POWER QUALITY, EARTHING & BONDING

TRAINIT ACADEMY

EPE154
Electrical & Power Engineering

COURSE TITLE

POWER QUALITY, EARTHING & BONDING

COURSE DATE/VENUE

28 March - 01 April, 2021

Dubai, UAE

COURSE REFERENCE

EPE154

COURSE DURATION

05 Days

DISCIPLINE

Electrical & Power Engineering

COURSE INTRODUCTION

The increasing use of equipment sensitive to power system disturbances and the related economic aspects, the increasing awareness of power quality issues and deregulation have created a need for understanding the causes of these problems and the ways to solve. The course covers the Power quality issues, power frequency disturbances, electrical transients and earthing systems in electrical power systems. The course concerns the sources of distortion (loads) and the interaction between those and the propagation of the distortion in the power system. Effects on the power system are also indicated. Harmonics, its effects on electric power system and how to overcome are highlighted.

COURSE OBJECTIVE

Upon the successful completion of this course, participants will understand and learn the following:-

- Power Quality definitions and issues in electrical Power System.

- Voltage sag, voltage swing and power frequency disturbances
- Earthing methods, Bonding and static electricity affects on power quality
- Harmonics In Electrical Power Systems
- Power factor correction and Electromagnetic interferences and their consequences on power quality
- Power quality improvement using Distributed Generators in distribution systems.
- Measuring and Solving Power Quality Problems

COURSE AUDIENCE

- Electrical power generation systems and distribution engineers in utilities and industrial plants
- Managers of private electricity producers and large power consumers
- Substation engineers
- Consulting engineers
- Manufacturers of power equipment technicians and technologists
- Other technical personnel involved in the design, operation and maintenance of high/medium voltage substations
- Operations technicians
- Electrical maintenance technicians and supervisors

COURSE CONTENT

1. **Introduction to Power Quality**
   - 1.1. Definition of Power Quality
   - 1.2. Power Quality Progression
   - 1.3. Power Quality Terminology
   - 1.4. Power Quality Issues
   - 1.5. Susceptibility Criteria
   - 1.6. Responsibilities of the Suppliers and Users of Electrical Power
   - 1.7. Power Quality Standards
2. **Power Frequency Disturbance**
   - 2.1. Common Power Frequency Disturbances

2.1.1. Voltage Sags

2.2. Cures for Low-Frequency Disturbances

2.2.1. Isolation Transformers

2.2.2. Voltage Regulators

2.2.3. Static Uninterruptible Power Source Systems

2.2.4. Rotary Uninterruptible Power Source Units

2.3. Voltage Tolerance Criteria

3. Electrical Transients

3.1. Transient System Model

3.2. Examples of Transient Models and Their Response

3.3. Power System Transient Model

3.4. Types and Causes of Transients

3.5. Examples of Transient Waveforms (Motor Start, Capacitor Switching, Voltage Notch, Neutral Voltage Swing, Sudden Application of Voltage, Self-Produced Transients)

4. Harmonics

4.1. Definition of Harmonics

4.2. Harmonic Number

4.3. Odd and Even Order Harmonics

4.4. Harmonic Phase Rotation and Phase Angle Relationship

4.5. Causes of Voltage and Current Harmonics

4.6. Individual and Total Harmonic Distortion

4.7. Harmonic Signatures (Fluorescent Lighting, Adjustable Speed Drives, Personal Computer and Monitor)

4.8. Effect of Harmonics on Power System Devices (Transformers, AC Motors, Capacitor Banks, Cables, Bus ways, Protective Devices)

4.9. Guidelines for Harmonic Voltage and Current Limitation

4.10. Harmonic Current Mitigation(Equipment Design, Harmonic Current Cancellation, Harmonic Filters)

5. Grounding and Bonding

5.1. Shock and Fire Hazards

5.2. National Electrical Code Grounding Requirements
5.3. Essentials of a Grounded System
5.4. Ground Electrodes
5.5. Earth Resistance Tests
5.6. Earth–Ground Grid Systems (Ground Rods, Plates, Ground Ring)
5.7. Power Ground System
5.8. Signal Reference Ground
5.9. Signal Reference Ground Methods
5.10. Single-Point and Multipoint Grounding
5.11. Ground Loops
5.12. Electrochemical Reactions Due to Ground Grids
5.13. Examples of Grounding Anomalies or Problems

6. Power Factor

6.1. Active and Reactive Power
6.2. Displacement and True Power Factor
6.3. Power Factor Improvement
6.4. Power Factor Correction
6.5. Power Factor Penalty
6.6. Other Advantages of Power Factor Correction
6.7. Voltage Rise Due to Capacitance
6.8. Application of Synchronous Condensers
6.9. Static VAR Compensators

7. Electromagnetic Interference

7.1. Frequency Classification
7.2. Electrical Fields
7.3. Magnetic Fields
7.4. Electromagnetic Interference Terminology (Decibel (dB), Radiated Emission, Conducted Emission, Attenuation, Common Mode Rejection Ratio, Noise, Common Mode Noise, Transverse Mode Noise, Bandwidth, Filter, Shielding)
7.5. Power Frequency Fields
7.6. High-Frequency Interference

7.7. Electromagnetic Interference Susceptibility

7.8. EMI Mitigation

7.9. Cable Shielding to Minimize Electromagnetic Interference

7.10. Health Concerns of Electromagnetic Interference

8. Static Electricity

8.1. Tribo-electricity

8.2. Static Voltage Buildup Criteria

8.3. Static Model

8.4. Static Control

8.5. Static Control Floors

8.6. Humidity Control

8.7. Ion Compensation

8.8. Static-Preventative Casters

8.9. Static Floor Requirements

8.10. Measurement of Static Voltages

8.11. Discharge of Static Potentials

9. Improvement Power Quality using Distributed Generators in Distribution Networks

10. Measuring and Solving Power Quality Problems

10.1. Power Quality Measurement Devices

10.1.1. Harmonic Analyzers

10.1.2. Transient-Disturbance Analyzers

10.1.3. Oscilloscopes

10.1.4. Data Loggers and Chart Recorders

10.1.5. True RMS Meters

10.2. Power Quality Measurements

10.3. Number of Test Locations

10.4. Test Duration

10.5. Instrument Setup

10.6. Instrument Setup Guidelines

COURSE CERTIFICATE

TRAINIT ACADEMY will award an internationally recognized certificate(s) for each delegate on completion of training.

COURSE FEES

$4,150 per Delegate. This rate includes participant's manual, Hand-Outs, buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

COURSE METHODOLOGY

The training course will be highly participatory and the course leader will present, guide and facilitate learning, using a range of methods including formal presentation, discussions, sector-specific case studies and exercises. Above all, the course leader will make extensive use of real-life case examples in which he has been personally involved. 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.

- 30% Lectures
- 30% Workshops and work presentation
- 20% Case studies & Practical Exercises
- 10% Role Play
- 10% Videos, Software or Simulators (as applicable) & General Discussions