STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard

METHODS OF TEST FOR METALLIC AND RELATED COATINGS

PART 2—AVERAGE THICKNESS TESTS

AS 2331.2.3—1980
HYDROGEN EVOLUTION METHOD FOR ZINC COATINGS

1 SCOPE. This standard sets out the hydrogen evolution method for the determination of the average thickness of zinc coatings on steel.

2 APPLICATION. The method is suitable for the testing of the items on which the surface area can be calculated to within an accuracy of 1 percent. The method is normally accurate to within 5 percent.

3 PRINCIPLE. The coated item is exposed to inhibited hydrochloric acid at ambient temperature. The hydrogen gas liberated is collected and used as a means of determining the average thickness of the coating.

4 REAGENTS. The following reagent is known to perform satisfactorily:

Hydrochloric acid (ρ_{20} 1160 kg/m^3) . . 500 mL
Antimony trioxide (Sb_2O_3) . . . . . 10 g
Water to make . . . . . 1 L

5 APPARATUS. A suitable apparatus and arrangement is shown in Fig. 1. The following items are also required:

(a) A barometer accurate to 1 mb.
(b) A thermometer accurate to ±0.1°C.

6 PREPARATION OF TEST PIECES.

6.1 General. Test pieces shall be free of foreign matter and, if necessary, shall be degreased in a solvent that does not attack the coating.

Any supplementary treatment shall be removed before carrying out the determination.

NOTE: Freshly coated test pieces are preferred because there is less risk of contamination by foreign matter.

6.2 Surface Area. The area of the coated surface shall be determined to within an accuracy of 1 percent.

NOTE: The following procedures have been found useful for determining the area of irregularly shaped items.

(a) Attach masking tape over the entire surface without overlap; peel the tape from the surface and transfer to a sheet of graph paper. Then compute the area in square millimetres.

(b) After suitable preparation and weighing, coat the test piece along with a regular shaped control test specimen with a coating of electroless nickel.

The test pieces and the control specimen should be immersed simultaneously and removed simultaneously from the electroless nickel bath.

The test piece and the control specimen are reweighed and the increase in mass determined.

Increases in mass are proportional to their respective areas.

7 PROCEDURE. The volume of hydrogen evolved from test pieces shall be measured as follows (see Fig. 1):

(a) Ensure that all joints of the apparatus and all taps are clean, lubricated and gas-tight.

(b) Clean vessel A and rinse all adjacent pieces of apparatus to remove traces of acid from previous tests.

(c) Close tap G and fill vessel B with the reagent solution.

(d) Open tap H.

(e) Insert test piece in vessel A and attach vessel A to the apparatus. Close tap H.

(f) Adjust the position of vessel C to about the middle of the graduated tube D.

(g) Open tap F and pour water, preferably coloured, into vessel C until it is about three-quarters full.

(h) Gradually raise vessel C until the water rises in tube D to the zero mark.

(j) Close tap E.

NOTES:
1. The apparatus should now be at atmospheric pressure.
2. To ensure there are no leaks in the apparatus, close tap E and lower vessel C to near the bottom of the graduated tube D. Vessel A and associated apparatus are now at a pressure below atmospheric pressure. The water level should fall but soon stabilize. If the water level continues to fall, a leak is indicated in the apparatus. This leak needs to be located and remedied before proceeding with the test.

(k) Open tap G and admit sufficient reagent to cover the test piece. When the chemical reaction ceases, add a further small quantity of reagent to ensure that the zinc coating is completely dissolved.

(l) Adjust vessel C until the level of water in it coincides with that in tube D. Record the volume of hydrogen evolved as shown in tube D. Record the ambient temperature.