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IEEE Standard Test Procedure for Toroidal Magnetic Amplifier Cores (Including Core Material Data)

Nov 21, 1972

IEEE Std 106-1972



PUBLISHED BY

THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, Inc.

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IEEE Standard Test Procedure for Toroidal Magnetic Amplifier Cores (Including Core Material Data)

Sponsor

**Electronics Transformers Technical Committee
of the
IEEE Magnetics Society**

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Foreword

(This Foreword is not a part of IEEE Std 106-1972, Test Procedure for Toroidal Magnetic Amplifier Cores (Including Core Material Data).)

One of the major problems in the production of magnetic amplifiers is reproducibility. It is essential that the cores of magnetic amplifiers be tested and selected prior to winding if good quality control is to be maintained. There have been many approaches to the problem and each company has its own test circuit. Realizing that it would be advantageous to both the core vendors and users to standardize on core test methods, the Magnetic Amplifiers Materials Subcommittee formed the Working Group on Core Matching and Grading to establish standard test circuits. This publication constitutes a summary of the Working Group's activities over a two-year period and sets for recommendations for two standard core test circuits for toroidal cores.

In order to survey the field, questionnaires were sent to 46 companies who are active in the magnetic amplifier field. The information received from the eighteen companies that answered formed the pool of information from which the standard test circuits were determined.

The information was evaluated in the light of:

- (1) Reproducibility of results
- (2) Correlation of test data with amplifier performance
- (3) Simplicity of circuitry
- (4) The number of companies employing each of the submitted test circuits

All of the proposed test circuits, including the circuits presented here, excite the core in a manner that the resulting flux excursions as a function of time differ from the excursions that take place in actual magnetic amplifier operation. From this point of view the circuits are not ideal. The departure, however, is acceptable in view of the fact that correlation of test results with amplifier performance is acceptable.

Of the seven types of test circuits proposed, two were selected. They are the "constant-current flux-reset test" and the "sine-current excitation test." It was impossible to eliminate either one in preference to the other since both are widely used and neither presents outstanding advantages over the other.

The operation of both of these circuits has been well described in previous literature [1–4]. The purpose of this standard is to establish conditions of measurement so that test results may be reproduced from one test installation to the next.

The "sine-current excitation test" measures magnetic parameters while the flux is traversing a major dynamic hysteresis loop. The "constant-current flux-reset test," on the other hand, simulates the operation of a single-core half-wave magnetic amplifier. Measurements are made while the flux traverses minor dynamic hysteresis loops.

In both test methods magnetic properties are obtained by measuring electrical quantities. The test equipment is calibrated in magnetic units since core properties are the quantities of interest.

Since the two test methods excite the core in different manners one should not expect to obtain the same quantitative results. Only when measuring peak induction (B_m) and peak induction minus residual induction ($B_m - B_r$) are the test conditions identical in the two circuits.

There is evidence in the literature [8–11] to show that for design purposes, the basic magnetic information on core materials should include the static major hysteresis loop and the dynamic major hysteresis loop for a frequency corresponding to that supplied to the magnetic amplifier. Section 4 of this standard details the basic data that should be presented by manufacturers of core materials so that magnetic amplifier designers will have available the parameters of the material particularly significant to magnetic amplifier design.

This IEEE Standard represents a consolidation of the material contained in IEEE Std 105-1958 (AIEE-431), Proposed Standard for Presenting Data on Magnetic Amplifier Core Materials, and IEEE Std 106-1959 (AIEE-432), Test Procedure for Toroidal Magnetic Amplifier Cores.

The major work of preparing this standard was done by the Materials Subcommittee of the Magnetic Amplifiers Committee. The Subcommittee at that time consisted of the following members:

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The original work of combining the two documents into this revision was done by H. W. Lord of the Electronics Transformers Technical Committee of the IEEE Magnetics Society.

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