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Fire safety in construction

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PREFACE

Every year many construction site workers are killed or injured because of their work, and many others suffer serious ill health. The hazards are not, however, restricted to people working on sites. Children and other members of the public are also killed or injured because construction activities have not been adequately controlled. The construction industry's performance has steadily improved, but the rates of death, serious injury and ill health are still among the highest of all industries.

These deaths, injuries and ill health cause pain and suffering. They also cost money – accidental loss wastes a measurable percentage of the tender price, even on a site that has no serious (reportable) accidents.

Property adjacent to construction sites can also be damaged and occupants put at risk by potential injury from smoke inhalation, radiant heat or burns from site fire(s) that get out of control.

This publication is part of HSE's series of health and safety guidance for construction. This guidance aims to support those with legal duties under the Construction (Design and Management) Regulations 2015 (CDM), and under fire safety legislation, to embed good fire risk management from design through to project completion. It refers to other relevant guidance and standards so that you can build up a clear and comprehensive package.

This guidance is applicable to all construction processes on construction sites. Some aspects are relevant to specific construction methods. Following guidance is not compulsory; CDM dutyholders are free to devise alternative methods of achieving safety and legal compliance.

INTRODUCTION

What is this publication about?

1 This guidance is about preventing fires and ensuring people's safety if they start. It is relevant to all construction projects, small and large, and is aimed at everyone with a role in developing, managing and applying safety standards on site. Construction projects include those involving demolition, new build, maintenance and refurbishment, and site investigation.

Why is this guidance needed?

2 Fires can and do kill, injure and cause serious human suffering and financial loss. In the UK, most construction site fires are likely to be low-occurrence, high-consequence events. This means that reports of construction fires are low, but many people could be at risk from fire and/or smoke in the event of a fire spreading rapidly. All organisations and individuals with responsibilities for managing construction project fire risks must understand their role in reducing the risk of fire during all project phases. Fire prevention measures must be embedded within project planning because, during the construction phase, the permanent fire prevention measures have either been temporarily removed, or they have yet to be installed and commissioned.

3 Construction fire safety needs to be managed from the earliest stages of design and procurement and needs to address the risks both to site workers and to persons living or working in neighbouring buildings. This may mean reviewing particular construction methods, materials, or a specific site location to achieve effective fire risk reduction at the planning stage. Where design risk reduction is not practicable specific mitigation measures must be identified by the designers and principal designer. It is essential to consider fire safety measures throughout all stages of the design and procurement process and to implement them effectively during the construction phase. The risk assessment and fire safety measures must identify high-risk activities or construction methods where fires can spread quickly, and situations where evacuation plans are complex. All risk assessments and control measures must be reviewed during the construction phase to ensure they remain suitable and sufficient during the ever-changing environment and conditions.

Who should read this publication?

4 This publication is aimed at all CDM dutyholders (see Table 1) and their safety representatives to act as a guide and to assist with planning fire safety during the design and construction phases of projects. It should aid site managers and those appointed as responsible persons (see paragraphs 27–29) to manage fire risks on site.

5 This guidance should help you to carry out fire risk assessments for lower-risk and less complex projects.

6 A competent person (with the skills, knowledge and experience in fire risk assessments on construction sites), such as a fire engineer, should be engaged to provide specialist advice for complex and/or high-risk projects. Such projects are likely to need specialist advice beyond the scope of this guidance.

7 The following factors could indicate a complex site:

- high-rise building over 18 m tall (or seven storeys or more). The term 'storey' is defined in the relevant Building Regulations;

List continues on page 7

Table 1 Fire safety roles and responsibilities under CDM 2015

Dutyholder	Responsibility	Actions
Client (organisation or individual for whom a construction project is carried out)	Must make arrangements for managing the project. Ensure that relevant pre-construction information (PCI) is prepared and provided to other dutyholders.	Where the project involves more than one contractor, appoint principal designer and principal contractor with skills, knowledge, experience and organisational capabilities to fulfil the role. Set out how they expect the project to be managed. Ensure a construction phase plan is in place and includes project-specific fire risks and the procedures in case of fire. Allow sufficient time and resources for the project to be planned and completed. Provide relevant pre-construction information including existing general fire precautions (GFPs), building layout and any presence of hazardous materials such as flammable or combustible materials. Take reasonable steps to make sure the principal designer and principal contractor comply with their duties.
Principal designer (designer appointed by the client in projects involving more than one contractor)	Must plan, manage, monitor and co-ordinate health and safety in the pre-construction phase of a project.	Assist the client in providing the pre-construction information. Ensure other dutyholders are provided with information relating to fire risk and control and other relevant dutyholders. Ensure risk of fire is identified, eliminated and controlled, including challenging the decisions made by the designers to ensure they have carried out their duties. Liaise with the principal contractor to help in the planning, managing, monitoring and co-ordinating of fire risk in the construction phase.
Designer (organisation or individual who, as part of a business, prepares or modifies designs for a building, product or system relating to construction work)	Designers must ensure that the foreseeable risk of fire arising during construction is identified, eliminated and controlled when preparing or modifying designs.	Consider the risk of fire when designing the construction project, including choice of building materials and process of build. Consider off-site fire risk including impact on neighbouring properties and their emergency escape routes. Eliminate the risk or specify risk mitigation measures for the construction phase. Provide relevant information on risk mitigation measures and residual risks to the principal designer.

Dutyholder	Responsibility	Actions
Principal contractor (contractor appointed by the client to co-ordinate the construction phase of a project where it involves more than one contactor)	Must plan, manage, monitor and co-ordinate health and safety in the construction phase of a project.	Liaise with the client and principal designer in relation to identified fire risks. As the responsible person, ensure that a site-specific fire risk assessment forms part of the construction phase plan, together with a review process. Ensure programming considers fire mitigation measures. Ensure fire mitigation measures are implemented. Co-ordinate contractors and organise their co-operation to ensure fire mitigation measures are in place and maintained. Inform and consult with people working on site and their safety representatives.
Contractor (those who carry out or control construction activities; can be an individual or a company)	Must plan, manage and monitor construction work under their control.	Co-ordinate and co-operate with the principal contractor and others working on site to ensure fire mitigation measures are maintained and additional risks are not created. Assess and manage fire process safety risks under their control, such as the use of solvents or fire spread. When there is only one contractor, ensure that a site-specific fire risk assessment is carried out and is reviewed.
Worker (people who work for, or under the control of, contractors)		Take care of their own health and safety, and others who may be affected by their actions. Co-operate with dutyholders. Comply with site rules and requirements including fire and emergency procedures. Report anything they see that is likely to endanger their own or others' health and safety, such as incomplete compartmentation or other inadequate GFPs.

- large timber-frame development;
- old or historic building with hidden voids;
- interconnected buildings;
- a large-scale or multi-storey refurbishment project;
- sites that are partially occupied or will be occupied as part of a phased release;
- use of novel construction methods or materials;
- multiple underground levels; and/or
- complex fire arrangements in the final design.

8 The above factors are only an indicator of complexity; each site needs to be assessed individually. Sites that are not considered complex may be considered high-risk; for example, sites where there are significant storage risks from combustible materials or flammable gases.

The law

9 All persons with duties under the Construction (Design and Management) Regulations 2015 must contribute to good fire risk management and legal compliance. Go to Part 3, paragraphs 388–389 to see a full list of relevant fire legislation. Table 1 summarises the responsibilities relating to fire safety for CDM dutyholders. Further examples are provided in Appendix 4.

10 Not all the safeguards in this guidance will be relevant in all circumstances. What is needed depends on the extent and nature of the risks. This is important since it should not be assumed that small-scale construction work is necessarily low-risk. For instance, minor hot works in areas containing combustible materials could have catastrophic consequences if they are not properly controlled. In such cases, it is vital to apply the appropriate safeguards described in this publication.

11 This guidance is concerned with the safety of people carrying out construction work and those nearby who may be affected by it. It does not deal with fire safety requirements for the occupants of completed buildings. However, where construction work takes place in occupied or part-occupied buildings, construction managers and other dutyholders need to take account of the implications for occupiers. Effective liaison between the principal contractor and occupiers is essential – this guidance indicates what issues should be addressed (see Part 2).

12 The commercial consequences of construction fires can be devastating. It is estimated that there are hundreds of construction fires annually. These fires not only put the lives of workers and others at risk, but can also result in damage both on site and off site, ranging from tens of thousands to millions of pounds and invariably leading to severe delays in the project programme.

13 Construction companies and property developers may find it difficult to arrange insurance cover on potentially high-risk projects unless they can demonstrate good fire safety standards. On larger projects, insurers will normally require compliance with at least the standards set out in *Fire prevention on construction sites. Joint code of practice*[1] (under review). The joint code is produced by the Fire Protection Association and aims to limit property damage caused by fire.

14 Relevant legislation includes the Regulatory Reform (Fire Safety) Order 2005 (FSO) which applies in England and Wales and the Fire (Scotland) Act 2005 (FSA) in Scotland.

15 Although there are detailed differences between the FSO and the FSA, the fundamental requirements are generally the same. This guide uses terminology from the FSO and this should be taken into account in applying the guidance to Scotland. Information on the obligations imposed by the Fire (Scotland) Act 2005 and the Fire Safety (Scotland) Regulations 2006 can be found at https://www.gov.scot/policies/fire-and-rescue/non-domestic-fire-safety/

16 The Construction (Design and Management) Regulations 2015 (CDM) also place duties on dutyholders in relation to fire safety. Appendix 4 of this guidance explains how CDM dutyholders should manage fire risks. See the HSE publication L153 *Managing health and safety in construction*[2] for further information.

17 The Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) place duties on employers to prevent fires and explosions arising from work with dangerous substances. Examples include flammable liquids and gases, gases under pressure, organic dusts, and corrosive substances. Employers must mitigate the consequences should they occur. Dangerous substances and explosive atmospheres are defined in Regulation 2 of DSEAR. See DSEAR Approved Code of Practice L138.[3]

18 The FSO, the FSA and Regulation 36 of CDM set out who is responsible for enforcement relating to fire safety (see paragraph 412).

19 The legislation sets out requirements and duties relating to fire risk assessment, controls and practical precautions.

20 In outline, the legislation requires that everyone who has control over construction work can demonstrate that they have:

- recognised the risks in their workplaces;
- considered all people who may be affected;
- assessed the extent of the risks;

- made an informed decision on the necessary action to reduce them; and
- checked that the risk controls have been implemented.

21 Where the responsible person implements any preventive and protective measures, they must do so on the basis of the principles specified in Part 3 of Schedule 1 of The Regulatory Reform (Fire Safety) Order 2005.

22 Dutyholders may find it easier to incorporate fire matters into their wider risk management strategies rather than attempting to deal with them as separate issues. In particular, other types of emergencies, such as security alerts and flooding, may involve similar risk management principles although the detailed requirements to deal with them may differ.

HOW TO USE THIS GUIDANCE

23 This guide is divided into three parts:

Part 1 (paragraphs 27–97) explains what fire risk assessment is and how it could be undertaken. The risk assessment should be the foundation for all the fire precautions for the site.

Part 2 (paragraphs 98–386) provides further guidance on fire precautions. The information is provided to help when carrying out the fire risk assessment or when reviewing the precautions. Part 2 is divided into the following sections:

- Reducing ignition sources (paragraphs 101–144);
- Reducing potential fuel sources (paragraphs 145–214);
- General fire precautions (paragraphs 215–303);
- Emergency procedures (paragraphs 304–330);
- Higher-fire-risk methods and materials of construction (paragraphs 331–362); and
- Guidance for high-rise buildings (new or refurbished) (paragraphs 363–386).

Part 3 (paragraphs 387–420) outlines the main fire legislation that governs construction, how this affects various construction sites, and who has responsibility for enforcing the legislation.

24 There are four appendices to this guidance. Readers may wish to use the material in them to develop their own management responses to fire risks, but they are not intended to be definitive for all situations. The glossary provides definitions of common terms and the References section signposts to further relevant information.

25 Please note that the duties of the principal contractor and principal designer defer to the contractor, or designer, in charge of the project on sites with a single contractor.

26 This document does not include legislation that is enforced by the Building Safety Regulator (BSR). You can find out more about the work of BSR via its website:
https://www.hse.gov.uk/building-safety/regulator.htm

PART 1 FIRE RISK ASSESSMENT

27 Legislation requires a suitable and sufficient fire risk assessment to be carried out by a responsible person. Figure 1 shows the five stages of a fire risk assessment and these are explained in more detail in paragraphs 30–97. Full details of the relevant legislation are provided in paragraphs 387–420.

28 The FSO places responsibility for compliance on the 'responsible person'. Article 3 defines the responsible person as:

- the employer (for a workplace to any extent under the employer's control); or
- a person who has control of a premises in connection with them carrying out any trade, business or other undertaking (for profit or not); or
- the owner, where the person in control of the premises does not have control in connection with the carrying on by that person of any trade, business or other undertaking.

29 The responsible person may change throughout the duration of the project. For many projects it will be the principal contractor during the construction phase, as they have control of the premises.

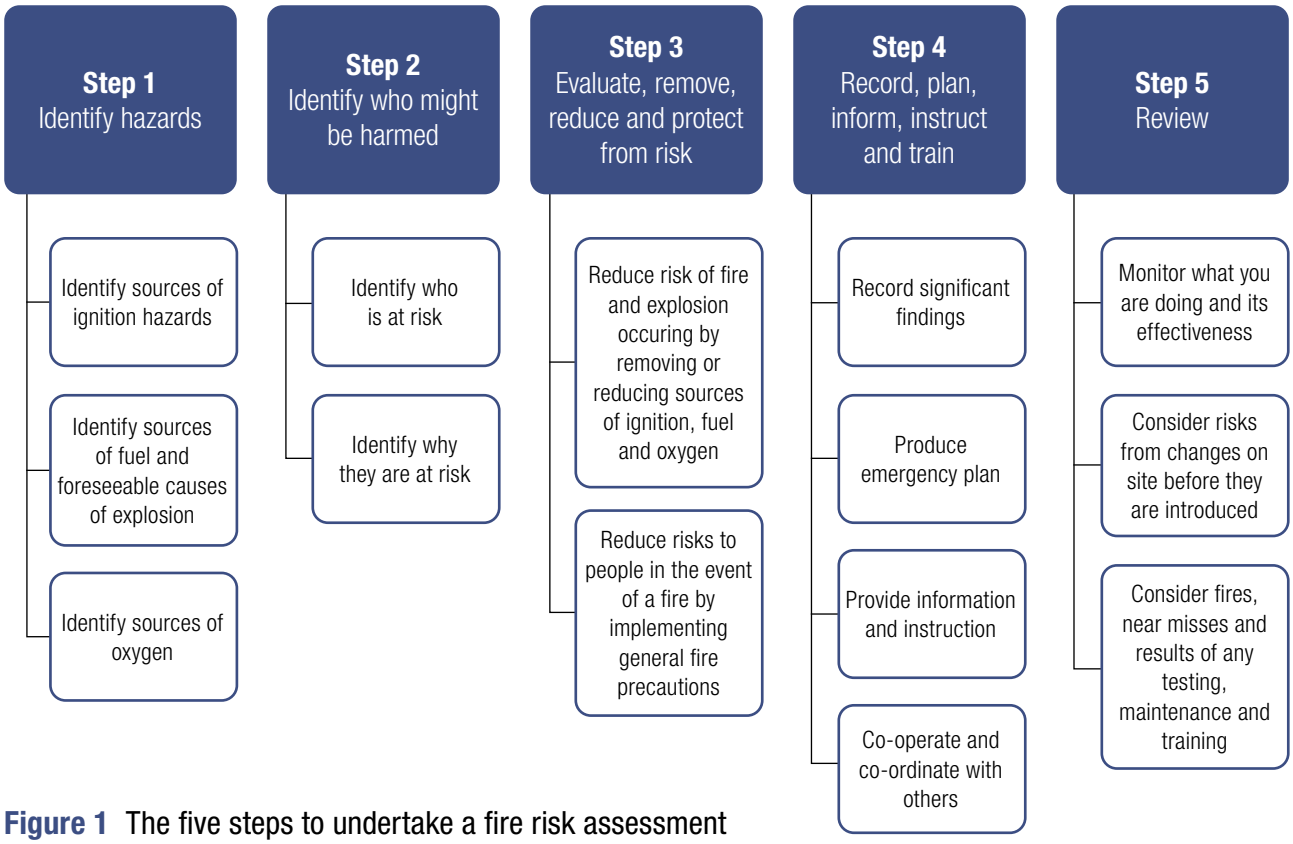


Figure 1 The five steps to undertake a fire risk assessment

Step 1 Identify hazards

30 The following basic principles are relevant to fire risk assessment in all circumstances. However, note that there will be different things to consider for new builds compared with the refurbishment of an existing building. For a new build, the assessment will include its location and proximity to other buildings, the type of construction materials and methods.

31 While completed buildings have the fire safety measures required by Building Regulations, the building can be more vulnerable to fire during construction and before final fire protection is in place. This vulnerability can often lead to the whole structure being involved in a fire with resultant on- and off-site fire spread issues. For example, the building could be made of timber without appropriate construction phase fire mitigation measures and the building is more likely to be vulnerable to fire until the completed external finishes are in place. Significant construction phase fire risks must be identified early in the design phase. Alternative methods or materials must be specified to reduce fire risks, where practicable. See paragraphs 50 and 331–386 for more examples of high-risk projects.

32 For a refurbishment project it will be important to take into account, among other things, the age and construction of the premises. For example, the building could have concealed voids or incomplete compartmentation which would assist fire spread.

33 When identifying potential fire hazards, as well as looking at hazards on site, try to identify hazards on neighbouring properties; for example, whether a neighbouring property has flammable materials stored adjacent to the shared boundary.

34 For a fire to start, three things are needed (see Figure 2):

- heat (a source of ignition);
- fuel; and
- oxygen.

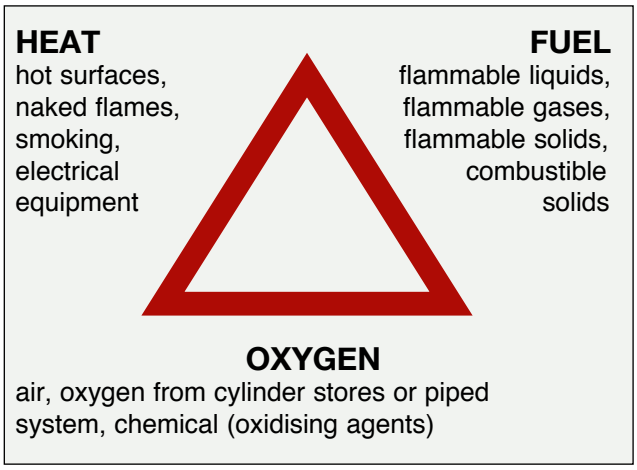


Figure 2 The three elements that combine to start a fire

35 If any one of these is missing a fire cannot start. Taking measures to prevent the three coming together will therefore reduce the chances of a fire occurring.

36 Paragraphs 37–41 advise on how to identify potential ignition sources, the materials that might fuel a fire, and the oxygen supplies which will help it burn.

Identify sources of ignition

37 Identify the potential ignition sources before and during the construction process by looking for possible sources of heat that could get hot enough to ignite material found on the site. These sources could include:

- hot processes/hot work, such as welding or grinding;
- smokers' material, such as cigarettes, matches and lighters;
- naked flames, such as gas- or liquid-fuelled open-flame equipment;
- faulty or misused electrical equipment;
- light fittings and lighting equipment, such as temporary lighting or halogen lamps;
- bonfires;
- use of oxy-fuel equipment;
- plant and equipment, such as fuel and vehicle exhausts;

- heaters, such as fixed or portable, electrical, gas- or oil-fired heaters in temporary accommodation units (TAUs);
- friction-generated heat from mechanical equipment such as disc cutters;
- static charge from mechanical equipment;
- heat sources, such as gas or electric cooking equipment;
- unsuitable or damaged electrical installations, such as overloads or heating from bunched and/or damaged cables;
- spontaneous ignition and self-heating, such as oil-soaked rags or paint scrapings;
- those deliberately introduced (arson); and
- lightning and refracted sunlight.

Identify sources of fuel

38 Anything that burns is fuel for a fire. Many materials that can burn are used during construction work. Reducing the quantity of material on site, and therefore the level of fire loading, reduces the chances of fire occurring and limits the extent of any fire. Ensure that sources of fuel that may accelerate a fire, or that may create explosive atmospheres, are secured in well ventilated spaces as far away as practicable from sources of ignition.

39 Look for the things that will burn and are in enough quantity to provide fuel for a fire or cause it to spread to another fuel source. Some of the fuels most commonly found on site include:

- components of the structure itself or materials being stored to be used to form part of the structure, such as some composite panels, insulation, PVC and timber;
- rubbish;
- flammable liquids, such as paints and varnishes;
- protective coverings;
- scaffold sheeting;
- volatile flammable materials, such as paints, thinners;
- fuel for plant and portable equipment; modern batteries or sources of hydrogen (fuel);
- gas cylinders containing flammable gases, such as those used in bitumen boilers and heaters;
- acetylene;
- packaging materials;
- petrol disc cutters and other portable equipment; and
- fall-arrest bags.

Identify sources of oxygen

40 The main source of oxygen for a fire is in the air around us. On construction sites this will be natural airflow through doors, windows and other openings. Wind or the 'chimney effect' can also cause increased oxygen to feed the fire. Sources of air flow may be hidden if a building layout has been altered from its original design, resulting in concealed voids.

41 Additional sources of oxygen can sometimes be found in site processes or materials used or stored on site, such as oxidising agents. They can provide a fire with additional oxygen and so help it burn. These chemicals should have identification on their container (and on their safety data sheet), together with advice on their safe use and storage. Examples include:

- oxygen used in welding processes; and
- oxidising agents (which carry the symbol shown in Figure 3).

Figure 3 Warning symbol for oxidising agents

Step 2 Identify who might be harmed

42 As part of the fire risk assessment, identify everyone at risk if there is a fire and how they might be harmed. To do this consider where on the site people are working. Also consider those who are affected by the site, such as contractors, visiting dutyholders and members of the public in nearby premises. It is also important to consider who is affected if the site is occupied or partially occupied (risks can be significantly reduced if the work is undertaken when a building is unoccupied). When parts of a completed refurbishment or new build are handed over to the client on a phased sequence it is important to make sure that all those who may be affected by fire in either the construction site or the occupied premises have been identified.

43 Consider all the people who use or could be affected by the site, particularly those who may be especially at risk such as:

- people who work alone, such as security staff;
- people who are in isolated areas or work out of normal hours, such as maintenance workers, crane operators and cleaners;
- people wearing personal protective equipment which may affect their ability to hear any alarm or warning;
- people who are unfamiliar with the site, such as new subcontractors or visitors;
- people who are unable to clearly understand written or spoken instruction due to language or literacy barriers;
- young people and children;
- pregnant women;
- people with a health condition or impairment;
- other people in the vicinity of the premises;
- residents asleep in the building; and
- people occupying adjacent buildings who may be at risk from radiated heat/fire spread.

44 If a fire does break out, it is most likely that the local fire and rescue service will attend the site. In implementing the findings of the fire risk assessment and preparing the emergency plan, consider the risks that firefighters would face on the site, such as asbestos or stored gas cylinders, in the event of a fire or other emergency. Consider how and when to communicate any significant risks to them; either preventively during the planning stages or actively during an incident. Fire mitigation measures must not rely on the fire service attending the site and extinguishing a fire.

45 Fires on construction sites can also cause the closure of roads and railways, affect nearby structures, and impact on businesses both on site and off site.

Step 3 Evaluate, remove, reduce and protect from risk

46 Once you have identified the hazards in Step 1 and the people at risk in Step 2, now take action to reduce the risks to an acceptable level. You can do this in two ways, by:

- reducing the risk of a fire occurring; and
- reducing the risks to people in the event of a fire.

Reducing the risk of a fire occurring

47 There are two elements to reducing fire risk. Firstly, measures to stop a fire occuring in the first place. Secondly, measures that reduce the size and spread of a fire.

48 In general, fires start in one of three ways:

- accidentally, such as when smoking materials are not properly extinguished;
- by act or omission, such as when electrical equipment is not properly maintained; when combustibles are stored near to a heat source; when gas cylinders are stored next to an electric fire or other source of heat; or if hot works are carried out without proper precautions; or
- deliberately, such as an arson attack involving setting fire to external rubbish skips.

49 Look critically at the project and try to identify any fires waiting to happen and any acts or omissions which might allow a fire to start. Consider any situation that may present an opportunity for an arsonist. Evaluate the cumulative effect of materials being used or stored, or different processes in use. For example, having different trades working on site with different combustible materials may significantly increase the total amount of combustible material present in the work area.

50 Remove hazards at the design stage, where reasonably practicable, using substitution or a change to the construction method. If the hazards cannot be removed, take reasonable steps to reduce them to an acceptable level. For example, for a proposed timber-frame construction where the risk to neighbouring properties has been identified as high, the principal designer must tell the client about safer alternative timber products and appropriate fire mitigation measures to significantly reduce the overall fire risk from the project.

51 Minimise the quantity of fuel stored in case a fire occurs. Stocks of high-fire-hazard material should be managed to balance production needs with the need to reduce the risk of fire. Use just-in-time ordering to limit the material present on site. Restrict materials in the work area to those needed for half a day or a single shift and return unused material to the stores when the work is finished. Where combustible or flammable substances have to be used, select the least hazardous alternatives.

52 Evaluate any actions being considered to remove or reduce fire hazards to ensure they are not substituted by other hazards and greater risk. For example, if a flammable material is replaced with a toxic or corrosive one, consider whether this might harm people in other ways.

53 The way the site is managed may affect the precautions that need to be put in place. There may be more than one dutyholder with control of works or areas on site. For example, during refurbishment work part of the site, outside the construction area, may remain occupied. It may be necessary to work with managing agents or building owners and, in multiple occupancy buildings, all those with some control must co-operate to reduce the risk to an acceptable level.

Examples of ways to reduce the risk caused by potential sources of ignition

Wherever possible, replace a potential source of ignition with a safer alternative. For example, replace naked flame and radiant heaters with fixed convector heaters or other types of heaters with no red element.

Separate ignition hazards and combustibles; for example, ensure there is sufficient clear space between lights and combustibles.

Control, inspect and monitor ignition hazards, such as temporary lighting, halogen lamps or display lighting.

Make sure that electrical, mechanical and gas equipment is installed, used, maintained and protected in accordance with the manufacturer's instructions, including any equipment in temporary accommodation.

Turn off equipment when it is not attended or being used.

Provide suitable charging points for tools to prevent overloading sockets.

Take action to prevent any parts of the site, and in particular storage areas, being vulnerable to arson or vandalism.

Ensure there is no smoking on site except in designated smoking areas away from buildings and combustible materials.

Do not permit bonfires on site.

Where reasonably practicable, substitute hot works processes with cold systems. For example, use roof systems that avoid naked flames.

List continues

Conduct routine hot works such as steel cutting in a designated area away from combustible material and the main structure. Consider providing fire-resisting enclosures for hot work processes.

Strictly control hot processes and hot work by operating permit-to-work schemes.

Maintain a careful watch for fire while hot work is being carried out. Also maintain a fire watch in the hot works area when workers are taking breaks during the working day. There should be a continuous fire watch of the hot work area for at least an hour after the end of hot work, followed by at least one more check two hours after the end of hot work.

Make sure that no-one carrying out work on gas fittings that involves exposing pipes that contain or have contained flammable gas uses any source of ignition, such as blowlamps or hot-air guns.

Examples of ways to reduce the risks caused by potential sources of fuel

Substitute flammable materials with less flammable ones.

Plan to reduce storage of combustible substances and flammable liquids and gases (through just-in-time ordering).

Minimise stocks of flammable liquids and gases in use in construction areas.

Keep flammable liquids and gases that are not in use in dedicated external storage areas that are well ventilated, away from sources of ignition, and where only the appropriate workers are allowed to go.

Do not keep flammable solids, liquids and gases together.

Keep areas containing flammable gases well ventilated; for example, liquid petroleum gas (LPG) cylinders should be stored outdoors in a secure cage.

Remove combustible packaging and make sure any protective materials are flame-retardant.

Develop a formal system for the control of combustible waste by ensuring that waste materials and rubbish are not allowed to build up and are carefully stored until properly disposed of, particularly at the end of the day (for example, in lockable metal skips).

Be aware of the changing flammability of materials as they are used; for example, if they release flammable vapours while drying or the process creates dust that is easily ignited.

Sequence works to encapsulate walls immediately and progressively; close up openings to provide compartmentation.

Examples of ways to reduce the potential sources of oxygen supplied to a fire

In both new builds and refurbishments close doors, windows and other openings not required for ventilation, particularly out of working hours.

Identify any hidden sources of ventilation if a building layout has been altered.

Shut down any ventilation systems that are not essential to the function of the premises.

Eliminate any oxidising materials such as oxygen gas, or if this is not possible, reduce the amount and do not store such materials near any heat source or flammable gas or liquids.

Control the use of oxygen cylinders and ensure that they are not used to ‘sweeten’ stale atmospheres.

Regularly check oxygen cylinders for leaks.

Make sure that oxygen cylinders are held in a suitable storage area that has adequate ventilation.

54 Further guidance on removing and reducing hazards and oxygen can be found in paragraphs 98–214.

55 Once you have removed or reduced the sources of fuel and ignition on site, consider the interaction between any remaining sources. For example, on complex or high-risk sites, a fire engineer may be required to assess any remaining fuel load and the required separation distances between the fuel and any sources of ignition.

Reducing the risk to people in the event of a fire

56 Once you have reduced the risk of a fire occurring to an acceptable level, consider how people will be protected in the event of a fire. A first step is to reduce the number of people who might be affected by a fire. That could be by keeping the number of workers to a minimum during any hot works, or by ensuring the building is not occupied during such work, so far as is reasonably practicable.

57 To evaluate the potential harm to people on site or nearby it is necessary to understand the way fire can spread. Fire is spread by three methods: convection, conduction and radiation. These are explained below.

58 Convection – fire spread by convection is the most dangerous and causes the largest number of injuries and deaths. When fires start in enclosed spaces, such as buildings, the smoke rising from the fire gets trapped by the ceiling and then spreads in all directions to form an ever-deepening layer over the entire room. The smoke will pass through any holes or gaps in the walls, ceiling and floor into other parts of the building. The heat gets trapped in the building and the temperature rises.

59 Conduction – some materials, such as structural steel, pipe work and ducting, can absorb heat and transfer it to the next room, where it can set fire to combustible items that are in contact with the heated material.

60 Radiation – this heats any solid it strikes in the same way as an electric bar heater heats a room. Any material close to a fire will absorb the heat until the item starts to smoulder and then burn.

61 The radiated heat from large construction site fires can ignite buildings many metres away.

62 Smoke produced by a fire also contains toxic gases. A fire in a building with modern fittings and materials generates smoke that is thick and black, obscures vision, causes great difficulty in breathing and can block the escape routes. It is essential that the means of escape and other fire precautions are adequate to ensure that everyone can reach a place of total safety before the fire and its effects can trap them in the building or on the site itself. In evaluating this risk to people, consider situations such as:

- fire starting on a lower floor affecting the only escape route for people on upper floors and roofs;
- fire starting in storage areas and affecting hazardous materials (such as gas cylinders);
- fire developing in an unoccupied area that people have to pass by to escape from the building;
- fire spreading extremely rapidly through the building because of combustible structural elements and/or large quantities of combustible goods;
- fire or smoke spreading through a building via routes such as vertical shafts, service ducts, ventilation systems, partially installed walls, partitions and ceilings;
- fire and smoke spreading through a building because of the incomplete structure or poor installation of fire precautions; for example, fire doors are not installed or fire doors are wedged open;
- fire and smoke spreading through the building because there is no fire stopping in service openings through compartmentation;
- fire spreading to adjacent buildings; and
- fire affecting the escape routes of nearby properties.

General fire precautions

63 In the event of a fire, people must be able to escape from it in a safe manner. The measures that are put in place to allow people to escape are called general fire precautions (GFPs).

64 GFPs include:

- escape routes and fire exits, including signage and lighting;
- measures to limit the spread of fire (compartmentation or venting systems);
- means of raising the alarm;
- fire detection;
- making and communicating emergency plans; and
- firefighting equipment.

65 The GFPs needed will vary from site to site. Sometimes they will be very simple and other times much more detailed, depending on the risks involved. For example, refurbishment of an occupied nursing home will involve more complex GFPs (to ensure the safety of both workers and residents) than a new-build steel framed industrial unit.

66 The GFP requirements will also vary depending on the stage of the project. The risk assessment should consider the impact of construction work on existing GFPs and how requirements will change as the project progresses.

67 All GFPs need to take account of the nature and size of the site, the number of people present and the work being done. The number of people present during construction work may differ from the number expected to occupy the building on completion; therefore additional temporary GFPs may be needed even where the permanent GFPs are commissioned and fully operational.

68 An existing large or complex structure may already have a fire strategy that contains information about existing physical fire safety precautions. This should be considered in the assessment of fire safety during the construction phase. When available, the fire strategy should be provided with the pre-construction information.

69 An independent review of the arrangements for GFPs would assist in monitoring the suitability of the arrangements, including identifying any omissions. The required skills, knowledge and experience of anyone carrying out a review of the arrangements will depend on the complexity of the site.

Step 4 Record, plan, inform, instruct and train

70 In Step 4 there are four further elements of the risk assessment to focus on to address the management of fire safety on site. In some sites with simple layouts this could be done as part of the day-to-day management. However, for larger or more complex sites it will be necessary to develop a formal structure and written policy. Further guidance on managing high-risk projects can be found in paragraphs 331–386.

Recording the significant findings and action taken

71 If the organisation employs five or more people, the responsible person must record any significant findings of the fire risk assessment and the actions taken. Significant findings must include details about the:

- fire hazards identified in Step 1 (trivial things, such as a small tin of solvent-based glue, do not need to be included);
- actions that have been, or will be, taken to remove or reduce the chance of a fire occurring (preventive measures);
- people who may be at risk, including those who may be affected in adjacent premises;
- actions that have been, or will be, taken to reduce the harm to people from the spread of fire and smoke;
- GFPs, ie escape routes and fire exits, firefighting equipment and raising the alarm;
- actions that people need to take in case of fire, including details of any people nominated to carry out a particular function (the emergency plan); and

- requirements regarding information, instruction and training, and how they will be provided.

72 Recording of worker or worker representative engagement about fire risks and controls is recommended.

73 Written records should provide sufficient detail to demonstrate that a suitable and sufficient fire risk assessment has been carried out. As a minimum they must include the significant findings and action taken, and any subsequent reviews during the construction phase. It is helpful to include a site plan or drawings. This can help with checking that GFPs are in place.

74 The information concerning the fire risk assessment should be included in site inductions and in the construction phase plan.

75 On more complex builds it is best to keep a dedicated record including details of significant findings for each phase of work, any action taken, a copy of the emergency plan, maintenance of fire protection equipment and training. There is no single 'correct' format specified for this.

76 The findings of the fire risk assessment will help to:

- develop the emergency plan;
- identify the instruction, information and training that is required;
- determine the co-operation and co-ordination arrangements that may be required with other responsible people; and
- establish the arrangements for maintenance and testing of the fire precautions.

77 When you are required to do so, record these arrangements alongside the significant findings of the risk assessment.

78 The findings of the risk assessment should feed into developing the construction programme for the project to ensure fire safety measures are installed and commissioned at the earliest opportunity.

Fire emergency plan

79 The fire emergency plan must be based on the outcome of the fire risk assessment. Consult workers and their safety representatives (where appointed) on its production and content. The fire emergency plan must be available for workers, contractors, subcontractors, safety representatives, other occupiers and the enforcing authority. It should be produced before the work begins and any control measures identified must be in place from the start of the construction work.

80 This guidance concentrates on fire; however, other potential risks may need emergency procedures and plans. Examples include flooding in excavations, or risk from asphyxiation or toxic gases in confined spaces.

81 The purpose of a fire emergency plan is to set out the action to take in case of a fire and to ensure that the physical control measures identified in the risk assessment will work effectively if needed. It must ensure that people on the site, including those with literacy or language barriers and those with a health condition or impairment, know what to do if there is a fire and that the premises can be safely evacuated.

82 Some emergencies may require only partial evacuation (for example, where there is a series of separate structures on the site). Give careful thought to ensuring that the emergency plan is appropriate and is capable of ensuring that people who need to take action know what to do and when.

83 Where a site is partially occupied, or if there are other structures outside the site boundary that may be affected by fire, the emergency plan must consider the occupants of the premises outside the construction area itself.

84 Liaise with any other occupiers and agree emergency procedures. Ensure that the means are in place to let each other know straight away if an emergency does arise. If simultaneous evacuation is needed, make sure the escape routes are of sufficient capacity to achieve this.

Inform, instruct, co-operate and co-ordinate

85 Give clear and relevant information, and appropriate instructions to people on the site, including subcontractors (and their employees) and visitors, about how to prevent fires and what they should do if there is a fire. Include this in the site induction and also include any site rules for general fire and process fire precautions.

86 Base the information and instructions on the emergency plan. It must include:

- the significant findings from the fire risk assessment;
- the measures that have been put in place to reduce the risk;
- what people should do if there is a fire;
- the identity of people who have been have nominated with responsibilities for fire safety; and
- the emergency arrangements, to prevent injury, in case of a fire.

87 Make sure any person with specific responsibilities for fire safety receives information, instruction and training to allow them to fulfil their role.

88 Co-operate and co-ordinate with other responsible people who use any part of the site/ premises or nearby properties that may be affected in case of a fire, to enable them to review their own fire risk assessment and emergency plan.

89 Consider whether liaison with the emergency services is necessary to alert them to any significant risks in case of an incident.

Step 5 Review

90 Monitor the implementation of the fire risk controls to assess their effectiveness as works progress.

91 Because sites change rapidly, and often the workforce is transient, it is essential to make sure the risk assessment and control measures reflect this. Consider the potential risk from any significant change in construction process or material before it is introduced.

92 Reasons for review could include:

- changes to work activities or the way they are organised, including the introduction of new equipment;
- progression through the various stages of construction, such as alterations to the building, including the internal layout;
- the introduction, change of use or increase in the storage of dangerous substances and combustible materials;
- the failure of fire precautions, such as fire detection and alarm systems;
- significant changes to types, quantities or methods of storage of construction materials;
- a significant increase in the number of people present;
- if new fire precautions are implemented; and
- after a fire or near miss, such as a false alarm.

93 The assessment should be reviewed when a change introduces new hazards; for example, there is a change to a product specification. If the risk is significant, implement new controls. The assessment should be regularly reviewed to ensure that the precautions are effective.

94 If a fire or 'near miss' occurs, carry out a reassessment. It is good practice to identify the cause of any incident and then review and, if necessary, revise the fire risk assessment in the light of this.

95 Records of testing, maintenance and training are useful aids in a review process.

96 On complex projects, a review of the risk assessment and arrangements for managing fire safety will assist in ensuring it is thorough and there are no omissions. The required skills, knowledge and experience of anyone carrying out a review of the arrangements will depend on the complexity of the site.

97 A more detailed checklist is available in *Fire prevention on construction sites. Joint code of practice.*

Risk assessment checklist

Step 1 Identify hazards

- Have all potential ignition sources been identified?
- Have all potential fuel sources been identified?
- Have all potential sources of oxygen been identified?

Step 2 Identify who might be harmed

- Have all people at risk been identified?
- Have the ways in which they might be harmed been identified?

Step 3 Evaluate, remove, reduce and protect from risk

- Have sources of ignition been removed or reduced?
- Have sources of fuel been removed or reduced?
- Have additional sources of oxygen been removed or reduced?
- Have the risks to people if a fire occurs been removed or reduced by:
  - determining how fire and smoke will be prevented from spreading?
  - determining whether the escape routes are adequate?
  - determining whether the lighting and emergency lighting are adequate?
  - checking that there are adequate signs and notices?
  - providing a system for fire warning and detection?
  - providing firefighting equipment?
  - regularly testing and maintaining safety equipment?
  - considering whether any other equipment or facilities are needed?
- Has the impact of the construction work on the GFPs been considered?

Step 4 Record, plan, inform, instruct and train

- Have the significant findings of the assessment been recorded?
- Have the findings of the assessment been used to develop the construction programme?
- Have the steps taken to remove or reduce the risk been recorded?
- Have the findings been communicated to everyone on site?
- Are the findings and assessment available for all to see?
- Are the records available for inspection by the enforcing authority?
- Has an emergency plan been produced?
- Are workers aware of their fire safety responsibilities if there is a fire?
- Have workers received fire safety training?
- Is a record of training sessions being maintained?
- Are joint training sessions and fire drills carried out in multi-occupied buildings?
- Has a fire drill been carried out recently?
- Do workers know how their work may pose a fire risk to others on site?
- Has there been liaison with other responsible people who occupy the site/premises or nearby properties that may be affected in case of fire?
- If dangerous or explosive substances are used or stored, have workers received appropriate training?

Step 5 Review

- Is there a process in place to ensure the assessment and emergency plan are reviewed before any significant change is introduced?
- Would a review of the assessment and arrangements by someone independent to the process be beneficial?

PART 2 DETAILED GUIDANCE ON FIRE RISK ASSESSMENT AND FIRE PRECAUTIONS

98 There are two parts to addressing fire safety in construction:

- Prevent it happening in the first place with process fire precautions. These are required in connection with the work processes being carried out to prevent or reduce the likelihood of a fire breaking out and, if one does occur, to reduce its spread and intensity.
- Prepare for and deal with the consequences if fire does happen, with GFPs that include the structural features and equipment to ensure everyone reaches safety in case of a fire.

99 The points listed in paragraph 98 form the basis of good fire safety management that must start at the design stage. The actions to be taken, and related management processes, must relate to the degree of risk from fire.

100 Whatever size the construction project, an assessment of the fire risks will always be required. In some cases, only simple assessments will be required, but in others much more complicated issues will need to be decided. Fire precautions should be proportionate to the risks from fire.

Reducing ignition sources

Smoking

101 In accordance with UK legislation, establish a 'no smoking' policy. Any designated safe open-air locations where smoking is allowed should be away from any combustible or flammable substances, and provided with metal ashtrays filled with sand. There must be a fire point in the immediate vicinity.

102 Bring the smoking rules to the attention of all workers and visitors to the site. Display the appropriate signs, particularly in high-risk or communal areas, such as canteens and site access points.

103 For high-risk sites smoking is a significant potential source of ignition, therefore the controls and policing should reflect the risk. This includes ensuring any designated smoking areas are 20 m away from high-risk structures, smoking materials are kept in locker rooms and electric lighters are used.

Plant and equipment

104 Plant and equipment should be appropriate for the task. Select plant, both electrical and engine-driven, to match the demands placed upon it to prevent its overheating during use, especially in dusty conditions.

105 Consider the area where plant is sited. For example, it may be acceptable to use a small generator in an open, well-ventilated building constructed of non-combustible materials. However, this would not be appropriate in a basement, an enclosed space or an unprotected, framed construction, such as timber, without appropriate fire mitigation.

106 Also consider how to store plant and equipment in relation to fire risk. There must be sufficient space

to ensure it does not interfere with escape routes and emergency procedures. Store plant and equipment away from timber-frame structures and other combustible or flammable substances.

107 Maintain all plant properly and make sure air filters and intakes are regularly cleaned in dusty conditions. Position air intakes so that air is free from flammable gases and vapours.

108 The use of petrol-fuelled plant and equipment (such as generators to provide power for light and heating) not only creates a source of ignition and fuel for fire, but in confined spaces can put operators at risk of serious illness and death from carbon monoxide (CO) poisoning. This hazard is present from the exhaust fumes of any internal combustion engine. Design out the need for such equipment, or substitute with equipment powered by battery, mains electricity or compressed air if it can be used safely. When substituting other equipment consider the risks specific to each alternative and make a reasoned decision. Minimise the use of such equipment on site, e.g. with off site manufacture.

109 When the use of petrol-fuelled plant is unavoidable, its use and refuelling must not take place within an enclosed space. Refuel only in designated refuelling areas in the open air, or in well-ventilated spaces, away from ignition sources and once the plant or equipment has cooled. Refuelling must not take place on scaffold, in escape routes or in high-risk areas. Bulk flammable liquid storage tanks should be sited and bunded in accordance with current standards.

110 Employers, operators and others should be aware of the hazard and take the following precautionary measures:

- Do not operate petrol-fuelled generators or tools indoors or in poorly ventilated areas. Even apparently well-ventilated locations, such as partially open temporary enclosures, can allow the accumulation of gases or vapours to levels that could cause an explosion.
- Do not operate gas/petrol-fuelled hot-air blowers or use tools with naked flames within buildings that have exposed combustible materials, such as timber or paper.
- Advise users to read and adhere to the safety instructions supplied with the equipment.
- Consider substituting other types of equipment powered by mains electricity, battery or compressed air if they can be used safely.
- Recognise potential sources and symptoms of carbon monoxide poisoning.
- Design and label equipment for safe operation.

111 All types of plant, vehicle, plant or equipment refuelling, including hydrogen equipment, must be situated away from combustible materials, ignition sources and escape routes.

112 Modern batteries used in plant and tools, such as lithium-ion batteries, may create a significant source of ignition resulting from short circuits, mechanical damage, extremes of temperature, over-charging and fast discharging. Explosive and toxic gases may be released once damage has occurred. Battery cell explosions may spread a fire via projectiles.

113 A site-specific DSEAR risk assessment must be carried out where it is foreseeable that any gases from the delivery, use, storage, or recharging of batteries, or the storage of hydrogen and refuelling of hydrogen plant, could reach explosive levels. See paragraph 116.

114 Temporary lights can easily become an ignition source if broken. Use lower-risk lighting where possible, such as LEDs. Ideally, position lamps carefully and fasten them securely to a solid backing and off the ground. If they are mounted on tripods, make sure that the tripod cannot be dislodged or overturned. Make sure that lighting equipment (especially halogen lamps and heaters) is not inadvertently covered or left bunched together so that it cannot ignite any combustible material nearby, or the structure itself (see Figure 4).

115 Where you provide generators you must include them in the risk assessment. Position them away from, or protected from, combustible structures and materials, and refuel them in a safe manner.

Figure 4 Festoon lighting: poor positioning creates a potential fire risk

116 Where explosive atmospheres might occur the requirements of Dangerous Substances and Explosive Atmosphere Regulations 2002 apply. You must classify the workplace into hazardous areas (zones) and use the right category of explosion-protected equipment in such zones. The use and storage of flammable gas or liquids, or paint spraying or floor laying with flammable liquids, can create hazardous zones. Avoid this by selecting alternative substances that eliminate the risk. More detailed advice on zoning is contained in BS EN IEC 60079-10-1:2021, and HSE guidance note HSG140 *The safe use and handling of flammable liquids*.[4]

117 When you have to create a hazardous zone, remove sources of ignition by making sure the equipment is explosion-protected and is designed, selected and installed in accordance with the provisions of BS EN 60079–14:2004. It should be constructed in accordance with the relevant parts of BS EN 60079. Keep any equipment that is not explosion-protected a safe distance away, usually at least 4 m from the hazardous area.

Hot works

118 'Hot work' is defined as any process that generates flame, sparks or heat. Hot works should be designed out where practicable and substituted with cold methods. The need for hot works must be justified using a design stage risk assessment. Information (in the PCI) must be given to people responsible for planning and managing the work to enable them to control the risk.

119 Where there is a higher risk of fire because combustible material is present, either incidentally or as part of the building structure, use alternatives to hot works.

120 Common types of hot works include the use of oxy-fuels for heating, cutting and welding (see paragraphs 182–194 for further information); also, the use of tools for grinding and cutting metal, torch-applied roofing, heat guns, and soldering irons. Figure 5 shows typical welding equipment.

121 Use alternatives where hot works cannot be avoided, such as electrically powered torches or heat guns.

122 Precautions to take before, during and after the hot work include:

- The principal contractor must liaise with the hot works contractor to assess the implications of the

work on the GFPs. For example, if isolation of part of the alarm or detection system is necessary, implement robust procedures to ensure it is reactivated when work is completed or stops at the end of the day or for a break.

- The assessment should involve a visit to the hot work area, especially for refurbishment where existing materials in the area may not be known.
- Make a record of the site assessment and controls needed.
- Loose combustible materials should be removed from:
  - in and around the work area;
  - within any breaches in walls, floors and ceilings in the work area where heat, sparks or flames could enter;
  - within the area beneath where the hot work is being carried out; and
  - on the other side of a wall or partition, where work takes place only on one side.
- Adequately protect any combustible material that cannot be removed and any openings with non-combustible board.
- Identify what firefighting precautions are necessary for the work. Make sure that at least two suitable fire extinguishers are provided within reach of the hot work activity and any hot watch location.

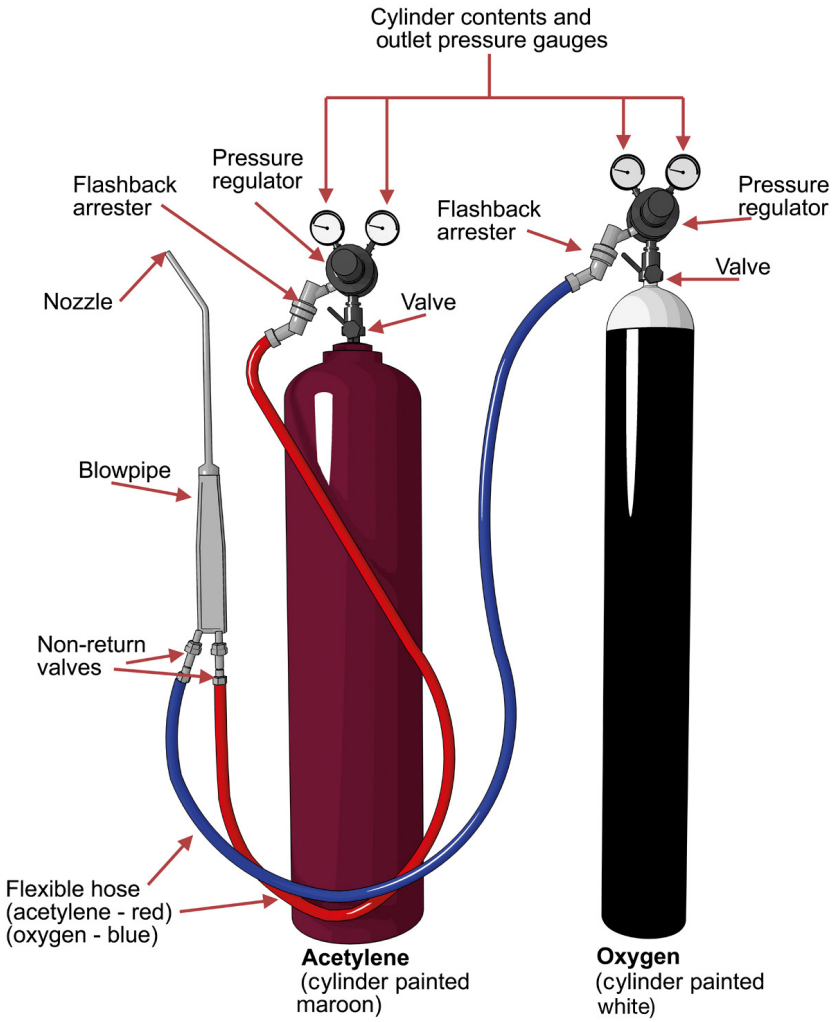


Figure 5 Typical equipment used in gas welding and allied processes

- Provide and use combustible gas detectors and/or thermal imaging cameras as appropriate.
- Maintain a careful watch for fire while work is being carried out. Also maintain a fire watch in the hot works area when workers take breaks during the working day. This fire watch should include any areas where the hot work might breach walls, floors and ceilings; this could lead to a fire in an area not directly visible from where the hot work is being carried out.
- There should be a continuous fire watch of the hot work area for at least an hour after the end of hot work, followed by at least one more check two hours after the end of hot work.
- To close the permit undertake a visual inspection of the work area and include any images (e.g. thermal) from the hot watch period.

123 The risk of a fire arising from hot works depends on many factors such as the environment, materials being used, and the composition of the structure being worked on. Some combustible/higher-risk materials can smoulder for a significant period of time after work has been completed and before they ignite. All hot works should be completed two hours before the end of the working day to allow for the appropriate fire checks to be carried out.

124 Although this is less likely to happen, smouldering can still develop into a fire after a longer period. Site security personnel should be told to check former hot work areas for signs of a fire so they can monitor these areas, ideally using thermal imaging equipment.

125 Only where a suitable and sufficient risk assessment clearly demonstrates that the risk of a fire from hot works is minimal will it be acceptable to follow a different procedure.

126 The RISC Authority publication *Recommendations for hot work* RC7[5] provides further information on precautions to take when carrying out hot works.

Permit-to-work systems

127 Where you cannot avoid hot works use formal systems of management, such as a permit-to-work (PTW) system.

128 PTW systems are formal management documents. Only people with clearly assigned authority should issue or close a PTW. They need to have sufficient information about the proposed hot work to be able to identify the potential hazards in the work location and suitable precautions. A PTW should be issued for clearly defined pieces of work with a specified time period and should end once the activity at that location is complete and/or the time period has ended. PTW documents should not give blanket authorisations to carry out hot works anywhere on site at any time. The PTW should set out the required precautions to take before, during and after the hot work (see paragraphs 118–126). A robust PTW system will include checks to ensure the precautions are complied with.

129 PTW systems should normally include the:

- location and nature of the hot work intended;
- proposed time and duration of the work;
- limits of time for which the permit is valid;
- the precautions to be taken before, during and after the hot work;
- procedure for raising the alarm;
- person in direct control of the work; and
- person authorising and closing the work.

130 Information on and legal obligations relating to systems of work, permits to work and hot works on premises where DSEAR applies are detailed in DSEAR ACOP L138.

131 If the site is in a high-risk area, and for more detailed information on PTW systems, see HSG250 *Guidance on permit-to-work systems: A guide for the petroleum, chemical and allied industries*.[6]

132 A fully documented PTW system may not be needed where the risks arising from hot work are low (e.g. in a designed hot work area). However,

precautions such as having a fire extinguisher and arrangements for fire watching are still required. Site rules are an effective means of making these precautions clear to people carrying out such work.

Electrical installations

133 Electrical installations, including temporary ones, must be of sufficient capacity for their intended use. They must be designed, installed, inspected and maintained by competent personnel. The installation should meet the requirements of BS 7671, which includes a specific section on construction and demolition site installations. Do not put electrical equipment used for a site temporary distribution system in escape routes unless this is justified by a robust risk assessment. Do not allow ad hoc additions or alterations to the electrical installation by people who are not competent.

134 Some common electrical faults posing fire risks include:

- use of flat twin and earth cable as extension leads instead of suitable flexible cable;
- overloading sockets and multi-gang extensions;
- plugging extension leads into each other;
- use of coiled extension leads without unwinding them fully;
- laying multiple cables together in or near combustible material (frequently in roof and ceiling voids);
- accumulation of rubbish against distribution boards (this often occurs when installations are sited in quiet parts of the site);
- intentional bypassing of safety devices, such as fuses or circuit breakers;
- mechanical damage to cables, often as a result of inappropriate routeing of cables;
- makeshift cable joints made without correct proprietary connectors; and/or
- use of non-heat-resistant glass or broken glass cover over a halogen lamp (poor heat-resisting glass covers have been known to ignite flammable vapours being emitted from a freshly applied solvent-based covering laid onto floors).

135 The proper use of electrical safety devices, such as residual current devices (RCDs), can reduce the risks of fire arising from electrical faults. However, they are no substitute for an electrical installation that is properly designed, installed, inspected and maintained by an electrically competent person.

136 In order to design and install a system that is safe, with adequate capacity, the people responsible need to be informed about its likely use including what power supply is needed and where. Check the electrical systems periodically to make sure they remain safe and free from damage or deterioration. Also check them before carrying out any addition, extension or modification. Most sites will require some form of systematic electrical inspection and maintenance regime.

137 Electrical equipment must meet standards that reflect the adverse conditions on most construction sites. Guidance regarding site electrical safety and periodic checks is given in the web page on electrical safety in construction.[7]

Bonfires

138 Do not burn trade waste or rubbish on site. Avoid burning vegetation and untreated wood on site and consider this only in very limited situations such as site clearance for major road construction.

139 There is environmental legislation governing the rare circumstances where site burning may be permitted. Contractors must check with clients, local authorities and the Environment Agency (or in Scotland the Scottish Environment Protection Agency (SEPA)) and obtain the relevant permit before burning any material on site.

140 Precautions for on-site burning:

- Notify the local fire and rescue service.
- Site the fire in an open area, on designated ground and far enough removed so that there is no risk of setting adjoining material, storage areas or structures alight.
- Limit the amount burnt in one go to what can be dealt with in an incinerator. This could be a

properly designed incinerator; or, for example, a 200-litre spent oil drum that has been properly cleaned of flammable residues and provided with ventilation holes may be used in a controlled manner for this purpose. Large open bonfires can easily get out of control.

- Never leave fires unattended until they are completely out, damping down if necessary.
- Make sure attendants have water, the correct fire extinguishers or other suitable equipment to hand, and are trained in their use, to enable a rapid response to the bonfire if it starts to get out of control.
- Check material for dangerous items, such as empty cylinders, aerosol cans and flammable materials, and remove them before material is brought to the bonfire.
- Consider environmental factors; for example, do not light fires on windy days or during periods of extreme dry weather.
- Make sure that flames, heat, smoke and any airborne debris do not affect overhead electrical lines.
- Never use petrol or other similar accelerants to start or fuel any fire.

Arson and site security

141 Arson is a real, substantial problem and risk on all sites. Trespassers on site may deliberately or accidentally start a fire. CDM requires measures to be in place to prevent unauthorised access. The fire risk assessment should consider wilful fire raising, including whether the site is particularly vulnerable to arson, especially those sites with a high fire loading or in localities with a known history of vandalism and arson.

142 Ensure the site is secure. Security measures to prevent unauthorised access and arson include:

- perimeter fencing, or hoarding, and securing all access points such as windows and doors on a refurbishment site;
- securing all openings on vulnerable buildings with fire-resisting material;
- regular out-of-hours security patrols or a permanent security presence;
- security lighting;
- closed circuit television monitoring (CCTV) including possible use of thermal imaging cameras;
- intruder alarm systems;
- liaison with the local police service;
- secure storage (or if necessary removal) of flammable liquids, gas cylinders and other combustible materials while the site is closed; and
- storing materials and waste within the site perimeter preferably in secure compounds or away from the perimeter fencing (skips are often a target and their vulnerability should be considered).

143 Security staff need to be based outside of vulnerable buildings. They need to be alert to the possibility of detecting fire and know what to do if they discover it.

144 Where arson is a high-risk factor, site management must reinforce and monitor worker compliance with fire safety site rules to detect deliberate unsafe worker behaviours at an early stage.

Reducing potential fuel sources

Modern batteries and fuel types

145 The use of modern fuel types, such as hydrogen, and battery-powered vehicles and plant, is increasing. Risks associated with the use and storage of batteries, and the refuelling of hydrogen, must be considered during all phases of a project. For example, the use of hydrogen gas or lithium-ion batteries may create explosive atmospheres under the right conditions. Volatile and flammable materials are included in the definition of dangerous substances provided in the DSEAR ACoP L138 (see paragraph 17). Such substances should be substituted at the design stage, where practicable, to reduce sources of available fuel.

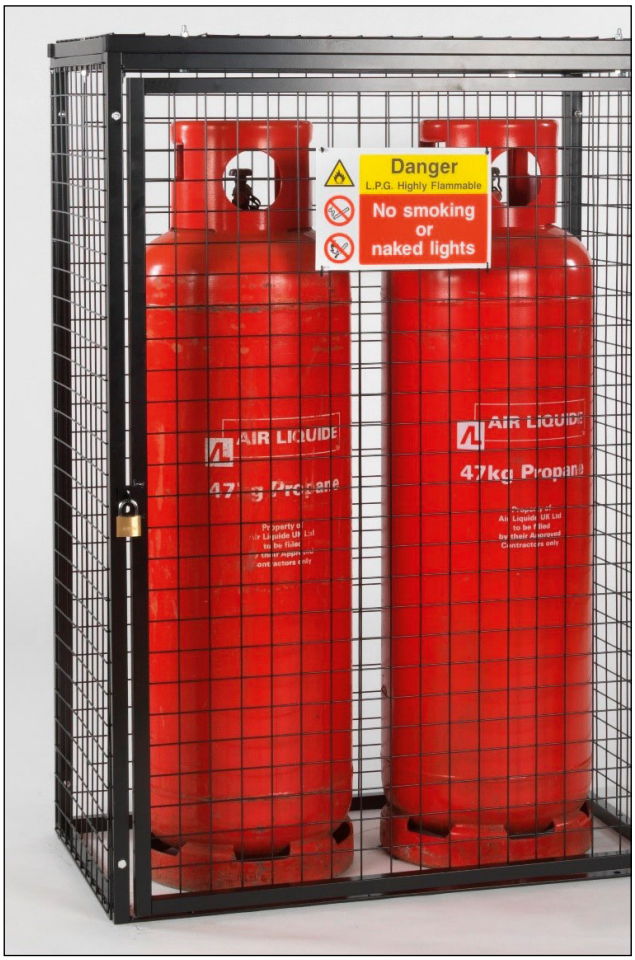


Figure 6 Provide purpose-built, secure storage for volatile and flammable materials

Storage of volatile and flammable materials, and gases under pressure

146 Extra precautions are needed when storing flammable substances and gases under pressure. Examples include extremely flammable gases, such as LPG, flammable gases, and flammable liquids. Flammable liquids include petrol, along with many solvents and adhesives.

147 In general, reduce the total amount of flammable material held on site as far as is reasonably practicable. Limit quantities of volatile flammable solvents and flammable gases to an absolute minimum.

148 The risk assessment should define the most appropriate storage arrangements, based on the nature of the materials, the size and design of the packaging and the number of packages required. The assessment must also take into account the layout of the site to ensure that the storage will be secure, well ventilated and adequately separated from the work being undertaken on the site.

149 Flammable liquids, especially extremely flammable or highly flammable liquids, need careful handling. Practices to limit the likelihood of spills and the release of flammable vapour concentrations are required. Storage areas should be in the open air and in a well-ventilated area. External stores should be enclosed by a 1.8-m-high wire mesh fence to provide security without restricting ventilation. However, internal storage may be suitable for smaller quantities of flammable materials, as long as it is adequately ventilated and properly separated by fire-resistant partitioning from work activity and other sources of ignition. Figure 6 shows an example of a secure store for highly flammable liquids.

150 Unless the site itself is secure, prevent access to outdoor storage areas by suitable fencing and lockable gates. Similarly, make sure storage buildings are secure and the doors are fitted with locks. In addition to ensuring the gates and doors to storage facilities are locked outside normal work hours, determine whether to prevent uncontrolled/unauthorised access during the periods the premises are working. One way of achieving this is to keep the area locked and restrict access to the keys to authorised people.

151 Storage areas must be as far away as is practicable from occupied buildings, construction activities, other materials and ignition sources. Contact the supplier for advice on the safe storage of LPG cylinders (see Figure 6 for an example). Apply the guidance in HSG51 *The storage of flammable liquids in containers*[8] when storing flammable liquids. Relevant trade associations may also provide useful advice on these subjects (see Further reading section).

152 Where the recommended separation distances between the store and any occupied building cannot be achieved, it may be possible to reduce the distance by the use of a fire wall or other appropriate physical barrier of fire resisting construction.

153 If drains or excavations are within the separation zones, these must be sealed or otherwise protected, such as by using suitable spillage retention walls and/or vapour barriers.

154 It may be necessary to store volatile flammable materials inside buildings for various reasons, such as security. Any building used for this purpose should be separate from the one undergoing construction work. Such a building does not need to be fire-resistant if it is in a safe location. However, it should be of a generally non-combustible construction and be provided with ventilation.

155 Make sure good ventilation is provided in storage areas to prevent dangerous levels of gases or vapours accumulating.

156 High and low openings in the external wall help to achieve ventilation. The openings should not ventilate into the surrounding structure. Openings representing 1% of the total floor and wall area are sufficient for flammable liquid storage. For flammable gas and oxygen cylinders, openings representing 2.5% of the total floor and wall area are usually sufficient.

157 Small quantities (eg up to 50 litres) of flammable materials such as paints, solvents, petrol and adhesives can be stored in lockable steel cabinets or chests. These must be of fire-resisting construction and designed to retain spills. Store them in designated well-ventilated areas that are away from the immediate work area where possible; and do not jeopardise any means of escape.

158 Never store flammable gas (or any other type of gas cylinder) in unventilated metal boxes or other enclosed spaces, such as temporary accommodation. If there is a leak, gas can build up to a dangerous level and flammable gas may explode when ignited.

159 Where people could be trapped in the event of a fire, storage areas should have at least two exits, both unlocked whenever anyone is accessing the store. However, where travel distances do not exceed 12 m, a single exit may be adequate.

160 Do not store anything other than flammable materials in flammable material stores.

161 Avoid any operations that could result in a spillage, such as decanting liquids or refuelling, within the storage area as the ignition of a small spillage could rapidly escalate (see also paragraphs 164–166).

162 Store oxygen cylinders separately from cylinders of flammable gases such as LPG and acetylene.

163 The Further reading section lists guidance provided by relevant trade associations.

Handling volatile flammable materials

164 Flammable liquids, especially those with flash points less than 10°C above the temperature at which they are used, need careful handling. Practices to limit the likelihood of spills and the release of flammable vapour concentrations are required. In particular:

- avoid dispensing or decanting operations within storage areas;
- provide drip trays to contain spillages during dispensing and decanting;
- carry out operations in well-ventilated areas;
- use proper handling aids when dispensing liquids from large containers;
- keep flammable liquids in secure closed-top containers when transporting or moving them;
- dispose of contaminated rags safely – waste containers must be of metal construction and be suitably covered with a metal lid; and
- make sure that any clothing contaminated with flammable liquids is removed immediately and dealt with appropriately. Do not store contaminated clothing.

165 Refuel petrol-driven equipment only in designated safe areas that are outside and well ventilated. Return petrol cans to flammable stores promptly and do not keep or use them inside the structure or on escape routes.

166 Further information is given in HSE guidance note HSG140 *The safe use and handling of flammable liquids*.

Precautions for all uses of gas cylinders

167 The following are important precautions:

- Minimise the quantity of gas cylinders stored on site; gas cylinders are readily available and, in most cases, can be delivered without significant delay.
- Choose the most appropriate fuel gas for the application. Always read the product label and the Safety Data Sheet.
- Check cylinders and associated fittings before use. A leak detection fluid or soapy water is a reliable method of checking for leaks. If there are any signs of leaking or damage, do not use them.
- Before use, secure cylinders in an upright position unless used in another position, such as on an LPG-fuelled forklift truck.
- Close cylinder valves before connecting or disconnecting any equipment.
- Never kink hoses during disconnection, connection or at any other time. This damages the hose and can easily lead to accidental release of the gas.
- If there is any smell of gas during use, turn off the main cylinder valve immediately and make sure the cause is investigated, determined and put right.
- Handle cylinders carefully. Mishandling of cylinders can damage valves and repeated abuse can also lead to serious structural weakness.
- Where it is necessary to ignite a flammable gas mixture, always follow the recommended lighting instructions. In general, the appliance valve should be closed before the cylinder valve is opened. If the lighting procedure fails, allow gas to disperse before attempting to relight it.

Liquid petroleum gas

168 LPG is widely used across the entire range of construction activities. It is probably the largest single contributor to the risk of fire on construction sites and has been involved in many serious fires and explosions, particularly where there have been leaks in temporary site accommodation.

169 LPG appliances brought onto the site need to be constructed, installed, used and maintained to appropriate standards. There are several relevant British Standards including the following:

- BS EN 521:2019;
- BS EN 1596:1998;
- BS 6891:2015;
- BS EN 461:1999;
- BS 5440–1:2008; and
- BS 5440–2:2009.

170 When purchasing LPG equipment, make sure it complies with the above or other equivalent standards. Make sure gas cylinders and equipment are obtained from reputable suppliers.

171 Properly install all appliances and keep them maintained by people who are competent to do so. Make sure that fixed installations are installed and maintained by a registered Gas Safe engineer.

172 Ensure there is adequate ventilation whenever gas appliances are used. Where there are fixed installations inside buildings, permanent ventilation openings are required, such as gas flues, which must be kept clear.

173 Fit a flame-failure device (this may not be needed where the flame can always be seen by someone in attendance whenever the appliance is used).

174 Use appliances in accordance with the manufacturer's instructions. Make sure that the instruction booklet is available to the user or that a notice is placed on the appliance.

175 Different appliances are designed to work at different inlet pressures. The correct gas regulator must always be used with the appliance concerned. Check with the manufacturer or a registered Gas Safe engineer if there is any doubt.

176 Make sure that replacement hoses are of an appropriate standard, such as BS EN 16436-1: 2014+A3:2020, and that they are properly secured to the equipment with appropriate clips. Proprietary crimped clips or swaged fittings should be used on hoses that have an internal diameter of greater than 8 mm and an operating pressure greater than 50 mbar.

177 Advice on the transportation of LPG cylinders is not covered by this guidance. The Further reading section lists guidance provided by relevant trade associations.

Precautions for bitumen boilers

178 Where the design and risk assessment have shown that it is necessary to use a hot bitumen system and that it can be applied safely, the precautions for using LPG as a fuel gas for bitumen and hot melt boilers include:

- Check for leaks before use with a detergent solution. Never use a naked flame.
- Follow the manufacturer's instructions for lighting up. Where possible remove the burner from under the boiler, light, and then replace it. This avoids a build-up of gas under the boiler during the lighting process.
- LPG cylinders should be set up at least 3 m from the burner or boiler (at roof level) or protected by an appropriate heat shield. Cylinders not in use should be stored as far from the work site as is reasonably practicable. They should be sited clear of traffic to prevent damage to the hose. The hose should always be armour braided, at least 4 m in length, in good condition and properly connected. A pressure regulator of no more than 2 bar must be fitted to the gas cylinder.
- Never leave boilers unattended while the burner is alight.
- Do not tow or move boilers while the burner is alight.
- When possible, avoid taking tar boilers and similar equipment onto roofs. If this cannot be avoided place them on a non-combustible insulating base to protect the roof from ignition. Equipment should be under the supervision of an experienced operator and sited where spillages can be easily controlled.
- Have at least one fire extinguisher close by (9 litre foam or 9 kg dry powder). Never use water to combat a bitumen fire. Ideally also keep two boxes of sand (or similar) to hand.
- In the case of a boiler fire or where the bitumen boils over, close the lid, turn off the gas supply and where possible move the gas cylinder away.

179 The National Federation of Roofing Contractors' publication *Safe2Torch*[9] provides guidance for the safe installation of torch-on reinforced bitumen membranes and use of gas torches in the workplace.

180 Additional guidance can be found in Appendix 6 of HSG33 *Health and safety in roof work.*[10] See the Further reading section for more advice.

Precautions for heating in temporary site accommodation and similar areas

181 The following are important precautions when using flammable gas in temporary site accommodation:

- If equipment leaks or heater flames fail, flammable vapour can build up inside temporary site accommodation and can result in a fire or explosion. It is especially dangerous if vapour accumulates out of hours.
- Temporary site accommodation needs to be adequately ventilated at high and low levels and heaters must be properly maintained. Make sure heaters have flame-failure devices incorporated so that the gas supply is shut off if the flame fails.

- Where cylinders are an integral part of the appliance, such as in cabinet heaters, you may keep them inside the temporary site accommodation, but where they are separate from the heater, keep them outside the temporary site accommodation and connected to the heater by the shortest practicable length of suitable hose or piping.
- In both cases, turn off the fuel supply at the appliance and the cylinder after use (and especially when the site closes overnight or at weekends). Always keep heaters clear of obstructions, such as clothing.
- Do an end-of-day check.

Precautions for oxy-fuel cutting

Choosing fuel gas

182 It is important when deciding which fuel gas to use for a task to take into account the properties of the individual gases and to select the most suitable gas. Adopt less hazardous alternatives to hot cutting and welding when reasonably practicable, such as cold-cutting techniques.

183 When choosing a fuel gas consider the following characteristics of each gas:

- the quality of the flame required. This will be affected by the flame temperature, the heat intensity and the heat distribution;
- the number of cylinders required to be on site. Fuel gases consume oxygen at different rates, and the choice may require a greater number of cylinders to be stored on site. Extra cylinders will increase the fire risk and the manual handling requirements;
- the density of the gas. A gas that is heavier than air will drop into lower spaces, whereas a gas that is lighter than air will rise and more readily disperse in the air; and
- the location at which it is being used. When you are working in, for example, confined spaces, tunnels or on top of a building, it is safer to use a gas lighter than air that will rise and readily disperse.

Safety precautions for oxy-fuel gas cylinders

184 The following are important safety precautions:

- Have only sufficient gas cylinders on site for current work activities.
- Remove gas cylinders from the workplace and return them to the storage area as soon as the period of work has been completed.
- Oxygen cylinders must be stored separately from flammable, highly flammable, extremely flammable liquids and cylinders of flammable gases, such as LPG and acetylene.
- Always secure gas cylinders in a vertical position, preferably by mounting them on a purpose-built trolley.
- Regulators and hoses should be of a recognised standard: BS EN ISO 3821:2019 Gas welding equipment. Rubber hoses for welding, cutting and allied processes.
- To avoid confusion colour-code hoses as:
  - blue – oxygen;
  - red – acetylene; and
  - orange – propane.
- Use proprietary hoses with properly made hose end connections. Worm drive fasteners are not recommended.
- Keep the hose length to a minimum. This reduces the likelihood of damage and should help to ensure that the hose is not damaged by the hot work.
- On both gas lines provide non-return valves at the torch (blowpipe) inlet and flashback arresters at the pressure outlet from the gas cylinders. All non-return valves and flashback arrester devices should be to an appropriate standard, such as BS EN ISO 5175–1:2017.
- Equipment and hoses used with oxy-fuel and similar equipment must be in good condition, set up in accordance with the manufacturer's instructions and visually inspected before each period of use. Always check assembled equipment

for leaks by applying a soap solution around joints and watching for bubbles.

- Nominally empty cylinders still contain some gas; treat them in the same way as full cylinders. Put them back in the storage area before returning them to the gas supplier.
- Gas welding and cutting procedures must be carried out only by a competent person or under the supervision of competent personnel.
- Oxygen cylinders must be stored separately from flammable, highly flammable, extremely flammable liquids and cylinders of flammable gases, such as LPG and acetylene.

185 See paragraphs 118–136 for further information on hot works.

186 More detailed information is available in HSE guidance note HSG139 *The safe use of compressed gases in welding, flame cutting and allied processes.*[11]

187 Many of the legal obligations associated with the use of oxy-fuel equipment are detailed in the DSEAR ACOP *L138 Dangerous substances and explosive atmospheres*.

Safety precautions specifically for acetylene cylinders

188 If acetylene cylinders are directly exposed to fire, or other sources of extreme heat (>350 °C), an exothermic decomposition reaction of acetylene may be initiated within them. This reaction may continue after the fire is extinguished, possibly to the point of causing the cylinder to explode in some cases. For this reason the fire and rescue service follow their National Operational Guidance and will operate, as a minimum, a protocol of cooling heated cylinders with water for 1 hour with a further period of monitoring for 1 hour, while maintaining a precautionary 200-m hazard zone around the suspect cylinder(s).

189 While movement or impact alone to an unheated acetylene cylinder cannot cause decomposition, it is important not to move, strike or vent a heated cylinder until the fire and rescue service have declared it safe. Do not attempt to fight a fire involving acetylene cylinders.

190 More detailed guidance is available in the HSE publication INDG327 *Working safely with acetylene*.[12]

191 Consider how the fire and rescue service will be informed about the presence and location of gas and acetylene if they are required to attend the site for a fire.

Dismantling of tank structures

192 Storage tanks and drums often contain residues of flammable materials. Even tiny amounts of these can result in flammable and explosive concentrations. This is especially dangerous when hot work dismantling methods are used, including oxy-fuel cutting or methods generating ignition sources such as angle grinding. Use such methods only after the tank has been thoroughly cleaned and certified free of gas and residues by competent people as this work is specialised and potentially extremely dangerous. (Alternatively consider mass filling with concrete and leaving *in situ*.)

193 A full description of the extensive precautions needed in this work is beyond the scope of this guidance. Further information on small tanks and drums is available in HSE publication INDG314 *Hot work on small tanks and drums*.[13]

194 Primary measures of dismantling tank structures include:

- clearly identifying the contents of tanks and associated pipework;
- cleaning tanks and pipework before dismantling work begins;
- keeping to clearly defined systems of work during dismantling (PTW systems will be appropriate; see paragraphs 127–132 for more information); and
- avoiding hot work wherever possible, such as by using hydraulically powered shears.

Underground gas services

195 Always assume that buried gas pipes are present on a site unless it is positively confirmed that they are not. Identify the location of gas service pipes before beginning any work that breaks the ground. The client or local supply company will often be able to indicate where pipes are located, but you must also carry out a survey of the site. A competent person must perform the survey using service pipe-locating devices. Once the locations of all service pipes have been identified, arrange for a competent person to disconnect them from the mains supply and to purge any gas service pipes of any residual gas. It is extremely dangerous to merely assume that this has been done. It needs to be confirmed by a formal process in which a competent person, usually a representative of the local supply company, gives authoritative assurance of disconnection and clearance. Further information is contained in HSE publication HSG47 *Avoiding danger from underground services*.[14]

196 Even if removal of the gas services is not an intended part of the work, it is still important to locate and isolate services to avoid damaging them. In some cases, it may be necessary for supply systems to remain charged. In such cases, take particular care in implementing systems of work to minimise the risk of contact.

197 Consider using a PTW system to ensure no work is carried out that is liable to damage service pipes that have not yet been identified and isolated, or those that are remaining and charged.

Reducing the amount of combustible material

198 Many materials used during construction work can burn, including structural elements, insulation, cladding, fixtures and fittings. Designers must consider the combustibility of materials, both singularly and in combination, and assess fire risks. Where reasonably practicable they must design out fire risks by selecting suitable alternative materials. If it is not reasonably practicable to eliminate the risk, fire risks must be mitigated. Carry out an assessment of fire risk when selecting innovative materials.

199 Some timber-frame structures are vulnerable to rapid fire spread and possible collapse in the early stages of construction as the timber is not protected by the final fire-resisting finish. Where fire in a timber-frame structure might affect or spread off site to adjacent or nearby buildings a more resisting specification must be considered by designers. Robust mitigation measures must be specified where no alternatives are available. See paragraphs 341–355.

200 The fire risks change at different stages in the build. For example, early in a refurbishment project there is greater risk when the building is stripped back removing the compartmentation, such as plasterboard and fire doors, and revealing old and dry timbers, or later in a new-build project when there is an increased quantity of flammable and combustible material such as packaging and solvents, or large quantities of stored materials (often insulation), around the site.

201 The risk and severity of fire decreases by reducing the quantity of material on site that can burn. This will also ease movement around the site and reduce the likelihood of escape routes becoming blocked.

202 To minimise the amount of fuel stored on site:

- use just-in-time ordering to limit the overall quantity of material on site;
- limit materials in the work area to what is needed for half a day or a single shift and return unused material to the stores when the work is finished;
- where combustible or flammable materials have to be used, select the least hazardous alternative. This must be addressed when planning and sequencing works;
- where a large structure is constructed of combustible material, use a fire-retardant treatment and early compartmentation to reduce the volume of the area likely to be affected by fire;
- prioritise enclosing the combustible elements of the structure when planning the build sequence;

- make sure waste material is regularly removed from the work areas and stored away from the structure (see paragraphs 211–214);
- order materials with reduced combustible packaging;
- avoid stockpiling materials; and
- do not bring items such as fixtures and fittings onto the site early in the build.

203 Where possible, identify any materials on neighbouring premises to which a fire might spread and raise any concerns with the person in control of the premises. When necessary make sure on-site storage areas take into account hazards from neighbouring premises.

The changing flammability of materials as they are used

204 Construction work can alter the flammability of materials, including nominally flame-retardant ones. For example, when worked on, solid materials produce dust, crumbs or other fine material which are always more easily ignited than the bulk material. This must be addressed when planning and sequencing works.

Protective coverings

205 Protective coverings are a common feature during fit-out stages where final fixtures, such as doors, handrails, floor coverings and panels, need to be protected against damage. Such coverings and the tape used to secure and join the coverings can contribute substantially to the overall fire load. Reduce fire risks by using covering materials that are flame-retardant (flexible protective coverings that comply with the Loss Prevention Standard LPS 1207, or equivalent, such as Technical Standard 63: Reaction to fire performance requirements: materials used as temporary protective coverings, CERTIFIRE product certification scheme). Products compliant with either standard will be marked with the certification information. Though such products have greater fire-retardant properties they can still burn. At least one fire escape stairway must be kept free of such protective coverings. If protective coverings are printed on this may affect their compliance with the flame-retardant testing.

206 Avoid the need for protective covers by installing vulnerable features as late as possible in the fit-out stage or by using temporary products such as fire doors. Such products can be reused on other construction projects.

Scaffold sheeting

207 If the scaffold is intended as part of the means of escape the scaffold sheeting must be to a flame-retardant standard and you must carefully consider the extent of the sheeting. Do not use the sheeting to enclose scaffold stair towers or escape ladders (see Figure 7). This is to minimise smoke in the escape route and make fire and rescue service access easier. Flame-retardant sheeting is also recommended in other circumstances such as on a structure containing exposed timber or flammable insulation material or on an occupied building. An example of sheeting that satisfies flame-retardant criteria is that which complies with the Loss Prevention Standard LPS 1215 or equivalent, such as TS62: Technical Schedule 62: Reaction to fire performance requirements: materials used to clad scaffolding, CERTIFIRE product certification scheme. Products compliant with either standard will be marked with the relevant certification. If the sheeting is printed with an image or colour this may affect its compliance with the flame-retardant testing.

General requirements for storage of all combustible materials

208 Ideally, store combustible materials securely outside buildings under construction, especially volatile, extremely flammable substances such as LPG (see paragraphs 168–187). If you do store combustible materials inside buildings, keep them in an area where the safety of people (on and adjacent to the site) is not threatened in the event of a fire. For example, do not put paint stores next to emergency exits; and do not store materials under staircases or along escape routes.

Figure 7 Where sheeted scaffolds form part of the escape route, do not sheet the stairways or ladder points so that smoke can escape and the fire and rescue service can gain access

209 Control access to storage areas so that only authorised personnel can enter and remove material.

210 If storage outside the structure is not possible, arrange internal stores to limit the spread of fire. In more enclosed buildings you may need to separate internal stores from the rest of the structure with a partition providing at least 30 minutes' fire resistance. Good-quality plasterboard partition walls with skimmed joints will usually achieve this and can be very useful for constructing small internal stores. Doors must be fire-resisting and self-closing.

Rubbish disposal

211 When you are developing waste management plans setting out how to manage building materials and resulting waste during the project, assess the risk from fire and implement any controls deemed necessary.

212 All construction sites, especially in the latter stages such as fit-out, can generate large amounts of mostly combustible and easily ignitable rubbish. Implement some simple site rules to prevent the accumulation of rubbish (see Figure 8).

213 Consider the following:

- Set site rules and ensure that they are followed; for example, contractors must clear rubbish daily or more often.
- Provide facilities for storage of rubbish, such as skips.
- Keep flammable rubbish, such as contaminated rags, in a closed-top, fire-resisting container, such as a metal dustbin.
- Situate rubbish skips outside (place it so that if it does catch fire it does not put at risk the site or other properties nearby).
- Store empty bulk fibre bags, sacks and wooden pallets in a safe place until they can be removed from site.

214 If a skip is less than 3 m away from other structures, take the following precautions to prevent skip fires spreading to the structure:

- situate the skip against a fire-resisting wall, such as brick, that is high enough and has no unprotected openings to prevent fire from reaching other flammable parts of the structure;
- avoid placing skips beneath canopies or overhanging eaves;

- use a chute made of non-combustible materials, such as those complying with BS 1703: 2005;
- restrict the amount of flammable material placed in the skip; and
- empty the skip before it contains a significant fire load.

General fire precautions

215 If there is a fire, people need to be able to evacuate the structure and possibly the construction site itself to reach a place of safety. It cannot be overemphasised that the main aim is to make sure everyone reaches safety if there is a fire. On fast-paced projects the means of escape may need to be considered daily.

216 The term 'general fire precautions' (GFPs) is used to describe the structural features and equipment needed to achieve this aim. GFPs include such things as:

- escape routes and fire exits, including signs and lighting;
- limiting the spread of fire inside (compartmentation) and outside the building;
- fire detection;
- raising the alarm;
- making emergency procedures; and
- firefighting equipment.

217 Part 3 provides further information on the definition of GFP (paragraph 392).

218 Buildings are often at their most susceptible during the construction phase and the GFPs needed will vary from site to site. Sometimes they will be very simple and other times much more complicated, depending on the risks involved at each stage of the construction process. They all need to take account of the size of the site, the number of people present and the nature of the work being done. Individual elements of GFPs must be considered as part of the overall package and not in isolation.

Figure 8 Most construction rubbish can burn. Make sure that it is cleared up and removed from the site as soon as possible

219 This section will help you to decide which GFPs are appropriate in particular construction circumstances. An essential requirement is that GFPs and people's ability to escape must not depend on ad hoc arrangements, such as the use of manipulative devices like portable or throw-out ladders. Nor must it rely on rescue by others such as the fire and rescue service.

Means of escape

220 Escape routes need to be available and accessible for everyone on the site. On open-air sites and unenclosed, single-storey structures such routes may be both obvious and plentiful. However, in more complicated structures, especially where work is above or below ground, more detailed consideration will be needed:

- Proper provision is needed for all workers and visitors wherever they are and however transient the activity, such as workers on the roof in a plant or lift gear room.
- During the course of construction, escape routes are likely to change and possibly become unavailable. It is important to plan and provide replacement routes and to communicate the changes to workers. Reposition emergency signage if necessary.
- Building designs often incorporate fire escape routes for the eventual occupiers. For new buildings, install these at the earliest stage possible to make them available for those undertaking the construction work; for example, by installing staircases with fire protection and fire doors. For buildings being refurbished, try to arrange the work to make use of existing escape routes and keep them available, including keeping fire doors in situ. For demolition sites, ensure protected escape routes and fire doors are kept as long as possible.
- Check the exit capacity of the escape route to confirm it is sufficient for the number of people expected to use it. This must take into account any adjacent occupiers who share the escape route.

Figure 9 Avoid creating dead ends and misleading fire exit signage

- In an emergency, escape via a scaffold is difficult. Try to minimise reliance on it. Where practicable, provide well-separated, alternative access from a scaffold to escape routes in the main building floor (if this is not practicable, see paragraphs 234–238).
- Make sure no flammable or combustible materials are temporarily or permanently stored in any means of escape.
- There should normally be at least two escape routes offering escape in different directions.
- Escape routes need to be appropriate for people who are vulnerable or in a difficult area, such as tower crane operators or people with a health condition or impairment, and suitable support provided.

221 Escape routes need to be clear, uncomplicated passageways which are well lit, properly maintained, prominently signed (see paragraphs 252–267) and kept free of obstruction. See Figure 13a. Figures 9 and 13b show unsafe exits onto escape routes.

222 A basic principle of escape routes is that any person confronted by a fire, or the effects of it, can turn away from it or pass it safely to reach a place of safety.

223 Where the basic principle above cannot be realistically accommodated, it is important to minimise the risk of being trapped by a fire in dead-end situations (see Figure 9). The distance from a dead end to the fire exit must be as short as possible. Avoid making this route pass through a higher-risk area. For example:

- Where operations of high fire risk are carried out, nobody should have to negotiate their way past the work area or plant to make their escape. For example, if people are laying floor tiles or working on pipes that have carried flammable materials, start at the dead end and work back to the escape route.
- Do not store combustible materials or allow them to accumulate at the exits from dead ends, such as by doorways from rooms or along narrow or restricted escape routes such as corridors.

Travel distance

224 In a fire, smoke, flames and heat can spread quickly. Do not overestimate how far people can travel before they are adversely affected. Identifying the appropriate distances and time required to reach safety (travel distance) will depend on various factors, including the structure and layout of the building, the location of the fire, where people are relative to this and the activities they are undertaking, and how quickly the fire could grow. Travel distances are an essential part of the site-specific risk assessment.

225 Table 2 gives guidance on the maximum travel distances from a work area to a place of safety. This is usually an exit from the structure, typically a door, leading to a safe area outside at ground level. Persons should not be required to approach or re-enter the structure. Where a protected escape route is needed it should be within the maximum travel distance, where practicable. Examples include a stairway or a compartment protected against fires (see Stairways, paragraphs 232–241 and Compartmentation, paragraphs 268–277).

226 The figures listed in Table 2 originate from approved documents for the Building Regulations.

227 The risk assessment must consider all aspects that can affect the ease of escape, including the type of surface people have to travel over and the work process being carried out. It may be necessary to have shorter distances than those stated in Table 2; for example, if a surface such as reinforcing bars slows down speed of travel or if work needs to be made safe before evacuation can commence. It is imperative that all people can escape in a reasonable time. Figure 10 shows an example of uneven surfaces on an escape route.

228 The travel distances are measured as the actual distance a person must walk and not as the crow flies. Take care to minimise obstructions so that maximum travel distances are not exceeded. It is sensible to arrange the work to keep travel distances as short as possible.

229 This guidance recommends that wherever possible workplaces have two separate means of escape in case of fire. For high-risk buildings it recommends a maximum distance of 25 m to safety, or to a protected route out of the premises (see Table 2).

230 Remember that all recommendations such as travel distances are guidelines. They must be considered as part of the overall package of fire protection measures. Variations from individual advisory standards have to be matched by a commensurate increase in other fire protection measures.

231 Some building trades associations issue their own specific guidance for particular construction methods and, in so doing, recommend travel distances slightly higher than those advised in Table 2. However, these trade associations base these higher values on requirements that their members enhance other fire safety measures. One example is the Structural Timber Association (STA). It provides advice to members about timber-frame site escape distances

and additional advanced warning systems (see Further reading section). Such measures could include heat or smoke detectors that are suitable for use on the particular construction site and/or fire detection by CCTV and thermal imaging cameras at suitable locations. The earlier warning gives slightly more time for escape and to cover the additional travel distance; however, the practicalities of implementing these measures effectively must be considered for each site individually.

Stairways

232 Consider carefully the means of escape from work areas above or below ground level. The speed of travel on ladders, scaffold staircases and permanent staircases can vary significantly. Assess the time people take to get to a place of safety when using ladders and different types of staircases. Those planning the project must consider evacuation routes as part of the process and make sure that staircases are provided in preference to ladders where reasonably practicable.

233 It is especially important to ensure that the stairways and ladders are positioned or protected so that any fire will not prevent people using them.

234 Except for small two-storey buildings with travel distances well within those given in Table 2 (see also paragraphs 221–231) for dead-end travel, there is normally a need for at least one stairway to be properly protected against any fire. In the finished building, this is typically provided by situating the stairway in its own dedicated, fire-resisting shaft. In these circumstances, the travel distance is measured from the worksite to the fire door of the protected stairway.

235 Fire-protected stairways are a feature in many buildings. Sequence the project to ensure these are installed and made available for use as early as is practicable in the construction of new structures and before the fire risks increase, such as when fitting-out starts. The protected stairway must progress floor by floor with the building. Plan the construction work in an existing building so the protected stairways are maintained during the project.

236 In escape stairways do not use ceiling, wall or floor coverings which, if ignited, would allow the fire to spread rapidly, or the effects from it to be exacerbated. The ideal surfaces are plaster or concrete, which may be painted or sealed, as appropriate. Protective coverings in escape stairways must be flame-retardant (see paragraphs 205–206).

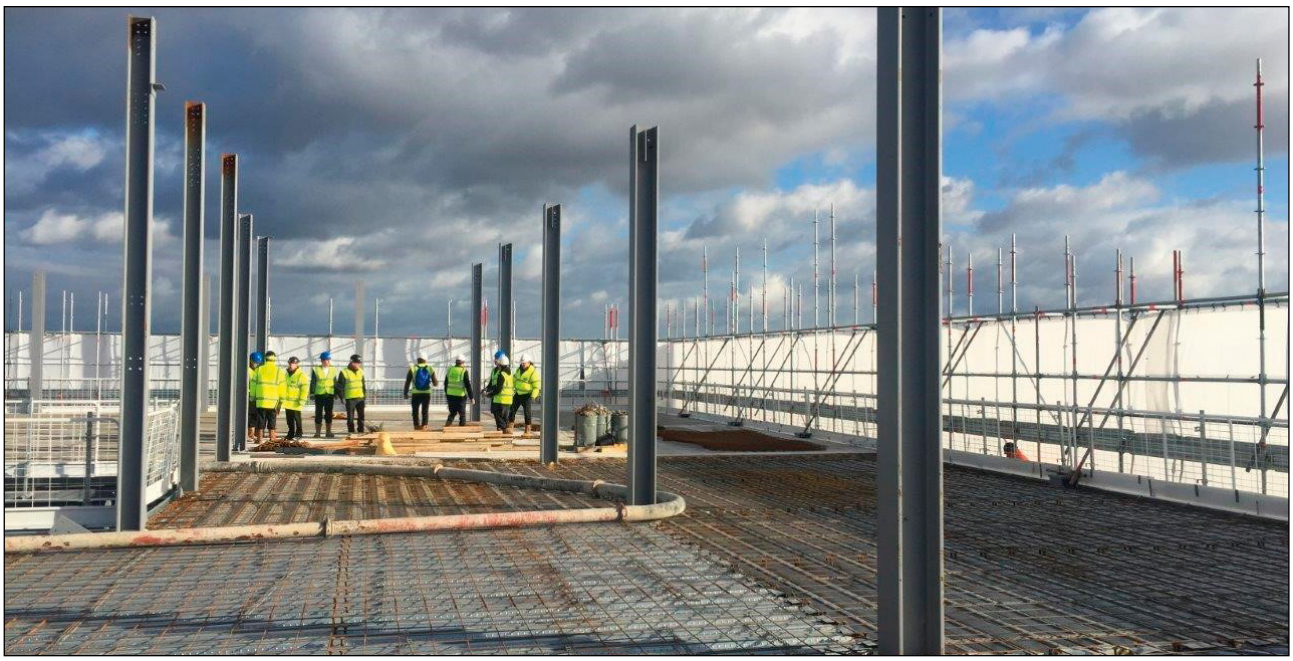


Figure 10 The surface of the escape route can affect the speed of travel and time to escape to a place of safety in case of emergency

237 Where reasonably practicable, provide alternative protected stairways. This is essential for structures that are more than four storeys above ground. If a second protected stairway cannot be achieved, implement more robust GFPs in accordance with the risk assessment. With the exception of small basements or subterranean structures, at least one stairway must exit to the open air at ground level.

238 When temporary escape routes are required for changes in level (changes from one floor to another) consider installing proprietary all-metal system staircases. These can be adapted to any scaffold. If there are practical reasons why these cannot be used, such as a lack of space, under certain limited circumstances a fixed ladder may be acceptable instead of stairs. Designers must allow sufficient space for a safe exit, or protected stairway, from the building using stairs. Ladder access should only be used as a last resort.

External escape stairways and ladders

239 If the nature of the work means it is not practicable to provide or maintain an internal protected stairway, you should provide external temporary escape stairways. Adequate stairways can be constructed from scaffolding (see Figure 11) or using a proprietary system. A temporary stairway attached to the external walls, as part of scaffolding, becomes part of the premises until it is removed (see Part 3, Fire Safety Act 2021). The important requirement is that the external wall against which the stairway is erected must be imperforate and afford a nominal period of 30 minutes' fire resistance for 9 m vertically below the stairway and 1.8 m either side and above, as measured from the stair treads. This means that all doors, apart from the uppermost one leading onto the external stairway, must have 30 minutes' fire resistance and be self-closing. Any other openings, including windows, that are not of fire-resisting construction, must be suitably protected (eg with plasterboard, proprietary mineral fibre-reinforced cement panels or steel sheets).

Table 2 Maximum travel distances for enclosed structures

	Fire hazard		
	Lower	Normal	Higher
Alternative	60 m	45 m	25 m
Dead end	18 m	18 m	12 m

Notes

Alternative escape routes should, where possible, proceed in substantially opposite directions. The principle is that they are sufficiently apart that any fire should not immediately affect both routes. As such, they should not be less than 45° apart (and in Scotland may need to be greater than 45° in accordance with Building standards technical handbook 2017: non-domestic buildings[15]*).*

Dead-end travel distances are significantly shorter. This is so people have time to negotiate their way past any fire between them and the exit before it threatens their escape.

Lower-hazard areas are those where there is very little flammable or combustible material present and the likelihood of fire occurring is low. Examples could be steel or concrete structures in pre-fitting-out stages.

Normal-hazard areas will cover the majority of situations. Flammable and combustible materials are present, but of such a type and disposition that any fire will initially be localised.

Higher-hazard areas are locations where significant quantities of flammable or combustible materials are present such that, in the event of a fire, rapid spread will occur possibly accompanied by copious amounts of smoke or fume. Normal precautions to minimise the fire load should ensure that such areas are rare on construction sites. Examples of where they might occur are timber-frame developments when the timber is not treated to ensure fire resistance, demolition or refurbishment work involving oil-contaminated wooden floors or linings, and fixing floor and wall coverings using flammable adhesives.

The fire hazard category of a building may alter throughout the construction phase. For example, a

lower-hazard steel-frame building may move to normal- or higher-hazard during fit-out depending on the combustibility of materials used and the construction methods. The escape routes requirements need to be assessed during programming and reassessed as construction progresses.

240 In the open air, such as work on the initial framework of a structure, it is unlikely that an imperforate barrier will be available to separate the escape stairway from the work area. In such circumstances, unless the travel distances are well within those given in Table 2 (see paragraphs 224–231) for dead-end travel, you should provide at least two alternative routes. These should be well apart, ideally at opposite ends. If the structure or building is within a sheeted enclosure, such as for weather protection, environmental or safety reasons, at least one of the routes must be outside the enclosure (see Figure 12).

241 Remember that the speed at which people can escape via ladders is much slower. Ladders may be suitable for simple projects and for small numbers of able-bodied, trained workers. On complex or high-rise buildings you should use proprietary stairways.

Escape route sizing

242 While stairways may be adequate for normal entry and exit, do not overestimate their capacity in an emergency, when 'bottlenecks' can easily occur. Recommended widths are related to the number of people expected to use them in an emergency. For example, a stairway (in a building under construction)

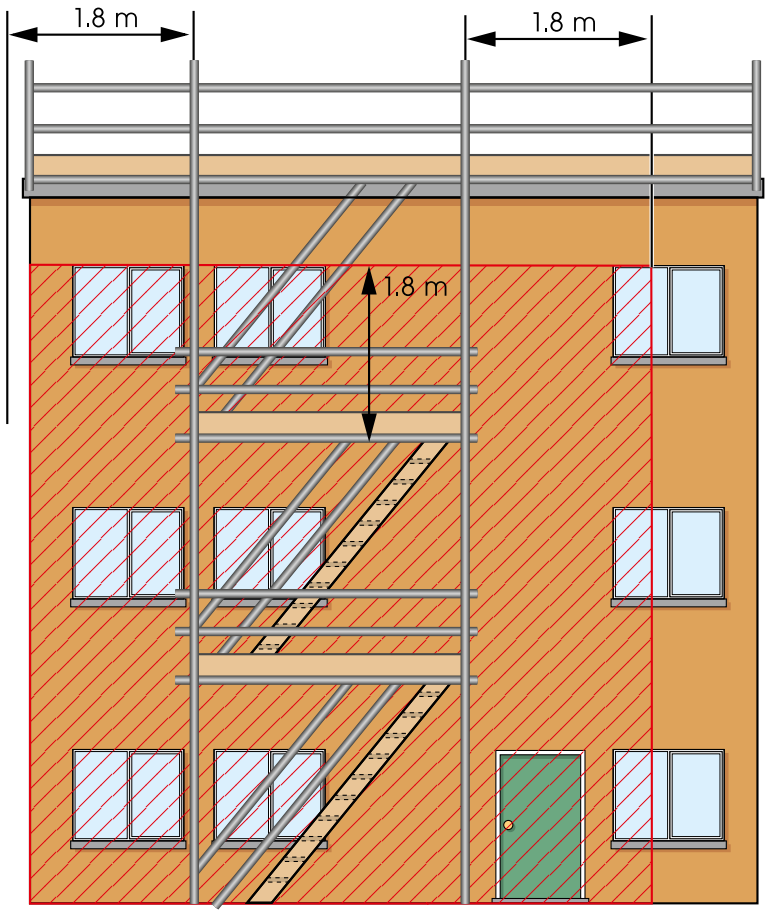


Figure 11 Temporary scaffold-based escape routes need to be protected from fire inside the building. The windows inside the shaded area need to be blocked off with fire-resisting material and the ground- and first-floor doors need be fire-resistant and self-closing

serving two floors should normally be a minimum of 1 m wide to adequately cater for about 200 people. However, if the door leading to or from this is only 750 mm wide, the escape route via this door is considered adequate for only about 100 people.

243 More detailed advice on the size of escape routes is available in BS 9999:2017, in Approved Document B and the Technical Standards that support the Building Regulations and Building (Scotland) Regulations respectively. The majority of structures will be built in compliance with one of these. Therefore, in most cases, the early installation of these escape routes will provide adequate means of escape during construction work. However, if during the construction work the number of people present is greater than the design maximum of the finished building, additional measures must be identified using a site-specific risk assessment carried out by a competent person.

Fire doors

244 Fit fire doors giving access to protected stairways as early as possible. If it is not practicable to fit the final fire doors, install temporary fire doors for short-term use and replace them with the final fire doors later in the construction project.

245 Keep fire doors closed and do not wedge them open. If this is not possible, they must be fitted with effective proprietary self-closing devices; these are activated by the fire alarm and release the door, allowing it to close automatically. Fill in any gaps between fire doors and their frames with intumescent strip and smoke seals. Evaluate the fire resistance period of the doors in the fire risk assessment. The minimum period of fire resistance considered appropriate for protected stairways is 30 minutes, and the fire doors and door set must be designed and installed to meet this standard.

246 The fire doors leading to the protected stairway and the final exit from it must open outwards in the direction that people will escape (if more than 60 people are expected to use them). Revolving doors are not considered suitable as they can jam. For similar reasons, avoid sliding doors.

247 The fire doors must be easily and immediately openable from the escape side with a single action and without using a key. If security is required, proprietary fastenings should be used, such as those which comply with BS EN 1125: 2008 or other relevant standards. Configure security doors and turnstiles in such a way that they do not prevent rapid egress from the site in case of an emergency. If turnstiles cannot be suitably configured, or the risk assessment indicates that in an emergency the escape route is inadequate, install a separate fire escape door in close proximity. Fit the escape door with a push bar or similar device.

248 If it is necessary to protect a stairway, corridor or other circulation spaces to ensure safe travel distances, the integrity of the enclosure is critical to its safe use in an emergency. Check that the fire doors are properly maintained and close correctly.

249 It is also important to check that there are no other openings present or made, such as for pipes, wiring and ductwork. If there are, infill them with an appropriate material at the earliest opportunity. Any gap that may cause a fire to spread from one side to another must be suitably fire stopped with fire-resisting materials. Fire can also spread rapidly over suspended ceilings and raised floors. In refurbishment work, do not assume that there are no holes breaching the enclosure in the existing structure. See paragraphs 268–277 for further information on compartmentation.

Assembly points

250 All designated escape exits from the structure should give direct access to an unenclosed space in the open air at ground level. From here there must be an unobstructed passageway from the structure to a place of safety where people can assemble and be accounted for. The need for assembly points should be considered at the design stage. Sites without sufficient space for on-site assembly must offer alternative methods to account for the building occupants. This must form part of the evacuation plan

and instructions. Consider the size and location of these assembly points:

- on small sites – the pavement outside may be adequate (provided this does not obstruct the fire and rescue service on their arrival);
- on larger sites – you may need to make arrangements to use an area such as a car park; and
- on sites such as chemical refineries – you may have to use a safe refuge such as a plant control room. Where the site is in operation, consult a responsible person from the company regarding a safe assembly point.

251 Where the construction site is surrounded by a hoarding or fence and the assembly point is outside this, you will need an adequate number of gates giving access to the assembly point. There should be clear and unobstructed access to the gates, which should be unlocked and available for use at all times that people are at work on the site.

Emergency signs

252 Escape routes need to be clearly indicated by proper signs (see Figure 14). The Health and Safety (Safety Signs and Signals) Regulations 1996 set the standards for these signs. They should comprise a white pictogram on a green background supplemented with text if appropriate. See HSE guidance L64 *Safety signs and signals: Guidance on regulations*[16] for further details.

253 Signs need to be large enough so that they can be clearly seen and positioned where they are least likely to be obstructed or obscured by smoke.

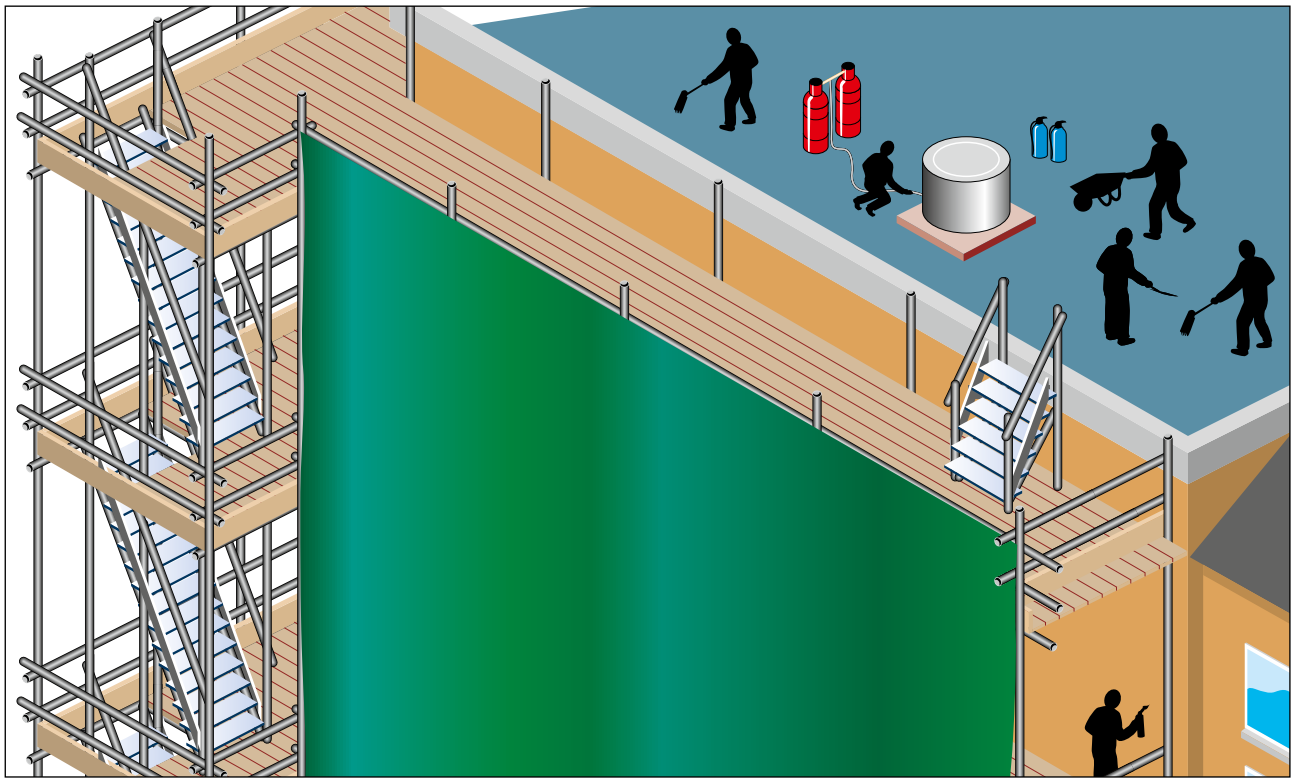


Figure 12 In this job, hot work on the roof and window renovation using blowlamps and substantial amounts of flammable materials mean the fire risk is high. Escape via ladders inside the sheeting could be difficult so unsheeted external access is provided at one end. Some scaffold components have been omitted for clarity (such as roof edge protection). The escape route must lead away from the enclosure where practicable

Figure 13a Keep fire exits clearly signed and free from obstructions

Figure 13b This escape route will quickly fill with smoke in a fire because no fire door is fitted

Figure 14 Emergency signs

Typically, this is about 2 m above the floor, but the layout of the site may make alternative positioning more appropriate. BS 5499–4:2013 provides information on positions of signs for escape routes.

254 If emergency lighting is required (see Emergency lighting, paragraphs 259–267), it may be convenient to use units that incorporate the appropriate fire safety sign. Photo-luminescent way-marking can also emphasise escape routes where lighting is poor.

255 Supplementary signs may also be required to clarify escape procedures; for example, how to open the door if this is not obvious, or where a patent security device is fitted, such as a 'Push bar to open' sign. Similarly, where there is danger that a fire exit may become obstructed, display a conspicuous 'Keep clear – Fire escape' sign. Signs complying with BS ISO 3864–1:2011 are acceptable.

256 Signs need to be made of suitable material, be sufficiently durable to withstand site conditions, securely fastened and properly maintained (including kept clean).

257 If circumstances alter and any sign becomes inappropriate remove it. For example, if an escape route is changed it is imperative to take down any signs giving misleading or confusing information and to display signs indicating the new route.

258 Give training to all workers (not forgetting those who are unable to clearly understand written or spoken information and instructions) so that they fully understand the signage in a fire emergency to ensure their safe escape.

Emergency lighting

259 Emergency escape lighting illuminates escape routes, firefighting equipment and escape signage to aid escape in case of emergency.

260 Normal lighting could fail during a fire. If work carries on inside enclosed structures or at night, emergency escape lighting will normally be required to ensure that escape routes can be identified and used safely. Escape lighting does not have to meet normal work standards but must be adequate for people to use the route safely.

261 For work at night on outdoor or substantially open sites, spill lighting from adjacent sites or locations, such as from street lighting, may be enough to enable escape.

262 Within buildings and enclosed structures, escape lighting (especially in escape routes) will generally be needed in the following circumstances:

- underground or windowless accommodation;
- stairways without natural, borrowed or spill lighting;
- internal corridors without borrowed light, which are long enough for the escape route to be unclear; and/or
- where work continues outside daylight hours (consider the shorter daylight hours in winter).

263 In the event of failure of the primary lighting, the emergency escape lighting needs to come on immediately. It may be powered by a battery or emergency generator supply. The lighting should conform to BS 5266–1:2016.

264 If work is carried out in buildings in which such emergency escape lighting is already fitted, plan the work to retain this for as long as possible. Similarly, if it is to be installed in a new building, plan the work so the emergency escape lighting is commissioned as early as possible.

265 Way-finding methods, such as photo-luminescent signs and paints to indicate the main escape route features, can be useful. These can, for example, emphasise changes of floor level, stairways and ladders, and obstructions such as pipes or features which extend into the escape route.

266 The correct operation of the emergency escape lighting systems should be:

- tested after installation and after any new components are added;

- routinely checked and tested by a competent person;
- periodically serviced and any necessary rectification or repair carried out by a competent person with the appropriate level of training and experience; and
- the work must be carried out in accordance with the supplier's instructions or, where relevant, to the appropriate standard. Keep records of the work carried out.

267 Test escape lighting at a time of minimum risk, such as when the site is substantially unoccupied. After tests powered systems usually need to recharge.

Compartmentation

268 To stop a fire spreading (in some types of high-risk structure this can be very rapid), a building can be subdivided by fire-resisting walls, floors and sometimes ceilings. This is called 'compartmentation' and a possible example of this is discussed in the stairways section (paragraphs 232–238). Compartmentation is particularly important for high-risk projects (see paragraphs 331–386).

Compartmentation might form a major part of the fire strategy for the completed building, especially for the larger and more complex structures. The early installation and completion of compartments can also provide protection during the construction phase (in accordance with the Building Regulations). It should be a priority during the planning stages of a project but, in practice, there will be limits on how early compartmentation can be installed. Any openings need to be protected to an equivalent standard of fire resistance to the rest of the compartment.

269 It is essential to maintain the entirety of the fire-resisting construction of compartments. Compromised compartments (eg with unprotected openings) do not work either during construction or in completed buildings and can undermine fire precautions catastrophically.

270 To be effective, the compartment must be complete both horizontally and vertically, without any voids and/or holes passing through it. The following are examples where compartments may be breached:

- refurbishment – consider concealed spaces such as behind panelling and cavity walls;

Figure 15 Fire stopping installed around penetrations made for services and in the gap around windows

- raised floors for computer suites;
- holes requiring patching;
- voids/openings for services to pass through; and
- damage from site vehicles.

Figure 16 An example of an interconnected alarm and fire extinguisher point in a refurbishment project. Most sites will require an interconnected alarm system (either wired or wireless)

271 Alternative measures must be found and implemented to mitigate fire risks where compartmentation is not practicable. The risk assessment must take account of process fire precautions and GFPs and must be communicated to all relevant parties.

272 Monitor work activities carefully to ensure that any holes or gaps remaining after the construction work is carried out are correctly filled in. This may need to be a temporary measure until the permanent fire stopping is installed. Protect any openings to an equivalent standard of fire resistance to the rest of the compartment (see Figure 15).

273 As discussed for escape routes, compartmentation can assist evacuation where areas are large and they should provide a degree of protection above or below floor/roof level.

274 Large or more complex buildings may entail fire-safety engineering solutions, making use, for example, of smoke control systems. It is recommended that you complete the installation of the complete fire-safety engineered package of safeguards as soon as possible in the build. This is not always practicable, and you may need to use temporary compartmentation during the construction phase (of, for example, an atrium).

275 Compartmentation of staircases in high-rise buildings needs to be installed early and maintained throughout the construction work. This includes suitable self-closing fire doors. If necessary, install temporary fire doors and compartmentation until it can be replaced by final finish products.

276 Temporary compartmentation must provide a nominal period of 30 minutes' fire resistance, paying particular attention to escape routes, stairwells, services ducts, lift shafts and voids. You can do this by using a timber studding framework faced with 12.5 mm thick plasterboard, skimmed with 5 mm of plaster to protect the joints. Alternatively, use mineral fibre-reinforced cement boards. Typically, boards need to be fixed to both sides of the studding. However, where the compartmentation needs to contain a fire

on one side only, you may need boards only on that side. Take the advice of the supplier on the methods of fixing and finishing needed to achieve the period of fire resistance in such circumstances. If fire compartmentation cannot be achieved, a risk assessment must be completed by a competent person with the skills, knowledge and experience to evaluate the risk of not providing compartmentation. You must identify and implement reasonably practicable alternative measures to mitigate the risk.

277 If there is a high risk of impact from work activities breaching the plasterboard compartmentation, it may need protection or other precautions to be provided.

Fire alarms

278 The aim of any fire warning system is to ensure that people on the site are alerted to make their escape before a fire becomes life-threatening. The essential requirements of the fire warning signal are that it is distinctive, clearly audible above any other noise, or visible, can be heard and is recognised by all the people on the site.

279 False alarms and unwanted fire signals can be costly on any project and can also lead to complacency in people needing to respond. Careful selection of systems and management arrangements can reduce this nuisance.

280 The sophistication of the method of giving warning of fire will vary from site to site. For example:

- using 'word of mouth' to raise the alarm would only be appropriate for very small open-air sites or small-scale open structures;
- on a limited number of sites that are either open structures or structures with only a few rooms, the minimum provision is a small self-contained proprietary fire alarm unit;
- it is expected that, on the majority of sites, an interconnecting system (wired-in or wireless; see Figure 16) of call points and warning devices, such as sounders or visual strobes, be required to provide an effective fire warning system. This could be a permanent or temporary solution as long as it works on the site;
- consider appropriate alarm systems (or other proprietary measures) for noisy areas, people with a health condition or impairment, lone workers and people whose ability to hear may be affected by personal protective equipment.

281 The permanent fire alarm systems may be fitted as part of the construction contract. If so, plan the work to install the fire alarm system as early as possible. If the building has a wired-in fire alarm system already installed, keep it in working order for as long as possible. Where fire alarms are relied on during the construction phase, it is vital that existing systems are not inadvertently disabled, such as during work on electrical systems in refurbishment work. If they are disabled for any reason, provide alternative arrangements. If you need to isolate part of the alarm or detection system to avoid activating it inadvertently, implement robust procedures to make sure it is reactivated when work is completed or stops at the end of the day or for a break.

282 Indicator panels sometimes form part of more sophisticated alarm systems. They can provide information on the location of the fire, although this is limited to the location of the activated call point. Such systems require comprehensive labelling so that there is an identifiable floor location, not just a code. Such a system can help inform site managers and the fire and rescue service about what emergency action is required.

283 Consider the use of automatic fire detectors during construction work. These are only effective in more enclosed areas and options include smoke or heat detectors. It is not acceptable to cover or deactivate smoke detectors where work generates dust. Instead, dust should be minimised or extracted. Detectors may be appropriate on high-risk sites, in TAUs such as site offices, or in locations where a fire might occur and develop unnoticed until it threatens people's means of escape.

284 Install any permanent detection system as soon as possible. If it is not practicable or required, temporary detection could be used. Any detectors should be interconnected to the fire alarm system.

285 Domestic-type smoke detectors are not considered appropriate on complex high-rise sites. However, on small, lower-risk sites or small TAUs they may be acceptable.

286 When a fire is detected, and the alarm raised, everyone must make their escape without delay. If it is possible that a false alarm could cause significant problems, develop procedures to verify the outbreak of a fire. For example, you could provide an intercom system adjacent to the fire alarm to allow verbal confirmation of a fire once someone has raised the alarm. This could link to a control centre from which the main alarm is then raised. Alternatively, the person in the control centre might be in radio contact with a nominated person on the fire floor trained to assist with fire safety management. Build safeguards into such procedures to ensure that, while anyone is on site, the control centre is always occupied (including during breaks) and, if the system for verbal communication fails, effective sounding of the alarm is not delayed.

287 The operation, maintenance and effectiveness of the fire alarm system must be regularly checked. The system should be:

- tested after installation and when any additional components are added to the system by the competent person installing the system;
- tested weekly by a nominated and competent person to ensure the alarm is operational and audible in the work areas; and
- periodically serviced and any necessary rectification or repair carried out by a competent person having the appropriate level of training and experience.

288 The work should be carried out in accordance with the supplier's instructions or, where relevant, to an appropriate standard (eg BS 5839–1:2017). Keep records of the work carried out. It is particularly important to check the effective operation in practice of the alarm systems that rely on verbal communications.

289 It is especially important to ensure that, as the site develops, the alarm system is modified to maintain effective coverage of the entire site.

290 General means for communication should be tested daily; for example, portable radios or any intercom devices should be checked at the start of shifts. Servicing should be in accordance with supplier recommendations.

Firefighting equipment

291 As well as providing fire extinguishers for specific activities, such as hot work or LPG storage, you must also situate them at identified fire points around the site. Unless the equipment itself is predominantly red in colour and the location self-evident, you can identify the fire point by providing a stand that is substantially red in colour or providing an appropriate safety sign (one which complies with the Health and Safety (Safety Signs and Signals) Regulations 1996 or BS ISO 3864–1:2011). Fire extinguishers should be situated on hooks or stands to keep them off the ground.

292 The primary purpose of fire extinguishers is to tackle incipient fires to prevent them becoming larger, or to aid an escape. Putting out larger fires is the fire and rescue service's role and, as such, should not be tackled by site workers. Do not delay calling the fire and rescue service while attempting to tackle a small fire with available firefighting equipment.

293 The extinguishers must be appropriate to the nature of the potential fire (see Figure 17). For:

- wood, paper and cloth, use a water, foam or multi-purpose dry powder extinguisher;
- flammable liquids, use a dry powder or foam extinguisher; and
- electrical items, use a carbon dioxide (CO_2) or dry powder extinguisher.

294 Extinguishers should conform to a recognised standard, such as BS EN 3–7:2004 +A1:2007. It is also important that they are under an appropriate management system to ensure they are regularly checked and properly maintained. This is not only to make sure that they are available and ready for use, but that accidents do not occur to the person using them.

295 Examine fire extinguishers and hose reels at least annually in accordance with a recognised procedure, such as that in BS 5306–3:2017 and BS 5306–1:2006 respectively. The work should be carried out by a competent person who has received appropriate training. Record the date and results of the examinations, preferably on a service sticker attached to the individual piece of equipment, so that the particular extinguisher or hose reel checked is identifiable.

296 The number and type of extinguishers present depends on the fire hazard that the fire risk assessment has identified. For a typical spread of fire hazards, the following are considered to provide a reasonable level of cover per 200 m^2 of floor area, with no fewer than both of the following on each floor:

- one 13A rated water or foam extinguisher; and
- one CO_2 extinguisher (at least 1.1 kg).

297 Note that dry powder extinguishers may be provided in addition to or substituted for any of these extinguishers, especially where the nature of the fire hazard warrants this. Dry powder does not have a cooling effect and may reduce visibility. Most fire extinguishers have a fire rating printed on the canister. This code defines the class (or type) and size of fire this type of fire extinguisher is capable of extinguishing.

298 Hose reels may also be used instead of the water-based extinguishers. One per 800 m^2 of floor area is recommended, but make sure it can reach all points of the area to be covered. Hose reels should be of an appropriate standard, such as BS 5306: Part 1, 2006 and, as with extinguishers, they need to be

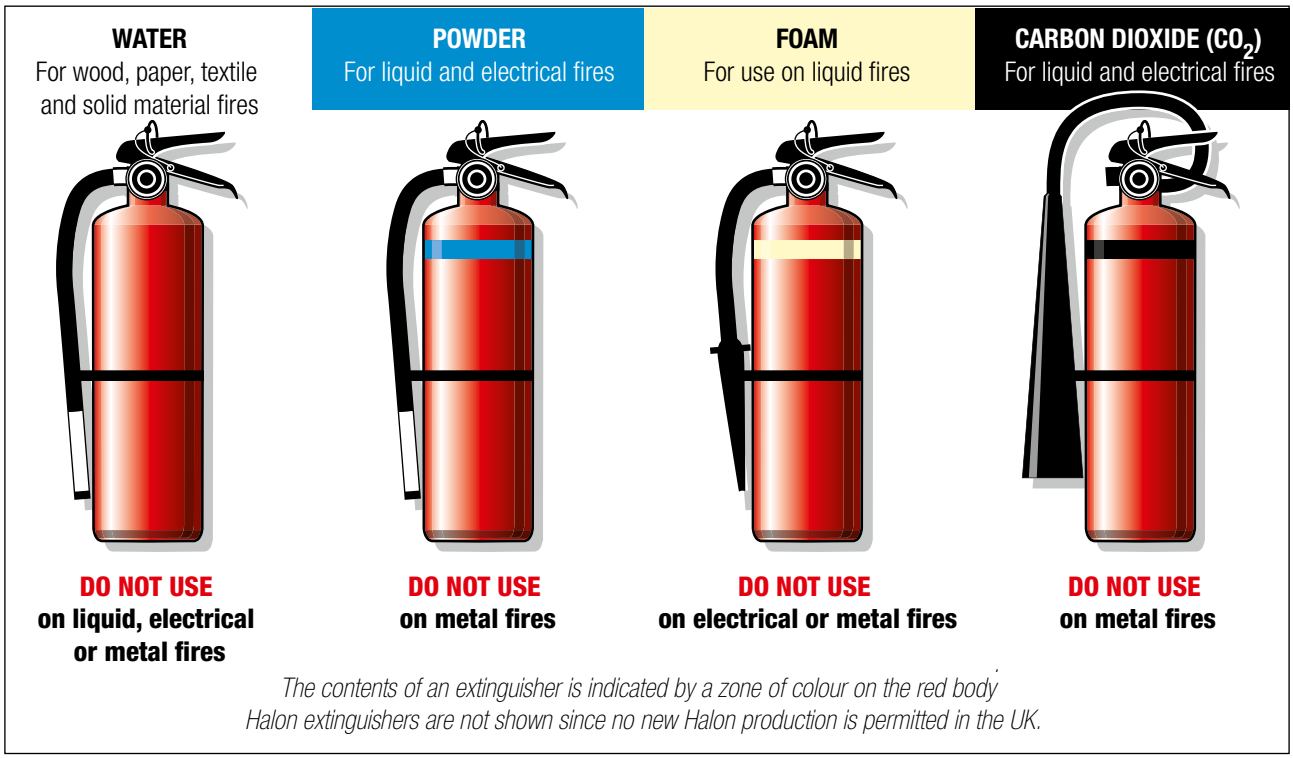


Figure 17 A selection of fire extinguishers. Fire extinguishers complying with BS EN 3 are red with a coloured zone identifying the extinguishing agent. For example, blue signifies a dry powder fire extinguisher. The contents of an extinguisher are indicated by a zone of colour on the red body.

regularly checked, properly maintained and used by trained personnel.

299 It is important that everyone knows how to use the firefighting equipment. All firefighting equipment must have clear operating instructions with it. Workers carrying out higher-risk activities, such as hot work, need to be competent in the use of the firefighting equipment provided and training will normally be required to achieve this. Competent advice should be taken about fighting fires that involve batteries, such as lithium-ion, and hydrogen gas fires.

300 Large or more complex structures, such as high-rise buildings, may have fixed firefighting systems installed. These may range from dry and wet risers to automatic sprinkler systems. Commission these early, as the build progresses, or keep them in service during refurbishment projects (see paragraphs 377–386).

301 It is worth planning the work so that the above systems are available for as much of the construction phase as possible.

302 Recognise that sprinkler provision, when commissioned and fully operational, may have allowed for reduced fire resistance or extended travel distances. Reliance on sprinklers at construction stage should be carefully risk assessed if you intend to use them as a control measure. You should manage sprinklers carefully to avoid isolating the system and the potential for other works to impact on its operability.

303 If you are working on an existing building that is fitted with fire-engineered solutions, such as sprinklers or smoke control, and these are put offline, this needs to be reflected in the assessments and it may be necessary to provide temporary alternatives.

Emergency procedures

304 The previous section described physical GFP measures. This section describes the management procedures to make sure that the physical measures will work effectively if they are ever needed. The most important element is an effective emergency plan.

Other risks that require emergency plans may be integrated with fire procedures. Plan emergency procedures before the work begins and put arrangements in place to ensure these are supported from the start of the construction work.

305 On existing occupied sites, liaise and agree emergency procedures with the other occupiers. Ensure that the means are in place to let each other know straight away if an emergency arises. If simultaneous evacuation is needed, make sure the escape routes are of sufficient capacity to achieve this.

306 Some emergencies may require total evacuation of the site; for example, where it comprises a single high-rise structure. Some emergencies may require only partial evacuation; for example, where a series of separate structures is present on the site. Some emergencies may require evacuation of adjacent premises. Give careful thought to ensuring that the emergency arrangements are appropriate and capable of achieving the desired goal.

307 It is important that all people on site understand any procedures. Ensure procedures are communicated to everyone, taking into account the changing workforce, transient nature of construction workers and any personnel who may have difficulty understanding written or spoken instructions.

Developing an emergency plan for fire

308 All emergency plans need to be clear, unambiguous and known to all who are on the site. When developing plans, consider the following aspects:

- Where will workers gather after evacuation from the site? (See Assembly points, paragraphs 250–251.)
- Who will be in charge of the situation and what will be their responsibilities? What information and/or training will that person need to carry out those functions? Who else needs to be appointed to assist the person in charge in fulfilling their duties? (See People to assist with fire safety management, paragraphs 311–312.)

- How will the people in charge communicate with each other?
- How will it be confirmed that everyone has reached the assembly point? (For example, head counts, checking off against site security logs brought to the assembly point, or wardens performing a sweep of their areas to ensure no one has been left behind.)
- Will adjacent premises need to be evacuated, and how will this be communicated?
- Who will contact the emergency services and how? (The arrangements should not result in a presumption that someone else has called the emergency services.)
- Who will meet the emergency services when they arrive and provide them with information? They will need to know:
    - of any particular risks that could affect the firefighting or emergency operations, such as the location of gas cylinders (especially those containing acetylene, LPG and oxygen), asbestos, unguarded voids, edges and unstable structures, and changes to access or water supplies;
    - the likely whereabouts of anyone unaccounted for who may still be on site, including details of any suspected, unauthorised occupation;
    - location of vehicles and plant fuelled by electricity or hydrogen, refuelling points and battery storage areas.
- What are the arrangements for the fire and rescue service to gain access if the site is unoccupied? How are these arrangements communicated to them?
- If the fire and rescue service are called to a fire when the site is unoccupied, or occupied only by security staff, how will they obtain relevant information to enable them to work safely and effectively? Even if the site is unoccupied, they will still need to know of any particular risks, such as the location of gas cylinders.
- How will the plan be communicated to workers who are unable to clearly understand spoken instructions?

309 Keep the number of people involved in managing the emergency response to the minimum necessary. This will reduce the scope for confusion between different parties carrying out different tasks during the emergency. Nominate and train deputies to cover for key personnel when they are absent, such as for sickness or holidays.

310 Managers, supervisors, and their deputies must understand and implement safe evacuation procedures to avoid delayed evacuation. Workers may be reluctant to leave work if they are at a critical stage in their work or if they perceive the alarm to be false or a drill.

People to assist with fire safety management

311 On larger or higher-fire-risk sites, it may be appropriate for the responsible person to appoint others to assist with the management of fire safety and provide an increased level of management oversight in relation to fire safety on site. The number of people appointed should be appropriate for the size of the site and risk involved. Different people may fulfil the role dependent on the organisation of the site and the business. The title given to workers who are appointed to provide assistance is not important; examples include ‘fire marshal’, ‘fire warden’ or ‘fire safety co-ordinator’. It is important to clearly define their roles and responsibilities and to give them sufficient time and authority to fulfil their role. Give relevant training to anyone with a specific role.

312 The following tasks could be part of the defined roles to assist with fire safety management:

- completing the fire plan/construction phase plan for fire safety;
- undertaking or arranging for fire risk assessments to be completed;

- checking that the site's fire rules are observed, including requirements for smoking, hot works and compartmentation;
- ensuring the GFPs remain adequate, available and in good order;
- arranging for inspections, testing and maintenance of fire safety systems;
- co-ordinating with designers and principal designers;
- co-ordinating with other occupiers on the site and any adjacent premises;
- running fire drills;
- arranging for fire safety training for people with specific roles and workers on site;
- maintaining a pack of information for use by the fire and rescue service to include site-specific hazards, water access points and routes through the site, etc.
- issuing hot work permits;
- accounting for people in case of a fire evacuation;
- liaising with the fire and rescue service if there is a fire and providing information on access, people trapped and any special hazards.

Liaison with the fire and rescue service

313 In some cases, it will be appropriate for people managing construction work to liaise with the local fire and rescue service before work starts. Where there is liaison, it is important to keep the fire and rescue service informed of any changes affecting access, risks and firefighting facilities throughout the project as the work progresses.

314 Liaison with the fire and rescue service may be relevant, especially on large sites or if any of the following high-risk situations apply. All these situations must be specifically addressed in the site fire risk assessment:

- There is a substantial risk to the public; for example, where fire may result in the need for large-scale evacuation of heavily occupied neighbouring areas.
- Large or high-fire-risk structures are built close to other occupied premises.
- There are particular risks posed to firefighters: for example, acetylene; the presence of large numbers of other gas cylinders or flammable liquids on site; timber-frame structures made from non-treated wood or panels; unusual construction techniques; the re-ignition of lithium-ion batteries; basements or underground structures such as tunnels.
- There are volatile materials with flash points less than 10°C above the maximum expected ambient temperature. Install warning signs in the storage areas for these hazardous materials and have information available about them for the fire and rescue service.
- The fire and rescue service's access to the site may be limited; for example, if access roads are narrow and congested or there is no access available to one side of a large site.
- Water supplies are limited or do not exist, such as on a large factory development in a greenfield site, or a large historic building.
- Work takes place above 18 m high (or seven storeys or more), where specialist equipment may be required, and anywhere else where specialised rescue equipment may be needed, such as in tunnels.
- Sleeping accommodation is provided for construction workers.
- Occupied buildings with large or high-risk occupancy (eg residential) are undergoing refurbishment.
- New buildings are undergoing partial occupation before completion (especially where the partial occupation is for residential use).
- Vulnerable people may be affected by a fire.
- For fires that involve batteries, such as lithium-ion, and hydrogen gas, competent advice should be obtained.

315 The construction of timber-framed buildings creates a heightened risk of a fire spreading beyond the site to neighbouring buildings. STA membership requires members to register the following projects with the National Fire Chiefs' Council:

- where the building floor area (or accumulated floor area for multiple buildings) is over 600 m²; or
- which are in high-risk areas (such as areas of high-density population; adjacent to a petrol station; school; nursing home); or
- which are in areas with known high vandalism rates.

316 Liaison with the fire and rescue service provides them with important information they can use to plan their response, especially for high-risk sites.

317 For smaller and low-risk sites, liaison with the fire and rescue service may be disproportionate. However, it is still necessary to consider how the emergency services will have access to relevant information should they get called to site either in or outside of normal working hours.

Monitoring GFP and fire practices

318 It is important to check escape routes regularly. This may be by the site manager or someone appointed to assist with fire safety management who has the authority to enforce site rules. The frequency of the checks will depend on the complexity of the site and the rate of change. Usually at least a weekly check will be needed, and a daily check of the main escape routes on larger and high-risk sites. The frequency of the checks should be clearly defined.

319 Check fire alarm systems weekly to ensure that they work and can be heard in real conditions. The check should be at the same time each week and people should be informed that the alarm, at that time, is a test. Keep simple records.

320 Fire drills, in which the entire workforce evacuates the site, are a useful means of checking that the GFP arrangements are effective. As the risks of, and from, fire increase and the number of people on site rises (often when the main structure of the building is complete) the need for a drill increases in order to check the training and understanding of site workers and visitors, and also for problems such as 'bottlenecks'.

321 It is important to check that people on site really know what to do if there is a fire. Asking individual workers: 'What is the fire alarm?' and 'What would you do?' are a useful way of checking that the instructions and information given have been adequate.

Fire instruction notices

322 Display fire instruction notices (see Figure 18) permanently and prominently on major escape routes, places where people meet, and circulation spaces. They must be kept up to date to reflect alterations to the building, escape routes, and any other significant changes. The actions must include:

- on discovering a fire, including raising the alarm and firefighting; and
- on hearing the fire alarm, including evacuation, and accounting for people.

323 Consider supplementing these notices with information specifically given to the individual (eg with site passes). Site visitors also need to be made aware of what to do if there is a fire.

324 The fire instruction notices are intended to serve only as a reminder. All people on site, even if they are there for just a few hours, must receive sufficient information to know what to do in the event of fire.

325 The minimum information that needs to be given, and must be given to people the first day they are on site, is:

- location and use of escape routes from their work area, and assembly points;
- the location and operation of the fire alarm point in their working area; and
- any significant fire hazard in their area of work.

326 People will need to be regularly updated on any changes.

327 People required to perform specific functions in the event of fire must be given the additional instruction and training needed for them to carry out their duties. For example:

FIRE ACTION

RAISE THE ALARM

CALL THE FIRE SERVICE

At night

ON HEARING THE FIRE ALARM

Your assembly point is:

Do not stop to collect personal belongings

Attack fire with available equipment if you feel safe to do so

Obey instructions from floor wardens or fire service

Do not re-enter building until told it is safe

Figure 18 Typical fire notice format, with space for entering clear and concise instructions on what to do if there is a fire

- Anyone expected to use firefighting equipment, including an extinguisher, must have instruction and training on the correct selection and use of this. In particular, they need to know when to tackle a fire and when to leave it.
- Equipment such as oxy-fuel gas equipment and bitumen boilers can turn small fires into very big ones if they are left on during a fire. The work method must detail how to leave their equipment in a safe condition without endangering themselves.
- People nominated to liaise with the fire and rescue service require information to carry out this role effectively. Keep them up to date with changes to the site, including those that might affect access for the fire and rescue service, the location and number of people on site, processes presenting a high fire risk, and availability of water.

328 Give workers adequate and regularly updated fire safety training. The type of training should be based on the particular features of the premises and should:

- take account of the findings of the fire risk assessment;
- explain the emergency procedures, and when to report fire incidents or near misses;
- take account of the work activity and explain the duties and responsibilities of individuals;
- take place during normal working hours and be repeated periodically, where appropriate;
- be easily understandable by workers and other people who may be on site; and
- be tested by fire drills.

329 Training must include the following:

- what to do on discovering a fire;
- how to raise the alarm and what happens then;
- what to do upon hearing the fire alarm;
- the procedures for alerting contractors and visitors including, where appropriate, directing them to exits;
- the arrangements for calling the fire and rescue service; and
- the emergency procedures for high-risk activities.

330 Workers must receive appropriate update training when there are any changes to the fire arrangements. Periodic training may also be appropriate to refresh their knowledge, in particular for workers carrying out hot works.

High fire risk build methods

331 From conception, throughout the design phase and during the construction phase, all CDM and FSO dutyholders must consider the risks from fire. They must share information, co-operate and execute their legal duties under CDM to ensure all risks from fire are reduced to as low as reasonably practicable.

332 In most cases, taking the precautions outlined in this publication will control the risk to an acceptable level. Certain build types are more vulnerable to fire during the construction phase and this section deals with the additional precautions to take on sites that present a high risk from fire. In situations where fire spread from a construction site might endanger the lives of people in adjacent properties, and you cannot identify or implement any effective precautions to reduce this risk to an acceptable level, the principal designer must adopt alternative build methods with a lower fire risk, where practicable.

333 Some methods of construction use technology, composite materials and conventional materials to produce buildings that are often quicker to erect or have different properties from traditional buildings. Some of these components are produced off site and then assembled on site, reducing the use of many traditional wet trades such as bricklaying, plastering and plumbing.

334 Because of the nature of their component parts (for example, timber), they may be more vulnerable to fire during the construction phase, when frames and supports are unprotected and exposed. Any fire at this time, when the supporting frame is exposed, may result in rapid fire spread, accompanied by

structural collapse and the potential to affect neighbouring properties.

335 When programming the work, give priority to reducing the duration of the most vulnerable phases. This includes installing the final internal and external cladding as early as possible as well as completing and maintaining vertical and horizontal fire stopping. The installation of fire prevention measures must be a priority. You can keep fire load to a minimum by staggering deliveries of vulnerable material or arranging off-site storage; a good level of housekeeping across the site is essential.

336 From the start of the contract to handover to the client, the person in control must be engaged in and aware of the control measures to follow to prevent fires on site. The site-specific fire risk assessment must be drawn up before the construction phase begins. Fire risk management arrangements and procedures must be in place before work starts. They must include foreseeable processes generated by all contractors.

337 In these types of high-risk structures fire can spread extremely rapidly, making effective firefighting almost impossible and extremely hazardous. Fire mitigation measures must therefore be in place at the earliest stage.

338 Because of the potential for rapid fire spread the selected alarm system must be capable of alerting all people on site to any fire from one activation point, such as an interconnected alarm system. The alarm system must be installed early in the construction process and added to as the build progresses. This may be earlier than on builds using brick and concrete.

339 Because of the potential higher risk, you may need extra precautions at certain vulnerable times of the build. The refurbishment of large traditional or historic buildings are potential high-risk projects because they often contain large amounts of dry timber. The precautions detailed in paragraphs 341–386 for specific high-risk build types are additional to the other fire precautions discussed in this guidance for all projects.

340 See Appendix 3 for a summary list.

Timber-frame buildings and engineered wood products

341 Timber is an accepted form of construction and has been used as a building material for centuries. An increasing variety of timber products are in use. Structural products, such as roof trusses, wall panels, cross-laminated timber, glue-laminated timber and structural insulated panels, are common examples. Each type will have different fire reaction and fire-resistant characteristics. Further information is available from the STA. In the finished building the fire protection should be complete. However, during the construction phase and before the final fire safety measures are installed, fire may spread quickly through the structure and to adjacent buildings.

342 During the planning phase where timber frame is the client's preferred structure, the design phase fire risk assessment must address both the on-site and off-site fire risks.

343 An off-site risk assessment must consider fire spread and the risk to people and property beyond the site boundary and outside of the control of the principal contractor. When a timber-frame extension is being added to an occupied building, the occupied building would be considered off site.

344 The off-site assessment must:

- consider the risk of a fire from within the site boundary spreading to properties outside the site boundary;
- consider the occupiers of any nearby properties, their ability to escape and their escape route in case a fire occurs; and
- identify fire mitigation measures, such as use of timber frame with appropriate fire resistance, which are required to reduce the off-site risk to an acceptable level.

345 There are three categories of timber frame (A, B and C) which have increasing resistance to fire spread. The three categories of timber frame allow the designer to specify the appropriate timber category based on the findings of the off-site fire risk assessment. These categories do not apply to mass timber products, such as cross-laminated timber. Relevant STA guidance is listed in the Further Information section.

346 In situations where fire spread from a construction site might endanger the lives of people in adjacent properties, a more fire-resisting category of timber or other suitable risk mitigation method must be adopted or alternative build methods with a lower fire risk must be specified.

347 The STA's publications *Design guide during construction to separating distances for timber frame buildings*[17] and *16 steps to fire safety*[18] provide further information.

348 The on-site risk assessment must consider risk to people within the site boundary and the principal contractor's control.

349 Dutyholders must prioritise the use of timber and/or materials that have received an appropriate fire protection/retardant treatment for timber buildings. This will not only significantly reduce the risk of fire during the construction phase but also give added protection for the completed building.

350 The removal of permanent fire protection measures during the refurbishment of timber-frame structures creates a high risk of fire spread. Action must be taken to prevent the rapid spread of fire fuelled by dry timber. For example, the use of temporary compartmentation, more robust fire alarm systems, and protected escape routes.

351 The principal contractor will be in control of the site once the construction phase begins. The significant findings of the fire risk assessment and mitigating actions required, along with the emergency procedures, should be incorporated in the construction phase plan before work commences on site. The plan and precautions will need to remain under review as the project progresses. The principal contractor must liaise closely with subcontractors – particularly the structural timber building supplier – to make sure the necessary fire precautions and emergency arrangements are in place and understood before they start work on site.

352 Large timber-frame structures must be designed to ensure the building can be constructed to achieve fire compartmentation progressively and at the earliest stage possible. This will help to prevent fire spread and ensure that personnel within the structure can achieve safe travel distances (see Table 2 and paragraphs 224–241). If it is not practicable to install the final fire materials or fittings early, use suitable temporary materials.

353 Where several timber-framed structures are being built on one site, assess the risk of fire spread between buildings, and the risk of injury to persons on site. The off-site fire assessment must consider the risk to people outside the site boundary if a fire spreads between multiple buildings on site. It must specify mitigation measures where practicable; for example, by the early installation of non-combustible materials on external façades (this must not compromise any emergency exits).

354 When planning GFPs, give priority to providing multiple means of escape to the ground from different parts of the timber-frame structure. Provide temporary external staircases as necessary; do not rely on ladders because of the extended time it takes to descend them.

355 For further information on controlling fire risk and compartmentation in timber-frame developments see the STA's publication *16 Steps to fire safety*.

Composite building panels

356 Composite panels (sometimes called sandwich panels or cassettes) consist of two faces (often made of metal) positioned on either side of a core of a thermally insulating material. These are bonded together so that the three components act compositely when under load.

357 Many thermal insulating products used in sandwich panel systems are combustible. These include expanded polystyrene (EPS), extruded polystyrene (XPS), polyurethane (PUR) and polyisocyanurate (PIR). When openly exposed to a fire they will burn. Some insulation products will release toxic gases during a fire.

358 Designers should consider the potential fire risks during construction when specifying composite panels in the structure. They should also comply with the Building Regulations requirements for the type of building and the part of Great Britain in which the building is located. These may require materials to be non-combustible and to achieve a specific reaction to fire performance.

359 With composite panels, incorrect installation, such as poor joint detailing and inadequate support, can lead to exposed combustible material that is vulnerable to fire.

360 In the construction phase plan consider eliminating sources of ignition during the removal and installation of composite panels. This includes avoiding methods of cutting panels that create sparks; avoiding methods of fixing that involve flammable solvents; and minimising hot works as a means of drying the surface before the panel is fixed.

361 Manage any works on or near an installed composite building panel carefully to ensure the core of the panel is not left exposed and any gaps are filled. Avoid hot works that might come into contact with the exposed core of the panel.

Civil engineering projects

362 In some specific civil engineering projects, such as tunnelling operations, all dutyholders must consider fire risks from conception, through design and construction phases. Fire risks will need detailed assessment by a person with the relevant skills, knowledge and experience of the project type. Specific, fire-engineered measures may be needed to mitigate fire risk; for example, where recommended safe travel distances are not achievable. Designers should substitute combustible materials with non-combustible wherever practicable, including for temporary works.

High-rise buildings (new or refurbished)

363 There are many definitions for 'high-rise' buildings. The Building Regulations, for example, require additional measures on buildings above 18 m (or seven storeys or more). The important factor, in relation to construction site fire safety, is that the risks associated with the build can be adequately controlled, and the GFPs needed in the event of a fire are sufficient to ensure every person on site can return to the ground and to a place of safety. More complex and very high-rise projects are beyond the scope of this guidance. You may need additional help with these from a competent specialist with the necessary skills, knowledge and experience of both fire safety and construction of high-rise buildings.

Process fire precaution considerations for high-rise buildings

364 The problems in high-rise buildings under construction or refurbishment relate to the process of the build method. For example, many of the safety features that make the completed building fire-safe, such as correct compartmentation or fire-engineered solutions, are missing or incomplete until fully commissioned.

365 Incomplete or absent fire-engineered solutions or incomplete compartmentation of the structure may lead to a very rapid spread of smoke and fire. Undertake a specific fire risk assessment of these elements at the design stage (and include in the pre-construction information), to develop provisions for the construction phase, such as temporary compartmentation or other solutions to protect workers and allow the build to progress safely. One solution is to identify control measures within the permanent works fire strategy that could be applied earlier in the construction phase. Put in place an appropriate level of instruction and checking to ensure the elements are correctly installed.

366 Sites are often in built-up areas and close to other structures. From the design stage onwards consider the risks associated with this, such as fire and rescue service access and fire spread to other properties.

367 It is becoming more common for completed floors of new high-rise buildings to become occupied by the client while construction continues on the other levels, or for floors in existing buildings to be refurbished while the remainder of the building is occupied. Clients must make it clear from the design stage if they are considering partial occupation during the construction phase so that appropriate fire protection is planned. The fire protection must address how fire in occupied parts might affect construction workers and vice versa. Competent specialist advice would be required to complete the risk assessment for partially occupied high-rise construction sites.

368 The assessment must take into account the impact on fire escape routes, stairwells and other fire precautions. Communicate clearly any shared arrangements between all parties and define responsibilities.

369 Any design changes or changes to the build sequence during partial occupation must trigger a review of the fire risk assessment.

370 Any occupied floors must fully comply with Building Regulations and full compartmentation and fire safety measures must be in place, including in risers and other vertical shafts that run between occupied and construction areas of the building. Lower floors of high-rise developments should only be occupied where appropriate fire protection is in place in construction areas to prevent fire spread between construction and occupied areas, and fire mitigation measures are inspected and managed.

General fire precautions on high-rise buildings

371 The provision of adequate GFPs, such as escape routes, the travel distances to a safe place, lighting and means of raising the alarm, need careful planning to ensure they are adequate and in place as the construction phase progresses.

372 Because of the extended times necessary to escape from the structure and to maintain the recommended safe travel distances (see Table 2 and paragraphs 239–241), compartmentation will be required. The compartmentation will need to prevent smoke and fire spread both vertically and horizontally.

373 Create compartmentation in buildings over 18 m high (or seven storeys or more) at the earliest opportunity using temporary, fire-resisting materials or fittings with no less than one hour's fire resistance until the permanent fire-stopping arrangements can be put in place. Close off vertical risers, stairwells and lift shafts (including tower crane shafts) at every floor using doors with 30 minutes' fire resistance and cover other gaps and openings. Implement measures to make sure fire doors remain closed, such as self-closing mechanisms or physical locks on risers controlled with a permit-to-work system. Where reasonably practicable, all vertical shafts should be horizontally compartmented at intervals deemed appropriate in the fire risk assessment (not exceeding 10 floors) to prevent the upward or downward spread of smoke and fire.

374 The main stairways will probably provide the primary means of escape and, if this is the case, they will need self-closing, fire-resisting doors (temporary if necessary) at every floor to protect their integrity. If the main stairways are not available, alternative protected routes will be needed. These alternative routes will also need to be suitable for the number of people on site and safe travel distances.

375 If the building is to remain partially occupied, it will be necessary to make sure adequate means of escape are provided for occupants and construction workers and that the fire alarm systems for the occupied parts of the building, and those still under construction, are co-ordinated. Remember that an emergency in the occupied parts of the building could affect the construction site and vice versa. Note that the fire enforcing authority for the GFPs may change

from HSE to the fire and rescue service in any partially occupied building. See Part 3 for further information on the enforcing authority.

376 When practicable, designate at least one staircase with adequate fire protection as the firefighting staircase for the use of the fire and rescue service during an emergency. Such access points are often blocked by scaffolding and must be kept clear.

377 Fixed firefighting systems include dry and wet risers, firefighting shafts, protected stairways and sometimes lifts. They are provided for the fire and rescue service to tackle a fire quickly. Fixed firefighting systems should not be decommissioned or obstructed, and should be brought into use as soon as possible.

378 The laws of physics dictate how high water can be pumped. Principal designers, designers and principal contractors must plan how water might be supplied to higher floors progressively during the construction phase; for example, by early commissioning of rising fire mains and firefighting shafts as the building is constructed and before work commences inside. This should be agreed with the fire and rescue service.

379 Where risers are provided, liaise with the fire and rescue service and review the access points periodically. General requirements are that there is adequate supply available from a hydrant within 90 m from the building riser inlet. Install protected firefighting shafts as the building progresses.

380 As the building extends, it is essential that the fire alarm extends with it so that it is audible (and, where necessary, visible) in all areas of the build at all times. The fire alarm should be an electrically operated system throughout the height of the building, comprising:

- manual activation points, eg break glass (or similar);
- call points and sounders on appropriate levels (it may be possible to install the hard-wired system as the building progresses but radio operated systems can also be considered);
- a link to an occupied office (or similar) from where the fire and rescue service can be summoned.

381 During refurbishment, the risk assessment must identify where any temporary alarm systems for construction areas should connect to the main/existing alarm system or be adequate such that occupants who might be affected are also alerted to any fire emergency.

382 Put in place the other elements of the emergency plan to accommodate the size of the build.

383 On large buildings, it is likely that temporary lighting will be provided for work to be carried out in the interior. Consider carefully the provision of emergency lighting, especially in stairwells, should the power fail for any reason.

384 If controls such as sprinkler systems are to be installed in the completed building, consider commissioning them as soon as possible to ensure the safety of personnel during the construction phase.

385 Because fire protection is often incomplete during the construction process, the fire and rescue service may not be able to access all parts of the building. Therefore, you must identify controls in the risk assessment to enable all site personnel to exit the building in an emergency without external assistance. Provide these controls as soon as practicable (whatever the height) because the site must not rely on the fire and rescue service to provide mechanical rescue.

386 When constructing or refurbishing high-rise buildings, it is important to liaise with the fire and rescue service at regular intervals as the build progresses to be sure that firefighters are familiar with the risks on the site and the controls that are in place.

PART 3 LEGAL AND ENFORCEMENT RESPONSIBILITIES

Legislation

387 Several pieces of legislation govern fire safety for construction sites and construction activities.

388 The overarching health and safety requirements during construction work, which include fire safety, are provided by the Construction (Design and Management) Regulations 2015.

389 Other legislation covering fire safety includes:

- The Regulatory Reform (Fire Safety) Order 2005;
- The Fire (Scotland) Act 2005;
- The Fire Safety (Scotland) Regulations 2006;
- The Dangerous Substances and Explosive Atmospheres Regulations 2002;
- Fire Safety Act 2021. This Act applies in England and Wales. It makes changes to the FSO, such as the definition of an external wall. Items fixed to said walls, such as scaffolding, form part of the premises;
- Fire Safety (Employee's Capabilities) (England) Regulations 2010;
- The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013 – the reporting of dangerous occurrences that relate to site fires and/or explosions.
- The Fire Safety (England) Regulations 2022 (coming into force 23 January 2023). CDM dutyholders must co-ordinate and co-operate on fire safety precautions with the responsible person(s) when construction work is taking place on an occupied high-rise residential building.

390 These make detailed requirements for fire safety and also apply to construction work of a minor nature (such as decorating and maintenance work), and work incidental to the construction activity (such as provision of office and welfare facilities including sleeping accommodation).

391 The legislation distinguishes between the general fire safety requirements for the premises and specific process-related fire safety requirements.

392 The general fire safety requirements are made under the FSO and the FSA; in the FSO they are termed 'general fire precautions' (GFPs) and in the FSA 'fire safety measures' (FSMs). These are defined in the FSO and the FSA as:

- measures to reduce the risk of fire on the premises and the risk of the spread of fire on the premises;
- measures in relation to the means of escape from premises;
- measures for ensuring, that at all material times, the means of escape can be safely and effectively used;
- measures in relation to the means of fighting fires on the premises;
- measures in relation to the means for detecting fire on the premises and giving warning in case of fire on the premises; and
- measures in relation to the arrangements for action to be taken in the event of fire on the premises, including:
    - measures relating to the instruction and training of employees; and
    - measures to mitigate the effects of the fire.

393 The FSO and FSA exclude specific process-related fire safety requirements. The term used to describe these is 'process fire precautions' (PFPs) and is defined as those special, technical or organisational measures required to be taken or observed in any workplace in connection with the carrying on of any 'work process', where those precautions are:

- designed to prevent or reduce the likelihood of fire arising from such a work process or reduce its intensity; and
- required to be taken or observed to ensure compliance with any requirement of the relevant statutory provisions within the meaning given by section 53 (1) of Health and Safety at Work etc Act 1974.

394 The FSO defines 'work process' as all aspects of work involving, or in connection with:

- the use of plant or machinery; or
- the use or storage of any dangerous substance (as defined under DSEAR).

395 As such, in addition to DSEAR, PFP requirements can arise from other legislation made under the Health and Safety at Work Act, as well as the Act itself.

396 Construction sites are also covered by the Fire and Rescue Services Act 2004 (in England and Wales) and the Fire (Scotland) Act 2005 in providing the Fire and Rescue Authorities responsibilities to respond to fire and other emergencies to protect life, the environment (including animals) and property. These responsibilities include:

- the right to access water supplies and enter premises where they reasonably believe a fire or other emergency has occurred;
- to take such action as they consider appropriate to prevent and limit injury and loss;
- to obtain information needed to enable the authority to discharge its functions; and
- to investigate the cause and extent of fires.

What does this mean for people with responsibilities for construction work?

397 The FSO and the FSA both impose obligations on people (usually the employer, owner or occupier) as being responsible for the safety not only of employees, but of any person lawfully on the site, or in the immediate vicinity, and at risk from a fire on the site. They have the duty to implement and take adequate GFPs/FSMs for premises under their control.

398 In circumstances where there is not an employer, the responsible person in respect of the GFP/FSM legislation is the occupier, or, where the occupier does not have control of the premises, the owner. In respect of legislation covering PFP, the duty is placed on the employer to implement and take appropriate precautions or, if there is no employer, the person undertaking the work.

399 Under CDM, there is a requirement for every contractor carrying out construction work to take suitable and sufficient steps to ensure the risk of injury from fire or explosion that might arise from such work is prevented or reduced, so far as is reasonably practicable. There is a further requirement for adequate GFP/FSM to be provided to enable people on the construction site to safely and promptly escape from a fire or explosion and reach a place of safety.

400 The client must provide pre-construction information allowing adequate provision of precautions to be developed. The contractor then has responsibility to ensure that adequate PFP and GFP/FSM provisions are made. In respect of construction work carried out on premises that remain occupied, or remain the responsibility of the owner/occupier, the contractor has a duty to liaise and co-ordinate the work with the owner/occupier to ensure adequate PFP and GFP/FSM provisions are made and the work is carried out in a manner that does not compromise these.

401 The owner/occupier of the premises also has a duty to provide the contractor with sufficient health and safety information for the contractor to identify the hazards and risks associated with design and construction work to enable them to put in place safe

work procedures. This is especially pertinent where work is on plant or services containing dangerous substances, or such plant or services are close to the construction work and may be affected by this.

402 The FSO, FSA, DSEAR and other health and safety legislation require risk assessments to be carried out. The assessments should detail the precautions needed to ensure, so far as is reasonably practicable, the safety of people on the construction site and any other people who may be affected by a fire or explosion arising from the construction work.

403 An overarching fire safety risk assessment may be carried out covering the requirements of both the GFP/FSM and PFP legislation. This guidance (Part 1) is structured to assist in this approach and will help identify risks that can be removed or reduced and to decide the nature and extent of the fire precautions people with responsibilities for construction work need to take.

404 Where five or more people are employed by the person or organisation carrying out the risk assessment, the significant findings of the risk assessment must be recorded. These findings must include the identification of any dangerous substances used, including its storage and/or plant or machinery presenting pertinent risk of fire or explosion that is or is liable to be present, and details of the measures taken to comply with the requirements of the relevant fire safety legislation.

405 The principal contractor will have the particular responsibility to plan, manage and co-ordinate the construction phase to ensure the health and safety of people on the construction site, or who might be affected by it. As this includes the risks from fire or explosion, the significant findings from the fire safety risk assessment should be included in the construction phase plan.

406 The principal contractor is also likely to be responsible for office and welfare facilities (including sleeping accommodation, if provided). See Appendices 1 and 2 for further information.

407 Inclusion of the significant findings from the fire safety risk assessment in the health and safety file will also help the client to understand that the fire-related health and safety aspects of the design and construction phase work have been properly provided for.

408 For compliance with Building Regulations, licensing legislation and/or other contractual requirements, the completed building or structure will be provided with many of the GFP/FSM required for its eventual occupation and safe use. The principal designer must identify the significant risks that may arise to people from fire and explosion during the construction phase (this must include the risks to people both on site and around adjacent buildings). In co-ordination with the client, designers and the principal contractor, the principal designer should determine the stages at which the fire safety provisions to be present in the final building/structure are implemented (or removed in the case of refurbishment/demolition), or compensated for until they are implemented, to eliminate or reduce these risks. The principal contractor must apply these stages in the construction phase plan for the project.

409 The client, principal designer, designers and principal contractor should also consider how they will assist the fire and rescue service in the discharge of their duties under the Fire and Rescue Services Act 2004 (in England and Wales) and the Fire (Scotland) Act 2005. In any case, notice should be given to the fire and rescue service of any intended works affecting the water supply and/or fire hydrants. Liaison may also be appropriate to inform the fire and rescue service of the nature of the work and the access facilities to be provided, including for fire appliances.

410 Dangerous substances can put people's safety at risk from fire and explosion. DSEAR puts duties on employers and the self-employed to protect people from risks to their safety from fires, explosions and similar events in the workplace; this includes members of the public who may be put at risk by work activity.

411 Under DSEAR, there is also a requirement to make available to the fire and rescue service information on the dangerous substances present on the premises and the hazards likely to arise from these in the event of incident, to enable the fire and rescue service to prepare their own procedures to deal with these. On a construction site, it is likely the nature and quantity of any dangerous substances will change as the project progresses. Consideration should be given to determine how the provision of this information to the fire and rescue service is best achieved (see paragraphs 313–317).

Enforcement of fire safety legislation for construction sites, construction work and incidental activities

412 Because of the overlapping nature of construction and fire safety legislation, inspectors from different agencies have different enforcement powers to deal with fire matters during the course of construction work. Primarily these are inspectors from:

- Health and Safety Executive;
- local fire and rescue authorities; or
- local authorities;

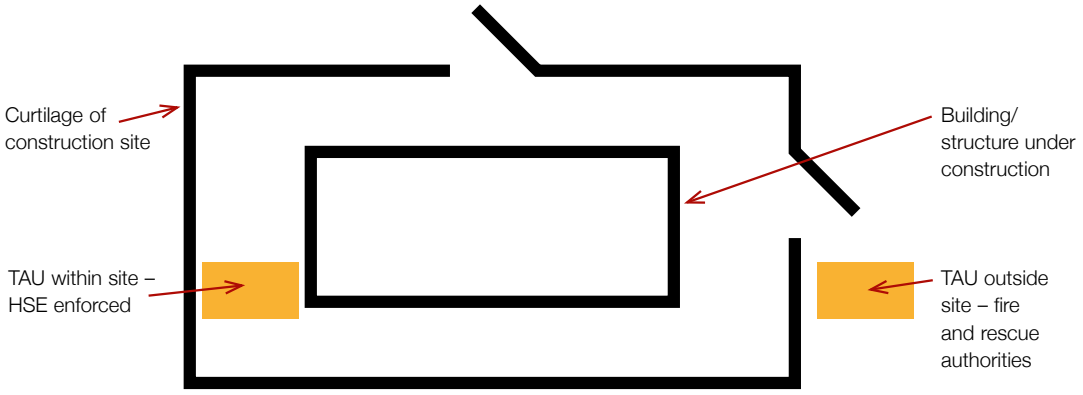


Figure 19 Enforcing authority arrangements for construction sites with support buildings/TAUs

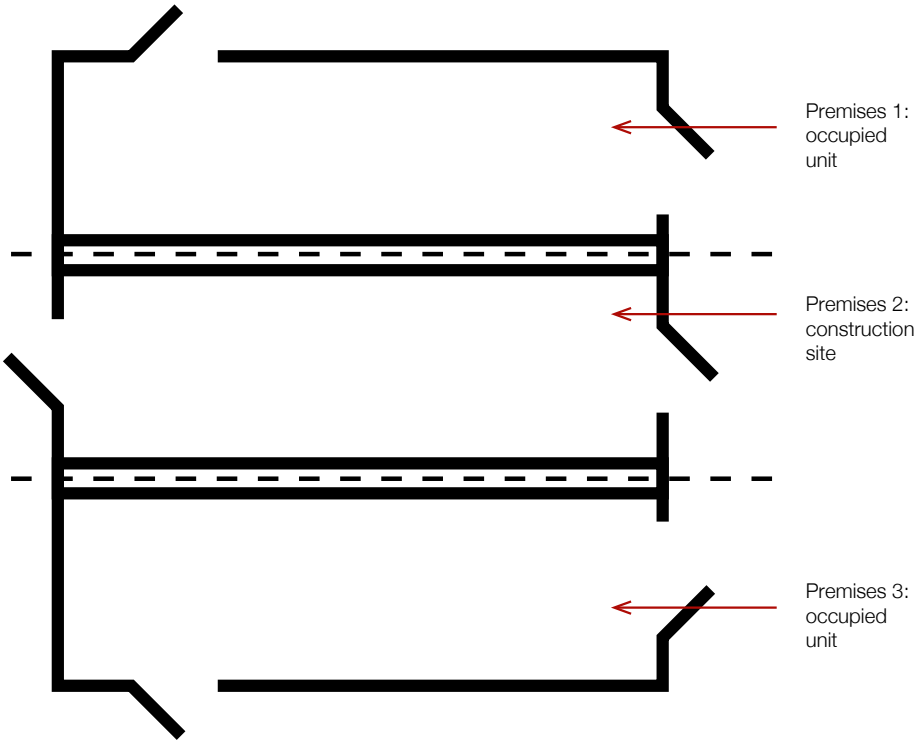
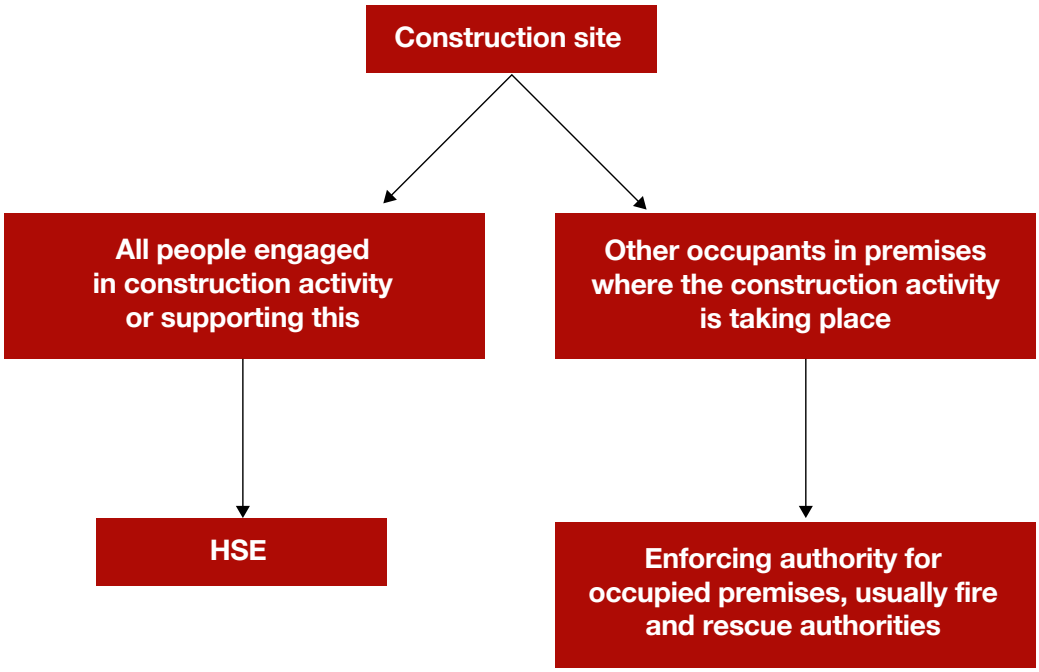


Figure 20 Illustration of row of industrial units or terrace of premises that are individual premises



GFP/FSM = General fire precautions/Fire safety measures

Figure 21 The enforcing authority for general fire precautions/fire safety measures on construction sites

and, for their specific premises, inspectors from:

- Crown Premises Fire Inspection Group;
- Office for Nuclear Regulation;
- Office of Rail and Road, or
- Defence Fire and Rescue Service.

413 In most workplaces these agencies (principally the fire and rescue authority) have enforcement responsibility for the permanent general fire precautions (GFP) in England and Wales, and fire safety measures (FSM) in Scotland. In England and Wales, the fire and rescue authority also enforce the GFP requirements for the common parts of multi-occupancy dwellings. Where an inspector from any agency becomes aware of fire safety issues for which they do not have the appropriate enforcement powers they can refer these issues to the correct authority. It is important that enquiries about fire issues at particular premises are directed towards the agency with the enforcement powers to deal with them.

Which authority enforces fire safety?

414 Under health and safety at work legislation HSE is the enforcing authority on construction sites for all process fire precautions (for example, the control of sources of ignition and fuel for a fire including highly flammable materials, liquids and gases). HSE is also the enforcing authority for the GFP/FSM required on construction sites where the only people present on site are engaged in the construction activity or supporting this.

415 Buildings provided in support of the construction activity, such as temporary accommodation units (TAUs) for site offices and welfare facilities (including any sleeping accommodation), also require appropriate GFP/FSM. Where these buildings/TAUs are within the curtilage of the site HSE is the enforcing authority. However, where they are outside and separate from the curtilage of the construction site (e.g. on the other side of, or further along, a road), the local fire and rescue authority has enforcement responsibility for those buildings (see Figure 19).

416 For a construction site that is within, or forms part of, another premises, and that premises is, or becomes, occupied by people who are not the construction workers (e.g. the usual occupants in a workplace), the enforcing authority will be the usual agency for the occupied premises. In most workplaces, this will be the fire and rescue authority. This ensures that one agency addresses and co-ordinates the GFP/FSM for both the permanent premises and the construction site.

417 In a row of industrial units or terrace of premises (see Figure 20), where each of the premises is separated by a continuous fire-resisting structure (usually to Building Regulations standard), and there are no shared areas or routes (for example, each has its own fire exit from the building and there are no internal connecting doors), these are treated as individual premises. Therefore, the enforcing authority will depend on whether the individual premises where construction works is taking place remains occupied during the construction work.

418 In high-rise buildings the enforcing authority will depend on occupation. In England and Wales, this is the local fire and rescue authority in occupied high-rise residential buildings. In other high-rise buildings, where construction works are taking place across a complete floor(s) and there are no other occupants on that floor these may be deemed unoccupied premises and HSE will address GFPs within the construction floor(s). However, for the building-wide GFPs and works to other occupied floors, the local fire and rescue authority has responsibility. Where a high-rise building has no other occupants HSE is the enforcing authority.

419 Figure 21 is a flowchart illustrating the relevant enforcing authority for general fire precaution/fire safety measure arrangements on construction sites. The local fire and rescue authority and HSE will liaise on the enforcement of GFP/FSM where the enforcing authority is unclear.

420 As part of construction planning, there must be communication with other responsible persons and occupiers in a building or nearby buildings to ensure they respond appropriately in the event of an emergency, as a fire in one may escalate and affect adjacent premises.

APPENDIX 1 TEMPORARY ACCOMMODATION UNITS

1 This section concerns temporary accommodation units (TAUs) brought onto site to provide offices, canteens and welfare facilities used by people at work on construction sites. These must be subject to a specific fire risk assessment. The standards described apply to accommodation provided only during the construction phase. They are not requirements for completed buildings.

2 TAUs can vary from very simple, single mobile units to complex multi-storey composite units for many workers. TAUs are usually situated in the open air, but where they are inside structures this gives rise to particularly acute risks, since smoke will accumulate very rapidly and escape routes will become blocked very quickly. In addition, they can set the entire structure on fire, putting everyone on the site at risk.

3 Use TAUs only for their intended purpose. In particular do not use offices for storing materials, especially flammable ones such as paint. Do not store materials on the top of TAUs to avoid damaging structural members and to minimise fire loading.

4 Preventing fire is the primary aim but it is also important to be able to deal with it. In simple cases, such as a single-site hut on an open site, basic precautionary measures are appropriate, such as:

- keeping a tidy office;
- providing appropriate fire extinguishers;
- enforcing smoking rules;
- correct installation and careful use of heaters and cooking equipment (see Liquefied Petroleum Gas (LPG), paragraphs 168–180); and
- proper installation and maintenance of electrical services (see Electrical installations, paragraphs 133–137).

5 More extensive precautions in the following paragraphs are required as TAUs and the associated fire risks increase in size and complexity.

Location and fire integrity of TAUs

6 All vertically stacked TAUs must have suitable protection to achieve a minimum of 30 minutes' fire resistance (integrity, insulation and load-bearing capacity) of the roof/floor assembly and the supporting members. This is required to prevent fire spread and/or structural collapse within the stack.

7 TAUs should be situated away from the building work, a suitable distance proportionate with the type of construction site and the propensity for ignition from adjacent external sources of fire in the open air. If TAUs have to be closer, the risk of a TAU fire spreading can be reduced if either the TAU or the part of the building adjacent to it is fire-resisting to a minimum of 30 minutes. If TAUs are situated inside buildings or structures, consider their fire resistance more carefully. The Loss Prevention Council Standard LPS 1195 sets out fire resistance criteria which are appropriate in these circumstances. Never site TAUs within high-fire-risk structures such as timber frames. TAUs need to be an appropriate distance away from any high-fire-risk structures.

8 This standard applies specifically to temporary buildings and not parts of existing buildings, but the

same standard may be useful in identifying appropriate measures for existing buildings.

Means of escape

9 TAU complexes can be assembled in many different combinations. As they increase in size and complexity, give careful consideration to ensuring that:

- there are, whenever possible, at least two means of escape in clearly different directions;
- if escape is possible in only one direction, the escape route is adequately protected (to a minimum of 30 minutes if the travel distance exceeds those given in the guidance);
- sufficient escape stairways are provided and protected;
- higher-risk items, such as electrical equipment, are not sited near the escape routes;
- escape routes are kept clear of obstructions at all times and not used for storage;
- travel distances are in keeping with those indicated in Table 2 (see paragraphs 239–241); and
- there are suitable means of escape for people with a health condition or impairment.

Raising the alarm

10 Provide all TAU complexes with a means of raising the alarm. The nature of it will vary, but the main requirement is for it to be audible throughout the complex. It is good practice to link to the main site.

11 A manual call point system complying with BS 5839–1:2017 is likely to be needed where:

- in TAUs such as site offices, if there are locations where a fire might occur and develop unnoticed until it threatens people's means of escape (smoke detectors may also be required); or
- the risk assessment shows that it is the most effective way of alerting people in case of fire. This may be the case where there are multiple rooms or storeys or the complex contains hazardous areas such as canteens and/or cooking facilities.

12 For fewer people and smaller complexes, it may be adequate to use manually operated devices that are clearly audible to everyone in the complex, but it is better to have self-contained, electrically operated alarms comprising an actuation switch and sounder.

13 Test both manual and more sophisticated fire alarms weekly to check that they work and can be heard in real conditions. Keep simple records.

14 For individual and pairs of non-compartmented TAUs a shout of 'Fire!' is adequate provided it can be heard in practical circumstances.

15 The means of raising the alarm needs to take account of people with a health condition or impairment.

16 For TAUs within the building under construction, the TAU alarm system must be integrated with that for the rest of the building.

Firefighting equipment

17 Provide all TAUs with some form of firefighting equipment and a sufficient number of hand-held extinguishers. The most typical fire risk in TAUs involves materials such as wood and paper. Water-based extinguishers must be provided for this.

18 Where large pieces of electrical equipment are used, such as computers or photocopiers, provide carbon dioxide extinguishers.

19 In kitchen and canteen areas, where cooking oils are used, provide appropriate fire extinguishers (foam or dry powder) and fire blankets.

Workers' instruction and training

20 Emergency plans must take TAUs into account as well as the rest of the site.

APPENDIX 2 SLEEPING ACCOMMODATION

1 The fundamental principles for minimising the risk of fire occurring, and preparing for it if it does, need to be addressed in depth for sleeping accommodation. The details are beyond the scope of this guidance and specialist fire safety expertise will normally be required.

Within the building being constructed

2 Even though a partially completed building (of whatever type) might contain space suitable for contractors to sleep in, sleeping must be avoided within the building during the construction phase.

In proprietary designed sleeping accommodation

3 It may be acceptable, in limited circumstances, for construction workers to sleep on some projects in purpose-built accommodation – including hut-type dormitories – placed on site with adequate separation distances from the building under construction or in an off-site location. This accommodation needs to be fully assessed for fire risk to identify the needs for firefighting apparatus, fire alarm and auto-detection, emergency lighting and obviate such risks as cooking, smoking, flame or radiant heating (HM Government guide on sleeping accommodation[19] provides further information for premises in England and Wales while the Scottish Government provides guidance *Fire safety guidance for existing premises with sleeping accommodation*.[20] Also consider the off-site risk in terms of risks to the public and from the public.

4 Worker caravan parks are sometimes provided. Caravans are often highly combustible and fire can spread quickly between them if they are parked close together (see HSG175).[21] Fire prevention and precautions need to be planned for caravan sleeping accommodation as much as any other, but pay particular attention to:

- the area provided: it should be enclosed by a palisade, fence or hoarding such that there is no direct interconnecting route between the caravans and construction site areas;
- adequate space between vehicles: a minimum separation distance of 6 m is recommended; and
- provision of adequate emergency alarm and firefighting equipment.

APPENDIX 3 SUMMARY OF BASIC PRECAUTIONS FOR ALL SITES AND ADDITIONAL PRECAUTIONS FOR HIGH-RISK SITES

Process fire precautions: How to stop fire occurring during the construction phase

For all construction (including high-risk)	Additional for high-risk construction sites such as timber-frame structures without appropriate fire mitigation or high-rise buildings (see paragraphs 331–386 for further information)
Design and planning	
Consider precautions for fire control at the design stage and before work starts. The principal designer needs to co-ordinate designers and other dutyholders. Plan and select materials, methods of construction, site processes and order of work to minimise fire risk. For example, specifying materials which can be fixed together using mechanical rather than hot means. A detailed fire risk assessment which identifies required controls needs to be undertaken at the outset. It must identify the stages, materials and activities that give rise to critical risk points and, therefore, will need highest levels of process control. Consider process fire precautions in conjunction with the GFPs required at critical risk points and particular stages of the project.	Carry out an off-site fire risk assessment. Consider risk to people in properties adjoining or near the site perimeter and, where necessary, control them. In situations where a construction site fire might spread off-site endangering the lives of people, and effective precautions to reduce this risk to an acceptable level cannot be identified or implemented, adopt alternative build methods with a lower fire risk. Information relating to assessing and planning timber-frame projects is available in the Structural Timber Association (STA) publication *Design guide to separating distances during construction.* Consider using timber and/or materials that have received an appropriate fire protection/resistant treatment to reduce both on-site and off-site risk. The fire risk assessment needs to consider, and minimise if necessary, fire spread between buildings.

For all construction (including high-risk)	Additional for high-risk construction sites such as timber-frame structures without appropriate fire mitigation or high-rise buildings (see paragraphs 331–386 for further information)
Design and planning *continued*	
Sites involving high-risk materials and processes will need higher standards of GFP. Any design and specification changes that can be made to reduce the fire risk will reap benefits in the extent and nature of required GFPs. Reducing the risks is particularly important when there are constraints that cannot be removed, such as location of site and space available. A high degree of communication and co-operation is required between all parties, including principal designer, designers, principal contractor and subcontractors, to ensure adequate controls are in place at all times. For refurbishment projects the client must provide relevant fire information regarding existing process safety issues and GFPs.	The fire plan and precautions will need to remain under review as the project progresses. The principal contractor will need to liaise closely with subcontractors – particularly the structural timber supplier and erector – to make sure the necessary fire precautions and emergency arrangements are in place and understood before they start work on site. High-rise buildings must be designed to allow compartmentation to be completed progressively and firefighting and fire-engineered solutions to be installed and commissioned at the earliest opportunity.
Ignition sources	
Smoking (see paragraphs 101–103 for further information)	
Indoor areas of construction sites must be 'no smoking'. Communicate the rules clearly. Allow smoking only in designated areas that are a good distance away from the building and away from areas used for the storage of combustible or highly flammable items. Smoking shelters must be constructed from non-combustible material and suitable means of disposing of smoking materials must be provided. Smoking areas must have a nearby fire point.	The smoking ban must be vigorously enforced by the principal contractor. Ensure that any smoking materials are kept safely away in a locker room. Designated areas where smoking is permitted should be as far away as is reasonably practicable from the structure or any combustible materials. Ensure only electric lighters are used.

For all construction (including high-risk)	Additional for high-risk construction sites such as timber-frame structures without appropriate fire mitigation or high-rise buildings (see paragraphs 331–386 for further information)
Plant and equipment (see paragraphs 104–117 for further information)	
Plant and equipment has the potential to increase the risk of fire (causes sparks, heats up or has flammable fuel), and each of these risks needs addressing. Consider use of alternative fuels to petrol. Fit mobile plant with an appropriate fire extinguisher. Ensure plant is positioned away from escape routes and combustible material and is used in a well-ventilated area. Modern batteries in electric vehicles or plant must be checked for damage after any collision. Ensure refuelling is carried out in a suitable, designated location. Provide charging stations for tools. Keep air filters and intakes clean and free of dust. Portable plant must be maintained and used safely.	Avoid using equipment that requires flammable fuels. Instead use alternatives such as battery or compressed-air-powered equipment. Provide suitable charging stations for battery tools. Ensure that the refuelling of electric-powered plant and vehicles is carried out using control measures identified in a site DSEAR risk assessment. Protect vulnerable structures from any heat generated by working plant. Do not operate equipment with naked flames or exposed heating elements within buildings that have exposed timber walls and floors, or high fire loading.
Hot works and permits to work (see paragraphs 118–132 for further information)	
Design out hot work as far as possible or have the work done off site, such as alteration of any structural steel, or substitute with other methods of construction, such as push-fit service instead of soldered or other suitable cold working techniques. If you cannot avoid hot work, ensure that hot watch arrangements are in place. Use a hot work permit-to-work system as required. Find a safe area for hot work (keep combustible materials away from any hot work). Ensure equipment is maintained and inspected before use. Maintain a careful watch for fire while hot work is being carried out. Maintain a fire watch in the hot works area when breaks are taken during the working day. There should be a continuous fire watch of the hot work area for at least an hour after the end of hot work, followed by at least one more check two hours after the end of hot work. Complete all hot works 2 hours before the end of the working day to allow for the appropriate fire checks to be carried out.	The aim of all dutyholders (principal designers, designers, principal contractors and subcontractors) must be to design out any hot works in high-risk buildings. Any decisions to carry out hot works must be justified to the principal designer and/or the principal contractor. Manage any hot works under a strict hot work permit-to-work system controlled by the principal contractor. Also consider the use of thermal imaging equipment and more detailed or longer fire watch.

For all construction (including high-risk)	Additional for high-risk construction sites such as timber-frame structures without appropriate fire mitigation or high-rise buildings (see paragraphs 331–386 for further information)
Electrical (see paragraphs 133–137 for further information)	
Maintain fixed and portable electrical equipment to prevent it becoming a source of ignition. Installation and maintenance of electrical equipment must be carried out by a competent person. Do not put temporary electrical supplies in emergency escape routes unless justified by a robust risk assessment Festoon lighting and cables should be adequately supported off the ground to avoid damage.	
Bonfires (see paragraphs 138–140 for further information)	
Avoid burning waste materials on site. Never use petrol or similar accelerants to start or encourage fires.	Do not allow site fires.
Security/arson (see paragraphs 141–144 for further information)	
Install perimeter fencing, or hoarding, and secure all access points such as windows and doors and scaffolding. Liaise with the local police service. Secure storage of (or if necessary remove) flammable liquids, gas cylinders and other combustible materials, ideally in locked containers. Store materials and waste within the site perimeter, preferably in secure compounds or away from the perimeter fencing (skips are often a target; consider their vulnerability). Where there is a known risk of vandalism or arson in an area, or where the consequences of a fire on surrounding premises are high, such as petrol stations, hospitals and residential, consider the additional security precautions for a high-risk site.	Secure all openings on vulnerable building with fire-resisting material. Implement regular out-of-hours security patrols or a permanent security presence; security staff need to be based outside of vulnerable buildings. They need to be alert to the possibility of detecting fire and know what to do if they discover it. Install suitable security lighting. Have closed circuit television monitoring (CCTV) including possible use of thermal imaging cameras; install intruder alarm systems. The STA's guidance *16 steps to fire safety* describes security packages for timber-frame construction.

For all construction (including high-risk)	Additional for high-risk construction sites such as timber-frame structures without appropriate fire mitigation or high-rise buildings (see paragraphs 331–386 for further information)
Storage and use of volatile and flammable materials (LPG, acetylene or other fuel types) (see paragraphs 146–194 for further information)	
Keep the quantity to an absolute minimum. Provide a suitable storage area that is secure, well ventilated and appropriately separated from combustible materials and work areas. Ensure storage is organised and tightly controlled. Do not store materials in a building under construction. Store acetylene or oxidising materials in a separate facility (units may be permitted during normal working hours but must then be removed from site). Dispense fuels, including hydrogen gas and petroleum, in a safe area away from combustible material. Handling practices must limit likelihood of spills and flammable vapour. Ensure equipment is maintained and inspected.	The Fire Protection Association's Joint Code of Practice (JCoP) requires such storage to be a minimum of 4 m from buildings and boundary fences, and 20 m for high-risk sites. During roofing operations that involve hot works, the minimum number of LPG cylinders should be stored at least 3 m from the work zone, stored combustible materials, and sources of ignition. Do not use petrol-fuelled plant within a timber-framed or high-fire-risk building. Implement DSEAR control measures where fuel sources may lead to an explosive concentration of gas, such as hydrogen or damaged modern batteries.
Combustible material (see paragraphs 198–210 for further information)	
Substitute combustible materials with less combustible or fire-resisting ones. Soft landing system bags should be fire-retardant. Install vulnerable features as late as possible to reduce the quantity of protective coverings. Ensure protective coverings and scaffold sheeting are to flame-retardant specifications. Ensure discarded coverings are disposed of correctly. Plan to reduce storage of combustible materials, such as by using just-in-time ordering. Keep combustible material away from TAUs, buildings being constructed and escape routes. Control access to stores to prevent materials being distributed across the site. Do not use TAUs for storage of materials, including on the roof.	Specify use of timber and/or materials that have received an appropriate fire protection/retardant treatment. Minimise use of foam plastics on site. Do not use soft landing systems containing polystyrene. Ensure only the minimum quantity of materials is held within the structure.

For all construction (including high-risk)	Additional for high-risk construction sites such as timber-frame structures without appropriate fire mitigation or high-rise buildings (see paragraphs 331–386 for further information)
Rubbish disposal and housekeeping (see paragraphs 211–214 for further information)	
Good housekeeping is essential – untidy sites are usually unsafe sites. Flammable materials such as timber become a lot more vulnerable if waste materials, such as timber shavings, paper and flammable materials, are left lying around. Regular disposal of rubbish from the active areas of construction will help to prevent an accidental fire starting or stop an arsonist. Keep rubbish away from TAUs, buildings being constructed and any escape routes. Control disposal points; secure and empty them regularly. Organise regular removal of rubbish off site. It is good practice to use metal or fire-resisting rubbish containers. Set site rules relating to tidying up and disposing of waste.	Have robust and monitored waste management arrangements in and around the structure.

General fire precautions (GFPs): What is needed in the event of a fire?

For all construction (including high-risk) (see paragraphs 215–330 for further information)	Additional for high-risk construction sites such as timber-frame structures without appropriate fire mitigation or high-rise buildings (see paragraphs 331–386 for further information)
GFPs will always be needed to mitigate the effects of a fire occurring and ensure the safety of anyone who might be affected by it, no matter the process precautions put in place. Plan the GFPs at the design stage and consider them for all stages of the project, including those where fire risks will be at their most critical in terms of processes, materials and build sequence. The GFPs may change for different stages of the project. An important principle should be to maximise the use of the finished building fire precautions to protect people during the construction work: ■ on new build, install finished building fire precautions as early as possible; ■ on refurbishment, maintain existing GFPs for as long as possible.	Identify where a site fire may spread off site to neighbouring properties, who might be affected and whether these are vulnerable groups, such as residential properties, care homes, hospitals or schools, occupants of buildings under construction or refurbishment. Co-operate with neighbours to understand their existing emergency and evacuation arrangements and consider the impact of site emergency arrangements on these.
Means of escape (see paragraphs 220–267 for further information)	
Plan escape routes from all working areas. Keep travel distances to safety to a minimum (see Table 2 and paragraphs 224–241). Remember that routes in and out of the build may be incomplete and obstructions may be present. Make sure that, wherever practicable, there are at least two escape routes in different directions. Ensure escape routes are a sufficient size for the number of people using them. Ladders may be suitable for simple projects for small numbers of able-bodied, trained workers. On complex or large projects use temporary proprietary stairways if reasonably practicable. Sequence the build to ensure the early commission of the permanent stairways to enable them to be used as an escape route. For buildings over two storeys high, maintain the permanent stairways as a 30-minute protected escape route that progresses up with the building.	In a category A timber-frame structure fire will spread rapidly. It is essential that escape routes are clearly signed and lit. The STA provide detailed advice on designing means of escape for timber frame structures (see paragraph 347). Organise work to reduce the risk of being trapped in a dead end. The permanent stairway(s) must be installed and protected as the build progresses. Other routes down may be required where sacrificial cassettes or crash decks are used. To achieve safe escape in different directions provide additional temporary proprietary external staircases. Where these are external, they must be left unsheeted to prevent the build-up of smoke. Protected stairways and escape routes will be necessary in many high-risk buildings to maintain safe travel distances.

For all construction (including high-risk) (see paragraphs 215–330 for further information)	Additional for high-risk construction sites such as timber-frame structures without appropriate fire mitigation or high-rise buildings (see paragraphs 331–386 for further information)
Means of escape *continued*	
If an exit onto scaffold is deemed part of an escape plan it must be easily accessible. Access should not be through a window opening unless it is designed for the purpose or has easy access such as a full-height window with the glazing panel removed. Keep escape routes and exits clear and clearly signed (never locked when people are on site). Install emergency lighting if necessary, to enable escape. This is very important in enclosed stairways if normal lighting fails during a fire. Fit self-closing fire doors early, or use temporary fire doors if necessary. Use suitable signage and keep it up to date to reflect any escape route changes. Provide an assembly point. Ensure everyone is accounted for; for example, by carrying out a head count or sweeping the location being evacuated.	
Compartmentation/stopping spread (see paragraphs 268–277 for further information)	
If safe travel distances cannot be achieved to exit the whole structure, then you will need appropriate levels of internal compartmentation to protect escape routes and limit fire spread. Any openings need to be fire stopped to an equivalent standard of fire resistance to the rest of the compartment. This means that holes and gaps must be correctly filled and if doors are needed through the compartment they need to be fire-resisting. Manage and monitor work activities carefully to ensure that any openings made, such as for service, are immediately refilled or covered.	Design openings for services such that they can be temporarily covered or filled vertically and horizontally. Programme the early installation of fire stopping (vertical and horizontal), progressive internal cladding of combustible structures, and doors to protect stairways and escape routes. Programme progressive fixing of the final external cladding to combustible structures so that it is put in place as soon as is reasonably practicable to prevent external fire spread.

For all construction (including high-risk) (see paragraphs 215–330 for further information)	Additional for high-risk construction sites such as timber-frame structures without appropriate fire mitigation or high-rise buildings (see paragraphs 331–386 for further information)
Fire alarms – giving warning and detection (see paragraphs 278–290 for further information)	
Fire warning systems are needed on all sites other than very small sites. There are a range of alarm types with the majority of sites requiring an interconnecting alarm system. The alarm system must be: ■ appropriate for the size of the building, number of storeys and complexity; ■ heard by everyone working on site over normal background noise; ■ sited so it can be activated immediately and simply. Automatic detection may be needed in TAUs and other areas where fire could start and go unnoticed. Alarms need to be tested and serviced by a competent person.	Alarms must be interconnected (by protected cables or wireless) to enable all to access and hear from one activation. Install permanent detection systems as early as possible. When this is not practicable, consider temporary detection systems, especially where a fire could start and go unnoticed. On complex alarm systems, such as on high-rise buildings, ensure that people with a role to monitor the system understand the control panel and can identify the location of the activation point. Provide means of communicating between the person at the control panel and people with a role in fire management who are on site.
Emergency procedures (see paragraphs 304–330 for further information)	
Small and low-risk sites require only very simple plans and procedures. As the site increases in size or fire risk more careful and detailed consideration will be needed, including: ■ a responsible person to ensure that fire precautions are in place; ■ an emergency plan, which should be available before work starts; ■ clearly defined roles and responsibilities for managing fire safety; ■ workers who know what they need to do if there is a fire; ■ managers who need to make sure that everyone (including visitors) on their sites knows what to do; ■ fire drills, which are an important check for the principal contractor on whether induction and fire safety plans work, and whether training for site workers had been effective; ■ fire instruction notices, which must be clearly displayed where everyone on site will see them; for example at fire points, site entrances or canteen areas;	Detailed planning and written emergency procedures, including regular fire drills, are required. Nominate people to assist in the management of fire safety on site, such as fire marshals/wardens or fire co-ordinators, and ensure they are aware of their functions. It is crucial to liaise with the fire and rescue service during the pre-construction phase regarding access and water supply. Keep in contact with the fire and rescue service as the work progresses so they are aware of the site layout and organisation, storage of any hazardous materials and specific risks. Create and update an information pack of key fire risks (on paper or stored digitally) that could be handed to the fire and rescue service in the event of a fire.

For all construction (including high-risk) (see paragraphs 215–330 for further information)	Additional for high-risk construction sites such as timber-frame structures without appropriate fire mitigation or high-rise buildings (see paragraphs 331–386 for further information)
Emergency procedures *continued*	
■ arrangements to ensure the fire and rescue services can access the site and are made aware of site-specific risks, such as the storage of hydrogen gas or lithium-ion batteries; ■ arrangements to ensure instruction, information and training are given to all involved with work on the site; and ■ post-fire re-ignition risks from lithium-ion batteries should be part of the induction.	
Temporary accommodation (see Appendix 1 for further information)	
The responsible person must carry out a risk assessment, identify the necessary precautions and ensure these precautions are in place. Position TAUs away from the building work (no less than 6 m) in the open air. If TAUs have to be closer, the risk of a TAU fire spreading can be reduced if either the TAU or the part of the building adjacent to it is fire-resisting. All stacked TAUs must be protected to achieve a fire resistance of at least 30 minutes in line with guidance in Appendix 1. Include TAUs in emergency plans. Litter skirts, or other suitable means, should be used to stop combustible materials, and potential ignition sources, from accumulating under the units. Ensure the TAU is used only for its intended purpose. Provide adequate means of escape, means of raising the alarm and firefighting equipment.	Temporary accommodation, such as site offices, should be separated from the building under construction by 20 m to establish a fire break. If this is not possible, other measures must be put in place to make sure the risk is controlled. TAUs must not be placed within high-risk buildings.

APPENDIX 4 WHO DOES WHAT?

Summary of duties under the Construction (Design and Management) Regulations 2015 (CDM 2015)

1 The CDM Regulations place duties on everyone who can contribute to the health and safety of a construction project. See Table 1 for a summary of the duties of the different dutyholders.

The role of the client

2 Clients, and the decisions they take, can have a major influence on the health and safety of a project and play an important role in helping deliver a safer and healthier industry. Clients can create the vision, provide the commitment and establish the culture of a project, demonstrating their respect for the health and safety of others.

3 The client should outline how they expect the project to be managed and set a realistic timeframe and budget to allow these expectations to be met. The timeframe should be agreed with the principal contractor and allow adequate time for the principal contractor to plan the construction phase.

4 Among other duties the client must take reasonable steps to ensure that people or organisations they appoint to undertake the work have relevant skills, knowledge, experience and (if an organisation) organisational capability. The client must assess the ability of the appointee to understand and manage fire risks. Examples of questions include:

- previous experience of similar work;
- existing organisational arrangements to address fire issues;
- how off-site fire risks are assessed (principal designer);
- how particular fire problems arising from the project might be addressed; and
- how GFPs will be addressed.

5 Clients should co-ordinate their work activities with those of their project team so that all parties can work safely and effectively throughout the project. The client must ensure that their actions and decisions do not impinge on the ability of others to comply with their duties or instruct them to do something that is unlawful. Where the client's activities overlap with those of a contractor, such as on a partially occupied site, they might need to become involved in the operational management of site activities. However, the principal contractor has the main responsibility for co-ordinating site safety in these circumstances.

6 The client must provide pre-construction information (PCI) relevant to health and safety, which they either possess or can reasonably obtain. This could be information about the site, the premises, work processes or activities where the construction work is to be carried out. For example, they should provide information on:

- details of any occupation on site;
- site rules on fire safety standards at occupied premises;
- proximity of the site to other occupied buildings and the nature of their use such as residential properties or schools;
- location of buried services or presence of overhead power lines;
- previous contents of tanks;
- previous uses of the site;

- flammable and combustible materials on site;
- special precautions required for fire-sensitive activities nearby, such as chemical processing;
- restrictions of on-site storage;
- arrangements for, or limitations on, rubbish disposal;
- existing GFPs and fire strategy; and
- any restrictions on where temporary accommodation units (TAUs) can be positioned and configured (see Appendix 1).

7 The pre-construction information must be provided as soon as practicable and be available for the tendering process.

8 The client must make suitable arrangements to monitor designers' and contractors' performance to ensure they fulfil their respective duties in respect of reducing fire risk.

9 The client should discuss the selection of construction materials and processes with designers and consider available alternatives such as the use of off-site construction methods to avoid welding processes.

10 Ignition sources on site during the construction phase are largely outside the control of the client, so they may not have much relevant or useful additional information to provide to designers or contractors. In some cases, clients may wish to specify operational constraints to take into account the risks to their employees who may be affected by the construction work, especially if the work is in high-risk areas such as in a chemical plant. This should be included in the pre-construction information.

11 GFPs for the construction site are often outside the client's control so they will have little role in providing them. However, part of the client's monitoring arrangements should address whether adequate GFPs are in place to allow workers to stay safe in the event of a fire. Monitoring could include providing evidence of the use of GFPs (such as photographs and reports) to the client on a regular basis.

12 Clients must provide the principal designer with information about the existing GFPs installed in the building so that these are maintained during the construction phase. This should include:

- location of dry and wet risers;
- information on existing compartmentation;
- installation diagrams of the fire alarm system;
- operational status of equipment, such as whether the sprinklers are still connected; and
- existing means of escape provision.

13 If occupied premises are to be shared with construction workers, provide information on existing emergency arrangements in the PCI. This must include information on the following:

- when there will be fire drills;
- existing fire escape routes;
- limitations on the location of assembly points; and/or
- existing arrangements with local fire and rescue services.

14 If there is a need to integrate the occupier and construction emergency arrangements the client must co-operate with the principal designer and principal contractor to achieve this.

15 If site accommodation, such as welfare and site offices, is provided by the client for use during the construction phase they must co-operate with the principal designer and principal contractor to meet the appropriate standards (see Appendix 1), especially if the accommodation is within the building or structure being worked on.

16 All stacked TAUs must be protected to achieve a minimum of 30 minutes' fire resistance. See Appendix 1.

17 Contractors may need to provide sleeping accommodation for construction workers. If so, the principal designer and principal contractor must be told of any restrictions on where sleeping accommodation can and cannot be sited. It is

important that no workers sleep within the building under construction or refurbishment.

The role of the principal designer

18 Principal designers have an important role in influencing how risks to health and safety are managed throughout a project. Design decisions made during the pre-construction phase have a significant influence in ensuring the project is delivered in a way that secures the health and safety of everyone affected by the work.

19 The principal designer is an individual or organisation appointed by the client to plan, manage, monitor and co-ordinate the design phase of any project involving more than one contractor.

20 The principal designer must make clients aware of their duties under CDM, including where technical advice may be needed, such as when undertaking a fire risk assessment.

21 Pre-tender plans need to consider site-wide fire issues and provide relevant information on fire risks; for example:

- location and nature of flammable materials on site;
- location of buried services (gas, electricity);
- nature of nearby activities, especially if they are sensitive to site-generated fire risks or pose fire risk to the construction work;
- details of any likely continued occupation of the site (especially in office or residential projects);
- details of any intended construction materials, processes or methods which lead to high fire risk; and
- details of any design-specific fire controls that may require sequencing of fire compartmentation or certain construction materials and details of GFPs (to be maintained) in existing buildings.

22 It may also be appropriate at the pre-tender stage to set out generally applicable site standards. This is necessary where premises are shared with occupiers and their needs have to be considered in the site arrangements. For example, there may be constraints arising from the occupiers' needs for rubbish removal and clearance. There may also be a need to co-ordinate the GFPs such as alarms and emergency exits. This does not detract from the principal contractor's duty to develop the subsequent construction phase plan, but it is legitimate for the principal designer to describe the general limitations within which the construction phase plan has to be drawn up.

23 Where the client chooses a design with a particular build method or type of structure with a higher fire risk, the principal designer must advise the client about its suitability, taking account of the site location and its surroundings. An example would be where the client has specified a potentially higher-fire-risk build method, such as timber frame, or materials that require the use of hot works instead of cold techniques.

24 During the earliest planning stages for high-risk projects, assess both the on-site and off-site fire risks. The risk will be greatest when the structure is erected but the protective measures are not yet installed. This period of maximum vulnerability, during which fire may spread quickly, must be considered in detail and minimised as part of the fire risk assessment. Where sites are close to residential property, schools or similar premises, or near higher-fire-risk sites such as petrol stations, the risk should be assessed by a competent fire engineer with relevant skills, knowledge and experience.

25 In situations where fire spread from a construction site might endanger the lives of people in adjacent properties, and effective precautions to reduce this risk to an acceptable level cannot be identified or implemented, adopt alternative build methods with a lower fire risk. The principal designer must provide alternative build methods to the client that have a lower fire risk, where practicable.

26 Where the risks cannot be controlled to an acceptable level, the PCI must contain details of the precautions which will need to be adopted (residual risk information). Principal designers should take advice from specialists where this is appropriate.

27 Principal designers must also check that other designers are considering fire risk and providing additional information on any fire hazards that are not obvious from the standard design documents. For fire-engineered design elements, information may be needed about installation methods or the sequence of installation as the correct installation will be critical to their performance in the overall fire strategy.

28 Principal designers must challenge decisions made by designers to ensure the principles of prevention are applied when selecting material and work processes, beginning with avoiding fire risk when possible. For example, could they use technical developments such as crimp fittings rather than pipe welding?

29 Successful control of ignition sources is largely dependent on detailed day-to-day site control, but some site-wide constraints may be appropriate for inclusion in the PCI, especially where such matters arise from constraints placed by the client; for example, any restrictions on hot works and requirements in permit-to-work systems.

30 The principal designer must provide information to designers and principal contractors about existing fire precautions and any requirements specified by the client. The principal designer should consider the interaction between designs and the implications the design may have for control measures. This includes, for example, the effect the mechanical and electrical designs may have on compartmentation. The principal designer must provide details of the fire risks and control measures identified in the fire risk assessment. It is the principal contractor's duty to establish the fire precautions for the site during the construction phase.

31 The principal designer must monitor the design phase to ensure the products and materials specified by designers will be used within their certified parameters and therefore perform as expected in the event of a fire. Information on the design parameters should be provided to the principal contractor.

32 Include information on design conclusions relevant to construction phase fire safety in the pre-construction information. Principal contractors need this information to arrange for appropriate construction sequences so that, for example, in high-rise buildings protected stairways are installed at an early stage. Principal contractors will also need to engage with designers in planning the precautions throughout the project.

33 Pre-construction information should include information available that would influence the development of the construction phase plan by the principal contractor; for example:

- available access and facilities for fire and rescue services;
- available areas for assembly points;
- existing emergency arrangements on occupied sites; and
- information about significant residual fire risks.

34 The principal designer will not usually be concerned with the practical details of using TAUs on site. However, the PCI must contain information from the client on:

- any limitations on where TAUs can be sited and their configuration;
- any information from designers on TAU location; and
- any requirements or restrictions on the use or siting of sleeping accommodation provided by principal contractors.

35 The principal designer needs to implement arrangements to ensure relevant information is passed between relevant parties including any changes made to designs.

36 The principal designer should review the information relating to design changes to ensure they do not adversely affect the project or other parts of the design.

The role of designers

37 Designers are in a position to contribute to the elimination of fire hazards in construction from the earliest stages of a project.

38 Designers are organisations or individuals who carry out design work for a construction project, including temporary works design. Designers may include architects, consulting engineers, quantity surveyors, interior designers, temporary work engineers, chartered surveyors, technicians, specifiers, principal contractors and specialist contractors. Anyone who specifies or alters a design may be considered a designer. In certain circumstances, this can include clients. Designers have duties under CDM regardless of the size, duration or nature of the project.

39 The term 'design' is a wide term under the CDM Regulations and includes drawings, design details, specifications and bills of quantity.

40 Designers should eliminate or reduce fire risk in their designs and ensure that issues are identified and integrated into the overall design process to develop appropriate provision to ensure that workers and others are protected as the build progresses.

41 Designers must consider the pre-construction information at the earliest opportunity and use the information to influence design decisions where appropriate.

42 Designers must co-operate with the arrangements put in place by the principal designer for sharing information (including relating to design changes) and reviewing designs.

43 Designers must provide sufficient and relevant information to everyone who will need it; this could be in the form of notes on drawings, written information provided with the design, or information determining when fire safety measures should be implemented (or removed in the case of refurbishment or demolition). It may be necessary to design fire engineered solutions for the construction phase such as temporary compartmentation and fire doors, or to specify the construction sequence required to improve fire safety. It is very important to pass any relevant information to the contractor to enable them to properly plan the work and so that (temporary) measures are in place to ensure the safety of site personnel in the event of a fire.

44 You must take the findings of the design phase fire risk assessment into account to eliminate or reduce fire risks when selecting, or specifying, build methods. Adopt lower-risk methods for high-risk projects, where practicable (see Appendix 3).

45 To reduce potential fuel sources designers should consider the quantity of flammable and combustible materials that are required by the design. As the quantity and variety of potentially flammable and combustible materials increases, the designer's role in their selection becomes increasingly important in controlling workplace risks.

46 Designers need to know whether the materials they are specifying are flammable and, if so, to what extent. If it is not known, find out from manufacturers or suppliers. Designers must assess if such materials can be substituted for less hazardous materials. Pay particular attention to the selection of:

- paints and solvents; and
- adhesives.

47 Consider if the use of such materials is necessary. For instance, is there really a need to paint the wall of an underground car park?

48 The sequence of construction may have implications for fire loads. For example, if final internal fixtures and fittings are designed for installation last, there will be less need to protect them with potentially flammable coverings such as plastic wrap or cardboard.

49 Any products and materials specified in the design should have supporting information confirming that they achieve the required performance parameters and that the design allows them to be used as specified within their certified parameters. Where products are not used in accordance with the certified parameters, the certfication is no longer valid and you should not rely on them to perform their specific function.

50 Details about products and materials and relevant certificates may be required as part of the project information management system (IMS) and the CDM health and safety file. One example of an IMS is the Building Information Modelling (BIM) Framework.[22] Such an IMS could be used to deliver the health and safety file that must provide key information to the client for the safe operation, cleaning and maintenance of the building.

51 Designers can reduce hot works as a source of ignition by considering alternatives at the design stage; for example, by specifying:

- steel components that can be fabricated off site rather than being welded on site;
- steel sections designed to be bolted rather than welded together;
- push- or thread-fit plumbing connections rather than soldered jointing; or
- hot air or cold roof applications which avoid the need for torching.

52 Designers will have little influence on the provision of the construction phase GFPs. However, there are features required as part of the specification for the completed building that they could design in to improve GFP standards during construction. The following are matters in which designers should engage with the principal designer and others for pre-construction planning:

- Specify wet and dry risers that can be installed early in the construction sequence and commissioned progressively. This is important in high-rise projects.
- Identify where and when compartmentation is needed to ensure safety of people on site, both to achieve escape distances and to substantially reduce the spread of fire and smoke. Compartmentation should always be designed in on high-risk projects.
- Design the structure to allow the installation of internal stairways early in the build. This eases general movement around site but also allows for a protected safe route. Ensure it is clear in the design where a stairway is part of a protected route and specify the use of self-closing fire-resisting doors. For the construction phase these could be temporary doors.
- Allow space in the design where feasible, for the installation of additional temporary proprietary stairways. These could be internal or external.
- Allow for installing the permanent alarm systems at the start of the fit-out stage or before.

53 The above guidance contains some basic construction phasing issues. For instance, installation of primary stairways is dependent on, and affects, other design features. It is therefore important that designers liaise with other designers and members of the project team on such matters.

54 Fire and rescue service access may be easy once the building is finished, but designers should also consider the building footprint design in relation to the access that will be available during construction; for example, when roads will not be completed and the site will be obstructed by materials, plant or temporary site accommodation. In high-risk projects, such as high-rise structures with large numbers of contractors at work, this should be considered in more depth.

55 In most cases, designers will be concerned with the finished building rather than the TAUs provided during the construction phase. Where designers specify the use of TAUs, off-site locations should be prioritised. As a last resort consider suitable locations for internal accommodation. This can be only where the highest standards of fire protection can be achieved to ensure the safety of sleeping workers. Inform the principal designer of the conclusions and apply Appendix 1 TAU requirements.

56 Designers should obtain specialist advice and follow the guidance in Appendix 2 where they are involved in specifying sleeping accommodation.

The role of the principal contractor

57 A principal contractor must be appointed in writing by the client for projects with more than one contractor. The principal contractor's role is to plan, manage, monitor and co-ordinate health and safety while construction work is being undertaken. The principal contractor is usually the main or managing contractor for the work. The principal contractor is responsible for producing the construction phase plan.

58 The principal contractor should be given adequate time by the client to plan the construction phase. An early appointment of the principal designer and principal contractor will ensure adequate co-ordination and co-operation with the project team and sufficient time to plan.

59 The principal contractor must consider the fire risks and control measures identified in the design fire risk assessment (part of the PCI) when developing a site-specific fire risk assessment for the construction phase. Incorporate the significant findings of the fire risk assessment, along with the action required and the emergency procedures, in the construction phase plan before work starts. This should cover the off-site risks from fire as well as the on-site risks. For timber-frame constructions, consider carefully the risk of a fire spreading and affecting people in neighbouring properties. Set out appropriate fire mitigation in detail in the plan and put this in place before the critical phases of the timber-frame construction. The plan and precautions will need to remain under review as the project progresses. The principal contractor must liaise closely with subcontractors, particularly for high-risk projects, to make sure the necessary fire precautions and emergency arrangements are in place and understood before work starts on site.

60 The principal contractor should ensure the construction programme allows for the installation and commissioning of the main fire safety features as early as possible and should phase the work appropriately.

61 Include the site rules within the construction phase plan. They can be a particularly important part of controlling potential sources of ignition and the accumulation of flammable materials. Site rules can include fire safety standards to be followed, including:

- how frequently contractors will clear rubbish;
- what sort of rubbish storage facilities to provide and where;
- precautions to take when carrying out work that may impact on compartmentation or that involve hot works;
- how frequently to empty communal skips;
- the arrangements for bringing flammable materials or dangerous substances onto site;
- storage arrangements for any flammables brought onto site; and
- any site arrangements for smoking.

62 Principal contractors should follow a similar process to the principal designer when issuing tenders for packages of work to sub-contractors that will impact on site GFPs. See paragraphs 24–36. This should include the provision of information about fire safety standards.

63 Make sure site workers are familiar with site rules and procedures. This can be done effectively using site inductions, posters or notices, and the issue of rules to individuals. On larger sites where risks change as the build progresses and/or there are large numbers of contractors, additional briefings or training will also be appropriate.

64 Make sure parties comply with the plan and site rules. Merely having site rules is not enough to ensure adequate standards are achieved on site. Arrange for proactive inspection of fire safety standards. Either the principal contractor can do this, or you can delegate monitoring responsibilities to other competent parties, such as site supervisors or people nominated to assist with fire safety management (fire wardens/marshals).

65 Inspection regimes should be appropriate for the degree of risk. Where fire risks are low, such as during the frame erection stage of a steel-frame

building, inspection for fire matters will be a low priority compared with potential falls. However, fire safety will require much closer monitoring during, for example, the fit-out stage of an office refurbishment. This is especially significant in situations where there are many trades on site. This requires tight management control to ensure that they all comply with appropriate standards. The principal contractor must clearly define the roles and responsibilities for monitoring compliance.

66 If poor fire safety standards or non-compliance with site rules are found during inspection, action must be taken to resolve such matters. Authority should be delegated to persons with suitable skills, knowledge, and training to rectify non-compliances. Where risks are high a formal and systematic assurance system should be used. For example, fire resistance checks must be made where penetrations in timber frame products have been made by multiple contractors. Principal contractors must have procedures to deal with persistent breaches of site rules.

67 Principal contractors may need to amend site rules as circumstances change during construction.

68 Address the management of ignition risks in the construction phase plan and site rules. The detail required in the plan will depend on the level and extent of risks on the individual site concerned and should address different stages of the project.

69 Construction phase plans can usefully consider the following for the control of sources of ignition:

- Permit-to-work systems. Are the high-risk activities necessary? If so:
  - Who will administer and control their implementation?
  - To what sort of work will they apply?
  - Where on the site will they apply?
- Details of any smoking policy. If designated smoking areas are to be provided, where will they be?
- Scrutiny of proposals for hot work processes, particularly in high-fire-risk structures (such as refurbishment of occupied buildings or tank demolition). A job-specific method must be agreed with the principal contractor that details clear fire controls. A post-job fire watch system must be in place.
- Specification of any banned or restricted equipment or activities, for example:
  - unauthorised additions to electrical system;
  - use of blowlamps and heaters; and
  - possession of lighters and lighting of fires.
- Details of site security arrangements and the allocation of clear authority to security staff to carry out their work.

70 Principal contractors must address GFPs in the construction phase plan. Underlying design assumptions (such as phasing of stairway installation) should already have been made clear and indicated to them in the pre-construction information. They must ensure that these criteria are reflected in construction sequences and methods. Provide relevant information to the contractors concerned with those parts of the project. Both the principal contractor and the contractors should be clear about who is doing what and when so that the design decisions can be complied with.

71 The construction phase plan must address detailed operational matters as well as the implementation of design criteria. Examples include:

- organisational arrangements to manage fire safety for the construction phase;
- nature, number and location of fire points;
- arrangements for inspecting and maintaining firefighting equipment;
- clarification of the arrangements for raising the alarm and checking that it is effective;
- any arrangements for provision of emergency power and lighting – what is to be provided and by whom;

- work on protected means of escape requiring openings to be made in them; whether this can be done at weekends or during slack times so that the minimum number of people are at risk if a fire occurs when the fire resistance of the escape route is compromised;
- specifying where scaffolding is part of the means of escape; and
- having specific site rules, such as:
  - keep escape routes clear;
  - no horseplay with extinguishers and wet risers; and
  - inform management if extinguishers are used.

72 The principal contractor must devise an adequately detailed emergency plan and incorporate it in the construction phase plan. The following elements must always be included:

- location of assembly points;
- instructions on what to do in the event of fire; and
- who is in charge if there is a fire and a description of their role.

73 In low-risk situations, the contents of emergency plans may be very simple. For higher-fire-risk situations and more complex sites, the following items must be included in construction phase plans:

- regular fire drills;
- special arrangements for evacuation from high-risk areas, such as the LPG store;
- appointment of people to assist with managing fire safety;
- regular liaison with local fire and rescue services;
- liaison with occupiers of shared premises; and
- firefighting training for people carrying out high-risk work.

74 Significant changes to phases, work methods or designs must be reflected in the emergency arrangements relating to fire. For example, means of escape will be different during steel erection to what is required during the fit-out stage. Make sure that everyone on the site is familiar with the emergency arrangements.

75 Make sure that contractors' and individuals' responsibilities in implementing fire precautions are clearly identified. Also make sure people with the responsibilities have the skills, knowledge, experience and where relevant, the organisational capability, to implement them.

76 The construction phase plan should set out the arrangements for TAU provision. TAU arrangements are one of the first elements that should be decided in the construction phase plan, since they are provided right from the start of construction. TAUs should meet the requirements of Appendix 1.

77 On larger or high-risk projects, construction phase plans should normally consider:

- where the units will be sited and configured;
- the standards they need to meet, such as office, canteen or sleeping accommodation;
- necessary fire precautions;
- who is responsible for providing satisfactory TAUs (eg principal contractor or nominated contractor); and
- whether they will be stacked.

78 Tell contractors about any site rules concerning TAU fire precautions. Contractors will especially need to know any limits or controls on storing materials inside TAUs to plan their work. Inform contractors of these matters at an early stage, preferably during the tendering process.

79 With regard to sleeping accommodation (see Appendix 2), specify the detailed requirements for sleeping accommodation in the construction phase plan. Specialist advice must be obtained if site sleeping accommodation is the only available option.

80 Compliance with those requirements must be checked.

81 Principal contractors must check that site workers understand the site rules for sleeping accommodation, where provided on site.

82 No workers should sleep in the building under construction or refurbishment unless all the criteria of Appendix 2 are met.

The role of contractors and workers

83 A 'contractor' is a business or person involved in construction, alteration, maintenance or demolition work. This could involve building, civil engineering, mechanical, electrical, demolition and maintenance companies, partnerships and self-employed workers.

84 A 'worker' is anyone who carries out construction work, as described above, under the control of a contractor. The degree of control of the work activities will determine whether you are a worker or a contractor.

85 For all contracts, contractors must plan, manage and monitor their own work and that of workers and check the competence of all their appointees and workers. Contractors must train their own employees and provide information to their workers about fire risks and associated controls. Contractors must comply with the specific requirements in Part 4 of the CDM Regulations. For example, making sure that penetrations made in fire-resistant materials are sealed to reduce the risk of fire spread.

86 When more than one contractor is on site, there must be a principal contractor. Contractors must provide the principal contractor with significant fire risk information and controls.

87 Contractors must reference health and safety information and standards set out in tender documents to develop their own site plans and work methods. Contractors and their workers should be familiar with site rules and comply with them.

88 A method statement is often used by contractors to show compliance with the construction phase plan and site rules. It is not a legal requirement to have a method statement, but it can be an effective way to communicate how the job will be done using a safe system of work. Where there is no principal contractor, contractors must ensure they have planned the work and addressed any fire risks and have arrangements to ensure the plan is followed by workers.

89 Contractors must inform the principal contractor where there are difficulties in complying with the construction phase plan or where fire safety issues are discovered that are not addressed by the existing plan. For example, if:

- significant amounts of flammable materials need to be brought onto the site that were not envisaged in the health and safety plan;
- rubbish skips are not being emptied;
- flammable material is discovered during work, such as if ground workers discover drums of buried waste or unforeseen gas services during excavations;
- unsatisfactory or damaged electrical installations or equipment;
- occurrence of any minor fires;
- difficulties in complying with site work, such as if there is a need to use blowlamps but the site rules ban their use;
- where works impact on escape routes or affect designed fire measures; or
- absent or incomplete fire stopping or compartmentation.

90 Where there is no principal contractor some matters may need to be brought to the attention of the designer or the client, such as where work is on occupied premises.

91 Contractors should check that products are installed in accordance with their fire design and certification parameters. If contractors are not installing them in accordance with these parameters, they are no longer certified and you should not rely on them to perform their specified function.

92 Workers carrying out or supervising higher-risk works must understand the hazards and be trained how to react in the event of a fire. The contractor, or person in charge, must ensure that the workers understand how to follow a permit-to-work (if used). Instructions should include: where to store fuel and ignition sources, how to use fire extinguishers, how to raise the alarm, and how to do a fire watch and for how long.

93 Contractors and their workers need to be familiar not only with the emergency arrangements for the construction project but also for the premises where it is occupied, such as a factory, nursing home or chemical plant. Often, this will be achieved by the principal contractor providing information; but on smaller projects contractors may need to provide their own emergency plan in co-ordination with the client.

94 Contractors must have clear arrangements to evacuate the premises in accordance with the emergency procedures to avoid any delays. Managers, supervisors and their deputies must have a thorough understanding of said arrangements.

95 Contractors and workers must co-operate with the principal contractor, such as by attending induction training and participating in fire drills where required to do so. Report any shortcomings to principal contractors, such as if any workers have not attended site induction training. Contractors must provide adequate supervision on all projects to ensure the construction plan and safety precautions are followed by their workers.

96 Contractors and workers must know and comply with site rules and standards concerning TAUs. In practice, relevant instructions and information may be provided directly by the TAU supplier or come from the principal contractor, but they should not merely assume this will happen. If there is any doubt, liaise with the principal contractor to check that the necessary information or instruction has been provided.

97 Workers must report any fire safety issues with TAUs, both to their manager and any principal contractor. This could include information on:

- damage to the fire-resisting integrity of accommodation;
- non-compliance with site rules;
- a need for additional TAU material storage space;
- overloaded sockets with charging tools;
- misuse of heaters for drying clothes; and
- damage to fire alarms or firefighting equipment.

98 If the contractor provides TAUs, they must carry out a fire risk assessment. They should apply both the principles in this guidance and the requirements of the construction phase plan.

GLOSSARY

automatic fire detection	A system with detectors that will identify conditions which could indicate fire and raise the alarm. Detectors can pick up smoke or heat.
category A timber frame	A standard system of stud/panel frames and decking which contains no additional fire mitigation features.
category B timber frame	A system of stud/panel frames and decking designed for reduced fire spread, usually pressure-treated with fire retardant. Category B is subdivided into three types, B1, B2 and B3, with increasing protection from fire.
category C timber frame	A system of stud/panel frames and decking designed to resist fire spread. It offers the greatest protection from fire for a timber-frame building. Category C is subdivided into two types, C1 and C2.
combustible material	A material capable of burning in air when ignited.
compartmentation	Vertical and horizontal divides in the building which act as a barrier to the spread of fire, heat and smoke. Compartmentation (separating different areas using fire-resistant elements) is only as good as the weakest element. A '60-minute' wall with a '30-minute' door only gives a '30-minute' compartment.
composite panel (sometimes called sandwich panel or cassette)	Consists of two skins (usually metal) either side of a bonded core of a thermally insulating material.
construction project	Can include investigation and ground clearance, demolition, new build, maintenance and refurbishment, commissioning and decommissioning.
dangerous substances	As defined in Regulation 2 of the Dangerous Substances and Explosive Atmospheres Regulations 2002 (as amended).
dry riser	A vertical pipe intended to distribute water to multiple levels of a building or structure as a component of the firefighting system. Dry risers are normally empty and will be externally connected to a pressurised water source by firefighters.
emergency escape lighting	Lighting that is provided to enable safe exit in the event of failure of the normal power supply.

explosive atmosphere	A mixture, under atmospheric conditions, of air and one or more dangerous substances in the form of gases, vapours, mists or dusts in which, after ignition has occurred, combustion spreads to the entire unburned mixture.
fire-engineered solutions	Measures for the protection of people, property and the environment specified after the application of scientific and engineering principles. These will take into consideration the individual characteristics of the structure rather than following prescriptive approaches to fire safety.
fire mitigation	Measures, arrangements and precautions to be taken to reduce the risk of fire by controlling sources of ignition, sources of fuel, and additional sources of oxygen.
fire-resistant	A building element (wall, floor, door, structural member) that acts as a barrier against fire spread for a certain length of time, even if exposed directly to a fire. It will have a rating based on the time it will survive under specific test conditions (for example, a '60-minute fire-resistant door'). Real fire conditions may be different from the test conditions, so the exact lifetime in a fire event may not be quite the same as the rating.
fire-retardant, flame-retardant, fire-proof, flame-proof	These terms are used to describe materials that do not burn particularly well. When they are used to describe sheet materials, it normally means that a fire will not be any worse if they are present – although they will typically burn or melt away if they are close to an existing fire. When these terms are used to describe treatments applied to materials, they normally mean that it takes a longer time and/or a larger fire to make them burn, and that when they are on fire the flames spread more slowly. Often, they are tested for effectiveness only in small fires, and may not perform as well if exposed to a larger fire.
fire risk	The potential for a fire to cause loss of life or injury and/or damage to property.
fire stopping	Sealing of gaps and openings to allow walls with services passing through to be part of fire compartmentation.
fire strategy	Provides information on the physical fire safety precautions that are provided with the design, particularly in large or complex buildings, to comply with Building Regulations.
fireproofing	Adding an insulating material to the structure to extend the length of time it can survive in a fire. An example would be spray coating for structural steel. This will have a 'fire-resistant' rating.
flammable liquid	Flammable liquids are liquids with a flashpoint of 60 °C or below. There are three categories: flammable, highly flammable and extremely flammable. They are dangerous substances as defined by DSEAR.
flammable material	A material capable of burning with a flame.
FSA	Fire (Scotland) Act 2005 – applies in Scotland.

FSO	The Regulatory Reform (Fire Safety) Order 2005 (as amended) – applies in England and Wales.
general fire precautions (GFP)	Structural features and equipment to ensure everyone reaches safety in case of a fire. GFP includes measures: ■ to reduce the risk of fire and to control the spread of fire; ■ in relation to the means of escape from premises; ■ for ensuring that the means of escape can be safely and effectively used whenever they are needed; ■ in relation to the means of fighting fires; ■ in relation to the means for detecting fire and giving warning in case of fire; and ■ in relation to the arrangements for action to be taken in the event of fire.
high-rise building	Buildings over 18 m high (or with seven storeys or more).
non-combustible	Not capable of undergoing combustion under specified test conditions.
occupied	Regulation 36 of CDM states that premises are 'occupied' where there are persons within the premises who are not carrying out construction work. In this situation HSE is not usually the relevant enforcing authority for emergency fire arrangements and general fire precautions.
off-site risk	Risk from the construction work that affects areas outside the principal contractor's direct control because they are beyond the site boundary.
on-site risk	Risk affecting areas within the site boundary and under the principal contractor's control.
process fire precautions	Special fire precautions, required in connection with the construction work being carried out (including the storage of articles, substances and materials relating to that work). They are to prevent or reduce the likelihood of a fire breaking out and if a fire does occur, to reduce its spread and intensity. Process fire precautions are always enforced by HSE for all HSE enforced premises and activities.
reasonably practicable	When weighing the risk against the resource needed to further reduce it, the decision is weighted in favour of health and safety unless the dutyholder can demonstrate it would be grossly disproportionate to the benefits of risk reduction that would be achieved.

responsible person (a requirement of the FSO)	Who the 'responsible person' is depends on the situation. In relation to a workplace it is the employer, if the workplace is to any extent under their control. In relation to any premises not considered a workplace it will be the person who has control of the premises (as occupier or otherwise) in connection with the carrying on by them of a trade, business or other undertaking (for profit or not). It will be the owner where the person in control of the premises does not have control in connection with the carrying on by that person of a trade, business or other undertaking.
relevant persons	Relevant persons under the FSA are those people who are on site, or who may be in the immediate vicinity of the premises, and would be at risk in the event of a fire on the premises.
storey	See definition contained in Approved Document B. Ground floor is the first storey.
temporary accommodation unit (TAU)	TAUs include temporary buildings brought to site, such as prefabricated cabins, modular units, linked modular buildings, caravans, storage containers and welfare units that are occupied by persons at work on a construction site.
timber frame	A build method that relies on a timber frame for structural support. The construction method uses wall panels and floor decks, often factory-manufactured. The main systems used are classified as either open-panel, insulated or closed-panel. These panels can include the wall insulation pre-fitted and sometimes include the pre-fitting of doors, windows and service zones for on-site installation of mechanical and electrical works.
volatile material	A substance that evaporates readily at normal temperatures and/or has a measurable vapour pressure. The term usually applies to liquids.
wet riser	A vertical pipe intended to distribute water to multiple levels of a building or structure as a component of the firefighting system. A wet riser has on-site water supply and pumps, and is permanently charged with water.
work process	All aspects of work involving, or in connection with, the use of plant or machinery or the use or storage of any dangerous substance (as defined under DSEAR).

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FURTHER INFORMATION

For information about health and safety visit https://books.hse.gov.uk or http://www.hse.gov.uk

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They are also available from bookshops. Statutory Instruments can be viewed free of charge at www.legislation.gov.uk where you can also search for changes to legislation.

Fire safety in construction

Although the construction industry's performance has improved over the past decade, the rates of death, serious injury and ill health for construction site workers are still too high. Workers and members of the public may be at risk from fire during construction works, when large fires can spread rapidly (including off site) because suitable controls are absent or are mis-managed.

The guidance will be extremely useful to everyone who has a role in the development, management and application of fire safety standards on construction sites (ie clients, principal designers, designers, principal contractors and contractors). It will also support those with legal responsibilities under the Construction (Design and Management) Regulations 2015, the Regulatory Reform (Fire Safety) Order 2005 and the Fire (Scotland) Act 2005, while assisting site managers in the day-to-day management of fire risks on site.

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