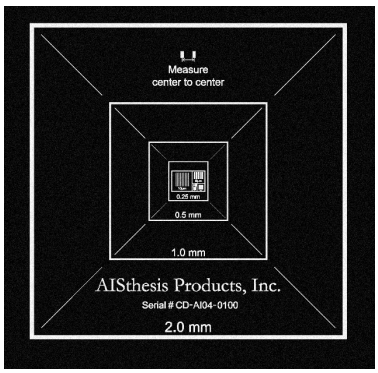
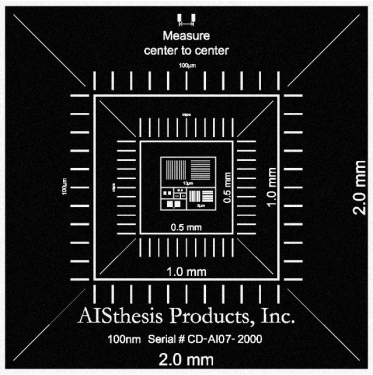
# Pelcotec™ CDMS – Critical Dimension Magnification Standards
# Pelcotec™ CDMS-1T, Pelcotec™ CDMS-1C,
# Pelcotec™ CDMS-0.1T, Pelcotec™ CDMS-0.1C
# Pelcotec™ CDMS-1T-ISO, Pelcotec™ CDMS-1C-ISO
# Pelcotec™ CDMS-0.1T-ISO, Pelcotec™ CDMS-0.1C-ISO




**X-Axis only** **X-Y Axes**

## CDMS X AXIS

| | |
|---|---|
| 682-1 and 682-1A through 682-1S: | Pelcotec™ CDMS-1T, 2mm - 1µm, Traceable |
| 683-01 and 683-01A through 683-01S: | Pelcotec™ CDMS-0.1T, 2mm - 100nm, Traceable |
| 686-1 and 686-1A through 686-1S: | Pelcotec™ CDMS-1C, 2mm - 1µm, Certified |
| 687-01 and 687-01A through 687-01S: | Pelcotec™ CDMS-0.1C, 2mm - 100nm, Certified |

## CDMS X-Y AXIS

| | |
|---|---|
| 684-1 and 684-1A through 684-1S: | Pelcotec™ CDMS-XY-1T, 2mm - 1µm, Traceable |
| 685-01 and 685-01A through 685-01S: | Pelcotec™ CDMS-XY-0.1T, 2mm - 100nm, Traceable |
| 689-1 and 689-1A through 689-1S: | Pelcotec™ CDMS-XY-1C, 2mm - 1µm, Certified |
| 690-01 and 690-01A through 690-01S: | Pelcotec™ CDMS-XY-0.1C, 2mm - 100nm, Certified |

## CDMS ISO X and XY - Calibration to ISO 17025:2017 requirement by AISthesis Products, Inc.

| | |
|---|---|
| 691-1 and 691-1A through 691-1S: | Pelcotec™ CDMS-1T-ISO, 2mm-1µm, Traceable |
| 692-01 and 692-01A through 692-01S: | Pelcotec™ CDMS-0.1T-ISO 2mm - 100nm, Traceable |
| 695-1 and 695-1A through 695-1S: | Pelcotec™ CDMS-1C-ISO 2mm - 1µm, Certified |
| 696-01 and 696-01A through 696-01S: | Pelcotec™ CDMS-0.1C-ISO 2mm - 100nm, Certified |
| 693-1 and 693-1A through 693-1S: | Pelcotec™ CDMS-XY-1T-ISO, 2mm - 1µm, Traceable |
| 694-01 and 694-01A through 694-01S: | Pelcotec™ CDMS-XY-0.1T-ISO, 2mm - 100nm, Traceable |
| 697-1 and 697-1A through 697-1S: | Pelcotec™ CDMS-XY-1C-ISO, 2mm - 1µm, Certified |
| 698-01 and 698-01A through 698-01S: | Pelcotec™ CDMS-XY-0.1C-ISO, 2mm - 100nm, Certified |

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The Pelcotec™ Critical Dimensions and Magnification Standards (CDMS) can be used for calibration of many different types of microscopes including scanning electron, scanning ion, atomic force, and reflected light microscopes.

To maintain optimum planarity, the patterns are fabricated on ultra-flat silicon wafers. Calibration features between 2.0mm and 5µm were patterned using photolithography and are 50nm thick chrome. Using typical imaging conditions in an SEM, the edge of each line produces a brightness that allows for easy edge detection and measurement of center-to-center distance.

Calibration features between 2.0µm and 100nm are patterned using e-beam lithography and consist of a 20nm thick chrome adhesion layer with 50nm thick gold on top. These features produce a high Z contrast image against the silicon substrate, again allowing for easy measurement of the center-to-center distance.

The zeros in the fiducial identifiers make excellent features for focus and stigmation. As always, for optimum results ensure that the instrument is aligned correctly and the beam current is stable. Use the largest number of pixels for image capture and a slow enough scan rate to achieve a good signal-to-noise ratio. By performing both short- and long-term repeat measurements, the user will be able to evaluate instrumental reproducibility and stability.

The design of the standard allows instrument calibration up to four orders of magnitude with the 0.1C or 0.1T product. Starting with the largest dimension that can be imaged (e.g. 2.0mm) and doubling the magnification brings the next calibration marker into view. Continuing this process until the 10µm features are imaged, the user can now move in a clockwise spiral to the next smallest calibration feature until a complete magnification calibration curve is obtained over the range of interest.

For the certified CDMS (0.1C and 1C), the physical distance between the first and last lines are given for the 10, 5, 2 and 1 micrometer pitch lines (extended to 500, 250 and 100nm for 0.1C). If needed, this data can be used to obtain the actual (rather than the stated average) pitch between the first and last lines, thereby extending the magnifications available to the user.

Use of the calibration lines to bring the CDMS into focus in an SEM should be minimized to reduce the build-up of contamination on the surface and thus increase the periods between cleaning.

When it becomes necessary to clean the CDMS standard, the following procedures are recommended:

- Remove dust and large particles with dry filtered nitrogen gas. A photographic lens quality “dust-off” product may be used as an alternative, as may a rinse in distilled water followed by blow-drying in high-purity methanol. Avoid gases and liquids that leave residues.
- For hydrocarbon residues, a gentle oxygen plasma clean may be used (for example a UV-Ozone cleaner).
- **Avoid mechanical abrasion of the surface such as touching or wiping with a cloth.**

*Technical note information continues onto next page*

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For die level certification purposes, the following measurements are made on each certified standard:

| Line | Number of Lines | Segment Length per Measurement | Position of Measurement | Number of Line Scans Averaged |
|---|---|---|---|---|
| **For 0.1C and 1C** | | | | |
| 2.0mm | 2 | 2.0mm | ± 1.00mm from center | 2500 |
| 1.0mm | 2 | 1.0mm | ± 0.5mm from center | 2500 |
| 0.5mm | 2 | 0.5mm | ± 0.25mm from center | 2500 |
| 0.25mm | 2 | 0.25mm | ± 0.125mm from center | 2000 |
| 10µm | 9 (X) / 11 (X-Y) | 80µm X, 100µm X-Y | ± 7.5µm from center | 3500 |
| 5µm | 12 | 55µm | ± 20mm from center | 3500 |
| 2µm | 16 | 30µm | ± 10µm from center | 3500 |
| 1µm | 17 | 16µm | ± 5µm from center | 3500 |
| **For 0.1C only** | | | | |
| 500nm | 20 | 9.5µm | ± 4µm from center | 3500 |
| 250nm | 21 | 5.0µm | ± 2.5µm from center | 2000 |
| 100nm | 52 | 5.1µm | ± 2.5µm from center | 2000 |

For the dies processed to meet the requirements for ISO 17025 accredited certification, results are reported to three decimal places as opposed to two decimal places reported for the non-ISO certified dies. In addition, the individual pitch is reported for the 10µm, 5µm, 2µm, 1µm as well as the 500nm, 250nm, and 100nm lines for the 0.1C-ISO standards. The certificate for these standards includes supplemental material covering expected versus actual measurements with associated linear regression and $R^2$ values reported for the low and medium (0.1C and 1C) as well as the high magnification (0.1C) scales.

The certification on these standards does not have an expiration date. The CDMS standards are constructed of lithographed Cr, and Au on Si and are chemically and mechanically stable under normal conditions of storage and use. The only deterioration mechanism is caused by contamination. When used under clean conditions, the validity of the certification is expected to last at least 5-10 years and the certified measurements are not expected to change over time. For this reason, there is no recommended recertification interval. We do not offer recertification for these standards.

For the wafer level traceability of the CDMS-1T and -0.1T, the reported uncertainty is determined statistically from selected dies from each wafer processed. In each case, several dies are randomly selected from each wafer and are measured. These become the fully certified standards, CDMS-1C and -0.1C. The average uncertainty of the measured samples is used to determine the uncertainty reported on the wafer level certificate.

For the higher certification level of the CDMS-1T-ISO and -0.1T-ISO standards, dies are sampled according to method SOP 08 Sampling Die in accordance with AISthesis Products, Inc. ISO 17025-2017 Scope of Accreditation.

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