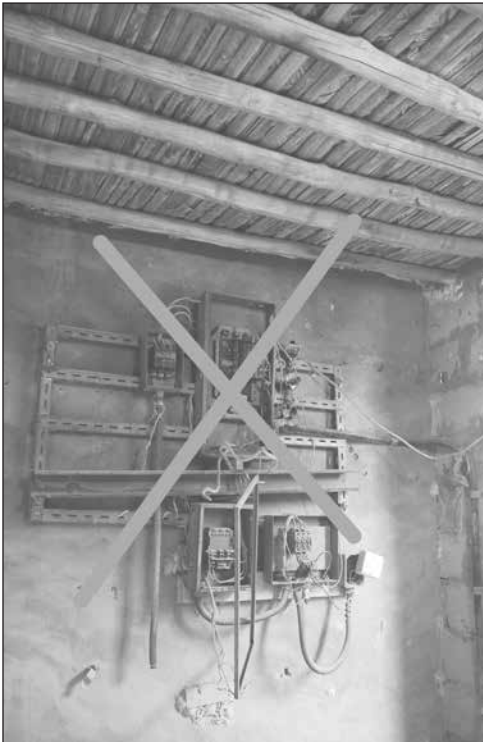


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# UNDERSTANDING ELECTRICAL ENGINEERING AND SAFETY FOR NON-ELECTRICIANS



## WHAT YOU WILL LEARN:

- Basic facts about electricity and its uses
- Operating principles of common appliances
- Protection of electrical circuits against faults
- Working on electrical circuits and troubleshooting
- What makes electricity unsafe and how to work safely

## WHO SHOULD ATTEND:

- Civil, mechanical, chemical, mining engineers, technologists and technicians
- Managers who are involved with or work with staff and projects in electrical engineering
- Non-electrical engineers and technicians
- Non-electrical personnel who want to understand the broader picture
- Plant and facility engineers
- Procurement and buying staff
- Project managers
- Sales engineers



*Technology Training that Works*

## The Workshop

Electrical engineering is often considered to be a mysterious science, because electricity cannot be seen. However, we are all aware of its existence and usefulness in our daily lives. This workshop aims to take the mystery out of electrical engineering and give a good understanding of the fundamental principles of electricity. While many of us work on electrical systems, we do not fully appreciate the dangers, which we get exposed to when doing so. All it takes is a few simple precautions to avoid getting hurt. This workshop teaches you all about the dangers of careless handling of electrical appliances and prevention of electrical accidents.

This workshop is not meant for electrical engineers and other qualified technicians. It is for those who are not formally trained as electricians but often have to handle and maintain electrical appliances in the course of their work. The participants will have an opportunity to understand how the appliances they see everyday actually function. This workshop will deal with the subject with a minimum of theory while emphasising on the practical, hands-on approach.

## Practical Sessions

This is a practical, hands on workshop enabling you to work through practical exercises which reinforce the concepts discussed. Some of these sessions will be in the nature of discussion groups and will take a specific topic related to the module for discussion.

**To gain full value from this workshop, please bring your laptop/notebook computer.**

## On-Site Training

- ✓ **SAVE** over 50% by having an IDC workshop presented at your premises.
- ✓ Customise the training to **YOUR** workplace.
- ✓ Have the training delivered when and where you need it.

Contact us for a **FREE** proposal.

## The Program

### ELECTRICITY

- Electricity is a form of energy
- Static electricity
- Electrical cells and DC
- Voltage and current relationship - ohms law
- Power and energy relationship
- A simple circuit using DC (battery) source
- Electromagnetic generators (AC) - relation between magnetism and electricity
- Speed of rotation and frequency
- Single phase and 3-phase AC systems - basic facts
- Phase sequence

### HOW IS ELECTRICITY DISTRIBUTED?

- A modern electrical power system
- Multiple voltage levels and transformers
- Substations
- Your local power utility
- Measurement of energy usage and tariff
- Conductors for carrying current (insulated versus bare)
- Receiving power from the utility
- Distribution within a facility
- Distribution boards
- Circuit breakers (ACB, MCCB, MCB, ELCB)
- Isolators and fuses

### HOW IS ELECTRICITY USED?

- Electricity as an energy carrier
- Electricity is clean, easily controlled and instantaneous in action
- Lighting
- Heating
- Mechanical drive/motion and transportation
- Common examples of appliances

### BASIC FACTS ABOUT ELECTRICAL APPLIANCES

- Lighting
  - Filament lamps
  - Metal halide lamps
  - Fluorescent lamps and CFL
  - Mercury and sodium vapor lamps
  - Starters and their function
- Electric heaters
  - Resistance heaters
  - Heaters using high frequency methods (example: microwave)
- Electrical motors
  - Pumps and compressors
  - Cooling and refrigeration
  - Transportation and lifting
- Control of electrical motors
  - Difference between single phase and 3-phase motors
  - Starting methods
  - Speed-frequency relationship
  - Speed control methods in AC motors
  - Phase reversal and its effect on direction of rotation in 3-phase motors

### ELECTRICAL FAULTS

- Basic faults in electrical circuits "an open connection or an unwanted connection"
- Insulation and its importance
- Reasons for failure
- Preventing overloads
  - Overload protection by thermal relay, temperature protection etc.
- Faults due to insulation failure
  - Short circuits
  - Earth faults
- Short circuit protection
  - Fuses
  - Circuit breakers with magnetic releases
- Earth fault protection
  - Earth leakage relay
  - Fuses and breakers can protect too
- Open circuits and reasons
  - Importance of proper terminations
- Danger of open circuit causing single phase operation of 3-phase motors
  - Why is single-phasing dangerous to motors?
  - Detection by single-phasing relays

### WORKING ON ELECTRICAL CIRCUITS

- Why is work needed on electrical circuits?
  - For maintenance
  - For fault finding (troubleshooting)
  - For testing
  - Working with circuit energised (refer to relevant codes)
  - Lamp changing
  - Troubleshooting (measuring current flow or checking for voltage at specific points)
  - Working with circuit switched off
  - Procedures lock-out/tag-out
  - Earthing a circuit for safety
  - Checking that a circuit is dead
  - Voltage tester (neon stick, single and two-lamp testers)
  - Instruments used for troubleshooting
  - Multimeters - what do they measure?
  - Clip-on ammeter
  - Continuity tester
  - Insulation tester

### ELECTRICAL SAFETY

- Dangers of electricity
  - Electric shock (direct and indirect)
  - Fall caused by electric shock
  - Arc flash and burns
- Role of PPE in safety
  - Examples of PPEs
- Avoiding shock danger
  - Safety while doing permitted live work
  - Safety while working on dead circuits
  - Role of protective earthing for safety during normal operation
- Arc flash dangers
  - Severe burns
  - Avoid live work except as permitted under codes
  - Use insulated tools
  - PPE for live work and for operations such as switching
- Codes and the need to follow them strictly
  - Australian Wiring Regulations; locally applicable code
- Electrical accidents and first-aid

### SUMMARY, OPEN FORUM AND CLOSING