unprotected openings

While a requirement for fire-resisting, separating elements may not be a major consideration for cold stores, nevertheless any unprotected opening shall not be allowed in any wall that is designated to be fire resisting. In other applications, a non-combustible collar or other product that can be shown to be suitable, intended to prevent fire spreading to any combustible core, shall surround the opening.

A wall approved to LPS 1208 which contains a non-fire-resisting door can no longer be regarded as being fire resisting unless the door is protected by a secondary fire-rated shutter.



6. DEFINITIONS

For the purposes of this document, these definitions apply:

Active fire safety

The combination of fire protection measures fitted in a premises which react in the event of fire. For example, automatic fire detection and alarm systems, automatic sprinkler systems, local application suppression systems.

Automatic fire suppression system

A system of fixed fire protective apparatus in a building which will automatically detect a fire, cause an alarm to sound and discharge an extinguishant to suppress (or extinguish) the fire.

Built-up systems

The external fabric of a building assembled on site from individual components and materials.

Cavity barrier

A construction which maintains fire separation in roof spaces or floor voids where such voids run past compartment walls or which subdivides voids above or below floors or within walls to restrict unseen spread of fire and/or smoke.

Chilled storage area

Part of cold store that is enclosed by an insulated envelope where the temperature is maintained typically in the range 0°-10°C.

Cladding

An external, non-loadbearing covering to a structure.

Cold storage area

Part of a cold store that is enclosed by an insulated envelope where the temperature is maintained typically at -25°C.

Compartment floor area

The recommended, fire-resisting floor area that will be bounded by fire-resisting elements such as compartment walls. Such elements will provide adequate fire resistance for the specific risk.

Compartment wall

A loadbearing or non-loadbearing vertical fire-resisting separating element of construction designed to contain a fire within an area for a predetermined duration in order to minimise the risk of fire spread. To be regarded as a compartment wall, the wall shall be continuous to the floor or roof above and achieve the recommended level of fire resistance appropriate to the risk.

Compartmentation

The division of a building into fire-tight compartments by fire-resisting elements of building construction in order to contain a fire within the compartment of origin.

Composite panel

This term covers sandwich panels (see below) but also includes non-metal-faced insulated panels.

Ductwork (or Duct)

A lightweight sheet metal tube, of circular or rectangular cross section (sometimes of large area), for conveying air (sometimes contaminated air) in ventilating or air-conditioning systems.

Electrical switchroom

A room which houses a building's basic electrical controls and related electrical equipment.

External envelope

The external elements of the structure of a building together with the brickwork, concrete, glass or other constructional panels that combine to form the building's external faces.

External fire exposure

The propensity of a building to ignite by exposure to fire from adjacent buildings, vehicles or material.

Financial exposure

The likely aggregate cost which a business might incur if its premises and/or contents are damaged by fire and the business is interrupted for any period of time.

Fire brigade response

The time which elapses between the report of a fire to the brigade and the arrival of the first appliance at the fire.

Fire damper

Strictly, a fire-resisting damper, a movable flap within a duct which will operate, in the event of fire, to seal the duct and prevent the passage a fire through it, for a specified period of time.

Fire hazard

Anything that might contribute to the risk of fire breaking out. Thus, fire hazards include, among other things, combustible and flammable materials and all potential or actual sources of ignition.

Fire load

The aggregate of the combustible contents of a building, including its furnishings, equipment and stored products but excluding the fabric of the building.

Fire resistance

The ability of an element of building construction to withstand the effects of fire for a specified period of time without losing its structural integrity or insulation or suffering reduction in any fire-separating capacity it may possess.

Fire stopping

A sealing material which has been designed for use to make good any gaps (for example, around pipework passing through a wall) such that the required fire resistance of the element of building construction to which it is applied (for example, the wall) maintains its required fire resistance. Also used to mean the application of such sealing material.

Fire venting

The conveyance of smoke and hot gases out of a building in a controlled manner via smoke vents and outlets, a method of improving visibility within a burning building which can help both occupants and firefighters.

Flue

For the purposes of this document, a flue is the route by which the products of combustion are removed from cooking equipment or from appliances involving the generation or application of heat.

Good housekeeping

In relation to fire prevention, the maintenance of a combination of fire safety measures which are calculated to keep a premises safe from the risk of fire breaking out. Such measures will embrace: cleanliness and tidiness; regular clearance of wastes; safe storage of flammable and combustible materials; maintenance of buildings and machinery in safe conditions; supervision of subcontractors; inspection of heating and lighting; the prohibition of smoking in inappropriate areas.

Hazard see Fire hazard

Hot state movement

The movement which is induced when fire weakens an element of a building and causes, for example, a wall to deflect and/or collapse as a result.

Hot work permit scheme

A scheme under which hot work is monitored and supervised by the issuing and checking of permits issued to workers, to ensure that all such processes (for example, welding, plumbing, cutting, tar boiling etc) are carried out under specified conditions and in the safest possible manner as a precaution against fire.

Ignition hazard

Any cause that leads to ignition of material, goods or process.

Insulated composite panel

See Composite panel *and* Sandwich panel.

Lining or Lining system

Non-structural boards/sheets/slabs of material used to line or insulate internal surfaces of a building envelope.

Passive fire safety

The planning of a building in such a manner that its layout, structural design and constructional elements all contribute to its fire resistance.

Plant room

A room which houses equipment dedicated (usually) to one or more of the building's services, such as air conditioning or lifts.

Risk

Risk is the chance that damage or injury will arise from one of the hazards that exist within a premises. See Fire hazard.

Sandwich panel

A building product consisting of two metal faces positioned on either side of a core of a thermally insulating material, these three elements being firmly bonded together so that they act compositely when under load (for example, wind load, access load etc).

Services

Services within a building are generally composed of the systems and equipment that deliver water, gas and electricity in the form in which they are needed to different parts of the premises.

Stand-alone building

A building not directly attached to another building.

Storage area

Storage area may be part of a building which is designed as a warehouse or a compartment or compartments or a nominated floor area within a building used for the storage of goods.

Third-party certification

The testing, approval and certification of suitability of a product or system or company for a specified purpose, such certification being bestowed by an accredited, independent, third-party certification body.

Unprotected opening

Any opening in a wall or ceiling which is not protected by a fire-resisting element.

7. REFERENCES

1. *LPC Code of Practice for Fire Protection in the Food and Drink Industry*, 1999, Fire Protection Association.
2. *FPA Design Guide for the Fire Protection of Buildings: Food Processing Factories 1: Design Principles*, 2004, Fire Protection Association.
3. ABI Technical Briefing, *Fire Performance of Sandwich Panel Systems*, May 2003, Association of British Insurers.
4. BS 7671: 2001: *Requirements for Electrical Installations*. IEE Wiring Regulations, 16th edition, British Standards Institution.
5. RC11, *Recommendations for the Use of Fork Lift Trucks*, Loss Prevention Council, 1996.
6. Adair Lewis, *The Prevention and Control of Arson*, 1999, Fire Protection Association.
7. Adair Lewis, *Fire Safety and Waste Materials*, 2003, Fire Protection Association.
8. Michael Gale and Howard Passey (eds), *FPA Hot Work Permit Scheme*, with CD-ROM which includes electronic versions of hot work permit and checklist, 2002, Fire Protection Association.
9. *LPC Design Guide for the Fire Protection of Buildings 2000*, 1999, Fire Protection Association.
10. LPS 1208: *Fire Performance Requirements for Metal-faced Fire-resisting Insulated Panels*, BRE Certification.
11. *FPA Workplace Fire Safety Log Book*, 2003, Fire Protection Association.
12. BS 476: *Fire tests on building materials and structures*, various parts, British Standards Institution.
13. *LPC Rules for Automatic Sprinkler Installations incorporating BS EN 12845*, 2003, Fire Protection Association.
14. Building Regulations 2000, Statutory Instrument 2000, No. 2531, HMSO.
15. *Approved Document B: Fire Safety*, 2000 (amended 2002), HMSO.
16. LPS 1181: *Series of Fire Growth Tests for LPCB Approval and Listing of Construction Product Systems: Part 1: 2003: Requirements and Tests for Built-up Cladding and Sandwich Panel Systems for Use as the External Envelope of Buildings*, BRE Certification.
17. LPS 1181: *Series of Fire Growth Tests for LPCB Approval and Listing of Construction Product Systems: Part 2: 2003: Requirements and Tests for Wall and Ceiling Lining Systems for Use as Internal Constructions in Buildings*, BRE Certification.
18. LPS 1181-3: *Series of Fire Growth Tests for LPCB Approval and Listing of Construction Product Systems*: this has been replaced by LPS 1181: Parts 1 and 2, see refs 16 and 17.
19. LPCB, *List of Approved Fire and Security Products and Services*, annual, Loss Prevention Certification Board.
20. IFSA, *Code of Practice, Sealing Apertures and Service Penetrations to Maintain Fire Resistance*, 1999, Intumescent Fire Seals Association.
21. BS 5839: *Fire Detection and Alarm Systems for Buildings: Part 1: 2002: Code of Practice for System Design, Installation, Commissioning and Maintenance*, British Standards Institution.
22. BS 5979: 2000: *Code of Practice for Remote Centres Receiving Signals from Security Systems*, British Standards Institution.
23. BS EN 12845: 2003: *Fixed Firefighting Systems – Automatic Sprinkler Installations – Design, Installation and Maintenance*, British Standards Institution.
24. *Design, Construction, Specification and Fire Management of Insulated Envelopes for Temperature Controlled Environments*, International Association of Cold Storage Contractors (European Division) 1999.

8 OTHER REFERENCE SOURCES

General guidance can be found in *The RFIC Guide to the Management and Control of Fire Risks in Temperature Controlled Structures of the Refrigerated Food Industry*, Cold Storage and Distribution Federation.

Some useful checklists are provided in *Fire Risk Minimisation Guidance*, Fire Industry Panels Group.

APPENDIX: HOT WORK FORMS

HOT WORK PERMIT CHECKLIST

The following checks should be carried out prior to commencing Hot Work.
The person carrying out these checks should consider each of the following statements. The box alongside each statement needs to contain a Y (Yes) or N (No) (if the matter is not relevant) if a Hot Work Permit is to be issued. An N (No) may result in refusal of a permit.

THIS CHECKLIST RELATES TO PERMIT NO. _____

GENERAL

Wherever practicable the use of Hot Work should be avoided and a safer way employed.

If you cannot comply with the following points, do not go ahead with the hot work.

FIRE PROTECTION

Where sprinklers are installed they are operative.

Where an automatic fire detection system has been installed, it will be kept operative. Only the zone where the Hot Work is being carried out will be isolated for the period whilst the Hot Work is in progress.

A trained person not directly involved with the work will provide a continuous fire watch during the period of Hot Work. Following completion of each period of the work, the fire watch will continue for at least 30 minutes, with further checks at regular intervals, up to 60 minutes after completion, to ensure that the working area and all adjacent areas, including the floors below and above, and areas on the other sides of walls, screens and partitions and above false ceilings are free of smouldering materials and flames.

At least two suitable extinguishers or a hose reel are immediately available. The personnel undertaking the work and providing the fire watch are trained in their use.

Personnel involved with the work and providing the fire watch are familiar with the means of escape and method of raising the alarm/calling the fire brigade.

PRECAUTIONS WITHIN 10 METRES (MINIMUM) OF THE WORK

Combustible materials have been cleared from the area. Where materials cannot be removed, protection has been provided by non-combustible or purpose-made blankets, drapes or screens.

Flammable liquids have been removed from the area.

Floors have been swept clean.

HOT WORK PERMIT		A copy of the completed permit should be retained/saved for auditing purposes.
ISSUING COMPANY _____	PERMIT NO. _____	
A PROPOSAL <i>(To be completed by the person responsible for carrying out the work)</i>		
BUILDING _____		
EXACT LOCATION OF PROPOSED WORK _____		
NATURE OF WORK TO BE UNDERTAKEN _____		
I understand the scope of work and precautions to be undertaken.		
SIGNED _____	BLOCK CAPITALS _____	
DATE _____	POSITION _____	
CONTRACTOR COMPANY (WHERE APPLICABLE) _____		
B AGREEMENT <i>(To be completed by the Company Safety Officer or other nominated person (the 'Issuer of the Permit'))</i>		
This Hot Work Permit is issued subject to the following conditions:		
ISSUE OF PERMIT: DATE _____	TIME _____	
EXPIRY OF PERMIT*: DATE _____	TIME _____	
*It is not desirable to issue permits for protracted periods. Fresh permits should be issued when, for example, work extends from morning to afternoon.		
A FINAL CHECK OF THE WORK AREA SHALL BE MADE, NOT BEFORE (TIME) _____		
ADDITIONAL CONDITIONS REQUIRED: _____		
The above location has been examined and the precautions listed on the attached checklist have been complied with. I have carried out a risk assessment and consider that there is no reasonably practical alternative to doing the job using Hot Work. I have been provided with evidence of appropriate Public Liability Insurance.		
SIGNED _____	BLOCK CAPITALS _____	
DATE _____	POSITION _____	
C FOLLOWING COMPLETION OF WORK <i>(To be completed by member of staff or contractor responsible for the work. The permit should then be returned to the Issuer)</i>		
The work area and all adjacent areas to which sparks and heat might have spread (such as floors below and above, and areas on other sides of walls) have been inspected and found to be free of smouldering materials and flames. <input type="checkbox"/>		
Paint strippings, stub ends of welding rods and other hot waste materials have been removed and disposed of safely. <input type="checkbox"/>		
All equipment, including gas cylinders, has been removed to a safe area. <input type="checkbox"/>		
TIME INSPECTION COMPLETED _____ <i>(This must be at least 60 minutes after work was completed)</i>		
SIGNED <input type="checkbox"/>	NAME OF SIGNATORY _____	
DATE _____	POSITION _____	
CONTRACTOR (WHERE APPLICABLE) _____		
D SIGN OFF BY ISSUER OF PERMIT		
The Hot Work has been completed. Any zone of the fire alarm system that was isolated has been fully reinstated.		
SIGNED <input type="checkbox"/>	NAME OF SIGNATORY _____	
DATE _____		



for the Fire
Protection of
Buildings

STAND-
ALONE COLD
STORES 1:

DESIGN
PRINCIPLES

F|P|A

Fire Protection Association

InFiReS
Insurers' Fire Research Strategy funding scheme

FPA Design guide