How to Build A Zap Line

Presented by:

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Introduction:

When selecting a rope for use, one of the last considerations for many would be the electrical conductivity of the rope. While for the vast majority of rope applications, this is not an important consideration, there are a number of applications for which this parameter could be extremely important. This study is intended to present a quick-look snapshot of the electrical conductivity of several different static ropes in order to provide some useful data for those situations where this could be a safety consideration. Depending on the results of this study, further electrical characterization of these ropes can help in the selection and design of rope systems in rescue and industry. The data, not yet available, will be presented in the symposium presentation.

Approach:

This study is limited in scope to a few types of static rope products. The ropes were selected to be generally representative of the static ropes in common use. Included in the study are nylon kernmantle, polyester kernmantle, aramid kernmantle, and braided ropes sold as dielectric ropes. Using a mechanical clamp for contact, the ropes will be measured for electrical conductivity and the results will be compared. The conductivity of the rope refers to the rope's ability to conduct electrical current. By measuring this current through a fixed length of rope, the rope's conductivity will be able to be compared to other rope segments of the same length. By applying Ohm's law, this will allow the resistance of the rope to be characterized as a function of its length. Ropes with very little resistance will be classified as highly conductive. Ropes with a very high resistance will be classified as insulative. For the ropes selected for this

study, the comparison will indicate how the design and material used in a rope affect the rope's conductivity. One special consideration will be the comparison of ropes marketed as dielectric ropes to those without that designation.

The above measurements will be made on dry rope segments. Additionally, the ropes will be measured when wet. These measurements will allow consideration of how different rope materials and construction change, in terms of conductivity, when wet. Each rope segment will be soaked for the same amount of time and then measured as before. The results will again be compared.

After applying a firm mechanical connection to the rope ends, the electrical conductivity will be measured using either a megohmeter or a driving current and resulting voltage. The measured results will be normalized to a resistance per unit length (ohms/meter). Although ohms, being the unit of resistance, are actually the inverse of conductivity (expressed in mhos), they are more commonly used and a familiar term. Should one want to give the results of this study in terms of true conductivity, it is a simple matter to take the inverse of the results in ohms and change the term to mhos. Another note to make about this study is that it is limited to resistance measurements and does not consider impedance that is a function of the frequency of an alternating current. This means that the current study is concerned with directly conducted currents at reasonably low frequencies and not the potential of coupled currents from radio frequency sources. In other words, this preliminary study is to begin the investigation of the conductivity of ropes as it applies to either contact with voltage sources or as conductors of electrical static discharge sources.

Results:

The results of this study will be presented at the symposium in the form of plotted comparisons. Pictures of the various samples that are being measured will accompany the plots.

Significance:

Without delving into the specific applications of the ropes being tested, a preliminary conclusion can be reached concerning the conductivity of ropes. This conductivity can be used as a guide in assessing the potential use of a rope in an application where either the conductivity from contact with a voltage source is a concern or where the rope may be part of an electrostatic discharge (ESD) analysis. Finally, some correlation to a standard for dielectric ropes will be explored. Because decisions are being made to use or not use specific ropes based on assumptions regarding their conductivity, this study will provide some preliminary information to either affirm or bring into question the basis for those decisions.

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