

Electrical Fault Analysis

In Utilities and Industries Electrical Networks

(Causes, Detection & Remedies)

5-day Training Program

Introduction

The continuity of Electrical Power Supply is very important to the consumers specially, for industrial sector where the curtail of electrical power supply is costly.

Electrical systems are subjected to several external & internal influences like weather conditions, lightning phenomenon, pollution, insulation failure, temperature rise, etc., these influences cause abnormal operational condition, which could lead to voltage and frequency variations and feeder trips, brown out or black out of the electrical system, and sometimes, may lead to equipment damage or system failure. Performance and characteristics of electrical system configurations are vital factor in reducing or increasing the effect of faults on the system as earthing system, switch gear, protective relays, active and reactive power generation, etc.

This course discusses electrical system faults and elements of the system that affect its behavior during the fault. The course also will suggest measures to mitigate the problems that would arise. Many utilities need this course which studies the influences of the above mentioned events on the electrical networks and their effect on the continuity of electrical power supply and how to mitigate these problems.

Who Should Attend?

This course is intended for Engineers & supervisors who work in transmission, distribution, Maintenance, operation, control and analysis of Utilities & Industrial Electrical Networks.

Course Objectives

To know the major faults which the electrical networks encounter cause curtail of electrical supply and how to mitigate it by means of:

- Understanding the Grounding System of generation, Transmission and Distribution Networks

- How it affects the electrical quantities, short circuit level and protection system.
- Understanding the causes of Voltage Deviations and its effect on auxiliaries of generators, industrial loads and the stability of Electrical Power Systems.
- Knowing the reasons for the shortage of active and reactive power in electrical networks and its effect on the electrical quantities.
- Understanding the effect of environmental conditions on the electrical equipment
- Understanding the abnormal phenomena, which affect the electrical networks.

Program outline

Day One

INTRODUCTION

- Importance of Continuity of Supply
- Power System Components.
 - Causes of Faults
 - Type of Faults.

System Grounding

- Generation Units
- Power Transformers
- Transmission Lines
- Distribution System
- Arrangement of Grounding in Power System

Day Two

Factors Effect The Fault Current Contribution & Continuity of Supply.

- Vector Groups
- Parallel Transformers with Different Vector Groups

- Grounding Transformers (Zig Zag T., 3wdg.T.,...)
- Common & Separate Grounding Resistance (High & Low value) for Number of Parallel
- Transformers.

Fault Calculations

- System Configurations
- Per unit Values.
- Symmetrical Components
- Symmetrical & Unsymmetrical Fault Calculations.
- Short Circuit Level.
- Effect of Induction Machines on Short Circuit Level.
- Rupture Capacity of Circuit Breaker.
- Methods, To Reduce The Short Circuit Level.
- Peak Current Limiters.
- Numerical Examples.

Day Three

Male & False Operation Of The Following Protective Relays:

- Directional and non-directional over current & Earth fault Relays
- Differential and restricted earth fault Relays
- Impedance Relays
- Sensitive Earth Fault Relays
- Over fluxing Relays
- Bochoz Relays
- Case Studies.

Day Four

System Behavior Due To The Following Abnormal Operational Conditions:

- Shortage of active Power
- Shortage of Reactive Power
- Frequency deviations
- Voltage deviations
- Collapse of voltage
- Voltage stability
- Voltage rise

Case Studies

Day Five

Faults Due To the Following External & Internal Influences:

- Lightning
- Pollution
- Switching
- Transients
- Harmonics

Case studies (Brown out & Black out of Elect. Networks)

Discussions