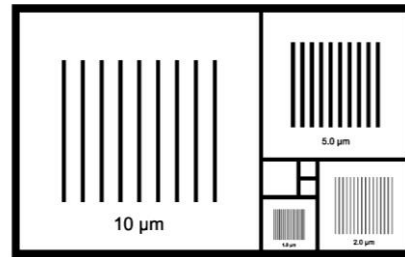
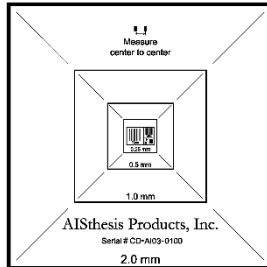


AISthesis Products

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



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

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
<i>Sum</i>	<i>80.018 μm</i>	
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 $\pm 0.012 \mu\text{m}$. 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 $25^\circ\text{C} \pm 5^\circ\text{C}$ 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	$\pm 1.00\text{mm}$ from center	2.000 mm	2.000 mm
1.0 mm	2	$\pm 0.5\text{mm}$ from center	1.000 mm	1.000 mm
0.5 mm	2	$\pm 0.25\text{mm}$ from center	0.500 mm	0.500 mm
0.25 mm	2	$\pm 0.125\text{mm}$ from center	0.250 mm	0.250 mm
5.0 μm	12	$\pm 20 \mu\text{m}$ from center	55.057 μm	5.005 μm
2.0 μm	16	$\pm 10 \mu\text{m}$ from center	30.051 μm	2.001 μm
1.0 μm	17	$\pm 5 \mu\text{m}$ 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%	$22.7 \pm 0.3^\circ\text{C}$	$34.5 \pm 1.5\%$	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.

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P.O. Box 1950, Clyde, North Carolina 28721 Tel: 828.627.6555 E-mail: CDMS@aisthesisproducts.com

Non-ISO 17025:2017 Compliant Supplemental Material.

AI03 1234

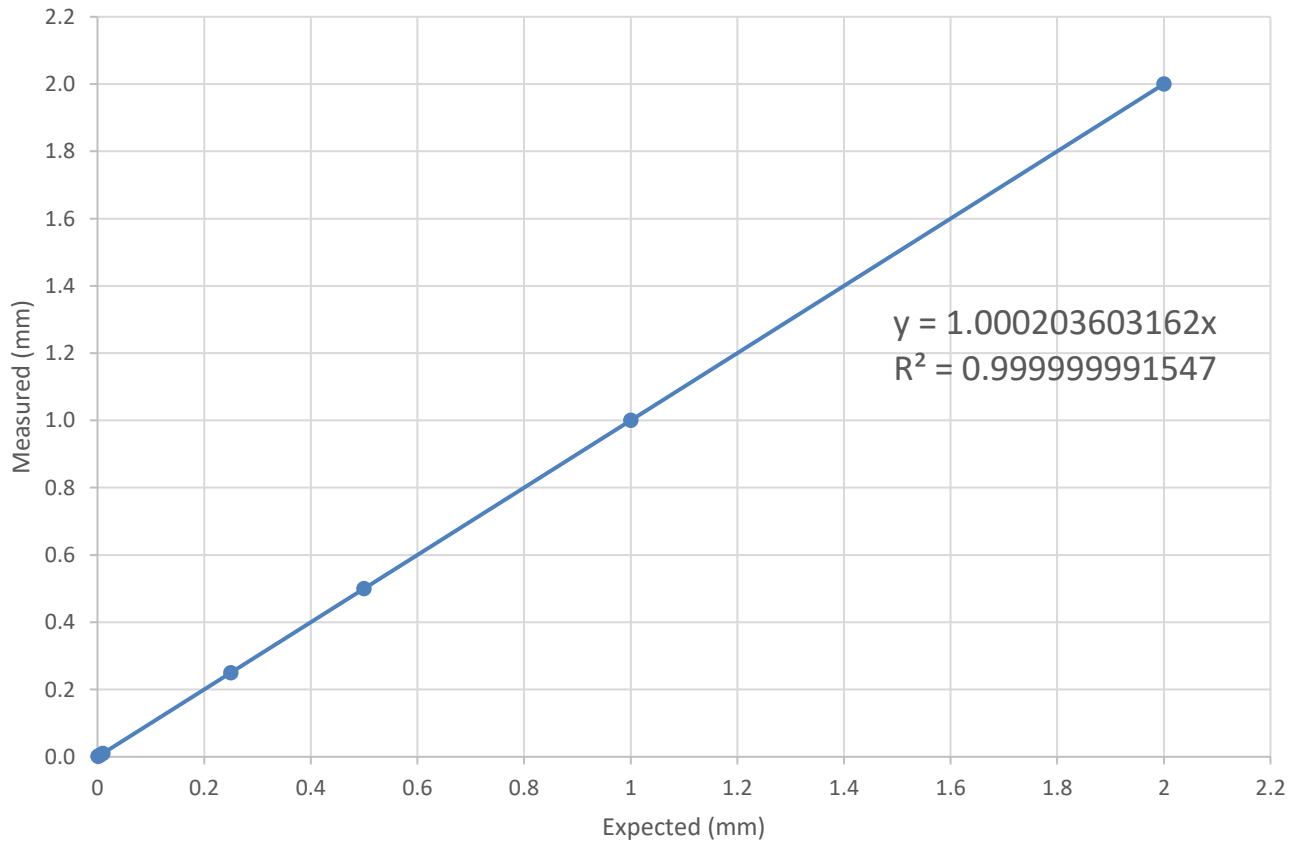


Figure 1. Expected versus actual measurements including all lines with linear regression and R² values reported.

AI03 1234

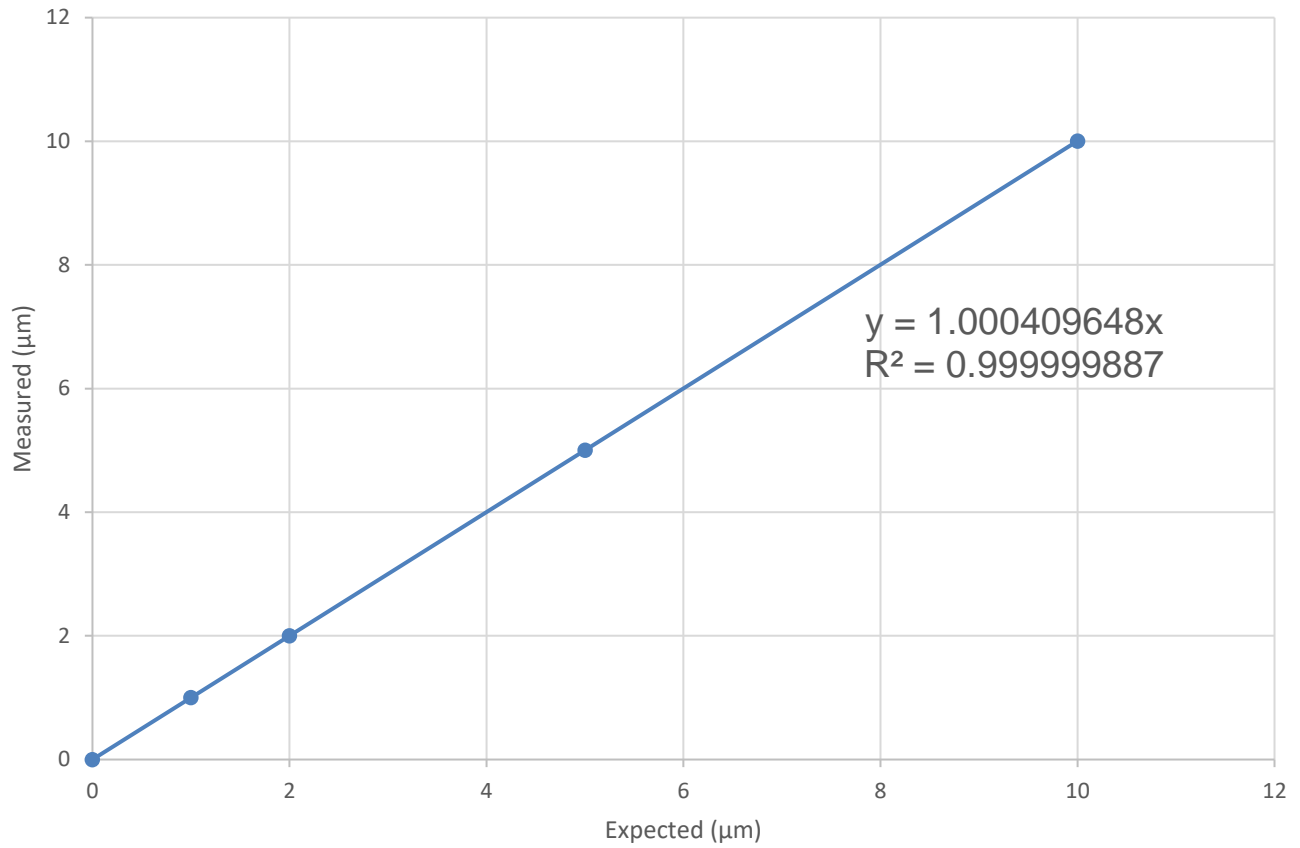


Figure 2. Expected versus actual measurements for the 10μm, 5μm, 2μm and 1μm pitch lines with linear regression and R² values reported.

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

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

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

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

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

End of report.