



ELECTRICAL EQUIPMENT Inspection

Course Introduction:

The course begins with the fundamental principles that always apply to ensure safety, the course then progresses through basic design procedures, inspection, testing and maintenance requirements, concluding with a review of power quality problems that affect the reliability of an installation where high technology interfaces with a supply.

The seminar will provide an understanding of:

- The initial assessment of an installation prior to the design
- Selection of protective devices
- Cable sizing and installation
- Inspection and testing procedures
- The maintenance requirements

Course Objectives:

Upon completion of this training, participants will be able to demonstrate inspections performed during electrical installation, modification, or maintenance repair activities using example procedures, instructions, drawings, inspection criteria, and appropriate inspection equipment.

Who Should Attend?

This training is designed for Inspectors, Technicians, Engineers, and their supervision who are candidates for performing or monitoring electrical inspections during installation, modification, or maintenance activities. Attendees with an inspection or technical background will gain the most from this training; however, prior electrical inspection experience is not required.

المركز العالمي للتدريب والتطوير
International Centre For Training & Development

Course Outline:

CHAPTER 1: INTRODUCTION AND BASICS

- Introduction
- Magnetic Field
- Magnetic And Electric Fields
- Electromagnetism
- Electromagnetic Induction
- Generating Electrical Current
- Alternating Current Circuits
- Instantaneous Power (P)
- Complex Power
- Power Triangle
- Power Factor

- Three Phase System
- Worldwide Ac Voltages And Frequencies
- Per-Unit Values
- Do It Yourself

CHAPTER 2: ELECTRICITY SUPPLY

- Introduction
- Standard voltages
- Variations of voltage and frequency
- Systems of supply
- Industrial distribution systems
- Low voltage distribution circuits

CHAPTER 3: PROBLEMS RELATING TO OHM'S LAW

- Introduction
- Practical problems involving Ohm's law
- Problems relating to installation faults in series
- Resistances in series formation
- Installation problems involving ohm's law
- Summary

CHAPTER 4: INSPECTION AND TESTING

- Needs for inspection and testing
- Identification and notices
- Visual inspection
- Continuity tests
- Polarity test
- Insulation tests
- Phase sequence test
- Earthing tests
- After testing

CHAPTER 5: INTRODUCTION TO SWITCHGEAR

- Introduction
- Switchgear
- Difference Between A Fuse And A Circuit Breaker
- Comparison Between Switch, Isolator And Circuit Breaker
- Components Of A Switch Gear
- Bus-Bar Arrangements
- Ratings Of Busbars

- Switchgear Accommodation
- Clearance Of Busbars
- Short-Circuit
- Short-Circuit Currents
- Faults In A Power System
- Do It Yourself

CHAPTER 6: CIRCUIT BREAKER

- Introduction
- Circuit Breakers
- Arc Phenomenon
- Principles Of Arc Extinction
- Methods Of Arc Extinction
- Important Terms
- Classification Of Circuit Breakers
- Oil Circuit Breakers
- Types Of Oil Circuit Breakers
- Plain Break Oil Circuit Breakers
- Arc Control Oil Circuit Breakers
- Low Oil Circuit Breakers
- Air Blast Circuit Breakers
- Types Of Air-Blast Circuit Breakers
- Sulphur Hexafluoride (Sfg) Circuit Breakers
- Vacuum Circuit Breakers (Vcb)
- Circuit Breaker Components
- Circuit Breaker Ratings
- Application Range Of Circuit Breakers
- Types Of Circuit Breaker Mountings And Enclosures
- Testing Of Circuit Breakers
- Mechanical Tests
- Thermal Tests
- Dielectric Tests (High Voltage Tests)
- Short-Circuit Tests
- Insulation Resistance Measurement At Site
- Contact Resistance Test
- Operation Test
- Maintenance Of Circuit Breaker
- Maintenance Schedule For Circuit-Breakers
- Maintenance Of Oil Circuit Breaker (Boch, Moch)

- Maintenance Of Air-Blast Circuit Breakers
- Maintenance Of Vacuum Circuit-Breaker
- Maintenance Of Sf6 Circuit-Breaker
- Do It Yourself

CHAPTER 7: TRANSFORMER THEORY

- Purpose
- Scope
- Types Of Transformers
- Transformer Applications
- Magnetic Circuit
- Magnetic And Electric Circuits Of A Transformer
- Winding, Current And Voltage Ratios
- Laws Of Transformer
- Principle Of Operation Of A Transformer
- Reflected Impedance
- Transformer Equivalent Circuit
- Transformer Losses
- Efficiency
- Why Is Transformer Efficiency Usually High?
- Regulation
- Transformer's Voltage Per Turns
- Significance Of Volts Per Hertz
- Do It Yourself

CHAPTER 8: OIL TESTING

- Definitions
- Functions Of Transformer Oil
- Transformer Oil Properties
- Transformer Oil Standards
- Hydrocarbon Compounds In Transformer Oil
- Moisture Problems
- Factors Affecting Transformer Oil Properties
- Cellulose Degradation
- Global View
- Oil Dielectric Strength Test
- Relative Water Content Test
- Physical & Chemical Tests (Polar Characteristics Of Oil)
- Dielectric Losses Angle & Resistivity Test (Power Factor Test)

- Transformer Dissolved Gas-In-Oil Analysis (Dga)
- Oil Color Test
- Insulating Oil Sampling Procedure
- Oil Purification And Dehydration
- Yearly Insulating Oil Testing
- Oil Aging
- Preventive Maintenance Procedures For Transformer Oil
- Do It Yourself

CHAPTER 9: TRANSFORMER INSPECTION AND TESTING

- Test Data
- Abnormal Operating Conditions Of Power Transformer
- Reasons For Transformer Testing
- Transformer Performance Assurance
- Classification Of Transformer Tests
- Winding Resistance Test
- Polarity Test
- Ratiometer Test
- No-Load Losses Test
- Load Losses Test
- Percent Impedance Voltage Measurement
- Leakage Reactance Measurement
- Efficiency Test
- Winding Insulation Resistance Test
- Winding Insulation Capacitance & Dissipation Factor ($\tan \delta$) Test
- Sudden Short Circuit Withstand Test
- Oil Pressure Test
- Temperature Rise Test
- Impluse Testing
- Transformer Arrival: Handling, Inspection And Pre-Commissioning
- Do It Yourself

CHAPTER 10: MOTORS AND GENERATORS

- Introduction
- Nema Classification Of Motors And Generators
- Applications Of Motors And Generators
- Ac Motors
- Ac Generators Maintenance
- Dc Motors

- Dc Generators
- Motor And Generator Insulation Systems
- Motor And Generator Maintenance
- Testing Of Motors And Generators
- Other Insulation Test Methods

CHAPTER 11: EARTHING INSTALLATION AND TESTING

- Earthing Principles
- Protective Earthing Equipments
- Soil Resistivity
- Earth
- Grounding Electrodes
- Earthing Conductors
- Equipment Grounding
- Bonding
- Practical Considerations
- Methods For Decreasing Earthing Resistance
- Ground Inspection Wells
- Software
- Ground Resistance Measurements
- Protective Grounding Of Power Lines

CHAPTER 12: INSTALLATION AND TESTING SAFETY EQUIPMENTS

- Introduction
- General Inspection And Testing Requirements For
- Electrical Safety Equipment
- Flash And Thermal Protection
- Head And Eye Protection
- Rubber-Insulating Equipment
- Hot Sticks
- Insulated Tools
- Barriers And Signs
- Safety Tags, Locks, And Locking Devices
- Voltage-Measuring Instruments
- Safety Grounding Equipment
- Ground Fault Circuit Interrupters
- Safety Electrical One-Line Diagram
- The Electrician's Safety Kit

CHAPTER 13: SAFETY WORKING PRACTICES AND GENERAL GUIDELINES

- Common causes of accidents
- General dos and don'ts: your responsibilities
- Installation guidelines
- Fire hazards
- Lifting techniques
- First aid

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 Questionnaires
- 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

