PD DETECTION AND DISASSEMBLY ANALYSIS ON THE CABLE TERMINAL

Yu **ZHAO**, He ming **HUANG**, Hua chun **LI,** Zuo chun **ZHOU**, Beijing Power Grid Company, (Beijing, China),
zhaoyu19831016@163.com

ABSTRACT

Partial discharge (PD) signal was detected during the online monitoring on a 110kV transformer substation at Huanghoudian in Beijing. We located the PD source successfully at the transformer cable terminal, using multiple PD detection equipment and technologies. Disassembly analysis was also performed on the cable terminal. The PD detection technologies and analysis results are introduced in this paper. Our work provided valuable experience for the electric equipment on-line diagnosis.

KEYWORDS

Cable terminal, PD detection, PD source location, disassembly analysis.

INTRODUCTION

In the past years, on-line monitoring and inspection on the electric apparatus have received much attention. The study on the on-line state monitoring technique has become a hot topic in the power grid companies and electric research institutes in China. The on-line state monitoring technologies are making significant contributions to the electric equipment maintenance and service management.

Since 2007, much effort has been made by our company on the research of on-line partial discharge (PD) detection and PD source location technology. This paper introduced one of the successful cases of PD source location at a transformer substation in Huanghoudian. In this case, multiple PD detection equipment and location techniques were adopted. Serious defect was located in the cable terminal of a 110kV transformer. Our successful experience provided a valuable example of electric equipment on-line diagnosis.

PD DECECTION

Figure 1 show the wiring diagram of the #2 110kV transformer in Huanhoudian transformer substation. The 110kV inlet cable is connected to the GIS cabinet. The 10kV and 35kV outlet cables are connected to the switch cabinets. The PD current taking place in the system was coupled by the (HFCT, with bandwidth of 40 MHz) connected to the ground lead. Then, the coupled signal was recorded and processed by the PD measurement instrument, PDCheck (bandwidth of 35MHz and sampling rate of 100MS/s), as shown in Figure 1. In the on-line diagnosis on the 110kV cable terminal, PD signals having amplitude of 1.4V were detected at phase A. The typical patterns of the PD signal are shown in Figure 2.

According to the characteristics of the PD signal, the following observation and deduction can be made.

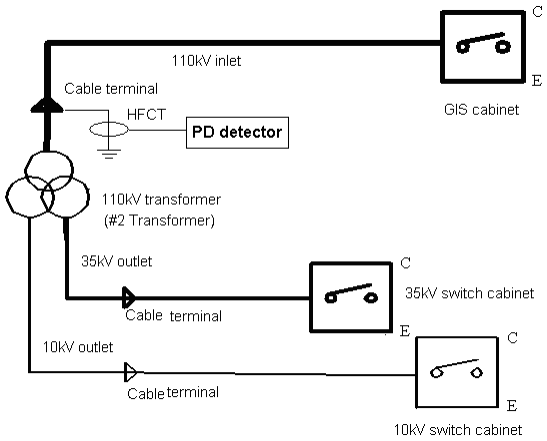
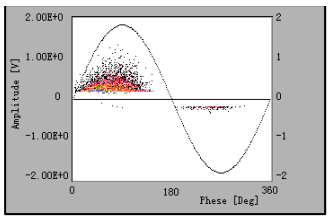
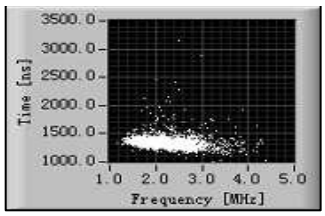


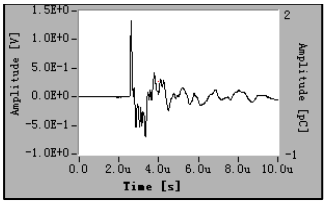
Figure 1. Wiring diagram of the #2 110kV transformer in Huanghoudian transformer substation



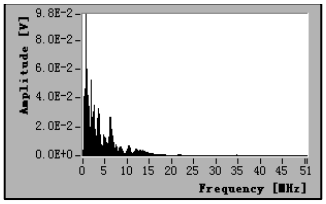
(a) Phase resolved pattern



(b) Time-Frequency pattern



(c) Discharge waveform



(d) Amplitude-Frequency pattern

Figure 2. Typical patterns of the PD at phase A of the 110kV cable terminal

(1)Phase characteristic: most discharges took place at the rising edges of the voltage cycle (i.e. from 0° to 90°and from 180° to 270°, see Figure 2a), which is the typ ical phase characteristic of the internal PD [1]. PD having large amplitudes occur at 0°~90°, suggesting the PD source is closer to the high voltage electrode.

(2) Time-Frequency pattern (see Figure 2b): all the discharges are distributed between 1.2MHz and 4.5MHz.

(3) Waveform characteristic (see Figure 2c): the first waveform has the highest amplitude and the least distortion. The following PD waveforms show large attenuation and oscillation. These behaviours fit the characteristics of the PD waveform. The single pulse occupies 0~15MHz continuous frequency (see Figure 2d).