

SEMI P21-92 (Reapproved 0703) GUIDELINES FOR PRECISION AND ACCURACY EXPRESSION FOR MASK WRITING EQUIPMENT

This guideline was technically approved by the Global Micropatterning Committee and is the direct responsibility of the Japanese Micropatterning Committee. Current edition approved by the Japanese Regional Standards Committee on April 28, 2003. Initially available at www.semi.org June 2003; to be published July 2003. Originally published in 1992.

NOTICE: This Standard or Safety Guideline has an Inactive Status because the conditions to maintain Current Status have not been met. Inactive Standards or Safety Guidelines are available from SEMI and continue to be valid for use.

1 Purpose

1.1 This guideline describes general requirements concerning precision and accuracy expression of mask writing equipment. Writing accuracy of the mask writing equipment is evaluated by measuring a written mask and is affected greatly by process conditions to be carried out. Therefore, the writing conditions are to be agreed upon by the user and supplier.

2 Scope

NOTICE: SEMI Standards and Safety Guidelines do not purport to address all safety issues associated with their use. It is the responsibility of the users of the Documents to establish appropriate safety and health practices, and determine the applicability of regulatory or other limitations prior to use.

3 Precision and Accuracy Expression Items, Definitions, Measurement, and Requirements

3.1 Minimum Pattern

3.1.1 Definition

- The minimum line and space pattern and minimum pattern which is possible to be separated.

3.1.2 Expression

- SEM photograph

3.1.3 Measurement

- SEM photograph of the resist pattern or the chrome pattern.

3.2 Pattern Dimension Precision and Accuracy

3.2.1 Definition

- Critical Dimension (CD) variation and deviation of written pattern from designed value.

3.2.2 Expression

- Deviation of measured mean value to design value (Δ : μm) and variations (3σ : μm).
- Measured area and number of sampling point should be clearly described.

3.2.3 Measurement

- Optical CD measurement
- Electron beam CD measurement
- CD measurement done by self-diagnostic feature of writing equipment.

3.2.4 Requirement

- Width of a long line pattern in X and Y direction should be measured.
- Pattern types are isolated pattern; 1:1 line and space pattern or 1:2 line and space pattern.

- The line width to be measured is not specified, but at least three different line widths should be measured.
- Examples of patterns are shown in Figures 1 and 2.

3.3 *Overlay Accuracy*

3.3.1 *Definition*

- Relative deviation of pattern position between two masks.

3.3.2 *Expression*

- $3\sigma; \mu\text{m}$ (X and Y direction separately)
- Measured area and number of sampling points should be clearly described.

3.3.3 *Measurement*

- Optical coordinates measurement
- Electron beam coordinates measurement
- Coordinates measurement done by self-diagnostic feature of writing equipment.

3.3.4 *Requirement*

- The pattern should be cross or L mark. Uniform rotation error in measurement should be subtracted from the measurement result.
- Overlay accuracy between different cassette should be clearly described. An example of a pattern is shown in Figure 3.

3.4 *Pattern Stitching Accuracy*

3.4.1 *Definition*

- Position errors at the stitching boundary of writing fields, stripes, and shots.

3.4.2 *Expression*

- $|\text{average value}| \pm 3\sigma \mu\text{m}$ (X and Y direction separately) measured area and number of sampling points should be clearly described.

3.4.3 *Measurement*

- Optical coordinates measurement
- Electron beam coordinate measurement
- Coordinates measurement done by self-diagnostic feature of writing equipment.
- Vernier measurement
- Boundary measurement by SEM image

3.4.4 *Requirement*

- The pattern should be cross or L marks in both sides adjacent to the stitching boundary for coordinate measurement.
- When the optical microscope is used for measurement, the Vernier pattern should be used.

4 **Notice**

4.1 The following subjects should be agreed upon beforehand between users and makers in order to evaluate the above-mentioned writing precision and accuracy item.

4.1.1 *Process Requirements*

- Resist Materials