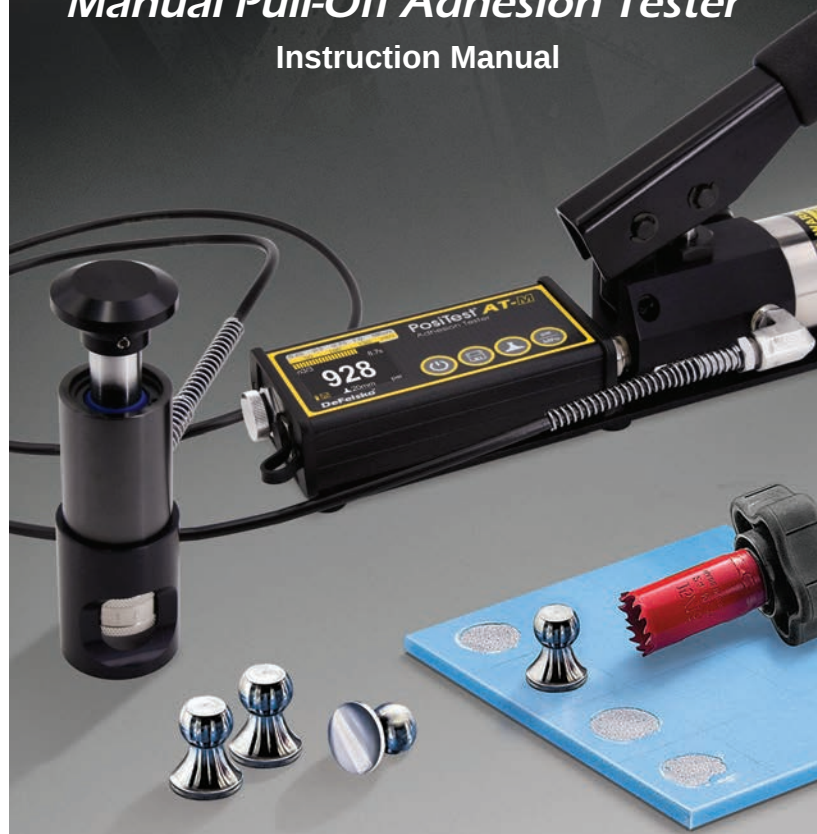


PosiTest[®] **AT-M**

Manual Pull-Off Adhesion Tester
Instruction Manual



DeFelsko[®]
The Measure of Quality

Introduction

The **PosiTest AT-M Pull-Off Adhesion Tester** measures the force required to pull a specified test diameter of coating away from its substrate using hydraulic pressure. Pressure is calculated based on force and test area and represents the coating's strength of adhesion to the substrate.

In accordance with ASTM D4541, D7234, ISO 4624, and others, the **PosiTest AT-M** evaluates the adhesion (pull-off strength) of a coating by determining the greatest tensile pull-off force that it can bear before detaching. Breaking points, demonstrated by fractured surfaces, occur along the weakest plane within the system consisting of the dolly (*loading fixture, stub*), glue, coating layers, and substrate.

Basic Steps to Perform a Pull-Off Test

1. Dolly & Coating Preparation

The dolly and the coating are cleaned and abraded (see below).

2. Glue & Dolly Application

The glue is prepared and applied to the dolly. The dolly is then adhered to the coated surface and the glue is allowed to cure (see pg. 2).

3. Test Area Isolation - *optional*

The test area of the coating is isolated from the area surrounding the dolly by cutting or drilling (see pg. 3).

4. Pull-Off Test

5. Analysis of Test Results

The dolly and the coating are examined and evaluated to determine the nature of the coating failure (see pg. 6).

Dolly & Coating Preparation

Dolly Preparation

1. To remove oxidation and contaminants, place the included abrasive pad on a flat surface and rub the base of the dolly across the pad 4-5 times.
2. As required, remove residue left from the abrading process using a dry cloth or paper towel.

Coating Preparation

1. Lightly roughen the coating using the included abrasive pad. As coating abrasion may introduce flaws, it should only be used when necessary to remove surface contaminants, or when the bond strength between the glue and the coating is insufficient.
2. To promote the bond between the dolly and the coating, degrease the area of the coating to be tested using alcohol or acetone to remove any oil, moisture, or dust.

NOTE: Ensure that any alternative abrasion techniques, degreasers or adhesives do not alter the properties of the coating. Test by applying a small amount of degreaser or glue to a sample area and observing effects.

Glue & Dolly Application

Glue Selection

The glue included in the **PosiTest AT-M** has been selected due to its versatility. This glue has minimal impact on a variety of coatings and has a tensile strength exceeding the maximum performance capabilities of most coatings. Other glues may be preferred based on requirements such as cure time, coating type, working temperature and pull-off strength. Quick curing one-part cyanoacrylates (super glues) may be sufficient for smooth coatings, but two-part epoxies are preferred for porous or rough coatings.

Dolly Application

1. Mix the glue per manufacturer's instructions and apply a uniform film of glue on the base of the dolly.
2. Attach the dolly to the prepared coating test area.

NOTE: If the coated surface to be tested is overhead or vertical, a means to hold the dolly in place during the cure time may be required, i.e. removable tape.

3. Gently push down on the dolly to squeeze out excess adhesive. Do not twist or slide the dolly back and forth on the coating as air bubbles may be generated.

4. Carefully remove excess adhesive from around the edges of the dolly with the included cotton swabs.
5. Allow to cure per the adhesive manufacturer's instructions.

Test Area Isolation

The decision of when to cut around a dolly is dependent on the specified standard, specification or contractual agreement. The primary purpose for cutting through the coating is to isolate a specific diameter test area. When the decision to cut into the coating has been made, it is recommended to cut all the way through to the substrate. As a minimum, it is suggested to carefully cut away any excess glue from the dolly application process. This typically prevents a larger area of coating from being pulled away from the substrate, resulting in a higher pull-off pressure.

Cutting Instructions

1. Cut through the coating around the edges of the dolly with the included cutting tool, removing any excess glue.
2. Clear away any debris from the cutting process.

NOTES:

- Cutting may induce coating surface flaws such as microcracking that may alter test results.
- For coatings with strong lateral bonding, it is recommended to cut completely through the coating down to the substrate.

Drilling Template

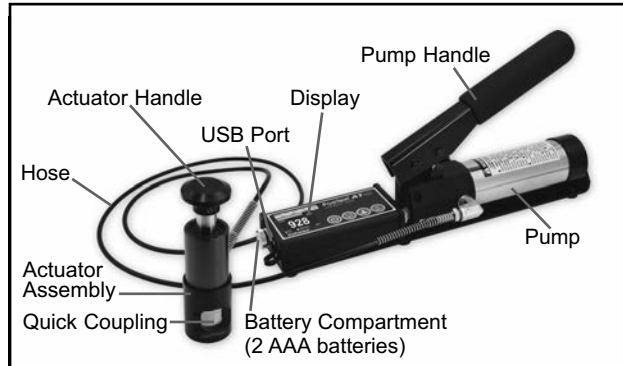
When testing very thick coatings, the optional drilling template accessory may be preferred.

Pull-Off Test

The **PosiTest AT-M** powers-up and displays dashes when the  button is pressed. To preserve battery life, the instrument powers-down after 5 minutes of no activity. Alternatively, press and hold the  button to immediately power-down the instrument.

NOTE: The display will dim slightly after 30 seconds of inactivity. Press any button to brighten the display.





1. Ensure the pressure relief valve is **completely open** (turn counter clockwise). 
2. Push the actuator handle completely down into the actuator assembly. Place the actuator over the dolly head and attach the quick coupling to the dolly by reaching through the holes in the actuator and lifting the coupling. Release the quick coupling when the dolly head is completely engaged.
3. Close the pressure relief valve on the pump **completely** (turn clockwise). 

As required, adjust the dolly size by pressing the  button. Select the pressure units by pressing the  button. The instrument will maintain these settings even after the  button is pressed.

NOTE: The 50 x 50 mm square dolly size is used for testing tile adhesion and should NOT be used when testing with 50 mm round dollies.

4. Zero the instrument **BEFORE** pumping by pressing the  button. This prepares the instrument for the test by clearing the display, and zeroing the instrument. The priming icon  will appear (flashing) on the display indicating the instrument has not achieved priming pressure.
5. Prime the pump slowly until the displayed reading approaches the priming pressure. The priming pressure is the point that the instrument begins calculating and displaying the pull rate (priming icon  will disappear). It is also the pressure at which the ability to store readings is enabled. Priming pressures for the various dolly diameters are:

10 mm	400 psi	2.8 MPa
14 mm	200 psi	1.4 MPa
20 mm	100 psi	0.7 MPa
50 mm	16 psi	0.11 MPa
50 mm x 50 mm	12 psi	0.08 MPa

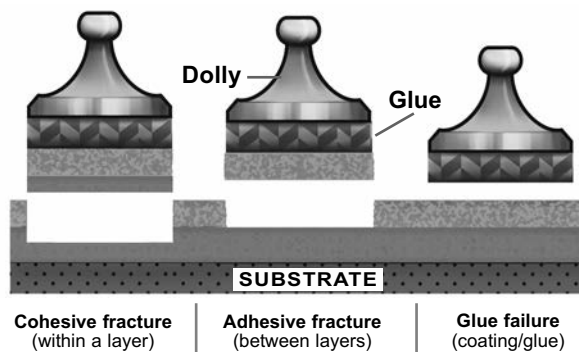
For optimum results, prior to exceeding the priming pressure, return the pump handle to its full upright position and then complete a **single continuous stroke** at the desired pull rate until the actuator separates the dolly from the coating.

6. Open the pressure relief valve and remove the dolly from the actuator assembly.
7. Readings may be stored into memory by pressing the  button (memory storage for up to 200 pulls). Press again to review stored readings. Stored measurements can be accessed using our *PosiSoft Desktop* software (pg. 7).
8. To erase all stored test results from memory, press and hold the  button, then press the  button. The  icon will disappear from the display

Analysis of Test Results

Glue failures typically occur when the glue is improperly mixed (pg. 2) or the coated surface has not been adequately prepared (pg. 2). Upon completion of the pull-off test, the dolly and coated surface should be examined. In addition to pull-off force, many National and International standards such as ASTM D4541 and ISO 4624 require the nature of the fracture to be recorded.

- | | Dolly Face | Coated Surface |
|---|---|--|
| <p>■ Cohesive fracture:
fracture occurs within a coating layer (same coating on dolly face and coated surface).</p> |  |  |
| <p>■ Adhesive fracture:
fracture occurs at the interface between layers (coating on dolly face differs from surface).</p> |  |  |
| <p>■ Glue failure: visible separation of the glue from itself, the coating, or dolly (no coating visible on the dolly face).</p> | | |



Accessing Stored Measurement Data

The **PosiTest AT-M** includes the following free solutions for accessing stored measurements:

PosiSoft Desktop – Connect the instrument to a PC/Mac using the supplied USB cable. Powerful desktop software for downloading, viewing, printing and storing measurement data. Includes a customizable, templated PDF Report Generator. Learn more at

USB Drive – The **PosiTest AT-M** uses a USB mass storage device class which provides users with a simple interface to retrieve stored pull-off measurements in a manner similar to USB flash drives and digital cameras. Access comma-delimited value (.csv) files for simple import into spreadsheets, databases and other 3rd party applications. No software required.

NOTE: When connected to a computer, the USB icon will appear on the display and the instrument will not automatically power down. New pull-off tests cannot be performed until the instrument is disconnected from the computer. 

Calibration and Verification

Calibration

Calibrations are typically performed by the instrument manufacturer or by a certified calibration laboratory in a controlled environment using a documented process. The **PosiTest AT-M** is shipped with a Certificate of Calibration showing traceability to a national standard. For organizations with re-certification requirements, the **PosiTest AT-M** may be returned at regular intervals for calibration. DeFelsko recommends that customers establish calibration intervals based upon their own experience and work environment. Based on product knowledge, data, and customer feedback a one-year calibration interval from the date the instrument was first put into service is a typical starting point.

Verification

The **PosiTest AT Verifier** is available for verifying the accuracy and operation of **PosiTest Adhesion Testers** and is an important component in fulfilling both ISO and in-house quality control requirements. Fully portable with hardshell carry case for use in the field or laboratory. Learn more at: _____

Power Supply

The **PosiTest AT-M** is powered by 2 AAA alkaline batteries which provide up to 16 hours of continuous use. The batteries should be replaced when the battery state indicator is low (flashing red).

Technical Data

Conforms to: ASTM D4541, ASTM D7234, ISO 4624, and others.

Specifications:

Resolution: 1 psi (0.01 MPa)

Accuracy: $\pm 1\%$ Full Scale

Dolly Size (mm)	Max Pull-Off Pressure
10 mm	10,000 psi (70 MPa)
14 mm	6,000 psi (40 MPa)
20 mm	3,000 psi (20 MPa)
50 mm ¹	480 psi (3.3 MPa)
50 x 50 mm ²	375 psi (2.6 MPa)

¹ requires the use of a 50 mm stand off

² requires the use of a 50 x 50 mm stand off

Returning for Service

Before returning the instrument for service, install new or newly recharged AAA batteries in the proper alignment as shown within battery compartment. Re-attempt the pull-off test (pg. 3).

IMPORTANT: If these steps do not resolve the issue and the instrument must be returned for service, please follow the instructions provided at

Limited Warranty, Sole Remedy and Limited Liability

DeFelsko's sole warranty, remedy, and liability are the express limited warranty, remedy, and limited liability that are set forth on its website: _____



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