Introduction

This conference on electrical fault analysis, detection, remedies, and solutions focuses on calculating fault currents in practical electrical power systems. Short-circuit currents are linked to extremely high and destructive energy levels. For this reason, calculations must be performed to ensure that the short-circuit ratings of equipment are sufficient to withstand such high currents. Accurate calculation of these currents is also essential in determining appropriate settings for protection devices within the system.

The conference provides a comprehensive explanation of the analysis methods used across the industry. To support participants, a professional engineering software tool will be applied throughout the workshop. This software simplifies complex and repetitive calculations while maintaining a high degree of accuracy with minimal assumptions. A significant portion of the training is dedicated to applying these techniques to practical systems, beginning with system preparation, moving through manual and computer-based calculation processes, and concluding with the application and interpretation of results.

Real-world examples from electrical systems, including those outlined in recognized industrial standards, will be presented to ensure participants understand how to follow and apply them. Additionally, participants will be introduced to specialized engineering programs capable of modelling complex systems and conducting fault analysis efficiently, provided the user can correctly interpret and explain the program's results.

The conference emphasizes that, as with any computer-based engineering application, incorrect input data inevitably lead to unreliable results. Therefore, participants will develop the ability to recognize such errors and exercise sound engineering judgment to correct them.

Understanding Electrical Faults and Remedies

Electrical fault analysis plays a critical role in operational safety and system reliability. Throughout this conference, attendees will engage in a practical fault-finding program that addresses the types of faults commonly occurring in power systems. Discussions will cover the underlying causes of electrical faults along with methods for fault detection and effective remedies.

Participants will also conduct root cause analysis of electrical faults, enhancing their understanding of issues such as resistance, insulation failure, and system breakdowns. This training defines electrical faults in technical terms, provides clear explanations, and reinforces learning through interactive sessions, case studies, and applied use of engineering software.

By the end of the program, participants will possess both theoretical knowledge and practical skills, enabling them to identify, analyze, and prevent electrical faults while implementing reliable remedial measures in their respective fields.

Intended Audience

- Electricians
- Design electrical engineers
- Electrical supervisors
- Plant electricians
- Operations and maintenance engineers, supervisors, and technicians
- Maintenance technicians

Objectives of the Conference
By the end of this training program, participants will be able to:

- Understand the theory of three-phase power systems under both balanced and unbalanced conditions.
- Apply the per-unit system and circuit-based analysis methods to calculate faults in industrial power systems.
- Use advanced engineering software to simplify complex fault calculations.
- Analyze both balanced and unbalanced faults using symmetrical components.
- Apply impedance reduction methods, including positive, negative, and zero sequence networks, and understand their interconnections for fault studies.
- Utilize computer-aided engineering tools to verify manual calculations and extend analysis to more complex power systems.
- Collect and organize the data required to conduct structured fault studies effectively.

Targeted Competencies
Participants will enhance their ability to:

- Identify and analyze the causes of electrical faults.
- Understand three-phase short-circuit current calculations.
- Recognize and analyze unsymmetrical faults in electrical transformers.
- Understand partial discharge phenomena and their required analysis.
- Represent unsymmetrical faults in power systems.
- Perform both manual and computer-assisted fault current calculations.
- Apply simulation techniques for configuring protection relays.

Conference Content

Unit 1: Introduction to Fault Analysis

- Sources of fault current
- Statistical overview of electrical faults
- Fundamental assumptions for analysis
- Short-circuit ratings of electrical equipment
- Selecting appropriate switchgear ratings based on fault levels
- Overview of the per-unit system
- Development of one-line diagrams
- Sources of impedance data for electrical equipment
- Tutorial on preparing systems for analysis
- Introduction to the engineering software used for calculations

Unit 2: Three-Phase Short-Circuit Currents

- Manual calculation of three-phase short-circuit currents
- Techniques for circuit reduction
- Analysis of industrial systems
- Power supply system considerations
- Tutorial based on participant project scenarios
- Effects of short-circuit currents on cables
- Ensuring compliance with regulatory standards

Unit 3: Unsymmetrical Fault Conditions

- Overview of symmetrical components
- Study of different fault types
- Sequence network analysis
- Phase shift considerations in two-winding transformers
- Earth impedance effects
- Analysis of three-winding transformers

Unit 4: Representation of Unsymmetrical Faults in Power Systems

- Development of fault diagrams
- Interconnection of sequence networks

- Special considerations for limiting earth fault currents
- Demonstration examples using industrial power systems

Unit 5: Computer-Based Fault Calculations

- Introduction to specialized engineering software for modelling complex electrical systems under fault conditions
- Application of software in practical case studies to validate manual calculations
- Review of industrial standards for fault analysis