Training Program:

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 for 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 industry, are thoroughly explained in this seminar. A powerful engineering software package that makes complex and repetitive calculations easy to follow and 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 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 relative easy task for engineers provided that one is able to explain and understand the results a computer programme 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.

Who Should Attend?

Engineers and Technicians responsible for the specification, commissioning and operation of electrical equipment in a power system, particularly those involved with specifying and commissioning protection gear. It is also suitable for those operating in power networks who require to update or refresh their knowledge and skills.

Course Objectives:

By the end of this course delegates 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 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
- Gain knowledge on basic theory of three phase power system under balanced and unbalanced conditions
- Know about the per-unit system and analytical circuit based techniques to calculate industrial power systems for faults

- Know about advanced engineering mathematical software that can be used to make difficult and complicated calculations an easy task
- Gain knowledge on balanced three-phase faults and unbalanced faults and their analysis using symmetrical components

Accreditation:

BTS attendance certificate will be issued to all attendees completing minimum of 80% of the total course duration.

Course Outline

Introduction to Fault Analysis

- Introductions
- Goals - discussion
- Source of fault current
- Fault statistics
- Basic assumptions
- Short-circuit rating of equipment
- Selecting the correct switchgear rating for fault duties
- Overview of per-unit system
- One-line diagrams
- Sources of impedance data for all items of plant
- Tutorial to demonstrate preparation of a system for study
- Closing discussion

Three-Phase Short-Circuit Currents

- Review - summary - discussion
- 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

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

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

Computer Based Calculation of Faults

- Introduction to a scaled down industrial programme capable to model complex power systems under fault conditions
- Use of the software program in practical studies (checking manual calculations)
- Industrial standards