



Training Program:

**Fault Level Analysis And Protection Coordination In
Distribution Network**

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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 without recourse to complex mathematical manipulation, but are sufficiently detailed to enable engineers to carry out analysis of his or her system to the required accuracy. 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 located in the Middle East.

Who Should Attend?

Managers, 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.

Training Methodology

The latest educational methods and strategies will be employed. The course is designed to maximize delegate benefit from the outset and any specific goals of each participant will be discussed to ensure needs are fulfilled as far as possible. Questions are encouraged throughout including at the daily wrap-up sessions. This provides opportunities for participants to discuss with the presenter and others, specific problems and appropriate solutions. All delegates take away a detailed and comprehensive copy of the material presented, therefore minimal note taking is encouraged to ensure maximum delegate participation and attention. All delegates will also be provided with a copy of the computer software used throughout the course.

Course Objectives:

This course is designed to enable participants to:

- The sources of fault current
- How to prepare a system for fault analysis
- The effect of different types of load on the level of fault current
- The effect of different types of fault and how they are catered for in the analysis
- The effect of different types of earthing on the fault level
- The use of computer programs in determining system faults
- The effect of fault level on switchgear rating
- The effect of voltage regulators

Course Outline

PARTICIPANTS ARE ENCOURAGED TO BRING LAPTOP COMPUTERS

Introductions

Goals - discussion

INTRODUCTION TO FAULT ANALYSIS

- Source of fault current
- Fault statistics
- Basic assumptions
- Short-circuit rating of equipment
- Selecting the correct switchgear rating for fault duties

CALCULATION PRELIMINARIES

- 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

Goals - discussion

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

CLOSING DISCUSSION

Goals - discussion

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

CLOSING DISCUSSION

Goals - discussion

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

CLOSING DISCUSSION

Goals - discussion

COMPUTER CALCULATION OF FAULT CURRENTS

- Introduction to program
- Use of program in practical studies (checking manual calculations)
- Use of transient program to derive fault-current decrement
- Application to switchgear rating
- Effect of voltage regulators
- (The program will be made available to attendees for private study)

Accreditation:

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