MEASUREMENT OF EARTH RESISTANCE IN PYAY UNIVERSITY COMPOUND USING MODEL *2720 ER* EARTH RESISTANCE TESTER

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Abstract

The purpose of this research work was to find out the temperature would have an effect on the earth resistance (resistivity). The earth resistance tester (Model 2720 ER) which containing three electrodes were used to measure the earth resistance. The earth resistance data were collected for different temperatures (actually different times). The electrodes were driven down to the same depth and equal distances apart in a straight line. According to the data, it was found that the earth resistance depends on temperature and seasonal variation. From the results, the values of earth resistance were less than 5Ω. According to the IEEE standard, this area is suitable for telecommunication facilities and distribution substation.

Key words; Earth resistance, Earth resistance tester, Fall of potential method.

Introduction

"Earth resistance" is the resistance of soil to the passage of electric current. Actually the earth is a relatively poor conductor of electricity compared to normal conductors like copper wire. But if the area of a path for current is large enough, resistance can be quite low and the earth can be a good conductor. It is the earth's abundance and availability that make it an indispensible component of a properly functioning electrical system.

Soil resistivity is the key factor that determines what the resistance of a grounding electrode will be, and to what depth it must be driven to obtain low ground resistance. The resistivity of the soil varies widely throughout the world and changes seasonally. Soil resistivity is determined largely by its content of electrolytes, which consist of moisture, minerals and dissolved salts. A dry soil has high resistivity if it contains no soluble salts.

Measurements of earth resistivity are useful also for finding the best location and depth for low resistance electrodes. Such studies are made, for example, when a new electrical unit is being constructed; a generating station,

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substation, transmission tower, or telephone central office. Finally earth resistivity may be used to indicate the degree of corrosion to be expected in underground pipelines for water, oil, gas, gasoline, etc.

2. Measuring Earth Resistance

Earth resistance meter is connected with the special ground components introduced on the earth by mean of the checking cables. Ground components will be put in a straight line (place the green cable for ground rod, then connect the yellow one and the red cable for the second ground rod). All measurements are done in dry earth condition. Everything is ready to connect the earth resistance meter to check the earth connection of building. Data collecting is started from 9:00 AM and 12:00 noon exactly. Surrounding temperature is known using thermometer and read in Celsius scale. This can be also used inside a building to check that water connections with earth work properly. This meter has been developed according to IEC 1010-1 standard and fulfills all the safety conditions for control electronic mechanism.

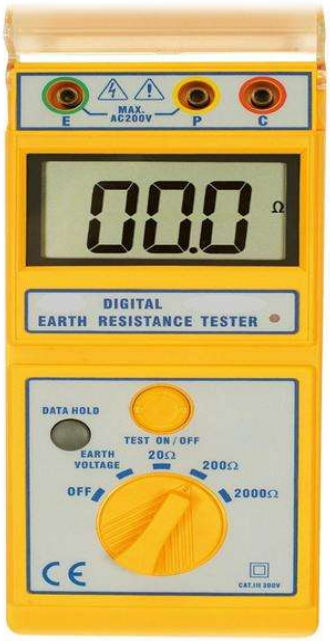

Figure 2.1: Earth resistance tester (Model 2720 ER)

Figure 2.2: Earth resistance measuring area (Palae hostel, Pyay University)

Figure 2.3: Setting up to measure the earth resistance

3. Experimental Results

The measurement data of the earth resistance (using 2720 ER earth tester) is shown in table 3.1 to 3.4. The data are collected two times daily (9:00 am and 12:00 am).

Table 3.1 Measurement data for 2016 October

Date	9:00 AM		12:00 AM(noon)	
	Temperature (°C)	Resistance (Ω)	Temperature (°C)	Resistance (Ω)
12-Oct			34	3.72
13-Oct	32	3.69	34	3.66
14-Oct	32	3.65	34	3.6
15-Oct	31	3.67	34	3.64
16-Oct	32	3.62	34	3.64
17-Oct	31	3.66	32	3.64
18-Oct	30	3.61	32	3.62
19-Oct	31	3.6	32	3.59
20-Oct	31	3.57	33	3.55
21-Oct	32	3.65	33	3.56
22-Oct	31	3.59	33	3.56
23-Oct	31	3.6	33	3.59
24-Oct	30	3.6	33	3.6
25-Oct	30	3.61	32	3.57
26-Oct	30	3.58	31	3.62
27-Oct	29	3.55	31	3.53
28-Oct	29	3.6	31	3.57
29-Oct	30	3.64	32	3.58
30-Oct	29	3.63	31	3.62
31-Oct	30	3.54	32	3.62

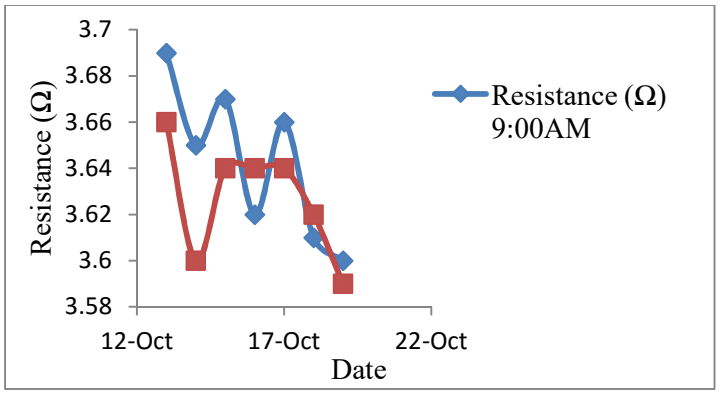

Figure 3.1: Resistancevs date and time graph
(13 October 2016 to 19 October 2016)

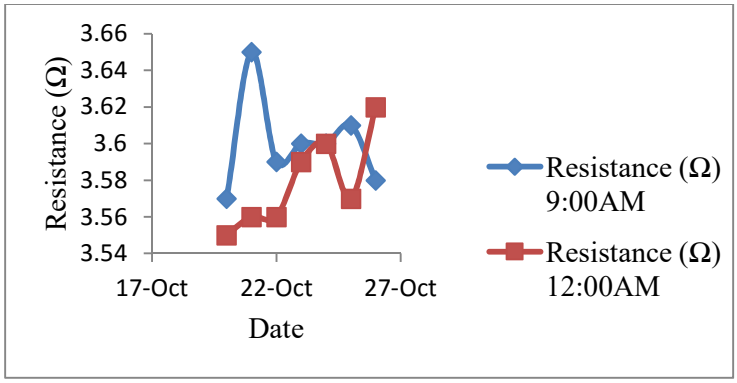

Figure 3.2: Resistancevs date and time graph
(20 October 2016 to 26 October 2016)

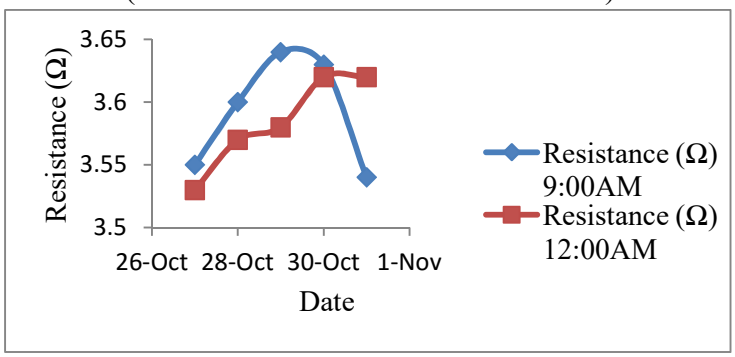

Figure 3.3: Resistancevs date and time graph
(27 October 2016 to 31 October 2016)

Table 3.2. Measurement data for 2016 November

Date	9:00 AM		12:00 AM(noon)	
	Temperature (°C)	**Resistance (Ω)**	**Temperature (°C)**	**Resistance (Ω)**
1-Nov	29	3.57	32	3.57
2-Nov	31	3.62	31	3.62
3-Nov	29	3.65	31	3.65
4-Nov	29	3.71	33	3.64
5-Nov	30	3.69	32	3.64
6-Nov	30	3.66	32	3.66
7-Nov	30	3.61	31	3.66
8-Nov	30	3.65	32	3.62
9-Nov	30	3.69	33	3.6
10-Nov	31	3.6	32	3.54
11-Nov	30	3.55	31	3.55
12-Nov	30	3.6	32	3.55
13-Nov	29	3.6	31	3.58
14-Nov	29	3.64	31	3.58
15-Nov	28	3.68	31	3.64
16-Nov	28	3.64	30	3.63
17-Nov	28	3.68	30	3.65
18-Nov	28	3.65	30	3.63
19-N0v	27	3.7	29	3.7
20-Nov	27	3.7	29	3.68
21-Nov	25	3.74	28	3.77
22-Nov	25	3.73	27	3.74
23-Nov	25	3.72	28	3.73
24-Nov	23	3.82	27	3.75
25-Nov	24	3.78	26	3.75
26-Nov	25	3.77	27	3.78
27-Nov	25	3.8	27	3.58
28-Nov	25	3.81	28	3.94
29-Nov	25	3.83	28	3.78
30-Nov	27	3.74	30	3.74

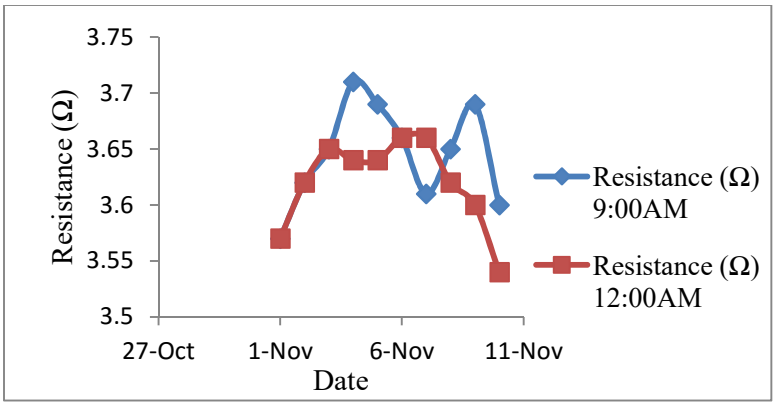

Figure 3.4: Resistancevs date and time graph
(1 November 2016 to 10 November 2016)

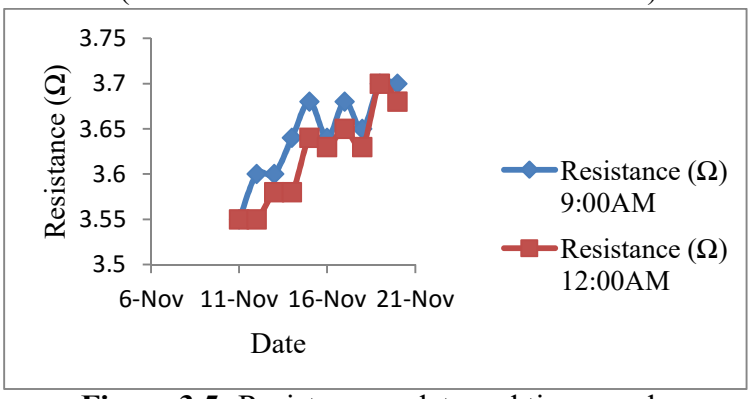

Figure 3.5: Resistancevs date and time graph
(11 November 2016 to 20 November 2016)

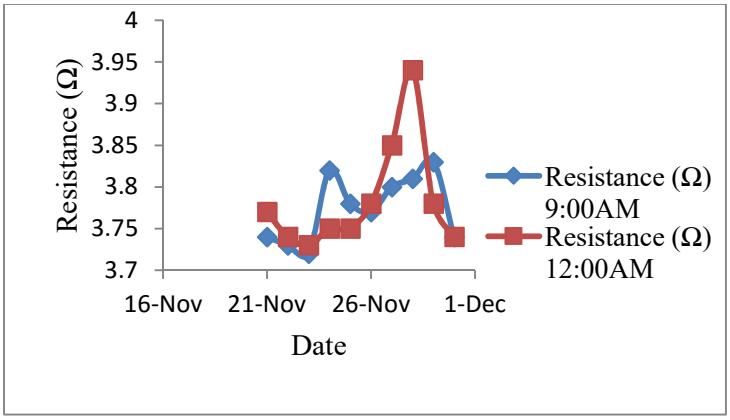

Figure 3.6: Resistancevs date and time graph
(21 November 2016 to 30 November 2016)

Table 3.3. Measurement data for 2016 December

Date	9:00 AM		12:00 AM(noon)	
	Temperature (°C)	**Resistance (Ω)**	**Temperature (°C)**	**Resistance (Ω)**
1-Dec	26	3.82	29	3.77
2-Dec	27	3.84	30	3.81
3-Dec	27	3.86	30	3.84
4-Dec	27	3.84	30	3.92
5-Dec	26	3.88	29	3.9
6-Dec	26	3.87	29	3.87
7-Dec	26	3.96	29	3.82
8-Dec	25	3.84	29	3.86
9-Dec	25	3.87	29	3.96
10-Dec	25	3.97	29	3.93
11-Dec	25	3.91	29	3.94
12-Dec	25	3.96	29	3.91
13-Dec	26	3.96	29	3.87
14-Dec	25	3.96	28	3.91
15-Dec	23	3.95	28	3.93
16-Dec	25	3.95	28	3.95
17-Dec	25	3.98	28	3.96
18-Dec	26	3.94	30	3.9
19-Dec	26	3.94	30	3.89
20-Dec	25	3.9	29	3.91
21-Dec			27	3.9
22-Dec	22	3.98	26	3.93
23-Dec	23	3.95	28	3.95
24-Dec	26	4		
25-Dec	26	3.92	27	3.95
26-Dec	26	3.91	30	3.96
27-Dec	26	3.95	30	3.94
28-Dec	27	3.97	29	3.91
29-Dec	24	3.97	29	3.97
30-Dec	25	3.96	28	3.98

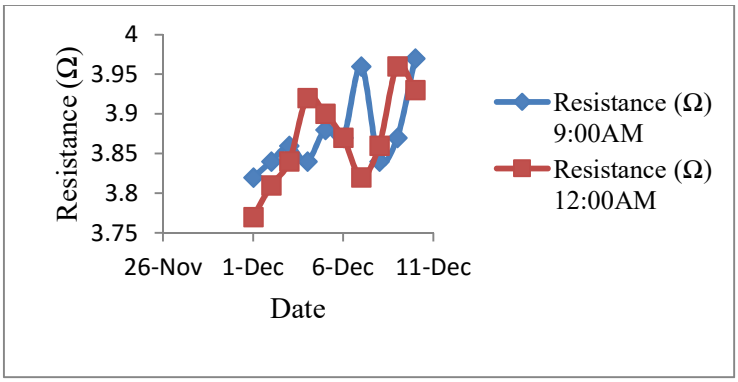

Figure 3.7:Resistancevs date and time graph
(1 December 2016 to 10 December 2016)

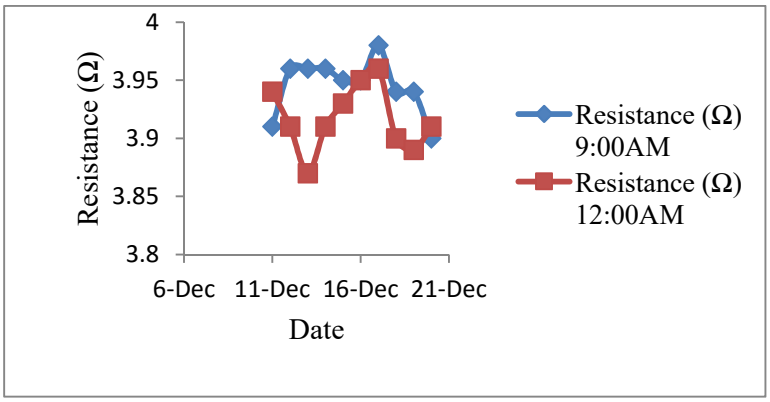

Figure 3.8: Resistancevs date and time graph
(11 December 2016 to 20 December 2016)

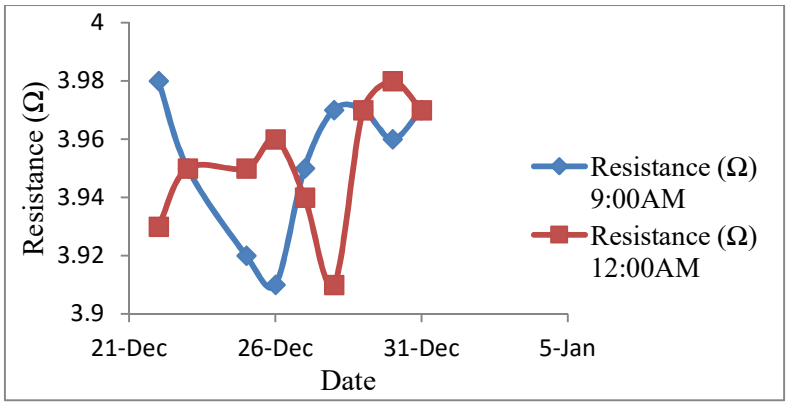

Figure 3.9: Resistancevs date and time graph
(22 December 2016 to 31 December 2016)

Table 3.4. Measurement data for 2017 January

Date	9:00 AM		12:00 AM(noon)	
	Temperature(°C)	**Resistance (Ω)**	**Temperature(°C)**	**Resistance (Ω)**
1-Jan	24	4		
2-Jan				
3-Jan	24	3.49	26	3.48
4-Jan	24	3.48	28	3.49
5-Jan	25	3.49	29	3.49
6-Jan	25	3.49	29	3.49
7-Jan	24	3.51	27	3.5
8-Jan	23	3.52	28	3.51
9-Jan	24	3.53	28	3.52
10-Jan	25	3.53	30	3.52
11-Jan	24	3.54	28	3.53
12-Jan	23	3.54	27	3.53
13-Jan	22	3.55	27	3.55
14-Jan	21.5	3.57	27	3.56
15-Jan	22	3.58	27	3.57
16-Jan	21	3.59	26	3.59
17-Jan	21	3.59	26	3.59
18-Jan	22	3.6	28	3.59
19-Jan	23	3.6	27	3.6
20-Jan	22	3.6	28	3.59
21-Jan	24	3.6	29	3.59
22-Jan	23	3.6	29	3.6
23-Jan	24	3.6	30	3.6
24-Jan	25	3.59	30	3.59
25-Jan	26	3.59	30	3.58
26-Jan	26	3.58	30	3.58
27-Jan	24	3.58	29	3.58
28-Jan	24	3.58	28	3.59
29-Jan	23	3.59	30	3.59
30-Jan	23	3.6	28	3.59
31-Jan	23	3.6	29	3.61

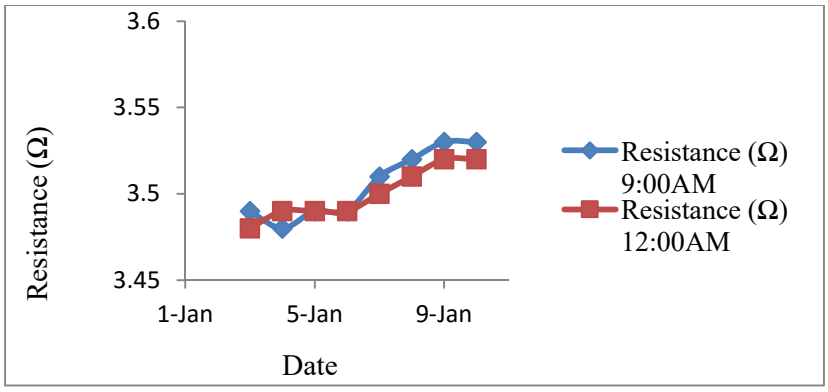

Figure 3.10: Resistancevs date and time graph
(3January 2017 to 10 January 2017)

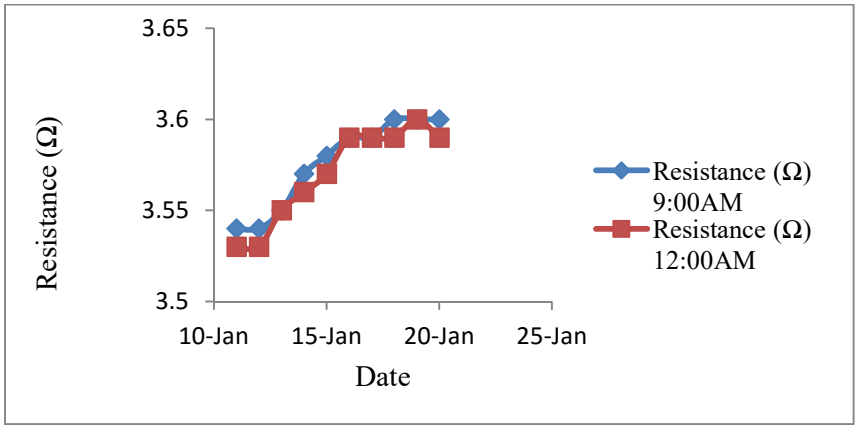

Figure 3.11: Resistancevs date and time graph
(11 January 2017 to 20 January 2017)

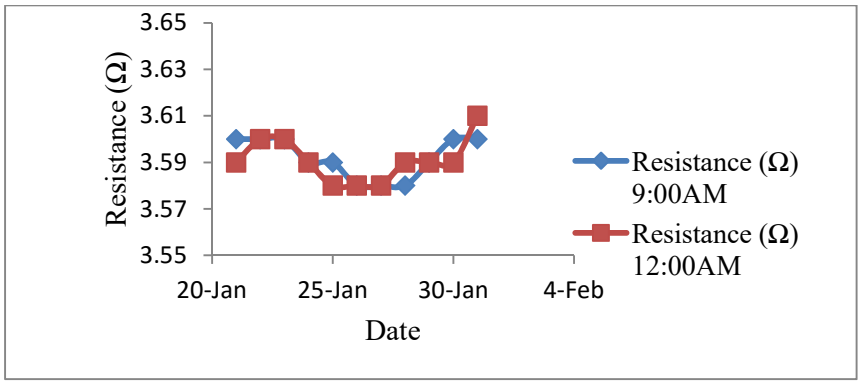

Figure 3.12: Resistancevs date and time graph
(21 January 2017 to 31 January 2017)

Discussion and Conclusion

Discussion

In this research work, the earth resistance datum have been collected since mid- October (13 October, 2016) to the end of January (31 January, 2017). The datum were collected two times for every day. Collected parameters are environ- mental temperature, electrode temperature, ground temperature and earth resistance. From those data, earth resistivity can be calculated by using the equation of $2\pi AR$. Where, A is the distance between each pair of electrodes.

According to the collected datum and calculated values, the earth resistance changes proportionally with temperatures. From the graph of figure 4.1 shows, the value of earth resistance is decreased and stable from the first week of January 2017. This means that earth resistance is affected upon temperature and moisture of the environment. So, the earth resistivity of the soil depends on seasonal variations also. From the results, the values of each resistance are lower than 4Ω (collected data results). According to the IEEE standard, the area is suitable for telecommunication facilities, distribution substation and industrial plant.

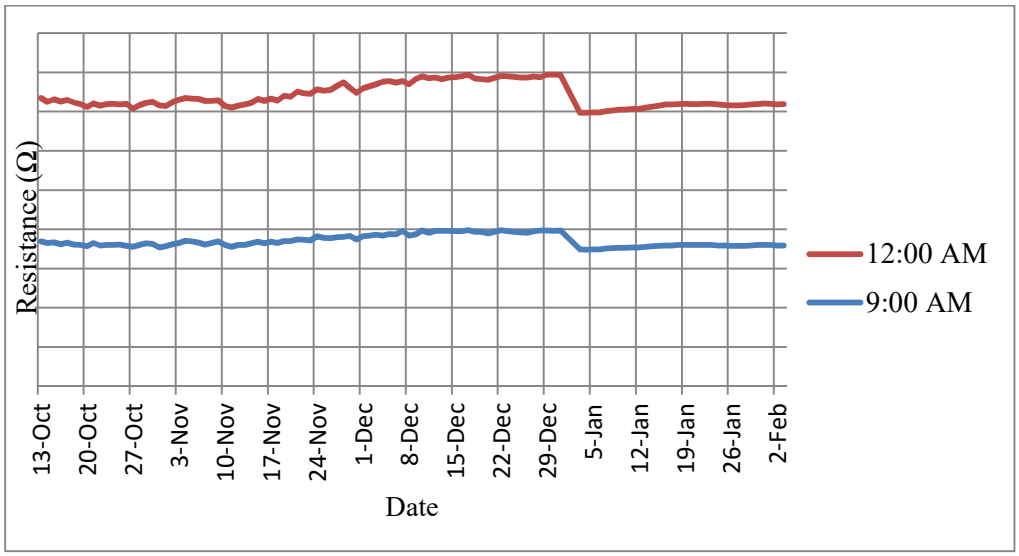

Figure 4.1: Date and temperature dependence of resistance graph

Conclusion

It is important for a facility to have a good grounding system. The safety of all personnel and equipment is at stake. In order to be sure that a good grounding system is in place, it is necessary to maintain a low resistance of all the electrodes and a low resistivity of the local soil. There are different methods for obtaining these measurements. Due to variations in electrodes and soil, a number of repeated measurements should be taken and evaluated for a consistency.

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References

E.D. Sunde, (1968), "Earth Conduction Effects in Transmission System", Dover Publications, New York.

C. Arnovx, "Understanding Ground Resistance Testing", AEMC Instruments, http://www.aemc.com.

G.F. Tagg, George, (1964), "A Practical Guide to Earth Resistances", Newnes Limited, London.

S.K. Pole and A.K. Sharma, "Analysis on the Factors Affecting Resistance of the Earth Electrode", International Journal of Engineering Research & Technology (IJERT), Vol. 2 Issue 5, Received May – 2013, http://www.ijert.org.