

€ TRAINING

Electrical Faults: Causes, Analysis, Detection
& Remedies





Electrical Faults: Causes, Analysis, Detection & Remedies

Introduction:

The course is concerned with the calculation of fault currents in practical electrical power systems. Short-circuit currents are associated with large amounts of very destructive energy and therefore calculations must be made to ensure that the short-circuit ratings of equipment are adequate to cater to these high currents. In addition, an accurate assessment of these currents is also essential for determining the settings of the system protection devices.

The methods of analysis, used throughout the industry, are thoroughly explained in this seminar. A powerful engineering software package that makes complex and repetitive calculations easy to follow and the document is used throughout the seminar to ensure that attention to detail is not compromised and minimum simplifications are made. A considerable portion of the course is devoted to the application of these methods to practical systems, starting from the preparation of the system for analysis through the calculation process, by manual calculation, and by the use of computer analysis to the point of application of the results. The course is illustrated by practical examples of systems including ones as explained in detail in industrial standards that engineers need to be familiar with and able to follow and apply. Finally, industrial software programs are introduced that are capable of modeling complex electrical systems and make power system fault analysis a relatively easy task for engineers provided that one is able to explain and understand the results a computer program gives. This is important as with any computer software-based application where if the input data are wrong, for whatever reason, the results are also wrong and one needs to be able to observe such errors and make engineering judgments for their correction.

Course Objectives:

At the end of this course, the participants will be able to:

- Learn how to collect in a structured way data and information needed for a power system prior to fault analysis.
- Be exposed to the analytical techniques to study a power system under various types of faults.
- Understand faults, their effect, and different types of calculations involved with short, medium, and a long time of these phenomena affecting the power system.
- Be able to assess the design and functionality of protective equipment.
- Become familiar with the latest software-based approaches to deal with complicated commercial and industrial power systems and their analysis under fault conditions.

Targeted Audience:

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

Course Outlines:

Unit 1: Introduction to Fault Analysis:

- Source of fault current
- Fault statistics
- Basic assumptions
- Short-circuit rating of the equipment
- Selecting the correct switchgear rating for fault duties
- Overview of the per-unit system
- One-line diagrams
- Sources of impedance data for all items of plant
- Tutorial to demonstrate the preparation of a system for the study
- Introduction to the engineering software used throughout the course to make complex and repetitive calculations as accurate as possible

Unit 2: Three-Phase Short-Circuit Currents:

- Manual calculation of three-phase short-circuit current
- Circuit reduction techniques
- Industrial systems
- Electricity supply systems
- Tutorial - based on attendees plant
- Cables subjected to short-circuit currents
- Compliance with regulations

Unit 3: Unsymmetrical Fault Conditions:

- Overview of symmetrical components
- Consideration of various fault types
- Sequence networks
- Consideration of phase shift in two-winding transformers
- Consideration of earth impedance
- Consideration of three-winding transformers

Unit 4: Representation of Unsymmetrical Faults in Power Systems:

- Fault diagrams
- Interconnected sequence networks
- Special considerations with reference to limitation of earth fault current
- Demonstration examples based on industrial power systems

Unit 5: Computer-Based Calculation of Faults:

- Introduction to a scaled-down industrial program capable to model complex power systems under fault conditions
- Use of the software program in practical studies checking manual calculations
- Industrial standards
- Case studies of faults in a high voltage network
- Case study of faults in a low voltage network