



AMS - Safety instructions - Electricity

LODIGE
INDUSTRIES

Advanced Measurement System

Endangered by electricity



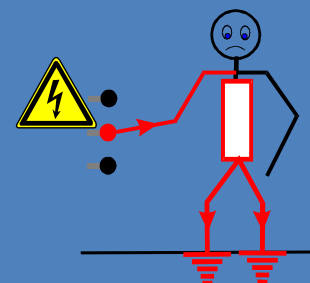
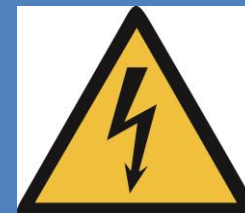
TECHNOLOGY IN MOTION





Content

1. Effect of Electric current
2. When the current flows through body?
3. Current strength and exposure time
4. Physiological effect on humans
5. The 5-safety rules of Electrical Engineering
 - Rule 1: Disconnect
 - Rule 2: Secure against re-energisation
 - Rule 3: Determine Voltage Absence
 - Rule 4: Grounding and short-circuiting
 - Rule 5: Cover or fence off nearby energised parts
6. Activating voltage after finishing work
7. Additional Safety Measures
8. Causes of Electrical Accidents
9. Avoiding Accidents
10. Warning – Please DO NOT do this
11. First Aid for Accidents with electric current





1. Effect of electric current



Exposure to electric current may cause various health issues for a person, direct or indirect i.e. fall off the ladder.

130 fatal accidents per year

Fires can be ignited by electric current, mostly caused by short circuits.

From 50V up, a deadly current can occur

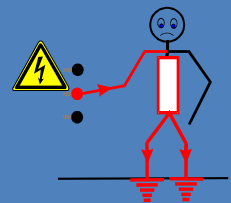
The effect of the current depends on:

- The amount of current flowing through the body (A).
- The length of time the body is in the circuit.
- The path of the current through the body.

Effects:

- Burns
- Muscle cramps, organ loss
- Cardiac ventricular fibrillation
- Heart stroke

More than half of all current accidents occur in the low voltage range (<1,000 V)





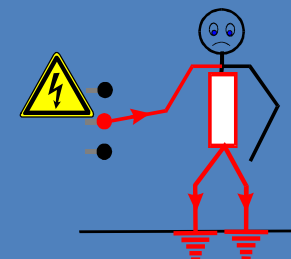
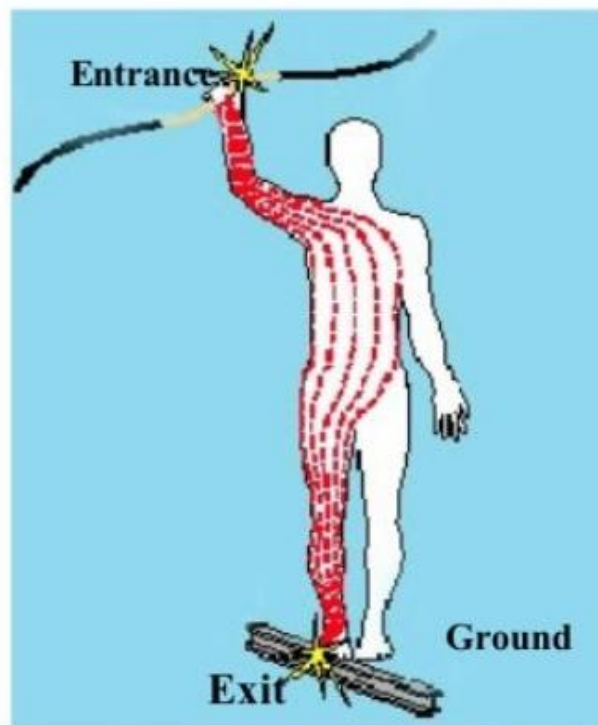
2. When the current flows through body?

Electric current flows only if the circuit is closed!

Current always flows from positive to negative potential.

Electric Shock

- Received when current passes through the body
- Severity of the shock depends on:
 - Path of current through the body
 - Amount of current flowing through the body
 - Length of time the body is in the circuit
- **LOW VOLTAGE DOES NOT MEAN LOW HAZARD**



Great resistance = Low body flow → Low risk



AMS - Safety instructions - Electricity

3. Current strength and exposure time

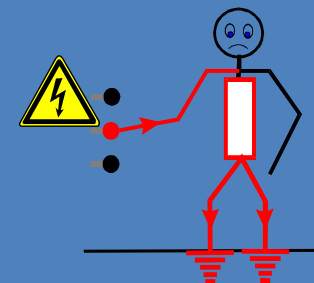
The current path from hand to foot at 240V
Creates 230 mA current through the body

In extreme conditions, the body current can be
up to a few amperes

While any amount of current over 10 mA is
capable of producing painful to severe shock,
currents between 100 and 200 mA are lethal!



CURRENT PATH	BODY RESISTANCE
Hand-Hand or Hand-Foot	1000 Ω
Hand-Feet	750 Ω
Hands-Feet	500 Ω
Hand-Chest	450 Ω
Hands-Chest	230 Ω
Hand-Buttocks	550 Ω
Hands-Buttocks	300 Ω



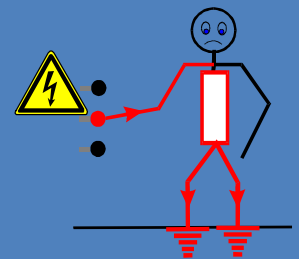
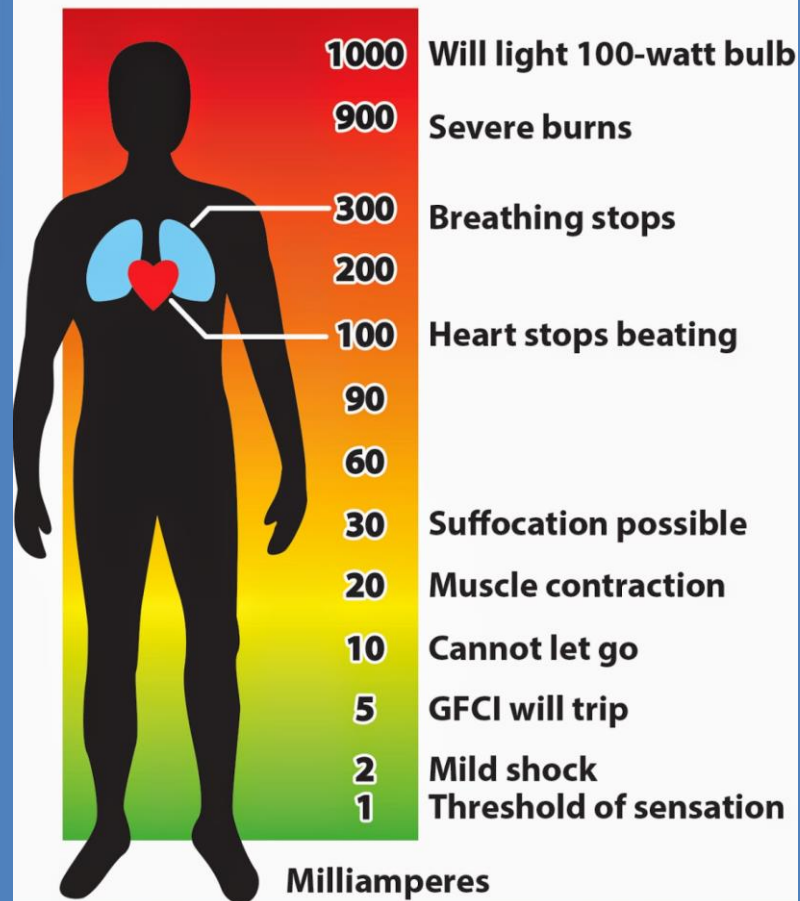


AMS - Safety instructions - Electricity

4. Physiological effect on humans



Electricity's Effects





AMS - Safety instructions - Electricity

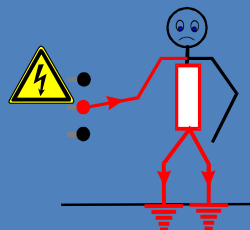
5. The 5 Safety Rules of Electrical Engineering

The 5 safety rules of electrical engineering are crucial safety guidelines based on the IEC 61439-1 standard.

Their primary objective is to prevent accidents and injuries when working with electrical equipment, which is essential for anyone involved in electrical work.

By adhering to these 5 safety rules, individuals can minimize the risk of electric shock and ensure a safe working environment.

It is imperative to follow these guidelines to protect oneself and others and prevent any unwanted incidents from occurring.



Safety Regulations for the work electrical equipment

- Disconnect mains!
- Prevent reconnection!
- Test for absence of harmful voltages!
- Ground and short circuits!
- Cover or close of nearby live parts!

To energize apply in reverse order



AMS - Safety instructions - Electricity

Rule 1: Disconnect

The first and foremost rule among the 5 safety rules of electrical engineering is to disconnect. It is crucial to disconnect all parts of the system that require maintenance or repair from all possible power sources.

How to Disconnect

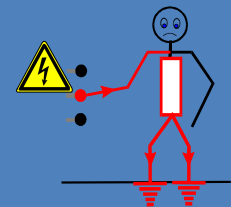
- Turn off/disconnect circuit breakers
- Lock disconnect switches
- Disconnect contactors
- Remove fuse elements

What else is important?

- Use personal protective equipment (PPE)
- To consider possible backfeed voltage



Control cabinet
with main switch





AMS - Safety instructions - Electricity

Rule 2: Secure against re-energisation

To prevent an electrical system from accidentally being re-energized, all switching devices used to activate a part of the system must be secured against re-energizing. This can be done by locking the actuating mechanism (**Lockout**).

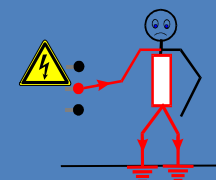
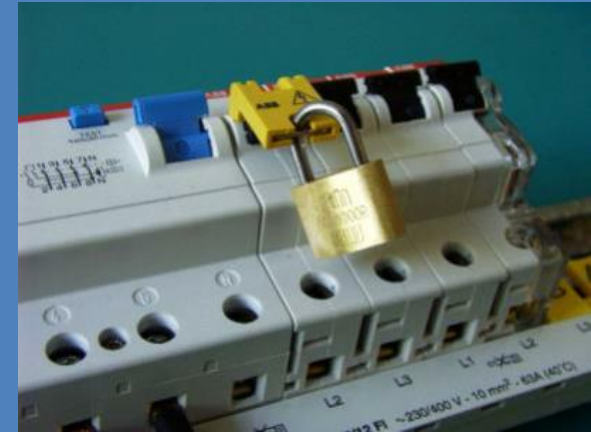
Before starting work, warning tags must be securely attached to warn against unauthorized switching actions (**Tagout**). The tag also warns others not to operate the equipment while the tag is in place.

How to secure against re-energising

- Lockout
- Tagout

What else is important?

- Securely fasten warning tags
- Secure switches with protective covers
- Secure switches/actuators with locking mechanisms





AMS - Safety instructions - Electricity

Rule 3: Determine Voltage Absence

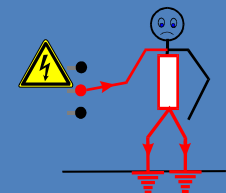
This step is essential to ensure that the workers are not exposed to any electrical hazards

Determine Voltage-free Condition on All Poles

When verifying the voltage-free condition on an electrical installation, **it is crucial to check each individual conductor or pole.** This task should only be performed by a qualified electrician.

Use the Right Measuring/Test Equipment

Using the correct measuring and testing equipment is critical in ensuring electrical safety. Multipurpose measuring instruments are not permitted, as there may be errors in selecting the appropriate measuring range.





AMS - Safety instructions - Electricity

Rule 4: Grounding and short-circuiting

Not applicable in our system

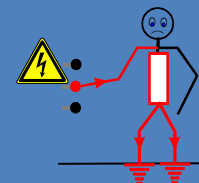
Grounding and short-circuiting are crucial safety measures when working on de-energized electrical systems, particularly in medium and high voltage systems.

These measures are essential to prevent electrical hazards during maintenance or repair work, especially in overhead lines or low voltage main distributions.



In low and medium voltage systems (up to 1,000 V), grounding and short-circuiting can be omitted in most cases.

However, it is necessary to apply these measures if there is a risk that the system may be energized by a backup power supply system, decentralized generation systems, or overhead lines that are crossed or electrically influenced by other lines.





Rule 5: Cover or fence off nearby energized parts

When working near live parts, it is crucial to avoid contact as much as possible.

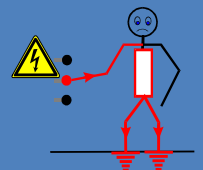
However, if de-energizing adjacent components is not possible, **it is necessary to cover or fence them off** to prevent contact with work materials.



The coverings used must provide sufficient insulation and be able to withstand all expected mechanical stresses. They must also be securely fastened to prevent accidental contact.

Insulating materials such as plates, mats, cover cloths, or protective screens can be used for this purpose. Insulating fittings or rubber mats are only suitable for voltages up to 1000 V.

If covering or fencing off is not possible, maintain minimum clearances to avoid contact.





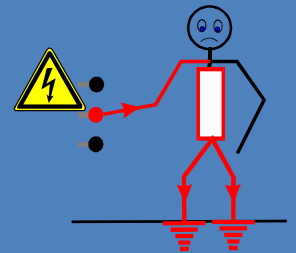
6. Activating voltage after finishing work



The process of restarting power after completing and checking the work should only commence when no persons, tools, or equipment are left at the workplace.

The safety measures of the five electrical engineering rules are typically reversed in order.

- Remove covers and barriers
- Remove short circuit and remove earthing, if applied
- Cancel measures against re-energisation
- Turn the power on





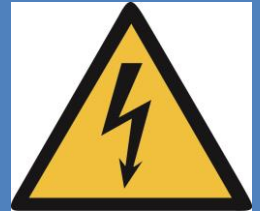
AMS - Safety instructions - Electricity

7. Additional Safety Measures

Clear work orders are mandatory

Workers: Do not start work until an order is understood.

Supervisors: Give clear work orders, do not tolerate improvisations.



Only use adequate personnel

Workers: Only perform those work orders for which you are trained.

Supervisors: Use only trained and qualified staff.

Only work with safe work equipment

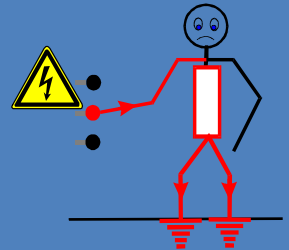
Workers: Use only approved work equipment/tools. Visually inspect it before use.

Supervisor: Ensure that all working equipment/tools are tested, and calibrated, if required.

Personal protective equipment (PPE)

Workers: PPE must be adequate and free from any defects.

Supervisors: Provide adequate PPE, pay attention on correct PPE use.





8. Causes of Electrical Accidents

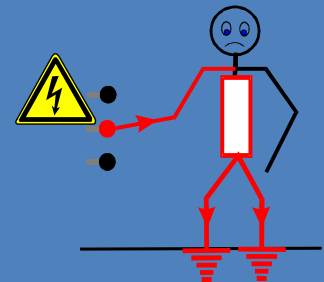
Non-Compliance with the 5 Safety Rules of electrical engineering is a major cause of electrical accidents involving electrical professionals.



Statistically, the following causes of accidents are registered:

- Disconnection: 25.9%
- Lock-out and tag-out: 2.2%
- Voltage testing: 28.2%
- Earthing and short-circuiting: 1.0%
- Covering or fencing off adjacent live parts: 7.9%

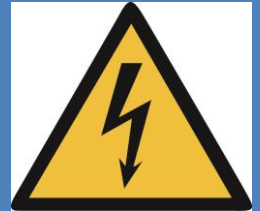
These statistics highlight the importance of adhering to the five safety rules of electrical engineering in order to prevent accidents and ensure the safety of all those involved in electrical work.





AMS - Safety instructions - Electricity

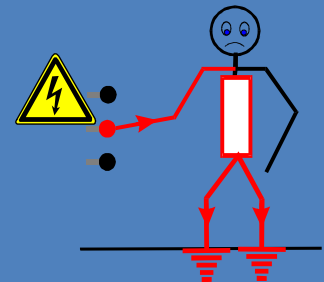
9. Avoiding Accidents



- Before using electrical equipment/tools, perform visual inspection.
- Defective/damaged electrical equipment/tools must not be used.

Defective equipment/tools must be immediately withdrawn from use, and labelled, if necessary

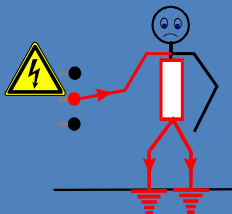
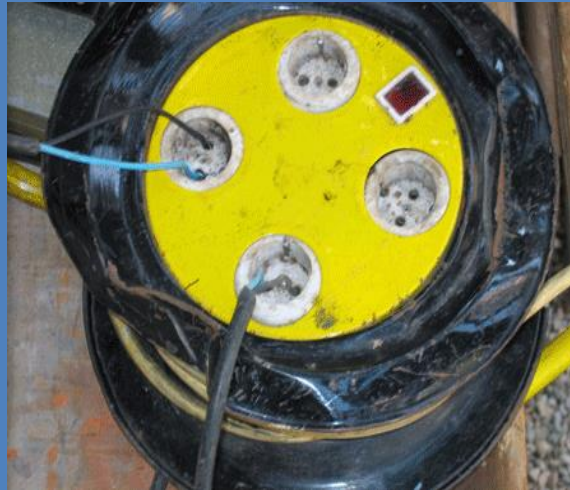
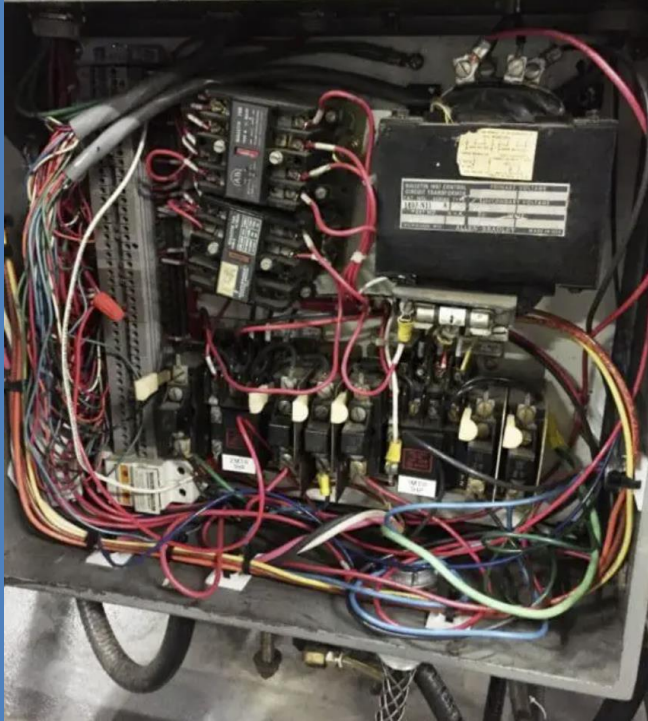
- Handle the equipment as per user manuals, never pull or squeeze the cables.
- Power socket strips must **never** be connected in series.
- Electrical equipment and tools must be repaired only by qualified personnel.
- There is a risk of tripping with loosely laid cables.
- If the electrical hazard is high, use the isolating transformer.
- Only use insulated tools when working on electrical installations.
- Do not place tools on electrical installations (i.e. control cabinets).





AMS - Safety instructions - Electricity

10. Warning – Please DO NOT do this!



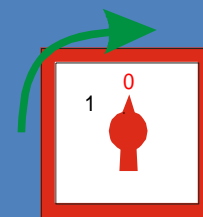
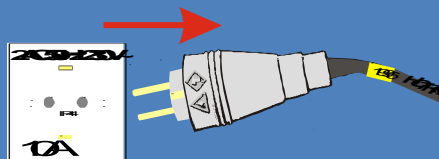


11. First aid for accidents with electric current

- There is a life-threatening risk when touching **live parts!**

1. Act to break the contact between the casualty and the electrical supply :

- Press the Emergency Stop Button.
- Switch off, disconnect the plug.
- Remove the fuse.
- Disconnect the injured person from the power source using a non-conductive object or pull it away from him.



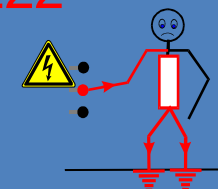
2. Initiate first aid measures

- Call a rescue service / Medical Emergency Ambulance.
- Check responsiveness.
- Check breathing and pulse.
- Do not leave the injured person alone.



Emergency call: 222

A precautionary examination for cardiac arrhythmia should always take place.





Thank you!

and always adhere to

Safe Working Practice!