TechTalk

Introduction Medium Voltage Feeder Cables

Compiled by John Sherriff | January 2019 | Rev 1

The scope

The condition and life expectancy of medium voltage cable networks are being confronted frequently with the question “How much longer will the cable remain functional?”

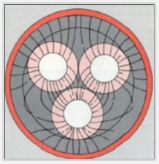
This question is based on the increasing need to avoid replacing cables sooner than strictly necessary. Replacing cable without the necessary knowledge often means simply throwing money away and then not replacing a cable without the necessary knowledge means that unacceptable risk is being taken.

PILC cable

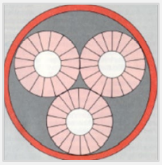
The paper insulated lead covered cable is mainly used for distribution networks.

Two types of PILC cable are used as belted and screened PILC cables:

- The belted cable is mainly applied in the lower range medium voltages. A high risk of using the belted cable in the higher medium voltage range can cause partial discharges in the area of the three cores that can occur during heavy load conditions that may cause core separation.



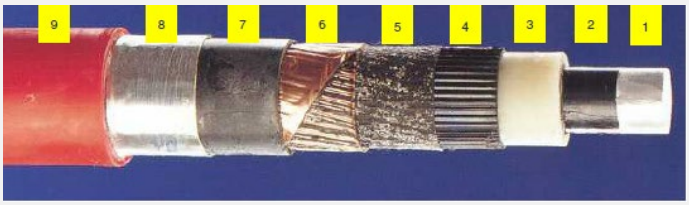
- The screened metal shield keeps the electrical stress between the cores equal to zero. Further improvement of the medium voltage screened core paper cables, is that a semi-conductive paper layer around the conductor (conductor screen) and under the lead sheath (insulation screen) is implemented to provide a smooth surface for the insulation at the metallic conductor and sheath. This improved the radial field stresses.



XLPE cable

The conductor can be stranded copper or solid or stranded aluminium. If stranded, such conductor can be made watertight by adding mastic filler or swelling powders.

Shields are semi-conductive a provide a smooth surface of the insulation. Small burrs on the conductor surface will not be harmful because the conductor shield shields them. A semi-conductive material has a conductivity much smaller than that of metal, but far more than that of insulation material. (Range of 1Ωm) Normally such conductivity is obtained by mixing a powered of carbon-black in a polymer or a tape.



1 – Conductor
2 – Shield (Semi-conductive)
3 – Insulation (XLPE)
4 – Insulation Shield (Semi-conductive)
5 – Swelling tape (Semi-conductive)
6 – Copper screen + Tape (Counter wound)
7 – Filling rubber (Semi-conductive)
8 – Aluminium complex strip
9 – PE Sheath

Key challenges

The key to the solution is to implement the correct assessment process, study the type of insulation system and the operating conditions and environment. This will provide you with the knowledge to make a calculated engineering decision of the remaining operational life of the cable.

Typical defects

Corrosion | chemical from the soil corrode the metal armour.

Thermal | brittle paper, dry wax and electrical treeing.

Moisture | moisture ingress and electrical treeing.

Voids | cuts through surfaces, peeling semi cons. Cracks insulation pre-moulded stretched material. Shape edges – irregular peeling of semi conductive layers.