



# ELECTRICAL FAULT ANALYSIS & FAULT-FINDING TECHNIQUES

Causes, Detection and Remedies



Effective  
Human  
Intervention  
LEADERS IN TRAINING



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



EHI HAS BEEN ACCREDITED BY MERSETA | ACCREDITATION No: 17-QA/acc/0603/11 | B-BBEE LEVEL 2 CONTRIBUTOR

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# ELECTRICAL FAULT ANALYSIS & FAULT-FINDING TECHNIQUES

“Electrical faults in any electrical network have the potential to cause significant damage to electrical equipment and production downtime resulting in major cost implications for the company. Understanding of the electrical network will help to reduce such incidents”

## ATTEND THIS INFORMATIVE EVENT AND GAIN PRACTICAL INSIGHTS INTO:

- Understanding the arrangement of earthing (grounding) system of generation, transmission and distribution networks and how it affects the electrical quantities, short circuit level and protection system
- Exploring the causes of voltage deviations and its effect on auxiliaries of generators, industrial loads and the stability of electrical power systems
- Knowing the reasons of the shortage of active and reactive power in electrical networks and its effect on the electrical quantities
- Understanding the effect of environmental conditions on the electrical equipment
- Learning the abnormal phenomena, which affect the electrical networks

## WHO SHOULD ATTEND?

The course will be of benefit to those who have the responsibility in **Operation, testing, maintenance, protection, control and analysis in transmission, distribution, maintenance, operation, control and analysis of utilities, industrial and commercial distribution systems**

- ✓ Chief Engineers
- ✓ Electrical Engineers
- ✓ Master Engineers
- ✓ Senior Engineer
- ✓ Reliability and Control Engineers
- ✓ Maintenance Manager, Technicians, Supervisors
- ✓ Field Service Engineers



## CUSTOMISED VIRTUAL TRAINING AND/OR IN-HOUSE TRAINING

If you wish to organize a Virtual Instructor Led Training session or In-House session for your organization, we will custom design a session that will help you achieve your desired learning goal. The main advantage of custom designed VILT, in addition to being significantly cost effective, is that they address topics specifically related to the needs of your organization. **To discuss the possibility of designing and conducting such a session or In-House training session, contact us on 021 979 5891 or [callie@ehiafrica.co.za](mailto:callie@ehiafrica.co.za) for a comprehensive quotation.**



## REGISTRATION CONFIRMATION

Complete your registration form and submit to attend a public or virtual course.

**Alternatively, a signed In-house quotation will secure your group training session, followed by an invoice and date confirmation.**

## BENEFITS INCLUDE:

- Participation in an interactive workshop
- Learn from a recognised expert with cross industry experience
- Comprehensive course documentation
- Upon completion of the workshop, attendees can return to the job prepared to work productively in substation operation, maintenance and troubleshooting
- This course is approved for Continuing Professional Development (CPD) and will earn each ECSA registered delegate 3 CPD credits.

## ABOUT YOUR FACILITATOR

**Ian Mee** (CEM, Pr. Tech.Eng. Pr.Cert.Eng. SM-ICMEE-SA, M SAIEE, M-IPET MIE 00009)

Ian Mee is registered as a Professional Technologist, Professional Certificated Electrical and Mechanical Engineer and registered as a Master Installation Electrician. He has 50 years of Industrial experience in Electrical, Mechanical and Process Engineering which included chemical, rubber, paper, sugar, shipping and food industries. With over 20 years in the chemical and allied Industrial environment at senior management levels. The last 20 years running a consulting practice. Ian Mee is a registered Assessor for EWSETA and is a SANAS accredited Authorised inspection Body and is recognised by Department of Labour as an AIA (CI 014)



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## COURSE SUMMARY:

The continuity of Electrical Power Supply is very important to the consumers specially, for industrial sector where interruption of electrical power supply is costly. It is important to take the necessary action to prevent faults, and if they do occur, to minimise damage and power disruption by insuring the faulty system is isolated, thus avoiding damage to equipment and property.

Electrical systems are subjected to several external and internal influences like weather conditions, lightning phenomenon, pollution, insulation failure, temperature rise, etc., these influences cause abnormal operational conditions, which lead to voltage variations, brown outs or black outs of electrical system, which, may lead to equipment damage or system failure. Performance and characteristics of electrical system configurations are a vital factor in reducing the effect of faults on the system, such as system earthing, installation of protective relays, etc. This course discusses electrical system faults and elements in the system that affects its behaviour during the fault.

## DAY ONE

### Session 1: Electrical Theory

- Electrical circuits
- Electrical system components
- General circuit configurations
- Electrical circuit analysis
- Symmetrical and unsymmetrical systems

### Session 2: Transformers

- Vector groups
- Parallel transformers with different vector groups
- Earthing (grounding) transformers
- Common and separate grounding resistance (high & low) for number of parallel transformers

### Session 3: Switchgear

- Types
- Protection
- Fuses
- Circuit breakers

### Session 4: Cables

- Overhead lines
- Bus bar

### Session 5: Factors Effecting Fault Current

- Importance of continuity of supply
- Relation between substation equipment connection and the fault contribution

## DAY TWO

### Session 6: Introduction to Fault Analysis

- Causes of faults
- Types of faults
- Source of fault current
- Fault statistics
- Basic assumptions
- Short-circuit rating of equipment
- Selecting the correct switchgear rating for fault duties

### Session 7: System Earthing (Grounding)

- Power transformers
- Transmission lines
- Distribution system
- Arrangement of earthing (grounding) in power system

### Session 8: Fault Calculations

- Symmetrical & unsymmetrical fault calculations
- System configurations
- Per unit values
- Symmetrical components
- Short circuit level
- Effect of induction machines on short circuit level
- Methods to reduce the short circuit level
- Rupture capacity of circuit breaker
- Peak current limiters
- Numerical examples

### Session 9: Arc Flash Analysis

- Beyond fault levels
- Electrical system co-ordination
- Grading studies
- NFPA 70 E
- IEEE 1584
- Other systems

## DAY THREE

### Session 10: Operation of the Following Protective Relays

- Directional and non-directional over current & earth fault relays
- Differential and restricted earth fault relays
- Sensitive earth fault relays
- Over fluxing relays
- Bochoz relays

### Session 11: Computer Software and Its Use

- Computer software will be discussed at a generic level

### Session 12: Fault Due to the Following External and Internal Influences

- Lightning
- Pollution
- Switching
- Transients
- Harmonics

### Session 13: Occupational Health and Safety Act and Fault Levels

### Session 14: Generic Action Plan for Electrical Networks

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