

Lead-Free EPR Insulation for Industrial Medium-Voltage Cable

Background:

As the issues of environmental impact and sustainability continue to be a topic of worldwide discussion, initiatives such as RoHS, California Proposition 65 and REACH have been enacted with the goal to limit the content of hazardous materials, including the use of lead, in a wide variety of manufactured goods. In many industries, including wire and cable, these types of regulatory actions have already forced major changes in the types of materials used in the manufacture of goods.

Historically, the medium-voltage (MV) industrial cable market has been dominated by Ethylene Propylene Rubber (EPR) insulation designs that include "lead" compounds. To date, the EPA has not restricted the use of lead in EPR insulations, stating that the lead content is below the threshold limit allowing for their continued use; however, it would appear to only be a matter of time before MV EPR insulation is included in this scope.

In an effort to adapt to this shifting market dynamic and to further reduce our overall environmental footprint, General Cable has proactively developed a proprietary lead-free EPR formulation that not only meets environmental regulatory requirements, but also meets or exceeds all applicable industry requirements.

Discussion:

EPR insulation is composed of a base polymer resin along with many additives that are designed to deliver the desired mechanical and electrical properties. One of the additives used in commercially available MV EPR formulations is lead oxide, which functions as a stabilizer, providing stable electrical properties at elevated temperatures, especially in wet environments. The most commonly utilized lead oxide is a "red" lead that also gives MV EPR insulation its characteristic red or pink color.

As environmental concerns increased, General Cable commenced development of an alternate stabilization package that would provide the same electrical performance as leaded MV EPR insulation without increasing cost or negatively impacting other physical properties. To accomplish this, General Cable's technology team has developed a proprietary stabilization package that utilizes Hindered Amine Light Stabilizers (HALS). This stabilization package serves to trap free radicals through a cyclical reaction, thereby providing long-term stability without the use of lead oxide or any other lead compounds.

After the development process was completed, rigorous long-term testing was performed on the new lead-free EPR insulation as required by ICEA, UL, and AEIC. This testing included the accelerated water treeing test, which measures electrical performance in water under voltage for a 360-day period, to validate long-term electrical stability and breakdown strength. All applicable qualification data is available upon request.

Summary:

In light of increasing environmental awareness, it's important to consider the full environmental impact of every cable choice and therefore, the amount of lead in the MV cable insulation. As an example, for one circuit mile of 4/0 copper 220 mil wall leaded EPR insulated cable, the removal of lead from the insulation would result in a reduction of approximately 43 pounds of red lead oxide. If you extrapolate that amount over all of our medium voltage industrial product lines, you can see why General Cable has chosen to pursue this no-lead design for its MV EPR industrial insulation.

The no-lead EPR conversion has been implemented with no increase in cost or loss of any performance characteristics as compared to leaded MV EPR insulations. General Cable lead-free EPR insulation demonstrates outstanding thermal, wet and dry electrical performance, and has been tested to all applicable requirements of AEIC, ICEA and UL, as well as all requirements outlined for installation per the NEC.

While leaded EPR insulations are still within the current EPA thresholds and will likely remain in the market for a number of years, General Cable's proactive shift to lead-free EPR for all industrial MV cable products introduces a "Green" solution that will stand the test of time.