

Cable Lore

ANACONDA 

BY POWER CABLE ENGINEERING AND RESEARCH

Issue No. 18

March 1967

SUNLIGHT-RESISTANCE OF CABLE COVERINGS

The explosion of interest in beautification has been felt in the wire and cable industry. The interest in cables other than those that are round and back grows with each passing day. Power lines and auxiliary equipment that blend into the surrounding terrain and sky are more than a curiosity. The aesthetic qualities of a cable design will become a significant factor in cable specifications.

The continuous exposure of cables to weather is of major concern to a cable engineer. It is a matter of record that all polymer-type coverings undergo degradation over a period of time. Environment, manner of installation, and chemical composition of the polymer are significant factors influencing cable longevity. In a very broad sense, the weathering-resistance of a specific polymer is dependent on its ability to resist chemical change brought about by exposure to oxygen and sunlight. The attack of oxygen on wire and cable coverings has been well established and will not be dwelt upon.

Sunlight, the source of all earthly life, can likewise be a serious and potent threat to wire covering. Generally speaking, the ultraviolet band of the sunlight acts as a promoting agent for the oxidation reaction of polymeric material - resulting in crazing, chalking, or cracking of the covering. To cite an example, during the earlier part of the 1940's, unpigmented polyethylene-insulated wire encountered severe weathering degradation after only a few months of outdoor exposure. After culmination of a 10-year investigation, Bell Telephone Laboratory found that suitable protection can be provided by a 1-2% concentration of channel black having particle diameters of about 25 millimicrons or less when well dispersed in an appropriately selected polyethylene. The last 20 years' field experience has further proven that this carbon black polyethylene composition is completely satisfactory for outdoor wire and cable. This practice also holds true for other polymer systems. Certainly, most thermosetting wire coverings contain carbon black for reinforcement purposes and prolonged exposure to sunlight poses no problem. With light-colored compounds, sunlight effect is predominant. This is the existing reason why "black" is a highly preferable color for cable coverings.

Colored compounds containing certain amounts of white inorganic filler show a diminished rate of oxidation in the early stages, since much of the sunlight is reflected by these high-refractive index materials. However, after certain periods of light exposure, the oxidation reaction ultimately breaks down the molecular chain of polymers involved which finally leads into chalking and cracking. Recently, certain colorless organic compounds, having absorptive characteristics for ultraviolet light, have been introduced into the market as a light or ultraviolet absorber. These are being used either singly or collectively with some inorganic fillers. There has been some expression of doubt that a complete protection of polymer covering can be achieved in this way since not enough of the additive can be used to effect complete absorption and the shortwave visible light, which is still quite effective in promoting the light reaction, is not really absorbed at all.

The question will naturally arise concerning the method of evaluating various polymers containing these ultraviolet light absorbents for outdoor weathering resistance. Various laboratory devices, such as Weather-O-Matic, Fade-O-Meter, etc., have been frequently used to ascertain at a greatly accelerated speed the trend of reactions which will occur in outdoor exposure. This type of equipment serves as an invaluable aid in the development work of screening new compositions to obtain comparative data under uniform and reproducible exposure conditions.

Although trials are made in correlating practical outdoor weathering with accelerated laboratory test results as so many thousand-hours-exposure in Weather-O-Matic being equal to so many years actual outdoor weathering, this correlation remains true only to a specific type of material and cannot always be transferred to a different family of polymer. For this reason final conclusions in the evaluation of various polymers' systems for sunlight stability or outdoor weathering rely solely on actual outdoor test results.

In summary, there is a definite interest in colored cables that could develop into a trend. Accelerated tests for evaluating weathering-resistance are underway and will be valuable in screening the most promising compounds. Only actual outdoor weathering for an extended period of time will give a true evaluation. Compounds with histories of outdoor exposure approaching the life expectancy associated with black coverings are not currently available. Both cable manufacturers and consumers must be tolerant concerning this situation and plan their activities and experimental installations accordingly. Testing has been underway for several years and only time can provide a tangible answer.

T. H. Ling