



Effective  
Human  
Intervention  
LEADERS IN TRAINING

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



## BEST PRACTICE FOR MANAGEMENT OF TRANSFORMER OPERATION & MAINTENANCE



An intensive two-day workshop to provide management with the necessary tools for operating and maintaining power transformers in your plant environment up to 22 KV and 10 MVA.



EHI has been accredited by MERSETA Accreditation No: 17-QA/ACC/0603/23 BBBEE LEVEL 2 STATUS

ADDRESS: EFFECTIVE HUMAN INTERVENTION (PTY) LTD, 11 HODGSON STREET, VERGESIG, DURBANVILLE, 7550 – SOUTH AFRICA

TEL: +27 21 979 5891 EMAIL: [CALLIE@EHIAFRICA.CO.ZA](mailto:CALLIE@EHIAFRICA.CO.ZA) WWW.EHIAFRICA.CO.ZA | MANAGING DIRECTOR: CAREL DAVID KRUGER DIRECTOR: DESHUN BESTER | JUSTICE NGWENYA

# TRANSFORMER MAINTENANCE & OPERATIONS

Transformers are major components of electrical power systems. When a failure of a transformer occurs, it can be very costly not only because of the damage to the transformer itself but also because of the ramifications of such failure. This may include disruption of supply, explosions or fire damage. It is therefore paramount that power transformers are properly operated and maintained.

## About Your Workshop Facilitator

Ian Mee, 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 and Mechanical Engineering 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 Africa, fellow of the South African Institute of Electrical Technician Engineers, member of the South African Institute of Electrical Engineers (SAIEE) and many others.

## Who should attend?

- ✓ Electrical Engineers
- ✓ Chief Engineers
- ✓ Senior Engineers
- ✓ System Planners
- ✓ Reliability Engineers
- ✓ Maintenance Managers, Technicians, Supervisors
- ✓ Field Service Engineers
- ✓ Power systems professionals with maintenance and power utilities, industrial or commercial
- ✓ Also highly recommended for those who are responsible for testing and maintenance performed by contractors



## 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 for a comprehensive quotation.**

## Benefits include

- Participation in an interactive workshop
- Learn form 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 transformer design, operation, maintenance and troubleshooting**
- Earn 2 CPD Points

## Upon completion of this workshop the participant should be able to:

- Explain the basic operation of a transformer
- Discuss construction features and essential components
- Discuss applications, installation, connections and general maintenance
- Explain how to perform site maintenance and carry out maintenance schedules
- Discuss the various tests performed on insulating oil
- Know what test instruments to use
- Know what the authorizing persons responsibilities are



**Registration of Public Courses** will commence at 08:00 on the first day with the workshop beginning at 08:30 each day. Refreshments will be provided at appropriate intervals, and lunch will be served at 12:30. The workshop will conclude at 16:30 each day.  
**\*All timings are approximate due to the nature of the workshop.**

# TRANSFORMER MAINTENANCE & OPERATIONS

## THE MAIN OBJECTIVES OF EACH SESSION ARE:

1. Introduction to the Occupational Health and Safety Act and the regulations for work place safety including electrical switchgear
2. Introduction to the substation environment and the various types of transformer configurations and their operations including access conditions and develop a switching plan
3. Understand how the transformer and the electrical system combine to present electrical hazards to the workers
4. Understand transformer component maintenance when in service
5. Understand how a transformer is loaded and the effects of parallel operation on fault levels
6. Understand transformer failure modes
7. to be able to take oil sample and send for analysis
8. To prepare a maintenance schedule
9. Understand transformer site maintenance

## DAY ONE

### THE MAIN OBJECTIVES OF EACH SESSION ARE:

**Introduction to the Occupational Health and Safety Act and the regulations for work place safety including electrical transformers**

#### Session 1

##### Introduction

- Occupational Health and Safety Act – Background to the working environment
  - How the regulations apply when work has to be carried out on apparatus
  - Responsibilities and duties of authorised persons
- Abnormal conditions
- The regulations in place
- Electrical switchgear
  - Electrical installations include many components such as switchgear and control gear
  - These items are regulated by the OHSACT, Various codes of practice, company switching policies and safe operating procedures
  - How do these procedures make for a safe electrical environment?

#### Self-Assessment

#### Session 2

- Develop a switching plan
- Isolation procedures (how to isolate)
- Permit to work system
- Review the company permit
- Develop the switching task
- Earthing equipment
- P P E requirements
- Key and Key control
- Lock out and tagging
- The general layout and drawings required
- Types of switch gear and control gear
- General safety features and operating requirements
- The OEM operating manuals

#### Session 3

- Electrical sub stations
- Safety notices
- Access control
- Understanding of control to be exercised over access to prohibited areas and live chambers
- The controlled access to live chambers and prohibited areas
- Are there conditions under which unauthorised persons **may have** access to live chambers and prohibited areas?
- Barricading of the work area
- General functioning of a substation and its installed equipment including transformers and protection

#### Session 4

##### Site Maintenance:

- External
- Bushings
- Temperature measurement
- Gas detection
- Thermal scan of the external components
- MV and LV connections
- Group activity

##### Assignment preparation

#### Session 5

- Transformer condition monitoring concepts
- Transformer loading
- Parallel operation
- Fault levels at bush
- Transformer impedance
- Power factor
- Harmonics
- Unit protection
- Concepts of protection and the principles of selectivity, sensitivity and reliability
- Group activity

##### Assignment for the Day



# TRANSFORMER MAINTENANCE & OPERATIONS

## DAY TWO

### Session 6

- Transformer failure analysis
- Failure modes
- Fault current contribution to failure
- Power surges
- Transformer condition monitoring techniques for reducing Failure

### Assignment Preparation

### Session 7

- Transformer oil analysis
- Sampling challenges

### Assignment Preparation

### Session 8

- Transformer maintenance schedules
- Test instruments
- Group activity

### Assignment Preparation

### Session 9

#### Summary of the following:

- Transformer maintenance
- Permit to work system
- Authorised person responsibility

### Assignment

## OUTCOME FROM EACH MODULE

### Session 1:

To understand the Occupational Health and Safety Act and the regulations for work place safety

### Session 2:

To be able to recognize the components within a substation including transformers

### Session 3:

To be able to apply the various substation techniques, limited to the concepts of maintenance and protection Be able to apply the principles of permits and isolation techniques

### Session 4:

To understand how the transformer is assembled and what test are done in the works

### Session 5:

To understand how to operate transformers in parallel and how the operation mode affects the downstream fault level

### Session 6:

To understand how transformers fail in service

### Session 7:

Be able to instruct a contractor on how to sample transformer oil and what the oil analysis will mean and why the importance of age analysis

### Session 8:

Able to demonstrate how to develop a maintenance schedule for a transformer

### Session 9:

To be able to demonstrate what level of transformer maintenance can be done on site

