Training Title

ELECTRIC DISTRIBUTION SYSTEM EQUIPMENT: Transformers, Switchgears, Circuit Breakers, Relays, Capacitors, Surge Arresters, Cables & Meters: Operation, Inspection, Testing, Evaluation, Maintenance & Safety

Training Duration

5 days

Training Venue and Dates

REF EE032	Electric Distribution System Equipment	5 Days	04 -08 October 2020	$4,500	Dubai, UAE

In any of the 5 star hotels. The exact venue will be informed once finalized.

Training Fees

- **4,500 US$ per participant for Public Training includes Materials/Handouts, tea/coffee breaks, refreshments & Buffet Lunch.**

Training Certificate

Define Management Consultancy & Training Certificate of course completion will be issued to all attendees.

TRAINING INTRODUCTION & DESCRIPTION

Course will introduce a full understanding to the technology of the electrical equipment to electrical personnel. It will explain the successful start-up and subsequent continued operation followed by the electrical equipment periodic inspection and testing. To successfully aware and understand the electrical maintenance principles and basics. They could successfully not only inspect and test electrical equipment but also perform diagnostics and find out the faults to fix it shortly and safely;

This will ensure the electrical equipment operates correctly so that production is maximized in a safe, cost effective and efficient manner.

Delegates are encouraged to raise queries both during and at any time after attending the course and are also asked to bring with them any technical issues that they may have.

TRAINING OBJECTIVES

Participants attending this program will return to their respective organizations equipped with new or refreshed skills to ensure that electrical equipment is inspected, tested and operated in safe and a fashion that ensures reduced costs.

On successful completion of this course, participants will have:

- **A better understanding of distribution system basics and operation to realize the effect of equipment faults on electric network.**

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- **A better understanding of maintenance purposes and types.**
- **A better understanding of inspection and testing methods**
- **A better understanding of the updated electrical condition monitoring.**
- **A better understanding of troubleshooting procedures**
- **A better understanding for the major equipment operations.**
- **An improved capability in testing electric equipment.**
- **An better understanding of safety issues.**
- **A refreshed outlook on reading electrical drawings**
- **A refreshed awareness of electrical safety concerns**

WHO SHOULD ATTEND?

This course is intended for Electrical Engineers, Electrical Supervisors and Electrical Technicians engaged in the maintenance, inspection and testing of Electrical Equipment. Because the methods and examples are generic, personnel from all industries will benefit. Participants require a good understanding of electricity and magnetism and possess some relevant experience.

TRAINING METHODOLOGY:

A highly interactive combination of lectures and discussion sessions will be managed to maximize the amount and quality of information and knowledge transfer. The sessions will start by raising the most relevant questions, and motivate everybody find the right answers. You will also be encouraged to raise your own questions and to share in the development of the right answers using your own analysis and experiences. Tests of multiple-choice type will be made available on daily basis to examine the effectiveness of delivering the course. Very useful Course Materials will be given.

- **30% Lectures**
- **30% Workshops and work presentation**
- **20% Group Work& Practical Exercises**
- **20% Videos& General Discussions**

DAILY OUTLINE

DAY 1

I. INTRODUCTION AND ELECTRICAL ENGINEERING BASICS

1. **Power System Supplies**
2. **Generation System Layout**
3. **Main and Standby Power**
4. **Basic Services Power**
5. **Distribution System Design And Safety**
   - **I.5.1. load schedules**
   - **I.5.2. Diversity Factor**

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- I.5.3. Load Factor
- I.5.4. Load Flow
- I.5.5. Interlocking And Inter-tripping

6. DISTRIBUTION SYSTEMS LAYOUT
   - I.6.1. Simple radial system
   - I.6.2. Expanded radial system
   - I.6.3. Primary loop system
   - I.6.4. Closed-loop operation
   - I.6.5. Secondary selective system
   - I.6.6. Type of Feeders
7. Transmission Voltage Levels And Layouts

II. MAINTENANCE SCHEDULING FOR ELECTRICAL EQUIPMENT

1. Introduction
2. Maintenance and Test Procedures
   - General.
   - Infrared Scanning
   - Fault and Load Flow Studies/Equipment Ratings
   - Electrical Equipment Monitoring
   - Maintenance Schedules and Documentation.
3. Electrical equipment maintenance schedules
   (Transformers, Generators, Power Cables, Batteries and Battery Chargers,..)

DAY 2

III. TESTING, TROUBLESHOOTING PRINCIPLES AND COMMISSIONING GUIDE OF ELECTRICAL EQUIPMENT

1. Introduction
2. Basic principles in using a drawing and meter in Troubleshooting circuits
3. Checks for circuit continuity with disconnected supply
4. Checks for circuit continuity with live supply
5. Tests and methods
6. Testing devices
7. Testing and Commissioning Methods
8. Testing and Commissioning Procedures.
9. Maintenance of Particular Types of Electrical Equipment
10. Nomo gram for temperature correction
11. Test voltages for Commissioning and Maintenance
12. Recommended insulation values for equipment

IV. CONDITION MONITORING FOR ELECTRICAL EQUIPMENT

1. Insulation Resistance Monitoring

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- Insulation resistance test (IR)
- Megger test
- Polarization index test
- Dc hi-pot test
- Measuring insulation degradation
- Insulation power factor
- On line measuring partial discharge activity for insulation

2. On-Line Monitoring Of Transformers
   - Local Indications
   - Thermography
   - PDA - Partial Discharge Analysis
   - Insulating Oil Properties And Tests
     - Test for Dielectric Strength
     - Water Content in Oil
     - Acidity Test (Neutralization Number)
     - Oxidation Inhibitor
     - Interfacial Tension Test (IFT)
     - Oil Color
     - Oil Power Factor Test
     - Insulating Oil Dissolved Gas Analysis (DGA)
3. Understanding cable thermal behavior after installation
   - Optical cable Temperature Monitoring

<u>DAY 3</u>

V. EARTHING SYSTEMS

1. Introduction
2. Equipment Earthing
3. System Earthing
   - Unearthed systems
   - Solid earthing
   - Resistance earthing
   - Reactance earthing
4. Classification Of Supply / Installation System Earthing
5. Earthing Via Neutral Earthing Compensator
   - Distribution transformers
   - Zig Zag transformers
6. Comparison of Methods (Advantages/Disadvantages)
   - Evaluation of earthing methods

VI. GENERATOR FUNDAMENTALS MAINTENANCE ,TESTING AND TROUBLE SHOOTING

1. Principles of Generators

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- AC Generators
- GENERATOR EXCITATION AND VOLTAGE CONTROL
- DIESEL GENERATOR SETS
- SYNCHRONISING OF GENERATORS
- LOAD SHARING
- LOAD SHEDDING

2. Preventative Maintenance
3. Trouble Shooting
    - General Procedure
    - Generator Does Not Produce Voltage
    - Generator Produce Low Voltage
    - Generator Produce High Voltage
    - Generator Voltage Fluctuating
4. Fault analysis for Generator Control Circuit

<u>DAY 4</u>

VII. MOTORS, MOTOR CONTROLLER, MOTOR STARTERS FUNDAMENTALS, MAINTENANCE AND TROUBLESHOOTING

1. Fundamentals
    - Types of A.C Electric Motors
    - Principles of Operation of the Induction Motor
    - Enclosures and Cooling
    - POWER FOR INDUCTION MOTORS
    - STARTING OF INDUCTION MOTORS
    - Motor Operation at Reduced Voltage
    - Power Factor Correction
2. Motor Testing
3. Motor Failures

VIII. CIRCUIT BREAKER FUNDAMENTALS, MAINTENANCE, SERVICE ,TESTING AND TROUBLESHOOTING

1. Fundamentals
    - Air Circuit Breakers.
    - Vacuum Circuit Breaker
    - SF6 Circuit breaker
    - Oil Circuit Breaker Ratings
    - Fuses
    - Trip Circuit Supervision
    - Circuit-Breaker Control
    - Low Voltage Molded Case Current Limiting Circuit Breakers

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2. **HV Circuit Breakers Maintenance**
3. **H.V Circuit-Breakers Tests**
4. **Low voltage Circuit Breaker Maintenance**

DAY 5

IX. TRANSFORMER FUNDAMENTALS, MAINTENANCE, TESTING AND TROUBLESHOOTING

1. **Principles of Transformers**
   - **Saturation Curve & Voltage Ratio of Transformers**
   - **Current Ratio & Impedance of Transformers**
   - **Transformer Construction**
   - **Transformer losses and efficiency**
   - **Transformer Cooling & Types**
   - **Transformer Polarity**
   - **Transformer Applications**
   - **Transformer Accessories**
   - **Maintaining Transformers**
2. **Preventative Maintenance**
   - **Transformer Inspection**
   - **Transformer Liquids**
   - **Dielectric Test**
   - **General Testing**
   - **Other Important Tests**
   - **Transformer Failure**
   - **Disassembly for Inspection**
3. **Common Transformer Abnormalities**
4. **Transformer Oil Tests**
5. **Fault Analysis**

X. UPS, RECTIFIERS, INVERTERS AND BATTERIES FUNDAMENTALS MAINTENANCE ,TESTING AND TROUBLESHOOTING

1. **UPS Fundamentals**
   - **Rectifications & Inverters**
   - **Inverters**
   - **Batteries And Battery Charging**
   - **Battery Charging Tests**
   - **Safety During Battery Charging**
   - **Mixing Electrolyte**
2. **Battery discharge test.**

Troubleshooting Guide

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NOTE:

Pre & Post Tests will be conducted

Case Studies, Group Exercises, Group Discussions, Last Day Review & Assessments will be carried out.

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