ICTD

المركز العالمي للتدريب والتطوير

International Centre For Training & Development

TRANSFORMER OPERATIONAL

Principles, Selection & Troubleshooting

Course Introduction:

Power and distribution transformers are essential devices in electricity supply. Their ratings can vary from small size distribution transformers of a few kVA up to very large power transformers of 1000 MVA or more. In terms of voltage ratings transformers can have operating voltages up to several hundreds of kilovolts. They represent a major asset of the power utility and any industrial plant. Failure of a transformer can be very costly and dangerous for other major equipment and personnel alike.

The design and operation of any transformer must fulfil certain requirements in order to withstand the electric, thermal and mechanical stresses during its service life. Tests and maintenance of transformers according to the relevant standards are intended to ensure that a transformer passing them will give trouble-free service for many years under the conditions it is likely to experience after its installation.

This training course will provide an understanding of transformer:

- Operational principles
- Design guidelines and different types
- Selection methodology
- Maintenance and commissioning procedures
- Troubleshooting checklists and failure analysis techniques
- Testing procedures
- Diagnostics and monitoring technologies

Course Objectives:

This course aims are to provide understanding of the basic fundamentals and constructional features of power and distribution transformers with particular reference to the design, testing, operation and maintenance.

Delegates will gain a detailed appreciation of the following:

- Practical solutions for specifying, operating and maintaining power transformers in a utility or plant environment
- Comprehensive understanding of principles, selection, testing and commissioning, protection, maintenance and troubleshooting of distribution, and power transformers
- The necessary safe procedures relating to transformer operation and related circuitry
- Testing and maintenance of transformers
- How to care for your transformers

Who Should Attend?

- Engineers and Technicians from electricity supply industry
- Technical Management Professionals and Department Leaders
- Engineering Professionals from companies manufacturing and operating power and distribution transformers
- Engineers and Technical Personnel in power utilities, petrochemical plants, service professionals of large infrastructure projects.
- Participants need no specific requirements other than basic understanding of electricity and magnetism and circuit theory and general knowledge of nature and operation of power and distribution transformers.

Course Outline:

Day 1:

Introduction, General Principles and Classification

- General Classification of Transformers: Transformer Construction, Core-Type, Shell-Type, Dry-type Transformers, Oil-filled Transformers, Cooling Techniques
- Transformer Windings, Interconnection of Windings, Advantages and Disadvantages of Principal Connections. Tertiary Windings, Autotransformers
- Harmonics in Transformers, Parallel Operation of Transformers, Loadings of Transformers in Parallel, Paralleling Requirements, Polarity
- Standards for Transformers, Types and Requirements
- Transformer Tappings and Connections
- Ability to withstand Short Circuit, Sound Level
- Case studies and workshop discussion

Day 2:

Transformer Constructional Details

- Transformer Oil, Characteristics, Oil Oxidation, Breakdown Voltage, Water Content, Acidity, Oil Testing, Field Oil Testing, Dissolved Gas Analysis, Treatment and Filtering of Oil
- Effect of Oil Expansion, Breathing Action, Buchholz Relay, Explosion Vents
- Instrument Transformers
- Transformers for Industrial Applications: Electro-chemical, Arc and Induction Furnaces, Rectifier Transformers, High Voltage Testing Transformers, Precipitator Transformers, Dry Type Transformers
- Construction And Details, Transformer Cooling, Natural Cooling, Forced Cooling
- Case studies and Workshop Discussion

Day 3:

Transformer Features and Thermal Performance

- Thermal performance and Cyclic Rating of Transformers. Temperature indicators and alarms
- Transformer Impedance, Electromagnetic Forces
- Transformer Construction: Cores, Assembly
- Transformer Windings Construction: Coil Types, Disc Coils, Cross-over Coils, Concentric Coils, Sandwich Coils, Transpositions
- Transformer Tanks and Radiators, Tank Losses, Paint Treatments
- Transformer Fittings: Lifting Lugs, Undercarriages, Jacking Pads, Tie-Down Lugs, Bleed Pipes, Thermometers
- Case studies and Workshop Discussion

Day 4:

Transformer Operation and Maintenance

- Distribution Voltage Adjustment, Off-Load Tap Changing, On-Load Tap Changing
- Switching of high voltage underground cables supplying Distribution Transformers
- Earthing and Over-Current Protection of Distribution Transformers
- Transformer Maintenance: Oil p reservation , Deterioration of oil, Breathers, Condition Monitoring, Faults in Transformers, Tappings and Windings
- Advanced Transformer Maintenance
- Guidelines on how to care for your Distribution Transformer
- Case studies and Workshop Discussion

Day 5:

Transformer Testing

- Transformer Routine Tests
- Measurement of winding resistance
- Measurement of voltage ratio
- Measurement of impedance voltage short-circuit impedance and load loss
- Measurement of No-load loss and current
- Insulation resistance
- Harmonics testing
- Separate-source power-frequency voltage withstand test
- Induced overvoltage withstand test
- Transformer Type Tests
- Temperature–rise test
- Lightning impulse test
- Sound level
- Special Tests: Transformer Partial Discharge testing

- Accuracy and Interpretation of test results and of test reports
- Workshop and Tutorials
- Open session for questions, answers and case studies

Course Methodology:

A variety of methodologies will be used during the course that includes:

- (30%) Based on Case Studies
- (30%) Techniques
- (30%) Role Play
- (10%) Concepts
- Pre-test and Post-test
- Variety of Learning Methods
- Lectures
- Case Studies and Self Questionaires
- Group Work
- Discussion
- Presentation

Course Certificate:

International Center for Training & Development (ICTD) will award an internationally recognized certificate(s) for each delegate on completion of training.

Course Fees:

To be advised as per course locations. This rate includes participant's manual, Hand-Outs, buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Course Timings:

Daily Course Timings:

08:00 - 08:20	Morning Coffee / Tea
08:20 - 10:00	First Session
10:00 - 10:20	Coffee / Tea / Snacks
10:20 - 12:20	Second Session
12:20 - 13:30	Lunch Break & Prayer Break
13:30 - 15:00	Last Session