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GUMENI SUBSTATION EARTH TESTS

TESTS RESULTS

1. The earth mat resistance to true earth was measured using the slope method, as described in the Eskom Standard DST 34-1985.

The return current earth electrode C, was placed at 1000m from the substation earth mat with the potential electrodes P₁, P₂ and P₃ at 20%, 40% and 60% of the distance C.

Voltage measurements were conducted at frequencies ranging from 60 to 170Hz with a current of 1 amp flowing between the substation earth mat and the return electrode (C - 1000m). The impedances were plotted against frequency; the lines formed were extrapolated to the zero frequency axis to obtain the DC resistance values. From the resistance values measured the P_T/C value of 0,5829 was obtained and the correct resistance to true earth was measured (Figure 1) with P_T placed at 582m from the substation earth mat.

Resistance to true earth of substation earth mat: **0,41 ohms.**
Grid Potential Rise: **15 580 volts.**

(The fault current of 38 000 amps was used to calculate the GPR)

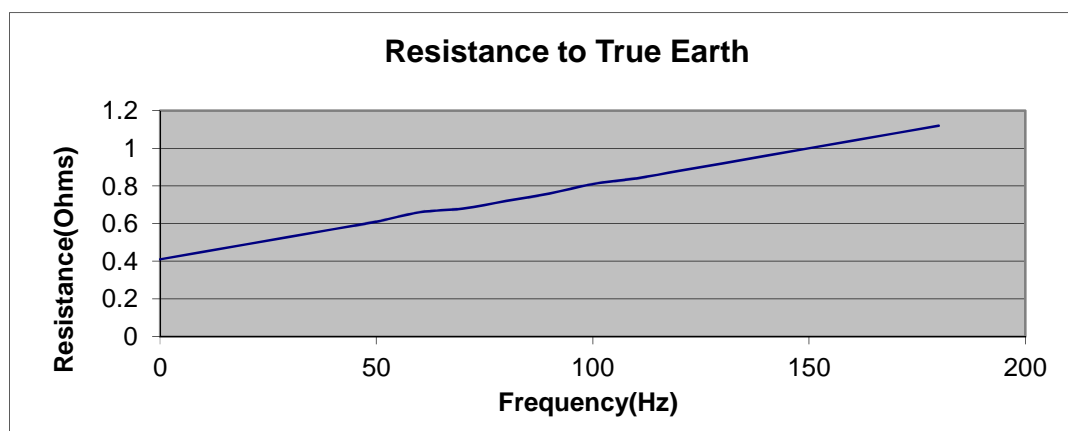


Figure 1

2. Step and Touch potentials were measured with a test current of 1 amp at a frequency of 70 Hz. Step and Touch potentials were done in the HV Yard, on various equipment structures and on the HV Yard Fences. The prospective step and touch potentials were then scaled up, using the stations fault current of 38 000 Amps on the 132kV Bus bar, to obtain the maximum possible touch potential

(It should be noted that no division of fault current is taken into consideration therefore it is unlikely that touch potentials will ever reach the values given).

Equipment	Measured Values (milli-Volts)	Prospective Step and Touch Potentials (Volts)
Touch Potentials inside 400kV Yard	3,2 to 6,1	122 to 232
Step Potentials inside 400kV Yard	0,6 to 5,1	23 to 194
On 400kV Yard Fence	1,6	61
Touch Potentials inside 132kV Yard	0,3 to 1,1	11 to 42
Step Potentials inside 132kV Yard	0,5 to 1,6	19 to 61
On 132kV Yard Fence	0,4	15

Table 2.1

COMMENTS:

The grid potential rise of 15 580 volts is higher than the permissible value of 5kV but no division of fault current was taken into consideration (overhead earth conductors) and a high fault current of 38kA was used to calculate the GPR.

Step and Touch Potentials (Table 2.1) measured inside the HV Yard and on the HV Yard Fence were below the value of 1008 as stipulated by the IEEE Code 80.

TESTED BY: N Kruger

Signature:

Date: 22 March 2013

ACCEPTED BY: Bertram Jordaan

Signature:

Date: 17 April 2013