



# Experience with the AEMC Pylon Tester Model 6472

**Presented to IEEE Lightning Performance  
Working Group  
On January 13, 2009 in Atlanta**



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# *Lightning Performance Mitigation Using the AEMC 6472/74*

- **NB Power first learned about the AEMC 6472/74 Ground Tester at IEEE conference in Chicago in 2008**
- **NB Power has used this test set on two projects**
  - **First was a 138 kV line where it was demonstrated in May 2008 by AEMC**
  - **Second was on a 345 kV transmission line in Fall 2008**
- **NB Power purchased the test set in August 2008**



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## *Note*

**Some of the following information has been supplied by AEMC for this presentation with their permission**



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# AEMC® Instruments

## Tower Ground Resistance Testing System



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# GroundFlex Coil Sensors (Rogowski Coils)



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# Specifications

- Measures Ground resistance from 0.01 to 99,000 Ohms
- Selectable test voltages of 16 or 32 VDC
- Manual, automatic or sweep selection of test frequency from 41 to 5078 Hz
- Test currents up to 250mA
- Soil resistivity measurement from 0.01 to 99,000 Ohms
- Bond resistance measurement from 0.01 to 99,000 ohms
- Stores up to 512 test results
- Operates off of AC, battery or vehicular power
- Includes DataView software (free) to program, run tests and print reports
- Color coded inputs and test leads



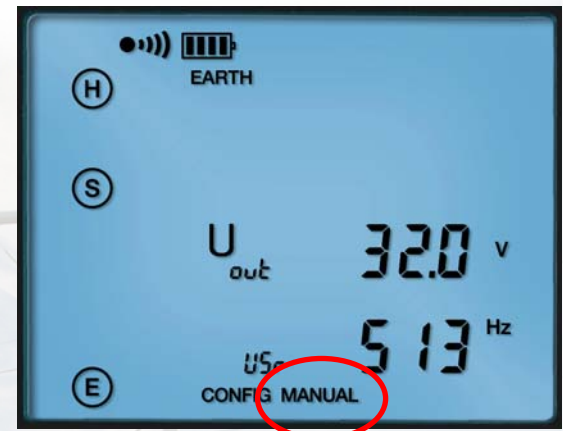
# 6472/74

## GroundFlex™ Adaptor

- Heavy duty case to house both instruments such that they can operate from within the case.
- Case has wheels and pull handle similar to travel luggage.
- Lower compartment holds cables and GroundFlex sensors



# 6472 Modes of Operation



## 3 operating modes:

**Automatic mode** in each function the instrument performs a measurement at 128 Hz and then chooses the most appropriate frequency in the event of interference voltages.

**Sweep mode** (automatic measurements at different frequencies) allowing a graph of impedance as a function of frequency to be plotted. Frequencies used can be selected in Set-Up or using DataView

**Manual mode** (User chooses the measurement frequency, display of all the voltages measured, etc.) for expert customers

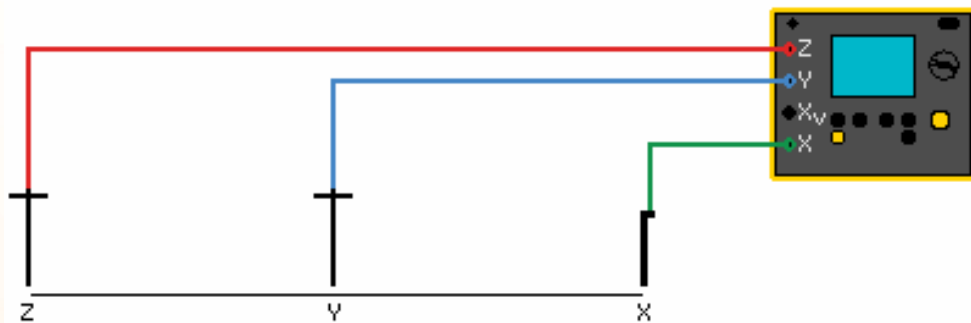


# 6472 Modes of Operation

## 3 Pole Fall of Potential Test

### Characteristics:

- Resistance range  $0.01 \Omega$  to  $100 \text{ k}\Omega$
- Selectable measurement voltage: 16 or 32 Vrms
- Adjustable measurement frequency:  
Auto, Manual or Sweep from 41Hz to 5.078 kHz



6472/74

# GroundFlex™ Adaptor

## GroundFlex® Method

- Capable of testing ground resistance of towers without disconnecting the Overhead ground wire
- Tests both ground resistance of tower legs (individually and total) and Overhead ground wires
- Test at frequencies up to 5kHz to profile impedance, important to characterize for lightning strikes



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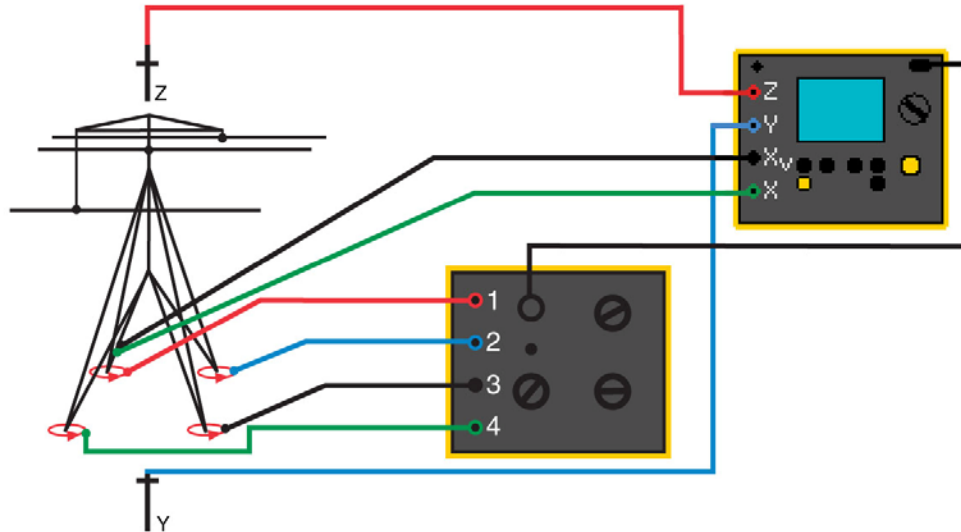
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# 6472/74

## GroundFlex™ Adaptor

### GroundFlex® Method

- Connect flexible sensors and reference rods
- Test individual legs and total resistance



# ***NB Power 138 kV Line 1183***

## ***Lighting Performance Improvement***



- **38 wood pole shielded H-frame structures**
- **Overhead shield wires present**



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# *Lightning Mitigation Criteria*

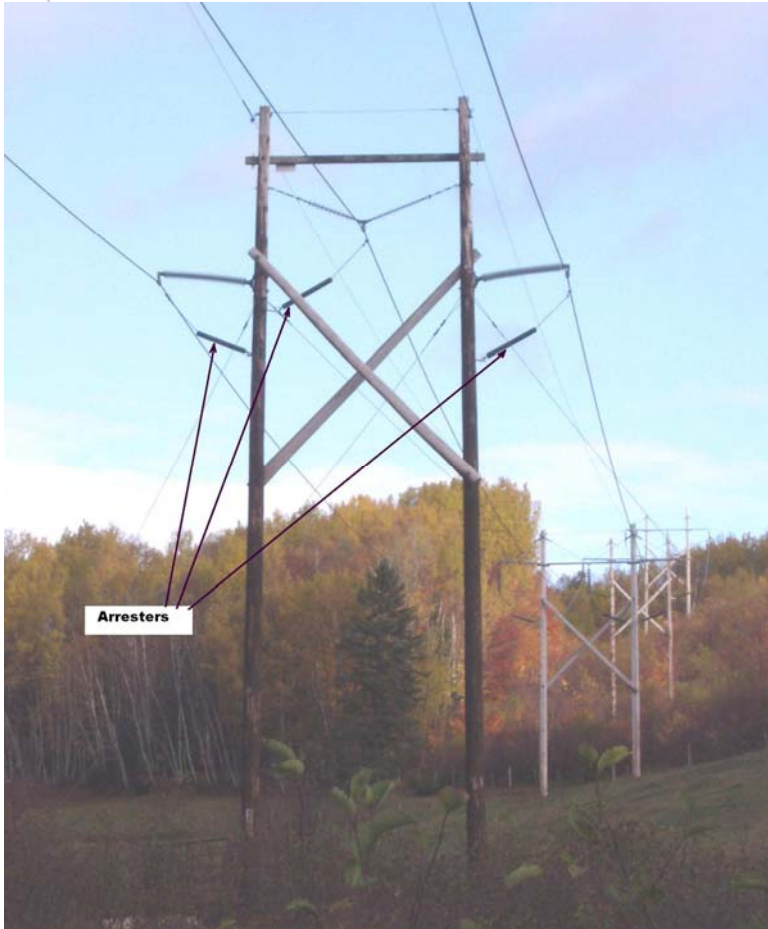
- **Maximize the lightning performance of overhead shield wires**
- **Minimize the risk outages due to an arrester failure**



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# 138 kV Line 1183



- Field testing and computer modeling determined that good grounding could not be achieved at many of the structures
- Reasonable improvements were made to existing structure grounding systems
- Arresters were added where good grounding could not be achieved



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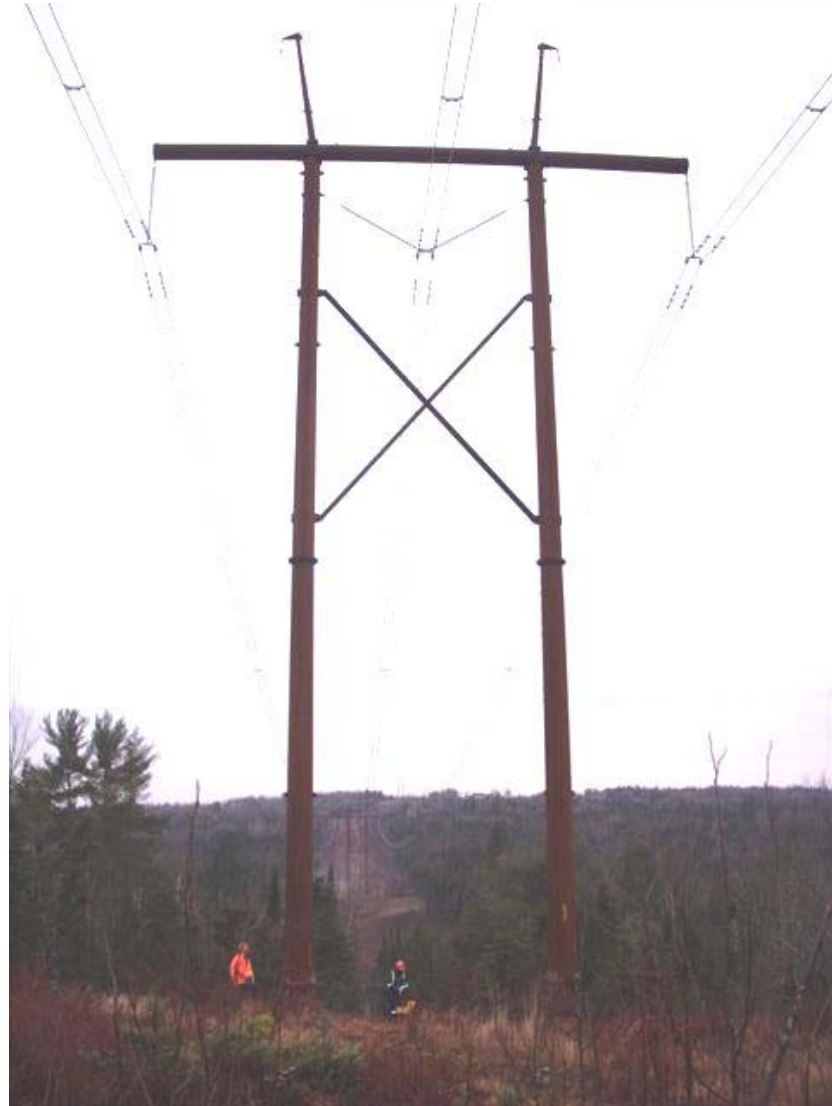
# ***Results of Demonstration Tests***

- **The AEMC 6472/74 test set was demonstrated at a suspension and a deadend structure**
- **The computed value for the suspension structure did not match the 6472/74 test result**
- **This is still being investigated by AEMC**



# 345 kV Line 3016

## Typical Tower



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# Steel Foundations



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# Foundation Design

- Steel culverts  
1<sup>st</sup> installed
- Corrocoate  
coating on steel  
foundation



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# *Test Equipment Used*

- **Soil Resistivity Testing using 4-point Wenner**
  - **Megger Earth Tester Model - DET4TD**
- **Ground Impedance by Fall of Potential**
  - **AEMC Ground Tester Model 6472 and Model 6474**

## **Important Note**

**Resistivity and Resistance tests were done on the same day**



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# *Calculated Values of Impedance*

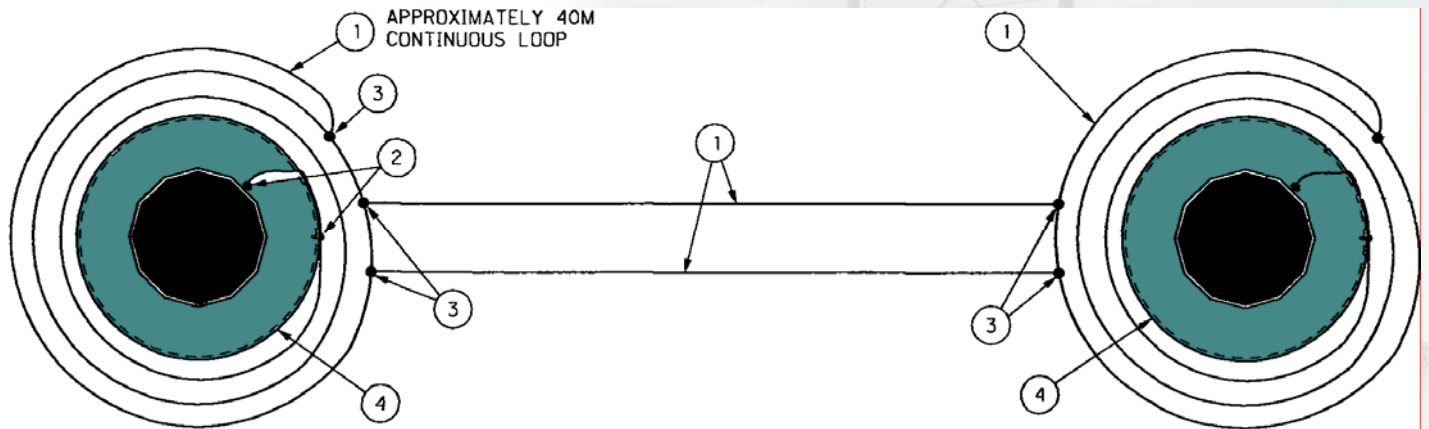
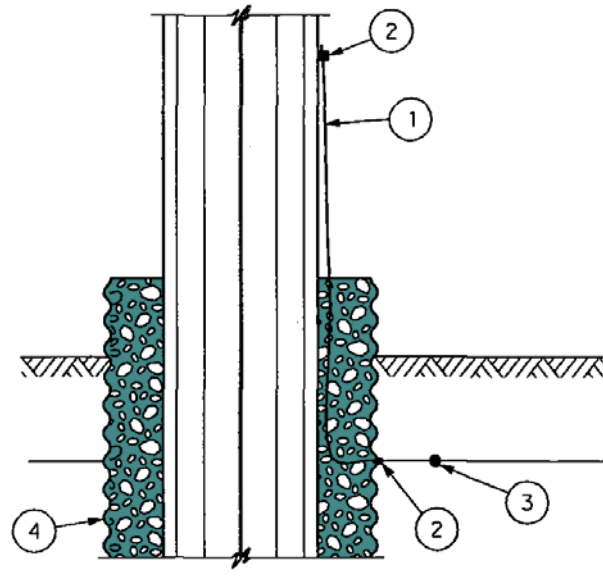
- **CDEGS Grounding Software was used to calculate the Ground Resistance Value**



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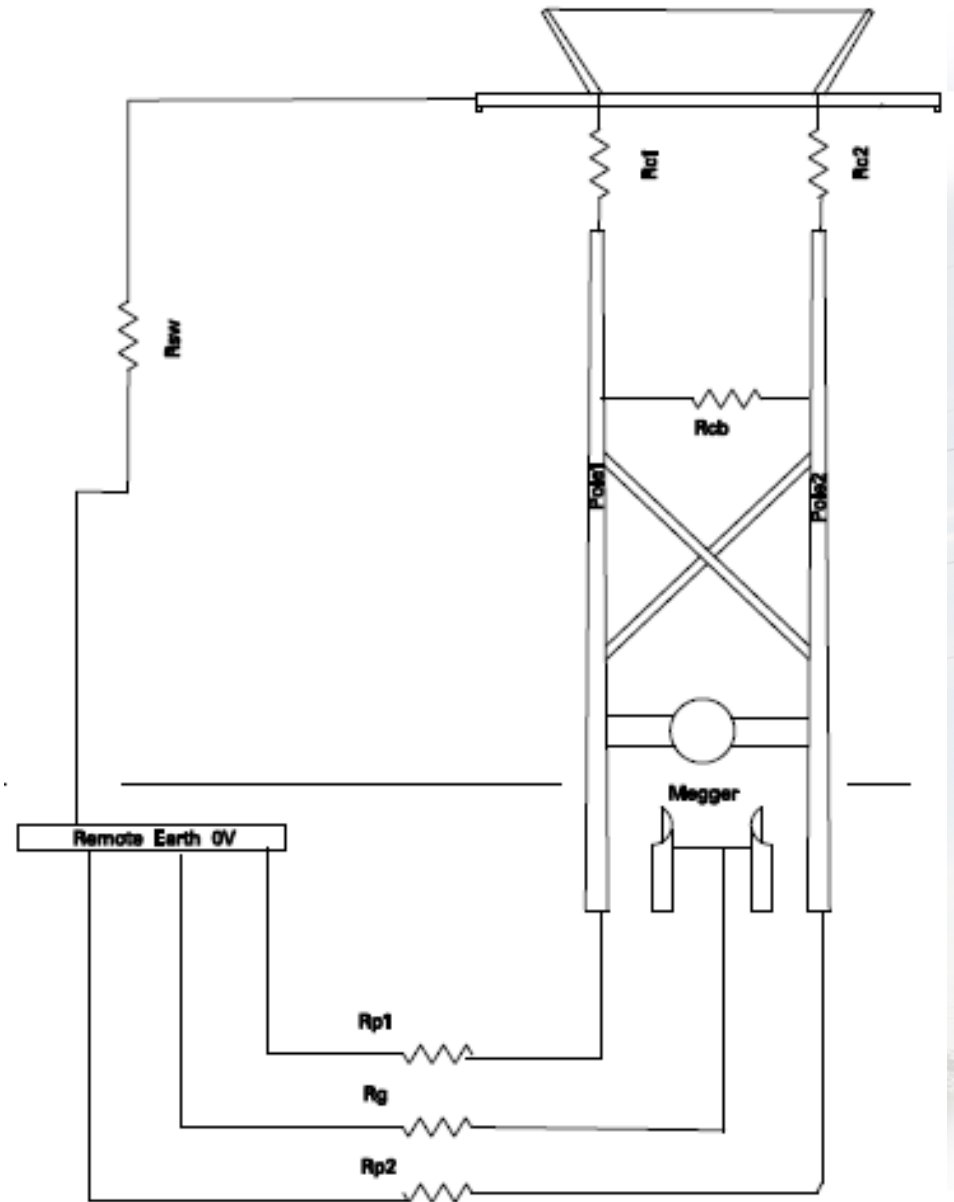
# Structure Grounding



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# Structure Electrical Circuit



# Sensor Installation

- Top sensor measures shield wire impedance
- Bottom sensor measures structure impedance



# Test Setup

- Two sensors on each pole
- Two turns in each sensor





# Results of Testing

- **Structure 243**
  - Calculated 7.9 ohms
  - Measured 6.7 ohms
- **Structure 248**
  - Calculated 13.3 ohms
  - Measured 12.9 ohms
- **Structure 184**
  - Calculated 110.8 ohms
  - Measured 120 ohms
- **Structure 144**
  - Calculated 155 ohms
  - Measured 40 ohms



# Observations

- An uncharged battery was a problem on one day of testing.
- Memory was full on another day and Sweep mode could not be used
- Shorter spools of wire would have been a help as shorter lengths were all that was required and each structure was the same
- Handles on the big case were uncomfortable to carry a long distance
- The complete setup for testing these towers was quite heavy to carry a long distance
- The cables to the sensors have colored numbered markers which would be better if they were larger
- The Megger test set was used for soil resistivity tests because it was lighter and more easily transported



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***The End***



**J'aime mon travail!**



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