Australian Standard™

AS 3894.1

Site testing of protective coatings

Method 1: Non-conductive coatings—Continuity testing—High voltage (brush) method

PREFACE

This Standard was prepared by the Australian members of the Joint Standards Australia/Standards New Zealand Committee CH-003, Paints and Related Materials, to supersede AS 3894.1—1991. After consultation with stakeholders in both countries, Standards Australia/Standards New Zealand decided to develop this Standards as an Australian Standard rather than an Australian/New Zealand Standard.

The Standard was originally requested by the Queensland and New South Wales professional associations concerned with blast cleaning and the protection of heavy-duty structures.

This test method is intended to locate accurately defects, which may subsequently be repaired by appropriate procedures, prior to the item being placed into service.

This Standard is part of a series of Standards that provide test methods for inspectors and technical staff involved in the conduct of continuity testing and the assessment of results. As products tested are generally expected to exhibit long life without maintenance, and are often difficult or costly to assess once installed, it is essential that sound inspection methods are used and accurate test results are obtained before product installation can be commenced.

This Standard has drawn on literature issued by many professional bodies and instrument manufacturers, and acknowledgement is made of the assistance received. Source documents include the following:

AMERICAN SOCIETY FOR TESTING AND MATERIALS. ASTM G62-87 *Test methods for holiday detection in pipeline coatings.* Philadelphia: ASTM, 1984.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS. NACE RP 0188-88 *Discontinuity (holiday) testing of protective coatings.* Houston: NACE, 1988.

STEEL STRUCTURE PAINTING COUNCIL. *Steel structures painting manual.* Pittsburgh: SSPC, June 1983, vol. 1, pp 202-205.

BARTLETT, D.J. Cost effective coating inspection. *Corrosion Australasia.* April 1983, pp 8-12.

The terms 'normative' and 'informative' have been used in this Standard to define the application of the appendix to which they apply. A 'normative' appendix is an integral part of a Standard, whereas an 'informative' appendix is only for information and guidance.

CONTENTS

FOREWORD

Testing of the electrical properties of a continuous protective coating on metal may be carried out by various procedures, which yield differing results not related to the durability of the coating. Measurement of current flowing under the stress of high voltages provides a measure of the ohmic or volume resistivity. Application of alternating voltage produces a current related to the dielectric constant of the coating material. Measurement of current flow when the film is wet with conducting salts will provide a value for another characteristic.

The purpose of this Method is to produce electrical breakdown in a discontinuity, which exists between the substrate and the exploring electrode, wherever the electrode passes over a pinhole or defect in the coating. When films have been deposited from solvent-borne coatings, such pinholes in newly applied coatings may contain a significant vapour pressure over a prolonged period. As the available literature does not establish the degree to which the dielectric strength of air is altered by the solvent vapour content during high voltage testing, the committee carried out cooperative testing to address the behaviour of thermoplastics films. This work resulted in the empirical values adopted in Appendix D.

Although the coatings being considered here are applied to the metal substrate in liquid form, they may not necessarily be homogeneous or isotropic in nature which may impose limitations on the suitability of certain types of instrument for this test method. In addition, a specified delay may be required between the application of the coating and performance of the test. The design of the fabricated object may render this test unsuitable.

The rectification of discontinuities found by the use of this method should prolong the life of a coating.

METHOD

1 SCOPE

This Standard provides a practical test method for the on-site determination of the presence of pinholes, holidays, cracks and other discontinuities that penetrate to the substrate, in a non-conductive, protective coating of at least 150 µm thickness (see Note) on a conductive substrate, using the high voltage or 'brush' method.

NOTE: Where coatings are less than 150 µm thick, an alternative method such as the low voltage wet sponge method should be used.

This Standard is applicable to site testing of coated metal items of equipment or structures which may be subjected to long-term burial or immersion, such as structural steel, pipelines, storage vessels, bridges and mobile/transportable containers. The method is confined to testing instruments that can provide a minimum voltage of 500 V. The Standard is not intended to apply to coating types incorporating components that conduct an electric current such as zinc dust and aluminium flakes.

The voltages recommended in this Standard are intended to be applied under conditions of normal atmospheric pressure and temperature.

2 APPLICATION

Although it may be used in the laboratory for inspecting panels and relatively small test items, the Method is intended for use in the field (see also Clause 8).

WARNING: OWING TO THE POSSIBILITY OF THE TEST INSTRUMENTS INTERFERING WITH ELECTRICAL DEVICES SENSITIVE TO MAGNETIC AND ELECTRIC FIELDS, IT SHOULD BE ENSURED THAT OPERATORS HAVING PACEMAKERS OR OTHER BIO-ELECTRICAL DEVICES DO NOT USE THIS METHOD. REFER TO AS 2243.7 FOR GENERAL SAFE HANDLING OF ELECTRICAL DEVICES AND TO APPENDIX A FOR SAFE PRACTICES WHEN CONDUCTING HIGH VOLTAGE TESTING.

3 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS	
2886	Voltage measurement—Sphere-gap method (one sphere earthed)
AS/NZS	
1580	Paints and related materials—Methods of test
1580.101.5	Method 101.5: Conditions of test, temperature and humidity co trol
2243	Safety in laboratories
2243.7	Part 7: Electrical aspects
2310	Glossary of paint and painting terms
3894	Site testing of protective coatings
3894.7	Part 7: Determination of surface temperature

4 DEFINITIONS

For the purpose of this Standard, the definitions of AS/NZS 2310 and those below apply.

4.1 Coating

A material, applied to a surface at a specified film thickness, that is intended to protect the surface from corrosive elements or conditions such as moisture, gases, and abrasion by wind-blown or waterborne particles. A coating may also be required to insulate the substrate from temperature extremes.

4.2 Continuity

The quality of a coating that determines its freedom from those defects that increase its electrical conductivity.

4.3 Defect

A detectable weakness or discontinuity in a coating, which causes its ability to protect the substrate from corrosion to be suspect during the normal service life.

4.4 Holiday

A localized defect, characterized by a coating having areas of insufficient thickness, including the point where parts of the substrate may be uncoated.

4.5 Pinhole

A minute hole in a dry coating, which forms during the application and drying of the coating material.

5 PRINCIPLE

The electrode of a high voltage tester is passed over the surface to be tested at a prescribed rate. The location of any defect, as indicated by the instrument's response, is highlighted with a specified marker on the surface of the test area.