EMIN
Testing & Measuring Everything

Adhesion

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Why Measure Adhesion?

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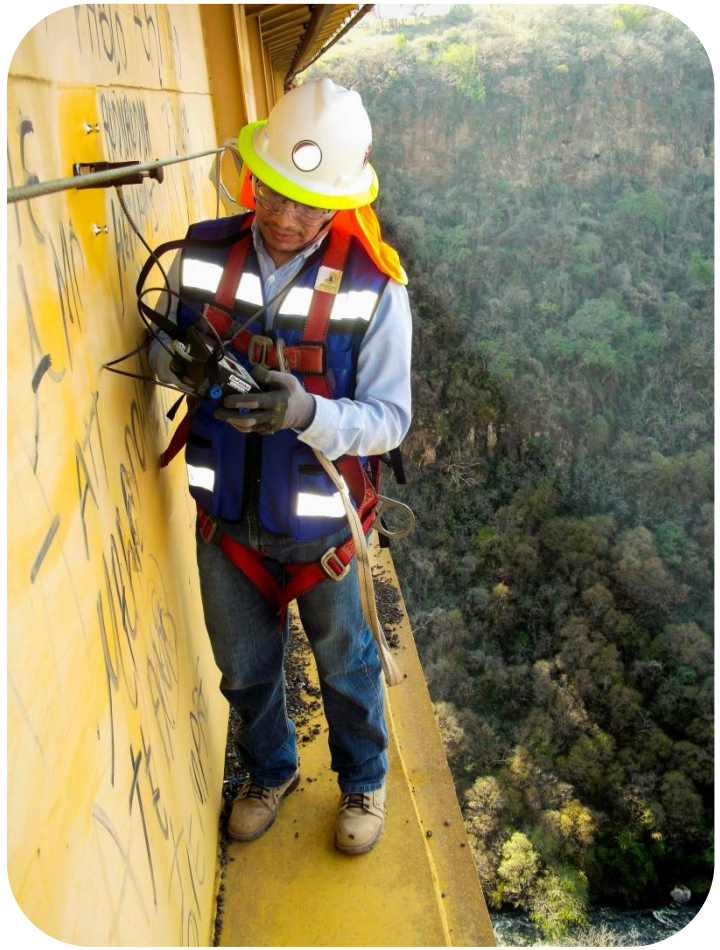
- Adhesion is a key predictor of long term coating performance
- Provides valuable assurance that the coating system has been applied correctly, and is meeting manufacturer's expected performance specifications



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Principle of Operation

Basic principle: A test fixture is adhered to the coating, and force is applied perpendicular to the surface using hydraulic pressure

Five steps to a typical adhesion test

Secure the loading fixture to the coating

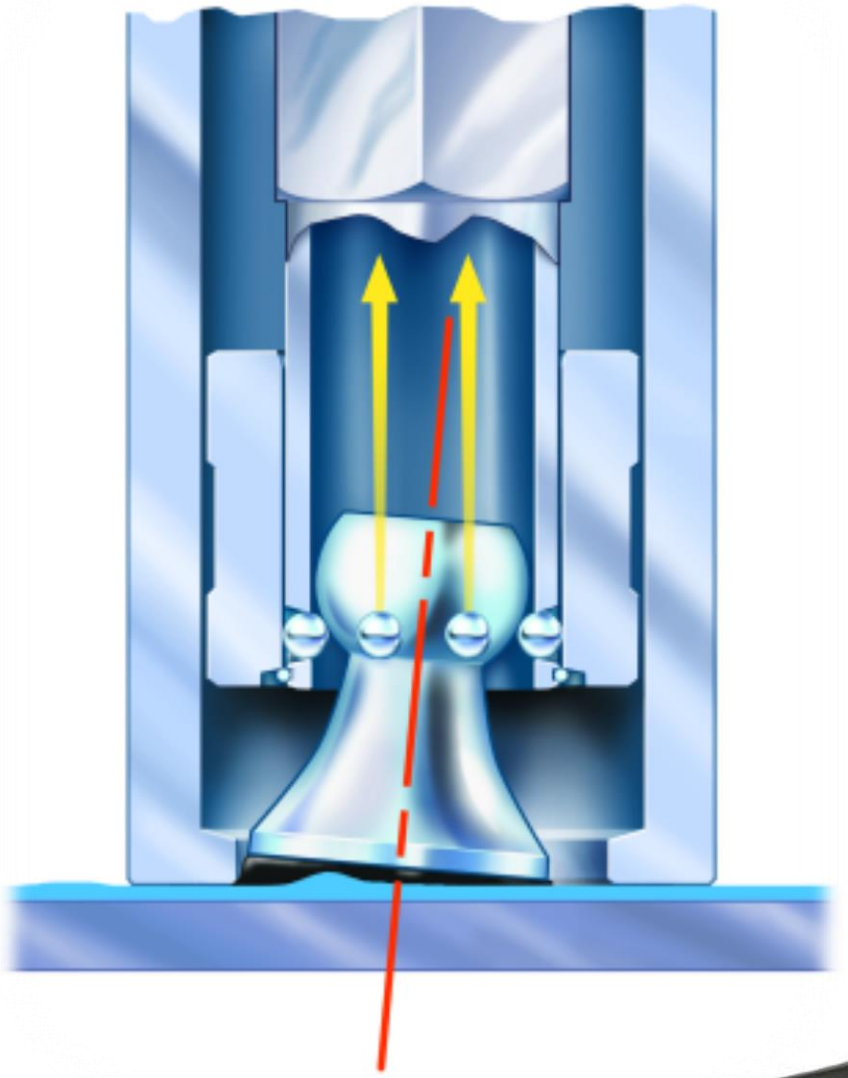
Attach the apparatus to the loading fixture

Slowly and consistently increase the force on the loading fixture, in a direction perpendicular to the surface

Record the force required to pull the loading fixture away from the surface

Qualify the nature of the failure

Not necessarily at the coating-substrate interface



Standards

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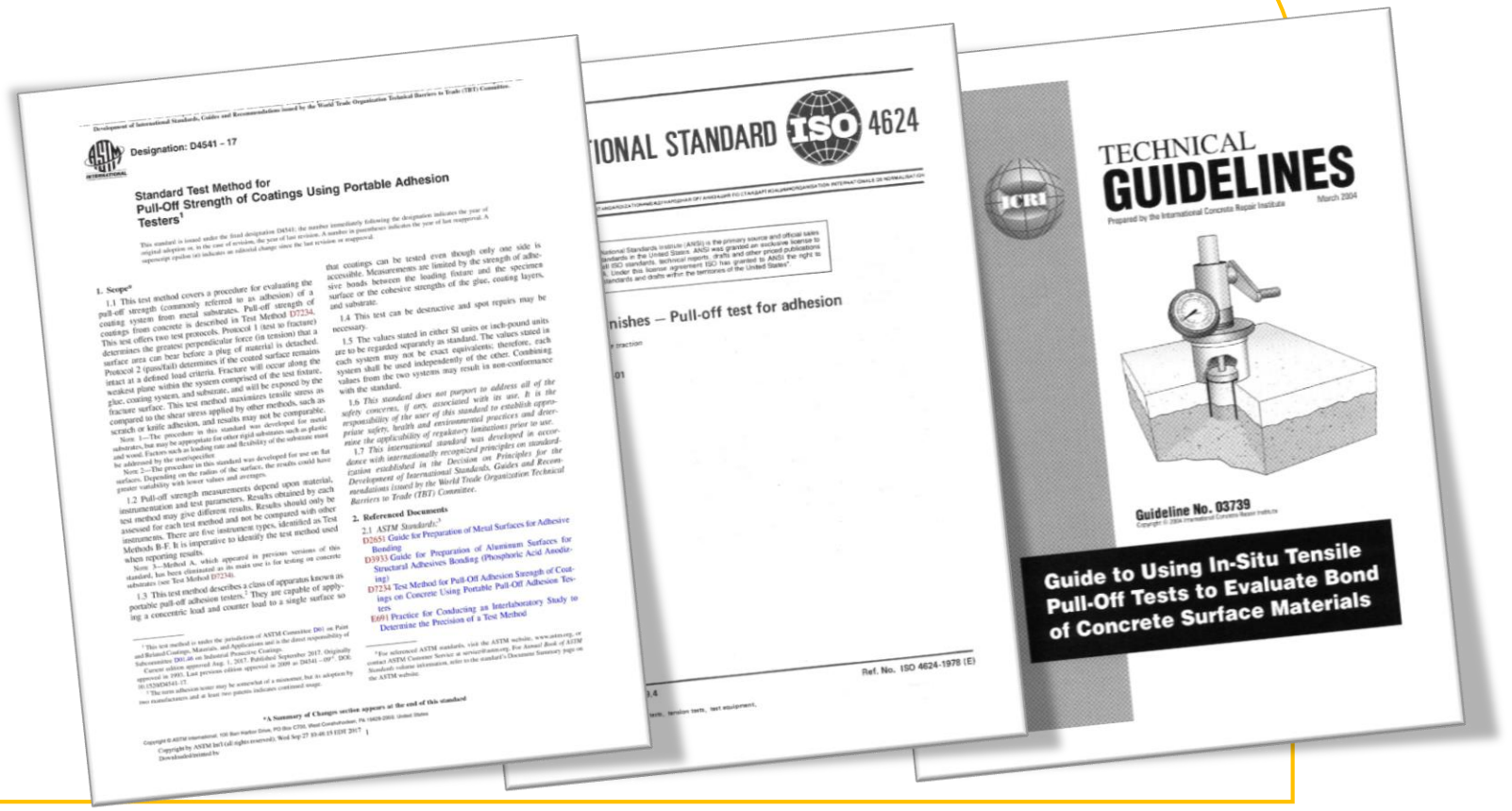
Adhesion testing is described in several international standards, for several applications

ASTM Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers:

The test determines either the greatest perpendicular force that a surface area can bear before a plug of material is detached, or whether the surface remains intact at a prescribed force (pass/fail).

Failure will occur along the weakest plane within the system comprised of the test fixture, adhesive, coating system, and substrate, and will be exposed by the fracture surface.



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Technical Note: Scoring

Scoring isolates the coating directly underneath the dolly, to prevent the surrounding coating from affecting the test

- BUT, the process of scoring can cause stresses and cracks that also affect the test

Some standards require or suggest scoring for some applications

- ASTM D4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers:
  - Scoring is recommended for thicknesses greater than 500 microns (20 mils), and reinforced and elastomeric coatings
- ASTM D7234 Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers
  - Scoring is **required** for thicknesses greater than 500 microns (20 mils), and reinforced and elastomeric coatings
- ISO 4624 Paints and varnishes – Pull-off test for adhesion (2002)
  - Cut “unless otherwise specified or agreed.”

Proven Design

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To validate the performance of various adhesion testing methods, the ASTM D4541 committee performed interlaboratory round-robin testing of screw-type, pneumatic, and hydraulic adhesion testers

The PosiTest AT was found to be far superior to 'screw-type' adhesion testers, and found comparable to more expensive bench-top laboratory instruments

TABLE 4 Adhesion Testing Method E, Pull-Off Strength (*psi*)

Coating	Average $\bar{x}$	Repeatability Standard Deviation sr	Reproducibility Standard Deviation sR	Repeatability Limit r	Reproducibility Limit SR
B	2210	173	215	483	601
C	1120	115	155	321	433
D	2481	361	422	1011	1181
E	2449	173	198	485	555

Coating	Average $\bar{x}$	Repeatability Limit r	Repeatability Limit % of average	Reproducibility Limit R	Reproducibility Limit % of average
B	2210	483	21.9	601	27.2
C	1120	321	28.7	433	38.7
D	2481	1011	40.7	1181	47.6
E	2449	485	19.8	555	22.7
Avg.			27.8		34.1

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Proven Design- Self Alignment

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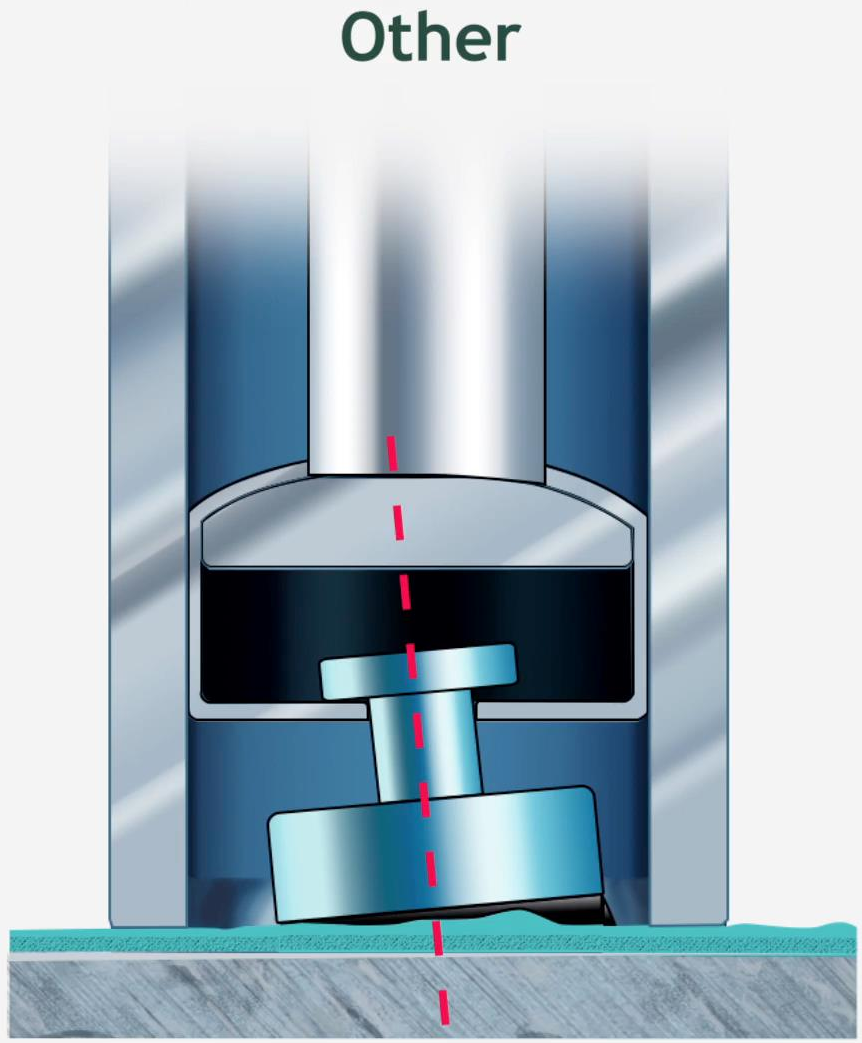
The PosiTector AT series features patented self-aligning technology

- Enables uniform distribution of the pulling force over the surface being tested, preventing a one-sided pull-off.



PosiTest® AT-M – Manual

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- Same accuracy and self-aligning technology as AT-A
- Manual hydraulic pump designed to apply smooth and continuous pressure with a single stroke
- Environmentally sealed- meets or exceeds IP65
- Pull Rate Indicator to manually monitor and adjust the rate of pull
- Internal memory stores maximum pull-off pressure, rate of pull, test duration and dolly size for up to 200 pulls
- Compatible with PosiSoft Desktop for viewing, printing and storing measurement data

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PosiTest® AT-A – Automatic

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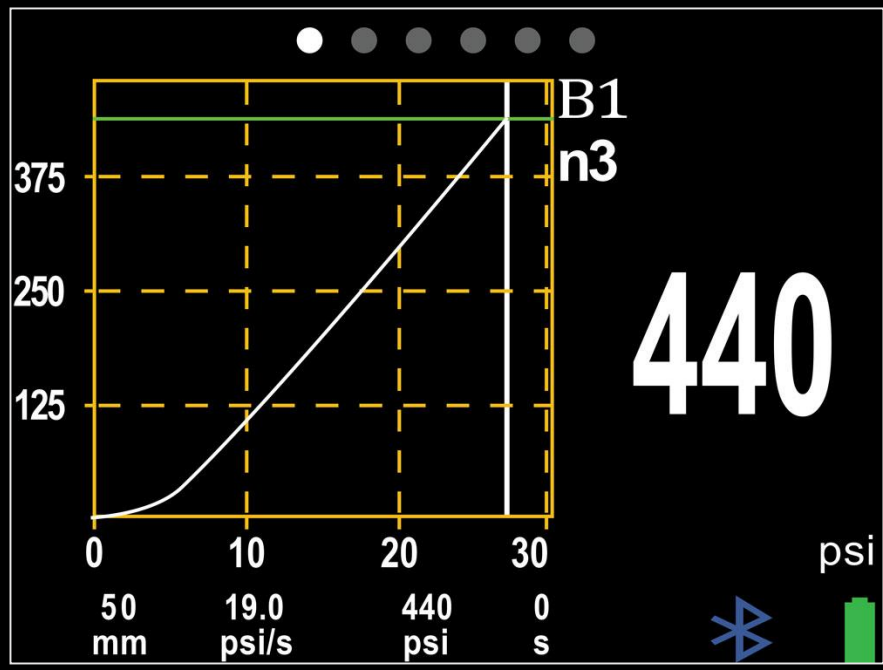
- Electronically controlled hydraulic pump automatically applies smooth and continuous pull-off pressure.
  - ✓ Greatly reduces user effort and the risk of influencing the pulling process
- User adjustable pull rate, pull limit and hold time
- Internal memory stores maximum pull-off pressure, rate of pull, test duration, dolly size, pass/fail, nature of fracture and user notes for 100,000 pulls in up to 1,000 batches
- Impact and scratch resistant color touch screen with keypad for operation with or without gloves
- Environmentally sealed- meets or exceeds IP65
- Compatible with PosiSoft Desktop, PosiSoft.net and PosiTector App (Apple iOS and Android)

PosiTest® AT-A – Key Feature: Touchscreen

- A large, color touchscreen makes data entry and gage operation easier than ever
- A fully redundant touchpad is also available for users wearing gloves



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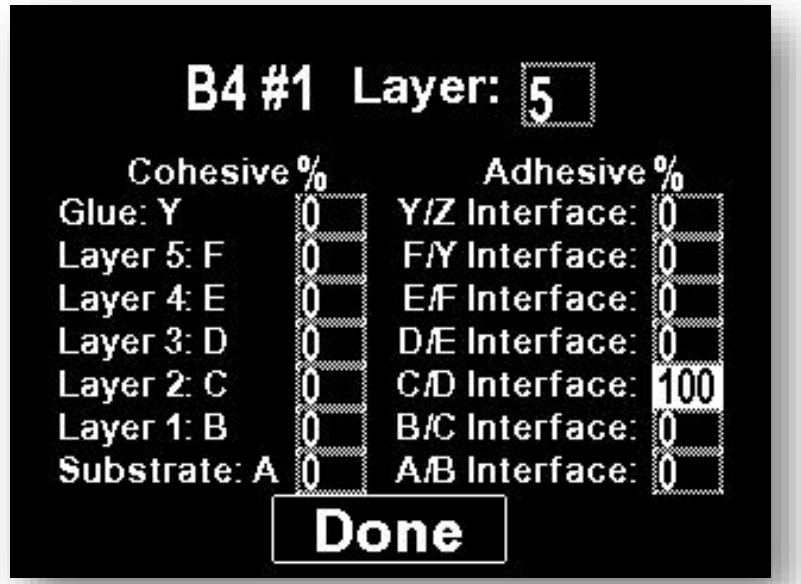
PosiTest® AT-A – Key Feature: Enhanced Memory

Internal memory stores data for up to 100,000 pulls in up to 1,000 batches, including:

- Maximum pull-off pressure
- Rate of pull
- Test Duration
- Dolly Size



- The nature of the fracture for up to 5 layers- cohesive, adhesive, and glue failures
  - ✓ Required by many standards

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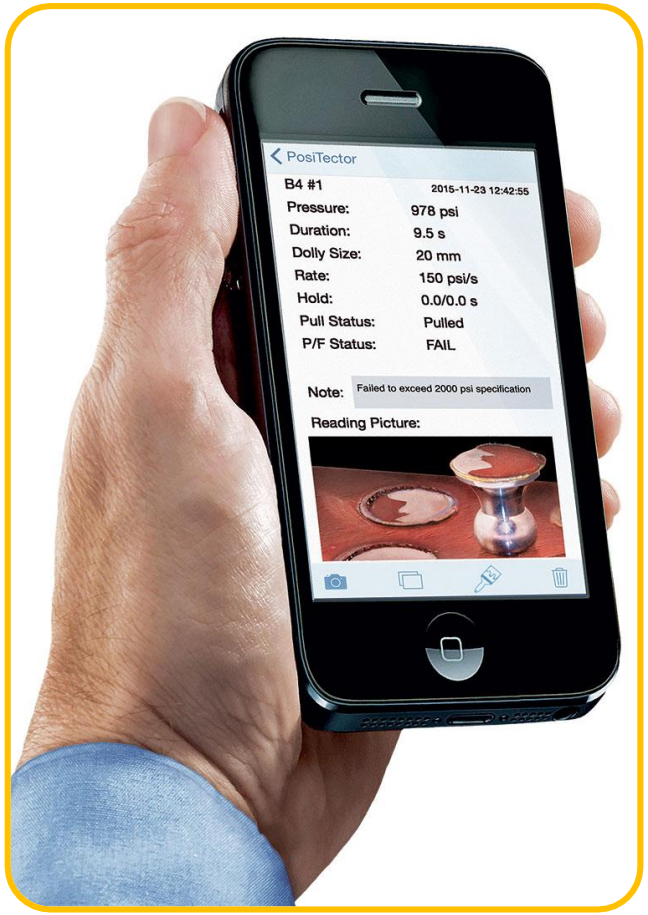
PosiTest® AT-A – Key Feature: PosiTector App



The PosiTest AT-A is compatible with the PosiSoft app- wireless connect to your smart device using our free PosiTector App (iOS and Android)

- Add images and notes using the camera or keyboard
  - ✓ Ideal for photographing the dolly after pulling
- Create customized, professional PDF reports, and email from your smart device
- Share, backup, synchronize and report measurement data
- Auto-pairing Bluetooth (BLE) connection

PosiTest® AT Series Kits

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Each PosiTest AT kit contains everything necessary to start testing, including

- PosiTest AT-M or AT-A Adhesion Tester
- Aluminum test fixtures (20mm or 50mm)
- Abrasive pad
- Cutting tool
- Cotton Swabs
- Instructional booklet and video
- Adhesive kit with mixing sticks & palettes
- Certificate of Calibration
- Sturdy, lightweight carrying case
- Two-year warranty

PosiTest AT-A and AT-M kits are available in various configurations

20mm dollies and standoff for higher bond strengths

- Ideal for most coatings on metals 50mm dollies and standoff for lower bond strengths
- Ideal for most coatings on concrete

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PosiTest® AT Series Kits

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50 mm x 50 mm Tile Conversion Kit

Interchangeable stand-off allows a PosiTest ATM or ATA to pull 50 mm x 50 mm square dollies conforming to BS EN 12004-2. Ideal for cementitious adhesive for tiles.

50 mm C1583 Conversion Kit

Interchangeable stand-off allows a PosiTest ATM or ATA to pull 50 mm dollies conforming to ASTM C1583. Ideal for concrete surfaces and overlays.

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PosiTest® AT Series Accessories

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- Conversion kits to swap between 20mm and 50mm models
- Additional adhesive kits, including mixing sticks, palettes, and cotton swabs

- Additional supplies of 20mm and 50mm loading fixtures
  - ✓ 10mm and 14mm dollies available for high bond strengths (compatible with 20mm kit)
  - ✓ Bulk sizes available- 100 packs (10mm, 14mm, 20mm) and 50 packs (50mm)

PosiTest® AT Verifier

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Verify accuracy of PosiTest AT-M and AT-A models, and issue certificates of accuracy

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