HSE JOINING

HEALTH, SAFETY AND ENVIRONMENT TRAINING FOR JOINING

HAZARDS OF ELECTRICITY

IO2 – EDUCATIONAL MATERIALS

ERASMUS + 2016-1-BE02-KA202-017322

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Electricity Hazards

Electricity might cause death

HSE Health & Safety Executive

~ 1000 work accidents/year due to electricity

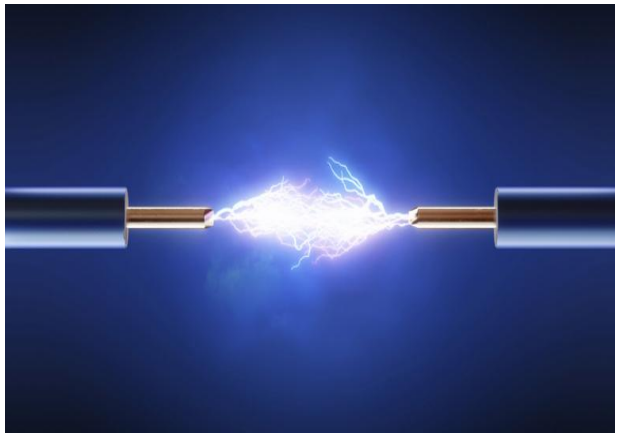

Figure 1 - Electricity
Source: Amazon.com

Electrical circuits include:

- Power sources;
- Equipment itself;
- Inter connecting cables;

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Electricity Hazards

The harmful effects on the human body can be divided into:

- Burns

Superficial burns

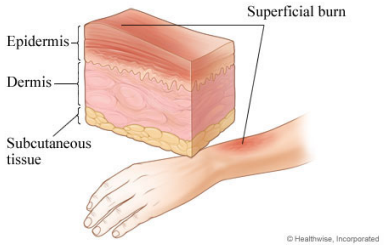

Figure 2 – Superficial burn
Source: travm.info

Deep skin tissue

Figure 3 – Deep skin tissue
Source: drfredericofernandes.com.br/traumas-e-queimaduras/

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Electricity Hazards

The harmful effects on the human body can be divided into:

- Electrical shocks

Figure 4 – Electrical shocks
Source: thesafetybloke.com/10-tips-to-avoid-electric-shocks/

- This occurrence also comprises severe effects in a person's body such as:
  - Muscular contraction
  - Asphyxia
  - Respiratory Arrest
  - Ventricular Fibrillation

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Electricity Hazards – Preventive Measures

Some important **preventive measures** that should take place when welding with arc processes:

- Welding equipment should always comply to the appropriate national or international standard;

Figure 5 - ISO logo
Source: iso.org

- The installation of any electric apparatus should always be carried out by qualified personnel and connected according to manufacturer recommendations;

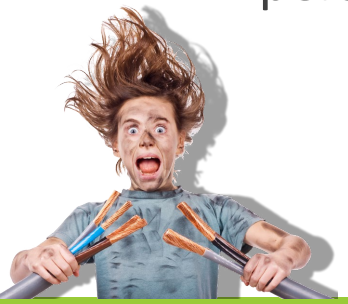

Figure 6 – Electric hazard sign
Source: SafetySign.com

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Electricity Hazards – Preventive Measures

Some important **preventive measures** that should take place when welding with arc processes:

- All the electrical connectors and leads should be clean, undamaged and always correctly rated for the current required;
- Always use welding equipment with undamaged insulations (either cables, plugs, clamps or electrode holders);
- Earth all the components prevents conductive from becoming “live” during faults.

Figure 7- Electrical shock
Source: ohdcortland.com/assets/destiny1200.pdf

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Electricity Hazards - How to proceed

Turn off the electric power

Use non-conducting material to free the victim from contact with wires or live parts

If the victim is not breathing, call your national emergency services to ask for help

Where an automatic electronic defibrillator (AED) is available, use according to instructions

Treat an electrical burn applying cold compresses

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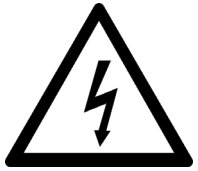
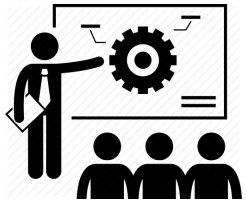
Electricity Hazards – Safety Management

There are some measures that can help in having a safe workplace for everyone:



All the precaution/danger signs should be correctly placed !

A safety plan should be published and taught to every worker.



There should be safety training on all equipment before use.

Figure 8 - Electrical hazard sign Source: kathleenhalme.com/explore/electric-clipart-electrical-hazard/

9 – Icon safety plan

10 – Training context

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Electricity Hazards – Workplace Signalization

Some examples of workplace signalization regarding electrical hazards are shown below:

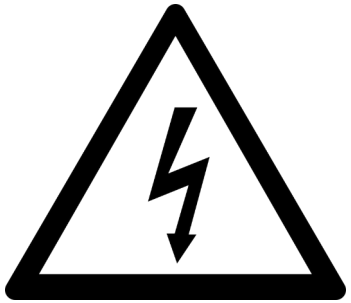

Figure 11, 12, 13 & 14 Signalization related to electrical hazards. Retrieved from https://www.panduit.com/en/products/signs-labels-identification/signs-accessories/pre-printed-write-on-safety-signs.html-

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Electricity Hazards – Workplace Signalization

Some examples of workplace signalization regarding electrical hazards are shown below:

Figure 15, 16, 17 & 18 Signalization related to electrical hazards. Retrieved from https://www.panduit.com/en/products/signs-labels-identification/signs-accessories/pre-printed-write-on-safety-signs.html-

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Electricity Hazards – Checking the workplace

The supervisor of a workshop should ensure:

- Maintenance is performed correctly;
- Operations and repair work of the equipment should be carried out in a safe way;
- All of the above should be done by qualified personnel;
- Provide necessary replacements of the equipment;
- All the equipment is installed and grounded according to national and local codes;

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Electricity Hazards – Checking the workplace

Control measures

Every worker should perform regular checks to all the equipment used and respective PPE.

Electrically live objects might cause death in extreme cases.

Checking the workplace should be implemented as an important task and performed with enough regularity.

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Electricity Hazards – Checking the workplace

Stray welding currents

These are the electrical currents that go back to the welding system by different paths than the return cable. This type of electrical currents can be considerably high when compared to the welding current.

Some older MMA equipment, commonly used in the shipbuilding and ship repair industry, has an earth return cable that is shared between several welding sets.

The current return path in these situations should be as short as possible to minimize risks.

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Electricity Hazards – Checking the workplace

Three-phase electrical supplies

When the welder is using three-phase welding circuits, the welding positions connected to different phases should be segmented by distance or partitions. This measure greatly reduces the risks of electric shock.

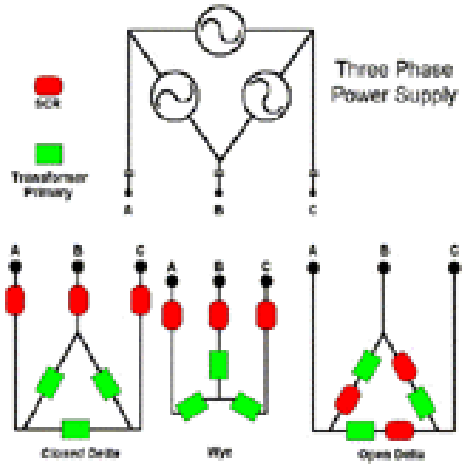

Figure 19 – Three phase power supply
Source: weldtechcorp.com

Figure 20 - Welding power source
Source: ht.jarilawelder.com

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Electricity Hazards – Use and maintenance of the equipment

All electrical equipment is prone to flaws and imperfections.

When welding with electrical equipment, additional care should be taken to prevent major accidents.

- The welder should regularly check his individual equipment.
- The workshop supervisor should frequently check the installations he is responsible for.
- Every worker, including the previously mentioned ones, should follow every standard related to personal protection equipment (PPE).

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Electricity Hazards – Use and maintenance of the equipment

Some measures that should be taken to avoid personal risks when working with electricity are listed below:

- Read all instructions, labels, and installation manuals before installing, operating, or servicing the equipment;
- Not touching live electrical parts;
- Do not work alone where there are electrically hazardous conditions;

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Electricity Hazards – Use and maintenance of the equipment

Some measures that should be taken to avoid personal risks when working with electricity are listed below:

- Do not touch an energized electrode while you are in contact with the work circuit;
- Do not wrap cables carrying electrical current around any part of your body;
- Never touch the electrode with bare hands;
- Use fully insulated electrode holders. Never dip the holder into water to cool it or lay it on conductive surfaces or the work surface;

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Electricity Hazards – Workshop Installations

A right and wrong earthing situation are depicted in the figure below. There should be no potential difference between the hand rail and the casing.

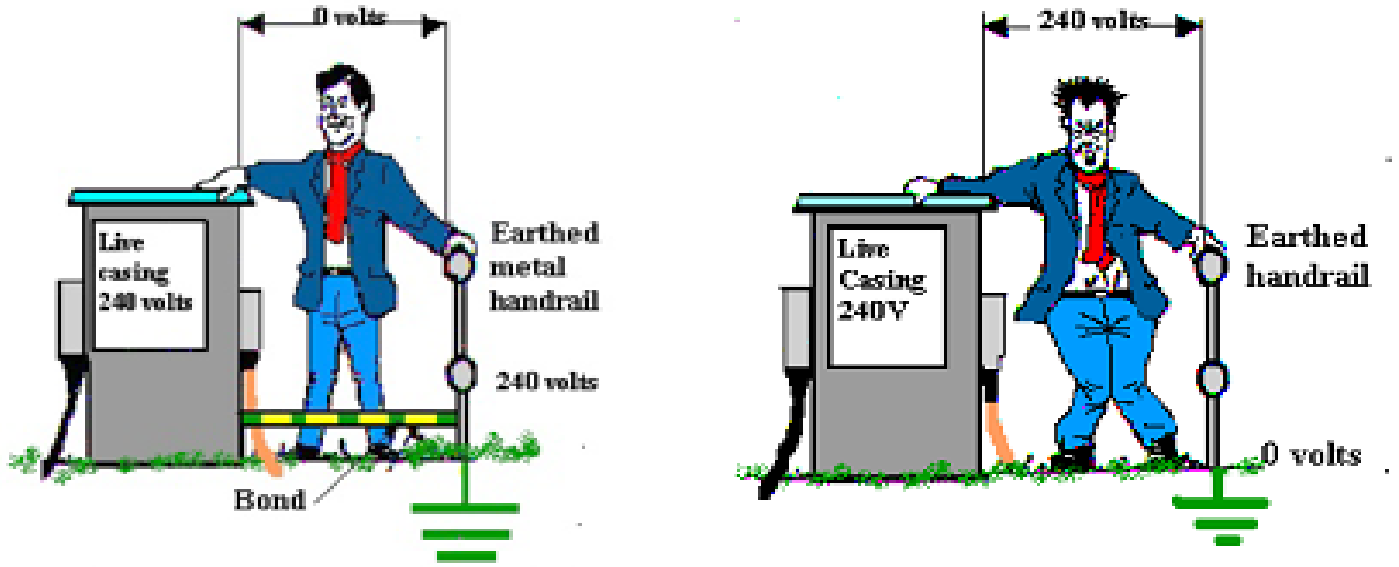

Figure 21 -Consequences in terms of potential difference when the whole circuit is connected. Retrieved from https://slideplayer.com/slide/8690671/

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Electricity Hazards – Personal Protective Equipment

Head and ear protection

- Helmet shell should insulate from electricity

Hand and Foot protection

- Always wear dry, hole-free, insulated welding gloves in good condition. They will help protect your hands electric shocks. Leather is a good insulator when maintained dry.

Body protection

- Keep clothing dry. Change it when needed (this reduces the possibility of electric shock).
- Wear leather aprons, leggings, capes and sleeves as needed for the application. Leather protects better than most materials.

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Electricity Hazards – European, national recommendations and regulations

European Recommendations:

EU legislation in the electrical sector is important to ensure Europe-wide harmonisation of a set of essential health and safety requirements for products placed on the market.

The Low Voltage Directive (LVD) 2014/35/EU ensures that electrical equipment within certain voltage limits provides a high level of protection for European citizens, and benefits fully from the Single Market.

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Electricity Hazards – European, national recommendations and regulations

European and national regulations

ISO 45001:2018 - Occupational health and safety management systems

ISO/TR 18786:2014 - Health and safety in welding - Guidelines for risk assessment of welding fabrication activities

IEC 60364-4-41:2005+AMD1:2017 CSV - Low voltage electrical installations - Part 4-41: Protection for safety - Protection against electric shock

IEC 60364-5-54:2011 - Low-voltage electrical installations - Part 5-54: Selection and erection of electrical equipment - Earthing arrangements and protective conductors

IEC 61140:2016 RLV - Protection against electric shock - Common aspects for installation and equipment

IEC TS 60479-2:2017 RLV - Effects of current on human beings and livestock - Part 2: Special aspects

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Electricity Hazards – European, national recommendations and regulations

European and national regulations

IEC 60974-1:2017 - Arc welding equipment - Part 1: Welding power sources

IEC GUIDE 116:2010 - Guidelines for safety related risk assessment and risk reduction for low voltage equipment

EN 61439 – Low voltage switchgear and control gear assemblies

EN 60422 – Monitoring and maintenance guide for mineral insulating oils in electrical equipment.

EN 50110 Parts 1 and 2 – Operation of electrical installations.

EN 60529 – Specification for degrees of protection provided by enclosures (IP code).

EN 60947 Parts 1 to 8 – Specification for low voltage switch gear and control gear

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