



**INLAND
WATERWAYS**
ASSOCIATION

GUIDANCE NOTE

*Fire & Electrical
Safety*

CONTENTS

Introduction: Fire Safety	3
Legal Requirements	4
The Nature of Fire	5
Responsible Person	
Fire Risk Assessment	6
Fire Safety & Evacuation Plan	7
Common Sources of Fire Risk	8
Fire Fighting Equipment	10
Fire Alarm Systems	
Fire Detection Systems	
Fire Action Notices	
Fire Drills	11
Means of Escape	12
Temporary Site Buildings	13
Emergency Lighting & Signs	14
Introduction: Electrical Safety	16
Legislative Requirements	17
Site Electrical Supply	18
Safe Working Practices with Electricity	19
Permit to Work	
Monitoring Contractors	20
Underground Services	21
Overhead Services	22
Dealing with Electric Shock	23

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INTRODUCTION: FIRE SAFETY

Fire safety precautions should be considered at every stage of a restoration project, from planning and design through to construction and completion. The fire risk is likely to change as construction proceeds so precautions should be adapted accordingly. Everyone on site should know the procedures to be taken in the event of a fire.

Under the Construction (Design and Management) Regulations (2015), the client, principal designer and principal contractor must be satisfied that fire risk is managed proactively, refer to the guidance note Construction (Design and Management) Regulations. A fire risk assessment must address fire prevention and protection measures and must be carried out in accordance with the Regulatory Reform (Fire Safety) Order (2005).



When planning the layout of a site, consider where flammable materials will be stored and the precautions needed for their safe storage and use. The nature of the fire risks on the site will determine the type of fire extinguishers which need to be available. Sites with stores, welfare facilities and office accommodation may need additional fire precautions.



**Fire
assembly
point**



LEGAL REQUIREMENTS

Fire prevention and control are covered in the Regulatory Reform (Fire Safety) Order (FSO) and the Construction (Design and Management) Regulations (CDM). The Health and Safety Executive (HSE) have produced a guidance note Fire Safety in Construction (HSG 168). Links to these documents are provided in Useful Resources on p.15.

The FSO applies to all workplaces and premises and covers fire prevention, detection, fire-fighting and emergency lighting routes. It requires that the project has a fire risk assessment that is updated regularly.

The FSO requires that a responsible person is nominated and must be identifiable during all stages of the restoration project. The responsible person must make sure the fire risk assessment is carried out and kept up to date. The principal contractor or contractor may be identified as the responsible person.

CDM covers the following:

- ① Prevention of risk from fire, flooding or asphyxiation.
- ② Emergency procedures.
- ③ Emergency escape routes and exits.
- ④ Fire detection and fire-fighting.

CDM identifies duty-holders and has a requirement that they cooperate and coordinate their activities.

Clients must ensure a construction phase plan (Project Plan) is in place and that it contains the fire safety and evacuation plan.

Principal Contractor or Contractor prepares the Project Plan and must ensure that it remains up to date.

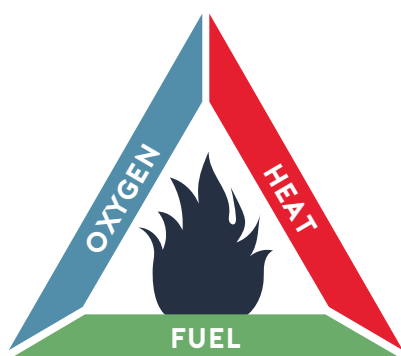
Principal Designers and Designers must ensure that all potential fire hazards have been eliminated or reduced so far as is reasonably practicable.



Although not a legal requirement, it is good practice for the restoration group to liaise with the local fire rescue service (FRS). During the design phase the FRS should be consulted about access requirements and arrangements. The principal contractor should make contact with the FRS and provide an initial site plan, which should be updated as necessary and available on site for emergency services.

It is a requirement of CDM that **‘suitable and sufficient fire-fighting equipment and fire detection and alarm systems must be provided and located at suitable places’**. The responsible person must consider this at all stages of the project and review and revise as necessary as the project develops and changes.

THE NATURE OF FIRE



The fire triangle shows the three elements that are needed to enable a fire to start:

- ① **Fuel** is the combustible material that, given sufficient heat and oxygen, will support combustion. It can be liquid, solid or gas.
- ② **Heat** is the ignition source. Every fuel has an ignition temperature.
- ③ **Oxygen or Air** sustains fire.

The removal of any one of the three elements will extinguish the fire.

Fire can spread in four ways:

- ① **Conduction** heat is transmitted from one place to another along or through solid material and has the potential to start a fire in a location remote from the original source of the heat.
- ② **Convection** is where superheated gases or heat arising from a fire ignite another combustible material or when burning particles are circulated in the air and are deposited in another place.
- ③ **Radiation** is the transfer of heat through the air to other combustible materials nearby causing those materials to rise to their ignition temperature.
- ④ **Direct contact** is a combination of conduction, convection and radiation and is where fire spreads and reaches other combustible materials adding fuel to the fire.

Take a look at the video clip link on p.15 to see how quickly a fire can spread. Look at the timeline on the video counter. This is the fire at Bradford football club and contains some disturbing images.

Classes of Fire:

- ① **Class A** Solid fuel fires from carbonaceous material (paper, cloth, wood, rubber).
- ② **Class B** Flammable liquids or liquefiable solids (oil, fat, paint, fuel) sub-divided into:
 - ▶ B1 liquids soluble in water, such as methanol.
 - ▶ B2 liquids not soluble in water, such as petrol and oil.
- ③ **Class C** Flammable gases or liquefied gasses (propane, butane, acetylene).
- ④ **Class D** Combustible metals (magnesium, sodium, phosphorus).
- ⑤ **Class F** High temperature cooking oils and fats.



RESPONSIBLE PERSON

The responsible person is usually the restoration manager / director, or a volunteer appointed by them. They must:

- 1 Ensure a suitable and sufficient fire risk assessment is carried out, kept up to date and communicated to all those on site, including visitors.
- 2 Put in place and maintain fire safety arrangements that are appropriate to the size of the restoration project and nature of activities being carried out. This includes safe storage and transport of flammable materials, maintenance of fire safety equipment, hot-works permits monitoring and inspection arrangements.
- 3 Ensure general fire precautions are taken to ensure the safety of volunteers and other relevant persons, such as others attending site and neighbours.
- 4 Plan for an emergency, including producing a fire safety and evacuation plan and liaison with the emergency services.
- 5 Provide volunteers with fire safety information, instruction and training.

A fire safety coordinator and/or fire warden could be appointed to help the responsible person. They should be trained to their role.

Their duties would include:

- 1 Assisting in the implementation of the fire safety and evacuation plan.
- 2 Conducting weekly inspections and keeping a record of all checks, inspections and fire drills.
- 3 Ensuring hot works have the appropriate permit and that it is being followed.
- 4 Liaison with fire and rescue services.
- 5 Assisting in fire evacuation and making sure everybody is accounted for.

FIRE RISK ASSESSMENT

The responsible person must make sure the fire risk assessment is carried out. They can delegate the assessment to a competent person to do it on their behalf.

The fire risk assessment will identify the risk that a fire could start and harm people and those around the site. Communicate the findings of the fire risk assessment to volunteers so they know what to do in the event of a fire.

The procedure is the same as for any risk assessment:

- 1 Identify the hazards, consider how a fire could start and what could burn.
- 2 Identify the people at risk, including volunteers, visitors and members of the public. Particular arrangements will be needed for those with disabilities.
- 3 Evaluate the risks and plan how to remove or reduce them and how to protect people from any residual risks.
- 4 Record the risks and actions, develop a fire safety and evacuation plan.
- 5 Review the fire risk assessment regularly to ensure it is kept up to date.

FIRE SAFETY & EVACUATION PLAN

The fire safety and evacuation plan will be based on the findings of the fire risk assessment and should be reviewed regularly to ensure it is up to date.

The plan should include:

- ① Who has responsibility for fire safety.
- ② Arrangements for recording fire safety training.
- ③ Details of site fire precautions:
 - ▶ Fire detection and alarm systems.
 - ▶ Temporary emergency lighting.
 - ▶ Fire extinguishers and fire points.
 - ▶ Fire escape arrangements and communications.
 - ▶ Procedures for calling the fire and rescue services.
- ④ Fire brigade access arrangements.
- ⑤ Requirements for fire drills and training.
- ⑥ Hot work permit regime.
- ⑦ Restrictions on smoking on site.
- ⑧ Security measures needed to prevent arson.
- ⑨ Storage and waste control of flammable materials.
- ⑩ Maintenance of temporary electrical installations.
- ⑪ Arrangements for plant and vehicles, including storage of fuel.
- ⑫ Measures to prevent the spread of fire to adjoining buildings.

Fire action

1. Operate the nearest fire alarm.
2. **Operations Manager** must call 999.
3. Only tackle the fire using the correct extinguishers and without taking risks.

When the fire alarm sounds:

1. Leave building by **Nearest** exit.
2. Make sure all doors are closed.
3. Go to the fire assembly point at:

Car Park 7

COMMON SOURCES OF FIRE RISK

HOT WORK

This is any activity or process that generates flame, spark or heat such as,

- ① Welding.
- ② Flame cutting.
- ③ Heat-stripping of paint.
- ④ Grinding.
- ⑤ Use of disc cutters.

A hot work permit is required to ensure work is carried out in a safe manner unless the fire risk is considered to be low, such as when water is used with a disc cutter. A link to a checklist and sample permit can be found in useful resources on p.15.

Precautions should be taken when carrying out hot work that heat is not transferred to other combustible materials. Sparks are a particular risk of heat transfer. Hot work should cease at least one hour before the site is vacated and the area monitored for signs of fire.

FLAMMABLE LIQUIDS AND GASES

Release of liquefied petroleum gas (LPG), such as propane or butane in a concentration in excess of 2% can result in a fire, or if confined, an explosion. A leak could be detected by the smell or the noise of gas escaping. If a leak is detected the supply should be switched off and the area ventilated.



When not in use LPG should only be stored in purpose-built ventilated cages with sufficient shelter to prevent cylinders being exposed to extremes of weather and should never be stored below ground in cellars or basements, unventilated boxes or site accommodation. Cylinders should be stored in an upright position.

Precautions for using LPG are:

- ① Minimise the amount of LPG being stored on site.
- ② Check cylinder and associated equipment before use and don't use if damage is found. Report the damage to the site leader.
- ③ Turn off valves before disconnecting any equipment.
- ④ Use soapy water to check connections and identify any leaks.

If LPG is used in an enclosed area a risk assessment must be undertaken and adequate ventilation must be provided. Remove cylinders from the area overnight. LPG cylinders must not be taken into confined spaces.

FLAMMABLE AND EXPLOSIVE SUBSTANCES

Some adhesives, solvents and paint are highly flammable and require special storage facilities:

- 1 Where site conditions allow, in a purpose-built, secure, external compound.
- 2 In a metal lockable cabinet fitted with signage such as 'highly flammable', 'no smoking', 'no naked flames'.
- 3 If materials are stored inside a building, ideally it would be in a fireproof storeroom with a fire detection and suppression system.

The same conditions apply to the storage of fuel (diesel or petrol) in drums or fuel cans. If stored in bulk containers, any outlet must be fitted with a valve or nozzle that closes automatically when not in use and the containers should be kept within a bund. Dispensing of fuels into vehicles or plant when the engine is hot can be a cause of fires.

MATERIAL STORAGE

Many construction materials are combustible and should not be exposed to a source of ignition. Ideally combustible materials should be stored outside any building in a lockable compound or storage container.

STORAGE OF WASTE

Rubbish and waste are generated on restoration sites and poor housekeeping can increase the fire risk.

- 1 Encourage regular clearing and segregation of waste to control the risk.
- 2 Waste skips should be placed a minimum of 3 metres from the location of work and not obstruct escape routes.
- 3 Consider making a site rule that all rubbish is cleared to the waste skip daily.
- 4 Don't allow rubbish to accumulate on access routes and fire escape routes.

ELECTRICAL INSTALLATIONS

This should be designed, installed, inspected and maintained by a qualified electrician. Do not allow unauthorised alteration to the distribution system.

Halogen light fittings can become very hot and cause material near them to ignite. Hand tools and other electrical equipment should be tested regularly to confirm that there are no defects likely to make them a fire risk.

Overloading of electrical circuits or sockets in site accommodation is a possible cause of fire.

BONFIRES

An exemption certificate from the Environment Agency (D7) and permission from the local authority is required. They should be lit in a designated area and attended at all times. Weather conditions need to be taken into account so that burning fragments do not pose a fire risk to adjoining property or combustible materials. Bonfires should be extinguished at least one hour before the end of the working day.

PLANT AND EQUIPMENT OPERATIONS

These will generate heat while in operation and can be a fire hazard when being refuelled.

PROTECTION OF FINISHED SURFACES

This often uses combustible material, such as paint, and can cause fires to spread.

SCAFFOLDING SHEETING

This should be flame retardant. Consider what ventilation is needed to clear fumes and smoke and how emergency services can get access if needed.

ARSON

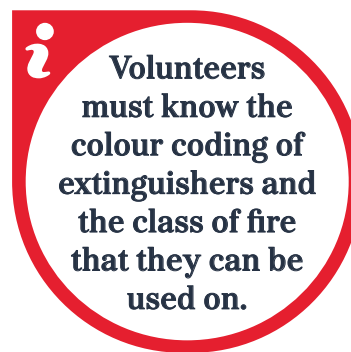
This is a risk on every site. Good housekeeping and the proper storage of materials and waste will reduce the risk. The site security measures must take into account the possibility of arson.

FIRE – FIGHTING EQUIPMENT

On restoration sites, fire-fighting equipment is likely to be portable fire extinguishers and fire blankets. Hose reels and fire hydrants may be considered on very large long term sites but are not included here.

PORTABLE FIRE EXTINGUISHERS

To be used by trained volunteers to aid escape and minimise loss and damage as the result of a fire. Fire extinguishers will not necessarily be sufficient to extinguish a fire completely. There should be sufficient number of extinguishers of the right type for the activities being carried out. They should be clearly located and using a ‘fire point’ sign which is clearly visible. Mechanically propelled plant should carry an appropriate extinguisher.



Volunteers must know the colour coding of extinguishers and the class of fire that they can be used on.

COLOUR CODING OF FIRE EXTINGUISHERS

Extinguishing medium	Water: for wood, textile and solid material fires	Foam: for liquid fires (oil and fuel)	Powder: for liquid and electrical fires Specialist dry powder: for metal fires	Carbon dioxide: for wood, paper, textiles, liquid and electrical fires	Wet chemical: for wood, paper, textile, cooking oil and solid material fires
Colour of panel	Red 	Cream 	Blue 	Black 	Yellow 
Where not to use	Do not use on liquid, electrical or metal fires	Do not use on electrical or metal fires	Note: check for M28 or L2 text printed on extinguisher to confirm that it is suitable for metal fires	Do not use on metal fires	Do not use on liquid, gas or electrical fires

Extinguishers should be regularly maintained, inspected monthly and tested once a year by a competent person.

The use of a carbon dioxide extinguisher in an enclosed space could deplete the oxygen in the air. The user should leave the area immediately and allow the area to ventilate before re-entry.

FIRE BLANKETS

To be used to deal with small contained fires, such as tea-making facilities, frying pans. Before using a fire blanket make sure the electricity or gas supply is switched off if possible. The blanket should be wrapped around the hands and placed over the fire. The blanket should be left in place until the container has cooled down.



FIRE ALARM SYSTEMS

It is essential that a fire alarm is raised quickly so that the people can evacuate to a place of safety. The type of alarm should take account of the activities that are being carried out on the site, in particular noise levels and whether an audible alarm will be heard. The alarm system may need to be modified as the site condition change.

FIRE DETECTION SYSTEMS

On a restoration site, fires will usually be detected by sight or smell, with the alarm then being raised. On a large, high risk site, an installed fire detection system may be required.

FIRE ACTION NOTICES

Fire action notices should be displayed clearly around the site, including in any site accommodation and should include:

- ① Action to take in the event of a fire.
- ② Instructions for calling the fire and rescue service.
- ③ The location of the fire assembly point.

Volunteers attending site should be briefed on the site emergency procedure in the site induction and by toolbox talks.

FIRE DRILLS

Fire drills will test the emergency procedures and should be carried out every six months. A record should be kept of when fire drills have been conducted.

One of the purposes of the fire drill is to test the emergency procedure and identify if there are problems. The emergency procedure should then be reviewed and revised if necessary.

MEANS OF ESCAPE

Escape routes provide a means to get to a place of safety and should be provided for every part of the site. Ideally there should be two means of escape available from every place on a site, in case one becomes blocked. The use of escape routes needs to take into account mobility of the volunteers, whether there is a need to climb ladders, how many people can move at one time.

When planning escape routes the following should be considered:

- 1 Dead end travel distance.
- 2 Alternative escape routes should be in opposite directions.
- 3 A semi-open structure has many openings that would allow the smoke and heat to disperse.

- 4 Level of hazard in the area:
 - ▶ Low hazard areas have very little flammable material and low risk of fire occurring.
 - ▶ Medium hazard areas (normal) have materials that are flammable and the fire is likely to initially be localised.
 - ▶ High hazard areas have significant quantities of flammable material and a fire in this area will spread rapidly.



The escape routes are likely to change during construction and will need to be reviewed and volunteers informed/trained on changes.

THE CITB RECOMMEND THE TRAVEL DISTANCES FOR THE LEVELS OF HAZARD IN AN AREA FOR ENCLOSED AND SEMI-ENCLOSED STRUCTURES.

Maximum travel distances from the fire to the safe area			
	Low level hazard	Medium level hazard	High level hazard
Enclosed structure			
Alternative	60m	45m	25m
Dead end	18m	18m	12m
Semi-open structure			
Alternative	200m	100m	60m
Dead end	25m	18m	12m



TEMPORARY SITE BUILDINGS

Temporary accommodation is often made of timber and other combustible materials.

A fire risk assessment for the temporary site buildings should address all the above issues, including:

- ① Locate in the open air and separate from construction work and storage compounds, ideally by at least six metres.
- ② Consider the use of smoke alarms to warn of fire.
- ③ Means of escape, with the priority being to get people out of the building.
- ④ Fire-fighting equipment, with the type and number depending on the use of the building.
- ⑤ Emergency lighting, if the building is to be used outside daylight hours.
- ⑥ Heaters and cooking appliances should be suitable and assessed for fire risk.
- ⑦ Furniture and fittings should be kept to a minimum and assessed for fire risk.



EMERGENCY LIGHTING & SIGNS

Emergency lighting may be required if the escape routes need to be seen in the dark (indoors or outside daylight hours). They must be powered separately from the site power supply, for example by battery.

Emergency signs should comply with the Health and Safety (safety signs and signals) Regulations and be illuminated in poor light.



USEFUL RESOURCES:

The Construction (Design and Management) Regulations 2015

The Regulatory Reform (Fire Safety) Order 2005

HSE Guidance, Fire Safety in Construction, HSG 168

Bradford Fire Caution (you may find some of the images disturbing)

Environment Agency D7 Exemption

CITB forms and check lists

GC02 Fire safety check list

GC03 Fire risk assessment

GC04 Fire safety action plan

GC05 Fire evacuation and escape checklist

GC06 Hot works checklist

GC07 Hot works permit

Fire extinguisher training

Sign up to read the full Practical Restoration Handbook and supporting resources here:
waterways.org.uk/practicalrestorationhandbook



INTRODUCTION: ELECTRICAL SAFETY

Your restoration project may have a small demand for electrical power, such as the occasional use of a small generator to power the mixer. Or you may have a high demand that requires a connection to the electricity mains or the use of a large generator. This guidance note describes the safety issues associated with the use of electricity. In addition you should make your volunteers aware of the hazards associated with electricity during the site induction.

Electricity cannot be seen, felt, smelt or heard and may only become apparent when somebody touches it.

There is a risk of electrocution from:

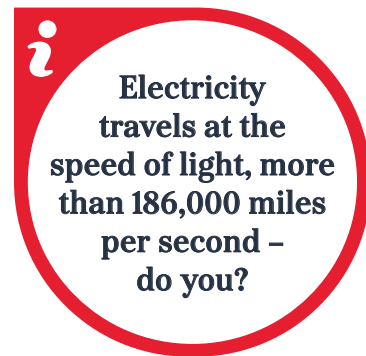
- 1 Contact or arcing (electric spark travelling across an air gap when you get too close) with live parts of an electrical distribution system.
- 2 Contact or arcing with overhead power lines.
- 3 Contact with underground cables.
- 4 Faulty electrical equipment, including hand tools.

Refurbishment of buildings presents a high risk and accidents can occur where the exact location of cables is unknown or not knowing whether a cable is live.

In addition to electrocution faulty equipment may create heat or sparks leading to ignition of combustible material.

An electrical safety poster should be displayed and should show basic first-aid for treating somebody with electric shock.

Work on or near to live, exposed conductors must be carried out by competent persons and a permit to work system must be in place.



LEGISLATIVE REQUIREMENTS

In the main Electricity at Work Regulations (1989) are technical and are not of general interest providing competent electrical contractors are employed to carry out electrical work.

The key general points are:

- ① Working on or near live electrical parts can only be carried out when:
 - ▶ It is unreasonable to make the electrical parts dead.
 - ▶ It is reasonable for the volunteer to be at work near electrical parts.
 - ▶ Suitable precautions have been made to prevent injury.
- ② Electrical equipment that could be exposed to hostile environments, such as wet muddy sites, or mechanical damage should be constructed or protected to avoid danger.
- ③ Electrical wiring that could result in personal danger is insulated, protected or positioned out of harm's way.
- ④ A suitable means must be provided for:
 - ▶ Cutting off the supply to electrical equipment.
 - ▶ Enabling the supply to be isolated.
 - ▶ Identifying all electrical circuits.



Anyone coming into contact with live electrical wiring must be fully trained and competent in how to protect themselves and others.

The **Management of Health and Safety at Work Regulations (1999)** require that a suitable and sufficient risk assessment is carried out and control measures are put in place to eliminate or reduce the risk of anyone being harmed by contact with electricity.

The Provision and Use of Work Equipment Regulations (1992) (PUWER) applies to electrical equipment and hand tools and require that electrical hand tools and equipment:

- ① Are suitable for their intended purpose.
- ② Are well maintained and inspected.
- ③ Are fitted with suitable controls.
- ④ Are fitted with guards.
- ⑤ Can be isolated from the supply.
- ⑥ Carry markings and warning notices.



The regulations require that users receive adequate information and instruction on the use of the equipment.

The Electricity at Work Regulations apply to fixed and temporary electrical distribution systems and include inspection and maintenance.

SITE ELECTRICAL SUPPLY

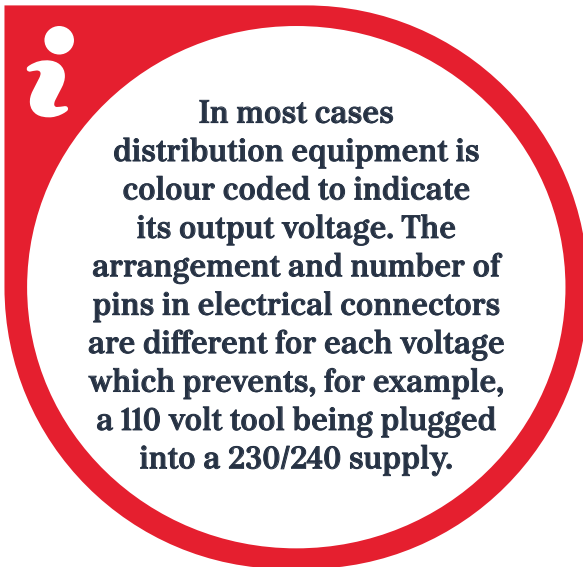
The requirement for a site electrical supply will depend on the activities taking place and the location of the site. For a large site near existing buildings or houses, connection to mains electricity company and the distribution system will need to be designed and installed by competent persons.

If the site is powered by a public supply or a large generator, there will need to be a site distribution system. The supply to electrical site tools and equipment will need to be rated at 110v. The site distribution system should be designed and installed by competent persons. Electrical distribution equipment should be obtained from a reputable supplier or hire company.

Violet	25 volts	Blue	230-240 volts
White	50 volts	Red	380-400 volts
Yellow	110 volts	Black	500-600 volts

There will be circumstances where a battery operated or 110 volt tools cannot be used. If 230/240 volt tools or equipment have to be used it is recommended to use a residual current device (RCD). The RCD detects an imbalance in the current and disconnects the supply. RCDs should have a combined inspection and test before first use.

For most restoration sites, the electrical supply will be provided by small generators to power tools and equipment. The siting of any generator should minimise nuisance caused by noise and fumes. Electrical tools and equipment used on site should have a 110volt rating or be battery operated.



SAFE WORKING PRACTICES WITH ELECTRICITY

Accidents where the presence of electricity is a factor occur equally to electricians and other workers. Most fatal accidents involve contact with overhead power cables. Other electrical accidents occur because people are working near electrical equipment that is thought to be dead but is actually live.

Work on or near live electrical circuits and equipment should only be carried out once the risk to safety has been assessed and control measures put in place. The risk assessment must be carried out by a person competent to identify the risks and devise effective control measures. People carrying out the work need to be informed of the risk and instructed in the methods of safe working and precautions to be taken.



During refurbishment work in buildings there are particular risks if the electrical system has not been isolated. The electrical system may be required to power tools, equipment or lighting, but tools, plugs and cables designed for DIY or domestic use are not suitable for site conditions. Battery powered or 110 volt equipment should be used.

It is essential that hidden electrical wiring is located before drilling or cutting into surfaces. A suitable cable detector can be used, but be aware that some cable detectors will not find a wire carrying a small or no current. Use a visual inspection to try to locate cable routes and remember to check both sides of walls.

Electrical tools and equipment should be selected that is safe and suitable for the intended use and the environment it is used in.

The following practices should be followed:

- ① Portable electrical equipment should be electrical safety tested (portable appliance testing or PAT) at appropriate intervals to suit the use and environment by a competent person.
- ② Protect light fittings and other easily damaged equipment.
- ③ Consider alternative air, hydraulic or hand tools and equipment.
- ④ Check the equipment for damage before use and report any damage to the site leader.
- ⑤ Do not carry power tools by their cable.
- ⑥ Replace any damaged cable or do not use the tool.
- ⑦ Use a power supply close to the work area to avoid excessive trailing cables.
- ⑧ Do not allow trailing cables to be left on access routes.
- ⑨ Use lower voltage or battery powered tools.
- ⑩ Use a RCD where the voltage cannot be reduced.
- ⑪ Use “intrinsically safe” electrical equipment in potentially flammable or explosive atmospheres.

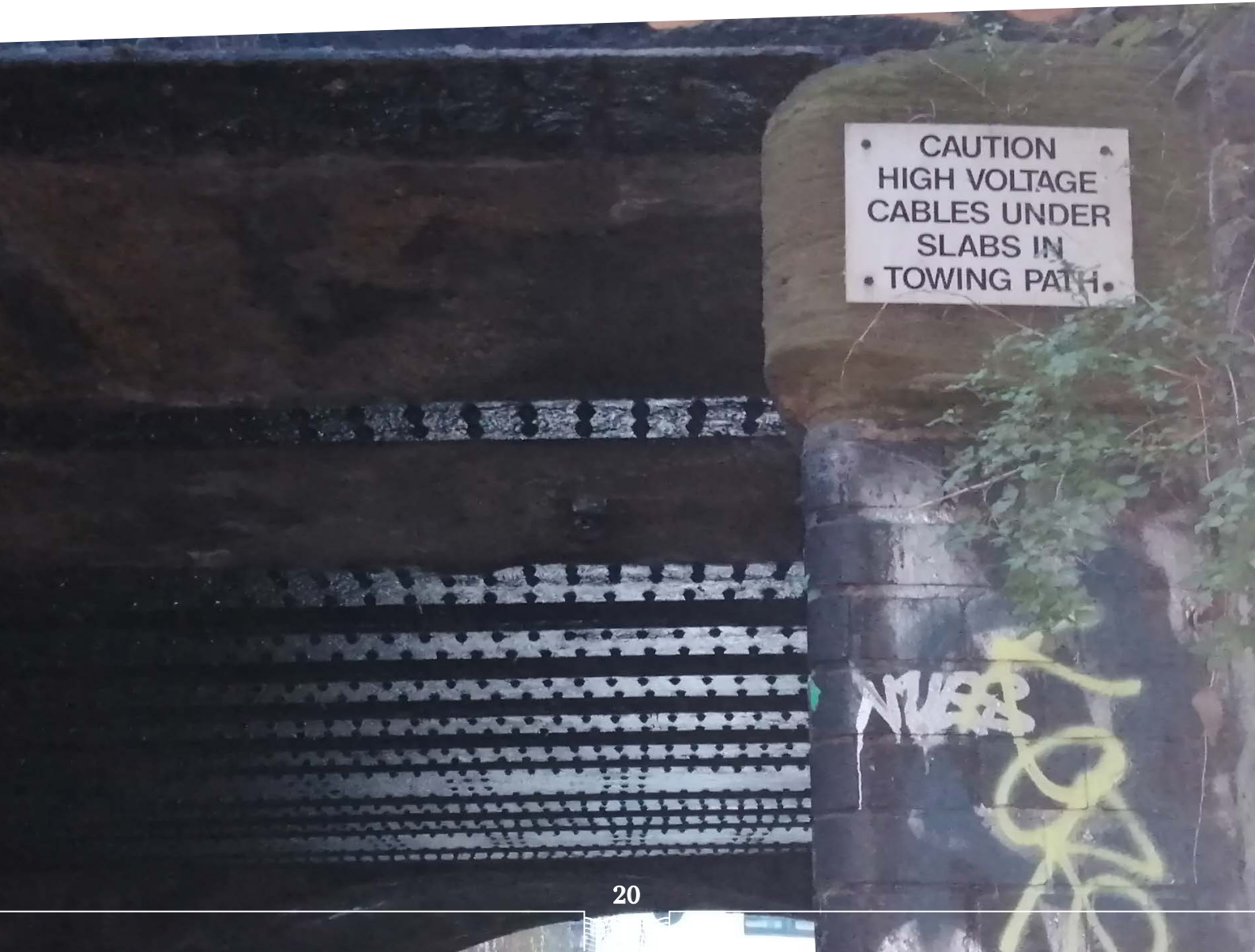
PERMIT TO WORK

A permit to work system is essential when carrying out work on live electrical supplies, cables and equipment and needs tight control to ensure work is done safely and to an appropriate standard.

Work on live electrical apparatus is beyond the scope of most restoration groups and should be carried out by competent contractors who will implement a permit to work system. It is the restoration group's responsibility to make sure the permit to work system is in place and managed adequately.

MONITORING CONTRACTORS

Electrical and other tradesmen may be required to work on your site. The person in control of the site, principal contractor, will need to inspect the method statements and risk assessments and make sure the contractors follow them. There may be a requirement to coordinate the work of the various tradesmen and pass control of parts of the site over to them.



UNDERGROUND SERVICES

Before carrying out any excavation, check the ground for any electric cables using a CAT (cable avoidance tool) detector and genny. They should be used together to provide a full picture. Make sure that whoever uses the equipment is competent to use it.

On the power frequency a CAT will find most electricity cables whilst power is flowing through them unless the current is small beyond the detection capacity. The radio frequency can detect electricity cables not picked up on the power frequency, but can have geographical limitations and will detect other metal objects. Use the transmitter and receiver method to locate services when there is no current in the services. The genny (generator) has to be attached to the cable and will provide a signal for the CAT to track.

Where underground cables are known to be on a site from utilities plans, but have not been detected by CAT and genny, a hand dug trial trench can be used to accurately locate the services. Any services encountered must be identified and the utilities should be contacted to identify their apparatus. Never assume that a cable is dead, always treat it as live until it has been confirmed otherwise. The location of any services encountered must be provided to the client for inclusion in the health and safety file.

When excavating near any electrical cable do not use power tools or excavators within 500mm of a cable. Hand digging should be undertaken using insulated tools and sharp tools, such as picks or forks should not be used. Power tools can be used to break paved surfaces, but be careful not to over-penetrate because the cable may be located immediately below the paving.



Once the cable routes have been identified, mark them with paint, tape or markers. Do not use metal spikes as they could penetrate a cable. Don't forget that the exact position will not be known until the underground cable has been exposed.



OVERHEAD SERVICES

Location of overhead services is sometimes missed because of weather conditions or because people don't look up. Work may only be carried out in close proximity to live overhead power lines when there is no alternative and the risks are acceptable and can be properly controlled. Incidents occur when activities are not properly planned and there is accidental contact or a piece of equipment gets too close and the electricity is conducted to earth.

Electricity supplies above 33,000volts are usually routed overhead. There is a minimum height above ground for overhead power lines according to the voltage they carry:

- ① 400 kV – 7.3m.
- ② 275 kV – 7.0m.
- ③ 132 kV – 6.7m.
- ④ 33 kV, low voltage – 5.2m, except for roads where the minimum is 5.8m.

Where work cannot be avoided the local electricity company or distribution network operator (DNO) must be contacted before any work is started. A safe system of work must be planned and implemented. Other people, such as Local Authorities, National Grid or other electricity companies may need to be contacted.

Where work is carried out near, but not under, overhead lines a safety zone needs to be established and should extend at least 6m horizontally from the nearest apparatus. If cranes or other plant is operating in the area a high level warning should also be erected. The barriers can be erected from concrete filled steel drums painted red and white and must be visible at night. The safety zone may need to be extended if any moving parts, such as excavator arms, could encroach the zone. The electricity supplier will give specific advice on the position of safety zones.

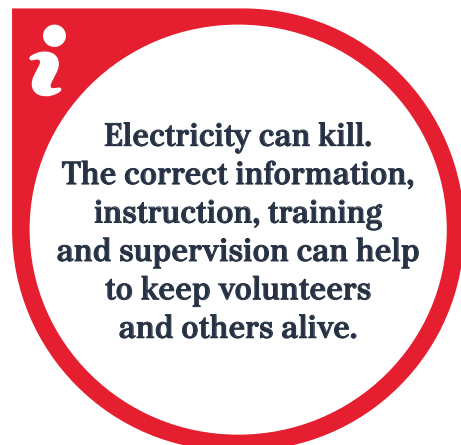
Where plant has to travel underneath an overhead line the route must be adequately defined by fencing and goalposts erected at each end. Warning notices need to be displayed at each end on or near the goal posts. The notices and cross bars need to be illuminated at night and in poor weather. The fences and goalposts need to be maintained.

When working under power lines an exclusion zone needs to be set up. The minimum extent of these zones varies according to the voltage carried:

- ① 1m from low-voltage lines.
- ② 3m from 11kV and 33kV lines.
- ③ 6m from 132 kV lines.
- ④ 7m from 275 kV and 400 kV lines.

The owner of the overhead line should be consulted about line voltage and the use of exclusion zones.

Work under overhead lines must be supervised by someone familiar with the risks and may be a representative of the owner. Volunteers must understand the risk and be provided with instructions about the risk prevention measures. Work should not be carried out during darkness or in conditions of poor visibility.



DEALING WITH ELECTRIC SHOCK

If the casualty is in contact with a potentially live source of electricity, switch off the power supply if possible and shout for help. Do not touch the casualty with bare hands, but move them away from the electrical source using non-conductive material, such as a wooden broom handle. Seek prompt help from a first-aider and call the emergency services to get qualified medical help.



USEFUL RESOURCES:

Management of Health and Safety at Work Regulations

Provision and Use of Work Equipment Regulations (PUWER)

Electricity at Work Regulations

HSE Guidance on Electricity at Work Regulations

HSE Electricity at Work, safe practices, HSG85

HSE Maintaining Portable Electrical Equipment, HSG107

HSE Electrical Safety and You

Sign up to read the full Practical Restoration Handbook and supporting resources here:
waterways.org.uk/practicalrestorationhandbook





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