

Calibration Procedure

DeFelsko Corporation

CAL-P# and STDP#

Polystyrene Blocks

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1 Introduction and UUC Performance Requirements

1.1 This procedure describes the calibration of Polystyrene Blocks. These standards have the following specifications:

Table 1-1 Thickness Ranges

Material	Measurement Range
Polystyrene	0.38 – 19 mm 15 - 750 mils

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) Function	Range	Accuracy	Test Method
Standard Thickness	0.38 – 2.5 mm (15 – 100 mils)	± 13.25 microns (± 0.52 mils)	Indicator
	> 2.5 mm – 6.5 mm (>100 – 250 mils)	± 77.03 microns (± 3.04 mils)	
	> 6.5 mm (>250 mils)	± 197 microns (± 7.75 mils)	

Table 2-2 Minimum Use Specification

Range	Accuracy
0.38 - 19 mm (15 - 750 mils)	± 3.31 microns (± 0.13 mils)

Table 2-3 Actual Equipment Specification

Equipment Generic Name	Range	Accuracy	Manufacturer/Model #'s Applicable
Digital Indicator	0 – 25.4 mm (0 – 1")	± 2 microns (± 0.08 mils)	Brown & Sharpe Digit-Dial Plus

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: $23 \pm 5^{\circ} \text{C}$. Relative Humidity: Less than 95%
Measurement Standards & Support Equipment Warm-up and Stabilization Requirements:	None

3 Preliminary Operations

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

3.1 Visually inspect the UUC for:

- wear
- gouges or nicks
- proper identification

3.2 Damaged or excessively worn blocks shall be discarded and replaced.

3.3 When preparing new sets follow the steps in Section 4. For the periodic calibration of existing sets follow the steps in Section 5.

3.4 Verify rectangular blocks have been labeled with the ultrasonic transit by production. Square blocks will not have this label.

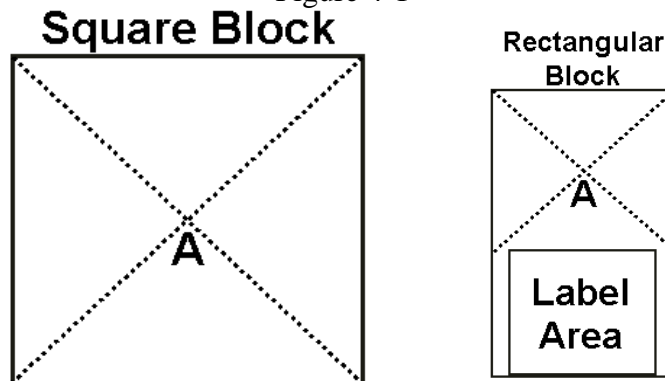
3.5 Ensure the indicator has been properly zeroed.

4 Calibration Process for New Blocks

4.1 Make sure the block and gage surfaces are clean then take five measurements of the block using the indicator. **Do not touch the block with your fingers while measuring it because it will change the readings.** Express all readings in microns. Convert from millimeters to microns by multiplying by 1000.

Note: In making readings the probe tip shall be centered on point A of the block as shown below.

Figure 4-1



- 4.2 Determine the average of these readings and round the reading to the nearest micron (0.001mm).
- 4.3 For rectangular blocks record the thickness value on the Standard Label as shown below. Square blocks will be engraved with the measurement, in millimeters, so record the value on a temporary label and apply it to the measured side of the block.

Figure 4-2



- 4.4 Calculate the thickness value in mils by dividing the micron value by the constant 25.4 (1 mil = 25.4 microns) and round to the nearest 0.05 mils. Enter the mil value on the label in the proper location.
- 4.5 Sound Velocity Constant (not required for square blocks)
- 4.5.1 Calculate the Sound Velocity Constant using the equation:

$$SoundVelocity = \left(\frac{2T}{\Delta t} \right)$$

Where: T = Thickness measurement in mils
 Δt = time measurement, in microseconds (previously recorded on the standard).

Note: New blocks have the time measurement on a small label placed at the opposite end from where the readings were taken.

- 4.5.2 Round off the result of the calculation to two places to the right of the decimal (For example 83.56). Enter the value for v_s in the appropriate block on the label.
- 4.5.3 Remove the small label with the time measurement from the standard. Replace with the newly created DeFelsko Standard label.

Note: Be sure to place the new label at the correct end of the standard (the one opposite where the readings were taken).

- 4.6 Square blocks are engraved with the serial number on one line and the thickness in mils and mm on a second line.

Figure 4-3



- 4.7 Repeat steps 4.1 through 4.6 for each of the blocks in the new set.
- 4.8 The record the serial number, sound velocity constant (if applicable) and average thickness values in microns (or mm) and mils on the Calibration Certificate.
- 5 Re-Certification of Blocks
 - 5.1 In column A of table 6-1 record the thickness reading in microns (or millimeters) indicated on the label of the block.
 - 5.2 Make sure the block and gage surfaces are clean then take five measurements of the block in microns (or millimeters) using the indicator and record the values in column B of Table 6-1. **Do not touch the block with your fingers while measuring it because it will change the readings.**

Note: In making readings the probe tip shall be centered on point A of the block as shown in Figure 4-1.

 - 5.3 Determine the average of the five readings and round to the nearest micron (0.001mm). Enter this value in column C of table 6-1.
 - 5.4 Refer to the Performance Requirements Table 6-1 for the UUC being calibrated. Verify that the average readings are within the allowable limits shown in columns D and E. If any one of the individual blocks is no longer within tolerance, the block may either be replaced or the DeFelsko Standard label can be replaced with updated information. If replacing the label, use the existing reading for the Sound Velocity Constant and make new measurements of the thickness.

Note: When a block is replaced or updated, the serial number will change. The customer shall be advised of this prior to the change. Be sure to put the new serial number on the Calibration Certificate.

5.5 Record the serial number, sound velocity constant (if applicable) and average thickness values in microns (or mm) and mils on the Calibration Certificate.

6 Performance Requirements

Note: The technician shall collect the data needed to complete column B of the table below. Do not write in this procedure.

Table 6-1 Performance Requirements and Calibration Data for Re-Certified Blocks

Thickness on UUC Label (microns)	Individual Readings (microns)					Average (microns)	Min. Reading Allowed ^① (microns)	Max. Reading Allowed ^② (microns)
A	B					C	D	E

*For imperial readings convert using 1 mil = 25.4 microns.

① Calculation: (A times 0.9995) – 2.5. Round up to the nearest micron.

② Calculation: (A times 1.0005) + 2.5. Round down to the nearest micron.

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