C.8.1.5.

Real time ampacity estimation system for 345 kV transmission cable installed on tunnel

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Abstract: In this paper, the results of real time ampacity evaluation test for 345kV OF cables during summer peak load period are described. Its evaluation test was performed for double circuits of 345kV 2000mm^2 oil filled cable system installed in tunnel. Each of circuits has the static power capacity of 652.6[MVA] and is installed at a 16.7km long tunnel with fire barriers.

Keywords: Power Cable, Ampacity, Rating, Distributed Temperature, Transmission Line.

1. Introduction

In Seoul, the capital of Korea, the main transmission line makes loop network and it consists of 345kV underground cables mostly in tunnel. Since 1999, LG Cable Ltd. has been installed surveillance system to be able to monitor several tens kilometers of underground cable system more efficiently. The main monitoring items in the system were entrance, gas, fire and water level monitoring.

However, as the peak load grows more and more in summer every year, the number of circuit in the tunnel has been increased and so it is very necessary to investigate the thermal condition of the cable and tunnel with respect to the ampacity.

To upgrade the conventional surveillance system into the system to be able to monitor the thermal condition of cable, we have developed cable conductor temperature monitoring system and real-time ampacity estimation system in tunnel which were based on measuring the distributed temperature along the total cable route.

This paper describes the first experience of the upraded system in transmission cables in summer Korea.

2. Basic Investigation of Transmission Line

The applied transmission line has the length of 16.7km and maximum power delivery is designed as 652.6MVA, which consists of double circuits of 345kV 2000mm^2 OF cable system.

The cables were attached at the wall of tunnel in trefoil configuration within the fire barrier and the metallic sheath in the cables were cross-bonded to reduce induced voltage.

Above the each 345kV circuit, there were one circuit of 154kV XLPE cable system and communication cables which make the thermal analysis more complex.

To measure the temperature of tunnel and 345kV power cable surface, three optical fibre sensors were set up along the cable route. Two sensors were laid on the 345kV power cable surface within the fire barrier and one was laid in the tray of communication cables.

Figure 1 shows the tunnel configuration.

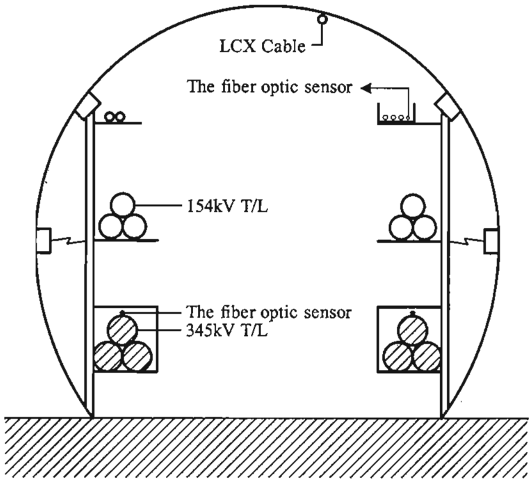

Figure 1. Tunnel configuration

It has been reported that the outside circumstance of the tunnel is very delicate to analyze the thermal condition of power cable such as the weather, the earth surface condition and the depth of tunnel etc [1][2]. Especially the depth of the tunnel has been well known one of the main fator to affect the cable thermal condition[3].

To find out the basic thermal characteristics of tunnel and cable, the distributed temperature was measured by the fiber optic sensor along the cable route. Figure 2 shows the depth of the tunnel and typical distributed temperature profile of tunnel along the route. From the basic investigation, we limited the monitoring section from C to F in figure 2.