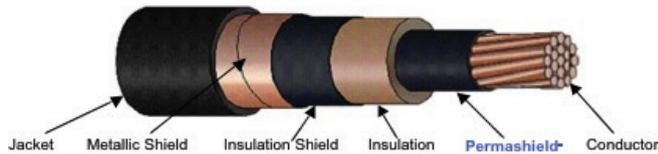


## Kerite Permashield®



### General

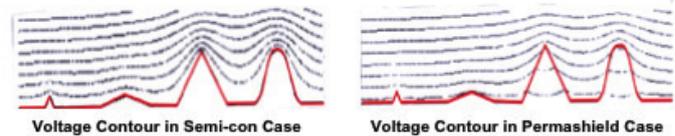
The Permashield® concept was developed by Kerite in 1957 and introduced commercially in 1962. At that time, the extrudable semi-conducting shields began to replace carbon-impregnated fabric tapes as the shielding layers on medium voltage cable.

Semi-conducting materials provide stress control due to their high conductivity. Permashield provides stress control by virtue of its high dielectric constant. Like capacitors in series, the voltage within a power cable will divide in proportion to the capacitance of the layers. Because Permashield has a high dielectric constant, it provides stress grading at the insulation interface. The net effect is that the Permashield shares just enough of the stress to blunt any concentration at the boundary between the Permashield and insulation. Kerite is unique in its approach to conductor shielding.

### Interface Stress

Electrical stress can be portrayed as lines of equal voltage potential. The closer the lines of equal potential, the greater the electrical stress (like closely spaced contour lines on a topographical map represent steep grades). Because Permashield is non-conducting, it affects stress in two ways:

1. Because of the capacitive stress grading, it shares a small part of the voltage with the primary insulation, thereby reducing the average voltage stress in the insulation (about 6 percent in URD cable).
2. It minimizes the stress enhancement at protrusions from the shield into the insulation (ANSI/ICEA S-94-649 prohibits protrusions and irregularities that extend more than 5 mils into the insulation). Protrusions into the insulation create focused points of electrical stress concentrations, which are shown below (for 1 mil and 5 mil sharp and blunt protrusions):



The above illustration of surface protrusions provides a clear picture of how the two shielding approaches compare. The effectiveness of semi-conducting shields is very dependent on interfacial smoothness to control stress.

The practical implication of this is a significant enhancement of AC and impulse breakdown levels (over 20 percent) of a Permashield construction compared to the same cable construction with semi-conducting conductor shielding.

### Manufacturing Process

Standard extrusion involves the simultaneous application of multiple layers (conductor shield, insulation, and insulation shield). A continuous voltage test cannot be used to verify the integrity of the insulation shield layer. Therefore, there is no practical way to check conductor shield continuity before it goes into the extruder head.

Because Permashield is an insulating material, and because Kerite applies Permashield in a separate extrusion head, we are able to confirm the integrity of the layer by applying an in-line 2kV DC voltage withstand test on every foot of cable.

