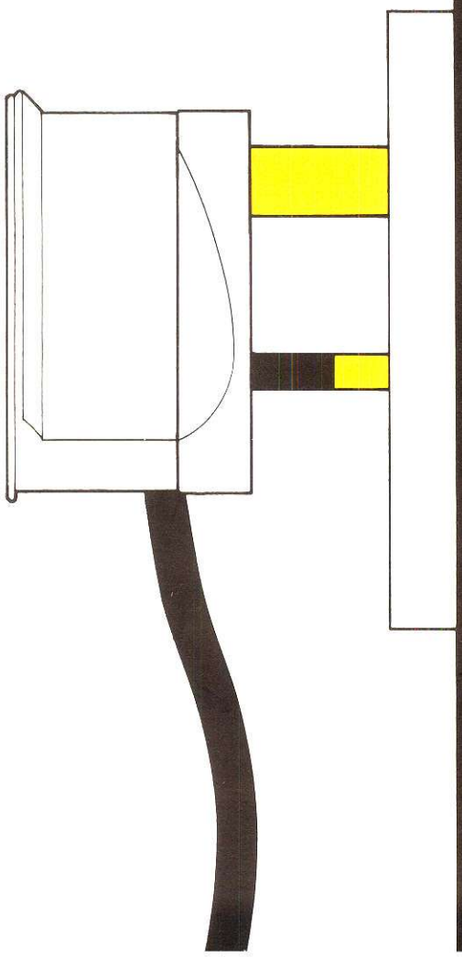
ELECTRICITY IN THE WORKPLACE

A Guide to Current Legislation



CREDITS

Author/Editor	John Guy Graham Smith
Technical Assistance	AVO MEGGER INSTRUMENTS LIMITED
Graphic Design	Nikki Hill
Printing	Kestrel Print (Croydon) The Drive Loxwood W Sussex RH14 0TD

AVO MEGGER INSTRUMENTS LIMITED
Archcliffe Road
Dover
Kent CT17 9EN

Telephone: 0304 202620
Fax: 0304 207342

Electrol
Omega House
22 Barnmead Road
Beckenham
Kent BR3 1JE

Telephone: 081 776 8411

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INTRODUCTION

The Electricity at Work Regulations 1989 came into force on April 1st 1990, and have extended electrical safety legislation to some sixteen million persons; almost the entire workforce of Great Britain.

This guide is intended to help those persons subject to the Regulations to design and carry into practice a suitable safety program. To cater for individual needs, the book has been divided into three sections dealing with the duties of:

- the person with overall executive responsibility for safety policy
- the 'responsible' person, charged with implementing the policy
- the employee with no specific safety brief.

In addition there is an introductory section, intended for all three target groups, which deals with the dangers of electricity.

The main target audience of the guide is the 'ordinary' business or organisation. The guide will undoubtedly be useful to specialists in the electrical field, but such specialists will need to consult the legislation directly to obtain all the technical detail that they require.

The guide is preceded by a short flowchart which suggests a route through the book to suit individual needs. In Section 3, the reader is also referred to the accompanying booklet, "Portable Appliance Testing", where some of the practical aspects of a safety programme are explored in greater detail.

The approach used throughout this book is the so-called 'open learning' style. In essence, this means that the reader is encouraged to take an active part in his or her learning rather than merely receive information passively. This is done by asking questions or assigning tasks to the reader, and then providing 'responses' against which the readers own answers can be compared.

The open learning approach is used for two reasons. Firstly, because people learn and retain things better by *doing* things rather than just reading about them, and secondly, because you have an important input into the course. As will become clear, the nature of the legislation requires judgements to be made by every individual, and, although we can discuss the general principles involved, only you can apply them to your specific situation.

If you are unfamiliar with this 'active' style, you may find it a little strange at first, but if you persist, we are sure that you will come to appreciate its merits.

We suggest that you now proceed to the flowchart on page four.

We hope you find the course enjoyable and instructive.

Do the regulations apply to me?

The Regulations apply unless you:

- have no electrical power
- work on a ship or aircraft moving under its own power
- have an exemption certificate from the Health & Safety executive
- work outside Great Britain and its territorial waters
- work on an oil rig or pipeline

NO

If the Regulations do not apply to you, the detailed comments about them will not help. However, you may decide that some of the general information and advice about electrical safety is of interest. In many instances, the Regulations do not apply because they are replaced by other, often more stringent legislation. If you decide to look at the rest of the book, you should continue to the next question.

YES

Do I have special needs?

You will need specialist advice if:

- your company specialises in the design, manufacture, installation, repair or servicing of electrical or electronic equipment
- you work in a mine or quarry

YES

This publication is designed for people who are not electrical specialists. For specialists, it makes a good introduction to the subject but it needs to be supplemented by other, more specialised sources. The Appendix at the end of the book provides a list of other relevant publications. Please continue to the next question.

NO

What are my responsibilities?

Answer *YES* if you fall into one or more of the following categories:

- self-employed
- a person with managerial or supervisory responsibilities

YES

You should read the whole book. Section 3 refers to the accompanying "Portable Appliance Testing" booklet, which you should also read. Depending upon your particular responsibilities, you may decide to delegate some of the activities suggested in the text. Equally, some of the activity may be appropriate to a more senior level.

NO

If you have no special needs and no managerial responsibilities, you need only read Sections 1 and 4.

SECTION ONE
THE DANGERS OF ELECTRICITY

Let's start with an extract from the regulations.

Extract from Regulation 2

1) In these Regulations, unless the context otherwise requires -

"danger" means a risk of injury;

"injury" means death or personal injury from electric shock, electric burn, electrical explosion or arcing, or from fire or explosion initiated by electrical energy, where any such death or injury is associated with the generation, provision, transmission, transformation, rectification, conversion, conduction, distribution, control, storage, measurement or use of electrical energy;

Most people tend think of electricity as being dangerous by virtue of its ability to produce electric shock. However, as you can see there are many other dangers listed in the regulations. We will look at each in turn.

Electric Shock

Electric shock is the effect on the nervous system of passing electricity through the human body. The current affects the normal control of the body muscles, and the effects of this vary from a mild tingling sensation to death. The most dangerous situations arise from the disruption of the normal regular contractions of the heart or respiratory muscles.

Electric Burns

Electricity passing through any 'resistance' liberates heat energy. The element of an electric fire, for example, has a resistance to the flow of the current, and heats up as a consequence. In the same way, human tissue resists the flow of electric current, and the heat liberated causes burns. Such burns are commonly associated with electric shock, and often occur at the point of contact with the source of electricity.

In certain circumstances, it is possible to suffer electrical burns without being in contact with an electrical source. High powered radio transmitters and microwave ovens, for example, can produce electrical burns due to high frequency electromagnetic waves.

Electrical Explosion

This means literally blowing a piece of electrical equipment apart due to electrical overload. A 12 V car headlight bulb, for example, will explode if mains voltage is connected across it.

Explosion Initiated by Electricity

Certain vapours, gases and fine dusts may explode if triggered by even tiny electric sparks. Examples are petrol, ether, methane, flour dust, and talcum powder.

Arcing

The air is normally a good insulator, but under certain circumstances this insulation is broken down, and sparks jump across air gaps. This is known as arcing. The most spectacular example of arcing is lightning, but you can see the effect quite clearly when you connect up a car battery.

Arcing has its own particular dangers which may be summarised as follows:

a) electrical burns

b) ultra violet radiation - this gives symptoms similar to that of severe sunburn, which is hardly surprising because sunburn is also caused by ultra violet radiation. The radiation from arcing can be particularly harmful to sensitive skin and eyes. Arc welding, for example, is likely to damage the light sensitive surface of the eyes (the retina) unless proper protection is provided

c) infra red or heat radiation - this will burn in the same way that you would be burned if you put your hand too close to an electric fire

d) burns due to molten metal particles which often accompany arcing.

Fire Caused by Electricity

Fires present a number of dangers. The most obvious is burning, but smoke or toxic fume inhalation are at least as dangerous. The main electrical causes of fire are:

a) overheating of cables and electrical equipment due to the passage of too much current

b) current leakage due to poor or inadequate insulation

c) overheating of flammable materials placed too close to electrical equipment (particularly electric fires)

d) the ignition of flammable materials by arcing, sparking or the scattering of hot particles from electrical equipment.

Question 1.1

Which of the dangers which we have just listed would you expect to be of particular concern in the following work situations:

a) a coal mine

b) a flour mill

c) a ship-building yard

d) a chemistry laboratory

e) a garage used for car repair and maintenance

f) a hosiery factory

g) your own workplace.

There aren't any 'right' or 'wrong' answers to this question. It's meant to make you think about the practical implications of what we have so far described. You may give different answers to the ones which we give, but so long as you have good reasons for your answers, they are just as valid as the ones which we suggest. If you have no knowledge of a particular workplace, you should miss out that example from the list.

Response on page 8

Let's summarize the dangers covered by the Regulations:

Danger, as defined in this legislation means a risk of injury. Injury means death or personal injury from:

- electric shock
- electric burn
- electrical explosion
- arcing
- fire or explosion initiated by electrical energy.

For the sake of completeness, we should also mention that there are other 'consequential dangers' which result from the use of electrical equipment. For example, an electric saw may get out of control and sever someone's arm. These dangers are covered by other legislation.

Response to Question 1.1

a) A coal mine - the main danger here is probably explosion initiated by electricity. Coal mines tend to fill up with methane gas, and this can be ignited by even tiny sparks from electrical equipment. For this reason, the regulations make special provision for coal mines, and other similar environments such as quarries.

b) A flour mill - the main danger here is probably explosion initiated by electricity. Flour forms a very fine dust, which may be ignited by tiny electrical sparks.

c) A ship-building yard - you might have chosen almost any of the list of dangers here. The one we have picked out is arcing, because of the heavy use of arc welding equipment needed for the construction of ships.

d) A chemistry laboratory - explosion initiated by electricity or fire caused by electricity are of particular concern in chemical laboratories, because of the extensive use of solvents such as ether and alcohol. Ether in particular evaporates very easily, and the vapour can form an explosive mixture.

e) A garage used for car repair and maintenance - petrol vapour can be a problem at garages, with its attendant risk of explosion or fire. Other problems are arcing from car batteries, which can give unpleasant although usually minor burns, and electric shocks from the high tension side of car electrics.

f) A hosiery factory - a factor which requires particular care is the danger of fire, because such an environment contains a great deal of combustible material.

g) Obviously, it isn't possible for us to give a specific list here. The majority of workplaces have no special hazards. They will therefore be safe, from the electrical point of view, provided that electrical equipment is not faulty and that it is used correctly. We will return to these themes later in the book.

SECTION TWO
THE EMPLOYER

INTRODUCTION

The Electricity at Work Regulations 1989 lay down broad guidelines about the safety of electrical systems and electrical equipment. The detailed interpretation of these Regulations requires employers to consult appropriate codes of practice and to apply these codes according to the individual needs of their workplace.

This section starts by looking at the main requirements of the Regulations, and then suggests a strategy to meet these requirements. The key steps are:

- a detailed assessment of your workplace for potential safety hazards
- the identification of recognised codes of practice appropriate to your workplace
- staff training to ensure appropriate levels of competence
- the provision and maintenance of safety equipment (where needed)
- a regular programme of testing and maintenance for electrical systems and equipment
- the establishment of a system of good working practices
- the systematic documentation of all the above provisions.

2.1 AN OUTLINE OF THE REGULATIONS

These Regulations represent a fundamental change in approach from the previous electrical safety legislation in force - The Electricity (Factories Act) Special Regulation 1908 and 1944. The Regulations do not attempt, as previously, to 'spell out' what is required in great detail. Instead, they give only broad guidelines and leave the details to be established by accepted codes of practice.

The main advantage of this approach is that the legislation becomes obsolete less quickly. Codes of practice do not require legislation to change them, and evolve naturally to suit changing circumstances. Hence, effectively, the Regulations are updated with the codes of practice on which they rely.

The legislation comprises 33 Regulations, arranged as follows:

Regulation 1 Citation and commencement

This gives the title by which the Regulations may be referred to, and the date on which the Regulations came into force.

Regulation 2 Interpretation

Regulation 2 defines the terms which have a special meaning under the act. We have already defined *danger* and *injury*, and the other terms which we need in this section are defined below.

Extract from Regulation 2

(1) In these Regulations, unless the context otherwise requires

"electrical equipment" includes anything used or installed for use, to generate, provide, transmit, transform, rectify, convert, conduct, distribute, control, store, measure, or use electrical energy.

"system" means an electrical system in which all the electrical equipment is, or may be, electrically connected to a common source of electrical energy, and includes such source and such equipment.

Note that:

- the definition of electrical equipment is all-embracing
- the system includes everything which you have which is electrical. The phrase "or may be" means that an appliance is still part of the system even when it is not connected.

Regulation 3 Persons on whom duties are imposed by these Regulations

This is stated below, with the reference to mines omitted.

Extract from Regulation 3

(1) Except where otherwise expressly provided in these regulations, it shall be the duty of every -

(a) employer and self-employed person to comply with the provisions of these Regulations in so far as they relate to matters which are within his control; . . .

(2) It shall be the duty of every employee while at work -

(a) to co-operate with his employer so far as is necessary to enable any duty placed on that employer by the provisions of these Regulations to be complied with; and

(b) to comply with the provisions of these Regulations in so far as they relate to matters within in his control.

The distinction between the terms "employer" and "employee", as used in Regulation 3 is important. In essence, it is given by the phrase:

". . . in so far as they relate to matters which are within his control."

Response to Question 3.1

Here are some possibilities:

- if additions or alterations are made to the system
- if other general building work is undertaken, which might affect the wiring circuits. Plumbing work is a good example. Many electrical systems are earthed using earthing straps onto metal pipes. If the plumber replaces old metal pipes with modern plastic ones, this might affect the earthing.
- if a fault occurs that may have overloaded a circuit then at least that circuit should be re-tested.

Response to Question 3.2

You might look for:

- sockets or switches not securely fastened to the wall
- switches which don't click over positively. That is, they stay half-way between the on and off positions.
- signs of arcing in plugs or switches

Inspection once a month is probably a reasonable guide. This, as always, will depend upon your individual circumstances. Some of the labour here can be avoided if the users are trained to carry out simple visual inspections. See Section 4 for details.

Reasonably practicable means that you may weigh the dangers involved against the cost of guarding against these dangers. If the danger is small and the cost of taking action to protect people from the danger is very high, you may judge that such action should not be taken. Conversely, if the danger is high and the cost of protection is low, you must take the appropriate action. Such phrasing reflects the need for legislation to operate in the 'real world'. If implementing the legislation drove everyone out of business, it would become unworkable.

Absolute duties are those which must be met regardless of cost. You are not given the option to weigh the balance of costs and benefits.

Regulations 5 - 16

These amplify and specify the detail of the overall statement given in Regulation 4. We will quote from these regulations as necessary to illustrate general points, but will leave the technical detail to Section 3.

Regulations 17 - 28

These refer exclusively to mines, and are not discussed.

Regulation 29

This specifies what would constitute a defence in the event of criminal proceedings under those Regulations which are absolute. We will look at the implications of this Regulation in our discussion of documentation.

Regulations 30 - 33

Deal with special exemptions, extension of the Regulations outside Great Britain and revocations and modifications. Effectively these specify the precise areas of application of the Regulations. Our initial questionnaire discussed these by implication, and we will not look at them further.

To summarise, the Regulations require you to ensure, as far as is reasonably practicable, that:

- the *construction* of your electrical system is safe.

  This means that the construction of each individual component must be safe, and the way that the individual components interact must also be safe.

- the system, or part of the system is *maintained* in a safe state.

- the system, or any part of the system is *operated* in a safe manner.

In addition, if you provide safety equipment of any kind for use on or near electrical equipment, it must be suitable for its intended use, and it must be properly maintained and properly used.

We have used the word "safe" to mean free from *danger*. The other terms used are as previously defined.

Response to Question 3.4

The talk which you give must obviously reflect your own particular situation, but here are a few headings which would probably figure in most such talks. You would obviously tailor the examples to suit the audience.

1. Look for signs of danger in appliances, such as:

   - cracks or splits in the lead
   - leads not securely fastened at either end
   - broken outer casing
   - incorrectly operating switches.

2. Look for potential dangers in the way appliances are used:

   - convector fires too near to flammable material (eg coat stands)
   - long trailing leads to appliances
   - appliances operated near water (eg kettles on draining boards).

3. Switch off/unplug appliances before working on appliances; for example:

   - changing bits on an electric drill
   - clearing a paper jam from a photocopier.

4. Reporting faults - there needs to be a clearly established channel of communication.

5. Action in the event of emergency. Do people know where the mains switch and the first aid kit is situated? Do they know the procedure for reporting accidents?

6. Action in the event of a power failure. Unless appliances are switched off, they may start up unexpectedly when the power comes back on.

Question 2.1

a) Are there any special circumstances within the working environment of my organisation which require special equipment or precautions? Refer to the four categories (a), (b), (c) and (d) given in Regulation 6 when considering your answer.

b) If there are special circumstances, are there recognised codes of practice to which we can work?

c) Where can I find appropriate codes of practice?

Obviously, we can't offer advice on your specific situation, so there is no response to a). You may already have carried out the necessary assessment of your environment in Question 1.1.

For b) and c), however, some of the suggestions in the response may provide you with a starting point.

Response on page 21

Thus, effectively, you have the duties of the employer in matters which you can control, but only those of an employee in matters outside your control. As an employer you are *responsible* for ensuring safety, and you are known as a *duty holder* under the regulations.

If you are self-employed, your duties are those of an employer.

The practical implication of this definition is that your responsibility is matched to your authority. This is hardly surprising - it would be surprising if it were not the case - but it should make you think carefully about the precise extent of your control.

An example might illustrate the point.

Many schools are, at the moment, moving over to a system of locally controlled funding, where the school administers its own budget.

Previously head-teachers had considerable control of academic and staffing matters, but little practical control of the repair and maintenance of the school building. This was under the control of the local education authority.

Under the new system head-teachers do have considerable control of the maintenance of the school building. This may well mean that the balance of responsibility under the Regulations has moved significantly away from the local education authority to the individual head-teacher.

Regulation 4 Systems, work activities, and protective equipment

This provides an overall statement of the Regulations, and is quoted in full below:

(1) All systems shall at all times be of such construction as to prevent, so far as is reasonably practicable, danger.

(2) As may be necessary to prevent danger, all systems shall be maintained so as to prevent, so far as is reasonably practicable, such danger.

(3) Every work activity, including operation, use and maintenance of a system and work near a system, shall be carried out in such a manner as not to give rise, so far as is reasonably practicable, to danger.

(4) Any equipment provided under these regulations for the purpose of protecting persons at work on or near electrical equipment shall be suitable for the use for which it is provided, be maintained in a condition suitable for that use, and be properly used.

Looking at Regulation 4 you can see that some of the duties are subject to the qualifying term *reasonably practicable*. Where this phrase is absent, the duties are said to be *absolute*.

Question 2.2

What electrical competence would you expect from the following employees:

a) a secretary

b) a plumber

c) a bank manager

There aren't any definitive answers to this question, but you should write four or five lines giving examples of the sorts of things you would expect each of them to be able to do. If you find it more helpful, you can substitute comparable clerical, practical and managerial staff from your own company or organisation.

Response on page 21

The point of the last question is that the Regulations require you to take a wider view of electrical expertise. Almost everybody needs some degree of competence in dealing with electricity, and hence they need some training.

Documentation

Reproduced below is Regulation 29.

Regulation 29 Defence

In any proceedings for an offence consisting of regulations 4(4), 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, or 25, it shall be a defence for any person to prove that he took all reasonable steps and exercised all due diligence to avoid the commission of that offence.

Note: the regulations referred to are those in which the requirements are absolute. Regulation 25 applies only to mines.

2.2 YOUR RESPONSE TO THE REGULATIONS

Any strategy devised to comply with the Electricity at Work Regulations must fit within the wider safety policy of a company or organisation. It most cases, a safety policy will already be in place, and the task faced by management will be that of implementing the changes needed to encompass the new act.

In the best cases, the existing policy may already cover all the requirements of the new Regulations. On the other hand, in some organisations, particularly small companies, a formal safety policy may be being considered for the first time.

To cater for this wide diversity of needs, the approach adopted in this publication is to highlight the key questions which need to be asked, and thus give you the basis for your own response.

Assessing Your Working Environment

Regulation 6 is the most relevant here, and is reproduced below.

Regulation 6 Adverse or hazardous environments

Electrical equipment which may reasonably foreseeably be exposed to -

(a) mechanical damage;

(b) the effects of the weather, natural hazards, temperature or pressure;

(c) the effects of wet, dirty, dusty, or corrosive conditions; or

(d) any flammable or explosive substance, including dusts, vapours or gases,

shall be of such construction or as necessary protected as to prevent, so far as is reasonably practicable, danger arising from such exposure.

As we said at the beginning of this section, the Regulations require that a system be safe, but they do not specify what constitutes a safe system. You have to make that judgement. In the vast majority of cases there will be accepted codes of practice available to help design a 'safe' system, for a given environment. The real judgement that *you* must make is the precise nature of *your* environment.

It must be emphasised that electrical equipment which is functioning normally, in the sense that it is not subject to any faults, is not necessarily safe. Equipment must be chosen and operated having regard to the nature of the workplace.

Electrically initiated explosion provides a good example. It is quite normal for all sorts of electrical equipment to produce small sparks. If these sparks are in a potentially explosive environment they may produce an explosion. In this situation, special electrical equipment must be used, which is appropriate to the environment.

From the point of view of the employer, the key questions which should be asked are given in Question 2.1.

To summarise the response to Question 2.3, your documentation should present a picture of a systematic approach to electrical safety with the following components:

- an overall policy statement
- detailed assessment of your workplace for potential safety hazards
- allocation of responsibilities to staff
- staff training
- provision and maintenance of safety equipment (where needed)
- testing and maintenance of equipment
- safe working practices.

Working Practices

Establishing good working practices is the last topic considered in this section. Such practices vary enormously. In large organisations with specialist electrical equipment, practices are likely to be formally documented. There may, for example, be arrangements for:

- formally recognising 'authorised personnel' as being the only persons allowed to undertake certain tasks.
- issuing written 'permits to work' for certain work.

Most companies with such requirements employ specialist safety personnel, who will consult the appropriate codes of practice directly. The ones most likely to be relevant are quoted in the appendix at the end of the book.

The requirements for organisations without specialist staff and equipment are much less demanding than for a large organisation, but there is still a need for management to lay down good working practices. Given below are the main areas which need attention.

Purchase and Testing of Portable Appliances

A specific person should be responsible for the purchase of electrical goods, and they should consider potential safety hazards when making such purchases. They should also be responsible for ensuring that such goods are checked and tested before being put into service, and for the subsequent routine testing of the appliances. This subject is discussed more fully in Section 3, and in the accompanying "Portable Appliance Testing" booklet.

Testing of Fixed Wiring Circuits

If you have only a standard 240 V mains circuit, such circuits require very little attention, but you need certification that the system is correctly wired, and you need to inspect the sockets, switches and distribution box from time to time. Sections 3 and 4 look at this in a little more detail.

Competence of Employees

The need for persons to be technically competent is referred to in Regulation 16 quoted below.

Regulation 16 Persons to be competent to prevent danger and injury

No person shall be engaged in any work activity where technical knowledge or experience is necessary to prevent danger or, where appropriate, injury, unless he possesses such knowledge or experience, or is under such degree of supervision as may be appropriate having regard to the nature of the work.

This regulation says more or less what one might expect; that persons working on or near electrical equipment must have an appropriate level of competence to perform the work safely.

One point which is slightly unusual is that the regulation refers to both *danger* and *injury*. This is deliberate, and is intended to cater for the need for work on 'live' systems in appropriate circumstances. In essence, the situation may be summarised thus.

1. Under normal circumstances electrical equipment should be made safe before being worked on. That is the *danger* should be removed, usually by isolating the equipment from all electrical supplies. The person doing the work obviously requires sufficient expertise to make sure that this is done properly.

2. In exceptional circumstances work may have to be carried out with equipment which is still live. In these circumstances, it is usually not possible to prevent *danger*, but *injury* must be prevented.

From an employer's point of view, the first point to establish is if there are any circumstances where working on or near 'live' equipment is justified. If there are, Regulation 14 must be studied in detail by someone with the appropriate expertise.

Staff Training

If your company or organisation employs people to carry out specialist electrical work, then it is obvious that such persons must be appropriately qualified. The competence of such specialist staff, however, represents only a fraction of the competence implied by the act. What about the electrical competence of the vast majority of your employees?

Question 2.2 is intended to make you think about this need for wider electrical competence.

2.3 SUMMARY

The Electricity at Work 1989 Regulations lay down broad guidelines about the safety of electrical systems and electrical equipment. The detailed interpretation of these Regulations requires the employer to consult appropriate codes of practice and to apply these codes according to the individual needs of their workplace.

In particular:

- Regulation 3 specifies the duties of employers and employees. You effectively have the duties of an employer in matters which are within your control.
- Regulation 4 is an overall statement of the intent of the Regulations.
- Regulations 6 refers to the special care needed where the workplace presents a hostile environment to electrical equipment.
- Regulations 16 refers to the need for persons working with electricity to have appropriate competence. This needs to be applied more widely than just specialist electrical staff.
- Regulation 29 lays down the requirements for a defence to prosecution under the Regulations. The onus is on the defendant to prove that he or she exercised all due diligence to comply with the Regulations.

Complying with the Regulations therefore entails:

- a detailed assessment of your workplace for potential safety hazards
- the identification of recognised codes of practice appropriate to your workplace
- staff training to ensure appropriate levels of staff competence
- the provision and maintenance of safety equipment (where needed)
- a regular programme of testing and maintenance for electrical systems and equipment
- the establishment of good working practices
- the systematic documentation of all the above provisions.

The gist of the regulation is that you have a defence against prosecution for failing to carry out an 'absolute' duty, provided that you can show that you "took all reasonable steps and exercised all due diligence to avoid the commission of that offence".

The rest of the regulations are subject to the qualifying statement 'so far as is reasonably practicable', and Section 40 of the Health and Safety at Work Act (1974) applies. This says that where someone is prosecuted for failing to comply with a duty 'so far as is reasonably practicable', it would be for the accused to show the court that it was not reasonably practicable for him to do more than he had in fact done to comply with the duty.

In summary, the Regulations as a whole place the onus on the accused to show that he or she took all necessary steps to avoid committing an offence. This is unusual, as the onus of proof is usually on the prosecution. To furnish such proof, you must be able to produce documentary evidence.

Before looking more closely at the sort of documentation needed, it ought to be stressed that providing a defence against prosecution is not the only reason for documenting safety measures. Such documentation provides information, guidance, and feedback to management in the same way as it does in implementing any other policy. Hopefully, you will be able to combine the two functions, so that not only is an effective safety policy operated, but it is seen to be operated.

Providing a defence against prosecution is also, hopefully, something which would be needed rarely, if ever. A situation which you may very well face, however, is a visit by a member of the Health and Safety Executive.

Question 2.3

Suppose you received a call from a Health and Safety Executive Officer, who proposes a visit to review the provisions made by your company/organisation to comply with the Electricity at Work Regulations. Write down the sort of documentation that you would need on hand to refer to in such a visit. Don't go in to too much detail; just write down broad headings, and examples of the sorts of documents needed under each heading.

Response on page 22

Response to Question 2.3

You ought to have documents relating to the following:

a) a broad statement of safety policy.

The exact form of such a document will depend upon the size of the organisation. For a large organisation, there may well be a Health and Safety Committee or some similar body charged with safety functions. This should have produced a safety policy document, which should have been submitted to the Board of Directors, Governing Body or other appropriate executive body. Such a committee may also have minutes in which detailed discussions of safety policy are recorded.

In smaller organisations, the safety function is likely to be less specialised, but there should still be some document relating to overall safety policy.

b) records relating to staff with specific safety responsibilities.

In a large organisation there may well be one or more persons with full time responsibility for safety. These should have job descriptions where their responsibilities are clearly stated. A director may well be charged with the overall direction of safety policy, and this decision should be recorded in the minutes of the Board of Directors. The responsible person under the Health and Safety at Work Act must obviously be identified.

In smaller organizations it is likely that safety functions will be carried out by someone as part of their total responsibilities. There should be a written job specification where these safety responsibilities are explicitly stated. This should include the time allowed for such duties.

c) records of safety training.

Brief details of all electrical or safety training provided for staff should be recorded.

d) safety equipment provision.

You ought to have a record of all equipment specifically related to safety, with dates of purchase, location, and so on specified.

e) testing and maintenance records.

This is a theme which we will pursue in other parts of this book. You should have records of a systematic testing policy for all electrical equipment.

f) standing instructions for working practices.

The main components for these are discussed in the text immediately following Question 2.3.

Use of Equipment

Appropriate action might be:

- a regular monthly inspection to look for potential hazards
- designation of a *named* individual to switch off appliances at the end of each day. This might be on a rota basis.
- the physical removal and repair or scrapping of appliances found to be faulty.

This subject is also discussed more fully in Sections 3 and 4.

Action in the Event of Accident

The following information should be readily available to all staff:

- location of the first aid kit
- name(s) of person(s) on the staff trained in first aid
- name of person to whom the accident should be reported
- location of the nearest switch which would isolate the supply from the victim in the event of an electric shock
- the procedures for emergency telephone calls to a hospital or doctor.

The safety procedures needed are, in most cases, obvious, but they should be clearly stated, preferably in writing. The responsibilities of individual employees must be clear.

Regulation 5 Strength and capability of electrical equipment

No electrical equipment shall be put into use where its strength and capability may be exceeded in such a way as may give rise to danger.

The strength and capability of electrical equipment refers to the ability of the equipment to withstand the thermal, electromagnetic, electrochemical or other effects of an electric current which might be expected to flow when the equipment is part of a system. When considering these effects, you must take into account not just the steady operating currents and voltages, but 'transient' currents and voltages induced by changes such as switching on or off. You must also consider the currents likely to flow under fault conditions.

The required strength and capability is not necessarily the same as the rating of a piece of equipment, but the manufacturer's rating, (continuous, intermittant or fault as appropriate) is a sensible starting point. In most cases operating within the the appropriate rating will satisfy Regulation 5.

Regulation 7 Insulation, protection and placing of conductors

All conductors in a system which may give rise to danger shall either -

a) be suitably covered with insulating material and as necessary protected so as to prevent, so far as reasonably practicable, danger; or

b) have such precautions taken in respect of them (including, where appropriate, their being suitably placed) as will prevent, so far as reasonably practicable, danger.

Regulation 7 requires that either a live conductor be suitably insulated to protect employees, or if this cannot reasonably be done, other measures must be adopted, such as placing live conductors out of reach of personnel or using restrictive working practices. Insulation of portable appliances is discussed further in the "Portable Appliance Testing" booklet. Note that such protection must apply to all dangers, not just electric shock. For example, you may wish to insulate conductors to protect against fire risks due to arcing.

Regulation 8 Earthing or other suitable precautions

Precautions shall be taken, either by earthing or by other suitable means, to prevent danger arising when any conductor (other than a circuit conductor) which may reasonably foreseeably become charged as a result of either the use of a system, or a fault in a system, becomes so charged; and, for the purposes of ensuring compliance with this regulation, a conductor shall be regarded as earthed when it is connected to the general mass of earth by conductors of sufficient strength and current-carrying capability to discharge electrical energy to earth.

The earthing of portable appliances is discussed in the "Portable Appliance Testing" booklet. For information on earthing of fixed wiring installations, consult the current IEE wiring regulations.

Response to Question 2.1

a) No response

b) Most safety problems that you are likely to meet will be documented somewhere. For example, potentially explosive atmospheres are covered by the Health and Safety guide booklet HS(G)22.

This is not to say that all safety problems will have a ready made solution. However, most situations will have a recognised standard which would act as a suitable starting point. Not only is this approach likely to save work - no one likes to re-invent the wheel - but it is also likely to afford a better defence in the event of your being prosecuted under the Regulations.

c) Probably the single most useful place for advice on safety is your local Health & Safety Executive office. This would be closely followed by the British Standards Institution. Other possible sources of information are the appropriate professional or trade association, the manufacturer or retailer of your electrical equipment, and the Institution of Electrical Engineers. Some useful sources of information are given at the end of this book in the appendix.

Response to Question 2.2

The general criterion ought to be the person's job specification. What an employee is required to do, which involves the use of electricity, they must be competent to do safely.

a) A secretary - plug in, switch on and operate photocopiers, wordprocessors, electric kettles, fax's and so on. Isolate machines under fault conditions by switching off and unplugging. Recognise and report visible electrical hazards, such as loose electrical sockets, frayed leads, switches which are and so on.

b) A plumber - you might reasonably expect someone with this degree of practical training to: wire up a mains plug correctly, recognise likely route of electrical cables from position of plugs (so as to avoid drilling through them), isolate a simple electrical system using mains switch, operate electric drills and similar electrical equipment, including recognising the potential hazards of such equipment in different environments.

c) a bank manager - a bank manager will have to supervise clerical and secretarial staff, so he should have all the electrical competences of a secretary, plus those needed to discharge his administrative functions. You would expect him to understand standard electrical terminology, and be able to monitor potential electrical hazards in his branch.

Regulation 12 Means of cutting off the supply and for isolation

(1) Subject to paragraph (3), where necessary to prevent danger, suitable means (including, where appropriate, methods of identifying circuits) shall be available for -

a) cutting off the supply of electrical energy to any electrical equipment; and

b) the isolation of any electrical equipment.

(2) In paragraph (1), "isolation" means the disconnection and separation of the electrical equipment from every source of electrical energy in such a way that this disconnection and separation is secure.

(3) Paragraph (1) shall not apply to electrical equipment which is itself a source of electrical energy but, in such a case as is necessary, precautions shall be taken to prevent, so far as reasonably practical, danger.

Regulation 12 requires that suitable means must be available for cutting off the electrical power to equipment. Where the equipment is a source of electrical power itself, the regulation requires suitable precautions to be taken to ensure safety.

This Regulation is aimed at preventing danger mainly in two situations. Firstly, where maintenance or repair work is carried out on equipment. This is discussed under the next regulation.

Secondly, during an emergency, such as a person suffering an electric shock, it must be possible to switch off the power quickly.

Regulation 13 Precautions for work on equipment made dead

Adequate precautions shall be taken to prevent electrical equipment, which has been made dead in order to prevent danger while work is carried out on or near that equipment, from becoming electrically charged during that work if danger may thereby arise.

Regulation 13 requires all sensible precautions to be taken to ensure safety while working on or near electrical equipment. The person carrying out such work must be able to isolate the system from all electrical power, and be certain that the equipment remains isolated during the work. Ideally it should be possible for the person working on the equipment to lock the supply off, so that no one else is able to reconnect it during the work.

SECTION THREE
THE RESPONSIBLE PERSON

INTRODUCTION

This section begins with a survey of those Regulations not previously discussed.

The section then goes on to discuss the three requirements that ensure a safe fixed wiring system. These are:

- testing the system
- routine maintenance of the sockets, switches and distribution box
- safe working practices.

The final topic discussed is the safe operation of portable appliances. This entails the establishment of safe working practices, and a programme of appliance testing. The importance of good documentation is also stressed.

At this point, you are referred to the "Portable Appliance Testing" booklet for details of the practical implementation of a portable appliance test programme.

3.1 A SURVEY OF THE REMAINING REGULATIONS

In Section 2 we avoided the technical detail of the Regulations, and concentrated on the broad strategy. It's now time to look at some of this technical detail, and we will start this section with a brief survey of those Regulations not yet discussed.

Regulation 2 Further extracts

(1) In these regulations, unless the context otherwise requires -

> *"circuit conductor" means any conductor in a system which is intended to carry electric current in normal conditions, or to be energised in normal conditions, and includes a combined neutral and earth conductor, but does not include a conductor provided solely to perform a protective function by connection to earth or other reference point;*
>
> *"conductor" means a conductor of electrical energy;*

We have already defined the terms *danger*, *injury*, *electrical system* and *electrical equipment*. The other terms with special meaning are *conductor* and *circuit conductor*, and these are defined above.

Testing the System

When a system is first wired up, the electricity supply authorities require a 'certificate of compliance' before it can be connected to the mains supply. This is a certificate issued by a qualified electrician stating that certain tests have been carried out, and that the system is in a fit state to be connected.

As the owner of a building, you should have this certificate. If you rent or lease premises you should get a copy. If a copy is not available, you should get your local Electricity Board or some other qualified person to test the system for you and issue a certificate.

After this initial certification the fixed wiring should need comparatively little attention. Re-testing every ten years or so should suffice, unless there are circumstances which demand otherwise.

Question 3.1

What circumstances can you think of which would warrant the system being tested before the ten years has elapsed?

Response on page 35

Maintaining the 'Working' Parts

The 'working' parts of the fixed wiring system are the sockets and switches. For convenience the distribution system with its fuse box, circuit breakers, and Residual Current Devices (RCDs) is included in the discussion.

The wiring itself is hidden away, and withstands the rigours of life quite well, but the switches and sockets get constant use, and need to be inspected regularly.

Regulation 9 Integrity of referenced conductors

If a circuit conductor is connected to earth or to any other reference point, nothing which might reasonably be expected to give rise to danger by breaking the electrical continuity or introducing high impedance shall be placed in that conductor unless suitable precautions are taken to prevent that danger.

The point about Regulation 9, is that if part of a circuit is supposed to be, say, at earth potential, you must ensure that it remains at earth potential. If, for example, the connection to earth is via an electrical device which may become open circuit in fault conditions, then the connection to earth will be broken, and the the circuit which should be earthed may reach a dangerous potential.

Regulation 10 Connections

Where necessary to prevent danger, every joint and connection in a system shall be mechanically and electrically suitable for use.

Special care must be taken with portable appliances. You must take into account the type and frequency of use that an appliance gets, and where it is used. The Health and Safety Executive Publication PM32: The Safe Use of Portable Electrical Apparatus, gives further details.

Regulation 11 Means for protecting from excess of current

Efficient means, suitably located, shall be provided for protecting from excess of current every part of a system as may be necessary to prevent danger.

Regulation 11 deals with the provision of fuses, circuit breakers and Residual Current Devices (RCDs). A good rule of thumb is to have the protection as close to the point of use of an appliance as possible, and set to operate at the lowest current consistent with the use of the appliance. A desk lamp, for example, rated at 100 W will draw less than 1 A current. The plug used with this lamp should therefore be fitted with a 3 A not a 13 A fuse. Further advice on the use of fuses, circuit breakers and so on is available in the current IEE wiring regulations, as referred to in the appendix.

3.3 PORTABLE APPLIANCES

By the time that an electrical appliance reaches the workplace it will already have undergone extensive testing. Such tests fall into two categories:

- proving the design
- manufacturers quality control testing

In the design proving stage, the appliances undergo so-called 'type' tests, which quite often push the product to the limit, to ensure that it can withstand user abuse, and still remain safe.

Once the design is proved, tests are carried out during and immediately after manufacture. Such tests are not as exhaustive as the type tests, but are carried out to an approved standard, and usually lead to the award of recognised safety mark such as the BEAB 'kite' mark.

It isn't reasonably practicable for you to be expected to repeat all the tests carried out by the independent proving bodies or those carried out by the manufacturers, hence you are entitled to assume that the basic design of the appliance is safe. You must, however, ensure that the design is suitable for your particular workplace, as previously discussed. If your workplace represents a particularly hostile environment, the specification of the appliances will need to be more rigorous.

You should, however, perform an initial series of tests before putting the appliance into service. These are discussed in the "Portable Appliance Testing" booklet, and you are referred to this booklet below.

Portable Appliance Testing

Assuming that all appliances coming into your workplace are initially safe to use, you need to test them at suitable intervals to ensure that they remain safe and to ensure that they are being used in a safe manner.

Let's look at the testing first.

The accompanying booklet, entitled "Portable Appliance Testing", gives a detailed treatment of what is needed. It is suggested that you read this booklet now.

Depending upon your own particular expertise and responsibilities, you may choose to carry out the tests described, or delegate them to others.

In summary, the "Portable Appliance Testing" booklet describes the following programme of tests:

- regular visual inspection
- regular essential tests (insulation and earth bond)
- occasional optional tests

The simplest way to carry out such a program is to use a dedicated item of test equipment known as a PAT (Portable Appliance Tester). The advantages of using a PAT are discussed in the "Portable Appliance Testing" booklet.

Regulation 14 Work on or near live conductors

No person shall be engaged in any work activity on or so near any live conductor (other than one suitably covered with insulating material so as to prevent danger) that danger may arise unless-

(a) it is unreasonable in all the circumstances for it to be dead; and

(b) it is reasonable in all the circumstances for him to be at work on or near it while it is live; and

(c) suitable precautions (including where necessary the provision of suitable protective equipment) are taken to prevent injury.

Regulation 14 has already been discussed to some extent in Section 2. Working on or near live equipment should only be allowed when there is no practical alternative. Suitable precautions must then be taken.

Regulation 15 Working space access and lighting

For the purpose of enabling injury to be prevented, adequate working space, adequate means of access, and adequate lighting shall be provided at all electrical equipment on which or near which work is being done which may give rise to danger.

Regulation 15 defines the need for proper working space, access, and adequate lighting, particularly in areas where distribution of power takes place.

This concludes our survey of the Regulations.

3.2 FIXED INSTALLATIONS

In order to keep our treatment of this area within sensible bounds, the discussion will be restricted to 'standard' 240 V single phase mains supplies. Organisations with more specialized fixed electrical installations, such as three phase power, high voltage systems, and so on are referred to the appendix for appropriate references.

Typically the sorts of organisations to which our restricted treatment applies might be offices, small shops, various service businesses, schools and so on. For such organisations the requirements needed to satisfy the Regulations are relatively straightforward.

There are three main actions needed:

- testing that the system is correctly wired up
- inspecting and maintaining the 'working' parts of the system
- operating the system within its capabilities.

Question 3.3

Give an example of a situation where you think that safety tests should be carried out:

a) every day

b) every 4 months

c) every year

Response on page 36

The previous question highlighted the factors to be taken into account when deciding upon the frequency of testing. These are:

- the environment in which the equipment is used
- the amount and type of use
- whether the equipment is used by a single person or many different people
- the experience and general competence of the user(s)
- the nature of the equipment itself.

A good rule of thumb might be that equipment should be tested each year unless the factors listed above dictate more frequent testing.

Question 3.2

What things would you look for when inspecting the sockets and switches of a mains system? How often would you inspect?

Response on page 35

In addition to the sockets and switches, the distribution point of the fixed wiring system needs regular inspection. This is usually contained, together with the current protection devices, within one or more circuit boxes. These may be fuses, circuit breakers or RCDs, or some combination of the three. These should be checked about once a year to ensure that the correct values are fitted, and that they are in good condition. RCDs usually have test buttons to enable rapid routine testing.

Obviously the current protection devices should also be checked if there are any faults on the circuit.

Correct Operation

This really amounts to not overloading the system. Points to watch are:

- the loading of lighting circuits. These are really only designed to carry low currents. The practice of plugging appliances other than lights into the lighting circuit happily seems to be dying out, but you need to look out for this. Be careful also with large chandeliers, which can exceed the rating of the circuit.
- the use of distribution boards allowing more than one appliance to be operated from a single board should be avoided if possible.
- the number of high current appliances being used.

3.4 SUMMARY

This section began with a survey of the Regulations not previously discussed, and then discussed the requirements for ensuring a safe fixed wiring system. Three factors were highlighted.

1. Testing the system:

   The fixed wiring should be tested by a qualified electrician and a certificate of compliance obtained. It is suggested that this test be carried out:

   - when taking over new premises
   - routinely, every ten years or so
   - when changes are made to the system, including general building work which may affect the system
   - when faults are reported.

2. Maintaining the working parts

   The working parts are the sockets, switches, and distribution box. These should be inspected at approximately monthly intervals.

3. Safe working practices

   This means not overloading the system by connecting too many appliances to it. Lighting circuits must be given particular attention.

As well as the fixed wiring, the section considered the safe operation of portable appliances. This entails a programme of testing and maintenance, plus the establishment of safe working practices. The testing programme should be based upon:

- regular visual inspection
- regular essential tests (insulation and earth bond)
- occasional optional tests.

The importance of good documentation was stressed, and the criteria used in deciding the important question of how often to test were discussed. Further details of this test programme are given in the "Portable Appliance Testing" booklet.

In establishing good working practices, the approach suggested is to encourage employees to monitor their own environment by:

- looking for faults in appliances (including leads & plugs)
- looking for potential dangers in the way appliances are used
- switching off/unplugging before working on appliances
- reporting faults to management.
- knowing the action to take in the event of emergency or power failure.

Test Documentation

The first step in the testing process is to produce a *Test Results Sheet* for the appliance concerned. This is a form for recording the relevant details of an appliance, together with the results of all tests carried out on that appliance. We have supplied a form which we consider suitable for this purpose - feel free to use it as it stands, or modify it to suit your individual circumstances.

Each appliance currently in use should be logged, and you should allow no exceptions. It is better to accept a tested 'illicit' kettle onto the list than to refuse to have it on the list and allow a potential hazard to be on site.

The best time to do this is when the appliance is first purchased, and before it is issued to the end user. The process can take a considerable time in a company that has hundreds of appliances in use, so the initial log-in process may have to be undertaken gradually.

This initial evaluation of the appliance is possibly the most important part of the testing process. At this time the peculiarities of each individual appliance must be noted, and the decision made as to which tests should, and which should not be carried out.

Having decided on the tests to be carried out, the initial series of tests will provide benchmarks against which all later test results may be judged. This enables you to see a gradual failing process in an appliance, and to take action before it becomes dangerous.

When the initial tests are carried out, the equipment itself must also be labelled to show the date tested and the date when the equipment is due for re-test. This is discussed further in the "Portable Appliance Testing" booklet.

Frequency of Routine Testing

When each appliance is logged in, it should be decided what tests to perform and how often to test. This is a process of balancing the greater safety likely to result from testing frequently against the cost and effort involved. This balance is a good practical example of the operation of the clause "as far as is reasonably practicable" in the Regulations.

Response to Question 3.3

How often equipment is safety-checked depends on how frequently it is being used, and how it is being used.

a) Situations which might require daily testing

On a building site, portable equipment like electric drills can suffer severe abuse. They may be dropped onto rubble, metal swarf may get inside the ventilation slots or the lead may be partially pulled out of the plug when the body of the drill is allowed to swing unsupported. Although 110 V is used on a site it is still very dangerous for an employee to receive an electric shock - however mild. They may be up a ladder or on scaffolding. So daily checks are a good idea.

The other aspect which should be taken into account here is that a given piece of equipment may well be used by a succession of people rather than a single operator. This has two effects. Firstly the operator is less likely to notice gradual failure, and secondly the level of care given to hire equipment tends to be poorer.

b) Situations which might require testing every four months

In a school or college, portable electrical apparatus can suffer abuse - although nothing as severe as the drill above. The academic term provides an ideal time slot for the technician to perform routine tests on such apparatus three times a year. The point about this situation is that electrical equipment is being used by inexperienced users, and again often on a rota basis. Sadly, there is also sometimes an element of deliberate vandalism which must be taken into account.

c) Situations which might require annual testing

A desk top computer is inherently very reliable and provided it is not being moved around, is unlikely to become unsafe. It may fail in use but that does not usually affect its safety. One could test this sort of equipment annually.

Safe Working Practices

In most cases safe working practices are simply a matter of 'common sense', but you need to make sure that employees are aware of what to do, even if it does mean stating the obvious. The next question asks you to think about a situation which is very commonly faced by the responsible person in a workplace.

Question 3.4

Suppose you were asked to give a short talk to the staff of your workplace about the safety of portable electrical appliances. Write down the main points that you would make in such a talk.

Response on page 37

Encouraging employees to take an active interest in looking after their own safety has obvious benefits. In summary this entails:

- visually inspecting equipment which they use
- looking for potential dangers in the way equipment is used
- reporting any defects to management
- switching off/unplugging equipment before working on it
- taking appropriate action in the event of emergency or power failure.

Obviously, having informed people of the working practices required of them, it is the responsibility of management to monitor this practice, and see that it is adhered to.

SECTION FOUR
THE EMPLOYEE

No rcponsc

Having identified all the electrical appliances in your workplace, the next step is to satisfy yourself that they they are in a safe condition.

Question 4.2

Use your list compiled in Question 4.1 to identify and list any of the following:

a) appliances in an unsafe state. Look for:

- cracks or splits in the lead
- leads not securely fastened at either end. You shouldn't be able to see the individual brown, blue, and yellow/green wires themselves (these may be red, black or green in older appliances). The cables should be fastened so that the outer insulation of the lead goes into the appliance at one end, and into the plug at the other.
- damage to the appliance itself. If, for example, the outer casing is broken, this may expose live wires to the user. Do the switches on the appliances operate properly?

b) sockets or switches in an unsafe state. Look for:

- sockets or switches not securely fastened to the wall
- switches which don't click over positively. That is they will stay half-way between the on and off positions
- signs of arcing (sparking across the contacts) in plugs or switches.

No response

Finally, even appliances in a safe working state can be dangerous if they aren't used correctly. The next question gives you a chance to look for potential dangers due to bad operating practices.

Question 4.3

Can you think of any potential dangers from the way your appliances are operated? If there are any, list them below.

Response on page 43

4.3 OTHER SAFETY MATTERS

Being aware of potential dangers is probably the biggest factor in ensuring a safe workplace, but it's only part of the story.

Reporting Potential Hazards

Having identified potential hazards, you obviously want to do something about them. Some things, such as not putting convector fires near to coat stands you can remedy yourself, but what about defective switches and sockets? You can't be expected to fix these.

You need a clear channel of communication to report such matters to the management. How this is done depends on your individual organisation but there ought to be a named individual to whom these things should be reported, who can then take the appropriate action.

Safety Equipment

In many situations special safety equipment isn't needed, but where it is you need to know:

- where is it kept,
- when to use it, and
- how to use it.

Your employer should provide any necessary information and training.

Safety Procedures

Safety procedures may be very elaborate or very simple. If your organisation has sophisticated electrical equipment, this may need complex operating instructions and perhaps lengthy training. At the other end of the scale you may work in an office where the only decision to be made is who switches off the photocopier at night.

The point is, that whatever procedures are needed, they should be clearly stated, preferably in writing. Such a statement should clearly identify the responsibilities of individual employees.

Action in the Event of Accident

With minor electrical accidents, you need to think about the following.

- Where is the nearest first aid kit?
- Who is the nearest person trained in first aid?
- To whom should the accident be reported?

With more serious accidents you may have to cope with the additional problems of:

- where is the nearest switch which will isolate the supply from the victim
- where is the nearest telephone with an external line to call an ambulance/doctor
- is immediate mouth-to-mouth resuscitation needed, and if so, who will administer it?

You should have clear guidance from your employers on these matters.

4.4 SUMMARY

Your duties as an employee are to:

- operate electrical equipment responsibly, so as to avoid danger
- report all potentially dangerous defects to your employer
- use any safety equipment supplied according to your employer's instructions
- ensure that you know what to do in the event of an accident.

Response to Question 4.3

If you couldn't think of any dangers, then that's good news. However, have you considered the following?

Fires close to flammable materials. Convector fires under desks are a favourite. These represent a fire risk.

Long trailing leads, possibly with extension leads, to appliances. People may trip over these and pull the appliance off a desk.

Electrical appliances operated near water. They might fall into the water and give someone an electric shock. Kettles are probably the most likely appliance to be in this position.

APPENDIX

The following publications are by the HSE and HSC; details of how they can be obtained are given in the Health & Safety Executive, Library and Information Services, *Publications in Series* booklet - available from any of HSEs three public enquiry points at:

Broad Lane, Sheffield S3 7HQ Tel: 0742 752539

St Hugh's House, Stanley Precinct, Trinity Road, Bootle, Merseyside L20 3QY Tel: 051 951 4381

Baynards House, 1 Chepstow Place, Westbourne Grove, London W2 4TF Tel: 071 221 0870

ELECTRICAL HAZARDS FROM STEAM/WATER PRESSURE CLEANERS
ISBN 0 11 883538 6

THE SAFE USE OF PORTABLE ELECTRICAL APPARATUS
ISBN 0 11 883563 7

ELECTRICAL INSTALLATIONS IN MOTOR VEHICLE REPAIR PREMISES
ISBN 0 11 883569 6

SELECTION AND USE OF ELECTRIC HANDLAMPS
ISBN 0 11 883582 3

SAFETY IN THE USE OF RADIO-FREQUENCY DIELECTRIC HEATING EQUIPMENT
ISBN 0 11 883615 3

EMERGENCY PRIVATE GENERATION: ELECTRICAL SAFETY
ISBN 0 11 883527 0

ELECTRICAL SAFETY IN ARC WELDING
ISBN 0 11 883938 1

AVOIDANCE OF DANGER FROM OVERHEAD ELECTRIC LINES
ISBN 0 11 883045 7

ELECTRICAL SAFETY IN SCHOOLS
ISBN 0 11 883567 X

ELECTRICITY ON CONSTRUCTION SITES
ISBN 0 11 883570 X

PROTECTION AGAINST ELECTRIC SHOCK
ISBN 0 11 883583 1

AVOIDING DANGER FROM BURIED ELECTRICITY CABLES
ISBN 0 11 883612 9

ELECTRICAL SAFETY IN DEPARTMENTS OF ELECTRICAL ENGINEERING
ISBN 0 11 883613 7

FLEXIBLE LEADS, PLUGS, SOCKETS ETC
ISBN 0 11 883533 5

ELECTRICAL TEST EQUIPMENT FOR USE BY ELECTRICIANS
ISBN 0 11 883533 5

ELECTRICAL WORKING PRACTICES (IN PREPARATION)

ELECTRICAL TESTING
ISBN 0 11 883253 0

ELECTRICAL APPARATUS FOR USE IN POTENTIALLY EXPLOSIVE ATMOSPHERES
ISBN 0 11 883746 X

SAFETY OF ELECTRICAL DISTRIBUTION SYSTEMS ON FACTORY PREMISES
ISBN 0 11 883841 5

LIGHTING AT WORK
ISBN 0 11 883964 0

SAFETY OF ELECTRIC INDUCTION FURNACES
ISBN 0 11 883909 8

The following publications have an electrical safety content - however, they are not *solely* concerned with safety. British Standards Institution publications are obtainable from BSI Sales Department, Linford Wood, Milton Keynes, MK14 6LE.

EFFECTS OF CURRENT PASSING THROUGH THE HUMAN BODY
International Electrotechnical Commission Publication 479 / Also published as BS PD Pts 1 & 2

PRICIPLES CONCERNING THE SAFETY OF EQUIPMENT ELECTRICALLY CONNECTED TO A TELECOMMUNICATIONS NETWORK
International Electrotechnical Commission Publication 105

THE IEE WIRING REGULATIONS (16th EDITION)
Available from the IEE, PO Box 26, Hitchin, Herts SG5 1SA

SPECIFICATION FOR DISTRIBUTION UNITS FOR ELECTRICITY SUPPLIES FOR CONSTRUCTION AND BUILDING SITES
BS 4363:1968

DISTRIBUTION OF ELECTRICITY ON CONSTRUCTION AND BUILDING SITES
BS CP 1017:1969

SPECIFICATION FOR ELECTRIC POWER SWITCHGEAR AND ASSOCIATED APPARATUS
BS 162:1961 (replaced in part by BS 5486 Pt 1:1977 and BS 5227:1975)

CODE OF PRACTICE FOR THE MAINTENANCE OF ELECTRICAL SWITCHGEAR FOR VOLTAGES UP TO AND INCLUDING 145 kV
BS 5405:1976 (replaced in part by BS 6423:1983 and BS 6626:1985)

MAINTENANCE OF ELECTRIC MOTOR CONTROL GEAR
BS CP 1011:1961 (replaced partly by BS 6423:1983 and BS 6626:1985)

CODE OF PRACTICE FOR ELECTRICAL SWITCHGEAR AND CONTROL GEAR FOR VOLTAGES UP TO AND INCLUDING 650 V
BS 6423:1983

CODE OF PRACTICE FOR ELECTRICAL SWITCHGEAR AND CONTROL GEAR FOR VOLTAGES ABOVE 650 V AND UP TO AND INCLUDING 36 kV
BS 6626:1985

ELECTRICAL EQUIPMENT OF INDUSTRIAL MACHINES (Specification for general requirements)
BS 2771 Pt 1:1986

SPECIFICATION FOR RUBBER GLOVES FOR ELECTRICAL PURPOSES
BS 697:1986

SPECIFICATION FOR RUBBER MATS FOR ELECTRICAL PURPOSES
BS 921:1976 (1987)

SPECIFICATION FOR CLASSIFICATION OF DEGREES OF PROTECTION PROVIDED BY ENCLOSURES
BS 5490:1977

SPECIFICATION FOR DEGREES OF PROTECTION OF ENCLOSURES OF SWITCHGEAR AND CONTROL GEAR FOR VOLTAGES UP TO AND INCLUDING 1000 V ac AND 1200 V dc
BS 5420:1977

GENERAL REQUIREMENTS FOR ROTATING ELECTRICAL MACHINES
BS 4999 Part 20:1972

CODE OF PRACTICE FOR SELECTION, INSTALLATION AND MAINTENANCE OF ELECTRICAL APPARATUS FOR USE IN POTENTIALLY EXPLOSIVE ATMOSPHERES (OTHER THAN MINING APPLICATIONS OR EXPLOSIVE PROCESSING AND MANUFACTURE)
BS 5345

ELECTRICAL APPARATUS FOR POTENTIALLY EXPLOSIVE ATMOSPHERES
BS 5501

ELECTRICAL APPARATUS AND ASSOCIATED EQUIPMENT FOR USE IN EXPLOSIVE ATMOSPHERES OF GAS OR VAPOUR OTHER THAN MINING APPLICATIONS
BS CP 1003

ELECTROSTATIC PAINTING AND FINISHING EQUIPMENT USING FLAMMABLE MATERIALS
BS 6742 Part 1:1987

ELECTRICAL APPARATUS WITH PROTECTION BY ENCLOSURE FOR USE IN THE PRESENCE OF COMBUSTIBLE DUSTS
BS 6467: Part 1:1985

CODE OF PRACTICE FOR CONTROL OF UNDESIRABLE STATIC ELECTRICITY
BS 5958

GUIDE TO ELECTRICAL EARTH MONITORING
BS 4444:1969 (1980)

EARTHING
BS CP 1013:1965

SPECIFICATION FOR AIR BREAK SWITCHES, AIR BREAK DISCONNECTORS AND FUSE-COMBINATION UNITS FOR VOLTAGES UP TO AND INCLUDING 1000 V ac AND 1200 V dc
BS 5419:1977

CONSTRUCTION OF ELECTRICAL EQUIPMENT FOR PROTECTION AGAINST ELECTRIC SHOCK
BS 2754:1976

SAFETY RULES FOR THE CONSTRUCTION AND INSTALLATION OF ELECTRIC LIFTS
BS 5655:Part 1:1986

SPECIFICATION FOR AC DISCONNECTORS (ISOLATORS) AND EARTHING SWITCHES OF RATED VOLTAGE ABOVE 1 KV
BS 5253:1975