Change Crossarm Insulator

CLASS 1 RUBBER GLOVE

TRAINING MANUAL

03/01/99
OBJECTIVE:

From memory, given the tools and equipment, you will be able to change an outside tangent insulator using the basic rubber glove work rules on an alive 4kV three-phase line without an aerial device.

WHY?

The customer demand to maintain uninterrupted power may require that work be done on lines that are alive. An aerial device is not always available, so following this basic work procedure provides an environment to perform the work safely and efficiently on a 4kV system.

LEARNING OBJECTIVES:

1. Describe the tools and protective cover required to replace an outside tangent insulator.
2. Select and inspect the tools and protective cover required to replace an outside tangent insulator.
3. Explain the procedure to replace an outside tangent insulator using applicable protective cover.
4. Demonstrate the procedure to replace an outside tangent insulator using applicable protective cover.
## IN THIS MODULE:

1. Tool Selection  
2. Tool Inspections  
3. Work Procedure

## RESOURCES:

- Applicable protective cover  
- Climbing equipment  
- Hand line

## ESTIMATED TIME:

2 hours

## PREREQUISITES:

- *Introduction to Protective rubber Equipment* module  
- *Class 1 Rubber Glove Work Rules* module  
- *Weights and Forces* module

## LEARNING STEPS:

1. Review the prerequisite modules.  
2. Cover this module.  
3. Complete the Review Questions and Skills Practice.  
4. Clarify any questions you may have.  
5. Complete the Knowledge Check.  
6. Perform the Skills Check.
Introduction

The procedure to replace an insulator using the Class 1 rubber glove method ensures adequate protection to the lineman involved. Class 2 protective rubber cover and specified work rules allow linemen to work on energized conductors in a safe manner. Replacing an outside insulator on a three-phase tangent will require a thorough tailboard discussion and a planned work procedure. It may be necessary to move the center phase out of the work location to maintain safe working clearances. Key topics to become competent in this work procedure are:

- tool selection
- tool inspection
- work procedure

Although the work procedure in this module deals with a 4kV system, Class 1 rubber gloves can be used on voltages up to 7.5kV as indicated by the chart below:

```
<table>
<thead>
<tr>
<th>System</th>
<th>Nominal Typical Voltage</th>
<th>ANSI/ASTM</th>
<th>ANSI/ASTM</th>
<th>Max. Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4160V/2400</td>
<td>Class</td>
<td>Proof Test</td>
<td>Voltage Allowable per ANSI/ASTM</td>
</tr>
<tr>
<td></td>
<td>12470V/7200</td>
<td>1</td>
<td>10kV</td>
<td>D120</td>
</tr>
<tr>
<td></td>
<td></td>
<td>White</td>
<td>40kV</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7500V</td>
<td></td>
</tr>
</tbody>
</table>
```

NOTE: Italic underlined print indicates exposure voltage

* Phase to ground rule not utilized - see below

** Exposure limited to phase to ground voltage shown - no multi-phase exposure by virtue of one or more of the following: (1) single phase construction, (2) insulation or isolation
This module does not provide detailed instruction in the work rules, conductor tensions, or care and use of the equipment. It is assumed that the participant is competent at these tasks. Further information regarding these tasks can be obtained in the following modules: Introduction to Protective Rubber Equipment, Class 1 Rubber Glove Work Rules, and Weights and Forces.

Class 2 protective rubber cover is used in conjunction with Class 1 rubber gloves.
Tool Selection

When selecting the tools and protective equipment needed, the following must be considered:

• conductor weight
• second point of contact
• work location

These three points will determine the type and size of equipment, as well as the amount of protective cover needed.

Conductor Weight

Conductor size and adjacent span lengths determine the conductor weight. The support tools required must be able to support the conductor in a cantilever position. If no support tools are required, the conductors may be moved by hand.

*For further information, refer to the Weights and Forces module.*
Second Point of Contact

It will be necessary to identify all second points of contact. They must be avoided, removed from the work location, or covered with protective cover. Some examples include:

- guy wires
- ground wires
- secondary circuits
- communication cables
- any grounded pole hardware

Work Location

The work location will require adequate protective cover, allowing the worker protection in the event of an unplanned movement. Risers or jumpers may require a blanket to cover them properly.

The integrity of adjacent structures must be checked to ensure the work location is safe for the procedure being planned.
Tool Inspections

It is necessary to do a complete inspection of all protective cover and tools. Several things to check for include:

- current test dates
- contamination
- defects

All protective cover and tools must be in perfect working order to do the work procedure safely.

*For further information, refer to the Introduction to Protective Rubber Equipment module.*
Work Procedure

Care must be taken in the replacement of the insulator. Points to consider include:

- protective cover installation
- conductor relocation
- insulator replacement

Protective Cover Installation

Rubber gloves are to be put on prior to reaching the work location. The rubber cover should be installed *from below* in the following order:

- inside to outside
- closest to farthest

Cover any risers in the work area.
This procedure will require protective cover on the center and outside phases being worked on. Complete the installation of the protective cover on one side of the pole, then move to the other side. Beginning with the center phase, install the protective cover in the following order:

- Install a line hose.
- Install a hood over the insulator and secure it to the line hose.
- Install an additional line hose on the opposite side of the crossarm.

The second point of contact must be covered if it cannot be removed from the work location.

Prior to installing any protective cover in the energized work zone, the hand line must be removed from the lineman’s belt and attached to the pole or crossarm.

The work area must have adequate protective cover to provide a safe work zone for the lineman.
Conductor Relocation

In order to maintain the limits of approach, it may be necessary to untie and move the center phase out of the work location. This is accomplished by following these steps:

- Remove the insulator hood from the center phase.
- Remove the conductor tie.

Control the excess tie wire.

- Join the two hoses together.
- Move the center phase out of the work location, in a controlled manner (ie: to the other side of the pole, tight against the pole, secured to the pole above the work location).
Insulator Replacement

It is now possible to replace the outside insulator while maintaining appropriate clearances. The steps to replace the insulator are as follows:

• Remove the insulator hood from the outside phase.
• Remove the conductor tie.

![Control the excess tie wire.]

• Join the rubber hoses together.
• Lay the conductor (with protective cover) on the crossarm close to the pin.
• Replace the damaged insulator.

![Care must be taken not to cut the rubber gloves on the damaged insulator.]

• Move the conductor onto the new insulator.
• Split the rubber hoses.
• Tie the conductor onto the insulator.
• Replace the hood.
Now that the insulator is replaced, the center phase is moved back into position using the same steps as the outside phase.

With the work completed, remove the protective cover \textit{from below} in the following order:

- outside to inside
- farthest to closest
Protective Cover Storage

Protective rubber should be stored and handled with care. It should be stored in:

• its natural position
• a cool location
• a dry location
• a dark location
• its storage container

By storing the protective cover in this manner, it will not deteriorate, nor will it become damaged before the next job.
Summary

To summarize this module, you have learned:

- The tools and protective cover required to replace a tangent insulator.
- How to select and inspect the tools and protective cover required to replace a tangent insulator.
- The procedure to replace a tangent insulator using applicable protective cover.

Now...

- Complete the Review Questions and Skills Practice.
- Clarify any questions or concerns you may have.
- Complete the Knowledge Check.
- Perform the Skills Check.
Review Questions

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This section is a practice for your module Knowledge Check. Complete the Review Questions, and verify your answers with the Review Question Solutions located at the end of this module.

Describe the tools and protective cover required to replace an outside tangent insulator.

1. List two things which determine conductor weight.

2. The second point of contact must be: (You may choose more than one answer.)
   (a) avoided.
   (b) removed.
   (c) covered.

T/F 3. The structure being worked on is the only one that needs to be checked.

T/F 4. If the protective cover is new but has an expired test date, it may be used.
Select and inspect the tools and protective cover required to replace an outside tangent insulator.

5. Protective cover is installed: (You may choose more than one answer.)
   (a) closest to farthest.
   (b) inside to outside.
   (c) farthest to closest.
   (d) outside to inside.

T / F 6. When replacing an outside tangent insulator, all three phases will require protective cover.

7. When installing rubber to change an outside insulator on the same side as the center phase:
   (a) cover the center phase first then the outside phase on one side of the crossarm, move to the other side and install covering in the same order.
   (b) cover the center phase first on both sides of the crossarm, then cover the outside phase on both sides of the crossarm.
   (c) cover both sides of the outside phase, then move to the other side of the pole and cover both sides of the center phase.
   (d) cover the outside phase, then the center phase on one side of the arm, move to the other side of the pole and install cover on the center phase, then the outside phase.

Explain the procedure to replace an outside tangent insulator using applicable protective cover.

T / F 8. If adequate cover is installed on the center phase, it is permissible to contact it with any part of your body.

T / F 9. A rubber blanket or crossarm guard is required when the conductor is set on the crossarm.
10. Number the steps below, in the correct order, for replacing the insulator.

___ Replace the damaged insulator.
___ Tie the conductor onto the insulator.
___ Remove the insulator hood from the outside phase.
___ Remove the conductor tie.
___ Join the rubber hoses together.
___ Split the rubber hoses.
___ Move the conductor onto the new insulator.
___ Lay the conductor (with protective cover) on the crossarm close to the pin.
___ Replace the hood.

T / F 11. Once the outside insulator is replaced, you may remove the protective cover before moving the center phase back into position.
SKILLS PRACTICE

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This section is a practice for your module Skills Check. Perform each task, as described, under the direction and observation of a competent person. They will complete the checklist and give you appropriate feedback.

Select and inspect the tools and protective cover required to replace an outside tangent insulator.

1. Select the appropriate rubber gloves required to replace a 4kV tangent insulator.
   ___ Voltage class

2. Inspect the rubber gloves.
   ___ Test date
   ___ Inspect leathers
   ___ Systematically stretch entire glove — both sides
   ___ Air test

3. Select required rubber cover.
   ___ Voltage class

4. Inspect the rubber cover.
   ___ Test date
   ___ Blanket — roll from corner to corner, do adjacent corner and same on other side
   ___ Hoses and hoods — inspect outer shell thoroughly, roll inside out and inspect
5. Select the appropriate tools and equipment required to replace a 4kV tangent insulator (may require tensioning tools to move phases).
___ Rope blocks
___ Live line hoist/spiral link

6. Inspect the tools and equipment.
___ Clean sticks with silicone wiping rag
___ Inspect rope and blocks

**Demonstrate the procedure to replace an outside tangent insulator using applicable protective cover.**

7. Replace a 4kV tangent insulator.
___ Put rubber gloves on before entering hot work zone
___ Apply rubber cover to the required second points of contact
___ Install rubber on the conductors (inside to outside)
___ Move center phase if required (in a controlled manner)
___ Maintain the recommended working clearances
___ Remove the insulator hood
___ Remove the conductor tie (control excess tie wire — prevent it from touching the crossarm)
___ Join the rubber hoses together
___ Reposition conductor (Move center phase out of work location. Outside phase beside pin on arm. Both conductors should have protective cover — two hoses joined together. May be laid directly on arm if covered with hoses.)
___ Replace the damaged insulator
___ Move the conductor onto the new insulator (move center back to insulator)
___ Split the rubber hoses
___ Tie the conductor onto the insulator
___ Replace the hood
Now that the insulator is replaced, move the center phase back into position (Split the rubber hoses. Tie the conductor onto the insulator. Replace the hood.)

Remove rubber in the opposite order from the installation (outside to inside, farthest to closest)

Store rubber in the required fashion
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1. conductor size
   span length
2. a, b, c
3. False
4. False
5. a, b
6. False
7. a
8. False
9. False
10. 5, 8, 1, 2, 3, 7, 6, 4, 9
11. False