

Indirect Pipe Water Cooling Study for a 220kV Underground XLPE Cable System in New Zealand

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This paper describes the findings of a Proof of Concept Design Study for forced water cooling of the Brownhill - Pakuranga 220kV cable circuits installed on the Transpower NZ network. The study considered the use of separate pipe water cooling of 220kV power cables and accessories to increase the continuous current carrying capability of a new 220kV underground cable system. The 11 km double circuit connection was required to reinforce the Auckland grid and bring additional power into the Auckland area.

The original design concept called for pipes to be installed with the building and commissioning of the cooling system approximately 20 years into their service life; during this phase of operation the study considered the potential to reduce the rating due to the need to limit the temperature of the empty plastic pipe so as to preserve its physical properties over this period. Further information was sought from other Wienstrom, Austria who had adopted a similar approach for a number of 380kV circuits commissioned in the 1970's.

Using generic cable and accessory designs, an arrangement of cooling stations (3 off) and cable loops (5 off) provided a force cooled current rating of up to 2632 A. The lack of an XLPE cable joint with a highly efficient water cooling design significantly restricted the water cooled rating downwards towards 2360 A to 2490 A. The paper discusses the factors of the joint design that will need to be considered in order to achieve a design capable of matching the rating of a water cooled XLPE insulated cable.

The paper also presents the methods used and the considerations given to allow the cooling pipes to survive water pressures and temperature excursions over the expected life of the cable circuit in terrain having changes in elevation above 130 m.

A description of the factors, affecting the decision of the system owner to select a naturally cooled 220kV underground cable circuit where the cables are buried directly rather than a water cooled option is also provided.

The circuits have now been installed in New Zealand as part of the North Island Grid Update Project (NIGUP).

Key words

XLPE cables; Separate Pipe Water Cooling;