

October 12, 2021
ICRI 2021 Fall Convention



Evaluating Adhesion of Concrete Repair and Protection Materials



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Evaluating Adhesion

Objectives

- Identify negative influences on a material's bonding ability
- Introduce common field adhesion and bonding tests
- Learn proper techniques associated with these evaluations
- Understand the significance of results obtained



Evaluating Adhesion



Evaluating Adhesion



Evaluating Adhesion

Influences on Adhesion

- Moisture / Lack of Moisture
- Surface Profile / Texture
- Contamination
- Material Installation
- Incompatibility



Evaluating Adhesion

Influences on Adhesion

- Not enough time for mock-ups
- Not enough time for testing
- Not enough time on the tools
- Vast amount of material technology in the marketplace
- Not enough site information (for example: previous coatings)
- Mis-communication
- Previous Experience “Done it this way for 30 years without fail”



Evaluating Adhesion

Testing Protocols

- Knife tests
 - ASTM D3359
 - ASTM D6677
- Tensile Pull-Off
 - D7234
 - D1583
- Sealant Tests
 - ASTM C1521



Evaluating Adhesion

Industry Accepted Testing

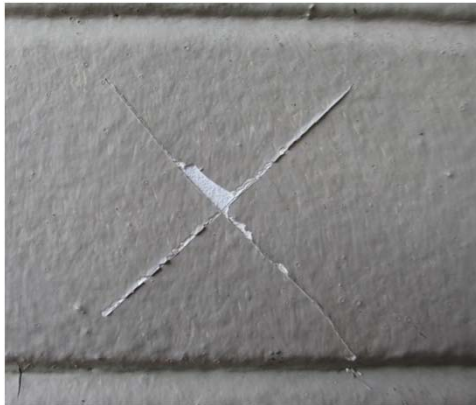
- Slurry Bond Test
 - Epoxy/MMA Based
- Fabric Pull Test
 - Flexible Membranes
 - Jeans to Curtain



Evaluating Adhesion

ASTM D3359

1.2 Test Method A is primarily intended for use at job sites while Test Method B is more suitable for use in the laboratory. Also, Test Method B is not considered suitable for films thicker than 5 mils (125µm).



Method A



Method B

This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

ASTM INTERNATIONAL Designation: D3359 – 17

Standard Test Methods for Rating Adhesion by Tape Test¹

This standard is issued under the fixed designation D3359; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last approval. A superscripted epsilon (ϵ) indicates an editorial change since the last revision or approval.
This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope^{*}

1.1 These test methods cover procedures for assessing the adhesion of relatively ductile coating films to metallic substrates by applying and removing pressure-sensitive tape over cuts made in the film.

1.2 **Test Method A is primarily intended for use in the field while Test Method B is more suitable for use in laboratory or shop environments. Also, Test Method B is not considered suitable for films thicker than 125µm (5 mils) unless wider spaced cuts are employed and there is an explicit agreement between the purchaser and seller.**

1.3 These test methods are used to evaluate whether the adhesion of a coating to a substrate is adequate for the user's application. They do not distinguish between higher levels of adhesion for which more sophisticated methods of measurement are required.

1.4 This test method is similar in content (but not technically equivalent) to ISO 2409.

1.5 In multicoat systems adhesion failure may occur between coats so that the adhesion of the coating system to the substrate is not determined.

1.6 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.7 *This standard does not purport to address the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*²
D609 Practice for Preparation of Cold-Rolled Steel Panels for Testing Paint, Varnish, Conversion Coatings, and Related Coating Products
D823 Practices for Producing Films of Uniform Thickness of Paint, Varnish, and Related Products on Test Panels
D1000 Test Methods for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications
D1730 Practices for Preparation of Aluminum and Aluminum-Alloy Surfaces for Painting
D2092 Guide for Preparation of Zinc-Coated (Galvanized) Steel Surfaces for Painting (Withdrawn 2008)³
D2370 Test Method for Tensile Properties of Organic Coatings
D3330/D3330M Test Method for Peel Adhesion of Pressure-Sensitive Tape
D3924 Specification for Environment for Conditioning and Testing Paint, Varnish, Lacquer, and Related Materials (Withdrawn 2016)⁴
D4060 Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser

2.2 *Other Standards:*
ISO 2409 Paint and Varnishes — Cross-cut test⁵
PSTC 101 International Standard for Peel Adhesion of Pressure Sensitive Tape⁶

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

¹For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.
²The last approved version of this historical standard is referenced on www.astm.org.
³Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10018, http://www.ansi.org.
⁴Available from the Pressure Sensitive Tape Council (PSTC), 1833 Centre Point Circle, Suite 123, Naperville, IL 60563, http://www.pstc.org.
⁵A Summary of Changes section appears at the end of this standard.
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DOI: 10.1533/D3359-17

Evaluating Adhesion

ASTM D3359

- Coatings fully cured
- Razor utility knife to cut a 2" X through the coating
- Adhesive tape is applied across the "X"
- Free end of the tape is removed rapidly at as close to a 180° angle as possible
- Coating removal evaluated according to the supplied table

Method A



Evaluating Adhesion

ASTM D3359

- | | |
|----|--|
| 5A | No peeling or removal, |
| 4A | Trace peeling or removal along incisions or at their intersection, |
| 3A | Jagged removal along incisions up to 1.6 mm ($\frac{1}{16}$ in.) on either side, |
| 2A | Jagged removal along most of incisions up to 3.2 mm ($\frac{1}{8}$ in.) on either side, |
| 1A | Removal from most of the area of the X under the tape, and |
| 0A | Removal beyond the area of the X. |



4A



1A

Evaluating Adhesion

ASTM D3359

Influences

- Temperature
- Rate of cure of coating
- Tape adhesive properties
- Unintended bias
- Confirms that one area

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ASTM D7234

“Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers”



Evaluating Adhesion

ASTM D7234

Process

- Prepare surface
- Prepare dolly
- Adhere dolly with adhesive
- Score perimeter of dolly
- Apply force and document results
- (Coating should cover at least half of the dolly face to be valid)



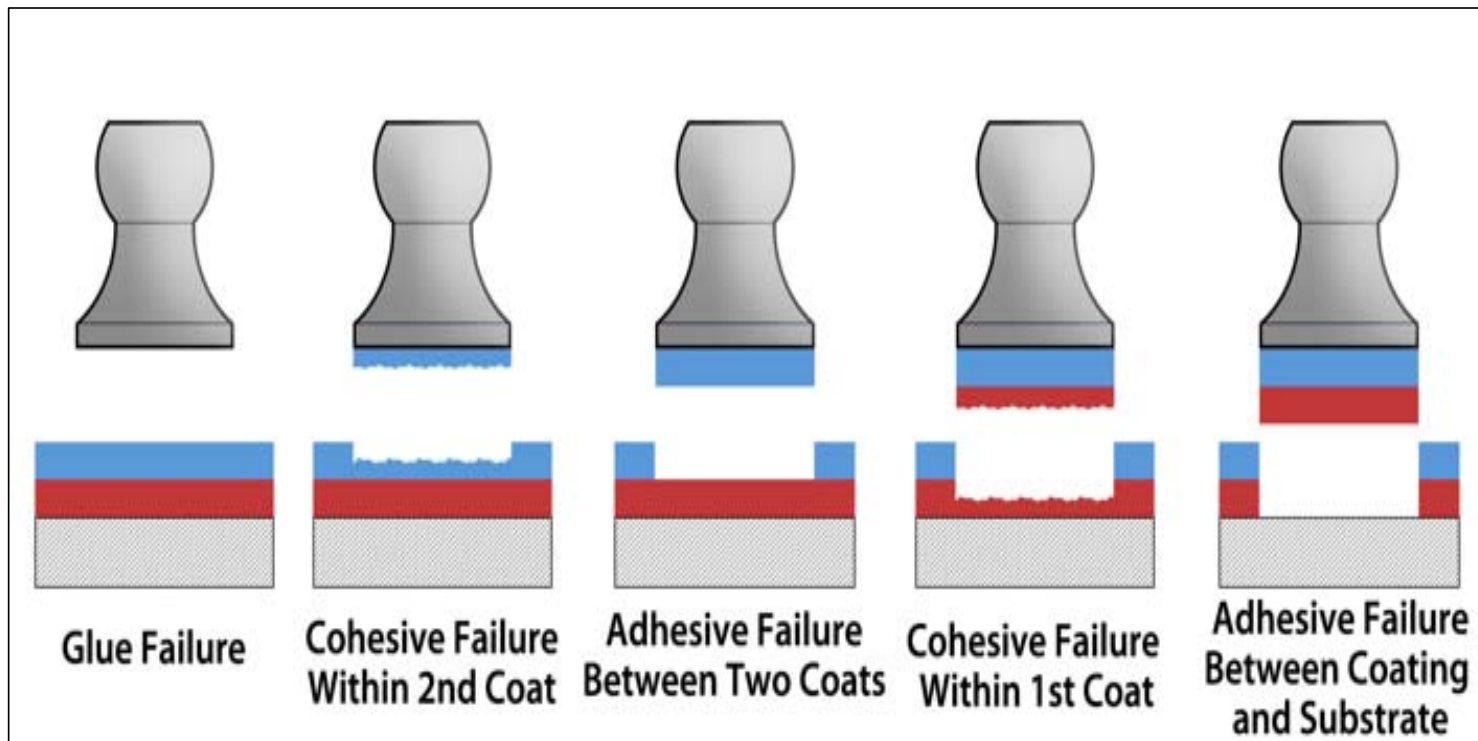
Evaluating Adhesion

ASTM D1583



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ASTM D7234



Evaluating Adhesion

ASTM D7234

Influences

- Temperature
- Rate of cure of coating
- Adhesive properties
- Equipment calibration
- Understanding failure points



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ASTM C1521



Evaluating Adhesion

ASTM C1521



Evaluating Adhesion

Industry Accepted Testing

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Evaluating Adhesion

Why Evaluate Adhesion?



Evaluating Adhesion



Questions?

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