

ICS 29.030
CCS K 14



**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 44391-2024

**Methods of measurement of the magnetostriction
characteristics of grain-oriented electrical steel strip and sheet
by means of a single sheet tester and an optical sensor
(English Translation)**

Issued on: August 23, 2024

Implemented on: August 23, 2024

**Issued by: State Administration for Market Regulation, China National
Standardization Administration**

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Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for standardization work Part 1: Structure and drafting rules for standardization documents" Drafting.

This document is equivalent to IEC 60404-17:2021 "Magnetic materials Part 17: Measurement of grain size using a single-piece tester and an optical sensor" Method for determining magnetostrictive properties of oriented electrical steel strip (sheet).

The following minimal editorial changes were made to this document.

--- In order to coordinate with the Chinese standard, the name of the standard is changed to "Measurement of grain orientation of electrical steel strip (sheet) using a single-piece tester and optical sensor Magnetostrictive properties method.

Introduction

This document provides the magnetostrictive properties of grain-oriented electrical steel strip (sheet) measured at a frequency of 50 Hz or 60 Hz and an applied AC magnetic field.

This standard method specifies technical details after extensive research, so that the reproducibility of the measurements can be expected to be satisfactory.

This measurement requires measuring the tiny vibration of the sample with a resolution of 0.01 μ m or higher. To meet this demanding condition, not only in addition to specifying the magnetic aspects of the measuring device, its mechanical aspects, such as friction, Maxwell forces, resonance and the influence of external vibrations, must also be specified.

This document specifies the method for determining the magnetostrictive properties of the butterfly loop, the peak-to-peak value and the zero-to-peak value of the magnetostrictive strain. Appendix E Describes additional characteristics of velocity and acceleration levels.

IEC TR62581:2010[5] reviews the method for measuring the magnetostrictive properties of grain-oriented electrical steels using a single-sheet tester.

The method has been used to measure the length change of various samples. However, for the method where the sensor is in contact with the sample, it is difficult to avoid the problems associated with the contact method.

In addition, these methods require special techniques for measurement. Therefore, this document provides methods using optical sensors.

The laser Doppler vibrometer method meets the measurement requirements of non-contact, high resolution and high reproducibility.

It is well known that mechanical stress has a significant effect on the magnetostriction of grain-oriented electrical steel[5].

Grain-oriented electrical steel is particularly sensitive to compressive stress in the rolling direction. This depends on the grain orientation angle of the material and the surface coating on the material.

Appendix B describes the measurement method under applied compressive stress.

Several international rounds of comparisons of magnetostrictive measurements have been carried out by narrowing the range of methods [6-8].

The reproducibility of the measurements expressed as relative standard deviation exceeds 20 % when the magnetic polarization intensity is high.

When the grain-oriented electrical steel strip is cut along the rolling direction at a peak value of 1.7 T and a magnetization frequency of 50 Hz, the relative standard deviation is used.

The measurement reproducibility is less than 2%.

Measuring grain orientation using a single wafer tester and optical sensors Method for magnetostrictive properties of electrical steel strip (sheet)

1 Scope

This document describes the general principles and methods for measuring the magnetostrictive properties of grain-oriented electrical steel strip (sheet) using a single-sheet tester and optical sensors.

General provisions, specifying the measurement procedure, calculation of the characteristic, reproducibility of the peak-to-peak λ_{dp} value, measurement setup and test report.

This document is applicable to the measurement of magnetostrictive properties of grain-oriented electrical steel strip (sheet) at a frequency of 50 Hz or 60 Hz.

NOTE 1 The accelerometer method [9] is also an established method for measuring magnetostriction. However, it is more suitable for magnetostriction under applied tensile or compressive stress.

It is not suitable for measurements under stress-free conditions because a weight is placed on the specimen to prevent deformation of the specimen.

Therefore, the optical sensor method is the best method.

This document applies to the measurement of the following characteristics.

---Butterfly loop;

---Peak-to-peak value λ_{dp} ;

---Zero-peak value λ_{d0} .

The magnetostrictive characteristics are measured under specified magnetic polarization intensity peak value and magnetization frequency, as well as sinusoidal secondary induced voltage waveform.

Note 2: This document uses the term "magnetic polarization intensity" and adopts the description of