



Standard Guide for Mutual Inductance Bridge Applications for Wall Thickness Determinations in Boiler Tubing¹

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1. Scope

1.1 This guide describes a procedure for obtaining relative wall thickness indications in ferromagnetic and non-ferromagnetic steels using the mutual inductance bridge method. The procedure is intended for use with instruments capable of inducing two substantially identical magnetic fields and noting the change in inductance resulting from differing amounts of steel. It is used to distinguish acceptable wall thickness conditions from those which could place tubular vessels or piping at risk of bursting under high temperature and pressure conditions.

1.2 This guide is intended to satisfy two general needs for users of industrial Mutual Inductance Bridge (MIB) equipment: (1) the need for a tutorial guide addressing the general principles of Mutual Inductance Bridges as they apply to industrial piping; and (2) the need for a consistent set of MIB performance parameter definitions, including how these performance parameters relate to MIB system specifications. Potential users and buyers, as well as experienced MIB examiners, will find this guide a useful source of information for determining the suitability of MIB for particular examination problems, for predicting MIB system performance in new situations, and for developing and prescribing new scan procedures.

1.3 This guide does not specify test objects and test procedures for comparing the relative performance of different MIB systems; nor does it treat electromagnetic examination techniques, such as the best selection of scan parameters, the preferred implementation of scan procedures, the analysis of image data to extract wall thickness information, or the establishment of accept/reject criteria for a new object.

1.4 Standard practices and methods are not within the purview of this guide. The reader is advised, however, that examination practices are generally part and application specific, and industrial MIB usage is new enough that in many instances a consensus has not yet emerged. The situation is complicated further by the fact that MIB system hardware and performance capabilities are still undergoing significant evolution and improvement.

Consequently, an attempt to address generic examination procedures is eschewed in favor of providing a thorough treatment of the principles by which examination methods can be developed or existing ones revised.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory requirements prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

E 1316 Terminology for Nondestructive Examinations

3. Terminology

3.1 *Definitions*—The definitions of terms relating to conventional magnetic examination methods can be found in Terminology E 1316.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *inductance*—the property of an electric circuit or device whereby an electromotive force is created by a change of current in it or in a circuit near it.

3.2.2 *mutual inductance*—the electrical property of circuits that enables a current flowing in one conductor (or coil) to induce a current in a nearby conductor (or coil).

3.2.3 *mutual inductance bridge (MIB)*—a nondestructive examination method, which employs a magnetic induction method for the detection and assessment of variations of wall thickness in tubular vessels. In this procedure, an appropriate magnetic field is first induced into two identical sections of ferromagnetic or non-ferromagnetic tubing through two identical coils, and then a bridge circuit between the two coils is constructed and balanced from a voltage measurement. Although, the two coils are identical, one is designated as the reference coil and is left in place with the other (probe) coil being moved to a section of pipe with unknown thickness. The electrical effect of the tubing is to modify the inductance of the

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

