Insulated Aerial Device - 25kV
Prerequisites:

- Journey person Powerline Certificate preferred

Objectives: Given this module and a 25kV aerial device, you will be able to explain and/or demonstrate the daily maintenance of an insulated aerial device.

Rationale: To work on high voltage apparatus using Class 3 rubber glove work rules in an insulated aerial device, it is important for you to know the safe working limits and boom maintenance of that aerial device to maintain a safe working environment for you and your co-workers.

Learning Objectives

- List the components of an insulated aerial device.
- Explain the daily maintenance of a fiberglass boom.
- Demonstrate the daily maintenance of a fiberglass boom.
- Explain the insulated aerial device current leakage test.
- Perform the insulated aerial device current leakage test.
- Explain the holding valve test.
- Perform the holding valve test.

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
- Self-learning + On-the-job

EVALUATION METHODS

- Knowledge test
- Knowledge test
- Skill Check
- Knowledge test
• Skill Check
• Knowledge test
• Skill Check

STUDENT RESOURCES

• 25kV Rubber Glove Training Manual
• 25kV video
• A stocked 25kV aerial device
• Hard hat and gloves
• An energized 25kV line

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

This module will deal with:

• The function of the insulated aerial device
• Cleaning the boom
• Daily current leakage test
• Holding valve test
• C.S.A Standard Insulated Aerial Device 1988
Lesson 1: The Function of the Insulated Aerial Device

**Learning Objective:** List the components of an insulated aerial device.

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

**Evaluation Method:** Knowledge test

### Introduction

The function of the insulated aerial device is to provide sufficient mechanical and dielectric strength to safely support and insulate men and material from ground. Before going into service, the device must be mechanically and electrically tested to establish its stability and insulating capability. The aerial device must be electrically tested annually by SaskPower’s Technical Services & Research Department (T.S.&R.).

The aerial device must have facilities to measure current leakage. The maximum allowable leakage for 25kV rubber glove is 5ma (microamperes). The standard for field testing is 2ma per kV phase-to-phase system voltage.

An approved bucket liner with an initial rating of 50kV shall be used. Like the insulated portion of the boom, bucket liners must be kept clean. These bucket liners must also be tested at T.S.&R. annually when the unit goes in for test.

Insulated epoxiglass booms and buckets shall be equipped with canvas covers. These covers shall be in place during travel and storage. Boom straps are provided to secure booms in their rest. These straps shall be in place when moving the vehicle to avoid damage to the boom and turret.
Lesson 2: Cleaning the Boom

Learning Objective: Explain the daily maintenance of a fiberglass boom.
Learning Method: Self-learning + On-the-job
Evaluation Method: Knowledge test

Introduction

Contaminants of the external insulating surfaces of the aerial device shall be removed immediately prior to the undertaking of high voltage work.

Clean rags should be used to remove initial contaminants, followed by the use of a silicon wiping cloth in a circular motion. To clean the inside of the boom, remove the inspection plates, elevate the boom, and flush with a pressure hose using clean hard water with no soap.

When exceptionally dirty conditions are encountered, steam may be used. The temperature of the steam cannot exceed 135 degrees C (275 degrees F) and gauge pressure under 700kpa (100psi). Do not allow for prolonged application of steam directly to the hoses. Flush with clean water.

The cleaning of inside the boom should be done when current leakage tests indicate a leakage that is close to or above the recommended maximum.
Lesson 3: Cleaning the Boom

Learning Objective: Demonstrate the daily maintenance of a fiberglass boom.

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

Evaluation Method: Skill Check
Skills Practice

1. **Demonstrate the daily maintenance of a fiberglass boom. External surface:**

   1. Remove the boom straps.
   2. Remove the boom covers.
   3. Use clean rags to remove the initial contaminants.
   4. Inspect the surface of the fiberglass for fatigue.
   5. In a circular motion, wipe the inner surface of the fiberglass boom with a silicon impregnated cloth.

2. **Internal surface (water):**

   1. Remove the boom straps.
   2. Remove the inspection plates.
   3. Elevate the boom.
   4. Flush with a pressure hose using clean hard water with no soap.
   5. Elevate the boom to dry.

3. **Internal surface (steam):**

   1. Remove the boom straps.
   2. Remove the inspection plates.
   3. Elevate the boom.
   4. Using a steamer, wash the interior of the boom. Keep the temperature of the steam below 275 degrees F and the pressure below 100 psi. Do not allow prolonged
application of steam directly on the hoses.

5. Flush with clean hard water with no soap.

6. Elevate the boom to dry.
Lesson 4: Daily Current Leakage Test

Learning Objective: Explain the insulated aerial device current leakage test.
Learning Method: Self-learning + On-the-job
Evaluation Method: Knowledge test

Introduction

- Park the vehicle to provide the most advantageous access to work.
- Set out warning signs, traffic cones, and turn on the beacons.
- Stabilize the vehicle and use pads under the outriggers when necessary.
- Make sure the vehicle is as level as possible (+/- 5 degrees).
- Remove boom straps, boom and bucket covers.
- Wipe down the fiberglass portion of the upper boom in a circular motion to remove any contaminants.
- Ground the vehicle in the appropriate manner.
- If the lower boom has an insulated insert, ensure the insert has been bypassed in an approved manner.
- Attach a metal wand to the metallic portion of the upper boom. The wand should be about 3 ft. long.
- Attach a current leakage meter to the outlet provided on the boom. The Beckman multi meter works well for this. The aerial device should be equipped with two coaxial cables and lead ends. In case one is defective, you should never get a “0” reading on the meter with the truck on the line. An extra meter should also be made available.
- Have the auto reclose blocked and a standoff in effect on the circuit or circuits you are to be working on or near at your work location.
- Only the people doing the test should be on the vehicle, all others are to stay clear.
- Raise the boom until contact is made between the metallic wand and the energized conductor.
- The boom must remain in contact with the conductor for at least one minute. If the reading is under 5ma, record the reading on the boom leakage report form.
- If the boom is above the recommended levels, remove the boom from the line, record the reading on the boom leakage report form, locate the contaminated area, clean, and retest. If the readings are still to high and all measures have been taken to clean the boom (eg.
washing the interior of the boom) then the truck will have to be retested by T.S.&R.

CAUTION

If the boom has a higher than acceptable leakage reading due to moisture or frost, the boom must be removed from the line and allowed to dry. Failure to do so will cause carbon tracking on the interior of the boom causing permanent deterioration.

- After the boom is dry, wipe with a silicone wiping rag and retest.
- The boom must be tested once a day before any rubber glove work commences.
- When unfavorable conditions are encountered such as road salt, high humidity, or rain showers, more frequent tests may be necessary.
- Record daily readings and line voltages in the daily log and Insulation Leakage Record Form PT573. A sample is shown on the following page.
# Insulation Leakage Record

<table>
<thead>
<tr>
<th>UNIT #</th>
<th>LOCATION</th>
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<th>DUE FOR TEST</th>
<th>LEAKAGE</th>
<th>Microamps</th>
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<table>
<thead>
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<th>WEATHER</th>
<th>TEMP</th>
<th>LI VOLTAGE</th>
<th>TOTAL LEAKAGE</th>
<th>MICROAMPS</th>
<th>OPERATOR</th>
</tr>
</thead>
</table>

*Note: Copy returned by operator. Copies submitted to Line Line Training Coordinator, Waipuna*
Lesson 5: Daily Current Leakage Test

*Learning Objective:* Perform the insulated aerial device current leakage test.

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

*Evaluation Method:* Skill Check
Skills Practice

1. Demonstrate the isolated aerial device current leakage test:

0. Park the vehicle to provide the most advantageous access to work.

0. Set out warning signs, traffic cones and turn on the beacons.

0. Stabilize the vehicle and use pads under the outriggers when necessary.

0. Make sure the vehicle is level.

0. Ground the vehicle in the appropriate manner.

0. Remove the boom straps, boom and bucket covers.

0. Clean and inspect the fiberglass boom.

0. If the lower boom has an insulated insert, make sure it has been bypassed in an approved manner.

0. Attach a current leakage meter to the outlet provided.

0. Have a standoff in effect.

0. Attach a metal wand to the metallic portion of the upper boom.

0. Only the people performing the test should be on the vehicle. All others must stand clear.

1. Raise the boom. Watch the meter to ensure it is working before contact is made with the energized conductor.

2. Make contact with the metallic wand and the energized conductor.

3. The boom must remain in contact with the conductor for at least one minute.
4. Record the reading in the boom leakage report form.

5. If the reading is under 5m amps, the boom has tested OK.

6. You can then proceed with your work.
Lesson 6: Holding Valve Test

Learning Objective: Explain the holding valve test.
Learning Method: Self-learning + On-the-job
Evaluation Method: Knowledge test

Introduction

These tests are listed in the suggested sequence for all four valves on the upper and lower boom cylinders.

![Figure 1. First Position for Valve Test](image)

Upper Boom Cylinder - Left Holding Valve (Rod End)

Place the system in operation and set the outriggers. Unfold the upper boom until it and the lower boom form a straight line. Shut down the hydraulic system by turning off the ignition on the unit. While standing next to the turret, pull the control selector to the “Lower” position and the upper boom control to the “Unfold” position and hold fully actuated.
If the upper boom holds steady, the holding valve is working.

**Lower Boom Cylinder - Left Holding Valve (Base End)**

Leave the boom placed in the same position with the lower boom approximately one foot out of the rest. Shut down the hydraulic system again. Pull the control selector to the “Lower” position and the lower boom control to the “Lower” position, hold fully actuated. If the lower boom holds steady, the holding valve is working.

**DANGER**

*If the upper boom creeps, the holding valve needs to be looked at by a certified mechanic.*

**DANGER**

*If the lower boom creeps, the holding valve needs to be looked at by a certified mechanic.*
Lower Boom Cylinder - Right Holding Valve (Rod End)

Position the booms as shown above. Shut down the hydraulic system. Pull the control selector to the “Lower” position and the lower boom control to the “Raise” position, hold fully actuated. If the lower boom holds steady, the holding valve is working.

STOP DANGER

*If the lower boom creeps, the holding valve needs to be looked at by a certified mechanic.*
Upper Boom Cylinder - Right Holding Valve (Base End)

Position the booms as shown above. Shut down the hydraulic system. Pull the control selector to the “Lower” position and the upper boom control to the “Fold” position, hold fully actuated. If the upper boom holds steady, the holding valve is working.

DANGER

If the upper boom creeps, the holding valve needs to be looked at by a certified mechanic.
Hydraulic hose metal bulkhead to be electrically insulated from metal portion of boom

F.R.P. boom

Coaxial cable from receptacle

Fold back metal shielding approx. 50 mm from terminal and insulate exposed end of shielding

(2) 3/16 X 1/2" aluminum pop rivets on each strap

50 mm min.

9.5 mm X 19 mm plastic insulating blocks

102 mm

Centre guard ring over monitoring bands

No. 16 gauge stranded insulation wire

To Platform

Dimension "X" about 19 mm ref.

Current leakage metal monitoring bands (copper)

Section BB

*The distance between the inner metal monitoring band and metal bulkhead plate shall be 130 mm minimum to provide electrical shielding of metallic hose couplings.
†The distance between two leading edges of metal monitoring bands shall be four times the fibreglass-reinforced plastic thickness.
‡Coaxial cable Military Specification RG-56 c/u as shown.
§F.R.P. refers to fibreglass-reinforced plastic.

Vehicle-Mounted Aerial Devices
December 1988
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Lesson 7: Holding Valve Test

Learning Objective: Perform the holding valve test.

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

Evaluation Method: Skill Check
Skills Practice

1. Demonstrate the holding valve test.

1. Have a standoff in place.

2. Ground the vehicle. Make the vehicle as level as possible.

3. Test the outriggers by shutting down the hydraulic system and pulling the control valves for all of the outriggers.

4. Raise the upper boom until it forms a straight line with the lower boom. Raise the lower boom 1 foot out of the boom rest.

5. Shut down the hydraulic system. Pull the control selector valve on the turret to the “Lower” position and the upper boom control valve to the “Unfold” position. Hold fully actuated. Pull the lower boom control valve to the “Lower” position and hold fully actuated.

6. Raise the lower boom until it is straight up and down 15 degrees off centre, and the upper boom is 90 degrees to the lower boom.

7. Shut down the hydraulic system. Pull the control selector valve on the turret to the “Lower” position and the lower boom control valve to the “Raise” position. Hold fully actuated.

8. Lower the bottom boom back into the rest, and the upper boom down 15 degrees from the bottom boom.

9. Shut down the hydraulic system. Pull the control selector valve on the turret to the “Lower” position and the upper boom control valve to the “Lower” position. Hold fully actuated.
Summary

To summarize this module, you have learned:

- The components of an insulated aerial device.
- The daily maintenance of fiberglass boom.
- How to perform an insulated aerial device current leakage test.
- How to perform a holding valve test.

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. The aerial device must have facilities in place to measure leakage current.

T / F 2. The maximum allowable leakage current when performing 25kV work is 5ma.

T / F 3. When new, bucket liners have a tested rating of 50kV.

T / F 4. Bucket liners are tested every two years.

T / F 5. The aerial device must be tested annually at the T.S.&R. lab.

T / F 6. A dirty fiberglass boom must be wiped down with clean dry cloth before you use a silicone wiping rag.

T / F 7. When unfavorable current leakage readings are attained, the inner fiberglass boom should be inspected and washed if necessary.

T / F 8. An aerial device must be within plus or minus 5 degrees of being level.

T / F 9. The insulated portion of the boom must be cleaned before testing commences.

T / F 10. The aerial device does not have to be grounded when performing a boom test.

T / F 11. A standoff is required when performing a boom test on an aerial device.

T / F 12. A zero reading is acceptable when testing a boom.

T / F 13. A holding valve test is performed so that the integrity of the holding valves is known to the operator of the aerial device.

T / F 14. If the holding valve of a unit is found to be defective, the operator of the unit must adjust that valve.

T / F 15. The holding valve test must be performed yearly.
Review Question Solutions

1. T
2. T
3. T
4. F
5. T
6. T
7. T
8. T
9. T
10. F
11. T
12. F
13. T
14. F
15. F