

# Measurement and Analysis of Partial Discharge of Medium Voltage Power Equipment

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**Abstract**—The partial discharge measurement is gradually becoming an important preventing maintenance for power apparatuses with voltage level of higher than medium voltage. In practical, however, field measurement of partial discharge is easily suffered by interferences. The measurement compatible to the apparatuses and environmental features should be considered and different discharge models should be analyzed. This paper is aimed to measure partial discharge of medium voltage power equipment under use. Firstly, the measurement method by using high frequency current transformer (HFCT) is introduced, and then, the various partial discharges including internal discharge, along-surface discharge and tip discharge are modeled and energized to measurement. Furthermore, the discharge waveform features and phase distribution characteristics are analyzed for identifying the type of partial discharge. The measurement and analysis results for actual case are compared with the standard discharge pattern data of laboratory, which show that the proposed measurement and analysis have well representative. This can provide the basis for the establishment of the partial discharge database of medium voltage power equipment, which is also required for development of partial discharge automatic identification system.

**Keywords**—words: medium voltage power equipment ; partial discharge; phase map

## I. Introduction

The partial discharge is one of measurements to evaluate whether the insulation is aged [1, 2]. Because the partial discharge is an irreparable damage for the insulation of high voltage power equipment, the partial discharge detection has been used in the factory testing and the electric charge testing. The measurement can evaluate the status of the insulation so as to improve the system stability and decrease the loss of economic and human life by the broken equipment [3, 4].

For the high voltage power equipment, the switchgear panel is related to the power system and the equipment may contain switch, fuse, circuit breaker, current transformer, potential transformer, power cable and so on. The effective of the insulation of the equipment mentioned above may degrade in long-term operation. In addition, insufficient grounding distance, insufficient clearance distance, poor contact, or environment quality are also the reasons for the insulation aging. Before the insulation breakdown, the equipment may in

the process of partial discharge. Therefore, the partial discharge measurement for the medium voltage power equipment becomes the important issue.

The main measurements for the partial discharge of high voltage power equipment can divide into two types: offline detection and on-line detection [5]. The offline detection needs the equipment power off so the application is usually used in the factory test and maintenance. The on-line detection is no need for power off and can use many sensors to measure the partial discharge. Therefore, the on-line detection is the main measurement in the recent years [5-7].

According to the suggestion for high frequency and very high frequency in IEC 62478 [8], this research uses high frequency current transformer (HFCT) to measure partial discharge for high voltage switchgear panel which below 35 kV. The various partial discharges including internal discharge, along-surface discharge and tip discharge are modeled and energized to measurement. The measurement results of discharge waveform features and phase distribution characteristics are analyzed for identifying the type of partial discharge. Furthermore, the measurement and analysis results for actual case are compared with the standard discharge pattern data of laboratory, and the feature can be used to establish the database of partial discharge. In addition, the proposed method can be applied as a reference for development of partial discharge automatic identification system and provide the solution for users monitor the partial discharge of high voltage switchgear panel in the long term.

## II. High Voltage Power Equipment and the Device for Measuring Partial Discharge

The main function of the high voltage switchgear panel is to control and protect the operational safety of the power system. The internal structure of VCB high voltage switchgear panel, which contains CB, PT, Cable, Busway, voltage insulator and so on. The components mentioned above have the insulating material and the effect of insulation material may degrade by the human error or time so that the partial discharge may occur.