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

GB/T 19289-2019

Replacing GB/T 19289-2003

**Methods of measurement of resistivity, density and stacking
factor of electrical steel strip and sheet**

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Foreword

This standard was drafted in accordance with the rules given in GB/T 1.1-2009.

This standard replaces GB/T 19289-2003 "Measurement method of density, resistivity and stacking coefficient of electrical steel sheet (strip)". versus

Compared with GB/T 19289-2003, the main changes are as follows.

--- Introduce the gas pycnometer method, and quote the liquid immersion method and the theoretical calculation method based on the chemical composition of the sample (see 5.3);

---The example of measuring resistivity device with rectangular sample in the original standard text is described in the informative Appendix A (see Appendix A,.2003

3.4.3 of the annual version);

---Informative Appendix B has been added, which describes an example of density determination by the gas pycnometer method (see Appendix B);

---Informative appendix C has been added, describing the method of calculating density using silicon and aluminum content (see Appendix C).

The translation method used in this standard is equivalent to the IEC 60404-13.2018 "Magnetic Materials Part 13.Electrical Steel Strip (Sheet) Resistivity,

Measurement method of density and stacking factor".

The Chinese documents that have a consistent correspondence with the international documents cited in this standard are as follows.

---GB/T 1033.3-2010 Determination of the density of plastic non-foamed plastics Part 3.Gas pycnometer method (ISO 1183-3.

1999, IDT)

---GB/T 2900.60-2002 Electrotechnical terminology electromagnetics [eqvIEC 60050(121).1998]

---GB/T 3655-2008 Method for measuring the magnetic properties of electrical steel sheets (bands) with Epstein square circles (IEC 60404-2.1996,

IDT)

---GB/T 9637-2001 Electrical engineering terminology, magnetic materials and components [eqvIEC 60050(221).1990]

---GB/T 13789-2008 Method for measuring the magnetic properties of electrical steel sheets (bands) with a monolithic tester (IEC 60404-3..2002,

IDT)

This standard has made the following editorial changes.

---Modified the standard name.

This standard was proposed by the China Iron and Steel Association.

This standard is under the jurisdiction of the National Iron and Steel Standardization Technical Committee (SAC/TC183).

Drafting organizations of this standard. Baoshan Iron and Steel Co., Ltd., Changsha Tianheng Measurement and Control Technology Co., Ltd., Shaoxing Shangyu Hongxing Machinery Instrument

Manufacturing Co., Ltd., Metallurgical Industry Information Standard Research Institute.

1 Scope

This standard specifies the methods for determining the resistivity, density and stacking coefficient of oriented and non-oriented electrical steel strips (sheets). These physical parameters

It is a characterization of the physical properties of materials. Among them, density is the condition parameter needed to determine the magnetic polarization, resistivity and stacking coefficient.

Since these performance parameters are temperature-dependent, unless otherwise specified, the measurement will be performed at room temperature $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$.

2 Normative references

The following documents are indispensable for the application of this document. For dated reference documents, only the dated version applies to this document.

For undated references, the latest version (including all amendments) applies to this document.

ISO 1183-3 Plastic Non-foamed Plastics Density Determination Method Part 3. Gas Pycnometer Method

3 Terms and definitions

The terms and definitions defined by IEC 60050-121, IEC 60050-221 and ISO 1183-3 apply to this document.

4.1 General

This chapter describes two methods for measuring resistivity; method R1 uses Epstein square ring specimens, method R2 uses rectangular specimens.

Note. Method R2 is derived from the van-der-Pauw method (VDP method) [1], which is based on the theory of conformal mapping in two-dimensional space. Thick for any shape

For objects with uniform degree, the resistivity can be measured by the four-terminal contact method to obtain the ratio of voltage to current, and then calculated by the exact mathematical formula. when

When the symmetry between the specimen and the contact position is good, the formula can be simplified. Method R2 is particularly suitable for rectangular specimens.

The measurement method of resistivity ρ is based on the measurement of the sample geometry (thickness), which is suitable for samples of all types of materials. But when

When the method is further used for density ρ_m determination (see 5.2), the scope of application is limited to the materials specified in 5.1.

4.2.3.1 General

The thickness d of the sample in formula (2) and formula (4) shall be measured in accordance with 4.2.3.2.

4.2.3.2 Calculate thickness based on density ρ_m

The sample thickness d should be calculated from the density value ρ_m (measured according to 5.3 or provided by the manufacturer) according to formula (5).

4.3.1 Epstein square circle sample

The Epstein square ring sample used in Method R1 (see 4.2.1) shall meet the requirements of IEC 60404-2 and have the following dimensions.

---Width. $b=30\text{mm} \pm 0.2\text{mm}$;

---Length. $280\text{mm} \leq l \leq 320\text{mm}$, tolerance is $\pm 0.5\text{mm}$.

4.3.2 Rectangular specimen

The rectangular or square specimen used in Method R2 (see 4.2.2) shall meet the requirements of IEC 60404-3 and have the following dimensions.

---Width. $300\text{mm} \leq b \leq 500\text{mm}$, tolerance is $\pm 0.5\text{mm}$;

---Length. $500\text{mm} \leq l \leq 610\text{mm}$, tolerance is $\pm 0.5\text{mm}$.

4.4.1 General requirements for Method R1 and Method R2

The measuring device requirements are as follows.

---According to the requirements of 4.2.3.2, a calibrated balance, the error of the weighing sample is within $\pm 0.1\%$;

--- A low-voltage DC regulated power supply with a current load range of 1A~10A (or use a