NETWORKS

Information on Fluid-Filled Cables

esbnetworks.ie

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Fluid-Filled Cables

Like many international utilities, ESB Networks installed underground cables in urban locations where it was not feasible to construct overhead lines. Underground cables are used to transport electrical power from the generation source to the customer. Regardless of cable construction technology, all underground cables have four core components; the conductor, the insulator, the earth sheath and outer cover.

- The conductor transports electrical power.
- The insulator is used to stop electrical power from the conductor escaping.
- The earth sheath ensures the cable operates safely.
- The other covering serves as a protective coat around the cable.

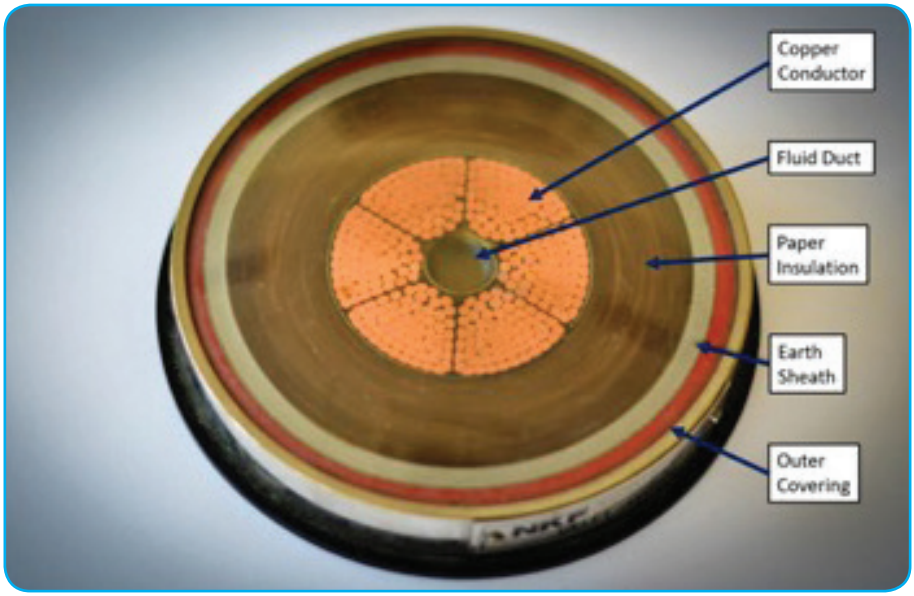

Figure 1. 400 kV Fluid-Filled Cable (1985)

Cable History

Like all technologies, underground cable technology developed with improvements in materials, science and engineering. There have been three distinct cable technology periods.

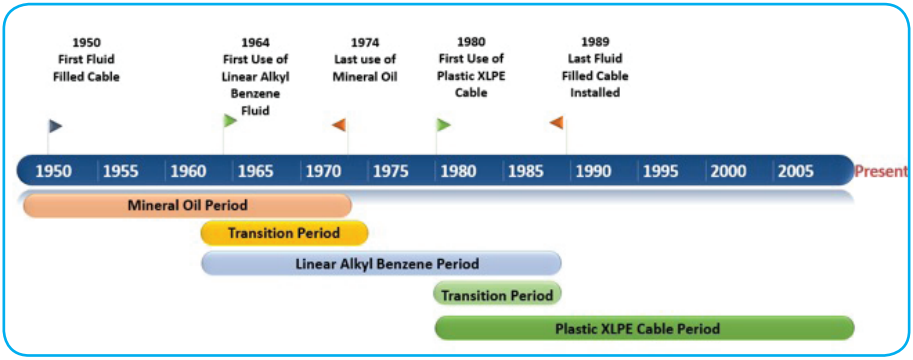

Figure 2. Cable History

First Period

Between 1950 and 1964 ESB Networks' first high voltage cables were insulated with paper impregnated with cable mineral oil. The copper electrical conductors are wrapped in paper. To improve the electrical insulation, the paper is moistened with cable fluid supplied from the cable fluid ducts.

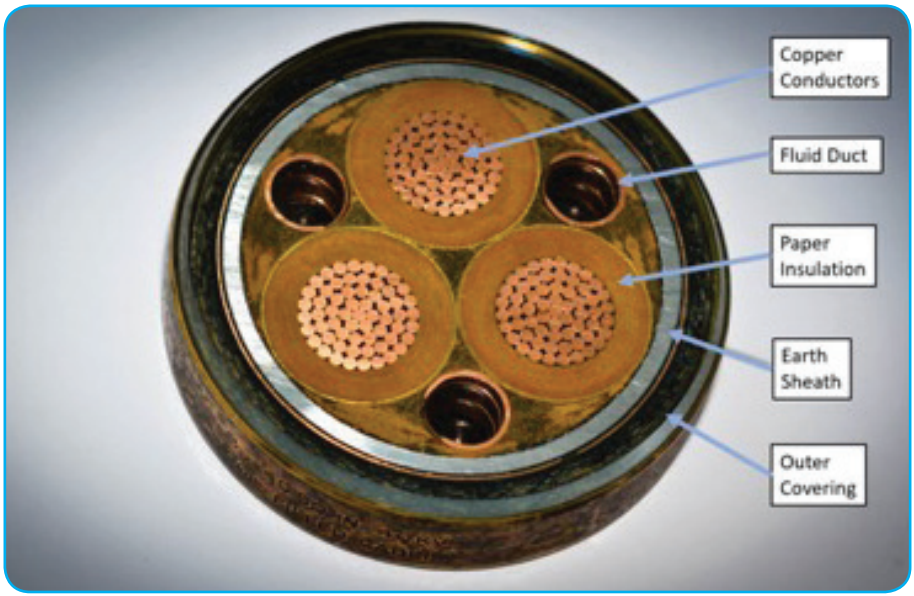

Figure 3 Mineral Oil Cable (1950)

Second Period

As material science improved a new more environmentally friendly fluid, linear alkyl benzene (LAB) was developed for power cables. There was a transition period between 1964 and 1974 when ESB Networks stopped installing mineral oil cables and changed over to use only linear alkyl benzene as the cable insulating fluid.

Plastic Period

During the late 1970s, material technology improved. The use of paper and insulating fluid was replaced with a new plastic compound called cross-linked polyethylene (XLPE). The transition between fluid-filled technology and plastic technology was gradual due to teething problems with the manufacture of the plastic compound. In 1989 ESB installed the last fluid-filled cable, and the transition to plastic cable technology was complete.

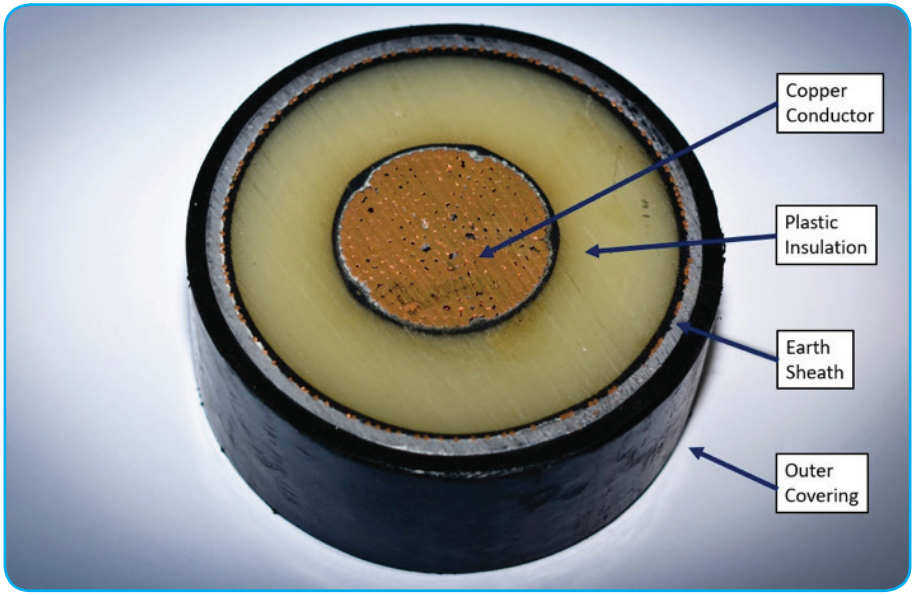

Figure 4 Modern 220 kV XLPE Plastic Cable

Replacement Period

Electrically the fluid-filled cables are performing flawlessly and could reliably remain in service for many more decades.

Recognising the environmental challenges in operating and maintaining fluid-filled cables, ESB Networks started a fluid-filled cable replacement programme in 2005. So far, 20% of the fluid-filled cables have been replaced, removing the source of 40% of the cable fluid leaks from the system. ESB Networks' multiyear replacement programme will continue until all fluid-filled cables have been removed from service.

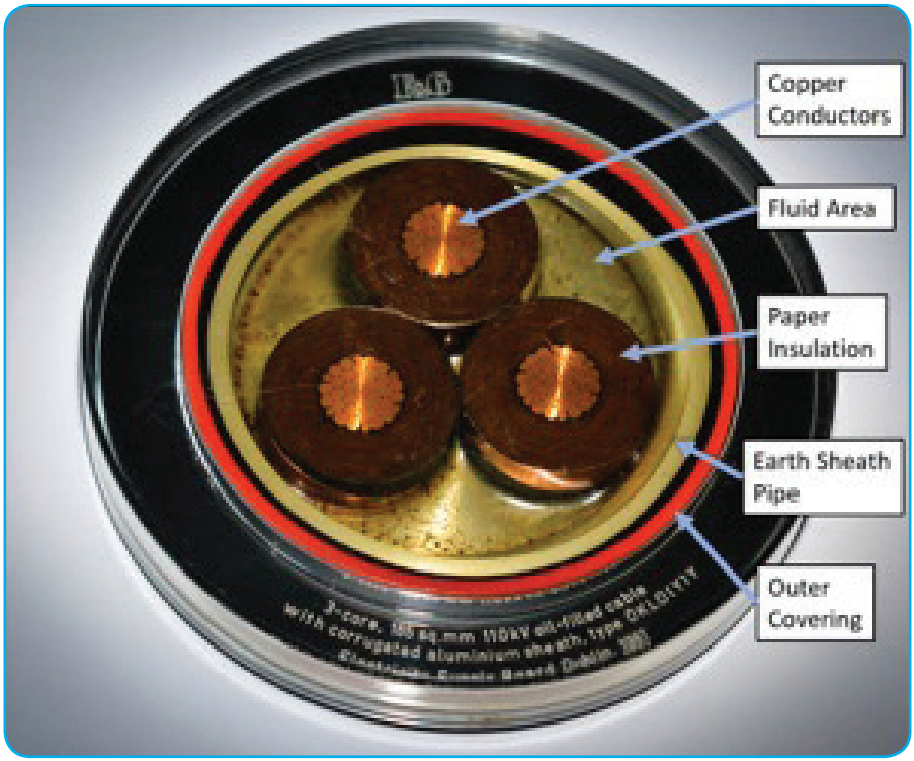

Figure 5 Typical legacy 110 kV Fluid-Filled Cable

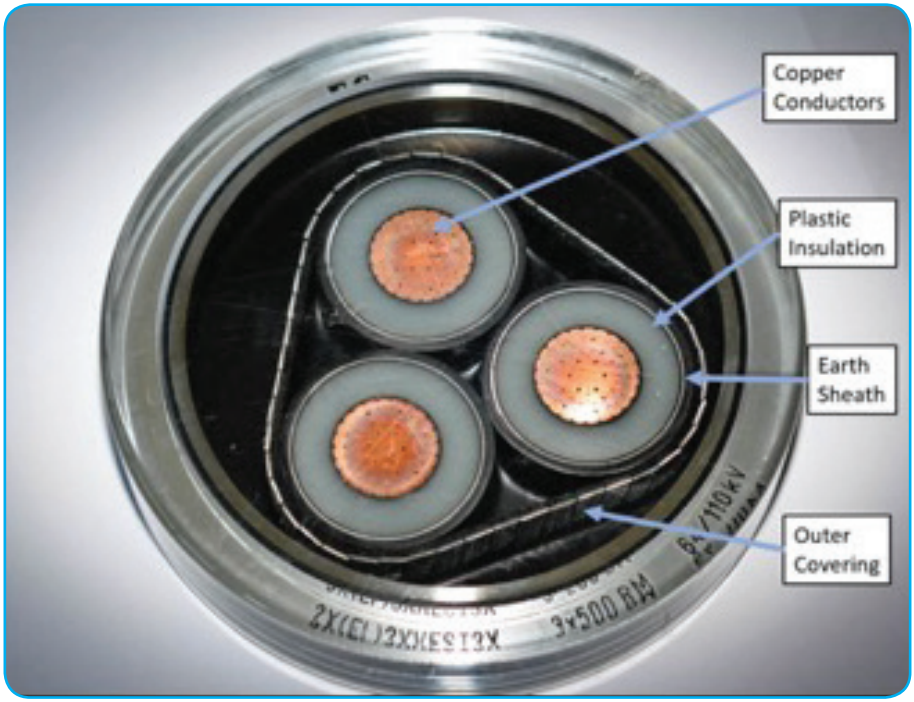

Figure 6 Modern 110 kV Plastic Replacement Cable

ESB Networks' cable replacement programme is extremely complex and challenging. 177 km of fluid-filled cables will be removed from service, which is equivalent in length of twenty-nine LUAS Cross City link projects. Adding to the complexity of the project are the labyrinth of new services (natural gas pipes, telephone and fibre optic cables, water and sewage pipes) that have been installed in the ground since these cables were installed seventy years ago. In addition to the congested space in the ground, the volume of commuter traffic has considerably increased in the intervening years. ESB Networks recognises the inevitable disruption to both residents and commuters as a consequence of these replacement works.