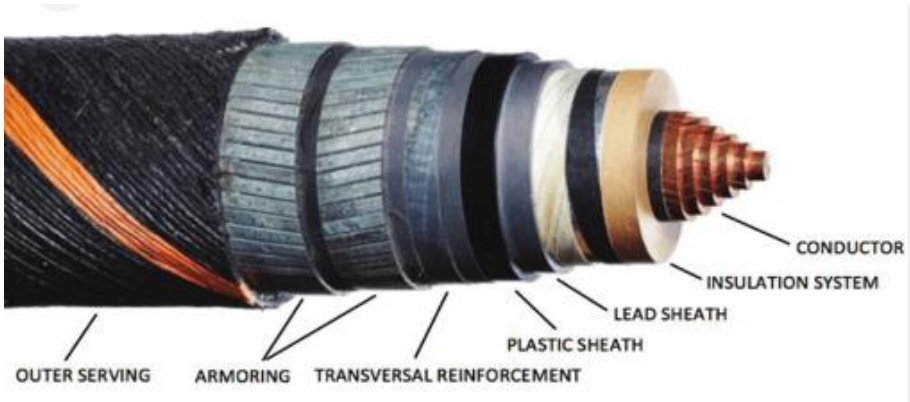
4.2 Self-contained Fluid-filled Cables:



- The fluid-filled cable is the most widely used type of transmission cable throughout the world and for a long time in the UK has been the only design used for new installations at 275 kV and 400 kV.
- Originally known as the oil-filled cable, the name was changed to fluid-filled to take into account the fact that the most widely used impregnants today are synthetic fluids.
- This is still so today with a capability to meet future requirements for 750 kV and 1100 kV cables, l together with further up-rating of 400 kV overhead lines.

Cable Design Features:

Construction:

- The standard design consists essentially of copper or aluminium conductors, paper insulation and an aluminium or reinforced lead sheath designed to withstand a sustained internal pressure up to 5.25 bar, with transient pressures up to 8 bar.
- In general, higher pressures might enable economies to be obtained in fluid feeding arrangements but would usually be insufficient to justify the associated increase in the cost of cable and accessories.
- The basic concept is one of full impregnation of the whole of the insulation at all times by a low viscosity hydrocarbon fluid under pressure.
- As temperature rises, the surplus fluid due to expansion is forced out of the cable into storage tanks and reverse flow takes place on cooling.
- The cable is filled with fluid at the time of impregnation and sheathing and is subsequently kept in this condition throughout its life.
- To avoid the need for numerous stop-joints in such applications, the cable sheath has to be reinforced to withstand the hydrostatic pressure, in the above case 30 bar, and the cable needs to be partially drained under vacuum to control the flow during jointing at the lower end.
- Ducts to provide channels for fluid flow have to be incorporated in the cable design and are indicated.

- For single-core cables a duct is normally included in the centre of the conductor, although for the short cable lengths which are used as terminations for 3-core cables the fluid channel may be on the outside of the insulation.
- For 3-core cables having fillers between the cores, the duct is formed by the use of an open helix of steel or aluminium strip incorporated into the filler.
- The normal size range comprises single-core cable with conductors from 120 to 2500 mm 2 and 3-core cables from 120 to 630 mm 2, although at 33 kV the range extends downwards to 70 mm 2.
- The former general practice to strand circular wires around an open steel spiral duct to form a hollow centre in single-core conductors now only applies for sizes of 150 mm 2 and below.
- Instead, a self-supporting ring is formed from segmental wires and this may form the basis for additional layers of circular wires, flat strips or segments applied with alternating direction of lay.
- Compared with paper, the benefit of the lower dielectric loss angle and lower permittivity on the current rating.
- It can be seen that at a voltage of 1100 kV there is still a useful current capability and that there are significant increases down to about 220kV.