TRANSFORMER MAINTENANCE & PROTECTION (REF:OTSTMP001)

Course Description

This three days course features the theory, operation, and maintenance associated with power transformers. Topics included are transformer theory, oil testing, gas analysis, electrical testing, receipt inspections and testing, load tap changers, various types of Transformer protection and preventive maintenance, applied the theoretical information to practical Using Electrical Control Trainer simulator.

Who Should Attend

Electrical maintenance and operation staff, Field Engineers, Supervisors and others responsible for the testing and maintenance of power transformers

Learning Outcomes

Upon completion of this course, the participant should be able to:

1. Understand the basic operation of a transformer.
2. Understand turns ratios and calculate terminal voltage and current.
3. Understand terminal markings and various single phase and three phase wiring schemes.
4. Understand how to perform a polarity test on a potential transformer.
5. Understand the electrical testing methods performed on transformers such as insulation resistance testing, excitation and power factor testing.
6. Understand the various tests performed on insulating oil.
7. Understanding the various types of transformer protection.

Course Outline

DAY 1

Participants will be introduced to the different types of single and three phase transformers construction, various types of core material, windings layout, connection, tap changers, voltage classifications and transformer applications.

1. Transformers types

- Single and three phases
- Power and distribution transformers
- Voltage (VT) and current transformers (CT's)
- Auto-transformer
- Phase shifting

2. Voltage classes and applications and connections

3. Load taps changers (LTC's)

- Resistance and Reactance types
- Tap position indication
- Ratings and selection criteria

4. Connections

- Polarity and angular displacement.
- Y – Y, Δ – Δ , Y – Δ and Δ – Y connections and other types connections.
- Interconnected Y and grounding.
- Phase shifting.
- 3phase to 6 phase connection

5. Temperature monitoring and cooling methods and accessories

6. Paralleling transformers

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Day 2

Introduce the fundamental theory behind the voltage and current transformation, winding resistance and impedance calculation, voltage regulation, losses and output efficiency estimation for both power and distribution transformers. the influence of saturation, harmonics and power electronic devices on the transformer performance will also be addressed.

1. Name plate rating - Volt Amp Vs Watt

2. Transformer testing

- Classes and sequence
- Turns ratio
- Polarity
- Insulation and impulse
- Control devices

3. Performance tests

- No load and excitation.
- Load losses and impedance measurement.
- Winding resistance and short circuit test.
- Winding resistance and impedance calculation.

4. Performance characteristics, loading, regulation and efficiency

5. Magnetizing, inrush and over excitation

6. Transformers for drives and harmonics influence on performance

- Secondary current distortion due to semiconductor devices loading.
- Total harmonic distortion.
- Reactors and Filters.

7. Transformer de-rating and what K-ratings means

DAY 3

Continue for Transformer testing, installation, safety operation, types of failures and protection methods.

1. Installation, Testing and Maintenance

- Standards for Transformers.
- Installation & Relocation.
- Transformer Type Tests.
- Transformer Routine Tests.
- Transformer Commissioning Tests.
- Transformer Maintenance: Concepts of preventive & condition based maintenance.
- Case studies.
- Discussion.

2. Installation and safety operation

- Connections and Vector groups.
- Safe procedures relating to transformer operation in a utility or industry environment.
- Thermal performance and Loading of Transformers.
- Practical solutions for operating and maintaining power transformers.
- Voltage Adjustment using Off-Load & On-Load Tap Changing.
- Earthing of HV Transformers.

3. Transformer failure statistics

- Transformer failure modes.
- Lightening.
- Internal Faults.
- External Faults.
- Insulation Damage.
- Component Failures.
- Transformer failure statistics.
- How to categorize transformer failure modes.

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4. Protection methods

- Oil temperature Alarm and Trip.
- Winding temperature Alarm and Trip.
- Buchholz relay, Oil Surge relay & Pressure relief relay.
- Surge protection.
- Fuse protection.
- Protective relaying, ? V Overcurrent, Earth fault, Differential and Over flux

5. General diagnostic and assessment test

- Insulation Resistance and Polarization Index.
- Turns Ratio and Excitation Current.
- Capacitance and Power Factor.
- Winding Resistance

6. Tap changers inspection and test

- Tap Changer Types ? V Off circuit & Load
- Off circuit Tap Changer Maintenance & Repairs.
- Load Tap Changer (LTC) Failure modes.
- Using Electrical Control Trainer simulator.

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