Substation Overvoltage Protection Seminar (4-8 hrs)

Course Overview

Surge protection of substations is a vital part of the overall reliability of power systems. The degree of surge protection afforded to a station is governed by the reliability required and the economics to obtain such reliability. Since major stations generally include strategic and highly valuable power equipment, surge protection is essential to avoid or minimize major system disturbances as well as major equipment failures. The subject of station surge protection involves the application of several types of surge protective equipment. Surge arresters limit the magnitude of transient overvoltages. The proper selection and application of these devices are the focus of this tutorial.

Course Text and Who Should Attend

The basic text for this course is the presentation slides as shown in the outline below. The actual presentation can be tailored to 4 or 8 hours, but the presentation slides are the same. This tutorial is targeted to those individuals involved in substation design, maintenance or specification. Participants will receive .1 CEU for every hour of participation.

The Instructor

Jonathan Woodworth is the Principal Consultant with ArresterWorks. Before starting ArresterWorks in 2008, Jon spent 29 years with Cooper Power Systems holding several arrester associated functions. More than 15 years as Engineering Manager, 7 years as Marketing Manager, and more than 5 years in MOV disk design and production. He is an active participant in both IEC and IEEE arrester standard development.

Course Outline

1.0 Substation Fundamentals as Related to Surge Protection
- 1.1 Types of Substations
- 1.2 Typical Substation System Voltages
- 1.3 Typical Substation Equipment That Needs Surge Protection

2.0 Surge Fundamentals
- 2.1 Nature of Surges in a Substation
  - 2.1.1 Direct Strike
  - 2.1.2 Nearby Insulator Flashover
  - 2.1.3 Switching Surges
  - 2.1.4 Nearby Strikes
- 2.2 Lightning Currents And Overvoltages
  - 2.2.1 Wave Shapes
  - 2.2.2 Energy Content
- 2.3 Switching Overvoltages

3.0 Arrester Fundamentals
- 3.1 Brief History of Arresters
  - 3.1.1 Pre Silicon Carbide Gapped
  - 3.1.2 Silicon Carbide Gapped
- 3.2 Gapless MOV Arresters
  - 3.2.1 Basic Components of Arresters
  - 3.2.2 Design Considerations
    - 3.2.2.1 VI Characteristics
    - 3.2.2.2 Thermal Characteristics
    - 3.2.2.3 Voltage Withstand Capability
  - 3.2.3 MOV Disk Overview
    - 3.2.3.1 How it works
  - 3.2.4 Design and Industry Trends
- 3.3 Arrester Test Standards
  - 3.3.1 Significant Tests
  - 3.3.2 Insignificant Tests
  - 3.3.3 Acceptance Tests
  - 3.3.4 Changes coming
- 3.4 Types of Arresters In Substations
  - 3.4.1 Station
  - 3.4.2 Intermediate
  - 3.4.3 Distribution
  - 3.4.4 Dual Rated Arresters
  - 3.4.5 Riser Pole Arresters
- 3.5 Arrester Housing Considerations
- 3.6 Grading Rings
  - 3.6.1 Purpose
  - 3.6.2 Installation Considerations
- 3.7 Failure Mode Considerations
  - 3.7.1 Reclosing on a failed arrester
  - 3.7.2 Advantages of Composite Housed Arresters
  - 3.7.3 Hollow Core Design Considerations

4.0 Arrester Selection Procedure
- 4.1 Arrester Selection Summary
- 4.2 Arrester Selection Detail
  - 4.2.1 Select Voltage Rating
  - 4.2.2 Check TOV Capability
    - 4.2.2.1 System TOV Amplitude Considerations
    - 4.2.2.2 System TOV Duration Considerations
    - 4.2.2.3 System TOV Due To Load Rejection
  - 4.2.3 Check Energy Requirements