



® Management Procedure 2571
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Calibration Procedure

DeFelsko Corporation

PosiTest ATA, ATA20A-B, ATA50A-B, ATM, ATM20A, and ATM50A

Pull-Off Adhesion Tester

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1 Introduction and UUC Performance Requirements

1.1 This procedure describes the calibration of DeFelsko Corporation PosiTest ATM and ATA Pull-Off Adhesion Testers with the following specifications:

Table 1-1 Measurement Ranges

Unit	Measurement Range
PosiTest ATA20A-B & ATA50A-B	3500 Psi Max.* (24 MPa Max.)
PosiTest ATA, ATM, ATM20A & ATM50A	3000 Psi Max.* (20 MPa Max.)

* when using 20mm dolly

1.2 The unit being calibrated will be referred to as the UUC (Unit-Under-Calibration).

2 Measurement Standards and Support Equipment Performance Requirements

2.1 The UUC accuracy requirements are based upon the published UUC performance specifications.

2.2 The test uncertainty ratio applied in this Calibration Procedure is 4:1 unless otherwise stated.

2.3 The Minimum-Use-Specifications are the minimum test equipment specifications required to meet all the UUC accuracy requirements and the test uncertainty ratio applied.

Table 2-1 UUC Accuracy Requirements and Description

UUC	Performance Specifications		Test Method
PosiTest ATA20A-B & ATA50A-B	3500 Psi Max. (24 MPa Max.)	± 1% of Full Scale	Load Cell
PosiTest ATA, ATM, ATM20A & ATM50A	3000 Psi Max. (20 MPa Max.)	± 1% of Full Scale	Load Cell

Table 2-2 Minimum Use Specification

UUC	Range	Accuracy
PosiTest ATA20A-B & ATA50A-B	3500 Psi Max. (24 MPa Max.)	± 8.75 Psi (± 0.06 MPa)
PosiTest ATA, ATM, ATM20A & ATM50A	0 – 3000 Psi (0 – 20 MPa)	± 7.5 Psi (± 0.05 MPa)

Table 2-3 Actual Equipment Specification

Equipment Generic Name	Range	Accuracy	Manufacturer / Model #'s Applicable
Load Cell and Display	0 – 10269 Psi (0 – 70 MPa)	± 6.53 Psi* (± 0.04 MPa)	Transducer Techniques Smart Sensor Indicator (SSI) and SB0-5K load cell

*See section 2.4 for determination of system accuracy

Caution: The instructions in this Calibration Procedure relate specifically to the equipment and conditions listed in Section 2. If other equipment is substituted, the information and instructions must be interpreted accordingly.

Table 2-4 Calibration Environmental and Warm-Up Requirements

Measurement Standards & Support Equipment Environmental Requirements:	Temperature: $23 \pm 5^\circ$ C. Relative Humidity: Less than 95%
Measurement Standards & Support Equipment Warm-up and Stabilization Requirements:	Not Required

2.4 The uncertainty of the load cell and display is determined in the following manner:

2.4.1 Manufacturer’s specifications for the maximum errors of the load cell are:

Non-linearity: 0.05 % FS (full scale)

Non-repeatability: 0.03 % FS

Hysteresis: 0.02 % FS

Full scale on the load cell is 5000 lbs and applying the surface area of the 20mm dolly (0.4869 in^2) this is equivalent to 10269 psi. With the 10269 psi FS value the load cell Non-linearity, Non-repeatability and Hysteresis errors become 5.1345, 3.0807 and 2.0538 psi respectively.

2.5 The error contributed to the measurement system by the SSI is determined as follows:

2.5.1 The manufacturer’s calibration certificate indicates the load cell output when increasing in tension at 2500 lbs. This value varies for each load cell and is typically 1.5724 mV/V. The system uses a 3.0 V excitation so $3.0 \text{ V} \times 1.5724 \text{ mV/V} = 4.7172 \text{ V}$ at 2500 lbs.

2.5.2 Using the 20mm dolly surface area of 0.4869 in^2 and dividing the load, 2500 lbs, by the dolly surface area yields 5134 psi.

2.5.3 Therefore we have 5134 psi at 4.7172 V or 1088.3575 psi/V.

2.5.4 The SSI has a published accuracy of $\pm 0.0015 \text{ V}$ at 25°C . So $1088.3575 \text{ psi/V} \times 0.0015 \text{ V} = \pm 1.6325 \text{ psi}$.

- 2.6 Performing a sum of squares on the system to determine the combined uncertainty yields:

$$\begin{aligned} & \pm (\text{SSI}^2 + \text{Non-linearity}^2 + \text{Non-repeatability}^2 + \text{Hysteresis}^2)^{1/2} \\ & \pm (1.6325^2 + 5.1345^2 + 3.0807^2 + 2.0538^2)^{1/2} \\ & \pm (42.7369)^{1/2} \\ & \pm 6.5373 \text{ psi} \end{aligned}$$

3 Preliminary Operations

Note: Review the entire document before starting the calibration process.

3.1 Visual Inspection

3.1.1 Visually inspect the UUC for:

- damage to LCD readout, keypad, hose, enclosure, or quick disconnect coupling
- missing USB and/or power port covers
- proper identification

3.1.2 Damage or excess wear shall be repaired prior to beginning the calibration process.

3.2 Attach the quick disconnect from the UUC to the load cell dolly and ensure that there is no tension on the dolly and that the actuator is loose on the dolly. Zero the load cell by cycling the power to the SSI display unit. Press the Peak button on the SSI display to engage Peak reading mode. Make sure that the “FAST”, “Peak”, and “PSI” are all displayed on the SSI display unit.

3.3 Review the Performance Requirements Table 7-1.

3.4 For ATM, ATM20A, and ATM50A, perform the calibration steps in Section 4. For ATA, perform the calibration steps in Section 5. For ATA20A-B and ATA50A-B, perform the calibration steps in Section 6.

4 ATM, ATM20A, and ATM50A Calibration Process

Note: Whenever the test requirement is not met, verify the results of each test and take corrective action before proceeding.

- 4.1 Press the green button on the UUC twice, the gage will turn on and then display zero.
- 4.2 Press the dolly button until “20” is displayed.
- 4.3 Press the “psi/MPA” button until “psi” is displayed.
- 4.4 Turn the pressure release knob clockwise to close the valve.
- 4.5 Pump the handle a couple of times until the slack comes out of the quick disconnect/dolly assembly.
- 4.6 Pump at an even rate until the value displayed on the UUC approaches 500 +/-75 psi. As you approach the target value slow the rate of pressure until the value displayed on the UUC is within the range shown in Figure 4-1.
 - 4.6.1 If you overshoot the target value you will need to turn the pressure release knob counter-clockwise to release all pressure and then return it to the closed position. Cycle the power on the SSI display unit to zero the load cell. Put the display unit back into Peak mode and retest the calibration point.

Figure 4-1

UUC target value (psi)		
Minimum	Nominal	Maximum
425	500	575
925	1000	1075
1425	1500	1575
1925	2000	2075
2425	2500	2575
2925	3000	3075

- 4.7 Record both the Target (load cell display) and Test Reading (UUC) values.
- 4.8 Repeat Steps 4.5-4.7 for the remaining UUC target values shown in Figure 4-1.
- 4.9 Release the pressure in the UUC by fully rotating the knob counter-clockwise and then remove the UUC actuator from the load cell.
- 4.10 Determine the allowed range of readings for the UUC using the calculation methods shown in Table 7-1.

5. ATA Calibration Process

Note: Whenever the test requirement is not met, verify the results of each test and take corrective action before proceeding.

- 5.1 Press the green button on the UUC twice, the gage will turn on and then display zero.
- 5.2 Press the dolly button until “20” is displayed.
- 5.3 Press the “psi/MPA” button until “psi” is displayed.
- 5.4 Press the rate button until “100” is displayed.
- 5.5 Press the green start button on the UUC and let the unit build pressure until the value displayed on the UUC approaches 500 +/-75 psi. Press the red stop button once the UUC is at the nominal reading shown in Figure 5-1. The pressure will be released from the unit and the peak value will be displayed.
- 5.5.1 If you overshoot the target value you will need to press the red stop button and wait for the UUC to stop retracting. Cycle the power on the SSI display unit to zero the load cell. Put the display unit back into Peak mode and retest the calibration point.

Figure 5-1

UUC target value (psi)		
Minimum	Nominal	Maximum
425	500	575
925	1000	1075
1425	1500	1575
1925	2000	2075
2425	2500	2575
2925	3000	----*

*Unit stops automatically at 3,000 psi.

- 5.6 Record both the Target (load cell display) and Test Reading (UUC) values. Cycle the power on the SSI display to zero the load cell after reading the value. Put it back into Peak mode.
- 5.7 Repeat Steps 5.5 and 5.6 for the remaining UUC target values in Figure 5-1 as displayed on the UUC display.
- 5.8 Remove the UUC actuator from the load cell.
- 5.9 Determine the allowed range of readings for the UUC using the calculation methods shown in Table 7-1.

6. ATA20A-B and ATA50A-B Calibration Process

Note: Whenever the test requirement is not met, verify the results of each test and take corrective action before proceeding.

- 6.1 Turn the UUC on by pressing the green button once.
- 6.2 Use the “Pull Parameters” menu option to set the Dolly Size to 20mm, the Pull Rate to 100 psi, and the Hold Time to 0 seconds.
- 6.3 Press the green start button on the UUC and let the unit build pressure until the value displayed on the UUC approaches 500 +/-75 psi. Press the red stop button once the UUC is at the nominal reading shown in Figure 6-1. The pressure will be released from the unit and the peak value will be displayed.
 - 6.3.1 If you overshoot the target value you will need to press the red stop button and wait for the UUC to stop retracting. Cycle the power on the SSI display unit to zero the load cell. Put the display unit back into Peak mode and retest the calibration point.

Figure 6-1

UUC target value (psi)		
Minimum	Nominal	Maximum
425	500	575
925	1000	1075
1425	1500	1575
1925	2000	2075
2425	2500	2575
2925	3000	3075
3425	3500	----*

*Unit stops automatically at 3,500 psi.

- 6.4 Record both the Target (load cell display) and Test Reading (UUC) values. Cycle the power on the SSI display to zero the load cell after reading the value. Put it back into Peak mode.
- 6.5 Repeat Steps 6.3 and 6.4 for the remaining UUC target values in Figure 6-1 as displayed on the UUC display.
- 6.6 Remove the UUC actuator from the load cell.
- 6.7 Determine the allowed range of readings for the UUC using the calculation methods shown in Table 7-1.

7. Performance Requirements

Table 7-1
Performance Requirements and Calibration Data for PosiTest
ATA, ATA20A-B, ATA50A-B, ATM, ATM20A, and ATM50A

Target Load Cell Value (psi)	Min. Reading Allowed ^❶ (psi)	Test Reading (UUC) (psi)	Max. Reading Allowed ^❷ (psi)
A			

❶ Calculation $(A - 35)$. Round up to the nearest 1 Psi increment (ATA20A-B and ATA50A-B Only)
 Calculation $(A - 30)$. Round up to the nearest 1 Psi increment (All others)

❷ Calculation $(A + 35)$. Round down to the nearest 1 Psi increment (ATA20A-B and ATA50A-B Only)
 Calculation $(A + 30)$. Round down to the nearest 1 Psi increment. (All others)

Management Procedure Change Notice

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Title: ATA, ATA20A-B, ATA50A-B, ATM, ATM20A, and ATM50A Calibration

Reason for Change: <ul style="list-style-type: none">• New product type and changes to the product codes
Description of Change: <ul style="list-style-type: none">• Rewrote relevant sections to include the new products and the new codes.• Added Section 6 to cover the new ATA-B• Removed the silicone application as it is now done at a later stage

I confirm I have read and understand the procedure and the change described above.

Printed Name	Signature	Date

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