Power Transformers

Testing and Failure Analysis

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Presented by:

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Manager, Extra High Voltage Research Center, Egyptian Electricity Holding Company, Egypt
About Instructor

Eng. Adel had B.SC in Electrical Power Engineering since 1982, from Helwan University, and he had Diploma in High Voltage Engineering from Cairo University 1997.

Eng. Adel had M.SC in power Quality Improvement in primary Distribution Networks from Ain Shams University, in 2005.

Now, he prepare final stage to get Ph.D. In High Voltage Insulations ageing due to Electrical Treeing and Partial Discharge from Cairo university.

He is Manager of Partial Discharge Measuring laboratory Extra High Voltage research Centre, Egyptian Electricity Holding Company, Ministry of Electricity & Energy, Egypt. He occupied many position in Ministry of Electricity & Energy, Egypt. Such as Low & Medium Voltage Electrical Insulation Engineer, Electrical Maintenance Engineer.

Eng. Adel performed a lot of inspection and maintenance activities inside and outside of Egypt related to Power Cables and on site of cable test system.

Eng. Adel had published (3) Papers, Power Quality Concerns in Industrial Plants, Important Power Quality aspects for Industrial Customers, and Diagnostic Methods and on site preventive Maintenance of Power Transformers.

Eng. Adel conducted with APEX a lot of Training Courses and Practical Workshops in many companies in Middle East.

COURSE INTRODUCTION

The Electricity Companies have to supply electricity to the consumers at the lowest possible cost, commensurate with safety. Power Transformers represent a major capital asset for electricity suppliers. While in service power Transformers must be maintained and monitored in order to anticipate faults and possibility avert any failure.

Faults in Power Transformers can occur at any time, and the causes are many and varied. When faults do occur they generally cause loss of supply to customers and loss of revenue for suppliers. So it is imperative that the fault location process is efficient and accurate to minimize excavation time, which results in reducing the inconvenience to all concerned. For fault locating to be efficient and accurate technical staff needs to have expert knowledge accompanied with experience in order to attained service reliability.

This course is designed to ensure that those responsible for diagnosis, operation, Testing, maintenance and monitoring of power transformers understand the technical issues involved and comply with relevant specifications and requirements.

WHO SHOULD ATTEND?

Engineers and Technicians from Electrical Power Utilities Companies, Manufactures and Distributors of Power Transformers, Engineering Professional in Petrochemical Companies, and Commercial Buildings.

Participants need no specific requirements other than basic understanding of Electricity and Magnetism and knowledge of nature and operation of Power supply and distribution system.

COURSE OBJECTIVES:

After the end of the course, participants will be able to:

- Understand the essential characteristics and requirements of Power Transformers.
- Appreciate the technical options for diagnosis, Operation, and Testing of Power Transformers.
- Apply practices for Fault detection and location for Power Transformers.
- Identify Problems and failure modes.
- Perform routine & preventative Maintenance and testing of Power Transformers.

TRAINING METHODOLOGY:

The course is designed to have an interactive format to maximize delegate participation. Questions and answers are encouraged throughout and at the daily sessions. Needs-Based case-studies and examples will be discussed in problem solving workshop sessions. This gives participants the opportunity to discuss with other delegates and the presenter their specific problems and appropriate solutions. Only minimum note taking is encouraged to ensure maximum delegate attention during the course.
### Course Outlines

#### Module (1) Introduction of Power Transformers
1.1 Historical survey of Transformer Development and Applications  
1.2 Transformer Design and Construction  
1.3 Defining Transformer Life Expectancy  
1.4 The Insulation System  
1.5 Life Time of Transformer  
1.6 Transformer’s Oil  

#### Module (2) Routine Tests
2.1 Measurement of Voltage Ratio and Check of Vector Relationship.  
2.2 Measuring of Winding Resistance  
2.3 Measuring of Impedance Voltage and Load Loss  
2.4 Measuring of No-Load Loss and Current  
2.5 Dielectric Tests  
2.6 Separate- Source Voltage withstand Test  
2.7 Induced over - Voltage withstand Test  
2.8 Partial Discharge Measurement  
2.9 Test on On - Load Tap Changer  

#### Module (3) Special Tests
3.1 Temperature Rise Test  
3.2 Measurement of Zero Sequence Impedance  
3.3 Measurement of Voltage & Current Harmonics  
3.4 Measurement of Insulation Resistance  
3.5 Measurement of Capacitance and (tan δ)  
3.6 Lightning Impulse Test  
3.7 Switching impedance Test  
3.8 Measurement of Acoustic Sound Level  

#### Module (4) Oil Immersed Transformers
4.1 Application Field  
4.2 Categories of Equipments  
4.3 Transformer Classification  
4.4 Specification for uninhabited Insulation mineral Oil  
4.5 Main Standards used for Routine Tests  
4.6 Recommended limits for unused mineral insulating oils field in new Power Transformer  
4.7 Oil Functions  
4.8 Dissolved Gas Analysis (DGA)  
4.9 Incipient Fault Detection in Oil Immersed Transformer and Faults Types  

#### Module (5) Measurements of Insulation Resistance
5.1 Introduction of Insulation Resistance Measurements  
5.2 Two Windings Measurements  
5.3 Three Windings Measurements  
5.4 Measurement Analysis  
5.5 Measurement Instruments  

#### Module (6) Measurements of Voltage Ration
6.1 Introduction  
6.2 Measuring Circuit  
6.3 Measurements Analysis  
6.4 Measurements Instruments  

#### Module (7) Capacitance & Power Factor (C & (tan δ)
7.1 Introduction  
7.2 Bushing Capacitance  
7.3 Power Factor Measurements  
7.4 Tap Insulation Capacitance  
7.5 Hot Collar Technique  
7.6 Transformer Capacitance  
7.7 Two Windings Transformer Test procedures  
7.8 Three Windings Transformer Test Procedures  
7.9 General Test Procedures for Windings  
7.10 Losses and Cos θ variation with Test Voltage  
7.11 Test of Oil Insulation Power Factor  
7.12 Transformer Exciting Current Measurements  

#### Module (8) Partial Discharge Techniques
8.1 Introduction  
8.2 What is Partial Discharge?  
8.3 Why Test for Partial Discharge?  
8.4 Occurrence of Discharge  
8.5 Physical Background of Partial Discharge  
8.6 Type of Partial Discharge  
8.7 Magnitude of Discharge  
8.8 Characteristic of discharge Patterns  
8.9 Partial Discharge Test Facility  
8.10 Partial discharge with Induced Voltage  
8.11 Actual Detection Circuits  
8.12 How to calibrate the Partial Discharge System?  
8.13 How to measure Partial Discharge?  
8.14 Partial Discharge Methods Available  
8.15 On - Site Partial Discharge Measurements  

**Course Conclusion and Summary**
COURSE FEE

The amount of **2800 USD** will be charged for the course. Send 3 delegates and get a **10% discount** on the third participant.

PAYMENT METHOD

A confirmation letter will be sent upon your registration. Note that full payment must be made prior to the event. Only those delegates who have paid in full will be admitted to the event. All payments should be in favor of Apex FZ-LLC. Account details are as follows:

**HSBC Bank Middle East limited,**
Jebel Ali Branch, Dubai, UAE
A/C: 035 - 626472 - 101

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CONTACT DETAILS

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About APEX

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- **Apex** core services focus mainly in Power & Utilities, Oil and Gas, Petrochemical Industries within Middle East.
- **Apex** courses and training programs are based in 2 major disciplines; Technical and Management
- For more information on APEX go to Website : [www.apex-dubai.com](http://www.apex-dubai.com)

CANCELLATION

If you are unable to attend the course you may send a substitute delegate. Cancellation should be made 15 days prior to the course conduction. Failure to cancel within 10 days will be required to pay the course fee in full amount.

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