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Test methods for electrical and magnetic properties of magnetic powder cores

**Méthodes d'essai des propriétés électriques et magnétiques des noyaux en
poudre magnétique**



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**Méthodes d'essai des propriétés électriques et magnétiques des noyaux en
poudre magnétique**

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CONTENTS

FOREWORD.....	6
INTRODUCTION.....	8
1 Scope.....	9
2 Normative references	9
3 Terms, definitions, abbreviated terms and symbols.....	9
3.1 Terms and definitions.....	9
3.2 Abbreviated terms.....	9
3.3 Symbols.....	10
4 Instruments and equipment.....	10
4.1 General provisions.....	10
4.2 Excitation source	10
4.2.1 General provisions.....	10
4.2.2 Sinusoidal wave excitation source	11
4.2.3 Square wave excitation source	11
4.2.4 Calculation of magnetic flux density.....	12
4.3 Measuring equipment.....	12
4.3.1 General provisions.....	12
4.3.2 Voltmeter.....	12
4.3.3 Data acquisition unit	13
4.4 Sensor.....	13
4.4.1 Sampling resistor.....	13
4.4.2 Current transformer	13
4.5 Other descriptions.....	14
4.5.1 Intermediate connector	14
4.5.2 Thermostat	14
5 Sample.....	14
5.1 Magnetic core	14
5.2 Winding	14
5.2.1 Winding conditions	14
5.2.2 Dual winding.....	15
5.2.3 Single winding.....	15
5.3 Mounting of sample.....	16
5.4 Parameters of sample.....	16
6 Measuring conditions.....	16
6.1 Relation to practice	16
6.2 Effective parameters.....	17
6.3 Magnetic state of measurement	17
7 Test methods for power loss.....	17
7.1 Summary	17
7.2 AC power method	18
7.3 DC power method	18
7.4 Calorimetric method.....	18
8 Test methods for effective permeability.....	18
8.1 Summary	18
8.2 Large signal AC method.....	19
8.3 Impedance method	19

8.4	Pulse method.....	19
9	Test method for effective complex permeability	19
10	Test method for quality factor (Q)	20
11	Verification of measurement accuracy	20
Annex A (informative) AC power method.....		21
A.1	Overview.....	21
A.2	Basic circuit diagram.....	21
A.3	Measuring device.....	22
A.3.1	High frequency excitation source	22
A.3.2	Exciting winding N_1 and voltage sensing winding N_2	22
A.3.3	Sensing resistor R	22
A.3.4	Data collector	22
A.4	Test steps	22
A.5	Measuring principle.....	22
A.6	Error analysis.....	23
A.7	Matters to consider	24
A.7.1	Measurement error	24
A.7.2	Deduction of the winding loss	24
A.8	Specific test methods.....	24
A.8.1	B-H analyzer method	24
A.8.2	Power analyzer method	24
A.8.3	Capacitive reactive compensation method	24
A.9	Measurement for quality factor (Q).....	26
Annex B (informative) DC power method.....		27
B.1	Overview.....	27
B.2	Basic circuit diagram.....	27
B.3	Measuring device.....	27
B.3.1	DC voltage source U_1	27
B.3.2	DC/AC inverter	27
B.3.3	Exciting winding N_1	27
B.3.4	DC ammeter and DC voltmeter for measuring the average value	28
B.4	Test steps	28
B.5	Measuring principle.....	28
B.6	Matters to consider	29
B.6.1	Inverter loss.....	29
B.6.2	Deduction of winding loss	29
Annex C (informative) Calorimetric method		30
C.1	Overview.....	30
C.2	Basic circuit diagram.....	30
C.3	Measuring device.....	30
C.3.1	Excitation source	30
C.3.2	Temperature sensor	30
C.3.3	Thermal insulated container.....	30
C.3.4	Thermal medium.....	31
C.3.5	Sample	31
C.4	Test steps	31
C.5	Measuring principle.....	31
C.6	Matters to consider	32

C.7	Specific test methods.....	32
C.7.1	Calibration calorimetric method	32
C.7.2	Comparative calorimetric method.....	33
Annex D	(informative) Large signal AC method.....	35
D.1	Overview.....	35
D.2	Basic circuit diagram.....	35
D.3	Measuring device.....	36
D.3.1	High-frequency excitation source.....	36
D.3.2	Exciting winding N_1 and voltage sensing winding N_2	36
D.3.3	Sampling resistor R	36
D.3.4	Data collector	36
D.4	Test steps	36
D.5	Measuring principle.....	37
D.6	Matters to consider	37
Annex E	(informative) Impedance method.....	38
E.1	Overview.....	38
E.2	Basic circuit diagram.....	38
E.3	Measuring device.....	38
E.3.1	Impedance analyzer or LCR meter.....	38
E.3.2	Exciting winding N_1	38
E.4	Test steps	39
E.5	Measuring principle.....	39
E.6	Matters to consider	39
Annex F	(informative) Pulse method	40
F.1	Overview.....	40
F.2	Basic circuit diagram.....	40
F.3	Measuring device.....	40
F.3.1	Sampling resistor R	40
F.3.2	Switch S	40
F.3.3	Exciting winding N_1	41
F.3.4	Capacitor C	41
F.4	Test steps.....	41
F.5	Measuring principle.....	41
F.6	Matters to consider	42
Annex G	(informative) Method of verification and criteria for judgment.....	43
Annex H	(informative) Imposing of DC bias on the core	46
H.1	Overview.....	46
H.2	Matters to consider	48
Annex I	(informative) References	49
I.1	Overview.....	49
I.2	Effect of rise time of square wave excitation on the core loss.....	49
I.3	Phase error limit	50
I.4	Derivation of Formula (8)	51
I.5	SRF consideration of the sample	52
Bibliography	54
Figure 1	– Figure of square waveform.....	12

Figure A.1 – Diagram of AC power method	21
Figure A.2 – Circuit diagram of reactive power compensation of capacitor	25
Figure A.3 – Phasor diagram of reactive power compensation of capacitor	26
Figure B.1 – Diagram of DC meter method.....	27
Figure C.1 – Diagram of the calorimetric method	30
Figure C.2 – Diagram of the calibration calorimetric method	33
Figure C.3 – Diagram of the comparative calorimetric method.....	34
Figure D.1 – Diagram of large signal AC method.....	35
Figure E.1 – Diagram of impedance method.....	38
Figure F.1 – Diagram of pulse method	40
Figure F.2 – Exciting voltage and current waveform on the exciting winding.....	42
Figure G.1 – Diagram of air-core inductor	44
Figure H.1 – Diagram of imposition of DC bias.....	47
Figure I.1 – Square wave excitation source.....	50
Figure I.2 – Diagram of the ratio error and phase error	50
Figure I.3 – Equivalent circuit model of sample	52
Table 1 – Comparisons of measuring methods for power loss	17
Table I.1 – Example for k , α , β and other parameters	50
Table I.2 – Example of core losses error with different t_r	50
Table I.3 – Example of core losses measuring error and ratio error for the phase error.....	51
Table I.4 – Example of ΔL at different frequencies	53

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**TEST METHODS FOR ELECTRICAL AND MAGNETIC
PROPERTIES OF MAGNETIC POWDER CORES**
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IEC 63300 has been prepared by IEC technical committee 51: Magnetic components, ferrite and magnetic powder materials. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
51/1419/CDV	51/1436/RVC

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

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INTRODUCTION

Magnetic powder cores have the characteristics of low relative permeability, high saturated flux density and low loss. Therefore, compared with ungapped ferrite, the equivalent impedance of a sample of magnetic powder core is much smaller, and the magnetizing current is very large, so the required excitation source will have both high frequency and high-power capacity, which is difficult to obtain in practice. Moreover, the impedance angle of a magnetic powder core under test is very close to 90° , and this results in great difficulties to obtain accurate measurements of power loss.

The IEC 62044 series provides measuring methods of magnetic properties at low and high excitation levels for magnetic cores made of magnetic oxides or metallic powders. However, the methods introduced in the IEC 62044 series cannot fully meet the measurement requirements for magnetic properties of magnetic powder cores. It is therefore useful to have a standard for suitable measuring methods for the magnetic properties of magnetic powder cores.

New test methods with pulse wave excitation and DC power method that account for the characteristics of magnetic power cores are introduced in this document, in addition to some modifications for the traditional test methods. Also, an air core inductor with single winding or dual windings is introduced in the document to verify or calibrate the accuracy of test methods for magnetic properties of magnetic powder cores, because of the linear properties of an air core inductor.

TEST METHODS FOR ELECTRICAL AND MAGNETIC PROPERTIES OF MAGNETIC POWDER CORES

1 Scope

This document provides the test methods for the electrical and magnetic properties of magnetic powder cores used for inductive components in electronics equipment, switch-mode power supplies and power conversion equipment, and introduces measuring principles, scope of application and matters of importance for each method.

The parameters used to characterize the magnetic powder cores include: inductance factor, effective permeability, complex relative permeability, temperature coefficient of permeability, frequency coefficient of permeability, DC bias characteristic, power loss, and quality factor. This document is the basis for determining the characteristic parameters of magnetic powder cores.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 63182-2, *Magnetic powder cores – Guidelines on dimensions and the limits of surface irregularities – Part 2: Ring-cores*

3 Terms, definitions, abbreviated terms and symbols

3.1 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.2 Abbreviated terms

ARV	average rectification value
EPR	equivalent parallel resistance
ESR	equivalent series resistance
FFT	fast Fourier transform
MSE	modified Steinmetz equation
PWM	pulse width modulation
RMS	root mean square
SCR	silicon controlled rectifier
SRF	self-resonant frequency
ZVS	zero voltage switching