Chinastandards.org

JJF

NATIONAL METROLOGY TECHNICAL SPECIFICATION OF THE PEOPLE'S REPUBLIC OF CHINA

JJF 1832-2020

Replacing JJG 242-1995

Calibration Specification for (1 mT~2.5 T) Magnetometers

(1 mT ~ 2.5 T)磁强计校准规范

(English Translation)

Issued on: January 17, 2020 **Implemented on: April 17, 2020**

Issued by: State Administration for Market Regulation

Preview: page 1 of 5 shown, 30 in the full document. Complete English PDF, instant download:
https://chinastandards.org/standards/jjf-1832-2020

Chinastandards.org

Table of Contents

Introduction 5
1 Scope 6
2 References 6
3 Terms and units of measurement 6
4 General 6
5 Metering characteristics 8
6 Calibration conditions 8
7 Calibration items and calibration methods 10
8 Expression of calibration results 16
9 Recalibration interval 18
Appendix A Influence of the angle between the Hall plate and the magnetic field on the
Appendix B Example of evaluating the measurement uncertainty of the indication error of
Appendix C Magnetometer calibration raw record format 26
Appendix D Calibration certificate inner page format 28

Introduction

This Specification is written in accordance with JJF 1071-2010 The Rules for Drafting National Calibration Specification and JJF 1059.1-2012 Evaluation and Expression of Uncertainty in Measurement.

This Specification is a revision of JJG 242-1995 Tesla - Meter. Compared with JJG 242-1995, the main technical changes, except editorial changes, are as follows:

-- Change the specification name to (1 mT~2.5 T) magnetometers;

-- Add introduction, references, and terms;

-- Change the indication return error to up and down variation;

-- Change the indication variability to short-term stability.

Previous versions of this specification are:

1 Scope

This Specification applies to the calibration of 1 mT ~ 2.5 T DC magnetic field magnetometers, and also to the calibration of the DC magnetic field measurement part of

Preview: page 2 of 5 shown, 30 in the full document. Complete English PDF, instant download:
https://chinastandards.org/standards/jjf-1832-2020

multifunctional magnetometers.

2 References

The following documents are referred to in this Specification:

JJF 1013-1989 Terms in common use and their definitions for the magnetic metrology For dated references, only the dated version applies to this Specification; for undated references, the latest version (including all amendments) applies to this Specification.

3.2 zero drift

The amount by which the magnetometer reading deviates from zero when the probe is placed in a zero magnetic field cavity.

3.3 basic range

The measuring range with the best maximum permissible error of magnetic flux density.

4 General

A magnetometer is an instrument used to measure the magnetic flux density (magnetic induction intensity) of an object at a point in space, among which the Hall effect magnetometer is the most typical. Magnetometers are divided into digital magnetometers and pointer magnetometers according to the display mode. Their principle structure block diagrams are shown in Figure 1 and Figure 2, respectively. Magnetometer probes are divided into radial probes and axial probes according to the direction of the measured magnetic field.

The magnetic flux density is calculated according to Formula (1).

B - magnetic flux density of DC magnetic field, T;

EH - Hall electromotive force generated in the semiconductor chip, V;

d - thickness of semiconductor wafer, m;

RH - Hall coefficient of semiconductor wafer, m3/C;

I - the current passing through the semiconductor wafer, A.

5.4 Up and down variation

The up and down variation of a pointer magnetometer generally does not exceed the error coefficient value related to its range value.

The above indicators are not applicable to qualification judgment and are for reference only.

Preview: page 3 of 5 shown, 30 in the full document. Complete English PDF, instant download:
https://chinastandards.org/standards/jjf-1832-2020

6.1 Environmental conditions

When calibrating the magnetometer, the environmental conditions shall meet the requirements of Table 1.

Ambient magnetic field The external magnetic field flux density is less than 1/5 of the maximum allowable error of the calibrated magnetometer Power supply frequency 50Hz±1Hz

6.2 Measurement standards and other equipment

The magnetometer calibration device consists of a zero magnetic field cavity, a magnetic field coil (Helmholtz coil, solenoid, etc.), an electromagnet, an excitation power supply, a DC ammeter, a probe position adjustment device, a standard magnetometer (or a magnetometer standard table), etc. The calibration device must be verified (or calibrated) against a higher-level measurement standard, and its combined standard uncertainty must not exceed 1/3 of the maximum allowable error of the calibrated magnetometer. The magnetic flux density in the zero magnetic field cavity is no more than 1x10-6 T. When the magnetic flux density of the magnetic field is in the range of 1 mT ~ 100 mT, the magnetic field generator can use a magnetic field coil. The magnetic field coil can be a Helmholtz coil, a solenoid coil, or the like. In the uniform area of the coil magnetic field, the error caused by the magnetic field uniformity shall be no more than 1/5 of the absolute value of the maximum allowable error of the calibrated magnetometer, and the error introduced by the coil constant shall be no more than 1/5 of the absolute value of the maximum allowable error of the calibrated magnetometer. When the magnetic flux density of the magnetic field is in the range of 10 mT ~ 2.5 T, the magnetic field generator can be an electromagnet. The pole surfaces of the electromagnet shall be flat and the two pole surfaces shall be parallel.

7.1 Calibration items

The calibration items are shown in Table 2.

? Applicable only to pointer type magnetometers.

7.2 Calibration methods

7.2.1.1

The housing, exposed switches, function buttons and corresponding markings of newly produced magnetometers shall be intact; magnetometers in use and after repair shall not have damage or defects that affect normal operation. 7.2.2.1 Preheat the magnetometer to be calibrated according to its instructions. 7.2.2.2 Place the magnetometer probe to be calibrated in the zero magnetic field cavity and adjust its range to the lowest range. 7.2.2.3 Zero the calibrated magnetometer and select a recording time based on the requirements (if no requirements are available, 60 seconds may be selected). Record the maximum value

Preview: page 4 of 5 shown, 30 in the full document. Complete English PDF, instant download:
https://chinastandards.org/standards/jjf-1832-2020

(Bmax) and minimum value (Bmin) of the readings within this time. The zero drift is calculated according to Formula (2). Bp - zero drift of the calibrated magnetometer, T; Bmax - maximum value of magnetometer reading, T; Bmin - minimum value of magnetometer reading, T. Select the calibration points according to the usage requirements. If there is no requirement, select by referring to the following method: graduation lines within the measuring range as calibration points, and the number of calibration points shall be no less than 3 points. For non-basic range, select two points as calibration points: the maximum point of basic range error and the upper limit point. -- Digital type magnetometer. The basic range can select (but not limited to) the upper limit of the range, 80% range point, 60% range point, 40% range point, and 20% range point as calibration points; for non-basic range, generally select 3 points. The indication error of the magnetic flux density value of the calibrated magnetometer is calculated according to Formula (3).

8 Expression of calibration results

After the error data of the calibrated instrument is calculated, it shall be rounded off and the even number rule shall be used to round off the data. The last digit shall be rounded off to 1/10 of the maximum allowable error of the calibrated instrument. When judging whether the error of the calibrated instrument exceeds the maximum allowable error, the rounded data shall be used as the basis.

The calibration results shall be reflected in the calibration certificate (report), which shall include at least the following information:

a) title, such as "calibration certificate";

identification of each page and the total number of pages;

f) description and clear identification of the object being checked;

and application of the calibration results, the date on which the calibrated object is received;

h) identification of the technical specification on which the calibration is based, including name and code;

i) a statement on the traceability and validity of the measurement standards used in this calibration;

j) description of the calibration environment;

k) a statement of the calibration results and their measurement uncertainty;

l) a description of the deviation from the calibration specification;

n) a statement that the calibration results are only valid for the object being calibrated;

o) a statement that no part of the certificate or report may be reproduced without the written approval of the laboratory.

Preview: page 5 of 5 shown, 30 in the full document. Complete English PDF, instant download:
https://chinastandards.org/standards/jjf-1832-2020