Prerequisites:

- None

Objectives: Given an energized voltage regulation device, the Construction Standards manual, and tools and equipment, you will be able to explain and demonstrate the operating procedure for voltage regulation devices.

Rationale: In order to maintain a standard voltage supply to customers, an operator must understand the operating and maintenance procedures of regulating devices. The operator must also understand the procedures to install and remove regulating devices.

Learning Objectives

- Explain the operating precautions when removing or returning a voltage regulating device to service.
- Explain the procedure to put a 32-step regulator in or out of service.
- Demonstrate the procedure to take a 32-step regulator in or out of service.

Learning Methods

- Self-learning + On-the-job
- Self-learning + On-the-job
- On-the-Job Demonstration and Practice

EVALUATION METHODS

- Written test
- Written test
- On-the-Job Evaluation

STUDENT RESOURCES

- None
Learning Steps

1. Read the Learning Guide.
2. Follow the steps outlined in the Learning Guide.
3. Clarify any questions or concerns you may have.
4. Complete the Practice and Feedback.
5. Complete the Evaluation.
Lesson 1: Voltage Regulating Device Inspections

Learning Objective: Explain the operating precautions when removing or returning a voltage regulating device to service.

Learning Method: Self-learning + On-the-job

Evaluation Method: Written test

Introduction

The voltage regulator is an integral part of the electrical system and certain inspections are required to ensure voltage remains within acceptable limits for customers.

Regulator Apparatus Inspection

All physical and associated fixtures are to be inspected and recorded. Some things to look for include:

- chipped or broken insulators
- wire connections
- oil leaks
- switch gear condition
- the state of the regulator grounding system
- structural stability

Voltage Levels

Faulty voltage regulating devices may be suspected when customers on the load side experience high or low voltage.

The output voltage will determine if the regulator is operating properly or not. If the output voltage is at the existing setting, the regulating device is working properly. Otherwise, further investigation is needed to correct the voltage regulation.

Operating Precautions

Bypassing the regulator is required when the pre-operating inspections indicate the voltage regulator is faulty.
The 4-step regulator(s) most commonly used have two types of controls. Each controller provides output voltage test terminals; however, one controller is equipped with a neutral light indicator. Regardless of the controller, the regulator has a light on the side of the tank which indicates the “Neutral” position.

The “Neutral” position must be obtained before the regulator is bypassed. This ensures there is no difference in potential between the line side bushing and the load side bushing. If the regulator is bypassed before the “Neutral” position is obtained, the difference in potential between the line side and load side bushings will create a major fault, resulting in equipment damage and possible personal injury.

A remote cable is used to move the tap position by operating the lower/raise tap switch. This removes the operator from any potential hazards.

---Note---
If the “Neutral” position cannot be confirmed, isolate the line that feeds the regulator and take it out of service.
Lesson 2: 32-Step Regulating Device

**Learning Objective:** Explain the procedure to put a 32-step regulator in or out of service.

**Learning Method:** Self-learning + On-the-job

**Evaluation Method:** Written test

### Introduction

In order to bypass the 32-step regulator, the tap changer must be in the “Neutral” position

- Set the tap changer control switch to the “Manual” position.
- Using the lower/raise tap switch, move the tap changer to the “Neutral” position.
- The “Neutral” position must be confirmed using the neutral light located on the control panel and the neutral indicator dial.

---Note---

If these conditions cannot be met in confirming the “Neutral” position, isolate the source line of the regulator.

### Restoring a Regulator to Service

In order to restore a 32-step regulator equipped with a three-blade bypass switch into service:

- Put the regulator tap changer control switch in the “Manual” position.
- Close the line side blade using a hotstick with a universal fusing attachment. This will energize the coil, providing 120V to the panel. Ensure closure by tug testing with a hotstick.
- Confirm the “Neutral” position using the tap indicator on the regulator and neutral light on the control panel.
- The control panel power switch must be in the “Off” position. This prevents the tap changer from moving.
- Close the load side blade using a hotstick with a universal fusing attachment. Ensure closure by tug testing with a hotstick.
- Open the bypass blade using a hotstick with a universal fusing
attachment.

- Turn the power switch on the control panel to the “On” position.
- Turn the tap changer control to the “Automatic” position.

---Note---

The tap changer should start to tap to the required position.

---Note---

The steps to operate a 4-step auto booster are indicative of the steps used to operate a 32-step regulator.
Lesson 3: 32-Step Regulating Device

*Learning Objective:* Demonstrate the procedure to take a 32-step regulator in or out of service.

*Learning Method:* On-the-Job Demonstration and Practice

*Evaluation Method:* On-the-Job Evaluation
Skills Practice

1. Tools and Equipment:
   1. Inspect and clean the hotstick.
   2. Use a fusing attachment.

2. Steps for Removal:
   1. Change the tap changer control to “Manual.”
   2. Using the lower/raise switch, tap the regulator to the “Neutral” position.
   3. Confirm the “Neutral” position.
   4. Turn the power to the control panel to the “Off” position.
   5. Close the bypass blade and tug test.
   6. Open the line and load blades.

3. Tools and Equipment
   1. Inspect and clean the hotstick.
   2. Use a fusing attachment.

4. Steps for installation:
   1. Change the tap changer control to “Manual”.
   2. Close the line side blade and tug test.
   3. Check the load side blade for potential.
   4. Use the lower/raise switch to tap the regulator to the
“Neutral” position.

5. Confirm the “Neutral” position.

6. Turn the power to the control panel to the “Off” position.

7. Close the load side blade and tug test.

8. Open the bypass blade.

9. Turn the power switch on the control panel to the “On” position.

0. Change the tap changer control to “Automatic”.
Summary

To summarize this module, you have learned:

• The pre-operating procedures and inspections associated with voltage regulation devices.
• The procedure to take a 4-step regulator in or out of service.
• The procedure to take a 32-step regulator in or out of service.

Practice Feedback

Review the lesson, ask any questions and complete the self-test.

Evaluation

When you are ready, complete the final test. You are expected to achieve 100%.
Review Questions

T / F  1. Faulty voltage regulating devices may be suspected when customers on the load side experience high or low voltage.

T / F  2. The voltage regulator can be bypassed on any tap position.

T / F  3. When the tap changer on an auto transformer is off load, no attempt shall be made to bypass it.

T / F  4. A 4-step voltage regulating device has only one type of control.

T / F  5. The “Neutral” position must be obtained before a regulator is bypassed.

T / F  6. The tapchanger on an auto transformer is on load.

T / F  7. The tapchanger on an auto transformer is off load.

T / F  8. If the “Neutral” position cannot be confirmed, isolate the line that feeds the regulator and take it out of service.

T / F  9. If the “Neutral” position cannot be confirmed, bypass the regulator to take it out of service.

T / F  10. When bypassing a 32-step voltage regulator, the position of the tap changer is unimportant.

11. The tool(s) required to bypass a 32-step voltage regulator are a:
    (a) Hotstick.
    (b) Universal hotstick fusing attachment.
    (c) Hotstick and universal hotstick fusing attachment.
    (d) Universal hotstick fusing attachment and hot line cutters.

T / F  12. The steps to operate a 4-step auto booster are indicative of the steps used to operate a 32-step regulator.
13. Ensure a tug test is done after closing the bypass blades.

14. The control panel power switch must be in the “On” position when switching a regulator into service.

15. The control panel power switch must be in the “Off” position when switching a regulator into service.

16. When restoring a regulator into service, the tap changer control switch must be in the “Auto” position.

17. When restoring a regulator into service, the tap changer control switch must be in the “Manual” position.
Review Question Solutions

1. T
2. F
3. T
4. F
5. T
6. F
7. T
8. T
9. F
10. F
11. Hotstick and universal hotstick fusing attachment.
12. T
13. T
14. F
15. T
16. F
17. T