

Australian/New Zealand Standard®

Paints and related materials—Methods of test

Method 408.5: Adhesion—Pull-off test

PREFACE

This Standard was prepared by the Joint Australia/New Zealand Standards Committee CH/3 on Paints and Related Materials, under the direction of the Multitechnics Standards Policy Board.

This method draws upon the procedures of ASTM D4541.

METHOD

1 SCOPE This test method provides a laboratory or field procedure for quantifying the adhesion of a coating by determining the greatest perpendicular force (in tension) that a given surface area of coating can bear before it is detached.

The test method can be used for all coatings on rigid materials but is particularly suitable for testing adhesion of coatings on concrete and masonry surfaces.

2 REFERENCED DOCUMENTS The following documents are referred to in this Standard:

AS

- 1580 Paints and related materials—Methods of test
1580.101.4 Method 101.4: Conditions of test, temperature controlled
1863 Coated abrasives (technical products)

ASTM

- D4541 Pull-off strength of coatings using portable adhesion testers

3 PRINCIPLE This method uses pull-off adhesion testers to maximize tensile stress, in contrast to the shear stress applied by knife and cross-cut adhesion tests. The pull-off test is performed by securing a loading fixture normal to the surface of the coating with an adhesive. After the adhesive has cured, the testing apparatus is attached to the loading fixture and aligned to apply tension normal to the test surface. The force applied to the loading fixture is then gradually increased and monitored until either a plug of coating material is detached, or a specified value is reached. Failure will occur along the weakest plane within the system formed by the loading fixture, the adhesive, the coating system and the substrate. Measurements are limited by the strength of the adhesive bond and the cohesive strength of the substrate.

4 APPARATUS

4.1 Adhesion tester (including loading fixture)—a commercially available pull-off adhesion tester.

The tester shall be calibrated at zero load and over the range of interest, and shall be accurate within ± 10 percent of the set reading.

NOTE: The Elcometer Model 106 Adhesion Tester or the SE Micro Corporation Pneumatic Adhesion Tester are suitable testers.

4.2 Adhesive—a high strength solventless adhesive, usually a two-pack epoxy that does not affect the coating properties, for securing the loading fixture to the coating.

4.3 Circular hole cutter—of diameter slightly larger than the diameter of the adhesion tester loading fixture, to cut through the coating to the substrate around the loading fixture.

4.4 Fine abrasive cloth—P220 abrasive cloth, in accordance with AS 1863, to roughen the test surface and promote adhesion of the loading fixture.

4.5 Solvent—an appropriate solvent to clean the surface of the loading fixture.

4.6 Surface temperature measuring device—for field use only, of known accuracy.

5 TEST CONDITIONS The test shall be performed under the routine conditions specified in AS 1580.101.4, unless it is a field test on a surface where it is not practicable to control the environmental conditions. For a field test, the temperature of the test surface shall be noted.

NOTE: Extremes of temperature may influence both the reading from the instrument and the deformation properties of the coating being measured.

6 PREPARATION OF TEST SURFACE The test surface shall be clean, free of foreign matter and, if necessary, be degreased using a suitable degreasing agent which does not attack the coating.

NOTE: The selected test area is to be flat and large enough to accommodate the detaching apparatus. It should not visibly flex during the pull-off test. If the surface is not flat, the adhesion tester should be aligned to apply a force normal to the loading fixture.

7 TEST PROCEDURE The procedure shall be as follows:

- (a) Select an adhesion tester with a detaching assembly having a force calibration spanning the range of expected values.
- (b) Roughen the contact surface of the loading fixture and the paint surface where the loading fixture is to be attached, using the specified grade of abrasive cloth and wipe with a lint-free soft rag to remove any dust.

NOTE: The use of P220 abrasive cloth is usually sufficient.

- (c) Apply the loading fixture to the test specimen, using the adhesive in accordance with the adhesive manufacturer's instructions, taking care to avoid entrainment of air. Remove any excess adhesive and allow the test piece to stand until the adhesive is fully cured.

NOTE: Movement, especially twisting, can cause flaws in the continuity of the adhesive and result in large stress variations when the load is applied to the test area.

- (d) Using the hole cutter, cut the coating around the loading fixture without stressing the joint between the loading fixture and the test surface.
- (e) Carefully connect the central grip of the detaching assembly to the loading fixture without bumping, bending or otherwise stressing the sample. For a non-horizontal surface, the detaching assembly should be manually supported so that its weight does not contribute to the force exerted during the test.
- (f) Align the pull-off tester in accordance with the manufacturer's instructions and set the force indicator to zero.

If shims are needed for fixed alignment devices, report the manner in which they are used.

NOTE: Proper alignment is critical.