

Guide for Safety at Work

Electric Shock Hazard of Manual Electric Arc Welding Work



Occupational Safety and Health Branch
Labour Department

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Labour Department

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Introduction

- Beware of electric shock when carrying out manual electric arc welding (arc welding) work.
- Even though the output voltage of a manual electric arc welding transformer (welding transformer) at open circuit no-load condition is not very high, only about 60 - 80 V a.c., it could cause electric shock and should not be neglected.
- From past accident records, getting electric shock whilst carrying out arc welding was not uncommon. It may cause injuries to the welding workers and sometimes, even death.
- This booklet gives a brief outline to the electric shock hazard of arc welding work, the common causes of accident and ways to reduce the accidents. It may serve as the guidelines to the welders, supervisors, employers and safety personnel for reference to ensure the safety of welders and prevent electric shock hazard.

Causes of Electric Shock During Welding

- From the analysis of accident cases, it is revealed that the common causes of electric shock in welding work are as follows:
 - overlook the potential hazards in the working environment,
 - carelessness during welding,
 - use of unsafe welding equipment.



When carrying out arc welding work, the two output terminals of the welding transformer are connected to the electrode holder and welding workpiece respectively via welding cable and welding return cable. It is the potential difference between the welding electrode, which was connected to the electrode holder, and the welding workpiece that creates an electric arc for the welding work.

When the hands or other parts of the body of the welding worker bridge between the output terminals of the welding transformer, either directly or indirectly, leakage current may flow between the terminals via the worker and gives him an electric shock.

Apart from the output terminals, one should also beware of the input terminals of the welding transformer. The input terminals are connected to the mains supply, usually at about 220 V a.c. or 380 V a.c. Any direct or indirect contact with the energized input terminals may also cause an electric shock.

According to past accident cases, the following conditions could cause an electric shock, in particular rainy days, when the workplace is flooded or when the hands and body of the welding worker are wet:

- Replacing the welding electrode with bare hands without switching off the welding transformer.
- Accidentally touching the exposed conductor of the electrode holder, or the welding electrode which is connected to the electrode holder.
- Sitting or leaning on the welding workpiece, such as large machinery, steel structure and steel tanks, etc. which is connected with the welding return cable.
- Lying on the floor to weld the underside of workpiece.
- Staying on flooded ground to carry out welding work.



Enhanced Welding Safety to Prevent Electric Shock

- In order to prevent electric shock and to minimize the damage or injury in case such an accident does happen, the following two points should be followed:
 - a) To avoid direct contact with the live parts of welding equipment and the workpiece to prevent electric shock.
 - b) To make the overall impedance of the leakage current path as large as possible. It is to minimize the leakage current that passes through the victim's body and thus the injury in case one gets an electric shock.
- To enhance the safety of arc welding work and to prevent electric shock, the following areas should be looked into :
 - Working environment
 - Working practices
 - Welding equipment
 - Personal protective equipment

Safe Working Environment

- Do not weld in open space during raining.
- Do not stay in water or seriously flooded workplace to weld.
- Stay on insulation mat, dry wooden board or non-conductive stand if welding is carried out in damp or slightly flooded workplace.
- Take due care to avoid electric shock if welding is carried out inside confined space which is electrically conductive, e.g. steel tank or large machinery.



Safe Working Practices

- Avoid making direct contact with any exposed conductor of the electrode holder, the connected welding electrode and the exposed metal part of the workpiece with the bare hands or the body.
- Always keep the hands and the body dry.
- Do not put the welding transformer too far away from the workplace. In case of need or accident, the welding transformer can be switched off in time to disconnect the power source.
- Switch off the welding transformer when it stops welding to take breaks for rest, tea and meal. Also properly dispose of the welding rod remained on the electrode holder.
- Welding workers, supervisors and safety personnel should know clearly the location of the welding transformer, which should bear labels on its switch to indicate 'ON' and 'OFF' positions.
- To properly place the electrode holder, in particular when the welding electrode is in place to avoid accidentally touching the live parts.
- To stay on a safe working platform when carrying out welding work at high level. Otherwise, even a slight electric shock may cause the welding worker to lose balance and fall down.



Use of Safe Welding Equipment

- Use proper and safe welding equipment.
- Properly earth the metal casing of welding transformer by connecting separate earth wire to the power source.
- **Attention:** The residual current device (RCD) installed at the power source, if there is any, can only give protection against electric shock that occurs at the input side of the welding transformer. If the electric shock occurs at the output side of the transformer, e.g. the output terminals, the welding cables, electrode holder, welding electrode and workpiece etc., the RCD will not function automatically to cut off the power supply.
- Properly place and protect the welding cables carefully to avoid any accidental damage of the cable insulation layer and exposure of the inner copper conductor.
- Use proper cable connectors to extend the welding cables.
- Install an automatic voltage regulator in the welding transformer to reduce the open circuit no-load voltage of the transformer and thus the risk of electric shock.
- Always check the welding equipment, in particular the welding cables and the electrode holder and to repair or replace them immediately in case of damage.
- Engage a competent person to thoroughly inspect and test the welding equipment regularly to ensure safety.



Use of Suitable Personal Protective Equipment

- Wear dry welding gloves.
- Wear good insulating shoes or boots.
- Wear protective clothing. Avoid naked body.



Summary

- There is potential hazard of electric shock in the arc welding process. The welding workers should take due care to prevent getting an electric shock.
- Based on the past cases, electric shock accidents usually occur at the output side of welding transformer where the residual current device installed at the power source could not offer protection.
- To avoid electric shock during electric arc welding, there are a number of points to note. They can be summarised into the following four main principles:
 - a) Always keep the welding workers' body, the welding equipment, the welding workpiece and the working environment dry.
 - b) Avoid making contact with exposed metal parts of the welding circuit, including the welding electrode, electrode holder, welding workpiece, cable terminals of welding transformer, etc.
 - c) Wear suitable personal protective clothing.
 - d) Always check and maintain the welding equipment.



Enquiries

If you wish to enquire about this guidebook or require advice on occupational safety and health, please contact the Occupational Safety and Health Branch of the Labour Department through :

Telephone : 2559 2297 (auto-recording after office hour)

Fax : 2915 1410

E-mail : enquiry@labour.gov.hk

Information on the services offered by the Labour Department and on major labour legislation can also be found by visiting our Home Page at <http://www.labour.gov.hk>.

You can also obtain information on the various services provided by the Occupational Safety and Health Council through telephone hotline at 2739 9000.

Complaints

If you have any complaint about unsafe workplaces and practices, please call the Labour Department's occupational safety and health complaint hotline at 2542 2172. All complaints will be treated in the strictest confidence.





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