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TECNOLOGÍA TOTAL
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TBE-0001

Date of Submittal: Thursday, October 20, 2005
Revision Date: None

Technical Bulletin 0001

Subject: Soil Resistance Effects on Reference Electrodes

When the earth dries out around a stationary reference electrode the resistance to "remote earth" increases. This can affect the potential sensed by either a portable meter or a remote monitoring system. The sensed potential will decrease. The effect is minimized by using a high resistance meter circuit. The error can be calculated as follows:

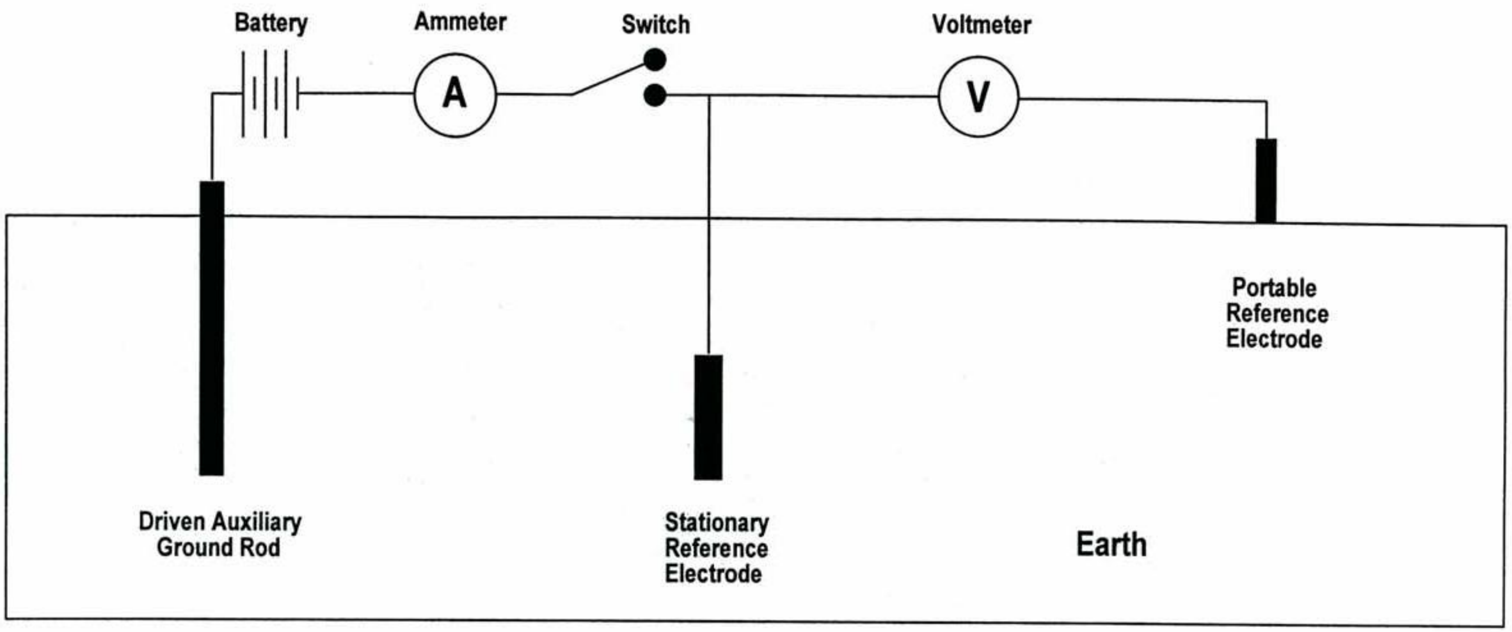
$$\text{True Potential} = \text{Measured Potential} \times \frac{\text{Meter Resistance}}{\text{Meter Resistance} + \text{Reference Resistance}}$$

This assumes that the meter resistance and reference resistance are much higher than other resistance in the circuit, such as, lead wire resistance and the resistance of the buried structure to remote earth, which is almost always the case.

By the use of a reference electrode that has a large surface reading area (diafragma), from 210 to 360 square centimeters (33 to 50 square inches), combined with a mechanism to retain moisture in the reference cell the above effects are dramatically reduced but not eliminated, especially when the soil is very dry, (see drawing SRE-007-CUY).

The resistance of the reference electrode can be measured using a "Vibroground" or "Nilsson" type instrument or by the alternative method described and illustrated in page two of this technical bulletin titled "SRE Resistance to Remote Earth".

Measurement of a Buried Stationary Reference Electrode Resistance to Remote Earth



The distance between the stationary reference electrode and the auxiliary ground rod should be 30 to 40 meters. The distance between the stationary reference electrode and the portable reference electrode should also be 30 to 40 meters. The distance between the auxiliary ground rod and the portable reference electrode should accordingly be 60 to 80 meters. The battery should have sufficient voltage to produce a current of at least 5 milliamps (50 Volts if the stationary reference electrode resistance is 100,000 ohms and less at lower reference electrode resistances). The soil around the driven auxiliary ground rod may be wetted to reduce overall circuit resistance.

The change in the potential difference between the portable and stationary reference electrodes, when the switch is closed, is measured.

The current flow with the switch closed is measured.

The resistance of the stationary reference electrode to remote earth is calculated as follows: $R = \frac{\Delta V}{I}$

R = Resistance of stationary reference electrode to remote earth (ohms)

ΔV = Absolute value of the change in potential between portable and stationary reference electrodes when current is applied (Volts)

I = applied current (Amperes)

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TITLE: SRE Resistance to Remote Earth			
SIZE: A	REVISION: 1.0	DRAWING NUMBER: Technical Bulletin TBE-0001	
SCALE: Representative		DATE: February 29, 1992	Page: 2 of 2

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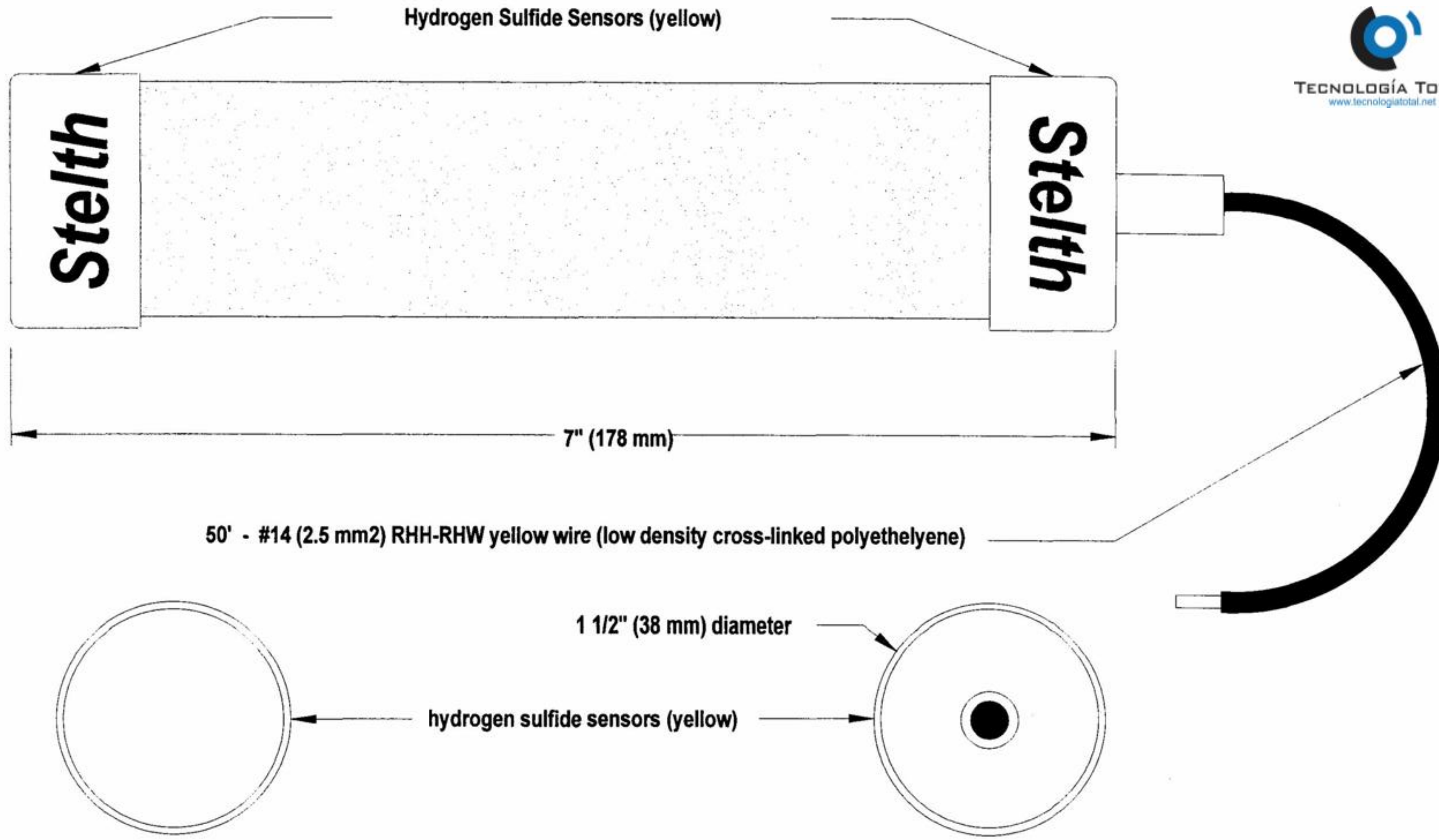

"Stelth 2" Cu-CuSO4 Stationary Reference Electrode
for underground or concrete service, chloride free conditions

***Note:** Available in wire sizes from #6 (16 mm2) to #24 (.25 mm2) and in all insulations standards.*

Specifications: Copper-Copper Sulfate reference electrode				
1. Medical grade ceramic body	6. Can be FROZEN !!!	WARRANTY:	30 Year Design Life (-0 +2 years)	
2. Element is 99.99% pure Copper	7. Moisture Retention Membrane	PART NUMBER:	SRE-007-CUY	
3. 30 micron Ceramic Sensor	8. Hydrogen Sulfide Ion Trap	FINISHED GOODS:	SRE-007-CUY	DATE
4. Stability 5 mV with 3 microA load	9. Chloride Ion Trap	DESIGNED BY:	Frank W. Borin	2/29/1992
5. Temperature Range -10 to 176 degrees F, (-23 to 80 degrees C)		DRAWN BY:	William H. Pruess	2/29/1992
		CHECKED BY:	Thomas Mierau	2/29/1992

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TITLE	"Stelth 2" Cu-CuSO4 reference cell		
SIZE: A	REVISION: 1.1	DRAWING NUMBER: SRE-007-CUY / TBE-0001	
SCALE: 1.0" = 1.0"		DATE: February 29, 1992	SHEET: 3 of 3