

Ageing of XLPE cables is related to the temperature of the insulation. All XLPE cables contain anti-oxidants which protect the XLPE from oxidation during the extrusion and cross-linking process, and also during the service life of the cable. The rate at which the anti-oxidant is used up is dependent on temperature. The normal maximum operating temperature of XLPE cables is 90°C. At this maximum temperature, the rate of consumption of anti-oxidant has been calculated to provide a cable life of a minimum of 30 years. Increasing the operating temperature of the cables will increase the rate at which the anti-oxidant is used up and hence reduce the service life. The reaction follows the Arrhenius relationship which is an exponential function, hence a small increase in temperature has a significant impact on the ageing of the XLPE. Once the anti-oxidant in the cable is used up, the XLPE will start to oxidise and become brittle. The cable will then be subject to stress cracking and electrical failure at positions of mechanical stress.

It is recognised that customers may need cables to accommodate an emergency current carrying capacity for a defined period. Tests have shown that XLPE cables can operate at a temperature of 105°C for a limited time without significantly reducing the service life of cables. To avoid undue ageing of the cables the overload should be applied for a maximum of 4 hours at any one time, for a maximum of not more than 100 hours in any consecutive months, and for not more than 500 hours in the lifetime of the cable.

In addition to thermal ageing, as the temperature increases XLPE softens and the mechanical performance of the XLPE reduces considerably. At temperatures in excess of 105°C deformation of XLPE readily occurs, particularly at positions where the insulation is under mechanical stress. At bends in the route, the conductor can move through the insulation resulting in a region of high electrical stress. At joints and terminations containing rubber mouldings which exert an inwards pressure on the XLPE, thinning of the insulation can occur in the region of highest pressure. This results in higher electrical stresses and also reduces the inwards pressure produced by the accessory which can result in a void formation and electrical failure. As a consequence of these factors, the maximum overload temperature of XLPE is limited to 105°C.

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Diagrams of cables are illustrative only and are not necessarily to scale.

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