APPLICATION NOTE

Fall-of-Potential Ground Testing, Clamp-On Ground Testing Comparison

April 17, 2002

On April 14, 2002, a ground resistance test was conducted to compare the results obtained from the Fall-of-Potential 3-Point testing method to the clamp-on testing method. The grounding system consisted of four copper clad rods installed in an approximate 20 ft square. Three of the rods are 5/8" in diameter and 10 ft in length. The fourth rod is 1/2" in diameter and 8 ft in length. All rods were coupled together with 3-gauge aluminum wire. Figure 1 shows the schematic of the system.

The tests were conducted with the following equipment manufactured by AEMC instrument:

Model 4500, 4-Point Ground Resistance Tester
Model 4630, 4-Point Ground Resistance Tester
Model 3731, Clamp-On Ground Resistance Tester.

Additionally, we used the AEMC Model 5600, a micro-ohmmeter to verify the bonding of the aluminum wire to the individual ground rods.

The soil conditions in the test area were predominately loam with some gravel. Conditions on the day of the test were dry and sunny, some light rain had occurred the previous day to the test. Therefore, the soil was somewhat moist at the surface.

The AEMC Model 5600 Micro-Ohmmeter was used to measure bonding resistance at each rod and was the first test completed. Measurements from each conductor to the rod were taken as well as measurements from conductor to conductor through the rod and clamp. Readings on rod number three ranged from 615 to 733μΩ at each bonding point, indicating that all connections were good. See Figure 2 for full results.

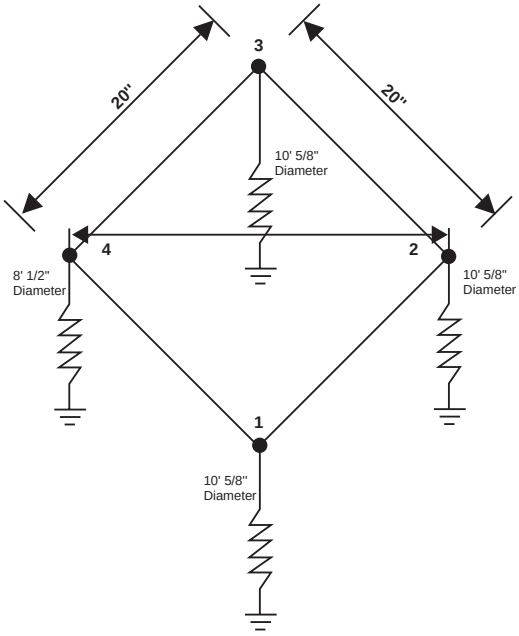
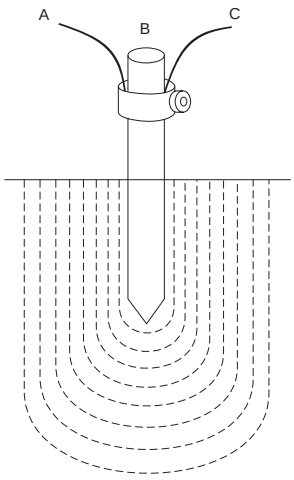


Figure 1. The Grounding System



Measurement Point	Resistance (μOhms)
A to B	713
C to B	615
A to C	733

Figure 2. Bonding resistance measurements

In the first test, the AEMC Model 4500 was used as 3-Point ground tester. Rod number three was first disconnected from the other rods in the system so that its individual resistance could be measured. The X lead was attached to rod number three (see Figure 3). The Z lead was attached to an auxiliary electrode 100 feet away and the Y lead was initially connected to the auxiliary electrode 60 feet away. Readings were taken with the Y electrode at 90, 80, 70, 60, 50, 40, 30, 20 and 10 feet. Figure 3 shows the results of this test.

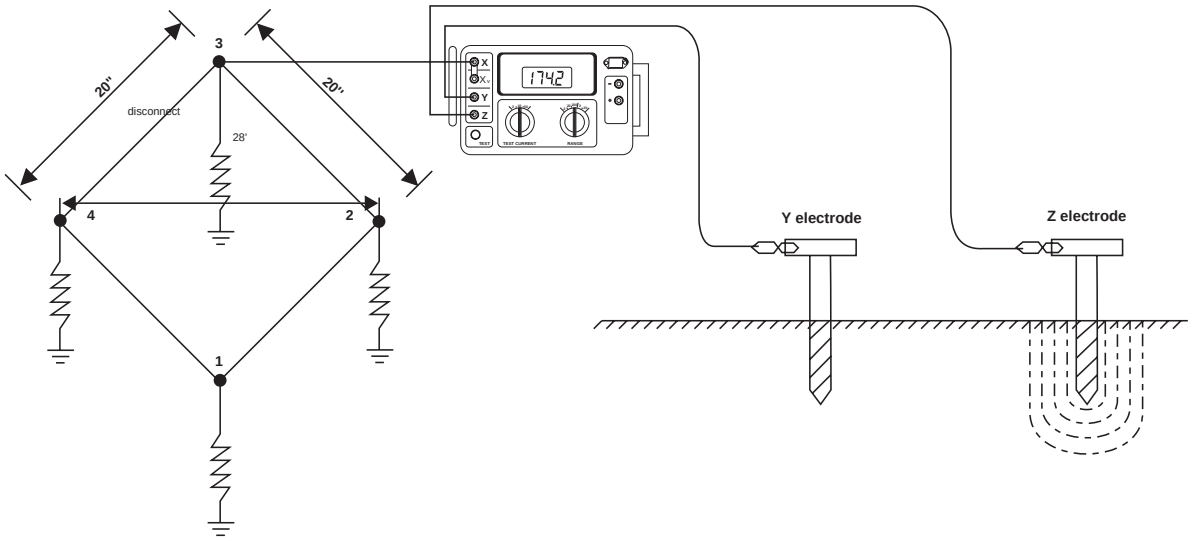


Figure 3. Three-Point test connection

Y Rod	Resistance
10%	79.4
20%	81.7
30%	83.1
40%	83.9
50%	84.3
60%	84.8
70%	85.6
80%	87.3
90%	94.1

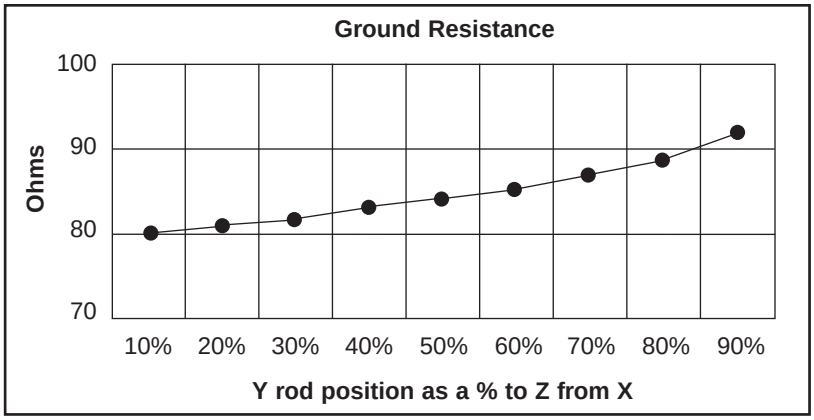


Figure 4. Model 4500 test results

The same test was repeated using the AEMC Model 4630 fall-of-potential ground tester. The results are shown in Figure 5.

Y Rod	Resistance
10%	71.5
20%	82.3
30%	83.2
40%	83.6
50%	83.7
60%	84.1
70%	84.6
80%	85.3
90%	94.8

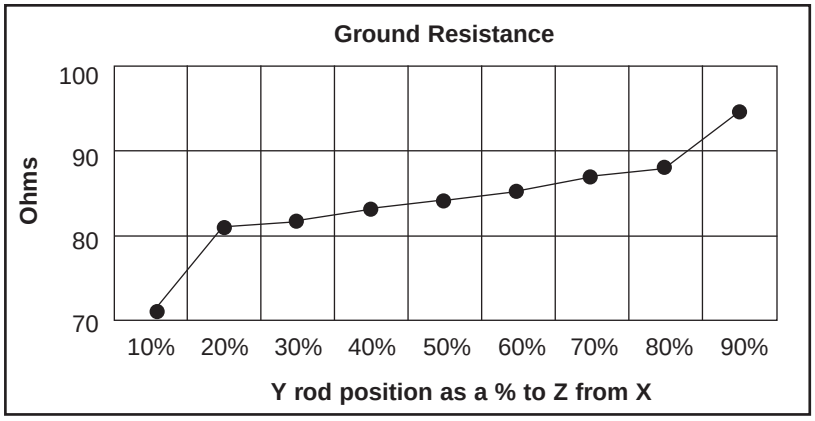


Figure 5. Model 4630 test results

Finally, the AEMC Model 3731 was used to measure the resistance at rod number three with all other rods detached from it. A temporary cable was installed between rod number three and the municipal grounding system thus setting up the required parallel paths necessary for accurate measurement using a clamp-on ground tester (see Figure 6). Under these conditions, the reading was 84.5Ω.

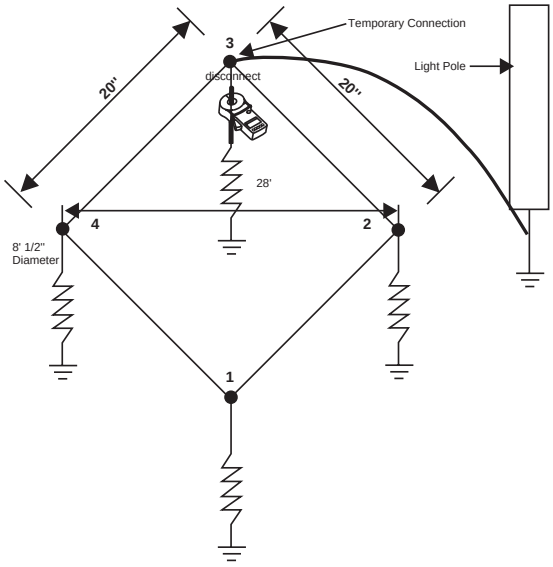


Figure 6. Single rod test using the Model 3731 clamp-on ground resistance tester

The results of these tests showed that the clamp-on ground tester is indeed an effective tool in measuring ground resistance when used under the proper conditions. Readings between the clamp-on ground testing and the fall-of-potential ground testing method correlate. The advantages of using the clamp-on tester were the ability to test without disconnecting the rod from service and the ability to test without the need for auxiliary ground electrodes. These two points saved considerable amount of time in conducting the test.