



Effective
Human
Intervention
LEADERS IN TRAINING

ARC FLASH AWARENESS FOR ELECTRICIANS & TECHNICIANS

Recognised for Continuing
Professional Development
(CPD) by SAAMA in accordance
with ECSA guidelines



EHI has been accredited by MERSETA Accreditation No: 17-QA/ACC/0603/23

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ARC FLASH AWARENESS

All electrical systems have the potential to cause an Arc Flash ARE THERE ANY RULES? WHO SHOULD BE CONCERNED?

This is what every person should know when they have electrical and equipment on their site, this includes factories, hospitals, housing estates, shopping malls and many others such installations

"Medium and Low Voltage and systems"

"What you don't know can kill you or cause damage to your plant"

Upon completion

- ✓ Understand what arc flash is and the potential dangers of arc flash
- ✓ What equipment is required to be isolated
- ✓ Medium voltage practice (11 000 volts)
- ✓ Low voltage practice (230 / 400/ 525 volts)
- ✓ What are the rules?

Benefits include:

- Participation in an interactive workshop
- Learn from a recognised expert with cross industry experience
- Comprehensive course documentation
- Certificate on completion of the assignment
- Accredited to gain 3 CPD points by SAAMA

About Your Course Facilitator

Ian Mee is a registered certified engineer and technologist with ECSA.

He has 50 years of industry including, maintenance and inspection in various industries including the rubber, paper and chemical industries of which the last twenty years was in the Chemical and Allied Industry at senior management level. The last 20 years running a consulting practice.

Ian is registered with various engineering council of South Africa and a senior member of the Institute of Mechanical and Electrical Engineers of South and many others.

Who Should Attend?

This course is designed for anyone who needs to understand fundamental operation of systems

- Plant Managers
- Plant Engineers
- Technicians and artisans
- Persons responsible for isolation such as authorised competent persons
- Maintenance Supervisors
- Maintenance Personnel
- Electrical contractors
- Facility management such as: Hospital Maintenance Staff, building management, body corporate responsibilities

MUST BRING SCIENTIFIC CALCULATORS AND NOT CELL PHONES

Objectives for Session 1

The main objective of the first four sessions is to assist the delegate with understanding safety in the workplace and how the Occupational Health and Safety ACT 85 of 1993 and the regulations help the employer provide a healthy and safe work place.



ARC FLASH AWARENESS

Day 1

Session 1

Knowledge Assessment

The occupational Health and Safety Act requires:

The employer provides a healthy and safe environment
How does the employer comply?

- Identify all hazards
- Mitigate the hazards
- Instruct all the employees on the hazards and the precautions to be observed

The general duties of employers and employees

The employer provides a healthy and safe environment

The employer makes certain appointments to ensure the work place is safe.

The isolation concepts are regarded as significant in the general risk assessment.

The following is a discussion regarding the employer responsibilities:

- The user duties (employer)
- The duties (persons responsible for the management of the electrical system)
- Functional requirements
- Contractor management
- The maintenance requirements
- The GMR requirements
- Appointments
- Statutory inspections (EIR and EMR regulations)
- Abnormal conditions
 - Safety of personnel
 - Safety of equipment
 - Safety of plant
 - Electrical safety – how do we achieve it?
 - Electrical switchgear safe operating
- Electrical installations include many components such as switchgear and control gear



Outcome of Session 1

- Understand health and safety in the work place
- Understand the safe practice required for isolation of electrical & mechanical systems
- Understand what an electrical installation is and how the application of these electrical installation regulations are applied
- Understand the effects of the new construction regulations

Objectives for Session 2 to 6

- ✓ To outline arc flash concepts
- ✓ To provide the necessary information for managing arc flash

Session 2

Basic Concepts

What is an Arc Flash? According to NFPA 70E (the relevant standard from the National Fire Protection Association), Arc Flash is a “dangerous condition associated with the release of energy caused by an electrical arc.” It is measured in terms of arc flash incident energy E (AFIE), which is used to determine the level of Personal Protective Equipment (PPE), and in terms of an arc flash protection boundary (FPB).

The energy released by the arc due to a fault creates a rise in the temperature and pressure in the surrounding area. This causes mechanical and thermal stress to nearby equipment and creates the potential for serious injuries in the vicinity.

Electrical machinery regulations (EMR)

Electrical safety

- Reason for electrical safety
- Precautions to take when working on or near energised equipment
- Details for high voltage and low voltage systems
- Precautions to take when working on d-energised equipment
- PPE to be used

Session 3

Create an “electrically safe work condition” by... *

Identifying all power sources,

Interrupting the load and disconnecting power,

Visually verifying that a disconnect has opened the circuit,

Locking out and tagging the circuit,

Testing for voltage and Grounding all power conductors.

Use a written permit system for planning and conducting work on or near energised parts.

Use tools, meters, and other equipment that is suitable for the voltage and current levels present when performing all electrical work.

Dangerous condition associated with the release of energy caused by an electrical arc.

Dangerous conditions deriving from the release of energy due to a phase-to-phase or a phase-to-ground fault.

Additionally, the arc flash analysis aimed at defining the procedure necessary to minimize the dangerous effects of the arc flash on personnel.



ARC FLASH AWARENESS

Bolted fault

Short-circuit current resulting from conductors at different voltages becoming solidly connected.

Arcing current

Current flowing through the electric arc plasma, also called arc fault current or arc current.

Normalized incident energy

The amount of energy measured on a surface, at 24" (610mm) from the source, generated during an electrical arc event of 0.2s.

Incident energy

The amount of energy measured on a surface, a certain distance from the source, generated during an electrical arc event.

Day 2

Session 4

Curable burn

A burn that will not cause irreversible tissue damage. This is a second degree burn where the skin temperature does not exceed 350°F (175°C) with a duration no longer than 0.1 second and is curable in 7 to 10 days.

Clearing time

The total time between the beginning of the over current and the final opening of the circuit at rated voltage by an over current protective device

Limited Approach Boundary

An electrical shock protection boundary to be crossed by qualified personnel only (distance from live parts), not to be crossed by unqualified personnel unless escorted by a qualified person.

Session 5

Restricted Approach Boundary

An electrical shock protection boundary to be crossed by qualified personnel only which, due to its proximity to a shock hazard, requires the use of shock protection techniques and equipment when crossed.

Prohibited Approach Boundary

A shock protection boundary to be crossed by qualified personnel only which, when crossed by a body part or object, requires the same protection as if direct contact is made with a live part.

Session 6

Implementing NFPA 70E requires:

- Arc Flash Hazard Analysis
- Where Possible Removing Hazards Found
- Written Electrical Safety Program
- Energized Work Permits
- Wearing of PPE
- Training of Qualified Personnel (Maintenance)
- Training of Unqualified Personnel (Operations)
- Cultural Change

Warning Labels

- Apply Warning Labels to Specified Equipment
- Include Incident Energy, Hazard/Risk Category, Boundaries, and PPE

Day 3

Session 7

Calculation of the flash protection boundary (NFPA 70E 130.3(A))

Calculation of the incident energy E (IEEE 1584) Numerical example NFPA 70E-2000, Electrical Safety Requirements for Employee Workplaces, provides assistance in determining severity of potential exposure, planning safe work practices, and selecting personal protective equipment.

Develop and Document an Electrically Safe Work Practices Program

- Determine Policies on Electrically Safe Work Conditions
- Develop an Electrically Energized Work Permit
- Establish PPE Requirements Inside Shock Boundaries
- Determine PPE Clothing Policy
- Establish Method of Maintaining Integrity of the Arc Flash Analysis
- Information must be kept current
- Once all these programs are completed you need to keep them up-to-date.

Session 8

Switching Operations (unit Standard 113900) switching (Unit Standard 114604) Isolation

- Operating Standards
- Safe Operation
- Efficient Operation
- Log sheets
- Measurement of parameters for correction operation
- NRS 040
- Identify hazards
 - Are Safe working procedures in place?
 - Are they Being used
 - Have the procedures been audited
 - Have the people been trained
 - Have they been observed doing the work
- Requirements for shock and arc flash boundaries
- Requirements for personal protective equipment Incident Energy and flash boundary calculations
- Energy Per Unit of Area Received on A Surface Located A Specific Distance Away from The Electric Arc, Both Radiant and Convective, in Units of cal/cm².

Outcome of Session 2 To 8

- Understand health and safety in the work place in terms of the regulations
- Understand what arc flash concepts are for any installation is and how the application of these regulations are applied including NFPA 70 E and IEEE 1584
- Understand the physical arc flash conditions
- Understand the basics of unit protection