TECHNICAL NEWS
from
THE OKONITE COMPANY

Engineering Information for the Professional Engineer

September, 2002 Edition: 013

MEDIUM VOLTAGE CABLE - RATING CRITERIA

The ampacity, ampere, rating of an insulated conductor is dependent on the nominal or continuous temperature rating of the insulation. Thermoplastic insulations such as; polyethylene or polyvinyl chloride are rated 60°C or 75°C depending on grade. Thermoset insulations, ethylene propylene rubber or crosslinked polyethylene are rated 90°C or 105°C again dependent on type and capability.

The 2002 NEC Code Table 310.16 list ampacity ratings for code type cable constructions based on the insulation temperature rating. In article 310.15.C, the code provides the formula for the ampacity rating. The rigorous use and explanation of this formula can be referenced in either AIEE paper 57-660 or IEC standard 287. In summary, the ampacity rating is dependent on the difference between the nominal temperature rating of the insulation and the cable's application ambient temperature. The larger this difference, the higher the ampere rating.

The general category of medium voltage cables, 5-35kV, present an insulation selection choice for the end user. There is a dramatic thermal performance difference between EPR and XLP insulations.

XLP insulation experiences a chemical phase change at 103°C. This material loses physical strength at this temperature - it softens. Physical forces on this cable at termination points, bends, and vertical supports may introduce deformation leading to premature cable failures. On the other hand EPR insulation maintains physical stability over a temperature range of 30°C to 150°C. Figure 1 demonstrates the phase change of the XLP compound and Figure 2 details the physical modulus of both insulation types. EPR is stable and XLP loses its' physical properties above 103°C.

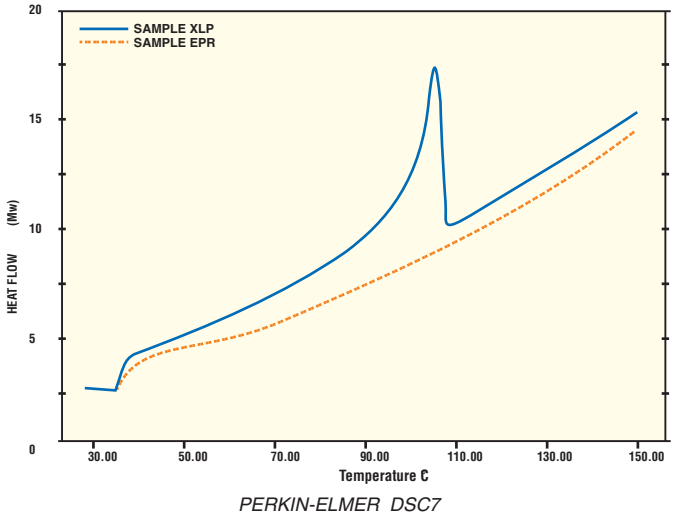


Figure 1

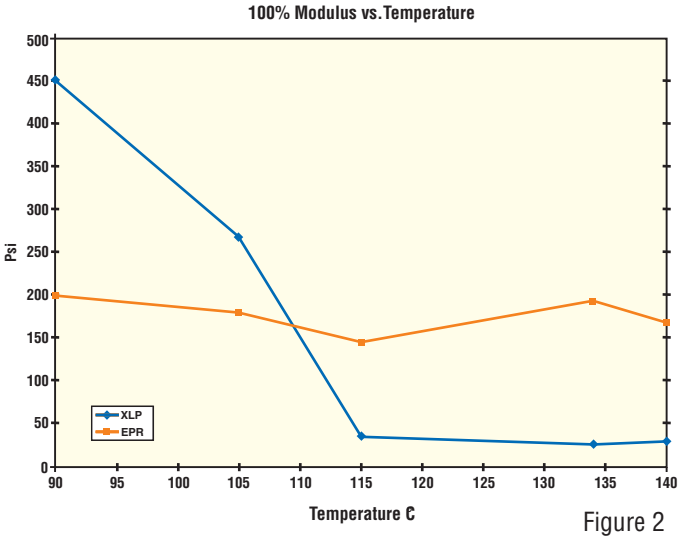
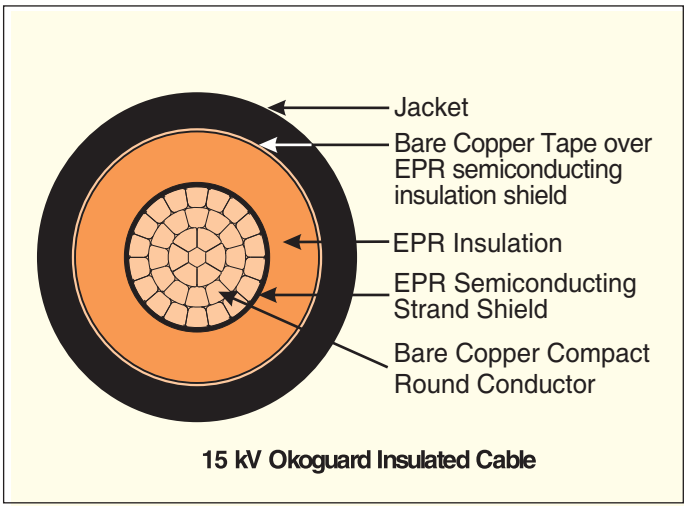


Figure 2

Cable applications requiring continuous ampere loading at the nominal 90°C insulation temperature rating offer little or no design margin for the XLP insulation compared to the considerable design margin for EPR insulation. At temperatures above 103°C, XLP behaves like a thermoplastic.

The 2002 NEC Code recognizes this difference in insulation capability in Table 310.61. EPR is the only medium voltage insulation capable of continuous and stable temperature operation above 90°C, the MV-105 rating. Thermal bottlenecks; such as, abrupt burial depths, minimum spacing from other power cables and adjacent heat sources or the need to heavily load cables dictate the requirement for EPR insulation. The installed cable route can present unintended thermal hot spots. EPR insulations can easily handle these situations without premature, mechanical deformation or causing the need for larger uneconomical copper conductor sizes.



The project specifying organization can select the insulation for the application presented. Medium voltage cables are not commodities in the same sense as the wire types in Table 310.13 of the 2002 NEC Code. A clear design choice having technical substantiation can be made for medium voltage cable applications.

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