Overhead Switching Devices

March 31, 2005

S T U D E N T M A N U A L
Prerequisites:

- Oil Circuit Recloser Operating Principles module

Objectives: Given the Construction Standards manual, you will be able to describe the electrical system requirements for switching devices and their operation.

Rationale: An electrical system is susceptible to many types of problems which may require isolating and switching. Proper switching helps the operator maintain and troubleshoot the system in a safe and efficient method.

Learning Objectives

- Describe the function and operation of primary single-phase switching devices.
- Describe the function and operation of primary three-phase switching devices.
- Describe the function and operation of secondary switching devices.
- Demonstrate the procedure to operate a primary three-phase switching device.

Learning Methods

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

EVALUATION METHODS

- Written test
- Written test
- Written test
- On-the-Job Evaluation
STUDENT RESOURCES

• Construction Standards manual

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: Primary Single-Phase Overhead Switching Devices

Learning Objective: Describe the function and operation of primary single-phase switching devices.

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

Evaluation Method: Written test

Introduction

Primary single-phase overhead switching devices are frequently used to isolate and connect electrical apparatus and/or electrical lines. Two basic types of switching devices are:

Sectionalizers
Sectionalizers are an oil type switch designed to work in conjunction with oil circuit reclosers (OCR) to isolate faults on distribution lines. They are usually installed on single-phase tap-off lines fed from the three-phase system.

When a fault occurs on the load side of the sectionalizer, the OCR will operate. The sectionalizer counts the number of OCR operations and, after two operations, the sectionalizer will lock out under a no current flow condition. This system design allows the OCR to energize the line up to the sectionalizer location on the third operation, thereby reducing the outage to affect only the customers on the load side of the sectionalizer and isolating the fault.

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**CAUTION**

Although Type Form 1-GH sectionalizers cannot be used to pick up load, Type GN-3 sectionalizers can. Identify each before operating.

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**Disconnects**

Disconnects are designed as a non-load break and non-load pickup switching device. Two types of disconnects are:

- solid blade
- bypass blade

These switching devices are available in high amperage ratings, which makes them useful in areas where high amperage conditions exist.
Solid Blade

A solid blade allows the operator to isolate and energize sections of electrical apparatus, as well as power lines, under no load conditions, while maintaining the ability for high current flow in the power lines and electrical apparatus.
A 3-blade bypass switch is basically three solid blades connected such that it allows the flow of electrical energy to be maintained in the power line while diverting the flow of electrical energy from apparatus such as OCRs and regulators. This allows maintenance and exchange of electrical apparatus while maintaining the electrical supply in the power
CAUTION

When operating bypass switches with porcelain insulators (brown or gray), two operators must be utilized. One supports the switch with a hotstick, while the other performs the switching operation. Because some bypass switch insulators have been known to break during switching, these types of bypass switches should be replaced with the polymer type.

CAUTION

Always ensure the blade is locked in the closed position with the use of a tug test.
Lesson 2: Three-Phase Overhead Primary Switching Devices

Learning Objective: Describe the function and operation of primary three-phase switching devices.

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

Evaluation Method: Written test

Introduction

A three-phase overhead primary switching device has three individual switches mechanically connected together to operate simultaneously by a single handle. These devices, usually referred to as GOPT (gang operated pole top) switches, allow an operator to isolate and energize three-phase power lines.

Two types of GOPT switching devices are:

• non-load break
• load break
Non-load Break Switch

Non-load break switches are used to isolate and energize power lines and electrical apparatus (transformers) under no load conditions. Non-load simply means that no form of energy is present.
Load Break Switch

Figure 1. Three-Phase Load Break GOPT Switch

Load break switches are designed to energize and isolate loaded circuits and transformers up to their manufacturer’s rating (current and power factor) as required for either radial or parallel operations.

Load break switches are available with a variety of arc interrupting devices such as:

- arcing horns and whips
- arc stranglers
• arc interrupters

**DANGER**

*Always wear the proper protection (appropriate class of rubber gloves) when operating overhead three-phase (GOPT) switches.*

**CAUTION**

*Always check the switch blades to ensure they are completely open or completely closed.*

**CAUTION**

*Ensure the switch handle is locked after switching is complete.*
Lesson 3: Secondary Switching Devices

Learning Objective: Describe the function and operation of secondary switching devices.

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

Evaluation Method: Written test

Introduction

Secondary switching devices are used to isolate and energize secondary circuits, and can be found on farms, oilfields and on irrigation services. They are also used for street light systems.

Two types of secondary switches are:

- current totalizing and thermal breakers
- secondary cabinet switches

Reference

For further information on breakers, refer to the Single Trip Overcurrent module

Secondary Cabinet Switch

A secondary cabinet switch provides a means of isolating and energizing secondary cables and electrical apparatus through the use of a load break and load pickup switch.
Lesson 4: Procedure to Operate a Three-Phase Switching Device

*Learning Objective:* Demonstrate the procedure to operate a primary three-phase switching device.

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

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

1. **Isolate:**
   1. Inspect and wear Class 1 rubber gloves.
   2. Unlock the switch handle.
   3. Open the switch with a firm positive motion.
   4. Check the blades.
   5. Lock the handle in the open position.

2. **Make alive:**
   1. Inspect and wear Class 1 rubber gloves.
   2. Unlock the switch handle.
   3. Close the switch with a firm positive motion.
   4. Check the blades.
   5. Lock the handle in the closed position.
Summary

To summarize this module, you have learned:

- The function and operation of primary single-phase switching devices.
- The function and operation of primary three-phase switching devices.
- The function and operation of secondary switching devices.

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

1. Two types of primary overhead single-phase switching devices are:
   (a) Solid blade and bypass blades.
   (b) Sectionalizers and disconnects.
   (c) Hot line clamps and sectionalizers.
   (d) None of these

T / F 2. A disconnect switch is used to open sections of power lines under no load conditions.

3. A bypass switch provides an operator with:
   (a) Three-phase switching capability.
   (b) Load breaking capability.
   (c) An ability to isolate electrical equipment.
   (d) None of these

T / F 4. A sectionalizer cannot be used with an OCR.

5. Two types of disconnects are:
   (a) Solid blade and bypass blades.
   (b) Hot line clamps and sectionalizers.
   (c) Hot line clamps and bypass blade.
   (d) Riser and hot line clamp.

T / F 6. Sectionalizers work in conjunction with oil circuit reclosers.

T / F 7. Sectionalizers lock out under a no current flow condition.

T / F 8. Sectionalizers work in conjunction with a cutout.

T / F 9. A three-phase overhead switching device always has load breaking ability.

10. To energize and isolate three-phase overhead primary power lines with a primary current of 60 amps, an operator would use a:
(a) Disconnect.
(b) Sectionalizer.
(c) Three-phase GOPT load break switch.
(d) All of these

T / F 11. Never use rubber gloves to operate a GOPT switch.

12. Load break switches are available with a variety of ARC interrupting devices such as:
   (a) Arcing horns and whips.
   (b) ARC stranglers.
   (c) ARC interrupters.
   (d) All of these

13. Two types of secondary switching devices are:
   (a) Breakers and solid blades.
   (b) Sectionalizers and secondary cabinet switches.
   (c) Bypass blades and sectionalizers.
   (d) Breakers and secondary cabinet switches.

T / F 14. A secondary cabinet switch provides a means of isolating and energizing secondary cables and electrical apparatus through the use of load break and load pick-up switch.
Review Question Solutions

1. Sectionalizers and disconnects.
2. T
3. An ability to isolate electrical equipment.
4. F
5. Solid blade and bypass blades.
6. T
7. T
8. F
9. F
10. Three-phase GOPT load break switch.
11. F
12. All of these
14. T