

# Standard Operating Procedure (SOP)

## PosiTest AT-M Manual

## Pull-off Adhesion Tester



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## 1. Introduction

PosiTest Pull off adhesion tester is a DeFelsko, USA made characterization instrument to quantify the adhesion strength of various coatings to the variety of substrates.

### 1.1. System components:



### 1.2. System Specifications:

- Standards: In accordance to ASTM D 4541, ASTM D 7234, ISO 4624
- Self aligning dolly and the actuator system: enables uniform pull off force
- Measures adhesion strength in terms of MPa and psi
- Measurable adhesion strength : 0.7 MPa (100 psi) to 40 MPa (6000 psi)
- Measurable adhesion strength can be enhanced to 70 MPa (10000 psi)
- Accuracy :  $\pm 1\%$  at full scale (calibrated with NIST certified load cell)
- Resolution: 1 psi (0.01 MPa)
- Display: digital

## 2. Sequential operating procedure

1. Read the instruction manual for PosiTest Pull off adhesion tester **carefully**.
2. Watch the instruction video CD provided with PosiTest system.
3. Select **appropriate** dolly size and adhesive w.r.t. coating-substrate system
4. Clean the dolly by using acetone and remove oxides, contaminants by rubbing the base of the dolly across the abrasive pad **only** 4-5 times in a **specified manner**. Then remove residues from the base by dry cloth or paper towel.
5. Prepare coating surface for the test by cleaning it using alcohol or acetone to remove any moisture, grease or dust. But the coating properties should not be affected.
6. One can use abrasive pad to lightly roughen the coating to improve the bond strength between adhesive and the coating.
7. Apply the appropriate **high** bond strength adhesive on the base of the dolly (~50-100 microns) and attach the dolly to the coating test site.
8. Gently push down on the dolly to squeeze out excess adhesive
9. Carefully remove the excess adhesive from the edges of the dolly base by a cotton swap.
10. Keep the coating bonded with dolly for a period to attain its **maximum** bond strength **as per** adhesive manufacturer's instructions.
11. Now **isolate** the test area under the dolly from remaining area of the coating.
12. Use the **drilling template** corresponding to dolly size to cut through the coating around the edges of the dolly and remove the generated debris.
13. Now the sample is **ready** to apply pull off adhesion test.
14. Ensure the **pressure relief valve** on the pump is completely open (**turn anti-clock wise**)
15. Push the **actuator handle** completely down into the actuator assembly.
16. Place the **actuator assembly** over the dolly head and attach the **quick coupling** to the dolly by lifting the **quick coupling ring** and pushing the actuator assembly down. When dolly head is completely engaged, release the quick coupling ring.
17. **Close** the pressure relief valve **completely** (**turn clockwise**).
18. **Verify** and adjust the dolly size '**dolly**' printed button.
19. **Select** the pressure unit (psi or MPa) by pressing '**psi/MPa**' printed button.
20. The instrument will maintain the adjustments even after the '**Start**' or On/Off printed button is pressed.

21. **Zero** the instrument **before** pumping by pressing the ‘**Start**’ or On/Off printed button. This will prepare the system for the test by **clearing** the display and **zeroing** the instrument.
22. **Pump** slowly until the LCD display reading reaches the **priming pressure**. For example: 20 mm dolly size it is 100 psi (0.7 MPa), 14 mm dolly size it is 200 psi (1.4 MPa).
23. The priming pressure is the point that the instrument begins calculating and displaying the pull rate. Also it is the pressure at which the ability to store the reading is enabled.
24. **Prior** to exceeding the priming pressure, **return** the pump handle to its full upright position and then complete a **single stroke** at a desired pull rate **until** the actuator separates the dolly from the coating.
25. **Open** the pressure relief valve and **remove** the dolly from the actuator assembly in the same way as it was inserted.
26. **Note down** the maximum pull of adhesion strength displaying on the **LCD screen**.
27. Same reading can be stored into memory by pressing the ‘**Memory**’ button.
28. The **PosiTest internal memory** stores maximum pull pressure, pull rate, test duration and dolly size for up to 200 tests.
29. **Press** ‘Memory’ button after completion of a test to store results. The display will show the **pull rate** and alternate between the test number and **maximum pull pressure** for that test. The ‘Save’ icon appears to indicate that there are test results in the memory.
30. **Press** the ‘Memory’ button repeatedly to view previously stored test results. The PosiTest also displays **dolly size** and **pull rate** by pressing their respective buttons.
31. Also, the complete information on all test results can be downloaded to a PC and viewed using the **PosiSoft software**. Test results are not erased from the downloading.
32. **Press** ‘Start’ or On/Off printed button to **exit** viewing mode.
33. To **remove** all stored test results from the memory, **press and hold** the ‘Start’ or On/Off printed button, then **press** the ‘Memory’ button. The ‘Save’ icon will **disappear** from the display.
34. All settings and test results in memory are **retained** during **power shut down**.
35. For **shutting down** the LCD screen, **leave** the system **uninterrupted** for some time and power will shut down **automatically**.
36. Built-in **rechargeable** NiMH battery (~ 60 hrs continuous operations) is used as a power source for the **LCD display** which can be charged using **USB AC power charger**.
37. The ‘**Battery**’ symbol appears when remaining **battery power is below 35%**.
38. The ‘Battery’ symbol will **blink** while **charging** and **disappear** when **fully charged**.
39. The **charging process** will take up to **14 hrs** depending on **remaining power**.

### 3. Do's and Don'ts

1. The sample (substrate with coating) size should be equal or more than the foot print of the actuator assembly.
2. If the substrate is too thin, non-rigid or mechanically weak, then first it should be bonded to some rigid and strong metallic base then only stick the dolly to the sample for adhesion test.
3. The adhesive paste screw caps should be properly closed.
4. Do not twist or slide the dolly on the coating after application of adhesive as air bubbles may get generated and affect the bond strength.
5. Cutting through the coating around the edge of the dolly may induce micro-cracks that may alter the test results. So it should be carefully done.
6. For coating with strong lateral bonding (like metallic coatings) it is recommended to completely cut through the coating down to the substrate.
7. Ensure battery is charged before use.
8. After completion of test, test dollies should be cleaned and made ready for the next use.
9. The cleaning of dolly should be carefully done. Surface of the dolly (especially base and the edges) should not be damaged.
10. While using abrasive pad for cleaning the base of the dolly, apply the pad very lightly and carefully so that the base of the dolly should NOT be affected and remain always perfectly flat.
11. The dollies can be used for hundred of tests. So it should be used till its capacity and don't try to use a new dolly again and again.
12. Only after complete preparation of the samples for the pull off test, take out the adhesion tester from the suitcase and after completing the test, clean it using lint free clothe and immediately put back into the case to keep the system clean, save battery power and avoid conditions to the physical damage of the system.
13. The battery charging status for LCD display should be regularly monitored and get recharged.
14. System should be handled carefully so that it should not get physically damaged. Always use spacious table to put the system components and perform the test.
15. Do not attempt to remove or replace the internal NiMH battery pack. In an unlikely event contact the SO/VENDOR for technical support.