STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard

METHODS OF TEST FOR METALLIC AND RELATED COATINGS

PART 1 — LOCAL THICKNESS TESTS

AS 2331.1.2—1980
COULOMETRIC METHOD

1 SCOPE. This standard sets out the method for measuring the local thickness of metallic coatings by the coulometric method.

2 APPLICATION. The method is suitable for the measurement of the thickness of all metallic coatings which can be dissolved by electrolytic action. The method can be used to determine the individual thicknesses of multilayer coatings which involve the use of different methods of measurement.

The accuracy of the method is normally within ±10 percent over the range 0.2 μm to 50 μm coating metal thickness.

3 PRINCIPLE. A small and accurately defined area of the test piece is made anodic in contact with a suitable electrolyte which may not be agitated. A current is applied which dissolves the coating at a known rate determined by the current density.

When the coating is perforated, a sharp voltage change takes place which automatically stops both the current flow and timing device. The coating thickness is determined by the amount of current used to dissolve the coating in the test area and the time required for penetration.

The electrolyte is chosen so as to dissolve the coating with an anode efficiency of 100 percent. It does not attack the basis metal, and gives rise to an appreciable change in cell potential when the coating is perforated.

4 APPARATUS. An instrument which complies with the principle described in Clause 3 is required.

The electrolyte cell of the instrument shall be fitted with a flexible sealing ring which incorporates an annular cathode enclosing a circle of known area. Provision shall also be made for an agitator to be inserted in the cell.

The system shall be provided with electrical connections so that the test piece is anodic during electrolysis. The system shall also be fitted with facilities such that when the coating is perforated, the sudden change in cell potential terminates the flow of current.

Provision shall be made to record the current used and the time if the instrument is not provided with direct readout.

NOTE: The readout may be in coulombs, metal thickness or discrete numbers.

5 REAGENTS. The test reagent shall be chosen to suit the coating and substrate metals, the current density, and the degree of stirring of the reagent required within the electrolytic cell. Suitable test reagents are listed in Table 1, and the application of these reagents to particular substrates is given in Table 2.

6 PREPARATION OF TEST PIECES. Test pieces shall be free of foreign matter and, if necessary, shall be degreased in a solvent which does not attack the coating.

NOTE: The test area selected requires to be reasonably flat so as to retain the test electrolyte. Should the product itself be too large to fit the instrument, it will require sectioning.

7 PROCEDURE. Dissolution of the coating shall be as follows:

(a) Set up the instrument in accordance with the manufacturer's written instructions and calibrate using standard test pieces having known coating thickness.

(b) Locate the test piece under the probe and position the electrolytic cell and sealing ring and clamp in position.

(c) Fill the cell with the appropriate electrolyte and, if specified, position the agitator in place.

(d) Make the appropriate electrical connections so that the test piece in anodic and electrolyse until the instrument is cut off by the sudden change in cell potential.

NOTE: The current density employed for dissolution of the coating should be of the order of 1 A/dm^2 to 5 A/dm^2. However, use the same test conditions as used for calibrating the test instrument.

(e) Record the current used in amperes and elapsed time in seconds to dissolve the coating.

NOTES:

1. To ensure that the coating is completely removed, the spent electrolyte should be withdrawn from the cell and the test area inspected.
2. Some measuring instruments may have a direct read-out in coulombs or in coating metal thickness.