THE INVESTIGATION AND APPLICATION OF MULTI-STATE MONITORING SYSTEM TO HIGH VOLTAGE CABLES AND TUNNELS

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ABSTRACT

Power Cables are getting more and more important in power systems because of the mass construction of them in our country. This paper described the present operating and maintaining status and some existing problems of power cables in Beijing, and introduced the principle and technical indexes of multi-state monitoring system (MSMS) used in HV cables and power cable tunnels. Based on the situation of power cable tunnels, MSMS was installed and tested, after which some techniques of MSMS were improved on basis of situation of the installation spot. Finally, a conclusion was made that the application of MSMS could be extended to other areas in China.

KEYWORDS

Multi-state monitoring system, power cable tunnels, collector

1.INTRODUCTION

Up to the end of June 2008, there were 64 cable lines for 220kV class with the total length of 164.1 km, 565 cable lines for 110kV class with the total length of 647.4 km, 97.6% of which were installed in cable power cable tunnels, thus making Beijing Electric Power Corporation as the leader in the area of HV cables and power cable tunnels. As city develops quickly, and power cable tunnels and power load increase, the operation and maintenance of power cable tunnels and working wells in Beijing power system face great pressure.

Nowadays, the administration of operation and overhaul lies at the stage of periodic patrol and planned overhaul which have many limits from the point of safety, the mode of cable operation and administration should be changed from that of periodic patrol and planned overhaul to that of condition-based maintenance, state detection, and automatic monitoring administration.

In 2007, Power Cable Company of Beijing Electric Power Corporation (PCCBEPC) has built monitoring center of the operation of cable system in Beijing. On basis of the monitoring system of well lids, temperature and video in cable tunnels, the company has been propelling the application of state detection-for example, the detection of infrared imaging and partial discharge, doing a lot of state detection of cables.

2.PRESENT STATUS OF OPERATION AND MAINTENANCE OF POWER CABLES IN BEIJING

From 2007, in order to control the come-into and come-out-of the power cable tunnels effectively, BEPC has conducted layout of monitoring system for well lids of cable tunnels two times, thus arriving at the aim of real-time control of manholes of cable tunnels in Beijing. Meanwhile, BEPC has laid out optical-fiber distribution temperature system (OFDTS) on cable lines and built operation monitoring system of cable system.

For the purpose of guaranteeing power supply safety and obtaining knowledge of condition of main cable lines in standard power cable tunnels, BEPC has conducted the project of multi-state monitoring system for power cables in June 2008. The system which can realize the aim of multi-state monitoring includes the installation of MSMS for power cables on 220 kV class cables in Chengsi One and Two cable lines (the distance is about 6 km), digital data acquisition, data processing, analysis of the processing result. The system can monitor PD, grounding current, deleterious gases in power cable tunnels (CO, CH4 and H2S), O2 content in surrounding air and the water level in power cable tunnels.

Through MSMS, the quality of on-line monitoring of cable system was improved and a foundation for on-line maintenance was built.

3.THE PRINCIPLE OF MSMS

3.1 Introduction to MSMS

MSMS consists of a real-time monitoring platform, which can realize the purpose of remote real-time multi-state monitoring, and three applicable subsystems, which include on-line monitoring subsystem of environment in power cable tunnels, on-line monitoring subsystem of grounding current from sheath and temperature of cable joints and on-line monitoring subsystem of PD.

3.2. The components of the system

Real-time power monitoring platform is the core of the system. Based on the platform and through the extension of module, some applicable subsystems which can perform many monitoring tasks were constructed, as shown in Fig. 1.