

Thermal Analysis of an Installation Fault Concerning a Ripple Control Transformer

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Abstract:

In many Greek cities, Ripple Control is used for the performance of certain services by the Public Power Company (PPC). These services include the transition of Low Voltage (LV) customers to reduced tariffs during the night, as well as the management of public lighting. The Ripple Control is realised with the usage of a 20-60 kW signal transmitter, which operates at a voltage of 1000 V and sends a series of pulses at a frequency of 175-1600 Hz, designating specific commands. The transmitters are connected via a current transformer to the Medium Voltage (MV) power distribution network of 20 kV, and the signal is thus spread until it reaches its final destination. The customers using Ripple Control services have respective receivers that are programmed to activate responding to the specific commands.

The signal produced by the transmitter is injected in the 3-phase MV power distribution network via three single phase infusion current transformers with a total 3-phase rated power of 25 MW. Each transformer is connected to the MV power grid via a 150 mm² copper cable with a maximum permissible thermal current of 442 A.

Recently a problem occurred in one of the transformers, when its feeding cable blew. The cable was replaced with a new one, which again blew after some time. The cable was replaced again, and thermal imaging was used to monitor its function. The thermal imaging results are shown in Fig. 1

As shown in the figure, the malfunctioning feeding cable exhibited at its junction with the transformer a temperature of about 120°C, whereas the respective temperature of the rest of the installation was less than 50°C, as would normally be expected. Further analysis of the incident indicated that the junction between the feeding cable and the transformer was made for aluminium cables, whereas the feeding cable itself was made of copper. Evidently the aluminium junction could not handle the temperature of the copper cable, the result being its overheating and the destruction of the cable.

The paper offers a thorough analysis of the incident, along with a full thermal analysis of the installation. Valuable conclusions result concerning the interaction of different materials in power distribution networks.

Keywords:

Infrared Thermography, Ripple Control Transformer, Thermal Analysis

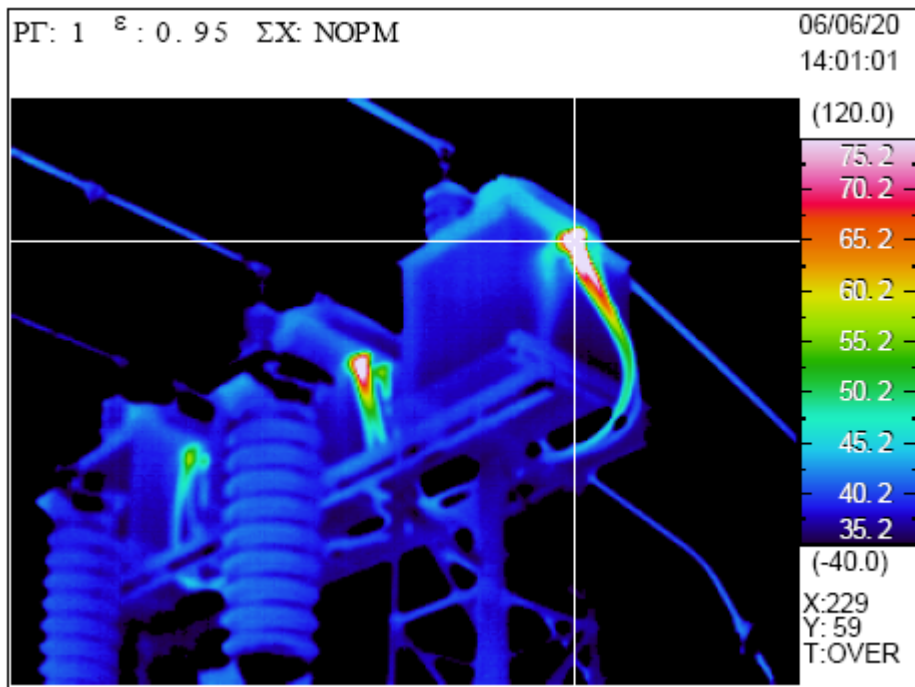


Fig. 1. Thermal image of the malfunctioning feeding cable