Operating Records and Recent Technology of DTS System and Dynamic Rating System (DRS)

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Distributed Temperature Sensing (DTS) system is utilized for power cable temperature monitoring regarding its long length distributing measurement capability.

Dynamic Rating System (DRS) which is a combination of the temperature and the real-time cable load current, calculates the conductor temperature in real time based on IEC standard formula, and activate alarms if the conductor temperature exceeds the permissible level in real time monitoring. It also calculates the emergency overload current which considers the surrounding soil temperature raise in future through the thermal diffusive models. They all are done on real-time basis so that they contribute the cable system operation and maintenance.

DTS fibers are basically attached on or incorporated in the power cables, but also are installed in the communication conduits attached outside of the cable conduits for some cables laid in conduits.

In the case of conductor temperature calculation from outside of conduits, the calculation parameter between the cable surface and DTS fibers shall be calibrated since the parameter of IEC standard tends to be conservative. Some experiments are done for calibrating the parameters. In addition, some DTS fibers are taped on the cables during the cable pulling into conduits in actual installation. Those fibers are used as a reference point sensor to measure the cable surface temperature for evaluation and fine tuning of the parameters.

JPS has been supplying the DTS system as a cable manufacturer, as well as the Dynamic Rating System (DRS) and those systems have more than 15 years operation history.

Installed DRS has acquired the historical data such as deep underground temperature and equivalent thermal resistance, which provided relevant thermal data in that region and contributed to the cable system design as well. Some hot-spot has been found and was taken into account for cable grid operation.

For the discussion of DRS modeling, the thermal diffusive model has been adopted for overload calculation with a constant of thermal resistivity in soil. However, thermal resistivity would vary in time therefore, in the prediction of overload rating, a considerable high value is used at the place, which would result in the pessimistic overload value rather than actual capacity. Therefore, some of recent DRS have a function to compare the measured temperature and the predicted temperature calculated by actual load data based on the programmed thermal resistivity, which are able to evaluate the actual thermal constant and adjust thermal constant in model for further accurate monitoring.

This paper describes those experiences and challenges on DTS and DRS.