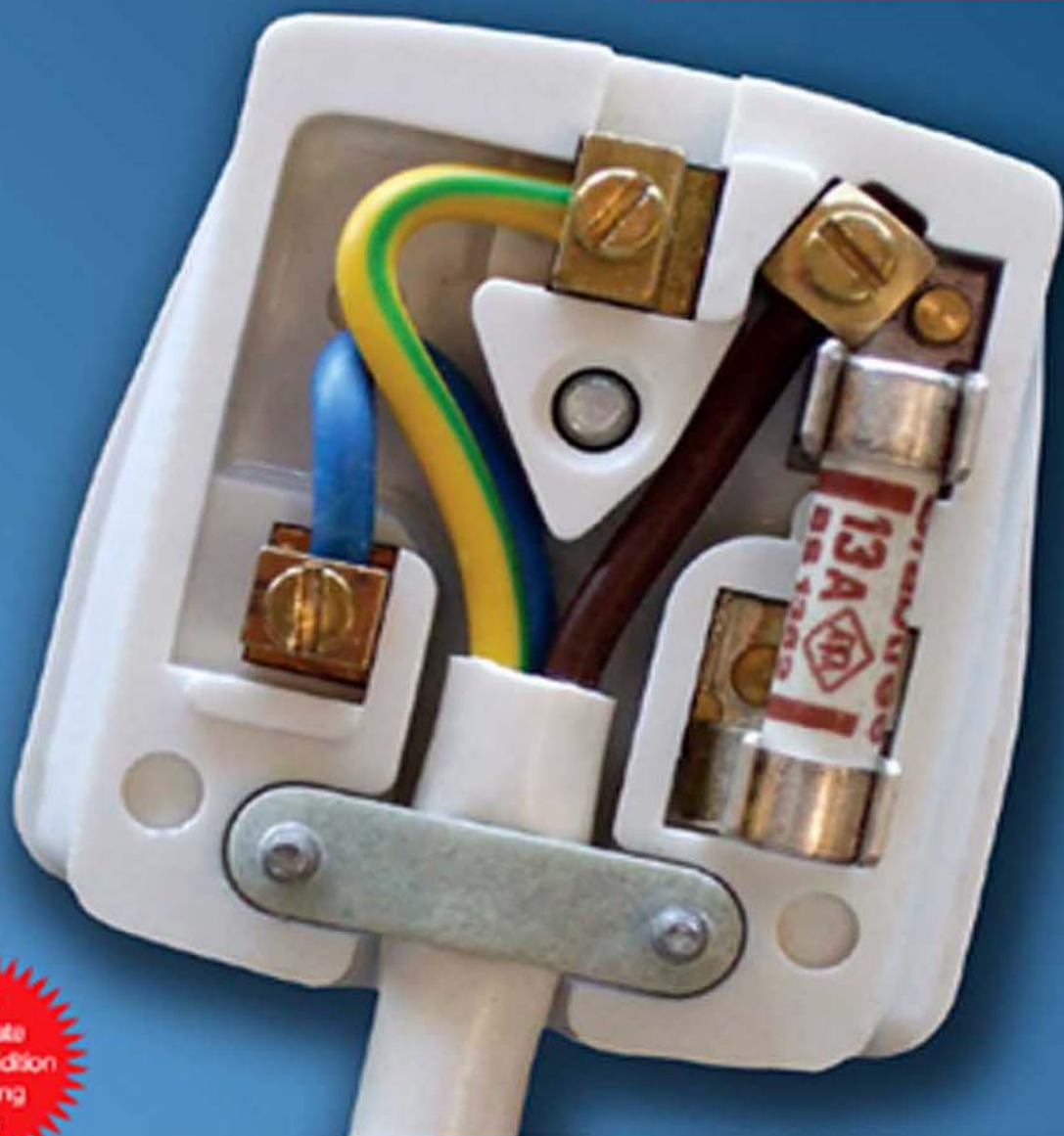


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TREVOR LINSLEY

Electrical Installation Work



Fully
up-to-date
with 17th Edition
IEE Wiring
Regs

FIFTH
EDITION

Level 3

City & Guilds 2330 Technical Certificate & 2356 NVQ



Advanced Electrical Installation Work

To Joyce, Samantha and Victoria

Advanced Electrical Installation Work

FIFTH EDITION

TREVOR LINSLEY

Senior Lecturer

Blackpool and The Fylde College



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Preface

The 5th Edition of *Advanced Electrical Installation Work* has been completely rewritten in 10 Chapters to closely match the 10 Outcomes of the City and Guilds qualification. The technical content has been revised and updated to the requirements of the new 17th Edition of the IEE Regulations BS 7671: 2008. Improved page design with new illustrations gives greater clarity to each topic.

This book of electrical installation theory and practice will be of value to the electrical trainee working towards:

- The City and Guilds 2330 Level 3 Certificate in Electrotechnical Technology, Installation Route.
- The City and Guilds 2356 Level 2 NVQ in Installing Electrotechnical Systems.
- The SCOTVEC and BTEC Electrical Utilisation Units at Levels II and III.
- Those taking Engineering NVQ and modern Apprenticeship Courses.

Advanced Electrical Installation Work provides a sound basic knowledge of electrical practice which other trades in the construction industry will find of value, particularly those involved in multi-skilling activities.

The book incorporates the requirements of the latest Regulations, particularly:

- 17th Edition IEE Wiring Regulations.
- British Standards BS 7671: 2008.
- Part P of the Building Regulations, Electrical Safety in Dwellings: 2006.
- Hazardous Waste Regulations: 2005.
- Work at Height Regulations: 2005.

Trevor Linsley
2008

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- Jason vann Smith MIET MiEEE MBCS MACM for the photographs used in the page design.

I would like to thank the many College Lecturers who responded to the questionnaire from Elsevier the publishers, regarding the proposed new edition of this book. Their recommendations have been taken into account in producing this improved 5th Edition.

I would also like to thank the editorial and production staff at Elsevier the publishers for their enthusiasm and support. They were able to publish this 5th Edition within the very short timescale created by the publication of the 17th Edition of the IEE Regulations.

Finally I would like to thank Joyce, Samantha and Victoria for their support and encouragement.

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UNIT 1

- C1 Hold-in contact
2 Main contacts
C3 Retaining contact
4 Start/close button
5 Stop/open button
6 Magnetic or thermal overload trip coil
7 Overload trip coil

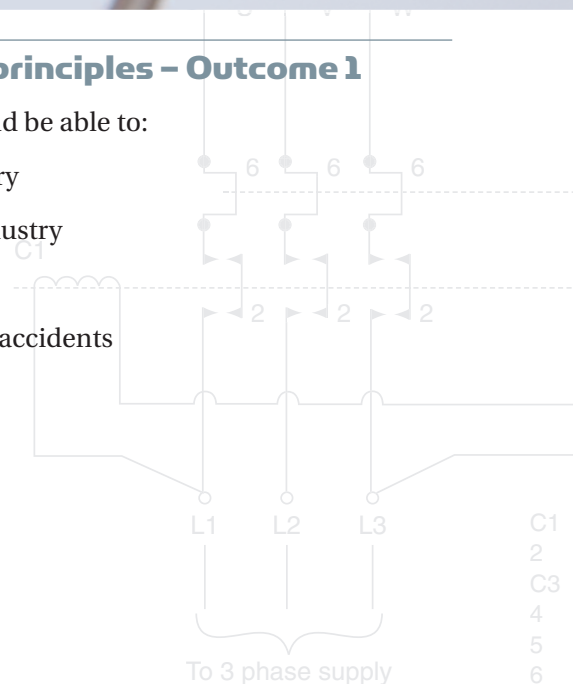
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Statutory regulations and safe working procedures

Unit 1 - Application of health and safety and electrical principles – Outcome 1

Underpinning knowledge: when you have completed this chapter you should be able to:

- identify the Safety Regulations relevant to the electrotechnical industry
- identify environmental legislation relevant to the electrotechnical industry
- state employer and employee responsibilities
- state the human and environmental conditions leading to workplace accidents
- describe a procedure for reporting accidents
- recognize workplace safety signs
- carry out a risk assessment
- list the changing work patterns within the industry



Introduction

This first chapter of Advanced Electrical Installation work covers the health and safety core skills required by the City and Guilds Level 3 Certificate in Electrotechnical Technology. That is the Health and Safety Laws and Regulations that underpin the electrotechnical industry.

Let me begin by looking at the background to the modern Health and Safety Regulations and the electricity supply and wiring regulations.

Electricity generation as we know it today began when Michael Faraday conducted the famous ring experiment in 1831. This experiment, together with many other experiments of the time, made it possible for Lord Kelvin and Sebastian de Ferranti to patent in 1882 the designs for an electrical machine called the Ferranti-Thompson dynamo, which enabled the generation of electricity on a commercial scale.

In 1887 the London electric supply corporation was formed with Ferranti as chief engineer. This was one of the many privately owned electricity generating stations supplying the electrical needs of the United Kingdom. As the demand for electricity grew, more privately owned generating stations were built until eventually the government realized that electricity was a national asset which would benefit from nationalization.

In 1926 the Electricity Supply Act placed the responsibility for generation in the hands of the Central Electricity Board. In England and Wales the Central Electricity Generating Board (CEGB) had the responsibility for the generation and transmission of electricity on the supergrid. In Scotland, generation was the joint responsibility of the North of Scotland Hydro-Electricity Board and the South of Scotland Electricity Board. In Northern Ireland electricity generation was the responsibility of the Northern Ireland Electricity Service.

In 1988 Cecil Parkinson, the Secretary of State for Energy in the Conservative government, proposed the denationalization of the electricity supply industry; this became law in March 1991, thereby returning the responsibility for generation, transmission and distribution to the private sector. It was anticipated that this action, together with new legislation over the security of supplies, would lead to a guaranteed quality of provision, with increased competition leading eventually to cheaper electricity.

During the period of development of the electricity services, particularly in the early days, poor design and installation led to many buildings being damaged by fire and the electrocution of human beings and livestock. It was the insurance companies which originally drew up a set of rules and guidelines of good practice in the interest of reducing the number of claims made upon them. The first rules were made by the American Board of Fire Underwriters and were quickly followed by the Phoenix Rules of 1882. In the same year the first edition of the Rules and Regulations for the Prevention of Fire Risk arising from Electrical Lighting was issued by the Institute of Electrical Engineers.

The current edition of these regulations is called the Requirements for Electrical Installations, IEE Wiring Regulations (BS 7671: 2008), and since

July 2008 we have been using the 17th edition. All the rules have been revised, updated and amended at regular intervals to take account of modern developments, and the 17th edition brought the UK Regulations into harmony with those of the rest of Europe.

The laws and regulations affecting the electrotechnical industry have steadily increased over the years. There is a huge amount of legislation from the European law-makers in Brussels. These laws and regulations will permeate each and every sector of the electrotechnical industry and reform and modify our future work patterns and behaviour.

In this section I want to deal with the laws and regulations that affect our industry under three general headings because there are a large number of them, and it may help us to appreciate the reasons for them.

- (i) First of all I want to look at the laws concerned with health and safety at work, making the working environment safe.
- (ii) Then I want to go on to the laws that protect our environment from, for example, industrial waste and pollution.
- (iii) Finally, I will look at employment legislation and the laws which protect us as individual workers, people and citizens in Chapter 3 of this book.

The Health and Safety at Work Act 1974

Many governments have passed laws aimed at improving safety at work but the most important recent legislation has been the Health and Safety at Work Act 1974. The purpose of the act is to provide the legal framework for stimulating and encouraging high standards of health and safety at work; the act puts the responsibility for safety at work on both workers and managers.

The Health and Safety at Work Act is an 'Enabling Act' that allows the Secretary of State to make further laws, known as regulations, without the need to pass another Act of Parliament. Regulations are law, passed by Parliament and are usually made under the Health and Safety at Work Act 1974. This applies to regulations based on European directives as well as new UK Regulations. The way it works is that the Health and Safety at Work Act established the Health and Safety Commission (HSC) and gave it the responsibility of drafting new regulations and enforcing them through its executive arm known as the Health and Safety Executive (HSE) or through the local Environmental Health Officers (EHO). The HSC has equal representation from employers, trade unions and special interest groups. Their role is to set out the regulations as goals to be achieved. They describe what must be achieved in the interests of safety, but not how it must be done.

Definition

Under the Health and Safety at Work Act an *employer* has a duty to care for the health and safety of employees.

Under the Health and Safety at Work Act an **employer** has a duty to care for the health and safety of employees (Section 2 of the Act). To do this he has a *responsibility* to ensure that:

- the working conditions and standard of hygiene are appropriate;

Safety First

Laws

The Health and Safety at Work Act provides the legal framework for stimulating and encouraging health and safety at work. It is:

- the most important,
- the most far reaching,
- single piece of legislation.

Definition

Employees have a duty to care for their own health and safety and that of others who may be affected by their actions.

- the plant, tools and equipment are properly maintained;
- safe systems of work are in place;
- safe methods of handling, storing and transporting goods and materials are used;
- there is a system for reporting accidents in the workplace;
- the company has a written Health & Safety Policy statement;
- the necessary safety equipment – such as personal protective equipment (PPE), dust and fume extractors and machine guards – are available and properly used;
- the workers are trained to use equipment and plant safely.

Employees have a duty to care for their own health and safety and that of others who may be affected by their actions (Section 7 of the Act). To do this they must:

- take reasonable care to avoid injury to themselves or others as a result of their work activity;
- co-operate with their employer, helping him or her to comply with the requirements of the act;
- not interfere with or misuse anything provided to protect their health and safety.

Failure to comply with the Health and Safety at Work Act is a criminal offence and any infringement of the law can result in heavy fines, a prison sentence or both.

ENFORCEMENT

Laws and rules must be enforced if they are to be effective. The system of control under the Health and Safety at Work Act comes from the HSE which is charged with enforcing the law. The HSE is divided into a number of specialist inspectorates or sections which operate from local offices throughout the United Kingdom. From the local offices the inspectors visit individual places of work.

The HSE inspectors have been given wide-ranging powers to assist them in the enforcement of the law. They can:

1. enter premises unannounced and carry out investigations, take measurements or photographs;
2. take statements from individuals;
3. check the records and documents required by legislation;
4. give information and advice to an employee or employer about safety in the workplace;
5. demand the dismantling or destruction of any equipment, material or substance likely to cause immediate serious injury;

- ## SAFETY DOCUMENTATION

HEALTH AND SAFETY LAW

What you should know

Your health, safety and welfare are protected by law. Your employer has a duty to protect and keep you safe from health and safety risks. You have a responsibility to look after others. If there is a problem, discuss it with your employer or safety representative or, if necessary, take action. It is a legal right to health and safety law. It does not mean that the law is death knell for those in the key positions

from creation to the day when they take their pension, or to be a minority shareholder.

Workplaces must comply with laws on health, safety and welfare at work. Your employer must ensure you are safe, healthy and protected from harm.

In general, your employer should include making you safe and healthy and welfare in its health and safety policy.

ensuring plans and measures are safe and that safe systems of work are set and followed.

ensuring risks and substances are assessed, assessed and not added.

providing adequate welfare facilities, giving people the information, training, ensuring any compensation recovery for your health and safety.

Health and safety consultation and the workplace

Health and safety representatives are elected by workers to represent them in the workplace. They are elected by workers to represent them in the workplace.

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They are elected by workers to represent them in the workplace. They are elected by workers to represent them in the workplace.

As an employer, you have a duty to ensure that you are safe and healthy.

Health and safety representatives are elected by workers to represent them in the workplace.

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New Health and Safety Law poster. *Source:* HSE © Crown copyright material is reproduced with the permission of the Controller of HMSO and Her Majesty's Stationery Office, Norwich.

Safety First

Information

- Have you seen the new Health and Safety Law poster like Fig 1.1?
 - in your place of work
 - at the college.
- Were the blank sections filled in?

All workplaces employing five or more people must display the type of poster shown in Fig. 1.1 after 30 June 2000.

To promote adequate health and safety measures the employer must consult with the employees' safety representatives. In companies which employ more than 20 people this is normally undertaken by forming a safety committee which is made up of a safety officer and employee representatives, usually nominated by a trade union. The safety officer is usually employed full-time in that role. Small companies might employ a safety supervisor, who will have other duties within the company, or alternatively they could join a 'safety group'. The safety group then shares the cost of employing a safety adviser or safety officer, who visits each company in rotation. An employee who identifies a dangerous situation should initially report to his site safety representative. The safety representative should then bring the dangerous situation to the notice of the safety committee for action which will remove the danger. This may mean changing company policy or procedures or making modifications to equipment. All actions of the safety committee should be documented and recorded as evidence that the company takes seriously its health and safety policy.

The Management of Health and Safety at Work Regulations 1999

The Health and Safety at Work Act 1974 places responsibilities on employers to have robust Health and Safety systems and procedures in the workplace. Directors and managers of any company who employ more than five employees can be held personally responsible for failures to control health and safety.

The Management of Health and Safety at Work Regulations 1999 tell us that employers must systematically examine the workplace, the work activity and the management of safety in the establishment through a process of 'risk assessments'. A record of all significant risk assessment findings must be kept in a safe place and be available to an HSE inspector if required. Information based on these findings must be communicated to relevant staff and if changes in work behaviour patterns are recommended in the interests of safety, then they must be put in place. The process of risk assessment is considered in detail later in this chapter.

Risks, which may require a formal assessment in the electrotechnical industry, might be:

- working at heights;
- using electrical power tools;
- falling objects;
- working in confined places;
- electrocution and personal injury;

- working with 'live' equipment;
- using hire equipment;
- *manual handling*: pushing, pulling, lifting;
- *site conditions*: falling objects, dust, weather, water, accidents and injuries.

And any other risks which are particular to a specific type of work place or work activity.

Provision and Use of Work Equipment Regulations 1998

These regulations tidy up a number of existing requirements already in place under other regulations such as the Health and Safety at Work Act 1974, the Factories Act 1961 and the Offices, Shops and Railway Premises Act 1963.

The Provision and Use of Work Equipment Regulations 1998 places a general duty on employers to ensure minimum requirements of plant and equipment. If an employer has purchased good quality plant and equipment, which is well maintained, there is little else to do. Some older equipment may require modifications to bring it in line with modern standards of dust extraction, fume extraction or noise, but no assessments are required by the regulations other than those generally required by the Management Regulations 1999 discussed previously.

The Control of Substances Hazardous to Health Regulations 2002

The original Control of Substances Hazardous to Health (COSHH) Regulations were published in 1988 and came into force in October 1989. They were re-enacted in 1994 with modifications and improvements, and the latest modifications and additions came into force in 2002.

The COSHH Regulations control people's exposure to hazardous substances in the workplace. Regulation 6 requires employers to assess the risks to health from working with hazardous substances, to train employees in techniques which will reduce the risk and provide PPE so that employees will not endanger themselves or others through exposure to hazardous substances. Employees should also know what cleaning, storage and disposal procedures are required and what emergency procedures to follow. The necessary information must be available to anyone using hazardous substances as well as to visiting HSE inspectors.

Hazardous substances include:

1. any substance which gives off fumes causing headaches or respiratory irritation;
2. man-made fibres which might cause skin or eye irritation (e.g. loft insulation);
3. acids causing skin burns and breathing irritation (e.g. car batteries, which contain dilute sulphuric acid);

4. solvents causing skin and respiratory irritation (strong solvents are used to cement together PVC conduit fittings and tube);
5. fumes and gases causing asphyxiation (burning PVC gives off toxic fumes);
6. cement and wood dust causing breathing problems and eye irritation;
7. exposure to asbestos – although the supply and use of the most hazardous asbestos material is now prohibited, huge amounts were installed between 1950 and 1980 in the construction industry and much of it is still in place today. In their latest amendments the COSHH Regulations focus on giving advice and guidance to builders and contractors on the safe use and control of asbestos products. These can be found in Guidance Notes EH 71.

Where PPE is provided by an employer, employees have a duty to use it to safeguard themselves.

PPE at Work Regulations 1992

PPE is defined as all equipment designed to be worn, or held, to protect against a risk to health and safety. This includes most types of protective clothing, and equipment such as eye, foot and head protection, safety harnesses, life jackets and high-visibility clothing.

Under the Health and Safety at Work Act, employers must provide free of charge any PPE and employees must make full and proper use of it. Safety signs such as those shown in Fig. 1.2 are useful reminders of the type of PPE to be used in a particular area. The vulnerable parts of the body which may need protection are the head, eyes, ears, lungs, torso, hands and feet and, additionally, protection from falls may need to be considered. Objects falling from a height present the major hazard against which head protection is provided. Other hazards include striking the head against projections and hair becoming entangled in machinery. Typical methods of protection include helmets, light duty scalp protectors called 'bump caps' and hairnets.

Safety First

PPE

- What type of PPE do you use at work?
- Make a list in the margin of the book.

The eyes are very vulnerable to liquid splashes, flying particles and light emissions such as ultraviolet light, electric arcs and lasers. Types of eye protectors include safety spectacles, safety goggles and face shields. Screen based workstations are being used increasingly in industrial and commercial locations by all types of personnel. Working with VDUs (visual display units) can cause eye strain and fatigue and, therefore, work patterns should be varied and operators are entitled to free eye tests.

Noise is accepted as a problem in most industries and surprisingly there has been very little control legislation. The HSE have published a 'Code of Practice' and 'Guidance Notes' HSG 56 for reducing the exposure of employed persons to noise. A continuous exposure limit of below 90 dB for an 8-hour working day is recommended by the code.

**FIGURE 1.2**

Safety signs showing type of PPE to be worn.

Noise may be defined as any disagreeable or undesirable sound or sounds, generally of a random nature, which do not have clearly defined frequencies. The usual basis for measuring noise or sound level is the decibel scale. Whether noise of a particular level is harmful or not also depends upon the length of exposure to it. This is the basis of the widely accepted limit of 90 dB of continuous exposure to noise for 8 hours per day.

A peak sound pressure of above 200 pascals or about 120 dB is considered unacceptable and 130 dB is the threshold of pain for humans. If a person has to shout to be understood at 2 m, the background noise is about 85 dB. If the distance is only 1 m, the noise level is about 90 dB. Continuous noise at work causes deafness, makes people irritable, affects concentration, causes fatigue and accident proneness and may mask sounds which need to be heard in order to work efficiently and safely.

It may be possible to engineer out some of the noise, for example, by placing a generator in a separate sound-proofed building. Alternatively, it may be possible to provide job rotation, to rearrange work locations or provide acoustic refuges.

Where individuals must be subjected to some noise at work it may be reduced by ear protectors. These may be disposable ear plugs, reusable ear plugs or ear muffs. The chosen ear protector must be suited to the user and suitable for the type of noise and individual personnel should be trained in its correct use.

Breathing reasonably clean air is the right of every individual, particularly at work. Some industrial processes produce dust which may present

a potentially serious hazard. The lung disease asbestosis is caused by the inhalation of asbestos dust or particles and the coal dust disease pneumoconiosis, suffered by many coal miners, has made people aware of the dangers of breathing in contaminated air.

Some people may prove to be allergic to quite innocent products such as flour dust in the food industry or wood dust in the construction industry. The main effect of inhaling dust is a measurable impairment of lung function. This can be avoided by wearing an appropriate mask, respirator or breathing apparatus as recommended by the company's health and safety policy and indicated by local safety signs.

A worker's body may need protection against heat or cold, bad weather, chemical or metal splash, impact or penetration and contaminated dust. Alternatively, there may be a risk of the worker's own clothes causing contamination of the product, as in the food industry. Appropriate clothing will be recommended in the company's health and safety policy. Ordinary working clothes and clothing provided for food hygiene purposes are not included in the PPE at Work Regulations.

Hands and feet may need protection from abrasion, temperature extremes, cuts and punctures, impact or skin infection. Gloves or gauntlets provide protection from most industrial processes but should not be worn when operating machinery because they may become entangled in it. Care in selecting the appropriate protective device is required; for example, barrier creams provide only a limited protection against infection.

Boots or shoes with in-built toe caps can give protection against impact or falling objects and, when fitted with a mild steel sole plate, can also provide protection from sharp objects penetrating through the sole. Special slip resistant soles can also be provided for employees working in wet areas.

Whatever the hazard to health and safety at work, the employer must be able to demonstrate that he or she has carried out a risk analysis, made recommendations which will reduce that risk and communicated these recommendations to the workforce. Where there is a need for PPE to protect against personal injury and to create a safe working environment, the employer must provide that equipment and any necessary training which might be required and the employee must make full and proper use of such equipment and training.

RIDDOR

RIDDOR stands for Reporting of Injuries, Diseases and Dangerous Occurrences Regulation 1995, which is sometimes referred to as RIDDOR 95, or just RIDDOR for short. The HSE requires employers to report some work related accidents or diseases so that they can identify where and how risks arise, investigate serious accidents and publish statistics and data to help reduce accidents at work.

What needs reporting? Every work related death, major injury, dangerous occurrence, disease or any injury which results in an absence from work of over 3 days.

Where an employee or member of the public is killed as a result of an accident at work the employer or his representative must report the accident to the Environmental Health Department of the Local Authority by telephone that day and give brief details. Within 10 days this must be followed up by a completed accident report form (Form No. F2508). Major injuries sustained as a result of an accident at work include amputations, loss of sight (temporary or permanent), fractures to the body other than to fingers, thumbs or toes and any other serious injury. Once again, the Environmental Health Department of the Local Authority must be notified by telephone on the day that the serious injury occurs and the telephone call followed up by a completed Form F2508 within 10 days. Dangerous occurrences are listed in the regulations and include the collapse of a lift, an explosion or injury caused by an explosion, the collapse of a scaffold over 5 m high, the collision of a train with any vehicle, the unintended collapse of a building and the failure of fairground equipment.

Depending upon the seriousness of the event, it may be necessary to immediately report the incident to the Local Authority. However, the incident must be reported within 10 days by completing Form F2508. If a doctor notifies an employer that an employee is suffering from a work related disease then form F2508A must be completed and sent to the Local Authority. Reportable diseases include certain poisonings, skin diseases, lung disease, infections and occupational cancer. The full list is given within the pad of report forms.

An accident at work resulting in an over 3 day injury, that is, an employee being absent from work for over 3 days as a result of an accident at work, requires that accident report form F2508 be sent to the Local Authority within 10 days.

An over 3 day injury is one which is not major but results in the injured person being away from work for more than 3 days not including the day the injury occurred.

Who are the reports sent to? They are sent to the Environmental Health Department of the Local Authority or the area HSE offices (see the Appendix L of this book for area office addresses). Accident report forms F2508 can also be obtained from them or by ringing the HSE Infoline or by ringing the incident contact centre on telephone number 0845 300 9923.

For most businesses, a reportable accident, dangerous occurrence or disease is a very rare event. However, if a report is made, the company must keep a record of the occurrence for 3 years after the date on which the incident happened. The easiest way to do this would probably be to file a photo copy of the completed accident report form F2508, but a record may be kept in any form which is convenient.

The Control of Major Accidents and Hazards Regulations 1999

The Control of Major Accidents and Hazards (COMAH) Regulations came into force on 1 April 1999. Their main aim is to prevent any major accidents

involving dangerous substances such as chlorine, liquefied petroleum gas (LPG), explosives and arsenic pentoxide that would cause serious harm to people or damage the environment. The COMAH Regulations regard risks to the environment just as seriously as harm to people.

These regulations apply mainly to the chemical industry but also apply to some storage facilities and nuclear sites.

Operators who fall within the scope of these regulations must 'take all measures necessary to prevent major accidents and limit their consequences to people and the environment'. This sets high standards of control but by requiring operators to put in place measures for both prevention and mitigation, which means to make less serious, there is the recognition that all risks cannot be completely eliminated. Operators must, therefore, be able to show that they have taken 'all measures necessary' to prevent an accident occurring.

The COMAH Regulations are enforced by the HSE and the Environment Agency.

Dangerous Substances and Explosive Atmospheres Regulations 2002

The Dangerous Substances and Explosive Atmospheres Regulations (DSEAR) came into force on 9 December 2002 and complement the Management of Health and Safety at Work Regulations 1999. They are designed to implement the safety requirements of the Chemical Agents and Explosive Atmospheres Directive.

DSEAR deals with any dangerous substance that has the potential to create a risk to persons from energetic or energy releasing events such as fires or explosions. Dangerous substances include petrol, LPG, paint, solvents and combustible or explosive dust produced in machining and sanding operations, flour mills and distilleries.

Many of these substances will also create a health risk, for example, solvents are toxic as well as being flammable. However, DSEAR does not address the health risk, only the fire and explosion risk. The potential health risk is dealt with under the COSHH Regulations discussed earlier in this chapter.

The DSEAR Regulations follow the modern risk assessment-based approach. Technical and organizational measures are required to eliminate or reduce risks as far as is reasonably practicable. There is a requirement to provide equipment and procedures to deal with accidents and emergencies and also to provide information and training for employees.

So what sort of industries does DSEAR apply to? DSEAR is concerned with the harmful effects from burns, pressure injuries from explosions and asphyxiation arising from fires and explosions. Typical industries might be those concerned with the storage of petrol as a fuel for vehicles, agricultural and horticultural storage and the movement of bulk powders for the food industry, the storing of waste dust in a range of manufacturing industries,

dust produced in the mining of coal, storage and transportation of paint and LPG.

The Construction (Design and Management) Regulations 1994

The Construction (Design and Management) Regulations (CDM) are aimed at improving the overall management of health, safety and welfare throughout all stages of the construction project.

Definition

'Duty holder', someone who has a duty of care for health, safety and welfare matters on site. This phrase recognizes the level of responsibility which electricians are expected to take on a part of their job in order to control electrical safety in the work environment.

The person requesting that construction work commence, the client, must first of all appoint a **'duty holder'**, someone who has a duty of care for health, safety and welfare matters on site. This person will be called a 'planning supervisor'. The planning supervisor must produce a 'pre-tender' health and safety plan and co-ordinate and manage this plan during the early stages of construction.

The client must also appoint a principal contractor who is then required to develop the health and safety plan made by the planning supervisor, and keep it up to date during the construction process to completion.

The degree of detail in the health and safety plan should be in proportion to the size of the construction project and recognize the health and safety risks involved on that particular project. Small projects will require simple straightforward plans, large projects, or those involving significant risk, will require more detail. The CDM Regulations will apply to most large construction projects but they do not apply to the following:

- Construction work, other than demolition work, that does not last longer than 30 days and does not involve more than four people.
- Construction work carried out inside commercial buildings such as shops and offices, which does not interrupt the normal activities carried out on those premises.
- Construction work carried out for a domestic client.
- The maintenance and removal of pipes or lagging which forms a part of a heating or water system within the building.

The Construction (Health, Safety and Welfare) Regulations 1996

An electrical contractor is a part of the construction team, usually as a sub-contractor, and therefore the regulations particularly aimed at the construction industry also influence the daily work procedures and environment of an electrician. The most important recent piece of legislation are the Construction Regulations.

The temporary nature of construction sites makes them one of the most dangerous places to work. These regulations are made under the Health and Safety at Work Act 1974 and are designed specifically to promote safety at work in the construction industry. Construction work is defined as any building or civil engineering work, including construction, assembly, alterations, conversions, repairs, upkeep, maintenance or dismantling of a structure.

Safety First

Head protection

- The Construction Regulations require everyone working on a construction site to wear head protection
- This includes electricians.

The general provision sets out minimum standards to promote a good level of safety on site. Schedules specify the requirements for guardrails, working platforms, ladders, emergency procedures, lighting and welfare facilities. Welfare facilities set out minimum provisions for site accommodation: washing facilities, sanitary conveniences and protective clothing. There is now a duty for all those working on construction sites to wear head protection, and this includes electricians working on site as sub-contractors.

Building Regulations – Part P 2006

The Building Regulations lay down the design and build standards for construction work in buildings in a series of Approved Documents. The scope of each Approved Document is given below:

- Part A structure
- Part B fire safety
- Part C site preparation and resistance to moisture
- Part D toxic substances
- Part E resistance to the passage of sound
- Part F ventilation
- Part G hygiene
- Part H drainage and waste disposal
- Part J combustion appliances and fuel storage systems
- Part K protection from falling, collision and impact
- Part L conservation of fuel and power
- Part M access and facilities for disabled people
- Part N glazing – safety in relation to impact, opening and cleaning
- Part P electrical safety.

Part P of the Building Regulations was published on 22 July 2004, bringing domestic electrical installations in England and Wales under building regulations control. This means that anyone carrying out domestic electrical installation work from 1 January 2005 must comply with Part P of the Building Regulations. An amended document was published in an attempt at greater clarity and this came into effect on 6 April 2006.

If the electrical installation meets the requirements of the IEE Regulations BS 7671, then it will also meet the requirements of Part P of the Building Regulations, so no change there. What is going to change under Part P is this new concept of 'notification' to carry out electrical work.

NOTIFIABLE ELECTRICAL WORK

Any work to be undertaken by a firm or individual who is *not* registered under an 'approved competent person scheme' must be notified to the Local Authority Building Control Body before work commences. That is, work that involves:

- the provision of at least one new circuit,
- work carried out in kitchens,

- work carried out in bathrooms,
- work carried out in special locations such as swimming pools and hot air saunas.

Upon completion of the work, the Local Authority Building Control Body will test and inspect the electrical work for compliance with Part P of the Building Regulations.

NON-NOTIFIABLE ELECTRICAL WORK

Work carried out by a person or firm registered under an authorized Competent Persons Self-Certification Scheme or electrical installation work that does not include the provision of a new circuit. This includes work such as:

- replacing accessories such as socket outlets, control switches and ceiling roses;
- replacing a like for like cable for a single circuit which has become damaged by, for example, impact, fire or rodent;
- re-fixing or replacing the enclosure of an existing installation component provided the circuits protective measures are unaffected;
- providing mechanical protection to existing fixed installations;
- adding lighting points (light fittings and switches) to an existing circuit, provided that the work is not in a kitchen, bathroom or special location;
- installing or upgrading the main or supplementary equipotential bonding provided that the work is not in a kitchen, bathroom or special location.

All replacement work is non-notifiable even when carried out in kitchens, bathrooms and special locations, but certain work carried out in kitchens, bathrooms and special locations may be notifiable, even when carried out by an authorized competent person. The IEE have published a guide called the *Electricians' Guide* to the Building Regulations which brings clarity to this subject. In specific cases the Local Authority Building Control Officer or an approved Inspector will be able to confirm whether Building Regulations apply.

Failure to comply with the Building Regulations is a criminal offence and Local Authorities have the power to require the removal or alteration of work that does not comply with these requirements.

Electrical work carried out by DIY home-owners will still be permitted after the introduction of Part P. Those carrying out notifiable DIY work must first submit a building notice to the Local Authority before the work begins. The work must then be carried out to the standards set by the IEE Wiring Regulations BS 7671 and a building control fee paid for such work to be inspected and tested by the Local Authority.

COMPETENT PERSONS SCHEME

The Competent Persons Self-Certification Scheme is aimed at those who carry out electrical installation work as the primary activity of their business. The government has approved schemes to be operated by BRE Certification Ltd., British Standards Institution, ELECSA Ltd., NICEIC Certification Services Ltd., and Napit Certification Services Ltd. All the different bodies will operate the scheme to the same criteria and will be monitored by the Department for Communities and Local Government, formally called the Office of the Deputy Prime Minister.

Those individuals or firms wishing to join the Competent Persons Scheme will need to demonstrate their competence, if necessary, by first undergoing training. The work of members will then be inspected at least once each year. There will be an initial registration and assessment fee and then an annual membership and inspection fee.

The Electricity Safety, Quality and Continuity Regulations 2002

The Electricity Safety, Quality and Continuity Regulations replaces the Electricity Supply Regulations 1988. They are statutory regulations which are enforceable by the laws of the land. They are designed to ensure a proper and safe supply of electrical energy up to the consumer's terminals.

These regulations impose requirements upon the regional electricity companies regarding the installation and use of electric lines and equipment. The regulations are administered by the Engineering Inspectorate of the Electricity Division of the Department of Energy and will not normally concern the electrical contractor except that it is these regulations which lay down the earthing requirement of the electrical supply at the meter position.

The regional electricity companies must declare the supply voltage and maintain its value between prescribed limits or tolerances.

The government agreed on 1 January 1995 that the electricity supplies in the United Kingdom would be harmonized with those of the rest of Europe. Thus the voltages used previously in low voltage supply systems of 415 and 240V have become 400V for three-phase supplies and 230V for single-phase supplies. The permitted tolerances to the nominal voltage have also been changed from $\pm 6\%$ to $+10\%$ and -6% .

The next proposed change is for the tolerance levels to be adjusted to $\pm 10\%$ of the declared nominal voltage. (IEE Regulations Appendix 2:14).

The frequency is maintained at an average value of 50 Hz over 24 hours so that electric clocks remain accurate.

Regulation 29 gives the area boards the power to refuse to connect a supply to an installation which in their opinion is not constructed, installed and protected to an appropriately high standard. This regulation would

only be enforced if the installation did not meet the requirements of the IEE Regulations for Electrical Installations.

The Electricity at Work Regulations 1989

This legislation came into force in 1990 and replaced earlier regulations such as the Electricity (Factories Act) Special Regulations 1944. The regulations are made under the Health and Safety at Work Act 1974, and enforced by the HSE. The purpose of the regulations is to 'require precautions to be taken against the risk of death or personal injury from electricity in work activities'.

Section 4 of the Electricity at Work Regulations (EWR) tells us that 'all systems must be constructed so as to prevent danger ..., and be properly maintained. ... Every work activity shall be carried out in a manner which does not give rise to danger. ... In the case of work of an electrical nature, it is preferable that the conductors be made dead before work commences'.

The EWR do not tell us specifically how to carry out our work activities and ensure compliance, but if proceedings were brought against an individual for breaking the EWR, the only acceptable defence would be 'to prove that all reasonable steps were taken and all diligence exercised to avoid the offence' (Regulation 29).

An electrical contractor could reasonably be expected to have 'exercised all diligence' if the installation was wired according to the IEE Wiring Regulations and this is confirmed in the 17th Edition at Regulation 114 (see below). However, electrical contractors must become more 'legally aware' following the conviction of an electrician for manslaughter at Maidstone Crown Court in 1989. The Court accepted that an electrician had caused the death of another man as a result of his shoddy work in wiring up a central heating system. He received a 9 month suspended prison sentence. This case has set an important legal precedent, and in future any tradesman or professional who causes death through negligence or poor workmanship risks prosecution and possible imprisonment.

DUTY OF CARE

The Health and Safety at Work Act and the Electricity at Work Regulations (EWR) make numerous references to employer and employees having a 'duty of care' for the health and safety of others in the work environment. In this context the EWR refer to a person as a 'duty holder'. This phrase recognizes the level of responsibility which electricians are expected to take on a part of their job in order to control electrical safety in the work environment.

Definition

Everyone has a *duty of care* but not everyone is a duty holder. The person who exercises 'control over the whole systems, equipment and conductors' and is the Electrical Company's representative on site, is the duty holder.

Everyone has a **duty of care** but not everyone is a duty holder. The regulations recognize the amount of control that an individual might exercise over the whole electrical installation. The person who exercises 'control over the whole systems, equipment and conductors' and is the Electrical Company's representative on site, is *the duty holder*. He might be a supervisor or

Definition

'Reasonably practicable' or 'absolute' If the requirement of the regulation is absolute, then that regulation must be met regardless of cost or any other consideration. If the regulation is to be met 'so far as is reasonably practicable' then risks, cost, time trouble and difficulty can be considered.

manager, but he will have a duty of care on behalf of his employer for the electrical, health, safety and environmental issues on that site.

Duties referred to in the regulations may have the qualifying terms '**reasonably practicable**' or '*absolute*'. If the requirement of the regulation is absolute, then that regulation must be met regardless of cost or any other consideration. If the regulation is to be met 'so far as is reasonably practicable' then risks, cost, time trouble and difficulty can be considered.

Often there is a cost effective way to reduce a particular risk and prevent an accident occurring. For example, placing a fire-guard in front of the fire at home when there are young children in the family is a reasonably practicable way of reducing the risk of a child being burned.

If a regulation is not qualified with 'so far as is reasonably practicable' then it must be assumed that the regulation is absolute. In the context of the EWR, where the risk is very often death by electrocution, the level of duty to prevent danger more often approaches that of an absolute duty of care.

The IEE Wiring Regulations 17th Edition to BS 7671: 2008 REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

The Institution of Electrical Engineers Requirements for Electrical Installations (the IEE Regulations) are non-statutory regulations. They relate principally to the design, selection, erection, inspection and testing of electrical installations, whether permanent or temporary, in and about buildings generally and to agricultural and horticultural premises, construction sites and caravans and their sites. Paragraph 7 of the introduction to the EWR says: 'the IEE Wiring Regulations is a code of practice which is widely recognized and accepted in the United Kingdom and compliance with them is likely to achieve compliance with all relevant aspects of the EWR'. The IEE Regulations confirm this relationship at Regulation 114 which states that compliance with the IEE Regulations may be used in a Court of Law to claim compliance with a statutory requirement such as the EWR. The IEE Wiring Regulations only apply to installations operating at a voltage up to 1000V a.c. They do not apply to electrical installations in mines and quarries, where special regulations apply because of the adverse conditions experienced there.

The current edition of the IEE Wiring Regulations, is the 17th edition. The main reason for incorporating the IEE Wiring Regulations into British Standard BS 7671: 2008 was to create harmonization with European standards.

To assist electricians in their understanding of the regulations a number of guidance notes have been published. The guidance notes which I will frequently make reference to in this book are those contained in the *On Site Guide*. Eight other guidance notes booklets are also currently available. These are:

1. *Selection and Erection;*
2. *Isolation and Switching;*
3. *Inspection and Testing;*

4. *Protection against Fire;*
5. *Protection against Electric Shock;*
6. *Protection against Overcurrent;*
7. *Special Locations;*
8. *Earthing and Bonding.*

These guidance notes are intended to be read in conjunction with the regulations.

The IEE Wiring Regulations are the electricians' bible and provide the authoritative framework of information for anyone working in the electro-technical industry.

ENVIRONMENTAL LAWS AND REGULATIONS

Environmental laws protect the environment in which we live by setting standards for the control of pollution to land, air and water.

If a wrong is identified in the area in which we now think of as 'environmental' it can be of two kinds.

1. An offence in common law which means damage to property, nuisance or negligence leading to a claim for damages.
2. A statutory offence against one of the laws dealing with the protection of the environment. These offences are nearly always 'crimes' and punished by fines or imprisonment rather than by compensating any individual.

The legislation dealing with the environment has evolved for each part – air, water, land noise, radioactive substances where an organization's activities impact upon the environmental laws they are increasingly adopting environmental management systems which comply with ISO 14001. Let us now look at some of the regulations and try to see the present picture at the beginning of the new millennium.

Environmental Protection Act 1990

In the context of environmental law, the Environmental Protection Act 1990 was a major piece of legislation. The main sections of the act are:

- Part 1 Integrated pollution control by HM Inspectorate of Pollution, and air pollution control by Local Authorities
- Part 2 Wastes on land
- Part 3 Statutory nuisances and clean air
- Part 4 Litter
- Part 5 Radioactive Substances Act 1960
- Part 6 Genetically modified organisms
- Part 7 Nature conservation
- Part 8 Miscellaneous, including contaminated land.

The Royal Commission of 1976 identified that a reduction of pollutant to one medium, air, water or land, then led to an increase of pollutant to another. It, therefore, stressed the need to take an integrated approach to pollution control. The processes subject to an integrated pollution control are:

- Air emissions.
- Processes which give rise to significant quantities of special waste, that is, waste defined in law in terms of its toxicity or flammability.
- Processes giving rise to emissions to sewers or 'Red List' substances. These are 23 substances including mercury, cadmium and many pesticides, which are subject to discharge consent to the satisfaction of the Environment Agency.

Where a process is under integrated control the Inspectorate is empowered to set conditions to ensure that the best practicable environmental option (BPEO) is employed to control pollution. This is the cornerstone of the Environmental Protection Act.

Pollution Prevention and Control Regulations 2000

The system of Pollution Prevention and Control is replacing that of Integrated Pollution Control established by the Environmental Protection Act 1990, thus bringing environmental law into the new millennium and implementing the European Directive (EC/96/61) on integrated pollution prevention and control. The new system will be fully implemented by 2007.

Pollution Prevention and Control is a regime for controlling pollution from certain industrial activities. This regime introduces the concept of Best Available Technique (BAT) for reducing and preventing pollution to an acceptable level.

Industrial activities are graded according to their potential to pollute the environment:

- A(1) installations are regulated by the Environment Agency.
- A(2) installations are regulated by the Local Authorities.
- Part B installations are also regulated by the Local Authority.

All three systems require the operators of certain industrial installations to obtain a permit to operate. Once an operator has submitted a permit application, the regulator then decides whether to issue a permit. If one is issued it will include conditions aimed at reducing and preventing pollution to acceptable levels. A(1) installations are generally perceived as having the greatest potential to pollute the environment. A(2) installations and Part B installations would have the least potential to pollute.

The industries affected by these regulations are those dealing with petrol vapour recovery, incineration of waste, mercury emissions from crematoria, animal rendering, non-ferrous foundry processes, surface treating of

metals and plastic materials by powder coating, galvanizing of metals and the manufacture of certain specified composite wood-based boards.

Clean Air Act 1993

We are all entitled to breathe clean air but until quite recently the only method of heating houses and workshops was by burning coal, wood or peat in open fires. The smoke from these fires created air pollution and the atmosphere in large towns and cities was of poor quality. On many occasions in the 1950s the burning of coal in London was banned because the city was grinding to a halt because of the combined effect of smoke and fog, called smog. Smog was a very dense fog in which you could barely see more than a metre in front of you and which created serious breathing difficulties. In the new millennium we are no longer dependent upon coal and wood to heat our buildings, smokeless coal has been created and the gaseous products of combustion are now diluted and dispersed by new chimney design regulations. Using well engineered combustion equipment together with the efficient arrestment of small particles in commercial chimneys of sufficient height, air pollution has been much reduced. This is what the Clean Air Act set out to achieve and it has been largely successful.

Definition

The *Clean Air Act* applies to all small and medium sized companies operating furnaces, boilers, or incinerators.

The **Clean Air Act** applies to all small and medium sized companies operating furnaces, boilers, or incinerators. Compliance with the Act does not require an application for authorization and so companies must make sure that they do not commit an offence. In general the emission of dark smoke from any chimney is unacceptable. The emission of dark smoke from any industrial premises is also unacceptable. This might be caused by, for example, the burning of old tyres or old cable.

In England, Scotland and Wales it is not necessary for the Local Authority to have witnessed the emission of dark smoke before taking legal action. Simply the evidence of burned materials, which potentially give rise to dark smoke when burned, is sufficient. In this way the law aims to stop people creating dark smoke under the cover of darkness.

Definition

A *public nuisance* is 'an act unwarranted by law or an omission to discharge a legal duty which materially affects the life, health, property, morals or reasonable comfort or convenience of Her Majesty's subjects'.

A **public nuisance** is 'an act unwarranted by law or an omission to discharge a legal duty which materially affects the life, health, property, morals or reasonable comfort or convenience of Her Majesty's subjects'. This is a criminal offence and Local Authorities can prosecute, defend or appear in proceedings that affect the inhabitants of their area.

Controlled Waste Regulations 1998

Under these Regulations we have a 'Duty of Care to handle, recover and dispose of all waste responsibly'. This means that all waste must be handled, recovered and disposed of by individuals or businesses that are authorized to do so under a system of signed Waste Transfer Notes.

The Environmental Protection (Duty of Care) Regulations 1991 state that as a business you have a duty to ensure that any waste you produce is handled safely and in accordance with the law. This is the 'Duty of Care' and

applies to anyone who produces, keeps, carries, treats or disposes of waste from business or industry.

You are responsible for the waste that you produce, even after you have passed it on to another party such as a Skip Hire company, a Scrap Metal merchant, recycling company or local council. The Duty of Care has no time limit and extends until the waste has either been finally and properly disposed of or fully recovered.

So what does this mean for your company?

- Make sure that waste is only transferred to an authorized company.
- Make sure that waste being transferred is accompanied by the appropriate paperwork showing what was taken, where it was to be taken and by whom.
- Segregate the different types of waste that your work creates.
- Label waste skips and waste containers so that it is clear to everyone what type of waste goes into that skip.
- Minimize the waste that you produce and do not leave waste behind for someone else to clear away. Remember there is no time limit on your Duty of Care for waste.

Occupiers of domestic properties are exempt from the Duty of Care for the household waste that they produce. However, they do have a Duty of Care for the waste produced by, for example, a tradesperson working at a domestic property.

Definition

Special waste is covered by the Special Waste Regulations 1996 and is waste that is potentially hazardous or dangerous and which may, therefore, require special precautions during handling, storage, treatment or disposal. Examples of special waste are asbestos, lead-acid batteries, used engine oil, solvent-based paint, solvents, chemical waste and pesticides.

Special waste is covered by the Special Waste Regulations 1996 and is waste that is potentially hazardous or dangerous and which may, therefore, require special precautions during handling, storage, treatment or disposal. Examples of special waste are asbestos, lead-acid batteries, used engine oil, solvent-based paint, solvents, chemical waste and pesticides. The disposal of special waste must be carried out by a competent person, with special equipment and a licence.

New Hazardous Waste Regulations were introduced in July 2005 and under these Regulations electric discharge lamps and tubes such as fluorescent, sodium, metal halide and mercury vapour are classified as hazardous waste. While each lamp only contains a very small amount of mercury, vast numbers are used and disposed of each year, resulting in a significant environmental threat. The environmentally responsible way to dispose of lamps and tubes is to recycle them and this process is now available through the electrical wholesalers.

Electrotechnical companies produce relatively small amounts of waste and even smaller amounts of special waste. Most companies buy in the expertise of specialist waste companies these days and build these costs into the contract.

Waste Electrical and Electronic Equipment EU Directive 2007

The Waste Electrical and Electronic Equipment (WEEE) Regulations will ensure that Britain complies with its EU obligation to recycle waste from electrical products. The Regulation came into effect in July 2007 and from that date any company which makes, distributes or trades in electrical or electronic goods such as household appliances, sports equipment and even torches and toothbrushes will have to make arrangements for recycling these goods at the end of their useful life. Batteries will be covered separately by yet another forthcoming EU directive.

Some sectors are better prepared for the new regulations than others. Mobile phone operators, O2, Orange, Virgin and Vodafone, along with retailers such as Currys and Dixons, have already joined together to recycle their mobile phones collectively. In Holland the price of a new car now includes a charge for the recycling costs.

Further Information is available on the DTI and DEFRA website under WEEE.

Radioactive Substances Act 1993

These regulations apply to the very low ionizing radiation sources used by specialized industrial contractors. The radioactive source may be sealed or unsealed. Unsealed sources are added to a liquid in order to trace the direction or rate of flow of that liquid. Sealed radioactive sources are used in radiography for the non-destructive testing of materials or in liquid level and density gauges.

This type of work is subject to the Ionising Radiations Regulations 1999 (IRR), which impose comprehensive duties on employers to protect people at work against exposure to ionizing radiation. These regulations are enforced by the HSE, while the Radioactive Substances Act (RSA) is enforced by the Environmental Agency.

The RSA 1993 regulates the keeping, use, accumulation and disposal of radioactive waste, while the IRR 1999 regulates the working and storage conditions when using radioactive sources. The requirements of RSA 1993 are in addition to and separate from IRR 1999 for any industry using radioactive sources. These regulations also apply to offshore installations and to work in connection with pipelines.

Dangerous Substances and Preparations and Chemicals Regulations 2000

Chemical substances that are classified as carcinogenic, mutagenic or toxic, or preparations which contain those substances, constitute a risk to the general public because they may cause cancer, genetic disorders and birth defects, respectively.

These Regulations were introduced to prohibit the supply of these dangerous drugs to the general public, to protect consumers from contracting fatal diseases through their use.

The Regulations require that new labels be attached to the containers of these drugs which identify the potential dangers and indicate that they are restricted to professional users only.

The Regulations implement Commission Directive 99/43/EC, known as the 17th Amendment, which brings the whole of Europe to an agreement that these drugs must not be sold to the general public, this being the only way of offering the highest level of protection for consumers.

The Regulations will be enforced by the Local Authority Trading Standards Department.

Noise Regulations

Before 1960 noise nuisance could only be dealt with by common law as a breach of the peace under various Acts or local by-laws. In contrast, today there are many statutes, Government circulars, British Standards and EU Directives dealing with noise matters. Environmental noise problems have been around for many years. During the eighteenth century, in the vicinity of some London hospitals, straw was put on the roads to deaden the sound of horses' hooves and the wheels of carriages. Today we have come a long way from this self-regulatory situation.

Definition

'A *statutory nuisance* must materially interfere with the enjoyment of one's dwelling. It is more than just irritating or annoying and does not take account of the undue sensitivity of the receiver'.

In the context of the *Environmental Protection Act 1990*, noise or vibration is a **statutory nuisance** if it is prejudicial to health or is a nuisance. However, nuisance is not defined and has exercised the minds of lawyers, magistrates and judges since the concept of nuisance was first introduced in the 1936 Public Health Act. There is a wealth of case law but a good working definition might be 'A statutory nuisance must materially interfere with the enjoyment of one's dwelling. It is more than just irritating or annoying and does not take account of the undue sensitivity of the receiver'.

The line that separates nuisance from no nuisance is very fine and non-specific. Next door's intruder alarm going off at 3 a.m. for an hour or more is clearly a statutory nuisance, whereas one going off a long way from your home would not be a nuisance. Similarly, an all night party with speakers in the garden would be a nuisance, whereas an occasional party finishing at say midnight would not be a statutory nuisance.

At Stafford Crown Court on 1 November 2004, Alton Towers, one of the country's most popular Theme Parks, was ordered by a judge to reduce noise levels from its 'white knuckle' rides. In the first judgment of its kind, the judge told the Park's owners that neighbouring residents must not be interrupted by noise from rides such as Nemesis, Air, Corkscrew, Oblivion or from loudspeakers or fireworks.

The owners of Alton Towers, Tussauds Theme Parks Ltd., were fined the maximum sum of £5000 and served with a Noise Abatement Order for being guilty of breaching the 1990 Environmental Protection Act. Mr Richard Buxton, for the prosecution, said that the £5000 fine reflected the judge's view that Alton Towers had made little or no effort to reduce the noise nuisance.

Many nuisance complaints under the Act are domestic and are difficult to assess and investigate. Barking dogs, stereos turned up too loud, washing machines running at night to use 'low cost' electricity, television, DIY activities are all difficult to assess precisely as statutory nuisance. Similarly, sources of commercial noise complaints are also varied and include deliveries of goods during the night, general factory noises, refrigeration units, noise from public houses and clubs are all common complaints.

Industrial noise can be complex and complaints difficult to resolve both legally and technically. Industrial noise assessment is aided by BS 4142 but no guidance exists for other noise nuisance. The Local Authority has a duty to take reasonable steps to investigate all complaints and to take appropriate action.

The Noise and Statutory Nuisance Act 1993

This Act extended the statutory nuisance provision of the Environmental Protection Act 1990 to cover noise from vehicles, machinery or equipment in the streets. The definition of equipment includes musical instruments but the most common use of this power is to deal with car alarms and house intruder alarms being activated for no apparent reason and which then continue to cause a nuisance for more than 1 hour.

In the case of a car alarm a notice is fixed to the vehicle and an officer from the Local Authority spends 1 hour trying to trace the owner with help from the police and their National Computer system. If the alarm is still sounding at the end of this period, then the Local Authority Officer can break into the vehicle and silence the alarm. The vehicle must be left as secure as possible but if this cannot be done then it can be removed to a safe compound after the police have been notified. Costs can be recovered from the registered keeper.

Home intruder alarms that have been sounding for 1 hour can result in a 'Notice' being served on the occupier of the property, even if he or she is absent from the property at the time of the offence. The Notice can be served by putting it through a letterbox. A Local Authority Officer can then immediately silence the alarm without going into the property. However, these powers are *adoptive* and some Local Authorities have indicated that they will not adopt them because Sections 7–9 of the Act makes provision for incorporating the 'Code of Practice relating to Audible Intruder Alarms' into the statute. The two key points of the Code are the installation of a 20 minute cut-off of the external sounder and the notification to the police and Local Authority of two key holders who can silence the alarm.

Noise Act 1996

This Act clarifies the powers which may be taken against work which is in default under the nuisance provision of the Environmental Protection Act 1990. It provides a mechanism for permanent deprivation, return of seized equipment and charges for storage.

The Act also includes an *adoptive* provision making night time noise between 23:00 and 07:00 hours a criminal offence if the noise exceeds

a certain level to be prescribed by the Secretary of State. If a notice is not complied with, a fixed penalty may be paid instead of going to court.

Noise at Work Regulations 1989

The Noise at Work Regulations, unlike the previous vague or limited provisions, apply to all work places and require employers to carry out assessments of the noise levels within their premises and to take appropriate action where necessary. The 1989 Regulations came into force on 1 January 1990 implementing in the United Kingdom the EC Directive 86/188/EEC 'The Protection of Workers from Noise'.

Three action levels are defined by the Regulations:

1. The first action level is a daily personal noise exposure of 85 dB, expressed as 85 dB(A).
2. The second action level is a daily personal noise exposure of 90 dB(A).
3. The third defined level is a peak action level of 140 dB(A) or 200 Pa of pressure which is likely to be linked to the use of cartridge operated tools, shooting guns or similar loud explosive noises. This action level is likely to be most important where workers are subjected to a small number of loud impulses during an otherwise quiet day.

The Noise at Work Regulations are intended to reduce hearing damage caused by loud noise. So, what is a loud noise? If you cannot hear what someone is saying when they are 2m away from you or if they have to shout to make themselves heard, then the noise level is probably above 85 dB and should be measured by a competent person.

At the first action level an employee must be provided with ear protection (ear muffs or ear plugs) on request. At the second action level the employer must reduce, so far as is reasonably practicable, other than by providing ear protection, the exposure to noise of that employee.

Hearing damage is cumulative, it builds up, leading eventually to a loss of hearing ability. Young people, in particular, should get into the routine of avoiding noise exposure before their hearing is permanently damaged. The damage can also take the form of permanent tinnitus (ringing noise in the ears) and an inability to distinguish words of similar sound such as bit and tip.

Vibration is also associated with noise. Direct vibration through vibrating floors or from vibrating tools, can lead to damage to the bones of the feet or hands. A condition known as 'vibration white finger' is caused by an impaired blood supply to the fingers, associated with vibrating hand tools.

Employers and employees should not rely too heavily on ear protectors. In practice, they reduce noise exposure far less than is often claimed, because they may be uncomfortable or inconvenient to wear. To be effective, ear protectors need to be worn all the time when in noisy places. If left off for even a short time, the best protectors cannot reduce noise exposure effectively.

Protection against noise is best achieved by controlling it at source. Wearing ear protection must be a last resort. Employers should:

- Design machinery and processes to reduce noise and vibration (mounting machines on shock absorbing materials can dampen out vibration).
- When buying new equipment, where possible, choose quiet machines. Ask the supplier to specify noise levels at the operator's working position.
- Enclose noisy machines in sound absorbing panels.
- Fit silencers on exhaust systems.
- Install motor drives in a separate room away from the operator.
- Inform workers of the noise hazard and get them to wear ear protection.
- Reduce a worker's exposure to noise by job rotation or provide a noise refuge.

New regulations introduced in 2006 reduce the first action level to 80 dB(A) and the second level to 85 dB(A) with a peak action level of 98 dB(A) or 140 Pa of pressure. Every employer must make a 'noise' assessment and provide workers with information about the risks to hearing if the noise level approaches the first action level. He must do all that is reasonably practicable to control the noise exposure of his employees and clearly mark ear protection zones. Employees must wear personal ear protection whilst in such a zone.

The EHO (Environmental Health Officer)

The responsibilities of the EHO are concerned with reducing risks and eliminating the dangers to human health associated with the living and working environment. They are responsible for monitoring and ensuring the maintenance of standards of environmental and public health, including food safety, workplace health and safety, housing, noise, odour, industrial waste, pollution control and communicable diseases in accordance with the law. Although they have statutory powers with which to enforce the relevant regulations, the majority of their work involves advising and educating in order to implement public health policies.

The majority of EHO are employed by Local Authorities, who are the agencies concerned with the protection of public health. Increasingly, however, officers are being employed by the private sector, particularly those concerned with food, such as large hotel chains, airlines and shipping companies.

Your Local Authority EHO would typically have the responsibility of enforcing the environmental laws discussed above. Their typical work activities are to:

- ensure compliance with the Health and Safety at Work Act 1974, the Food Safety Act 1990 and the Environmental Protection Act 1990;

- carry out Health and Safety investigations, food hygiene inspections and food standards inspections;
- investigate public health complaints such as illegal dumping of rubbish, noise complaints and inspect contaminated land;
- investigate complaints from employees about their workplace and carry out accident investigations;
- investigate food poisoning outbreaks;
- obtain food samples for analysis where food is manufactured, processed or sold;
- visit housing and factory accommodation to deal with specific incidents such as vermin infestation and blocked drains;
- test recreational water, such as swimming pool water and private water supplies in rural areas;
- inspect and licence pet shops, animal boarding kennels, riding stables and zoos;
- monitor air pollution in heavy traffic areas and remove abandoned vehicles;
- work in both an advisory capacity and as enforcers of the law, educating managers of premises on issues which affect the safety of staff and members of the public.

In carrying out these duties, officers have the right to enter any workplace without giving notice, although notice may be given if they think it appropriate. They may also talk to employees, take photographs and samples and serve an Improvement Notice, detailing the work which must be carried out if they feel that there is a risk to health and safety that needs to be dealt with.

Enforcement Law Inspectors

If the laws relating to work, the environment and people are to be effective, they must be able to be enforced. The system of control under the Health and Safety at Work Act comes from the HSE or the Local Authority. Local Authorities are responsible for retail and service outlets such as shops, garages, offices, hotels, public houses and clubs. The HSE are responsible for all other work premises including the Local Authorities themselves. Both groups of inspectors have the same powers. They are allowed to:

- enter premises, accompanied by a police officer if necessary;
- examine, investigate and require the premises to be left undisturbed;
- take samples and photographs as necessary, dismantle and remove equipment;
- require the production of books or documents and information;

Definition

An *improvement notice* identifies a contravention of the law and specifies a date by which the situation is to be put right.

Definition

A *prohibition notice* is used to stop an activity which the inspector feels may lead to serious injury.

- seize, destroy or render harmless any substance or article;
- issue enforcement notices and initiate prosecutions.

There are two types of enforcement notices, an '**improvement notice**' and a '**prohibition notice**'.

An improvement notice identifies a contravention of the law and specifies a date by which the situation is to be put right. An appeal may be made to an Employment Tribunal within 21 days.

A prohibition notice is used to stop an activity which the inspector feels may lead to serious injury. The notice will identify which legal requirement is being contravened and the notice takes effect as soon as it is issued. An appeal may be made to the Employment Tribunal but the notice remains in place and work is stopped during the appeal process.

Cases may be heard in the Magistrates' or Crown Courts.

Magistrates' Court (Summary Offences) for health and safety offences, employers may be fined up to £20,000 and employees or individuals up to £5000. For failure to comply with an enforcement notice or a court order, anyone may be imprisoned for up to 6 months.

Crown Court (Indictable Offences) for failure to comply with an enforcement notice or a court order, fines are unlimited in the Crown Court and may result in imprisonment for up to 2 years.

Actions available to an inspector upon inspection of premises:

- Take no action – the law is being upheld.
- Give verbal advice – minor contraventions of the law identified.
- Give written advice – omissions have been identified and a follow up visit will be required to ensure that they have been corrected.
- Serve an improvement notice – a contravention of the law has, or is taking place and the situation must be remedied by a given date. A follow up visit will be required to ensure that the matter has been corrected.
- Serve a prohibition notice – an activity has been identified which may lead to serious injury. The law has been broken and the activity must stop immediately;
- Prosecute – the law has been broken and the employer prosecuted.

On any visit one or more of the above actions may be taken by the inspector.

In-house safety representatives

The HSE and the EHO are the health and safety professionals. The day that one of these inspectors arrives to look at the health and safety systems and procedures that your company has in place is a scary day! Most companies

are very conscientious about their health and safety responsibilities and want to comply with the law. Many of the regulations demand that the Health and Safety systems and procedures are regularly reviewed and monitored and that employees are informed and appropriately trained. To meet the requirements there is a need for 'competent persons' to be appointed to the various roles within the company structure to support the company directors in their management of the Health and Safety Policy. The number of people involved, and whether health and safety is their only company role, will depend upon the size of the company and the type of work being carried out. To say that 'everyone is responsible for health and safety' is very misleading and would definitely not impress a visiting HSE inspector. There is no equality of responsibility under the law between those who provide direction and create policy and those who are employed to carry out instructions. Company directors and employers have substantially more responsibilities than employees as far as the Health and Safety at Work Act is concerned. There therefore needs to be an appropriate structure and nominated 'competent persons' within the company to manage health and safety at work.

At the top of the health and safety structure there will need to be a senior manager. Like all management functions, establishing control and maintaining it day in day out is crucial to effective health and safety management. Senior managers must take proactive responsibility for controlling issues that could lead to ill health or injury. A nominated senior manager at the top of the organization must oversee policy implementation and monitoring.

Health and safety responsibilities must then be assigned to line managers and health and safety expertise must be available to them to help them achieve the requirements of the Health and Safety at Work Act and the Regulations made under the Act. The purpose of a health and safety organization within a company is to harness the collective enthusiasm, skill and effort of the whole workforce, with managers taking key responsibility and providing clear direction. The prevention of accidents and ill health through management systems of control then becomes the focus rather than looking for individuals to blame after an accident has happened. Two key personnel in this type of system might hold the job title '*Safety Officer*' and '*Safety Representative*'.

The **Safety Officer** will be the specialist member of staff, having responsibility for health and safety within the company. He or she will report to the senior manager responsible for health and safety and together they will develop strategies for implementing and maintaining the company's health and safety policies.

The Safety Officer will probably hold a health and safety qualification such as NEBOSH (National Examination Board in Occupational Safety and Health) and will:

- monitor the internal health and safety systems,
- carry out risk assessments,

Definition

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The Safety Officer will probably hold a Health and Safety qualification such as NEBOSH (National Examination Board in Occupational Safety and Health) and will:

- monitor the internal Health and Safety systems,
- carry out risk assessments,
- maintain accident reports and records,
- arrange or carry out in-house training,
- update systems as Regulations change.

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- arrange or carry out in-house training,
- update systems as Regulations change.

If an accident occurs, the Safety Officer would lead the investigation, identify the cause and advise the senior manager responsible for health and safety on possible improvements to the system.

Definition

The *Safety Representative* will be the person who represents a small section of the workforce on the Safety Committee. The role of the Safety Representative will be to bring to the Safety Committee the health and safety concerns of colleagues and to take back to colleagues, information from the Committee.

The **Safety Representative** will be the person who represents a small section of the workforce on the Safety Committee. The role of the Safety Representative will be to bring to the Safety Committee the health and safety concerns of colleagues and to take back to colleagues, information from the Committee. The office of Safety Representative is often held by the Trade Union representative, since it is a similar role, representing colleagues on management committees. If the company does not have a Safety Committee then the Safety Representative will liaise with the Safety Officer, informing him of the training and other health and safety requirements of colleagues.

The Safety Officer and Safety Representative hold important positions within a company, informing both employers and employees on health and safety matters and helping the company meet its obligation to 'consult with employees' under the Health and Safety Regulations.

Regular monitoring and reviewing of systems and procedures is an essential part of any Health and Safety system. Similarly, monitoring and evaluating systems systematically is an essential part of many quality management systems. In Chapter 3 we will look at quality systems.

Try This

Safety Officer

- Is there someone in your company responsible for safety?
- What is his name?
- What does he do?

Safe working procedures

The principles which were laid down in the many Acts of Parliament and the Regulations that we have already looked at in this chapter, control our working environment. They make our workplace safer, but despite all this legislation, workers continue to be injured and killed at work or die as a result of a work-related injury. The number of deaths has consistently averaged about 200 each year for the past 8 years. These figures only relate to employees. If you include the self-employed and members of the public killed in work-related accidents, the numbers almost double.

In addition to the deaths, about 28,000 people have major accidents at work and about 130,000 people each year, receive minor work-related injuries which keep them off work for more than 3 days.

Definition

Human errors include behaving badly or foolishly, being careless and not paying attention to what you should be doing at work.

Definition

Environmental conditions include unguarded or faulty machinery.

Safety First

Safety Procedures

- Hazard Risk Assessment is an essential part of any Health and Safety management system.
- The aim of the planning process is to minimize risk.
- HSE publication HSG(65).

It is a mistake to believe that these things only happen in dangerous occupations such as deep sea diving, mining and quarrying, fishing industry, tunnelling and fire-fighting or that it only happens in exceptional circumstances such as would never happen in your workplace. This is not the case. Some basic thinking and acting beforehand, could have prevented most of these accident statistics, from happening.

CAUSES OF ACCIDENTS

Most accidents are caused by either human error or environmental conditions. **Human errors** include behaving badly or foolishly, being careless and not paying attention to what you should be doing at work, doing things that you are not competent to do or have not been trained to do. You should not work when tired or fatigued and should never work when you have been drinking alcohol or taking drugs.

Environmental conditions include unguarded or faulty machinery, damaged or faulty tools and equipment, poorly illuminated or ventilated workplaces and untidy, dirty or overcrowded workplaces.

The most common causes of accidents

These are:

- slips, trips and falls;
- manual handling, that is moving objects by hand;
- using equipment, machinery or tools;
- storage of goods and materials which then become unstable;
- fire;
- electricity;
- mechanical handling.

Accident prevention measures

To control the risk of an accident we usually:

- eliminate the cause;
- substitute a procedure or product with less risk;
- enclose the dangerous situation;
- put guards around the hazard;
- use safe systems of work;
- supervise, train and give information to staff;
- if the hazard cannot be removed or minimized then provide PPE.

Let us now look at the application of one of the procedures that make the workplace a safer place to work but first of all I want to explain what I mean when I use the words hazard and risk.

Definitions

A hazard is something with the 'potential' to cause harm, for example, chemicals, electricity or working above ground.

A risk is the 'likelihood' of harm actually being done.

Definition

A *competent person* is anyone who has the necessary technical skills, training and expertise to safely carry out the particular activity.

HAZARD AND RISK

Competent persons are often referred to in the Health and Safety at Work Regulations, but who is 'competent'? For the purposes of the Act, a competent person is anyone who has the necessary technical skills, training and expertise to safely carry out the particular activity. Therefore, a **competent person** dealing with a hazardous situation reduces the risk.

Think about your workplace and at each stage of what you do, think about what might go wrong. Some simple activities may be hazardous. Here are some typical activities where accidents might happen.

Typical activity

Receiving materials

Stacking and storing

Movement of people

Building maintenance

Movement of vehicles

Potential hazard

Lifting and carrying

Falling materials

Slips, trips and falls

Working at heights or in confined spaces

Collisions

How high are the risks? Think about what might be the worst result, is it a broken finger or someone suffering permanent lung damage or being killed? How likely is it to happen? How often is that type of work carried out and how close do people get to the hazard? How likely is it that something will go wrong?

How many people might be injured if things go wrong. Might this also include people who do not work for your company?

Employers of more than five people must document the risks at work and the process is known as Hazard Risk Assessment.

HAZARD RISK ASSESSMENT – THE PROCESS

The Management of Health and Safety at Work Regulations 1999 tells us that employers must systematically examine the workplace, the work activity and the management of safety in the establishment through a process of risk assessments. A record of all significant risk assessment findings must be kept in a safe place and be made available to an HSE Inspector if required. Information based on the risk assessment findings must be communicated to relevant staff and if changes in work behaviour patterns are recommended in the interests of safety, then they must be put in place.

So risk assessment must form a part of any employer's robust policy of health and safety. However, an employer only needs to 'formally' assess the significant risks. He is not expected to assess the trivial and minor types of household risks. Staff are expected to read and to act upon these formal risk assessments and they are unlikely to do so enthusiastically if the file is full of trivia. An assessment of risk is nothing more than a careful examination of what, in your work, could cause harm to people. It is a

record that shows whether sufficient precautions have been taken to prevent harm.

The HSE recommends five steps to any risk assessment.

Step 1

Look at what might reasonably be expected to cause harm. Ignore the trivial and concentrate only on significant hazards that could result in serious harm or injury. Manufacturers data sheets or instructions can also help you spot hazards and put risks in their true perspective.

Step 2

Decide who might be harmed and how. Think about people who might not be in the workplace all the time – cleaners, visitors, contractors or maintenance personnel. Include members of the public or people who share the workplace. Is there a chance that they could be injured by activities taking place in the workplace.

Step 3

Evaluate what is the risk arising from an identified hazard. Is it adequately controlled or should more be done? Even after precautions have been put in place, some risk may remain. What you have to decide, for each significant hazard, is whether this remaining risk is low, medium or high. First of all, ask yourself if you have done all the things that the law says you have got to do. For example, there are legal requirements on the prevention of access to dangerous machinery. Then ask yourself whether generally accepted industry standards are in place, but do not stop there – think for yourself, because the law also says that you must do what is reasonably practicable to keep the workplace safe. Your real aim is to make all risks small by adding precautions, if necessary.

If you find that something needs to be done, ask yourself:

- (i) Can I get rid of this hazard altogether?
- (ii) If not, how can I control the risk so that harm is unlikely?

Only use PPE when there is nothing else that you can reasonably do.

If the work that you do varies a lot, or if there is movement between one site and another, select those hazards which you can reasonably foresee, the ones that apply to most jobs and assess the risks for them. After that, if you spot any unusual hazards when you get on site, take what action seems necessary.

Step 4

Record your findings and say what you are going to do about risks that are not adequately controlled. If there are fewer than five employees you do not need to write anything down but if there are five or more employees, the

significant findings of the risk assessment must be recorded. This means writing down the more significant hazards and assessing if they are adequately controlled and recording your most important conclusions. Most employers have a standard risk assessment form which they use such as that shown in Fig. 1.3 but any format is suitable. The important thing is to make a record.

HAZARD RISK ASSESSMENT		FLASH-BANG ELECTRICAL CO.	
For Company name or site: Address:		Assessment undertaken by:..... Signed: Date:	
STEP 5 Assessment review date:			
STEP 1 List the hazards here		STEP 2 Decide who might be harmed	
STEP 3 Evaluate (what is) the risk – is it adequately controlled? State risk level as low, medium or high		STEP 4 Further action – what else is required to control any risk identified as medium or high?	

FIGURE 1.3
Hazard risk assessment standard form.

There is no need to show how the assessment was made, providing you can show that:

1. a proper check was made,
2. you asked those who might be affected,
3. you dealt with all obvious and significant hazards,
4. the precautions are reasonable and the remaining risk is low,
5. you informed your employees about your findings.

Risk assessments need to be *suitable* and *sufficient*, not perfect. The two main points are:

1. Are the precautions reasonable?
2. Is there a record to show that a proper check was made?

File away the written Assessment in a dedicated file for future reference or use. It can help if an HSE Inspector questions the company's precautions or if the company becomes involved in any legal action. It shows that the company has done what the law requires.

Step 5

Review the assessments from time to time and revise them if necessary.

COMPLETING A RISK ASSESSMENT

When completing a risk assessment such as that shown in Fig. 1.3, do not be over complicated. In most firms in the commercial, service and light industrial sector, the hazards are few and simple. Checking them is common sense but necessary.

Step 1

List only hazards which you could reasonably expect to result in significant harm under the conditions prevailing in your workplace. Use the following examples as a guide:

- Slipping or tripping hazards (e.g. from poorly maintained or partly installed floors and stairs).
- Fire (e.g. from flammable materials you might be using, such as solvents).
- Chemicals (e.g. from battery acid).
- Moving parts of machinery (e.g. blades).
- Rotating parts of handtools (e.g. drills).
- Accidental discharge of cartridge operated tools.
- High pressure air from airlines (e.g. air powered tools).
- Pressure systems (e.g. steam boilers).

- Vehicles (e.g. fork lift trucks).
- Electricity (e.g. faulty tools and equipment).
- Dust (e.g. from grinding operations or thermal insulation).
- Fumes (e.g. from welding).
- Manual handling (e.g. lifting, moving or supporting loads).
- Noise levels too high (e.g. machinery).
- Poor lighting levels (e.g. working in temporary or enclosed spaces).
- Low temperatures (e.g. working outdoors or in refrigeration plant).
- High temperatures (e.g. working in boiler rooms or furnaces).

Step 2

Decide who might be harmed, do not list individuals by name. Just think about groups of people doing similar work or who might be affected by your work:

- Office staff
- Electricians
- Maintenance personnel
- Other contractors on site
- Operators of equipment
- Cleaners
- Members of the public.

Pay particular attention to those who may be more vulnerable, such as:

- staff with disabilities,
- visitors,
- young or inexperienced staff,
- people working in isolation or enclosed spaces.

Step 3

Calculate what is the risk – is it adequately controlled? Have you already taken precautions to protect against the hazards which you have listed in Step 1. For example:

- Have you provided adequate information to staff.
- Have you provided training or instruction.

Do the precautions already taken

- meet the legal standards required,

- comply with recognized industrial practice,
- represent good practice,
- reduce the risk as far as is reasonably practicable.

If you can answer 'yes' to the above points then the risks are adequately controlled, but you need to state the precautions you have put in place. You can refer to company procedures, company rules, company practices, etc., in giving this information. For example, if we consider there might be a risk of electric shock from using electrical power tools, then the risk of a shock will be *less* if the company policy is to PAT test all power tools each year and to fit a label to the tool showing that it has been tested for electrical safety. If the stated company procedure is to use battery drills whenever possible, or 110V drills when this is not possible, and to *never* use 230V drills, then this again will reduce the risk. If a policy such as this is written down in the company Safety Policy Statement, then you can simply refer to the appropriate section of the Safety Policy Statement and the level of risk will be low.

Step 4

Further action – what more could be done to reduce those risks which were found to be inadequately controlled?

You will need to give priority to those risks that affect large numbers of people or which could result in serious harm. Senior managers should apply the principles below when taking action, if possible in the following order:

1. Remove the risk completely.
2. Try a less risky option.
3. Prevent access to the hazard (e.g. by guarding).
4. Organize work differently in order to reduce exposure to the hazard.
5. Issue PPE.
6. Provide welfare facilities (e.g. washing facilities for removal of contamination and first aid).

Any hazard identified by a risk assessment as *high risk* must be brought to the attention of the person responsible for health and safety within the company. Ideally, in Step 4 of the Risk Assessment you should be writing, 'No further action is required. The risks are under control and identified as low risk'.

The assessor may use as many standard Hazard Risk Assessment forms, such as that shown in Fig. 1.3, as the assessment requires. Upon completion they should be stapled together or placed in a plastic wallet and stored in the dedicated file.

You might like to carry out a risk assessment on a situation you are familiar with at work, or at college using the standard form of Fig. 1.3, or your employer's standard forms.

Accident reports

Every accident must be reported to an employer and minor accidents reported to a supervisor, safety officer or first aider and the details of the accident and treatment given suitably documented. A first aid logbook or accident book such as that shown in Fig. 1.4 containing first aid treatment record sheets could be used to effectively document accidents which occur in the workplace and the treatment given. Failure to do so may influence the payment of compensation at a later date if an injury leads to permanent disability. To comply with the Data Protection Regulations, from 31 December 2003 all First Aid Treatment Logbooks or Accident Report books must contain perforated sheets which can be removed after completion and filed away for personal security.

If the accident results in death, serious injury or an injury that leads to an absence from work of more than 3 days, then your employer must report the accident to the local office of the HSE. The quickest way to do this is to call the Incident Control Centre on 0845 300 9923. They will require the following information:

- The name of the person injured.
- A summary of what happened.
- A summary of events prior to the accident.
- Information about the injury or loss sustained.
- Details of witnesses.
- Date and time of accident.
- Name of the person reporting the incident.

The Incident Control Centre will forward a copy of every report they complete to the employer for them to check and hold on record. However, good practice would recommend an employer or his representative make an extensive report of any serious accident that occurs in the workplace. In addition to recording the above information, the employer or his representative should:



FIGURE 1.4

First aid logbook/Accident book with data protection compliant removable sheets.

- Sketch diagrams of how the accident occurred, where objects were before and after the accident, where the victim fell, etc.
- Take photographs or video that show how things were after the accident, for example, broken stepladders, damaged equipment, etc.
- Collect statements from witnesses. Ask them to write down what they saw.
- Record the circumstances surrounding the accident. Was the injured person working alone – in the dark – in some other adverse situation or condition – was PPE being worn – was PPE recommended in that area?

The above steps should be taken immediately after the accident has occurred and after the victim has been sent for medical attention. The area should be made safe and the senior management informed so that any actions to prevent a similar occurrence can be put in place. Taking photographs and obtaining witnesses' statements immediately after an accident happens, means that evidence may still be around and memories still sharp.

Safety signs

The rules and regulations of the working environment are communicated to employees by written instructions, signs and symbols. All signs in the working environment are intended to inform. They should give warning of possible dangers and must be obeyed. At first there were many different safety signs but British Standard BS 5499 Part 1 and the Health and Safety (Signs and Signals) Regulations 1996 have introduced a standard system which gives health and safety information with the minimum use of words. The purpose of the regulations is to establish an internationally understood system of safety signs and colours which draw attention to equipment and situations that do, or could, affect health and safety. Text-only safety signs became illegal from 24 December 1998. From that date, all safety signs have had to contain a pictogram or symbol such as those shown in Fig. 1.5. Signs fall into four categories: prohibited activities; warnings; mandatory instructions and safe conditions.

PROHIBITION SIGNS

These are must not do signs. These are circular white signs with a red border and red cross bar, and are given in Fig. 1.6. They indicate an activity which *must not* be done.



FIGURE 1.5

Text-only safety signs do not comply.

WARNING SIGNS

Warning signs give safety information. These are triangular yellow signs with a black border and symbol, and are given in Fig. 1.7. They *give warning* of a hazard or danger.

MANDATORY SIGNS

These are must do signs. These are circular blue signs with a white symbol, and are given in Fig. 1.8. They *give instructions* which must be obeyed.

ADVISORY OR SAFE CONDITION SIGNS

These are square or rectangular green signs with a white symbol, and are given in Fig. 1.9. They *give information* about safety provision.



FIGURE 1.6

Prohibition signs. (These are MUST NOT DO signs.)

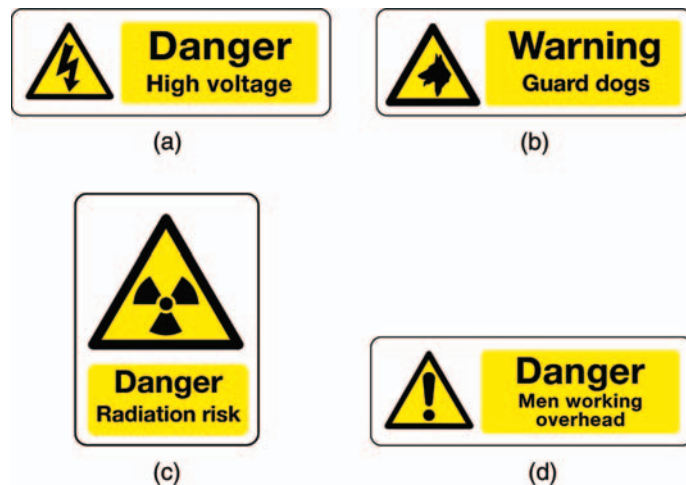
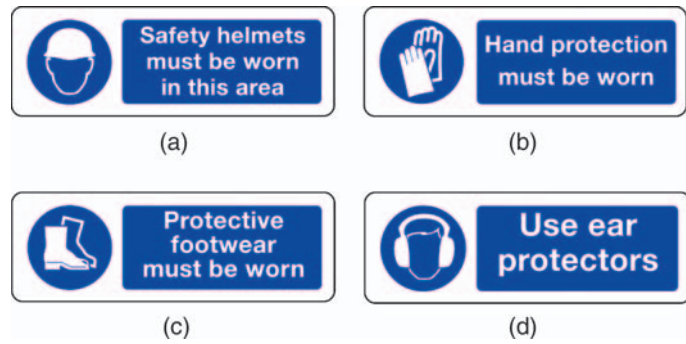


FIGURE 1.7

Warning signs. (These give safety information.)

**FIGURE 1.8**

Mandatory signs. (These are MUST DO signs.)

**FIGURE 1.9**

Advisory or safe condition signs. (These also give safety information.)

Good customer relationships

Remember that it is the customers who actually pay the wages of everyone employed in your company. You should always be polite and listen carefully to their wishes. They may be elderly or of a different religion or cultural background than you. In a domestic situation, the playing of loud music on a radio will not be approved of. Treat the property in which you are working with the utmost care. When working in houses, shops and offices use dust sheets to protect floor coverings and furnishings. Clean up periodically and make a special effort when the job is completed.

Dress appropriately: an unkempt or untidy appearance will encourage the customer to think that your work will be of poor quality.

The electrical installation in a building is often carried out alongside other trades. It makes good sense to help other trades where possible and to

Safety First

Safety signs

Which safety signs do you see around you?

- When you are at work?
- When you are at college?

Key Fact

Customer relationships

- Good customer relationships are important.
- Always be polite.
- Do not switch on a radio.
- Do not use a mobile phone during the 'customer's time'.
- Always be punctual.
- Always behave in a professional manner.

develop good working relationships with other employees. The customer will be most happy if the workers give an impression of working together as a team for the successful completion of the project. The customer will be most impressed by the workers punctuality, professional attitude, dedication to the job in hand and completion of the work in the agreed time.

Finally, remember that the customer will probably see more of the electrician and the electrical trainee than of the managing director of your firm and, therefore, the image presented by you will be assumed to reflect the policy of the company. You are, therefore, your company's most important representative. Always give the impression of being capable and in command of the situation, because this gives customers confidence in the company's ability to meet their needs. However, if a problem does occur which is outside your previous experience and you do not feel confident to solve it successfully, then contact your supervisor for professional help and guidance. It is not unreasonable for a young member of the company's team to seek help and guidance from those employees with more experience. This approach would be preferred by most companies rather than having to meet the cost of an expensive blunder.

Legal contracts

Before work commences, some form of legal contract should be agreed between the two parties, that is, those providing the work (e.g. the sub-contracting electrical company) and those asking for the work to be carried out (e.g. the main building company) or an individual customer or client.

A contract is a formal document which sets out the terms of agreement between the two parties. A standard form of building contract typically contains four sections:

1. The articles of agreement – this names the parties, the proposed building and the date of the contract period.
2. The contractual conditions – this states the rights and obligations of the parties concerned, for example, whether there will be interim payments for work or a penalty if work is not completed on time.
3. The appendix – this contains details of costings, for example, the rate to be paid for extras as daywork, who will be responsible for defects, how much of the contract tender will be retained upon completion and for how long.
4. The supplementary agreement – this allows the electrical contractor to recoup any value-added tax paid on materials at interim periods.

In signing the contract, the electrical contractor has agreed to carry out the work to the appropriate standards in the time stated and for the agreed cost. The other party, say the main building contractor, is agreeing to pay the price stated for that work upon completion of the installation.

If a dispute arises the contract provides written evidence of what was agreed and will form the basis for a solution.

For smaller electrical jobs, a verbal contract may be agreed, but if a dispute arises there is no written evidence of what was agreed and it then becomes a matter of one person's word against another's.

Changing work patterns

The electrotechnical industries cover a large range of activities and occupations from panel building, instrumentation, maintenance, cable jointing, highway electrical systems to motor re-winding, alarm and security systems, building management systems and computer installations. Electricians are often employed in the electrical contracting industry, installing wiring systems and equipment in houses, hospitals, schools, shops and offices. Electricians are also employed directly by factories, local councils, large commercial organizations, hospitals and the armed services where their skills are in demand. Employment opportunities for electrically trained people are enormous. There are about 21,000 electrical contracting companies registered in the United Kingdom. These companies employ from less than 10 people to the big multi-national companies, although the majority are small companies of less than 10 people. Then there are the small self-employed electrical businesses and those who work for the Local Authority, hospitals or armed forces who do not get counted as electrical personnel but as blue collar workers or soldiers.

The new technology of recent times has created many new opportunities for electrically competent personnel from installing satellite dishes, computer networks, extension telephone sockets for Internet connections to dichroic reflector miniature spotlight installations, intruder alarms and external illumination of garden areas.

New editions of the Regulations create work opportunities in domestic and public buildings bringing them up to the latest safety requirements.

A structured apprenticeship gives a broad range of experience opportunities and the achievement of the appropriate City and Guilds qualifications will lead to qualified electrician status with good electrical core skills.

New technologies present new opportunities to build on these core skills. New editions of the Regulations present new training opportunities. The acquisition of new skills gives the opportunity to transfer these new skills to new employers. Flexible workers with a range of skills can work in different disciplines in different parts of the electrotechnical industry in different parts of the country. Flexible workers are an attractive proposition to a prospective employer.

Electricians trained in the installation of conduit systems can easily transfer their skills to those we think of as belonging to a plumber or heating engineer in mechanical services. For those employed in the maintenance of fluid systems, instrumentation, monitoring and control will be required, and this may present opportunities of further responsibility or an increase in salary or status within a company.

Maintenance work demands that a craftsman has a range of skills and the flexibility to use them. If an electric motor was found to be faulty, then to replace it would require mechanical engineering and fitting skills as well as electrical skills and the one man who can do that job has multiple skills and can demand more pay.

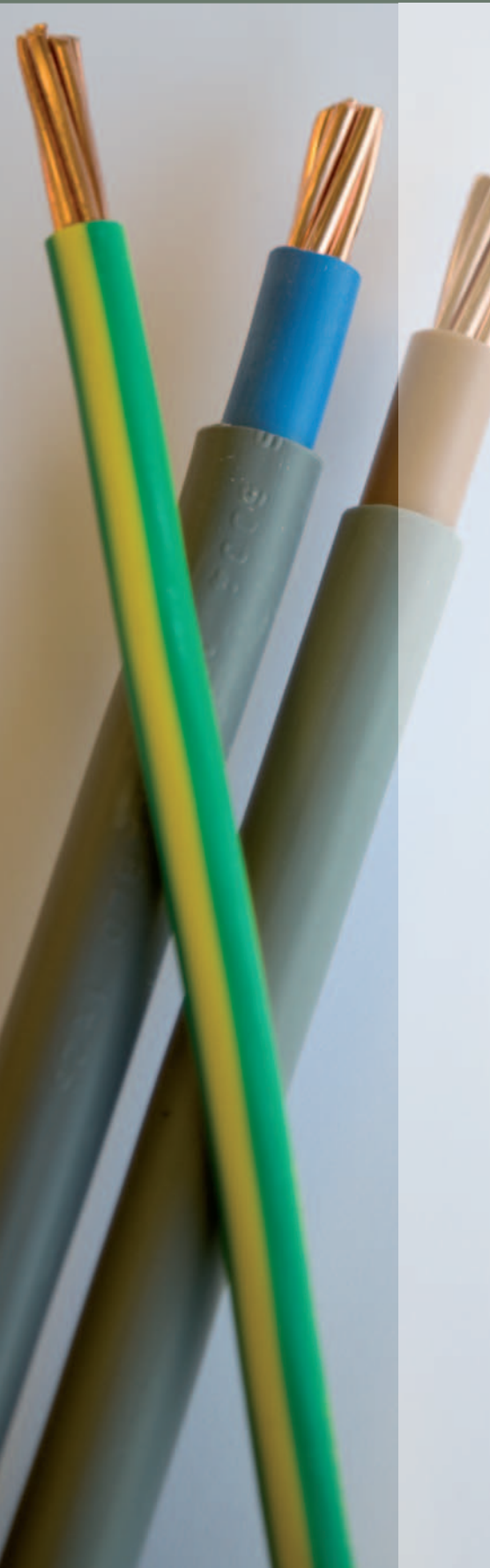
Increased leisure opportunities have seen a huge increase in fitness centres containing lots of electrical equipment. The overuse and misuse of equipment means that it breaks down more frequently. When does it break down? At the most inconvenient time of course! The fitness centre manager wants the equipment fixed reasonably quickly, even if it is Sunday. They are at work so why isn't the electrician!

I live close to a seaside resort. All the people involved in the holiday seasonal work, work hard long hours, usually from Easter until the end of the summer. Everything then closes down and they then get on with their planned maintenance work. However, things also go wrong during the holiday season and the electrician is expected to support them when they need him.

This leads to a demand for flexible working hours or a flexible working week. Some of the small electrical companies have a rota system so that at least one member of staff is on cover for breakdowns and emergencies over a weekend. If the rota is shared out, then each individual only need cover, say one in four weekends, and as a result receives extra pay.

The foreseeable future for those employed in the electrotechnical industries is that they will require a firm practical and academic foundation. New technologies will require that we continue to learn new skills and new ideas will create new business opportunities for electrical companies. Regulations and laws will be updated to improve health and safety and to meet the demands of industry along with new training opportunities for employees to keep up to date with new requirements. Employees will also need to be flexible, not only in relation to what they can do but when they can do it. Very few people these days work regular fixed hours.

Check your Understanding



When you have completed these questions check out the answers at the back of the book.

Note: more than one multiple choice answer may be correct.

1. Under the Health and Safety at Work Act an employer has a duty of care to his employees. Identify an employer's duties from the list below.
 - a. provide appropriate PPE
 - b. wear appropriate PPE
 - c. have plant and equipment properly maintained
 - d. take reasonable care to avoid injury.
2. Under the Health and Safety at Work Act an employee has a duty of care to his employer. Identify an employee's responsibilities from the list below.
 - a. provide appropriate PPE
 - b. wear appropriate PPE
 - c. have plant and equipment properly maintained
 - d. take reasonable care to avoid injury.
3. The Health and Safety Laws are enforced by:
 - a. The Local Trading Standards
 - b. The IEE Regulations
 - c. The ECA (Electrical Contractors Association)
 - d. The HSE (Health and Safety Executive).
4. Every company that employs more than **five** people must have a:
 - a. Health and Safety Policy statement
 - b. pension plan for employees
 - c. Health and Safety Law poster displayed
 - d. means of ensuring Health and Safety awareness among its employees.
5. Safety signs showing the type of PPE are coloured:
 - a. blue and white
 - b. green and white
 - c. red and white
 - d. yellow and white.
6. Warning signs are coloured:
 - a. blue and white
 - b. green and white
 - c. red and white
 - d. yellow and white.

7. Prohibition signs are coloured:

- a. blue and white
- b. green and white
- c. red and white
- d. yellow and white.

8. Advisory or Safe Condition signs are coloured:

- a. blue and white
- b. green and white
- c. red and white
- d. yellow and white.

9. Someone who has the necessary technical skills training and experience to safely carry out a particular activity is said to be a:

- a. legal contract
- b. risk
- c. hazard
- d. competent person.

10. Something with the potential to cause harm is called a:

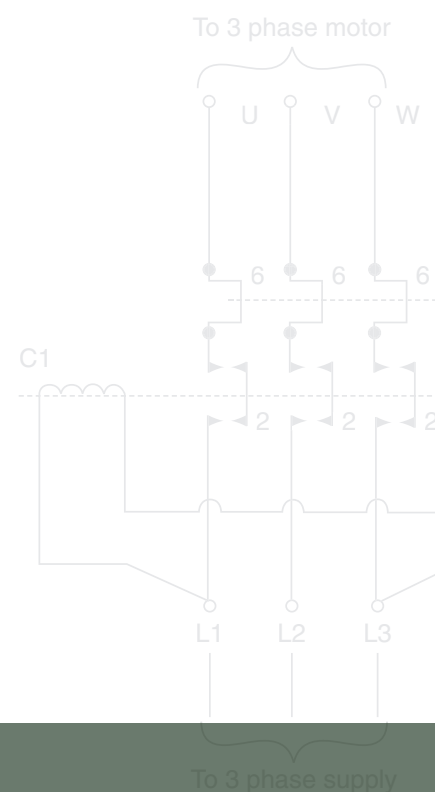
- a. legal contract
- b. risk
- c. hazard
- d. competent person.

11. The chance of harm actually being done as a result of a work activity we call a:

- a. legal contract
- b. risk
- c. hazard
- d. competent person.

12. Before any work begins, some form of agreement between the two parties should be made regarding cost, completion date and what work is to be done. This is called a:

- a. legal contract
- b. risk
- c. hazard
- d. competent person.





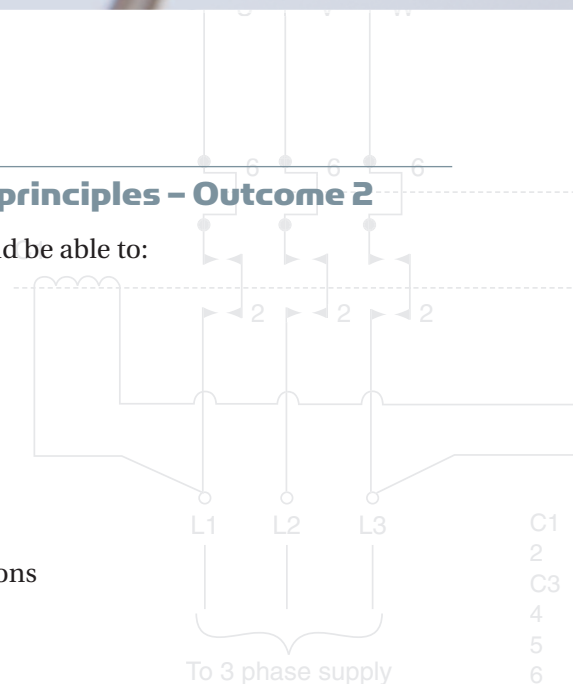
13. List **five** Safety Regulations which are very relevant to the electrotechnical industry.
14. List **three** pieces of environmental legislation which has an impact on electrotechnical activities.
15. List the responsibilities of an employer and employee under the Health and Safety at Work Act.
16. List the human and environmental conditions which lead to accidents in the workplace.
17. Produce a rough sketch and show the colour of the **four** types of Safety Sign, that is: Warning, Advisory, Mandatory and Prohibition signs.
18. Everyone has a duty of care but not everyone is a duty holder. Briefly describe the meaning of 'duty of care' and 'duty holder'.
19. Which **five** laws or regulations have the most impact upon your work in the electrotechnical industry?
20. The Electricity at Work Regulations describe things that must be done as 'reasonably practicable' or 'absolute'. Briefly describe the meaning of 'reasonably practicable' and 'absolute'.
21. State the advantages of having a written contract between the electrical company and their customers rather than a verbal contract.
22. Make a list of the things that could be done to ensure a good customer relationship.
23. The electrotechnical industry is expanding to meet the changing needs of customers who want to use the latest technology in their businesses. Make a list of the different types of electrical activity that your company provides to its customers.

Safe working practices and emergency procedures

Unit 1 – Application of health and safety and electrical principles – Outcome 2

Underpinning knowledge: when you have completed this chapter you should be able to:

- outline 'permit-to-work' and 'secure electrical isolation procedures'
- state the requirements for the provision of first aid equipment
- state fire prevention methods and evacuation procedures
- describe work situations where you must not work alone
- state the emergency action following electric shock
- define asphyxiation, dangerous occurrence and hazardous malfunctions



Definition

A *hazard* is something with the potential to cause harm, for example, chemicals, electricity, working above ground.

Definition

A *risk* is the likelihood or chance of harm actually being done by the hazard.

Definition

PPE is defined as all equipment designed to be worn, or held, to protect against a risk to health and safety.

Safe working procedures to prevent injury

Where a particular hazard exists in the working environment, an employer must carry out a risk assessment and establish procedures which will reduce or eliminate the risk. When the risk cannot be completely removed, an employer must provide personal protective equipment (PPE) to protect his employees from a risk to health and safety.

Personal protective equipment

PPE is defined as all equipment designed to be worn, or held, to protect against a risk to health and safety. This includes most types of protective clothing, and equipment such as eye, foot and head protection, safety harnesses, life jackets and high-visibility clothing.

Under the Health and Safety at Work Act, employers must provide free of charge any **PPE** and employees must make full and proper use of it. Safety signs such as those shown in Fig. 2.1 are useful reminders of the type of PPE to be used in a particular area. The vulnerable parts of the body which may need protection are the head, eyes, ears, lungs, torso, hands and feet and, additionally, protection from falls may need to be considered. Objects falling from a height present the major hazard against which head protection is provided. Other hazards include striking the head against projections and hair becoming entangled in machinery. Typical methods of protection include helmets, light duty scalp protectors called 'bump caps' and hairnets.

The eyes are very vulnerable to liquid splashes, flying particles and light emissions such as ultraviolet light, electric arcs and lasers. Types of eye



FIGURE 2.1

Safety signs showing type of PPE to be worn.

protectors include safety spectacles, safety goggles and face shields. Screen based workstations are being used increasingly in industrial and commercial locations by all types of personnel. Working with VDUs (visual display units) can cause eye strain and fatigue and therefore, every display screen operator is entitled to a free eye test.

Noise is accepted as a problem in most industries and we looked in some detail at the Noise Regulations a little earlier in this book under the Environmental Laws section.

Noise may be defined as any disagreeable or undesirable sound or sounds, generally of a random nature, which do not have clearly defined frequencies. The usual basis for measuring noise or sound level is the decibel scale. Whether noise of a particular level is harmful or not also depends upon the length of exposure to it. This is the basis of the widely accepted limit of 85 dB of continuous exposure to noise for 8 hours per day.

Where individuals must be subjected to some noise at work it may be reduced by ear protectors. These may be disposable ear plugs, reusable ear plugs or ear muffs. The chosen ear protector must be suited to the user and suitable for the type of noise and individual personnel should be trained in its correct use.

Breathing reasonably clean air is the right of every individual, particularly at work. Some industrial processes produce dust which may present a potentially serious hazard. The lung disease asbestosis is caused by the inhalation of asbestos dust or particles and the coal dust disease pneumoconiosis, suffered by many coal miners, has made people aware of the dangers of breathing in contaminated air.

Some people may prove to be allergic to quite innocent products such as flour dust in the food industry or wood dust in the construction industry. The main effect of inhaling dust is a measurable impairment of lung function. This can be avoided by wearing an appropriate mask, respirator or breathing apparatus as recommended by the company's health and safety policy and indicated by local safety signs such as those shown in Fig. 2.2.

A worker's body may need protection against heat or cold, bad weather, chemical or metal splash, impact or penetration and contaminated dust. Alternatively, there may be a risk of the worker's own clothes causing contamination of the product, as in the food industry. Appropriate clothing will be recommended in the company's health and safety policy. Ordinary



FIGURE 2.2

Breathing protection signs.

working clothes and clothing provided for food hygiene purposes are not included in the PPE at Work Regulations.

Hands and feet may need protection from abrasion, temperature extremes, cuts and punctures, impact or skin infection. Gloves or gauntlets provide protection from most industrial processes but should not be worn when operating machinery because they may become entangled in it. Care in selecting the appropriate protective device is required; for example, barrier creams provide only a limited protection against infection.

Boots or shoes with in-built toe caps can give protection against impact or falling objects and, when fitted with a mild steel sole plate, can also provide protection from sharp objects penetrating through the sole. Special slip resistant soles can also be provided for employees working in wet areas.

Whatever the hazard to health and safety at work, the employer must be able to demonstrate that he or she has carried out a risk assessment, made recommendations which will reduce that risk and communicated these recommendations to the workforce. Where there is a need for PPE to protect against personal injury and to create a safe working environment, the employer must provide that equipment and any necessary training which might be required and the employee must make full and proper use of such equipment and training.

WORKING ALONE

Some working situations are so potentially hazardous that not only must PPE be worn but you must also never work alone and safe working procedures must be in place before your work begins to reduce the risk.

It is unsafe to work in isolation in the following situations:

- when working above ground,
- when working below ground,
- when working in confined spaces,
- when working close to unguarded machinery,
- when a fire risk exists,
- when working close to toxic or corrosive substances.

WORKING ABOVE GROUND

We looked at this topic as it applies to electrotechnical personnel in Chapter 8 of *Basic Electrical Installation Work* 5th Edition under the sub-heading 'Safe Working above Ground'. The new Work at Height Regulations 2005 tells us that a person is at height if that person could be injured by falling from it. The Regulations require that:

- We should avoid working at height if at all possible.
- No work should be done at height which can be done on the ground. For example, equipment can be assembled on the ground then taken up to height, perhaps for fixing.

- Ensure the work at height is properly planned.
- Take account of any risk assessments carried out under Regulation 3 of the Management of Health and Safety at Work Regulations.

WORKING BELOW GROUND

Working below ground might be working in a cellar or an unventilated basement with only one entrance/exit. There is a risk that this entrance/exit might become blocked by materials, fumes or fire. When working in trenches there is always the risk of the sides collapsing if they are not adequately supported by temporary steel sheets. There is also the risk of falling objects so always:

- wear a hard hat,
- never go into an unsupported excavation,
- erect barriers around the excavation,
- provide good ladder access,
- ensure the work is properly planned,
- take account of the risk assessment before starting work.

WORKING IN CONFINED SPACES

When working in confined spaces there is always the risk that you may become trapped or overcome by a lack of oxygen or by gas, fumes, heat or an accumulation of dust. Examples of confined spaces are:

- storage tanks and silos on farms,
- enclosed sewer and pumping stations,
- furnaces,
- ductwork.

In my experience, electricians spend a lot of time on their knees in confined spaces because many electrical cable systems run out of sight away from public areas of a building.

The Confined Spaces Regulations 1997 require that:

- A risk assessment is carried out before work commences.
- If there is a serious risk of injury in entering the confined space then the work should be done on the outside of the vessel.
- Follow a safe working procedure such as a 'permit-to-work procedure' which is discussed later in this chapter, and put adequate emergency arrangements in place before work commences.

WORKING NEAR UNGUARDED MACHINERY

There is an obvious risk in working close to unguarded machinery and indeed, most machinery will be guarded but in some production processes

Safety First*Working alone*

- Never work alone in:
 - confined spaces
 - storage tanks
 - enclosed ductwork.

and with overhead travelling cranes, this is not always possible. To reduce the risks associated with these hazards:

- have the machinery stopped during your work activity if possible,
- put temporary barriers in place,
- make sure that the machine operator knows that you are working on the equipment,
- identify the location of emergency stop buttons,
- take account of the risk assessment before work commences.

A RISK OF FIRE

When working in locations containing stored flammable materials such as petrol, paraffin, diesel or bottled gas, there is always the risk of fire. To minimize the risk:

- take account of the risk assessment before work commences,
- keep the area well ventilated,
- locate the fire extinguishers,
- secure your exit from the area,
- locate the nearest fire alarm point,
- follow a safe working procedure and put adequate emergency arrangements in place before work commences.

Secure electrical isolation

Electric shock occurs when a person becomes part of the electrical circuit. The level or intensity of the shock will depend upon many factors, such as age, fitness and the circumstances in which the shock is received. The lethal level is approximately 50mA, above which muscles contract, the heart flutters and breathing stops. A shock above the 50mA level is therefore fatal unless the person is quickly separated from the supply. Below 50mA only an unpleasant tingling sensation may be experienced or you may be thrown across a room or shocked enough to fall from a roof or ladder, but the resulting fall may lead to serious injury.

To prevent people receiving an electric shock accidentally, all circuits contain protective devices. All exposed metal is earthed, fuses and miniature circuit breakers (MCBs) are designed to trip under fault conditions and residual current devices (RCDs) are designed to trip below the fatal level.

Construction workers and particularly electricians do receive electric shocks, usually as a result of carelessness or unforeseen circumstances. As an electrician working on electrical equipment you must always make sure that the equipment is switched off or electrically isolated before commencing work. Every circuit must be provided with a means of isolation (IEE Regulation 132.15). When working on portable equipment or desktop units it is often simply a matter of unplugging the equipment from the adjacent supply. Larger pieces of equipment, and electrical machines may require isolating at

Definition

Electrical isolation: We must ensure the disconnection and separation of electrical equipment from every source of supply and that this disconnection and separation is secure.

the local isolator switch before work commences. To deter anyone from re-connecting the supply while work is being carried out on equipment, a sign 'Danger – Electrician at Work' should be displayed on the isolator and the isolation 'secured' with a small padlock or the fuses removed so that no one can reconnect whilst work is being carried out on that piece of equipment. The Electricity at Work Regulations 1989 are very specific at Regulation 12(1) that we must ensure the disconnection and separation of electrical equipment from every source of supply and that this disconnection and separation is secure. Where a test instrument or voltage indicator is used to prove the supply dead, Regulation 4(3) of the Electricity at Work Regulations 1989 recommends that the following procedure is adopted.

1. First connect the test device such as that shown in Fig. 2.3 to the supply which is to be isolated. The test device should indicate mains voltage.
2. Next, isolate the supply and observe that the test device now reads zero volts.
3. Then connect the same test device to a known live supply or proving unit such as that shown in Fig. 2.4 to 'prove' that the tester is still working correctly.
4. Finally secure the isolation and place warning signs; only then should work commence.

The test device being used by the electrician must incorporate safe test leads which comply with the Health and Safety Executive (HSE) Guidance Note 38 on electrical test equipment. These leads should incorporate barriers to prevent the user touching live terminals when testing and incorporating a protective fuse and be well insulated and robust, such as those shown in Fig. 2.5.



FIGURE 2.3

Typical voltage indicator.

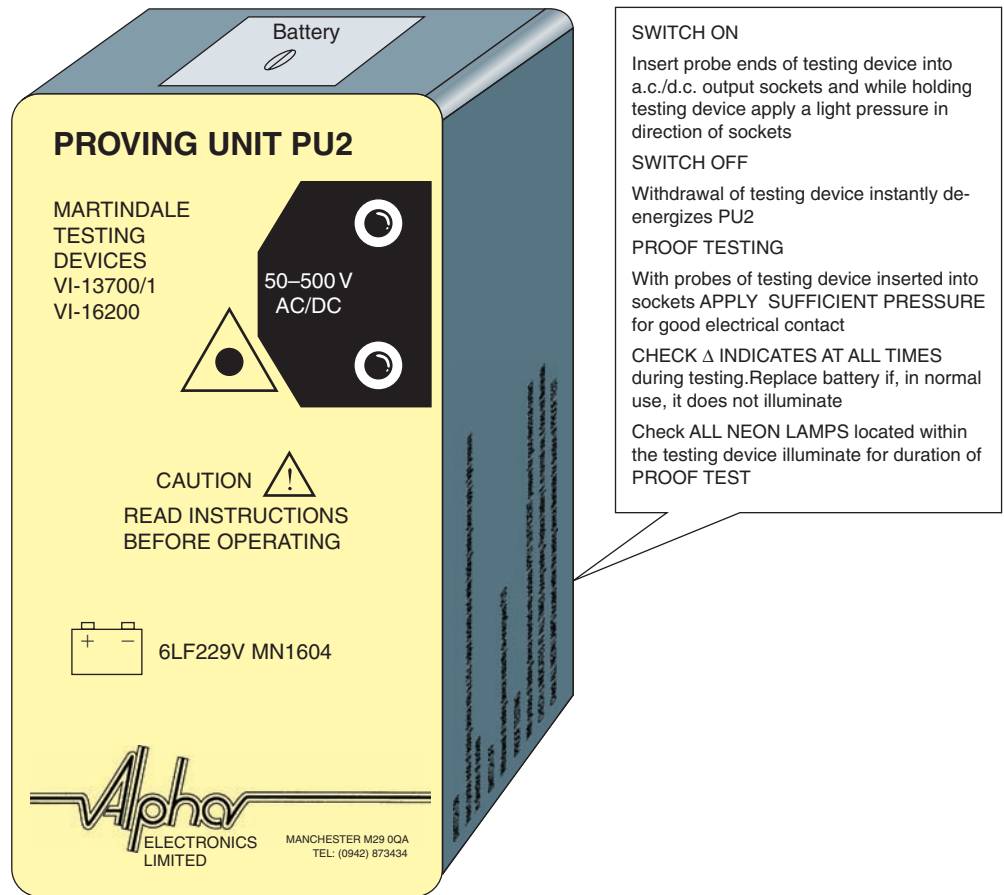


FIGURE 2.4

Voltage proving unit.

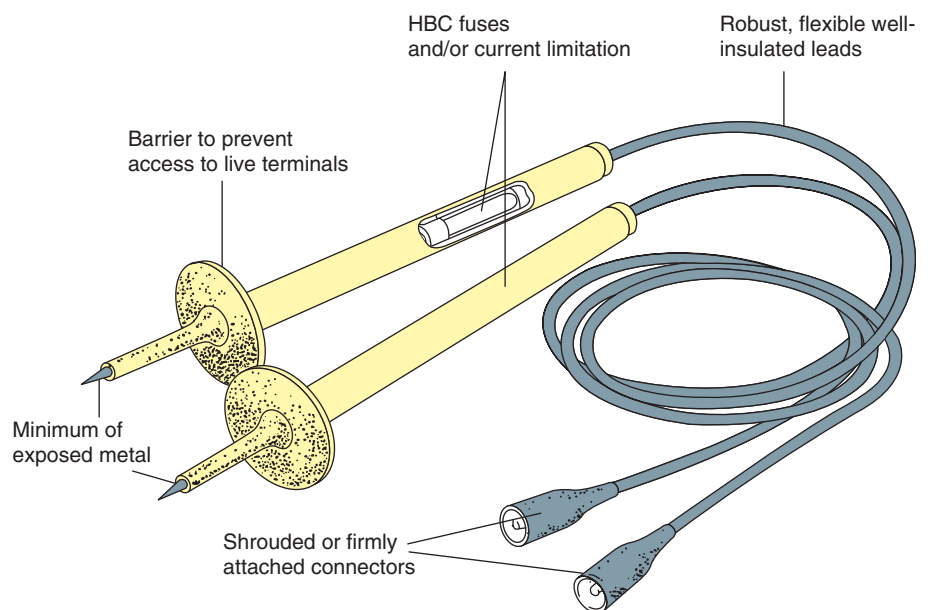


FIGURE 2.5

Recommended type of test probe and leads.

To isolate a piece of equipment or individual circuit successfully, competently, safely and in accordance with all the relevant regulations, we must follow a procedure such as that given by the flow diagram in Fig. 2.6. Start at the top and work down the flow diagram. When the heavy outlined amber boxes are reached, pause and ask yourself whether everything is satisfactory up to this point. If the answer is 'yes', move on. If the answer is 'no', go back as indicated by the diagram.

LIVE TESTING

The Electricity at Work Regulations 1989 at Regulation 4(3) tells us that it is preferable that supplies be made dead before work commences. However, it does acknowledge that some work, such as fault finding and testing, may require the electrical equipment to remain energized. Therefore, if the fault finding and testing can only be successfully carried out live then the person carrying out the fault diagnosis must:

- be trained so that they understand the equipment and the potential hazards of working live and can, therefore, be deemed 'competent' to carry out that activity;
- only use approved test equipment;
- set up appropriate warning notices and barriers so that the work activity does not create a situation dangerous to others.

While live testing may be required by workers in the electrotechnical industries in order to find the fault, live repair work must not be carried out. The individual circuit or piece of equipment must first be isolated before work commences in order to comply with the Electricity at Work Regulations 1989.

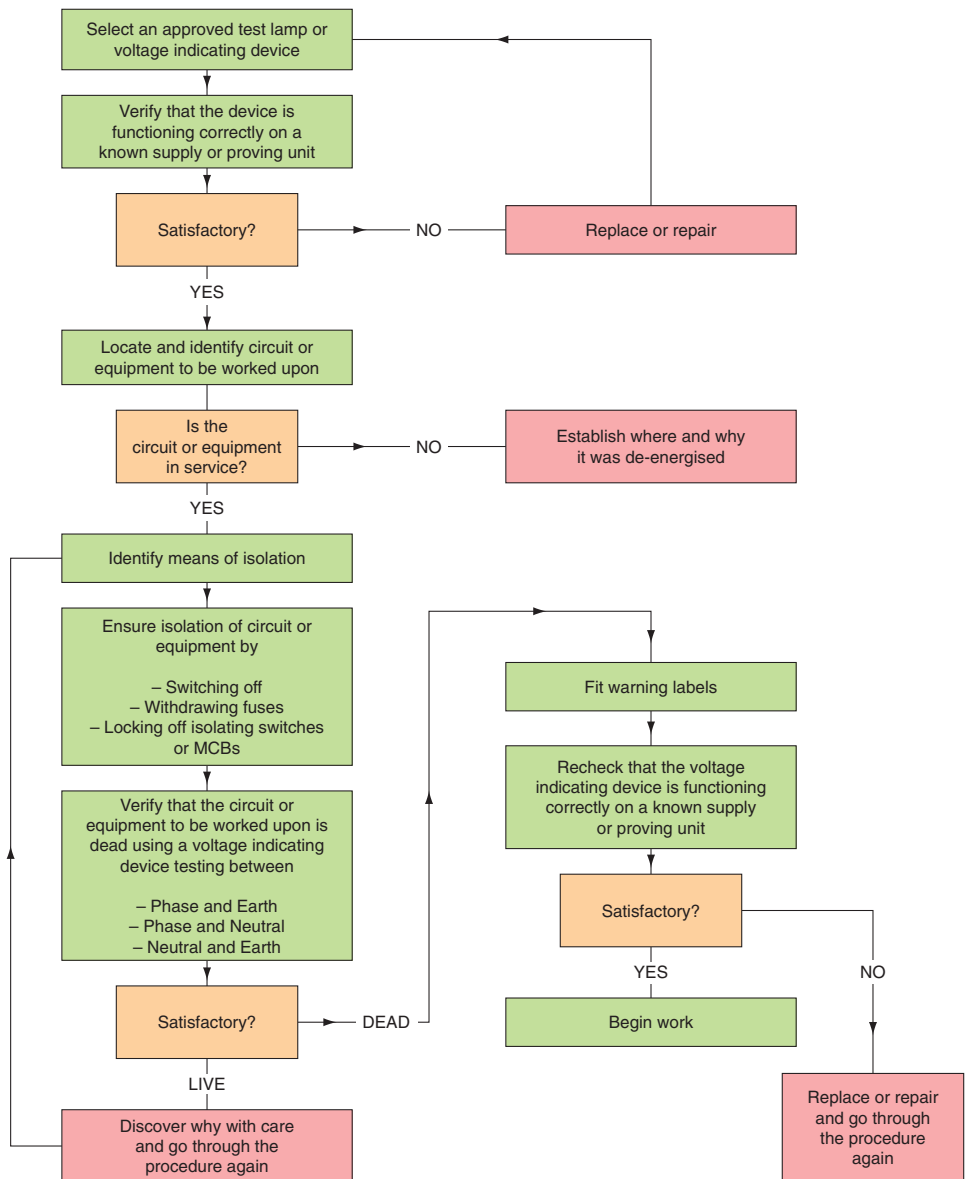
Definition

The *permit-to-work procedure* is a type of 'safe system to work' procedure used in specialized and potentially dangerous plant process situations.

Permit-to-work system

The **permit-to-work procedure** is a type of 'safe system to work' procedure used in specialized and potentially dangerous plant process situations. The procedure was developed for the chemical industry, but the principle is equally applicable to the management of complex risk in other industries or situations. For example:

- Working on part of an assembly line process where goods move through a complex, continuous process from one machine to another (e.g. the food industry).
- Repairs to railway tracks, tippers and conveyors.
- Working in confined spaces (e.g. vats and storage containers).
- Working on or near overhead crane tracks.
- Working underground or in deep trenches.
- Working on pipelines.
- Working near live equipment or unguarded machinery.
- Roof work.

**FIGURE 2.6**

Flowchart for a secure isolation procedure.

- Working in hazardous atmospheres (e.g. the petroleum industry).
- Working near or with corrosive or toxic substances.

All the above situations are high-risk working situations that should be avoided unless you have received special training and will probably require the completion of a permit-to-work. Permits to work must adhere to the following eight principles:

1. Wherever possible the hazard should be eliminated so that the work can be done safely without a permit-to-work.
2. The Site Manager has overall responsibility for the permit-to-work even though he may delegate the responsibility for its issue.

3. The permit must be recognized as the master instruction, which, until it is cancelled, overrides all other instructions.
4. The permit applies to everyone on site, other trades and sub-contractors.
5. The permit must give detailed information, for example: (i) which piece of plant has been isolated and the steps by which this has been achieved (ii) what work is to be carried out (iii) the time at which the permit comes into effect.
6. The permit remains in force until the work is completed and is cancelled by the person who issued it.
7. No other work is authorized. If the planned work must be changed, the existing permit must be cancelled and a new one issued.
8. Responsibility for the plant must be clearly defined at all stages because the equipment that is taken out of service is released to those who are to carry out the work.

Safety First

Isolation

Never carry out live repair work.

- First – test to verify circuit is ‘alive’.
- Second – isolate the supply.
- Third – test to verify circuit is ‘dead’.
- Fourth – secure the isolation.
- Fifth – test the tester.

Definition

Manual handling is lifting, transporting or supporting loads by hand or by bodily force.

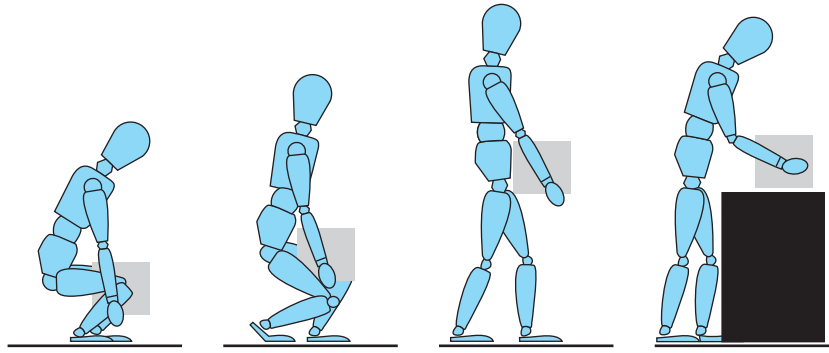
The people doing the work, the people to whom the permit is given, take on the responsibility of following and maintaining the safeguards set out in the permit, which will define what is to be done (no other work is permitted) and the time scale in which it is to be carried out.

The permit-to-work system must help communication between everyone involved in the process or type of work. Employers must train staff in the use of such permits and ideally, training should be designed by the company issuing the permit, so that sufficient emphasis can be given to particular hazards present and the precautions which will be required to be taken. For further details see Permit to Work @ www.hse.gov.uk

Safe manual handling

Manual handling is lifting, transporting or supporting loads by hand or by bodily force. The load might be any heavy object, a printer, a VDU, a box of tools or a stepladder. Whatever the heavy object is, it must be moved thoughtfully and carefully, using appropriate lifting techniques if personal pain and injury are to be avoided. **Many people hurt their back, arms and feet, and over one third of all 3 day reported injuries submitted to the HSE each year are the result of manual handling.**

When lifting heavy loads, correct lifting procedures must be adopted to avoid back injuries. Figure 2.7 demonstrates the technique. Do not lift objects from the floor with the back bent and the legs straight as this causes excessive stress on the spine. Always lift with the back straight and the legs bent so that the powerful leg muscles do the lifting work. Bend at the hips and knees to get down to the level of the object being lifted, positioning the body as close to the object as possible. Grasp the object firmly and, keeping the back straight and the head erect, use the leg muscles to raise in a smooth movement. Carry the load close to the body. When putting the object down, keep the back straight and bend at the hips and

**FIGURE 2.7**

Correct manual lifting and carrying procedure.

knees, reversing the lifting procedure. A bad lifting technique will result in sprains, strains and pains. **There have been too many injuries over the years resulting from bad manual handling techniques. The problem has become so serious that the HSE has introduced new legislation** under the Health and Safety at Work Act 1974, the Manual Handling Operations Regulations 1992. Publications such as *Getting to Grips with Manual Handling* can be obtained from HSE Books; the address and Infoline are given in the Appendix.

Where a job involves considerable manual handling, employers must now train employees in the correct lifting procedures and provide the appropriate equipment necessary to promote the safe manual handling of loads.

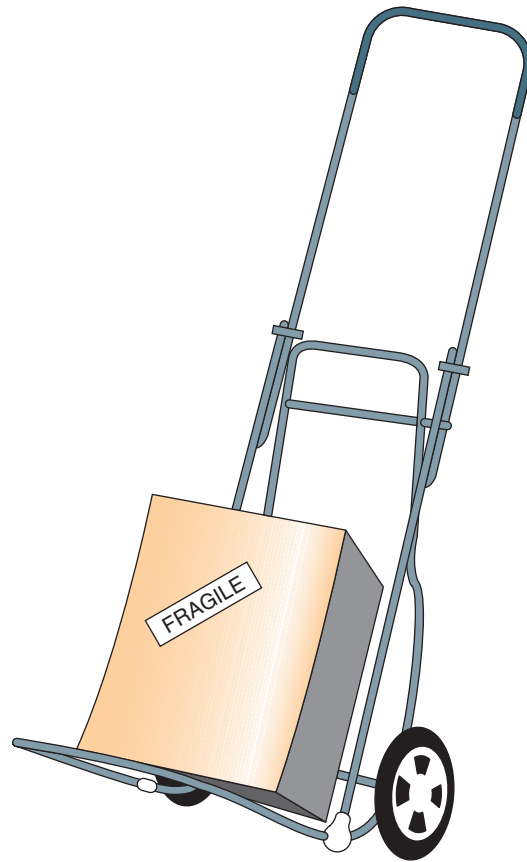
Consider some 'good practice' when lifting loads:

- Do not lift the load manually if it is more appropriate to use a mechanical aid. Only lift or carry what you can easily manage.
- Always use a trolley, wheelbarrow or truck such as those shown in Fig. 2.8 when these are available.
- Plan ahead to avoid unnecessary or repeated movement of loads.
- Take account of the centre of gravity of the load when lifting – the weight acts through the centre of gravity.
- Never leave a suspended load unsupervised.
- Always lift and lower loads gently.
- Clear obstacles out of the lifting area.
- Use the manual lifting techniques described above and avoid sudden or jerky movements.
- Use gloves when manual handling to avoid injury from rough or sharp edges.
- Take special care when moving loads wrapped in grease or bubble-wrap.
- Never move a load over other people or walk under a suspended load.

Safety First

Lifting

- bend your legs when lifting from the floor
- keep your back straight
- use leg muscles to raise the weight in a smooth movement.

**FIGURE 2.8**

Always use a mechanical aid to transport a load when available.

Definition

Fire is a chemical reaction which will continue if fuel, oxygen and heat are present.

Fire control

Fire is a chemical reaction which will continue if fuel, oxygen and heat are present. To eliminate a fire *one* of these components must be removed. This is often expressed by means of the fire triangle shown in Fig. 2.9; all three corners of the triangle must be present for a fire to burn.

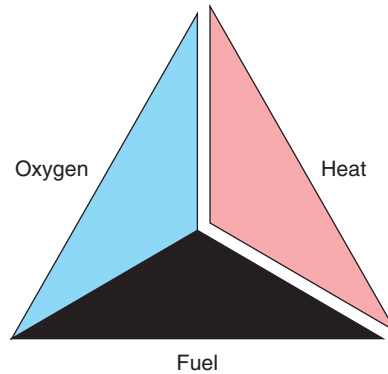
FUEL

Fuel is found in the construction industry in many forms: petrol and paraffin for portable generators and heaters; bottled gas for heating and soldering. Most solvents are flammable. Rubbish also represents a source of fuel: off-cuts of wood, roofing felt, rags, empty solvent cans and discarded packaging will all provide fuel for a fire.

To eliminate fuel as a source of fire, all flammable liquids and gases should be stored correctly, usually in an outside locked store. The working environment should be kept clean by placing rags in a metal bin with a lid. Combustible waste material should be removed from the work site or burned outside under controlled conditions by a competent person.

OXYGEN

Oxygen is all around us in the air we breathe, but can be eliminated from a small fire by smothering with a fire blanket, sand or foam. Closing doors

**FIGURE 2.9**

The fire triangle.

and windows but not locking them will limit the amount of oxygen available to a fire in a building and help to prevent it spreading.

Most substances will burn if they are at a high enough temperature and have a supply of oxygen. The minimum temperature at which a substance will burn is called the 'minimum ignition temperature' and for most materials this is considerably higher than the surrounding temperature. However, a danger does exist from portable heaters, blow torches and hot air guns which provide heat and can cause a fire by raising the temperature of materials placed in their path above the minimum ignition temperature. A safe distance must be maintained between heat sources and all flammable materials.

HEAT

Heat can be removed from a fire by dousing with water, but water must not be used on burning liquids since the water will spread the liquid and the fire. Some fire extinguishers have a cooling action which removes heat from the fire.

Fires in industry damage property and materials, injure people and sometimes cause loss of life. Everyone should make an effort to prevent fires, but those which do break out should be extinguished as quickly as possible.

In the event of fire you should:

- raise the alarm;
- turn off machinery, gas and electricity supplies in the area of the fire;
- close doors and windows but without locking or bolting them;
- remove combustible materials and fuels away from the path of the fire, if the fire is small, and if this can be done safely;
- attack small fires with the correct extinguisher.

Only attack the fire if you can do so without endangering your own safety in any way. Always leave your own exit from the danger zone clear. Those not involved in fighting the fire should walk to a safe area or assembly point.

Safety First

Fire

If you discover a fire

- raise the alarm
- attack small fires with an extinguisher
- BUT only if you can do so without risk to your own safety.

Fires are divided into four classes or categories:

- Class A – wood, paper and textile fires.
- Class B – liquid fires such as paint, petrol and oil.
- Class C – fires involving gas or spilled liquefied gas.
- Class D – very special types of fire involving burning metal.

Electrical fires do not have a special category because, once started, they can be identified as one of the four above types.

Fire extinguishers are for dealing with small fires, and different types of fire must be attacked with a different type of extinguisher. Using the wrong type of extinguisher could make matters worse. For example, water must not be used on a liquid or electrical fire. The normal procedure when dealing with electrical fires is to cut off the electrical supply and use an extinguisher which is appropriate to whatever is burning. Figure 2.10 shows the correct type of extinguisher to be used on the various categories of fire. The colour coding shown is in accordance with BS EN3: 1996.

To prevent a fire that has already started from spreading, you must remove one or more of the three elements of fuel, oxygen and heat from the fire.

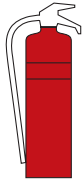
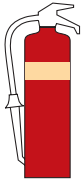
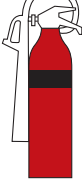
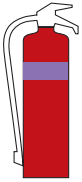
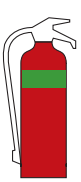
Type of fire extinguisher Type of fire	(i) Water	(ii) Foam	(iii) Carbon dioxide gas	(iv) Dry powder	(v) Vapourizing foam
	 Signal red flash on red	 Pale cream flash on red	 Black flash on red	 French blue flash on red	 Emerald green flash on red
Class A. Paper, wood and fabric	✓ Yes	✓ Yes	✗ No	✓ Yes	✓ Yes
Class B. Flammable liquids	✗ No	✓ Yes	✓ Yes	✓ Yes	✓ Yes
Class C. Flammable gases	✗ No	✗ No	✓ Yes	✓ Yes	✓ Yes
Electrical fires	✗ No	✗ No	✓ Yes	✓ Yes	✓ Yes
Motor vehicle protection	✗ No	✓ Yes	✗ No	✓ Yes	✓ Yes

FIGURE 2.10

Fire extinguishers and their applications (colour codes to BS EN3:1996). The base colour of all fire extinguishers is red, with a different coloured flash to indicate the type.

Definition

Fire extinguishers remove heat from a fire and are a first response for small fires.

Definition

Exit routes are usually indicated by a green and white 'running man' symbol. Evacuation should be orderly, do not run but walk purposefully to your designated assembly point.

Definition

The purpose of an *assembly point* is to get you away from danger to a place of safety where you will not be in the way of the emergency services.

Even small fires, once started, can generate sufficient heat to spread to any surrounding combustible material so this is another good reason for keeping work areas clean and tidy. Remove rubbish regularly. Off-cuts of wood, rags, empty solvent cans and discarded packaging will all provide fuel for a fire.

To remove oxygen from the fire, close doors and windows.

Fire extinguishers remove heat from a fire and are a first response for small fires. Only attack a small fire with an extinguisher if you can do so without putting your own safety at risk and you feel confident to do so.

Evacuation procedures

When the fire alarm sounds you must leave the building immediately by any one of the escape routes indicated. **Exit routes** are usually indicated by a green and white 'running man' symbol. Evacuation should be orderly, do not run but walk purposefully to your designated assembly point.

The purpose of an **assembly point** is to get you away from danger to a place of safety where you will not be in the way of the emergency services. It also allows for people to be accounted for and to make sure that no one is left in the building. You must not re-enter the building until a person in authority gives permission to do so.

An evacuation in a real emergency can be a frightening experience, especially if you do not really know what to do, so take time to familiarize yourself with the fire safety procedures where you are working before an emergency occurs.

First aid

Despite all the safety precautions taken in the workplace to prevent injury to the workforce, accidents do happen and *you* may be the only other person able to take action to assist a workmate. If you are not a qualified first aider limit your help to obvious common sense assistance and call for help *but* do remember that if a workmate's heart or breathing has stopped as a result of an accident he has only minutes to live unless you act quickly. The Health and Safety (First Aid) Regulations 1981 and relevant approved codes of practice and guidance notes place a duty of care on all employers to provide *adequate* first aid facilities appropriate to the type of work being undertaken. Adequate facilities will relate to a number of factors such as:

- How many employees are employed?
- What type of work is being carried out?
- Are there any special or unusual hazards?
- Are employees working in scattered and/or isolated locations?
- Is there shift work or 'out of hours' work being undertaken?
- Is the workplace remote from emergency medical services?
- Are there inexperienced workers on site?
- What were the risks of injury and ill health identified by the company's Hazard Risk Assessment?

The Regulations state that:

Employers are under a duty to provide such numbers of suitable persons as is *adequate and appropriate in the circumstances* for rendering first aid to his employees if they are injured or become ill at work. For this purpose a person shall not be suitable unless he or she has undergone such training and has such qualifications as the Health and Safety Executive may approve.

This is typical of the way in which the Health and Safety Regulations are written. The Regulations and codes of practice do not specify numbers, but set out guidelines in respect of the number of first aiders needed, dependent upon the type of company, the hazards present and the number of people employed.

Let us now consider the questions ‘what is first aid?’ and ‘who might become a first aider?’ The Regulations give the following definitions of first aid. ‘*First aid* is the treatment of minor injuries which would otherwise receive no treatment or do not need treatment by a doctor or nurse’ or ‘in cases where a person will require help from a doctor or nurse, **first aid** is treatment for the purpose of preserving life and minimizing the consequences of an injury or illness until such help is obtained’. A more generally accepted definition of first aid might be as follows: first aid is the initial assistance or treatment given to a casualty for any injury or sudden illness before the arrival of an ambulance, doctor or other medically qualified person.

Definition

First aid is the initial assistance or treatment given to a casualty for any injury or sudden illness before the arrival of an ambulance, doctor or other medically qualified person.

Definition

A *first aider* is someone who has undergone a training course to administer first aid at work and holds a current first aid certificate.

Definition

An *appointed person* is someone who is nominated to take charge when someone is injured or becomes ill, including calling an ambulance if required. The appointed person will also look after the first aid equipment, including re-stocking the first aid box.

Now having defined **first aid**, who might become a first aider? A **first aider** is someone who has undergone a training course to administer first aid at work and holds a current first aid certificate. The training course and certification must be approved by the HSE. The aims of a first aider are to preserve life, to limit the worsening of the injury or illness and to promote recovery.

A **first aider** may also undertake the duties of an *appointed person*. An **appointed person** is someone who is nominated to take charge when someone is injured or becomes ill, including calling an ambulance if required. The appointed person will also look after the first aid equipment, including re-stocking the first aid box.

Appointed persons should not attempt to give first aid for which they have not been trained but should limit their help to obvious common sense assistance and summon professional assistance as required. Suggested numbers of first aid personnel are given in Table 2.1. The actual number of first aid personnel must take into account any special circumstances such as remoteness from medical services, the use of several separate buildings and the company’s hazard risk assessment. First aid personnel must be available at all times when people are at work, taking into account shift working patterns and providing cover for sickness absences.

Every company must have at least one first aid kit under the Regulations. The size and contents of the kit will depend upon the nature of the risks involved in the particular working environment and the number of employees. Table 2.2 gives a list of the contents of any first aid box to comply with the HSE Regulations.

Table 2.1 Suggested Numbers of First Aid Personnel

Category of risk	Numbers employed at any location	Suggested number of first aid personnel
Lower risk For example, shops and offices, libraries	Fewer than 50 50–100 More than 100	At least one appointed person At least one first aider One additional first aider for every 100 employed
Medium risk For example, light engineering and assembly work, food processing, warehousing	Fewer than 20 20–100 More than 100	At least one appointed person At least one first aider for every 50 employed (or part thereof) One additional first aider for every 100 employed
Higher risk For example, most construction, slaughterhouses, chemical manufacture, extensive work with dangerous machinery or sharp instruments	Fewer than five 5–50 More than 50	At least one appointed person At least one first aider One additional first aider for every 50 employed

There now follows a description of some first aid procedures which should be practised under expert guidance before they are required in an emergency.

Bleeding

If the wound is dirty, rinse it under clean running water. Clean the skin around the wound and apply a plaster, pulling the skin together.

If the bleeding is severe apply direct pressure to reduce the bleeding and raise the limb if possible. Apply a sterile dressing or pad and bandage firmly before obtaining professional advice.

To avoid possible contact with hepatitis or the AIDS virus, when dealing with open wounds, first aiders should avoid contact with fresh blood by wearing plastic or rubber protective gloves, or by allowing the casualty to apply pressure to the bleeding wound.

Burns

Remove heat from the burn to relieve the pain by placing the injured part under clean cold water. Do not remove burnt clothing sticking to the skin. Do not apply lotions or ointments. Do not break blisters or attempt to remove loose skin. Cover the injured area with a clean dry dressing.

Broken bones

Make the casualty as comfortable as possible by supporting the broken limb either by hand or with padding. Do not move the casualty unless by

Table 2.2 Contents of First Aid Boxes

Item	Number of employees				
	1–5	6–10	11–50	51–100	101–150
Guidance card on general first aid	1	1	1	1	1
Individually wrapped sterile adhesive dressings	10	20	40	40	40
Sterile eye pads, with attachment (Standard Dressing No. 16 BPC)	1	2	4	6	8
Triangular bandages	1	2	4	6	8
Sterile covering for serious wounds (where applicable)	1	2	4	6	8
Safety pins	6	6	12	12	12
Medium sized sterile unmedicated dressings (Standard Dressings No. 9 and No. 14 and the Ambulance Dressing No. 1)	3	6	8	10	12
Large sterile unmedicated dressings (Standard Dressings No. 9 and No. 14 and the Ambulance Dressing No. 1)	1	2	4	6	10
Extra large sterile unmedicated dressings (Ambulance Dressing No. 3)	1	2	4	6	8
Where tap water is not available, sterile water or sterile normal saline in disposable containers (each holding a minimum of 300ml) must be kept near the first aid box. The following minimum quantities should be kept:					
Number of employees	1–10	11–50	51–100	101–150	
Quantity of sterile water	1 × 300ml	3 × 300ml	6 × 300ml	6 × 300ml	

remaining in that position he is likely to suffer further injury. Obtain professional help as soon as possible.

Contact with chemicals

Wash the affected area very thoroughly with clean cold water. Remove any contaminated clothing. Cover the affected area with a clean sterile dressing and seek expert advice. It is a wise precaution to treat all chemical substances as possibly harmful; even commonly used substances can be dangerous if contamination is from concentrated solutions. When handling dangerous substances it is also good practice to have a neutralizing agent to hand.

Disposal of dangerous substances must not be into the main drains since this can give rise to an environmental hazard, but should be undertaken in accordance with Local Authority Regulations.

Definition

Asphyxiation is a condition caused by lack of air in the lungs leading to suffocation. Suffocation may cause discomfort by making breathing difficult or it may kill by stopping the breathing.

Exposure to toxic fumes

Get the casualty into fresh air quickly and encourage deep breathing if conscious. Resuscitate if breathing has stopped. Obtain expert medical advice as fumes may cause irritation of the lungs.

Asphyxiation

Asphyxiation is a condition caused by lack of air in the lungs leading to suffocation. Suffocation may cause discomfort by making breathing difficult or it may kill by stopping the breathing. There is a risk of asphyxiation to workers when:

- working in confined spaces,
- working in poorly ventilated spaces,
- working in paint stores and spray booths,
- working in the petro-chemical industry,
- working in any environment in which toxic fumes and gases are present.

Under the Management of Health and Safety at Work Regulations a risk assessment must be made if the environment may be considered hazardous to health. Safety procedures, including respiratory protective equipment, must be in place before work commences.

The treatment for fume inhalation or asphyxia is to get the patient into fresh air but only if you can do this without putting yourself at risk. If the patient is unconscious proceed with resuscitation as described below.

Sprains and bruising

A cold compress can help to relieve swelling and pain. Soak a towel or cloth in cold water, squeeze it out and place it on the injured part. Renew the compress every few minutes.

Breathing stopped – Resuscitation

Remove any restrictions from the face and any vomit, loose or false teeth from the mouth. Loosen tight clothing around the neck, chest and waist. To ensure a good airway, lay the casualty on his back and support the shoulders on some padding. Tilt the head backwards and open the mouth. If the casualty is faintly breathing, lifting the tongue clear of the airway may be all that is necessary to restore normal breathing. However, if the casualty does not begin to breathe, open your mouth wide and take a deep breath, close the casualty's nose by pinching with your fingers, and, sealing your lips around his mouth, blow into his lungs until the chest rises. Remove your mouth and watch the casualty's chest fall. Continue this procedure at your natural breathing rate. If the mouth is damaged or you have difficulty making a seal around the casualty's mouth, close his mouth and inflate the lungs through his nostrils. Give artificial respiration until natural breathing is restored or until professional help arrives.

Heart stopped beating – chest compressions

This sometimes happens following a severe electric shock. If the casualty's lips are blue, the pupils of his eyes widely dilated and the pulse in his neck cannot

be felt, then he may have gone into cardiac arrest. Act quickly and lay the casualty on his back. Kneel down beside him and place the heel of one hand in the centre of his chest. Cover this hand with your other hand and interlace the fingers. Straighten your arms and press down on his chest sharply with the heel of your hands and then release the pressure. Continue to do this 15 times at the rate of one push per second. Check the casualty's pulse. If none is felt, give two breaths of artificial respiration and then a further 15 chest compressions. Continue this procedure until the heartbeat is restored and the artificial respiration until normal breathing returns. Pay close attention to the condition of the casualty while giving heart massage. When a pulse is restored the blueness around the mouth will quickly go away and you should stop the heart massage. Look carefully at the rate of breathing. When this is also normal, stop giving artificial respiration. Treat the casualty for shock, place him in the recovery position and obtain professional help.

Shock

Everyone suffers from shock following an accident. The severity of the shock depends upon the nature and extent of the injury. In cases of severe shock the casualty will become pale and his skin become clammy from sweating. He may feel faint, have blurred vision, feel sick and complain of thirst. Reassure the casualty that everything that needs to be done is being done. Loosen tight clothing and keep him warm and dry until help arrives. *Do not* move him unnecessarily or give him anything to drink.

Every accident must be reported to an employer and minor accidents reported to a supervisor, safety officer or first aider and the details of the accident and treatment given suitably documented as described in Chapter 1 of this book under the sub-heading 'Accident reports'.

If the accident results in death, serious injury or an injury that leads to an absence from work of more than 3 days, then your employer must report the accident to the local office of the HSE.

Emergency procedures – electric shock

Electric shock occurs when a person becomes part of the electrical circuit, as shown in Fig. 2.11. The level or intensity of the shock will depend upon many factors, such as age, fitness and the circumstances in which the shock is received. The lethal level is approximately 50 mA, above which muscles contract, the heart flutters and breathing stops. A shock above the 50 mA level is therefore fatal unless the person is quickly separated from the supply. Below 50 mA only an unpleasant tingling sensation may be experienced or you may be thrown across a room, roof or ladder, but the resulting fall may lead to serious injury.

To prevent people receiving an electric shock accidentally, all circuits contain protective devices. All exposed metal is earthed, fuses and MCBs are designed to trip under fault conditions.

Construction workers and particularly electricians do receive electric shocks, usually as a result of carelessness or unforeseen circumstances.