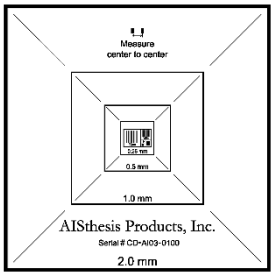
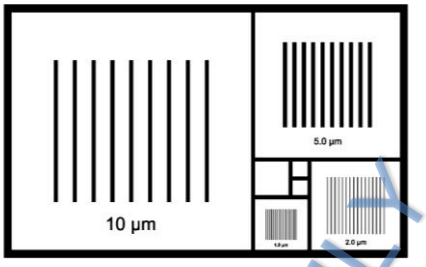
AISthesis Products
Advanced Imaging Products for Nanotechnology, Engineering and Life Sciences
PO Box 1950, Clyde NC 28721

ACCREDITED CERT #4904.01

Certificate of Calibration for Pelcotec™ Critical Dimension Magnification Standard





Product Number: **Pelcotec™** 695-1 CDMS-1C-ISO

Product Description: 2.5x2.5mm, **Pelcotec™** 2mm-1µm Critical Dimension Magnification Standard

Product Serial Number: CD-AI03-1234

As Received Condition: New

As Returned Condition: N/A

Date of Receipt: N/A

Customer name and contact information:

TED PELLA, INC.
Microscopy Products for Science and Industry

P.O. Box 492477
Redding, CA 96049-2477
Tel: 530.243.2200
www.tedpella.com

The accuracy of this product with Serial Number CD-AI03-0918 was determined using a Field Emission Scanning Electron Microscope (FE-SEM) by reference comparison to working standards traceable to the National Institute of Standards and Technology (NIST), using methods in CP 01 FE-SEM Imaging of Critical Dimension Magnification Standards (CDMS) and CP 02 Certification of Critical Dimension Magnification Standards. The data applies only to the CDMS identified in this report. All results are "as-is". Repair and/or adjustments are not possible.

Below are the ISO 17025:2017 compliant Certified 10 µm Pitch Measurements unique to Serial Number CD-AI03-1234 and traceable to NIST Certified Standard CD-PG01-0211.

Line	ISO 17025:2017 Compliant Certified Pitch	Position of Measurement
0-10 µm	10.004 µm	± 7.5 µm from center
10-20 µm	10.000 µm	± 7.5 µm from center
20-30 µm	10.002 µm	± 7.5 µm from center
30-40 µm	10.002 µm	± 7.5 µm from center
40-50 µm	10.004 µm	± 7.5 µm from center
50-60 µm	10.000 µm	± 7.5 µm from center
60-70 µm	10.004 µm	± 7.5 µm from center
70-80 µm	10.002 µm	± 7.5 µm from center
Sum	*80.018 µm*	

Average	10.0023 µm
2-Sigma *	0.0042 µm

* Corrected for sample size using the appropriate Student t-factor.

Measurements are reported with an uncertainty (k=2)** of ± 0.012 µm. Statements of Conformity are not provided in this report. Review the results and verify that they meet the requirements for the intended use. Physical damage to or contamination of the CDMS occurring after calibration may invalidate the reported measurements. Use this product at 25ºC ± 5ºC and at less than 80% RH.

** Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2. The reported expanded measurement uncertainty is stated as the standard measurement uncertainty multiplied by the coverage factor K such that the coverage probability corresponds to approximately 95%.

Line	Number of Lines	Position of Measurement	Non-ISO 17025:2017 Compliant Measured Distance (first to last line)	Average Pitch
2.0 mm	2	± 1.00mm from center	2.000 mm	2.000 mm
1.0 mm	2	± 0.5mm from center	1.000 mm	1.000 mm
0.5 mm	2	± 0.25mm from center	0.500 mm	0.500 mm
0.25 mm	2	± 0.125mm from center	0.250 mm	0.250 mm
5.0 µm	12	± 20 µm from center	55.057 µm	5.005 µm
2.0 µm	16	± 10 µm from center	30.051 µm	2.001 µm
1.0 µm	17	± 5 µm from center	16.033 µm	1.002 µm

The average pitch is derived from the stated length that was determined using measurements (taken center-to-center) over the stated number of lines (i.e., length divided by the number of lines minus one).

Date of Analysis: January 29th, 2023

Equipment used:

Instrument	Model	Serial #	Resolution	Repeatability	Temperature	Humidity	Ref.
FE-SEM	FEI Verios 460L	9922551	0.9nm	0.030%	22.7 ± 0.3 °C	34.5 ± 1.5%	CD-PG01-0211

Location: Analytical Instrumentation Facility, NC State University, Raleigh NC 27695-7531.

Notes:

D.S. Finch
Certified by

Signature

H. Haehlen
Authorized by

Signature

January 29th, 2023
Date report issued.

Non-ISO 17025:2017 Compliant Supplemental Material.

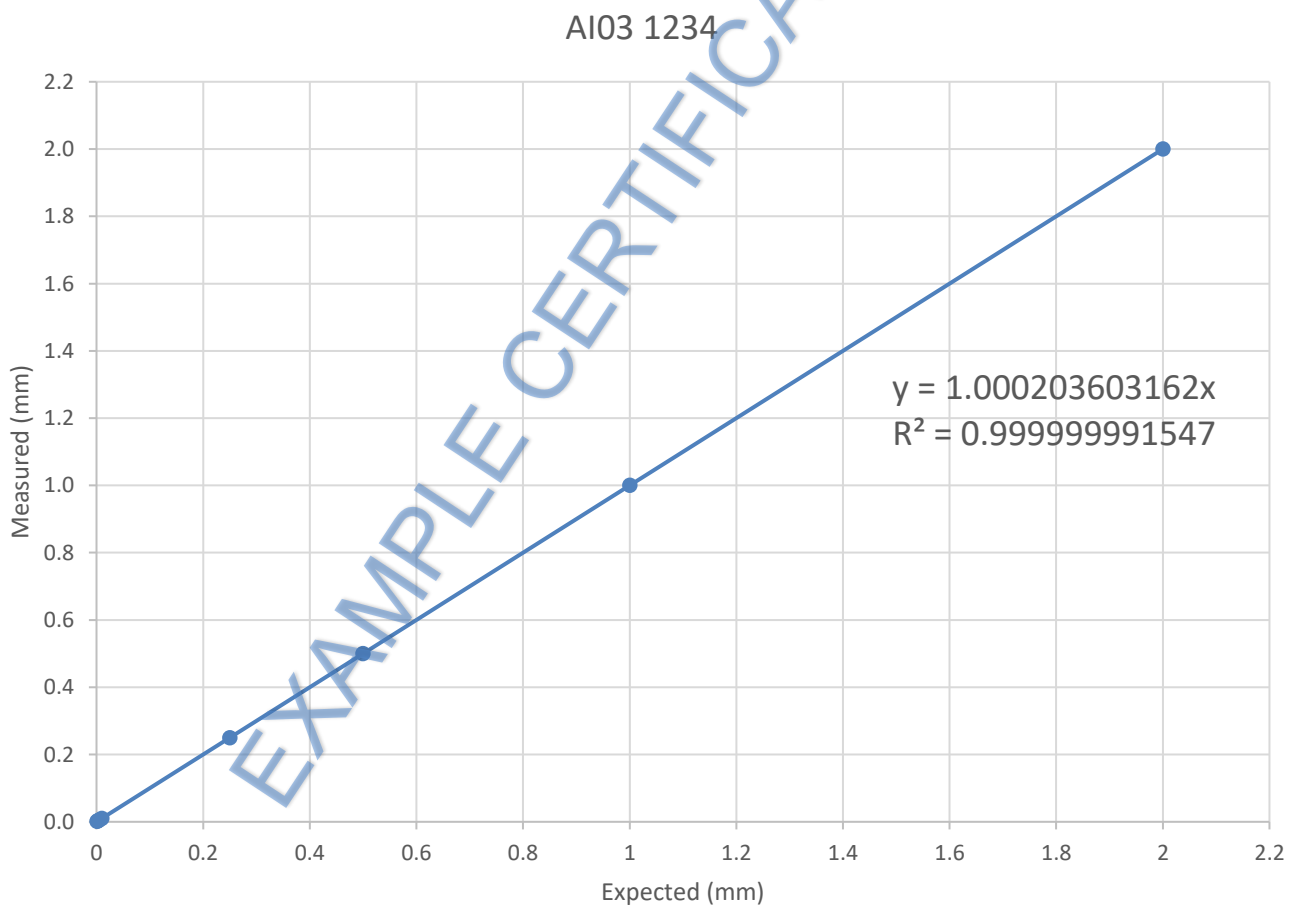


Figure 1. Expected versus actual measurements including all lines with linear regression and R^2 values reported.

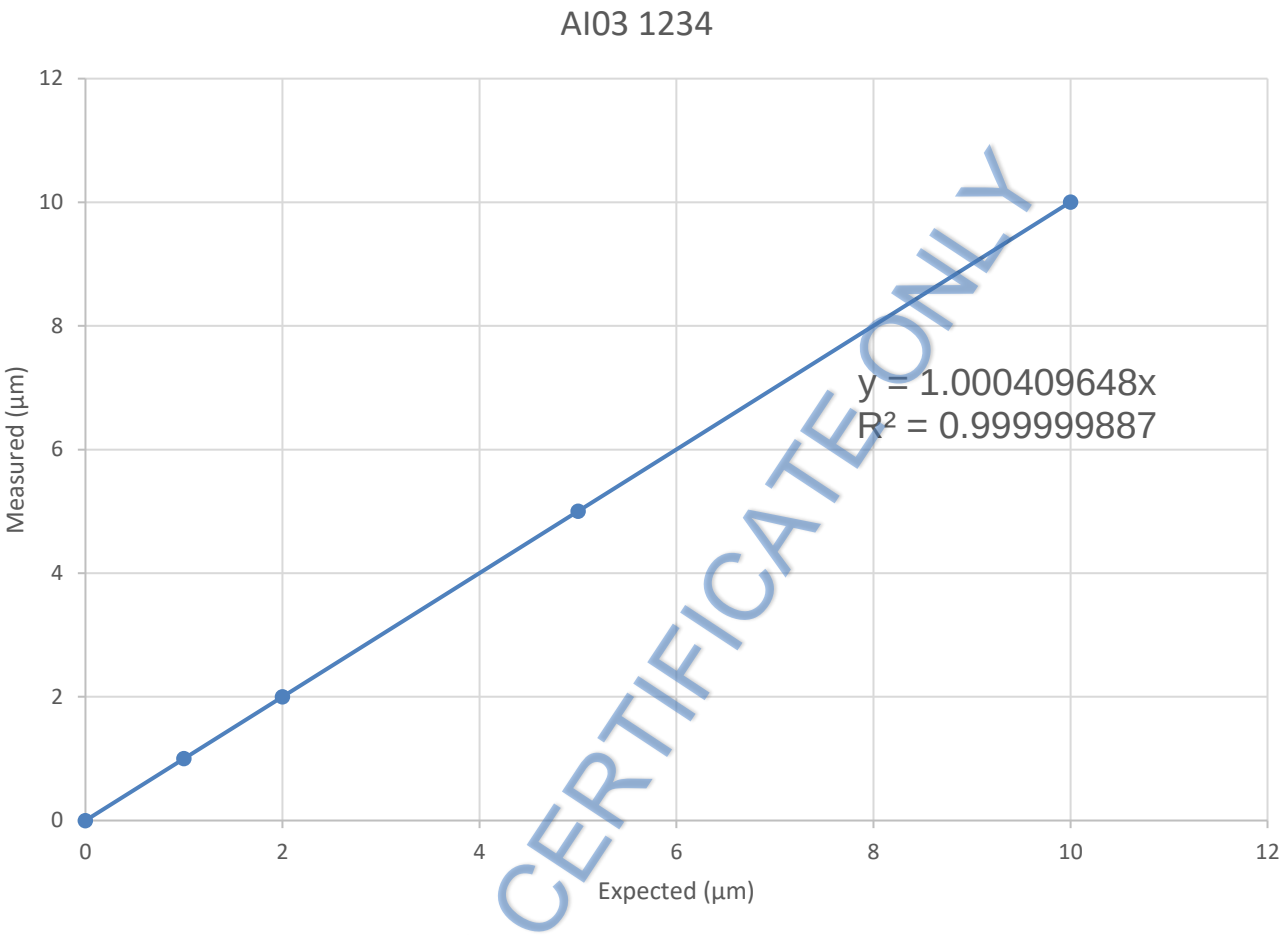


Figure 2. Expected versus actual measurements for the 10µm, 5µm, 2µm and 1µm pitch lines with linear regression and R^2 values reported.

5 µm Line	Pitch
0-5µm	5.005 µm
5-10µm	5.005 µm
10-15µm	5.005 µm
15-20µm	5.010 µm
20-25µm	5.010 µm
25-30µm	5.005 µm
30-35µm	5.005 µm
35-40µm	5.003 µm
40-45µm	5.000 µm
45-50µm	5.008 µm
50-55µm	5.000 µm
Sum	*55.057 µm*
Average	5.0051 µm
2-Sigma *	0.0079 µm

2 µm Line	Pitch
0-2µm	2.031 µm
2-4µm	2.003 µm
4-6µm	2.001 µm
6-8µm	2.003 µm
8-10µm	2.001 µm
10-12µm	2.001 µm
12-14µm	2.003 µm
14-16µm	1.998 µm
16-18µm	2.003 µm
18-20µm	2.001 µm
20-22µm	2.001 µm
22-24µm	2.001 µm
24-26µm	2.003 µm
26-28µm	2.001 µm
28-30µm	2.003 µm
Sum	*30.051 µm*
Average	2.0034 µm
2-Sigma *	0.0173 µm

Excluding 1st and last lines	
Average	2.0013 µm
2-Sigma *	0.0036 µm

1 µm Line	Pitch
0-1µm	1.005 µm
1-2µm	1.001 µm
2-3µm	1.002 µm
3-4µm	1.002 µm
4-5µm	1.001 µm
5-6µm	1.002 µm
6-7µm	1.001 µm
7-8µm	1.001 µm
8-9µm	1.004 µm
9-10µm	1.001 µm
10-11µm	1.000 µm
11-12µm	1.002 µm
12-13µm	1.001 µm
13-14µm	1.001 µm
14-15µm	1.004 µm
15-16µm	1.004 µm
Sum	*16.033 µm*
Average	1.0021 µm
2-Sigma *	0.0032 µm

Excluding 1st and last lines	
Average	1.0017 µm
2-Sigma *	0.0026 µm

End of report.