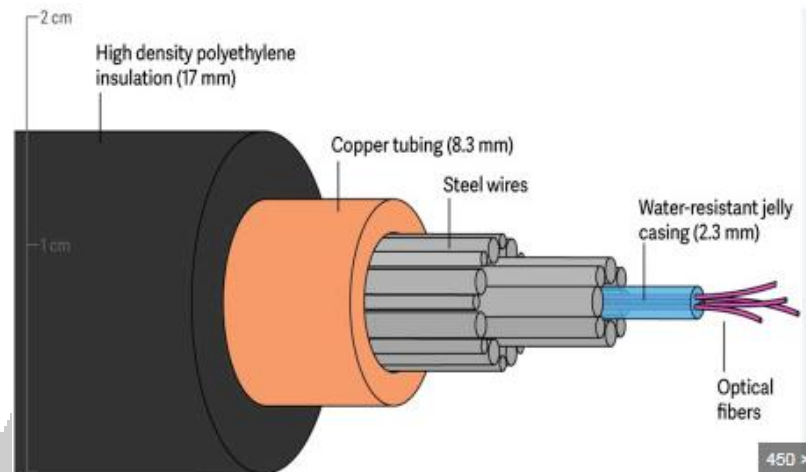


4.4 High Pressure Fluid-filled Pipe Cables



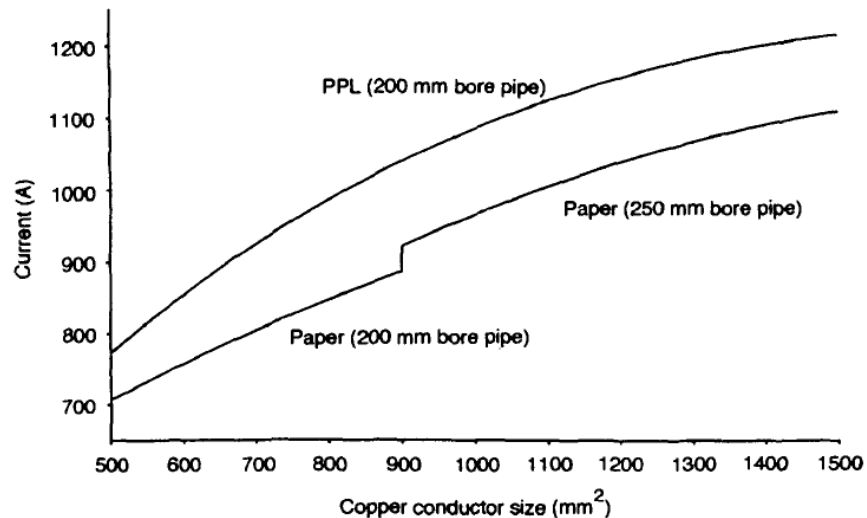
- pressure fluid-filled (HP FF) pipe type cables are used mainly in North America.
- The three insulated conductors are drawn into a steel pipe which is subsequently filled with liquid and maintained under a high pressure.
- The basic principle of the HP FF cable is the same as that of the self-contained fluid filled (SC FF) cable, i.e the insulation is kept fully impregnated at all times.
- To reduce drainage of fluid from the insulation during transit from the factory to site, the cable is impregnated with an impregnant which has a much higher viscosity than that used for the SC FF cable.
- HP FF cables are at present in operation at voltages up to 550 kV (former USSR), 1 but the amount at the maximum voltage is very limited and the highest voltage at which significant quantities of cable have been installed is 345 kV (New York, USA). 2 Cables have been developed for 765 kV operation.

Conductors:

- Both aluminium and copper conductors are used up to a maximum conductor size of approximately 1250 mm .
- Larger sizes are generally not economic because the closeness of the cores in the pipe gives rise to a high proximity loss in the conductor which significantly increases the a.c. resistance

Insulation:

- The requirements for the insulating papers and lapping are generally similar to those already described for SC FF cables. However, in the case of HP FF cables there is an additional requirement for a very firm insulation to minimise deformation due to the side pressures which occur during installation, as previously mentioned.



- The electrical characteristics are similar to those of SC FF cable insulation.

Steel Pipe And Installation:

- The pipes are made of carbon steel complying with appropriate national standards for thickness and testing requirements.
- The size is chosen to permit adequate clearance between the three cores and the pipe.
- It is important to avoid an internal diameter of the pipe of about three times the diameter of the individual cores as it is possible for the cores to align across a diameter and jam during the pulling-in operation.
- A requirement of great importance is a need to have the internal surface smooth and clean so that on final filling with insulating fluid no serious contamination is introduced.