

T-LEVELS

THE NEXT LEVEL QUALIFICATION

SECOND EDITION

**BUILDING SERVICES
ENGINEERING FOR
CONSTRUCTION**

CORE

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 **hachette**
LEARNING

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Introduction

A T Level in Building Services Engineering for Construction will provide you with broad and deep foundations for a career in the Building Services Engineering industries, including in areas such as electric installation or maintenance and plumbing or heating. The Level 3 technical qualification, which was developed by WJEC/Eduqas in collaboration with employers and industry bodies, will enable you to progress to a range of careers and further education opportunities. You can find out more about the qualification on the WJEC/Eduqas website.

This book will help you to develop the knowledge and understanding you need to complete the core component of your T Level. Each of the chapters in the book follows the topics required for the core component's knowledge outcomes, which you can find on the WJEC/Eduqas website. Headings in the book follow those in the qualification handbook, so that you can check your learning. Although the book focuses on the core component only, the content that you cover

and the skills that you learn will also be useful in your chosen occupational specialism(s).

The book will introduce you to the Building Services Engineering workplace, and the fundamental principles that underpin it, across a range of engaging and real-world examples. The book covers the key content in detail and includes hundreds of photos and technical drawings, as well as industry tips to support you in your T Level work placement. There are also lots of activities and learning features; you can find out more about these and how to use them on the next page.

Your teacher or lecturer might decide to use the book in your classroom, either as a central learning tool or to supplement their teaching. The book will also prepare you for your final exams and the employer set project. (You can find out more about how you will be assessed on page 394 of this book.) If you have any questions about how you should be using the book, you should consult your teacher or lecturer.

Guide to the book

The following features can be found in this book.

Learning outcomes

Core knowledge outcomes that you must understand and learn

Key term

Important terms that you should understand

Industry tip

Useful tips and advice to help you in the workplace

Research

Research-based activities: either stretch and challenge activities enabling you to go beyond the course, or industry placement based activities encouraging you to discover more about your placement

Case study

Placing knowledge into a fictionalised, real-life context, to introduce dilemmas and problem solving

Test yourself

A knowledge-consolidation feature containing questions and tasks to aid understanding and guide you to think about a topic in detail

Health and safety

Important points to ensure safety in the workplace

Improve your maths

Short activities that encourage you to apply and develop your functional maths skills in context

Improve your English

Short activities that encourage you to apply and develop your functional English skills in context

Assessment practice

Knowledge-based practice questions to help prepare you for the exam (answers found at the back of the book)

Project practice

Short scenarios and focused activities, reflecting one or more of the tasks that you will need to undertake during completion of the employer-set project

Chapter 1 Health and safety in construction

This chapter looks at health and safety legislation and approved standards, and how they protect workers and others who may be affected by work activities.

We will also consider the legal responsibilities of people working in construction and building services engineering (BSE) and the implications of not following health and safety law.

Learning outcomes

By the end of this chapter, you will understand:

- 1 construction legislation and regulations
- 2 public liability and employer's liability
- 3 approved construction codes of practice
- 4 development of safe systems of work
- 5 safety conscious procedures
- 6 safety inspection of a work environment
- 7 implications to those working within the BSE industry of not following health and safety legislation
- 8 safe working practices for the safe isolation of systems
- 9 implications of poor health and safety on building performance and individual stakeholders
- 10 recording and reporting of safety incidents and near misses
- 11 emergency procedures for unsafe situations
- 12 types of PPE
- 13 first-aid facilities
- 14 warning signs for the main groups of hazardous substance
- 15 safe practices and procedures for the use of access equipment and manual handling
- 16 safe practices and procedures for working in excavations and confined spaces.

1 Construction legislation and regulations

1.1 The role of legislation and regulations in the construction industry

Working in the construction industry can be extremely hazardous. In 1974, the Health and Safety at Work etc. Act (HASAWA) was introduced. It replaced many older laws and enabled new regulations to be passed in Parliament to protect workers and the general public from work activities.

The main objectives of the HASAWA are to:

- ▶ secure the health, safety and welfare of people at work
- ▶ protect people other than those at work (for example the general public or visitors) from risks to health or safety arising out of or in connection with work activities
- ▶ control the possession and use of highly flammable, explosive and dangerous substances.

Everyone has a moral responsibility to protect the health and safety of themselves and others at work. However, under HASAWA some parties – known as **duty holders** – have legal responsibilities. Employers, employees, the self-employed, manufacturers and people in control of premises are all duty holders.

Key term

Duty holders: people with a legal responsibility under health and safety law

Shortly after HASAWA was introduced, the UK government established the Health and Safety Executive (HSE). The HSE is an independent regulator that aims to prevent workplace ill health, injury and death by targeting industries with the greatest risks and worst risk-management records, which include construction and manufacturing.

The HSE provides advice and guidance to employers so that they can identify hazards and manage risks correctly. Its emphasis is on the prevention of accidents and ill health by raising awareness in workplaces, so that workers and other people can stay safe and well.

Research

Visit the HSE website (www.hse.gov.uk) to find out the responsibilities of duty holders under HASAWA.

The HSE has legal powers to hold people or companies to account when risks are not managed and legislation is breached. We will look at how the HSE enforces HASAWA later in this chapter.

Legislation made under HASAWA is divided into a number of different regulations. Table 1.1 outlines the main regulations that control health, safety and welfare in the construction industry.

▼ Table 1.1 Main regulations that control health, safety and welfare in the construction industry

Regulation	Overview
Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) 2013	These regulations place legal duties on employers, the self-employed and people in control of premises to report to the HSE serious accidents, dangerous occurrences and occupational diseases resulting from workplace activities.
Control of Substances Hazardous to Health (COSHH) Regulations 2002	These regulations state that employers must control substances hazardous to health by preventing or reducing workers' exposure. This can be achieved by: <ul style="list-style-type: none"> • finding out what the health hazards are • deciding how to prevent harm to health by assessing the risks (risk assessment) • providing control measures, such as secure storage for chemicals • making sure that control measures are followed • maintaining control measures • providing training, information and instruction for employees and others • monitoring and providing health surveillance when necessary • planning for emergencies. <p>Note: asbestos is not covered by COSHH Regulations.</p>



Regulation	Overview
Control of Asbestos Regulations 2012	<p>There are several different types of asbestos that have been used in the construction industry, some of which are more hazardous than others. In most cases, asbestos can only be removed by a licensed contractor. However, small quantities of lower-risk asbestos can be removed by non-licensed contractors, providing they are competent and have effective controls in place.</p> <p>The law states that before doing any building work or maintenance on premises or on plant and equipment that contain asbestos, a risk assessment has to be carried out to manage and control the risks.</p> <p>It is mandatory for anyone who is likely to be exposed to asbestos fibres at work to receive training.</p>
Provision and Use of Work Equipment Regulations (PUWER) 1998	<p>These regulations place duties on people and organisations that operate or have control over work equipment. They state that:</p> <ul style="list-style-type: none"> • equipment must be suitable for its intended use • equipment must be safe, maintained and regularly inspected • people who use the equipment must have received training, information and instruction • equipment must be used accompanied by suitable health and safety measures, for example guarding or emergency stop devices.
Manual Handling Operations Regulations (MHOR) 1992	<p>These regulations define manual handling as ‘any transporting or supporting of a load ... by hand or bodily force’. They set out a hierarchy of control measures for dealing with the risks posed by manual handling:</p> <ol style="list-style-type: none"> 1 Avoid hazardous manual handling operations so far as is reasonably practicable. 2 Assess any hazardous manual handling operations that cannot be avoided. 3 Reduce the risk of injury so far as is reasonably practicable.
Personal Protective Equipment (PPE) at Work Regulations 1992 (Note: the current legislation which refers to the supply of PPE is the Personal Protective Equipment Regulations 2016/425, which is enforced by the Personal Protective Equipment (Enforcement) Regulations 2018)	<p>These regulations relate to the use of personal protective equipment (PPE). Employers have a responsibility to provide PPE free of charge to employees to control the hazards identified in risk assessments. They should also provide information, instruction and training on how to use it and take care of it.</p>
Work at Height Regulations 2005	<p>Under these regulations, people who are in control of others working at height have a duty to make sure work is properly planned, supervised and carried out by competent people. All work at height must be risk assessed.</p>
Control of Noise at Work Regulations 2005	<p>Exposure to high levels of noise can cause temporary or permanent hearing loss. Employers have a duty to reduce the risk by:</p> <ul style="list-style-type: none"> • assessing the risks • eliminating or controlling the noise • providing hearing protection • providing hearing checks for those at risk • providing employees with information and training • maintaining any noise-control equipment and ensuring it is being used.
Control of Vibration at Work Regulations 2005	<p>These regulations place a duty on employers to reduce the risk to employees’ health from exposure to vibration caused by work equipment, machinery and tools, for example when using a core drill.</p> <p>Employers must calculate the amount of vibration that employees may be exposed to at work. At a specific level (referred to as the ‘exposure action value’), employers must introduce technical and organisational measures to reduce the risk of personal injury to an acceptable level. The law also prevents workers from being exposed to a higher exposure limit value of 5.0 m/s² A(8).</p>



▼ Table 1.1 Main regulations that control health, safety and welfare in the construction industry

Regulation	Overview
Confined Spaces Regulations 1997	The aim of these regulations is to prevent people working in confined spaces whenever possible, because of the serious risk to health and safety from collapse, drowning, low oxygen levels and exposure to natural gases. If the activity is unavoidable, a safe system of work must be followed to control the risk.
Management of Health and Safety at Work Regulations 1999	These regulations apply to every work activity. They explain what employers need to do to manage health and safety at their place of work under HASAWA. The main requirement is for employers to complete a risk assessment and record significant findings when they have five or more employees.
Electricity at Work Regulations 1989	These regulations outline the responsibilities of those involved in the design, operation, construction and maintenance of electrical equipment and systems. They are relevant to most work activities and premises, except certain offshore installations and particular ships.
Environmental legislation	There are numerous environmental laws in the UK that protect wildlife, the countryside, listed buildings, national parks and monuments, for example the Control of Pollution Act 1974, the Wildlife and Countryside Act 1981 and the Planning (Listed Buildings and Conservation Areas) Act 1990. The environment is protected further by the Planning and Energy Act 2008, Energy Act 2020 and Climate Change Act 2008. The Climate Change Act 2008 is an environmental law designed to meet the UK government's target to reduce carbon emissions recorded in 1990 by at least 80 per cent by 2050.
Waste management legislation	There are several requirements for handling waste, including the Waste Electrical and Electronic Equipment (WEEE) Regulations 2013, as well as regulations on waste carriers. For more information, see Chapter 5, section 7.
Lone working	Lone working refers to situations where someone works by themselves without direct supervision, and UK regulations require employers to ensure these workers are safe. Under the Health and Safety at Work Act and the Management of Health and Safety at Work Regulations, employers must assess risks, provide proper training, and ensure lone workers can communicate and get help if needed.

Key terms

Risk assessment: a formal process of identifying significant workplace hazards, whom they affect and control measures that could be used to eliminate or reduce risk to an acceptable level

Asbestos: a naturally occurring mineral that used to be mixed with other construction materials to create insulation, pipe lagging and flooring; it has been banned in the UK since 1999 because it is extremely hazardous to health, however workers may still be exposed to it in older buildings

Safe system of work: a formal set of procedures that must be followed when hazards cannot be eliminated completely

Carbon emissions: carbon dioxide released into the atmosphere; scientists believe this is a cause of climate change

Health and safety legislation is regularly reviewed and updated to reflect changes in the construction and BSE industries. These changes are often made with guidance and support from the following bodies:

- ▶ employers
- ▶ unions
- ▶ trade associations
- ▶ professional bodies
- ▶ academics.

Test yourself

How can you reduce the risk of personal injury caused by manual handling?

Health and safety

The use of PPE should be a last resort after all other methods of controlling a hazard have been considered. For example, the use of guardrails, safety nets and airbags should be considered for use while working at height before a lanyard. This is because PPE only protects the user, whereas the other methods protect others as well.

Research

Find out the short- and long-term effects that vibration can cause on different parts of the human body. Suggest ways to reduce or control the risks to comply with the Control of Vibration at Work Regulations 2005.

Health and safety

The CDM Regulations state that, if necessary, employers have to provide facilities for pregnant or nursing mothers to rest lying down.

1.2 Regulations relating to the provision of welfare facilities during construction work

Under HASAWA, employers have a duty to provide basic welfare facilities for their employees at their place of work. The Construction (Design and Management) (CDM) Regulations 2015 outline the minimum facilities that should be provided on construction sites:

- ▶ Drinking water:
 - An adequate supply of fresh drinking water should be appropriately labelled and accessible in suitable places.
 - An adequate supply of cups or other drinking vessels must be provided, unless the water is supplied from a fountain for workers to drink easily.
- ▶ Toilets:
 - These should be separate for men and women, with doors that are lockable from the inside.
 - They should be clean and maintained with adequate ventilation and lighting.
- ▶ Washing facilities:
 - These should be located in the vicinity of the toilets and changing rooms, with clean cold and hot or warm running water if possible.
 - Soap or another means of cleaning must be provided, along with towels or another suitable method of drying.
 - Showers may also need to be provided if the nature of the work requires it.
- ▶ Rest facilities:
 - These should be equipped with tables and seating with backs for the number of people expected to use them.
 - The rest area must be able to maintain an appropriate temperature and have facilities to prepare and eat meals and boil water.
- ▶ Changing rooms with lockers:
 - These must be provided if workers have to wear special clothing for their job, unless they can be reasonably expected to change elsewhere.
 - Changing rooms should be provided with seating and facilities to dry and store clothing.
 - Separate rooms must be provided for men and women.



▲ Figure 1.1 Welfare facilities on a construction site

1.3 Implications of not adhering to legislation

Health and safety law is made up of Acts of Parliament and statutory regulations. Failure to comply with them is a criminal offence. HSE inspectors have a number of powers to enforce the law, including carrying out inspections, issuing simple cautions and notices to duty holders, and sometimes initiating prosecutions.

The law states that HSE inspectors can enter a workplace without notice at any reasonable time to conduct an inspection or investigation. During a visit, they may want to speak to workers, look at possible health risks, and inspect equipment and machinery. They can also take samples, such as sound and dust levels, photographs and measurements, and make copies of records or other documentation needed as part of their investigation.

If the inspector thinks that the employer has broken the law, they will issue a 'notification of contravention'. This document outlines what laws have been broken and how, and what needs to be done to put things right.

An HSE inspector may issue an improvement notice when one or more laws have been breached; this means that faults have to be remedied within a specific period of time, which should be no less than 21 days.

If there has been a serious breach of the law and people are at risk of immediate harm, the HSE will issue a prohibition notice, preventing work from continuing.

Failure to comply with improvement or prohibition notices can result in prosecution, fines and imprisonment.

Research

What are the maximum legal penalties for employers that have not adhered to health and safety legislation?

Case study

Amelia is a self-employed painter and decorator who subcontracts work from medium-sized developers in the local area.

Several months ago, she was visited by an HSE inspector. During the visit, the inspector noticed that a large amount of hazardous paint was not being stored correctly and was a potential source of fuel for a fire; therefore, they issued an improvement notice.

The enforcement action taken by the inspector has been published on the HSE website. What impact do you think this will have on Amelia's business?

When people suffer loss or injury as a result of an accident at work, they may seek compensation. If health and safety legislation has been breached, the duty holder is usually fined because they have broken criminal law. Magistrates and the Crown Court have a discretionary power to award compensation to an injured person. However, claims are usually pursued by the injured person because of a breach of **common law**.

Employers should have liability insurance to cover any claims against them for a breach of common law; however they cannot insure against fines when they have broken criminal law.

Key term

Common law: legislation made in the civil courts rather than statute law that is made in Parliament

Research

Research an employer's common-law duty of care and compare this to their duties under HASAWA.

1.4 Statutory and non-statutory documents in construction

The UK construction industry is subject to a number of laws which cover many different areas, including health, safety and welfare. Legislation comprises Acts of Parliament and regulations (statutory legislation) which have legal status and must be complied with. However, there are also many non-statutory guidance documents, which are not compulsory but offer advice on good practice and compliance with the law, for example the Approved Codes of Practice (ACOPs) produced by the HSE which describe preferred methods and standards. Unless stated, you do not need to follow the ACOP guidance, but in doing so you will meet the requirements of HASAWA. The HSE states that other practical methods can be used, but they must meet or exceed the standards in the ACOP.



▲ Figure 1.2 An Approved Code of Practice

Test yourself

State one example of statutory legislation that is applicable to a construction activity and an ACOP to support it.

2 Public liability and employer's liability

2.1 Current requirements

We have already seen that the HSE has the power to issue fines to employers and other duty holders if they neglect the law. The fines issued by the HSE are intended to punish employers financially; therefore they cannot insure against them.

However, employers can protect themselves with insurance against claims made by employees through the common-law courts in the pursuit of compensation. In this section, we will look at the different types of insurance that employers may have.

Public liability insurance

Public liability insurance protects a business against claims for compensation for any loss or injury to members of the public, customers or employees in connection with work activities.

There is no legal requirement for employers to have public liability insurance. However, if they engage with the public, or the public and their property are likely to be affected by the employer's work activities, then they should have this insurance to protect themselves from any potential claims made against them.

The level of insurance protection is determined by the nature and scale of the work undertaken. Some clients will stipulate the minimum level of insurance cover needed by a contractor, and have it agreed in writing before awarding any contracts or allowing construction work to start.

Employers' liability insurance

Common law is legislation that places a duty of care on employers to protect their employees from any unnecessary risks, and to ensure a safe system of work. If a person is injured or suffers a loss in the workplace, they may seek financial compensation from the employer if they are **liable**.

Key term

Liable: legally responsible

Under the Employers' Liability (Compulsory Insurance) Act 1969, all employers are required by law to insure against liability for injury or disease to their employees

arising out of their employment and any financial claims made against them.

The amount of liability insurance an employer needs is usually determined by the number of employees and level of risk involved with their business. However, the minimum amount of cover for most insurance policies starts between 5 and 10 million pounds. If the injured person was successful with their claim against the employer, the compensation would go towards the recovery of their lost earnings, medical treatment, ongoing care and any legal fees.

Research

Find out the other types of insurance that a contractor or subcontractor may take out to safeguard themselves and their assets.

Improve your maths

The HSE reported that there were 142 work-related fatal injuries in the UK in 2020–21; 39 fatalities occurred in the construction industry. What percentage of fatalities occurred to construction workers?

3 Approved Codes of Practice (ACOPs)

3.1 The HSE Legal (L) Series

In 2015, the Construction (Design and Management) (CDM) Regulations came into force. Their aim was to manage health, safety and welfare on all construction projects by defining roles for duty holders. People with responsibilities under the regulations include clients, designers and contractors. If there is more than one designer or contractor working on the same construction project, a **principal designer** or **principal contractor** must be appointed (named). Any other designers or contractors must work under the control of the principal designer or contractor.

The CDM Regulations state that where possible the designer (or principal designer) should plan for health and safety by identifying then eliminating or minimising all foreseeable risks at the planning stage of a project. They also state that all construction work, regardless of size, should have a 'construction phase plan'. This is a key document

that identifies all the potential hazards for a project and the measures that will be used to remove or mitigate them.

Contractors and principal contractors have a duty under the CDM Regulations to:

- ▶ provide site inductions for all workers and visitors to the site
- ▶ provide suitable welfare facilities
- ▶ secure the site to prevent unauthorised access and protect non-workers (for example members of the public).

The HSE has published a range of documents known as the HSE Legal (L) Series (also referred to as the CDM Series). Their primary purpose is to support duty holders in meeting their obligations under the CDM Regulations. They are available online to download for free, or a hard copy can be purchased through the HSE's website. The L Series contains both Approved Codes of Practice (ACOPs) and guidance on various health, safety and welfare regulations.

Key terms

Principal designer: a designer appointed by the client to take the lead in planning, managing, monitoring and co-ordinating health and safety during the pre-construction phase of a project involving more than one designer

Principal contractor: a contractor appointed by the client to take the lead in planning, managing, monitoring and co-ordinating health and safety during the construction phase of a project involving more than one contractor

Improve your English

Include the word 'mitigate' in a short sentence about health and safety hazards that you may face at your training centre.

3.2 Legionnaires' disease: the control of *Legionella* bacteria in water systems (L8)

Legionnaires' disease is a type of pneumonia caused by *Legionella* bacteria that naturally occur in fresh-water environments such as streams and lakes. It can be contracted by inhaling infected airborne water droplets and can be fatal.

'Legionnaires' disease: The control of *Legionella* bacteria in water systems (L8)' is an example of an ACOP and part of the HSE's L Series. It outlines the responsibilities that employers and further duty holders have towards others in relation to *Legionella*. The latest (fourth) edition of the document provides revisions to simplify some of the text contained in the regulations (for example COSHH).

The ACOP provides practical advice to prevent the growth and spread of *Legionella* bacteria in manmade water systems. The first step in managing the risk is to complete a suitable and sufficient *Legionella* risk assessment (LRA), to identify the source of any risk. The ACOP recognises the importance of the LRA and states that it must be completed by a trained and competent person who fully understands the water systems being evaluated. Risk assessments must be regularly reviewed and updated when changes are necessary as a result of a review, to keep records up to date and current.

The ACOP states that duty holders must appoint a competent person (known as a responsible person) with suitable authority to manage the day-to-day operational procedures, to make sure 'effective and timely' actions are taken to manage the hazards identified in the risk assessment.

In addition to risk assessments, the L8 ACOP describes other methods of implementing control schemes and measures, including managing, monitoring precautions and inspection.

3.3 (IET) Codes and Guidance

The Institute of Engineering and Technology (IET) Codes and Guidance, including the IET Wiring Regulations (BS 7671), serve as authoritative standards for electrical installation and safety in the UK construction industry. While not legally binding in themselves, they are widely recognised as the benchmark for compliance with statutory requirements under the Electricity at Work Regulations 1989. These documents provide detailed technical guidance on design, installation, inspection, testing, and maintenance of electrical systems, helping professionals ensure safe and efficient practices.

4 Development of safe systems of work

4.1 Development and use of safe systems of work in construction projects

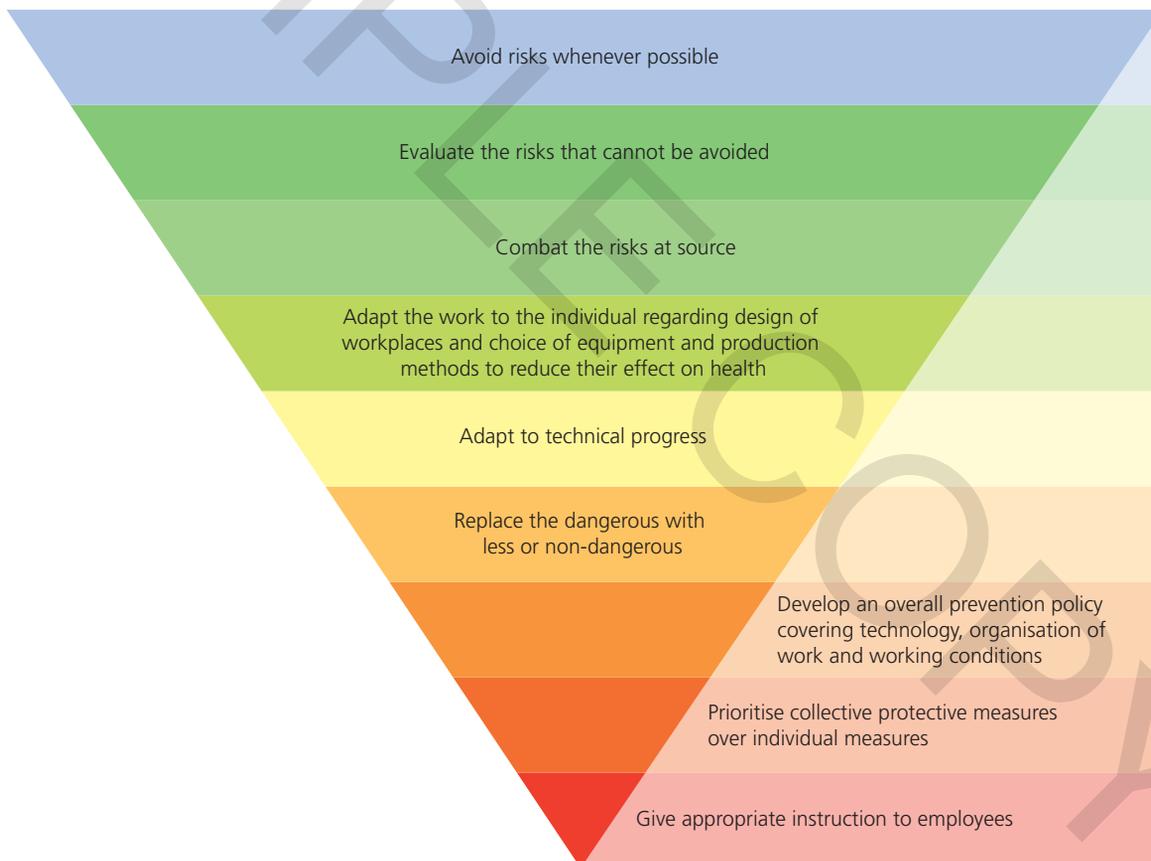
There are different types of management system that can be used to create safe systems of work. However, the HSE favours the following approach, which can be applied to most construction businesses:

- ▶ **Plan** – for specific health and safety objectives
- ▶ **Do** – implement the plan
- ▶ **Check** – that the plan is working and measure performance, for example the number of accidents and near misses
- ▶ **Act** – learn from any mistakes and put them right.

The law states that every employer must have a policy for managing health and safety, and that it must be in written form if they have five or more employees. A health and safety policy sets out the general approach an employer has towards managing health and safety in their business and is divided into three sections:

- ▶ general statement of intent (the employer's commitment)
- ▶ arrangements (what the employer intends to do and how)
- ▶ responsibilities (areas of responsibility within their business and defining roles).

The Management of Health and Safety at Work Regulations 1999 contain a schedule known as the 'General principles of prevention'. This provides a hierarchy of control measures for employers to manage risks to health and safety in the workplace (see Figure 1.3).



▲ Figure 1.3 Hierarchy of control measures for managing health and safety risks (source: www.legislation.gov.uk)

Test yourself

What is the least effective method of controlling health and safety risks?

Research

Find out about permits to work as part of a safe system of work. Explain:

- ▶ when they are used
- ▶ who issues them
- ▶ how they are controlled

You should also make a list of as many work activities as you can think of that would benefit from a permit-to-work system and justify your reasons for choosing these tasks.

A risk assessment should be a structured examination of workplace activities, appropriate and proportional to the level of risk and the nature of the hazards. It should be site and task specific; therefore generic risk assessments would not be considered suitable or sufficient.

Completing a risk assessment is a five-step process:

- 1 Identify hazards and potential hazards (what could cause injury or illness).
- 2 Decide who might be harmed and how.
- 3 Assess the risks by looking at the likelihood of the hazard causing harm and the severity of that harm.
- 4 Establish control measures to remove or reduce the risk of harm. (Look at what you are already doing to protect people, what future actions need to be taken and who needs to take those actions).
- 5 Record any significant hazards found (when there are five or more employees) and review the assessment after the control measures have been put in place to see if they are working, or if anything further could be done.

4.2 How to complete risk assessments

The Management of Health and Safety at Work Regulations 1999 place a legal duty on employers to manage the risk of potential harm to people from work activities. A risk assessment that identifies hazards and determines measures to eliminate or control them is fundamental to reducing work-related accidents and ill health.

Risk assessments should not be designed to produce lots of paperwork, neither do they need to be complicated or difficult to understand.

As part of a good management system, employers should prioritise the highest-level risks before assessing medium-level risks. Once all of these

Risk Assessment

Activity / Workplace assessed: Return to work after accident
 Persons consulted / involved in risk assessment
 Date:
 Reviewed on:

Location:
 Risk assessment reference number:
 Review date:
 Review by:

Significant hazard	People at risk and what is the risk Describe the harm that is likely to result from the hazard (e.g. cut, broken leg, chemical burn etc.) and who could be harmed (e.g. employees, contractors, visitors, etc.).	Existing control measure What is currently in place to control the risk?	Risk rating Use matrix identified in guidance note. Likelihood (L) Severity (S) Multiply (L) * (S) to produce risk rating (RR)				Further action required What is required to bring the risk down to an acceptable level? Use hierarchy of control described in guidance note when considering the controls needed.	Actioned to: Who will complete the action?	Due date: When will the action be completed by?	Completion date: Initial and date once the action has been completed.
Uneven floors	Operatives	Verbal warning and supervision	L 2	S 1	RR 2	L/M/H M	None applicable	Site supervisor	Active now	Ongoing
Steps	Operatives	Verbal warning	2	1	2	M	None applicable	Site supervisor	Active now	Ongoing
Staircases	Operatives	Verbal warning	2	2	4	M	None applicable	Site supervisor	Active now	Ongoing

		Likelihood		
		1 Unlikely	2 Possible	3 Very likely
Severity	1 Slight/minor injuries/minor damage	1	2	3
	2 Medium injuries/significant damage	2	4	6
	3 Major injury/extensive damage	3	6	9

1 – Low risk: action should be taken to reduce the risk if reasonably practicable.
 2, 3, 4 – Medium risk: is a significant risk and would require an appropriate level of resource.
 6 & 9 – High risk: may require considerable resource to mitigate. Control should focus on elimination of risk, if not possible control should be obtained by following the hierarchy of control.

◀ Figure 1.4 A risk assessment

hazards have been identified and eliminated or controlled in some way to a satisfactory level, lower-risk activities should be risk assessed.

Risk assessments should be completed by a competent person with a satisfactory level of knowledge and experience. For more complex activities, the person completing them may seek advice from other sources, such as the HSE or trade organisations. Employers with five or more employees are required by law to record significant findings from their risk assessments.

Health and safety

Some regulations require risk assessments to be carried out for specific tasks, for example the Work at Height Regulations 2005 and the Control of Substances Hazardous to Health (COSHH) Regulations 2002.

4.3 How to write method statements

Method statements are documents prepared by employers that describe a logical sequence of steps to complete a work activity in a safe manner. They reflect the hazards identified in risk assessments and describe the way in which the job should be undertaken.

These documents are used as part of a safe system of work to communicate vital health and safety information and guidance to people completing the activity; together with risk assessments they are referred to as RAMS (risk assessments and method statements).

A typical method statement describes:

- ▶ hazards identified
- ▶ safe access and egress
- ▶ supervision needed
- ▶ hazardous substances and how to control them
- ▶ permit-to-work systems (if applicable)
- ▶ personal protective equipment
- ▶ emergency procedures
- ▶ environmental controls
- ▶ health and safety monitoring
- ▶ workforce details.

Although method statements are an effective way of keeping people safe at work, there is no legal requirement for employers to produce them. However, they are often requested by principal contractors.

Key term

Egress: an exit or way out

METHOD STATEMENT			
Revision Date:	Revision Description:		Approved By:
Work Method Description	Risk Assessment	Risk Levels	Recommended Actions* (Clause No.)
1.			
2.			
3.			
4.			
RISK LEVELS: Class 1 (high) Class 2 (medium) Class 3 (low) Class 4 (very low risk)			
Engineering Details/Certificates/Work Cover Approvals:		Codes of Practice, Legislation:	
Plant/Equipment:		Maintenance Checks:	
Sign-off			
Print Name:	Print Name:	Print Name:	Print Name:
Signature:	Signature:	Signature:	Signature:
Print Name:	Print Name:	Print Name:	Print Name:
Signature:	Signature:	Signature:	Signature:

▲ Figure 1.5 A method statement

4.4 How to complete a COSHH assessment

Hazardous substances can take many forms, including chemicals, dust and biological agents, and are not just products labelled as hazardous.

People at work are often exposed to hazardous substances and may be at risk of long-term (**chronic**) health problems such as asthma, cancer and skin disease.

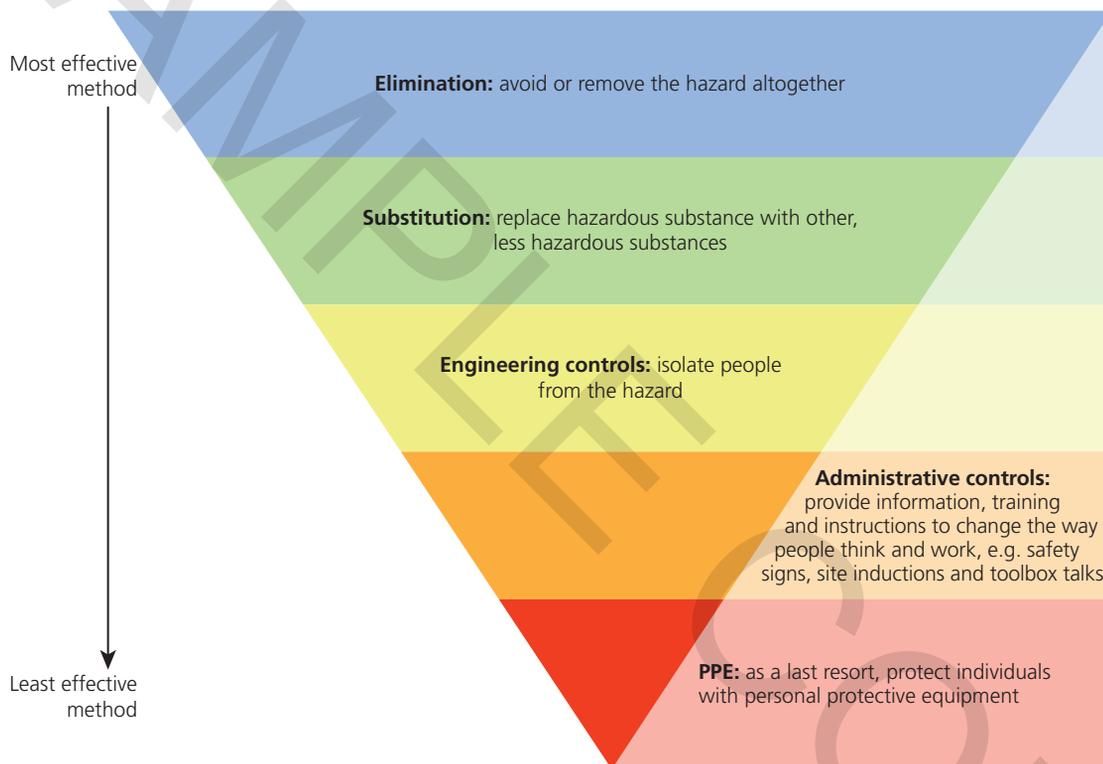
Employers and the self-employed have a legal duty under the COSHH Regulations to assess the risk to their employees and others from exposure to

products and processes that may contain or create substances harmful to health. If they have five or more employees, these assessments must be written down.

The main legal requirement is to use appropriate control measures to prevent harm from exposure, and this can be achieved by applying the hierarchy of control measures outlined in Figure 1.6.

Key term

Chronic: continuing for a long time



▲ Figure 1.6 Hierarchy of control measures to prevent exposure

By law, suppliers must provide up-to-date **safety data sheets** for any hazardous substances. These contain the supplier's information about a product and should not be confused with COSHH assessments.

Key term

Safety data sheets: written documents produced by manufacturers and suppliers of hazardous substances that contain important information about how products should be transported, used, stored and safely disposed of after use, any special conditions you should be aware of and how to deal with the substance in an emergency

Steps to follow to complete a COSHH assessment:

- 1 Identify the hazardous substance, who is likely to be harmed and how.
- 2 Evaluate the risk of the hazard causing harm by considering frequency of exposure to the substance and what effects it could have.
- 3 Decide what reasonably practicable measures are necessary to prevent or control any exposure to the hazard and how these will be maintained; make a plan for emergencies.
- 4 Record the assessment.
- 5 Decide if and when the assessment needs to be reviewed, and by whom.

Company name: Patio path and paving Department:		Date assessment made: Date discussed with employees:				
Step 1 Substance	Step 2	Step 3		Step 4 Action		
What is the hazard?	What harm, and who?	What are you doing already?	What improvements do you need?	Who	When	Check
Breathing in dust from cutting paving	Long-term lung damage, e.g. bronchitis and silicosis. Everyone involved in cutting and anyone working nearby	Water to suppress dust. Protective goggles	Get enough water. Those involved should wear P3 respirators, ear plugs			
Breathing in exhaust fumes from cutter	Carbon monoxide poisoning. Everyone nearby	Always use cutter outdoors	Make sure area is not enclosed and fumes can disperse			
Ready-mix cement – skin contact – splashes	Skin burns when laying cement. Anyone – cement on skin	Avoid skin contact. Use protective gloves	Get access to running water. Wash off splashes immediately. Use skin care products			
Moss killer – skin irritation	Mixing concentrate. Anyone – splash on skin	Use protective gloves. Wash out applicator after use	Get access to running water. Use skin care products			
Also:		Action taken	Action needed			
Thorough examination and test – COSHH		None	Check water suppression			
Supervision		When available				
Instruction and training		Yes	Respirator training for P3 and fit test			
Emergency plans		Mobile phone				
Health surveillance		None	Ask doctor about lung function tests			
Monitoring		None	None			
Step 5 Review date:		1. Review your assessment – make sure you are not sliding back 2. Any significant change in the work? Check the assessment and change it if necessary				
Other hazards needing attention: lifting and handling heavy weights, noise, reversing vehicles						

▲ Figure 1.7 A COSHH assessment

Test yourself

Which substances are covered by the COSHH Regulations?

Categories of safety signs

There are four main categories of safety signs:

- ▶ Mandatory
- ▶ Prohibition
- ▶ Information
- ▶ Warning

Please see section 13 on page 32 for more information on safety signs.

5 Safety conscious procedures

5.1 Construction Skills Certification Scheme

The Construction Skills Certification Scheme (CSCS) is one of many industry-recognised card schemes accredited by the Construction Industry Training Board (CITB). CSCS cards prove that the card holder has a satisfactory level of health and safety awareness; they also show relevant qualifications the holder has achieved to confirm they are working in the correct job role on site.

There are various types of CSCS card, designed to suit people working at different levels in the construction industry, from labourers to academically and professionally qualified managers. CSCS cards last a maximum of five years before the holders have to reapply, however once an apprentice or trainee card has expired it cannot be renewed. There is no legal requirement for workers to hold a CSCS card, although most principal contractors and clients require people to have them as a way of managing health and safety on sites under their control.

To qualify for a basic CSCS card, a candidate must first successfully complete the CITB (Site Safety Plus) Health and Safety Awareness course and test. They must then pass the online CITB Health, Safety and Environment test before they are allowed to apply for an appropriate CSCS card.

5.2 Site Management Safety Training Scheme

Principal contractors and clients usually require people with planning, organising, controlling

and monitoring responsibilities (for example site managers) to hold the Site Management Safety Training Scheme (SMSTS) qualification. This qualification ensures that the holder is up to date with health, safety, welfare and environmental legislation, so that they can fulfil their legal responsibilities. Every five years, the holder has to complete the Site Management Safety Training Scheme Refresher (SMSTS-R) to retain the qualification and to make sure they are aware of any changes in legislation, new guidance and industry best practice.

5.3 Site Supervision Safety Training Scheme

The Site Supervision Safety Training Scheme (SSSTS) is a similar qualification to the SMSTS. It is designed for people with supervisory responsibilities or those preparing to start in this role and provides an understanding of topics such as **site inductions**, risk assessments and method statements. Every five years, the Site Supervision Safety Training Scheme Refresher (SSSTS-R) course has to be completed, to keep up to date with any changes that affect the supervisory role and to retain the qualification status.

Key term

Site induction: an occasion when all new visitors and workers on a construction site are informed about potential hazards and the control measures used to protect people from harm

5.4 Procedures that promote and support safety consciousness

HASAWA states that employers have a duty to provide information, instruction and training to their employees, so that they know how to work safely without risks to health. Employees and the self-employed should be made aware of:

- ▶ the hazards and risks they may face
- ▶ control measures that are in place to deal with hazards
- ▶ what to do in the event of an emergency, for example assemble at the designated muster point (assembly point).

Employers must pay particular attention to certain groups, such as young people, new recruits and people changing roles, because they are less likely to be aware of potential risks and therefore require additional training and support.

Under the Construction (Design and Management) (CDM) Regulations 2015, principal contractors must engage with workers about their health, safety and welfare, and provide a site-specific induction and any other information and training that they need. Before entering a workplace, people should be made aware of potential hazards and the measures they need to take to protect themselves and others. On construction sites, this is usually achieved by following the site rules displayed on notice boards and safety signs. All workers and visitors to site have to sign in, so that the site manager is aware of who is on site at all times, especially in the event of an emergency. Visitors and new workers will have to attend a site induction, where they will be informed about:

- ▶ hazards
- ▶ site rules
- ▶ personal protective equipment (PPE)
- ▶ welfare facilities
- ▶ first aid
- ▶ fire extinguishers
- ▶ emergency procedures
- ▶ key personnel (for example site manager, assistant manager, supervisors, first aider)
- ▶ pedestrian routes
- ▶ parking
- ▶ working hours
- ▶ waste and the environment
- ▶ boundaries
- ▶ working at height
- ▶ traffic-management plans
- ▶ **permits to work**
- ▶ security
- ▶ risk assessments and method statements (RAMS).



▲ Figure 1.8 A hot works permit-to-work activity

The duration of a site induction will depend on the size and nature of the work and the personnel undertaking the training. Experienced workers or designers (architects and engineers) may only need to attend a brief site induction, whereas someone that is newly qualified will need to attend a full induction. Inductions must be completed for every new site that is visited, regardless of whether the person is working for the same employer or principal contractor.

It is likely that the conditions and hazards on a site will evolve as work progresses, after people have attended a site induction. Workers will need to be updated on any matters of health and safety when necessary. Short presentations known as **toolbox talks** are often used to provide this information to workers. These are usually delivered to small groups of workers, in an area of the workplace where they should not be disturbed. These talks usually cover a single aspect of health and safety, such as good housekeeping (keeping areas clean and clear).

Key term

Permits to work: documents issued by site managers to workers undertaking high-risk activities as a method of control; they authorise certain people to carry out specific work tasks within a given timeframe and set out the precautions needed to complete the work safely

Key term

Toolbox talks: short training sessions arranged at regular intervals at a place of work to discuss health and safety issues; they give safety reminders and inform personnel about new hazards that may have recently arisen

Research

Make a list of activities that should be controlled by a permit-to-work system. Choose one activity from your list and create a detailed permit to work using a template from the HSE's website.

5.5 Benefits of procedures that promote and support safety consciousness

It is important to remember that employees have duties under HASAWA, as well as employers, and that every effort must be made to comply with the law.

The law states that employees must:

- ▶ take care of their own health and safety and that of others
- ▶ report any work situations that present a serious and imminent risk
- ▶ co-operate with their employer to help them comply with health and safety legislation
- ▶ follow any instructions or health and safety training provided by their employer
- ▶ inform their employer of any shortcomings they identify in their health and safety arrangements.

When an employee fails in these responsibilities or does not follow their employer's health and safety procedures, they are essentially breaking the law and could be putting themselves and others at risk of injury, illness or death.

Accidents and near misses in the workplace often cost the employer in terms of time, effort and money. There may also be penalties imposed on them by the HSE and civil claims made against them.

A workplace accident could also result in indirect costs for the employer, such as:

- ▶ project timescales slipping and missed deadlines
- ▶ time spent training new staff
- ▶ increased insurance premiums.

Employers with a poor health and safety record usually have difficulty retaining staff, because they do not feel safe in their place of work. It also leads to low morale and a negative health and safety culture, which in turn makes it challenging to recruit new employees.

Poor standards of health and safety can also have a detrimental effect on future contracts and potentially result in losing business.

Safety consciousness within construction sites/environments/workshop areas include:

- ▶ reporting of potential hazards, following the company's reporting procedure and RIDDOR.
- ▶ procedures that must be followed when hazards cannot be eliminated completely.
- ▶ construction site inductions for all new visitors and workers including identification of risks and hazards and the control measures used to mitigate them.

- ▶ on and off the job health and safety training and related qualifications.
- ▶ toolbox talks which involve short training sessions at a place of work to discuss health and safety issues and inform personnel about new hazards that may have recently arisen.
- ▶ good housekeeping including systematic ways of working and keeping areas clean and clear.

Test yourself

- 1 What powers does the HSE have to enforce HASAWA?
- 2 What impact do you think an accident at work could have on an injured employee?

Improve your maths

In 2020, the HSE published a profile of non-fatal workplace injuries by accident kind:

- ▶ falls from a height 8%
- ▶ struck by a moving object 11%
- ▶ slips, trips or falls on the same level 29%
- ▶ acts of violence 9%
- ▶ handling, lifting or carrying 19%
- ▶ other 24%.

Produce a pie chart on a computer to illustrate this data.

6 Safety inspection of a work environment

6.1 Methods used to inspect a workplace to ensure it is safe

Employers have a responsibility to monitor health and safety arrangements in the workplace, to ensure they are effectively controlling risks.

There are two types of monitoring system that are typically used in the construction industry:

- ▶ **Active monitoring** is the monitoring of people, procedures, premises and plant in the workplace in order to identify potential hazards before an accident or incident occurs, so that control measures can be taken to prevent harm.
- ▶ **Reactive monitoring** is an inspection completed after an incident has taken place, for example a review of accident forms or statistics which might identify an area of concern, such as skin burns from welding equipment or falls from height.

Although reactive monitoring is a review of performance standards, it is a useful method of identifying problems to prevent further accidents and incidents occurring and should be used alongside active monitoring.

Key terms

Active monitoring: monitoring people, procedures, premises and plant in the workplace in order to identify potential hazards before an accident or incident occurs, so that control measures can be taken to prevent harm

Reactive monitoring: an inspection completed after an incident has taken place to prevent further incidents occurring

6.2 Monitoring health and safety in the workplace

As part of a good health and safety management system, employers should plan a programme of statutory, routine, periodic and pre-use inspections of equipment and their workplace. The frequency of the inspections will be determined by a number of factors, for example pre-use inspections of safety equipment may be completed daily by employees, whereas a periodic inspection of lifting equipment could be every six months, as determined by the Lifting Operations and Lifting Equipment Regulations (LOLER) 1998.



▲ Figure 1.9 A construction crane covered by LOLER

Active monitoring should involve structured, well-planned and organised examinations carried out by competent, experienced inspectors. Employers must decide:

- ▶ what type of inspections need to be completed
- ▶ who needs to be involved
- ▶ what analytical equipment may be needed, even if this means consulting specialists.

There are various types of health and safety inspection that can be implemented in the workplace:

- ▶ Health and safety audits (also known as desktop audits) are used to inspect health and safety documentation used in the workplace.
- ▶ Safety sampling is used to focus an investigation on a representative sample of a workplace standard, for example a random selection of portable electrical equipment could be selected to check if portable appliance testing (PAT) is up to date. If a big enough sample is selected, then it is likely to reflect any issues that may be identified on a wider scale within the company.
- ▶ Safety surveys are often used to focus a detailed health and safety investigation on a particular topic or issue, rather than the workplace as a whole.
- ▶ Safety tours are full inspections of entire workplaces to identify any hazards or shortcomings in employers' or employees' health and safety responsibilities.
- ▶ Incident inspections are carried out after an accident, a near miss or a case of reported ill health to the HSE.

Routine health and safety inspections are often guided by checklists and templates of set items that must be covered. These provide excellent prompts and are easy to complete with little training. They are also cheap, easy to reproduce and provide a consistent approach for every inspection, regardless of who completes it. The disadvantage is that hazards can often be overlooked if they are not listed, and therefore this form of inspection is not always preferred.

A random visual or sensory inspection of a work area by a team of representatives is sometimes a better way of identifying all potential hazards, because inspectors are not restricted by a checklist or template.

6.3 Types and use of recording documentation

Employers and their safety representatives are responsible for recording all inspections in a clear written report, as soon as possible after they have taken place. In some cases, this is a legal duty.

The report should contain:

- ▶ the date the inspection took place
- ▶ any potential hazards or defects found
- ▶ when the next inspection is due.

Inspection reports are then used to inform an action plan to put right any problems identified. An action plan should detail:

- ▶ any corrective actions needed
- ▶ people with responsibilities for carrying out the corrective actions
- ▶ the timescale in which the corrective actions must be completed.

Research

Research HSE forms F2534 and F2533 – documents that can be used to record the results of inspections and notify an employer of any unsafe or unhealthy working practices and unsatisfactory welfare facilities.

Under the Provision and Use of Work Equipment Regulations (PUWER) 1998, employers have specific duties to ensure that equipment provided for use at work is:

'... maintained in a safe condition and inspected to ensure it is correctly installed and does not subsequently deteriorate.'

Other legislation, such as the Lifting Operations and Lifting Equipment Regulations (LOLER) 1998, the Pressure Systems Safety Regulations (PSSR) 2000, the Work at Height Regulations 2005 and the Personal Protective Equipment Regulations 2002, also give specific duties to employers to examine work equipment and keep an up-to-date register of all inspections.

It is important that employers maintain these inspection records because they may be referred to in the event of an investigation into an accident or near miss in the workplace. Inspection records, maintenance schedules and service plans could also be requested by HSE inspectors or required by an employer's insurance company.

7 Safe working practices for the safe isolation of systems

During the installation and maintenance of Building Services Engineering systems, engineers are required to isolate a range of supplies:

- ▶ water supplies (hot and cold)
- ▶ gas supplies
- ▶ electrical supplies.

It is important that isolation is carried out safely and in accordance with relevant guidance documents and set procedures.

Prior to isolating any building services system, the responsible person should be informed and should also be advised as to how long the system will be out of action (**decommissioned**). Where applicable you should always arrange for alternative services to be provided.

Key term

Decommissioning: the process of isolating a system and taking it out of action either permanently or temporarily

7.1 Water supplies (hot and cold)

When working on both cold and hot water supplies, it is important to know where to safely isolate the system. Isolation valves turn off (isolate) either complete systems, parts of systems or individual appliances. They can be divided into the following types:

- ▶ those that isolate high-pressure systems, such as stop valves
- ▶ those that isolate low-pressure systems, such as full-way gate valves
- ▶ those that isolate appliances and terminal fittings on either high- or low-pressure systems.

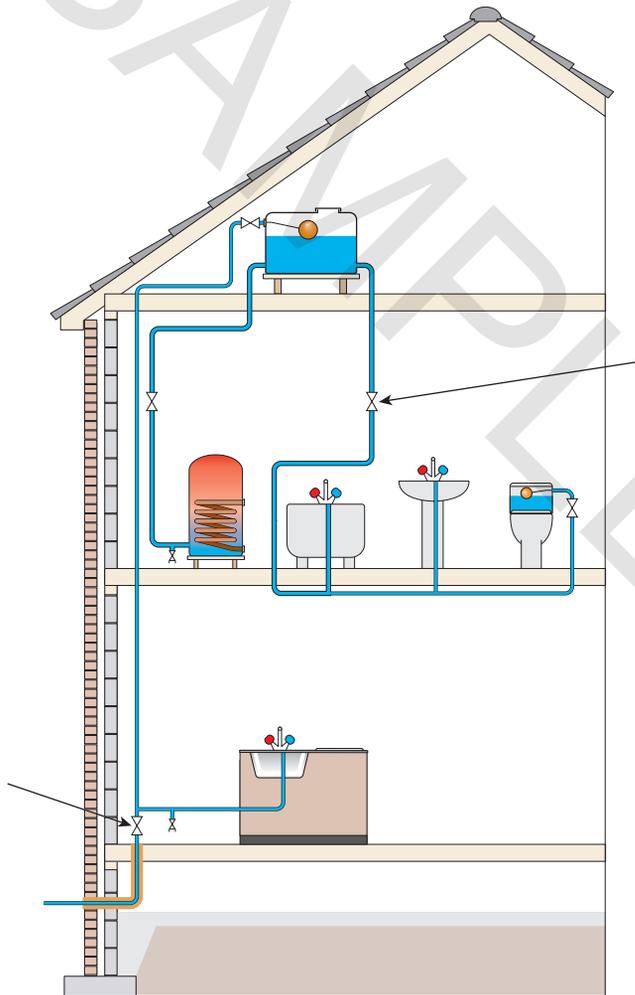
Where isolation valves are not in place, a pipe freezing kit can be used to isolate the system.



▲ Figure 1.10 Service valve supplying a cold water storage cistern

Direct cold water systems can be completely isolated at the main stop valve where the supply enters the building. If this is used to isolate the water supply, both the hot and cold water will be isolated. However, the CWSC and cylinder will need draining down before beginning work if it is an open vented system.

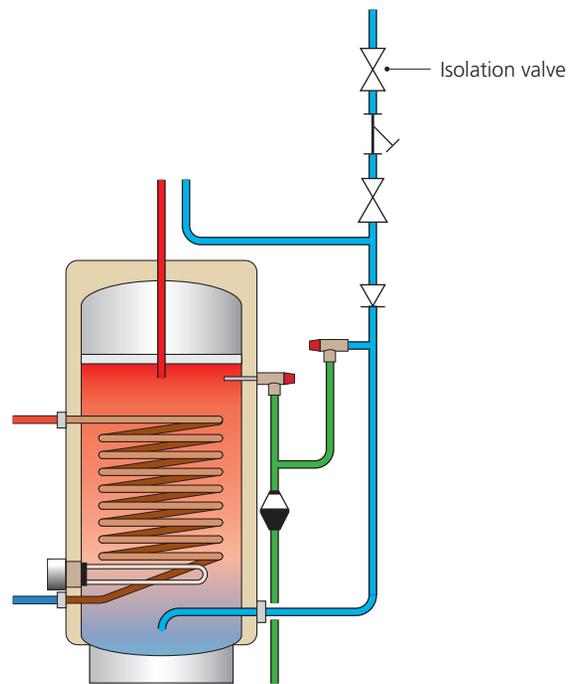
Indirect cold water systems can be isolated at the gate valve located on the distribution pipe connected to the cold water storage cistern. If the cold water storage cistern requires replacement, it will need to be isolated at the service valve supplying it.



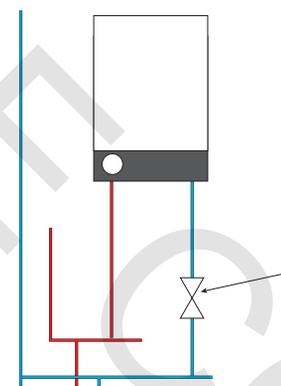
▲ Figure 1.11 Isolating an indirect cold water system

Unvented hot water systems can be isolated at the service valve on the cold water supply to the cylinder.

Where hot water in a property is supplied from a combination boiler or water heater, this should be isolated at the service valve located under the boiler. (Remember to isolate the electrical supply.)



▲ Figure 1.12 Isolating an unvented hot water system

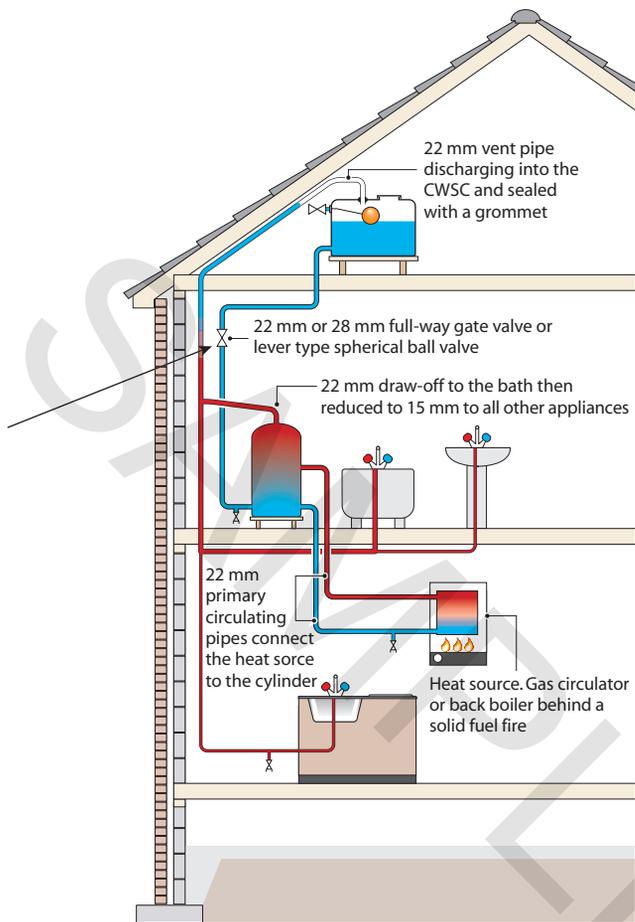


▲ Figure 1.13 Isolating a combination boiler or water heater

Vented hot water systems are isolated at the gate valve supplying the hot water cylinder.

Health and safety

Care should be taken when draining down hot water systems to prevent scalding.



▲ Figure 1.14 Isolating a vented hot water system

At the point of isolation, a warning notice should be displayed informing people that the system is out of order and not to use it. This will prevent the system being turned on while it is being worked on.



▲ Figure 1.15 Warning notice

Where there are open ends on hot and cold water supply pipework, these should be capped off using a suitable fitting.

Test yourself

- 1 Where is the cold water supply to the entire property isolated?
- 2 Where hot water is supplied from a combination boiler or water heater where do we isolate it?
- 3 Where is the hot water supply from a vented hot water system isolated?

7.2 Gas supplies

Anyone can turn an ECV off in the event of an emergency, but capping it off has to be completed by a Gas Safe registered engineer.

Located at the inlet of the gas meter is an emergency control valve (ECV) which is used to isolate the gas supply to a property. The ECV should:

- ▶ fall to the 'off' position
- ▶ have on/off tape indicating the direction to close the valve
- ▶ move freely.



▲ Figure 1.16 Gas meter showing the position of the ECV

In the event of an emergency gas situation, the following procedure should be followed:

- ▶ Turn off the ECV
- ▶ Open doors and windows to ventilate the property
- ▶ Call the National Gas Emergency Service number
- ▶ DON'T turn any power or light switches on or off
- ▶ DON'T light any sort of flame within the property
- ▶ DON'T use any appliances that could cause a spark.

As stated in the Gas Safety (Installation and Use) Regulations 1998, there should be an isolation valve at the inlet of all gas appliances to aid localised isolation of the supply.



▲ Figure 1.17 Appliance gas isolation valve

Industry tip

It is an offence to leave an open end on gas supply pipework. All open ends must be capped using a suitable stop end.

7.3 Electrical supplies

Before any work is carried out on electrical systems, the isolation procedure should be carried out to ensure the installation is safe to be worked on.

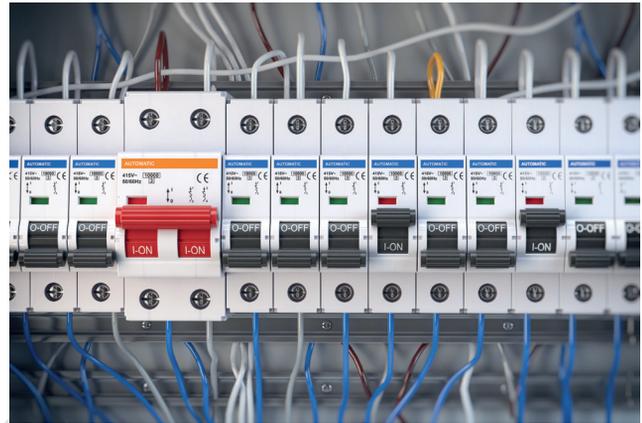
When you isolate an electricity supply, there will be disruption. Careful planning should precede isolation of circuits. For example, when isolating a section of a nursing home where elderly residents live, you will need to consult the nursing home staff to consider the possible consequences of isolation and to prepare a procedure.

The following questions are useful:

- 1 How will the isolation affect the staff and other personnel? For example, think about loss of power to lifts, heating and other essential systems.
- 2 How could the isolation affect the residents and clients? For example, some residents may rely on oxygen, medical drips and ripple beds to aid circulation. These critical systems usually have battery back-up facilities for short durations.
- 3 How could the isolation affect the members of the public? For example, fire alarms, nurse call systems, emergency lighting and other systems may stop working.
- 4 How can an isolation affect systems? For example, IT programs and data systems could be affected; timing devices could be disrupted. In this scenario, you must make the employers, employees, clients, residents and members of the public aware of the planned isolation.

Alternative electrical back-up supplies may be required in the form of generators or uninterruptable power supply systems.

The main incoming electrical supply can be isolated at the consumer unit or distribution board. This component contains a main switch which will isolate all the power within a property. Each individual circuit will have its own miniature circuit breaker (MCB) and means of isolation allowing isolation of individual circuits such as lighting, sockets, cooker points, immersion heaters and appliances.



▲ Figure 1.18 Distribution board



▲ Figures 1.19 and 1.20 Switched fuse unit (left) and locked fuse (right)

The electricity supply to appliances and components is usually provided by a fused spur, either switched or unswitched. These appliances can be isolated at this point by isolating and removal of the cartridge fuse.

Industry tip

The electricity supply to a macerator should be provided via an unswitched fused spur.