The introduction of PD detection with On-Line PD diagnosis System in EHV underground power cable

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ABSTRACT

*Korea Electric Power Corporation(hereinafter **KEPCO**) has installed On-line PD diagnosis System for both 154kV and 345kV cables since in 2011. The system is composed of HFCT sensor, Antenna Sensor, Local and Master Station and so on. By using the PD detection system, PD pulses were detect two times in the 345kV joint box and the PD detected joint boxes were replaced, prior to the fault occurrence. Through this PD detection system for EHV underground power cable, KEPCO is able to secure the stable power system and prevent the relevant failures in underground power cables.*

KEYWORDS

Underground power Cable, Partial Discharge, Diagnosis of EHV, On-line Partial Discharge Diagnosis, PD

INTRODUCTION

In recent years, downtown area expands due to industrial development and centralized population, and the importance of underground power cable is increasing. As a result, cables linked to power plants and heavy load underground power cable are increasing, which in turn increases the importance of a diagnosis of underground power cables for the prevention of failure.

Generally, techniques used to diagnose the underground power cables included a measurement of thermal infrared image of joint box, an analysis of dissolved gas in oil(in case of Oil Filled cable), a measurement of SVL leakage current and a diagnosis of PD at joint boxes. Partial discharge (PD) will be addressed in this paper.

CHARACTERISTICS OF PD DIGNOSIS AND CURRENT SITUATION

Partial discharge (PD) is local electric discharge occurring inside the insulator and caused by the pores and voids inside the insulator. In the event that pores occur, PD signal advances slowly, so it is regarded as a diagnosis method to detect the insulation breakdown in cables and joint boxes in advance, and is widely used for testing cables after installation by power companies in the world.

KEPCO also conducts a PD diagnosis immediately after the installation of power cables and at regular intervals - according to the condition ; once every year ~ every 5 years - of power cables in compliance with the internal regulations of KEPCO.

PD diagnosis is considered as an excellent method in that it allows it to detect a potential failure such as pores in advance, yet it may not measure PD due to the insulation aging of joint box depending on the time of measurement because of the characteristics of PD which occurs and ceases repetitively. In addition, the determination of PD is based on the experience and knowledge of the personnel conducting a diagnosis at the time of diagnosis; base data lacks due to intermittent PD diagnosis; and it is difficult to analyze PD patterns.

To compensate for such limitations of PD diagnosis, KEPCO devised and installed a system enabling it to measure PD in real time, diagnose on-line at ordinary times and manage PD pattern data on a cumulative basis, and then analyzed its effect through system operation on a demonstration basis.

SUMMARY OF ON-LINE PD DIAGNOSIS SYSTEM

Selection of the subjects for the installation on a demonstration basis

KEPCO selected 154kV Yeondae-SinChon transmission line of domestic XLPE cables which has been in operation for the longest period of time (23 years)- as the subjects for demonstration.

System Configuration

On-line PD diagnosis system is configured as follows.

Category	Configuration and Functions
Sensor Unit	• Number of Locations : 9 (EBG: 2; IJ : 6; NJ ; 1 location) • Sensor Type ◆ Capacitive Type (Metal Foil), ◆ Inductive Type (HFCT) • Frequency Band : 1~300Mhz
Detection Unit	• Filtering Function : noise gate • Three-phase simultaneous measurement and data processing function
Analysis Unit	• Real-time PD monitoring and detection, Pattern diagnosing function • Analyzing frequency and pulse (based on PRPDA) • Estimating the locations of PD through an analysis of pulse amplitude and frequency
System Operation	• Remote surveillance and monitoring • Implementing alert situation screen and sending SMS message • Off-line PD diagnosing in the event of alerts

Table. 1: System Configuration and Main Functions