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Rotating electrical machines - Measurement of stator end-winding vibration at form-wound windings

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Table of Contents

Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part 1.Structure and Drafting Rules of Standardization Documents"

Drafting.

This document is equivalent to IEC TS60034-32.2016 "Rotating electrical machines Part 32.Measurement of vibration at the end of the stator formed winding",

The document type was adjusted from IEC technical specifications to my country's guiding technical documents.

This document has made the following minimal editorial changes.

---In order to coordinate with the existing standards, the name of the standard is changed to "Measurement of Vibration at the End of the Stator Formed Winding of Rotating Electric Machines";

---Footnotes added to the introduction.

Please note that some content in this document may be subject to patents. The publisher of this document assumes no responsibility for identifying patents.

Introduction

Large AC motors usually adopt a multi-phase stator winding structure. This document is intended for systems powered by multiphase voltage (or current) and built in an air gap.

Double-layer winding large AC motor with vertical rotating magnetic field. During operation, the voltage and current of the motor will change with the mechanical load. This type of motor

Usually designed in motor or generator mode with three-phase symmetrical windings.

Large AC rotating machines usually use formed windings consisting of formed coils (as defined in 2.3 of IEC 60034-15.2009).

Before assembling to the motor, the individual coils (single winding conductors) must be shaped.

The end of the winding is the part of the stator winding that extends out of the iron core. This part is mostly in a conical structure, as shown in Figure 1.

Note. The end of a single coil is marked with a black line.

Figure 1 The stator winding ends of the turbine generator (left) and large electric motor (right) are connected by parallel rings

Most large AC motors with stator formed windings are equipped with stator winding end support structures. The motor generates electricity in the power supply system

When gas faults occur (such as grid power supply line faults and electronic power supply device faults), it is also expected that it can withstand high electromagnetic force loads. Designing the stator

When supporting the structure at the winding end, it is not only necessary to enhance the strength of the winding end, but also to provide it with appropriate stiffness and inertia, thereby systematically affecting

affects structural dynamics and therefore vibration levels during operation.

The ends of the winding usually use support components such as plates and rings, and spacers are used to limit the distance between the coils at the end of the winding, and they are fixed with fasteners.

Typical materials such as fiberglass, resin-impregnated felt and strapping are used for support components, gaskets and fasteners (as shown in Figure 2). In addition, metal

High electric fields around components can produce discharges that affect long-term electrical strength.

Figure 2 Example of winding end structure connected to cooling motor

At present, there are no comprehensive technical specifications that can be used to determine the natural frequency of the motor at rest and the vibration phenomenon at the winding end during operation.

Reliable results.

Stator winding end modal test analysis is a relatively mature method and has been used to test the natural frequencies and vibration shapes of large motors around the world.

certification work. The purpose of this method is to prevent the vibration of the winding end from being aggravated due to the influence of the natural frequency when the motor is running. The impact test is

A common measurement method for measuring transfer functions and identifying the

dynamic properties of structures. Usually, the stator winding should be carried out during motor manufacturing and overhaul inspection.

End impact test.

The stator winding ends can be measured during operation by installing special vibration sensors at specific locations on the winding ends.

The stator winding vibration phenomenon is measured regularly or permanently online.

Although the measurement method of the natural frequency and vibration level of the stator winding end is already a relatively complete technology, the analysis of the results is not consistent with the

Interpretation still needs further improvement and development. Therefore, this document only serves as a technical specification rather than a mandatory standard.

Measurement of Vibration at the Ends of Stator Formed Windings of Rotating Electric Machines

1 Scope

This document stipulates unified guidelines for measuring and reporting the vibration of the stator winding end when the motor is running and shut down. include.

--- Defines terms for measuring, analyzing and evaluating stator winding end vibration and related structural dynamics;

--- Provide guidance for offline measurement of dynamic characteristics/structural characteristics and online measurement of stator winding end vibration;

---Describes the use and installation method of winding end vibration detection equipment;

---Established general principles for reporting test results;

---Describes the theoretical background of stator winding end vibration.

This document applies to.

---Three-phase synchronous generators with a rated output of 150MVA and above and driven by steam turbines or gas turbines;

---Three-phase direct grid-connected synchronous motors with rated output of 30MW and above.

This document only describes the measurement procedures for 2-pole and 4-pole motors. For motors with ratings lower than those specified in this document, both supply and demand parties may

Reach consensus on whether to use the measurement methods in this document.

2 Normative reference documents

The contents of the following documents constitute essential provisions of this document through normative references in the text. Among them, the dated quotations

For undated referenced documents, only the version corresponding to that date applies to this document; for undated referenced documents, the latest version (including all amendments) applies to

this document.

shock-Signalprocessing-Part 1.Generalintroduction)

Note. GB/T 29716.1-2013 Mechanical vibration and shock signal processing Part 1.Introduction (ISO 18431-1.2005, IDT)

ISO 18431-2 Mechanical vibration and shock signal processing Part 2.Time domain window for Fourier transform analysis (Mechanicalvi-

Note. GB/T 29716.2-2018 Mechanical vibration and shock signal processing Part 2.Time domain window for Fourier transform analysis (ISO 18431-2.2004,

IDT)

performance)

Note. GB/T 755-2019 Ratings and performance of rotating electrical machines (IEC 60034-1.2017, IDT)

IEC 60034-15 Rotating electrical machines Part 15.Impact voltage withstand level of stator formed windings of AC rotating electrical machines (Rotating

acmachines)

Note. GB/T 22715-2016 Impulse voltage resistance level of rotary AC motor stator formed coils (IEC 60034-15.2009, IDT)

Note. GB/T 3836 (all parts) Explosive atmosphere [IEC 60079 (all parts)]

3.1 Terms and definitions

The following terms and definitions apply to this document.