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Proposed
Test Procedure for
MAGNETIC AMPLIFIERS

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This Test Procedure was prepared by the Working Group on Test Codes of the Standards Subcommittee of the AIEE Magnetic Amplifiers Committee. The contributions of past, as well as present, members of the Standards Subcommittee are gratefully acknowledged. The present members of the Working Group on Test Codes are:

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FOREWORD

The magnetic amplifier definitions contained in AIEE Transactions Paper No. 58-175 are adhered to. In addition, the following definitions are presented for clarity only; they are not a part of the proposed test procedure, nor have they been formally approved by the Definition Subcommittee.

1. **Current Amplification**—The current amplification of a magnetic amplifier is the ratio of the change in output current to the change in current in the control winding required to produce the output current change.
2. **Figure of Merit**—The figure of merit of a magnetic amplifier is the ratio of power amplification to the response time, preferably expressed in seconds.
3. **Power Amplification**—The power amplification of a magnetic amplifier is the product of the voltage amplification and the current amplification.
4. **Voltage Amplification**—The voltage amplification of a magnetic amplifier is the ratio of the change in output voltage to the change of voltage across the control winding circuit required to produce the output voltage change.

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Proposed Test Procedure for

MAGNETIC AMPLIFIERS

I. GENERAL CONSIDERATIONS

A. General Operating Conditions

The magnetic amplifier should be operated at its nominal rated conditions except for its control circuit quantities and output quantities.

B. Control Signal

1. For the magnetic amplifiers with direct-current signal, the control signal should be obtained from a voltage source which has less than 5 percent ripple and whose internal impedance is such that the source voltage at no time under transient or steady-state conditions decreases by more than 10 percent of the value which would exist if the control circuit of the magnetic amplifier were open.
 - a. The average magnitude of the control-signal voltage should be measured at the terminals of the voltage source.*
 - b. Control-circuit currents flowing as a result of this voltage should be measured with an average-reading meter.*
2. For magnetic amplifiers with alternating-current signal, the control signal ("carrier") should be obtained from a voltage source of power frequency and specified phase which has a total harmonic content less than 5 percent and whose internal impedance is such that the source voltage at no time under transient or steady-state conditions decreases by more than 10 percent of the value which would exist if the control circuit of the magnetic amplifier were open.
 - a. The magnitude of the average values (averaged over one-half cycle) of the alternating-current signal voltage should be measured.**
 - b. The average value (averaged over one-half cycle) of the control-circuit currents flowing as a result of this voltage should be measured.**
3. Any impedance inserted between the external control-circuit terminals of the magnetic amplifier and the terminals of the signal voltage source must be specifically described. This impedance, if present, must be the same in all of the tests described below.

* For example, a D'Arsonval meter movement can be used for steady-state direct-current measurements.

C. Output Voltage

1. For magnetic amplifiers with direct-current output, the average value of the output voltage should be measured.*
2. For magnetic amplifiers with alternating-current output, the output voltage should be measured in the same units as stated in the output rating of the amplifier.
 - a. For root-mean-square output ratings, the output voltage should be measured with a voltmeter which responds to the root-mean-square value.***
 - b. For average output ratings, the output voltage should be measured with an instrument which responds to the average value.**
 - c. For ratings based on the fundamental component of the output voltage, the amplitude of the fundamental component should be measured with a wave analyzer.

D. Output Current

Output currents should be measured with the same type instruments as used to measure the output voltages.

E. Load

The amplifier shall be terminated in a resistive load, or if other loads are used, they must be accurately defined.

F. The Determination of Parameters

1. Rated output voltage is as specified in ratings.
2. Magnetic amplifier with non-reversible output.
 - a. Signal voltage should be applied to the control circuit of the magnetic amplifier to determine the minimum output voltage.
 - b. The maximum test output voltage is defined as the minimum output voltage plus 80 percent of the difference between the rated and minimum output voltages.
 - c. The minimum test output voltage is defined as the minimum output voltage plus 20 percent of the difference between the rated and minimum output voltages.

** For example, steady-state alternating-current measurements can be made with instruments having full-wave rectification and D'Arsonval movements. Since these instruments are usually calibrated to measure the root-mean-square value of a pure sine wave, the scale reading should be divided by 1.11.

*** For example, a thermocouple-type voltmeter can be used.