

Automatic Voltage Regulator (AVR): Operation and Maintenance

INTRODUCTION:

Utilities are required to provide power to their customers within a specific range of voltage. Voltages that are outside of that range may damage equipment or cause it to operate inefficiently. For example, voltage that is significantly lower than the desired range may cause lights to dim and motors to burn out. Voltage that is significantly higher may cause lights or appliances to fail prematurely. In an ideal ac power system, the voltage and frequency at every supply point would be constant and free of harmonics, and the power factor would be unity. In particular these parameters would be independent of the size and characteristics of consumers' load. In an ideal system, each load could be designed for optimum performance at the given supply voltage, rather than for merely adequate performance over an unpredictable range of voltage. Moreover, there could be no interference between different loads as a result of variations in the current taken by each one.

COURSE OBJECTIVES:

- Describe why voltage regulation is needed in a transmission and distribution system
- Explain the Effect of Raising Voltage at the Substation Bus
- Identify the main components of automatic voltage regulator
- Identify the principle of operation of the auto reclosure
- Explain the typical locations of auto-reclosure on the distribution system
- Identify the advantages of installing auto-reclosures on the distribution system
- Describe how a sectionalize operates in a reclosure circuit
- Describe how an automatic voltage regulator adjusts voltage

WHO SHOULD ATTEND?

In general, electrical power engineers, supervisors and qualified distribution system technicians can which work in substation and operation & maintenance of distribution department take part in this course.

MATERIAL LANGUAGE: English

PRESENTATION LANGUAGE: English

TRAINING METHODOLOGY:

Each course participant will receive a copy of the comprehensive course notes. The presenter will discuss the topics using OHP-Data show. The course is designed to have an interactive format to maximize delegate participation. Questions and answers are encouraged throughout and at the daily sessions. Needs based case studies and examples will be discussed in problem solving workshops sessions. This gives participants the opportunity to discuss with other delegates and the presenter their specific problems and appropriate solutions.

COURSE CONTENTS:

1. INTRODUCTION

- 1.1 Describe why voltage regulation is needed in a transmission and distribution system
- 1.2. Voltage Standards
- 1.3. Factors affecting voltage drop along distribution feeders
- 1.4. The Effect of Raising Voltage at the Substation Bus
- 1.5. The effect of load power factor on line voltage drop
- 1.6. Functional of the capacitor in raising voltage
- 1.7. Purpose of auto-reclosure (ACR)

2. CONSTRUCTION AND FUNCTION

- 2.1. Auto-reclosure
 - 2.1.1. Re-closing arrangements
 - 2.1.2. The function of the auto-reclosure
 - 2.1.3. Auto-reclosure characteristics
 - 2.1.4 The inverse time characteristics for tripping an auto-reclosure
 - 2.1.5 Fast and slow auto-reclosure curves
 - 2.1.6. Coordination of auto-reclosure
 - 2.1.7. Coordinating auto-reclosures with fuses
 - 2.1.8. Auto-reclosure construction and types of extinguishing medium
- 2.2 Automatic Voltage Regulator
 - 2.2.1 Identify the main components of automatic voltage regulator
 - 2.2.2 The function of voltage regulator
 - 2.2.3 Voltage Regulator Operation
 - 2.2.4 A voltage detector and how it works
- 2.3 Voltage Regulator Control
- 2.4 Voltage Detectors
- 2.5 Solid-State Voltage Detectors
- 2.6 Additional Voltage Controls
 - 2.6.1 Line Drop Compensators
 - 2.6.2 Time Delay Component
 - 2.6.3 Limit Switches
- 2.7 Voltage Reduction Control
- 2.8 First House Voltage Protector

3. OPERATION PROCEDURES OF:

- 3.1. Auto-reclosures
 - 3.1.1 Principle of operation of the auto reclosure
 - 3.1.2 Typical locations of auto-reclosure on the distribution system
 - 3.1.3 The advantages of installing auto-reclosures on the distribution system
 - 3.1.4. Consideration in selecting re-closing time
 - 3.1.5. Describe how a sectionalize operates in a reclosure circuit
- 3.2 Voltage Regulators
 - 3.2.1 Explain how automatic voltage regulators operate (AVR)
 - 3.2.2 Identify the main components that enable a step voltage regulator to adjust voltage
 - 3.2.3 Describe how an automatic voltage regulator adjusts voltage

4. CIRCUIT BREAKERS

- 4.1 Control Circuits of Circuit Breakers
 - Closing circuit and mechanism
 - Tripping and opening circuit and mechanism
 - Antislam
 - Anti pumping
 - Seal – in
 - Trip free
 - Auxiliary switch
 - Contactors
- 4.2 Interlock System
 - C.B. & isolators
 - C.B.& earthing switch
 - Lock out
 - Pressure & level gauges
- 4.3 Breaker Failure Scheme
- 4.4 The Various Times in C.B. Control
 - Breaker interrupting time
 - Closing time
 - Contact Parting time
 - Arcing time
 - Re-closing time
 - Trip-free time
 - Fault clearing time
 - Relaying time
 - C.B. total break time
- 4.5 C.B. Various Tests
 - Site acceptance test (SAT)
 - Factory acceptance test (FAT)

5. VOLTAGE REGULATORS INSPECTION AND CONTROL

- 5.1 Field Control Checks
- 5.2 Voltage Readings
- 5.3 Field Control Checks (continued)
- 5.4 Regulator Operation Check

6. OPERATING MECHANISMS FOR AUTO RECLOSERS

- 6.1 Closing and opening
- 6.2 Interlocking
- 6.3 Integral earthing
- 6.4 Re-closing Relays

7. REGULATOR REPLACEMENT

- 7.1 Operating the Regulator to Neutral
- 7.2 Bypassing the Regulator
- 7.3 Isolating the Regulator
- 7.4 Physically Disconnecting the Regulator
- 7.5 Regulator Installation

8. THE PROCEDURE OF TROUBLE ANALYSIS

9. COMMON TROUBLE & REMEDIAL ACTIONS

10. SUPERVISORY-LOCAL-REMOTE CONTROL CIRCUITS OF C.B.

11. SECONDARY WIRING OF CONTROL CIRCUIT