**Vol. No. 14 Issue No. 17** *Fortnightly, Free soft copy* **1st September 2023**

# Occupational Health and Safety in Construction Industry (Continued)

## Electricity

Electrical equipment is used on virtually every site. Everyone is familiar with it, but unlike most other hazards, which can be seen, felt or heard, there is no advance warning of danger from electricity, and **electricity can kill**.

Electrical systems and equipment must be properly selected, installed, used and maintained. Hazards arise through faulty installations, lack of maintenance and abuse of equipment.

Accidents happen because people are working on or close to equipment which is either:

- assumed to be dead, but is in fact live; or
- known to be live, but workers have not received adequate training or adequate precautions have not been taken.

It is essential that the electricity power supply requirements are established before any work takes place. Arrangements for the electricity supply should be completed with the local electricity supplier and the supply system installed.

Electrical equipment used on building sites (particularly power tools and other portable equipment and their leads) faces harsh conditions and rough use. It is likely to be damaged and therefore become dangerous. Modern double-insulated tools are well protected, but their leads are still vulnerable to damage and should be regularly checked.

Where possible, eliminate risks. Cordless tools or tools which operate from a 110V supply system, which is centre-tapped to earth so that the maximum voltage to earth should not exceed 55V, will effectively eliminate the risk of death and greatly reduce injury in the event of an electrical accident. For other purposes such as lighting, particularly in confined and wet locations, still lower voltages can be used and are even safer.

If mains voltage has to be used, the risk of injury is high if equipment, tools, leads etc are damaged, or there is a fault. Residual current devices (RCDs or trip devices as they are sometimes called) with a rated tripping current not greater than 30 mA with no time delay will be needed to ensure that the current is promptly cut off if contact is made with any live part.

RCDs must be installed and treated with great care if they are to save life in an accident. They have to be kept free of moisture and dirt and protected against vibration and mechanical damage. They need to be properly installed and enclosed, including sealing of all cable entries. They should be checked daily by operating the test button. If mains voltage is to be used, make sure that tools can only be connected to sockets protected by RCDs. By installing an RCD at the start of the work, immediate protection can be provided. Even so, RCDs cannot give the assurance of safety that cordless equipment or a reduced low-voltage (such as 110V) system provides.

Mains equipment is more appropriate to dry indoor sites where damage from heavy or sharp materials is unlikely. Where mains leads to sockets may be damaged, they should be:

- positioned where they are least likely to be damaged, eg run cables at ceiling height; or
- protected inside impact-resistant conduit.

Alternatively, special abrasion-resistant or armoured flexible leads can be used.

Electrical systems should be regularly checked and maintained. Everyone using electrical equipment should know what to look out for. A visual inspection can detect about 95% of faults or damage. Before any 230V hand tool, lead or RCD is used, check that:

- no bare wires are visible;
- the cable covering is not damaged and is free from cuts and abrasions (apart from light scuffing);
- the plug is in good condition, eg the casing is not cracked, the pins are not bent and the key way is not blocked with loose material;
- there are no taped or other non-standard joints in the cable;
- the outer covering (sheath) of the cable is gripped where it enters the plug or the equipment. The coloured insulation of the internal wires should not be visible;
- the equipment outer casing is not damaged and all screws are in place;
- there are no overheating or burn marks on the plug, cable or the equipment;
- RCDs are working effectively, by pressing the ‘test’ button every day.

Workers should be instructed to report any of these faults immediately and stop using the tool or cable as soon as any damage is seen. Managers should also arrange for a formal visual inspection of 230V portable equipment on a weekly basis.

Damaged equipment should be taken out of service as soon as the damage is noticed. **Do not carry out makeshift repairs.**

Some faults, such as the loss of earth continuity due to wires breaking or coming loose within the equipment, the breakdown of insulation and internal contamination (eg dust containing metal particles may cause shorting if it gets inside the tool), will not be spotted by visual inspections. To identify these problems, a programme of testing and inspection is necessary. This testing and inspection should be carried out by someone trained to do this. As well as testing as part of the planned maintenance programme, combined inspection and testing should also be carried out:

- if there is reason to suspect the equipment may be faulty, damaged or contaminated, but this cannot be confirmed by visual inspection; and
- after any repair, modification or similar work to the equipment, which could have affected its electrical safety.

Similar checks to those recommended for 230V hand tools are appropriate for other site electrical equipment.

With lighting systems, provide protection for cabling in the same way as for tools. Protect bulbs against breakage. If breakage does occur, the exposed filaments may present a hazard. Make sure there is a system for checking bulbs to maintain electrical safety and also to keep the site well lit.

Tools and equipment should be suitable for site conditions. DIY tools and domestic plugs and cables are not designed to stand up to everyday construction work. Also observe other restrictions on use imposed by manufacturers.

If work is to be done in areas where there is a risk of flammable vapours (such as in a petrochemical works), it will be necessary to select specially designed electrical equipment to prevent it acting as a source of ignition due to sparks and overheating. Precautions should be covered in the project health and safety plan and the operator of the premises should be able to provide advice. Specialist advice may also be needed.

## Overhead power lines

Contact with overhead power lines is a regular cause of death and injury. Any work near electric distribution cables or railway power lines must be carefully planned to avoid accidental contact.

The most common operations leading to contact with overhead lines are:

- operating cranes and other lifting equipment;
- raising the body or inclined container of tipper lorries;
- operating excavators and other earth-moving equipment;
- handling long items such as scaffold tubes, metal roof sheets, ladders etc;
- using MEWPs.

Where possible all work likely to lead to contact with the overhead line should be done in an area well clear of the line itself. Where this is not feasible, either the power line must be made **dead** or suitable precautions must be taken to prevent any danger. For some jobs, it may be necessary for the electricity supplier to isolate or re-route overhead lines to enable work to proceed.

In some cases it may be possible to alter the work to eliminate the risk, eg by reducing the length of scaffold tubes, ladders or roof sheets to ensure that the line cannot be contacted accidentally.

If plant is working in the vicinity of an overhead power line, the distance between the plant and the overhead line should be **at least**:

- 15 m (plus the length of the jib) if the lines are suspended from steel towers; or
- 9 m (plus the length of the jib) if the lines are supported on wooden poles.

In cases where approach is likely, stout, distinctive barriers should be erected at ground level to prevent access (see Figure below). Where work is to take place close to overhead lines, detailed precautions should be discussed with the owner of the lines (any work next to any railway where the work is likely to encroach onto railway land should in any case be discussed with the railway operator before work begins). However, the responsibility for ensuring that precautions are adequate remains with the contractors undertaking the work, **not** with the owner of the power lines.


**Figure: Ground-level barrier for plant working near an overhead power line**

In addition to the specific precautions required when working in the vicinity of overhead power lines, you should also:

- erect high-visibility barriers at least 6 m away, to prevent inadvertent approach by other site vehicles (see Figure below);
- install clearly marked crossing points beneath the lines at a height specified by the electricity supplier;
- prohibit the storage of materials in the area between the overhead lines and the ground-level barriers.

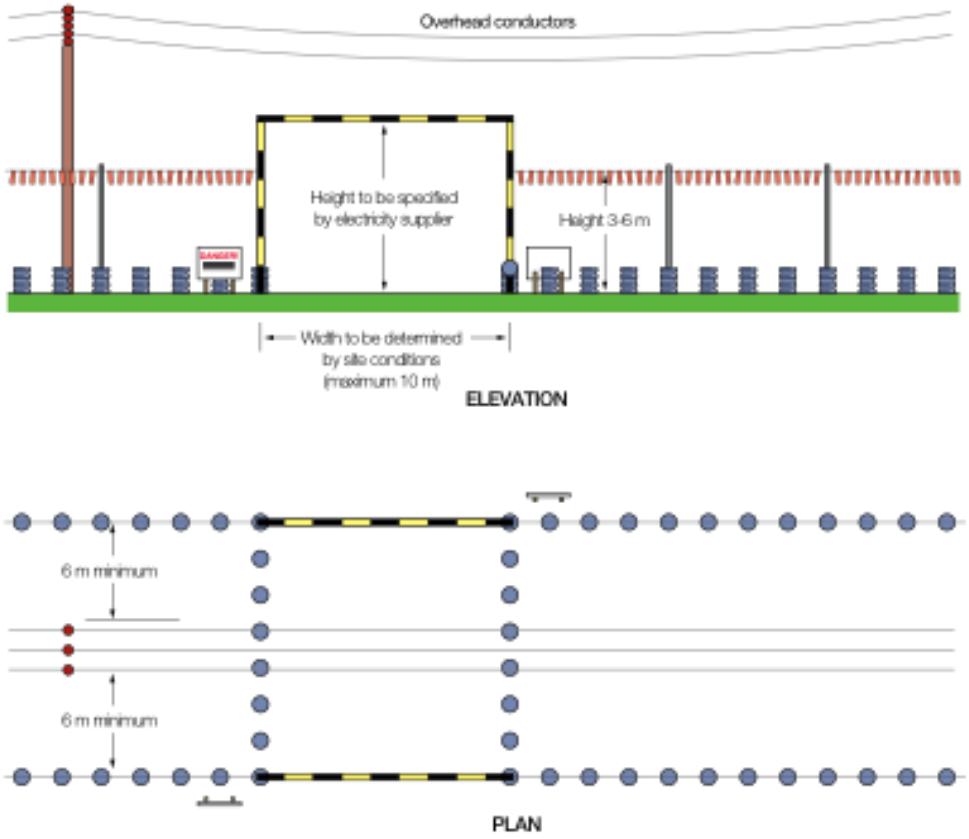


**Figure: Diagram showing normal dimensions for 'goal post' crossing points and barriers**

## Slips and trips

Something as simple as a slip or trip is the single largest cause of injuries on construction sites, leading to more than 1000 major injuries being reported each year. Most of these injuries can be easily avoided by effective management of those areas of the site where workers need access, such as corridors, footpaths, stairwells and site cabins.

The main causes of this type of accident are:

- having to walk over uneven ground, particularly when carrying unwieldy objects;
- tripping over building materials or waste which has simply been left lying around;
- tripping over trailing cables;
- slipping caused by wet surfaces or poor ground conditions;
- trips caused by small changes in level.

Although each of the problems can be dealt with quite simply, in practice it is difficult because site conditions are constantly changing. It is therefore essential that site managers exercise good control and that everybody working on site takes responsibility for ensuring that the way they do their work does not create a risk for others, e.g. due to leaving trailing cables across corridors or leaving waste materials in stairwells.

## Working in confined spaces

### What can you do to prevent accidents?

- Keep the work and storage areas tidy;
- Plan deliveries to minimize the amount of materials on site;
- Make sure corridors, stairways, footpaths and other areas used by pedestrians are kept clear of obstructions at all times;
- Have clearly designated walkways with good conditions underfoot (leveled if rutted, stoned if muddy, gritted when icy);
- Where small changes of level cannot be avoided (e.g doorways into buildings) consider the use of soundly constructed temporary ramps or some other way of providing easy and safe access;
- Have proper arrangements for the disposal of waste materials, e.g provide clearly identified areas where waste can be left for later collection. Don't forget that this is just as important for work inside buildings; you might want to consider providing wheelie bins or wheeled skips for people to put their rubbish in. Ask yourself the following questions:
  - Whose job is it to clear up the waste?
  - How often does this need to be done?
  - Are bins provided? By whom? How many? Where are they positioned?
  - Who empties the bins? Where to? How do they do this?
  - Whose job is it the make sure the waste is removed from site?
- Keep inside and outside work areas adequately lit;
- Pay particular attention to maintaining good conditions at the foot of access stairs and ladders;
- Ensure everybody on site wears footwear that provides good grip;
- Use cordless tools when possible to avoid having to manage cable runs.
- Where cables are needed for temporary lighting or mains-powered tools, run these at high level, particularly along corridors;
- If temporary coverings are used to protect finished floor surfaces, make sure these do not create a risk of slipping or tripping;
- Use mechanical plant to move materials to storage areas that are convenient to where they will be used. This will reduce the need to carry objects over poor ground;
- Make sure that steps leading to site cabins are properly constructed;

- Make sure everyone knows what they have to do to manage their own materials, waste and equipment to keep the site tidy and reduce the risk of tripping.

Not knowing the dangers of confined spaces has led to the deaths of many workers. Often those killed include not only those working in the confined space but also those who try to rescue them but who are not properly equipped to carry out the task safely.

Inadequate planning and insufficient knowledge are a major cause of accidents in confined spaces. Accidents are caused by a combination of factors arising from a lack of safety awareness, inadequate supervision and a lack of training. It is therefore essential that work in such spaces is only undertaken by skilled and trained people. If work in a confined space cannot be avoided, it will often be safer to bring in a specialist for the job.

**What is a confined space?**

A 'confined space' can be either:

- a place which is substantially, though not always entirely, enclosed; or

- a place where there is a reasonably foreseeable risk of serious injury from hazardous substances or conditions within the space or nearby.

Some confined spaces are easy to identify, such as closed tanks, vessels, ducts and sewers. Other are less obvious, such as basement rooms, toilets, building voids, vats, deep excavations and open-topped tanks. Of course a confined space may not necessarily be enclosed on all sides or may only become a confined space because of a change in the conditions inside.

**Why is a confined space dangerous?**

Air in the confined space is made unbreathable either by harmful gases and fumes or by lack of oxygen. There is not enough natural ventilation to keep the air fit to breathe. In some cases the gases may be flammable, so there may also be a fire or explosion risk.

Working space may be restricted, bringing workers into close contact with other hazards such as moving machinery, electricity or steam vents and pipes. The entrance to a confined space, eg a manhole, may make escape or rescue in an emergency more difficult.

**How does a confined space become dangerous?**

Some confined spaces are naturally dangerous, e.g. because of:

- gas build-up in sewers and in manholes and pits connected to them;

- gases leaking into trenches and pits in contaminated land such as old refuse tips and old gas works;

- rust inside tanks and vessels, which eats up the oxygen;

- liquids and slurries, which can suddenly fill the space or release gases into it when disturbed;

- chemical reaction between some soils and air causing oxygen depletion, or the action of ground water on chalk and limestone producing carbon dioxide.

Some places are made dangerous by vapours from the work done in them. Keep hazards out of confined spaces. Do not use petrol or diesel engines because exhaust gases are harmful. Paints, glues etc may give off hazardous vapours. Ensure the confined space has enough ventilation to make the air fit to breathe. Mechanical ventilation might be needed.

**How do I work safely?**

There should be a safe system of work for operations inside confined spaces. Everyone should know and follow the system. A permit-to-work system may be required.

For safe working, first try to find a way of doing the job without going into the confined space. If entry is essential:

- identify what work must be done in the confined space and the hazards involved;
- consider if the space could be altered to make it permanently safe or if the work could be changed to make entry to the dangerous area unnecessary;
- make sure workers have been trained in the dangers and precautions, including rescue procedures;
- make sure the entrance to the space is big enough to allow workers wearing all the necessary equipment to climb in and out easily;
- before entry, ventilate the space as much as possible, test the air inside the space and only enter if the test shows it is safe;
- after entry, continue to ventilate the space and test the air for toxic substances, flammable gases and oxygen deficiency as necessary;
- if there is a flammable risk, the space must be ventilated until it is safe. When selecting equipment, remember heat or sparks from electrical or other equipment could ignite flammable vapours, so air-powered tools may be required. The risk from flammable vapours is very high when work is carried out on the tanks of petrol service stations and similar sites. This is work which may be safer left to a specialist contractor;
- disturbing deposits and slurries in pipes and tanks may produce extra vapour, resulting in a greater risk, so clear deposits before entry where possible;
- if the air inside the space cannot be made fit to breathe because of a toxic risk or lack of oxygen, workers must wear breathing apparatus;
- never try to ‘sweeten’ the air in a confined space with oxygen as this can produce a fire and explosion risk;
- workers inside the confined space should wear rescue harnesses with lifelines attached, which run back to a point outside the confined space;
- someone should be outside to keep watch and to communicate with anyone inside, raise the alarm in an emergency and take charge of rescue procedures if it becomes necessary. It is essential those outside the space know what to do in an emergency. They need to know how to use breathing apparatus if they are to effect a rescue.

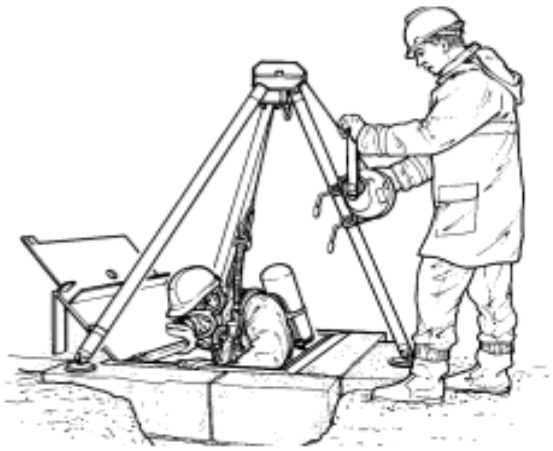

**Figure : A worker wearing full breathing apparatus is also wearing a harness and lanyard connected to a winch so that he can be hauled to the surface in an emergency without others having to enter the manhole to rescue him**

**To be continued in next issue.**

**Readers may please note that D. L. Shah Trust brings out two e-journals on a fortnightly basis. These are mailed to those persons or institutions who are desirous of receiving them: These two e-journals are:**

**1. Safety Info**
**2. Quality Info**

**If you or your friends or colleagues wish to receive these journals, you may send us an e-mail requesting for the same. There is no charge for these journals. Our e-mail address is:**

**dlshahtrust@yahoo.co.in**
**or**
**haritaneja@hotmail.com**
**or**
**dlshahtrust@gmail.com**

**You can also access these journals on our website: www.dlshahtrust.org**

**Published by : D. L. Shah Trust,**
**Room No. 16, 1st Floor, Gool Mansion,**
**Homji Street, Mumbai 400 001**
**email: dlshahtrust@yahoo.co.in**
**Ph: 022-22672041**
**Subscription: Free on request**
**(soft copy only)**

**Edited by : Hari K Taneja, Trustee,**
**D. L. Shah Trust**
**email: dlshahtrust@gmail.com**
**Phone: 022-2309 6529**
**Subscription: Free on request**
**(soft copy only)**