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Subject: Discharge Resistant vs Discharge Free Cable Designs

Partial-Discharge Resistance

When voids are present in solid dielectrics and the electrical field is sufficiently high, air (or other gas) inside the voids ionizes and creates breakdown pulses across the voids. These pulses are called partial discharges (PDs). Most solid-dielectric insulations degrade under the presence of partial discharge and lead to premature failure of the insulation. However, some dielectric materials are relatively insensitive to PD activities. The ability of solid dielectrics to with-stand voltage under the presence of partial discharges is called Partial-Discharge Resistance.

Discharge Resistant vs Discharge Free

Discharge Resistant (DR) is recognized by Industry Standards, such as ICEA S-94-649 and AEIC CS8, as one of two cable design concepts for extruded, solid-dielectric cables. The other design concept, Discharge Free (DF), has fundamental differences when compared to Discharge Resistant. The Discharge Free concept is based on the idea that new cables are free of partial discharge. Admittedly, the Industry understands new cable cannot reliably be demonstrated as "discharge free" and although today's cables contain fewer apparent PD activities than their predecessors, there is no assurance that they are completely free of partial discharge. And so, the Industry Standards pass/fail criteria for the factory PD test of Discharge Free cable is 5-pC (picocoulomb). For perspective, a single 5-pC signal requires at least three 10-mil voids, nine 5-mil voids, 100 1-mil voids, or other equivalent void combinations to simultaneously discharge.

Testing for Discharge Resistant Cables vs Discharge Free Cables

Understanding no cable is guaranteed to be perfectly free from PD, Kerite chooses to employ the Discharge Resistant design concept. In doing so, Kerite cable is subjected to different factory test requirements, as defined by ICEA and AEIC. Many of the required tests are the same, but there are a few differences. One such difference is Discharge Resistant cables are not required to factory PD test. Instead, the insulation material of Discharge Resistant cables is required to be tested once per month for Discharge Resistance per ICEA/AEIC. The table below highlights some additional differences.

Difference in Test Requirements as defined by ICEA S-94-649 and AEIC CS8

Cable Component	Test	Test Required: Yes/No		Comment
		Discharge Resistant	Discharge Free	
Conductor Shield	Volume Resistivity (VR) of Semiconducting Conductor Shield	No	Yes	VR is only applicable for a semiconducting material. DR designs utilize a nonconducting material.
	Spark Test of Conductor Shield	Yes	No	Spark Test is only applicable for nonconducting materials. DF designs are required to use a semiconducting material.
Insulation	Partial Discharge	No	Yes	Partial Discharge measurements are only required for DF cable designs and allowed up to 5-pC of PD.
	Discharge Resistance	Yes	No	DR insulation is verified once per month in accordance with ICEA S-94-649 / ASTM D 2275.
Insulation Shield	Minimum Tension for Strip	No	Yes	Per ICEA, there is no minimum tension requirement for removing insulation shields used with DR cables.

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