

STANDARDS AUSTRALIA

RECONFIRMATION

OF

AS 2331.1.4—2001

Methods of test for metallic and related coatings

Method 1.4: Local thickness tests—Magnetic induction and eddy current methods

RECONFIRMATION NOTICE

Technical Committee MT-009 has reviewed the content of this publication and in accordance with Standards Australia procedures for reconfirmation, it has been determined that the publication is still valid and does not require change.

Certain documents referenced in the publication may have been amended since the original date of publication. Users are advised to ensure that they are using the latest versions of such documents as appropriate, unless advised otherwise in this Reconfirmation Notice.

Approved for reconfirmation in accordance with Standards Australia procedures for reconfirmation on 20 March 2017.

The following are represented on Technical Committee MT-009:

Australasian Institute of Surface Finishing
Australian Chamber of Commerce and Industry
Australian Industry Group
Australian Steel Institute
Bureau of Steel Manufacturers of Australia
Galvanizers Association of Australia
Galvanizing Association of New Zealand
New Zealand Metal Roofing Manufacturers

NOTES

Australian Standard™

AS 2331.1.4

Methods of test for metallic and related coatings**Method 1.4: Local thickness tests—
Magnetic induction and eddy current methods****1 SCOPE**

This Standard sets out the requirements for the following non-destructive methods for the measurement of the local thickness of metallic and non-metallic coatings:

(a) *Magnetic induction (low frequency) method*

The magnetic induction method is used for the thickness testing of non-magnetic and non-metallic coatings on magnetic substrates.

(b) *Eddy current (high performance) method*

The eddy current method is used for the thickness testing of —

- (i) a non-conductive coating on a non-magnetic substrate; and
- (ii) a metallic coating or a non-metallic coating on a substrate that has appreciably different conductivity.

These methods apply when the coating thickness is not less than 2 µm, and the surface contour permits calibration of the test instrument.

The magnetic induction (low frequency) method is suitable for the measurement of thickness of gold, silver, tin, cadmium, zinc, copper, chromium, lead and organic coatings, such as paints and plastics, on magnetic substrates.

The eddy current (high frequency) method is suitable for the measurement of thickness of oxide coatings on metals. Using selected frequencies, it is also possible to measure the thickness of various metallic coatings on either magnetic or non-magnetic substrates, e.g. tin-lead on copper, silver on nickel/silver, copper, zinc, cadmium or tin on steel, and copper or silver on a non-metallic base.

Under the best conditions of use, these methods are accurate to $\pm 0.7 \mu\text{m}$, or $\pm 10\%$, whichever is the greater.

NOTES:

- 1 Factors affecting the accuracy of measurement are given in Appendix A.
- 2 The methods given in this Standard are not suitable for the measurement of chemical conversion coatings.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

- | | |
|----------|---|
| 2331 | Methods of test for metallic and related coatings |
| 2331.1.1 | Method 1.1: Local thickness tests—Micrographic examination of cross-sections |
| 2331.2.1 | Method 2.1: Tests for average coating mass per unit area or for thickness—
Dissolution methods—Strip and weigh, and analytical |

ISO
2064 Metallic and other inorganic coatings—Definitions and conventions concerning the measurement of thickness

3 DEFINITIONS

For the purpose of this Standard, the definitions in ISO 2064, and that below apply.

3.1 Reference area

The area within which a specified number of single measurements is required to be made.

4 PRINCIPLE

An electromagnetic field is generated in the probe system of both magnetic induction and eddy current instruments.

Magnetic induction instruments generate an alternating current of low frequency (typically 50 Hz to 60 Hz) in a probe which, when placed on a test piece that has a magnetic basis metal, produces measurable magnetic induction. The degree of induction is dependent on the permeability of the basis metal and on the thickness of any non-magnetic coating being measured.

Eddy current instruments generate higher frequencies (typically 6000 Hz and higher) in a probe which, when placed on the test surface, produces eddy currents in the test piece. Eddy currents can also be produced in the test piece when using a sensing element which may be in the form of a coil.

The amplitude and phase of these currents is a function of the differences in the thickness of the coating and the relative conductivities of the coating and the basis metal.

5 APPARATUS

An appropriate instrument which can be calibrated for a known thickness or thicknesses of coating is required (see Clause 6).

6 CALIBRATION OF MEASURING INSTRUMENTS

6.1 General

Instruments shall be calibrated in accordance with the manufacturers' instructions, using suitable thickness standards. Calibration shall be carried out under conditions which apply during tests, and, to ensure accuracy of measurements, it is important that calibrations be carried out at frequent intervals during use and at the conclusion of the series of tests.

The type of calibration standard will depend on the type of instrument and the nature of the coating under test.

6.2 Calibration foils

Calibration foils may be made of plastics materials or of a non-magnetic metal such as brass, provided that they give a similar equipment response to the coating being tested.

NOTES:

- 1 The use of foils is advantageous for the calibration of instruments used for measuring curved surfaces; they are also more readily available than coated standards.
- 2 To avoid errors in measurement, it is necessary to ensure intimate contact between a foil and the substrate.
- 3 Calibration foils are subject to indentation and require replacement when worn or damaged. Resilient foils should not be used.