Electricity

Level 3 Health and Safety in the Workplace

Introduction

If not carefully managed, electricity can be very dangerous to those who work with it and around it.

Equipment must be installed, used and maintained correctly to help reduce the likelihood of electricity causing injuries in the workplace.

This section of the course covers portable electrical equipment, underground cables and overhead wiring, and explains your responsibilities for ensuring that employees are kept safe from harm.

This includes details on installing equipment correctly, dealing with electric shocks and understanding how to train staff to work safely with electricity.

Topics to be Covered

The topics covered in this section are:

- Common causes of electrical accidents
- Injuries caused by electricity
- Employer responsibilities
- Electrical risk assessments
- Safe installations
- Portable appliances
- Residual current devices
- Working near electricity and wiring
- Underground cables
- Overhead power lines
- Potentially explosive atmospheres
- Maintaining electrical equipment
- Dealing with electric shocks

Common Causes of Electrical Accident

The Health and Safety Executive estimates that every year there are around 1,000 accidents relating to electricity. These are commonly as a result of electric shocks, burns and fires.

According to government statistics, in 2015/16:

- 15,984 fires occurred in non-dwelling buildings.
- There were 21 fatalities.
- 1089 people suffered from non-fatal injuries.

These figures show why electrical safety training is so important for you and your business.

Common Causes of Electrical Accidents

The main causes of workplace electrical injuries are:

- Using poorly maintained electrical equipment.
- Working near overhead power lines.
- Coming into contact with underground cables.
- Working on or near mains electricity supplies.
- Using unsuitable electrical equipment in explosive atmospheres.
- Working near a live electricity supply believing it is dead.
- Using flexible leads and extension cables which are prone to damage.
- Using electrical equipment near to a source of water.

Injuries Caused by Electricity

The types of injury that can be sustained from contact with electricity include:

- Electric shock - if a voltage is applied to the body then a current can flow through it and block the electrical signals between the brain and the muscles. The shock can stop your heart beating properly, prevent you from breathing and cause muscle spasms.
- Loss of muscle control - people who receive an electric shock often get painful muscle spasms that can be strong enough to break bones or dislocate joints.
- Electrical burns - when an electrical current passes through the body it heats the tissue along the length of the current flow. This can result in deep burns that often require major surgery and which can be permanently disabling.
- Thermal burns - faulty or overloaded electrical equipment can get very hot, even if they are of low voltage. Some electrical equipment also gets hot in normal operation. You can receive a thermal burn if you get too near hot surfaces or if you are near an electrical explosion.

Employer Responsibilities

All employers have a responsibility to ensure that their employees are trained in how to carry out their job roles safely.

They must also carry out a risk assessment of the workplace hazards, including electrical installations, equipment, work activities and fire hazards, so that suitable control measures can be put in place for employees to follow.

The Electricity at Work Regulations 1989 is the main legislation governing safe working practices in regards to electricity at work. Under the regulations, employer responsibilities include:

- Ensuring that all work systems are designed and maintained to prevent danger.
- Providing protective equipment to workers where necessary.
- For the purposes of preventing injury, ensuring adequate working space, means of access and lighting are provided at all electrical equipment on which, or near which, work is being done.
- Ensuring that employees are competent and trained to carry out their work safely.

Electrical Risk Assessments

If your business works with electricity, then you will need to undertake a relevant risk assessment using each of the five steps.

Step 1: Identify the electrical hazards.

Take a look at what electrical equipment is being used around the workplace, and consider whether there is the risk of employees coming into contact with live electricity in their work activities. Electrical hazards to look out for include:

- Smoking power tools.
- Burn, scorch marks or burning smells that indicate a fault.
- Damaged leads and cables.
- Partly unwound cable reels.
- Overloaded plug sockets.
- Cables presenting trip hazards.
- Fires caused by electrical sparks.
- Explosive atmospheres triggered by sparks or static electricity.
- Overhead power lines.

Step 2: Decide who might be harmed and how.

Consider everyone in the work area who may come into contact with electricity, including employees, customers and visitors. Pay particular attention to those with extra requirements, such as workers who are colour blind and who may have difficulty identifying the colour of live cables.

People whose roles involve direct work with electricity are most at risk, such as:

- Electricians.
- Builders and construction workers.
- IT technicians.
- Communications engineers.
- Power and energy suppliers and engineers.
- Appliance repair workers.
- PAT testers.
- Cable engineers.

Step 3: Evaluate the risks and decide what needs to be done to prevent or control the risks posed by electricity.

Your first control should be to try and avoid working with electricity altogether - although this is often impractical. If the work cannot be avoided, then you should look at how you can control the risks so that harm is unlikely.

Step 4: Record your findings and implement them.

Remember to keep a record of your risk assessment, including information of all the hazards you've identified, who is at risk, and which control measures are being used to reduce the likelihood of harm.

Step 5: Review your risk assessment and update if necessary.

Check on a regular basis whether there have been any changes to the workplace or work activities that would mean the risk assessment needs updating. For example, has new electrical equipment been introduced? Have employees provided you with feedback? Have there been any accidents?

Control Measures - Safe Installations

Safe installations are a key first step in controlling the risks from electricity. This includes the electrical system found in the workplace, such as wiring, fuse boards, sockets and electrically powered equipment. This system must be properly maintained and inspected regularly by a competent person.

The IET Wiring Regulations (BS 7671) set the standards for electrical installation in the UK and recommend that electrical systems are inspected and tested every five years.

You should ensure that:

- Sufficient electrical sockets are provided for the needs of the site, as using adaptors can overload sockets and cause fires.
- Fuses, circuit breakers and other devices are correctly rated for the circuit they protect.
- Isolator and fuse box covers are kept closed, and if possible locked, to keep people out.
- Accessible and clear switches are provided near fixed machinery to enable the power to be cut off in an emergency.
- If any new electrical systems are introduced, they must be installed safely and maintained regularly.

Control Measures - Portable Appliances

Hand-held electrical equipment is used by many workplaces as it is convenient, portable and often light-weight. It's essential that all portable appliances are suitable for the task and the working environment. Cables, plugs, sockets and fittings must also be robust enough for the job and adequately protected.

You should ensure that:

- The equipment is suitable for the electrical supply to which it will be connected, for example voltage and current.
- The equipment is checked for obvious faults and defects before use, and undergoes Portable Appliance Testing (PAT) on a regular basis, such as every year.
- Flexible cables have adequate plugs and the outer sheath of the cable is firmly clamped to stop the wires pulling out of the terminals.
- Damaged or frayed cables are completely replaced.
- When joining lengths of cables, ensure they are in good condition and use proper connectors or cable couplers.

For hand-held equipment, it is important to remember to:

- Use socket outlets that are close by so that the equipment can be easily turned off in an emergency.
- Switch off tools and power sockets before plugging in or unplugging.
- Switch off appliances and unplug them before cleaning or making adjustments.

If the work environment is unfavourable, such as damp or humid, then consider using battery, air or hydraulic powered equipment instead or provide a residual current device (RCD) for higher-voltage tools.

Control Measures - Residual Current Devices

A residual current device (RCD) should be fitted to any 230 volt tool. The RCD will cut the power if there is a fault and can be tested by pressing the test button.

If portable equipment or tools operating at 230 volts or higher are being used, an RCD can provide additional safety.

RCDs are best used when they are built into the main switch board, as this means that all circuits fed from the RCD are permanently protected.

Exercise

When using a portable electrical appliance, which three of the following do you need to ensure?

- [x] The appliance is switched off before it's plugged in
- [ ] The cable is frayed
- [x] The appliance is checked for defects before use
- [ ] The plug socket is far away from the work activity
- [x] The equipment is suitable for the voltage of the electrical supply

Working Near Electricity and Wiring

Workers must not be permitted to carry out work on or near exposed electrical parts or equipment unless it is unavoidable, a risk assessment has been carried out, and suitable control measures are in place. Examples of work where this applies include:

- Refurbishment work near electrical wiring in a building.
- Digging near underground cables.
- Working near overhead power lines during construction.

A safe system of work is recommended for work near electricity. The safe system of work should:

- Only allow competent and trained workers to work on or near live electricity.
- Specify the levels of competence required to carry out each aspect of the work safely.
- Clearly indicate the limits set on work to ensure they are not exceeded.

Wherever possible, work should be carried out away from electrical wiring. Sometimes you might not see any wires near the work area but that doesn't mean there aren't any there: wires may be hidden in walls, under the floor or in pipes.

Before proceeding with work on surfaces that could contain electrical wiring:

- Look for any obvious electrical wires plus any other hazards, such as asbestos.
- Ask to see plans of the electrical installation and use them to locate electrical wiring.
- If competent, use a suitable cable detector.
- Look for nearby electrical equipment or installations and find where the wiring runs.
- Consider suitable protective clothing.
- Select equipment that will minimise the risks during work.

Before work begins, it is important to ensure that the power has been switched off. Once switched off it must remain off and be prevented from being turned back on again without the agreement of those doing the work.

If the electrical supply cannot be turned off, a competent person should be consulted to identify how the work should proceed.

Before commencing work on any electrical equipment, machinery or installations, all sources of energy (including electrical, mechanical, hydraulic and pneumatic) must be released and isolated.

The isolation must be secure so that it cannot be inadvertently or deliberately re-connected whilst work is being carried out. This can be done by:

- Applying a lock to each isolation device.
- Ensuring that the person doing the work retains all keys.
- Placing warning notices at the points of isolation.

Underground Cables

Underground cables are potentially more hazardous than overhead power lines as they are hidden from view and it is not possible to tell if they are live by looking at them.

You should always assume that electric cables will be present when digging in streets, pavements or near buildings.

Before digging begins, the local electricity company, the highways authority and local council should be consulted to see if they have up to date plans of the locations of buried services. This should be included as part of the risk assessment process.

Other control measures include using suitable cable-avoidance tools and ensuring all workers are instructed in how to dig safely.

Overhead Power Lines

The HSE estimates that over 50% of fatal electrical accidents are caused by contact with overhead electric power lines. What's more is that every single one of these accidents can be prevented if a thorough risk assessment is carried out.

The majority of overhead power line accidents occur during construction and agricultural work. If vehicles or machinery get too close to the lines then electricity will be conducted through them, as well as through anyone in the vehicle or anyone touching the machinery or equipment at the time.

If work needs to be carried out under or near overhead power lines, then the local electricity company should be consulted on how to proceed safely.

You should always assume that power lines are dangerous when planning to work near them.

Overhead Power Lines

The HSE estimates that over 50% of fatal electrical accidents are caused by contact with overhead electric power lines. What's more is that every single one of these accidents can be prevented if a thorough risk assessment is carried out.

The majority of overhead power line accidents occur during construction and agricultural work. If vehicles or machinery get too close to the lines then electricity will be conducted through them, as well as through anyone in the vehicle or anyone touching the machinery or equipment at the time.

If work needs to be carried out under or near overhead power lines, then the local electricity company should be consulted on how to proceed safely.

You should always assume that power lines are dangerous when planning to work near them.

Potentially Explosive Atmospheres

Electrical installations and equipment can generate hot surfaces or sparks which, as well being a fire hazard, can ignite a potentially explosive atmosphere.

An explosive atmosphere is any atmosphere where a dangerous substance, air and a source of ignition are present together. Dangerous substances include flammable liquids, gases, dusts, vapours and solids, such as petrol, adhesives, LPG, dust clouds and flammable textiles.

As a result of this, specially constructed electrical equipment and installations are required in potentially explosive atmospheres. Examples include:

- Sealing electrical equipment.
- Reducing the power of equipment.
- De-energising electrical equipment where a fault or explosive atmosphere is detected.
- Wearing anti-static shoes and clothing if static electricity is likely.

Potentially Explosive Atmospheres

Electrical installations and equipment can generate hot surfaces or sparks which, as well being a fire hazard, can ignite a potentially explosive atmosphere.

An explosive atmosphere is any atmosphere where a dangerous substance, air and a source of ignition are present together. Dangerous substances include flammable liquids, gases, dusts, vapours and solids, such as petrol, adhesives, LPG, dust clouds and flammable textiles.

As a result of this, specially constructed electrical equipment and installations are required in potentially explosive atmospheres. Examples include:

- Sealing electrical equipment.
- Reducing the power of equipment.
- De-energising electrical equipment where a fault or explosive atmosphere is detected.
- Wearing anti-static shoes and clothing if static electricity is likely.

Maintaining Electrical Equipment

Users should look regularly at the electrical equipment they are using in order to spot obvious faults or damage. Ideally, the equipment should be visually inspected before each use. You should look at:

- The outside of the equipment - is it damaged or split?
- Loose parts and screws - is everything connected securely?
- Damage to the lead or plug - are there any frayed or damaged wires?

If equipment is found to be faulty, it should be labelled as damaged and immediately taken out of use. Encourage employees to report defects to their manager or supervisor so that they can arrange for the equipment to be repaired or replaced.

Workers should never try to repair or take apart the broken electrical equipment themselves.

It's vital that all electrical equipment and systems are properly maintained to prevent hazards, including fires.

Many faults or damage to hand-held or smaller electrical equipment can be found by visual inspection and employees should be encouraged to check regularly for defects.

The workplace should have an appropriate system of:

- Regular checks by users.
- Formal visual inspections by a competent person.
- Combined inspection and tests by a competent person.

A formal inspection should be carried out every few months by a competent person who is trained to do so. Before the inspection begins, all equipment must be switched off and unplugged. The inspection will include:

- Checking that electrical cables are not damaged and haven't been incorrectly repaired, such as with insulating tape.
- Checking for damage to plugs, for example bent pins or a cracked casing.
- Ensuring that cables are properly secured where they enter the plug or equipment, with no internal wires visible.
- Checking for damage to the outer covers of the equipment for loose parts or loose screws.
- Making sure that the correct fuse is fitted by checking the equipment's rating plate or instruction book.
- Checking for burn marks or staining that suggests equipment may be overheating.
- Ensuring that equipment has not been used in unsuitable working conditions, such as wet or dusty workplaces.

Formal inspections should also include removing the plug cover to check that:

- The correct fuse is being used.
- The cord grip is holding the outer part of the cable tightly.
- The wires, including the earth where fitted, are attached to the correct terminals.
- No bare wire is visible other than at the terminals.
- The terminal screws are tight.
- There is no sign of internal damage, overheating or entry of liquid, dust or dirt.

Visual checks also apply to extension leads and their plugs and sockets but do not apply to moulded plugs where only the fuse can be checked.

A combined inspection and test is also required where electrical faults cannot be spotted by visual inspection alone. The inspection must be carried out by a competent, trained person.

All earthed equipment and most leads and plugs connected to electrical equipment should undergo an occasional combined inspection and test.

This test should be carried out:

- At the start of a maintenance system.
- Where a fault or damage is suspected.
- After a repair or modification.
- At periods appropriate to the equipment, manner and frequency of use and the operating environment.

Dealing With Electric Shock

If you come across someone who has had an electric shock, don't touch them with your bare hands while they are in contact with the electrical current. Try to move the person away from the source using a piece of wood (which won't conduct electricity), such as a broom handle or piece of timber, to break the person's contact with the electricity.

If the shock is near water, don't reach into water in which there's an electrical current or you may be electrocuted.

Turn off the power at the mains if possible or unplug the appliance. Do not touch anything made of metal or any object that is wet.

Once the area is safe, check the person’s airway and breathing. If they are not breathing, have someone call the emergency services on 999/112 while you give CPR. If you are alone, give the person CPR first before calling the emergency services.

Exercise

Before inspecting or carrying out maintenance on electrical equipment, what should you do?

- **Ensure the equipment is switched off and unplugged**
- Look for an up to date PAT label
- Try to repair any damaged parts of the equipment

Summary

Employers have a responsibility to ensure that their workers are protected from the risks created by electricity. This means carrying out a risk assessment based on the electrical equipment, installations and supplies that are used or located in the workplace, and ensuring that employees understand how to work safely.

It's also essential that any electrical systems, installations or equipment used on the premises are inspected regularly, properly maintained and used correctly by employees. If any faults or defects are found, the equipment must be removed from use.

Particular care must be taken if work is being carried out near underground cables, overhead power lines, or on or near electrical wiring. Wherever possible, ensure that the electricity supply is switched off before work commences.