

MATREX TRANSFORMER FEST

5 courses in 5 days! All you need to know about transformers *can* be learned in one week! **R3995.00/day**

TR101 – TRANSFORMER CONSTRUCTION AND DESIGN

Course Synopsis:

This course provides a comprehensive insight into main aspects of transformer construction and most critical design parameters. It provides practical guidance for transformer sizing, calculating transformer losses and efficiency and understanding transformer overload capability.

A 2-hour workshop is included in the classroom course for case studies and real scenario problem solving.

Learning outcomes:

- Become familiar with the design, basic components, terminology and manufacturing of transformers.
- Learn basic theory of transformers, their classification and the materials used for their construction.
- Identify the causes of transformer losses, learn how to calculate them and how to minimise them.
- Understand the overload capability of transformers and how to utilise them safely.

Who should attend:

Suggested for all technical personnel involved with operations and/or maintenance of power and distribution transformers; in particular for all engineers, supervisors and managers who work in transmission, distribution, maintenance and operation of utilities, industrial and commercial distribution.

Requirements:

You should be familiar with basic electrical knowledge of voltage, current & power.

Course Content:

Theory of transformers

- Transformer function
- Equivalent diagram
- Vector groups

Classification of transformers based on

- Mode of operation
- Type of application
- Type of cooling/insulation
- Winding/core configuration

Transformer main components

- Core; Windings; Tank and Bushings

Aux equipment & fittings

- Tappings & tapchanger
- Protective devices

Insulation system & cooling

- Function of mineral oil and solid insulation
- Cooling systems and their designations

Understanding transformer rating plates

Transformer losses and efficiency

- No-load losses and Load-losses
- Transformer efficiency

Transformer overload capability

- Normal loading;
- Planned overloading
- Emergency overloading

Practical guide for calculating critical transformer parameters

Workshop / case studies:

Discuss transformer design issues and calculate critical transformer parameters.

Assignments:

- Voltage drop calculation
- Calculating transformer losses and efficiency
- Parallel operation with different secondary voltages
- Parallel operation with different rated impedance voltages
- Parallel operation with different tapchanger settings
- Mark various transformer parts on the provided drawing
- Read transformer parameters from the provided plate

TR102 – TRANSFORMER SPECIFICATION AND PURCHASING

Course Synopsis:

This course is focusing on technical and economic issues that should be considered before purchasing a transformer. Transformer specification must be compiled to ensure that all performance requirements are met, but also to allow manufacturers to offer the best design and most cost effective solution. Guidelines for transformer installation and required testing regime are also advised.

A 2-hour workshop is included in the classroom course for case studies and real scenario problem solving.

Learning outcomes:

- Identify key aspects of transformer planning, installation and procurement
- Understand the purpose and objective of a transformer specification and how to provide adequate input into transformer specification and design.
- Learn how to choose appropriate transformer type, cooling system, components, fittings, etc.
- Learn what aspects of installation, transformer testing and service conditions need to be specified.
- Understand how transformer losses and efficiency impact on the total cost of owning a transformer and how to evaluate the bidders based on this total cost.

Who should attend:

Suggested for consultants, engineers and managers involved with planning, operations and/or maintenance of electrical power systems. Project managers, operational managers and other personnel responsible for purchasing, commissioning and inspecting transformers in industrial and commercial distribution systems, will find this workshop extremely beneficial.

Requirements:

Unless you are familiar with transformer construction you should attend T101 as well.

Course Content:

Transformer specification

- Misconception about the “standard” design
- Specification purpose and objectives;
- Preparing technical specification
- Normal and Special information
- Useful tips for compiling technical specifications

Selection of transformer material

- Selection of core materials
- Copper or Aluminium conductors
- Mineral oil or synthetic fluids

Main considerations for installation

- Site selection, Transport; Preparations; Field assembly; Inspections;
- Vacuum filling; Energising; Loading; Warranty

Transformer testing requirements

- Testing philosophy based on actual service conditions
- Factory acceptance tests
- Commissioning and acceptance tests
- Specifying testing requirements and responsibilities

Economic considerations

- Capitalisation of losses
- Specifying to minimise owning cost
- Economics of energy efficient transformers

Practical guide for developing and evaluating transformer specification

Workshop / case studies:

Discuss typical technical transformer specification, calculate critical transformer parameters, discuss tender evaluation and selection process.

- Example of calculating capitalisation losses
- Selection process
- Economics of parallel operation
- Typical technical transformer specification
- Introduction to IEEE/IEC power transformer standards

TR103 – TRANSFORMER CONDITION MONITORING

Course Synopsis:

This course discusses various types of field testing and their applications. Through a number of case studies, it provides guidance on what are the key parameters that should be checked during testing, what kind of results should be expected and how to interpret the test results. This course was specifically designed to improve the diagnostic skills and to enable the attendees to make informed decision for appropriate corrective action.

Practical guide for testing procedures and interpreting transformer test results is incorporated in the course to teach real scenario problem solving.

Learning outcomes:

- Understand the various types of tests, what is their purpose and application.
- Learn a number of procedures for various tests used during factory testing, commissioning, maintenance and fault finding process.
- Learn how to interpret the test results to identify the problem and take appropriate course of action.
- Understand limitations of monitoring and diagnostic tests and how to overcome them.

Who should attend:

Suggested for all technical personnel involved with operations and/or maintenance of power and distribution transformers; in particular for all engineers, supervisors and managers who work in transmission, distribution, maintenance and operation of utilities, industrial and commercial distribution.

Requirements:

You should be familiar with transformer construction and understand electrical circuits.

Course Content

Types of transformer tests & their applications

Essential oil tests

Gas-in-oil analysis and diagnostics

- Dissolved-gas-analysis (DGA) principles
- Key gas analysis
- Guidelines for combustible gas concentration
- Basic gas ratios; Rogers Ratio
- Total Dissolved Combustible Gases
- Dissolved key gas concentration limits

Electrical testing procedures for monitoring purposes

- Winding insulation resistance
- Voltage ratio and tap changer test
- Measurement of magnetic currents
- Winding resistance
- Polarity check of CTs built into transformers
- Core earthing test
- Power factor/Tan-delta measurements
- Induced overvoltage withstand test

Condition monitoring inspections

- External visual inspection
- Infrared scanning

Online condition monitoring

- Transformers
- Bushings

Complete physical examination

Workshop / case studies

Discuss most common transformer problems and how to identify them. This interactive workshop will enable the delegates to practically apply the knowledge presented during the course.

Practical guide for interpreting transformer test results

- Interpreting Oil Test results
- Diagnostics with Gas-in-oil analysis
- Range of expected results for electrical testing.
- Limitations of monitoring and diagnostic tests
- Developing an effective monitoring program

TR104 – TRANSFORMER MAINTENANCE AND LIFE EXTENSION

Course Synopsis:

This course is focusing on critical issues that should be considered in establishing good operating practices and implementing an effective transformer maintenance program.

A three-hour workshop is included in the course to provide practical guidance for maintenance scheduling, operational and testing procedures to achieve long service life of power and distribution transformers.

Learning outcomes:

- Learn about aspects of proper transformer operation and how operating conditions affect transformer life expectancy.
- Understand what causes transformer aging and how to control aging accelerators to ensure long life of transformers.
- Explore various maintenance strategies, technical and organisational aspects of maintenance and maintenance activities that would ensure an effective transformer maintenance program.
- Learn about oil sampling and oil preserving procedures and understand how to implement them to extend the life expectancy of a transformer.
- Discuss testing procedures, various case studies and a typical maintenance schedule through an interactive workshop.

Who should attend:

Suggested for all technical personnel involved with operations and/or maintenance of power and distribution transformers; in particular for all engineers, supervisors and managers who work in transmission, distribution, maintenance and operation of utilities, industrial and commercial distribution.

Requirements:

You should be familiar with transformer construction and condition monitoring procedures.

Course Content

Aspects of proper transformer operation

- Normal and Special service conditions
- Parallel operation
- Temperature rise
- Transformer overload capability
- Transformer aging

Maintenance program

- Objective of transformer maintenance
- Maintenance strategies
- Technical and organisational aspects

Maintenance activities

- General maintenance activities
- Inspections for maintenance purposes
- Monitoring and diagnostic tests
- Oil management
- Bushings maintenance
- Tap-changer maintenance

Transformer life extension

- Controlling aging accelerators
- Dehydrating transformers
- Reclaiming oil
- Confronting the sludge problem

Workshop / case studies

Interactive discussion on various maintenance related issues. This three-hour workshop will enable the delegates to practically apply the knowledge presented during the course.

Practical guide for transformer maintenance

- Oil sampling procedure
- Oil preserving procedures
- Degree of maintenance required based on oil test results
- Degree of maintenance required based on total dissolved combustible gas level
- Energised and de-energised maintenance activities broken down per maintenance intervals

TR105 – TRANSFORMER FAULT FINDING

Course Synopsis:

This course was specifically designed to improve the diagnostic skills of the attendees and to enable them to make a correct decision. This course explains main risk factors and causes of transformer failure, what are the types of faults and tests that can be used in the fault finding process and how to set up a proper fault investigation to minimise the cost of repairs and the duration of downtime.

A four-hour workshop is included in the course to provide practical guidance on how to lead a fault investigation and interpret the test results.

Learning outcomes:

- Understand the main causes of transformer failure, examine various types of faults and their effect on transformers and how to diagnose them.
- Learn about field tests and special diagnostic tests and how to use them for fault finding purposes.
- Learn how to interpret the test results to identify a probable cause of failure and make informed decisions on the appropriate course of action.
- Discuss investigation procedures, various case studies and most common transformer failures through an interactive workshop.

Who should attend:

Suggested for all technical personnel involved with operations and/or maintenance of power and distribution transformers; in particular for all engineers, supervisors and managers who work in transmission, distribution, maintenance and operation of utilities, industrial and commercial distribution. Inspectors of power and distribution transformers, will find this course extremely beneficial.

Requirements:

You should be familiar with transformer construction and condition monitoring procedures.

Course Content

Importance & reliability of transformers

- Transformer life expectancy
- Probability and time distribution of transformer failures

Factors influencing transformer reliability

- Weakness in specification or defective design
- Manufacturing deficiency or material defects
- Adverse operating conditions
- Improper maintenance practices
- Transformer aging

Types of transformer faults

- Internal faults: Winding to ground faults, Inter-turn faults, Core faults, Tank faults, Phase to phase
- External system conditions: Overload, Overvoltages, System failures, Reduced system frequency

Typical transformer failures

- Electrically induced failures
- Mechanically induced failures
- Thermally induced failures
- Failure modes, stressors and their effects on transformers

Overview of oil testing and DGA

Electrical tests for troubleshooting purposes

Specialised diagnostic tests

- Infrared scanning;
- Frequency response (SFRA)
- Acoustic analysis; Vibration analysis
- Noise level test
- Evaluation of transformer solid insulation (DP level and Furan)

Workshop / case studies

Interactive discussion on various fault finding issues. This four-hour workshop will enable the delegates to practically apply the knowledge presented during the course.

Practical guide for transformer fault investigation

- Conducting transformer failure investigation
- Transformer diagnostic guide: 15 most common transformer failures and their probable causes.
- Review common failure modes and typical gases generated in each case.
- Review 5 investigation cases, which will cover all main causes of transformer failure (bad specification, bad manufacturing, bad installation, bad operation and bad maintenance).