

# IEEE Guide for the Measurement of Partial Discharges in AC Electric Machinery

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**IEEE-SA Standards Board**

**Abstract:** A review of the nature of partial discharge in machine windings, how it can be measured under both off-line and on-line conditions, how it can be measured for individual form wound coils or bars, and the significance and limitations of the measured values are covered in this standard.

**Keywords:** ac electric machine windings, electrical insulation, form-wound bars, form-wound coils, IEEE 1434™, partial discharge

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## Introduction

This introduction is not part of IEEE Std 1434™-2014, IEEE Guide for the Measurement of Partial Discharges in AC Electric Machinery.

Partial discharge (PD) measurements have been made on the windings of ac electric machinery for over 40 years. The electrical insulation of these windings may be prone to PD activity as a result of internal delaminations and of surface or slot discharge. These kinds of PD activity, when the machine is in normal operation, can result in significant deterioration over a period of time. Experience has indicated that PD measurements can be useful for assessing the condition of complete windings as well as of individual formwound coils and bars.

This guide provides a review of the nature of PD in machine windings, how it can be measured under both off-line and on-line conditions, how it can be measured for individual form-wound coils or bars, and the significance and limitations of the measured values.

IEC 60505 (2004-10)<sup>a</sup> defines the various factors that influence the performance of electrical insulation systems. These are the thermal, electrical, environmental, and mechanical stress factors. Stator winding insulation systems of ac electric machinery experience thermal, electrical, mechanical, and environmental stresses during operation. These stresses, individually or in combination, will age the insulation system and may lead to delamination of the groundwall insulation, abrasion of the outer semiconducting (Faraday) shield, loosening of the wedging system, and other potential deterioration mechanisms. Sometimes, as a result of the initial manufacturing process, or because of the subsequent aging, PDs may occur adjacent to the high voltage conductor, in the internal voids of the groundwall, on the outer surface of the coil/bar in the slot, or in the endwinding region. These various PD sites have the potential to cause deterioration to a greater or lesser extent and, in some cases, may ultimately result in an in-service failure. The number, magnitude, and polarity of these PDs can be a direct indication of the condition of the insulation system. However, the trend of these parameters over time is frequently most valuable. Care must be taken that the effects of operating and environmental conditions and test procedures are considered.

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<sup>a</sup> IEC publications are available from the International Electrotechnical Commission (<http://www.iec.ch/>). IEC publications are also available in the United States from the American National Standards Institute (<http://www.ansi.org/>).

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## 1. Overview

### 1.1 Scope

This guide discusses both on-line and off-line partial discharge (PD) measurements on complete windings of any type, as well as measurements on individual form-wound coils and bars. Measurements selected from those that are outlined may be appropriate for application during the manufacture, installation, operation, and maintenance of windings of ac electric machinery.

### 1.2 Purpose

The purpose of this guide is to identify test methods that may be useful in the measurement of PD activity involving the electrical insulation systems of ac electric machinery for quality control and to detect winding aging.

### 1.3 Limitations

The users of this guide are cautioned that: