

Magnetic materials — Methods for the determination of the relative magnetic permeability of feebly magnetic materials

ICS 17.220.20

Confirmed January 2010

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- Federation of the Electronics Industry
- Institute of Physics
- International Coil Winding Association
- National Physical Laboratory
- Rotating Electrical Machines Association
- Transmission & Distribution Association
- UK Steel Association
- University of Sunderland
- Wolfson Centre for Magnetism Technology

This British Standard, having been prepared under the direction of the Engineering Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 December 1999

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First published September 1987
Second edition December 1999

The following BSI references relate to the work on this standard:
Committee reference ISE/NFE/5
Draft for comment 98/717722 DC

ISBN 0 580 33060 5

Amendments issued since publication

Amd. No.	Date	Comments

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Foreword

This British Standard has been prepared by Technical Committee ISE/NFE 5/2. It is a revision of BS 5884:1987, which is withdrawn.

BS 5884 has been revised to reflect improvements in the methods of measurement and, in particular, in reference materials currently available.

It should be noted that for some of the methods described in this British Standard, the uncertainty of the measured value is a complex function dependent upon the accuracy of the measuring instruments and the measuring conditions. It is therefore not always possible to state the exact uncertainty. However, for a given method, experience has shown the uncertainty that can be expected and where possible an indication of the uncertainties is given.

Annex A is informative.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 9 and a back cover.

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Introduction

The determination of the relative magnetic permeability of feebly magnetic materials is often required to assess their effect on the ambient magnetic field. Typical feebly magnetic materials are austenitic stainless steels and “non-magnetic” brass. The relative magnetic permeability of some of these materials can vary significantly with the applied magnetic field strength. In the majority of cases these materials find application in the ambient earth’s magnetic field which has a total magnetic field strength of approximately 35 A/m. However, at present, methods of measurement are not available to determine the relative magnetic permeability of feebly magnetic materials at such a low value of magnetic field strength.

Studies of the properties of feebly magnetic materials have been carried out at the National Physical Laboratory, primarily with a view to the production of improved reference materials. These studies have shown [1] that it is possible to produce reference materials which have a substantially constant relative magnetic permeability over the range from the earth’s magnetic field to at least a magnetic field strength of 100 kA/m. Figure 1 shows typical data points for non-magnetic brass, having a relative permeability of between 1.03 and 1.05, compared with the data points for a specially prepared reference material of nominal relative magnetic permeability 1.05.

Therefore, when determining the relative magnetic permeability of feebly magnetic materials it should be borne in mind that the value obtained will be dependent on the applied magnetic field strength and that the actual value of relative magnetic permeability of that material could be significantly different under operational conditions. Moreover, where a magnetic balance method or permeability meter is used, employing reference materials, it is important to know the relative magnetic permeability of the reference materials at the magnetic field strength at which these instruments operate. Where the effect of a feebly magnetic material on the ambient earth’s magnetic field is critical, the direct measurement of this effect using a sensitive magnetometer should be considered.

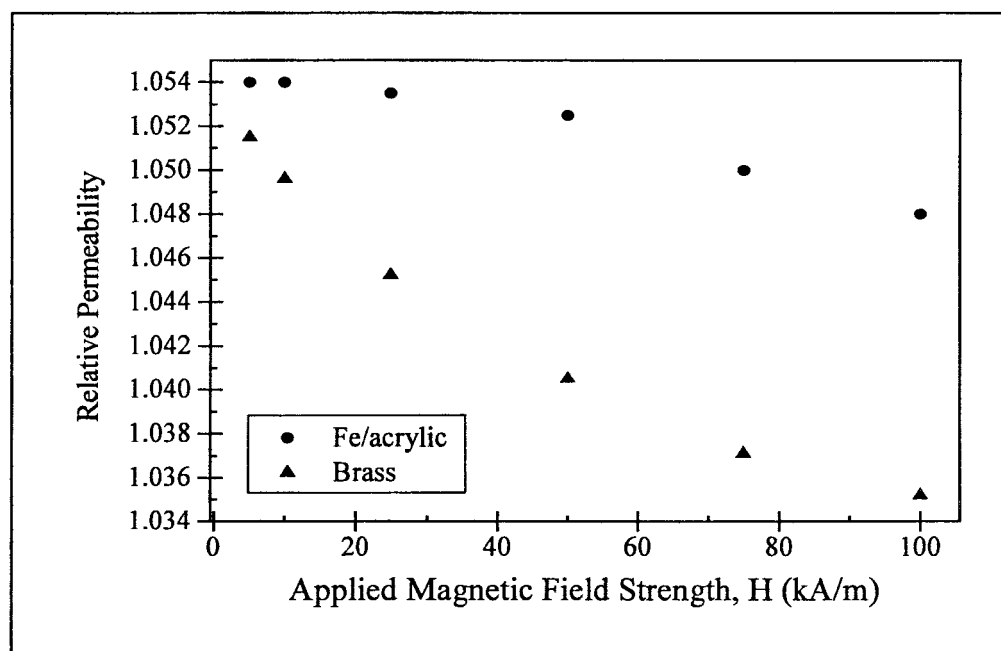


Figure 1 — Comparison of reference materials of brass and Lowmu 105 Fe/acrylic