Change Transmission Deadend Insulator with Hotsticks
Prerequisites:

- Introduction to Hotsticks module
- Use and Care of Hotsticks module
- Weights and Forces module
- Universal Tools and Accessories I module
- Universal Tools and Accessories II module
- Wire Tongs and Accessories module
- Live Line Tensioning Tools module

Objectives: Given a hotstick trailer and a transmission deadend structure, you will be able to replace insulators on an H-frame deadend using the hotstick method, without the aid of an aerial device.

Rationale: The customer demand for uninterrupted power may require the work to be done energized.

Learning Objectives

- Describe the procedure to hold a tailboard discussion.
- Calculate the deadend tension of the conductor.
- Identify the hotsticks and tools required to replace deadend insulators.
- Install the strain carrier and insulator cradle in the configuration required to replace deadend insulators.
- Describe the procedure to remove the tension from the deadend insulators using strain carriers
- Describe the procedure to disconnect and connect the conductor deadend from an insulator string.
- Describe the procedure to remove and install an insulator string using an insulator cradle.

Learning Methods

- Self-learning + On-the-job
- Self-learning + On-the-job
- Self-learning + On-the-job
- Self-learning + On-the-job
- Self-learning + On-the-job
• Self-learning + On-the-job
• Self-learning + On-the-job

EVALUATION METHODS

• Written test
• Written test
• Written test
• Written test
• Written test
• Written test
• Written test

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.

Introduction

In the procedure of replacing an insulator on a deadend structure, the conductor deadend tension is transferred from the insulator string to the strain carriers. This configuration will allow adequate clearance for the removal of the insulators using an insulator cradle.

No matter what tools you are using, remember that your safety and that of your co-workers is a prime consideration in all work activities. Recommended working clearances must be maintained at all times for the voltage being worked.
The following chart indicates the minimum number of good insulators required when performing live line work at the applied voltage under specific conditions.

The integrity of an insulator is determined by checking for voltage across the insulating surface. This is accomplished with either an energized insulator tester or a metal fork insulator tester. The tester, which is attached to the appropriate universal stick for the voltage being worked on, measures a difference in potential between the two points.
Lesson 1: Tailboard Discussion

Learning Objective: Describe the procedure to hold a tailboard discussion.
Learning Method: Self-learning + On-the-job
Evaluation Method: Written test

Introduction

Upon arriving at the job site, a “tailboard” discussion must be held with all personnel prior to commencing work.

The power line technician must obtain a standoff permit on the circuit, and the crew must be made aware of its status.

A proper tailboard includes a discussion covering the following details:

- The procedure to be executed—a job drawing may be used to clarify any questions
- Potential hazards and the possible safeguards to take
- Work assignments defined and designated
- Specialty tools or equipment to be utilized
- All personnel involved clearly understand their roles and responsibilities

Additional briefings should be conducted as required to ensure that all personnel involved understand each step of the work when changes have been made.
Lesson 2: Tension of the Conductor

**Learning Objective:** Calculate the deadend tension of the conductor.

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

**Evaluation Method:** Written test

**Introduction**

When performing hotstick maintenance, the conductor tension must be known in order to determine the mechanical load that will be imposed on the hotstick rigging. This is calculated by using a pre-determined formula.

\[
T = \frac{M \times \text{SPAN}^2}{8 \times \text{SAG}}
\]
Lesson 3: Select the Hotsticks and Tools

**Learning Objective:** Identify the hotsticks and tools required to replace deadend insulators.

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

**Evaluation Method:** Written test

**Introduction**

Once the conductor dead end tension is determined, the appropriate hotsticks and accessories can be selected to safely remove the insulator string.

You must determine the condition of the structure including the pole, insulators and hardware. The selection of the adjustable strain pole will be determined by its ability to relieve the deadend tension from the insulator string and the voltage being worked on. The type of strain carrier used will be determined by the type of deadend.

A two pole strain carrier will be used on single insulator strings and a single pole strain carrier will be used on double insulator strings. The conductor deadend clamp will dictate the type of deadend socket used. Our procedure requires the use of a two pole strain carrier.

An insulator cradle supported by 1-1/2 inch wire tongs which are attached to the pole with wire tong saddles, will be used to lower the insulator cradle. The universal tool accessories used in this procedure will include a cotter key puller, adjustable insulator fork, and a ball socket adjuster attached to universal sticks.

**Inspect and Clean the Hotsticks and Tools**

All of the hotsticks and accessories should be set out on a tarp and thoroughly inspected. The hotsticks must be cleaned and wiped down with a silicone wiping cloth and all of the tools and accessories must be in perfect working order. The hotsticks should be set on hotstick tool
holders after they have been cleaned.

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>• All hotsticks must have a valid test date.</td>
</tr>
<tr>
<td>• All hotsticks are tested for a period of two years.</td>
</tr>
</tbody>
</table>
Lesson 4: Installing the Two Pole Strain Carrier

Learning Objective: Install the strain carrier and insulator cradle in the configuration required to replace deadend insulators.

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

Evaluation Method: Written test

Introduction

The installation of the two pole strain carrier will require a minimum of two power line technicians on the structure and one groundman.

First we must install an insulated platform below the insulator string to be changed. The platform should be installed to allow adequate working clearance to the energized conductor. The platform should be installed at a slight angle to the insulator.
Using a rotary prong stick, install a grip on the conductor. Install the cum-a-long hook in the conductor end yoke. Estimate the distance from the grip to the back of the pole and install the adjustable pole clamp on the adjustable strain poles. Attach the pole end yoke assembly to the pole slightly above the deadend hardware and on the opposite side of the pole. Secure it using a wheel tightener.

With one strain pole attached to the hot end yoke and with the aid of two grip-alls, straddle the conductor until the conductor is engaged in the hot end yoke. Rotate the forward yoke to a horizontal position and install the strain jack in the pole end yoke. Engage the other strain pole in the same order starting with the conductor end yoke first and the pole end yoke second. Connect the grip to the cum-a-long hook with the aid of the rotary prong.

Using a ratchet wrench, tighten the take-up trunions equally, keeping the strain carrier in proper alignment, until the deadend tension is removed from the insulator string.
Lesson 5: Insulator Cradle Installation

**Learning Objective:** Describe the procedure to remove the tension from the deadend insulators using strain carriers

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

**Evaluation Method:** Written test

**Introduction**

The insulator cradle is attached to the pole using support ropes which are installed approximately 6 inches below the insulator deadend hardware. The insulator cradle will be supported by two 1-1/2 inch wire tongs attached to the pole with wire tong saddles.

With the insulator cradle hanging from the support ropes, mark the pole where the bottom cradle bracket reaches. Install the wire tong saddles at this point. Attach the wire tongs to the support end of the cradle brackets, and engage them in the wire tong saddles. The insulator cradle can now be positioned below the insulator string.
Lesson 6: Disconnect the Conductor

*Learning Objective:* Describe the procedure to disconnect and connect the conductor deadend from an insulator string.

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

*Evaluation Method:* Written test

**Introduction**

With sufficient slack in the insulator string, disconnect the conductor deadend. The hotstick accessories used will be an adjustable insulator fork, ball socket adjuster and a cotter key puller, all attached to universal sticks. Using the cotter key puller, pull the cotter key on the socket tongue.

Attach the insulator fork to the last insulator and a ball socket adjuster to the socket tongue. By manipulating both sticks, disconnect the deadend clamp from the insulator string.
Lesson 7: Remove Insulator String

Learning Objective: Describe the procedure to remove and install an insulator string using an insulator cradle.

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

Evaluation Method: Written test

Introduction

Take hold of the wire tongs and slowly let off the wire tong saddle clamps. Let the wire tongs slide through the saddle clamps, thus lowering the insulator cradle. Let the insulator cradle down to a position along side the pole. Tie a handline to the insulator string prior to disconnecting the insulator string from the deadend hardware. Lower the damaged insulators to the ground and replace with new ones.

Install Insulator String

Raise new insulators up the pole with a handline and attach them to the deadend hardware. Raise the insulator cradle by pushing the wire tongs through the wire tong saddles.

When the cradle is in place, tighten the wire tong saddle clamps. Attach the insulator fork to the last insulator and manipulate the ball socket adjuster on the socket tongue to re-connect the insulators to the conductor deadend. Reset the cotter key by tapping it back into the ball socket.

Reverse the steps used to install the strain carrier, moving the deadend tension from the strain carrier to the insulator string. Remove the strain carrier.
Summary

To summarize this module, you have learned:

- The procedure to hold a tailboard discussion
- The procedure to calculate the deadend tension of the conductor
- The identity of the hotsticks and tools required to replace deadend insulators
- The procedure to inspect and clean the hotsticks and tools required to replace deadend insulators
- The procedure to install the strain carrier and insulator cradle in the configuration required to replace deadend insulators
- The procedure to remove the tension from the deadend insulators using strain carriers
- The procedure to disconnect and connect the conductor deadend from an insulator string
- The procedure to remove and install an insulator string using an insulator cradle

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. Recommended working clearances have to be maintained at all times when performing live line work.

2. It is not necessary to hold a tailboard meeting before performing a live line work procedure.

3. All personnel do not have to understand each step of the work when changes have been made.

4. The minimum number of good insulators necessary to perform live line work from a structure under dry conditions on a 138kV line are:
   (a) Two.
   (b) Five.
   (c) Three.
   (d) Four.

5. The correct formula for determining deadend tension must include the sag.

6. The constant in the formula for determining deadend tension is 6.

7. All hotsticks must have a valid test sticker.

8. All hotsticks must be cleaned with a silicone rag before use.

9. A hold stick is used to install the grip on the conductor.

10. The strain poles take up the tension on the conductor.

11. The take up trunions must be taken up equally.

12. You must use a two pole strain carrier when removing a single insulator string.

13. The insulator cradle is attached 12 inches below the insulator string.

14. The insulator cradle is supported by one 1-1/2 inch wire tong.
T / F 15. The insulator cradle will support the weight of the insulators.

T / F 16. An adjustable insulator fork is used to remove a cotter key.

T / F 17. The ball socket adjuster is used to manipulate the socket tongue.

T / F 18. The insulator cradle can be used to lower or raise the deadend insulator.

T / F 19. The insulator cradle is fastened to the pole with a wheel tightener.

T / F 20. The wire tongs are used to support the insulator cradle.
Review Question Solutions

1. T
2. F
3. F
4. Four.
5. T
6. F
7. T
8. T
9. F
10. T
11. T
12. T
13. F
14. F
15. T
16. F
17. T
18. T
19. F
20. T