# SEMI P30-0997 (Reapproved 1104)
# PRACTICE FOR CATALOG PUBLICATION OF CRITICAL DIMENSION MEASUREMENT SCANNING ELECTRON MICROSCOPES (CD-SEM)

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**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 The purpose of this practice is to define terms listed in Critical Dimension-Scanning Electron Microscopes (CD-SEM).

1.2 This document is designed to create a common understanding between suppliers and users.

## 2 Scope

2.1 This practice applies to terms listed in the CD-SEM catalog.

2.2 This practice also applies to terms listed in the estimate and purchasing specification.

**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 Referenced Standards and Documents

3.1 None.

## 4 Terminology

4.1 *Definitions*

4.1.1 *accelerating voltage* — the mean kinetic energy of primary electrons converted into voltage.

4.1.2 *alignment* — corrects coordinates for positions and specimen stage. Matching the coordinates of a wafer and a specimen stage in order to address measured patterns formed on a wafer.

4.1.3 *alignment error* — distance from the pattern center to screen center after alignment. This is the maximum distance between the screen center and a target pattern after addressing by its coordinates and completing alignment.

4.1.4 *Critical Dimension Measurement SEM (CD-SEM)* — selects fine patterns on a wafer and measure dimensions. Here, wafers include SEMI Standards (defined sizes) only. The operation is normally in the following “sequence”: Transport -> Stage Travel -> Positioning -> Measuring -> Transport.

4.1.5 *image resolution* — resolution between two points. This is the minimum resolving distance between any two points in an image.

4.1.6 *magnification* — the ratio of a deflection width on a display to that on a measurement pattern. Compares the deflection width on the screen and on the pattern.

4.1.7 *measurable range* — measurement range to guarantee static and dynamic repeatability as well as linearity. Measuring dimensions guaranteed to be within the specification of static repeatability, dynamic repeatability, and linearity.

4.1.8 *measurement pattern determination method* — identifies the pattern to be measured. This method is used to identify the pattern to be measured. It is performed by automatic pattern recognition, or instructions from the operator.

4.1.8.1 *automatic pattern determination method* — the pattern selection method based on the automatic pattern recognition system.

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4.1.8.2 *manual pattern determination method* — operator uses cursors, etc. The pattern selection method is accomplished by the operator placing cursors on the measurement pattern.

4.1.9 *measurement precision*

4.1.9.1 *dynamic repeatability* — variations between the nominal and measured dimensions. This is the maximum dispersion of measurements from the best approximate line defined between the nominal and measured dimensions.

4.1.9.2 *linearity* — variations in measurement values without changing device and wafer conditions. This is the closeness of agreement between the measured values obtained by measuring a pattern repeatedly without any changes of measurement conditions.

4.1.9.3 *reproducibility* — variations in average measurement values acquired in a sequence during a certain period. This is the closeness of agreement between the mean values obtained by measuring a pattern repeatedly at stated period with wafer loading, wafer alignment, stage traveling to a measurement site, positioning of a measured pattern, measuring, and wafer unloading.

4.1.9.4 *static repeatability* — variations in average measurement values acquired in a sequence for a pattern. This is the closeness of agreement between the measured values obtained by measuring a pattern with wafer loading, wafer alignment, stage traveling to a measurement site, positioning of a measured pattern, measuring, and wafer unloading.

4.1.10 *measurement target* — kind of measurement pattern. The measurement pattern, such as line, space, pitch, hole, box-in-box, etc.

4.1.11 *operation method* — the control method of operation sequence. There are three methods: auto, semi-auto, and manual.

4.1.11.1 *automatic operation method* — the operation method controlled by a computer automatically, after an operator sets a carrier on the equipment. The computer follows the commands written in a recipe. Uses a recipe on a computer.

4.1.11.2 *manual operation* — the operation method controlled by an operator without a recipe. Uses an operator.

4.1.11.3 *semi-auto operation* — the operating method controlled by a computer and an operator. The operator confirms the results of each command in a recipe using an automatic operation. Uses a recipe with an operator.

4.1.12 *pattern edge determination method* — uses a computer or an operator to look at the image. This is the method for determining the edge position of a given pattern, which is calculated by computer algorithm or by operator instructions.

4.1.12.1 *automatic pattern edge determination* — there are several methods, such as the threshold method, the linear approximation method, and the curve fitting method. This is the method used to determine the edge position automatically by calculating from the line profile signal of the secondary or back-scattered electrons. The calculations are performed using the aforementioned three algorithms.

4.1.12.2 *manual pattern edge determination method* — the operator measures the distance between cursors per image edge area. This method is used to determine the edge position manually by calculation based on the width between cursors, which are set to the measurement pattern edges by operator.

4.1.13 *pattern positioning error* — distance from the center of screen after positioning. This is the maximum distance between the screen center and a target pattern after pattern positioning.

4.1.14 *permissible air vibration* — the maximum air vibration that can provide the guaranteed resolution.

4.1.15 *permissible floor loading capability* — the minimum floor loading capability where the equipment can be settled.

4.1.16 *permissible floor vibration* — the maximum floor vibration that can provide the guaranteed resolution.

4.1.17 *permissible stray magnetic field* — the maximum change in the stray magnetic field that can provide the guaranteed resolution.

4.1.18 *positioning of measured patterns* — moving pattern to the center screen (center of image field).

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