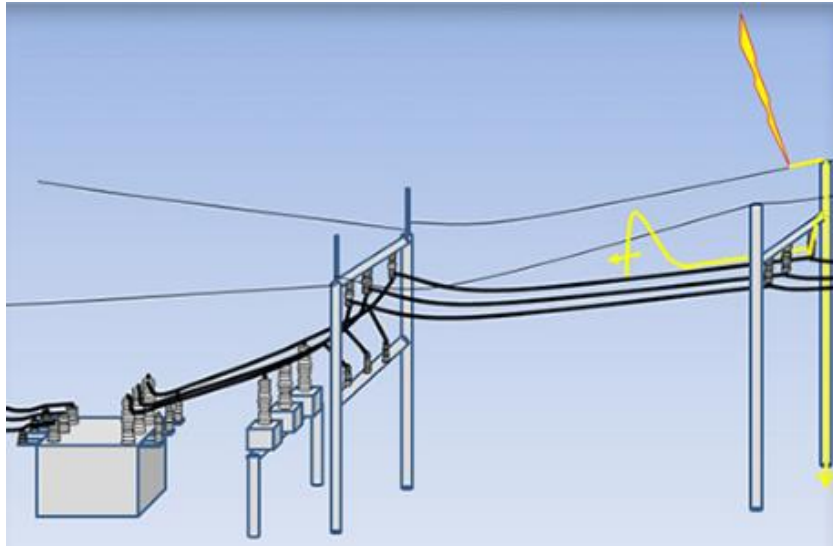


2.5 FUNDAMENTALS OF ELECTRICAL INSULATION MATERIALS



- Electrical insulation materials are utilized to provide protection over the metallic conductors of underground cables. The insulating materials physically enclose the conductor and provide a margin of safety.
- These materials are composed of either synthetic or natural polymers.
- The polymeric insulation material selected for use may vary with the voltage class of the cable.
- Metallic neutrals or tapes are applied over this cable core, and polymeric jackets are applied on the outside of the cable core.

Preferred insulation characteristics of this class of polyolefin-based polymers include:

- Excellent electrical properties
- Low dielectric constant
- Low power factor
- High dielectric strength
- Excellent moisture resistance
- Extremely low moisture vapor transmission

- High resistance to chemicals and solvents
- Ease of processing and extrusion

Paper-insulated cables were historically one of the first types of polymer used since paper was, and is, readily available from natural sources.

Paper is derived from wood pulp and is a natural polymer based on cellulose. In use, the paper is impregnated with a dielectric fluid (a low molecular weight hydrocarbon) so the practical insulation is actually a two-phase composition.

The dielectric losses of polyolefin's are superior to those of paper/oil insulation systems, and the polymers are considerably more moisture-resistant than paper.

Branching:

When ethylene monomer is converted to ethylene polymer (polyethylene), the polymer chains that form are not always linear

There is a tendency to form side chains or “branches.” These branches are “hanging” off the main chains as appendages. This is a natural event; when polyethylene is manufactured, the process employed always leads to side chains “hanging” off the long main chain.

The chain branching phenomenon contributes to increase in the molecular weight, but does not lead to an increase in the chain length. Branches for various grades of polyethylene